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YAMAHA

FJ1100 & FJ1200 • 1984-1993

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INTERTEC PUBLISHING

P.O. Box 12901, Overland Park, Kansas 66282-2901

FIRST EDITION
First Printing November, 1993
Second Printing April, 1996

Printed in U.S.A.

ISBN: 0-89287-605-0

Library of Congress: 93-78507

MEMBER
MOTORCYCLE INDUSTRY COUNCIL, INC.

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Technical and photographic assistance by Curt Jordan, Jordan Engineering, Santa Ana, California.

Technical illustrations by Mitzi McCarthy and Robert Caldwell.

COVER: Photographed by Mark Clifford, Mark Clifford Photography, Los Angeles, California.

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CONTENTS

QUICK REFERENCE DATA

TIRE INFLATION PRESSURE (COLD)*

Load	psi	kPa
Up to 198 lb. (90 kg)		
Front	32	226
Rear	36	250
198-** lb. (90-** kg)		
Front	36	250
Rear	42	290
High speed riding		
Front	36	250
Rear	42	290

*Recommended air pressure for factory equipped tires. Aftermarket tires may require different air pressure.
**Maximum load limit includes total weight of motorcycle with accessories, rider(s) and luggage.

RECOMMENDED LUBRICANTS AND FLUIDS

Engine oil	
Temperatures 40° F (5° C) and up	SAE 20W/40 SE/SF
Temperatures 40° F (5° C) and below	SAE 10W/30 SE/SF
Brake fluid	DOT 4
Clutch hydraulic fluid	DOT 3 or DOT 4
Battery refilling (non-sealed)	Distilled water
Fork oil	10WT or SAE 10W/30 motor oil
Cables and pivot points	Yamaha chain and cable lube or SAE 10W/30 motor oil
Fuel	Unleaded regular
Drive chain	SAE 30-50W motor oil

APPROXIMATE REFILL CAPACITIES

Engine oil	
Without filter change	3.0 L (2.6 Imp. qt./3.2 U.S. quarts)
With filter change	3.35 L (2.9 Imp. qt./3.5 U.S. quarts)
Engine rebuild	4.2 L (3.7 Imp. qt./4.4 U.S. quarts)
Front forks	
Capacity	
1984-1990	424 cc (14.9 Imp. oz./14.3 U.S. oz.)
1991-on	446 cc (15.7 Imp. oz./15.08 U.S. oz.)
Fuel tank	
Tank total capacity	
1100 cc	24.5 L (5.4 Imp. gal./6.5 U.S. gal.)
1200 cc	22 L (4.8 Imp. gal./5.8 U.S. gal.)
Reserve (1200 cc)	5 L (1.1 Imp. gal./1.3 U.S. gal.)

MAINTENANCE AND TUNE-UP TIGHTENING TORQUES

Item	N•m	ft.-lb.
Oil drain plug	43	31
Oil filter drain bolt	7	5.1
Fork cap bolt	23	17
Upper fork bridge bolt	20	14
Spark plug (new)	17.5	12.5
Rear axle nut	150	110
Drive chain adjuster locknut	15	11

TUNE-UP SPECIFICATIONS

Air filter element	Dry element type
Ignition timing	Fixed
Valve clearance (cold)	
Intake	0.11-0.15 mm (0.0043-0.0059 in.)
Exhaust	0.16-0.20 mm (0.0063-0.0079 in.)
Spark plug	
Type	
U.S.	NGK DP8EA-9
	ND X24EP-U9
U.K.	NGK DPR8EA-9
	ND X24EPR-U9
Gap	0.8-0.9 mm (0.031-0.035 in.)
Tightening torque	17.5 N•m (12.5 ft.-lb.)
Idle speed	950-1,050 rpm
Compression pressure (cold at sea level)	
Standard	980 kPa (142 psi)
Minimum	882 kPa (128 psi)
Maximum	1,176 kPa (171 psi)
Maximum difference between cylinders	100 kPa (15 psi)

REPLACEMENT BULBS

U.S. Models

Item	Wattage
Headlight	12V 60W/55W
Position light	8W (2)
Tail/brakelight	8/27W (2)
Directional light	27W (4)
Meter light	3.4W (3)
Indicator light	3.4W (6)

U.K. Models

Item	Wattage
Headlight	12V 60W/55W
Auxiliary light	5W (1)
Tail/brakelight	5/21W (2)
Flasher light	21W (4)
Meter light	3.4W (3)
Indicator light	3.4W (6)

INTRODUCTION

This detailed, comprehensive manual covers the U.S and the U.K. models of the Yamaha FJ1100 from 1984-1985 and FJ1200 from 1986-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 book.

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 FJ1100 from 1984-1985 and FJ1200 from 1986-on. **Table 1** lists engine and chassis numbers for models covered in this manual.

Troubleshooting, tune-up, maintenance and repair are not difficult, if you know what tools and equipment to use and what to do. Step-by-step instructions guide you through jobs ranging from simple maintenance to complete engine and suspension overhaul.

This manual can be used by anyone from a first time do-it-yourselfer to a professional mechanic. Detailed drawings and clear photographs give you all the information you need to do the work right.

Some of the procedures in this manual require the use of special tools. The resourceful mechanic can, in many cases, think of acceptable substitutes for special tools—there is always another way. This can be as simple as using a few pieces of threaded rod, washers and nuts to remove or install a bearing or fabricating a tool from scrap material. However, using a substitute for a special tool is not recommended as it can be dangerous to and may damage the part. If you find that a tool can be designed and safely made, but will require some type of machine work, you may want to search out a local community college or high school that has a machine shop curriculum. Shop teachers sometimes welcome outside work that can be used as practical shop applications for advanced students.

Table 1 lists model coverage with engine serial numbers.

Metric and U.S. standards are used throughout this manual. U.S. to metric conversion is given in **Table 2**.

Tables 1-5 are found at the end of the chapter.

MANUAL ORGANIZATION

This chapter provides general information and discusses equipment and tools useful both for preventive maintenance and troubleshooting.

Chapter Two provides methods and suggestions for quick and accurate diagnosis and repair of problems. Troubleshooting procedures discuss typical symptoms and logical methods to pinpoint the trouble.

Chapter Three explains all periodic lubrication and routine maintenance necessary to keep your Yamaha operating at top performance. Chapter Three also includes recommended tune-up procedures, eliminating the need to constantly consult other chapters on the various assemblies.

Subsequent chapters describe specific systems such as the engine top end, engine bottom end, clutch, transmission, fuel, exhaust, electrical, suspension, drive train, steering and brakes. Each chapter provides disassembly, repair and assembly procedures in simple step-by-step form. If a repair is impractical for a home mechanic, it is so indicated. It is usually faster and less expensive to take such repairs to a Yamaha dealer or competent repair shop. Specifications concerning a particular system are included at the end of the appropriate chapter.

NOTES, CAUTIONS AND WARNINGS

The terms NOTE, CAUTION and WARNING have specific meanings in this manual. A NOTE provides additional information to make a step or procedure easier or clearer. Disregarding a NOTE could cause inconvenience, but would not cause damage or personal injury.

A CAUTION emphasizes areas where equipment damage could occur. Disregarding a CAUTION could cause permanent mechanical damage; however, personal injury is unlikely.

A WARNING emphasizes areas where personal injury or even death could result from negligence. Mechanical damage may also occur. WARNINGS *are to be taken seriously*. In some cases, serious injury and death have resulted from disregarding similar warnings.

SAFETY FIRST

Professional mechanics can work for years and never sustain a serious injury. If you observe a few rules of common sense and safety, you can enjoy many safe hours servicing your own machine. If you ignore these rules you can hurt yourself or damage the equipment.

1. *Never* use gasoline as a cleaning solvent.
2. *Never* smoke or use a torch in the vicinity of flammable liquids, such as cleaning solvent, in open containers.
3. If welding or brazing is required on the machine, remove the fuel tank and rear shock to a safe distance, at least 50 feet away.
4. Use the proper sized wrenches to avoid damage to fasteners and injury to yourself.
5. When loosening a tight or stuck nut, be guided by what would happen if the wrench should slip. Be careful; protect yourself accordingly.
6. When replacing a fastener, make sure to use one with the same measurements and strength as the old one. Incorrect or mismatched fasteners can result in damage to the bike and possible personal injury. Beware of fastener kits that are filled with cheap and poorly made nuts, bolts, washers and cotter pins. Refer to *Fasteners* in this chapter for additional information.
7. Keep all hand and power tools in good condition. Wipe greasy and oily tools after using them. They are difficult to hold and can cause injury. Replace or repair worn or damaged tools.
8. Keep your work area clean and uncluttered.
9. Wear safety goggles during all operations involving drilling, grinding, the use of a cold chisel or anytime you feel unsure about the safety of your eyes. Safety goggles should also be worn anytime solvent and compressed air is used to clean a part.
10. Keep an approved fire extinguisher (**Figure 1**) nearby. Be sure it is rated for gasoline (Class B) and electrical (Class C) fires.
11. When drying bearings or other rotating parts with compressed air, never allow the air jet to rotate the bearing or part. The air jet is capable of rotating them at speeds far in excess of those for which they were designed. The bearing or rotating part is very likely to disintegrate and cause serious injury and

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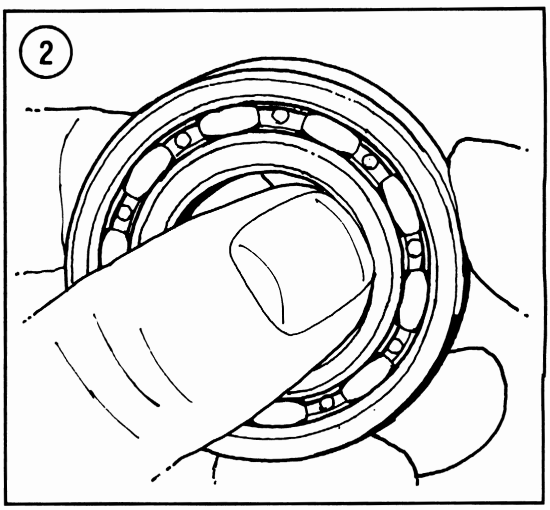


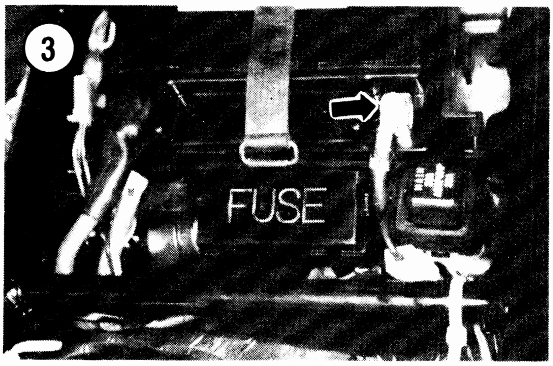
damage. To prevent bearing damage when using compressed air, hold the inner bearing race by hand (**Figure 2**).

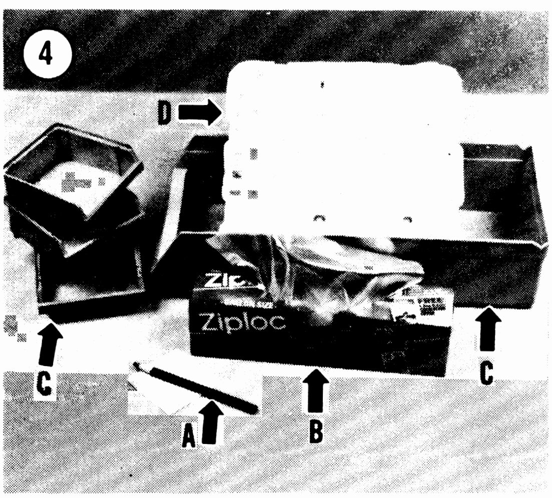
SERVICE HINTS

Most of the service procedures covered are straightforward and can be performed by anyone reasonably handy with tools. It is suggested, however, that you consider your own capabilities carefully before attempting any operation involving major disassembly of the engine or transmission.

Take your time and do the job right. Do not forget that a newly rebuilt engine must be broken in the same way as a new one. Keep the rpms within the limits given in your owner's manual when you get back on the road.

1. "Front," as used in this manual, refers to the front of the bike; the front of any component is the end closest to the front of the bike. The "left-" and "right-hand" sides refer to the position of the parts as viewed by a rider sitting on the seat facing forward. For example, the throttle control is on the right-hand side. These rules are simple, but confusion can cause a major inconvenience during service.





2. Whenever servicing the engine or clutch, or when removing a suspension component, the bike should be secured in a safe manner.

WARNING
Never disconnect the positive (+) battery cable unless the negative (–) cable has first been disconnected. Disconnecting the positive cable while the negative cable is still connected may cause a spark. This could ignite hydrogen gas given off by the battery, causing an explosion.

3. Disconnect the negative battery cable (**Figure 3**) when working on or near the electrical, clutch or starter systems and before disconnecting any electrical wires. On most batteries, the negative terminal will be marked with a minus (–) sign and the positive terminal with a plus (+) sign.

4. Tag all similar internal parts for location and mark all mating parts for position (A, **Figure 4**). Record number and thickness of any shims as they are removed. Small parts such as bolts can be identified by placing them in plastic sandwich bags (B, **Figure 4**). Seal and label them with masking tape.

5. Place parts from a specific area of the engine (e.g. cylinder head, cylinder, clutch, shift mechanism, etc.) into plastic boxes (C, **Figure 4**) to keep them separated.

6. When disassembling transmission shaft assemblies, use an egg flat (the type that restaurants get their eggs in) (D, **Figure 4**) and set the parts from the shaft in one of the depressions in the same order in which they were removed.

7. Wiring should be tagged with masking tape and marked as each wire is removed. Again, do not rely on memory alone.

8. Finished surfaces should be protected from physical damage or corrosion. Keep gasoline and brake fluid off painted surfaces.

9. Use penetrating oil on frozen or tight bolts, then strike the bolt head a few times with a hammer and punch (use a screwdriver on screws). Avoid the use of heat where possible, as it can warp, melt or affect the temper of parts. Heat also ruins finishes, especially paint and plastics.

10. No parts removed or installed (other than bushings and bearings) in the procedures given in this manual should require unusual force during disassembly or assembly. If a part is difficult to remove or install, find out why before proceeding.
11. Cover all openings after removing parts or components to prevent dirt, small tools, etc. from falling in.
12. Read each procedure *completely* while looking at the actual parts before starting a job. Make sure you *thoroughly* understand what is to be done and then carefully follow the procedure, step by step.
13. Recommendations are occasionally made to refer service or maintenance to a Yamaha dealer or a specialist in a particular field. In these cases, the work will be done more quickly and economically than if you performed the job yourself.
14. In procedural steps, the term "replace" means to discard a defective part and replace it with a new or exchange unit. "Overhaul" means to remove, disassemble, inspect, measure, repair or replace defective parts, reassemble and install major systems or parts.
15. Some operations require the use of a hydraulic press. Unless you have a press, it would be wiser to have these operations performed by a shop equipped for such work, rather than to try to do the job yourself with makeshift equipment that may damage your machine.
16. Repairs go much faster and easier if your machine is clean before you begin work. There are many special cleaners on the market, like Bel-Ray Degreaser, for washing the engine and related parts. Follow the manufacturer's directions on the container for the best results. Clean all oily or greasy parts with cleaning solvent as you remove them.

WARNING

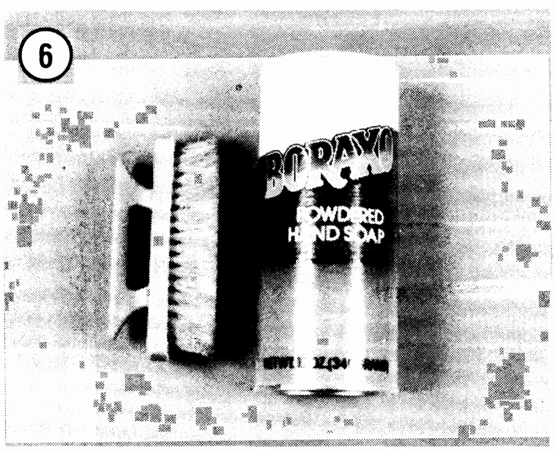
***Never** use gasoline as a cleaning agent. It presents an extreme fire hazard. Be sure to work in a well-ventilated area when using cleaning solvent. Keep a fire extinguisher, rated for gasoline fires, handy in any case.*

CAUTION

If you use a car wash to clean your bike, don't direct the high pressure water hose at steering bearings, carburetor hoses, suspension linkage components, wheel bearings and electrical components. The water will flush grease out of the bearings or damage the seals.

17. Much of the labor charges for repairs made by dealers are for the time involved in the removal, disassembly, assembly and reinstallation of other parts in order to reach the defective part. It is frequently possible to perform the preliminary operations yourself and then take the defective unit to the dealer for repair at considerable savings.
18. If special tools are required, make arrangements to get them before you start. It is frustrating and time-consuming to get partly into a job and then be unable to complete it.

19. Make diagrams (or take a Polaroid picture) wherever similar-appearing parts are found. For instance, crankcase bolts are often not the same length. You may think you can remember where everything came from—but mistakes are costly. There is also the possibility that you may be sidetracked and not return to work for days or even weeks—in which time the carefully laid out parts may have become disturbed.



20. When assembling parts, be sure all shims and washers are replaced exactly as they came out.

21. Whenever a rotating part butts against a stationary part, look for a shim or washer. Use new gaskets if there is any doubt about the condition of the old ones. A thin coat of oil on non-pressure type gaskets may help them seal more effectively.

22. High spots may be sanded off a piston with sandpaper, but fine emery cloth and oil will do a much more professional job.

23. Carbon can be removed from the head, the piston crowns and the exhaust ports with a dull screwdriver. Do *not* scratch machined surfaces. Wipe off the surface with a clean cloth when finished.

24. A baby bottle makes a good measuring device for adding oil to the front forks. Get one that is graduated in fluid ounces and cubic centimeters. After it has been used for this purpose, do *not* let a small child drink out of it as there will always be an oil residue in it.

25. If it is necessary to make a clutch cover or ignition cover gasket and you do not have a suitable old gasket to use as a guide, you can use the outline of the cover and gasket material to make a new gasket. Apply engine oil to the cover gasket surface. Then place the cover on the new gasket material and apply pressure with your hands. The oil will leave a very accurate outline on the gasket material that can be cut around.

CAUTION

When purchasing gasket material to make a gasket, measure the thickness of the old gasket and purchase gasket material with the same approximate thickness.

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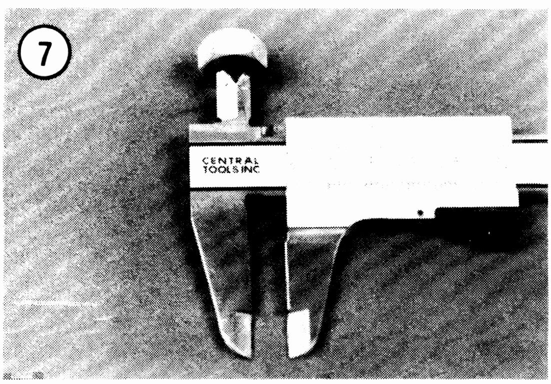

26. Heavy grease can be used to hold small parts in place if they tend to fall out during assembly. However, keep grease and oil away from electrical and brake components.

27. The carburetor is best cleaned by disassembling it and soaking the parts in a commercial carburetor cleaner. Never soak gaskets and rubber parts in these cleaners. Never use wire to clean out jets and air passages. They are easily damaged. Use compressed air to blow out the carburetor only if the float has been removed first.

28. There are many items available that can be used on your hands before and after working on your bike. A little preparation prior to getting "all greased up" will help when cleaning up later. Before starting out, work Vaseline, soap or a product such as Invisible Glove (**Figure 5**) onto your forearms, into your hands and under your fingernails and cuticles. This will make cleanup a lot easier. For cleanup, use a waterless hand soap such as Sta-Lube and then finish up with powdered Boraxo and a fingernail brush (**Figure 6**).

TORQUE SPECIFICATIONS

Torque specifications throughout this manual are given in Newton-meters (N•m) and foot-pounds (ft.-lb.).

Existing torque wrenches calibrated in meter kilograms can be used by performing a simple conversion. All you have to do is move the decimal point one place to the right; for example, 3.5 mkg = 35 N•m. This conversion is accurate enough for mechanical work even though the exact mathematical conversion is 3.5 mkg = 34.3 N•m.

Refer to **Table 3** for general torque specifications for various size screws, bolts and nuts that may not be listed in the respective chapters. To use the table, first determine the size of the bolt or nut. Use a Vernier caliper and measure the inside dimension of the threads of the nut (**Figure 7**) and across the threads for a bolt (**Figure 8**).

FASTENERS

The materials and designs of the various fasteners used on your Yamaha FJ1100 and FJ1200 are not arrived at by chance or accident. Fastener design determines the type of tool required to work the fastener. Fastener material is carefully selected to decrease the possibility of physical failure.

Nuts, bolts and screws are manufactured in a wide range of thread patterns. To join a nut and bolt, the diameter of the bolt and the diameter of the hole in the nut must be the same. It is just as important that the threads on both be properly matched.

The best way to tell if the threads on 2 fasteners are matched is to turn the nut on the bolt (or the bolt into the threaded hole in a piece of equipment) with fingers only. Be sure both pieces are clean. If much force is required, check the thread condition on each fastener. If the thread condition is good but the fasteners jam, the threads are not compatible. A thread pitch gauge (**Figure 9**) can also be used to determine pitch. Yamaha motorcycles are manufactured with ISO (International Organization for Standardization) metric fasteners. The threads are cut differently than that of American fasteners (**Figure 10**).

Most threads are cut so that the fastener must be turned clockwise to tighten it. These are called right-hand threads. Some fasteners have left-hand threads; they must be turned counterclockwise to be tightened. Left-hand threads are used in locations where normal rotation of the equipment would tend to loosen a right-hand threaded fastener.

ISO Metric Screw Threads

ISO (International Organization for Standardization) metric threads come in 3 standard thread sizes: coarse, fine and constant pitch. The ISO coarse pitch is used for most all common fastener applications. The fine pitch thread is used on certain precision tools and instruments. The constant pitch thread is used mainly on machine parts and not for fasteners. The constant pitch thread, however, is used on all metric thread spark plugs.

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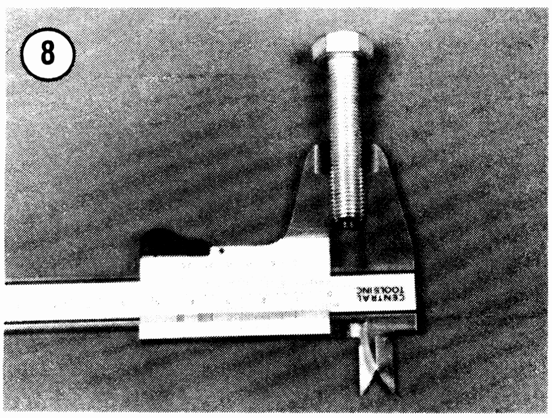

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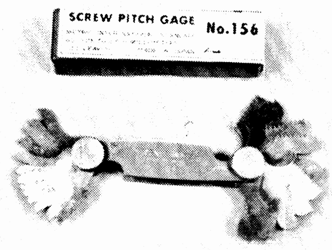

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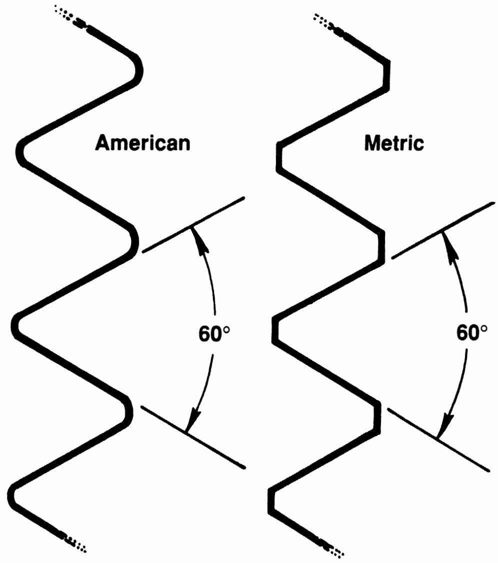

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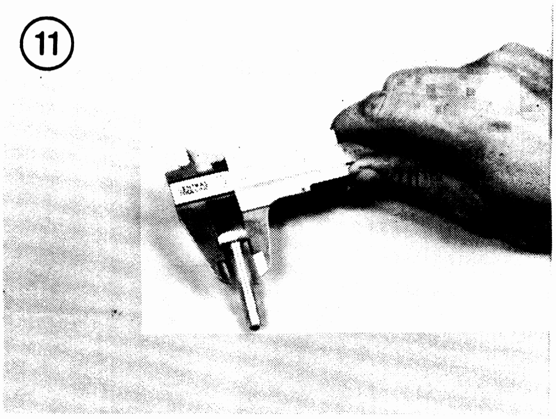

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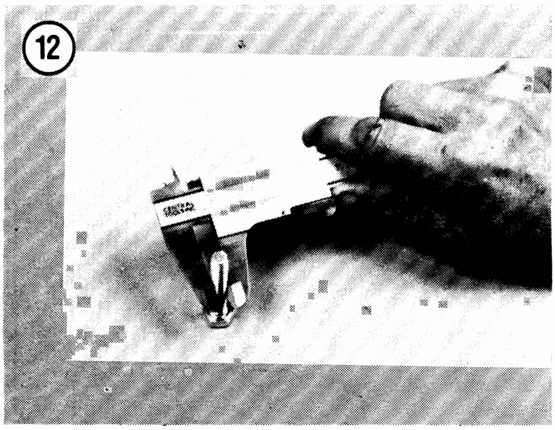

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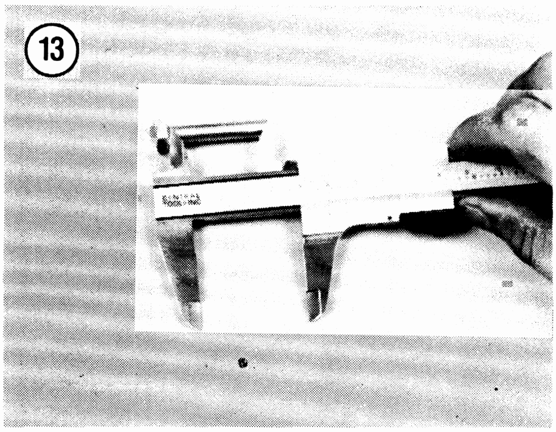

ISO metric threads are specified by the capital letter M followed by the diameter in millimeters and the pitch (or the distance between each thread) in millimeters separated by the sign ×. For example a M8 × 1.25 bolt is one that has a diameter of 8 millimeters with a distance of 1.25 millimeters between each thread. The measurement across 2 flats on the head of the bolt (**Figure 11**) indicates the proper wrench size to be used. **Figure 12** shows how to determine bolt diameter.

NOTE
*When purchasing a bolt from a dealer or parts store, it is important to know how to specify bolt length. The correct way to measure bolt length is by measuring the length starting from underneath the bolt head to the end of the bolt (**Figure 13**). Always measure bolt length in this manner to avoid purchasing bolts that are too long.*

Machine Screws

There are many different types of machine screws. **Figure 14** shows a number of screw heads requiring different types of turning tools. Heads are also designed to protrude above the metal (round) or to be slightly recessed in the metal (flat). See **Figure 15**.

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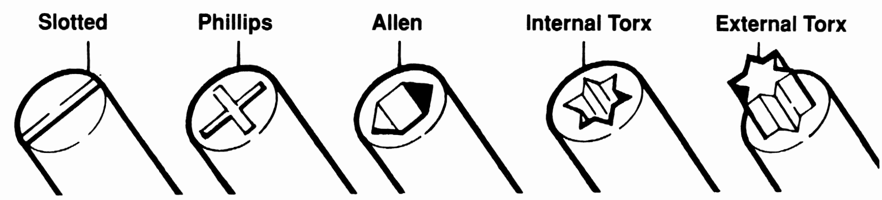
OPENINGS FOR TURNING TOOLS



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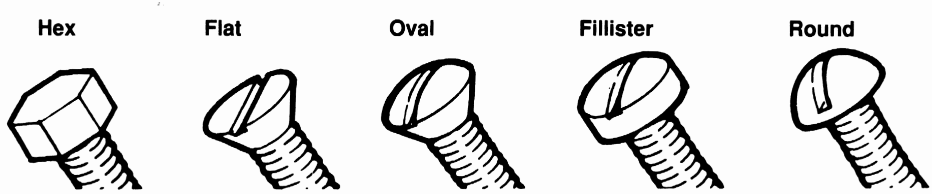
MACHINE SCREWS



Bolts

Commonly called bolts, the technical name for these fasteners is cap screws. Metric bolts are described by the diameter and pitch (or the distance between each thread). For example, a M8 × 1.25 bolt is one that has a diameter of 8 millimeters and a distance of 1.25 millimeters between each thread. The measurement across 2 flats on the head of the bolt (**Figure 11**) indicates the proper wrench size to be used. Use a Vernier caliper and measure across the threads (**Figure 12**) to determine the bolt diameter and to measure the length (**Figure 13**).

Nuts

Nuts are manufactured in a variety of types and sizes. Most are hexagonal (6-sided) and fit on bolts, screws and studs with the same diameter and pitch.

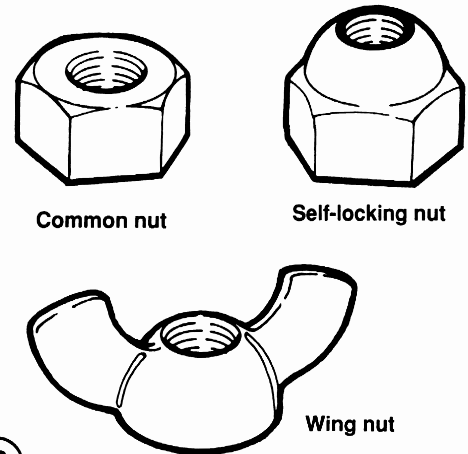
Figure 16 shows several types of nuts. The common nut is generally used with a lockwasher. Self-locking nuts have a nylon insert which prevents the nut from loosening; no lockwasher is required. Wing nuts are designed for fast removal by hand. Wing nuts are used for convenience in non-critical locations.

To indicate the size of a metric nut, manufacturers specify the diameter of the opening and the thread pitch. This is similar to bolt specifications, but without the length dimension. The measurement across 2 flats on the nut indicates the proper wrench size to be used (**Figure 17**).

Prevailing Torque Fasteners

Several types of bolts, screws and nuts incorporate a system that develops an interference between the bolt, screw, nut or tapped hole threads. Interference is achieved in various ways: by distorting threads, coating threads with dry adhesive or nylon, distorting the top of an all-metal nut, using a nylon insert in the center or at the top of a nut, etc.

Prevailing torque fasteners offer greater holding strength and better vibration resistance. Some prevailing torque fasteners can be reused if in good condition. Others, like the nylon insert nut, form an initial locking condition when the nut is first installed; the nylon forms closely to the bolt thread pattern, thus reducing any tendency for the nut to loosen. When the nut is removed, the locking effi-



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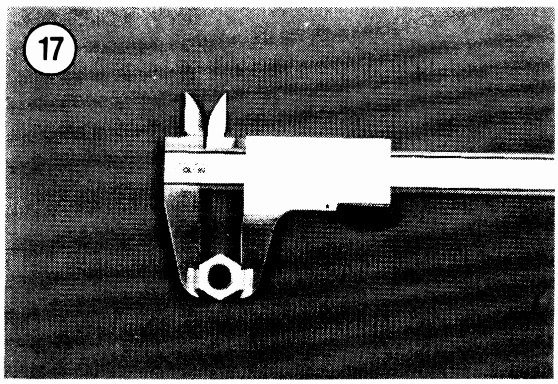

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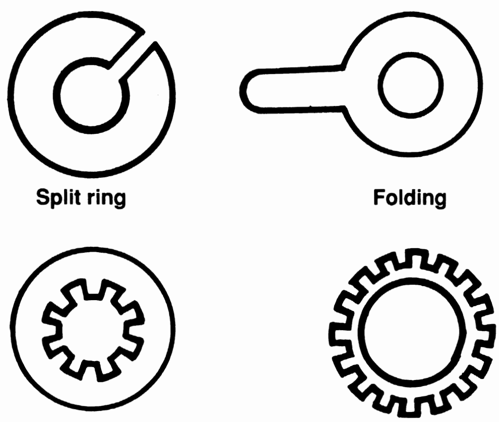
LOCKWASHERS


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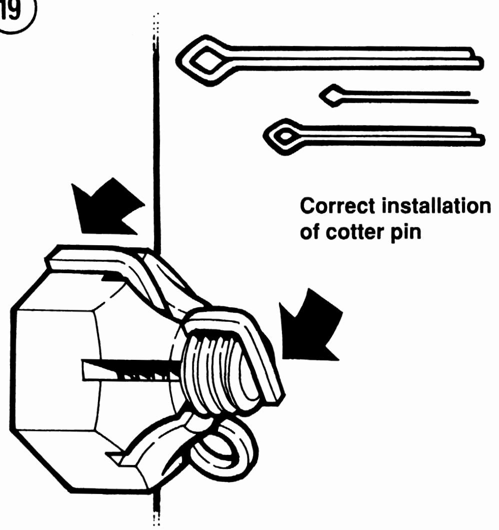

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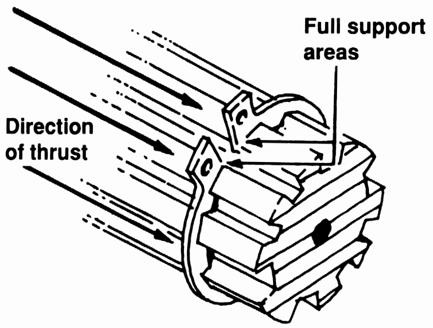

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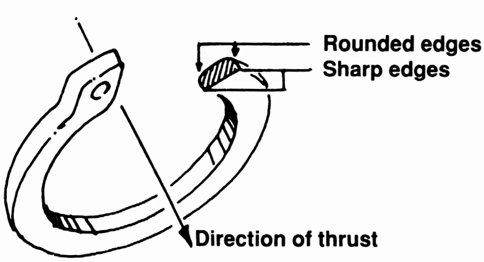


ciency is greatly reduced. For greatest safety, it is recommended that you install new prevailing torque fasteners whenever they are removed.

Washers

There are 2 basic types of washers: flat washers and lockwashers. Flat washers are simple discs with a hole to fit a screw or bolt. Lockwashers are designed to prevent a fastener from working loose due to vibration, expansion and contraction. **Figure 18** shows several types of washers. Washers are also used in the following functions:

a. As spacers.
b. To prevent galling or damage of the equipment by the fastener.
c. To help distribute fastener load during torquing.
d. As seals.

Note that flat washers are often used between a lockwasher and a fastener to provide a smooth bearing surface. This allows the fastener to be turned easily with a tool.

Cotter Pins

Cotter pins (**Figure 19**) are used to secure special kinds of fasteners. The threaded stud must have a hole in it; the nut or nut lock piece has castellations around which the cotter pin ends wrap. Cotter pins should not be reused after removal.

Circlips

Circlips can be internal or external design. They are used to retain items on shafts (external type) or within tubes (internal type). In some applications, circlips of varying thicknesses are used to control the end play of parts assemblies. These are often called selective circlips. Circlips should be replaced during installation, as removal weakens and deforms them.

Two basic styles of circlips are available: machined and stamped circlips. Machined circlips (**Figure 20**) can be installed in either direction (shaft or housing) because both faces are machined, thus creating two sharp edges. Stamped circlips (**Figure 21**) are manufactured with one sharp edge and one rounded edge. When installing stamped circlips in a thrust situation (transmission shafts, fork tubes, etc.), the sharp edge must face away from the part producing the thrust. When installing circlips, observe the following:

a. Compress or expand circlips only enough to install them.
b. After the circlip is installed, make sure it is completely seated in its groove.

Transmission circlips become worn with use and increase side play. For this reason, always use new circlips whenever a transmission is reassembled.

LUBRICANTS

Periodic lubrication assures long life for any type of equipment. The *type* of lubricant used is just as important as the lubrication service itself, although in an emergency the wrong type of lubricant is better than none at all. The following paragraphs describe the types of lubricants most often used on motorcycle equipment. Be sure to follow the manufacturer's recommendations for lubricant types.

Generally, all liquid lubricants are called "oil." They may be mineral-based (including petroleum bases), natural-based (vegetable and animal bases), synthetic-based or emulsions (mixtures). "Grease" is an oil to which a thickening base has been added so that the end product is semi-solid. Grease is often classified by the type of thickener added; lithium soap is commonly used.

Engine Oil

Four-cycle *oil* for motorcycle and automotive engines is graded by the American Petroleum Institute (API) and the Society of Automotive Engineers (SAE) in several categories. Oil containers display these ratings on the top or label.

API oil grade is indicated by letters; oils for gasoline engines are identified by an "S." Yamaha models described in this manual require SE or SF graded oil.

Viscosity is an indication of the oil's thickness. The SAE uses numbers to indicate viscosity; thin oils have low numbers while thick oils have high numbers. A "W" after the number indicates that the viscosity testing was done at low temperature to simulate cold-weather operation. Engine oils fall into the 5W-30 and 20W-50 range.

Multi-grade oils (for example 10W-40) are less viscous (thinner) at low temperatures and more viscous (thicker) at high temperatures. This allows the oil to perform efficiently across a wide range of engine operating conditions. The lower the number, the better the engine will start in cold climates. Higher numbers are usually recommended for engine running in hot weather conditions.

Grease

Greases are graded by the National Lubricating Grease Institute (NLGI). Greases are graded by number according to the consistency of the grease; these range from No. 000 to No. 6, with No. 6 being the most solid. A typical multipurpose grease is NLGI No. 2. For specific applications, equipment manufacturers may require grease with an additive such as molybdenum disulfide (MOS2) (**Figure 22**).

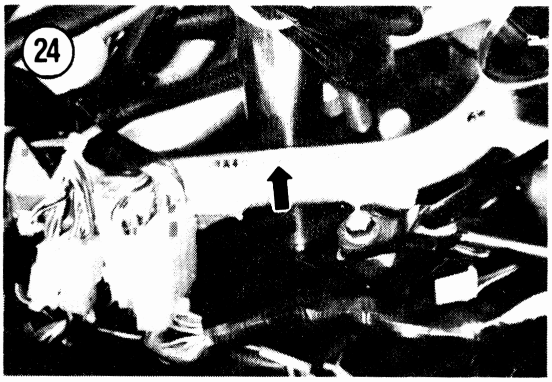
EXPENDABLE SUPPLIES

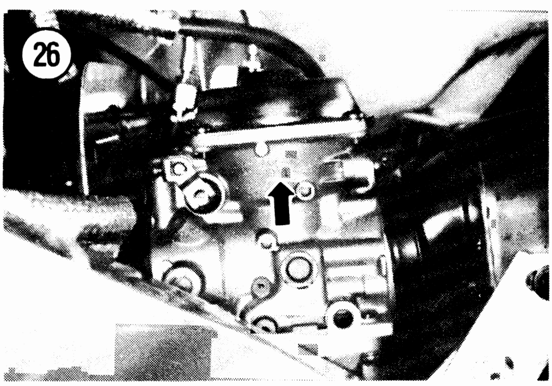
Certain expendable supplies are required during maintenance and repair work. These include grease, oil, gasket cement, wiping rags and cleaning solvent.

Ask your dealer for the special locking compounds, silicone lubricants and other products (**Figure 23**) which make bike maintenance simpler and easier. Cleaning solvent or kerosene is available at some service stations, paint or hardware stores.

WARNING
Having a stack of clean shop rags on hand is important when performing engine and suspension service work. However, to prevent the possibility of fire damage from spontaneous combustion from a pile of solvent soaked rags, store them in a lid sealed metal container until they can be washed or discarded.

NOTE
To avoid absorbing solvent and other chemicals into your skin while cleaning parts, wear a pair of petroleum-resistant rubber gloves. These can be purchased through industrial supply houses or well-equipped hardware stores.





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 distributor, always order by frame and engine numbers. The frame number serial number is stamped on the right-hand side of the upper frame tube (**Figure 24**). The engine number is stamped on a raised pad on the right-hand side of the crankcase (**Figure 25**) by the clutch cover. The carburetor number (**Figure 26**) 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 the information listed 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.*

EMISSION CONTROL AND BATTERY LABELS

On U.S. models, an emission control information label is fixed to the top surface of the front portion of the rear fender under the seat (**Figure 27**). This decal lists the emission control related tune-up information for your specific model.

On California models, an emission hose routing labels is also located in the same area.

Battery related information and caution label is also included in the same area. Refer to these whenever servicing the battery.

BASIC HAND TOOLS

Many of the procedures in this manual can be carried out with simple hand tools and test equipment familiar to the average home mechanic. Keep your tools clean and in a tool box. Keep them organized with the sockets and related drives together, the open-end combination wrenches together, etc. After using a tool, wipe off dirt and grease with a clean cloth and return the tool to its correct place.

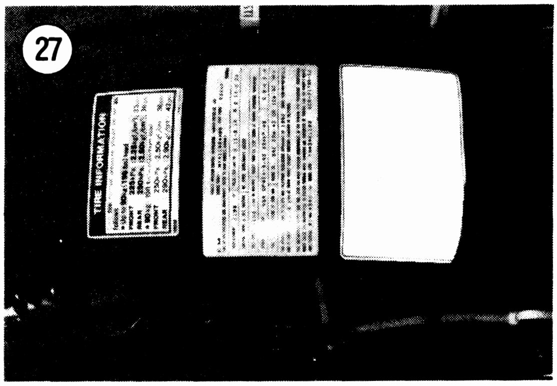
Top quality tools are essential; they are also more economical in the long run. If you are now starting to build your tool collection, stay away from the "advertised specials" featured at some parts houses, discount stores and chain drug stores. These are usually a poor grade tool that can be sold cheaply and that is exactly what they are—*cheap*. They are usually made of inferior material, and are thick, heavy and clumsy. Their rough finish makes them difficult to clean and they usually don't last very long. If it is ever your misfortune to use such tools, you will probably find out that the wrenches do not fit the heads of bolts and nuts correctly and damage the fastener.

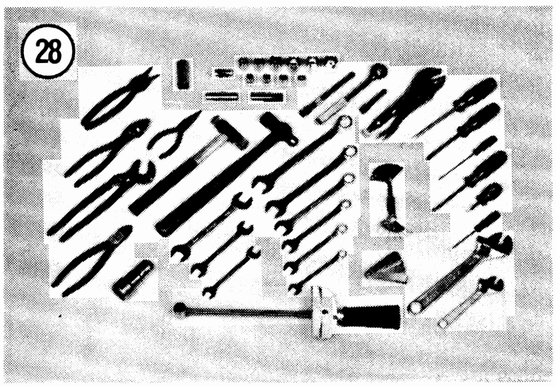
Quality *tools* are made of alloy steel and are heat treated for greater strength. They are lighter and better balanced than cheap ones. Their surface is smooth, making them a pleasure to work with and easy to clean. The initial cost of good quality tools may be more but they are cheaper in the long run. Don't try to buy everything in all sizes in the beginning; do it a little at a time until you have the necessary tools.

The following tools are required to perform virtually any repair job on a bike. Each tool is described and the recommended size given for starting a tool collection. **Table 4** includes the tools that should be on hand for simple home repairs and/or major overhaul as shown in **Figure 28**. Additional tools and some duplicates may be added as you become more familiar with the bike. Almost all motorcycles and vehicles (with the exception of the U.S.-built Harley and some English bikes) use metric size bolts and nuts. If you are starting your collection now, buy metric sizes.

Screwdrivers

The screwdriver is a very basic tool, but if used improperly it will do more damage than good. The slot on a screw has a definite dimension and shape. A screwdriver must be selected to conform with that shape. Use a small screwdriver for small screws and a large one for large screws or the screw head will be damaged.





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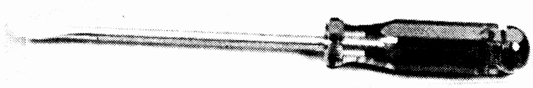

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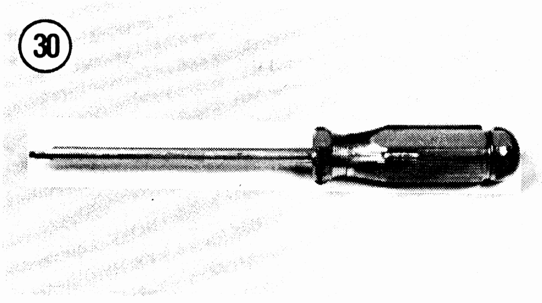

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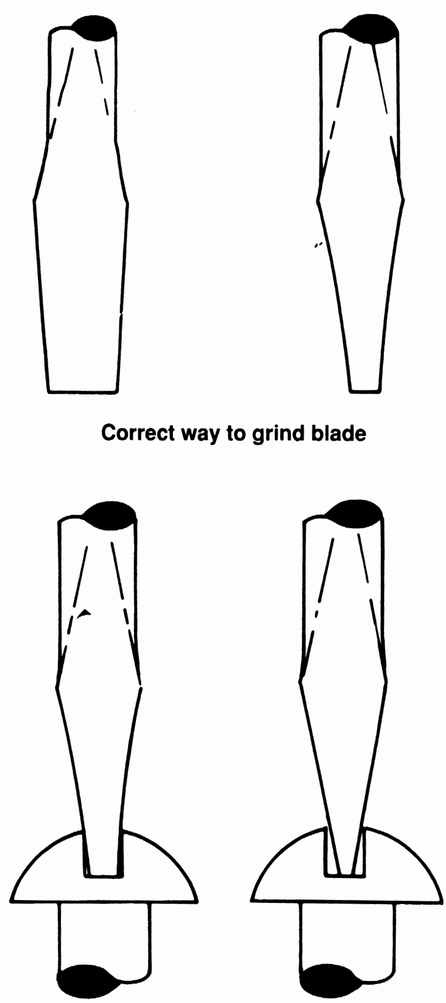


Two basic types of screwdriver are required: common (flat-blade) screwdrivers (**Figure 29**) and Phillips screwdrivers (**Figure 30**).

Screwdrivers are available in sets which often include an assortment of common and Phillips blades. If you buy them individually, buy at least the following:

a. Common screwdriver—5/16 × 6 in. blade.

b. Common screwdriver—3/8 × 12 in. blade.

c. Phillips screwdriver—size 2 tip, 6 in. blade.

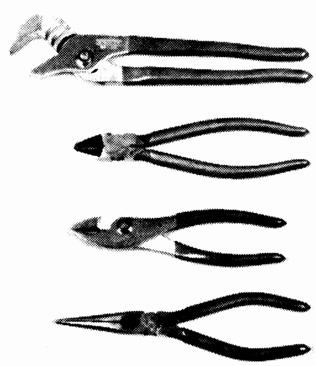
Use screwdrivers only for driving screws. Never use a screwdriver for prying or chiseling metal. Do not try to remove a Phillips or Allen head screw with a common screwdriver (unless the screw has a combination head that will accept either type); you can damage the head so that the proper tool will be unable to remove it.

Keep screwdrivers in the proper condition and they will last longer and perform better. Always keep the tip of a common screwdriver in good condition. **Figure 31** shows how to grind the tip to the proper shape if it becomes damaged. Note the symmetrical sides of the tip.

Pliers

Pliers come in a wide range of types and sizes. Pliers are useful for cutting, bending and crimping. They should never be used to cut hardened objects or to turn bolts or nuts. **Figure 32** shows several pliers useful in motorcycle repairs.

Each type of pliers has a specialized function. Slip-joint pliers are general purpose pliers and are used mainly for holding things and for bending.



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Needlenose pliers are used to hold or bend small objects. Channel lock pliers can be adjusted to hold various sizes of objects; the jaws remain parallel to grip around objects such as pipe or tubing. There are many more types of pliers. The ones described here are most suitable for bike repairs.

Vise-grip Pliers

Vise-grip pliers (**Figure 33**) are used to hold objects very tightly like a vise. But avoid using them unless absolutely necessary since their sharp jaws will permanently scar any objects which are held. Vise-grip pliers are available in many types for more specific tasks.

Circlip Pliers

Circlip pliers (**Figure 34**) are special in that they are only used to remove circlips from shafts or within engine or suspension housings. When purchasing circlip pliers, there are two kinds to distinguish from. External pliers (spreading) are used to remove circlips that fit on the outside of a shaft. Internal pliers (squeezing) are used to remove circlips which fit inside a gear or housing.

WARNING
Because circlips can sometimes slip and "fly off" during removal and installation, always wear safety glasses.

Box-end, Open-end and Combination Wrenches

Box-end, open-end and combination wrenches are available in sets or separately in a variety of sizes. On open-end and box-end wrenches, the number stamped near the end refers to the distance between 2 parallel flats on the hex head bolt or nut. On combination wrenches, the number is stamped near the center.

Box-end wrenches require clear overhead access to the fastener but can work well in situations where the fastener head is close to another part. They grip on all six edges of a fastener for a very secure grip. They are available in either 6-point or 12-point. The 6-point gives superior holding power and durability but requires a greater swinging radius. The 12-point works better in situations with limited swinging radius.

Open-end wrenches are speedy and work best in areas with limited overhead access. Their wide flat jaws make them unstable for situations where the bolt or nut is sunken in a well or close to the edge of a casting. These wrenches grip only two flats of a fastener so if either the fastener head or the wrench jaws are worn, the wrench may slip off.

Combination wrenches (**Figure 35**) have open-end on one side and box-end on the other with both

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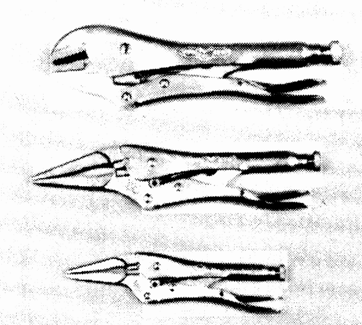

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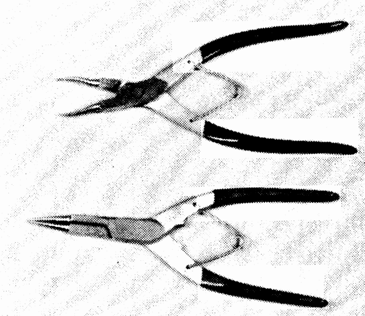

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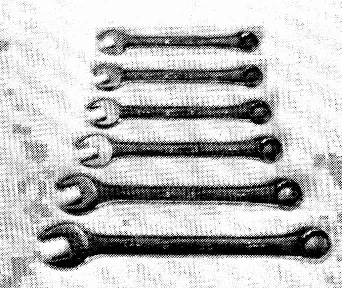

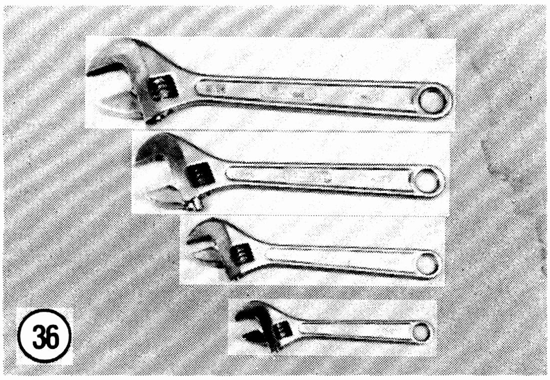

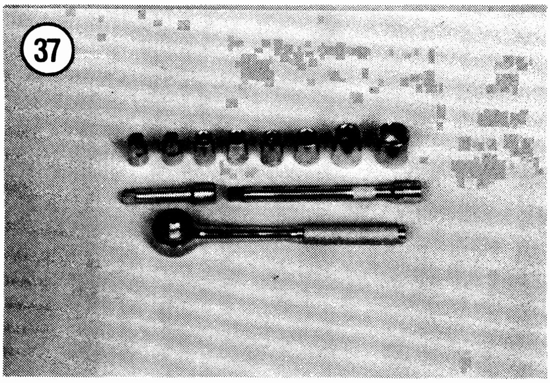

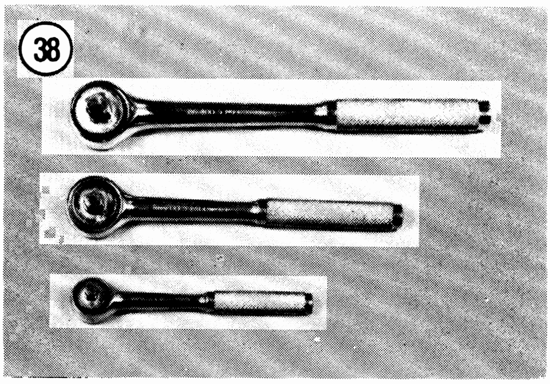

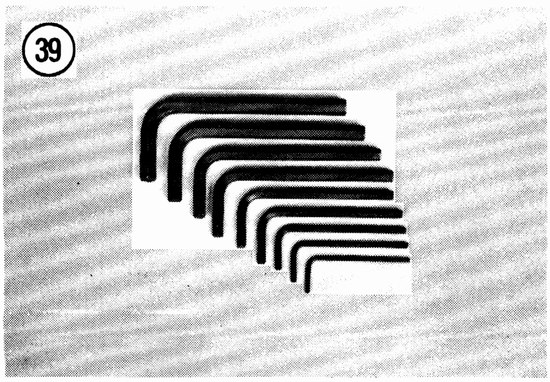

ends being the same size. These wrenches are favored by professionals because of their versatility.

Adjustable (Crescent) Wrenches

An adjustable wrench (sometimes called crescent wrench) can be adjusted to fit nearly any nut or bolt head which has clear access around its entire perimeter. Adjustable wrenches (**Figure 36**) are best used as a backup wrench to keep a large nut or bolt from turning while the other end is being loosened or tightened with a proper wrench.

Adjustable wrenches have only two gripping surfaces which make them more subject to slipping off the fastener and damaging the part and possibly injuring your hand. The fact that one jaw is adjustable only aggravates this shortcoming.

These wrenches are directional; the solid jaw must be the one transmitting the force. If you use the adjustable jaw to transmit the force, it will loosen and possibly slip off.

Adjustable wrenches come in all sizes but something in the 6 to 8 in. range is recommended as an all-purpose wrench.

Socket Wrenches

This type is undoubtedly the fastest, safest and most convenient to use. Sockets which attach to a ratchet handle (**Figure 37**) are available with 6-point or 12-point openings and 1/4, 3/8, 1/2 and 3/4 in. drives. The drive size indicates the size of the square hole which mates with the ratchet handle (**Figure 38**).

Allen Wrenches

Allen wrenches (**Figure 39**) are available in sets or separately in a variety of sizes. These sets come in SAE and metric size, so be sure to buy a metric set. Allen bolts are sometimes called socket bolts. Sometimes the bolts are difficult to reach and it is suggested that a variety of Allen wrenches be purchases (e.g. socket driven, T-handle and extension type) as shown in **Figure 40**.

Torque Wrench

A torque wrench is used with a socket to measure how tightly a nut or bolt is installed. They come in a wide price range and with either 3/8 or 1/2 in. square drive (**Figure 41**). The drive size indicates the size of the square drive which mates with the socket. Purchase one that measures 0-280 N•m (0-200 ft.-lb.).

Impact Driver

This tool might have been designed with the bike in mind. This tool makes removal of fasteners easy and eliminates damage to bolts and screw slots. Impact drivers and interchangeable bits (**Figure 42**) are available at most large hardware, motorcycle or auto parts stores. Don't purchase a cheap one as they do not work as well and require more force (the "use a larger hammer" syndrome) than a moderately priced one. Sockets can also be used with a hand impact driver. However, make sure that the socket is designed for use with an impact driver or air tool. Do not use regular hand sockets, as they may shatter during use.

Hammers

The correct hammer (**Figure 43**) is necessary for repairs. Use only a hammer with a face (or head) of rubber or plastic or the soft-faced type that is filled with buckshot. These are sometimes necessary in engine teardowns. *Never* use a metal-faced hammer on engine or suspension parts, as severe damage will result in most cases. You can always produce the same amount of force with a soft-faced hammer. A metal-faced hammer, however, will be required when using a hand impact driver.

PRECISION MEASURING TOOLS

Measurement is an important part of motorcycle service. When performing many of the service procedures in this manual, you will be required to make a number of measurements. These include basic checks such as valve clearance, engine compression and spark plug gap. As you get deeper into engine disassembly and service, measurements will be required to determine the size and condition of the piston and cylinder bore, valve and guide wear,

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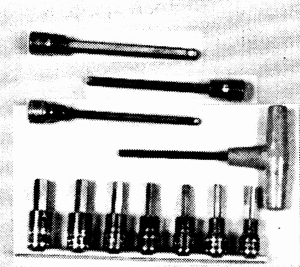

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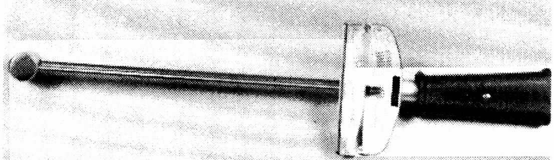

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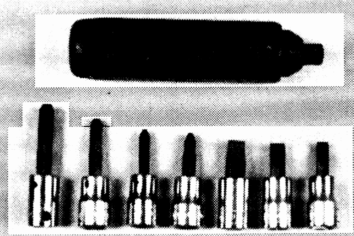

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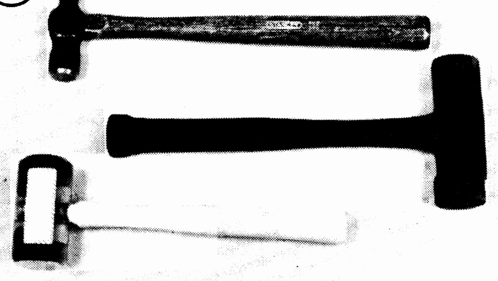

camshaft wear, crankshaft runout and so on. When making these measurements, the degrée of accuracy will dictate which tool is required. Precision measuring tools are expensive. If this is your first experience at engine or suspension service, it may be more worthwhile to have the checks made at a Yamaha dealer or machine shop. However, as your skills and enthusiasm increase for doing your own service work, you may want to begin purchasing some of these specialized tools. The following is a description of the measuring tools required during engine and suspension overhaul.

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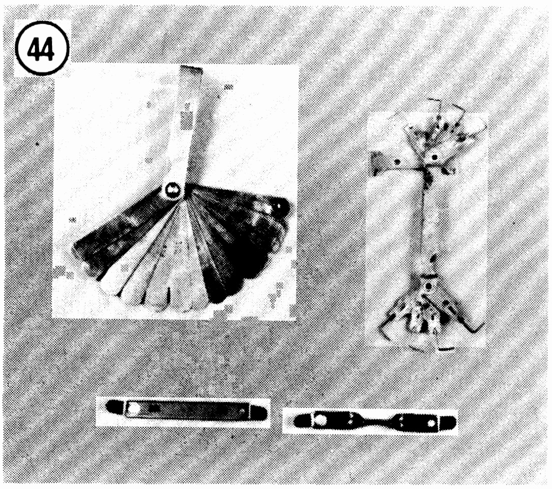

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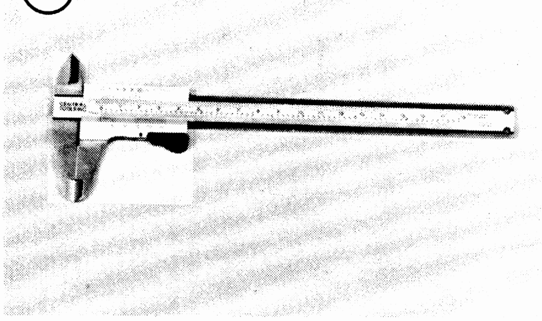

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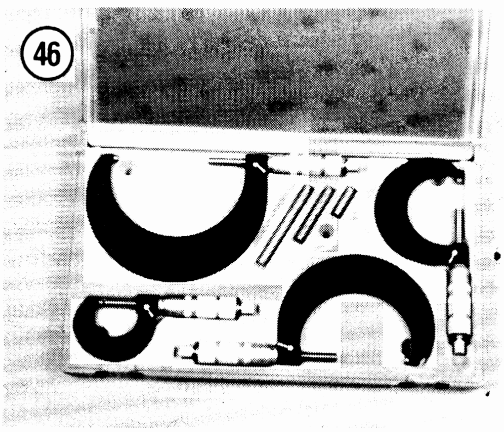

Feeler Gauge

Feeler gauges come in assorted sets and types (**Figure 44**). The feeler gauge is made of either a piece of a flat or round hardened steel of a specified thickness. Wire gauges are used to measure spark plug gap and valve clearance. Flat gauges are used for all other measurements. Feeler gauges are also designed for specialized uses, such as for measuring valve clearances. On these gauges, the gauge end is usually small enough and angled so as to make checking valve clearances easier.

Vernier Caliper

This tool (**Figure 45**) is invaluable when reading inside, outside and depth measurements to within close precision. It can be used to measure clutch spring length and the thickness of clutch plates, shims and thrust washers.

Outside Micrometers

One of the most reliable tools used for precision measurement is the outside micrometer (**Figure 46**). Outside micrometers will be required to measure valve shim thickness, piston diameter and valve stem diameter. Outside micrometers are also used with other tools to measure the cylinder bore and the valve guide inside diameters. Micrometers can be purchased individually or as a set.

Dial Indicator

Dial indicators (**Figure 47**) are precision tools used to check dimension variations on machined parts such as transmission shafts and axles and to check crankshaft and axle shaft end play. Dial indicators are available with various dial types for different measuring requirements.

Cylinder Bore Gauge

The cylinder bore gauge is a very specialized precision tool. The gauge set shown in **Figure 48** is comprised of a dial indicator, handle and a number of length adapters to adapt the gauge to different bore sizes. The bore gauge can be used to make cylinder bore measurements such as bore size, taper and out-of-round. Depending on the bore gauge, it can sometimes be used to measure brake caliper and master cylinder bore sizes. An outside micrometer must be used together with the bore gauge to determine bore dimensions.

Small Hole Gauges

A set of small hole gauges allow you to measure a hole, groove or slot ranging in size up to 13 mm (0.500 in.). A small hole gauge will be required to measure valve guide, brake caliper and brake master cylinder bore diameters. An outside micrometer must be used together with the small hole gauge to determine bore dimensions.

Compression Gauge

An engine with low compression cannot be properly tuned and will not develop full power. A compression gauge (**Figure 49**) measures engine compression. The one shown has a flexible stem with an extension that can allow you to hold it while turning the engine over. Open the throttle all the way when checking engine compression. See Chapter Three.

Strobe Timing Light

This instrument is useful for checking ignition timing. By flashing a light at the precise instant the spark plug fires, the position of the timing mark can be seen. The flashing light makes a moving mark appear to stand still opposite a stationary mark.

Suitable lights range from inexpensive neon bulb types to powerful xenon strobe lights (**Figure 50**). A light with an inductive pickup is recommended to eliminate any possible damage to ignition wiring. Use according to manufacturer's instructions.

Multimeter or VOM

This instrument (**Figure 51**) is invaluable for electrical system troubleshooting. See *Electrical Troubleshooting* in Chapter Nine for its use.

Screw Pitch Gauge

A screw pitch gauge (**Figure 52**) determines the thread pitch of bolts, screws, studs, etc. The gauge

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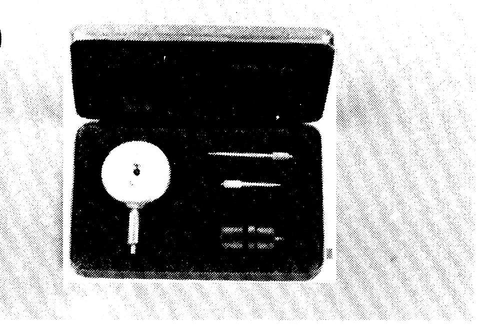

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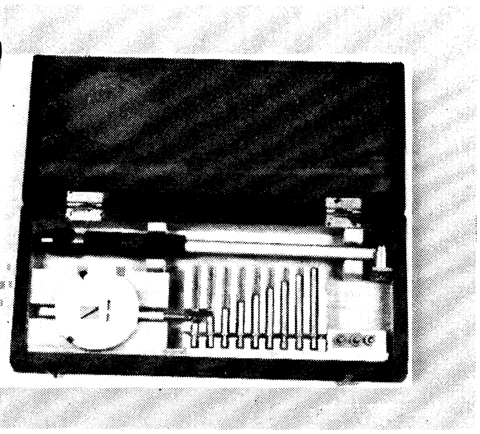

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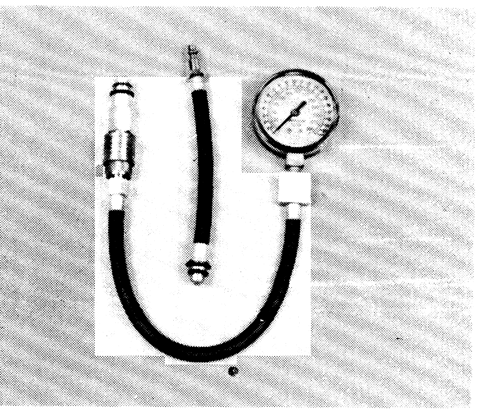


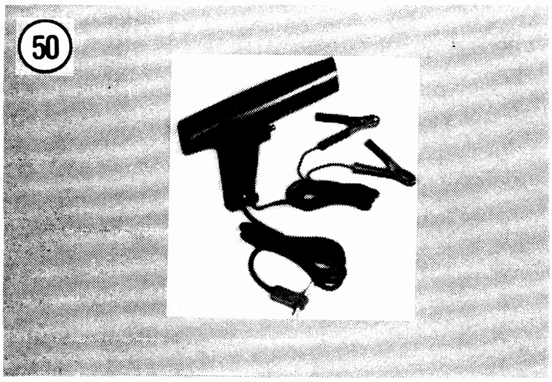
is made up of a number of thin plates. Each plate has a thread shape cut on one edge to match one thread pitch. When using a screw pitch gauge to determine a thread pitch size, try to fit different blade sizes onto the bolt thread until both threads match (**Figure 53**).

Magnetic Stand

A magnetic stand (**Figure 54**) is used to securely hold a dial indicator when checking the runout of a round object or when checking the end play of a shaft.

V-Blocks

V-blocks (**Figure 55**) are precision ground blocks used to hold a round object when checking its runout or condition. In motorcycle repair, V-blocks can be used when checking the runout of such items as valve stems, camshaft, balancer shaft, crankshaft, wheel axles and fork tubes.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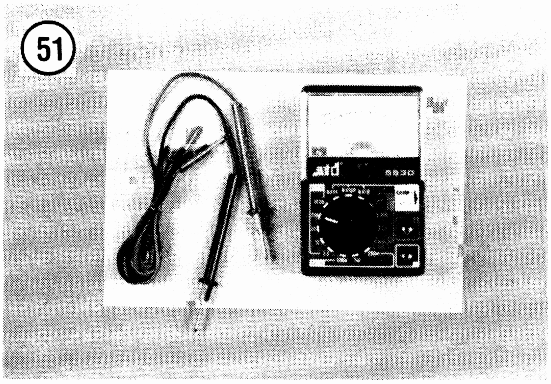
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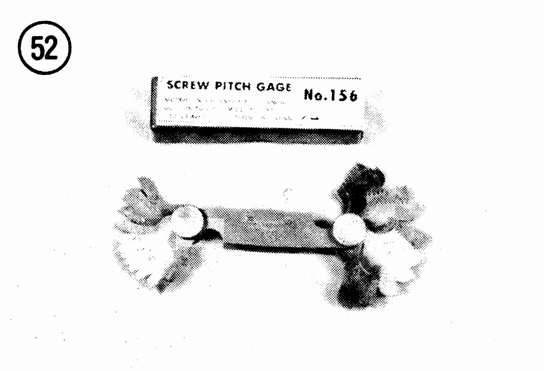

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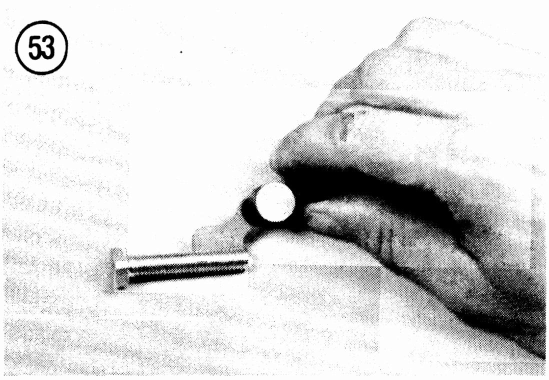
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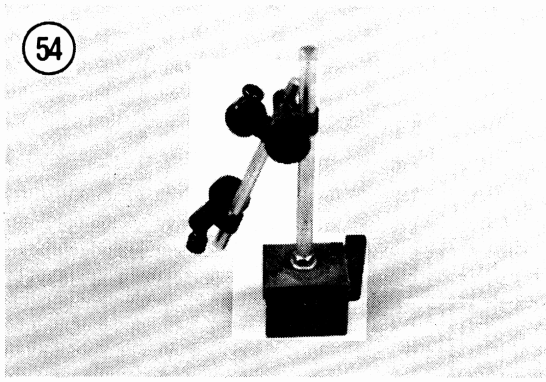
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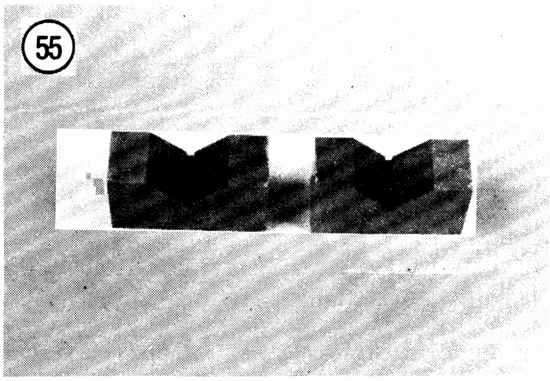
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SPECIAL TOOLS

A few special tools may be required for major service. These are described in the appropriate chapters and are available either from a Yamaha dealer or other manufacturers as indicated.

This section describes special tools unique to this type of bike's service and repair.

The Grabbit

The Grabbit (**Figure 56**) is a special tool used to hold the clutch boss when removing the clutch nut and to secure the drive sprocket when removing the sprocket nut.

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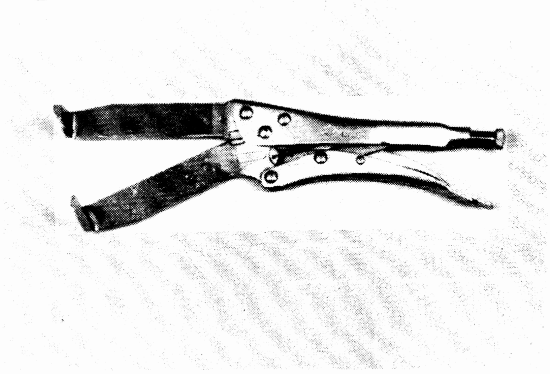

MECHANIC'S TIPS

Removing Frozen Nuts and Screws

When a fastener rusts and cannot be removed, several methods may be used to loosen it. First, apply penetrating oil such as Liquid Wrench or WD-40 (available at hardware or auto supply stores). Apply it liberally and let it penetrate for 10-15 minutes. Rap the fastener several times with a small hammer; do not hit it hard enough to cause damage. Reapply the penetrating oil if necessary.

For frozen screws, apply penetrating oil as described, then insert a screwdriver in the slot and rap the top of the screwdriver with a hammer. This loosens the rust so the screw can be removed in the

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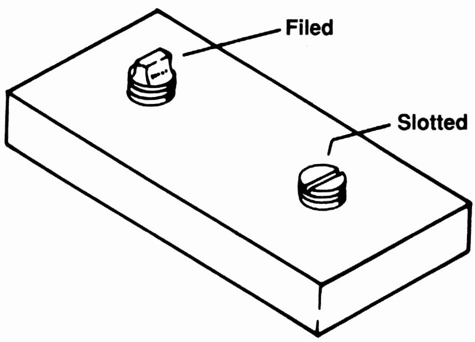

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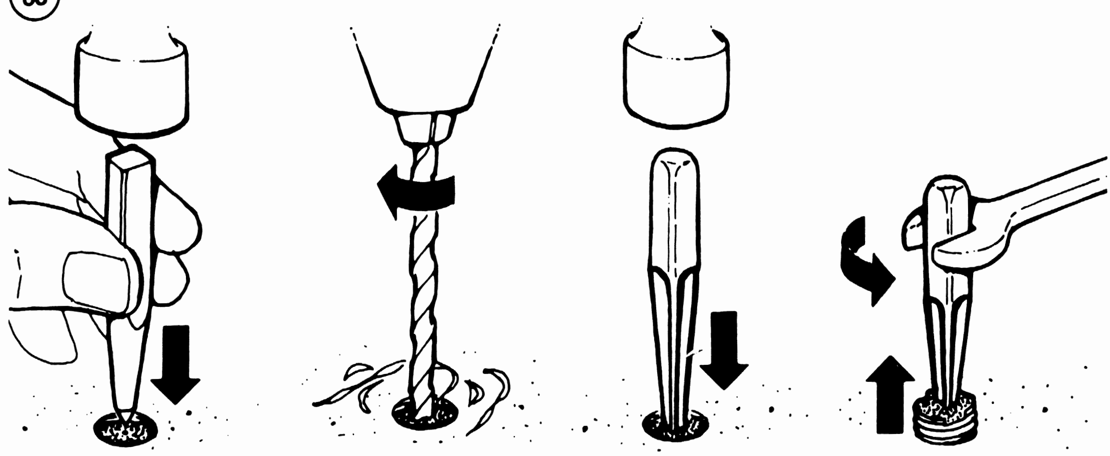
REMOVING BROKEN SCREWS AND BOLTS



normal way. If the screw head is too chewed up to use this method, grip the head with vise-grip pliers and twist the screw out.

Avoid applying heat unless specifically instructed, as it may melt, warp or remove the temper from parts.

Removing Broken Screws or Bolts

When the head breaks off a screw or bolt, several methods are available for removing the remaining portion.

If a large portion of the remainder projects out, try gripping it with vise-grip pliers. If the projecting portion is too small, file it to fit a wrench or cut a slot in it to fit a screwdriver. See **Figure 57**.

If the head breaks off flush, use a screw extractor. To do this, center punch the exact center of the remaining portion of the screw or bolt. Drill a small hole in the screw and tap the extractor into the hole. Back the screw out with a wrench on the extractor. See **Figure 58**.

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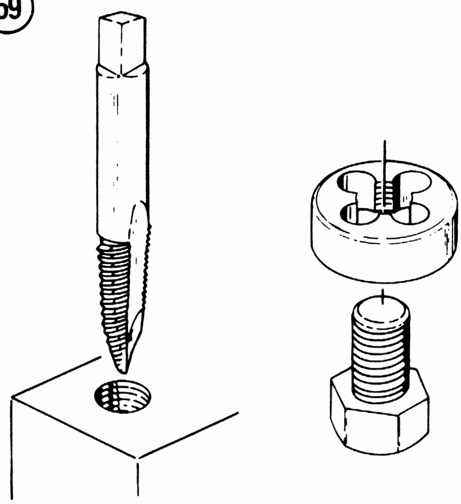

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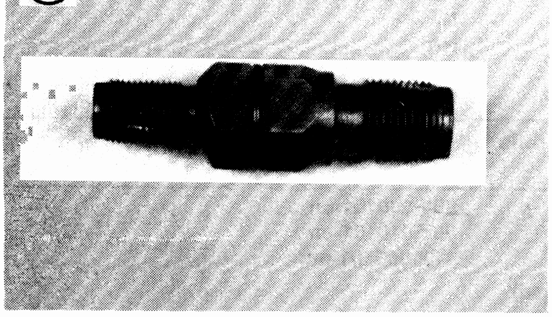

Remedying Stripped Threads

Occasionally, threads are stripped through carelessness or impact damage. Often the threads can be cleaned up by running a tap (for internal threads on nuts) or die (for external threads on bolts) through the threads. See **Figure 59**. To clean or repair spark plug threads, a spark plug tap can be used (**Figure 60**).

NOTE

*Tap and dies can be purchased individually or in a set as shown in **Figure 61**.*

If an internal thread is damaged, it may be necessary to install a Helicoil (**Figure 62**) or some other type of thread insert. Follow the manufacturer's instructions when installing their insert.

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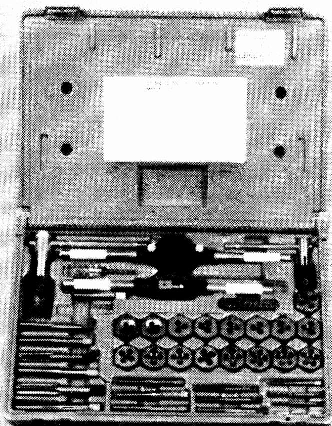

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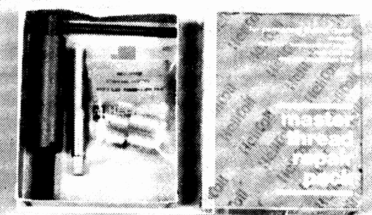


RIDING SAFETY

General Tips

1. Read your owner's manual and know your machine.
2. Check the throttle and brake controls before starting the engine.
3. Know how to make an emergency stop.
4. Never add fuel while anyone is smoking in the area or when the engine is running.
5. Never wear loose scarves, belts or boot laces that could catch on moving parts.
6. Always wear eye and head protection and protective clothing to protect your *entire* body. Today's riding apparel is very stylish and you will be ready for action as well as being well protected.
7. Riding in the winter months requires a good set of clothes to keep your body dry and warm, otherwise your entire trip may be miserable. If you dress properly, moisture will evaporate from your body. If you become too hot and if your clothes trap the moisture, you will become cold. Even mild temperatures can be very uncomfortable and dangerous when combined with a strong wind or traveling at high speed. See **Table 5** for wind chill factors. Always dress according to what the wind chill factor is, not the ambient temperature.
8. Never allow anyone to operate the bike without proper instruction. This is for their bodily protection and to keep your bike from damage or destruction.
9. Never attempt to repair your bike with the engine running except when necessary for certain tune-up procedures.
10. Check all of the machine components and hardware frequently, especially the wheels and the steering.

Table 1 ENGINE AND CHASSIS SERIAL NUMBERS

Model number	Year	Engine number/Chassis number
U.S. Models		
FJ1100L	1984	50H-000101-on
FJ1100LC	1984	47M-000101-on
FJ1100N	1985	50H-010101-on
FJ1100NC	1985	47M-010101-on
FJ1200S	1986	1UX-000101-on
FJ1200SC	1986	1WJ-000101-on
FJ1200T	1987*	1UX-010101-on
FJ1200TC	1987*	1WJ-010101-on
FJ1200W	1989	3SK-000101-on
FJ1200WC	1989	3SK-008101-on
FJ1200A	1990	3SK-010101-on
FJ1200AC	1990	3SK-015101-on
FJ1200B	1991	4AH-000101-on
FJ1200BC	1991	4AH-003101-on
FJ1200D Non-ABS	1992	4AH-005101-on
FJ1200DC Non-ABS	1992	4AH-008101-on
FJ1200D ABS equipped	1992	4CR-000101-on
FJ1200DC ABS equipped	1992	4CR-001101-on
FJ1200E Non-ABS	1993	NA
FJ1200EC Non-ABS	1993	NA
FJ1200E ABS equipped	1993	4CR-003101-on
FJ1200EC ABS equipped	1993	4CR-004101-on
U.K. Models		
Model number	**Year**	**Engine number/Chassis number**
FJ1100	1984	36Y-000101-on
FJ1100	1985	36Y-010101-on
FJ1200	1986	1TX-000101-on

(continued)

Table 1 ENGINE AND CHASSIS SERIAL NUMBERS (continued)

Model number	Year	Engine number/Chassis number
U.K. Models (continued)		
FJ1200	1987	1TX-010101-on
FJ1200	1988/1989	3CV-000101-on
FJ1200	1990	3CV-010101-on
FJ1200 Non-ABS	1991	3XW-000101-on
FJ1200 ABS equipped	1991	3XW-004101-on
FJ1200 Non-ABS	1992	3XW-009101-on
FJ1200 ABS equipped	1992	3XW-017101-on
FJ1200 Non-ABS	1993	NA
FJ1200 ABS equipped	1993	NA

* There was no 1988 U.S. model.
NA=Information not available from Yamaha.

Table 2 DECIMAL AND METRIC EQUIVALENTS

Fractions	Decimal in.	Metric mm	Fractions	Decimal in.	Metric mm
1/64	0.015625	0.39688	33/64	0.515625	13.09687
1/32	0.03125	0.79375	17/32	0.53125	13.49375
3/64	0.046875	1.19062	35/64	0.546875	13.89062
1/16	0.0625	1.58750	9/16	0.5625	14.28750
5/64	0.078125	1.98437	37/64	0.578125	14.68437
3/32	0.09375	2.38125	19/32	0.59375	15.08125
7/64	0.109375	2.77812	39/64	0.609375	15.47812
1/8	0.125	3.1750	5/8	0.625	15.87500
9/64	0.140625	3.57187	41/64	0.640625	16.27187
5/32	0.15625	3.96875	21/32	0.65625	16.66875
11/64	0.171875	4.36562	43/64	0.671875	17.06562
3/16	0.1875	4.76250	11/16	0.6875	17.46250
13/64	0.203125	5.15937	45/64	0.703125	17.85937
7/32	0.21875	5.55625	23/32	0.71875	18.25625
15/64	0.234375	5.95312	47/64	0.734375	18.65312
1/4	0.250	6.35000	3/4	0.750	19.05000
17/64	0.265625	6.74687	49/64	0.765625	19.44687
9/32	0.28125	7.14375	25/32	0.78125	19.84375
19/64	0.296875	7.54062	51/64	0.796875	20.24062
5/16	0.3125	7.93750	13/16	0.8125	20.63750
21/64	0.328125	8.33437	53/64	0.828125	21.03437
11/32	0.34375	8.73125	27/32	0.84375	21.43125
23/64	0.359375	9.12812	55/64	0.859375	21.82812
3/8	0.375	9.52500	7/8	0.875	22.22500
25/64	0.390625	9.92187	57/64	0.890625	22.62187
13/32	0.40625	10.31875	29/32	0.90625	23.01875
27/64	0.421875	10.71562	59/64	0.921875	23.41562
7/16	0.4375	11.11250	15/16	0.9375	23.81250
29/64	0.453125	11.50937	61/64	0.953125	24.20937
15/32	0.46875	11.90625	31/32	0.96875	24.60625
31/64	0.484375	12.30312	63/64	0.984375	25.00312
1/2	0.500	12.70000	1	1.00	25.40000

Table 3 GENERAL TIGHTENING TORQUES*

Nut	Bolt	ft.-lb.	N·m
10 mm	6 mm	4.5	6
12 mm	8 mm	11	15

(continued)

Table 3 GENERAL TIGHTENING TORQUES* (continued)

Nut	Bolt	ft.-lb.	N•m
14 mm	10 mm	22	30
17 mm	12 mm	40	55
19 mm	14 mm	61	85
22 mm	16 mm	94	130

*This table lists general torque for standard fasteners with standard I.S.O. pitch threads.

Table 4 WORKSHOP TOOLS

Tool	Size or specification
Screwdriver	
Common	1/8 × 4 in. blade
Common	5/16 × 8 in. blade
Common	3/8 × 12 in. blade
Phillips	Size 2 tip, 6 in. overall
Pliers	
Slip joint	6 in. overall
Vise-grips	10 in. overall
Needlenose	6 in. overall
Channel lock	12 in. overall
Snap ring	Assorted
Wrenches	
Box-end set	Assorted
Open-end set	Assorted
Crescent	6 in. and 12 in. overall
Socket set	1/2 in. drive ratchet with assorted metric sockets
Socket drive extensions	1/2 in. drive, 2 in., 4 in. and 6 in.
Socket universal joint	1/2 in. drive
Allen	Socket driven (long and short), T-handle driven and 90°
Hammers	
Soft faced	—
Plastic faced	—
Metal faced	—
Other special tools	
Impact driver	1/2 in. drive with assorted bits
Torque wrench	1/2 in. driver (ft.-lb.)
Flat feeler gauge	Metric set

Table 5 WINDCHILL FACTOR

Estimated Wind Speed in MPH	Actual Thermometer Reading (° F)*											
	50	40	30	20	10	0	–10	–20	–30	–40	–50	–60
	Equivalent Temperature (° F)*											
Calm	50	40	30	20	10	0	–10	–20	–30	–40	–50	–60
5	48	37	27	16	6	–5	–15	–26	–36	–47	–57	–68
10	40	28	16	4	–9	–21	–33	–46	–58	–70	–83	–95
15	36	22	9	–5	–18	–36	–45	–58	–72	–85	–99	–112
20	32	18	4	–10	–25	–39	–53	–67	–82	–96	–110	–124
25	30	16	0	–15	–29	–44	–59	–74	–88	–104	–118	–133
30	28	13	–2	–18	–33	–48	–63	–79	–94	–109	–125	–140
35	27	11	–4	–20	–35	–49	–67	–82	–98	–113	–129	–145
40	26	10	–6	–21	–37	–53	–69	–85	–100	–116	–132	–148
**	Little Danger (for properly clothed person)				Increasing Danger			Great Danger				
					• Danger from freezing of exposed flesh •							

* To convert Fahrenheit (°F) to Celsius (°C), use the following formula: °C = 5/9 × (°F – 32).
** Wind speeds greater than 40 mph have little additional effect.

CHAPTER TWO

TROUBLESHOOTING

Every motorcycle engine requires an uninterrupted supply of fuel and air, proper ignition and adequate compression. If any of these are lacking, the engine will not run.

Diagnosing mechanical problems is relatively simple if you use orderly procedures and keep a few basic principles in mind.

The troubleshooting procedures in this chapter analyze typical symptoms and show logical methods of isolating causes. These are not the only methods. There may be several ways to solve a problem, but only a systematic approach can guarantee success.

Never assume anything. Do not overlook the obvious. If you are riding along and the bike suddenly quits, check the easiest, most accessible problem spots first. Is there gasoline in the tank? Has a spark plug *wire fall*en off?

If nothing obvious turns up in a quick check, look a little further. Learning to recognize and describe symptoms will make repairs easier for you or a mechanic at the shop. Describe problems accurately and fully. Saying that "it won't run" isn't the same thing as saying "it quit at high speed and won't start," or that "it sat in my garage for 3 months and then wouldn't start."

Gather as many symptoms as possible to aid in diagnosis. Note whether the engine lost power gradually or all at once. Remember that the more complicated a machine is, the easier it is to troubleshoot because symptoms point to specific problems.

After the symptoms are defined, areas which could cause problems are tested and analyzed. Guessing at the cause of a problem may provide the solution, but it can easily lead to frustration, wasted time and a series of expensive, unnecessary parts replacements.

You do not need fancy equipment or complicated test gear to determine whether repairs can be attempted at home. A few simple checks could save a large repair bill and lost time while the bike sits in a dealer's service department. On the other hand, be realistic and don't attempt repairs beyond your abilities. Service departments tend to charge heavily for putting together a disassembled engine that may have been abused. Some won't even take on such a job—so use common sense and don't get in over your head.

OPERATING REQUIREMENTS

An engine needs 3 basics to run properly: correct fuel/air mixture, compression and a spark at the correct time. If one or more are missing, the engine will not run. Four-stroke engine operating principles are described under *Engine Principles* in Chapter Four. The electrical system is the weakest link of the 3 basics. More problems result from electrical breakdowns than from any other source. Keep that in mind before you begin tampering with carburetor adjustments and the like.

If the machine has been sitting for any length of time and refuses to start, check and clean the spark plugs and then look to the gasoline delivery system. This includes the fuel tank, fuel pump, fuel filter, fuel shutoff valve and fuel line to the carburetor assembly. Gasoline deposits may have formed and gummed up the carburetor jets and air passages. Gasoline tends to lose its potency after standing for long periods. Condensation may contaminate the fuel with water. Drain the old fuel (fuel tank, fuel lines and carburetors) and try starting with a fresh tankful.

TROUBLESHOOTING INSTRUMENTS

Chapter One lists the instruments needed and instruction on their use.

TROUBLESHOOTING

When the bike is difficult to start, or won't start at all, it doesn't help to wear down the battery using the electric starter. Check for obvious problems even before getting out your tools. Go down the following list step by step. Do each one; you may be embarrassed to find the engine stop switch off, but that is better than wearing down the battery.

Engine Fails to Start

If the bike will not start, perform the following checks in order:

a. Fuel system check.
b. Compression check.
c. Battery check.
d. Ignition system check.

Fuel system check

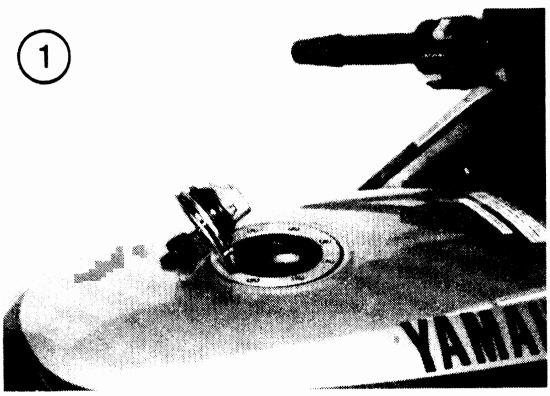
WARNING
Do not use an open flame to check in the tank. A serious explosion is certain to result.

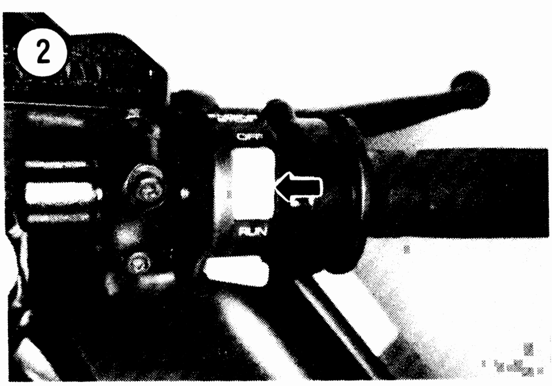
1. Is there fuel in the tank? Remove or open the filler cap (**Figure 1**) and rock the bike. Listen for fuel sloshing around.

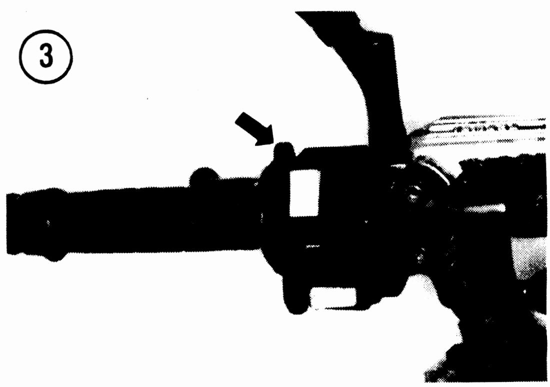
2. Is the fuel shutoff valve in the ON position and, on models so equipped, is the vacuum line to the valve from the engine still connected?

3. Make sure the engine stop switch (**Figure 2**) is not in the OFF position.

4. Is the choke in the correct position? On 1984-1985 models, the choke lever (**Figure 3**) should be rotated *toward* you for a cold engine and rotated *away* for a warm engine. On 1986-on models, the choke knob (**Figure 4**) should be pulled *up* for a cold engine and pushed *down* for a warm engine.







Compression check

A compression test shows how much pressure builds in a cylinder during starting. If the compression falls below specified levels, the engine will become difficult to start or will not start. Refer to *Compression Testing* in Chapter Three. Interpret results as follows:

a. Normal: Perform the *Ignition Check* in this chapter.
b. Abnormal: If the engine compression is low, perform the procedures listed under *Compression Testing* in Chapter Three.

Ignition check

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.
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 spark plug, wire or connector with fingers or a serious electrical shock may result. If necessary, use a pair of insulated 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.

NOTE
If the starter does not operate or if the starter motor rotates but the engine does not turn over, refer to ***Engine Will Not Crank*** *in this section.*

4. If the spark is good, recheck the fuel and compression systems.
5. If the spark is not good, check for one or more of the following:

a. Loose electrical connections.
b. Dirty electrical connections.
c. Loose or broken ignition coil ground wire.
d. Broken or shorted high tension lead to the spark plug(s).
e. Ignition unit malfunction.
f. Clutch or sidestand switch malfunction.
g. Ignition or engine stop switch malfunction.
h. Blown fuse.

Battery check

If ignition system tests okay, but the starter turns slowly, service the battery as described under *Battery* in Chapter Three.

Engine is Difficult to Start

Check for one or more of the following possible malfunctions:

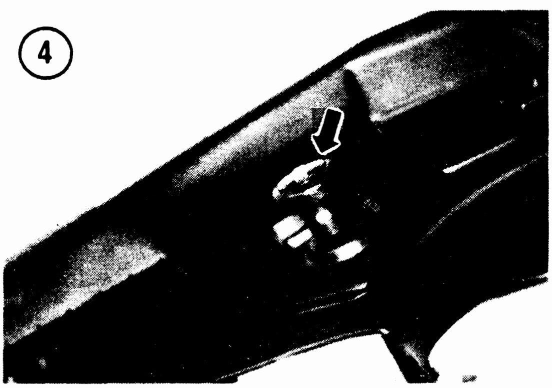
a. Fouled spark plug(s).
b. Improperly adjusted choke.
c. Intake manifold air leak.
d. Contaminated fuel system.
e. Improperly adjusted carburetor(s).
f. Weak ignition unit.
g. Weak ignition coil(s).
h. Poor compression.
i. Engine and transmission oil too heavy.

Engine Will Not Crank

Check for one or more of the following possible malfunctions:

a. Blown fuse.
b. Discharged battery.
c. Defective starter motor.
d. Seized piston(s).
e. Seized crankshaft bearings.

4



f. Broken connecting rod(s).
g. Sidestand, neutral or clutch safety switch(s) malfunction.
h. Engine stop switch malfunction.
i. Defective starter motor button and contact.

ENGINE PERFORMANCE

In the following checklist, it is assumed that the engine runs, but is not operating at peak performance. This *will* serve as a starting point from which to isolate a performance malfunction.

Engine Will Not Idle

a. Carburetor(s) incorrectly adjusted.
b. Fouled or improperly gapped spark plug(s).
c. Leaking head gasket.
d. Obstructed fuel line or fuel shutoff valve.
e. Obstructed fuel filter.
f. Fuel pump malfunction (models so equipped).
g. Ignition timing incorrect due to defective ignition component(s).
h. Valve clearance incorrect.

Engine Misses at High Speed

a. Fouled or improperly gapped spark plugs.
b. Improper carburetor main jet selection.
c. Ignition timing incorrect due to defective ignition component(s).
d. Weak ignition coil(s).
e. Obstructed fuel line or fuel shutoff valve.
f. Obstructed fuel filter.
g. Fuel pump malfunction (models so equipped).
h. Clogged carburetor jets.
i. Dirty air filter element.

Engine Overheating

a. Incorrect carburetor adjustment or jet selection.
b. Ignition timing retarded due to defective ignition component(s).
c. Improper spark plug heat range.
d. Clogged or dirty cooling fins on cylinder and cylinder head.
e. Oil level low.
f. Oil not circulating properly.
g. Valves leaking.
h. Heavy engine carbon deposits.
i. Dragging brake(s).
j. Clutch slipping.

2

Smoky Exhaust and Engine Runs Roughly

a. Clogged air filter element.
b. Carburetor adjustment incorrect—mixture too rich.
c. Choke not operating correctly.
d. Water or other contaminants in fuel.
e. Clogged fuel line.
f. Spark plugs fouled.
g. Ignition coil defective.
h. Ignition unit or pickup coil defective.
i. Loose or defective ignition circuit wire.
j. Short circuit from damaged wire insulation.
k. Loose battery cable connection.
l. Valve timing incorrect.
m. Intake manifold or air filter air leak.

Engine Loses Power at Normal Riding Speed

a. Carburetor incorrectly adjusted.
b. Engine overheating.
c. Ignition timing incorrect due to defective ignition component(s).
d. Incorrectly gapped spark plugs.
e. Obstructed muffler.
f. Dragging brake(s).

Engine Lacks Acceleration

a. Carburetor mixture too lean.
b. Clogged fuel line.
c. Ignition timing incorrect due to defective ignition component(s).
d. Dragging brake(s).
e. Slipping clutch.

ENGINE NOISES

Often the first evidence of an internal engine problem is a strange noise. That knocking, clicking or tapping sound which you never heard before may be warning you of impending trouble.

While engine noises can indicate problems, they are difficult to interpret correctly; inexperienced mechanics can be seriously misled by them.

Professional mechanics often use a special stethoscope (which looks like a doctor's stethoscope) for isolating engine noises. You can do nearly as well with a "sounding stick" which can be an ordinary piece of doweling, a length of broom handle or a section of small hose. By placing one end in contact with the area to which you want to listen and the other end near your year, you can hear sounds emanating from that area. The first time you do this, you may be horrified at the strange sounds coming from even a normal engine. If you can, have an experienced friend or mechanic help you sort out the noises.

Consider the following when troubleshooting engine noises:

1. *Knocking or pinging during acceleration*—Caused by using a lower octane fuel than recommended. May also be caused by poor fuel. Pinging can also be caused by a spark plug of the wrong heat range or carbon build-up in the combustion chamber. Refer to *Correct Spark Plug Heat Range* and *Compression Test* in Chapter Three.

2. *Slapping or rattling noises at low speed or during acceleration*—May be caused by piston slap, i.e., excessive piston-cylinder wall clearance.

3. *Knocking or rapping while decelerating*—Usually caused by excessive rod bearing clearance.

4. *Persistent knocking and vibration*—Usually caused by worn main bearing(s).

5. *Rapid on-off squeal*—Compression leak around cylinder head gasket or spark plug(s).

6. *Valve train noise*—Check for the following:

   a. Valves adjusted incorrectly.

   b. Valve sticking in guide.

   c. Low oil pressure.

ENGINE LUBRICATION

An improperly operating engine lubrication system will quickly lead to engine seizure. The engine oil level should be checked weekly and topped up, as described in Chapter Three. Oil pump service is described in Chapter Four.

Oil Consumption High or Engine Smokes Excessively

a. Worn valve guides.
b. Worn or damaged piston rings.

Excessive Engine Oil Leaks

a. Clogged air filter breather hose.
b. Loose engine parts.
c. Damaged gasket sealing surfaces.

Black Smoke

a. Clogged air filter element.
b. Incorrect carburetor fuel level (too high).
c. Choke stuck open.
d. Incorrect main jet (too large).

Grey Smoke

a. Worn valve guide.
b. Worn valve oil seal.
c. Worn piston ring oil ring.
d. Excessive cylinder and/or piston wear.

CLUTCH

The four basic clutch troubles are:

a. Clutch noise.
b. Clutch slipping.
c. Improper clutch disengagement or dragging.
d. Low hydraulic level in master cylinder or air in hydraulic fluid line.

All clutch troubles, except adjustments, require partial clutch disassembly to identify and cure the problem. The troubleshooting chart in **Figure 5** lists clutch troubles and checks to make. Refer to Chapter Five for clutch service procedures.

TRANSMISSION

The basic transmission troubles are:

a. Excessive gear noise.
b. Difficult shifting.
c. Gears pop out of mesh.
d. Incorrect shift lever operation.

Transmission symptoms are sometimes hard to distinguish from clutch symptoms. The troubleshooting chart in **Figure 6** lists transmission trou-

5 CLUTCH TROUBLESHOOTING

Problem	Check
Clutch slipping	Check: • Incorrect clutch adjustment • Weak clutch springs • Worn clutch plates • Damaged pressure plate • Clutch release mechanism damage
Clutch dragging	• Incorrect clutch adjustment • Clutch spring tension uneven • Warped clutch plates • Excessive clutch lever play • Clutch housing damage
Excessive clutch noise	• Damaged clutch gear teeth • Worn or warped clutch plates

6 TRANSMISSION TROUBLESHOOTING

Problem	Check
Excessive gear noise	Check: • Worn bearings • Worn or damaged gears • Excessive gear backlash
Difficult shifting	Check: • Damaged gears • Damaged shift forks • Damaged shift drum • Damaged shift lever assembly • Incorrect main shaft and countershaft engagement • Incorrect clutch disengagement
Gears pop out of mesh	Check: • Worn gear or transmission shaft splines • Shift forks worn or bent • Worn dog holes in gears • Insufficient shift lever spring tension • Damaged shift lever linkage
Incorrect shift lever operation	Check: • Bent shift lever • Bent or damaged shift lever shaft • Damaged shift lever linkage or gears
Incorrect shifting after engine reassembly	Check: • Missing transmission shaft shims • Incorrectly installed parts • Shift forks bent during reassembly • Incorrectly assembled crankcase assembly • Incorrect clutch adjustment • Incorrectly assembled shift linkage assembly

bles and checks to make. Refer to Chapter Six for transmission service procedures. Be sure that the clutch is not causing the trouble before working on the transmission.

ELECTRICAL PROBLEMS

If bulbs burn out frequently, the cause may be excessive vibration, loose connections that permit sudden current surges or the installation of the wrong type of bulb.

Most light and ignition problems are caused by loose or corroded ground connections. Check these prior to replacing a bulb or electrical component.

EXCESSIVE VIBRATION

Usually this is caused by loose engine mounting hardware. If not, it can be difficult to find without disassembling the engine. High speed vibration may be due to a bent axle shaft or loose or faulty suspension components. Vibration can also be caused by the following conditions:

a. Broken frame.
b. Worn drive chain.
c. Improperly balanced wheels.
d. Defective or damaged wheels.
e. Defective or damaged tires.
f. Internal engine wear or damage.

CARBURETOR TROUBLESHOOTING

Basic carburetor troubleshooting procedures are found in **Figure 7**.

FRONT SUSPENSION AND STEERING

Poor handling may be caused by improper tire pressure, a damaged or bent frame or front steering components, worn wheel bearings or dragging brakes. Possible causes of suspension and steering malfunctions are listed in the following.

Irregular or Wobbly Steering

a. Loose wheel axle nuts.
b. Loose or worn steering head bearings.
c. Excessive wheel hub bearing play.
d. Damaged wheel.
e. Unbalanced wheel assembly.
f. Worn hub bearings.
g. Incorrect wheel alignment.
h. Bent or damaged steering stem or frame (at steering neck).
i. Tire incorrectly seated on rim.
j. Excessive front end loading from non-standard equipment.
k. Damaged fairing assembly.
l. Loose fairing mounts or brackets.

Stiff Steering

a. Low front tire air pressure.
b. Bent or damaged steering stem or frame (at steering neck).
c. Loose or worn steering head bearings.

Stiff or Heavy Fork Operation

a. Incorrect fork springs.
b. Incorrect fork oil viscosity.
c. Incorrect fork adjustment.
d. Excessive amount of fork oil.
e. Bent fork tubes.

Poor Fork Operation

a. Worn or damage fork tubes.
b. Fork oil level low due to leaking fork seals.
c. Incorrect fork adjustment.
d. Bent or damaged fork tubes.
e. Contaminated fork oil.
f. Worn fork springs.
g. Heavy front end loading from non-standard equipment.

Poor Rear Shock Absorber Operation

a. Damper unit leaking.
b. Incorrect rear shock adjustment.
c. Heavy rear end loading from non-standard equipment.
d. Incorrect loading.

BRAKE PROBLEMS

Sticking disc brakes may be caused by a stuck piston(s) in a caliper assembly, warped pad shim(s) or improper rear brake adjustment. See **Figure 8** for disc brake troubles and checks to make.

7

CARBURETOR TROUBLESHOOTING

Problem	Check
Hard starting	Check: • Choke not operating correctly • Idle mixture misadjusted • Air leak at carburetor mount or hose • Fuel overflow
Fuel overflow	Check: • Worn float needle valve or dirty seat • Incorrect float level • Damaged float bowl O-ring • Damaged float pin • Damaged float
Poor idling	Check: • Idle misadjusted • Worn idle mixture screw • Blocked jet or port in carburetor bore • Air leak at carburetor mount
Poor acceleration	Check: • Clogged pilot jet • Float level too high • Idle mixture misadjusted
Low power at all speeds	Check: • Dirty or plugged carburetor passages • Clogged fuel line • Clogged fuel tank strainer • Air leak at carburetor mount • Dirty air filter • Loose carburetor jets
Poor power at high speeds	Check: • Loose or clogged main jet • Incorrect float level • Dirty or plugged carburetor passages
Fuel starvation	Check: • Clogged fuel line • Carburetor dirty • Fuel tank strainer clogged or dirty • Fuel tank dirty

8 DISC BRAKE TROUBLESHOOTING

Problem	Check
Disc brake fluid leakage	Check: • Loose or damaged line fittings • Worn caliper piston seals • Scored caliper piston and/or bore • Loose banjo bolts • Damaged sealing washers • Leaking master cylinder diaphragm • Leaking master cylinder secondary seal • Cracked master cylinder housing • Too high brake fluid level • Loose master cylinder cover
Brake overheating	Check: • Warped brake disc • Incorrect brake fluid • Caliper piston and/or brake pads hanging up • Riding brakes during riding
Brake chatter	Check: • Warped brake disc • Loose brake disc • Incorrect caliper alignment • Loose front axle nut and/or clamps • Worn wheel bearings • Damaged front hub • Restricted brake hydraulic line • Contaminated brake pads
Brake locking	Check: • Incorrect brake fluid • Plugged passages in master cylinder • Incorrect front brake adjustment • Caliper piston and/or brake pads hanging up • Warped brake disc
Insufficient brakes	Check: • Air in brake lines • Worn brake pads • Low brake fluid level • Incorrect brake fluid • Worn brake disc • Worn caliper piston seals • Glazed brake pads • Leaking primary cup seal in master cylinder • Contaminated brake pads and/or disc
Brake squeal	Check: • Contaminated brake pads and/or disc • Dust or dirt collected behind brake pads • Loose parts

CHAPTER THREE

3

PERIODIC LUBRICATION, MAINTENANCE AND TUNE-UP

A motorcycle, even in normal use, is subjected to tremendous heat, stress and vibration. When neglected, any bike becomes unreliable and actually dangerous to ride.

To gain the utmost in safety, performance and useful life from the Yamaha FJ1100 and FJ1200, it is necessary to make periodic inspections and adjustments. Frequently minor problems are found during these inspections that are simple and inexpensive to correct at the time. If they are not found and corrected at this time they could lead to major and more expensive problems later on.

When neglected, any bike becomes unreliable and actually dangerous to ride. When properly maintained, your Yamaha 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. Start out by doing simple tune-up, lubrication and maintenance. Tackle more involved jobs as you become more acquainted with the bike.

Table 1 is a suggested factory maintenance schedule. **Tables 1-8** are located at the end of this 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.

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.

General Inspection

1. Examine the engine for signs of oil or fuel leakage.
2. Check the tires for imbedded stones. Pry them out with a suitable tool.
3. Make sure all lights work.

NOTE

At least check the brake light. It can burn out anytime. Motorists cannot stop *as quickly as you and need all the warning you can give.*

Tire Pressure

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

Battery

Non-sealed type

The battery must be removed to check the electrolyte level. For complete details see *Battery Removal/Installation and Electrolyte Level Check* in this chapter.

Sealed type

There is no routine upkeep on the sealed battery other than to keep the terminals free of corrosion and keep the terminal screws securing the leads to the battery tight.

The electrolyte level cannot be corrected on a sealed battery as the battery top is not removable.

Crankcase Breather Hose

1. Remove the seat and frame side covers as described in Chapter Twelve.
2. Make sure the crankcase ventilation hose is attached to the base of the air filter housing and to the crankcase and that the clamps are tight.
3. Install the seat.

Evaporative Emission Control System (California Models)

1. Remove the seat as described in Chapter Twelve.
2. Remove the fuel tank as described in Chapter Seven.
3. Make sure all ventilation hoses (**Figure 1**) are attached to the canisters and to the carburetor assembly and that all clamps are tight.
4. Inspect all other hoses to make sure they are not kinked or bent and that they are securely connected to their respective parts.
5. Install the seat and fuel tank.

Lights and Horn

With the engine running, check the following.

1. Pull the front brake lever and check that the brake light comes on.
2. Push the rear brake pedal and check that the brake light comes on soon after you have begun depressing the pedal.
3. With the engine running, check to see that the headlight and taillight are on.

4A. On U.S. models, move the dimmer switch up and down between the high and low positions and check to see that both headlight elements are working.

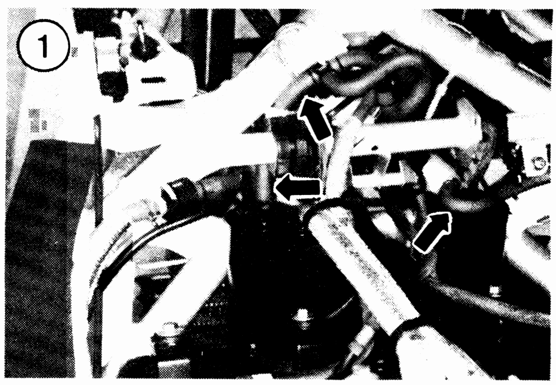
4B. On U.K. models, turn the light switch on and off and check to see that both headlight elements are working. Also check the passing light operation.

5. Push the turn signal switch to the left position and to the right position and check that all 4 turn signal lights are working.
6. Push the horn button and note that the horn blows loudly.
7. If the horn or any light failed to work properly, refer to Chapter Eight.

PRE-CHECKS

The following checks should be performed prior to the first ride of the day.

1. Inspect all fuel lines and fittings for wetness.
2. Make sure the fuel tank is full of fresh gasoline.
3. Make sure the engine oil level is correct.
4. Check the operation of the front and rear brakes. Add hydraulic fluid to the front and/or rear brake master cylinder(s) if necessary.
5. Check the operation of the clutch. Add hydraulic fluid to the clutch master cylinder if necessary.



6. Check the throttle and the rear brake pedal. Make sure they operate properly with no binding.
7. Inspect the front and rear suspension; make sure they have a good solid feel with no looseness.
8. Check tire pressure. Refer to **Table 2**.
9. Check the exhaust system for damage or leaks.
10. Check the tightness of all fasteners, especially engine mounting hardware.

MAINTENANCE INTERVALS

The services and intervals shown in **Table 1** are recommended by the Yamaha 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 convenience when maintaining 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 *Table of Contents* and *Index* can help you locate a particular service procedure.

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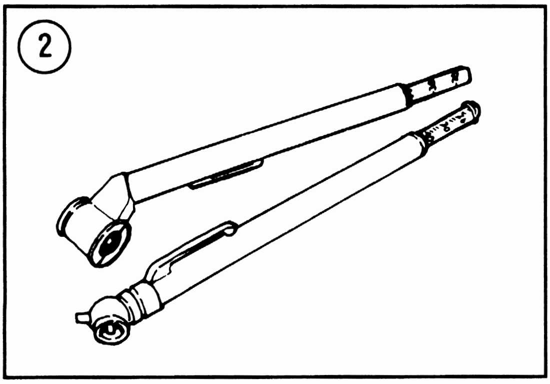

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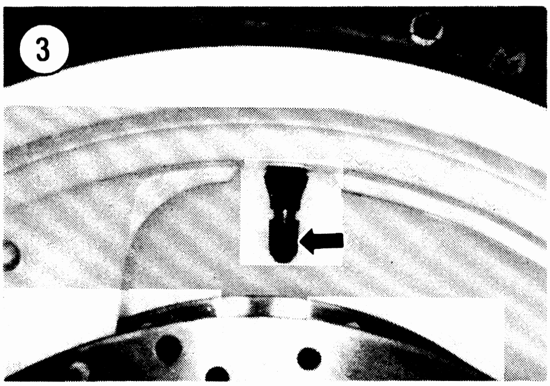

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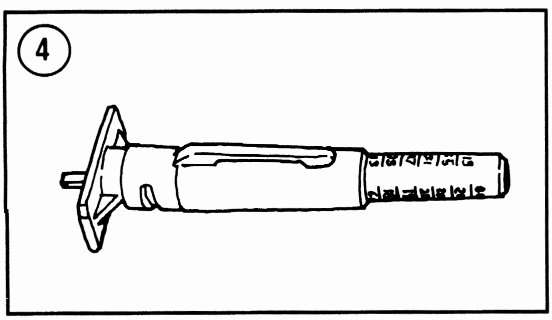

TIRES

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** for factory equipped tires. If aftermarket tires have been installed, refer to inflation pressure information provided by the tire manufacturer.

NOTE
*After checking and adjusting the air pressure, make sure to reinstall the air valve cap (**Figure 3**). The cap prevents small pebbles and/or dirt from collecting in the valve stem; this could allow air leakage or result in incorrect tire pressure readings.*

Tire Inspection

The likelihood of tire failure increases with tread wear. It is estimated that the majority of all tire failures occur during the last 10% of usable tread wear. Check tire tread for excessive wear, deep cuts, embedded objects such as stones, nails, etc. Check also for high spots that indicate internal tire damage. Replace tires that show high spots or swelling. If you find a nail in a tire, mark its location with a light crayon before pulling it out. This will help locate the hole for repair. Refer to *Tubeless Tires and Tubeless Tire Changing* in Chapter Nine.

Measure tread wear at the center of the tire with a tread depth gauge (**Figure 4**) or small ruler. Because tires sometimes wear unevenly, measure wear at several points. Minimum tread depth for front and rear tires is 1.0 mm (0.04 in.).

Rim Inspection

Frequently inspect the wheel rims (**Figure 5**). If a rim has been damaged it might have been knocked out of alignment. Improper wheel alignment can cause severe vibration and result in an unsafe riding condition. If the rim portion of an alloy wheel is damaged the wheel must be replaced as it cannot be repaired.

BATTERY (NON-SEALED TYPE)

The battery is an important component in the electrical system. It is also the one most frequently neglected. In addition to checking and correcting the battery electrolyte level on a weekly basis, the battery should be cleaned and inspected at periodic intervals.

A non-sealed battery should be checked periodically for electrolyte level, state of charge and corrosion. During hot weather periods, frequent checks are recommended. If the electrolyte level is below the fill line, add distilled water as required. To assure proper mixing of the water and acid, operate the engine immediately after adding water. *Never* add battery acid instead of water; this will shorten the battery's life.

CAUTION

If it becomes necessary to remove the battery breather tube when performing any of the following procedures, make sure to route the tube correctly during installation to prevent electrolyte or gas from spewing onto the frame, chain or any other component. Incorrect breather tube routing can cause structural and/or cosmetic damage.

Removal/Installation and Electrolyte Level Check

The battery is the heart of the electrical system. It should be checked and serviced as indicated in **Table 1**. Most 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 (**Figure 6**). If the electrolyte level is low, it's a good idea to completely clean, service and check the battery.

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.

1. Remove the frame side covers and the seat as described in Chapter Twelve.
2. Disconnect the battery hold-down strap (A, **Figure 7**).
3. Disconnect the negative (–) battery cable (C, **Figure 7**) from the battery.
4. Disconnect the positive (+) battery cable (B, **Figure 7**).
5. Lift the battery (D, **Figure 7**) up slightly and disconnect the battery breather tube.
6. Lift the battery out of the battery box and remove it.

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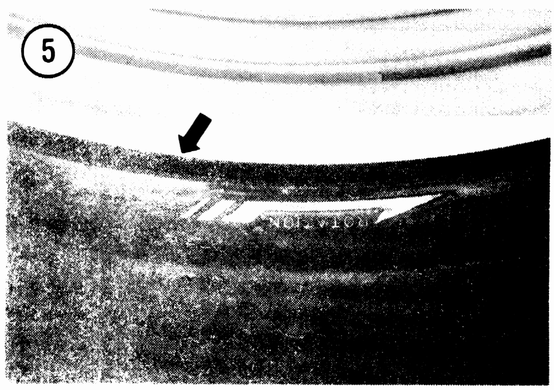

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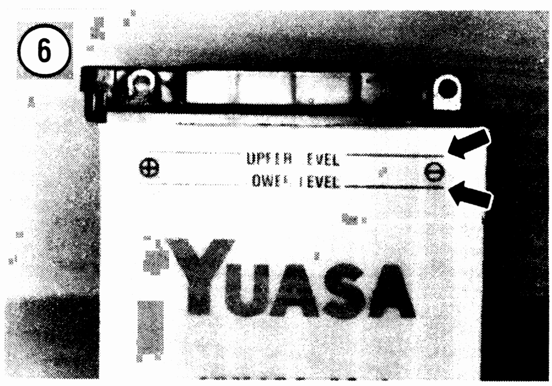


CAUTION

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.

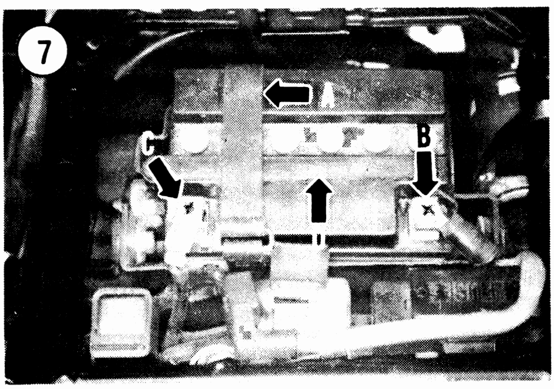
7. Rinse the battery off with clean water and wipe dry.

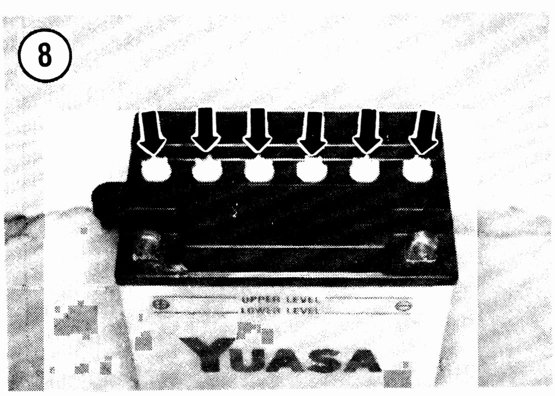
8. Remove the caps (**Figure 8**) from the battery cells and add distilled water. Never add electrolyte (acid) to correct the level. Fill only to the upper battery level mark (**Figure 6**).

9. 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 9**). Follow the manufacturer's instructions for reading the instrument. See *Battery Testing* in this chapter.

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.*





10. 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 to the battery. If the tube was removed with the battery, make sure to route it in its correct position.

Testing

Hydrometer testing is the best way to check battery condition. Use a hydrometer with numbered graduations from 1.100 to 1.300 rather than one with just color-coded bands. To use the hydrometer, squeeze the rubber ball, insert the tip into the cell and release the ball. Draw enough electrolyte to float the weighted float inside the hydrometer (**Figure 9**). Note the number in line with the electrolyte surface; this is the specific gravity for this cell. Return the electrolyte to the cell from which it came.

The specific gravity of the electrolyte in each battery cell is an excellent indication of that cell's condition as indicated in **Table 3**. A fully charged cell will read 1.275-1.280 while a cell in good condition reads from 1.225-1.250 and anything below 1.225 is practically dead.

NOTE

Specific gravity varies with temperature. For each 10° that electrolyte temperature exceeds 80° F (27° C), add 0.004 to reading indicated on hydrome-

ter. Subtract 0.004 for each 10° below 80° F (27° C).

If the cells test in the poor range, the battery requires recharging. The hydrometer is useful for checking the progress of the charging operation. **Table 3** shows approximate state of charge.

Charging

CAUTION
Always remove the battery from the motorcycle before connecting charging equipment.

WARNING
During charging, highly explosive hydrogen gas is released from the battery. The battery should be charged only in a well-ventilated area, and open flames and any smoking material should be kept away. Never check the charge of the battery by arcing across the terminals; the resulting spark can ignite the hydrogen gas.

1. Remove the battery from the motorcycle as described in this chapter.
2. Connect the positive (+) charger lead to the positive battery terminal and the negative (–) charger lead to the negative battery terminal.
3. Remove all vent caps from the battery, set the charger at 12 volts, and switch it on. Normally, a battery should be charged at a slow charge rate of 1/10 its given capacity.

CAUTION
The electrolyte level must be maintained at the upper level during the charging cycle; check and refill as necessary.

4. The charging time depends on the discharged condition of the battery. The chart in **Figure 10** can be used to determine approximate charging times at different specific gravity readings. For example, if the specific gravity of your battery is 1.180, the approximate charging time would be 6 hours.
5. To ensure good electrical contact, cables must be clean and tight on the battery's terminals. If the cable's terminals are badly corroded, even after performing the above cleaning procedures, the cables should be disconnected, removed from the bike and cleaned separately with a wire brush and a baking soda solution. After cleaning, apply a very thin coating of petroleum jelly (Vaseline) to the battery terminals before reattaching the cables. After connecting the cables, apply a light coating to the connections also—this will delay future corrosion.

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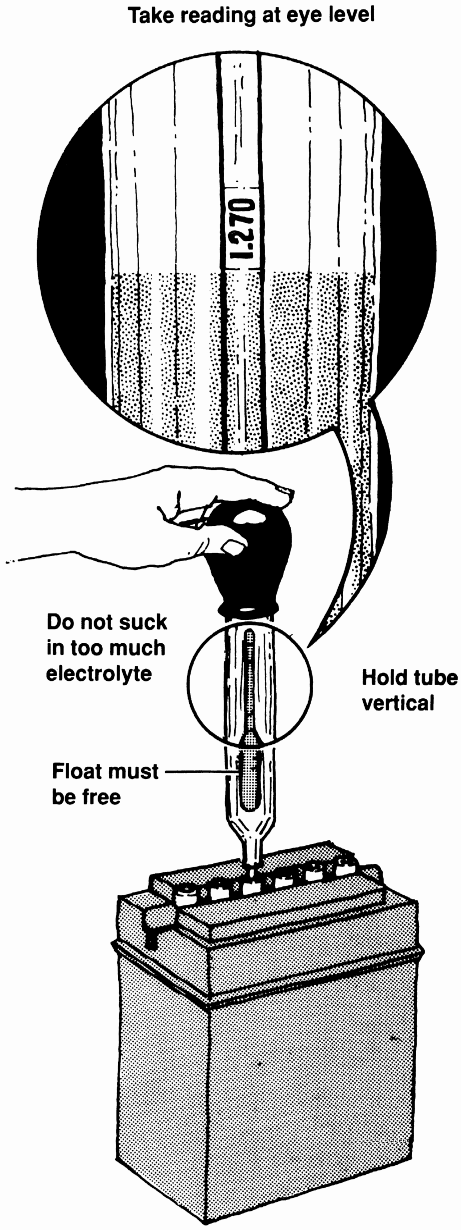

BATTERY (SEALED TYPE)

There is no routine upkeep on the sealed battery other than to keep the terminals free of corrosion and keep the terminal screws securing the leads to the battery tight.

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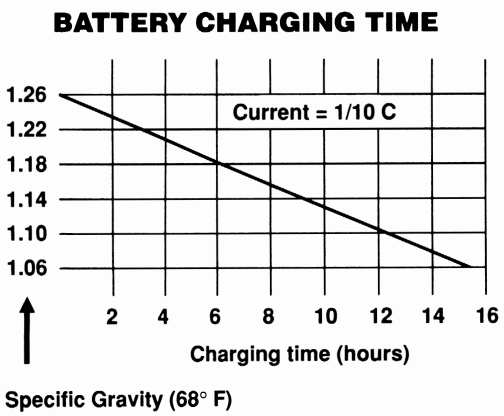

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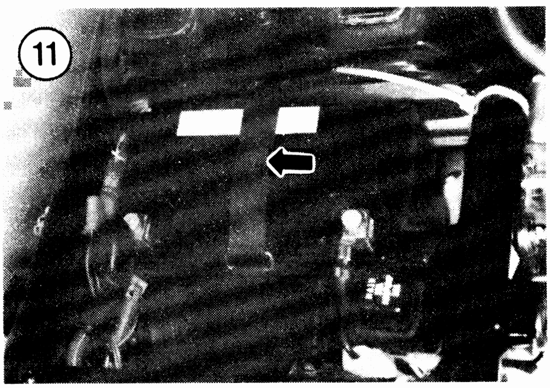

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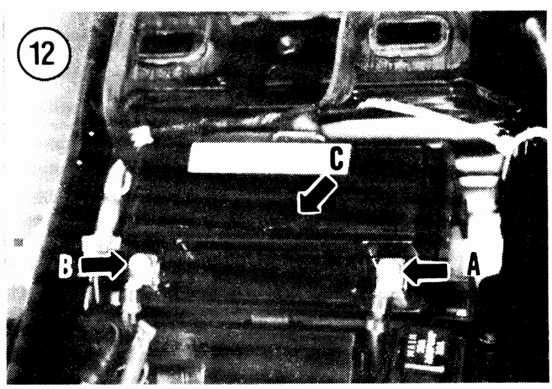


The electrolyte level cannot be corrected on a sealed battery as the battery top is not removable.

Removal/Installation

1. Remove the frame side covers and the seat as described in Chapter Twelve.
2. Disconnect the battery hold-down strap (**Figure 11**).
3. Disconnect the negative (–) battery cable (A, **Figure 12**) from the battery.
4. Disconnect the positive (+) battery cable (B, **Figure 12**).
5. Lift the battery (C, **Figure 12**) up and out of the battery box and remove it.
6. Install 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.

Inspection

For a preliminary test, connect a digital voltmeter across the battery negative and positive terminals and measure the battery voltage. A fully charged battery should read between 13.0-13.2 volts. If the voltage is 12.3 or less the battery is undercharged.

Clean the battery terminals and surrounding case and reinstall the battery as described in this chapter. Coat the battery terminals with a thin layer of dielectric grease to retard corrosion and decomposition of the terminals.

Charging

The battery is a sealed type and if recharging is required a special type of battery charger must be used. Yamaha recommends using a constant current type charger used in conjunction with an ammeter that is designed for use with this type of battery. It is recommended that the battery be recharged by a Yamaha dealer to avoid damage to a good battery that only requires recharging. The following procedure is included if you choose to recharge your battery.

CAUTION
***Never** connect a battery charger to the battery with the leads still connected. **Always** disconnect the leads from the battery. During the charging procedure the charger may damage the diodes within the voltage regulator/rectifier if the battery leads were left connected.*

1. Remove the battery from the frame.

2. Connect the positive (+) charger lead to the ammeter and then onto to the positive (+) battery terminal and the negative (–) charger lead to the negative (–) battery terminal.

CAUTION
Do not exceed the recommended charging amperage rate or charging time on the battery charging time label attached to the battery.

3. Set the charger to 12 volts. If the output of the charger is variable, it is best to select a low setting. Use the following suggested charging amperage and length of charge time:

   a. Standard charge: 1.4 amps at 5 to 10 hours.

   b. Quick charge: 6.0 amps at 1 hour.

4. Turn the charger ON.

5. After the battery has been charged for the specified amount of time, turn the charger off and disconnect the charger and ammeter leads.

6. Connect a volt meter across the battery negative and positive terminals and measure the battery voltage. A fully charged battery should read 13.0-13.2 volts. If the voltage is 12.3 or less the battery is undercharged.

7. If the battery remains stable for 1 hour at the specified voltage, the battery is considered charged.

8. Clean the battery terminals and surrounding case. Coat the terminals with a thin layer of dielectric grease to retard corrosion and decomposition of the battery.

9. Reinstall the battery as previously described.

BATTERY ELECTRICAL CABLE CONNECTORS

To ensure good electrical contact between the battery and the electrical cables, the cables must be clean and free of corrosion.

1. If the electrical cable terminals are badly corroded, disconnect them from the bike's electrical system.
2. Thoroughly clean each connector with a wire brush and then with a baking soda solution. Wipe dry with a clean cloth.
3. After cleaning, apply a thin layer of dielectric grease to the battery terminals before reattaching the cables.
4. If disconnected, connect the electrical cables to the bike's electrical system.
5. After connecting the electrical cables, apply a light coating of dielectric grease to the electrical terminals of the battery to retard corrosion and decomposition of the terminals.

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

On models so equipped, always replace the sealed battery with another sealed-type battery. The charging system is designed to have this type of battery in the system.

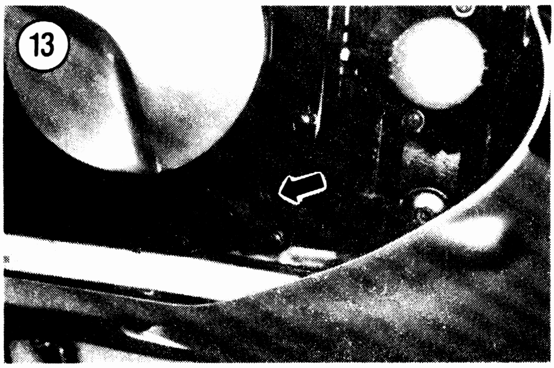
NOTE
***Recycle your old battery**. When you replace the old battery, be sure to turn in the old battery at that time. The lead plates and the plastic case can be recycled. Most motorcycle dealers will accept your old battery in trade when you purchase a new one, but if they will not, many automotive 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*

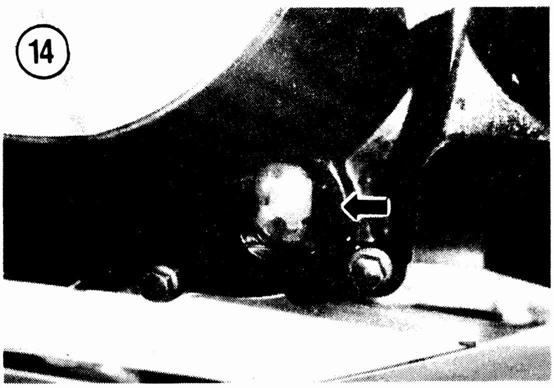
being crushed in the trash truck and spraying acid on the truck operator.

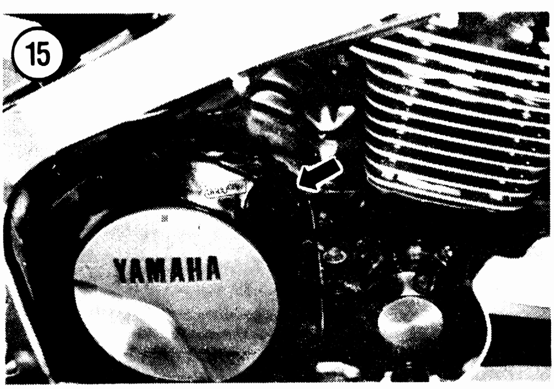
PERIODIC LUBRICATION

Oil

Oil is graded according to its viscosity, which is an indication of how thick it is. The Society of Automotive Engineers (SAE) system distinguishes oil viscosity by numbers. Thick oils have higher viscosity numbers than thin oils. For example, an SAE 5 oil is a thin oil while an SAE 90 oil is relatively thick.







Grease

A good quality grease (preferably waterproof) should be used. Water does not wash grease off parts as easily as it washes oil off. In addition, grease maintains its lubricating qualities better than oil on long and strenuous rides. In a pinch, though, the wrong lubricant is better than none at all. Correct the situation as soon as possible.

3

Engine Oil Level Check

Engine oil level is checked through the inspection window (**Figure 13**) in the right-hand side of the crankcase below the clutch cover.

1. Start the engine and let it reach normal operating temperature.
2. Stop the engine and allow the oil to settle.
3. Place the bike on level ground and on the center-stand. Make sure the bike is *straight up and level.*

CAUTION
If the bike is not parked correctly, an incorrect oil level reading will be observed.

4. The oil level should be between the maximum and minimum window marks (**Figure 14**). To add oil, remove the oil fill cap (**Figure 15**) and add the recommended oil listed in **Table 4** to raise the oil to the proper level. Do not overfill.
5. Reinstall the oil fill cap and tighten securely.

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 high-quality detergent motor oil with an API rating of SE or SF. The quality rating is stamped on top of the can or printed on the label on the plastic bottle (**Figure 16**). Try to use the same brand of oil at each change. Use of oil additives is not recommended as it may cause clutch slippage. Refer to **Table 4** for correct oil viscosity to use under anticipated ambient temperatures (not engine oil temperature).

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

a. Drain pan.
b. Funnel.
c. 19 mm wrench or socket to remove drain plug.
d. Quantity of oil, see **Table 5**.
e. Oil filter element.

NOTE
If you are going to recycle the oil, do not add any other type of chemical (fork oil, brake fluid, etc.) to the oil as the oil recycler will probably not accept the oil.

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 bike securely on the centerstand.
2. Remove the lower fairing as described in Chapter Twelve.
3. Start the engine and run it until it is at normal operating temperature, then turn it off.
4. Remove the oil fill cap (**Figure 15**). This will speed up the draining process.
5. Place a drip pan under the crankcase and remove the 19 mm drain plug and sealing washer (**Figure 17**) from the oil pan.
6. Let the oil drain for at least 15-20 minutes.
7. Inspect the sealing washer on the crankcase drain plug. Replace if its condition is in doubt.
8. Install the drain plug and washer and tighten to the torque specification listed in **Table 6**.
9. Drain and remove the oil filter as follows:
   a. Move the drain pan to the left-hand side of the engine under the oil filter housing.
   b. Remove the oil filter drain bolt (A, **Figure 18**).
   c. Let the oil drain for at least 5-10 minutes.
   d. Reinstall the oil filter drain bolt and tighten to the torque specifications listed in **Table 6**.

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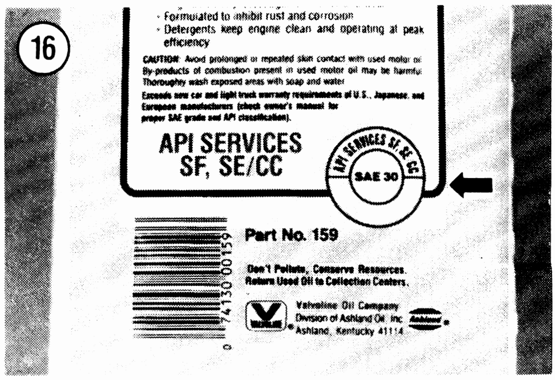

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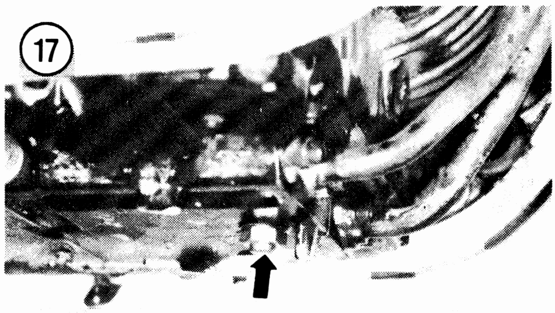

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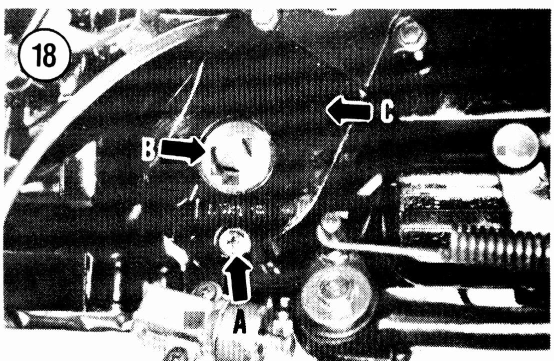

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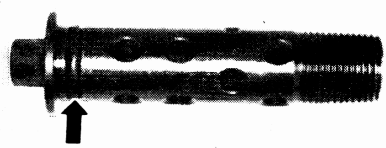

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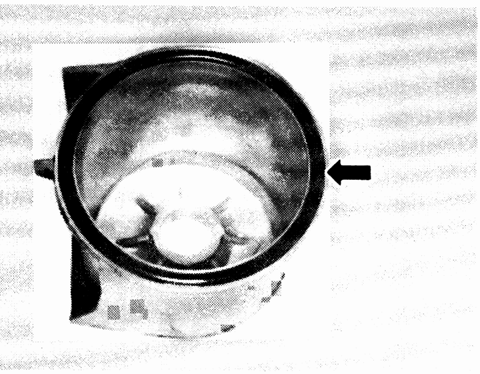

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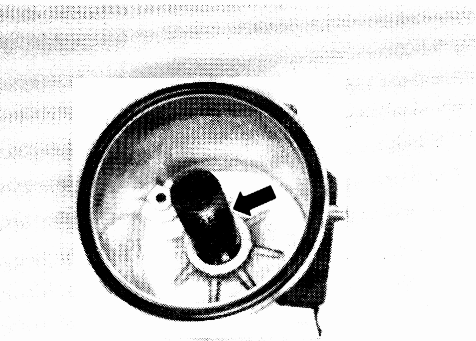

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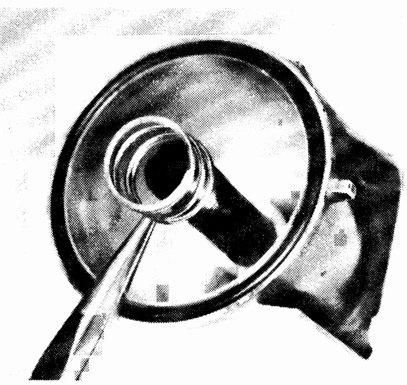

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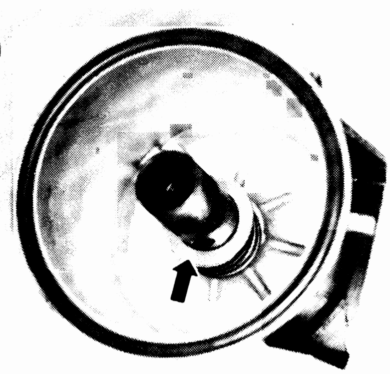


NOTE
Before removing the oil filter cover, thoroughly clean off all dirt and oil residue around it.

e. Unscrew the filter mounting bolt (B, **Figure 18**) and remove the filter cover assembly (C, **Figure 18**).

f. Remove the filter from the filter cover. Place the old filter in a plastic bag and close it to prevent residual oil from draining out. Discard the used oil filter.

g. Remove the washer and the spring from the mounting bolt.

h. Pull the mounting bolt out of the filter cover.

i. Clean the filter cover and mounting bolt in cleaning solvent. Be sure to remove all oil residue from both parts, then dry with compressed air.

j. Inspect the filter cover, the mounting bolt and its O-ring seal (**Figure 19**). Replace the O-ring seal (**Figure 20**) if deformed, cracked or if the filter cover leaked previously.

k. The oil filter bypass valve is located in the mounting bolt. Clean the mounting bolt in solvent and check bypass valve assembly for damage. Check the mounting bolt hex head for damage that could make further removal of the bolt difficult. Replace the mounting bolt if necessary.

l. Wipe the crankcase gasket surface with a clean, lint-free cloth. Install the new oil filter as follows.

m. With the mounting bolt and filter cover O-rings installed, insert the bolt (**Figure 21**) through the filter cover.

n. Slide the spring (**Figure 22**) and washer (**Figure 23**) onto the mounting bolt.

o. Position the oil filter with the concave side going in last and install the oil filter (**Figure 24**). Make sure the rubber grommets on both sides of the oil filter do not dislodge or tear.

p. Apply clean engine oil to the filter cover O-ring seal (**Figure 20**) prior to installation.

q. Install the oil filter assembly into the crankcase. Align the tab on the filter housing with the notch on the crankcase and tighten the mounting bolt to the torque specification listed in **Table 6**.

10. Insert a funnel into the oil fill hole. Fill the crankcase with the correct weight listed in **Table 4** and quantity of oil listed in **Table 5**.

11. Make sure the gasket (**Figure 25**) is in place on the oil fill plug. Install the oil fill plug and tighten securely.

CAUTION
If the engine has been disassembled for service and is being started for the first time, perform Step 12. If this is just an normal oil change, proceed to Step 13.

12. After the engine has been disassembled for service, perform the following to make sure that oil is flowing throughout the engine's lubrication system:

a. Remove the engine oil check bolt (**Figure 26**) and washer from the right-hand side of the cylinder head.
b. Place a shop cloth under the check bolt hole to catch the oil when it exits the engine.
c. Start the engine and allow it to idle.
d. Don't panic as it will usually take about 30-45 seconds for the oil to exit the check bolt hole.
e. When the oil starts to exit the hole reinstall the screw and washer and tighten securely.
f. Wipe off any spilled oil with a shop cloth to avoid smoke from the oil on the warm cooling fins. If necessary, spray the area with an aerosol electrical contact cleaner to clean off the oil residue.

13. Start the engine, allow it to idle and check for any oil leaks.

14. Turn the engine off and allow the oil to settle. Then check for correct oil level as described under *Engine Oil Level Check* in this chapter. Adjust if necessary.

15. Reinstall the lower fairing assembly as described in Chapter Twelve.

Front Fork Oil Change

It is a good practice to change the fork oil at the interval listed in **Table 1** or once a year. If it becomes contaminated with dirt or water, change it immediately.

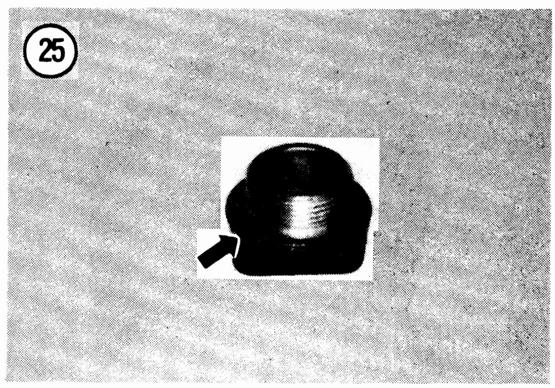
1. Place the bike securely on the centerstand.

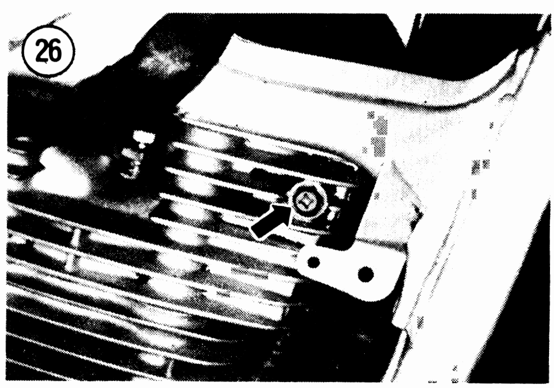
2. Remove the handlebars (A, **Figure 27**) as described in Chapter Nine.

CAUTION
On 1984-1990 models, there is a long adjusting rod attached to the fork cap bolt. Be careful not to damage the rod when withdrawing it from the fork tube.

3A. On 1984-1990 models, loosen the cap bolt as follows:

NOTE
A Yamaha special tool (U.S. part No. YM-01388, U.K. part No. 09890-





01388) is required to loosen the cap bolt. In place of this special tool, a 27 mm nut can be used and will perform the same function when used along with an adjustable wrench. The rear axle nut on these models is 27 mm and can be used as shown in this procedure.

a. Loosen the upper fork bridge bolt (A, **Figure 28**).

b. Remove the rear axle nut as described in Chapter Ten.

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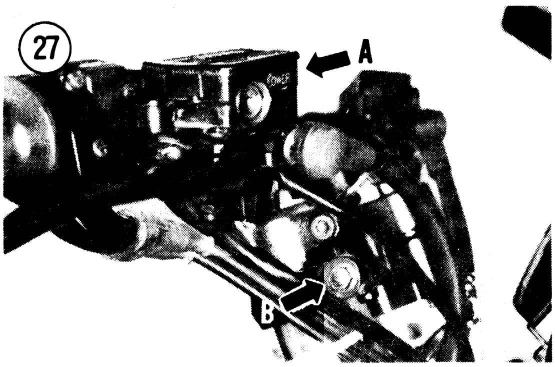

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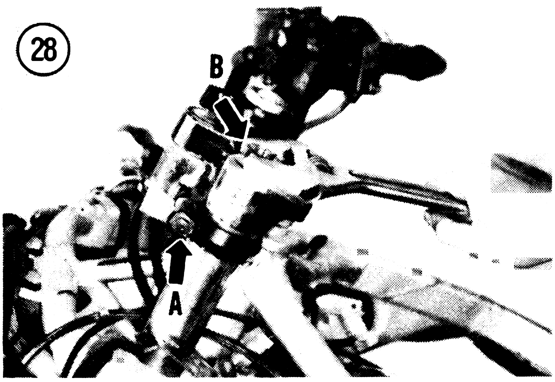

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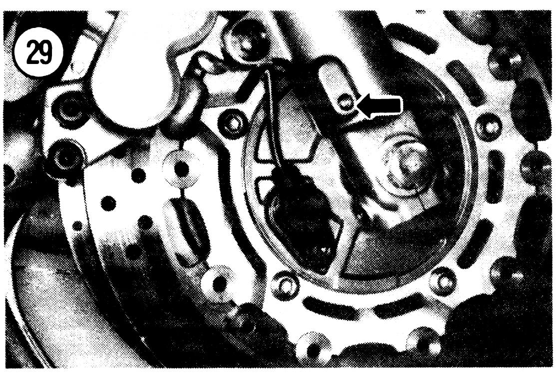

c. Remove the trim cap from the top of the fork tube.

d. Adjust the fork pre-load adjust rod completely counterclockwise to raise the rod. This will hold the 27 mm nut, installed in the next step, up sufficiently to get a good grip on the nut with the wrench.

e. Install a 27 mm wrench or an adjustable wrench on the 27 mm nut (B, **Figure 28**) and loosen the cap bolt.

f. Remove the wrench and nut from the fork cap bolt.

3B. On 1991-on models, loosen the cap bolt as follows:

a. Loosen the upper fork bridge bolt (B, **Figure 27**).

b. Remove the front fork top cap.

CAUTION

Cover the brake discs with shop cloths or plastic. Do not allow the fork oil to contact the discs. If any oil comes in contact with them, clean off with lacquer thinner or electrical contact cleaner. Remove all oil residue from the discs or the brake will be useless.

4. Place a drip pan beside one fork tube, then remove the drain screw (**Figure 29**) and allow the fork oil to drain for at least 5 minutes. Never reuse fork oil, discard it but do not mix in with any engine oil that is going to be recycled.
5. 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 spacer is removed. Withdraw the fork spacer from the fork tube.
6. Repeat Steps 3-5 for the other fork tube.
7. Take the bike off the centerstand.
8. With both the bike's wheels on the ground, have an assistant steady the bike. Move the front end up and down several times to expel all remaining oil from the fork tubes.
9. Again, place the bike securely on the centerstand.
10. Install both drain screws and tighten securely.

NOTE

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

3

11. Fill each fork tube with the specified quantity of oil listed in **Table 5**. **Table 4** indicates the recommended fork oil to use.
12. Inspect the O-ring seal on the fork cap; replace if necessary. Refer to **Figure 30** for 1984-1990 models or **Figure 31** for 1991-on models.
13. Install the fork spacer into the fork tube.
14A. On 1984-1990 models, install the fork cap bolt as follows:

a. Adjust the damper rod (**Figure 32**) to the softest setting (**Figure 33**). This will make installation easier.
b. Install the sub-spring and washer (**Figure 34**) onto the adjust rod.
c. Carefully insert the fork cap bolt and adjust rod into the fork spring (**Figure 35**).
d. Properly index the flat on the end of the damper adjust rod (**Figure 36**) into the receptacle in the top of the damper rod (**Figure 37**). If the rod is indexed correctly the fork cap bolt will be positioned close enough to the top of the fork tube (**Figure 38**) to enable the fork cap bolt to be pushed down for thread engagement.
e. If the cap bolt is sitting up too high, slowly rotate the damper adjust rod until it is correctly seated in the damper rod receptacle allowing the cap bolt to move closer to the top of the fork tube.
f. Start the fork cap bolt slowly while pushing down on the spring. Start the bolt slowly and don't cross-thread it.

14B. On 1991-on models, install the fork cap bolt (**Figure 39**) and start the fork cap bolt slowly while pushing down on the spring. Start the bolt slowly and don't cross-thread it. Tighten it to the torque specification listed in **Table 6**.

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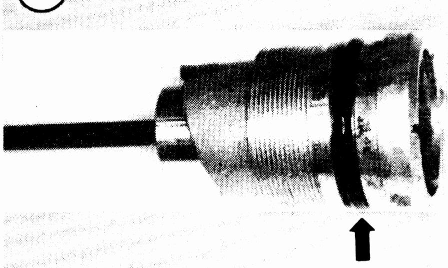

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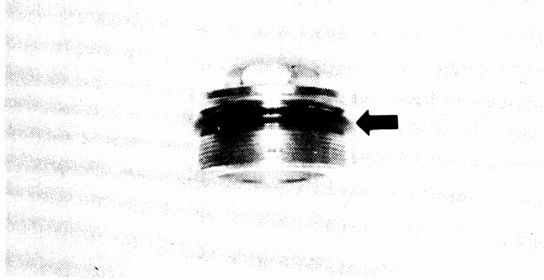

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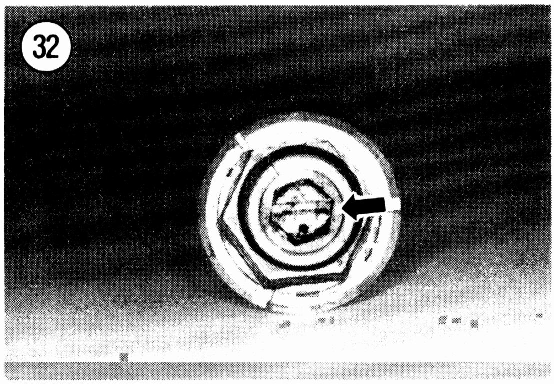

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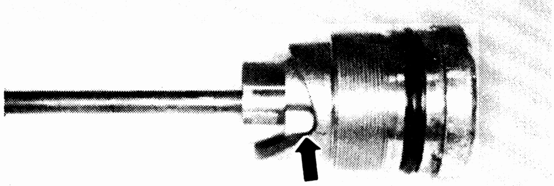

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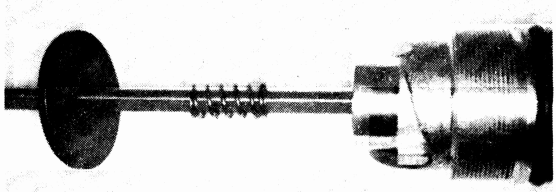

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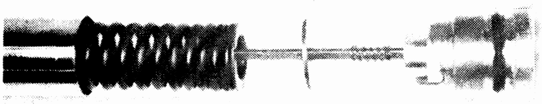

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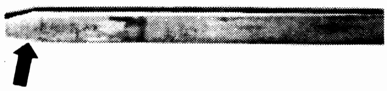

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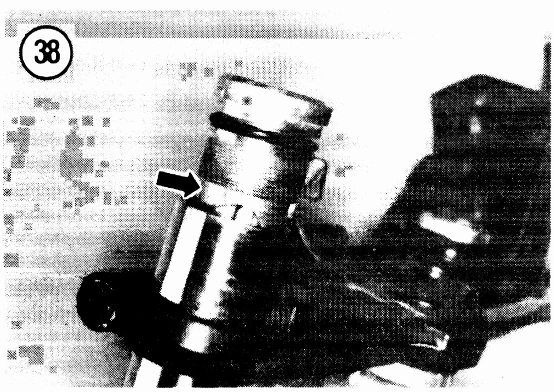

15. Tighten the upper fork bridge bolts to the torque specification listed in **Table 6.**
16. Install the handlebars.
17. Road test the bike and check for oil and air leaks.

Throttle Cable Lubrication

The throttle cables should be lubricated at the intervals specified in **Table 1**. At this time, they should also be inspected for fraying, and each cable sheath should be checked for chafing. The throttle cables are relatively inexpensive and should be replaced when found to be faulty.

The 1984-1990 models are equipped with a cable connector located under the fuel tank. There are 4 throttle cables, 2 upper cables and 2 lower cables and they are joined at this connector.

The 1991-on models are equipped with the typical single push and single pull throttle cables.

The throttle cables should be lubricated with a cable lubricant and a cable lubricator available at most motorcycle dealers.

NOTE
The main cause of cable breakage or cable stiffness is improper lubrication. Maintaining the throttle cable as described in this section will assure a long service life.

1984-1990 models

Both the upper and lower sets of cables must be lubricated. They can be lubricating at the connector without disconnecting the cables from either the throttle grip or carburetor assembly.
1. Remove the fuel tank as described in Chapter Seven.

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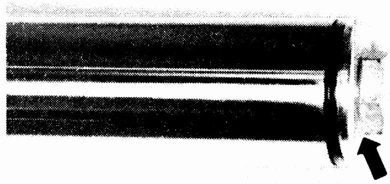


2. Remove the screws and remove the cable connector cover (**Figure 40**).

NOTE
Prior to disconnecting the throttle cables from within the cable connector, note which set is the pull and which set is the push cable and label them accordingly so they will be reconnected correctly.

3. Disconnect the upper and lower pull and push cables (**Figure 41**) from the connectors within the cable connector and remove the cables.
4. First attach a cable lubricator (**Figure 42**) to upper set of cables following the manufacturer's instructions.

NOTE
Place a shop cloth under the throttle grip to catch all excess lubricant that will flow out.

5. Insert the nozzle of the lubricant can into the lubricator, press the button on the can and hold it down until the lubricant begins to flow out of the other end of the upper cable. Repeat for the other throttle cable. Disconnect the lubricator.

NOTE
If lubricant does not flow out the end of the cable, check the entire cable for fraying, bending or other damage.

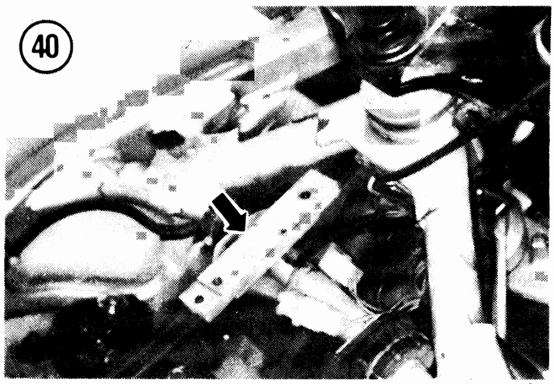
6. Attach a cable lubricator (**Figure 42**) to lower set of cables following the manufacturer's instructions.

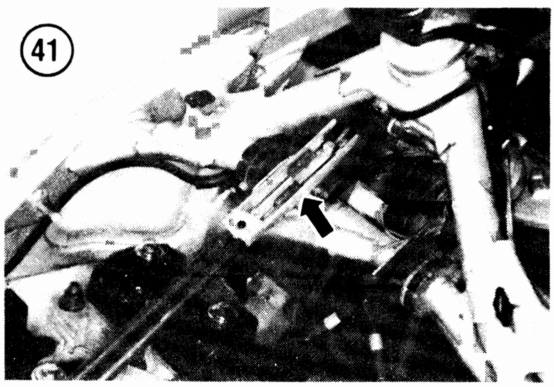
NOTE
Place a shop cloth under the throttle wheel on the carburetor assembly to catch all excess lubricant that will flow out.

7. Insert the nozzle of the lubricant can into the lubricator, press the button on the can and hold it down until the lubricant begins to flow out of the other end of the upper cable. Repeat for the other throttle cable. Disconnect the lubricator.
8. Reconnect the upper and lower pull and push cables (**Figure 41**) to the connectors within the cable connector.
9. Spray some additional lubricant within the connector body and operate the throttle grip several times. Make sure the throttle cable guides within the connector slide easily with no binding.
10. Install the connector top cover and tighten the screws securely.
11. 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.
12. Install the fuel tank.
13. Adjust the throttle cable as described in this chapter.

1991-on models

1. Remove the fuel tank as described in Chapter Seven.
2. Remove the screws (A, **Figure 43**) securing the throttle grip lower case halves together.
3. Remove the lower case halves from the handlebar and disengage the throttle cables (B, **Figure 43**) from the throttle grip.





4. Attach a cable lubricator (**Figure 42**) to the throttle grip end of one of the cables following the manufacturer's instructions.

NOTE

Place a shop cloth under the throttle wheel on the carburetor assembly to catch all excess lubricant that will flow out.

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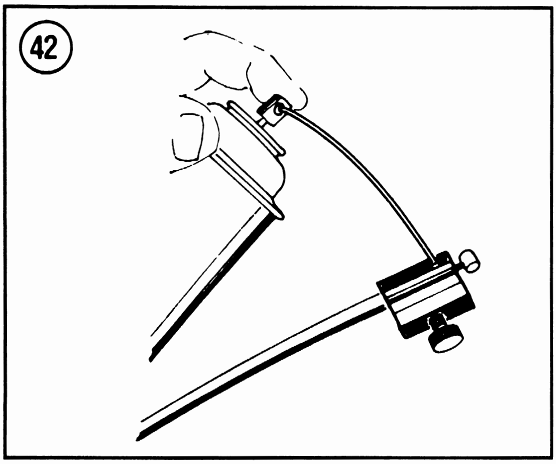

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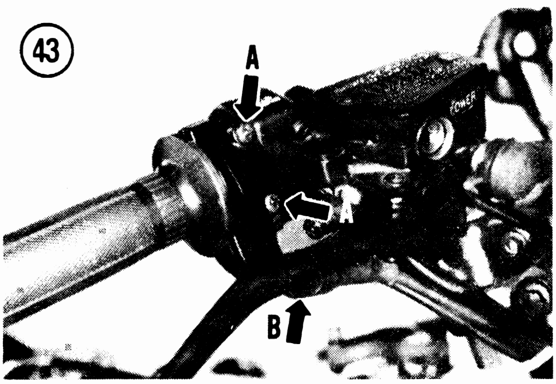

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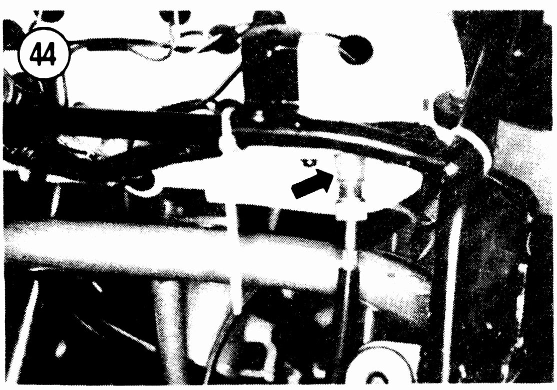


5. Insert the nozzle of the lubricant can into the lubricator, press the button on the can and hold it down until the lubricant begins to flow out of the other end of the cable. Repeat for the other throttle cable.

NOTE

If lubricant does not flow out the end of the cable, check the entire cable for fraying, bending or other damage.

6. Remove the lubricator and reconnect both throttle cables to the twist grip. Reassemble the throttle grip lower case halves and tighten the screws securely. Operate the throttle to make sure there is no binding.
7. Install the fuel tank.
8. Adjust the throttle cable as described in this chapter.

Swing Arm Bearings Lubrication

The rear swing arm needle bearings should be cleaned in solvent and lubricated with a molybdenum disulfide grease at the intervals specified in **Table 1**. The swing arm must be removed to service the needle bearings. Refer to *Rear Swing Arm Removal/Installation* in Chapter Ten.

Relay Arm and Connecting Arm Lubrication

The relay arm and connecting rod needle bearings and bushings should be cleaned in solvent and lubricated with molybdenum disulfide grease at the intervals specified in **Table 1.** The relay arm linkage must be removed to service the needle bearings; refer to Chapter Ten.

Speedometer Cable Lubrication

Lubricate the speedometer cable every year or whenever needle operation is erratic.
1. Remove the upper fairing as described in Chapter Twelve.
2. Unscrew the end of the speedometer cable (**Figure 44**) at the instrument cluster and at the front wheel (**Figure 45**).
3. Pull the cable from the sheath.
4. If the grease is contaminated, thoroughly clean off all old grease.

5. Thoroughly coat the cable with a good grade of multi-purpose grease and reinstall into the sheath.
6. Make sure the cable is correctly seated into the speedometer drive unit.

Wheel Bearings Inspection/Lubrication

Worn wheel bearings cause excessive wheel play that result in vibration and other steering troubles. At the intervals specified in **Table 1**, the bearing should be inspected and lubricated with wheel bearing grease. Refer to *Front Hub* in Chapter Nine and *Rear Hub* in Chapter Ten.

Steering Stem Lubrication

Refer to *Steering Head* in Chapter Ten.

Drive Chain Lubrication

Yamaha recommends SAE 30 to SAE 50 motor oil or a chain lubricant *specified* for use on O-ring drive chains for lubrication; it is less likely to be thrown off the chain than lighter oils.

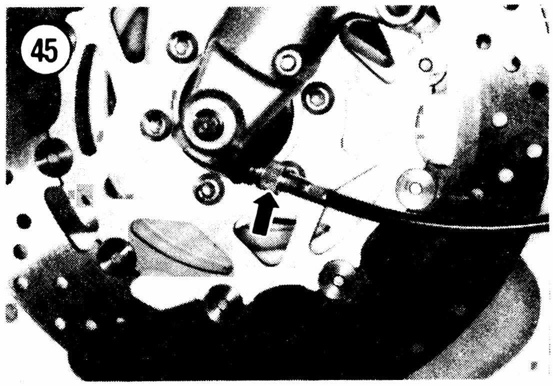
NOTE
If the drive chain is obviously dirty, remove and clean it as described under ***Drive Chain Cleaning*** *in Chapter Ten before lubricating it as described in this procedure.*

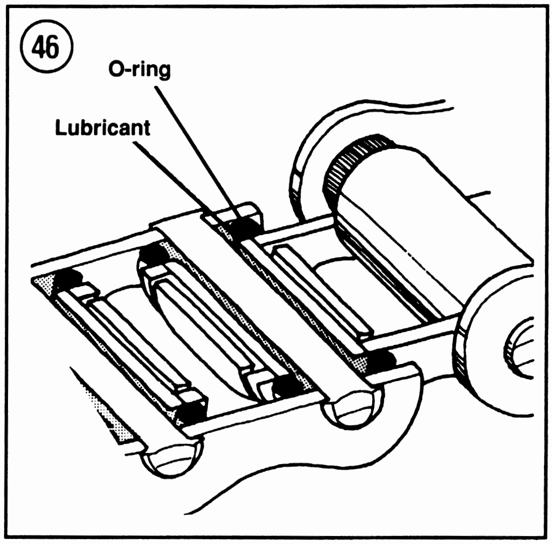
CAUTION
*The factory drive chain is equipped with O-rings between the side plates (**Figure 46**) that seal lubricant between the pins and bushings. To prevent damaging these O-rings, use only kerosene for cleaning. Do not use gasoline or other solvents that will cause the O-rings to swell or deteriorate. Refer to the cleaning procedure in Chapter Ten.*

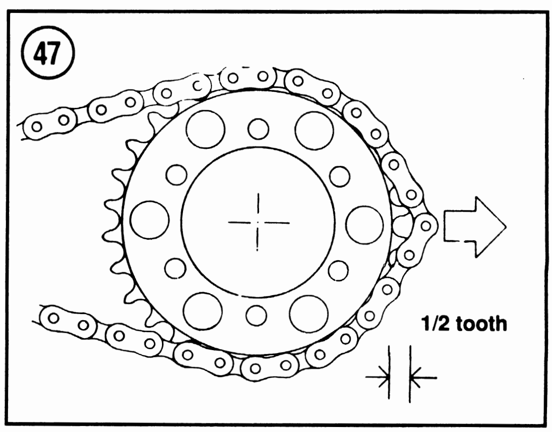
1. Place the bike securely on the centerstand with the rear wheel clear of the ground.
2. Oil the bottom chain run with SAE 30 to 50 motor oil or a commercial drive chain lubricant approved for O-ring use. Concentrate on getting the oil down between the side plates of the chain links.
3. Rotate the rear wheel and chain and continue until the entire chain has been lubricated.

Miscellaneous Lubrication Points

Lubricate the clutch lever, front brake lever, sidestand pivot point and the footpeg pivot points. Use SAE 10W-40 engine oil.







PERIODIC MAINTENANCE

Preliminary Drive Chain Inspection

Before adjusting the drive chain, it should be inspected for wear. This procedure describes how to check a drive chain for excessive stretch while it is installed on the bike.

1. Place the bike securely on the centerstand with the rear wheel clear of the ground.
2. Pull the drive chain rearward at the point midway down the rear sprocket (**Figure 47**). If more than one-half of each tooth on the sprocket is uncovered, the drive chain should be removed and further inspected as described in this section.

CAUTION
Drive chain stretch is caused by a loss of metal from the drive chain's bushings and pins. This can result in chain breakage which could cause a serious accident while riding the bike.

Drive Chain Adjustment

NOTE
As drive chains stretch and wear in use, the chain will become tighter at one point. The chain must be checked and adjusted at this point.

1. Place the bike securely on the centerstand with the rear wheel clear of the ground.
2. Turn the rear wheel and check the chain for its tightest point. Mark this spot and turn the wheel so that the mark is located on the chain's lower run, midway between both drive sprockets. Check and adjust the drive chain as follows.
3. With thumb and forefinger, lift up and press down the chain at that point, measuring the distance the chain moves vertically.
4. The drive chain should have approximately 15-20 mm (0.6-0.8 in.) of vertical travel at midpoint (**Figure 48**). If necessary, adjust the chain as follows.
5. Remove the rear axle cotter pin (A, **Figure 49**) and loosen the axle nut (B, **Figure 49**).
6. Loosen the axle adjuster locknut (A, **Figure 50**) on both sides of the wheel.
7. Turn each adjuster nut (B, **Figure 50**) in either direction until the correct amount of chain slack is achieved. Be sure to turn each adjuster nut equally to maintain rear wheel alignment. Alignment is checked by observing the swing arm marks (**Figure 51**) on both sides of the swing arm.
8. Check rear wheel alignment by sighting along the chain as it runs over the rear sprocket. It should not appear to bend sideways as shown in B and C, **Figure 52**.
9. Recheck chain play and readjust if necessary.
10. Tighten the rear axle nut to the torque specification listed in **Table 6**. Tighten the adjuster locknut (A, **Figure 50**) to the torque specification listed in **Table 6**.
11. Install a new cotter pin through the rear axle and bend the ends over to lock it.
12. Adjust the rear brake light switch as described in this chapter.

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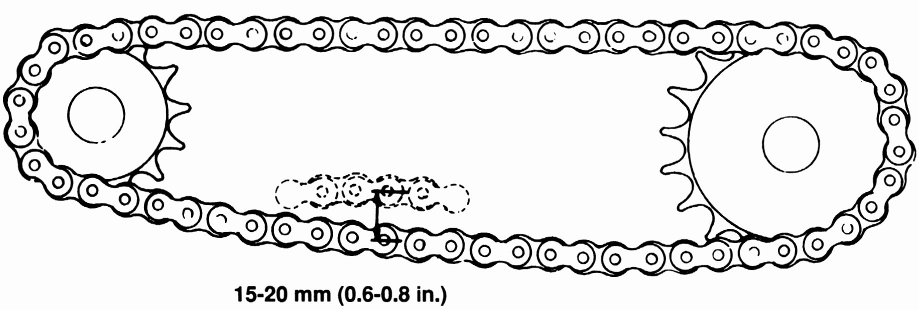

Drive Chain Slider Inspection/Replacement

A drive chain slider (**Figure 53**) is attached to the left-hand side of the swing arm near the pivot point. There are no factory-specified wear limit dimensions for the slider. If the slider is worn unevenly or if the wear groove is worn more than halfway through the material, replace the slider.

1. Remove the swing arm as described in Chapter Ten.
2. Remove the screws securing the slider (**Figure 54**) to the swing arm.
3. Remove the slider and install a new slider.
4. Tighten the screws securely.
5. Install the swing arm as described in Chapter Ten.
6. Adjust the drive chain as described in this chapter.

Clutch Fluid Level

The clutch is hydraulically operated and requires no routine adjustment.

The hydraulic fluid in the clutch master cylinder should be between the upper and lower marks within the reservoir. If the hydraulic fluid level reaches the lower level mark, visible through the viewing port (**Figure 55**) on the clutch master cylinder, the fluid level must be corrected by adding fresh hydraulic (brake) fluid.

1. Place the bike securely on the centerstand with the rear wheel clear of the ground.
2. Position the handlebars so the clutch master cylinder reservoir is level.
3. Clean any dirt from the area around the top cover prior to removing the cover.
4. Remove the screws (A, **Figure 56**) securing the front top cover (B, **Figure 56**). Remove the top cover and the diaphragm.

WARNING
Use hydraulic (brake) fluid from a sealed container and clearly marked DOT 3 or DOT 4. 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 silicone-based (DOT 5) hydraulic brake fluid as it can cause clutch component damage leading to clutch system failure.

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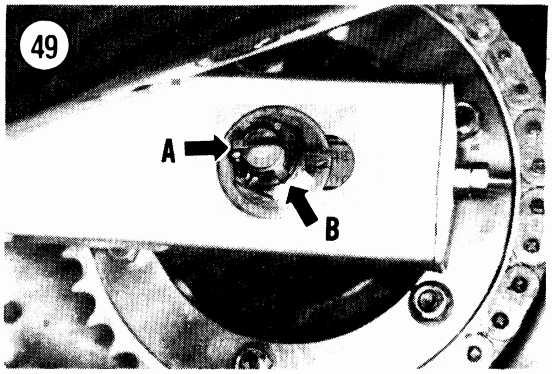

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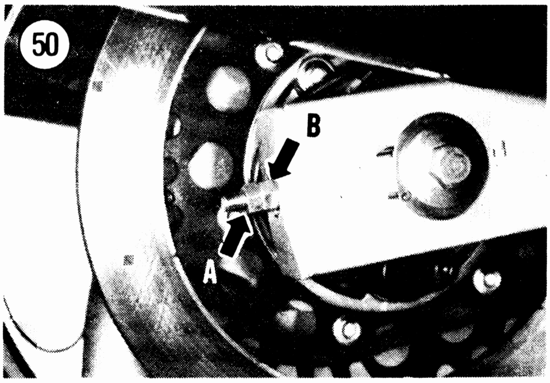

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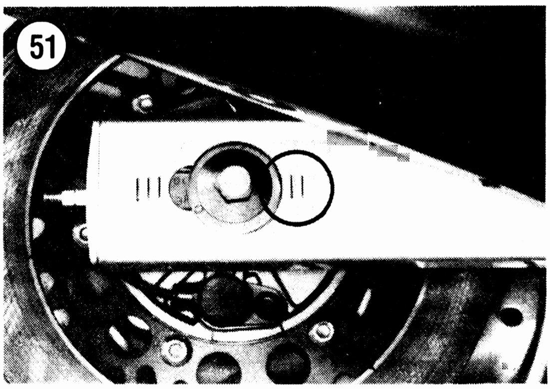

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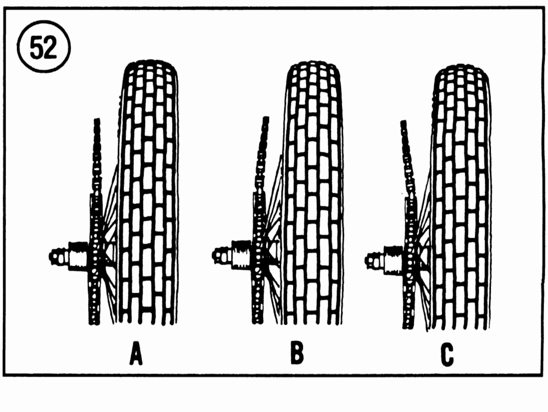

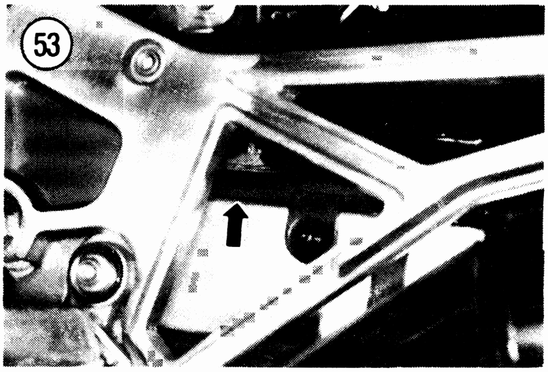
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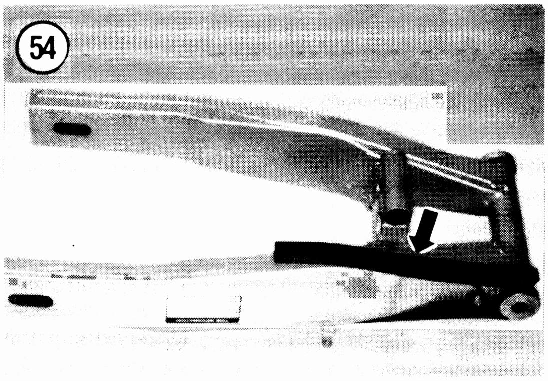
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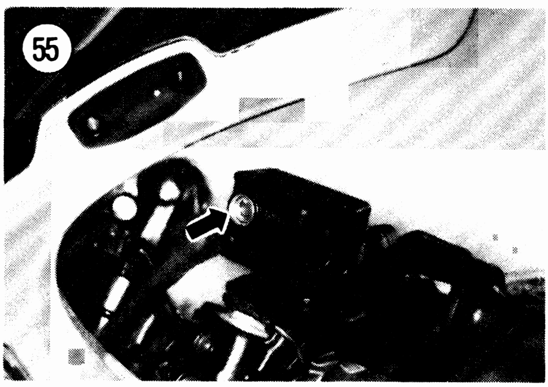
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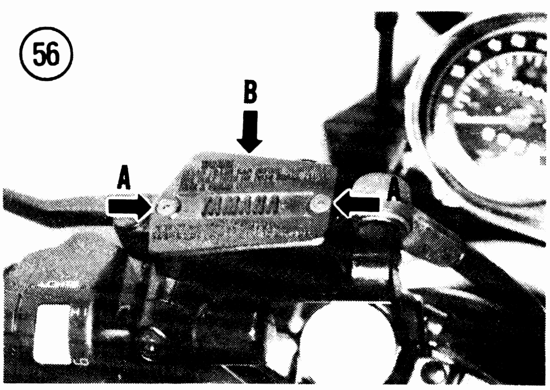

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CAUTION

Be careful when handling hydraulic fluid. Do not spill it on painted or plated surfaces or plastic parts as it will destroy the surface. Wash the area immediately with soapy water and thoroughly rinse it off.

5. Add brake fluid until the level is to the upper level line within the master cylinder reservoir (**Figure 55**). Use fresh hydraulic brake fluid from a sealed brake fluid container.
6. Reinstall the diaphragm and the top cover. Tighten the screws securely.

Clutch Hydraulic Lines and Hoses

Clutch hoses should be replaced every 4 years. Check clutch hoses between the master cylinder and the clutch slave cylinder. If there is any leakage, tighten the connections and bleed the clutch system as described in Chapter Five. If this does not stop the leak or if a line is obviously damaged, cracked or chafed, replace the hoses and bleed the clutch system.

Disc Brake Inspection

The hydraulic brake fluid in the disc brake master cylinders should be checked every month. The disc brake pads should be checked at the intervals specified in **Table 1**. Replacement is described under *Brake Pad Replacement* in Chapter Eleven.

Disc Brake Fluid Level

The fluid level should be up between the upper and lower marks within the reservoir. If the brake fluid level reaches the lower level mark, visible through the viewing port (**Figure 57**) on the front master cylinder and the transparent reservoir (**Figure 58**) on the rear master cylinder, the fluid level must be corrected by adding fresh brake fluid.

1. Place the bike securely on the centerstand with the rear wheel clear of the ground.
2. Position the handlebars so the front master cylinder reservoir is level.
3. Remove the seat and the right-hand frame side cover in order to check the rear master cylinder. Refer to Chapter Twelve.

4. Clean any dirt from the area around the top cover prior to removing the cover.

5. Remove the screws securing the front top cover (**Figure 59**) or unscrew the rear cap (**Figure 60**). Remove the top cover and the diaphragm.

WARNING

Use brake fluid from a sealed container and clearly marked DOT 4 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 silicone-based (DOT 5) brake fluid as it can cause brake component damage leading to brake system failure.

CAUTION

Be careful when handling brake fluid. Do not spill it on painted or plated surfaces or plastic parts as it will destroy the surface. Wash the area immediately with soapy water and thoroughly rinse it off.

6. Add brake fluid until the level is to the upper level line within the master cylinder reservoir. Refer to **Figure 57** for the front master cylinder or **Figure 58** for the rear master cylinder. Use fresh brake fluid from a sealed brake fluid container.

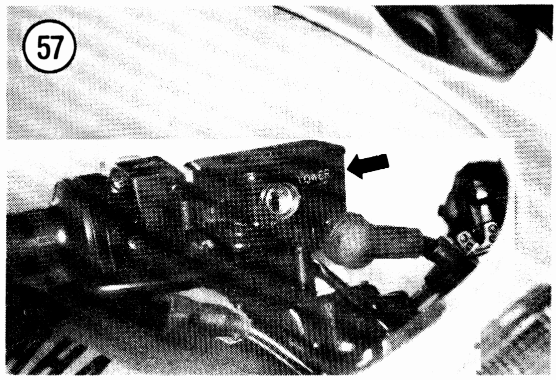
7. Reinstall the diaphragm and the top cover. Tighten the screws securely on the front master cylinder. On rear disc brakes, tighten the cap securely.

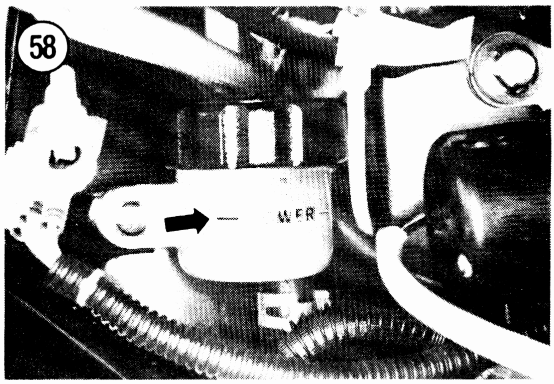
8. Reinstall the frame side cover and the seat.

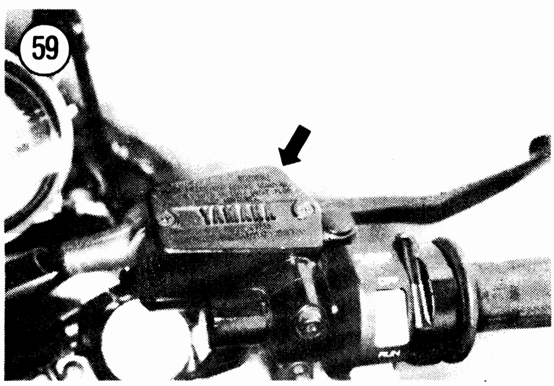
Disc Brake Hoses and Seals

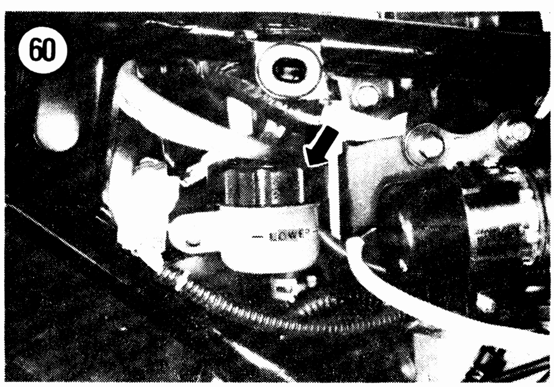
Disc brake hoses should be replaced every 4 years; the brake piston seals should be replaced every 2 years.

Check brake hoses between the master cylinder and the brake caliper. On 1984-1987 models, also check the hydraulic hose from the front caliper to the anti-dive unit on the front fork. If there is any leakage, tighten the connections and bleed the brakes as described in Chapter Eleven. If this does not stop the leak or if a line is obviously damaged, cracked, or chafed, replace the hose and seals and bleed the brake.









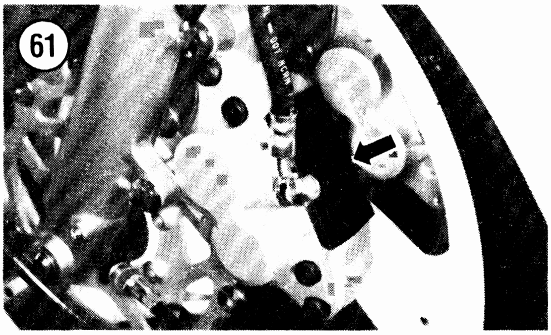
Disc Brake Pad Inspection

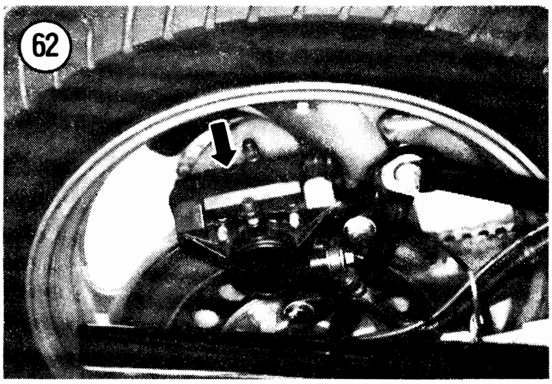
Inspect the brake pads for excessive or uneven wear, scoring and oil or grease on the friction surface.

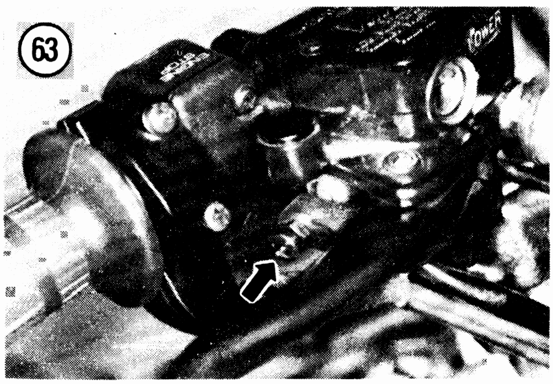
1. Remove the caliper cover. Refer to **Figure 61** for the front caliper and **Figure 62** for the rear caliper.

2. Look into the caliper assembly and check the location of the wear indicator in relation to the disc.

3. Replace both pads if the wear line on the pads reaches the brake disc. On the front brake, replace both pads in both calipers at the same time.







4. If any of these conditions exist, replace the pads as described in Chapter Eleven.

Disc Brake Fluid Change

Every time you remove the reservoir cap a small amount of dirt and moisture enters the brake fluid. The same thing happens if a leak occurs or when any part of the hydraulic system is loosened or disconnected. Dirt can clog the system and cause unnecessary wear. Water in the fluid vaporizes at high temperatures, impairing the hydraulic action and reducing brake performance.

To change brake fluid, drain the master cylinders as described under *Front Master Cylinder Removal/Installation* or *Rear Master Cylinder Removal/Installation* in Chapter Eleven. Add new fluid to the master cylinder and bleed at the caliper until the fluid leaving the caliper is clean and free of contaminants and air bubbles. Refer to *Bleeding the System* in Chapter Eleven.

WARNING
Use brake fluid clearly marked DOT 4 only. Others may vaporize and cause brake failure.

Front Brake Lever Adjustment

The front brake lever free play must be maintained or the front brake may drag and overheat. An adjuster is provided to maintain the front brake lever free play.

NOTE
Free play is the distance the lever travels from the at-rest position to the applied position, or the point at which the master cylinder is depressed by the lever adjuster.

1. Loosen the adjuster locknut and turn the adjuster (**Figure 63**) to obtain 5-8 mm (0.20-0.30 in.) of lever free play. Turn the adjuster in to decrease free play or out to increase free play.

2. Hold onto the adjuster and tighten the locknut securely. Don't allow the adjuster to rotate while tightening the locknut.

3. 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. Readjust if necessary.

Rear Brake Pedal Height Adjustment

Rear brake pedal height is the distance from the top of the footpeg to the top of the brake pedal (**Figure 64**).

1. Support the bike so that it sits straight up.
2. Check to be sure the brake pedal is in the at-rest position.
3. The correct height position from the top of the footpeg to the top of the brake pedal is 30 mm (1.20 in.).
4. Loosen the locknut (A, **Figure 65**) and turn the pushrod (B, **Figure 65**) until the brake pedal is at the correct position. Tighten the locknut securely.

WARNING
After adjusting the brake pedal, check that the end of the adjuster is visible through the hole in the joint holder. If the adjuster is not positioned correctly, check for worn or damaged brake pedal and adjuster components. Do not ride the motorcycle until the rear brake pedal is adjusted correctly.

5. Install the side cover and tighten the bolts securely.

Rear Brake Light Switch Adjustment

1. Turn the ignition switch ON.
2. Depress the rear brake pedal. The brake light should come on after the brake pedal is depressed. If necessary, adjust as follows.
3. Loosen the locknut and turn the switch body (**Figure 66**) in either direction until adjustment is correct. Tighten the locknut.
4. Once again, perform Step 2 to recheck brake light operation.

WARNING
Do not ride the bike until the rear brake light operates properly.

Throttle Cable Adjustment

Always check the throttle cables before you make any carburetor adjustments. Too much free play

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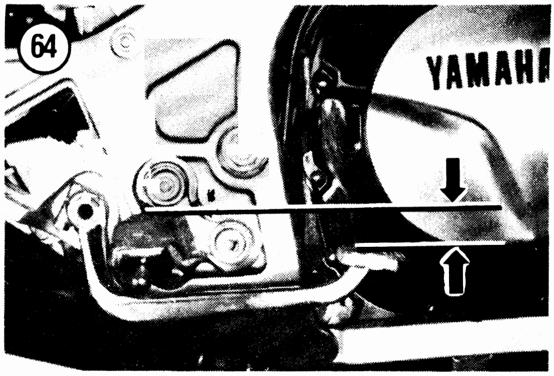

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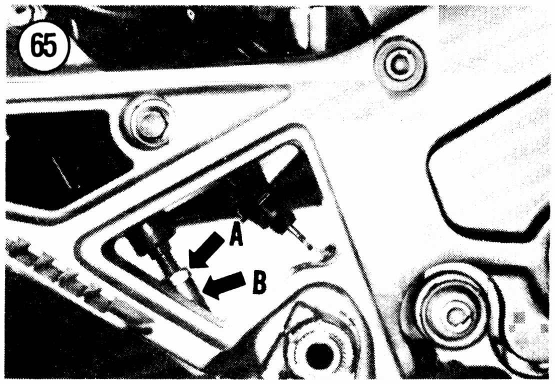

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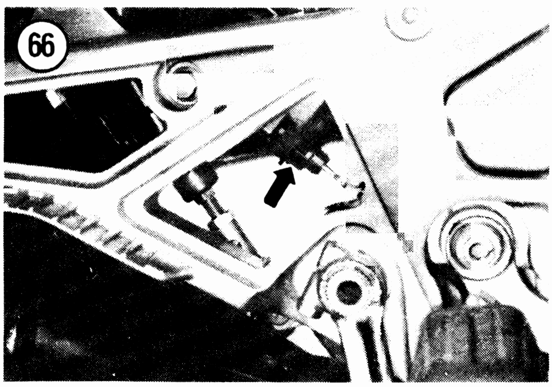

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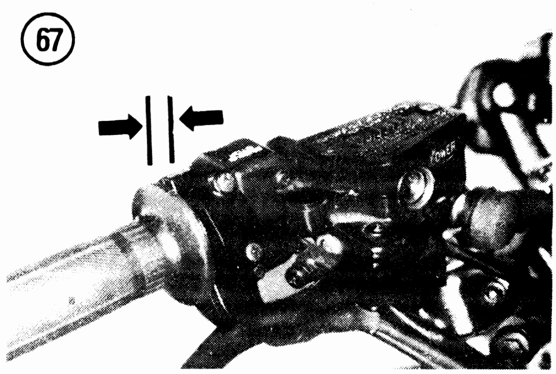

causes delayed throttle response; too little free play will cause unstable idling.

Check the throttle cables from grip to carburetors. Make sure they are not kinked or chafed. Replace the cables 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.

Check free play at the throttle grip flange (**Figure 67**). It should be approximately 5 mm (0.2 in.). If adjustment is necessary perform the following:

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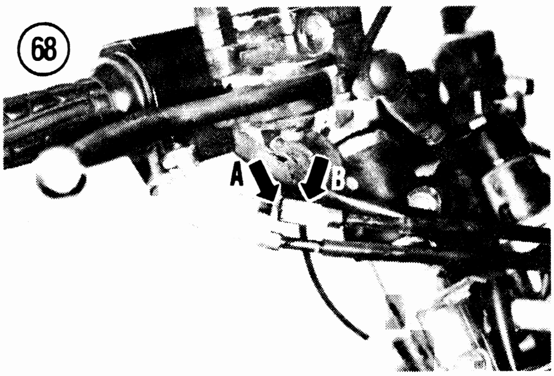

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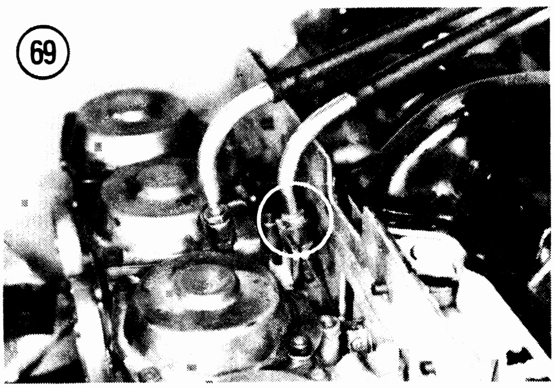

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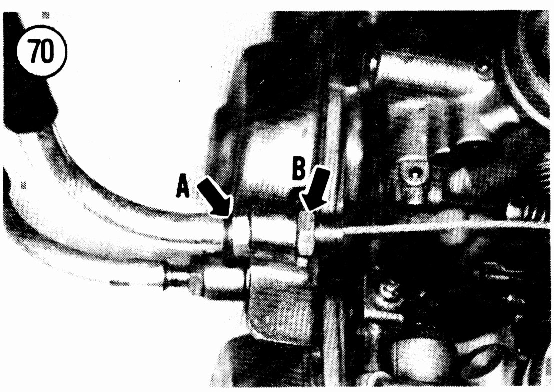

1984-1990 models

1. Remove the seat as described in Chapter Twelve.
2. Remove the fuel tank as described in Chapter Seven.
3. At the throttle grip, make sure the throttle cable locknut (A, **Figure 68**) and adjuster (B, **Figure 68**) are tight.

NOTE
Figure 70 *is shown with the carburetor assembly removed for clarity only.*

4. At the carburetor assembly (**Figure 69**), loosen the throttle cable locknut (A, **Figure 70**).

NOTE
If the correct amount of free play cannot be achieved at the carburetor end of the throttle cable, additional adjustment can be accomplished at the throttle grip.

5. Rotate the adjust nut (B, **Figure 70**) in either direction until the correct amount of free play is achieved. Tighten the adjuster locknut. If additional adjustment is necessary, proceed to Step 6. If correct adjustment is achieved, proceed to Step 8.
6. At the throttle grip, loosen the throttle cable locknut (A, **Figure 68**).
7. Rotate the adjuster (B, **Figure 68**) in either direction until the correct amount of free play is achieved. Tighten the adjuster locknut.
8. Install the fuel tank and seat.

WARNING
If idle speed increases when the handlebar is turned to right or left, check throttle cable routing. Do not ride the motorcycle in this unsafe condition.

1991-on models

1. Remove the seat as described in Chapter Twelve.
2. Remove the fuel tank as described in Chapter Seven.
3. Follow the throttle pull cable from the throttle grip through the front portion of the frame and steering head. Locate the cable mid-point adjuster and pull back the rubber sleeve (A, **Figure 71**) to expose the adjuster and locknut.
4. At the mid-point adjuster, make sure the locknut (B, **Figure 71**) and adjuster (C, **Figure 71**) are tight.

3

5. At the carburetor assembly, loosen both throttle cable locknuts (A, **Figure 70**).

NOTE
If the correct amount of free play cannot be achieved at the carburetor end of the throttle cable, additional adjustment can be accomplished at the mid-point adjuster.

6. Rotate the adjust nuts (B, **Figure 70**) in either direction until the correct amount of free play is achieved. Tighten both adjust locknuts. If additional adjustment is necessary, proceed to Step 7. If correct adjustment is achieved, proceed to Step 9.
7. At the mid-point adjuster, loosen the throttle cable locknut (B, **Figure 71**).
8. Rotate the adjuster (C, **Figure 71**) in either direction until the correct amount of free play is achieved. Tighten the adjuster locknut.
9. Pull the rubber sleeve back over the adjuster and locknut.
10. Install the fuel tank and seat.

WARNING
If idle speed increases when the handlebar is turned to right or left, check throttle cable routing. Do not ride the motorcycle in this unsafe condition.

Fuel Valve and Filter

At the intervals specified in **Table 1**, remove and drain the fuel tank. Remove the fuel shutoff valve and clean it of all dirt and debris. Replace worn or damaged O-rings and gaskets. Refer to *Fuel Valve* in Chapter Seven.

Fuel and Vacuum Line Inspection

Inspect the condition of the fuel and vacuum lines for cracks or deterioration; replace if necessary. Make sure the hose clamps are in place and holding securely.

Exhaust System

Check for leakage at all fittings. Tighten all bolts and nuts; replace any gaskets as necessary. Refer to *Exhaust System* in Chapter Seven.

Air Filter Removal/Installation

The air filter element should be removed and cleaned at the interval listed in **Table 1**. The air filter element should be replaced at the interval listed in **Table 1** or sooner if soiled, severely clogged or broken in any area.

The air filter removes dust and abrasive particles from the air before the air enters the carburetors and the engine. Without the air filter, very fine particles

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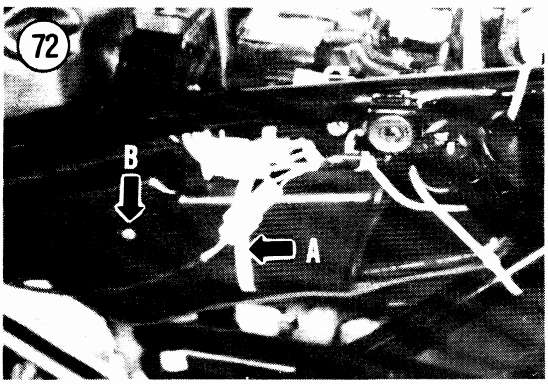

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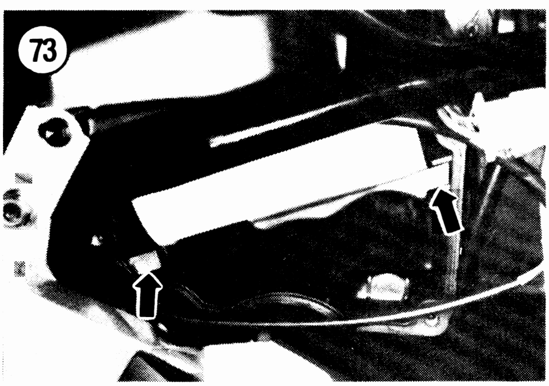

could enter into the engine and cause rapid wear of the piston rings, cylinders and bearings and might clog small passages in the carburetors. Never run the bike without the air filter element installed.

Proper air filter servicing can do more to ensure long service from your engine than almost any other single item.

The air filter is a dry-element type; no oiling is required.

1. Place the bike securely on the centerstand.

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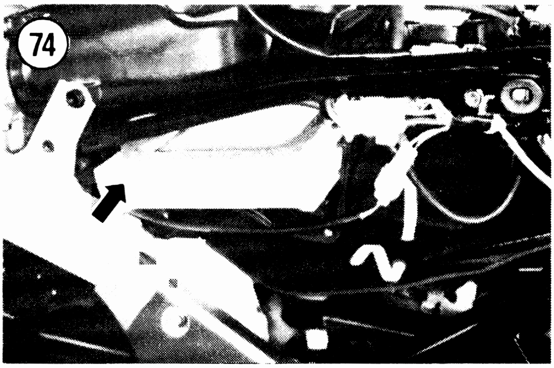

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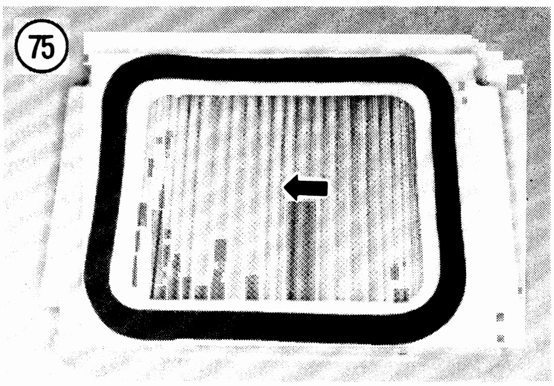

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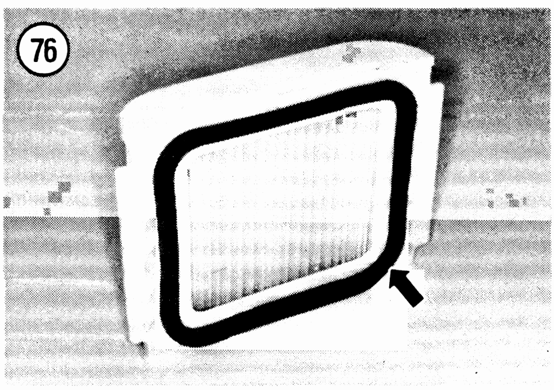

2. Remove the seat and the frame left-hand side cover as described in Chapter Twelve.

3. Loosen and remove the reusable tie-wrap (A, **Figure 72**) from the air filter cover.

4. Remove the air filter cover screws and remove the cover (B, **Figure 72**).

5. Pull out the 2 plastic air filter element retainers (**Figure 73**).

6. Remove the air filter element (**Figure 74**).

7. Wipe out the interior of the air box with a shop rag dampened with cleaning solvent. Remove any foreign matter that may have passed through a broken element.

8. Inspect the air filter element filtering area (**Figure 75**) for tears or other damage that would allow unfiltered air to pass into the engine. Check the sponge gasket (**Figure 76**) for tears or deterioration. Replace the element if necessary.

9. Gently tap the air filter element to loosen the dust.

CAUTION

In the next step, do not direct compressed air toward the inside surface of the element. If air pressure is directed to the inside surface it will force the dirt and dust into the pores of the element thus restricting air flow.

10. Apply compressed air toward the *outside surface* of the element (**Figure 77**) to remove all loosened dirt and dust from the element.

11. Install by reversing these removal steps. Make sure the new air filter element is correctly seated into the air box so there are no air leaks.

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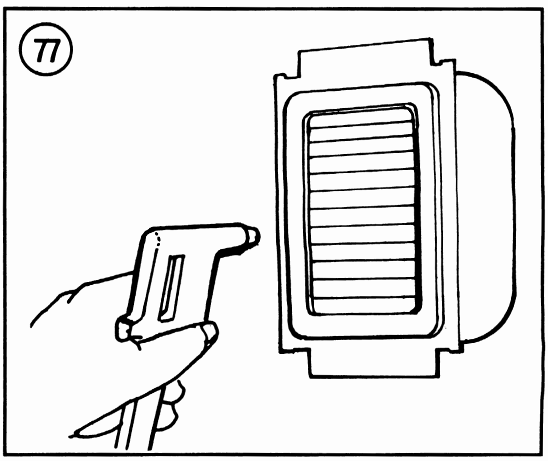


Steering Play

The steering head should be checked for looseness at the intervals specified in **Table 1** or whenever the following symptoms or conditions exist:

a. The handlebars vibrate more than normal.
b. The front forks make a clicking or clunking noise when the front brake is applied.
c. The steering feels tight or slow.
d. The motorcycle does not want to steer straight on level road surfaces.

Inspection

1. Place the bike securely on the centerstand with the front wheel clear of the ground.
2. Center the front wheel. Push lightly against the left handlebar grip to start the wheel turning to the right, then let go. The wheel should continue turning under its own momentum until the forks hit their stop.
3. Center the wheel, and push lightly against the right handlebar grip.
4. If, with a light push in either direction, the front wheel will turn all the way to the stop, the steering adjustment is not too tight.
5. If the front wheel would not turn all the way to the stop, the steering is too tight. Adjust the steering as described in this chapter.
6. Have an assistant steady the bike or sit on the seat. Center the front wheel and kneel in front of it. Grasp the bottoms of the 2 front fork slider legs. Try to pull the forks toward you, and then try to push them toward the engine. If no play is felt, the steering adjustment is not too loose.
7. If the steering adjustment is too tight or too loose, adjust it as described in this chapter.

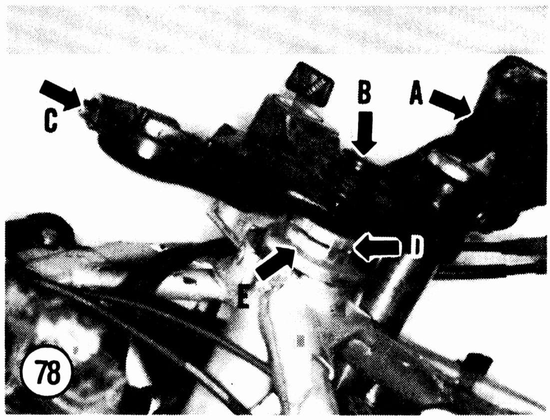
Adjustment

1. Place the bike securely on the centerstand with the front wheel clear of the ground.
2. Remove the fuel tank as described in Chapter Seven.
3. Remove the upper front fairing as described in Chapter Twelve.
4. Remove the handlebars (A, **Figure 78**) as described in Chapter Ten.
5. Remove the steering stem nut (B, **Figure 78**) and lift the upper fork bridge (C, **Figure 78**) off of the steering stem shaft.
6. Remove the lockwasher from the top of the steering stem.
7. Loosen the upper ring nut (D, **Figure 78**) and remove it and the washer (**Figure 79**).

NOTE
Yamaha sells a special ring nut wrench (U.S. part No. YU-33975 or U.K. part No. 90890-01381) that can be used with a torque wrench for accurate steering stem adjustment. See ***Figure 80****.*

8. Tighten the lower ring nut (E, **Figure 78**) in the following order:

a. Tighten the lower ring nut to 50 N•m (36 ft.-lb.).
b. Loosen the lower ring nut completely.



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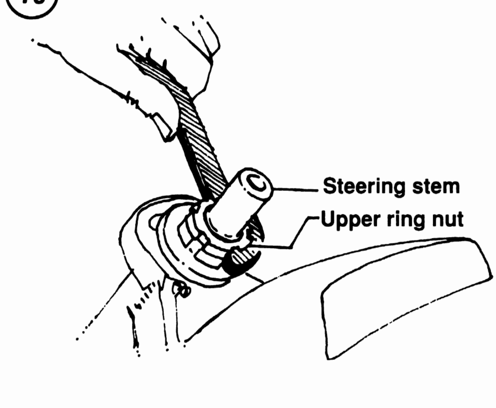

c. Retighten the lower ring nut to 3 N•m (2.2 ft.-lb.).

9. Install the washer and the upper ring nut. (**Figure 80**). Tighten the upper ring nut finger-tight. Then check that the upper ring nut grooves line up with the lower ring nut grooves. If not, tighten the upper ring nut as required.

10. Install the lockwasher.

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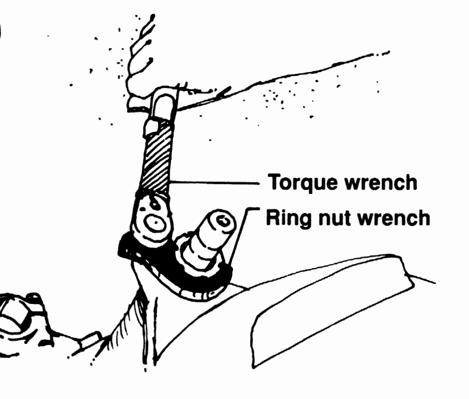

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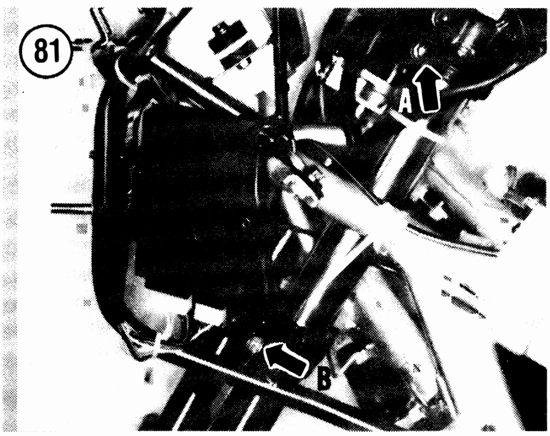

11. Install the upper steering stem and the steering stem nut.

12. Turn the steering stem again by hand to make sure it turns freely and does not bind. If the steering stem is too tight, the bearings can be damaged; if the steering stem is too loose, the steering will become unstable. Readjust if necessary.

13. Reverse Steps 2-5 to complete installation.

14. Recheck the steering adjustment. Repeat if necessary.

Front Suspension Check

1. Remove the upper fairing as described in Chapter Twelve.

2. Apply the front brake and pump the forks up and down as vigorously as possible. Check for smooth operation and check for any oil leaks.

3. Make sure the upper (A, **Figure 81**) and lower (B, **Figure 81**) fork bridge bolts are tight.

4. Make sure the handlebar boss Allen pinch bolts (**Figure 82**) and holder bolt securing each handlebar are tight and that each handlebar is secure.

5. Make sure the front axle pinch bolt (**Figure 83**) and axle (**Figure 84**) are tight.

WARNING
If any of the previously mentioned bolts and nuts are loose, refer to Chapter Nine for correct procedures and torque specifications.

6. Install the upper fairing as described in Chapter Twelve.

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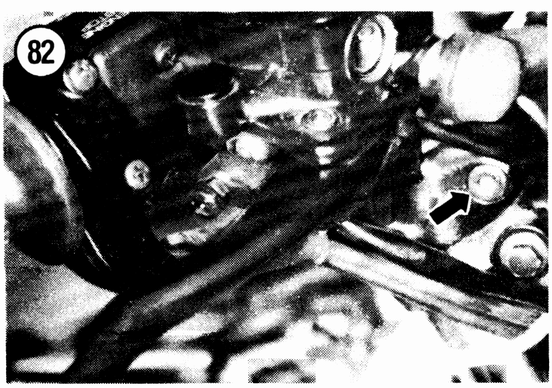

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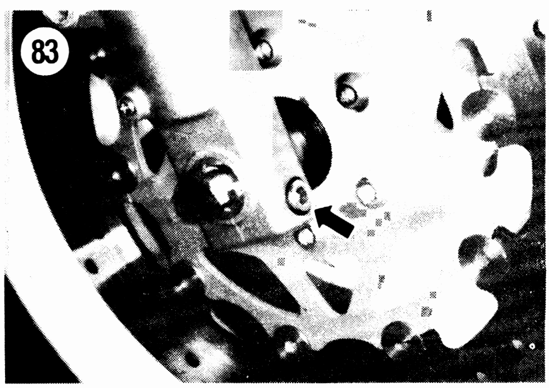


Rear Suspension Check

1. Place the bike securely on the centerstand with the rear wheel clear of the ground.
2. Have an assistant steady the bike or sit on the seat.
3. Push hard on the rear wheel sideways to check for side play in the rear swing arm bearings.
4. Make sure the swing arm pivot bolt nut (**Figure 85**) is tight.
5. Check the tightness of the shock absorber's upper (**Figure 86**) and lower (**Figure 87**) mounting bolts and nuts.
6. Check the tightness of the rear shock linkage.
7. Make sure the cotter pin is in place (A, **Figure 88**) and the rear axle nut is tight (B, **Figure 88**).
8. Check the tightness of the rear caliper torque arm front and rear bolt (**Figure 89**) and make sure both cotter pins are in place.

WARNING
If any of the previously mentioned nuts or bolts are loose, refer to Chapter Ten for correct procedures and torque specifications.

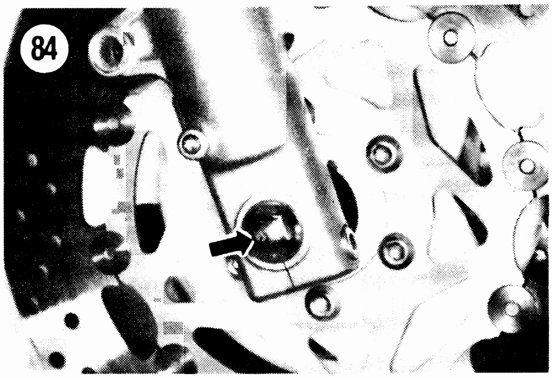
Nuts, Bolts and Other Fasteners

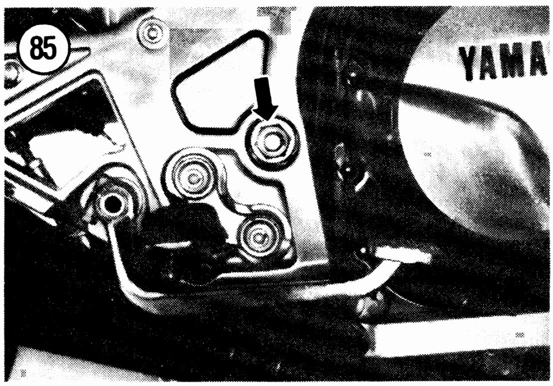
Constant vibration can loosen many fasteners on a motorcycle. Check the tightness of all fasteners, especially those on:

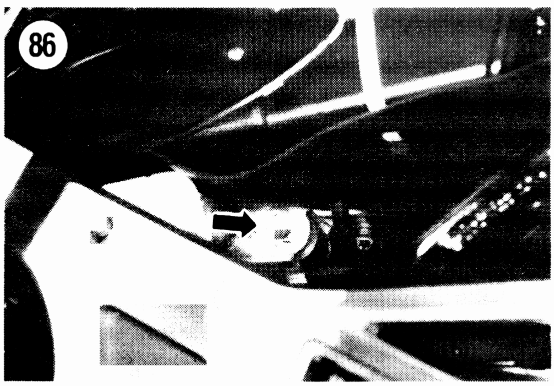
a. Engine mounting hardware.
b. Engine crankcase covers.
c. Handlebars and front forks.
d. Gearshift lever.
e. Sprocket bolts and nuts.
f. Brake pedal and lever.
g. Exhaust system.
h. Lighting equipment.
i. Fairing assembly.

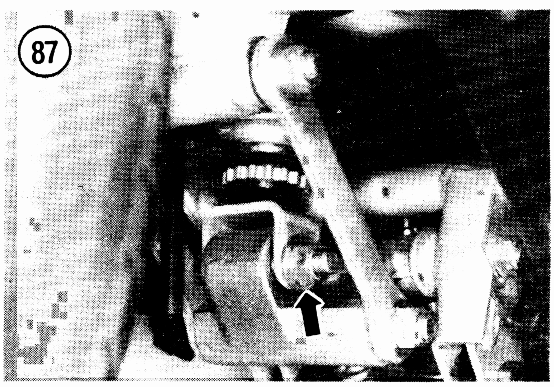
Front Fork Adjustment (1984-1990 Models)

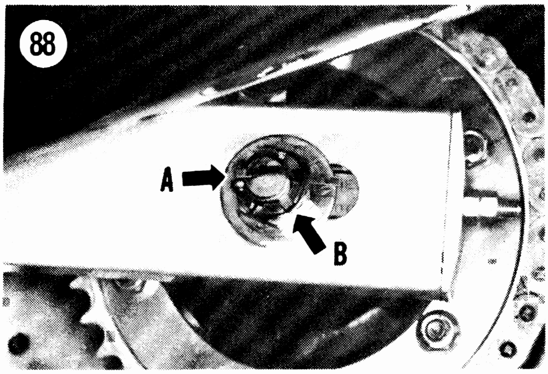
The adjustment settings for the fork spring pre-load and anti-dive must correspond to the rear shock absorbers spring pre-load and damping adjustments. All adjustments must correspond to vehicle load. Refer to **Table 7** for recommended settings for both the front and rear suspension.

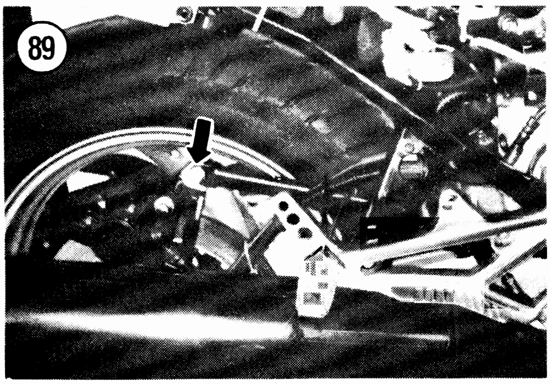


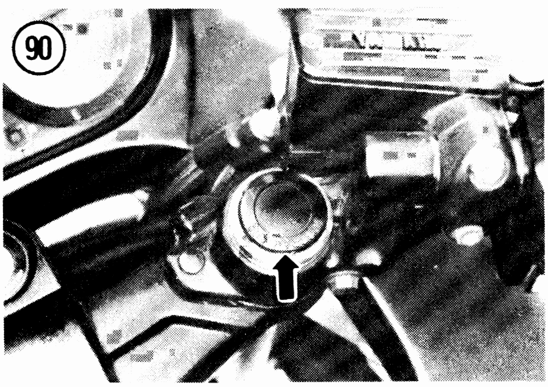


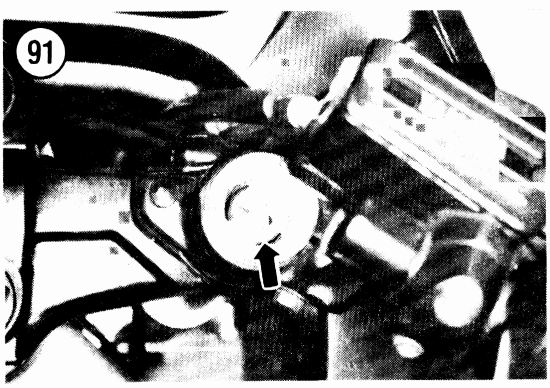












Spring pre-load adjustment

The spring pre-load can be adjusted to 3 different positions to best suit riding, load and speed conditions. The different adjuster ranges are as follows:

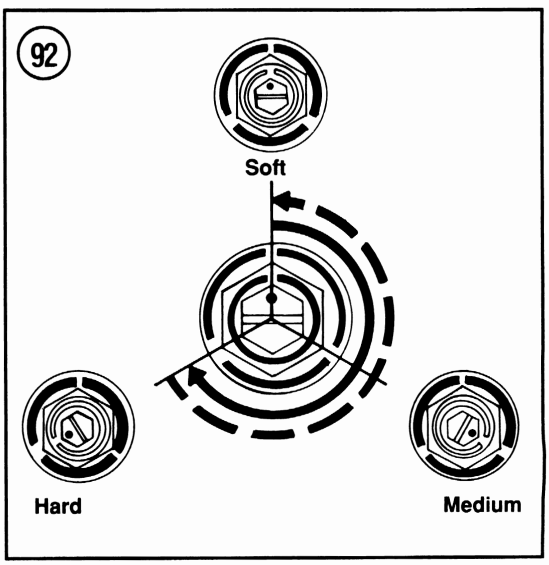
a. Standard: No. 1
b. Minimum: No. 2.
c. Maximum: No. 3.

WARNING
Always adjust both forks to the same setting. If adjusted to different settings, it will result in poor handling and stability that could lead to loss of control of the bike resulting in an accident.

1. Remove the fork cap (**Figure 90**).
2. Place a flat-tipped screwdriver in the slot of the damping adjuster (**Figure 91**).

CAUTION
Turn the pre-load adjuster in progressive steps, i.e. from No. 1, to No. 2 to No. 3 and vice-versa. Never turn it directly from No. 1 to No. 3 or No. 3 to No. 1.

3. Press down on the adjuster and rotate it in either direction to the desired setting as shown in **Figure 92**. Always place the adjuster in one of the 3 settings—never leave the adjuster in between any of the settings.
4. Remove the screwdriver and install the fork cap.



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Anti-dive adjustment (1984-1987 models)

The anti-dive can be adjusted to 4 different positions to best suit riding, load and speed conditions. The different adjuster ranges are as follows:

a. Standard: No. 1
b. Maximum: No. 4.

WARNING
Always adjust both forks to the same setting. If adjusted to different settings, it will result in poor handling and stability that could lead to loss of control of the bike resulting in an accident.

Rotate the anti-dive adjuster (**Figure 93**) in either direction to the desired setting as shown in **Figure 94**. Always place the adjuster in one of the 4 settings—never leave the adjuster in between any of the settings.

Front Fork Spring Pre-load Adjustment (1991-on Models)

The adjustment setting for the fork spring pre-load must correspond to the rear shock absorbers spring pre-load and damping adjustments. All adjustments must correspond to vehicle load. Refer to **Table 7** for recommended settings for both the front and rear suspension.

The spring pre-load can be adjusted to 4 different positions to best suit riding, load and speed conditions. The different adjuster ranges are listed in **Table 7**.

WARNING
Always adjust both forks to the same setting. If adjusted to different settings, it will result in poor handling and stability that could lead to loss of control of the bike resulting in an accident.

1. Remove the protective cap (**Figure 95**) from the fork cap.
2. Place a flat-tipped screwdriver in the slot of the spring pre-load adjuster (**Figure 96**).

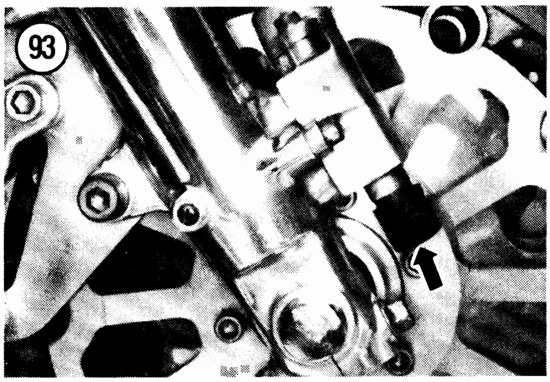
CAUTION
Turn the pre-load adjuster in progressive steps, i.e. from No. 1, to No. 2, to No. 3, to No. 4 and vise-versa. Never turn it directly from No. 1 to No. 4 or No. 4 to No. 1.

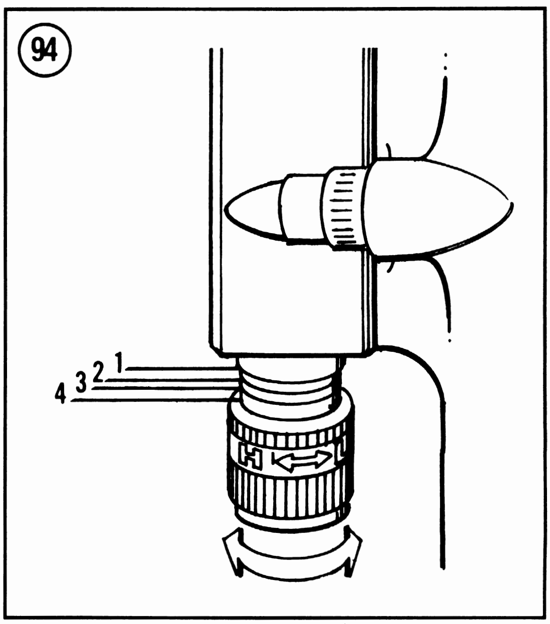
3. Press down on the adjuster and rotate it in either direction to the desired setting. Always place the adjuster in one of the 4 settings—never leave the adjuster in between any of the settings.

4. Remove the screwdriver and install the protective cap.

Rear Shock Absorber Adjustment (1984-1990 Models)

The adjustment settings for the rear shock absorbers spring pre-load and damping adjustments must correspond to the front fork spring pre-load and anti-dive adjustments. All adjustments must correspond to vehicle load. Refer to **Table 7** for recom-





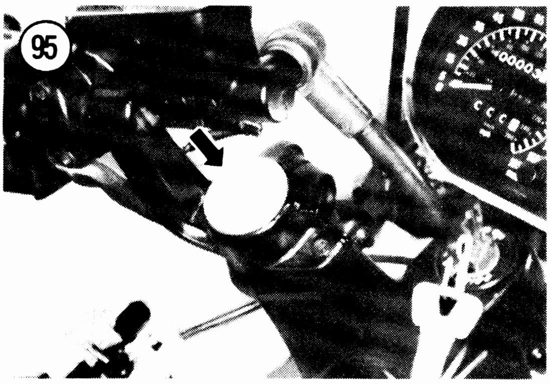
mended settings for both the rear and front suspension.

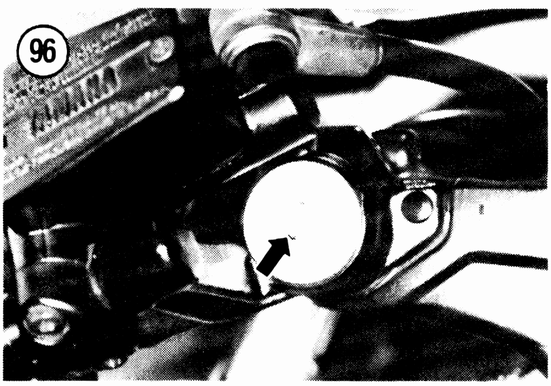
Spring pre-load adjustment

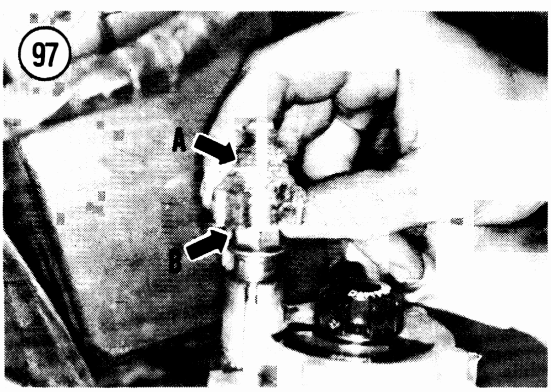
The spring pre-load can be adjusted to 5 different positions to best suit riding, load and speed conditions. The different adjuster ranges are as follows:

a. Minimum: No. 1 or No. 2.
b. Maximum: No. 4 or No. 5.

1. Place the bike securely on the centerstand with the rear wheel clear of the ground.







2. Remove the frame right-hand side cover.

CAUTION
Turn the pre-load adjuster in progressive steps, i.e. from No. 1, to No. 2 to No. 3, etc. and vise-versa. Never turn it directly from No. 1 to No. 5 or No. 5 to No. 1.

3. Lift up the rubber cap (A, **Figure 97**).

NOTE
*Rotating the adjuster **clockwise** will increase spring pre-load and rotating the adjuster **counterclockwise** will decrease spring pre-load.*

4. Use a wrench and rotate the anti-dive adjuster (B, **Figure 97**) in either direction to the desired setting. Always place the adjuster in one of the 5 settings—never leave the adjuster in between any of the settings.
5. Install the rubber cap and the frame side cover.

Damping adjustment

The spring damping can be adjusted to 5 different positions to best suit riding, load and speed conditions. The different adjuster ranges are as follows:

a. Minimum: No. 1 or No. 2.
b. Maximum: No. 4 or No. 5.

1. Place the bike securely on the centerstand with the rear wheel clear of the ground.
2. Remove the frame right-hand side cover.

CAUTION
Turn the damping adjuster in progressive steps, i.e. from No. 1, to No. 2 to No. 3, etc. and vise-versa. Never turn it directly from No. 1 to No. 5 or No. 5 to No. 1.

NOTE
*Rotating the damping adjuster **clockwise** will decrease damping and rotating the adjuster **clockwise** will increase damping.*

3. Rotate the damping adjuster (**Figure 98**) in either direction to the desired setting. Always place the adjuster in one of the 5 settings—never leave the adjuster in between any of the settings.
4. Install the frame side cover.

Rear Shock Absorber Adjustment (1991-on Models)

The adjustment settings for the rear shock absorbers spring pre-load and damping adjustments must correspond to the front fork spring pre-load and anti-dive adjustments. All adjustments must correspond to vehicle load. Refer to **Table 7** for recommended settings for both the rear and front suspension.

Spring pre-load adjustment

The spring pre-load can be adjusted to 9 different positions to best suit riding, load and speed conditions. The different adjuster ranges are listed in **Table 7**.

1. Place the bike securely on the centerstand with the rear wheel clear of the ground.
2. Remove seat and the frame left-hand side cover.

CAUTION
Turn the pre-load adjuster in progressive steps, i.e. from No. 1, to No. 2 to No. 3, etc. and vise-versa. Never turn it directly from No. 1 to No. 9 or No. 9 to No. 1.

NOTE
*Rotating the adjuster **clockwise** will decrease spring pre-load and rotating the adjuster **counterclockwise** will increase spring pre-load.*

CAUTION
Do not try to rotate the adjuster past the minimum or maximum settings.

3. Use the special wrench furnished in the owners tool kit and rotate the spring pre-load adjuster (**Figure 99**) in either direction to the desired setting. Always place the adjuster in one of the 9 settings—never leave the adjuster in between any of the settings.
4. Install the frame side cover and seat.

Damping adjustment

The spring damping can be adjusted to 12 different positions to best suit riding, load and speed conditions. The different adjuster ranges are listed in **Table 7**.

1. Place the bike securely on the centerstand with the rear wheel clear of the ground.

NOTE
*Rotating the damping adjuster **clockwise** will decrease damping and rotating the adjuster **counterclockwise** will increase damping.*

CAUTION
Do not try to rotate the adjuster past the minimum or maximum settings.

2. Rotate the damping adjuster (**Figure 100**) in either direction to the desired setting. Always place the adjuster in one of the 12 settings—never leave the adjuster in between any of the settings.

TUNE-UP

Perform a complete tune-up at the interval listed in **Table 1** of normal riding. More frequent tune-ups may be required if the bike is ridden in stop-and-go traffic. The purpose of the tune-up is to restore the

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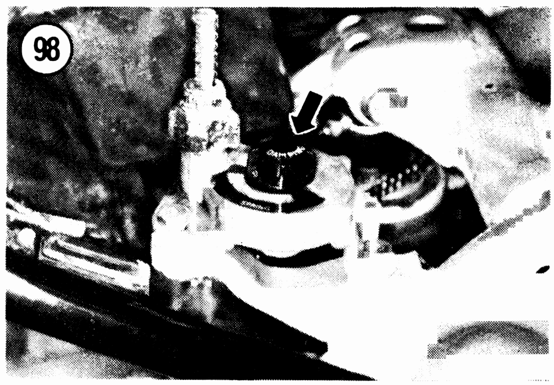

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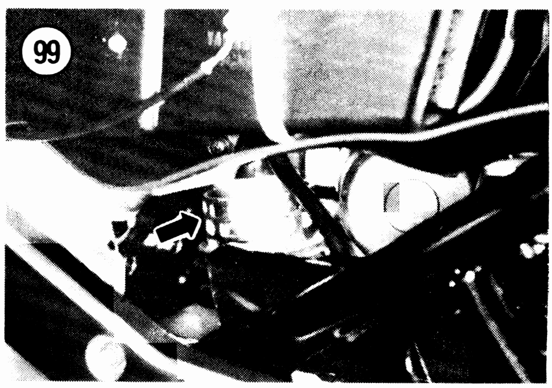


performance lost due to normal wear and deterioration of parts.

The spark plugs should be routinely replaced at every other tune-up or if the electrodes show signs of erosion. In addition, this is a good time to clean the air filter element. Have the new parts on hand before you begin.

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

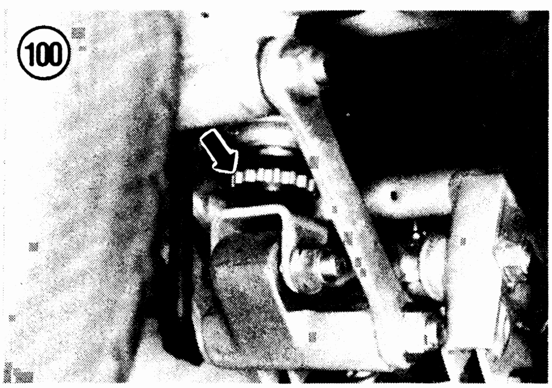
a. Adjust valve clearances.
b. Run a compression test.
c. Check the ignition timing.
d. Synchronizing carburetors and set the idle speed.

Table 8 summarizes tune-up specifications.

Tools

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

100



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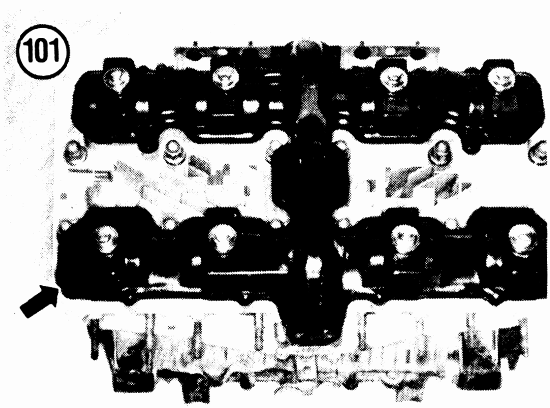

a. Yamaha special tool, Tappet adjusting tool (U.S. part No. YM-33966 or U.K. part No. 90890-04010).
b. Spark plug wrench.
c. Socket wrench and assorted sockets.
d. Flat feeler gauge.
e. Compression gauge.
f. Spark plug wire feeler gauge and gapper tool.
g. Ignition timing light.
h. Carburetor synchronization tool—to measure manifold vacuum.

3

Valve Clearance Measurement

Valve clearance measurement and adjustment must be performed with the engine cool, at room temperature (below 35° C [95° F]). The correct valve clearance is as follows:

a. Exhaust valves: 0.16-0.20 mm (0.0063-0.0079 in.).
b. Intake valves: 0.11-0.15 mm (0.0043-0.0059 in.).

The exhaust valves are located at the front of the engine and the intake valves are located at the rear of the engine.

NOTE
Some of the steps in this procedure are shown with the engine removed from the frame for clarity. It is not necessary to remove the engine for this procedure.

NOTE
The cylinders are numbered 1, 2, 3 and 4 from the left-to-right. The left-hand side refers to a rider sitting on the seat looking forward.

NOTE
Measure the valve clearance in the normal firing order sequence: cylinder No. 1, No. 2, No. 4 and then No. 3.

1. Remove the cylinder head cover (**Figure 101**). Refer to *Cylinder Head Cover Removal/Installation* in Chapter Four.
2. Remove the spark plugs as described in this chapter. This will make it easier to rotate the engine by hand.
3. Remove the bolts securing the ignition pick-up coil cover (**Figure 102**) and remove the cover and gasket.

NOTE
A cylinder at TDC on the compression stroke will have all 4 of the camshaft lobes facing away from the valve lifters, indicating that both the 2 intake and the 2 exhaust valves are closed.

4. Using a 17 mm wrench on the pick-up coil timing plate mounting bolt (**Figure 103**), rotate the crankshaft *counterclockwise* until the "T" mark (for the No. 1 and No. 4 cylinders) on the timing plate aligns with the stationary pointer on the pick-up coil (**Figure 104**). Observe the camshaft lobes and check that the No. 1 and 4 cylinders are now at top dead center (TDC) on the compression stroke. If not, rotate the engine *counterclockwise* an additional 360° and realign the "T" mark, then recheck the camshaft lobes location.

5. Working on the No. 1 cylinder valves, insert a feeler gauge between the cam and the lifter surface (**Figure 105**). In order to obtain a correct measurement, the lobe must be directly opposite the lifter surface (**Figure 106**). The clearance is correct if there is a slight drag on the feeler gauge when it is inserted and withdrawn. The correct valve clearance for intake and exhaust valves is listed in **Table 8**. For best performance, adjust to the smaller dimension. Measure the valve clearance with a metric feeler gauge as it will be easier to calculate pad replacement.

6. Record valve clearances for the No. 1 cylinder intake and exhaust valves.

7. Rotate the crankshaft in the following order and indicated amount of degrees, then measure the No. 2, 4 and 3 cylinder valves and record the clearances. Repeat Step 5 and Step 6 for each cylinder's valves as follows:

   a. No. 2 cylinder: Rotate crankshaft 180°.
   b. No. 4 cylinder: Rotate crankshaft additional 180°.
   c. No. 3 cylinder: Rotate crankshaft additional 180°.

8. Measure all valves and record the clearance. They must be measured very accurately. If any are out of specification, correct the clearance as described in this chapter.

9. If all valve clearances are within specifications, reinstall the cylinder head cover as described in Chapter Four. If any adjustment is necessary, proceed to the following procedure.

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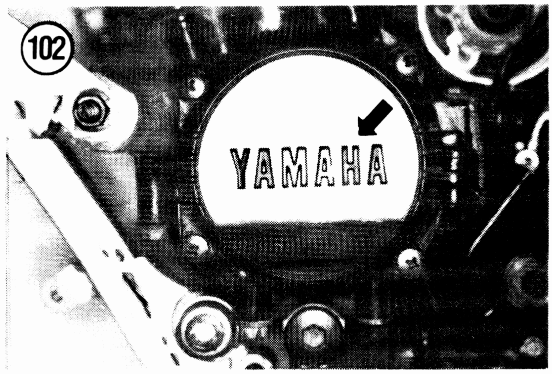

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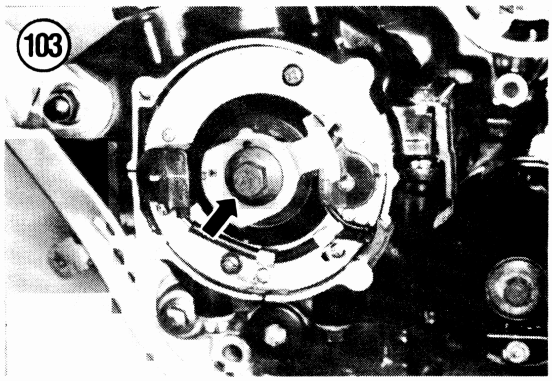

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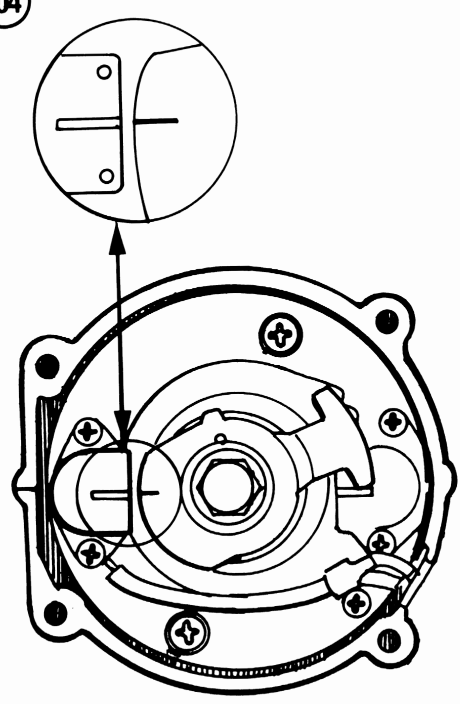
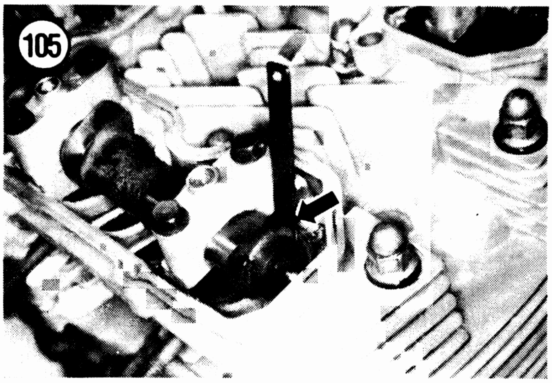


Valve Clearance Adjustment

A special tool, Yamaha Tappet Adjusting Tool is necessary for this procedure (U.S part No. YM-33966, U.K. part No. 90890-04110).

It is attached to the cylinder head, next to the valve being adjusted, with an Allen bolt. This tool holds the valve lifter down so the adjusting pad can be removed and replaced.

105



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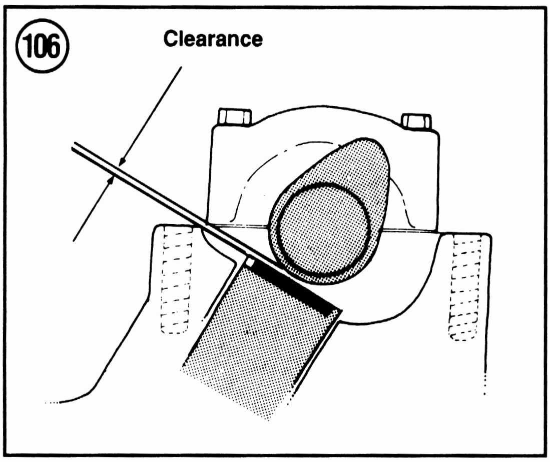

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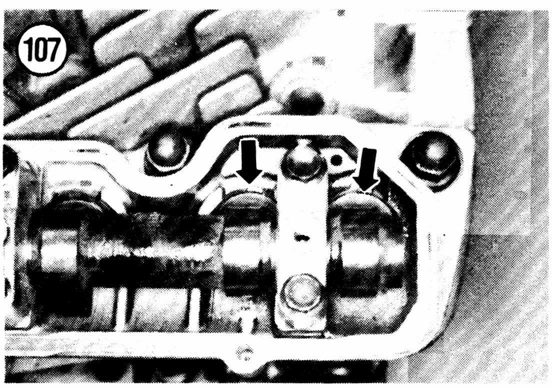


There is no set order to adjust the valves but it is suggested that you start with the No. 1 cylinder and work across from left-to-right to finish with the No. 4 cylinder in a systematic order. If necessary, do both the intake and exhaust valves for one cylinder, then move on to the next cylinder and repeat the procedure.

To correct the valve clearance, the adjustment pads must be removed from the top of the valve lifter body and be replaced with one of the correct thickness. These pads are available in 25 different thicknesses from 200 (2.00 mm) to No. 320 (3.20 mm) in increments of 0.05 mm. They are available from Yamaha dealers. The thickness is marked on the top side of the pad.

1. The top of the valve lifter has a slot. This slot (**Figure 107**) must be turned opposite the blade of the valve adjusting tool prior to installing the tool.

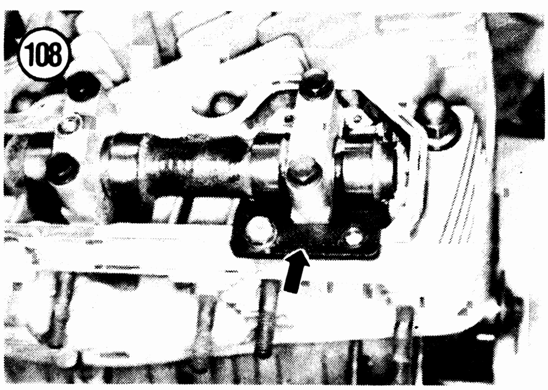
2. Turn the camshaft by rotating the crankshaft until the camshaft lobe fully depresses the valve lifter (valve in the completely open position).

3. Install the adjusting tool (**Figure 108**), using an Allen bolt (A, **Figure 109**). Make sure the tool blade touches only the lifter body (B, **Figure 109**), not the pad (C, **Figure 109**).

CAUTION

*Do not allow the camshaft lobe to come in contact with the valve adjusting tool as it may fracture the cylinder head. To avoid camshaft contact with the tool, rotate the camshafts as follows; intake—**clockwise** and exhaust—**counterclockwise**, as viewed from the left-hand side looking directly at the No. 1 cylinder (**Figure 110**).*

108



4. Carefully rotate the camshaft lobe off of the pad so it can be removed. Remove the pad from the lifter with a small screwdriver or scribe (**Figure 111**) and needlenose pliers or a magnetic tool. Turn the pad over and note the number. If the number is not legible, measure it with a micrometer.

5. For correct pad selection, proceed as follows:

NOTE:
For calculations use the mid-point of the specified clearance — e.g. intake valve clearance 0.11-0.15 mm = ***0.13 mm*** *and exhaust 0.16-0.20 mm =* ***0.18 mm****.*

NOTE:
The following numbers are examples only. Use the actual measured clearance, correct clearance specification and existing pad number from your engine.

Examples:	**Intake**	**Exhaust**
Actual measured clearance	0.50 mm	0.41 mm
Subtract specified clearance	– 0.13 mm	– 0.18 mm
Equals excess clearance	0.37 mm	0.23 mm

Existing pad number	220	245
Add excess clearance	+ 37	+ 23
Equals new pad number	257	268
(round off to the nearest pad number)	255	270

6. Install the new pad into the lifter with the number facing down. Make sure the pad is positioned correctly into the lifter.

7. Carefully rotate the camshaft until the lobe comes in contact with the new pad and lifter. Remove the adjusting tool.

8. Rotate the camshaft several complete revolutions to make sure the pad has properly seated into the lifter.

9. Recheck the valve clearance as described under *Valve Clearance Measurement* in this chapter. If clearance is incorrect, repeat Steps 1-6 until proper clearance is achieved.

10. Discard all old removed pads. They are worn and their numbers are no longer accurate.

11. Repeat for each valve that had excessive valve clearance.

12. After replacing all necessary valve pads, reinstall the cylinder head cover as described in Chapter Four.

Compression Test

At every tune-up, check cylinder compression. Record the results and compare them at the next check. A running record will show trends in deterioration so that corrective action can be taken before complete failure.

The results, when properly interpreted, can indicate general cylinder, piston ring and valve condition.

NOTE
The valves must be properly adjusted to correctly interpret the results of this test.

1. Warm the engine to normal operating temperature. Ensure that the choke valve and throttle valve are completely open.

2. Remove the spark plugs as described in this chapter.

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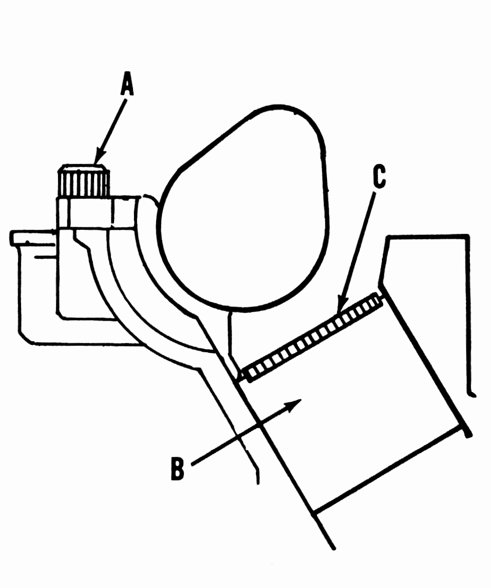

NOTE
*A screw-in type compression tester (**Figure 112**) will be required for this procedure.*

3. Connect the compression tester to one cylinder following manufacturer's instructions.
4. Crank the engine over until there is no further rise in pressure.
5. Remove the tester and record the reading.
6. Repeat Steps 3-5 for the other cylinders.
7. When interpreting the results, actual readings are not as important as the difference between the readings. Standard compression pressure is specified in **Table 8**. Greater differences indicate worn or broken rings, leaky or sticky valves, blown head gasket or a combination of all.

If compression reading does not differ between cylinders by more than 10 psi, the rings and valves are in good condition.

If a low reading (10% or more) is obtained on one of the cylinders, it indicates valve or ring trouble. To determine which, pour about a teaspoon of engine oil through the spark plug hole onto the top of the piston. Turn the engine over once to clear some of the excess oil, then take another compression test and record the reading. If the compression returns to normal, the valves are good but the rings are defective on that cylinder. If compression does not increase, the valves require servicing. A valve could

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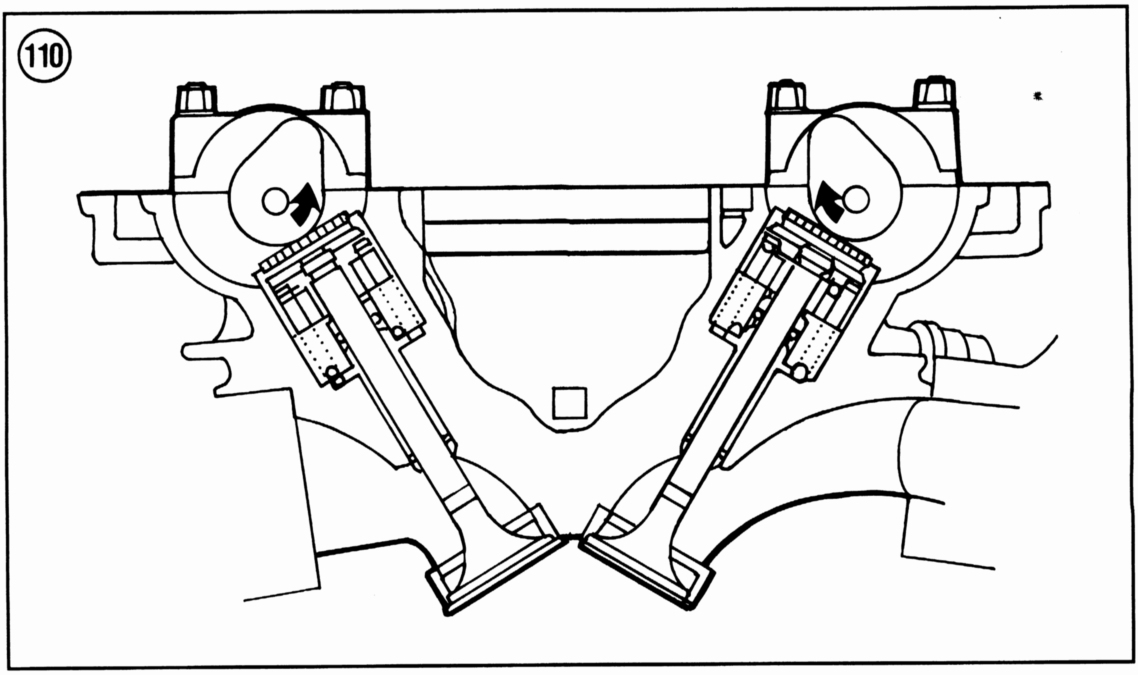

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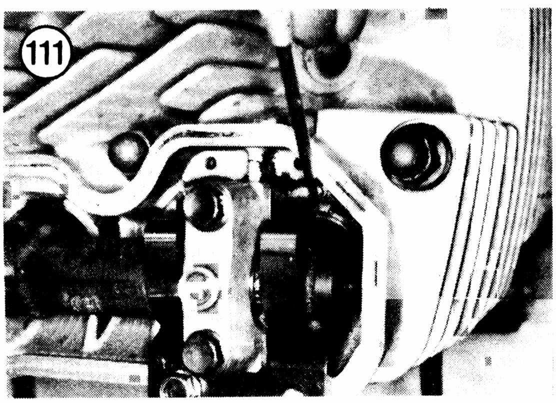

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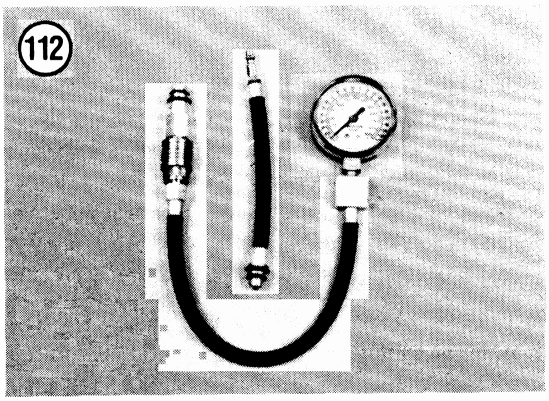


be hanging open but not burned or a piece of carbon could be on a valve seat.

NOTE
If the compression is low, the engine cannot be tuned to maximum performance. The worn parts must be replaced and the engine rebuilt.

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.

In general, use a hotter plug for low speeds, low loads and low temperatures. Use a colder plug for high speeds, high engine loads and high temperatures.

NOTE
In areas where seasonal temperature variations are great, the factory recommends a "two-plug system"—a cold plug for hard summer riding and a hot plug for slower winter operation—may prevent spark plug and engine problems.

The reach (length) of a plug is also important. A longer than normal plug could interfere with the valves and pistons, causing permanent and severe damage (**Figure 113**). The standard heat range spark plugs are listed in **Table 8**.

Spark Plug Removal/Cleaning

1. Remove the air duct from the upper fairing on each side as described in Chapter Twelve.

2. Remove the fuel tank as described in Chapter Seven.

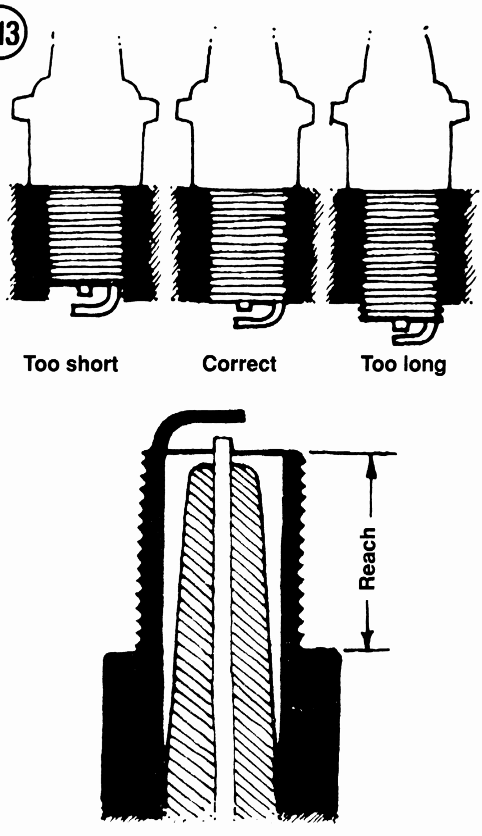
3. Grasp the spark plug leads (**Figure 114**) as near to the plug as possible and pull them off the plugs.

4. Blow away any dirt that has accumulated in the spark plug wells.

CAUTION
The dirt could fall into the cylinders when the plugs are removed, causing serious engine damage.

5. Use a 18 mm spark plug wrench and a ratchet socket wrench and remove spark plugs. Keep them in the order that they were removed. If anything turns up during the inspection step, you will then know which cylinder it came from.

113



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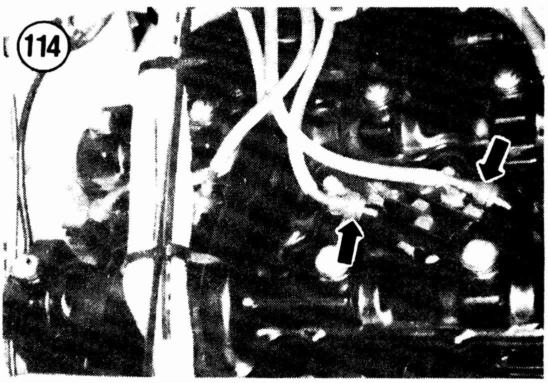

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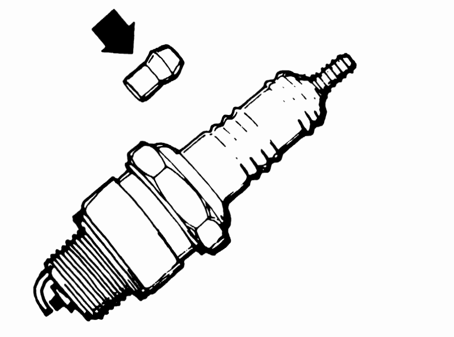

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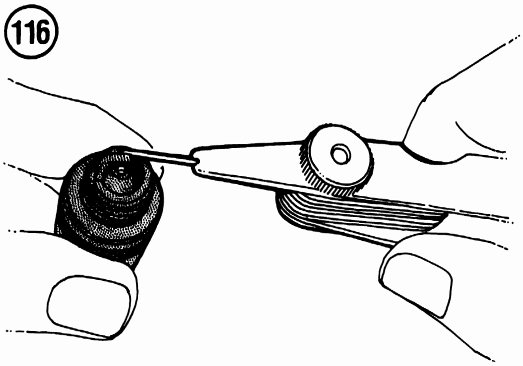

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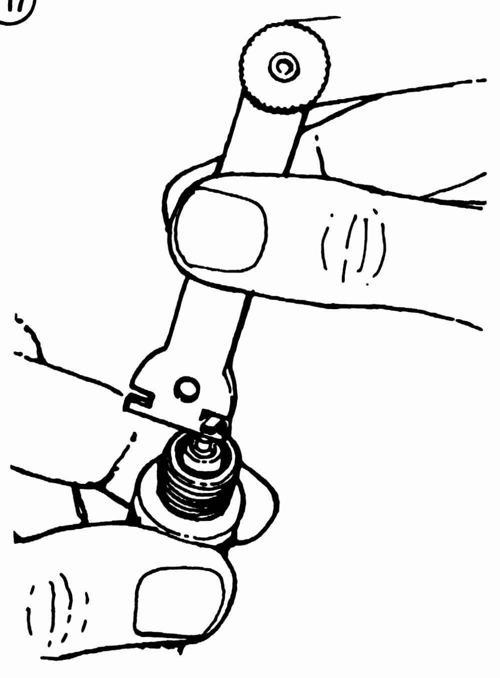

NOTE
If plugs are difficult to remove, apply penetrating oil, like WD-40 or Liquid Wrench, around base of plugs and let it soak in for about 10-20 minutes.

6. Inspect the spark plug carefully. Look for a plug with broken center porcelain, excessively eroded electrodes and excessive carbon or oil fouling. Replace such a plug. If deposits are light, the plug may be cleaned in solvent with a wire brush or in a special spark plug sandblast cleaner. Regap the plug as explained in this chapter.

3

NOTE
Spark plug cleaning with the use of a sand-blast type device is not recommended. While this type of cleaning is thorough, the plug must be perfectly free of all abrasive cleaning material when done. If not, it is possible for the cleaning material to fall into the engine during operation and cause damage.

Spark Plug Gapping and Installation

New plugs should be carefully gapped to ensure a reliable, consistent spark. You must use a special spark plug gapping tool with a wire gauge.

1. Remove the new plugs from the box. Do *not* screw in the small pieces that are loose in each box (**Figure 115**); they are not used.
2. Insert a wire gauge between the center and the side electrode of each plug (**Figure 116**). The correct gap is found in **Table 8**. If the gap is correct, you will feel a slight drag as you pull the wire through. If there is no drag, or the gauge won't pass through, bend the side electrode *with the gapping tool* (**Figure 117**) to set the proper gap listed in **Table 8**.
3. Put a *small* drop of oil or aluminum anti-seize compound on the threads of the spark plug.
4. Screw each spark plug in by hand until it seats. Very little effort is required. If force is necessary, you have the plug cross-threaded; unscrew it and try again.

NOTE
If a spark plug is difficult to install, the cylinder head threads may be dirty or slightly damaged. To clean the threads, apply grease to the threads of a spark plug tap and screw it carefully into the

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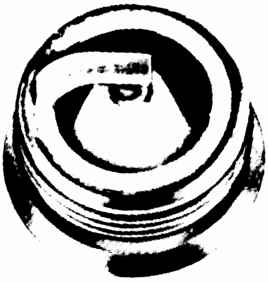
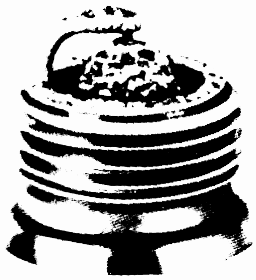
SPARK PLUG CONDITION



NORMAL

- Identified by light tan or gray deposits on the firing tip.
- Can be cleaned.



GAP BRIDGED

- Identified by deposit buildup closing gap between electrodes.
- Caused by oil or carbon fouling. If deposits are not excessive, the plug can be cleaned.

OIL FOULED

- Identified by wet black deposits on the insulator shell bore and electrodes.
- Caused by excessive oil entering combustion chamber through worn rings and pistons, excessive clearance between valve guides and stems, or worn or loose bearings. Can be cleaned. If engine is not repaired, use a hotter plug.

CARBON FOULED

- Identified by black, dry fluffy carbon deposits on insulator tips, exposed shell surfaces and electrodes.
- Caused by too cold a plug, weak ignition, dirty air cleaner, too rich a fuel mixture, or excessive idling. Can be cleaned.

LEAD FOULED

- Identified by dark gray, black, yellow, or tan deposits or a fused glazed coating on the insulator tip.
- Caused by highly leaded gasoline. Can be cleaned.

WORN

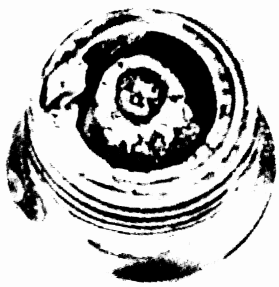
- Identified by severely eroded or worn electrodes.
- Caused by normal wear. Should be replaced.

FUSED SPOT DEPOSIT

- Identified by melted or spotty deposits resembling bubbles or blisters.
- Caused by sudden acceleration. Can be cleaned.

OVERHEATING

- Identified by a white or light gray insulator with small black or gray brown spots and with bluish-burnt appearance of electrodes.
- Caused by engine overheating, wrong type of fuel, loose spark plugs, too hot a plug, or incorret ignition timing. Replace the plug.



PREIGNITION

- Identified by melted electrodes and possibly blistered insulator. Metallic deposits on *insulator* indicate engine damage.
- Caused by wrong type of fuel, incorrect ignition timing or advance, too hot a plug, burned valves, or engine overheating. Replace the plug.

cylinder head. Turn the tap slowly until it is completely installed. If the tap cannot be installed, the threads are severely damaged.

5. Tighten the spark plugs to the torque listed in **Table 6**. If you don't have a torque wrench, an additional 1/4 to 1/2 turn is sufficient after the gasket has made contact with the head. If you are reinstalling old, regapped plugs and are reusing the old gasket, tighten only an additional 1/4 turn.

CAUTION

Do not overtighten. Besides making the plug difficult to remove, the excessive torque will squash the gasket and destroy its sealing ability.

6. Install each spark plug wire (**Figure 114**). Make sure it goes to the correct spark plug and is completely seated on the plug.

NOTE

If the ignition timing is going to be checked, do not install the lower fairing air duct at this time.

7. Install the air duct into the upper fairing on each side.
8. Install the fuel tank as described in Chapter Seven.

Reading Spark Plugs

Much information about engine and spark plug performance can be determined by careful examination of the spark plugs. This information is only valid after performing the following steps.

1. Ride bike a short distance at full throttle in any gear.

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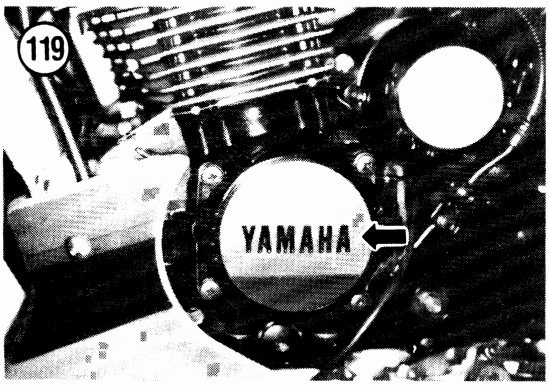


2. Turn off kill switch before closing throttle, and simultaneously, pull in clutch and coast to a stop. Do *not* downshift transmission in stopping.
3. Remove spark plugs and examine them. Compare them to **Figure 118.**

If the insulator tip is white or burned, the plug is too hot and should be replaced with a colder one.

A too-cold plug will have sooty deposits ranging in color from dark brown to black. Replace with a hotter plug and check for too-rich carburetion or evidence of oil blow-by at the piston rings.

If any one plug is found unsatisfactory, replace all four.

Ignition Timing

The models covered in this manual are equipped with either a Transistor Control Ignition (TCI) ignition system or Digital Control ignition system. Both systems are electronic and are not equipped with breaker points, they are also non-adjustable. The timing should be checked to make sure all ignition components are operating correctly.

NOTE

The timing marks on the pick-up coil timing plate are as follows: the straight line indicates TDC for the No. 1 cylinder, the bracket just below it indicates the firing range for the No. 1 cylinder.

1. Start the engine and let it reach normal operating temperature. Shut the engine off and place the bike securely on the centerstand.
2. Remove the air duct from the upper fairing on each side as described in Chapter Twelve.
3. Remove the bolts securing the ignition pick-up coil cover (**Figure 119**) and remove the cover and gasket.
4. Connect a portable tachometer following the manufacturer's instructions. The bike's tachometer is not accurate enough in the low rpm range for this adjustment.
5. Connect a timing light to the No. 1 spark plug following the manufacturer's instructions.
6. Start the engine and let it idle at the idle speed listed in **Table 8.**
7. Aim the timing light at the pick-up coil timing plate (**Figure 120**) and pull the trigger. If the bracket aligns with the stationary pointer on the pick-up coil (**Figure 121**), the timing is correct.

8. If the timing is incorrect, refer to the ignition system section in Chapter Eight for probable causes. The ignition timing cannot be adjusted.
9. Shut off the engine.

NOTE
If the idle speed is going to be checked, do not disconnect the portable tachometer nor install the upper fairing air duct at this time.

10. Disconnect the timing light and portable tachometer. Install the ignition pick-up coil cover and gasket. Tighten the bolts securely.
11. Install the air duct into the upper fairing on each side.

Idle Speed Inspection and Adjustment

Proper idle speed setting is necessary to prevent stalling and to provide adequate engine compression braking, but you can't set it perfectly with the bike's tachometer—it's not accurate at the low rpm range. A portable tachometer is required for this procedure.
1. If still in place, remove the air duct from the fairing on each side as described in Chapter Twelve.
2. Attach a portable tachometer, following the manufacturer's instructions.
3. Start the engine and warm it to normal operating temperature.
4. Sit on the seat while the engine is idling and adjust your weight to remove as much weight as possible away from the front wheel. Turn the front wheel from side to side without touching the throttle grip. If the engine speed increases when the wheel is turned, the throttle cable may be damaged or incorrectly adjusted. Perform the *Throttle Cable Adjustment* as described in this chapter.

NOTE
***Figure 122** is shown with the carburetor assembly removed for clarity. Do not remove the assembly for this procedure.*

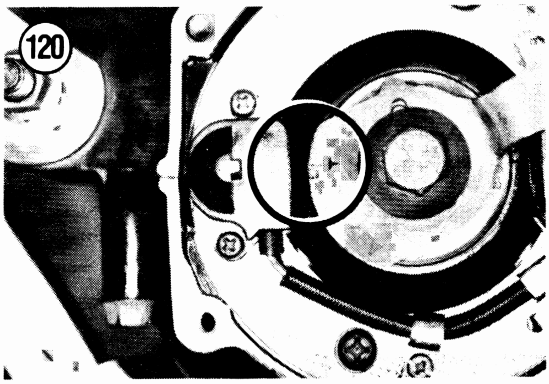
5. Turn the throttle stop screw (**Figure 122**) to set the idle speed as specified in **Table 8**. Turning the screw *in* will increase idle speed and *out* will decrease idle speed.
6. Rev the engine a couple of times to see if it settles down to the set speed. Readjust, if necessary.
7. Shut off the engine and disconnect the portable tachometer.

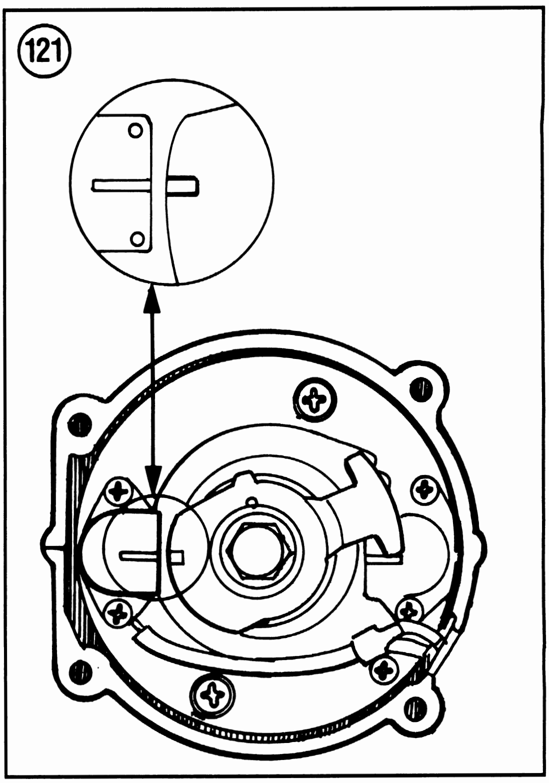
Carburetor Idle Mixture

The idle mixture (pilot screw) is preset at the factory and *is not to be reset*. Do not adjust the pilot screw unless the carburetors have been overhauled. If so, refer to Chapter Seven for service procedures.

Carburetor Synchronization

Synchronizing the carburetors makes sure that one cylinder doesn't try to run faster than the other,



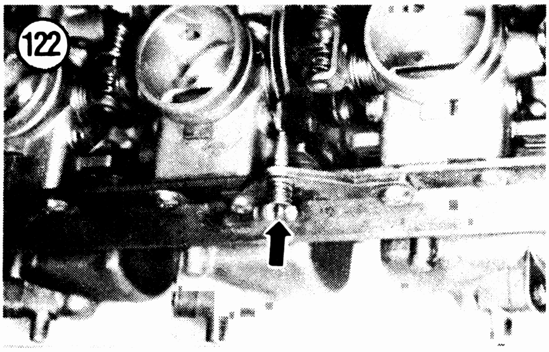


cutting power and gas mileage. The only accurate way to synchronize the carburetors is to use a set of vacuum gauges that measure the intake vacuum of all 4 cylinders at the same time.

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

1. Start the engine and warm it up fully.

2. Check and, if necessary, adjust the idle speed as described in this chapter. Shut off the engine.



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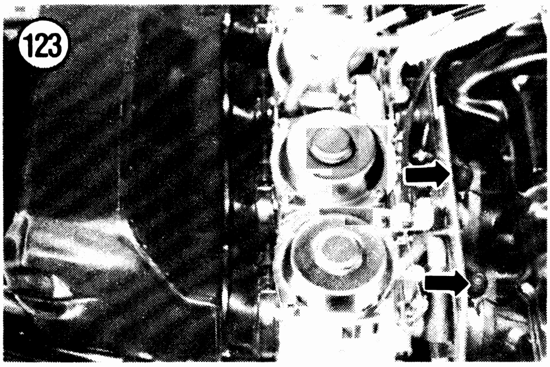

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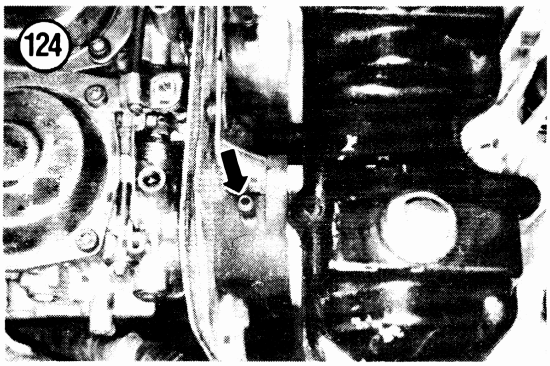

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3. Remove the fuel tank as described in Chapter Seven.

4. Install an auxiliary fuel tank onto the motorcycle and attach its fuel hose to the carburetor assembly.

NOTE
Carburetor synchronization ***cannot*** *be performed with the stock fuel tank in place because of the lack of room required to install the gauges and make adjustments. An auxiliary fuel tank is required to supply fuel to the carburetors during this procedure.*

NOTE
Fuel tanks from small displacement motorcycles, ATVs and lawn mowers make excellent auxiliary fuel tanks. Make sure the tank is mounted securely and positioned so that connecting fuel hose is not kinked or obstructed.

WARNING
When supplying fuel by temporary means, make sure the auxiliary fuel tank is secure and that all fuel lines are tight—no leaks.

NOTE
On the 1984-1987 U.S. and the 1984-1990 U.K. models, the No. 2 carburetor has an ignition system boost control vacuum hose attached to it instead of a port screw plug.

NOTE
Figure 123 *only shows 2 of the vacuum port plugs. Be sure to remove all plugs for this procedure.*

5A. On the 1984-1987 U.S. and the 1984-1990 U.K. models, disconnect the boost control vacuum hose from the No. 2 carburetor's cylinder head rubber intake tube. Remove the remaining vacuum port screw plugs (**Figure 123**) from the cylinder head rubber intake tubes.

5B. On all other models, remove all vacuum port screw plugs (**Figure 123**) on the cylinder head rubber intake tubes.

6. On models so equipped, remove the vacuum hoses from the carburetor assembly.

7. Install the vacuum line adapters into the vacuum hole (**Figure 124**) in each manifold.

8. Connect the vacuum lines from the carb-synch tool, following the manufacturer's instructions. Be sure to route the vacuum lines to the correct cylinder.
9. Start the engine and let it idle at the idle speed listed in **Table 8**.
10. If the difference in gauge readings is 10 mm Hg (0.4 in. Hg) or less between the 4 cylinders, the carburetors are considered synchronized. If not, proceed as follows:

NOTE
Figure 125 *is shown with the carburetor assembly removed for clarity. Do not remove the carburetor assembly for this procedure.*

a. The carburetor adjusting screws are identified in **Figure 125**.
b. With the engine at idle, synchronize the No. 1 carburetor to the No. 2 carburetor by turning the left-hand adjusting screw (A, **Figure 125**).
c. Then synchronize the No. 4 carburetor to the No. 3 carburetor by turning the right-hand adjusting screw (C, **Figure 125**).
d. Finally synchronize the No. 1 and No. 2 carburetors to the No. 3 and No. 4 carburetors by turning the middle adjusting screw (B, **Figure 125**).

NOTE
To gain the utmost in performance and efficiency from the engine, adjust the carburetors so that the gauge readings are as close to each other as possible.

11. Reset the idle speed and stop the engine.

NOTE
Make sure the vacuum plug screws are tight to prevent a vacuum leak.

12A. On the 1984-1987 U.S. and the 1984-1990 U.K. models, connect the boost control vacuum hose onto the No. 2 carburetor's cylinder head rubber intake tube.

12B. On all other models, install all vacuum port screw plugs (**Figure 123**) onto the cylinder head rubber intake tubes.

13. Disconnect the auxiliary fuel tank and install the standard fuel tank.

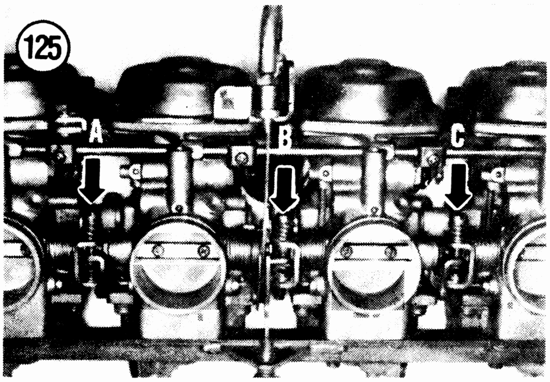


Table 1 MAINTENANCE SCHEDULE*

Every 300 miles (500 km)	**Lubricate drive chain** **Check drive chain tension; adjust if necessary**
Initial 600 miles (1,000 km) or 1 month	**Check and adjust valve clearance** **Change engine oil and filter** **Check carburetor synchronization; adjust if necessary** **Check front and rear brake free play; adjust if necessary** **Check front brake pad and rear brake pad thickness** **Lubricate all control cables** **Check operation of sidestand switch operation; clean if necessary (U.S.)**

(continued)

Table 1 MAINTENANCE SCHEDULE* (continued)

Initial 4,400 miles (7,000 km); thereafter every 3,800 miles (6,000 km) or every 7 months	Check spark plugs; adjust gap and clean Check crankcase ventilation hose for cracks or damage Check evaporation system hose for cracks or damage (California models) Check fuel and vacuum hoses for cracks or damage Check exhaust system for leakage Check carburetor synchronization; adjust if necessary Check engine idle speed; adjust if necessary Change engine oil and filter Clean air filter; replace if damaged Check front and rear brake free play; adjust if necessary Check front and rear brake pad thickness Lubricate all control and speedometer cables Check rear suspension adjust chain; adjust if necessary Lubricate brake and clutch lever pivot shafts Lubricate brake pedal and shift shaft pedal pivot shafts Lubricate sidestand pivot shafts Check front fork operation and check for oil seal leakage Check steering play; adjust if necessary Check wheel bearing operation Check battery level and specific gravity (non-sealed type) Check sidestand switch operation (U.S.)
Initial 8,200 miles (13,000 km) or 13 months; then every 7,600 miles (12,000 km) or 12 months	Check and adjust valve clearance Replace spark plugs
Initial 12,000 miles (19,000 km) or 19 months; then every 11,400 miles (18,000 km) or 19 months	Repack wheel bearings Lubricate swing arm and shock linkage pivot shafts
Initial 19,600 miles (31,000 km); then every 19,000 miles (30,000 km)	Replace fuel filter
Every 62,000 miles (100,000 km)	Replace the generator brushes

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

Table 2 TIRE INFLATION PRESSURE (COLD)*

Load	psi	kPa
Up to 198 lb. (90 kg)		
Front	32	226
Rear	36	250

(continued)

3

Table 2 TIRE INFLATION PRESSURE (COLD)* (continued)

Load	psi	kPa
198-** lb. (90-** kg)		
Front	36	250
Rear	42	290
High speed riding		
Front	36	250
Rear	42	290

*Recommended air pressure for factory equipped tires. Aftermarket tires may require different air pressure.
**Maximum load limit includes total weight of motorcycle with accessories, rider(s) and luggage.

Table 3 BATTERY STATE OF CHARGE

Specific gravity	State of charge
1.110-1.130	Discharged
1.140-1.160	Almost discharged
1.170-1.190	One-quarter charged
1.200-1.220	One-half charged
1.230-1.250	Three-quarters charged
1.260-1.280	Fully charged

Table 4 RECOMMENDED LUBRICANTS AND FLUIDS

Engine oil	
Temperatures 40° F (5° C) and up	SAE 20W/40 SE/SF
Temperatures 40° F (5° C) and below	SAE 10W/30 SE/SF
Brake fluid	DOT 4
Clutch hydraulic fluid	DOT 3 or DOT 4
Battery refilling (non-sealed)	Distilled water
Fork oil	10WT or SAE 10W/30 motor oil
Cables and pivot points	Yamaha chain and cable lube or SAE 10W/30 motor oil
Fuel	Unleaded regular
Drive chain	SAE 30-50W motor oil

Table 5 APPROXIMATE REFILL CAPACITIES

Engine oil	
Without filter change	3.0 L (2.6 Imp. qt./3.2 U.S. quarts)
With filter change	3.35 L (2.9 Imp. qt./3.5 U.S. quarts)
Engine rebuild	4.2 L (3.7 Imp. qt./4.4 U.S. quarts)
Front forks	
Capacity	
1984-1990	424 cc (14.9 Imp. oz./14.3 U.S. oz.)
1991-on	446 cc (15.7 Imp. oz./15.08 U.S. oz.)
Fuel tank	
Tank total capacity	
1100 cc	24.5 L (5.4 Imp. gal./6.5 U.S. gal.)
1200 cc	22 L (4.8 Imp. gal./5.8 U.S. gal.)
Reserve (1200 cc)	5 L (1.1 Imp. gal./1.3 U.S. gal.)

Table 6 MAINTENANCE AND TUNE-UP TIGHTENING TORQUES

Item	N•m	ft.-lb.
Oil drain plug	43	31
Oil filter drain bolt	7	5.1
Fork cap bolt	23	17
Upper fork bridge bolt	20	14
Spark plug (new)	17.5	12.5
Rear axle nut	150	110
Drive chain adjuster locknut	15	11

Table 7 RECOMMENDED FRONT FORK AND REAR SHOCK SETTINGS

Load conditions*	1984-1990 A	B	C	D
Front fork				
Spring preload adjuster	1	2	2	3
Damping adjuster	1	2	2	3
Rear shock absorber				
Spring preload adjuster	1, 2	2, 3	2, 3	4, 5
Damping adjuster	1, 2	2, 3	2, 3	4, 5
Anti-dive adjustment (1984-1987)				
Adjust bolt position	1, 2		2, 3	3, 4
1991-on				
Front fork				
Spring preload adjuster	1, 2	2, 3	2, 3	3, 4
Rear shock absorber				
Spring preload adjuster	1-4	5-8	5-8	6-9
Damping adjuster	12-7	7-3	7-3	5-3

*Load conditions
A = Solo rider
B = With passenger
C = With accessories
D = With accessories and passenger

Table 8 TUNE-UP SPECIFICATIONS

Air filter element	Dry element type
Ignition timing	Fixed
Valve clearance (cold)	
Intake	0.11-0.15 mm (0.0043-0.0059 in.)
Exhaust	0.16-0.20 mm (0.0063-0.0079 in.)
Spark plug	
Type	
U.S.	NGK DP8EA-9 ND X24EP-U9
U.K.	NGK DPR8EA-9 ND X24EPR-U9
Gap	0.8-0.9 mm (0.031-0.035 in.)
Tightening torque	17.5 N•m (12.5 ft.-lb.)
Idle speed	950-1,050 rpm
Compression pressure (cold at sea level)	
Standard	980 kPa (142 psi)
Minimum	882 kPa (128 psi)
Maximum	1,176 kPa (171 psi)
Maximum difference between cylinders	100 kPa (15 psi)

CHAPTER FOUR

ENGINE

The engine is an air-cooled double overhead camshaft eight-valve parallel four. Valves are operated by two chain-driven overhead camshafts.

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

Before starting any work, read the service hints in Chapter One. You will do a better job with this information fresh in your mind.

Table 1 lists engine specifications. **Table 1** and **Table 2** are at the end of the chapter.

SERVICING ENGINE IN FRAME

Many components can be serviced while the engine is mounted in the frame:

a. Cylinder head and camshafts.
b. Cylinder block and pistons.
c. External gearshift mechanism.
d. Clutch.
e. Carburetors.
f. Starter motor.
g. Alternator and electrical systems.

ENGINE PRINCIPLES

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

ENGINE

Removal/Installation

NOTE

There are 2 different frame design configurations used on the various models covered in this book. Both frame designs have a sub-frame on each side but the mounting hardware differs slightly from model to model and where differences occur they are noted. This procedure is shown on a 1985 model.

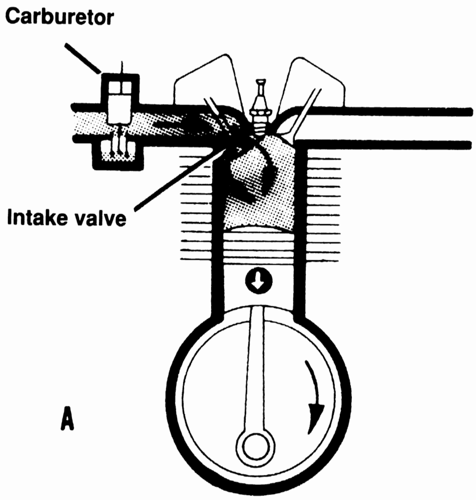
1. Remove the seats, the front fairing and frame side covers as described in Chapter Twelve.
2. Remove the exhaust system as described in Chapter Seven.
3. Remove the fuel tank as described in Chapter Seven.
4. Disconnect the negative battery terminal (**Figure 2**).
5. Drain the engine oil as described in Chapter Three.
6. Remove the air filter air box and the carburetor assembly as described in Chapter Seven.

CAUTION

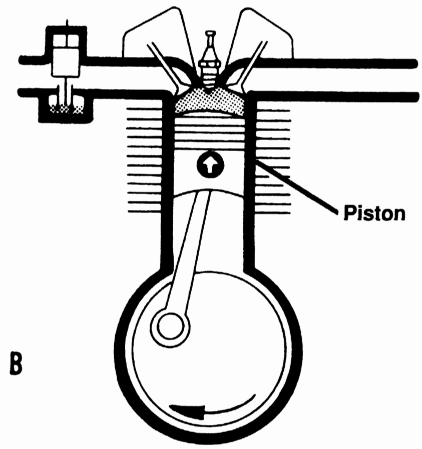
Stuff clean shops rags into the intake manifold openings to prevent the entry of foreign matter through the intake tubes and into the cylinder head.

4-STROKE PRINCIPLES

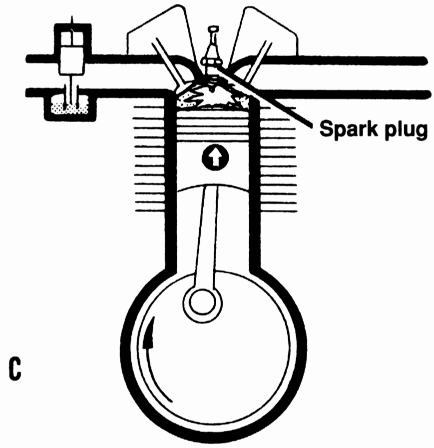
1



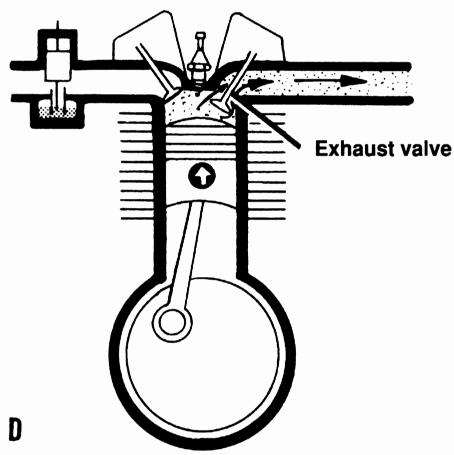
As the piston travels downward, the exhaust valve is closed and the intake valve opens, allowing the new air-fuel mixture from the carburetor to be drawn into the cylinder. When the piston reaches the bottom of its travel (BDC), the intake valve closes and remains closed for the next 1 1/2 revolutions of the crankshaft.



While the crankshaft continues to rotate, the piston moves upward, compressing the air-fuel mixture.



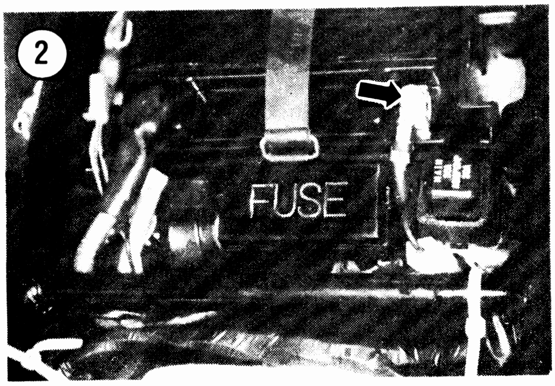
As the piston almost reaches the top of its travel, the spark plug fires, igniting the compressed air-fuel mixture. The piston continues to top dead center (TDC) and is pushed downward by the expanding gases.

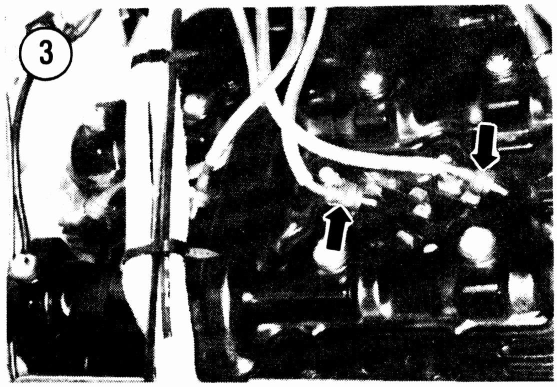


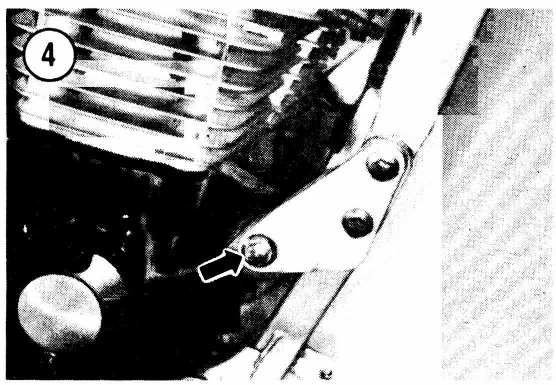
When the piston almost reaches BDC, the exhaust valve opens and remains open until the piston is near TDC. The upward travel of the piston forces the exhaust gases out of the cylinder. After the piston has reached TDC, the exhaust valve closes and the cycle starts all over again.

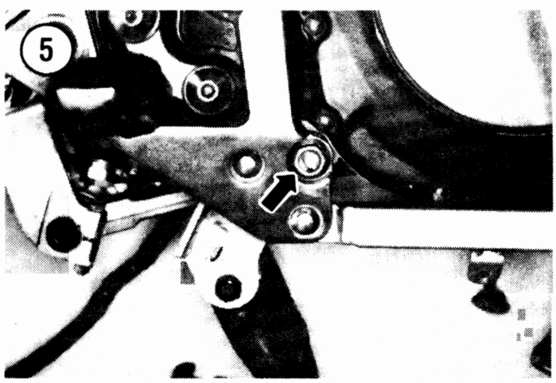
NOTE
Before pulling the spark plug caps off of the spark plugs, twist the caps from side to side to break the mating seal.

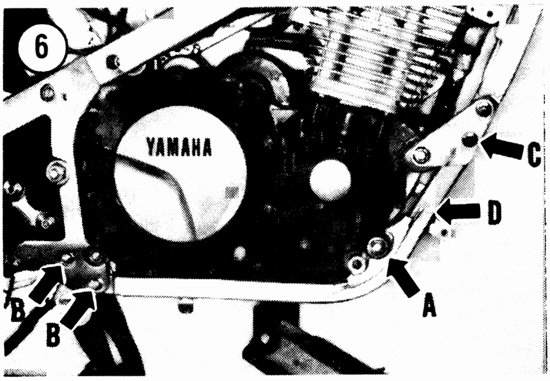
7. Label and disconnect the spark plug wires (**Figure 3**).
8. Remove the left-hand crankcase cover as described in this chapter.
9. Remove the engine sprocket as described in Chapter Six.
10. Disconnect the following electrical leads:
   a. Alternator and pickup coil.
   b. Oil level switch.
   c. Neutral switch.
   d. Starter motor.
   e. Sidestand switch (U.S. models).
11. If the engine requires disassembly, it will be easier to remove many of the large sub-assemblies while the engine is mounted in the frame. Remove the following as described in this chapter unless otherwise noted:
   a. Oil cooler assembly.
   b. Cylinder head and camshafts.
   c. Cylinder block.
   d. Pistons.
   e. Alternator and pickup coil (Chapter Eight).
   f. Starter (Chapter Eight).
   g. Clutch (Chapter Five).
   h. External shift mechanism (Chapter Six).
12. Place a jack under the crankcase to support the engine prior to removing the mounting bolts.
13A. On 1984-1990 models, remove the following engine mounting components in this order:
   a. Front upper through bolt (**Figure 4**). Don't lose the long collar on the bolt between the engine mounts. This must be reinstalled during installation.
   b. Rear lower through bolt (**Figure 5**). Don't lose the long collar on the bolt between the engine mounts. This must be reinstalled during installation.
   c. Lower front bolt and nut (A, **Figure 6**) on each side of the frame.
   d. Lower rear bolt (B, **Figure 6**) and the front upper bolt and nuts (C, **Figure 6**) on each side of the frame securing the frame down tubes.
   e. Remove both frame down tubes (D, **Figure 6**).
   f. Frame trim cap on each side.
   g. Upper rear through bolt (A, **Figure 7**) and nut.

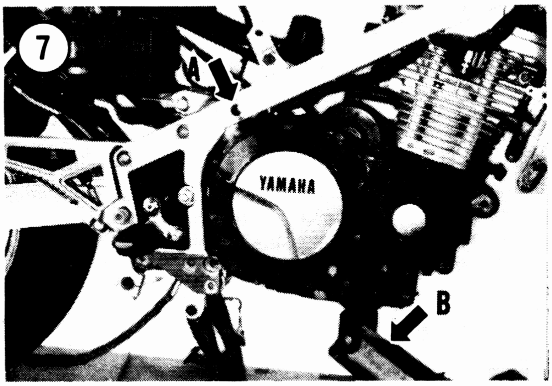


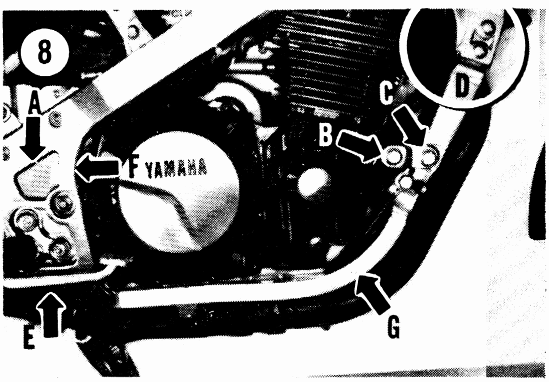


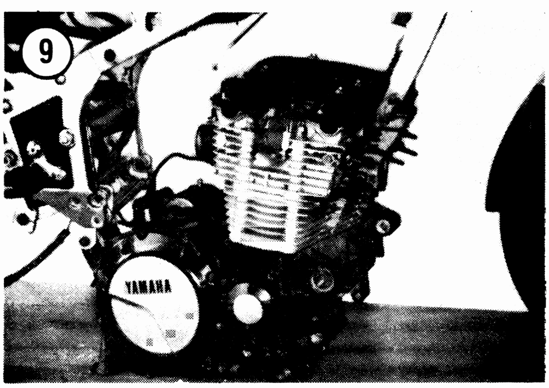












13B. On 1991-on models, remove the following engine mounting components in this order:

NOTE
The upper rear through bolt and nut and the frame down tube rear bolts are located under the muffler bracket on each side.

a. Remove the muffler bracket (A, **Figure 8**) from each side.
b. Front through bolt (B, **Figure 8**) and nut. Don't lose the long collar on the bolt between the engine mounts. This must be reinstalled during installation.
c. Bolt (C, **Figure 8**) securing the front mounting bracket to the frame on each side and remove both brackets.
d. Front upper bolts and nuts (D, **Figure 8**) securing the frame down tubes.

NOTE
*"E" and "F" in **Figure 8** shows bolt location only under the muffler bracket. These bolts are not visible.*

e. Rear lower bolt (E, **Figure 8**) securing the frame down tubes.
f. Rear lower through bolt (F, **Figure 8**) and nut.
g. Right- and left-hand down tube assemblies (G, **Figure 8**).

WARNING
The engine is very heavy and has many sharp edges. It may shift or drop suddenly when removing the mounting bolts. Never place your hands or any other part of your body where the engine could drop and crush your hands or arms. One or more assistants will be required to remove the engine from the frame. Do not attempt engine removal by yourself.

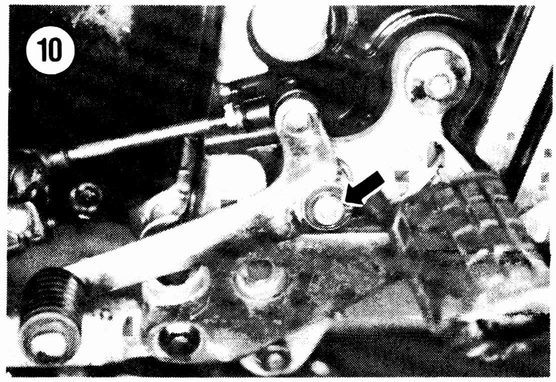
NOTE
Double check that all electrical leads and hoses have been disconnected from the engine. Make sure all mounting bolts are removed.

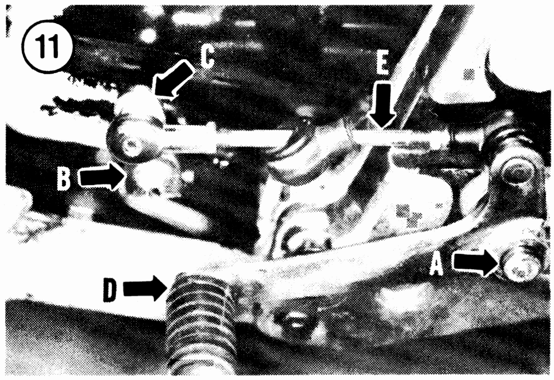
14. Lower the jack (B, **Figure 7**) to the ground. Then with the help of an assistant, lift the engine off the jack (**Figure 9**). Pick up the engine assembly and place it on the workbench.

15. While the engine is removed for service, check all of the frame engine mounts for cracks or other damage. If any cracks are detected, take the chassis assembly to a Yamaha dealer for further examination.

16. Install by reversing the removal steps while noting the following:

   a. Where applicable on the through bolt, be sure to install the collar between the crankcase mounting boss and the frame on each side when installing this bolt.
   b. Tighten the engine mounting bolts to the torque specifications in **Table 2**.
   c. Fill the crankcase with the recommended type and quantity of engine oil as described in Chapter Three.
   d. Adjust the following as described in Chapter Three; the drive chain, the rear brake and the throttle cable.
   e. Start the engine and check for oil and exhaust leaks.





LEFT-HAND CRANKCASE COVER

Removal

1. Remove the circlip (**Figure 10**) and washer (A, **Figure 11**) securing the shift pedal from the pivot post.

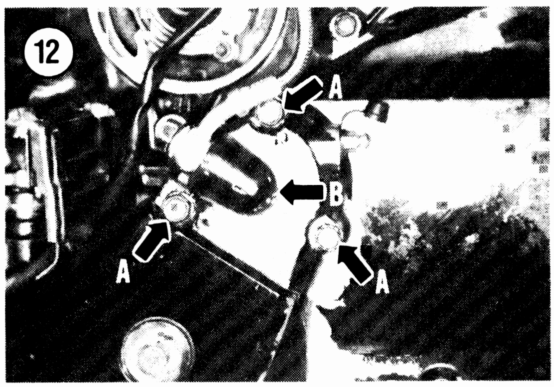
2. Remove the clamp bolt (B, **Figure 11**) and remove the shift arm (C, **Figure 11**) from the left-hand end of the shift shaft.

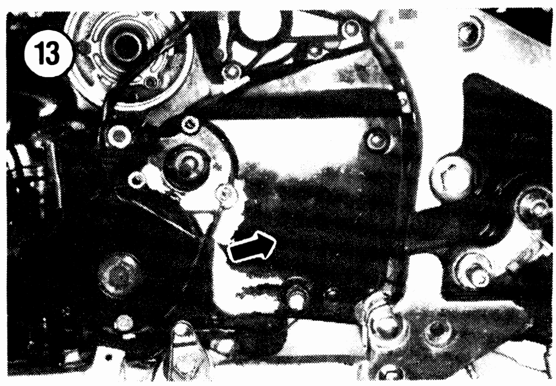
3. Remove the shift pedal (D, **Figure 11**), shift rod and shift arm assembly (E, **Figure 11**) from the engine and frame.

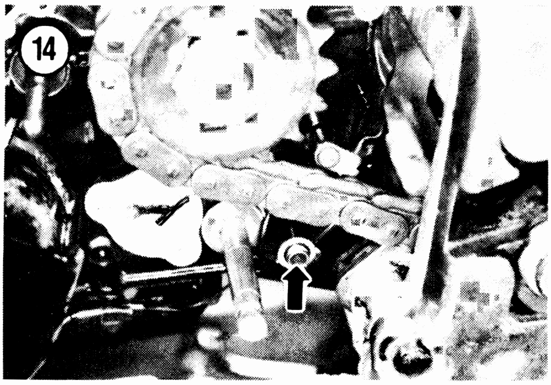
4. Remove the bolts (A, **Figure 12**) securing the clutch slave cylinder (B, **Figure 12**) to the left-hand crankcase cover and withdraw the unit from the cover.

5. Tie the slave cylinder out of the way with a Bungee cord or piece of wire. It is not necessary to disconnect the hydraulic hose from the slave cylinder.

6. Remove the bolts securing the left-hand crankcase cover and remove the cover (**Figure 13**). Don't lose the locating dowel (**Figure 14**) at the lower mounting bolt location.



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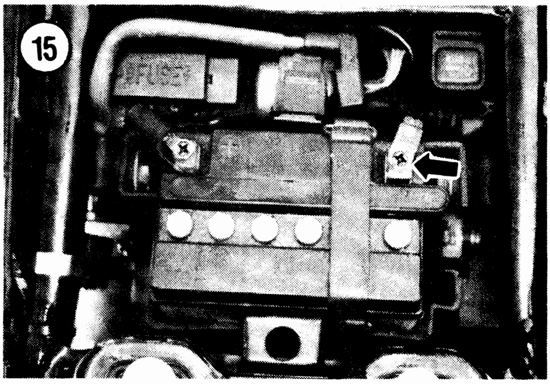
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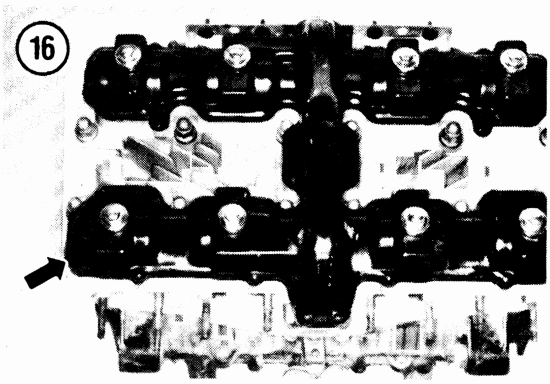
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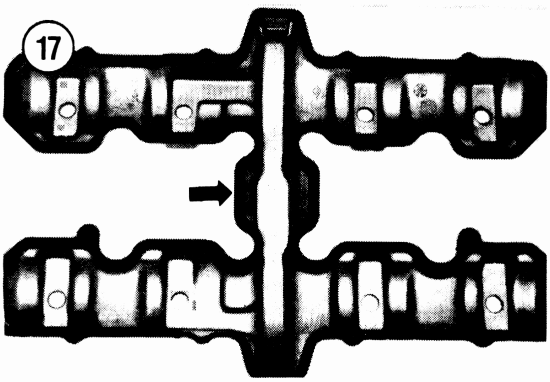
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Installation

1. If removed, install the locating dowel (**Figure 14**) at the lower mounting bolt location.
2. Install the left-hand crankcase cover (**Figure 13**) and bolts. Tighten the bolts securely.
3. Install the clutch slave cylinder onto the crankcase. Install the bolts and tighten to the torque specification listed in **Table 2**.
4. Apply a light coat of multipurpose grease to the shift pedal post on the frame.
5. Install the shift pedal, shift rod and shift arm assembly onto the engine and frame.
6. Install the washer and circlip securing the shift pedal onto the pivot post. Make sure the circlip is properly seated on the pivot post.
7. Install the shift arm onto the left-hand end of the shift shaft. Install the clamp bolt and tighten it securely.

CYLINDER HEAD COVER AND CAMSHAFTS

This section describes removal, inspection and installation procedures for the camshaft components.

Cylinder Head Cover Removal/Installation

NOTE
This procedure is shown with the engine removed from the frame for clarity. The cylinder head cover can be removed with the engine in the frame.

1. Place the bike securely on the centerstand.
2. Remove the seat as described in Chapter Twelve.
3. Remove the front fairing as described in Chapter Twelve.
4. Disconnect the negative battery terminal (**Figure 15**).
5. Remove the cylinder head cover bolts and remove the cover (**Figure 16**) and gasket.
6. Inspect the cover for cracks, warpage or damage and replace if necessary.
7. Replace the cylinder head cover gasket (**Figure 17**) and bolt seals if worn, damaged or if there are signs of oil leakage.
8. Apply a light coat of gasket sealant to the machined recesses of the cylinder head (**Figure 18**).

This is necessary to assure a good seal between these surfaces and the gasket.

9. Position the cylinder head cover with the flat tab (**Figure 19**) toward the front of the engine and install the cover.

10. Make sure the oil seals (**Figure 20**) are in place on each bolt. If left off it will result in a sizable oil leak.

11. Make sure the right-hand end of the gasket is correctly seated in the machined recesses of the cylinder head (**Figure 21**).

12. Tighten the cylinder head cover bolts to the torque specification listed in **Table 2**.

13. Connect the negative battery terminal.

14. Install the front fairing and the seat as described in Chapter Twelve.

Camshaft Removal

NOTE

This procedure is shown with the engine removed from the frame for clarity. The camshafts can be removed with the engine in the frame but the work space is quite limited. If the camshafts, as well as the cylinder head, are going to be removed, it is suggested that the engine be partially removed from the frame (as described in this chapter) except for the lower rear through bolt that is to be left in place. Lower the jack under the engine, pivot the front of engine down on the lower rear through bolt to gain sufficient access for camshaft removal and installation.

1. Remove the cylinder head cover as described in this chapter.
2. Disconnect the battery ground cable.
3. Remove the spark plugs as described in Chapter Three. This will make it easier to turn the engine by hand.
4. Remove the bolts securing the ignition pickup coil cover (**Figure 22**) and remove the cover and gasket.

NOTE

The factory specified valve clearance check is every 8,200 miles (13,000 km). Because valve adjustment requires camshaft removal to gain access to the pads and valve lifters, it is suggested to first check valve clearance before the cam-

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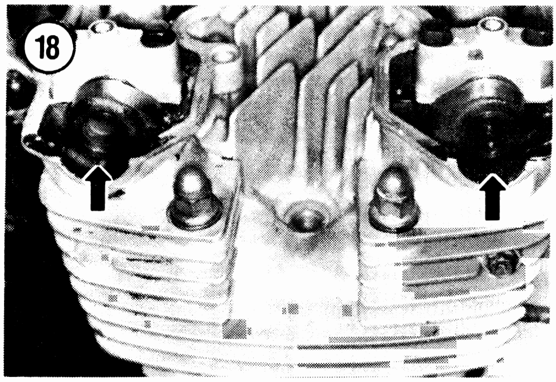

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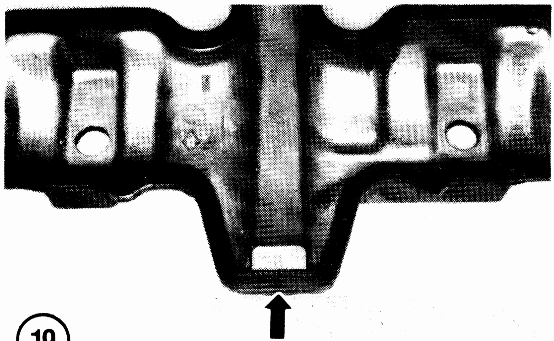

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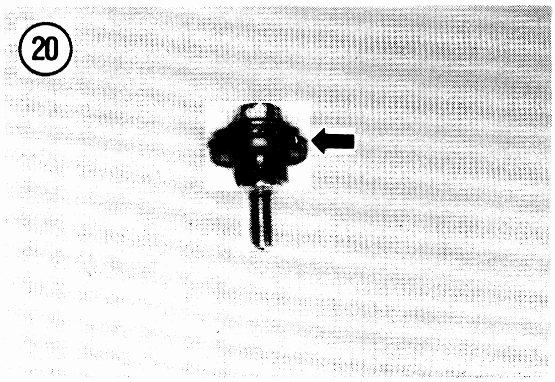

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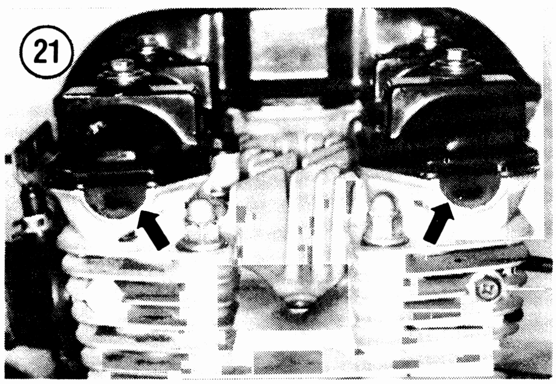


shafts are removed. Record all valve clearances and, if necessary, purchase new pads so that they can be reinstalled during camshaft installation. Refer to Valve Clearance Measurement in Chapter Three.

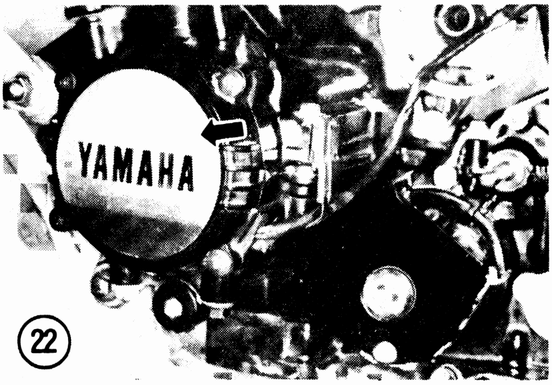
NOTE
*A cylinder at TDC on the compression stroke will have all 4 of the camshaft lobes facing away from the valve lifters (**Figure 23**), indicating that both the 2 intake and the 2 exhaust valves are closed.*

5. Using a 17 mm wrench on the pickup coil timing plate mounting bolt (**Figure 24**), rotate the crankshaft *counterclockwise* until the "T" mark (for the No. 1 and No. 4 cylinders) on the timing plate aligns with the stationary pointer on the pickup coil (**Figure 25**). Observe the camshaft lobes and check that the No. 1 and 4 cylinders are now at top dead center (TDC) on the compression stroke. If not, rotate the engine *counterclockwise* an additional 360° and realign the "T" mark, then recheck the camshaft lobes location.

6. Remove the camshaft chain tensioner as described in this chapter.

7. Remove the bolts (A, **Figure 26**) on each side, then remove the chain guide (B, **Figure 26**).

NOTE
*Each camshaft bearing cap is marked with an arrow pointing toward the right-hand side or clutch side of the engine and with a letter and number (E1 through E4 and I1 through I4) representing position as shown in **Figure 27**.*



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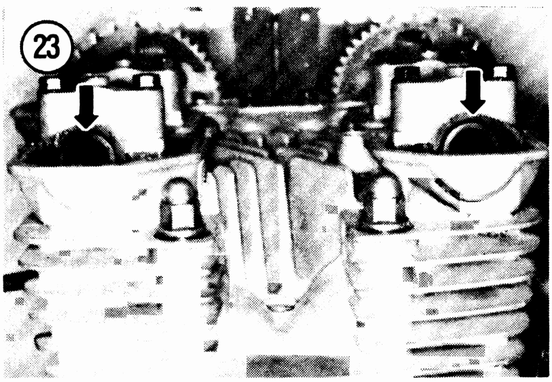
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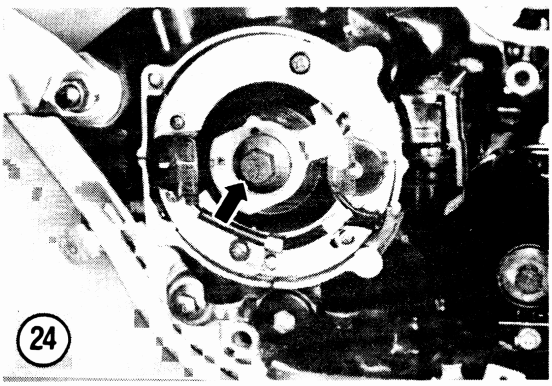
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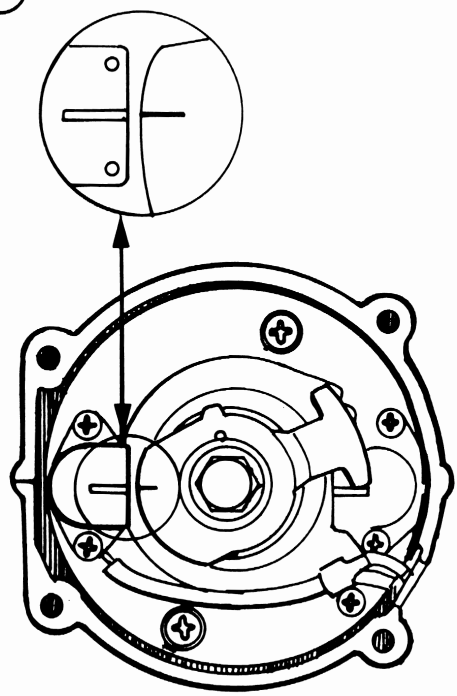

If the camshaft bearing cap markings on your bike differ from these or if there are no marks, label them for direction and position before performing Step 9.

8. Remove the "I3" (**Figure 28**) camshaft bearing cap first (1, **Figure 29**).

9. Starting from the outermost bolts, working toward the inner bolts, loosen then remove the bolts securing the remainder of the camshaft bearing caps in the indicated order shown in **Figure 29**.

10. Remove the bearing caps and don't lose the locating dowels. They will usually stay with the camshaft bearing cap.

11. Remove the intake camshaft and sprocket assembly (5, **Figure 29**). Remove the camshafts slowly to prevent damaging any camshaft lobe or bearing surface.

12. Remove the "E3" (**Figure 30**) camshaft cap first.

13. Starting from the outermost bolts, working toward the inner bolts, loosen then remove the bolts securing the remainder of the camshaft bearing caps in the indicated order shown in **Figure 31**.

14. Remove the bearing caps and don't lose the locating dowels. They will usually stay with the camshaft bearing cap.

15. Remove the exhaust camshaft and sprocket assembly (5, **Figure 31**). Remove the camshafts slowly to prevent damaging any camshaft lobe or bearing surface.

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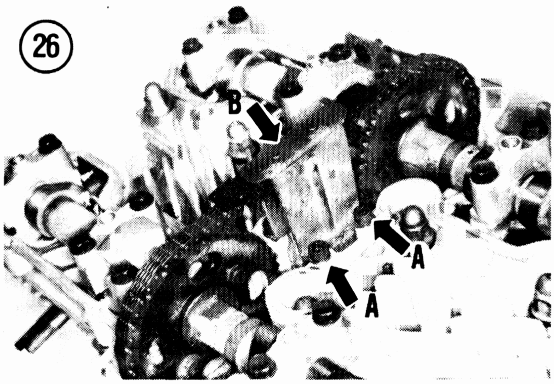

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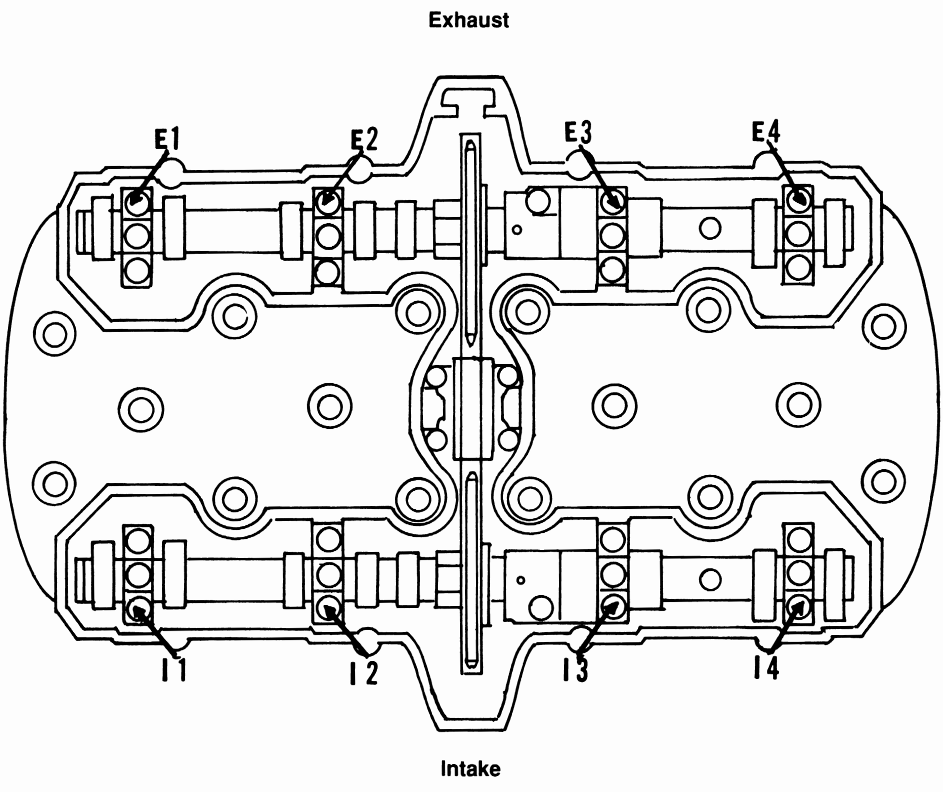
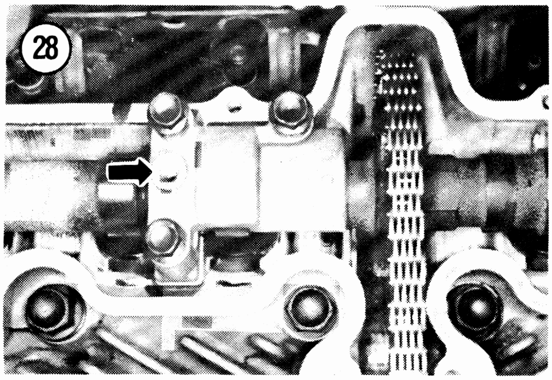
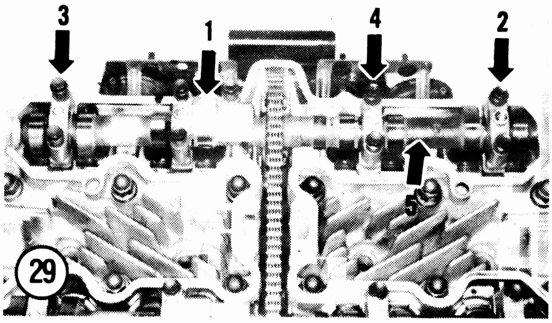
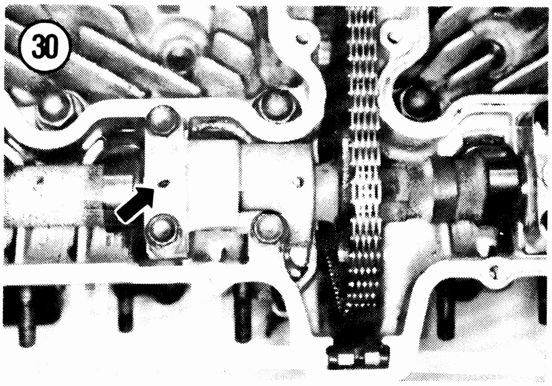
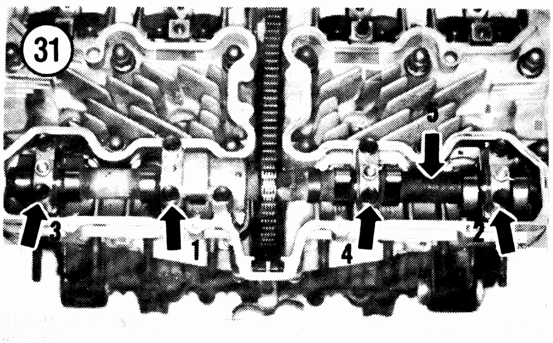










16. Secure the camshaft chain with wire or place a screwdriver or scribe (A, **Figure 32**) through the chain loop to prevent the chain from falling into the crankcase.

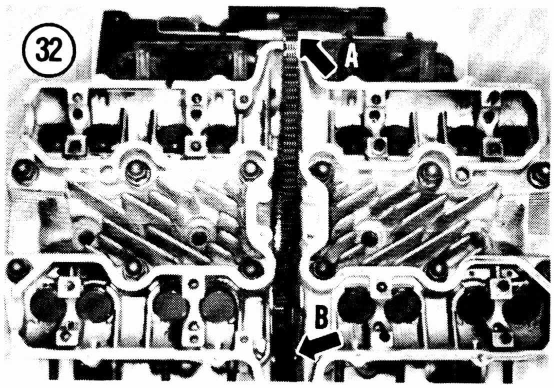
17. Lift the front chain guide (B, **Figure 32**) out of the chain cavity.

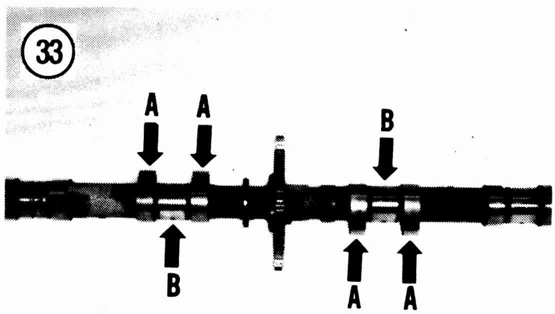
CAUTION
If the crankshaft must be rotated while the camshafts are removed, lift up on the camshaft chain to prevent it from binding up on the crankshaft timing sprocket.

Camshaft Inspection

1. Wash the camshafts thoroughly in solvent and blow dry.

2. Check camshaft lobes (A, **Figure 33**) for wear. The lobes should not be scored and the edges should be square. Slight damage may be removed with a silicon carbide oilstone. Use No. 100-120 grit initially, then polish with a No. 280-320 grit.





3. Even though the camshaft lobe surface appears to be satisfactory, with no visible signs of wear, it must be measured with a micrometer (**Figure 34**). Compare to the dimensions given in **Table 1** and if worn to the service limit or less the camshaft(s) must be replaced.
4. Check the camshaft bearing journals (B, **Figure 33**) for wear and scoring.
5. Even though the camshaft bearing journal surface appears satisfactory, with no visible signs of wear, the camshaft bearing journals must be measured with a micrometer (**Figure 35**). Compare to the dimensions given in **Table 1** and if worn to the service limit or less the camshaft(s) must be replaced.
6. Place the camshaft on a set of V-blocks and check its runout with a dial indicator. Replace the camshaft if runout exceeds specifications in **Table 1**. Repeat for the opposite camshaft.
7. Inspect the camshaft sprockets (**Figure 36**) for wear; replace if necessary.

NOTE
If the camshaft sprockets are worn, also check the camshaft chain, chain guides and chain tensioner as described in this chapter.

8. Check the tightness of the sprocket bolts (**Figure 37**). If necessary tighten to the torque specification listed in **Table 2**.
9. Make sure the oil control holes (**Figure 38**) are clear. If necessary, clean out with a piece of wire followed by solvent and then blow out with compressed air.
10. Check the camshaft bearing journals in the cylinder head (**Figure 39**) and camshaft caps (**Figure 40**) for wear and scoring. They should not be scored

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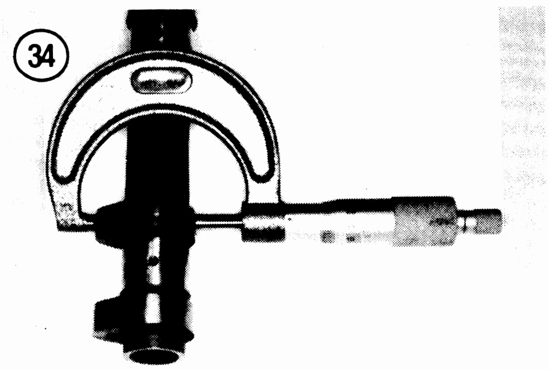

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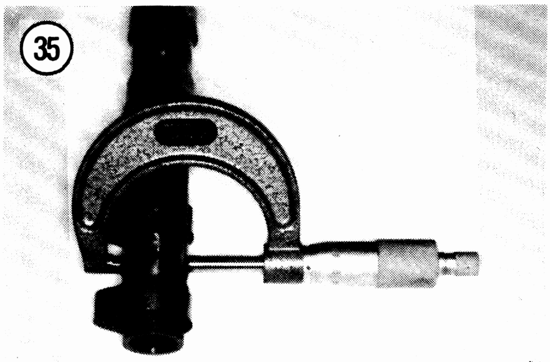

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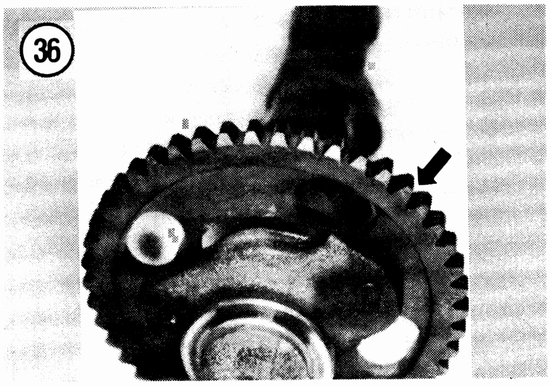

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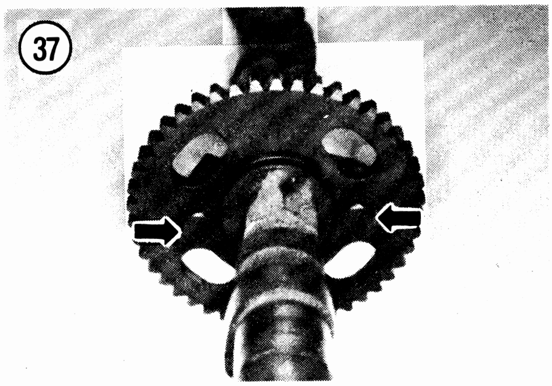

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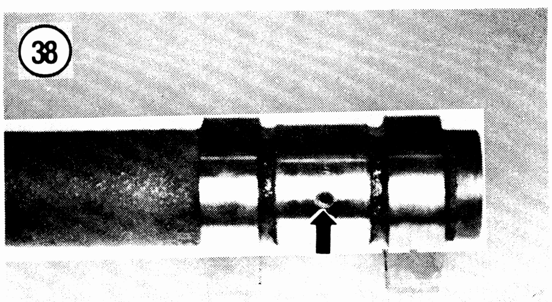

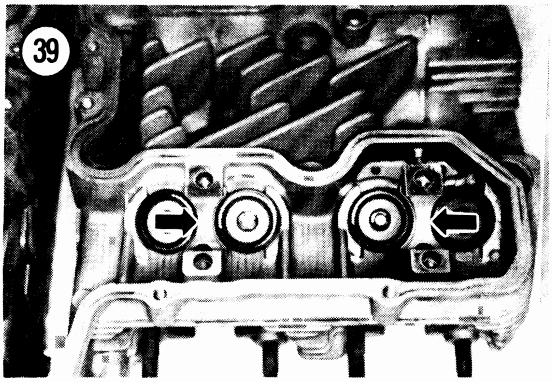

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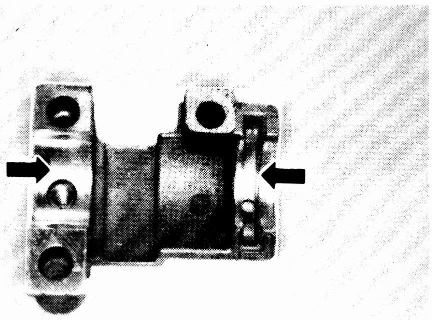

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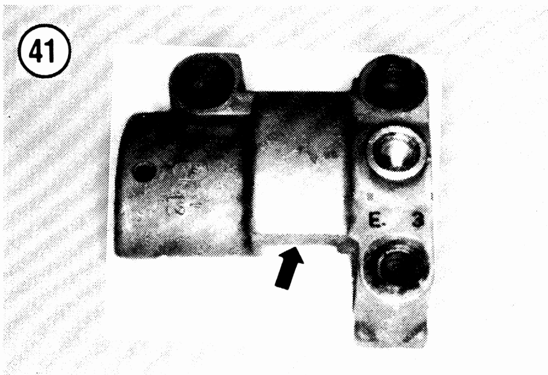

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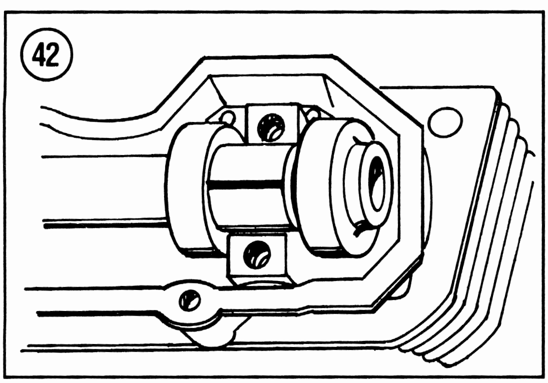

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or excessively worn. Inspect the camshaft bearing cap (**Figure 41**) for cracks or damage. If necessary, replace the cylinder head assembly.

Camshaft Bearing Clearance Measurement

This procedure requires the use of a Plastigage set. The camshaft must be installed into the head. Prior to installation, wipe all oil residue from each camshaft bearing journal and bearing surface in the head and all camshaft caps.

1. Install the camshafts into the cylinder head.
2. Install all locating dowels into each camshaft cap.
3. Wipe all oil from the camshaft bearing journals prior to using the Plastigage material.
4. Place a strip of Plastigage material on top of each camshaft bearing journal (**Figure 42**) parallel to the camshaft.
5. Place the camshaft cap into position.
6. Install all camshaft cap bolts. Install finger-tight at first, then tighten in a crisscross pattern starting from the inner most bolts working toward the outer bolts. Tighten to the final torque specification listed in **Table 2**.

CAUTION

Do not rotate the camshaft with the Plastigage material in place.

7. Gradually remove the camshaft cap bolts in a crisscross pattern, starting from the outermost bolts, working toward the inner bolts, loosen then remove the bolts securing the camshaft caps.
8. Measure the width of the flattened Plastigage (**Figure 43**) according to manufacturer's instructions.
9. If the clearance exceeds the wear limits in **Table 1**, measure the camshaft bearing journals (**Figure 35**) with a micrometer and compare to the limits in **Table 1**. If the camshaft bearing journal is less than dimension specified, replace the camshaft. If the camshaft is within specifications, the cylinder head and camshaft caps must be replaced as a matched set.

CAUTION

Remove all particles of Plastigage from all camshaft bearing journals and the camshaft holder. Be sure to clean the camshaft holder groove and all cam-

4

shaft oil control holes. This material must not be left in the engine as it can plug up a oil control orifice and cause severe engine damage.

Camshaft Chain and Sprockets Inspection/Replacement

1. Examine the camshaft sprockets (**Figure 36**) for any signs of wear, cracks or tooth damage. Replace if necessary and tighten the bolts to the torque specification listed in **Table 2**.
2. If the camshaft sprockets are worn, also check the camshaft chain (**Figure 44**) for wear or damage.
3. Also check the crankshaft drive sprocket for wear as described under *Crankshaft Inspection* in this chapter.
4. Severe wear of one component will require the replacement of both camshaft sprockets and the chain.

Camshaft Chain Guides

Inspect the camshaft chain guides for severe wear or damage. Refer to **Figure 45** and **Figure 46**. Replace if necessary.

Camshaft Installation

1. If camshaft bearing oil clearance was checked, make sure all Plastigage material has been removed from the camshaft and bearing caps surfaces.
2. Insert the front chain guide (**Figure 47**) into the cylinder head and make sure the lower end is seated correctly in the lower receptacle.

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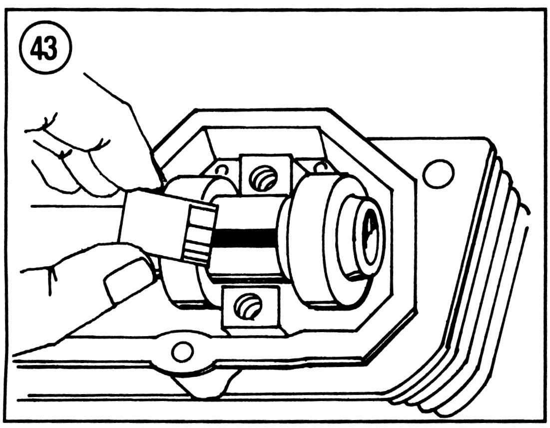

CAUTION

When rotating the crankshaft in Step 3, lift the camshaft chain tightly on the exhaust side (front) to prevent it from binding on the crankshaft sprocket.

3. Make sure the No. 1 piston is still at TDC, as follows:
   a. Check that the "T" mark (for the No. 1 and No. 4 cylinders) on the timing plate is still aligned with the stationary pointer on the pickup coil (**Figure 25**).

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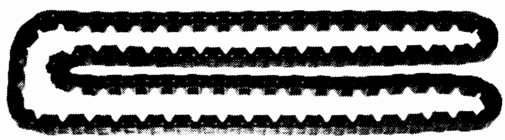

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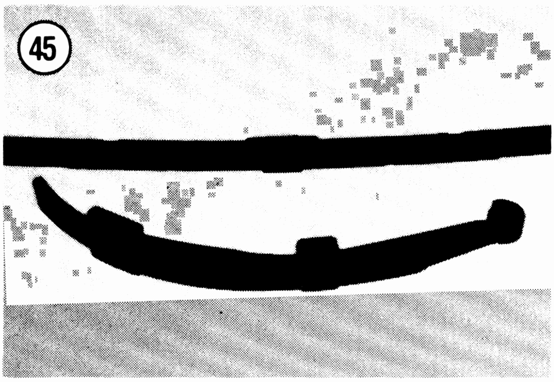

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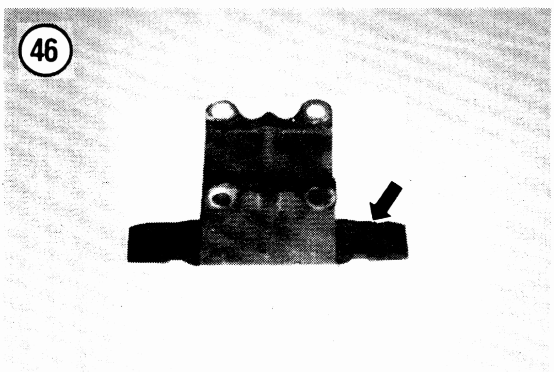

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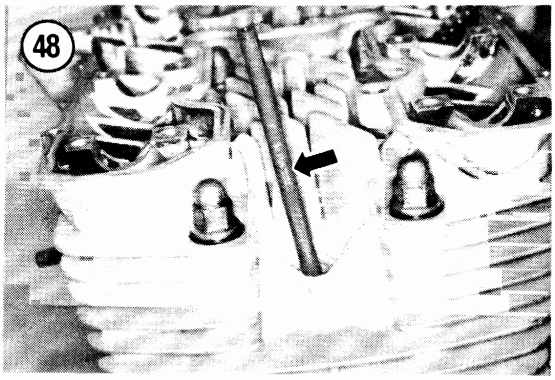

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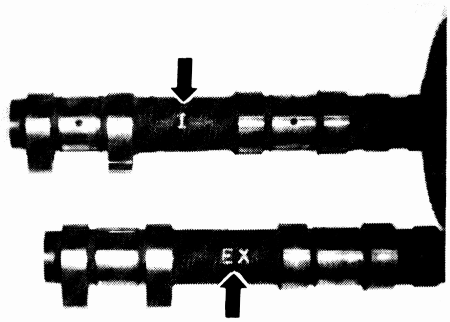

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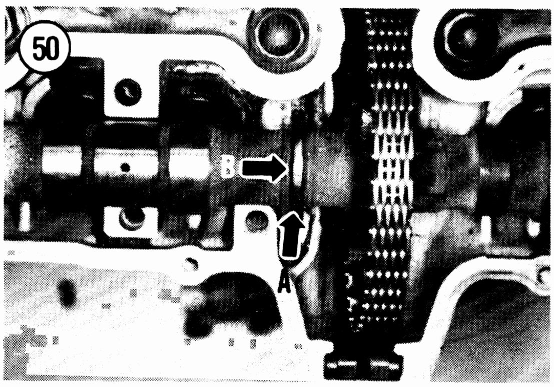

b. To make sure it is at TDC, insert a plastic or wood rod (**Figure 48**) down the spark plug hole of the No. 1 cylinder until it touches the top of the piston.

c. Using a 17 mm wrench on the pickup coil timing plate mounting bolt (**Figure 24**), rotate the crankshaft slightly back and forth until the rod protrudes out of the cylinder the maximum amount indicating the piston is at TDC.

d. Check again that the "T" mark on the timing plate is still aligned with the stationary pointer on the pickup coil (**Figure 25**). Make a slight adjustment if necessary until alignment is achieved.

4. Coat all camshaft lobes and bearing journals with molybdenum disulfide grease or Red Line Assembly Lube.

5. Also coat the bearing surfaces in the cylinder head and camshaft bearing caps with the same type of lubricant.

NOTE
*The camshafts are marked with an "EX" for exhaust and "I" for intake (**Figure 49**). Make sure the camshafts are installed in their correct location in the cylinder head.*

6. Position the camshafts so the camshaft sprocket is toward the left-hand side of the engine.

7. Pull up on the front of the camshaft chain to take out all slack. Hold it in this position.

8. Install the exhaust camshaft as follows:

a. Move the exhaust camshaft into position and set it in the cylinder head bearing journals. Make sure the left-hand shoulder is correctly seated in the cylinder head groove (A, **Figure 50**).

b. Position the camshaft so the punch mark on the left-hand shoulder (B, **Figure 50**) is facing straight up, 90° to the cylinder head top surface.

c. Mesh the drive chain onto the sprocket, while keeping the slack out of the chain.

d. Hold the camshaft and chain in this position.

NOTE
Make sure the locating dowels are in place in the camshaft bearing caps prior to installation.

e. Install the "E3" camshaft bearing cap (**Figure 30**) and bolts. Make sure the punch mark correctly positioned in Step 8b is visible through the hole in the "E3" bearing cap (**Figure 22**). If the punch mark is not visible readjust the camshaft-to-chain relationship until this alignment is correct. Tighten the bolts to the torque specification listed in **Table 2**.

f. Install the reminder of the camshaft bearing caps in the same order as removal as shown in **Figure 31**. Tighten the bolts to the torque specification listed in **Table 2**.

9. Install the intake camshaft as follows:

a. Pull back on the camshaft chain to take out all slack. Hold it in this position, make sure it is meshed properly with the intake camshaft. Also make sure the intake camshaft has not rotated even the slightest amount.

b. Move the intake camshaft into position and set it in the cylinder head bearing journals. Make sure the left-hand shoulder is correctly seated in the cylinder head groove (A, **Figure 50**).

c. Position the camshaft so the punch mark on the left-hand shoulder (B, **Figure 50**) is facing almost straight up (a little toward the front of the engine), see following NOTE.

NOTE

*Make sure the exhaust camshaft punch mark is still correctly positioned and is visible through the hole in the "E3" bearing cap (**Figure 51**). If the punch mark is not visible readjust the camshaft and chain. The intake camshaft punch mark will rotate slightly toward the rear of the engine when the camshaft chain tensioner is installed as it will take up the slack on the backside of the chain. Compensate for this by positioning the intake punch mark a little toward the front of the engine.*

d. Mesh the drive chain onto the sprocket, while keeping the slack out of the front portion of the chain.

e. Hold the camshaft and chain in this position.

f. Install the "I3" camshaft bearing cap (**Figure 52**) and bolts.

g. Install the camshaft chain tensioner as described in this chapter. The tensioner will take up the slack in the chain and the intake camshaft timing mark should now be aligned correctly.

10. After the tensioner has been installed, recheck all timing marks as follows:

a. Check again that the "T" mark on the timing plate is still aligned with the stationary pointer on the pickup coil (**Figure 25**). Make a slight adjustment if necessary until alignment is achieved.

b. Make sure the exhaust camshaft punch mark is still correctly positioned and is visible through the hole in the "E3" bearing cap (**Figure 51**).

c. Check the timing marks on both camshaft sprockets. The timing punch mark must be aligned with the top surface of the cylinder head. Refer to **Figure 53** for the exhaust camshaft and **Figure 54** for the intake camshaft.

d. If the timing marks are not aligned as indicated, the camshaft timing is incorrect. Remove the camshaft bearing caps and reposition the camshafts.

11. Install the reminder of the camshaft bearing caps in the same order as removal as shown in **Figure 29**.

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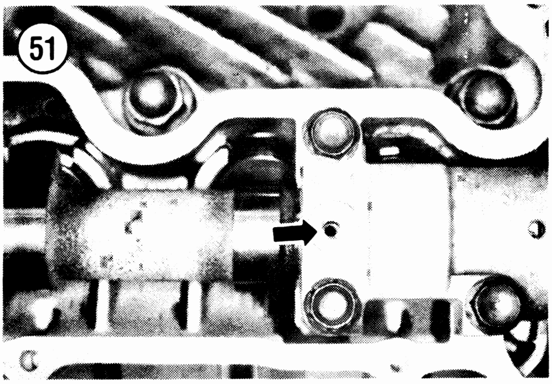

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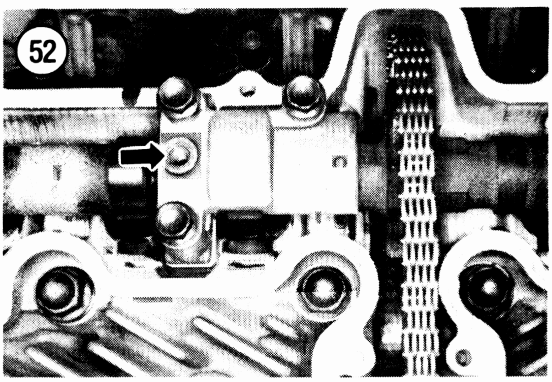

Tighten the bolts to the torque specification listed in **Table 2**.

CAUTION
If there is any binding while turning the crankshaft, ***stop****. Recheck the camshaft timing marks. Improper timing can cause valve and piston damage.*

12. Perform a final timing check as follows:
   a. Using a 17 mm wrench on the pickup coil timing plate mounting bolt (**Figure 24**), rotate the crankshaft *counterclockwise* 2 complete revolutions (720°).
   b. Again align the "T" mark (for the No. 1 and No. 4 cylinders) on the timing plate aligns with the stationary pointer on the pickup coil (**Figure 25**).
   c. Make sure the exhaust camshaft punch mark is still correctly positioned and is visible through the hole in the "E3" bearing cap (**Figure 51**).
   d. Check the timing marks on both camshaft sprockets. The timing punch mark must be aligned with the top surface of the cylinder head. Refer to **Figure 53** for the exhaust camshaft and **Figure 54** for the intake camshaft.
   e. If all marks align as indicated, camshaft timing is correct.

13. If the camshaft timing is incorrect, remove the camshaft bearing caps and reposition the camshafts as described in this procedure.
14. Check valve clearance as described under *Valve Clearance Measurement* in Chapter Three.
15. Install the spark plugs as described in Chapter Three.
16. Install the cylinder head cover as described in this chapter.

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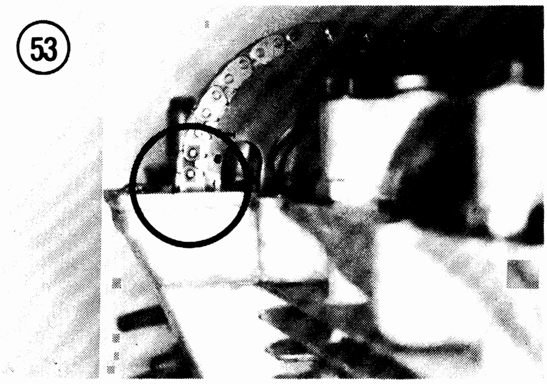

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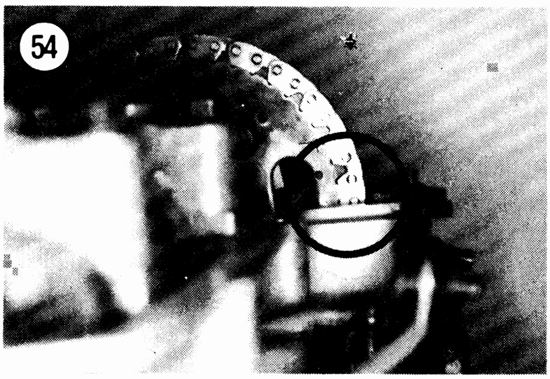

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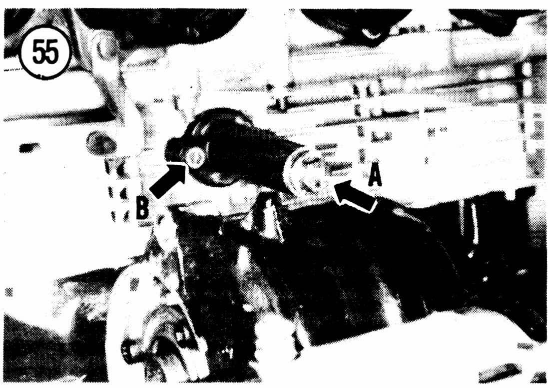


CAMSHAFT CHAIN TENSIONER

The automatic tensioner is continually self-adjusting. The tensioner pushrod is free to move inward, but can't move out. Whenever the camshaft chain tensioner bolts are loosened, the tensioner assembly will automatically extend to the limit. Therefore prior to installation, it must be completely removed and reset as described in this section.

Removal/Inspection/Installation

1. Perform Steps 1-5 under *Camshaft Removal* in this chapter.
2. Loosen but do not remove the tensioner end cap bolt (A, **Figure 55**).
3. Remove the tensioner bolts (B, **Figure 55**) and withdraw the tensioner from the cylinder block. Remove and discard the gasket as a new one must be installed.
4. Disassemble and inspect the tensioner assembly as follows:
   a. Remove the end cap bolt and washer.

b. Pull the spring and tensioner rod out of the tensioner body.
c. Inspect the tension rod and one-way camshaft for smooth movement. Replace the tensioner assembly if the camshaft movement is rough or if there is noticeable wear or damage.
d. Inspect the spring for breakage, sagging or other damage.
e. Replacement parts are not available. If any part is worn or damaged, replace the entire assembly.

5. Install the tensioner assembly as follows:
   a. Push on the one-way camshaft to release the camshaft.
   b. Then push the tension rod (A, **Figure 56**) in until it sticks out of the housing by 35.5 mm (1.4 in.) (Dimension B, **Figure 56**).
6. Clean off all old gasket residue from both the cylinder block and the tensioner assembly.
7. Install a new gasket onto the cylinder block.
8. Position the tensioner with the one-way cam (C, **Figure 56**) facing up and install the tensioner (A, **Figure 57**) into the cylinder block.
9. Install the tensioner mounting bolts (B, **Figure 57**) and tighten to the torque specifications in **Table 2**.
10. Insert the springs (**Figure 58**), washer and end cap bolt (A, **Figure 55**) into the tensioner housing.
11. Push the springs in and tighten the end cap bolt to the torque specifications in **Table 2**.

CYLINDER HEAD

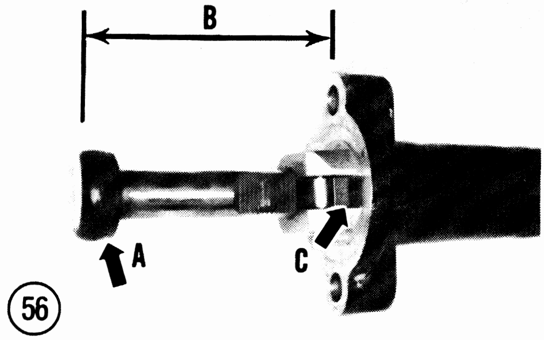
Removal

The cylinder head assembly can be removed with the engine in the frame.

NOTE
This procedure is shown with the engine removed from the frame for clarity. The cylinder head can be removed with the engine in the frame but the work space is quite limited. If the engine is not removed from the frame, it is suggested that the engine be partially removed from the frame (as described in this chapter) ***except for the lower rear through bolt*** *that is to be left in place. Lower the jack under the engine, pivot the front of engine down on the lower rear through bolt to gain sufficient access for cylinder head removal and installation.*

1. Remove the cylinder head cover and camshafts as described in this chapter.
2. If still installed, remove the carburetor assembly as described in Chapter Seven.

NOTE
The valve lifters and adjuster pads must be reinstalled in their exact position as they determine valve clearance. Store



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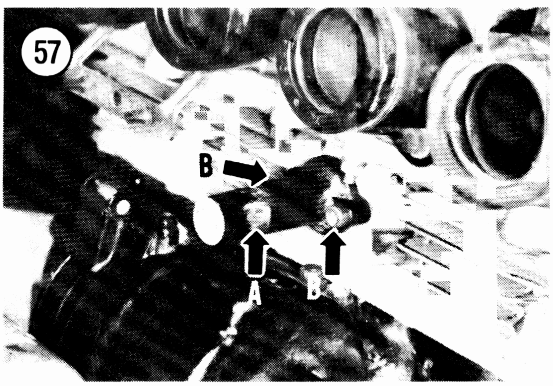

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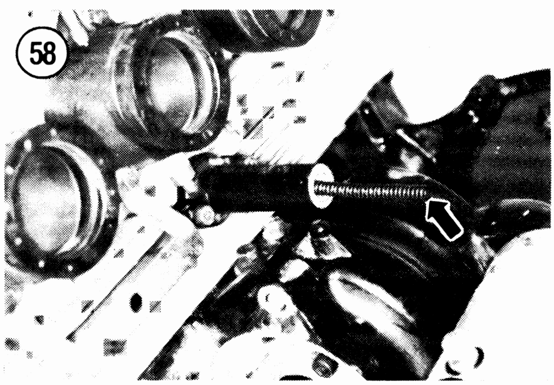
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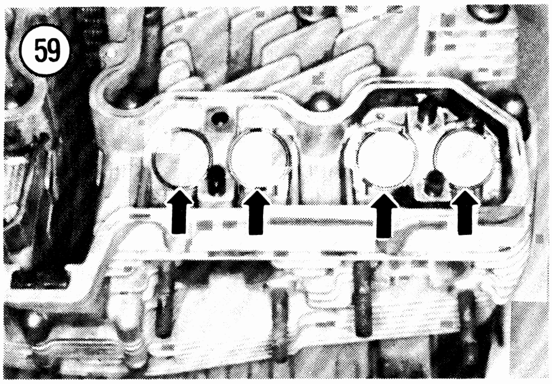
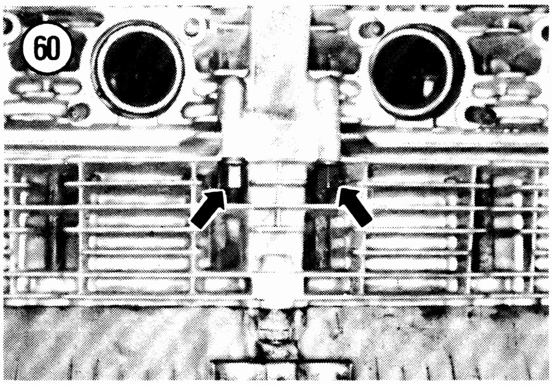
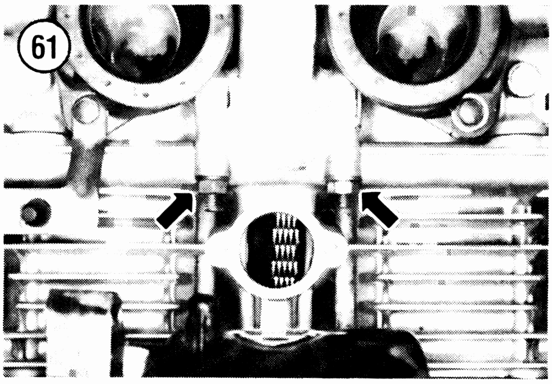
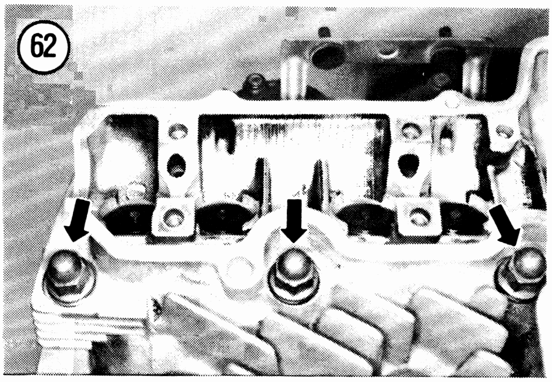








all parts in order in a divided container so that they can be reinstalled in their exact position.

NOTE
It is suggested that the valve lifters and adjuster pads be removed from the cylinder head prior to removing the cylinder head. If not, the lifters and pads may fall out during cylinder head removal.

NOTE
After each valve lifter is removed, check to see if the adjuster pad has stuck to the bottom inner surface of the lifter. If this occurs, remove the pad and place it in its designated place in the divided container.

3. Use a suction cup tool or scribe and carefully remove the 16 valve adjuster pads (**Figure 59**) and then remove the 16 lifters.

4. First remove the front nuts and washers (**Figure 60**) then the rear nuts and washer (**Figure 61**) securing the cylinder head to the cylinder block.

5. Using a crisscross pattern, loosen the cylinder head nuts. Starting with the outermost nuts and working toward the inner nuts. Loosen each of the 12 nuts (**Figure 62**) 1/2 turn at a time in several stages until all nuts are loose.

NOTE
Note the location of the 2 copper washers under the outermost 2 nuts on the right-hand side (No. 4 cylinder). These copper washers seal the oil flow and must be reinstalled in the correct location during assembly.

6. Use a magnetic tool and remove all 12 nuts, then the washers (2 copper and 10 steel) from their receptacles in the cylinder head.

7. Loosen the cylinder head by tapping around the perimeter with a rubber or plastic mallet.

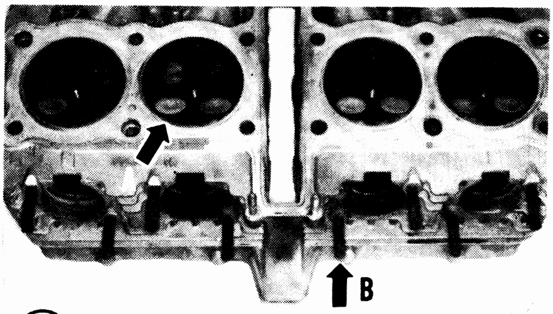
8. Pull the cylinder head straight up and off the cylinder block and the crankcase studs. Work the camshaft chain trough the tunnel in the cylinder and tie it to the exterior of the engine.

9. Place a clean shop rag into the camshaft chain tunnel in the cylinder to prevent the entry of foreign matter into the crankcase.

4

NOTE
After removing the cylinder head, check the top and bottom mating surfaces for any indications of leakage. Also check the head and base gaskets for signs of leakage. A blown gasket could indicate possible cylinder head warpage or other damage.

10. Remove the 4 dowel pins and the cylinder head gasket from the cylinder head or cylinder block.



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Cylinder Head Inspection

1. Remove all traces of gasket residue from the head (A, **Figure 63**) and cylinder block (**Figure 64**) mating surfaces. Do not scratch the gasket surface.
2. Without removing valves, remove all carbon deposits from the combustion chambers (A, **Figure 65**) with a wire brush or wooden scraper. Take care not to damage the head, valves or spark plug threads.

CAUTION
Do not attempt to clean the combustion chambers while the valves are removed. A damaged or even slightly scratched valve seat will cause poor valve seating.

3. Examine the spark plug threads (B, **Figure 65**) 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 to clean the threads following the manufacturer's instructions. If thread damage is severe, refer further service to a Yamaha dealer or machine shop.
4. After all carbon is removed from combustion chambers, and the valve ports and the spark plug thread holes are repaired, clean the entire head in solvent.
5. Check for cracks in the combustion chamber and exhaust ports. A cracked head must be replaced.

CAUTION
When cleaning coolant passages in Step 6, use care and do not damage the cylinder head gasket surface.

6. Check the intake manifold boots (**Figure 66**) for cracks and damage that would allow unfiltered air to enter the engine. Also check the hose clamps for breakage or fatigue. Replace parts as necessary.
7. Inspect the mounting brackets (**Figure 67**) for fatigue or damage, replace if necessary. Check the

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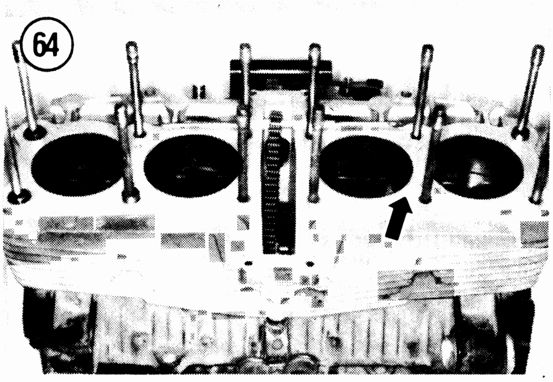

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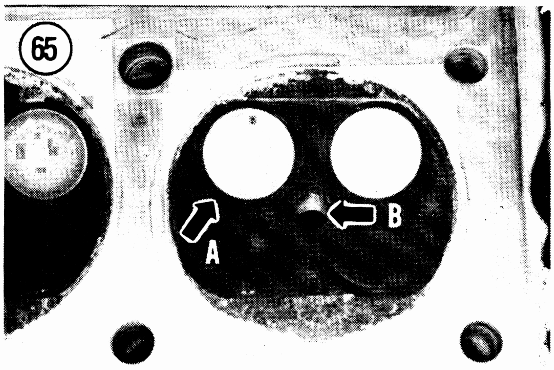

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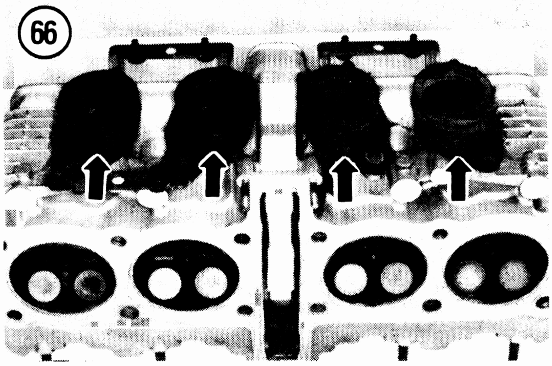

tightness of the mounting bolts and tighten securely if necessary.

8. After the head has been thoroughly cleaned, place a straightedge across the gasket surface at several points (**Figure 68**). Measure warp by inserting a feeler gauge between the straightedge and cylinder head at each location. Maximum allowable warpage is 0.03 mm (0.0012 in.). Warpage or nicks in the cylinder head surface could cause an air leak and result in coolant leakage and overheating. If warpage exceeds this limit, the cylinder head must be replaced.

9. Check the exhaust pipe studs (B, **Figure 63**) for looseness or thread damage. Slight thread damage can be repaired with a thread file or die. If thread damage is severe, replace the damaged stud(s).

10. Thoroughly inspect the cooling fins and cylinder head cover mating surface of the cylinder head for damage (**Figure 69**).

11. Clean the valve as described under *Valves and Valve Components* in this chapter.

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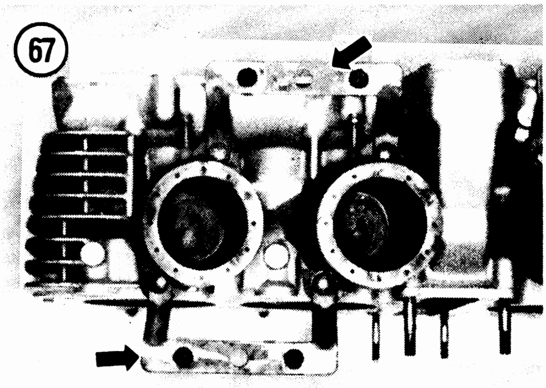

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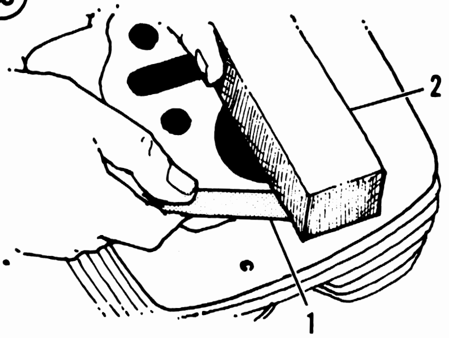

1. Flat feeler gauge
2. Straightedge

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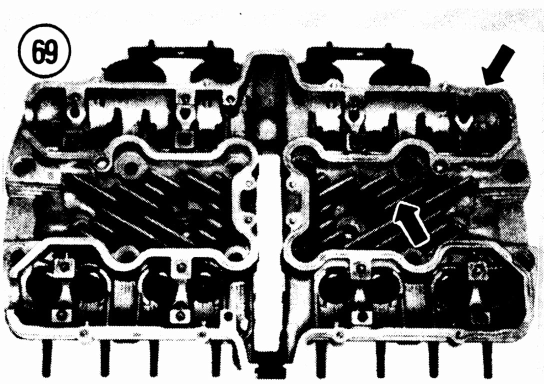

Installation

1. Clean the cylinder head (A, **Figure 63**) and cylinder block (**Figure 64**) mating surfaces of all gasket residue.
2. Blow out the cylinder head oil passages before installing the head.
3. Install the locating dowels on the crankcase studs. Refer to **Figure 70** and **Figure 71**.

CAUTION
The 2 O-ring seals must be installed as is indicated or there will be a loss of oil pressure and a severe oil leak after the engine is started.

4. Install the 2 oil control O-rings (**Figure 72**) onto the 2 outermost right-hand crankcase studs.

NOTE
*The cylinder head gasket has the word "HEAD" on one side (A, **Figure 73**).*

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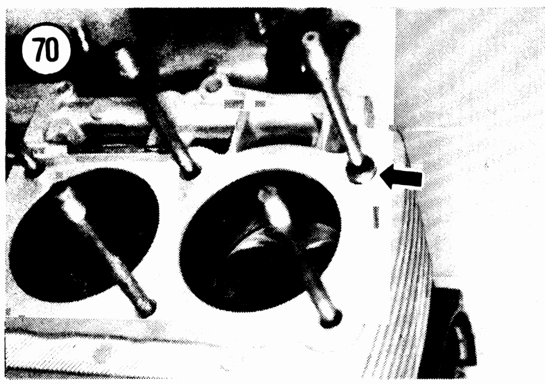


This side must face up toward the cylinder head.

5. Install a new head gasket (B, **Figure 73**).

6. Install the cylinder head (**Figure 74**) onto the cylinder block and push it down until it seats completely.

CAUTION

The 2 copper washers must be installed as is indicated or there will be a loss of oil pressure and a severe oil leak after the engine is started and continues to run.

7. Install the 2 cylinder head mounting nut copper washers (**Figure 75**) onto the 2 outermost right-hand crankcase studs.

8. Install the remaining 10 steel washers on a thin screwdriver or scribe and place the end of the tool on the top of the crankcase stud. Release the washer and it will slide down the tool and onto the crankcase stud (**Figure 76**).

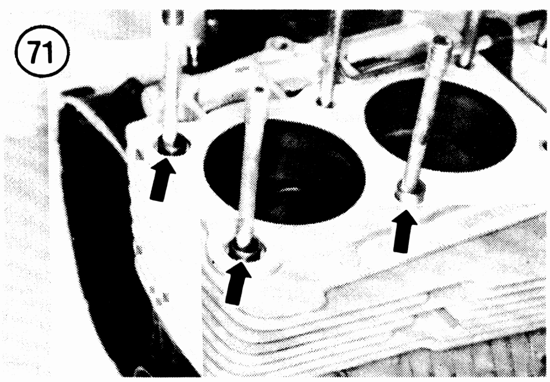
9. Install the cylinder head nuts (**Figure 77**).

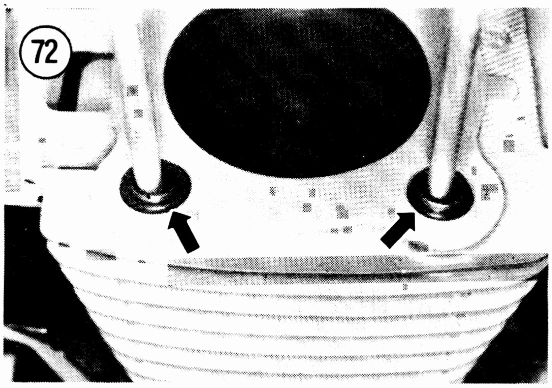
10. Tighten the nuts in 2-3 stages and in the torque sequence shown in **Figure 78**. Tighten the nuts to the torque specifications listed in **Table 2**.

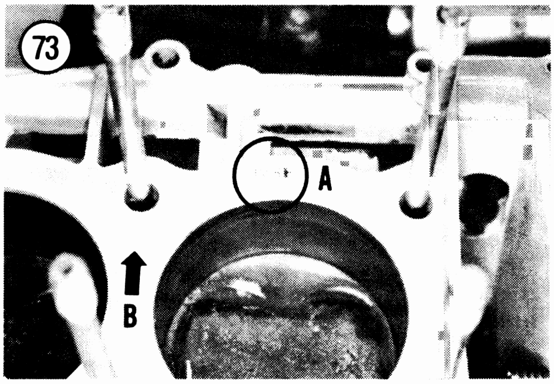
11. First install the rear nuts and washer (**Figure 61**) and then the front nuts and washers (**Figure 60**) securing the cylinder head to the cylinder block. Tighten the nuts to the torque specifications listed in **Table 2**.

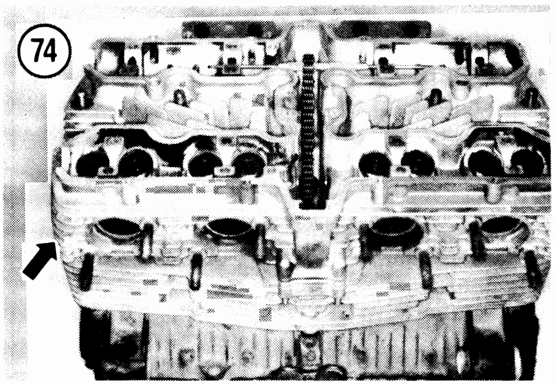
NOTE

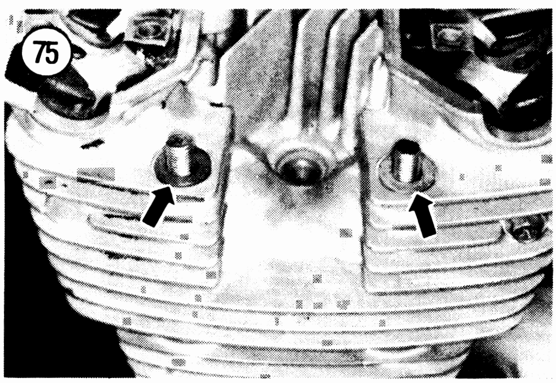
The valve lifters and adjuster pads must be reinstalled in their exact position as they determine valve clearance. Remove the parts in order from the divided

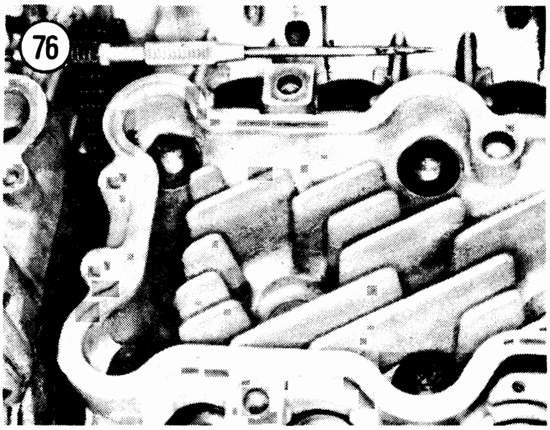








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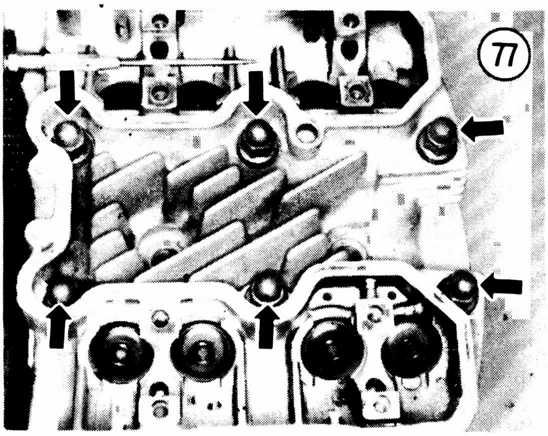
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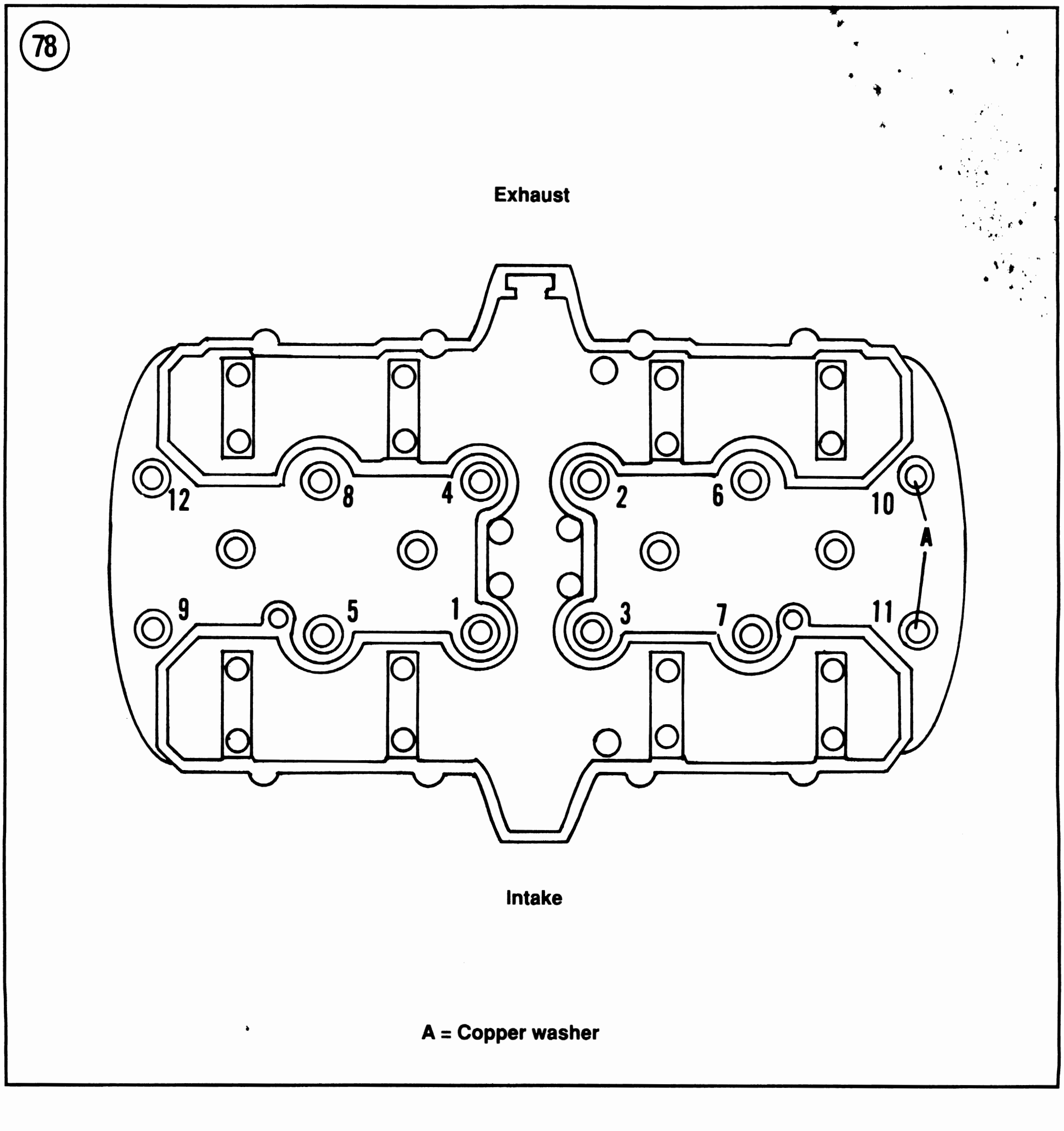

78
Exhaust
12
8
4
2
6
10
A
9
5
1
3
7
11
Intake
A = Copper washer

container and install them in their exact position.

12. Apply clean engine oil to the side of the valve lifters.
13. Install each valve lifter into its correct receptacle in the cylinder head. Push the lifter down until it is completely seated on top of the valve assembly.
14. Install the 16 valve adjuster pads into the correct valve lifters. The pads must be reinstalled into the correct valve lifter to minimize the time used for the valve clearance procedure.
15. Install the camshafts as described in this chapter.
16. Install the cylinder head cover as described in this chapter.

VALVES AND VALVE COMPONENTS

Correct valve service requires a number of special tools. The following procedures describe how to check for valve component wear and to determine what type of service is required. In most cases, valve troubles are caused by poor valve seating, worn valve guides and burned valves.

General practice among those who do their own service is to remove the cylinder head and take it to a machine shop or dealer for inspection and service. Since the cost is relative to the required effort and equipment, this is the best approach even for the experienced mechanics.

This procedure is included for those who chose to do their own valve service.

Refer to **Figure 79** for this procedure.

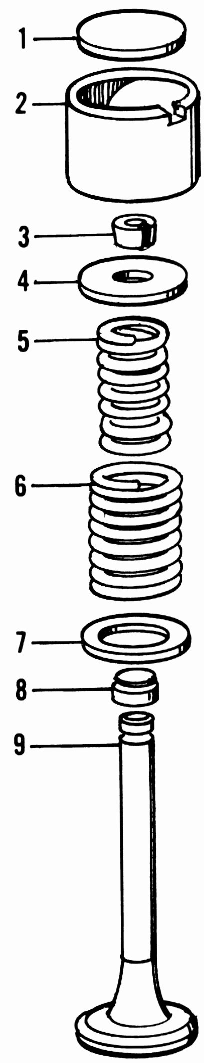
Valve Removal

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

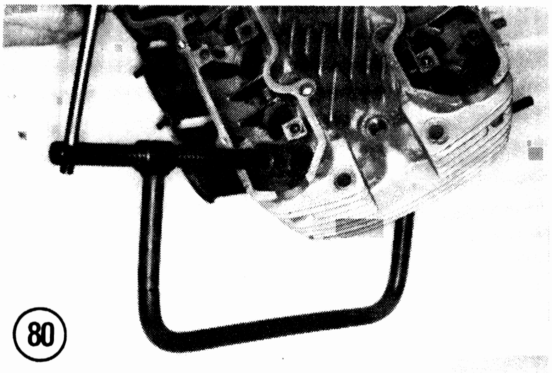
NOTE
The valve lifters and adjuster pads must be reinstalled in their exact position as they determine valve clearance. Store all parts in order in a divided container so that they can be reinstalled in their exact same position. Even if the valves are going to be serviced, with all components going back to their original position, this is a good starting point for measuring valve service.

2. If the valve lifters and adjustment pads are still in place, use a suction cup tool and remove the 16 valve adjuster pads (**Figure 59**) and then remove the 16 lifters.

(79) VALVE ASSEMBLY



1. Adjuster pad
2. Lifter
3. Valve keepers
4. Retainer
5. Inner spring
6. Outer spring
7. Lower spring seat
8. Oil seal
9. Valve



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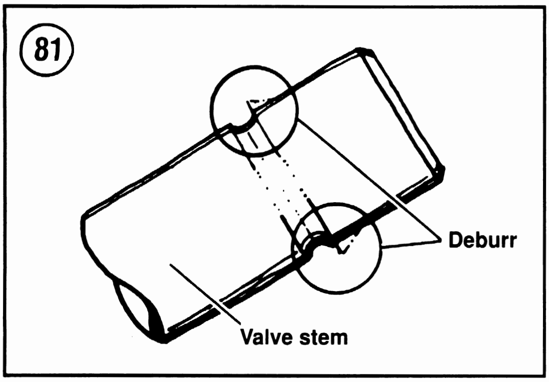

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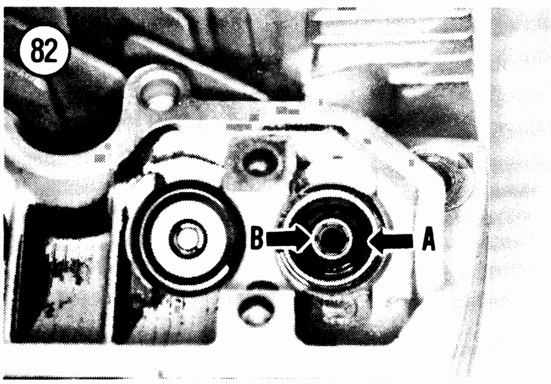

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83

3. Compress the valve springs with a valve compressor tool (**Figure 80**) placed directly over the valve retainer.

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

4. Tighten the compressor tool until the valve keepers separate. Lift out the valve keepers with needlenose pliers.
5. Gradually release the compressor tool. Remove the valve compressor tool.
6. Remove the valve spring retainer and both valve springs.
7. Prior to removing the valve, remove any burrs from the valve stem (**Figure 81**) with a fine cut file. Otherwise the valve guide will be damaged.
8. Remove the valve.

NOTE
*The valve spring seat (A, **Figure 82**) is held in place by the valve stem oil seal (B, **Figure 82**). Unless the oil seal is going to be replaced, do **not** remove the spring seat.*

9. Repeat for all intake and exhaust valves.
10. Mark all parts as they are disassembled and keep them in sets (**Figure 83**) so that they will be installed in their original locations.
11. If necessary, remove the oil seal from each valve guide, then remove the spring seat.

Valve Inspection

1. Clean the valves with a wire brush and solvent.
2. Inspect the contact surface of each valve for burning or pitting (**Figure 84**). Unevenness of the contact surface is an indication that the valve is not serviceable. The valve contact surface *cannot* be ground and must be replaced if defective.
3. Inspect each valve stem for wear and roughness and measure the vertical runout of the valve stem as shown in **Figure 85**. The runout should not exceed the service limit listed in **Table 1.**
4. Measure each valve stem for wear (**Figure 86**). If worn to the wear limit listed in **Table 1** or less, the valve must be replaced.

4

5. Measure the thickness of the valve face (**Figure 87**) with a vernier caliper. If worn to the wear limit listed in **Table 1** or less, the valve must be replaced.

6. Measure the thickness of the valve head (**Figure 88**) "Dimension A," the beveled end thickness "Dimension B" and stem length to the keeper groove "Dimension C." Compare to dimensions listed in **Table 1**. If worn to the wear limit listed in **Table 1** or less, the valve must be replaced.

7. Inspect the valve stem end for mushrooming and replace if necessary.

8. Remove all carbon and varnish from each valve guide with a stiff spiral wire brush.

9. Measure each valve guide (A, **Figure 89**) at the top, middle and bottom with a small hole gauge (B, **Figure 89**). If worn to the wear limit listed in **Table 1** or less, the valve guide must be replaced.

10. Subtract the valve stem measurement made in Step 4 from the valve guide dimensions made in Step 9. The difference is the valve guide-to-valve stem clearance. See **Table 1** for correct clearance. Replace any valve or guide that is not within specifications.

NOTE
If you do not have the special measuring equipment for Step 9, perform Step 11. Step 11 assumes that all valve stems have been measured and are within specifications. Replace any valves with worn valve stems prior to performing Step 11.

11. Insert each valve in its guide. Hold the valve with the head just slightly off the valve seat and rock it sideways in 2 directions, "X" and "Y," perpendicular to each other as shown in **Figure 90**. If the valve rocks more than slightly the valve guide is probably worn. If the valve stem is worn, replace the valve. If the valve stem is within tolerances, replace the valve guide.

12. Measure each valve spring free length with a Vernier caliper (**Figure 91**). All should be within the length specified in **Table 1** with no signs of bends or distortion. Replace defective springs.

13. Measure the tilt of all valve springs as shown in **Figure 92**. If distorted to the wear limit listed in **Table 1** or less, the valve spring must be replaced.

14. Check the valve spring retainer and valve keepers. If they are in good condition they may be reused; replace as necessary.

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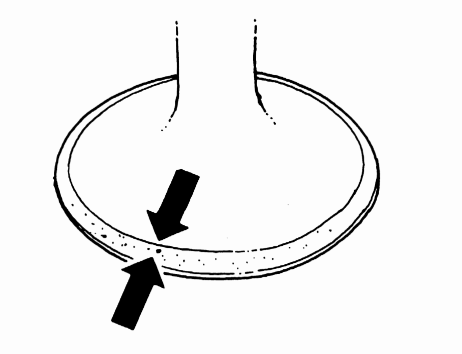

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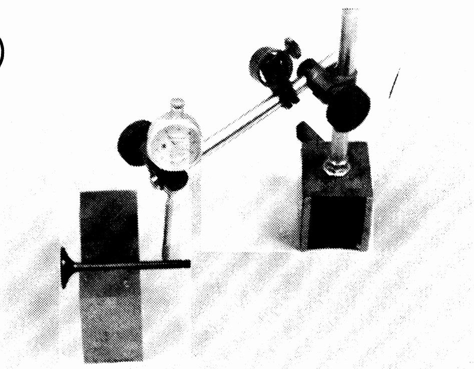

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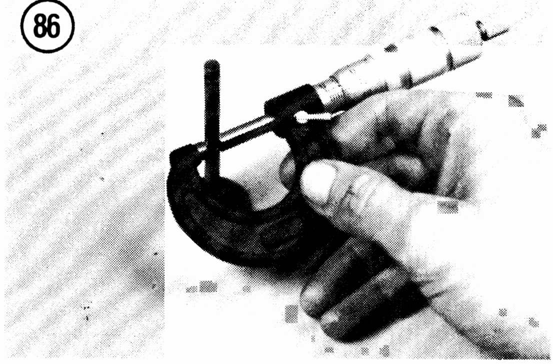

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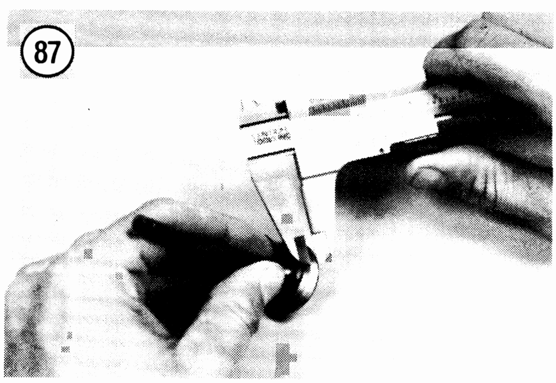

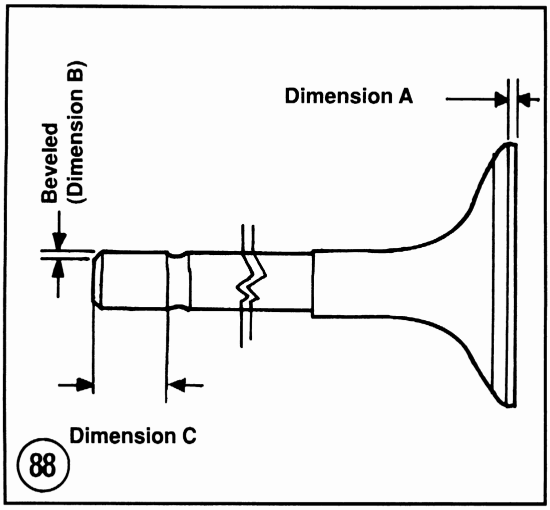

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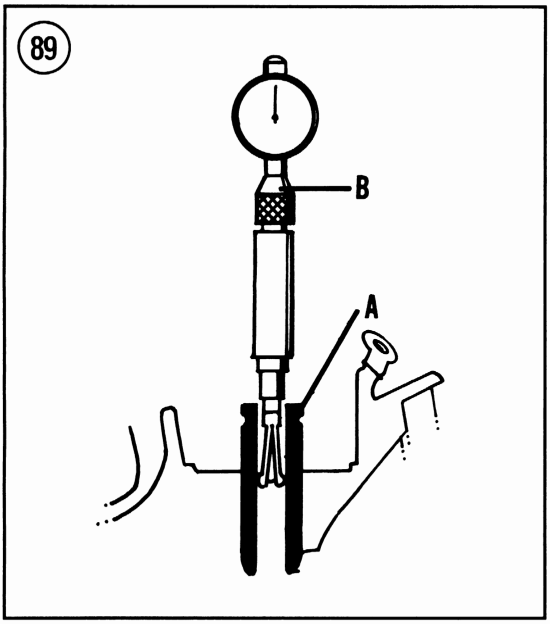

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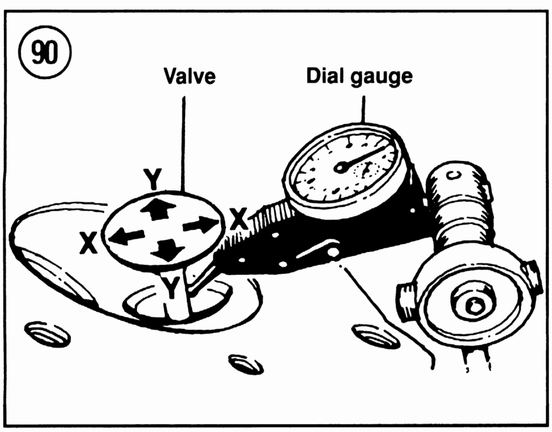

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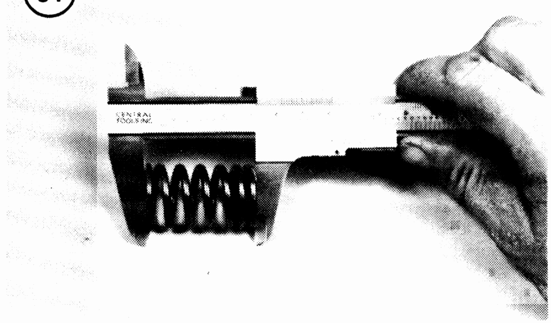
15. Inspect the valve seats. If worn or burned, they must be reconditioned as described in this chapter.

Valve Installation

1. If removed, install the valve seat and a new seal on each valve guide.
2. Coat the valve stems with molybdenum disulfide grease. To avoid damage to the valve stem seal, install and turn the valve slowly while inserting the valve into the cylinder head (**Figure 93**).

91



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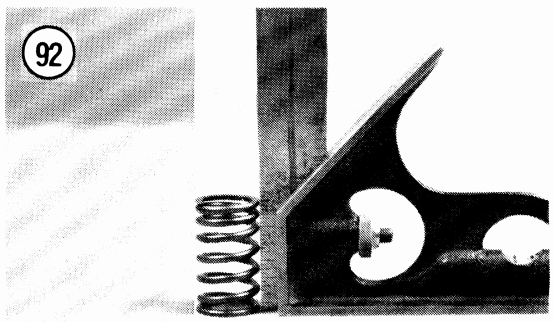

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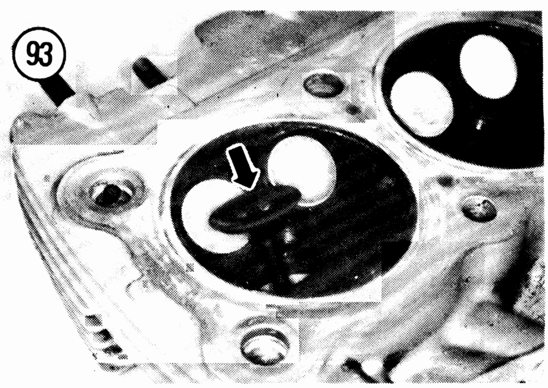

3. Position the valve spring with the closer wound coils (**Figure 94**) facing the cylinder head.
4. Install the outer spring (**Figure 95**) then the inner spring (**Figure 96**).
5. Install the valve spring retainer (**Figure 97**) on top of the valve spring and make sure it is correctly seated.

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

6. Compress the valve springs with a compressor tool (**Figure 80**) and install the valve keepers. Make sure the keepers fit snug into the rounded groove in the valve stem.
7. Remove the compression tool.
8. After all springs have been installed, gently tap the end of the valve stem (**Figure 98**) with a soft aluminum or brass drift and hammer. This will ensure that the keepers are properly seated.
9. Repeat for all valve assemblies.

NOTE
The valve lifters and adjuster pads must be reinstalled in their exact position as they determine valve clearance. Remove the parts in order from the divided container and install them in their exact position.

10. Apply clean engine oil to the side of the valve lifters.
11. Install each valve lifter into its correct receptacle in the cylinder head. Push the lifter down until it is completely seated on top of the valve assembly.
12. Install the 16 valve adjuster pads (**Figure 99**) into the correct valve lifters. The pads must be reinstalled into the correct valve lifter to minimize the time used for the valve clearance procedure.
13. Install the camshafts and cylinder head as described in this chapter.

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.

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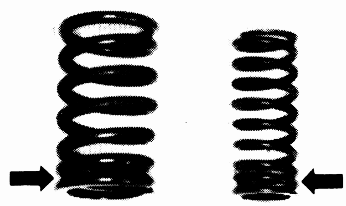

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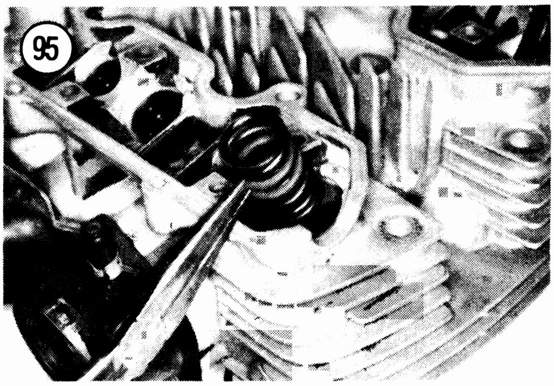

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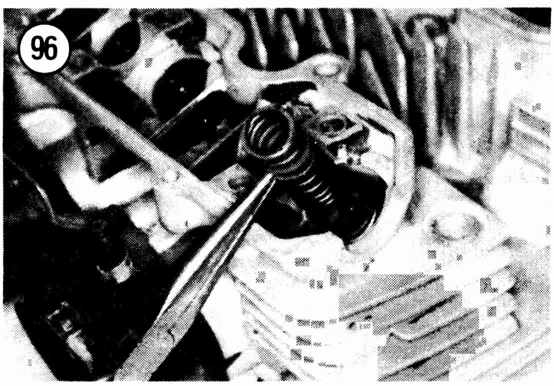

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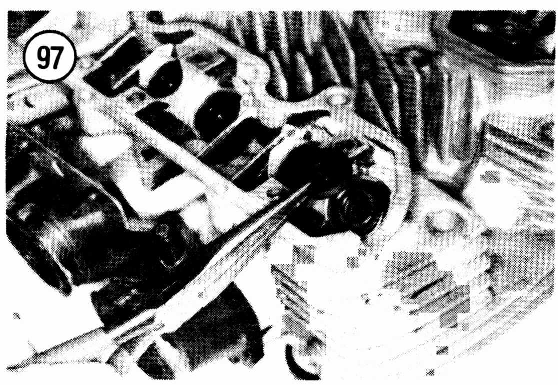
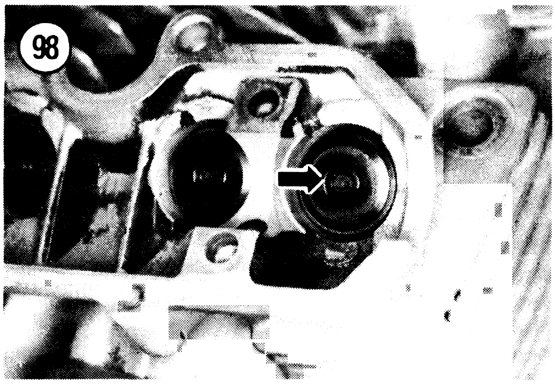


The following procedure is provided in case you choose to perform this task yourself.

CAUTION
*There **may** be a residual oil or solvent odor left in the oven after heating the cylinder head. If you use a household oven, first check with the person who uses the oven for food preparation to avoid getting into trouble.*

98



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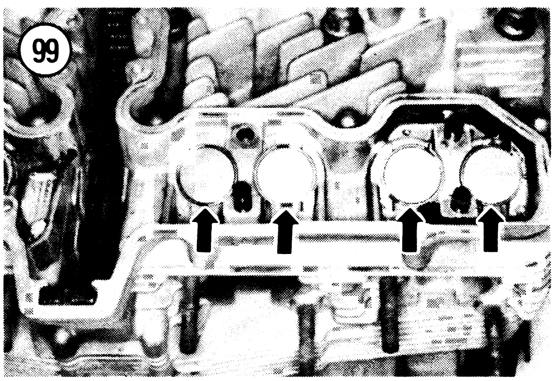

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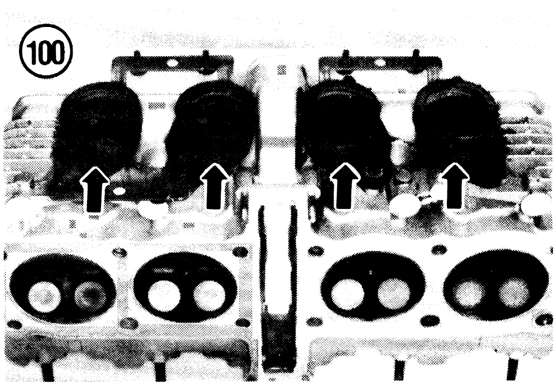


NOTE
Mark each intake pipe relating to cylinder number prior to removal to ensure proper installation. If installing new intake pipes, refer to marks made on the old intake pipes to ensure proper installation location.

1. Remove the screws securing the intake pipes (**Figure 100**) onto the cylinder head. Remove all intake pipes prior to placing the cylinder head in the oven.
2. While heating up the cylinder head, place the new valve guides in a freezer (or refrigerator) if possible. Chilling them will slightly reduce their overall diameter while the hot cylinder head is slightly larger due to heat expansion. This will make valve guide installation much easier.

CAUTION
Do not heat the cylinder head with a torch (propane or acetylene); never bring a flame into contact with the cylinder head or valve guide. The direct heat will destroy the case hardening of the cylinder head and will likely cause warpage.

3. The valve guides are installed with a slight *interference* fit. Place the cylinder head in a heated oven (or on a hot plate). Heat the cylinder head to a temperature of 100° C (212° F). An easy way to check the proper temperature is to drop tiny drops of water on the cylinder head; if they sizzle and evaporate immediately, the temperature is correct.
4. Remove the cylinder head from the oven and hold onto it with kitchen pot holders, heavy gloves or heavy shop cloths—*it is very hot.*
5. Place the cylinder head upside down on wood blocks. Make sure the cylinder is properly supported on the wood blocks.
6. From the combustion chamber side of the cylinder head, drive out the old valve guide (**Figure 101**) with a hammer and valve guide remover (**Figure 102**). Use Yamaha special tool, Valve Guide Remover (U.S. part No. YM-01122, U.K. part No. 90890-01122). Remove the valve guide and the special tool.
7. Remove and discard the valve guide and the circlip. *Never* reinstall a valve guide or circlip that has been removed as it is no longer true nor within tolerances.
8. Install a new circlip onto the valve guide.

4

CAUTION
Failure to apply fresh engine oil to both the valve guide and the valve guide hole in the cylinder head will result in damage to the cylinder head and/or the new valve guide.

9. Apply fresh engine oil to the new valve guide and the valve guide hole in the cylinder head.

10. Turn the cylinder head over on wood blocks. Make sure the cylinder is properly supported on the wood blocks.

11. From the top side (camshaft side) of the cylinder head, drive in the new valve guide with a hammer and valve guide installer (B, **Figure 103**) and Yamaha special tool, Valve Guide Installer (U.S. part No. YM-01129, U.K. part No. 90890-04015) and valve guide installer (A, **Figure 103**) Yamaha special tool, Valve Guide Remover, (U.S. part No. YM-01122, U.K. part No. 90890-01122).

12. Drive the valve guide in until it completely seats in the cylinder head. Remove the special tools.

13. After installation, ream the new valve guide as follows:

a. Use Yamaha special tool, 5.5 mm Valve Guide Reamer (U.S. part No. YM-01196, U.K. part No. 90890-04015), and appropriate handle (**Figure 104**).
b. Apply cutting oil to both the new valve guide and the valve guide reamer during the reaming operation.

CAUTION
***Always** rotate the valve guide reamer **clockwise**. If the reamer is rotated counterclockwise, a good valve guide will be damaged.*

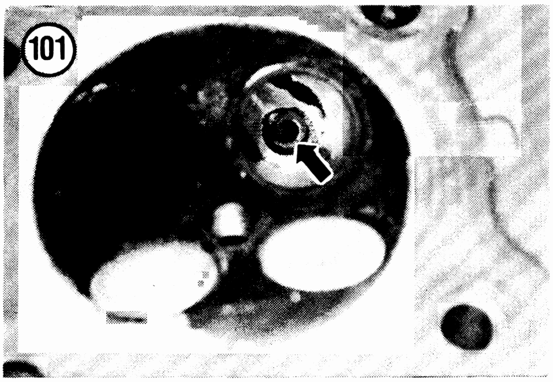
c. Rotate the reamer *clockwise*. Continue to rotate the reamer and work it down through the entire length of the new valve guide. Continue to apply additional cutting oil during this procedure.
d. Rotate the reamer *clockwise* until the reamer has traveled all the way through the new valve guide.
e. Rotate the reamer *clockwise* and completely withdraw the reamer from the valve guide.

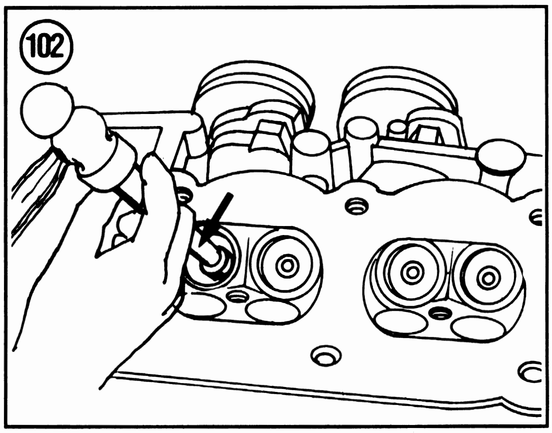
14. If necessary, repeat Steps 1-13 for any other valve guides.

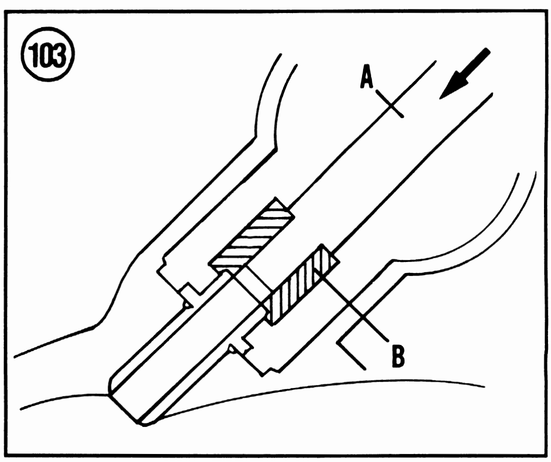
15. Thoroughly clean the cylinder head and valve guides with solvent to wash out all metal particles. Dry with compressed air.

16. Reface the valve seats as described in this chapter.

17. Install the intake pipes on their correct locations and tighten the bolts securely.







Valve Seat Inspection

1. Remove the valves as described in this chapter.

2. The most accurate method for checking the valve seal is to use Prussian Blue or machinist's dye, available from auto parts stores or machine shops. To check the valve seal with Prussian Blue or machinist's dye, perform the following:

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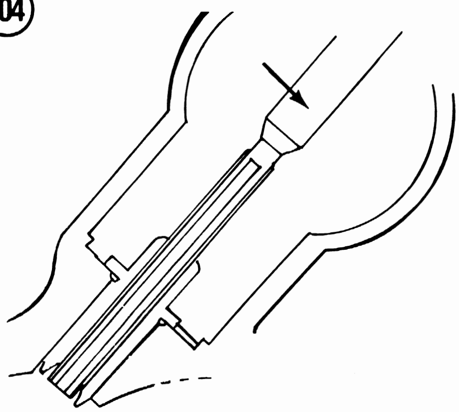

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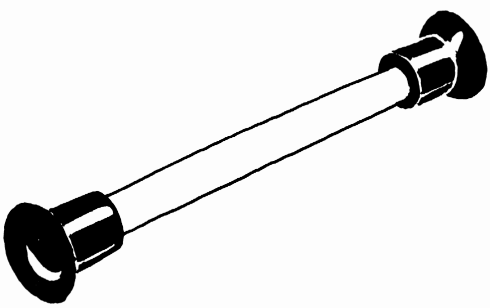

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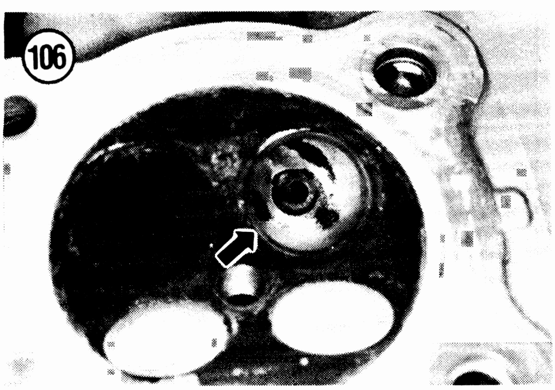

a. Thoroughly clean off all carbon deposits from the valve face with solvent or detergent, then thoroughly dry.

b. Spread a thin layer of Prussian Blue or machinist's dye evenly on the valve face.

c. Moisten the end of a suction cup valve tool (**Figure 105**) and attach it to the valve. Insert the valve into the guide.

d. Using the suction cup tool, tap the valve up and down in the cylinder head. Do *not* rotate the valve or a false indication will result.

e. Remove the valve and examine the impression left by the Prussian Blue or machinist's dye. If the impression left in the dye (on the valve or in the cylinder head) is not even and continuous and the valve seat width is not within specified tolerance listed in **Table 1**, the cylinder head valve seat must be reconditioned.

3. Closely examine the valve seat in the cylinder head (**Figure 106**). It should be smooth and even with a polished seating surface.

4. Measure the valve seat width. Compare to the wear limit listed in **Table 1**.

5. If the valve seat is okay, install the valves as described in this chapter.

6. If the valve seat is not correct, recondition the valve seat in the cylinder head as described in this chapter.

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 and taking just the cylinder head to a dealer or machine shop and have the valve seats ground.

The following procedure is provided in case you choose to perform this task yourself.

You will need a valve seat cutter set consisting of the following angles: 30°, 45° and 60° and an appropriate handle. These tool sets are usually available from a Yamaha dealer or from machine shop supply outlets. Follow the manufacturer's instruction in regard to the operating the cutter.

The valve seat for both the intake valves and exhaust valves are machined to the same angles as follows:

a. The area below the contact surface (closest to the combustion chamber) is cut to a 30° angle (A, **Figure 107**).
b. The valve contact surface is cut to a 45° angle (B, **Figure 107**).
c. The area above the contact surface (closest to the valve lifter) is cut to a 60° angle (C, **Figure 107**).

1. Using the 45° angle side of the cutter, install the cutter and the T-handle.
2. Using the 45° cutter, descale and clean the valve seat with one or two turns (**Figure 108**).

CAUTION
Measure the valve seat contact area in the cylinder head after each cut to make sure the contact area is correct and to prevent removing too much material. If too much material is removed, the cylinder head must be replaced.

3. If the seat is still pitted or burned, turn the 45° cutter additional turns until the surface is clean. Refer to the previous *CAUTION* to avoid removing too much material from the cylinder head.
4. Remove the valve cutter and T-handle from the cylinder head.
5. Inspect the valve seat-to-valve face impression as follows:
   a. Spread a thin layer of Prussian Blue or machinist's dye evenly on the valve face.
   b. Moisten the end of a suction cup valve tool and attach it to the valve. Insert the valve into the guide.
   c. Using the suction cup tool, tap the valve up and down in the cylinder head. Do *not* rotate the valve or a false indication will result.
   d. Remove the valve and examine the impression left by the Prussian Blue or machinist's dye.
   e. Measure the valve seat width. Refer to **Table 1** for the seat width specifications.
6. If the contact area is centered on the valve but is too wide (**Figure 109**), use either the 60° or the 30° cutter and remove a portion of the valve seat material to narrow the contact area.
7. If the contact area is centered on the valve but is too narrow (**Figure 110**), use the 45° cutter and remove a portion of the valve seat material to increase the contact area.

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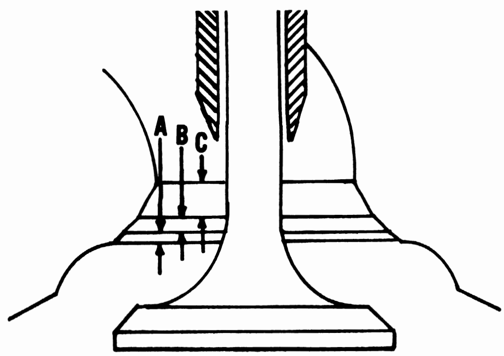

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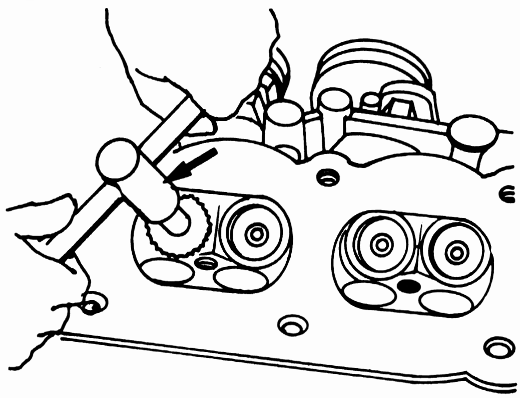

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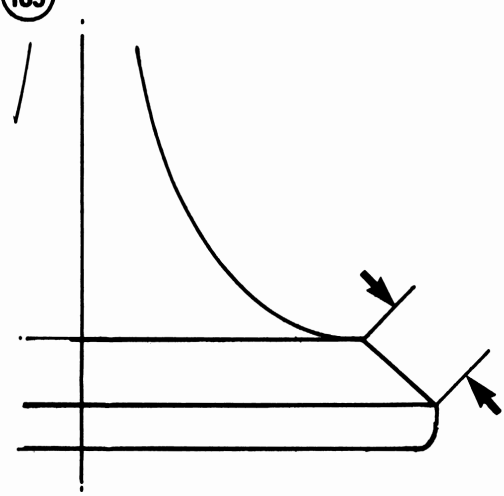
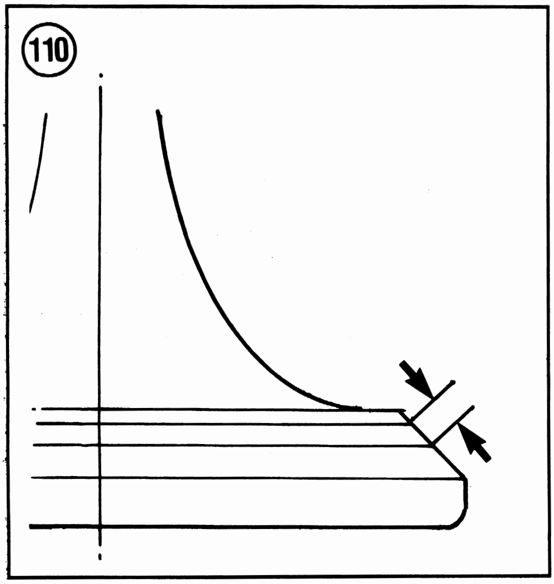


8. If the contact area is too narrow and up close to the valve head (**Figure 111**), first use the 30° cutter and then use the 45° cutter to center the contact area.

9. If the contact area is too narrow and down away from the valve head (**Figure 112**), first use the 60° cutter and then use the 45° cutter to center the contact area.

10. After the desired valve seat position and width is obtained, use the 45° side of the cutter and T-handle and *very lightly* clean off any burrs that may have been caused by the previous cuts—remove only enough material as necessary.



11. Check that the finish has a smooth and velvety surface, it should *not* be shiny or highly polished. The final seating will take place when the engine is first run.

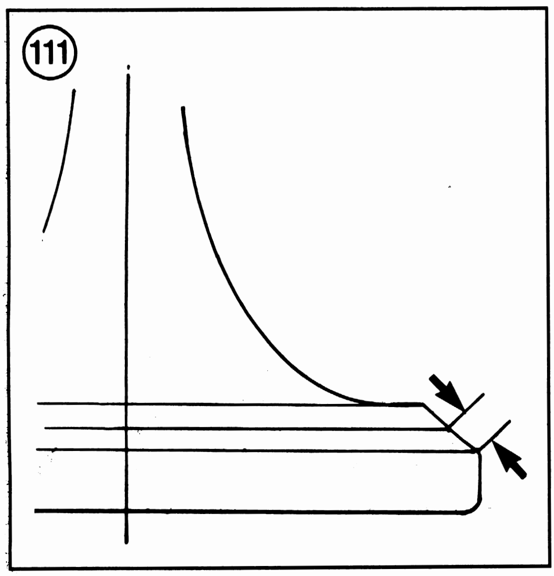
12. Repeat Steps 1-11 for all remaining valve seats.

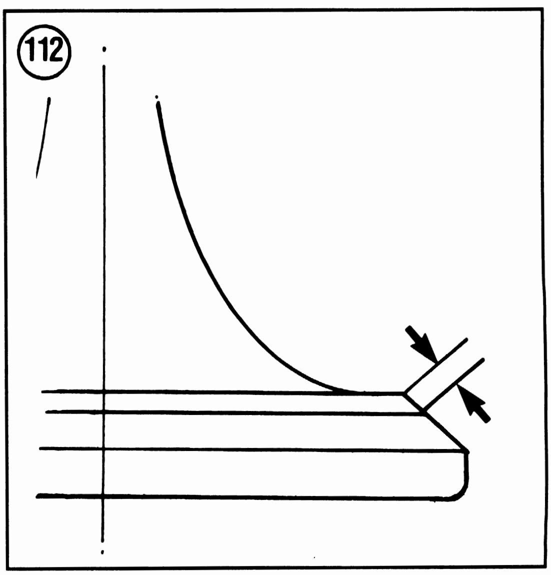
13. After the valve seat has been reconditioned, lap the seat and valve as described in this chapter.

Valve Seat 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. Lapping is also recommended after the valve seat has been serviced.

1. Smear a light coating of fine grade valve lapping compound such as Carborundum or Clover Brand on the seating surface of the valve.
2. Insert the valve into the cylinder head.
3. Wet the suction cup of the lapping stick (**Figure 105**) and stick it onto the valve head.
4. Lap the valve to the valve seat as follows:
   a. Lap the valve by rotating the lapping stick between your hands in both directions (**Figure 113**).
   b. Every 5 to 10 seconds, *stop* and rotate the valve 180° in the valve seat.
   c. Continue lapping until the contact surfaces of the valve and valve seat are a uniform grey. Stop as soon as they turn this color to avoid removing too much material.





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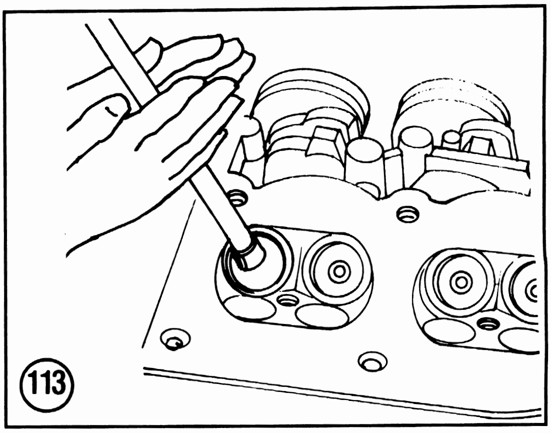
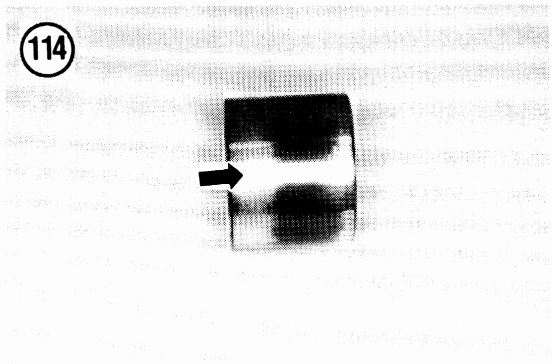
5. Thoroughly clean the cylinder head and all valve components in solvent, then detergent and hot water.
6. After the lapping has been completed and the valve assemblies have been reinstalled into the cylinder head, the valve seal should be tested. Check the seal of each valve by pouring solvent into each of the intake and exhaust ports. The solvent should not flow past the valve head and the valve seat. Perform on all sets of valves. If the fluid leaks past and off the seats, disassemble that valve assembly and repeat the lapping procedure until there is no leakage.
7. After the cylinder head and valve components are cleaned in detergent and hot water, apply a light coat of engine oil to all bare metal surfaces to prevent any rust formations.

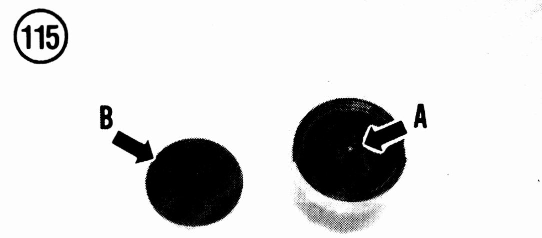




Valve Lifters and Adjusting Pads Inspection

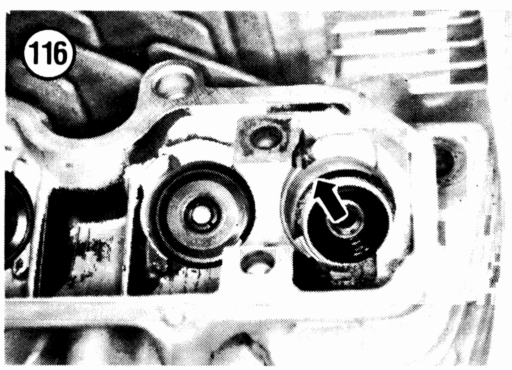
CAUTION
Do not intermix the valve lifters and pads during inspection. They must be reinstalled into their original position in the cylinder head upon reassembly.

1. Inspect the sides of the valve lifter body (**Figure 114**) for scratches and scoring. If it is damaged in any way, replace it.
2. Inspect the adjuster pad receptacle in valve lifter (A, **Figure 115**) for wear or damage. If the damage is severe, replace the lifter and adjuster pad.
3. Check the valve lifter's adjuster pad top surface (B, **Figure 115**) where the camshaft rides. Check for scratches or scoring. Replace any parts as necessary.
4. Inspect the valve lifter cavity in the cylinder head (**Figure 116**) in which it travels. If the damage is severe, cylinder head may have to be replaced.



CYLINDER BLOCK

The alloy cylinder block has pressed-in cylinder sleeves, which can be bored to 0.5 mm (0.020 in.) oversize and again to 1 mm (0.040 in.) oversize.



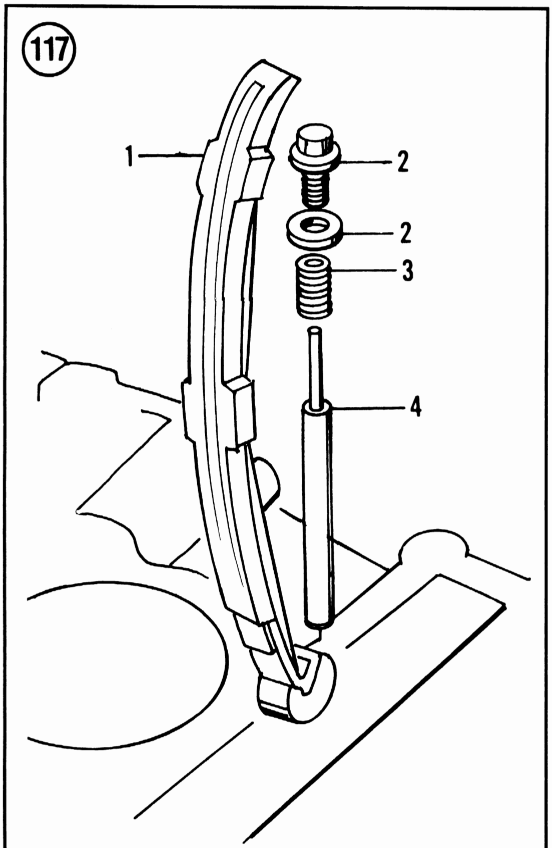
Removal

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

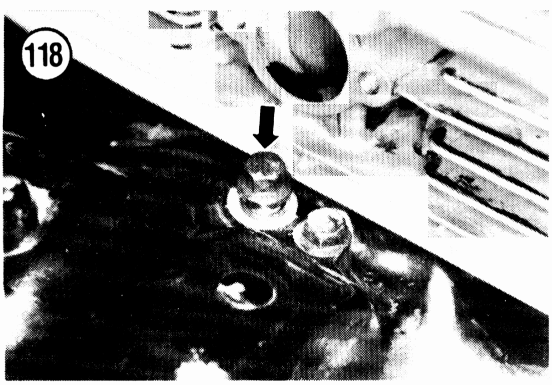
2. Remove the head gasket, 4 dowel pins and 2 O-ring seals.

3. Remove the camshaft chain rear guide (**Figure 117**) as follows:

   a. Remove the bolt and washer (**Figure 118**).



1. **Camshaft chain rear guide**
2. **Bolt and washer**
3. **Spring**
4. **Pushrod**

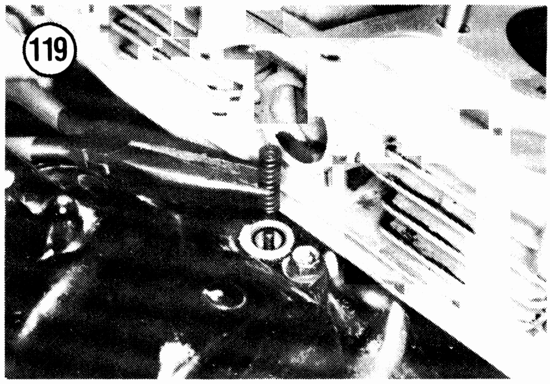


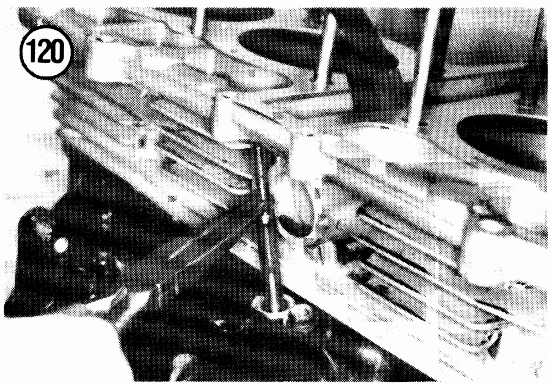
   b. Remove the spring (**Figure 119**) and the pushrod (**Figure 120**) from the crankcase.

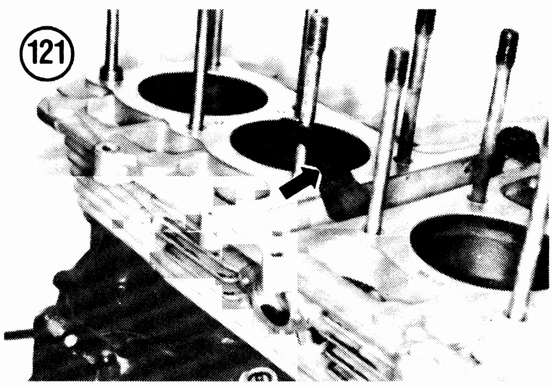
   c. Pull the camshaft chain rear guide (**Figure 121**) up and out of the cylinder block.

4. Loosen the cylinder block (**Figure 122**) by tapping around the perimeter with a rubber or plastic mallet.

5. Pull the cylinder block straight up and off the pistons and cylinder studs.





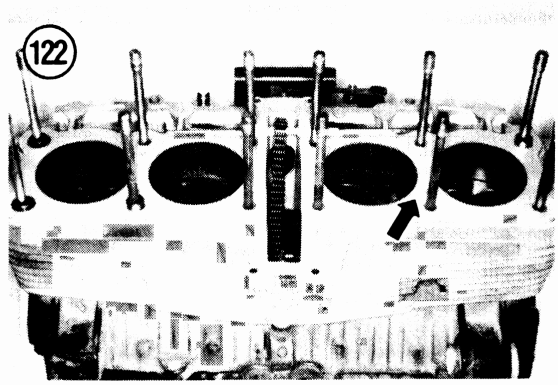


NOTE

Be sure to keep the camshaft chain wired up to prevent it from falling into the lower crankcase.

6. Remove the 2 dowel pins and base gasket.
7. Stuff clean shop rags into the crankcase opening to prevent objects from falling into the crankcase.

122

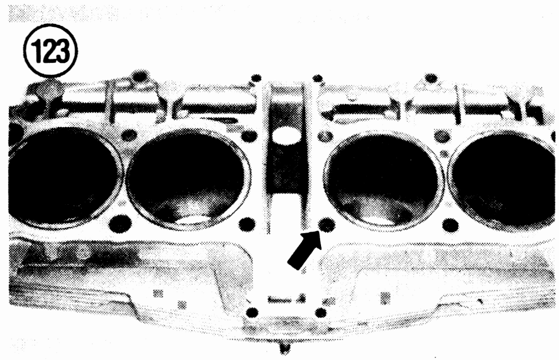


Inspection

The following procedure requires the use of highly specialized and expensive measuring instruments. If such equipment is not readily available, have the measurements performed by a dealer or qualified machine shop.

1. Apply a gasket remover or use solvent and soak the old cylinder head and cylinder base gasket material stuck to the cylinder block. If necessary use a broad-tipped *dull* chisel and gently scrape off all gasket residue. Do not gouge the sealing surface as oil leaks will result.
2. Wash the cylinder block in solvent to remove any oil and carbon particles. The cylinder bores must be cleaned thoroughly before attempting any measurement as incorrect readings may be obtained.
3. Remove all gasket residue from the top (**Figure 123**) and bottom (A, **Figure 124**) gasket surfaces.
4. Check the cylinder walls (**Figure 125**) for scratches; if evident, the cylinders should be rebored.
5. Measure the cylinder bores with a cylinder gauge (**Figure 126**) or inside micrometer at the points shown in **Figure 127**.

123



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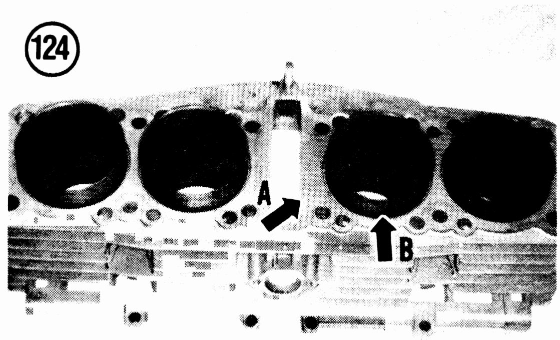
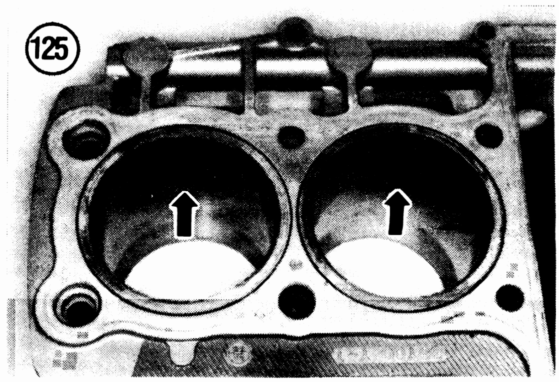


NOTE

*The new pistons should be obtained first before the cylinders are bored so that the pistons can be measured; each cylinder must be bored to match one piston only. Piston-to-cylinder clearance is specified in **Table 1**.*

6. Measure in 2 axes—in line with the piston pin and at 90° to the pin. If the taper or out-of-round is greater than specifications (**Table 1**), the cylinders must be rebored to the next oversize and new pistons and rings installed. Rebore all 4 cylinders even though only one may be worn.
7. If the cylinder(s) are not worn past the service limits, check the bore carefully for scratches, gouges

125



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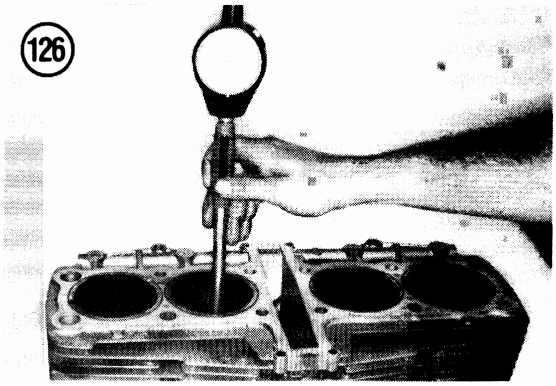

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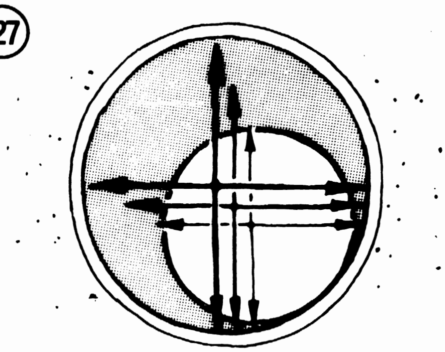

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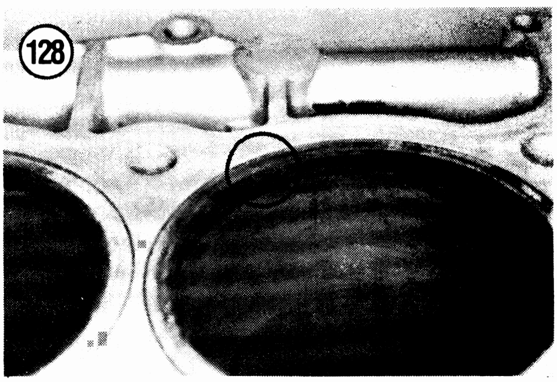

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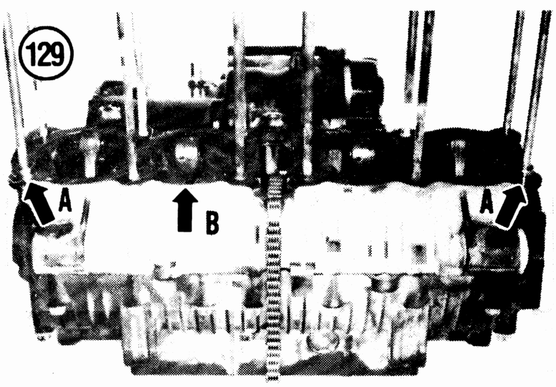


or ridge (**Figure 128**) at the top of the cylinder. The bore still may require boring and reconditioning.

8. If the cylinders require reboring, remove all dowel pins from the cylinder block before taking the cylinder block to the dealer or machine shop for service.

CAUTION
A combination of soap and water is the only solution that will completely clean cylinder walls. Solvent and kerosene cannot wash fine grit out of cylinder crevices. Grit left in the cylinder will act as a grinding compound and cause premature wear to the new rings.

9. After the cylinders have been serviced, wash each cylinder bore in hot soapy water. This is the only way to clean the cylinders of the fine grit material left from the bore or honing job. After washing the cylinder walls, run a clean white cloth through each wall; it should show no traces of grit or other debris. If the rag is dirty, the wall is not thoroughly clean and must be rewashed. After the cylinder is cleaned, lubricate the cylinder walls with clean engine oil to prevent the cylinder liners from rusting.

10. Check the O-ring (B, **Figure 124**) at the base of each cylinder for deterioration, wear or other damage. Replace all 4 as a set even if only 1 or 2 are damaged.

Installation

1. Check that the top and bottom cylinder surfaces are clean of all gasket residue.

NOTE
***Figure 129** is shown with the pistons removed for clarity.*

2. Install the 2 dowel pins (A, **Figure 129**) onto the crankcase studs.

3. Install a new cylinder base gasket (B, **Figure 129**). Make sure all holes align with openings in the top of the crankcase.

4. Lubricate cylinders and pistons liberally with engine oil prior to installation.

5. Rotate the crankshaft so the No. 2 and No. 3 pistons are at top dead center.

6. Carefully align the cylinder with the 2 raised pistons.

4

NOTE
Make sure to align the rear chain guide with the cylinder block camshaft chain tunnel.

7. Compress each ring as it enters the cylinder with your fingers or by using aircraft type hose clamps of appropriate diameter. Start the 2 center pistons into the cylinder block (**Figure 130**).

8. After the 2 center pistons are engaged properly into their cylinder bores (**Figure 131**), start the No. 1 and No. 4 pistons into the cylinder bores (**Figure 132**).

9. At this time, run the camshaft drive chain through the camshaft chain tunnel in the cylinder block. Insert a tool through the chain and rest it on top of the cylinder block (**Figure 133**).

10. Push the cylinder block all the way down until it bottoms out.

11. Install the camshaft chain rear guide (**Figure 117**) as follows:

   a. Position the camshaft chain rear guide with the round end (A, **Figure 134**) going in first and install it in through the chain cavity in the cylinder block and into the receptacle in the crankcase.

   b. Position the pushrod with the smaller diameter end going in last. This is necessary in order to accept the spring.

   c. Install the pushrod (**Figure 120**) into the crankcase and onto the flat portion of the guide (B, **Figure 134**).

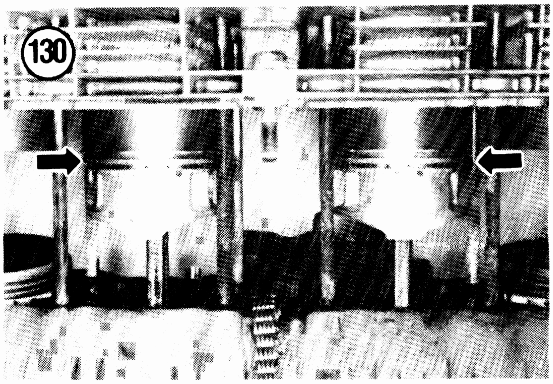
   d. Install the spring (**Figure 119**) onto the pushrod.

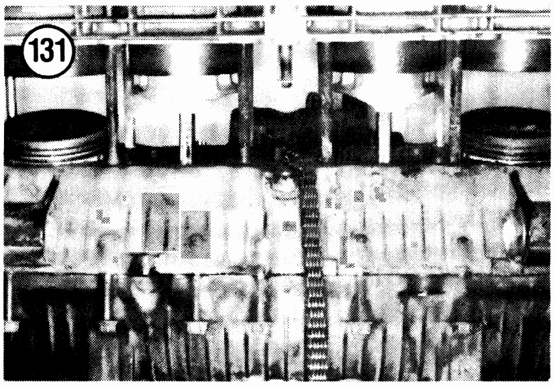
   e. Install the bolt and washer (**Figure 118**) and tighten to the torque specification in **Table 2.**

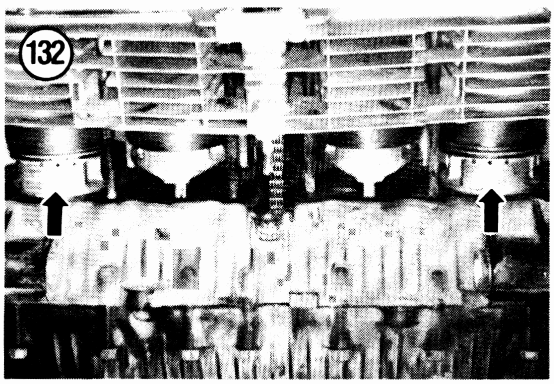
   f. After the bolt has been tightened, move the chain guide back and forth and make sure it pivots freely within the receptacle in the crankcase.

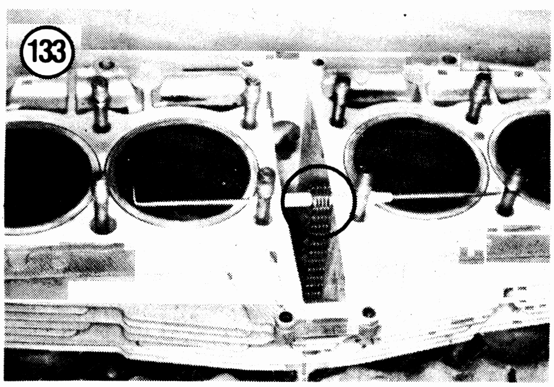
12. Install the cylinder head as described in this chapter.

13. Follow the *Break-in* procedure in this chapter if the cylinder block was rebored or honed or new pistons or piston rings were installed.



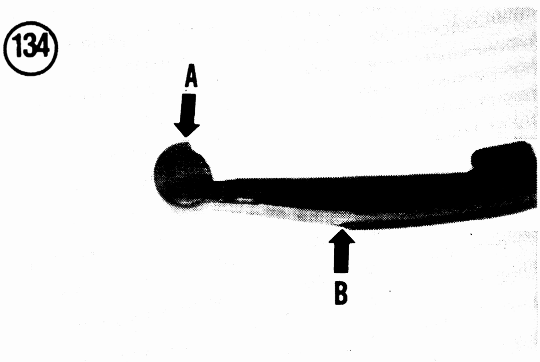






PISTONS, PISTON PINS AND PISTON RINGS

The pistons are made of an aluminum alloy. The piston pins are made of steel and are a precision fit. The piston pin is held in place by a clip at each end.



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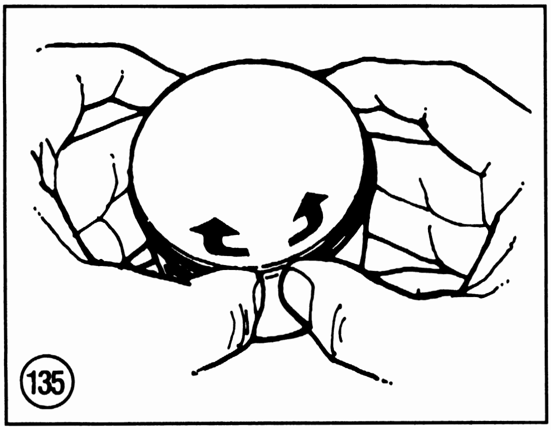
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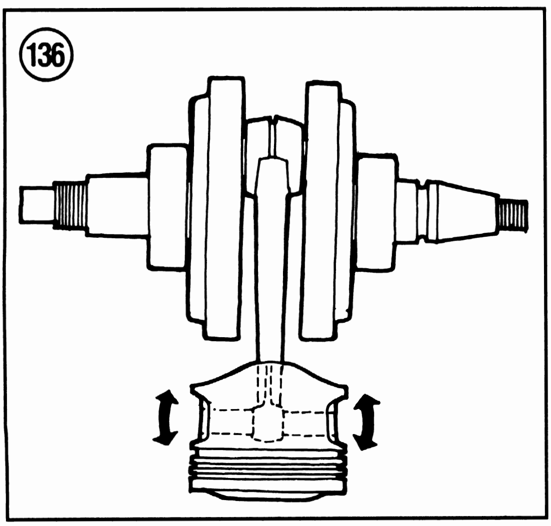

136

Piston Removal

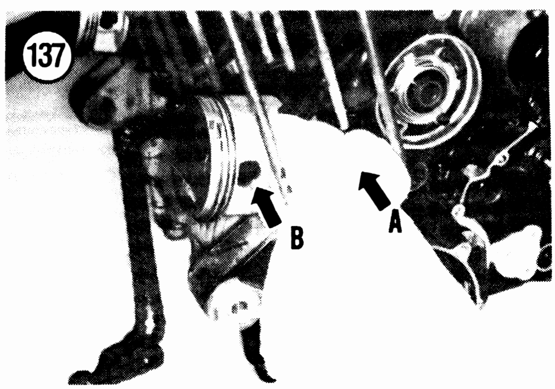
1. Remove the cylinder head and cylinder block as described in this chapter.
2. Lightly mark the top of the piston with an identification number (1 through 4), starting with the No. 1 piston on the left-hand side and working across to the right. The left-hand side refers to a rider sitting on the seat facing forward. These marks will make it easier to assure that the pistons will be installed into the correct cylinder bores during installation.

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

3. Remove the top ring with a ring expander tool or by spreading the ends with your thumbs just enough to slide the ring up over the piston (**Figure 135**). Repeat for the remaining rings.
4. Before removing the piston, hold the rod tightly and rock the piston (**Figure 136**). 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).

NOTE
*Wrap a clean shop cloth (A, **Figure 137**) under the piston so that the piston pin clip will not fall into the crankcase.*

5. Remove the clip from each side of the piston pin bore (B, **Figure 137**) 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.



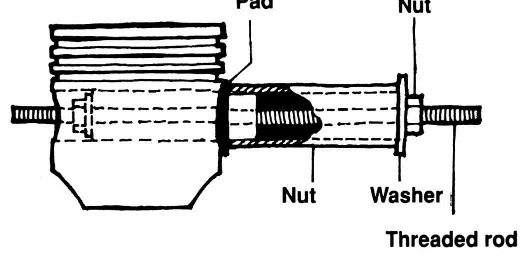
137

6. Use a proper size wooden dowel or socket extension and push out the piston pin. Mark the piston pin in relation to the piston so that they will be reassembled into the same set.

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.

7. 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 138**.
8. Lift the piston off the connecting rod.
9. 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.
10. Repeat Steps 3-9 for the remaining pistons.

138



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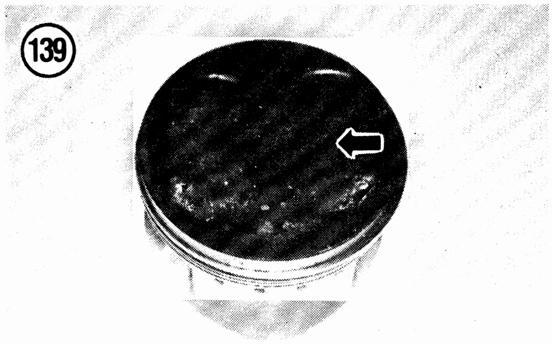

Inspection

1. Carefully clean the carbon from the piston crown (**Figure 139**) 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 (A, **Figure 140**). If the pistons, rings and cylinders are found to be dimensional 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 block wall will promote excessive oil consumption in this cylinder.

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* in this chapter.
4. Oil the piston pin and install it in the connecting rod. Slowly rotate the piston pin and check for radial

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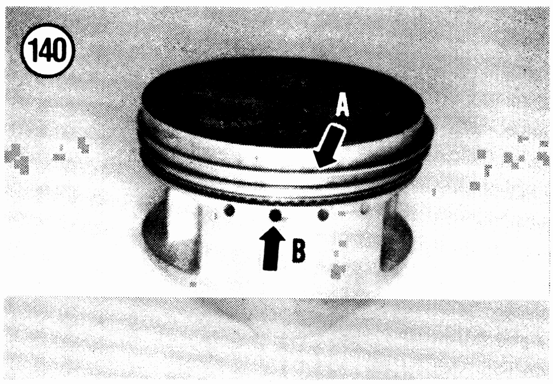

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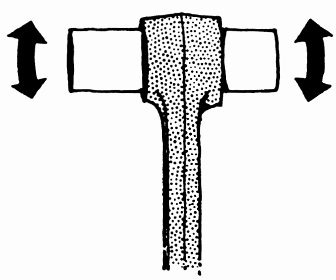

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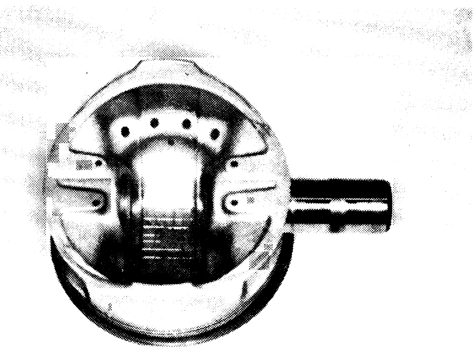

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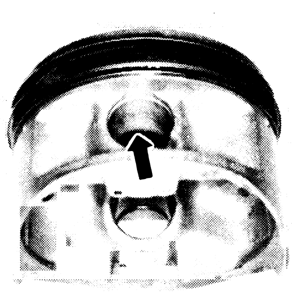

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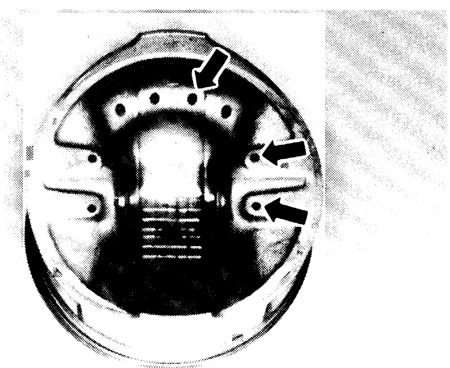

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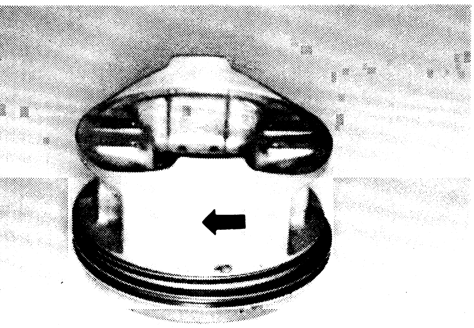

and axial play (**Figure 141**). If any play exists, the piston pin should be replaced, providing the rod bore is in good condition.

5. Oil the piston pin and install it in the piston (**Figure 142**). Slowly rotate the piston pin and check for radial and axial play. If any play exists, the piston pin should be replaced, providing the piston bore (**Figure 143**) is in good condition.

6. Check the oil control holes in the piston for carbon or oil sludge buildup. Refer to B, **Figure 140** and **Figure 144**. Clean the holes with a small diameter drill bit of the correct size.

7. Check the piston skirt (**Figure 145**) for galling and abrasion which may have been caused by piston seizure. If a piston(s) shows signs of partial seizure (bits of aluminum build-up on the piston skirt), the pistons should be replaced and the cylinders bored (if necessary) to reduce the possibility of engine noise and further piston seizure.

8. Inspect the piston pin (**Figure 146**) for chrome flaking or cracks. Replace if necessary. Yamaha does not provide specifications for the outer diameter of the piston pin.

9. Install a new piston pin circlip in each piston circlip groove and check the groove for wear or circlip looseness by pulling the circlip from side-to-side. If the circlip has any side play, the groove is worn and the piston must be replaced.

Piston Clearance

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

2. Measure the inside diameter of the cylinder bore at a point 13 mm (1/2 in.) from the upper edge with a bore gauge (**Figure 126**).

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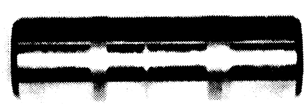


3. Measure the outside diameter of each piston across the skirt at right angles to the piston pin. Measure at a distance 3.0 mm (0.118 in.) up from the bottom of the piston skirt (**Figure 147**).
4. Piston clearance is the difference between the maximum piston diameter and the minimum cylinder diameter. Subtract the dimension of the piston from the cylinder dimension and compare to the dimension listed in **Table 1**. If the clearance exceeds that specified, the cylinders should be rebored to the next oversize and new pistons installed.
5. To establish a final overbore dimension with new pistons, add the piston skirt measurement to the specified clearance. This will determine the dimension for the cylinder overbore size. Remember, do not exceed the cylinder maximum service limit inside diameter indicated in **Table 1**.

Piston Installation

1. Apply molybdenum disulfide grease to the inside surface of the connecting rods.

NOTE
New piston pin clips should be installed during assembly. Install the clips with the gap away from the cutout in the piston.

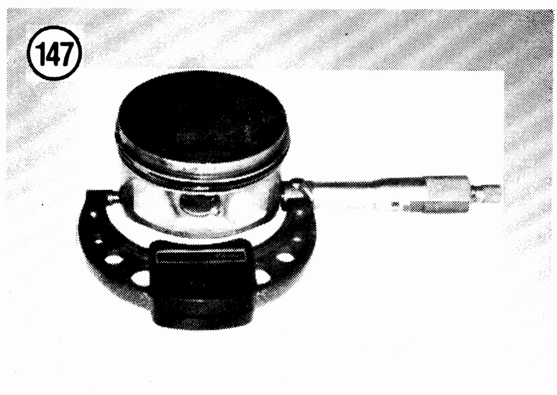
2. Install one piston pin clip in each piston on the side that faces toward the center of the engine. The arrow on top of the piston must point toward the front of the engine.
3. Oil the piston pin with assembly oil or fresh engine oil and install the piston pin in the piston until its end extends slightly beyond the inside of the boss (**Figure 142**).
4. Place the piston over the connecting rod. If you are reusing the same pistons and connecting rods, match the piston to the rod from which it came. If the cylinders were bored, install the pistons as marked by the machinist. Remember that the arrow on top of the piston must point toward the front of the engine.

CAUTION
When installing the piston pin in Step 5 do not push the pin in too far, or the piston pin clip installed in Step 2 will be forced into the piston metal, destroying the clip groove and loosening the clip.

5. Line up the piston pin with the hole in the connecting rod. Push the piston pin into the connecting rod. It may be necessary to move the piston around until the piston pin enters the connecting rod. Do not use force during installation or damage may occur. Push the piston pin in until it touches the pin clip on the other side of the piston.
6. If the piston pin does not slide easily, use the homemade tool (**Figure 138**) used during removal but eliminate the piece of pipe. Pull the piston pin in until it stops.
7. After the piston is installed, recheck and make sure that the arrow on top of the piston is pointing toward the front of the engine.

NOTE
In the next step, install the second clip with the gap away from the cutout in the piston.

8. Install the second piston pin clip (**Figure 148**) in the groove in the piston. Make sure both piston pin clips are seated in the grooves in the piston.
9. Check the installation by rocking the piston back and forth around the pin axis and from side to side

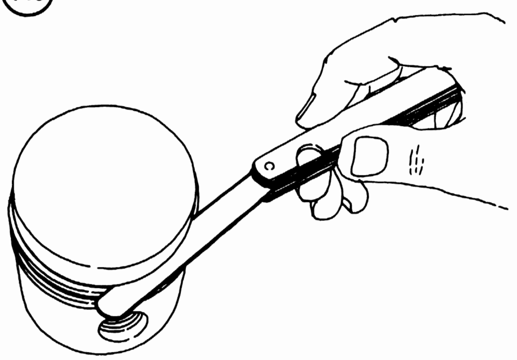


along the axis. It should rotate freely back and forth but not from side to side.

10. Repeat Steps 3-9 for the remaining pistons.

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

149



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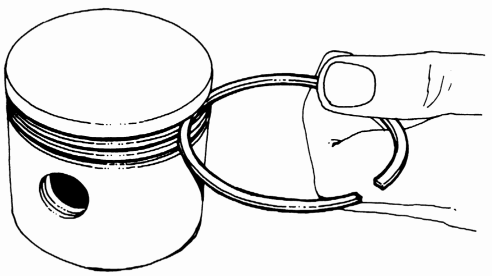


12. Install the cylinder and cylinder head as described in this chapter.

Piston Ring Replacement

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 149**) 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(s) must also be replaced.
2. Remove the old top ring by spreading the ends with your thumbs just enough to slide the ring up over the piston (**Figure 135**). Repeat for the remaining rings.
3. Carefully remove all carbon buildup from the ring grooves with a broken piston ring (**Figure 150**). Inspect the grooves carefully for burrs, nicks or broken and cracked lands. Recondition or replace the piston if necessary.
4. Roll each ring around its piston groove as shown in **Figure 151** to check for binding. Minor binding may be cleaned up with a fine-cut file.
5. Measure the thickness of each ring with a micrometer and compare to dimensions given in **Table 1**. If the thickness is less than specified, the ring(s) must be replaced.
6. Place each ring, one at a time, into the cylinder and push it in about 20 mm (3/4 in.) 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 152**) and compare to dimensions in **Table 1**. If the gap is greater than specified, the rings should be replaced.
7. When installing new rings, measure their end gap as described in Step 6 and compare to dimensions given in **Table 1**. If the end cap is greater than specified, return the rings for another set(s).
8. Install the oil ring spacer first, then both side rails. If reassembling used parts, install the side rails as they were removed.

NOTE
Install the top and 2nd rings with their manufacturing marks (e.g. "R") facing up.

NOTE
Oversize compression rings (top and second) are stamped with a 0.50 or 1.00 to indicate the oversize. The oil control expander (bottom ring) is color-coded to indicate oversize.

9. Install the second compression ring, then the top—by carefully spreading the ends of the ring with your thumbs and slipping the ring over the top of the piston. Remember that the manufacturing marks on the piston rings are toward the top of the piston.
10. 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. The important thing is that the ring gaps are not aligned with each other when installed to prevent compression pressures from escaping past them during initial start-up.
11. If new rings are installed, the cylinders must be deglazed or honed. This will help to seat the new rings. Refer honing service to a Yamaha dealer or competent machine shop. After honing, measure the end clearance of each ring (**Figure 152**) and compare to dimensions in **Table 1**.

CAUTION
*If the cylinders were deglazed or honed, thoroughly clean each cylinder as described under **Cylinder Block Inspection** in this chapter.*

12. Follow the *Break-in* procedure in this chapter if new pistons or new piston rings have been installed or the cylinders were rebored or honed.

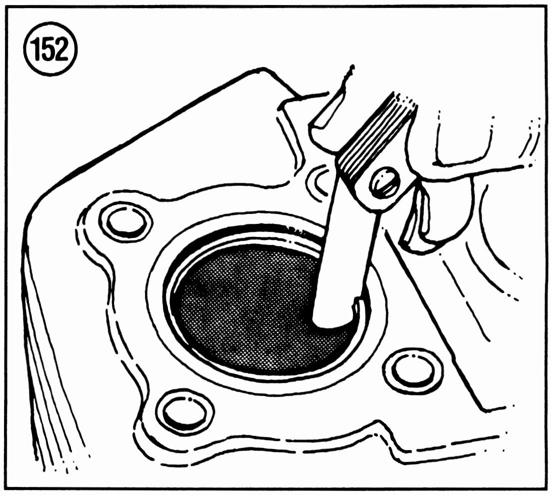
OIL PUMP AND STRAINER

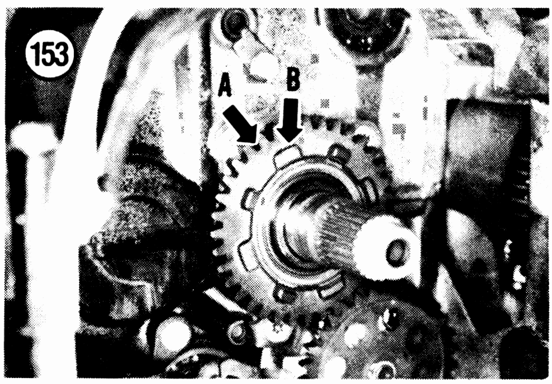
A wet sump system with a trochoid oil pump is used on all models. Two sets of rotors are enclosed in a housing located behind the clutch. The pump is shaft driven by the gear behind the clutch outer housing. The oil pan and oil pump can be removed with the engine mounted in the frame.

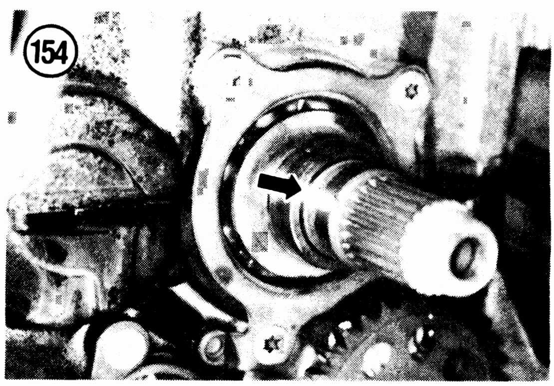
Service Notes

Because the lubrication system is a vital key to engine reliability, note the following during service and inspection:

a. Was the engine oil level correct?
b. Was the engine oil contaminated with sludge or condensation?
c. Was the oil pump properly mounted?
d. Were external oil cooler lines damaged or their fittings loose?
e. Were union bolts loose or clogged?
f. Was the oil filter element clogged?





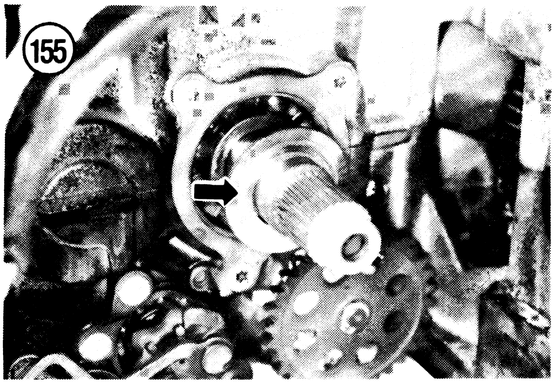


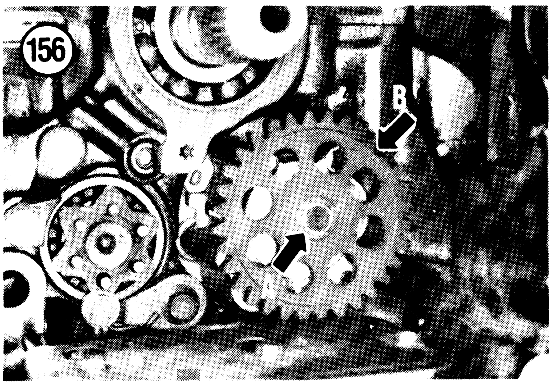
g. Was the oil pump screen clogged?
h. Was the relief valve working properly, clogged or damaged?
i. Were all O-rings properly installed or were they damaged?
j. Were the oil passages partially restricted or clogged?

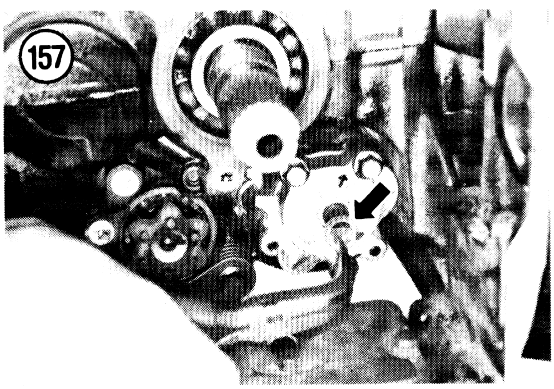
Oil Pump Removal/Installation

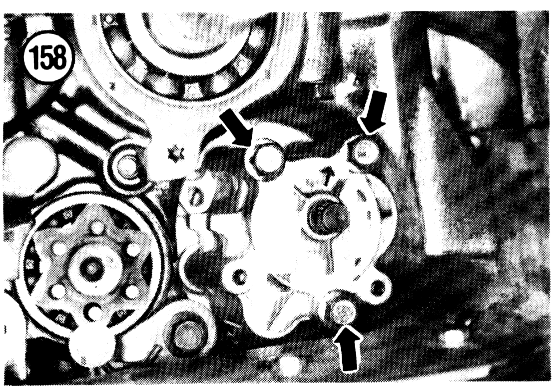
NOTE
This procedure is shown with the engine removed from the frame for clarity. It is not necessary to remove the engine to service the oil pump.

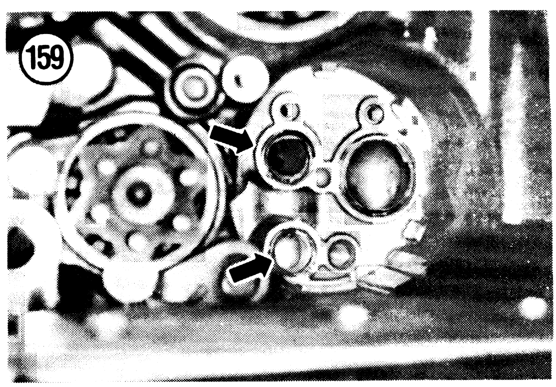
1. Remove the clutch as described in Chapter Five.
2. Slide the oil pump drive gear (A, **Figure 153**) off the transmission shaft.
3. Slide the collar (**Figure 154**) and thrust washer (**Figure 155**) off the transmission shaft.
4. Remove the circlip (A, **Figure 156**) and remove the oil pump driven gear (B, **Figure 156**).
5. Remove the washer (**Figure 157**) from the oil pump shaft.
6. Remove the bolts (**Figure 158**) securing the oil pump to the crankcase and remove the oil pump.
7. Remove the O-rings (**Figure 159**) and the large locating dowel (**Figure 160**) from the crankcase.
8. Installation is the reverse of these steps while noting the following:
   a. Be sure to install new O-rings (**Figure 159**) and the large locating dowel (**Figure 160**) into the recesses in the crankcase.
   b. Make sure the locating dowel (**Figure 161**) is in place on the backside of the assembly.



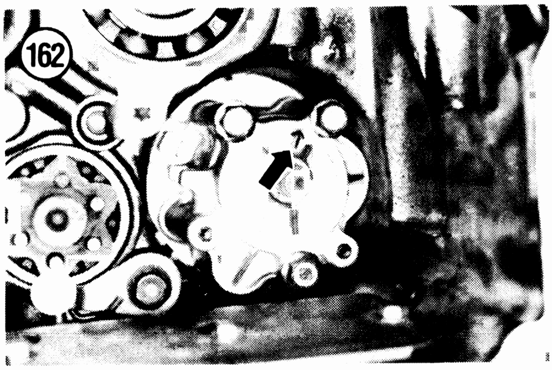








c. Align the arrow on the oil pump with the arrow on the crankcase (**Figure 162**) and install the oil pump.
d. Apply red Loctite (No. 271) to the oil pump mounting screw threads prior to installation, then tighten to the torque specification in **Table 2**.
e. Position the drive gear with the raised bosses (B, **Figure 153**) facing out so they will engage the recesses in the backside of the clutch outer housing.

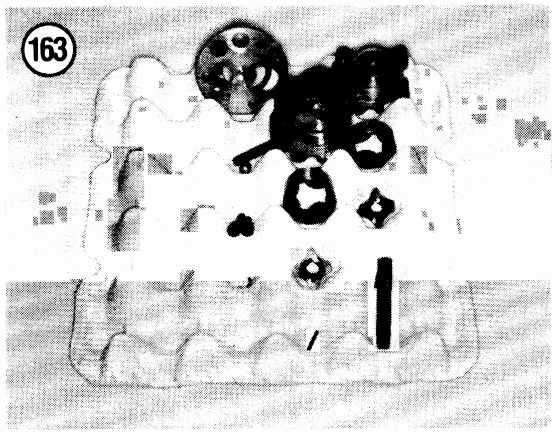


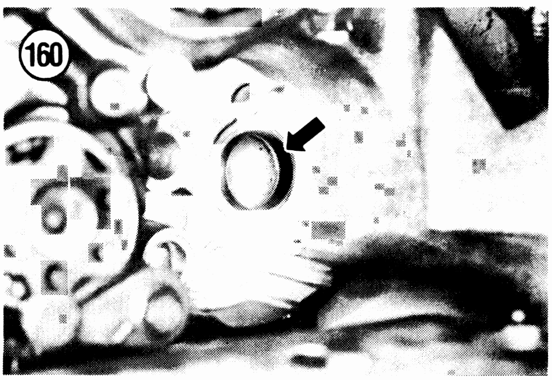
Disassembly

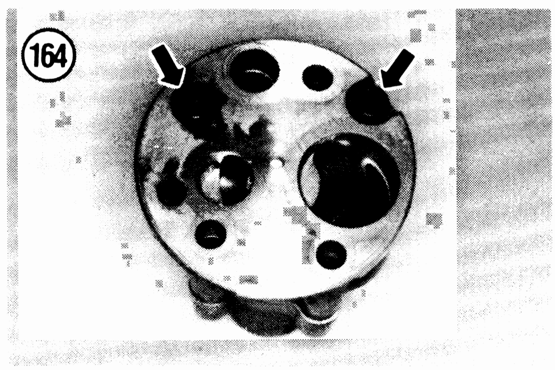
Replacement parts are *not* available for the oil pump. If 1 or 2 parts show signs of severe wear or measure out of specification, replace the complete assembly.

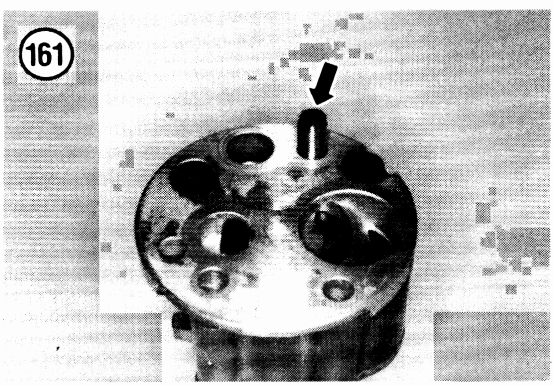
The work area should be clean when disassembling and reassembling the oil pump.

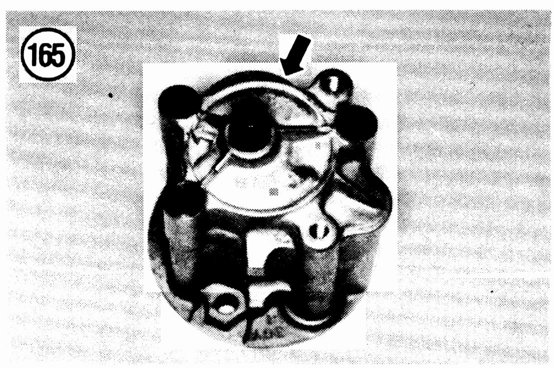
A divided container, such as an egg carton (**Figure 163**) can be used to help maintain correct alignment and positioning of the parts as the oil pump is disassembled.











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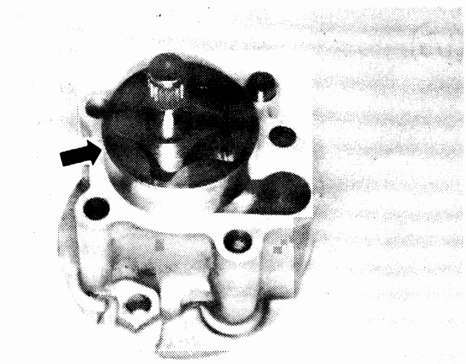

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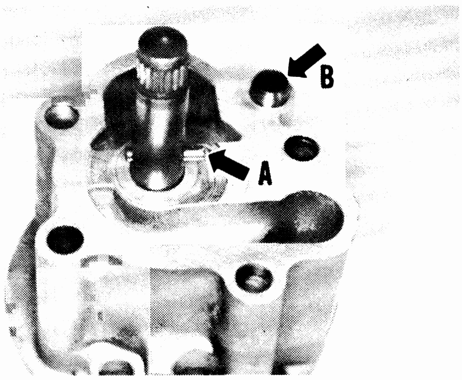

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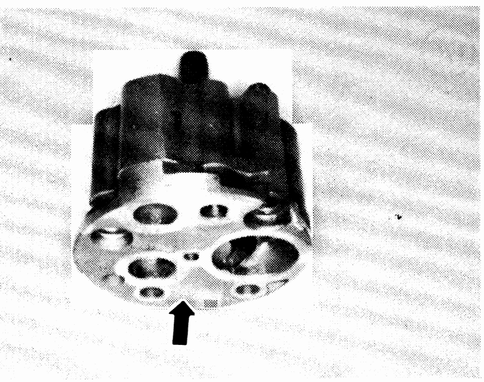

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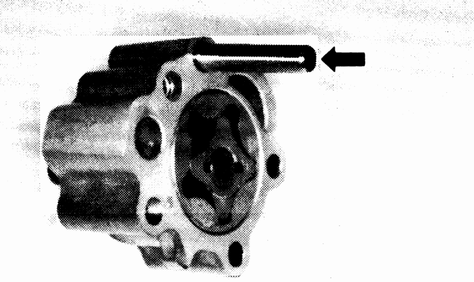

CAUTION

If compressed air is not available to dry parts after cleaning, place the oil pump parts on newspaper or lint-free towels and allow to air dry. Do not dry with towels as lint may be picked up on a part. The oil pump operates with very close tolerances. Small dirt or lint particles left in a pump can score the pump's rotors and reduce pressure output.

1. Remove the oil pump as described in this chapter.
2. Remove the locating dowel (**Figure 161**).
3. Remove the screws (**Figure 164**) holding the assembly together.
4. Remove the outer cover (**Figure 165**).
5. Remove the outer and inner rotors (**Figure 166**) from the shaft.
6. Slide the pin (A, **Figure 167**) out of the oil pump shaft.
7. Remove the locating dowel (B, **Figure 167**).
8. Remove the inner cover (**Figure 168**) from the main body.
9. Remove the long locating dowel (**Figure 169**) from the main body.
10. Remove the outer, inner rotors and pump shaft (**Figure 170**) from the main body.

Inspection

1. Clean all of the oil pump parts in solvent and blow dry.
2. Inspect both sets of rotors (**Figure 171**) for wear, cracks or other damage.
3. Inspect the oil pump main body and outer cover rotor cavities (**Figure 172**) for cracks or bore damage.

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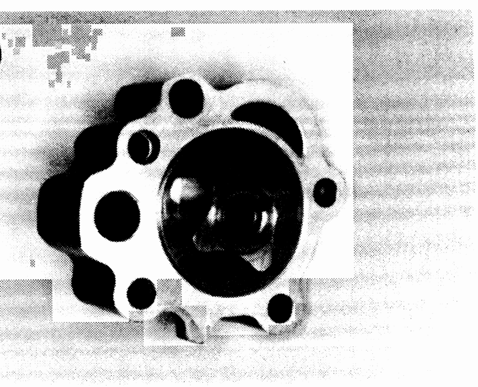


4. Inspect the inner cover for wear or cracks. Refer to **Figure 173** and **Figure 174.**

5. Check the pump shaft (**Figure 175**) for scoring, pin hole damage or seizure. Inspect the driven gear splines for wear or damage.

6. Inspect the pump driven gear teeth for chipped or missing teeth or abnormal wear. Replace if necessary.

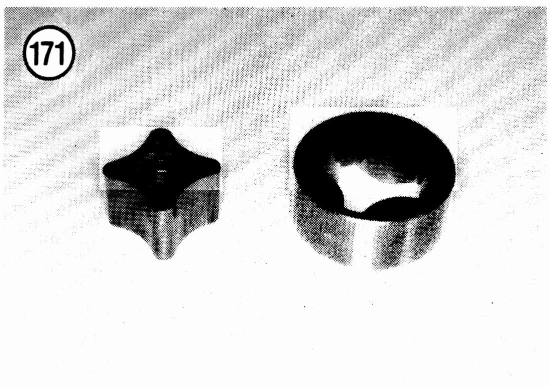
7. Inspect the pump drive gear teeth (**Figure 176**) for chipped or missing teeth or abnormal wear. Replace if necessary.

8. Inspect the pump drive gear inner bearing (**Figure 177**) for wear or damage. It must rotate freely with no binding. Replace if necessary.

9. Insert the collar (A, **Figure 178**) onto the gear bearing (B, **Figure 178**). It should be a snug fit and be able to rotate freely. Replace the collar if necessary.

10. Install the outer rotor into the outer cover and check the clearance between the housing and the rotor (**Figure 179**) with a flat feeler gauge. The side clearance should be within the specifications listed in **Table 1**. If the clearance is greater, replace the oil pump.

171



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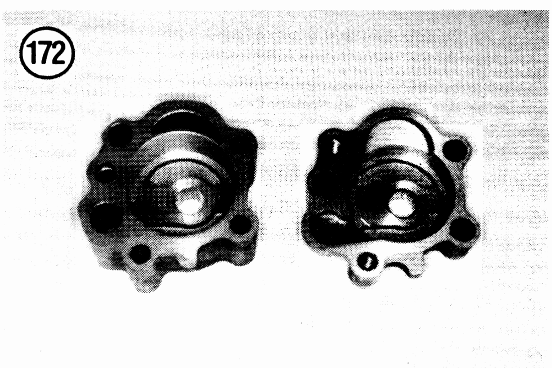

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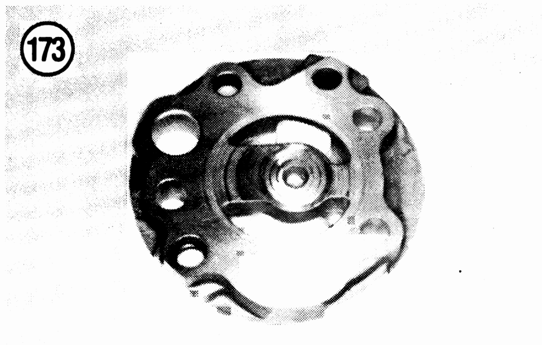

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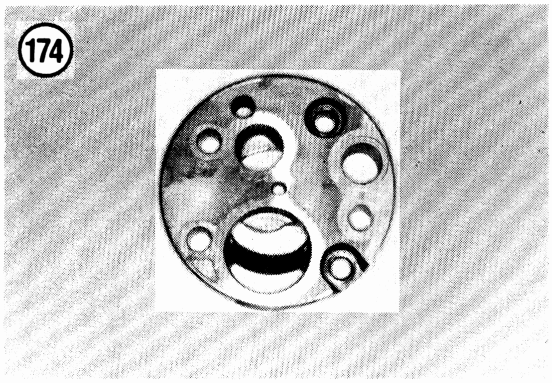

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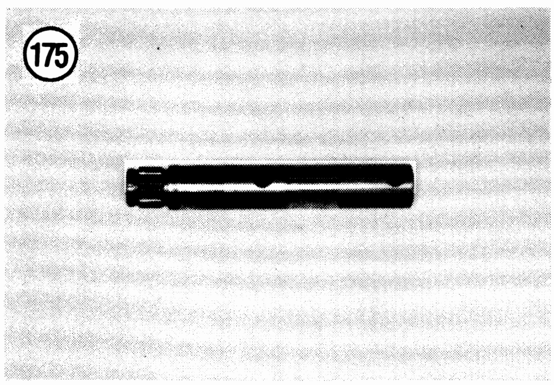

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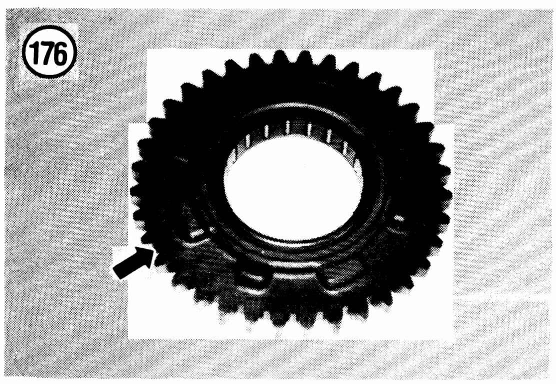

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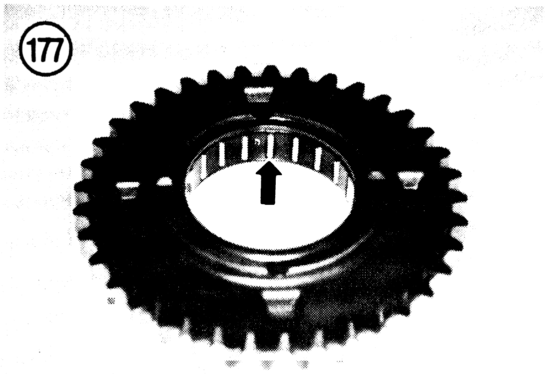

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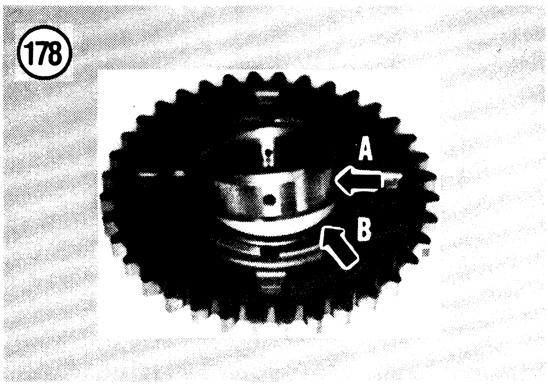

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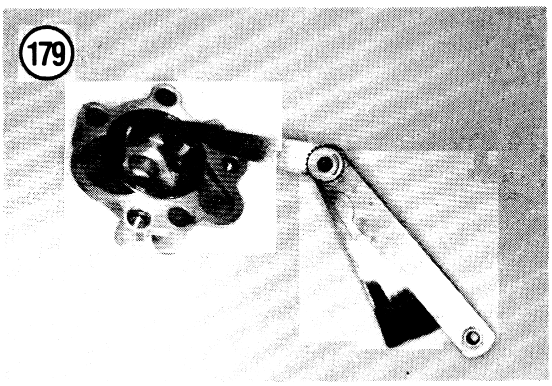

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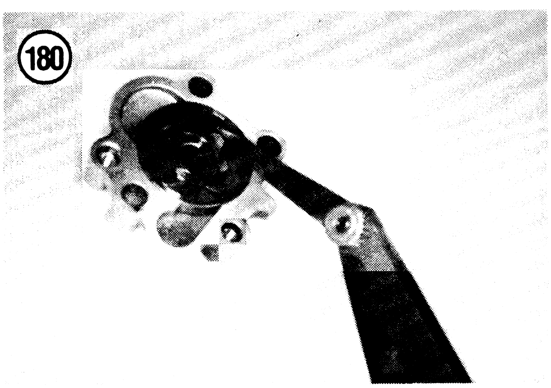


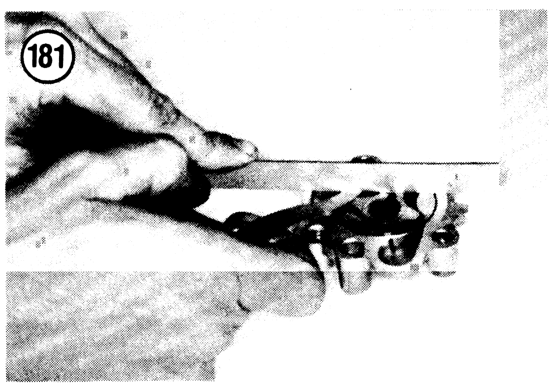
11. Install the inner rotor into the outer rotor and check the side tip clearance between the inner and outer rotor (**Figure 180**) with a flat feeler gauge. The clearance should be within the specifications listed in **Table 1**. If the clearance is greater, replace the oil pump.

12. Install the inner rotor into the outer rotor and check the end clearance between the rotors and the outer cover with a flat feeler gauge and straightedge as shown in **Figure 181**. The clearance should be within the specifications listed in **Table 1**. If the clearance is greater, replace the oil pump. Remove both rotors from the outer cover

Assembly

NOTE
Assemble the oil pump only when the preceding inspection and measurement steps indicate the parts are in good condition. If any of the parts are faulty or out of specification, replace the oil pump assembly.

1. Coat all parts with fresh engine oil prior to assembly.
2. Insert the pin (A, **Figure 182**) into the oil pump shaft lower hole.
3. Install the inner rotor (B, **Figure 182**) onto the shaft and align the recess in the inner rotor onto the pin.
4. Install the outer rotor (**Figure 183**) into the main body.
5. Install the shaft and inner rotor (**Figure 170**) into the outer rotor in the main body. Make sure the pin is properly meshed with the recess in the inner rotor.
6. Install the long locating dowel (**Figure 169**) into the main body.

181


7. Install the inner cover (**Figure 184**) onto the main body. Push it on until it stops (**Figure 168**). Hold the inner cover in place, turn the assembly over and rotate the pump shaft. It must rotate freely with no binding.

8. Insert the pin (A, **Figure 167**) into the oil pump shaft lower hole and install the locating dowel (B, **Figure 167**).

9. Align the recess in the inner rotor onto the pin (**Figure 185**) and install the inner rotor (**Figure 186**). Make sure the pin is properly meshed with the recess in the inner rotor.

10. Install the outer rotor (**Figure 166**) onto the inner rotor. Move the outer rotor into position so the outer cover can be installed over it and onto the shaft.

11. Install the outer cover (**Figure 165**).

12. Hold the assembly together and turn it over.

CAUTION

Make sure the outer cover is completely seated on the main body prior to installing the attachment screws. If not, determine the problem and correct it prior to installing and tightening the bolt. Do not try to pull the components together with the screws as the oil pump may be locked up. If locked up, the oil pump will not rotate rendering the oil pump useless.

13. Install the screws (**Figure 164**) and tighten securely.

14. After the screws are tightened, rotate the shaft and make sure it rotates freely with no binding. If there is any binding problem, correct it at this time—do not install an oil pump that does not rotate freely.

15. Install the locating dowel (**Figure 161**).

Oil Pan, Oil Strainer and Pressure Relief Valve Removal/Inspection

1. Remove the lower fairing as described in Chapter Twelve.

2. Remove the exhaust system as described in Chapter Seven.

3. Disconnect the oil level switch single connector (1 black/red wire).

4. Drain the engine oil as described in Chapter Three.

5. Keep the oil drain pan underneath the engine.

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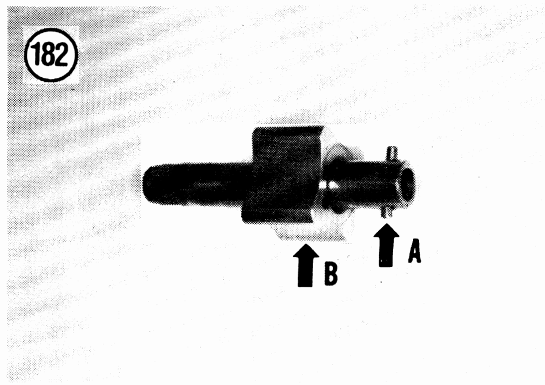

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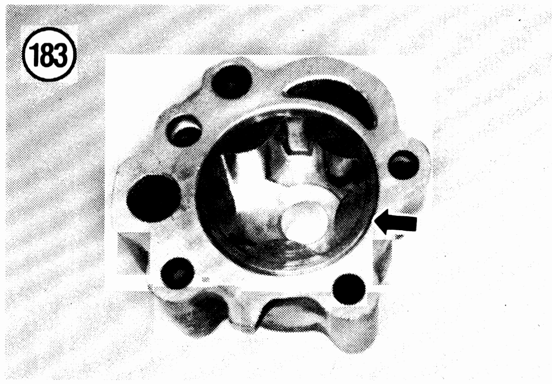

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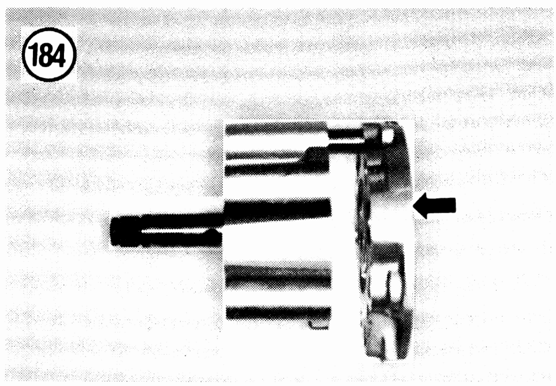

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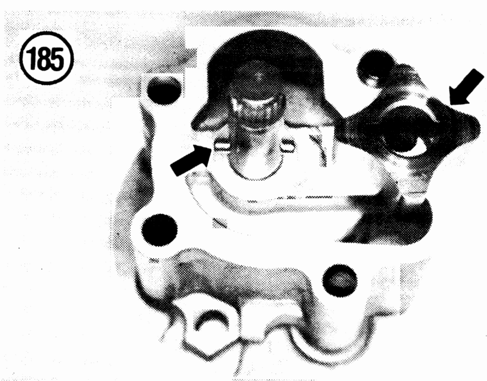

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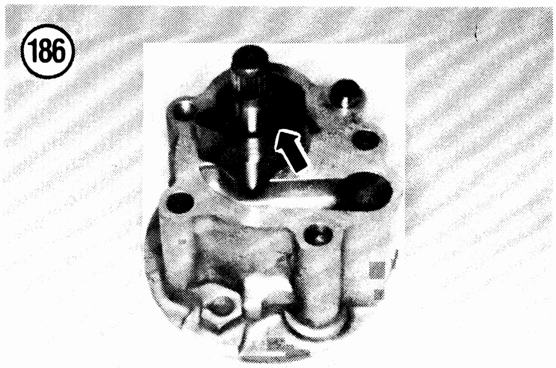

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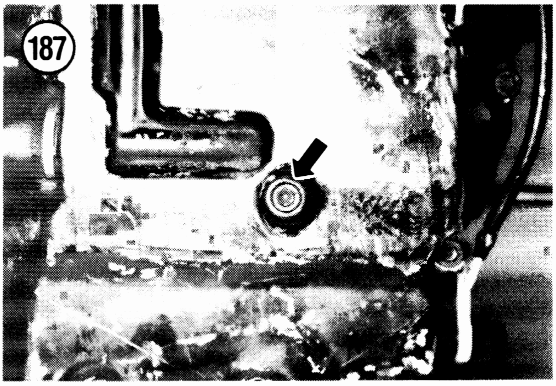

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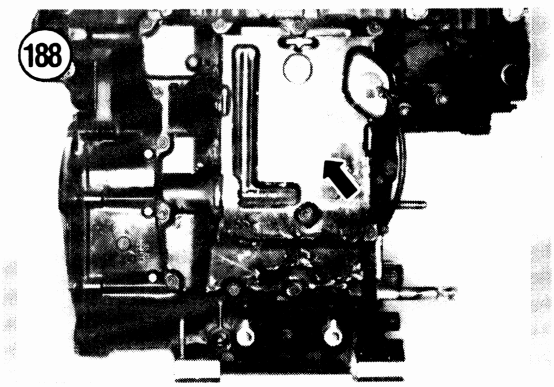

NOTE
*All bolts are located around the perimeter of the oil pan with the exception of one bolt (**Figure 187**) located next to the raised oil path. **Be sure to remove this bolt**.*

6. Using a crisscross pattern, loosen the oil pan mounting bolts around the perimeter of the pan and allow more oil to drain into the pan.

NOTE
The following procedure is shown with the engine removed for clarity. It is not necessary to remove the engine in order to remove the oil pan.

7. Completely remove the oil pan mounting bolts then remove the pan (**Figure 188**) from the crankcase.
8. Remove the dowel pin and gasket.
9. Remove the oil strainer (**Figure 189**).
10. Remove the bolts (A, **Figure 190**) securing the oil strainer housing and remove the oil strainer assembly (B, **Figure 190**) from the crankcase.
11. Remove the gasket from the crankcase.
12. If necessary, carefully pull the oil pressure valve (**Figure 191**) out of the receptacle in the crankcase. Don't lose the O-ring seal.
13. Before cleaning the oil pan, check the inside for signs of excessive aluminum or metal debris that may indicate engine, clutch or transmission problems.
14. Clean the oil pan and the strainer assembly in solvent and dry.
15. If necessary, carefully pull the oil pressure valve (**Figure 192**) out of the receptacle in the oil pan. Don't lose the O-ring seal.

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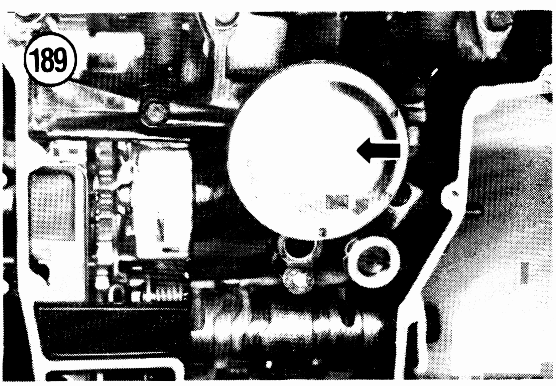

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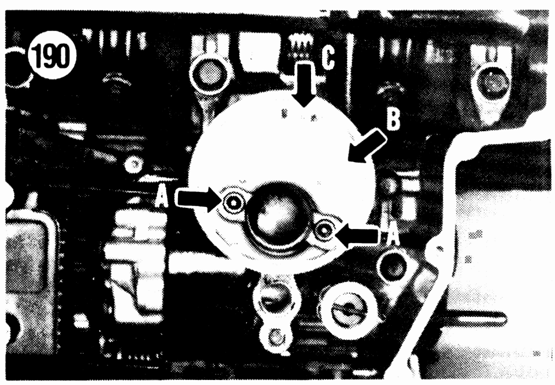
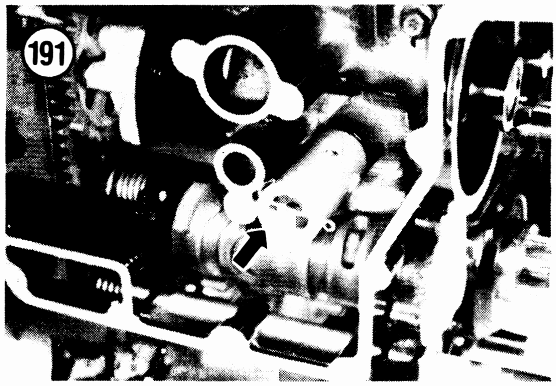


16. Inspect the strainer screen (A, **Figure 193**) for aluminum build-up or damage. If necessary, replace the strainer screen.

17. Thoroughly clean off old gasket residue from the oil pan gasket sealing surface.

18. Inspect both oil pressure relief valves (A, **Figure 194**) for wear or damage. Replacement parts are not available and must be replaced as a unit if defective.

19. Inspect the O-ring seal (B, **Figure 194**) on both pressure relief valve for hardness or deterioration. Replace if necessary.



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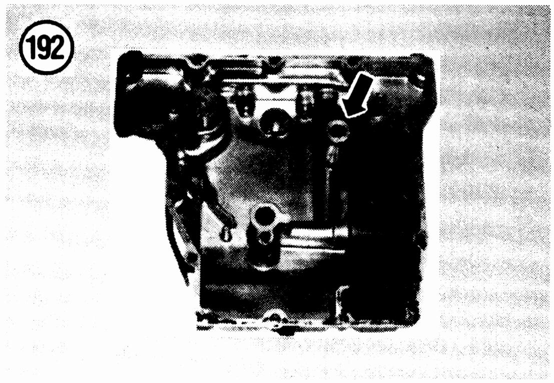

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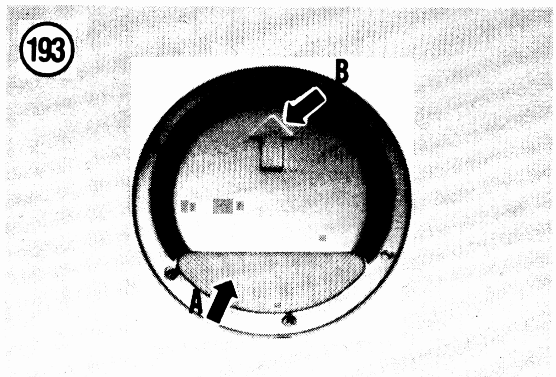

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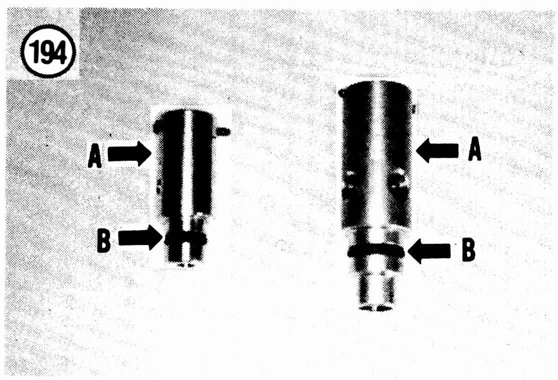


194

Installation

1. Apply clean engine oil to the O-ring seal (B, **Figure 194**) on both pressure relief valves. Install the small valve in the oil pan and the larger valve in the crankcase. Push the valve in until it completely seats.

2. Install a new oil strainer gasket (**Figure 195**).

3. Position the oil strainer assembly with the "FRONT" arrow (C, **Figure 190**) facing toward the front of the engine and install the assembly (B, **Figure 190**).

4. Install the bolts (A, **Figure 190**) and tighten to the torque specification listed in **Table 2**.

5. Position the strainer with the arrow (B, **Figure 193**) facing toward the front of the engine and install the strainer (**Figure 189**). Push the strainer on until it locks in place.

6. Install a new oil pan gasket (A, **Figure 196**). Make sure the bolt holes align properly.

7. Install the dowel pin (B, **Figure 196**).

NOTE

*Be sure to install the single bolt (**Figure 187**) next to the raised oil path on the pan.*

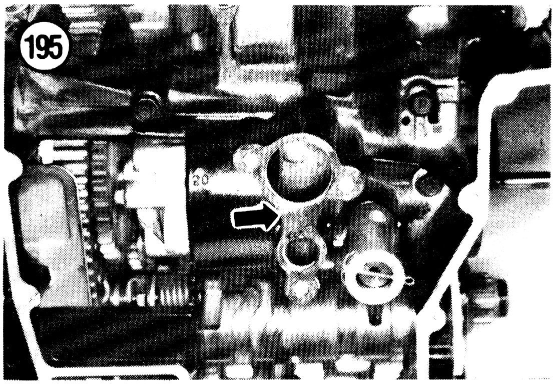
8. Install the oil pan (**Figure 188**) and the mounting bolts. Tighten the bolts in a crisscross pattern to the specification in **Table 2**.

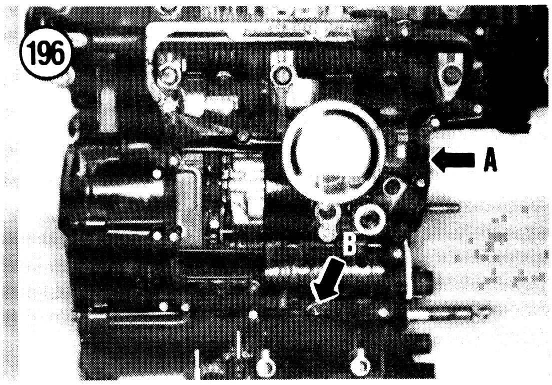
9. Refill the engine oil as described in Chapter Three.

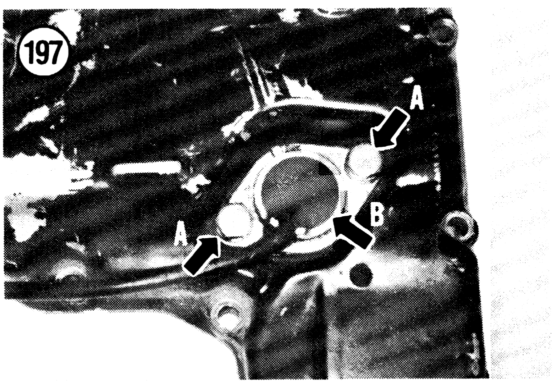
10. Connect the oil level switch connector. Make sure it is free of corrosion and is tight.

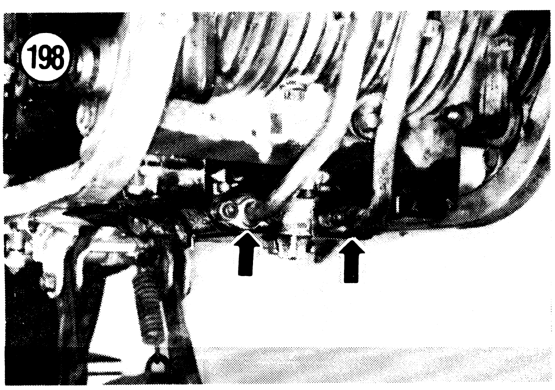
11. Install the exhaust system as described in Chapter Seven.

12. Install the lower fairing as described in Chapter Twelve.









OIL LEVEL SWITCH

Removal/Installation

NOTE
This procedure is shown with the engine removed for clarity. It is not necessary to remove the engine in order to remove the oil level switch.

1. Drain the engine oil as described in Chapter Three.
2. Disconnect the oil level switch single connector (1 black/red wire).
3. Remove the oil level switch mounting bolts (A, **Figure 197**) and remove the switch (B, **Figure 197**).
4. Installation is the reverse of these steps while noting the following:
   a. Make sure the area around the switch mounting position is clean of all dirt and debris.
   b. Replace the oil level switch O-ring if deformed or if there are signs of oil leakage.
   c. Tighten the oil level switch bolts to the specification in **Table 2.**
   d. Refill the engine oil as described in Chapter Three.

OIL COOLER

Removal/Installation

1. Remove the lower fairing as described in Chapter Twelve.
2. Drain the engine oil as described in Chapter Three.
3. Place a drain pan under the oil cooler hoses where they attach to the oil pan.
4. Remove the Allen bolts securing the hose lower fittings (**Figure 198**) to the oil pan. Pull the fittings away from the oil pan and let any additional oil drain out.
5. Remove the bolt, spacer and outer bracket (**Figure 199**) from the cylinder block.
6. Remove the bolt and collar (A, **Figure 200**) securing the oil cooler to the frame mounting bracket on each side.
7. Carefully pull the oil cooler assembly down and disengage the upper location pins from the receptacles on the frame (B, **Figure 200**). Remove the assembly from the frame.
8. If necessary, remove the nut securing the inner bracket (**Figure 201**) to the base of the cylinder block and remove the inner bracket.

9. Inspect the oil cooler fins (A, **Figure 202**) for damage. Carefully clean out any road dirt and bugs from the fins with a whisk broom or stiff paint brush.
10. If oil has been leaking from the upper hose fitting, perform the following:
   a. Remove the screw securing the upper fitting (B, **Figure 202**) to the side of the oil cooler.
   b. Remove the O-ring seal and install a new one.
   c. Reinstall the upper fitting and tighten the bolt securely.
11. Install by reversing these removal steps while noting the following:
   a. Install new O-ring seals (**Figure 203**) to the lower fittings.
   b. Tighten all bolts to the torque specification listed in **Table 2**.
   c. Refill the engine with the recommended type and quantity of engine oil as described in Chapter Three.

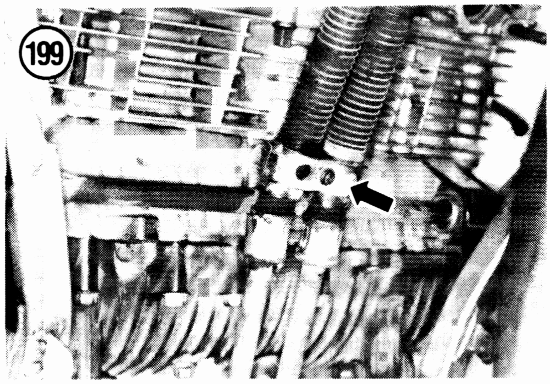
CRANKCASE

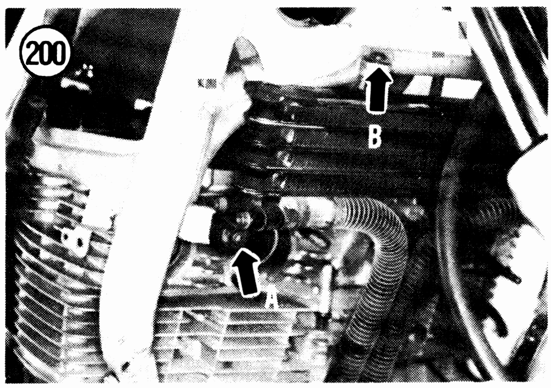
Service to the lower end requires that the crankcase assembly be removed from the motorcycle frame.

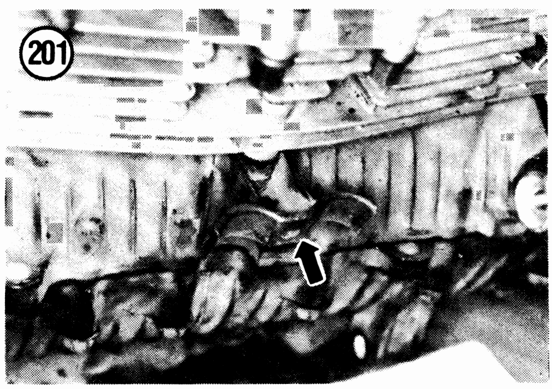
Disassembly

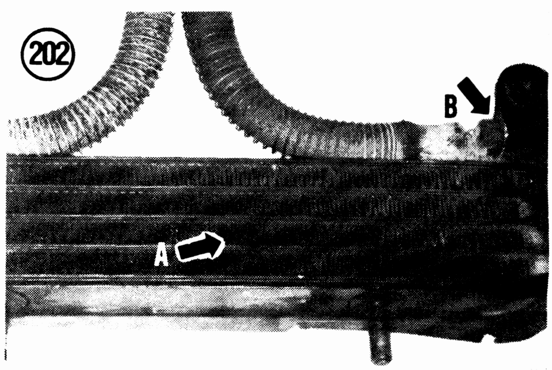
1. While the engine is still in the frame, remove the cylinder head assembly, cylinder block, pistons, starter motor, alternator, oil filter, oil cooler assembly and clutch assembly as described in this and other related chapters.
2. Remove the oil pan, strainer and oil pressure relief valve as described in this chapter.
3. On the left-hand side, remove the No. 30 Torx screws (A, **Figure 204**) securing the transmission main shaft retainer and remove the retainer (B, **Figure 204**). Discard the screws as they must be replaced every time they are removed.
4. On the right-hand side, remove the screws securing the oil seal cover (**Figure 205**) and remove the cover.

NOTE
*Remove the crankcase bolts in the reverse order shown in **Figure 206**. Crankcase bolt numbers are cast into the upper and lower crankcase halves next to the bolts (**Figure 207**). Follow*







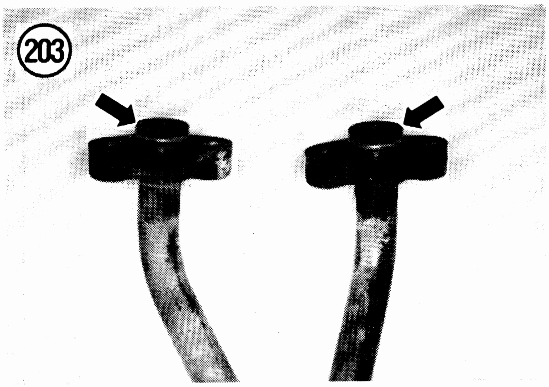


the number sequence on your specific engine if the number sequence is different than that shown in ***Figure 206****.*

NOTE

When removing the crankcase bolts in the following steps, keep the upper crankcase bolts separate from the lower crankcase bolts to prevent mixup during reassembly. Note the location of all brackets and washers. They must be reinstalled in the same location during assembly.

203



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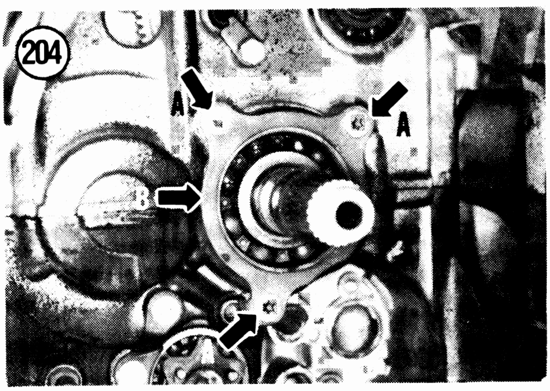

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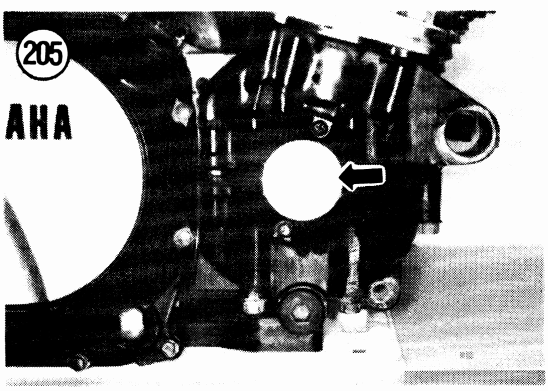


5. Place the engine on the workbench in the normal position with the upper crankcase facing up.

NOTE

*Don't forget the single bolt (****Figure 208****) next to the transmission shaft.*

6. Loosen all of the bolts in the upper crankcase 1/2 turn at a time starting with the highest number first (**Figure 206**). After loosening the bolts, remove all of them and place them in a container.

7. Double check that you have removed *all* of the upper and lower crankcase bolts.

8. Turn the engine over on the workbench so that the lower crankcase half is facing up. Place it on several wood blocks to protect the protruding connecting rod ends and the crankcase studs.

NOTE

*Note the location of the battery negative cable and bolt (****Figure 209****). The cable must be reinstalled in the same location during assembly.*

9. Loosen all of the bolts in the lower crankcase 1/2 turn at a time starting with the highest number first (**Figure 206**). After loosening the bolts, remove all of them and place them in a container.

10. Double check that you have removed *all* of the upper and lower crankcase bolts.

CAUTION

The crankcase halves are made of thin-walled aluminum. To avoid damage to the cases, do not hammer projected walls. These areas are easily damaged.

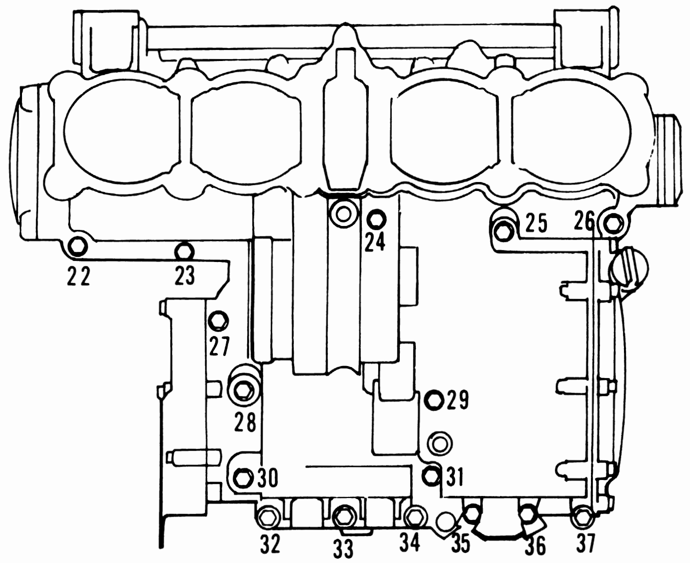
CAUTION

If it is necessary to pry the halves apart, do it very ***carefully*** *so that you do not mar the gasket surfaces. If you do, the cases will leak oil and must be replaced.*

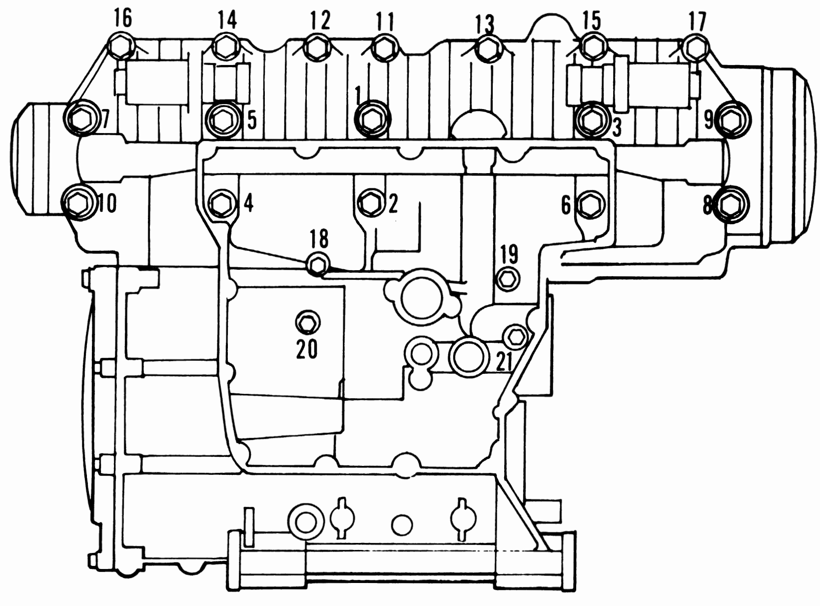
11. Tap around the perimeter of the crankcase halves with a plastic mallet—do not use a metal hammer as it will damage the crankcase.

12. Lift the lower crankcase half (**Figure 210**) up and off the upper crankcase assembly. Turn the lower crankcase over immediately and be careful that the crankshaft main bearing inserts do not fall out. If any do, reinstall them immediately and into their original position if possible.

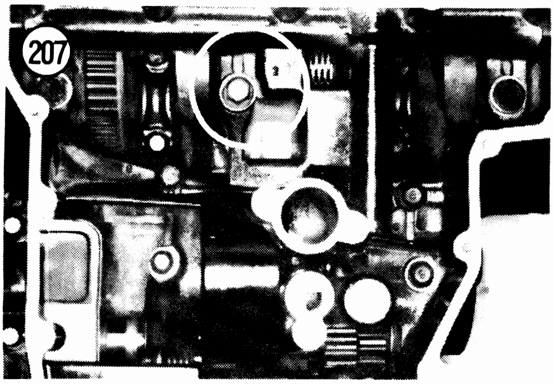
206



Upper crankcase



Lower crankcase


207

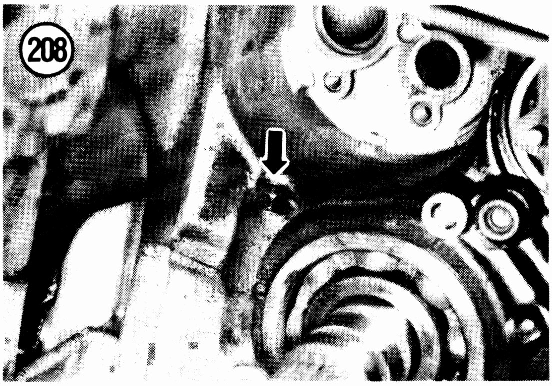
13. Remove both locating dowels (**Figure 211**) from the upper crankcase half.

14. Remove the transmission, shift forks and shift drum assemblies as described in Chapter Six.

15. Remove the starter gears as described in this chapter.

16. If necessary, remove the screws securing the oil baffle plate (**Figure 212**) and remove the baffle plate.

17. If still installed, remove the neutral indicator switch (A, **Figure 213**) and O-ring seal.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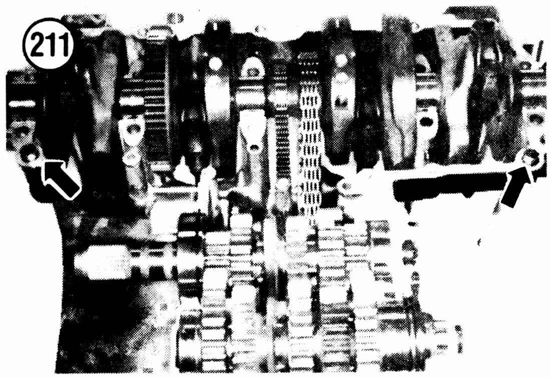
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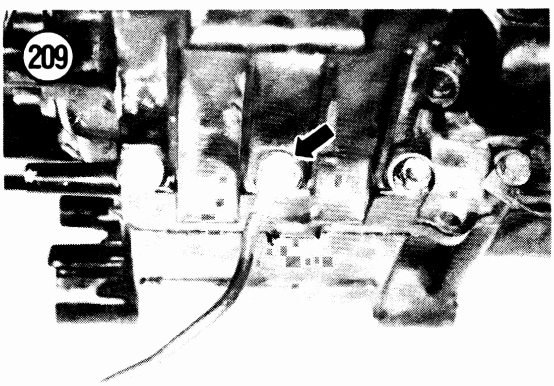
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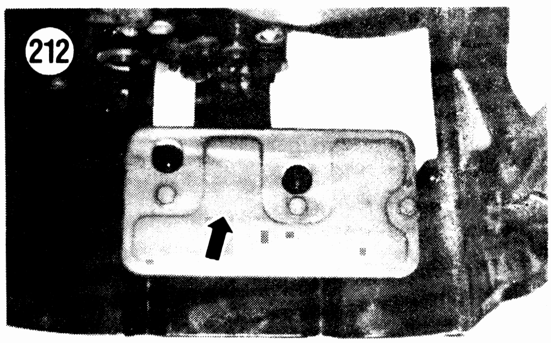
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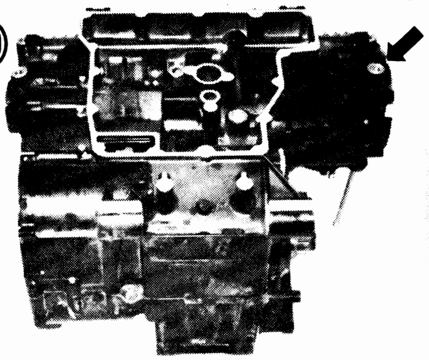
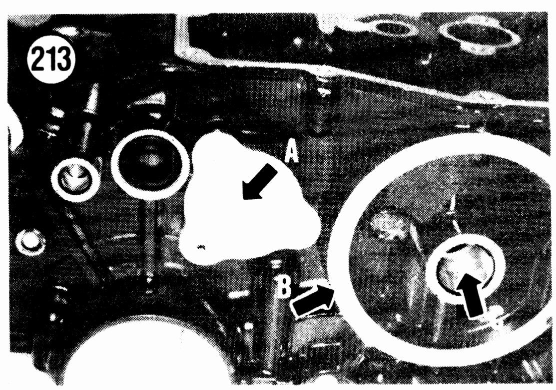


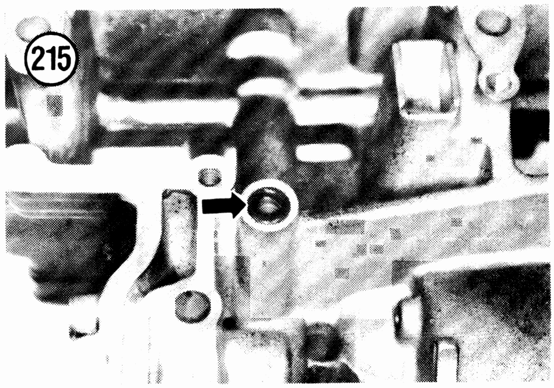


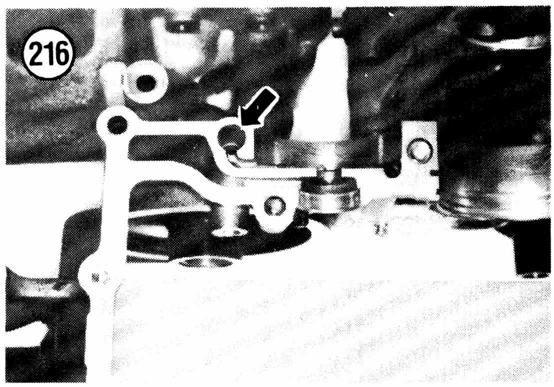
213

18. Remove the bolts securing the starter drive chain guide (**Figure 214**) and remove it from the upper crankcase.

19. Remove the oil control O-ring (**Figure 215**) from the lower crankcase.

20. If necessary, remove the crankshaft and the crankshaft bearing inserts as described under *Crankshaft* in this chapter.





Inspection

1. 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.

2. Make sure all oil passages (**Figure 216**) are clean; blow them out with compressed air.

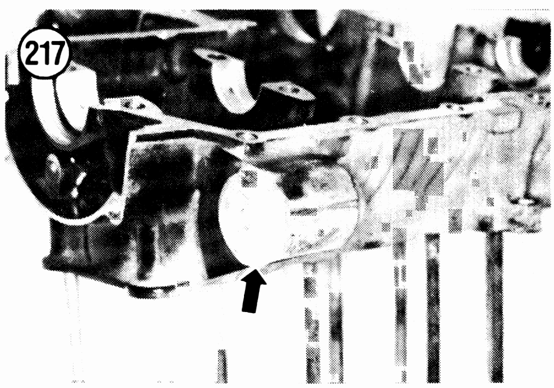
3. Check the crankcases for cracks or other damage. Inspect the mating surfaces of both halves. They must be free of gouges, burrs or any damage that could cause an oil leak.

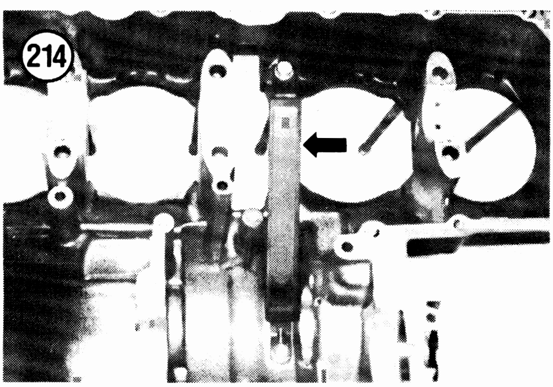
4. Inspect the front (**Figure 217**) and rear (**Figure 218**) through bolt mounting bosses in the upper crankcase. Also check the rear (**Figure 219**) through bolt mounting boss in the lower crankcase. Check the bosses for cracks or damage.

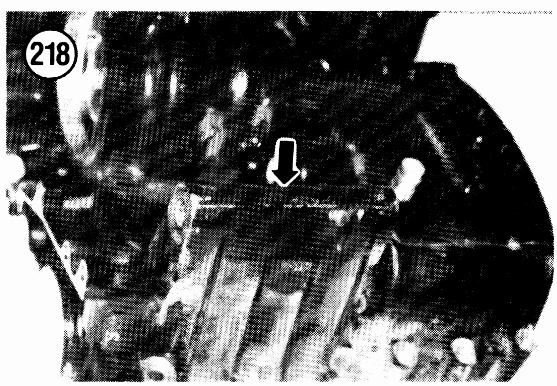
5. Check the oil filter sealing surface (B, **Figure 213**) for cracks or other damage. It must be free of gouges, burrs or any damage that could cause an oil leak.

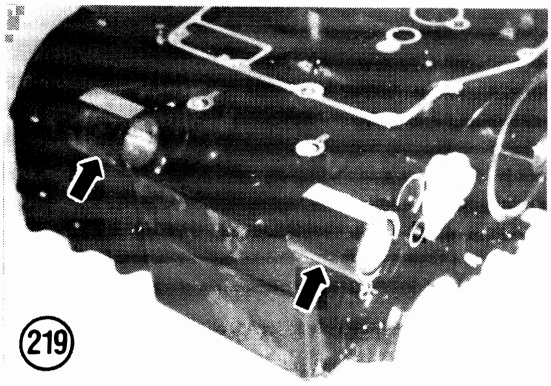
6. Inspect the oil filter threaded hole (C, **Figure 213**) for damage. Clean out the threads with the proper size tap if necessary.

7. Make sure the crankcase studs (**Figure 220**) are tight. Yamaha does not provide a torque specification for the studs.





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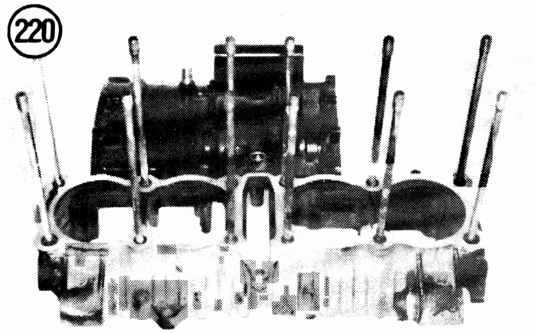
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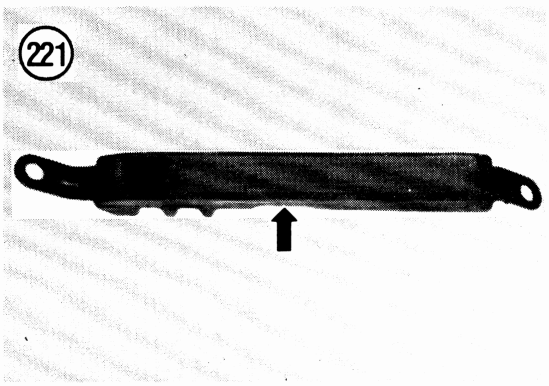
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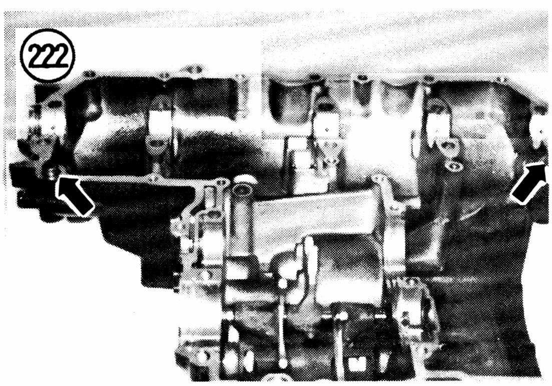

222

8. Inspect the crankshaft bearing inserts as described in this chapter.

9. Inspect the starter drive chain guide (**Figure 221**) for wear or damage and replace if necessary.

Assembly

1. Prior to assembly, coat all rotating parts with assembly oil or engine oil.

2. Turn the upper crankcase upside down and place it on several wood blocks to protect the protruding connecting rod ends and the crankcase studs.

3. Install the starter drive chain guide (**Figure 214**). Apply red Loctite (No. 271) to the bolt threads prior to installation. Install the bolts in the upper crankcase and tighten the bolts to the torque specification in **Table 2**.

4. Apply some cold grease to the O-ring and install the oil control O-ring (**Figure 215**) into the lower crankcase.

5. Make sure the O-ring seal is in place and install the neutral indicator switch (A, **Figure 213**). Tighten the screws securely.

6. If removed, install the oil baffle plate (**Figure 212**) and tighten the screws securely.

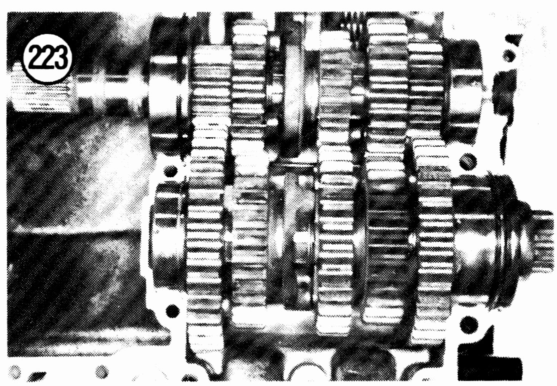
7. Install the starter gears as described in this chapter.

8. If removed, install the crankshaft bearing inserts and crankshaft as described under *Crankshaft* in this chapter.

9. Install the transmission, shift forks and shift drum assemblies as described in Chapter Six.

10. Install both locating dowels (**Figure 222**) into the upper crankcase half. Push them in until they seat completely.

11. Shift the transmission into NEUTRAL as shown in **Figure 223**. With the gears in this position it will


223

make it easier for shift fork engagement in the following steps.

12. Make sure both crankcase half mating sealing surfaces are perfectly clean and dry. Clean off with an aerosol electrical contact cleaner and wipe off with a lint-free cloth.

NOTE
Use a gasket sealer similar to Three Bond, Yamabond No. 1215, Quick Gasket (part No. ACC-11001-05-01) or equivalent. When selecting an equivalent, avoid thick and hard setting materials.

CAUTION
Failure to apply sealant to the following areas in Step 13 may result in reduced oil pressure and crankshaft bearing damage.

13. Apply a light coat of gasket sealer, or equivalent, to the following surfaces:
   a. Sealing surfaces of the lower crankcase half. Cover only flat surfaces, *not curved bearing surfaces.*
   b. Sealing surface next to each of the main bearing inserts. Apply sealant to within 2.5 mm (0.10 in.) of the insert.
   c. Make the coating as thin as possible, but still completely covered, or the case can shift and hammer out bearings.

14. Pick up the lower crankcase half and move the rear portion into position.

15. Lower the lower crankcase half down and allow the front portion to touch—keep the rear portion up to aid in shift fork alignment.

16. Look through the rear portion of the crankcase halves and check for proper alignment of both shift forks with the shift fork groove in both countershaft gears.

17. Once the alignment is correct, lower the rear of the lower crankcase onto the upper crankcase and push it down until it is correctly seated all around the perimeter. Join both halves and tap them together lightly with a plastic mallet—do not use a metal hammer as it will damage the case.

CAUTION
Crankcase halves should fit together without force. If the crankcase halves do not fit together completely, do not attempt to pull them together with the crankcase bolts. Separate the crankcase halves and investigate the cause of the interference. If the transmission shafts were disassembled, recheck to make sure that a gear is not installed backwards. Do not risk expensive damage by trying to force the cases together.

18. Before installing the bolts, slowly spin the transmission shafts and shift the transmission through all gears using the shift drum. Make sure the shift forks are operating properly and that you can shift through all gears. This is the time to find that something may be installed incorrectly—not after the crankcase is completely assembled.

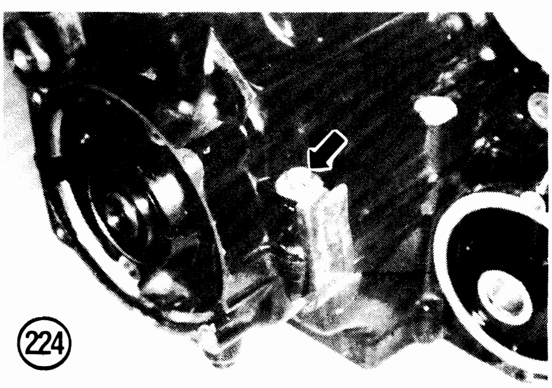
NOTE
*Refer to the notes made prior to Disassembly Step 4 for the correct location of all brackets (**Figure 224**) and washers. Install all in the same location.*

19. Apply a light coat of oil to all crankcase bolts prior to installation.

NOTE
*Crankcase bolt numbers are cast into the upper and lower crankcase halves next to the bolts (**Figure 207**). Follow the number sequence on your specific engine as the numbers vary with the different years.*

20. Install all bolts into all lower crankcase bolt holes. If the bolts are in their correct receptacles the bolt heads will all stick up the same amount (**Figure 225**). If this is not true then the bolt(s) is incorrectly placed and must be relocated.

21. Tighten the bolts 1/2 turn at a time in the sequence marked on the crankcase half (**Figure 206**).


224

Start with the smallest number first surrounding the crankshaft main bearings. Tighten the bolts to the torque specifications listed in **Table 2**.

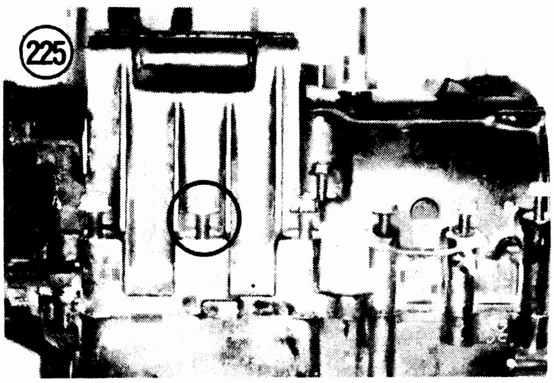
NOTE
*Install the battery negative cable and bolt (**Figure 209**) in the same location noted during disassembly.*

22. Turn the engine over and install all of the bolts in the upper crankcase. Once again check that all bolts are in their correct receptacles. The bolt heads will all stick up the same amount (**Figure 225**). If this is not true then the bolt(s) is incorrectly placed and must be relocated.

NOTE
*Don't forget the single bolt (**Figure 208**) next to the transmission shaft.*

23. Tighten the bolts 1/2 turn at a time in the sequence marked on the crankcase half (**Figure 206**). Start with the smallest number first surrounding the crankshaft main bearings. Tighten the bolts to the torque specifications listed in **Table 2**.

225



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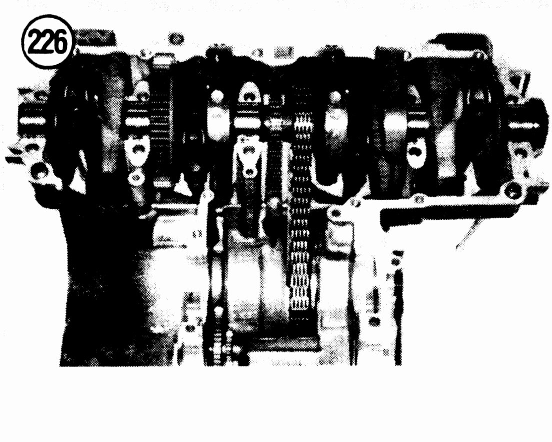

24. Install the transmission main shaft retainer as follows:

a. On the left-hand side, install the retainer (B, **Figure 204**) securing the transmission main shaft.
b. Apply red Loctite (no. 271 to the Torx bolt threads prior to installation. Install *new* No. 30 Torx screws (A, **Figure 204**).
c. Tighten the screws to the torque specification listed in **Table 2**.

4

25. Install the oil pressure relief valve, strainer and oil pan as described in this chapter.

26. On the right-hand side, install the oil seal cover (**Figure 205**) and screws. Tighten the screws securely.

27. Install the engine as described in this chapter. Install all major components removed prior to removal as described in this and other related chapters.

CRANKSHAFT

Removal/Installation

1. Split the crankcase as described in this chapter.
2. Remove the starter clutch assembly as described in this chapter.
3. Remove the crankshaft/connecting rod assembly and camshaft and starter gear chains (**Figure 226**) from the upper crankcase half.
4. Remove the crankshaft oil seal from the left-hand end and the blind plug from the right-hand end.

NOTE
In Step 5, the No. 1 mark is for the left-hand No. 1 cylinder. The No. 1-5 marks go from left to right across the engine. The left-hand side of the engine refers to the engine as it sits in the bike frame—not as it sits on your bench upside down.

5. If the bearing inserts are going to be removed for cleaning, perform the following:

a. Remove the main bearing inserts from the from the upper (**Figure 227**) and lower (**Figure 228**) crankcase half.
b. Mark the backside of the inserts with a 1, 2, 3, 4 or 5 and "U" (upper) or "L" (lower).

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

6. Inspect the crankshaft and main bearings as described in this chapter.

7. Installation is the reverse of these steps while noting the following:

   a. Install the camshaft and starter drive chains over the crankshaft.

   b. Align the tab on the bearing inserts with the notch in the case (**Figure 229**) and install the inserts.

   c. Install a new crankshaft oil seal (**Figure 230**) and make sure it seats properly into the groove (**Figure 231**) in the left-hand side of the crankcase.

   d. Install a new crankshaft blind plug (**Figure 232**) and make sure it seats properly into the groove (**Figure 233**) in the right-hand side of the crankcase.

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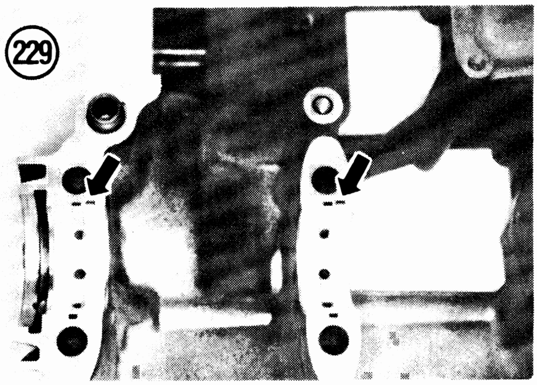

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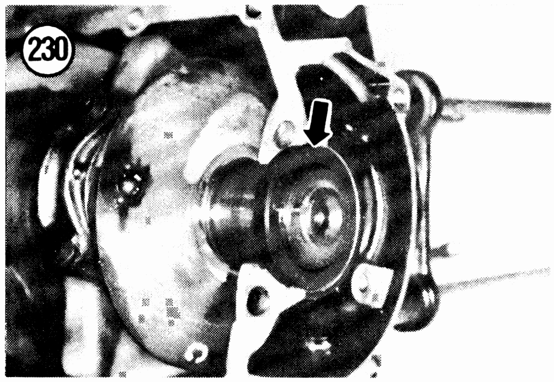

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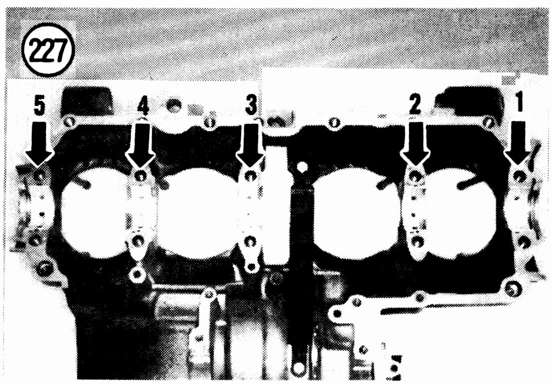

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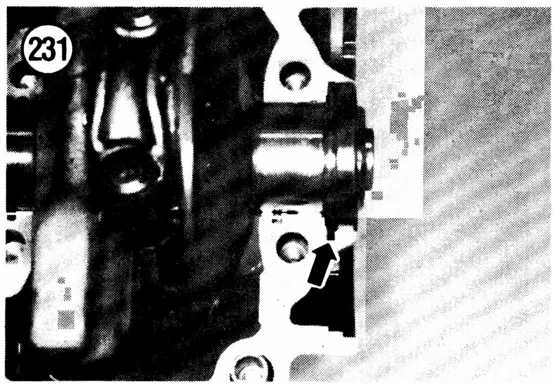

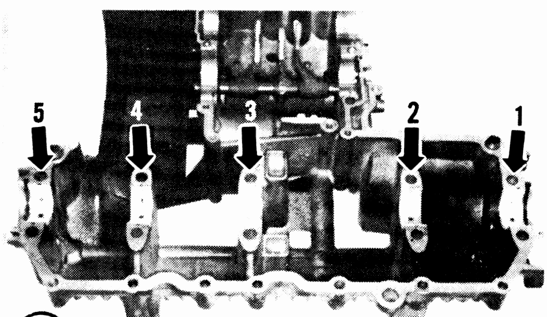

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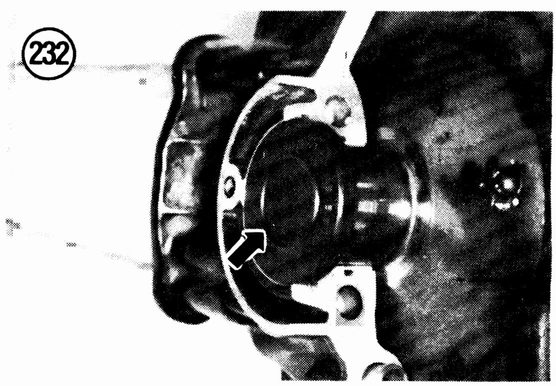
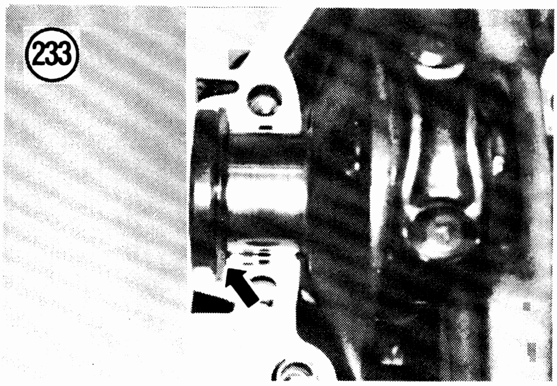
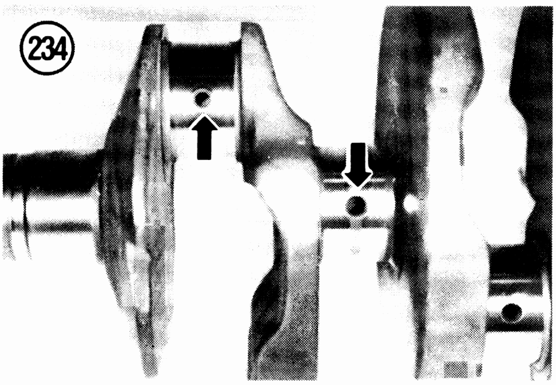






Crankshaft Inspection

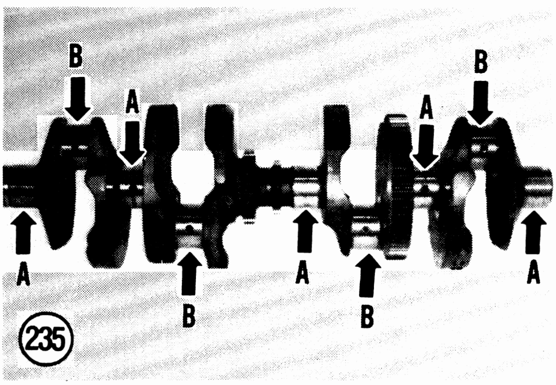
1. Remove the connecting rods from the crankshaft as described in this chapter.

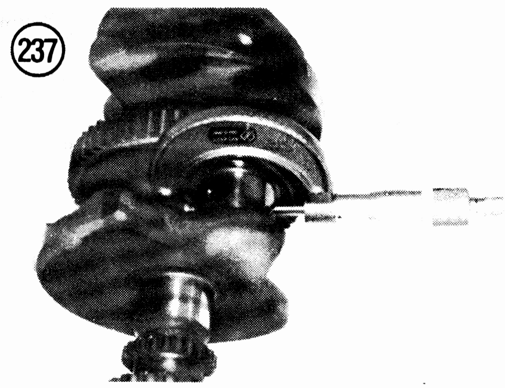
2. Clean the crankshaft thoroughly with solvent. Clean the main journal and connecting rod oil holes (**Figure 234**) with rifle cleaning brushes; flush thoroughly and dry with compressed air. Lightly oil all oil journal surfaces immediately to prevent rust.

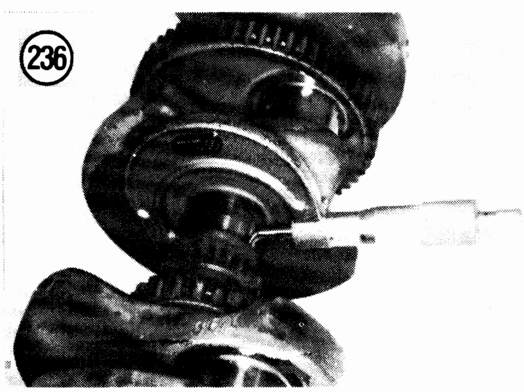
3. Inspect each journal for scratches, ridges, scoring, nicks, etc. Refer to A, **Figure 235** for main journals and B, **Figure 235** for connecting rod journals.

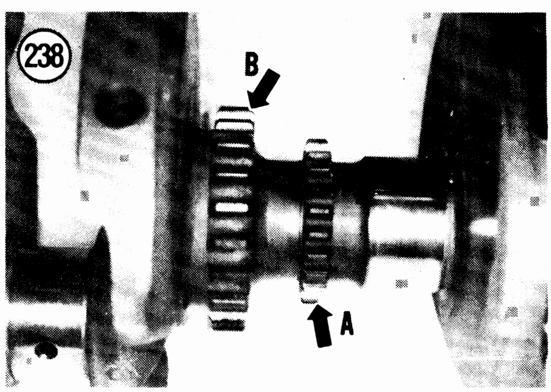
4. If the surface on all journals is satisfactory, measure all journals with a micrometer and check out-of-roundness, taper and wear on the journals. Refer to **Figure 236** for main journals and **Figure 237** for connecting rod journals. Check against measurements given in **Table 1**.

5. Inspect the camshaft sprocket (A, **Figure 238**) and starter drive sprocket (B, **Figure 238**). If they are worn or damaged, the crankshaft will have to be replaced.









6. Inspect the primary drive gear (**Figure 239**) for chipped, worn or missing teeth. If worn or damaged, the crankshaft will have to be replaced.
7. Inspect the camshaft drive chain (**Figure 240**) and the starter drive chain (**Figure 241**) for visible wear or damage. If necessary, replace the chain(s) as required.

Crankshaft Main Bearing Clearance Measurement

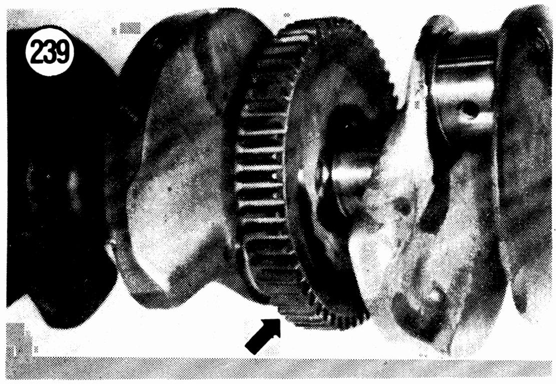
1. Check the inside and outside surfaces of the bearing inserts (**Figure 242**) for wear, bluish tint (burned), flaking abrasion and scoring. If the bearings are good, they may be reused. If any insert is questionable, replace the entire set.
2. Clean the bearing surfaces of the crankshaft and the main bearing inserts.
3. Measure the main bearing clearance by performing the following steps.
4. Place the upper crankcase on a workbench upside down on a couple of 2 × 4 in. wood blocks. This is to protect the protruding connecting rod ends and the crankcase studs.
5. Install the existing main bearing inserts into the upper (**Figure 227**) and lower (**Figure 228**) crankcase into their original positions.
6. Install the crankshaft (**Figure 226**) into the upper crankcase.
7. Place a piece of Plastigage over each main bearing journal parallel to the crankshaft (**Figure 243**).

CAUTION
Do not rotate crankshaft while Plastigage is in place.

8. Install the lower crankcase over the upper crankcase.

NOTE
*The 3 bolts (A, **Figure 244**) within the oil pan area are equipped with washers.*

9. Apply oil to the bolt threads and install the 10 lower crankcase 8 mm bolts and washers (**Figure 244**) surrounding the crankshaft.
10. Tighten the 8 mm bolts to the torque specification listed in **Table 2**. Following the torque pattern indicated by the crankcase bolt numbers cast into the lower crankcase half next to the bolts (**Figure 207**) or follow the torque sequence shown in **Figure 245**.



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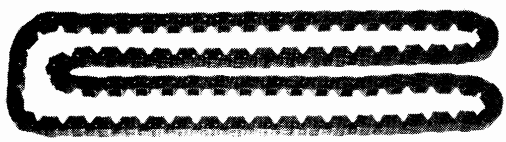

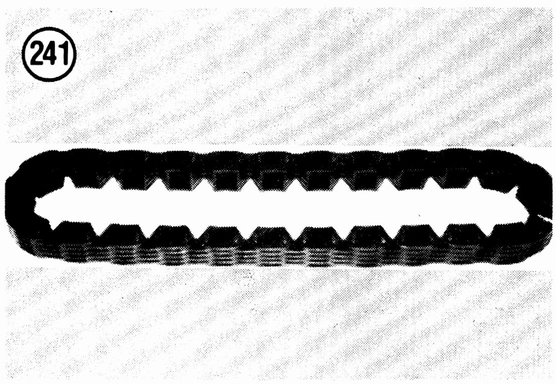

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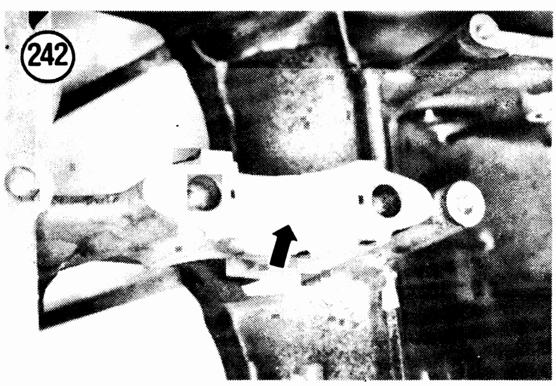


242

11. Remove bolts in the reverse order of installation.

12. Carefully remove the lower crankcase. Do not move the crankshaft.

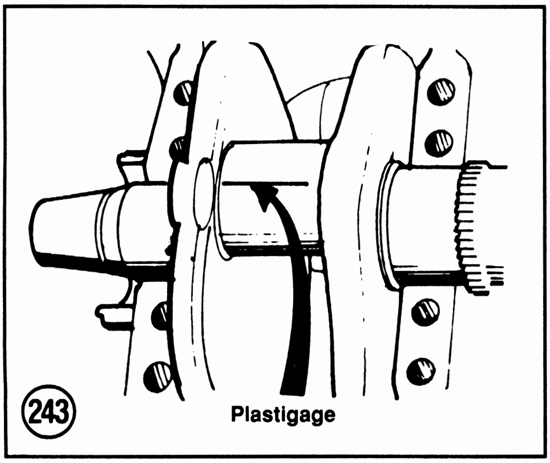
13. Measure the width of the flattened Plastigage according to the manufacturer's instructions (**Figure 246**). Measure at both ends of the strip. A difference of 0.025 mm (0.001 in.) or more indicates a tapered crankpin. Confirm with a micrometer. Remove the Plastigage strips from all bearing journals.

14. New bearing clearance is listed in **Table 1**. Remove the Plastigage strips from all bearing journals.

15. If the bearing clearance is greater than specified, use the following steps for new bearing selection.

16. The crankshaft is marked on the left-hand counterbalancer with 5 left-hand set of numbers (A, **Figure 247**) that relate to the crankshaft 5 main bearing journals.

NOTE
*The group of 4 right-hand set of numbers (B, **Figure 247**) relates to the crankshaft 4 connecting rod journals—**do not** refer to these 4 numbers.*



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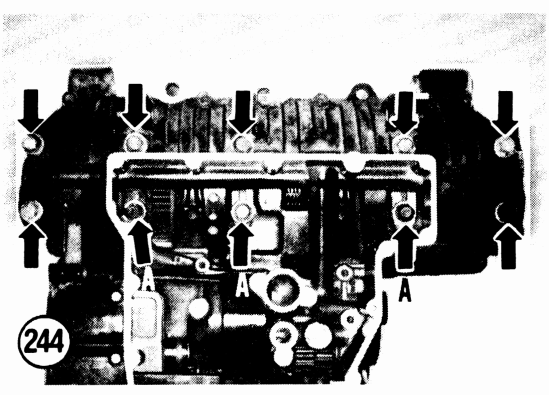

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17. The 5 numbers marked on the upper crankcase half (**Figure 248**) relate to the crankcase bearing journals. The numbers read from left to right (with the top crankcase half facing up as it sits on the bike). The first number on the left is for the No. 1 crankcase journal; the numbers continue from left to right for journals No. 2-5 (**Figure 249**).

18. To select the proper main bearing insert number, subtract the crankshaft bearing journal number from the crankcase bearing journal number. For example, if the crankcase journal is a No. 5 and the crankshaft journal is a No. 2, 5 – 2 = 3. The new bearing insert is a No. 3. The bearings are then identified by number and color as follows:

a. No. 1 (blue).
b. No. 2 (black).
c. No. 3 (brown).
d. No. 4 (green).
e. No. 5 (yellow).

NOTE
Determine the bearing insert number for all main bearing journals, then take the insert numbers to a Yamaha dealer for bearing purchase.

19. Repeat Steps 13-18 for all bearing journals.

20. After new bearings have been selected, recheck the clearance as described in Steps 13-18. If the clearance is out of specification, the crankshaft bearing journals are worn. Refer to *Crankshaft* in this chapter.

21. Clean all Plastigage from the crankshaft and bearing inserts. Assemble the crankcase as described in this chapter.

CONNECTING RODS

Removal/Installation

1. Split the crankcase as described in this chapter.

2. Measure the connecting rod big end side clearance. Insert a flat feeler gauge between a connecting rod big end and either crankshaft machined web (**Figure 250**). Record the clearance for each connecting rod and compare to the specifications in **Table 1**. If the clearance is excessive, replace the

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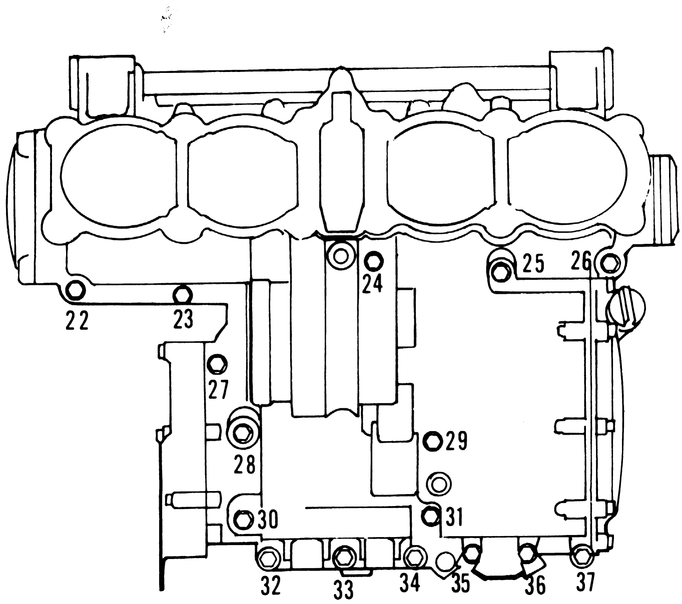
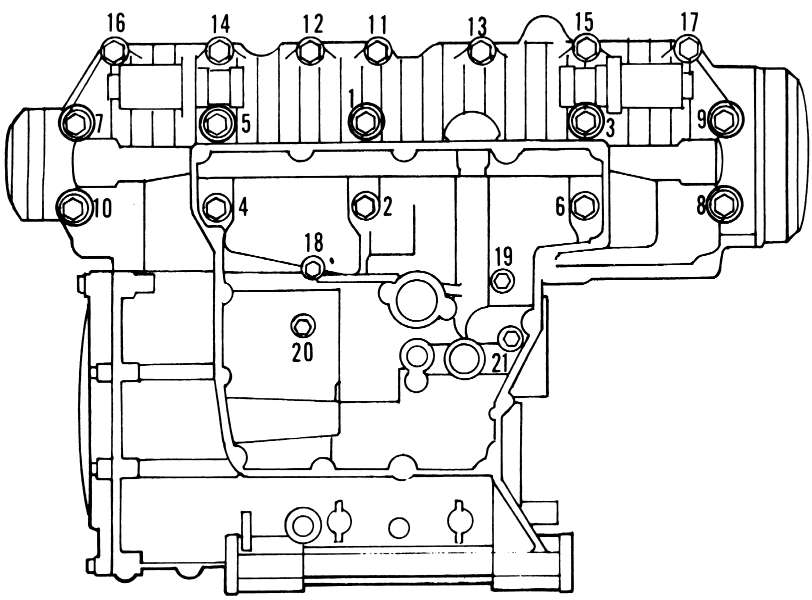


Upper crankcase



Lower crankcase

connecting rod(s) and recheck clearance. If clearance is still excessive, replace the crankshaft.

NOTE
*Prior to disassembly, use a centerpunch and hammer and carefully mark the rods and caps (**Figure 251**) with a "1," "2," "3" and "4" starting from the left-hand side (**Figure 252**).*

3. Remove the crankshaft assembly as described in this chapter.
4. Remove the connecting rod cap nuts (**Figure 253**) and separate the rods from the crankshaft. Keep each cap with its original rod, with the weight mark on the end of the cap matching the mark on the rod (**Figure 254**).

NOTE
Keep each bearing insert in its original place in the crankcase, rod or rod cap. If you are going to assemble the engine with the original inserts, they must be installed exactly as removed in order to prevent rapid wear.

5. Install by reversing these removal steps while noting the following:
   a. Install the bearing insert (**Figure 255**) into each connecting rod and cap. Make sure they are locked in place correctly.

NOTE
*Each connecting rod is embossed with a "Y" on one side (**Figure 256**). The connecting rod must be installed so that the "Y" mark faces toward the left crankshaft end.*

   b. Apply assembly lube or Red Line Assembly Lube to the bearing inserts.
   c. If new bearing inserts are going to be installed, check the bearing clearance as described in this chapter.
   d. Apply molybdenum disulfide grease to the bolt threads prior to installation in the rod cap.
   e. Install the bearing caps so that the number on the rod and cap align with each other (**Figure 251**).
   f. Carefully install the rod and cap (**Figure 257**) onto the crankshaft. Do not "nick" the rod journal with the cap bolt during installation.
   g. Tighten the connecting rod nuts (**Figure 253**) to the torque specifications in **Table 2**.

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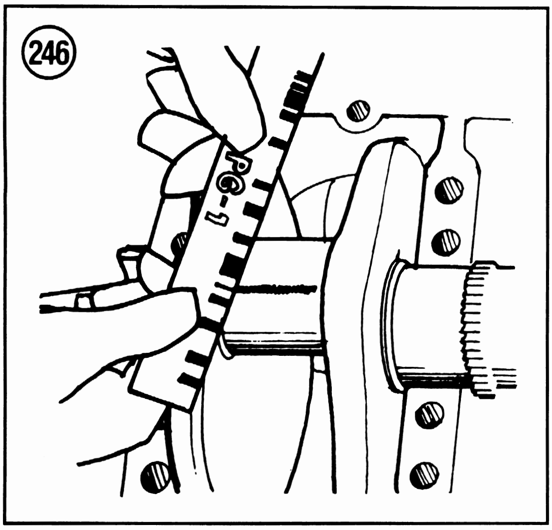

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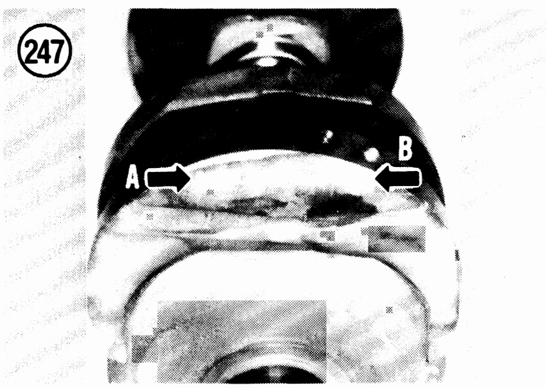

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Connecting Rod Inspection

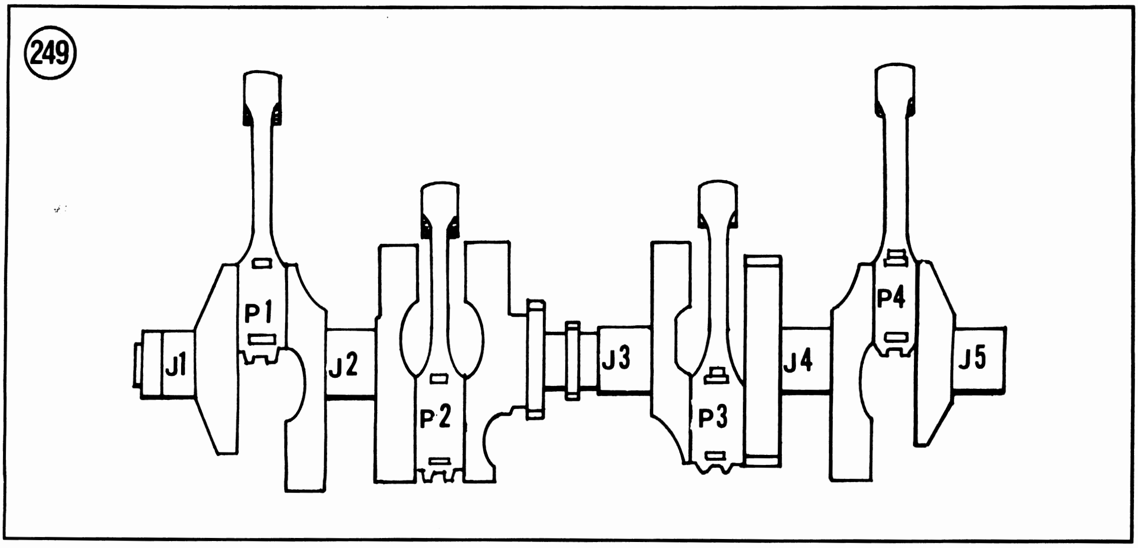
1. Check each rod for obvious damage such as cracks and burns.

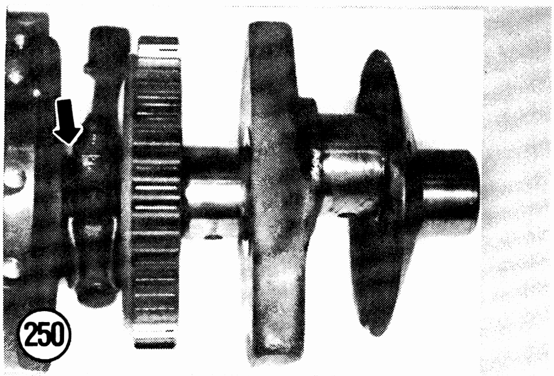
2. Check the piston pin bushing (**Figure 258**) for wear or scoring.

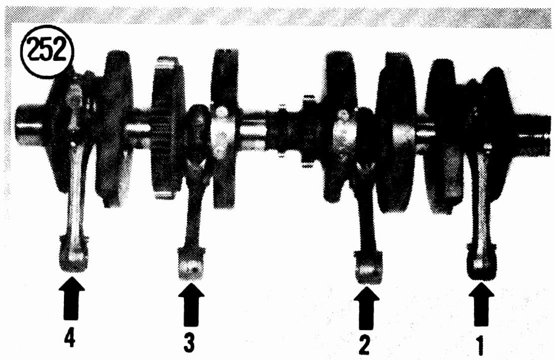
3. Take the rods to a machine shop and have them checked for twisting and bending.

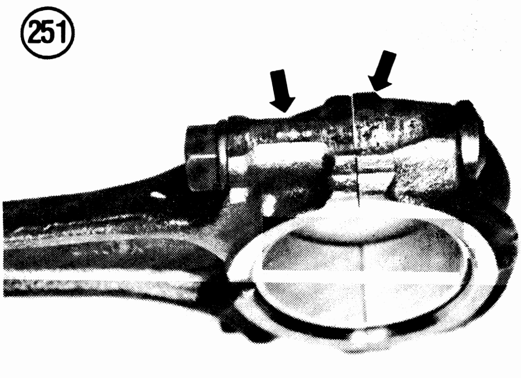
4. Examine the bearing inserts (**Figure 255**) for wear, scoring or burning. They are reusable if in good condition. Make a note of the bearing size or color (if any) on the back of the insert if the bearing is to be discarded; a previous owner may have used undersize bearings.

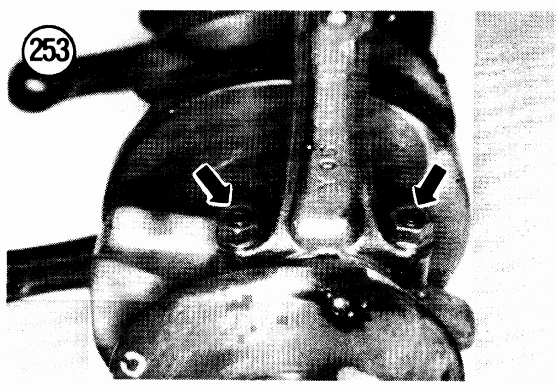
5. Remove the connecting rod bearing bolts (A, **Figure 259**) and check them for cracks or twisting.











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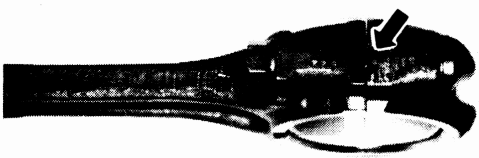

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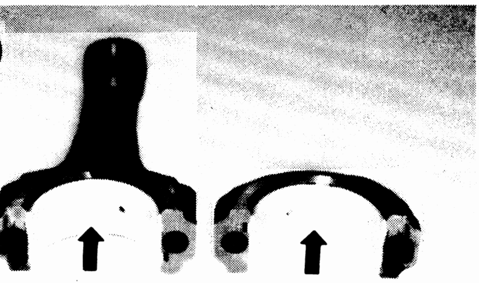

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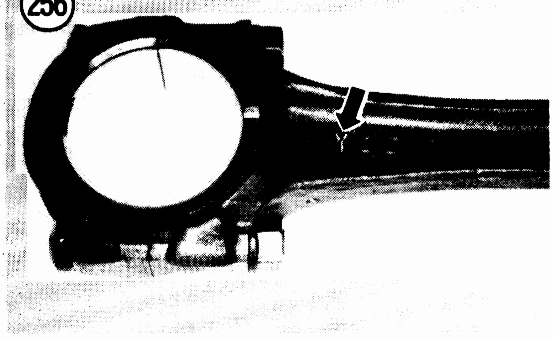

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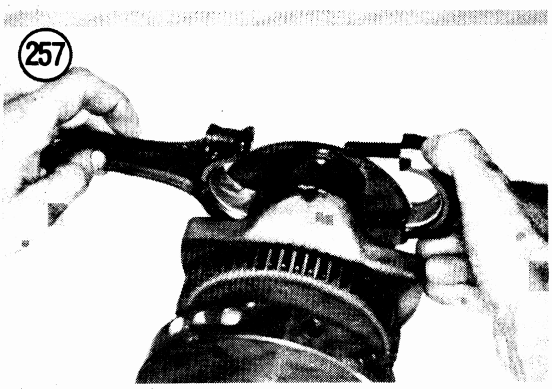

Replace any bolts as required. Also check the bolt nut (B, **Figure 259**) threads for damage, replace if necessary.

6. Check bearing clearance as described in this chapter.

Connecting Rod Bearing and 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 255**).
2. Place a piece of Plastigage on one crankpin parallel to the crankshaft (**Figure 243**).

NOTE
*Each connecting rod is embossed with a "Y" on one side (**Figure 256**). The connecting rod must be installed so that the "Y" mark faces toward the tapered end or left-hand end of the crankshaft.*

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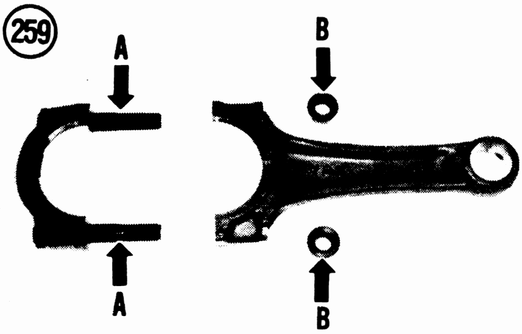

3. Install rod and cap. Tighten nuts (**Figure 253**) to the torque specification in **Table 2**.

CAUTION
Do not rotate crankshaft while Plastigage is in place.

4. Remove the nuts and remove the rod cap.
5. Measure width of flattened Plastigage according to the manufacturer's instructions (**Figure 246**). Measure at both ends of the strip. A difference of 0.025 mm (0.001 in.) or more indicates a tapered crankpin; the crankshaft must be replaced. Confirm with a micrometer (**Figure 237**) measurement of the rod journal OD.
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 the Plastigage strips.
7. If the bearing clearance is greater than specified, use the following steps for new bearing selection.
8. Bearing clearance should be within the specifications in **Table 1**. Remove the Plastigage strips from all bearing journals.
9. If the bearing clearance is greater than specified, use the following steps for new bearing selection.

NOTE
*A double check of the big end rod ID with a micrometer (**Figure 260**) may help determine the extent of any wear pattern.*

10. The connecting rods and caps are marked with a No. 4 or No. 5 (**Figure 254**). The crankshaft is marked on the left-hand counterbalancer with 4 right-hand set of numbers (B, **Figure 247**) that relate to the connecting rod bearing journals.

NOTE
*The group of 5 left-hand set of numbers (A, **Figure 247**) relates to the crankshaft main bearing journals—**do not** refer to these 5 numbers.*

11. To select the proper bearing insert number, subtract the crankshaft connecting rod journal number

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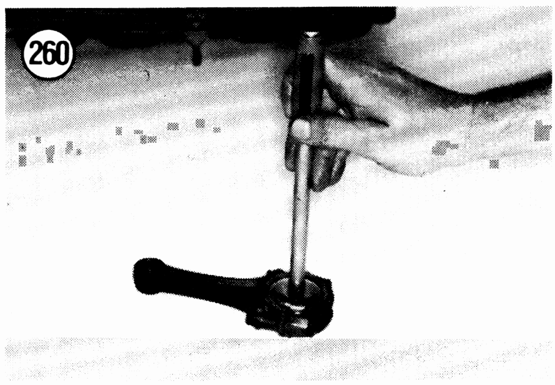

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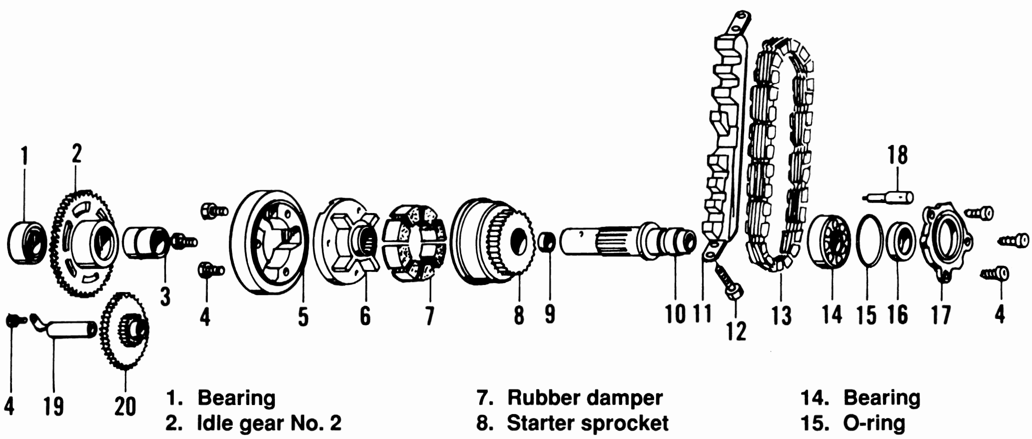
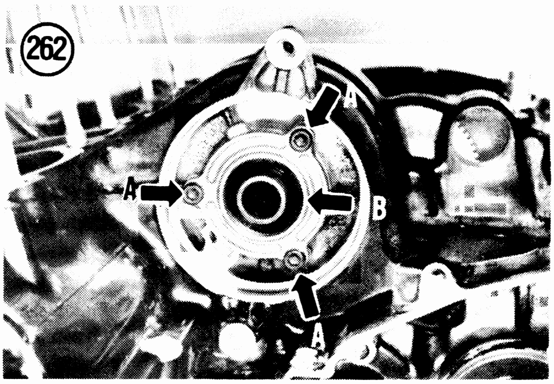
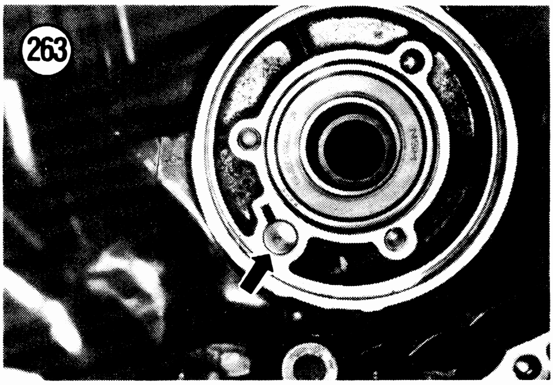
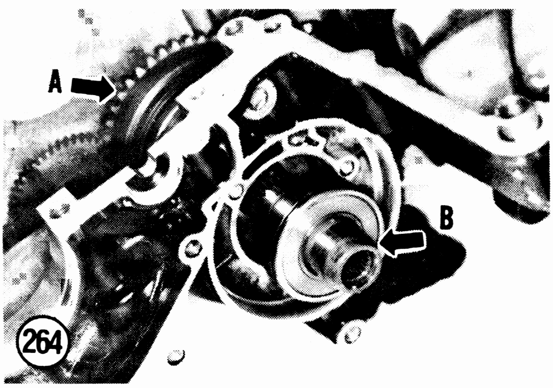
STARTER CLUTCH AND GEARS

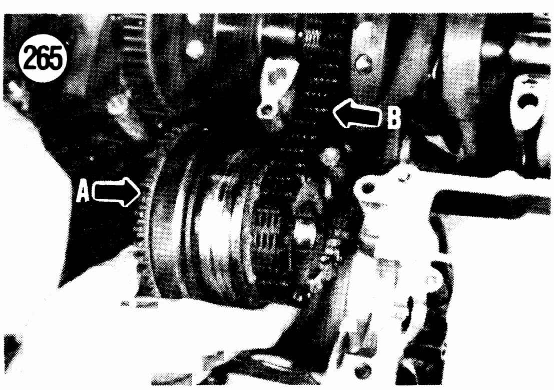


1. Bearing
2. Idle gear No. 2
3. Bushing
4. Allen bolt
5. Starter clutch outer housing
6. Starter wheel
7. Rubber damper
8. Starter sprocket
9. Plug
10. Drive shaft
11. Chain guide
12. Bolt
13. Chain
14. Bearing
15. O-ring
16. Oil seal
17. Bearing retainer
18. Oil jet nozzle
19. Shaft and retainer
20. Idle gear No. 1









from the connecting rod and cap number. For example, if the connecting rod is marked with a No. 4 and the matching crankshaft journal is a No. 2, 4 – 2 = 2. The new bearing insert is a No. 2. The bearings are then identified by number and color as follows:

a. No. 1 (blue).
b. No. 2 (black).
c. No. 3 (brown).
d. No. 4 (green).

NOTE
Determine the bearing insert number for all 4 connecting rods. Then take insert numbers and colors to a Yamaha dealer for bearing purchase.

12. Repeat Steps 1-11 for the other 3 connecting rods.
13. After new bearings have been selected, recheck clearances as described in Step 6. If clearance is still out of specification, take the crankshaft and connecting rods to a Yamaha dealer for further service. Yamaha does not provide connecting rod or crankpin journal wear specifications.
14. Clean all Plastigage from crankshaft and bearing inserts. Install the connecting rods as described in this chapter.

STARTER CLUTCH AND GEARS

Removal/Installation

Refer to **Figure 261** for this procedure.

1. Remove the engine from the frame as described in this chapter.
2. If not already removed, remove the alternator from the crankcase as described in Chapter Eight.
3. Remove the bolts (A, **Figure 262**) securing the bearing retainer and remove the retainer (B, **Figure 262**).
4. Remove the oil jet nozzle (**Figure 263**) from the crankcase.
5. Split the crankcase as described in this chapter.
6. Hold onto the starter clutch assembly (A, **Figure 264**) within the crankcase and withdraw the drive shaft assembly (B, **Figure 264**).
7. Pull the starter clutch assembly up (A, **Figure 265**) and disengage it from the drive chain (B, **Figure 265**). Remove the starter clutch assembly.
8. To remove the idle gear, perform the following:

a. Remove the bolt and shaft retainer (A, **Figure 266**) and withdraw the idle gear No. 1 shaft (B, **Figure 266**) from the crankcase.
b. Remove the No. 1 idle gear assembly (**Figure 267**) from the crankcase.

9. Inspect the components as described in this chapter.
10. Install by reversing these removal steps while noting the following:
   a. Be sure to install the oil jet nozzle (**Figure 263**) into the crankcase.
   b. Install the bearing retainer. Add blue Loctite (No. 242) to the retainer bolt threads prior to installation. Install the bolts (A, **Figure 262**) and tighten to the torque specification in **Table 2**.

Disassembly/Inspection/Assembly

Refer to **Figure 261** for this procedure.

1. Separate the starter sprocket from the starter clutch outer housing assembly.
2. Remove the bushing (**Figure 268**) from the starter clutch outer housing.
3. Remove the idle gear No. 2 (**Figure 269**) from the starter clutch outer housing.
4. Remove the rubber dampers (**Figure 270**) from the starter sprocket.
5. Inspect the rubber dampers (**Figure 271**) for wear, deterioration or distortion, replace as necessary.
6. Inspect the starter sprocket gear (**Figure 272**) for burrs, chipped or missing teeth, replace if necessary.
7. Inspect the idle gear No. 2 (A, **Figure 273**) for burrs, chipped or missing teeth, replace if necessary.
8. Inspect the rubber damper separators (**Figure 274**) in the starter sprocket for wear or cracks, replace if necessary.

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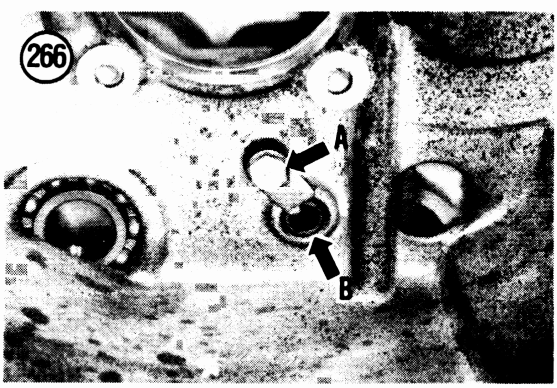

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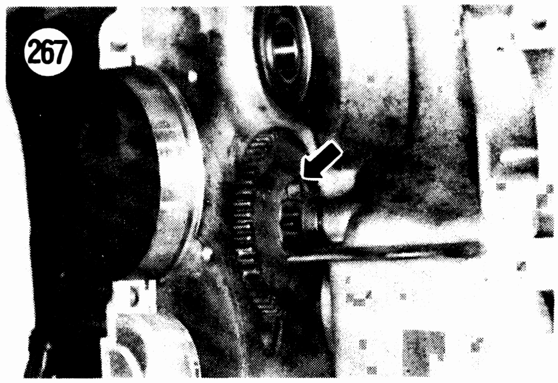

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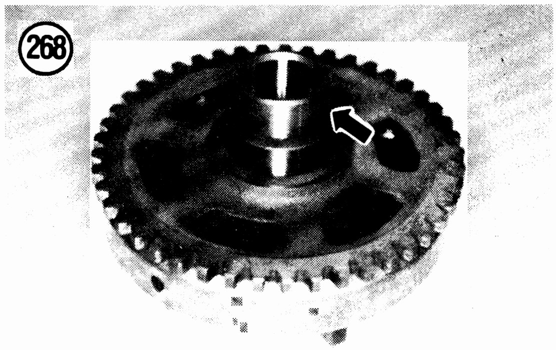

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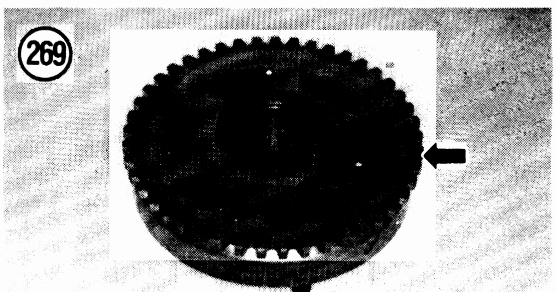

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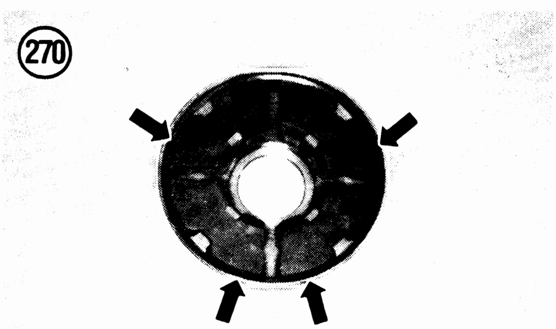

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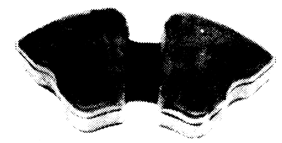

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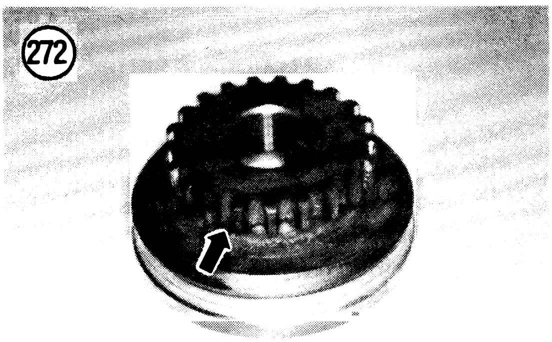

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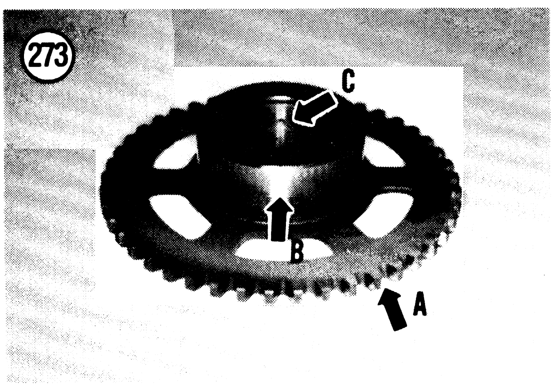

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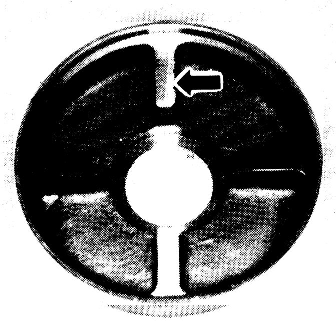

9. Inspect the inner splines (**Figure 275**) of the starter wheel for wear or damage, replace if necessary.
10. Inspect the outer surface (B, **Figure 273**) and the inner surface (C, **Figure 273**) of the idle gear No. 2 for wear or abrasions, replace if necessary.
11. Inspect the rollers (**Figure 276**) in the starter clutch outer housing for wear. They should move back and forth easily and should be free of burrs. Replace all 3 rollers as a set even if only 1 is damaged.
12. Check the starter clutch outer housing Allen bolts (**Figure 277**) for tightness. If the bolts are loose, remove them and apply blue Loctite (No. 242) to the threads. Then install the bolts and tighten to the torque specification in **Table 2.**
13. Inspect the idle gear No. 2 bushing (**Figure 278**) for wear or scoring. Insert the bushing into the gear (**Figure 268**) and rotate it. It should rotate smoothly with no binding, replace if necessary.
14. Inspect the shaft bearing (A, **Figure 279**) and splines (B, **Figure 279**) for wear or damage. Spin the bearing and check for wear or damage, replace if necessary.

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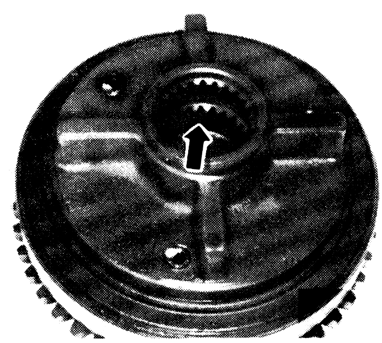

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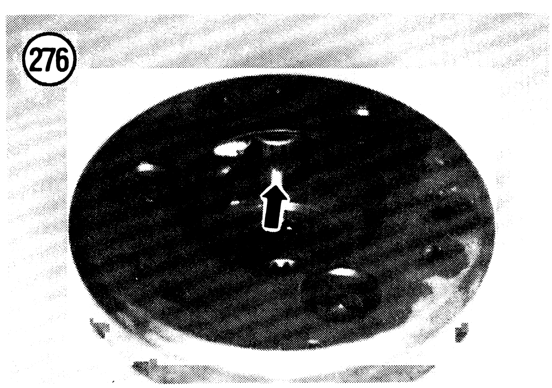

15. Inspect the shaft bearing (**Figure 280**) in the crankcase for wear or damage. Spin the bearing and check for wear or damage, replace if necessary.

16. Assemble the starter clutch assembly by reversing these disassembly steps while noting the following:

   a. Install the idle gear No. 2 (A, **Figure 281**) by rotating it *counterclockwise* while pushing down and install it into the starter clutch outer housing (B, **Figure 281**).
   b. Apply clean engine oil to all rotation parts prior to assembly.

17. Test the starter clutch operation as follows:

   a. Hold the starter clutch outer housing assembly in your left hand.
   b. With your right hand, turn the idle gear No. 2 clockwise (as looking directly at the gear). The idle gear should *not* rotate.
   c. With your right hand, now turn the idle gear No. 2 counterclockwise (as looking directly at the gear). The gear should turn freely in this direction but not the other direction.
   d. If the starter clutch does not operate correctly, replace the starter clutch outer housing assembly.

BREAK-IN

Following cylinder servicing (boring, honing, new rings, etc.) and major lower end work, the engine should be broken in just as though it were new. The performance and service life of the engine depends greatly on a careful and sensible break-in.

For the first 800 km (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

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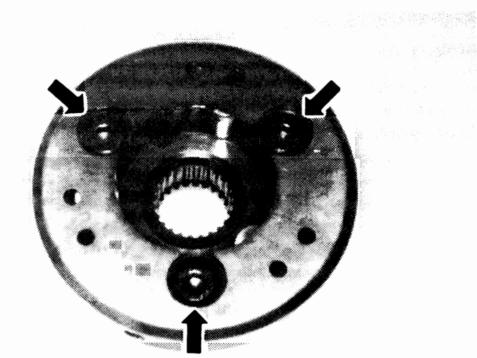

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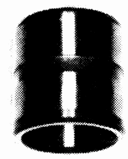

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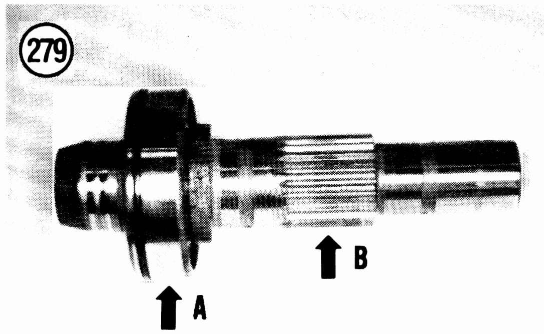

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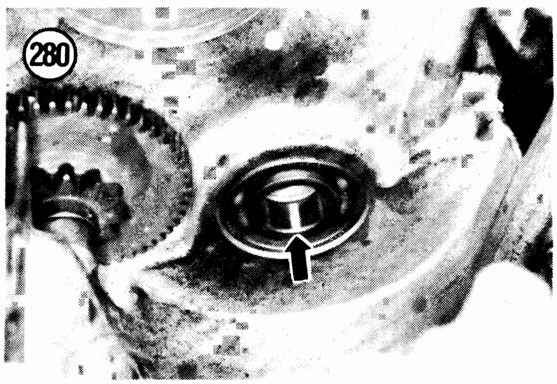

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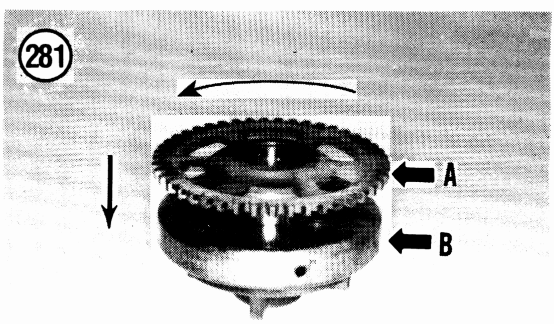


speed, no matter how moderate, is to be avoided, as is hard acceleration.

Following the 800 km (500 mile) service, increasingly more throttle can be used but full throttle should not be used until the motorcycle has covered at least 1,600 km (1,000 miles) and then it should be limited to short bursts until 2,410 km (1,500 miles) have been logged.

The mono-grade oils recommended for break-in and normal use provide a more 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 dipstick; if the oil level is low, the oil will become overheated resulting in insufficient lubrication and increased wear.

800 km (500 mile) Service

It is essential that oil and filter be changed after the first 800 km (500 miles). In addition, it is a good idea to change the oil and filter at the completion of break-in (about 2,410 km/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	Wear limit
General		
1100 cc		
Type	4-stroke, air-cooled, DOHC	
No. of cylinders	Inline 4	
Bore and stroke	74.0 × 63.8 mm (2.91 × 2.51 in.)	
Displacement	1,097 cc	
Compression ratio	9.5:1	
1200 cc		
Type	4-stroke, air-cooled, DOHC	
No. of cylinders	Inline 4	
Bore and stroke	77.0 × 63.8 mm (3.03 × 2.51 in.)	
Displacement	1,188 cc	
Compression ratio	9.7:1	
Cylinders		
Cylinder liner	Aluminum alloy with cast iron sleeve	
Warp limit	—	0.05 mm (0.002 in.)
Bore		
1100 cc	73.97-74.03 mm (2.912-2.915 in.)	—
1200 cc	76.96-77.02 mm (3.030-3.032 in.)	—
Taper	—	0.05 mm (0.002 in.)
Out-of-round	—	0.05 mm (0.002 in.)
Piston/cylinder clearance	0.03-0.05 mm (0.0012-0.0020 in.)	0.10 mm (0.004 in.)
Pistons		
1100 cc		
Diameter	73.93-73.99 mm (2.9106-2.9130 in.)	—
Measuring point	3 mm (0.118 in.) up from bottom	

(continued)

Table 1 ENGINE SPECIFICATIONS (continued)

Item	Specifications	Wear limit
Pistons (continued)		
1200 cc		
Diameter	76.92-76.98 mm (3.028-3.031 in.)	—
Measuring point	2 mm (0.08 in.) up from bottom	
Piston rings		
Number per piston		
Compression	2	—
Oil control	1	—
Ring end gap		
Top and second	0.20-0.35 mm (0.0079-0.0138 in.)	—
Oil rail	0.2-0.7 mm (0.0079-0.0276 in.)	—
Ring side clearance		
Top	0.4-0.8 mm (0.0016-0.0031 in.)	0.10 mm (0.004 in.)
Second	0.3-0.7 mm (0.0012-0.0028 in.)	0.11 mm (0.0043 in.)
Oil (side rail)	—	—
Crankshaft		
Runout	—	0.03 mm (0.0012 in.)
Connecting rod oil clearance	0.017-0.040 mm (0.0007-0.0016 in.)	—
Journal oil clearance	0.020-0.044 mm (0.0008-0.0017 in.)	—
Big end side clearance	0.160-0.262 mm (0.0063-0.0103 in.)	—
Camshaft (U.S.)		
Runout	—	0.03 mm (0.0012 in.)
Lobe height		
Intake and exhaust	35.95-36.05 mm (1.4153-1.4193 in.)	35.85 mm (1.41 in.)
Lobe width	28.25-28.35 mm (1.112-1.116 in.)	28.15 mm (1.10 in.)
Camshaft bearing outside diameter	24.967-24.980 mm (0.9830-0.9835 in.)	—
Camshaft cap inside diameter	25.000-25.021 mm (0.9843-0.9851 in.)	—
Camshaft-to-cap clearance	0.020-0.054 mm (0.0008-0.0021 in.)	—
Camshaft (U.K.)		
Runout	—	0.03 mm (0.0012 in.)
Lobe height		
Intake and exhaust	36.25-36.35 mm (1.427-1.431 in.)	36.15 mm (1.42 in.)
Lobe width	28.27-28.37 mm (1.113-1.117 in.)	28.17 mm (1.109 in.)
Camshaft outside diameter	24.967-24.980 mm (0.9830-0.9835 in.)	—
Camshaft cap inside diameter	25.000-25.021 mm (0.9843-0.9851 in.)	—

(continued)

Table 1 ENGINE SPECIFICATIONS (continued)

Item	Specifications	Wear limit
Camshaft (U.K.) (continued)		
Camshaft-to-cap clearance	0.020-0.054 mm (0.0008-0.0021 in.)	
Valves		
Valve head thickness (Dimension A)	—	0.5 mm (0.020 in.)
Bevel end thickness (Dimension B)	—	0.5 mm (0.020 in.)
Stem length to keeper groove (Dimension C)	—	4.0 mm (0.157 in.)
Head diameter		
Intake	28.9-29.1 mm (1.1378-1.1457 in.)	—
Exhaust	24.9-25.1 mm (0.9803-0.9882 in.)	—
Face width		
Intake and exhaust	1.98-2.55 mm (0.0780-0.1004 in.)	—
Seat width		
Intake and exhaust	0.9-1.1 mm (0.0354-0.0433 in.)	—
Stem diameter		
Intake	5.475-5.490 mm (0.2156-0.2161 in.)	5.445 mm (0.2144 in.)
Exhaust	5.460-5.475 mm (0.2150-0.2155 in.)	5.430 mm (0.2138 in.)
Runout	—	0.01 mm (0.0004 in.)
Valve guide inside diameter		
Intake and exhaust	5.500-5.512 mm (0.2165-0.2170 in.)	5.55 mm (0.219 in.)
Valve stem to guide clearance		
Intake	0.010-0.037 mm (0.0004-0.0015 in.)	0.08 mm (0.0031 in.)
Exhaust	0.025-0.052 mm (0.0010-0.0020 in.)	0.10 mm (0.0039 in.)
Valve spring free length		
Intake and exhaust	39.65 mm (1.56 in.)	37.65 mm (1.48 in.)
Valve spring tilt limit	—	1.6 mm (0.063 in.)
Oil pump		
Tip clearance	0.12 mm (0.0047 in.)	0.17 mm (0.0067 in.)
Side clearance	0.03-0.08 mm (0.0012-0.0031 in.)	0.15 mm (0.006 in.)

Table 2 ENGINE TIGHTENING TORQUES

	N•m	ft.-lb.
Engine mounting bolts and nuts		
1984-1990		
Upper front through bolt and nut	55	40
Upper rear through bolt and nut	55	40
Lower rear through bolt and nut	90	65
Sub-frame upper and lower bolt and nut	28	20
(continued)		

4

Table 2 ENGINE TIGHTENING TORQUES (continued)

	N•m	ft.-lb.
Engine mounting bolts and nuts (continued)		
1991-on		
Front through bolt and nut	90	65
Front mounting bracket-to-frame bolt	90	65
Sub-frame bolts		
Front	48	35
Rear	30	22
Lower rear through bolt and nut	90	65
Clutch slave cylinder mounting bolts	10	7.2
Cylinder head cover bolts	10	7.2
Camshaft		
Sprocket bolts	20	14
Bearing cap bolt	12	8.7
Camshaft chain tensioner		
Mounting bolt	10	7.2
End cap bolt	6	4.3
Camshaft chain rear guide bolt	10	7.2
Cylinder head nuts		
6 mm	10	7.2
8 mm	20	14
10 mm	35	25
Front external oil line		
Bracket bolt	20	14
Union bolt	20	14
Oil pump mounting bolts	10	7.2
Oil strainer housing bolts	10	7.2
Oil pan bolts	10	7.2
Oil level switch bolts	10	7.2
Rear camshaft chain guide bolts	10	7.2
Crankcase bolts		
6 mm	10	7.2
8 mm	24	17
Transmission main shaft retainer Torx bolts	12	8.7
Connecting rod nuts	36	25
Starter clutch		
Outer housing Allen bolts	25	18
Starter shaft bearing retainer bolts	10	7.2
Drive chain guide bolts	10	7.2
Oil cooler		
Lower fitting-to-oil pan bolt	10	7.2
Oil cooler-to-frame bolts	10	7.2
Hose-to-bracket bolt	10	7.2

CHAPTER FIVE

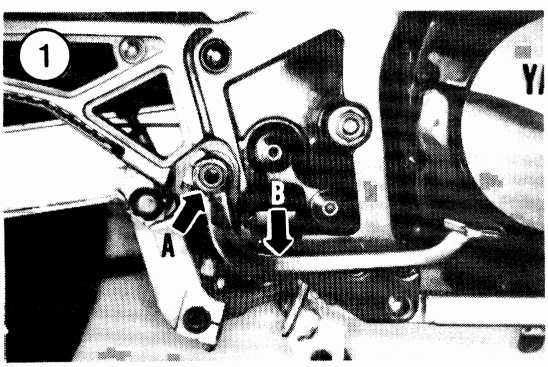
CLUTCH

5

The clutch is a wet, multi-plate type which operates immersed in engine oil. It is mounted on the right-hand side of the transmission main shaft. The clutch can be serviced with the engine in the frame.

The clutch release mechanism is hydraulic and requires no routine adjustment. The mechanism consists of a clutch master cylinder on the left-hand handlebar, a slave cylinder is mounted on the left-hand crankcase and sprocket cover on the left-hand side of the engine and a pushrod that rides within the transmission main shaft.

Clutch specifications are listed in **Table 1**. **Table 1** and **Table 2** are at the end of the chapter.



CLUTCH COVER

Clutch Cover Removal/Installation

1. Remove the lower fairing as described in Chapter Twelve.
2. Remove the clamping bolt and lockwasher (A, **Figure 1**) and remove the rear brake pedal (B, **Figure 1**). Reinstall the bolt and washer onto the brake pedal to avoid misplacing them.

NOTE
If the clutch or transmission is going to be serviced for abnormal operation, drain the engine oil into a clean container so that it can be checked for broken gear teeth, or other debris.

3. Drain the engine oil as described under *Engine Oil and Filter Change* in Chapter Three.

NOTE
The following steps are shown with the engine removed from the frame for clarity. It is not necessary to remove the

engine in order to remove the clutch cover.

4. Remove the bolts securing the clutch cover (**Figure 2**) and remove the cover and gasket.

5. Remove the dowel pins (A, **Figure 3**) and gasket (B, **Figure 3**).

6. Installation is the reverse of these steps while noting the following:

   a. Replace the clutch cover gasket if damaged or if it leaked previously.

   b. Remove all gasket residue from the clutch cover and crankcase mating surfaces.

NOTE
When installing the cover screws, check that each one sticks up the same amount before you screw them all in. If not, you've got a short screw in a long hole or vice versa.

   c. Refill the engine oil as described in Chapter Three.

Clutch Cover Breather Removal/Installation

1. Remove the clutch cover as described in this chapter.

2. Remove the breather cover screws (A, **Figure 4**) and remove the breather (B, **Figure 4**).

3. Remove the special washers and grommets from the breather.

4. Check the grommets (**Figure 5**) for wear or damage; replace if necessary.

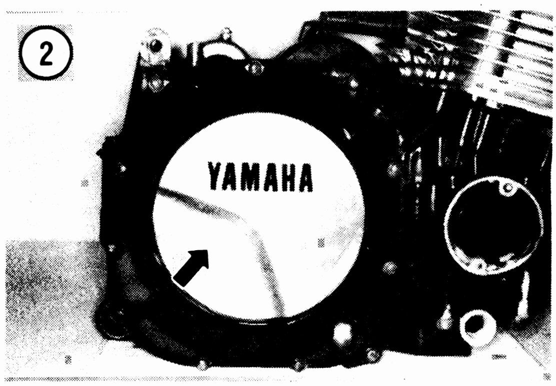
5. Inspect the breather (**Figure 6**) and clutch cover (**Figure 7**) for cracks or damage; replace if necessary.

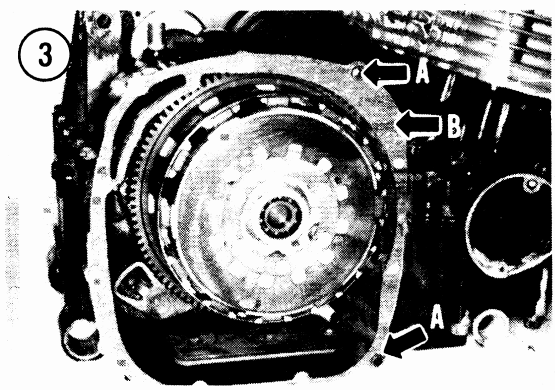
6. Installation is the reverse of these steps while noting the following:

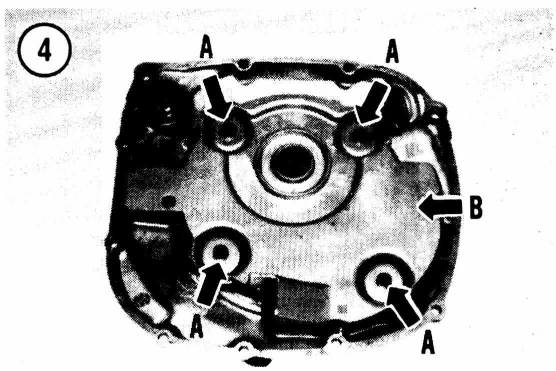
   a. Replace the breather cover gasket (**Figure 8**) if necessary.

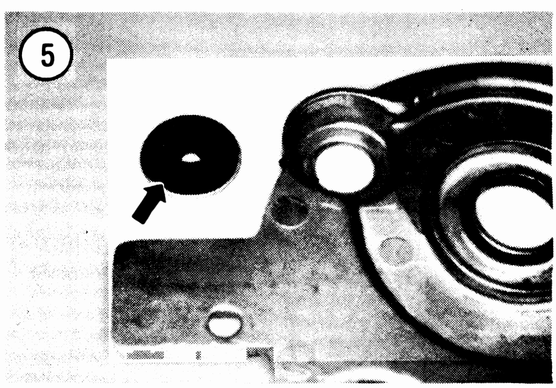
   b. Apply blue Loctite (No. 242) to the washer screws. Then tighten the screws securely.

   c. Install the clutch cover as described in this chapter.









CLUTCH

Removal

Refer to **Figure 9** for this procedure.

1. Remove the clutch cover as described in this chapter.

NOTE
Do not operate the clutch lever after the clutch assembly or slave cylinder is removed from the engine. If the lever is applied it will force the slave cylinder piston out of the body and make slave cylinder installation difficult.

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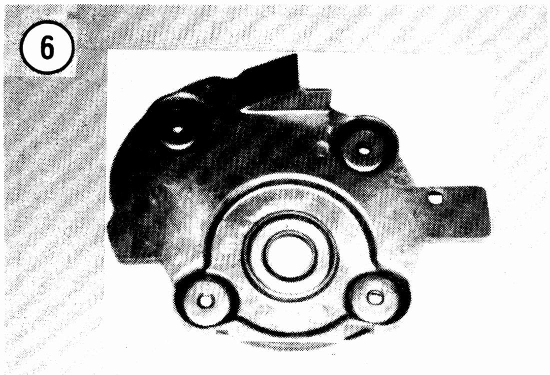

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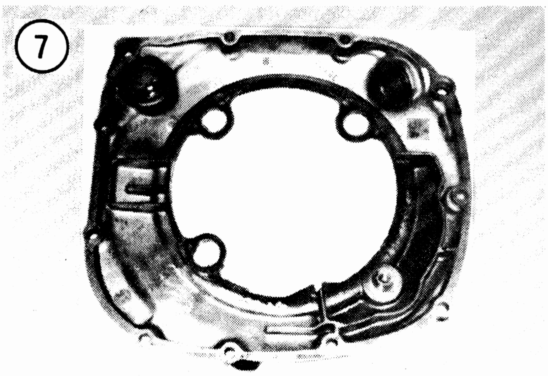

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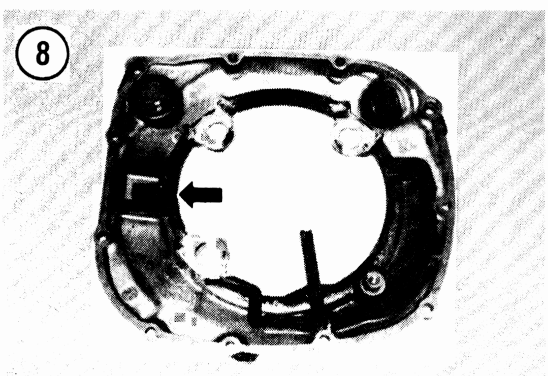


2. Place a block of wood between the clutch lever and the hand grip to hold the lever in the released position. Secure the wood with a rubber band, tie wrap or tape. This will prevent the clutch lever from being applied accidentally after the clutch slave cylinder is removed from the crankcase.

NOTE
The remainder of this procedure is shown with the engine removed for clarity. The clutch assembly can be removed with the engine in the frame.

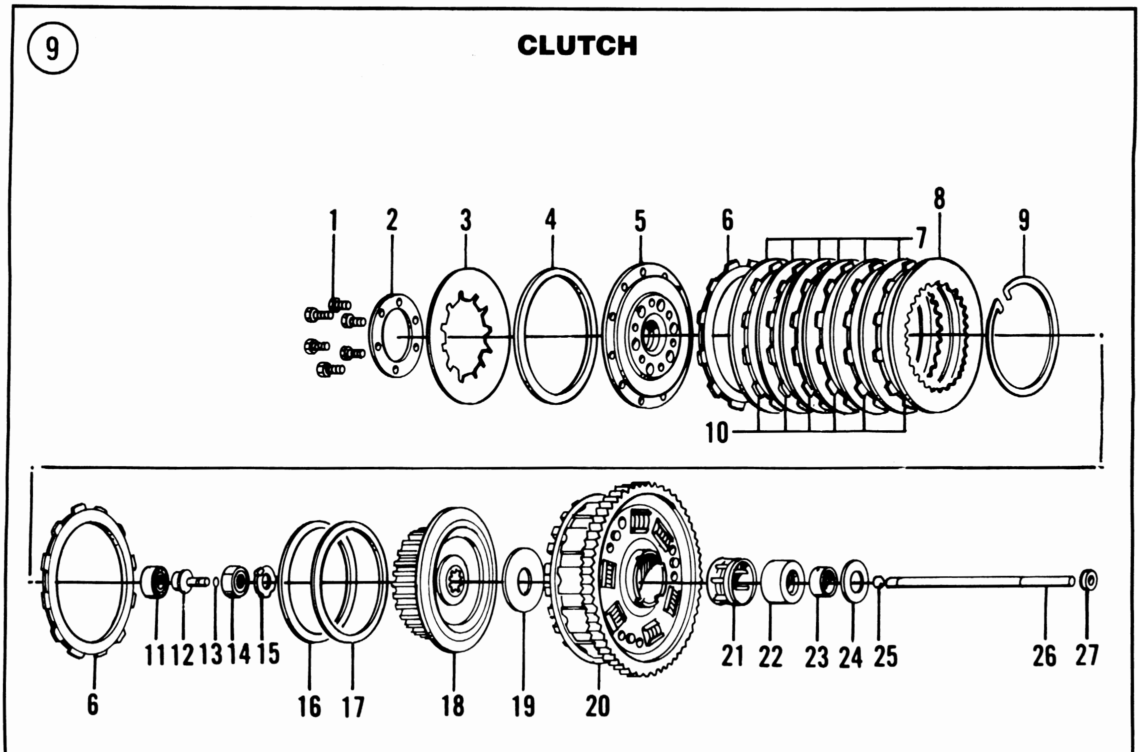
5

3. Loosen the 6 pressure plate screws (A, **Figure 10**) in a criss-cross pattern, then remove all screws.
4. Remove the pressure plate No. 2 (B, **Figure 10**).
5. Remove the clutch spring No. 2 (**Figure 11**).
6. Remove the spring housing (A, **Figure 12**) and the pressure plate No. 1 (B, **Figure 12**). The first friction disc (designated No. 2 type in **Figure 9**) will usually come out along with the pressure plate.
7. Remove the short pushrod No. 1 (**Figure 13**) from the end of the transmission shaft.
8. Using a magnet, pull the steel ball out of the end of the transmission main shaft then remove it (**Figure 14**).
9. Remove the long pushrod No. 2 (A, **Figure 15**) from the transmission shaft.

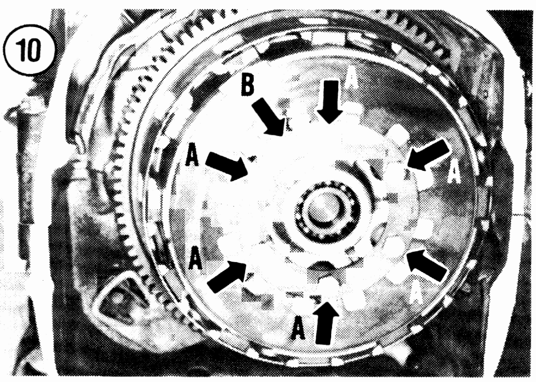
NOTE
*Note that the first friction disc (designated No. 2 type in **Figure 9**) has a larger inside diameter (A, **Figure 16**) than all of the other friction discs (designated No. 1) (B, **Figure 16**). Remember their location during installation.*

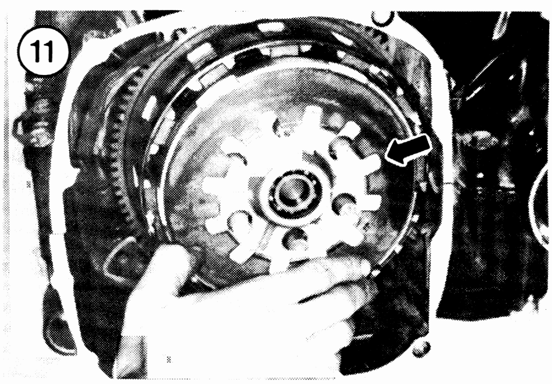
10. Remove all of the clutch plates and friction discs (B, **Figure 15**). Stack the plates and discs in order of removal.
11. Straighten out the locking tab (**Figure 17**) on the locknut.

NOTE
To keep the clutch housing from turning when removing the clutch hub nut in Step 11, use the "Grabbit," or Yamaha Universal Clutch Holder (U.S. part No. YM-91042 or U.K. part No. 90890-



1. Screw
2. Pressure plate No. 2
3. Clutch spring No. 2
4. Spring housing
5. Pressure plate No. 1
6. Friction disc (No. 2 type)
7. Clutch disc
8. Clutch disc (No. 2 type)
9. Large wire ring
10. Friction disc
11. Bearing
12. Pushrod No. 1
13. O-ring
14. Clutch nut
15. Lockwasher
16. Spring
17. Spring seat
18. Clutch boss
19. Thrust plate
20. Clutch housing
21. Bearing
22. Spacer
23. Collar
24. Thrust washer
25. Steel ball
26. Pushrod No. 2
27. Oil seal





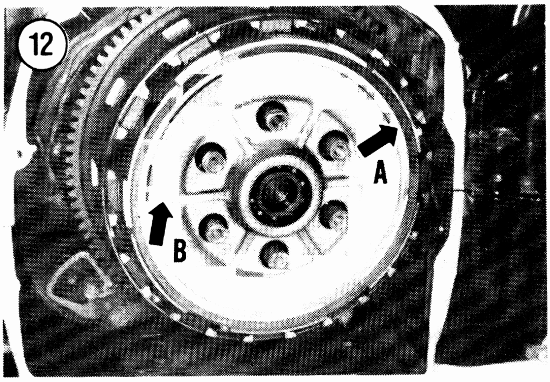
04086) or equivalent, special tool available from motorcycle dealers.

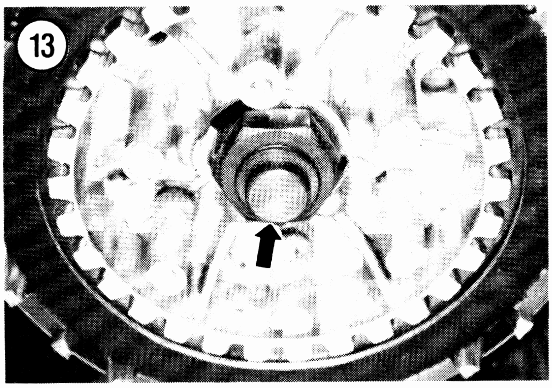
12. Loosen, then remove the clutch nut (**Figure 18**).

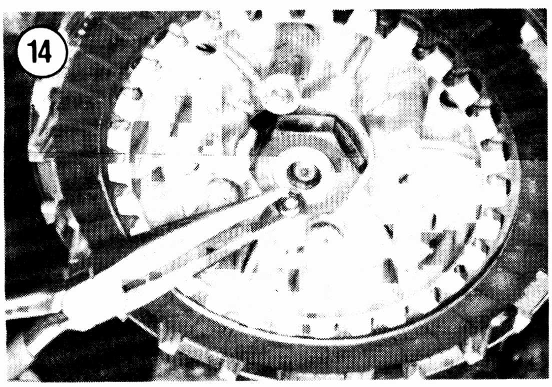
13. Slide off the lockwasher (**Figure 19**).

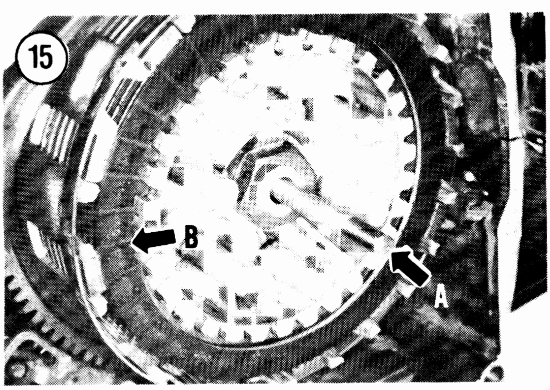
14. Remove the clutch boss assembly (**Figure 20**) and slide off the thrust plate (**Figure 21**).

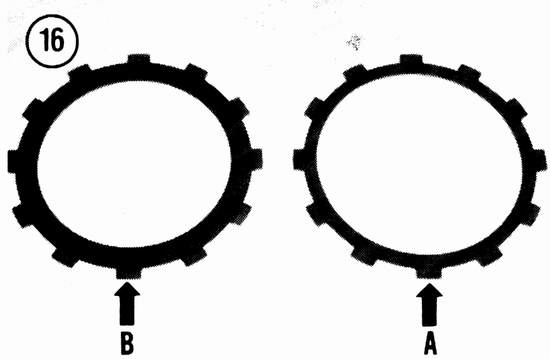
15. Install two 6 mm bolts (A, **Figure 22**) into the spacer (B, **Figure 22**).

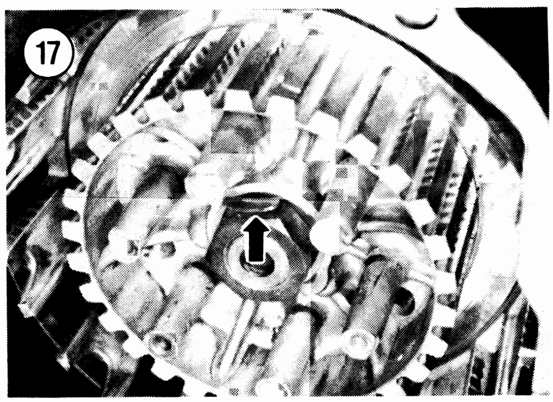


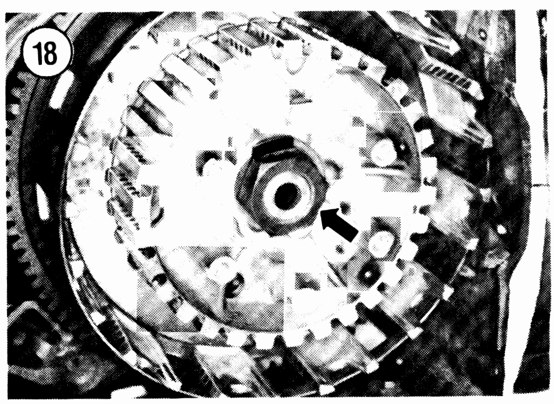










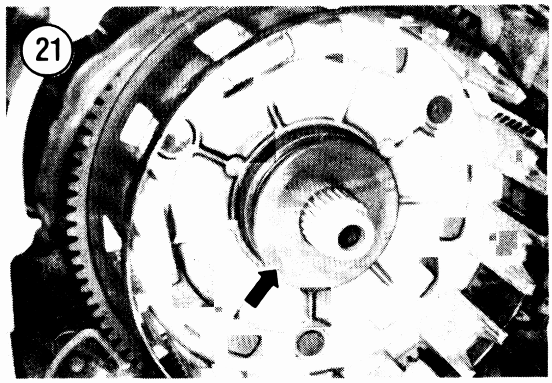


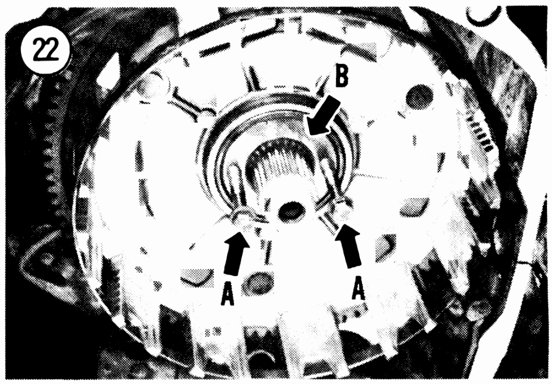
CAUTION
Failure to hold onto the clutch housing while removing the spacer will damage the clutch housing bearing.

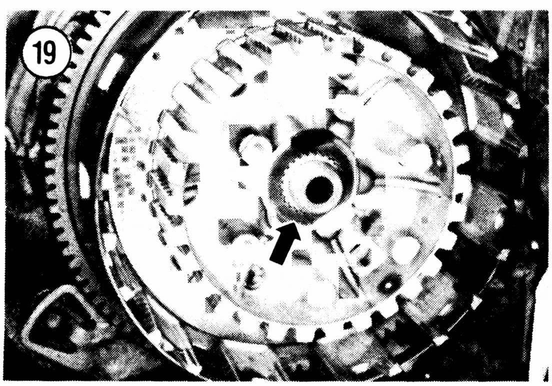
16. Hold onto the clutch housing (**Figure 23**) and using the installed bolts, withdraw the spacer.
17. Remove the clutch housing and bearing (**Figure 24**).
18. The oil pump drive gear, collar and thrust washer can be left in place on the transmission shaft.

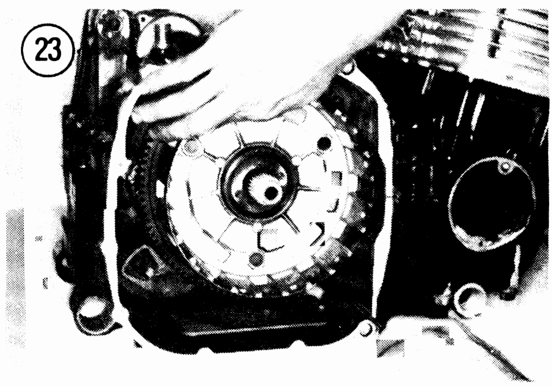
Inspection

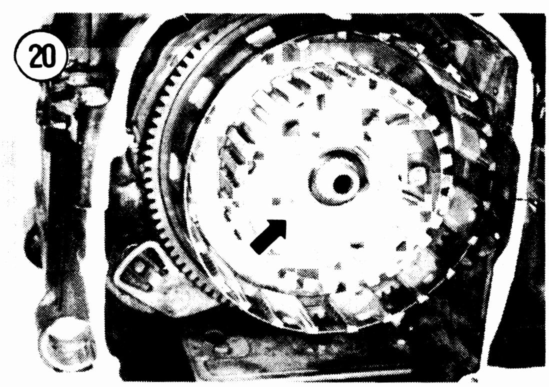
1. Clean all clutch parts in petroleum-based solvent such as a commercial solvent or kerosene and thoroughly dry with compressed air.
2. Use a depth gauge or Vernier caliper and measure the free height of the clutch spring (**Figure 25**). Compare to the specifications listed in **Table 1**. Replace the spring if it has sagged to the service limit or less.
3. Measure the thickness of each friction disc at several places around the disc as shown in **Figure**

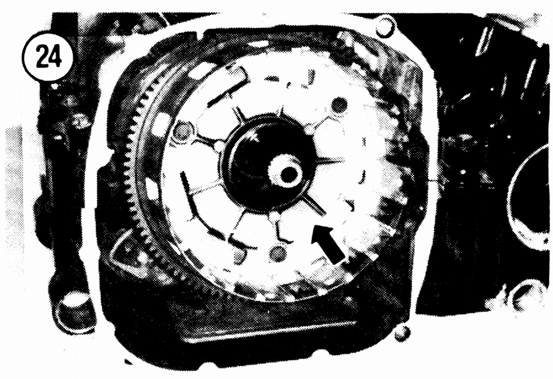


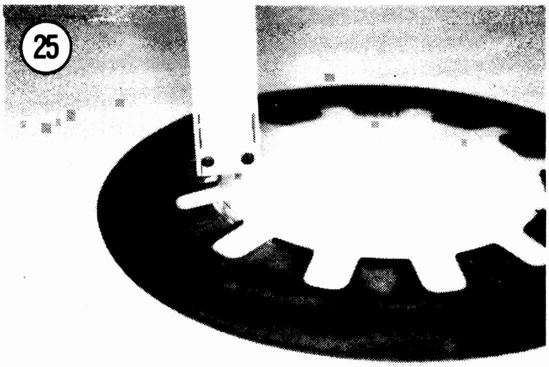








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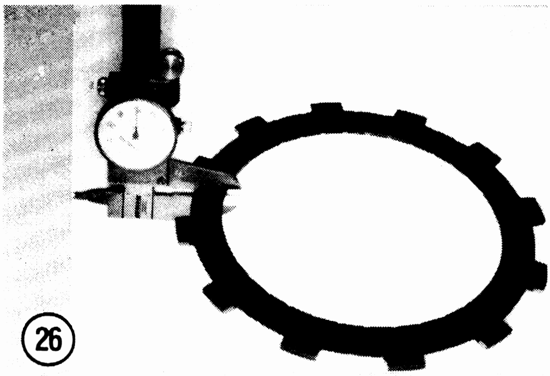
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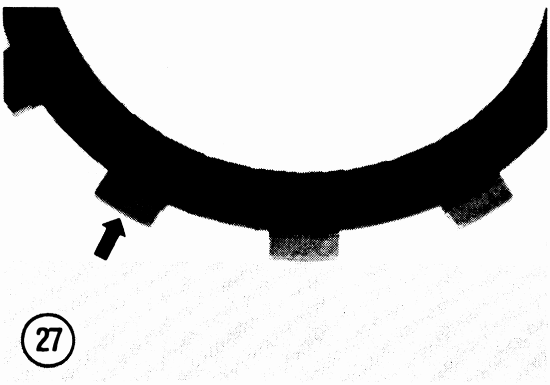
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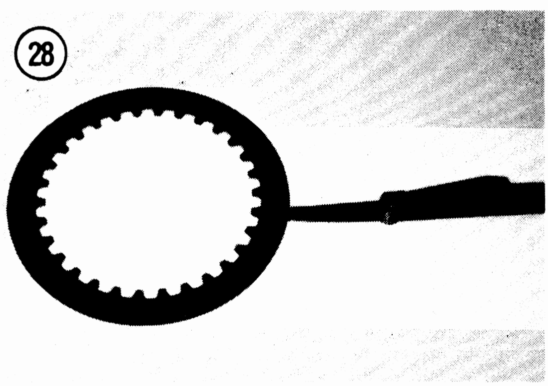
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26. Compare to the specifications listed in **Table 1**. Replace any disc that is worn to the service limit or less.

4. Check the fingers of each friction disc (**Figure 27**) for wear or damage. Replace any disc that is worn or damaged.

5. Check the clutch plates for warpage on a surface plate such as a piece of plate glass (**Figure 28**). Compare to the specifications listed in **Table 1**. Replace any plate that is warped to the service limit or more.

NOTE

If any of the friction discs, clutch plates or clutch springs require replacement, you should consider replacing all of them as a set to retain maximum clutch performance.

5

6. Inspect the clutch housing for the following:

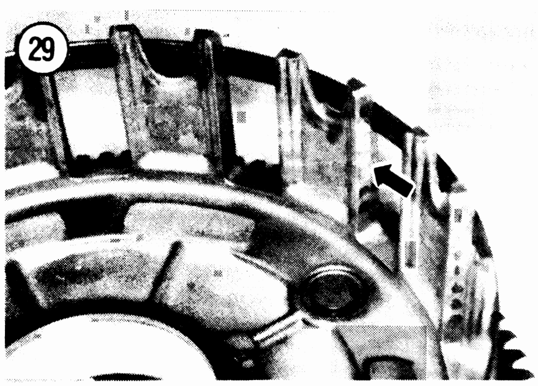
a. Check the fingers for cracks, nicks or galling (**Figure 29**) where they come in contact with the friction disc tabs. They must be smooth for chatter-free operation. If any severe damage is evident, the components must be replaced.

b. Check the outer gear (**Figure 30**) for tooth wear, damage or cracks. Replace the clutch housing if necessary.

c. Inspect the damping springs (**Figure 31**) for breakage or wear. Replace the clutch housing if necessary.

d. Inspect the outer ring (**Figure 32**) for cracks, fatigue or damage. Replace the clutch housing if necessary.

e. Check center bearing bore (**Figure 33**) for cracks, deep scoring, excessive wear or heat discoloration. If the bearing bore is damaged, also check the clutch bearing (**Figure 34**) and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bearing spacer (**Figure 35**) for damage. Replace worn or damaged parts.

7. Inspect the clutch boss for the following:
   a. Check the grooves for cracks, nicks or galling (**Figure 36**) where they come in contact with the clutch plate tabs. They must be smooth for chatter-free operation. If any severe damage is evident, the components must be replaced.
   b. Inspect the posts (**Figure 37**) for thread damage or cracks. If any severe damage is evident, the components must be replaced.
   c. Inspect the inner splines (**Figure 38**) for damage. Remove any small nicks with an oilstone. If damage is severe, the clutch boss must be replaced.
   d. Make sure the large wire ring is secure and is holding the last clutch plate, spring and spring seat in place on the clutch boss. It is not necessary to disassemble these parts from the clutch boss unless there has been a serious clutch chatter problem. If disassembly is necessary, refer to Step 14.
8. Inspect the pressure plate No. 1 (**Figure 39**) and No. 2 for wear or damage, replace if necessary.

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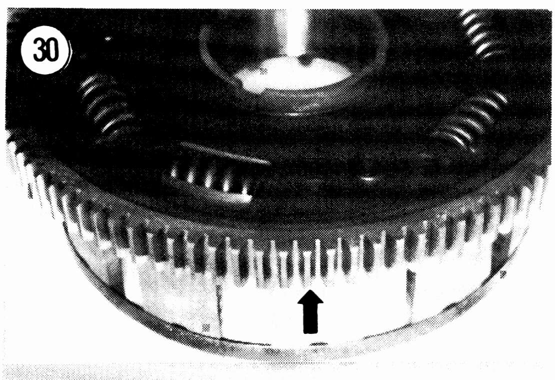

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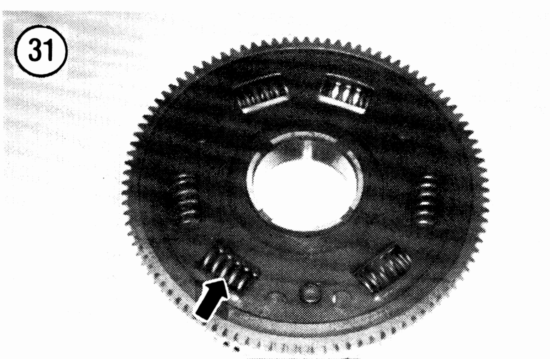

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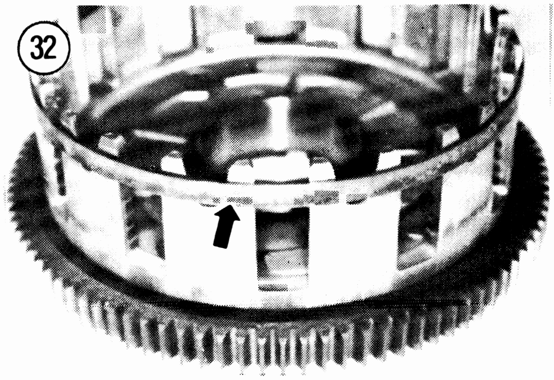

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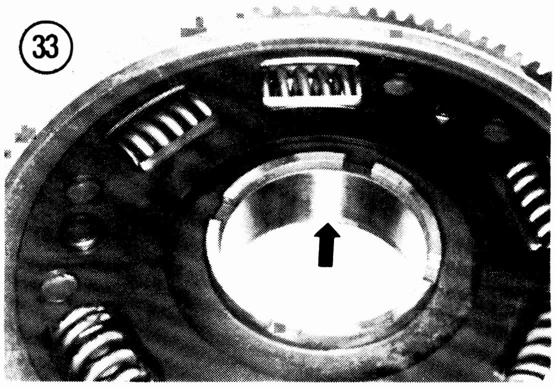

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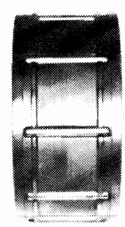

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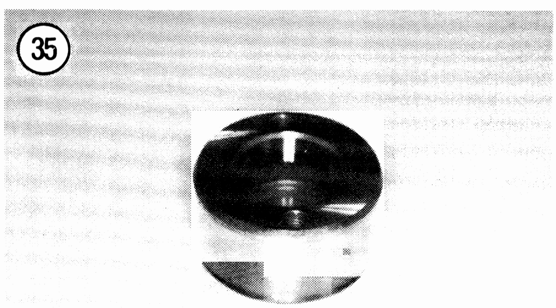

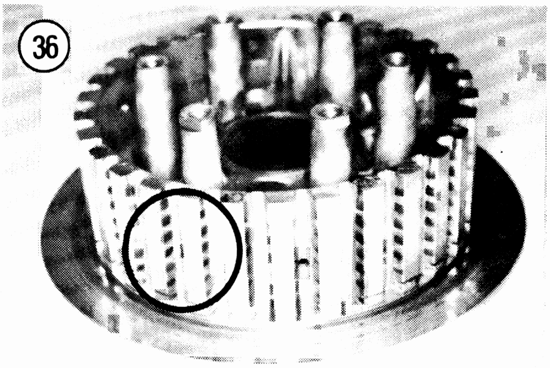
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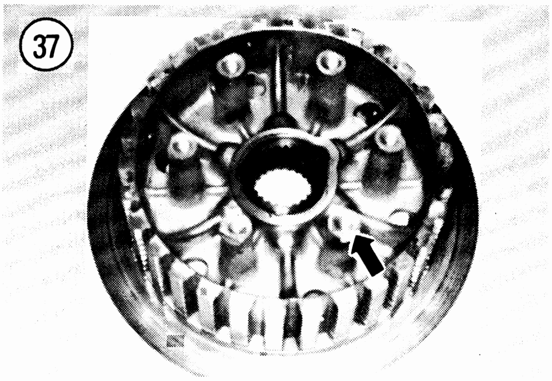
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9. Check the bearing (**Figure 40**) in pressure plate No. 1 for smooth operation, replace the bearing if necessary.

10. Inspect the pressure plate spring housing for wear or damage, replace if necessary.

11. Inspect the long pushrod (**Figure 41**) for bending or damage. If the pushrod is bent to the limit listed in **Table 1** it will hang up in the transmission shaft tunnel. Replace the long pushrod if necessary.

12. Inspect the short pushrod where it contacts the long push rod and the push lever assembly. Inspect the O-ring seal for wear, hardness or deterioration. Replace the O-ring if its condition is doubtful.

13. Check the grooved thrust washer for galling or damage, replace if necessary.

14. If clutch action has been abnormal, disassemble and assemble the clutch boss as follows:

   a. Remove the large wire ring (**Figure 42**) from the clutch boss.
   b. Remove the clutch plate, friction disc No. 2, spring and spring seat.
   c. Position the spring seat with the dished side facing up and install it (**Figure 43**) onto the clutch boss.

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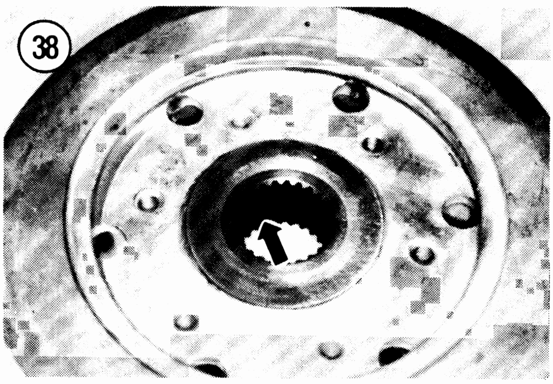
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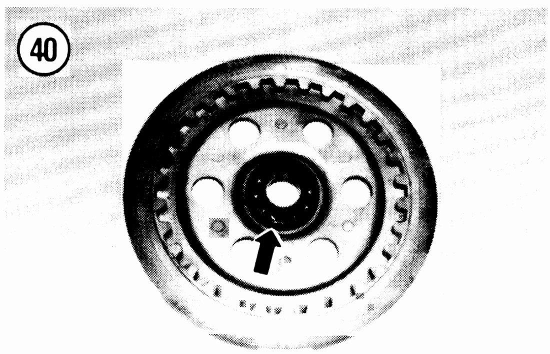
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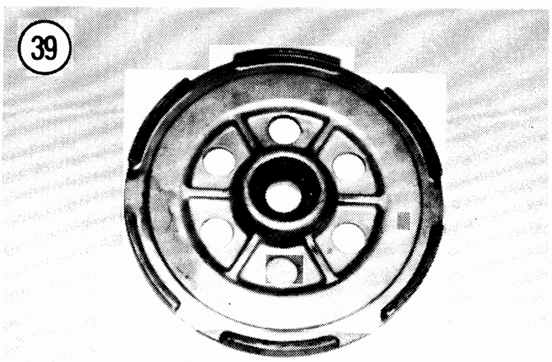
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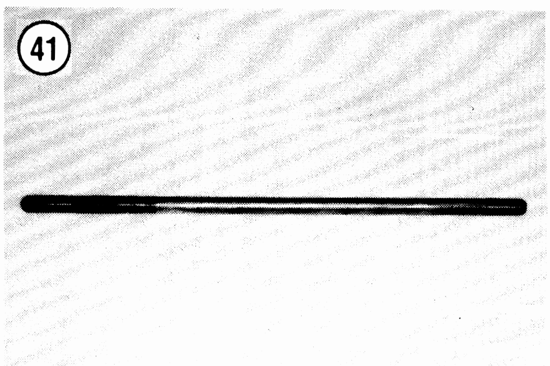
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d. Position the spring with the dished side facing down and install it (**Figure 44**) onto the clutch boss.

NOTE
The I.D. of the No. 2 type friction disc must fit around the already installed spring and spring seat. If the friction disc installed in the next step sits on top of the spring and spring seat, a wrong No. 1 friction disc has been installed—remove it and install a correct one with the larger inside diameter.

NOTE
If a new No. 2 type friction disc is being installed, apply new engine oil to all surfaces to avoid having the clutch lock up when used for the first time.

e. Install the No. 2 type friction disc (**Figure 45**).
f. Install the clutch plate (**Figure 46**). Push down on the clutch plate (**Figure 47**), you should be able to see the groove for the large wire ring. If the ring groove is not visible, the preceding steps are incorrect. Disassemble and solve the problem.
g. Install the large wire ring into one of the holes in the clutch boss (**Figure 42**) and carefully pull the ring around clutch boss and install the other end into the other hole (**Figure 48**) in the clutch boss. Make sure both ends are secure in both holes.

Installation

Refer to **Figure 9** for this procedure.

1. Make sure the oil pump drive gear, collar and thrust washer (**Figure 49**) are still in place and that

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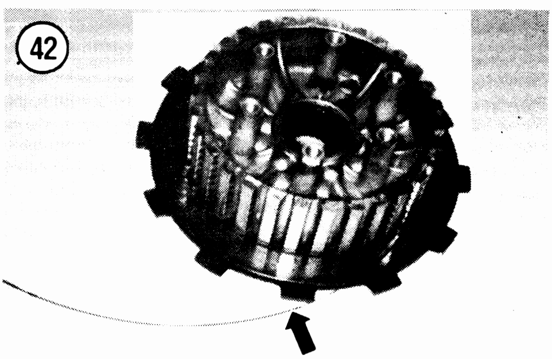

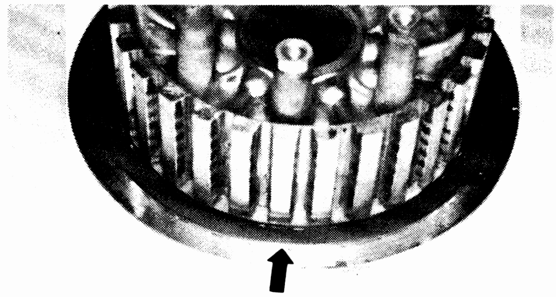
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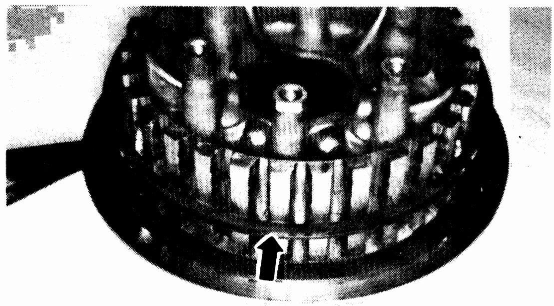
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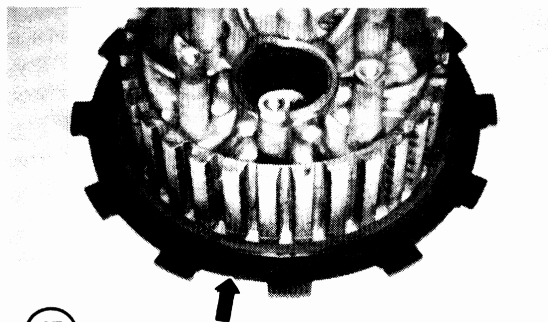
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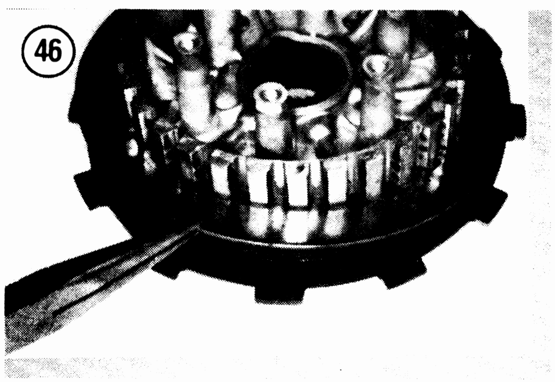

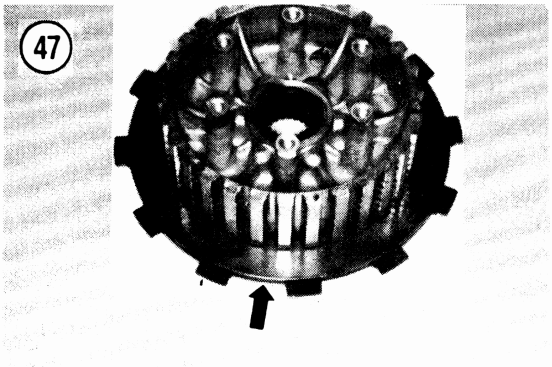
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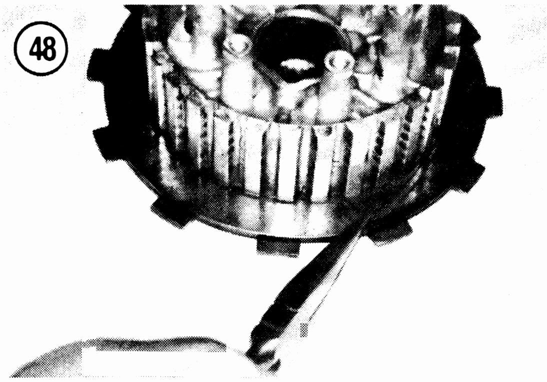
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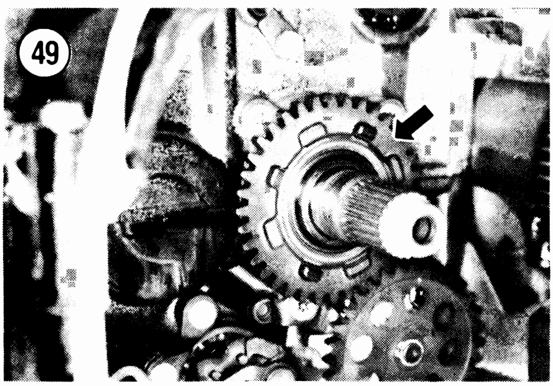
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the drive gear is meshed properly with the oil pump drive gear. This is necessary for proper oil pump operation.

2. Install the clutch housing onto the transmission shaft and hold it centered on the shaft (**Figure 24**).

3. Hold the clutch housing centered (**Figure 23**) and install the bearing (**Figure 50**) and spacer (**Figure 51**) into the clutch housing. Carefully push them in until they are both properly seated (**Figure 51**).

CAUTION

The proper meshing of the oil pump drive gear and the clutch housing is necessary for proper clutch engagement and oil pump operation. Also, if these 2 parts are not meshed properly the clutch housing will stick out too far and will interfere with the clutch cover.

4. Place a long screwdriver on the oil pump driven gear and slowly rotate it while pushing in on the clutch housing. Rotate the oil pump driven gear until the projections on the oil pump drive gear mesh properly with the receptacles in the backside of the clutch housing, then push the clutch housing on the rest of the way. This alignment is necessary for proper clutch and oil pump operation.

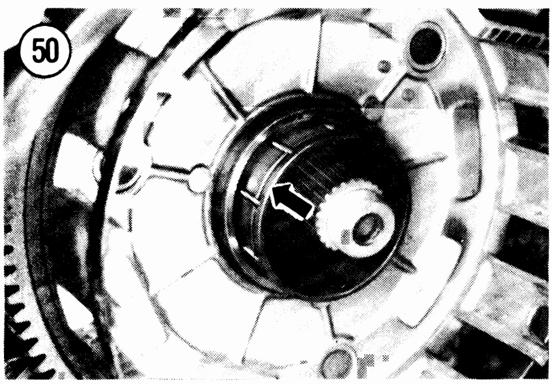
5. Install the thrust plate (**Figure 21**) and the clutch boss assembly (**Figure 20**).

6. Slide on a new lockwasher and index the locating tab (**Figure 19**) into the receptacle in the clutch boss.

7. Install the clutch nut (**Figure 18**).

8. Use the same tool set-up used during removal to hold the clutch boss in place and tighten the clutch nut (**Figure 52**) to the torque specification listed in **Table 2**. Remove the special tool.

9. Bend down one of the locking tabs (**Figure 17**) against one of the flats on the locknut.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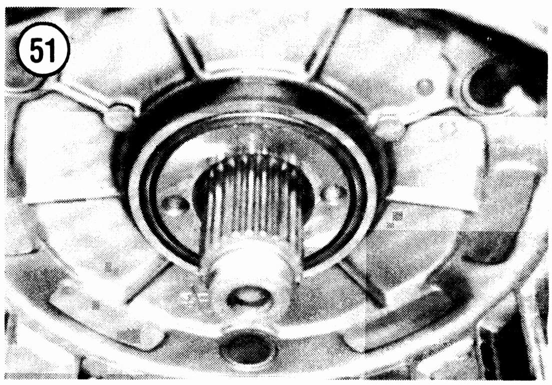
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NOTE
If new friction discs and clutch plates are being installed, apply new engine oil to all surfaces to avoid having the clutch lock up when used for the first time.

NOTE
*Note that the last friction disc to be installed has a larger inside diameter (A, **Figure 16**) than all of the other friction discs (B, **Figure 16**).*

10. Onto the clutch hub install first a friction disc (**Figure 53**) then a clutch plate (**Figure 54**).
11. Continue to install the friction discs and clutch plates, alternating them until all are installed. The last item installed is a clutch disc.
12. Install the long pushrod (A, **Figure 15**) into the transmission main shaft tunnel.
13. Install the steel ball (**Figure 14**) into the end of the transmission main shaft.
14. Make sure the O-ring seal (**Figure 55**) is in place and install the short pushrod No. 1 (**Figure 13**) into the end of the transmission shaft.
15. Install the remaining No. 2 type friction disc, with the large inside diameter onto the backside of pressure plate No. 1 and install the pressure plate No. 1 (B, **Figure 12**) assembly.
16. Install the spring housing (A, **Figure 12**) and clutch spring No. 2 (**Figure 11**).
17. Install pressure plate No. 2 (B, **Figure 11**) and install the 6 pressure plate screws.
18. Tighten the 6 pressure plate screws (A, **Figure 7**) in a criss-cross pattern. Tighten the screws to the torque specification listed in **Table 2**.
19. Make sure the dowel pins (A, **Figure 5**) are in place and install a new gasket (B, **Figure 5**).
20. If removed, install the rubber seal (C, **Figure 5**) onto the crankcase.
21. Install the clutch cover (**Figure 2**) and push it onto the crankcase. There should be about a 1 mm (0.04 in.) gap between the cover and the crankcase mating surface. If the gap is about 6 mm (0.24 in.) or more there is an internal problem—do not install the cover bolts and try to pull the cover into place. Refer to Step 6 and the *CAUTION* preceding it.
22. If the gap is correct, install the bolts and tighten them securely in a criss-cross pattern.
23. Install the clutch cover as described in this chapter.
24. Remove the block of wood from the clutch lever.

CLUTCH HYDRAULIC SYSTEM

The clutch is actuated by hydraulic fluid pressure and is controlled by the hand lever on the clutch master cylinder. As clutch components wear, the fluid level drops in the reservoir and automatically adjusts for wear. There is no routine adjustment necessary or possible.

When working on the clutch hydraulic system, it is necessary that the work area and all tools be absolutely clean. Any tiny particles of foreign matter

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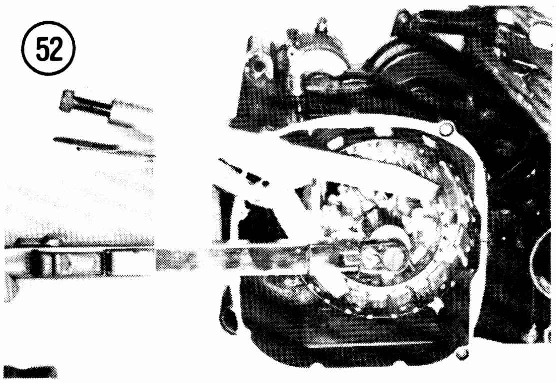

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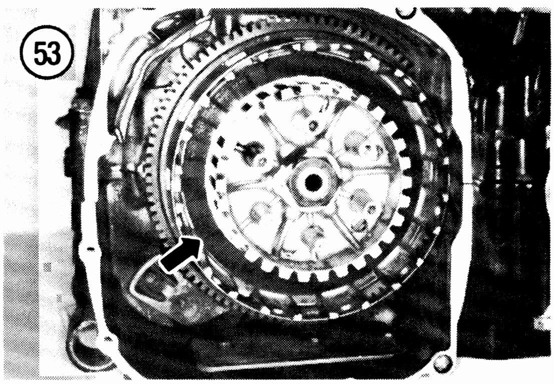

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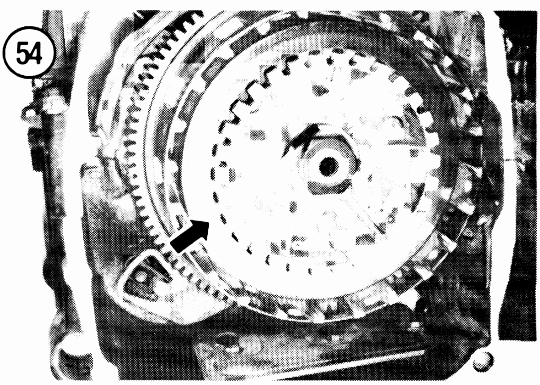

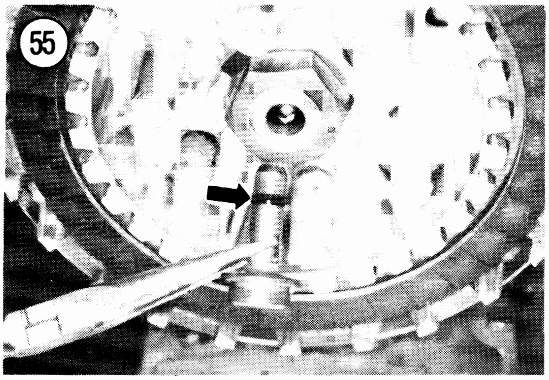

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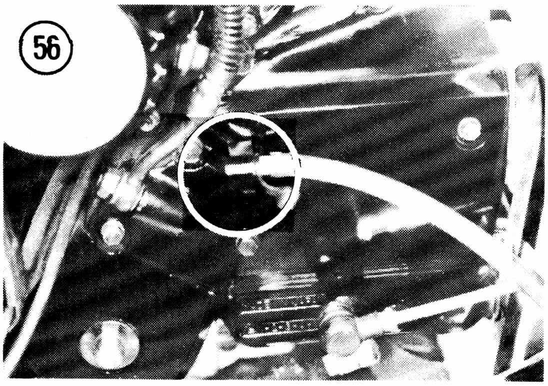

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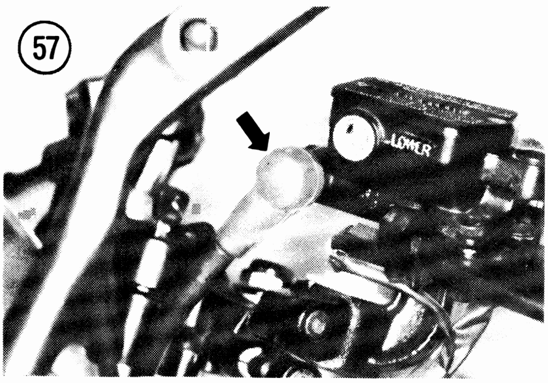

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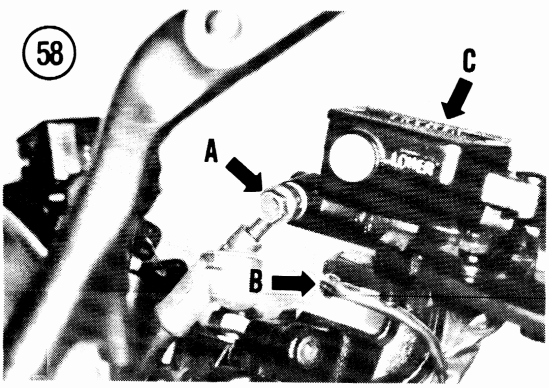

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and grit in the clutch slave cylinder or the clutch master cylinder can damage the components. Also, sharp tools must not be used inside the slave cylinder or on the piston. If there is any doubt about your ability to correctly and safely carry out major service on the clutch hydraulic system, take the job to a dealer.

CAUTION

*Throughout the text, reference is made to hydraulic fluid. Hydraulic fluid is the same as DOT 3 brake fluid. Yamaha recommends the use of DOT 3 (or DOT 4) brake fluid in the clutch system; do **not** use other types of fluids as they are not compatible. Do not intermix silicone-based (DOT 5) brake fluid as it can cause clutch component damage leading to clutch system failure.*

CLUTCH MASTER CYLINDER

Removal/Installation

1. Drain the clutch master cylinder as follows:
   a. Attach a hose to the slave cylinder bleed screw (**Figure 56**).
   b. Place the end of the hose in a clean container.
   c. Open the bleed screw and operate the clutch lever to drain all hydraulic fluid from the master cylinder reservoir.
   d. Close the bleed screw and disconnect the hose.
   e. Discard the hydraulic fluid.
2. Remove the upper fairing as described in Chapter Twelve.

CAUTION

Cover the fuel tank and upper fairing with a heavy cloth or plastic tarp to protect them from accidental hydraulic fluid spills. Wash fluid off any painted or plated surfaces immediately as it will destroy the finish. Use soapy water and rinse completely.

3. Pull back the rubber boot (**Figure 57**) and remove the union bolt (A, **Figure 58**) securing the clutch hose to the clutch master cylinder. Remove the clutch hose; tie the hose up and cover the end to prevent entry of foreign matter.

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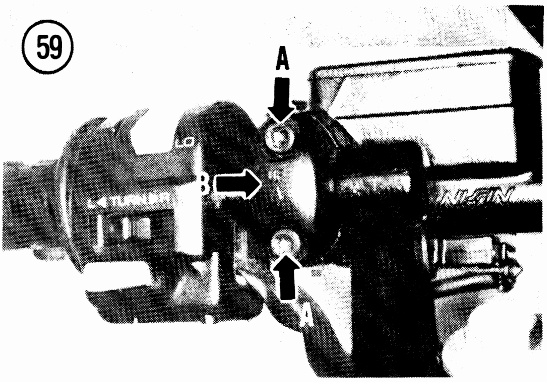

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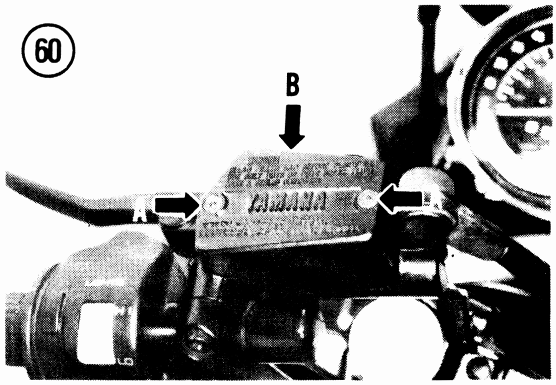

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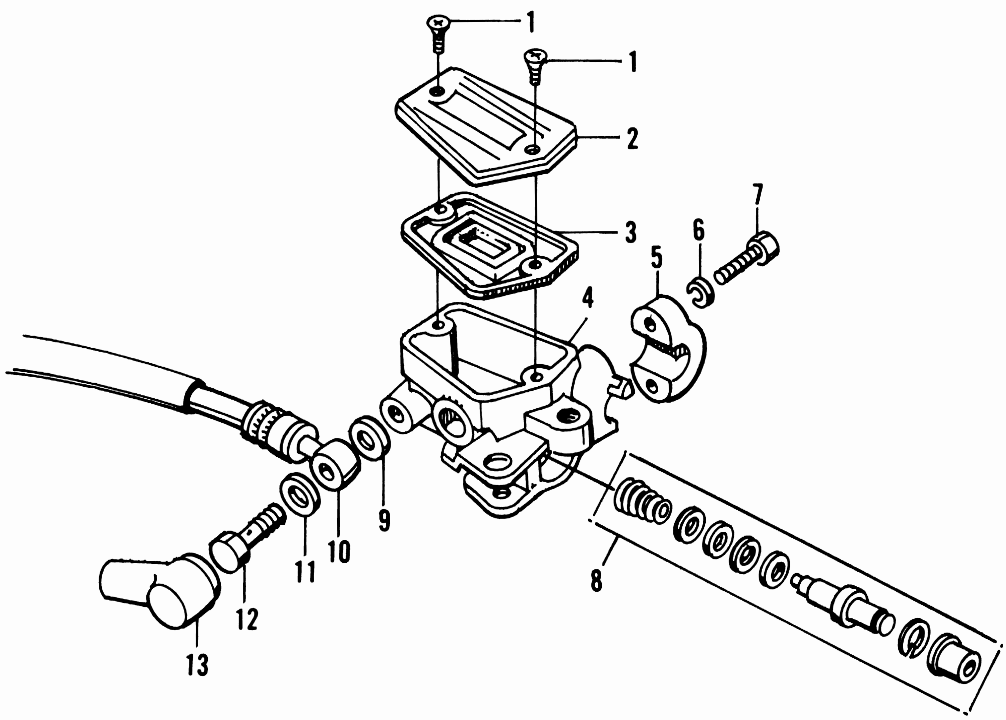
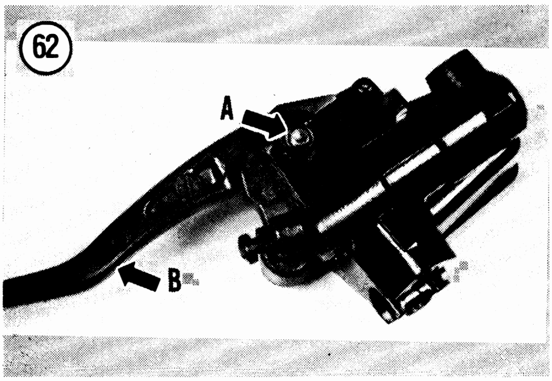
CLUTCH MASTER CYLINDER



1. Screw
2. Cover
3. Diaphragm
4. Body
5. Clamp
6. Lockwasher
7. Bolt
8. Piston assembly
9. Sealing washer
10. Clutch hose
11. Sealing washer
12. Union bolt
13. Rubber boot



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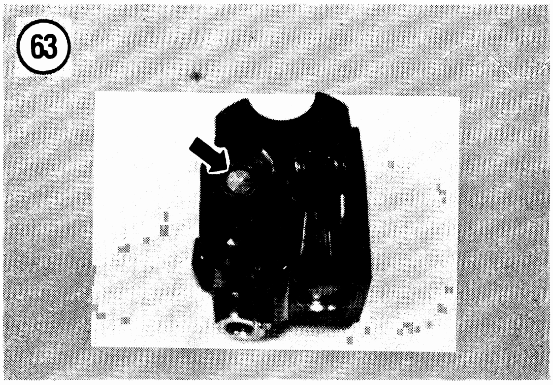
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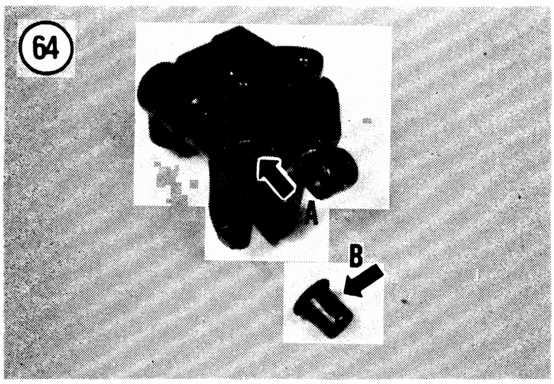

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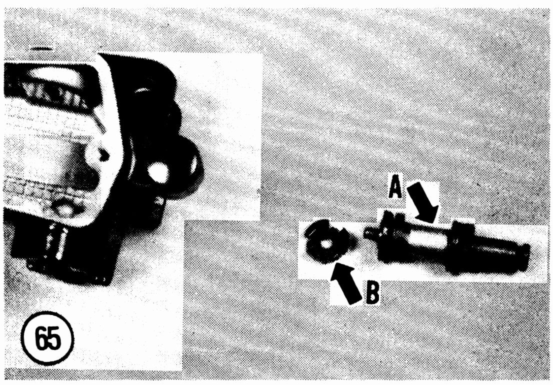

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4. Disconnect the electrical connector to the clutch switch (B, **Figure 58**).
5. Remove the clamping bolts, lockwashers and the clamp (A, **Figure 59**) securing the clutch master cylinder to the handlebar and remove the clutch master cylinder (C, **Figure 58**).
6. Install the clamp with the UP arrow facing up (B, **Figure 59**), lockwashers and the clamp bolts (A, **Figure 59**). Tighten the bolts to the torque specification listed in **Table 2**.
7. Install the clutch hose to the clutch master cylinder. Be sure to place a new sealing washer on each side of the fitting and install the union bolt (A, **Figure 58**). Tighten the union bolt to the torque specification listed in **Table 2**.
8. Attach the electrical connector (B, **Figure 58**) to the clutch switch.
9. Turn the handlebar to level the clutch master cylinder. Clean the top of the clutch master cylinder of all dirt and foreign matter. Remove the screws (A, **Figure 60**) securing the cover and remove the cover (B, **Figure 60**) and diaphragm. Fill the reservoir almost to the top line; insert the diaphragm and install the cover loosely.
10. Bleed the clutch as described in this chapter.

Disassembly

Refer to **Figure 61** for this procedure.
1. Remove the clutch master cylinder as described in this chapter.
2. Remove the pivot bolt and nut (A, **Figure 62**) securing the clutch lever and remove the lever (B, **Figure 62**).
3. Remove the screws securing the cover and remove the cover and diaphragm; pour out any residual hydraulic fluid and discard it. *Never* reuse hydraulic fluid.
4. Remove the rubber dust boot (**Figure 63**).
5. Using circlip pliers, remove the internal circlip (A, **Figure 64**) from the body.
6. Remove the piston assembly (A, **Figure 65**) and spring (**Figure 66**).
7. Remove the seat (B, **Figure 65**) from the piston.
8. Remove the clutch switch if necessary.

Inspection

1. Clean all parts (**Figure 67**) in denatured alcohol or fresh hydraulic fluid.

2. Check the cylinder bore and piston contact surfaces for wear or damage. If either part is less than perfect, replace it.
3. Check the end of the piston for wear caused by the hand lever pushrod. Replace the piston if necessary.
4. Check both the primary cup (A, **Figure 68**) and the secondary cup (B, **Figure 68**) for damage, swelling or softness. Replace the piston assembly if necessary. Yamaha recommends replacing the piston assembly every 2 years.
5. Check the hand lever pivot bore in the clutch master cylinder. If worn or elongated, the master cylinder must be replaced.
6. Inspect the pivot bore (**Figure 69**) in the hand lever. If worn or elongated it must be replaced.
7. Make sure the passages in the bottom of the fluid reservoir (**Figure 70**) are clear.
8. Check the reservoir cover (A, **Figure 71**) and diaphragm (B, **Figure 71**) for damage and deterioration and replace as necessary.

Assembly

1. Soak the new cups in fresh hydraulic fluid for at least 15 minutes to make them pliable. Coat the inside of the cylinder with fresh fluid prior to assembly of parts.

CAUTION
When installing the piston assembly, do not allow the cups to turn inside out as they will be damaged and allow clutch fluid leakage within the cylinder bore.

2. Install the spring into the master cylinder with the small end facing toward the piston assembly (**Figure 66**).

3. Install the piston assembly into the master cylinder (**Figure 65**).

4. Compress the piston assembly slightly and install the circlip (A, **Figure 64**) with circlip pliers. Make sure the circlip seats in the housing groove completely.

5. Install the rubber dust boot (B, **Figure 64**). Make sure the dust boot is firmly seated in the master cylinder.

6. Install the clutch lever (B, **Figure 62**) onto the master cylinder body. Then secure the lever with the

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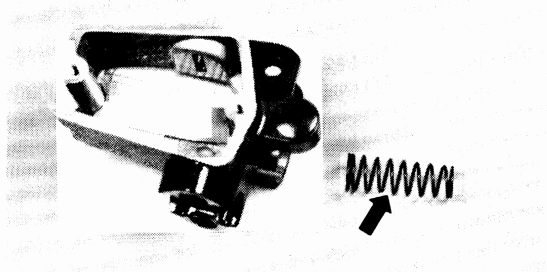

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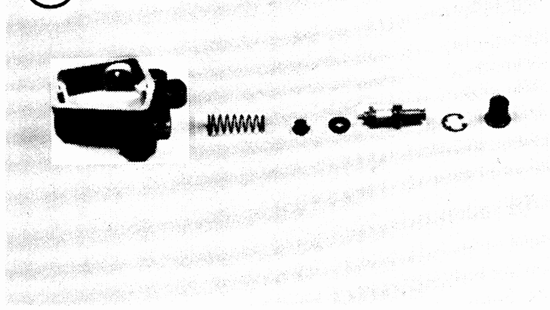

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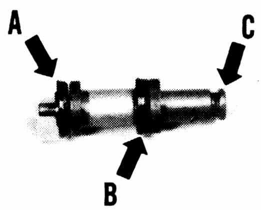

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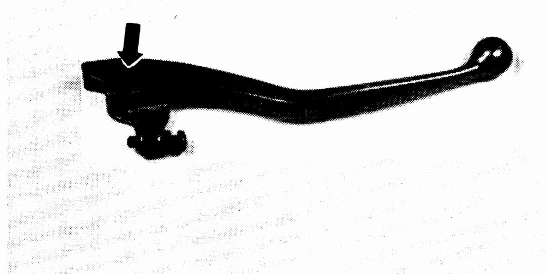
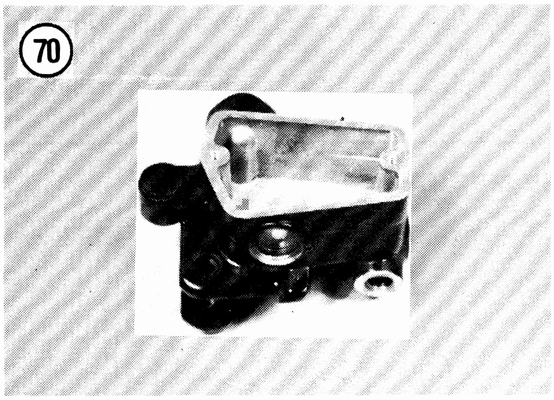


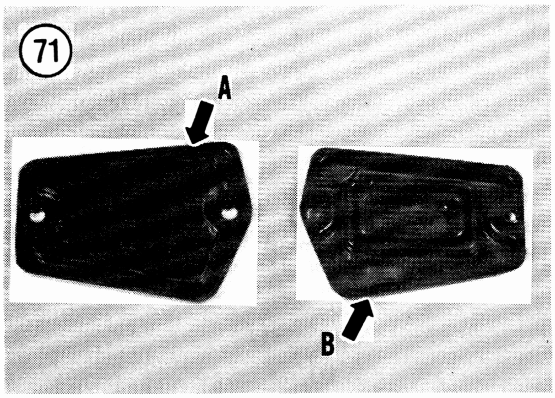
bolt and nut (A, **Figure 62**). Tighten the nut securely. Check that the lever pivots easily.

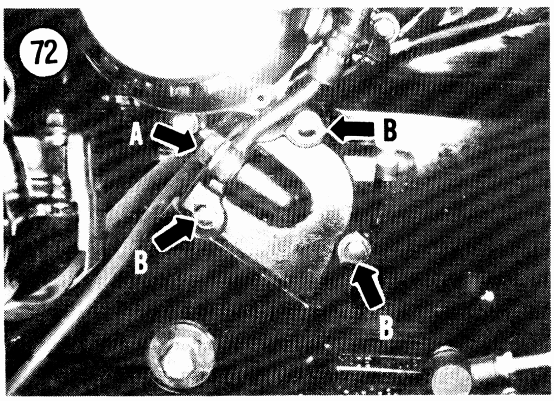
7. Install the diaphragm and cover. Do not tighten the cover screws at this time as fluid will have to be added later.

8. If removed, install the clutch switch.

9. Install the clutch master cylinder and bleed the clutch system as described in this chapter.







SLAVE CYLINDER

Removal/Installation

1. Drain the clutch master and slave cylinders as follows:
   a. Attach a hose to the slave cylinder bleed screw (**Figure 56**).
   b. Place the end of the hose in a clean container.
   c. Open the bleed screw and operate the clutch lever to drain all hydraulic fluid from the master cylinder reservoir.
   d. Close the bleed screw and disconnect the hose.

WARNING
Dispose of this fluid—never reuse hydraulic fluid. Contaminated fluid can cause clutch failure.

   e. Discard the hydraulic fluid.

2. Place a piece of wood between the clutch lever and the hand grip to hold the lever in the released position. Secure the piece of wood with a rubber band, tie wrap or tape. This will prevent the clutch lever from being applied accidentally after the clutch slave cylinder is removed from the crankcase.

NOTE
Do not operate the clutch lever after the slave cylinder is removed from the crankcase. If the clutch lever is applied it will force the piston out of the slave cylinder body and make installation difficult.

3. Place a container under the clutch hose at the clutch slave cylinder to catch any remaining fluid. Remove the union bolt and sealing washers (A, **Figure 72**) securing the clutch hose to the clutch slave cylinder. Remove the clutch hose and let any remaining fluid drain out into the container.
4. Remove the bolts (B, **Figure 72**) securing the clutch slave cylinder to the left-hand crankcase cover and withdraw the unit from the cover.
5. Installation is the reverse of these steps while noting the following:
   a. Tighten the slave cylinder bolts to the torque specification listed in **Table 2**.
   b. Install the union bolt and new sealing washers onto the slave cylinder. Tighten the union bolt to the torque specification listed in **Table 2**.
   c. Turn the handlebar to level the clutch master cylinder. Clean the top of the clutch master

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cylinder of all dirt and foreign matter. Remove the screws (A, **Figure 60**) securing the cover and remove the cover (B, **Figure 60**) and diaphragm. Fill the reservoir almost to the top line; insert the diaphragm and install the cover loosely.

d. Bleed the clutch as described in this chapter.

Disassembly/Inspection/Assembly

Refer to **Figure 73** for this procedure.

1. To remove the piston, perform the following:

a. Hold the slave cylinder body in your hand with the piston facing away from you. Place a clean shop cloth behind the piston.

WARNING

Do not use your hand to catch the piston as it is removed from the slave cylinder body.

b. Apply compressed air in the hole (**Figure 74**) where the union bolt was attached. The air pressure will force the piston out of the body.

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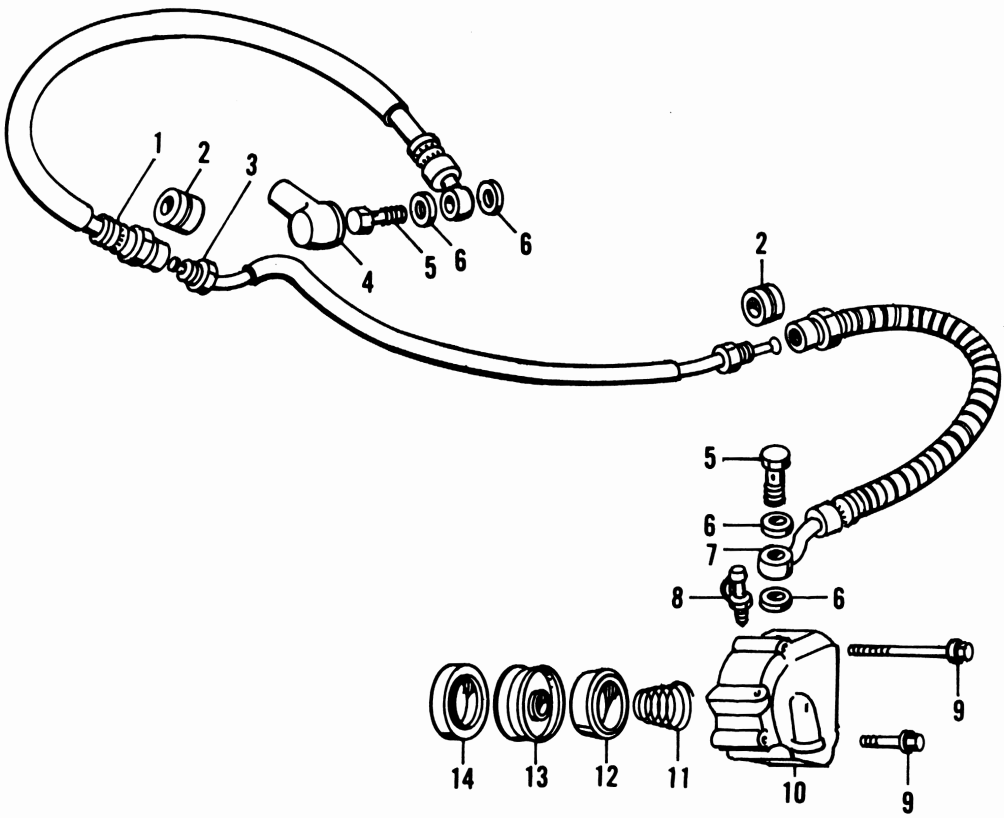
CLUTCH RELEASE MECHANISM



1. Upper flexible hose
2. Rubber grommet
3. Clutch pipe
4. Rubber boot
5. Union bolt
6. Sealing washer
7. Lower flexible hose
8. Bleed valve and cap
9. Bolt
10. Slave cylinder housing
11. Spring
12. Inner seal
13. Piston
14. Outer seal

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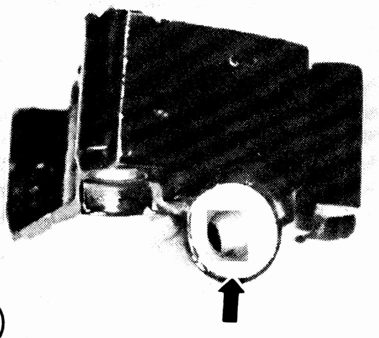

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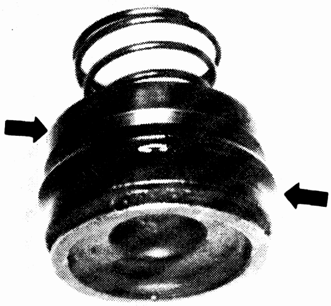

CAUTION
Be sure to catch the piston when it is pushed out of the body. Failure to do so will result in damage to the piston.

2. Remove the oil seals (**Figure 75**) from the piston and replace them.

3. Remove the spring (**Figure 76**) from the piston.

4. Check the spring for damage or sagging. Replace the spring if its condition is doubtful.

5. Check the piston and cylinder body (A, **Figure 77**) for scratches, severe wear or damage. Replace questionable parts.

6. Make sure the oil passageway (B, **Figure 77**) in the base of the cylinder body is clear.

7. Apply a light coat of hydraulic fluid to the piston and new piston seals prior to installation.

8. Install the seals (**Figure 75**) onto the piston.

9. Insert the piston into the slave cylinder (**Figure 78**) and push it down until it stops (**Figure 79**).

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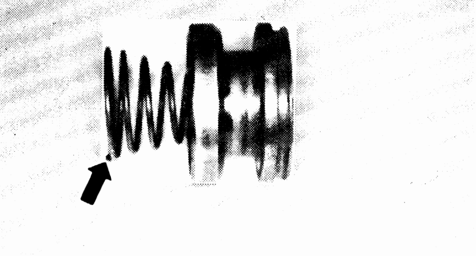

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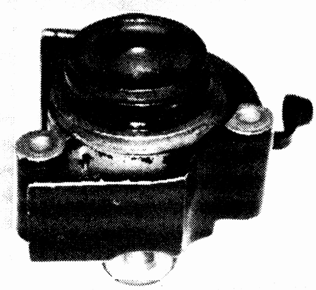

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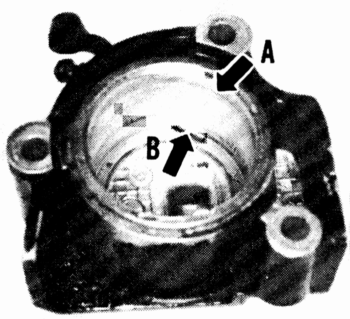

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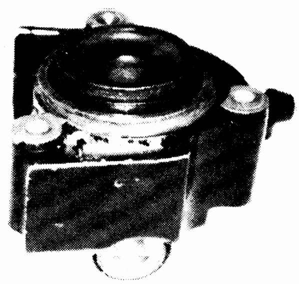

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BLEEDING THE CLUTCH

This procedure is not necessary unless the clutch feels spongy (air in the line), there has been a leak in the system, a component has been replaced or the hydraulic fluid is being replaced. If the clutch operates when the engine is cold or in cool weather but operates erratically (or not at all) after the engine warms up or in hot weather, there is air in the hydraulic line and the clutch must be bled.

CAUTION
Throughout the text, reference is made to hydraulic fluid. Hydraulic fluid is the same as DOT 3 brake fluid. Use only DOT 3 (or DOT 4) brake fluid; do ***not*** *use other types of fluids as they are not compatible. Do not intermix silicone-based (DOT 5) brake fluid as it can cause clutch component damage leading to clutch system failure.*

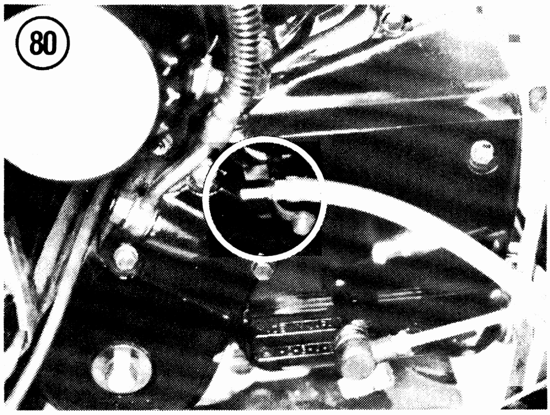
1. Remove the dust cap from the bleed valve on the clutch slave cylinder.
2. Connect a length of clear tubing to the bleed valve (**Figure 80**).
3. Place the other end of the tube into a clean container. Fill the container with enough fresh hydraulic fluid to keep the end submerged. The tube should be long enough so that a loop can be made higher than the bleed valve to prevent air from being drawn into the clutch slave cylinder during bleeding.

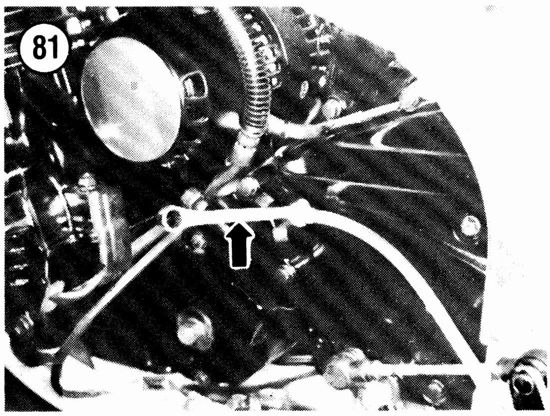
CAUTION
Cover the clutch slave cylinder and lower frame with a heavy cloth or plastic tarp to protect them from accidental fluid spilling. Wash any fluid off of any painted or plated surface immediately, as it will destroy the finish. Use soapy water and rinse completely.

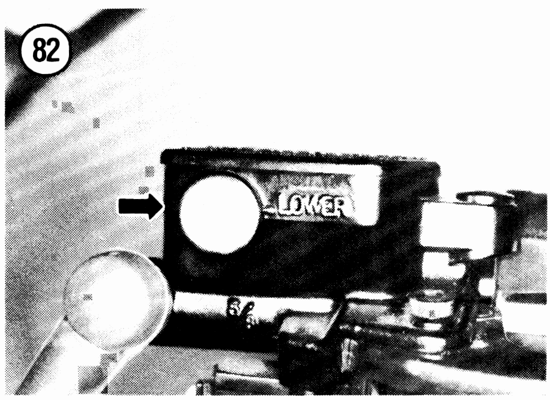
4. Clean the top of the clutch master cylinder of all dirt and foreign matter. Remove the screws (A, **Figure 60**) securing the cover and remove the cover (B, **Figure 60**) and diaphragm. Fill the reservoir almost to the top. Insert the diaphragm and install the cover loosely.

CAUTION
Failure to install the diaphragm on the master cylinder will allow fluid to spurt out when the clutch lever is applied.

CAUTION
Use hydraulic fluid clearly marked DOT 3 (or DOT 4) only. Others may vaporize and cause clutch failure. Always use the same brand name; do not intermix as many brands are not compatible. Do not intermix silicone-based (DOT 5) brake fluid as it can cause clutch component damage leading to clutch system failure.







5. Slowly apply the clutch lever several times. Hold the lever in the applied position. Open the bleed valve about one-half turn with a wrench (**Figure 81**). Allow the lever to travel to its limit. When the limit is reached, tighten the bleed valve. Occasionally tap or jiggle the clutch flexible hoses to loosen any trapped air bubbles that won't come out the normal way. As the fluid enters the system, the level will drop in the reservoir. Maintain the level at the top of the reservoir to prevent air from being drawn into the system.

6. Repeat Step 5 until fluid emerging from the hose is completely free of bubbles.

NOTE
Do not allow the reservoir to empty during the bleeding operation or air will enter the system. If this occurs, the entire procedure must be repeated.

7. Hold the lever in, tighten the bleed valve, remove the bleed tube and install the bleed valve dust cap.

8. If necessary, add fluid to correct the level in the reservoir. It should be above the lower level line (**Figure 82**).

9. Install the diaphragm and reservoir cover. Install and tighten the screws securely.

10. Test the feel of the clutch lever. It should be firm and should offer the same resistance each time it's operated. If it feels spongy, it is likely that there still is air in the system and it must be bled again. When all air has been bled from the system and the fluid level is correct in the reservoir, double-check for leaks and tighten all the fittings and connections.

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Table 1 CLUTCH SPECIFICATIONS

Item	Standard	Minimum
Friction plate (8)		
Thickness	2.9-3.1 mm (0.1142-0.1220 in.)	2.8 mm (0.11 in.)
Clutch plate (7)		
Thickness	1.9-2.1 mm (0.0748-0.0827 in.)	—
Warp limit	—	0.1 mm (0.004 in.)
Clutch spring		
Free height	6.5 mm (0.256 in.)	36.0 mm (0.236 in.)
Warp limit	—	0.1 mm (0.004 in.)
Push rod bend limit	—	0.3 mm (0.012 in.)
Clutch hydraulic fluid	Brake fluid DOT 3 or DOT 4	

Table 2 CLUTCH TIGHTENING TORQUES

	N•m	ft.-lb.
Clutch nut	70	50
Clutch spring No. 2 bolts	8	5.8
Clutch master cylinder		
Clamp bolt	9	6.5
Union bolt	26	19
Slave cylinder		
Mounting bolts	10	7.2
Bleed screw	6	4.3

CHAPTER SIX

TRANSMISSION AND SHIFT MECHANISM

This chapter covers all the parts that transmit power from the clutch to the drive chain; engine drive sprocket, transmission gears, shift drum and forks and the gearshift linkage.

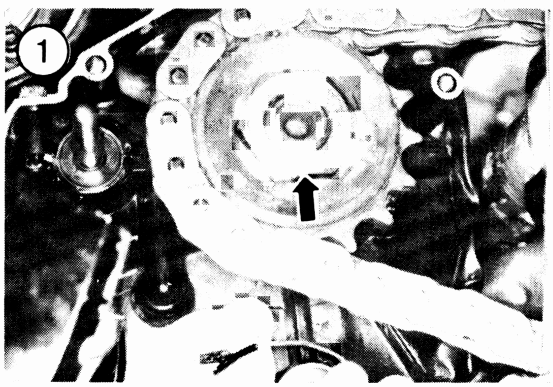
Torque specifications are listed in **Table 1** at the end of the chapter.

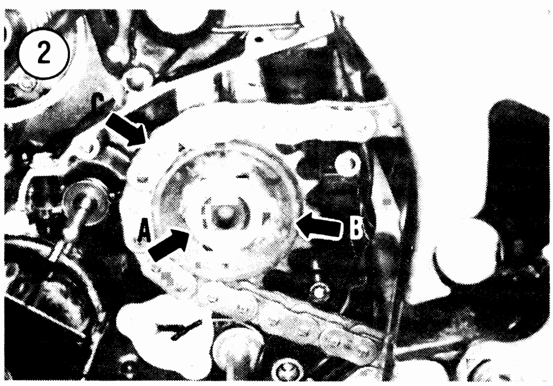
ENGINE SPROCKET

The engine sprocket is on the left-hand end of the transmission countershaft, behind the left-hand crankcase cover. The drive chain is endless—it has no master link. To remove the drive chain, remove the engine sprocket from the countershaft and remove the swing arm; see *Rear Swing Arm Removal/Installation* in Chapter Ten.

Removal/Installation

1. Place the bike securely on the centerstand with the rear wheel clear of the ground.
2. Remove the left-hand crankcase cover as described in Chapter Four
3. Straighten the locking tab (**Figure 1**) on the sprocket nut lockwasher.
4. Have an assistant apply the rear brake and loosen the drive sprocket nut (A, **Figure 2**). Remove the nut and lockwasher.
5. Loosen the drive chain adjusting locknuts (A, **Figure 3**) and adjust nuts (B, **Figure 3**).
6. Remove the cotter pin (A, **Figure 4**) then loosen the rear axle nut (B, **Figure 4**).

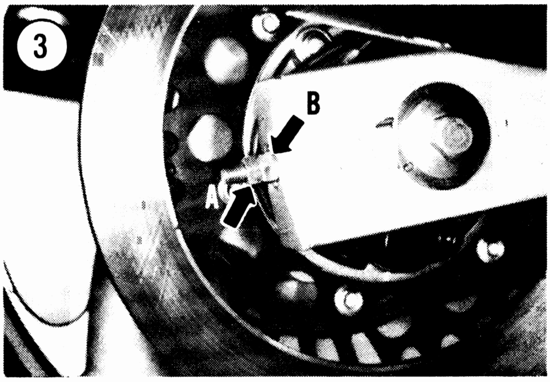


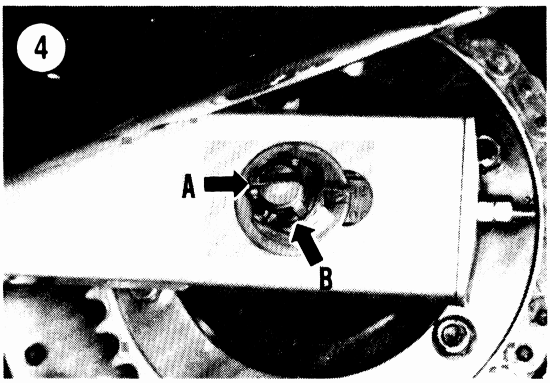


7. Push the rear wheel forward to allow slack in the drive chain.

8. Slide the drive sprocket (B, **Figure 2**) and drive chain (C, **Figure 2**) off the transmission shaft.

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





a. Position the drive chain on the sprocket, then slide the sprocket along with the drive chain onto the countershaft.
b. Install a new sprocket lockwasher.
c. Install the sprocket nut and tighten to the torque specification listed in **Table 1**.
d. Bend the lockwasher tab over the sprocket to lock the nut.
e. Adjust the drive chain. See *Drive Chain Adjustment* in Chapter Three.

Inspection

Inspect the driven sprocket teeth (**Figure 5**). If the teeth are visibly worn or undercut, replace both the drive and driven sprockets and the drive chain. Never replace any one sprocket or chain as a separate item; worn parts will cause rapid wear of the new component.

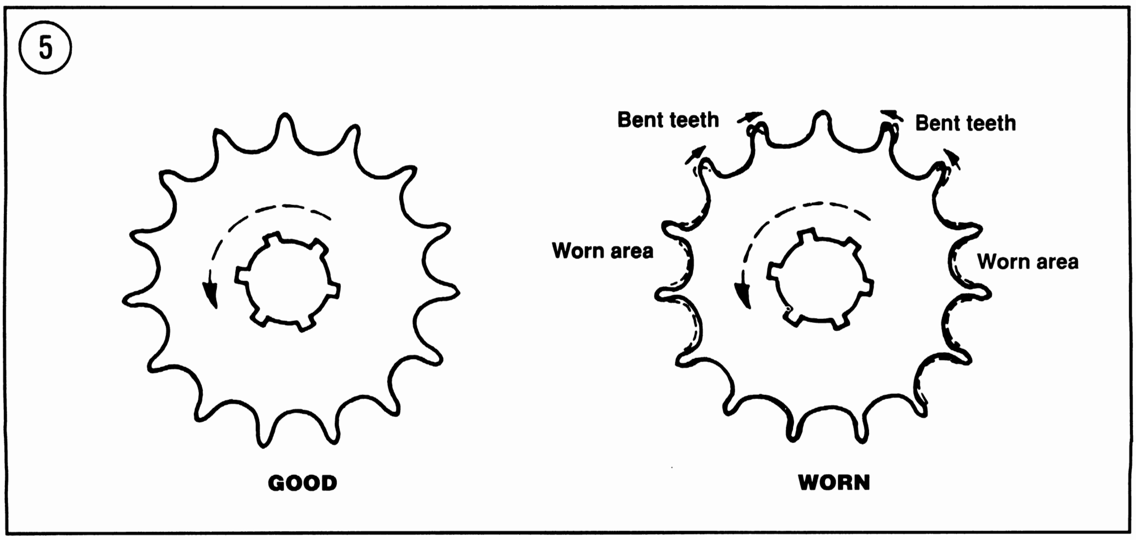
EXTERNAL SHIFT MECHANISM

The external shift mechanism can be removed with the engine in the frame. This procedure is shown with the engine removed from the frame for clarity.

Removal/Installation

Refer to **Figure 6** for this procedure.

1. Drain the engine oil as described in Chapter Three.



2. Remove the clutch as described in Chapter Five.

3. Remove the left-hand crankcase cover as described in Chapter Four.

4. Remove the E-clip (**Figure 7**) from the end of the shift shaft.

5. Move the shift linkage arms out of engagement with the shift drum and pull the shift shaft assembly (**Figure 8**) out of the crankcase. Don't lose the washer (**Figure 9**) on the shaft.

Inspection

1. If the transmission fails to shift gears, check the shift shaft for a weak pawl spring; bent, worn or binding pawls (**Figure 10**); a broken return spring (**Figure 11**); a broken return spring pin; or worn shift drum pins.

2. If the transmission undershifts or overshifts, check for bent or worn pawls; worn shift drum pins;

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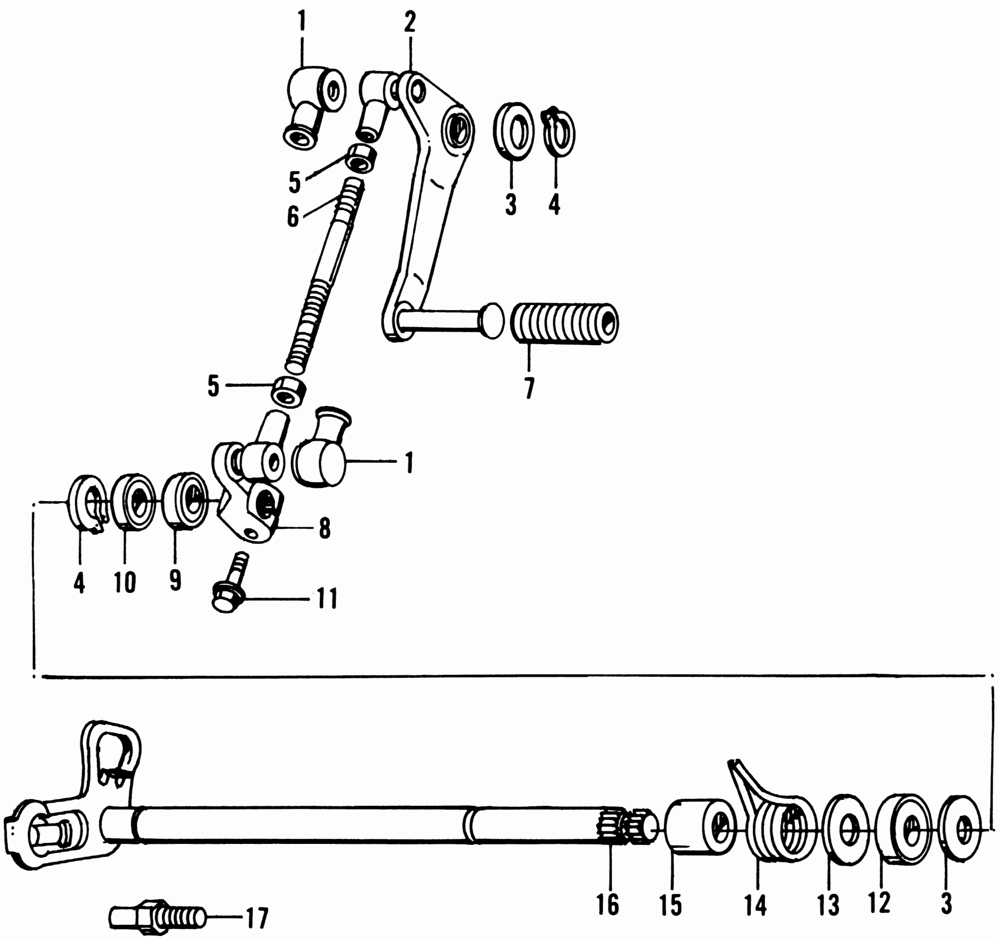
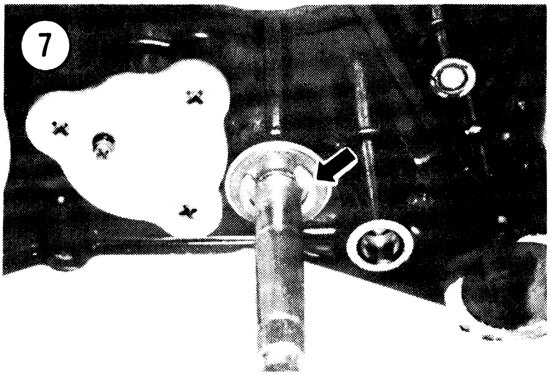
EXTERNAL GEARSHIFT MECHANISM



1. Rubber boot
2. Shift pedal
3. Washer
4. Circlip
5. Locknut
6. Shift rod
7. Pedal cover
8. Shift arm
9. Oil seal
10. Oil seal
11. Bolt
12. Oil seal
13. Washer
14. Spring
15. Collar
16. Shift shaft
17. Crankcase post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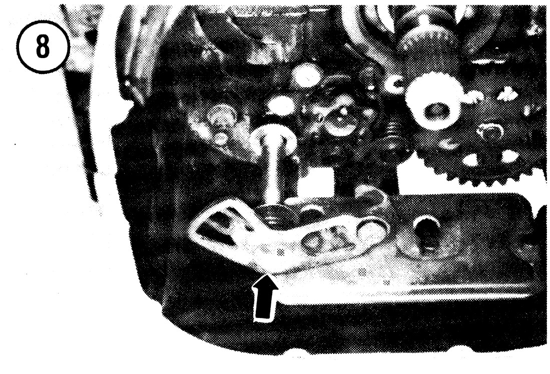
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a loose return spring pin; a bent or weak return spring; or worn stopper lever spring or roller.

3. Replace any other broken, bent, binding or worn parts, including the shift drum pin assembly.

NOTE

If the shift drum pins are worn or damaged, it will be necessary to replace the shift drum assembly as described in this chapter.

4. Inspect the shift shaft assembly (**Figure 12**) for bending, wear or other damage; replace if necessary.

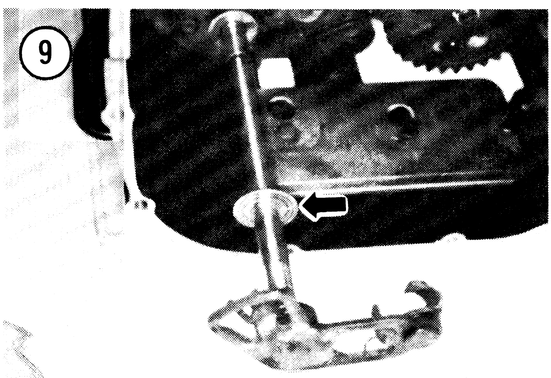
Installation

Refer to **Figure 6** for this procedure.

1. Make sure the washer (**Figure 9**) is in place on the shift shaft.

2. Insert the shift shaft (**Figure 8**) partway through the crankcase.

3. Engage the return spring ends with the crankcase post (**Figure 13**) and push the shift shaft all the way in until it bottoms out.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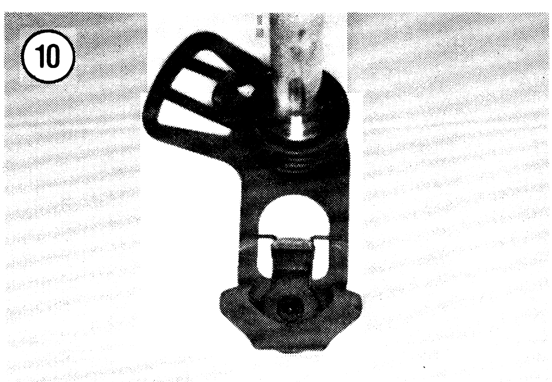
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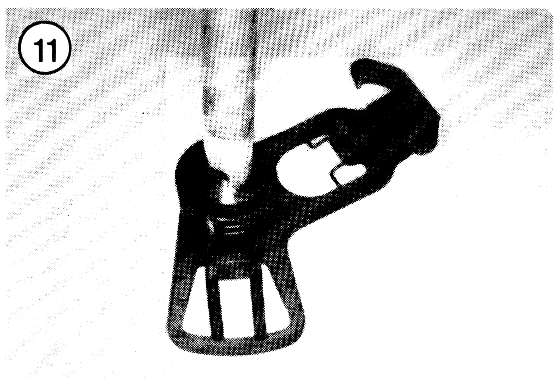
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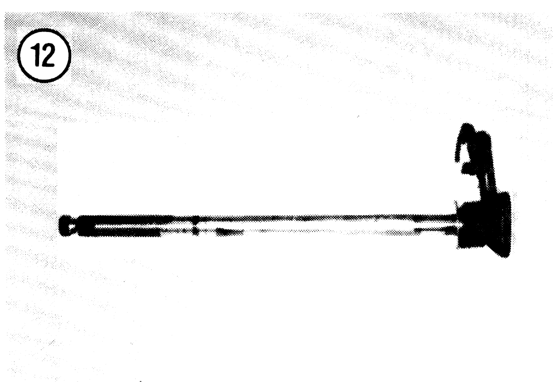
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4. Install the washer (**Figure 14**) and install the E-clip (**Figure 15**) onto the end of the shift shaft. Make sure the E-clip is properly seated in the shaft groove (**Figure 7**).
5. Install the clutch as described in Chapter Five.
6. Install the left-hand crankcase cover as described in Chapter Four.
7. Refill the engine with the recommended type and quantity of oil as described in Chapter Three.

TRANSMISSION GEARS

Removal

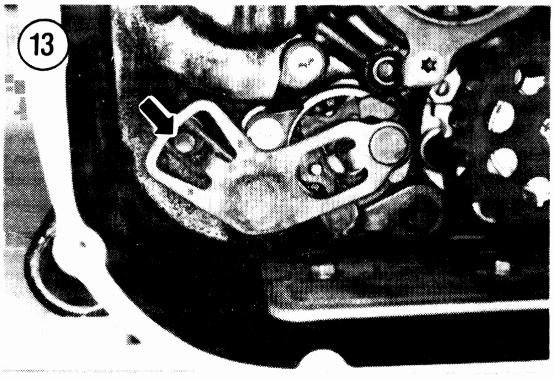
1. Remove the engine and split the crankcase as described under *Crankcase Disassembly* in Chapter Four.

NOTE
It is not necessary to remove crankshaft assembly when removing the transmission shafts.

2. Carefully lift up and remove the countershaft (**Figure 16**) and then the main shaft (**Figure 17**) from the upper crankcase.
3. Remove the single countershaft bearing set ring (**Figure 18**) from the upper crankcase.

Installation

1. Prior to installing any components, coat all bearing surfaces with assembly oil.
2. Install the main shaft assembly into the upper crankcase (**Figure 17**).
3. Rotate the left-hand bearing until the locating pin is at a 90° angle to the crankcase mating surface (**Figure 19**). Also check that the index mark on the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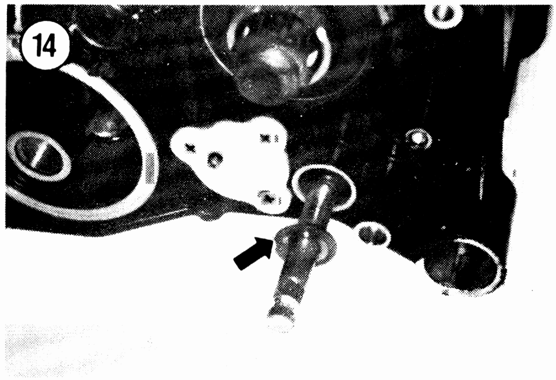
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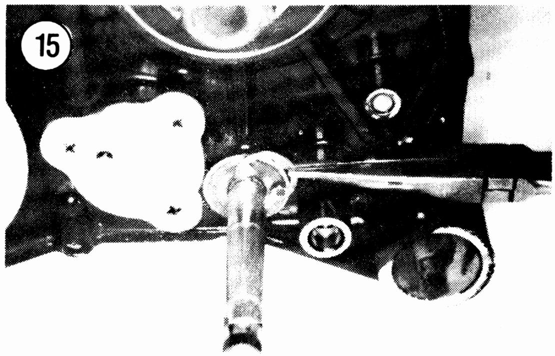
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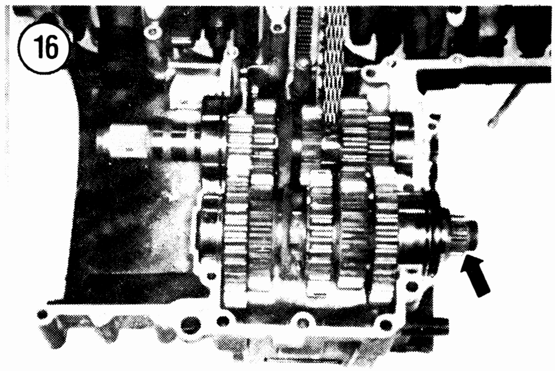
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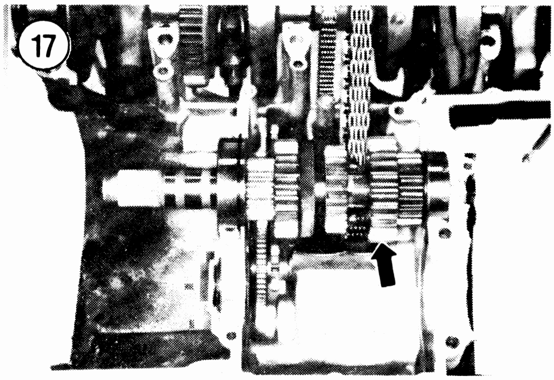
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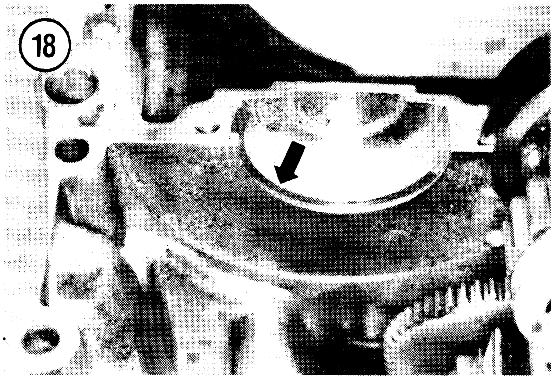

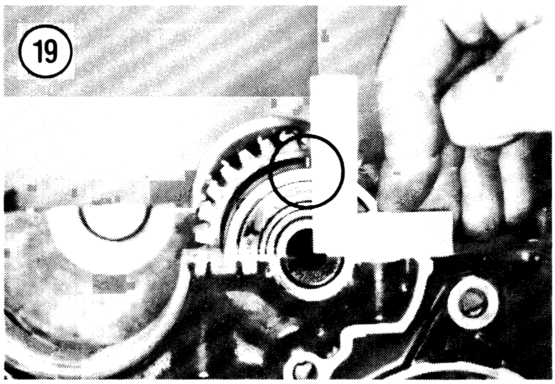

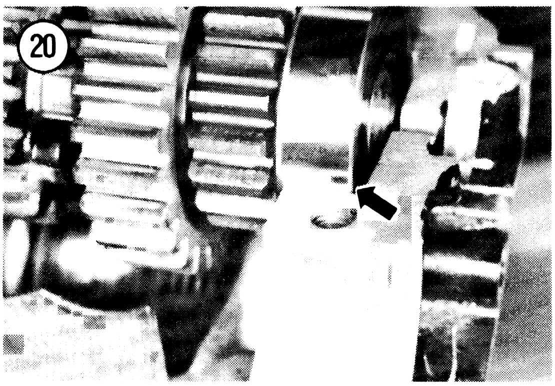

bearing outer race is flush with the crankcase mating surface (**Figure 20**). This alignment is necessary since this pin goes into a mating hole in the lower crankcase half when the crankcase is assembled.

CAUTION

If the countershaft bearing does not engage the transmission bearing set rings correctly, there will be excessive clearance between the crankcase and the outer bearing race.

CAUTION

If the transmission bearing set ring is left out, the transmission will disengage during riding.

4. Install the single countershaft bearing set ring (**Figure 18**) into the upper crankcase.
5. Install the countershaft into the upper crankcase (**Figure 16**). Check that the bearing set ring is properly indexed into the groove in the transmission right-hand bearing (A, **Figure 21**).
6. Rotate the right-hand bearing until the locating pin is at a 90° angle to the crankcase mating surface (**Figure 22**). Also check that the index mark on the bearing outer race is flush with the crankcase mating surface (B, **Figure 21**). This alignment is necessary since this pin goes into a mating hole in the lower crankcase half when the crankcase is assembled.
7. Make sure the left-hand bearing set ring (A, **Figure 23**) is properly indexed into the groove in the crankcase and that the oil seal (B, **Figure 23**) is properly seated.
8. If removed, install the clutch long pushrod oil seal (**Figure 24**) in the upper crankcase.
9. Shift the transmission gears into the NEUTRAL position (**Figure 25**). This is necessary so the shift

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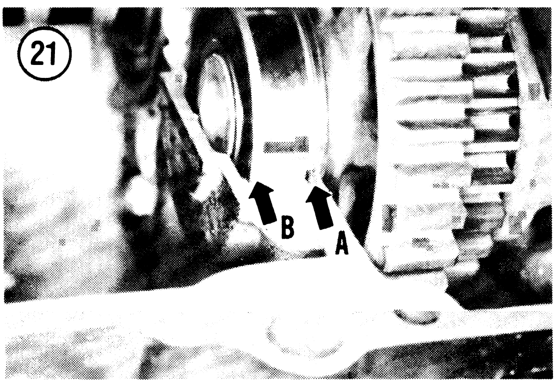
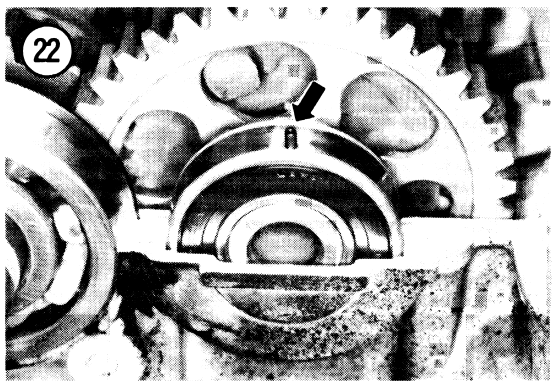




forks can engage the shaft assemblies properly during crankcase assembly.

10. Assemble the crankcase and install the engine as described in Chapter Four.

Transmission Service Notes

1. A divided container, such as a restaurant type egg carton (**Figure 26**) can be used to help maintain correct alignment and positioning of the parts as they are removed from the transmission shaft.

2. The circlips are a tight fit on the transmission shafts. It is recommended to replace all circlips during reassembly.

3. Circlips will turn and fold over making removal and installation difficult. To ease replacement, open the circlips with a pair of circlip pliers while at the same time holding the back of the circlip with a pair of pliers and remove them. See **Figure 27**. Repeat for installation.

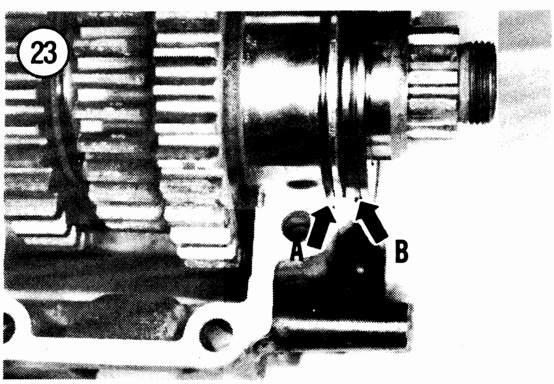
Main Shaft Disassembly

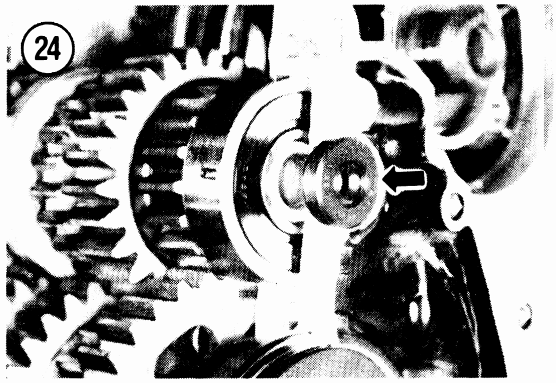
The main shaft disassembly and assembly procedure requires the use of a hydraulic press and insert to remove and install the second gear. If you don't have access to a press, have the second gear removed and installed by a machine shop.

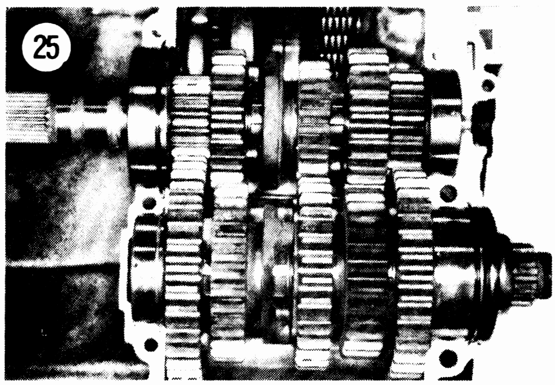
Refer to **Figure 28** for this procedure.

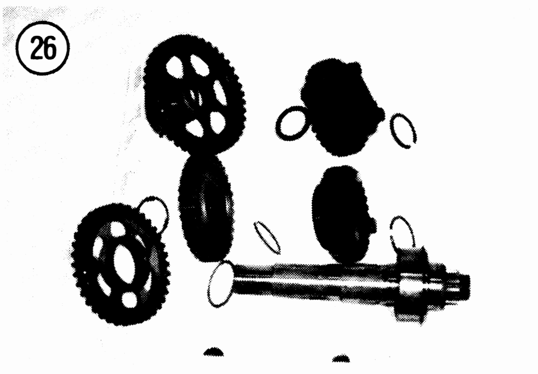
1. Remove the bearing (**Figure 29**) from the end of the shaft.

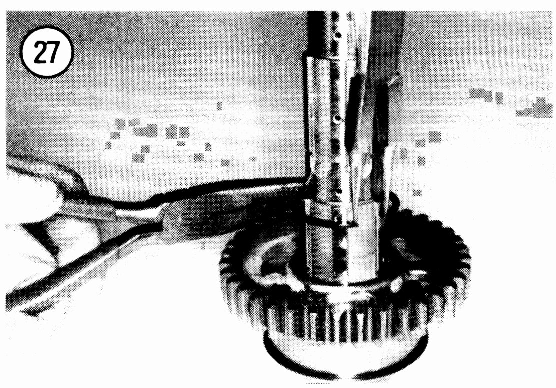
2. Install an insert (**Figure 30**) under the 5th gear and install the shaft and insert assembly in the hydraulic press.











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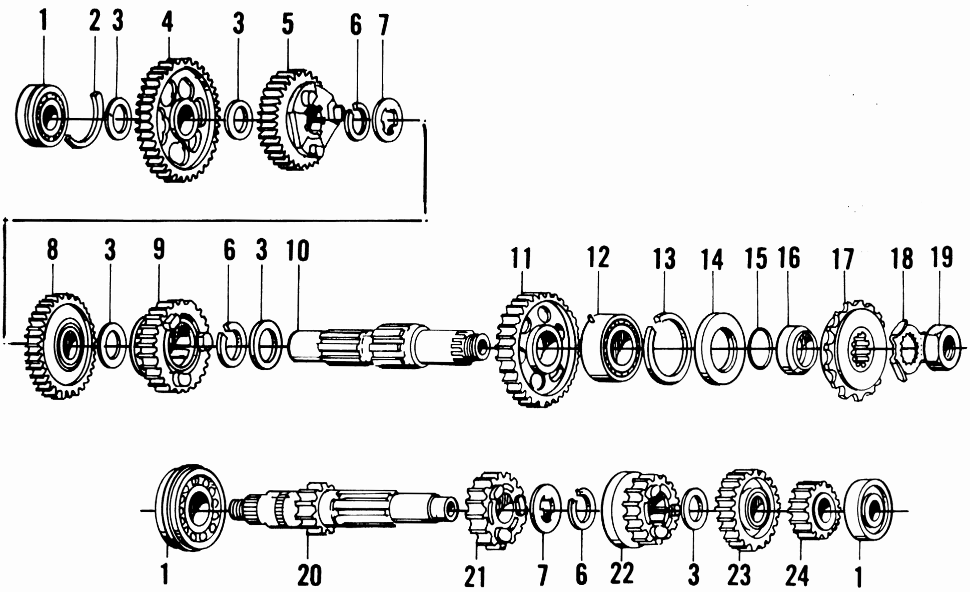
TRANSMISSION



1. Bearing
2. Bearing set ring
3. Thrust washer
4. Countershaft first gear
5. Countershaft forth gear
6. Circlip
7. Splined washer
8. Countershaft third gear
9. Countershaft fifth gear
10. Countershaft
11. Countershaft second gear
12. Bearing
13. Circlip
14. Oil seal
15. O-ring
16. Collar
17. Drive sprocket
18. Lockwasher
19. Nut
20. Main shaft/first gear
21. Main shaft forth gear
22. Main shaft third gear
23. Main shaft fifth gear
24. Main shaft second gear

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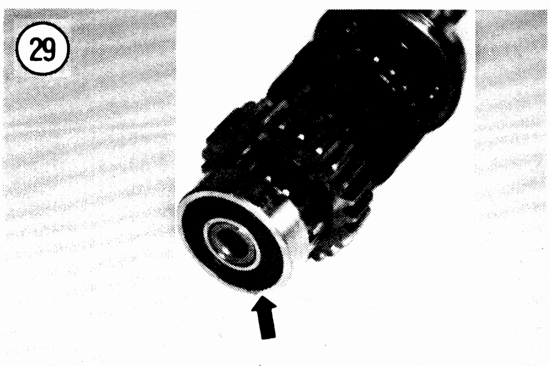

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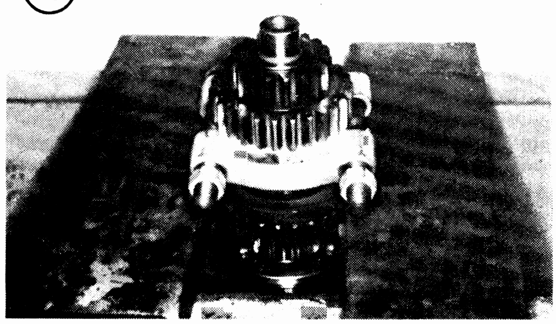

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3. Place a suitable size socket (A, **Figure 31**) on the end of the shaft. This socket must be small enough to pass through the inside diameter of the second gear (B, **Figure 31**) that is being pressed off.
4. While holding onto the transmission shaft assembly, slowly press the second gear off the shaft.
5. Release hydraulic pressure and remove the shaft assembly from the hydraulic press.
6. Slide off the fifth gear and remove the washer.
7. Slide off the third gear.
8. Remove the circlip and washer.
9. Slide off the fourth gear.
10. If necessary, press off the bearing (A, **Figure 32**) from the other end of the shaft.
11. Inspect the main shaft assembly as described in this chapter.

Main Shaft Assembly

1. If removed, press the bearing (A, **Figure 32**) onto the shaft.
2. Onto the other end of the shaft, install the fourth gear (**Figure 33**).

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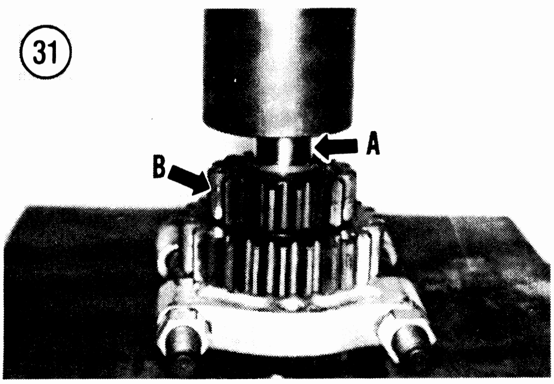

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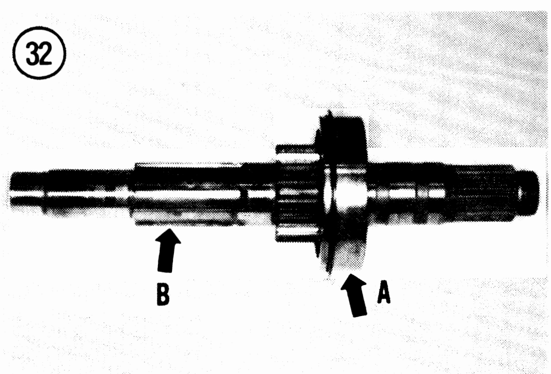

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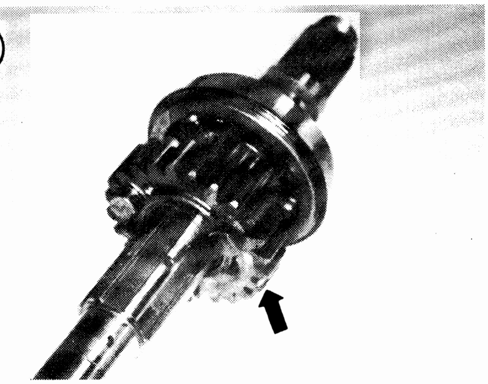

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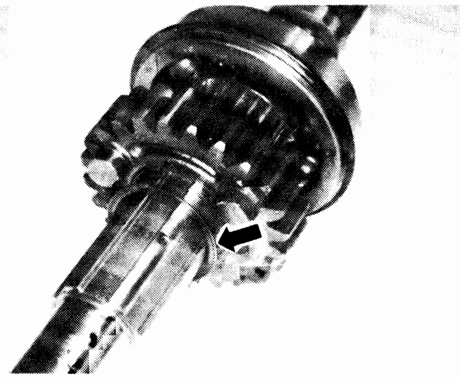

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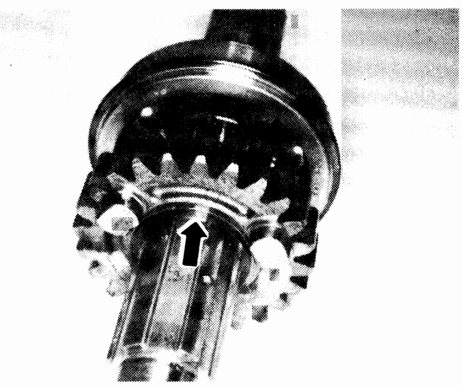

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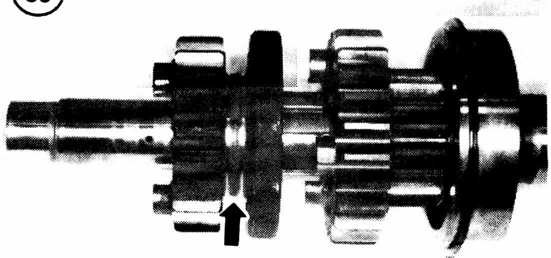

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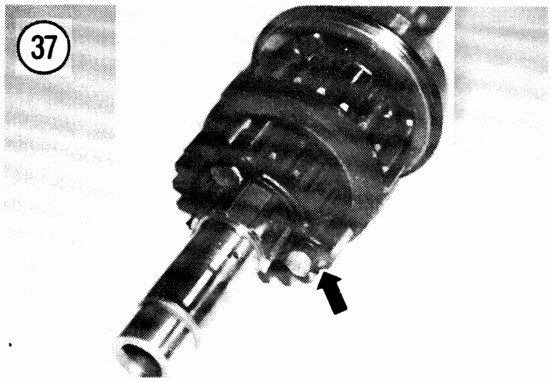

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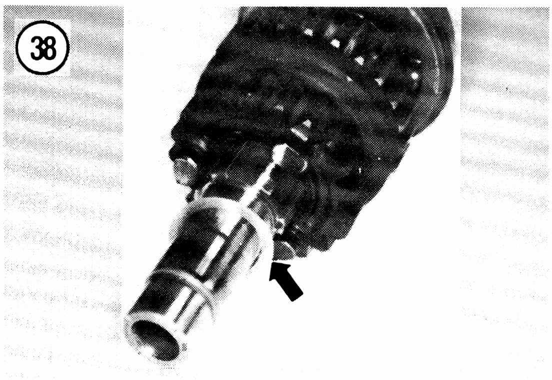

3. Install the splined washer (**Figure 34**) and circlip. Make sure the circlip is correctly seated in the shaft groove (**Figure 35**).
4. Position the third gear with the shift fork groove going on first (**Figure 36**) and slide on the third gear (**Figure 37**).
5. Slide on the washer (**Figure 38**).
6. Position the fifth gear with the engagement dog side going on first and install the fifth gear (**Figure 39**).
7. Apply a light coat of engine oil to the outer surface of the shaft and to the inner surface of the second gear. This will aid in the installation of the gear and to minimize the gear from "jumping" down while being pressed onto the shaft.
8. Position the second gear with the shoulder side (**Figure 40**) going on first and install the second gear (**Figure 41**) onto the shaft as far as it will go without force.
9. Install the shaft assembly in the hydraulic press on the press plate.
10. Place a suitable size socket (A, **Figure 42**), or piece of pipe or tubing on top of the second gear (B, **Figure 42**). The socket or tubing inner diameter

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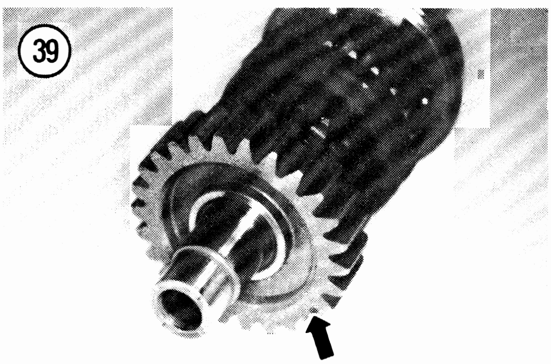

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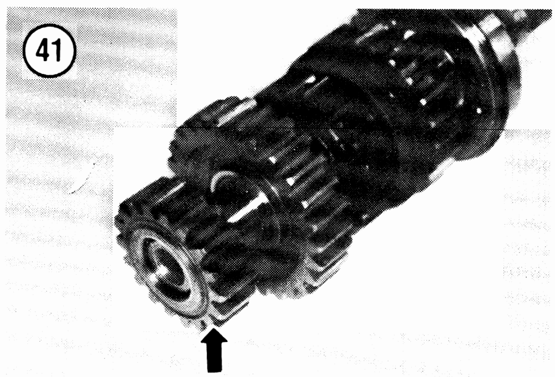

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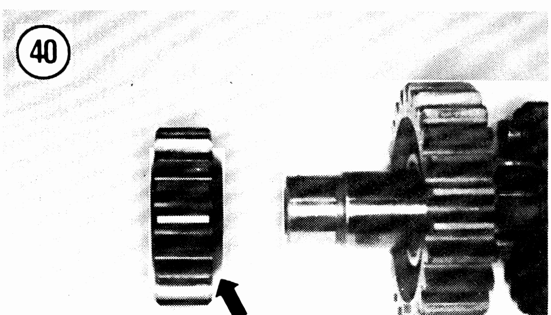

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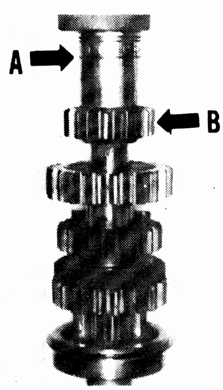

must be large enough to pass over the outer diameter of the shaft.

11. Slowly press the second gear onto the shaft until it approaches the fifth gear, then stop.

NOTE

Yamaha does not specify the clearance between the fifth and second gears, but the clearance of 0.05-0.06 mm is usually sufficient.

12. Insert a 0.05-0.06 mm flat feeler gauge either between the fifth and second gears or between the fifth gear and the main shaft shoulder (A, **Figure 43**).

CAUTION

If the gear is pressed on too far without sufficient clearance the fifth gear will not be able to rotate properly. If the gear "jumps" during the final pressure application, stop and partially press the gear back away from the sixth gear, then repeat pressing the gear on the rest of the way maintaining the proper clearance.

13. Continue to slowly apply hydraulic pressure and continue to check the clearance between the 2 gears with the feeler gauge. Press the gear on until this clearance is achieved.

14. After the second gear has been pressed on, hold the third gear (B, **Figure 43**) away from the fifth gear and spin the fifth gear (C, **Figure 43**) with your fingers to make sure it rotates freely.

15. Release hydraulic pressure and remove the shaft from the hydraulic press.

16. Install the bearing (**Figure 29**).

17. Refer to **Figure 44** for correct placement of all gears. Make sure the circlip is correctly seated in the shaft groove.

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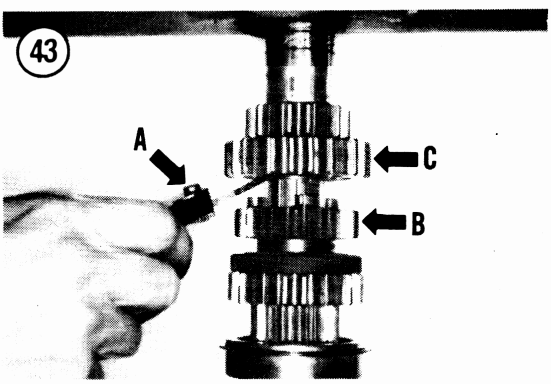

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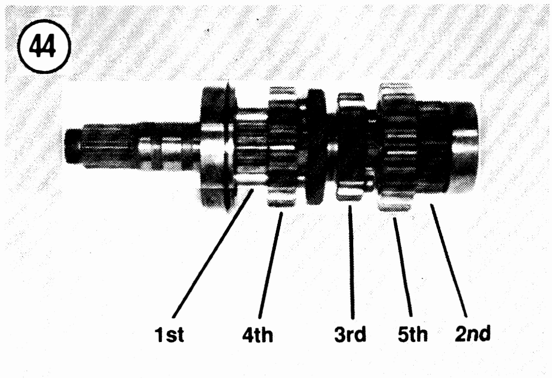

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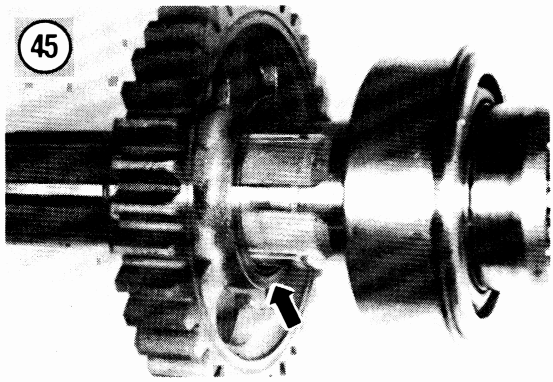

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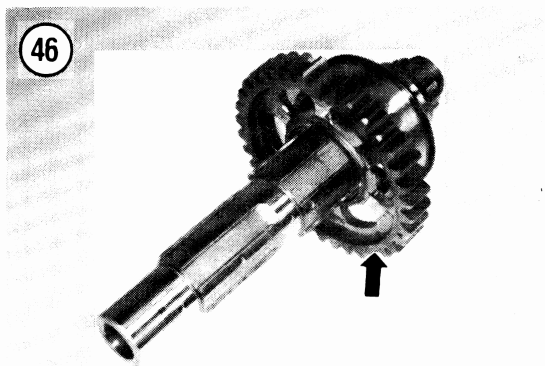

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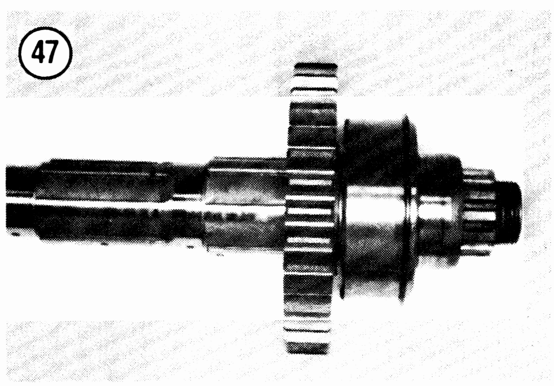

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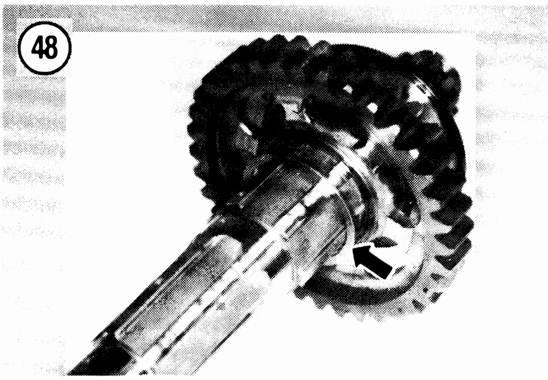

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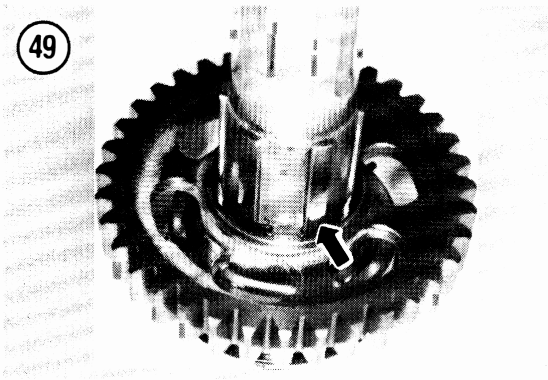

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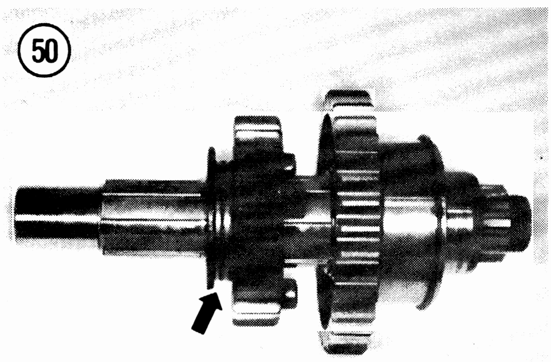

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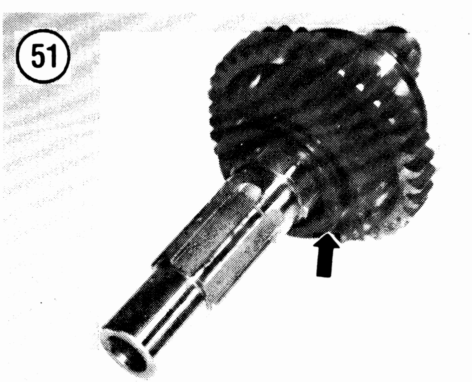

18. Make sure each gear engages properly to the adjoining gear where applicable.

Countershaft Disassembly

Refer to **Figure 28** for this procedure.

1. Remove the bearing and the thrust washer.
2. Slide off first gear and the fourth gear.
3. Remove the circlip and the splined washer.
4. Slide off the third gear, washer and the fifth gear.
5. Remove the circlip and the splined washer.
6. Slide off the second gear.
7. If still installed, remove the drive sprocket from the other end of the shaft.
8. Inspect the countershaft assembly as described in this chapter.

6

Countershaft Assembly

1. Position the second gear with the long shoulder (**Figure 45**) going first and install the second gear (**Figure 46**). After installation the relationship of gear to the bearing should look like **Figure 47**. If the second gear is installed backwards the gear will overlap the bearing as seen from straight on viewing.
2. Install the washer (**Figure 48**) and circlip (**Figure 49**). Make sure the circlip is correctly seated in the shaft groove.
3. Position the fifth gear with the shift fork groove (**Figure 50**) going on last and install the fifth gear (**Figure 51**).
4. Slide on the washer (**Figure 52**).
5. Position the third gear with the flush side going on first and install the third gear (**Figure 53**).

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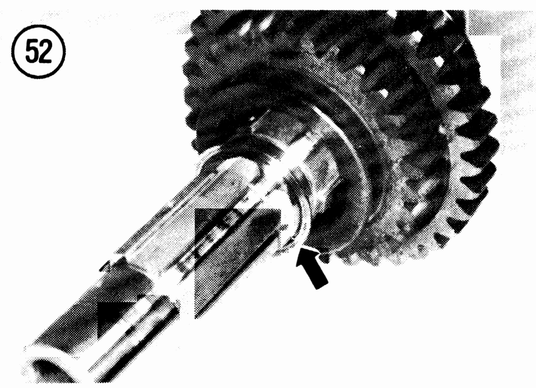


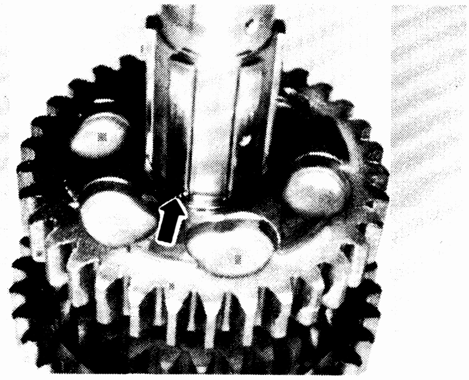
6. Install the splined washer (**Figure 54**) and circlip (**Figure 55**). Make sure the circlip is correctly seated in the shaft groove (**Figure 56**).

7. Position the fourth gear with the shift fork groove going on first and install the fourth gear (**Figure 57**).

8. Slide on the washer (**Figure 58**).

9. Position the first gear with the long shoulder (**Figure 59**) going on last and install the first gear (**Figure 60**).

10. Install the thrust washer (**Figure 61**) and bearing (**Figure 62**).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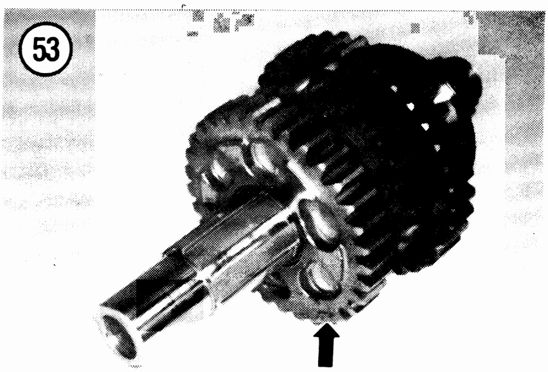
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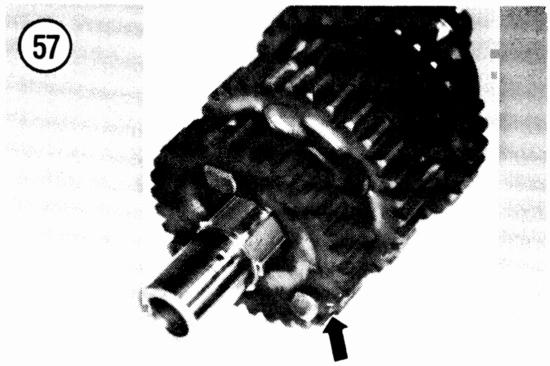
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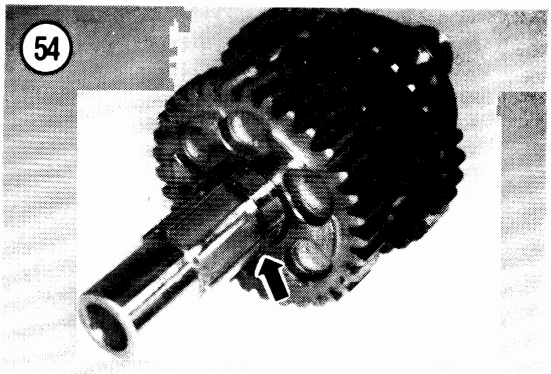
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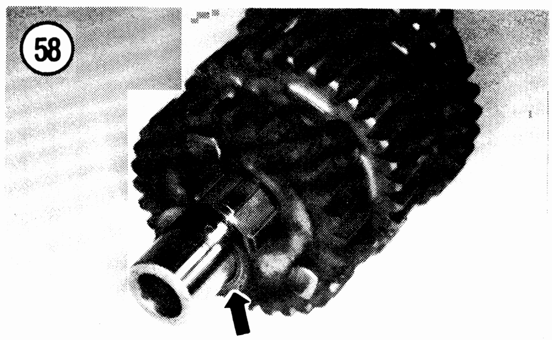
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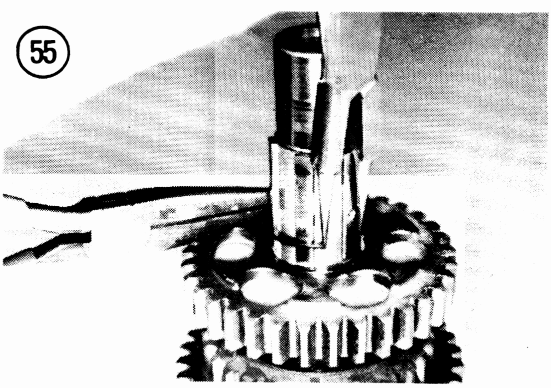
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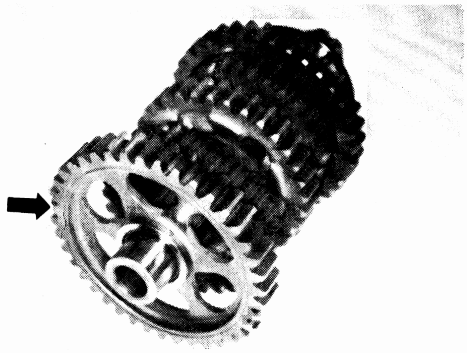

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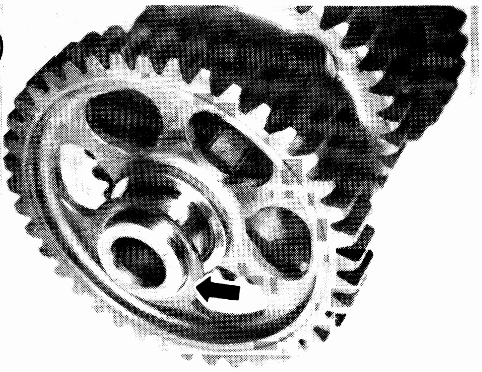

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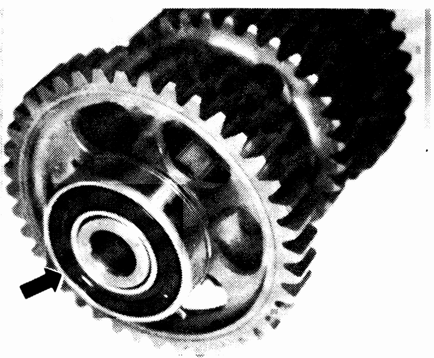

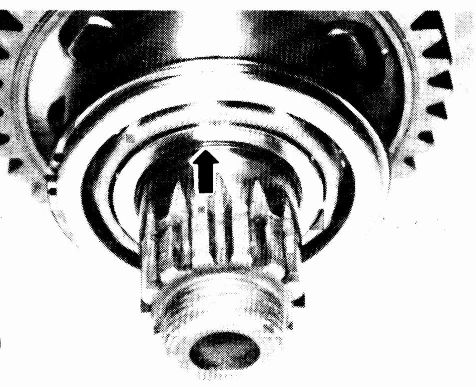

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11. Onto the other end of the shaft, perform the following:

a. Install a new O-ring (**Figure 63**) and push it up against the bearing inner race.

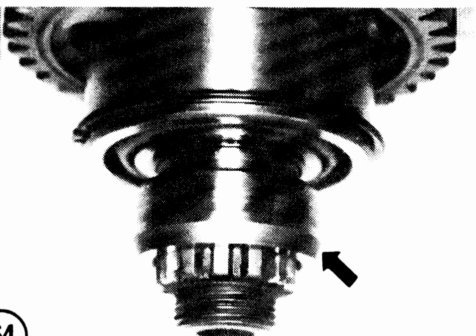
b. Position the collar with the beveled side (**Figure 64**) going on last and install the collar. This is necessary so the inner relief (**Figure 65**) allows room for the already installed O-ring.

c. Install the drive sprocket onto the shaft.

d. Install a new lockwasher and nut. Do not tighten the nut until the engine is reassembled and installed in the frame.

12. Refer to **Figure 66** for correct placement of all gears. Make sure the circlip is correctly seated in the shaft groove.

13. After both shafts are assembled, mesh them together (**Figure 67**) as they would be in the upper crankcase. Make sure each gear engages properly to the adjoining gear where applicable.



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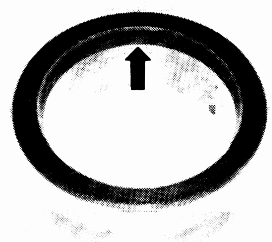

Inspection

1. Clean all parts in cleaning solvent and thoroughly dry.
2. Rotate the bearings (**Figure 68**) by hand and check for roughness or damage. Replace the bearing(s) if necessary.
3. Inspect the bearing set rings and locating pins (**Figure 69**) for wear or damage; replace if necessary.
4. Inspect the gears (**Figure 70**) visually for cracks, chips, broken teeth and burnt teeth.
5. Check the gear dogs (A, **Figure 71**) to make sure they are not rounded off. If dogs 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 on the other shaft 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.

6. Inspect all free wheeling gear bearing surfaces (**Figure 72**) for wear, discoloration and galling. Inspect the mating shaft bearing surface also. If there is any metal flaking or visual damage, replace both parts.
7. Inspect the countershaft (**Figure 73**) and the main shaft (B, **Figure 32**) splines for wear or discoloration. Check the mating gear internal splines also (B, **Figure 71**). If no visual damage is apparent, install each sliding gear on its respective shaft and work the gear back and forth to make sure the gear operates smoothly with no hesitation.

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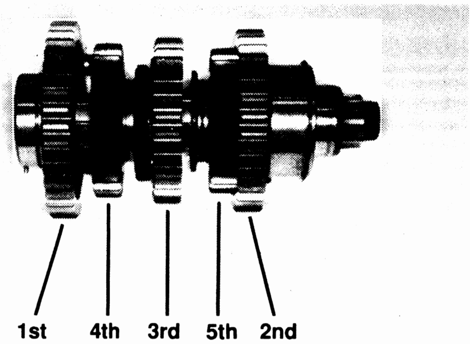

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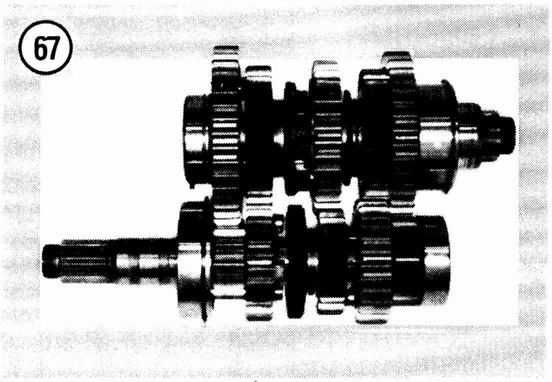

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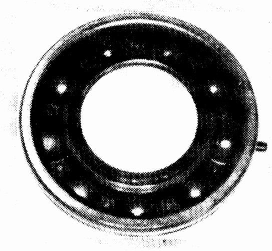

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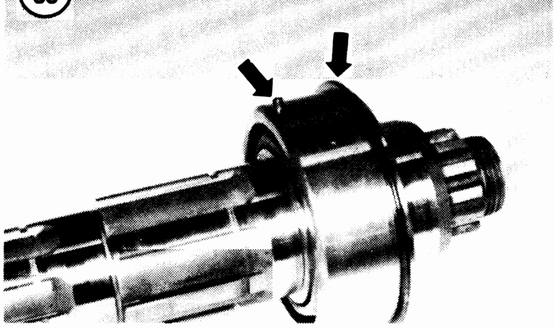

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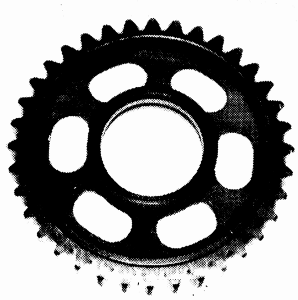

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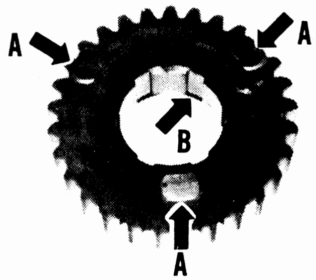

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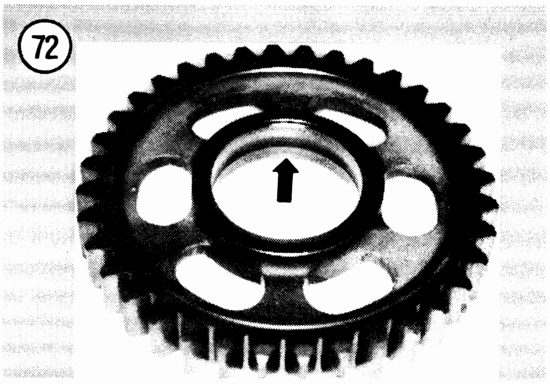

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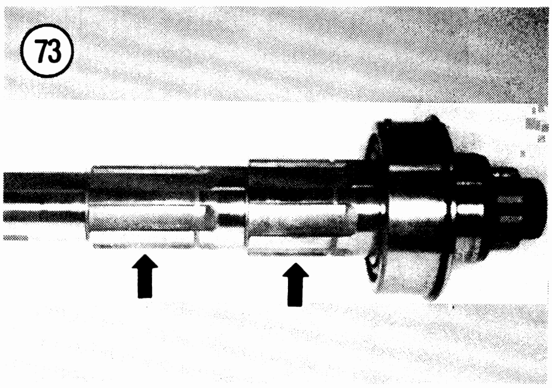

8. Inspect the countershaft drive sprocket splines (**Figure 74**) for wear or discoloration.

9. Inspect the shift fork groove (**Figure 75**) for wear or damage. Replace the gear(s) if necessary.

10. Replace any washers that show wear.

11. Discard all circlips and install all new ones during assembly.

INTERNAL SHIFT MECHANISM

Removal

Refer to **Figure 76** for this procedure.

1. Remove the engine and split the crankcase as described under *Crankcase Disassembly* in Chapter Four.

NOTE
Label the shift forks so that they can be reinstalled in their original positions. The shift forks are marked but may not be legible after prolonged use.

2. Slowly withdraw the shift fork shaft and remove the 3 shift forks from the lower crankcase.

3. If not already removed, remove the shift shaft as described in this chapter.

4. Remove the bolt and remove the shift cam stopper lever (**Figure 77**) and the spring from the crankcase.

5. Remove the bolts and remove the shift drum bearing retainer and remove the retainer (B, **Figure 78**) from the crankcase.

6. Withdraw the shift drum (A, **Figure 78**) from the crankcase.

7. Inspect the shift drum and forks as described in this chapter.

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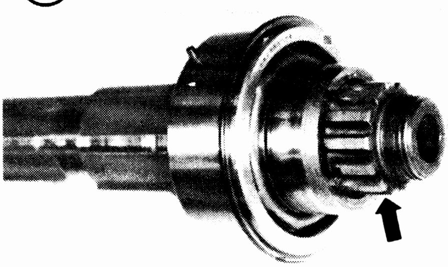

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6

Installation

Refer to **Figure 76** for this procedure.

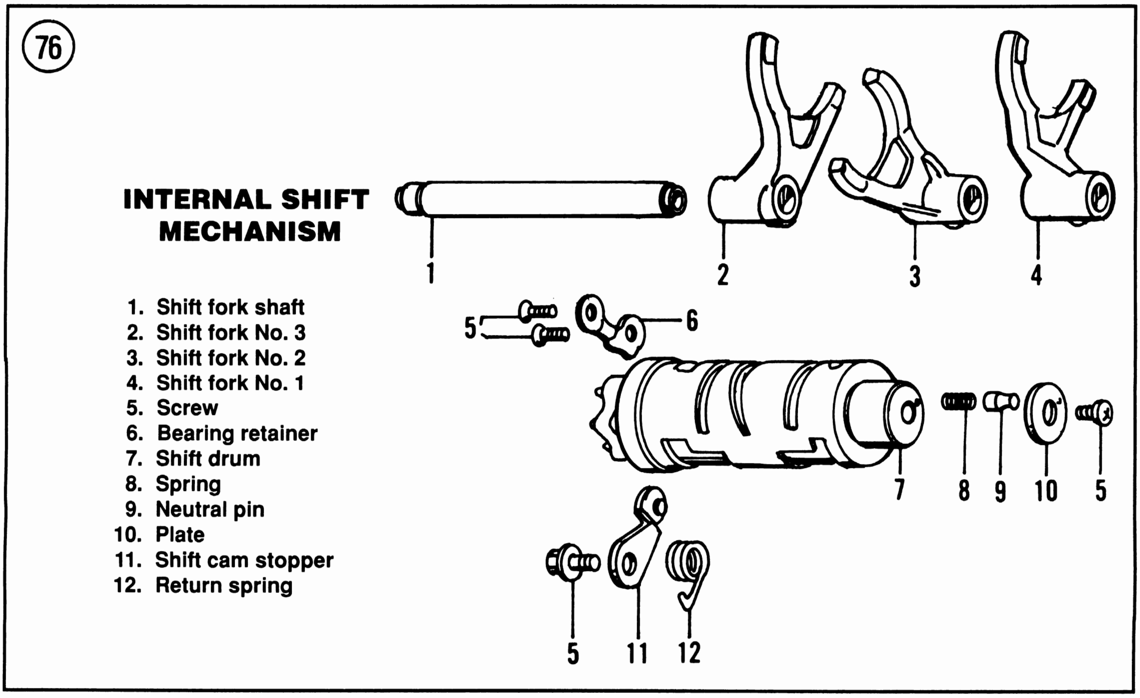
1. Apply engine oil to all bearing surfaces.
2. Insert the shift drum into the crankcase.

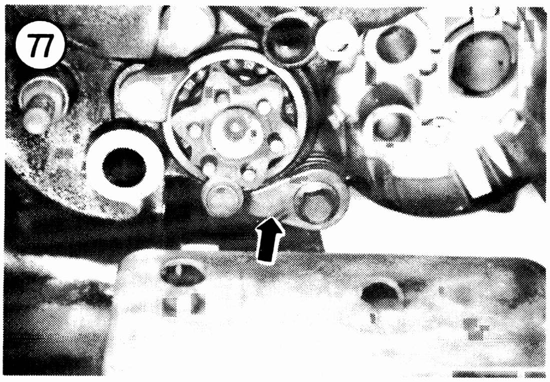
NOTE
Apply blue Loctite (No. 242) to the shift drum bearing retainer bolts prior to installation.

3. Install the shift drum bearing retainer (B, **Figure 78**) and bolts. Tighten the bolts to the torque specification listed in **Table 1**.
4. Install the spring (**Figure 79**) onto the crankcase post.
5. Apply blue Loctite (No. 242) onto the shift cam stopper lever bolt prior to installation.
6. Install the stopper lever and bolt and engage the spring (**Figure 80**). Tighten the bolt finger-tight at this time.
7. Rotate the stopper lever counterclockwise and engage the shift cam stopper lever roller with the shift cam (**Figure 81**).
8. Use a large flat-bladed screwdriver and hold down the stopper lever and keep it out of engagement with the shift drum pins (**Figure 82**). Tighten the bolt to the torque specification listed in **Table 1** and remove the screwdriver.
9. Rotate the shift drum to the NEUTRAL position (**Figure 83**).
10. Install the shift forks as follows:

NOTE
*The shift forks are marked with identification letters: "R," "C" and "L" (**Figure 84**). Install all the shift forks with these letters facing toward the left-hand side of the crankcase and in this following sequence: "L," "C" and "R" starting from the right-hand side.*

a. Position the shift fork shaft with the relief end (A, **Figure 85**) going in last and insert the front shift fork shaft partway through the right-hand side of the crankcase.
b. Position shift fork "R" (B, **Figure 85**) with the long side of the bearing surface toward the right-hand side. Push the shaft all the way through this shift fork. Engage the shift fork pin with the shift drum groove.
c. Position shift fork "C" (**Figure 86**) with the long side of the bearing surface toward the left-hand side. Push the shaft all the way through this shift fork. Engage the shift fork pin with the shift drum groove.
d. Position shift fork "L" (**Figure 87**) with the long side of the bearing surface toward the

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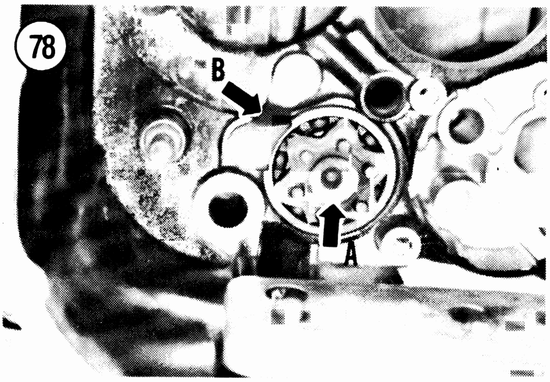
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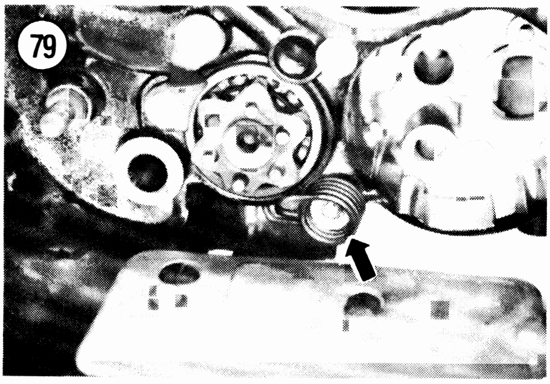
B
A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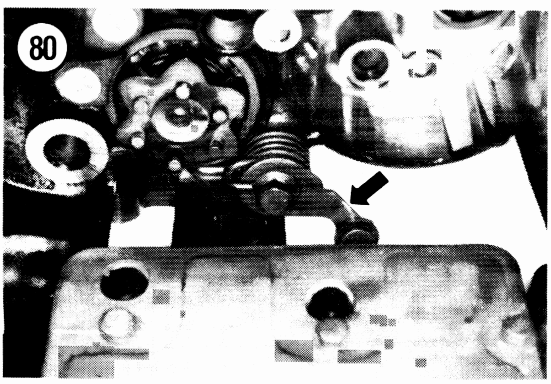
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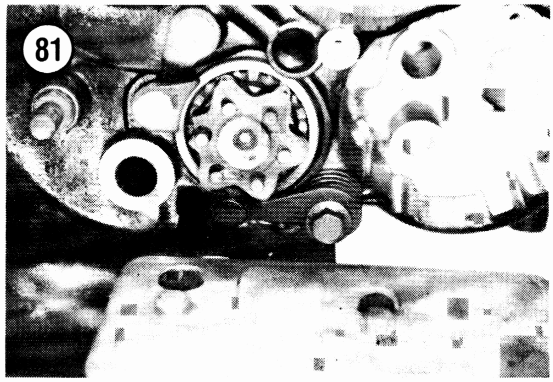
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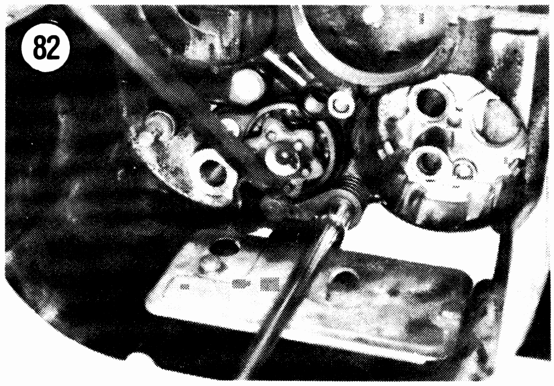
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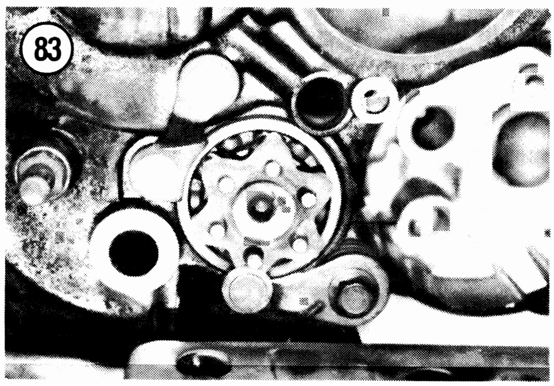
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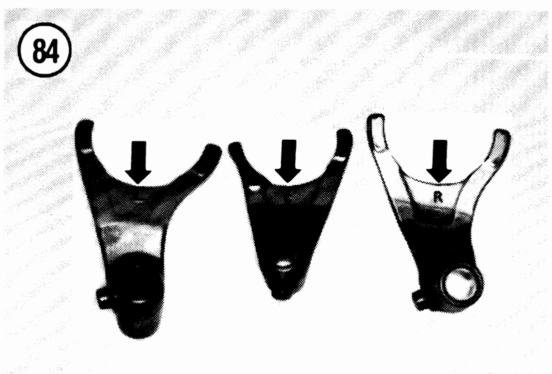
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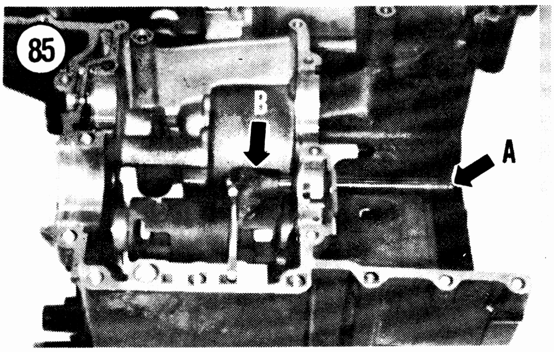
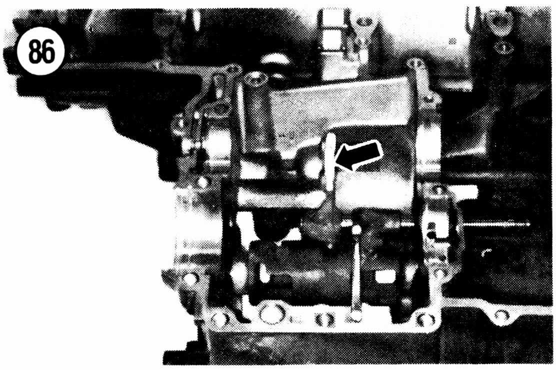
R

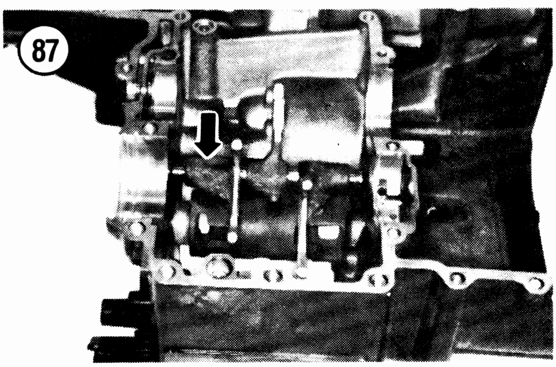
left-hand side. Push the shaft all the way through this shift fork. Engage the shift fork pin with the shift drum groove.

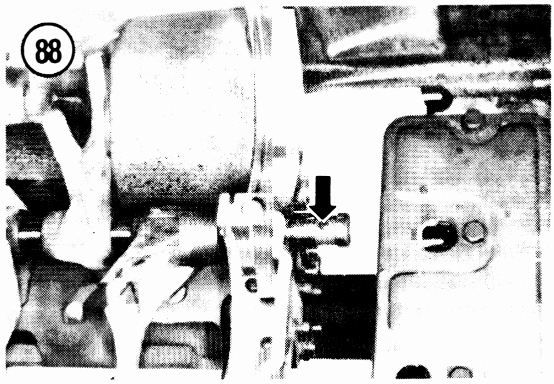
e. Rotate the shaft until the oil control hole (**Figure 88**) is facing up, then push the shaft all the way through the last shift fork and into the other side of the crankcase.
f. Make sure all 3 shift fork pins are engaged properly with the shift drum grooves.
g. After the 3 shift forks have been installed they should be positioned as shown in **Figure 87**.

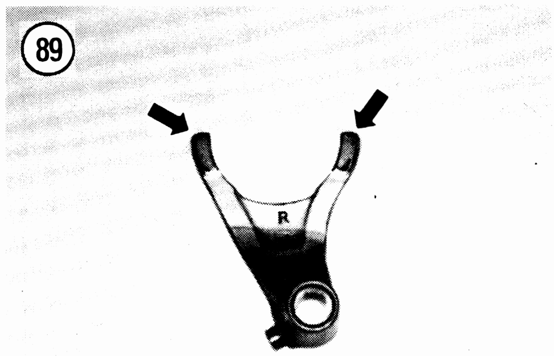
11. Assemble the crankcase and install the engine as described in Chapter Four.

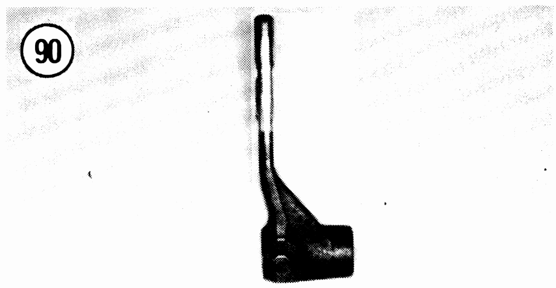


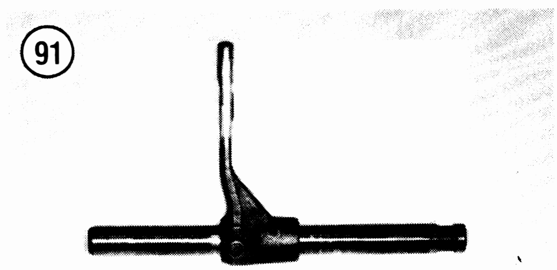












Inspection

1. Inspect each shift fork for signs of wear or cracking. Examine the shift forks at the points (**Figure 89**) where they contact the slider gear. This surface should be smooth with no signs of wear or damage. Make sure the fingers are straight (**Figure 90**) and are not bent.

2. Make sure the forks slide smoothly on the shaft (**Figure 91**). Make sure the shaft is not bent. This can be checked by removing the shift forks from the shaft (**Figure 92**) and rolling the shaft on a piece of plate glass. Any clicking noise detected indicates a bent shaft. Replace the shaft if it is bent—never try to straighten a bent shaft.

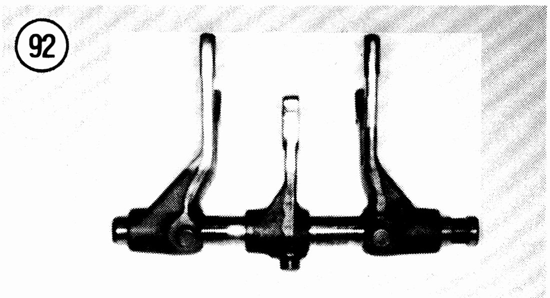
3. Inspect the shift fork pin (**Figure 93**) that rides in the shift drum groove for wear or damage. Replace the shift fork if necessary.

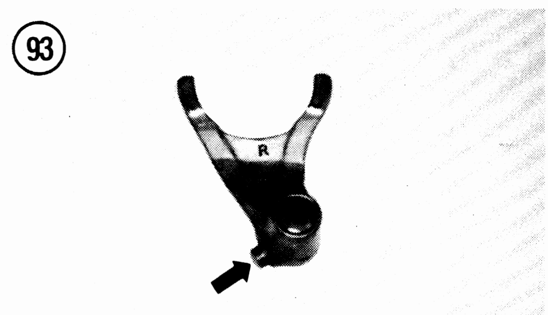
4. Check the grooves in the shift drum (A, **Figure 94**) for wear or roughness. Replace the shift drum if any groove is worn or damaged.

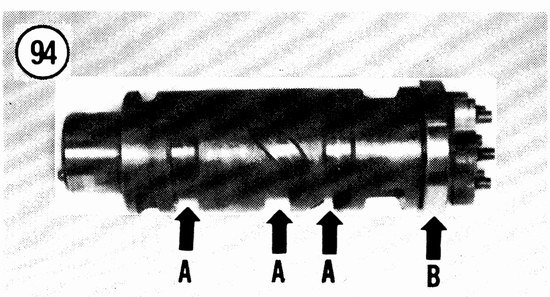
5. Spin the shift drum bearing (B, **Figure 94**) and check for excessive play or roughness. Check the shift drum pins (**Figure 95**) for wear, damage or looseness. Replace the shift drum if necessary.

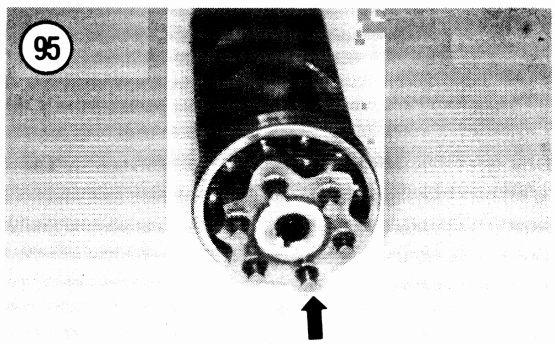
6. Inspect the neutral indicator pin (A, **Figure 96**) for wear or damage. If necessary, remove the screw securing the end plate (B, **Figure 96**) and remove the indicator pin and spring, replace the pin. Tighten the screw securely.

6









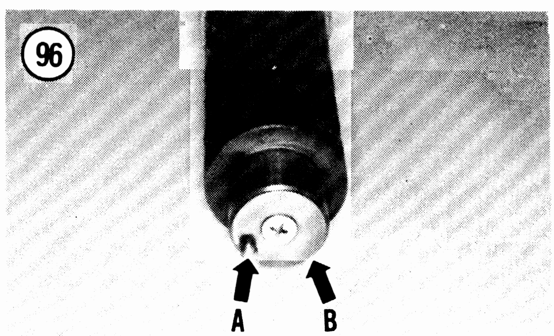


Table 1 SHIFT MECHANISM TIGHTENING TORQUES

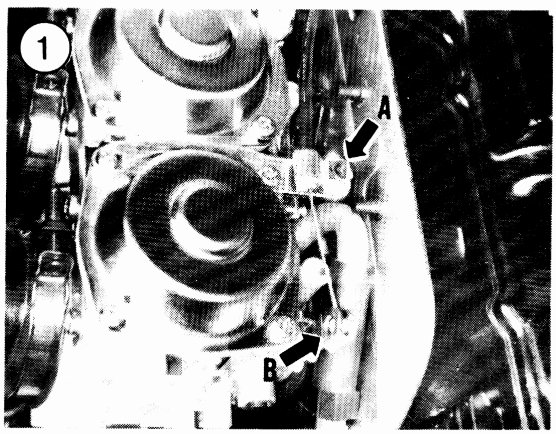
	N•m	ft.-lb.
Shift drum bearing retainer bolt	7	5.1
Shift cam stopper lever bolt	10	7.2

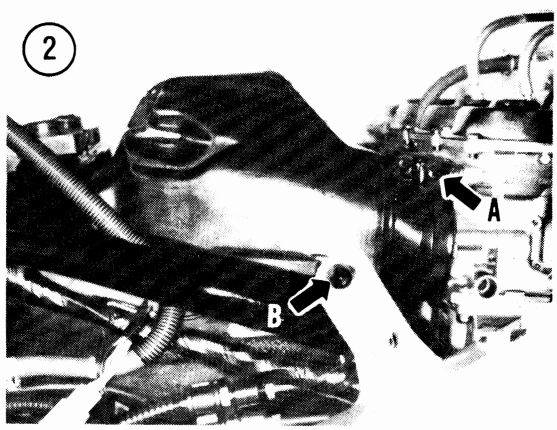
CHAPTER SEVEN

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** 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.





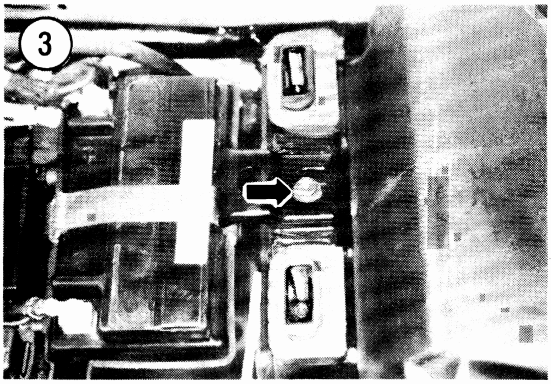
CARBURETOR

Removal/Installation

Remove all 4 carburetors as an assembled unit.

1. Place the motorcycle securely on the centerstand.
2. Remove the seat and side covers.
3. Disconnect the battery negative cable as described in Chapter Three.
4. Remove the fuel tank as described in this chapter.
5. Loosen the choke cable clamp screw (A, **Figure 1**) and disconnect the cable (B, **Figure 1**) from the carburetor assembly.
6. Loosen the hose clamps (A, **Figure 2**) securing the air filter housing to all 4 carburetors.

3



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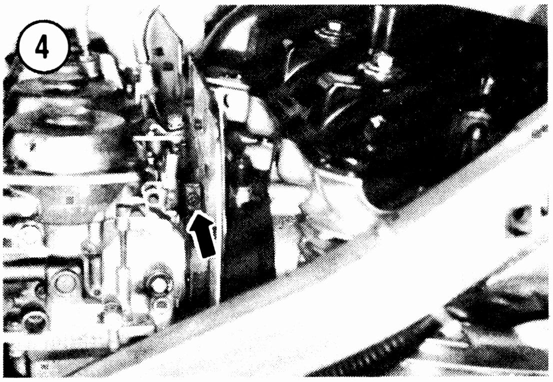

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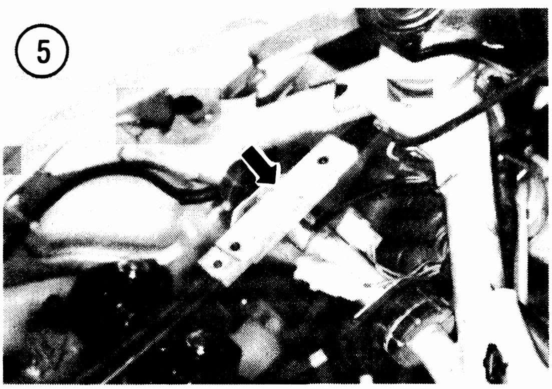

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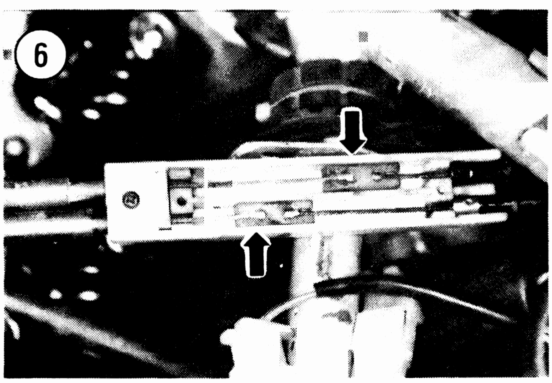


7. Remove the side bolts (B, **Figure 2**) and top bolt (**Figure 3**) securing the air filter housing to the frame. Pull it toward the rear and disengage it from the carburetor assembly.

8. Loosen the hose clamps (**Figure 4**) securing the carburetors to the rubber intake tubes on the cylinder head.

9. On models so equipped, disconnect the boost control hose from the No. 2 carburetor.

10. Partially pull the carburetor assembly up and disengage it from the rubber intake tubes on the cylinder head.

11. Grasp the carburetor assembly on both ends and work the assembly toward the back away from the rubber intake tubes.

NOTE
Prior to disconnecting the throttle cables within the cable connector, note which is the pull and push cable and label them so they will be reconnected correctly.

12A. On 1984-1990 models, perform the following:

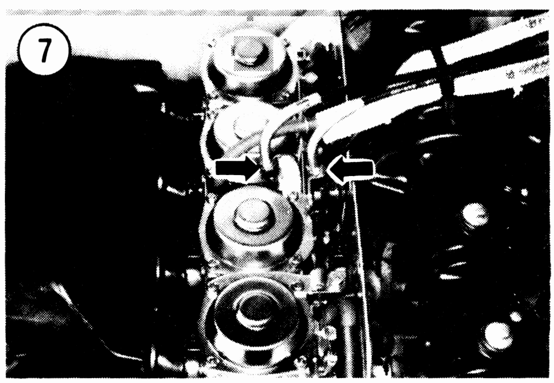
a. Remove the screws and remove the cable connector cover (**Figure 5**).
b. Disconnect the pull and push cables (**Figure 6**) from the connectors within the cable connector and remove the cables.

12B. On 1991-on models, perform the following:

a. Loosen the locknuts on both throttle cables (**Figure 7**).
b. Open the throttle wheel with your finger and disconnect the throttle cables from the carburetor throttle wheel (**Figure 8**).

13. Remove the carburetor assembly from the frame.

7



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CAUTION
Stuff clean shop rags into the intake tube openings to prevent foreign objects from falling into the intake tubes and into the cylinder head.

14. While the carburetor assembly is removed, examine the intake tubes on the cylinder head 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.

NOTE
***Figure 9** is shown with the air filter case removed for clarity.*

15. Inspect the heat shield (A, **Figure 9**) for damage. If damaged, pull the heat shield off the rubber nibs (B, **Figure 9**) on the mounting brackets and replace it.
16. Install by reversing these removal steps while noting the following:
   a. Make sure the carburetors are fully seated forward in the rubber intake tubes in the cylinder head. You should feel a solid "bottoming out" when they're correctly installed. Tighten the tube clamps securely.

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.

   b. Check both throttle cables for correct routing after installation. The cables must not be twisted, kinked or pinched.
   c. Adjust the throttle cable as described under *Throttle Cable Adjustment* in Chapter Three.
   d. Tighten the air filter housing-to-carburetor clamp screws securely.

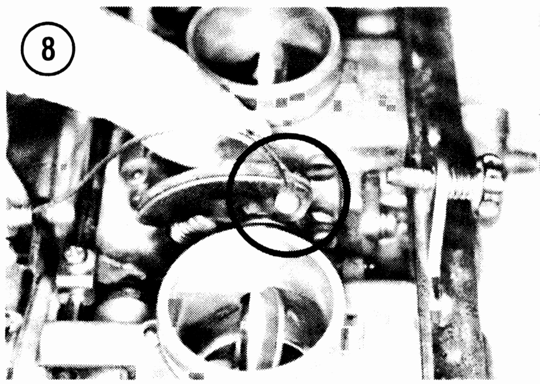
Carburetor Assembly Separation/Reassembly

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

Mark the carburetors prior to separating them. The No. 1 carburetor is on the left-hand side and working across from left to right, No. 2, No. 3 and No. 4. Remember the left-hand refers to the carburetor assembly installed in the bike not as it sits on your workbench.

1. Remove the end choke lever screw and remove the choke lever (**Figure 10**). Loosen all remaining choke lever screws (A, **Figure 11**).
2. Slide the choke lever rod (B, **Figure 11**) from the carburetor assembly.
3. Disconnect the fuel line assembly (**Figure 12**) from the carburetor assembly.
4. Remove the screws securing the lower bracket (C, **Figure 11**) and remove the bracket.

8



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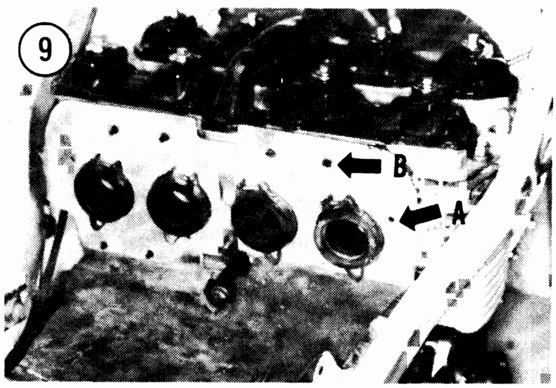

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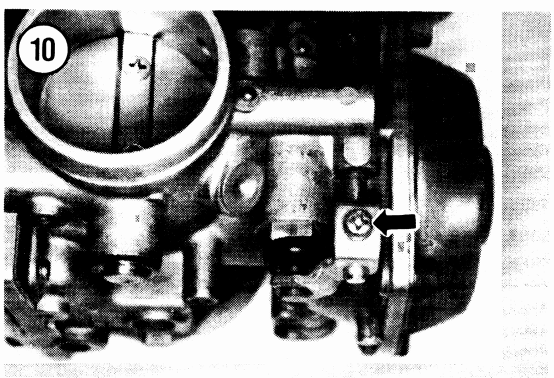


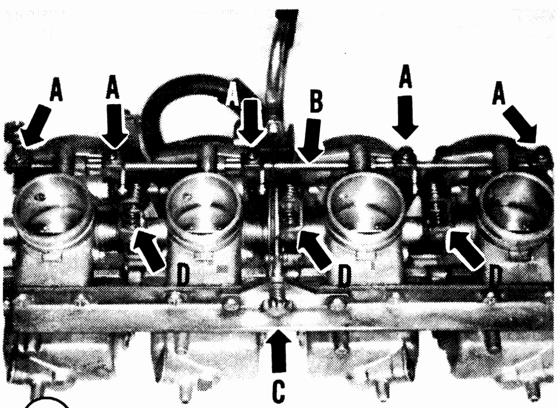
5. Turn the carburetor assembly over and remove the screws securing the upper bracket (**Figure 13**) and remove the bracket.

6. Place the carburetor assembly on a piece of plate glass with the cylinder head side (smaller outlet opening) facing down.

7. Carefully separate the carburetor bodies from each other. Don't lose the small spring (D, **Figure 11**) that will usually fall out where the throttle levers connect.

8. Reassemble by reversing these separation steps while noting the following:

   a. Install new O-rings on the fuel pipes connecting the carburetors.
   b. Place the carburetor assembly on a piece of plate glass with the side facing the cylinder head down.
   c. Tighten the upper and lower interconnecting bolts and nuts securely while pressing down on all 4 carburetors to maintain proper alignment between all 4 carburetors.
   d. Connect the rubber fuel line assembly onto the carburetor assembly. Make sure they are connected correctly as shown in **Figure 12**.



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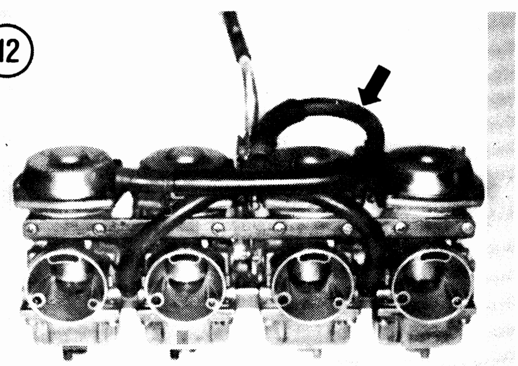

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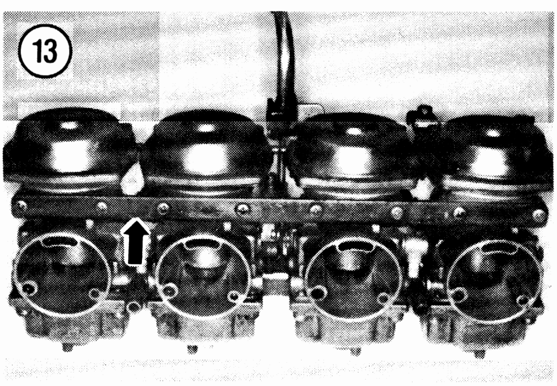

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Individual Carburetor Disassembly/Assembly

Refer to **Figure 14** for this procedure. It is recommended to disassemble only one carburetor at a time to prevent accidental interchange of parts.

1. Remove the screws and the vacuum chamber cover (**Figure 15**).
2. Remove the diaphragm spring (**Figure 16**) from the diaphragm.
3. Lift the diaphragm assembly (**Figure 17**) out of the carburetor.
4. Unscrew the pilot air jet (**Figure 18**).
5. Remove the screws securing the float bowl (**Figure 19**) and remove the float bowl.
6. Remove the main jet (**Figure 20**) and the washer (**Figure 21**) under it.
7. Turn the carburetor over and tap it with your hand. Remove the main jet nozzle (**Figure 22**).
8. Unscrew the pilot jet (**Figure 23**).
9. Remove the float pivot pin (A, **Figure 24**) and the float (B, **Figure 24**).
10. Remove the screw and holder (**Figure 25**) securing the needle valve seat.
11. Remove the needle valve seat (**Figure 26**). Don't lose the O-ring seal.
12. Clean and inspect the carburetor as described in this chapter.
13. Installation is the reverse of these steps while noting the following:

    a. Check the throttle shaft and throttle plate (**Figure 27**) for excessive play or damage. Check the throttle plate screws for looseness. If the

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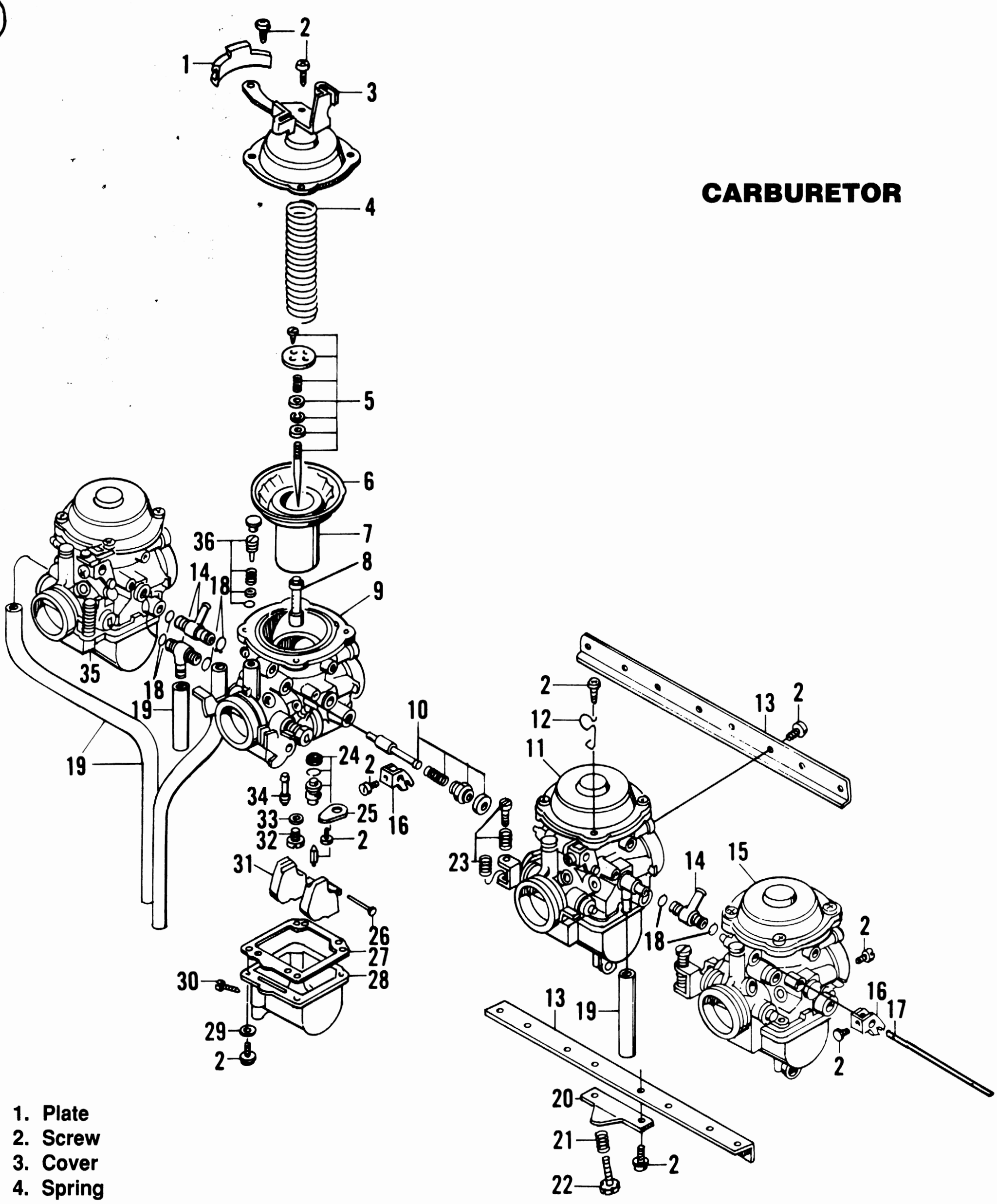
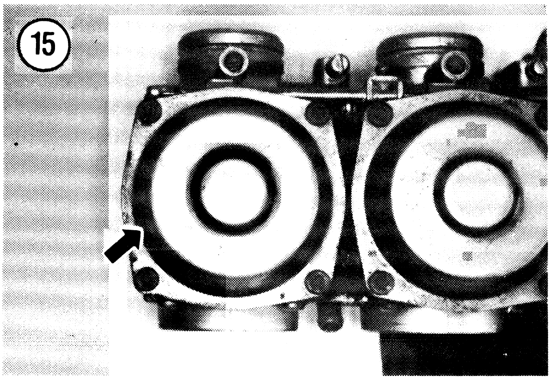
CARBURETOR



1. Plate
2. Screw
3. Cover
4. Spring
5. Jet needle assembly
6. Diaphragm
7. Slide
8. Main nozzle
9. No. 3 carburetor body
10. Starter choke assembly
11. No. 2 carburetor assembly
12. Clip
13. Upper bracket
14. Joint
15. No. 1 carburetor assembly
16. Clamp
17. Starter choke lever
18. Clamp
19. Hose
20. Plate
21. Spring
22. Throttle adjust knob
23. Throttle stop screw and spring set
24. Needle valve set
25. Plate
26. Float pivot pin
27. Gasket
28. Float bowl
29. Washer
30. Drain screw
31. Float
32. Main jet
33. Washer
34. Pilot jet
35. No. 4 carburetor assembly
36. Pilot screw set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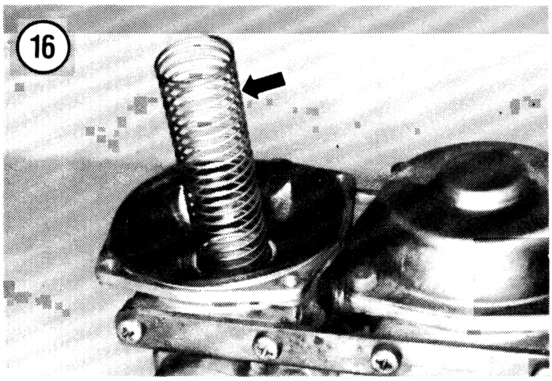
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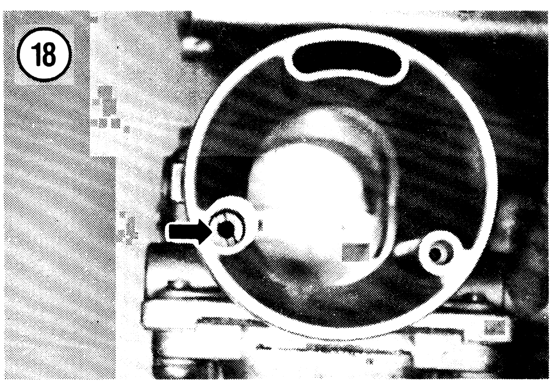
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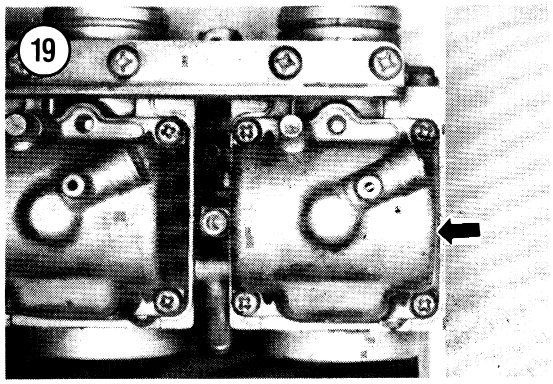
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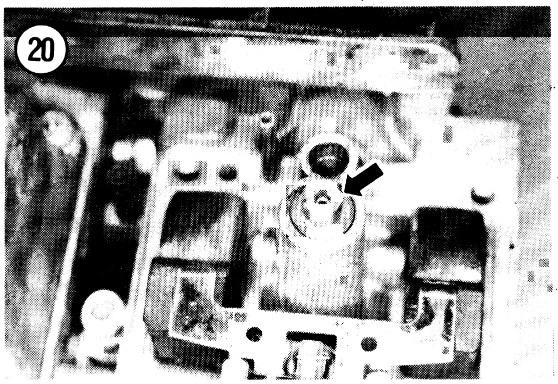
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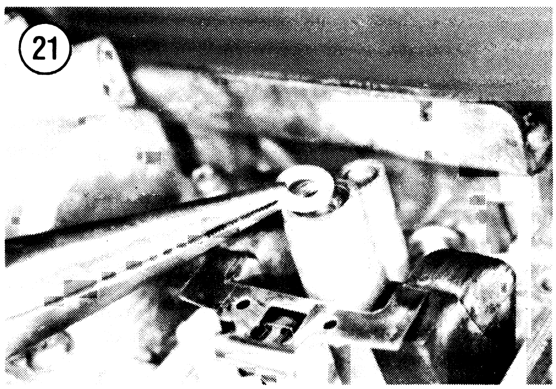
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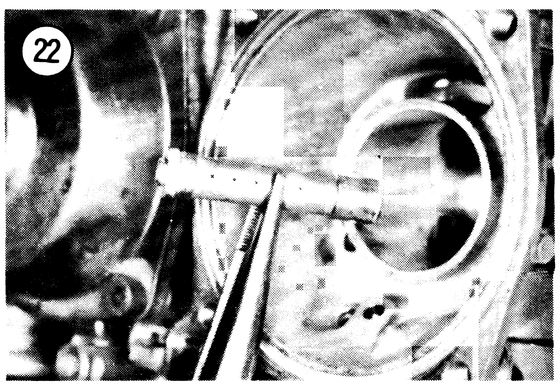
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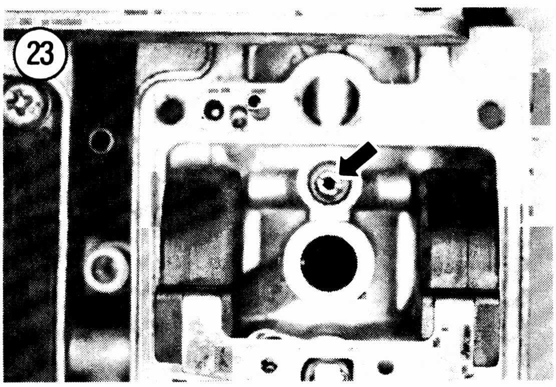
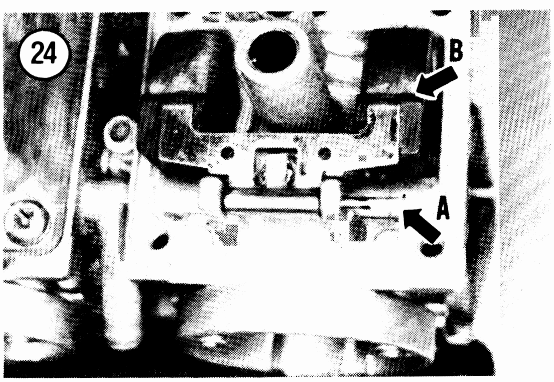
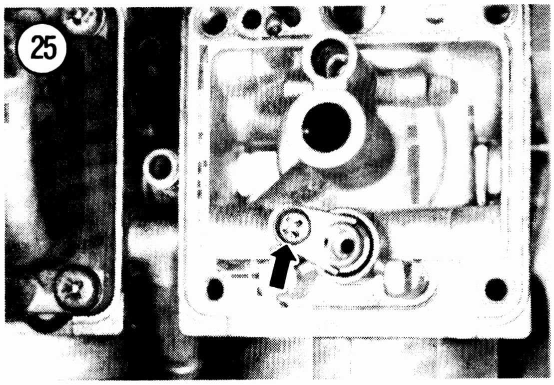
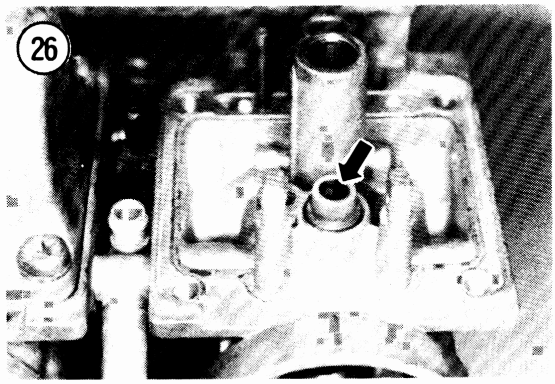
throttle shaft and/or plate is damaged, that carburetor body must be replaced as an assembly.

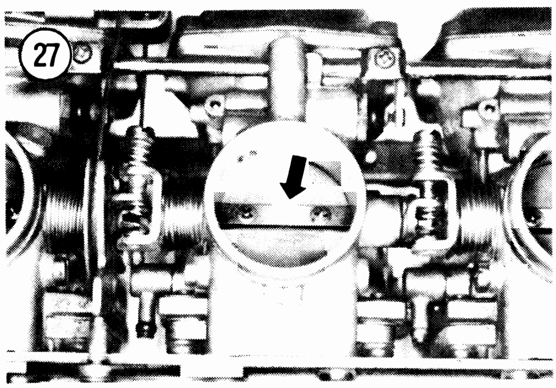
b. Make sure the O-ring seal (**Figure 28**) is in place on the needle valve assembly prior to installation.
c. Align the projection on the bottom of the jet holder with the receptacle in the carburetor body and install the jet holder (**Figure 29**).
d. Install the needle valve onto the float (**Figure 30**) prior to installing the float.
e. Replace the float bowl seal (**Figure 31**) if deformed or starting to deteriorate or if the bowl has leaked.
f. Align the locating tab on the vacuum diaphragm (**Figure 32**) 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.
g. Install the cover and tighten the cover screws securely.

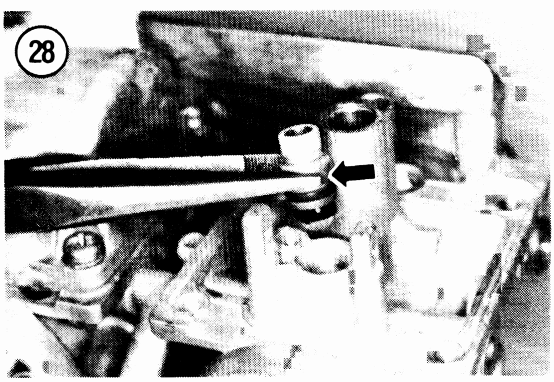


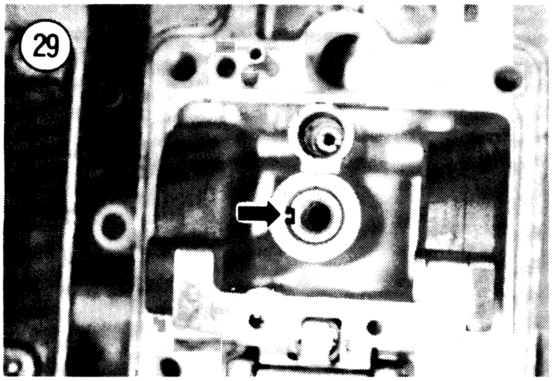








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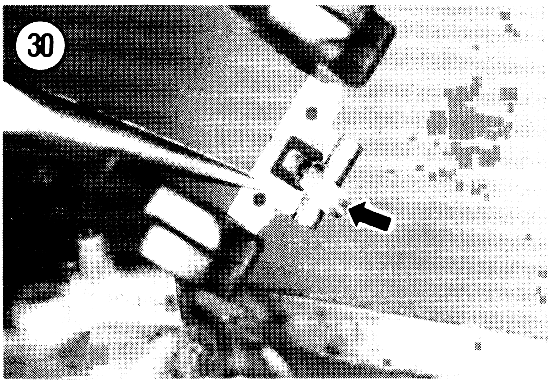
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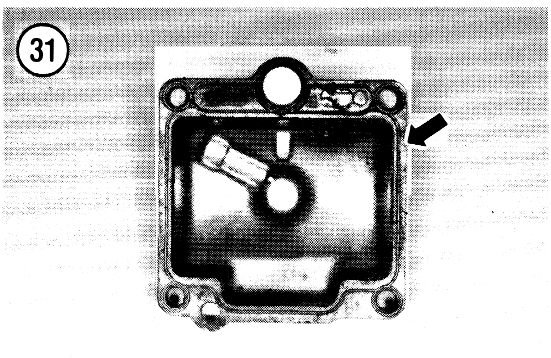
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14. Repeat Steps 1-13 for the other 3 carburetors. Do not interchange parts—keep them separate.

15. After the carburetors have been disassembled the idle speed should be adjusted and the carburetors synchronized as described in Chapter Three.

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.

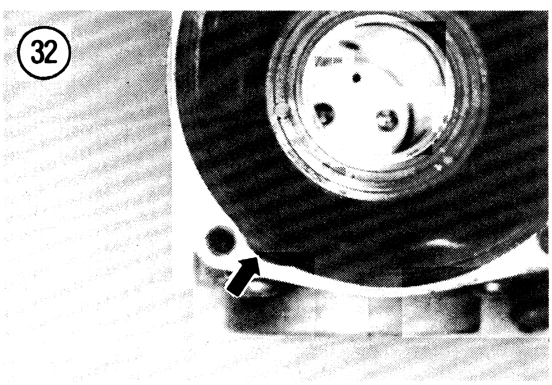
2. Allow the carburetor to dry thoroughly before assembly and blow dry with compressed air. Blow out the jets and needle jet holder with compressed air.

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 them as minor gouges in the jet can alter flow rate and upset the fuel/air mixture.*

3. Remove the drain screw (**Figure 33**) from each float bowl.

4. Inspect the end of the float valve needle (**Figure 34**) 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 assem-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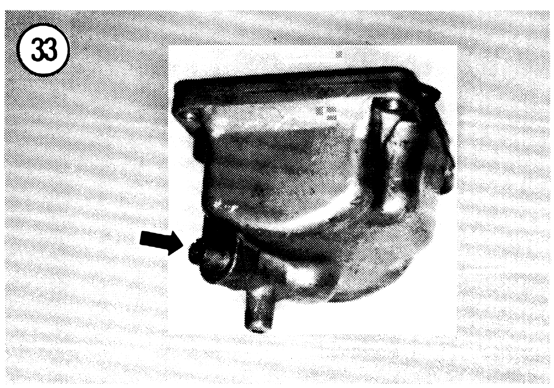
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bly will cause the carburetor to flood and overflow fuel.

5. Inspect the seal (**Figure 35**) on the needle valve assembly prior to installation. The seal tends to become hardened after prolonged use and heat and therefore loses its ability to seal properly. Replace if necessary.

6. Inspect the inlet screen (**Figure 36**) on the needle valve assembly. If there are any holes or it is starting to deteriorate, replace the needle valve assembly.

7. Make sure the holes in the main jet nozzle and all jets are clear (**Figure 37**). Clean out if they are plugged in any way. Replace the main jet nozzle if you cannot unplug the holes.

8. Make sure all openings in the carburetor body are clear. Refer to **Figure 38**, A, **Figure 39** and **Figure 40**. Clean out if they are plugged in any way.

9. Inspect the slide area (B, **Figure 39**) 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 during normal operation.

10. Inspect the diaphragm slide (**Figure 41**) for scoring and wear. Replace if necessary.

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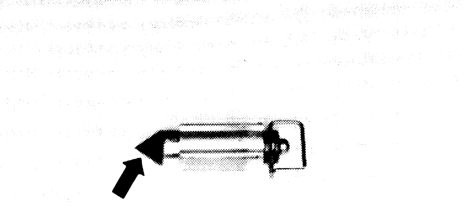

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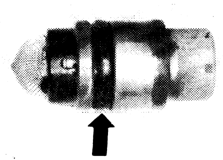

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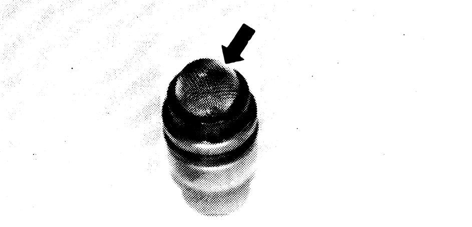

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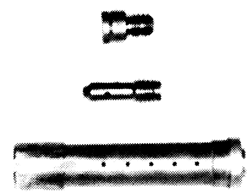

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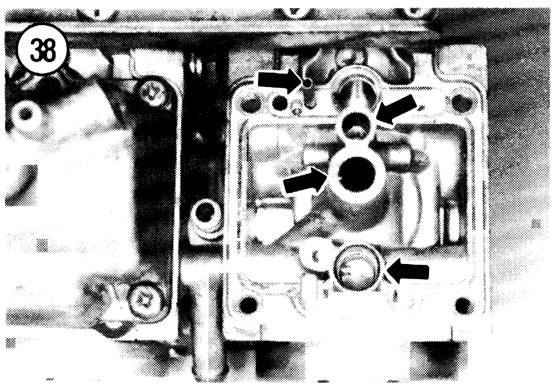

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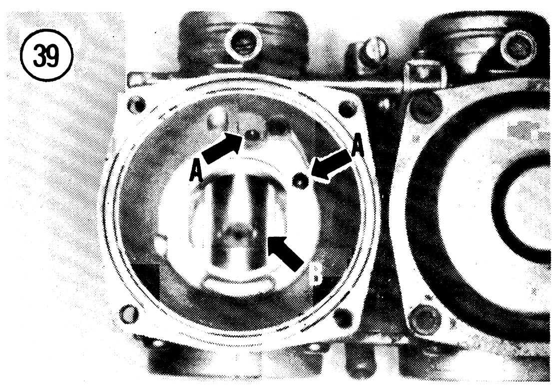

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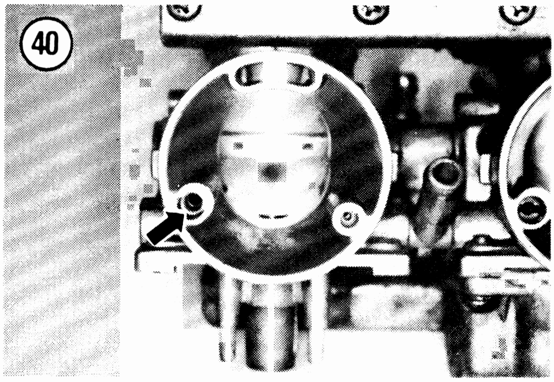

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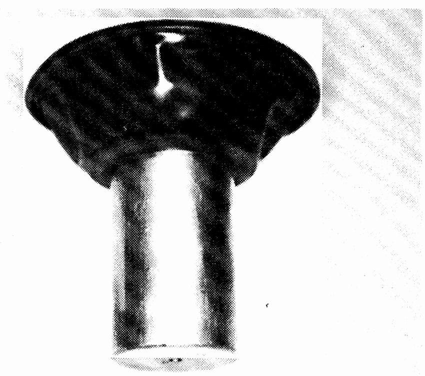

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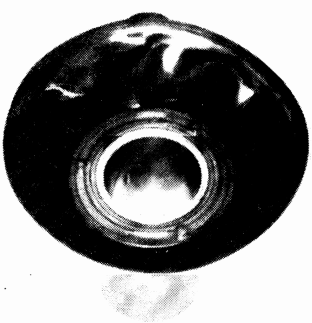

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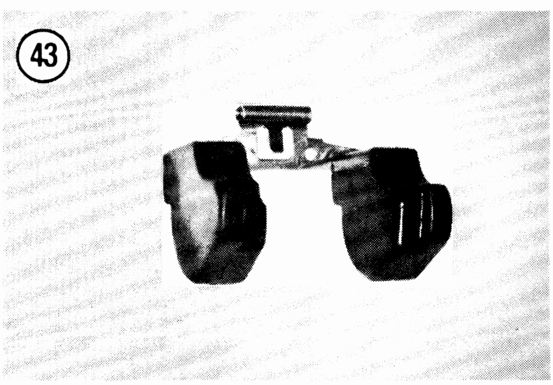

11. Inspect the diaphragm (**Figure 42**) for tears, cracks or other damage. Replace the throttle slide assembly if the diaphragm is damaged.

12. Inspect the float (**Figure 43**) 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.

13. Remove the jet needle as follows:

   a. Remove the screws securing the jet needle holder and remove the holder.
   b. Remove the jet needle holder, spring and washer.
   c. Remove the jet needle.
   d. Inspect the jet needle assembly (**Figure 44**) for wear or damage, replace if necessary.

CARBURETOR ADJUSTMENTS

Idle Speed, Idle Mixture Adjustment and *Carburetor Synchronization* are covered in Chapter Three.

Float Adjustment

The carburetor assembly has to be removed and partially disassembled for this adjustment.

1. Remove the carburetor as described in this chapter.

2. Remove the screws securing the float bowl and remove float bowl (**Figure 45**).

3. Hold the carburetor so the float arm is just touching the float needle—not pushing it down. Use a float level gauge, vernier caliper or small ruler (**Figure 46**) and measure the distance from the carburetor body to the float. The correct height is listed in **Table 1**.

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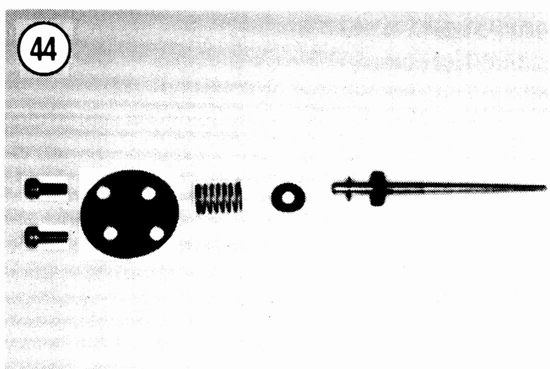

4. If the float level is incorrect, carefully bend the float tang (**Figure 47**) and repeat Step 3, readjust if necessary.
5. Reassemble and install the carburetor.

Fuel Level

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 the top edge of the float bowl with the carburetors mounted on the motorcycle (**Figure 48**).

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. part No. 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 47**).

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 centerstand. Make sure the bike and carburetor assembly are in a true vertical position. If necessary, place shims under either side of the centerstand to achieve a true vertical position for the carburetor assembly.
2. Remove the seat and both side covers.
3. Disconnect the battery negative cable as described in Chapter Three.
4. Remove the fuel tank as described in this chapter.

NOTE
***Figure 49** is shown with the carburetor assembly removed for clarity. Do not remove the assembly for this procedure.*

5. Install an auxiliary fuel tank onto the motorcycle and attach its fuel hose to the carburetor assembly.

NOTE
Fuel tanks from small displacement motorcycles, ATVs and lawn mowers make

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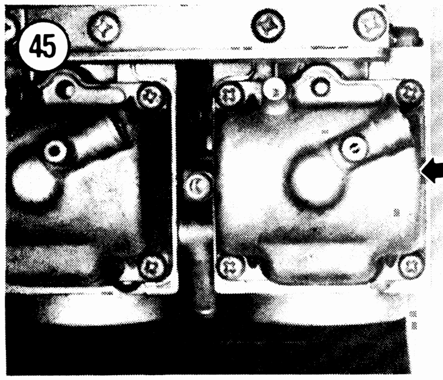
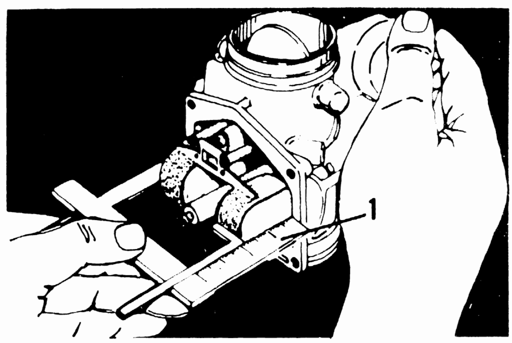
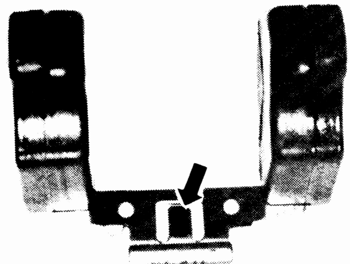




46 1. Float level gauge



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excellent auxiliary fuel tanks. Make sure the tank is mounted securely and positioned so that connecting fuel hose is not kinked or obstructed.

WARNING
When supplying fuel by temporary means, make sure the auxiliary fuel tank is secure and that all fuel lines are tight—no leaks.

6. Connect the fuel level gauge (U.S. part No. YM-01312, U.K. part No. 90890-01312) or a vinyl tube (with a 6 mm/0.24 in. inside diameter) to the drain nozzle on the float chamber (**Figure 49**) on the No. 1 left-hand carburetor. Secure the gauge so that it's vertical against the float bowl.

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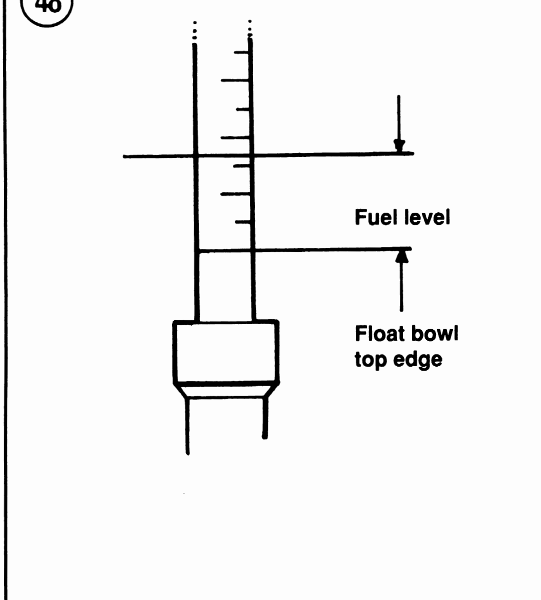

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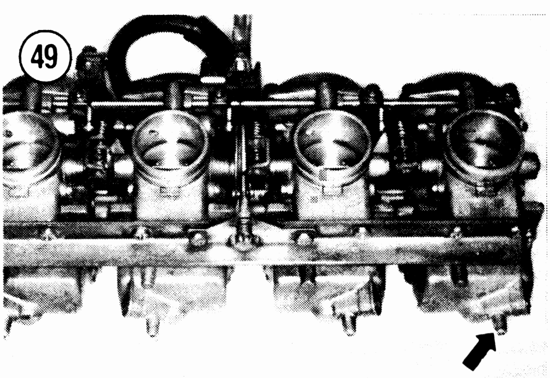

7. Loosen the No. 1 carburetor drain screw.
8. Start the engine and allow it to idle for a few minutes. Turn the engine off.
9. Wait until the fuel in the gauge settles.
10. The fuel level should be 2.0-4.0 mm (0.08-0.16 in.) above the line on the carburetor float bowl (**Figure 48**). Note the reading for the No. 1 carburetor.
11. If the fuel level is within specification, note the dimension for the No. 1 carburetor, tighten the drain screw and then repeat this procedure for the remaining 3 carburetors. Note the fuel levels in each of the remaining carburetors.
12. If the fuel level is incorrect, adjust the float height as described under *Float Adjustment* in this chapter.
13. Install the carburetor assembly as described in this chapter.

7

FUEL TANK

Removal/Installation

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.

Refer to the following illustrations for this procedure:

a. 1984-1987 U.S. 49-state and U.K.: **Figure 50.**
b. 1989-on U.S. 49-state and 1988-on U.K.: **Figure 51.**
c. 1984-1987 California: **Figure 52.**
d. 1989-on California: **Figure 53.**

1. Check that the ignition switch is OFF.
2. Place the bike securely on the centerstand.
3. Remove both seats and both frame side covers.
4. Disconnect the negative battery terminal (**Figure 54**).
5. On 1989-on models, disconnect the fuel tank breather hose (A, **Figure 55**) from the rear of the tank.
6. Remove the bolts and washers (B, **Figure 55**) securing the rear of the fuel tank to the frame.

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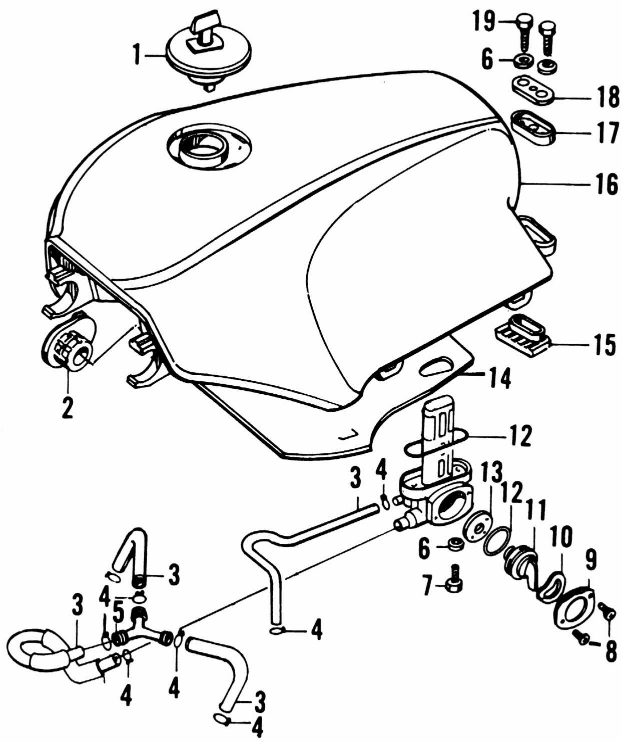
FUEL TANK AND FUEL FILTER (1984-1987 U. S. 49-STATE AND U. K.)



1. Filler cap
2. Rubber grommet
3. Fuel hose
4. Hose clamp
5. T-fitting
6. Washer
7. Bolt
8. Screw
9. Plate
10. Spring
11. Valve
12. O-ring
13. Plate
14. Heat shield
15. Rubber damper
16. Fuel tank
17. Rubber damper
18. Plate
19. Bolt

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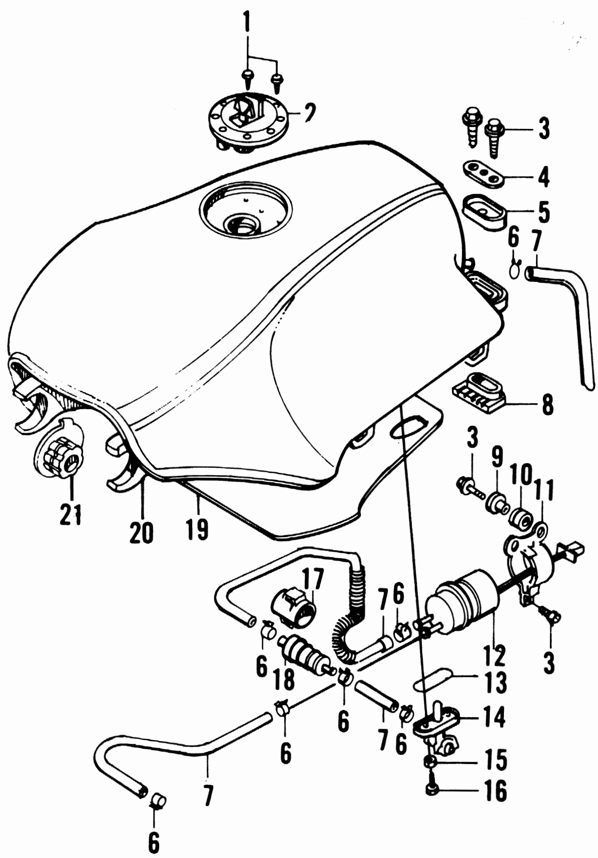
FUEL TANK AND FUEL FILTER
(1989-ON U. S. 49-STATE AND 1988-ON U. K.)



1. Screw
2. Filler cap
3. Bolt
4. Plate
5. Rubber damper
6. Hose clamp
7. Fuel hose
8. Rubber damper
9. Collar
10. Rubber grommet
11. Bracket
12. Fuel pump
13. O-ring
14. Fuel shutoff valve
15. Washer
16. Screw
17. Rubber mount
18. Fuel filter
19. Heat shield
20. Fuel tank
21. Rubber damper

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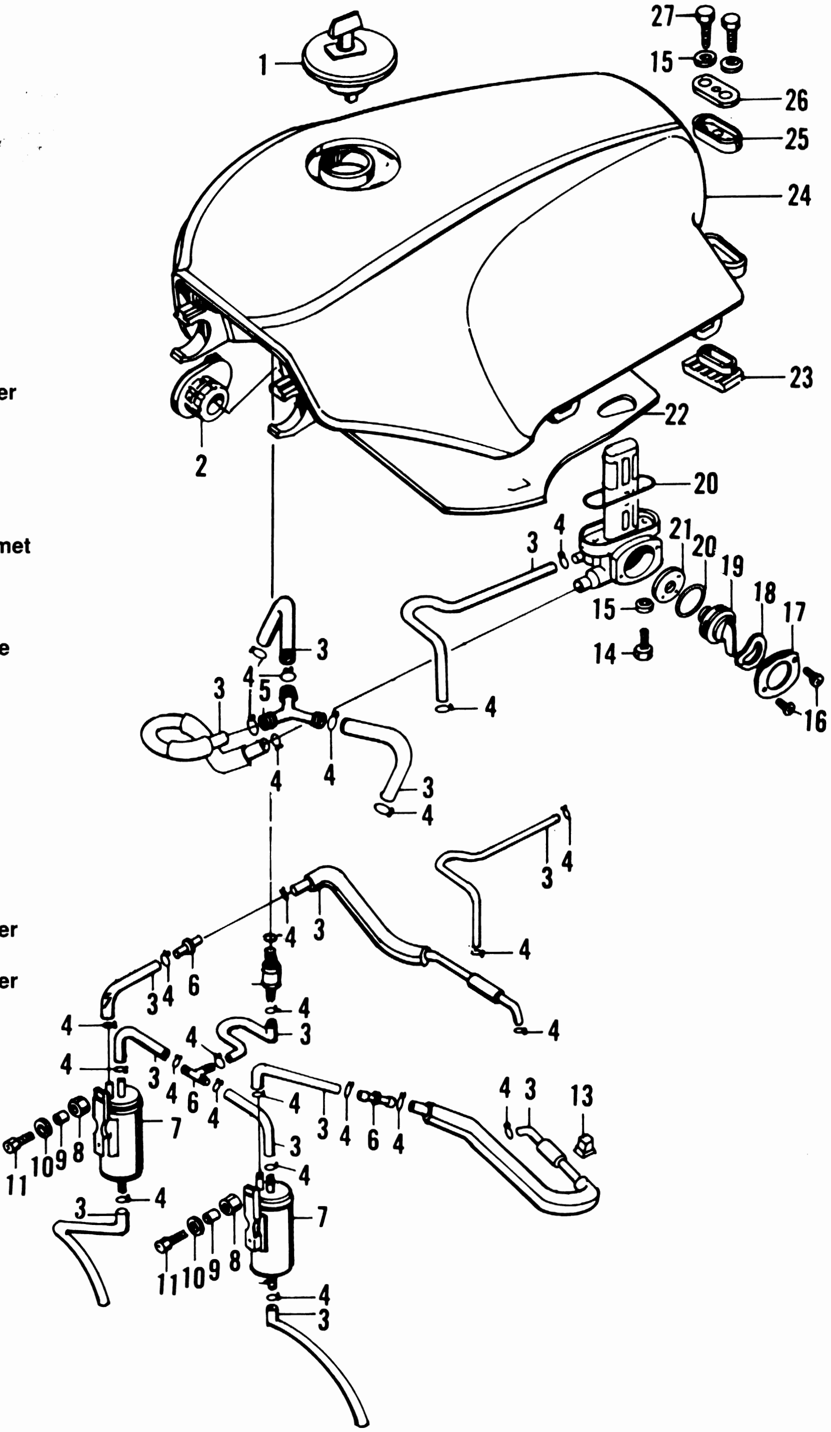
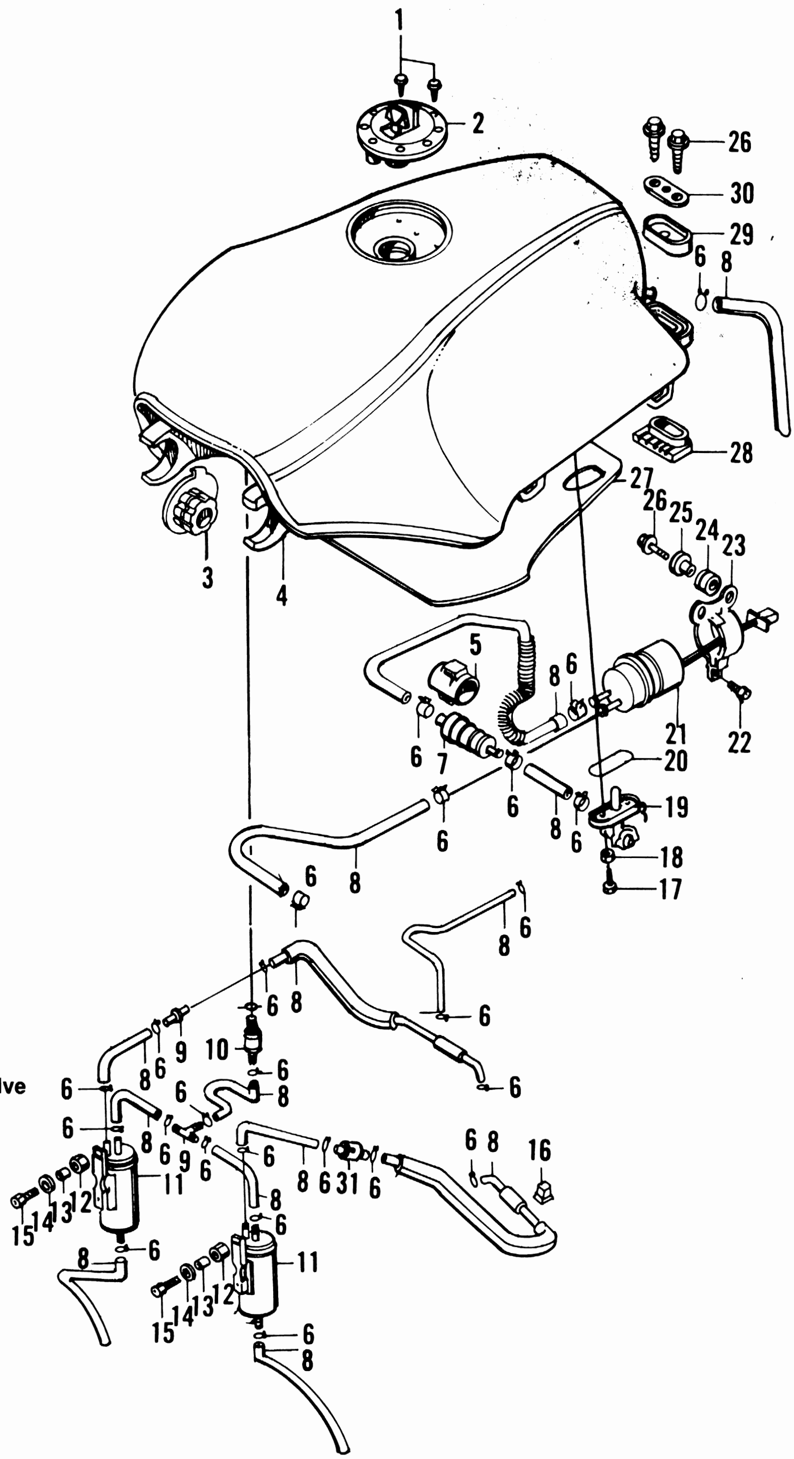
FUEL TANK, FUEL FILTER AND EVAPORATION SYSTEM (1984-1987 CALIFORNIA)



1. Filler cap
2. Rubber damper
3. Fuel hose
4. Hose clamp
5. T-fitting
6. Joint
7. Canister
8. Rubber grommet
9. Collar
10. Washer
11. Bolt
12. Roll over valve
13. Rubber pad
14. Bolt
15. Washer
16. Screw
17. Plate
18. Spring
19. Valve
20. O-ring
21. Plate
22. Heat shield
23. Rubber damper
24. Fuel tank
25. Rubber damper
26. Plate
27. Bolt

53 FUEL TANK, FUEL FILTER AND EVAPORATION SYSTEM (1989-ON CALIFORNIA)



1. Screw
2. Filler cap
3. Rubber damper
4. Fuel tank
5. Rubber mount
6. Hose clamp
7. Fuel filter
8. Fuel hose
9. Joint
10. Roll over valve
11. Canister
12. Rubber grommet
13. Collar
14. Washer
15. Bolt
16. Rubber pad
17. Bolt
18. Washer
19. Shutoff valve
20. O-ring
21. Fuel pump
22. Bolt
23. Bracket
24. Rubber grommet
25. Collar
26. Bolt
27. Heat shield
28. Rubber damper
29. Rubber damper
30. Plate
31. Outer vent control valve

7A. On 1984-1987 models, partially pull the fuel tank up and off the frame and perform the following:

a. On the left-hand side of the fuel tank, turn the fuel shutoff valve to the OFF position.
b. Disconnect the fuel line and the vacuum line (**Figure 56**) from the shutoff valve. Plug the end of the fuel line with a golf tee to prevent the entry of foreign matter.
c. On California models, disconnect the evaporative emission hoses from underneath the fuel tank.
d. Disconnect the fuel gauge electrical connector (**Figure 57**).

7B. On 1988-on models, partially pull the fuel tank up and off the frame and disconnect the following:

a. Use an 8 mm socket and turn the fuel shutoff valve to the off position.
b. Disconnect the fuel hose from the fuel filter (**Figure 58**). Plug the end of the fuel line with a golf tee to prevent the entry of foreign matter.
c. On California models, disconnect the evaporative emission hose (**Figure 59**) from underneath the fuel tank.
d. Disconnect the fuel gauge electrical connector (**Figure 60**).

8. Check to make sure everything is disconnected from the fuel tank and remove it from the frame.
9. Don't lose the large metal plates in the rubber dampers in the fuel tank rear mounting boss.
10. If necessary, pour the fuel out of the fuel tank into a container approved for gasoline storage.
11. Check any fuel tank frame front (**Figure 61**) and rear (**Figure 62**) rubber dampers for damage. Replace if necessary.
12. If necessary, on 1988-on models, remove the bolts securing the fuel filler cap assembly (**Figure 63**) and remove the assembly.
13. Install by reversing these removal steps while noting the following:

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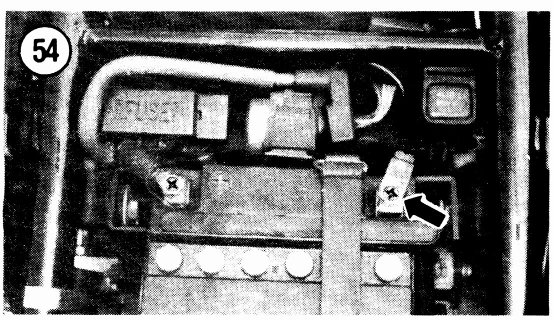

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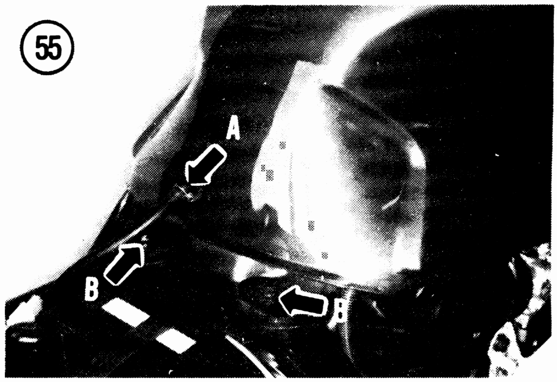

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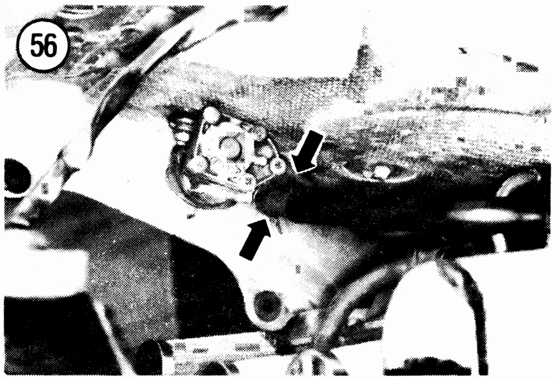

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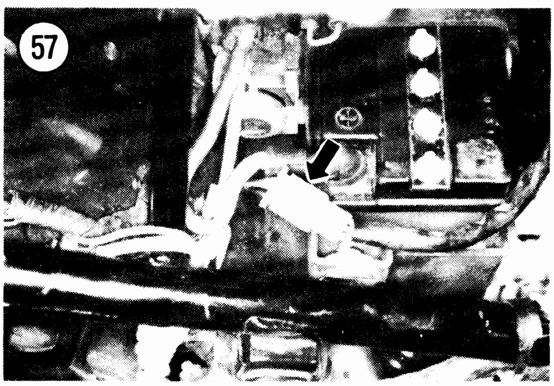

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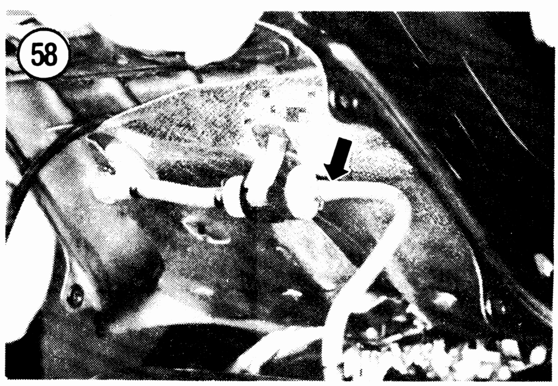
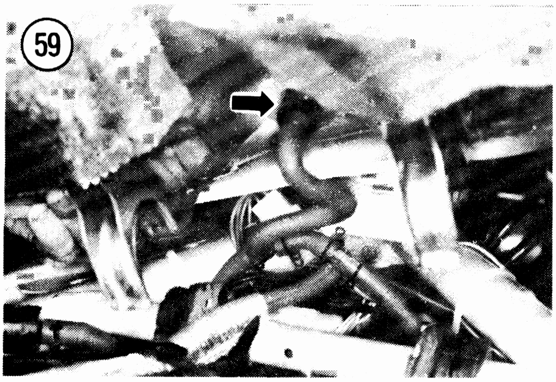
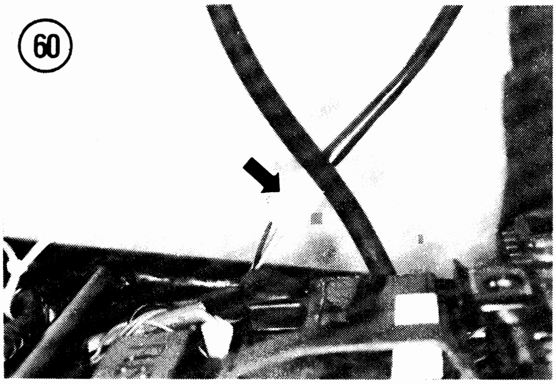
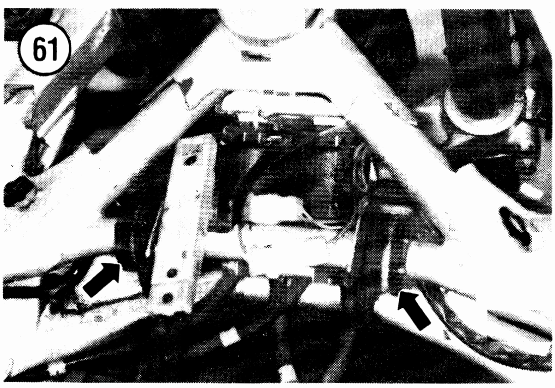
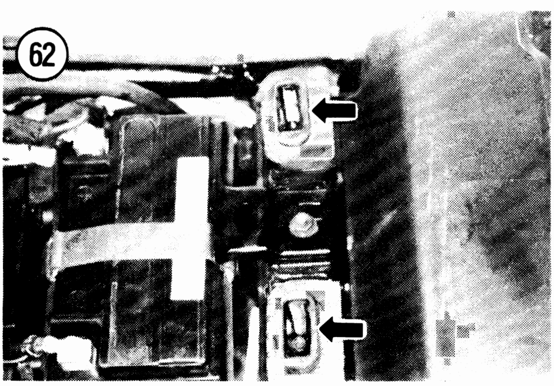










a. Don't pinch any wires or control cables during installation.
b. Reconnect all hoses and connectors. Make sure all hose clamps are in place and are on tight.
c. Make sure the overflow hose is routed correctly through the frame.

FUEL SHUTOFF VALVE

Removal/Installation

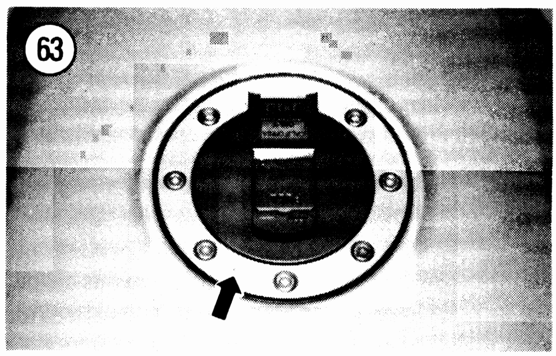
WARNING

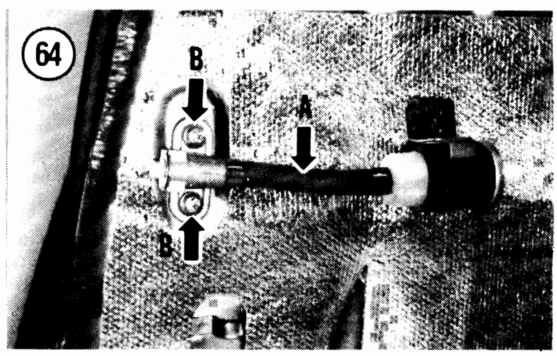
Some fuel may spill in the following procedure. Work in a well-ventilated area at least 50 feet from any sparks or flames, including gas appliance pilot lights. Do not allow anyone to smoke in the area. Keep a B:C rated fire extinguisher handy.

1. Remove the fuel tank as described in this chapter.

2. If still attached, disconnect the fuel line from shutoff valve (A, **Figure 64**).

3. Remove the bolts and washers securing the shutoff valve to the fuel tank and remove the valve. Refer to **Figure 65** for 1984-1987 models or B, **Figure 64** for 1988 and later models.





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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.

Diaphragm Test (1984-1987)

The internal diaphragm on this shutoff valve tends to deteriorate with age and heat. When this happens it allows fuel to flow to the carburetor assembly instead of shutting it off as it is designed to do when the engine is shut off and there is no vacuum present.

1. Remove the fuel tank as described in this chapter.
2. Connect a piece of tubing to the vacuum port (A, **Figure 66**) and connect this tubing to a hand held vacuum pump.
3. Apply vacuum to the valve. The vacuum should remain steady. If the vacuum leaks down or fuel is drawn into the hand pump, the diaphragm is leaking and the valve (B, **Figure 66**) must be replaced as described in this chapter.

FUEL FILTER (1988-ON)

All 1988-on 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).

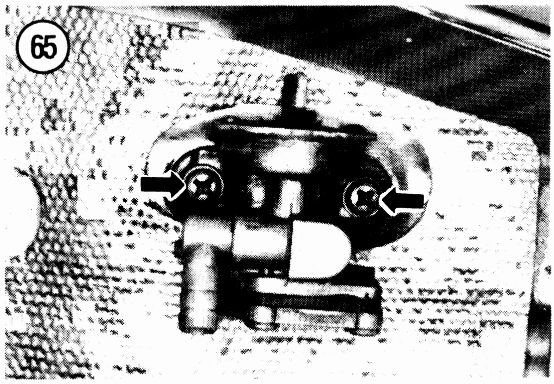
Removal/Installation

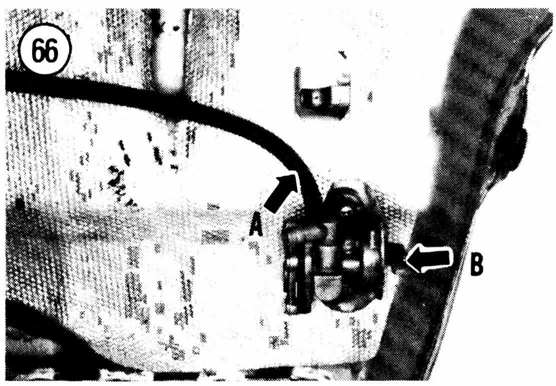
1. Remove the fuel tank as described in this chapter.
2. Disconnect the inlet (A, **Figure 67**) fuel line from the fuel filter. Plug the end of the fuel line with a golf tee.
3. Remove the fuel filter from the rubber mount and remove the filter (B, **Figure 67**).
4. Install by reversing these removal steps while noting the following:
   a. Install the fuel filter so that the flange end (C, **Figure 67**) faces toward the fuel pump.
   b. Check the fuel line clamps for damage; replace if necessary.
   c. After installation is complete, thoroughly check for leaks.

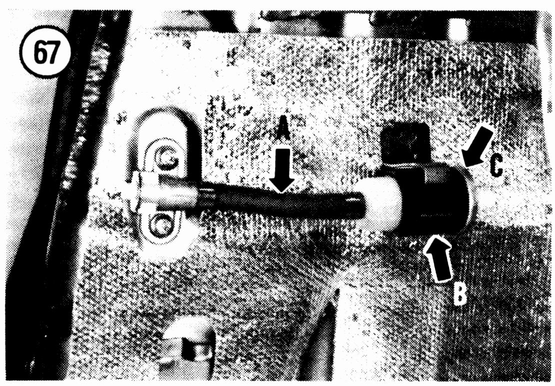
FUEL PUMP (1988-ON)

Removal/Installation

1. Remove the fuel tank as described in this chapter.
2. Remove the bolts (**Figure 68**) securing the fuel pump mounting bracket to the frame and pull the assembly away from the frame.
3. Disconnect the fuel pump electrical connector (A, **Figure 69**).







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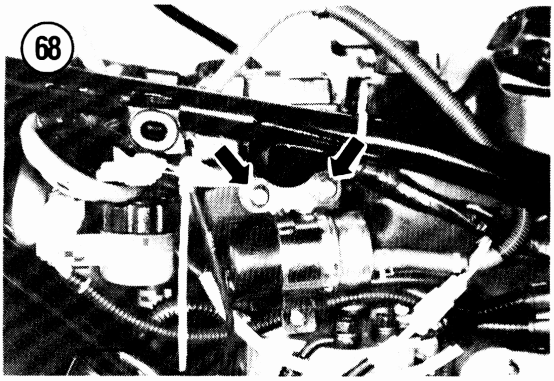

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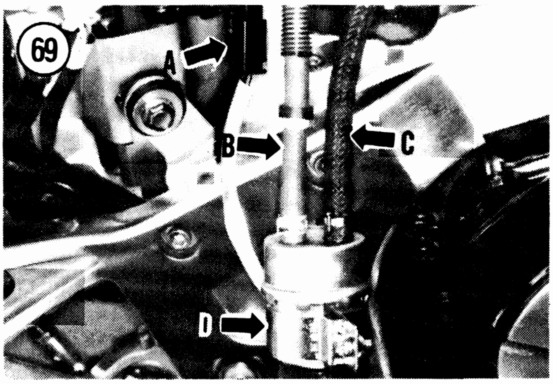

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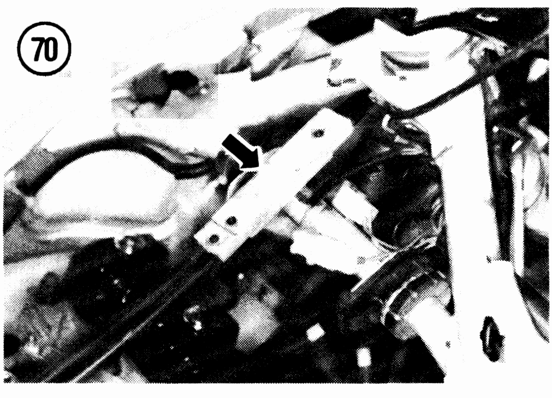

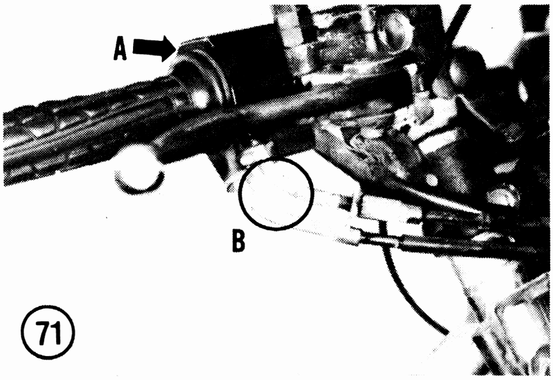

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4. Disconnect the fuel inlet (B, **Figure 69**) and the fuel outlet (C, **Figure 69**) lines from the fuel pump. Plug the end of the fuel lines with golf tees to prevent fuel leakage.
5. Loosen the clamping bolt and nut and remove the fuel pump (D, **Figure 69**) from the mounting bracket.
6. 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.

THROTTLE CABLE ASSEMBLY REPLACEMENT

On 1984-1990 models there are 4 separate throttle cables that make up the throttle cable assembly. The 2 long cables run from the throttle grip and meet the 2 short cables at the cable connector (**Figure 70**) located under the fuel tank. It is advisable to replace all 4 cables at the same time unless one cable has been damaged by other than normal usage and wear.

All other models have only 2 long cables that run from the throttle grip to the carburetor assembly.

1. Place the bike securely on the centerstand.
2. Remove the seat.
3. Remove the fuel tank as described in this chapter.

4A. On 1984-1990 models, perform the following:
   a. Remove the screws securing the right-hand switch/throttle housing halves together (A, **Figure 71**).
   b. Remove the housing from the handlebar and disengage the throttle cables (B, **Figure 71**) from the throttle grip.

4B. On 1991-on models, perform the following:
   a. Remove the screws (**Figure 72**) securing the throttle grip lower case halves together.
   b. Remove the lower case halves from the handlebar and disengage the throttle cables from the throttle grip.

5. Perform Steps 5-12 of *Carburetor Removal/Installation* in this chapter.
6. Disconnect the throttle cables from any clips holding the cables 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.

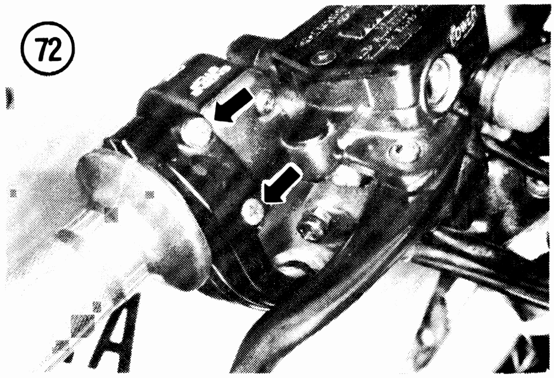
7. Tie a piece of heavy string or cord (approximately 2 m/7 ft.) to the carburetor end of the throttle cables. Wrap this end with masking or duct tape. Do not use an excessive amount of tape as it will be pulled through the frame. Tie the other end of the string to the frame.
8. At the throttle lever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

Installation

1. Lubricate the new cables as described in Chapter Three.
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 1-8 of *Removal* while noting the following:

NOTE
The routing of the upper throttle cables on the 1984-1990 models is critical to their safe operation and must be routed as shown in the following sub-step.

a. On 1984-1990 models, be sure the front long cables are routed around the steering head and through the front portion of the frame as shown in **Figure 73**, **Figure 74** and **Figure 75**.
b. 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.
c. Adjust the throttle cable as described in Chapter Three.
d. Test ride the bike and make sure the throttle is operating correctly.



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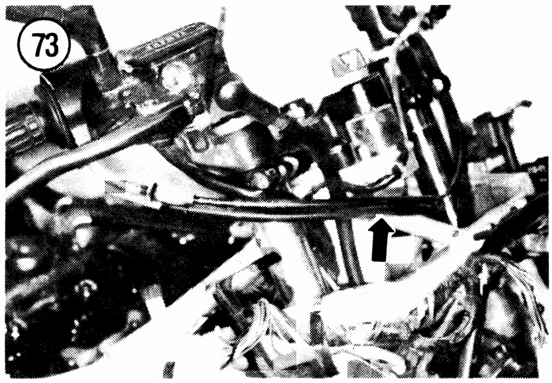
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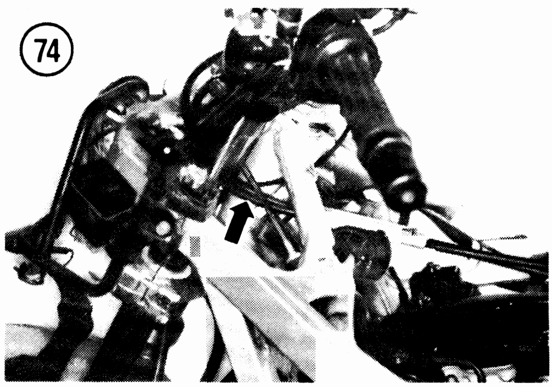
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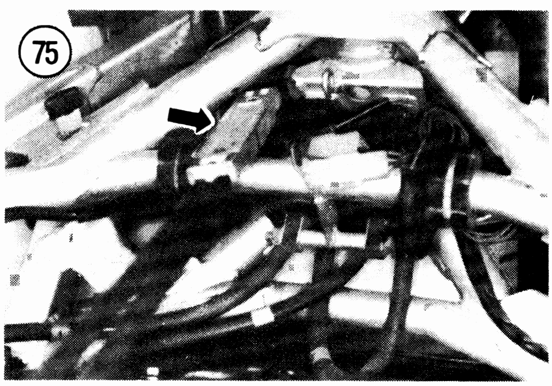
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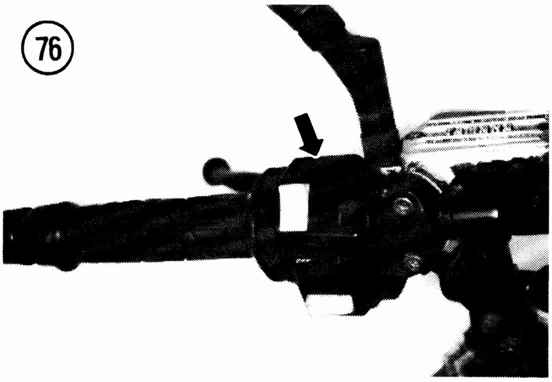
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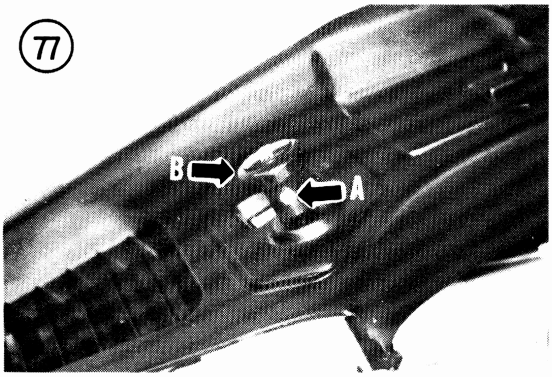

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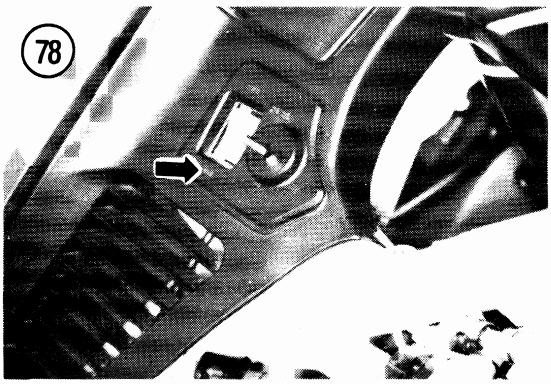
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CHOKE CABLE

Replacement

1. Remove the seat as described in Chapter Twelve.
2. Remove the fuel tank as described in this chapter.

3A. On 1984-1985 models, perform the following:

   a. Remove the screws securing the left-hand switch/choke lever housing halves together (**Figure 76**).
   b. Remove the housing from the handlebar and disengage the choke cable from the choke lever.

3B. On 1986-on models, perform the following:

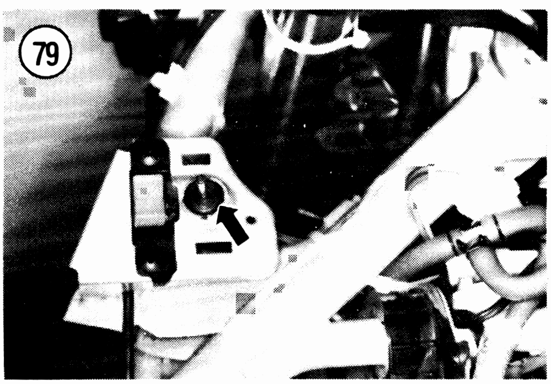
   a. Use a small screwdriver and remove the set screw (A, **Figure 77**) securing the choke knob (B, **Figure 77**) and remove it from the cable assembly. Reinstall the small screw to avoid misplacing it.
   b. Remove the fairing inner trim panel cover (**Figure 78**).

NOTE
Figure 79 *is shown with the upper fairing removed for clarity. It is not necessary to remove any fairing components for this procedure.*

   c. Unscrew the retaining ring (**Figure 79**) securing the choke knob assembly to the mounting bracket.

4. At the carburetor assembly, loosen the cable clamp screw (A, **Figure 80**) and remove the cable from the choke lever (B, **Figure 80**).

NOTE
The piece of string attached in the next step will be used to pull the new choke cable back through the frame so it will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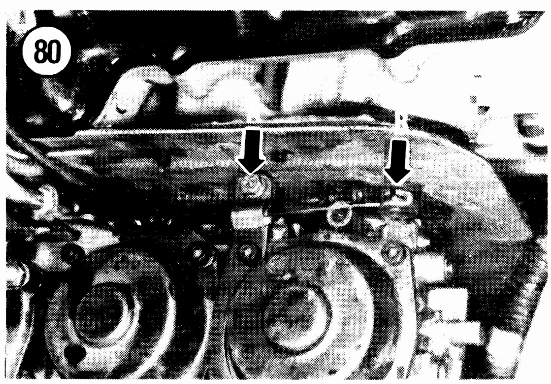
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be routed in exactly the same position as the old one was.

5. Tie a piece of heavy string or cord (approximately 7 ft./2 m long) to the carburetor end of the choke cable. Wrap this end with masking or duct tape. Do not use an excessive amount of tape as it must be pulled through the frame during removal. Tie the other end of the string to the frame or air box.

6. At the grip end, or knob end, of the cable, carefully pull the cable (and attached string) out through the frame. Make sure the attached string follows the same path as the cable through the frame.

7. Remove the tape and untie the string from the old cable.

8. Lubricate the new cable as described under *Control Cable* in Chapter Three.

9. Tie the string to the new choke cable and wrap it with tape.

10. Carefully pull the string back through the frame routing the new cable through the same path as the old cable.

11. Remove the tape and untie the string from the cable and the frame.

12. Attach the new cable to the choke linkage and tighten the cable clamp screw.

13A. On 1984-1985 models, perform the following:

a. Attach the new choke cable to the choke lever. Install the choke lever and cable to the left-hand switch housing.

b. Install the screws securing the left-hand switch/choke lever housing halves together and tighten securely.

13B. On 1986-on models, perform the following:

a. Move the choke knob assembly into position on the mounting bracket, install the retaining ring (**Figure 79**) and tighten securely.

b. Install the fairing inner trim panel cover (**Figure 78**).

c. Install the choke knob and install the set screw (A, **Figure 77**). Tighten the screw securely.

14. Reverse Steps 1-8 of *Removal*. Operate the choke lever or knob and make sure the choke linkage is operating correctly 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.

AIR FILTER AIR BOX

Removal/Installation

1. Place the motorcycle securely on the centerstand.
2. Remove the seat and side covers.
3. Disconnect the battery negative cable as described in Chapter Three.
4. Remove the fuel tank as described in this chapter.
5. Remove the air filter from the air box as described in Chapter Three.
6. Loosen the hose clamps (A, **Figure 81**) securing the air filter housing to all 4 carburetors.
7. Remove the side bolts (B, **Figure 81**) and top bolt (**Figure 82**) securing the air filter housing to the frame. Pull it toward the rear and disengage it from the carburetor assembly.
8. Disengage the crankcase ventilation hose from the crankcase.
9. Withdraw the air box up and out of the frame.

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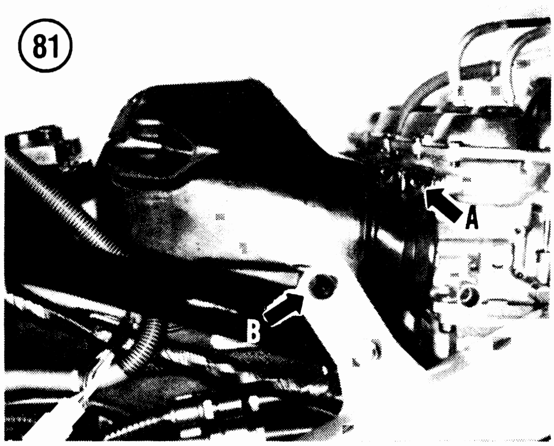

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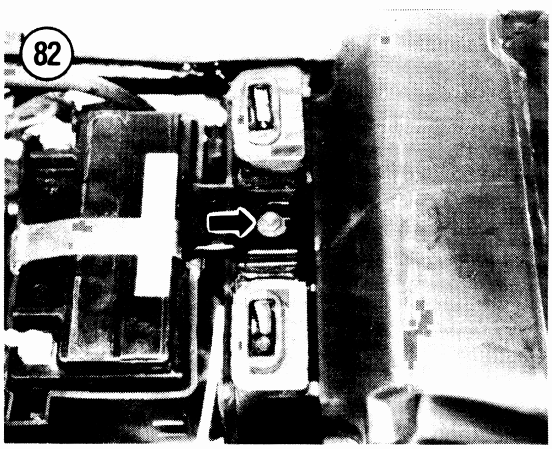

10. Inspect all rubber components of the air box assembly and replace any that are damaged or starting to deteriorate.

11. Install by reversing these removal steps, make sure all clamping bands are all seated correctly on the carburetors and that the screws are tight.

CRANKCASE BREATHER SYSTEM (U.S. AND U.K. ONLY)

To comply with air pollution standards, all models are equipped with a closed crankcase breather system (**Figure 83**). 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 clamps are tight. Check the hose for deterioration and replace as necessary.

EVAPORATIVE EMISSION CONTROL SYSTEM (CALIFORNIA MODELS)

All models sold in California are equipped with an evaporative emission control system to reduce the amount of fuel vapors released into the atmosphere.

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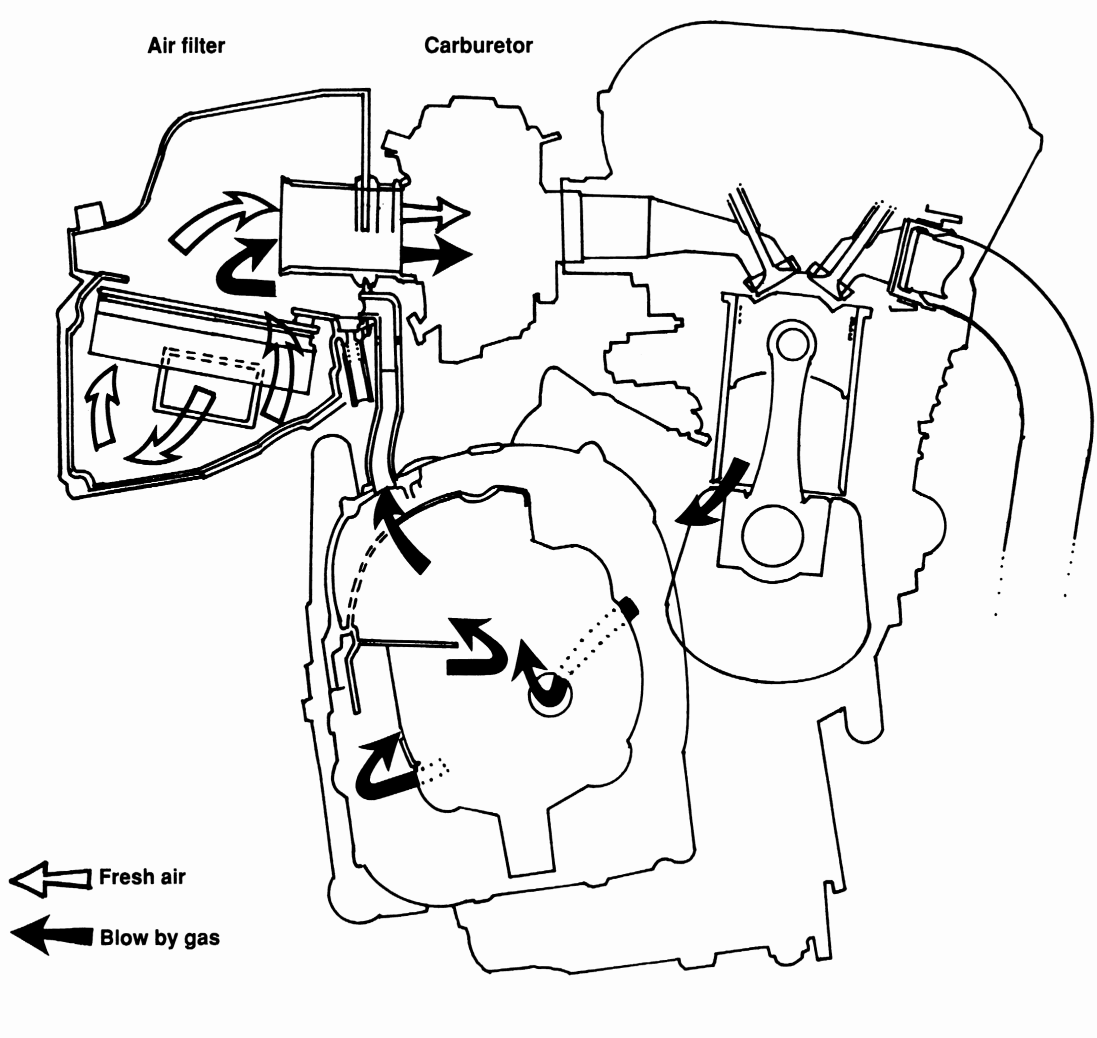


The system consists of 2 charcoal canisters, a roll-over valve, a pressure control valve, an air vent control valve, assorted vacuum lines and modified carburetors and fuel tank. A schematic of the emission control system is on a special label (**Figure 84**) attached to the top front portion of the rear fender.

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 (**Figure 85**) 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 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 (**Figure 86**). 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 at the correct engine speed. 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.

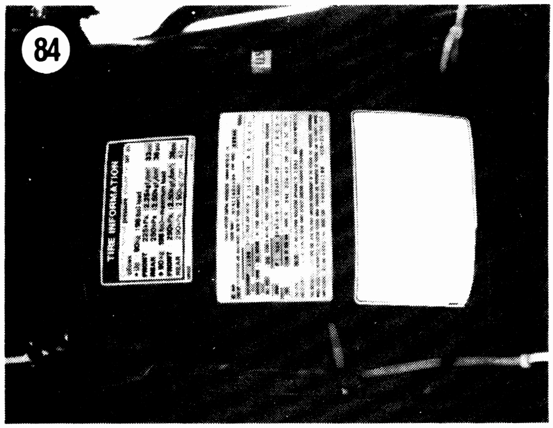
Service to the emission control system is limited to replacement of damaged parts. No attempt should be made to modify or remove the emission control system.

Parts Replacement

When purchasing replacement parts (carburetor and fuel tank), be sure to specify that the parts are for a 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 brackets.



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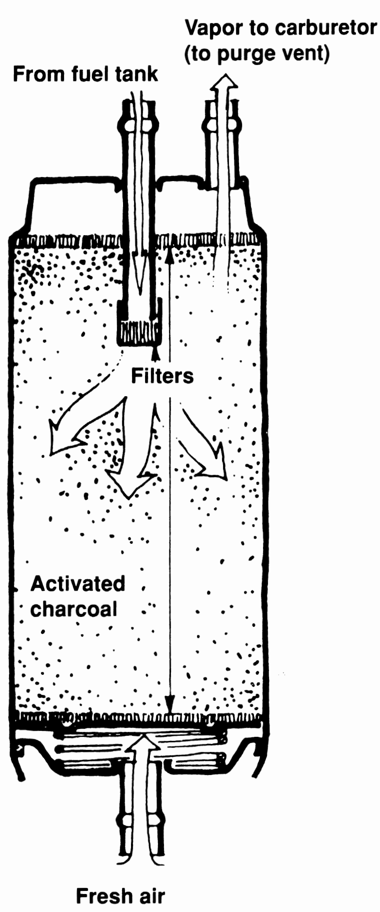

WARNING
Because the evaporative emission control system stores fuel vapors, make sure the work area is free of all flame or sparks before working on the emission system.

1. Whenever servicing the evaporative 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 fuel tank as described in this chapter.
2. Unscrew the roll-over valve (**Figure 87**) from the fuel tank.
3. Install by reversing these removal steps. Make sure the roll-over valve is tight.

Canister and Hose Replacement

NOTE
This procedure represents a typical system. The hose layout and canister location varies with different years and models.

1. Remove the fuel tank as described in this chapter.
2. Remove the front fairing as described in Chapter Twelve.
3. Label the hoses and fittings prior to disconnecting them.
4. Move the hose clamps off the hoses, then disconnect the hoses (A, **Figure 88**) from each canister.
5. Remove the bolt and washer securing the canister (B, **Figure 88**) to the frame. Don't lose the collar in the rubber grommet.
6. Remove the canister from the frame.
7. To remove the hoses, perform the following:
   a. Remove the tie wraps securing the hoses (**Figure 89**) to the frame and throttle cables.
   b. Disconnect the hoses (**Figure 90**) from the engine and carburetor assembly.

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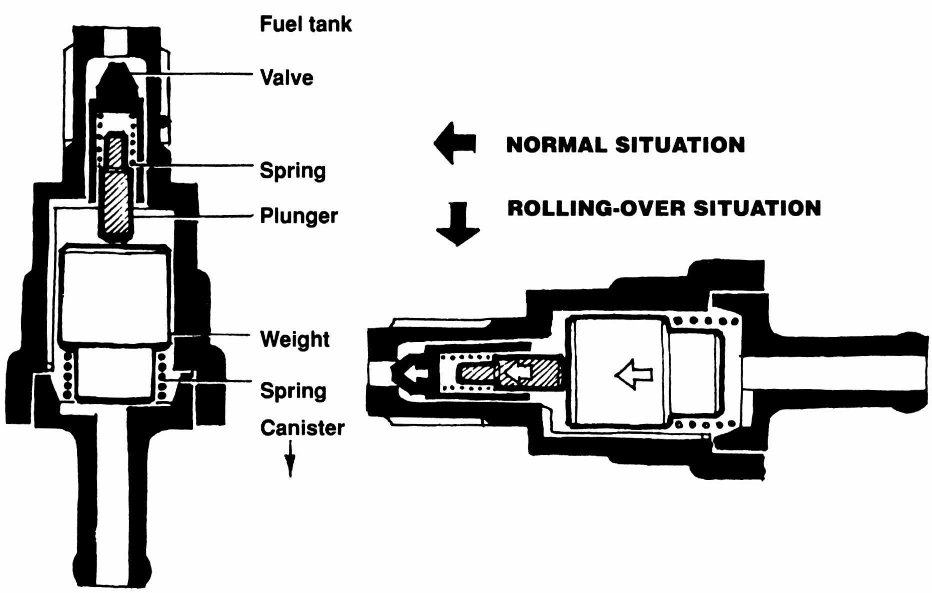

8. On models so equipped, if removed, install the outer control vent valve with the arrow (**Figure 91**) pointing toward the engine.
9. Install by reversing these removal steps while noting the following:
   a. Make sure all hoses are connected to the correct fitting.
   b. Make sure the hose clamps and bolts are tight.

EXHAUST SYSTEM

Removal/Installation

Refer to **Figure 92** for this procedure.
1. Place the bike on the centerstand.
2. Remove the lower fairing as described in Chapter Twelve.
3. Remove the nuts (**Figure 93**) securing the exhaust pipe clamp to the cylinder head. Slide the clamp off the cylinder head stud and move it down on the exhaust pipe. Repeat for all cylinders.
4. If the exhaust pipes are going to be separated from the common collector, loosen the clamping bolts (**Figure 94**) at this time.
5. Loosen the clamping bolt (**Figure 95**) securing the muffler to the common collector.
6. Remove the Allen bolt and washer (**Figure 96**) securing the muffler to the rear footpeg bracket.
7. Pull the muffler back and out of the common collector and remove the muffler.
8. Repeat Steps 5-7 for the other muffler.
9. Remove the bolt and collar securing the common collector to the frame.

NOTE
Don't lose the gasket at each exhaust port when the exhaust pipe is removed from the cylinder head.

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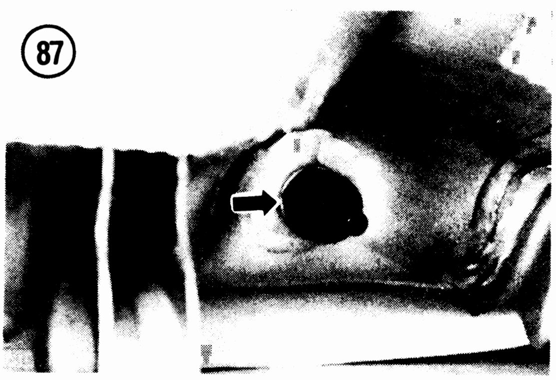

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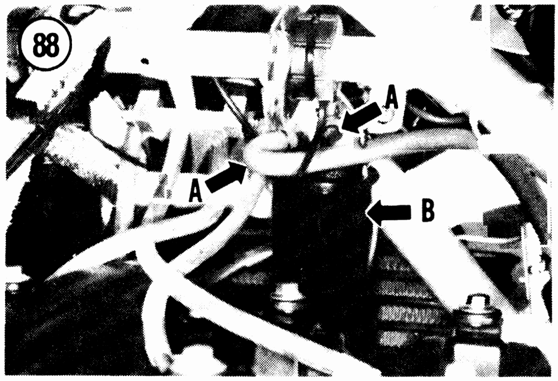

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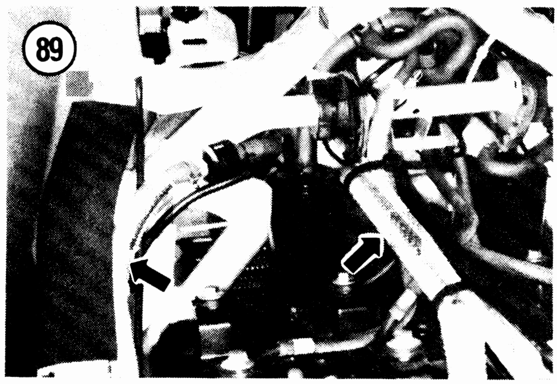

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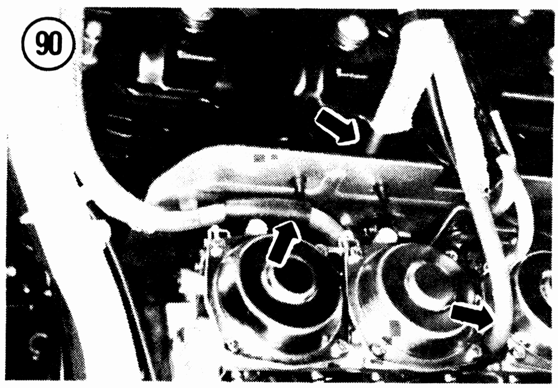

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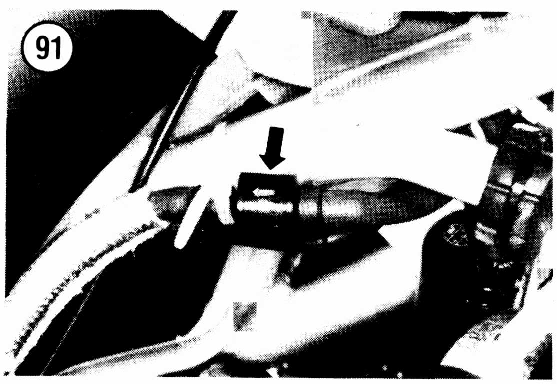

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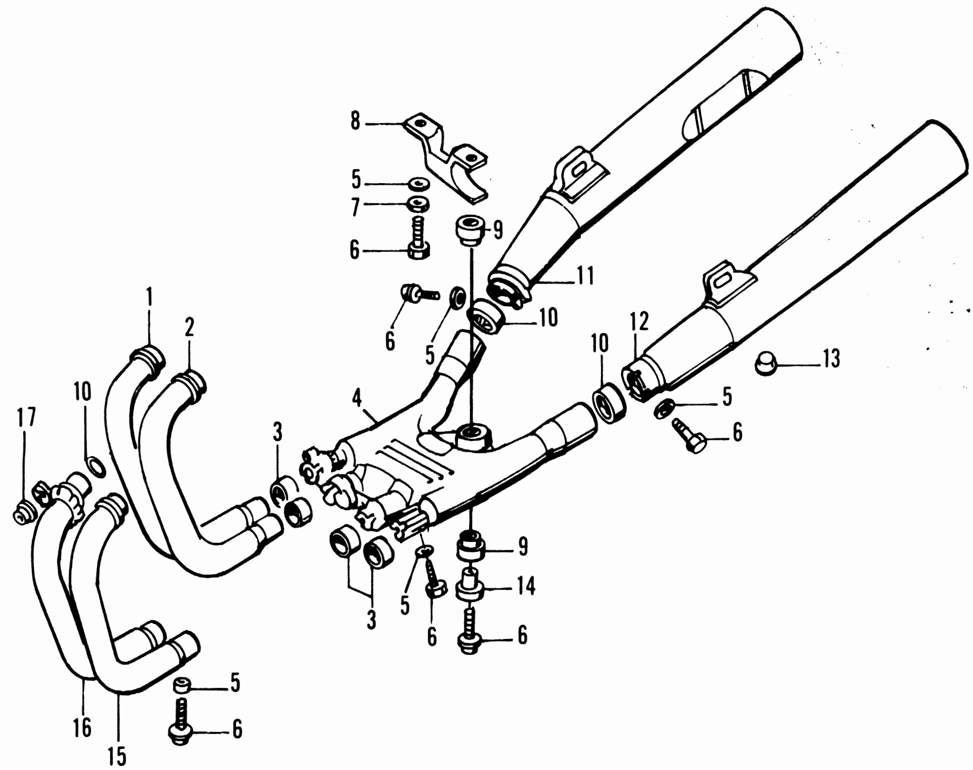
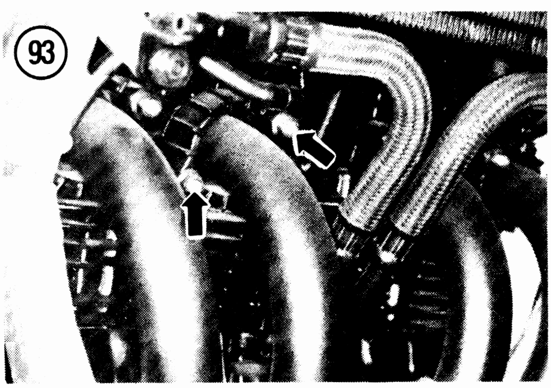
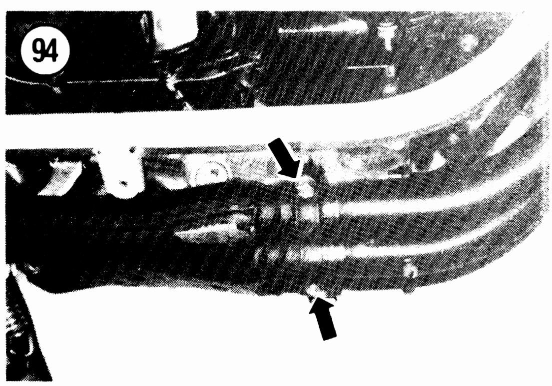
EXHAUST SYSTEM



1. Exhaust pipe No. 4
2. Exhaust pipe No. 3
3. Gasket
4. Common collector
5. Washer
6. Bolt
7. Lockwasher
8. Bracket
9. Rubber cushion
10. Gasket
11. Muffler—right-hand
12. Muffler—left-hand
13. Rubber pad
14. Collar
15. Exhaust pipe No. 1
16. Exhaust pipe No. 2
17. Nut





10. Carefully move the front portion of the exhaust system forward to clear the threaded studs on the cylinder head exhaust ports and remove the front portion of the exhaust system.
11. Inspect the system as described in this chapter.
12. Be sure to install a new gasket in each exhaust port in the cylinder head and at all joints.
13. Inspect the rubber dampers on the common collector mounting point. Replace if either is starting to harden or deteriorate or if they are damaged in any way.
14. 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 ports.
15. Securely tighten the nuts securing each exhaust pipe clamp to the cylinder head then tighten the bolts and nuts securing the common collector and mufflers to the frame. This will minimize exhaust leakage at the cylinder head.
16. After installation is complete, start the engine and make sure there are no exhaust leaks. Correct any leak prior to riding the bike.
17. Install the lower fairing sections on each side as described in Chapter Thirteen.

Inspection

1. Check for leakage where the exhaust pipe and muffler join. If necessary, loosen the clamping screw and separate the 2 parts. Remove the gasket and install a new one.

2. Inspect the drain bolts for corrosion or exhaust leakage. Replace the bolts and washers if necessary.

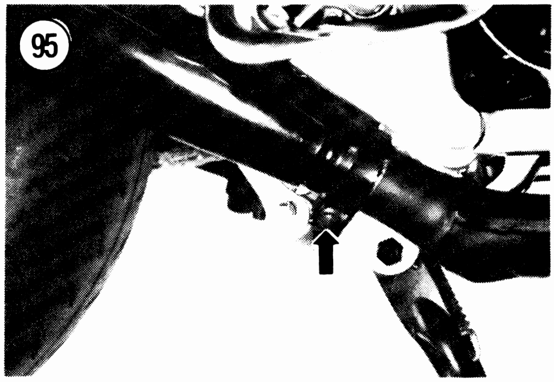
3. Inspect the common collector mounting bracket for wear or damage. Replace if necessary.

Maintenance

The exhaust system is a vital key to the motorcycle's 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.



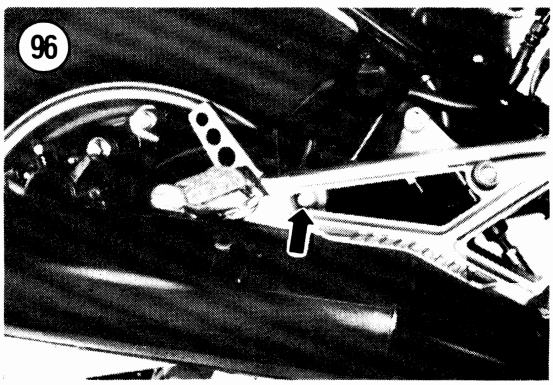


Table 1 CARBURETOR SPECIFICATIONS

U. S. MODELS	
1984-1985 FJ1100	
Carburetor model No.	BS36 Mikuni
I.D. mark	
49-state	50H-00
California	47M-00
(continued)	

Table 1 CARBURETOR SPECIFICATIONS (continued)

U. S. MODELS (continued)		
	1984-1985 FJ1100 (continued)	
Main jet	112.5	
Main air jet	45	
Jet needle	5FZ63-3	
Jet needle clip position	3	
Needle jet	Y-0	
Pilot jet	37.5	
Pilot air jet	160	
Pilot screw	pre-set	
Valve seat size	2.3	
Starter jet	30	
Fuel level	2.0-4.0 mm (0.08-0.16 in.)	
Float height	21.3-24.3 mm (0.84-0.92 in.)	
Idle speed	950-1,050 rpm	
	1986-1990 FJ1200	**1991-on FJ1200**
Carburetor model No.	BS36 Mikuni	BS36 Mikuni
I.D. mark		
49-state	1UX-00	4AH-00
California	1WJ-00	4AH-10
Main jet	112.5	110
Main air jet	45	45
Jet needle	5FZ72	5FZ72
Jet needle clip position	fixed	fixed
Needle jet	Y-2	Y-2
Pilot jet	37.5	37.5
Pilot air jet	155	155
Pilot screw	pre-set	pre-set
Valve seat size	2.3	1.5
Starter jet	30	30
Fuel level	2.5-3.5 mm (0.098-0.138 in.)	2.0-4.0 mm (0.079-0.157 in.)
Float height	21.3-23.3 mm (0.84-0.917 in.)	21.3-23.3 mm (0.84-0.917 in.)
Idle speed	950-1,050 rpm	950-1,050 rpm
U.K. MODELS		
	1984-1985 FJ1100 **1986-1987 FJ1200**	**1988-on FJ1200**
Carburetor model No.	BS36 Mikuni	BS36 Mikuni
I.D. mark	36Y-00	3CV-00
Main jet	112.5	110
Main air jet	45	45
Jet needle	5FZ62-3	5FZ74-2
Jet needle clip position	3rd from top	2nd from top
Needle jet	Y-0	Y-2
Pilot jet	40	42.5
Pilot air jet	160	155
Pilot screw	pre-set	pre-set
Valve seat size	2.3	1.5
Starter jet	30	30
Fuel level	2.0-4.0 mm (0.079-0.157 in.)	2.0-4.0 mm (0.079-0.157 in.)
Float height	21.3-23.3 mm (0.84-0.917 in.)	21.3-23.3 mm (0.84-0.917 in.)
Idle speed	950-1,050 rpm	950-1,050 rpm

7

CHAPTER EIGHT

ELECTRICAL SYSTEM

This chapter describes service procedures for the electrical system.

If the bike is going to be ridden in a costal area or where the relative humidity is usually high, it is important to keep all electrical connections completely coupled to each other. It is also suggested that you apply Dielectric Compound (available from motorcycle dealers or parts houses) to all electrical connectors whenever they are disconnected and reconnected. This will help seal out moisture and help to prevent the corrosion of electrical connector terminals.

Information regarding the battery and spark plugs is covered in Chapter Three.

The electrical system includes the following systems:

a. Charging system.

b. Ignition system.

c. Lighting system.

Tables 1-3 are 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.

CHARGING SYSTEM

The charging system consists of the battery, main fuse, main switch, alternator and the rectifier/regulator assembly. Refer to **Figure 1** for U.S. models or **Figure 2** for U.K. models.

Alternating current generated by the generator is rectified to direct current. The voltage regulator maintains the voltage to the battery and additional electrical loads (lights, ignition, etc.) at a constant voltage regardless of variations in engine speed and load.

Leakage Test

Perform this test prior to performing the output test.

1. Remove the seat as described in Chapter Twelve.

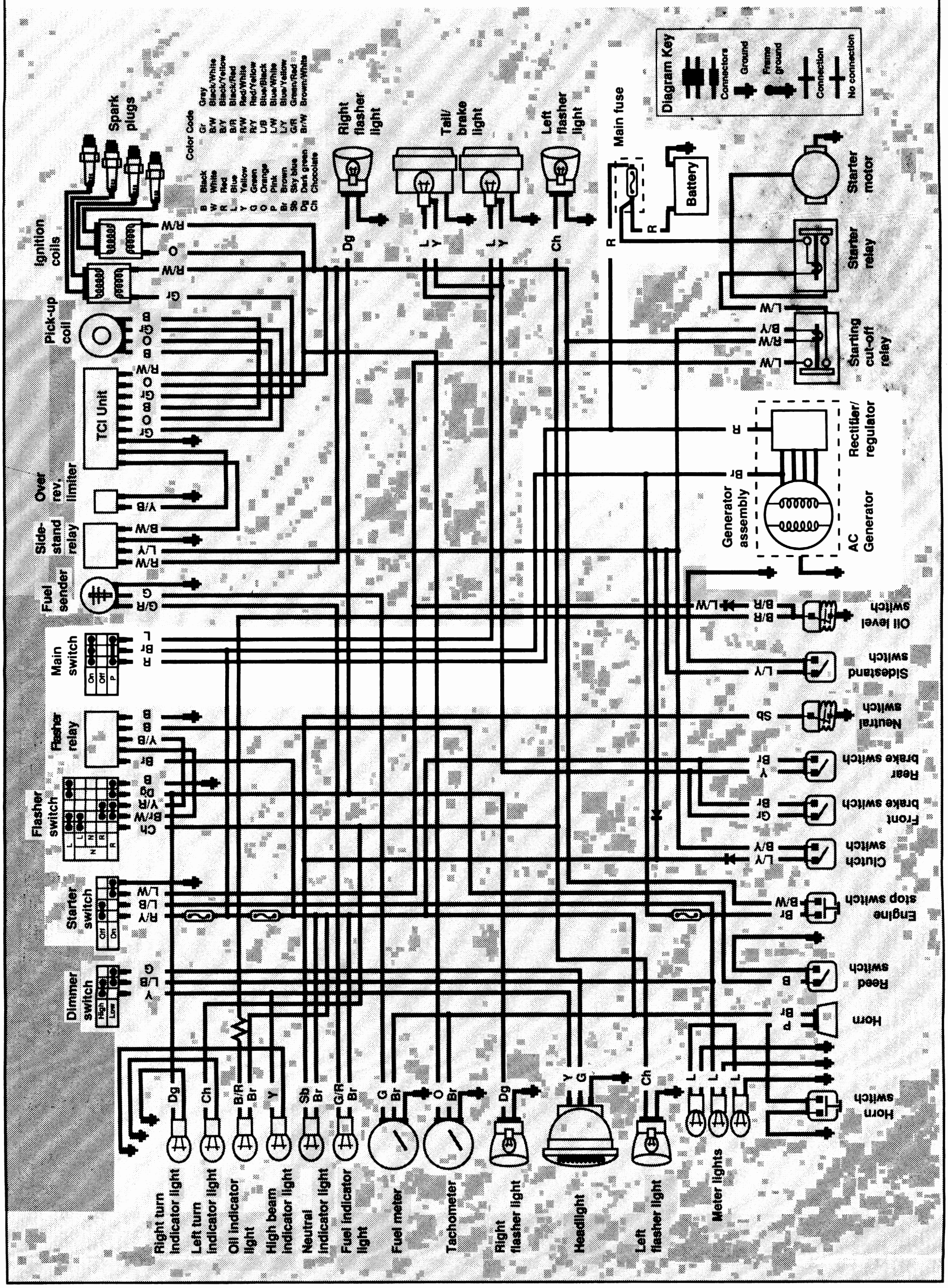
2. Turn the ignition switch OFF.

3. Disconnect the battery negative lead (**Figure 3**).

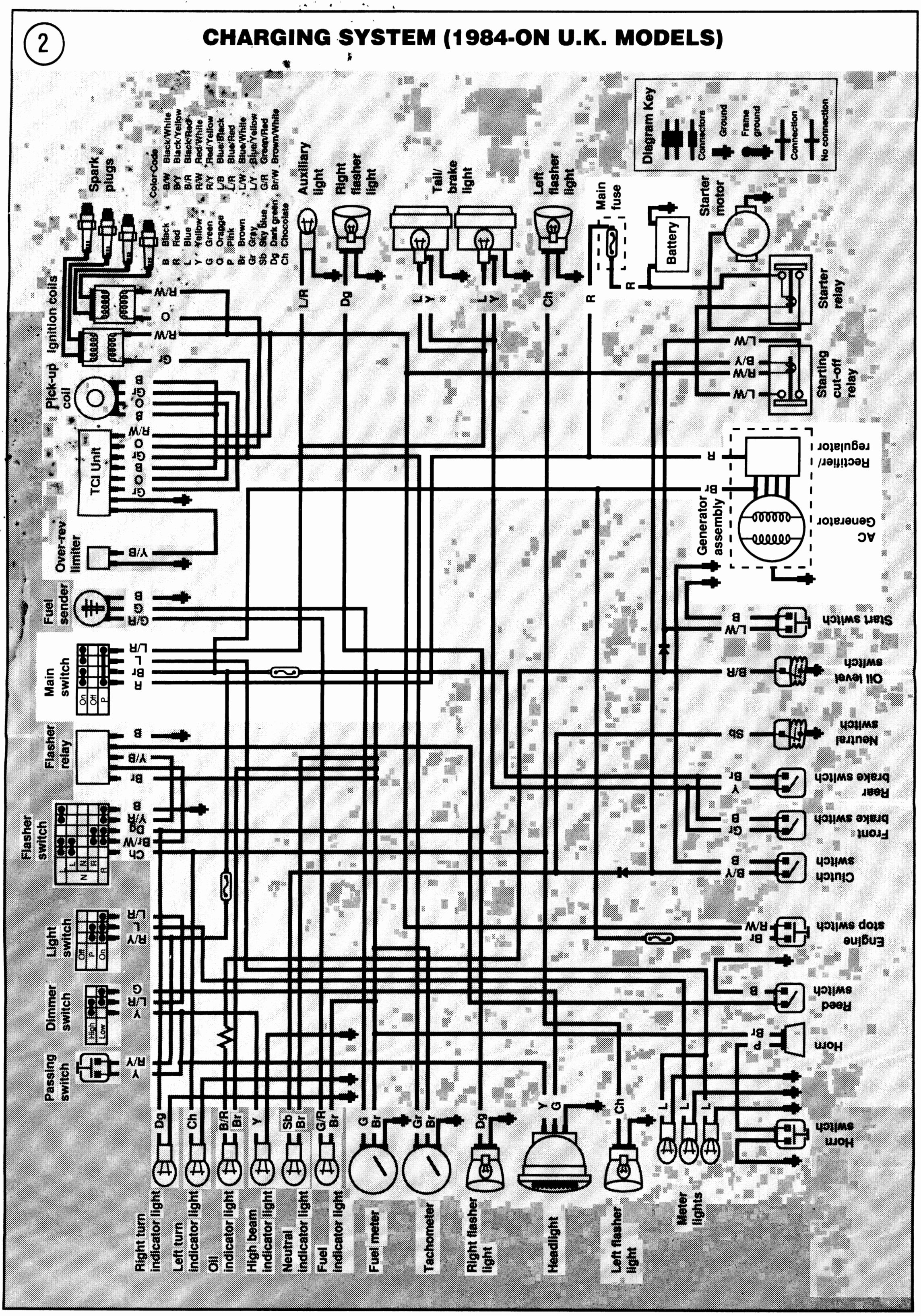
4. Connect an ammeter between the battery negative lead and the negative terminal of the battery.

1

CHARGING SYSTEM (1984-ON U.S. MODELS)



CHARGING SYSTEM (1984-ON U.K. MODELS)



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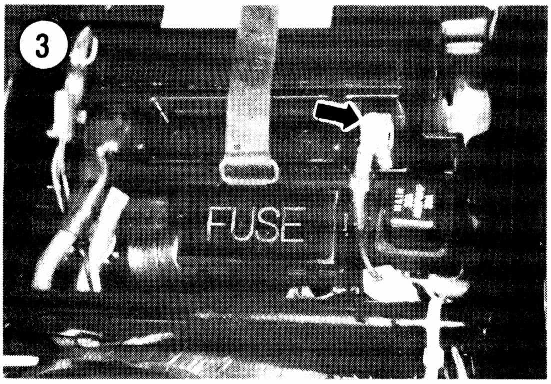

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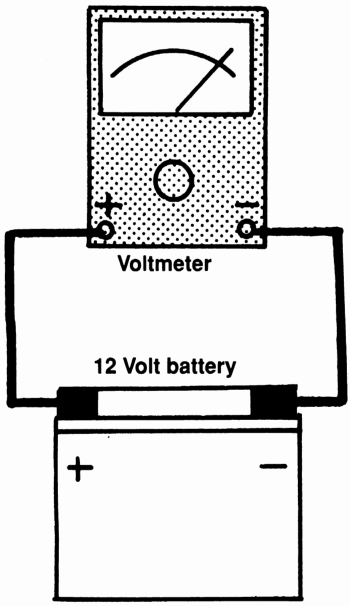

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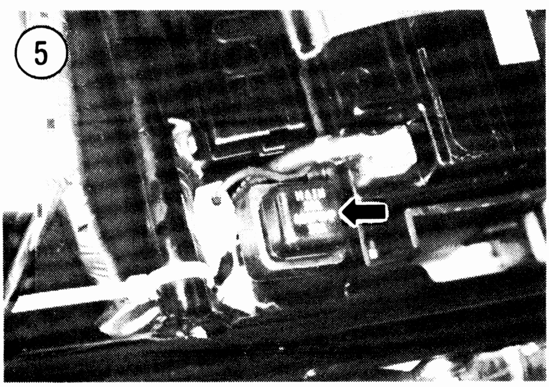

5. The ammeter should read less than 0.1 mA. If the amperage is greater this indicates there is a voltage drain in the system that will discharge the battery.

Charging System Test

Whenever the charging system is suspected of trouble, make sure the battery is fully charged before testing further. Clean and test the battery as described under *Battery* in Chapter Three. If the battery is in good condition, test the charging system as follows:

1. Remove the seat and both frame side covers as described in Chapter Twelve.
2. Refer to the charging system schematic in **Figure 1** or **Figure 2** and check all connections to make sure they are clean, free of corrosion and are tight. Check the wiring for fraying, worn insulation or other damage. Electrical connections should be cleaned with electrical contact cleaner, an application of dielectric compound applied and then reconnected.

NOTE
Do not disconnect either the positive or negative battery cables; they are to remain in the circuit as is.

3. Test the battery as described under *Battery* in Chapter Three. Once the battery charge is correct, proceed to Step 4.
4. Connect a 0-20 DC voltmeter to the battery terminals as shown in **Figure 4**. Start the engine and increase engine speed to approximately 3,000 rpm. Voltage should read 14.3-15.3 volts. Interpret results in Step 5.

5A. *Charging voltage lower than 13.5 volts:* First check the main fuse located next to the battery. Flip open the cover (**Figure 5**) and pull the fuse (**Figure 6**) out of its holder and visually inspect it. If the fuse is blown, refer to *Fuses* in this chapter and replace it. If the main fuse is okay, test the following components in order as described in this chapter:

a. Rectifier (see *Rectifier Testing/Replacement*).
b. Stator coil resistance (see *Stator Coil Testing/Replacement*).
c. Field coil resistance (see *Field Coil Resistance Check*).

5B. *Charging voltage higher than 15.3 volts:* Remove the generator cover (**Figure 7**). Then check the regulator assembly mounted on the generator (A, **Figure 8**) for loose connections. If the regulator mounting and electrical connections appear okay, replace the regulator.

Rectifier Testing/Replacement

The rectifier is mounted on the generator assembly. An ohmmeter is required for this procedure.

1. Remove the generator cover (**Figure 7**).

CAUTION
If the rectifier is subjected to overcharging it can be damaged. Be careful not to short-circuit or incorrectly connect the battery positive and negative leads. Never directly connect the rectifier to the battery for a continuity check.

2. Measure the resistance between each of the following terminals with an ohmmeter (**Figure 9**). Record each of the measurements:
   a. E and B.
   b. E and C.
   c. E and D.
   d. A and B.
   e. A and C.
   f. A and D.
3. Reverse the ohmmeter leads, then repeat Step 3. Compare results with **Figure 10**. Each set of measurements must be high with the ohmmeter connected one way and low with the ohmmeter leads reversed. It is not possible to specify exact ohmmeter readings.
4. Even if only one of the elements is defective, replace the rectifier assembly. Remove the generator as described in this chapter and have the rectifier assembly replaced by a Yamaha dealer.

Stator Coil Testing/Replacement

The stator coil is mounted on the generator assembly. An ohmmeter is required for this test procedure.

1. Remove the generator cover (**Figure 7**).

NOTE
The test in Step 2 should be made with the engine at room temperature (68° F [20° C]).

2. Measure the resistance between each of the following terminals with an ohmmeter (**Figure 11**). Record each of the measurements:

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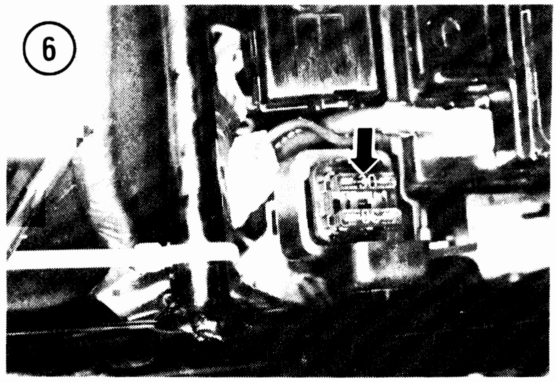

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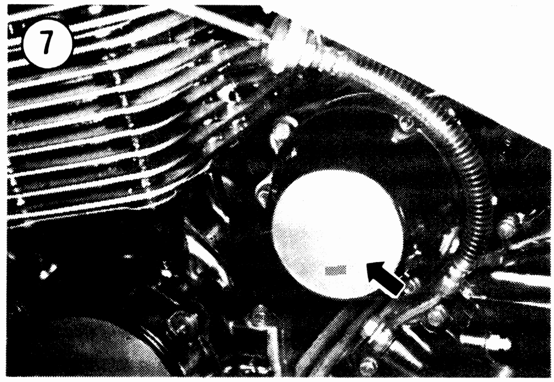

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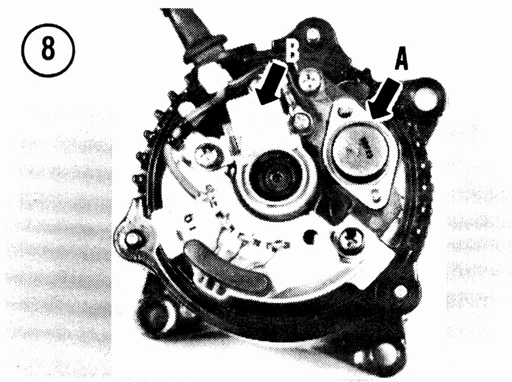

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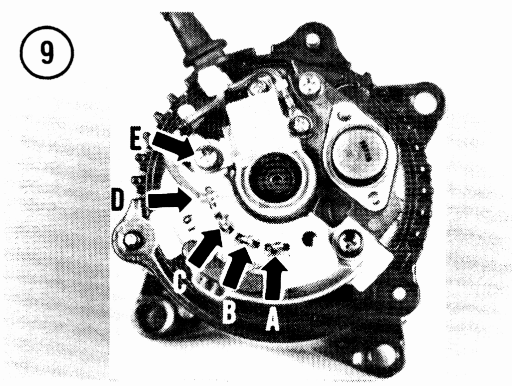

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Checking Element	Pocket Tester Connecting Point		Good
	Red (+)	Blk (–)	
D_1	E	B	O
	B	E	X
D_2	E	C	O
	C	E	X
D_3	E	D	O
	D	E	X
D_4	A	B	O
	B	A	X
D_5	A	C	O
	C	A	X
D_6	A	D	O
	D	A	X

O: Continuity
X: No continuity (∞)

a. A and B.
b. A and C.
c. B and C.

3. The correct reading is 0.2 ohms.
4. Even if only one of the elements is defective, replace the stator coil assembly. Remove the generator as described in this chapter and have a Yamaha dealer replace the stator coil assembly.

Field Coil Resistance Check

Because field coil resistance check requires complete disassembly of the generator, refer service to a Yamaha dealer. Remove the generator as described in this chapter.

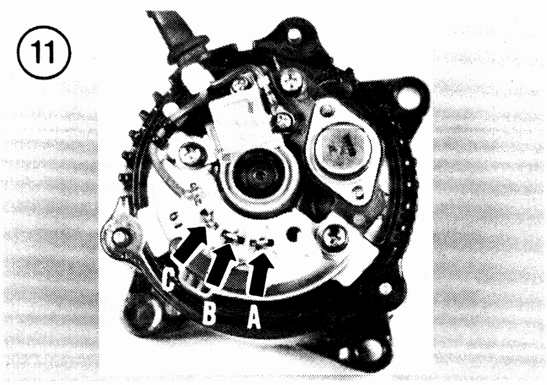
Generator Brush Length

1. Remove the generator cover (**Figure 7**).
2. Remove the brush holder (B, **Figure 8**) and remove the brushes and springs.
3. Measure the brushes with a Vernier caliper. Replace the brush holder assembly if the brushes measure 4.5 mm (0.180 in.) or less.
4. Install by reversing these steps.

Generator Removal/Installation

1. Place the bike securely on the centerstand.
2. Disconnect the battery negative terminal (**Figure 3**).
3. Disconnect the electrical connector (**Figure 12**) from the generator.
4. Remove the bolts securing the generator and remove the generator (**Figure 13**).

11



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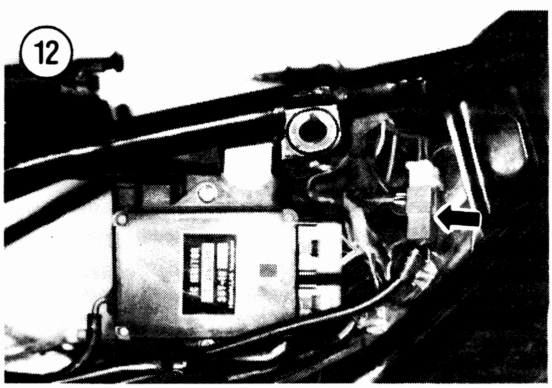


5. Install by reversing these steps while noting the following:

a. Check the generator O-ring (**Figure 14**) for flat spots or wear; replace if necessary.

b. Align the generator shaft (**Figure 15**) with the starter clutch and install the generator assembly.

c. Tighten the generator mounting bolts to 20 N•m (14 ft.-lb.).

IGNITION SYSTEMS

The models covered in this manual are equipped with 2 different electronic ignition systems. The first system covered in this section is designated as the Transistor Control Ignition system that is equipped on the 1984-1987 U.S. models and the 1984-1990 U.K. models. This 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 boost control circuit which monitors engine vacuum via a hose from the No. 2 carburetor. This 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 16** for U.S. models or **Figure 17** for U.K. models.

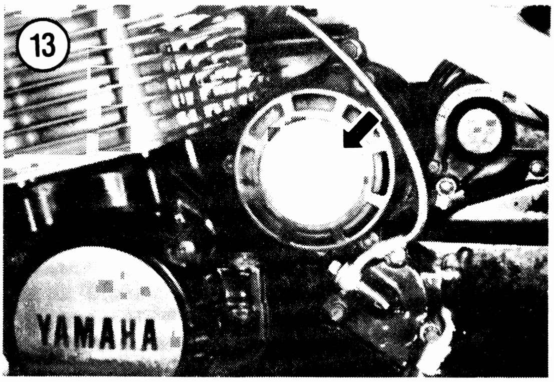
The second ignition system is designated as the Digital Control Ignition system and is equipped on the 1989-on U.S. models and the 1991-on U.K. models. This system also uses no breaker points and is non-adjustable, but the timing should be checked to make sure all ignition components are operating correctly. The digital control ignition system is computer controlled and is operated by the digital microprocessor within the ignitor unit. The ignition advance curve is pre-programmed into the ignitor unit and is closely performance matched to the spark timing of the engine's ignition requirements. This 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 18** for U.S. models or **Figure 19** for U.K. models. The electric fuel pump is also controlled by the ignitor unit.

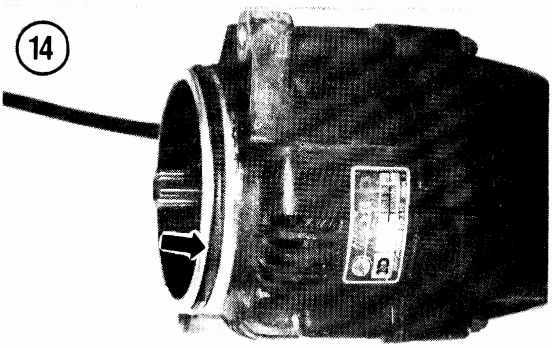
Most problems involving failure to start, poor driveability or rough running are caused by trouble in the ignition system.

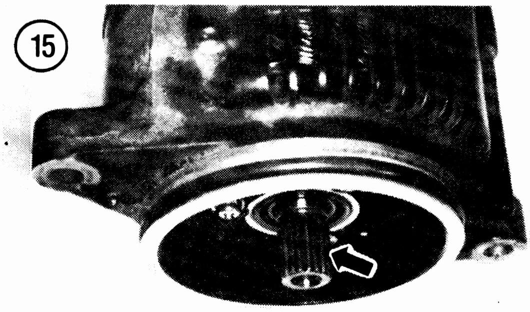
Note the following symptoms:

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.







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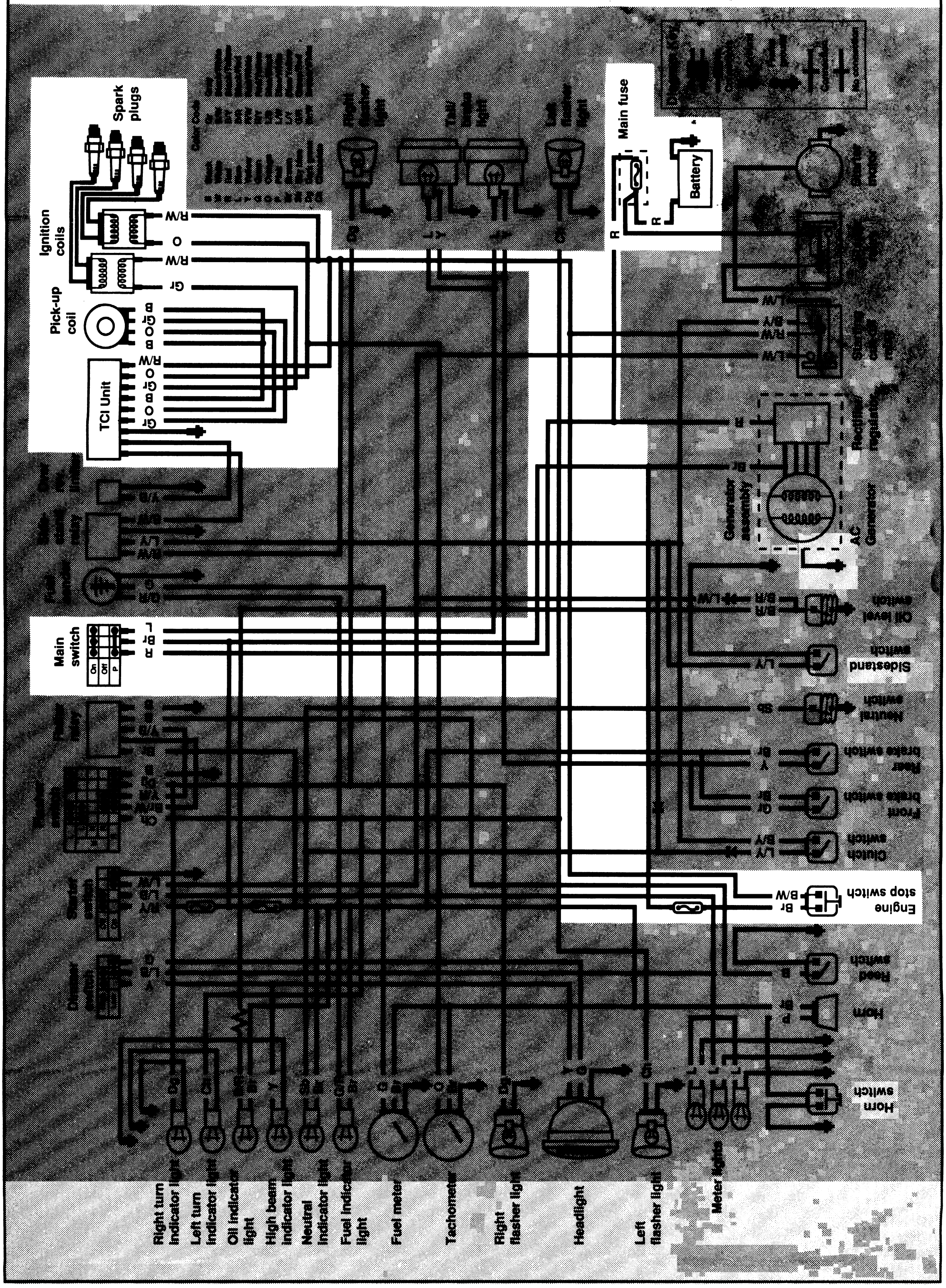
IGNITION SYSTEM (1984-1987 U.S. MODELS)



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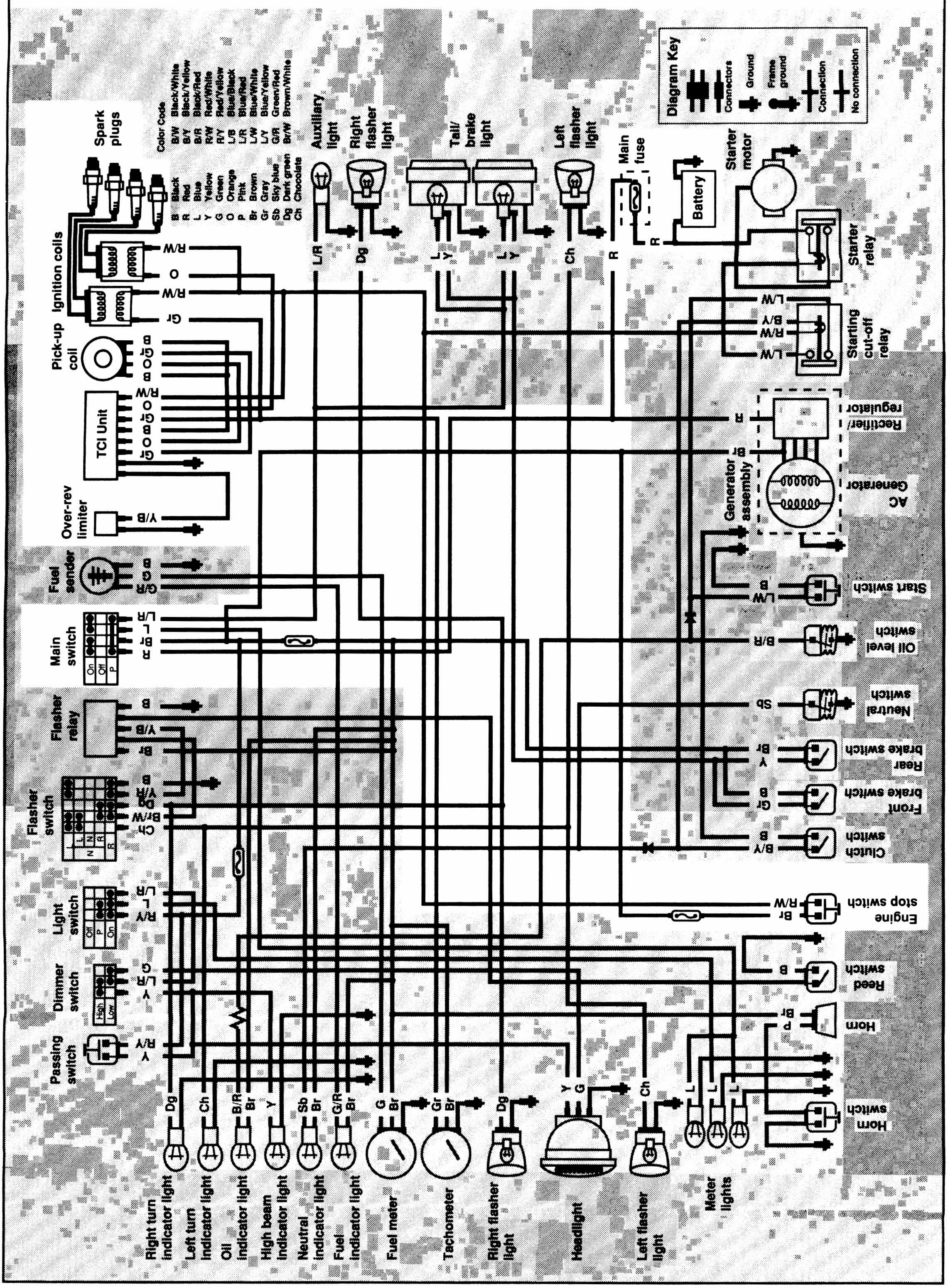
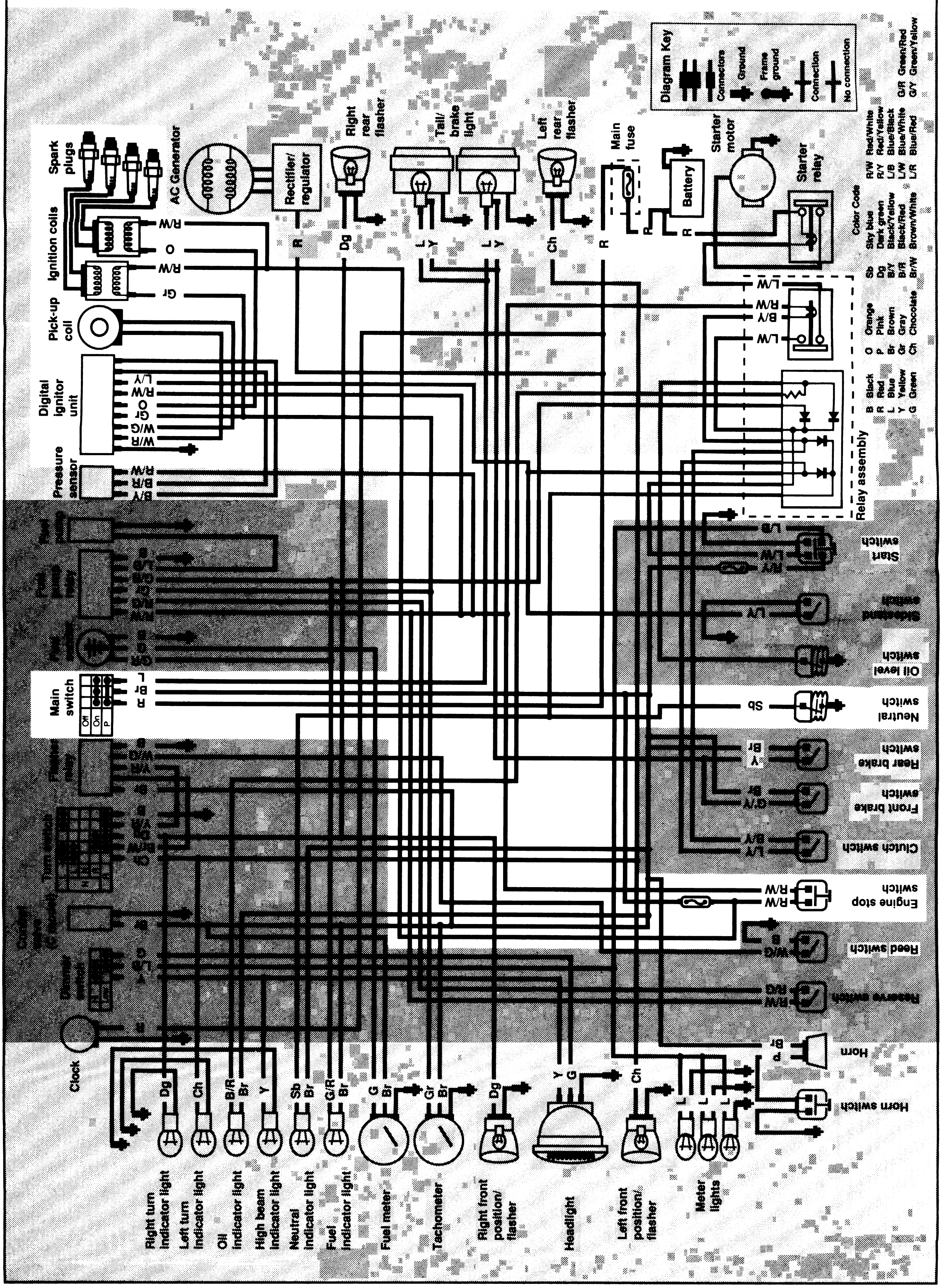
IGNITION SYSTEM (1984-1990 U.K. MODELS)



(18) **IGNITION SYSTEM (1989-ON U.S. MODELS)**



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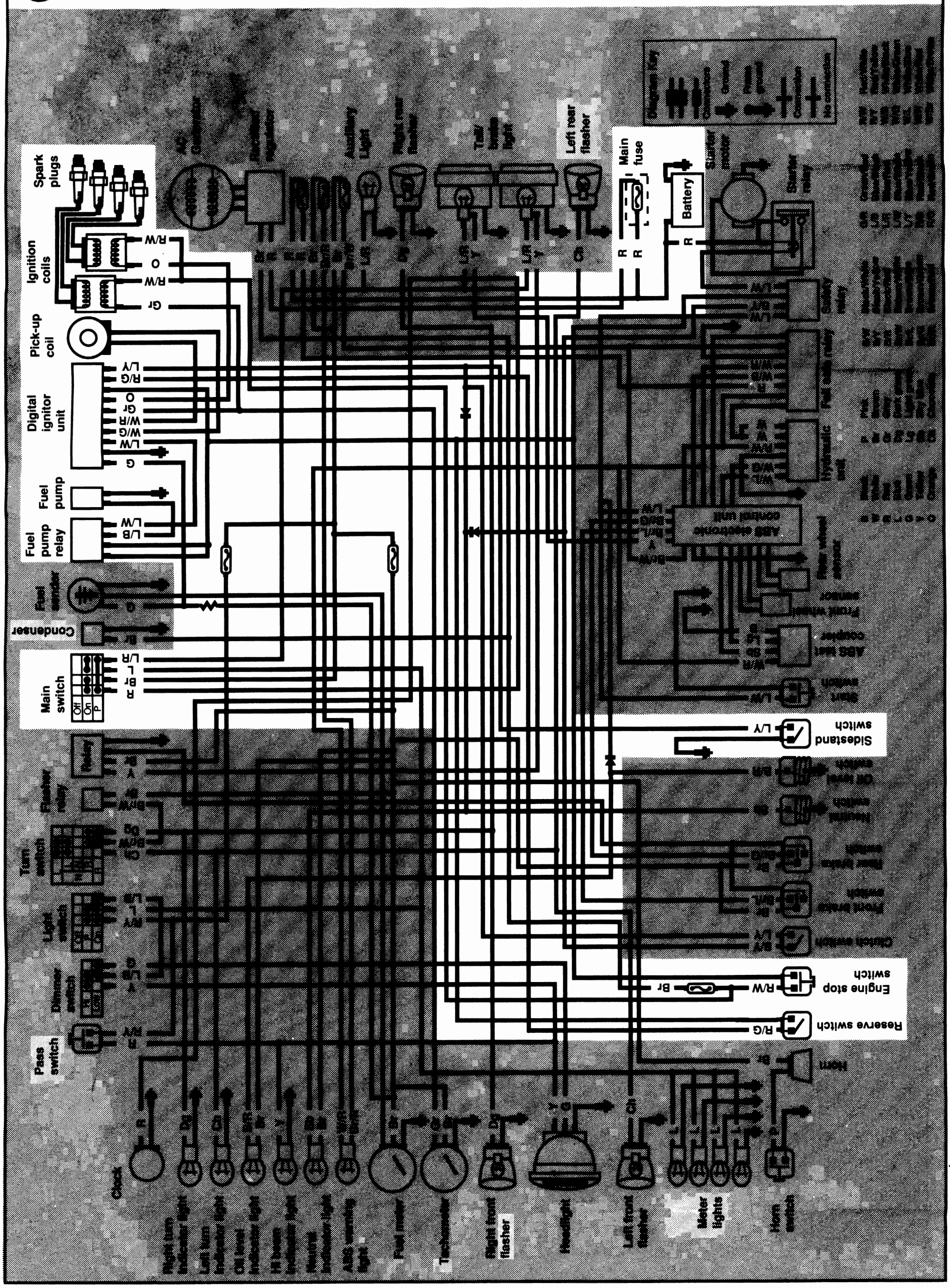
IGNITION SYSTEM (1991-ON U.K. MODELS)



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.
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 spark plug, wire or connector or a serious electrical shock may result. If necessary, use a pair of insulated 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 in 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 for are found in the diagnostic chart in **Figure 20**. A multimeter, as described in Chapter One, is required to perform the test procedures.

Before beginning actual troubleshooting, read the entire test procedure (**Figure 20**). When required, the diagnostic chart will refer you to a certain procedure in this chapter for testing.

Pickup Coil Testing (Transistor Control Ignition System)

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 the frame left-hand side cover as described in Chapter Twelve.
2. Disconnect the battery negative lead (**Figure 21**).
3. Disconnect the pickup coil lower 3-pin electrical connector (**Figure 22**) (containing 1 orange, 1 black and 1 gray wire) from the ignitor unit. The ignitor unit is located on the left-hand side of the frame next to the battery.

NOTE
Connect the ohmmeter to the electrical connector attached to the wiring harness leading to the pickup coil.

4. Use an ohmmeter on R × 100 to measure the pickup coil resistance between the following terminals:
   a. Orange to black.
   b. Gray to black.
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 Testing (Digital Control Ignition System)

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 the left-hand frame side cover as described in Chapter Twelve.
2. Disconnect the battery negative lead (**Figure 3**).
3. Disconnect the pickup coil 2-pin electrical connector (**Figure 23**) (containing 1 gray and 1 black wire) from the harness. This connection is located on the left-hand side of the frame behind the battery.

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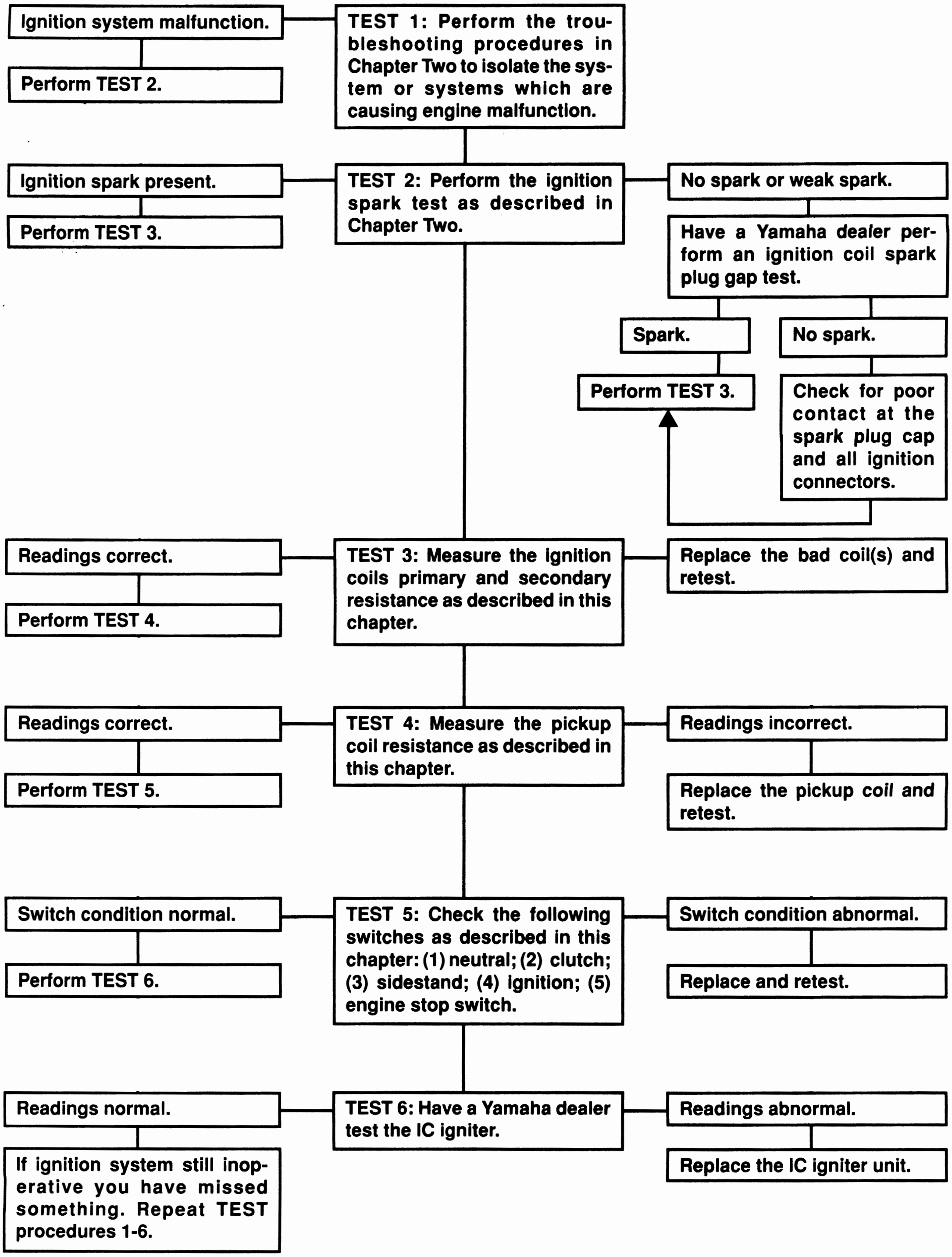
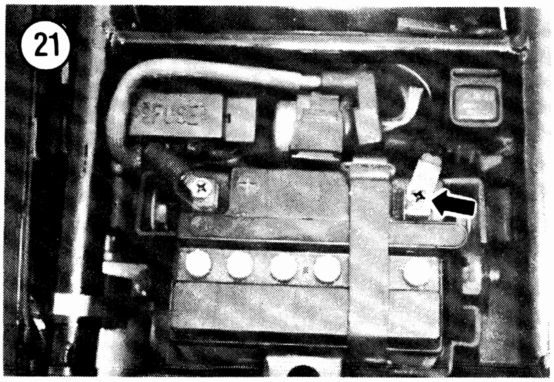
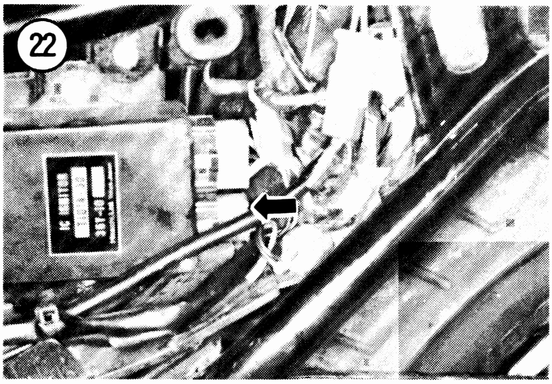
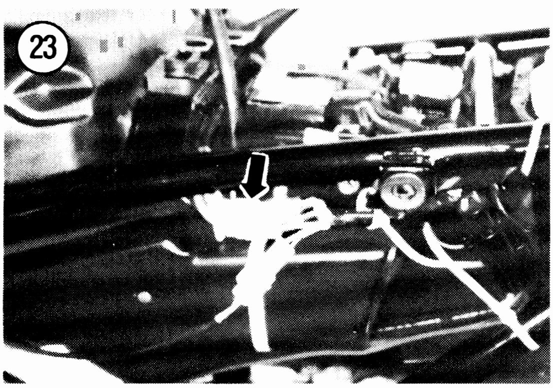
IGNITION SYSTEM DIAGNOSIS

PROBLEM: WEAK SPARK OR NO SPARK AT ALL









NOTE
Connect the ohmmeter to the electrical connector attached to the wiring harness leading to the pickup coil.

4. Use an ohmmeter on R × 100 to measure the pickup coil resistance between the gray and the black terminals. Attach the positive (+) test lead to the gray terminal and the negative (–) test lead to the black terminal.

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 the frame left-hand side cover as described in Chapter Twelve.

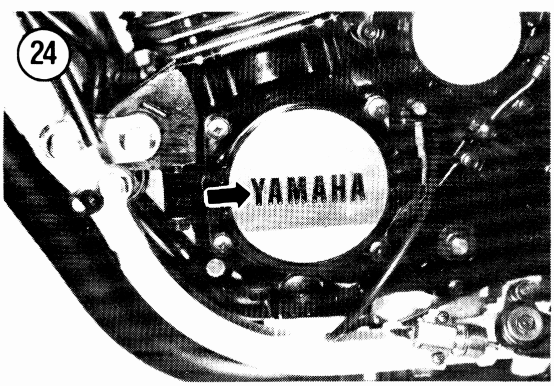
2. Disconnect the battery negative lead (**Figure 21**).

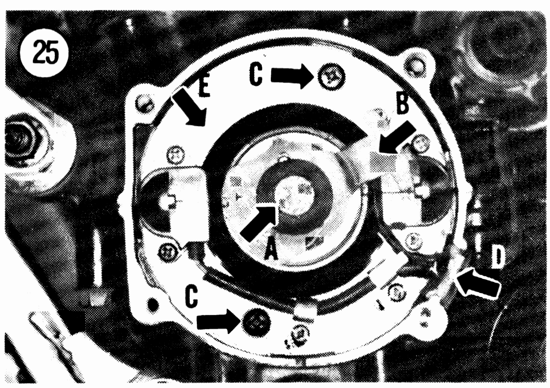
3. Remove the bolts securing the pickup coil cover (**Figure 24**) and remove the cover and gasket.

4. Remove the bolt (A, **Figure 25**) securing the timing plate and remove the timing plate (B, **Figure 25**).

5. Remove the screws (C, **Figure 25**) securing the pickup coil assembly. Carefully pull the rubber grommet (D, **Figure 25**) out of the notch in the crankcase and remove the pickup coil assembly (E, **Figure 25**) from the engine.

6. 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.





7. Disconnect the electrical connector from the ignitor unit or main harness and remove the pickup coil assembly from the frame.
8. Install by reversing these removal steps while noting the following:
   a. Make sure the rubber grommet is 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 centerstand.
2. Remove the fuel tank as described in this chapter.
3. On models so equipped, remove the fuel evaporation emission canisters as described in Chapter Seven.
4. If necessary, move any electrical connectors out of the way in order to gain access to the ignition coils.
5. Disconnect the ignition primary coil wire electrical connectors (**Figure 26**). Each connector contains 2 wires: the right-hand coil (1 red/white and 1 gray) and the left-hand coil (1 red/white and 1 orange).
6. Measure the coil primary resistance using an ohmmeter set at R × 1 as follows:
   a. Connect the ohmmeter test leads to the right-hand ignition coil connector as shown in **Figure 27**.
   b. Connect the ohmmeter test leads to the left-hand ignition coil connector as shown in **Figure 28**.

The correct primary resistance is listed in **Table 1**.

7. Disconnect the spark plug leads from the spark plugs as described under *Spark Plugs* in Chapter Three.
8. Carefully remove the spark plug cap from each spark plug lead.

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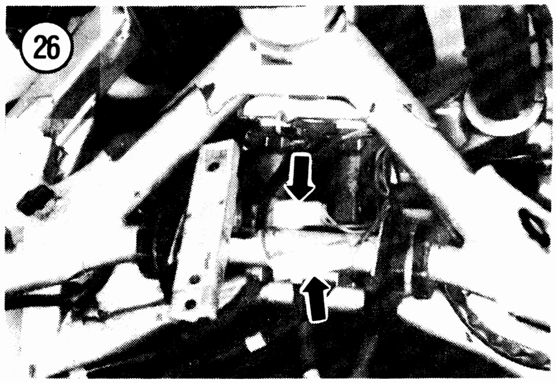

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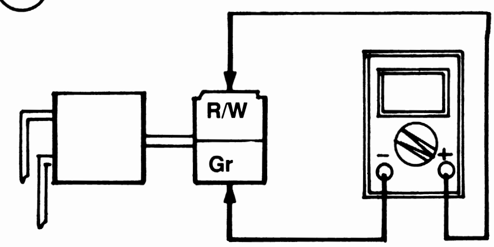

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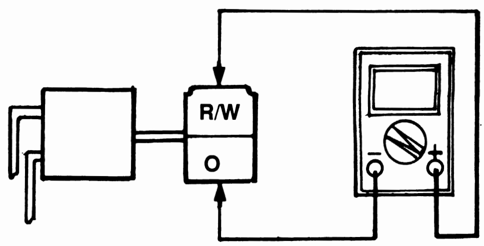

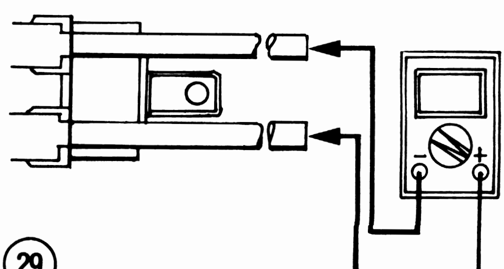

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9. Measure the secondary resistance using an ohmmeter set at R × 1,000. Measure between the coil's secondary spark plug leads (**Figure 29**). The correct secondary resistance is listed in **Table 1**.

10. Replace the ignition coil(s) if it doesn't test within the specifications in Step 5 and/or Step 8.

11. Prior to reinstalling the spark plug cap, check its resistance as described in this chapter.

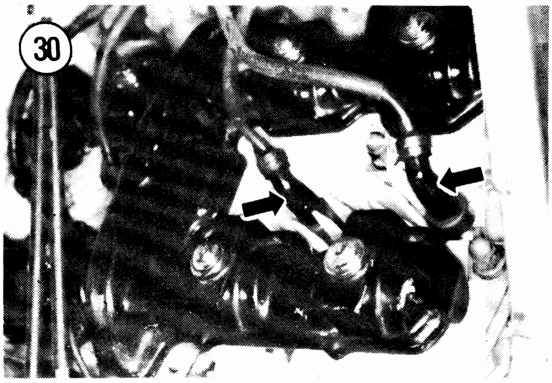
12. Reconnect all electrical connections while noting the following:

a. Apply a dielectric compound to the primary electrical connectors prior to reconnecting them. This will help seal out moisture.

b. Make sure the electrical connectors are free of corrosion and are completely coupled to each other.

13. Install all items removed.

30



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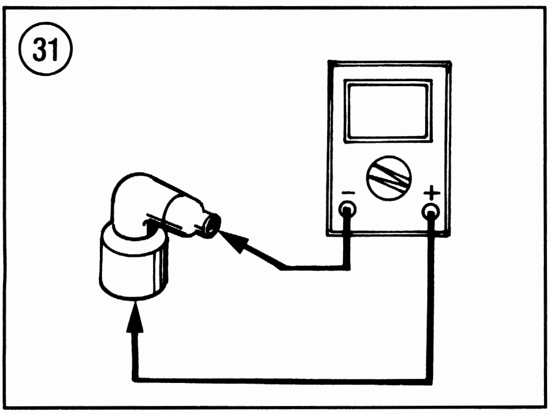

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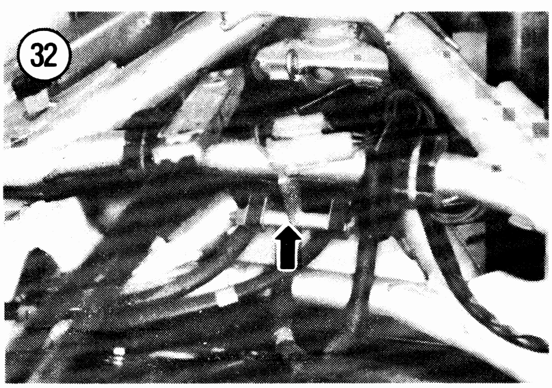


Spark Plug Cap
Testing

1. Place the motorcycle on the centerstand.
2. Remove the fuel tank as described in this chapter.
3. Disconnect the spark plug leads (**Figure 30**) from the spark plugs.
4. Carefully remove the spark plug cap from each spark plug lead.
5. Measure the spark plug cap resistance using an ohmmeter set at R × 1,000. Measure between each end of the cap as shown in **Figure 31**. The correct resistance is listed in **Table 1**.
6. Replace the spark plug cap if the resistance exceeds the specification in **Table 1**.
7. Repeat for each spark plug cap.
8. Reconnect the spark plug caps that are within specification.
9. Reconnect the spark plug leads and install the fuel tank.

Ignition Coil
Removal/Installation

1. Perform Steps 1-4 of *Ignition Coils Testing* in this chapter.
2. Disconnect the spark plug leads (**Figure 30**) from the spark plugs.
3. Remove the bolt, washer and nut (**Figure 32**) securing the ignition coils to the frame mounting bracket and remove the ignition coils.
4. Install by reversing these removal steps while noting the following:
   a. Apply a dielectric compound to the primary electrical connectors prior to reconnecting them. This will help seal out moisture.
   b. Make sure the electrical connectors are free of corrosion and are completely coupled to each other.
   c. Tighten the bolt and nut securely.
   d. Install all items removed.

Ignitor Unit Check

The ignitor unit on both ignition systems 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

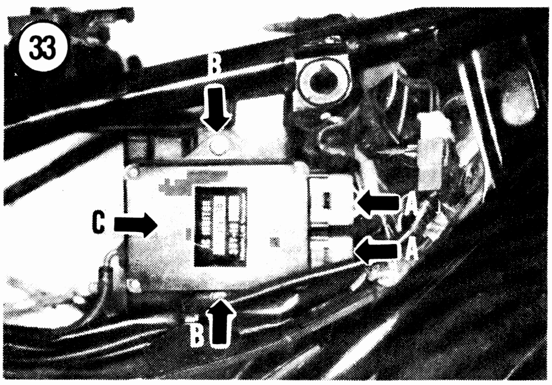
1. Remove the seat and frame left-hand side cover as described in Chapter Twelve.
2. On digital control ignition system models, remove the upper fairing as described in Chapter Twelve.
3. Disconnect the battery negative lead (**Figure 21**).
4A. On transistor control ignition system models, perform the following:
   a. Carefully disconnect the 2 electrical connectors (A, **Figure 33**) from the ignitor unit.
   b. Remove the ignitor mounting bolts (B, **Figure 33**) and remove the ignitor unit (C, **Figure 33**) from the frame.
4B. On digital control ignition system models, perform the following:
   a. Remove the tie-wrap securing the electrical cables to the frame.
   b. Carefully disconnect the 2 electrical connectors (A, **Figure 34**) from the ignitor unit.
   c. Remove the ignitor mounting screws, lockwashers and washer and remove the ignitor unit (B, **Figure 34**) from the upper fairing mounting bracket.
5. Install by reversing these removal steps while noting the following:
   a. Apply a dielectric compound to the electrical connectors prior to reconnecting them. This will help seal out moisture.
   b. Make sure the electrical connectors are free of corrosion and are completely coupled to each other.
   c. Tighten the bolts securely.
   d. Install all items removed.

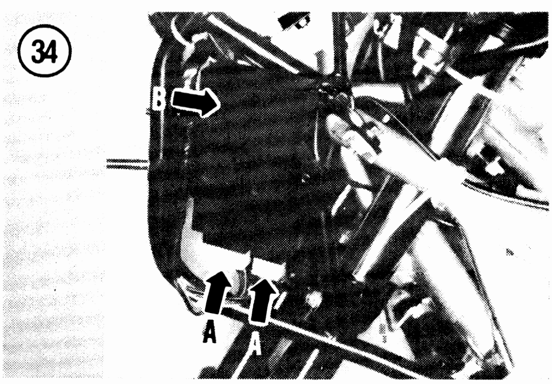
ELECTRIC STARTER

The starter circuit includes the starter button, starter relay, battery and starter motor. Refer to the following illustrations:
   a. 1984-1987 U.S. models: **Figure 35**.
   b. 1989-on U.S. models: **Figure 36**.
   c. 1984-1990 U.K. models: **Figure 37**.
   d. 1991-on U.K. models: **Figure 38**.

Removal/Installation

NOTE
This procedure is shown with the engine removed for clarity. The starter motor can be removed with the engine in the frame.





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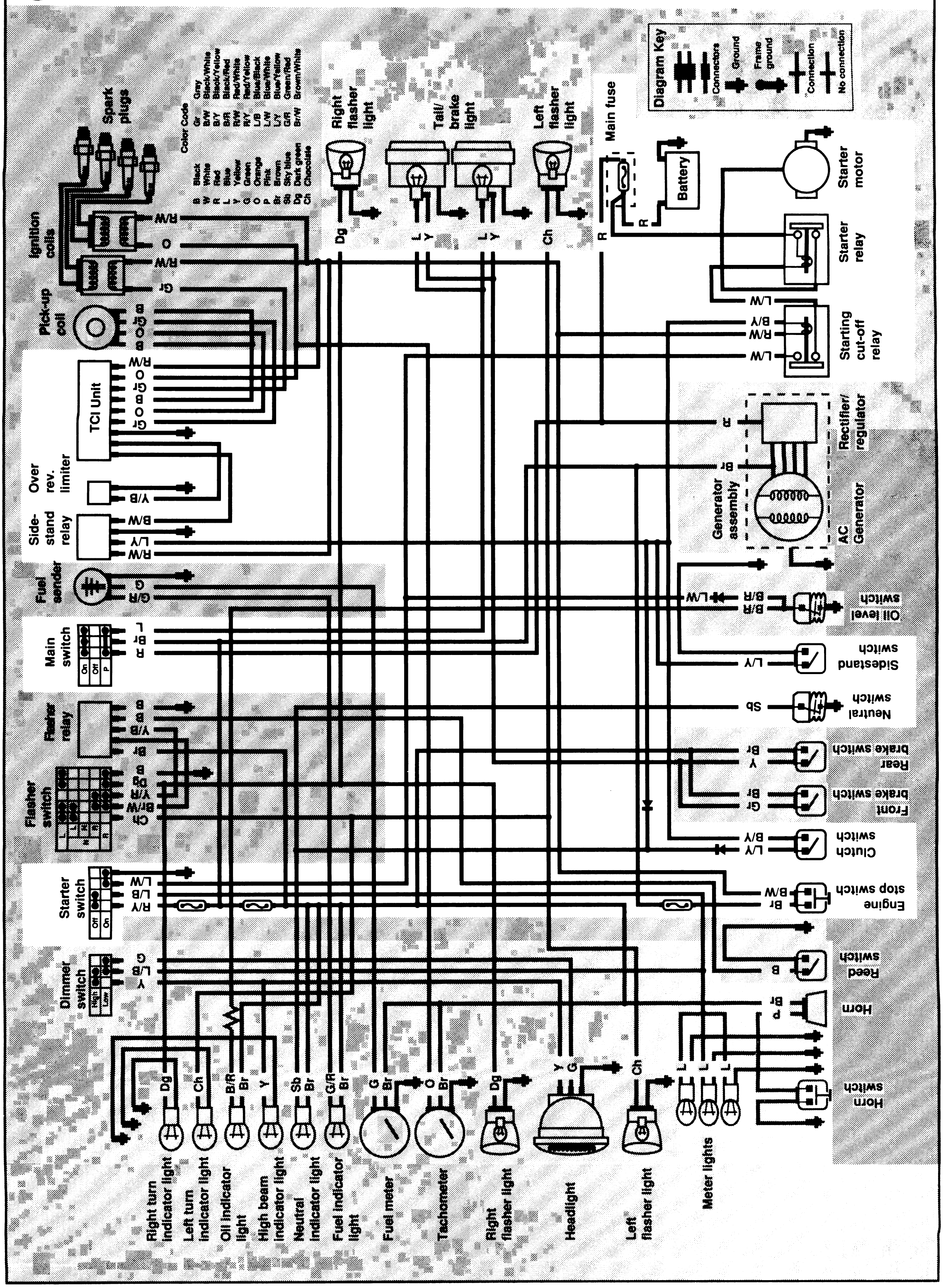
STARTING SYSTEM (1984-1987 U.S. MODELS)



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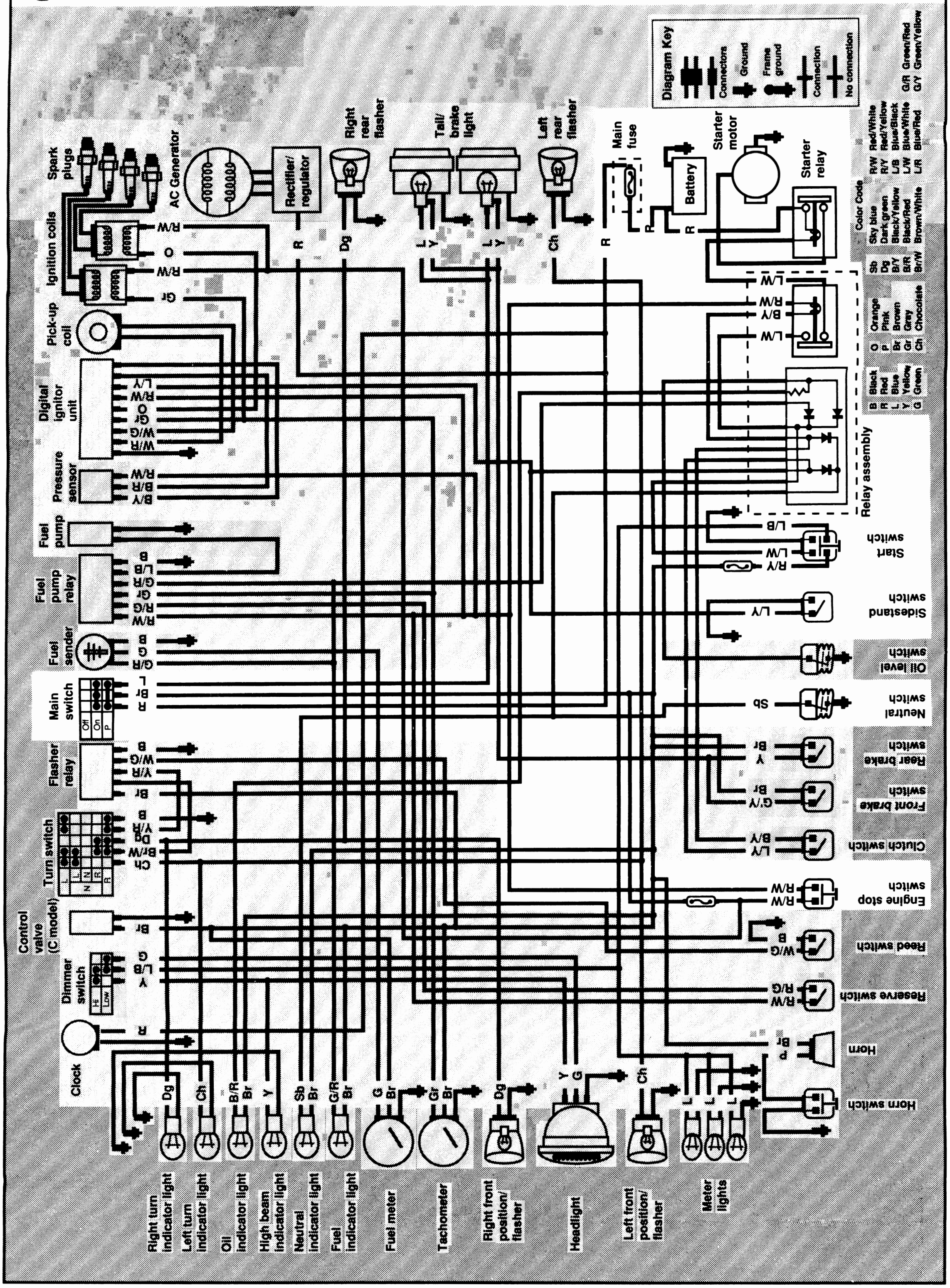
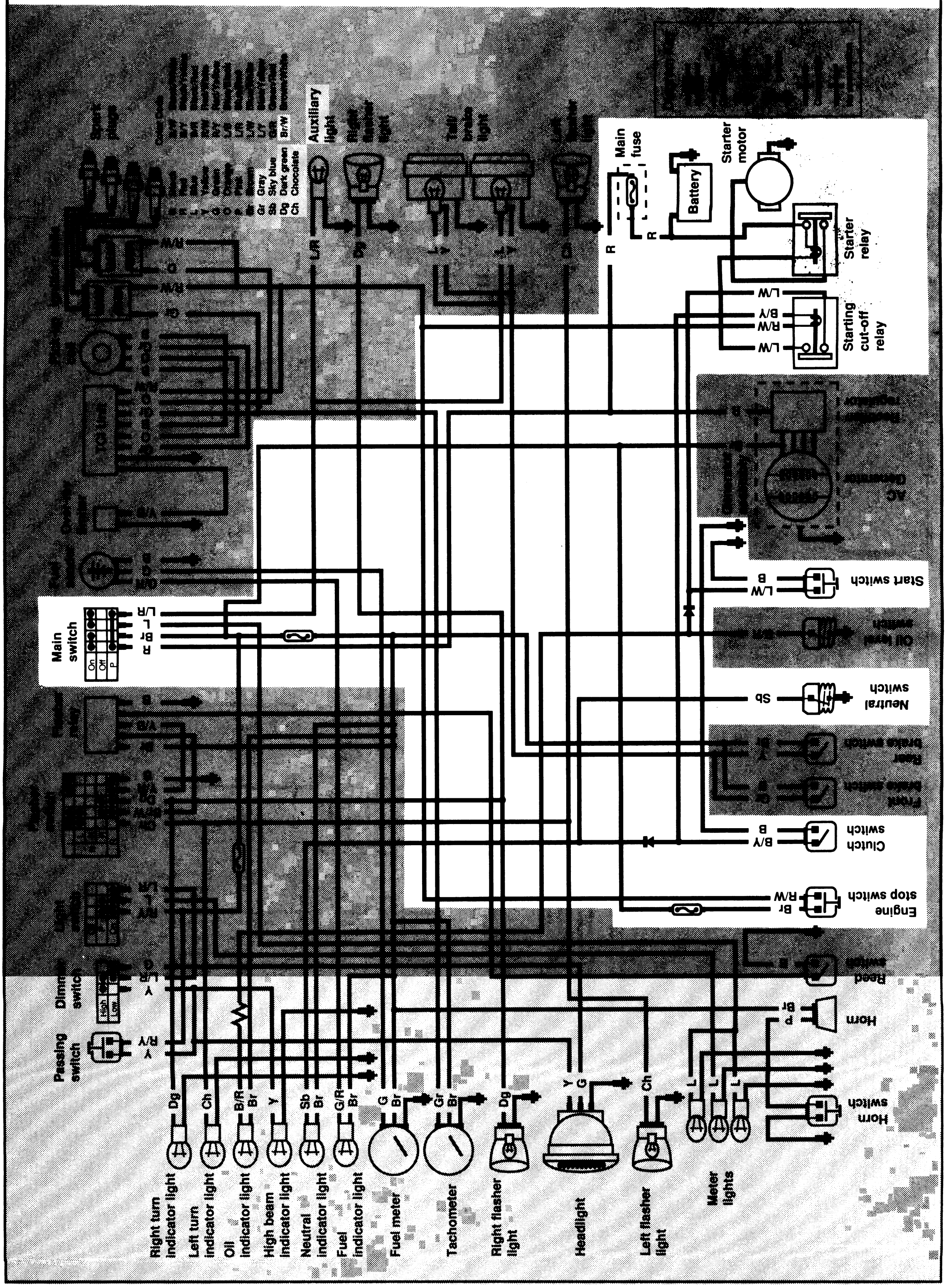
36 STARTING SYSTEM (1989-ON U.S. MODELS)



37 **STARTING SYSTEM (1984-1990 U.K. MODELS)**



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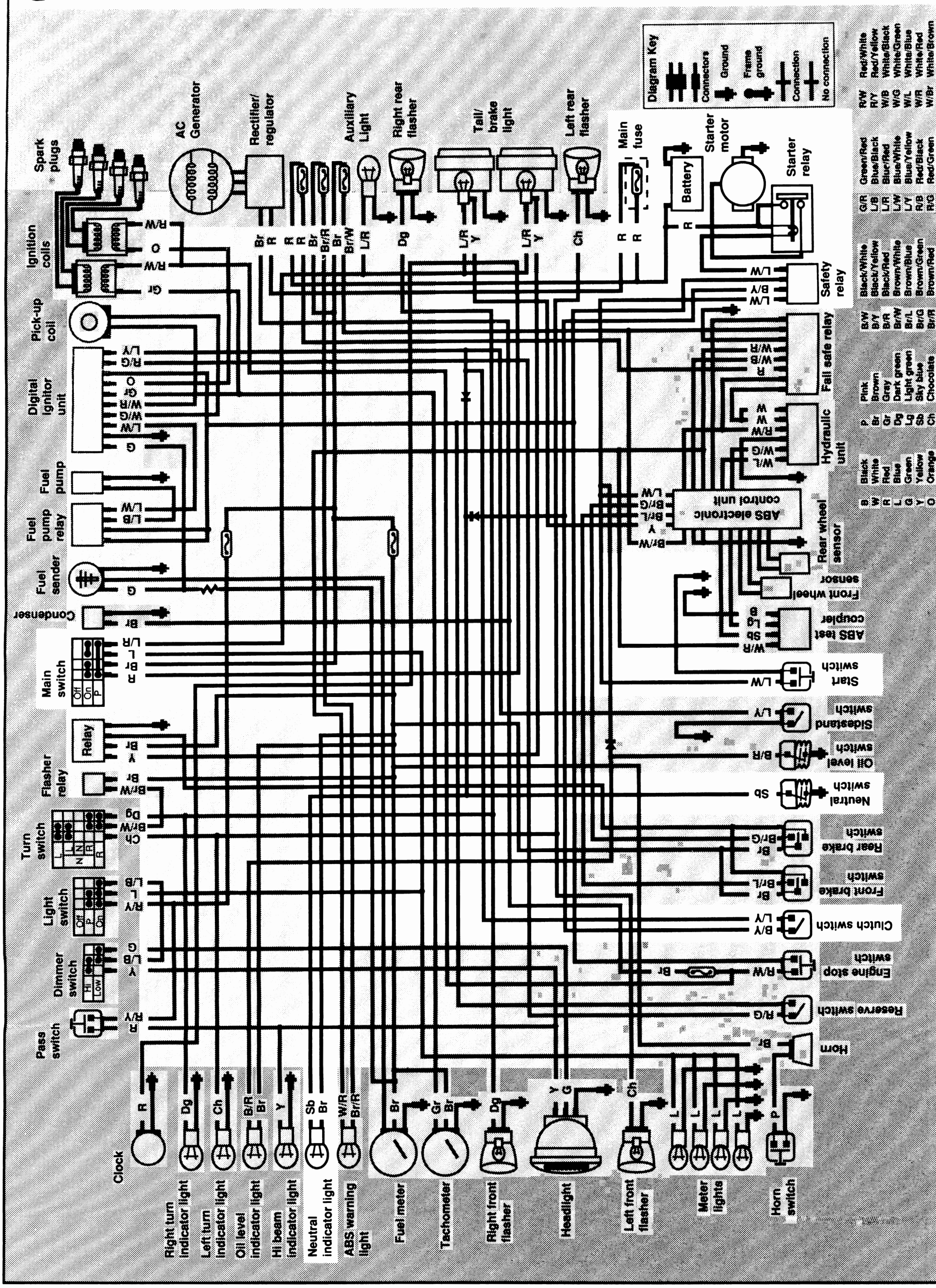
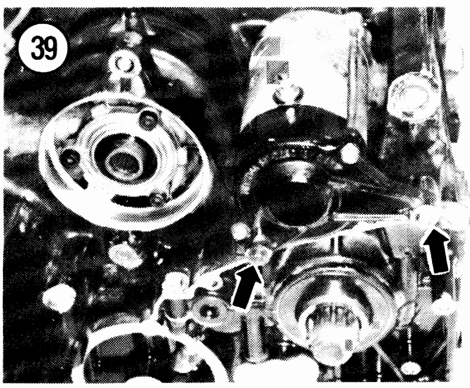
STARTING SYSTEM (1991-ON U.K. MODELS)

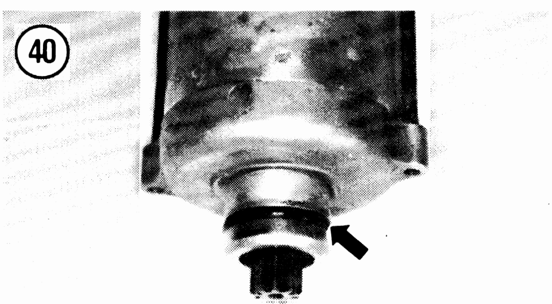


1. Remove the frame left-hand frame cover as described in Chapter Twelve.
2. Disconnect the battery negative lead (**Figure 21**).
3. Remove the fuel tank as described in Chapter Seven.
4. Pull back the rubber boot and disconnect the cable from the starter.
5. Remove the starter mounting bolts (**Figure 39**) and pull the starter toward the left and out of the opening in the upper crankcase.
6. Install by reversing these removal steps while noting the following:
   a. Apply engine oil to the starter O-ring (**Figure 40**) before assembly.
   b. Tighten the bolts securely.
   c. Make sure the electrical connector is free of corrosion and is tight.

Disassembly

Starter motor repair is generally a job for electrical shops or a Yamaha dealer. The following procedure is provided if you choose to perform this procedure yourself.





Refer to **Figure 41** for this procedure.

1. Use a center punch and hammer and make alignment marks (**Figure 42**) between the case and both front and rear covers. These alignment marks will be used during assembly.
2. Remove the 2 case screws, washers and lockwashers (A, **Figure 43**).
3. Slide the front cover (B, **Figure 43**) off of the armature shaft.
4. Remove the screw and washer (**Figure 44**) attaching the field coil wire to the brush holder assembly.
5. Carefully pull the brush holder assembly (**Figure 45**) off the commutator.
6. Slide the washer (**Figure 46**) off the armature shaft.
7. Slide the rear cover and the armature (**Figure 47**) out of the case.
8. Slide the rear cover off the armature (**Figure 48**).

NOTE
Write down the number of shims used on the shaft next to the commutator and next to the rear cover. Be sure to install the same number when reassembling the starter.

NOTE
Labeling and storing these shims removed in Step 9 is important because other shims are also used on the opposite side of the armature.

NOTE
*The number of shims used in each starter varies. The starter shown in **Figure 49** uses 3 shims. The starter you are working on may use a different number of shims.*

9. Slide the shims (**Figure 49**) off of the armature shaft. Record the number of shims at their location. Store the shims in a marked plastic bag.
10. Remove the lockwasher (**Figure 50**) from the rear cover.
11. Clean all grease, dirt and carbon from the armature, case and end caps.

CAUTION
Do not immerse the wire windings in the case or the armature coil in solvent as the insulation may be damaged. Wipe the windings with a cloth lightly moistened with solvent and thoroughly dry.

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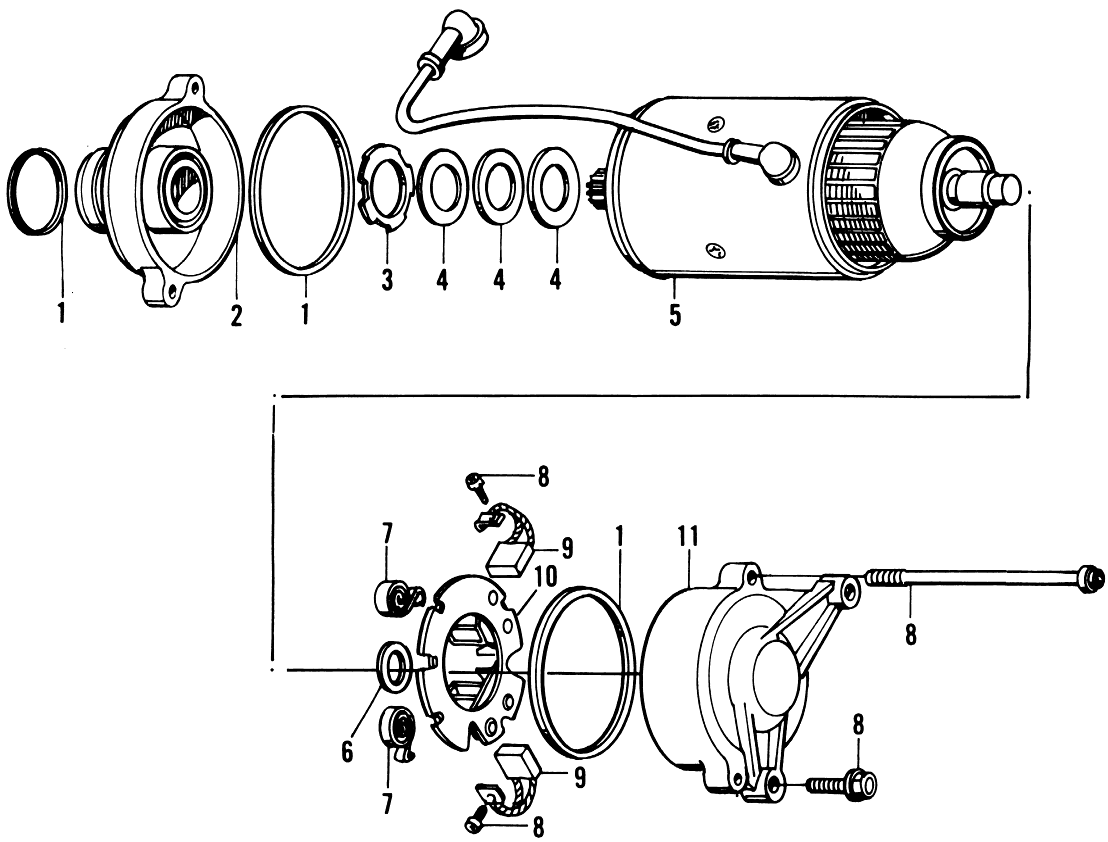
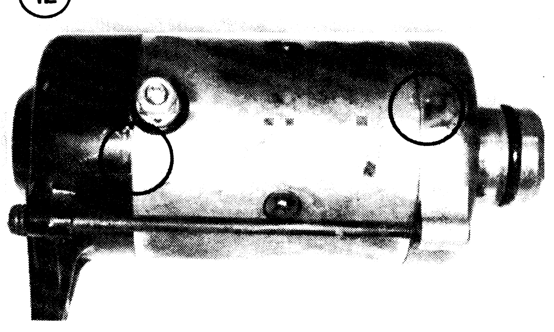
STARTER MOTOR



1. O-ring
2. Rear cover
3. Lockwasher
4. Shim
5. Case/armature
6. Shim
7. Spring
8. Bolt
9. Brush
10. Brush holder
11. Front cover

42



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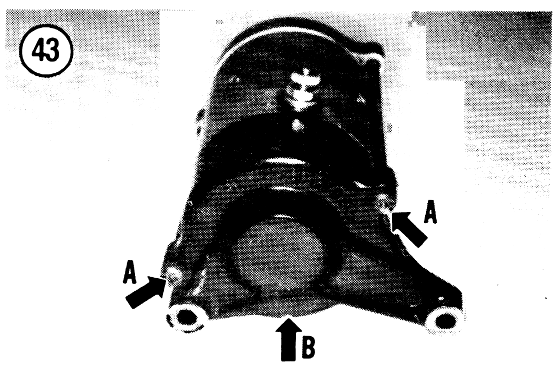

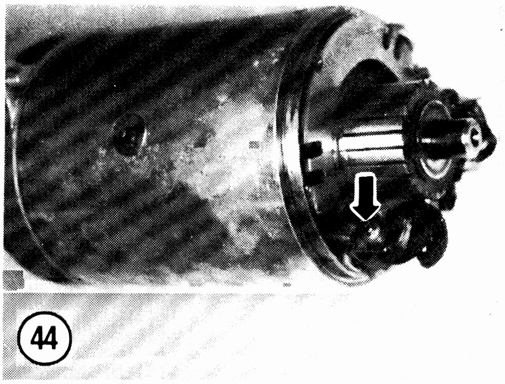

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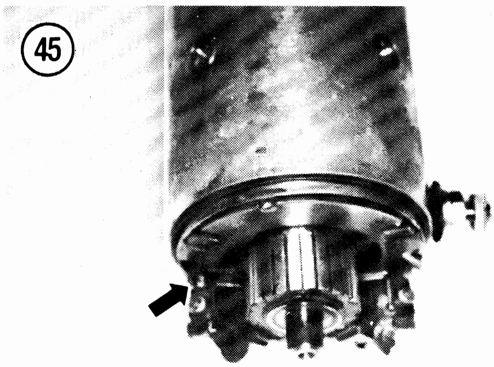

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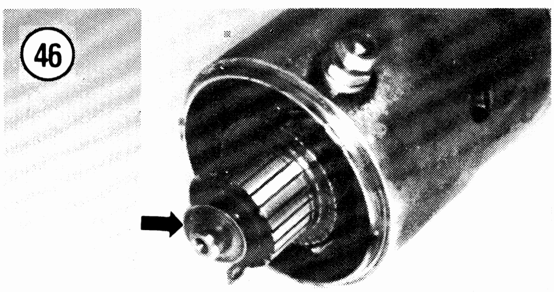

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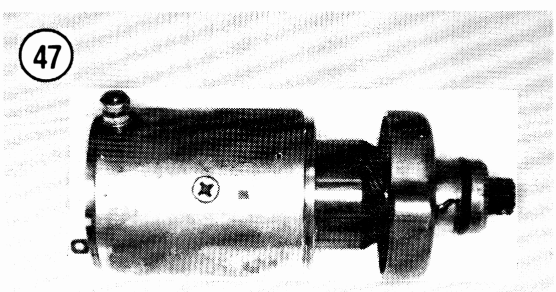

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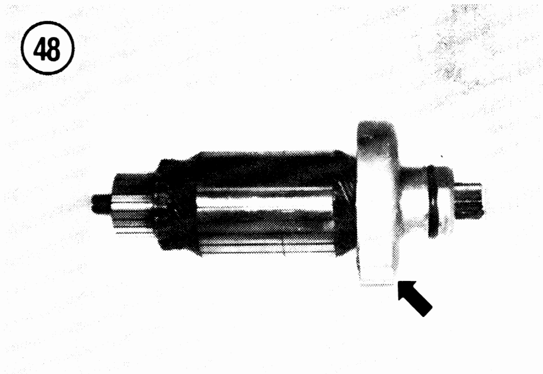
Inspection

1. Pull the spring (A, **Figure 51**) away from each brush (B, **Figure 51**) and pull each brush out of its guide.

2. Measure the length of each brush with a Vernier caliper (**Figure 52**). If the length is 5.5 mm (0.22 in.) or less for any one of the brushes, the brush holder assembly must be replaced. The brushes cannot be replaced individually.



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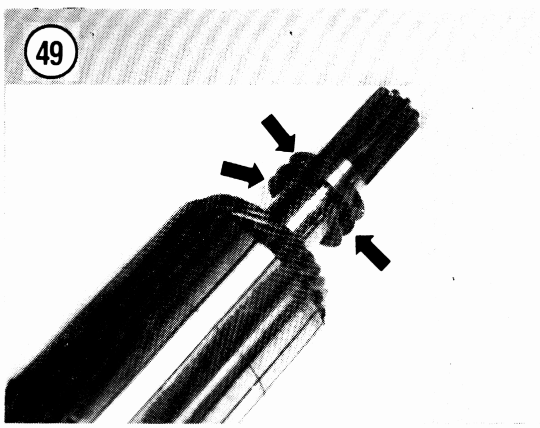

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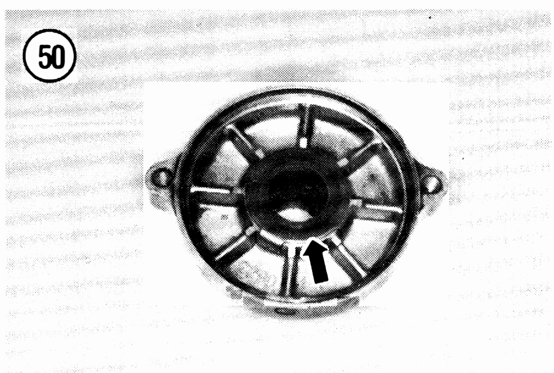

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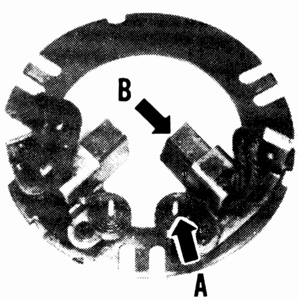
NOTE
The starter case cable terminal assembly is composed of 3 insulated washers, a regular washer and 2 nuts. Label each component when removed, especially the insulated washers, as they must be reinstalled in the same order to insulate the brushes from the case.

3. There is no need to disassemble the cable terminal except to replace a damaged part. If necessary, disassemble the terminal as follows:
   a. Remove the outer nut (A, **Figure 53**).
   b. Remove the inner nut (B, **Figure 53**) from the cable terminal and slide off the regular washer (C, **Figure 53**).
   c. Remove the large insulated washer and the 2 small insulated washers.
   d. Slide the O-ring off of the cable terminal.
   e. Assemble the cable terminal assembly by reversing these removal steps. Make sure to install washers and nuts in their original order.
4. Inspect the commutator (**Figure 54**). The mica in a good commutator is below the surface of the copper bars. On a worn commutator the mica and copper bars may be worn to the same level (**Figure 55**). If necessary, have the commutator serviced by a dealer or electrical repair shop.
5. Inspect the commutator copper bars for discoloration. If a pair of bars is discolored, grounded armature coils are indicated.
6. Use an ohmmeter and perform the following:
   a. Check for continuity between the commutator bars (**Figure 56**); there should be continuity (indicated resistance) between pairs of bars.
   b. Check for continuity between the commutator bars and the shaft (**Figure 57**); there should be *no* continuity (infinite resistance).

51



   c. If the unit fails either of these tests, the starter assembly must be replaced. The armature cannot be replaced individually.
7. Use an ohmmeter and perform the following:

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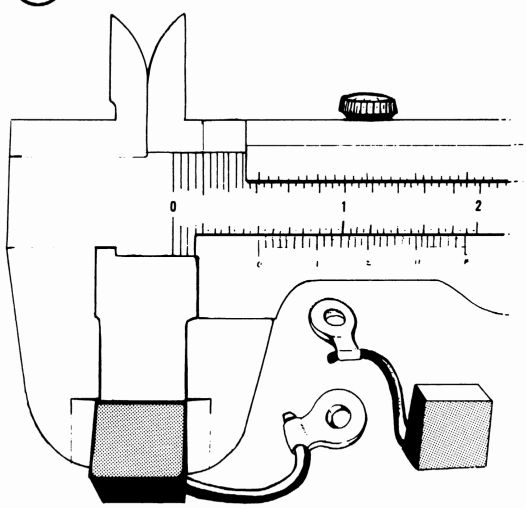

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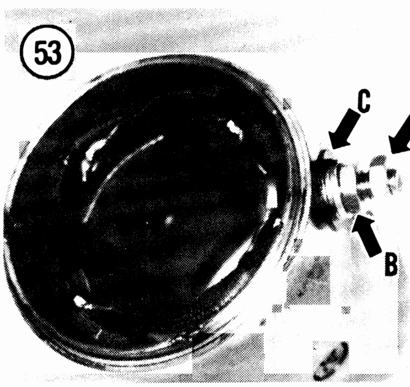

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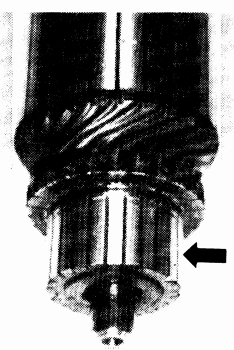

a. Check for continuity between the starter cable terminal and the end case cover; there should be continuity (indicated resistance).

b. Check for continuity between the starter cable terminal and the brush black wire terminal; there should be *no* continuity (infinite resistance).

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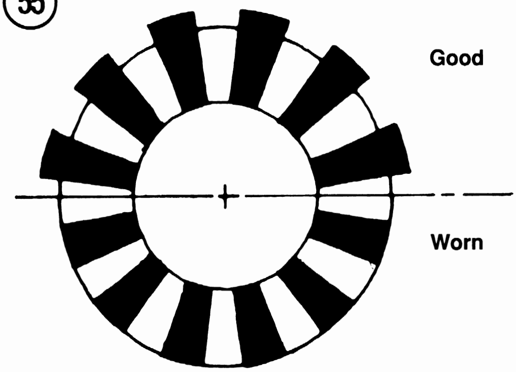
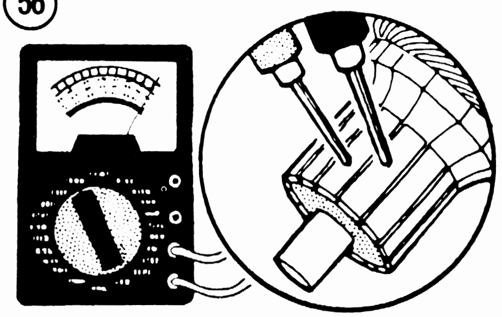


Armature condition

56



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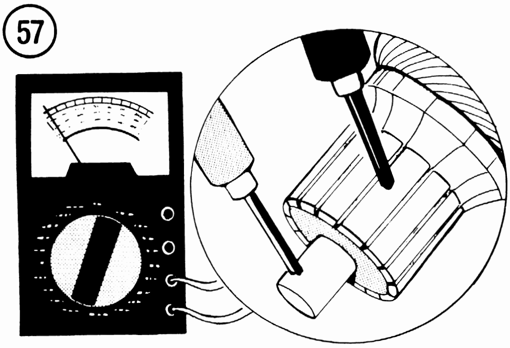

c. If the unit fails either of these tests, the starter assembly must be replaced. The case/field coil assembly cannot be replaced individually.

8. Inspect the splines (**Figure 58**) on the end of the armature shaft. Check for abnormal wear or damage. If it is damaged, replace the starter assembly as this part is not available separately.

9. Inspect the oil seal and bearing (**Figure 59**) in the rear cover for wear or damage. If either is damaged, replace the starter assembly as these parts are not available separately.

10. Inspect the bushing (**Figure 60**) in the front cover for wear or damage. If it is damaged, replace

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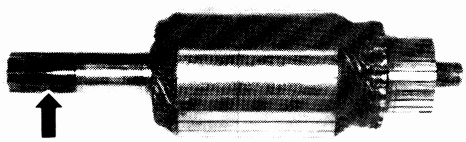

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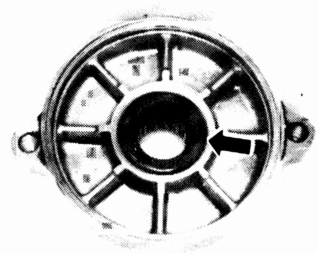

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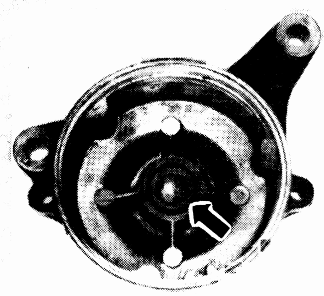

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the starter assembly as this part is not available separately.

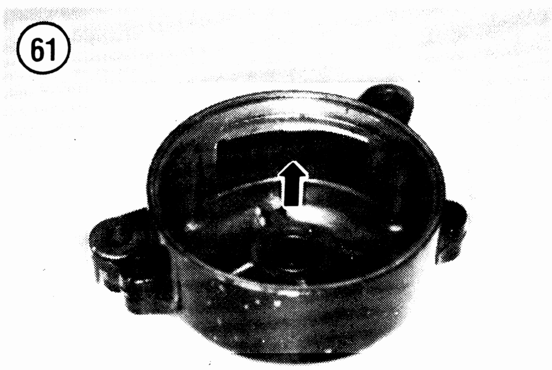
11. Make sure the insulation strips (**Figure 61**) are still in place in the front cover. Replace if necessary.

12. Make sure the field coil wire and connector (**Figure 62**) are in good condition. Check the insulation on the wire.

Assembly

1. Install the lockwasher (**Figure 50**) onto the front cover so that the lockwasher tabs engage the cover slots.
2. Install the correct number of shims (**Figure 49**) onto the armature shaft.
3. Make sure the O-rings are installed on each end of the case.
4. Slide the rear cover onto the armature (**Figure 48**).
5. Slide the rear cover and the armature (**Figure 47**) into the case.
6. Install the washer (**Figure 46**) onto the armature shaft.
7. If removed, install the brushes into their holders and secure the brushes with the springs.
8. Carefully install the brush holder assembly (**Figure 45**) onto the commutator. Turn the armature during installation so the brushes engage the commutator properly. Do not damage the brushes during this step.
9. Align the brush holder locating tab with the notch in the case (**Figure 63**).
10. Install the screw and washer (**Figure 44**) attaching the field coil wire to the brush holder assembly.
11. Align the index marks made in *Removal*, Step 1 on the case and both covers.

61



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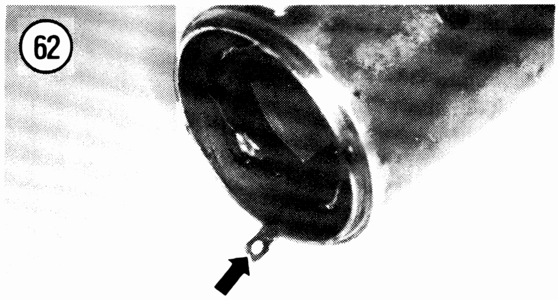

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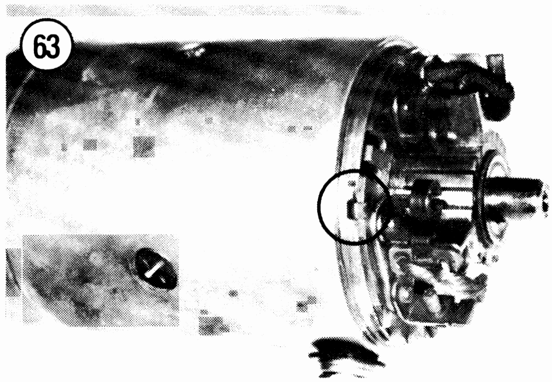

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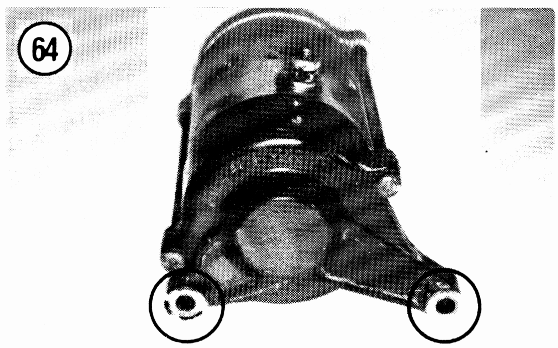

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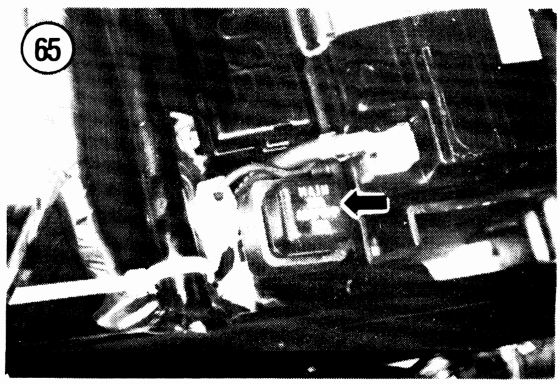

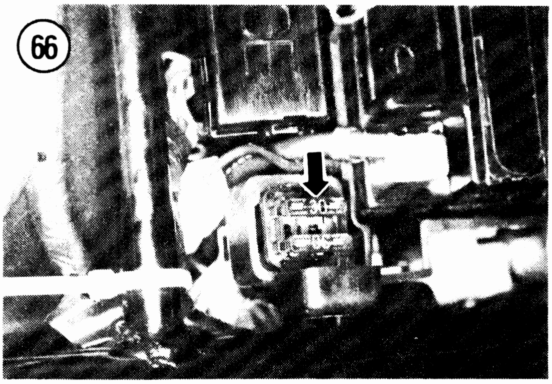
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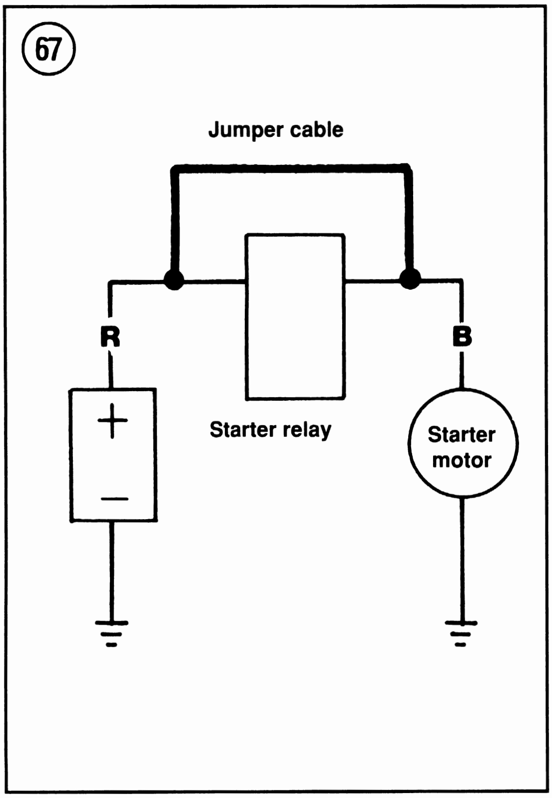

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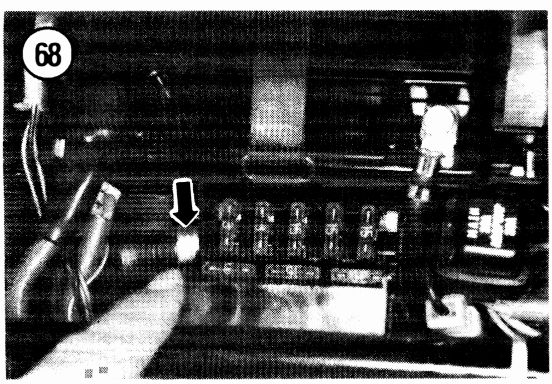
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12. Apply blue Loctite (No. 242) onto the case screw threads and install the screws, washers and lock-washers. Tighten the screws securely.

13. Clean the cover mounting lugs (**Figure 64**) of all dirt and other contaminants as they act as the ground for the starter motor.

Starter Troubleshooting

During this test procedure, after each step is completed, reconnect the electrical connector to the component that was just tested, providing it tested okay.

If the starter does not operate, perform the following.

1. Remove the seat as described in Chapter Twelve.

2. First check the main fuse. Open the fuse panel cover (**Figure 65**) and pull the fuse (**Figure 66**) out of its holder and visually inspect it. If the fuse is blown, refer to *Fuses* in this chapter. If the main fuse is okay, reinstall it, or install a new one, then proceed to the next step.

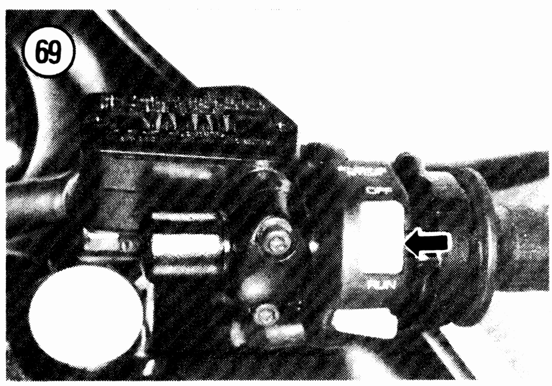
WARNING

The jumper cable installed in Step 3 must be the same gauge as that of the battery leads or the jumper cable may burn.

3. Connect a jumper wire across the starter relay terminals as shown in **Figure 67**. The starter relay terminals are shown in **Figure 68**.

NOTE

*When it is required to operate the starter in the following procedures, turn the main switch to ON and the engine stop switch to RUN (**Figure 69**). Shift the transmission into NEUTRAL and push*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the starter button. Turn the main switch OFF after performing each test.

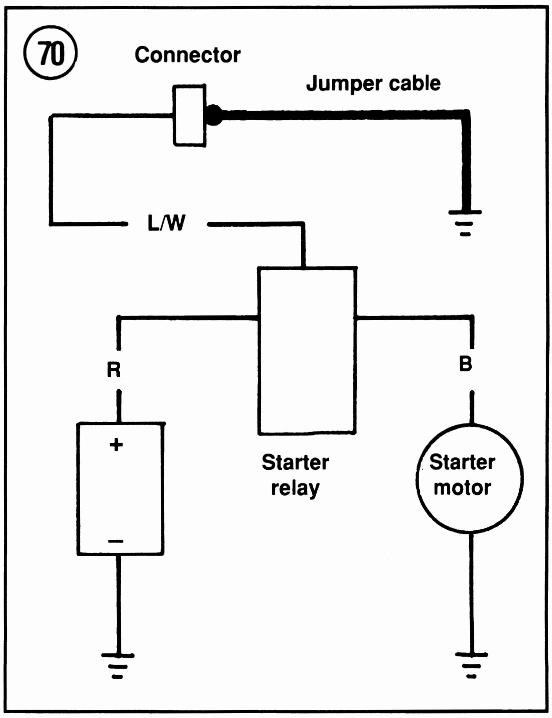
4. Operate the starter. Interpret results as follows:
   a. Starter does not turn: Check the battery as described in Chapter Three. Recharge the battery if necessary. If the battery is okay, remove the starter and check the brushes and armature as described in this chapter.
   b. Starter turns: Perform Step 5.
   c. Disconnect the jumper wire.
5. Disconnect the starter relay blue/white connector and connect a jumper wire from the connector to ground as shown in **Figure 70**. Operate the starter. Interpret results as follows:
   a. Starter turns: Replace the starter relay.
   b. Starter does not turn: Perform Step 6.
   c. Disconnect the jumper wire.
6. Remove the upper fairing as described in Chapter Twelve. Disconnect the starter cut-off relay unit assembly electrical connector. The starter cut-off relay assembly is located on either the right-hand (**Figure 71**) or the left-hand (**Figure 72**) side of the front frame section, depending on model year.
7. To test the starter cut-off relay assembly, turn the main switch to ON, and check for battery voltage between the red/white lead and ground. There should be battery voltage present; if there isn't, check for an open or poor connection between the main switch and the relay unit.
8. Attach a jumper wire to the starter cut-off relay assembly coupler black/yellow terminal and ground. There should be an audible click as the starter cut-off relay operates. If there is no click, replace the relay assembly. If the relay clicks, inspect the starter motor clutch (Chapter Four) and the neutral switch for proper operation.
9. Disconnect the jumper wire and reconnect the electrical connector to the starter cut-off relay.
10. Make sure all connectors disassembled during this procedure are free of corrosion and are reconnected properly.

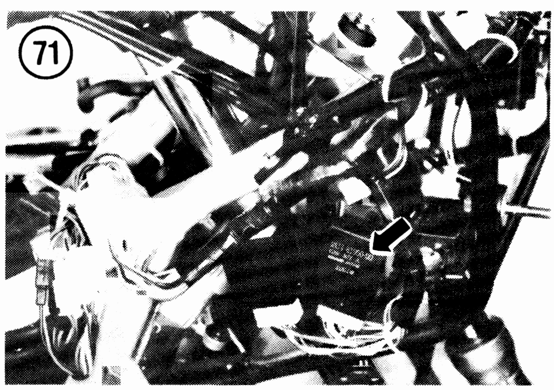
Starter Relay Removal/Installation

1. Remove the seat as described in Chapter Twelve.
2. Make sure the ignition switch is turned OFF.
3. Label and disconnect the wires (A, **Figure 73**) from the starter relay and pull it out of its holder (B, **Figure 73**).
4. Install by reversing these steps. Make sure the nuts securing the electrical connections are free of corrosion and are tight.

LIGHTING SYSTEM

The lighting system consists of the headlight, taillight/brakelight combination, directional signals, warning lights and speedometer and tachometer illumination lights. In the event of trouble with any





light, the first thing to check is the affected bulb itself. If the bulb is good, check all wiring and connections with a test light. Replacement bulbs are listed in **Table 2**.

Headlight Bulb Replacement

CAUTION
All models are equipped with quartz-halogen bulbs. 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.

WARNING
*If the headlight has just burned out or turned off it will be **Hot!** Don't touch the bulb until it cools off.*

1984-1990

Refer to **Figure 74** for this procedure.

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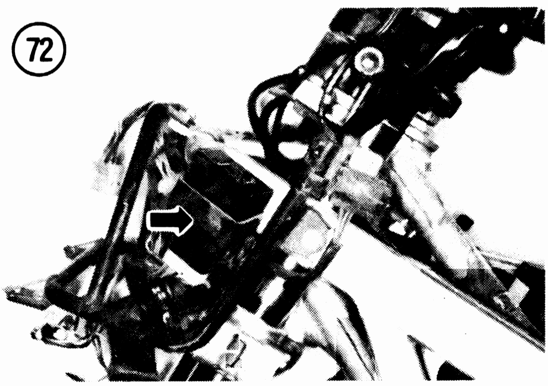

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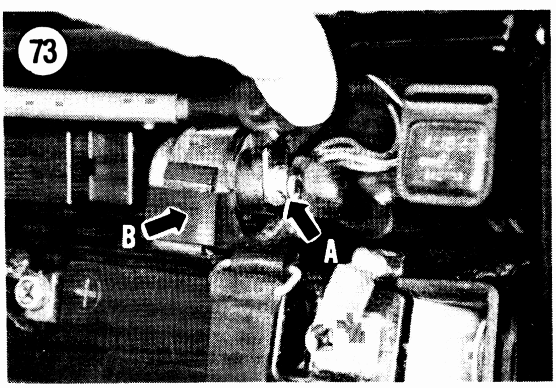


NOTE
The following steps are shown with the upper fairing removed for clarity. It is not necessary to remove the upper fairing assembly to replace the bulb but it is easier. There is very little working space between the headlight assembly, steering stem and front forks to allow easy bulb removal with the fairing in place.

1. Unplug the electrical connector (**Figure 75**) from the headlight assembly.
2. Remove the socket cover (A, **Figure 76**).
3. Unhook the spring retainer clip (**Figure 77**) and move it out of the way.
4. Lift the bulb (**Figure 78**) out of the headlight lens assembly.
5. Install by reversing these steps while noting the following:
   a. Install the bulb and make sure the projections on the bulb are meshed with the slots in the lens assembly.
   b. Position the socket cover with the raised ridge (B, **Figure 76**) located at the top. Push it on until it is completely seated.
   c. Make sure the electrical connector is free of corrosion and is pushed on tight.

1991-on

Refer to **Figure 79** for this procedure.

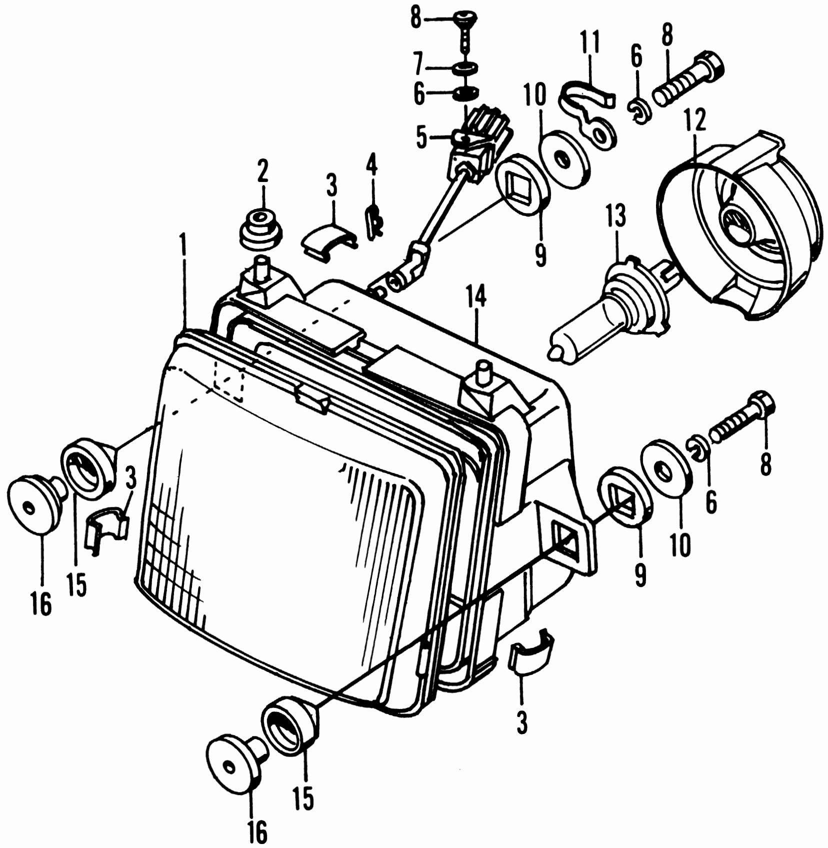
NOTE
The following steps are shown with the upper fairing removed and the headlight assembly removed from the fairing for clarity. It is not necessary to remove the upper fairing assembly and headlight assembly to replace the bulb but it is easier. There is very little working space between the headlight assembly, steering stem and front forks to allow easy bulb removal with the fairing in place.

1. If not already completed, unplug the electrical connector from the headlight assembly (**Figure 80**).
2. Remove the socket cover (A, **Figure 81**).
3. Unhook the spring retainer clip (**Figure 82**) and move it out of the way.

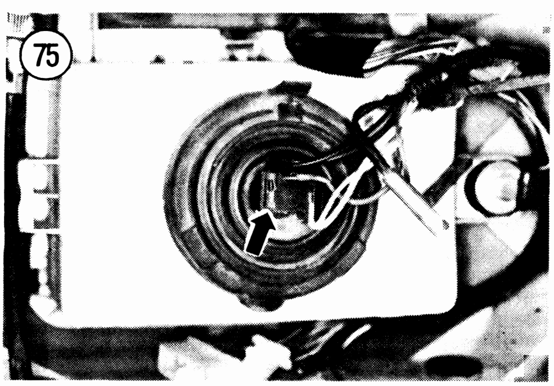
8

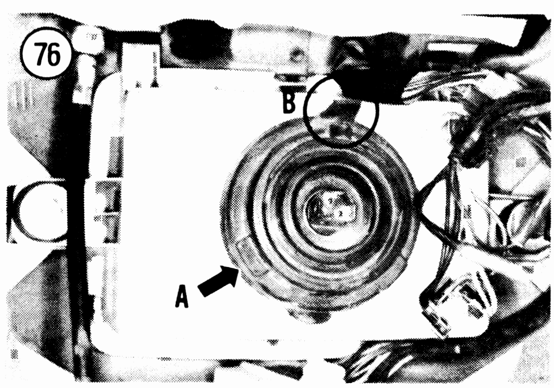
(74)

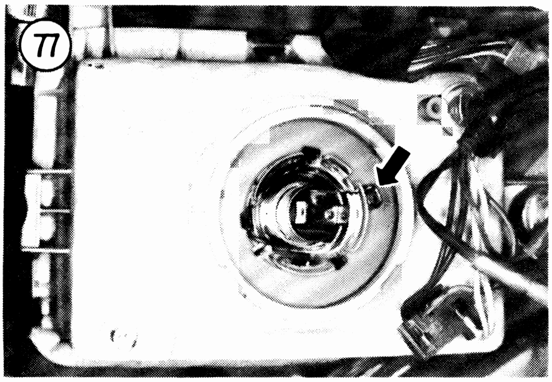
HEADLIGHT ASSEMBLY (1984-1990)



1. Lens assembly
2. Rubber damper
3. Clip
4. Pin
5. Vertical adjust knob
6. Washer
7. Lockwasher
8. Screw
9. Rubber damper
10. Washer
11. Clamp
12. Socket cover
13. Bulb
14. Case
15. Rubber damper
16. Collar



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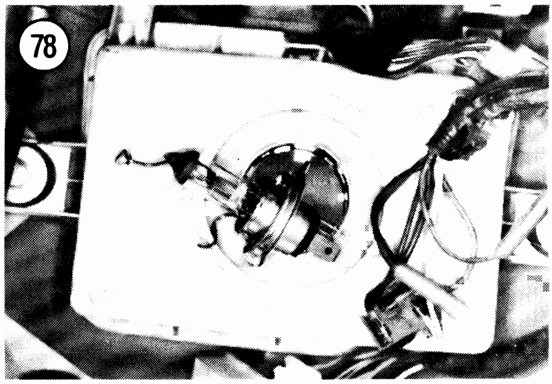
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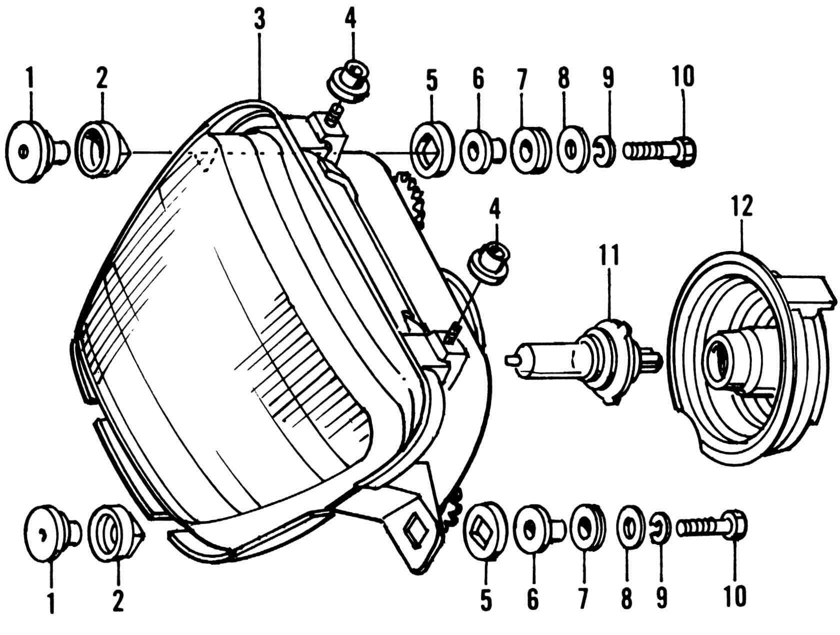
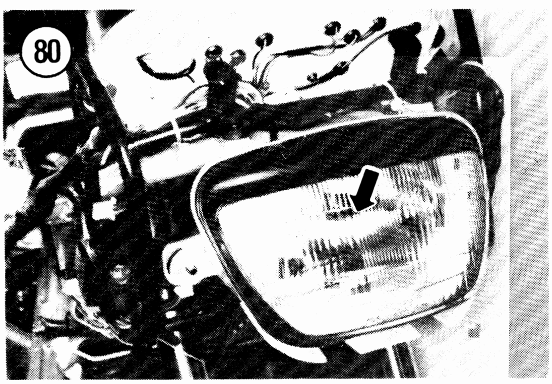
HEADLIGHT (1991-ON)

1. Collar
2. Rubber damper
3. Lens assembly
3. Housing
4. Rubber damper
5. Rubber damper
6. Collar
7. Rubber grommet
8. Washer
9. Lockwasher
10. Bolt
11. Bulb
12. Socket cover

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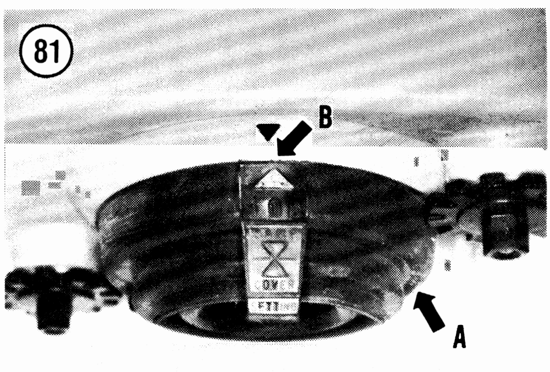

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4. Lift the bulb (**Figure 83**) out of the headlight lens assembly.

5. Install by reversing these steps while noting the following:

   a. Install the bulb and make sure the projections on the bulb are meshed with the slots in the lens assembly.

   b. Position the socket cover with the "TOP" mark located at the top (B, **Figure 81**). Push it on until it is completely seated.

   c. Make sure the electrical connector is free of corrosion and is pushed on tight.

Headlight Assembly Removal/Installation

1984-1990

Refer to **Figure 74** for this procedure.

1. Remove the upper fairing as described in Chapter Twelve.

2. Remove the bolt, lockwasher and washer (A, **Figure 84**) securing the vertical adjust knob to the front fairing.

3. Remove the bolt, lockwasher and washer (A, **Figure 85**) on each side securing the headlight assembly to the front fairing and remove the assembly (B, **Figure 85**) and vertical adjust knob (C, **Figure 85**).

4. Inspect the rubber dampers for hardness, deterioration or damage, replace as necessary.

NOTE

The lens and the case can be purchased separately if either part is damaged. If the lens and case are going to be separated, remove the bulb as described in this chapter.

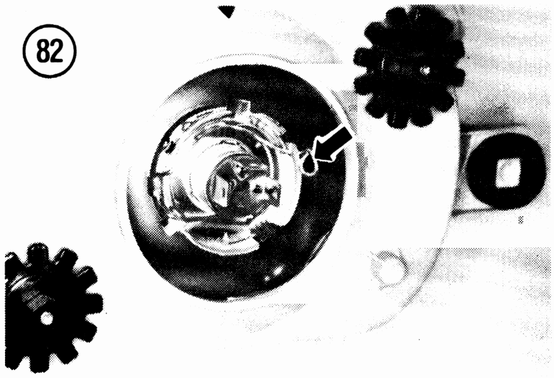
5. If necessary, remove the perimeter clips and separate the lens from the headlight case.

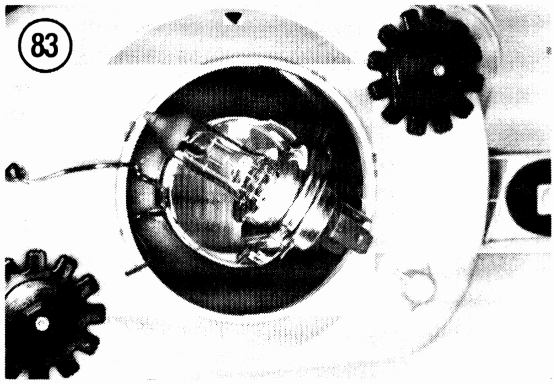
6. Wash out the inside and outside of the lens with mild detergent and wipe dry with a soft lint-free rag.

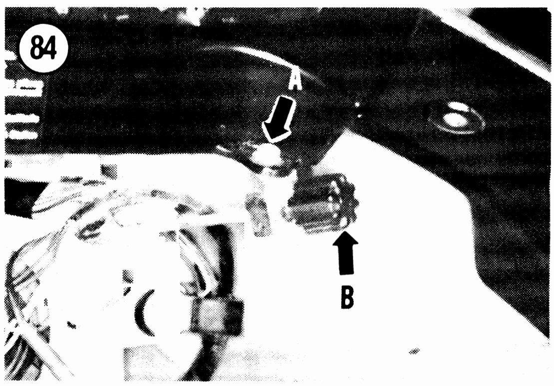
7. Install by reversing these removal steps while noting the following:

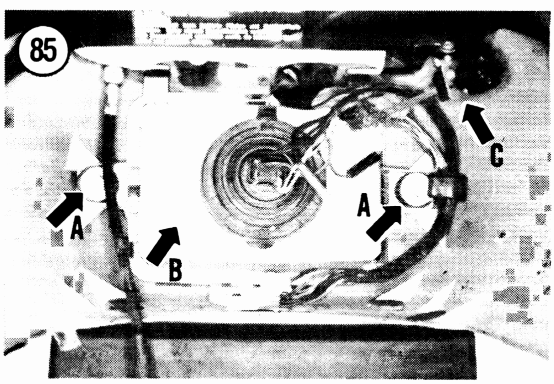
   a. Make sure the threaded collar is in place on the backside of the lens assembly.

   b. Adjust the headlight as described in this chapter.









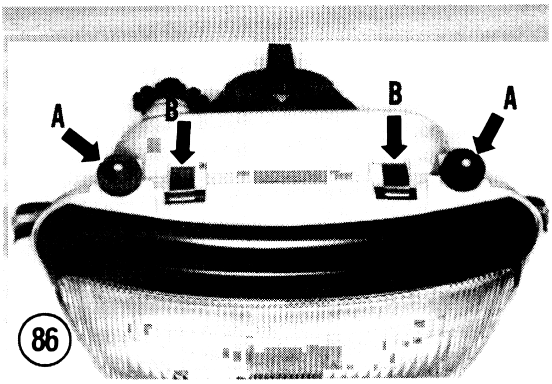
1991-on

Refer to **Figure 79** for this procedure.

1. Remove the upper fairing as described in Chapter Thirteen.

2. If still in place, remove the headlight assembly (**Figure 80**) from the upper fairing mounting bracket.

3. Inspect the upper rubber dampers (A, **Figure 86**) and side rubber dampers (**Figure 87**) for hardness, deterioration or damage, replace as necessary.



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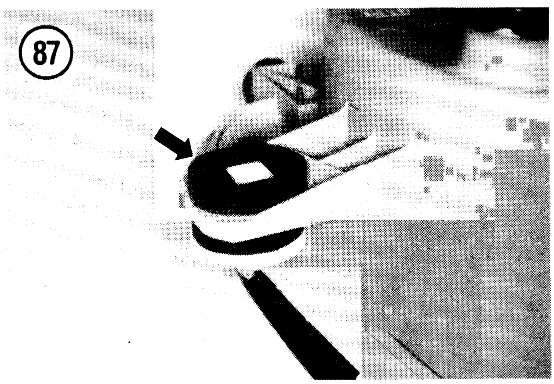

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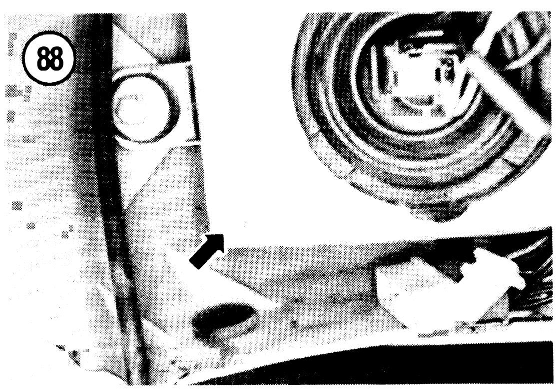


88

4. Make sure both adjust knobs rotate smoothly. If either knob is not operating correctly, replace the lens assembly.

NOTE
The lens and the case are sold as an assembly and both parts must be replaced if either part is damaged. If the lens and case are going to be separated, remove the bulb as described in this chapter.

5. If necessary, remove the perimeter clips (B, **Figure 86**) and separate the lens from the headlight case.

6. Wash out the inside and outside of the lens with a mild detergent and wipe dry with a soft lint-free rag.

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

   a. Make sure the threaded collar is in place on the backside of the lens assembly.

   b. Adjust the headlight as described in this chapter.

8

Headlight Adjustment

Adjust the headlight horizontally and vertically according to the Department of Motor Vehicles regulations in your area.

When performing this procedure, make sure the tire pressure is correct and that the fuel tank is approximately 1/2 to full. Have an assistant sit on the seat.

1984-1990

NOTE
The following steps are shown with the headlight assembly removed for clarity. It is not necessary to remove the headlight assembly to adjust the headlight.

Horizontal adjustment: To adjust the beam to the right, turn the adjusting screw (**Figure 88**) clockwise. To adjust the beam to the left, turn the screw counterclockwise.

Vertical adjustment: To lower the beam, turn the adjusting knob (B, **Figure 84**) counterclockwise. To raise the beam, turn the screw clockwise.

1991-on

NOTE
The following steps are shown with the headlight assembly removed for clarity. It is not necessary to remove the headlight assembly to adjust the headlight.

Horizontal adjustment: To adjust the beam to the left, turn the right-hand adjusting knob (A, **Figure 89**) clockwise. To adjust the beam to the left, turn the right-hand knob counterclockwise.

Vertical adjustment: To raise the beam, turn the left-hand knob (B, **Figure 89**) counterclockwise. To lower the beam, turn the left-hand knob clockwise.

Taillight/Brakelight Replacement

Refer to **Figure 90** for this procedure.

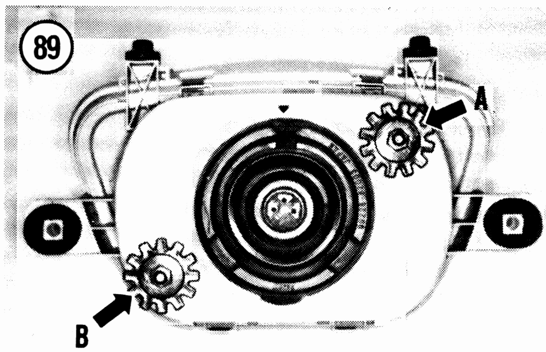
1. Remove the seat as described in Chapter Twelve.
2. Reach into the rear fender cover and turn the bulb holder about 1/8 of a turn, pull back and remove it from the lens assembly.
3. Turn the bulb counterclockwise and remove it from the bulb holder.
4. Push the new bulb into the socket and turn it clockwise to lock it in position.
5. Align the bulb holder and turn it to lock it in the lens assembly.
6. Check bulb operation.
7. Install the seat.

Taillight/Brakelight Assembly Removal/Installation

Refer to **Figure 90** for this procedure.

1. Remove the seat as described in Chapter Twelve.
2. Disconnect the taillight/brakelight electrical connector under the rear fender cover.

89



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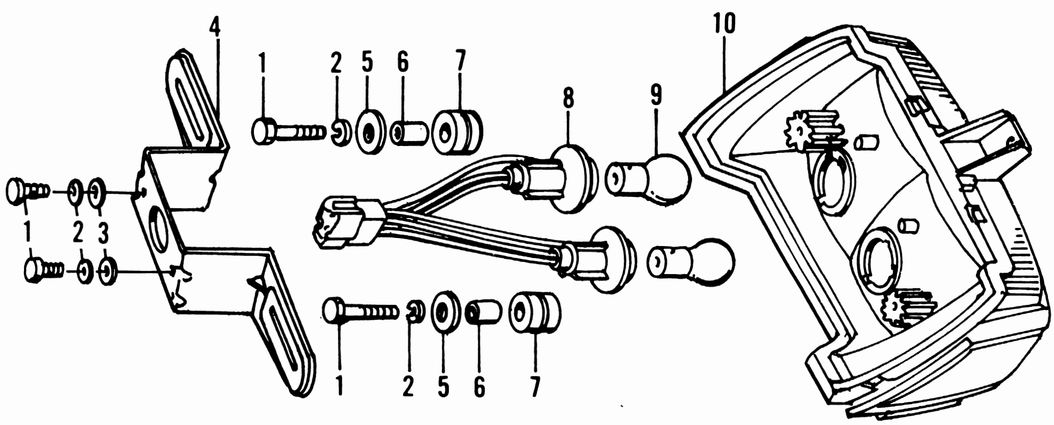
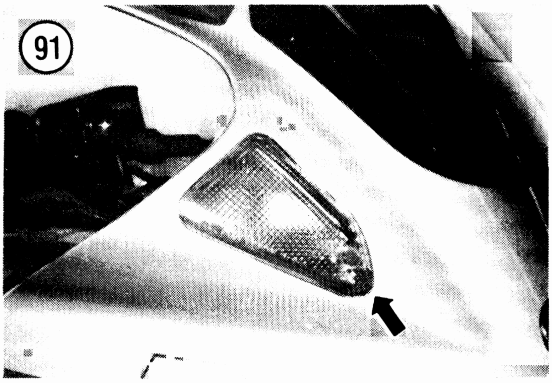
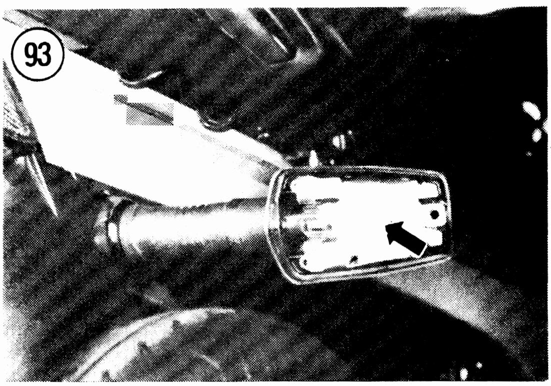
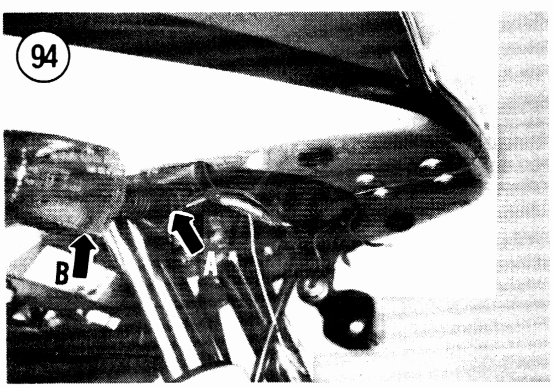
TAILLIGHT/BRAKELIGHT



1. Bolt
2. Lockwasher
3. Washer
4. Bracket
5. Washer
6. Collar
7. Rubber grommet
8. Wiring harness
9. Bulb
10. Lens







3. Remove the bolts, lockwasher and washer on each side securing the lens assembly to the rear fender cover.
4. Carefully pull the lens assembly out from the rear and remove it from the rear fender cover.
5. Install by reversing these removal steps.

Fairing Mounted Front Directional Signal Light Replacement (1986-on)

1. Remove the screw (**Figure 91**) securing the lens. Remove the lens.
2. Remove the old bulb (**Figure 92**).
3. Wash off the lens with mild detergent and dry.
4. Wipe off the reflector portion of the housing with a soft cloth.
5. Inspect the lens gasket for damage or deterioration, replace if necessary.
6. Install the new bulb.
7. Install the lens; do not overtighten the screw as that will crack the lens.

Front and Rear Free-Standing Directional Signal Light Replacement (All Other Models)

1. Remove the screw on the backside of the housing securing the lens and remove the lens.
2. Remove the old bulb (**Figure 93**).
3. Wash off the lens with mild detergent and dry.
4. Wipe off the reflector portion of the housing with a soft cloth.
5. Install a new bulb.
6. Install the lens; do not overtighten the screw as that will crack the lens.

Directional Signal Assembly Removal/Installation

1A. *Front turn signals (1984-1985)*: Perform the following:

a. Working under the upper fairing, locate and disconnect both front turn signal assemblies electrical connectors.
b. Loosen, then remove the large nut (A, **Figure 94**) securing each turn signal assembly (B, **Figure 94**) to the mounting bracket and upper fairing. Remove the turn signal assembly(ies).

1B. *Front turn signals (1986-on)*: Perform the following:

a. Remove the screw (**Figure 91**) securing the lens. Remove the lens.
b. Remove the old bulb (**Figure 92**).
c. Working under the upper fairing, locate and disconnect the front turn signal assembly electrical connector (A, **Figure 95**).
d. Remove the screws (B, **Figure 95**) securing the turn signal housing to the backside of the upper fairing. Remove the housing.

1C. *Rear turn signals*: Perform the following:

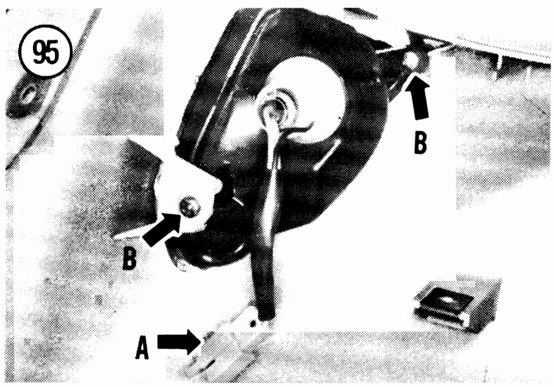
a. Working under the rear fender, locate and disconnect both rear turn signal assemblies electrical connectors.
b. Loosen, then remove the large nuts securing each turn signal assembly to the mounting bracket. Remove the turn signal assembly(ies).

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

a. Apply a dielectric compound to the electrical connectors prior to reconnecting them. This will help seal out moisture.
b. Make sure the electrical connectors are free of corrosion and are completely coupled to each other.
c. On models so equipped, tighten the large nuts securely.

Speedometer and Tachometer Illumination Bulb and Indicator Light Bulb Replacement

Refer to **Figure 96** for this procedure.



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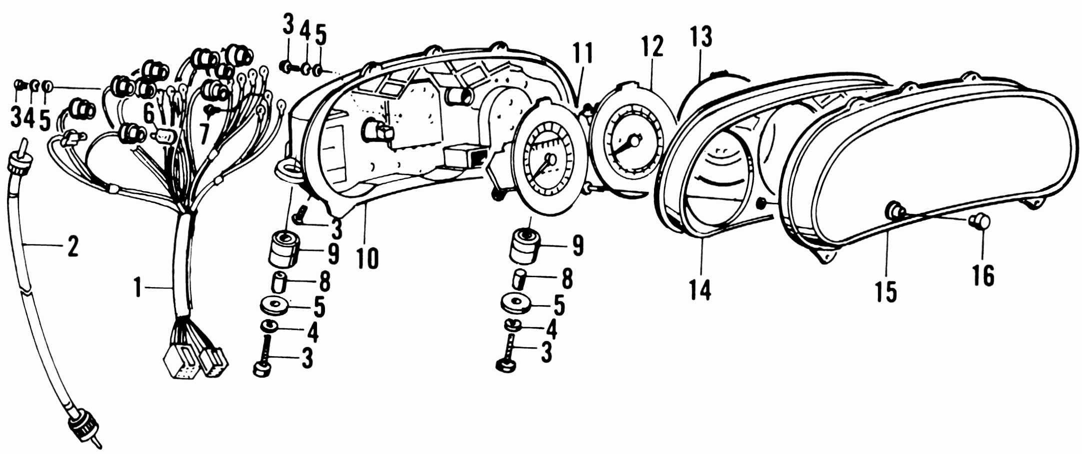
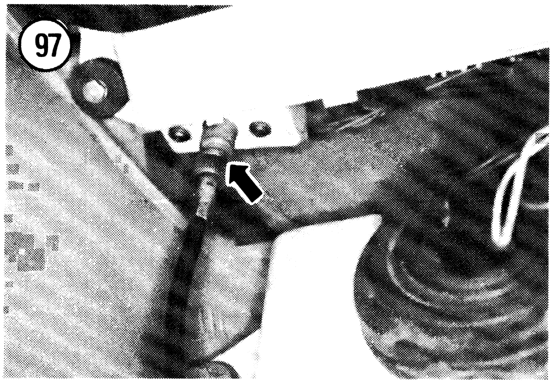
METER ASSEMBLY



1. Wiring harness
2. Speedometer cable
3. Screw
4. Lockwasher
5. Washer
6. Bulb
7. Screw
8. Collar
9. Rubber grommet
10. Inner case
11. Speedometer
12. Tachometer
13. Fuel meter
14. Cover
15. Lens
16. Trip reset knob



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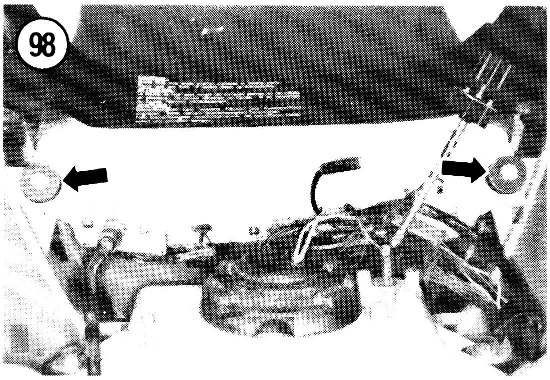

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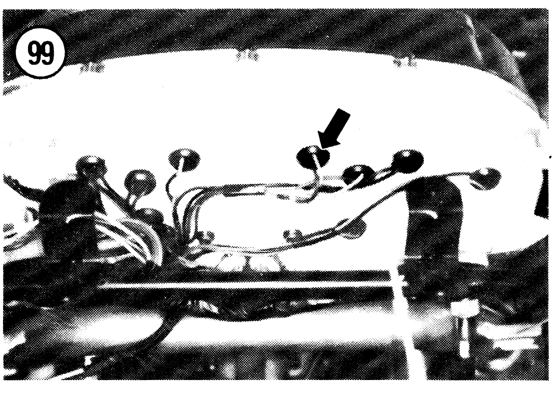

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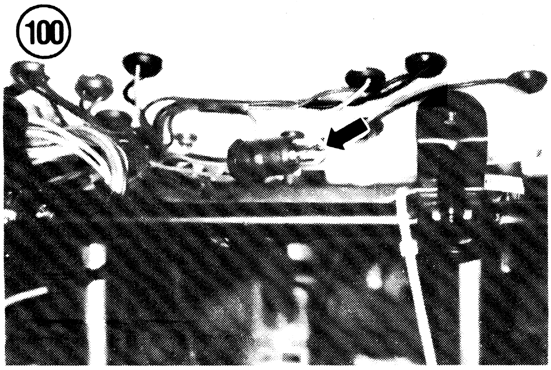


100

NOTE
The same meter assembly is used on all models. The only difference is the way the meter assembly is mounted either to the upper fairing or to the upper fairing mounting bracket.

1. Remove the upper fairing assembly as described in Chapter Twelve.
2. On 1984-1985 models, perform the following:
   a. Unscrew the speedometer cable (**Figure 97**) from the meter assembly.
   b. Remove the bolts, lockwashers and washers (**Figure 98**) securing the meter assembly to the upper fairing.
   c. Remove the meter assembly from the upper fairing.
3. Remove the socket assembly (**Figure 99**) from the meter assembly.
4. Remove the bulb (**Figure 100**).
5. Install a new bulb and push the socket into the meter.
6. Repeat for any other defective bulbs.
7. On 1984-1985 models, install the meter assembly in the upper fairing and tighten the bolts securely.
8. Install the upper fairing assembly as described in Chapter Twelve.

SWITCHES

Switches can be tested for continuity with an ohmmeter (see Chapter One) or a test light at the switch connector plug by operating the switch in each of its operating positions and comparing results with the switch operation. For example, **Figure 101** shows a continuity diagram for a typical ignition switch. It shows which terminals should show continuity when the ignition switch is in a given position.

When the ignition switch is in the PARK position, there should be continuity between terminals red and blue. This is indicated by the line on the continuity diagram. An ohmmeter connected between these 2 terminals should indicate little or no resistance and a test lamp should light. When the ignition switch is OFF, there should be no continuity between the same terminals.

8

Testing

If the switch or button doesn't perform properly, replace it. Refer to the following figures when testing the switches:

a. Main switch (U.S.): **Figure 101.**
b. Main switch (U.K.): **Figure 102.**
c. Engine stop switch (U.S. and U.K.): **Figure 103.**
d. Sidestand switch (U.S. only): **Figure 104.**
e. Clutch switch (U.S.): **Figure 105.**

101

MAIN SWITCH (U.S.)

Switch position	Wire color		
	Red	Brown	Blue
ON	●	●	●
OFF			
P	●	—	●

102

MAIN SWITCH (U.K.)

Switch position	Wire color			
	Red	Brown	Blue	Blue/red
ON	●	●	●	●
OFF				
P	●	—	—	●

103

ENGINE STOP SWITCH (U.S. & U.K.)

Switch position	Wire color	
	Red/white	Red/white
OFF		
ON	●	●

104

SIDESTAND SWITCH (U.S.)

	Blue/yellow	Black
Free	●	●
Pushed-in		

105

CLUTCH SWITCH (U.S.)

Clutch lever position	Wire color	
	Black/yellow	Blue/yellow
FREE		
DEPRESS	●	●

106

CLUTCH SWITCH (U.K.)

Clutch lever position	Wire color	
	Black/yellow	Black
FREE		
DEPRESS	●	●

107

START SWITCH (U.S.)

Button position	Wire color			
	Blue/ white	Black	Red/dark green	Blue/ black
OFF			●	●
PUSH	●	●		

f. Clutch switch (U.K.): **Figure 106.**
g. Start switch (U.S.): **Figure 107.**
h. Start switch (U.K.): **Figure 108.**
i. Headlight dimmer switch (U.S. and U.K.): **Figure 109.**
j. Front brake switch (1984-1991 U.S. and all U.K.): **Figure 110.**
k. Front brake switch (1992-on U.S.): **Figure 111.**
l. Rear brake switch (1984-1991 U.S. and all U.K.): **Figure 112.**
m. Rear brake switch (1992-on U.S.): **Figure 113.**
n. Light switch (U.K.): **Figure 114.**
o. Passing switch (U.K.): **Figure 115.**
p. Turn signal switch (U.S. and U.K.): **Figure 116.**
q. Horn switch (U.S. and U.K.): **Figure 117.**

When testing switches, note the following:

a. First check the fuses as described under *Fuses* in this chapter.
b. Check the battery as described under *Battery* in Chapter Three; charge the battery to the correct state of charge, if required.

8

108

START SWITCH (U.K.)

Button position	Wire color	
	Blue/white	Black
OFF		
PUSH	●—	—●

109

DIMMER SWITCH (U.S. & U.K.)

Switch position	Wire color		
	Yellow	Blue/black	Green
HI	●—	—●	
LO		●—	—●

110

BRAKE SWITCH (FRONT) (1984-1991 U.S. & ALL U.K.)

Brake lever position	Wire color	
	Brown	Green/yellow
FREE		
DEPRESS	●—	—●

112

BRAKE SWITCH (REAR) (1984-1991 U.S. & ALL U.K.)

Brake pedal position	Wire color	
	Brown	Yellow
FREE		
DEPRESS	●—	—●

111

BRAKE SWITCH (FRONT) (1992-ON U.S.)

	Wire color		
	Yellow	Brown	Brown/blue
ON (Pull-in)	●—	—●	
Off (Free)		●—	—●

113

BRAKE SWITCH (REAR) (1992-ON U.S.)

	Wire color		
	Brown/green	Brown	Yellow
ON (Depress)		●—	—●
OFF (Free)	●—	—●	

c. Disconnect the negative cable (**Figure 118**) from the battery if the switch connectors are not disconnected in the circuit.

CAUTION
Do not attempt to start the engine with the battery negative cable disconnected or you will damage the wiring harness.

d. When separating 2 connectors, depress the retaining clip and pull on the connector housings and *not* the wires.
e. After locating a defective circuit, check the connectors to make sure they are clean and properly connected. Check all wires going into a connector housing to make sure each wire is properly positioned and that the wire end is not loose.
f. To properly connect connectors, push them together until they click into place.
g. When replacing handlebar switch assemblies, make sure the cables are routed correctly so that they are not crimped when the handlebar is turned from side to side.

Left-hand Handlebar Switch Replacement

1. The left handlebar switch housing is equipped with the following switches:
   a. Headlight dimmer.
   b. Turn signal.
   c. Horn.
   d. Passing (U.K. only).
2. Remove the front fairing as described in Chapter Twelve.
3. Remove the fuel tank as described in Chapter Seven.

NOTE
The clutch safety switch wiring is part of the left-hand handlebar switch wiring harness.

4. Disconnect the clutch safety switch electrical connector (A, **Figure 119**) from the clutch master cylinder.
5. Follow the switch electrical wiring harness behind the steering head and through the frame. Locate the

114

LIGHT SWITCH (U.K.)

Switch position	Wire color		
	Red/yellow	Blue	Blue/black
OFF			
P	●	●	
ON	●	●	●

115

PASSING SWITCH (U.K.)

Button position	Wire color	
	Red/yellow	Yellow
OFF		
PUSH	●	●

116

TURN SIGNAL SWITCH (U.S. & U.K.)

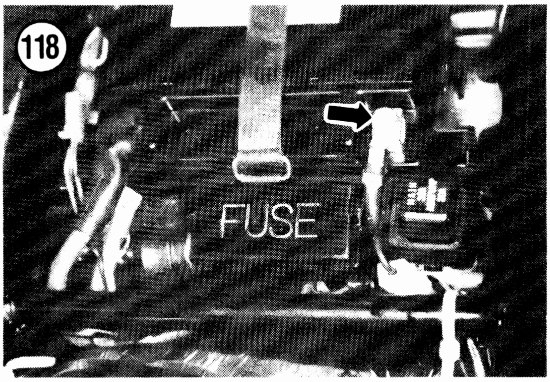
Switch position	Wire color				
	Chocolate	Brown/white	Dark green	Yellow/red	Black
L	●	●		●	●
L → N	●	●			
N → Push					
R → N		●	●		
R		●	●	●	●

117

HORN SWITCH (U.S. & U.K.)

Button position	Wire color	
	Pink	Black
PUSH		
OFF		

118



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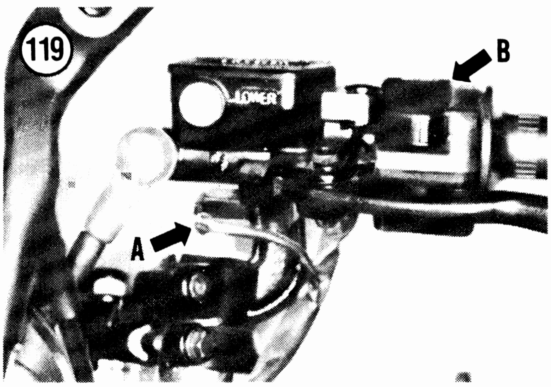
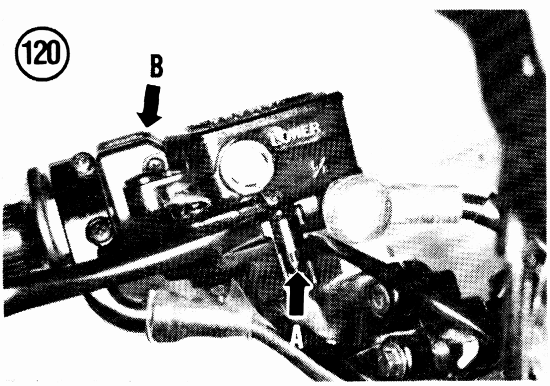


120



10-pin electrical connector (containing 9 wires) and disconnect it.

6. Remove the screws and separate the left-hand switch assembly (B, **Figure 119**). Remove the switch assembly from the handlebar.
7. Remove the switch housing and wiring harness.
8. Installation is the reverse of these steps while noting the following:
   a. Apply a dielectric compound to the electrical connector prior to reconnecting it. This will help seal out moisture.
   b. Make sure the electrical connectors are free of corrosion and are completely coupled to each other.
   c. Install all items removed.

Right-hand Handlebar Switch Replacement

1. The right handlebar switch housing is equipped with the following switches:
   a. Engine stop.
   b. Starter.
   c. Lights (U.K. only).
2. Remove the front fairing as described in Chapter Twelve.
3. Remove the fuel tank as described in Chapter Seven.

NOTE
The front brake light switch wiring is part of the right-hand handlebar switch wiring harness.

4. Disconnect the front brake light switch electrical connector (A, **Figure 120**) from the master cylinder.
5. Follow the switch electrical wiring harness behind the steering head and through the frame. Locate the 10-pin electrical connector (containing 8 wires) and disconnect it.
6. Remove the screws and separate the right-hand switch assembly (B, **Figure 120**). Disconnect the throttle cables from the twist grip. Remove the switch assembly from the handlebar.
7. Installation is the reverse of these steps while noting the following:
   a. Apply a dielectric compound to the electrical connectors prior to reconnecting them. This will help seal out moisture.

8

b. Make sure the electrical connectors are free of corrosion and are completely coupled to each other.
c. Install all items removed.
d. Adjust the throttle cable as described under *Throttle Cable Adjustment* in Chapter Three.

Ignition Switch Replacement

1. Remove the front fairing assembly as described in Chapter Twelve.
2. Remove the fuel tank as described in Chapter Seven.
3. Disconnect the ignition switch 3-pin electrical connector.
4. Remove the wiring harness clamp (A, **Figure 121**) at the base of the switch.
5. Remove the bolts and washers securing the ignition switch to the upper fork bridge and remove the switch (B, **Figure 121**).
6. Installation is the reverse of these steps while noting the following:
   a. Apply a dielectric compound to the electrical connector prior to reconnecting it. This will help seal out moisture.
   b. Make sure the electrical connectors are free of corrosion and are completely coupled to each other.
   c. Install all items removed.

Neutral Switch Replacement

1. Remove the left-hand crankcase cover as described in Chapter Four.
2. Disconnect the electrical connector from the neutral switch.

NOTE
***Figure 122** is shown with the drive sprocket and drive chain removed for clarity only.*

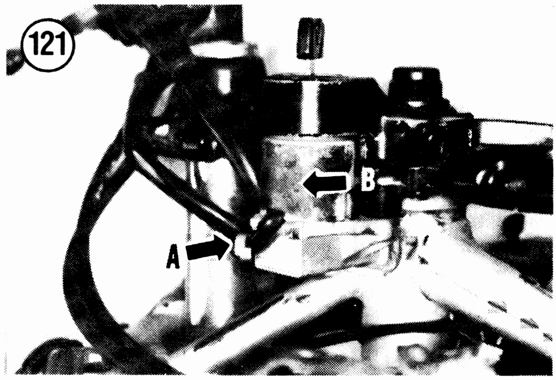
3. Remove the neutral switch screws and remove the switch (**Figure 122**).
4. If there are signs of oil leakage around the neutral switch, replace the O-ring on the back of the switch housing.
5. Install by reversing these removal steps. Make sure the electrical connector is free of corrosion and is tight.

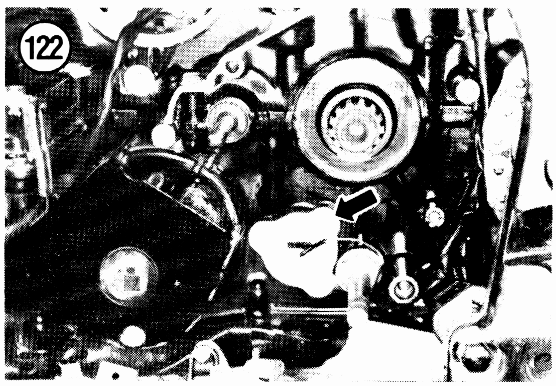
Low Oil Level Warning Switch Replacement

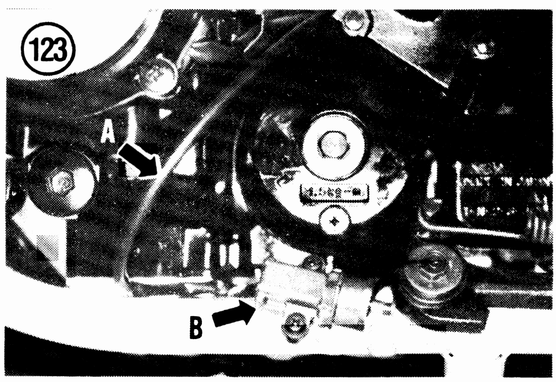
Refer to *Low Oil Level Warning Switch Removal/Installation* in Chapter Four.

Sidestand Switch (U.S. only) Replacement

1. Place the bike securely on the centerstand.





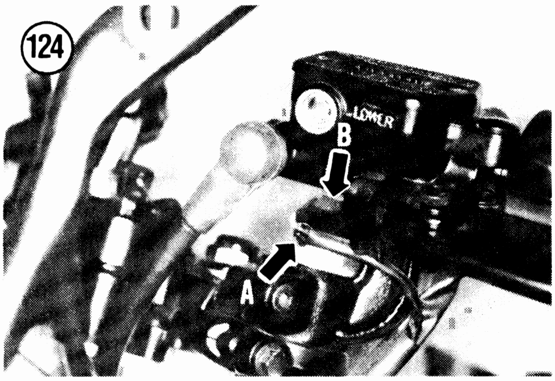


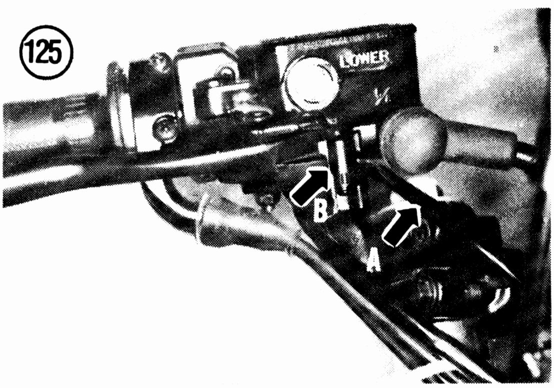
2. Follow the switch electrical wiring harness (A, **Figure 123**) through the frame. Locate the 2-pin electrical connector and disconnect it.

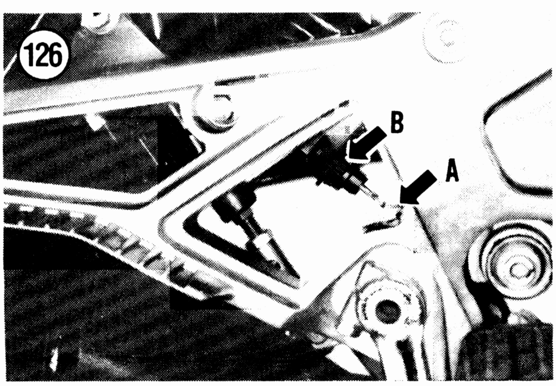
3. Remove the screws securing the sidestand switch to the frame and remove the switch (B, **Figure 123**).

4. Installation is the reverse of these steps while noting the following:

   a. Apply a dielectric compound to the electrical connector prior to reconnecting it. This will help seal out moisture.







   b. Make sure the electrical connector is free of corrosion and are completely coupled to each other.

Clutch Safety Switch

The clutch safety switch is mounted underneath the front clutch lever mounting bracket.

1. Disconnect the electrical connector (A, **Figure 124**).
2. Remove the screw securing the switch (B, **Figure 124**) and remove the switch.
3. Install by reversing this procedure. Check switch operation. The engine should start only with the clutch lever pulled in when the transmission is in gear.

Front Brake Light Switch Replacement

The front brake switch is mounted to the side of the front brake master cylinder.

1. Disconnect the electrical connector (A, **Figure 125**).
2. Remove the screw securing the switch (B, **Figure 125**) and remove the switch.
3. Install by reversing this procedure. Check switch operation. The brake light should come on when applying the front brake lever.

Rear Brake Light Switch Replacement

The rear brake switch is mounted on the right-hand muffler bracket next to the brake pedal pivot point.

1. Disconnect the spring (A, **Figure 126**) from the base of the switch.
2. Unscrew the switch locknut (B, **Figure 126**) and remove the switch assembly from the frame bracket.
3. Follow the switch electrical wiring harness up the right-hand side of the frame.

4A. On 1984-1991 models, locate the 2-pin electrical connector containing 2 wires (1 yellow and 1 brown) and disconnect it.

4B. On 1992-on models, locate the 3-pin electrical connector containing 3 wires (1 brown/green, 1 yellow and 1 brown) and disconnect it.

5. Screw a new switch into the switch mount. Attach the spring and plug in the electrical connector.

6. Adjust the rear brake switch as described under *Rear Brake Light Switch Adjustment* in Chapter Three.

WIRING CONNECTORS

Many electrical troubles can be traced to damaged wiring or connectors that are contaminated with dirt and oil. Connectors can be serviced by disconnecting them and cleaning with electrical contact cleaner. Multiple pin connectors should be packed with a dielectric compound (available at most automotive and motorcycle supply stores).

ELECTRICAL COMPONENTS

This section contains information on electrical components other than switches covered under *Switches* in this chapter.

Meter Housing Removal/Installation

Refer to **Figure 127** for this procedure.

NOTE
The same meter assembly is used on all models. The only difference is that the meter assembly is mounted either to the upper fairing (1984-1985) or to the upper fairing mounting bracket (1986-on).

1. Remove the upper fairing assembly as described in Chapter Twelve.

2A. On 1984-1985 models, perform the following:

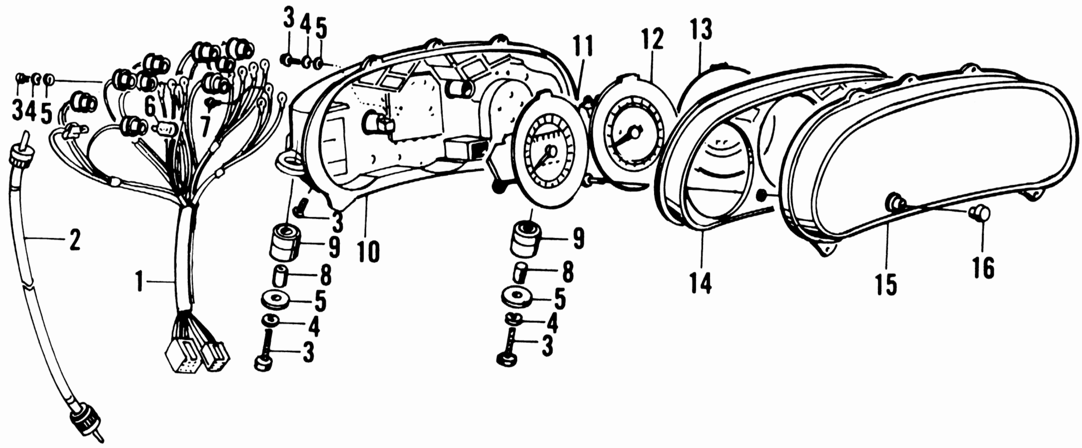
a. Unscrew the speedometer cable (**Figure 128**) from the meter assembly.

b. Remove the bolts, lockwashers and washers (**Figure 129**) securing the meter assembly to the upper fairing.

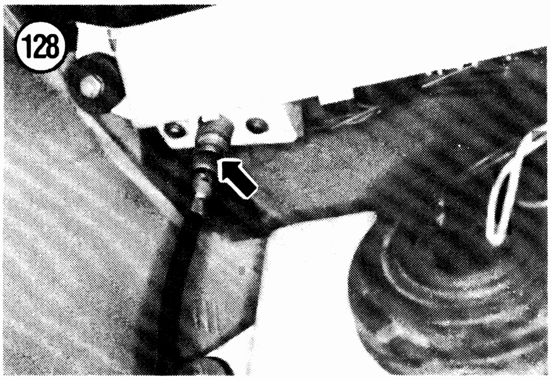
c. Remove the meter assembly from the upper fairing. Don't lose the metal collar in the mounting boss.

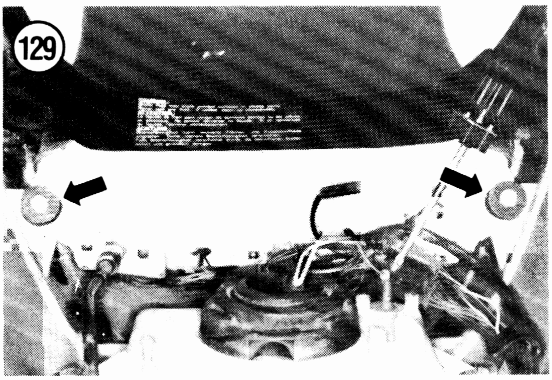
127

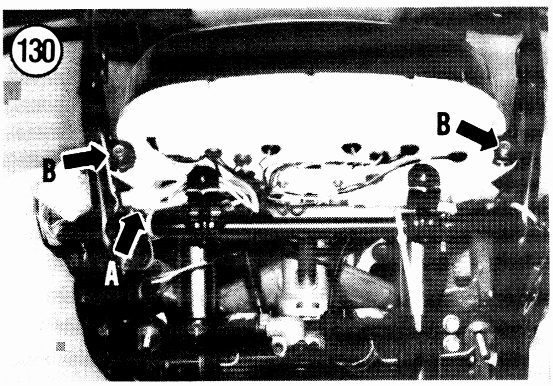
METER ASSEMBLY

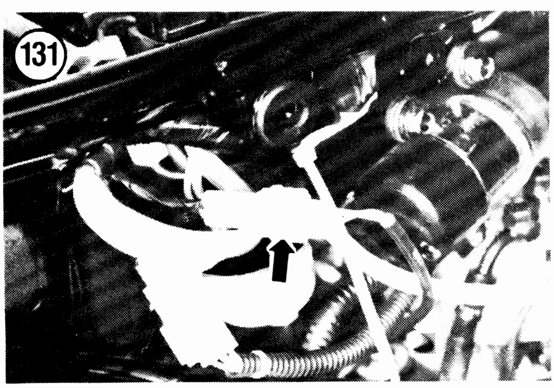


1. Wiring harness
2. Speedometer cable
3. Screw
4. Lockwasher
5. Washer
6. Bulb
7. Screw
8. Collar
9. Rubber grommet
10. Inner case
11. Speedometer
12. Tachometer
13. Fuel meter
14. Cover
15. Lens
16. Trip reset knob









2B. On 1986-on models, perform the following:

a. Disconnect the 2 electrical connectors (A, **Figure 130**) from the meter assembly.
b. Disconnect the speedometer cable from the backside of the meter assembly. Move the cable out of the way.
c. Remove the bolts, lockwashers and washers (B, **Figure 130**) securing the meter assembly to the upper fairing mounting bracket and remove it. Don't lose the metal collar in the mounting boss.

CAUTION

Whenever the meter housing is removed from the bike, it must be placed so that the gauges face up. If the meter is left in any other position it will become damaged.

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

a. Apply a dielectric compound to the electrical connector prior to reconnecting it. This will help seal out moisture.
b. Make sure the electrical connectors are free of corrosion and are completely coupled to each other. Make sure the small screws are tight.
c. Make sure the metal collar is in place in the mounting boss and tighten the bolts and nuts securely.

8

ABS Sensor Testing

If you suspect trouble within the ABS system, the first thing to check is the resistance of each ABS sensor with an ohmmeter.

To get an accurate reading, the ABS sensor must be warm (minimum temperature is 20° C—68° F). If the ambient temperature is less than this, heat the sensor to the proper temperature with a portable hair dryer.

1. Remove the seat and both frame side covers as described in Chapter Twelve.
2. Follow the sensor electrical wiring harness up the right-hand side of the frame.
3. Locate the sensor electrical connector and disconnect it (**Figure 131**).
4. Use an ohmmeter (**Figure 132**) and check the resistance between the sensor side of the electrical connector as follows:

a. Connect the positive (+) test lead to the "A" terminal.

b. Connect the negative (–) test lead to the "B" terminal.

The specified resistance is listed in **Table 1**.

5. Replace the sensor if the resistance exceeds the specification in **Table 1**.

ABS Sensor and Electrical Cable Assembly Removal/Installation

Refer to *Front Sensor Removal/Installation* or *Rear Sensor Removal/Installation* in the ABS section in Chapter Eleven for replacement of the ABS sensor and electrical cable assembly.

Horn Removal/Installation

NOTE

It is not necessary, but removing the front fairing does allow additional work room.

1. If necessary, remove the front fairing as described in Chapter Twelve.
2. Disconnect the electrical connector.
3. Remove the bolt securing the horn and remove the horn.
4. Install by reversing these removal steps. Make sure the electrical connector is free of corrosion and is tight.

FUEL PUMP (1989-ON)

During this test procedure, after each step is completed, reconnect the electrical connector to the component that was just tested, providing it tested okay.

Prior to starting any of the following test procedures, check the condition of the battery as described in Chapter Three. Recharge the battery if necessary. If the battery is not fully charged, the fuel pump circuit (**Figure 133**) will not operate correctly.

Fuel Pump Test

1. Remove the fuel pump as described in Chapter Seven.

WARNING

Wear eye protection as some fuel may be expelled from the outlet port during the following test.

2. Cover the outlet port of the fuel pump with a shop cloth as there may be some residual fuel remaining in the fuel chamber.

CAUTION

Operate the fuel pump for only a few seconds for this test. The fuel pump will be damaged if run for any long duration without fuel in the fuel chamber.

3. Connect a 12 volt battery to the terminals in the fuel pump electrical connector.

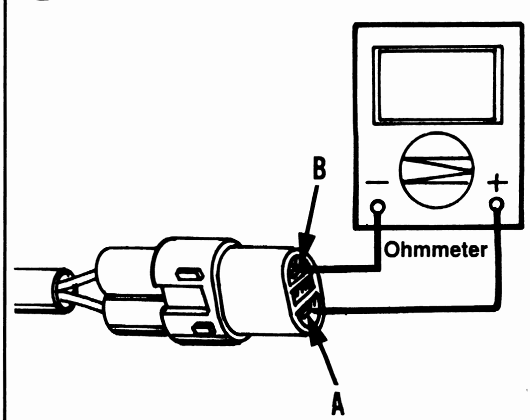
4. The fuel pump should operate. If it does not, it is faulty and must be replaced.

5. If the fuel pump checks out okay, reinstall the fuel pump.

Fuel Pump Relay Removal/Installation

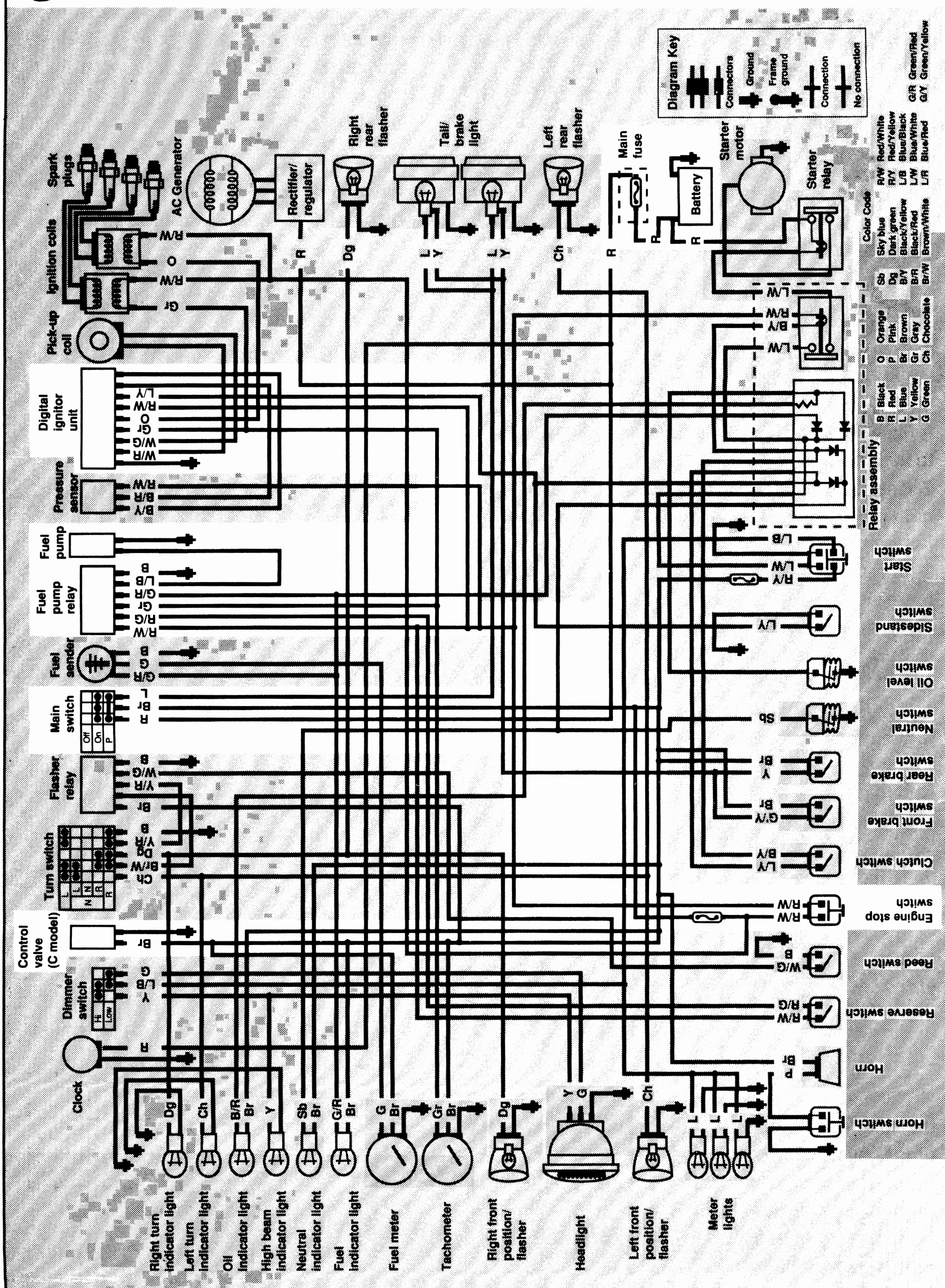
1. Remove the seat as described in Chapter Twelve.
2. Make sure the ignition switch is turned OFF.
3. Label and disconnect the wires from the starter relay (**Figure 134**) and pull it out of its holder.
4. Install by reversing these steps. Make sure the nuts securing the electrical connections are free of corrosion and are tight.

132



133

FUEL SYSTEM



Fuel Pump Circuit and Fuel Pump Relay Test

For the following test procedures, perform the following:

a. Place the bike securely on the centerstand.
b. Remove the seat and frame side covers as described in Chapter Twelve.
c. Remove the fuel tank as described in Chapter Seven.

Fuel pump does not operate after the engine is started

1. First check the main fuse. Open the fuse panel cover (**Figure 135**) and pull the fuse (**Figure 136**) out of its holder and visually inspect it. If the fuse is blown, refer to *Fuses* in this chapter. If the main fuse is okay, reinstall it, or install a new one, then proceed to the next step.
2. Check the main switch and engine stop switch for proper operation, refer to *Switches* in this chapter. Replace either switch if necessary.
3. Locate the fuel pump relay (**Figure 134**) on the left-hand side of the battery and disconnect the 6-pin electrical connector from it.
4. Turn the main switch ON and the engine stop switch to RUN.
5. Connect a DC voltmeter to the wiring harness side of the connector. Connect the positive (+) test lead to the red/white terminal and the negative (–) test lead to ground.
6. There should be battery voltage (more than 12 volts).
7. If the voltage is less than specified, check all electrical connections in the system.

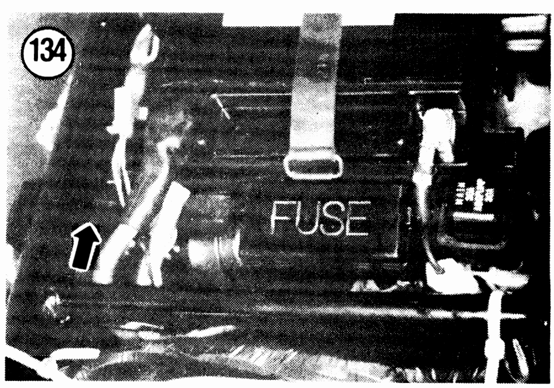
WARNING
The jumper cable installed in Step 8 must be the same gauge as the wires within the relay electrical connector or larger.

8. Connect a jumper wire across the red/white and the blue/black terminals on the wiring harness side of the connector.
9. The switches must be in the same position as indicated in Step 4.
10A. If the fuel pump fails to operate, it is defective. Replace the fuel pump as described in Chapter Seven.
10B. If the fuel pump operates, check all electrical connections in the system. If all electrical connections are okay, the fuel pump relay is faulty and must be replaced.
11. Reconnect the 6-pin electrical connector to the relay.
12. Install all parts removed.

Fuel pump does not operate for a 5 second interval

The fuel pump will operate for a 5 second interval to maintain the fuel level in the carburetor float bowls, then turn off.

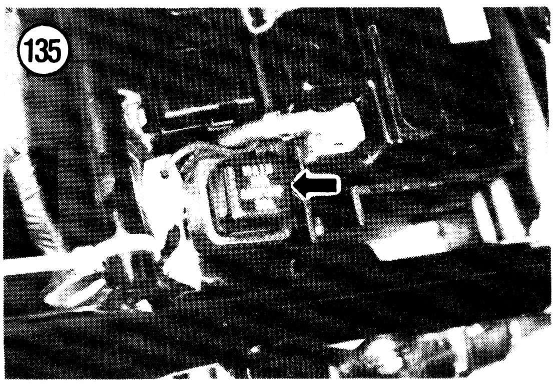
1. First check the main fuse. Open the fuse panel cover (**Figure 135**) and pull the fuse (**Figure 136**) out of its holder and visually inspect it. If the fuse is blown, refer to *Fuses* in this chapter. If the main fuse is okay, reinstall it, or install a new one, then proceed to the next step.
2. Check the main switch and engine stop switch for proper operation, refer to *Switches* in this chapter. Replace either switch if necessary.
3. Locate the fuel pump relay (**Figure 134**) on the left-hand side of the battery and disconnect the 6-pin electrical connector from it.
4. Turn the main switch ON and the engine stop switch to RUN.
5. Connect a DC voltmeter to the wiring harness side of the connector. Connect the positive (+) test lead to the red/white terminal and the negative (–) test lead to ground.
6. There should be battery voltage (more than 12 volts).
7. If the voltage is less than specified, check all electrical connections in the system. If all electrical connections are okay, proceed to Step 8.

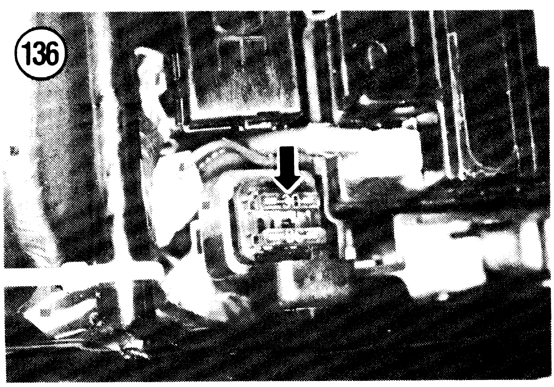


8. Reconnect the electrical connector to the fuel pump relay and test the input voltage.
9. The switches must be in the same position as indicated in Step 4.
10. Connect a DC voltmeter into the backside of the electrical connector still connected to the relay. Connect the positive (+) test lead to the blue/black terminal and the negative (–) test lead to ground.
11. Press the START switch and measure the voltage.
12. There should be battery voltage (more than 11 volts).
13. If the voltage is less than specified, check all electrical connections in the system.
14. If all electrical connections are okay, the fuel pump is faulty and must be replaced.
15. Install all parts removed.

Fuel pump does not stop after 30 seconds

The fuel pump will operate for a 5 second interval to maintain the fuel level in the carburetor float bowls, then turn off. The fuel pump should never run for more than 30 seconds.





1. First check the main fuse. Open the fuse panel cover (**Figure 135**) and pull the fuse (**Figure 136**) out of its holder and visually inspect it. If the fuse is blown, refer to *Fuses* in this chapter. If the main fuse is okay, reinstall it, or install a new one, then proceed to the next step.

2. Check the main switch and engine stop switch for proper operation, refer to *Switches* in this chapter. Replace either switch if necessary.

3. Locate the fuel pump relay (**Figure 134**) on the left-hand side of the battery and leave the 6-pin electrical connector attached to the relay—do not unplug it.

4. Turn the main switch ON and the engine stop switch to RUN.

5. Connect a DC voltmeter into the backside of the electrical connector still connected to the relay. Connect the positive (+) test lead to the blue/black terminal and the negative (–) test lead to ground.

6. Press the START switch and measure the voltage.

7. There should be battery voltage (more than 11 volts).

8A. If the voltage is less than specified, the digital ignitor unit is faulty and must be replaced.

8B. If the voltage is more than 11 volts, check all electrical connections in the system.

NOTE

Prior to purchasing a new ignitor unit, have the fuel pump system checked by a Yamaha dealer. They may perform a "remove and replace" test to see if the ignitor 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 fuel pump 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.*

9. If all electrical connections are okay, the digital ignitor unit is faulty and must be replaced.

10. If all electrical connections are okay, the fuel pump relay is faulty and must be replaced.

11. Install all parts removed.

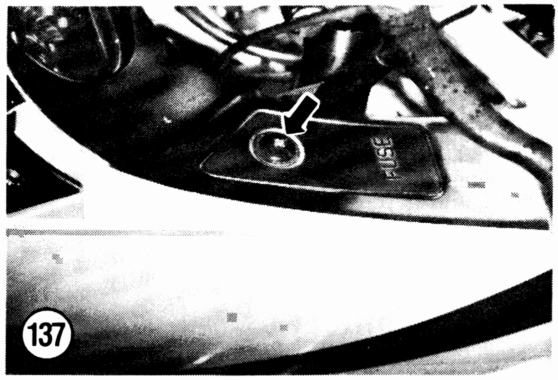
FUSES

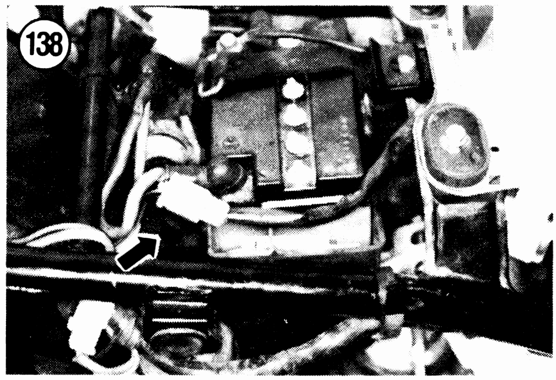
Whenever a fuse blows, find out the reason for the failure before replacing the fuse. Usually, the trouble is a short circuit in the wiring. This may be caused by worn-through insulation or a disconnected wire shorting to ground. Fuse ratings are listed in **Table 3**.

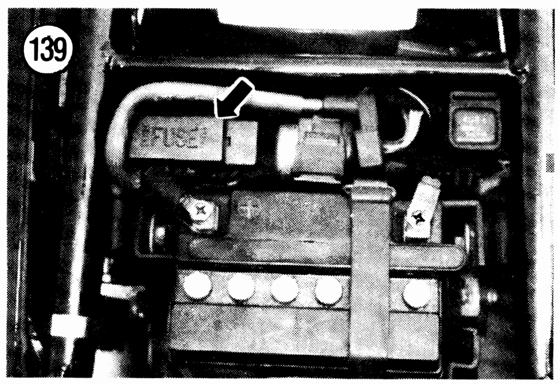
CAUTION
Never substitute metal foil or wire for a fuse. Never use a higher amperage fuse than specified. An overload could result in fire and complete loss of the bike.

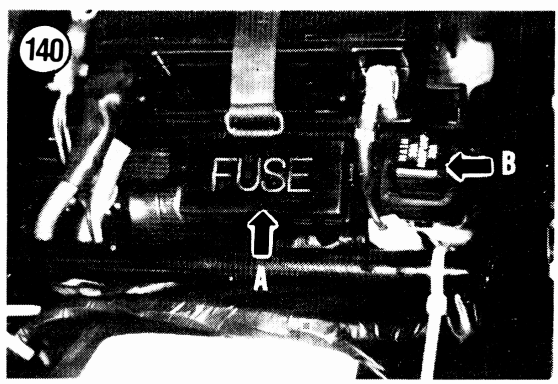
Fuse Location

1. On 1984-1985 models, there are 3 fuses located in the fuse holder mounted underneath the front fairing left-hand cover (**Figure 137**). The main fuse is located in a separate holder underneath the seat behind the battery (**Figure 138**). The fuse functions and amperage rating are as follows:
   a. Main fuse: 30 amp.
   b. Headlight: 15 amp.
   c. Signal: 15 amp.
   d. Ignition: 15 amp.
2. On 1986-1990 models, all 4 fuses are located in a single fuse holder (**Figure 139**) located under the seat behind the battery. The fuse functions and amperage rating are as follows:
   a. Main fuse: 30 amp.
   b. Headlight: 15 amp.
   c. Signal: 15 amp.
   d. Ignition: 15 amp.
3. On 1991-on models, there are 5 fuses located in the fuse holder under seat (A, **Figure 140**). There are 2 additional fuses, the main fuse and the ABS fuse and they are located in a separate holder (B, **Figure 140**) also underneath the seat behind the battery. The fuse functions and amperage rating are as follows:
   a. Main fuse: 30 amp.
   b. Headlight: 15 amp.
   c. Signal: 15 amp.
   d. Ignition: 15 amp.
   e. Warning: 15 amp.
   f. ECU: 15 amp.
   g. ABS: 30 amp.



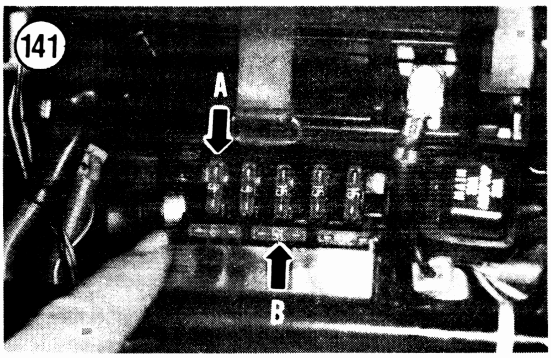






Fuse Replacement

1. Remove the seat as described in Chapter Twelve.
2. Prior to removing the fuse, turn the ignition switch OFF and turn any switch relating to that specific circuit to the OFF position.
3. On 1984-1985 models, perform the following:
   a. To replace the main fuse, unlock the tabs on the fuse holer and separate the fuse holder. Carefully pull the glass tube type fuse out of the holder.



   b. To replace the additional fuses, remove the screw and open the front fairing left-hand cover (**Figure 137**). Remove the fuse by pulling it out of its holder with needlenose pliers.
   c. Visually inspect the fuse to make sure it has blown.
   d. Install a new fuse with the same amperage rating.
4. On 1986-on models, perform the following:
   a. Open the fuse panel cover (A, **Figure 140**).
   b. Remove the fuse (A, **Figure 141**) by pulling it out of its holder with needlenose pliers. Visually inspect the fuse to make sure it has blown.
   c. Install a new fuse with the same amperage rating.

NOTE

*The fuse holder is equipped with spare fuses (B, **Figure 141**). If you replaced a fuse on the road, replace the spare fuse as soon as possible. Always carry extra fuses.*

Table 1 ELECTRICAL SYSTEM SPECIFICATIONS

System voltage	12 volts
Battery	
Capacity	12 volt/14 amp hour
Transistorized Ignition System	
Pick-up coil resistance	108-132 ohms*
Ignition coil resistance	
Primary	2.4-3.0 ohms*
Secondary	9,600-14,400 ohms*
Spark plug cap resistance	9,000-1,100 ohms*
Digital Control Ignition System	
Pick-up coil resistance	149-182 ohms*
Ignition coil resistance	
Primary	2.4-3.0 ohms*
Secondary	9,600-14,400 ohms*
Spark plug cap resistance	10,000 ohms*
Generator	
Brush length wear limit	4.5 mm (0.18 in.)
Coil winding resistance	
Stator	0.2 ±5% ohms*
Field (rotor)	4.0 ±5% ohms*
Spring pressure	230-330 grams (8.12-11.65 oz.)
Electric starter	
Brush length wear limit	5.5 mm (0.22 in.)
Commutator	
Diameter wear limit	27 mm (1.06 in.)
Mica undercut	0.5 mm (0.02 in.)

(continued)

Table 1 ELECTRICAL SYSTEM SPECIFICATIONS (continued)

System voltage	12 volts
Electric starter (continued)	
Coil winding resistance	3.9-4.7 ohms*
Amperage rating	100 amps
ABS sensor resistance	1,190-2,210 ohms*

* Test performed to unit at a temperature of 68° (20° C).

Table 2 REPLACEMENT BULBS

U.S. Models	
Item	**Wattage**
Headlight	12V 60W/55W
Position light	8W (2)
Tail/brakelight	8/27W (2)
Directional light	27W (4)
Meter light	3.4W (3)
Indicator light	3.4W (6)
U.K. Models	
Item	**Wattage**
Headlight	12V 60W/55W
Auxiliary light	5W (1)
Tail/brakelight	5/21W (2)
Flasher light	21W (4)
Meter light	3.4W (3)
Indicator light	3.4W (6)

FRONT SUSPENSION AND STEERING

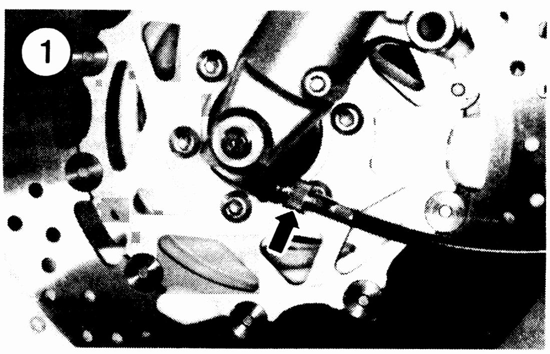
This chapter describes service operations on the front wheel, forks, steering components and tire changing.

Front suspension specifications are listed in **Table 1**. **Tables 1-3** are at the end of the chapter.

FRONT WHEEL

Removal/Installation

CAUTION
*Care must be taken when removing, handling and installing a wheel with disc brake rotors. The rotors are relatively thin in order to dissipate heat and to minimize unsprung weight. The rotors are designed to withstand tremendous rotational loads but can be damaged when subjected to side impact loads. If the rotor(s) is knocked out of true by a side impact, a pulsation will be felt in the front brake lever when braking. The rotor(s) is too thin to be trued and must be replaced with a new one. Protect the rotors when transporting a wheel to a dealer or tire specialist for tire service. Do **not** place a wheel in a car trunk or pickup bed without protecting the rotors from side impact.*



1. Place the bike securely on the centerstand with the front wheel clear of the ground.

2. Unscrew the speedometer cable (**Figure 1**) and pull the cable out of the speedometer drive unit.

NOTE
*On ABS-equipped models, the right-hand caliper assembly **must** be removed in order to remove the sensor lead from the fork assembly in Step 4.*

3. Remove the right-hand brake caliper assembly as described in Chapter Eleven.

4. On ABS-equipped models, perform the following:

a. Remove the plastic clamps holding the wheel sensor cable to the hydraulic brake hose (A, **Figure 2**).

b. Remove the bolt (B, **Figure 2**) securing the wheel sensor cable and hydraulic brake hose upper holder to the right-hand fork slider.
c. Remove the bolt (A, **Figure 3**) securing the wheel sensor cable lower holder to the right-hand fork slider.

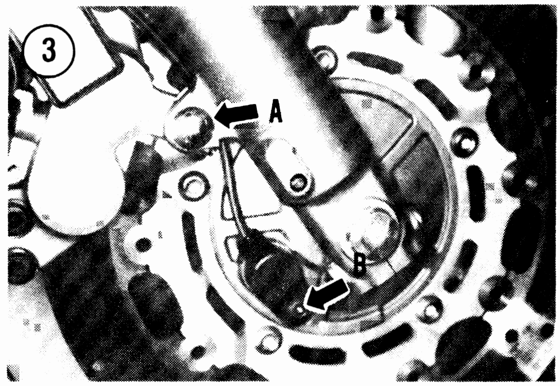
CAUTION
Do not allow the sensor pole to make contact with any metal object on the bike.

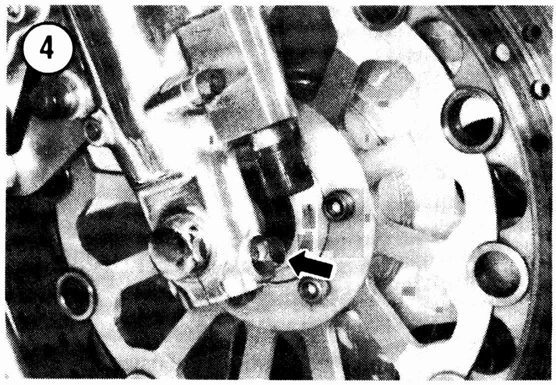
d. Remove the bolt securing the wheel sensor (B, **Figure 3**) to the sensor housing. Carefully pull the sensor from the housing and place it in a reclosable plastic bag to protect it from damage and dirt. Move it out of the way.

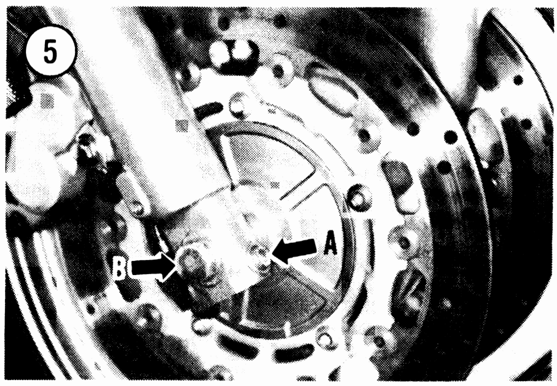
5. Remove the front fender as described in Chapter Twelve.
6A. On 1984-1990 models, loosen the front axle clamp bolt (**Figure 4**) on both fork sliders.
6B. On 1991-on models, loosen the front axle clamp bolt (A, **Figure 5**) on the right-hand fork slider.
7A. On 1984-1987 models, loosen then remove the front axle nut. On the left-hand side, withdraw the axle from the fork legs and wheel.
7B. On 1988-on models, on the right-hand side loosen the axle (B, **Figure 5**), then withdraw it from the fork legs and wheel.
8. Carefully lower the front wheel and disengage the disc from the remaining caliper assembly.

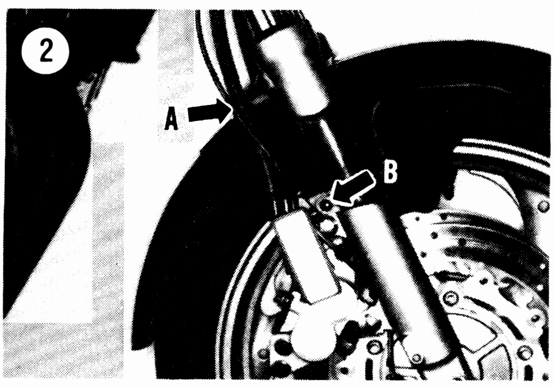
NOTE
On ABS-equipped models, hold onto the sensor housing as it will fall out of the wheel hub as the wheel is removed.

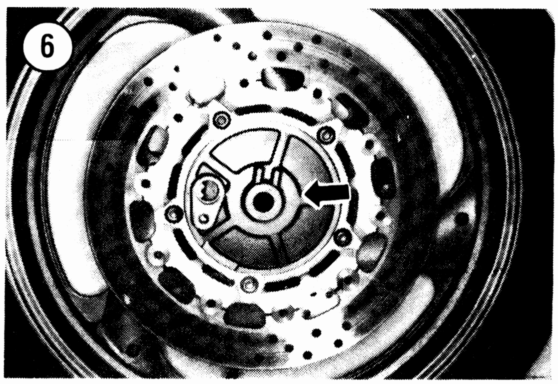
9. Pull the wheel forward and remove it from the forks.

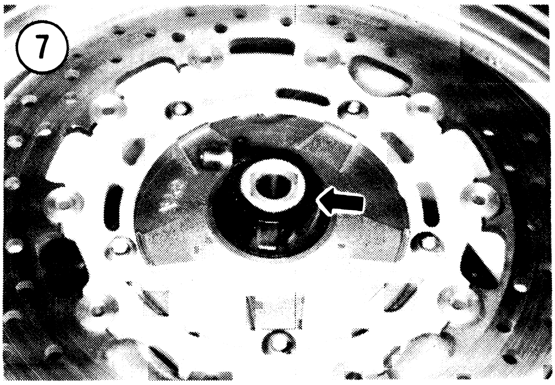


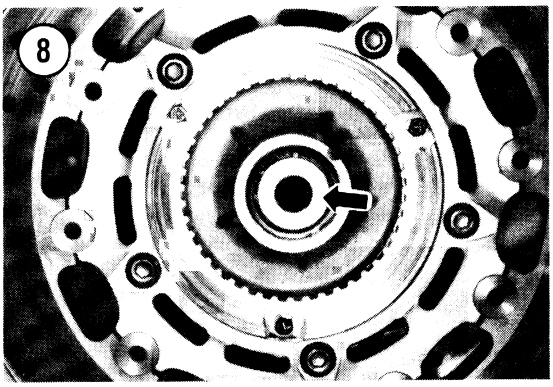


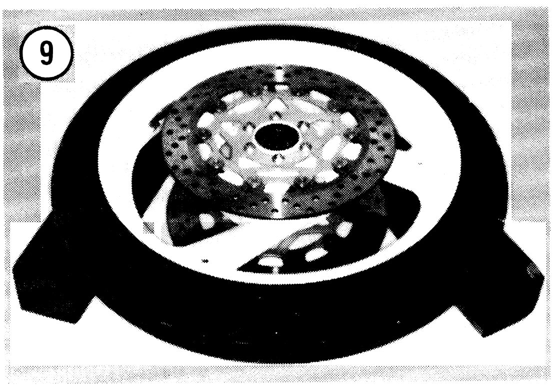












10. On ABS-equipped models, remove the sensor housing (**Figure 6**) from the wheel.
11. Remove the speedometer housing (**Figure 7**) from the left-hand side.
12. Remove the spacer (**Figure 8**) from the right-hand side.

CAUTION

*Do not set the wheel down on the disc surface as it may get scratched or warped. Set the sidewalls on 2 wood blocks (**Figure 9**).*

NOTE

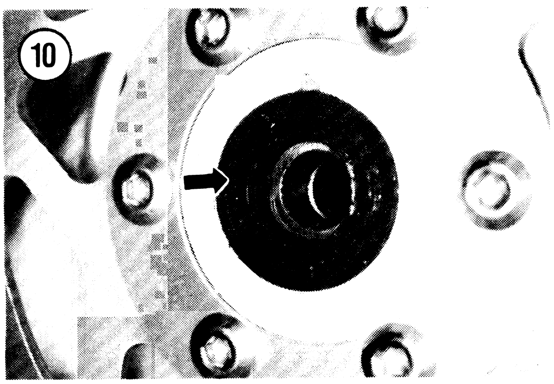
Insert a piece of vinyl tubing or wood in each caliper in place of the brake disc. That way if the brake lever is inadvertently squeezed, the piston will not be forced out of the cylinder. If this does happen, the caliper may have to be disassembled to reseat the piston and the system will have to be bled. By using the wood, bleeding the brake is not necessary when installing the wheel.

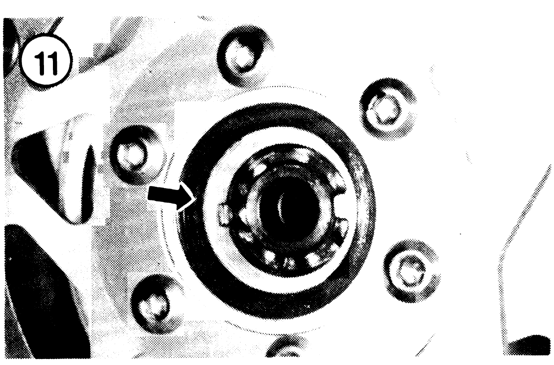
Installation

1. Make sure the axle bearing surfaces of the fork sliders and axle are free from burrs and nicks.
2. To prevent axle seizure, coat the axle with an anti-seize compound such as Bostik Never-Seez Lubricating & Anti-Seize Compound (part No. 49501).
3. Apply a light coat of lithium based grease to the lips of the right-hand oil seal (**Figure 10**) and to the seal (**Figure 11**) for the speedometer housing.
4. Install the wheel spacer (**Figure 12**) in the right-hand side.

NOTE

Make sure the speedometer housing seats completely. If the speedometer





components do not mesh properly, the hub components of the wheel will be too wide for installation.

5. Align the slots in the speedometer housing (A, **Figure 13**) with the 2 speedometer drive tabs (B, **Figure 13**) in the front wheel hub, then install the speedometer housing. Push it in until it is completely seated in the hub.
6. On ABS-equipped models, install the sensor housing (**Figure 6**) into the wheel.
7. Position the wheel into place within the fork legs and guide the right-hand brake disc into the brake caliper.
8. Properly index the locating boss on the fork tube so that it is engaged with the locating slot on the speedometer gear box (**Figure 14**).
9. On ABS-equipped models, properly index the locating boss on the fork tube so that it is engaged with the locating slot on the sensor housing (**Figure 15**). This is necessary for proper ABS operation.

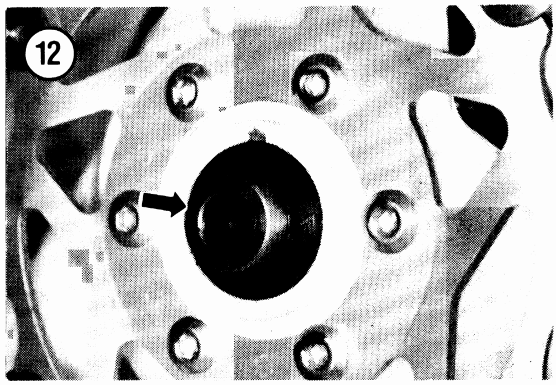
10A. On 1984-1987 models, insert the front axle from the left-hand side through the wheel hub and the speedometer gear box. Install the axle nut and tighten to the torque specification listed in **Table 1**.

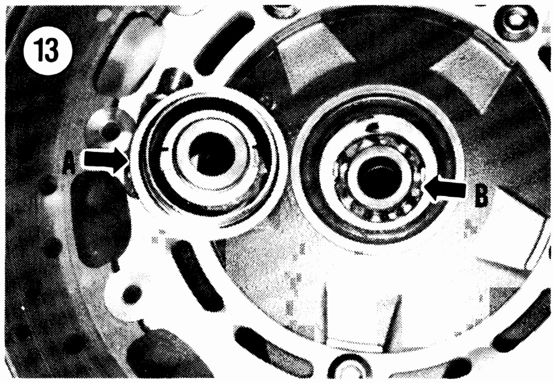
10B. On 1988-on models, insert the front axle from the right-hand side and screw it into the left-hand fork leg. Tighten the axle to the torque specification listed in **Table 1**.

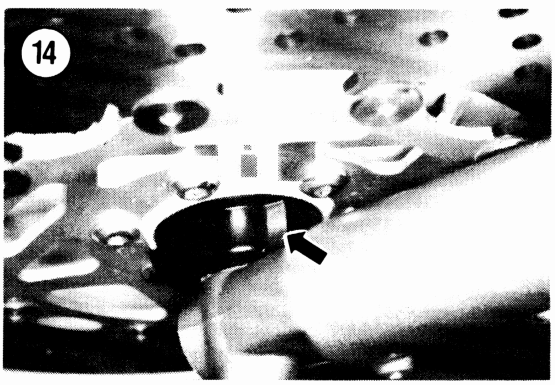
11. Slowly rotate the wheel and install the speedometer cable into the speedometer housing.
12. Remove the vinyl tubing or pieces of wood from the brake calipers.
13. Install the right-hand brake caliper as described in Chapter Eleven.
14. On ABS-equipped models, perform the following:

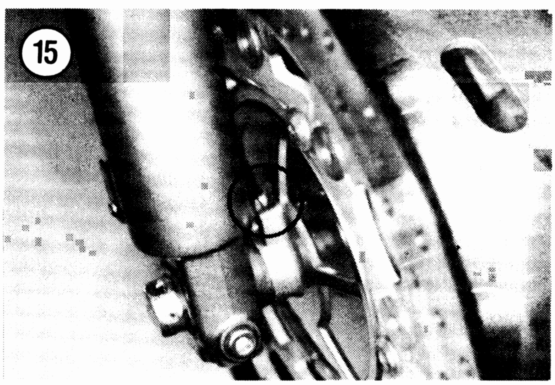
CAUTION
Do not allow the sensor pole to make contact with any metal object on the bike.

   a. Remove the sensor from the plastic bag and make sure the end of the sensor (**Figure 16**) is free of any dirt or debris. Wipe clean with a lint-free cloth.
   b. Insert the wheel sensor into the sensor housing and install the bolt. Tighten the bolt (B, **Figure 3**) to the torque specification listed in **Table 2**.









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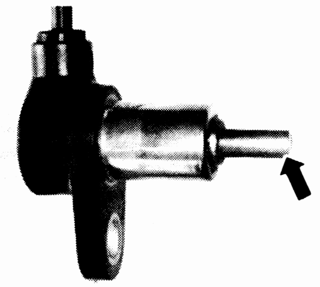

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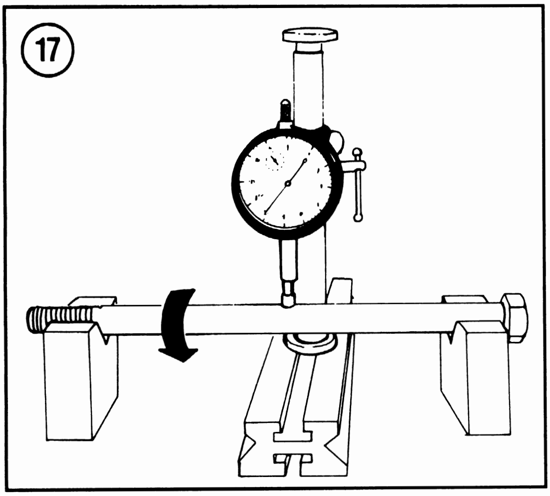

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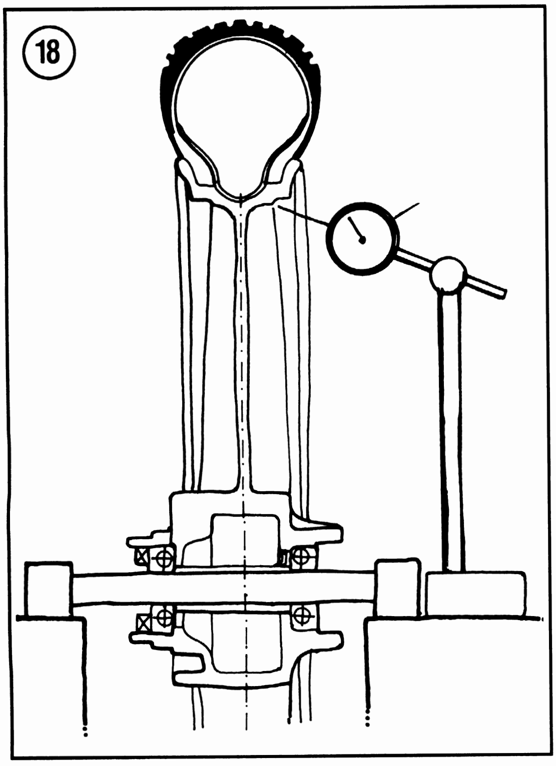

c. Move the lower holder into place on the fork slider and install the bolt (A, **Figure 3**). Tighten the bolt securely.
d. Move the upper holder into place on the fork slider and install the bolt (B, **Figure 2**). Tighten the bolt securely.
e. Install the plastic clamps (A, **Figure 2**) holding the wheel sensor cable to the hydraulic brake hose. Make sure the clamps are positioned correctly on the cable and hose and that they close shut completely.

15. After the wheel is completely installed, rotate it several times to make sure that it rotates freely. Apply the front brake as many times as necessary to make sure all brake pads are against both brake discs correctly.
16. With the front brake applied, push down hard on the handlebars and pump the forks several times to seat the front axle within the front forks.
17. Tighten the front axle pinch bolt(s) and nut to the torque specification listed in **Table 2**.

Inspection

1. Remove any corrosion on the front axle with a piece of fine emery cloth. Wipe the axle clean with a lint-free cloth.
2. Check axle runout. Place the axle on V-blocks and place the tip of a dial indicator in the middle of the axle (**Figure 17**). Rotate the axle and check runout. If the runout exceeds 0.2 mm (0.008 in.), replace the axle; do not attempt to straighten it.
3. Check rim runout as follows:
   a. Remove the tire from the rim as described in this chapter.
   b. Measure the radial (up and down) runout of the wheel rim with a dial indicator as shown in **Figure 18**. If runout exceeds 2.0 mm (0.08 in.), check the wheel bearings.
   c. Measure the axial (side to side) runout of the wheel rim with a dial indicator as shown in **Figure 18**. If runout exceeds 2.0 mm (0.08 in.), check the wheel bearings.
   d. If the wheel bearings are okay, the wheel cannot be serviced, but must be replaced.
   e. Replace the front wheel bearings as described under *Front Hub* in this chapter.
4. Inspect the wheel rim (**Figure 19**) for dents, bending or cracks. Check the rim and rim sealing surface for scratches that are deeper than 0.5 mm

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(0.01 in.). If any of these conditions are present, replace the wheel.

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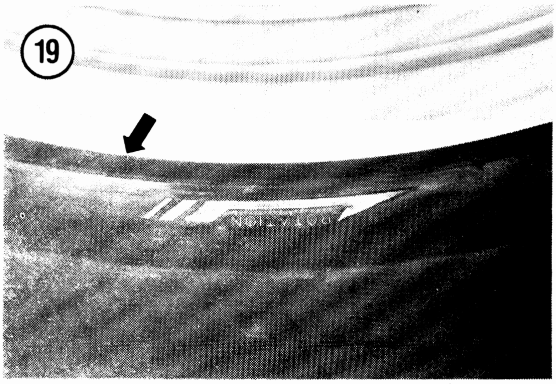

FRONT HUB

Disassembly/Inspection/Assembly

Refer to the following illustrations for this procedure:

a. 1984-1988 models: **Figure 20**.

b. 1989-on non-ABS models: **Figure 21**.

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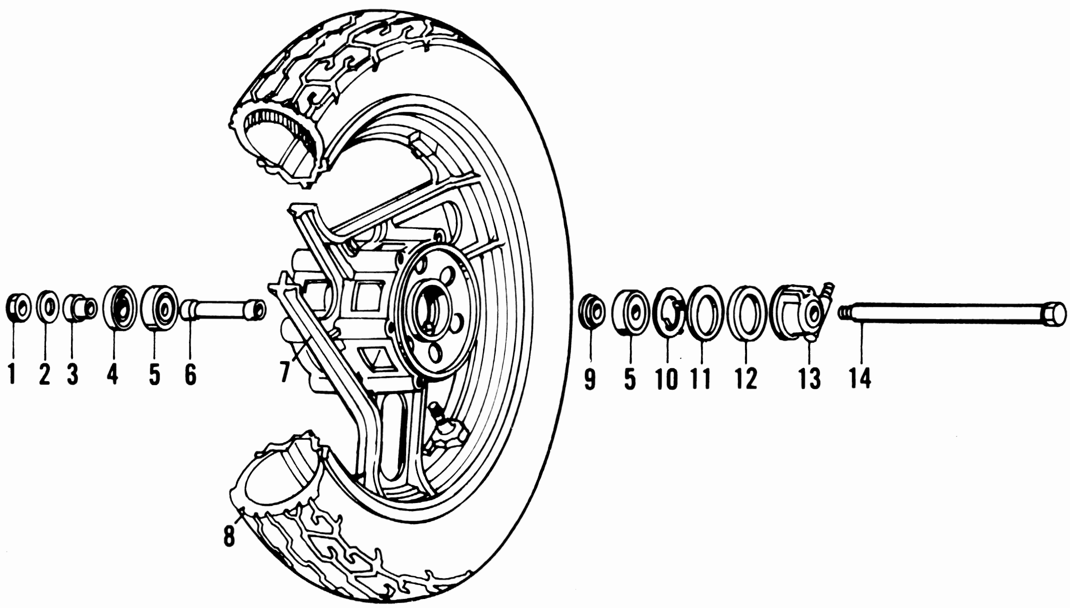
FRONT WHEEL (1984-1988)



1. Nut
2. Washer
3. Spacer
4. Oil seal
5. Bearing
6. Distance collar
7. Wheel
8. Tire
9. Spacer flange
10. Speedometer clutch
11. Speedometer clutch retainer
12. Oil seal
13. Speedometer housing
14. Front axle

c. ABS-equipped models: **Figure 22.**

1. Remove the front wheel as described in this chapter.

2. If not already removed, remove the speedometer housing (**Figure 7**) from the left-hand side and the spacer (**Figure 12**) from the right-hand side.

3. On ABS-equipped models, if not already removed, remove the sensor housing (**Figure 6**).

4. Inspect the speedometer housing (**Figure 23**) for wear or damage, replace if necessary.

5. Check both oil seals for damage and replace if necessary. Refer to **Figure 10** for the right-hand side and **Figure 11** for the left-hand side.

6. Check the wheel bearings by rotating the inner race. Refer to **Figure 24.** Check for bearing roughness, excessive noise or damage. If necessary, replace the bearings as follows. Always replace bearings in a set.

7. Use a long screwdriver and pry the oil seal (**Figure 25**) from each side of the hub. Place a shop cloth under the screwdriver to protect the hub surface.

8. Remove the speedometer clutch retainer and clutch from the left-hand side.

9. Using a long drift and hammer, tilt the distance collar away from one side of the right-hand bearing (**Figure 26**). Then drive the right-hand bearing out of the hub.

10A. On 1984-1987 models, remove the distance collar, then remove the left-hand bearing and spacer flange.

10B. On 1988-on models, remove the distance collar, then remove the left-hand bearing.

11. Clean the distance collar and hub thoroughly in solvent. Thoroughly dry with compressed air.

12. On ABS-equipped models, perform the following:

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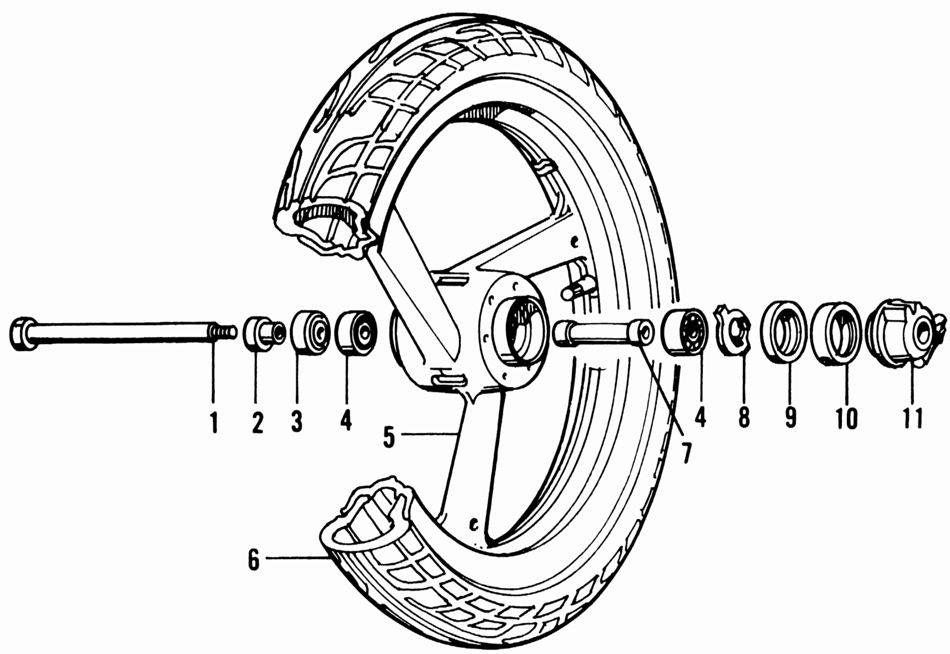
FRONT WHEEL (1989-ON NON-ABS)



1. Front axle
2. Spacer
3. Oil seal
4. Bearing
5. Wheel
6. Tire
7. Distance collar
8. Speedometer clutch
9. Speedometer clutch retainer
10. Oil seal
11. Speedometer housing

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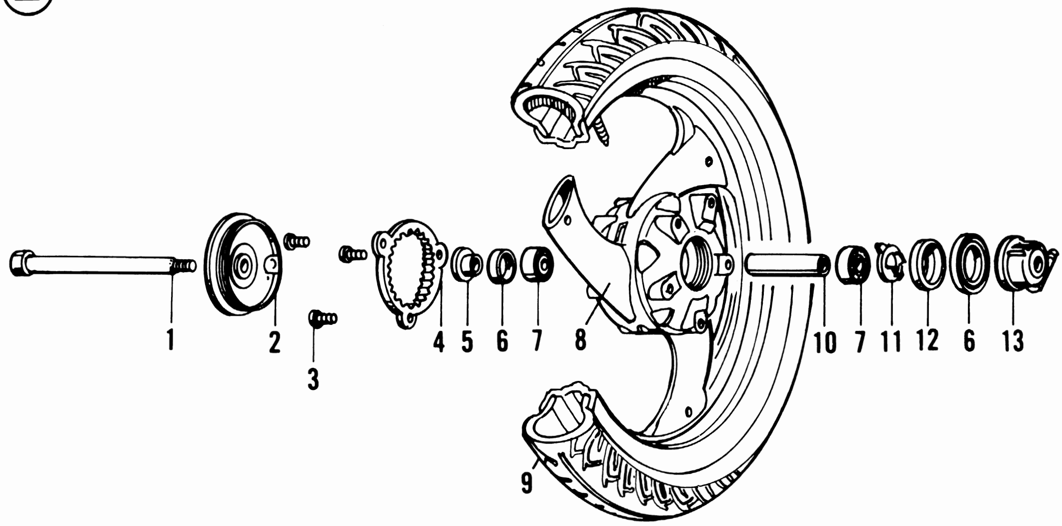
FRONT WHEEL (ABS MODELS)



1. Front axle
2. Sensor housing
3. Bolt
4. Sensor rotor
5. Spacer
6. Oil seal
7. Bearing
8. Wheel
9. Tire
10. Distance collar
11. Speedometer clutch
12. Speedometer clutch retainer
13. Speedometer housing

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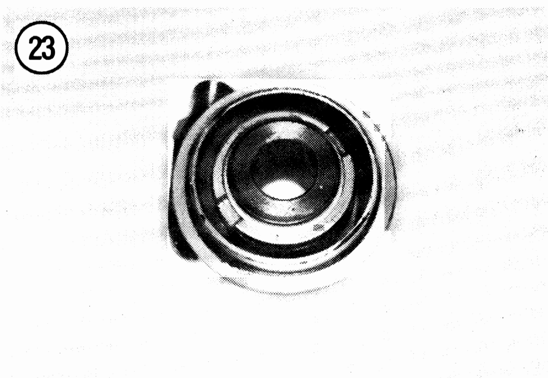

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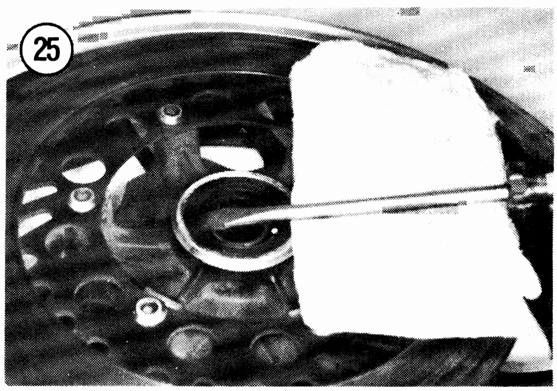

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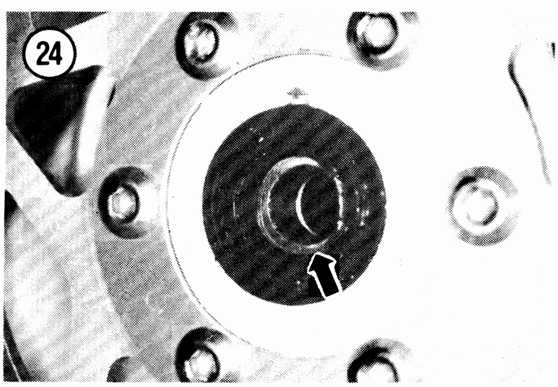

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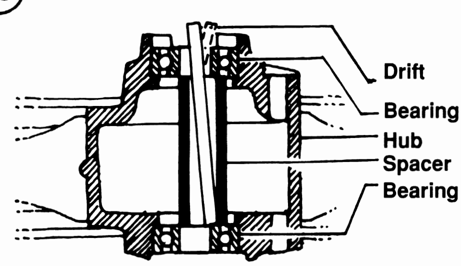

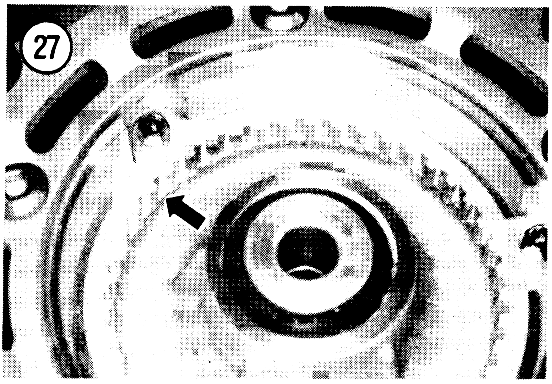

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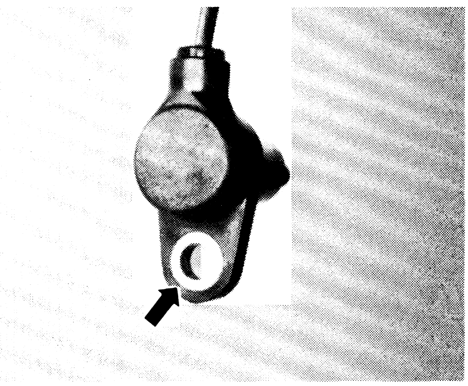

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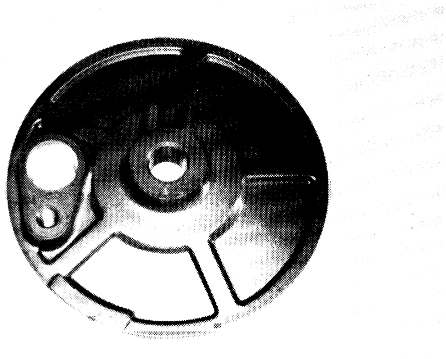


a. Inspect the ABS rotor (**Figure 27**) for wear or damage. Clean out any foreign matter that may have entered the area. If the teeth are damaged, refer to Chapter Eleven for service procedures.

b. Inspect the sensor tip (**Figure 16**) for cracks, bends or warpage.

c. Inspect the mounting flange (**Figure 28**) for elongation or damage. If the sensor is damaged in any way, replace the sensor and electrical cable as an assembly.

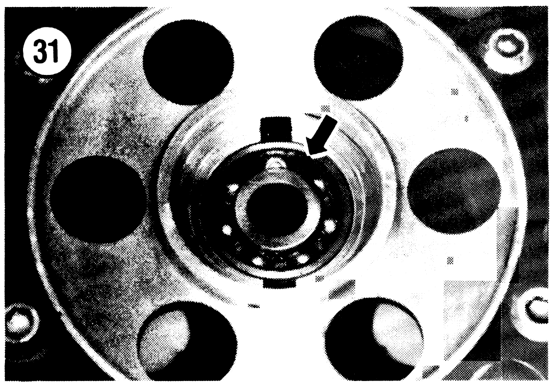
d. Inspect the sensor housing (**Figure 29**) for cracks or damage. Replace if necessary.

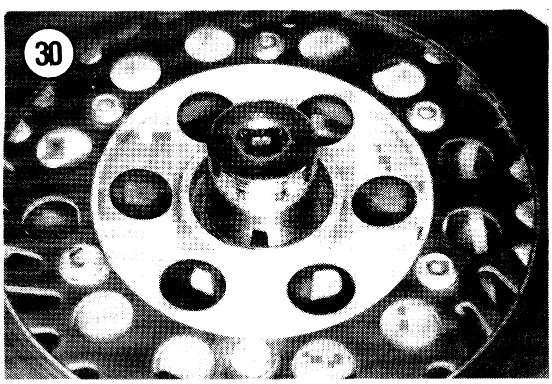
13. Tap the right-hand bearing into place carefully using a suitable size socket placed on the outer bearing race (**Figure 30**). Tap the bearing into place until it is correctly seated (**Figure 31**).

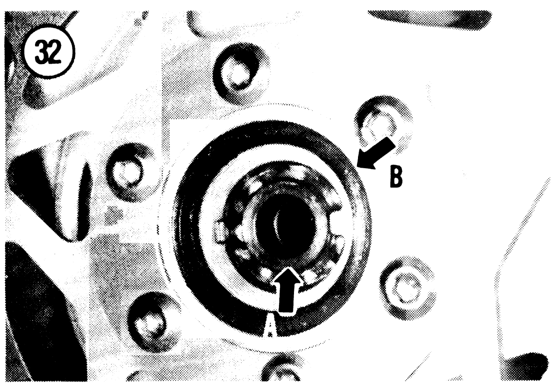
14A. On 1984-1987 models, install the distance collar, the left-hand bearing and the spacer flange.

14B. On 1988-on models, install the distance collar and the left-hand bearing (A, **Figure 32**).

15. Install the speedometer clutch and clutch retainer.







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16. Install a new left-hand grease seal (B, **Figure 32**). Drive the seal in squarely with a large diameter socket on the outer portion of the seal. Drive the seal until it is against the bearing or when the outer surface is flush with the hub.
17. Install a new right-hand grease seal (**Figure 10**). Drive the seal in squarely with a large diameter socket placed on the outer portion of the seal. Drive the seal in until it seats against the bearing or when the outer surface is flush with the hub.
18. On ABS-equipped models, install the sensor housing (**Figure 6**) into the hub. Push it in squarely until it is completely seated.
19. Install the speedometer housing (**Figure 7**) into the left-hand side and the spacer (**Figure 12**) into the right-hand side.

WHEEL BALANCE

An unbalanced wheel results in unsafe riding conditions. Depending on the degree of unbalance and the speed of the motorcycle, the rider may experience anything from a mild vibration to a violent shimmy and loss of control.

Weights can be attached to various areas of the rim (**Figure 33**). Adhesive weights are available from motorcycle dealers. These weights contain test weights and strips of adhesive-backed weights that can be cut to the desired length and attached directly to the rim.

NOTE
Be sure to balance the wheel with the brake disc(s) attached as it also affects the balance.

Before attempting to balance the wheels, check to be sure that the wheel bearings are in good condition and properly lubricated. The wheel must rotate freely.

1. Remove the wheel as described in this chapter or in Chapter Ten.
2. Mount the wheel on a fixture such as the one in **Figure 34** so it can rotate freely.
3. Give the wheel a spin and let it coast to a stop. Mark the tire at the lowest point.
4. Spin the wheel several more times. If the wheel keeps coming to rest at the same point, it is out of balance.
5. Tape a test weight to the upper (or light) side of the wheel.
6. Experiment with different weights until the wheel, when spun, comes to rest at a different position each time.
7. Remove the test weight and install the correct size weight (**Figure 33**).

TIRES

Tire Rating and Warnings

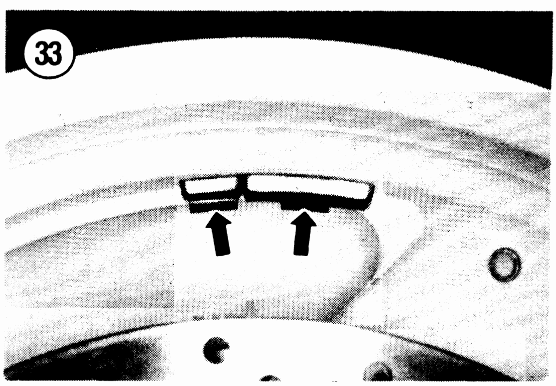
The Yamaha FJ1100 and FJ1200 are factory equipped with "V" range tires (rated for super high speed running). When replacing the factory-equipped tires be sure to purchase "V" range tires. Installing a "S" or "H" range tire may result in instant tire failure at high speed riding that could result in loss of control.

After installing new tires on the FJ, break them in correctly. Remember that a new tire has relatively poor adhesion to the road surface until it is broken in properly. Don't subject a new tire to any high speed riding for at least the first 60 miles (100 km).

Even after the tires are broken in properly, always warm them up prior to any high speed runs. This will lessen the possibility of loss of control of the bike. If you have purchased a tire brand other than those originally installed by the factory, maintain the correct tire inflation pressure recommended by *that tire manufacturer* and not those listed in **Table 3**. **Table 3** is for original equipment tires only.

Tubeless Tires

WARNING
Do not install an inner tube inside a tubeless tire. The tube will cause an abnormal heat buildup in the tire.



Tubeless tires have the word "TUBELESS" molded in the tire sidewall and the rims have "SUITABLE FOR TUBELESS TIRES" cast on them.

When a tubeless tire is flat, it best to take it to a motorcycle dealer for repair. Punctured tubeless tires should be removed from the rim to inspect the inside of the tire and to apply a combination plug/patch from the inside. Don't rely on a plug or cord repair applied from outside the tire. They might be okay on a car, but they're too dangerous on a motorcycle.

After repairing a tubeless tire, don't exceed 50 mph (80 kph) for the first 24 hours. Never race on a repaired tubeless tire. The patch could work loose from tire flexing and heat.

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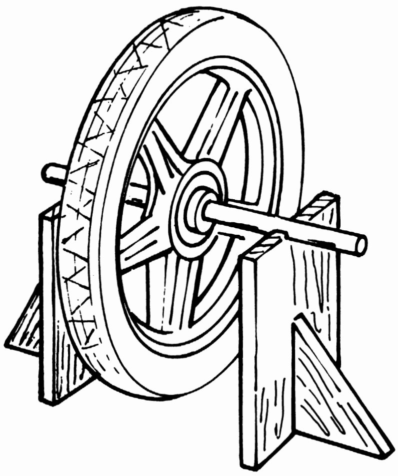

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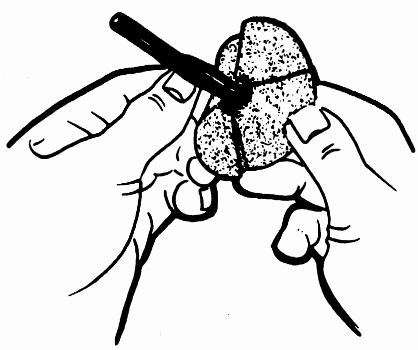


Repair

Do not rely on a plug or cord patch applied from outside the tire. Use a combination plug/patch applied from inside the tire (**Figure 35**).

1. Remove the tire from the rim as described in this chapter.
2. Inspect the rim inner flange. Smooth any scratches on the sealing surface with emery cloth. If a scratch is deeper than 0.5 mm (0.020 in.), the wheel should be replaced.
3. Inspect the tire inside and out. Replace a tire if any of the following is found:
   a. A puncture larger than 1/8 in. (3 mm) diameter.
   b. A punctured or damaged sidewall.
   c. More than 2 punctures in the tire.
4. Apply the plug/patch, following the instructions supplied with the patch kit.

TUBELESS TIRE CHANGING

The wheels can easily be damaged during tire removal. Special care must be taken with tire irons when changing a tire to avoid scratches and gouges to the outer rim surface. Insert scraps of leather between the tire iron and the rim to protect the rim from damage. The stock cast wheels are designed for use with tubeless tires.

Tire repair is different and is covered under *Tubeless Tires* in this chapter.

When removing a tubeless tire, take care not to damage the tire beads, inner liner of the tire or the wheel rim flange. Use tire levers or flat handled tire irons with rounded ends.

Removal

NOTE
*While removing a tire, support the wheel on 2 blocks of wood (**Figure 36**), so the brake disc doesn't contact the floor.*

1. Mark the valve stem location on the tire (**Figure 37**), so the tire can be installed in the same position for easier balancing.
2. Remove the valve core to deflate the tire.

NOTE
Removal of tubeless tires from their rims can be very difficult because of the

*exceptionally tight bead/rim seal. Breaking the bead seal may require the use of a special tool (**Figure 38**). If you have trouble breaking the seal, take the tire to a motorcycle dealer to avoid damaging the wheel.*

CAUTION

The inner rim and tire bead area are sealing surfaces on a tubeless tire. Do not scratch the inside of the rim or damage the tire bead.

3. Press the entire bead on both sides of the tire into the center of the rim.
4. Lubricate the beads with soapy water.

NOTE

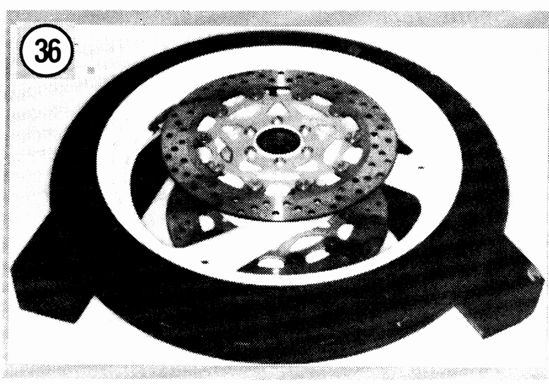
*Use rim protectors (**Figure 39**) or insert scraps of leather between the tire irons and the rim to protect the rim from damage.*

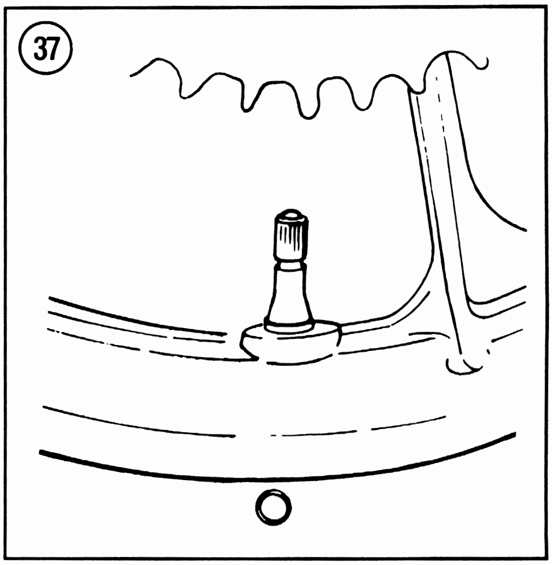
5. Insert the tire iron under the bead next to the valve (**Figure 40**). Force the bead on the opposite side of the tire into the center of the rim and pry the bead over the rim with the tire iron.
6. Insert a second tire iron next to the first to hold the bead over the rim. Then work around the tire with the first tool prying the bead over the rim (**Figure 41**).

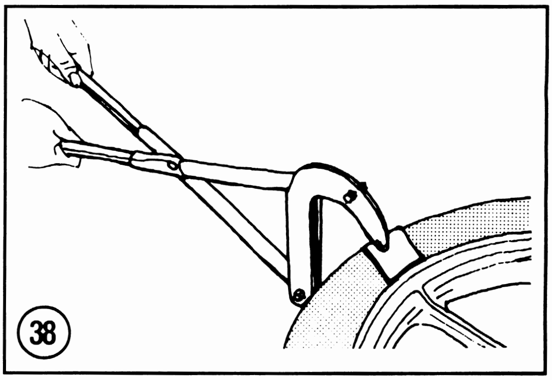
NOTE

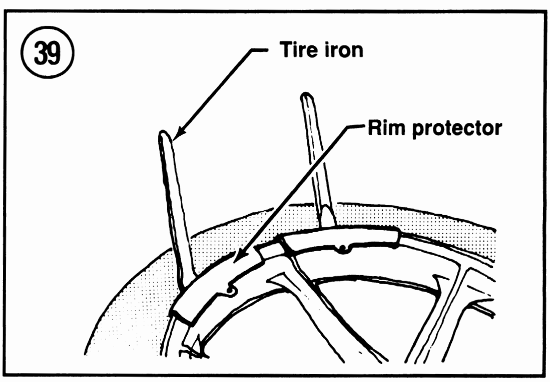
Step 7 is required only if it is necessary to completely remove the tire from the rim.

7. Turn the wheel over. Insert a tire tool between the second bead and the same side of the rim that the first bead was pried over (**Figure 42**). Force the bead on the opposite side from the tool into the center of the rim. Pry the second bead off the rim, working around the wheel with 2 tire irons as with the first.
8. Inspect the valve stem seal. Because rubber deteriorates with age, it is advisable to replace the valve stem (**Figure 43**) when replacing a tire.









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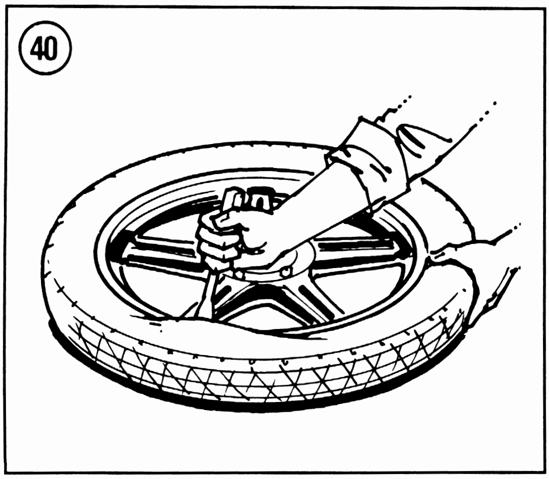

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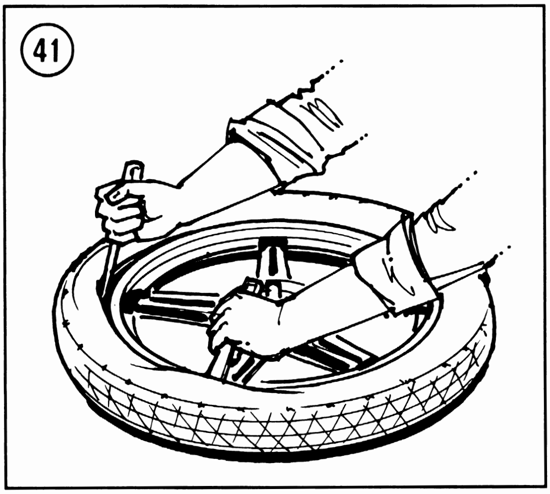

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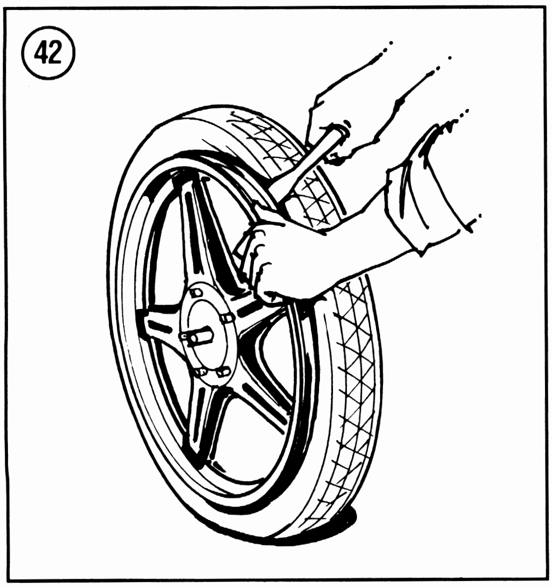

Installation

1. Carefully inspect the tire for any damage, especially inside.

2. A new tire may have balancing rubbers inside. These are not patches and should not be disturbed. A colored spot near the bead indicates a lighter point on the tire. This spot should be placed next to the valve stem. In addition, most tires have a ROTATION arrow (A, **Figure 44**) molded on the side of the tire that indicates in which direction the tire should rotate. Make sure to install the tire accordingly.

3. Lubricate both beads of the tire with soapy water.

4. Place the backside of the tire into the center of the rim. The lower bead should go into the center of the rim and the upper bead outside. Work around the tire in both directions (**Figure 45**). Use a tire iron for the last few inches of bead (**Figure 46**).

5. Press the upper bead into the rim opposite the valve (**Figure 47**). Pry the bead into the rim on both sides of the initial point with a tire tool, working around the rim to the valve.

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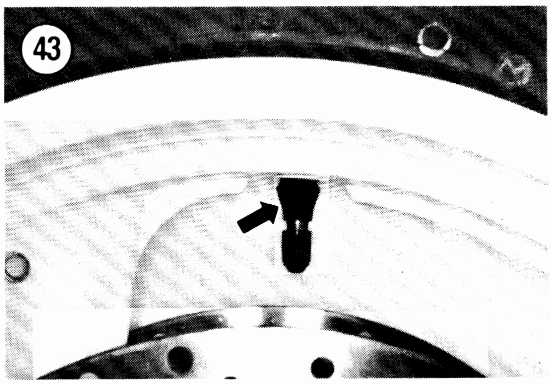

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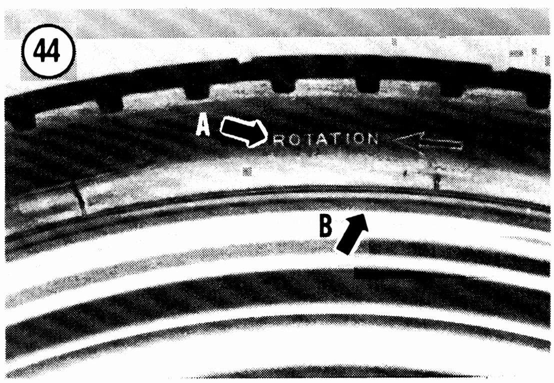

6. Check the bead on both sides of the tire for an even fit around the rim.
7. Place an inflatable band around the circumference of the tire. Slowly inflate the band until the tire beads are pressed against the rim. Inflate the tire enough to seat it, deflate the band and remove it.

WARNING
Never exceed 56 psi (4.0 k/cm²) inflation pressure as the tire could burst causing severe injury. Never stand directly over the tire while inflating it.

8. After inflating the tire, check to see that the beads are fully seated and that the tire rim lines (B, **Figure 44**) are the same distance from the rim all the way around the tire. If the beads won't seat, deflate the tire, re-lubricate the rim and beads with soapy water and re-inflate the tire.
9. Inflate the tire to the required pressure. Refer to tire inflation pressure specifications listed in **Table 3**. Screw on the valve stem cap.
10. Balance the wheel assembly as described in this chapter.

HANDLEBARS

Removal/Installation

CAUTION
Cover the upper portion of the fairing and fuel tank with a heavy cloth or plastic tarp to protect it from accidental spilling of brake and clutch fluid. Wash spilled fluid off any painted or plated surface immediately, as it will destroy the finish. Use soapy water and rinse thoroughly.

NOTE
If handlebar replacement is not required, proceed to Step 10.

1. Loosen the handlebar pinch bolt (**Figure 48**) on each side.
2. On models equipped with handlebar mounted rear view mirrors, loosen the locknut and unscrew the mirror from the master cylinder (**Figure 49**).
3. Unscrew the right-hand end cap (A, **Figure 50**).
4. Remove the bolts securing the front brake master cylinder (B, **Figure 50**) and move it away from the handlebar. Secure the master cylinder in the upright position with a Bungee cord.

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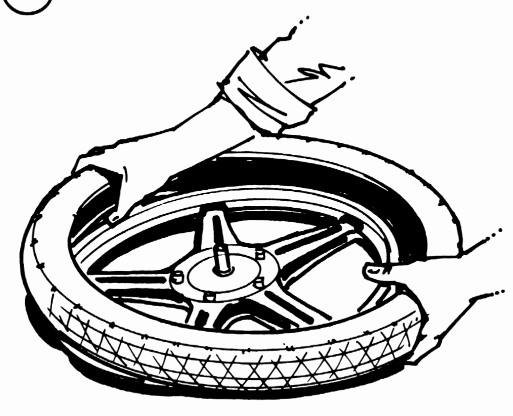

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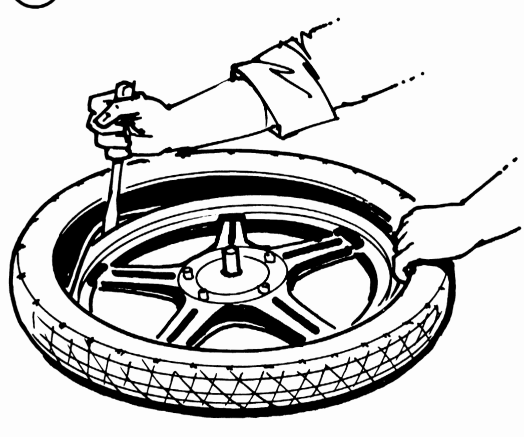

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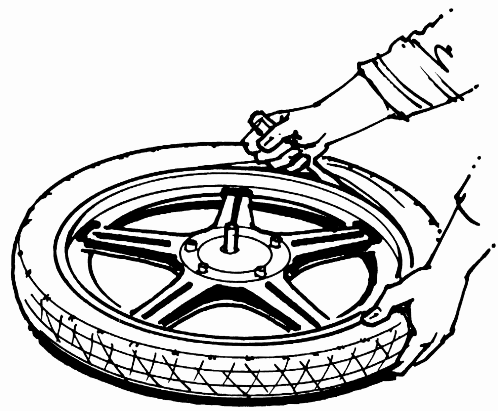

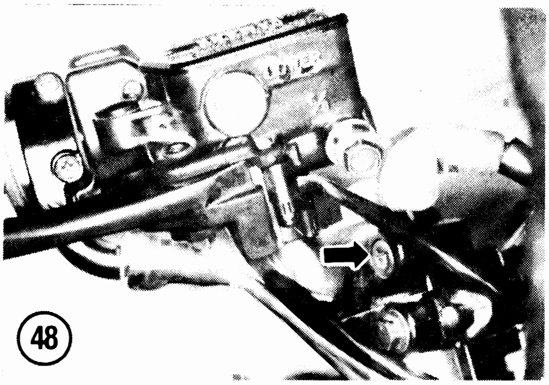

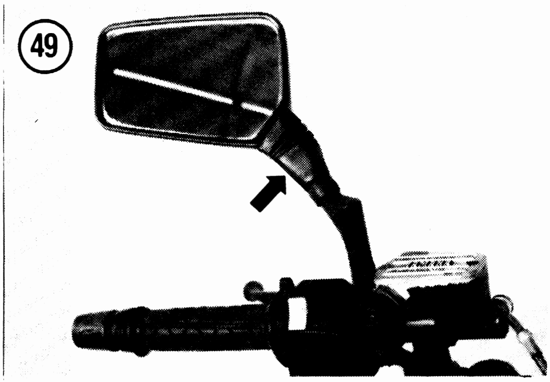

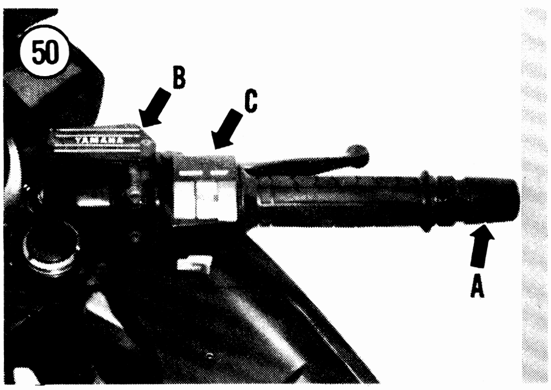

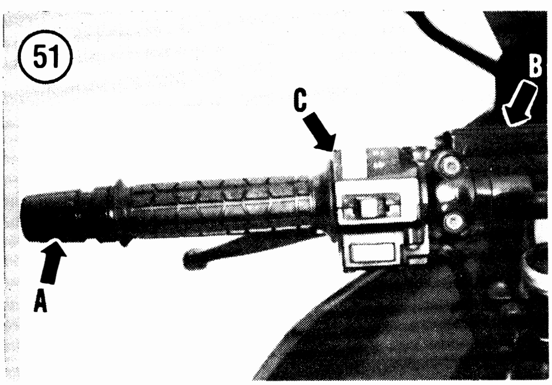

5. Remove the screws and separate the right-hand switch assembly (C, **Figure 50**). Disconnect the front brake light switch. Disconnect the throttle cables from the twist grip. Remove the switch assembly from the handlebar.

6. Unscrew the left-hand end cap (A, **Figure 51**).

7. Remove the bolts securing the clutch master cylinder (B, **Figure 51**) and move it away from the handlebar. Secure the master cylinder in the upright position with a Bungee cord.

8. Remove the screws and separate the left-hand switch assembly (C, **Figure 51**). Remove the switch assembly from the handlebar.

9. Refer to Step 14 and remove the left-hand hand grip.

10. Disconnect the clutch switch electrical connector.

11. Remove the handlebar pinch bolt (**Figure 48**) loosened in Step 1.

12. Remove the trim cap (**Figure 52**) and remove the handlebar boss mounting bolt. Slide the handlebar assembly straight up and off the fork tube.

13. Repeat Step 11 and Step 12 for the other handlebar.

14. If necessary, replace the hand grips as follows:

   a. Insert a thin-bladed screwdriver under the hand grip.

   b. Squirt electrical contact cleaner under the hand grip and twist it quickly to break its seal and remove it.

   c. Squirt electrical contact cleaner into the new hand grip, then quickly install it by turning it onto the handlebar or twist grip.

   d. Check the hand grip(s) after 10 minutes to make sure they are tight.

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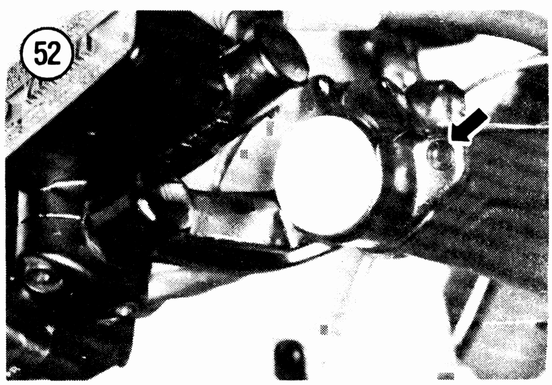

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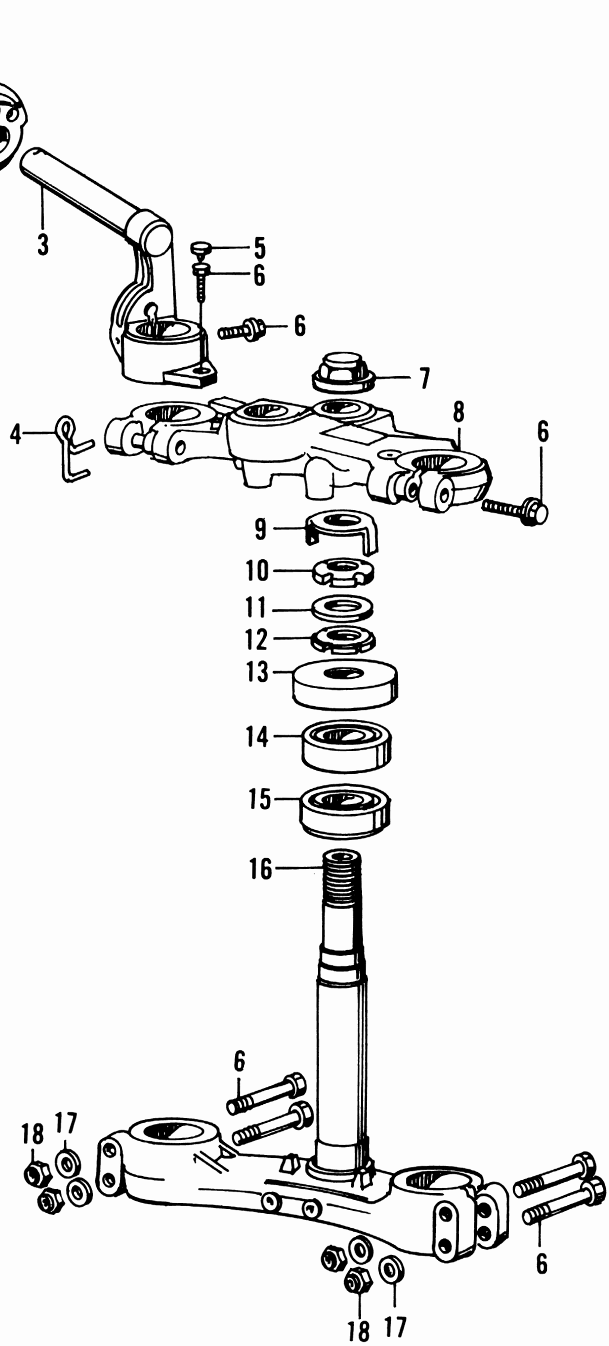
STEERING STEM AND HANDLEBAR



1. End cap
2. Grip
3. Handlebar
4. Clip
5. Cap
6. Allen bolt
7. Steering stem nut
8. Upper fork bridge
9. Lockwasher
10. Upper ring nut
11. Washer
12. Lower ring nut
13. Bearing cap
14. Upper bearing
15. Lower bearing
16. Steering stem
17. Washer
18. Bolt

WARNING
Do not ride with loose hand grips. Loss of control is sure to result.

15. Install by reversing these steps while noting the following:

a. Replace the handlebar assemblies if bent or if even slightly damaged.
b. Install the handlebar assembly onto the fork tube and align the hole in the handlebar boss with the threaded hole in the upper fork bridge and install the handlebar mounting bolt. Tighten the bolt to the torque specification listed in **Table 2**.
c. Repeat for the other handlebar assembly.
d. Tighten the handlebar boss pinch bolts and end caps to the torque specifications in **Table 2.**
e. When installing the throttle assembly, do not push the end of the hand grip against the end of the handlebar as this will cause grip drag when rotated. Leave a slight clearance between both parts.

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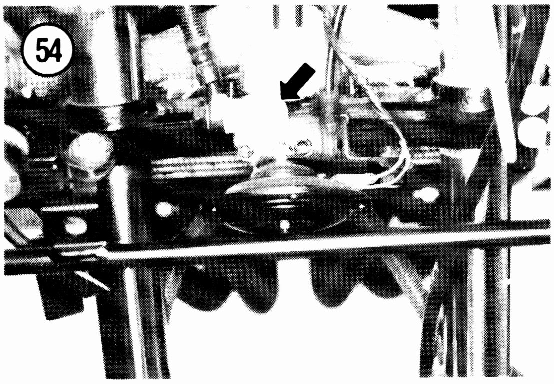

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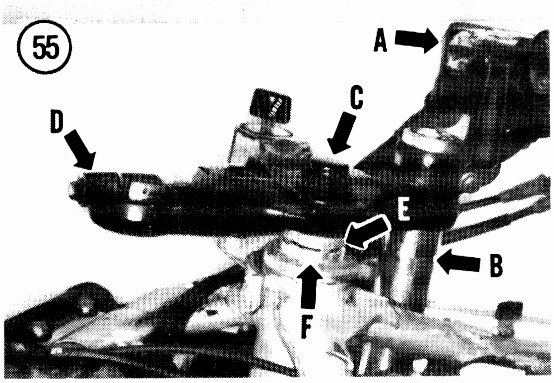

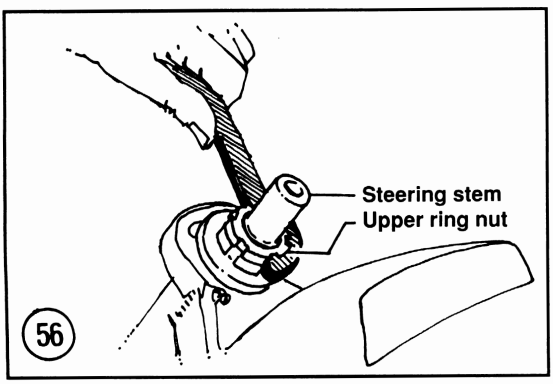

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Inspection

Check the handlebars at their bolt holes and along the entire mounting area for cracks or damage. Replace a bent or damaged handlebar immediately. If the bike is involved in a crash, examine the handlebars, steering stem and front forks carefully.

STEERING HEAD

Removal/Disassembly

Refer to **Figure 53** for this procedure.

1. Place the bike securely on the centerstand with the front wheel off the ground.
2. Remove the front fairing and mounting bracket as described in Chapter Twelve.
3. Remove the front wheel as described in this chapter.
4. Remove the fuel tank as described in Chapter Seven.
5. Remove the bolts securing the front brake joint (**Figure 54**) and move the joint and hose assembly out of the way. It is not necessary to disconnect any of the brake hoses from the joint.
6. Remove the handlebars (A, **Figure 55**) and front forks (B, **Figure 55**) as described in this chapter.
7. Remove the steering stem nut (C, **Figure 55**) and lift the upper fork bridge (D, **Figure 55**) off of the steering stem shaft.
8. Remove the lockwasher from the top of the steering stem.
9. Loosen the upper ring nut (**Figure 56**) and remove it (E, **Figure 55**) and the washer.
10. Hold onto the lower end of the steering stem assembly.

9

11. Loosen then remove the lower ring nut (F, **Figure 55**).
12. Remove the bearing cap then remove the upper bearing (**Figure 57**) from the frame tube.
13. Lower the steering stem assembly down and out of the steering head.
14. Remove the lower bearing from the steering stem. The lower bearing race will stay on the steering stem.

Assembly/Installation

1. Apply a coat of wheel bearing grease to both bearings.
2. Install the lower bearing into the steering stem.
3. Apply a coat of wheel bearing grease to both bearing races in the steering head.
4. Carefully slide the steering stem up through the frame steering head.
5. Install the upper bearing (**Figure 57**) and the bearing cap.

NOTE
*Yamaha dealers have a special ring nut wrench (U.S. part No. YU-33975 or U.K. part No. 90890-01381) (**Figure 58**) that should be used with a torque wrench for accurate steering stem installation and adjustment.*

6. Install the lower ring nut with the tapered side of the nut facing down. Use the special tool and torque wrench and tighten in the following order:
   a. Tighten the lower ring nut to 50 N•m (36 ft.-lb.) to seat the bearings within the steering head.
   b. Loosen the lower ring nut completely.
   c. Re-tighten the lower ring nut (F, **Figure 55**) to 3 N•m (26.4 in.-lb.).
7. Install the washer and the upper ring nut with the tapered side of the nut facing down. Tighten the upper ring nut (E, **Figure 55**) finger-tight. Then check that the upper ring nut grooves line up with the lower ring nut grooves. If not, tighten the upper ring nut until alignment is achieved.
8. Install the lockwasher making sure the long finger is located correctly in both the upper and lower ring nut grooves.
9. Install the upper fork bridge (D, **Figure 55**) and the steering stem nut (C, **Figure 55**).
10. Temporarily insert both fork tubes through the upper fork bridge and tighten the lower bridge pinch bolts to hold the fork tube in position. Then tighten the steering stem nut to the torque specification listed in **Table 2**.
11. Turn the steering stem again by hand to make sure it turns freely and does not bind. If the steering stem is too tight, the bearings can be damaged; if the steering stem is too loose, the steering will become unstable. Repeat Steps 6-10 if necessary.
12. Install the front forks (B, **Figure 55**) and the handlebars (A, **Figure 55**) as described in this chapter.
13. Install the front brake joint (**Figure 54**) and bolts. Tighten the bolts to the torque specification listed in **Table 2**.
14. Install the fuel tank as described in Chapter Seven.
15. Install the front wheel as described in this chapter.
16. Install the mounting bracket and the front fairing as described in Chapter Twelve.

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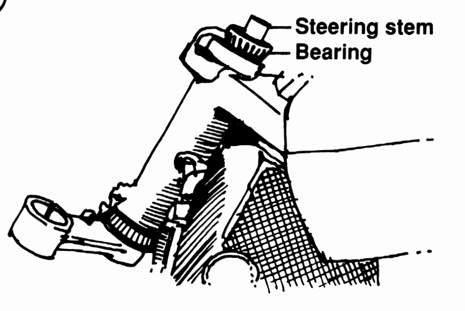

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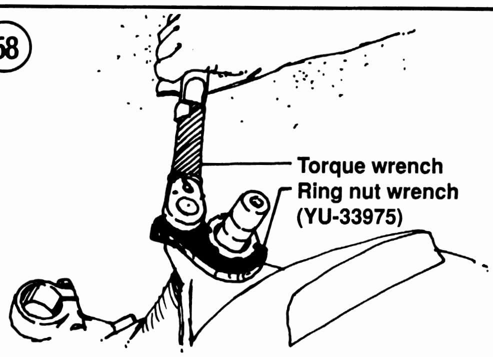

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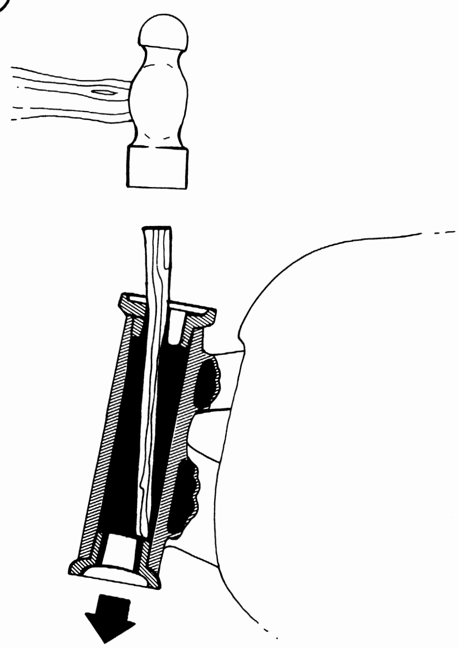

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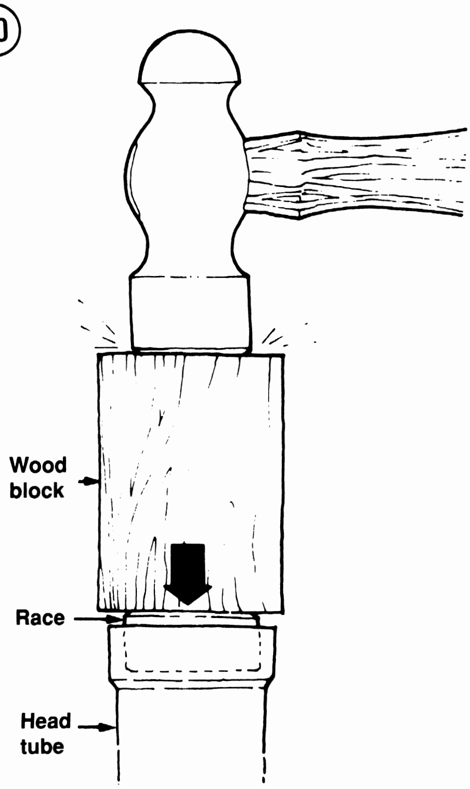


Inspection

1. Clean the bearing races in the steering head and both bearings with solvent.

2. Check for broken welds on the frame around the steering stem. If any are found, have them repaired by a competent frame shop or welding service familiar with motorcycle frame repair.

3. Check the bearings 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 them as described under *Bearing Race Replacement* 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 into place. Because they are easily bent, do not remove them unless they are worn and require replacement.

To remove a headset race, insert a hardwood stick or brass drift into the head tube and carefully tap the race out from the inside (**Figure 59**). 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 60**).

FRONT FORKS

Front Fork Service

Before suspecting major trouble, drain the front fork oil and refill with the proper type and quantity; refer to *Front Fork Oil Change* in Chapter Three. 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. Remove the upper fairing as described in Chapter Twelve.

NOTE
Insert a piece of wood in the calipers in place of the disc. That way, if the brake lever is inadvertently squeezed, the pistons will not be forced out of the calipers. If it does happen, the calipers might have to be disassembled to reseat the pistons. By using the wood, bleeding the brake is not necessary when installing the wheel.

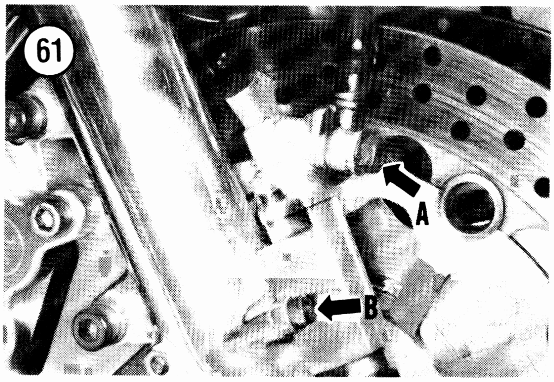
2. On 1984-1987 models, perform the following:
   a. Remove the union bolt and sealing washers (A, **Figure 61**) and disconnect the brake hose from the anti-dive plunger case. Place the loose end of the brake hose in a container to catch any brake fluid that may drain out.
   b. If the fork is going to be disassembled, loosen but do not remove the bolts (B, **Figure 61**) securing the anti-dive plunger case to the case on the slider.
3. Remove both brake calipers (A, **Figure 62**) as described in Chapter Eleven.
4. Remove the front wheel (B, **Figure 62**) as described in this chapter.
5. Remove the front reflector (C, **Figure 62**) from the fork slider.
6. On models so equipped, remove the bolt securing the front caliper brake hose to the fork slider and move the brake hose out of the way.
7. Remove the front fender (D, **Figure 62**) as described in Chapter Twelve.
8. Remove the handlebars as described in this chapter.

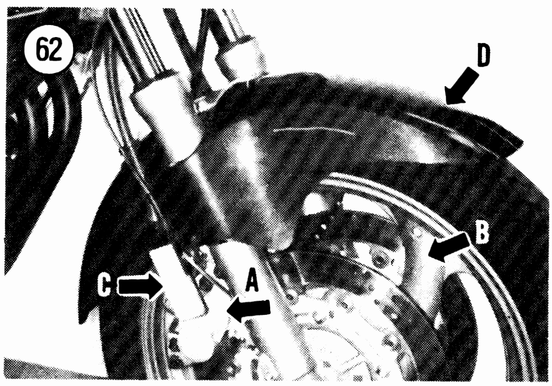
NOTE
If the front forks are not going to be disassembled, proceed to Step 11.

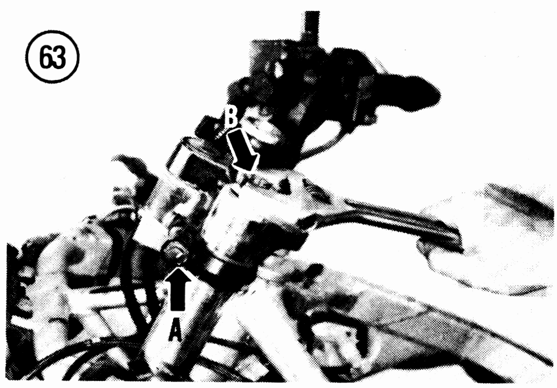
9. On 1984-1990 models, loosen the cap bolt as follows:

NOTE
A Yamaha special tool (U.S. part No. YM-01388 or U.K. part No. 90890-01388) is required to loosen the cap bolt. In place of this special tool, a 27 mm nut can be used in place of this special tool and will perform the same function when used along with an adjustable wrench. The rear axle nut on these models is 27 mm and can be used as shown in this procedure.

   a. Loosen the upper fork bridge bolt (A, **Figure 63**).
   b. Remove the rear axle nut as described in Chapter Ten.
   c. Remove the trim cap from the top of the fork tube.







d. Adjust the fork preload adjust rod completely counterclockwise to raise the rod. This will hold the 27 mm nut, installed in the next step, up sufficiently to get a good grip on the nut with the wrench.

e. Install a 27 mm wrench or an adjustable wrench on the 27 mm nut (B, **Figure 63**) and loosen the cap bolt—do not remove it at this time.

f. Remove the wrench and nut from the fork cap bolt.

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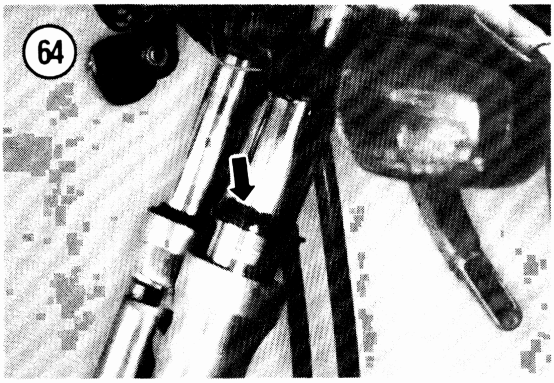

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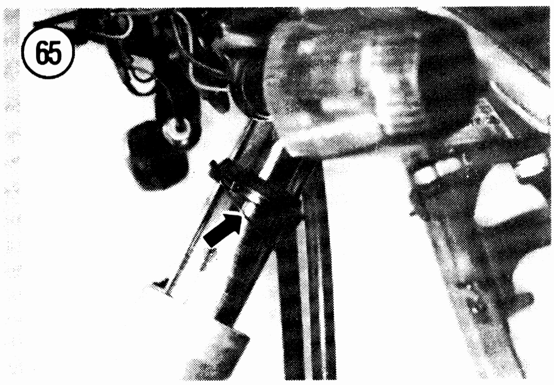

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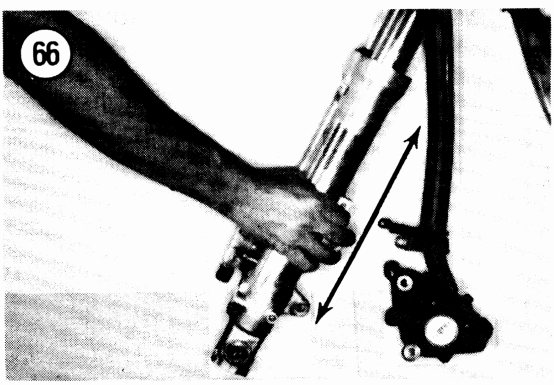


10. If the forks are going to be disassembled, perform the following steps:

NOTE
The Allen bolt at the base of the slider has been secured with a locking agent and is often very difficult to remove because the damper rod will turn inside the slider. It sometimes can be removed with an air impact driver. If you are unable to loosen or remove it, remove the fork tube and take the fork tubes to a dealer and have the bolts removed.

a. Place a drain pan under the fork slider.

b. Remove the Allen bolt and washer at the base of the slider and drain the fork oil. After the fork oil has completely drained, reinstall the Allen bolt and washer to avoid misplacing them.

c. Slide the dust seal (**Figure 64**) up on the fork tube, then remove the retaining clip (**Figure 65**) above the fork oil seal in the slider.

NOTE
On this type of fork, force is needed to remove the fork tube from the slider.

d. There is an interference fit between the guide bushing in the fork slider and the guide bushing on the fork tube. In order to remove the fork tube from the slider, pull hard on the fork slider using quick up-and-down strokes (**Figure 66**). Doing so will withdraw the guide bushing, washer and oil seal from the slider.

e. Remove the fork slider from the fork tube.

f. Remove the oil lock piece from the end of the damper rod.

g. On 1984-1990 models, also remove the valve spring, washer and other valve spring from the damper rod. In some cases, the oil lock piece (and valve springs and washer on 1984-1990 models) will fall off into the slider, if so, remove it.

h. On 1991-on models, loosen the fork cap.

11. Measure the height of the fork tube from the top surface of the upper fork bridge (**Figure 67**). Record this measurement so that the fork tube can be reinstalled in the same position.

12. Loosen the upper and lower fork bridge pinch bolts.

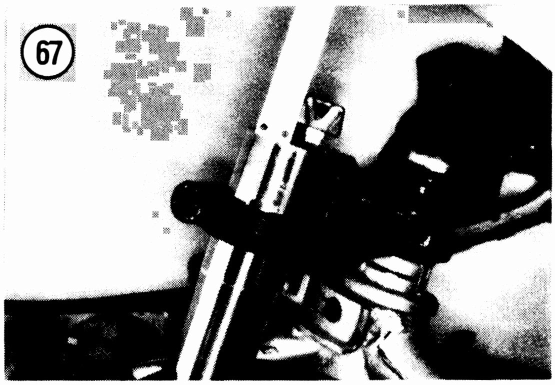
13. Slide the fork tube from the upper and lower fork bridges. It may be necessary to slightly rotate the fork tube while pulling it down and out.
14. Repeat for the opposite side.
15. Install by reversing these removal steps while noting the following:
   a. Slide the fork tube into the lower and upper fork bridges. Move the fork tube up so that the distance from the upper fork bridge to the top of the fork tube is the same as that recorded in Step 11 (**Figure 67**).
   b. On 1984-1990 models, position the fork assembly with the narrow notch toward the front (A, **Figure 68**).
   c. Tighten the upper and lower fork bridge pinch bolts sufficiently to hold the fork assembly in place.
   d. Temporarily install the handlebar assembly and install the mounting bolt securely.
   e. The top of the fork tube (A, **Figure 69**) must be flush with the top of the handlebar boss (B, **Figure 69**).
   f. If necessary, loosen the upper and lower fork bridge pinch bolts and readjust the fork assembly until alignment is correct.
   g. Tighten the upper and lower fork bridge pinch bolts to the specifications in **Table 2**.
   h. On 1984-1987 models, install the brake hose to the top of the anti-dive plunger case. Install the union bolt (A, **Figure 61**) with new sealing washers on each side of the fitting. Tighten the union bolt to the torque specification listed in **Table 2**. If the anti-dive plunger case mounting bolts were removed, tighten them to the torque specification listed in **Table 2**. Bleed the brakes as described under *Bleeding the System* in Chapter Eleven.
   i. After installing the front wheel, apply the front brake lever several times. If the brake lever feels spongy, bleed the brakes as described under *Bleeding the System* in Chapter Eleven.

Disassembly (1984-1990)

Refer to **Figure 70** for this procedure.

NOTE
The 1984-1987 models are the only ones equipped with the anti-dive plunger assembly.

67



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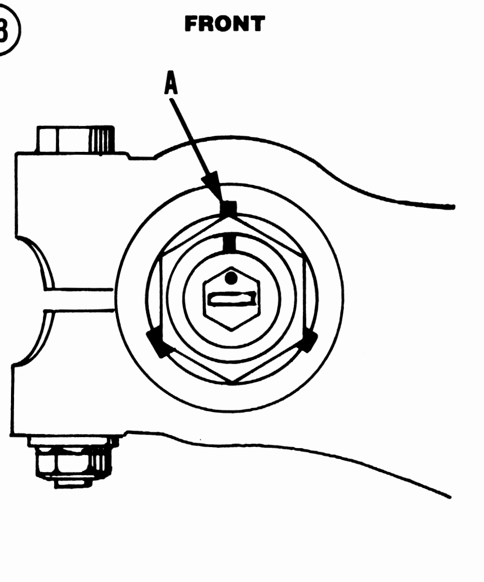

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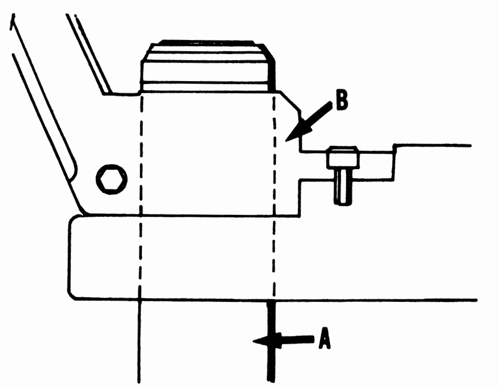
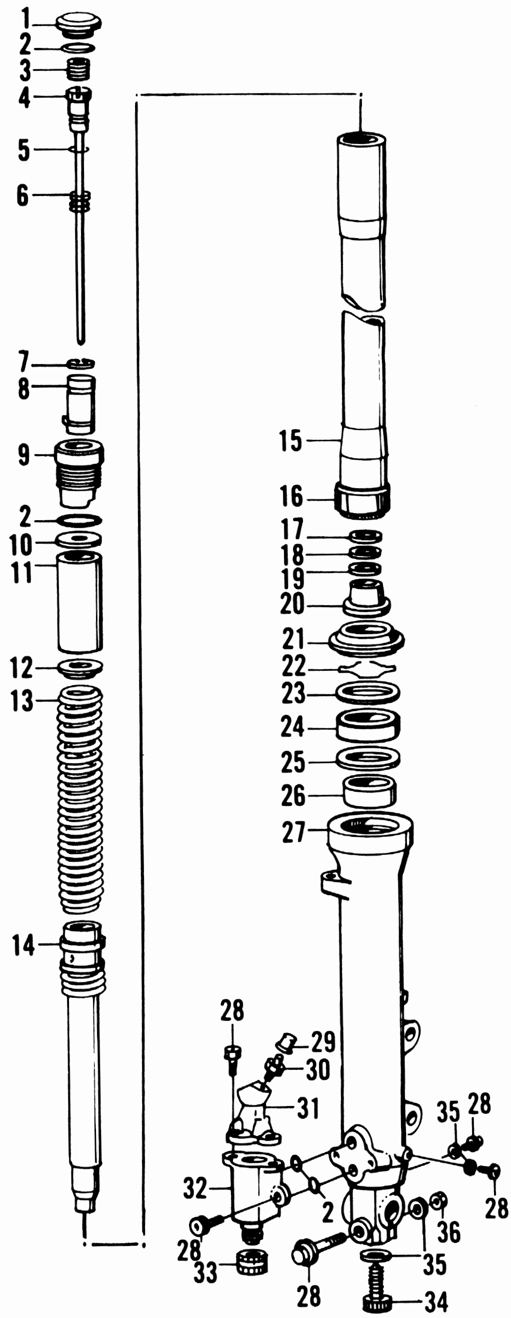


70

FRONT FORK (1984-1990)

1. Trim cap
2. O-ring
3. Special nut
4. Damper adjust rod
5. O-ring
6. Spring
7. Circlip
8. Spring pre-load adjuster
9. Cap bolt
10. Washer
11. Spacer*
12. Spring seat
13. Fork spring
14. Damper rod and rebound spring
15. Fork tube
16. Fork tube bushing
17. Valve spring *
18. Washer *
19. Valve spring *
20. Oil lockpiece
21. Dust seal
22. Clip
23. Upper gasket
24. Oil seal
25. Washer
26. Slider bushing
27. Fork slider
28. Bolt
29. Cap
30. Bleed valve
31. Anti-dive plunger cap **
32. Anti-dive plunger case **
33. Adjust knob **
34. Allen bolt
35. Washer
36. Nut

* (1984-1985 only)
** (1984-1987 only)

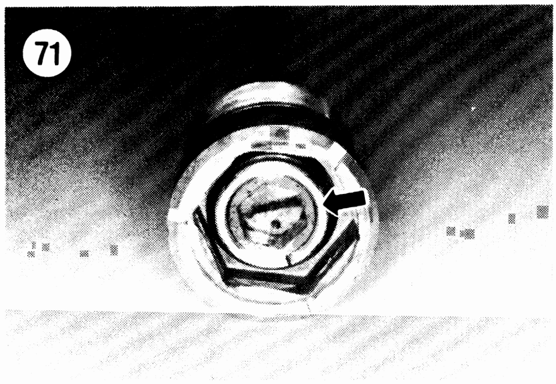


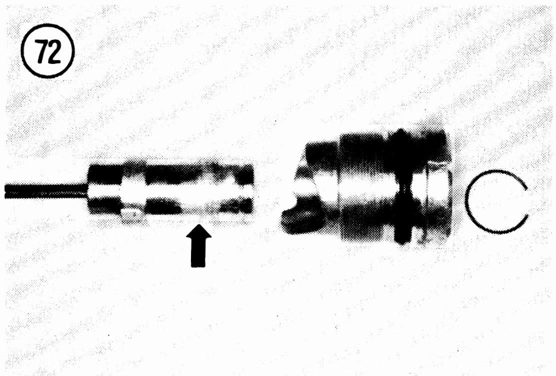
1. Secure the fork tube in a vise with soft jaws.
2. If still installed, remove the trim cap from the fork cap bolt assembly then unscrew and remove the fork cap bolt from the fork tube.

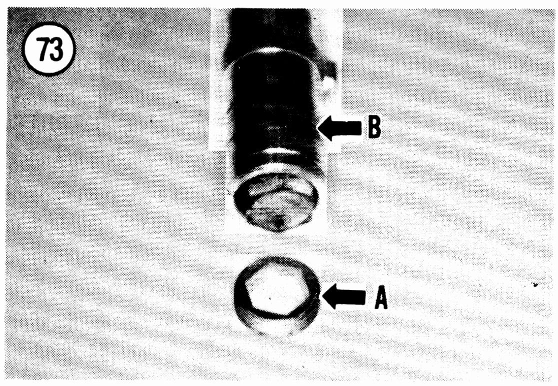
WARNING
Be careful when removing the fork cap bolt as the spring is under pressure. Protect your eyes accordingly.

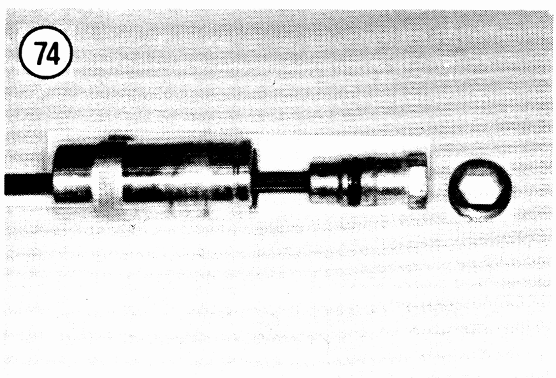
CAUTION
There is a long adjusting rod attached to the fork cap bolt. Be careful not to damage the rod when withdrawing it from the fork tube.

3A. On 1984-1985 models, remove the washer, spacer, spring seat and fork spring.
3B. On 1986-1990 models, remove the spring seat and fork spring.
4. Turn the fork tube upside down and remove the damper rod and rebound spring.
5. Slide the washer, oil seal, upper gasket and dust seal from the fork tube.
6. If necessary, disassemble the cap bolt assembly, perform the following:
   a. Remove the circlip within the cap bolt (**Figure 71**) and withdraw the spring-loaded adjuster assembly (**Figure 72**) from the cap bolt.
   b. Use a 12 mm Allen wrench and remove the special nut (A, **Figure 73**) from the spring-loaded adjuster assembly (B, **Figure 73**).
   c. Remove the damper adjust rod from the spring-loaded adjuster assembly (**Figure 74**).
7. Inspect all parts as described in this chapter.



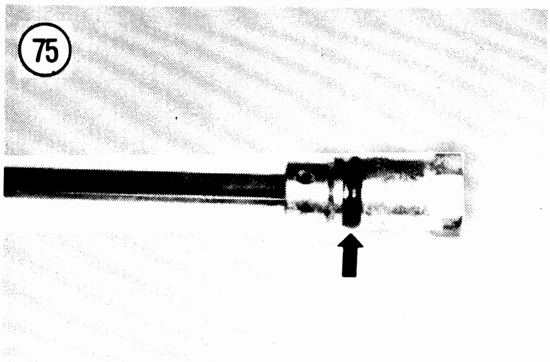


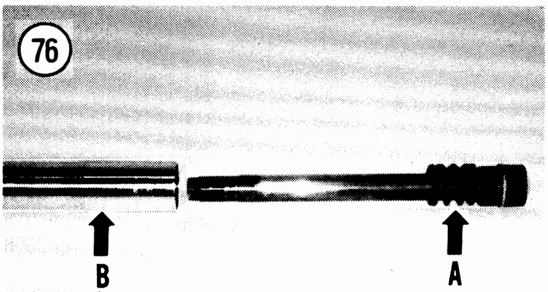


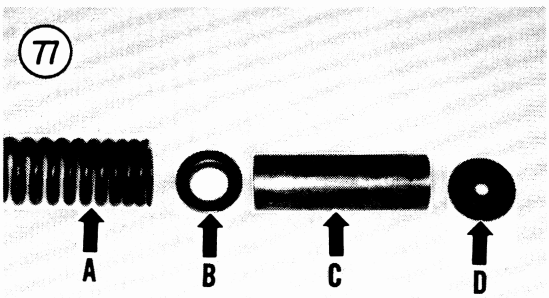


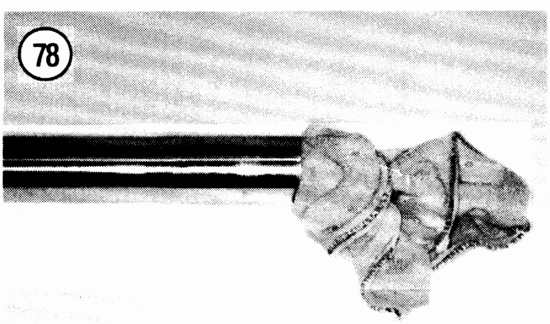
Assembly (1984-1990)

Refer to **Figure 70** for this procedure.
1. Coat all parts with fresh SAE 10W fork oil or SAE 10W30 Type SE motor oil prior to installation.
2. To assemble the cap bolt assembly, perform the following:
   a. Install a new O-ring seal (**Figure 75**) on the damper adjust rod.
   b. Install the damper adjust rod into the spring-loaded adjuster assembly (**Figure 74**).
   c. Apply blue Loctite (No. 242) to the threads of the special nut prior to installation. Install the special nut (A, **Figure 73**) into the spring-









loaded adjuster assembly (B, **Figure 73**) and tighten securely with a 12 mm Allen wrench.

3. Install the spring-loaded adjuster assembly (**Figure 72**) into the cap bolt. Install the circlip into the cap bolt (**Figure 71**) and make sure it's seated correctly in its groove.

4. Slide the rebound spring (A, **Figure 76**) onto the damper rod and insert the damper rod and spring into the upper fork tube (B, **Figure 76**).

5. To hold the damper rod in place, refer to **Figure 77** and temporarily install the fork spring (A), spring seat (B), spacer (C) and washer (D) (1984-1985 models) into the fork tube.

6. Insert a clean shop cloth into the top of the fork tube (**Figure 78**). Press down on spring and "screw" the shop cloth into the top of the fork tube. The cloth will grab hold of the inner threads in the fork tube and hold the spring in place.

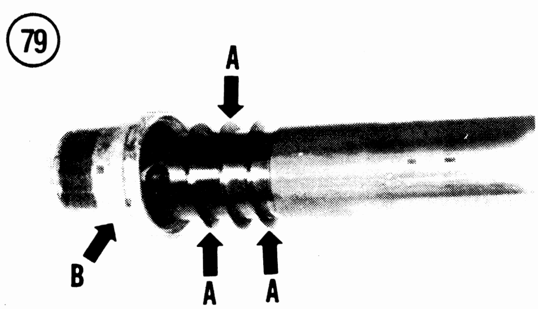
7A. On 1984-1985 models, slide on the valve spring, washer and other valve spring (A, **Figure 79**) onto the damper rod then install the oil lock piece (B, **Figure 79**).

7B. On 1986-1990 models, install the oil lock piece (**Figure 80**) onto the damper rod.

NOTE

*In order for the damper adjustment to operate correctly, the notch in the base of the damper rod (A, **Figure 81**) must be indexed onto the damper stopper screw in the slider (B, **Figure 81**) after the fork tube assembly is installed into the slider.*

8. Position the slide with the stopper screw threaded hole pointing straight up.



9. Make sure the oil lock piece (A, **Figure 82**) is still in place on the damper rod and that the damper rod notch is pointing straight up.

10. Insert the damper rod/upper fork assembly tube into the lower fork tube (B, **Figure 82**).

CAUTION
During installation of the stopper screw, if the screw bottoms out without going all the way in—stop, remove the screw and realign the damper rod notch to the threaded hole, then reinstall the stopper screw.

11. Push the upper fork tube assembly in all the way. Direct a flashlight into the threaded hole and check for correct alignment of the damper rod notch to this threaded hole. Adjust if necessary, then install the stopper screw (**Figure 83**) and tighten securely.

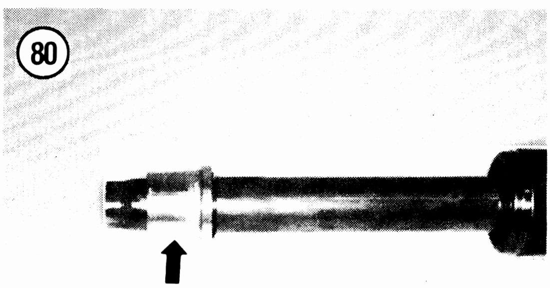
12. Apply blue Loctite (No. 242) onto the fork tube Allen bolt. Install the Allen bolt and sealing washer (**Figure 84**). Push down hard on the fork spring with the shop cloth installed in the top of the fork tube. Tighten the Allen bolt to the torque specification listed in **Table 2**.

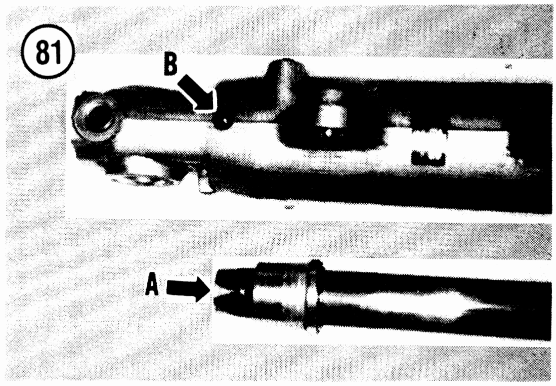
13. Remove the shop cloth from the fork tube.

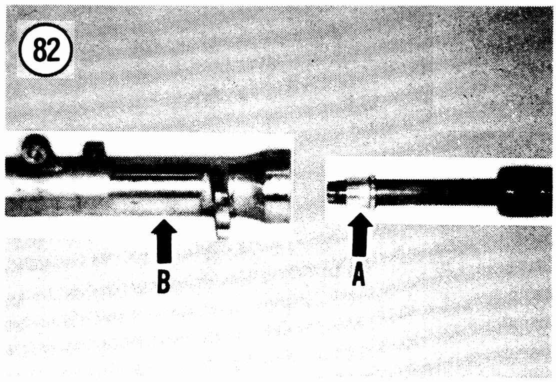
14. Install the fork slider bushing (A, **Figure 85**) onto the fork tube then install the washer (B, **Figure 85**).

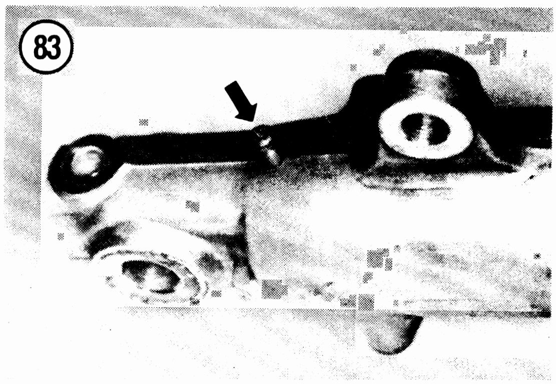
15. Position the oil seal with the open side (**Figure 86**) facing up and install the oil seal (A, **Figure 87**) onto the fork tube.

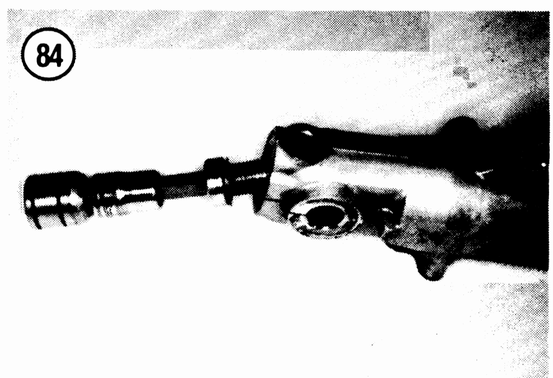
NOTE
In the next step, a piece of galvanized pipe and hammer can also work as a tool. If both ends of the pipe are threaded, wrap one end with duct tape











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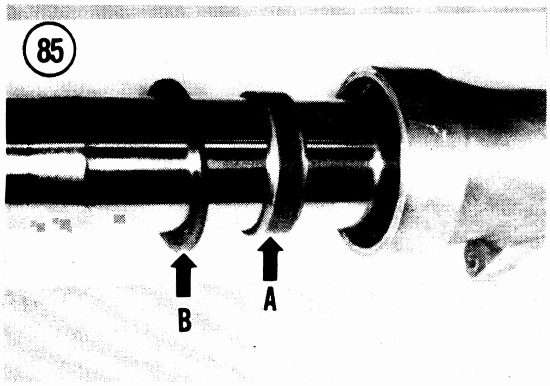

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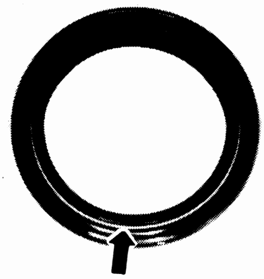

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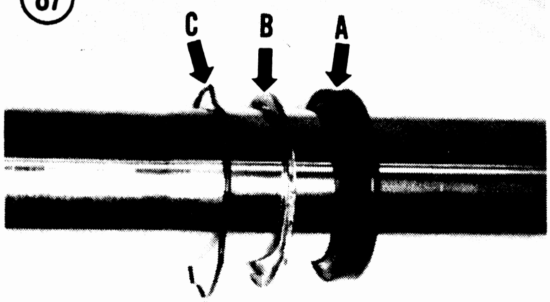

to prevent the threads from damaging the interior of the slider.

16. Slide the slider bushing, washer and oil seal down the fork tube. Then drive the bushing, washer and oil seal into the fork slider with the Yamaha Front Fork Seal Driver weight (U.S. part No. YM-33963 or U.K. part No. 90890-01367) and Fork Seal Driver Adapter (U.S. part No. YM-33968 or U.K. part No. 90890-01381).

17. Drive the oil seal in until the groove in the slider can be seen above the top surface of the oil seal.

18. Slide the upper gasket (B, **Figure 87**) and the retainer clip (C, **Figure 87**) down the fork tube.

19. Push the upper gasket down and install the retaining clip in the lower fork tube groove. Make sure the clip is completely seated in the slider groove (**Figure 88**).

20. Slide the dust seal (**Figure 89**) down the fork tube and seat it in the lower fork tube.

21. Remove the spacer and washer (1984-1985 models), spring seat and fork spring from the fork tube.

22. Hold the fork assembly upright and fill the fork tube with the correct quantity SAE 10W fork oil or SAE 10W30 Type SE motor oil. Refer to **Table 1** for specified quantity.

23. Continue to hold the fork assembly upright and slowly pump the fork up and down several times to distribute the fork oil.

24. Wipe the fork spring with a lint-free cloth.

25. Position the fork spring with the narrow wound coils toward the top (**Figure 90**).

26A. On 1984-1985 models, perform the following:

a. Install the spring (A, **Figure 77**), spring seat (B, **Figure 77**) onto the top of the fork spring. Make sure it is seated correctly.

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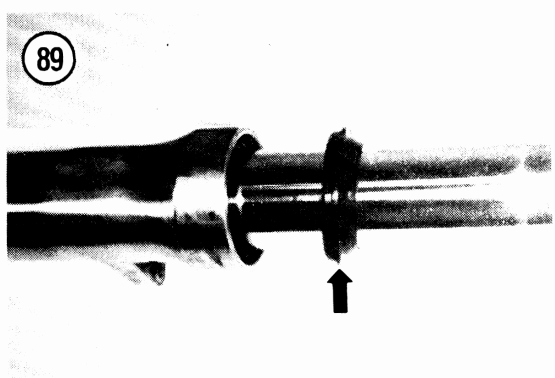
89



b. Install the spacer (C, **Figure 77**) and washer (D, **Figure 77**) into the fork tube.

26B. On 1986-on models, install the spring (A, **Figure 77**), spring seat (B, **Figure 77**) onto the top of the fork spring. Make sure it is seated correctly.

27. Make sure the O-ring seal is in place on the fork cap bolt (**Figure 91**).

28. Install the fork cap bolt as follows:

a. Adjust the damper rod to the softest setting (**Figure 92**). This will make installation easier.

b. Install the sub-spring and washer (**Figure 93**) onto the adjust rod.

c. Carefully insert the fork cap bolt and adjust rod into the fork spring (**Figure 94**).

d. Properly index the flat on the end of the damper adjust rod (**Figure 95**) into the receptacle in the top of the damper rod (**Figure 96**). If the rod is indexed correctly the fork cap bolt will be positioned close enough to the top of the fork tube (**Figure 97**) to enable the fork cap bolt to be pushed down for thread engagement.

e. If the cap bolt is sitting up too high slowly rotate the damper adjust rod until it is correctly seated in the damper rod receptacle allowing the cap bolt to move closer to the top of the fork tube.

f. Start the fork cap bolt slowly while pushing down on the spring. Start the bolt slowly and don't cross-thread it.

29. Place the slider in a vise with soft jaws and tighten the fork cap to the torque specifications listed in **Table 2**.

30. Repeat for the other fork assembly.

31. Install the fork assemblies as described in this chapter.

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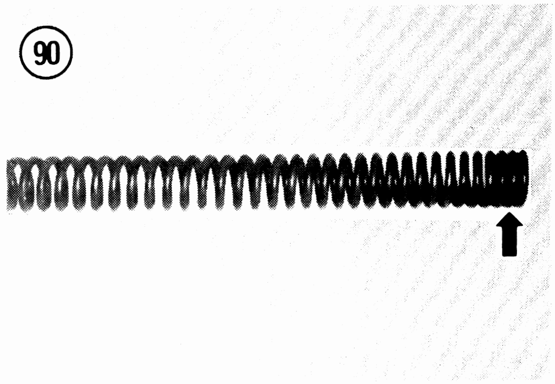

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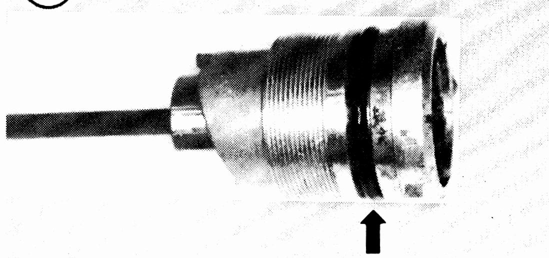

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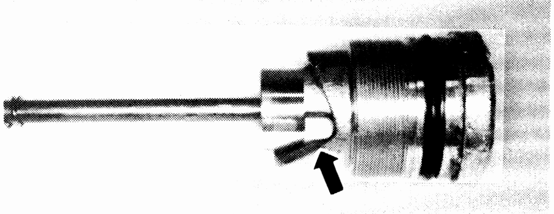

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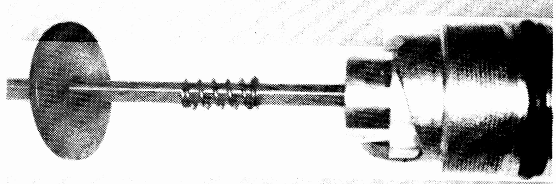


Disassembly (1991-on)

Refer to **Figure 98** for this procedure.

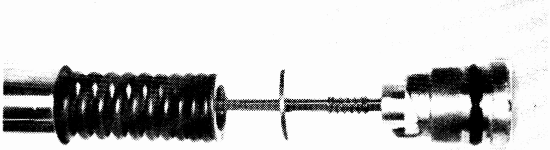
1. Secure the fork tube in a vise with soft jaws.

WARNING
Be careful when removing the fork cap as the spring is under pressure. Protect your eyes accordingly.

2. Remove the fork cap (**Figure 99**), loosened during removal, from the fork tube.

3. Remove the spacer, spring seat and fork spring.

94



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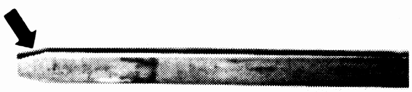

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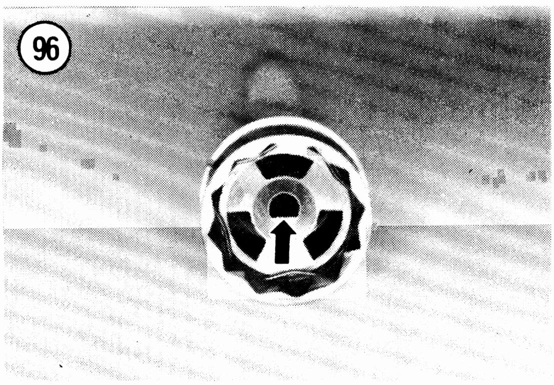

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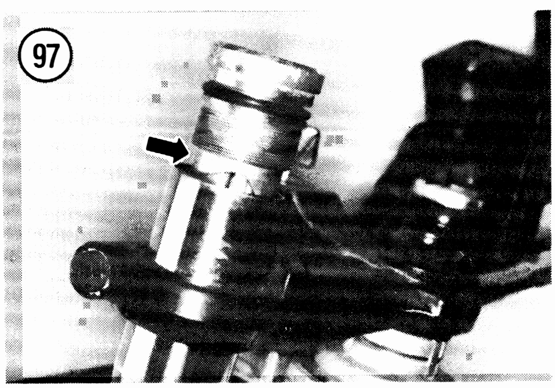

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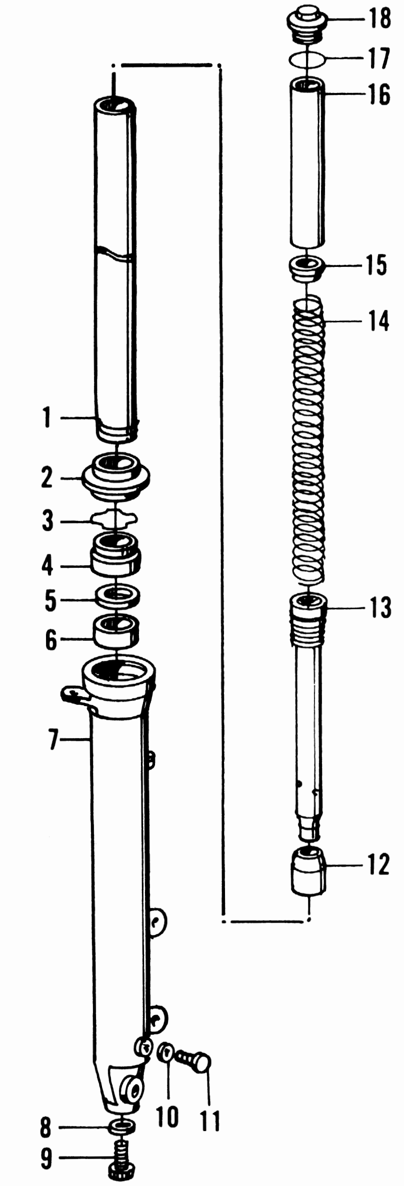
FRONT FORK (1991-ON)



1. Front tube and bushing
2. Dust seal
3. Retaining clip
4. Oil seal
5. Washer
6. Slider bushing
7. Fork slider
8. Washer
9. Allen bolt
10. Washer
11. Drain bolt
12. Oil lock piece
13. Damper rod and rebound spring
14. Fork spring
15. Spring seat
16. Spacer
17. O-ring
18. Fork cap

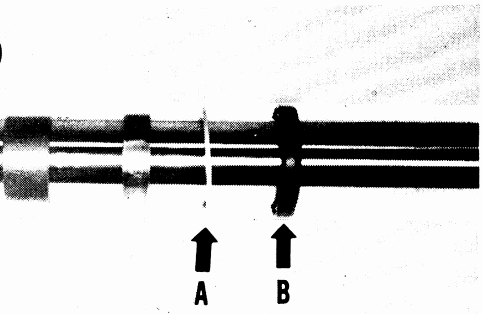
4. Turn the fork tube upside down and remove the damper rod and rebound spring.
5. Slide the washer, oil seal and dust seal from the fork tube.
6. Inspect all parts as described in this chapter.

Assembly (1991-on)

Refer to **Figure 98** for this procedure.

1. Coat all parts with fresh SAE 10W fork oil prior to installation.
2. Install the fork slider bushing (**Figure 100**) onto the fork tube then install the washer (A, **Figure 101**).
3. Position the oil seal with the open side (**Figure 102**) facing up and install the oil seal (B, **Figure 101**) onto the fork tube.
4. Slide the rebound spring (**Figure 103**) onto the damper rod and insert the damper rod and spring into the upper fork tube (**Figure 104**).
5. Slide the oil lock piece (**Figure 105**) onto the damper rod.
6. Temporarily install the fork spring, spring seat, spacer and fork cap to hold the damper rod in place. Tighten the fork cap bolt securely.

101



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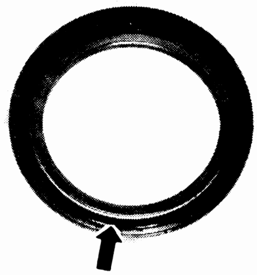

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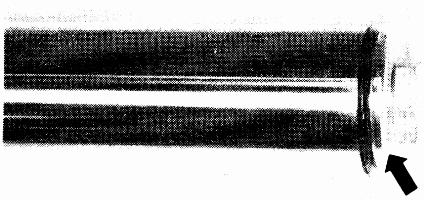

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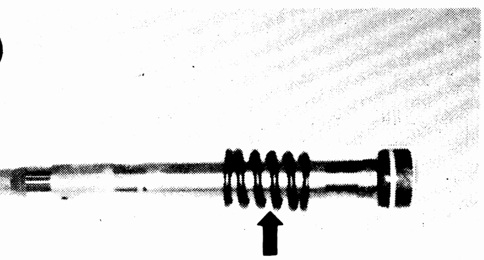

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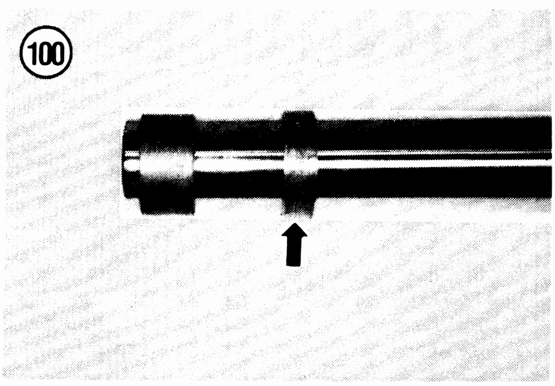

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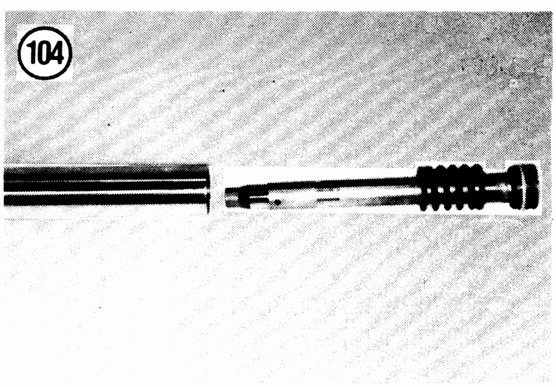

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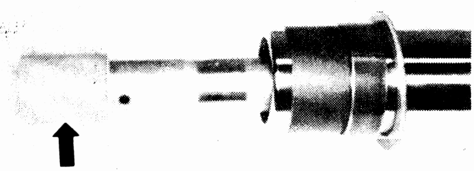

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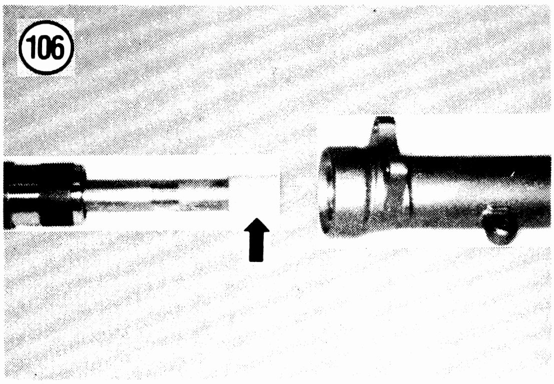

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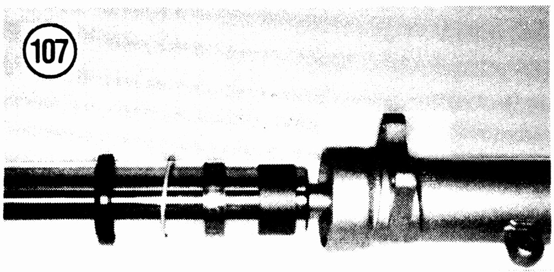

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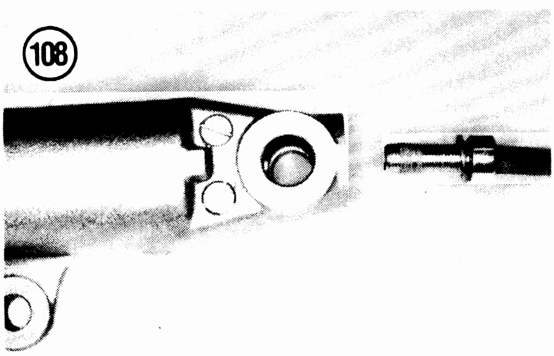


7. Make sure the oil lock piece (**Figure 106**) is still in place and insert the damper rod/upper fork assembly tube into the lower fork tube (**Figure 107**).

8. Apply blue Loctite (No. 242) onto the fork tube Allen bolt (**Figure 108**). Install the Allen bolt and tighten to the torque specification listed in **Table 2**.

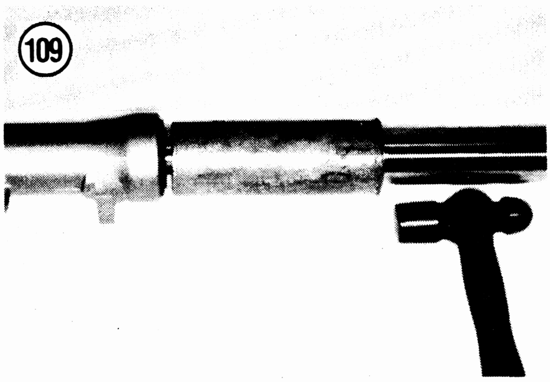
NOTE
*In the next step, a piece of galvanized pipe and hammer (**Figure 109**) can also work as a tool. If both ends of the pipe are threaded, wrap one end with duct tape to prevent the threads from damaging the interior of the slider.*

9. Slide the slider bushing, washer and oil seal down the fork tube. Then drive the bushing, washer and oil seal into the fork slider.

10. Drive the oil seal in until the groove in the slider can be seen above the top surface of the oil seal (**Figure 110**).

11. Slide the retainer clip (A, **Figure 111**) down the inner fork tube and install it in the lower fork tube groove. Make sure the circlip is completely seated in the slider groove.

(109)



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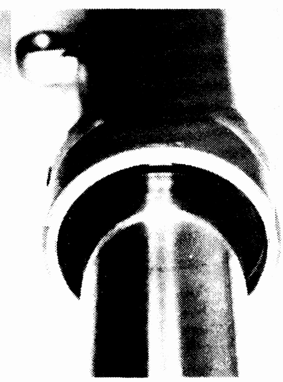

12. Slide the dust seal (B, **Figure 111**) down the fork tube and seat it in the lower fork tube.

13. Carefully tap the dust seal (**Figure 112**) into the slider.

14. Unscrew the fork cap bolt and withdraw the spacer, spring seat and the fork spring.

15. Hold the fork assembly upright and fill the fork tube with the correct quantity SAE 10W fork oil. Refer to **Table 1** for specified quantity.

16. Continue to hold the fork assembly upright and slowly pump the fork up and down several times to distribute the fork oil.

17. Compress the fork completely and measure the fluid level from the top of the fork tube after the fork oil settles. Refer to **Table 1** for the specified fork oil level.

18. Wipe the fork spring with a lint-free cloth.

19. Install the fork spring with the narrow wound coils toward the top (**Figure 113**).

20. Install the spring seat (**Figure 114**) onto the top of the fork spring. Make sure it is seated correctly (**Figure 115**).

21. Install the spacer (**Figure 116**).

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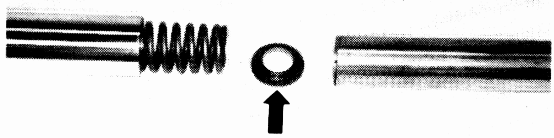

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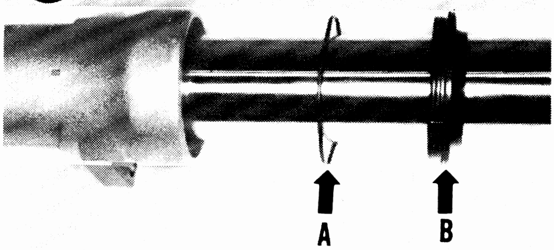

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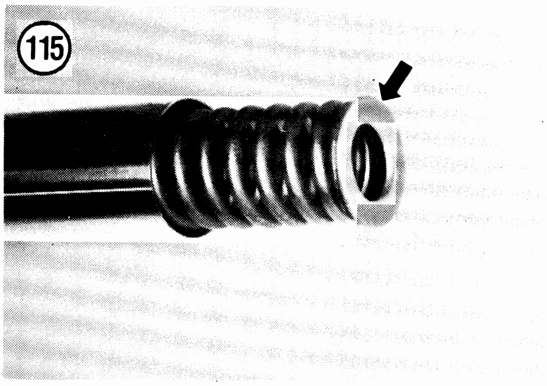

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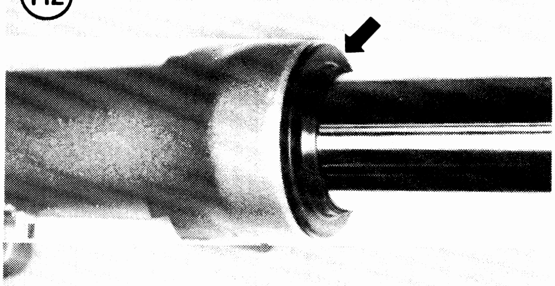

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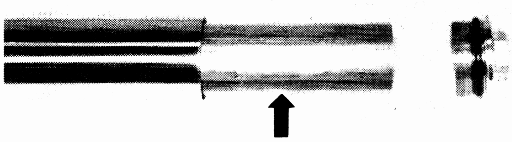

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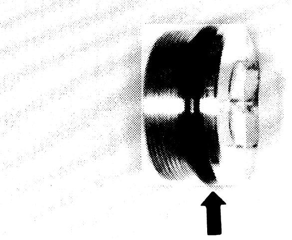

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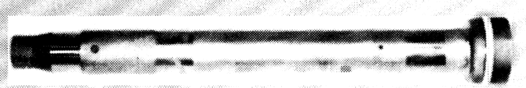

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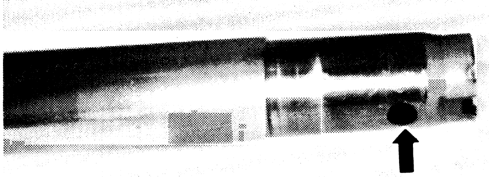

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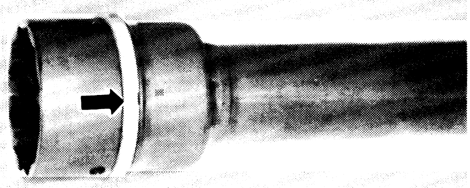

22. Make sure the O-ring seal (**Figure 117**) is in place on the fork cap.
23. Install the fork cap (**Figure 99**) while pushing down on the spring. Start the bolt slowly, don't cross-thread it.
24. Place the slider in a vise with soft jaws and tighten the fork cap to the torque specifications listed in **Table 2**.
25. Repeat for the other fork assembly.
26. Install the fork assemblies as described in this chapter.

Inspection (All Models)

1. Thoroughly clean all parts in solvent and dry them.
2. Check the fork tube for signs of wear or scratches. If bent, refer service to a Yamaha dealer.
3. Check the damper rod for straightness (**Figure 118**). The damper rod should be replaced if the runout is 0.2 mm (0.008 in.) or greater.
4. Make sure the oil holes (**Figure 119**) in the damper rod are clear. Clean out if necessary.
5. Inspect the damper rod and piston ring (**Figure 120**) for wear or damage. Replace as necessary.
6. Check the fork tube for straightness (**Figure 121**). If bent or severely scratched, it should be replaced.
7. Check the fork tube for chrome flaking or creasing; this condition will damage oil seals. Replace the fork tube if necessary.
8. Check the slider oil seal area (**Figure 122**) for dents or other damage that would allow oil leakage. Replace the slider if necessary.
9. Check the slider for dents or exterior damage that may cause the upper fork tube to hang up during riding. Replace if necessary. Check for cracks or

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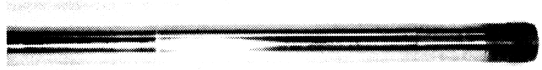

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damage to the brake caliper and hose mounting bosses (**Figure 123**).

10. On 1984-1987 models, perform the following:

a. Inspect the front axle threads (**Figure 124**) in the slider for damage. If damage is slight, clean out; if damage is severe, replace the slider.

b. Make sure the anti-dive openings (**Figure 125**) in the fork slider are clear, clean out if necessary.

11. Measure the uncompressed length of the fork spring (not rebound spring) as shown in **Figure 126**. If the spring has sagged to the service limit dimensions listed in **Table 2** the spring must be replaced.

12. Inspect the slider (**Figure 127**) and fork tube (**Figure 128**) guide bushings. If either is scratched or scored they must be replaced. If the Teflon coating is worn off so that the copper base material is showing on approximately 3/4 of the total surface, the bushing(s) must be replaced.

13. Inspect the gasket (**Figure 129**) on the Allen bolt, replace if damaged.

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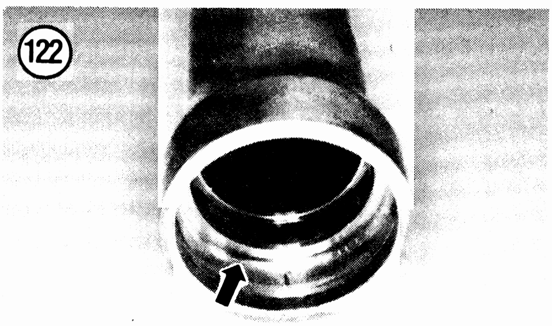

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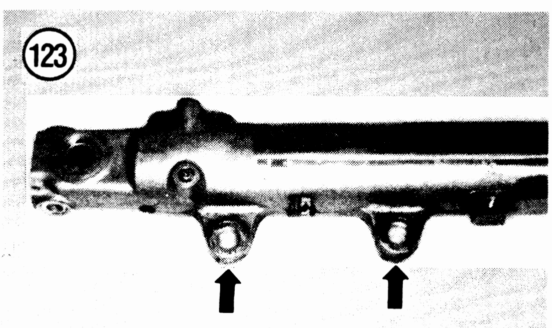

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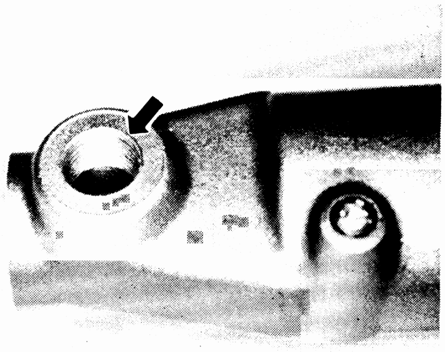

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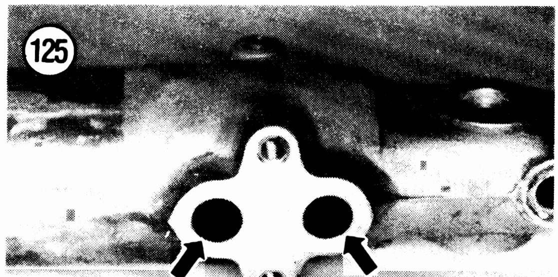

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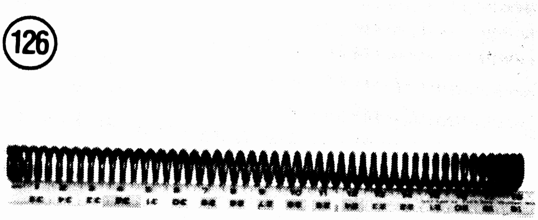

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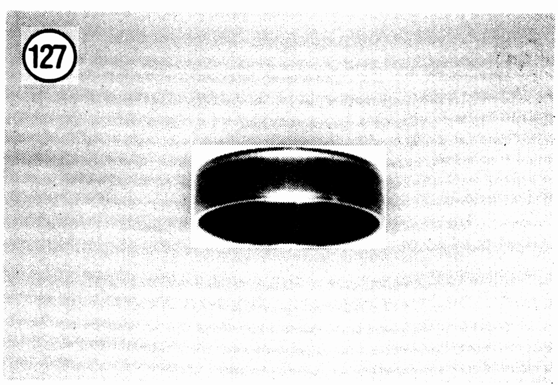
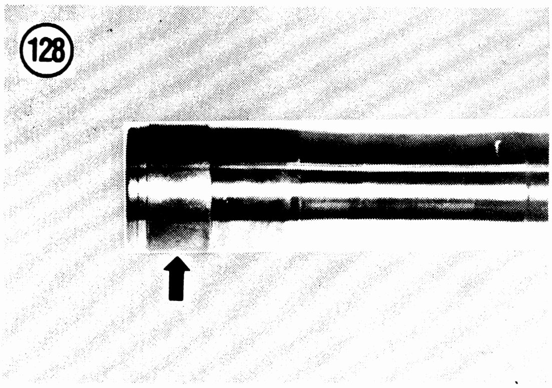
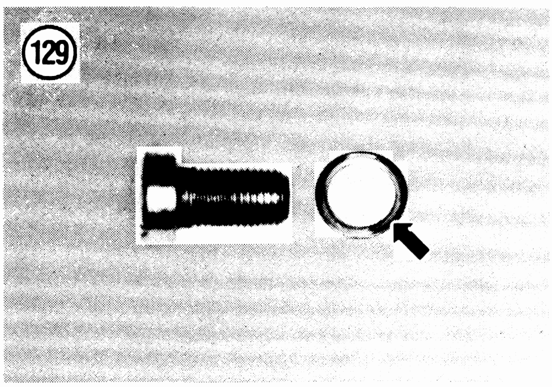
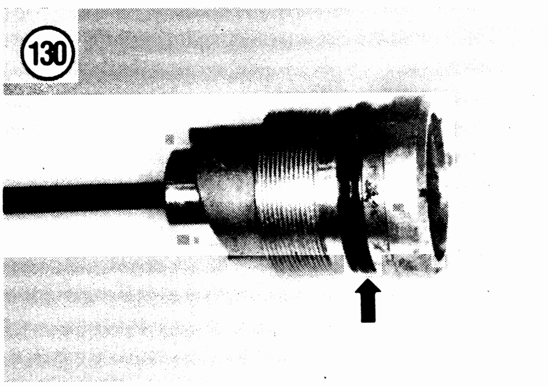
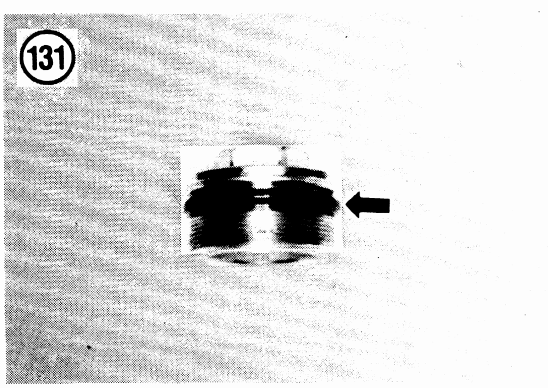










14. Replace the fork cap O-ring if deformed or damaged. Refer to **Figure 130** for 1984-1990 models or **Figure 131** for 1991-on models.

15. On 1984-1990 models, perform the following:

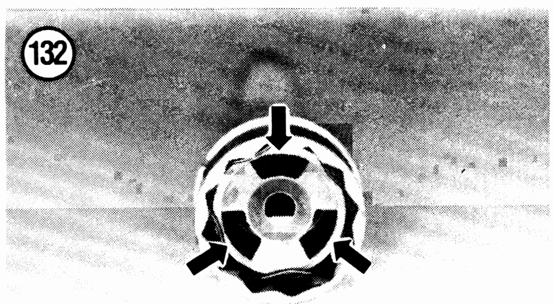
 a. Make sure the openings (**Figure 132**) in the damper rod are clear.

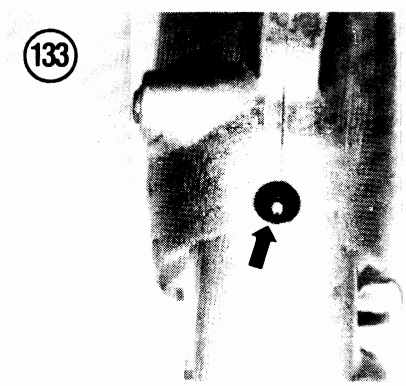
 b. Inspect the set screw gasket (**Figure 133**) in the slider, replace if necessary.

 c. Remove the inner O-ring seal (**Figure 134**) from the cap bolt. Inspect it for hardness or deterioration and replace if necessary.

 d. Inspect the inner surface (**Figure 135**) and the adjustment ramps (**Figure 136**) of the cap bolt. Check for roughness or damage, replace if necessary.

16. Any parts that are worn or damaged should be replaced. Simply cleaning and reinstalling unserviceable fork components will not improve performance of the front suspension.

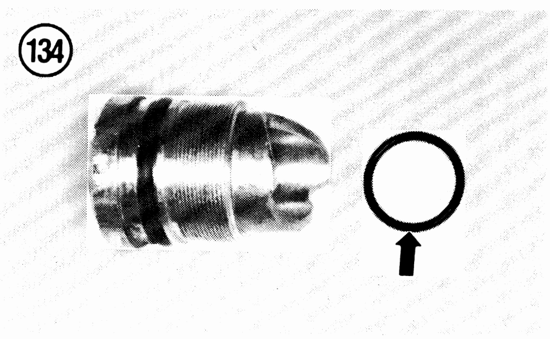




ANTI-DIVE UNIT (1984-1987 MODELS)

Removal/Installation

1. Remove the union bolt and sealing washers (A, **Figure 137**) and disconnect the brake hose from the anti-dive plunger case. Place the loose end of the brake hose in a container to catch any brake fluid that may drain out.
2. Loosen the bolts (B, **Figure 137**) securing the anti-dive plunger case to the slider.
3. Remove the bolts (A, **Figure 138**) securing the anti-dive plunger cap and remove the cap (B, **Figure 138**).
4. Remove the bolts (A, **Figure 139**) securing the anti-dive plunger case and remove the case (B, **Figure 139**) from the fork slider.
5. Inspect the components as described in this chapter.
6. Installation is the reverse of the removal steps while noting the following:
   a. Make sure the O-ring seals (**Figure 140**) are in place on the backside of the case prior to installation on the fork slider.
   b. Tighten the mounting bolts to the torque specifications listed in **Table 2**.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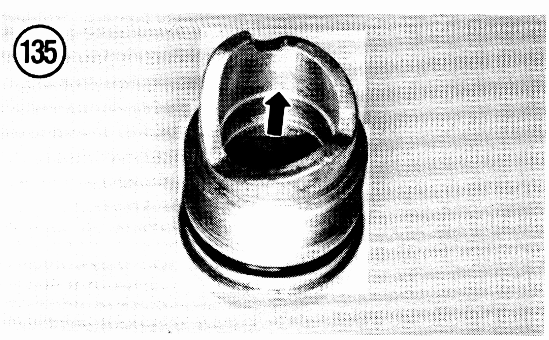
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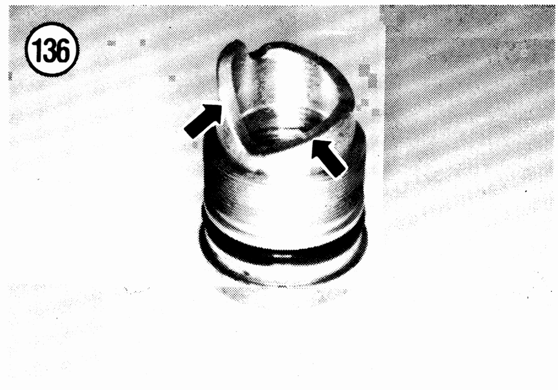
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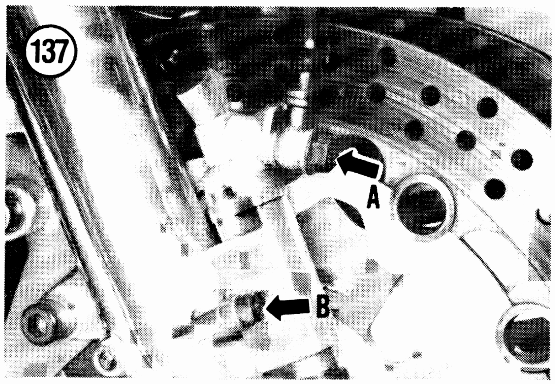

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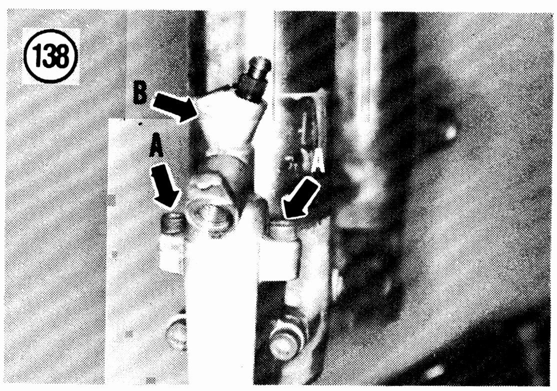

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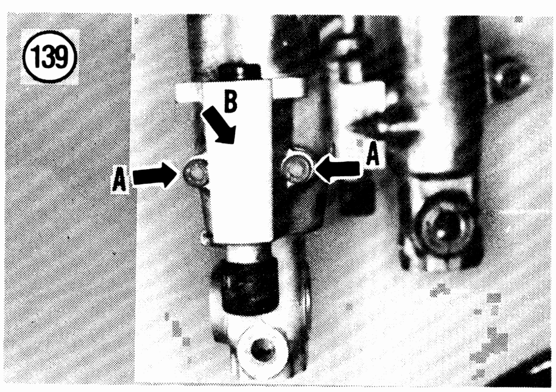

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c. Install a new sealing washer on each side of the brake hose and tighten the union bolt to the torque specifications listed in **Table 2**.

d. Bleed the brakes as described under *Bleeding the System* in Chapter Eleven.

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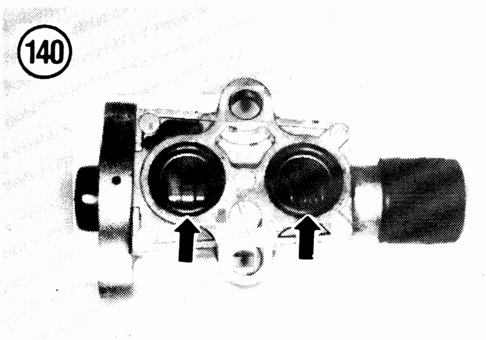

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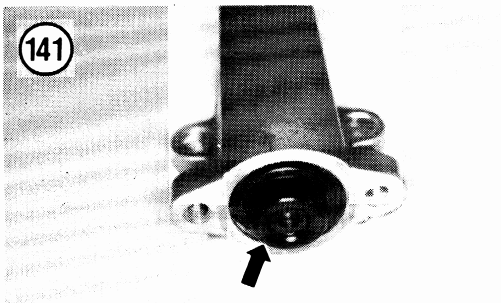

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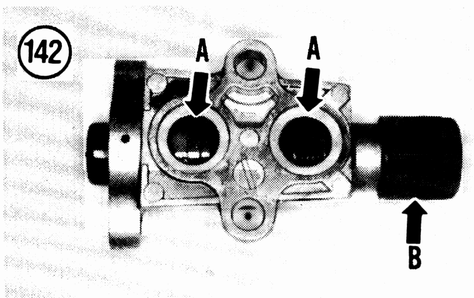

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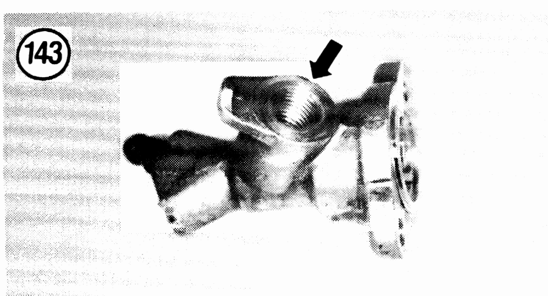

Inspection

1. Remove the O-ring seals (**Figure 140**) and inspect them for hardness or deterioration; replace if necessary.

CAUTION
Do not clean out the plunger case with solvent as it will damage the actuation piston O-ring. When in use, this area runs in brake fluid—not fork oil.

2. Remove the rubber diaphragm (**Figure 141**) from the plunger case. Inspect it for hardness or deterioration. This is not a replaceable part and if damaged, the plunger case must be replaced.
3. Inspect the inner chamber (A, **Figure 142**) of the plunger case for dirt or contamination. If necessary, clean out with fresh DOT 4 brake fluid. There are no replacement parts for the plunger case.
4. Make sure the adjust knob (B, **Figure 142**) turns freely.
5. Apply a small amount of compressed air to the union bolt threaded hole (**Figure 143**) to make sure the brake fluid passage (**Figure 144**) is clear. This passage must be clear and free of contamination for the anti-dive unit to work properly.
6. Inspect the bleed valve (**Figure 145**). Make sure it is not damaged and is tight.

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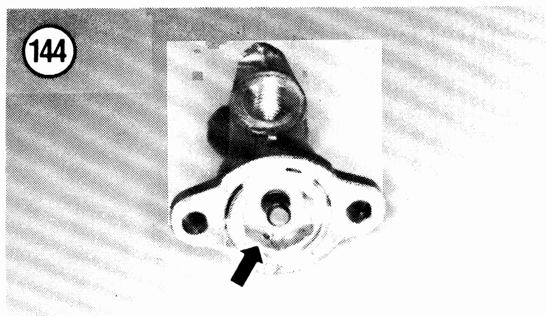

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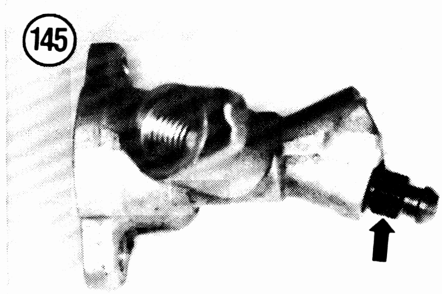


Table 1 FRONT SUSPENSION AND STEERING SPECIFICATIONS

Steering head type	Taper roller bearing
Front wheel runout	
Radial and lateral	2.0 mm (0.08 in.)
Front fork	
1984-1990	
Front fork travel	150 mm (5.91 in.)
Spring free length	
New	383 mm (15.08 in.)
Wear limit	378 mm (14.88 in.)
Oil weight	10WT or SAE 10W/30 type SE motor oil
Oil capacity	424 cc (14.9 Imp. oz./14.3 U.S. oz.)
1991-on	
Front fork travel	150 mm (5.91 in.)
Spring free length	
New	529 mm (20.8 in.)
Wear limit	524 mm (20.6 in.)
Oil weight	10WT
Oil capacity	446 cc (15.7 Imp. oz./15.08 U.S. oz.)

Table 2 FRONT SUSPENSION TIGHTENING TORQUES

Item	N•m	ft.-lb.
Front axle nut (1984-1988)	78	50
Front axle (1989-on)	58	42
Front axle pinch bolt	20	14
ABS front sensor mounting bolt	23	17
Handlebar		
Mounting bolt	9	6.5
Pinch bolt	20	14
End cap	26	19
Steering stem		
Steering stem nut	110	80
Lower ring nut		
Initial	50	36
Final	3	27 in.-lb.
Fork bridge bolts		
Upper	20	14
Lower	23	16
Anti-dive unit (1984-1987)		
Plunger case bolts	4	34.8 in.-lb.
Case mounting bolts	7	5.1
Union bolt	26	19
Front fork		
Allen bolt	37	27
Cap bolt	23	17

Table 3 TIRE INFLATION PRESSURE (COLD)*

Load	psi	kPa
Up to 198 lb. (90 kg)		
Front	32	226
Rear	36	250

(continued)

Table 3 TIRE INFLATION PRESSURE (COLD)* (continued)

Load	psi	kPa
198-**lb. (90-** kg)		
Front	36	250
Rear	42	290
High speed riding		
Front	36	250
Rear	42	290

*Recommended air pressure for factory equipped tires. Aftermarket tires may require different air pressure.
**Maximum load limit includes total weight of motorcycle with accessories, rider(s) and luggage.

CHAPTER TEN

REAR SUSPENSION

This chapter includes repair and replacement procedures for the rear wheel, drive chain and rear suspension components.

Table 1 lists rear suspension specifications and tightening torques are covered in **Table 2**.

REAR WHEEL

Removal

CAUTION
*Care must be taken when removing, handling and installing a wheel with a disc brake rotor. The rotor is relatively thin in order to dissipate heat and to minimize unsprung weight. The rotor is designed to withstand tremendous rotational loads but can be damaged when subjected to side impact loads. If the rotor is knocked out of true by a side impact, a pulsation will be felt in the rear brake pedal when braking. The rotor is too thin to be trued and must be replaced with a new one. Protect the rotor when transporting a wheel to a dealer or tire specialist for tire service. Do **not** place a wheel in a car trunk or pickup bed without protecting the rotor from side impact.*

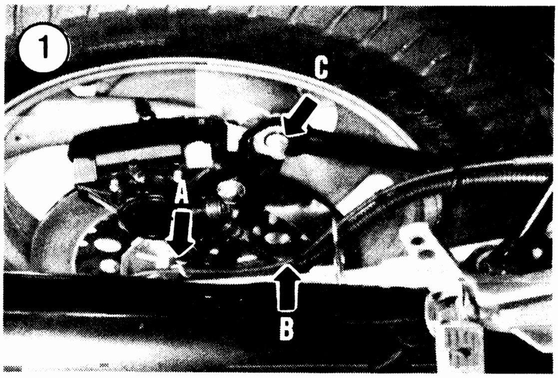
1. Place the bike securely on the centerstand with the rear wheel clear of the ground.

2. On ABS-equipped models, perform the following:

   a. Unhook the sensor cable from the rear holder (A, **Figure 1**) at the back of the swing arm.

   b. Remove the clip (B, **Figure 1**) holding the sensor cable to the hydraulic brake hose. Separate the cable and hose and reinstall the clip on the hose to avoid misplacing it.

   c. Remove the bolt (A, **Figure 2**) securing the wheel sensor (C, **Figure 2**) to the sensor housing. Do not remove the wheel sensor at this



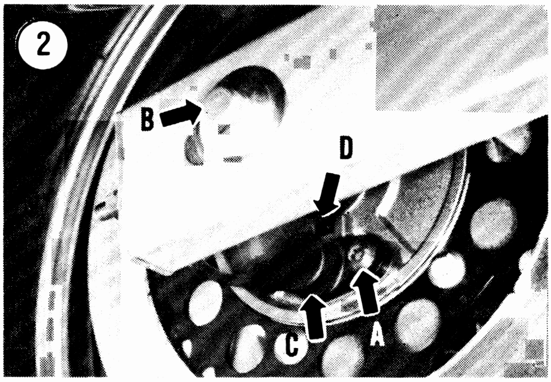
time as there is not sufficient room for removal.

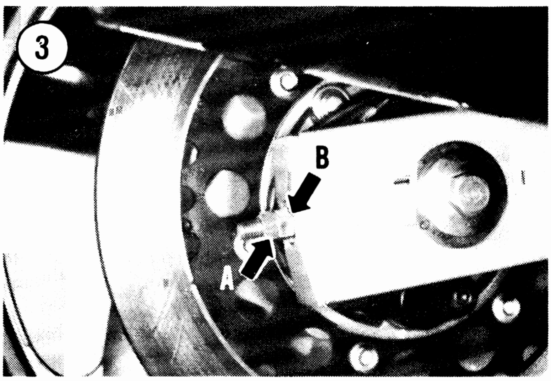
3. Remove the cotter pin and nut (C, **Figure 1**) securing the rear end of the torque link to the caliper carrier.

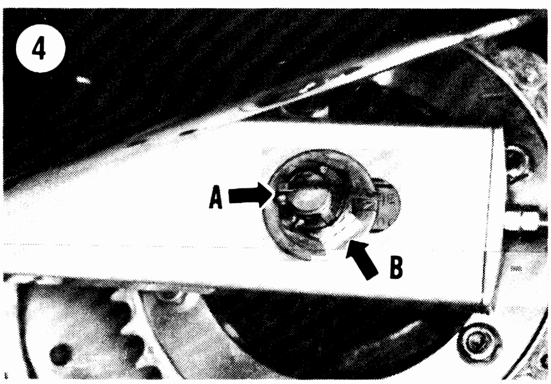
4. Remove the bolt and disconnect the torque link from the caliper carrier.

5. Loosen the drive chain adjusting locknuts (A, **Figure 3**) and adjust nuts (B, **Figure 3**).

6. Remove the screws securing the drive chain guard and remove the guard.







7. Remove the cotter pin (A, **Figure 4**). Loosen then remove the rear axle nut (B, **Figure 4**) and the special washer.

8. Push the rear wheel forward to allow the maximum amount of slack in the drive chain.

9. Withdraw the axle (B, **Figure 2**) from the wheel and swing arm and allow the wheel to drop to the ground. Don't lose the special washer on the axle.

CAUTION
Do not allow the ABS sensor pole to make contact with any metal object on the bike during removal.

10. On ABS-equipped models, carefully pull the sensor (C, **Figure 2**) from the housing and place it in a reclosable plastic bag to protect it from damage and dirt. Move it out of the way.

11. Lift the brake caliper off of the brake disc. Secure the caliper and caliper bracket up to the frame with a Bungee cord. This will take the strain off the brake hose.

NOTE
Insert a piece of wood in the caliper in place of the disc. That way, if the brake pedal is inadvertently applied, the pistons will not be forced out of the cylinders. If this does happen, the caliper might have to be disassembled to reseat the pistons and the system will have to be bled. By using the wood, bleeding the brake is not necessary when installing the wheel.

12. Remove the drive chain adjusters from each end of the swing arm.

13. Lift the drive chain off the sprocket and pull the wheel away from the swing arm.

NOTE
On ABS-equipped models, hold onto the sensor housing as it will fall out of the wheel hub as the wheel is removed.

14. Pull the wheel toward the rear and remove it from the swing arm.

15. On ABS-equipped models, remove the sensor housing from the wheel.

16. Remove the axle spacers from the left-hand (**Figure 5**) and right-hand (**Figure 6**) side of the rear wheel hub.

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.

17. 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 chain adjusters, axle spacers and special washers on the axle along with the axle nut to prevent misplacing any parts.
18. If necessary, service the rear sprocket as described in this chapter.

Installation

1. To prevent axle seizure, coat the axle with an anti-seize compound such as Bostik Never-Seez Lubricating & Anti-Seize Compound (part No. 49501).
2. Apply a coat of Lithium soap base grease to the bearings, oil seals, spacers and the inner surface of the distance collar prior to installation.
3. If removed, insert the rear sprocket/coupling assembly (**Figure 7**) into the rear hub.
4. Install the axle spacer into the left-hand (**Figure 5**) and right-hand (**Figure 6**) side of the rear wheel hub.
5. On ABS-equipped models, install the sensor housing into the wheel.
6. Move the rear wheel into position in the swing arm and install the drive chain onto the sprocket.
7. Install the drive chain adjusters into each end of the swing arm.
8. Unhook the Bungee cord from the brake caliper assembly and lower it.
9. Move the wheel up into position and carefully install the rear caliper onto the brake disc. Don't damage the leading edges of the brake pads during installation.
10. Align the axle hole in the brake caliper bracket, hub and swing arm.
11. On ABS-equipped models, properly index the locating boss on the brake caliper bracket so that it is engaged with the locating slot on the sensor housing (D, **Figure 2**). This is necessary for proper ABS operation.
12. Make sure the special washer is in place on the rear axle and install the rear axle (B, **Figure 2**) through the swing arm, wheel hub, brake caliper bracket and swing arm.
13. Install the special washer and rear axle nut (B, **Figure 4**). Temporarily tighten the nut until the drive chain is later adjusted.

CAUTION
Do not allow the sensor pole to make contact with any metal object on the bike.

14. On ABS-equipped models, perform the following:

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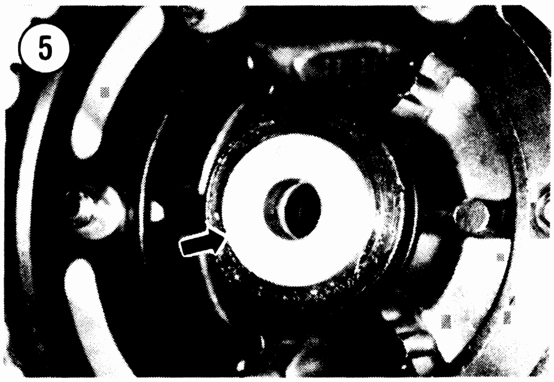

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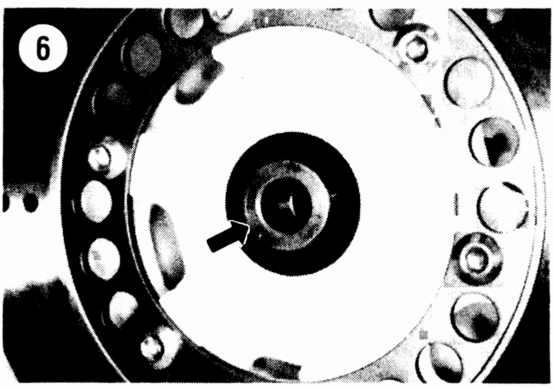

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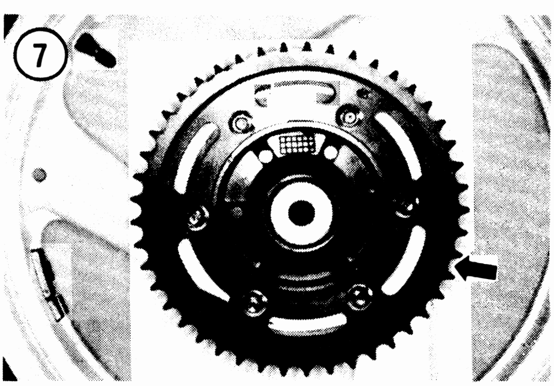

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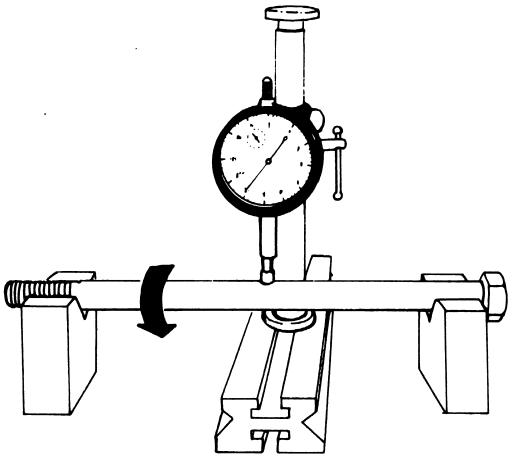

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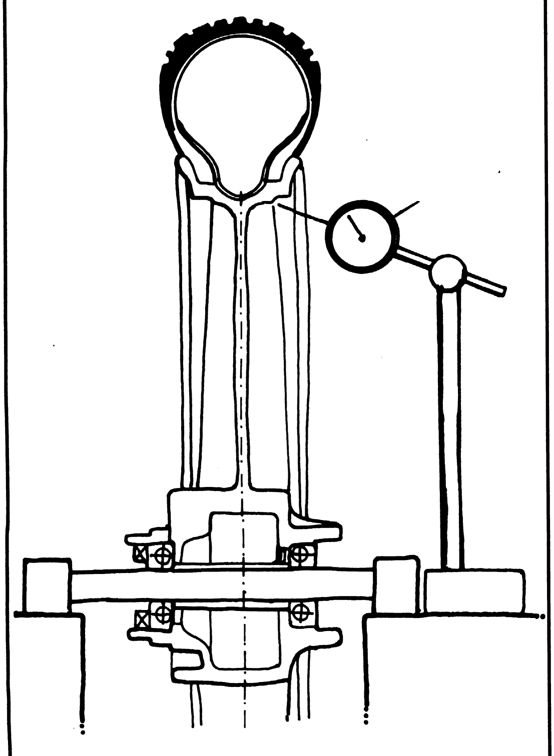

a. Remove the sensor from the plastic bag and make sure the end of the sensor is free of any dirt or debris. Wipe clean with a lint-free cloth.
b. Carefully insert the sensor (C, **Figure 2**) into the housing and install the mounting bolt (A, **Figure 2**). Do not tighten it at this time.

15. Install the drive chain guard and tighten the screws securely.
16. Tighten the caliper torque link nut to the torque specification listed in **Table 2**. Install a new cotter pin and bend the ends over completely.
17. On ABS-equipped models, perform the following:
   a. Tighten the wheel sensor bolt (A, **Figure 2**) to the torque specification listed in **Table 2**.
   b. Remove the clip (B, **Figure 1**) from the brake hose. Move the sensor cable and the hydraulic brake hose together and install the clip holding the cable and hose together.
   c. Hook the sensor cable onto the rear holder (A, **Figure 1**) at the back of the swing arm.
18. Spin the wheel several times to make sure it rotates freely and that the rear brake works properly.
19. Adjust the drive chain as described under *Drive Chain Adjustment* in Chapter Three. After the drive chain is properly adjusted, tighten the axle nut to the torque specification listed in **Table 2**. Install a new cotter pin (A, **Figure 4**) and bend the ends over completely.

10

Inspection

1. Remove any corrosion on the rear axle with a piece of fine emery cloth and wipe clean with solvent.
2. Check axle runout. Place the axle on V-blocks (**Figure 8**). Place the tip of a dial indicator in the middle of the axle. Rotate the axle and check runout. If the runout exceeds 0.7 mm (0.027 in.), replace the axle; do not attempt to straighten it.
3. Check rim runout as follows:
   a. Remove the tire from the wheel as described under *Tubeless Tire Changing* in Chapter Nine.
   b. Measure the radial (up and down) runout of the wheel rim with a dial indicator as shown in **Figure 9**. If the runout exceeds 2.0 mm (0.80 in.), check the wheel bearings as described in this chapter.

c. Measure the axial (side to side) runout of the wheel rim with a dial indicator as shown in **Figure 9**. If runout exceeds 2.0 mm (0.80 in.), check the wheel bearings as described in this chapter.
d. If the wheel bearings are okay, the wheel cannot be serviced, but must be replaced.

4. Inspect the wheel rim for dents, bending or cracks. Check the rim and rim sealing surface for scratches that are deeper than 0.5 mm (0.01 in.). If any of these conditions are present, replace the wheel.
5. Remove the rear sprocket/coupling assembly (**Figure 7**) from the rear hub.
6. Remove the rubber dampers (**Figure 10**) and inspect the hub separator webs (**Figure 11**) for the rubber dampers. Check for cracks or damage and if any are cracked or broken, replace the wheel.

REAR HUB

Disassembly/Inspection/Assembly

Refer to the following illustrations for this procedure:

a. 1984-1987 models: **Figure 12.**
b. 1988-on non-ABS models: **Figure 13.**
c. ABS-equipped models: **Figure 14.**

NOTE
This procedure is shown on a 1990-on non-ABS model. Where differences occur they are identified.

1. Remove the rear wheel as described in this chapter.
2. If not already removed, remove the axle spacers from the left-hand (**Figure 5**) and right-hand (**Figure 6**) side of the rear wheel hub.
3. On ABS-equipped models, if not already removed, remove the sensor housing.
4. Check the wheel bearings (A, **Figure 15**) by rotating the inner race. Check for bearing roughness, excessive noise or damage. If necessary, replace the bearings as follows. Always replace the bearings as a set.
5. Lift the rear sprocket/coupling assembly (**Figure 7**) out of the rear hub.
6. Using a long drift or screwdriver pry the oil seal (**Figure 16**) from the right-hand side.
7. Using a long drift and hammer, tilt the distance collar away from one side of the right-hand bearing (**Figure 17**). Then drive the right-hand bearing out of the hub.
8. Remove the distance collar, then remove the left-hand bearing (**Figure 18**).
9. Clean the distance collar and hub thoroughly in solvent. Thoroughly dry with compressed air.
10. On ABS-equipped models, perform the following:

a. Inspect the ABS rotor (**Figure 19**) for wear or damage. Clean out any foreign matter that may have entered the area. If the teeth are damaged, refer to Chapter Eleven for service procedures.
b. Inspect the sensor tip (**Figure 20**) for cracks, bends or warpage.
c. Inspect the mounting flange (**Figure 21**) for elongation or damage. If the sensor is damaged in any way, replace the sensor and electrical cable as an assembly.
d. Inspect the sensor housing (**Figure 22**) for cracks or damage. Replace if necessary.

11. Tap the right-hand bearing into place carefully using a suitable size socket placed on the outer bearing race.

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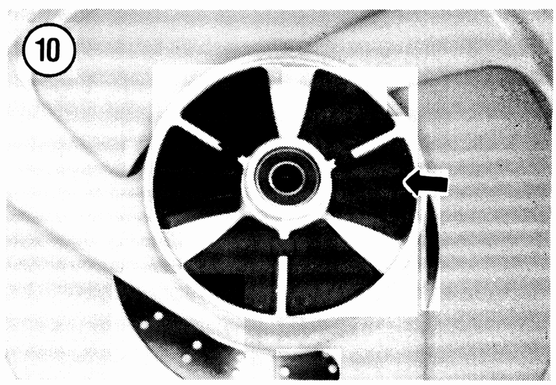

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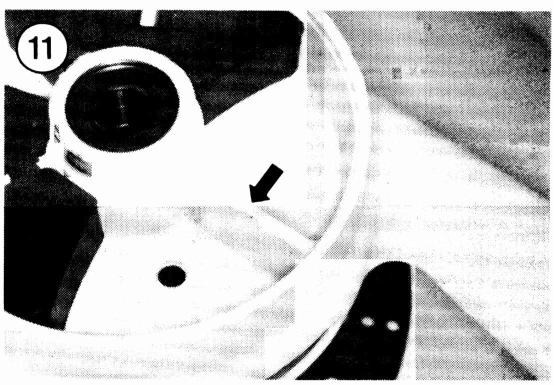
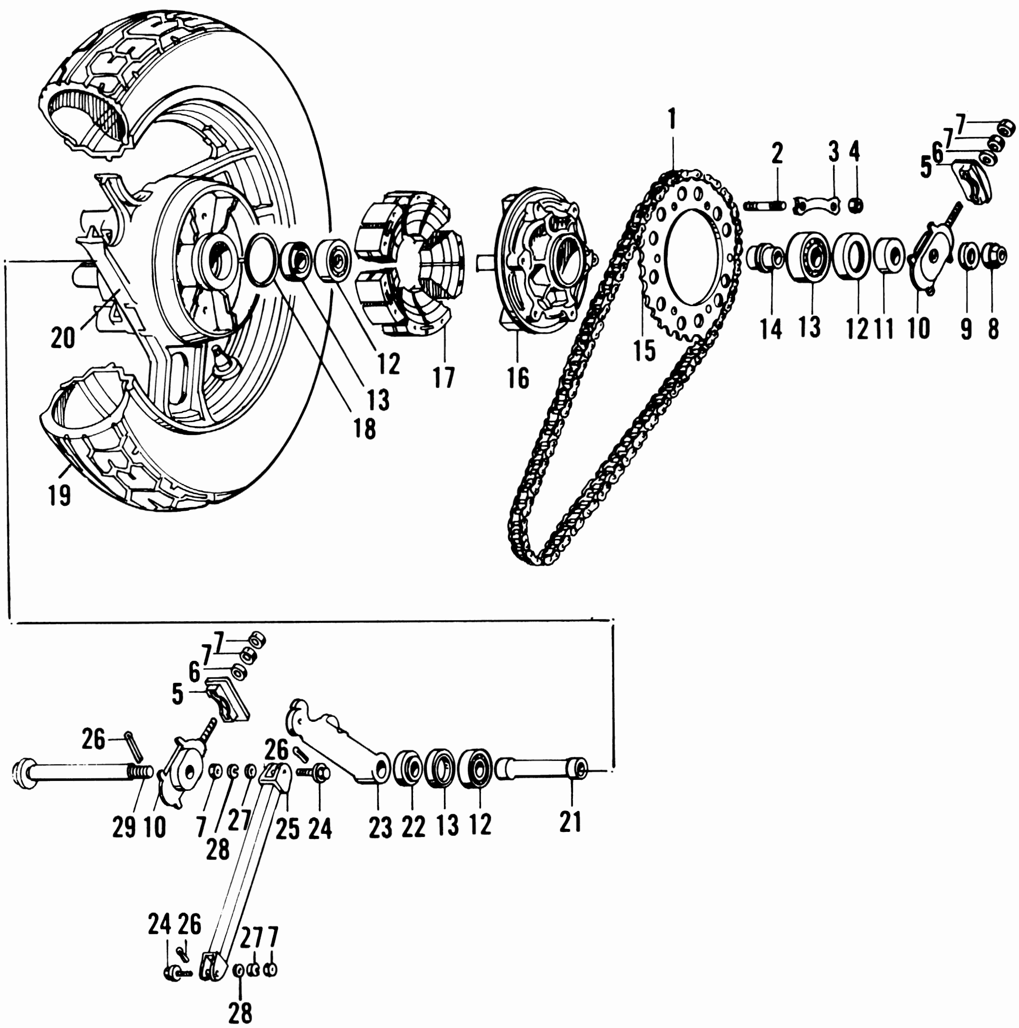


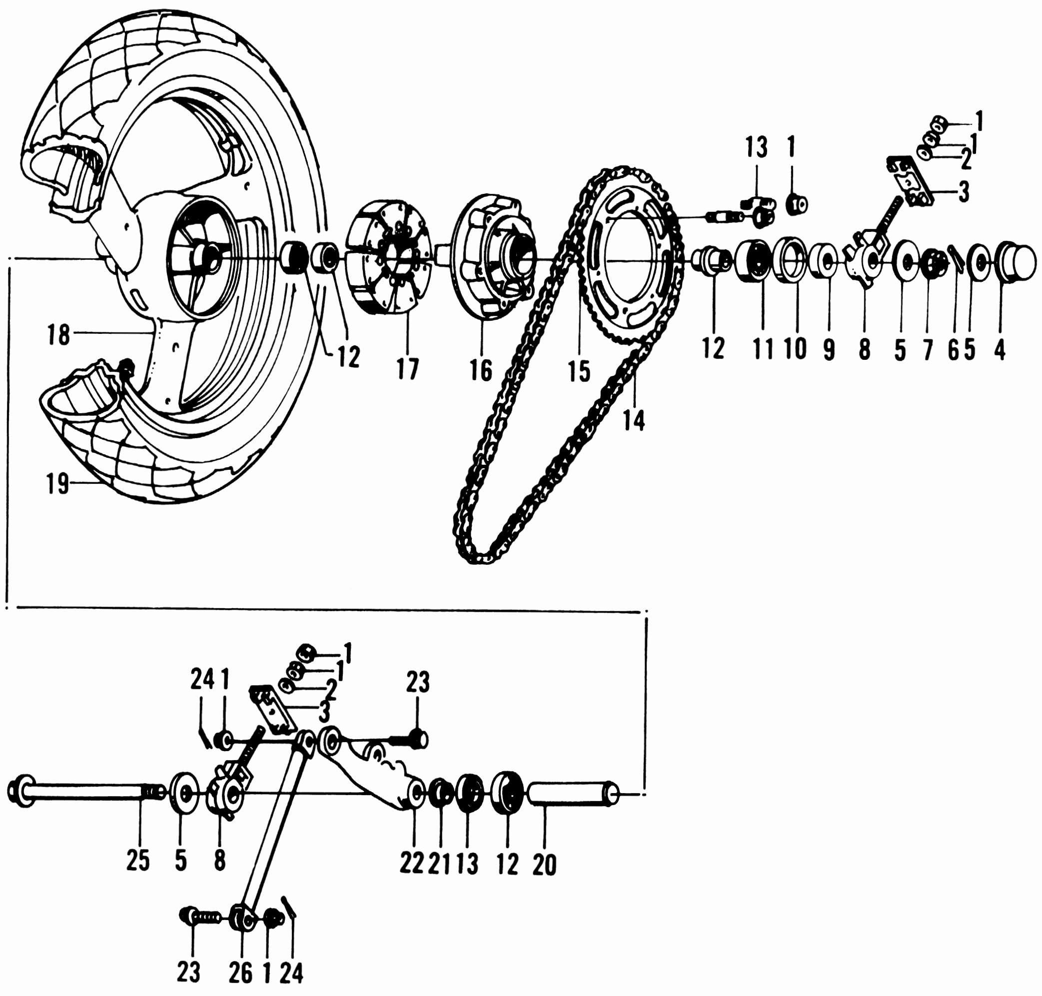
(12) REAR WHEEL AND CALIPER CARRIER (1984-1987)



1. Drive chain (closed loop)
2. Threaded stud
3. Lockwasher
4. Nut
5. Adjuster plate
6. Washer
7. Nut
8. Axle nut
9. Special washer
10. Chain adjuster
11. Spacer
12. Oil seal
13. Bearing
14. Spacer
15. Driven sprocket
16. Coupling hub
17. Rubber dampers
18. O-ring
19. Tire
20. Wheel
21. Distance collar
22. Spacer
23. Caliper carrier
24. Bolt
25. Rear brake torque link
26. Cotter pin
27. Washer
28. Lockwasher
29. Rear axle

(13)

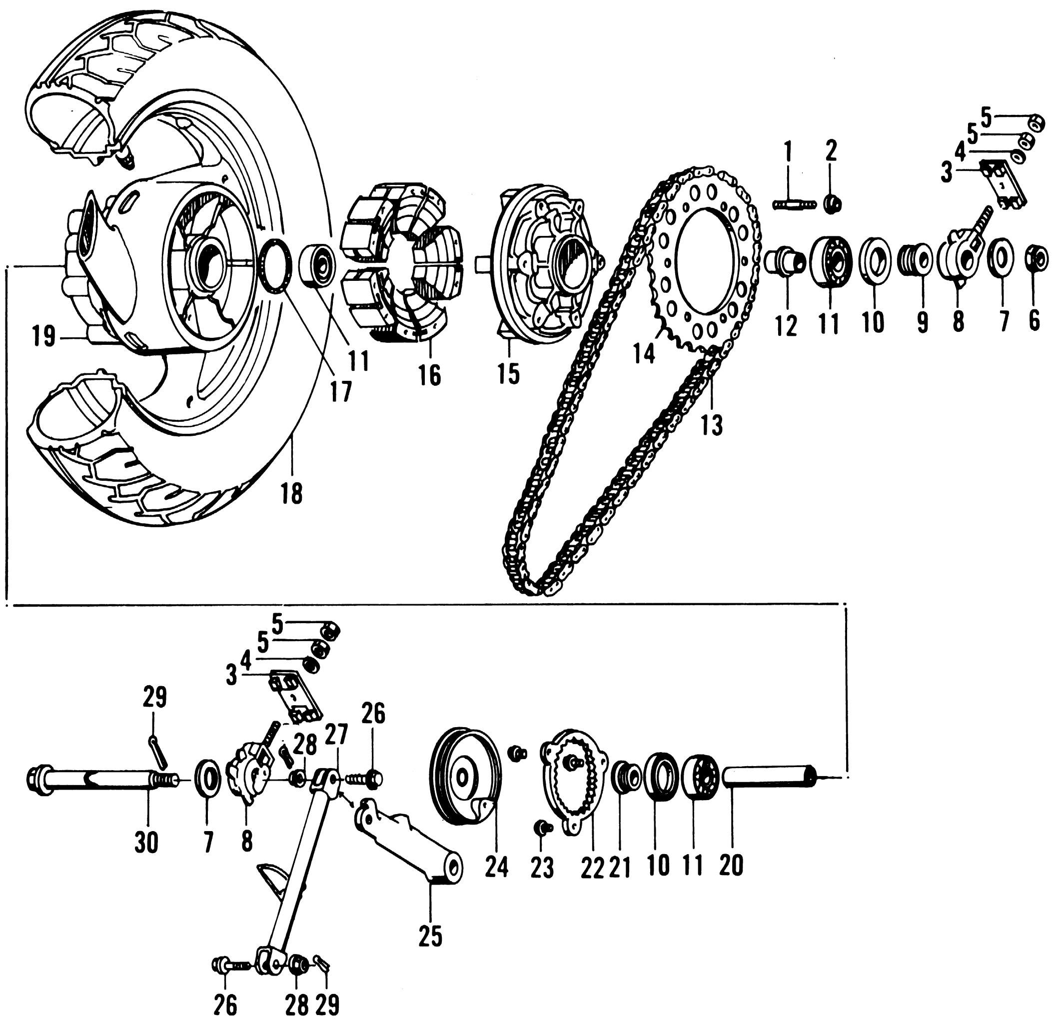
REAR WHEEL AND CALIPER CARRIER (1988-ON NON-ABS)



1. Nut
2. Washer
3. Adjuster plate
4. Cap
5. Washer
6. Cotter pin
7. Nut
8. Drive chain adjuster
9. Spacer
10. Oil seal
11. Bearing
12. Spacer
13. Threaded stud
14. Drive chain (closed loop)
15. Driven sprocket
16. Coupling hub
17. Rubber dampers
18. Wheel
19. Tire
20. Distance collar
21. Spacer
22. Caliper carrier
23. Bolt
24. Cotter pin
25. Rear axle
26. Rear brake torque link

14

REAR WHEEL AND CALIPER CARRIER (ABS MODELS)



1. Threaded stud	11. Bearing	21. Spacer
2. Nut	12. Spacer	22. Sensor rotor
3. Adjuster plate	13. Drive chain (closed loop)	23. Bolt
4. Washer	14. Driven sprocket	24. Sensor housing
5. Nut	15. Coupling hub	25. Caliper carrier
6. Nut	16. Rubber dampers	26. Bolt
7. Special washer	17. O-ring	27. Rear brake torque link
8. Drive chain adjuster	18. Tire	28. Nut
9. Spacer	19. Wheel	29. Cotter pin
10. Oil seal	20. Distance collar	30. Rear axle

12. Install the distance collar and install the left-hand bearing (**Figure 23**) as described in Step 7.

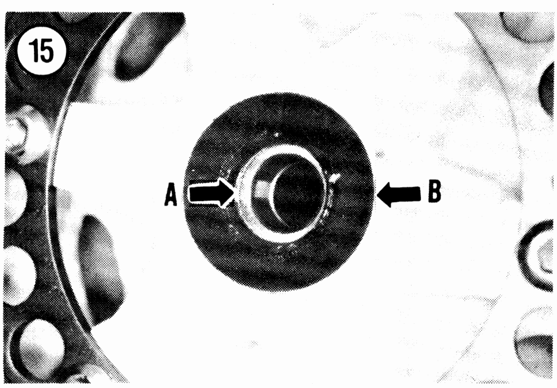
13. Install a new right-hand grease seal (B, **Figure 15**). Drive the seal in squarely with a large diameter socket on the outer portion of the seal. Drive the seal until it is flush with the side of the hub.

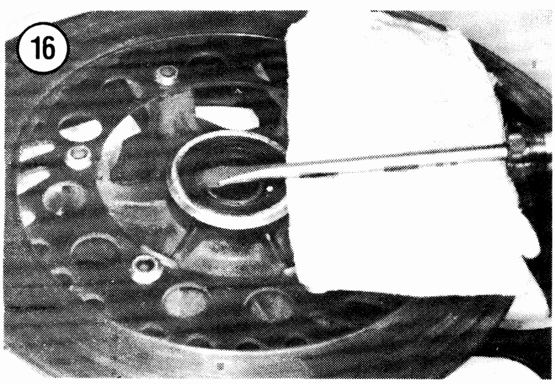
14. Install the axle spacers into the left-hand (**Figure 5**) and right-hand (**Figure 6**) side of the rear wheel hub.

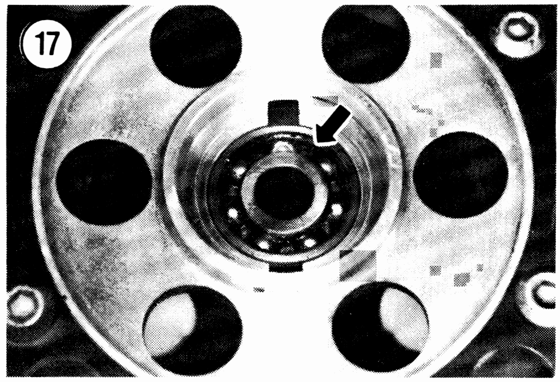
15. On ABS-equipped models, install the sensor housing into the hub. Push it in squarely until it is completely seated.

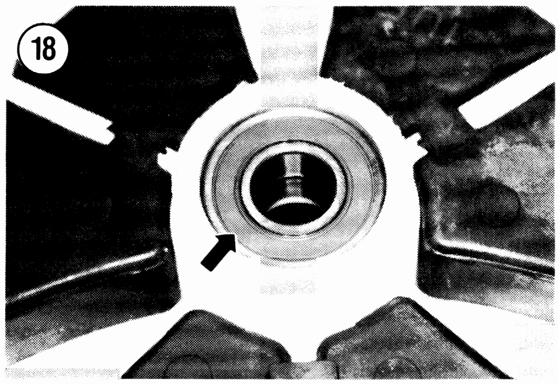
REAR SPROCKET AND COUPLING

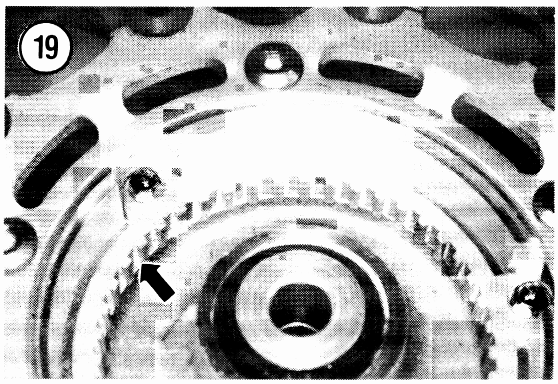
The rear wheel coupling (**Figure 24**) connects the rear sprocket to the rear wheel. The coupling housing is equipped with an oil seal, ball bearing and spacer. Rubber shock dampers installed in the coupling absorb some of the shock that results from torque changes during acceleration or braking.

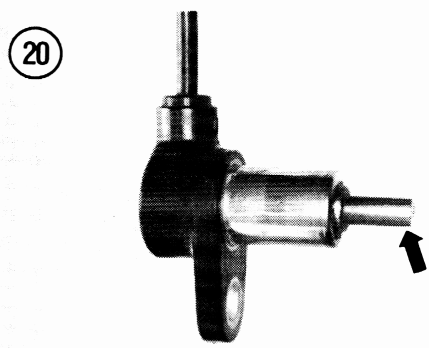












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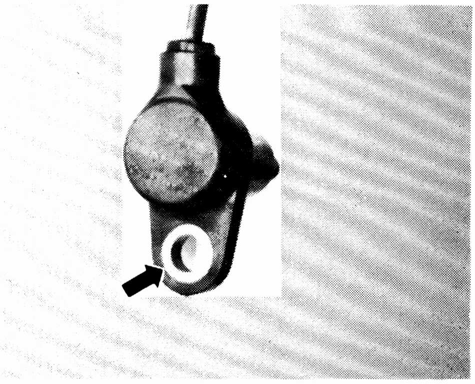

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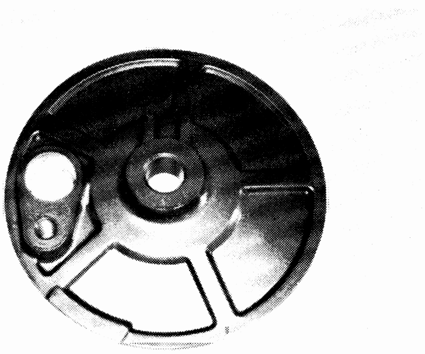

Removal/Installation

Refer to the following illustrations for this procedure:

a. 1984-1987 models: **Figure 12**.
b. 1988-on non-ABS models: **Figure 13**.
c. ABS-equipped models: **Figure 14**.

1. Remove the rear wheel as described in this chapter.
2. Pull the rear wheel coupling assembly (**Figure 25**) up and out of the wheel hub.

NOTE
There is a locating and holding boss on the backside of the damper that goes into a hole in the coupling hub.

3. Pull the dampers (**Figure 26**) out of the wheel hub.
4. Remove the spacer (**Figure 27**) from the coupling hub.
5. To remove the sprocket, loosen and remove the nuts (A, **Figure 28**) and lift the sprocket (B, **Figure 28**) off of the coupling hub.
6. Perform *Inspection/Disassembly/Reassembly* as described in this chapter.

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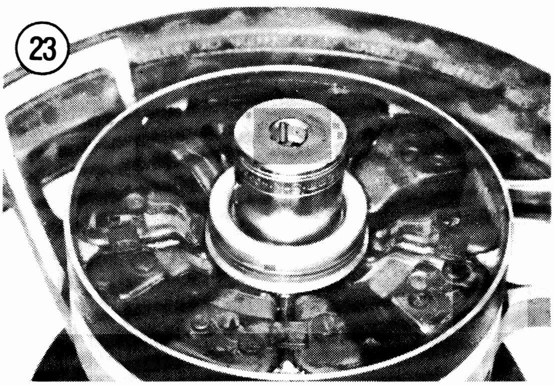

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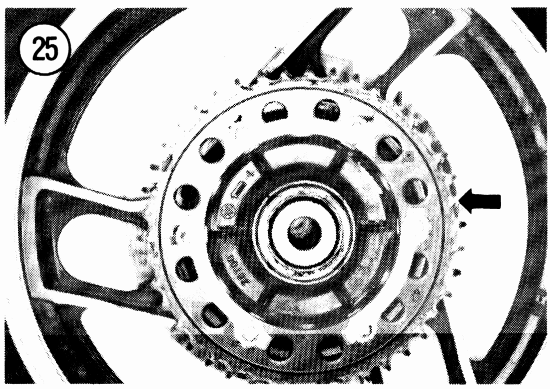

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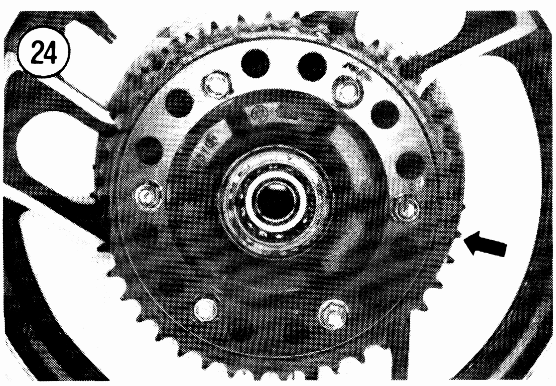

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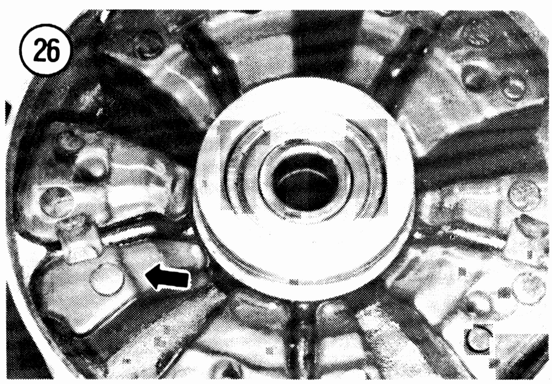

7. Install by reversing these removal steps while noting the following:
   a. Apply blue Loctite (No. 242) to the sprocket threaded studs prior to installing the nuts.
   b. Install new self-locking nuts and tighten securely.

Inspection/Disassembly/Reassembly

1. Visually inspect the rubber dampers (**Figure 29**) for damage or deterioration. Replace, if necessary, as a complete set.
2. Inspect the coupling hub and damper separators (**Figure 30**) for cracks or damage. Replace the coupling hub if necessary.
3. If necessary, replace the coupling housing bearing as follows:
   a. If not already removed, remove the left-hand spacer (**Figure 31**).
   b. Use a long screwdriver and pry the oil seal (**Figure 32**) from each side of the hub. Place a shop cloth under the screwdriver to protect the hub surface.
   c. Using a large diameter socket or drift on the bearing, drive it out of the hub (from the inside out).
   d. Discard the bearing.
   e. Clean the hub thoroughly in solvent and check for cracks or damage in the bearing area.
   f. Blow any dirt or foreign matter out of the hub prior to installing the bearing.
   g. Pack non-sealed bearings with grease before installation. Sealed bearings do not require packing.
   h. Tap the bearing into position with a socket placed on the outer bearing race.
   i. Install a new seal by driving it in squarely with a socket and hammer.

Driven Sprocket Inspection

Inspect the driven sprocket teeth (**Figure 33**). If the teeth are visibly worn, replace both the drive and driven sprockets and the drive chain. Never replace any one sprocket or chain as a separate item; worn parts will cause rapid wear of the new component.

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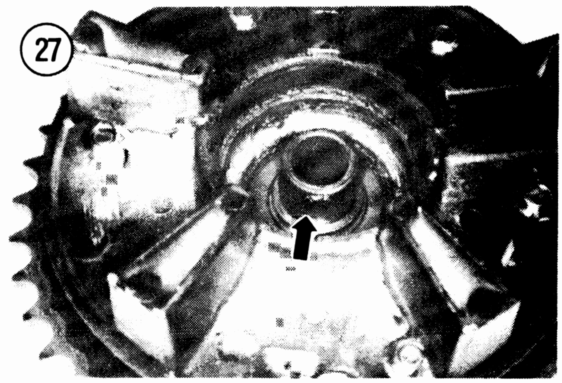

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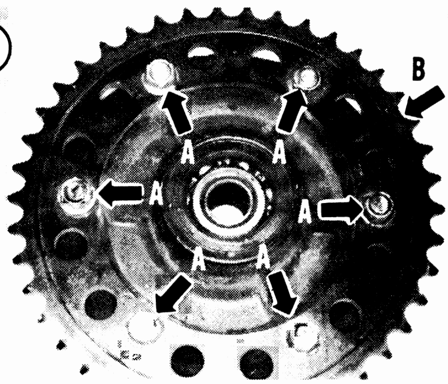

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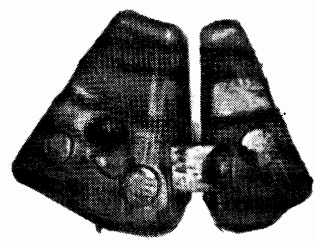

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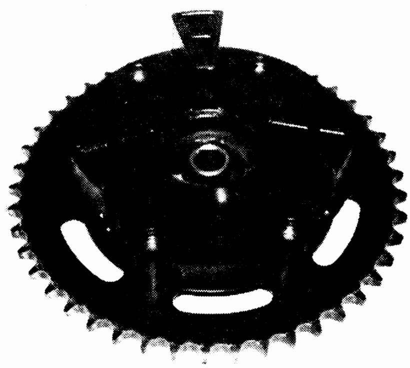

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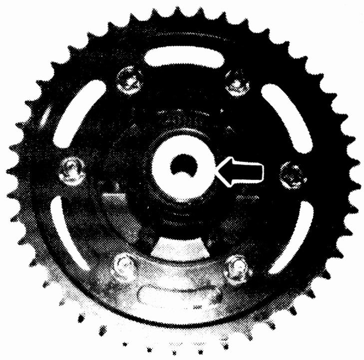

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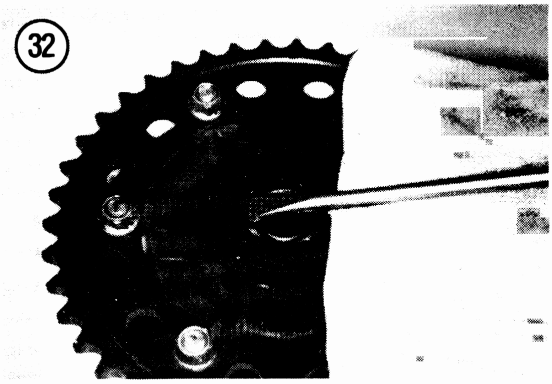

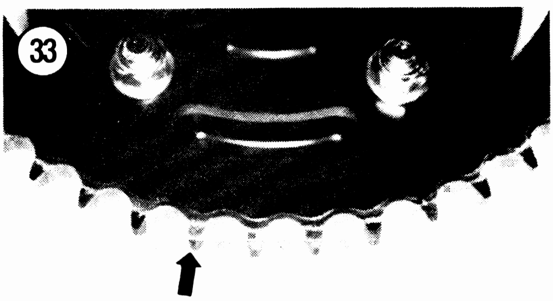

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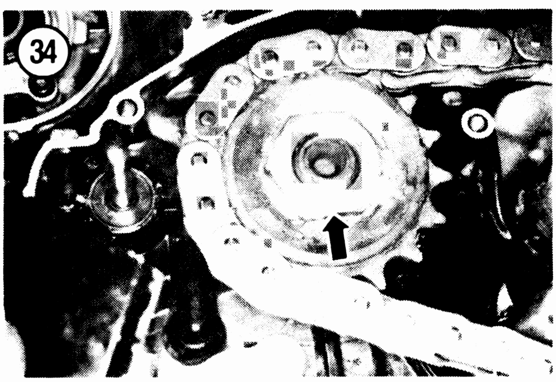

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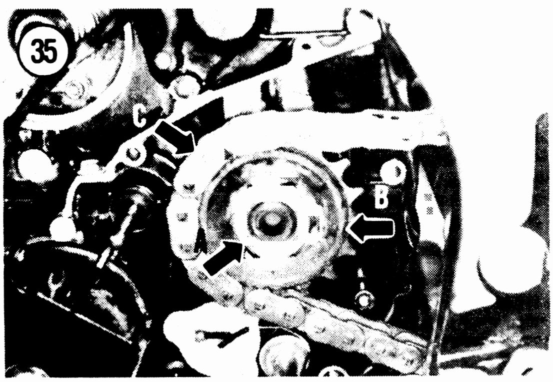

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DRIVE CHAIN

Because the drive chain is endless (has no master link), the swing arm must be removed to remove the drive chain.

WARNING
Yamaha uses an endless chain on all models for strength and reliability. Do ***not*** *cut the chain with a chain cutter or install a chain with a master link. The chain may fail and rear wheel lockup and an accident could result.*

Removal

1. Remove the left-hand crankcase cover as described in Chapter Four.
2. Straighten the locking tab on the lockwasher (**Figure 34**).
3. Have an assistant apply the rear brake and loosen the drive sprocket nut (A, **Figure 35**). Remove the nut and lockwasher.
4. Slide the drive sprocket (B, **Figure 35**) and drive chain (C, **Figure 35**) off the transmission shaft.
5. Remove the rear wheel and the swing arm as described in this chapter.
6. Slip the drive chain off of the swing arm.

Installation

1. Install the drive chain over the swing arm and install the swing arm and rear wheel as described in this chapter.
2. Mesh the drive chain onto the drive sprocket and slide the drive sprocket (B, **Figure 35**) and drive chain (C, **Figure 35**) onto the transmission shaft. Push the sprocket on until it bottoms out.

3. Install a new lockwasher, then install the drive sprocket nut.
4. Have an assistant apply the rear brake and tighten the drive sprocket nut to the torque specification listed in **Table 2**.
5. Bend up a locking tab (**Figure 34**) of the lockwasher against one of the flats on the drive sprocket nut.
6. Install the left-hand crankcase cover as described in Chapter Four.
7. Adjust the drive chain as described under *Drive Chain Adjustment* in Chapter Three.
8. Tighten the rear axle nut to the torque specification listed **Table 2**.
9. Rotate the wheel several times to make sure it rotates smoothly. Apply the brake several times to make sure it operates correctly.
10. Adjust the rear brake as described under *Rear Brake Pedal Height Adjustment* and *Rear Brake Light Switch Adjustment* in Chapter Three.

Cleaning and Inspection

Occasionally, the drive chain should be removed from the bike for a thorough cleaning and inspection.

CAUTION
The factory drive chain is equipped with O-rings between the side plates that seal lubricant between the pins and bushings. To prevent damaging these O-rings, use only kerosene for cleaning. Do not steam clean nor use gasoline or other solvents that will cause the O-rings to swell or deteriorate.

1. Brush off excess dirt and grit from the drive chain with a stiff paint brush.
2. Remove the drive chain as described in this chapter.
3. Soak the chain in kerosene for about half an hour. Move it around and flex it during this period so that dirt between the pins and rollers may work its way out. Clean it thoroughly.
4. Dry the chain with a shop cloth, then hang the chain from a piece of wire and allow it to air dry.
5. After cleaning the chain, examine it carefully for wear or damage. Check the O-rings, side plates and rollers for damage. Check the inner surface of the side plates. They should be lightly polished on both sides. If they show considerable wear of both sides, the drive and driven sprockets are not properly aligned. Align them as described under *Drive Chain Adjustment* in Chapter Three. If any signs of wear are visible on the drive chain, replace it.
6. Inspect the drive sprocket for wear or damage (**Figure 36**). If any wear is visible on the teeth, replace the sprocket. If the sprocket is replaced, also replace the drive chain and the driven sprocket. Never install a new chain over worn sprockets or a worn chain over new sprockets.
7. Install the chain on the motorcycle as described in this chapter.

Lubrication

For lubrication of the drive chain, refer to *Drive Chain Lubrication* in Chapter Three.

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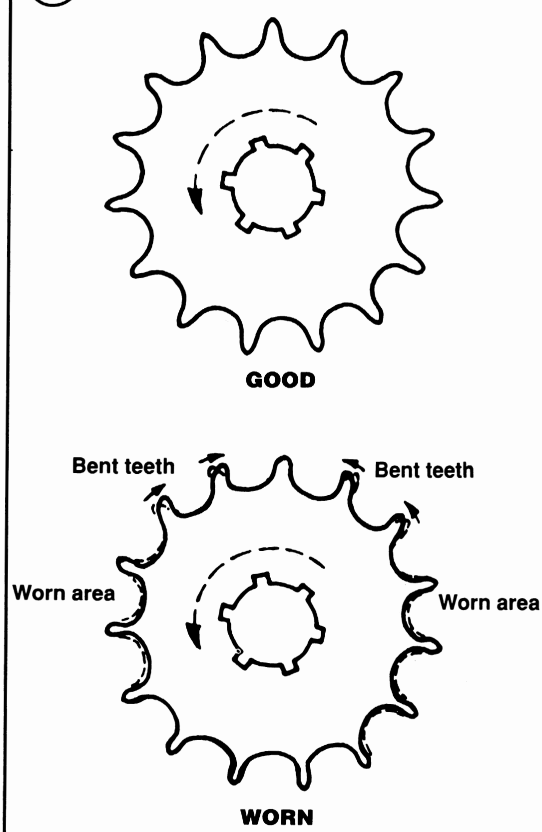


WHEEL BALANCING

For complete information refer to *Wheel Balance* in Chapter Nine.

TIRE CHANGING AND REPAIR

Refer to *Tubeless Tires* and *Tubeless Tire Changing* in Chapter Nine.

SHOCK ABSORBER

Removal (1984-1990)

Refer to **Figure 37** for this procedure.

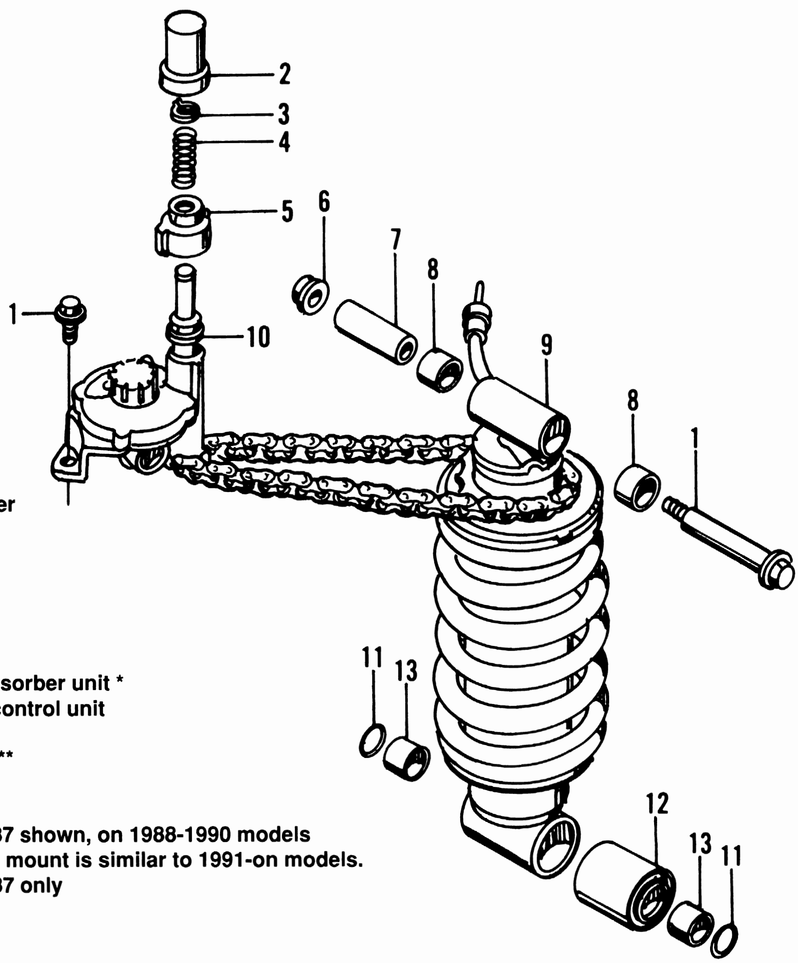
1. Place the bike securely on the centerstand with the rear wheel clear of the ground.
2. Remove both frame side covers.
3. Remove the bolts (**Figure 38**) securing the remote control unit.
4. Move the remote control unit off the frame and disengage the chain from it.
5. Remove the upper bolt and nut (**Figure 39**) securing the shock absorber to the frame.

6A. On 1984-1987 models, perform the following:

  a. Remove the circlip and washer (**Figure 40**) on relay arm No. 2.
  b. Loosen both pinch bolts (A, **Figure 41**) on relay arm No. 2.

(37)

SHOCK ABSORBER (1984-1990)



1. Bolt
2. Dust cover
3. Circlip
4. Spring
5. Cover
6. Nut
7. Collar
8. Bushing
9. Shock absorber unit *
10. Remote control unit
11. O-ring **
12. Bushing **
13. Collar **

* 1984-1987 shown, on 1988-1990 models the lower mount is similar to 1991-on models.
** 1984-1987 only

c. Hold onto the shock absorber and withdraw the pivot shaft (B, **Figure 41**) from relay arm No. 2 and the lower mount of the shock absorber.

d. Move the relay arm No. 1 and No. 2 apart and lower the shock absorber (**Figure 42**) and chain out through the frame and the swing arm and remove it. Don't lose the O-ring seal on each side of the lower pivot point.

6B. On 1988-1990 models, perform the following:

a. Remove the lower bolt, washer and nut securing the right-hand and left-hand control arms to the relay arm.

b. Move both control arms toward the rear and out of the way.

c. Remove the bolt, washer and nut securing the lower portion of the shock absorber to the relay arm.

d. Raise the swing arm and lower the shock absorber out through the swing arm and remove it.

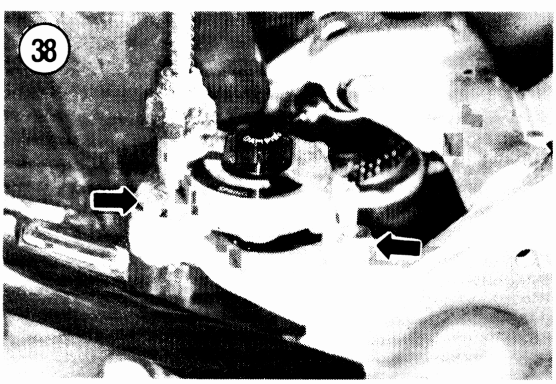
NOTE
Install the lower shock absorber bolt and nut through the relay arm to prevent losing the relay arm collars.

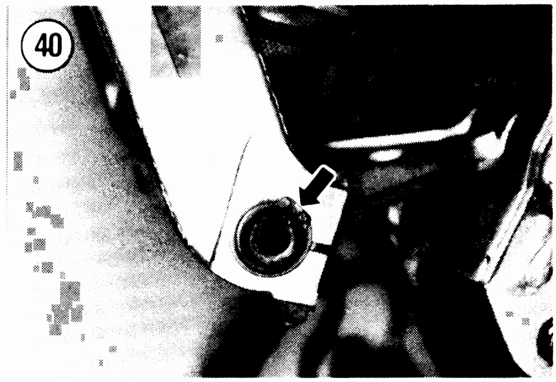
7. Inspect the shock absorber as described in this chapter.

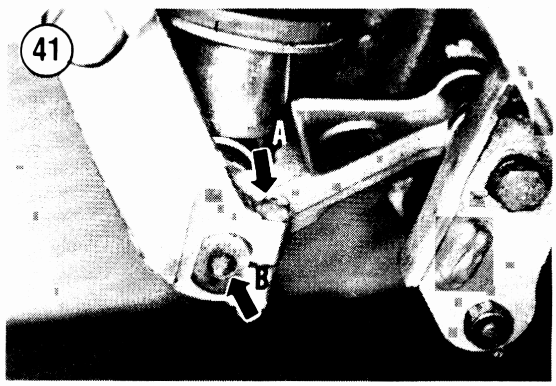
Inspection (1984-1990)

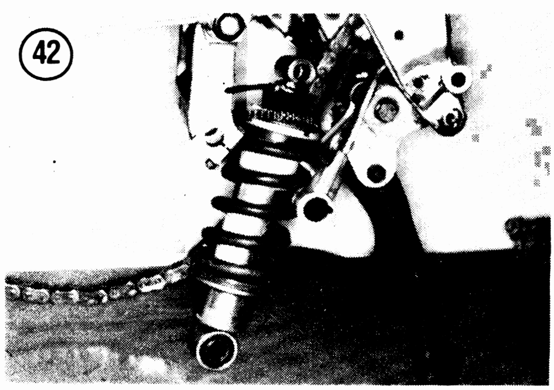
Refer to **Figure 37** for this procedure.

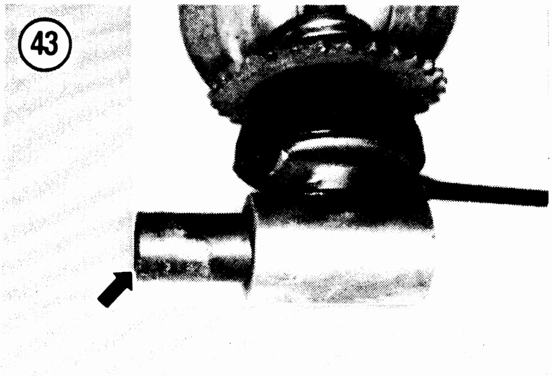
NOTE
The shock absorber cannot be disassembled and rebuilt; if damaged or de-











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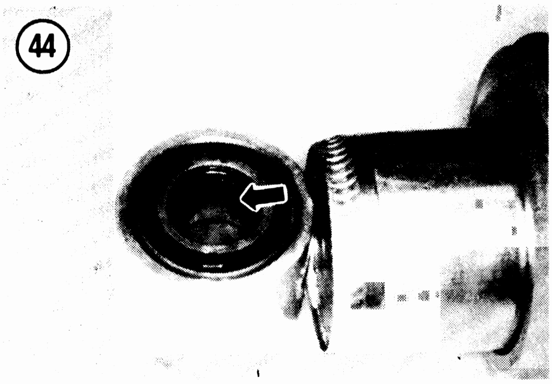
fective in any way it must be replaced as an assembly.

WARNING

The shock absorber contains highly compressed nitrogen gas. Do not tamper with or attempt to open the cylinder. Do not place it near an open flame or other extreme heat. Do not weld on the frame near it. Do not dispose of the shock absorber yourself. Take it to a Yamaha dealer where it can be deactivated and disposed of properly.



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1. Remove the upper collar (**Figure 43**) and 2 lower collars (**Figure 44**) from the shock absorber.
2. Inspect the collars for galling, cracks or other damage, replace if necessary. If the collars are in satisfactory condition, apply a coat of molybdenum disulfide grease to them and reinstall them. If damaged, they must be replaced.
3. Inspect the spring (**Figure 45**) for cracks or damage. If damaged, replace the shock absorber assembly.
4. Check the upper (A, **Figure 46**) and lower spring seats for cracks or looseness. If damaged, replace the shock absorber assembly.
5. Check the damper unit (B, **Figure 46**) for oil leakage. If there is any type of leakage, replace the shock absorber assembly.
6. Inspect the spring preload adjust sprocket (**Figure 47**) for wear or damage. If damaged, replace the shock absorber assembly.
7. Inspect the remote control unit. Rotate the spring damping control knob (**Figure 48**) and check for smooth operation. Inspect the spring preload sprocket (**Figure 49**) for wear or damage. If damaged, replace the remote control unit assembly.

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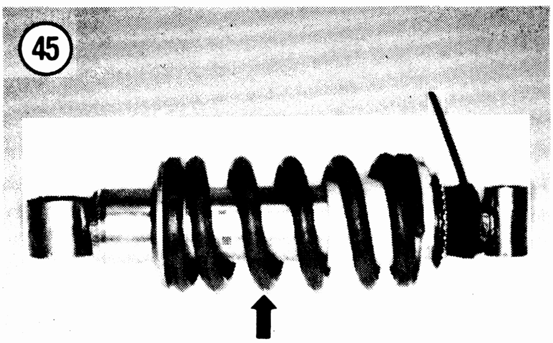

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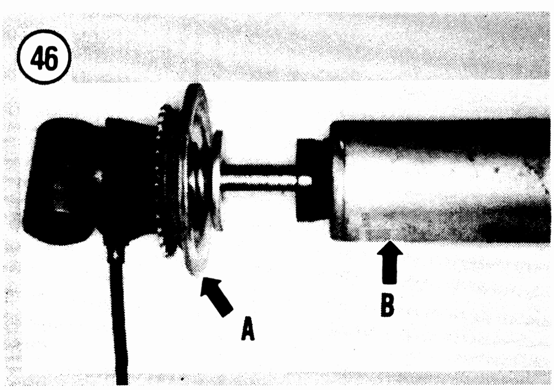

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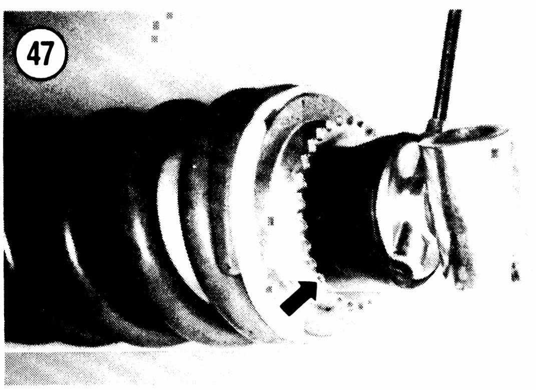

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8. Inspect the spring damping chain (**Figure 50**) for uneven wear, stiffness or damage; replace if necessary.

Installation (1984-1987)

Refer to **Figure 37** for this procedure.

1. Apply molybdenum grease to all bushings, collars, the lower pivot shaft and O-ring seals.
2. Position the shock absorber with the damper control wire facing toward the right-hand side of the bike (**Figure 42**).
3. Install the chain onto shock absorber and install this assembly up through the swing arm and into position in the frame.
4. Install the upper mounting bolt and nut (**Figure 39**) and tighten to the torque specification listed in **Table 2.**
5. If removed, install the O-ring seal on each side of the lower pivot point.
6. Move the relay arm No. 1 and No. 2 together and onto the lower pivot point of the shock absorber. Install the pivot shaft (B, **Figure 41**) in from the left-hand side and through both relay arms and the shock absorber.
7. Install the washer and circlip (**Figure 40**) onto the pivot shaft. Make sure the circlip is correctly seated in the pivot shaft.
8. Tighten both pivot shaft pinch bolts (A, **Figure 41**) to the torque specification listed in **Table 2.**
9. Rotate the damper control wire *counterclockwise* until it stops. Then rotate it *clockwise* until the top flat surface on the wire is horizontal.
10. Adjust the remote control unit to the following:
    a. Spring preload to No. 3
    b. Damping to No. 3
11. Move the remote control unit into place and connect the damper control wire into the control unit.
12. Make sure the chain is still properly meshed with the shock absorber sprocket.

NOTE
After the chain is meshed onto the remote control unit, the unit should not be rotated in either direction in order to install it onto the frame. If the control unit is rotated during installation it will alter the spring preload adjustment set in Step 10.

13. Hold the remote control unit in the exact position that it will be installed onto the frame and then mesh the chain onto the remote control unit sprocket (**Figure 51**).
14. Place the remote control unit on the frame mounting plate and install the mounting bolts (**Figure 38**). Tighten the bolts finger-tight at this time.
15. Pull on the remote control unit and check the chain slack on each side of the sprockets. The specified slack is 3-5 mm (0.12-0.20 in.) and it must be the same on each side.

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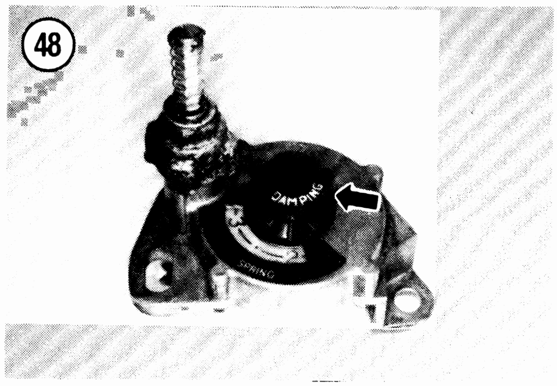

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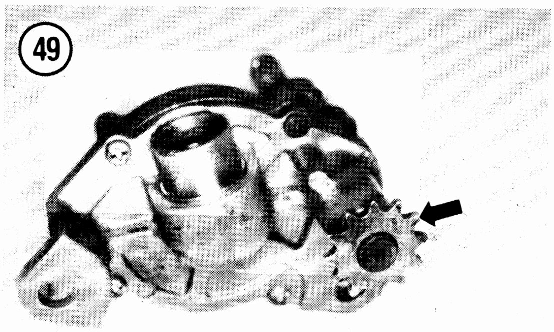

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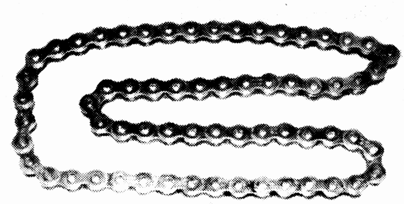
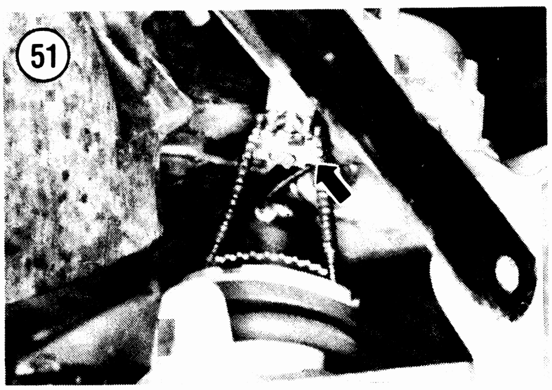
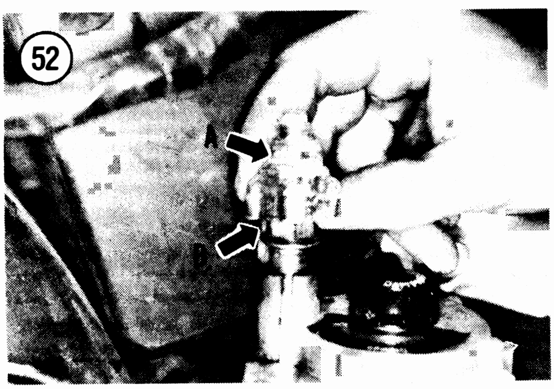


16. If the chain slack is not within specification, pull up the dust cover (A, **Figure 52**) and rotate the spring preload adjuster (B, **Figure 52**) until the chain slack is correct. Push the dust cover back into place.
17. Hold the remote control unit in this position and first tighten the rear mounting bolt, then the front mounting bolt. Tighten both bolts to the torque specification listed in **Table 2**.
18. Recheck chain slack on both sides of the chain. If the slack is not correct, loosen the bolts and repeat Steps 15-17.

Installation (1988-1990)

1. Apply molybdenum grease to all bearings, spacers and dust seals.
2. Make sure the collar is in place on each side of the relay arm.
3. Remove the lower shock absorber bolt and nut holding the relay arms and the relay arm collars together.
4. Install the shock absorber up through the swing arm and into position in the frame.





5. Install the upper mounting bolt and nut and tighten to the torque specification listed in **Table 2**.
6. Align the lower shock mount with the relay arm. Install the bolt, washer and nut securing the lower portion of the shock absorber to the relay arm. Tighten the nut to the torque specification listed in **Table 2**.
7. Move the right-hand and left-hand control arms toward the front and align them with the relay arm and install the lower bolt, washer and nut. Tighten the nut to the torque specification listed in **Table 2**.

Removal/Installation (1991-on)

Refer to **Figure 53** for this procedure.

1. Place the bike securely on the centerstand with the rear wheel clear of the ground.
2. Remove the seat and both frame side covers.
3. Remove the lower bolt, washer and nut (A, **Figure 54**) securing the right-hand and left-hand control arms (B, **Figure 54**) to the relay arm.
4. Move both control arms toward the rear and out of the way.
5. Remove the bolt, washer and nut (C, **Figure 54**) securing the lower portion of the shock absorber to the relay arm.
6. Remove the bolt, washer and nut (**Figure 55**) securing the upper portion of the shock absorber to the frame.
7. Raise the swing arm and lower the shock absorber out through the swing arm and remove it.

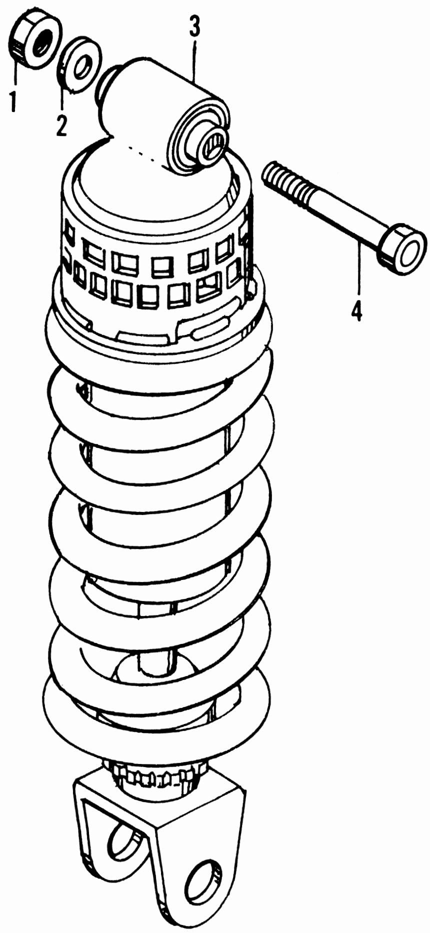
NOTE
Install the lower shock absorber bolt and nut through the relay arm to prevent losing the relay arm collars.

WARNING
*The shock absorber contains highly compressed nitrogen gas. Do not tamper with or attempt to open the cylinder (**Figure 56**). Do not place it near an open flame or other extreme heat. Do not weld on the frame near it. Do not dispose of the shock absorber yourself. Take it to a Yamaha dealer where it can be deactivated and disposed of properly.*

8. Installation is the reverse of these steps while noting the following:

a. Apply molybdenum grease to all bearings, spacers and dust seals.
b. Tighten the upper shock absorber bolt and nut to the specifications in **Table 2**.
c. Make sure the collar is in place on each side of the relay arm.
d. Tighten the lower shock absorber bolt and nut to the torque specification listed in **Table 2**.

SHOCK ABSORBER (1991-ON)



1. Nut
2. Washer
3. Shock absorber unit
4. Bolt

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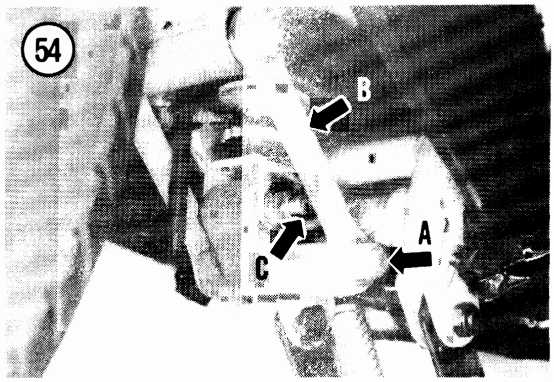

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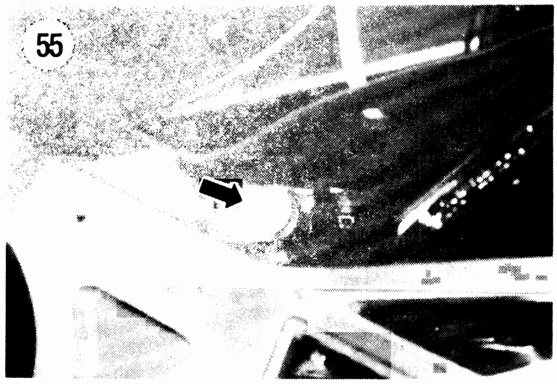

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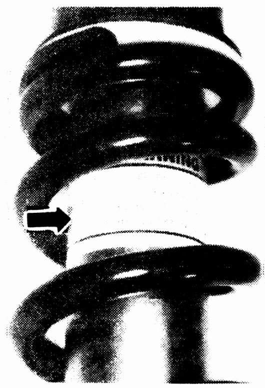

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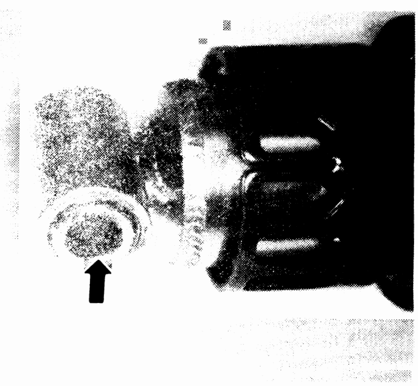

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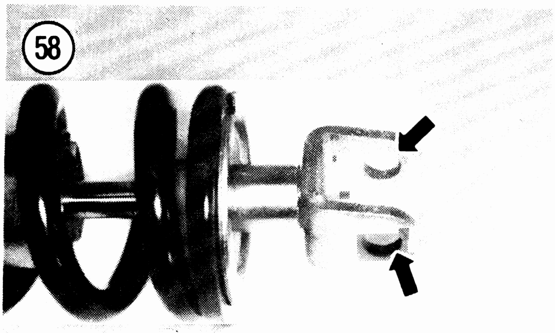

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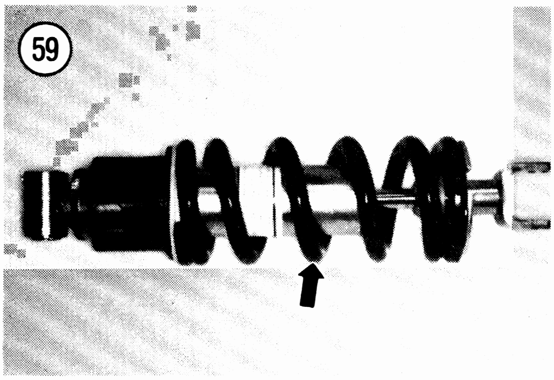

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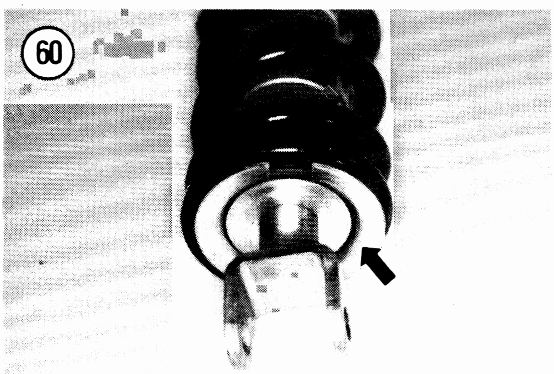

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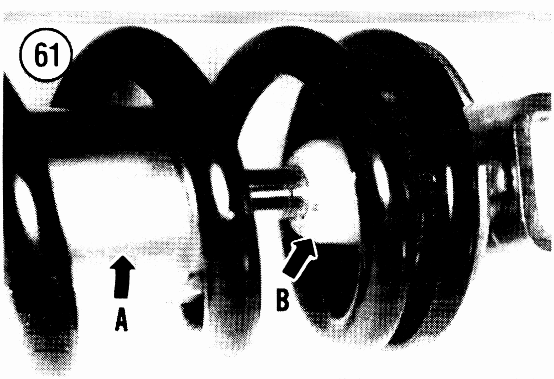


e. Tighten the connecting arm-to-relay arm bolt and nut to the torque specification listed in **Table 2**.

Inspection (1991-on)

Refer to **Figure 53** for this procedure.

NOTE
The shock absorber cannot be disassembled and rebuilt; it must be replaced as an assembly.

1. Remove the collar (**Figure 57**) from the shock absorber upper mount.
2. Inspect the collar for galling, cracks or other damage, replace if necessary.
3. Inspect the shock absorber lower mount holes (**Figure 58**) for elongation, cracks or other damage. If damaged, replace the shock absorber assembly.
4. Inspect the spring (**Figure 59**) for cracks or damage. If damaged, replace the shock absorber assembly.
5. Check the lower spring seat (**Figure 60**) for cracks or looseness. If damaged, replace the shock absorber assembly.
6. Check the damper unit (A, **Figure 61**) for oil leakage. If there is any type of leakage, replace the shock absorber assembly.
7. Inspect the rubber stopper (B, **Figure 61**) for deterioration or damage. If damaged, replace the shock absorber assembly.

10

SWING ARM

Removal/Installation

Refer to **Figure 62** for this procedure.

NOTE
This procedure is shown on a model equipped with the 1984-1987 model shock linkage.

1. Remove the rear wheel as described in this chapter.
2. Remove the exhaust system as described in Chapter Seven.
3. Before removing the pivot shaft nut, check swing arm side play as follows:

a. Grasp the swing arm at the rear and hold it in a horizontal position.

b. Check swing arm side play by moving the swing arm from side to side. There should be no noticeable side play.

c. Check swing arm movement by moving it up and down. The swing arm should move smoothly with no tightness or binding.

d. If the swing arm moved abnormally during this test, replace the swing arm bearings as described in this chapter.

4. Remove the pivot shaft nut and washer (**Figure 63**).

5. Remove the shock absorber as described in this chapter.

6. Have an assistant hold onto the swing arm or place a box under it to support it after the pivot shaft is removed.

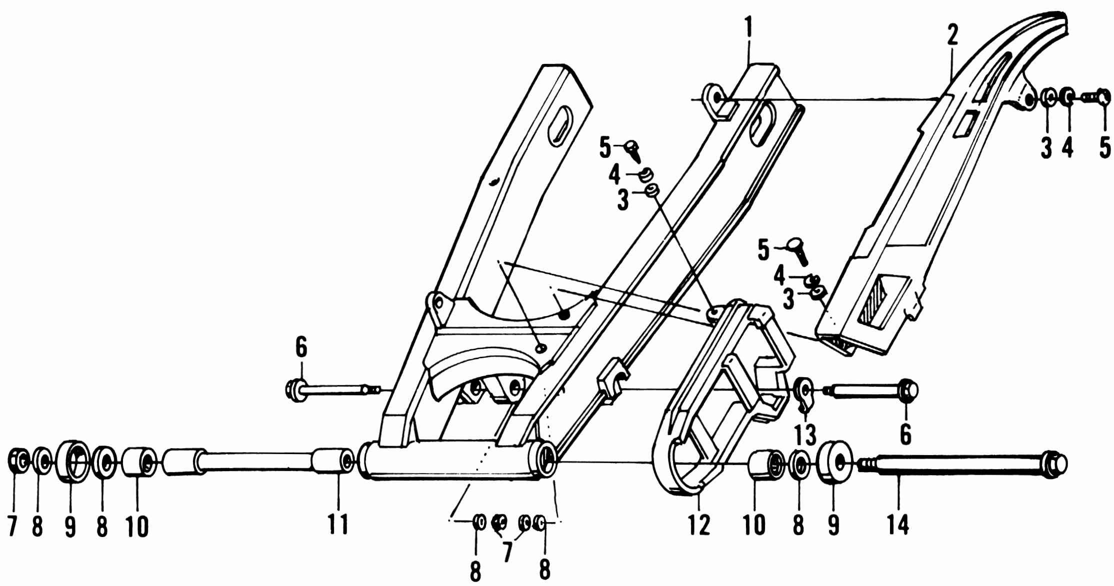
7. Push the pivot shaft (**Figure 64**) out and withdraw it from the left-hand side. If the pivot shaft is tight, use an aluminum or brass drift and tap the pivot shaft out.

NOTE

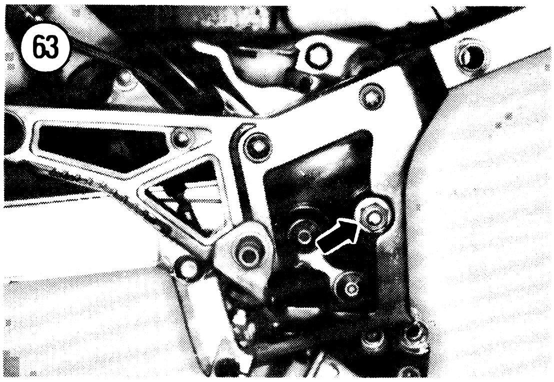
If the pivot shaft is real tight, try to push it out far enough so that its left end is clear of the frame. Then use an adjustable wrench on the end of the pivot shaft and turn the shaft back and forth to help break it loose. Continue to remove the pivot shaft with the brass or aluminum drift. If necessary, spray WD-40 into the pivot shaft hole in the swing arm and let it set for 15-30 minutes.

8. Move the swing arm slightly toward the front and then up. Now pull the swing arm toward the rear, around the drive chain and away from the frame and

(62) **SWING ARM**



1. Swing arm
2. Drive chain guard
3. Washer
4. Lockwasher
5. Screw
6. Bolt
7. Nut
8. Washer
9. Thrust cover
10. Needle bearing
11. Pivot bushing
12. Drive chain slipper
13. Special washer
14. Pivot bolt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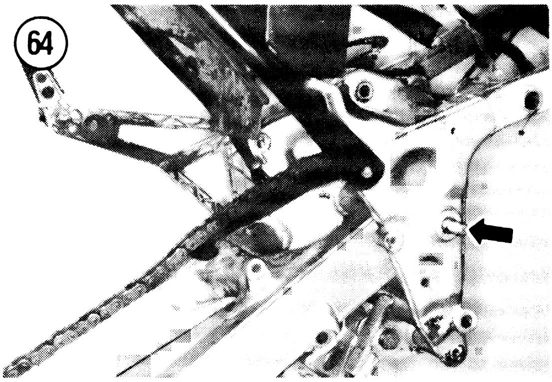
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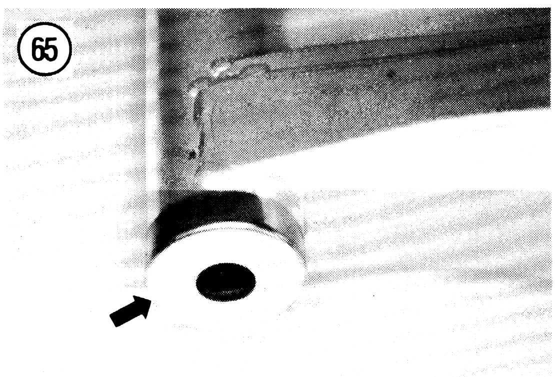
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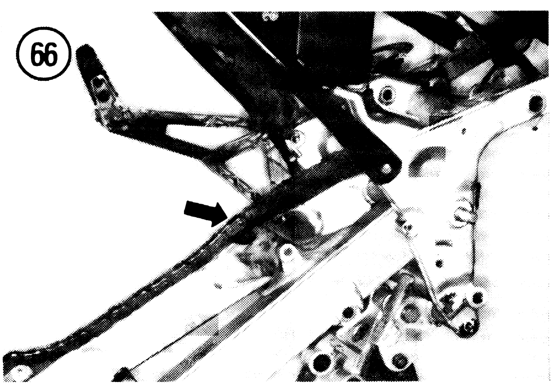
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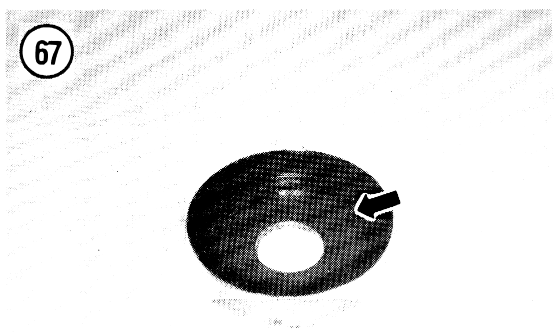
remove it. Don't lose the thrust covers and washers (**Figure 65**), as they may fall off during removal.
9. Inspect the swing arm, bearings and spacer as described in this chapter.
10. Installation is the reverse of these steps while noting the following:
   a. Apply molybdenum disulfide grease onto the bushing and onto the exterior of the pivot shaft.
   b. Tighten the swing arm pivot shaft nut to the torque specification listed in **Table 2**.
   c. Be sure to link the drive chain (**Figure 66**) over the swing arm prior to installing the swing arm pivot shaft and nut.
   d. Tighten the muffler bracket mounting bolts to the torque specification listed in **Table 2**.
   e. Adjust the drive chain as described under *Drive Chain Adjustment* in Chapter Three.

Swing Arm Inspection and Pivot Shaft Bearing Replacement

Refer to **Figure 62** for this procedure.
1. Remove the shock linkage from the swing arm as described in this chapter.
2. If still in place, carefully pry the thrust covers (**Figure 65**) off the ends of the swing arm. The washer (**Figure 67**) will usually stay with the thrust cover, if not remove the washer from the ends of the swing arm.
3. Slide the pivot shaft bushing (**Figure 68**) out of the swing arm pivot area. Inspect the bushing for wear or damage and replace if necessary.
4. Inspect the swing arm (**Figure 69**) for cracks, twisting, weld breakage or other damage. Refer repair to a competent welding shop or if damage is severe, replace the swing arm.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5A. On 1984-1987 models, inspect the relay arm No. 2 mounting bosses (**Figure 70**) for cracks or other damage. If damage is severe, replace the swing arm.
5B. On 1988-on models, inspect the connecting rod pivot area of the swing arm as described under *Shock Linkage* in this chapter.
6. The needle bearings at each end of the pivot area wear very slowly and the wear is difficult to measure. Turn the bearings (**Figure 71**) with your fingers. Make sure they rotate smoothly. Check the needles for evidence of wear, pitting or color change indicating heat from lack of lubrication. In severe instances, the needles will fall out of the bearing cage.
7. Replace the bearings as follows:
   a. Using a long metal rod or drift punch, tap one of the bearings out of the swing arm (**Figure 72**).
   b. Remove the opposite bearing in the same manner.
   c. Clean the swing arm bearing bore with solvent and allow to dry.
   d. Lubricate the bearings with oil before installation.
   e. Install the new bearings with a hydraulic press. If a press is not available, a bearing installer can be fabricated with a socket, 3 large washers, a long threaded rod and 2 nuts. Assemble the washers, threaded rod, bearing and nuts as shown in **Figure 73**. Hold the lower nut with a wrench and turn the upper nut to pull the bearing into the swing arm. Turn the nut slowly and watch the bearing carefully. Make sure the bearing does not turn sideways. Install the bearing so that it is flush with the end of the swing arm. Repeat for the opposite bearing.

CAUTION

Never reinstall a needle bearing that has been removed. During removal it is damaged and no longer true to alignment. If installed it will damage the sleeve and create an unsafe riding condition.

CAUTION

Do not drive the needle bearings into the swing arm or damage to the bearing will result.

   f. Apply a coat of molybdenum disulfide grease to the inner needle bearing surfaces.

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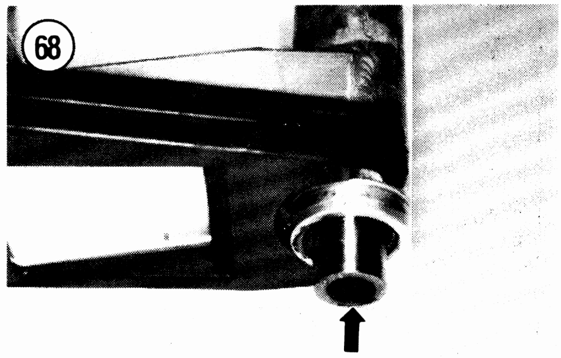

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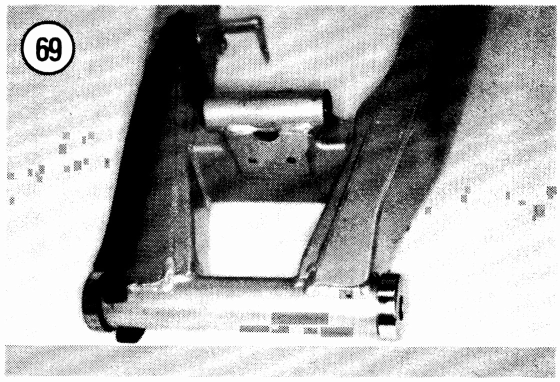

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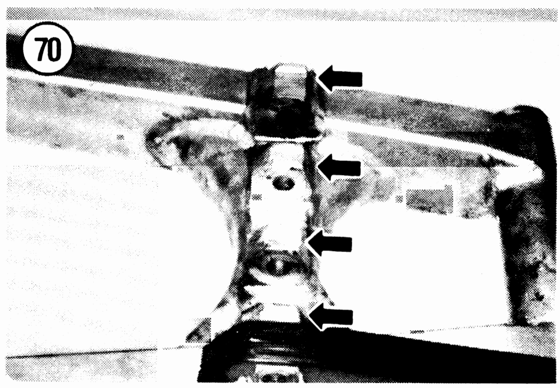

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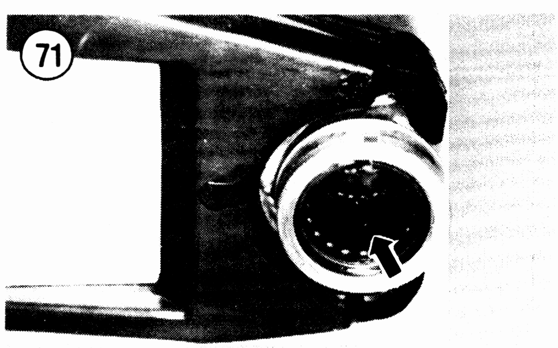

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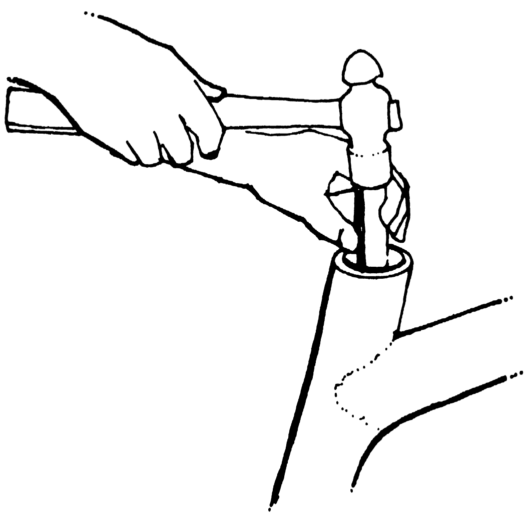
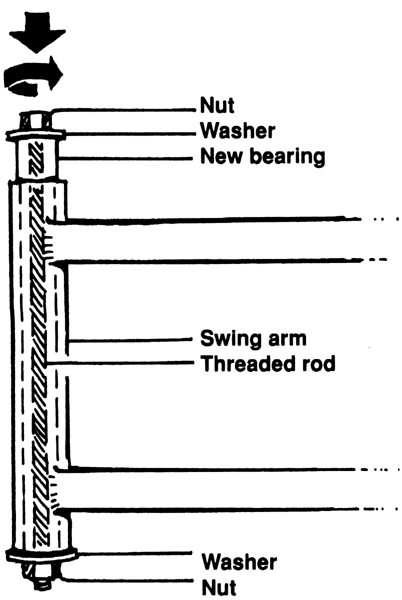


(73) **INSTALLING SWING ARM BEARINGS**



8. Check the thrust covers (**Figure 67**) for wear or damage. Check the seal inside each bearing cap for wear, tearing or deterioration. Replace the cap(s) if necessary.

9. Inspect the chain guide (**Figure 74**) for wear or damage. To replace, remove the bolts securing the chain guide and remove it. Install a new guide and tighten the bolts securely.

10. Inspect the drive chain adjusters (**Figure 75**). Check for cracks or damage. Make sure the threads are in good condition. Replace if necessary.

SHOCK LINKAGE

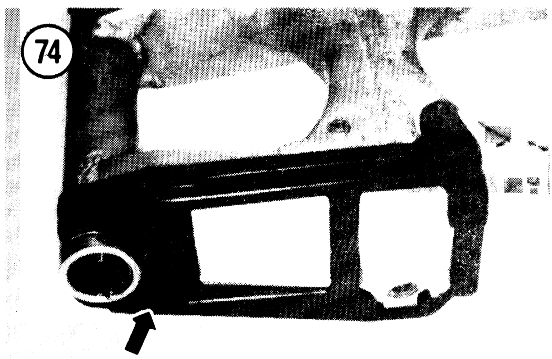
Removal/Installation (1984-1987)

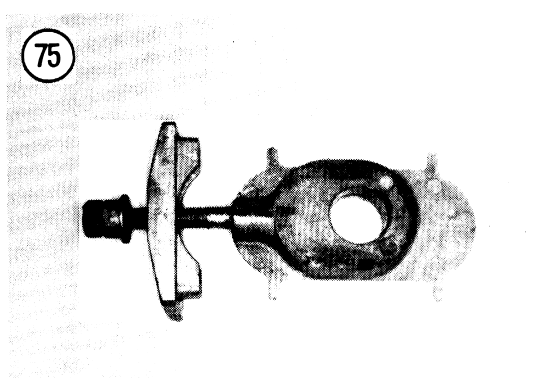
Refer to **Figure 76** for this procedure.

1. Remove the shock absorber as described in this chapter.

NOTE

Prior to removing the muffler bracket, check to see from which side the relay arm bolt is installed. If the bolt is in-





stalled from the right-hand side, then the right-hand muffler bracket must be removed, if the bolt is installed from the left-hand side then the left-hand muffler bracket must be removed. This bracket must be removed in order to completely withdraw the bolt from the relay arm and the frame mounting bracket.

NOTE

*If the right-hand muffler bracket must be removed, it is only necessary to remove the swing arm pivot bolt nut and washer (A, **Figure 77**). If the left-hand muffler bracket must be removed, then the swing arm pivot bolt, nut and washer must be removed.*

2. Refer to the previous NOTE and remove the bolts securing either the right-hand or left-hand muffler bracket and remove the bracket (B, **Figure 77**).
3. Remove the bolt (A, **Figure 78**), washer and nut on each side securing the relay arm No. 2 (B, **Figure 78**) to the swing arm. Remove relay arm No. 2 from

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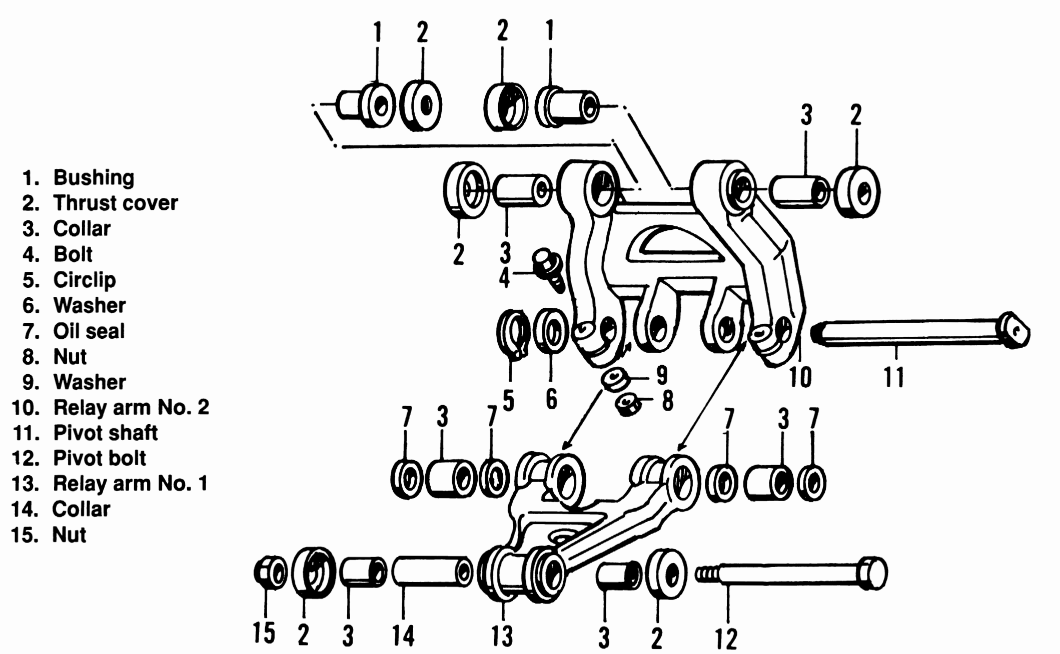
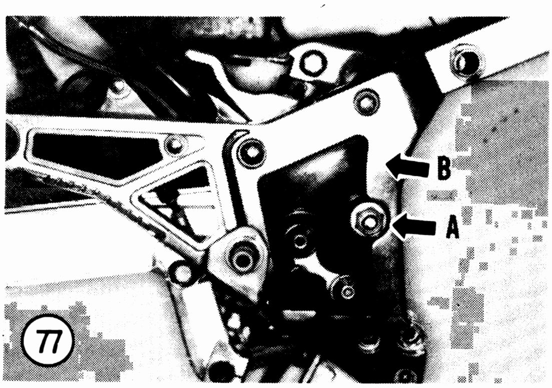
SHOCK LINKAGE (1984-1987)





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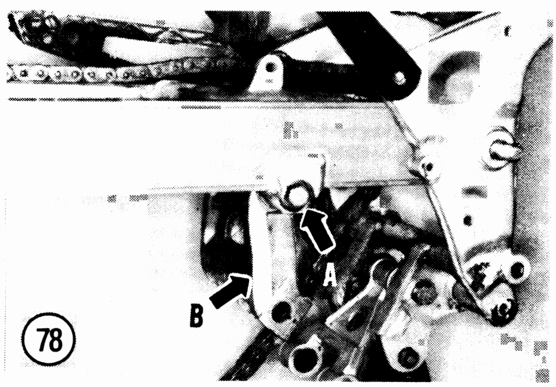

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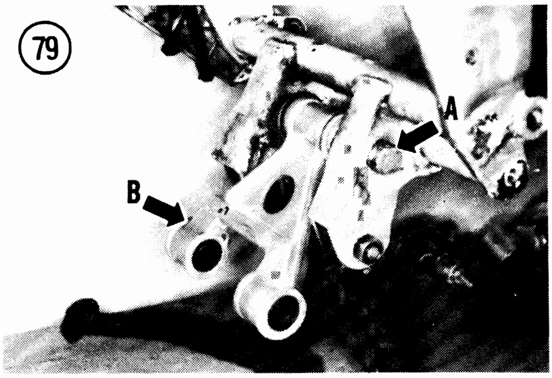

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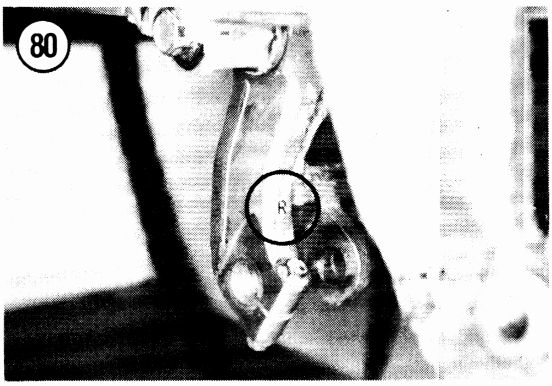

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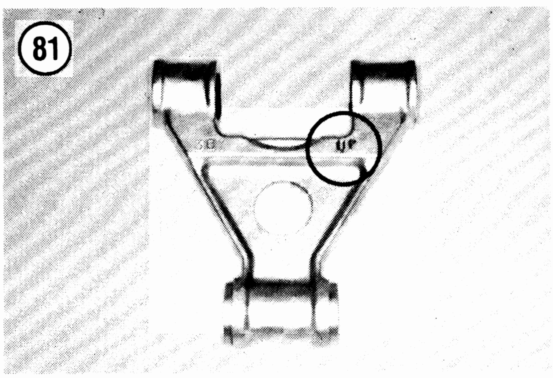

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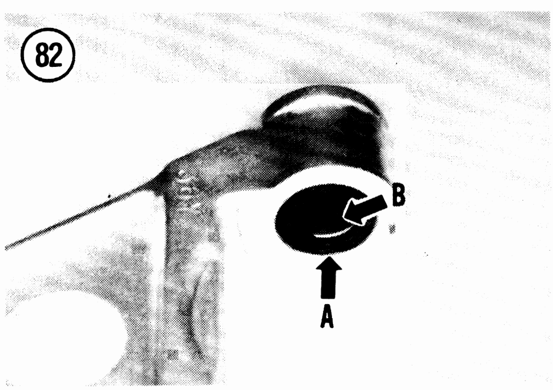


the swing arm, don't lose the thrust cover on each side of the pivot posts.

4. Remove the bolt (A, **Figure 79**) and nut securing relay arm No. 1 (B, **Figure 79**) to the frame and remove it. Don't lose the thrust cover on each side of the pivot posts.

5. Inspect all components as described in this chapter.

6. Apply molybdenum grease to all pivot bolts, collars and oil seals.

7. Make sure all 4 thrust covers are in place on relay arm No. 1.

8. Position relay arm No. 1 with the "R" mark (**Figure 80**) on the right-hand side of the swing arm and install it on the swing arm. Install the bolts, washers and nuts securing the relay arm and tighten the bolts and nuts to the torque specification listed in **Table 2**.

9. Make sure both thrust covers are in place on relay arm No. 2.

10. Position relay arm No. 2 with the "UP" mark (**Figure 81**) facing up and install it on the frame mounting bosses. Install the bolt and the nut and tighten to the torque specification listed in **Table 2.**

11. Install the muffler bracket (B, **Figure 77**) and tighten the bolts securely.

12. Install the shock absorber as described in this chapter.

13. After installation has been completed, carefully move the swing arm up and down to make sure all linkage is installed correctly and there is no binding.

10

Inspection (1984-1987)

Refer to **Figure 76** for this procedure.

1. On relay arm No. 1 perform the following:
   a. Inspect the relay arm (**Figure 81**) for cracks, damage and wear. Replace if any cracks or surface damage is evident.
   b. Inspect both sets of oil seals (A, **Figure 82**) on the rear pivot points on relay arm for wear or damage, replace as a set if any are damaged.
   c. Inspect the bushing (B, **Figure 82**) on the rear pivot point No. 1 for wear or damage, replace as necessary.
   d. Remove the thrust cover (**Figure 83**) from the front pivot point. Inspect the collar and bushings for wear or damage and replace if necessary.
2. On relay arm No. 2 perform the following:

a. Inspect the relay arm (**Figure 84**) for cracks, damage and wear. Replace if any cracks or surface damage is evident.
b. Remove the collar (**Figure 85**) from each upper pivot point of the relay arm. Inspect for wear or damage and replace if necessary.
c. Inspect the bushing (**Figure 86**) at each upper pivot point of the relay arm. Inspect for wear or damage and replace if necessary.
d. Inspect the pivot shaft mounting bosses (**Figure 87**) for cracks, fractures or damage. If damaged, replace No. 2 relay arm.

3. Inspect the pivot shaft for wear or damage and replace if necessary.

Removal (1988-on)

Refer to the following illustrations for this procedure:

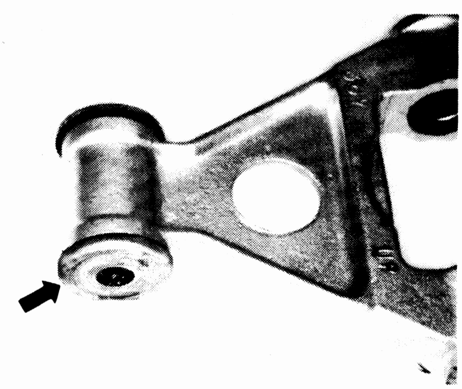
a. 1988-1990 models: **Figure 88**.
b. 1991-on models: **Figure 89**.

1. Remove the exhaust system (A, **Figure 90**) as described in Chapter Seven.
2. Remove the rear wheel (B, **Figure 90**) as described in this chapter.

NOTE
The connecting rods are symmetrical and can be reinstalled on either side. If so desired, you can mark them with a "L" and "R" so they can be reinstalled on the same side from where they were removed.

3. Remove the bolts, washers and nuts (C, **Figure 90**) securing the 2 connecting rods to the swing arm and to the relay arm. Remove both connecting rods,

(83)



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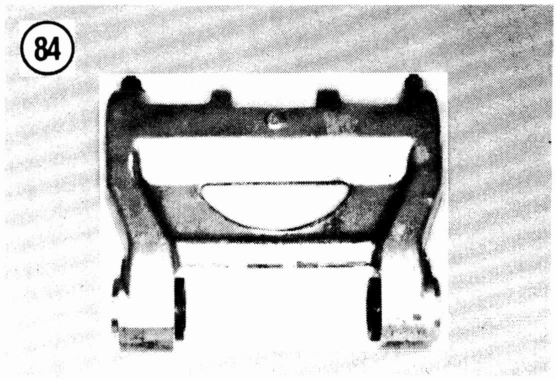

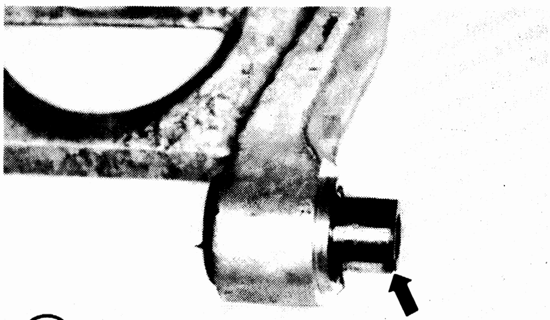

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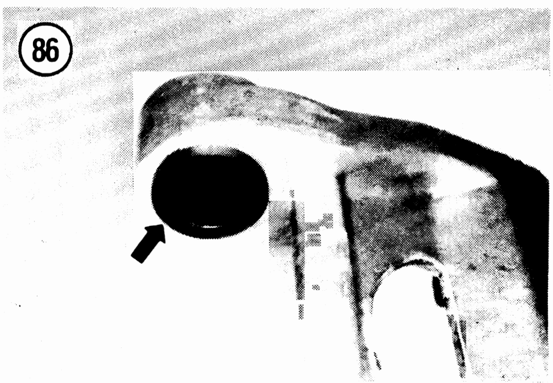

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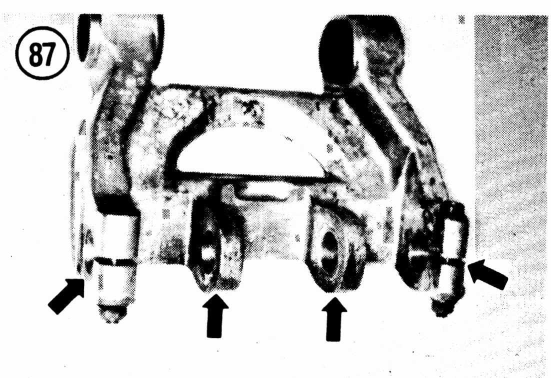

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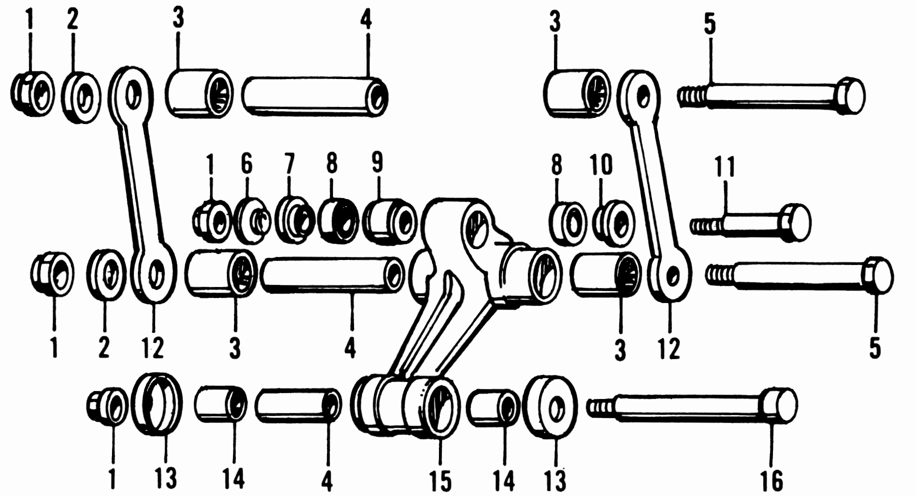
SHOCK LINKAGE (1988-1990)



1. Nut
2. Washer
3. Needle bearing
4. Pivot collar
5. Pivot bolt
6. Washer
7. Collar
8. Oil seal
9. Cylindrical bearing
10. Collar
11. Bolt
12. Connecting rod
13. Thrust cover
14. Collar
15. Relay arm

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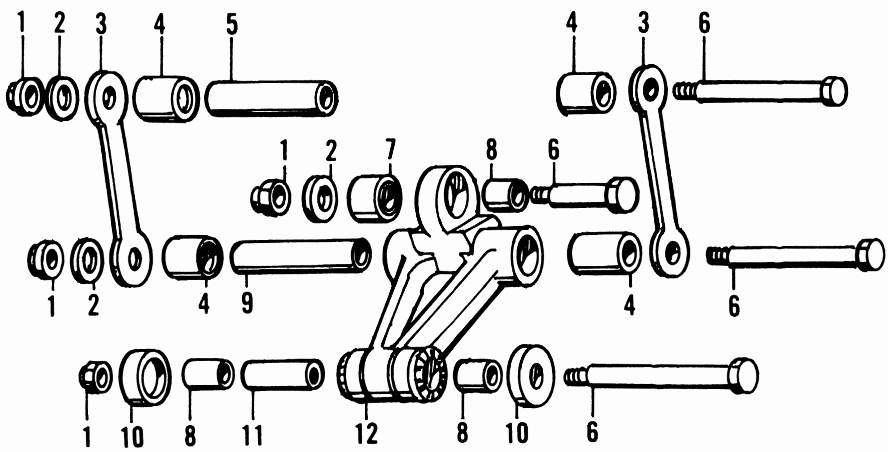
SHOCK LINKAGE (1991-ON)



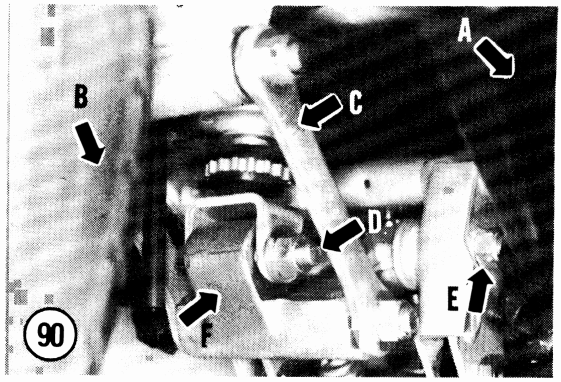
1. Nut
2. Washer
3. Connecting rod
4. Needle bearing
5. Pivot collar
6. Pivot bolt
7. Cylindrical bearing
8. Needle bearing
9. Collar
10. Thrust cover
11. Collar
12. Relay arm

reassemble and reinstall the bolts, washers and nuts (**Figure 91**) to avoid misplacing them.

4. Remove the bolts, washers and nuts (D, **Figure 90**) securing the shock absorber to the relay arm.

5. Remove the bolts, washers and nuts (E, **Figure 90**) securing the relay arm to the frame and remove the relay arm (E, **Figure 90**).

6. Inspect all components as described in this chapter.



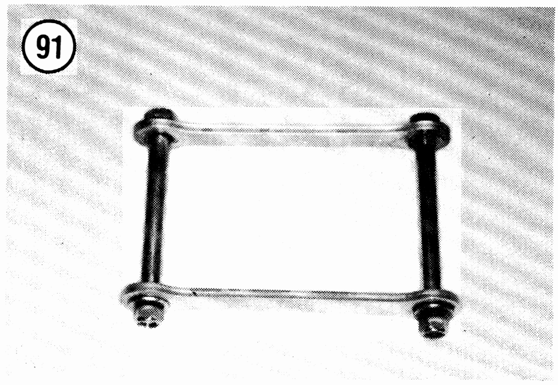
Installation (1988-on)

Refer to the following illustrations for this procedure:

a. 1988-1990 models: **Figure 88**.

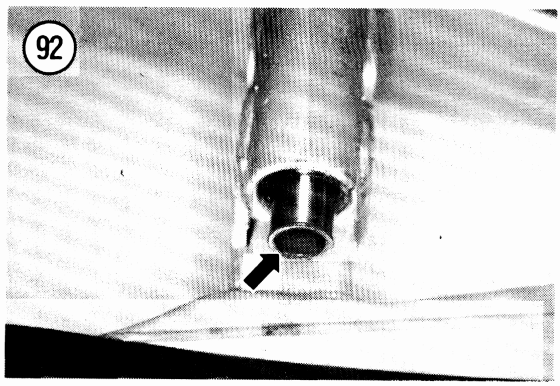
b. 1991-on models: **Figure 89**.

NOTE
This procedure is shown installing the shock linkage components to the swing arm that has been removed from the frame. This is to show the proper relationship of each part as it is installed. The linkage can be installed in this manner if the swing arm has been removed or can be installed with the swing arm installed in the frame.



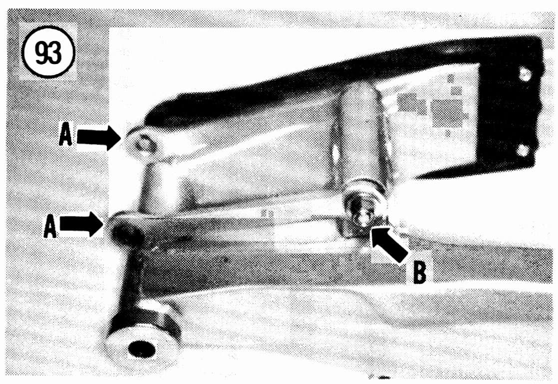
1. Apply molybdenum grease to all pivot bolts, collars and oil seals.

2. Make sure the pivot collar (**Figure 92**) is in place in the swing arm.

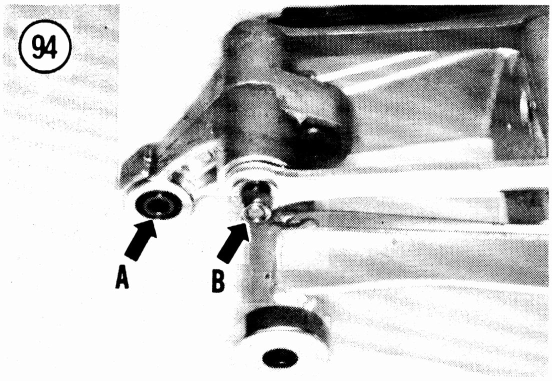


NOTE
Steps 3-6 are shown with the swing arm upside down on the workbench. Take this into consideration when installing the following bolts from the left-hand side.

3. Correctly position the 2 connecting rods (A, **Figure 93**) onto the swing arm. Install the bolt from the left-hand side and install the washer and nut (B, **Figure 93**). Tighten the nut finger-tight at this time.



CAUTION
The relay arm must be installed correctly in order for the shock absorber to be properly aligned within the frame and upper mounting boss.



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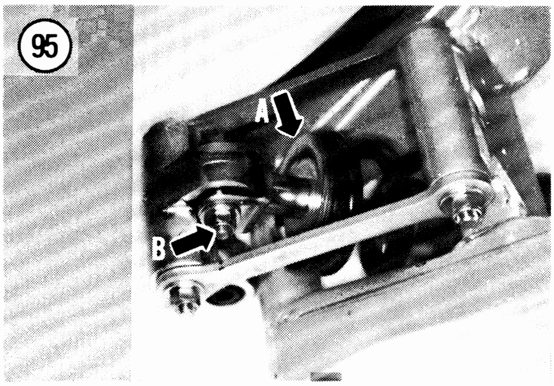

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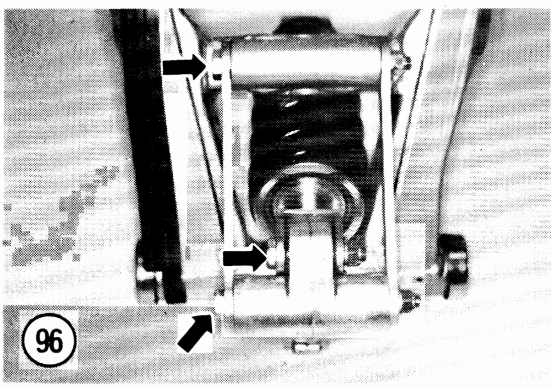

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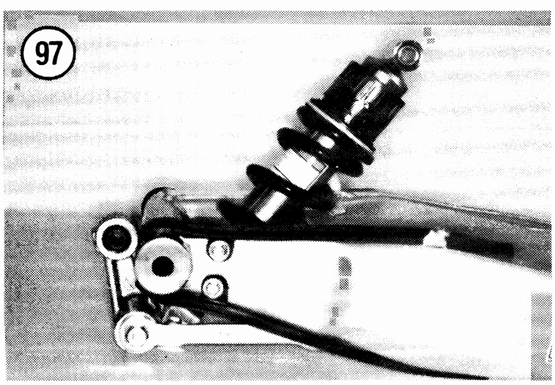

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4. Position the relay arm between the connecting rods with the long portion (A, **Figure 94**) pointing *away* from the swing arm (the shock absorber is attached to the short portion). Insert the bolt from the left-hand side. Install the washer and nut (B, **Figure 94**) and tighten finger-tight at this time.
5. Install the shock absorber (A, **Figure 95**) onto the relay arm. Install the bolt from the left-hand side and install the nut (B, **Figure 95**).
6. Double check to make sure all bolts have been installed from the left-hand side (**Figure 96**). Reverse any bolts and nuts that are installed incorrectly.
7. After all components have been installed onto the swing arm, turn the swing arm over and refer to **Figure 97**. This is how the assembled components should look. If the relay arm is installed backwards, correct this situation at this time.
8. If removed, install the swing arm assembly as described in this chapter.
9. Install the relay arm onto the frame and install the bolt from the left-hand side. Install the nut (E, **Figure 90**).
10. After all components have been installed, *tighten* the bolts and nuts to the torque specification listed in **Table 2**.
11. After installation has been completed, carefully move the swing arm up and down to make sure all linkage is installed correctly and there is no binding.

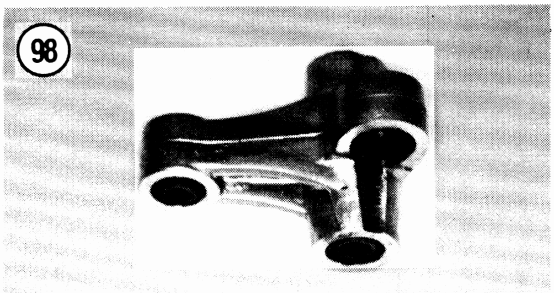
Inspection (1988-on)

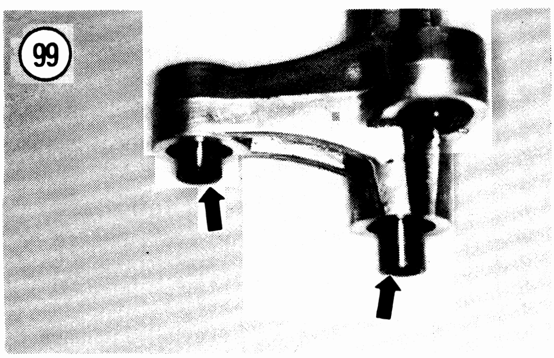
The relay arm is equipped with needle bearings. The bearings wear very slowly and the wear is difficult to measure.

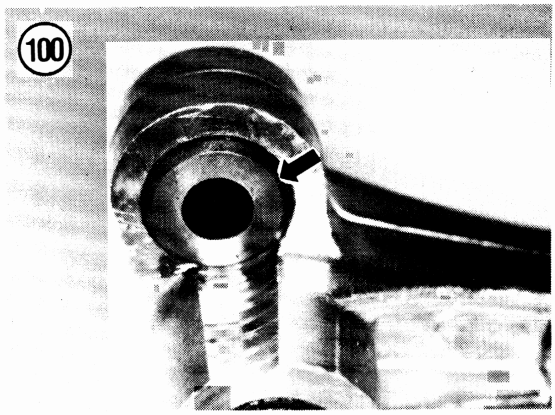
1. Inspect the connecting rods and their mounting bolts and nuts (**Figure 91**) for wear, damage or distortion. Replace the connecting rods as a pair even if only one requires replacement.
2. Inspect the relay arm (**Figure 98**) for cracks, damage and wear. Replace if any cracks or surface damage is evident.
3. Remove the long collars (**Figure 99**) from the relay arm, then remove the short collar (**Figure 100**) from each side of the relay arm. Inspect the long and short collars for wear or damage and replace if necessary.
4. Inspect the needle bearings in the relay arm as follows:
   a. Remove the oil seals (**Figure 101**) with a screwdriver.

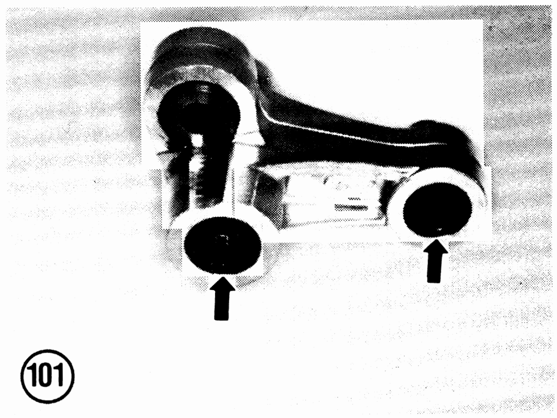
b. Turn the bearings with your fingers. Make sure they rotate smoothly.
c. Check the needles for evidence of wear, pitting or color change indicating heat from lack of lubrication. In severe instances, the needles will fall out of the bearing cage.
d. If necessary, have the bearings replaced by a machine shop or dealer as a press is required for both removal and installation.

5. Remove the collar (**Figure 92**) from the connecting rod pivot area of the swing arm. Inspect the collar for wear or damage and replace if necessary.
6. Inspect the oil seals (A, **Figure 102**) and needle bearings (B, **Figure 102**) in the connecting rod pivot area of the swing arm. Replace the oil seals if worn or starting to deteriorate. Inspect the needle bearings and replace them if necessary.









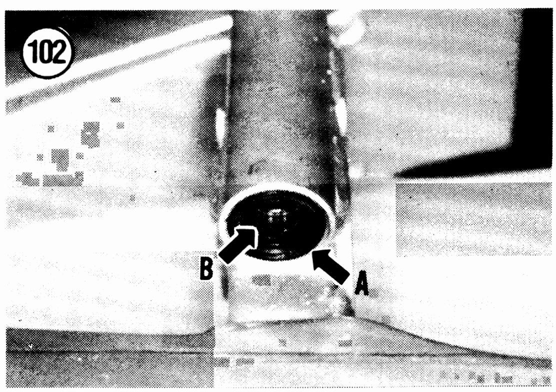


Table 1 REAR SUSPENSION SPECIFICATIONS

Shock travel	
1984-1990	40 mm (1.57 in.)
1991-on	48 mm (1.89 in.)
Shock spring free length	
1984-1990	
New	174.5 mm (6.87 in.)
Wear limit	170 mm (6.69 in.)
1991-on	
New	181 mm (7.13 in.)
Wear limit	174 mm (6.85 in.)
Swing arm free play limit	
End and side play	1 mm (0.04 in.)
Rear wheel runout limit	
Radial and lateral	2.0 mm (0.08 in.)
Drive chain	
Type	Diado 50ZL/DID
No. of links	110
Free play	15-20 mm (0.6-0.8 in.)

Table 2 REAR SUSPENSION TIGHTENING TORQUES

Item	N•m	ft.-lb.
Rear axle nut	150	110
Rear brake caliper torque link nuts	35	25
ABS rear sensor mounting bolt	23	17
Drive chain sprocket nut	85	61
Shock absorber (1984-1990)		
Upper mounting bolt	42	30
Lower pivot shaft pinch bolts	9	6.5
Remote control unit mounting bolts	16	11
Shock absorber (1991-on)		
Upper mounting bolt and nut	40	29
Lower mounting bolt and nut	65	47
Shock linkage		
1984-1987		
Relay arm No. 1 bolt	90	65
Relay arm No. 2 bolts and nuts	90	65
1988-1990		
Connecting rod-to-swing arm bolt	65	47
Connecting rod-to-relay arm bolt	65	47
Relay arm-to-frame bolt and nut	65	47
1991-on		
Connecting rod-to-swing arm bolt	65	47
Connecting rod-to-relay arm bolt	65	47
Relay arm-to-shock absorber	65	47
Relay arm-to-frame	65	47
Muffler bracket bolts	28	20
Swing arm pivot bolt nut	90	65

CHAPTER ELEVEN

BRAKES

All models are equipped with dual front and single rear disc brakes. This chapter describes repair and replacement procedures for all brake components.

An Anti-lock Brake System (ABS) was offered as an option on U.K. models starting in 1991 and on U.S. models starting in 1992. This system is described in detail at the end of this chapter and throughout the text where differences occur between the standard brake system and the ABS system they are identified.

Refer to **Table 1** for brake specifications. **Tables 1-2** are found at the end of the chapter.

DISC BRAKES

The disc brake units are actuated by hydraulic fluid controlled by the front brake hand lever or rear brake pedal. As the front brake pads wear, the brake fluid level drops in the master cylinder reservoir and automatically adjusts for pad wear. Rear disc brake pad wear must be compensated for by periodic rear brake pedal adjustment; see *Rear Brake Pedal Height Adjustment* and *Rear Brake Light Switch Adjustment* in Chapter Three.

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 a caliper or on a 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 4 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.

WARNING

Do not intermix silicone-based (DOT 5) brake fluid as it can cause brake component damage leading to brake system failure.

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 this chapter for complete details.

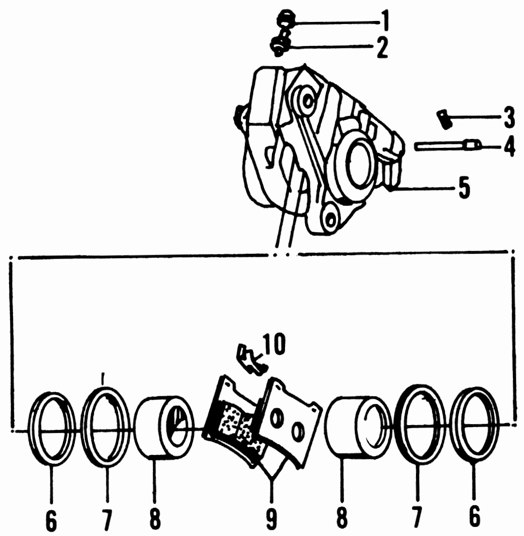
CAUTION

Disc brake components rarely require disassembly, so do not disassemble unless necessary. Do not use solvents of any kind on the brake system's internal components. Solvents will cause the *seals to swell and distort. When disassembling and cleaning brake components (except brake pads) use new brake fluid.*

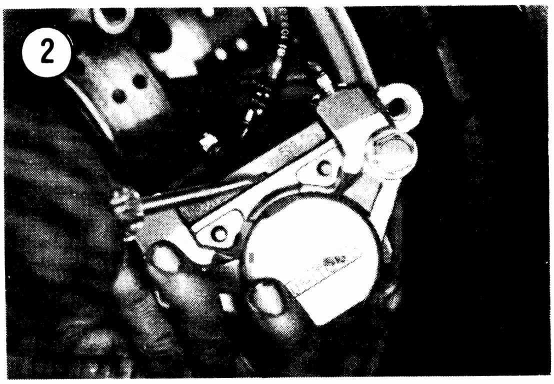
BRAKE PAD REPLACEMENT

There is no recommended mileage interval for changing the friction pads in the disc brakes. Pad wear depends greatly on riding habits and conditions. The pads should be checked for wear every 6 months and replaced when the wear indicator reaches the edge of the brake disc. To maintain an even brake pressure on the disc, always replace both pads in the caliper at the same time. Also replace the pads in both calipers at the same time.

1 **FRONT BRAKE CALIPER (1984-1987)**



1. Cap
2. Bleeder valve
3. Clip
4. Pad retaining pins
5. Caliper body
6. Dust seal
7. Piston seal
8. Piston
9. Pads
10. Pad spring



Service Notes

Observe the following service notes before replacing brake pads.

1. Brake pads should be replaced only as a set.
2. Disconnecting the hydraulic brake hose is not required for brake pad replacement. Disconnect the hose only if caliper removal is required.

WARNING
Use brake fluid clearly marked DOT 4 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. Do not intermix silicone-based (DOT 5) brake fluid as it can cause brake component damage leading to brake system failure.

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 this chapter.*

Front Pad Replacement (1984-1987)

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

NOTE
It is not necessary to remove the caliper from the front fork to service the brake pads. In this procedure the caliper is shown removed for clarity.

1. Carefully pry the brake pad cover (**Figure 2**) off of the caliper housing.
2. Pull the clip (**Figure 3**) out of each pad retaining pin.
3. Pull the upper (**Figure 4**) and lower (**Figure 5**) pad retaining pins out of the caliper.
4. Lift the pad spring (**Figure 6**) out of the caliper.

5. Lower the outer (**Figure 7**) and inner (**Figure 8**) brake pads out of the caliper.

6. Check the pad retaining pins and clips (**Figure 9**) for fatigue. Check the retaining pin clip holes for enlargement, cracks or other damage.

7. Check the pad spring (**Figure 10**) for fatigue or cracks.

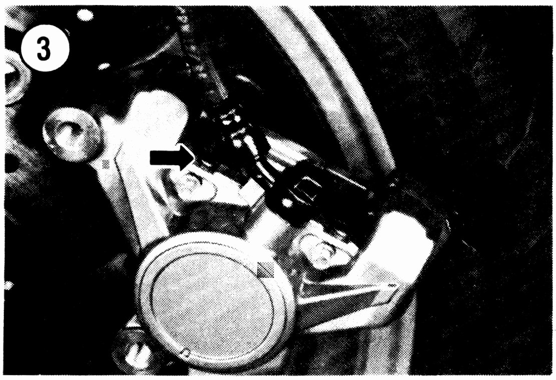
8. Check the brake pad friction surface (**Figure 11**) for oil contamination or fraying. Check the pad plates for cracks or other damage. If the brake pads appear okay, measure the friction thickness with a Vernier caliper (**Figure 12**). Replace the brake pads in a set if the friction thickness is worn to the service limit listed in **Table 1** or less.

WARNING

The brake pads must be replaced as a set. When servicing front brakes, both the left- and right-hand brake pads must be replaced at the same time.

9. When new pads are installed in the caliper, the master cylinder brake fluid level will rise as the caliper pistons are repositioned. Perform the following:

   a. Clean the top of the master cylinder of all dirt and foreign matter.
   b. Remove the screws securing the cover (**Figure 13**). Remove the cover and the diaphragm from the master cylinder and slowly push the caliper pistons into the caliper. Constantly check the reservoir to make sure brake fluid does not overflow. Remove fluid, if necessary, prior to it overflowing.
   c. The piston should move freely. If it doesn't and there is evidence of them sticking in the cylinder, the caliper should be removed and serviced as described in this chapter.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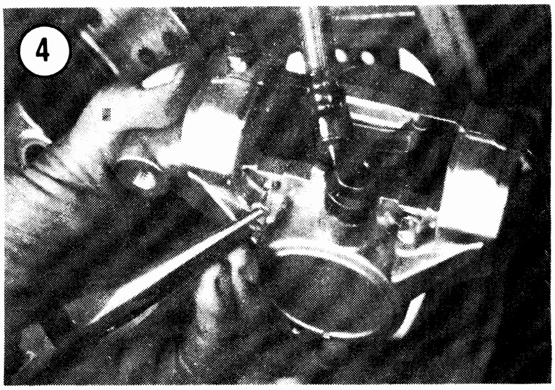
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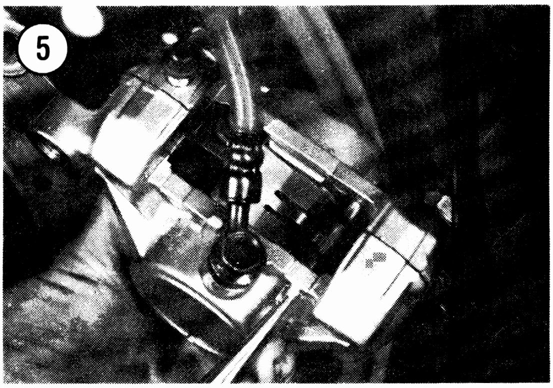
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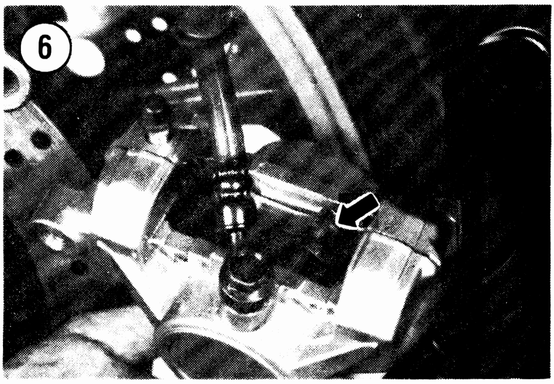
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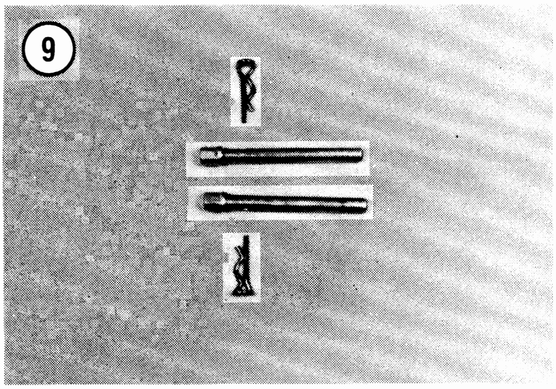
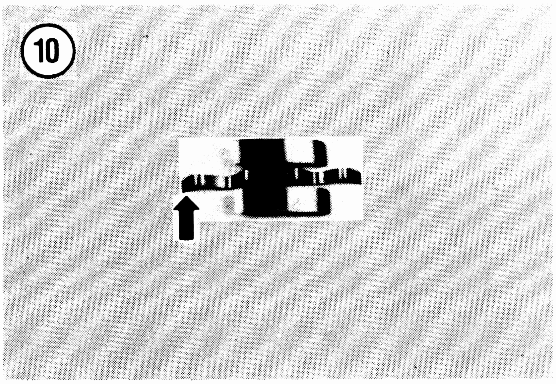
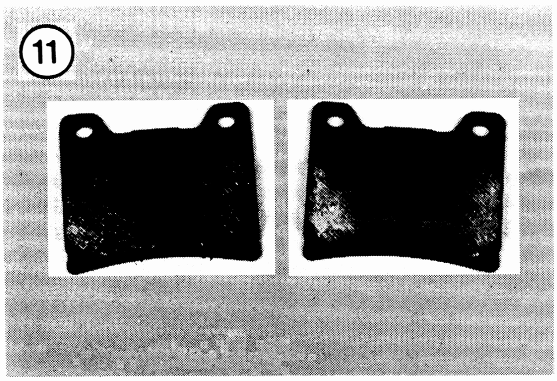




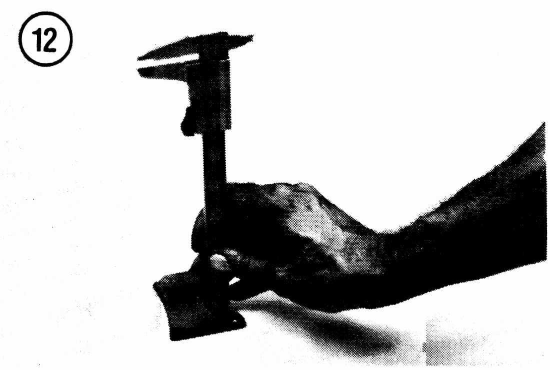


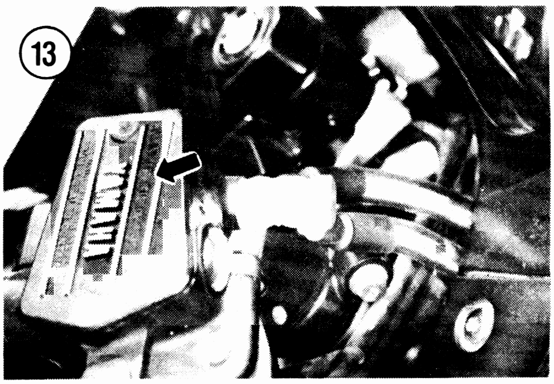
10. Push the caliper piston in all the way to allow room for the new pads.

NOTE
When purchasing new pads, check with your dealer to make sure the friction compound of the new pad is compatible with the disc material. Remove any roughness from the backs of the new pads with a fine-cut file; blow them clean with compressed air.

NOTE
Position the brake pads with the friction material facing inward toward the brake disc.

11. Insert the pads through the bottom of the caliper housing. Refer to **Figure 8** and **Figure 7**.
12. Install the pad spring (**Figure 14**) so that the end of the spring with the longer tang (**Figure 10**) and arrow (**Figure 15**) faces toward the front of the bike.
13. Install the front (**Figure 5**) and rear (**Figure 4**) retaining pins so that the pins slide over the top of the pad spring tangs (**Figure 16**).
14. Install the clips (**Figure 3**).





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15. Install the brake pad cover.

16. If removed, install the caliper assembly and tighten the bolts to the torque specification listed in **Table 2**.

17. Repeat for the other caliper assembly.

18. Place the motorcycle securely on the centerstand with the front wheel off the ground. Spin the wheel and pump the brake lever until the pads are seated against the disc.

19. Refill the master cylinder reservoir, if necessary, to maintain the correct fluid level. Install the diaphragm and top cover (**Figure 13**) and tighten the screws securely.

WARNING
Use brake fluid clearly marked DOT 4 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. Do not intermix silicone-based (DOT 5) brake fluid as it can cause brake component damage leading to brake system failure.

WARNING
*Do not ride the motorcycle until you are sure the brakes are operating correctly with full hydraulic advantage. If necessary, bleed the brake as described under **Bleeding the System** in this chapter.*

20. Bed the pads in gradually for the first 5-10 days of riding 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 Pad Replacement (1988-on)

Refer to **Figure 17** for this procedure.

1. Carefully pry the brake pad cover (**Figure 18**) off of the caliper housing.

NOTE
*In **Figure 19** only the lower clip is visible. Be sure to remove the clip from each pad retaining pin.*

2. Pull the clip (**Figure 19**) out of each pad retaining pin.

3. Pull the lower (**Figure 20**) and upper (A, **Figure 21**) pad retaining pins out of the caliper.

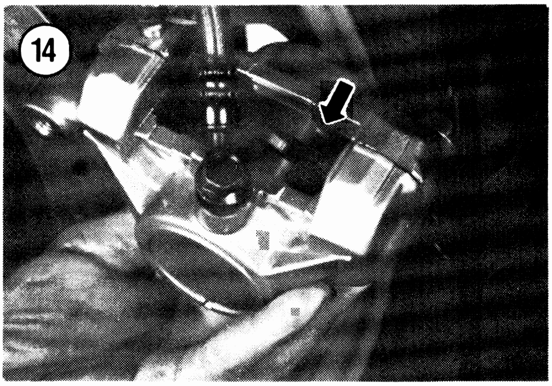
4. Lift the pad spring (B, **Figure 21**) out of the caliper.

5. Remove the inner (A, **Figure 22**) and outer (**Figure 23**) brake pads out of the caliper.

6. Check the pad retaining pins and clips (**Figure 9**) for fatigue. Check the retaining pin clip holes for enlargement, cracks or other damage.

7. Check the pad spring (**Figure 24**) for fatigue or cracks.

14



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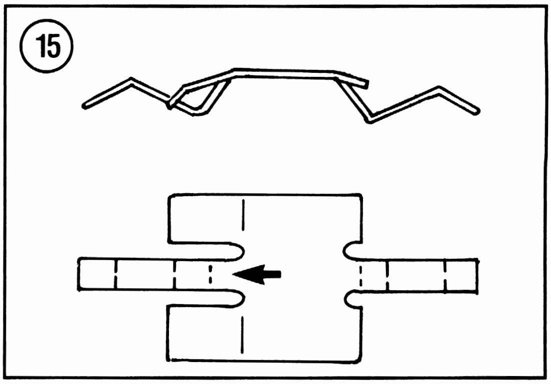

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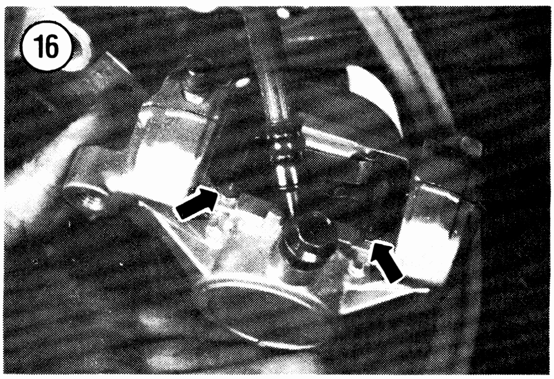
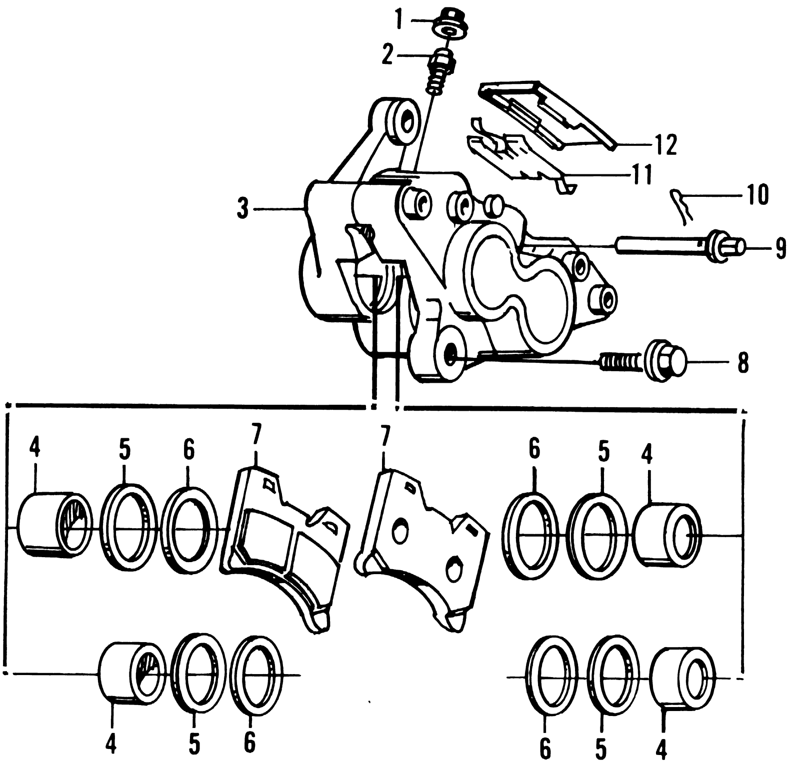
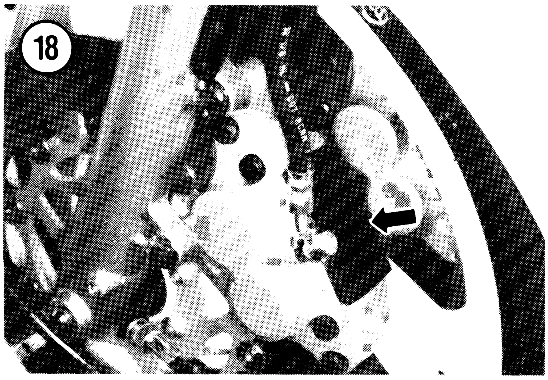


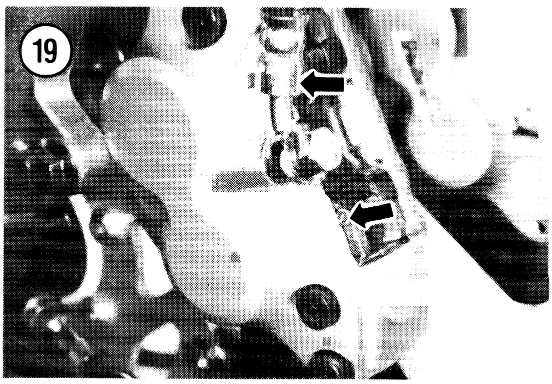
(17)

FRONT BRAKE CALIPER (1988-ON)



1. Cap
2. Bleeder valve
3. Caliper body
4. Piston
5. Piston seal
6. Dust seal
7. Pads
8. Bolt
9. Pad retaining pins
10. Clips
11. Pad spring
12. Cover





8. Check the brake pad friction surface (**Figure 25**) for oil contamination or fraying. Check the pad plates for cracks or other damage. If the brake pads appear okay, measure the friction thickness with a Vernier caliper (**Figure 26**). Replace the brake pads in a set if the friction thickness is worn to the service limit listed in **Table 1** or less.

WARNING
The brake pads must be replaced as a set. When servicing front brakes, both the left- and right-hand brake pads must be replaced at the same time.

9. When new pads are installed in the caliper, the master cylinder brake fluid level will rise as the caliper pistons are repositioned. Perform the following:

a. Clean the top of the master cylinder of all dirt and foreign matter.
b. Remove the screws securing the cover (**Figure 27**). Remove the cover and the diaphragm from the master cylinder and slowly push the caliper pistons into the caliper. Constantly check the reservoir to make sure brake fluid does not overflow. Remove fluid, if necessary, prior to it overflowing.
c. The pistons should move freely. If they don't and there is evidence of them sticking in the cylinder, the caliper should be removed and serviced as described in this chapter.

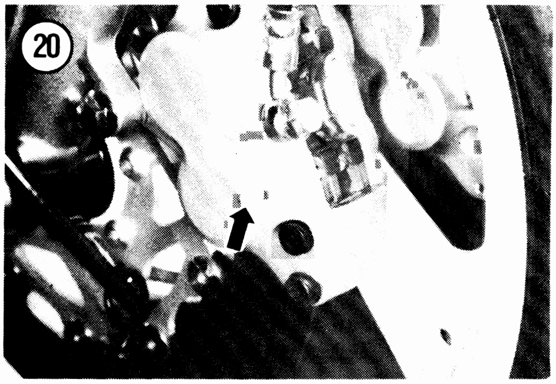
10. Push the caliper pistons in all the way to allow room for the new pads.

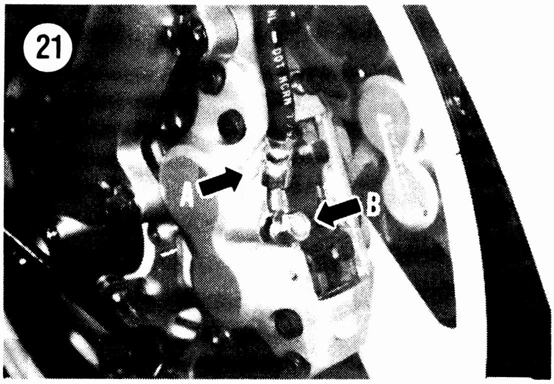
NOTE
When purchasing new pads, check with your dealer to make sure the friction compound of the new pad is compatible with the disc material. Remove any roughness from the backs of the new pads with a fine-cut file; blow them clean with compressed air.

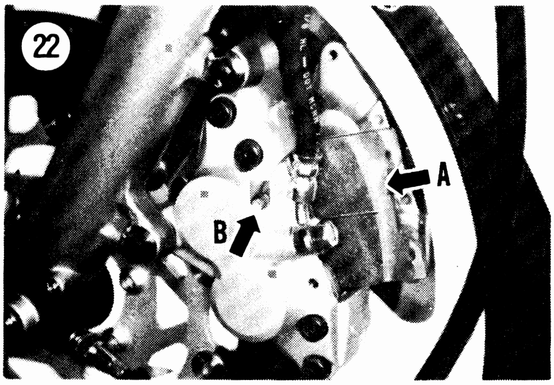
NOTE
Position the brake pads with the friction material facing inward toward the brake disc.

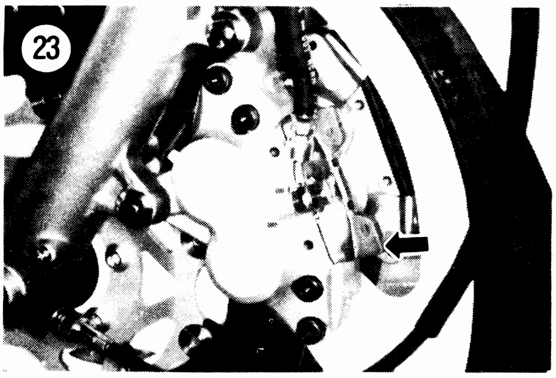
11. Install the outer pad (**Figure 23**) and insert the upper pad retaining pin (B, **Figure 22**) through the upper hole of the outer pad.

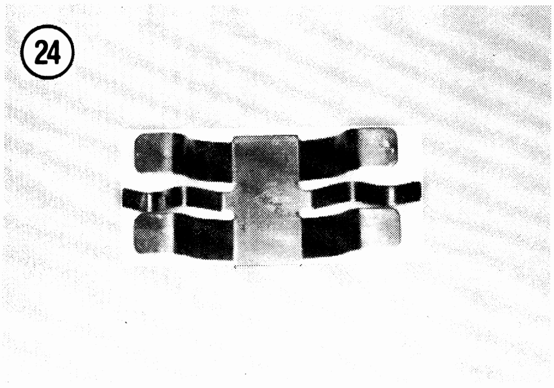
12. Install the inner pad (A, **Figure 22**) and push the upper pad retaining pin through the inner pad. Push











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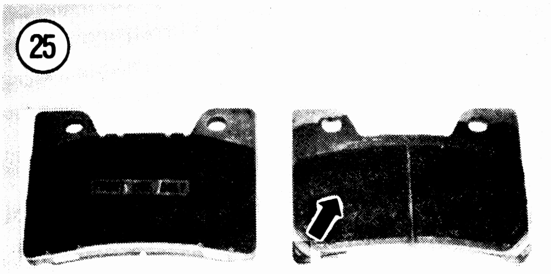

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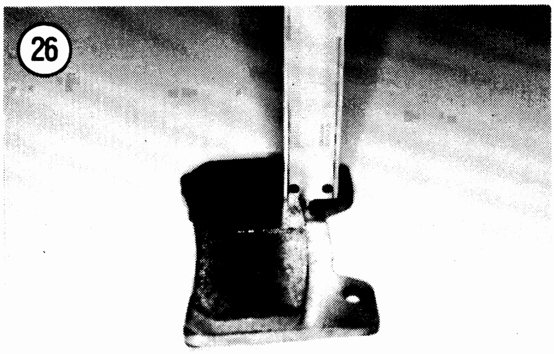

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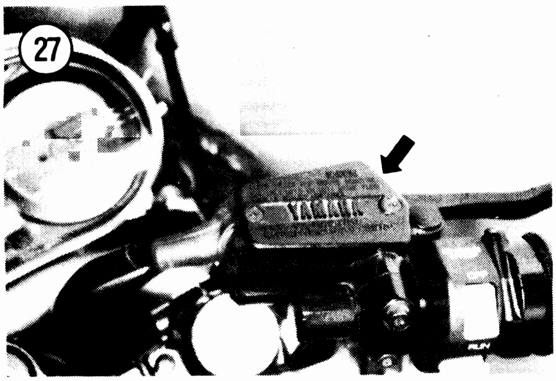

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it in until it completely seats in the caliper (A, **Figure 21**).

13. Install the pad spring (B, **Figure 21**) so that the end of the spring with the longer tang and arrow (**Figure 15**) faces toward the front of the bike. Hook the spring under the upper pad retaining pin.

14. Push down on the pad spring and insert the lower pad retaining pin (**Figure 20**). Push it in until it completely seats in the caliper.

15. Install the clip (**Figure 19**) into each pad retaining pin.

16. Install the brake pad cover (**Figure 18**).

17. Repeat for the other caliper assembly.

18. Support the motorcycle securely on the centerstand with the front wheel off the ground. Spin the wheel and pump the brake lever until the pads are seated against the disc.

19. 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 4 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. Do not intermix silicone-based (DOT 5) brake fluid as it can cause brake component damage leading to brake system failure.

WARNING

*Do not ride the motorcycle until you are sure the brakes are operating correctly with full hydraulic advantage. If necessary, bleed the brake as described under **Bleeding the System** in this chapter.*

20. Bed the pads in gradually for the first 5-10 days of riding 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.

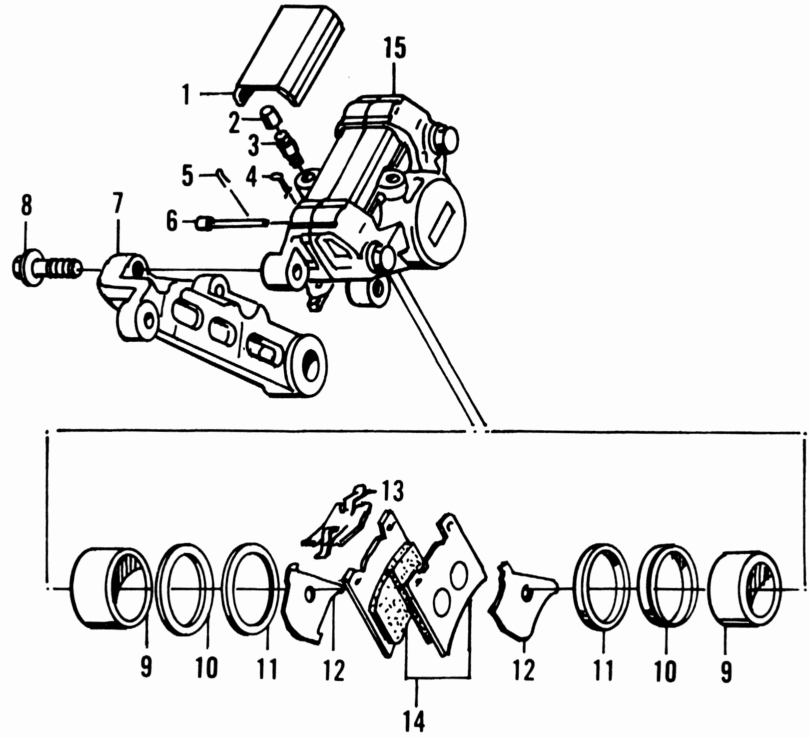
Rear Pad Replacement

Refer to **Figure 28** for this procedure.

1. Carefully pry the brake pad cover (**Figure 29**) off of the caliper housing.

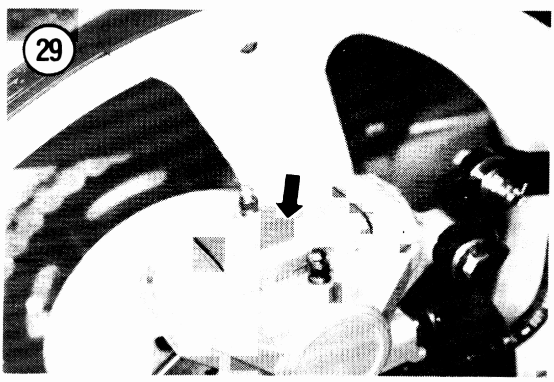
28

REAR BRAKE CALIPER



1. Cover
2. Cap
3. Bleeder valve
4. Clip
5. Clip
6. Pad retaining pin
7. Caliper bracket
8. Bolt
9. Piston
10. Piston seal
11. Dust seal
12. Pad shim
13. Pad spring
14. Pads

29



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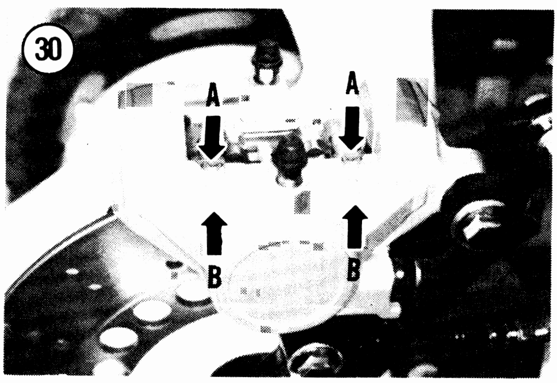

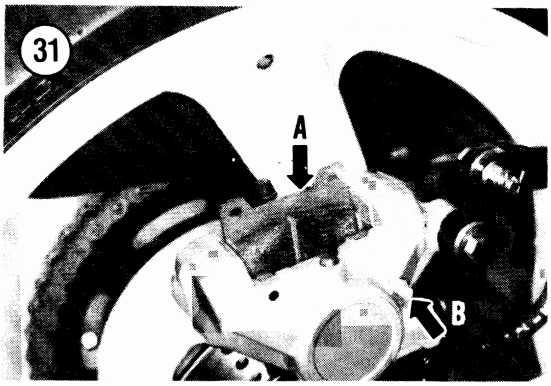

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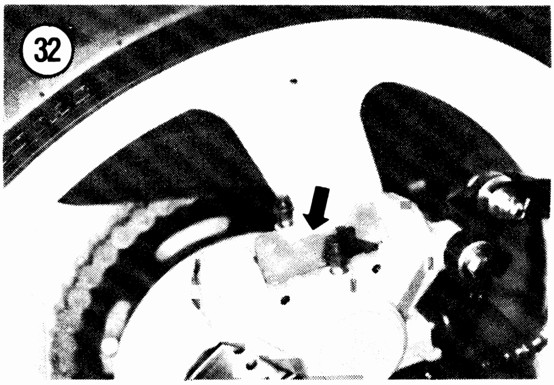

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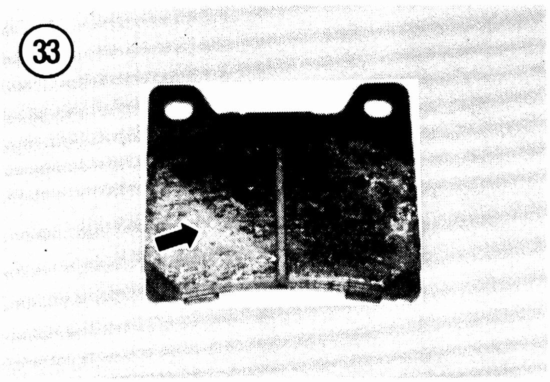

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2. Pull the clip (A, **Figure 30**) out of each pad retaining pin.

3. Pull the front and rear pad retaining pins (B, **Figure 30**) out of the caliper.

4. Lift the pad spring out of the caliper.

5. Remove the inner (A, **Figure 31**) and outer (**Figure 32**) brake pads from the caliper.

6. Check the pad retaining pins and clips (**Figure 6**) for fatigue. Check the retaining pin clip holes for enlargement, cracks or other damage.

7. Check the pad spring (**Figure 24**) for fatigue or cracks.

8. Check the brake pad friction surface (**Figure 33**) for oil contamination or fraying. Check the pad plates for cracks or other damage. If the brake pads appear okay, measure the friction thickness with a Vernier caliper (**Figure 26**). Replace the brake pads in a set if the friction thickness is worn to the service limit listed in **Table 1** or less.

9. When new pads are installed in the caliper, the master cylinder brake fluid level will rise as the caliper pistons are repositioned. Perform the following:

   a. Remove the seat and right-hand side cover as described in Chapter Twelve.
   b. Clean the top of the master cylinder of all dirt and foreign matter.
   c. Unscrew the cover (**Figure 34**). Remove the cover and the diaphragm from the master cylinder and slowly push the caliper pistons (**Figure 35**) into the caliper. Constantly check the reservoir to make sure brake fluid does not overflow. Remove fluid, if necessary, prior to it overflowing.
   d. The pistons should move freely. If they don't and there is evidence of them sticking in the

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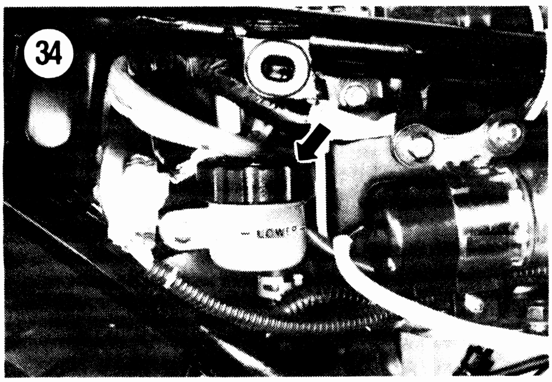

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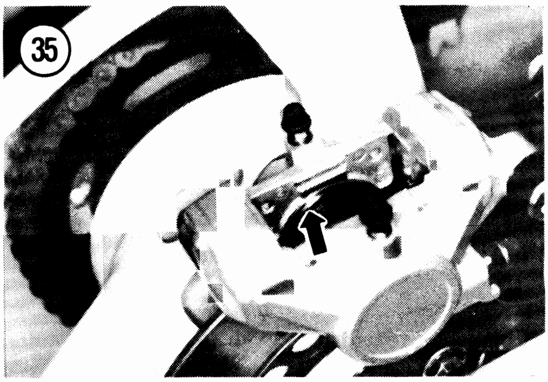

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cylinder, the caliper should be removed and serviced as described in this chapter.

10. Make sure the caliper pistons (**Figure 35**) are pushed in all the way to allow room for the new pads.

NOTE
When purchasing new pads, check with your dealer to make sure the friction compound of the new pad is compatible with the disc material. Remove any roughness from the backs of the new pads with a fine-cut file; blow them clean with compressed air.

11. Make sure the shim (**Figure 36**) is in place on each brake pad.

NOTE
*Position the brake pads with the friction material facing inward toward the brake disc and with the shim arrow (**Figure 37**) facing toward the front of the bike.*

12. Install the outer pad (**Figure 32**) and insert the front pad retaining pin (B, **Figure 31**) through the front hole of the outer pad.

13. Install the inner pad (A, **Figure 31**) and push the front pad retaining pin through the inner pad. Push it in until it completely seats in the caliper (A, **Figure 38**).

14. Install the clip (B, **Figure 38**) into the front pad retaining pin.

15. Install the pad spring (A, **Figure 39**) so that the end of the spring with the longer tang faces toward the front of the bike. Hook the spring under the front pad retaining pin.

16. Push down on the pad spring and insert the rear pad retaining pin (B, **Figure 39**). Push it in until it completely seats in the caliper.

17. Install the clip into the rear pad retaining pin.

18. Install the brake pad cover (**Figure 29**).

19. Shift the transmission into neutral.

20. Support the motorcycle securely on the center-stand with the rear wheel off the ground. Spin the wheel and pump the brake pedal until the pads are seated against the disc.

21. Refill the master cylinder reservoir, if necessary, to maintain the correct fluid level. Install the diaphragm and top cover and tighten the cover securely.

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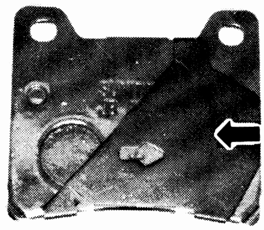

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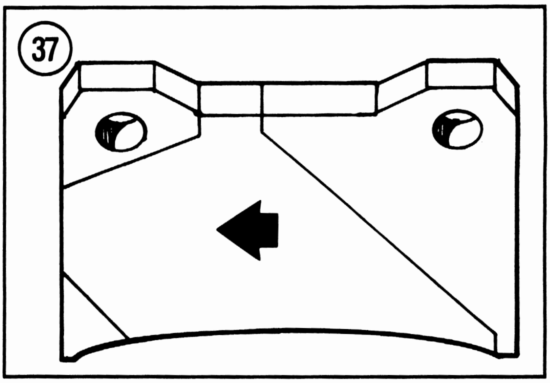

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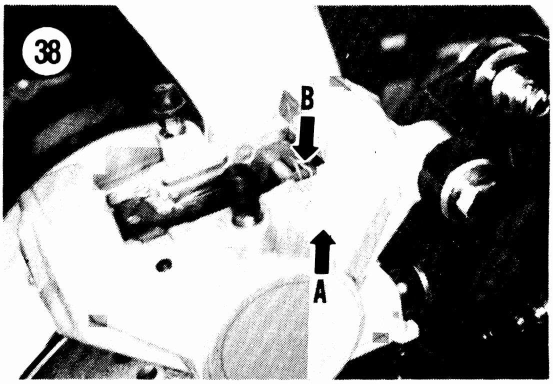

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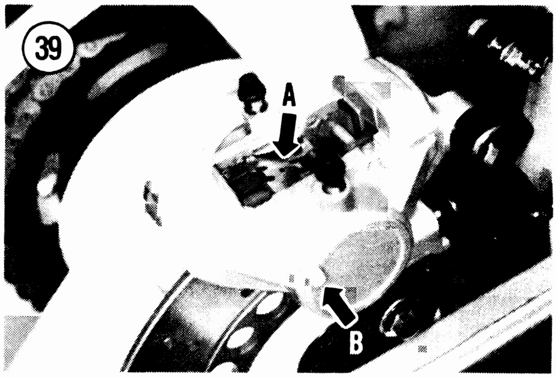


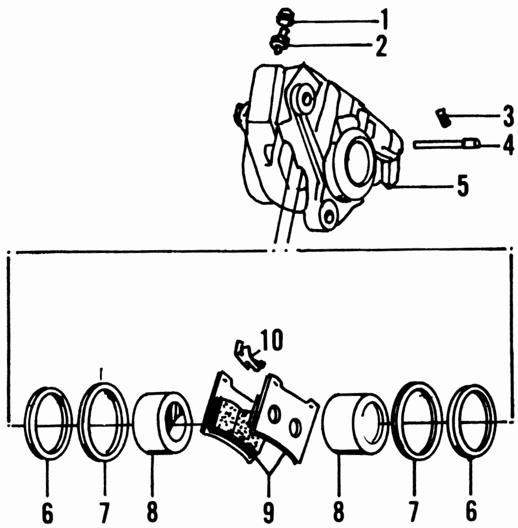
WARNING
Use brake fluid clearly marked DOT 4 from a sealed container. Other types may vaporize and cause brake failure. Always use the same brand name; do not intermix brake fluids, many brands are not compatible. Do not intermix silicone-based (DOT 5) brake fluid as it can cause brake component damage leading to brake system failure.

WARNING
Do not ride the motorcycle until you are sure the brakes are operating correctly with full hydraulic advantage. If necessary, bleed the brake as described under ***Bleeding the System*** *in this chapter.*

22. Install the right-hand side cover and seat.

23. Bed the pads in gradually for the first 5-10 days of riding 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.

(40) FRONT BRAKE CALIPER (1984-1987)



1. Cap
2. Bleeder valve
3. Clip
4. Pad retaining pins
5. Caliper body
6. Dust seal
7. Piston seal
8. Piston
9. Pads
10. Pad spring

BRAKE CALIPERS

Front Caliper Removal/Installation

Refer to **Figure 40** for 1984-1987 models or **Figure 41** for 1988-on models.

1. Drain the master cylinder as follows:
   a. Attach a hose to the brake caliper bleed screw. Refer to A, **Figure 42** for 1984-1987 models or **Figure 43** for 1988-on models.
   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 front brake pads as described in this chapter.

3A. On 1984-1987 models, perform the following:
   a. Remove the union bolt and copper sealing washers attaching the brake hoses to the caliper (B, **Figure 42**). Be sure to cap or tape the ends to prevent the entry of moisture and dirt.
   b. Remove the bolts (C, **Figure 42**) securing the brake caliper to the front fork and remove the brake caliper.

3B. On 1988-on models, perform the following:
   a. Remove the union bolt and copper sealing washers attaching the brake hose to the caliper (A, **Figure 44**). Be sure to cap or tape the ends to prevent the entry of moisture and dirt.
   b. Remove the reflector (B, **Figure 44**) from the brake hose bracket.
   c. Remove the bolt (**Figure 45**) securing the brake hose to the fork slider.
   d. Remove the upper and lower bolts (**Figure 46**) securing the brake caliper to the front fork slider and remove the brake caliper.

4. Installation is the reverse of these steps while noting the following:
   a. Tighten the caliper mounting bolts to specifications in **Table 2.**
   b. Install the brake hose using new copper washers (**Figure 47**).
   c. Tighten the brake hose union bolt to specifications in **Table 2.**
   d. Install the front brake pads as described in this chapter.
   e. Bleed the brakes as described under *Bleeding the System* in this chapter.

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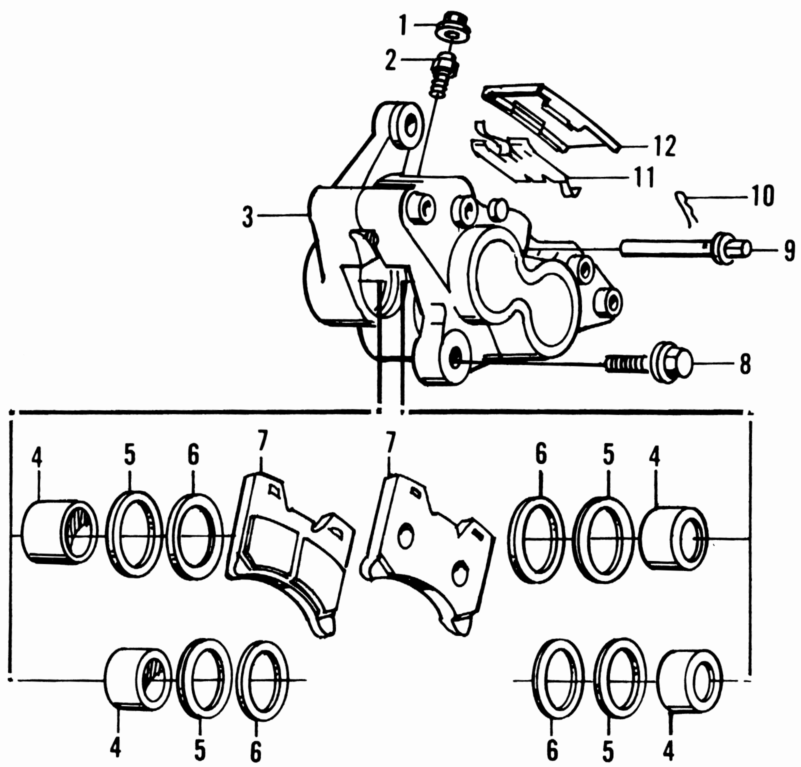
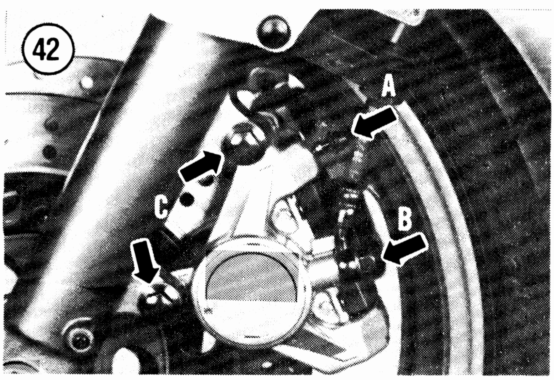
FRONT BRAKE CALIPER (1988-ON)



1. Cap
2. Bleeder valve
3. Caliper body
4. Piston
5. Piston seal
6. Dust seal
7. Pads
8. Bolt
9. Pad retaining pins
10. Clips
11. Pad spring
12. Cover

42



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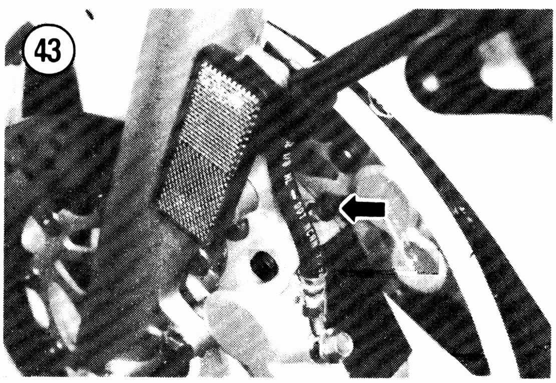
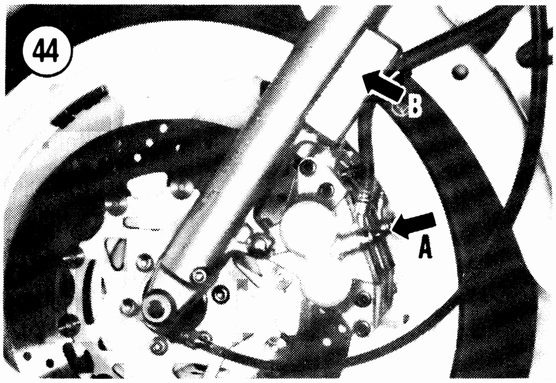
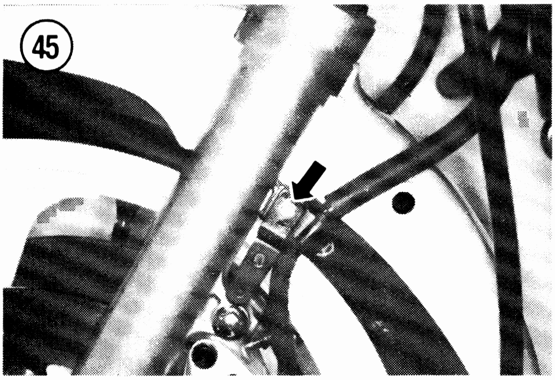
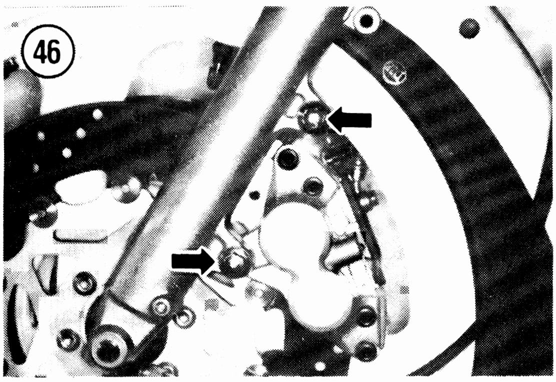
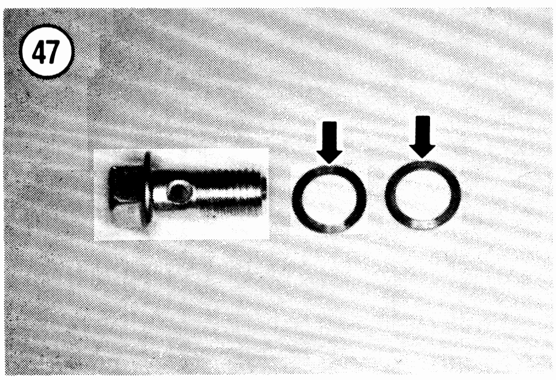










WARNING
Do not ride the motorcycle until you are sure that the brakes are operating properly.

Rear Caliper Removal/Installation

Refer to **Figure 48** for this procedure.

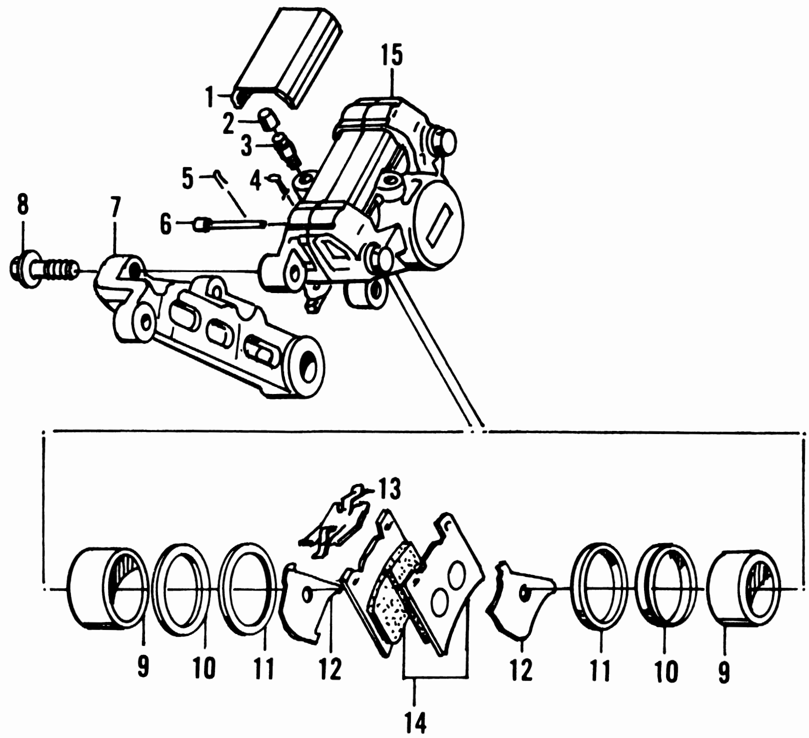
1. Drain the master cylinder as follows:
   a. Attach a hose to the brake caliper bleed screws (**Figure 49**) on each half of the caliper.
   b. Place the end of the hoses in a clean container.
   c. Open both bleed screws and operate the brake pedal to drain all brake fluid from the master cylinder reservoir.
   d. Close the bleed screw and disconnect the hoses.
   e. Discard the brake fluid.
2. Remove the rear brake pads as described in this chapter.
3. Remove the union bolt (A, **Figure 50**) and copper sealing washers attaching the brake hose to the caliper. Be sure to cap or tape the ends to prevent the entry of moisture and dirt.
4. Remove the bolts (B, **Figure 50**) securing the caliper and remove the brake caliper from the brake disc and caliper bracket.
5. Installation is the reverse of these steps while noting the following:
   a. Tighten the caliper mounting bolts to specifications in **Table 2**.
   b. Install the rear brake pads as described in this chapter.
   c. Install the brake hose using new copper washers (**Figure 47**).
   d. Tighten the brake hose union bolt to specifications in **Table 2.**
   e. Bleed the brakes as described under *Bleeding the System* in this chapter.

WARNING
*Do not ride the motorcycle until you are sure the brakes are operating correctly with full hydraulic advantage. If necessary, bleed the brake as described under **Bleeding the System** in this chapter.*

11

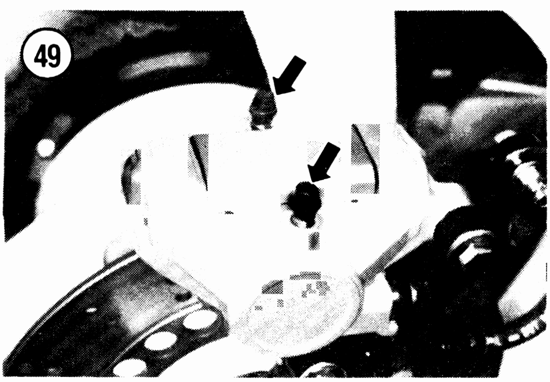
48

REAR BRAKE CALIPER



1. Cover
2. Cap
3. Bleeder valve
4. Clip
5. Clip
6. Pad retaining pin
7. Caliper bracket
8. Bolt
9. Piston
10. Piston seal
11. Dust seal
12. Pad shim
13. Pad spring
14. Pads

49



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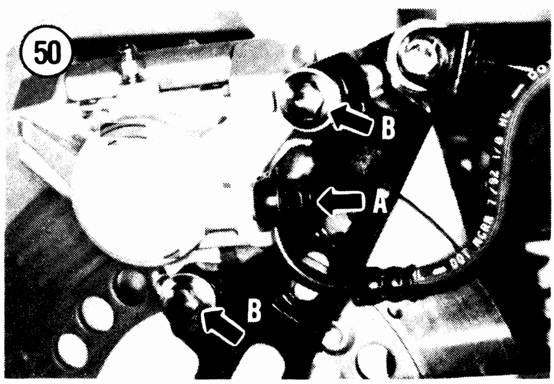
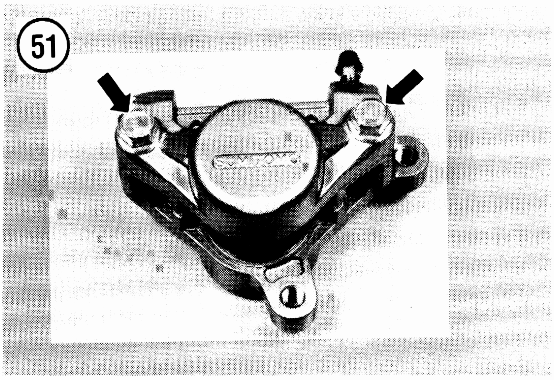
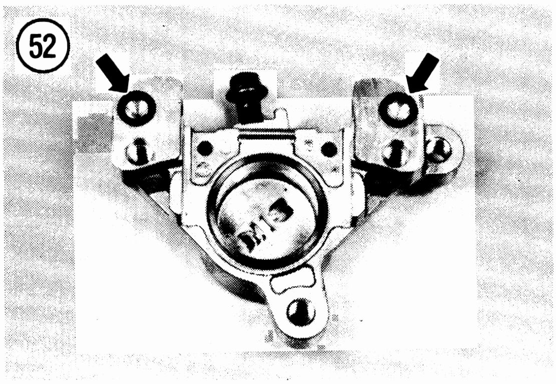
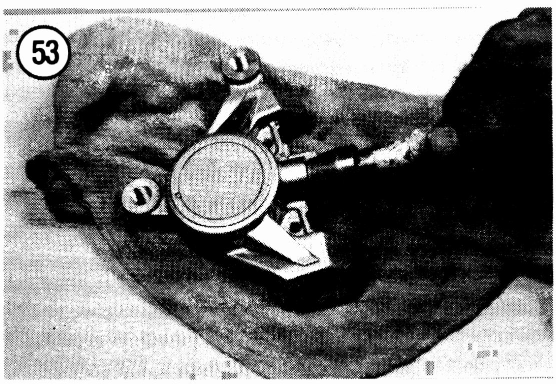
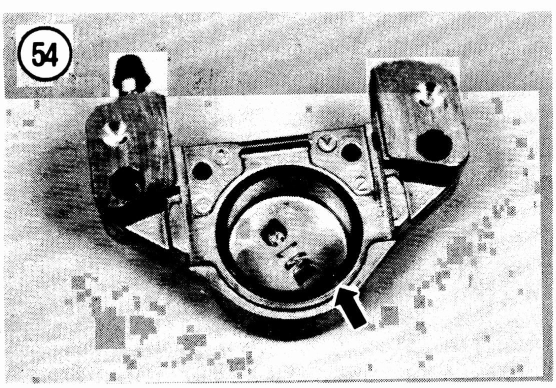










Front Caliper Rebuilding (1984-1987)

Refer to **Figure 40** for this procedure.

1. Remove the brake caliper as described in this chapter.
2. Remove the bolts (**Figure 51**) clamping the caliper halves together and separate the caliper assembly.
3. Remove the O-rings (**Figure 52**) and discard them.

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.*

4. Pad the piston with shop rags or wood blocks as shown in **Figure 53**. Block the exposed housing fluid port holes on the back of the caliper housing. Then apply compressed air through the caliper hose joint and blow the piston (**Figure 54**) out of the caliper.
5. Repeat for the opposite piston.

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.

6. 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. Repeat for the other set of seals.
7. 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.

8. Coat the new dust seal and piston seal with fresh DOT 4 brake fluid.

9. Carefully install the new dust seal and piston seal in the grooves in the caliper cylinders. Make sure the seals are properly seated in their respective grooves.
10. Coat the piston and caliper cylinder with fresh DOT 4 brake fluid.
11. Position the piston with the open end facing out toward the brake pads and install the piston into the caliper cylinder. Push the piston in until it bottoms out. Repeat for the other piston (**Figure 55**).
12. Install *new* O-rings (**Figure 52**) and coat them with DOT 4 brake fluid.
13. Place the caliper halves together and install the bolts (**Figure 51**) clamping the caliper halves together.
14. Tighten the bolts to the torque specification listed in **Table 2**.
15. Install the caliper and brake pads as described in this chapter.

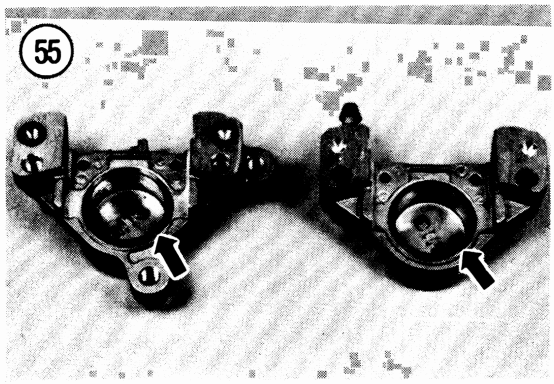
Front Caliper (1988-on) and Rear Caliper Rebuilding

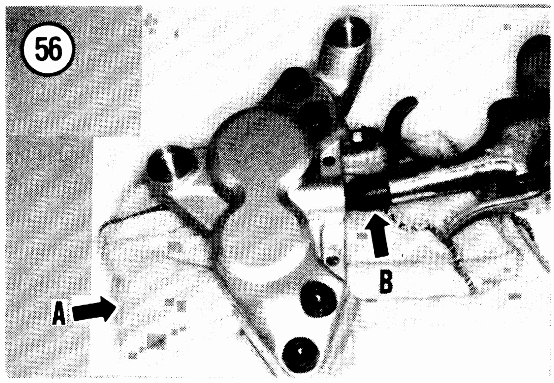
Refer to **Figure 28** for the front caliper or **Figure 48** for the rear caliper for this procedure.

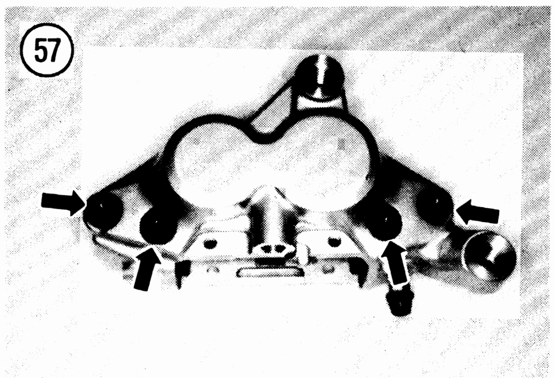
1. Remove the brake caliper as described in this chapter.

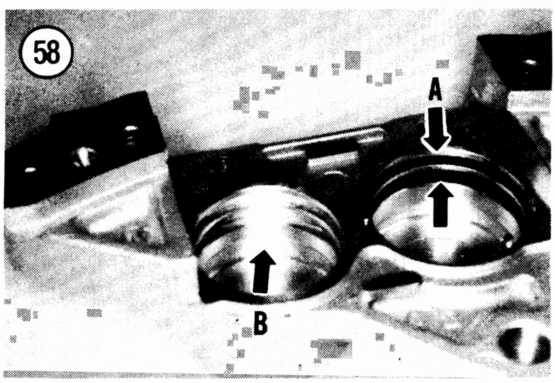
WARNING
*In the next step, the piston may shoot out of the caliper body like a bullet. Keep your fingers out of the way. Wear shop gloves and apply air pressure gradually. Do **not** use high pressure air or place the air hose nozzle directly against the hydraulic line fitting inlet in the caliper body. Hold the air nozzle away from the inlet allowing some of the air to escape.*

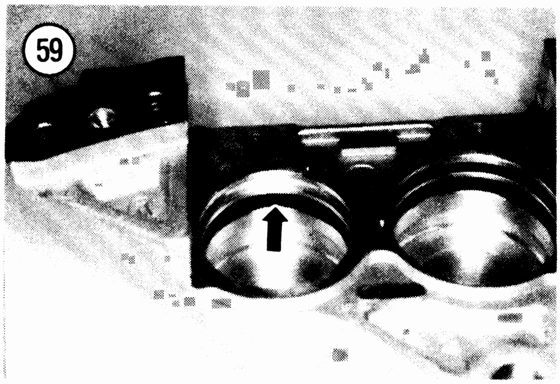
2. Pad the pistons with shop rags or wood blocks as shown in A, **Figure 56**. Block the exposed housing fluid port holes on the back of the caliper housing. Then apply compressed air through the caliper hose joint (B, **Figure 56**) and blow the pistons out of the caliper.
3. Repeat for the opposite set of pistons.
4. Remove the bolts (**Figure 57**) clamping the caliper halves together and separate the caliper assembly.
5. Remove the O-rings from each caliper half and discard them.

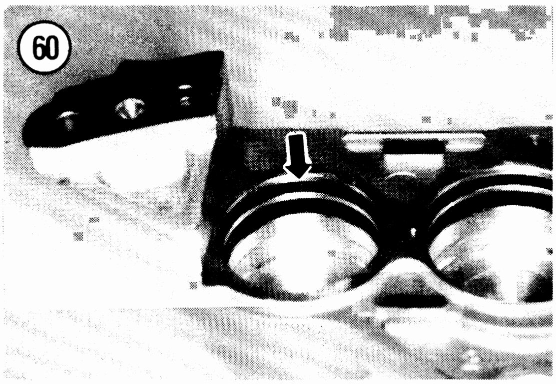


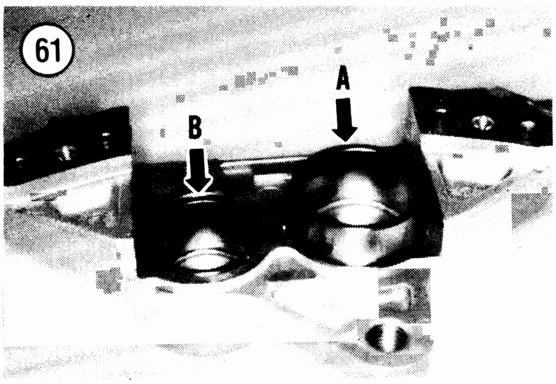


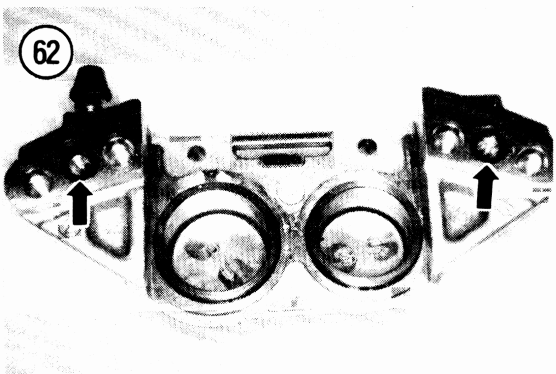












CAUTION
In the following step, do not use a sharp tool to remove the dust and piston seals from the caliper cylinder. Do not damage the cylinder surface.

6. Use a piece of plastic or wood and carefully push the dust seal and the piston seal (A, **Figure 58**) in toward the caliper cylinder and out of their grooves. Remove the dust and piston seals from both cylinders and discard both seals. Repeat for the other set of seals.
7. 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.

8. Coat the new dust seal and piston seal with fresh DOT 4 brake fluid.
9. Carefully install the new piston seal (**Figure 59**) and dust seal (**Figure 60**) in the grooves in the caliper cylinders. Make sure the seals are properly seated in their respective grooves.
10. Coat the pistons, the seals and caliper cylinder with fresh DOT 4 brake fluid.
11. Position the piston with the open end facing out toward the brake pads and install the piston (A, **Figure 61**) into the caliper cylinder. Push the piston in until it bottoms out. Repeat for the other piston (B, **Figure 61**) in that caliper half.
12. Repeat Step 11 for the other caliper half.
13. Install *new* O-rings (**Figure 62**) and coat them with DOT 4 brake fluid.
14. Place the caliper halves together and install the bolts (**Figure 57**) clamping the caliper halves together.
15. Tighten the bolts to the torque specification listed in **Table 2**.
16. Install the caliper and brake pads as described in this chapter.

Caliper Inspection (Front and Rear All Models)

1. Clean all parts (except brake pads) with rubbing alcohol and rinse with clean DOT 4 brake fluid. Place the cleaned parts on a lint-free cloth while performing the following inspection procedures.

2. Inspect the seal grooves (**Figure 63**) in both caliper bodies for damage. If damaged or corroded, replace the caliper assembly.

3. Inspect the cylinder walls (B, **Figure 58**) 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. Refer to **Figure 64** and **Figure 65**. Replace the brake caliper if the inside diameter(s) are worn to the service limit dimension listed in **Table 1** or greater.

5. Inspect the pistons (**Figure 66**) 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. Refer to **Figure 67** and **Figure 68**.

7. Inspect the caliper mounting bolt holes on the caliper body. If worn or damaged, replace the caliper assembly.

8. Remove the bleed screw (**Figure 69**) 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 70**) in the base of each 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 (**Figure 71**) 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

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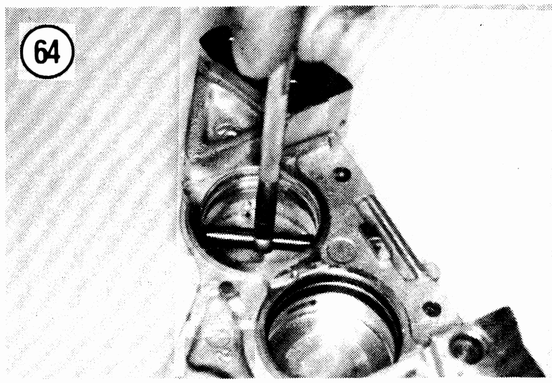

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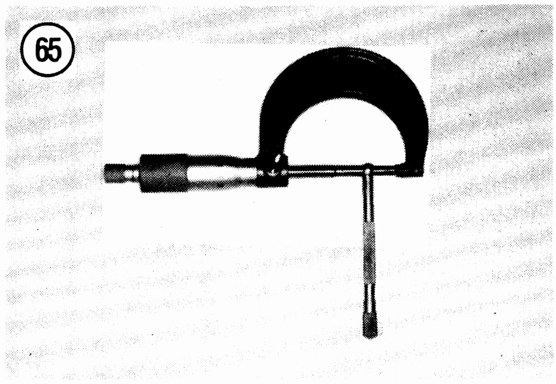

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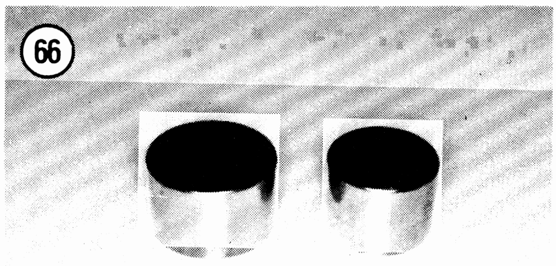

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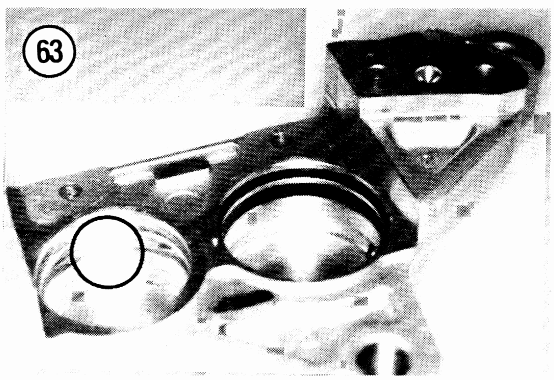

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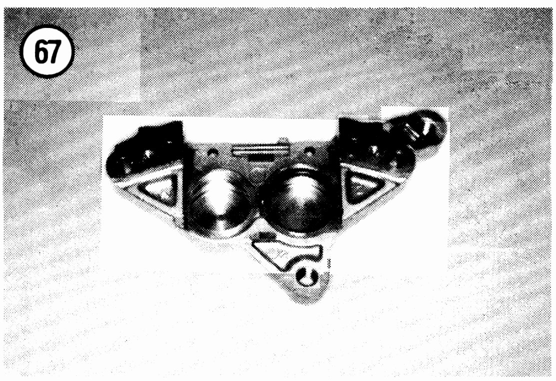
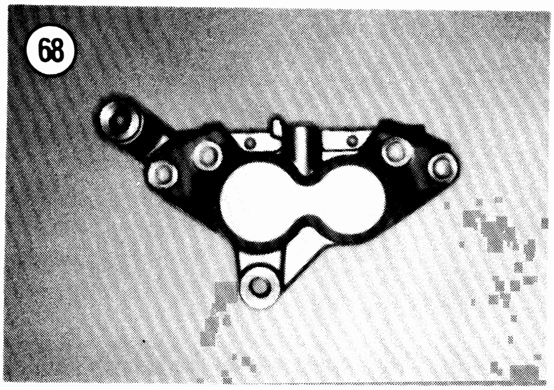
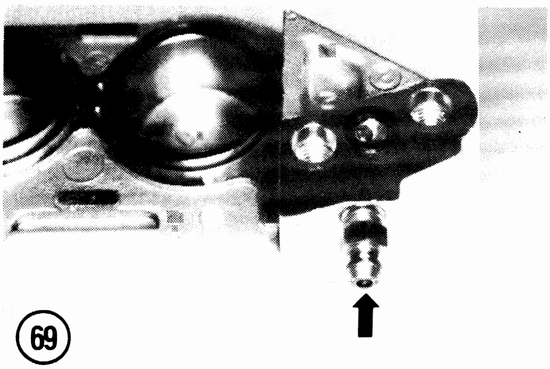
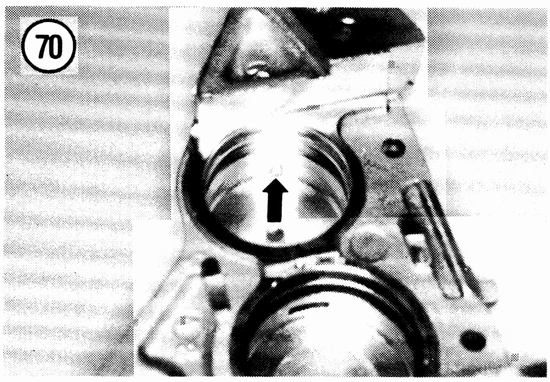
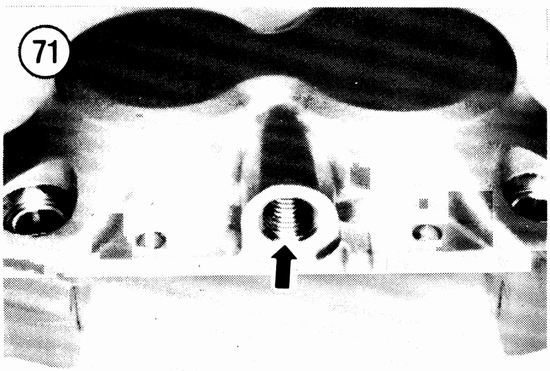










and brake fluid temperatures. Replace the piston and dust seals if the following conditions exist:

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 72**). Replace both brake pads if any one pad is worn to or is less than the service limit dimension listed in **Table 1**.

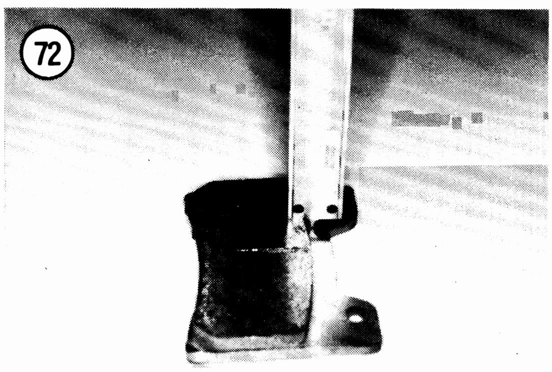
FRONT MASTER CYLINDER

Removal/Installation

CAUTION

Cover the fuel tank, front fairing, front fender and instrument cluster 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.

1. Drain the master cylinder as follows:
   a. Attach a hose to the brake caliper bleed screw (**Figure 43**).
   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. Disconnect the brake switch wires (A, **Figure 73**) at the master cylinder.



3. Slide the rubber boot (**Figure 74**) off the union bolt.
4. Remove the union bolt (B, **Figure 73**) securing the brake hose to the master cylinder. Remove the 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.
5. Remove the clamping bolts (**Figure 75**) and clamp securing the master cylinder to the handlebar and remove the master cylinder.
6. Install by reversing these removal steps while noting the following:
   a. Tighten the upper clamp bolt first, then the lower bolt to specifications in **Table 2**. There should be a gap at the lower part of the clamp after tightening.
   b. 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 (B, **Figure 73**). Tighten the union bolt to the specifications in **Table 2**. Slide the rubber boot back into position.
   c. Bleed the brake system as described under *Bleeding the System* in this chapter.

WARNING
Do not ride the motorcycle until you are sure the brakes are operating correctly with full hydraulic advantage. If necessary, bleed the brake as described under ***Bleeding the System*** *in this chapter.*

Disassembly

Refer to **Figure 76** for this procedure.
1. Remove the master cylinder as described in this chapter.
2. Remove the screws securing the reservoir cap and diaphragm. Pour out the remaining brake fluid and discard it. *Never* reuse brake fluid.
3. Remove the nut and bolt (A, **Figure 77**) and remove the brake lever (B, **Figure 77**).
4. Remove the brake lever spring (**Figure 78**).
5. Pull the dust boot (**Figure 79**) out of the master cylinder housing.
6. Remove the circlip (A, **Figure 80**) with circlip pliers.
7. Remove the piston assembly (A, **Figure 81**) and spring (**Figure 82**).
8. Remove the seat (B, **Figure 81**) from the piston.
9. Remove the primary cup (A, **Figure 83**) from the piston.

CAUTION
Do not remove the secondary cup (B, ***Figure 83****) from the piston or damage to the secondary cup will occur.*

Inspection

1. Clean all parts (**Figure 84**) in fresh DOT 4 brake fluid. Place the master cylinder components on a

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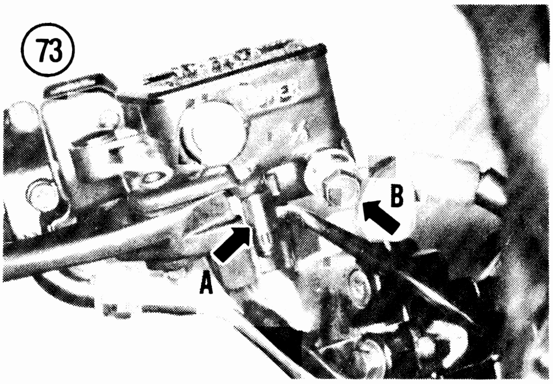

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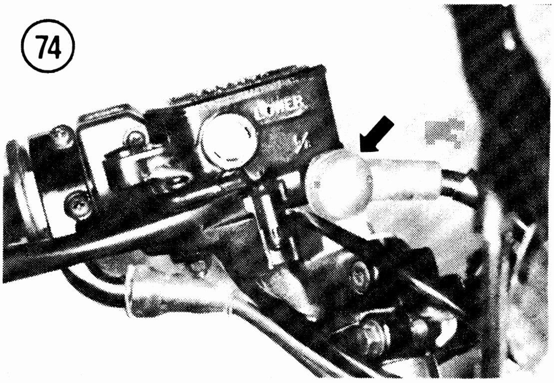

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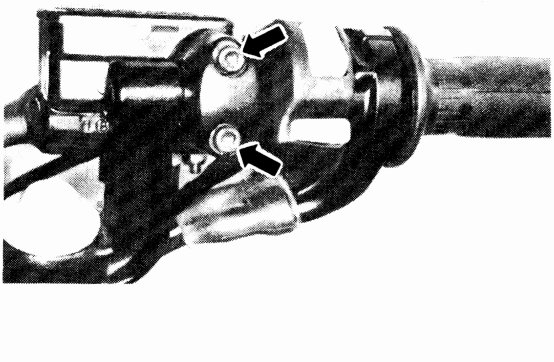

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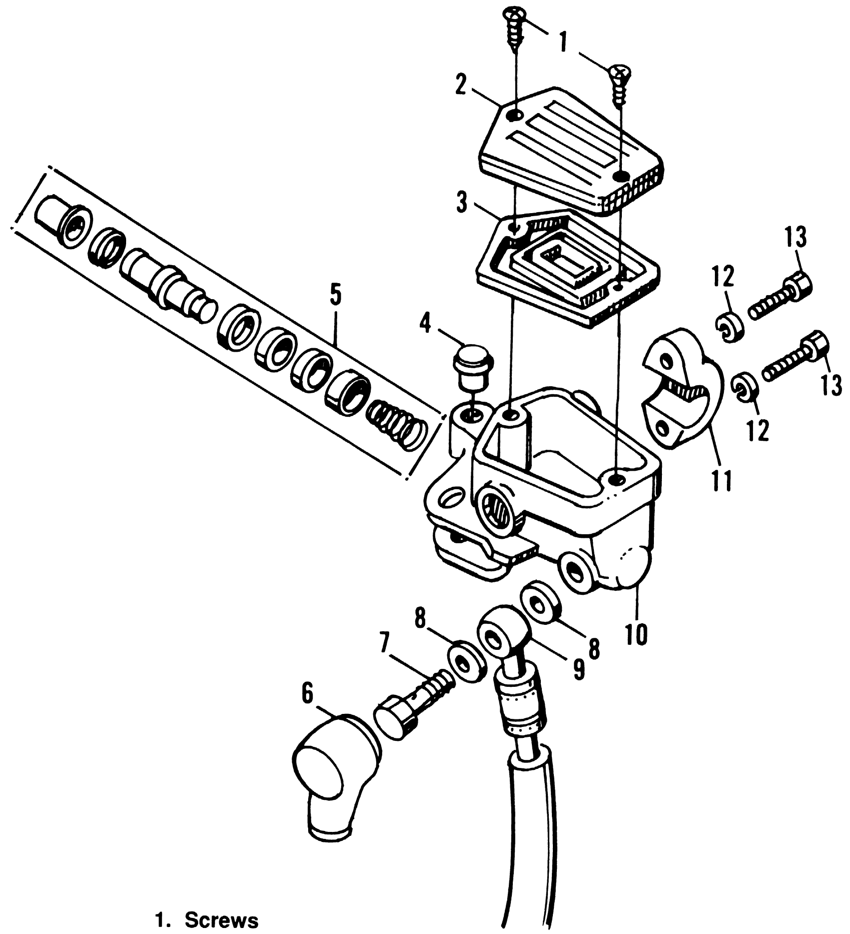
FRONT MASTER CYLINDER



1. Screws
2. Cap
3. Diaphragm
4. Plug
5. Piston assembly
6. Rubber boot
7. Union bolt
8. Copper washer
9. Brake hose
10. Master cylinder
11. Clamp
12. Washers
13. Bolts

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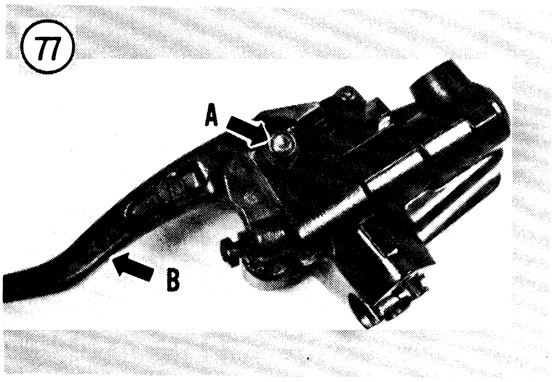

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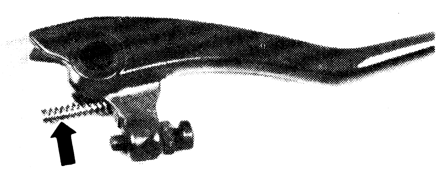


clean lint-free cloth when performing the following inspection procedures.

2. Inspect the cylinder bore and piston contact surfaces for signs of wear or damage. If either part is less than perfect, replace it.

3. Check the end of the piston (C, **Figure 83**) for wear caused by the hand lever. Replace the entire piston assembly if any portion of it requires replacement. If the piston assembly is replaced, also replace the primary cup.

4. Check the secondary cup on the piston (B, **Figure 83**) for damage, softness or for swollen conditions. Replace the piston assembly if necessary.

5. Check the primary cup (A, **Figure 83**) for the same conditions in Step 4. Replace the primary cup if necessary.

6. Inspect the pivot hole in the hand lever (**Figure 85**). If worn, it must be replaced.

7. Make sure the passages in the bottom of the brake fluid reservoir (**Figure 86**) are clear.

8. Check the reservoir diaphragm (A, **Figure 87**) and cap (B, **Figure 87**) for damage and deterioration. Replace if necessary.

9. Inspect the threads in the master cylinder body where the brake hose banjo bolt screws in. If the threads are damaged or partially stripped, replace the master cylinder body.

10. Measure the master cylinder inside diameter with a bore gauge. Replace the master cylinder if the inside diameter is worn to the service limit dimension listed in **Table 1** or greater.

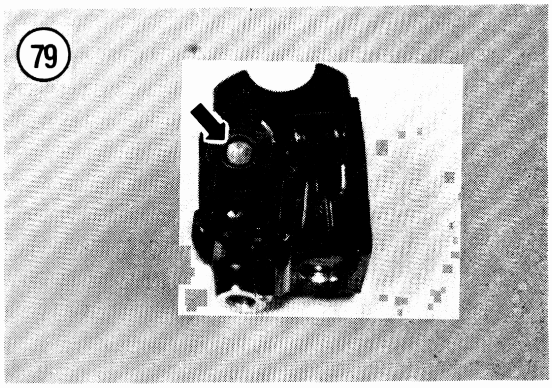
Assembly

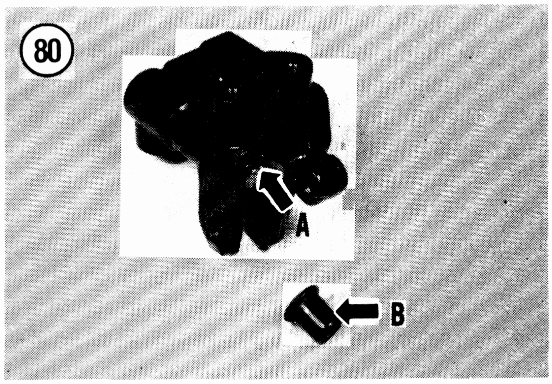
1. Soak the new cups in fresh brake fluid for at least 15 minutes to make them pliable. Coat the inside of the cylinder with fresh brake fluid prior to assembling the parts.

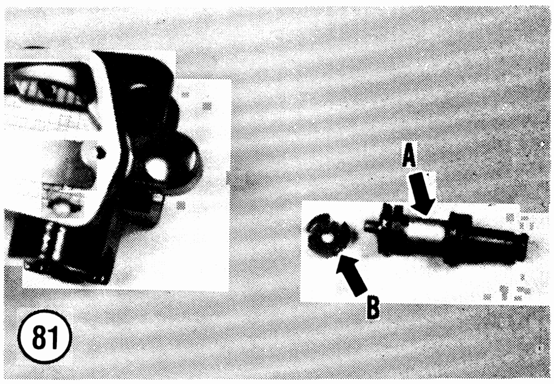
CAUTION
When installing the piston assembly, do not allow the cups to turn inside out as they will be damaged and allow brake fluid to leak within the cylinder bore.

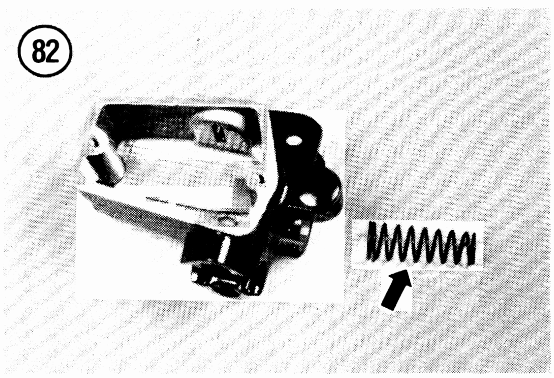
2. Slide the primary cup (A, **Figure 83**) onto the piston assembly. Install the primary cup so that the larger seal lip will face into the master cylinder first.

3. Install the piston seal seat.









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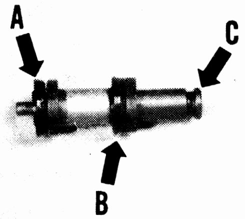

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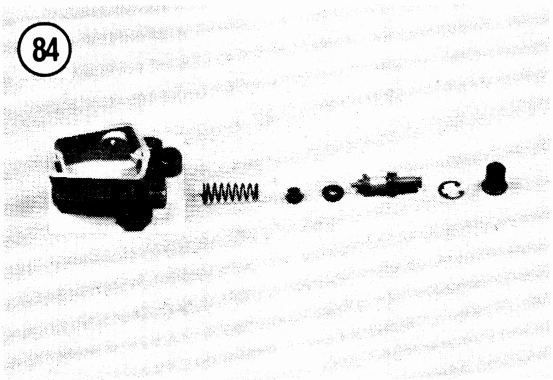

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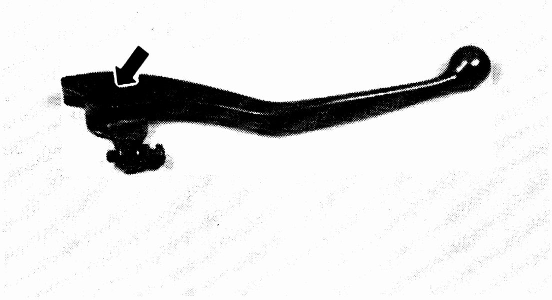

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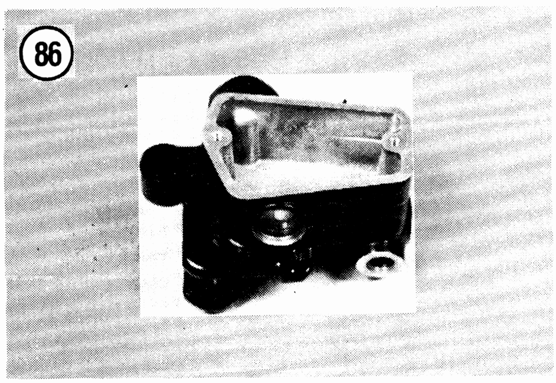

4. Install the spring into the master cylinder housing (**Figure 82**) so that the small end of the spring faces the piston assembly.
5. Install the piston assembly into the master cylinder (**Figure 81**).
6. Compress the piston assembly and install the circlip (A, **Figure 80**) with circlip pliers.
7. Install the dust cover (B, **Figure 80**). Make sure the dust cover is firmly seated in the master cylinder.
8. Install the spring into the brake lever (**Figure 78**) and install the brake lever (B, **Figure 77**) onto the master cylinder. Install the pivot bolt and nut (A, **Figure 77**) and tighten the nut securely.
9. Install the diaphragm and cover onto the master cylinder until reinstallation.

REAR MASTER CYLINDER

Removal/Installation

Refer to **Figure 88** for this procedure.

CAUTION
Cover the swing arm 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 surfaces immediately, as it will destroy the finish. Use soapy water and rinse completely.

1. Drain the master cylinder as follows:
   a. Attach a hose to each brake caliper bleed screw (**Figure 89**).
   b. Place the end of the hose in a clean container.
   c. Open the bleed screw and operate the brake pedal to drain all brake fluid from the master cylinder reservoir.

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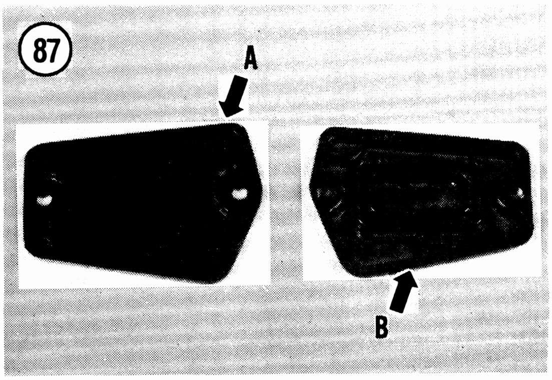

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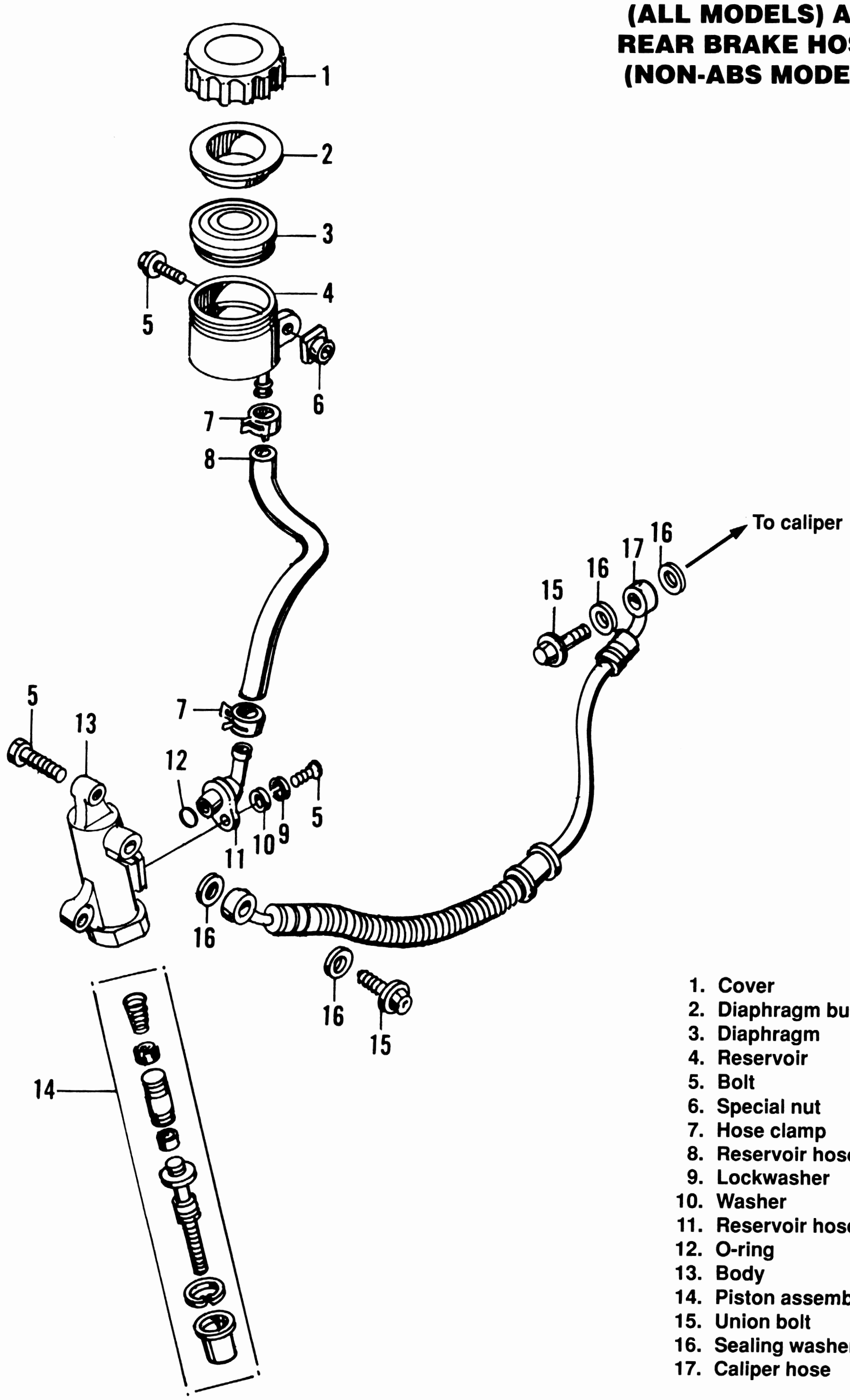
REAR MASTER CYLINDER (ALL MODELS) AND REAR BRAKE HOSES (NON-ABS MODELS)



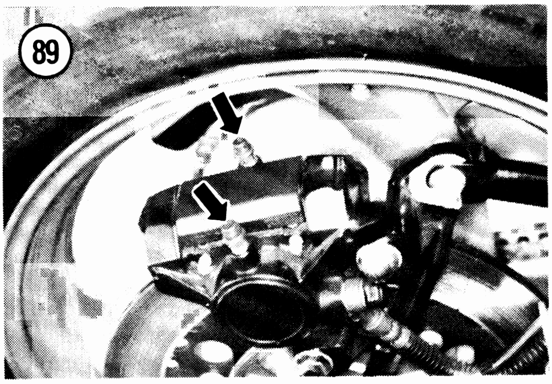
1. Cover
2. Diaphragm bushing
3. Diaphragm
4. Reservoir
5. Bolt
6. Special nut
7. Hose clamp
8. Reservoir hose
9. Lockwasher
10. Washer
11. Reservoir hose fitting
12. O-ring
13. Body
14. Piston assembly
15. Union bolt
16. Sealing washer
17. Caliper hose

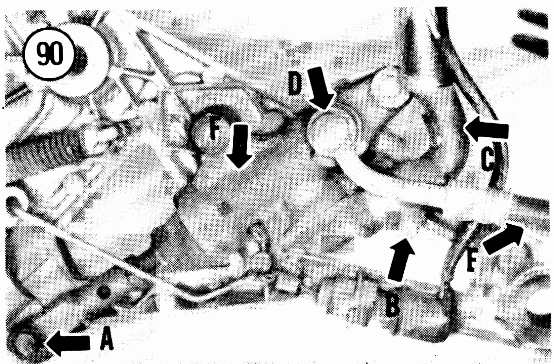
d. Close the bleed screw and disconnect the hoses.

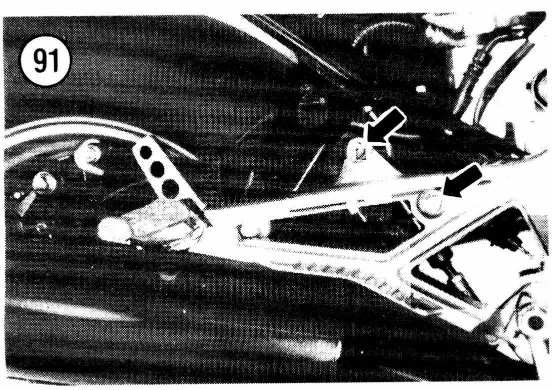
e. Discard the brake fluid.

2. Remove the right-hand frame side cover.

NOTE
The following procedure is shown with the right-hand muffler bracket removed for clarity. It is not necessary to remove this bracket in order to remove the master cylinder.







3. Remove cotter pin, slide out the pivot pin (A, **Figure 90**) and disconnect the master cylinder push rod from the brake pedal.
4. Loosen the hose clamp (B, **Figure 90**) and disconnect the reservoir hose (C, **Figure 90**) from the fitting on the master cylinder. Place the end of the hose in a plastic bag to prevent the entry of foreign matter and dirt.
5. Loosen the union bolt (D, **Figure 90**) securing the brake hose (E, **Figure 90**) to the backside of the master cylinder.
6. Remove the bolts (**Figure 91**) securing the master cylinder (F, **Figure 90**) to the frame and partially pull the master cylinder away from the frame.
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.
8. Remove the master cylinder and take it to the workbench for further disassembly.
9. Install by reversing these removal steps while noting the following:

a. Install the brake hose into the U-shaped notch in the master cylinder. Be sure to place a *new* copper sealing washer on each side of the hose fitting and install the union bolt. Tighten the union bolt to the specifications in **Table 2**.

b. Insert the reservoir hose into the master cylinder and secure it.

c. Tighten the master cylinder mounting bolt to the specifications in **Table 2**.

d. Bleed the brake system as described under *Bleeding the System* in this chapter.

e. Adjust the rear brake pedal as described in Chapter Three; refer to *Rear Brake Pedal Height Adjustment* and *Rear Brake Light Switch Adjustment.*

WARNING
*Do not ride the motorcycle until you are sure the brakes are operating correctly with full hydraulic advantage. If necessary, bleed the brake as described under **Bleeding the System** in this chapter.*

Reservoir and Hose Removal/Inspection/Installation

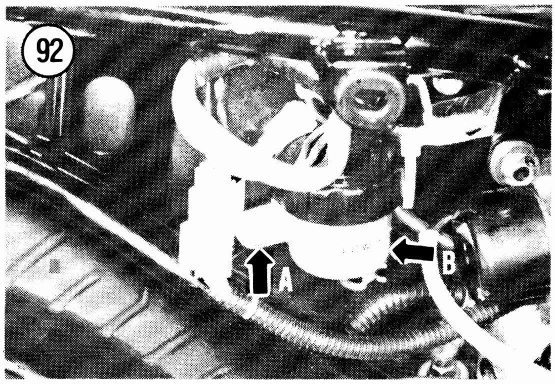
1. Drain the master cylinder reservoir by first draining the master cylinder as described under *Rear Master Cylinder Removal/Installation* in this chapter.

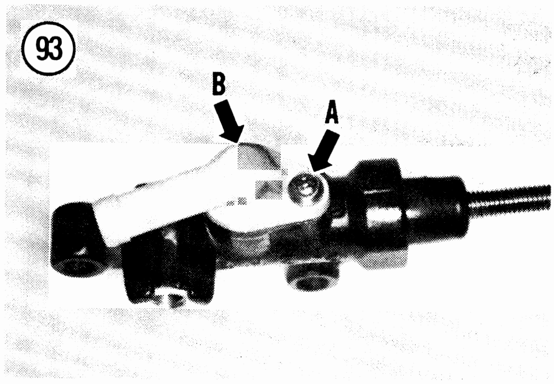
2. Remove the seat as described in Chapter Twelve.
3. Loosen the hose clamp (B, **Figure 90**) and disconnect the reservoir hose (C, **Figure 90**) from the fitting on the master cylinder. Plug the end of the hose with a golf tee to prevent any brake fluid residue from dripping on the frame and surrounding parts during removal.
4. Remove the bolt and special nut (A, **Figure 92**) securing the reservoir to the frame.
5. Note the routing of the hose in the frame, then pull the reservoir and reservoir hose (B, **Figure 92**) out of the frame.
6. Unscrew the cover and remove the diaphragm and the diaphragm bushing. Make sure the passages in the bottom of the reservoir are clear. Check the reservoir cover and diaphragm and diaphragm bushing for damage and deterioration. Replace if necessary.
7. Install by reversing these removal steps while noting the following:
   a. Be sure to route the reservoir hose through the frame in the same path as noted during removal.
   b. Bleed the brake as described in this chapter.

Master Cylinder Disassembly/Reassembly

Refer to **Figure 88** for this procedure.
1. Remove the master cylinder as described in this chapter.
2. Remove the screw, washer and lockwasher (A, **Figure 93**) securing the reservoir hose fitting (B, **Figure 93**) and remove the fitting.
3. Slide the dust boot (**Figure 94**) down and on the pushrod.
4. Remove the circlip (**Figure 95**) securing the pushrod assembly.
5. Remove the pushrod, piston (**Figure 96**) and spring (**Figure 97**).
6. Inspect the master cylinder assembly as described in this chapter.
7. Soak the piston caps 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





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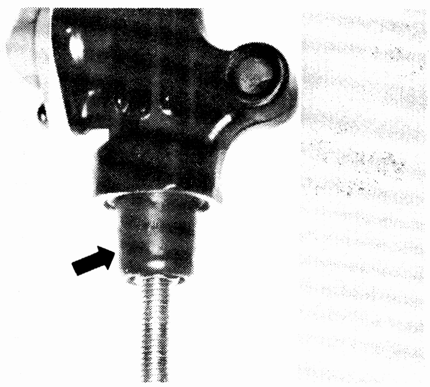

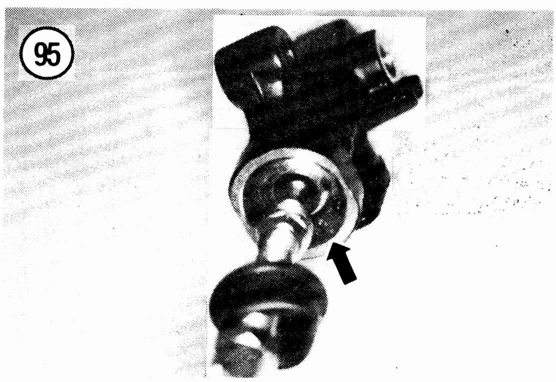

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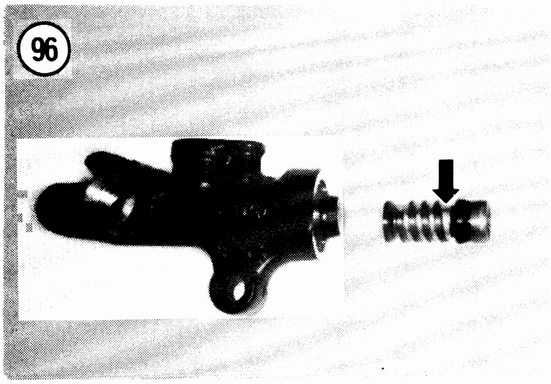

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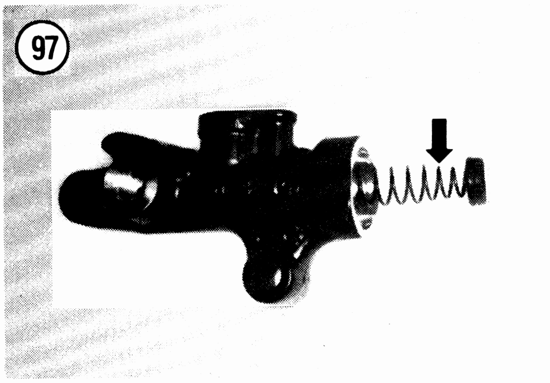

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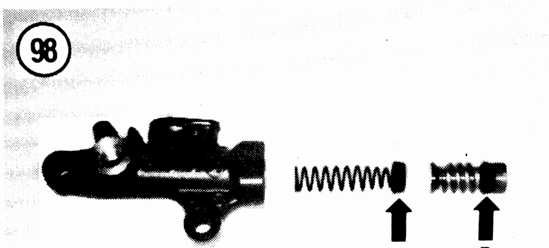

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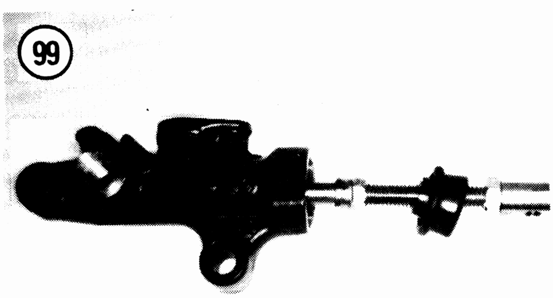

they will be damaged and allow brake fluid to leak within the cylinder bore.

8. Install the spring with the narrow end going in last (A, **Figure 98**) and the piston with the pushrod end going in last (B, **Figure 98**).
9. Slowly push the spring and piston into the master cylinder with the pushrod assembly (**Figure 99**).
10. Install the circlip (**Figure 95**) and make sure it is seated in its groove completely.
11. Slide the dust boot into position and make sure it is firmly seated against the master cylinder.
12. Make sure the O-ring seal (**Figure 100**) is in place on the reservoir hose fitting.
13. Install the reservoir hose fitting (B, **Figure 93**), then install the screw, washer and lockwasher (A, **Figure 93**). Tighten the screw securely, but do not overtighten as the plastic fitting may fracture.
14. Install the master cylinder as described in this chapter.

Master Cylinder Inspection

The piston, the spring, the primary and secondary cups and the pushrod are all replaced as a kit. Individual parts are not available, if any of these parts are faulty the master cylinder kit must be purchased.

1. Clean all parts in fresh DOT 4 brake fluid. Place the master cylinder components on a clean lint-free cloth when performing the following inspection procedures.
2. Inspect the cylinder bore (**Figure 101**) and piston contact surfaces for signs of wear or damage. If either part is less than perfect, replace it. See Step 10.

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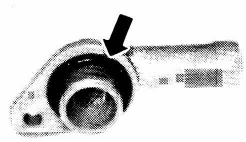

3. Check the end of the piston (**Figure 102**) for wear caused by the piston stop. See Step 10.

4. Check the primary and secondary cups (A, **Figure 103**) for damage, softness or for swollen conditions. See Step 10.

5. Inspect the piston (B, **Figure 103**) and the spring (C, **Figure 103**) for damage or bending. See Step 10.

6. Inspect the end of the pushrod where it contacts the piston for damage. See Step 10.

7. Inspect the pushrod assembly (**Figure 104**) for damage or bending. See Step 10.

8. If any of the parts inspected in Steps 2-7 are worn, damaged or bent, replace all of them with the master cylinder kit.

9. Measure the master cylinder inside diameter with a bore gauge (**Figure 105**). If worn to the service limit dimension listed in **Table 1**, or greater, replace the master cylinder.

10. Make sure the inlet passage (**Figure 106**) is clear.

11. Inspect the union bolt threads (**Figure 107**) in the master cylinder body. If the threads are damaged or partially stripped, replace the master cylinder body.

12. Inspect the master cylinder body and mounting bolt holes (**Figure 108**) for cracks or damage. If damaged in any way, replace the master cylinder body.

BRAKE HOSE REPLACEMENT (NON-ABS MODELS)

A brake hose should be replaced whenever it shows cracks, bulges or other damage. The deterioration of rubber by ozone and other atmospheric elements may require hose replacement every 4 years.

CAUTION
Cover components with a heavy cloth or plastic tarp to protect them 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.

NOTE
On ABS-equipped models, refer to ***ABS Brake System*** *for brake hose replacement.*

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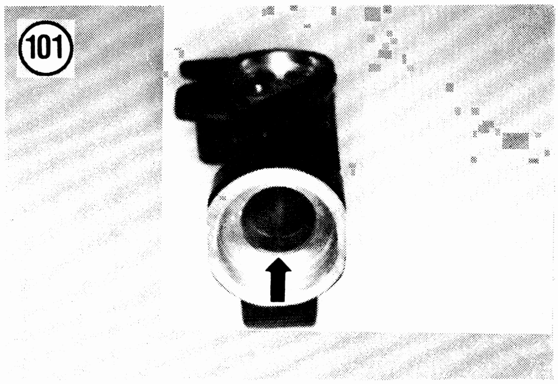

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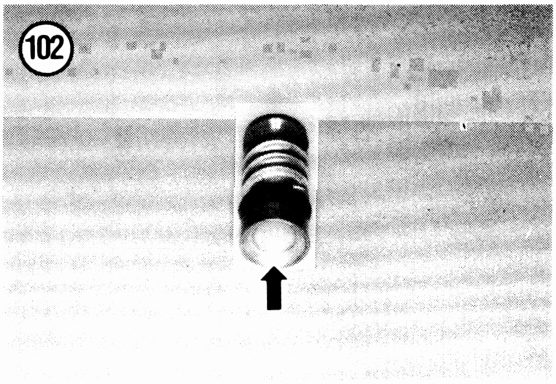

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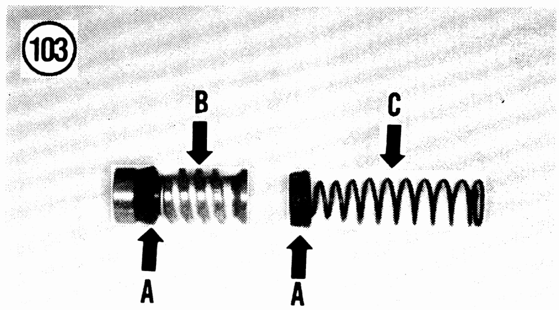

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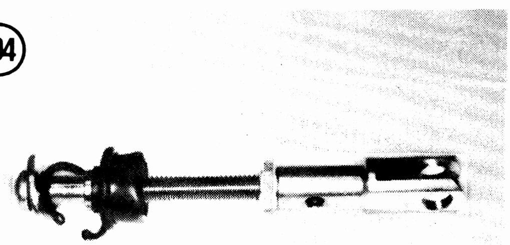

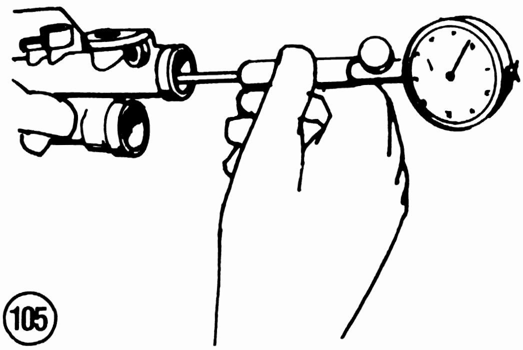

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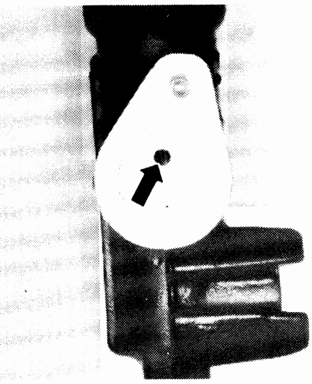

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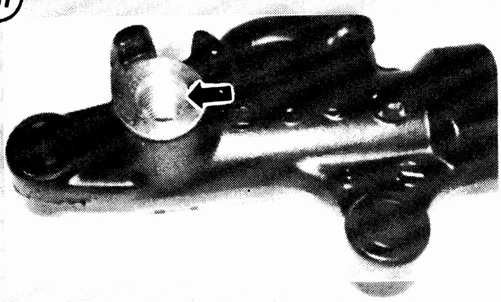

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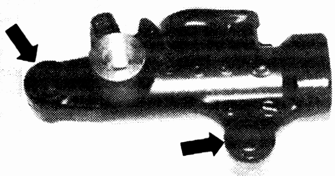

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Front Brake Hoses

Refer to **Figure 109** for this procedure.

NOTE
On 1984-1987 models, there are 2 brake hoses attached to each front caliper. The brake hose next to the caliper goes to the anti-dive unit on the front fork.

1. Remove the front fairing as described in Chapter Twelve.
2. Before replacing the front brake hoses, inspect the routing of the old hoses carefully, noting any guides and grommets the hoses may go through.
3. Drain the front master cylinder as described under *Front Master Cylinder Removal/Installation* in this chapter.
4. Slide the rubber boot (**Figure 110**) off the union bolt.
5. Remove the union bolt (**Figure 111**) securing the upper brake hose to the master cylinder. Disconnect the upper brake hose and remove both copper sealing washers.
6. Remove the union bolt (A, **Figure 112**) securing the upper brake hose to the 2-way fitting. Disconnect the upper brake hose and remove both copper sealing washers.
7. Remove the master cylinder brake hose (B, **Figure 112**) from the frame.
8. Remove the reflector (A, **Figure 113**) from both front fork sliders.
9. Remove the bolt and clamp (A, **Figure 114**) securing the lower brake hose to the front fork slider.
10. Remove the union bolt (B, **Figure 113**) securing the brake hose to the left-hand caliper. Disconnect the brake hose and remove both copper sealing washers.
11. Remove the bolt and clamp (**Figure 115**) securing the lower brake hose to the front fork slider.
12. Remove the union bolt (**Figure 116**) securing the brake hose(s) to the right-hand caliper. Disconnect the brake hose(s) and remove all copper sealing washers.
13. Remove the union bolt (A, **Figure 117**) securing both lower brake hoses to the 2-way fitting. Disconnect the brake hoses and remove the 3 copper sealing washers.
14. Remove the right-hand lower hose (B, **Figure 117**) and the left-hand lower hose (B, **Figure 114**) from the frame and front fork area.

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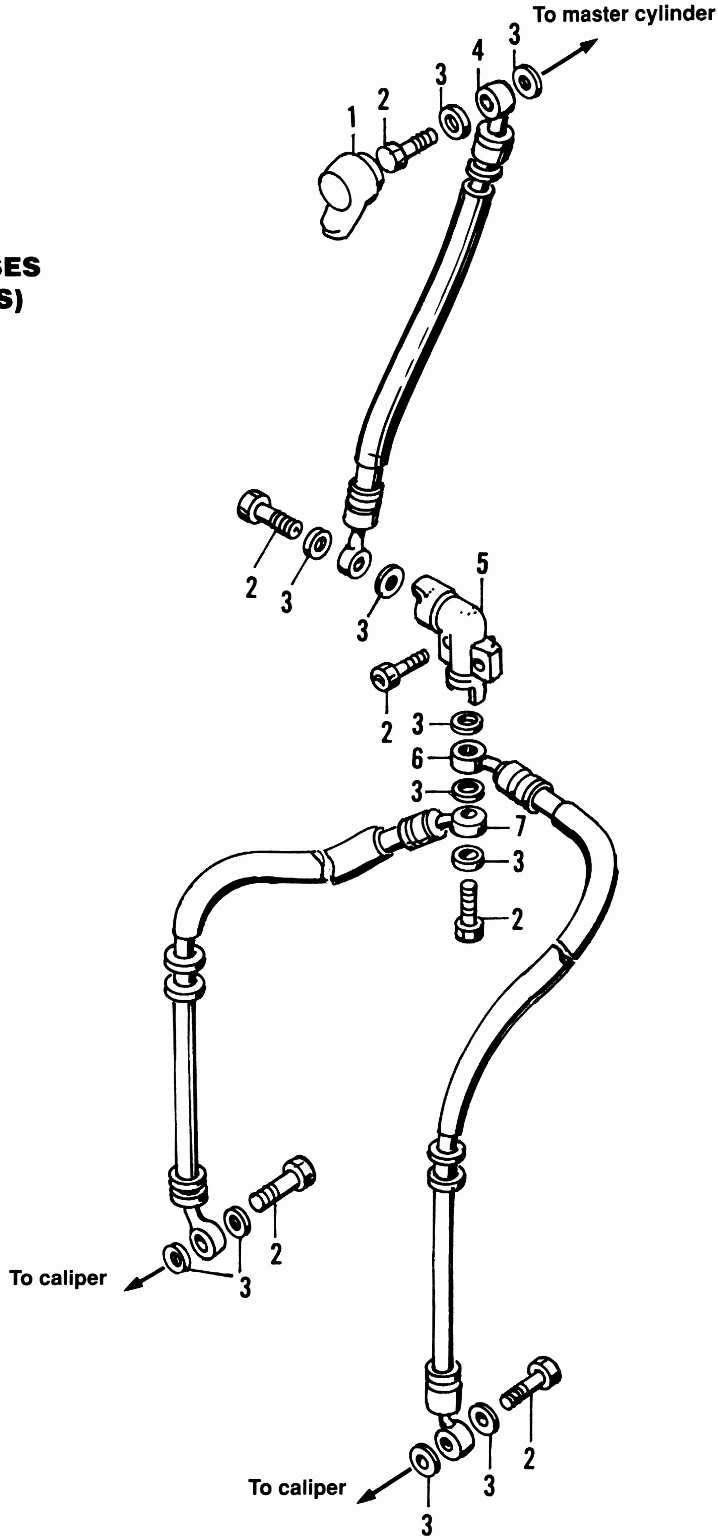
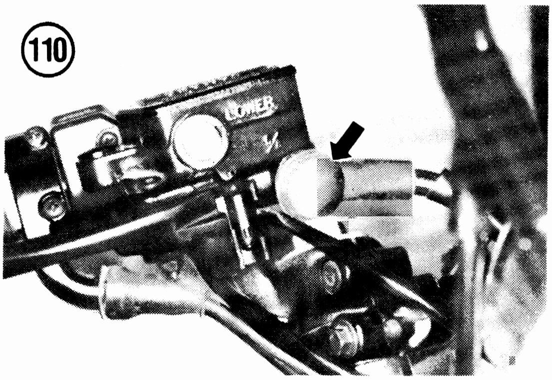
109

FRONT BRAKE HOSES (NON-ABS MODELS)

1. Rubber boot
2. Union bolt
3. Sealing washer
4. Master cylinder hose
5. 2-way fitting
6. Left-hand caliper hose
7. Right-hand caliper hose

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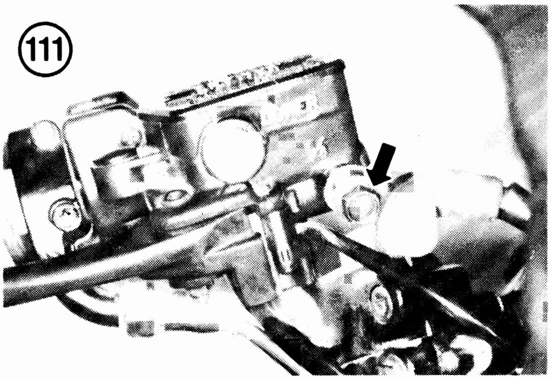
LOWER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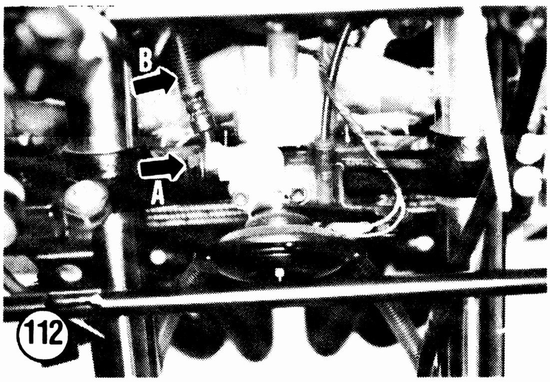
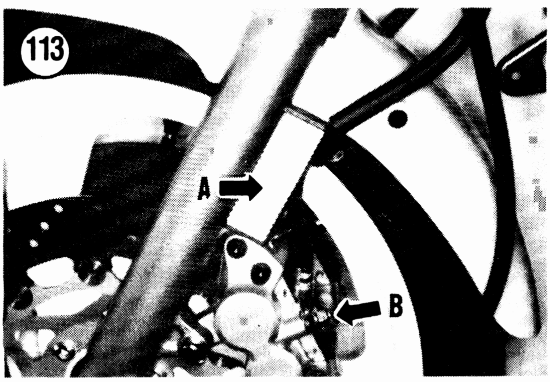

B
A
112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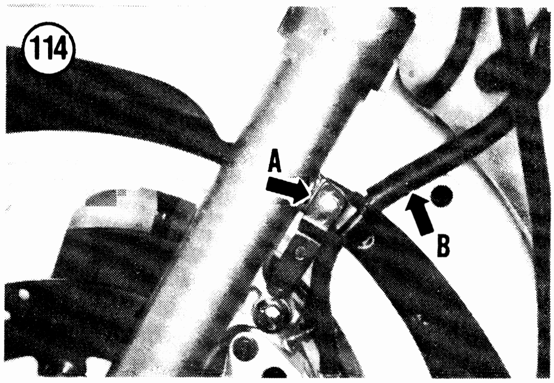
A
B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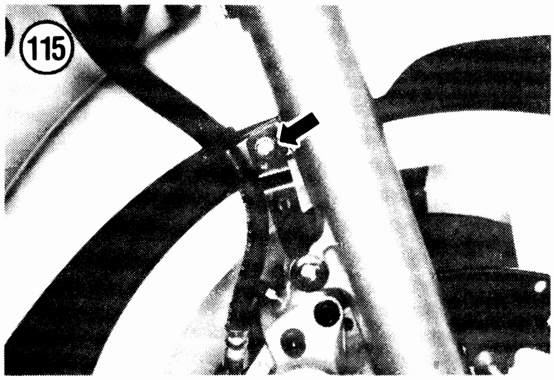
A
B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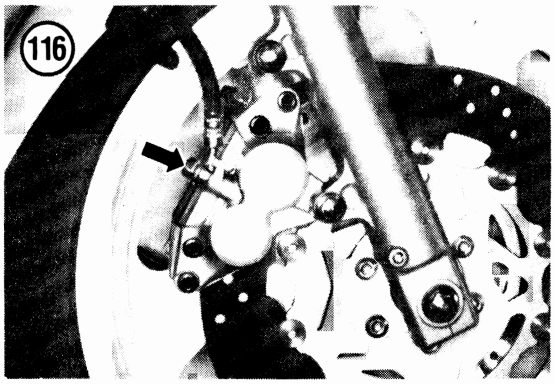
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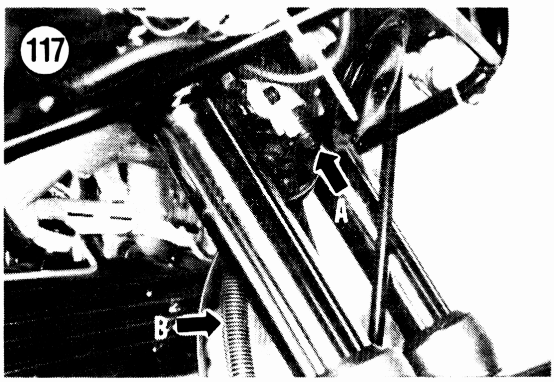

117
A
B

15. Install new brake hoses, new copper sealing washers (**Figure 118**) and union bolts in the reverse order of removal. Be sure to install the new sealing washers in their correct positions as shown in **Figure 109**.
16. Tighten all union bolts to the torque specification listed in **Table 2**.

WARNING
Do not intermix silicone-based (DOT 5) brake fluid as it can cause brake component damage leading to brake system failure.

17. Refill the front master cylinder with fresh brake fluid clearly marked DOT 4.
18. Bleed the front brakes as described under *Bleeding the System* in this chapter.
19. Install the front fairing.

Rear Brake Hoses

Refer to **Figure 88** for this procedure.

NOTE
*The rear master cylinder reservoir hose replacement is covered under **Reservoir and Hose Removal/Inspection/Installation** in this chapter.*

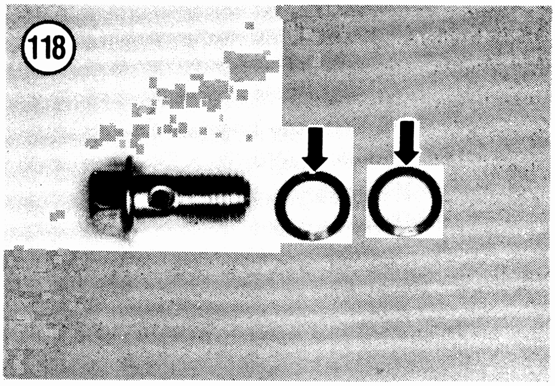
1. Before replacing the rear brake hose, inspect the routing of the old hoses carefully, noting any guides and grommets the hoses may go through.
2. Drain the rear master cylinder as described under *Rear Master Cylinder Removal/Installation* in this chapter.
3. Remove the union bolt (A, **Figure 119**) securing the brake hose to the rear caliper. Disconnect the brake hose and remove both copper sealing washers.
4. Carefully pry open the brake hose clamp (B, **Figure 119**) on the rear caliper torque link and remove the brake hose from the clamp.

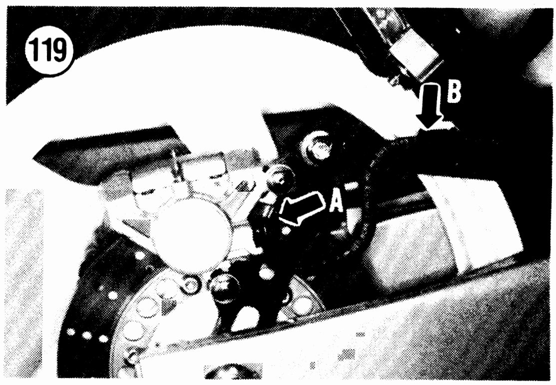
NOTE
The following procedure is shown with the right-hand muffler bracket removed for clarity. It is not necessary to remove this bracket in order to remove the hose from the master cylinder.

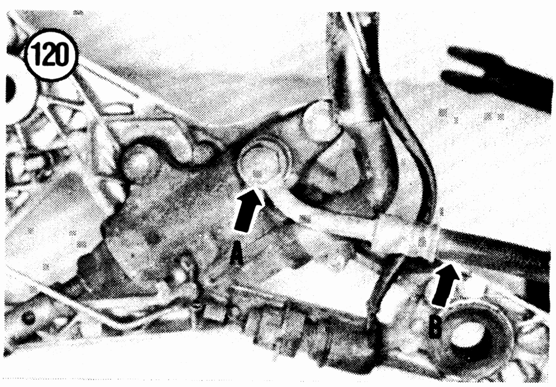
5. Remove the union bolt (A, **Figure 120**) securing the brake hose (B, **Figure 120**) to the backside of the master cylinder. Disconnect the brake hose and remove both copper sealing washers.

6. Carefully pull the brake hose through the retaining loop on the rear caliper torque link and remove the brake hose from the frame.

7. Install a new brake hose, new copper sealing washers (**Figure 118**) and union bolt in the reverse order of removal. Be sure to install the new sealing washers in their correct positions as shown in **Figure 88**.







8. Tighten both union bolts to the torque specification listed in **Table 2.**

9. Refill the rear master cylinder with fresh brake fluid clearly marked DOT 4.

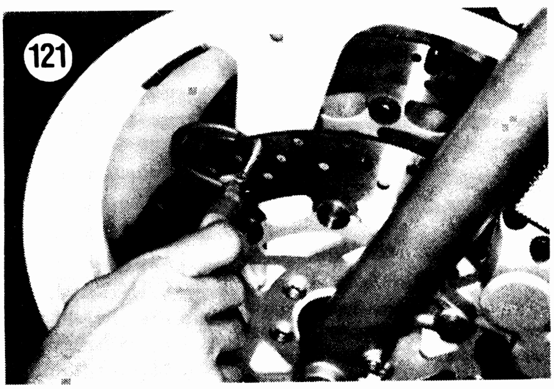
10. Bleed the rear brakes as described under *Bleeding the System* in this chapter.

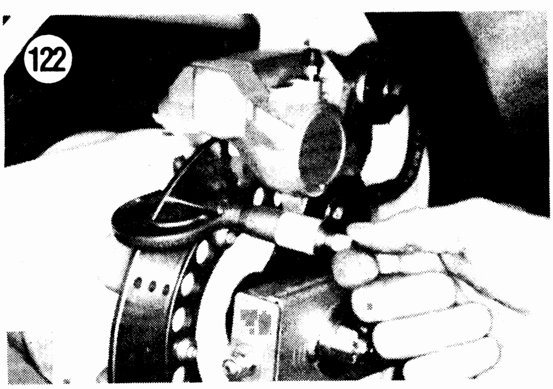
BRAKE DISC

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 a Vernier caliper or micrometer. Refer to **Figure 121** for the front disc and **Figure 122** for the rear disc. The disc must be replaced if the thickness at any point is less than the minimum specified in **Table 1.**





2. Make sure the disc bolts (**Figure 123**) are tight prior to performing this check. Check the disc runout with a dial indicator. Slowly rotate the wheel and watch the dial indicator. If the runout is 0.15 mm (0.006 in.) 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.

Removal/Installation

1. Remove the front or rear wheel as described in Chapter Nine or Chapter Ten.

NOTE

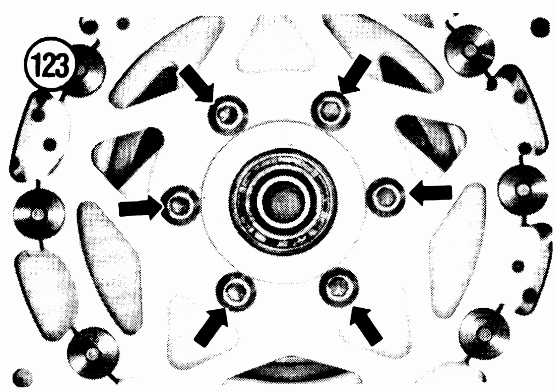
Place a piece of wood in the caliper(s) in place of the disc. This way, if the brake lever is inadvertently squeezed or the brake pedal applied, the pistons will not be forced out of the cylinders. If this does happen, the caliper might have to be disassembled to reseat the piston and the system will have to be bled. By using the wood, bleeding the system is not necessary when installing the wheel.

2. Remove the bolts securing the disc to the wheel and remove the disc. Refer to **Figure 124** for the front wheel or **Figure 125** for the rear wheel.

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

   a. Apply blue Loctite (No. 242) to the bolts before installation.

   b. Tighten the disc bolts to the specifications in **Table 2.**



REAR BRAKE PEDAL

Removal/Installation

NOTE
The following procedure is shown with the right-hand muffler bracket removed for clarity. It is not necessary to remove this bracket in order to remove the rear brake pedal from the bracket.

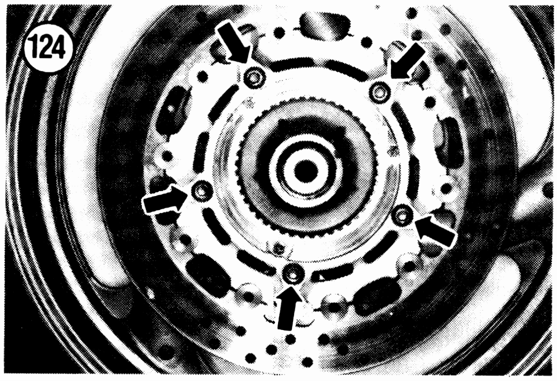
1. Remove the cotter pin and washer (A, **Figure 126**) securing the master cylinder pushrod yoke to the brake pedal. Discard the cotter pin.
2. Withdraw the pivot pin from the yoke and separate the 2 parts.
3. Unhook the rear brake light switch spring (B, **Figure 126**) from the rod, then unhook the pedal return spring (C, **Figure 126**) from the muffler bracket.
4. Remove the clamping bolt and lockwasher (A, **Figure 127**) securing the rear brake pedal to the pivot shaft assembly.
5. Remove the rear brake pedal (B, **Figure 127**) from the pivot shaft assembly.
6. Remove the pivot shaft assembly from the frame.
7. Install by reversing these removal steps while noting the following:
   a. Apply multipurpose grease to the pivot portion of the pivot shaft assembly.
   b. Tighten the clamping bolt securely.
   c. Adjust the rear brake light as described in Chapter Three.

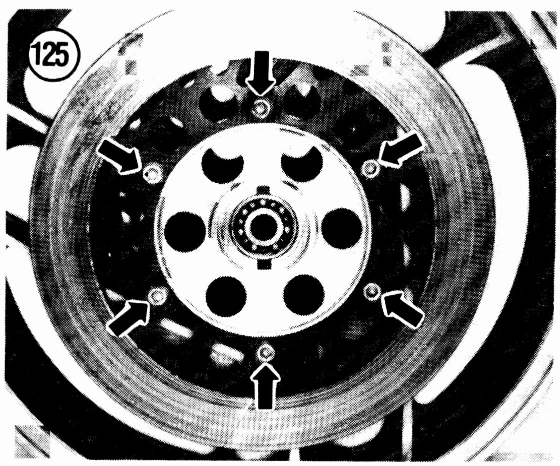
ABS BRAKE SYSTEM

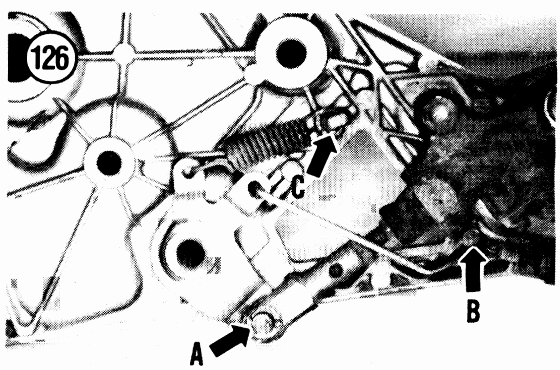
The Anti-lock Braking System (ABS) is designed to eliminate brake lock-up and skidding under wet or slippery conditions. The system is designed specifically for the Yamaha FJ1200 and replacement parts for the various components are available.

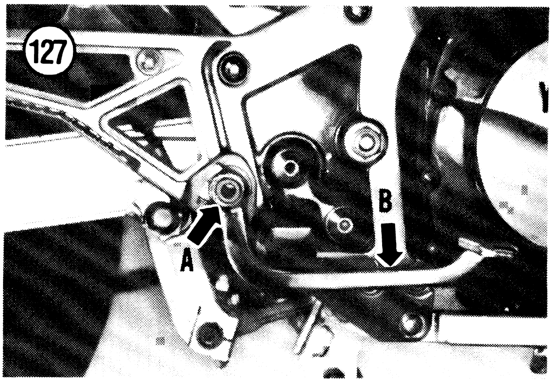
The system consists of the electronic control unit (ECU or computer) that controls the sensing and control functions of the entire system. The ECU is located in the rear cowl just ahead of the taillight assembly. The ECU receives information from the pulse generating inductive sensors that are located at each wheel hub. The inductive sensors relay information regarding wheel rotation speed from the tooth pulse-generating sensor rotor that is attached to the sensor housing on the right-hand side of the wheel hub. Refer to **Figure 128** for the front wheel and **Figure 129** for the rear wheel.

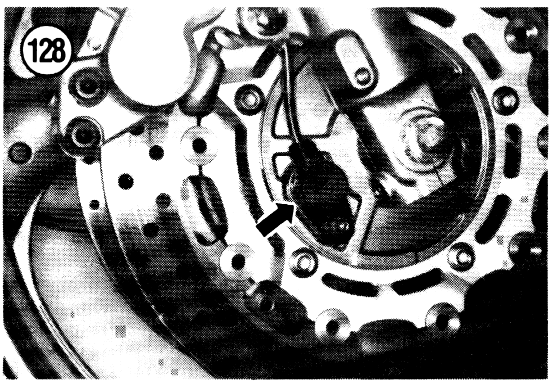
The hydraulic unit receives data (wheel speed rate, etc.) from the ECU and then regulates the brake pressure to both the front and rear caliper assemblies. The hydraulic unit is mounted on the right-hand side below the fuel pump assembly. The hydraulic unit regulates and interrupts brake pressures depending on specific traction situation. On

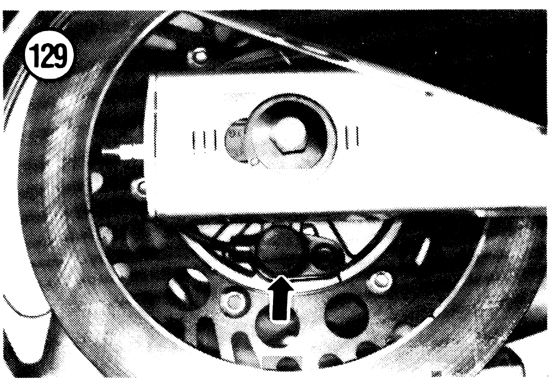


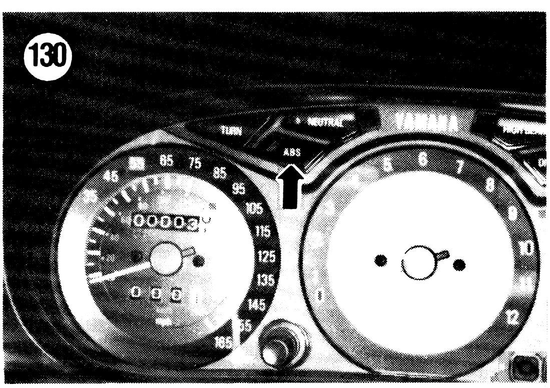












wet, icy or slick surfaces the bike will come to a quicker and safer stop.

If either wheel approaches lockup or decelerates quicker than the maximum rate programmed into the ECU the hydraulic unit reduces the hydraulic pressure in that brake line. This allows the wheel that is near lockup to rotate again.

When the master cylinder lever or pedal is applied the hydraulic fluid exits the master cylinder, travels to and goes through the hydraulic unit and then travels to the individual caliper assembly for braking action.

Most of the brake system plumbing uses metal brake lines with a minimal use of flexible brake hoses. Since brake pressure is critical in an ABS system, the flexible brake hoses are designed to have the same minimal flexing characteristics as the steel lines. When replacing the flexible brake hoses be sure to install authorized Yamaha replacement hoses specifically designed for use with the ABS system. Using a flexible brake hose of an alternate design will drastically change the characteristics of the brake system.

A warning light system is included to let the rider know that the ABS system is operating correctly—or if there is a problem and it is not working at all. The rider must know if the system is working properly, or is not working, as the rider becomes confident of the braking effectiveness of the system and tends to change his or her braking habits. When the ignition switch is turned ON, the ABS warning lamp (**Figure 130**) located on the instrument cluster, lights up solid (not flashing). If the ABS system is operating correctly the ABS warning light will stay ON up for about 1.4 seconds and then will go off. The ABS warning light will also come ON when the START button is pressed and will remain on while the START button is depressed. After the button is released the light will go off.

If the ABS warning light stays on after initial start up or comes on during normal operation, this indicates there is a problem within the ABS system. If during normal operation, the ABS warning light begins to flash this usually is not a fault but does indicate the following:

a. One of the brake light switches is faulty.
b. The rear wheel is rotating while the front wheel is stationary.
c. Riding over a bumpy road surface continuously where the wheels are bouncing off the

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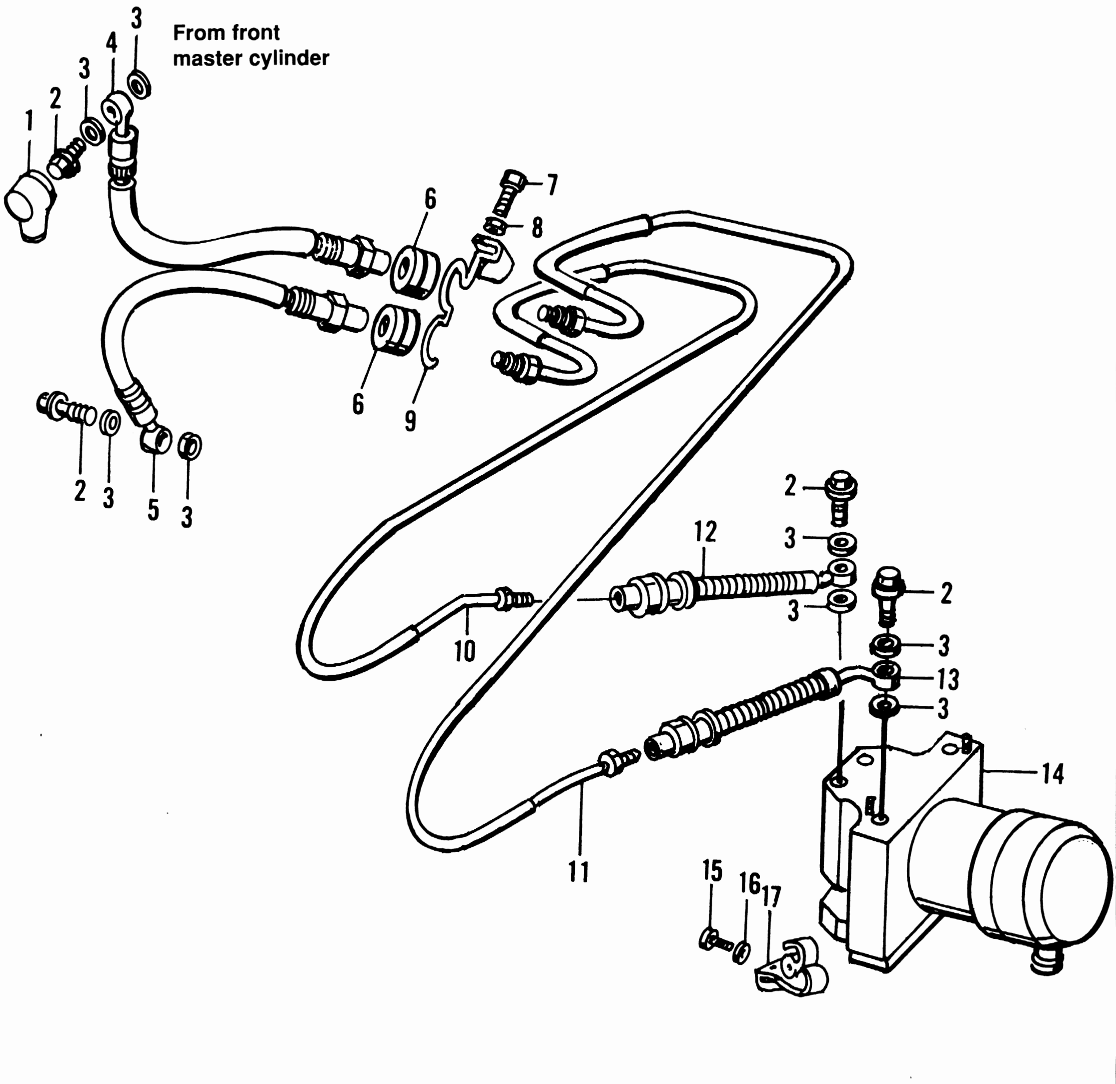
FRONT BRAKE HOSES (ABS MODELS)



1. Rubber boot	
2. Union bolt	10. Metal brake line No. 2 (outlet)
3. Sealing washer	11. Metal brake line No. 1 (inlet)
4. Brake hose No. 1	12. Brake hose No. 4 (outlet)
5. Brake hose No. 5	13. Brake hose No. 3 (inlet)
6. Rubber grommet	14. Hydraulic unit
7. Bolt	15. Bolt
8. Nut	16. Washer
9. Hose bracket	17. Bracket

pavement and are not rotating at the same rate of speed.

If the ABS warning light stays on after start up this indicates that the system has flawed and that the ECU has shut the system down. The regular brake system will still operate—*but with no ABS*. If the ABS warning lights stays on, take the bike to an authorized Yamaha dealer and have them troubleshoot the system.

The ABS system is simple yet very complex as with any computer-based equipment. If there is a fault within the system, the test procedures must be done by an authorized Yamaha dealer with service school training and the correct test equipment. *Do not try to work on the ECU or the hydraulic unit* as it will void any applicable Yamaha warranty.

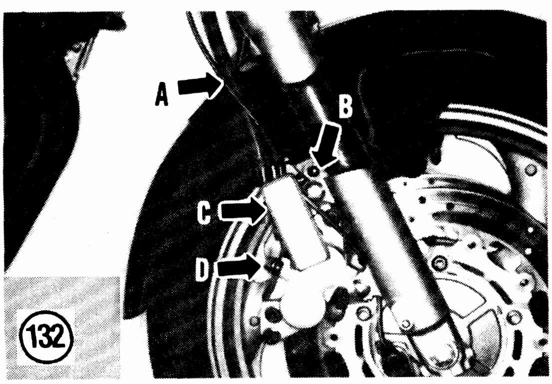
BRAKE HOSE AND LINE REPLACEMENT (ABS-EQUIPPED MODELS)

There is no factory-recommended replacement interval but it is a good idea to replace all flexible brake hoses every four years or when they show signs of cracking or damage.

The metal brake lines do not require routine replacement unless they are damaged or the end fittings are leaking. While replacing the flexible brake hoses, inspect the metal brake lines for damage. If they have been hit the line may be restricted thus decreasing braking effectiveness.

WARNING

On models equipped with the ABS brake system, the majority of the brake system uses metal brake lines with a minimal use of flexible brake hoses. Since brake pressure is critical in an ABS system the Yamaha flexible brake hoses are designed to have the same minimal flexing characteristics as the steel lines. When replacing the flexible brake hoses be sure to install authorized Yamaha replacement hoses specifically designed for use with the ABS system. Using a flexible brake hose of an alternate design will drastically change the characteristics of the brake system.



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CAUTION

Cover the fuel tank, front wheel, front fender, rear wheel and rear portion of the frame with a heavy cloth or plastic tarp to protect it from accidental spilling of brake fluid. Wash brake fluid off of any painted or plated surface immediately, as it will destroy the finish. Use soapy water and rinse completely.

Front Hoses and Lines Removal/Installation

Refer to **Figure 131** for this procedure.

1. Remove the front fairing as described in Chapter Twelve.
2. Remove the fuel tank as described in Chapter Seven.
3. Before replacing the front brake hoses and lines, inspect the routing of the existing hoses and lines carefully, noting any guides and grommets the hoses may go through. Make a drawing or take Polaroid pictures of the system.
4. Drain the front master cylinder as described under *Front Master Cylinder Removal/Installation* in this chapter.
5. Remove the plastic clamp (A, **Figure 132**) holding the wheel sensor cable to the hydraulic brake hose.
6. Remove the bolt (B, **Figure 132**) securing the wheel sensor cable and hydraulic brake hose upper holder to the right-hand fork slider.
7. Remove the bolt (**Figure 133**) securing the wheel sensor cable lower holder to the right-hand fork slider.
8. Remove the reflector (C, **Figure 132**) from both front fork sliders.
9. Remove the union bolt (D, **Figure 132**) securing the brake hose to the right-hand caliper. Disconnect the brake hose and remove both copper sealing washers.

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10. Remove the union bolt securing the brake hose(s) to the left-hand caliper. Disconnect the brake hose and remove the copper sealing washers.
11. Remove the union bolt (A, **Figure 134**) securing both lower brake hoses to the 2-way fitting. Disconnect the brake hoses and remove the 3 copper sealing washers.
12. Remove the right-hand lower hose (B, **Figure 134**) and the left-hand lower hose from the frame and front fork area.
13. To remove the No. 1 brake hose, perform the following:

   a. Slide the rubber boot (**Figure 135**) off the union bolt at the master cylinder.
   b. Remove the union bolt (**Figure 136**) securing the brake hose No. 1 to the master cylinder. Disconnect the brake hose and remove both copper sealing washers.
   c. Follow the brake hose through the frame and locate the joint where the hose and brake line connect.
   d. Using two brake flare nut wrenches, hold onto the lower end of brake hose No. 1, then loosen and unscrew the flare nut on the upper end of metal brake line No. 1.
   e. Remove the No. 1 brake hose.

14. To remove the No. 5 brake hose, perform the following:

   a. Remove the union bolt (A, **Figure 137**) securing the brake hose to the 2-way fitting. Disconnect the brake hose (B, **Figure 137**) and remove both copper sealing washers.
   b. Follow the brake hose through the frame and locate the joint where the hose and brake line connect.
   c. Using two brake flare nut wrenches, hold onto the lower end of the brake hose No. 5, then loosen and unscrew the flare nut on the upper end of metal brake line No. 2.
   d. Remove the No. 5 brake hose.

15. Remove the bolts (**Figure 138**) securing the fuel pump bracket to the frame. Move the fuel pump out of the way, it is not necessary to disconnect either fuel line from the pump.
16. To remove the No. 3 brake hose, perform the following:

   a. Remove the union bolt (A, **Figure 139**) securing the brake hose to the hydraulic unit. Disconnect the brake hose and remove both copper sealing washers.

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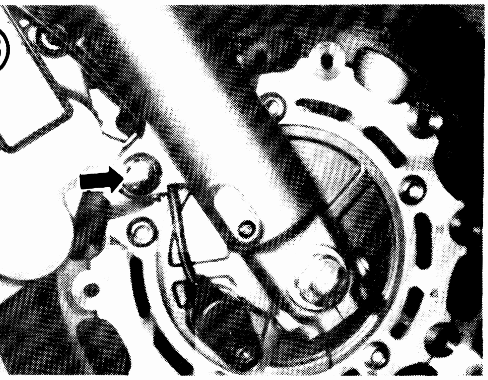

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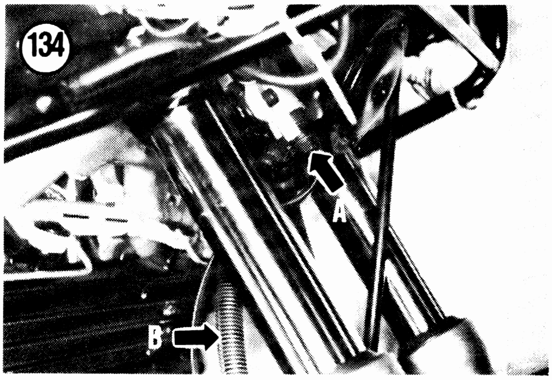

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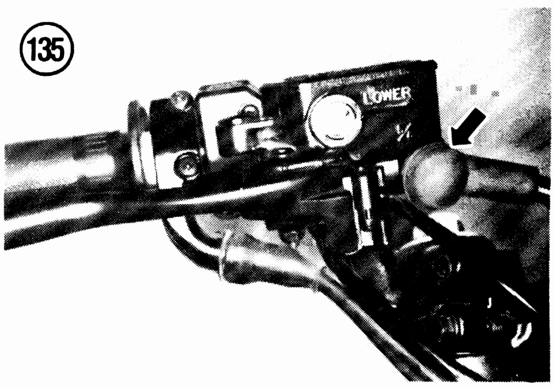

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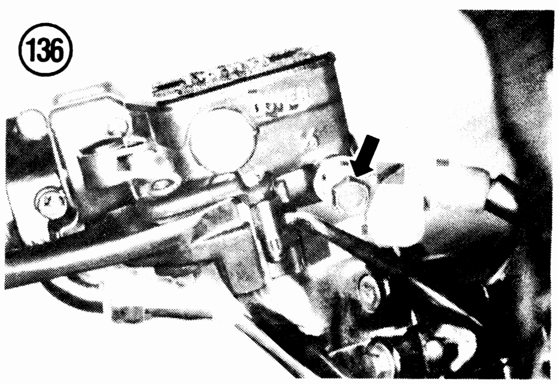

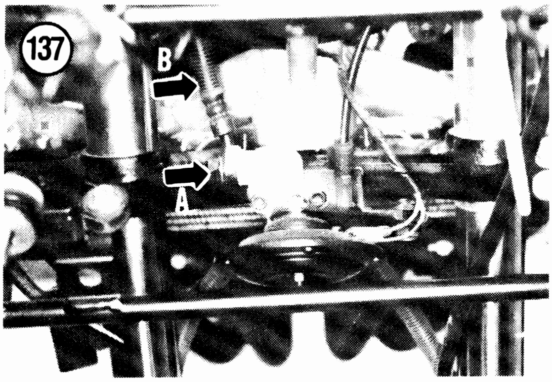

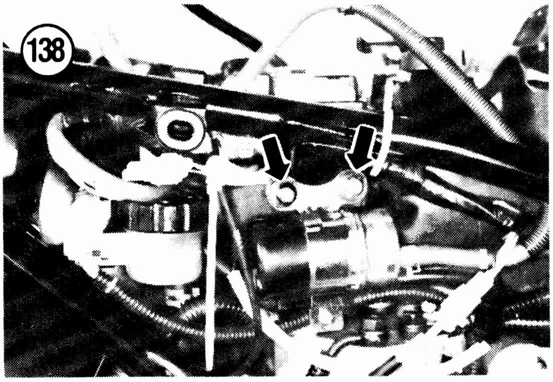

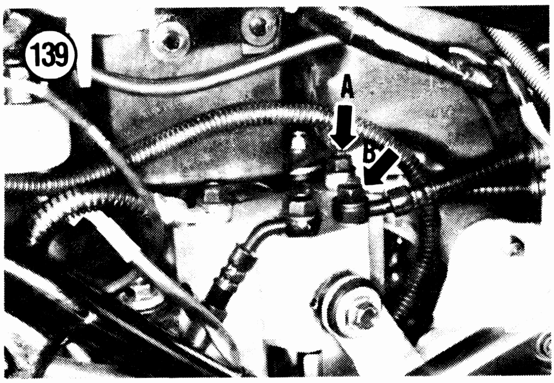

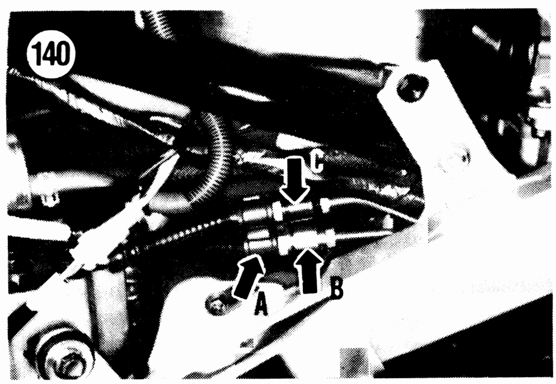

b. Carefully pull the brake hoses from the metal clamp (A, **Figure 140**).

c. Using two brake flare nut wrenches, hold onto the lower end of the brake hose No. 3, then loosen and unscrew the flare nut on the lower end of metal brake line No. 2 (B, **Figure 140**).

d. Remove the No. 3 brake hose.

17. To remove the No. 4 brake hose, perform the following:

a. Remove the union bolt (B, **Figure 139**) securing the brake hose to the hydraulic unit. Disconnect the brake hose and remove both copper sealing washers.

b. Using two brake flare nut wrenches, hold onto the lower end of the brake hose No. 3, then loosen and unscrew the flare nut on the lower end of metal brake line No. 2 (C, **Figure 140**).

c. Remove the No. 4 brake hose.

18. To remove the No. 1 and No. 2 metal brake lines, perform the following:

a. Refer to Steps 8-12 and disconnect the flexible brake hoses from the ends of both the No. 1 and No. 2 metal brake lines.

b. Remove the metal brake lines from all clips and clamps securing the lines to the frame and carefully remove the brake lines from the frame.

19. Installation is the reverse of the removal procedure while noting the following:

a. Be sure to install a new copper sealing washer in the correct positions. Refer to **Figure 131**.

b. At the hydraulic unit, correctly position the brake hose fitting against the raised projection on the top surface of hydraulic unit.

c. Tighten all flare nut fittings securely.

d. Tighten the union bolts to torque specifications listed in **Table 2**.

e. Refill the master cylinder with fresh brake fluid clearly marked DOT 4. Bleed the front brake system as described in this chapter.

WARNING

Do not ride the motorcycle until you are sure that the brakes are operating properly.

Rear Brake Hose Removal/Installation

Refer to **Figure 141** for this procedure.

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1. Before replacing the rear brake hoses, inspect the routing of the existing hoses, noting any guides and grommets the hoses may go through. Make a drawing or take Polaroid pictures of the system.
2. Drain the rear master cylinder as described under *Rear Master Cylinder Removal/Installation* in this chapter.
3. Remove the bolts (**Figure 138**) securing the fuel pump bracket to the frame. Move the fuel pump out of the way, it is not necessary to disconnect either fuel line from the pump.
4. To remove the No. 7 brake hose, perform the following:
   a. Remove the plastic clamps (A, **Figure 142**) holding the wheel sensor cable to the hydraulic brake hose.
   b. Carefully pry open the brake hose clamp on the swing arm (B, **Figure 142**) and on the rear caliper torque link (C, **Figure 142**) and remove the brake hose No. 7 from both clamps.
   c. Remove the union bolt (D, **Figure 142**) securing the brake hose No. 7 to the rear caliper. Disconnect the brake hose and remove both copper sealing washers.
   d. Remove the union bolt (A, **Figure 143**) securing the brake hose to the hydraulic unit. Disconnect the brake hose and remove both copper sealing washers.
   e. Remove the No. 7 brake hose.
5. To remove the No. 6 brake hose, perform the following:
   a. Remove the union bolt securing the brake hose to the backside of the master cylinder. Disconnect the brake hose and remove both copper sealing washers.
   b. Remove the union bolt (B, **Figure 143**) securing the brake hose to the hydraulic unit. Disconnect the brake hose and remove both copper sealing washers.
   c. Remove the No. 6 brake hose.
6. Install by reversing these removal steps while noting the following:
   a. Be sure to install a new copper sealing washer in the correct positions. Refer to **Figure 141**.
   b. At the hydraulic unit, correctly position the brake hose fitting against the raised projection on the top surface of hydraulic unit.
   c. Tighten the union bolts to torque specifications listed in **Table 2**.

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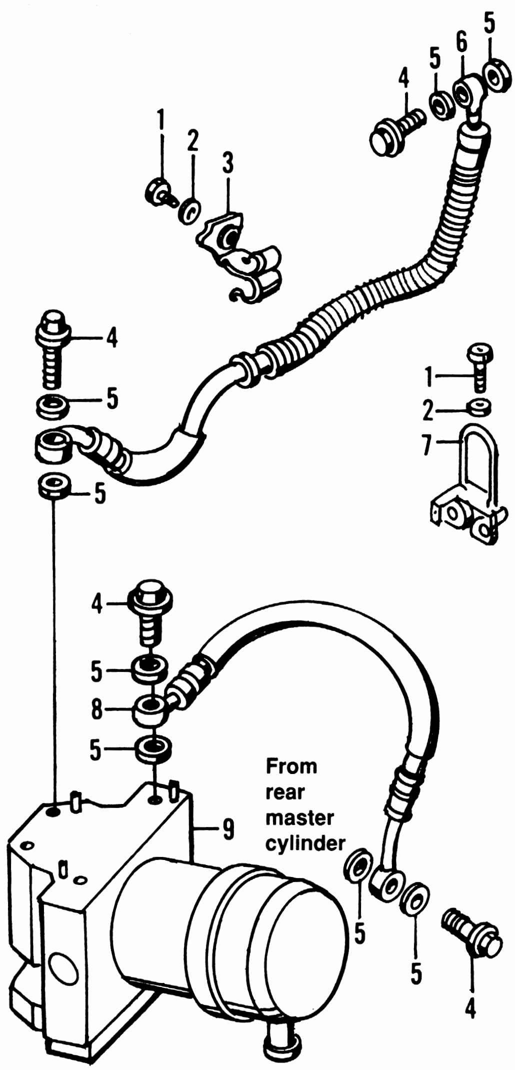
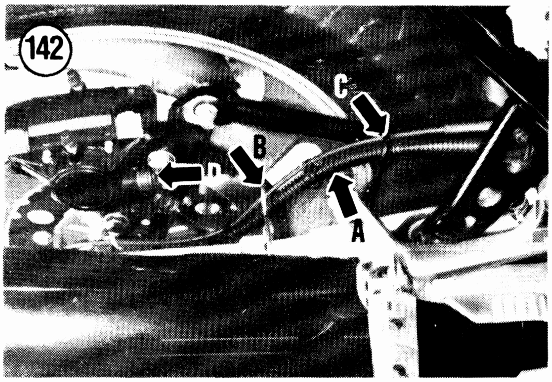
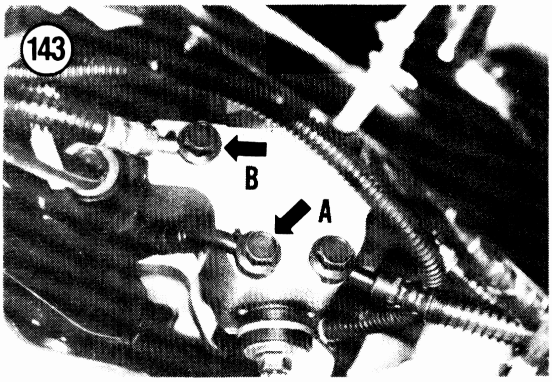
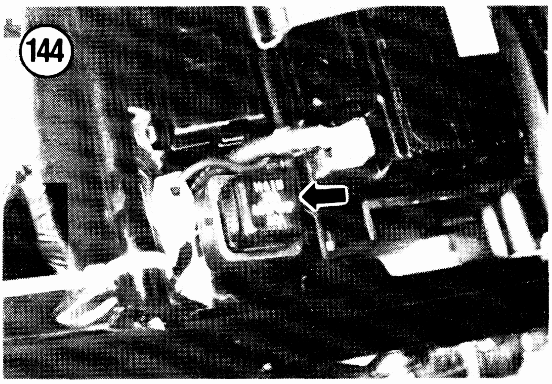
REAR BRAKE HOSES (ABS MODELS)

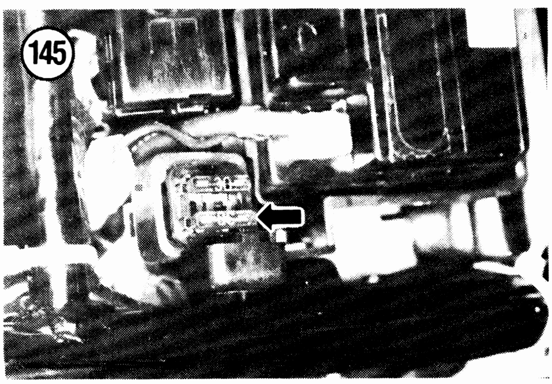


1. Bolt
2. Washer
3. Bracket
4. Union bolt
5. Sealing washer
6. Brake hose No. 7
7. Brake hose bracket
8. Brake hose No. 6
9. Hydraulic unit







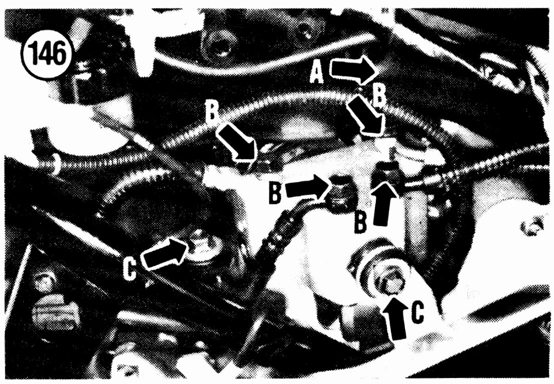


d. Refill the master cylinder with fresh brake fluid clearly marked DOT 4. Bleed the front brake system as described in this chapter.

WARNING
Do not ride the motorcycle until you are sure that the brakes are operating properly.

HYDRAULIC UNIT

1. Remove the seat and both frame side covers and lower fairing as described in Chapter Twelve.
2. Remove the fuel tank as described in Chapter Seven.
3. Remove the battery as described in Chapter Three.
4. Remove the battery case.
5. Flip open the fuse box lid (**Figure 144**) and disconnect the main and ABS PUMP fuse (**Figure 145**).
6. Disconnect the starter relay and move it out of the way.
7. Remove the air filter air box (A, **Figure 146**) as described in Chapter Seven.
8. Disconnect the rear brake switch and fuel pump electrical connectors.
9. Remove the bolts (**Figure 138**) securing the fuel pump bracket to the frame. Move the fuel pump out of the way, it is not necessary to disconnect either fuel line from the pump.
10. On the right-hand side, disconnect the hydraulic unit electrical connector (**Figure 147**) containing 2 wires (1 red/white and 1 black).
11. Remove the battery case damper rubber and rubber seat.
12. Drain the hydraulic brake fluid from the front and rear brake systems as described under *Front*



Master Cylinder Removal/Installation and *Rear Master Cylinder Removal/Installation* in this chapter.

NOTE

To prevent the entry of moisture and dirt, cap the ends of the brake hoses after they are disconnected from the hydraulic unit. Place the loose end in a plastic reclosable bag and zip it closed around the hose or line.

13. Remove the union bolts (B, **Figure 146**) securing all 4 brake hoses to the hydraulic unit. Disconnect the brake hoses and remove both copper sealing washers from each fitting.
14. Install suitable size rubber plugs into the union bolt holes on top of the hydraulic unit. This will prevent the loss of brake fluid during removal of the unit.
15. Remove the bolts and collars (C, **Figure 146**) securing the hydraulic unit to the frame.
16. Wrap the hydraulic unit with several shop cloths to catch any brake fluid that may drain out during removal.
17. Tilt the front of the hydraulic unit up about 90° and remove the unit up and through the top of the frame. After removal, hold the unit in the upright position so the remaining brake fluid will not drain out.
18. Install by reversing these removal steps. Note the following:

WARNING

The brake hoses must be correctly attached to the threaded holes in the hydraulic unit. If connected incorrectly the wheel will be locked up.

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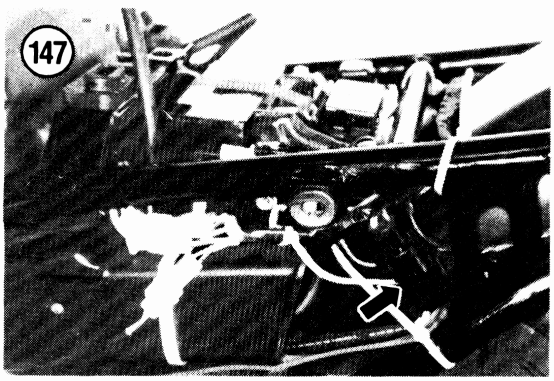

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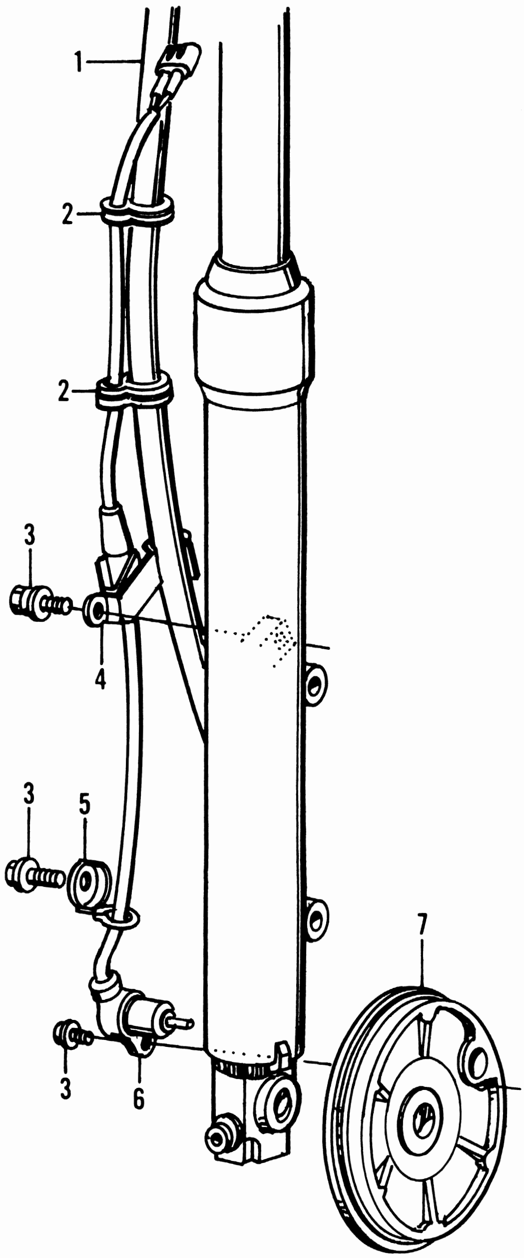
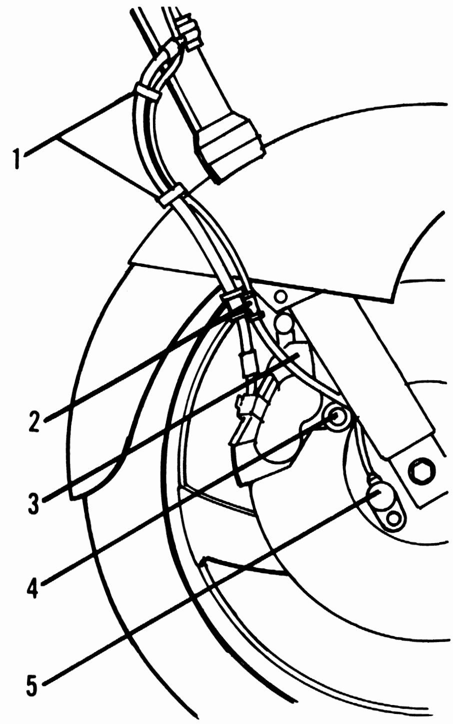
FRONT WHEEL SENSOR AND CABLE

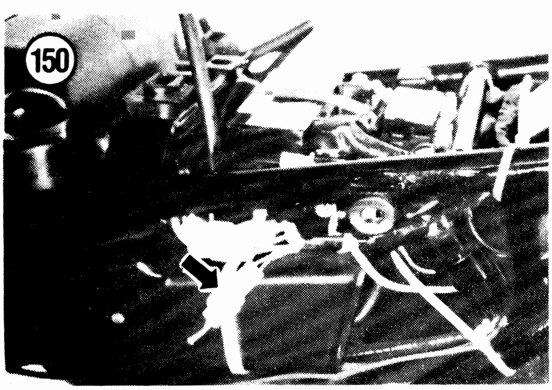


1. Brake hose
2. Plastic clip
3. Bolt
4. Upper holder
5. Lower holder
6. Sensor and cable assembly
7. Sensor housing

149 FRONT WHEEL SENSOR AND CABLE ROUTING



1. Plastic clip
2. Upper holder
3. Brake caliper
4. Lower holder
5. Sensor and cable assembly



a. Install the brake hoses to the correct threaded holes in the hydraulic unit (**Figure 131** and **Figure 141**). The No. 3 and No. 6 hose fittings are plated silver and they are attached to the inner threaded holes while the No. 4 and No. 7 are plated black and are attached to the outer threaded holes.
b. Install new copper sealing washers on each side of the fittings and install the union bolts. Tighten the union bolts to the torque specification listed in **Table 2**.
c. Tighten the hydraulic unit mounting bolts securely. Be sure to install the collar along with the mounting bolt.
d. Refill the master cylinder with fresh brake fluid clearly marked DOT 4. Bleed the front brake system as described in this chapter.
e. Make sure the electrical connector is free of corrosion and is tight.

WARNING
Do not ride the motorcycle until you are sure that the brakes are operating properly.

WHEEL SENSOR

Front Sensor Removal/Installation

Refer to **Figure 148** and **Figure 149** for this procedure.

1. Remove the seat and both frame side covers and upper fairing as described in Chapter Twelve.
2. Remove the fuel tank as described in Chapter Seven.
3. On the left-hand side of the frame, disconnect the sensor 2-pin electrical connector (**Figure 150**) from the wiring harness.
4. Remove the plastic clamps holding the wheel sensor cable to the hydraulic brake hose (A, **Figure 132**).
5. Remove the bolt (B, **Figure 132**) securing the wheel sensor cable and hydraulic brake hose upper holder to the right-hand fork slider.
6. Remove the bolt (A, **Figure 151**) securing the wheel sensor cable lower holder to the right-hand fork slider.

CAUTION
Do not allow the sensor pole to make contact with any metal object on the bike.

7. Remove the bolt securing the wheel sensor (B, **Figure 151**) to the sensor housing. Carefully pull the sensor from the housing and place it in a reclosable plastic bag to protect it from damage and dirt. Move it out of the way.
8. Remove all clamps and bands securing the front sensor electrical cable to the frame.
9. Remove the sensor and electrical cable from the fork and frame noting its path so it can be installed in the same place throughout the frame.

NOTE
The piece of string attached in the next step will be used to pull the new front wheel sensor 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 2 m[7 ft.]) to the electrical connector end of the electrical cable. Wrap this end with masking or

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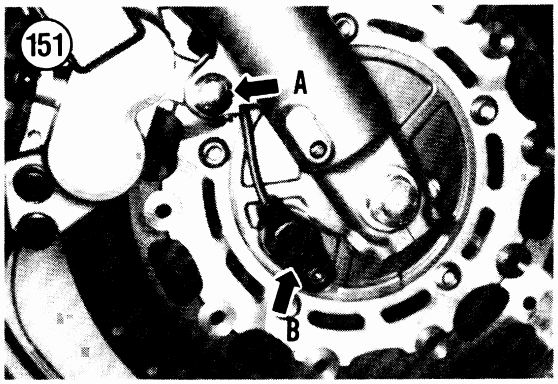

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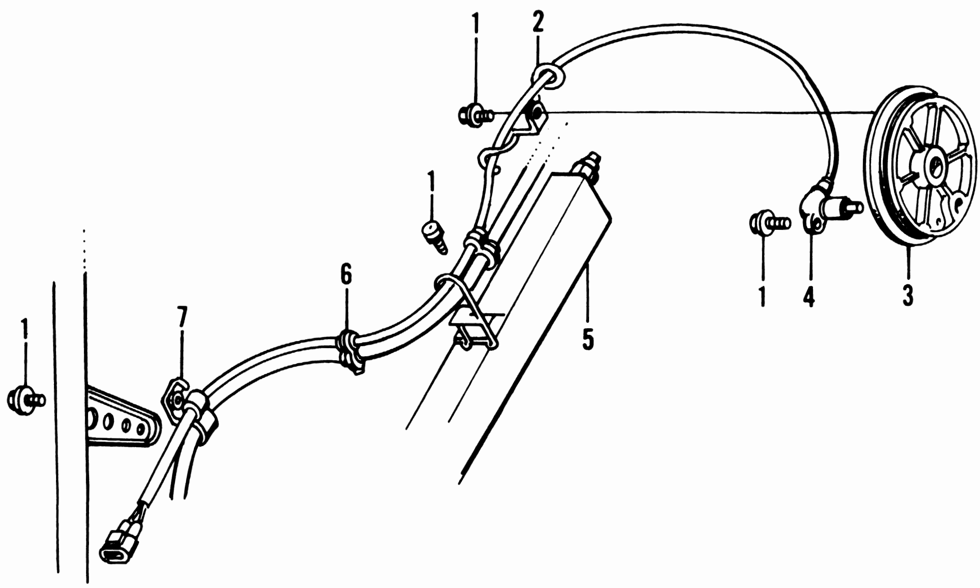
REAR WHEEL SENSOR AND CABLE



1. Bolt
2. Rear holder
3. Sensor housing
4. Sensor and cable assembly
5. Swing arm
6. Plastic clip
7. Front holder

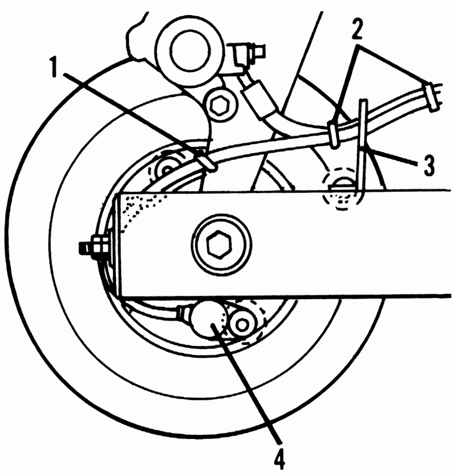
duct tape. Do not use an excessive amount of tape as it will be pulled through the frame. Tie the other end of the string to the frame.

11. At the front wheel sensor end of the cable, carefully pull the cable assembly (and attached string) out through the frame. Make sure the attached string follows the same path of the electrical cable through the frame.

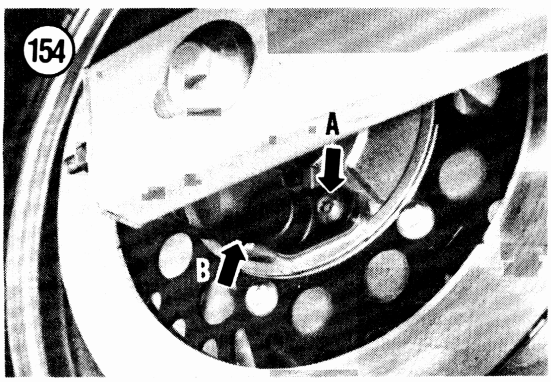
12. Remove the tape and untie the string from the old electrical cable.

13. Tie the string (used during removal) to the electrical connector end of the new electrical cable assembly and wrap it with tape.

153 **REAR WHEEL SENSOR AND CABLE ROUTING**



1. Rear holder
2. Plastic clip
3. Front holder
4. Sensor and cable assembly



14. Carefully pull the string back through the frame routing the new electrical cable through the same path as the old cable.

15. Remove the tape and untie the string from the cable and the frame.

16. Reverse Steps 1-9 while noting the following:
   a. Be sure to secure the electrical cable to the frame in the exact same location as noted during removal.
   b. Apply a dielectric compound to the electrical connector prior to reconnecting it. This will help seal out moisture.
   c. Make sure the electrical connectors are free of corrosion and are completely coupled to each other. Make sure the small screws are tight.

Rear Sensor Removal/Installation

Refer to **Figure 152** and **Figure 153** for this procedure.

1. Remove the seat and frame side covers as described in Chapter Twelve.
2. Place the bike securely on the centerstand.
3. Unhook the sensor cable from the rear holder (A, **Figure 142**) at the back of the swing arm.
4. Remove the clip (B, **Figure 142**) holding the sensor cable to the hydraulic brake hose. Separate the cable and hose and reinstall the clip on the hose to avoid misplacing it.
5. Remove the bolt (A, **Figure 154**) securing the wheel sensor (B, **Figure 154**) to the sensor housing. Do not remove the wheel sensor at this time as there is not sufficient room for removal.
6. Perform *Rear Wheel Removal* Steps 3-9 as described in Chapter Ten.

CAUTION
Do not allow the sensor pole to make contact with any metal object on the bike.

7. Carefully pull the sensor from the housing and place it in a reclosable plastic bag to protect it from damage and dirt.
8. Follow the sensor electrical wiring harness up the right-hand side of the frame.
9. Locate the sensor electrical connector (**Figure 155**) and disconnect it.

11

NOTE
Mark the location of each plastic clamp or tie-wrap holding the wheel sensor cable to the frame. These plastic clamps or tie-wraps must be reinstalled in the same location on the frame.

10. Remove all additional plastic clamps or tie-wraps holding the wheel sensor cable to the frame.

NOTE
The piece of string attached in the next step will be used to pull the new front wheel sensor cable back through the frame so it will be routed in the exact same position as the old one.

11. Tie a piece of heavy string or cord (approximately 1 m[3.5 ft.]) to the electrical connector end of the electrical 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.

12. At the rear wheel sensor end of the cable, carefully pull the cable assembly (and attached string) out through the frame. Make sure the attached string follows the same path of the electrical cable through the frame.

13. Remove the tape and untie the string from the old electrical cable.

14. Tie the string (used during removal) to the electrical connector end of the new electrical cable assembly and wrap it with tape.

15. Carefully pull the string back through the frame routing the new electrical cable through the same path as the old cable.

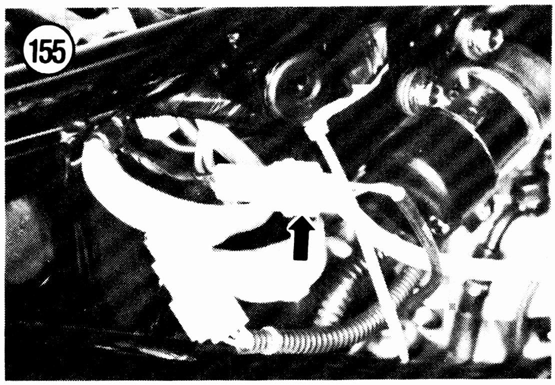
16. Remove the tape and untie the string from the cable and the frame.

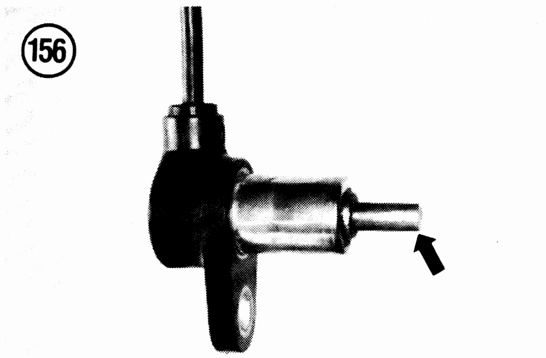
17. Reverse Steps 1-10 while noting the following:

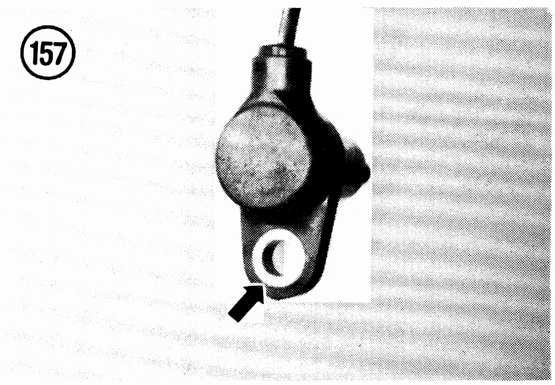
a. Be sure to secure the electrical cable to the frame and swing arm in the exact same location as noted during removal.

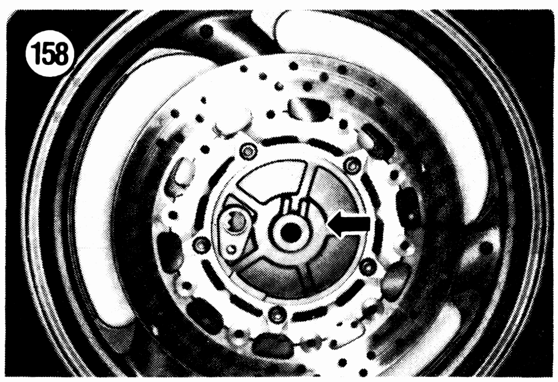
b. Apply a dielectric compound to the electrical connector prior to reconnecting it. This will help seal out moisture.

c. Make sure the electrical connectors are free of corrosion and are completely coupled to each other. Make sure the small screws are tight.









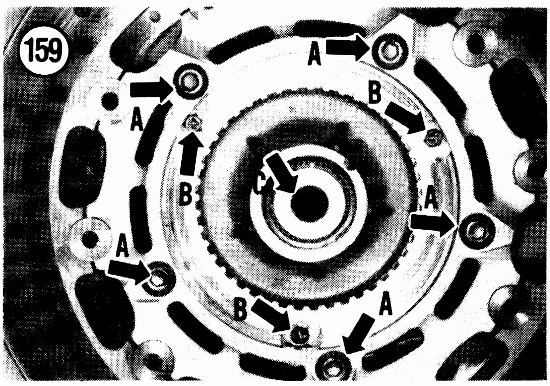
Wheel Sensor Inspection

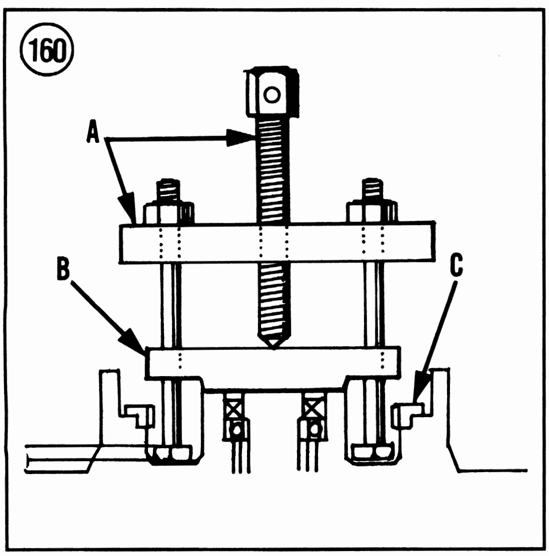
1. Inspect the sensor (**Figure 156**) for cracks, bends or warpage.
2. Inspect the mounting flange (**Figure 157**) for elongation or damage.
3. If the sensor is damaged in any way, replace the sensor and electrical cable as an assembly.

WHEEL ROTORS

Yamaha special tools are required for the removal and installation of the wheel's rotor along with a hydraulic press. The special tools are as follows:

a. Crankcase separation tool (Yamaha part No. YU-01135-A).
b. Sensor rotor puller guide (Yamaha part No. YM-04126).





c. Sensor rotor installation pot (Yamaha part No. YM-04124).

Unless you have these special tools and a press, it may be less expensive to have the rotor(s) replaced by a Yamaha dealer or qualified machine shop.

Front and Rear Wheel Sensor Rotor Removal

1. Remove the front or rear wheel as described in Chapter Nine or Chapter Ten.
2. Pull straight up and remove the sensor housing from the hub (**Figure 158**).
3. Remove the bolts (A, **Figure 159**) securing the brake disc and remove the disc.
4. Remove bolts (B, **Figure 159**) securing the rotor to the hub.
5. If not already removed, remove the spacer (C, **Figure 159**).

CAUTION

Make sure the sensor rotor guide tool is resting on the hub surface and not on the bearing inner race. If the tool is resting on the inner race, the bearing will be damaged and have to be replaced.

6. Assemble the special tools with the bolt heads facing down so they can be placed under the wheel rotor teeth.
7. Install the crankcase separating tool (A, **Figure 160**) and sensor rotor guide (B, **Figure 160**) into the hub.
8. Position the bolt heads under the wheel rotor teeth (C, **Figure 160**) and slowly tighten the nuts on the bolts to bring the under side of the bolt heads up and into even contact with the wheel's rotor teeth. Both bolt heads must be snug up against the rotor in order to withdraw the rotor straight up evenly from the hub. If the rotor becomes cocked during removal, the hub will be damaged and the wheel must be replaced.
9. Slowly tighten the center bolt of the separating tool and pull the rotor straight up and out of the hub receptacle. During removal, check that both bolt heads are properly engaged under the rotor so the rotor will not get cocked and damage the hub.

CAUTION

Discard any rotor that has been removed. Just like a wheel bearing, once *the rotor has been removed it is no longer true and must never be reinstalled.*

10. Discard the rotor as it cannot be reinstalled. A used rotor will not work correctly and will deter the operation of the ABS system.

Hub Inspection

1. Clean all dirt and foreign matter from the hub center with a rag and cleaning solvent. Thoroughly dry with compressed air.
2. Inspect the rotor receptacle in the wheel hub. Check for scratches and burrs resulting from improper rotor installation and removal.
3. If the hub receptacle is damaged, the new sensor rotor cannot be installed correctly and the wheel must be replaced.

Front and Rear Wheel Sensor Rotor Installation

1. Make sure the hub receptacle is free of any foreign matter.
2. Place the wheel in a hydraulic press so that it is level with the press head.
3. Place the new sensor rotor onto the hub center and align the 3 bolt holes with the threaded holes in the hub.
4. Install the sensor rotor installation pot (Yamaha part No. YM-04124) on top of the rotor and center it.
5. Install a suitable size support plate on top of the installation pot.
6. Gradually apply hydraulic pressure onto the support plate and press the sensor rotor into the hub until it bottoms out.
7. Release the hydraulic pressure and remove the special tools, then remove the wheel from the press.
8. Apply red Loctite (No. 271) to the sensor rotor bolts prior to installation. Install the bolts and tighten in a crisscross pattern to the torque specification listed in **Table 2**.

NOTE
After the sensor rotor has been installed, it must be inspected to make sure it is installed within specifications.

9. Measure the inside diameter of the sensor rotor with a Vernier caliper or pair of dividers (**Figure 161**). Measure at 4 equally divided spots around the rotor circumference and at a right angle to the axis of the wheel's axle (**Figure 162**). These are dimensions "X" and "Y."

10. Add dimensions "X" and "Y" and divide by 2. This will be an average or dimension "A." The specified inside diameter dimension "A" is 99.90-100.15 mm (3.933-3.943 in.).

11. Now subtract dimension "X" from "Y." This will be the allowance dimension "B" or the difference between the 2 dimensions. The allowable difference is less than 0.1 mm (0.004 in.).

12. If the inside diameter dimension "A" or the allowable dimension between "X" and "Y" are not within specification, replace the wheel.

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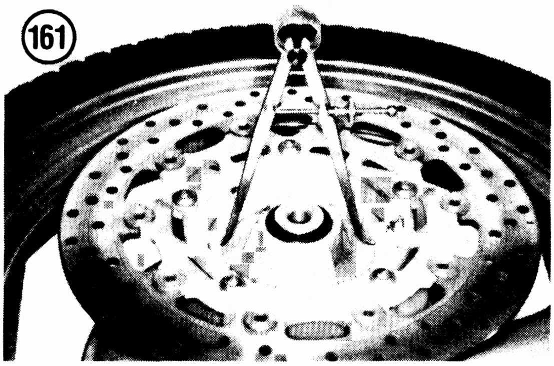

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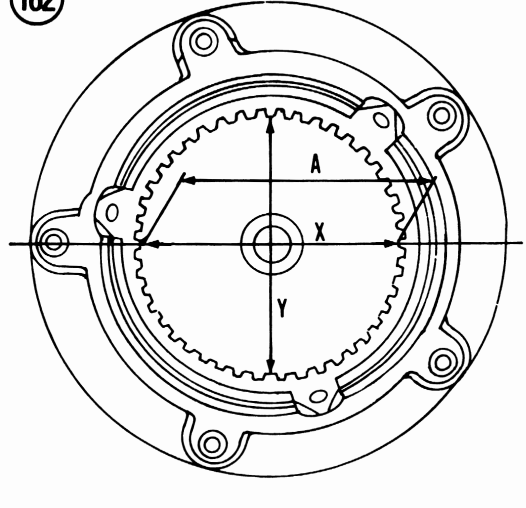

13. At 6 equally spaced intervals, use a Vernier caliper and measure the distance from the hub surface to the top of the sensor rotor Dimension "A" in **Figure 163.**

14. Add all 6 dimensions taken and divide by 6. This will be the average dimension and it must be within 18.15-18.85 mm (0.715-0.742 in.). If the rotor and wheel hub are out of specification, replace the wheel.

15. Apply red Loctite (No. 271) to the sensor rotor bolts prior to installation. Install the bolts and tighten in a crisscross pattern to the torque specification listed in **Table 2.**

16. Apply red Loctite (No. 271) to the brake disc bolts prior to installation. Install brake disc and tighten the bolts in a crisscross pattern to the torque specification listed in **Table 2.**

17. Install the sensor housing into the hub.

18. Install the front or rear wheel as described in Chapter Nine or Chapter Ten.

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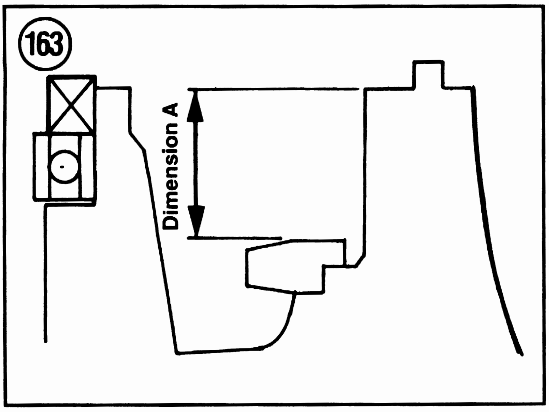

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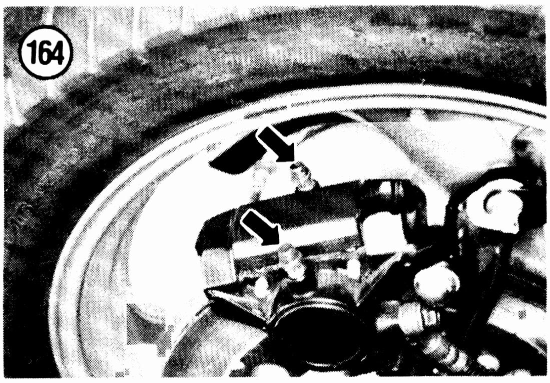

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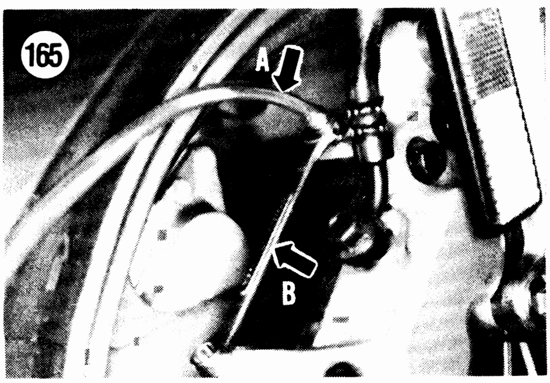


BLEEDING THE SYSTEM

This procedure is necessary only when the brakes feel spongy, there is a leak in the hydraulic system, a component has been replaced or the brake fluid has been replaced.

Bleed the non-ABS brake system in the following sequence:

a. Front calipers.
b. Rear caliper.
c. Anti-dive units (1984-1987 models).

Bleed the ABS-equipped brake system in the following sequence:

a. Front right-hand caliper.
b. Front left-hand caliper.
c. Rear caliper.

NOTE

On ABS-equipped models, due to the amount of brake hoses and lines, bleeding may be difficult. If necessary, bleed the system of the majority of the air bubbles and let the system rest for a few hours, then repeat the procedure. If you are unable to correctly bleed the system, trailer the bike to a dealer and have them properly bleed the system.

1. Remove the right-hand frame side cover.

2. Remove the dust cap(s) (**Figure 164**) from the brake bleeder valve(s).

NOTE

The rear caliper is equipped with 2 bleed valves. Bleed each half of the caliper separately—do not try to bleed both halves at the same time.

3. Connect a length of clear tubing to the bleeder valve on the caliper. Refer to A, **Figure 165** for the front caliper or A, **Figure 166** for the rear wheel.

4. Place the other end of the tube into a clean container. Fill the container with enough fresh brake fluid to keep the end submerged. The tube should be long enough so that a loop can be made higher than the bleeder valve to prevent air from being drawn into the caliper during bleeding.

CAUTION
Cover surrounding parts with a heavy cloth or plastic tarp to protect them 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.

5. Clean the top of the master cylinder of all dirt and foreign matter.

6. Remove the cover and diaphragm. Refer to **Figure 167** for the front master cylinder or **Figure 168** for the rear master cylinder.

7. Fill the reservoir to about 10 mm (3/8 in.) from the top. Install the diaphragm to prevent the entry of dirt and moisture.

WARNING
Use brake fluid clearly marked DOT 4 only. Others may vaporize and cause brake failure. Always use the same brand name; do not intermix the brake fluids, as many brands are not compatible. Do not intermix silicone-based (DOT 5) brake fluid as it can cause brake component damage leading to brake system failure.

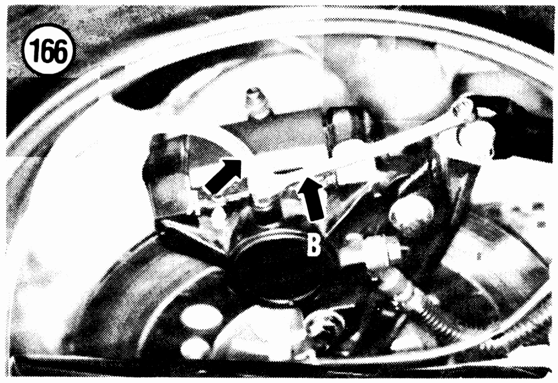
8. Slowly pump the front brake lever or rear pedal several times. Hold the lever or pedal in the applied position and open the bleeder valve with a wrench about 1/2 turn. Refer to B, **Figure 165** for the front caliper or B, **Figure 166** for the rear wheel.

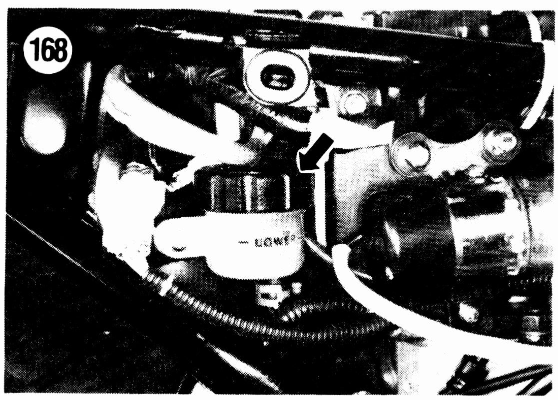
9. Allow the lever to travel to its limit. When this limit is reached, tighten the bleeder valve. As the brake fluid enters the system, the level will drop in the master cylinder reservoir. Maintain the level at about 10 mm (3/8 in.) from the top of the reservoir to prevent air from being drawn into the system.

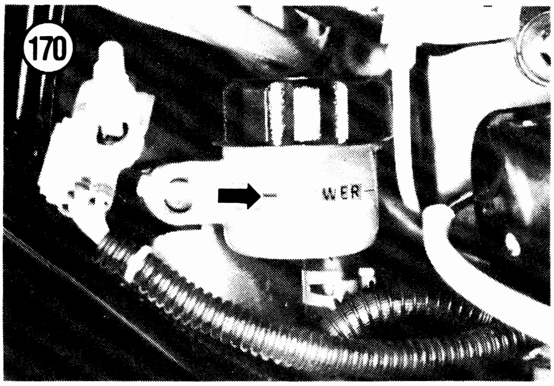
10. Continue to pump the front brake lever or rear brake pedal and fill the reservoir until the fluid emerging from the hose is completely free of air bubbles.

NOTE
If bleeding is difficult, it may be necessary to allow the fluid to stabilize for a few hours. Repeat the bleeding procedure when the tiny bubbles in the system settle out.

11. Hold the front brake lever or rear brake pedal in the applied position and tighten the bleeder valve. Remove the bleeder tube and install the bleeder valve dust cap.







12. If necessary, add fluid to correct the level in the master cylinder reservoir. It must be above the "LOWER" level line. Refer to **Figure 169** for the front master cylinder or **Figure 170** for the rear master cylinder.

13. Install the cover. Tighten the screws on front master cylinder securely.

14. Test the feel of the brake lever or pedal. It should feel firm and should offer the same resistance each time it's operated. If it feels spongy, it is likely that air is still in the system and it must be bled again. When all air has been bled from the system, and the brake fluid level is correct in the reservoir, double-check for leaks and tighten all fittings and connections.

WARNING
Before riding the motorcycle, make certain that the brakes are operating correctly by operating the lever several times. Then make the test ride a slow one at first to make sure the brake is operating correctly with full hydraulic advantage.

Table 1 BRAKE SYSTEM SPECIFICATIONS

Type	Front—dual disc Rear—single disc
Brake fluid type	DOT 4
Front brake disc	
Disc diameter	
1984-1988	282 mm (11.1 in.)
1989-on	298 mm (11.7 in.)
Disc thickness	
1984-1988	7.5 mm (0.30 in.)
1989-on	4.0 mm (0.20 in.)
Brake pad thickness	
New	5.5 mm (0.217 in.)
Wear limit	0.5 mm (0.02 in.)
Master cylinder inside diameter	15.87 mm (0.62 in.)
Brake caliper inside diameter	
1984-1988	42.8 mm (1.69 in.)
1989-on	32.1 mm (1.26 in.)
Rear disc brake	
Disc diameter	282 mm 11.1 in.)
Disc thickness	7.5 mm (0.30 in.)
Brake pad thickness	
New	5.5 mm (0.22 in.)
Wear limit	0.5 mm (0.02 in.)
Master cylinder inside diameter	14.0 mm (0.55 in.)

(continued)

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Table 1 BRAKE SYSTEM SPECIFICATIONS (continued)

Rear disc brake (continued)	
Brake caliper inside diameter	42.85 mm (1.69 in.)
Front brake lever free play	5-8 mm (0.2-0.3 in.)
Rear brake pedal	
Free play	20-30 mm (0.8-1.2 in.)
Position	30 mm (1.2 in.) below the top of the foot rest

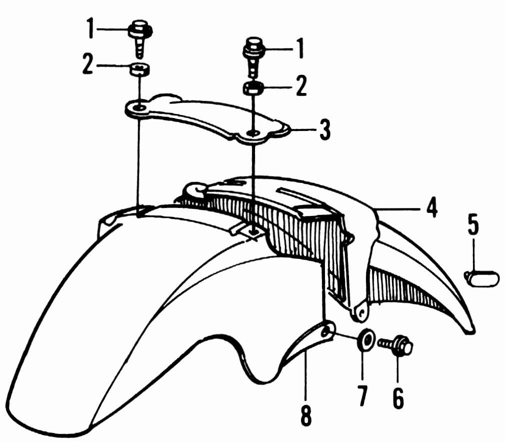
Table 2 BRAKE SYSTEM TIGHTENING TORQUES

Item	N•m	ft.-lb.
Caliper bolt (front and rear)	35	25
Front caliper clamping bolt	35	25
Brake hose union bolt	26	19
Front master cylinder clamp bolt	9	6.5
Rear master cylinder mounting bolt	20	14
Brake disc bolts (front and rear)	20	14
ABS components		
Sensor mounting bolts	23	17
Sensor rotor mounting bolts	6	4.3

CHAPTER TWELVE

BODY AND FRAME

(1) **FRONT FENDER**



1. Bolt
2. Washer
3. Fork brace
4. Front fender rear section
5. Plug
6. Bolt
7. Washer
8. Front fender rear section

This chapter contains removal and installation procedures for the front and rear fenders, front fairing assembly and the frame side covers.

When removing a body component, it is suggested that as soon as the part is removed from the bike all mounting hardware (i.e. small brackets, bolts, nuts, rubber bushings, metal collars, etc.) be reinstalled onto the removed component. After removal, the body components should be placed away from the work area to prevent accidental damage.

This chapter also describes procedures for completely stripping the frame. Recommendations are also provided for stripping and repainting.

FRONT FENDER

Removal/Installation

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

1. Remove the bolts and washers securing the front fender brace (A, **Figure 2**) to the front fork assemblies and remove the brace. Note the location of any cable guides (B, **Figure 2**) or brackets.

2. Carefully remove the speedometer cable and guide from the left-hand side of the fender.

3. Remove the bolt and washer (**Figure 3**) on each side securing the front and rear sections of the frame to the fork sliders.
4. Carefully move the rear section of the fender (A, **Figure 4**) toward the rear and remove it.
5. Carefully move the front section of the fender (B, **Figure 4**) forward and remove it.
6. Install by reversing these removal steps while noting the following:
   a. Apply a *small* amount of blue Loctite (No. 242) to the fender and brace mounting bolts prior to installation.
   b. Tighten the bolts securely. Don't overtighten the bolts as the fender mounting areas may be damaged.

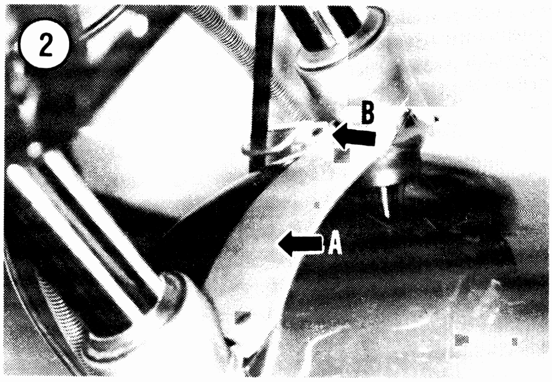
REAR FENDER

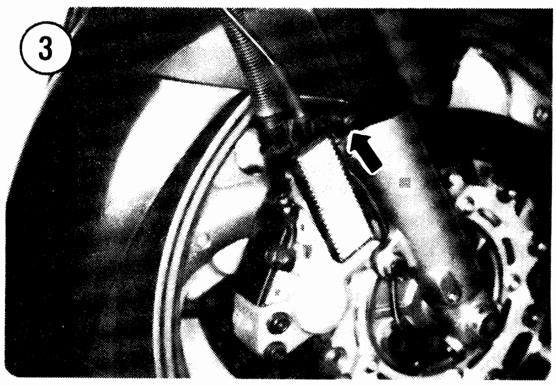
Removal/Installation

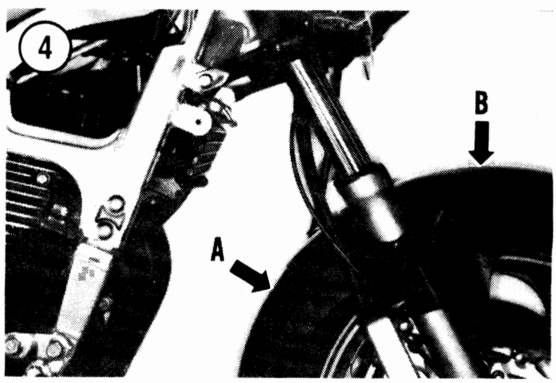
Refer to the following illustrations for this procedure:

a. 1984-1991 models: **Figure 5**.
b. 1992-on models: **Figure 6**.

1. Remove the seat and both side covers as described in this chapter.
2. Remove the rear wheel as described in Chapter Ten.
3. Remove the battery as described in Chapter Three.
4. Remove the battery box.
5. Remove the air filter air box as described in Chapter Seven.
6. Remove all electrical components and connectors from the rear fender panels.
7. Disconnect the electrical connectors to the taillight assembly.
8. Remove the bolts securing the hand grip(s) (A, **Figure 7**) and remove the grip(s).
9. Remove the bolts securing the rear fender cover (B, **Figure 7**) and remove it.
10. Remove the rear turn signal assemblies (C, **Figure 7**).
11. Remove the bolts and nuts securing the rear section (D, **Figure 7**) of the rear fender. Don't lose the metal collars in the bolt holes.
12. Remove the bolts securing the front section of the rear fender.
13. Carefully remove the rear and front sections from the frame.
14. Install by reversing these removal steps while noting the following:
   a. Be sure to install the metal collars in the bolt holes where applicable.
   b. Tighten the bolts and nuts securely. Don't overtighten them as the fender mounting areas may be damaged.
   c. Make sure the electrical connectors are free of corrosion and are completely coupled to each other.







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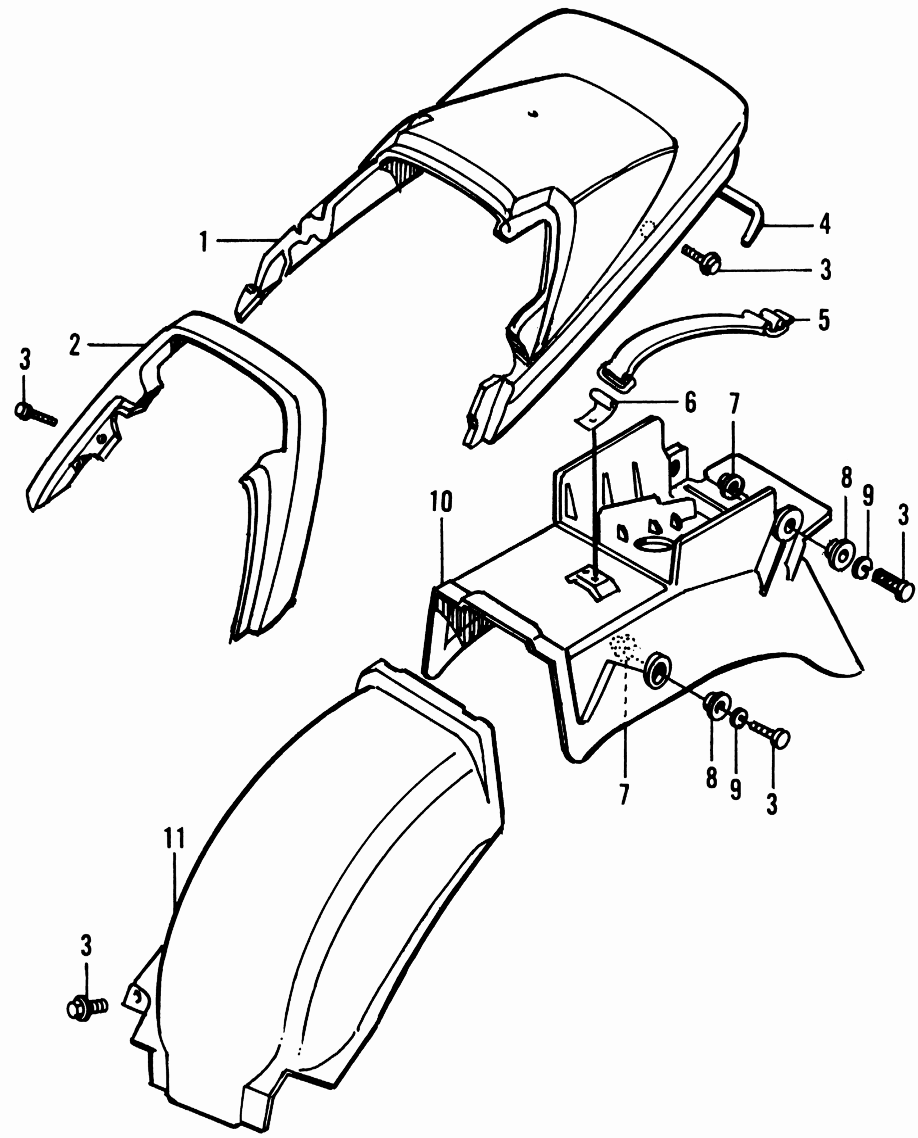
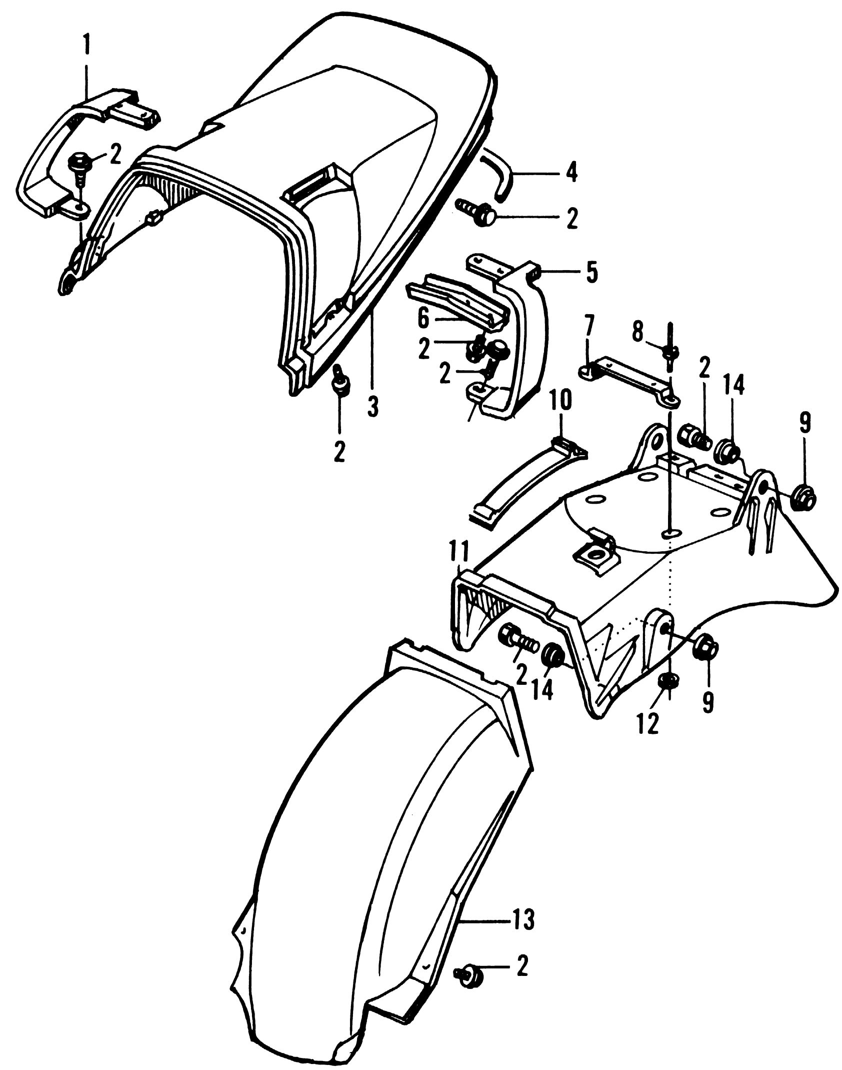
REAR FENDER (1984-1991)



1. Rear fender cover
2. Handgrip
3. Bolt
4. Trim
5. Rubber strap
6. Clamp
7. Nut
8. Collar
9. Washer
10. Rear fender rear section
11. Rear fender front section

6

REAR FENDER (1992-ON)



1. Handgrip (right-hand)
2. Bolt
3. Rear fender cover
4. Trim
5. Handgrip (right-hand)
6. Bracket
7. Bracket
8. Fastener
9. Collar
10. Rubber strap
11. Rear fender rear section
12. Special washer
13. Rear fender front section
14. Collar

LOWER FAIRING

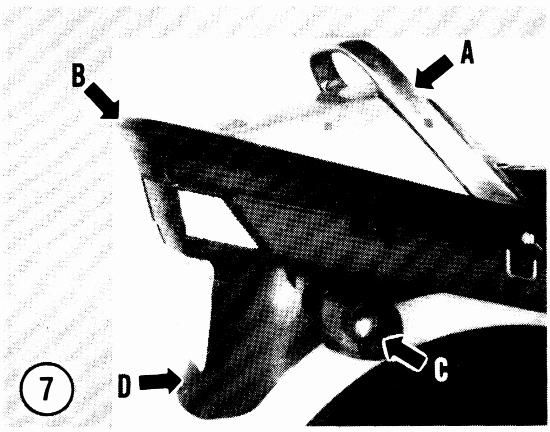
Removal/Installation

1. Place the bike securely on the centerstand.

2A. On 1984-1985 models, perform the following:

   a. Remove the screws (A, **Figure 8**) securing the lower fairing on each side.

   b. Lower the fairing (B, **Figure 8**) and remove it from the frame.



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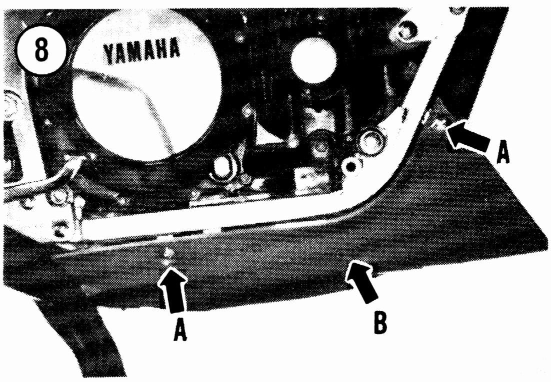

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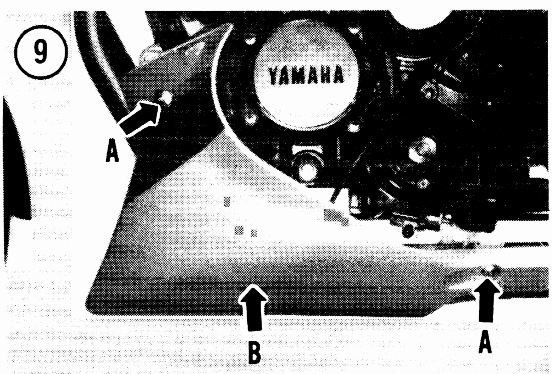

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2B. On 1986-on models, perform the following:

   a. Remove the screws (A, **Figure 9**), washer, collar and nut securing the lower fairing on each side.

   b. Lower the fairing (B, **Figure 9**) and remove it from the frame.

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

   a. Be sure to install the metal collars on the screws where applicable.

   b. Tighten the screws and nuts securely. Don't overtighten them as the fairing mounting areas may be damaged.

UPPER FAIRING

Removal/Installation (1984-1985)

Refer to **Figure 10** for this procedure.

1. Place the bike securely on the centerstand.
2. Disconnect the battery negative lead as described in Chapter Three.

NOTE
The air duct plastic retainers usually harden with age and may break when you try to release them. If they are removed successfully, they may not want to lock completely when reinstalled. These fasteners are inexpensive and it is suggested they be replaced during installation to ensure proper rattle-free retention of the air ducts.

3. To remove the air duct assembly, perform the following:

   a. Use a 3 mm (0.12 in.) rod or small Phillips screwdriver and push in on the center of each plastic retainer. This will release the center pin retainer on the inside.

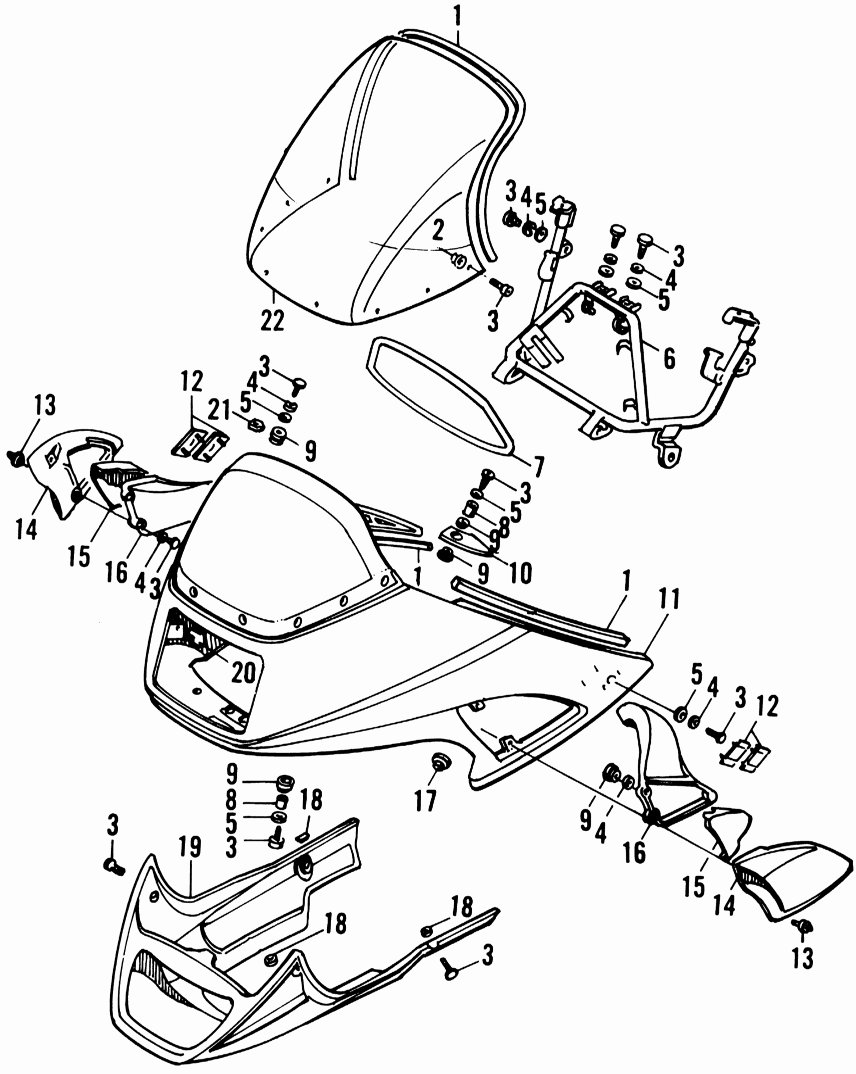
   b. Carefully withdraw the retainers (A, **Figure 11**) from the air duct and upper fairing.

   c. Pull the front of the air duct out away from the upper fairing, unhook the rear of the air duct from the opening and remove the air duct (B, **Figure 11**) assembly.

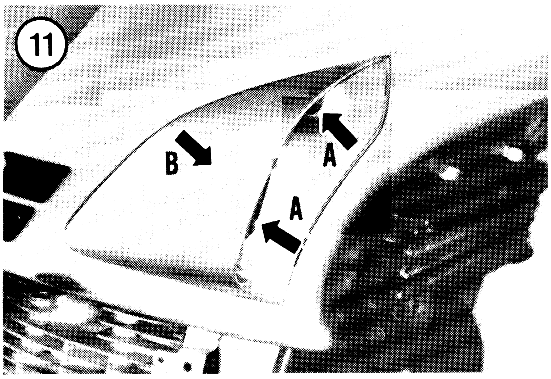
4. Working under the upper fairing, locate and disconnect the headlight electrical connector.
5. Remove the screw, washer and collar securing the top of the upper fairing to the mounting bracket.

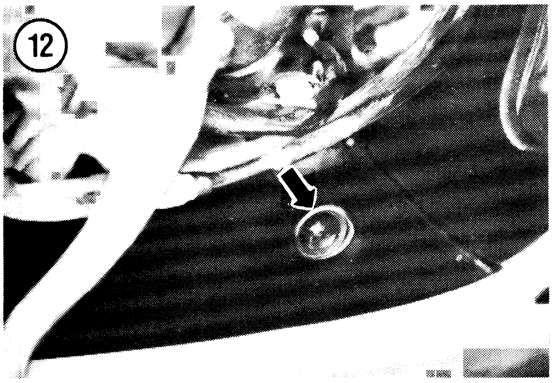
(10)

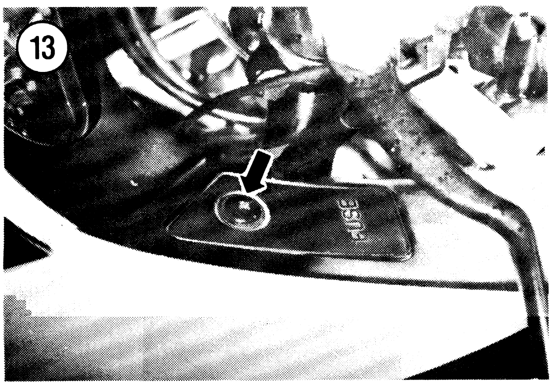
FRONT FAIRING (1984-1985)

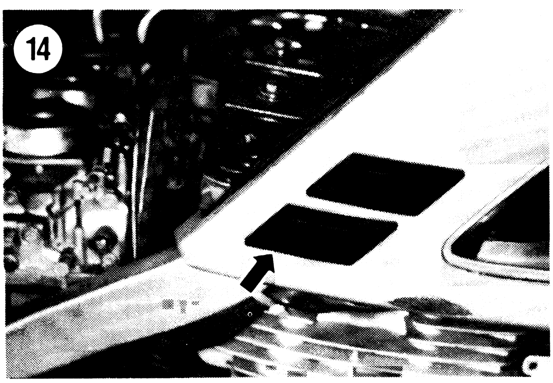


1. Trim strip	12. Trim caps
2. Collar	13. Plastic retainer
3. Screw	14. Air intake
4. Lockwasher	15. Cap
5. Washer	16. Air duct
6. Mounting bracket	17. Rubber stopper
7. Trim	18. Collar
8. Collar	19. Lower fairing
9. Rubber grommet	20. Rubber cushion
10. Trim panel	21. Special nut
11. Upper fairing	22. Windshield









Refer to **Figure 12** for the right-hand side or **Figure 13** for the left-hand side.

6. Remove the lower trim cap (**Figure 14**) to expose the screw under it.

7. Remove the screws, dished washers, collars and grommets (A, **Figure 15**) securing each side at the rear of the upper fairing to the mounting bracket.

8. Remove the screws, dished washers and collars (**Figure 16**) securing the under portion of the upper fairing to the mounting bracket.

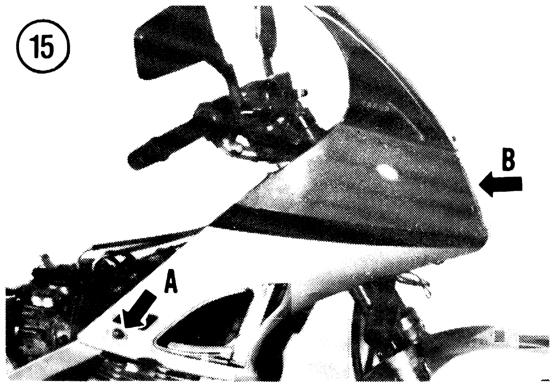
NOTE

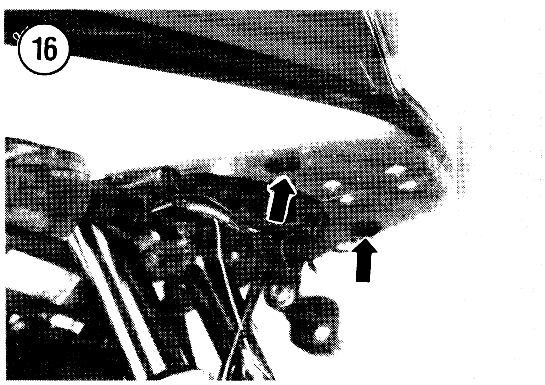
On these models the headlight assembly is attached to the upper fairing and will come out with the fairing during removal.

9. Slowly pull the upper fairing (B, **Figure 15**) forward while guiding it off the mounting bracket. Remove the upper fairing and headlight assembly.

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

a. Inspect the rubber grommets at the various attachment holes for hardness or deterioration, replace if necessary.





b. Where applicable, install the metal collar in the fairing mounting hole.

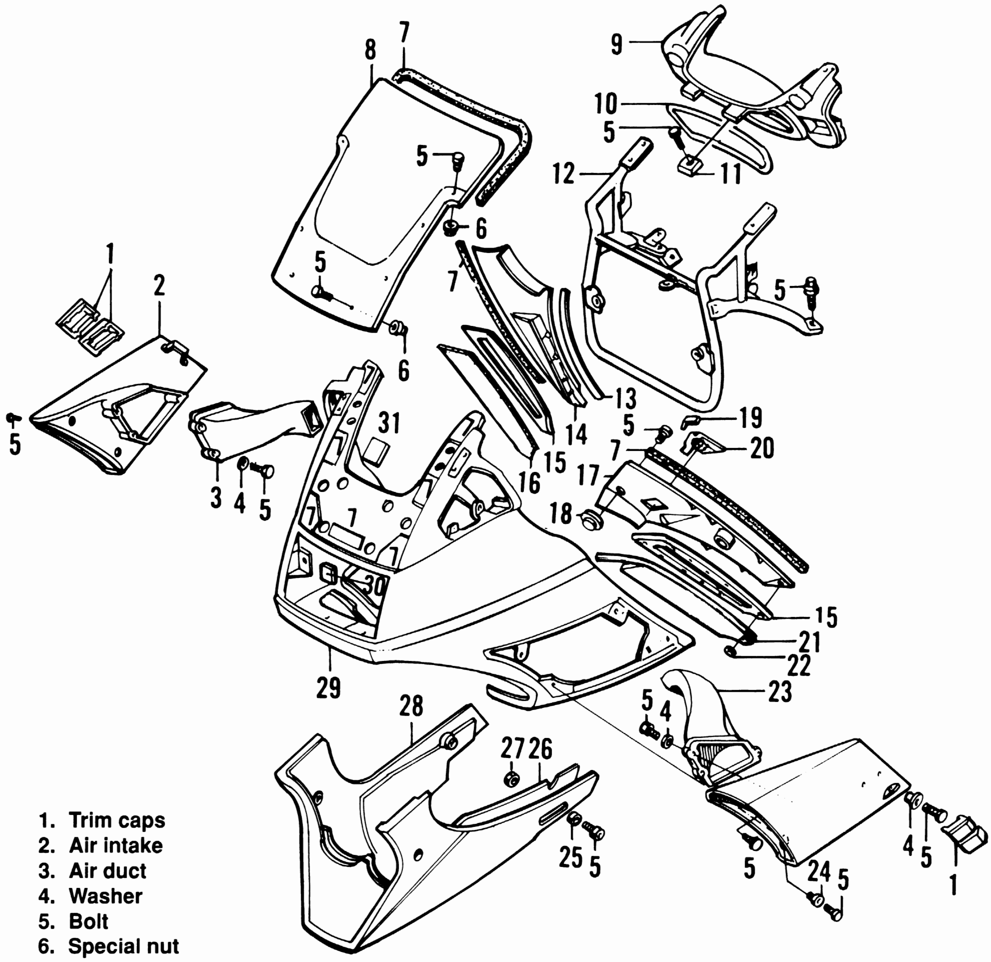
c. Hold the upper fairing in place and install all attaching hardware finger-tight. Do not tighten any of the bolts until all mounting bolt holes are aligned and all bolts are installed.

d. Tighten the bolts securely. Don't overtighten the bolts as the fairing mounting areas may be damaged.

e. After the upper fairing is completely installed, grab it with both hands and carefully try to move it back and forth to make sure it is securely installed.

17

FRONT FAIRING (1986-1987)



1. Trim caps
2. Air intake
3. Air duct
4. Washer
5. Bolt
6. Special nut
7. Trim strip
8. Windshield
9. Instrument cluster inner panel
10. Trim
11. Special nut
12. Mounting bracket
13. Trim strip
14. Air outlet grille
15. Damper
16. Plate
17. Air outlet grille
18. Spring nut
19. Clip
20. Trim plate
21. Plate
22. Special nut
23. Air duct
24. Collar
25. Collar
26. Heat shield
27. Nut
28. Lower fairing
29. Upper fairing
30. Rubber pad
31. Rubber pad

f. Check all controls to make sure the headlight electrical connector is properly attached and that the upper fairing does not alter throttle cable control.

Removal/Installation (1986-on)

Refer to the following illustrations for this procedure:

a. 1986-1987 models (Fairing): **Figure 17.**

b. 1988-1990 models (Fairing): **Figure 18.**

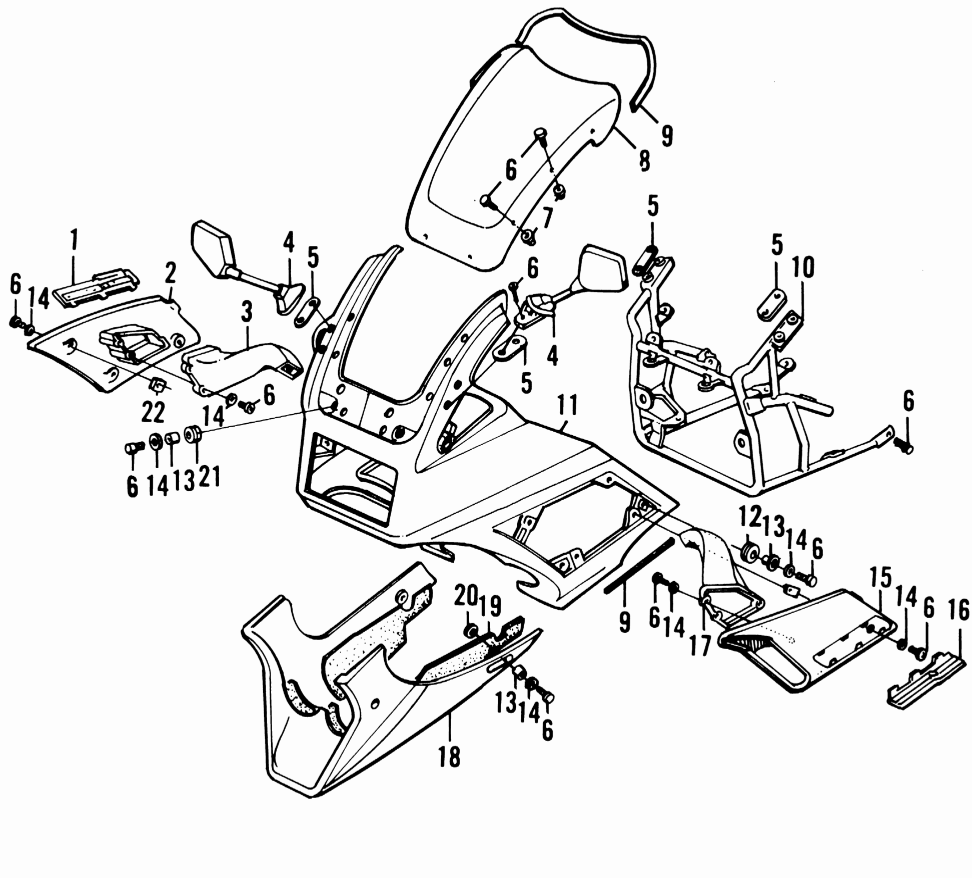
c. 1988-on models (Inner Panels): **Figure 19.**

d. 1991-on models (Fairing): **Figure 20.**

1. Place the bike securely on the centerstand.

2. Disconnect the battery negative lead as described in Chapter Three.

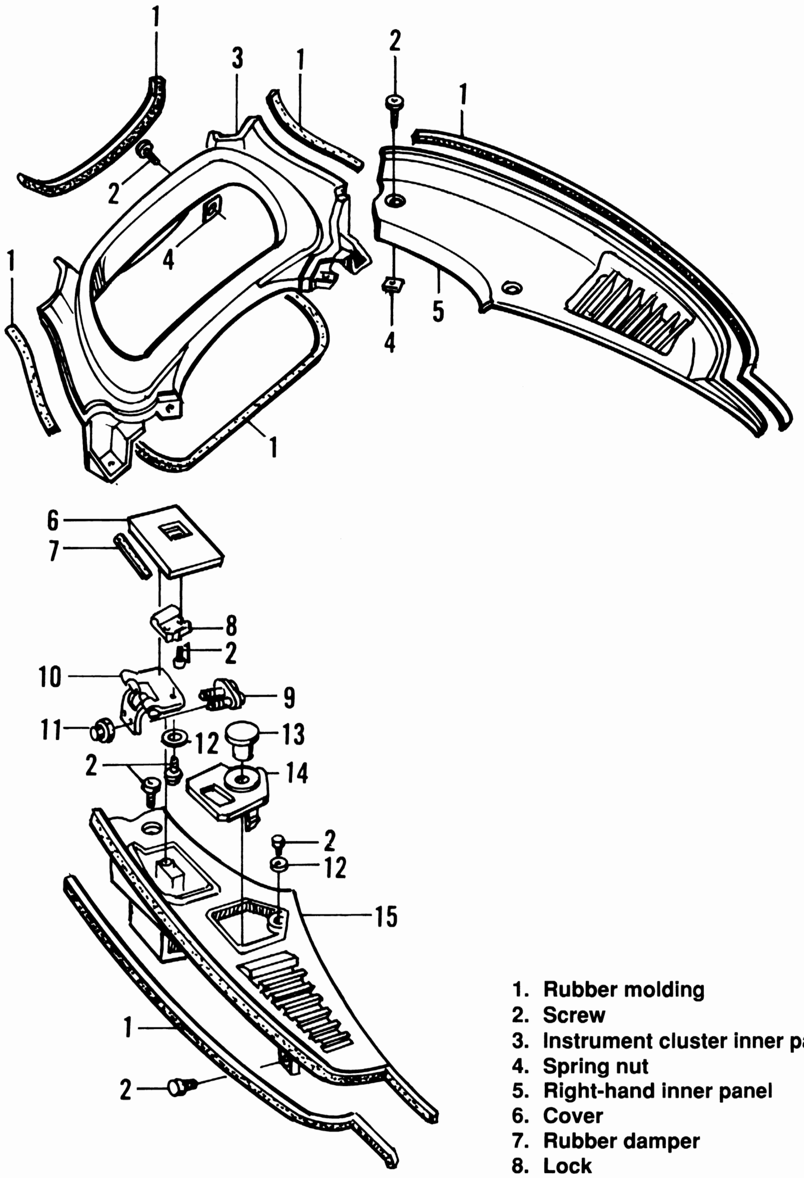
(18) **FRONT FAIRING (1988-1990)**



1. Trim bar
2. Air intake
3. Air duct
4. Rear view mirror
5. Rubber cushion
6. Screw
7. Special nut
8. Windshield
9. Trim
10. Mounting bracket
11. Upper fairing
12. Rubber grommet
13. Collar
14. Washer
15. Air intake
16. Trim bar
17. Air duct
18. Lower fairing
19. Heat shield
20. Special nut
21. Rubber grommet
22. Spring nut

19

FRONT FAIRING INNER PANELS (1988-ON)



1. Rubber molding
2. Screw
3. Instrument cluster inner panel
4. Spring nut
5. Right-hand inner panel
6. Cover
7. Rubber damper
8. Lock
9. Bracket
10. Hinge
11. Nut
12. Washer
13. Choke knob
14. Small trim panel
15. Left-hand inner panel

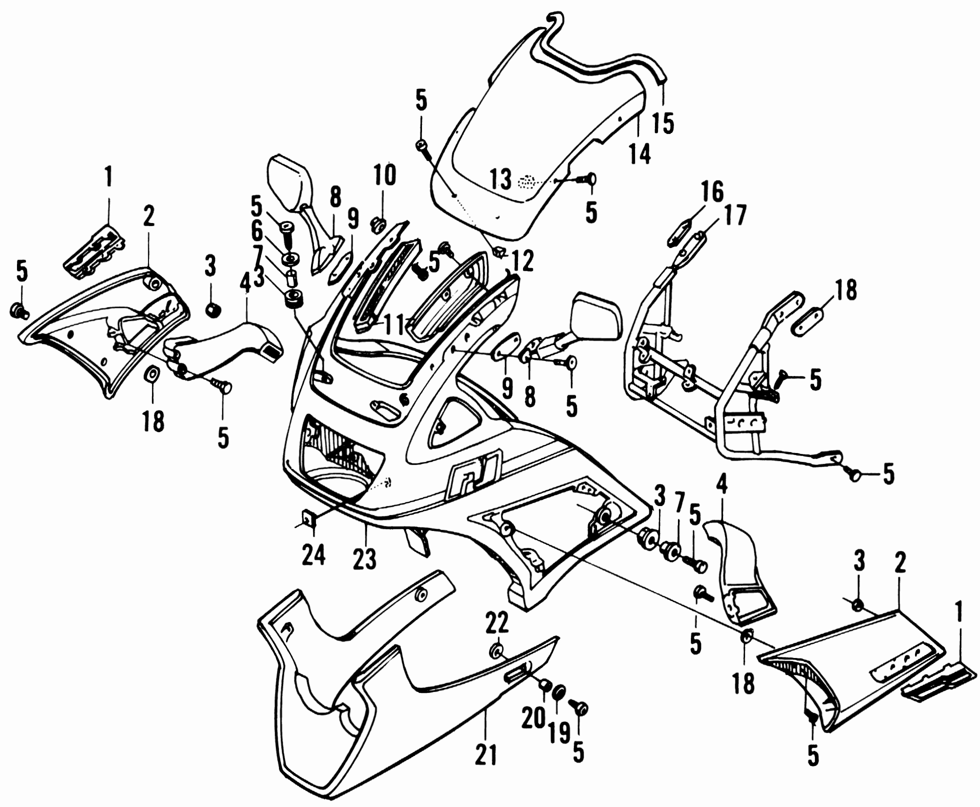
NOTE
The air duct plastic retainers usually harden with age and may break when you try to release them. If they are removed successfully, they may not want to lock completely when reinstalled. These fasteners are inexpensive and it is suggested they be replaced during installation to ensure proper rattle-free retention of the air ducts.

3A. On 1986-1987 models, to remove the air duct assembly, perform the following:

a. Use a 3 mm (0.12 in.) rod or small Phillips screwdriver and push in on the center of each plastic retainer. This will release the center pin retainer on the inside.

b. Carefully withdraw the retainers from the air duct and upper fairing.

(20) **FRONT FAIRING (1991-ON)**



1. Trim bar
2. Air intake
3. Rubber grommet
4. Air duct
5. Screw
6. Washer
7. Collar
8. Rear view mirror
9. Rubber pad
10. Nut
11. Upper inner trim panel
12. Special nut
13. Special nut
14. Windshield
15. Trim
16. Rubber cushion
17. Mounting bracket
18. Special washer
19. Grommet
20. Collar
21. Lower fairing
22. Nut
23. Upper fairing
24. Spring nut

c. Remove the lower trim cap at the rear of the air duct to expose the screw below it.

d. Remove the screw and collar at the rear of the air duct.

e. Pull the front of the air duct out away from the upper fairing, unhook the rear of the air duct from the opening and remove the air duct assembly.

3B. On 1988-on models, to remove the air duct assembly, perform the following:

a. Carefully pull the trim bar (**Figure 21**) up and off the air duct to expose the screw below it.

b. Remove the 2 front screws and the 1 rear screw (A, **Figure 22**) securing the air duct to the upper fairing.

c. Pull the front of the air duct (B, **Figure 22**) out away from the upper fairing, unhook the rear of the air duct from the opening and remove the air duct assembly.

4. Slide up the rubber boot (A, **Figure 23**), remove the screws (B, **Figure 23**) and remove the rear view mirror (C, **Figure 23**). Remove both mirrors.

5. Remove the screws securing the windshield (**Figure 24**) and remove the windshield. Wrap the windshield in a towel or blanket to protect it from damage and store it in a safe place.

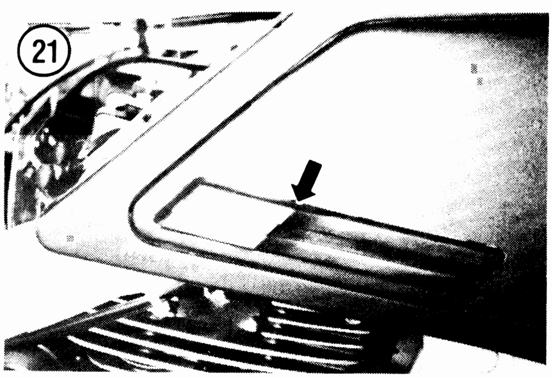
6. On 1991-on models, remove the screws and remove the upper inner trim panel (**Figure 25**). Remove both panels.

7. Remove the small set screw (A, **Figure 26**) and remove the choke knob (B, **Figure 26**). Reinstall the set screw in the knob to avoid misplacing it.

8. Remove the small trim panel (**Figure 27**).

9. Remove the inner panels as follows:

a. Remove the side screw (**Figure 28**) securing the inner panel.



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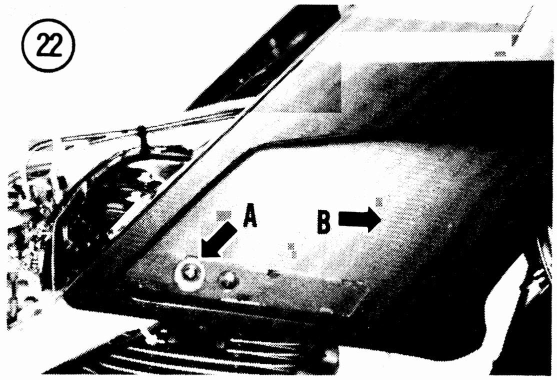

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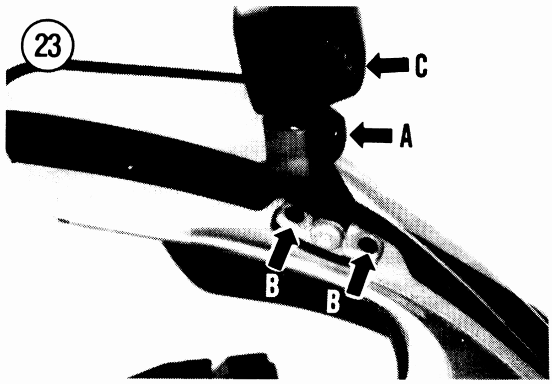

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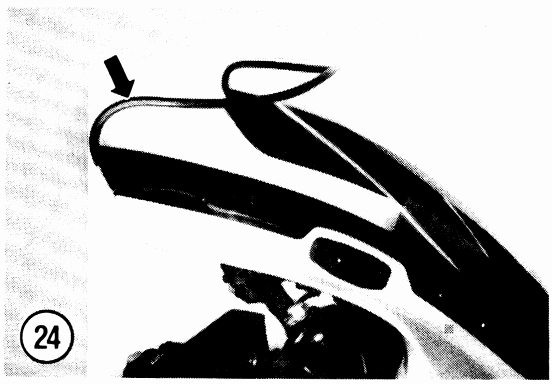

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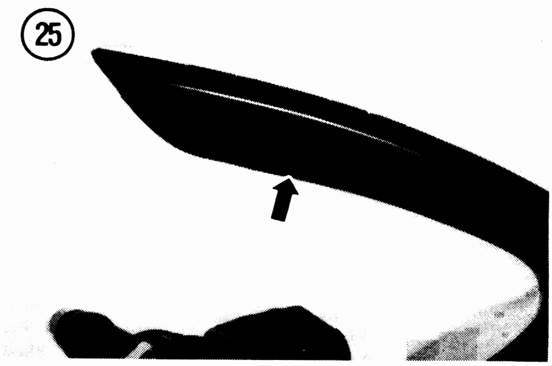

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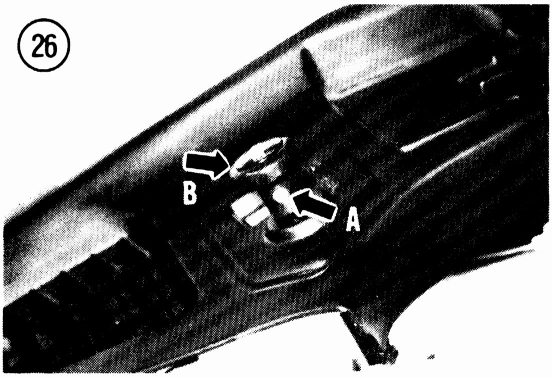

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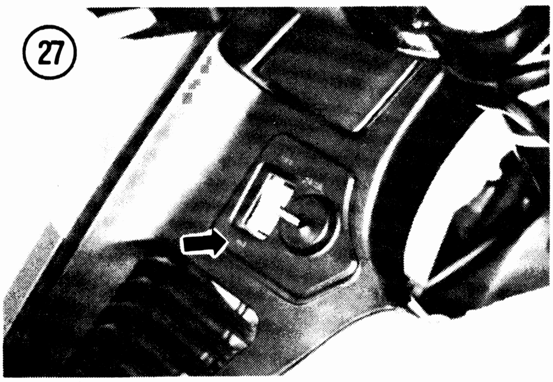

b. Remove the front and rear (A, **Figure 29**) screws securing the inner panel.

c. Carefully remove the inner panel (B, **Figure 29**) from the upper fairing.

d. Remove the other inner panel.

10. Working under the upper fairing, locate and disconnect the following electrical connectors:

a. Both front turn signal assembly connectors.

b. Headlight assembly connector.

11. Remove the screws (A, **Figure 30**) securing the meter cover and remove the cover (B, **Figure 30**).

12. To remove the main portion of the upper fairing, perform the following:

a. Working within the upper fairing, remove the inner front bolt and washer (**Figure 31**) on each side of the headlight assembly.

b. Remove the front upper screws and washers (**Figure 32**).

c. Remove the side screws and collars (**Figure 33**) securing the upper fairing to the mounting bracket.

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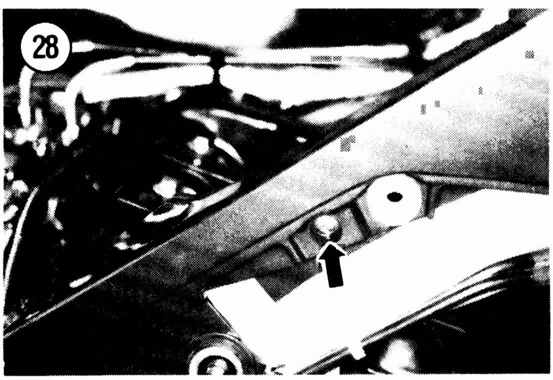

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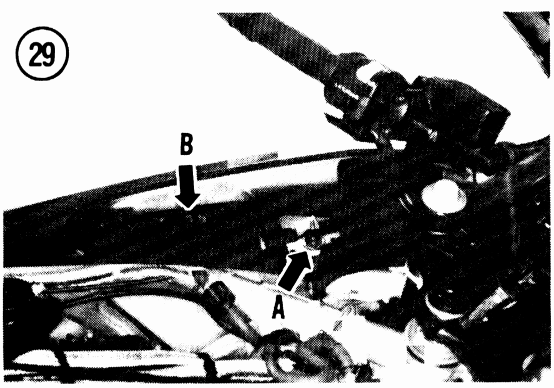

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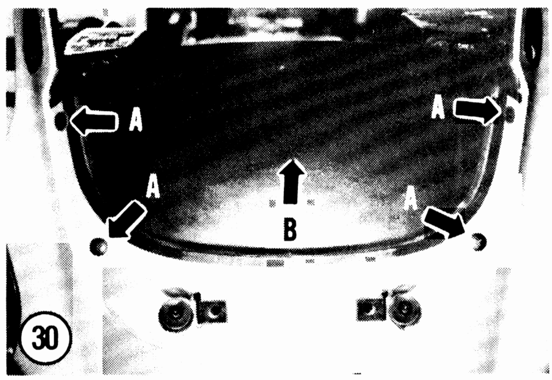

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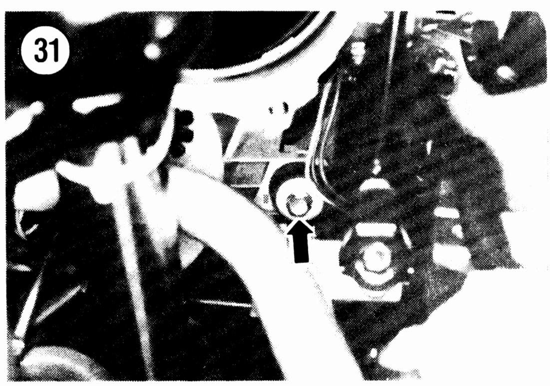

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CAUTION

After the screws are removed, the upper fairing will be loose and the following step requires the aid of a helper. Once the upper fairing is moved forward the headlight assembly will become loose since it is not attached to the upper fairing mounting bracket. Once the upper fairing is moved forward the headlight assembly ***will fall out*** *if not held in place.*

d. Slowly pull the upper fairing forward while holding the headlight assembly in place in the mounting bracket. Remove the upper fairing assembly
e. If the fairing mounting bracket is going to be removed, remove the headlight assembly from it.
f. If the fairing mounting bracket is going to remain in place, the headlight assembly (A, **Figure 34**) can be left in place also. Insert the inner bolts (B, **Figure 34**) through the headlight assembly and install a nut on each bolt.

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

a. Inspect the rubber grommets at the various attachment holes for hardness or deterioration, replace if necessary.
b. Where applicable, install the metal collar in the fairing mounting hole.
c. Hold the upper fairing in place and install all attaching hardware finger-tight. Do not tighten any of the bolts until all mounting bolt holes are aligned and all bolts are installed.
d. Tighten the bolts securely. Don't overtighten the bolts as the fairing mounting areas may be damaged.
e. After the upper fairing is completely installed, grab it with both hands and try to move it back and forth to make sure it is securely installed.
f. Check all controls to make sure the electrical connectors are properly attached and that the upper fairing does not alter throttle cable control.

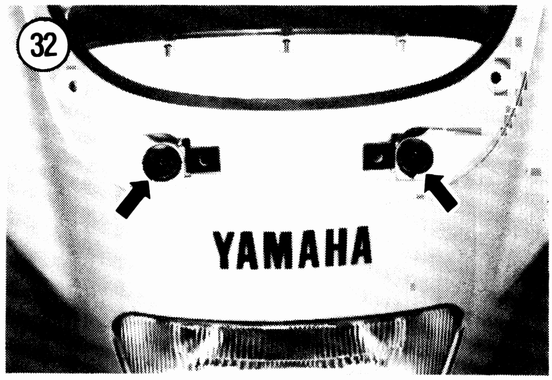
Windshield

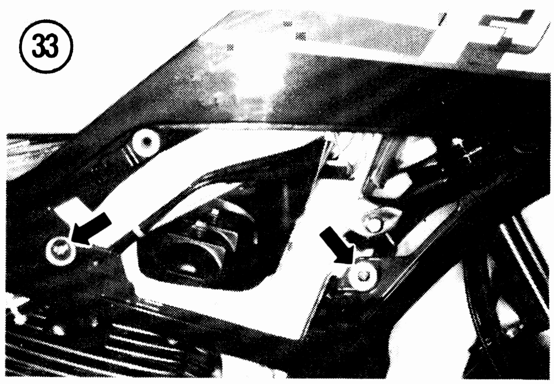
The windshield (**Figure 24**) can be replaced by removing the mounting screws. Reverse to install.

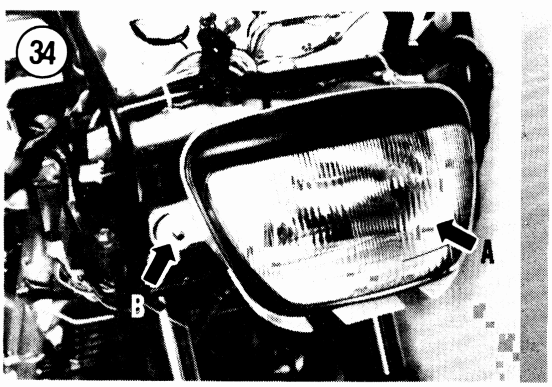
Windshield Cleaning

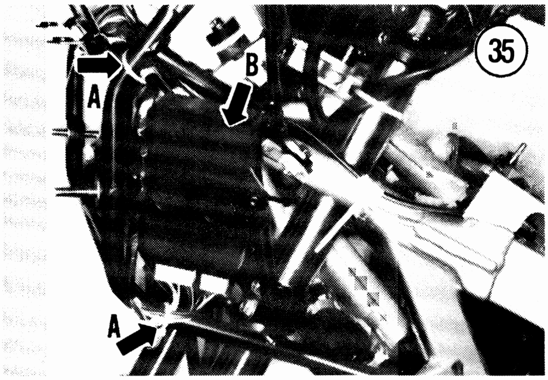
Be very careful when cleaning the windshield as it can be scratched or damaged. Do not use a cleaner with an abrasive, a combination cleaner and wax or any solvent that contains ethyl or methyl alcohol. Never use gasoline or cleaning solvent since these products will scratch or destroy the surface of the windshield.

To remove oil, grease or road tar use isopropyl alcohol. Then wash the windshield with a solution









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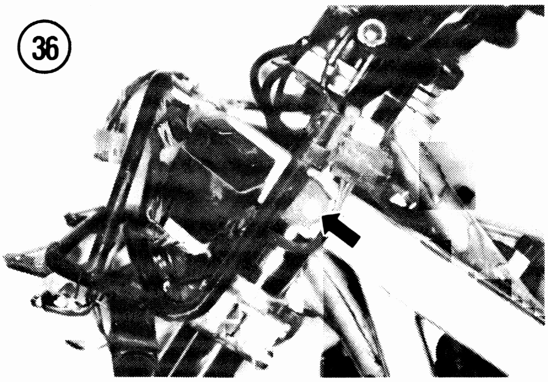
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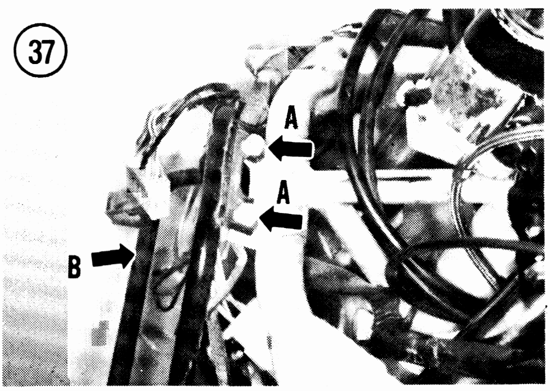

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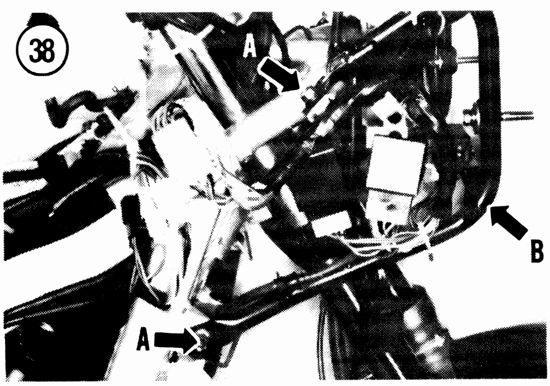

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of mild soap and water. Dry gently with a soft cloth or chamois—do not press hard.

NOTE
When removing road tar, make sure there are no small stones or sand imbedded in it. Carefully remove any abrasive particles prior to performing any rubbing action with a cleaner. This will help minimize scratching.

Many commercial windshield cleaners are available. If using a cleaner, make sure it is safe for use on plastic and test it on a small area first.

UPPER FAIRING MOUNTING BRACKET

Removal/Installation

Refer to the following illustrations for this procedure:

a. 1984-1985 models: **Figure 10.**
b. 1986-1987 models: **Figure 17.**
c. 1988-1990 models: **Figure 18.**
d. 1991-on models: **Figure 20.**

1. Remove the upper fairing as described in this chapter.
2. Disconnect any tie wraps (A, **Figure 35**) securing any electrical wires to the mounting bracket.
3. Remove all electrical components (B, **Figure 35**) from the front fairing bracket and move them out of the way.
4A. On 1984-1985 models, perform the following:
   a. Remove the side bolt (**Figure 36**) on each side.
   b. Remove the top bolts (A, **Figure 37**).
   c. Carefully pull the bracket (B, **Figure 37**) forward and remove it from the frame.
4B. On 1986-on models, perform the following:
   a. Remove the bolts (A, **Figure 38**).
   b. Carefully pull the bracket (B, **Figure 38**) forward and remove it from the frame.
5. Install by reversing these removal steps, tighten all bolts securely.

SEAT

Refer to **Figure 39** for this procedure.
1. Insert the ignition key into the seat lock (B, **Figure 40**) and turn it *counterclockwise*.

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2. Push down on the lever on each side to release the seat.

3. Lift up on the rear of the seat, then pull it toward the rear and unhook it from the front mounting bracket. Remove the seat (A, **Figure 40**).

4. Be sure to push and lock the rider's seat into position in the front mounting bracket. Push the rear portion down into the seat lock mechanism and turn the ignition key *clockwise* to the vertical position. If the seat is not properly secured at either the front or rear it could swing to one side when riding the bike, resulting in the possible loss of control of the bike resulting in an accident.

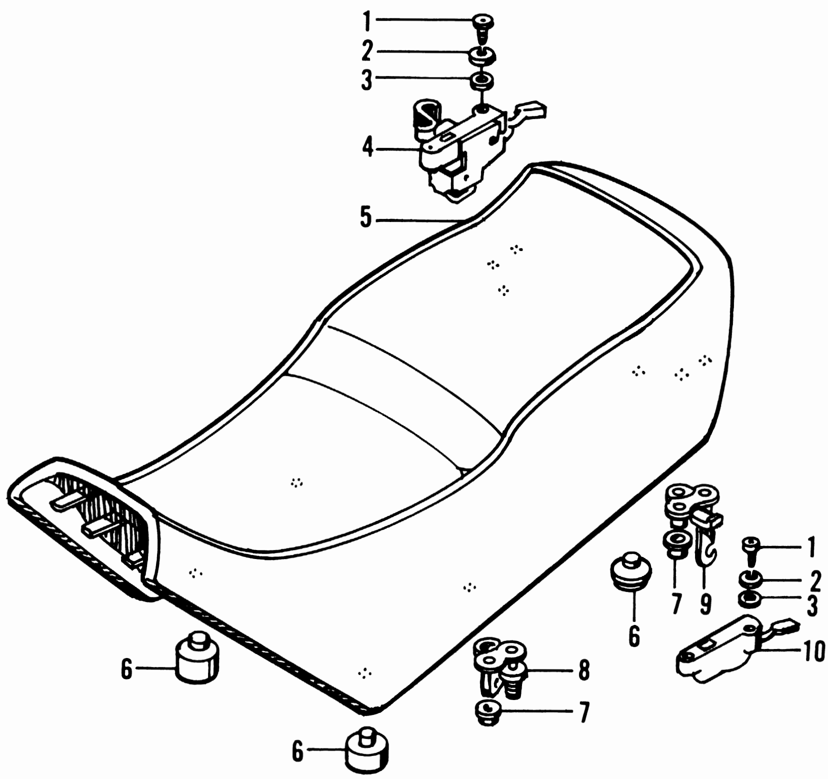
FRAME SIDE COVER

CAUTION
Follow this procedure exactly to avoid damage to the 2 locking tabs located at the rear of the frame side cover. These tabs are small and fragile and will easily break off.

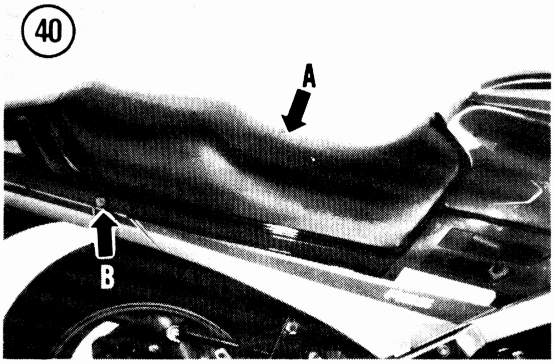
1. Remove the seat as described in this chapter.

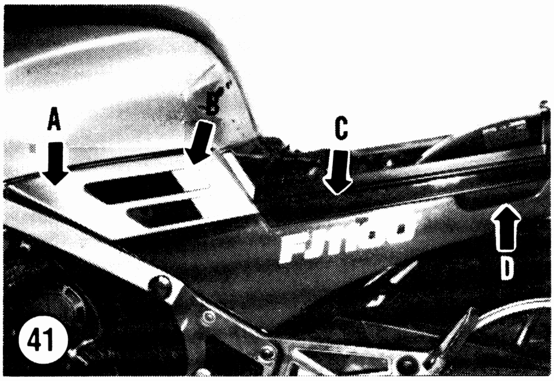
2. Refer to **Figure 41** showing the location of the locking tabs on the backside of the side cover. Carefully pull out on the backside of the frame side cover to release the locking tabs on the backside of the side

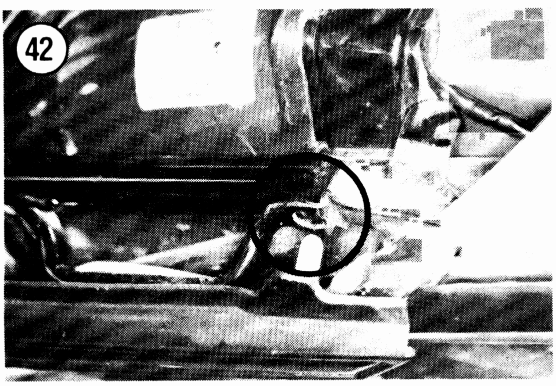
(39) **SEAT**

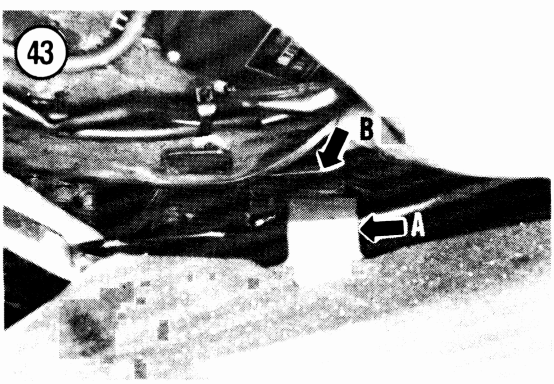


1. Screw
2. Lockwasher
3. Washer
4. Seat/helmet lock assembly
5. Seat
6. Rubber pad
7. Nut
8. Seat bracket
9. Seat bracket
10. Release lever assembly









cover from the rubber locating grommets on the frame in the order shown (A-B-C-D) in **Figure 41.**

3. After releasing the locking tabs on the backside, carefully pull the rear of the side cover out slightly and disengage the rear locating pin from the frame receptacle (**Figure 42**). Don't pull out any farther until the next step.

4. Slowly pivot the side cover *up* to release the locking tab (A, **Figure 43**) from the frame receptacle (B, **Figure 43**) and remove the side cover.

5. Install by reversing these removal steps, be careful when inserting the locating tab into the frame receptacle. The tab is fragile and will break off if forced.

SIDESTAND

Removal/Installation

1. Place the bike securely on the centerstand.

2. Remove the lower fairing as described in this chapter.

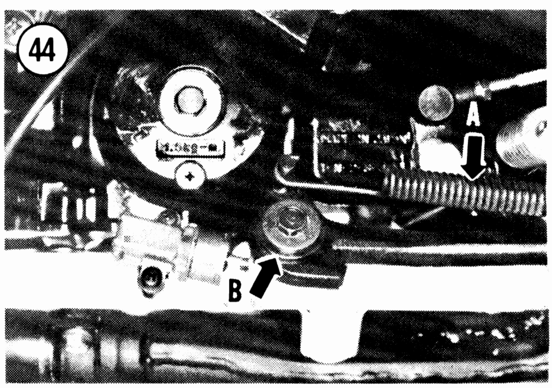
3. Raise the sidestand and disconnect the return spring (A, **Figure 44**) from the pin on the frame with vise-grip pliers.

4. Remove the bolt, washer and special hook washer (B, **Figure 44**) and remove the sidestand.

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

   a. Apply a light coat of multipurpose grease to the pivot surfaces of the frame tab and the sidestand yoke prior to installation.

   b. Install the bolt and tighten securely.



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CENTERSTAND

Removal/Installation

1. Remove the lower fairing as described in this chapter.
2. Remove the exhaust system (A, **Figure 45**) as described in Chapter Seven.
3. Place a wood block(s) under the engine and frame to support the bike securely.
4. Raise the centerstand (B, **Figure 45**) and disconnect the return spring from the pin on the frame with vise-grip pliers.
5. Remove the bolt (C, **Figure 45**) and the self-locking nut on each side and remove the centerstand (B, **Figure 45**) from the frame. Discard the nuts as new ones must be installed.
6. Install by reversing these removal steps while noting the following:
   a. Apply a light coat of multipurpose grease to the pivot surfaces of the frame tab and the centerstand yokes prior to installation.
   b. Install new self-locking nuts and tighten the bolts and nuts securely.

FOOTPEGS

Removal/Installation

1. To remove the front right-hand footpeg, remove the bolts and special washers (**Figure 46**) securing the footpeg to the muffler bracket and remove the footpeg assembly.
2. To remove the front left-hand footpeg, perform the following:
   a. Remove the circlip and washer (A, **Figure 47**) securing the gearshift lever to the front special bolt.
   b. Slide the gearshift lever (B, **Figure 47**) off the special bolt.

   NOTE

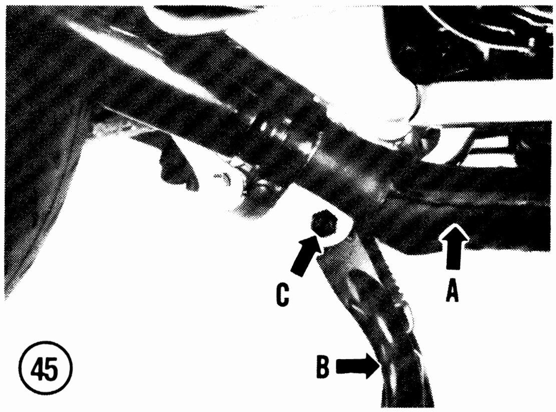
   ***Figure 48** is shown with the complete gearshift pedal assembly removed for clarity.*

   c. Remove the special bolt (A, **Figure 48**) and the rear bolt (B, **Figure 48**) and special washer securing the footpeg to the muffler bracket.
   d. Remove the footpeg assembly.

3. To remove the rear footpeg (**Figure 49**), remove the nut on the backside of the muffler bracket and remove the rear footpeg assembly.

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

   a. On the left-hand side, install the gearshift lever (B, **Figure 47**), washer and circlip. Make



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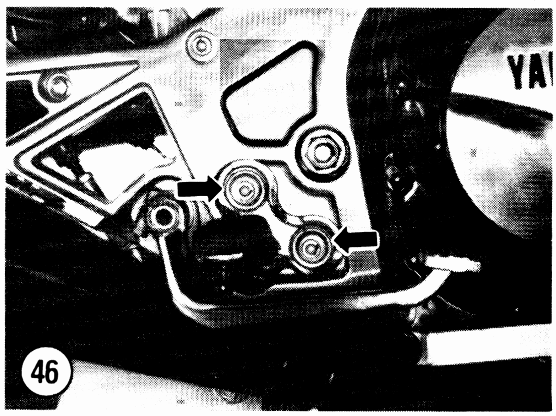

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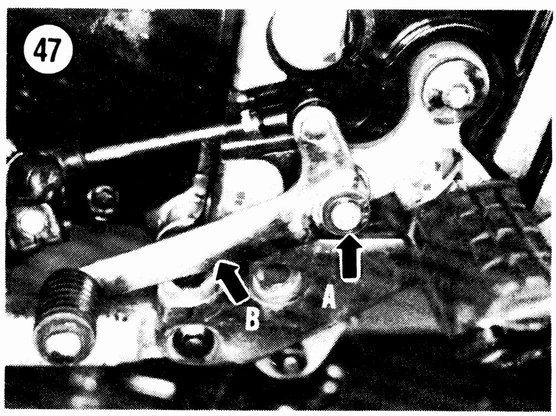

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sure the circlip is correctly seated in the groove in the special bolt.

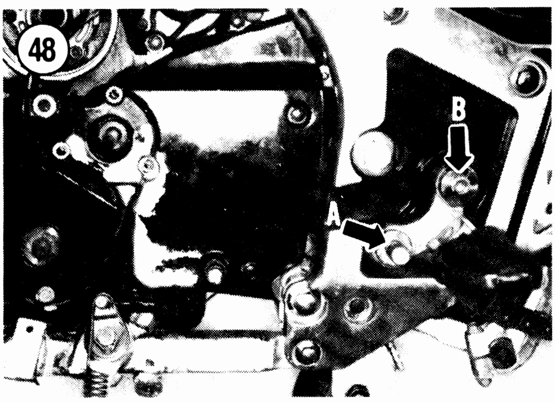
b. Tighten the bolts and nuts securely.

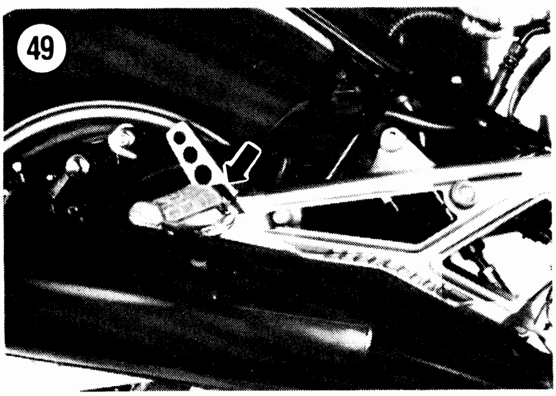
FRAME

The frame does not require routine maintenance. However, it should be inspected immediately after any accident or spill.

Component Removal/Installation

1. Remove the seat, frame side covers, lower and upper fairing and fuel tank.
2. Remove the engine as described in Chapter Four.
3. Remove the front wheel, steering head and front forks as described in Chapter Nine.
4. Remove the rear wheel, shock absorber and swing arm as described in Chapter Ten.
5. Remove the battery as described in Chapter Three.
6. Remove the wiring harness.





7. Remove the sidestand and footpegs as described in this chapter.
8. Remove the steering head races from the steering head tube as described in Chapter Nine.
9. Inspect the frame for bends, cracks or other damage, especially around welded joints and areas that are rusted.
10. Assemble by reversing these removal steps.

Stripping and Painting

Remove all components to expose the painted surface. Thoroughly strip off all old paint. The best way is to have it sandblasted down to bare metal. If this is not possible, you can use a liquid paint remover and steel wool and a fine, hard wire brush.

CAUTION
The fenders, frame side covers, front fairing and air box are molded plastic. If you wish to change the color of these parts, consult an automotive paint supplier for the proper procedure. Do not use any liquid paint remover on these components as it will damage the surface. The color is an integral part of some of these components and cannot be removed.

When the component is down to bare metal, have it inspected for hairline and internal cracks. Magnaflux is the most common and complete process.

Make sure that the primer is compatible with the type of paint you are going to use for the finish color. Spray on one or two coats of primer as smoothly as possible. Let it dry thoroughly and use a fine grade of wet sandpaper (400-600 grit) to remove any flaws. Carefully wipe the surface clean and then spray a couple of coats of the final color. Use either lacquer or enamel base paint and follow the manufacturer's instructions.

A shop specializing in painting will probably do the best job. However, you can do a surprisingly good job with a good grade of spray paint. Spend a few extra dollars and get a good grade of paint as it will make a difference in how good it looks and how long it will stand up. It's a good idea to shake the can and make sure the ball inside the can is loose when you purchase the can of paint. Shake the can as long as is stated on the can. Then immerse the can *upright* in a pot or bucket of *warm* water (not hot—not over 120° F).

WARNING
Higher temperatures could cause the can to burst. Do ***not*** *place the can in direct contact with any flame or heat source.*

Leave the can in the water for several minutes. When thoroughly warmed, shake the can again and spray the component. Be sure to get into all the crevices where there may be rust problems. Several light mist coats are better than one heavy coat. Spray painting is best done in temperatures of 70-80° F (21-26° C); any temperature above or below this will cause problems.

After the final coat has dried completely, at least 48 hours, any overspray or orange peel may be removed with a *light* application of Dupont rubbing compound (red color) and finished with Dupont polishing compound (white color). Be careful not to rub too hard or you will go through the finish.

Finish off with a couple coats of good wax prior to reassembling all the components.

It's a good idea to keep the component touched up with fresh paint if any minor rust spots or scratches appear.

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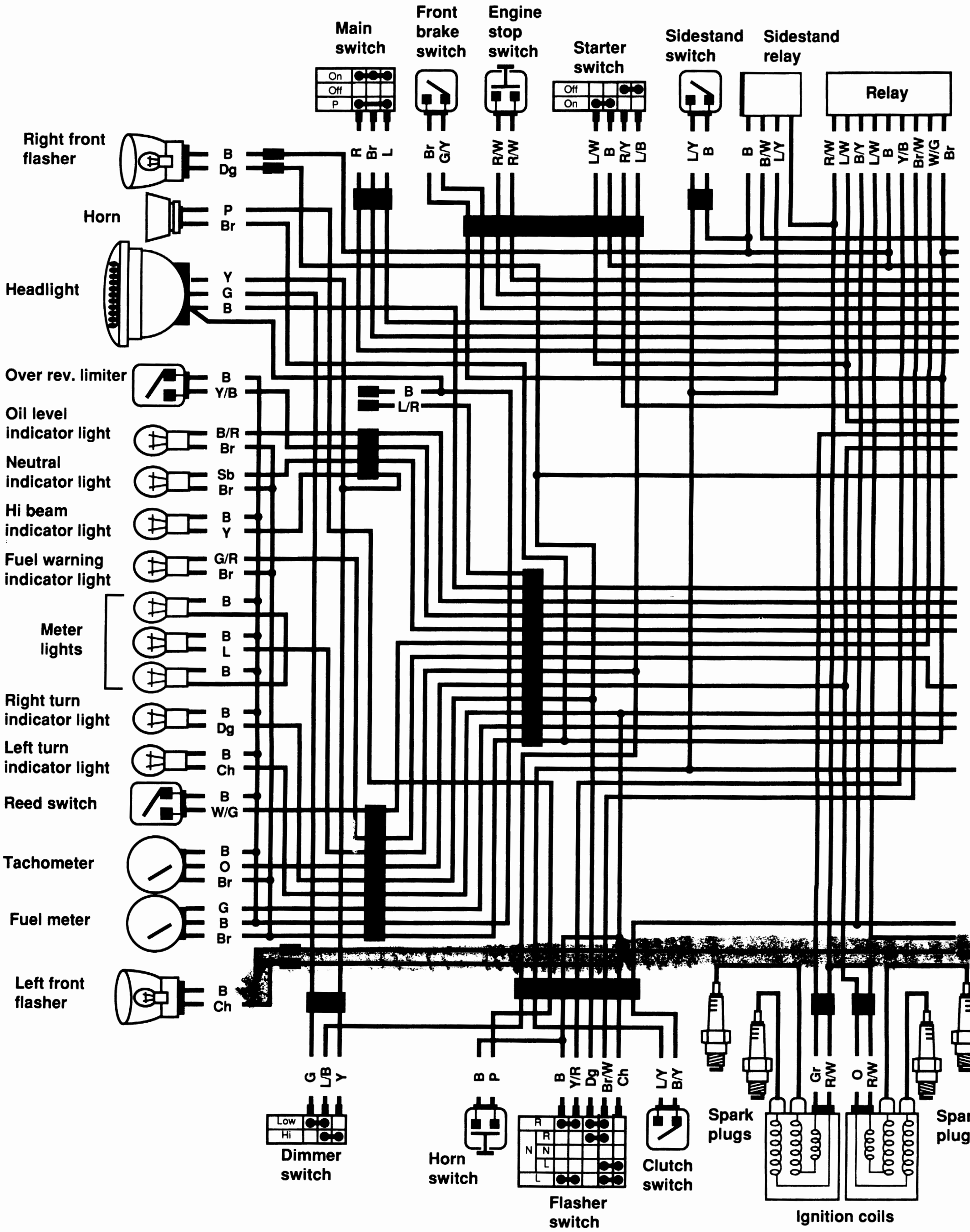
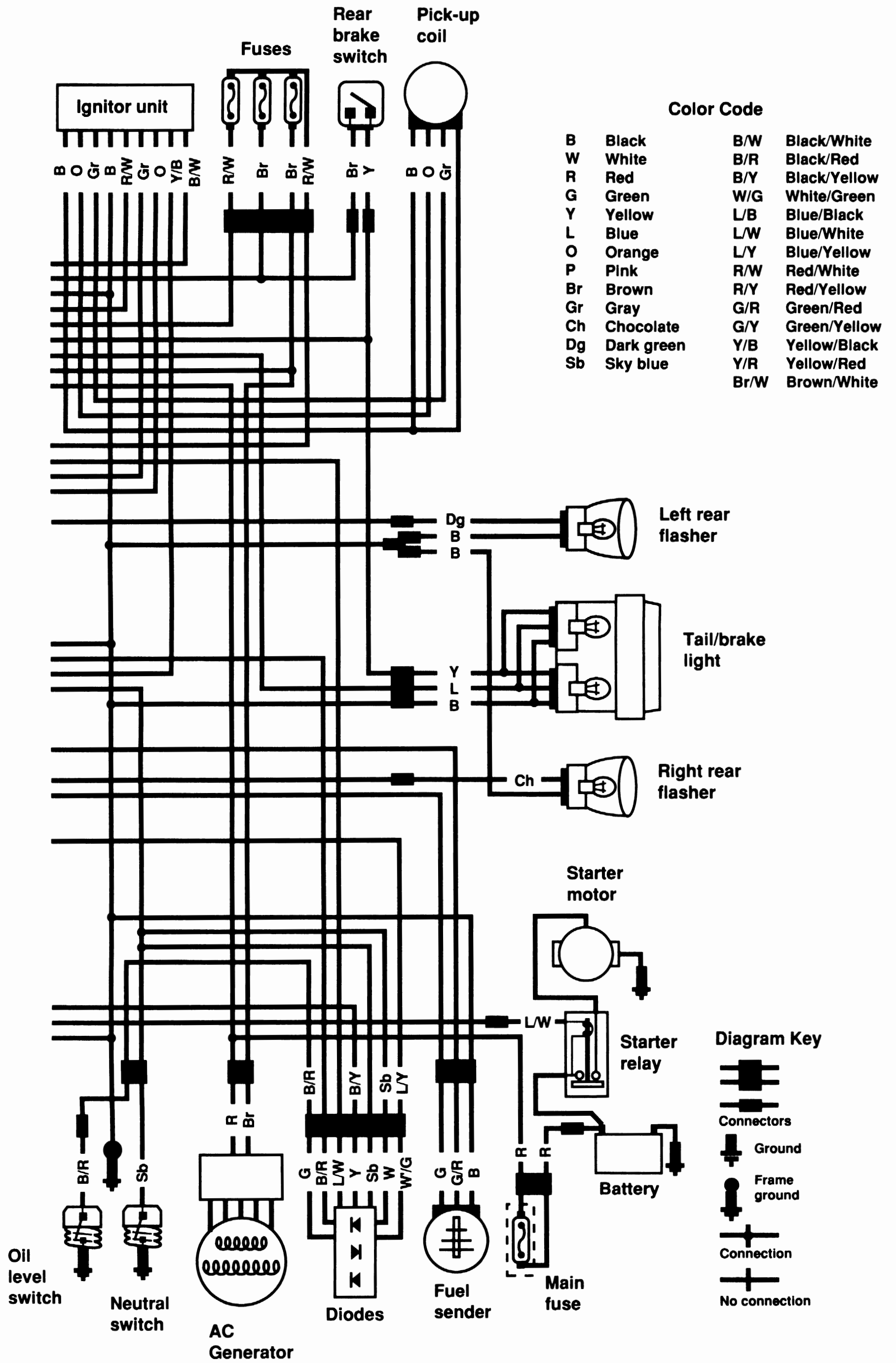
W

WIRING DIAGRAMS

1984-1985 FJ1100 (U.S.) (Part 1 of 2)



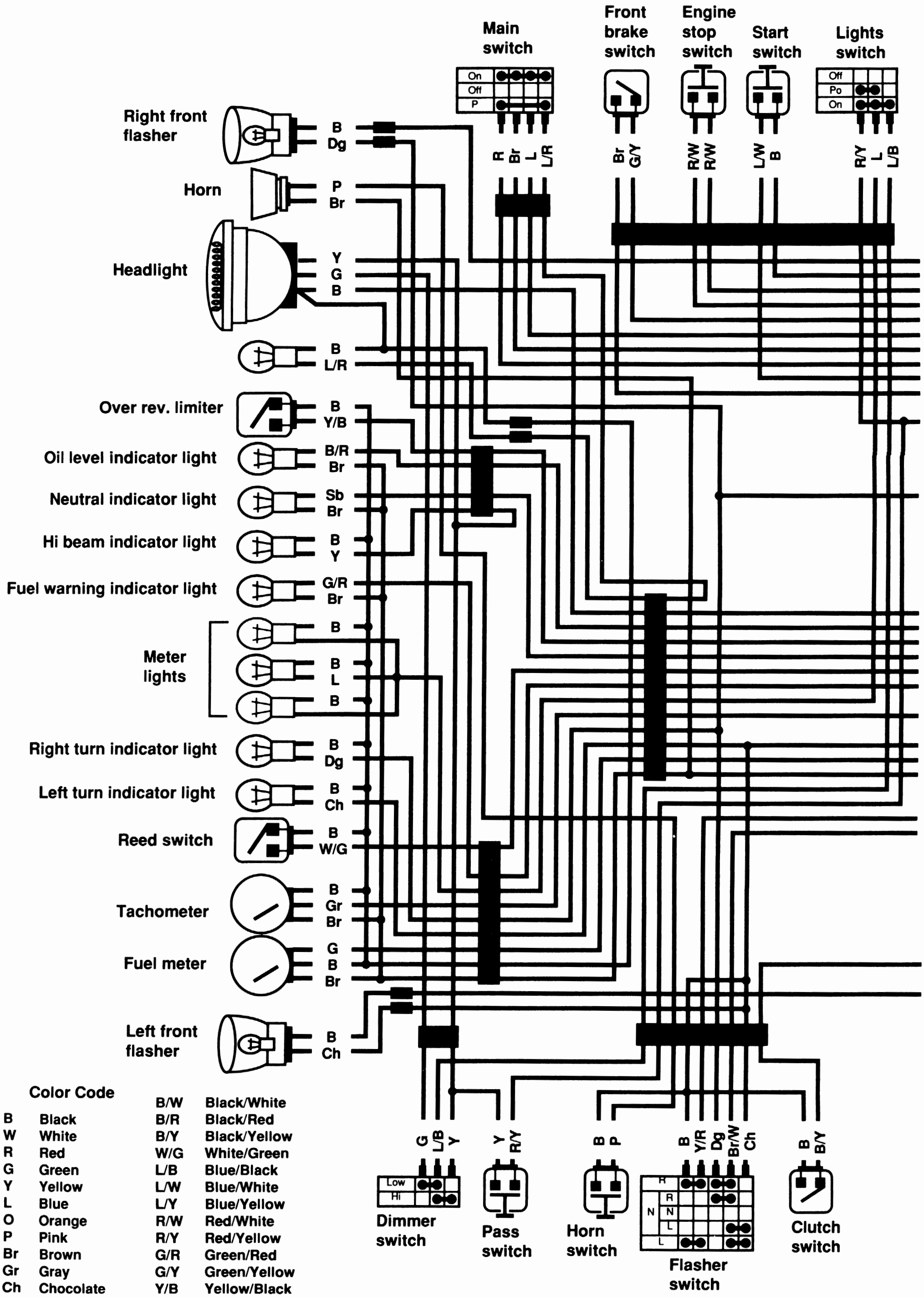
1984-1985 FJ1100 (U.S.) (Part 2 of 2)



Color Code

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

1984-1985 FJ1100 (U.K.) (Part 1 of 2)



Color Code

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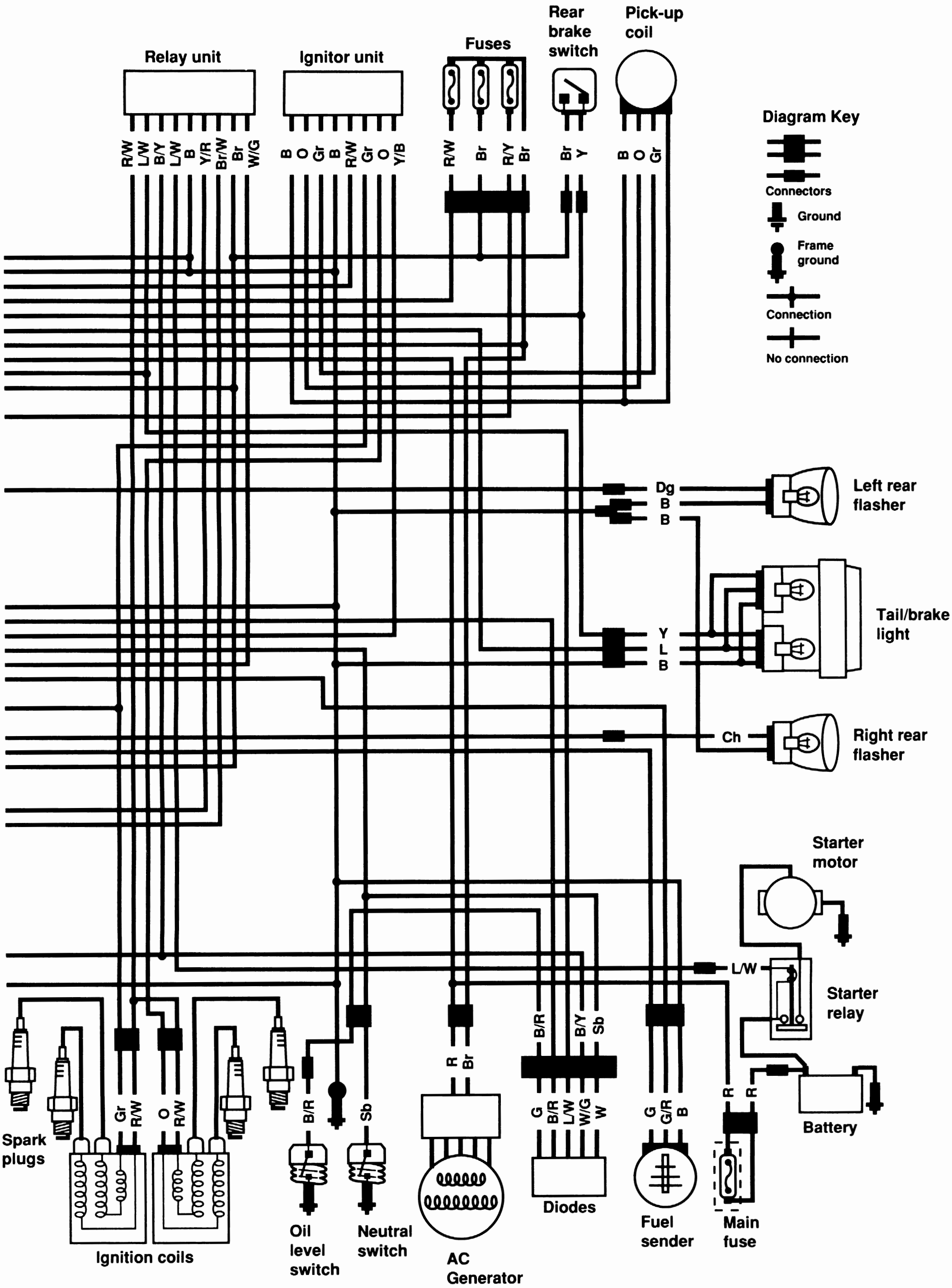
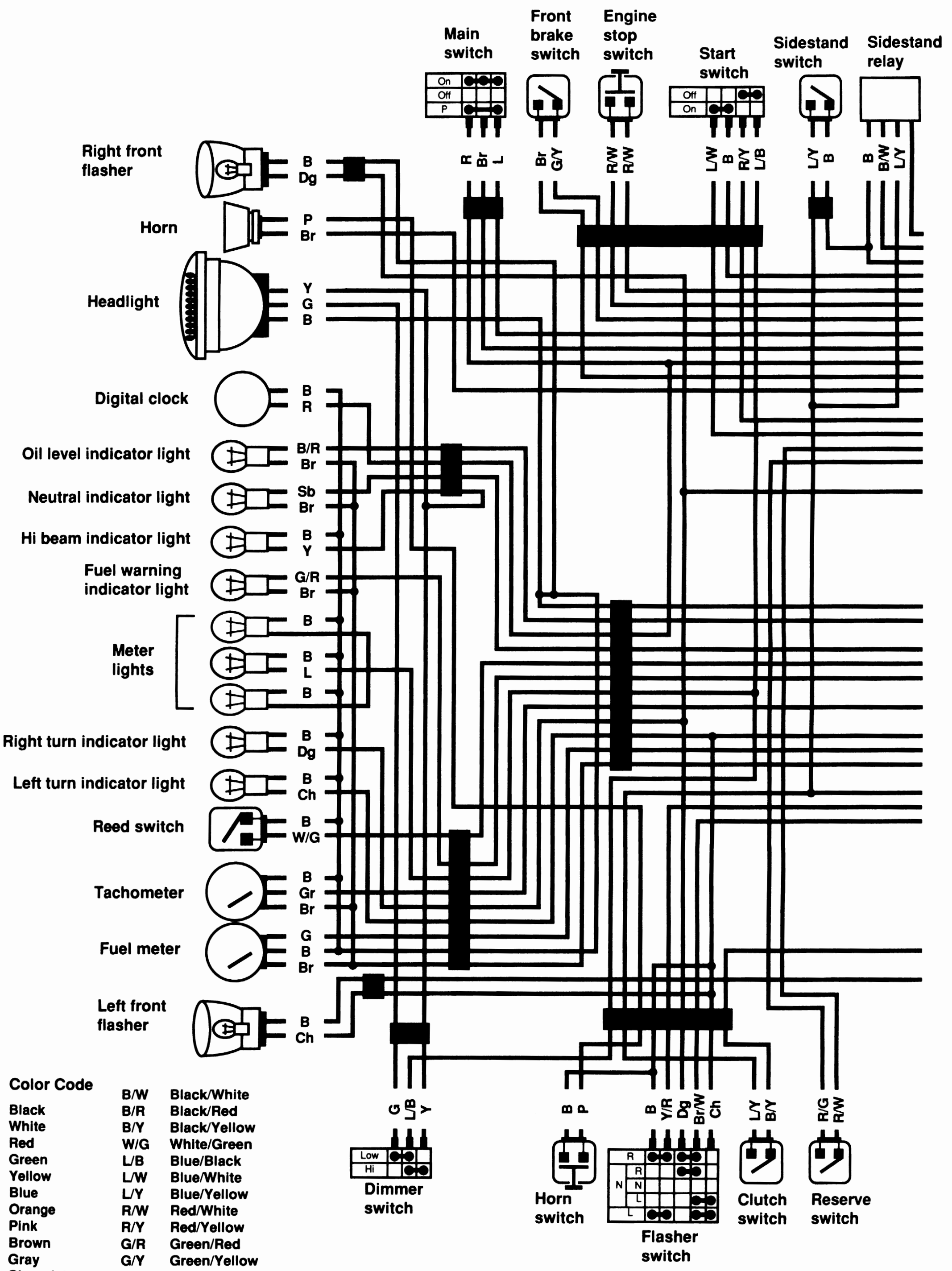
R	Red	B/Y	Black/Yellow
G	Green	W/G	White/Green
Y	Yellow	L/B	Blue/Black
L	Blue	L/W	Blue/White
O	Orange	L/Y	Blue/Yellow
P	Pink	R/W	Red/White
Br	Brown	R/Y	Red/Yellow
Gr	Gray	G/R	Green/Red
Ch	Chocolate	G/Y	Green/Yellow
Dg	Dark green	Y/B	Yellow/Black
Sb	Sky blue	Y/R	Yellow/Red
		Br/W	Brown/White

1984-1985 FJ1100 (U.K.) (Part 2 of 2)



1986-1987 FJ1200 (U.S.) (Part 1 of 2)



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Gr	Gray	G/R	Green/Red
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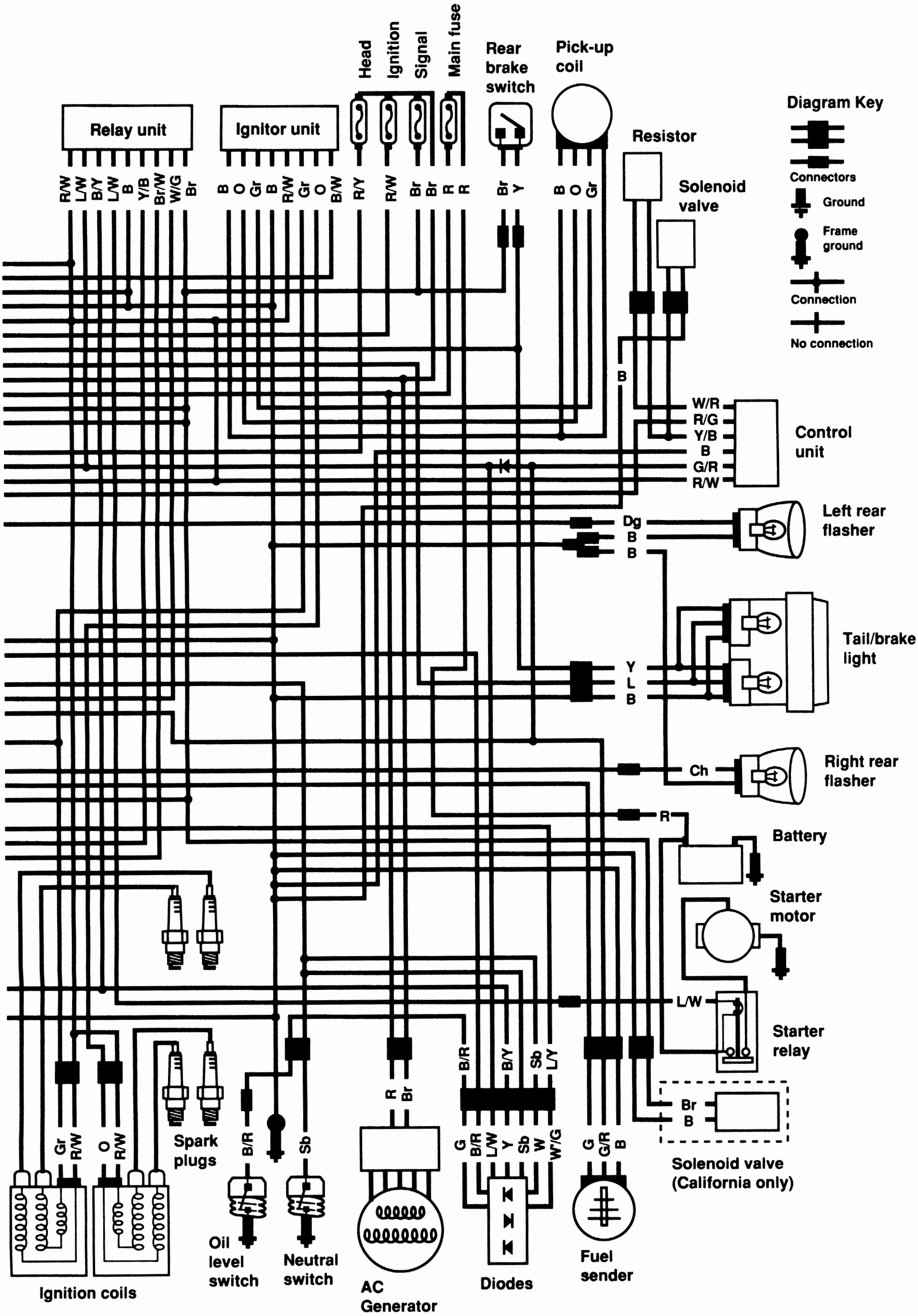
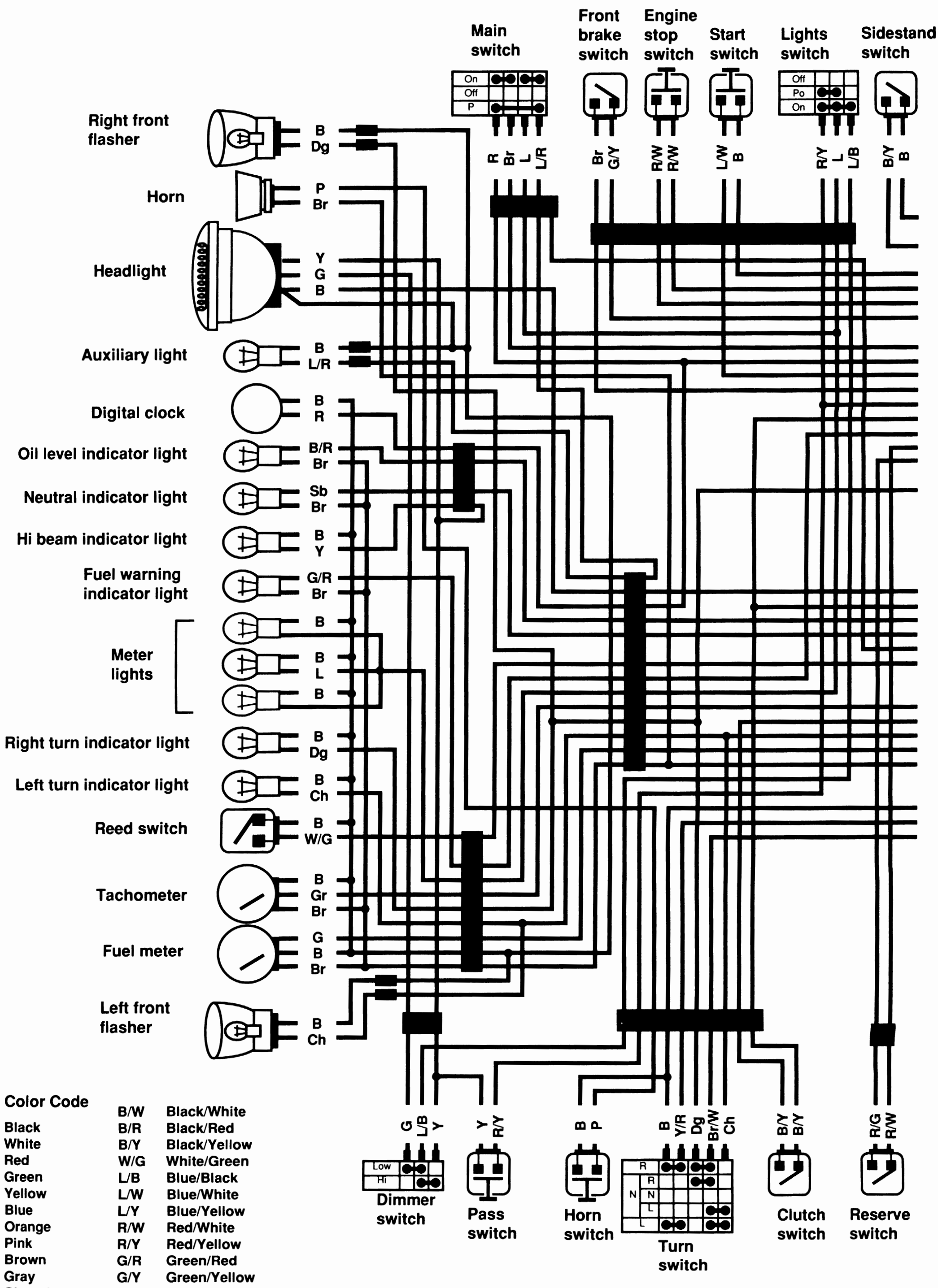
1986-1987 FJ1200 (U.S.) (Part 2 of 2)



1986-1990 FJ1200 (U.K.) (Part 1 of 2)



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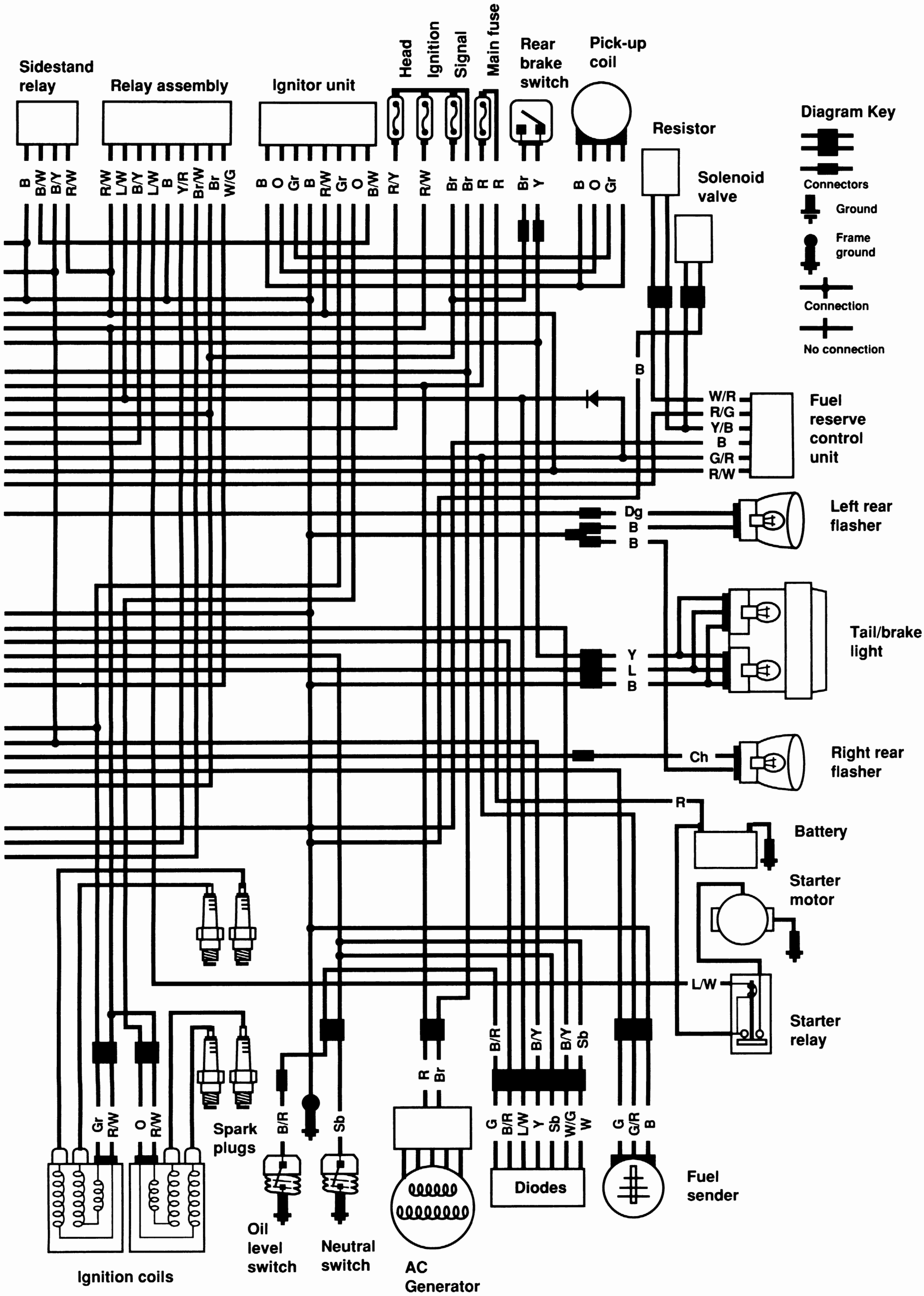
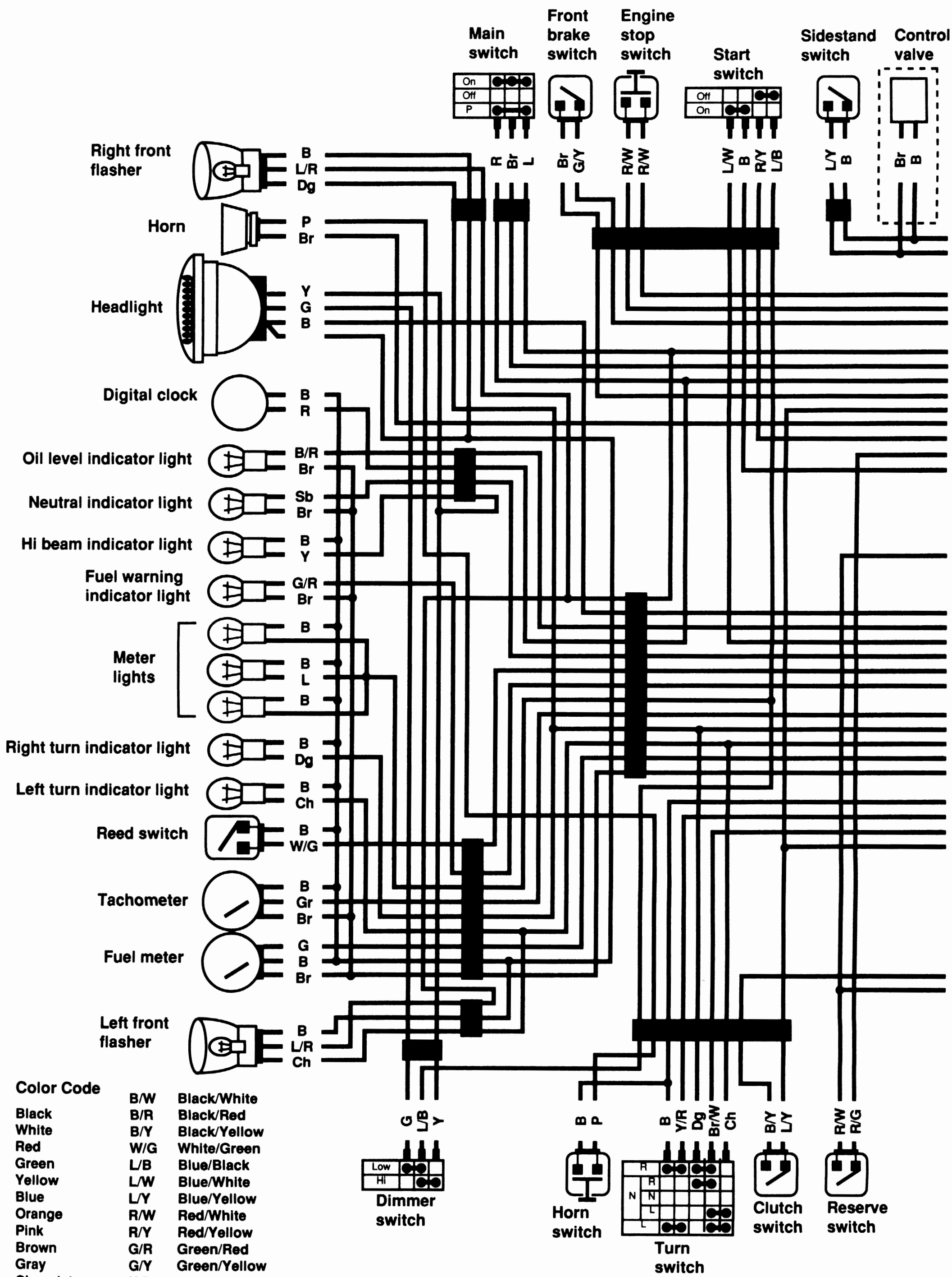
1986-1990 FJ1200 (U.K.) (Part 2 of 2)



1989-1990 FJ1200 (U.S.) (Part 1 of 2)



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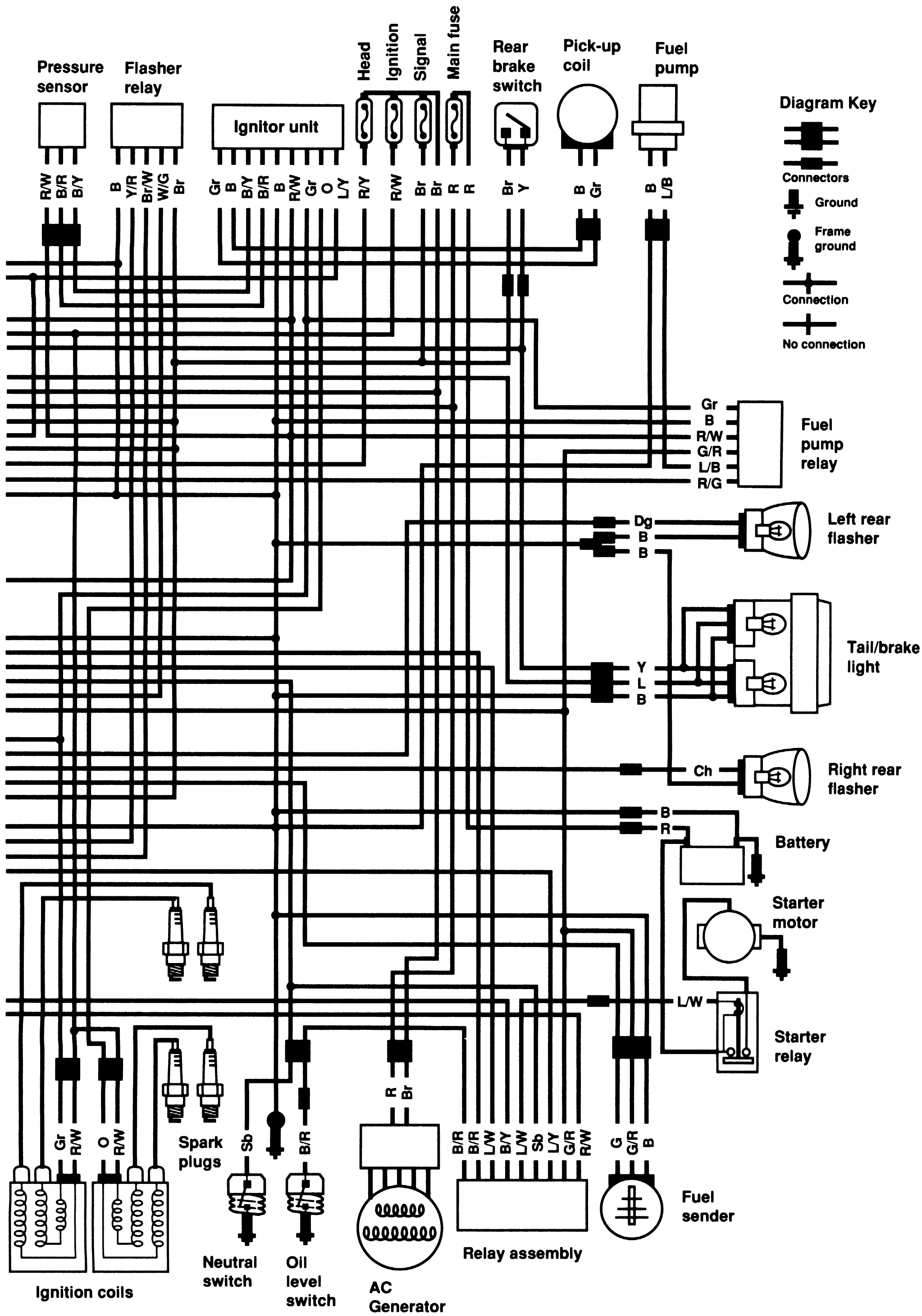
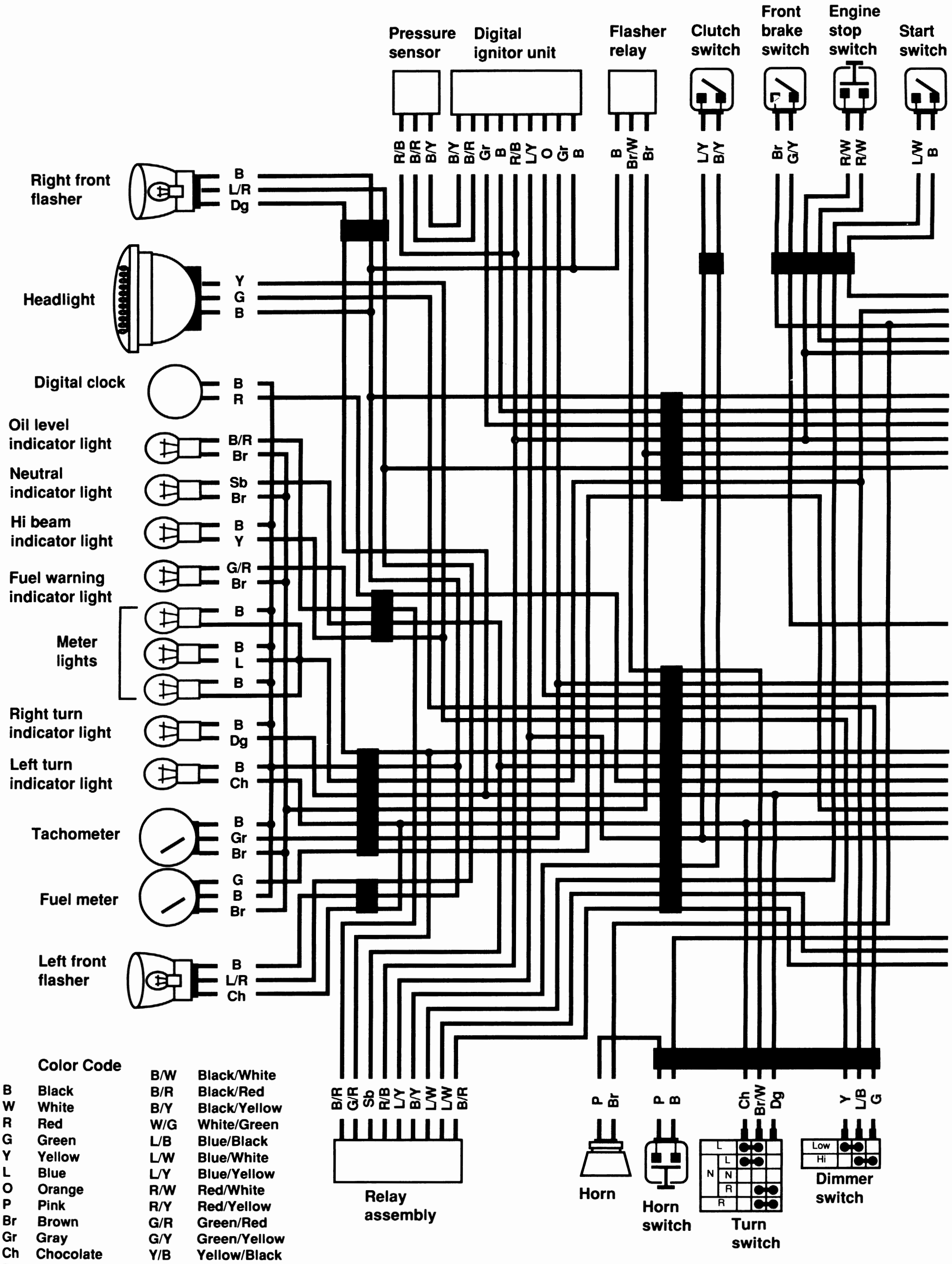
1989-1990 FJ1200 (U.S.) (Part 2 of 2)



1991 FJ1200 (U.S.) (Part 1 of 2)



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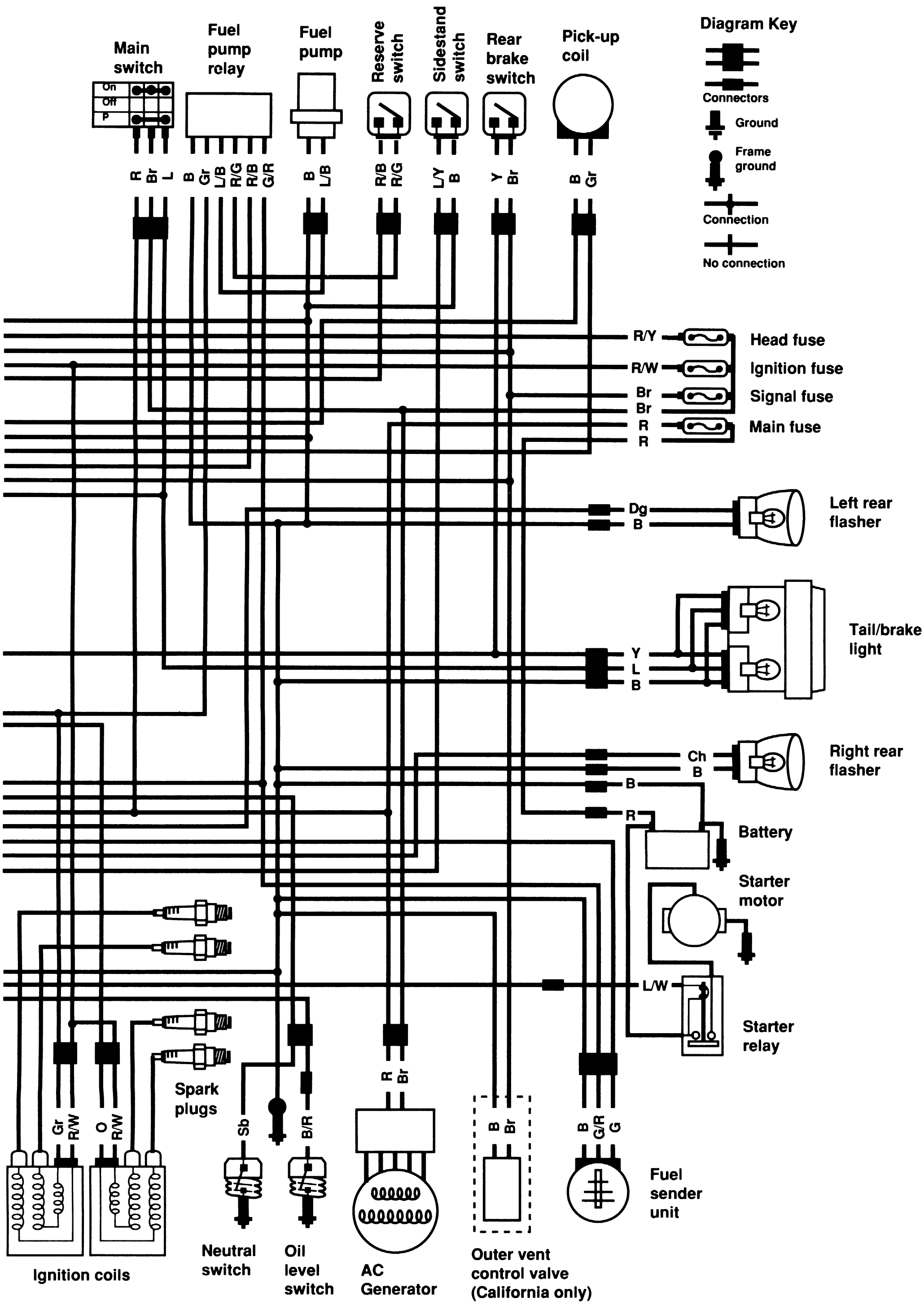
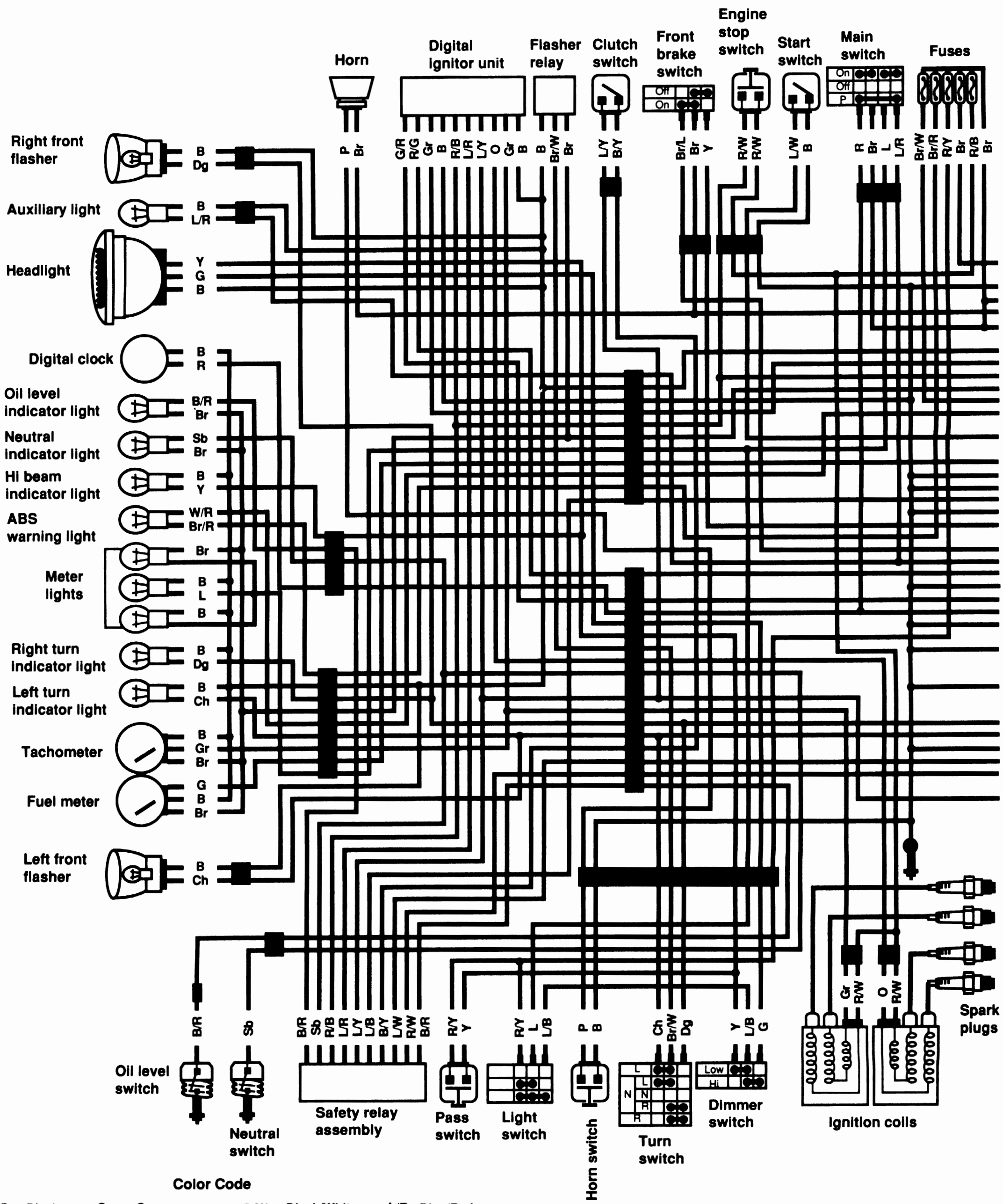
1991 FJ1200 (U.S.) (Part 2 of 2)



1991-1993 FJ1200 (U.K.) (Part 1 of 2)



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O	Orange	Br/L	Brown/Blue	W/R	White/Red	R/Y	Red/Yellow
P	Pink	Br/R	Brown/Red	W/Br	White/Brown	G/R	Green/Red
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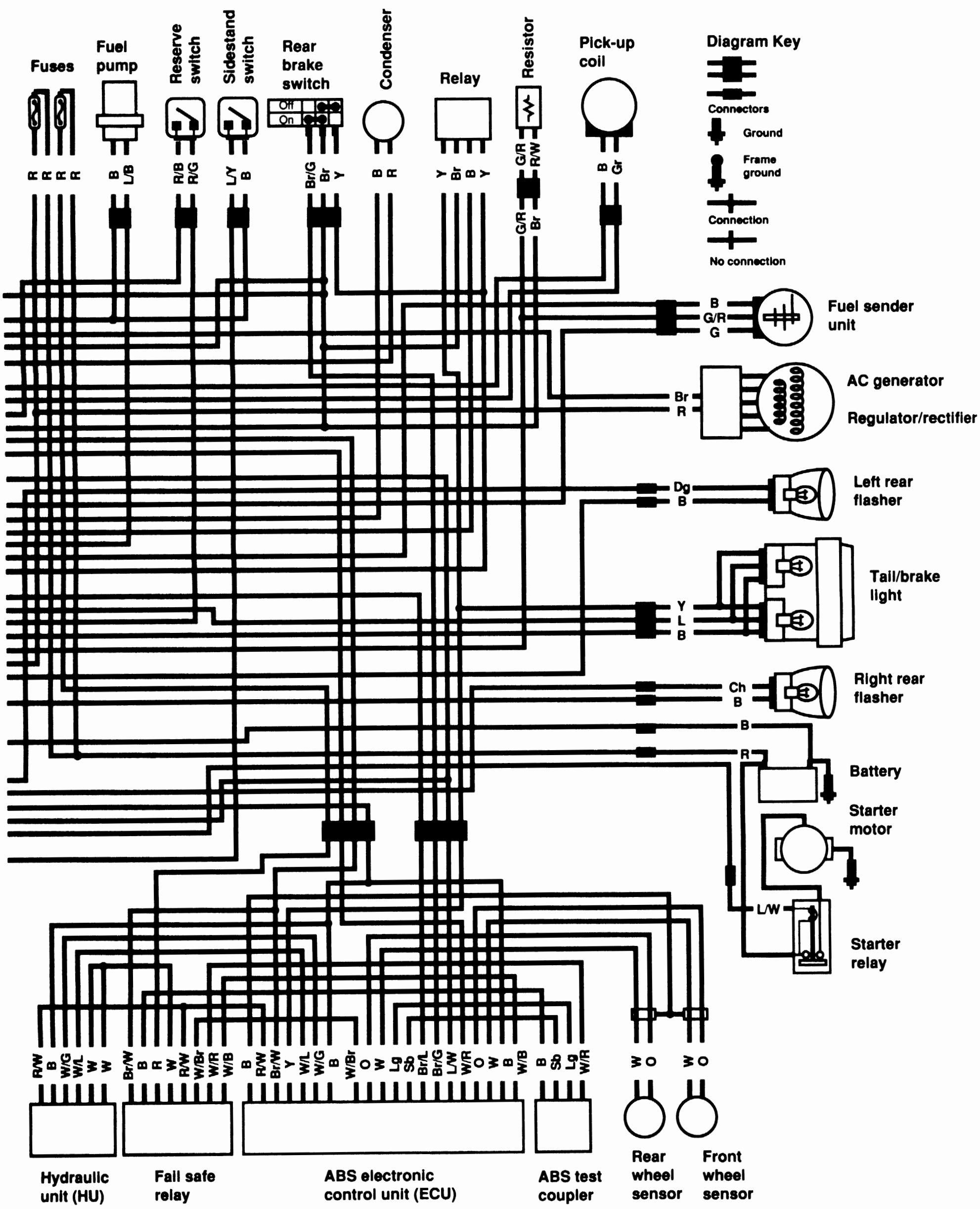
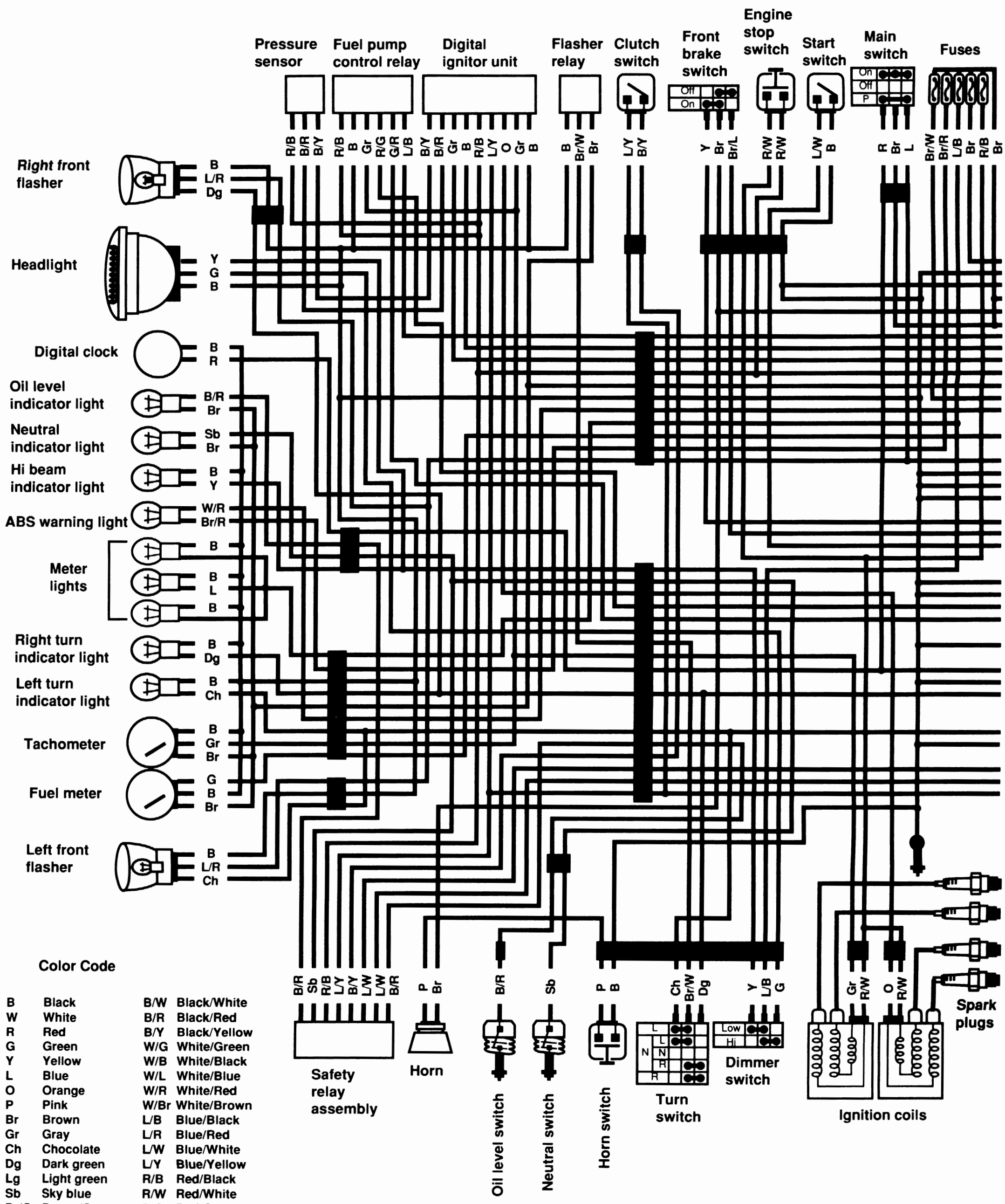
1991-1993 FJ1200 (U.K.) (Part 2 of 2)



1992-1993 FJ1200 (U.S.) (Part 1 of 2)



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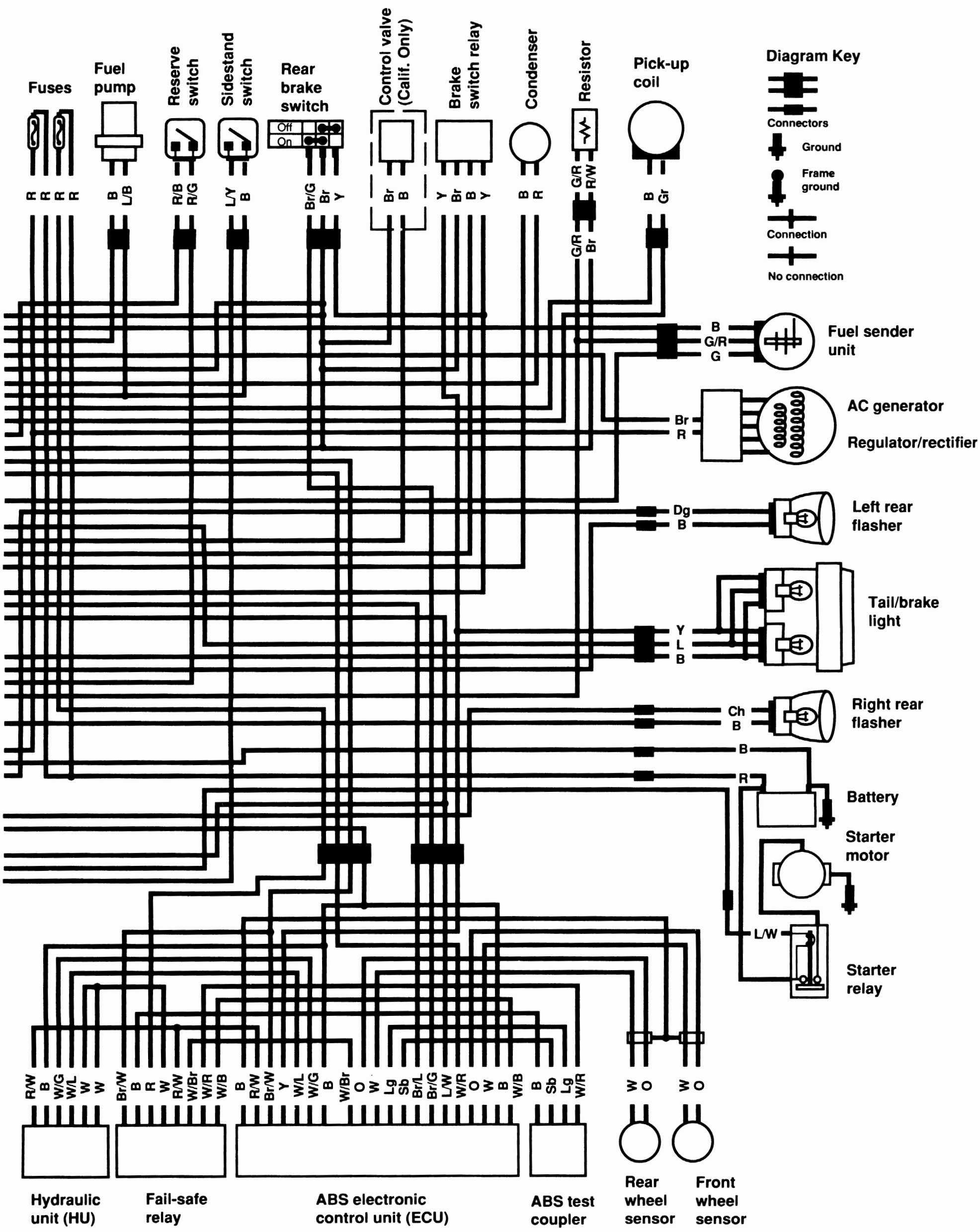
1992-1993 FJ1200 (U.S.) (Part 2 of 2)



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