SECRETS FROM TOP TUNERS

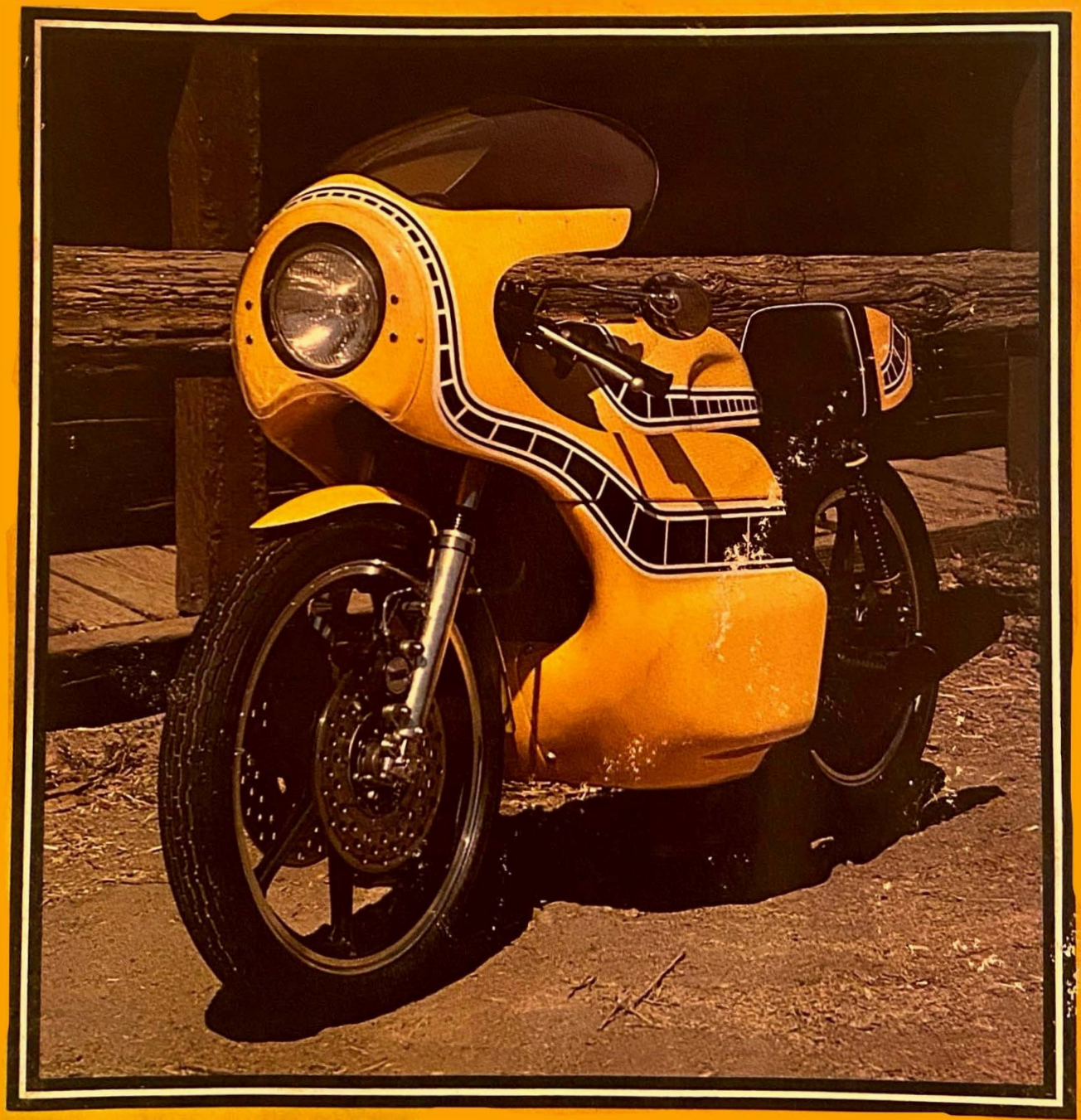
HIGH PERFORMANCE HOW-TO

CLYMER

YAMAHA

250-400cc 2-STROKE TWINS · 1965-1978

SERVICE • REPAIR • PERFORMANCE



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ERIC JORGENSEN
Editor

JEFF ROBINSON
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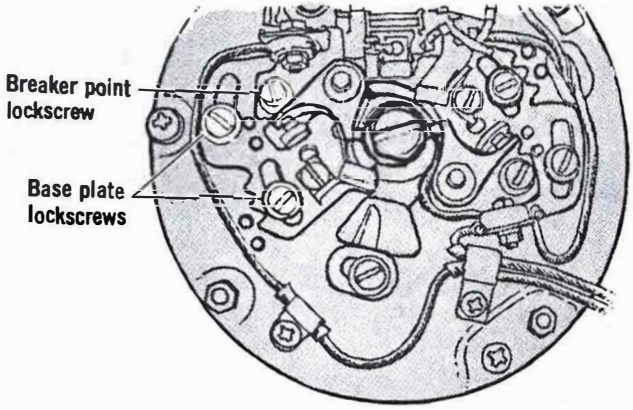

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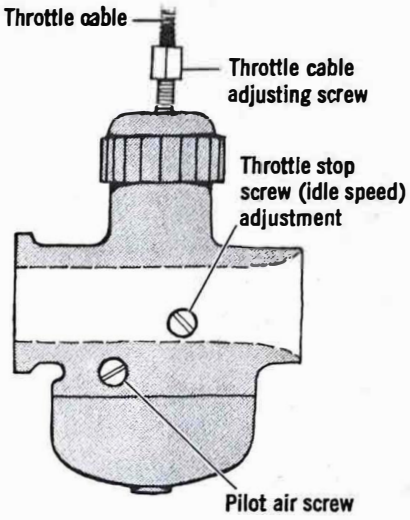


TUNE-UP SPECIFICATIONS

Breaker point gap	
YM2, YR, R3, R5, and RD350	0.012-0.014 in. (0.3-0.35mm)
All other models	0.012-0.016 in. (0.3-0.4mm)
Ignition timing (BTDC)	
DS6 Series, DS7 Series, YDS3 Series, YM1 Series, YDS5 Series	0.071 in. (1.8mm)
RD250 Series, RD350 Series, RD400	0.079 in. (2.0mm)
YM2 Series, R3 Series, R5 Series, YR Series	0.083 in. (2.1mm)
Idle speed	
VM24SC	1,050-1,150 rpm (1½ turns of air screw)
VM26SC	1,150-1,250 rpm (1½ turns of air screw)
VM28SC	1,300-1,400 rpm (1¾ turns of air screw)
Float level adjustment	
VM24SC	1.00 in. (25.4mm)
VM26SC	1.01 in. (25.7mm)
VM26SC (independent float)	0.59 in. (15mm)
VM28SC	1.00 in. (25.4mm)
VM28SC (independent float)	0.59 in. (15mm)

SPARK PLUGS

Model	Type		Gap
YDS Series, YM Series	NGK ND	B8HC W24F	0.024-0.028 in. (0.6-0.7mm)
YR Series	NGK ND	B8HC W24F	0.020-0.023 in. (0.5-0.6mm)
RD250, R5C, RD350	NGK ND	B8HS W24FS	0.020-0.023 in. (0.5-0.6mm)
RD400	NGK ND	B8ES W24ES	0.024-0.028 in. (0.6-0.7mm)
DS Series, R3 Series, R5, R5B	NGK ND	B9HC W27F	0.020-0.023 in. (0.5-0.6mm)

FUEL AND LUBRICANTS

Item	Capacity	Type
Autolube	As needed	Special 2-cycle oil
Transmission oil	1.8 U.S. qt.; 1.5 Imp. qt. (1700cc)	SAE 10W-30 SE
Drive chain	As needed	SAE 30 or special chain lubricant
Fuel	As needed	86 octane (pump) 91 octane (research)
Fittings, bearings, and bushings	As needed	Lithium grease
Cables	As needed	WD-40 or LPS-25
Front fork legs (each)		
YDS5, DS6 Series, YDS3 Series, YM Series	6.8 oz. (200cc)	10W-30 motor oil
YR Series, R3 Series	8.1 oz. (240cc)	10W-30 motor oil
R5 Series, DS7	4.9 oz. (145cc)	10W-30 motor oil
RD Series	4.7 oz. (140cc)	10W-30 motor oil

TIRE PRESSURE

	Front	Rear
Street use*	24 psi	28 psi

*Add 2 psi per tire for sustained high-speed riding and 2 psi to the rear tire if a passenger is carried.

ADJUSTMENTS

Clutch lever free play	0.20-0.40 in. (0.5-1.0mm)
Clutch adjustment	See Chapter Two
Rear brake pedal free play	1.0 in. (25mm)
Front brake lever	0.20-0.32 in. (5-8mm)
Throttle cable	0.04 in. (1mm)
Autolube pump	See Chapter Two
Drive chain free play	0.75 in. (20mm) total up-and-down movement

TIGHTENING TORQUES

Tightening Torques	Ft.-lb.	Mkg
Cylinder head nuts	14.5	(2.0)
Flywheel nut, rear sprocket nuts	25-29	(3.5-4.0)
Spark plug	18-22	(2.5-3.5)
Engine sprocket and clutch retainer	29-32	(4.0-4.5)
Front and rear axle nuts	29-32	(4.0-4.5)
Swing arm pivot nut	29-32	(4.0-4.5)
Fork cap and stem bolts	25-29	(3.5-4.0)

CHAPTER ONE

GENERAL INFORMATION

This book provides maintenance and repair information for Yamaha 250-400cc twin cylinder motorcycles.

Procedures common to different models are combined to avoid duplication. Read the following service hints to make the work as easy and pleasant as possible. Performing your own work can be an enjoyable and rewarding experience.

MANUAL ORGANIZATION

This chapter provides general information and useful service hints as to how the information presented in this manual can most efficiently and effectively be used.

Chapter Two explains all periodic lubrication and routine maintenance necessary to keep the bike running well. Chapter Two also includes recommended tune-up procedures, eliminating the need to constantly consult chapters on various subassemblies.

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

Subsequent chapters describe specific systems such as the engine, transmission, and electrical system. Each chapter provides disassembly, repair, and assembly procedures in simple step-by-step form. If a repair is impractical for the home mechanic, it is so indicated. It is usually faster and less expensive to take such repairs to a dealer or competent repair shop.

Some of the procedures in this manual specify special tools. A well-equipped mechanic may find he can substitute similar tools already on hand or can fabricate his own.

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 result. 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 or death has been caused by mechanics disregarding similar warnings.

Throughout this manual keep in mind 2 conventions. "Front" refers to the front of the bike. The front of any component, such as the engine,

is that end which faces toward the front of the bike. The left and right side refer to a person sitting on the bike facing forward. These rules are simple, but even experienced mechanics occasionally become disoriented.

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.

Some operations, for example, require the use of a press. It would be wiser to have these performed by a shop equipped for such work, rather than to try to do the job yourself with makeshift equipment. Other procedures require precision measurements. Unless you have the skills and equipment required, it would be better to have a qualified repair shop make the measurements for you.

Repairs go much faster and easier if the machine is clean before you begin work. There are special cleaners for washing the engine and related parts. Brush or spray on the cleaning solution, let it stand, then rinse away with a garden hose. 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.

Special tools are required for some repair procedures. These may be purchased at a dealer (or borrowed if you are on good terms with the service department) or may be fabricated by a mechanic or machinist, often at considerable savings.

Much of the labor charge for repairs made by dealers is for the removal and disassembly of other parts to reach the defective unit. It is frequently possible to perform the preliminary operations yourself and then take the defective unit in to the dealer for repair at considerable savings.

Once you have decided to tackle the job yourself, read the entire section in this manual which pertains to it, making sure you have identified the proper one. Study the illustrations and text until you have a good idea of what is involved in completing the job satisfactorily. 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.

Simple wiring checks are easily made at home; but knowledge of electronics is almost a necessity for performing tests with complicated electronic testing gear.

During disassembly of parts keep a few general cautions in mind. Force is rarely needed to get things apart. There is usually a tool designed to separate them. Never use a screwdriver to pry apart parts with machined surfaces such as crankcase halves. You will mar the surfaces and end up with leaks.

Make diagrams wherever similar-appearing parts are found. For instance, case cover screws 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 you may be sidetracked and not return to work for days or even weeks—in which interval, carefully laid out parts may have become disturbed.

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

Observing the following practices will save time, effort, and frustration, as well as prevent possible injury.

1. Tag all similar internal parts for location and mark all mating parts for position.
2. Record number and thickness of any shims as they are removed.
3. Small parts such as bolts can be identified by placing them in plastic sandwich bags. Seal and label the bags with masking tape.
4. Wiring should be tagged with masking tape

and marked as each wire is removed. Again, don't rely on memory alone.

5. Disconnect the battery ground cable before working near electrical connections and before disconnecting wires. Never run the engine with the battery disconnected; the alternator (doesn't apply to generators) could be seriously damaged.

6. Protect finished surfaces from physical damage or corrosion. Keep gasoline and brake fluid off painted surfaces.

7. Frozen or very tight bolts and screws can often be loosened by soaking with penetrating oil, then sharply striking the bolt head a few times with a hammer and punch (or screwdriver for screws). Avoid heat unless absolutely necessary, since it may melt, warp, or remove the temper from many parts.

8. Avoid flames or sparks when working near a charging battery or flammable liquids such as brake fluid or gasoline.

9. No parts, except those assembled with a press fit, require unusual force during assembly. If a part is hard to remove or install, find out why before proceeding.

10. Cover all openings after removing parts to keep dirt, small tools, etc., from falling in.

11. When assembling 2 parts, start all fasteners, then tighten evenly.

12. Clutch plates, wiring connections, and brake shoes and drums should be kept clean and free of grease and oil.

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

14. Whenever a rotating part butts against a stationary part, look for a shim or washer.

15. Use new gaskets if there is any doubt about the condition of old ones. Generally you should apply gasket cement to one mating surface only so the parts may be easily disassembled in the future. A thin coat of oil on gaskets helps them seal effectively.

16. 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 components and brake shoes and drums.

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

18. Carburetors are best cleaned by disassembling them 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.

19. A baby bottle makes a good measuring device for adding oil to forks and transmissions. Get one that is graduated in ounces and cubic centimeters.

SAFETY PRECAUTIONS

Professional motorcycle 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. You could hurt yourself or damage the bike if you ignore these rules.

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. Never smoke or use a torch in an area where batteries are being charged. Highly explosive hydrogen gas is formed during the charging process.

4. If welding or brazing is required on the machine, remove the fuel tank to a safe distance, at least 50 feet away. Welding on gas tanks requires special safety procedures and must be performed only by someone skilled in the process.

5. Use the proper sized wrenches to avoid damage to nuts and injury to yourself.

6. When loosening a tight or stuck nut, be guided by what would happen if the wrench should slip. Protect yourself accordingly.

7. Keep your work area clean and uncluttered.

8. Wear safety goggles during all operations involving drilling, grinding, or use of a cold chisel.
9. Never use worn tools.
10. Keep a fire extinguisher handy and be sure it is rated for gasoline and electrical fires.

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 engine and chassis number. 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 clerk explain the difference to your satisfaction.

TOOLS

Tool Kit

Most later models are equipped with fairly complete tool kits which are satisfactory for most small jobs and emergency roadside repairs.

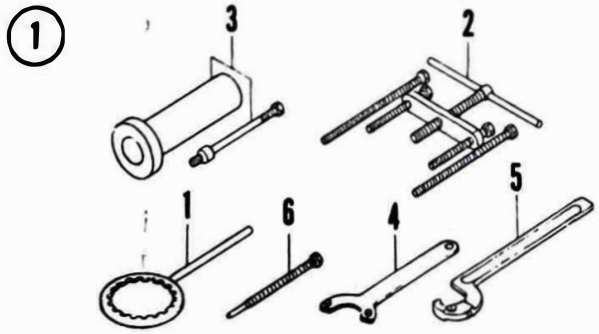
Shop Tools

For proper servicing, you will also need an assortment of ordinary hand tools. As a minimum, these include:

1. Metric combination wrenches
2. Metric sockets
3. Plastic mallet
4. Small hammer
5. Snap ring pliers
6. Phillips screwdrivers
7. Pliers
8. Blade (common) screwdrivers
9. Feeler gauges (flat blades)
10. Spark plug gauge (round wire gauge)
11. Spark plug wrench
12. Dial indicator (metric)

Representative samples of special tools required are shown in **Figure 1**.

Electrical system servicing requires a voltmeter, ammeter, ohmmeter or other device for determining continuity, and a hydrometer for checking battery condition.



TOOL KIT

1. Clutch holding tool
2. Universal puller
3. Crankshaft installing tool
4. Flywheel magneto holding tool
5. Exhaust ring nut wrench (pin wrench)
6. Magneto puller

CHAPTER TWO

PERIODIC MAINTENANCE AND TUNE-UP

Regular preventative maintenance is the best guarantee of a trouble-free, safe motorcycle. An afternoon invested in cleaning and maintenance can prevent costly mechanical problems in the future and unexpected, inconvenient breakdowns on the road.

This chapter covers all required maintenance procedures, including engine tune-up. Any owner with average mechanical ability can perform the procedures with ordinary tools by following the step-by-step instructions.

Table 1 summarizes a suggested maintenance and lubrication schedule. Procedures for performing these services are described in this chapter.

The table should be considered strictly as a guide to general maintenance and lubrication intervals. Weather, terrain, geographical location, and riding style require that you alter the suggested time schedule as required.

TOOLS

The basic tools suggested in Chapter One are essential for most work. In addition, equipment required for a thorough tune-up includes a static timing light, carburetor float gauge, and sets of flat and round feeler gauges measured in millimeters and inches.

PERIODIC CHECKS

The following checks should be made at each fuel stop.

Tire Pressure

1. For normal solo riding, inflate the front tire to 26 psi and the rear tire to 28 psi.
2. For normal double riding (with passenger), inflate the front tire to 26 psi and the rear tire to 30 psi.
3. For sustained high speed riding, increase both tire pressures to 2 psi over normal.
4. Remove any embedded stones or debris from the tire tread. Check each tire for cracks or cuts, and replace the tire if you find any (for removal procedure see Chapter Seven under *Tires and Tubes*).

Tire Wear

1. With a depth gauge or a machinist's scale, measure the tread depth on each tire (**Figure 1**).
2. Replace the front tire when its tread is less than 0.04 in. (1.0mm) deep. Replace the rear tire when its tread is less than 0.08 in. (2.0mm) deep.

Table 1 LUBRICATION AND MAINTENANCE

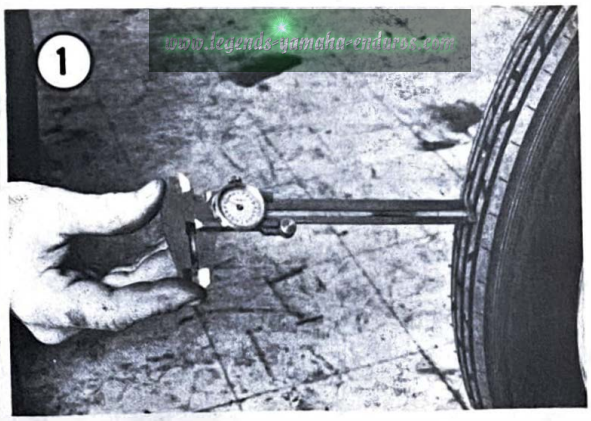
Service Required	Months or miles (km), whichever comes first				
	Months	—	6	12	18	24
	Miles	600	3,000	6,000	9,000	12,000
	Km	1,000	5,000	10,000	15,000	20,000
Engine						
Replace spark plug			X	X	X	X
Adjust ignition timing		X	X	X	X	X
Check ignition wiring				X		X
Service air cleaner			X	X	X	X
Adjust carburetor			X	X	X	X
Check throttle operation			X	X	X	X
Clutch						
Adjust clutch		X	X	X	X	X
Battery						
Check battery water level		X	X	X	X	X
Fuel System						
Clean fuel valve filter			X	X	X	X
Check fuel tank and fuel lines for leaks			X	X	X	X
Steering and Front Suspension						
Lube steering head bearings				X		X
Check steering handle lock				X		X
Check handlebar holder bolt tightness			X	X	X	X
Check front fork top plate			X	X	X	X
Check front fork bottom case			X	X	X	X
Change front fork oil				X		X
Rear Suspension						
Grease swing arm			X	X	X	X
Check rear suspension mounting bolts			X	X	X	X
Wheels and Brakes						
Check front and rear wheel spokes for tightness		X	X	X	X	X
Check front and rear wheel rims and hubs for damage and runout			X	X	X	X
Check front and rear wheels, bearings, and axles				X		X

(continued)

Table 1 LUBRICATION AND MAINTENANCE (continued)

Service Required	Months or miles (km), whichever comes first				
Months	—	6	12	18	24
Miles	600	3,000	6,000	9,000	12,000
Km	1,000	5,000	10,000	15,000	20,000
Wheels and Brakes (continued)					
Check front and rear tire pressure*			X	X	X
Check and adjust brake pedal free play	X	X	X	X	X
Check front and rear brake shoe linings for wear			X		X
Check rear brake stopper arm		X	X	X	X
Chassis and Final Drive					
Check frame for cracks or bends		X	X	X	X
Check exhaust system for holes or carbon deposits		X	X	X	X
Lube and adjust final drive chain	X	X	X	X	X
Check final drive and driven sprockets for wear			X		X
Lights and Accessories					
Check light and switch operation		X	X	X	X
Check horn		X	X	X	X
Check speedometer and tachometer		X	X	X	X

* Every fuel stop.

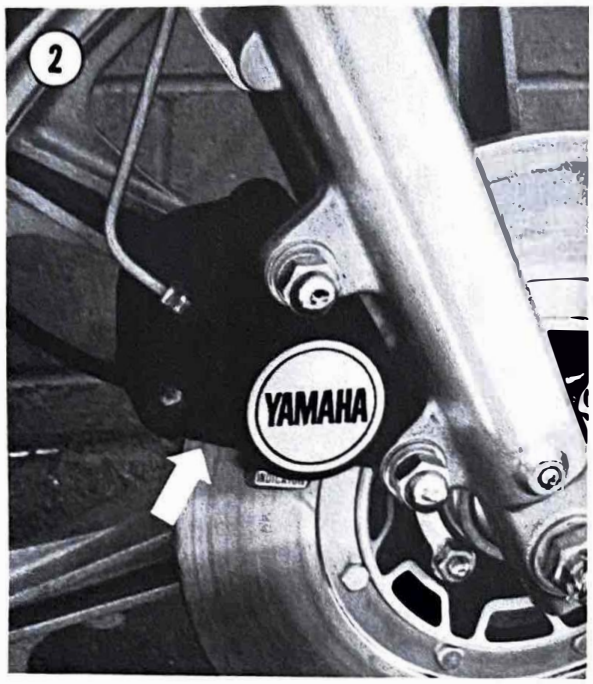


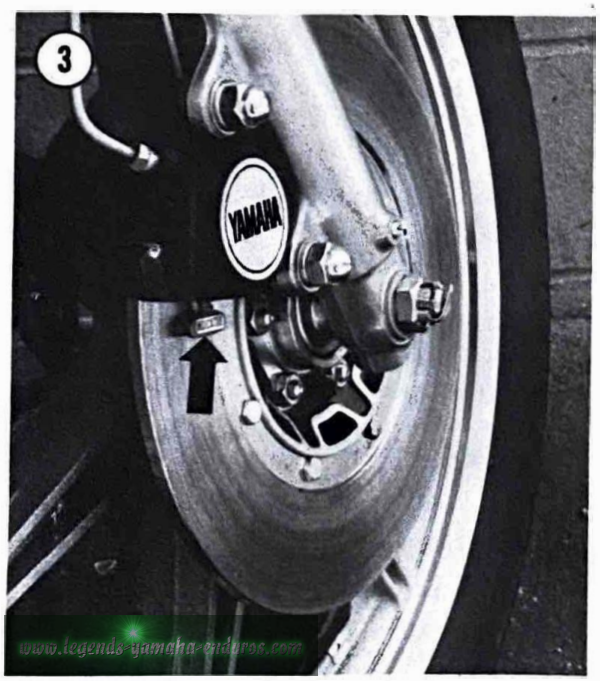
Wheel Spoke Tension

1. Tap each spoke with a wrench. The higher the pitch of sound it makes, the tighter the spoke. The lower the sound frequency, the looser the spoke. A "ping" is good, a "klunk" indicates a loose spoke.
2. If one or more spokes are loose, tighten them (see *Spokes*, Chapter Seven).

Front Disc Brake

1. Have an assistant apply the front brake.
2. Shine a light between the caliper and the disc and inspect the brake pads (**Figure 2**).
3. If either pad has worn enough so that its red line is touching the disc, replace both pads as a set (**Figure 3**). See Chapter Seven, *Disc Brakes*.
4. Place the gearbox in NEUTRAL, apply the front brake and try to move the motorcycle back and forth. This will assure that the caliper pads are clamping the disc(s).
5. Unscrew the top from the brake fluid reservoir on the handlebar and check the fluid level. If the reservoir is less than ½ full, add enough





fluid to bring the level up to the line on the inside of the reservoir. Use DOT 3 brake fluid.

6. Pull the front brake lever. Check that it does not feel spongy and that the lever does not touch the grip when applied.

7. If the brake is spongy, or there is too much lever travel, bleed the hydraulic brake (see *Master Cylinder, Hydraulic System Bleeding,* Chapter Seven).

Front Drum Brake

1. Squeeze the brake lever with some firmness. The lever should not come in contact with the grip. If this happens, you will not have full braking efficiency. See the section on *Brakes, Front Brake Linkage Adjustment,* in this chapter.

2. Front lever free play should be ⅛ in. (2-3mm). Loosen the locknut and turn the adjuster until set properly.

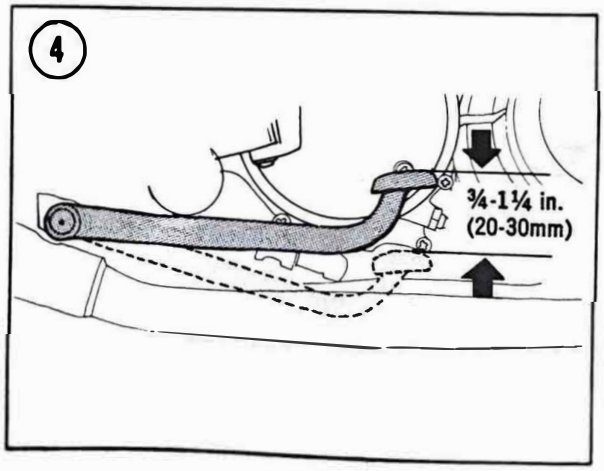
3. Tighten the locknut.

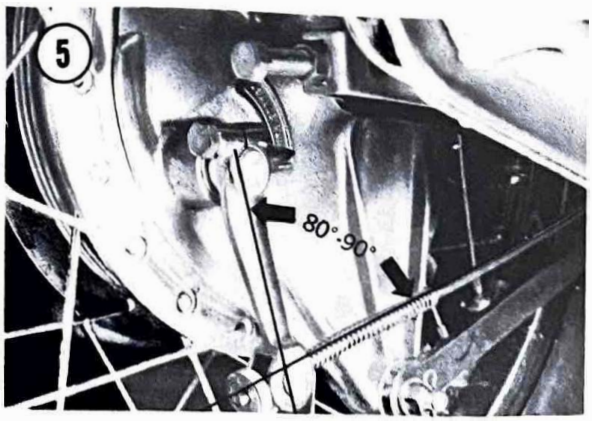
Rear Drum Brake

1. Check the position of the rear brake pedal at rest. The top of the pedal should be slightly below the top of the front footpeg.

2. Push the pedal down by hand. It should move approximately ¾-1¼ in. (20-30mm). See **Figure 4**. The brake cam lever should then form an angle of 80-90° with the brake rod (**Figure 5**).

3. If brake pedal travel exceeds 1½ in. (40mm)

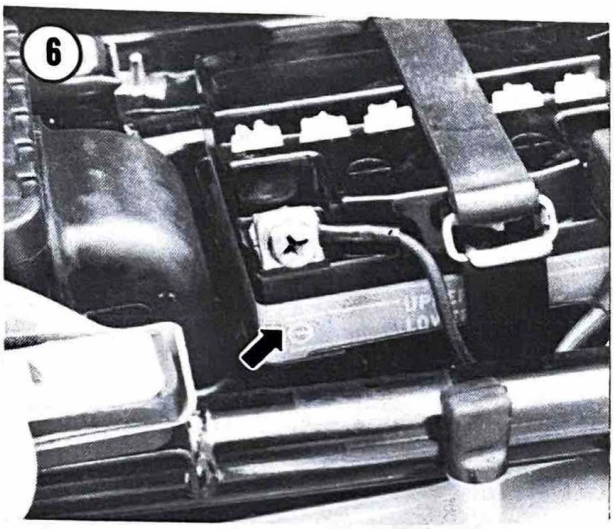




adjust the linkage (see *Brakes, Rear Brake Linkage Adjustment*, this chapter).

Battery Fluid Level

1. Lift the seat.
2. Check the electrolyte level in the battery (**Figure 6**).



3. If the electrolyte level is below the bottom line in any of the 6 cells, add enough distilled water to raise the level above the bottom line (but not above the top line) on the battery case.

Lighting and Horn

Start the engine and check the following with the engine idling:

1. Pull the front brake lever and check that the brake light comes on.
2. Push the rear brake pedal down, and check that the brake light comes on after the first 0.5 in. (12mm) of pedal travel.
3. Turn the headlight switch to the ON position. Check to see that the headlight and the taillight come on.
4. Move the dimmer switch between high and low positions, and check to see that both headlight elements are working.
5. Push the turn signal switch to the left and right positions and check that all 4 turn signal lights are working.
6. Push the horn button and note that the horn blows loudly.

Clutch Operation

1. With the engine oil warm and the transmission in NEUTRAL, pull the clutch lever all the way to the handlebar and check to see that you can shift into second gear without a jolt or clunking sound.
2. Shift into first gear. Check that the end of the lever moves at least ½ in. (12mm) from the handlebar before the clutch begins to engage. As you continue to let out the lever, check that the clutch is fully engaged at least ½ in. (12mm) before the lever reaches the end of its travel.
3. At rest, the clutch lever should have 1/16-⅛ in. (2-4mm) of slack.
4. If the clutch does not perform correctly, adjust the linkage (see *Clutch, Free Play Adjustment*, in this chapter).

Tightness of Nuts and Bolts

1. Check the looseness of the following by hand.
   a. Engine mount bolts
   b. Handlebar clamp bolts
   c. Top triple clamp bolts
   d. Bottom triple clamp bolts
   e. Front axle clamp nuts
   f. Shock absorber mounting nuts
   g. Swing arm pivot nut
   h. Rear brake backing plate torque link
   i. Rear axle nut
2. Check the engine cover screws for tightness.
3. Check the remaining nuts and bolts on the motorcycle for tightness. For torque figures, refer to Appendix II, *Bolt Tightening Torque*.

PERIODIC LUBRICATION

These procedures apply after initial break-in period. For a lubrication schedule to use during the break-in period, see a dealer or your owner's manual. **Table 1** summarizes required lubrication intervals.

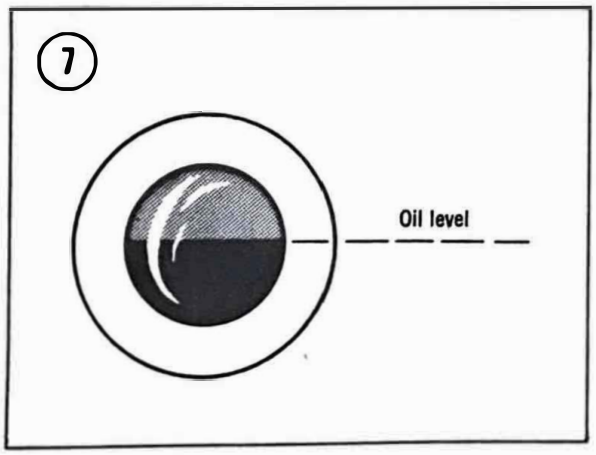
A 2-stroke engine cannot receive its lubrication from an oil supply in the crankcase (oil splash in the crankcase cannot be carried with the fuel/air charge into the cylinder).

One method for lubricating 2-stroke engines is to mix lubricating oil with gasoline. As the fuel mixture enters the crankcase, the oil is carried with it to moving parts. This method results in high consumption of oil, and also causes oil starvation during periods when the engine runs with the throttle closed, as when descending a long hill.

Yamaha's Autolube system uses an engine-driven oil pump to supply oil from a separate tank to the engine. The output from the pump is controlled both by engine speed and throttle position, and thus supplies the proper amount of oil to the engine under all operating conditions.

Oil Tank (Autolube)

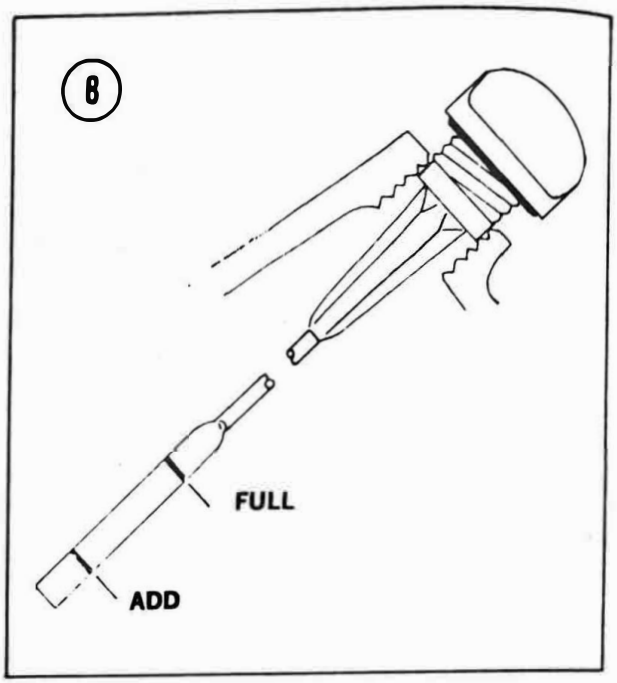
Check Autolube tank oil level at the sight glass before operating machine. Top off tank when low oil level shows at the sight glass, or before any prolonged use. See **Figure 7**. Use only 2-cycle oil BIA certified TC-W or 10W/30 SE rated motor oil.



Transmission Oil Level Check

The dipstick is located above and slightly in front of the kickstarter lever.

1. Start the engine and let it run for several minutes to warm and distribute oil.
2. Unscrew the dipstick, clean, and check oil level. When checking oil level, let the dipstick rest on the case threads. See **Figure 8**. Be sure the engine is in a level position. The dipstick has a minimum and maximum level mark. The oil level should be between them.



3. Top off as required with type of oil recommended in this section.

Use only a non-detergent oil with an API rating of SE. These quality ratings are stamped on the top of the can. Try to use same brand of oil when topping up, do not mix brands.

SAE 30 oil is recommended for normal operation in moderate climates. Heavier weight oils should be used if the motorcycle is to be run hard in high temperatures.

The factory recommends the following alternate weight oils according to prevailing temperature:

59°F and above (15°C)	SAE 30 or 10W/30
32°F to 59°F (0°C to 15°)	SAE 20 or 10W/30
32°F and below (0°C)	SAE 10W or 10W/30

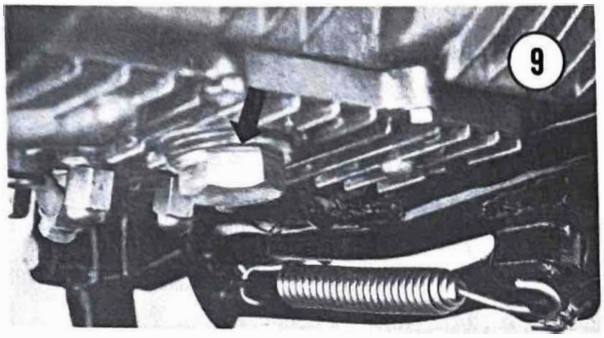
CAUTION

Never use oil additives in a mortorcycle engine. The clutch is lubricated by the same oil used in the crankcase.

Draining Transmission Oil

1. Warm up the engine. Warm oil drains faster than cold and carries more impurities with it.
2. Place a catch pan of at least one gallon capacity under the crankcase and remove the filler cap.

3. Remove the drain plug. Location of the plug is shown in **Figure 9**. Allow dirty oil to drain.



4. Crank the engine several times with the kick-starter to force out oil trapped in inner recesses.

CAUTION

Do not permit the engine to start; keep the ignition off.

NOTE: *Pour used oil into plastic bottles, such as those used for laundry bleach. Cap them and discard in a trash can.*

Filling Transmission With Oil

1. Install the crankcase drain plug with its gasket. Be careful not to overtighten or it will be difficult to remove next time. Torque to 25-29 ft.-lb. (3.5-4.0 mkg).
2. Fill the crankcase with 1.8 quarts (1.7 liters) of recommended oil. Check the level with the dipstick.
3. Run the engine at 1,000-1,500 rpm for 2 minutes, then check for oil seepage around the drain plug. Check the oil level and top up if necessary.

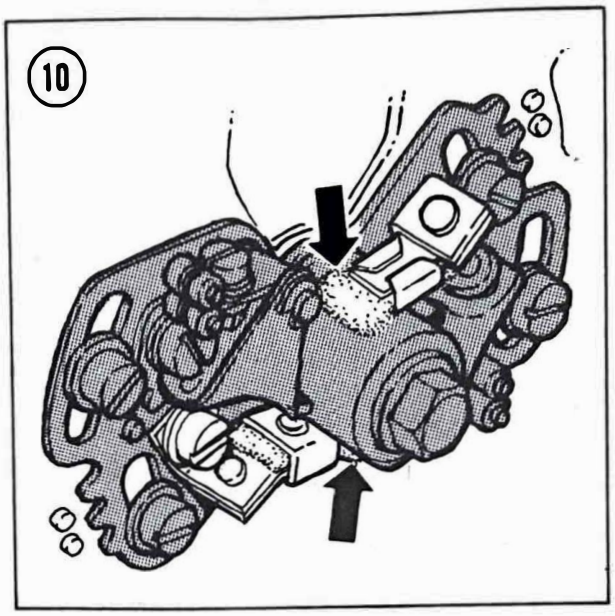
Contact Breaker Points

1. Remove the 3 screws that mount the breaker point cover. Remove the cover and its gasket.
2. Rub a small amount of high-temperature grease into the felt wicks that bear against the breaker point cams. See **Figure 10**.

CAUTION

If you use too much grease, the cams will sling it into the points, fouling them.

3. Install gasket and cover.



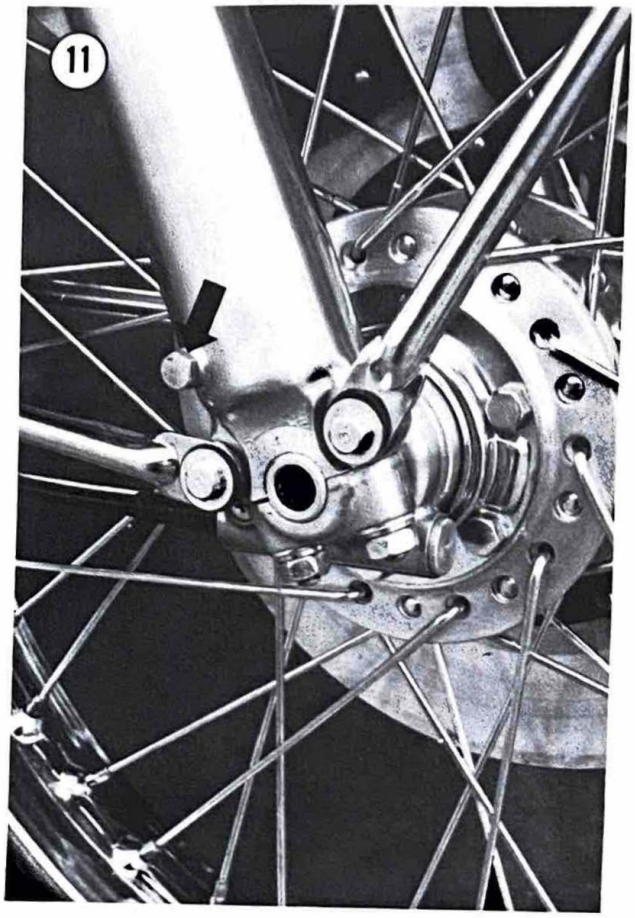
Swing Arm

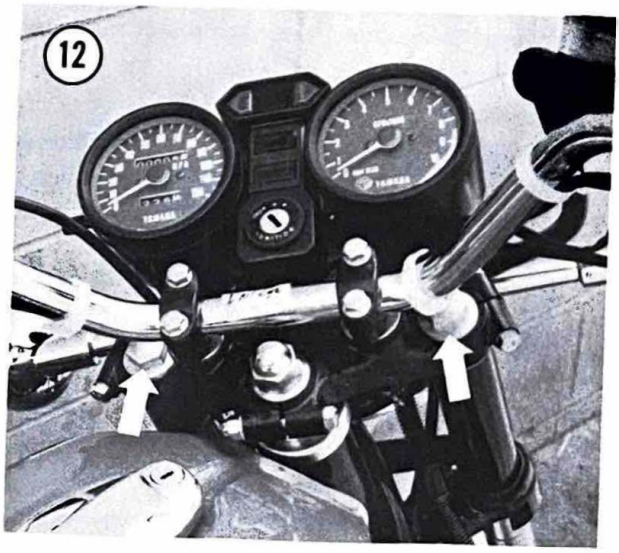
1. Use a gun to force grease into the fitting on the swing arm, until the grease runs out both ends (fittings can be installed by a dealer if your model is not already so equipped).
2. Clean off excess grease.
3. If grease will not run out of the ends of the swing arm, unscrew the grease fitting from the swing arm and clean it in kerosene. Reinstall fitting.
4. Use the grease gun again. If grease does not run out both ends of the swing arm, remove the swing arm (see *Swing Arm*, Chapter Seven). Clean out the old grease, install the swing arm, and lubricate it.

Changing Front Fork Oil

There is no simple method for checking fork oil level. If there is no evidence of leakage and the forks are damping properly, the oil level should be alright.

1. Drain the oil from the fork by removing the screws (**Figure 11**) from the bottom of each fork leg. Hold front brake on and pump front end up and down several times to force old oil out.
2. Reinstall the drain plug screws and remove the filler plug from the top of each fork leg (**Figure 12**).
3. Fill each fork leg with good quality 10W/30 motor oil. YDS, DS, and YM series forks use



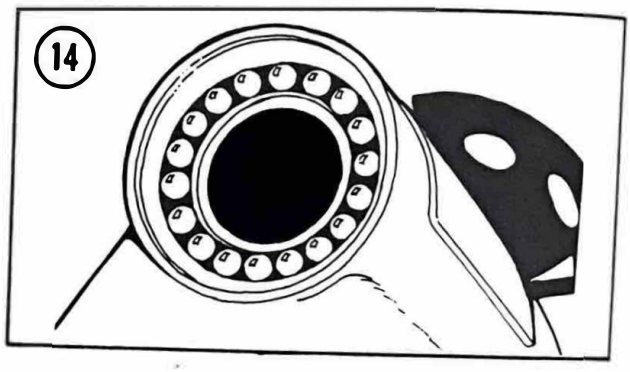


6.8 oz. (200cc); YR and R3 series forks use 8.1 oz. (240cc); R5, DS7 and RD series forks use 4.7 oz. (140cc).

4. Pull back on the brake lever to lock the front brake and rock the motorcycle back and forth. Check for smooth action of the forks and fork seepage around the seals.

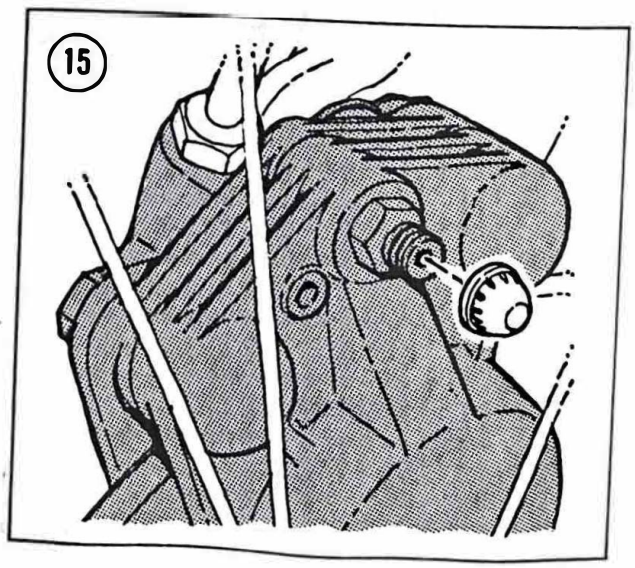
Steering Stem Bearing

1. Remove the steering stem (**Figure 13**). Procedures are given in Chapter Seven, *Steering Head, Bearing and Race Replacement*.
2. Clean the upper race, the lower race, and the balls of each bearing in kerosene.
3. Inspect the balls and races of each bearing for wear or damage. If any one component is faulty, replace everything.
4. Coat all 4 races with grease, and position the balls on their races (**Figure 14**).
5. Install the steering stem.

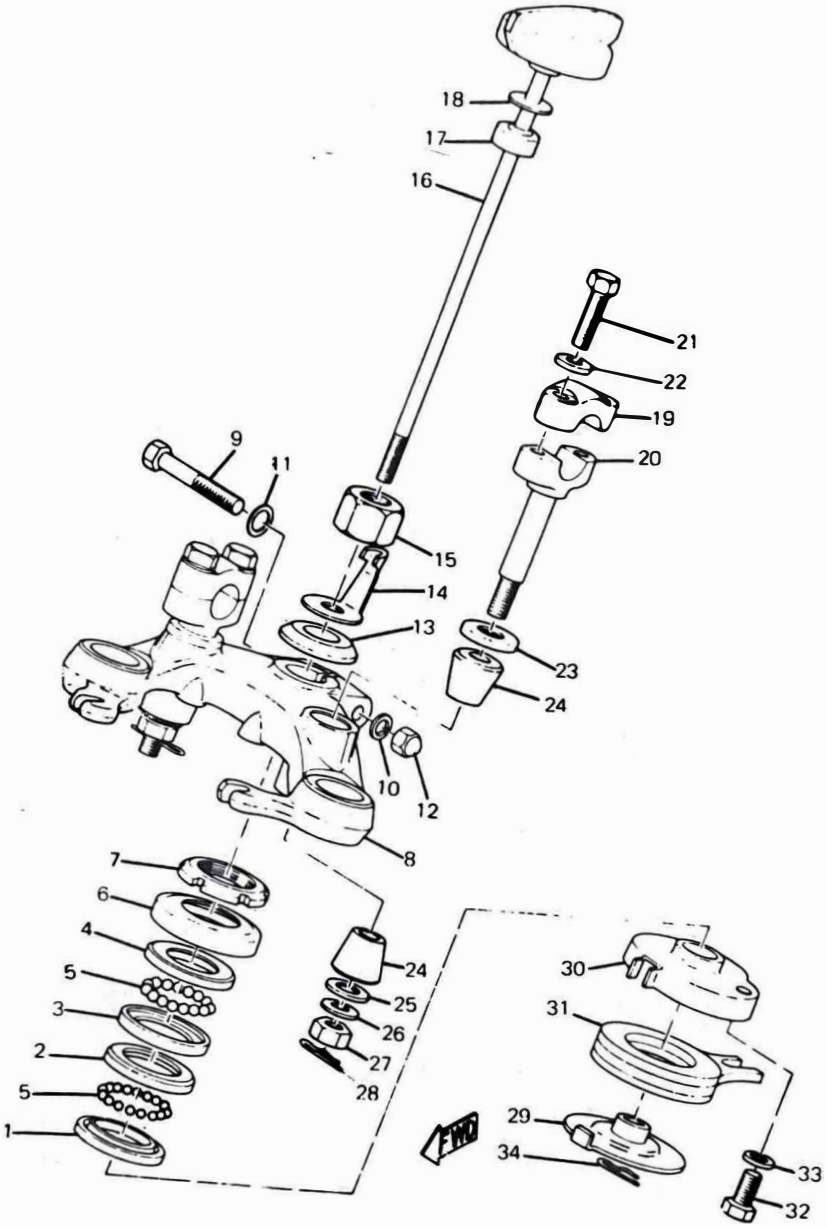


Disc Brake Fluid Change

1. Pull the rubber cap off the bleeder valve located on the brake caliper which clamps the disc. See **Figure 15**.



2. Attach one end of a piece of clear plastic tubing to the nipple at the end of the bleeder valve. Stick the other end of the tubing into an empty can.



TYPICAL STEERING HEAD

1. Ball race
2. Ball race
3. Ball race
4. Ball race
5. Ball
6. Ball race cover
7. Ring nut
8. Steering head
9. Bolt
10. Spring washer
11. Pedal link washer
12. Cap nut
13. Race
14. Damper spring
15. Nut
16. Damper shaft
17. Washer
18. Special washer
19. Upper handlebar clamp
20. Lower handlebar clamp
21. Bolt
22. Spring washer
23. Special washer
24. Rubber bushing
25. Special washer
26. Spring washer
27. Nut
28. Tension bar clip
29. Damper plate
30. Damper plate
31. Damper plate
32. Bolt
33. Spring washer
34. Clip

3. Unscrew the bleeder valve body enough to open the valve fully.

4. Actuate and release the brake until all of the fluid has been drained out of the reservoir, line, and caliper.

5. Screw in the bleeder valve body to close the valve. Pour out used fluid and stick the bottom end of the tubing back into the can.

CAUTION

Do not reuse old fluid. Brake failure could result.

6. Unscrew the cap from the fluid reservoir. Fill the reservoir with fresh fluid.

7. Use only DOT 3 disc brake fluid; correct functioning of the brake depends upon it. Continue using the same brand each time fluid is changed; do not mix brands. Use fluid only from a recently opened can.

8. Open the bleeder valve. See **Figure 16**. Actuate the brake and keep pressure on it. Close the valve, and quickly release the lever. Continue this operation until brake fluid starts coming out of the bleeder valve. Add fluid as necessary to prevent the reservoir from running dry.

9. Bleed air from the system. See *Master Cylinder, Hydraulic System Bleeding*, Chapter Seven.

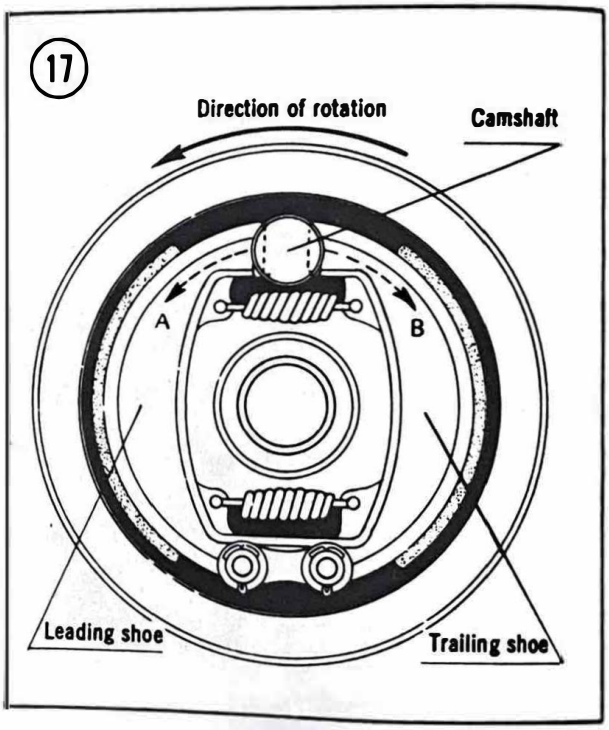
Drum Brake Cam

1. Remove the wheel (refer to Chapter Seven, *Front Wheel* or *Rear Wheel*).

2. Take out the brake backing plate.

3. Wipe away the old grease, being careful not to get any of it on the brake shoes.

4. Sparingly apply high-temperature grease to camming surfaces of the camshaft, camshaft groove, brake shoe pivots, and ends of the springs (**Figure 17**). Do not get any grease on the brake shoes.



5. Assemble the rear wheel and install it (see Chapter Seven, *Rear Wheel*).

Wheel Bearings

1. Remove the wheels from the motorcycle and remove the bearings (**Figures 18 and 19**). Refer to Chapter Seven, *Front Wheel*, or *Rear Wheel*.

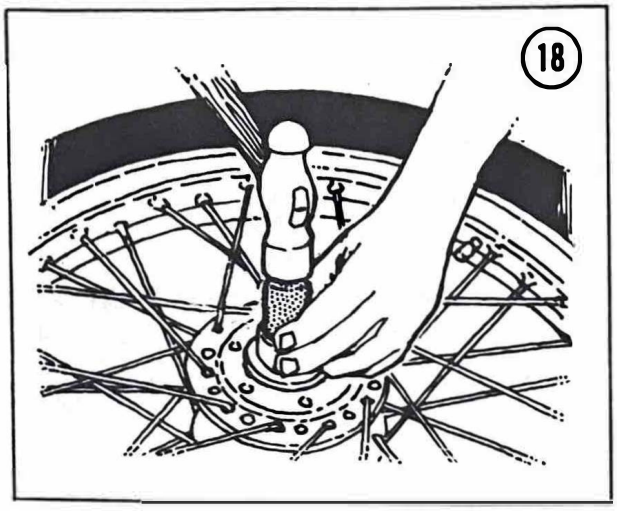
2. Clean old grease out of hub.

3. Wash each wheel bearing in kerosene and dry it.

CAUTION

Do not spin the bearing during cleaning process.

4. Oil each bearing, and spin it. If it will not spin smoothly, is noisy, or has rough spots,



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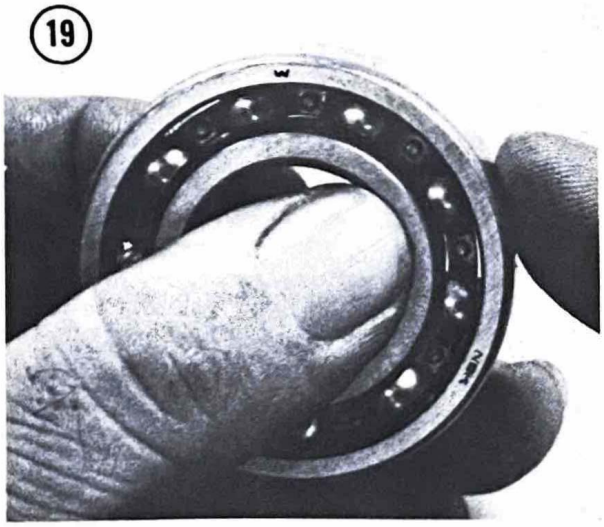

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replace it with a new one. Safety requires that the wheel bearings be in good condition.

5. Pack the bearings with good quality high-temperature bearing grease.
6. Grease the front hub speedometer gearbox.
7. Assemble and install the wheel.

Drive Chain

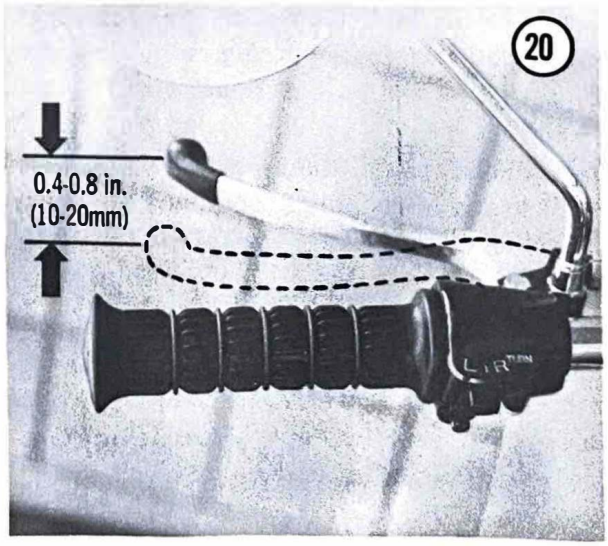
1. Check that the rear chain is lightly oiled.
2. With the motorcycle on its centerstand, oil as much of the bottom chain run as you can reach with SAE 30 motor oil in a long-spout oil can or commercial chain lube. Concentrate on getting the oil down between the side plates of the chain links. See *Drive Chain Cleaning and Lubrication*, this chapter, if the chain is rusty or mud caked.

Throttle Cable

1. Remove the screws (at the handlebars) that assemble the twist grip housing. Remove the top half of the housing.
2. Remove the throttle cable from the twist grip.
3. Examine the exposed parts of the inner cable. Pull the cable up and down in its housing to determine by feel whether it is clean or gritty.
4. If the cable is clean, hold the top part vertical and spray it with Dri-Slide or one of the thin spray-on chain lubricants.
5. Hold the spray can close to the inner cable, near the top ferrule of the cable housing, so that lubricant will run down between the inner cable and its housing.
6. If the cable is dirty, spray it instead with a lubricant/solvent, such as LPS-25, or WD-40.
7. Lubricate the twist grip assembly with grease.
8. Assemble in reverse order of disassembly. Refer to *Throttle Cable, Replacement*, Chapter Five.

Clutch Cable Lubrication

1. Loosen the locknut and cable adjuster at the clutch lever mount, to provide slack in the cable. See **Figure 20**.



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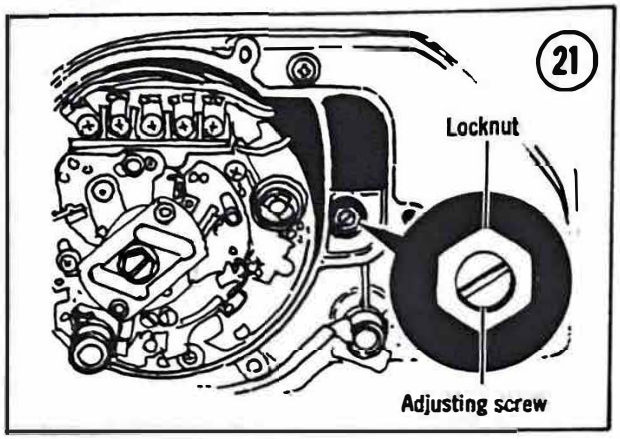
2. If there is enough slack in the cable, pull the cable housing (outer cable) free of the lever, and lift the inner cable out. Bend the inner cable around to match the slot in the lever, and pull the cable and its fitting out of the lever.

3. If there is not enough slack in the cable, remove the cover, and loosen the locknut on the clutch adjusting screw. See **Figure 21**. This will provide enough slack in the clutch cable so that it can be freed from the handlebar lever.



4. At the top of the clutch cable, examine the exposed portion of the inner cable. If it is clean, hold the cable vertical and spray it with Dri-Slide or one of the thin spray-on chain lubricants. Hold the spray can close to the inner cable, near the top ferrule of the cable housing, so that the lubricant will run down between the inner cable and its housing. Spray the cable until it is lubricated along its entire length.

5. If the exposed portion of the inner cable is dirty, or the cable feels gritty while moving it up and down in its housing, spray it instead with a lubricant/solvent, such as LPS-25 or WD-40.

6. Attach the cable to the clutch lever and then fit it to the lever mount. To adjust the clutch, refer to *Clutch, Free Play Adjustment*, this chapter.

ENGINE TUNE-UP

Different systems in an engine interact and cannot be considered apart. A tune-up should include the following in the order given:

a. Compression test
b. Decarbonization
c. Spark plugs
d. Condensers (capacitors)
e. Breaker points
f. Ignition timing
g. Ignition coils
h. Air cleaner
i. Carburetion
j. Autolube

COMPRESSION TEST

This is one of the simplest, yet one of the most significant tests to determine engine condition. It should be performed prior to each tune-up if indicated by rough engine idle.

A compression tester measures pressure buildup in each cylinder. The results, when properly interpreted, can indicate general cylinder condition.

To perform a compression check, proceed as follows:

1. Warm up engine to operating temperature.
2. Stop the engine.
3. Remove the spark plug.
4. Screw a compression gauge into the spark plug hole. If a press-in type gauge is used, hold it firmly in position.
5. Keep the ignition in the OFF position, crank the engine with the kickstarter and read the compression gauge. The compression gauge reading will increase with each operation of the kickstarter for the first few operations. Record the reading.
6. Repeatedly crank the engine until the compression gauge reading is the same for successive readings; for example:

1st kick	75 psi
2nd kick	105 psi
3rd kick	120 psi
4th kick	125 psi
5th kick	125 psi

Because of differences in engine design, carbon deposits and other factors, definite compression readings cannot be specified for any one engine. A series of measurements made over a period of time, however, may reveal an indication of trouble ahead, long before the engine exhibits other serious symptoms. Make and record the first compression reading when the engine is new and every 2,000 miles thereafter. An example is given in **Table 2**.

Table 2 COMPRESSION TEST RECORD

Mileage		Compression
Miles	Kilometers	Pressure (psi)
Zero	Zero	130
2,000	3,200	125
4,000	6,400	125
6,000	9,600	120
8,000	12,800	95

A difference of 20% between cylinders or successive compression test readings over a period of time, if made under identical conditions, is an indication of trouble. If the compression reading for the bike was taken for the first time at 8,000 miles (see **Table 2**), a reading of 95 psi might be considered normal but, compared with engine history, it is an indication of trouble.

NOTE: *Readings taken with different gauges are not necessarily conclusive, because of production tolerances, calibration errors, and other factors.*

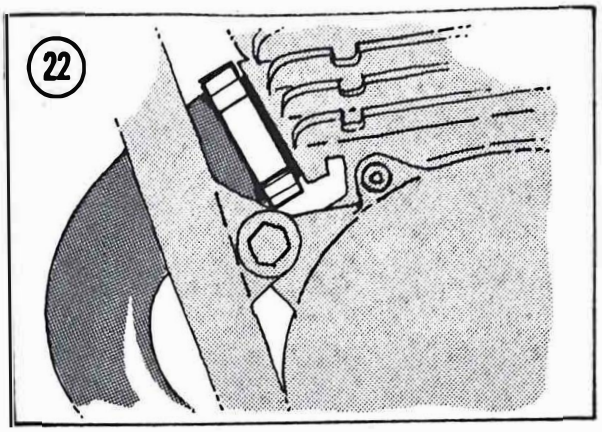
DECARBONIZATION

Cylinder Head

After an engine has been run for many hours it will probably require the removal of carbon from the piston crown and cylinder head. A way to detect this need is if the engine has preignition or a loss of power. Several new products are now being marketed to allow a simple approach to decarbonization without the need of dismantling the engine. These products will not be as thorough, but can be used periodically. The procedure for their use is given on the container. If this fails to completely decarbonize the cylinder, you will have to remove the head as outlined in Chapter Four, *Cylinder Head.*

Exhaust Pipes/Mufflers

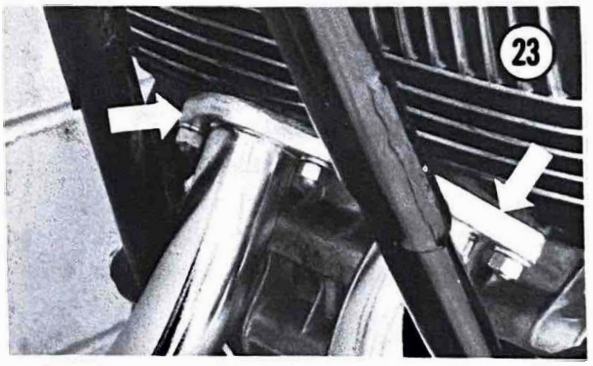
1. Remove both exhaust pipes and mufflers. On models that secure the pipe to the cylinder with a ring nut, use a pin wrench. See **Figure 22.** Sometimes penetrating oil helps, as rust buildup makes nut removal difficult.



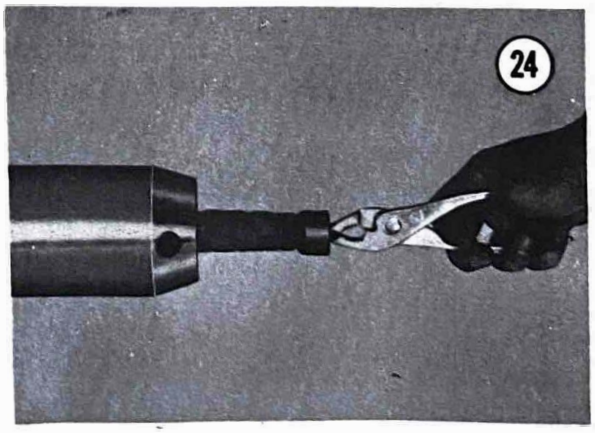
CAUTION

When threading nuts back on, oil them and take care to prevent cross-threading; these are fine threads which can easily be stripped.

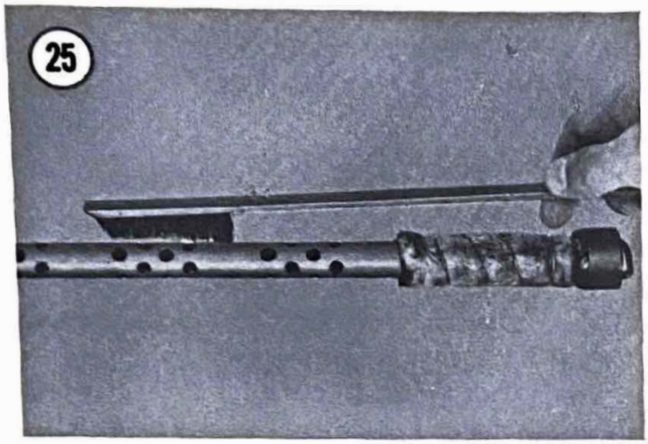
2. Use a rounded scraper to remove excess carbon deposits from manifold area of muffler. See **Figure 23.** Check exhaust gasket condition. The gasket seat is located around the cylinder exhaust port.



3. Remove silencer set screw and remove silencer from back end of muffler. See **Figure 24.**



4. Use a stiff brush to clean carbon off silencer. See **Figure 25**.



5. Carbon deposits within the muffler may be removed by lightly tapping the outer shell with a rawhide hammer and then blowing out with compressed air. Heavy wire, such as a coat hanger, may be inserted to break loose deposits if done carefully.

6. Install silencer, set screw, mufflers, and exhaust pipes.

SPARK PLUGS

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

Select plugs of a heat range designed for the loads and temperature conditions under which the bike will run.

CAUTION

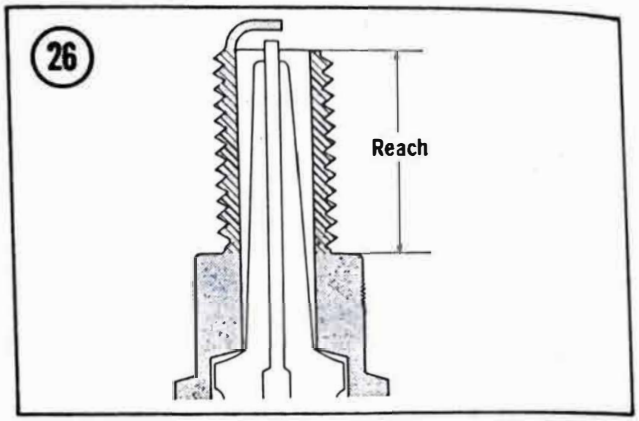
Use of incorrect heat ranges can cause seized pistons, scored cylinder walls, or damaged piston crowns.

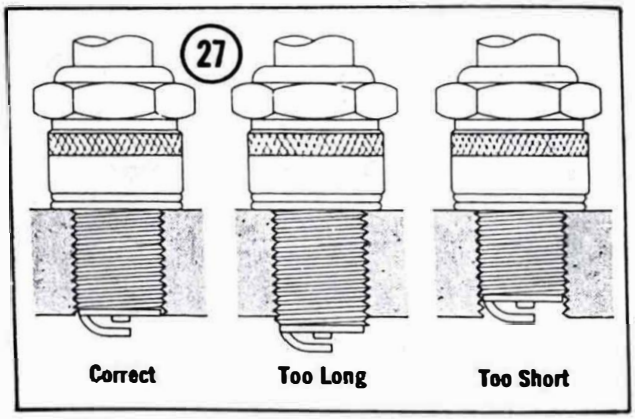
In general, use a lower numbered plug for low speeds, low loads, and low temperatures. Use a higher numbered plug for high speeds, high engine loads, and high temperatures.

NOTE: *Use the highest numbered plug that will not foul.*

In areas where seasonal temperature variations are great, the factory recommends a "2-plug system"—a high numbered plug for hard summer riding and a lower numbered plug for slower winter operation.

The reach (length) of a plug is also important. A longer-than-normal plug could interfere with the valves and piston, causing permanent and severe damage. Refer to **Figures 26 and 27**.





The standard spark plugs are given in **Table 3**.

Testing

A quick and simple test can be made to determine if the plug is correct for your type of riding. Accelerate hard into third gear and maintain a high, steady speed. Shut the throttle off, and kill the engine at the same time, allowing the bike to slow, out of gear. Do not allow the engine to slow the bike. Remove the plugs and check the condition of the electrode areas. A spark plug in the correct heat range, with the engine in a proper state of tune, will appear light tan. See **Figure 28**.

If the insulator is white or burned, the plug is too hot and should be replaced with a colder one. Also check the settings and jetting of the carburetors; they may be too lean.

SPARK PLUG CONDITION (28)

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 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 incorrect 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.

Table 3 SPARK PLUGS

Model	Standard Plug (NGK)	Plug Gap Inch	Plug Gap Millimeter
YDS3, YDS3-C, YDS5, YM1, YM2-C	B-8HC	0.024-0.028	(0.6-0.7)
DS6, DS6-B, DS6-C, DS7, R3, R3-C,R5, R5-B	B-9HC	0.020-0.023	(0.5-0.6)
RD250, RD250A, R5-C, RD350, RD350A	B-8HS	0.020-0.023	(0.5-0.6)
RD250B, RD350B, RD400	B-8ES	0.024-0.028	(0.6-0.7)
YR1, YR2, YR2-C	B-8HC	0.020-0.023	(0.5-0.6)

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, discard the set.

Removal/Installation

1. Blow out any debris which has collected in the spark plug wells. It could fall into the holes.
2. Gently remove the spark plug leads by pulling up and out. Do not jerk the wires or pull on the wire itself.
3. Apply penetrating oil to the base of the plugs and allow it to work into the threads.
4. Back out the plugs with a socket that has a rubber insert designed to grip the insulator. Be careful not to drop the plugs into the cooling fins where they could become lodged. Heat and corrosion can cause the plug to bind in the head, making removal difficult. Do not use force; the head is easily damaged.
5. Clean the seating areas after removal and apply graphite to the threads to simplify future removal. See **Figure 29**.

6. Clean the tips of the plugs with a sandblasting machine (some gas stations have them) or with a wire brush and solvent.
7. Set the gap at the specification given in **Table 3**. Use a round feeler gauge.
8. Always use a new gasket if old plugs are to be reused after cleaning.
9. Run the plugs in finger-tight and tighten ¼ turn more with a wrench.

CAUTION

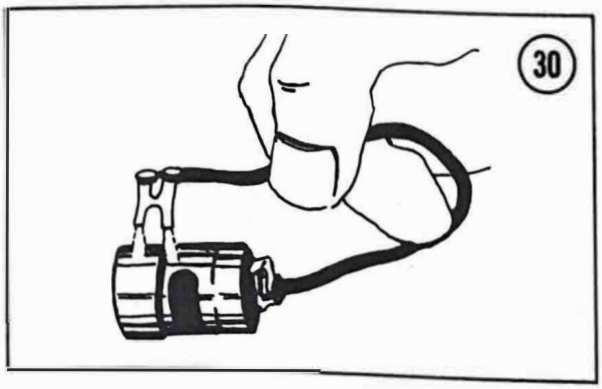
Further tightening will only flatten the gaskets and cause binding.

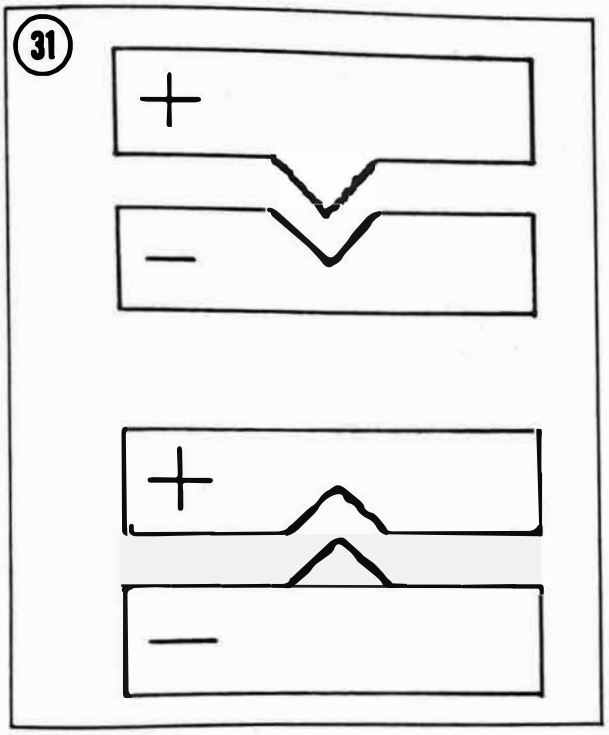
NOTE: *A short piece of fuel line can be used to install the plug initially in areas where space is a problem.*

CONDENSER (CAPACITOR)

The condenser (capacitor) is a sealed unit and requires no maintenance. Be sure the connections are clean and tight.

The only proper test is to measure the resistance of the insulation with an ohmmeter. The value should be 4,000 ohms. A make-do test is to charge the capacitor by hooking the leads, or case and lead, to a 12V battery. After a few seconds, touch the leads together, or lead to case, and check for a spark, as shown in **Figure 30**. A damaged capacitor will not store electricity or spark. The ignition point surfaces will help determine if the condenser needs replacement. **Figure 31** illustrates excessive metal transfer from one point to another, and means the condenser is not performing properly and should be replaced.





Most mechanics prefer to replace the condensers with new ones during engine tune-up.

BREAKER POINTS

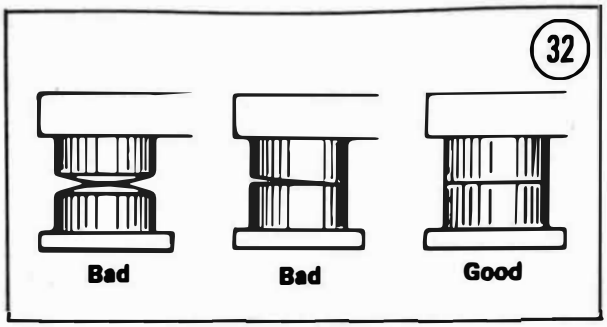
Inspection

1. Remove the breaker point cover by removing the 3 Phillips heads screws. If the cover does not come off easily, try tapping it loose with a rubber or rawhide mallet.

CAUTION

Do not use a metal hammer.

2. Pry open the points gently and check the 2 sets for alignment and wear. **Figure 32** shows what to look for. Replace the points if they are severely pitted or worn.



3. If the point spring is weak or broken, the points will bounce, causing misfiring at high speeds. Measure spring tension with a point tension gauge. Spring tension, as the points open, should be 25-28 oz. (700-800 grams).

Cleaning

1. Gray discoloration of the contacts is normal. Dress the surfaces with a point file. Never use sandpaper or emery cloth for this purpose.

2. Blow away residue and clean the contacts with chemical point cleaner, lacquer thinner, or a piece of unwaxed stiff paper such as a business card. Make certain the contacts are absolutely clean. Even fingerprint oil can affect performance.

3. If the same points are to be used, skip the next section (*Replacement*). If new points will be installed, it is recommended that the condensers also routinely be replaced. These parts usually are sold in sets.

Replacement

A complete set of ignition points is mounted to a point plate. There are 2 ignition point sets and 2 point plates. Each point plate assembly is replaced as a unit.

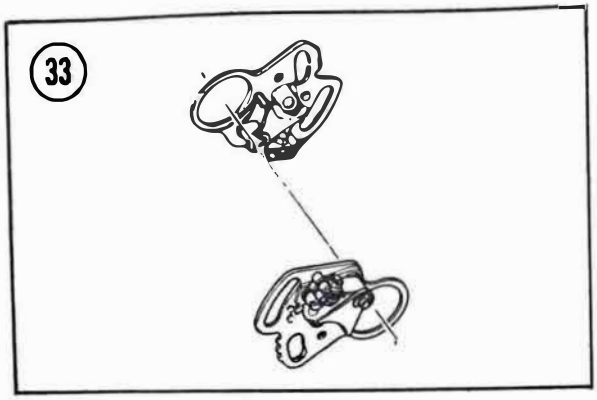
Although point plate shape differs slightly from one model to another, replacement procedure is the same.

1. Remove both wires that are bolted to the movable ignition point (one wire comes from the condenser, the other from a power source).

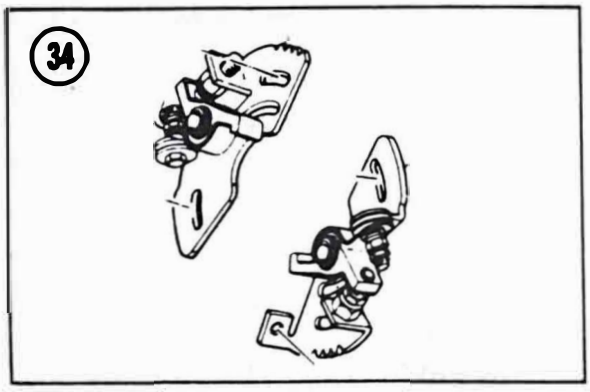
2. Each plate is held to the yoke by 2 screws that fit through slots in the point plate. Remove these screws and lift off the point plate.

3. When installing point plates shown in **Figure 33**, mount the right-hand point plate first,

then the left plate. The unusual shape of the metal rings of the plate requires this procedure.



NOTE: *Some models using the style of point plate shown in* **Figure 34** *have a different left and right plate design. When purchasing these points, ask the salesperson to identify each box of points with a pen. Either side may be installed first.*



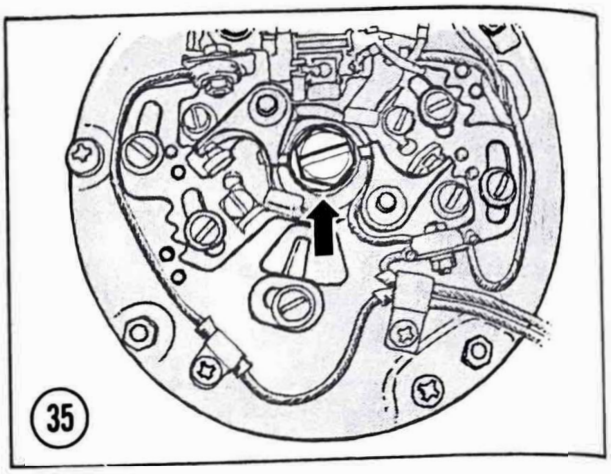
4. To install either style of point plate, place the plate into approximate position, then install and tighten both mounting screws.

5. Attach the condenser and power source wires to the movable point. Be sure to mount the wires to the outside of the bolt. The movable point is insulated, and these wire ends must be kept insulated also.

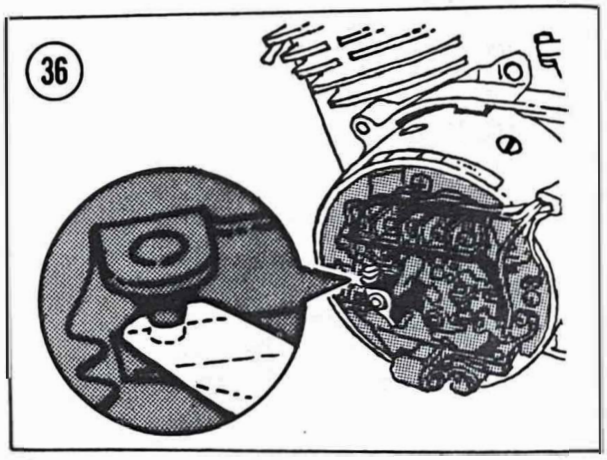
6. After replacing ignition points; check point gap and ignition timing.

Breaker Point Gap Adjustment

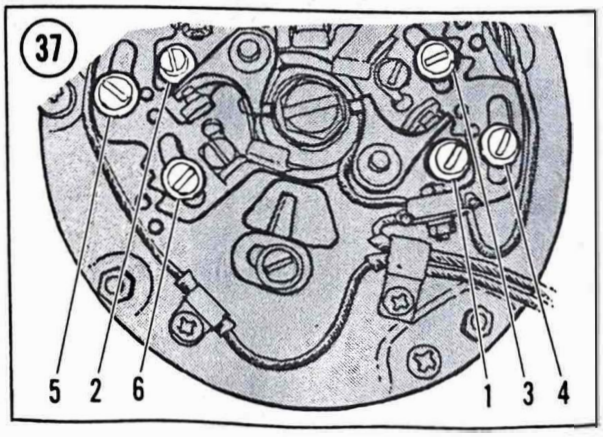
1. Rotate the crankshaft (use a socket on the big retainer bolt in the center shaft) until one set of points are fully open. See **Figure 35**.



2. Point gap should be 0.012-0.014 in. (0.30-0.35 mm). Check with a flat feeler gauge. See **Figure 36**.



3. To adjust, loosen the lockscrew (1) or (2) in **Figure 37**.



4. Insert a screwdriver into the adjustment slot (3) or (6), then adjust the moveable point until the feeler gauge indicates the correct gap.

5. Tighten the lock screw and recheck the gap.
6. Rotate the crankshaft until the other set of points is fully open and repeat Steps 2 through 5.
7. Apply a few drops of light oil to the felt cam lubricator. Do not apply too much oil.
8. The stationary point is adjusted by loosening a locknut, turning the contact with a small screwdriver, and retightening the locknut.

NOTE: *It is very important to check that the points meet squarely after the adjustment is made. Since the stationary contact rotates as it is adjusted, any pitting on either contact will make accurate measurement impossible and prevent proper closure of the cotnact points.*

9. Ignition timing is affected by any change in point gap. Always adjust the timing after servicing the points.

IGNITION TIMING

There is only one accurate method to adjust ignition timing—the static procedure. Methods suitable for other types of engines will not work well on the Yamaha.

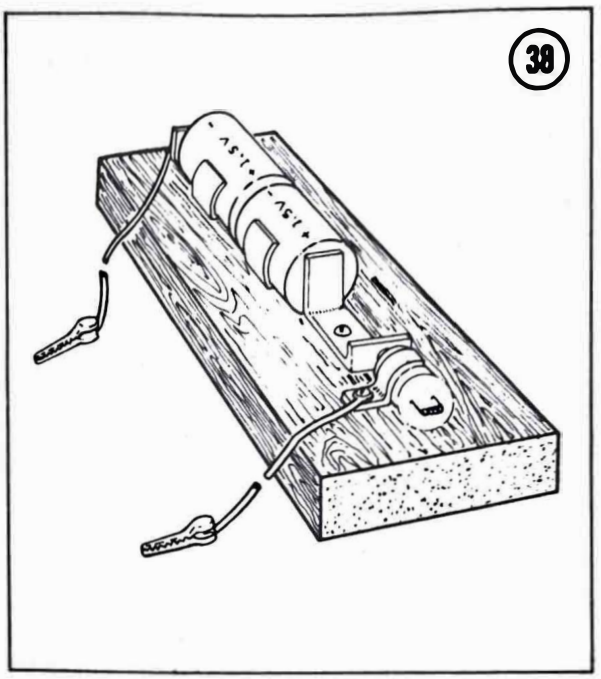
To set the timing you will need a device that will signal when an electronic circuit is opened or closed. This can be a buzz box, an ohmmeter, or a continuity light. The latter, often called a timing light, is the least expensive. It is available for under $2 at parts stores.

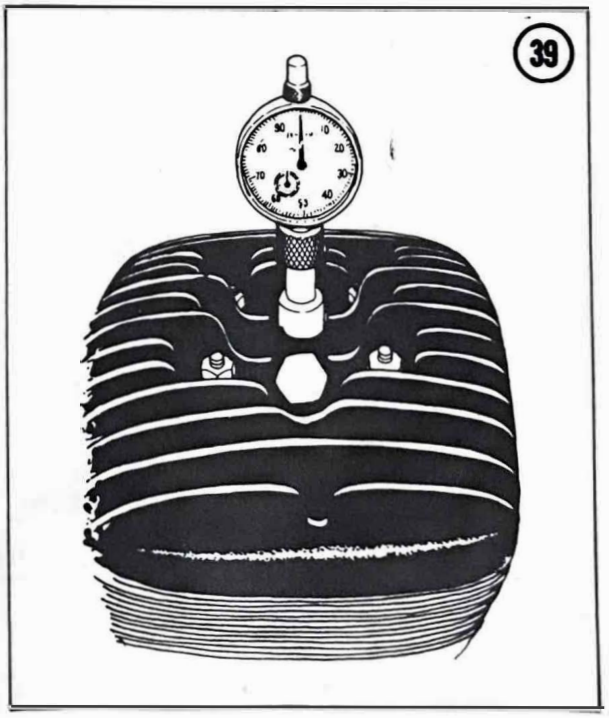
A homemade timing light consists of a 12-volt light bulb, a socket to hold it, and 2 wires attached to the socket with alligator clips at the ends of each wire. See **Figure 38**.

Any change in point gap, including that from normal point wear, point maintenance, or point replacement, affects ignition timing. It is necessary to adjust ignition timing each time the points are serviced. Do not start to set ignition timing until you have cleaned and gapped the points.

Adjust timing of each cylinder separately. Either side may be done first.

1. Remove a spark plug. Screw in the dial gauge adapter. Screw the long needle into the dial gauge, loosen the adapter set screw, then insert the dial gauge down through the adapter and tighten the set screw (**Figure 39**). This locks the dial gauge in place.





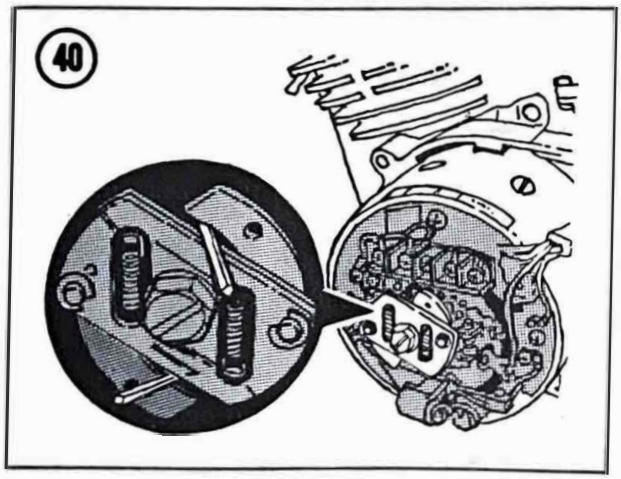
2. Use the dial gauge to find piston top dead center (TDC). Start with the piston low in the cylinder, rotate the crankshaft until the piston pushes on the dial gauge and the dial needle rotates.

NOTE: *The needle will continue sweeping in a counterclockwise direction as long as the piston travels upward. When the needle stops, then reverses its direction of sweep, that stopping point is piston* TDC. *Find* TDC, *then rotate the dial gauge face until the zero lines up with the needle.*

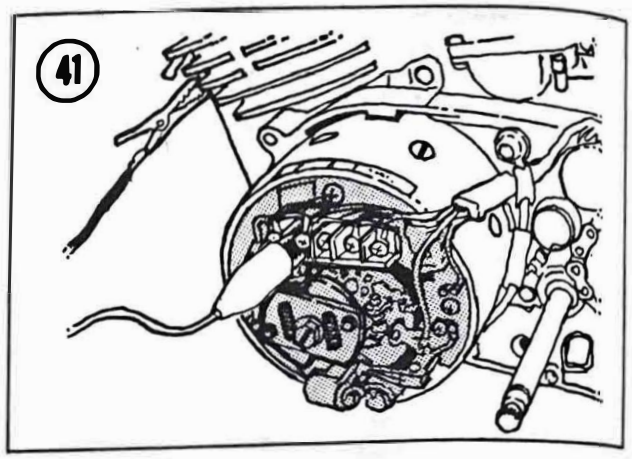
3. Turn the crankshaft in a clockwise direction until the needle has made 3 complete sweeps of the dial face. This puts the piston at 0.12 in. (3.0mm) before TDC. Each sweep of the face equals 0.04 in. (1.0mm).

4. Rotate the crankshaft counterclockwise until you have moved from 0.12 in. (3.0mm) BTDC to the figure listed in **Table 4**.

5. Electric start models have an automatic ignition advance. Wedge the advance unit in the full advance position. See **Figure 40**.



6. Connect an ohmmeter or continuity tester across the points (**Figure 41**). Connect one meter lead to the terminal leading to the



movable point, then connect the other lead to a good ground such as a cylinder fin or engine case. If the dial gauge is on the left cylinder, attach the meter to the points with orange lead wire. The right set of points have a gray wire.

NOTE: *These wires must be disconnected for the meter to work.*

CAUTION

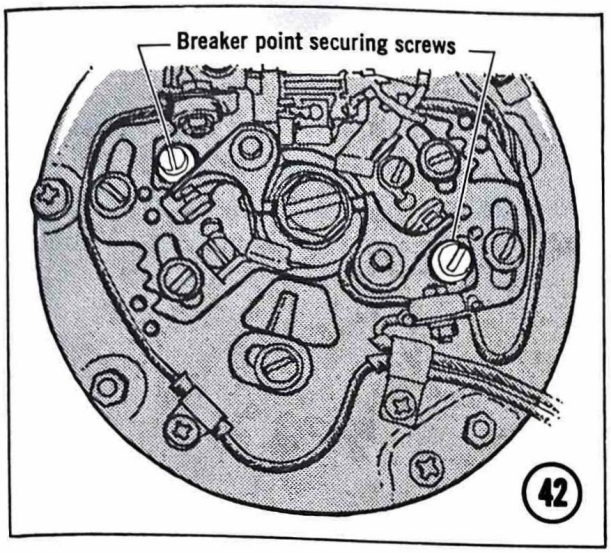
Be sure the ignition switch is off. If the meter is connected with the switch on, you will burn out the test meter.

7. Refer to **Figure 42**. Loosen both point plate fastening screws just enough to permit plate movement. Place a screwdriver in the slot on the outer plate edge, then rotate the plate until the points just open. Tighten the point plate securing screws.

NOTE: *The point plate tends to move as the setting screws are tightened. It may be necessary to repeat the adjustment and tightening sequence several times.*

Table 4 IGNITION STANDARDS

Model	Ignition Timing BTDC	
	Inch ± 0.04	(Millimeter) ± 0.1
YDS3, YDS3-C, YDS5, DS6, DS6-B, DS6-C, DS7	0.071	(1.8)
RD250, RD250A, RD250B, RD350, RD350A, RD350B, RD400	0.079	(2.0)
YM1	0.075	(1.9)
YM2, YM2-C, YR1, YR2, YR2-C, R3, R3-C, R5, R5-B, R5-C	0.083	(2.1)



8. When the adjustment is within tolerances, repeat Steps 1 through 7 for the other cylinder. Timing tolerance for each cylinder is ±0.04 in. (±0.1mm) BTDC. If you are setting timing to occur at 0.07 in. (1.8mm) BTDC, the points must just open between 0.065-0.075 in. (1.7-1.9mm). Timing between both cylinders has a tolerance of 0.002 in. (0.05mm).

IGNITION COIL

The ignition coil is a form of transformer which develops the high voltage required to jump the spark plug gap. The only maintenance required is that of keeping the electrical connections clean and tight, and making sure that the coil is mounted securely.

Testing

If coil condition is doubtful, several checks should be made:

1. Measure resistance with an ohmmeter between the positive and negative primary terminals. Resistance should indicate approximately 5 ohms for most coils on these machines. Some coils, however, have a primary resistance less than one ohm. Compare the measurement with that of the known good coil on the other cylinder.

2. Measure resistance between either primary terminal and the secondary high voltage terminal. Resistance should be in the range of 5,000-11,000 ohms.

3. Scrape the paint from the coil housing down to bare metal. Measure the resistance between this bare spot and the high voltage terminal. Insulation resistance must be at least 3 megohms (3 million ohms).

4. If these checks do not reveal any defects, but the coil condition is still doubtful, replace it with a known good one.

CAUTION

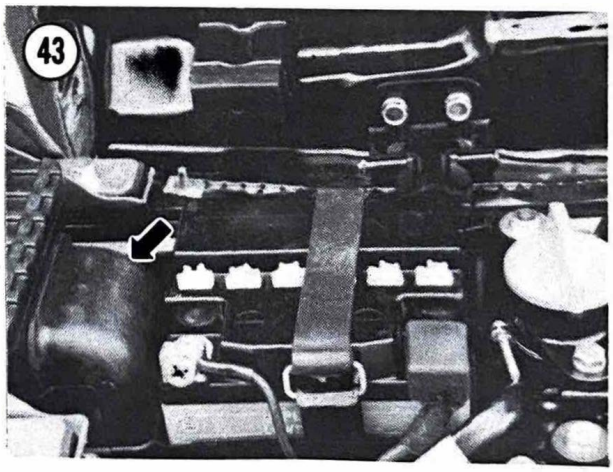
Be sure that you connect the primary wires correctly. The brown wire connects to the positive terminal. The orange and gray wire connects to the negative terminal.

AIR CLEANER

A clogged air cleaner can decrease the efficiency and life of the engine. It should be checked at each oil change, or more often if motorcycle is operated under dusty conditions.

Air Filter Element Replacement

1. Remove the air cleaner cover. Refer to **Figure 43**.



2. Remove the filter element. Replace it with a new one if the filter is clogged with dirt, oil soaked, or if the bonding material is cracked.

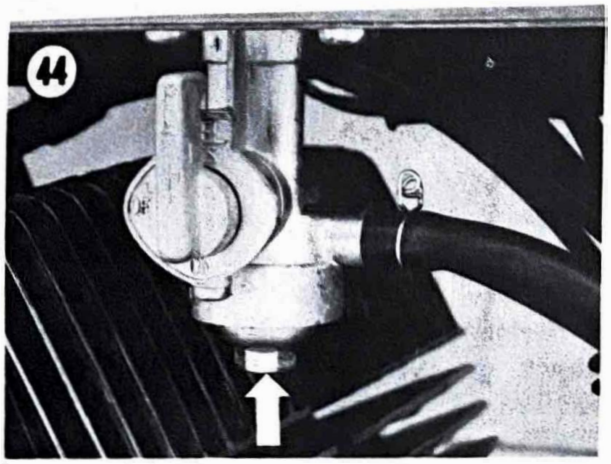
3. Light dust can be shaken off the element by tapping it while using a soft brush on the outside. A better method, if compressed air is available, is to force air through the element from the inside.

4. Replace the housing and the filter element.

FUEL FILTER

Removal/Installation/Cleaning

1. The fuel valve strainer is located in a cap on the underside of the valve. See **Figure 44**. Remove the cup by unscrewing it from the valve body. Remove the strainer and disassemble the valve.



2. Clean strainers with solvent and replace seal if damaged.

3. Install strainer and seal and assemble valve. Take care not to overtighten, as damage to the seal could result.

CARBURETION

Unless the carburetors have been disassembled, they normally should not require adjustment. They should be worked on only as a last resort when all other possible causes of problems, such as rough idling or misfiring, have been checked out. See Chapter Five, *Carburetor*.

Idle Mixture/Idle Speed Adjustment

To adjust idle mixture and idle speed on the various models, refer to **Table 5**. Set the idle mixture screw by turning it in until it seats lightly, then back it out the number of turns specified. Finally, adjust the idle speed as indicated. At higher altitudes, approximately 3,000 feet (1,000 meters), it may be advisable to back out the mixture screw an additional ¼ turn.

A good method for adjusting idle speed is to warm up the engine, then stop it and disconnect either spark plug lead. Restart the engine and very slowly reduce idling speed until the engine just dies. Repeat this procedure for the opposite cylinder. Adjust both idle speed screws equally to achieve specified rpm.

Throttle Cable Free Play

Prior to synchronizing carburetors, check for adequate throttle cable free play at the throttle grip and on the top of each carburetor.

First, check free play at the throttle grip. With the grip at a fully closed position, slide the outer cable housing away from the grip to determine existing cable free play. **Figure 45** shows the spot that you will need 0.04 in. (1mm) free play. To make an adjustment, loosen the locknut as shown and twist the adjuster. Tighten the locknut.

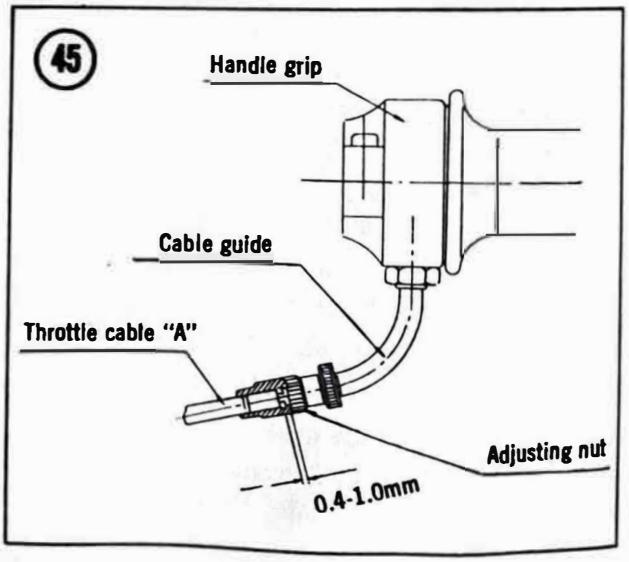
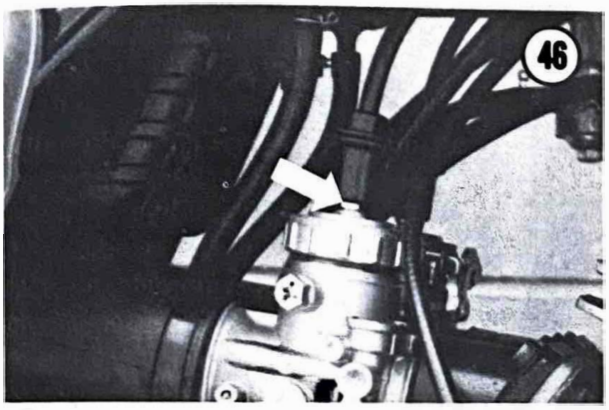


Table 5 IDLE SPEED/MIXTURE ADJUSTMENT

Carburetor Model	Idle Mixture	Idle Speed
VM24SC	1½ turns	1,050-1,150 rpm
VM26SC	1½ turns	1,150-1,250 rpm
VM28SC	1¾ turns	1,300-1,400 rpm

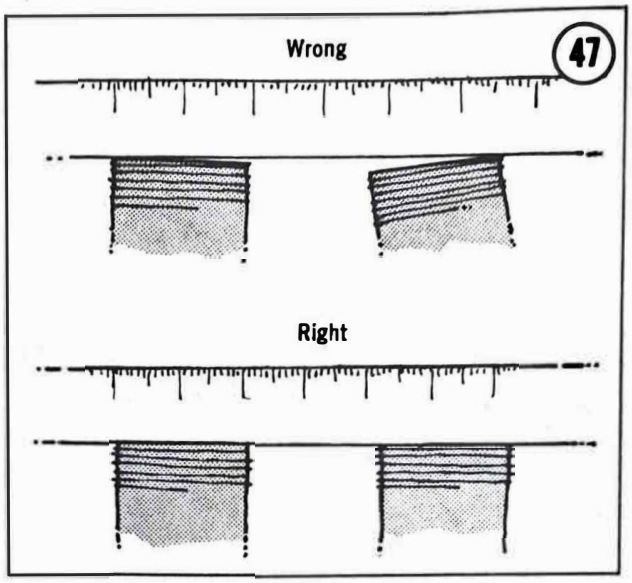
Check for 0.04 in. (1mm) of throttle cable free play where it enters the carburetor cap. **Figure 46** shows where to check. To determine existing free play, gently lift the outer cable housing until you feel resistance. Let the cable housing drop until seated. This dropped distance is the free play. To adjust, loosen the locknut and screw the adjuster in or out to obtain correct free play. Perform this adjustment on both carburetors.



Synchronization

Power output from the cylinders will be unbalanced unless both carburetors are synchronized. If one cylinder receives more fuel/air mixture from its associated carburetor than does the other cylinder, overall poor performance will result.

1. Remove both air filter connections.
2. Rotate the throttle grip to full open position.
3. Look into the carburetor bores as you slowly rotate the throttle grip to the closed position. It may be helpful to use a small mirror.
4. Both slides must enter their carburetor bores at the same time. If not, use the cable adjuster at the top of the carburetor to raise or lower one slide to match the other.
5. Both carburetors must be straight up and down. See **Figure 47**. If tipped, this will alter float level, causing improper fuel supply. Slide the rubber caps on top of each carburetor (if installed) upward, then lay a straightedge across the tops of both carburetors. The straightedge must touch completely across both tops. If not, loosen the carburetor cinch bolts and twist the carburetors until you achieve complete contact.



Retighten the cinch bolts, then double-check the setting.

Float Level

The procedure for cleaning carburetor float bowls and adjusting float levels is given in Chapter Five, *Carburetor, Float Level Adjustment.*

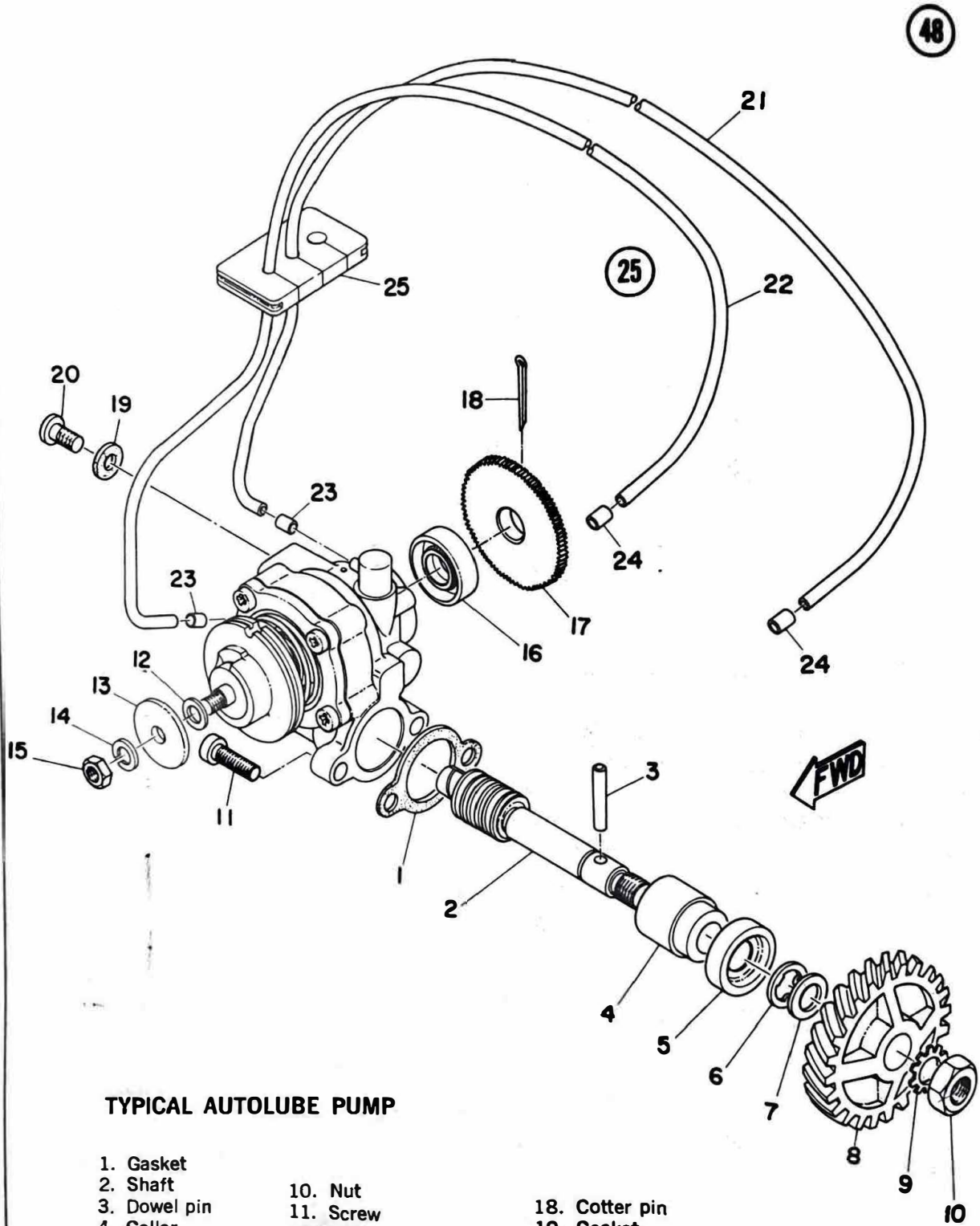
AUTOLUBE

Figure 48 is an exploded view of a typical Autolube pump. The pump is a precision assembly; do not attempt to disassemble it. Whenever the pump is removed, protect it at all times from dust, dirt, and foreign material. After you reinstall the pump, be sure to follow instructions for adjustment and bleeding.

Pump location varies on different models. On YDS3, YDS5, DS6 series, YM1, and YM2 models, it is located behind a plate on the engine's left side. On all other models, the pump is located behind a small cover on the front section of the engine's right case cover.

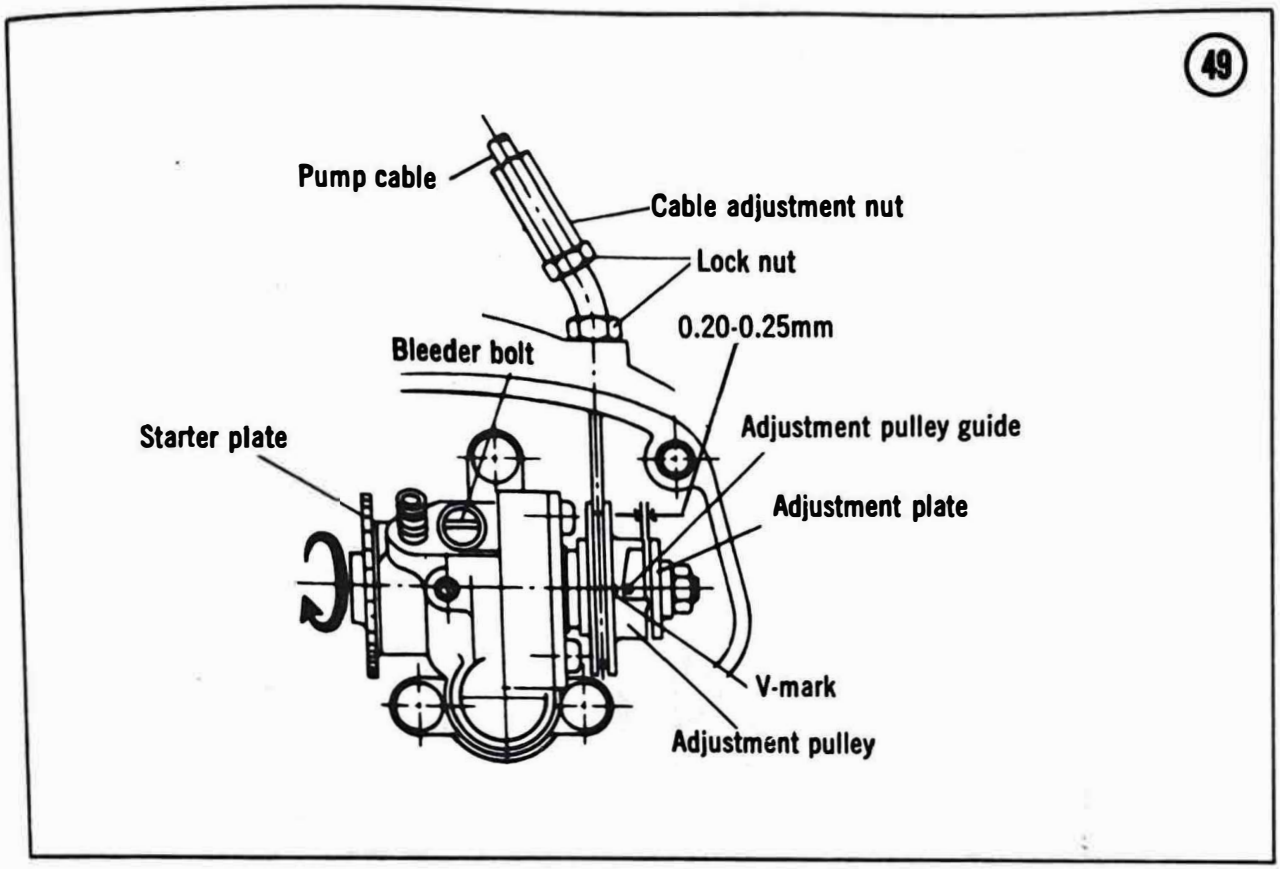
Pump Stroke Adjustment

1. Fully close the throttle grip (engine idle position).
2. Rotate the white plastic starter plate (**Figure 49**) in the direction of the arrow marked on the plate until the plunger (opposite end) moves out to the end of its stroke.

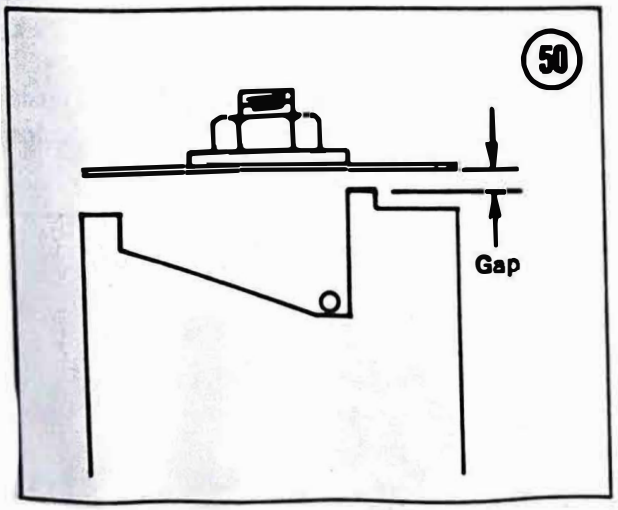


TYPICAL AUTOLUBE PUMP

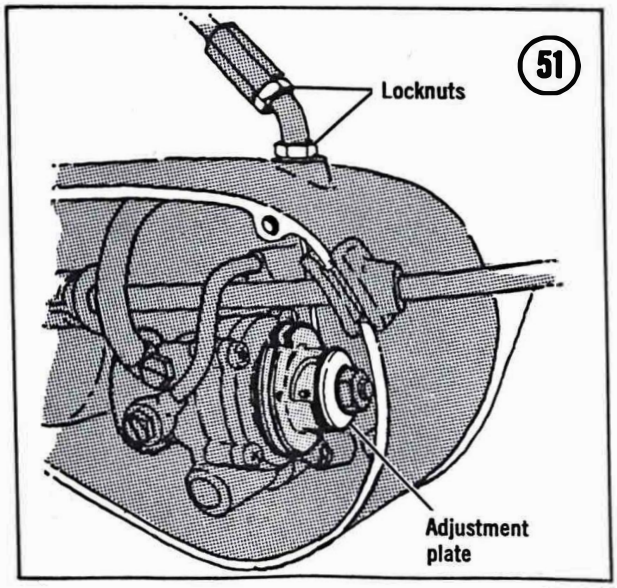
1. Gasket
2. Shaft
3. Dowel pin
4. Collar
5. Oil seal
6. Snap ring
7. Washer
8. Gear
9. Lockwasher
10. Nut
11. Screw
12. Shim
13. Adjusting plate
14. Lockwasher
15. Nut
16. Oil seal
17. Starter plate
18. Cotter pin
19. Gasket
20. Screw
21. Delivery tube
22. Delivery tube
23. Clip
24. Clip
25. Tube holder



3. Measure the gap shown in **Figure 50** with a feeler gauge, between the adjustment plate and raised nub on the pump pulley. The gap should be between 0.008-0.010 in. (0.20-0.25mm). Minimum allowable gap is 0.006 in. (0.15mm).



4. If adjustment is required, remove the adjustment plate and locknut shown in **Figure 51**. Install or remove thin shims under the adjustment plate as required. Adding a shim increases gap width. If shims are needed, it is easiest to buy shim stock and trim to fit.



Pump Cable Adjustment

1. Adjust carburetor cable free play, carburetor synchronization, and idle speed, as described under *Carburetion* in this chapter.

2. Slowly rotate the throttle grip until all throttle cable free play has been taken up. The grip will become harder to turn after all free play is eliminated. Hold throttle grip in this position.

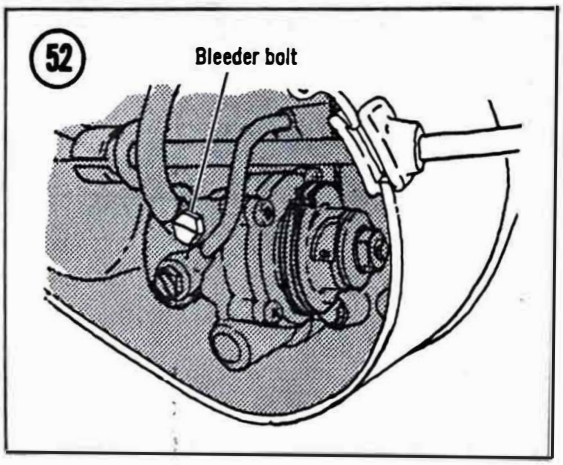
Pump Bleeding

The pump is equipped with a bleeder screw to bleed off air bubbles. The pump must be bled whenever it has been removed or the Autolub oil tank has run out of oil, or if there are air bubbles in the tank-to-pump delivery line.

CAUTION

If air enters the pump, it can possibly cause blockage of oil flow and irrepairable damage.

1. Remove the bleeder bolt. See **Figure 52**.

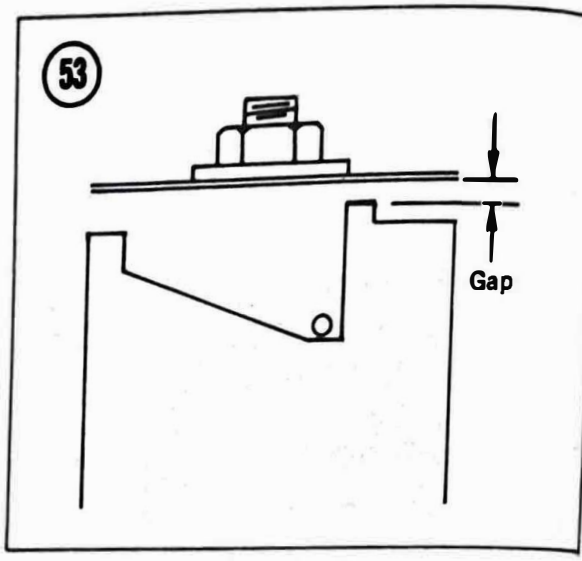


2. With the engine shut off, fully open the throttle grip and rotate the white plastic starter plate in the direction of the arrow on the plate. Continue priming the pump until air bubbles cease to come out of the bleed hole with the oil. Install the bleed screw.

3. See if the pulley guide pin lines up with the raised alignment mark on the pulley. See **Figure 53**. If adjustment is needed, loosen the adjuster locknut and rotate the cable adjuster until the pin and mark line up. Be sure to tighten the locknut.

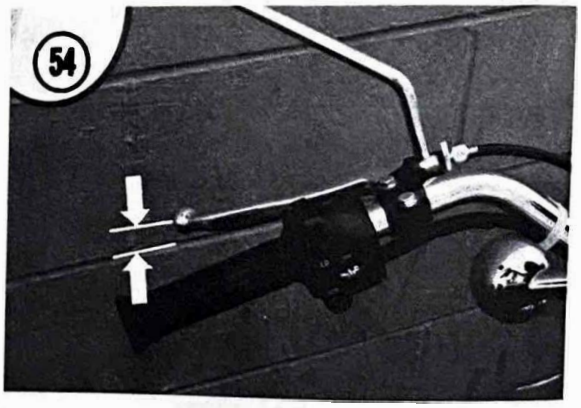
CLUTCH

If the clutch slips when it is engaged, or if the motorcycle creeps forward with the clutch disengaged, the free play is out of adjustment.

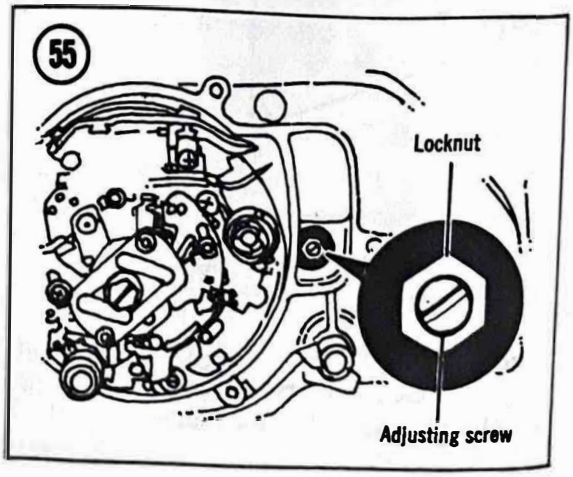


Free Play Adjustment

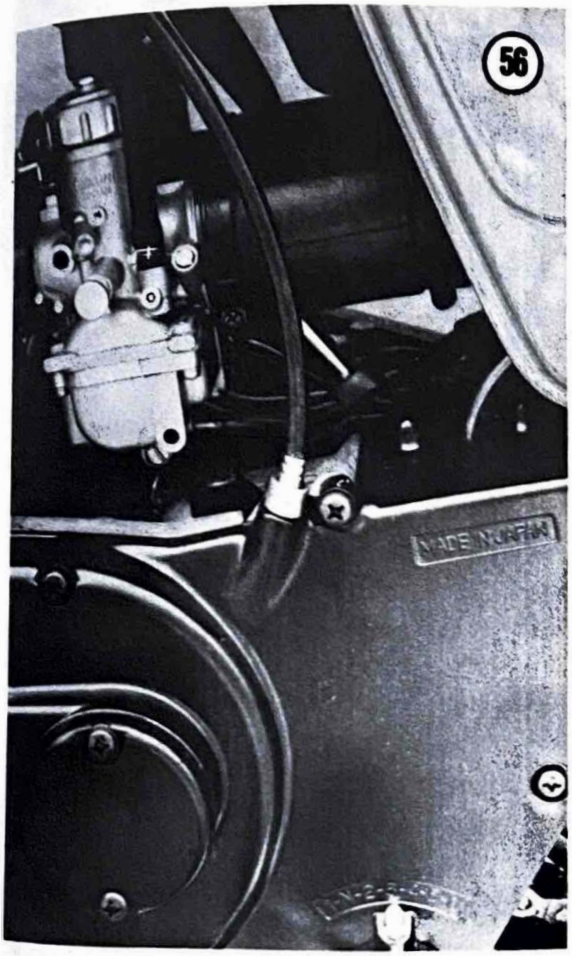
1. Measure free play at the tip of the lever. See **Figure 54**. It should be between 0.2-0.4 in. (0.5-1.0mm).



2. Major adjustment, if needed, should be made at the lower end of the clutch cable with fine adjustment at the grip end. See **Figure 55**.



3. Screw in the clutch cable adjusting bolt at the grip lever until it stops against the bracket.
4. Loosen the locknut, as shown in **Figure 56**. Slowly tighten the adjusting screw until it bottoms, then back the adjusting screw out ¼ turn. Tighten the locknut.



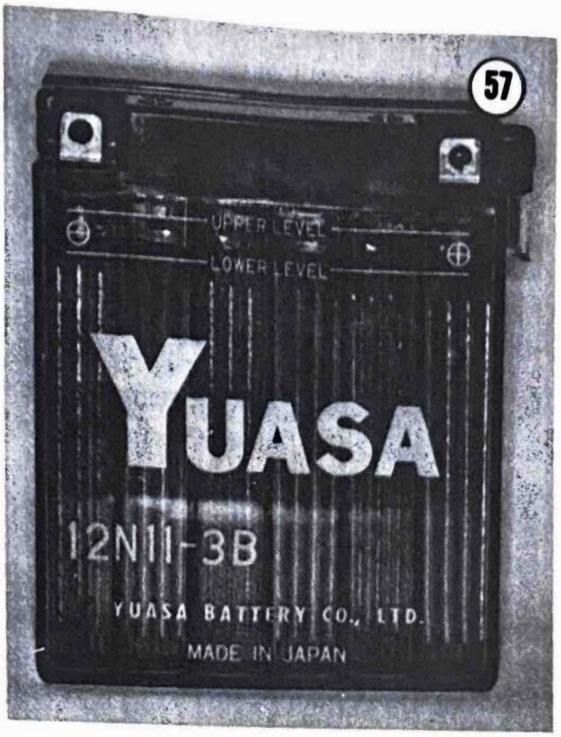
5. Final adjustment is made with the adjusting bolt at the clutch grip lever.
6. Back off the adjusting bolt until standard free play is achieved.

BATTERY CHECK

The battery is the heart of the electrical system. Its condition should be checked regularly.

Battery charging procedures are covered in Chapter Six, *Battery*.

1. Raise the seat.
2. Check electrolyte level. **Figure 57** shows the maximum and minimum marks. If necessary, top up with distilled water only. Be careful not to overfill.



CAUTION

Painted surfaces will be damaged if corrosive battery electrolyte is spilled on them. Flush away all spills with water, and neutralize with baking soda, if necessary.

3. Inspect the terminals for corrosion. Flush off any oxidation with a solution of baking soda and water. Coat the terminals lightly with Vaseline or a silicone grease to retard new corrosion.

HEADLIGHT

Adjustment

Proper headlight adjustment is essential to safe night riding. If the light is set too low, the road will be invisible. If set too high, it will blind oncoming cars. Adjustment is very simple and should be a part of routine maintenance. The procedure is as follows.

1. Place the machine approximately 15 ft. from a white or light colored wall.
2. Make sure the bike and wall are on level, parallel ground and that the machine is pointing directly ahead.
3. Measurements should be made with one seated rider and both wheels on the ground.

4. Draw a cross on the wall equal in height to the center of the headlight.

5. Put on the high beam. The cross should be centered in the concentrated beam of light.

6. If the light does not correspond to the mark, loosen the 2 bolts and adjust. Tighten the bolts and recheck positioning.

BRAKES

Disc Brake Adjustment

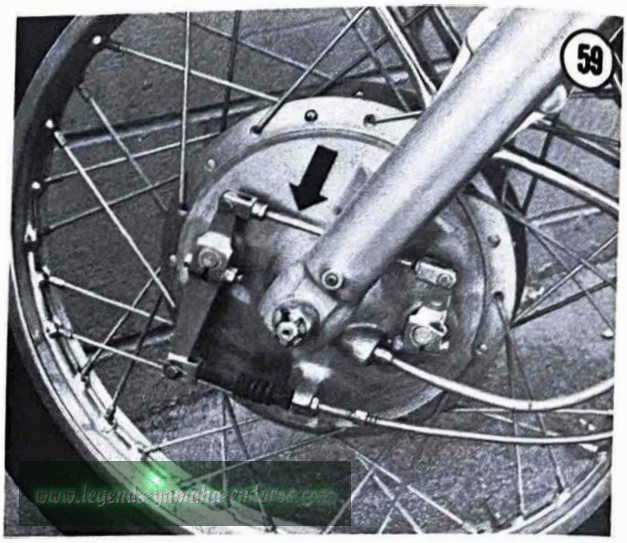
Disc brakes do not require adjustment in the same manner as drum type brakes. The hydraulic system automatically keeps the pucks in a correct position. The only adjustment needed is to take up brake pedal or lever free play at the adjustment points shown in **Figure 58**.

Front Brake Linkage Adjustment (Drum Brake)

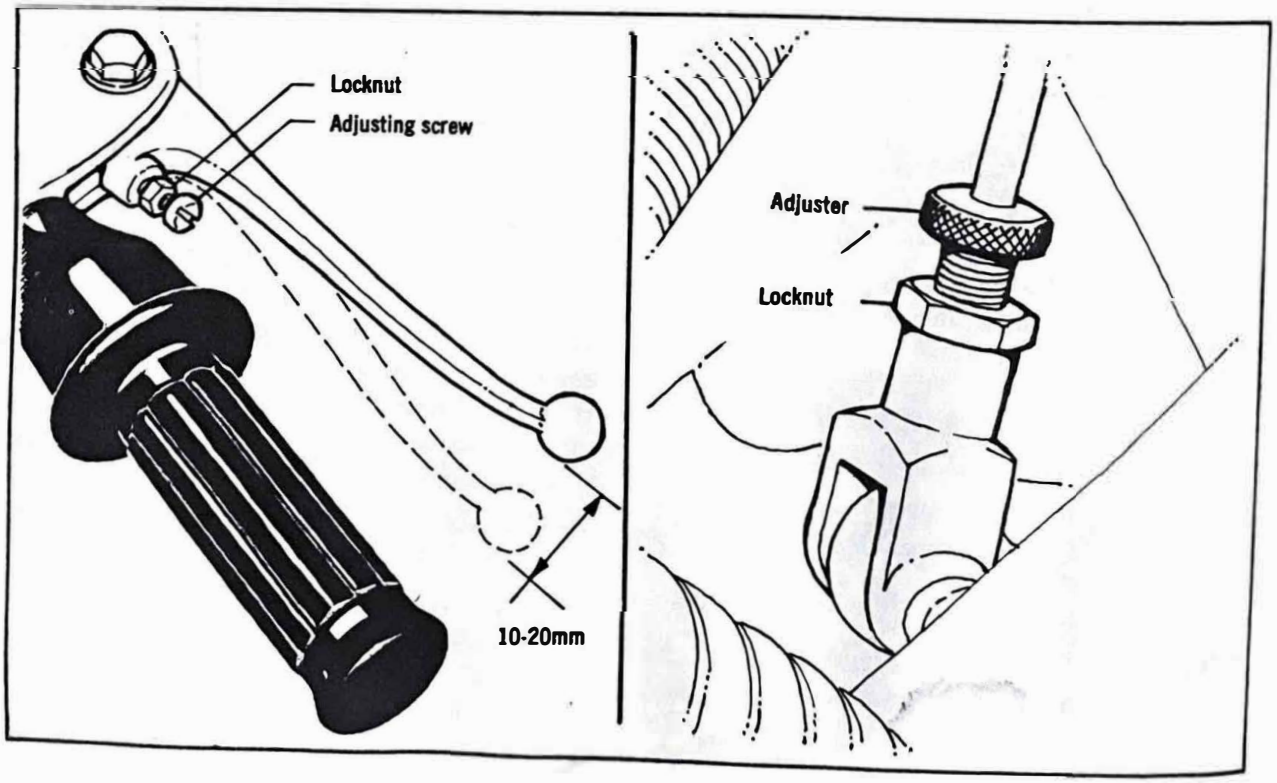
The front brake must be adjusted so that both shoes contact the drum simultaneously.

1. Disconnect the brake cable at the handlebar lever.

2. Loosen the interconnecting rod locknut and turn the rod so that both brake arms move away from each other until all free play is taken up. See **Figure 59**. Tighten the locknut. Raise the front wheel by placing a crate under the engine.



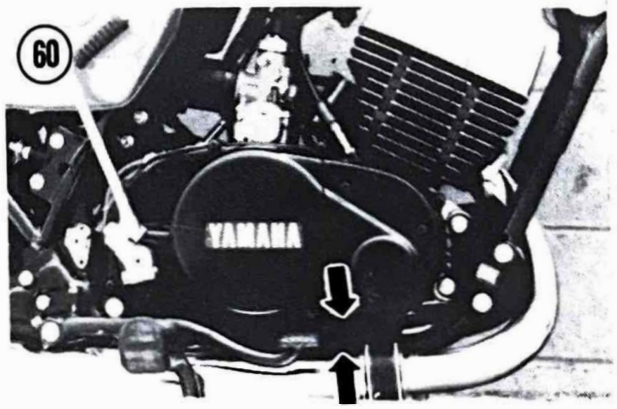
3. Reconnect the brake cable and turn out the cable adjuster while spinning the front wheel. Continue to adjust until you hear a scraping noise which indicates that the shoes are in contact with the drum. Back off on the cable adjuster until there is 0.25 in. (6.0mm) cable slack at the cable jacket end.



4. Adjust the brake lever by loosening the locknut and turning the adjuster until there is ⅛ in. (2-3mm) slack movement.

Rear Brake Linkage Adjustment (Drum Brake)

1. When it is at rest, the top of the brake pedal should be positioned about 1/16 in. (1.6mm) lower than the top of the right front footpeg. If it is not, loosen the locknut on the brake pedal stop bolt (**Figure 60**).



2. To raise the pedal, back out the stop bolt. To lower the pedal, screw in the stop bolt.

3. When the pedal is positioned correctly while at rest, tighten the stop bolt locknut.

4. Push down the rear brake pedal by hand. The brake cam lever and the brake rod should form an angle of 80-90°.

DRIVE CHAIN

Cleaning and Lubrication

Follow recommended service intervals listed in this chapter. More frequent attention is required when the machine has been ridden over dusty or muddy terrain. See *Periodic Lubrication, Drive Chain,* for normal lubrication.

Failure to clean the chain regularly will result in faster chain wear.

1. Remove the chain and clean with solvent and a stiff brush.

CAUTION

Always check both sprockets every time the chain is removed. If any wear is visible on the teeth, replace the sprocket. Never install a new chain over worn sprockets or a worn chain over new sprockets.

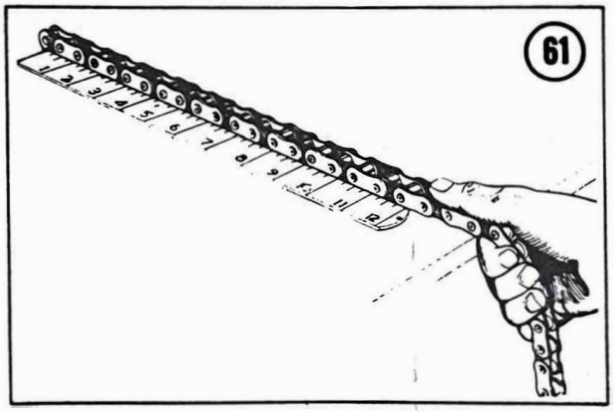
2. Rinse thoroughly in clean solvent and dry with a clean rag or compressed air.

3. Put the chain in a pail of melted grease or motor oil and then hang it up to drain excess lubricant. As an alternate, use one of the chain lubes sold by most motorcycle dealers.

Inspection

1. After cleaning the chain, examine it carefully for wear or damage. If any signs are visible, replace it.

2. Lay the chain alongside a ruler (**Figure 61**) and compress the links together. Then stretch them apart. If more than 0.25 in. (0.6mm) of movement is possible, replace the chain.



3. Check the inner faces of the inner plates. They should be lightly polished on both sides. If they show considerable wear on both sides, the sprockets are not aligned.

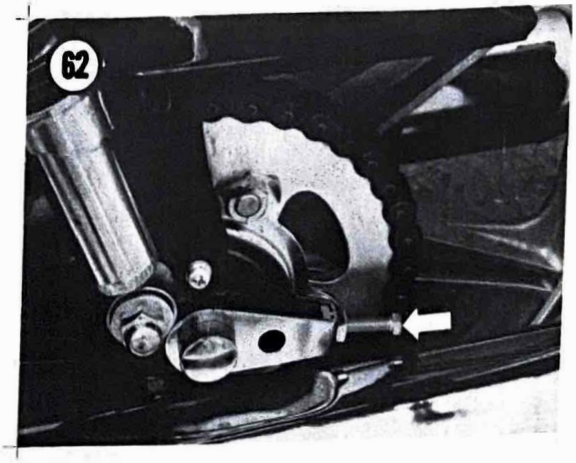
Adjust alignment as described in the following section.

Adjustment

1. Loosen the rear axle nut 3 turns.

2. Turn the chain adjuster nuts equally until the chain has 0.75 in. (20mm) slack on the bottom run with a rider on the machine (**Figure 62**).

3. Make sure that the sprockets are aligned by sighting along the top run of the chain. A straight chain is readily visible from the rear sprocket.



4. Tighten the axle nut and recheck alignment and slack.
5. Tighten the brake anchor bolt.

STORAGE

Long periods of inactivity can cause serious problems and a general deterioration of bike condition. This is especially important in areas of extreme cold weather. It can be important to specially prepare a bike for "hibernation."

Selecting a Storage Area

Most cyclists store their bikes in their home garage. Facilities suitable for long-term storage are readily available for rent or lease in most areas. In selecting a building, consider the following points:

1. The storage area must be dry, free from dampness, and excessive humidity. Heating is not necessary but the building should be well insulated to minimize extreme temperature variations.
2. Buildings with large window areas should be avoided, or such windows should be masked (also a good security measure) if direct sunlight can fall on the bike.
3. Buildings in industrial areas, where factories emit corrosive fumes, are not desirable, nor are facilities near bodies of salt water.
4. The area should be selected to minimize the possibility of loss by fire, theft, or vandalism. It is strongly recommended that the area be fully insured, perhaps with a package covering fire, theft, vandalism, weather, and liability. The advice of your insurance agent should be solicited on these matters. The building should be fireproof and items such as the security of doors and windows, alarm facilities, and proximity of police should be considered.

Preparing Bike for Storage

Careful pre-storage preparation will minimize deterioration and will ease restoring the bike to service in the spring. The following procedure is recommended:

1. Wash the bike completely to remove any accumulation of road salt that may have collected during the first weeks of winter. Wax all painted and polished surfaces.
2. Run the engine for 20-30 minutes to stabilize oil temperature. Drain oil regardless of mileage since oil change and replace with normal quantity of fresh oil.
3. Remove battery and coat cable terminals with petroleum jelly. If there is evidence of acid spillage in the battery box, neutralize with baking soda, wash clean, and repaint. Batteries should be kept in an area where they will not freeze, and where they can be recharged every 2 weeks.
4. Drain all gasoline from the fuel tank, settling bowl, and carburetor float bowls. Leave fuel cock on RESERVE position.
5. Remove spark plugs and add a small quantity of oil to each cylinder. Turn the engine a few revolutions by hand. Install spark plugs.
6. Insert a paper card, lightly saturated with silicone oil, between the points.
7. Check tire pressures. Move machine to storage area and store on center stand. If preparation is performed in an area remote from the storage facility, the bike should be trucked, not ridden, into storage.

Inspection During Storage

Try to inspect bike weekly while in storage. Any deterioration should be corrected as soon as possible. For example, if corrosion of bright metal parts is observed, cover them with a light film of grease or silicone spray after a thorough polishing.

Restoring Bike to Service

A bike that has been properly prepared, and stored in a suitable area, requires only light maintenance to restore it to service. It is advisable, however, to perform a spring tune-up.

1. Before removing the bike from the storage area, reinflate tires to the correct pressures. Air loss during storage may have nearly flattened the tires, and moving the bike can cause damage to tires, tubes, or rims.

2. When the bike is brought to the work area, immediately install the battery (fully charged) and fill the fuel tank. (The fuel cock should be on the RESERVE position; do not move yet.)

3. Check the fuel system for leaks. Remove carburetor float bowl or open the float bowl drain cock and allow several cups of fuel to pass through the system. Move the fuel cock slowly to the CLOSE position, remove the settling bowl and empty any accumulated water.

4. Perform normal tune-up described earlier and, when checking spark plugs, add a few drops of oil to each cylinder. Be especially certain to degrease ignition points if an oily card was used to inhibit oxidation during storage; use a non-petroleum solvent.

5. Check safety items, i.e., lights, horn, etc., as oxidation of switch contacts and/or sockets during storage may make one or more of these critical devices inoperative.

6. Test ride and clean the motorcycle.

CHAPTER THREE

TROUBLESHOOTING

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, methodical approach can guarantee success.

Never assume anything. Don't 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? Is the gas petcock in the ON or RESERVE position? Has a spark plug wire fallen off? Check the ignition switch. Sometimes the weight of keys on a key ring may turn the ignition off suddenly.

If nothing obvious turns up in a cursory 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 as saying "it quit on the highway at high speed and wouldn't start," or that "it sat in my garage for 3 months and then wouldn't start."

Gather as many symptoms together as possible to aid in diagnosis. Note whether the engine lost power gradually or all at once, what color smoke (if any) came from the exhaust, and so on. 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 the 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 don't 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 time lost 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.

TWO-STROKE ENGINE PRINCIPLES

The following discussion is provided to acquaint you with the operating cycle and principles of a 2-stroke engine. Understanding these principles can often times serve as an aid in

diagnosing, isolating, and remedying machine failures or malfunctions.

Figures 1 through 4 illustrate the 4 phases of the operating cycle of a 2-stroke engine. Notice that unlike conventional 4-stroke engines found in automobiles, the 2-stroke engine has no camshaft, timing gears, or valve mechanism. All valving action is accomplished by the piston as it moves up and down, thereby opening and closing ports in the cylinder and crankcase. Another major difference between the 2- and 4-stroke engine is that the crankcase in the 2-stroke engine must be sealed, since it doubles as a passageway through which fuel mixture reaches the combustion chamber.

During this discussion, assume that the crankshaft is rotating counterclockwise. In **Figure 1**, as the piston travels downward, a transfer port (A) between the crankcase and the cylinder is uncovered. The exhaust gases leave the cylinder through the exhaust port (B), which is also opened by the downward movement of the piston. A fresh fuel/air charge, which has previously been compressed slightly, travels from the crankcase (C) to the cylinder through the transfer port (A) as the port opens. Since the incoming charge is under pressure, it rushes into the cylinder quickly and helps to expel the exhaust gases from the previous cycle.

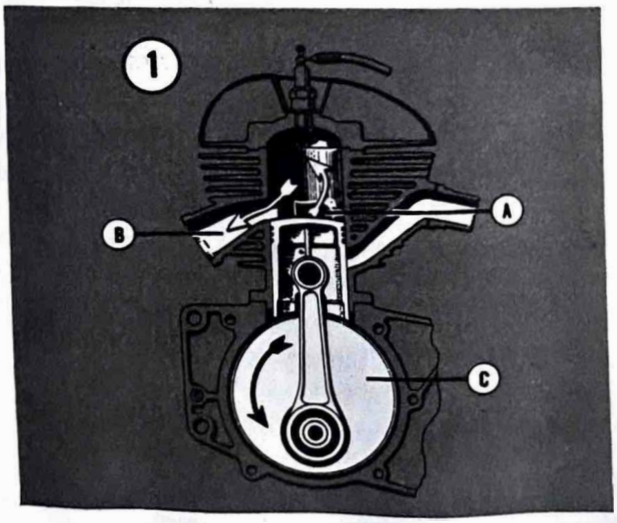
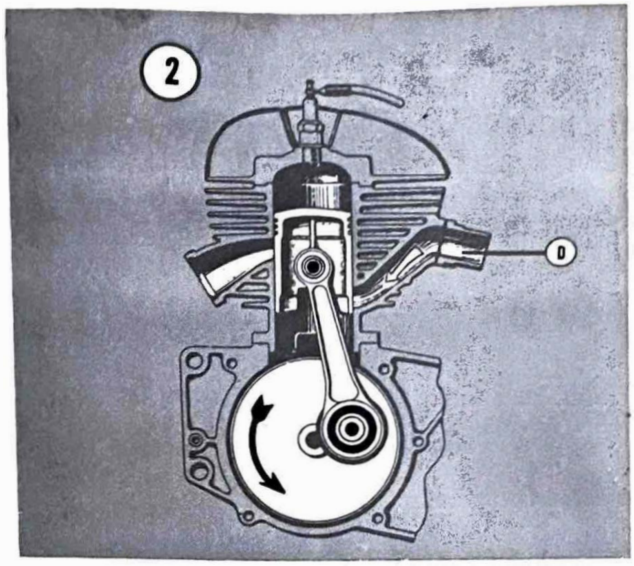
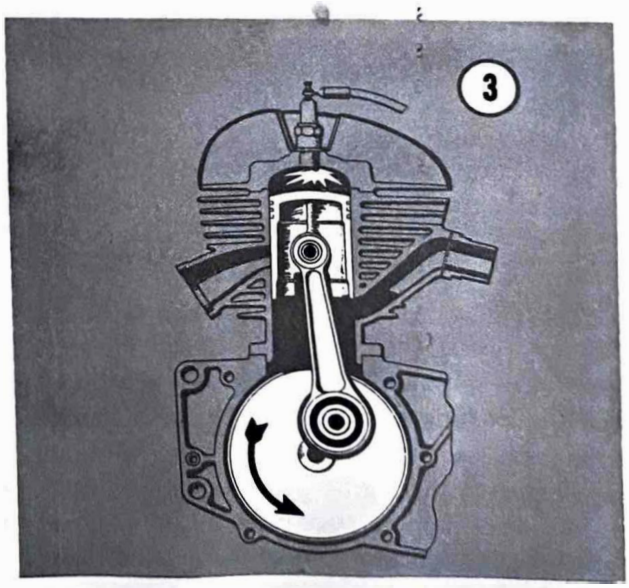


Figure 2 illustrates the next phase of the cycle. As the crankshaft continues to rotate, the piston moves upward, closing the exhaust and transfer ports. As the piston continues upward,



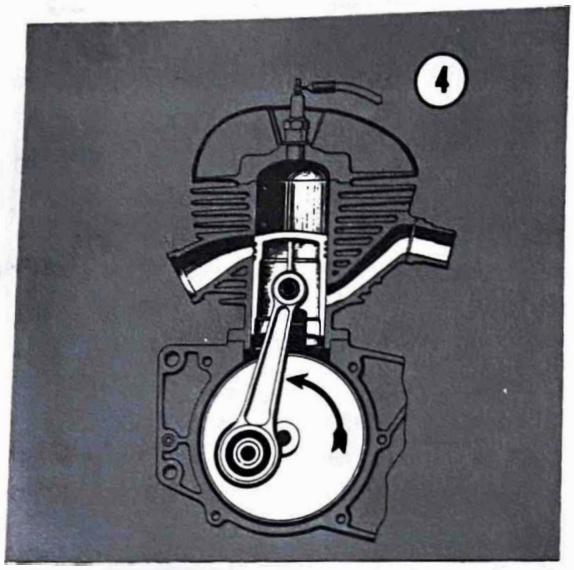
the fuel/air mixture in the cylinder is compressed. Notice also that a low pressure area is created in the crankcase at the same time. Further upward movement of the piston uncovers the intake port (D). A fresh fuel/air charge is then drawn into the crankcase through the intake port because of the low pressure created by the upward piston movement.

The third phase is shown in **Figure 3**. As the piston approaches top dead center, the spark plug fires, igniting the compressed mixture. The piston is then driven downward by the expanding gases.



When the top of the piston uncovers the exhaust port, the fourth phase begins, as shown in

Figure 4. The exhaust gases leave the cylinder through the exhaust port. As the piston continues downward, the intake port is closed and the mixture in the crankcase is compressed in preparation for the next cycle.



It can be seen from the foregoing discussion that every downward stroke of the piston is a power stroke. Twin cylinder engines are usually arranged so that the cylinders fire alternately, to produce 2 power strokes for each revolution of the crankshaft.

ENGINE LUBRICATION

The 2-stroke engine cannot receive its lubrication from an oil supply in the crankcase. Oil splash in the crankcase obviously would be carried with the fuel/air charge into the cylinder.

One common method for lubricating 2-stroke engines is to mix lubricating oil with gasoline. As the fuel mixture enters the crankcase, the oil is carried with it to the moving parts. This methods results in high consumption of oil, and also causes oil starvation during periods when the engine runs with the throttle closed, as when descending a long hill.

Yamaha's Autolube system uses an engine-driven oil pump to supply oil from a separate tank to the engine. The output from the pump is controlled both by engine speed and throttle position, and thus supplies the proper amount of oil to the engine under all operating conditions.

OPERATING REQUIREMENTS

An engine needs 3 basics to run properly: correct gas/air mixture, compression, and a spark at the right time. If one or more are missing, the engine won't run. The electrical system is the weakest link of the three. 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 a bike has been sitting for any length of time and refuses to start, check that battery is charged if the machine is so equipped. Then look to the gasoline delivery system; the tank, fuel petcocks, lines, and the carburetor. Rust may have formed in the tank, obstructing fuel flow. Gasoline deposits may have gummed up carburetor jets and air passages. Gasoline tends to lose its potency after standing for long periods. Condensation may contaminate it with water. Drain old gas and try starting with a fresh tankful.

Compression, or the lack of it, usually enters the picture only in the case of older machines. Worn or broken pistons, rings, and cylinder bores could prevent starting. Generally, a gradual power loss, and harder and harder starting will be readily apparent in this case.

STARTING DIFFICULTIES

Check gas flow first. Remove the gas cap and look into the tank. If gas is present, pull off a fuel line at the carburetor and see if gas flows freely. If none comes out, the fuel tap may be shut off, blocked by rust or foreign matter, or the fuel lines may be stopped up or kinked. If the carburetor is getting usable fuel, check the electrical system.

Check that the battery is charged by turning on the lights or by beeping horn. Have battery recharged if necessary.

Pull off the spark plug cap, remove the spark plug, and reconnect the cap. Lay the plug against the cylinder head so its base makes a good connection, and turn the engine over with the kick-starter. A fat, blue spark should jump across the electrodes. If there is no spark, or a weak one, you have electrical system trouble. Check for a

defective plug by replacing it with a known good one. Don't assume a plug is good just because it is new.

Once the plug has been cleared of guilt, but there's still no spark, start backtracking through the system. If the contact at the end of the spark plug wire can be exposed, it can be held about ⅛ inch from the head while the engine is turned over to check for a spark. Remember to hold the wire only by its insulation to avoid a nasty shock. If the plug wires are dirty, greasy, or wet, wrap a rag around them so you don't get shocked. If you do feel a shock or see sparks along the wire, clean or replace the wire and/or its connections.

If there is no spark at the plug wire, look for loose connections at the coil and battery. If all seems in order there, check next for oily or dirty contact points. Clean points with electrical contact cleaner, or a strip of paper. On battery ignition models, with the ignition switch turned on, open and close the points manually with a screwdriver.

No spark at the points with this test indicates a failure in the ignition system. Refer to Chapter Two for check-out procedures for the entire system and individual components. Refer to the same chapter for checking and setting ignition timing.

Note that spark plugs of an incorrect heat range (too cold) may cause hard starting. Set gap to specifications. If you have just ridden through a puddle or washed the bike and it won't start, dry off the plug and plug wire. Water may have entered the carburetor and fouled the fuel under these conditions, but a wet plug and wire are the more likely problem.

If a healthy spark occurs at the right time, and there is adequate gas flow to the carburetor, check the carburetor itself at this time. Make sure all jets and air passages are clean, check float level, and adjust if necessary. Shake the float to check for gasoline inside it, and replace or repair as indicated. Check that the carburetor is mounted snugly, and no air is leaking past the mounting flange. Check for a clogged air filter.

Compression may be checked in the field by turning the kickstarter by hand and noting that an adequate resistance is felt, or by removing the spark plug and placing a finger over the plug hole and feeling for pressure.

An accurate compression check gives a good idea of the condition of the basic working parts of the engine. To perform this test, you need a compression gauge. The motor should be warm.

1. Remove the plug on the cylinder to be tested and clean out any dirt or grease.
2. Insert the tip of the gauge into the hole, making sure it is seated correctly.
3. Open the throttle all the way.
4. Crank the engine several times and record the highest pressure reading on the gauge.

POOR IDLING

Poor idling may be caused by incorrect carburetor adjustment, incorrect timing, or ignition system defects. Check the gas cap vent for an obstruction. Also check for loose carburetor mounting bolts or a poor carburetor flange gasket.

MISFIRING

Misfiring can be caused by a weak spark or dirty plugs. Check for fuel contamination. Run the machine at night to check for spark leaks along the plug wires and under spark plug cap.

WARNING

Do not run engine in dark garage to check for spark leaks. There is considerable danger of carbon monoxide poisoning.

If misfiring occurs only at certain throttle settings, refer to the fuel system chapter for the specific carburetor components involved. Misfiring under heavy load, as when climbing hills or accelerating, is usually caused by bad spark plugs.

FLAT SPOTS

If the engine seems to die momentarily when the throttle is opened and then recovers, check for a dirty main jet in the carburetor, water in the fuel, or an excessively lean mixture.

POWER LOSS

Poor condition of rings, pistons, or cylinders will cause a lack of power and speed. Ignition timing should be checked.

OVERHEATING

If the engine seems to run too hot all the time, be sure you are not idling it for long periods. Air-cooled engines are not designed to operate at a standstill for any length of time. Heavy stop and go traffic is hard on a motorcycle engine. Spark plugs of the wrong heat range can burn pistons. An excessively lean gas mixture may cause overheating. Check ignition timing. Don't ride in too high a gear. Broken or worn rings may permit compression gases to leak past them, heating heads and cylinders excessively. Check oil level and use the proper grade lubricants.

BACKFIRING

Check that the timing is not advanced too far. Check fuel for contamination.

ENGINE NOISES

Experience is needed to diagnose accurately in this area. Noises are hard to differentiate and harder yet to describe. Deep knocking noises usually mean main bearing failure. A slapping noise generally comes from loose pistons. A light knocking noise during acceleration may be a bad connecting rod bearing. Pinging, which sounds like marbles being shaken in a tin can, is caused by ignition advanced too far or gasoline with too low an octane rating. Pinging should be corrected immediately or piston damage will result. Compression leaks at the head/cylinder joint will sound like a rapid on-and-off squeal.

PISTON SEIZURE

Piston seizure is caused by incorrect piston clearances when fitted, fitting rings with improper end gap, too thin an oil being used, incorrect spark plug heat range, or incorrect ignition timing. Overheating from any cause may result in seizure.

EXCESSIVE VIBRATION

Excessive vibration may be caused by loose motor mounts, worn engine or transmission bearings, loose wheels, worn swinging arm bushings, a generally poor running engine, broken or cracked frame, or one that has been damaged in a collision. Also see *Poor Handling*.

CLUTCH SLIP OR DRAG

Clutch slip may be due to worn plates, improper adjustment, or glazed plates. A dragging clutch could result from damaged or bent plates, improper adjustment, or uneven clutch spring pressure. Refer to appropriate chapters, as required, for adjustment, inspection, and maintenance procedures.

TRANSMISSION

Transmission problems are usually indicated by one or more of the following symptoms:

a. Difficult shifting gears
b. Gear clash when downshifting
c. Slipping out of gear
d. Excessive noise in neutral
e. Excessive noise in gear

Transmission symptoms are sometimes hard to distinguish from clutch symptoms. Be sure the clutch is not causing the problem before working on the transmission.

POOR HANDLING

Poor handling may be caused by improper tire pressures, a damaged frame or swinging arm, worn shocks or front forks, weak fork springs, a bent or broken steering stem, misaligned wheels, loose or missing spokes, worn tires, bent handlebars, worn wheel bearings, or dragging brakes.

BRAKE PROBLEMS

Sticking drum brakes may be caused by broken or weak return springs, an improper cable or rod adjustment, or dry pivot and cam bushings. Grabbing brakes may be caused by

greasy linings (which must be replaced). Brake grab may also be caused by out-of-round drums or brake linings which have broken loose from the brake shoes. Glazed linings or pads will cause a loss of stopping power.

LIGHTING PROBLEMS

Bulbs which continuously burn out may be caused by excessive vibration, loose connections that permit sudden current surges, poor battery connections, or installation of wrong type bulb.

A dead battery or one which discharges quickly may be caused by a faulty generator or rectifier. Check for loose or corroded terminals. Shorted battery cells or broken terminals will keep a battery from charging. Low water level will decrease a battery's capacity. A battery left uncharged after installation will sulphate, rendering it useless.

A majority of light and horn or other electrical accessory problems are caused by loose or corroded ground connections. Check those first, and then substitute known good units for easier troubleshooting.

TROUBLESHOOTING GUIDE

Table 1 summarizes the troubleshooting process. Use it to outline possible problem areas, then refer to the specific chapter or section involved.

Table 1 TROUBLESHOOTING GUIDE

Item	Problem or Cause	Things to Check
No start or difficult to start	No spark	Ignition main switch Point assembly Condenser Coil Spark plug and lead Ignition timing Wiring and connections
	No fuel	Fuel tank Fuel line Fuel petcock Carburetor (main jet and fuel flow)
	Blocked air intake or malfunction	Filter(s) Reed valve assembly
Air/fuel mixture	Rough idle Hard starting (especially when hot) Black exhaust deposits Gas-fouled spark plug Poor gas mileage	Carburetor mixture adjusted too rich
	Backfiring Rough idle Overheating Hesitation upon acceleration Loss of power White color on spark plug insulator	Carburetor mixture adjusted too lean
No spark, weak or improperly timed spark	No spark or weak spark, both cylinders	Battery Fuse Ignition main switch Loose or corroded connections Broken wires
	No spark or weak spark, one cylinder only	Incorrect point gap Dirty or oily points Spark plug lead damaged Defective primary wire Open or shorted coil winding Defective condenser
	Misfires	Dirty or fouled spark plug Improper spark plug (too hot or cold) Weak spring on ignition points Ignition timing
Loss of power	Poor compression	Piston rings and cylinder Head gaskets Crankcase leaks

(continued)

Table 1 TROUBLESHOOTING GUIDE (continued)

Item	Problem or Cause	Things to Check
Loss of power(continued)	Overheated engine	Lubricating oil supply Clogged cooling fins Ignition timing Slipping clutch Carbon in combustion chamber
	Improper mixture	Dirty air cleaner Restricted fuel flow Gas cap vent holes plugged
	Miscellaneous	Dragging brakes Tight wheel bearings Defective chain Clogged exhaust system
Steering problems	Hard steering	Tire pressure Steering damper adjustment Steering stem head Steering head bearings
	Pulls to one side	Unbalanced shock absorbers Drive chain adjustment Front/rear wheel alignment Unbalanced tires Defective swinging arm Defective steering head
	Shimmy	Drive chain adjustment Loose or missing spokes Deformed rims Worn wheel bearings Wheel balance
Gearshifting difficulties	Clutch	Adjustment Springs Friction plates Steel plates Oil quantity
	Transmission	Oil quantity Oil grade Change drum Change forks Change lever adjustment
Brake troubles	Poor brakes	Brake adjustment Oil or water on brake linings Loose linkage or cables
	Noisy brakes	Worn or scratched lining or disc Scratched brake drums or disc Dirt in brake hub
	Unadjustable brakes	Worn linings or pads Worn drums or disc Worn brake cams

CHAPTER FOUR

ENGINE, TRANSMISSION, AND CLUTCH

This chapter describes the removal, disassembly, servicing, and assembly of the engine, transmission, clutch, and Autolube system. Service the engine without removing it from the chassis except for overhaul of the crankshaft assembly, transmission, gearshift mechanism, or bearings.

Thoroughly clean the engine exterior of dirt, oil, and foreign material, using one of the cleaners formulated for the purpose.

Be certain that you have the proper tools for the job. See *Tools*, Chapter One.

As you remove parts from the engine, clean and place in trays in the order of disassembly. Doing this will make assembly faster and easier, and will ensure correct installation of all engine parts.

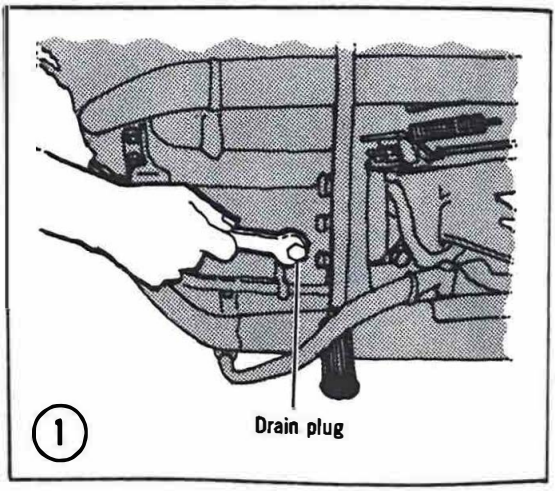
Note that there are different disassembly procedures for the various engines covered by this manual. Be sure to follow the procedure which applies to your engine.

ENGINE

Removal/Installation

The procedure for removing the engine is generally similar for all models.

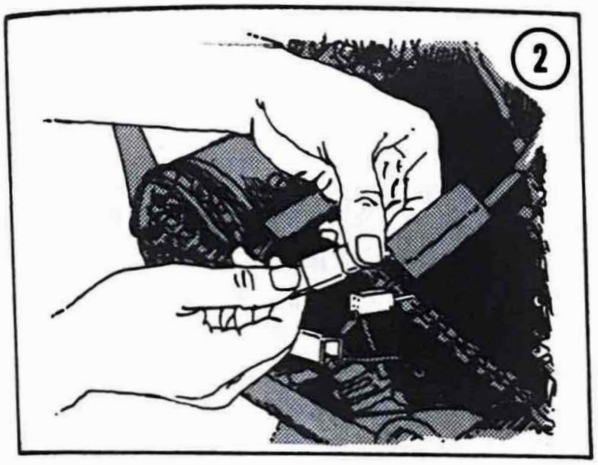
1. Start the engine and warm it up for a few minutes. Drain transmission oil. The drain bolt is located on the underside of the engine, as shown in **Figure 1**.

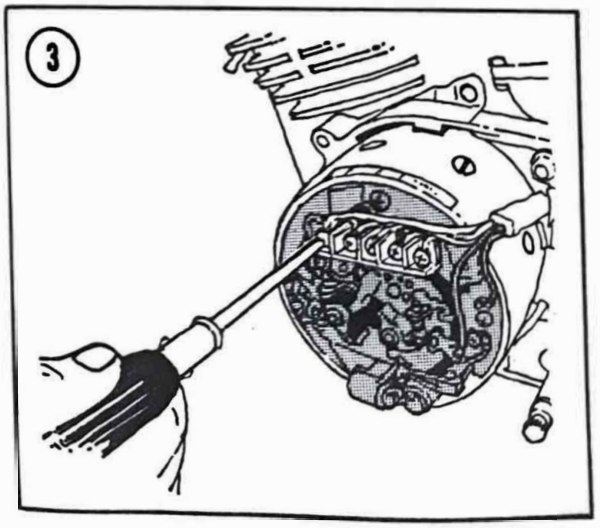


2. Remove both exhaust pipes and mufflers. On models that secure the pipe to the cylinder with a ring nut, use a pin wrench. Penetrating oil helps if rust build-up makes nut removal difficult. When threading these nuts back on, oil them, then take care to prevent cross-threading; these are fine threads which can easily be stripped.
3. Remove the gearshift lever on the left side, and remove the footrest assembly if needed.

4. Remove the case cover. (On YDS3 and YM1 models, this would be the right case; all other models require left case cover removal.)

5. Disconnect all wiring. On R5, RD250, and RD350 series, pull apart the connectors as shown in **Figure 2**. On all other models, first loosen the screw-type terminals on the yoke, then lift the wires free. **Figure 3** shows their location. Remove the black ground wire anchored to one side.

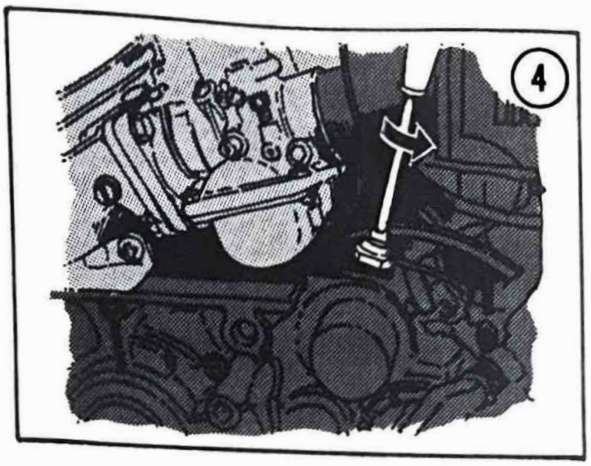


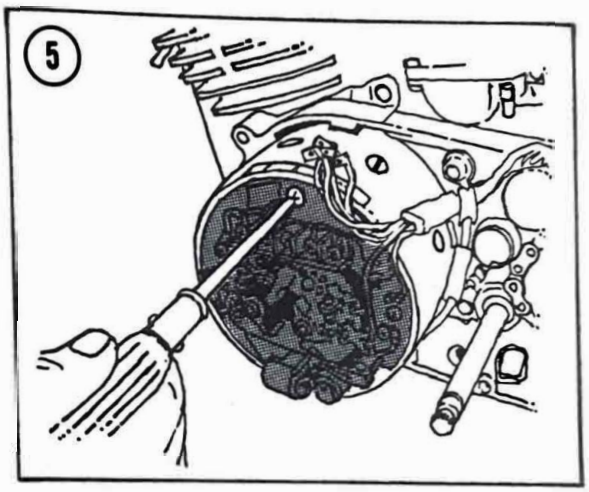


Match the wire color with the color identification band pasted right above the terminals during assembly.

6. Disconnect the light blue wire at the point shown in **Figure 4**.

7. Remove the yoke assembly. On all models you can slide the yoke off once the 2 long retaining screws have been removed. See **Figure 5**. Pull the carbon brushes back to prevent brush





damage during yoke removal or installation. The spring that pushes the brush against the commutator can be held to one side until the brush is pulled partially out. Release the spring to wedge it against the brush, holding it in place.

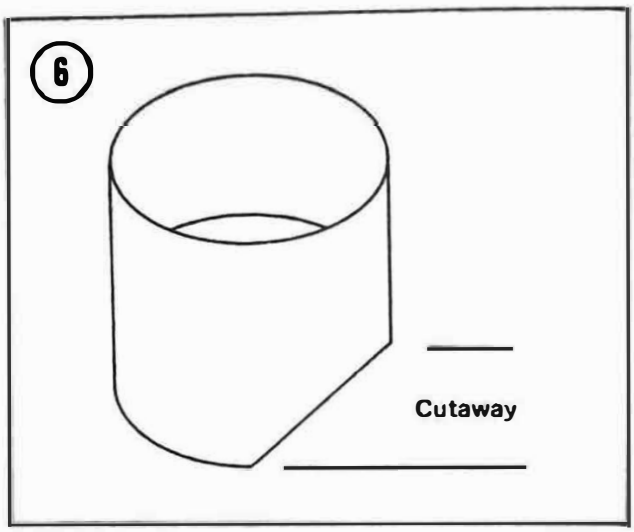
8. Remove the center bolt, then pull out the point cam (and combined advance unit, if it has a starter/generator). Use a slide hammer to run the proper fitting bolt through the slide weight, then screw the bolt into the threaded armature center until it seats. Slide the weight back quickly, striking the bolt end, until the armature (rotor) pops loose. Do not stand directly in line with the sliding weight; if the armature comes loose suddenly, it may come off with considerable force. Pull off the Woodruff key from its slot in the crankshaft.

9. Remove the carburetor-to-air cleaner rubber connectors.

10. Unscrew the ring nuts at the top of each carburetor and remove both throttle valves.

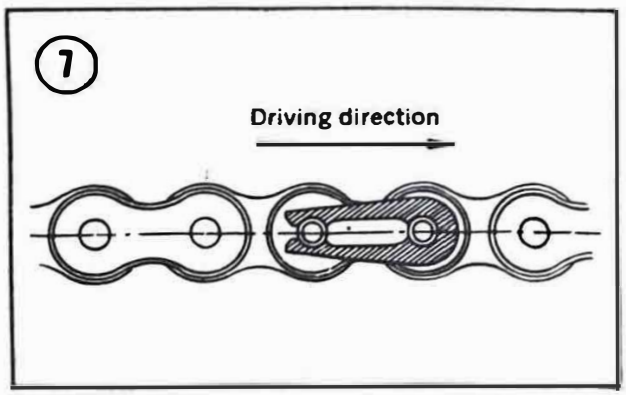
CAUTION

When installing the slides, the bottom notched part (cutaway) must face the air filter. See **Figure 6**. *If installed backward, the slides will not drop to idle position. This could cause sudden acceleration when the engine is started.*



11. Disconnect the fuel lines and remove the carburetors. Be sure the fuel petcock is closed.

12. Disconnect the master link and remove the chain. When you install the chain, be sure to position the master link as shown in **Figure 7**. Adjust chain tension so that there is approximately 0.8 in. (20mm) up-and-down movement of the chain, measured on the lower chain run, with the rider in position.



NOTE: *If you plan to remove the drive sprocket, loosen it now with the chain attached. With the rear brake applied, the chain will lock the drive sprocket in place, making it easy to loosen the nut.*

13. Disconnect the oil line at the oil tank. Be sure to plug the hole to prevent oil from flowing out.

14. Remove the Autolube pump cover, then disconnect the Autolube cable. Wind the wire off the pulley, then slide the end free. Completely unscrew the Autolube cable adjuster from the engine case.

NOTE: *During assembly, operate the throttle grip to make sure you have wound the wire around the pulley in the proper direction.*

15. Remove the tachometer cable. Disconnect the clutch cable.

16. Disconnect the engine mounting bolts. Straddle the machine, grasp the engine by the cylinder and starter pedal, and lift up and out.

17. To install the engine, reverse removal procedure. Fill the transmission and bleed the Autolube pump before you start the engine as described in Chapter Two, *Periodic Lubrication.*

CYLINDER HEAD

Removal/Installation

1. Let the engine cool.
2. Loosen the head retaining nuts ¼ turn at a time in a crisscross pattern.
3. Lift off the heads and head gaskets.
4. Install new gaskets during assembly if there is any doubt about their condition.
5. Tighten the cylinder head nuts in a crisscross pattern, in 2 torquing steps, to the final torque specified in **Table 1**.

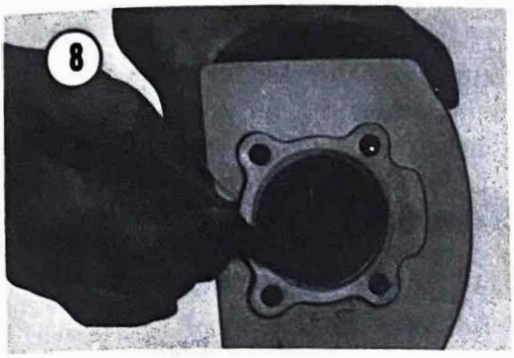
Table 1 CYLINDER HEAD TORQUE

Bolt Size	Torque
8mm	15 to 18 ft.-lb. (2.2 mkg)
10mm	25 to 30 ft.-lb. (3.5 to 4.0 mkg)

Carbon Removal

Carbon deposits inside the dome of the cylinder head increase the compression ratio and may cause preignition and overheating. To re-

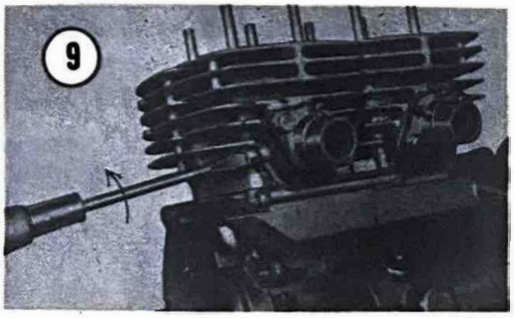
move, scrape them off with the rounded end of a hacksaw blade as shown in **Figure 8.**



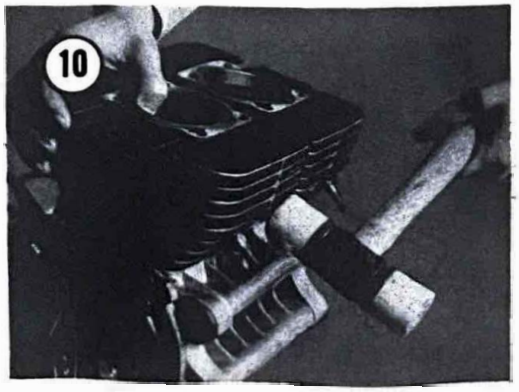
CYLINDER

Removal

1. Disconnect the oil delivery tube at each cylinder (**Figure 9**).



2. Strike the cylinder lightly with a soft mallet to loosen it from the crankcase, then pull upward to remove. See **Figure 10.** Stuff a rag in the crankcase openings to prevent any dirt or debris from entering.



CAUTION

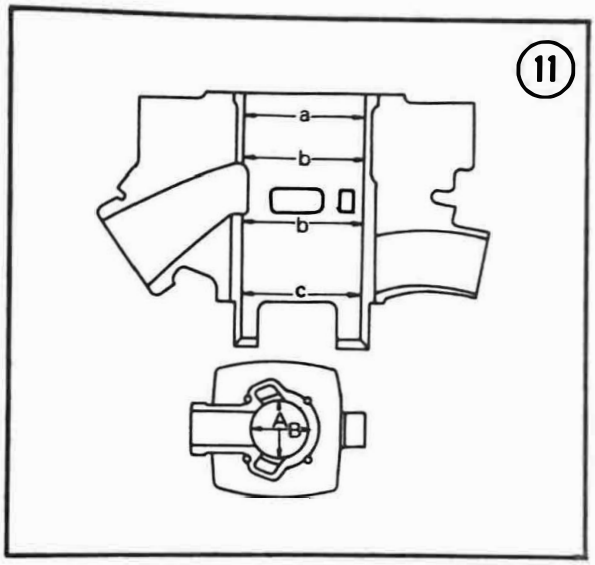
Don't allow the pistons to hit the case.

3. Remove clip and wrist pin to remove piston.

4. Replace the cylinder base gaskets during assembly.

Inspection

Measure the diameter of each cylinder at 4 depths, as shown in **Figure 11.** These measurements should be made at right angles and parallel to the crankshaft. For all models, if the difference between the maximum and minimum diameters exceeds 0.0019 in. (0.05mm), rebore and hone the cylinder to the next oversize.



Reconditioning

1. Pistons are available in oversizes of 0.25mm.
2. The cylinder should be bored and honed to the diameter of the oversize pistons, plus minimum allowable clearance, as specified in **Table 2.**
3. Maximum difference between minumum and maximum diameter of the cylinder should be 0.0004 in. (0.01 mm).

Carbon Removal

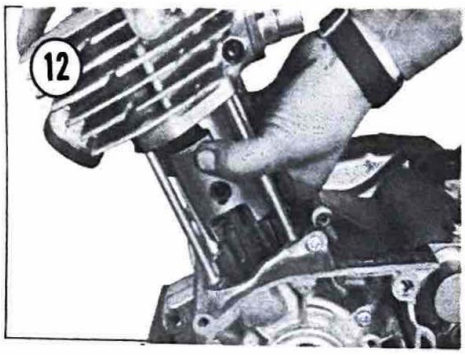
Use a broken rounded hacksaw blade to remove all carbon deposits from the exhaust and transfer ports.

Installation

Figure 12 illustrates cylinder installation procedure. Reverse the removal procedure, in addition to the following.

Table 2 CYLINDER OVERSIZE CLEARANCE

Engine Size	Clearance	
250cc*, 305cc, YR1, RD350B, RD400	0.0014-0.0016 in.	(0.035-0.040mm)
YR2, YR2-C, R3, R3-C	0.0012-0.0014 in.	(0.030-0.035mm)
R5, R5-B, R5-C*, RD350, RD350A	0.0016-0.0018 in.	(0.040-0.045mm)
* Except YM1 and YDS3, 0.0020-0.0022 in. (0.050-0.055mm)		



1. Lubricate the pistons and cylinders.
2. Be sure that the ends of the piston rings are aligned with the locating pins in the ring grooves.
3. Compress the rings with your fingers, then carefully insert the pistons into the cylinders.

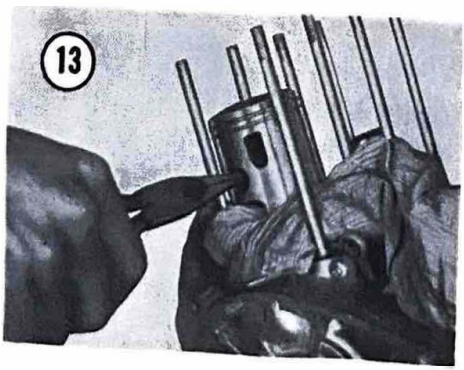
CAUTION

Be careful that you do not damage the rings against the base of the cylinder.

PISTON WRIST PINS

Removal

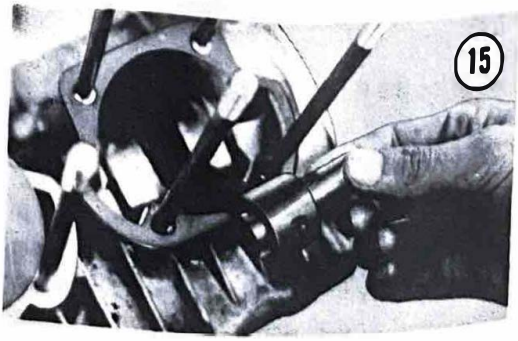
1. Use needlenose pliers to remove the clips from each end of the piston pins, as shown in **Figure 13**.



2. Press out the piston pins with a finger or suitable tool.
3. Throw away old circlips and use new ones during assembly.
4. Mark each piston with a felt pen to identify it as left- or right-hand piston. Pistons must always be kept matched with their proper cylinder, since they have been fitted to each other.

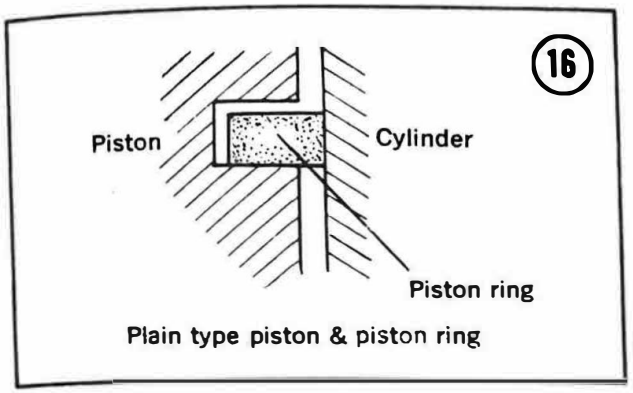
Installation

The piston pin should fit snugly in its bore so that it drags slightly as you turn it. Replace the piston pin and/or piston if the piston pin is loose. If the piston pin shows step wear in the center, replace the needle bearing in the upper end of the connecting rod also. Check the small end of the connecting rod for wear by inserting the piston pin into the bearing. **Figures 14 and 15** illustrate the procedure for checking the piston pin fit.

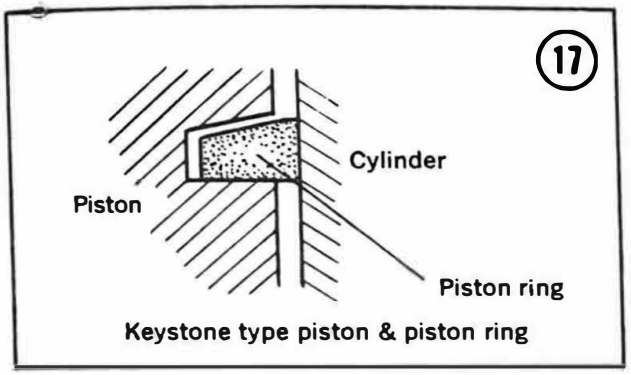


PISTON RINGS

Some engines are equipped with Keystone pistons and rings. Keystone and conventional rings are compared in **Figures 16 and 17**.

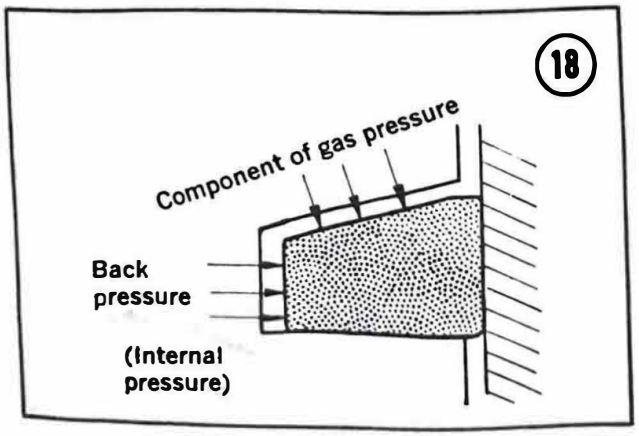


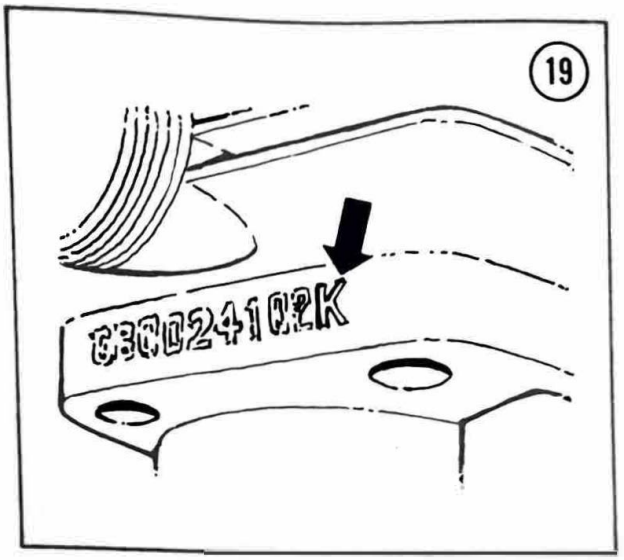
Plain type piston & piston ring



Keystone type piston & piston ring

Keystone rings can be identified by their shape; the top and bottom edges are not parallel and are not interchangeable with the conventional type. They must be used with special pistons. See **Figure 18**. Keystone pistons may be identified by a "K" stamped on the head (**Figure 19**) after the piston size. These are handled in the same manner as conventional rings.





Replacement

1. Remove the piston rings by spreading the top ring with a thumb on each end, as shown in **Figure 20**. Remove the ring from the top. Repeat this procedure for the remaining ring.
2. Measure each ring for wear by inserting the ring into the cylinder, parallel to the bottom edge. Measure the gap with a feeler gauge (**Figure 21**). If the end gap is not as specified in **Table 3**, replace the ring.

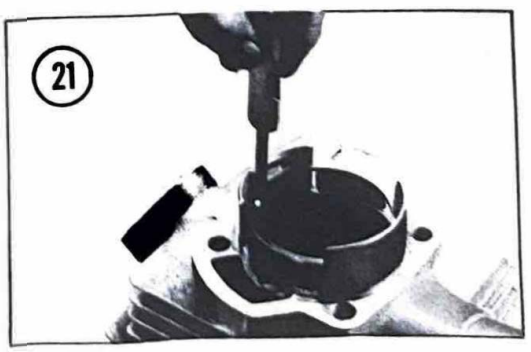
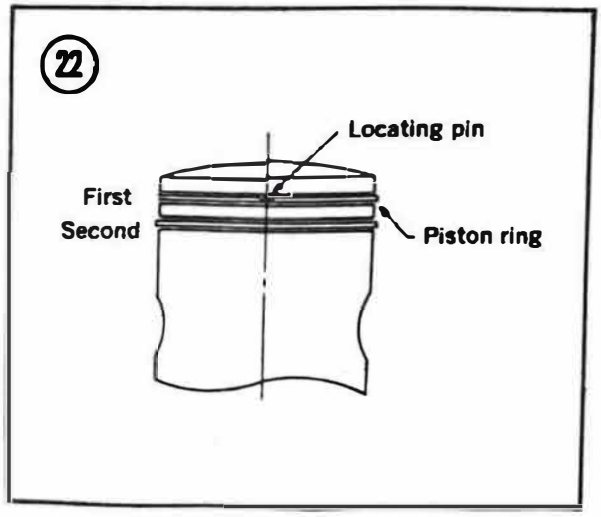


Table 3 PISTON RING GAP

Model	Gap Inch	Gap Millimeter
DS6, DS6-B, DS6-C, DS7	0.006-0.014	(0.15-0.35)
RD250, RD250A, RD250B	0.008-0.016	(0.20-0.40)
YDS3, YDS3-C, YM1, YDS5, YM2, YM2-C		
(Upper ring)	0.006-0.012	(0.15-0.30)
(Lower ring)	0.004-0.008	(0.10-0.20)
YR1, YR2, YR2-C	0.006-0.014	(0.15-0.35)
R5, R5-B, R5-C	0.018-0.025	(0.45-0.65)
R3, R3-C, RD350, RD350A	0.006-0.014	(0.15-0.35)
RD350B, RD400	0.008-0.016	(0.20-0.40)

3. Clean all carbon and gum from the piston ring grooves. Any deposits left in the grooves will cause the rings to stick, thereby allowing gas blow-by and loss of power. To clean the groove, carefully scrape with an old broken ring.

4. To replace the rings, first install the lower ring, then the upper one. Use a pair of piston ring pliers, if available. If not, spread the rings carefully with your thumbs enough to slip them over the piston. Align the end gaps with the locating pin in each ring groove, as shown in **Figure 22**. Conventional rings are installed with the printing upward. On Keystone rings, the beveled edge of the ring is installed upward.



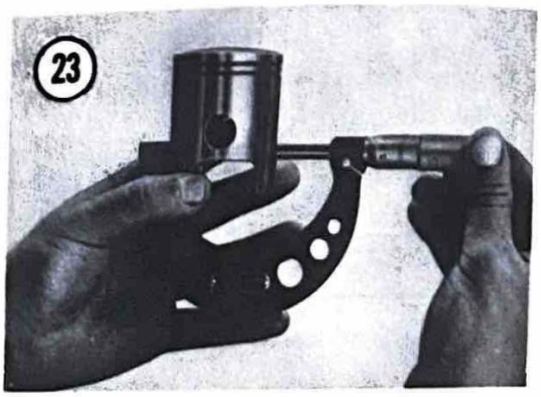
PISTON

Removal

Refer to *Cylinder, Removal,* in this chapter for piston removal procedure.

Piston-to-Cylinder Clearance

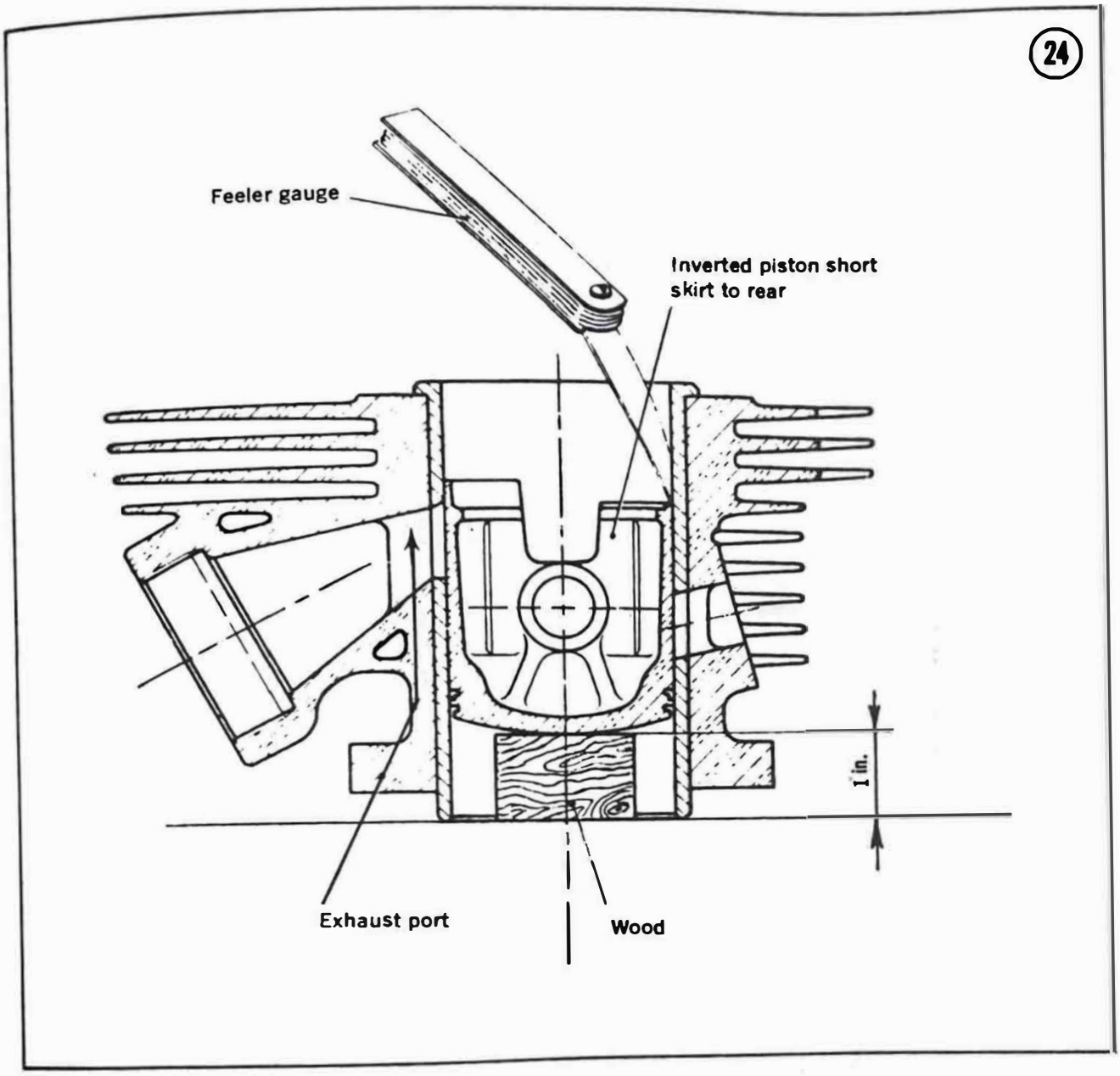
Piston clearance is the difference between minimum cylinder diameter and maximum piston diameter. See **Figure 23**. With an outside micrometer, measure the diameter of the piston ⅜ in. (10mm) from the bottom, at right angles to the piston pin. Proper clearance is 0.004 in. (0.01mm).



If a cylinder gauge and outside micrometer are not available to determine piston clearance, try the following procedure to establish an approximate value. **Figure 24** shows that if you insert the piston into the cylinder, then insert the largest possible feeler gauge that will fit alongside the piston, feeler gauge size will be close to existing piston-to-cylinder clearance. Compare with the figures given in **Table 2**. If clearance is 0.004 in. (0.1mm) or larger, piston noise will occur. Either reboring or installation of a new piston or cylinder will be required.

NOTE: *If above wear conditions exist, and you have no measuring micrometer, have a shop measure both cylinder and piston to decide which needs replacement or reconditioning.*

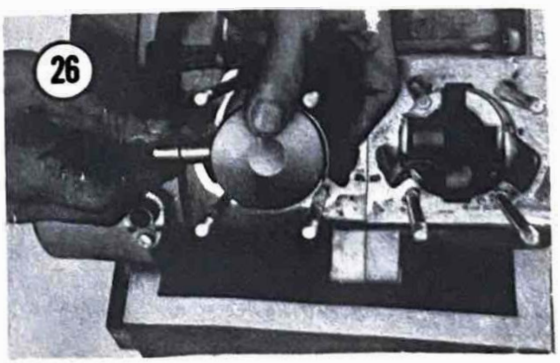
A piston showing signs of seizure will cause noise, loss of power, and damage to the cylinder wall. If such a piston is reused without correction, another seizure will develop. To correct this condition, lightly smooth the affected area with No. 400 emery paper or a fine oilstone (**Figure 25**). Replace the piston if seizure marks cannot be removed with minimal sanding. If in any doubt, replace the piston. Remove carbon accumulation from the top of the piston with a scraper or toothless portion of a hacksaw blade.



Installation

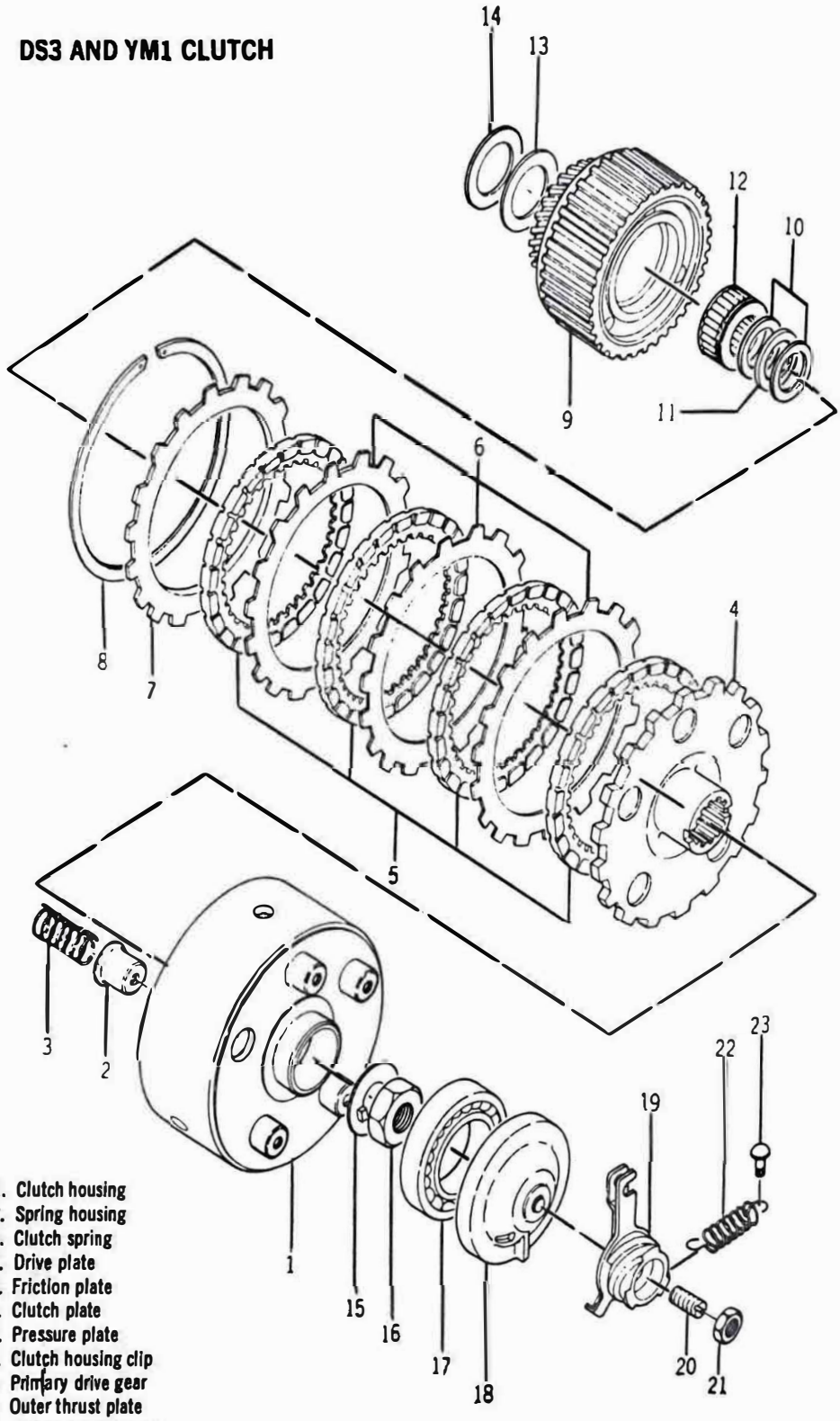
Install each piston so that the arrow on the piston head points forward, toward the cylinder exhaust port, as shown in **Figure 26**.

During this procedure, always have clean rags stuffed into the crankcase openings below the pistons to keep out debris.



(27)

DS3 AND YM1 CLUTCH



1. Clutch housing
2. Spring housing
3. Clutch spring
4. Drive plate
5. Friction plate
6. Clutch plate
7. Pressure plate
8. Clutch housing clip
9. Primary drive gear
10. Outer thrust plate
11. Outer thrust washer
12. Bearing
13. Inner thrust washer
14. Inner thrust plate
15. Lockwasher
16. Lock nut
17. Bearing
18. Push crown
19. Clutch push lever assembly
20. Adjusting screw
21. Adjusting nut
22. Return spring
23. Spring hook

CLUTCH

All models are equipped with wet multiplate clutches. Three types of clutches are used. Their operation is similar, but service procedures differ slightly.

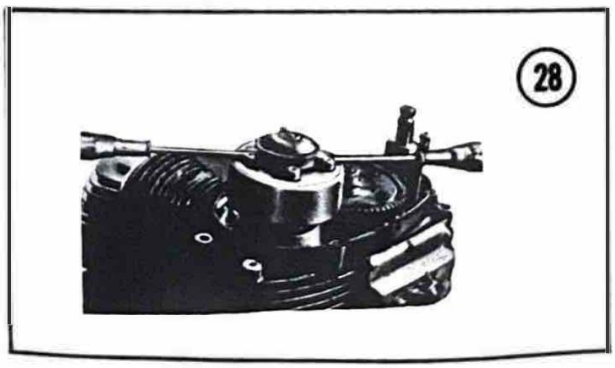
The location, disassembly, and assembly procedures for each type clutch will be discussed individually. A single set of service procedures for common parts are given.

To get to the clutch, remove the case cover. During assembly, make sure all gasket surfaces are clean, use a new gasket, and coat both sides of the gasket with gasket cement.

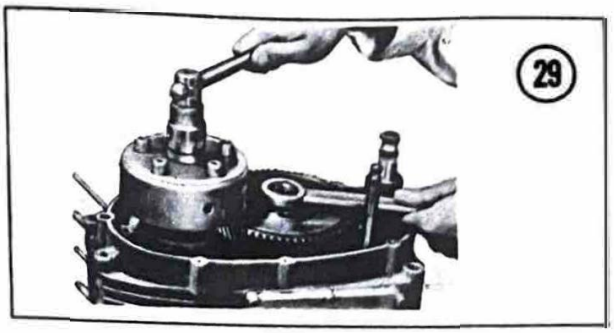
Removal (DS3 Series and YM1)

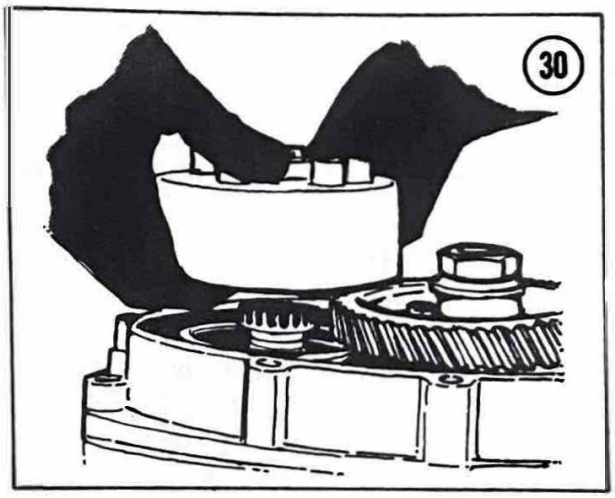
The clutch is located on the engine's left side, attached to the crankshaft. **Figure 27** identifies parts involved.

1. Remove the shift lever and kick lever. Disconnect Autolube delivery lines at the cylinders. Remove all case cover securing screws, then pull off the cover. If needed, tap the cover lightly with a rubber mallet to free it.
2. Pry off the clutch push crown. See **Figure 28**. Beneath it is a retaining nut and a bend-up type lockwasher.



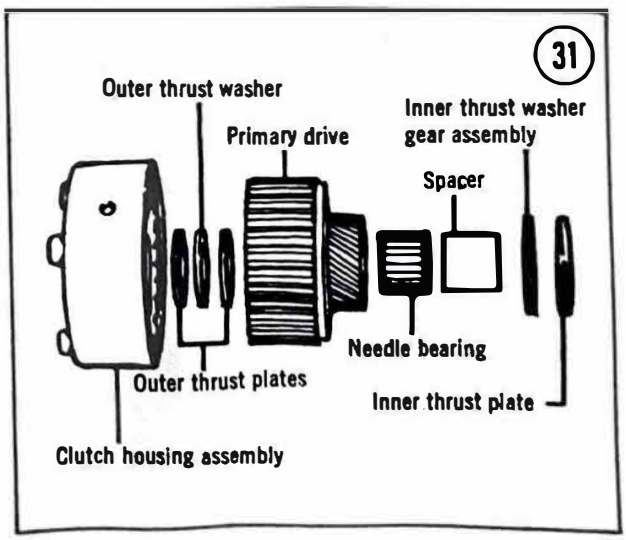
3. Straighten the lockwasher and loosen the clutch retaining nut with a 26 mm socket (**Figure 29**). Also loosen the 29 mm primary driven gear nut. It may help to stuff a rag into the meshing gear teeth if the nuts are on tightly.
4. Lift the clutch assembly off the crankcase end. See **Figure 30**. Remaining on the shaft will be needle bearings, a spacer inside the bearing, a thrust washer, and a thrust plate. Remove these, noting the order of the thrust washer and thrust plate. Identify their order of installation with tags for installation.





Disassembly/Assembly (DS3 Series and YM1)

1. Pull the primary drive gear assembly out of the clutch unit. See **Figure 31**. The inner thrust plate and thrust washer lay inside the drive gear assembly, on top of the spacer.



2. **Figure 27** is an exploded view of the clutch and its components. Using this as a guide, continue disassembly. From the open end of the clutch housing remove the retaining snap ring (8) at the edge.

CAUTION

Internal spring pressure will cause the plates to push out and spill parts when the circlip is released.

3. Remove the heavy outer steel clutch plate, then the spaced fiber and steel clutch plates. Clutch springs lay in the bottom of the clutch housing; lift them out. Inside are 3 thrust plates (10) and (11). Note their order for assembly.

4. Reverse procedure for assembly.

Installation (DS3 Series and YM1)

1. When installing the clutch unit, install the drive plate and springs. Place the primary drive gear inside the clutch housing, then install the fiber and steel plates. Push down on the plates and install the snap ring.

2. Pull out the primary drive gear. Slide the thrust plate and thrust washer over the crankshaft end. Slide the spacer over the crankshaft. Put the needle bearing into the primary drive gear, place this unit over the spacer onto the crankshaft. Slip the remaining 3 thrust plates on top of the primary drive gear. Place the clutch housing against the primary drive gear, line up the plates, then slide the housing on. Add the lockwasher, then tighten the nut and bend up the lockwasher. Finish by tapping the clutch push crown into place. Keep the push crown lever stopper turned upward.

3. When installing the case cover, make sure the Autolube pump drive gear engages properly.

Removal/Disassembly (YDS5, YM2, DS6 Series, R1, R2, and R3)

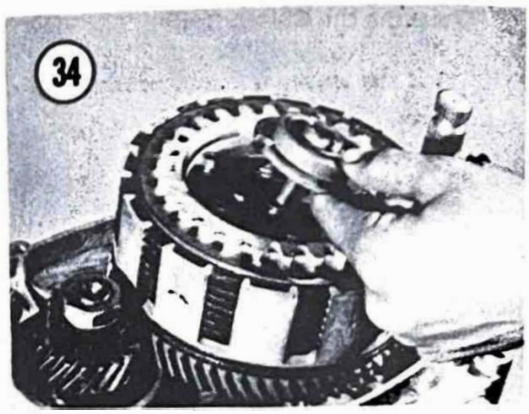
On the R1, R2, and R3, the clutch is located behind the right engine case cover. On other models, the clutch is located on the left side, attached to the main transmission axle.

1. Remove the shift lever, kick lever, and its seal.

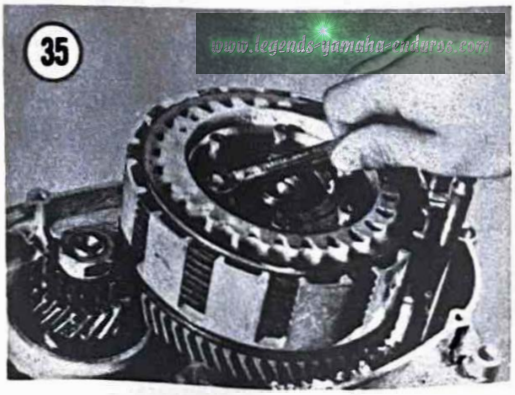
2. Disconnect the Autolube delivery lines at each cylinder.

3. Remove all case cover securing screws and pull off the cover. If needed, tap the cover lightly with a rubber hammer to free it. The cover can be removed without removing the Autolube pump.

4. **Figures 32 and 33** show exploded views of this clutch. Refer to them for guidance. Lift out push crown assembly (**Figure 34**).



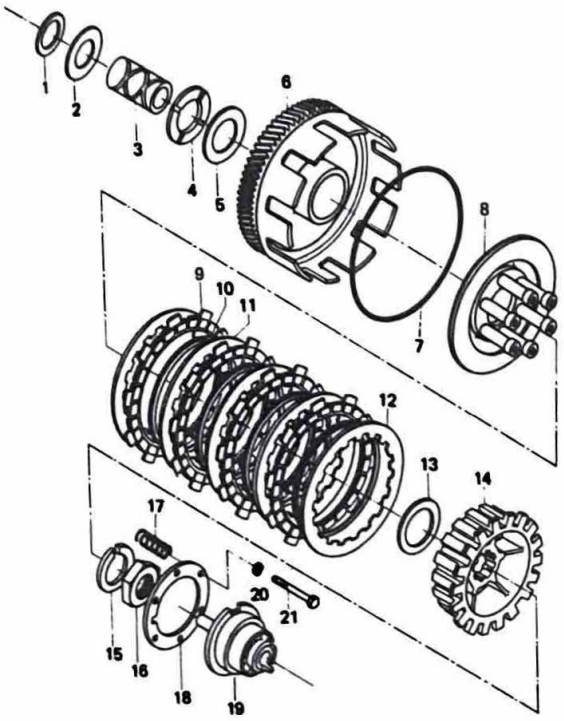
5. Unscrew 6 clutch holding screws shown in **Figure 35**, then lift off the pressure plate. Lift out the clutch springs.



6. Install the clutch holding tool shown in **Figure 36**, then loosen and remove the clutch boss retaining nut. This tool can be made out of an old steel clutch plate.

7. To complete disassembly, slide off all clutch plates, clutch boss, and thrust washer. Slide off the primary gear assembly, flat thrust bearing, needle bearing, spacer, and 2 remaining thrust plates which fit against the transmission bearing.

32



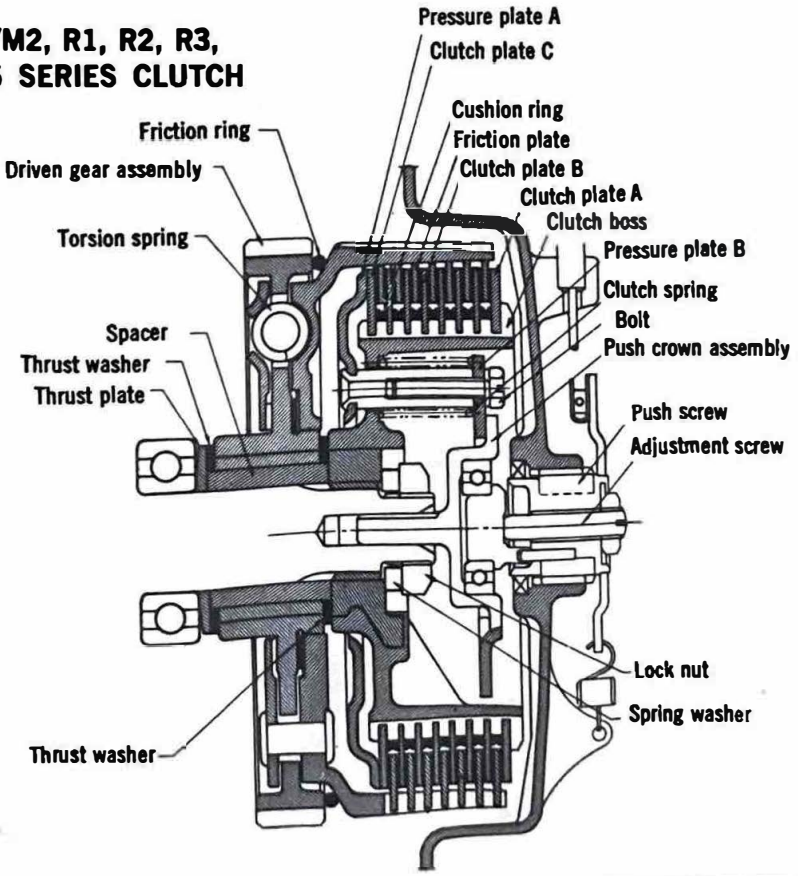
YDS5, YM2, R1, R2, R3, AND DS6 SERIES CLUTCH

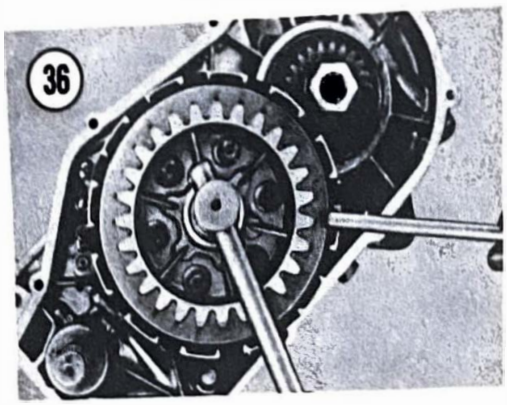
1. Thrust plate 1
2. Thrust plate 2
3. Spacer
4. Thrust bearing
5. Thrust bearing
6. Primary driven gear assembly
7. Friction ring
8. Pressure plate A
9. Friction plate
10. Cushion ring
11. Clutch plate B
12. Clutch plate A
13. Thrust plate 2
14. Clutch boss
15. Spring washer
16. Nut
17. Clutch spring
18. Pressure plate B
19. Push crown assembly
20. Spring washer
21. Bolt

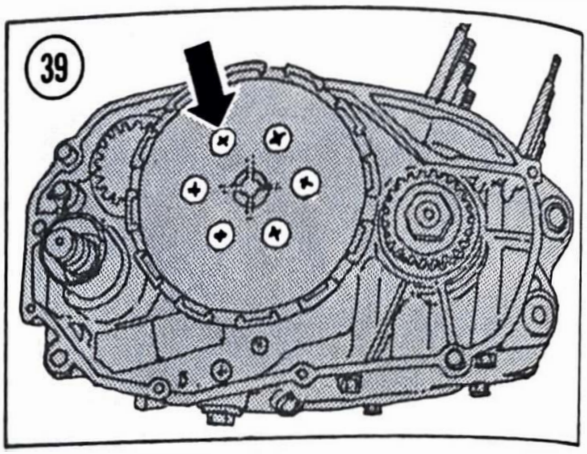
4

33

YDS5, YM2, R1, R2, R3, AND DS6 SERIES CLUTCH







Assembly/Installation (YDS5, YM2, DS6 Series, R1, R2, and R3)

1. When assembling parts, be careful to have the thrust plates and bearings in proper order. Four go behind the primary driven gear assembly and one goes between the clutch boss and primary driven gear assembly.
2. Alternately install all fiber and steel clutch plates on the clutch boss. Be sure the single thrust bearing has been installed, then slide the clutch boss on as you line up the fiber plate "ears" into the outer housing slots. Immediately add and tighten the retaining nut. Make sure the clutch unit spins freely. If it is tight, disassemble and check thrust bearing locations.
3. When tightening the spring retaining screws, tighten them until they are just snug. Do not overtighten.
4. When installing the case cover, make sure the Autolube pump drive gear engages properly with its mating gear on the crankshaft.

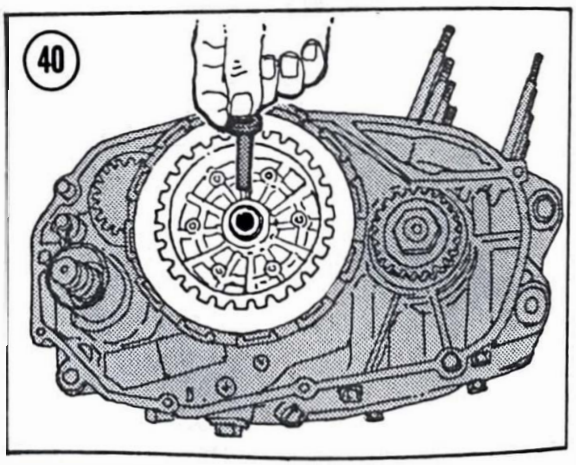
Removal/Disassembly (Remaining Models)

The clutch is located on the engine's right side, attached to the main transmission axle.

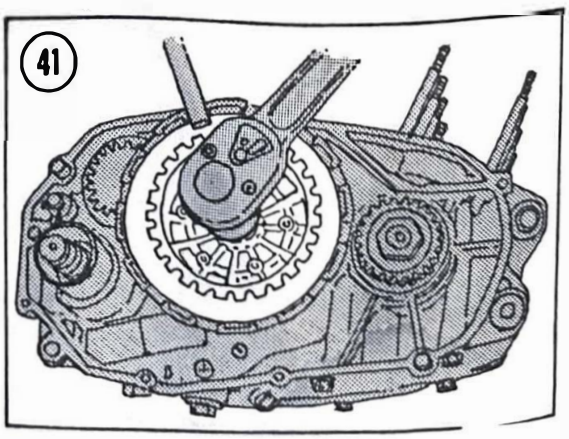
1. Remove the kick lever. Disconnect the Autolube delivery lines at each cylinder.
2. Remove all case cover screws, then pull off the cover. If needed, tap the cover lightly with a rubber mallet to free it. The cover can be removed without removing the Autolube pump.

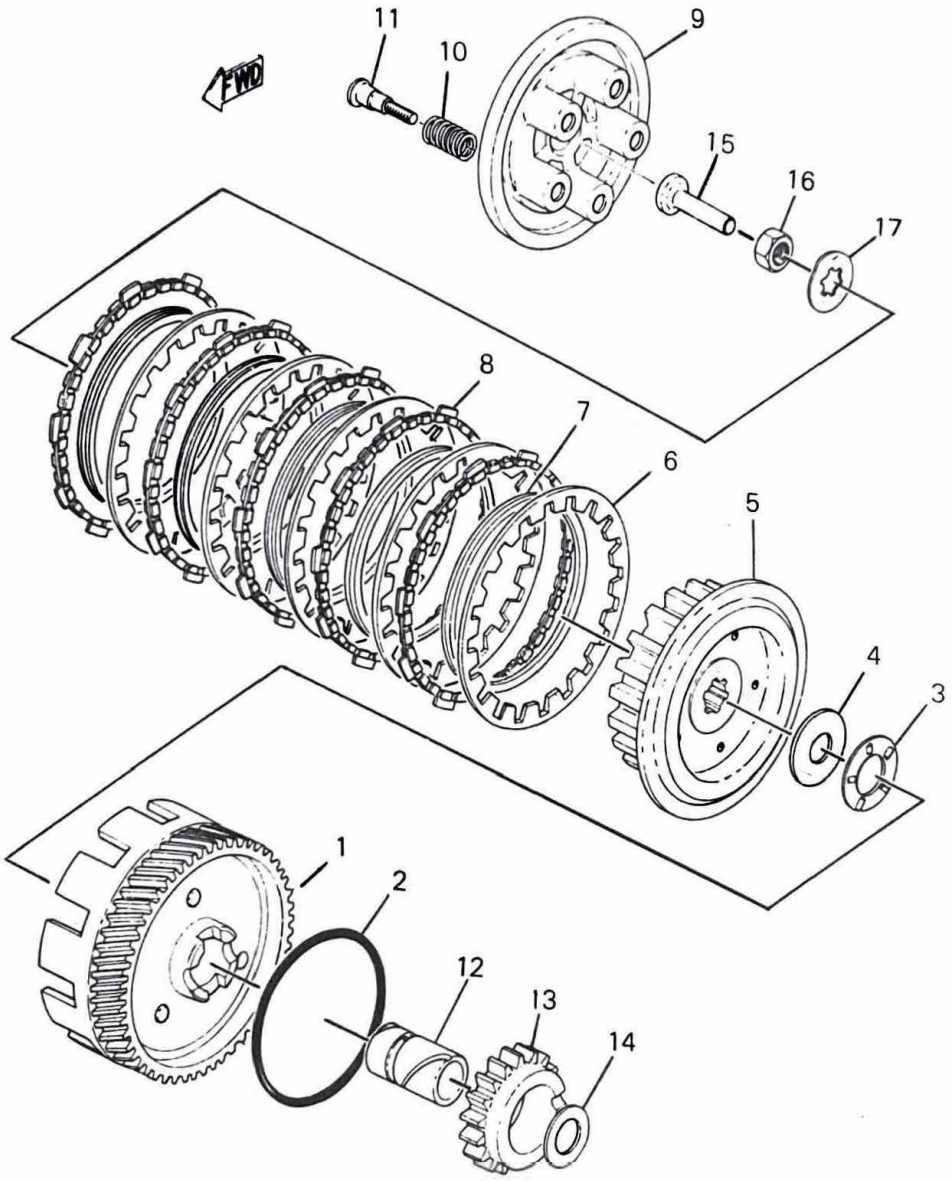
Refer to **Figures 37 and 38** during the following procedures.

3. Remove all 6 clutch spring holding screws (**Figure 39**) and lift off the pressure plate. Slide out the valve shaped pushrod located in the end of the transmission (**Figure 40**). In the same transmission hole is a ball bearing. Tip the engine or use a magnet to remove it and prevent its loss. A long rod-shaped pushrod will slide out after the ball.



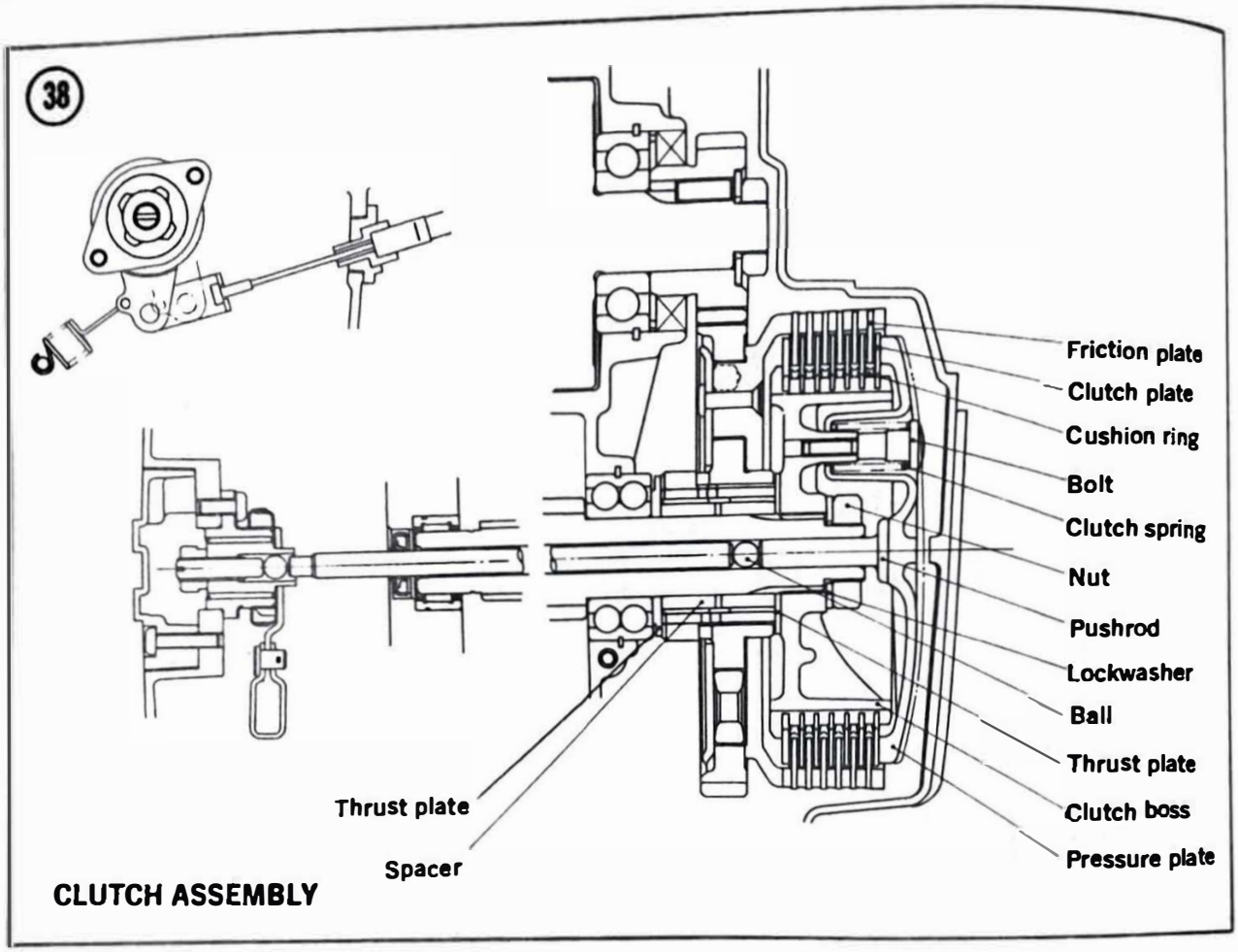
4. See **Figure 41**. Loosen and remove the clutch locknut by anchoring the clutch with a clutch holding tool. Be sure to bend down the lockwasher ends.





CLUTCH ASSEMBLY

1. Primary driven gear assembly
2. Friction ring
3. Thrust bearing
4. Thrust plate
5. Clutch boss
6. Clutch plate
7. Cushion ring
8. Friction plate
9. Pressure plate
10. Clutch spring
11. Clutch spring holding screw
12. Spacer
13. Kick pinion gear
14. Thrust plate
15. Pushrod
16. Lock nut
17. Lockwasher



CLUTCH ASSEMBLY

5. Slide off the clutch boss. Directly behind it will be a thrust washer, or 2 identical thrust washers with a flat thrust bearing (3, **Figure 37**) between them. Note their position for future installation.

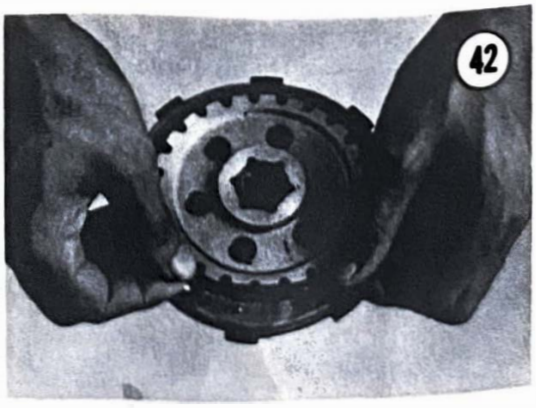
6. Slide off the primary driven gear assembly outer housing. Behind the outer housing (15) is a kick gear (13, **Figure 37**). On some models it is an integral part of the driven gear assembly; on other models it is a separate gear. Slide it off if separate. Slide off the spacer and thrust plate.

Assembly/Installation (Remaining Models)

1. During installation of these parts, be sure all thrust washers, plates, and bearings are in proper position. If your model has a separate kick gear, make sure its 2 protruding dogs engage the 2 squared off slots in the back of the primary driven gear. Take care; there are also 2 rounded slots that the dogs could accidentally engage.

2. After installing the primary driven gear assembly, slide on the thrust washers, then carefully slide on the clutch boss. Be careful; pulling the clutch boss out after its installation could dislodge the thrust washers and prevent the boss from sliding completely in.

3. Slide in alternate metal and fiber plates. If your engine has rubber cushions, these are installed over the clutch boss after each metal plate, as shown in **Figure 42**. The open end faces out. Make sure they are not twisted. These



cushions help separate the plates during disengagement, but are not required for clutch operation.

NOTE: *Be sure to install the long pushrod, ball bearings, and short pushrod into the transmission shaft hole. If any are left out, there will be no tension at the clutch lever after assembly.*

4. Add the pressure plate, springs, and spring retaining screws. Tighten the spring retaining screws just slightly until snug. Excessive torque can snap the screw, which will require you to replace the primary drive gear assembly.

Inspection

1. Friction plates wear with use. Measure the thickness of each plate at several places, as shown in **Figure 43**. Replace any plate that is worn unevenly, or more than 0.012 in. (0.3mm) below standard thickness.

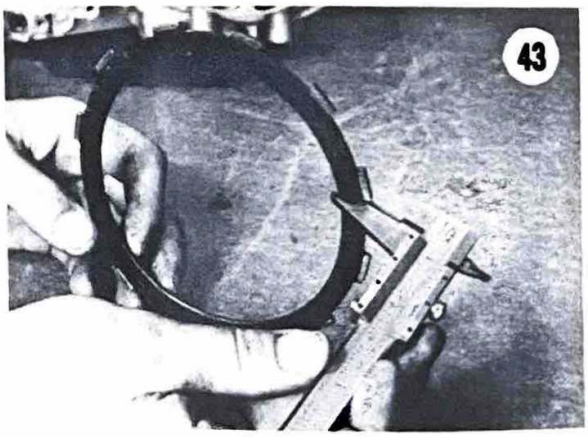
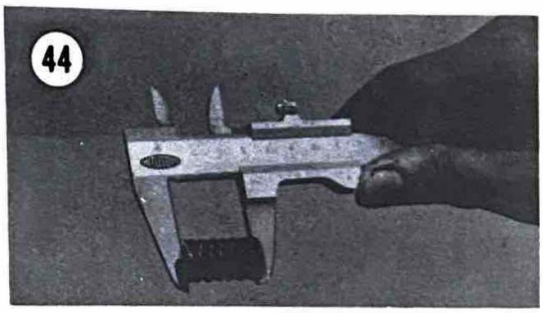


Plate thickness for the YDS series and YM1 models is 0.169 in. (4.3mm). All other models are 0.118 in. (3.0mm).

2. Metal plates will not be subject to wear, but heat can distort them. They must be flat. Lay each one on a flat surface. A piece of glass would be ideal. If they appear to be cupped, and the clutch does not want to disengage totally, replace the defective plates. If heat has turned the plate blue, or if the surface is scored, replace it.

3. Weak clutch springs result in slipping or uneven clutch action. Measure the length of each spring, as shown in **Figure 44**. Standard free lengths and dimensional tolerances are listed in **Table 4**.



4. Check the teeth on the primary driven gear for scratches or other damage. Also check for any scratches on the slotted surfaces of the clutch boss. Some models are equipped with a rubber friction ring between the primary driven gear and the clutch housing. This ring reduces gear noise at low engine speeds.

5. Check for scratches on the inner and outer surfaces of the spacer. Lightly smooth any scratches with a fine oilstone or fine grain emery paper. Replace the spacer if any scratches cannot be removed.

Lightly oil the spacer and insert it into the driven gear boss as shown in **Figure 45**. There

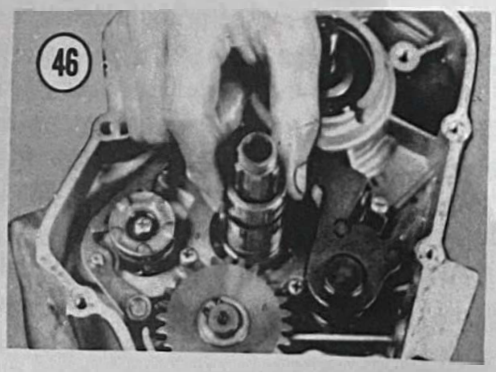
Table 4 CLUTCH SPRING LENGTH

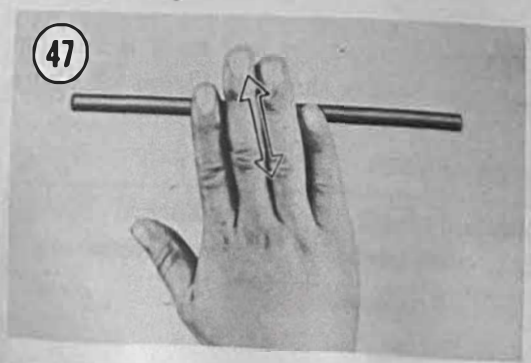
Model	Standard Length Inch	Standard Length (Millimeters)	Tolerance Inch	Tolerance (Millimeters)
YDS5	1.00	(25.5)	0.08	(2.0)
DS6, DS6-B, DS6-C	1.73	(44.0)	0.04	(1.0)
DS7	1.42	(36.0)	0.03	(0.8)
YDS3, YDS3-C, YM1, YM2, YM2-C	1.00	(25.5)	0.08	(2.0)
YR1, YR2, YR2-C, R3, R3-C, R5, R5-B	1.43	(36.4)	0.04	(1.0)
R5-C, RD250 series, RD350 series, RD400	1.42	(36.0)	0.04	(1.0)

should be no excess clearance. Replace the spacer and/or the primary driven gear if play is excessive.

Lightly lubricate the spacer and slide it onto the transmission main shaft (**Figure 46**). Replace the spacer if there is any noticeable play.

6. Clutches located on the right side of the engine are operated by a pushrod. Check this rod for straightness by rolling it over a flat surface, as shown in **Figure 47**. If the pushrod is bent, straighten or replace it.

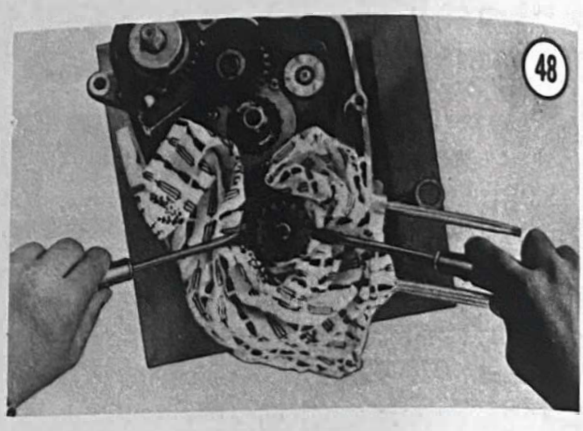




PRIMARY DRIVE GEAR

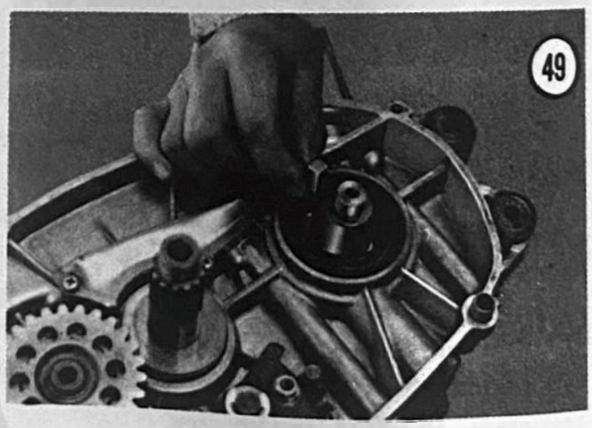
Removal/Installation

Wedge a rolled-up rag between the primary drive and primary driven gears. Pry the drive gear from the shaft (**Figure 48**) using 2 screwdrivers.



On some models there is a smaller gear mounted on top of the primary drive gear. This drives the Autolube pump. It should slip off easily.

Some primary drive gears are held by splines on the shaft. Others, as shown in **Figure 49**, use a Woodruff key.



Check the gear for scratches, wear, fit on the shaft, and backlash. Excessive backlash results in a clashing noise; insufficient backlash results in a whine. Gears are available in sizes to correct backlash.

Primary drive gears on some models have a chamfered end. This end must slide in first against the crankshaft bearing.

DRIVE SPROCKET AND CHAIN

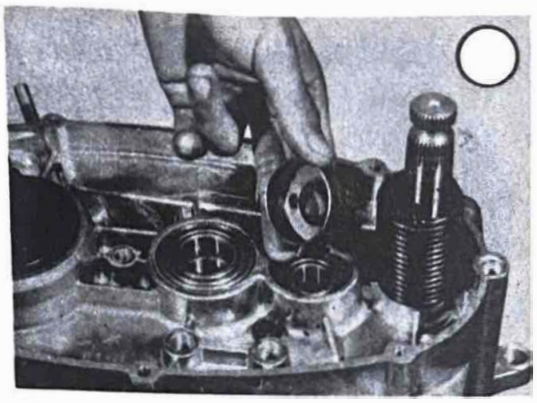
Removal/Installation

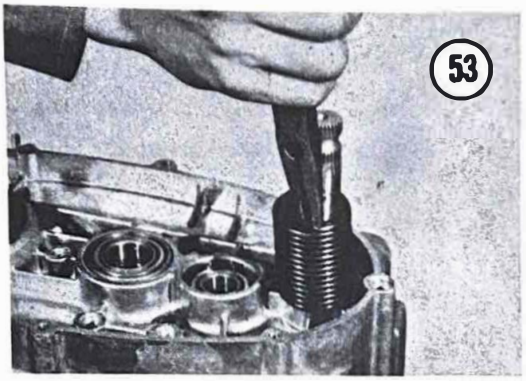
Straighten the lockwasher with a blunted metal punch. Shift the transmission into low

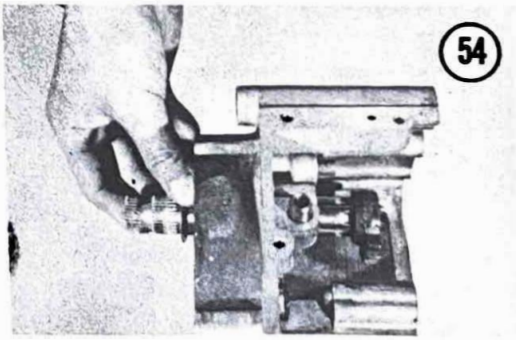
gear and use a striking wrench or impact wrench to loosen the sprocket nut. Remove the sprocket.

Behind the sprocket on each model is a metal spacer (collar). Grip with needlenose pliers and it will slide out easily. When installing, either end can go in first. Put oil on the seal lips to prevent this spacer from damaging the seal.

Check the sprocket teeth for wear. See **Figure 50**. Clean the chain and check to be sure it bends without any kinks. If you can pull the chain away from the sprocket a distance of half a link, the chain should be replaced.







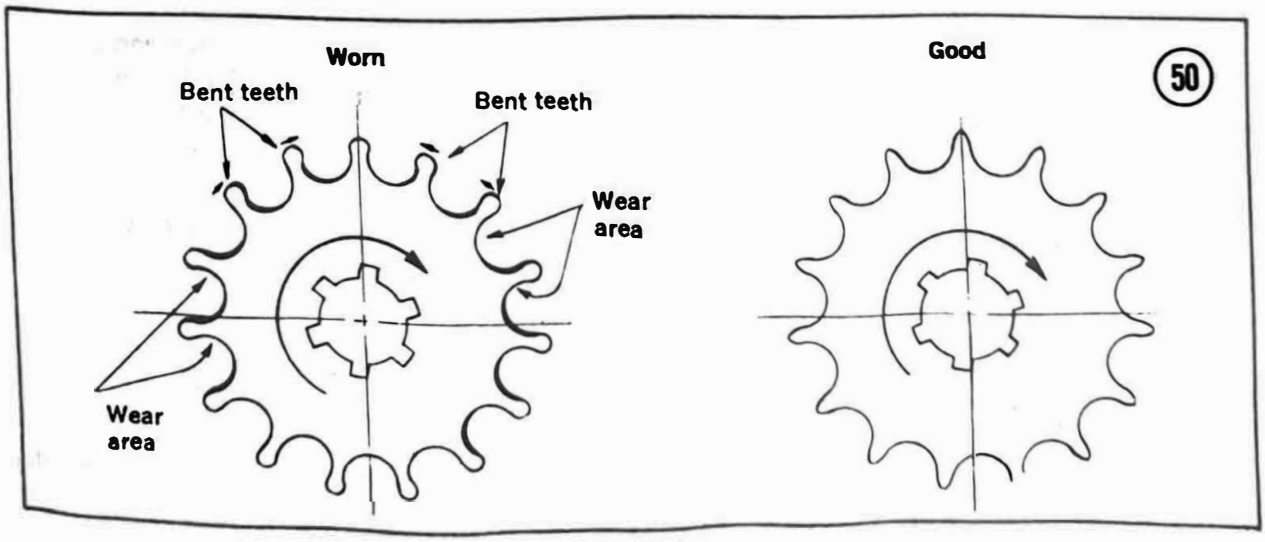
KICKSTARTER

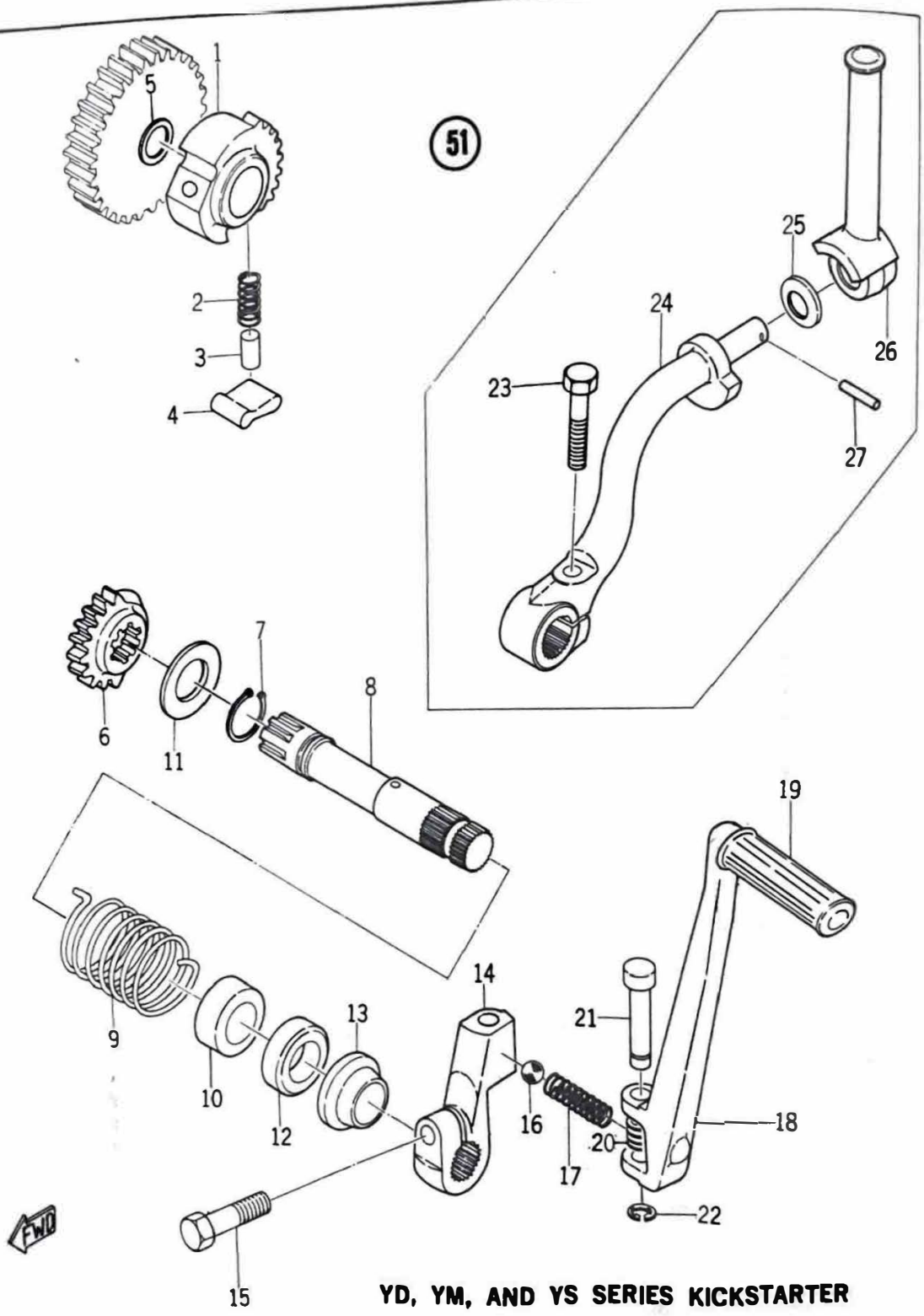
Three types of kickstarter mechanisms are used.

Disassembly/Assembly (YD, YM, and DS6 Series)

Figure 51 is an exploded view. The crankcase must be split and the transmission removed before the kickstarter can be disassembled. Refer to *Crankcase Disassembly* later in this chapter.

1. Remove the kick spring cover (**Figure 52**) and kick spring (**Figure 53**).
2. Use a pair of snap ring pliers to remove the snap ring from the shaft. Slide the shaft assembly toward the inside of the crankcase. See **Figure 54**.
3. Examine the parts for damage or wear. Pay particular attention to the tip of the kick pawl and the inner teeth of the first gear. Be sure that





YD, YM, AND YS SERIES KICKSTARTER

1. Kick pinion
2. Pawl spring
3. Pawl pin
4. Kick pawl
5. Thrust washer
6. Kick gear
7. Snap ring
8. Kick shaft
9. Kick spring
10. Spring guide
11. Washer
12. Oil seal
13. Shaft seal
14. Crank boss
15. Bolt
16. Ball
17. Spring
18. Kick crank
19. Cover
20. Spring
21. Pin
22. Snap ring
23. Bolt
24. Kick crank
25. Lockwasher
26. Kick lever
27. Dowel pin

there is no foreign material in the pawl pin hole (**Figure 55**).

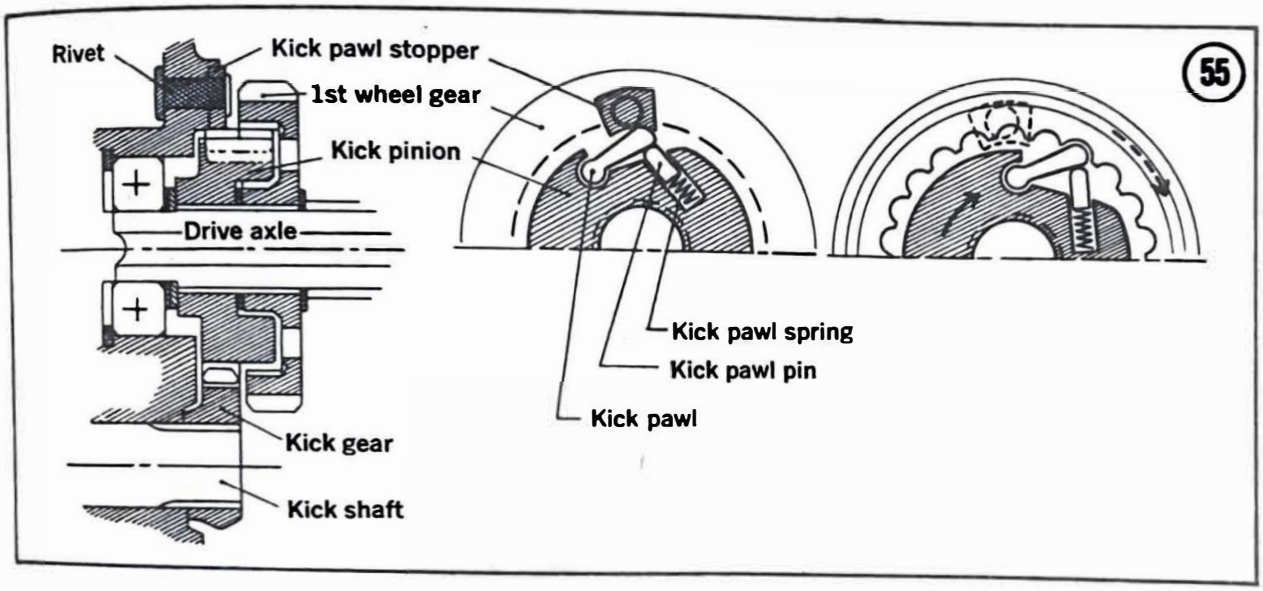
4. To assemble, reverse the disassembly procedure. The kickstarter shaft and kick gear can be pressed together after the kick gear is heated to 265-300°F (130-150°C). Insert the spring into the hole in the case, then hook it into the hole in the shaft. Install the spring cover with a soft mallet and pliers.

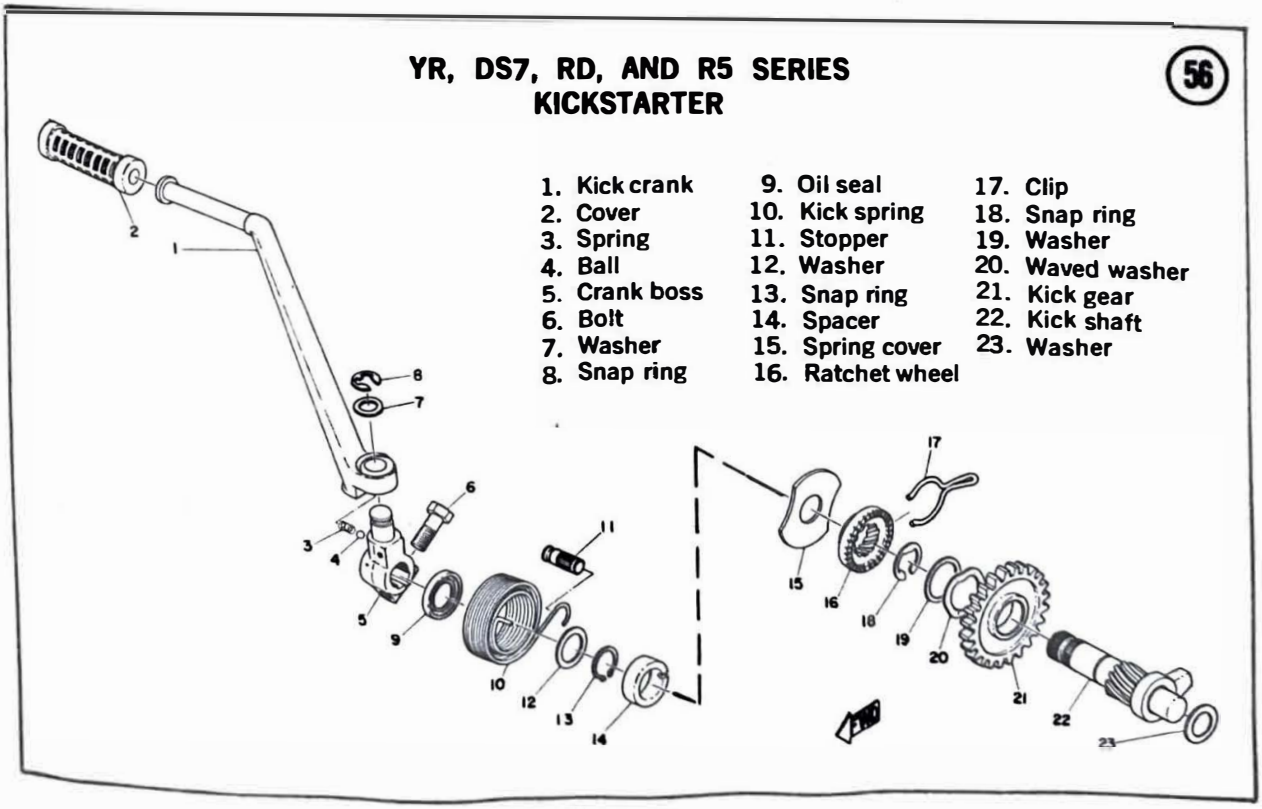
Disassembly/Assembly (YR, DS7, RD, and R5 Series)

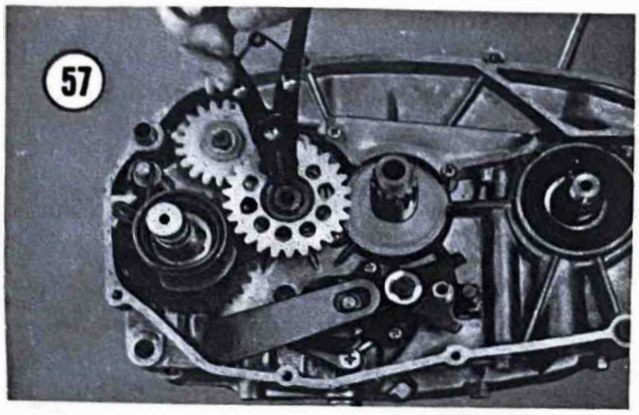
Figure 56 is an exploded view.

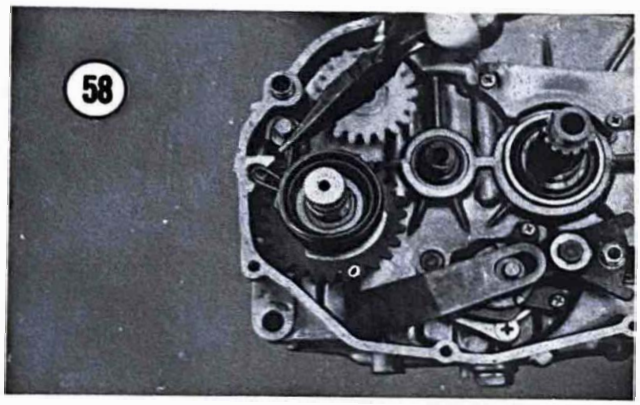
1. Remove the snap ring, then pull the kick idler gear (**Figure 57**) from its shaft. Note the position of the shims.

2. Remove the spring with a pair of pliers, and pull out the kickstarter assembly (**Figure 58**).



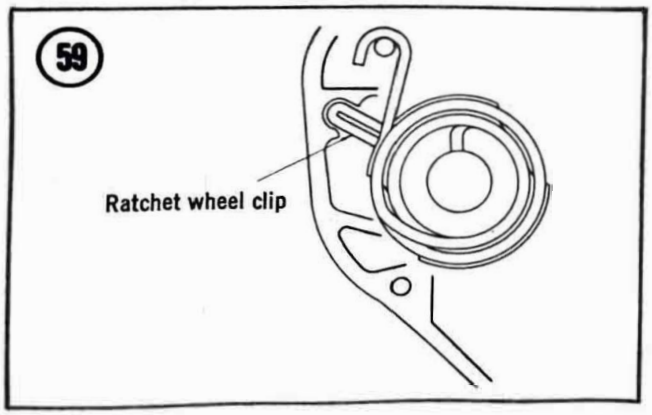


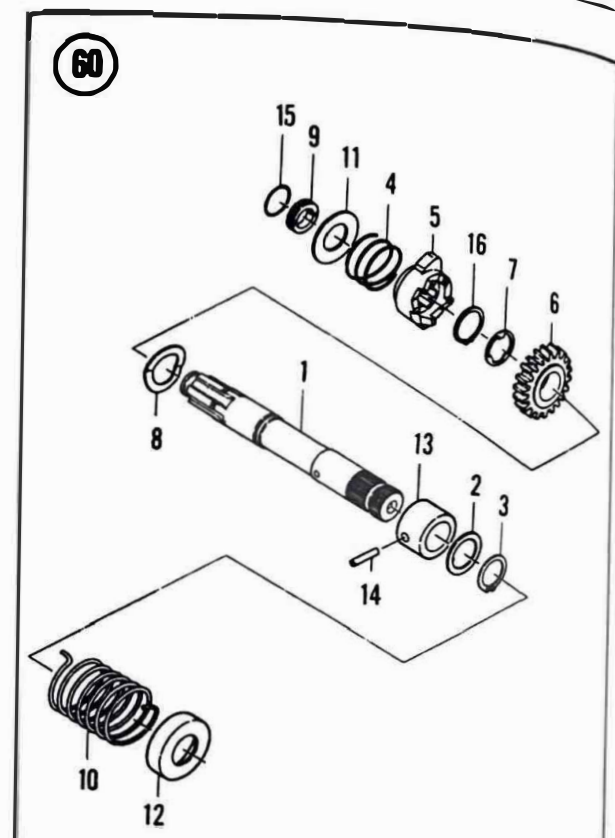




3. Examine parts carefully for wear or damage. Replace any parts which are in doubtful condition.

4. Reverse disassembly procedure to install. Pay particular attention to the position of the ratchet wheel clip (**Figure 59**).





R3 SERIES KICKSTARTER

1. Kick axle
2. Shim
3. Clip
4. Ratchet wheel spring
5. Kick ratchet wheel
6. Kick gear
7. Washer
8. Waved washer
9. Kick ratchet wheel holder
10. Kick spring
11. Spring cover
12. Spring guide
13. Spacer
14. Dowel pin
15. Clip
16. Circlip

Disassembly/Assembly (R3 Series)

Figure 60 is an exploded view. The crankcase must be split to gain access.

1. Remove the kick spring cover (**Figure 61**) and the kick spring (**Figure 62**).

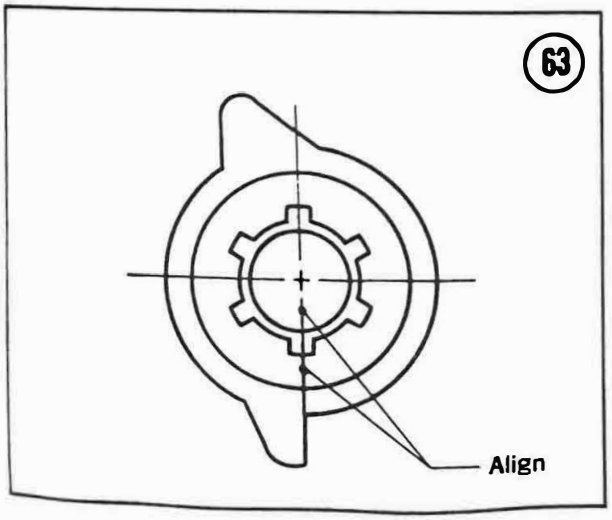
2. The transmission must be removed before further disassembly is possible. Refer to the section, *Transmission, Removal*, this chapter.

3. Remove the clip from the inner end of the shaft. Remove the ratchet wheel retainers, spring cover, spring, and ratchet wheel.

4. The kick gear may be pulled from the shaft after the snap ring and washer are removed.

5. Replace any broken or worn parts. Be sure that the teeth on the kick ratchet wheel and the mating teeth on the side of the kick gear are not worn.

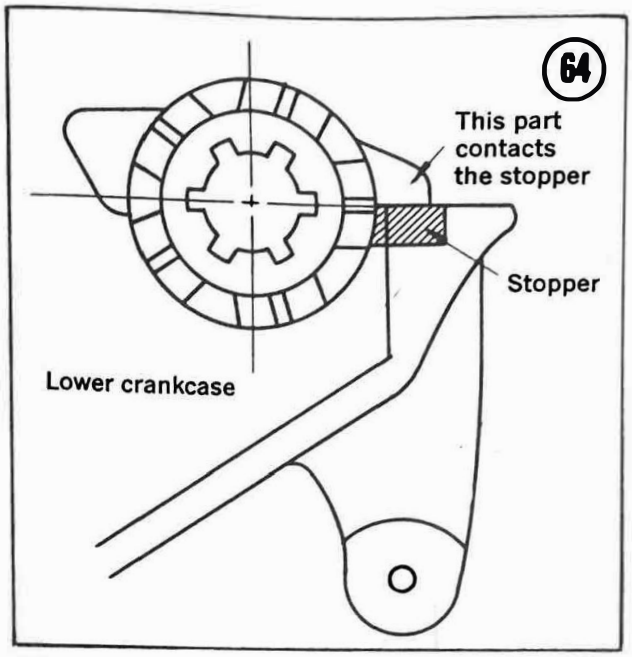
6. To install the kickstarter, reverse procedure. Align the markings on the kickshaft (**Figure 63**) and the kick ratchet wheel. Be sure that the ratchet wheel is installed correctly (**Figure 64**).

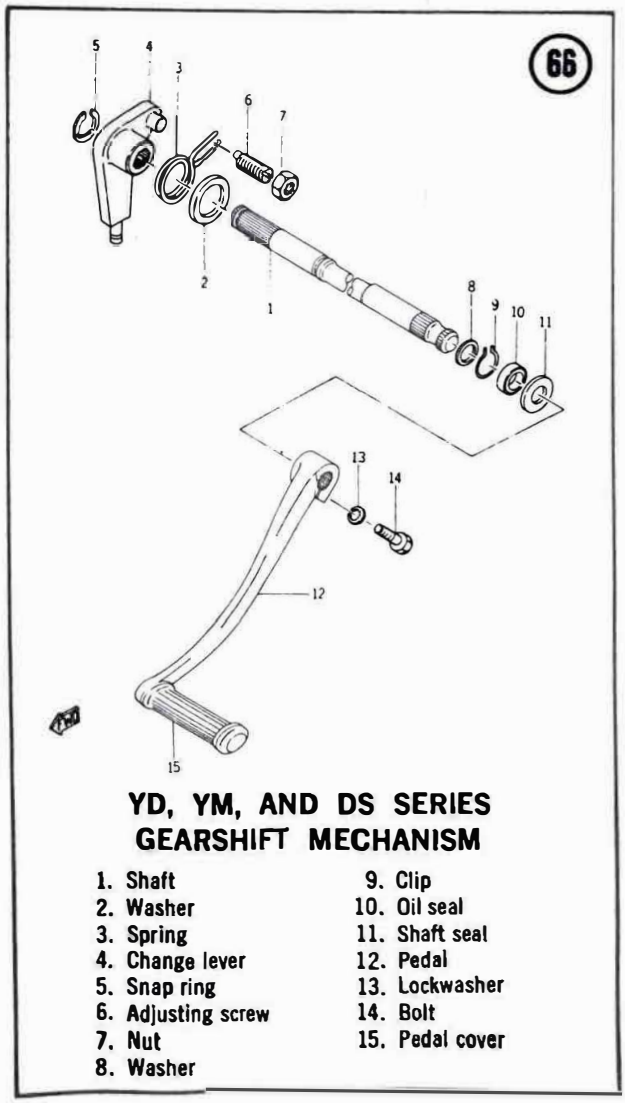


GEARSHIFT MECHANISM

Disassembly/Assembly (YDS, DS, and YM Series)

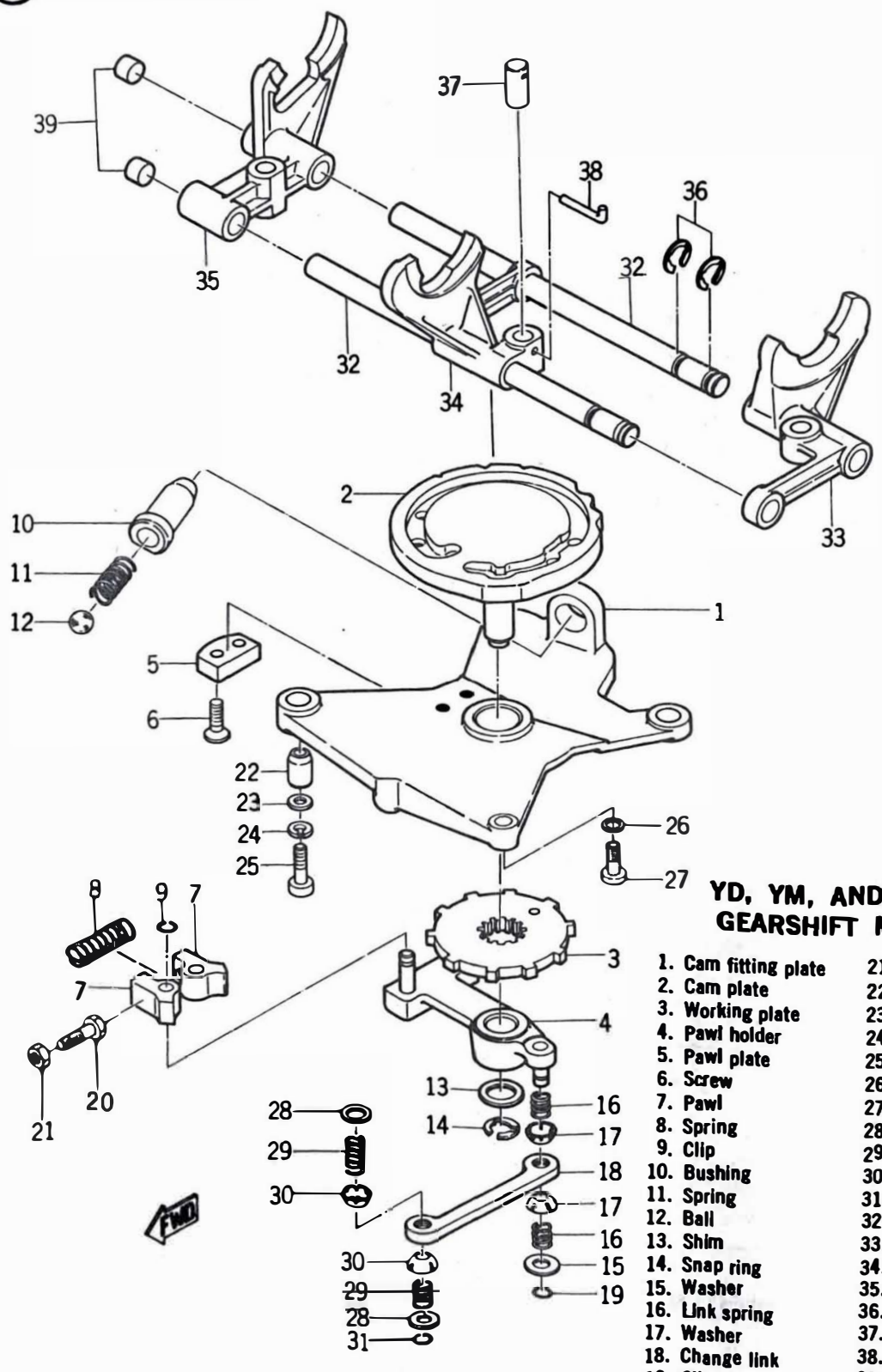
Figures 65 and 66 are exploded views of the internal and external parts. This shifter employs





YD, YM, AND DS SERIES GEARSHIFT MECHANISM

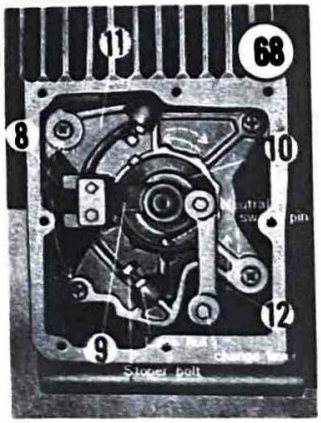
1. Shaft
2. Washer
3. Spring
4. Change lever
5. Snap ring
6. Adjusting screw
7. Nut
8. Washer
9. Clip
10. Oil seal
11. Shaft seal
12. Pedal
13. Lockwasher
14. Bolt
15. Pedal cover



YD, YM, AND DS SERIES GEARSHIFT MECHANISM

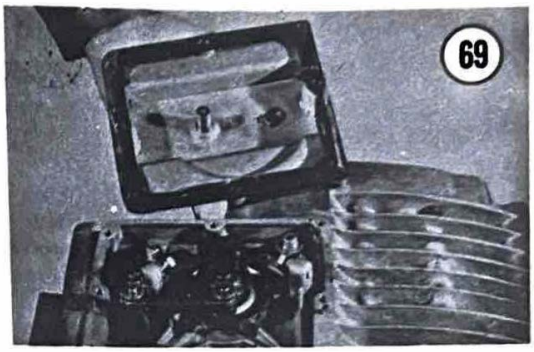
1. Cam fitting plate
2. Cam plate
3. Working plate
4. Pawl holder
5. Pawl plate
6. Screw
7. Pawl
8. Spring
9. Clip
10. Bushing
11. Spring
12. Ball
13. Shim
14. Snap ring
15. Washer
16. Link spring
17. Washer
18. Change link
19. Clip
20. Bolt
21. Nut
22. Dowel pin
23. Flat washer
24. Lockwasher
25. Screw
26. Lockwasher
27. Screw
28. Flat washer
29. Link spring
30. Link washer
31. Clip
32. Shaft
33. Fork
34. Fork
35. Fork
36. Snap ring
37. Rotor
38. Pin
39. Plug

a cam plate (**Figure 67**) to select gear ratios within the transmission. See **Figure 68**. Gearshift pedal motion is transmitted through the shaft to the change lever, and then to the change link (9) and the pawl holder (12). The shifter pawl (8) rotates the shifter working plate (10). The shifter working plate is splined to the gearshift cam, which rotates with the shifter working plate.



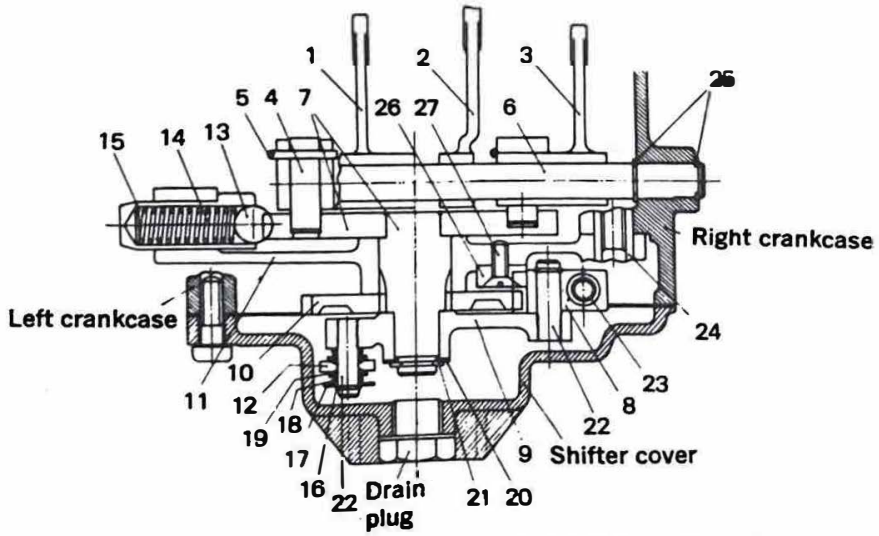
The shifter forks move in slots in the gearshift cam. The shifter forks, in turn, position the gears in the transmission. There are 5 gear positions and one neutral position.

1. Remove the shifter cover (**Figure 69**).



2. Disconnect the lever and change link. See **Figure 70**.
3. Cover the crankcase with a clean rag to prevent any foreign material from dropping into the crankcase.

67

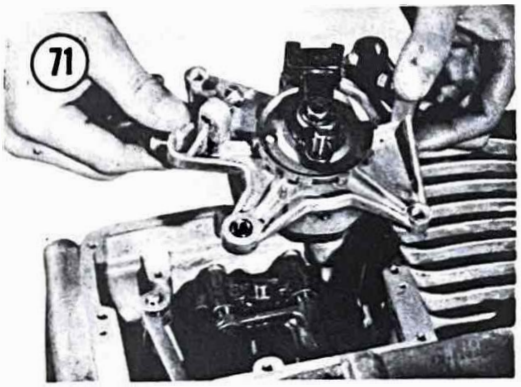


YD, YM, AND DS SERIES GEARSHIFT MECHANISM

1. Second gear wheel shift fork
2. Third and fifth pinion shift fork
3. Fourth gear wheel shift fork
4. Shifter rotor
5. Rotor stopper pin
6. Shifter shaft
7. Gearshift cam
8. Shifter pole
9. Shifter pole holder
10. Shifter working plate
11. Shift cam setting plate
12. Change link
13. Cam stopper ball
14. Cam stopper spring
15. Cam stopper bushing
16. Shifter pole shaft clip
17. Change link plane washer
18. Change link spring
19. Change link ball washer
20. Shift cam shim
21. Shift cam clip
22. Shifter pole shaft
23. Shifter pole spring
24. Shift cam setting plate pipe knock
25. Shifter shaft clip
26. Shifter pole free plate
27. Free plate set screw

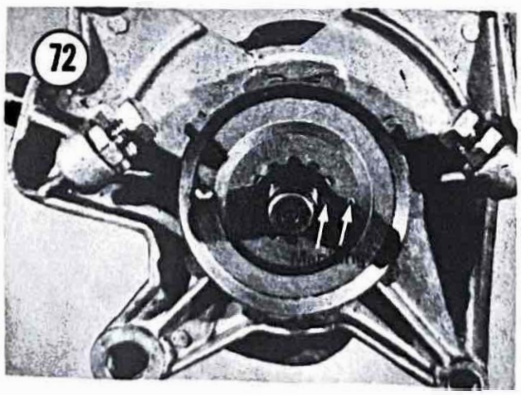
4. Pull out the shifter cam (**Figure 71**).

5. Remove the shifter shafts and forks by removing the shifter shaft snap rings on the outside of the transmission case. Pass the shafts inward and remove the inner snap rings.

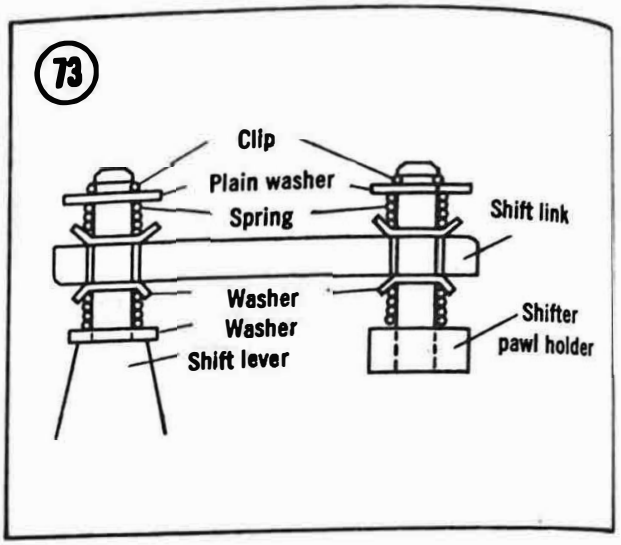


6. Check all parts for wear or damage. The shift forks are susceptible to wear, so check them very carefully. Replace any worn or damaged parts.

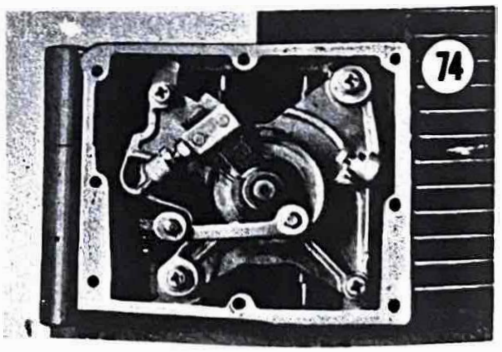
7. To install the shifter, reverse the procedure. Place the transmission in neutral. Align the markings (**Figure 72**) on the shift cam and shifter working plate.



To ensure proper assembly of the shift linkage, and related parts, see **Figure 73**.



8. Shift the transmission through all gears in both directions and observe the stroke of the shifter pawl arm. Engage the stopper ball in the detent and adjust the shifter so that the gap between the working plate pawl and the shifter stop is approximately 0.04 in. (1mm). See **Figure 74**.

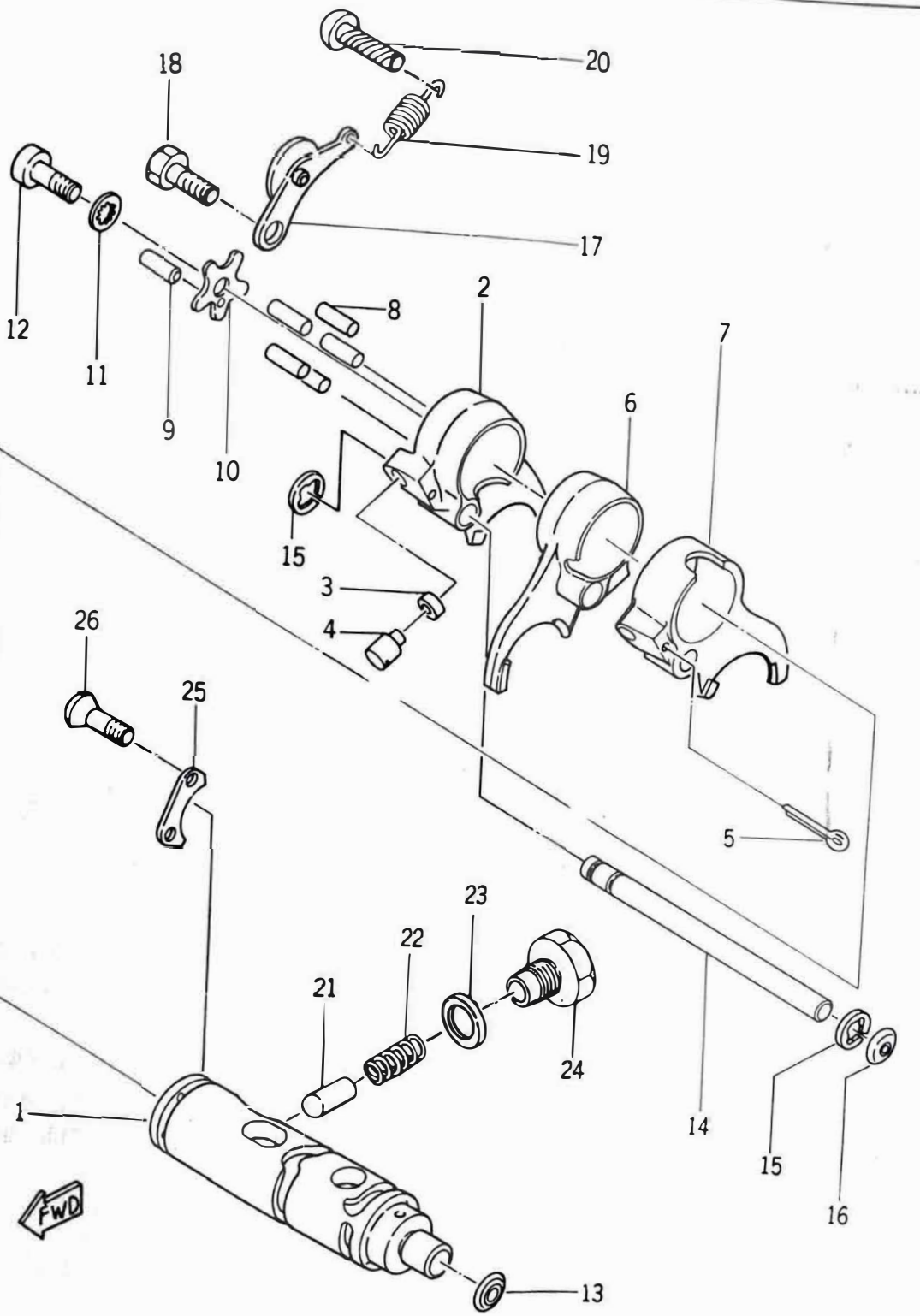


Disassembly/Assembly (R3 and YR Series)

Figures 75 and 76 are exploded views of the internal and external parts. This shifter uses a drum cam to move the shifter forks. The shifter cannot be completely disassembled until the crankcase is split and the transmission removed. Refer to this chapter under *Crankcase* and *Transmission*.

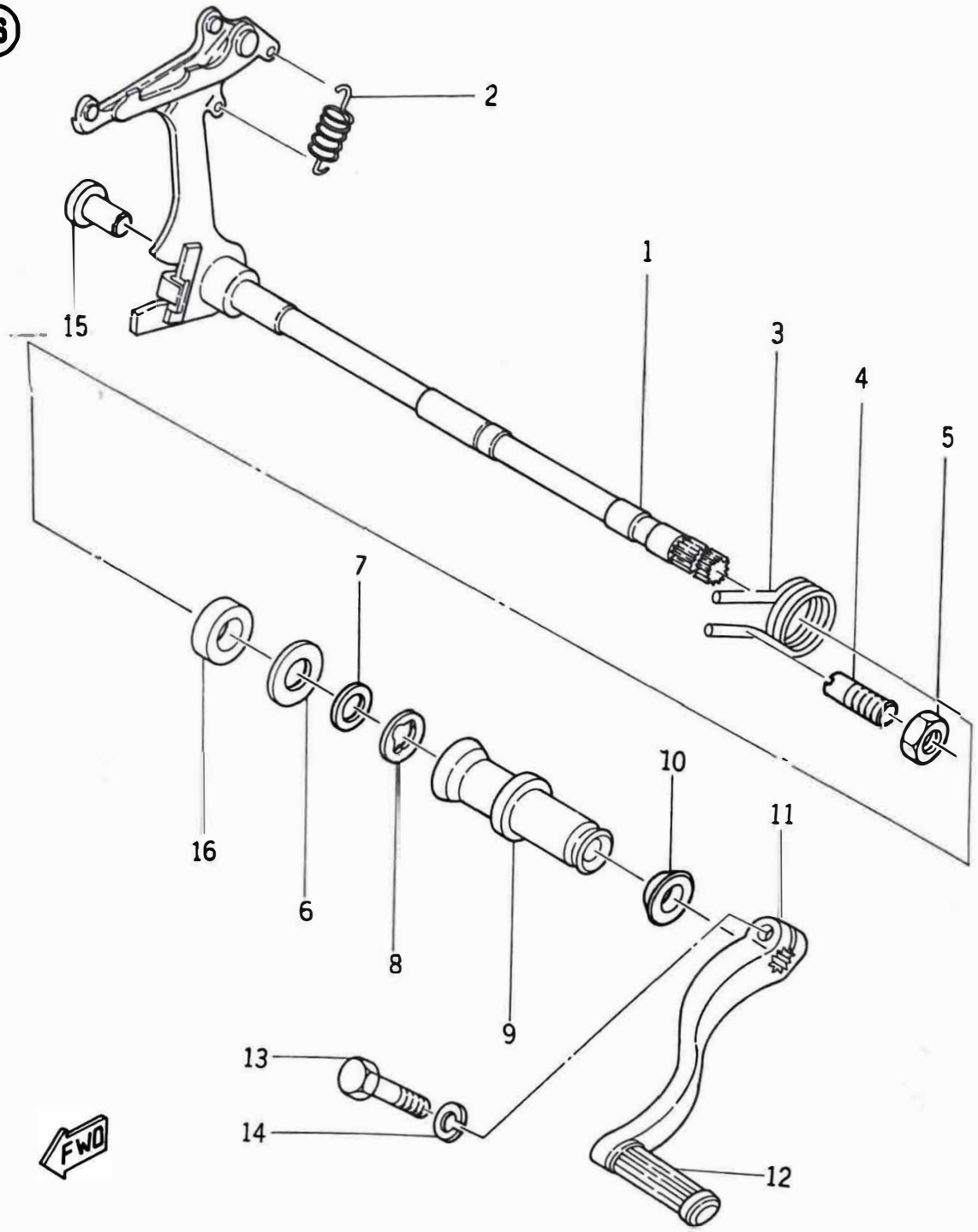
1. Remove the sealing boot from the gearshift shaft, then the snap ring and the adjustment shims (**Figure 77**). Hold the gearshift cam down and remove the arm from the pin on the shift drum (**Figure 78**).

2. Pull the shaft out from the left side of the crankcase.



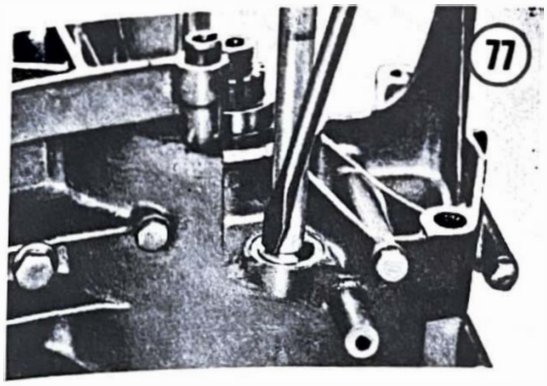
R3 AND YR SERIES GEARSHIFT MECHANISM

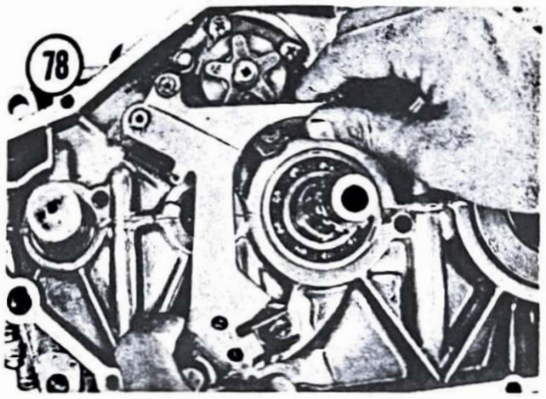
1. Cam
2. Fork
3. Roller
4. Pin
5. Cotter pin
6. Fork
7. Fork
8. Dowel pin
9. Dowel pin
10. Plate
11. Lockwasher
12. Screw
13. Plug
14. Guide bar
15. Snap ring
16. Plug
17. Stop lever
18. Bolt
19. Spring
20. Spring hanger
21. Cam stopper
22. Neutral spring
23. Gasket
24. Bolt
25. Plate
26. Screw



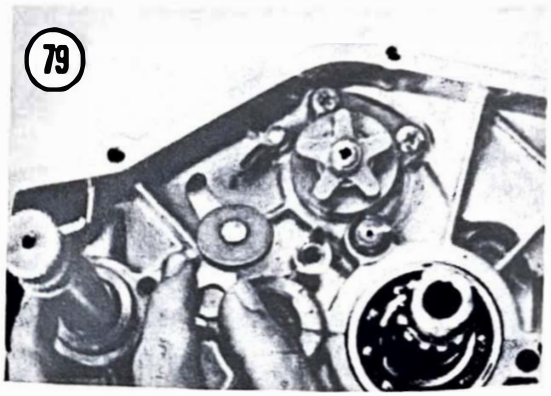
R3 AND YR SERIES GEARSHIFT MECHANISM

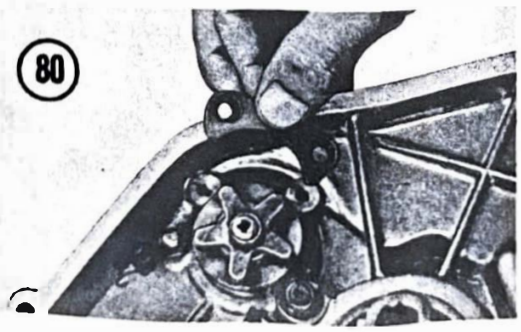
1. Shaft
2. Spring
3. Return spring
4. Adjusting screw
5. Nut
6. Washer
7. Washer
8. Snap ring
9. Boot
10. Seal
11. Pedal
12. Cover
13. Bolt
14. Lockwasher
15. Plug
16. Oil seal



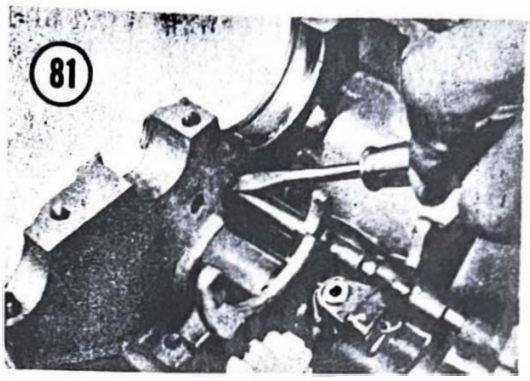


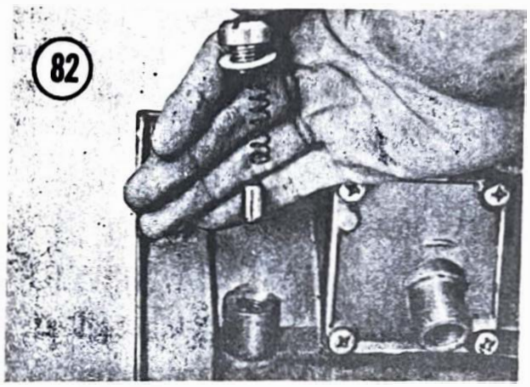
3. Remove gearshift drum stop lever (**Figure 79**) and the shift drum setting plate. See **Figure 80**. Further disassembly of the shifter requires transmission removal as described in the *Transmission* section, this chapter.





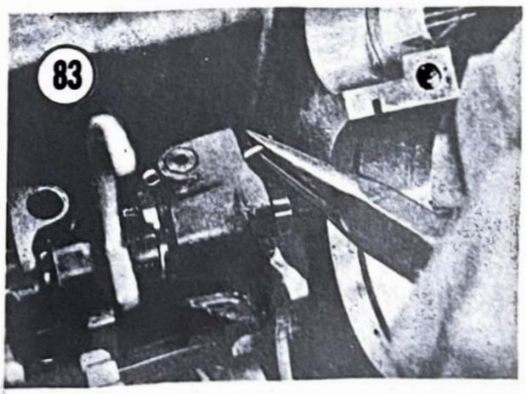
4. Remove the 2 snap rings from the shift fork guide bar (**Figure 81**). One is located inside the case; the other is outside. Withdraw the shift fork guide bar. Remove the neutral stop. See **Figure 82**.

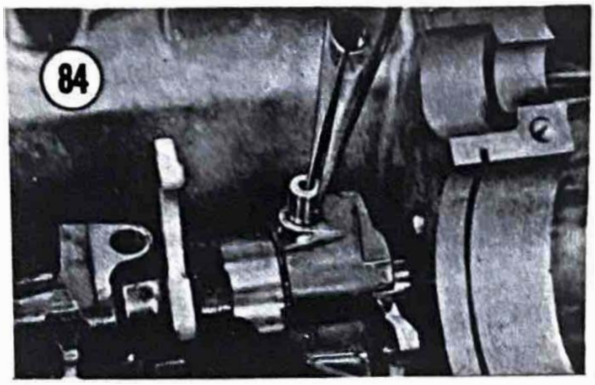


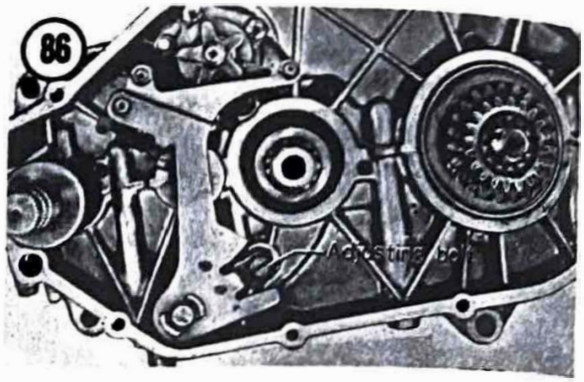


5. Pull the shift drum out slightly. Remove the cotter pin from the fourth gear shift fork cam follower (**Figure 83**). Remove the cam follower roller (**Figure 84**). Remove the center cotter pin and roller, then the cotter pin and roller from the end nearest the clutch. Lift out the shift drum.

6. Examine the parts carefully. Any part which shows wear or damage should be replaced.





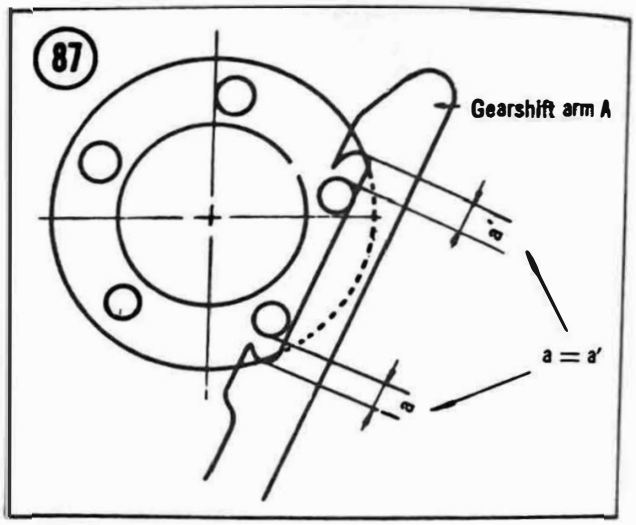


7. Reverse disassembly procedure to assemble. Refer to **Figure 85** during assembly.

CAUTION

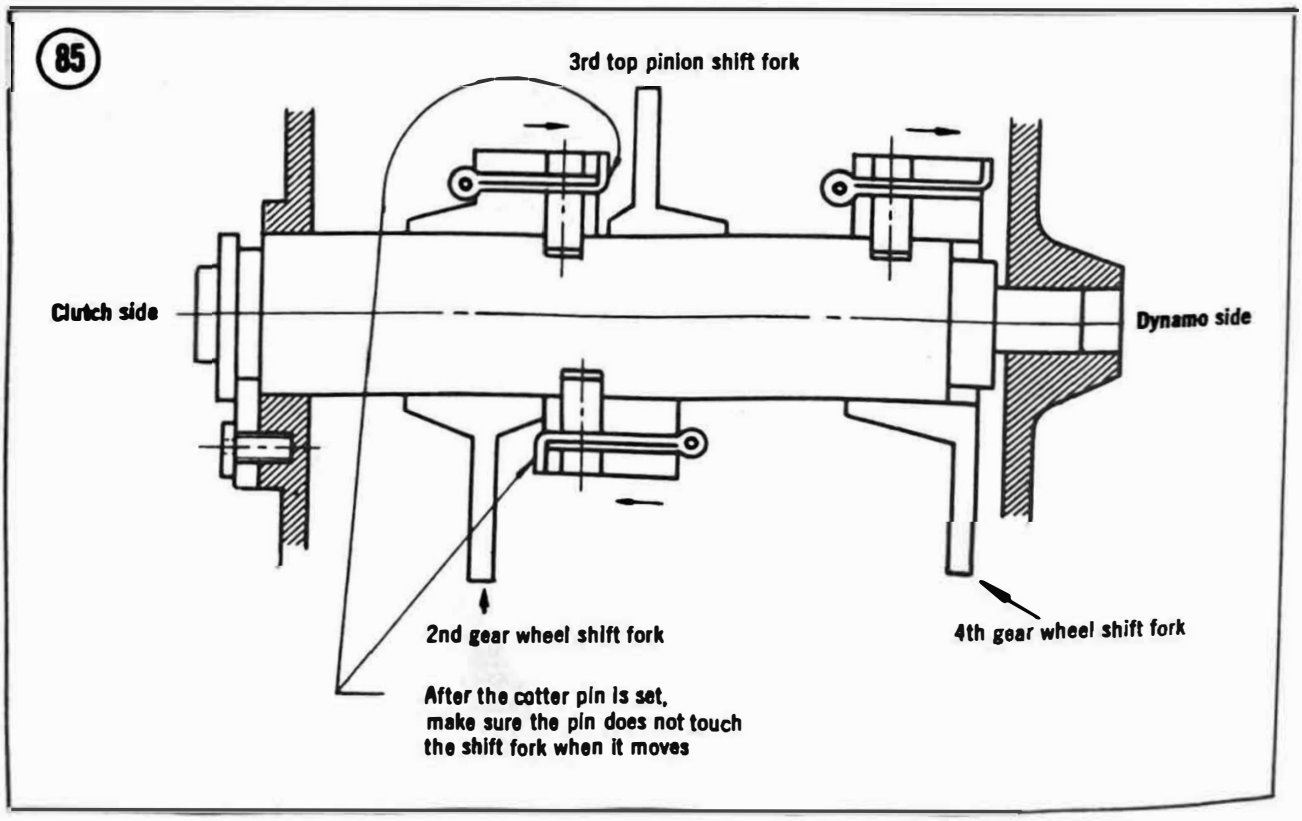
Be very careful that the cotter pins do not touch the shift forks.

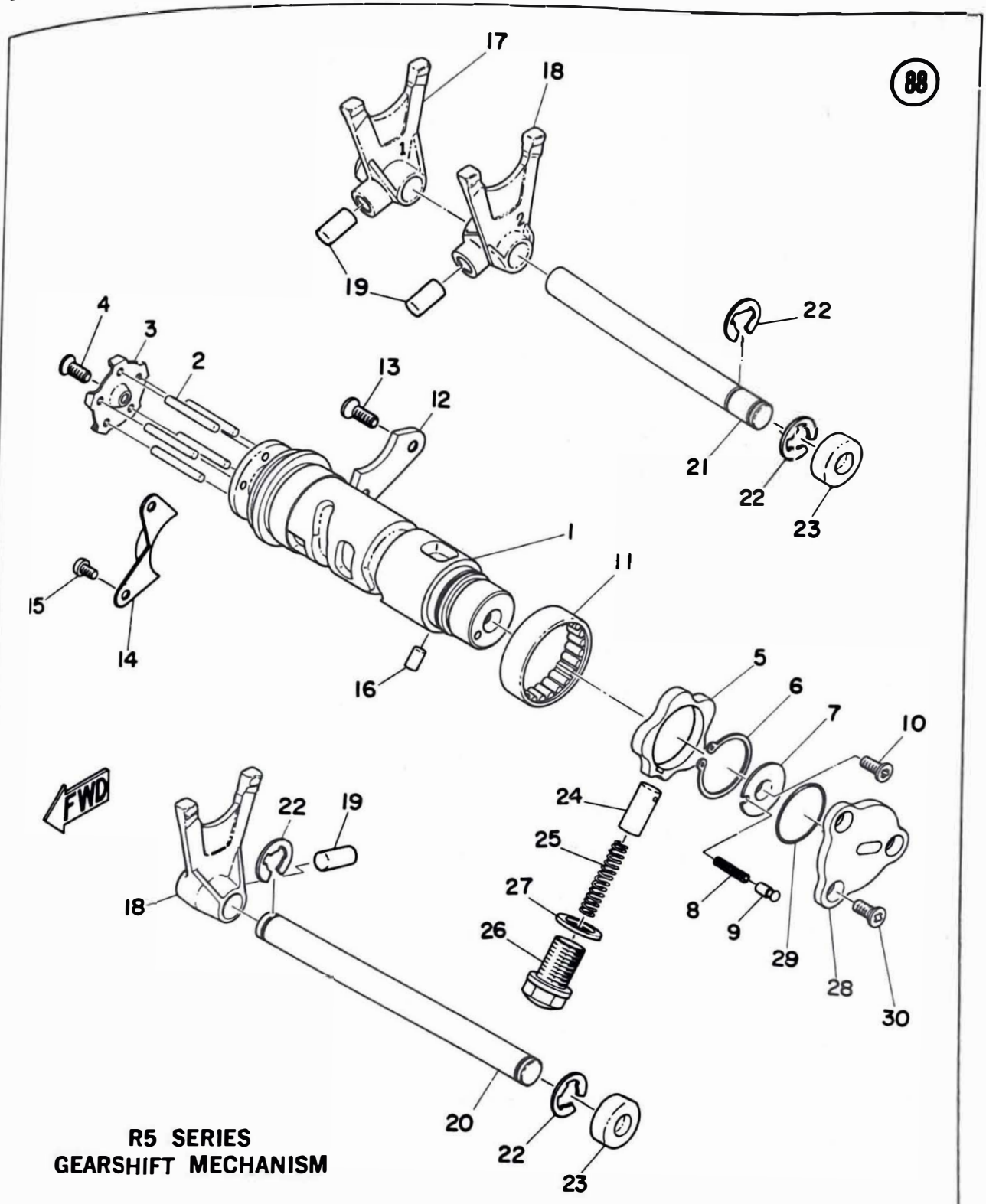
8. Refer to **Figures 86 and 87** to adjust the shifter. Turn the adjustment bolt so that the clearance between the shift drum pins and the gearshift arm is equal at both places while in third gear.



Disassembly/Assembly (R5 Series)

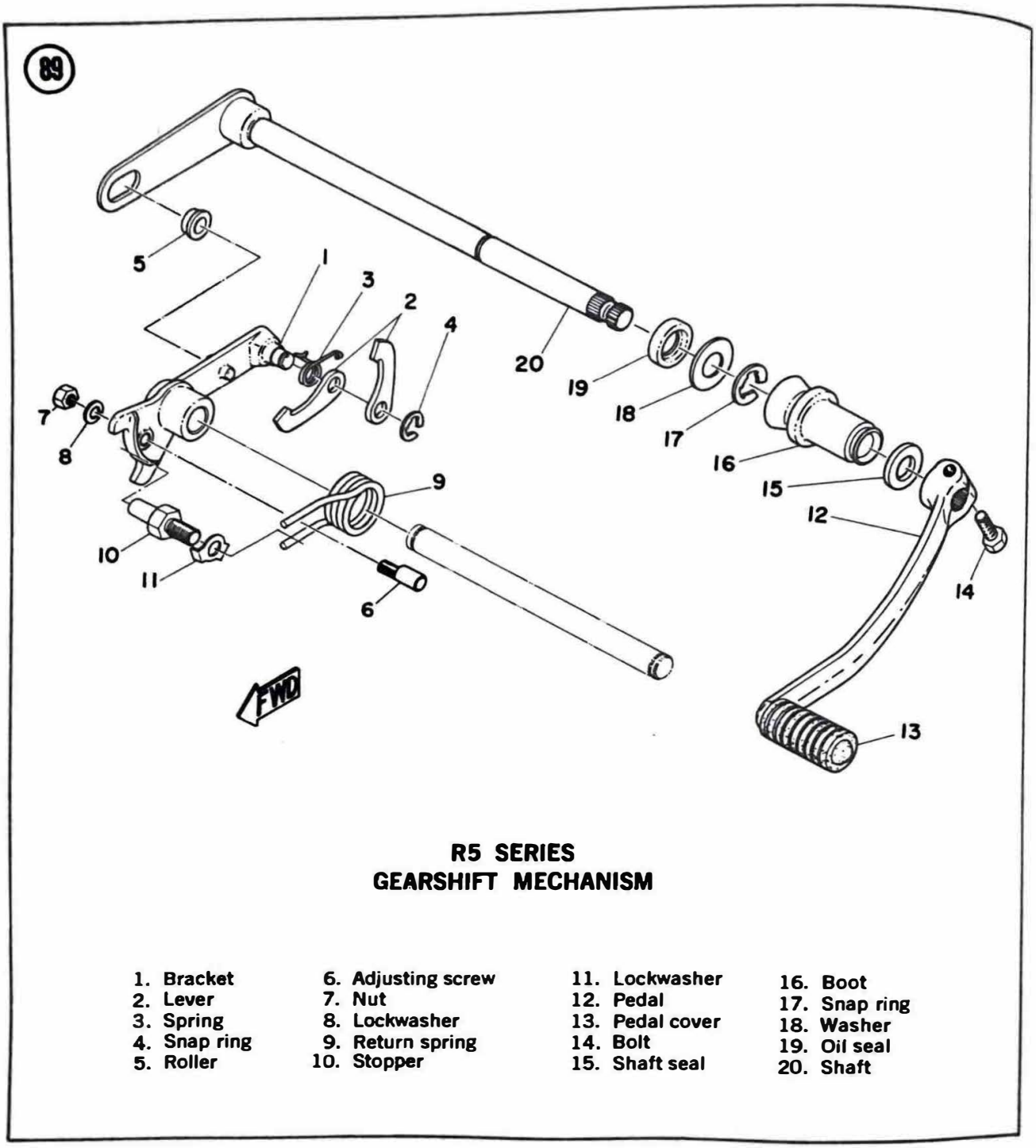
Figures 88 and 89 are exploded views of the





R5 SERIES
GEARSHIFT MECHANISM

1. Cam
2. Dowel pin
3. Plate
4. Screw
5. Plate
6. Snap ring
7. Plate
8. Spring
9. Neutral pin
10. Screw
11. Bearing
12. Plate
13. Screw
14. Guide
15. Screw
16. Dowel pin
17. Fork
18. Fork
19. Follower pin
20. Guide bar
21. Guide bar
22. Snap ring
23. Plug
24. Stopper
25. Spring
26. Screw
27. Gasket
28. Switch
29. O-ring
30. Screw

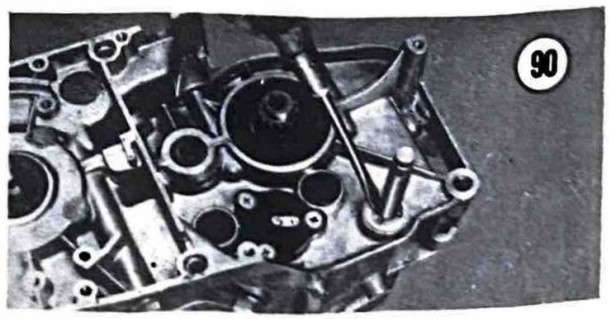


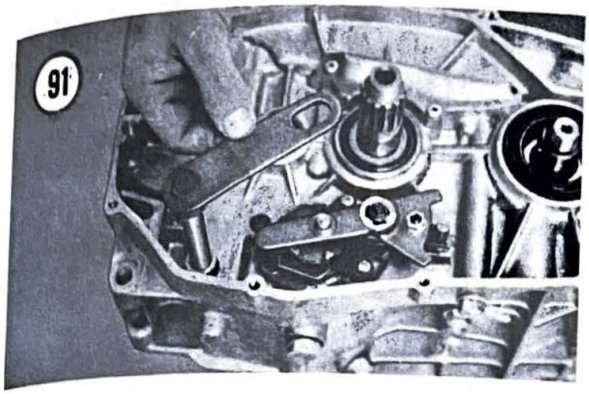
R5 SERIES
GEARSHIFT MECHANISM

1. Bracket
2. Lever
3. Spring
4. Snap ring
5. Roller
6. Adjusting screw
7. Nut
8. Lockwasher
9. Return spring
10. Stopper
11. Lockwasher
12. Pedal
13. Pedal cover
14. Bolt
15. Shaft seal
16. Boot
17. Snap ring
18. Washer
19. Oil seal
20. Shaft

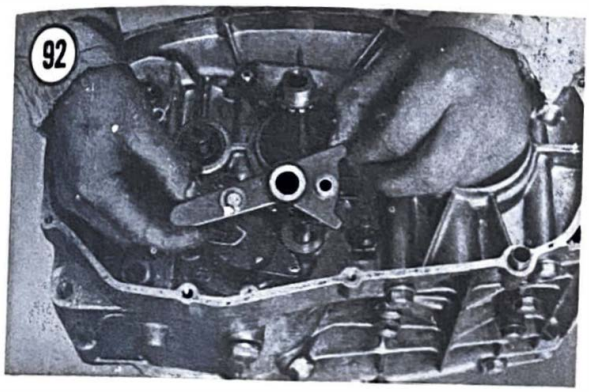
internal and external parts. In this shifter, a drum cam is rotated by the action of the gearshift pedal. The shift forks, which position the transmission gears, are moved by grooves on the drum. Complete removal of this shifter requires disassembly of the crankcase and transmission.

1. Remove the gearshift shaft snap ring and shim (**Figure 90**). Pull out the shaft from the opposite side (**Figure 91**).





2. Remove the change lever snap ring (**Figure 92**) and the change lever.



3. A roller fits on the change lever and slips into the only slot in the shift shaft plate. See (5), **Figure 89**. Remove it immediately to prevent its loss.

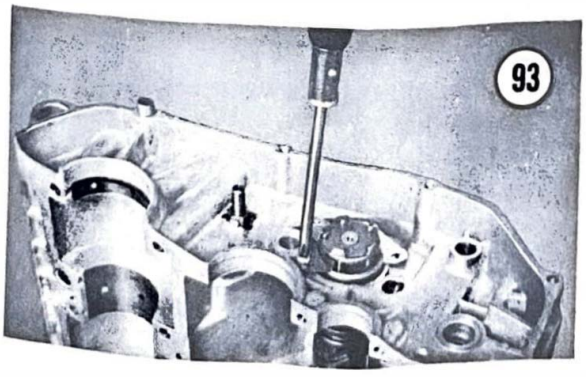
4. Further disassembly requires removal of the transmission. Refer to the *Transmission* section in this chapter.

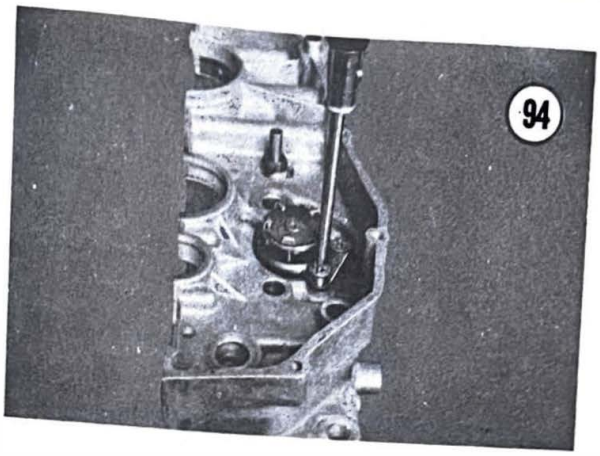
5. Remove the change lever guide (**Figure 93**).

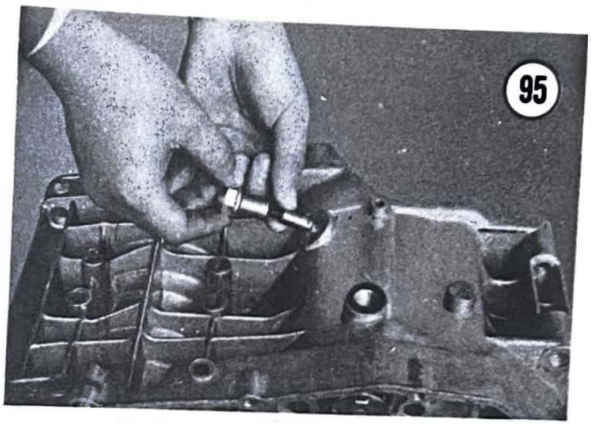
6. Remove the stop plate (**Figure 94**).

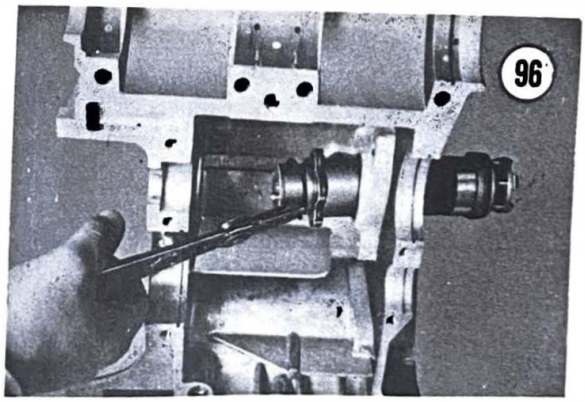
7. Pull out the guide bars and shift forks.

8. Remove the cam stop (**Figure 95**). The shift cam can be pulled out after the snap ring (**Figure 96**) is removed.









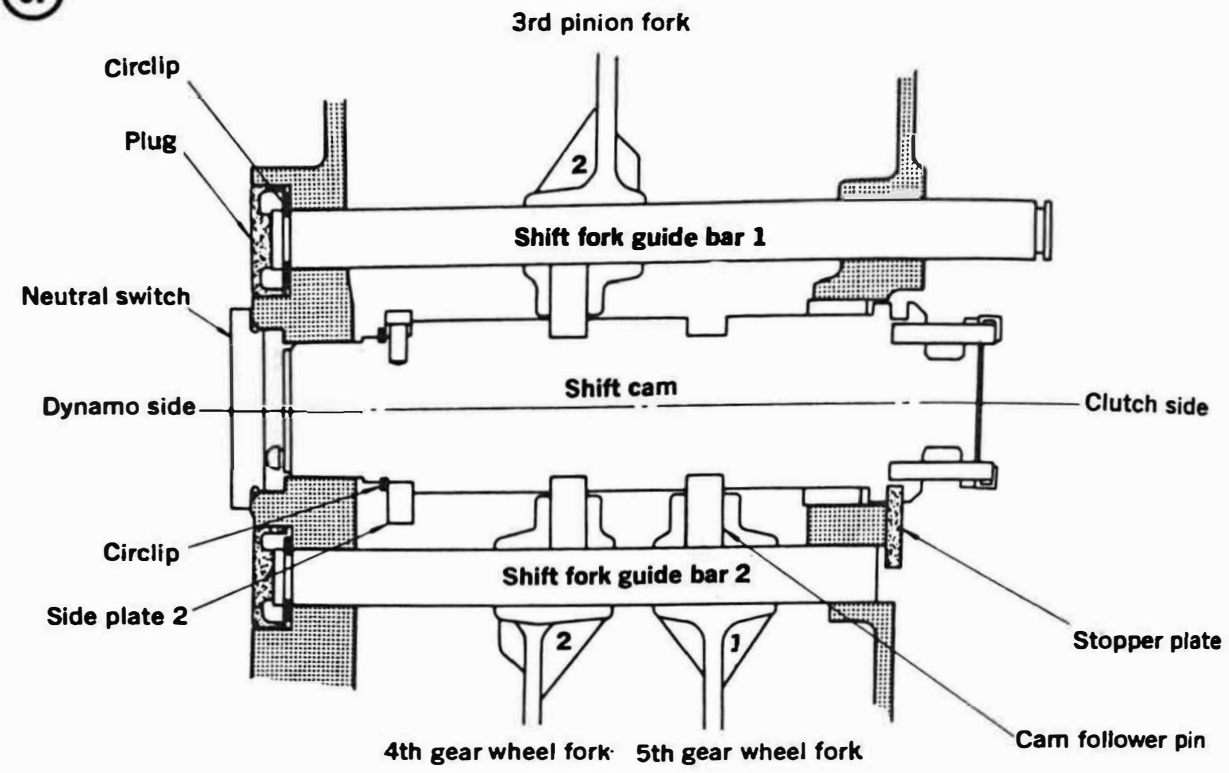
9. Examine all parts carefully. Worn or damaged parts can result in shifting difficulties, and should be replaced.

10. Reverse the disassembly procedure to assemble (**Figure 97**). Note the position of the stop plate snap ring (**Figure 98**).

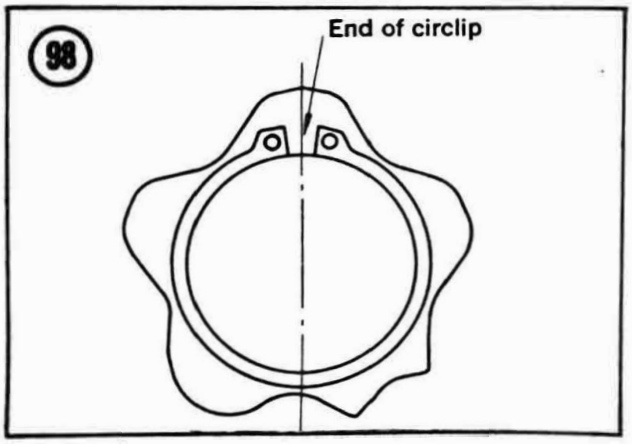
11. Place the transmission in second gear. Loosen the locknut (**Figure 99**) and turn the adjusting screw to adjust the shifter. Adjustment is correct when change lever 3 is equidistant from 2 pins on the shift drum. Tighten the locknut and recheck adjustment.

97

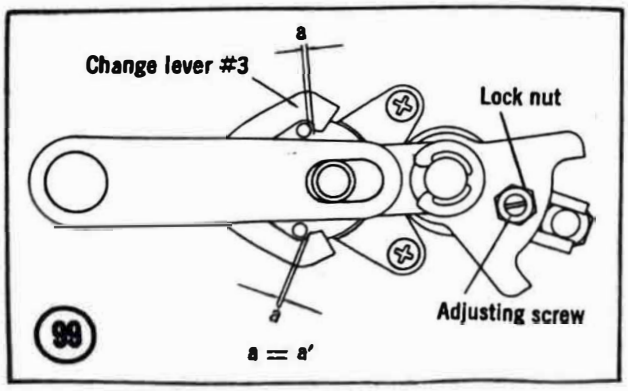
R5 SERIES GEARSHIFT MECHANISM



98



99



Disassembly/Assembly (RD Series)

Figures 100 and 101 are an exploded view and an assembled view of this system. It operates the 6-speed transmission. Basic removal and installation procedures, plus shift linkage adjustment, are identical to the R5 series shifter. The grooves cut into the shift cam are different, and there are 4, instead of 3, shift forks. Therefore, refer to the *Disassembly/Assembly (YR, DS7, RD, and R5 Series)* section for those procedures.

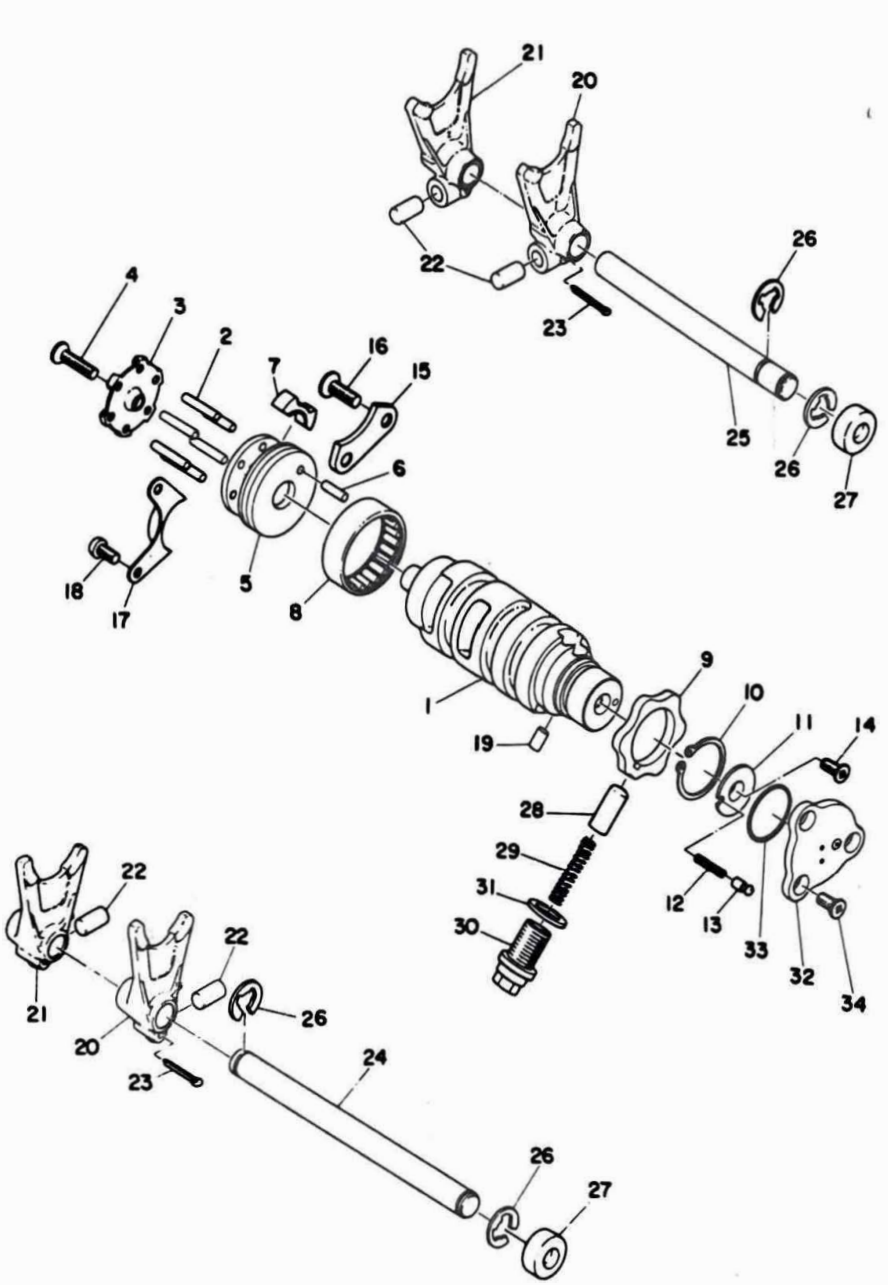
CRANKCASE

The Yamaha uses 2 types of crankcases. One type splits vertically into left and right halves. The other type splits horizontally into upper and lower halves.

It is important that the case halves be handled carefully and that no damage occur to the mating surfaces of the case halves.

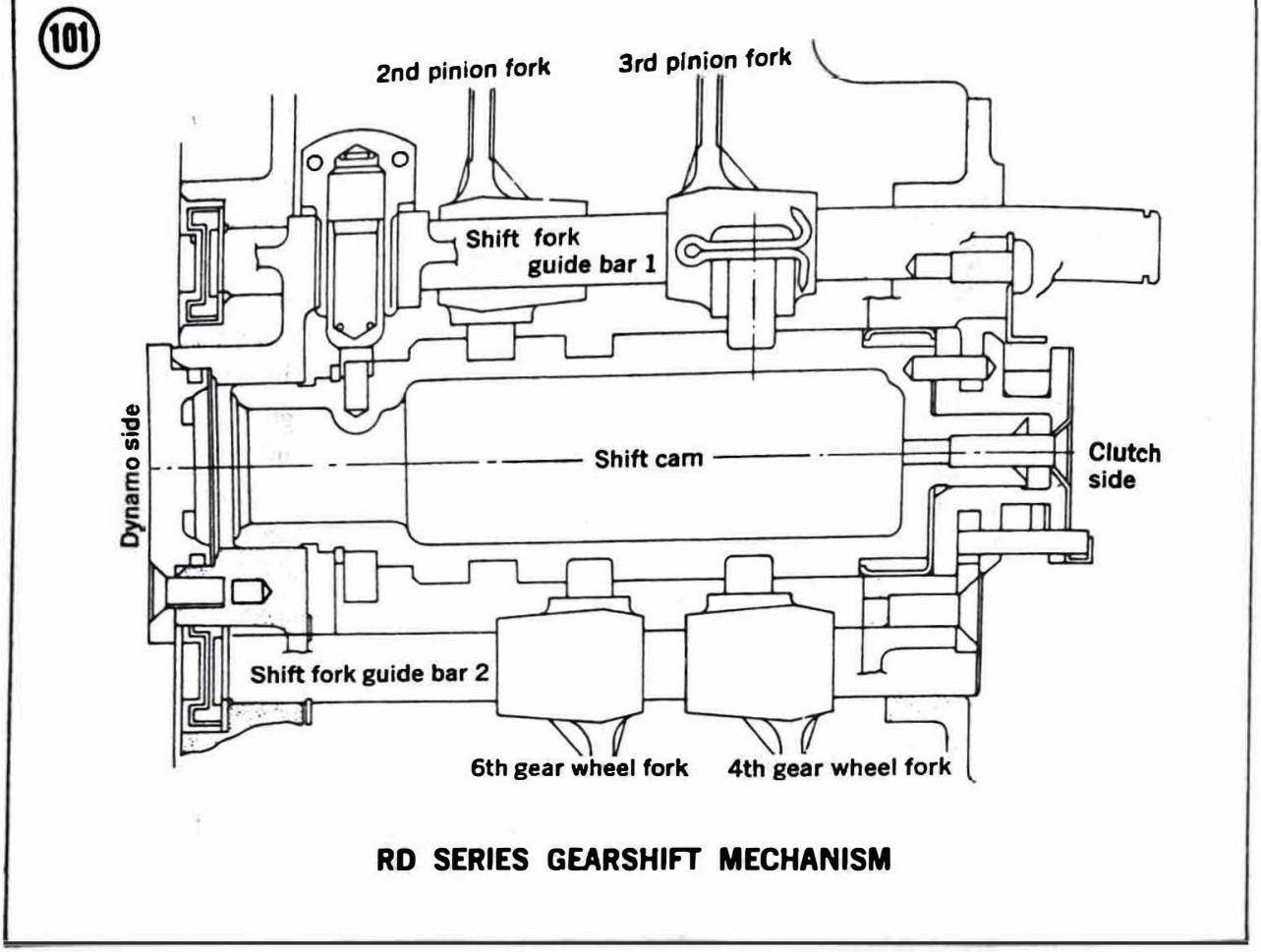
Disassembly (Vertical Split Type)

1. Remove the clutch, primary drive gear, ex-



RD SERIES GEARSHIFT MECHANISM

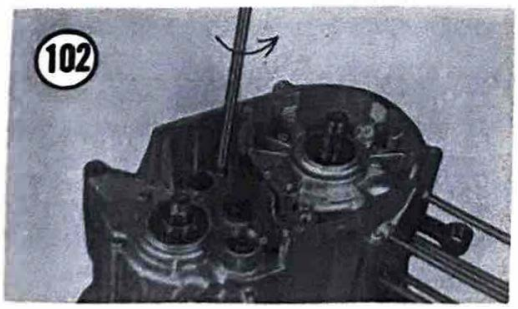
1. Shift cam
2. Dowel pin
3. Side plate
4. Flat head screw
5. Segment
6. Dowel pin
7. Pawl plate
8. Bearing
9. Stopper plate
10. Circlip
11. Side plate
12. Spring
13. Neutral point
14. Flat head screw
15. Stopper plate
16. Flat head screw
17. Change lever guide
18. Pan head screw
19. Dowel pin
20. Shift fork
21. Shift fork
22. Cam follower pin
23. Cotter pin
24. Shift fork guide bar
25. Shift fork guide bar
26. Circlip
27. Blind plug
28. Cam stopper
29. Cam stopper spring
30. Spring screw
31. Drain plug gasket
32. Neutral switch assembly
33. O-ring
34. Flat head screw



RD SERIES GEARSHIFT MECHANISM

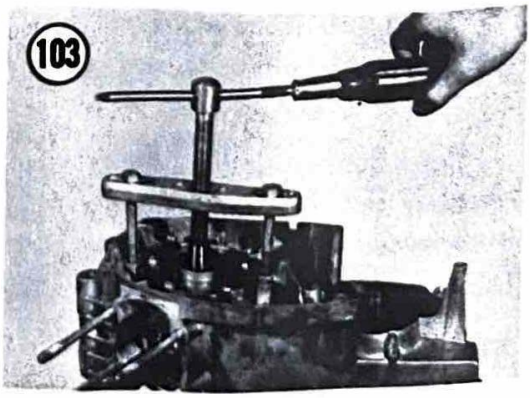
ternal kickstarter parts, generator, drive sprocket, and external parts of the shift mechanism. Refer to the procedures in this chapter.

2. Remove the screws (**Figure 102**) which hold the crankcase halves together. They are all located on one side, but may be on the left or right side depending on the model.



NOTE: *On the YDS3, YM, and the DS6 series, 2 case securing screws are protected (and hidden) by black rubber plugs. These screws are located up front in the finned crankcase area and must not be overlooked.*

3. Install a universal puller on the right crankcase half, as shown in **Figure 103**. Alternately tap the transmission main shaft and crankcase as you turn the handle on the tool. Be sure that the mounting bolts on the tool are fully tightened and that the tool remains parallel to the side of the crankcase (**Figure 104**).



Inspection (Vertical and Horizontal Split Type)

1. Thoroughly wash the case halves in kerosene.
2. Clean all gasket mating surfaces and crankcase half mating surfaces thoroughly.
3. Visually inspect case halves for any cracks or damage.
4. Check all fittings not previously removed for signs of loosening or damage.
5. If bearings have been removed, check their seats for signs of damage, such as the bearing spinning in the seat.
6. Check oil delivery passages in transfer ports for signs of blockage.
7. If bearings have not been removed, oil them thoroughly immediately after washing and drying. Rotate the bearings and look for hard spots indicating damaged races or balls.

Assembly (Vertical Split Type)

1. Make sure that the mating surfaces are perfectly clean and dry.
2. Assemble the crankshaft, transmission, and shift cam in the left case.
3. Shift the gearbox into neutral. In this position, each transmission shaft should spin freely without turning the other.
4. Apply gasket cement to both crankcase surfaces and lower the right case over the crankshaft end with the transmission shaft sticking up. Do not let cement dry before assembly.

CAUTION

The right case should easily slide down over the shafts and butt against the other case. If the cases get close, but do not want to come together, stop, pull the case back off, and examine for a transmission shaft out of place, improper shim location on either end of the shafts, or transmission in gear. Do not hammer or otherwise force the cases together.

5. Tap the case with a soft-headed mallet (plastic, rubber, or lead), alternating from one end of the case to the other. Drive the case down evenly over the shafts until mating surfaces meet.
6. Install screws and tighten in seqeunce. On most models there are numbers stamped next to each screw to signify the tightening order. If not, tighten by stages in a crisscross pattern. Hand-tighten until secure, but do not overtighten; the case threads are aluminum and may be stripped.

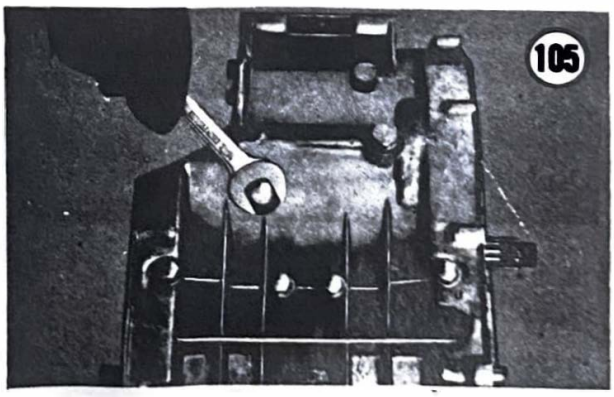
CAUTION

Be sure the connecting rods are at top and bottom dead center (one position each) during case assembly. The case could catch the rod and bend it. This damage would require costly rod replacement.

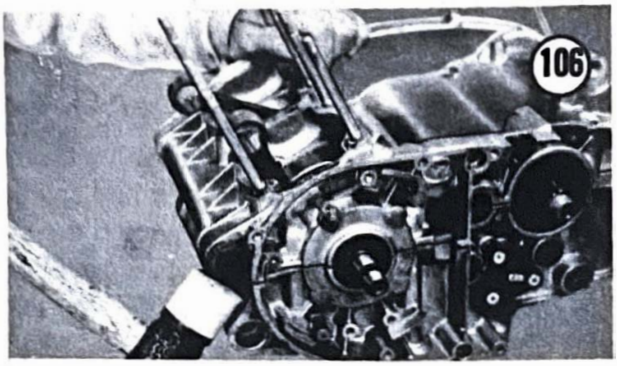
Disassembly (Horizontal Split Type)

Refer to the applicable procedure in this chapter to remove the clutch, primary drive gear, alternator or generator, drive sprocket, kickstarter mechanism, and external gearshift parts.

1. Turn over the crankcase and remove the hex bolts (**Figure 105**) which hold the sections together. Each bolt is numbered. Start with the highest number as you disassemble the unit.



2. Lightly strike the front portion of the upper section (**Figure 106**) and rear portion of the lower section to split the crankcase.



Inspection (Horizontal Split Type)

Inspection procedures are the same as those described for the vertical split crankcase.

Assembly (Horizontal Split Type)

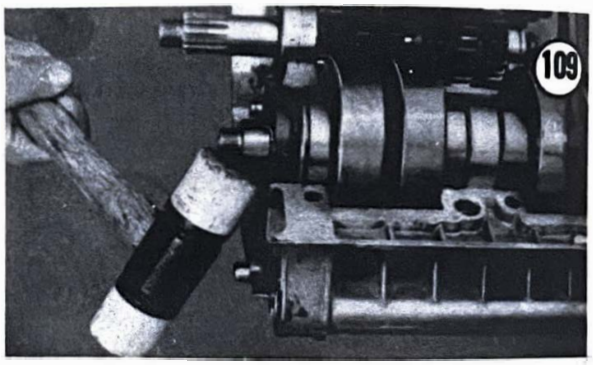
1. To assemble the crankcase, reverse the disassembly procedure. Clean the mating surfaces carefully, then apply gasket cement.
2. Tighten the bolts in ascending order. Use a torque wrench to tighten the bolts. Use 90 in.-lb. (1 mkg) on a 6mm bolt or 180 in.-lb. (2 mkg) on an 8mm bolt.

CRANKSHAFT

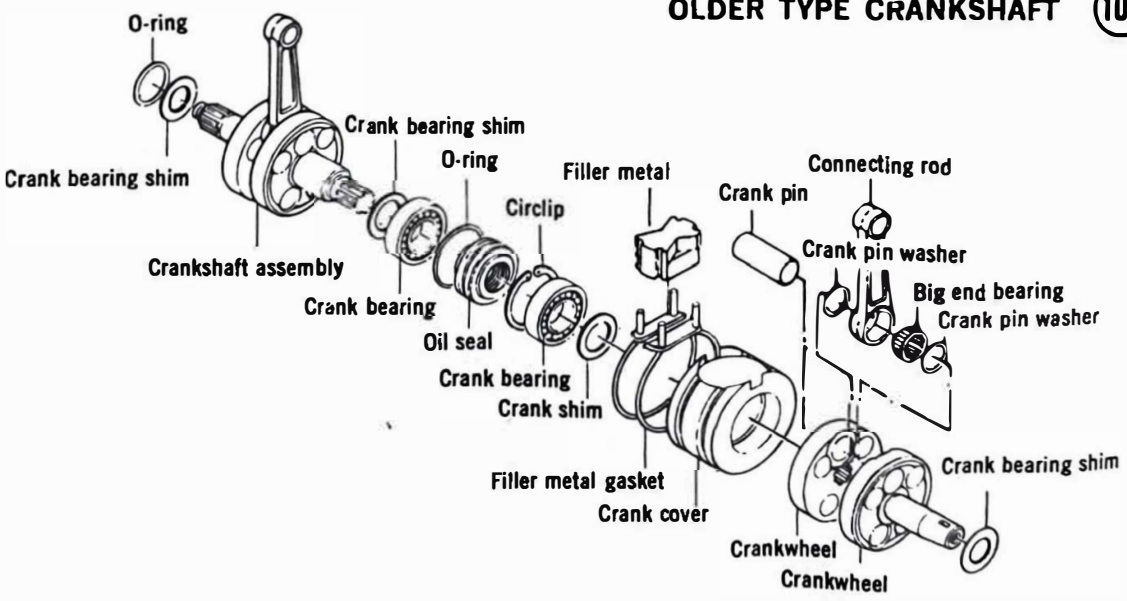
Figures 107 and 108 are exploded views of typical old and new crankshaft assemblies as found in vertically or horizontally split crankcases, respectively.

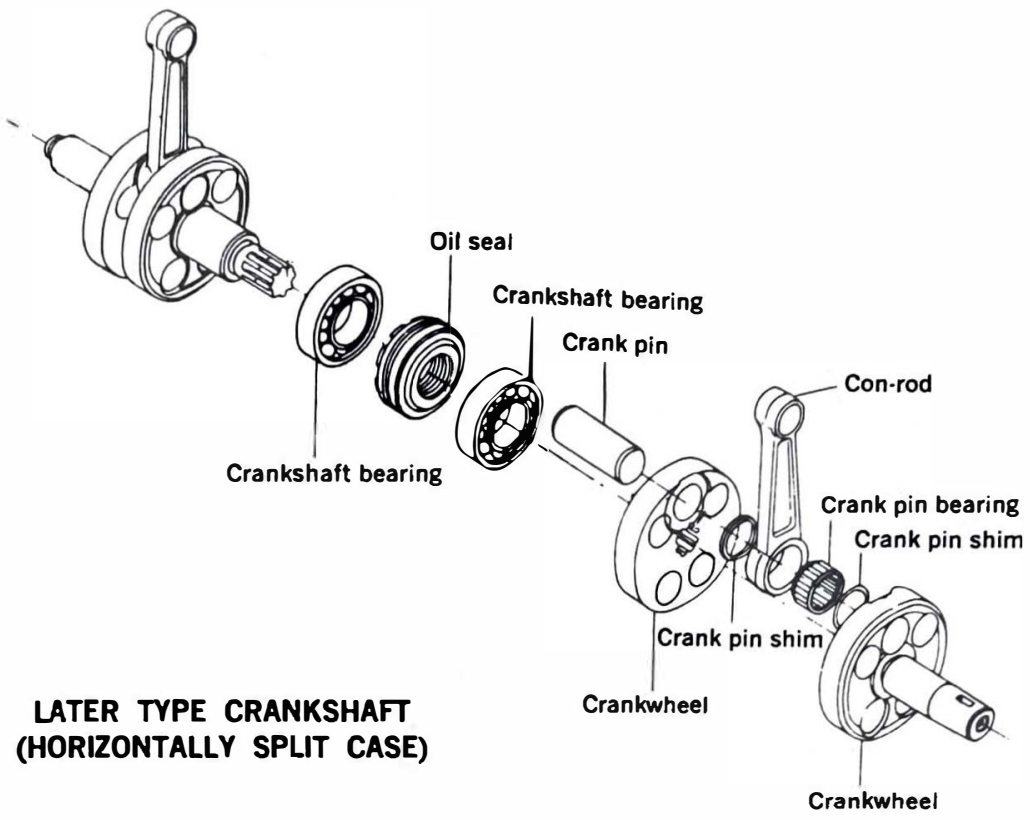
Removal (Horizontally and Vertically Split Crankcase)

The crankshaft assembly may be removed from the vertically split crankcase by striking the shaft (**Figure 109**) with a soft mallet. Use a puller (**Figure 110**) to remove the crankshaft from the horizontally split crankcase. Be sure that the bolts on the tool are tightened into the crankcase, and that the tool remains parallel to the side of the crankcase.

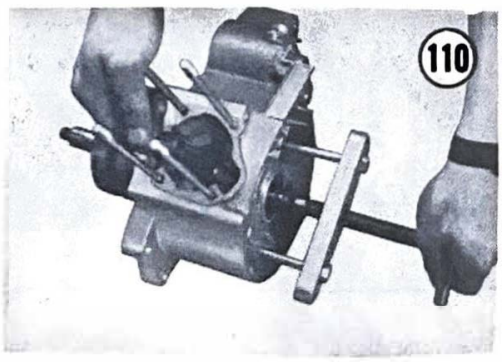


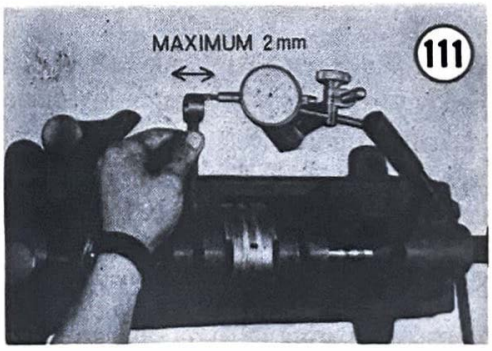
OLDER TYPE CRANKSHAFT (107)





LATER TYPE CRANKSHAFT (HORIZONTALLY SPLIT CASE)



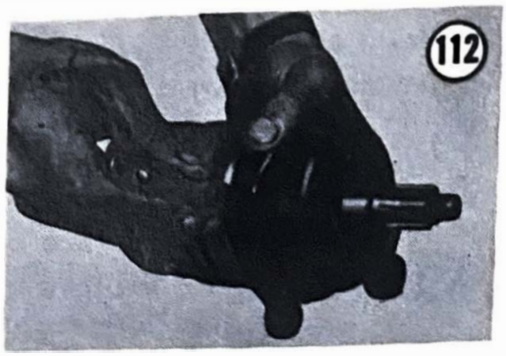


Inspection

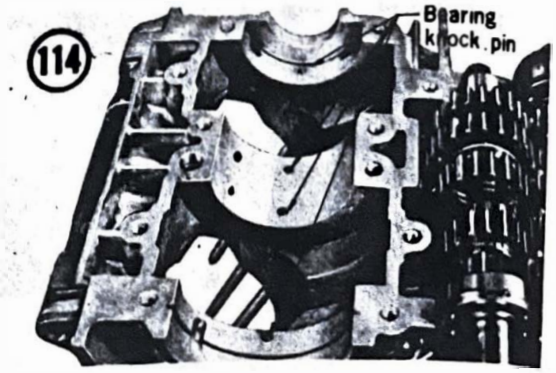
1. Determine crankpin and big end bearing wear by moving the small end of each rod back and forth (**Figure 111**). Axial play should be 0.08 in. (2 mm) or less. If play exceeds that amount, replace worn parts. Axial play should be approximately 0.03-0.04 in. (0.8-1.0 mm) after reconditioning.

2. Check side play at the big end of the connecting rod by inserting a feeler gauge between the big end and the crank wheel (**Figure 112**). Side play limits are 0.004-0.012 in. (0.1-0.3 mm).

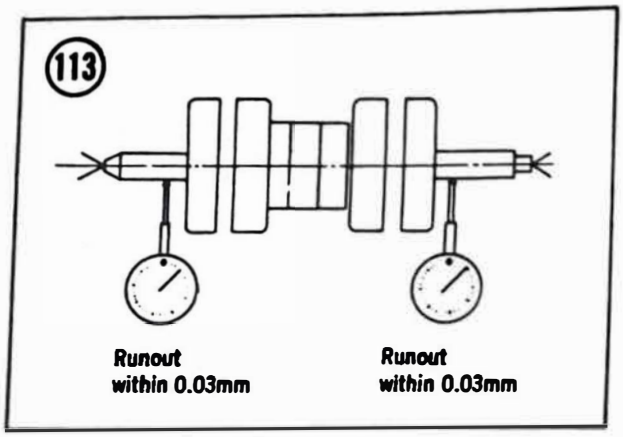
3. Measure runout as shown in **Figure 113**. As the crankshaft is rotated through a complete revolution, runout should not exceed 0.0012 in. (0.03 mm).



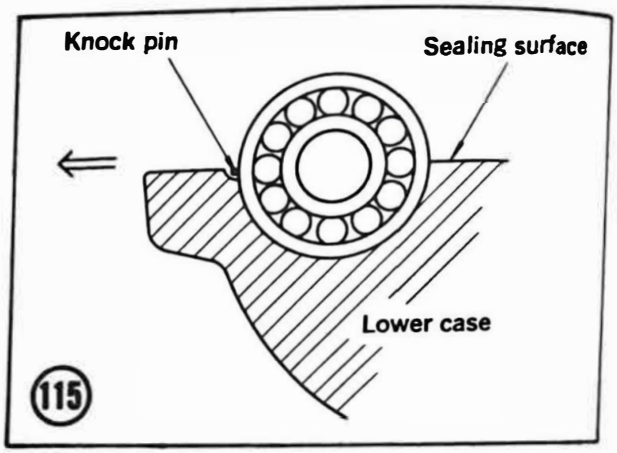
112



114



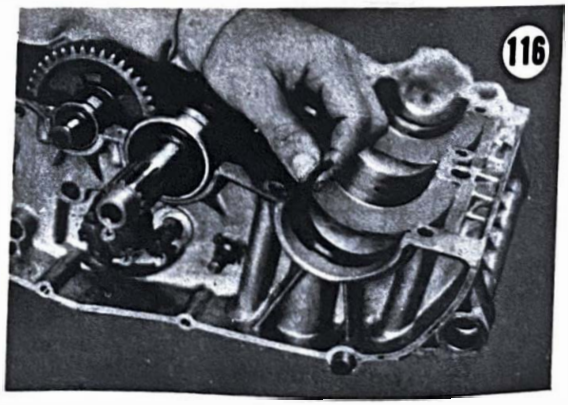
113



115

Disassembly/Assembly

Special crankshaft disassembly tools are required for this procedure. Take the job to a dealer.



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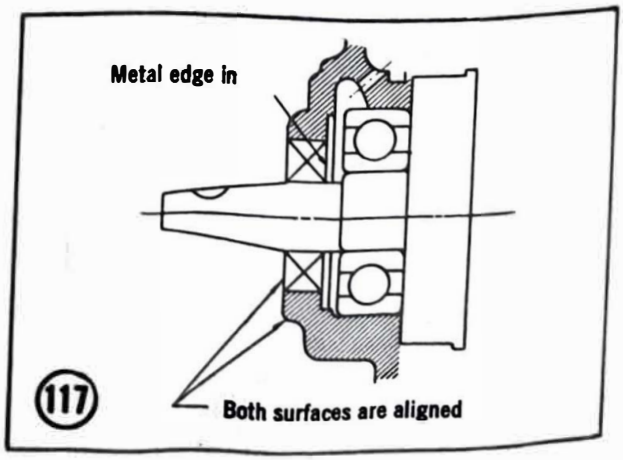
Alignment

1. Mount the assembled crankshaft in a lathe, V-blocks, or other suitable centering device.
2. Measure runout. Refer to **Figure 113**. If it exceeds 0.0012 in. (0.03mm), have a qualified repair shop align the crankshaft.

Installation (Horizontally Split Crankcase)

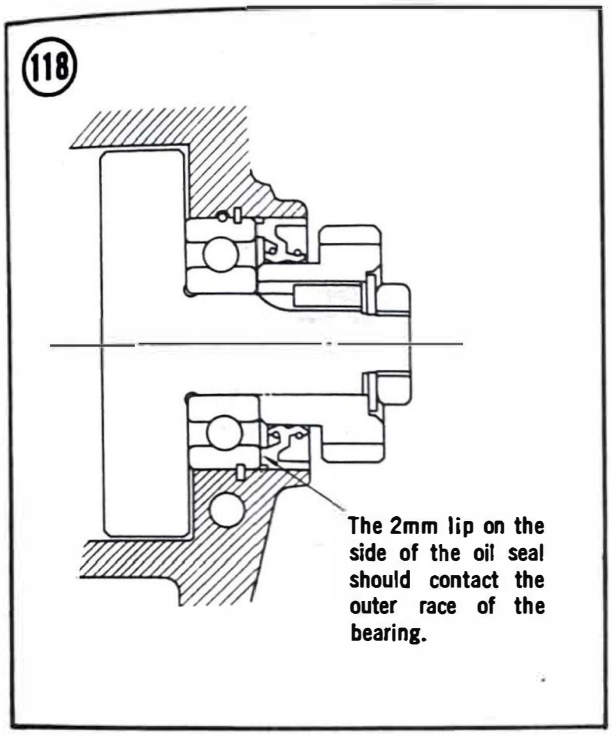
1. Align the bearing locating pins with the pin holes. Pin holes are in the upper crankcase half (**Figure 114**) on the YR1, YR2, YR3, R3, and R3-C models. On the R5, R250, and R350 series, the pin holes are in the lower crankcase half (**Figure 115**). Install the snap ring halves on the clutch side bearing (**Figure 116**).
2. Install the oil seal on the generator side so that the outer surface of the seal is even with the edge of the crankcase boss, as shown in **Figure 117**. The oil seal on the clutch side is to

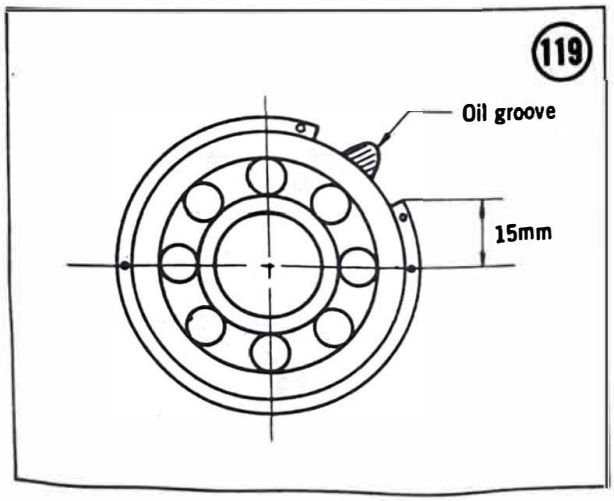


117

be installed so that the seal lip contacts the outer race of the bearing (**Figure 118**).

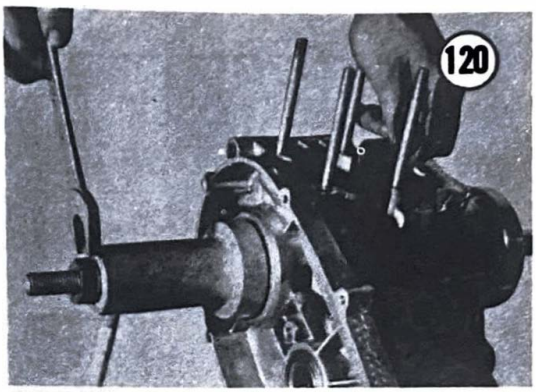
3. On R3 and YR series models, position the snap ring on the right crankshaft bearing so that the oil groove on the upper half of the crankcase is between the ends of the snap ring (**Figure 119**).





Installation (Vertically Split Crankcase)

1. Apply gasket cement to the crank cover seal.
2. Insert the crankshaft assembly into the crankcase and attach the crankshaft setting tool (**Figure 120**). Turn the nut on the tool, pulling the crankshaft into position. Hold the center filler block facing upward. Be careful that the crankshaft does not scrape the crankcase as it is pulled into position.



It is important that you watch connecting rod position during this procedure to prevent the rod from catching on the case and bending.

3. There is a rubber gasket around the large aluminum block in the center of the crankshaft (called a crank cover). Replace the rubber piece if at all flattened. Coat this gasket with gasket cement just before installing crankshaft.
4. Make sure you have the generator end of the crankshaft facing in the proper direction.

The metal filler block that rests on top of the crank cover can fit only one way. Be sure it matches up with the case mating surface. Also, keep tapping this metal filler block down when installing the crankshaft *and* when assembling the case halves.

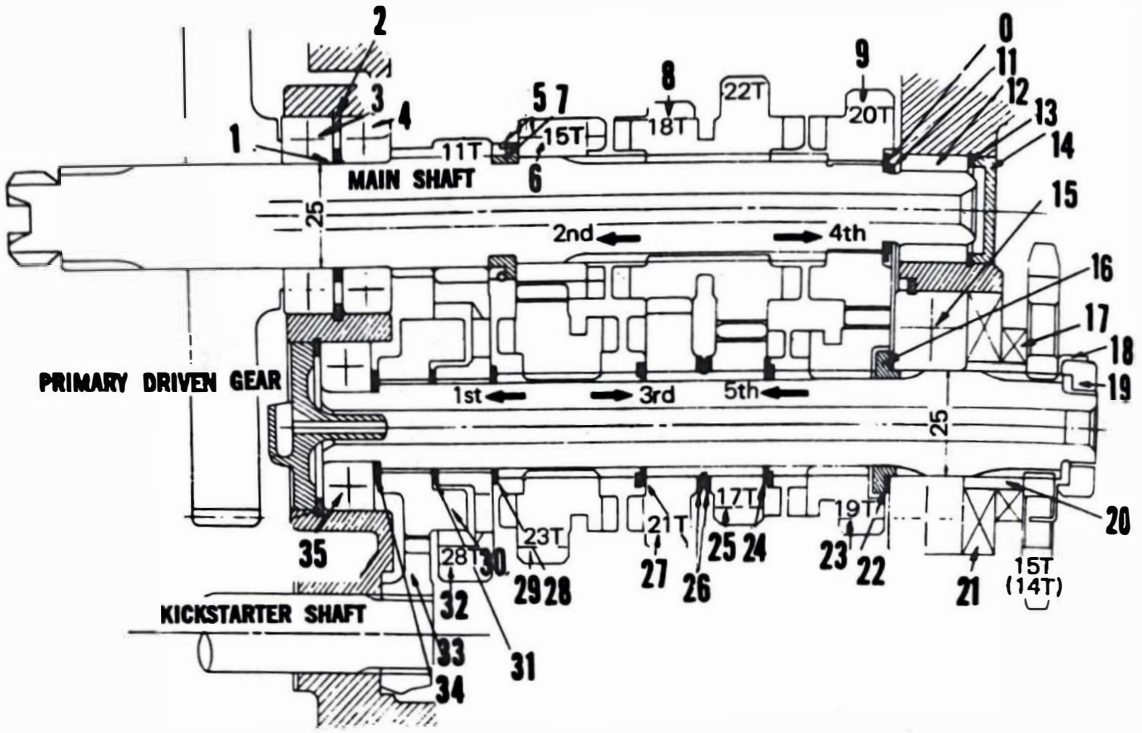
TRANSMISSION

There are 4 transmission types. Individual gear ratios vary in a given type, but service procedures are similar.

Removal/Installation (DS, YD, and YM Series)

Figures 121 and 122 are sectional and exploded views of the transmission. A portion of the kickstarter mechanism is incorporated into the transmission.

1. Remove the transmission by alternately tapping the ends of both transmission shafts to



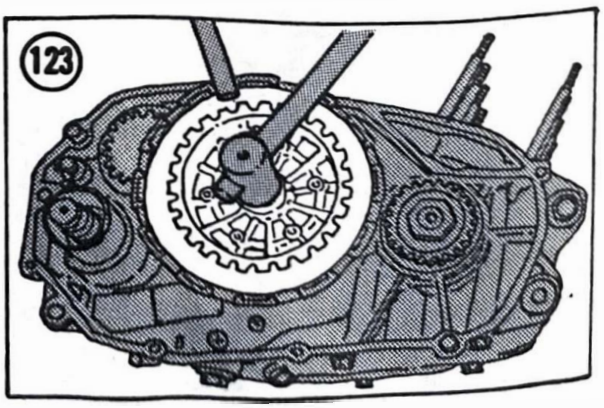
DS, YD, AND YM SERIES TRANSMISSION

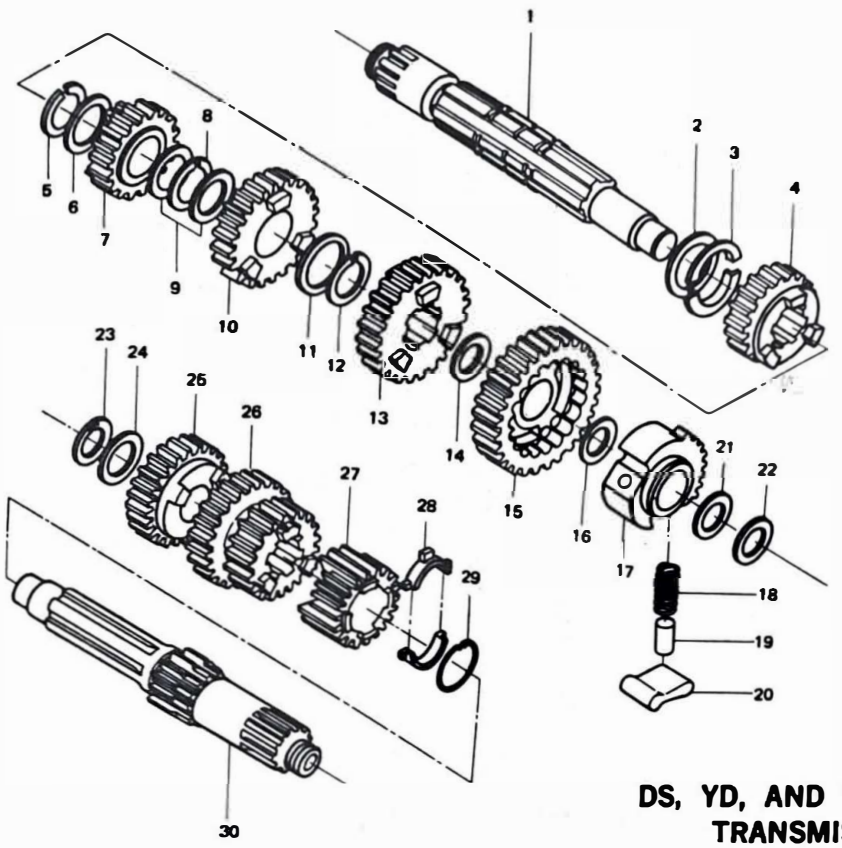
1. Spacer
2. Main shaft bearing clip
3. Main shaft bearing
4. Main shaft bearing
5. 2nd pinion retaining clip
6. 2nd pinion gear
7. 2nd pinion setting plate
8. 3rd and 5th pinion gears
9. 4th pinion gear
10. Main shaft washer
11. Main shaft snap ring
12. Main shaft needle bearing
13. Needle bearing snap ring
14. Needle bearing plug
15. Countershaft bearing
16. Countershaft setting plate
17. Fuel ring
18. Sprocket lockwasher
19. Sprocket lock nut
20. Distance collar
21. Countershaft bearing
22. 4th gear shim
23. 4th gear
24. Gear retaining washer
25. 5th gear
26. Gear retaining washers
27. 3rd gear
28. 1st gear spacer
29. 2nd gear
30. Kick pinion
31. Thrust washer
32. 1st gear
33. Kick gear
34. Countershaft adjusting shim
35. Countershaft bearing

drive them from the left crankcase half. When you replace the transmission, be sure that all washers are installed properly.

Be careful to check for shims on either end of both shafts. Once the transmission has been removed, check inside each case, against the transmission shaft bearings, to see if any shims are stuck to the bearings.

2. **Figure 123** shows how to mesh the kick pinion with the kick gear; notice the position of the teeth in relation to each other. In this position





DS, YD, AND YM SERIES TRANSMISSION

1. Countershaft
2. 4th gear shim
3. Countershaft setting plate
4. 4th gear
5. Countershaft snap ring
6. Gear retaining washer
7. 5th gear
8. Countershaft snap ring
9. Gear retaining washer
10. 3rd gear
11. Gear retaining washer
12. Countershaft snap ring
13. 2nd gear
14. 1st gear spacer
15. Kick gear
16. Thrust washer
17. Kickstarter pinion gear
18. Kickstarter pawl spring
19. Kickstarter pawl pin
20. Kickstarter pawl
21. Countershaft adjustment shim
23. Main shaft snap ring
24. Main shaft washer
25. 4th pinion gear
26. 3rd and 5th pinion gear
27. 2nd pinion gear
28. 2nd pinion gear setting plate
29. 2nd pinion gear snap ring
30. Main shaft

the kick lever can be fully depressed and the teeth will remain engaged. Also note that both kick pawls that spring out to cause kickstarter engagement are held inward by the kick pawl stoppers. **Figure 124** gives precise positioning detail. If either kick pawl stopper is loose, support the stopper and press or hammer the rivet end tight against the case.

3. Install the drive shaft assembly, meshing it with each gear on the main shaft. Alternately tap the end of each shaft with a plastic mallet to drive them in place. Be sure the gears are correctly meshed as you do so.

Removal/Installation (YR, R3, R5, and RD Series)

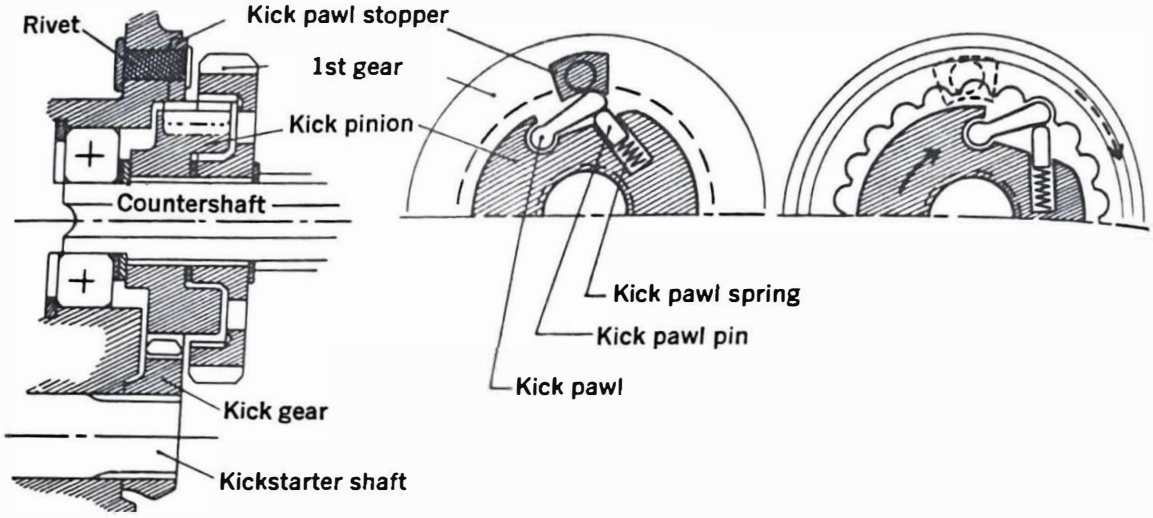
Figures 125 and 126 show the transmission.

1. To remove, lift it from the crankcase. It may be necessary to tap the shafts lightly with a soft mallet.

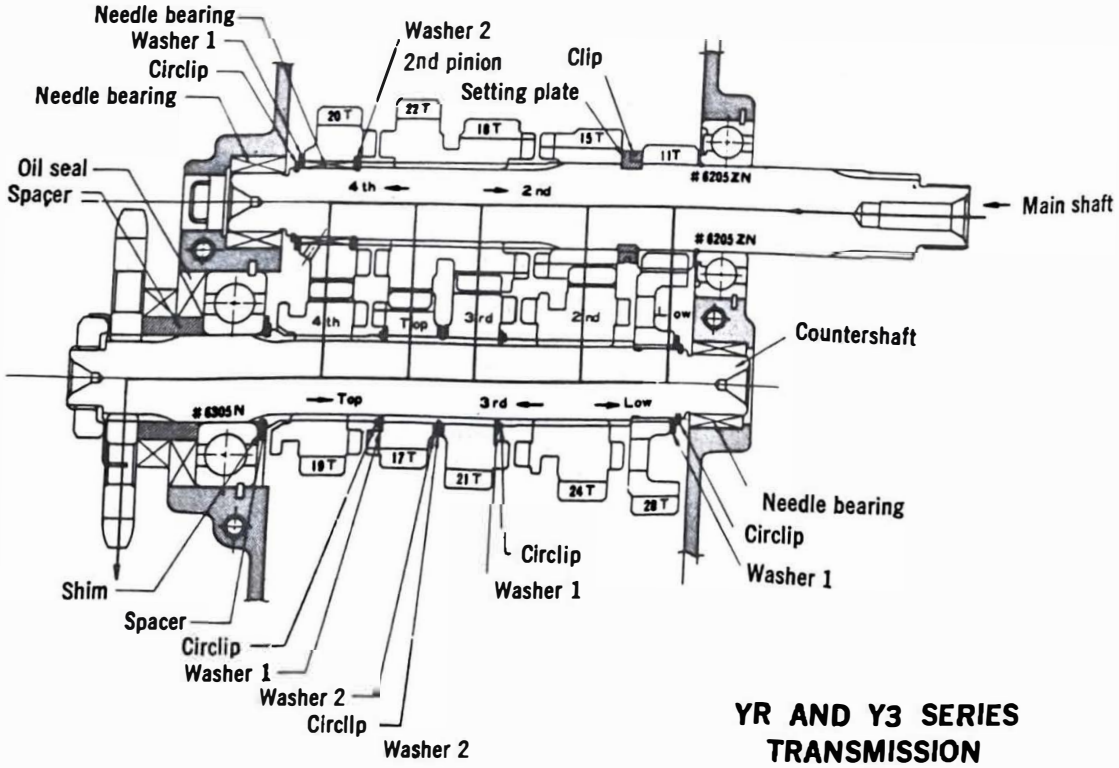
2. Install the oil seal on the transmission shaft before you replace the transmission.

3. Install the snap ring half (**Figure 127**) on the transmission drive shaft on the end toward the clutch. The transmission will drop into place. Be careful that you do not damage the oil seal.

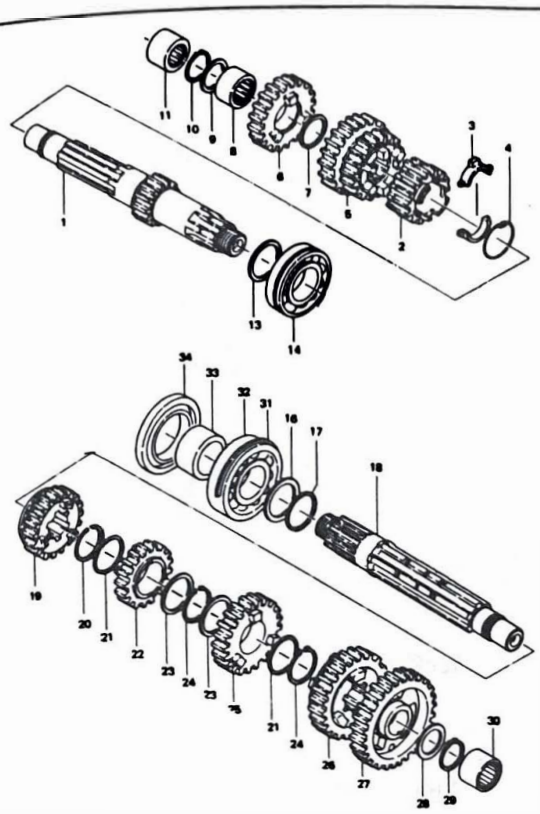
(124)



(125)



YR AND Y3 SERIES TRANSMISSION



126

TYPE 2 TRANSMISSION

1. Main shaft
2. 2nd pinion gear
3. 2nd pinion setting plate
4. Clip
5. 3rd and 5th pinion gear
6. 4th pinion gear
7. Washer 2
8. Needle bearing
9. Washer 1
10. Circlip
11. Needle bearing
13. Shim
14. Bearing
16. Shim
17. Spacer
18. Countershaft
19. 4th gear
20. Circlip
21. Washer 1
22. 5th gear
23. Washer 2
24. Circlip
25. 3rd gear
26. 2nd gear
27. 1st gear
28. Washer
29. Circlip
30. Bearing
31. Circlip
32. Bearing
33. Spacer
34. Oil seal

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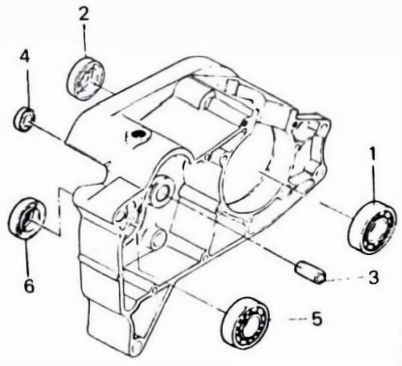
BEARINGS AND OIL SEALS

Removal/Installation

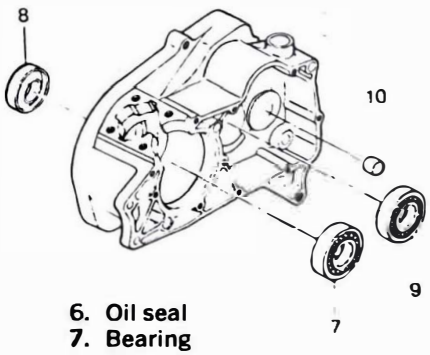
Figure 128 shows bearings and oil seals in a typical engine.

1. Heat the crankcase to approximately 250°F (120°C) in an oven before removing or installing the bearings and oil seals. Do not use a torch, as this will cause warping and metal fatigue.

LEFT HALF



RIGHT HALF



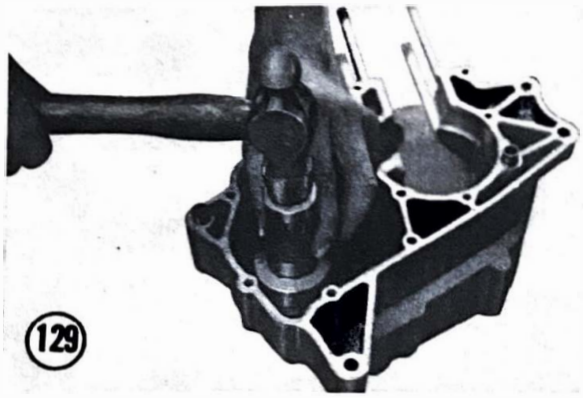
128

1. Bearing
2. Oil seal
3. Needle bearing
4. Oil seal
5. Bearing
6. Oil seal
7. Bearing
8. Oil seal
9. Bearing
10. Needle bearing

2. Pry out the old seals with a screwdriver.

3. Always use new oil seals when you overhaul the engine. Remove the bearings with a bearing removal tool (**Figure 129**).

4. Install all bearings and oil seals with the manufacturer's markings outward. Pack the bearings with light grease before installation.



AUTOLUBE

Pump Removal

1. Remove the case cover on the right front corner of the engine case. See **Figure 130**.

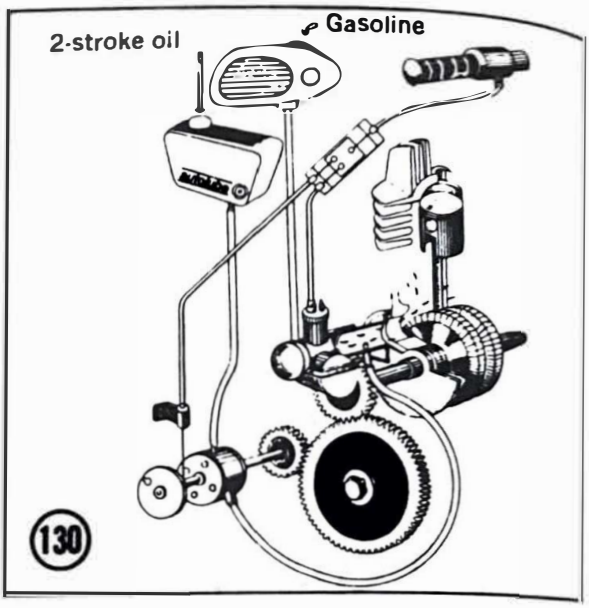
2. Unwind the pump actuating cable and disconnect from the pump.

3. Disconnect the 2 oil lines at the pump. Mark each line for installation.

4. Remove the 2 screws holding the pump in place and remove the pump.

Disassembly

The Autolube pump is a sealed unit which cannot be repaired. Replace the entire pump if damaged or worn.



Inspection

1. Check for obstructions in the oil delivery line or pump orifice.

2. Check for a worn or damaged pump body seal or crankcase cover seal.

3. Check for a missing or improperly installed check valve ball or spring.

4. Make sure the oil delivery lines are not hooked up backwards.

Pump Installation

Install new gaskets during installation.

1. Reverse *Pump Removal* sequence for installation.

2. Refer to the *Autolube* section of Chapter Two for *Pump Stroke Adjustment, Pump Cable Adjustment,* and *Pump Bleeding* before starting the engine. Fill Autolube tank with oil.

CHAPTER FIVE

FUEL AND EXHAUST SYSTEMS

The fuel system consists of the fuel tank, fuel petcock valve, and carburetors. The exhaust system consists of the exhaust headers, silencer, and mufflers.

CARBURETOR

The carburetors are of primary importance to proper engine operation. Considerable care should be taken during disassembly, inspection, and maintenance to ensure that all components are working correctly and that any adjustments are accurately made.

Prior to disassembly, carefully check the air filter, spark plugs, Autolube system, and ignition timing. Each of these components works in conjunction with the carburetor to provide maximum performance.

Figures 1 and 2 are exploded views of typical Mikuni carburetors used on these machines.

Service procedures for the carburetors are similar, but there are some differences, so be sure to follow the instructions which apply to your carburetor. The type of carburetor used on the various models is listed in the Specifications, Appendix I.

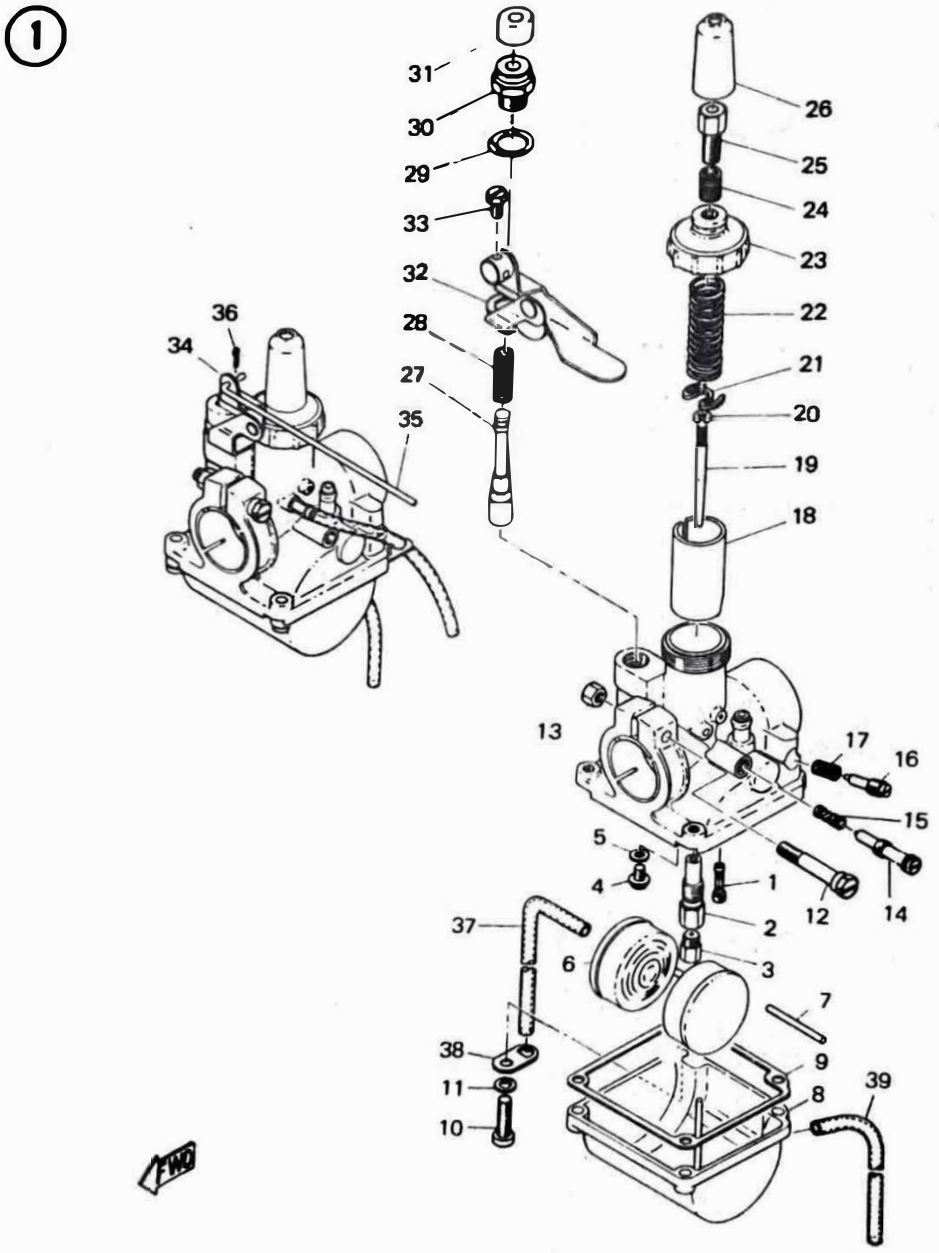
Removal/Installation

1. Turn fuel petcock lever to the OFF position.
2. Remove the gasoline tank fuel line from fittings at carburetors.
3. Unscrew the mixing chamber caps. Remove the throttle valve and needle assemblies.
4. Loosen the hose clamp screws and remove the air cleaner joints (left and right).
5. Remove the bolts securing the carburetors.
6. Remove the carburetors and disconnect starter jet joint hose or tube (if used).
7. Remove the carburetor mount gasket or packing. Replace during installation.
8. Installation is the reverse of these steps.

Disassembly/Assembly (Independent Float Type)

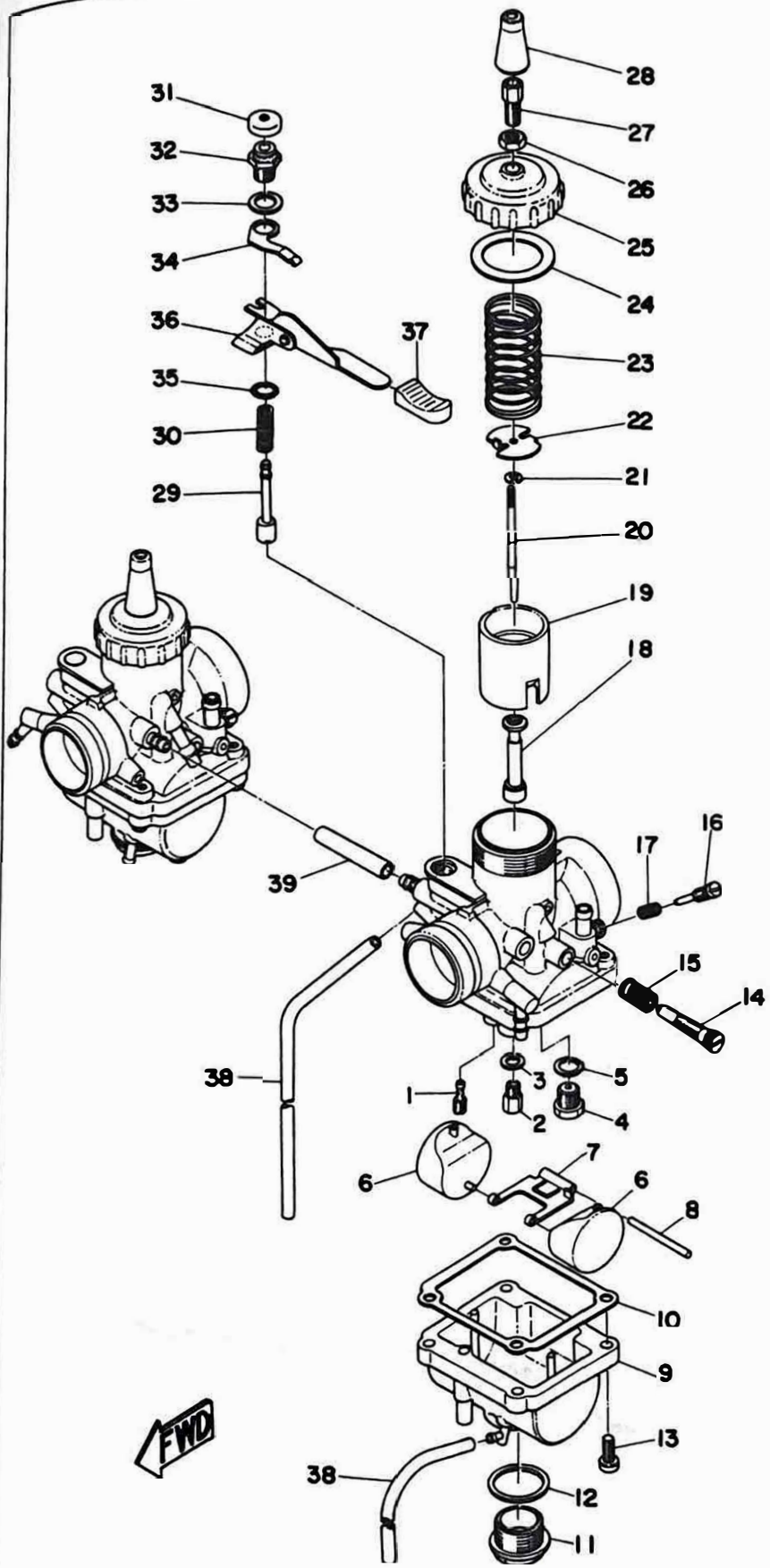
Figure 3 is an exploded view of a typical carburetor of this type. Refer to this during disassembly/assembly.

1. Remove the mixing chamber top (**Figure 4**). There is a spring under the top; do not allow any parts to fly away.
2. Remove the spring, then pull out the throttle slide (**Figure 5**).
3. Disconnect both vent tubes from their fittings (**Figure 6**).
4. Remove 4 screws, then take off the float



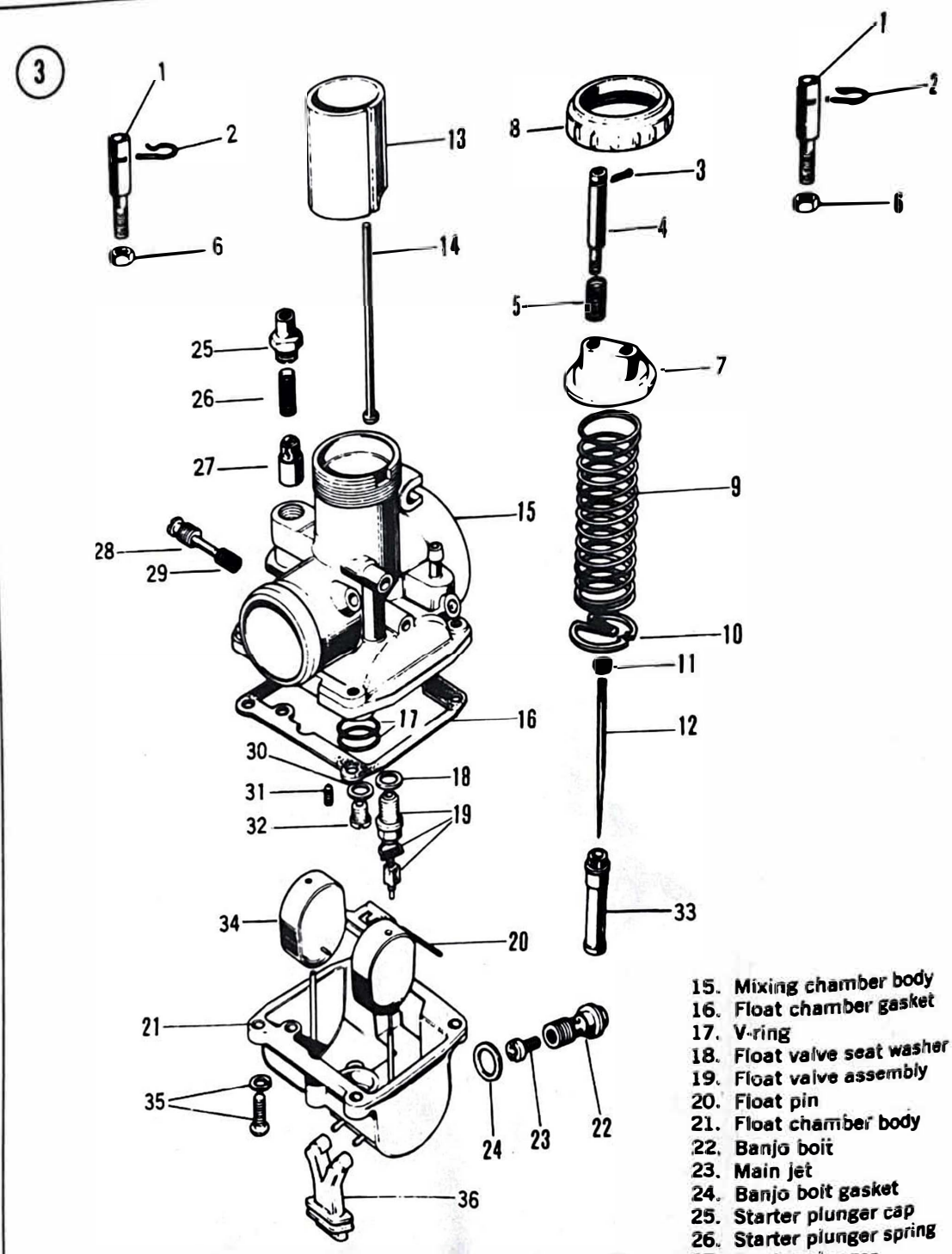
MIKUNI SINGLE FLOAT CARBURETOR

1. Pilot jet
2. Main nozzle
3. Main jet
4. Valve seat assembly
5. Valve seat washer
6. Float
7. Float pivot shaft
8. Float chamber body
9. Float chamber gasket
10. Pan head screw
11. Spring washer
12. Body fitting screw
13. Nut
14. Throttle stop screw
15. Throttle stop screw spring
16. Pilot air screw
17. Pilot air screw spring
18. Throttle valve
19. Jet needle
20. Jet needle clip
21. Clip retainer
22. Throttle valve spring
23. Mixing chamber top
24. Cable adjusting spring
25. Cable adjusting screw
26. Cap
27. Starter plunger
28. Plunger spring
29. Starter lever plate
30. Plunger cap
31. Plunger cap cover
32. Starter lever, left
33. Rod screw
34. Starter lever, right
35. Starter lever rod
36. Cotter pin
37. Air vent pipe
38. Plate
39. Overflow pipe



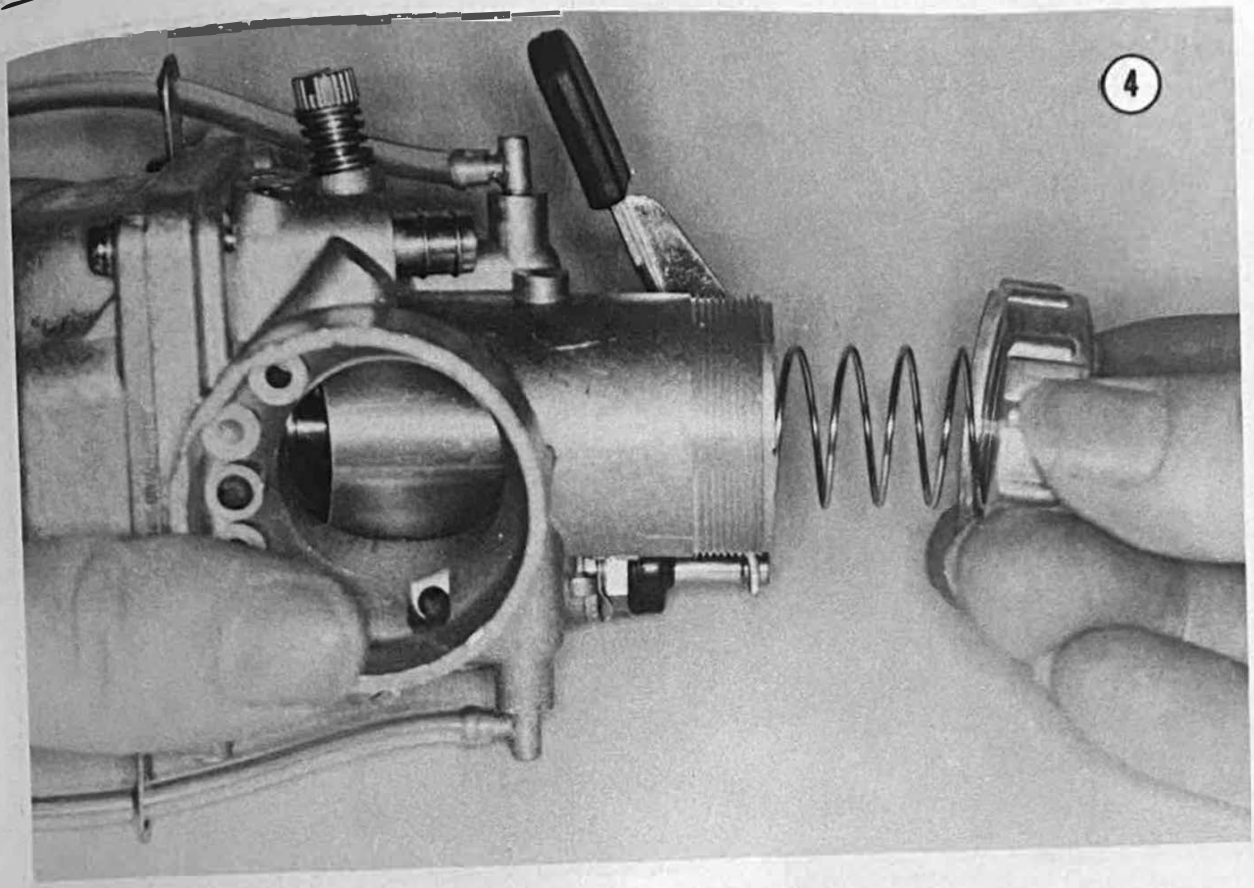
MIKUNI INDEPENDENT FLOAT CARBURETOR

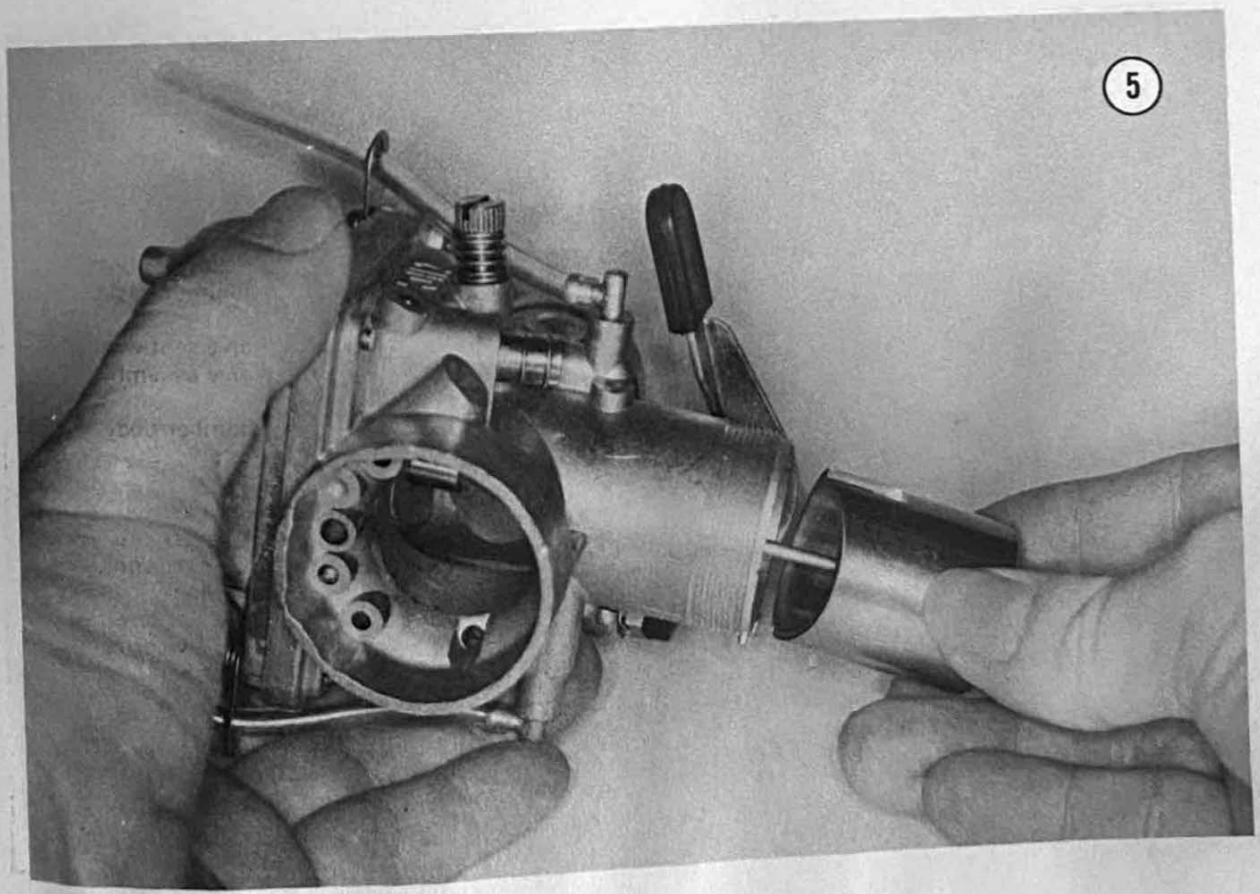
1. Pilot jet
2. Main jet
3. Main jet washer
4. Valve seat assembly
5. Valve seat gasket
6. Float
7. Float arm
8. Float pin
9. Float chamber body (float bowl)
10. Float chamber gasket
11. Plug
12. Plug gasket
13. Screw
14. Throttle stop screw
15. Spring
16. Pilot air screw
17. Spring
18. Needle jet/main nozzle
19. Throttle valve (slide)
20. Jet needle
21. Needle clip
22. Clip retainer/spring seat
23. Slide return spring
24. Gasket
25. Mixing chamber top
26. Lock nut
27. Cable adjuster
28. Cap
29. Starter plunger
30. Plunger spring
31. Cover
32. Plunger cap
33. Gasket
34. Starter lever plate
35. O-ring
36. Starter lever
37. Cap
38. Air vent tube
39. Starter system connecting tube

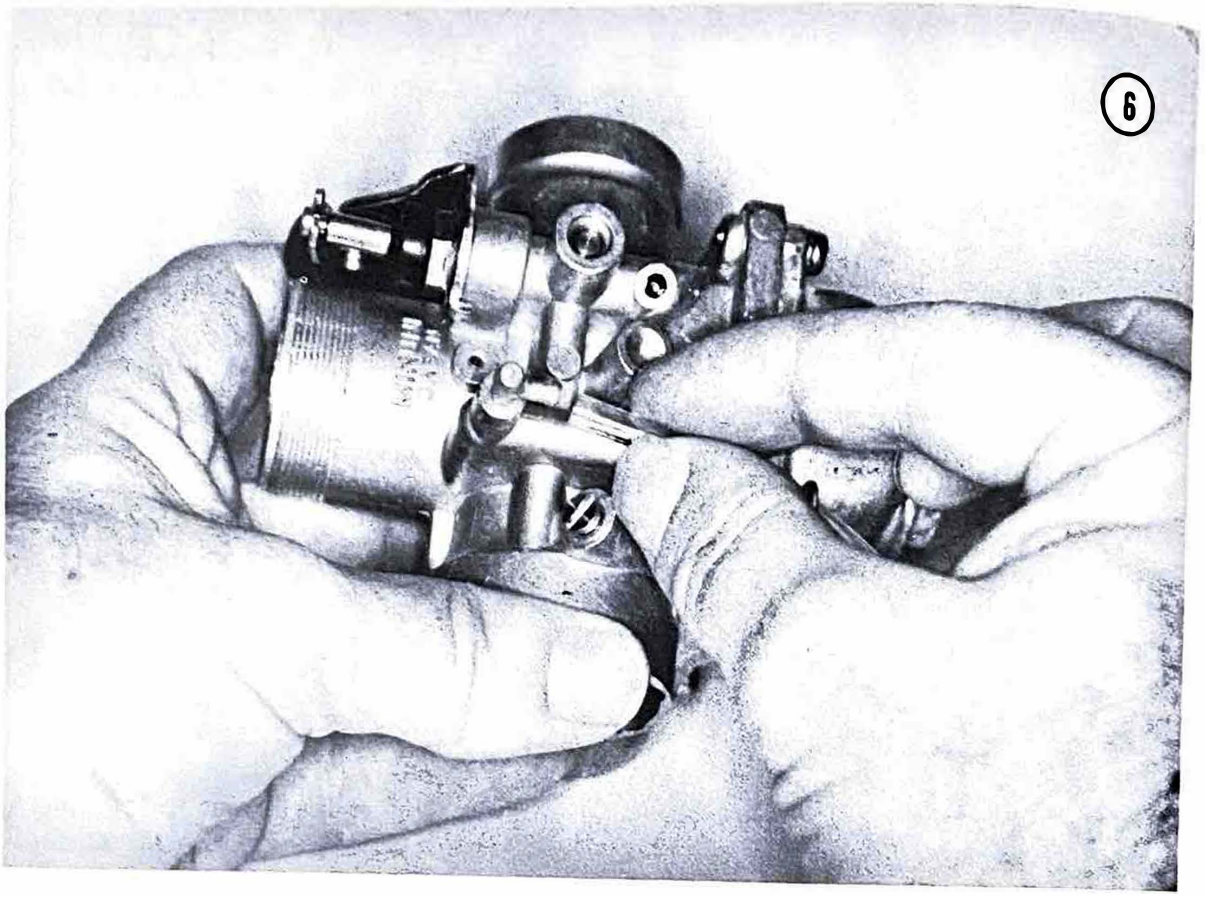


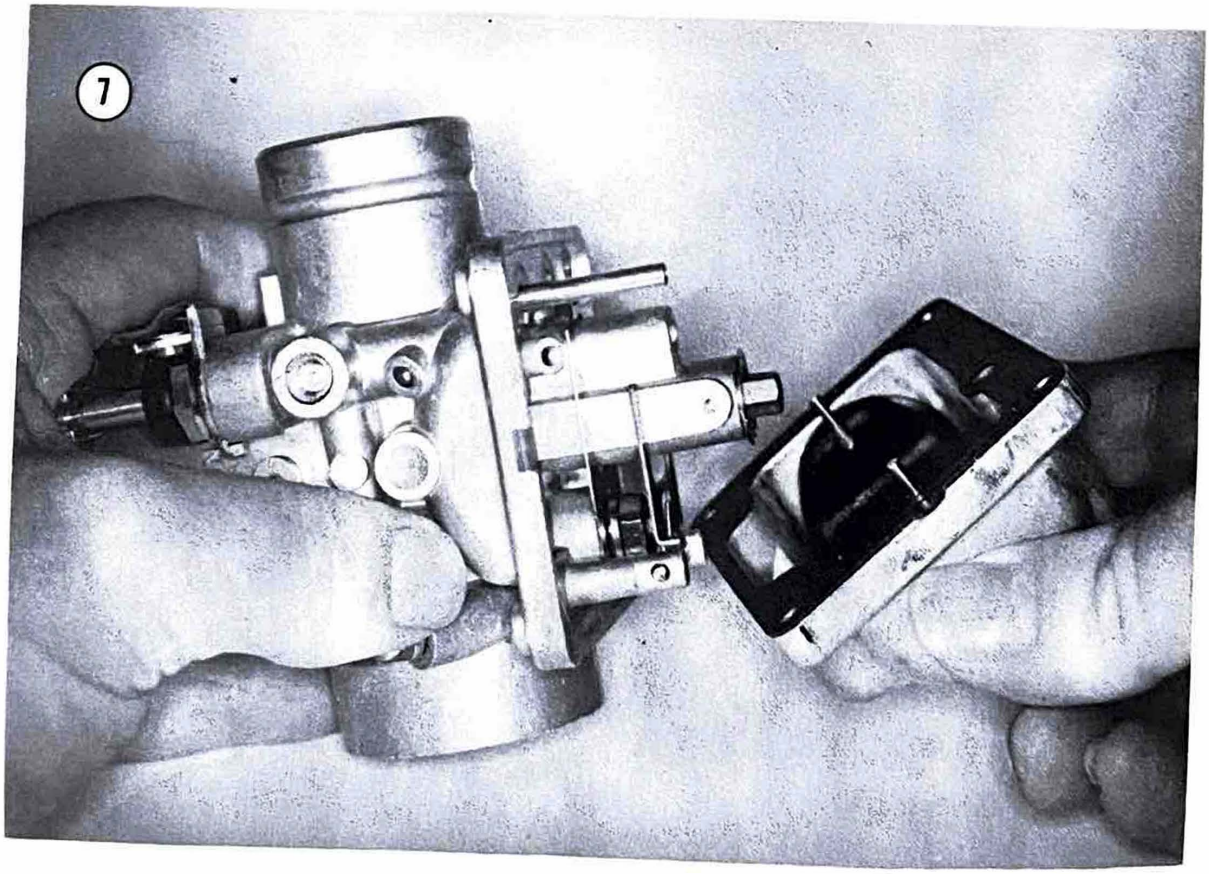
MIKUNI INDEPENDENT FLOAT CARBURETOR

1. Cable adjuster
2. Circlip
3. Cotter pin
4. Throttle stop screw
5. Throttle stop screw spring
6. Cable adjuster lock nut
7. Mixing chamber top
8. Mixing chamber cap
9. Throttle valve spring
10. Throttle valve spring seat
11. Circlip
12. Jet needle 5EH7
13. Throttle valve
14. Throttle valve stop rod
15. Mixing chamber body
16. Float chamber gasket
17. V-ring
18. Float valve seat washer
19. Float valve assembly
20. Float pin
21. Float chamber body
22. Banjo bolt
23. Main jet
24. Banjo bolt gasket
25. Starter plunger cap
26. Starter plunger spring
27. Starter plunger
28. Pilot air adjust screw
29. Pilot air screw spring
30. Main jet washer
31. Jet pilot
32. Main jet
33. Needle jet
34. Float
35. Float chamber screw
36. Overflow pipe grommet



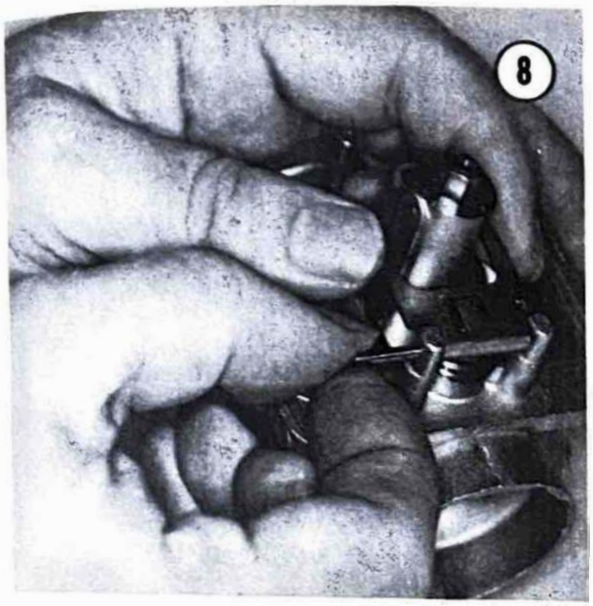




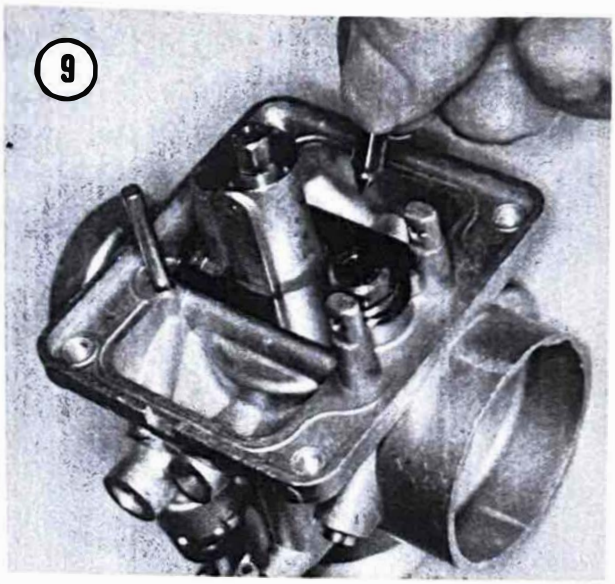


bowl (**Figure 7**). Both floats will come out with the float bowl.

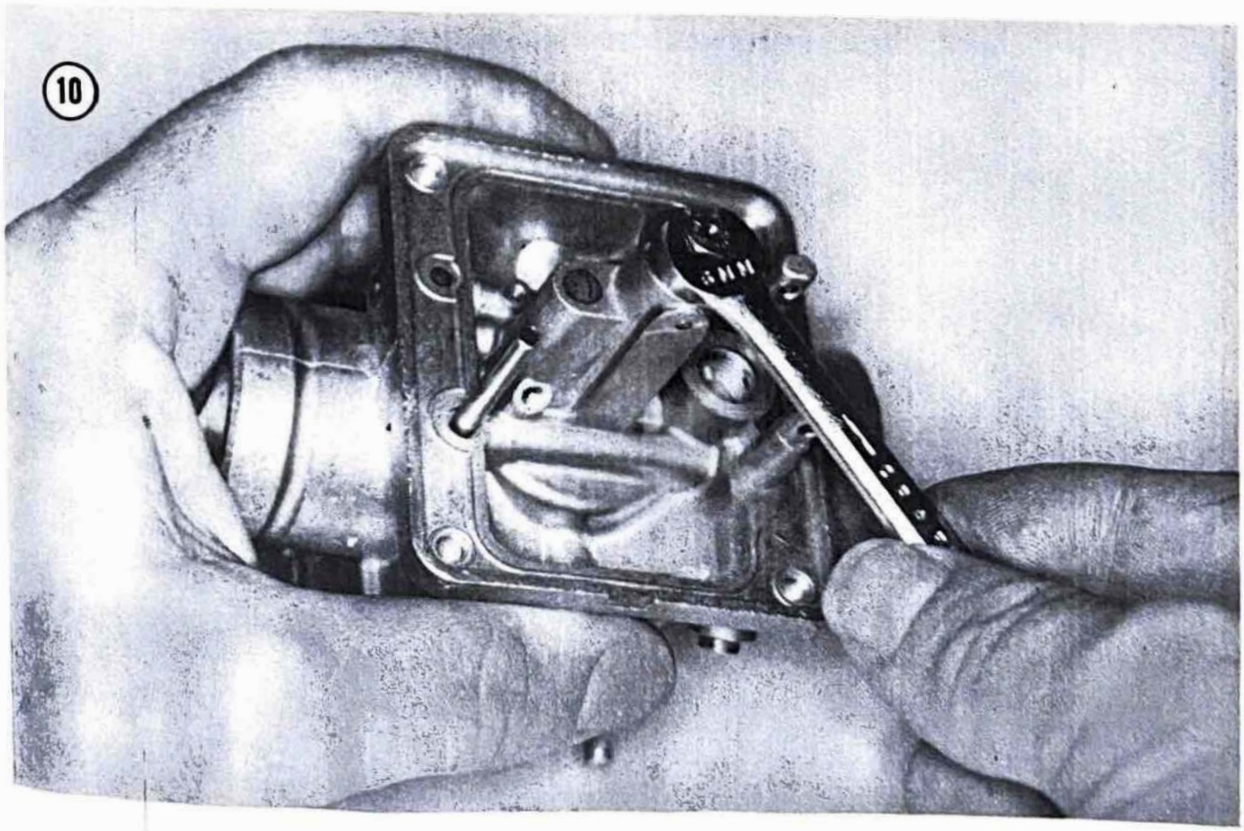
5. Pull out the float lever pivot pin (**Figure 8**) to remove the float lever. Note carefully which side of the lever goes toward the bottom of the carburetor; it is possible to assemble this component upside down.

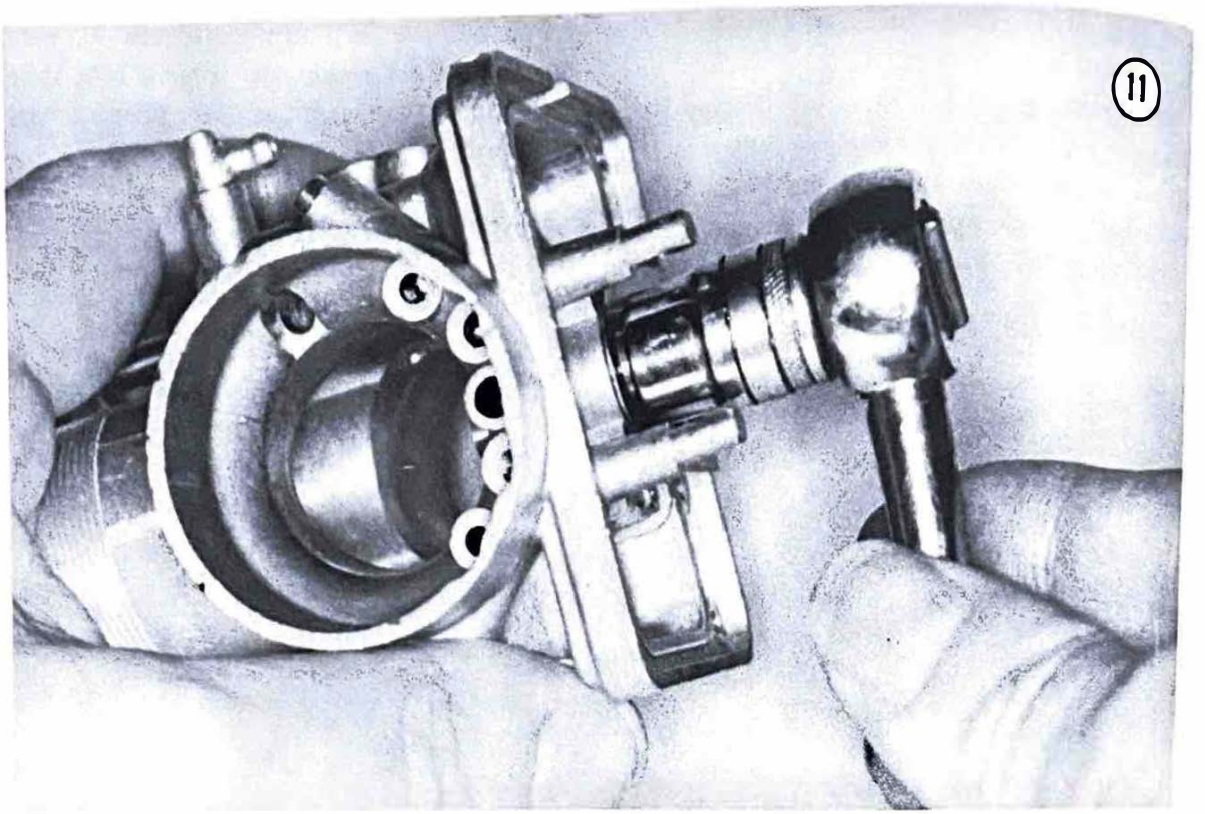


6. Pull out the float needle (**Figure 9**), then remove the float needle seat (**Figure 10**). Take careful note of the locations of the fiber washers and brass plate.



7. Remove the main and needle jet retaining washer (**Figure 11**). Note how the washer is installed before removing it.

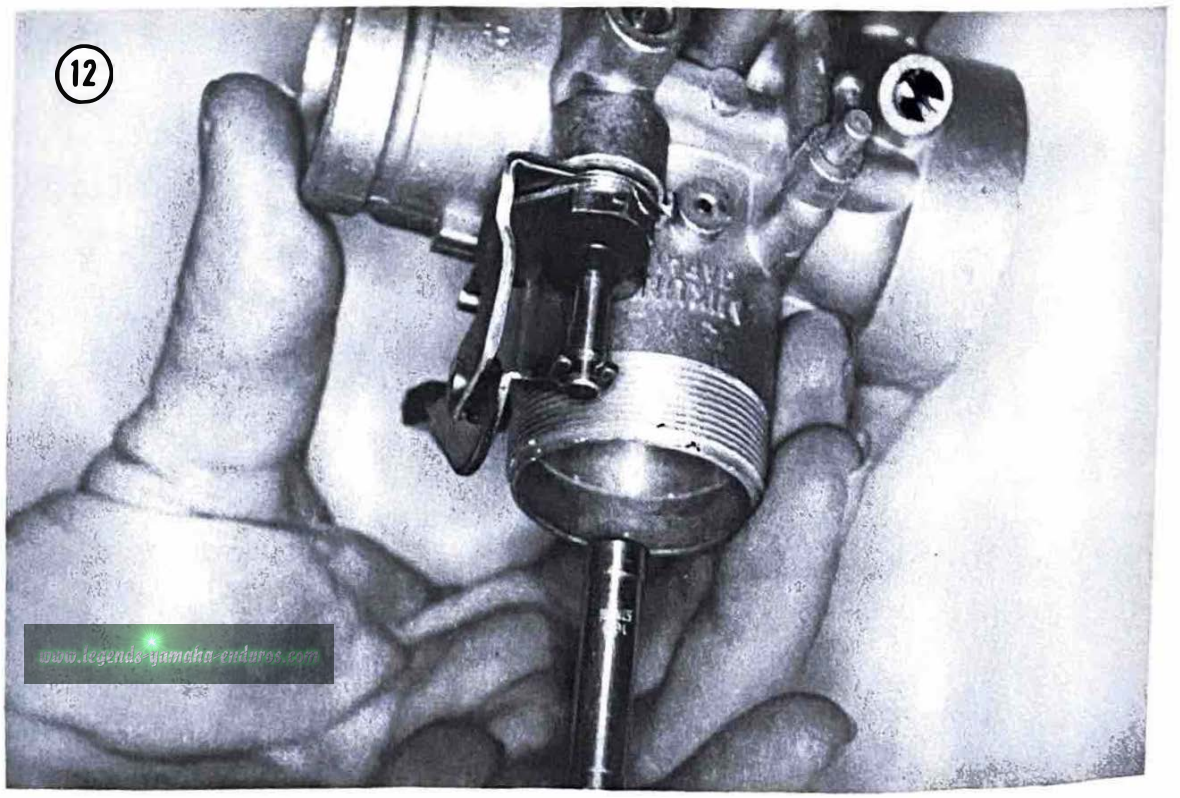


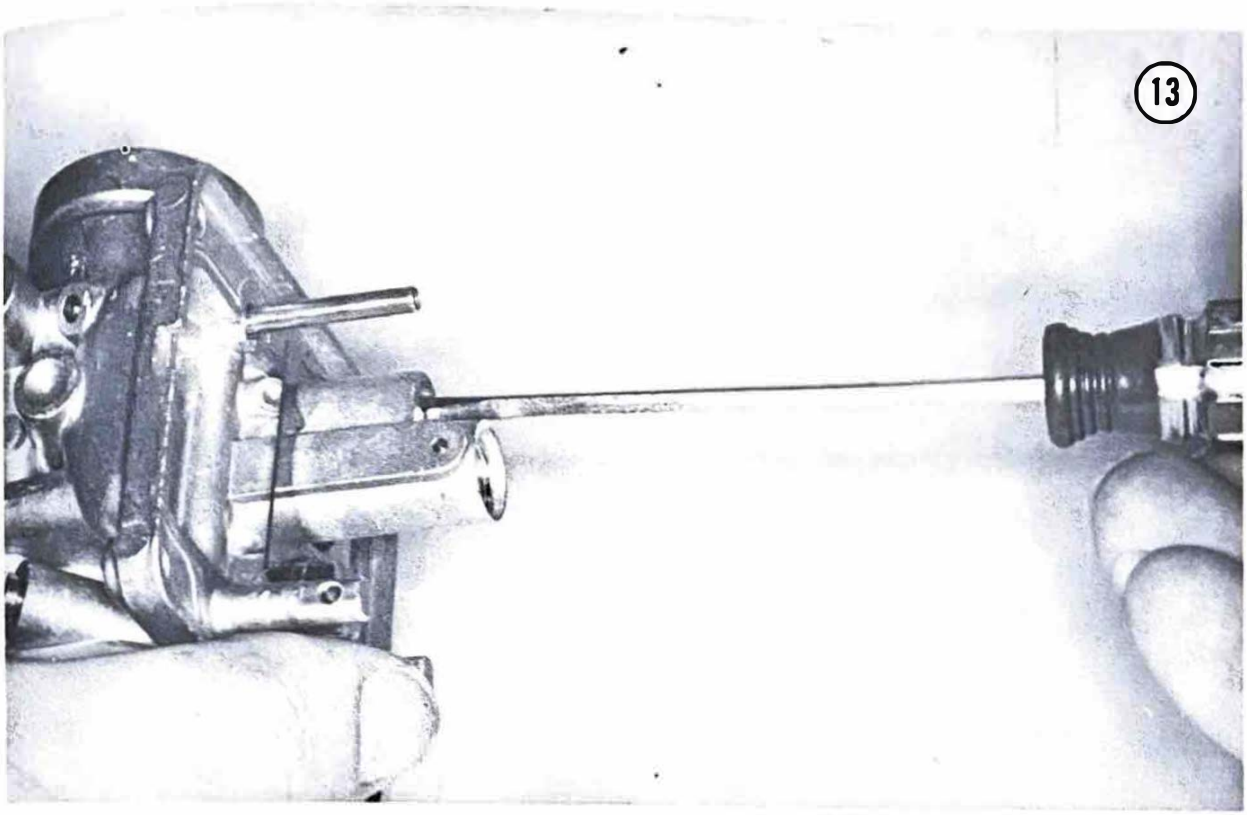


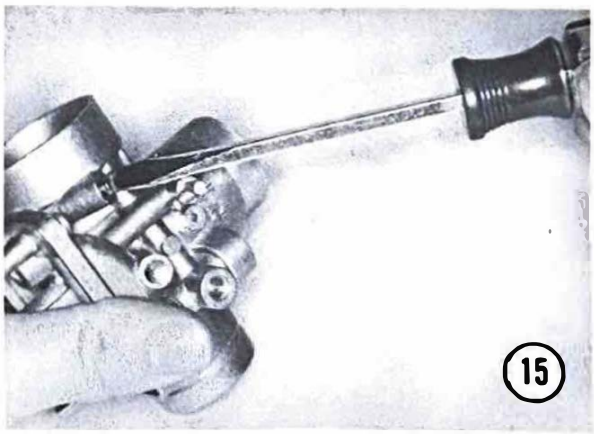
8. Invert the carburetor. The needle jet will fall out (**Figure 12**). Note the locating pin for the needle jet.

9. Remove the pilot jet (**Figure 13**).

10. After flattening its locking tab, unscrew the starter plunger retaining nut (**Figure 14**).





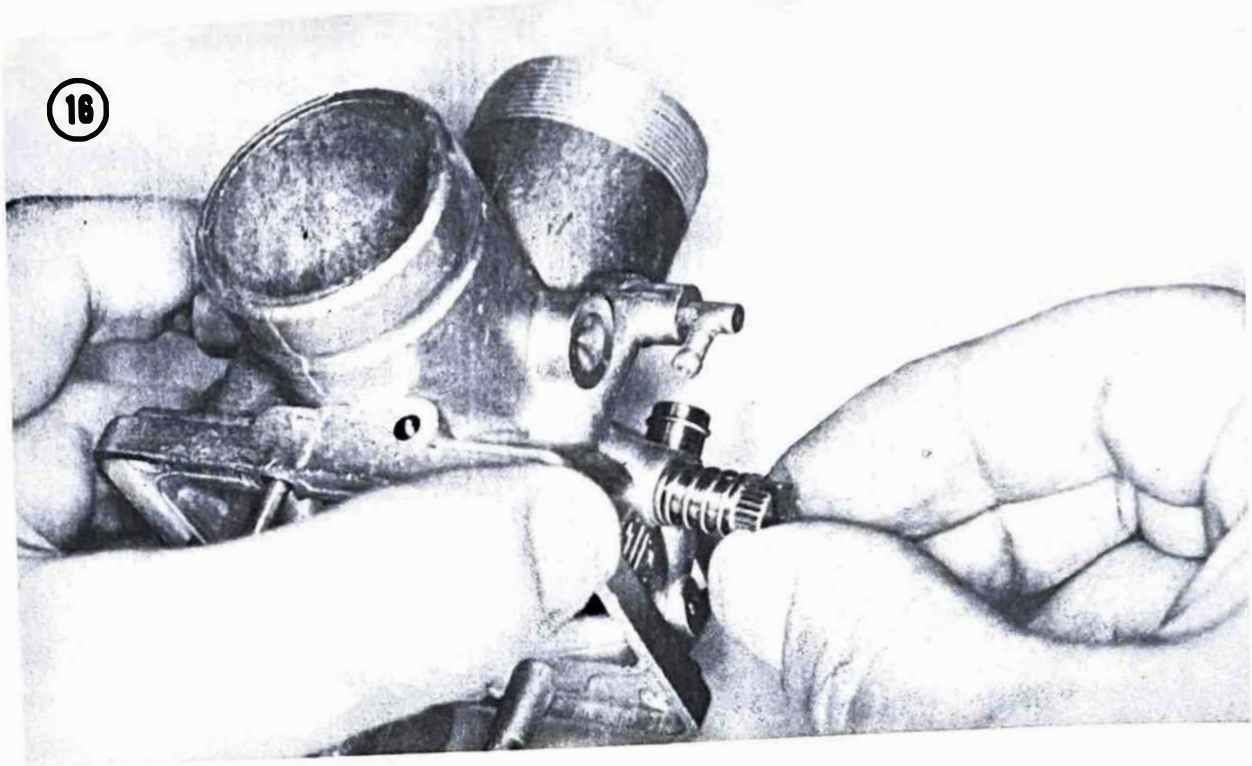


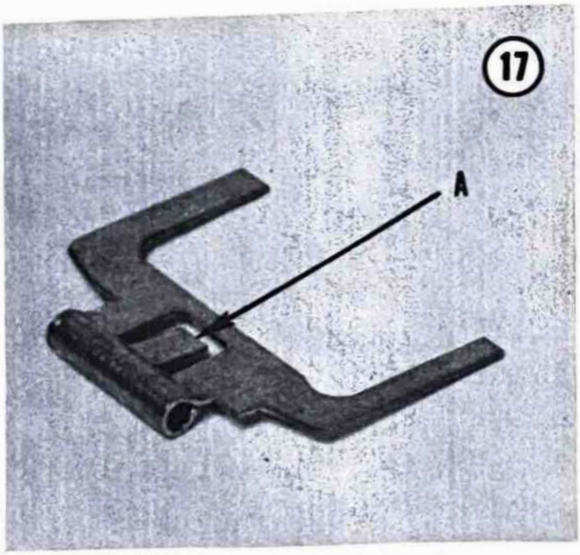
11. Remove idle mixture screws (**Figure 15**).
12. Remove the idle speed screw (**Figure 16**).
13. Reverse disassembly procedure to assemble carburetor. Always use new gaskets and O-rings.

Float Level Adjustment (Independent Float Type)

Mikuni carburetors with independent floats leave the factory with level properly adjusted. Rough riding, a worn needle valve, or a bent float arm can cause the float level to change. Refer to **Figure 17**, then proceed as follows.

1. Remove the float bowl and floats, then invert the carburetor body. Allow the float lever to rest on the needle by its own weight.
2. Measure distance from the float arm to the carburetor body surface.
3. Bend the tang on the float arm as required for adjustment.
4. Float levels are specified in **Table 1**.





A. Bend tang to adjust float level

Table 1 FLOAT LEVEL ADJUSTMENT

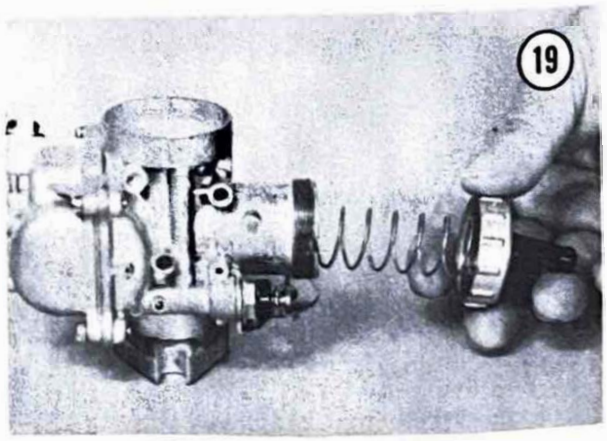
Carburetor	Distance A
VM24SC	1.00 inch (25.4mm)
VM26SC	1.01 inch (25.7mm)
VM26SC*	0.59 inch (15mm)
VM28SC	1.00 inch (25.4mm)
VM28SC*	0.59 inch (15mm)

*Independent floats have different measurements.

Disassembly/Assembly (Single-Unit Floats)

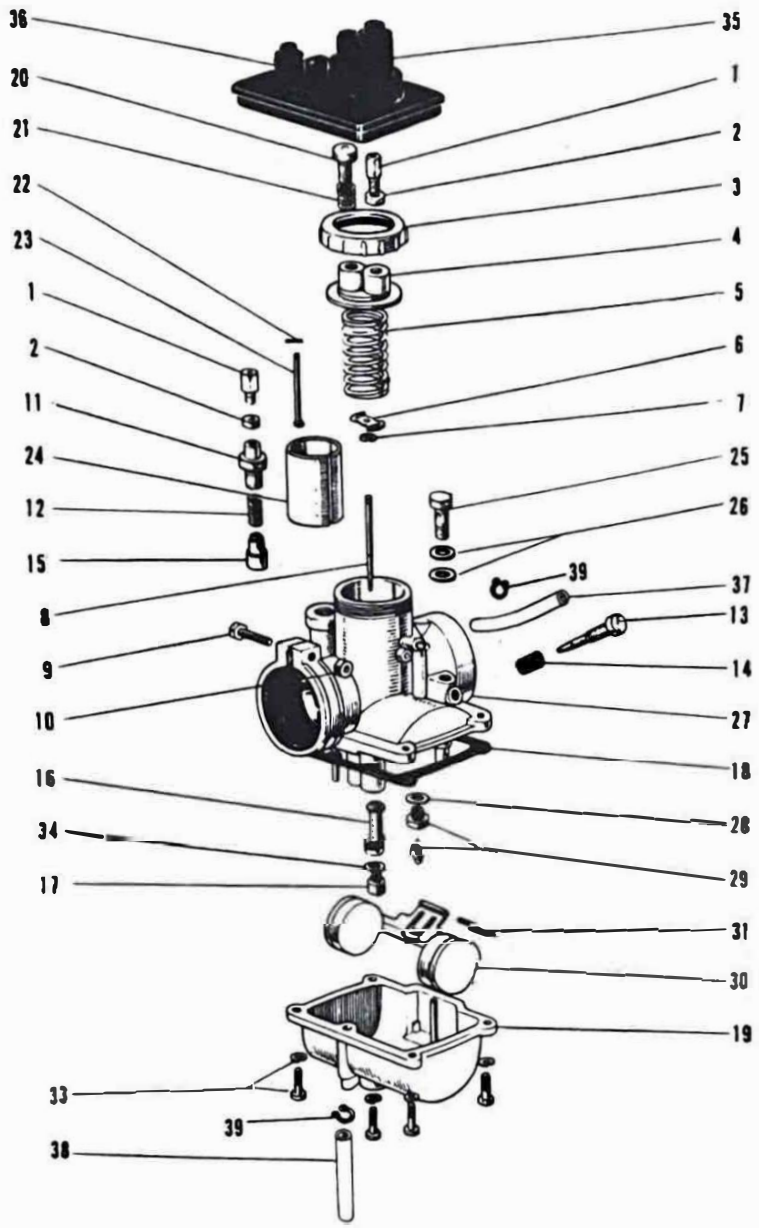
Figure 18 is an exploded view of a typical carburetor of this type. Refer to this illustration during disassembly/assembly.

1. Remove the mixing chamber top (**Figure 19**) if this step was not performed earlier.



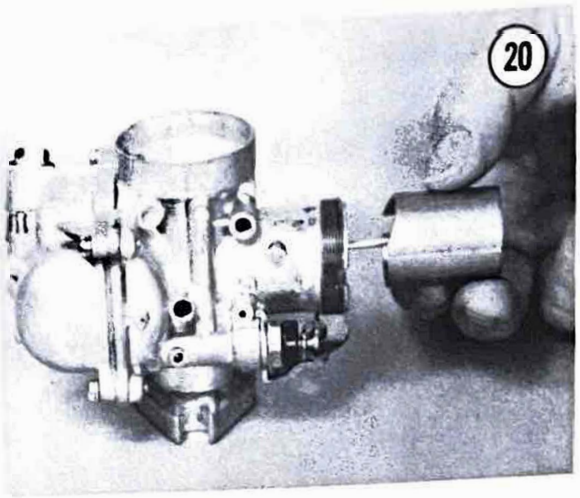
2. Remove the throttle valve (**Figure 20**).
3. Remove 4 screws, then the float bowl. See **Figure 21**.
4. Push out the float pivot shaft (**Figure 22**), then the float assembly. Handle this float gently to prevent bending.

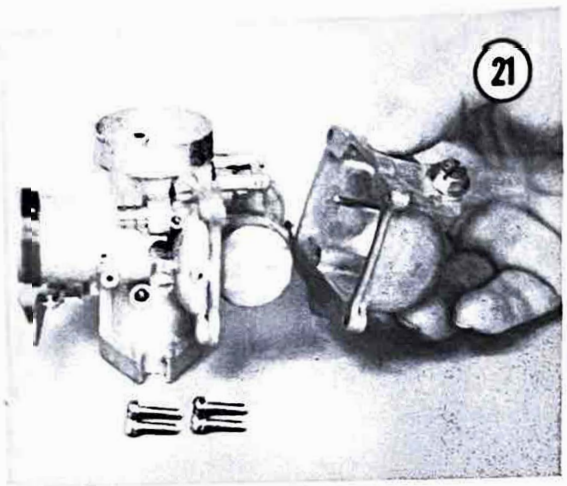
18

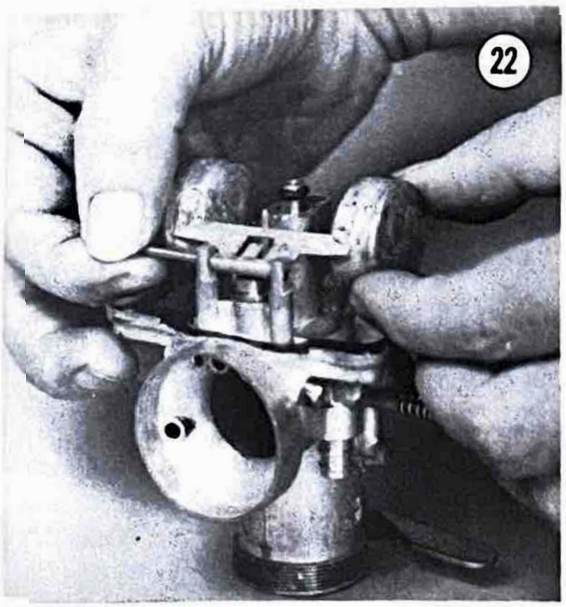


MIKUNI SINGLE FLOAT CARBURETOR

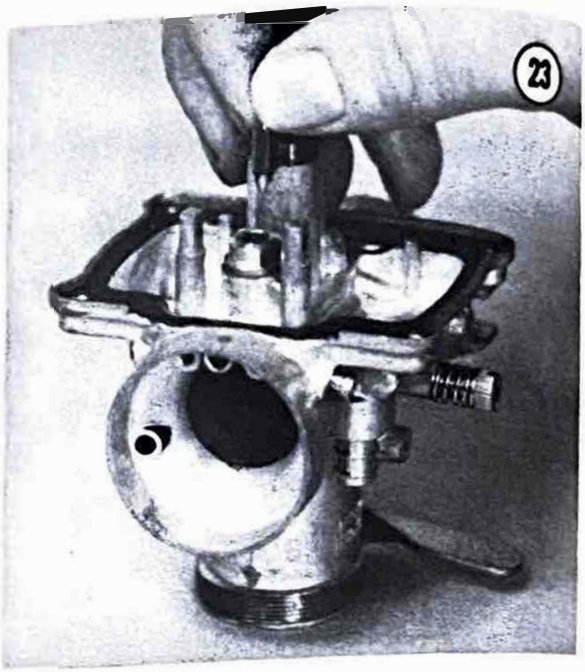
1. Cable adjuster
2. Cable adjuster lock nut
3. Mixing chamber cap
4. Mixing chamber top
5. Throttle valve spring
6. Throttle valve spring seat
7. Needle clip
8. Jet needle
9. Carburetor mounting clamp screw
10. Nut
11. Starter plunger cap
12. Starter plunger spring
13. Pilot air adjusting screw
14. Pilot air adjusting screw spring
15. Starter plunger
16. Needle jet
17. Main jet
18. Float chamber gasket
19. Float chamber body
20. Throttle adjuster
21. Throttle adjuster spring
22. Cotter pin
23. Throttle valve stop rod
24. Throttle valve
25. Banjo bolt
26. Gasket
27. Mixing chamber body
28. Float valve seat washer
29. Float valve complete
30. Float
31. Float pin
33. Float chamber fitting screw
34. Main jet washer
35. Carburetor cap grommet
36. Carburetor cap
37. Fuel overflow pipe
38. Air vent pipe
39. Circlip



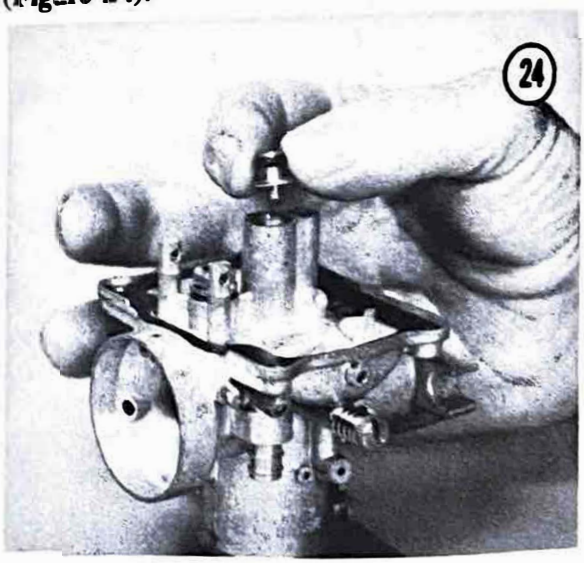




5. Remove the main jet and needle jet together (**Figure 23**).



6. Separate main and needle jets if required (**Figure 24**).

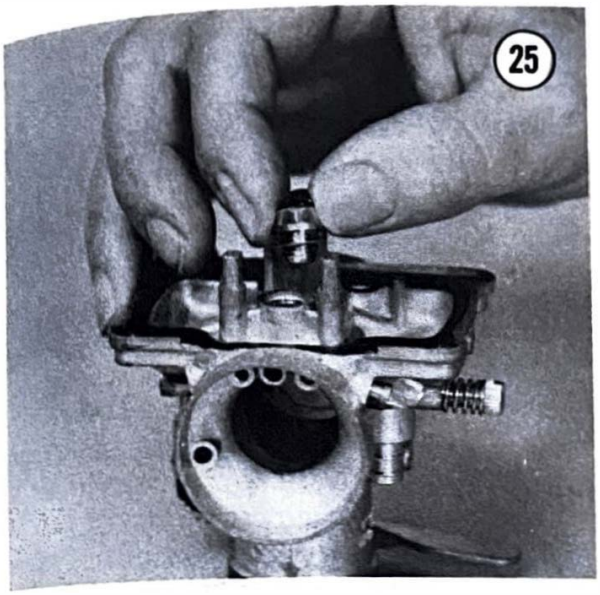


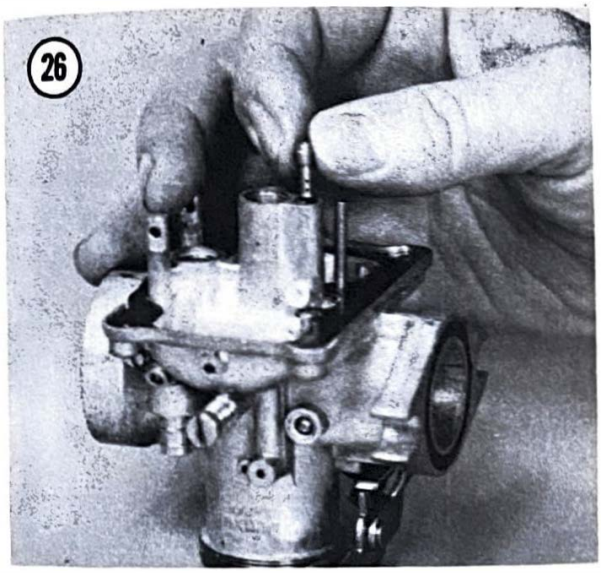
7. Remove float valve assembly (**Figure 25**). Do not forget fiber washer upon assembly.

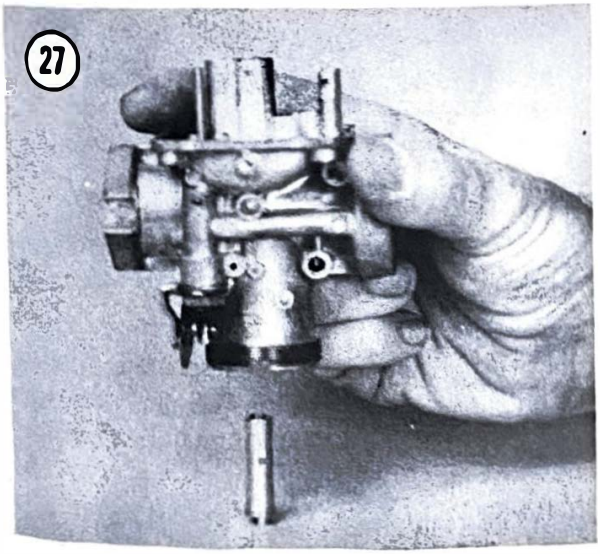
8. Remove the pilot jet (**Figure 26**).

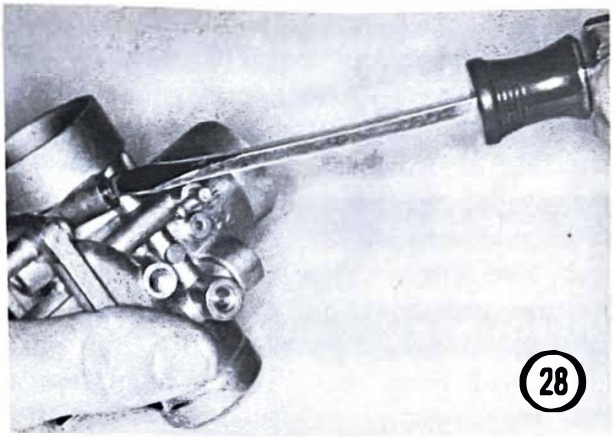
9. Remove the starter plunger spring cover and spring (**Figure 27**). Be careful; the spring is under compression and parts may fly out. Remove the starter plunger.

10. Remove the pilot air screw (**Figure 28**).





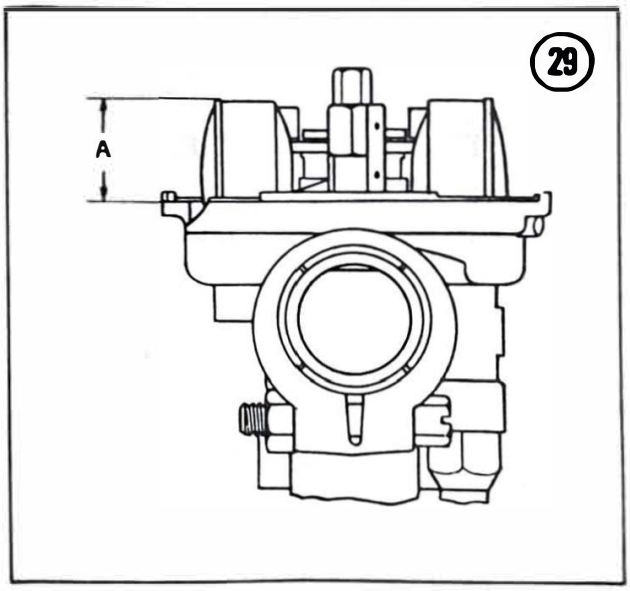




Float Level Adjustment (Single Unit Float)

Refer to **Figure 29**, then proceed as follows.

1. Remove the float chamber and invert the mixer body. Allow the float arm to rest on the needle valve by its own weight, without compressing the float needle spring.



2. Measure the distance from the top of the floats to the float bowl gasket surface. Note that the distance must be equal for each float.
3. Bend the tang on the float arm as required for adjustment.
4. Float levels are specified in **Table 1**.

Inspection (Typical)

1. Shake the float to check for gasoline inside. If fuel leaks into the float, float chamber fuel

level will rise, resulting in an overrich mixture. Replace the float if it is deformed or leaking.

2. Replace the float valve if its seating end is scratched or worn. Depress the float valve gently with your finger and make sure that the valve seats properly. If the float valve spring is weak, fuel will overflow, causing an overrich mixture and flooding the float chamber whenever the fuel petcock is open.

3. Clean all parts except rubber or plastic in carburetor cleaning solvent. Dry the parts with compressed air. Clean the jets and other delicate parts with compressed air after the float bowl has been removed. Use new gaskets upon assembly.

4. The DS7, R5, and RD series use rubber carburetor mounting flanges (joints). This reduces engine vibration to the carburetor. Periodically check the rubber flange for cracks. If a deep crack is found, replace the flange immediately to prevent possible air leakage.

STARTER JET SYSTEM

To provide a rich starting mixture, each carburetor is equipped with a special starter jet circuit. A plunger is raised when the starter jet lever is pushed down. This opens a separate carburetor fuel and air system that enriches the total carburetor mixture. There are 2 different actuating systems, with different adjustments.

The DS7, RD, and R5 series utilize only one starter jet plunger, located in the left carburetor. However, a rubber hose or metal tube transfers starting fuel from the left carburetor to the right carburetor. If this joint becomes cracked, or is bent due to carburetors not parallel, a potentially damaging air leak can develop.

All other twin carburetor models have linkage between both starter jet plungers that must be adjusted. The rod, anchored to the left carburetor, is held to the right carburetor by a set screw on the carburetor linkage. Loosen the set screw, then push the starter jet plunger, in each carburetor, until completely seated. Retighten the set screw. You should be able to push the starter lever a small distance without either plunger starting to lift. Failure to adjust this linkage could result in one plunger not seating completely. One carburetor would run rich, and the spark plug would be covered with black sooty deposits, especially after idling.

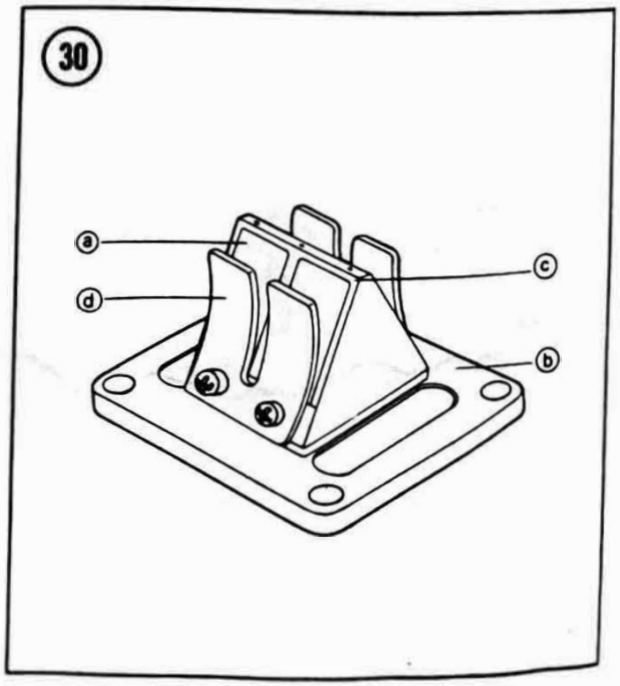
REED VALVES

The RD series engines have identical reed valves. These are located in the intake tract, between carburetor and crankcase. **Figure 30** identifies reed valve components. Each valve consists of 4 main components:

a. Stainless steel reeds.
b. Aluminum alloy valve case.
c. Valve seat bonded to the valve case.
d. Valve stopper.

Removal/Installation

1. Remove the carburetor as described earlier under *Carburetor, Removal.*
2. Unscrew the 4 reed valve retaining bolts that screw into the cylinder, then slip out the carburetor mounting flange and reed unit.
3. Installation is the reverse of these steps.



Inspection

This precision component must be handled with care. Store in a clean dry place. Avoid touching the reeds with your fingers.

Maintenance is limited to inspection and checking screw tightness. Check the reeds for cracks or chipped edges. A reed showing signs of failure must be replaced to prevent possible engine damage. Check to be sure the rubber seat remains securely bonded to the valve case. Make sure the reed stopper securing screws are completely tight.

Whenever the reed valve unit is removed, check the gasket that fits between the reed case and cylinder. If torn or scarred, replace it to prevent possible air leakage.

THROTTLE CABLE

Replacement

To replace any cable requires disconnecting the entire assembly at points (1), (2), (3), (4), and (5), as described in the following steps.

1. Unscrew the tops off both carburetors and lift out the slides.
2. Unhook each throttle cable from each slide. Lift the spring out of the slide, then remove the butterfly-shaped needle retaining plate. Grip the wire, push down to unseat its end, slide the wire over to the larger hole in the slide and lift out.

CAUTION

When inserting the slide back into its carburetor, the "cutaway" section must face back toward the air cleaner. If installed improperly, the slide can hang up in the full open throttle position. Make sure the slide drops down fully into the carburetor.

3. Remove both screws that hold the throttle grip retaining caps together, then pull the caps apart for access to the cable end.
4. Slide the end of the wire from its anchor hole in the acuator. For proper installation, notice which direction it is wound around the actuator channel.
5. Remove the Autolube pump cover. On the YDS3 series, YDS5, DS6, YM1, and YM2-C, this cover is located on the engine's left side. On all other models this cover is mounted on the right side.
6. Unhook the Autolube wire. You must twist the pulley to provide slack in the wire then slip the end out of its anchor hole in the pulley. Notice the direction this wire is wound around the pulley to ensure proper installation at a later time.
7. Grasp both ends of this junction and pull it apart.
8. To replace either cable, unhook its end from the white plastic junction piece, pull the cable out of the junction box, slide the new cable in, and hook it onto the white piece.

NOTE

On some models, the cables from the junction box to each carburetor and are not equal in length. When buying a replacement cable, specify left or right cable. After either cable has been replaced, you must adjust cable free play, carburetor synchronization, and Autolube cable.

FUEL TANK

Removal/Installation

1. Drain fuel tank.
2. Disconnect the fuel line and level pipe.
3. Lift up rear of tank and slide back pulling it out to the rear.
4. Installation is the reverse of these steps.

NOTE

During installation, check routing of all cables and wires. Install carefully to avoid improper routing or damage.

5. Check the tank for leaks and the fuel tubes for age cracks or other damage.
6. Check rubber mounts for deterioration. Replace if necessary.

NOTE

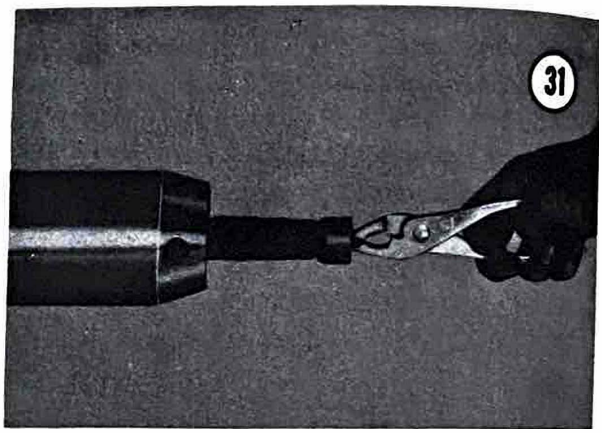
Engine heat causes these to deteriorate fairly quickly.

EXHAUST SYSTEM

The exhaust system on a 2-stroke motorcycle engine is much more that a means of routing exhaust gases to the rear of the motorcycle. It is a vital performance component and frequently, because of its design, it is a very vulnerable piece of equipment. Check the exhaust system for deep dents and fractures and repair them. Check the mountings for fractures and loose bolts and bushings. Check the cylinder mounting flange or collar for tightness. A loose headpipe connection will not only rob the engine of power, it could also damage the piston and the cylinder.

Removal/Installation

1. Loosen the muffler attachment hardware and remove the exhaust pipes at the cylinders.
2. Remove the front and rear attachment bolts from the mufflers.
3. Remove the bolt at the back of the muffler.
4. Pull out the baffle tube (**Figure 31**). If the tube is stuck, insert a pipe in the opposite end of the muffler and rap it with a hammer.
5. Reverse procedure for installation.
6. See Chapter Two, *Decarbonization*, for cleaning procedure.



CHAPTER SIX

ELECTRICAL SYSTEM

This chapter provides service procedures for the charging system, battery, ignition system, horn, and lighting.

The charging system consists of an electrical generator, voltage regulator, battery, and connecting wiring. The generators on these machines are either alternators, direct-current generators, or combination starter/generators.

ALTERNATOR

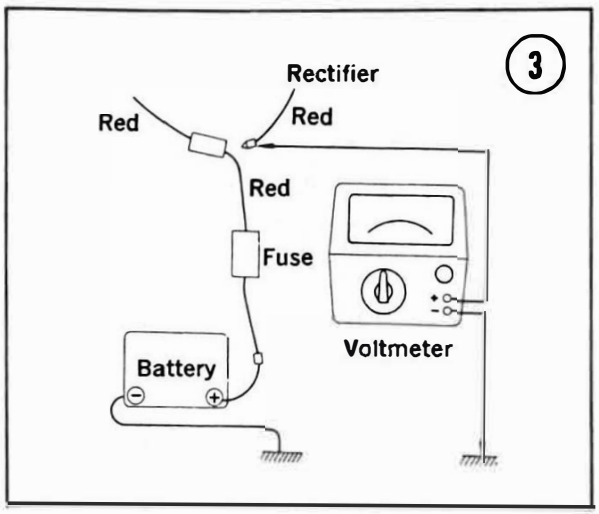
The alternator is excited by a separate field winding (**Figure 1**). A voltage regulator controls alternator output by varying field current. **Figure 2** is an exploded view of this alternator.

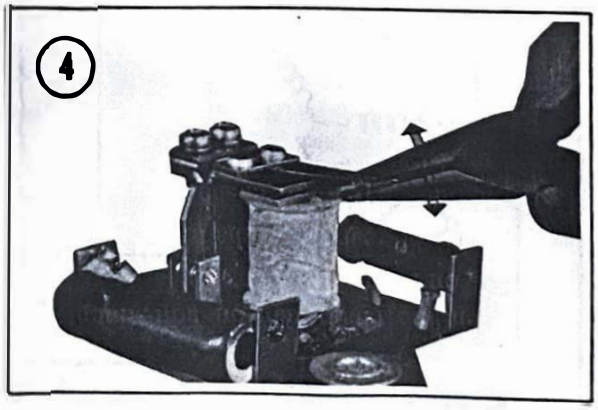
Voltage Output

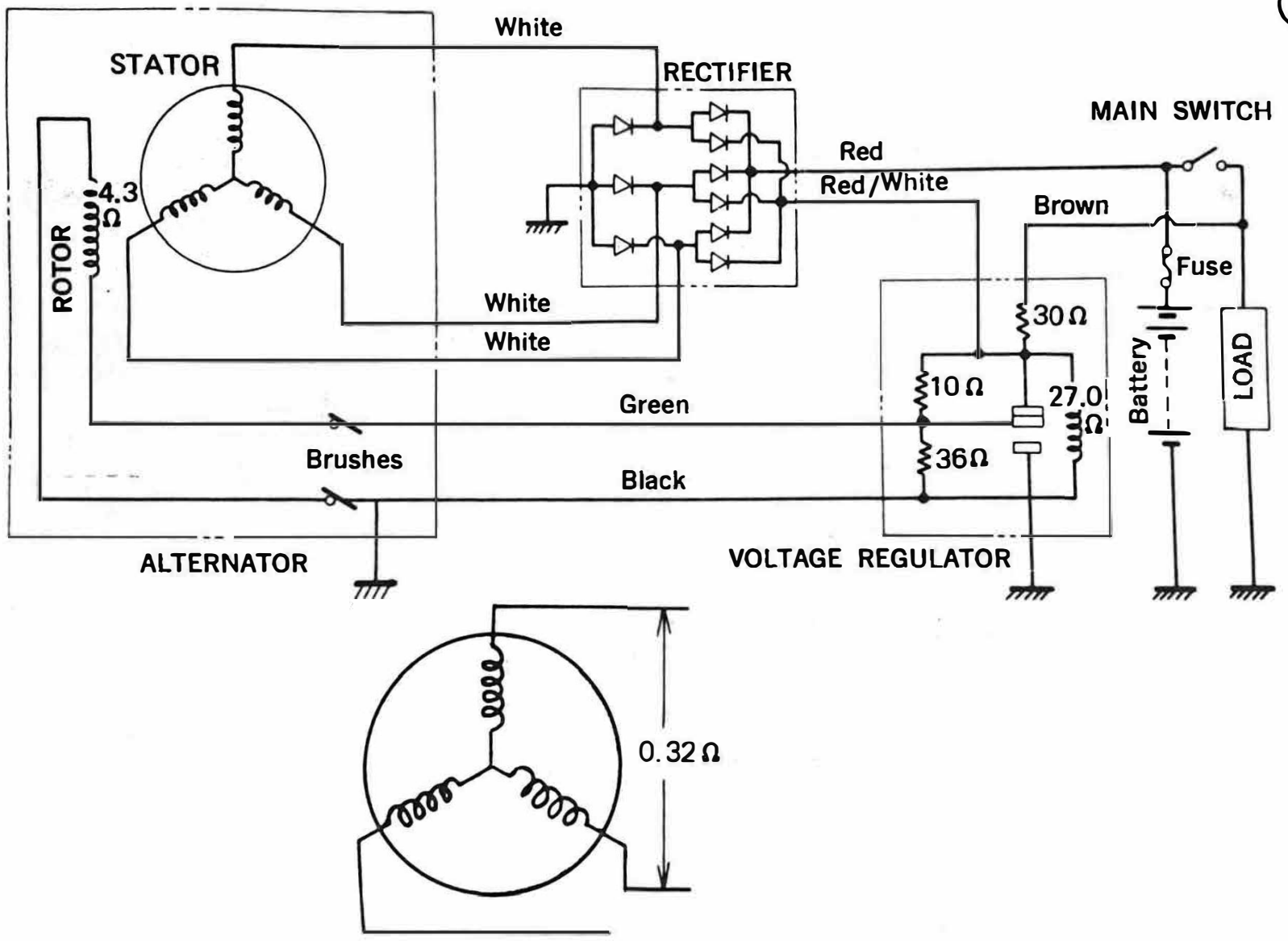
To check alternator output, start the engine. Disconnect the red wire at the rectifier, and connect a 0-20 DC voltmeter as shown in **Figure 3**. Run the engine at approximately 2,500 rpm. The meter should indicate 15.5-16.5 volts.

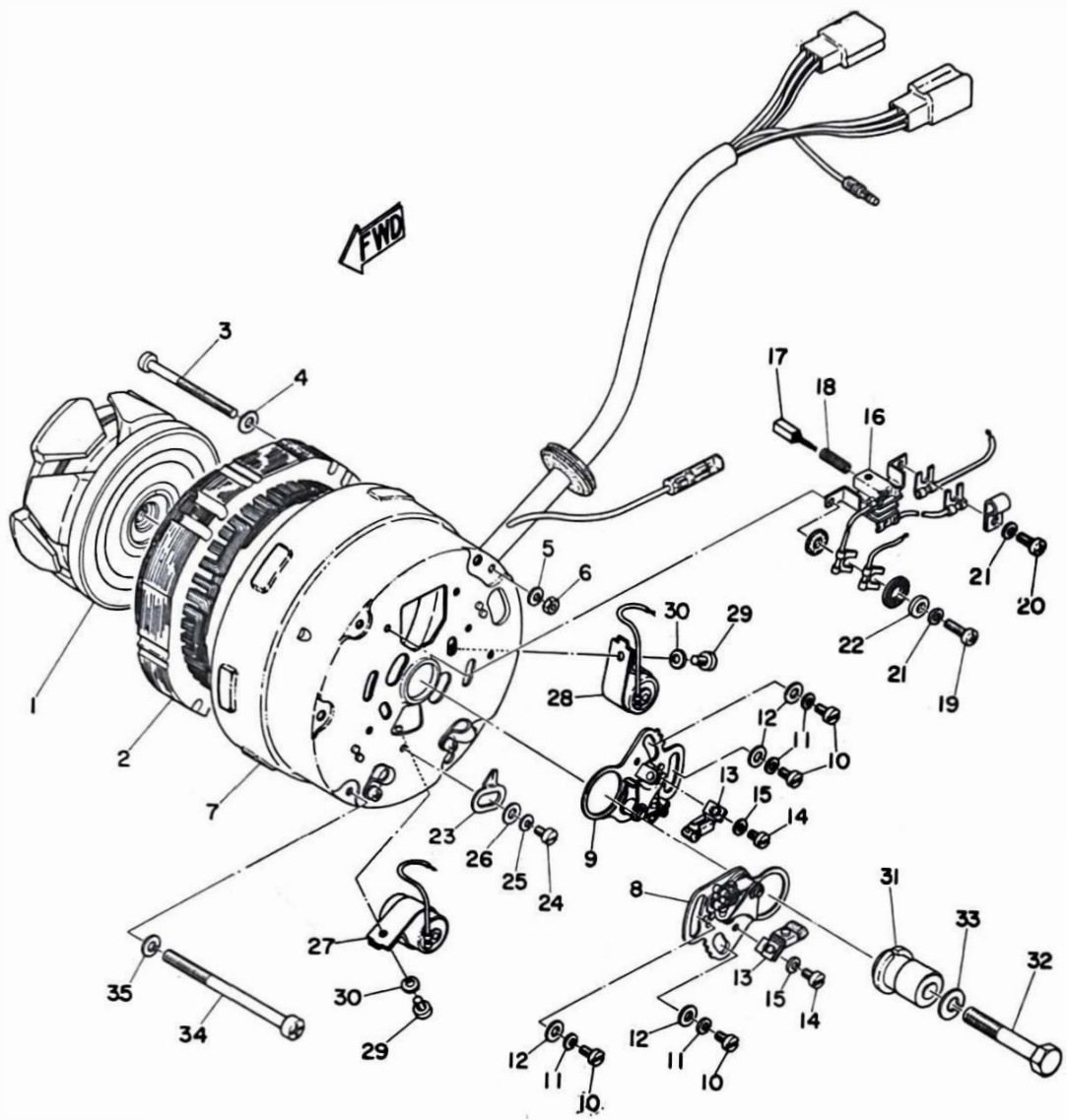
Adjust the regulator if voltage differs slightly from the specified value, as shown in **Figure 4**. Make the adjustment carefully, in small steps.

Remove the battery. The regulator will be visible through a large hole in the base of the battery box. Do not attempt regulator adjustment with the regulator still attached to the battery box. It is so easy to "ground" the regulator. Unscrew the single securing bolt, which






1
STATOR
White
RECTIFIER
MAIN SWITCH
Red
Red/White
Brown
4.3 Ω
ROTOR
Fuse
White
White
30 Ω
10 Ω
27.0 Ω
Battery
LOAD
Green
Brushes
36Ω
Black
ALTERNATOR
VOLTAGE REGULATOR
0.32 Ω



ALTERNATOR

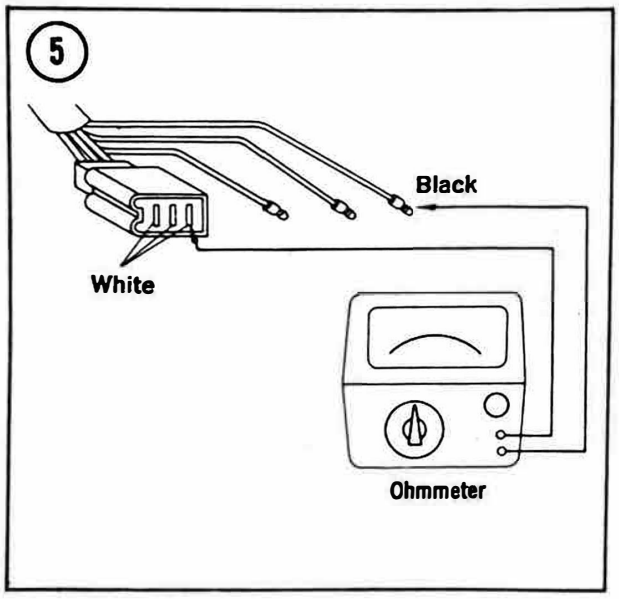
1. Rotor
2. Armature
3. Screw
4. Flat washer
5. Lockwasher
6. Nut
7. Stator
8. Left breaker assembly
9. Right breaker assembly
10. Screw
11. Lockwasher
12. Flat washer
13. Lubricator
14. Screw
15. Flat washer
16. Brush holder
17. Brush
18. Brush spring
19. Screw
20. Screw
21. Lockwasher
22. Flat washer
23. Timing plate
24. Screw
25. Lockwasher
26. Flat washer
27. Left condenser
28. Right condenser
29. Screw
30. Lockwasher
31. Cam
32. Bolt
33. Lockwasher
34. Screw
35. Lockwasher

is visible through the battery box base, then slide the regulator off its retaining shelf. Remove the cover, start the engine, and make the adjustment.

Look for obvious broken, corroded, or loose wires or terminals.

Rectifier Testing

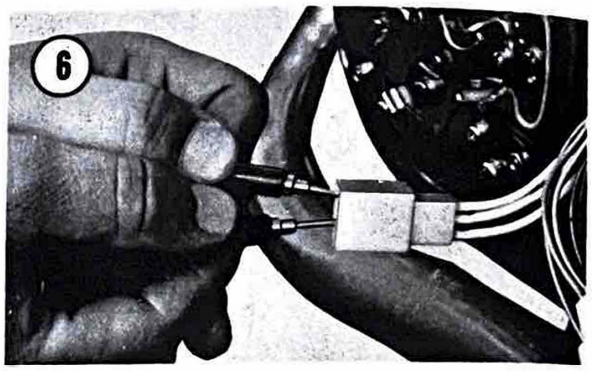
Check the rectifier, located behind the right-hand chassis cover, near the battery box. Trace the rectifier wiring back toward the alternator and disconnect the rectifier-to-alternator wiring connector (under the air filter) as shown in **Figure 5**.



1. Connect one ohmmeter lead to the black wire, and the other lead to each of the 3 white wires. Repeat measurements with the ohmmeter leads reversed. All measurements should be 20-30 ohms in one direction, and essentially infinite in the other direction.
2. Repeat Step 1, except make measurements between the red wire and each white wire. Meter indications should be as in Step 1.
3. Repeat Step 1, except make measurements between the red/white wire and the 3 white wires. Resistance readings should be the same as before.
4. If any reading differs greatly from the specified value, replace the rectifier unit.
5. Reconnect leads if rectifier checks OK.

Stator Testing

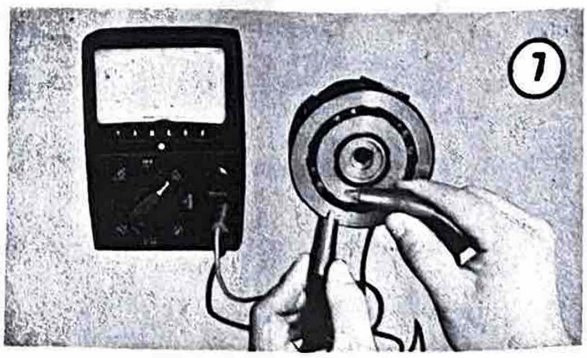
1. Trace the wiring from the alternator to the connector. Disconnect the connector.
2. Measure the resistance between each pair of white wires (3 possible combinations), as shown in **Figure 6**. Each combination should indicate 0.30-0.35 ohm.



3. Ground one ohmmeter lead to the stator housing. Set the ohmmeter to its highest resistance range.
4. Measure insulation resistance between each white lead and the stator housing. Resistance should be essentially infinite.
5. If the readings are not as specified in Steps 2 through 4, the windings are open, shorted, or shorted to the housing. Replace the entire stator unit.

Rotor Testing and Brush Inspection

1. Inspect the brushes for obvious damage or wear. Standard brush length is 0.43 in. (11mm). Wear limit is 0.23 in. (6mm).
2. Measure resistance between each of the rotor slip rings as shown in **Figure 7**. Resistance must be 4.0-4.5 ohms. If less than 3.5 ohms or more than 5.0 ohms, replace the rotor.



3. Measure insulation resistance between each slip ring and the rotor core, with the ohmmeter on the highest range. Insulation resistance should be essentially infinite.

4. Replace the rotor if measurements differ greatly from those specified.

GENERATOR

Several different models of generators are used, but they are all similar in construction and service procedures. **Figure 8** is a wiring diagram for a typical machine equipped with a generator. **Figure 9** is an exploded view of a typical generator.

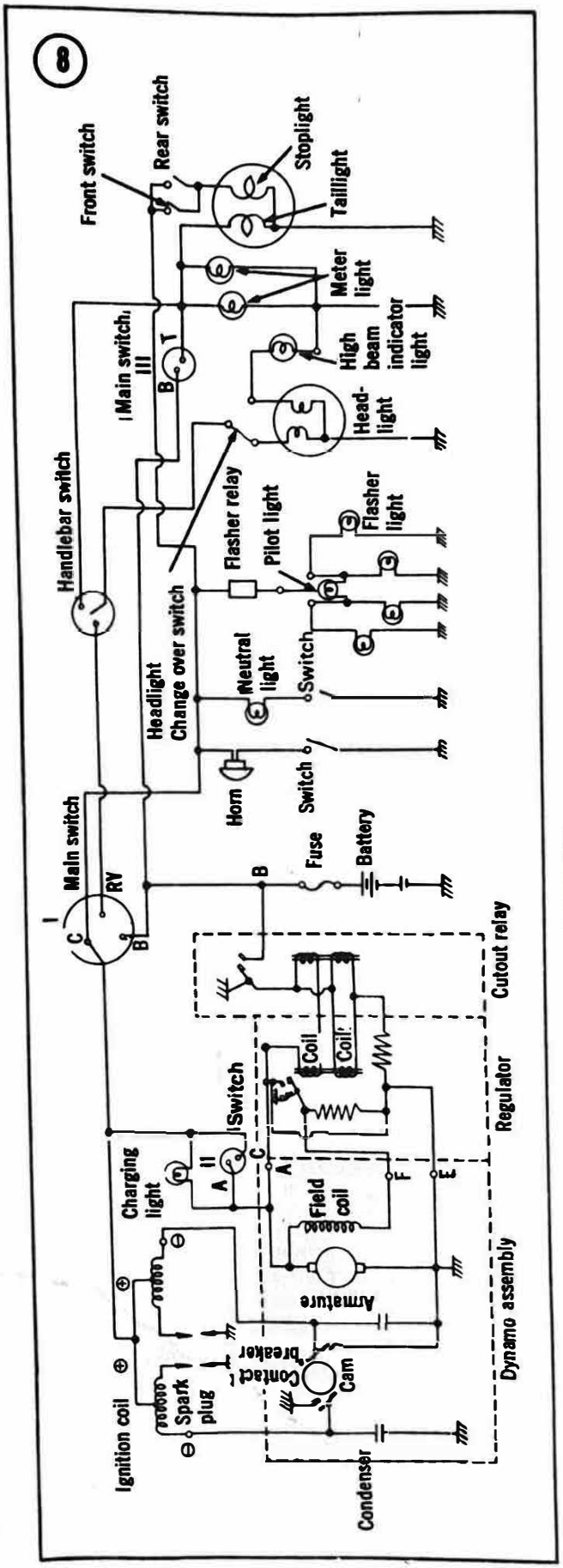
Varying engine speeds and electrical loads affect the output of the generator. The regulator controls the generator output, and also disconnects the battery whenever generator output voltage is less than that of the battery, thereby preventing battery discharge through the generator.

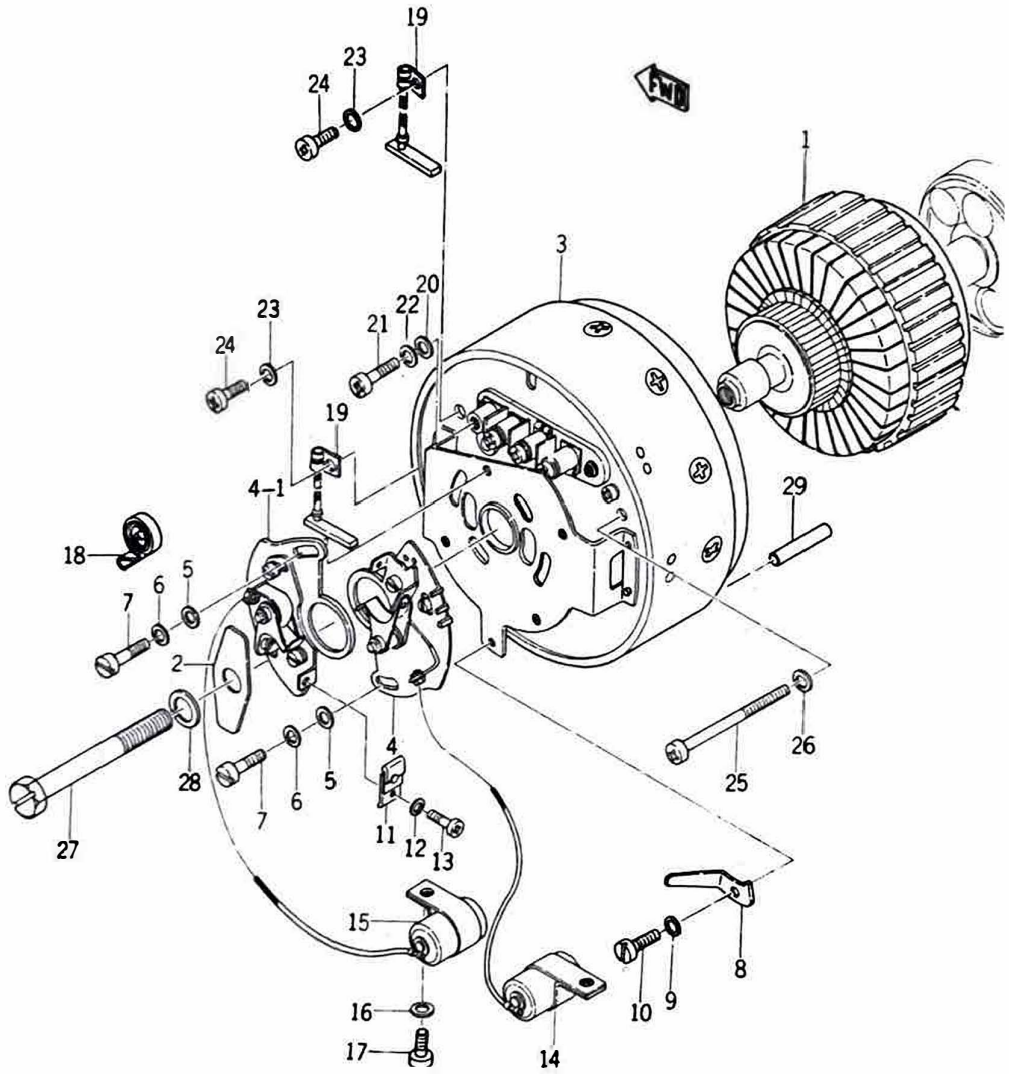
Voltage Output

If all the wiring and connectors are in good condition, trouble in the system may be either the generator or the regulator. To determine which, first check the generator.

1. Disconnect the wire (usually green) from terminal F on the generator.
2. Connect a jumper from terminal F to a good ground.
3. Disconnect the wire (usually white) from terminal A on the generator.
4. Connect the positive lead of a 0-20 DC voltmeter to terminal A. Connect the negative voltmeter lead to a good ground.
5. Start the engine and run it no higher than 2,000 rpm. The meter should indicate more than 14 volts for 12-volt electrical systems. Do not run the engine longer than is necessary to make the measurement.

If the meter indication was as specified, the generator is good, and any trouble will be found in the regulator or wiring. If the meter indicated less than specified, the generator is at fault.





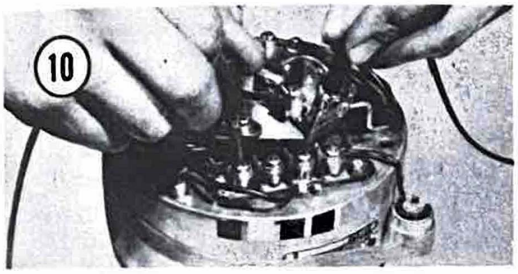
GENERATOR (TYPICAL)

1. Armature
2. Cam plate
3. Stator
4. Breaker points
5. Flat washer
6. Lockwasher
7. Screw
8. Timing plate
9. Lockwasher
10. Screw
11. Lubricator
12. Lockwasher
13. Screw
14. Right condenser
15. Left condenser
16. Lockwasher
17. Screw
18. Brush spring
19. Brush
20. Flat washer
21. Screw
22. Lockwasher
23. Lockwasher
24. Screw
25. Screw
26. Lockwasher
27. Bolt
28. Lockwasher
29. Dowel pin

Yoke Inspection/Testing

Clean the yoke assembly of all foreign material and remove it from the engine.

1. Use an ohmmeter to measure the insulation resistance between the positive brush and ground. If the meter indicates continuity, check for a short circuit at the brush holder or terminal A. The negative brush holder is not insulated. The positive brush holder has a piece of plastic located between the holder and the brush assembly.
2. Measure the resistance between terminals F and A (**Figure 10**). Field coil resistance should be 5-8 ohms.



3. Set the ohmmeter to its highest range. Measure insulation resistance between terminal F and a good ground. Insulation resistance should be essentially infinite.

If the readings obtained in Steps 2 or 3 are not as specified, replace the yoke. If the yoke assembly is good, check the brushes and armature.

Brush Inspection

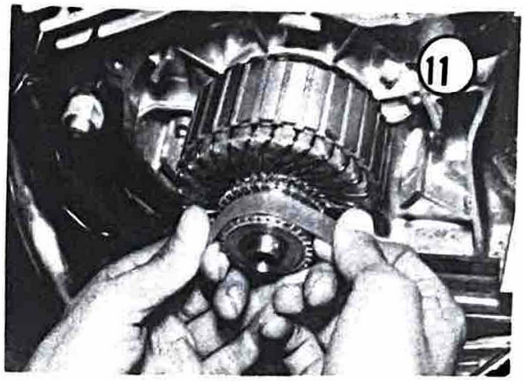
Poor brush condition is one of the most frequent causes of low generator output. Remove the brushes and examine them carefully. Each brush must contact the commutator with at least ¾ of its contact surface. If either brush is worn past the limit line, replace both brushes.

If the brushes and the commutator are rough, misalignment of the armature and crankshaft may be the cause. Check the tapered bore of the armature and smooth it if there are any burrs.

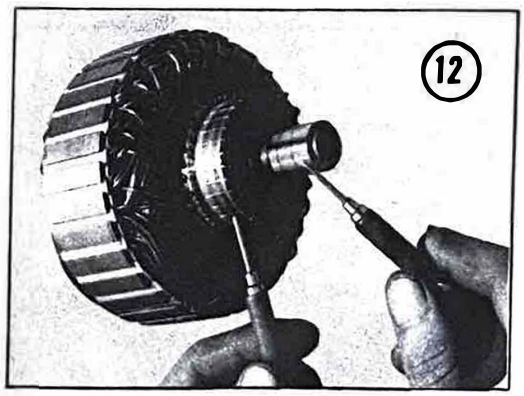
When you replace the brushes, be sure that the positive brush lead does not touch the brush holder or the edge of the breaker plate. Also be sure that the negative brush lead does not touch the positive brush spring.

Armature Inspection/Testing

1. Clean the commutator of oil, dust, and foreign material.
2. If the commutator is rough or covered with carbon dust, polish it as shown in **Figure 11** using fine emery paper.



3. Use an ohmmeter (**Figure 12**) or armature growler to determine that no commutator segment is shorted to the shaft. If any short exists, replace the armature.



Voltage Regulator Inspection

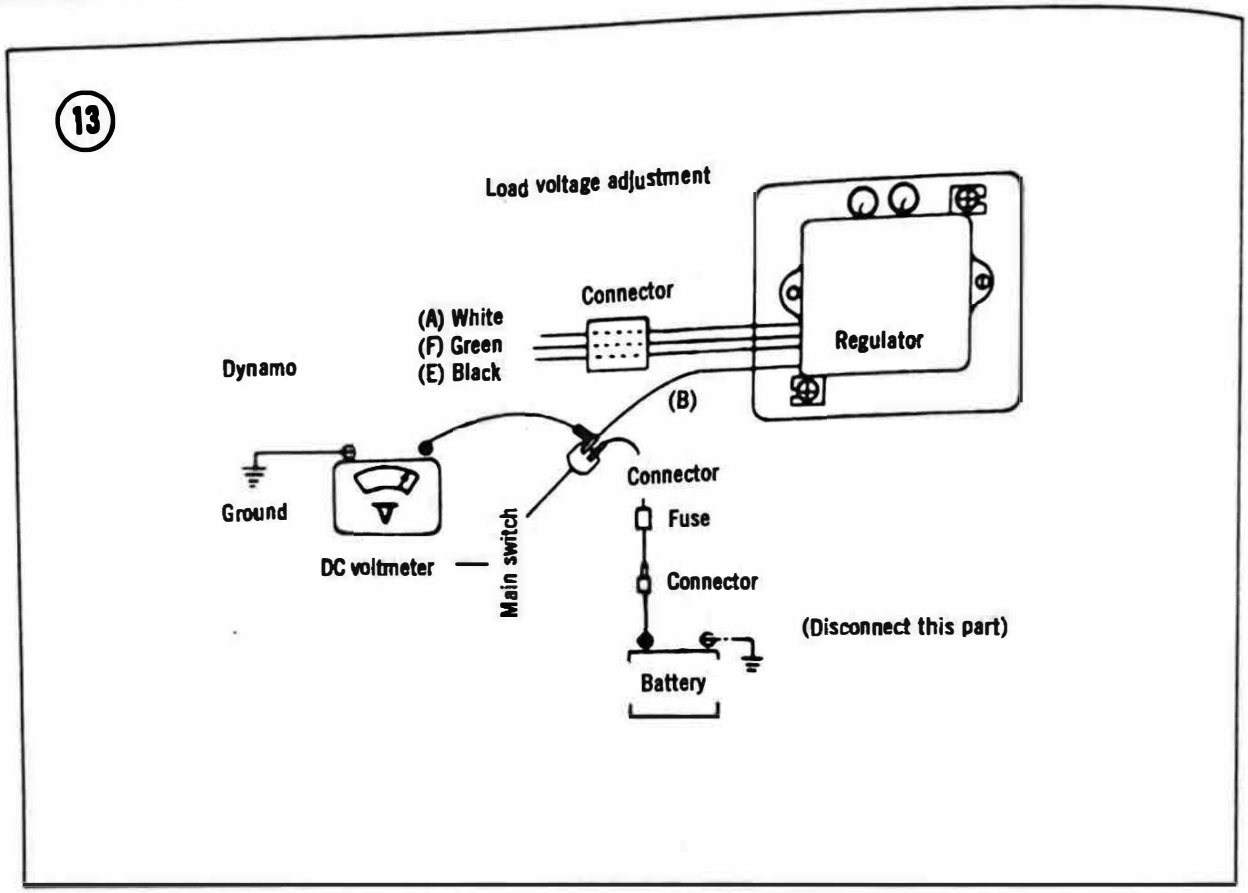
Make the connections shown in **Figure 13**. Start the engine and run it at 2,500 rpm. Remove the fuse or disconnect the battery. If the voltmeter does not indicate 15.0-15.8 volts, adjust or replace the regulator. See **Figure 14**.

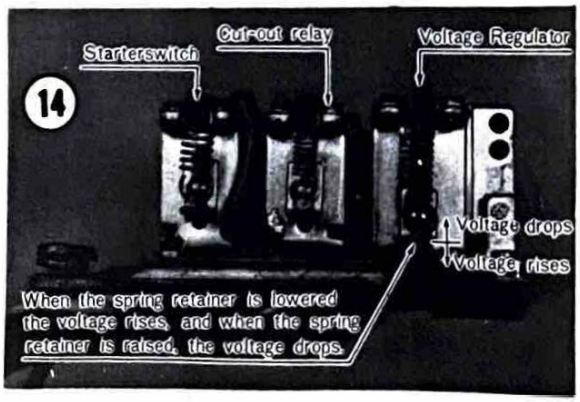
Observe the contacts on the cutout relay as you slowly increase the engine speed. The contacts should close when the voltmeter indicates 12.5-13.5 volts.

Voltage Regulator Adjustment

CAUTION

Disconnect the battery before you remove the regulator cover. Do not make

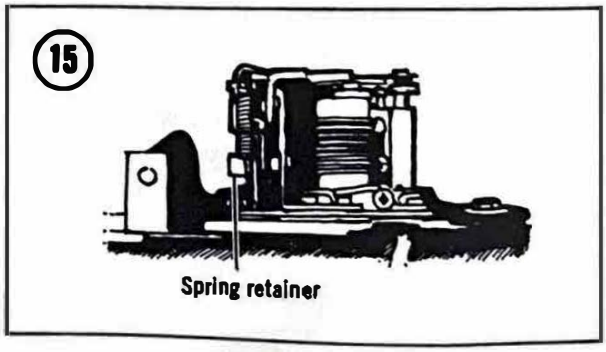


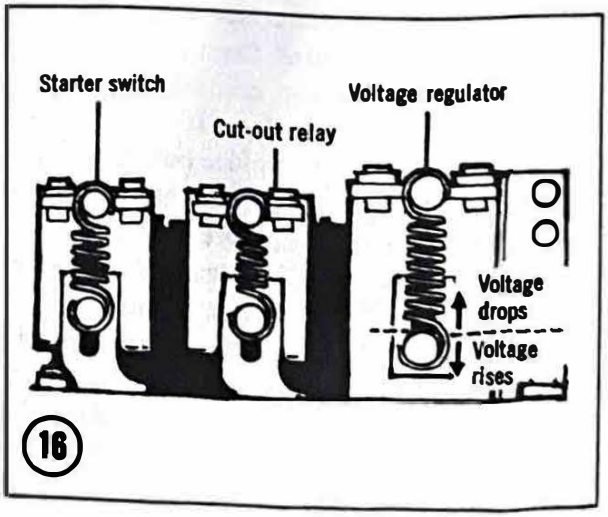


any adjustments with the battery wiring connected.

Remove the cover and adjust regulator by bending the adjustment spring (**Figure 15**). Bending the spring downward raises the voltage setting.

The cutout relay (**Figure 16**) can be identified by a single set of contacts which are normally open. The relay rarely, if ever, needs adjustment. Usually all that is required is to dress the contacts lightly to remove any corrosion or light pitting.





Should adjustment be required, bend the spring retainer up or down as required. Lowering the spring retainer raises the voltage setting.

STARTER/GENERATOR

The starter/generator and its associated voltage regulator function similarly to the standard generator and voltage regulator. When the engine is stopped, the starter/generator may be operated as a series-wound motor to start the engine. **Figure 17** is a schematic diagram of a typical engine equipped with a starter/generator. **Figure 18** is an exploded view of a typical starter/generator.

In general, service procedures for these units are the same as for the regular generator system. The procedures which are different are described in the following paragraphs.

Testing

Test connections are the same as a standard generator. Do not run the engine at over 1,700 rpm. At these speeds, the voltmeter should indicate at least 10 volts.

There are 3 field terminals to check on the starter/generator yoke instead of the 2 on the regular generator. Determine that there is continuity between Terminals A and F, A and M, and F and M. Resistance should be as given in **Table 1**.

Table 1 RESISTANCE

Terminals	Ohms
A to F	4.9
A to M	0
F to M	4.9

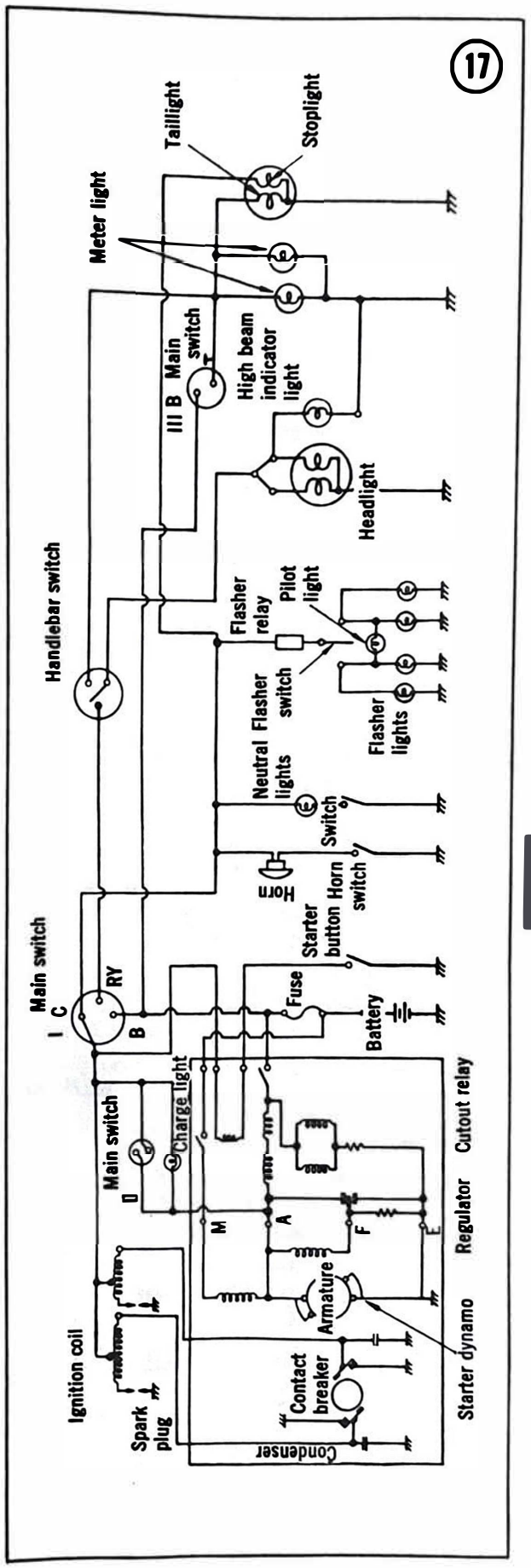
Starter Relay

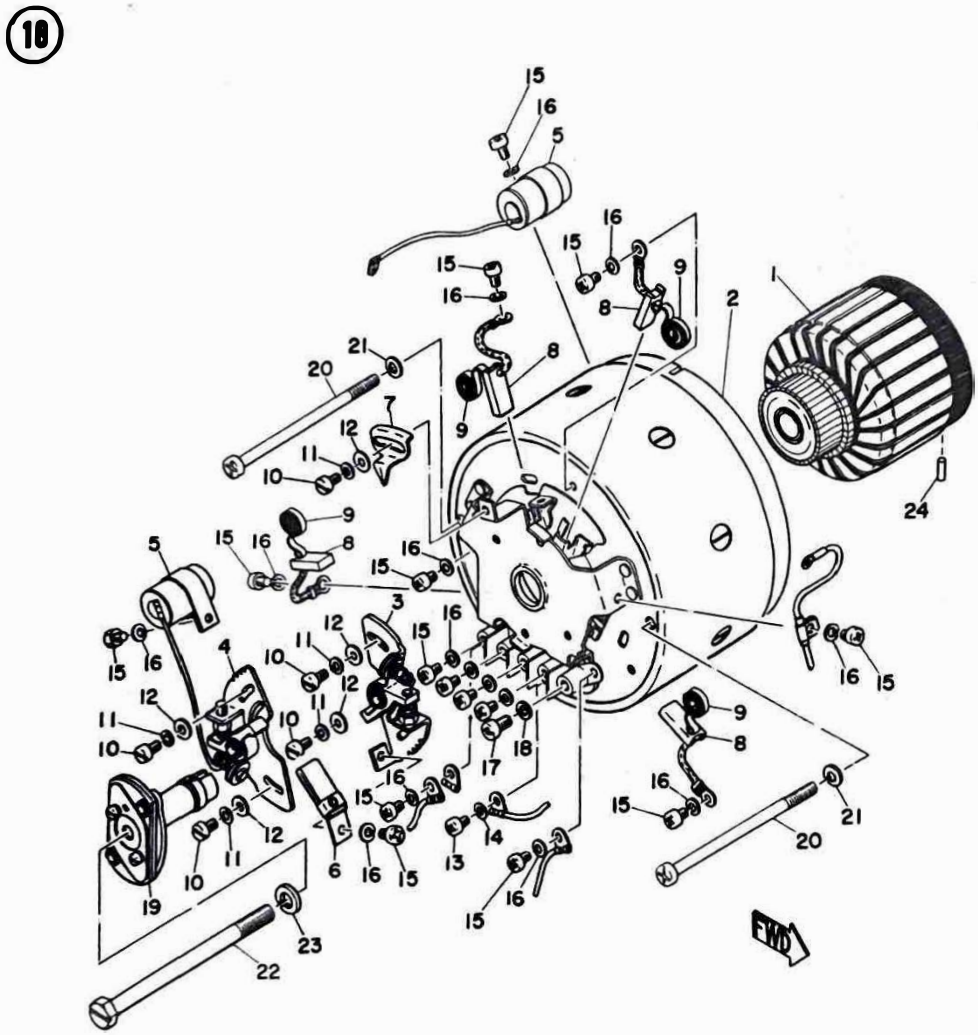
This relay connects the battery to the starter/generator to operate it as a motor for engine starting. See **Figure 19**.

If the relay fails to work, the entire unit must be replaced. There is no adjustment.

BATTERY

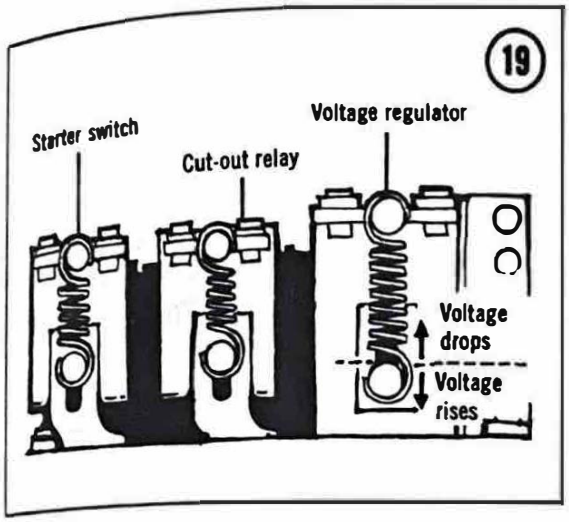
Battery construction is shown in **Figure 20**.

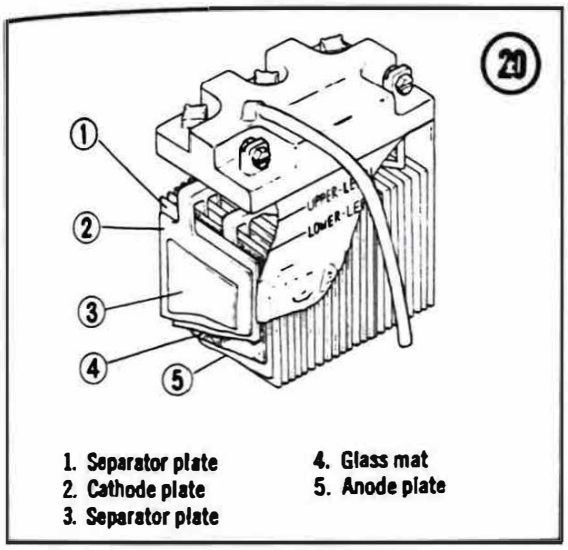




GENERATOR (TYPICAL)

1. Armature
2. Stator
3. Left breaker assembly
4. Right breaker assembly
5. Condenser
6. Lubricator
7. Timing plate
8. Brush
9. Spring
10. Screw
11. Lockwasher
12. Flat washer
13. Screw
14. Lockwasher
15. Screw
16. Lockwasher
17. Screw
18. Lockwasher
19. Advance mechanism
20. Screw
21. Lockwasher
22. Bolt
23. Lockwasher
24. Dowel pin





Be sure to check battery electrolyte level, especially during hot weather.

Removal

1. Lift the seat and remove the battery retaining strap.

2. Disconnect the ground, or negative (—) cable first, then the positive (+) cable.

3. Lift the battery from the carrier. Note that the battery vent tube is routed under the motorcycle and behind the swing arm lug.

Safety Precautions

When working with batteries, use extreme care to avoid spilling or splashing the electrolyte. Electrolyte contains sulphuric acid which can destroy clothing and cause serious chemical burns. If any electrolyte is spilled or splashed on clothing, body, or other surfaces, neutralize it *immediately* with a solution of baking soda and water, then flush with plenty of clean water.

WARNING

Electrolyte splashed into the eyes is extremely dangerous. Safety glasses should always be worn when working with batteries. If electrolyte is splashed into the eye, call a physician immediately, force the eye open, and flood with cool, clean water for about 5 minutes.

While batteries are being charged, highly explosive hydrogen gas forms in each cell. Some of this gas escapes through the filler openings and may form an explosive atmosphere around the battery. This explosive atmosphere may exist for several hours. Sparks, open flame, or even a lighted cigarette can ignite this gas, causing an internal explosion and possible serious personal injury. The following precautions should be taken to prevent an explosion.

1. Do not smoke or permit open flame near any battery being charged or which has been recently charged.

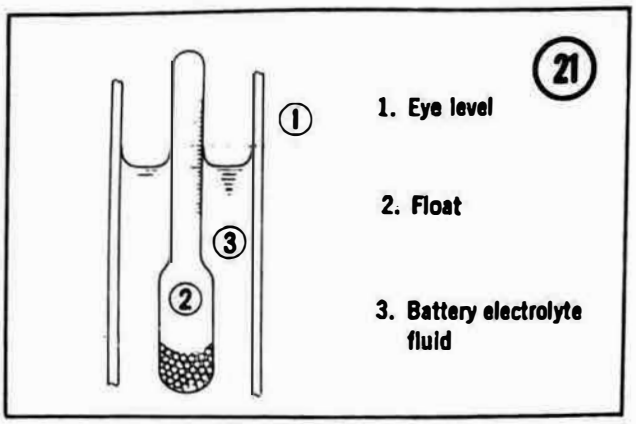
2. Do not disconnect live circuits at battery terminals because a spark usually occurs when a live circuit is broken. Care must always be taken while connecting or disconnecting any battery charger; be sure its power switch is off before making or breaking connections. Poor connections are a common cause of electrical arcs which cause explosions.

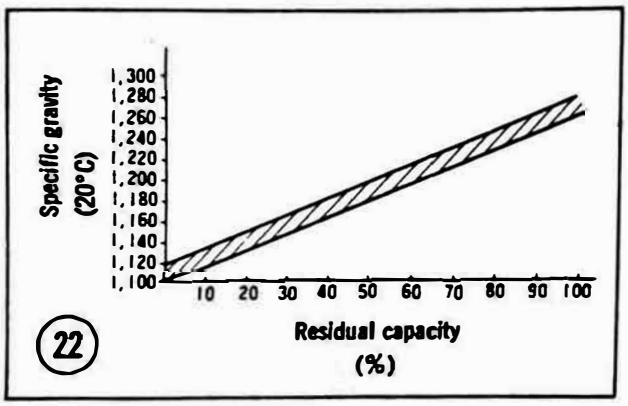
Inspection and Service

1. Measure the specific gravity of the battery electrolyte with a hydrometer. The specific gravity is calibrated on the hydrometer float stem. The reading is taken at the fluid surface level with the float buoyant in the fluid. See **Figure 21**.

2. If the reading is less than 1.20 with the temperature corrected to 68°F, recharge the battery. See **Figure 22** for a graph of specific gravity vs. residual capacity.

3. If any cell's electrolyte level is below the lower mark on the battery case, fill with distilled water to the upper mark.

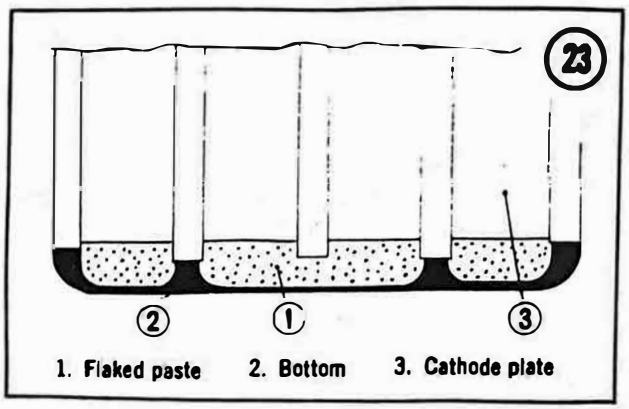




4. Replace the battery if the case is cracked or damaged. Corrosion on the battery terminals causes leakage of current. Clean with a wire brush or with a solution of baking soda and water.

5. Check the battery terminal connections. If corrosion is present, the connection is poor. Clean the terminal and connector and coat with Vaseline and reinstall.

6. Vibration causes the corrosion of the battery plates to flake off forming a paste on the bottom (**Figure 23**). Replace the battery when the paste builds up considerably.



Charging

Batteries are not designed for high charge or discharge rates. For this reason, it is recommended that a battery be charged at a rate not exceeding 10% of its ampere-hour capacity. That is, do not exceed 0.5 ampere charging rate for a 5 ampere-hour battery, or 1.5 amperes for a 15 ampere-hour battery. This charge rate should continue for 10-13 hours if the battery is completely discharged or until specific gravity of each cell is up to 1.260-1.280, corrected for temperature. If after prolonged charging, specific gravity of one or more cells does not come up to at least 1.230, the battery will not perform as well as it should, but it may continue to provide satisfactory service for a time.

Some temperature rise is normal as a battery is being charged. Do not allow the electrolyte temperature to exceed 110°F (43.3°C). Should temperature reach that figure, discontinue charging until the battery cools, then resume charging at a lower rate.

If possible, always slow-charge a battery. Quick-charging will shorten the battery service life. Use a quick-charge only if *absolutely* necessary.

Use the following procedure for charging.

1. Hook the battery to a charger by connecting the positive lead to the positive terminal on the battery and the negative lead to the negative terminal. To do otherwise could cause severe damage to the battery and result in injury if the battery explodes.

2. The electrolyte will begin bubbling, signifying that explosive hydrogen gas is being released. Make sure the area is adequately ventilated and that there are no open flames.

3. It will normally take at least 8 hours to bring the battery to a full charge. Test the electrolyte periodically with a hydrometer to see if the specific gravity is within the standard range of 1.26-1.28. If the reading remains constant for more than an hour, the battery is charged.

Installation

1. Wash the battery with water to remove spilled electrolyte. Coat the terminals with Vaseline or light grease before installing.

2. When replacing the battery, be careful to route the vent tube so that it is not crimped. Connect the positive terminal first, then the negative one. Do not overtighten the clamps.
3. Remeasure the specific gravity of the electrolyte with a bulb hydrometer, reading it as shown.

IGNITION COIL

Removal/Installation

Refer to **Figure 24** for an illustration of a typical coil.

1. Remove the gas tank. See Chapter Five, *Fuel Tank Removal/Installation*.
2. Disconnect battery ground lead.
3. Disconnect leads to coil.
4. Detach coil from mounting bracket and remove.
5. Install in reverse order of removal.

BREAKER POINTS

See *Breaker Points*, Chapter Two, for removal and installation of breaker points.

SPARK PLUGS

See *Spark Plugs*, Chapter Two, for removal, cleaning, and installation of plugs.

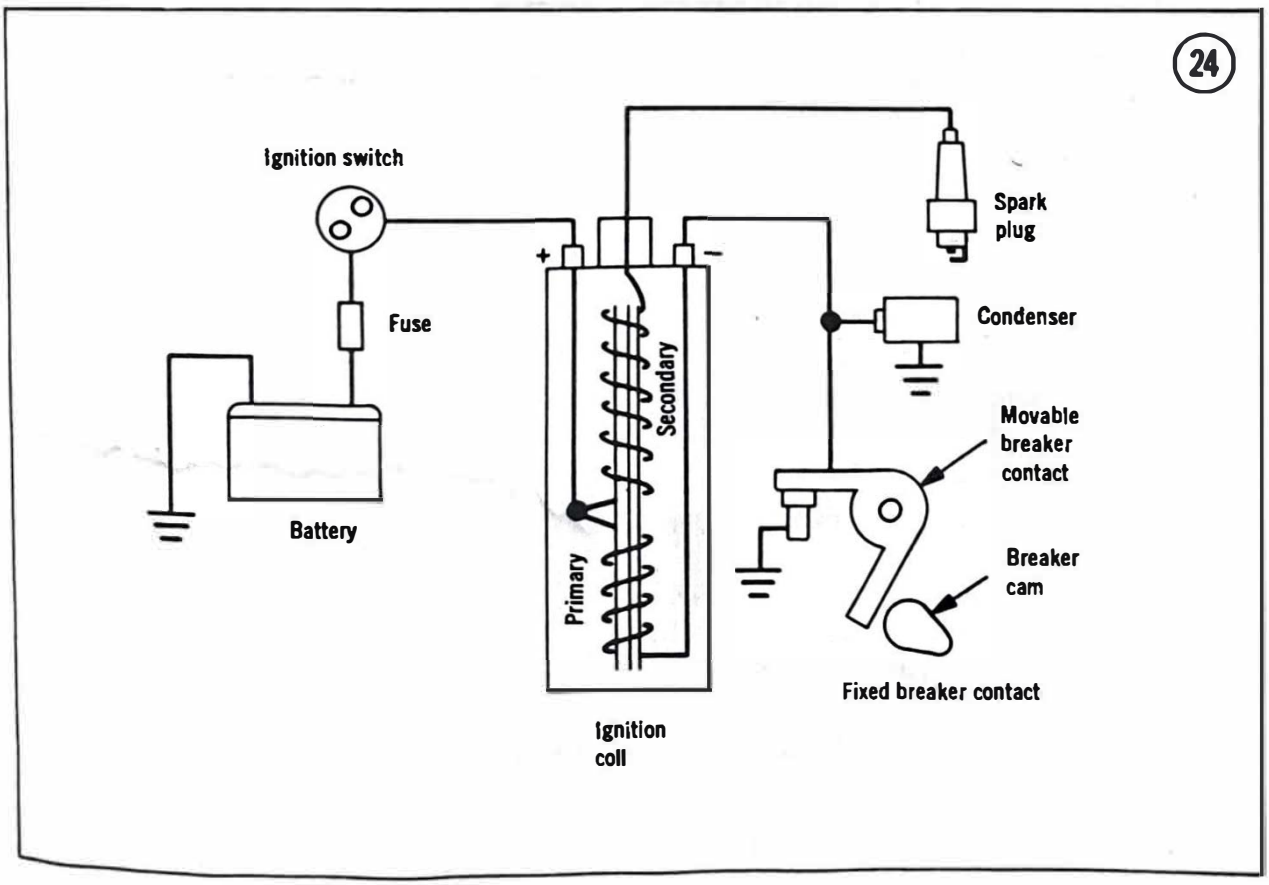
HEADLIGHT, TAILLIGHT, FLASHER LIGHTS, AND HORN

Removal/Installation

Removal and installation of the headlight, taillight, flasher lights, and horn are straightforward jobs.

Headlight Adjustment

Proper headlight adjustment is essential to safe night riding. If the lights are set too low, the road will not be visible. If set too high, they will blind oncoming vehicles. See *Headlight Adjustment*, Chapter Two.



CHAPTER SEVEN

CHASSIS, SUSPENSION, AND STEERING

Oil-damped front forks are used on all models. The rear suspension system consists of a swing arm, adjustable springs, and shock absorbers.

FRONT WHEEL

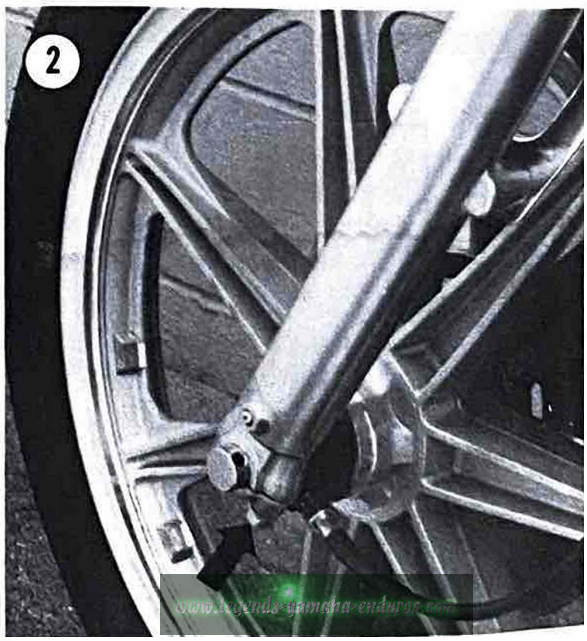
Removal/Installation (Drum Brake Models)

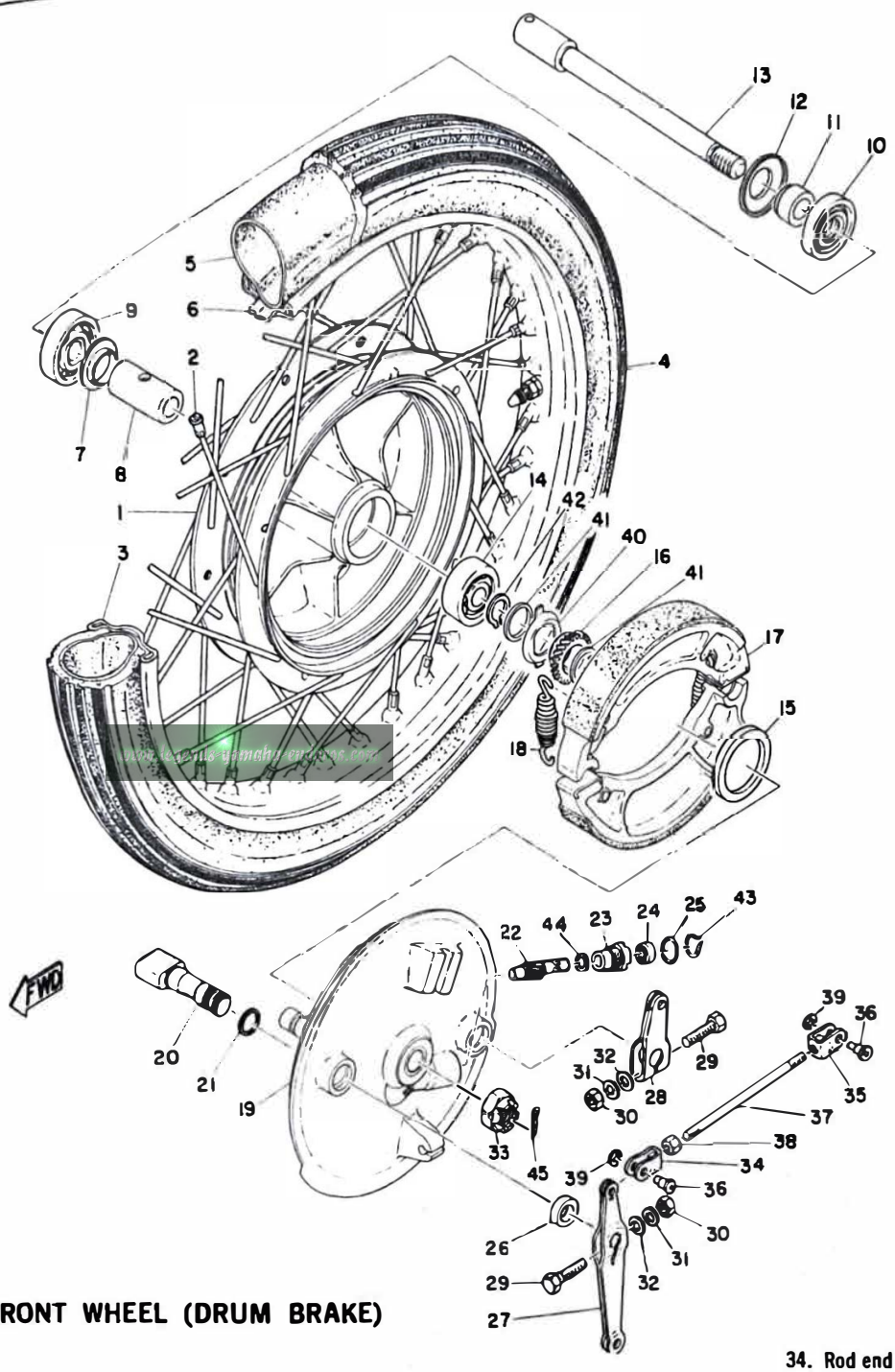
1. Disconnect the brake cable at the front brake hand lever.
2. Disconnect the brake cable and speedometer cable at the front wheel hub. See **Figure 1**.
3. Remove the front axle shaft nut. Remove the cotter pin on models so equipped.
4. Loosen the axle pinch bolts.
5. Raise the front of the motorcycle and support it on a box.
6. Insert the shank of a Phillips screwdriver through the hole in the end of the axle shaft, then simultaneously twist and pull the axle shaft to remove it.
7. Reverse the procedure to install.

When inserting the axle, be sure hub dust cover and wheel shaft (axle) collar (11 and 12, **Figure 1**) have been installed.

Removal/Installation (Disc Brake Models)

1. Prop the engine on a box so that the front wheel is in the air.
2. Disconnect the speedometer cable.
3. Remove the axle cotter pin, unscrew the axle bolt, and loosen the front axle pinch bolts (bottom of the fork leg). See **Figure 2**.





FRONT WHEEL (DRUM BRAKE)

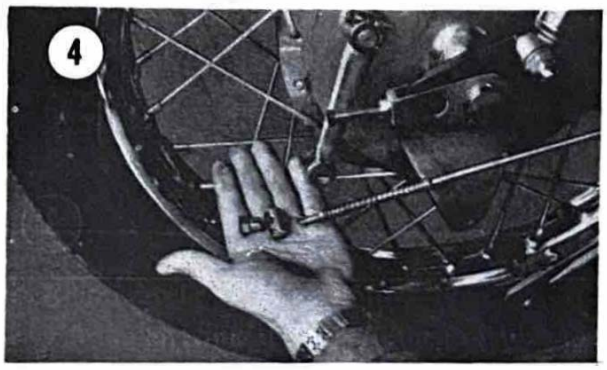
1. Hub
2. Spoke
3. Rim
4. Front tire
5. Tube
6. Rim band
7. Spacer flange
8. Bearing spacer
9. Bearing
10. Oil seal
11. Axle shaft collar
12. Hub dust cover
13. Axle shaft
14. Bearing
15. Oil seal
16. Drive gear
17. Brake shoe
18. Return spring
19. Brake shoe plate
20. Camshaft
21. Camshaft shim
22. Meter gear
23. Bushing
24. Oil seal
25. O-ring
26. Camshaft seal
27. Camshaft lever
28. Camshaft lever
29. Bolt
30. Nut
31. Spring washer
32. Plain washer
33. Axle shaft nut
34. Rod end
35. Rod end
36. Rod end pin
37. Connecting rod
38. Nut
39. Circlip
40. Meter clutch
41. Thrust washer
42. Circlip
43. Stop ring
44. Thrust washer
45. Cotter pin

7

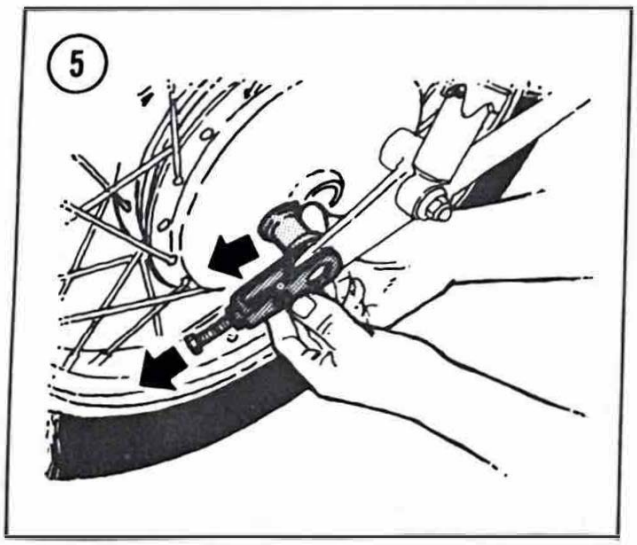
REAR WHEEL

Removal/Installation (Drum Brake Models)

1. Remove the brake rod and brake tension bar from the rear brake plate, as shown in **Figures 3 and 4**.



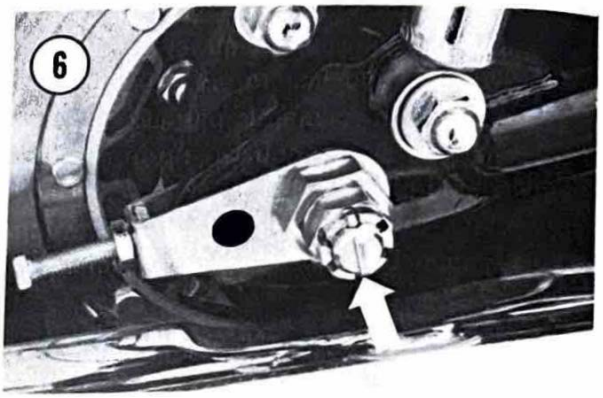
2. Loosen the chain tension adjustment nuts and bolts on both sides.
3. Remove the rear wheel shaft nut.
4. Drive out the rear wheel shaft with a plastic-tipped mallet.
5. Remove the right-hand chain adjuster and spacer (**Figure 5**).



6. Remove rear brake assembly.
7. Tilt the machine to the left, then remove the rear wheel assembly.
8. Reverse procedure for installation.
9. Adjust chain as described in Chapter Two, *Drive Chain*.

Removal/Installation (Disc Brake Models)

1. Place machine on blocks.
2. Disconnect the drive chain.
3. Remove cotter pin from rear axle. See **Figure 6**.

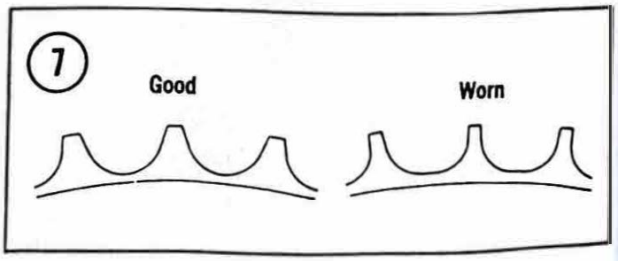


4. Remove the rear axle nut.
5. Remove the rear axle by simultaneously twisting and pulling out.
6. Remove rear wheel assembly.
7. Reverse procedure for installation.
8. Adjust chain as described in Chapter Two, *Drive Chain*.

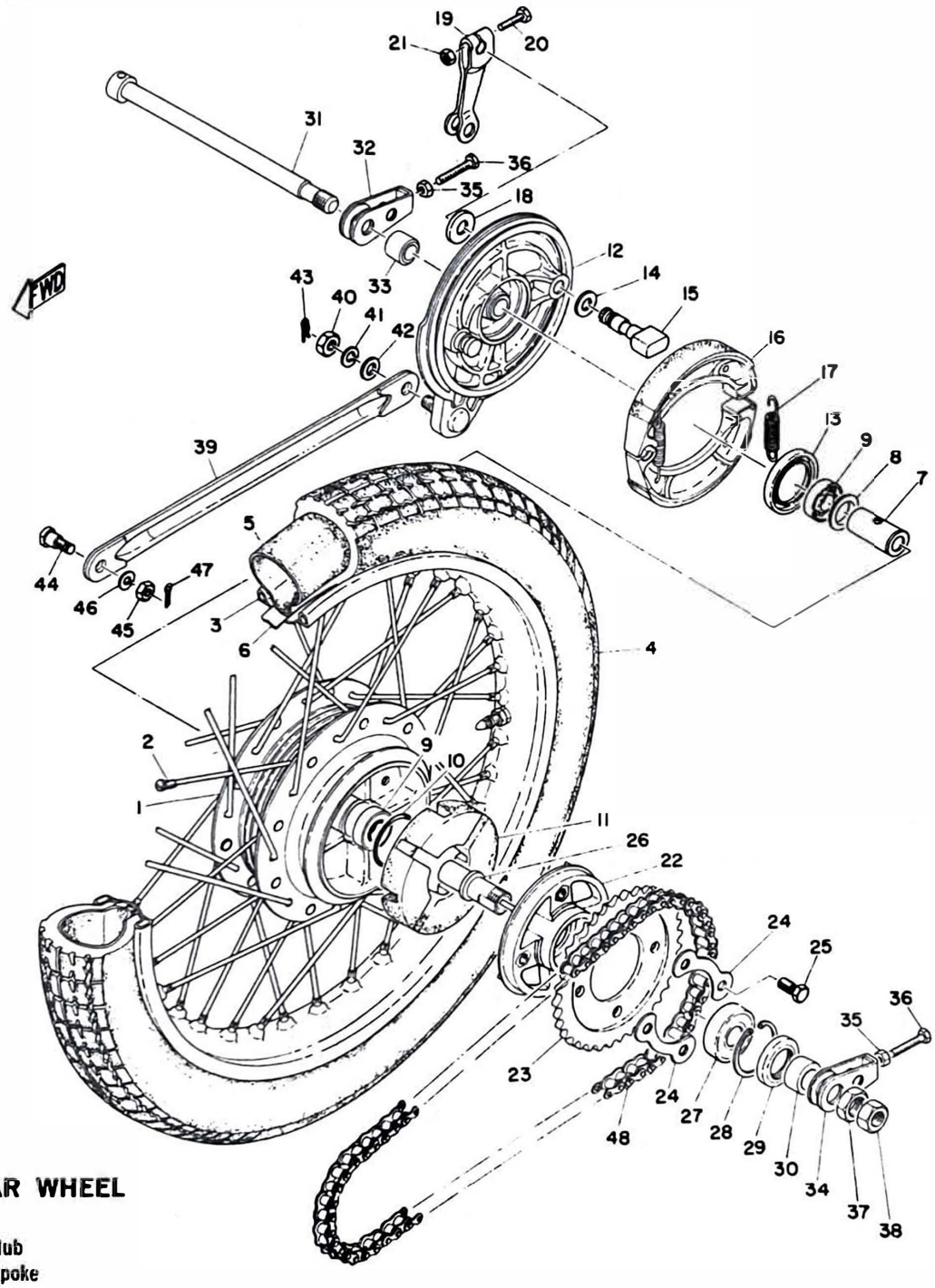
WHEEL RIM

Inspection

1. Measure the wobble and runout of the wheel rim with a dial indicator as shown in **Figure 7**. The standard value for both wobble and runout is 0.02 in. (0.5mm). The maximum permissible limit is 0.08 in. (2mm).



2. Measure the axial and radial runout of the wheel bearing with the dial indicator. Replace the bearing if axial value is more than 0.004 in. (0.1mm) or radial value is more than 0.002 in. (0.05mm).



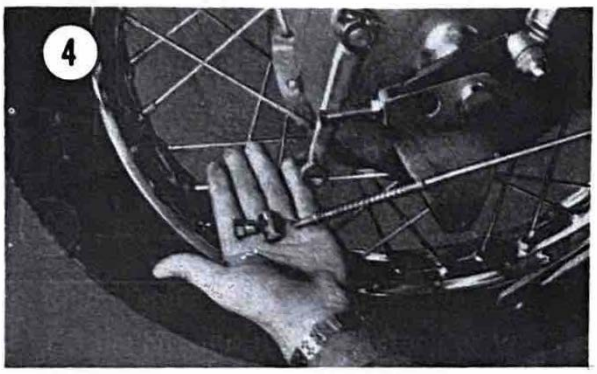
REAR WHEEL

1. Hub
2. Spoke
3. Rim
4. Tire
5. Tube
6. Rim band
7. Bearing spacer
8. Spacer flange
9. Bearing
10. O-ring
11. Damper
12. Brake shoe plate
13. Oil seal
14. Camshaft shim
15. Shaft cam
16. Brake shoe
17. Return spring
18. Camshaft seal
19. Camshaft lever
20. Bolt
21. Nut
22. Shock hub
23. Sprocket wheel gear
24. Lockwasher
25. Fitting bolt
26. Sprocket wheel shaft
27. Bearing
28. Circlip
29. Oil seal
30. Sprocket shaft collar
31. Axle shaft
32. Chain tensioner
33. Axle shaft collar
34. Chain tensioner
35. Nut
36. Chain tensioner bolt
37. Sprocket shaft nut
38. Nut
39. Tension bar
40. Nut
41. Spring washer
42. Plain washer
43. Tension bar clip
44. Tension bar bolt
45. Nut
46. Spring washer
47. Cotter pin
48. Chain

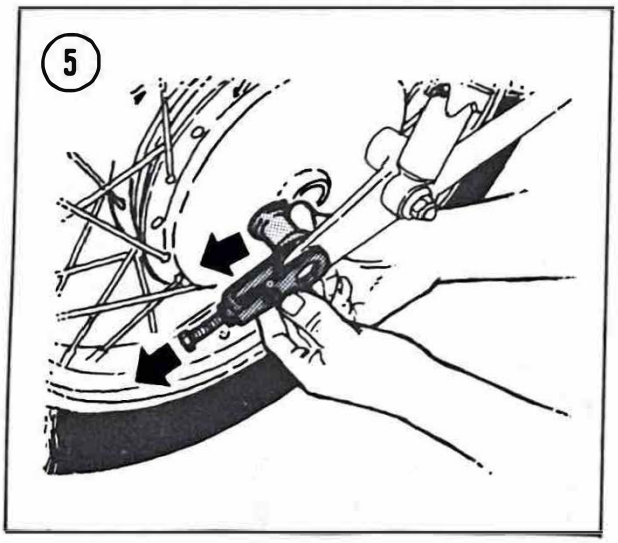
REAR WHEEL

Removal/Installation (Drum Brake Models)

1. Remove the brake rod and brake tension bar from the rear brake plate, as shown in **Figures 3 and 4.**



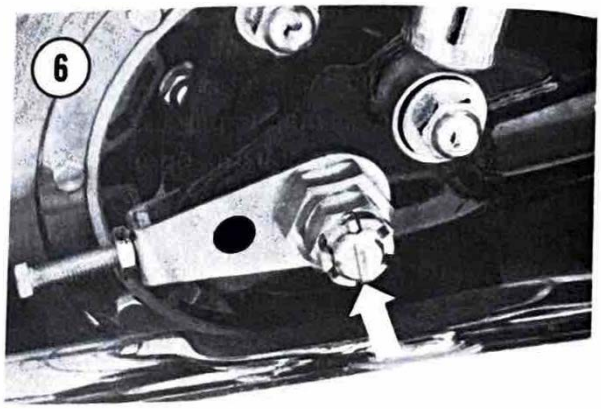
2. Loosen the chain tension adjustment nuts and bolts on both sides.
3. Remove the rear wheel shaft nut.
4. Drive out the rear wheel shaft with a plastic-tipped mallet.
5. Remove the right-hand chain adjuster and spacer (**Figure 5**).



6. Remove rear brake assembly.
7. Tilt the machine to the left, then remove the rear wheel assembly.
8. Reverse procedure for installation.
9. Adjust chain as described in Chapter Two, *Drive Chain.*

Removal/Installation (Disc Brake Models)

1. Place machine on blocks.
2. Disconnect the drive chain.
3. Remove cotter pin from rear axle. See **Figure 6.**

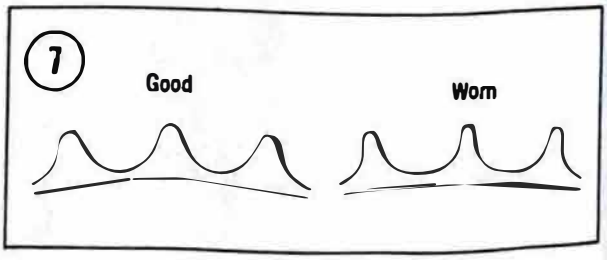


4. Remove the rear axle nut.
5. Remove the rear axle by simultaneously twisting and pulling out.
6. Remove rear wheel assembly.
7. Reverse procedure for installation.
8. Adjust chain as described in Chapter Two, *Drive Chain.*

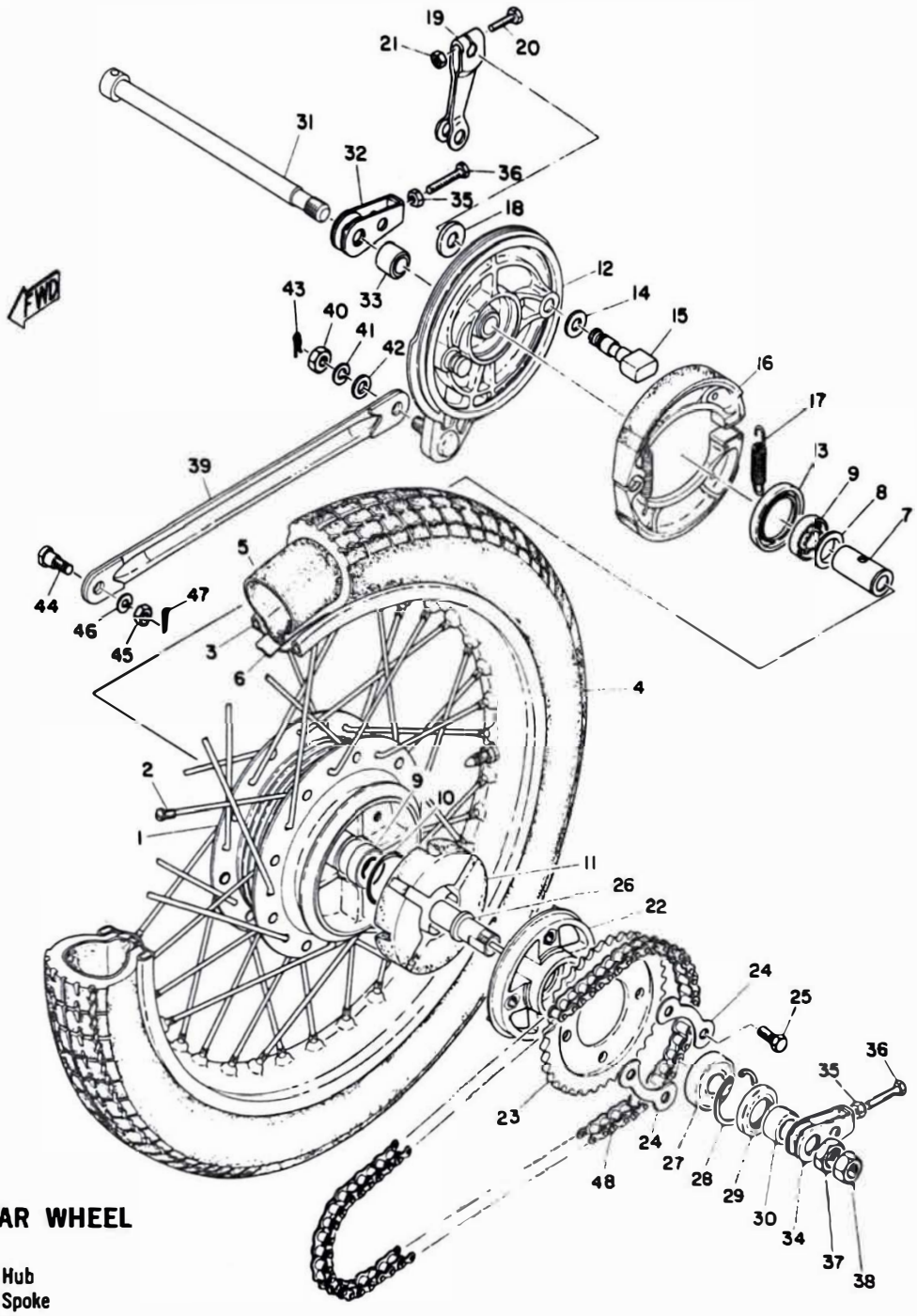
WHEEL RIM

Inspection

1. Measure the wobble and runout of the wheel rim with a dial indicator as shown in **Figure 7.** The standard value for both wobble and runout is 0.02 in. (0.5mm). The maximum permissible limit is 0.08 in. (2mm).



2. Measure the axial and radial runout of the wheel bearing with the dial indicator. Replace the bearing if axial value is more than 0.004 in. (0.1mm) or radial value is more than 0.002 in. (0.05mm).



REAR WHEEL

1. Hub
2. Spoke
3. Rim
4. Tire
5. Tube
6. Rim band
7. Bearing spacer
8. Spacer flange
9. Bearing
10. O-ring
11. Damper
12. Brake shoe plate
13. Oil seal
14. Camshaft shim
15. Shaft cam
16. Brake shoe
17. Return spring
18. Camshaft seal
19. Camshaft lever
20. Bolt
21. Nut
22. Shock hub
23. Sprocket wheel gear
24. Lockwasher
25. Fitting bolt
26. Sprocket wheel shaft
27. Bearing
28. Circlip
29. Oil seal
30. Sprocket shaft collar
31. Axle shaft
32. Chain tensioner
33. Axle shaft collar
34. Chain tensioner
35. Nut
36. Chain tensioner bolt
37. Sprocket shaft nut
38. Nut
39. Tension bar
40. Nut
41. Spring washer
42. Plain washer
43. Tension bar clip
44. Tension bar bolt
45. Nut
46. Spring washer
47. Cotter pin
48. Chain

Spokes

The spokes support the weight of the motorcycle and rider, and transmit tractive and braking forces, as shown in **Figure 8**. Diagram A illustrates action of the spokes as they support the machine. Tractive forces are shown in Diagram B. Braking forces are shown in Diagram C.

Check the spokes periodically for looseness or binding. A bent or otherwise faulty spoke will adversely affect neighboring spokes, and should therefore be replaced immediately. To remove the spoke, completely unscrew the threaded portion, then remove the bent end from the hub.

Spokes tend to loosen during use. Retighten each spoke one turn, beginning with those on one side of the hub, then those on the other side. Tighten spokes on a new machine after the first 50 miles (80 km) of operation, then at 50-mile (80-km) intervals until they remain tight.

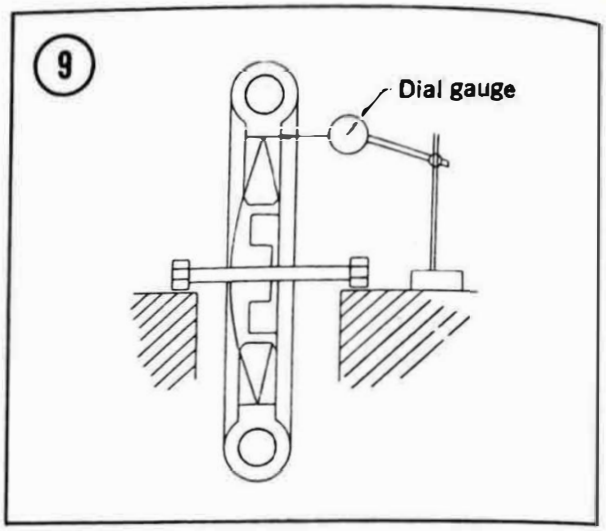
If the machine is subjected to particularly severe service, as in off-road or competition riding, check the spokes frequently.

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 which may even result in loss of control. Balance weights are applied to the spokes on the light side of the wheel to correct this condition.

Before you attempt to balance the wheel, check to be sure that the wheel bearings are in good condition and properly lubricated, and that the brakes do not drag, so that the wheel rotates freely.

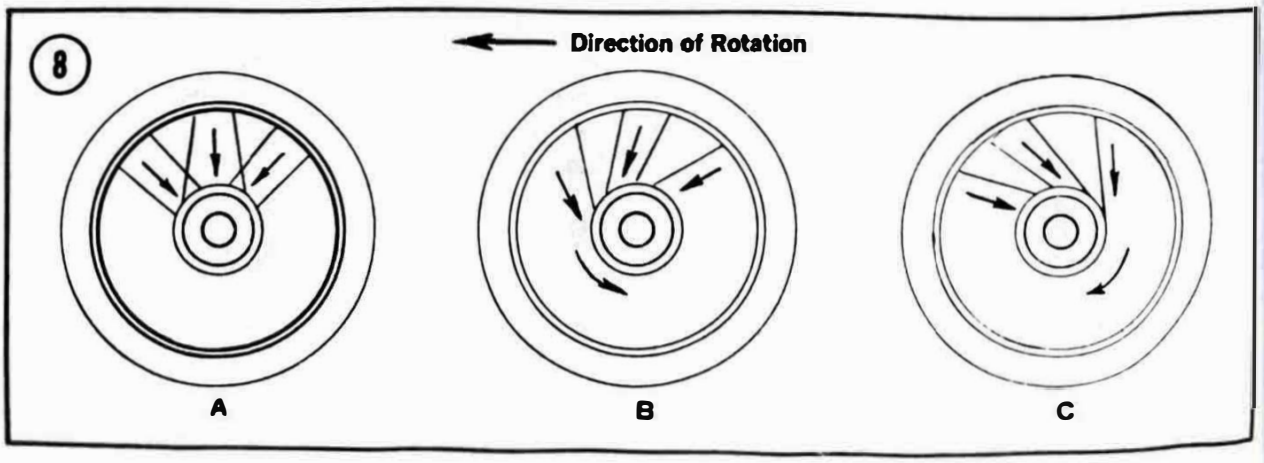
1. Mount the wheel on a fixture such as the one in **Figure 9** so it can rotate freely.

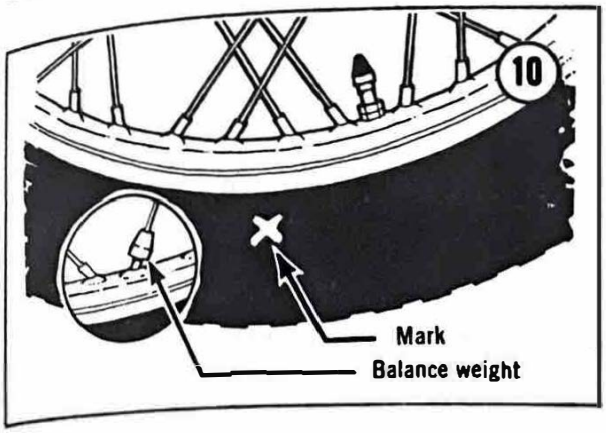


2. Give the wheel a spin and let it coast to a stop. Mark the tire at the lowest point.
3. Spin the wheel several more times. If the wheel keeps coming to a rest at the same point, it is out of balance.
4. Attach a weight to the upper—or light—side of the wheel at the spoke (**Figure 10**). Weights come in 4 sizes: 5, 10, 15, and 20 grams.
5. Experiment with different weights until the wheel, when spun, comes to rest at a different position each time.

Truing

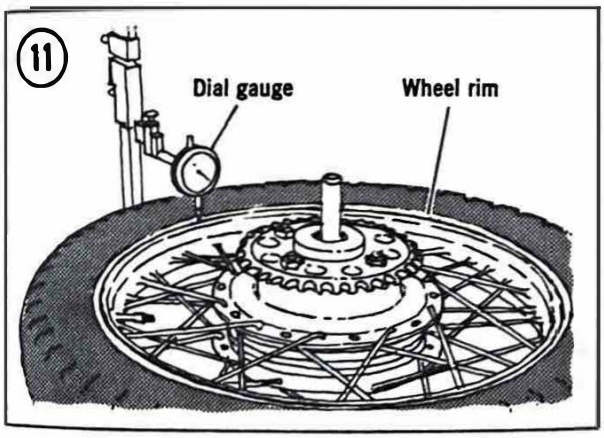
1. Prop motorcycle so wheel clear the ground.





2. For checking the rear wheel, remove the chain from the rear sprocket.

3. Position a dial gauge so that it bears against the side of the rim (**Figure 11**). Turn the wheel slowly, and write down the highest and lowest readings. Subtract the lowest from the highest reading to get the axial (side wobble) runout of the rim.



4. Position the dial gauge so that it bears against the inner face of the rim near the edge. Turn the wheel slowly, and write down the highest and lowest readings. Subtract the lowest from the highest reading to get the radial (up-and-down wobble) runout of the rim.

5. A new wheel has an axial runout of less than 0.04 in. (1.0mm), and a radial runout of less than 0.04 in. (1.0mm).

6. If you measure more than 0.12 in. (3.0mm) of axial runout, or more than 0.08 in. (2.0mm) of radial runout, remove the axle from the wheel and check it for runout. Place the axle in V-blocks with a dial indicator in the center. Rotate the axle and measure runout.

7. If axle runout is within tolerance, adjust spoke tension.

8. If you cannot true the rim with a reasonable amount of spoke tuning, the rim is bent and must be replaced with a new one.

9. Mark the tire with a piece of chalk at the point where runout is greatest.

10. Note whether the reading at the point of greatest runout is a high number or a low number on the dial gauge. If the number is high, the rim is warped toward the side of the wheel being checked with the dial gauge. If low, it is warped toward the far side.

11. Loosen the 2 nearest spokes (½ turn each) on each side of the chalk mark (that are laced to the side of the hub toward which the rim is warped).

12. Tighten the 2 nearest spokes (½ turn each) on each side of the chalk mark that are laced to the other side of the hub.

13. Check the axial runout again. Continue loosening or tightening those same spokes in the same sequence until the axial runout lies within the acceptable limits.

14. Tap each spoke in the wheel with a wrench, and listen to the sound, to check that you have not tightened or loosened any spoke too much. If considerable tightening of any spoke was required, you may need to remove the tire and grind off the protruding end of the spoke to prevent it from puncturing the tube.

15. If radial runout exceeds the limit, mark the tire with a piece of chalk at the point where runout is greatest.

16. Note whether the reading at the point of greatest runout is a high number or a low number on the dial gauge. If the number is high, the rim is stretched away from the hub at that point. If the number is low, the rim is pulled toward the hub at that point.

17. If the number was high, tighten the 2 nearest spokes on each side of the chalk mark ½ turn each. Make another chalk mark on the opposite end of the tire, and loosen the 2 nearest spokes on each side of the new chalk mark ½ turn each.

18. If the dial gauge reading at the point of

greatest runout was a low number, loosen the 4 spokes nearest the chalk mark, and tighten the 4 spokes at the opposite end of the wheel.

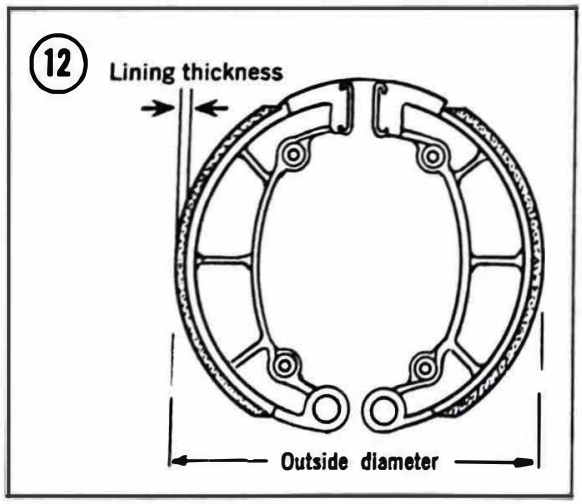
19. Check radial runout again. Continue loosening or tightening these spokes in the same sequence until runout lies within 0.040 in. (2.0mm). The same cautions apply as for correcting axial runout.

DRUM BRAKES

Removal/Inspection/Installation

1. Remove the front or rear wheel as described in this chapter.

2. To check for wear, measure the outside diameter of the brake shoe assembly as shown in **Figure 12**. Minimum brake shoe diameter is 6.9 in. (175mm) for all models.



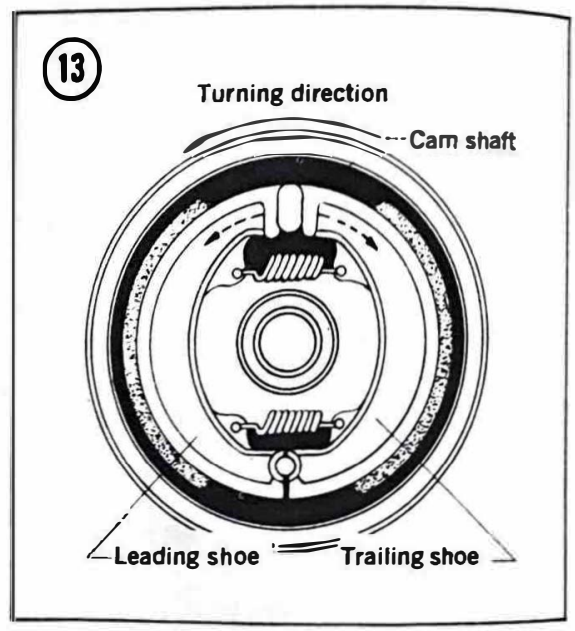
3. If contact surfaces of the brake shoe are glazed, scratched, scarred, or shows high spots (localized shiny spots), smooth with a dry type sandpaper or a hand file. Do not allow moisture, especially oil, to touch brake contact surfaces.

4. Examine the inner surface of the brake drum. Oil, grease, grooves, or scratches will result in noise or impaired braking performance, and should be considered dangerous. Smooth the inner surface of the drum with sandpaper and then clean it with a rag soaked in lacquer thinner.

5. To replace shoes (lining), lift up one brake shoe until it is off the pivot and cam; disconnect the return springs. The other shoe will then come off. Remove the split pin from the pivot pin at each end of the adjustment rod and move the pivot pins out of the way.

6. Hook the 2 return springs in the brake shoes (with the hooked spring ends up) and place the shoes over the pivot and cam.

7. Hold the shoes in a V-position until they are in place over the pivot and cam and then snap them down into their correct position. Leading and trailing shoes are not interchangeable and should be installed as shown in **Figure 13**.



8. Install wheel as described in *Rear Wheel, Removal/Installation*, this chapter.

9. Adjust brakes as described in Chapter Two, *Brakes*.

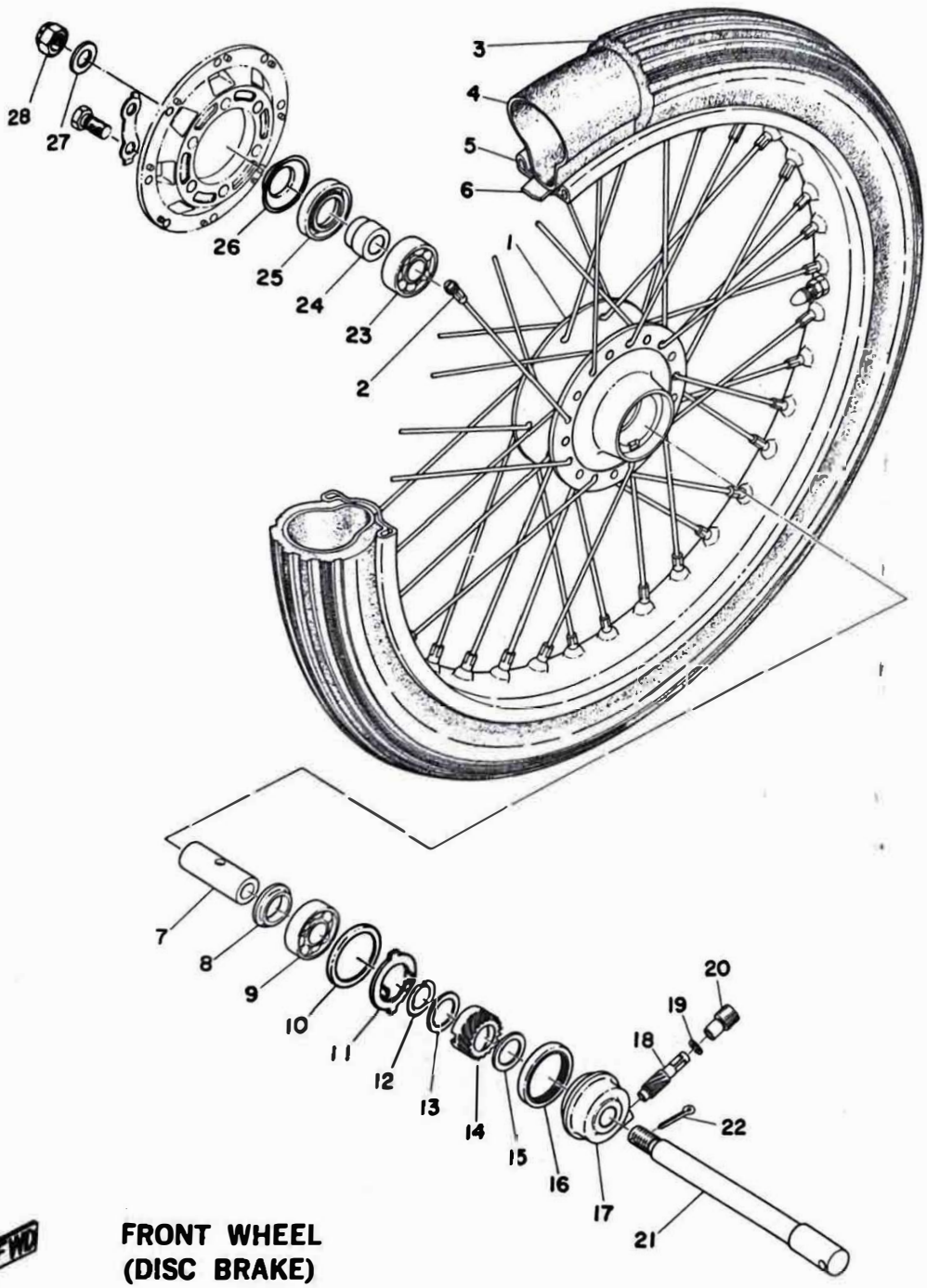
DISC BRAKE

This system includes a hydraulic master cylinder, a flexible brake hose, and a caliper to grip a disc fastened to the hub. Refer to **Figures 14 through 17** for parts location.

Inspection

The disc contact surface will become scarred and develop blue discoloration from normal use. If the disc is worn to less than 0.250 in. (6.5mm), as measured in **Figure 18**, replace it. If it has more than 0.006 in. (0.15mm) runout as meas-

14

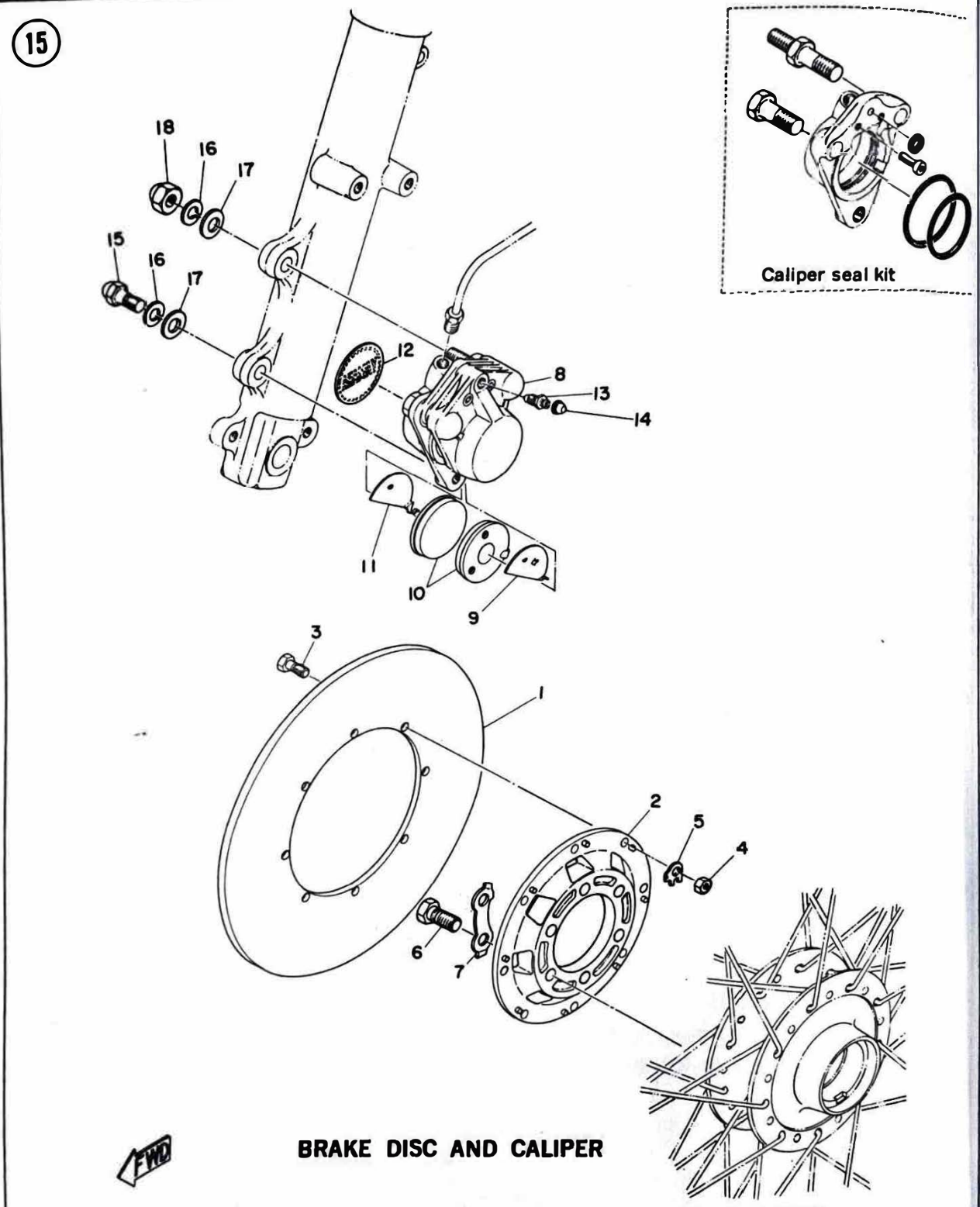


FWD

FRONT WHEEL (DISC BRAKE)

1. Front hub
2. Spoke
3. Tire
4. Tube
5. Rim
6. Rim band
7. Bearing spacer
8. Spacer flange
9. Bearing
10. Clutch meter retainer
11. Speedometer clutch
12. Stop ring
13. Thrust washer
14. Drive gear
15. Thrust washer
16. Oil seal
17. Speedometar gear housing
18. Speedometer gear
19. Washer
20. Bushing
21. Axle
22. Cotter pin
23. Bearing
24. Axle shaft collar
25. Oil seal
26. Hub dust cover
27. Plain washer
28. Shaft nut

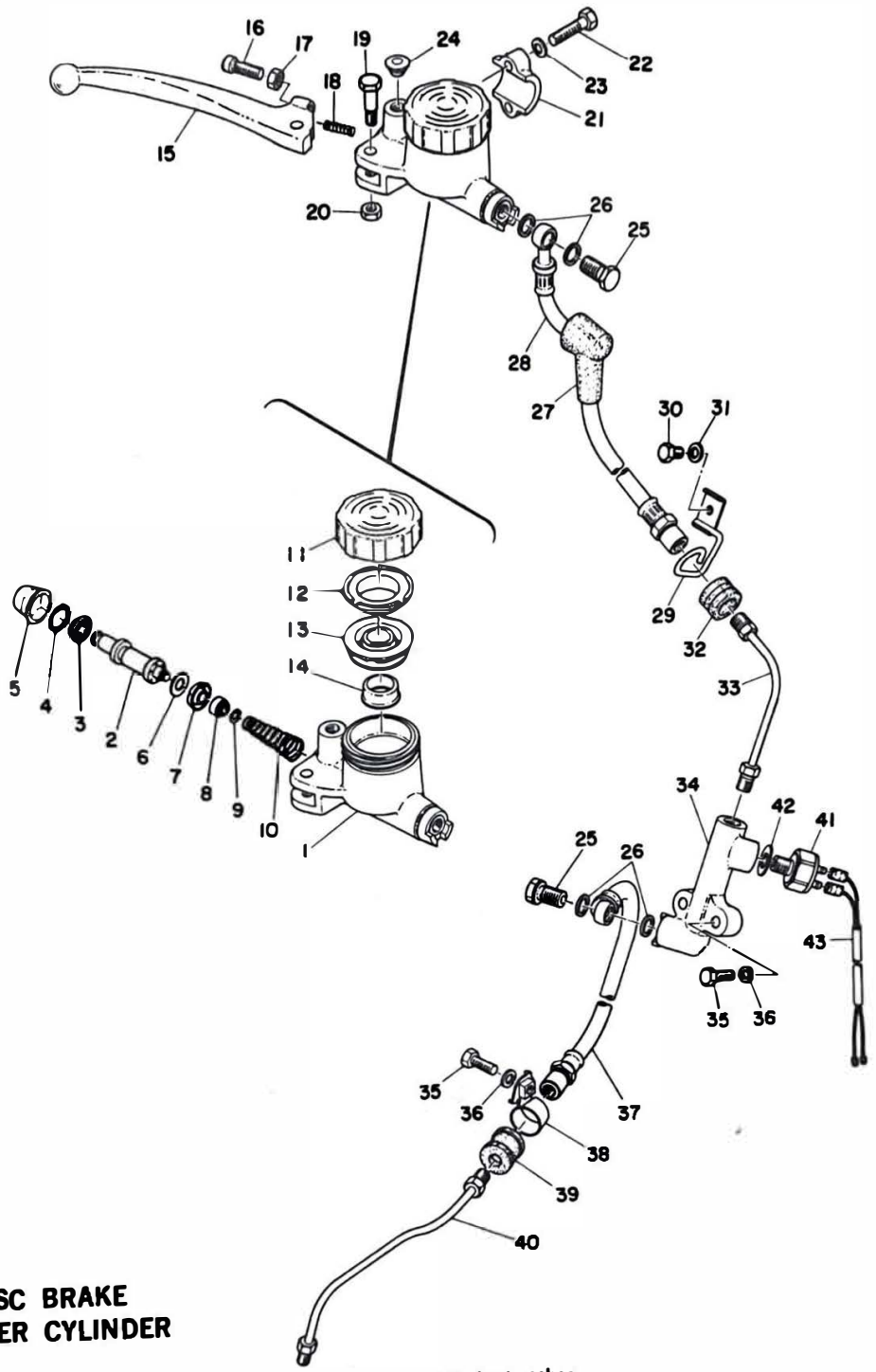
7



BRAKE DISC AND CALIPER

1. Brake disc
2. Disc bracket
3. Fitting bolt
4. Nut
5. Lockwasher
6. Fitting bolt
7. Lockwasher
8. Caliper
9. Shim
10. Caliper pad
11. Shim
12. Caliper emblem
13. Bleed screw
14. Cap
15. Fitting bolt
16. Spring washer
17. Plain washer
18. Cap nut

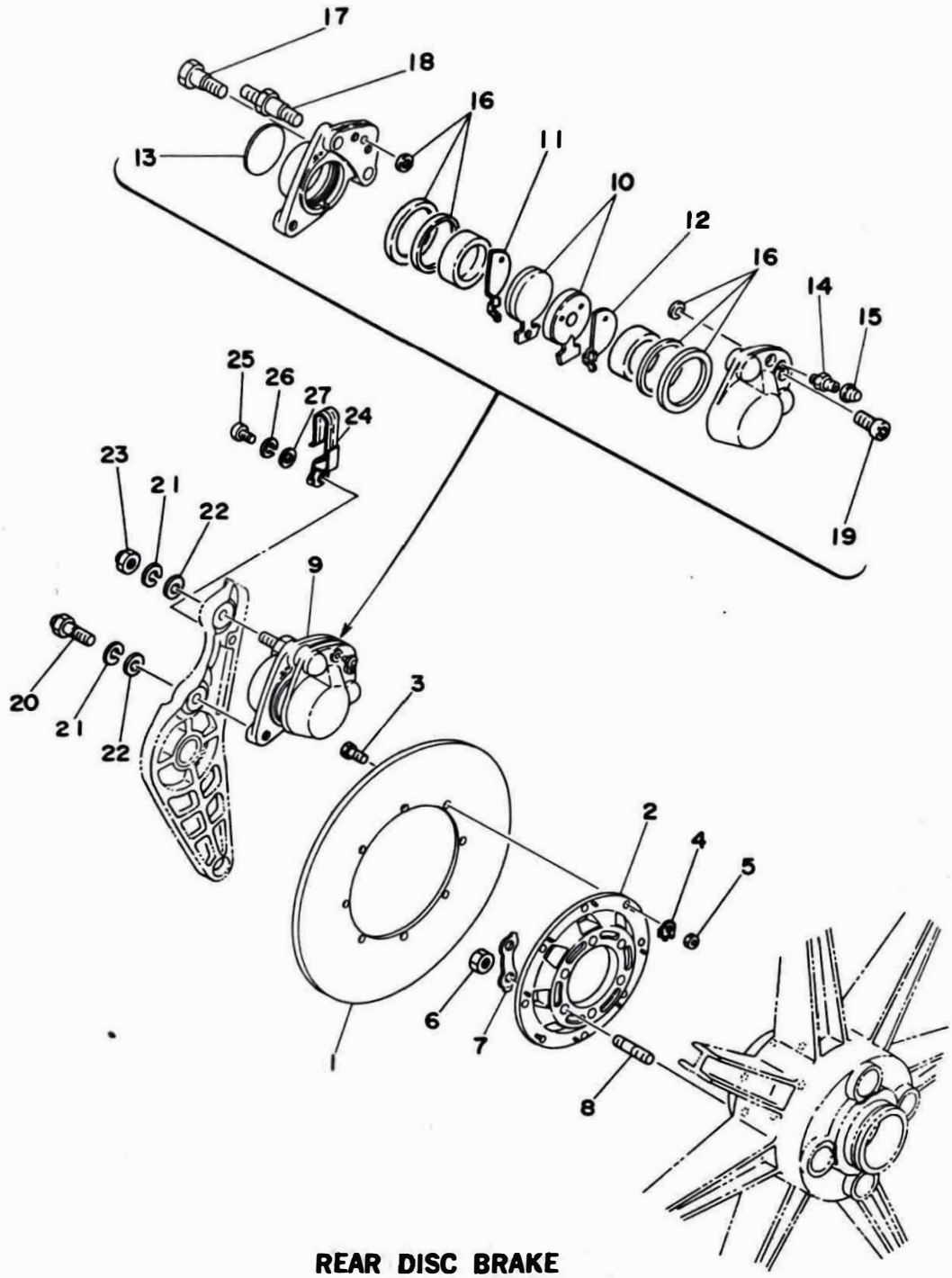
16



DISC BRAKE MASTER CYLINDER

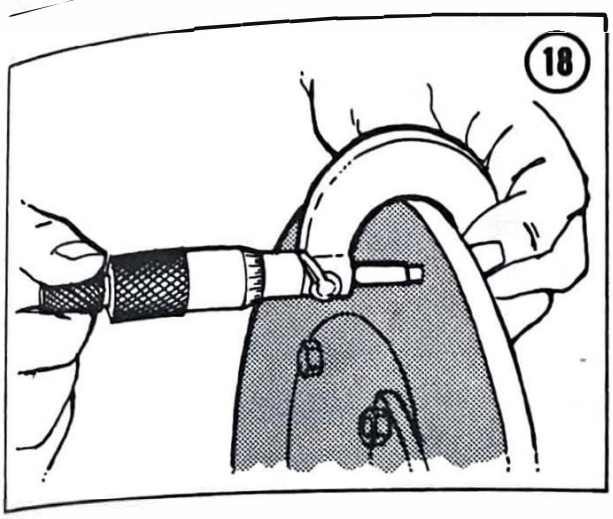
1. Master cylinder
2. Piston
3. Cup
4. Snap ring
5. Cover
6. Piston cup spacer
7. Cup
8. Spring retainer
9. Snap ring
10. Spring
11. Reservoir cap
12. Diaphragm bushing
13. Reservoir diaphragm
14. Reservoir float
15. Brake lever
16. Adjusting screw
17. Adjusting nut
18. Lever return spring
19. Lever attaching screw
20. Nut
21. Bracket
22. Bolt
23. Lockwasher
24. Blind plug
25. Oil plug
26. Oil plug washer
27. Master cylinder connection
28. Brake hose
29. Brake hose clip
30. Bolt
31. Lockwasher
32. Brake hose connector
33. Brake line
34. Fitting
35. Bolt
36. Lockwasher
37. Brake hose
38. Brake hose clip
39. Brake hose connection
40. Brake line
41. Front stop switch
42. Washer
43. Front stop switch wires

7

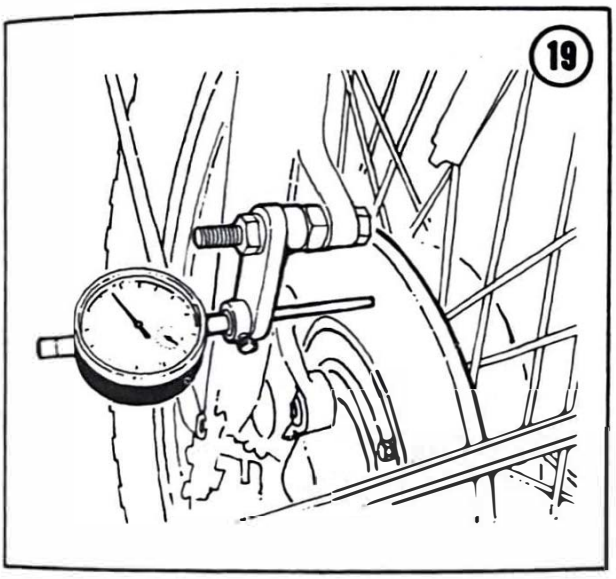


REAR DISC BRAKE

1. Brake disc
2. Bracket
3. Bolt
4. Lockwasher
5. Nut
6. Nut
7. Lockwasher
8. Stud
9. Caliper assembly
10. Caliper pad
11. Caliper shim
12. Caliper shim
13. Emblem
14. Bleed screw
15. Cap
16. Caliper seal kit
17. Bolt
18. Bolt
19. Bolt
20. Bolt
21. Spring washer
22. Plate washer
23. Cap nut
24. Brake hose holder
25. Screw
26. Spring washer
27. Plain washer



ured in **Figure 19**, check the bearings for wear or the disc for warpage. Replace parts as needed to reduce runout to an acceptable amount.



Caliper Removal

1. Trace the brake line from the master cylinder to its connection point on the caliper unit and disconnect it.
2. Pull the handlebar-mounted brake lever until it touches the grip, then cinch the lever in position to prevent master cylinder fluid loss.
3. Tie rags and plastic around the disconnected brake line to keep out dirt and to protect the end from damage.
4. Remove the bottom caliper securing bolt, unscrew the top securing nut, and pivot the housing upward to clear the disc. Remove the housing from its mount.

Caliper Disassembly

1. Remove both pads. Carefully slide a thin tool into the notch in the side of the housing and wedge out each pad.

> NOTE: *Measure each pad for wear. If worn to within 0.02 in. (0.5mm) thickness, replace it.*

2. Separate the caliper housing into halves. Remove both remaining bridge bolts. Remove both small hex head bolts that are located on each side of the bleed screw.
3. Remove the small seal that lays on the inner housing surface in a small cavity around the fluid delivery hole.
4. Behind each pad is a piston that fluid pushes against, which in turn pushes the pad into contact with the brake disc. Blow air into the fluid delivery hole to force out this piston.

> CAUTION
> *Do not try to pry the piston out as this could easily damage the housing or piston.*

5. Lift out the flat dust seal located just inside the pad/piston cavity.
6. Remove the piston seal. This rubber seal, which has a square cross-sectional shape, fits into a groove in the pad/piston cavity. When in operation, this seal prevents fluid from leaking past the piston. Replace this seal if it is cut, gouged, or damaged in any way.

Caliper Assembly

1. To assemble this unit, first wash off all parts and parts cavities with brake fluid. Do not use a different grade of brake fluid and do not use solvent or gasoline. These liquids will not mix with the brake fluid in the system.
2. Reverse the order of disassembly to assemble all parts. During this procedure, be sure to perform the following special steps:
   a. Wet the piston seal with brake fluid so the piston will slide past without catching.
   b. Re-examine each part for wear before installing it.

c. Two small hex head bolts help hold the caliper housing halves together. Tighten these to 4-6 ft.-lb. (0.55-0.82 mkg).

d. Replace all 3 bridge bolts that help hold the caliper halves together and mount the unit to the front fork. Tighten the bridge bolts to 55-70 ft.-lb. (7.5-9.5 mkg).

Caliper Installation

1. Mount the caliper housing to the front fork and tighten both bolts to 29-36 ft.-lb. (4.0-5.0 mkg).
2. Reverse Steps 1-3, *Caliper Removal* section.
3. Bleed hydraulic system. Refer to *Hydraulic System Bleeding*, this chapter.

MASTER CYLINDER

Removal

1. Remove the lever pivot bolt, then set the lever to one side (front brake).
2. Disconnect the brake line at its master cylinder junction point.
3. The master cylinder is anchored with 2 bolts. Unscrew and remove the cylinder.

Disassembly/Assembly

1. Remove the reservoir cap, reservoir diaphragm, and empty out all brake fluid.
2. Remove the dust boot.
3. Use snap ring pliers to remove the piston retaining circlip.
4. Examine the master cylinder bore (cavity) that the piston slips into. If it is rusted or scored to the extent that it would gouge the cup, replace the master cylinder.
5. Check for swollen or cracked rubber cups (on piston) or reservoir diaphragm.

NOTE: *Replace all rubber parts every 2 years, even if they are not apparently damaged.*

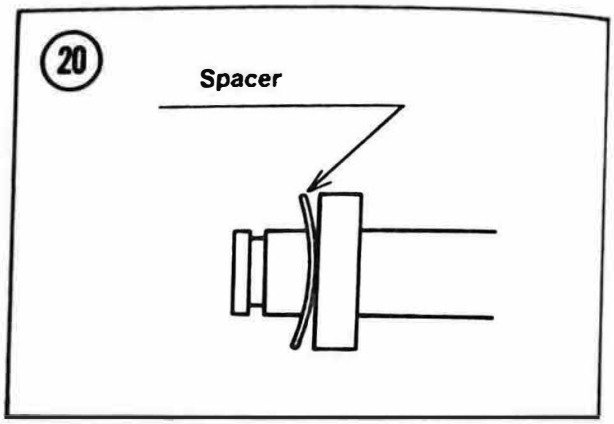
6. Examine the piston for signs of rust or scoring which would prevent the cups from sealing. Replace the piston if this wear is found.
7. Examine the brake hose for leaks or cracks.

NOTE: *The brake hose should be replaced every 4 years, even if not apparently damaged.*

8. To assemble this unit, reverse disassembly procedure, taking note of the following special instructions.

a. When installing new cups onto the piston, wet both parts with brake fluid to avoid scratching the cup.

b. The spacer which is installed behind the cup must be installed as it is shown in **Figure 20**.



c. When installing the piston assembly, wet the cups and master cylinder bore to prevent damage to cup sealing edges.

d. After completing the assembly, add approximately 30cc of grade DOT 3 brake fluid to the master cylinder reservoir.

Installation

1. To install, reverse *Removal* steps.
2. Bleed the hydraulic brake system. Refer to *Hydraulic System Bleeding* section, this chapter.

Hydraulic System Bleeding

The brake hydraulic system will require bleeding if the system has been disassembled or if air is trapped inside the hydraulic fluid line. Air will displace an area normally occupied with brake fluid. When the lever is actuated, it will feel spongy until all this trapped air is compressed.

1. Fill the master cylinder reservoir fully to the "fill line" with DOT 3 brake fluid.

CAUTION

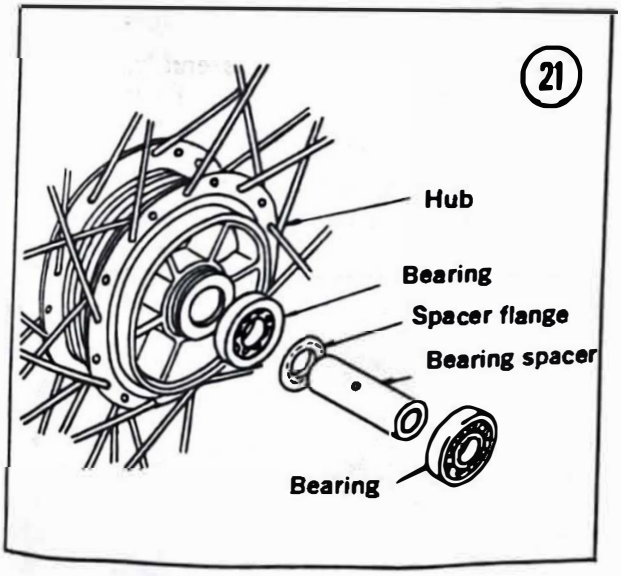
Do not mix brands or use cheap grades, and never reuse old brake fluid. Brake failure could result.

2. Install the reservoir diaphragm, but not necessarily the cap.
3. Attach a clear flexible tube to the bleed screw and place the remaining tube end into a container.
4. Slowly squeeze the brake lever until pressure is felt. Continue pushing on the lever and open the bleed screw until fluid and air start to drain down the clear tubing. Tighten the bleed screw before the lever touches the grip. Release the brake lever, then again squeeze the lever until pressure is felt, and open the bleed screw. Repeat this procedure until air bubbles no longer appear in the brake fluid. Fully tighten the bleed screw when finished.
5. Check and refill master cylinder reservoir.

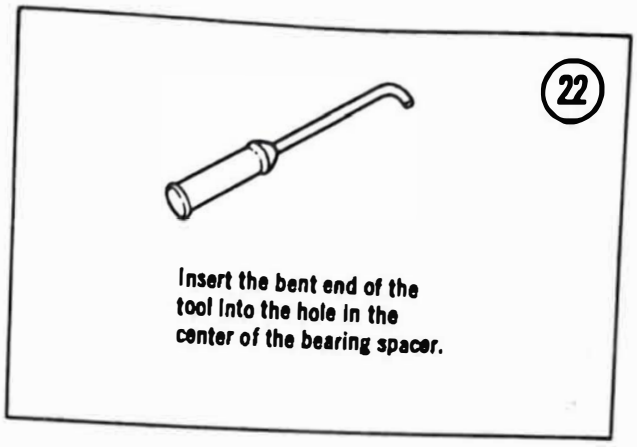
WHEEL BEARINGS

Removal/Installation (Front)

1. Clean the dirt from the outside of the front wheel hub. See **Figure 21**.



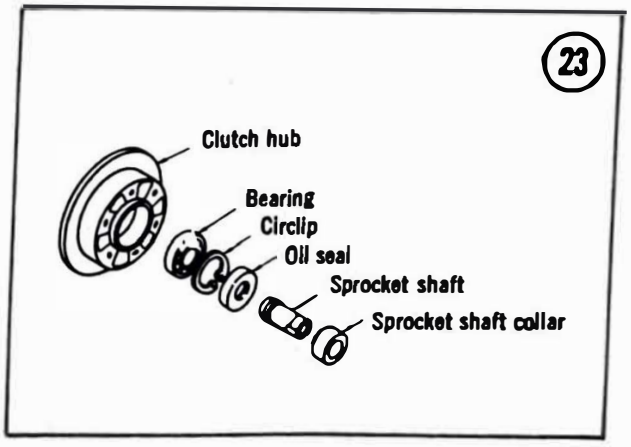
2. If possible, make a tool like that shown in **Figure 22**. Otherwise use a long thin punch. Place the end of the tool into the hole in the center of the bearing spacer. Tap the tool with a hammer to drive the bearing out.



3. Remove the other bearing in a similar manner.
4. To install wheel bearings, reverse the procedure using a taper punch. Grease the wheel bearings before you install them. Use the bearing fitting tool for installation.

Removal/Installation (Rear)

Figure 23 is an exploded view of a typical shock hub. To replace bearings, proceed as follows:



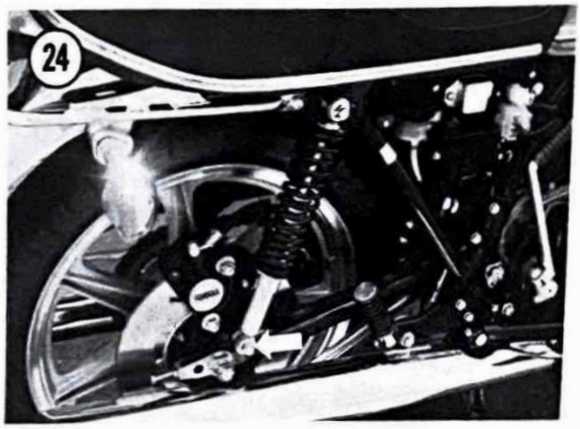
1. Remove rear sprocket as described in the next section.
2. Push out the sprocket shaft.
3. Pull out the sprocket shaft collar.
4. Remove the oil seal. Be careful not to damage it.
5. Remove the snap ring.
6. Press out the bearing.
7. Reverse the procedure to replace the bearing. Be sure to grease the bearing and the oil seal before installation.

REAR SPROCKET

Removal/Installation

The rear sprocket assembly is similar for all models. To remove this unit, proceed as follows.

1. Disconnect the master link, then remove the chain.
2. Remove the sprocket shaft nut (**Figure 24**) and the sprocket.

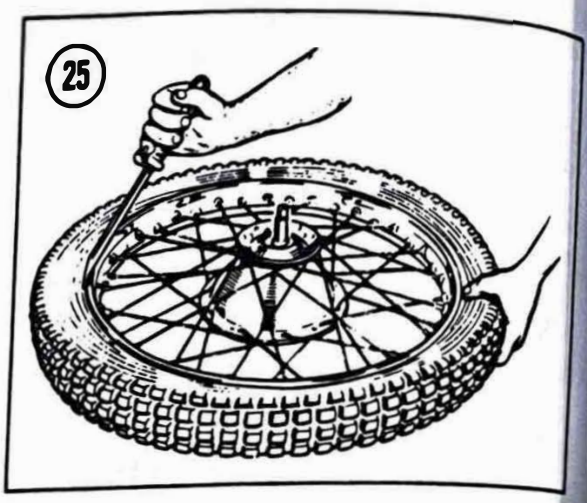


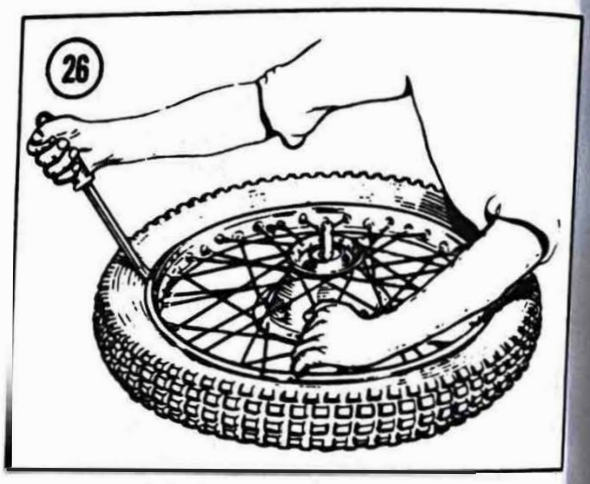
3. Flatten the tabs on the lock plates, then remove the bolts which attach the sprocket to the shock hub.
4. Check the rear sprocket carefully. If the teeth are worn or bent, replace the sprocket. When you replace the sprocket, be sure that the bolts which attach the shock hub are tight, and that the tabs on the lock plates are bent around the bolt heads.

TIRES AND TUBES

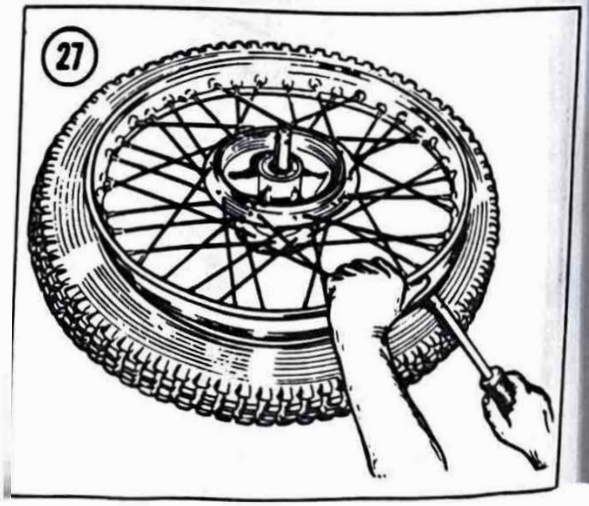
Removal

1. Remove the valve core to deflate the tire.
2. Press the entire bead on both sides of the tire into the center of the rim.
3. Lubricate the beads with soapy water.
4. Insert the tire iron under the bead next to the valve. 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 (**Figure 25**).
5. Insert a second tire iron next to the first to hold the bead over the rim. Then work around the tire with the first tire iron, prying the bead over the rim (**Figure 26**). Be careful not to pinch the inner tube with the tire irons.





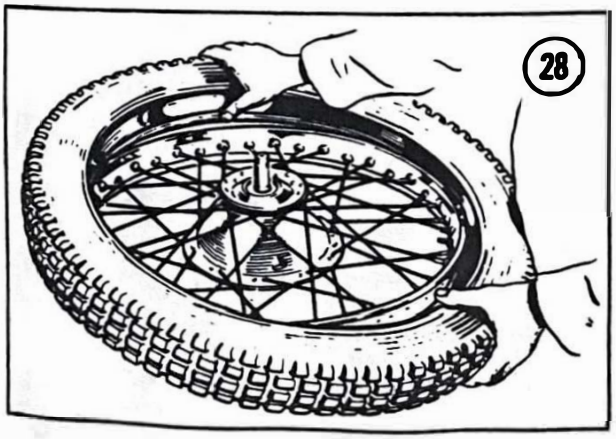
6. Remove the valve from the hole in the rim and remove the tube from the tire. Lift out and lay aside.
7. Stand the tire upright. Insert a tire iron between the second bead and the side of the rim that the first bead was pried over (**Figure 27**).



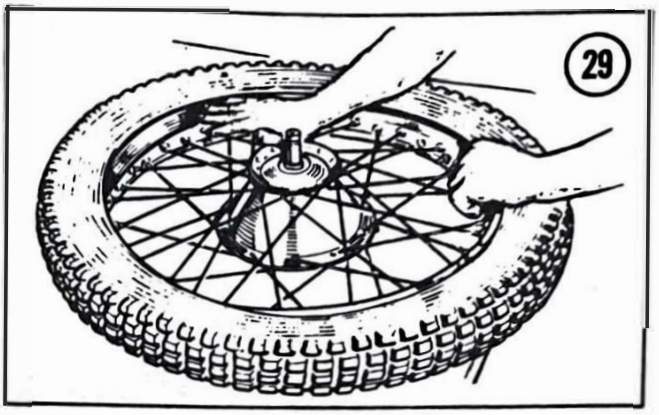
Force the bead on the opposite side from the tire iron into the center of the rim. Pry the second bead off the rim, working around as with the first.

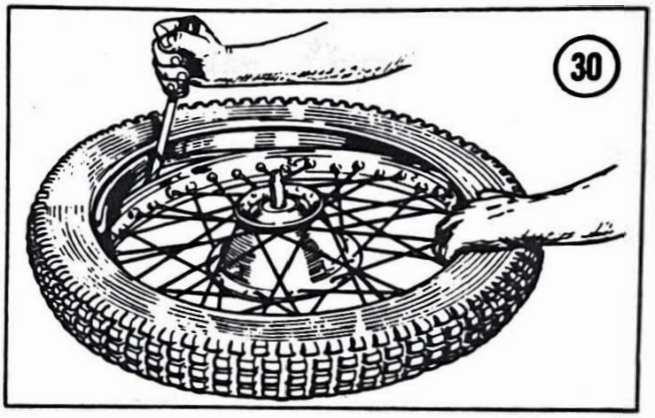
Installation

1. Carefully check 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 white spot near the bead indicates a lighter point on the tire. This should be placed next to the valve or midway between the 2 rim locks if they are installed.
3. Check that the spoke ends do not protrude through the nipples into the center of the rim to puncture the tube. File off any protruding spoke ends.
4. Be sure the rim rubber tape is in place with the rough side toward the rim.
5. Put the core in the tube valve. Put the tube in the tire and inflate just enough to round it out. Too much air will make installing the tire difficult, and too little will increase the chances of pinching the tube with the tire irons.
6. Lubricate the tire beads and rim with soapy water. Pull the tube partly out of the tire at the valve. Squeeze the beads together to hold the tube and insert the valve into the hole in the rim (**Figure 28**). The lower bead should go into the center of the rim with the upper bead outside it.

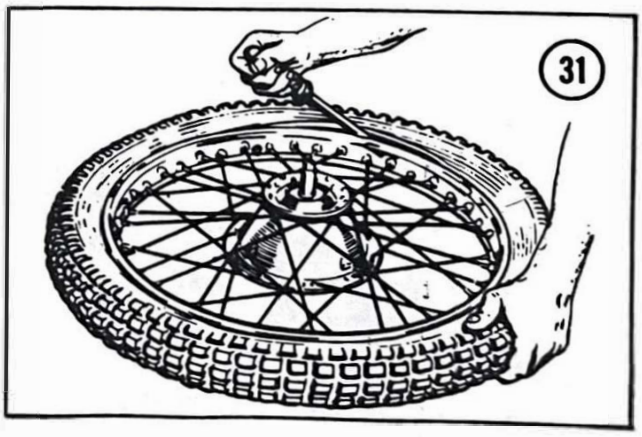


7. Press the lower bead into the rim center on each side of the valve, working around the tire in both directions. See **Figure 29**. Use a tire iron for the last few inches of bead (**Figure 30**).





8. Press the upper bead into the rim opposite the valve. Pry the bead into the rim on both sides of the initial point with a tire iron, working around the rim to the valve. See **Figure 31**.



9. Wiggle the valve to be sure the tube is not trapped under the bead. Set the valve squarely in its hole before screwing on the valve nut to hold it against the rim.
10. Check the bead on both sides of the tire for

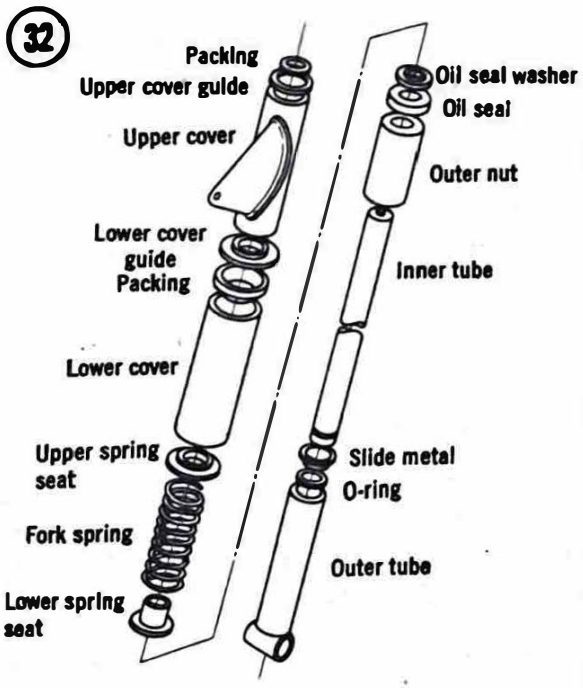
even fit around the rim. Inflate the tire slowly to seat the beads in the rim. It may be necessary to bounce the tire to complete the seating. Inflate to the required pressure. Balance the wheel as described previously.

Air Pressure

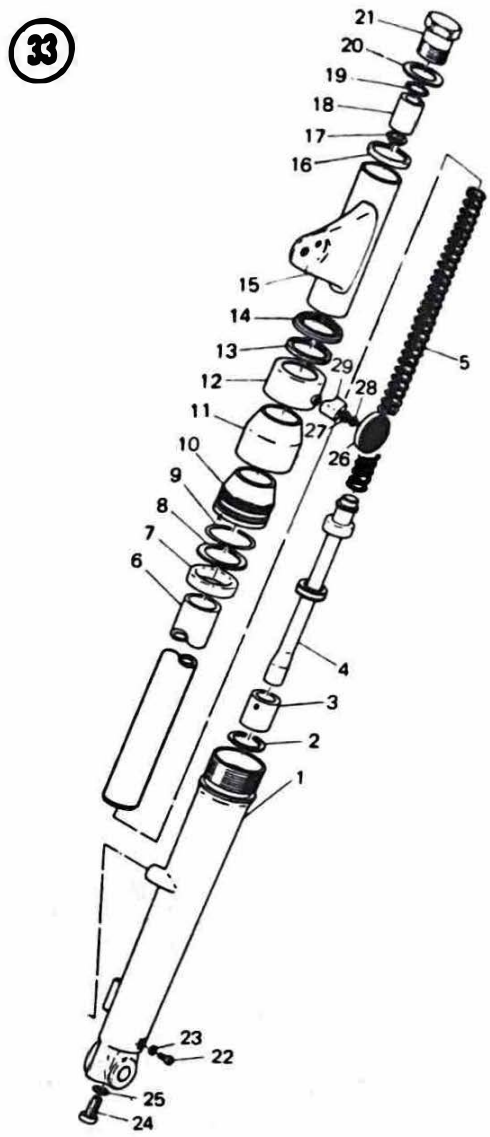
1. Inflate the front tire to 26 psi when measured cold.
2. Inflate the rear tire to 28 psi when riding solo or 30 psi when riding double.
3. Tires warm up when ridden. Sustained high speed riding requires adding 2 psi for either solo or double riding.

FRONT FORKS

All models are equipped with oil-damped telescopic front forks. **Figure 32** is an exploded view of a typical front fork tube used on most models. An exploded view of the fork tube assembly on the R5 and RD series is shown in **Figure 33**.



TYPICAL FRONT FORK (ALL MODELS EXCEPT R5 AND RD SERIES)



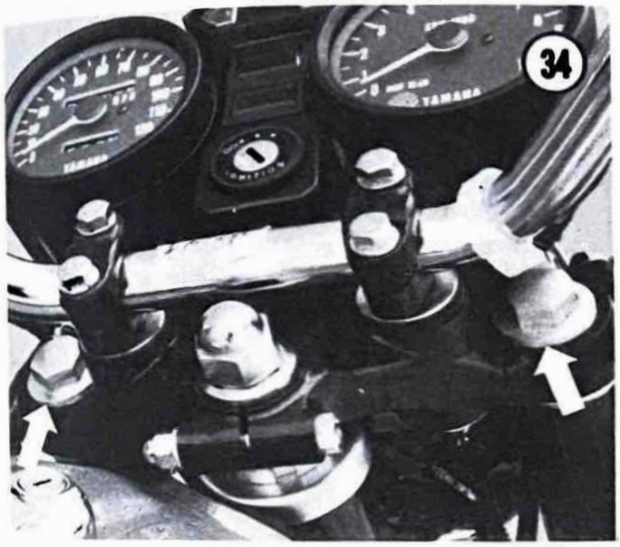
R5 AND RD SERIES FRONT FORK

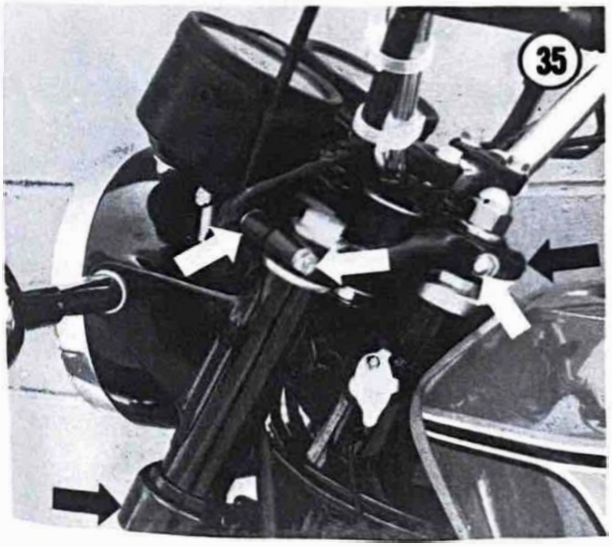
1. Outer tube
2. Circlip
3. Front fork piston
4. Cylinder
5. Fork spring
6. Inner tube
7. Oil seal
8. Oil seal washer
9. Oil seal clip
10. Dust seal
11. Dust seal cover
12. Outer cover
13. Packing
14. Lower guide cover
15. Upper cover
16. Upper cover guide
17. Upper seat spring
18. Spacer
19. Packing
20. Cap washer
21. Cap bolt
22. Drain plug
23. Drain plug gasket
24. Bolt
25. Packing
26. Reflector
27. Plain washer
28. Spring washer
29. Damper

Removal (Typical)

Front fork removal procedure is similar for all models.

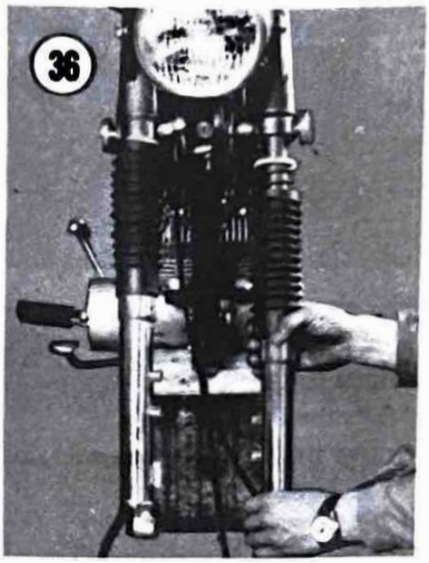
1. Remove the front wheel and front fender.
2. Remove the inner tube cap bolts (**Figure 34**). On some models it may be necessary to loosen the handlebar pinch bolts and move the handlebar assembly to gain access to the cap bolts.
3. Loosen the underbracket bolts (**Figure 35**).
4. Pull the fork tube assembly downward to remove it from the steering head (**Figure 36**).



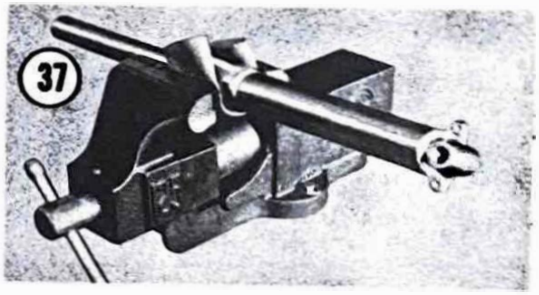


Disassembly (Typical, Except R5 and RD Series)

1. Drain the oil from the fork. Discard the used oil.



2. Wrap an inner tube from a tire or a piece of rubber sheeting around the outer tube nut and clamp the nut in a vise (**Figure 37**). Be careful that you do not deform the outer tube by clamping the vise too tightly.



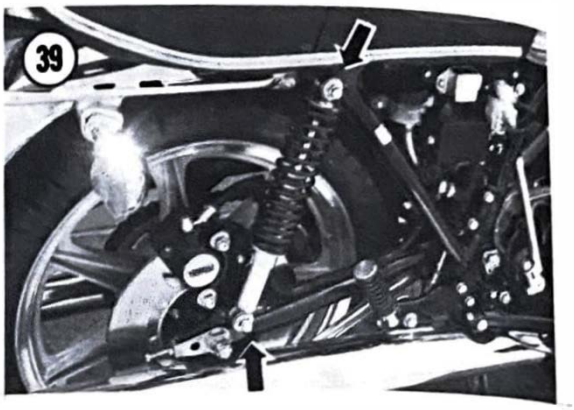
3. Turn the outer shaft counterclockwise to loosen the nut. The outer shaft may be turned easily by using the front axle shaft as a lever. The inner and outer tubes may be separated after the nut is loosened.

Disassembly (R5 and RD Series)

Fork disassembly on these models is similar to other models described previously, with one exception. It is first necessary to remove the bolt from the lower end of the fork tube. See **Figure 38**.

Inspection (Typical)

Check the inner tubes for bends and scratches. A slightly bent inner tube may be straightened in a press, but it is better to replace the tube if possible.



Assembly (Typical)

Reverse the disassembly procedure to assemble the fork tube. Be sure that the inner tube slides in and out smoothly. Always replace the oil seal upon assembly.

Installation (Typical)

1. To install the fork tube on the steering head, place the assembly in the correct position, then tighten the underbracket pinch bolts.
2. Refill each fork with the correct quantity of 10W-30 motor oil. After refilling each leg, install the cap bolts. Fork leg oil quantity is listed in **Table 1.**

Table 1 FORK OIL CAPACITY

Model	Ounces	(cc)
YDS5, YDS6, DS6-B, DS6-C	6.8	(200)
YDS3, YDS3-C, YM1, YM2, YM2-C	6.8	(200)
YR1, YR2, YR2-C, R3, R3-C	8.1	(240)
R5, R5-B, R5-C, DS7	4.9	(145)
RD250, RD250A, RD250B	4.7	(140)
RD350, RD350A, RD350B/RD400	4.7	(140)

REAR SHOCKS

Removal/Installation

Many accessories such as luggage racks and saddlebags use the upper shock mounting stud. Usually these accessories must be removed first.

1. Rest bike on centerstand and set shock to its softest setting.
2. Remove upper mounting nut and lower mounting bolt. See **Figure 39.**
3. Pull shock off.
4. Installation is the reverse of these steps.

Disassembly/Assembly

WARNING

Without the proper tool, this procedure can be dangerous. The spring can fly loose, causing injury. For a small bench fee, your dealer can do the job for you.

1. Compress shock as shown in **Figure 40** and remove spring seat stops.

2. Release compression.
3. Remove cover and spring from damper unit.
4. Check damper unit for leakage and make sure damper rod is straight.
5. Reverse procedure to assemble.

SWING ARM

Check swing arm play by shaking from side to side. If play is excessive, replace the swing arm bushings and/or shaft. To replace the shaft and bushings, proceed as follows.

1. Remove the chain cover mounting bolts.
2. Remove the swing arm shaft nut, then withdraw the shaft to remove the arms.
3. Insert new bushings as shown in **Figure 41**.

On machines used primary for street riding, bushings should normally be replaced every 6,000 miles (10,000 km). Machines subjected to severe service will require more frequent replacement. Need for replacement may be indicated by wander, shimmy, or rear wheel hop.

STEERING HEAD

Figure 42 is an exploded view of a typical steering head. Occasionally check ball races and balls for pitting, cracks, or wear. If any of these conditions exist, replace all the balls and races. Always replace the whole ball and race assembly when replacement is required. Do not use a combination of new and used parts.

Bearing and Race Replacement

Remove the front wheel assembly and both front forks as described in the previous section. Do not disassemble; just loosen all underbracket pinch bolts, remove each cap bolt (on top), then pull the fork legs out.

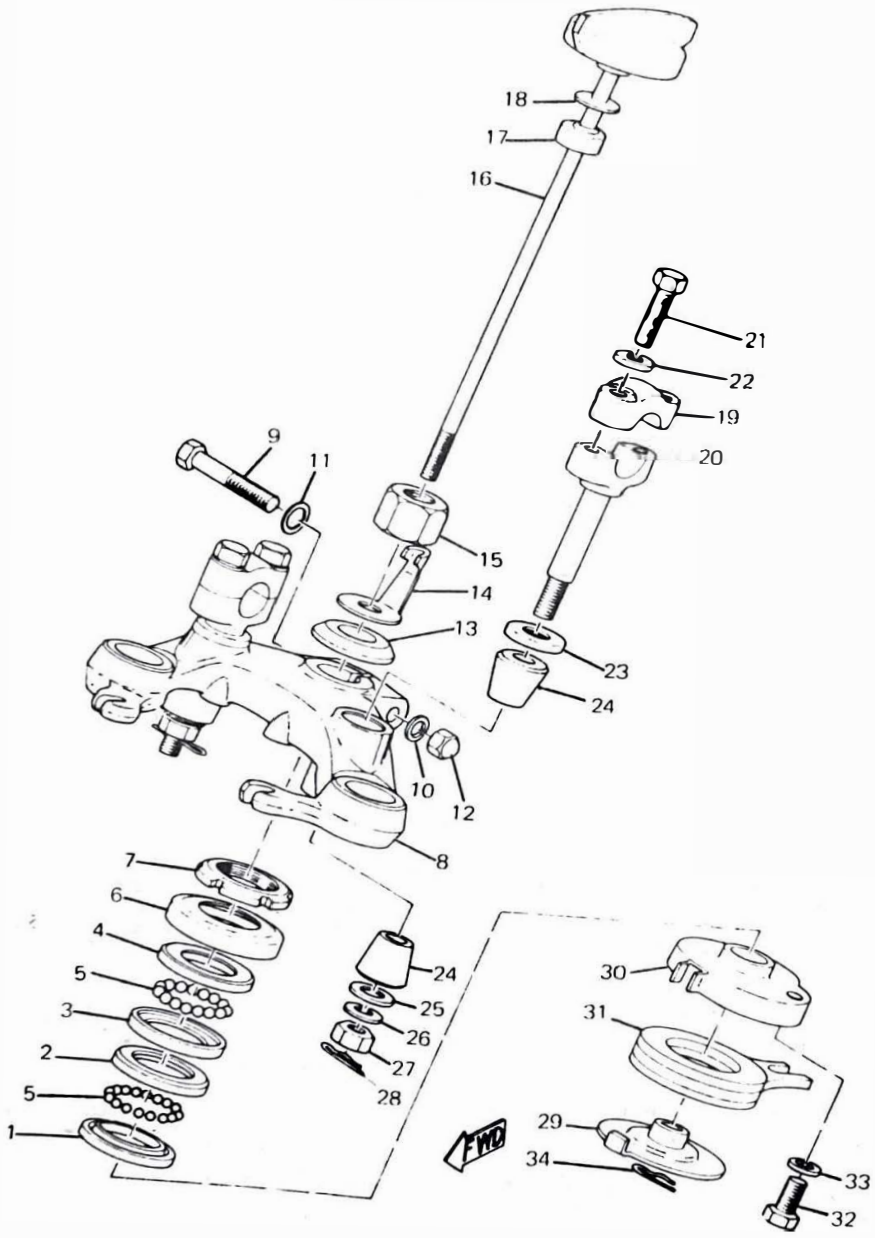
1. Remove the steering head damper if so equipped.
2. In the center of the top bracket is a nut that must be loosened and removed. The top bracket can now be lifted off.

NOTE: *Before removing bearing assemblies, it is advisable to first determine the quantity of ball bearings in the upper and lower bearing assemblies, as the number of balls vary with different models. This information can usually be obtained from an authorized dealer's service department.*

3. Loosen the ring nut by tapping with a hammer and punch in a counterclockwise direction. As this ring is loosened, the bottom bracket (underbracket) will start to drop down. Hold this bracket up to prevent the upper and lower steering head bearings from falling out.
4. Remove the ring nut, then lift off the top race and carefully remove all balls. A magnet is helpful. Lower the underbracket until you can remove the bottom balls. Keep a rag or container under the bracket to catch any balls that fall.
5. To remove the ball races inside the steering head, tap each one out from the opposite end with a hammer and punch. To remove the bottommost race, carefully wedge it up and off the underbracket stem.

NOTE: *When installing new inner races, carefully tap them down until fully seated.*

6. Grease the bottom bearing race and push all the balls firmly into the grease so they will not fall. Slide the bottom bracket (underbracket) up and hold in place while you grease the top bearing race and place all top bearings into place, then install and tighten the ring nut just until all underbracket free play is removed.
7. Install the top bracket and nut. Install both fork leg units. For final adjustment, use a hammer and punch to tighten the ring nut until the underbracket is not loose, but the forks can still swing from lock to lock without binding.



STEERING HEAD (TYPICAL)

1. Ball race
2. Ball race
3. Ball race
4. Ball race
5. Ball
6. Ball race cover
7. Ring nut
8. Steering head
9. Bolt
10. Spring washer
11. Pedal link washer
12. Cap nut
13. Race
14. Damper spring
15. Nut
16. Damper shaft
17. Washer
18. Special washer
19. Upper handlebar clamp
20. Lower handlebar clamp
21. Bolt
22. Spring washer
23. Special washer
24. Rubber bushing
25. Special washer
26. Spring washer
27. Nut
28. Tension bar clip
29. Damper plate
30. Damper plate
31. Damper plate
32. Bolt
33. Spring washer
34. Clip

CHAPTER EIGHT

PERFORMANCE IMPROVEMENT

The Yamaha twins are designed primarily as low-cost commuting bikes with enough comfort for occasional touring junkets. As performance bikes, they are quite swift despite their modest displacement.

The 2-stroke design that makes this bike desirable also allows room for performance modification without stressing the bike beyond its design limits. It is possible to create an exciting, inexpensive machine without sacrificing reliability or tractability.

The modifications described in this chapter are not intended for the professional road racer. He would be better off to purchase the latest "trick" racer and start with that as a basis. The material in the following sections is intended for the rider who wants better performance without spending a fortune.

The best approach begins with chassis modification; it is best to improve the handling and braking so that power which is already available can be used more effectively.

Faster does not necessarily mean quicker. Excessive horsepower which will cause the motorcycle to accelerate rapidly will do little in helping the same motorcycle on rough roads or sharp curves if the suspension is inadequate. Conversely, chassis improvements can help the motorcycle negotiate a road course quicker without any power increase. In addition, chassis modifications usually cost less than engine work.

Before modifying the engine, decide if you want more low end torque or more peak horsepower (it is often impossible to obtain both). Increased torque will be more desirable for commuting, while increased horsepower will be needed for competition. Beyond initial stages of modification the engine may become too inflexible and will idle poorly or bog at low speeds. It is rarely practical to go "all out" on performance modifications in one large step. Perform one or two simple changes, evaluate them fully, then go on to a few more changes.

One of the first procedures you should consider may add up to a 10% horsepower improvement on a stock engine, improve gas mileage, make the engine run smoother and quieter, and will cost less than $5! It is a simple tune-up. The steps involved in a thorough tune-up are described in Chapter Two under *Tune-up*. Once the engine is running properly in stock form, it will be easier to evaluate other changes to improve power. The items discussed in this chapter will produce a satisfying, strong street machine, not an all-out, unreliable racer.

The term "bolt-on" can be misleading. It can mean something you can add in 10 minutes with ordinary hand tools. In this manual, it is any

component which can be added by anyone who can do similar work on a stock engine. Very little, if any, machine work is necessary. Bolt-on equipment designs and materials change frequently. We cannot control how the equipment will be installed, or how the bike will be used. Good judgment and common sense will help you avoid disappointment.

CAUTION

Clymer Publications cannot guarantee or be responsible for performance, damage to the motorcycle, or personal injury resulting from the performance modification procedures given in this manual. In addition, any modification you make may void all warranties regardless of the motorcycle's age or mileage.

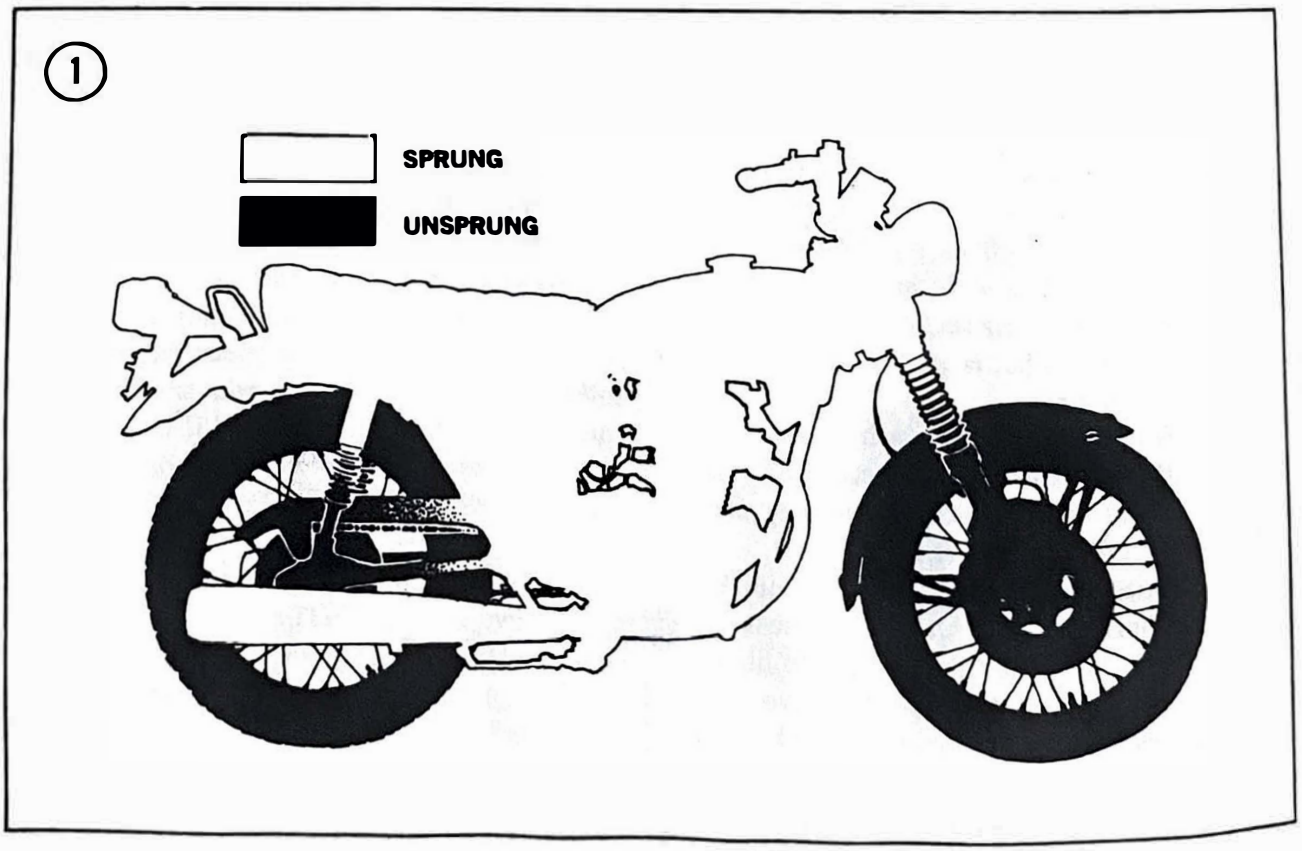
Finally, be wary of performance improvement claims by aftermarket equipment manufacturers. For the most part, they are honest and sincere and their products are generally what they claim to be. But be sure to assess what they are offering in terms of your own needs, ability, and budget.

WEIGHT REDUCTION

The weight of a motorcycle is divided between sprung weight and unsprung weight. Sprung weight is the weight of most of the motorcycle and excludes the wheels and the lower working half of the suspension, which is the unsprung weight (**Figure 1**).

While total weight reduction will improve total performance, reduction of unsprung weight produces the greatest improvement in handling performance. A light wheel (low unsprung weight) reacts more quickly to bumps than a heavy wheel (high unsprung weight) and transmits less shock to the rest of the motorcycle. Therefore, it has less effect in altering the primary (forward) direction of the machine and contributes less to rider fatigue.

Every component of the motorcycle should be considered when trying to lower overall weight. Unfortunately, some of these lightweight items can be very expensive. Most of the major items covered in this chapter are inexpensive, however, and can be readily bought new or used. Wherever possible, use stock parts from another motorcycle to keep the cost down.



Rather than itemize every possible component in this section, methods for weight reduction have been included with other modification procedures. Small items are listed in each section to prevent a duplication of effort on your part when working on the motorcycle.

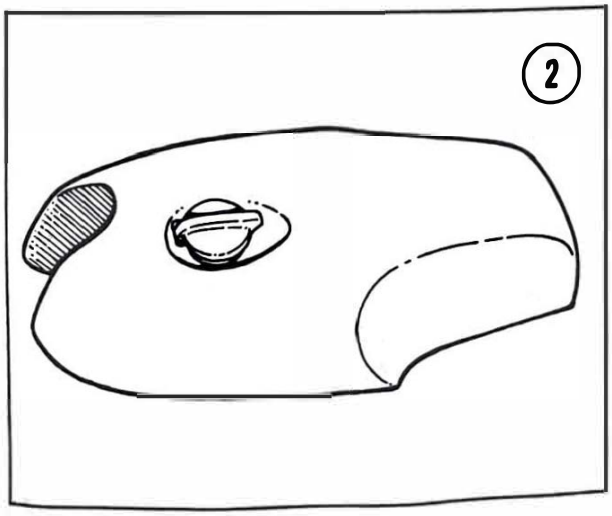
Handlebars and Controls

With the exception of unsprung weight, the reduction of excess weight at the top of the motorcycle should be a top priority, because it has to be thrown around by the rider. In addition, a motorcycle which is light on top will be more responsive in the turns. Dunstall and several other companies have good quality steel clip-ons to fit the fork tubes. Be sure to specify tube diameter when ordering.

Use Magura or K & N polycarbonate control levers and a "quick turn" twist grip for the throttle.

Gas Tank

There are basically 2 types of construction—aluminum and fiberglass. The choice of tanks should in part be determined by how the fuel is carried, since the center of gravity will be lowered. The difference will be noticed when cornering because a low-slung tank does not have that top-heavy feeling. See **Figure 2**.

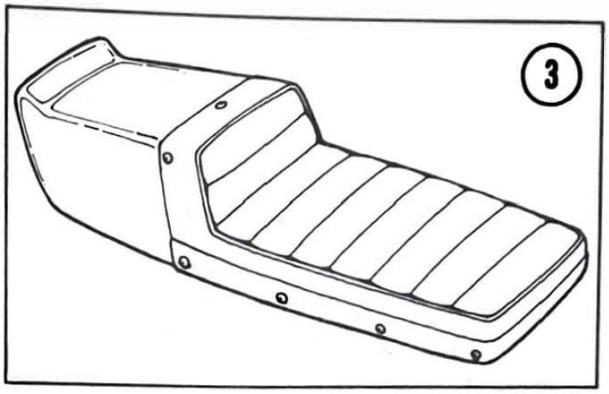


WARNING

Fiberglass tanks for street use can pose a potential hazard in an accident. The tank could rupture, covering you in gasoline.

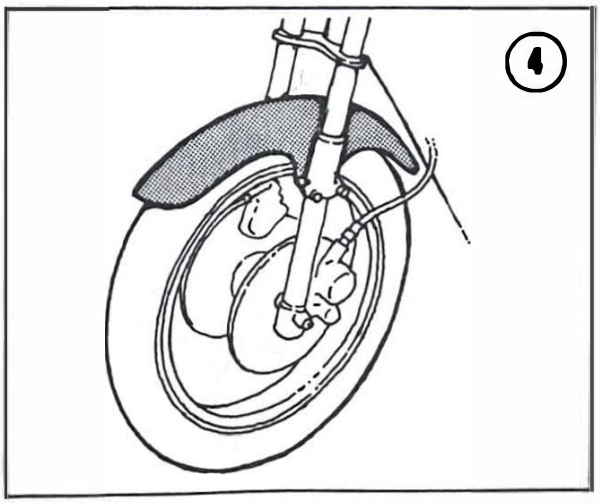
Seat

Many after-market companies produce excellent seats in a wide array of designs. Be sure to get one which allows for plenty of movement. Ease of movement will lessen fatigue and allow surer control of the bike. See **Figure 3**.



Fenders

Replace the front fender with one made of plastic. A plastic fender is strong, light, and resistant to bumps or damage. See **Figure 4**.



The rear fender on most models is heavy. Replace it with a plastic or fiberglass fender, but make sure the replacement is strong enough to support a taillight and license plate.

LIGHTING

Equipping the bike with a fairing permits the elimination of the heavy steel headlight bucket on most models. Either way, the standard headlight can be replaced with a brighter quartz-iodine unit. Marchal makes an excellent unit

called the Amplilux, which bolts in place without modification. This type of driving light is unsurpassed for safety because it illuminates the road much better than stock, and permits greater top speeds at night without overdriving the visibility range.

WARNING

Make sure that the light is correctly adjusted or it will blind oncoming drivers, creating an unsafe condition for both of you. This type of light may be illegal in some states because of the high-intensity. If so, you can still improve visibility with a GE Plus-25 replacement light. This unit is made for cars but there are sizes which will readily adapt.

WHEELS, BRAKES AND HUBS

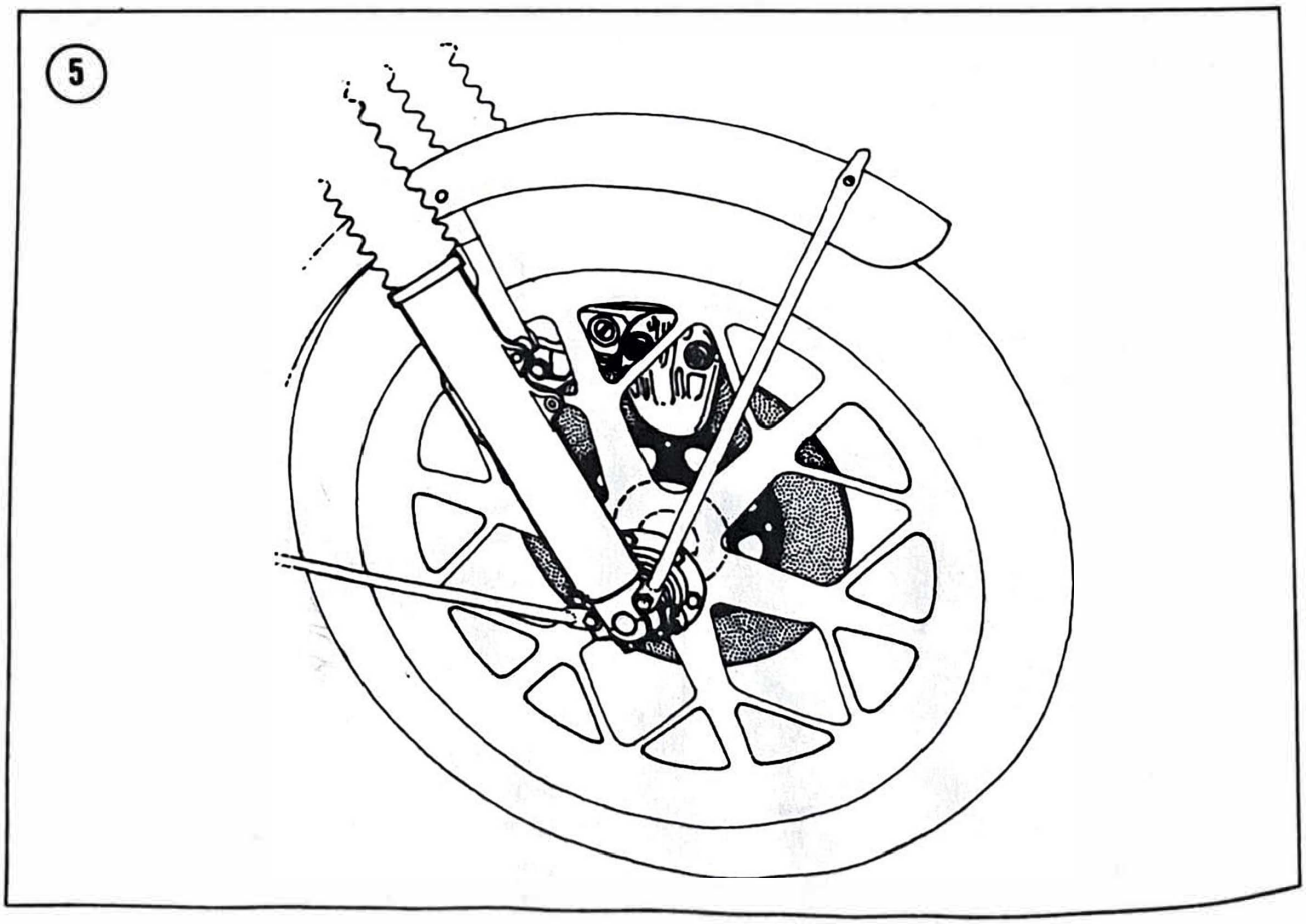
Efficient braking is the most critical aspect of a motorcycle, regardless of its intended purpose or use. It matters little how fast it will go if it cannot be stopped in a reasonable distance. As speed increases, so should braking efficiency.

Improved braking using the stock drum units is possible with the simple substitution of a metallic lining such as the Lakewood-type, available through most dealers. Machine both front and rear brake drums to provide 100% contact during braking.

WARNING

It is important that the brakes be inspected and cleaned frequently. Otherwise, brake failure could result. Service procedures described in the brake chapter are given for cleaning and inspection.

Handling can be improved by modifying the wheels and hubs to reduce unsprung weight. Standard drum brake models can benefit considerably by swapping the entire front and rear ends from a later disc brake model. The forks, swing arm, disc brakes and spindle hub (or cast wheels) will bolt on with little modification. See **Figure 5**. These components are available from a motorcycle dealer (and possibly from a motorcycle wrecking yard, at considerable savings).



Be sure to check the local papers and custom shops as well. Someone else might have switched over to custom forks and left the old parts behind. Be sure to get the brake lever pedal, hydraulic reservoir(s) and all hook-up lines. On models which are already equipped with disc brake components, unsprung weight can further reduced by using aluminum rims or cast "mag-style" wheels. If you can afford it, buy the aluminum cast wheels. See **Figure 6**.

NOTE: *The RD-400 comes stock with these wheels.*

CAUTION

These wheels are relatively brittle and can be damaged easily if not handled properly.

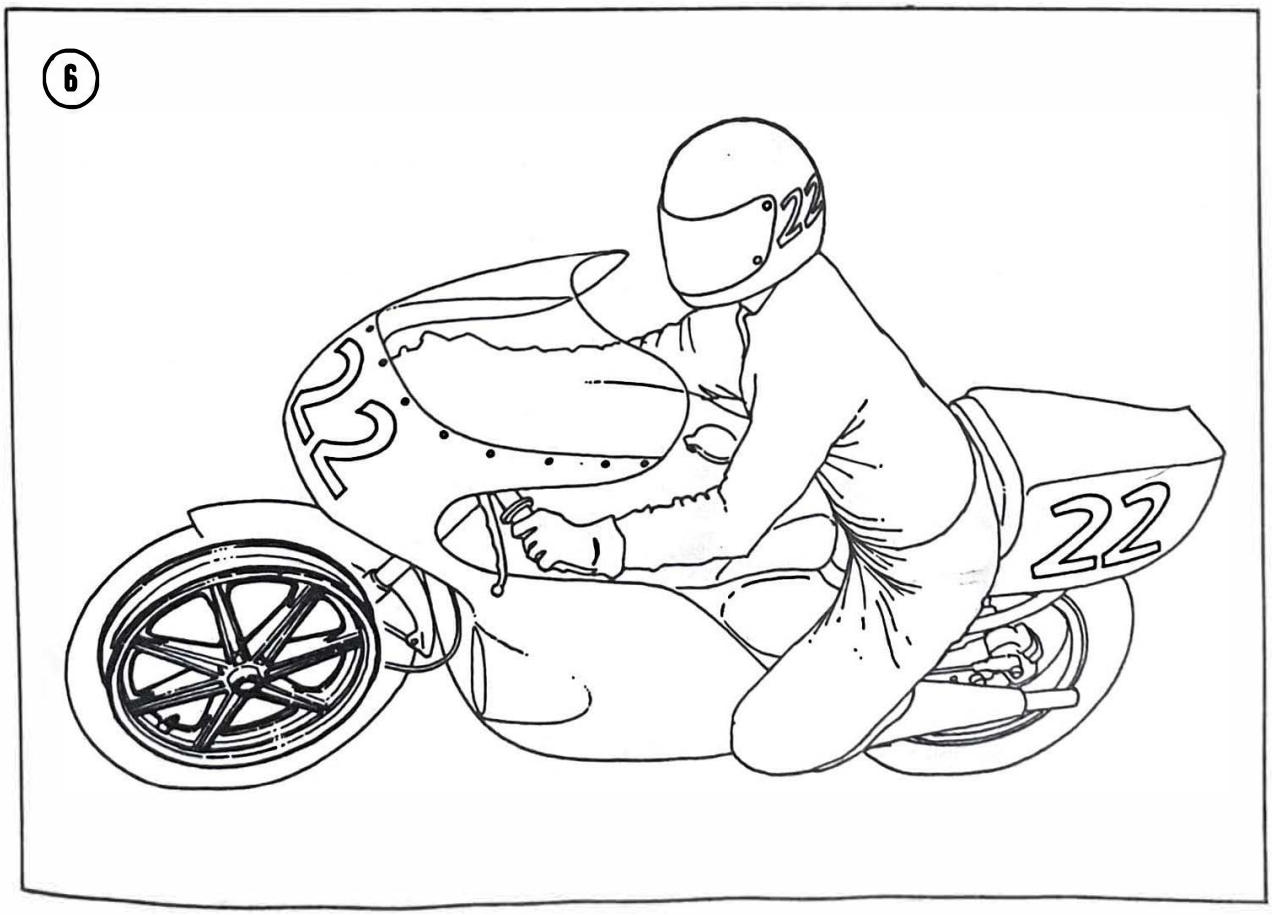
There are several aluminum rims available for use with standard steel spokes. The most common are Akront and D.I.D., both of which can be drilled for the spoke pattern suitable for Yamaha hubs.

New stainless steel spokes will also be required, so order them at the same time. Rear hubs should be laced with heavy-duty spokes, while the front hub should have standard weight spokes. The spoke holes in the rear hub must be countersunk deeper for the larger, heavy-duty spoke heads.

An additional weight savings can be made by drilling the final drive sprocket. This can amount to as much as a pound of unsprung weight saved without sacrificing the strength of the sprocket.

Figure 7 illustrates the extent to which a sprocket can be lightened. Do not use an overlay sprocket (**Figure 8**). Instead, select an aluminum sprocket with the correct number of teeth for the gearing you desire. Refer to the section titled *Gearing* in this chapter for more detailed information.

Do not use clincher-type rim locks (**Figure 9**). Instead, use sheet metal screws to prevent the tire from slipping on the rim. Use eight No. 10 screws on the rear wheel, 4 on each side, installed 90 degrees apart, see **Figure 10**. Use six



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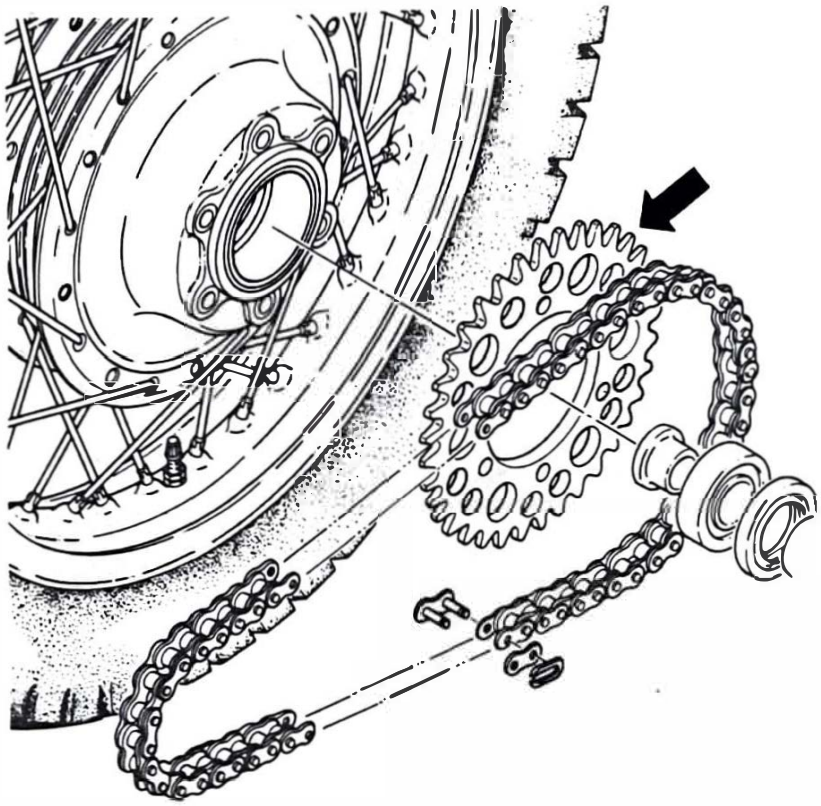

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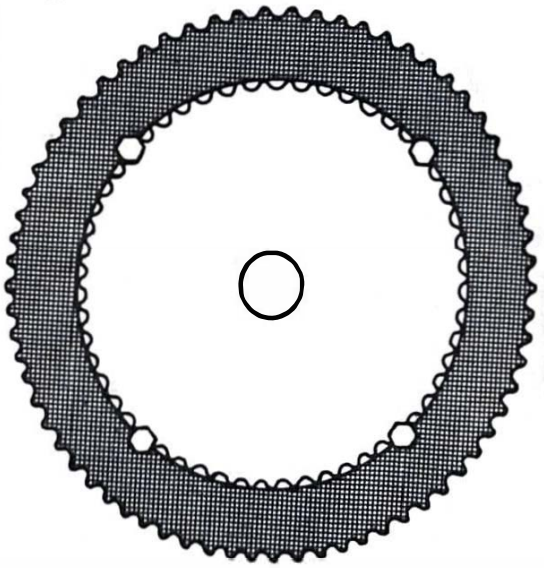

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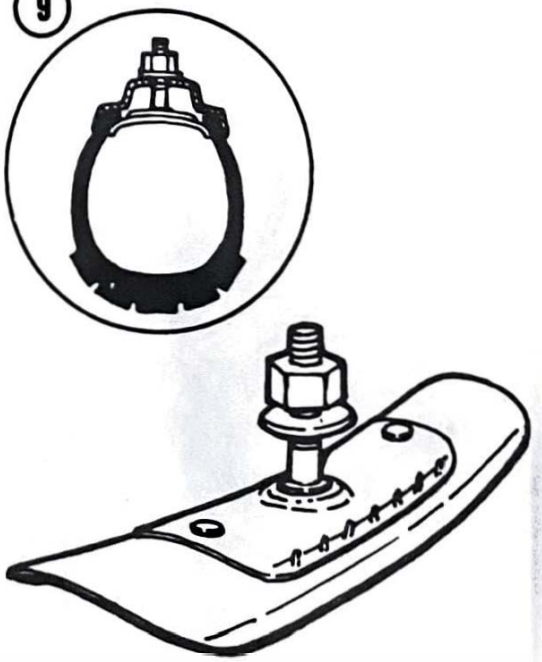
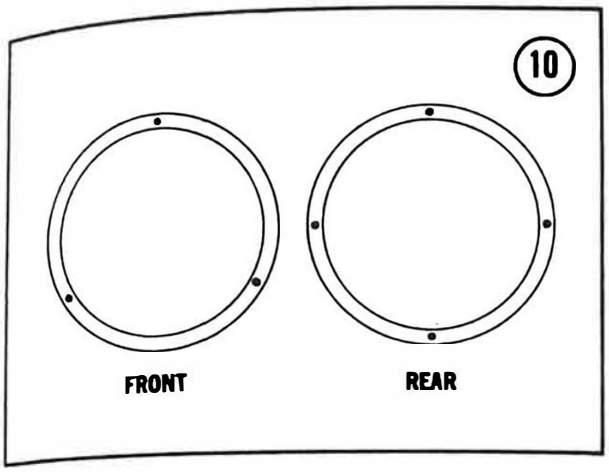




No. 10 screws on the front wheel, 3 on each side installed 120 degrees apart. Other methods of preventing tire slippage, such as chiseling burrs along the bead seating flange of the rim, are of little benefit and can distort the rim badly.

TUBES AND TIRES

Tires sustain all cornering, braking and acceleration forces. Consequently, handling difficulties and pecularities in riding can often be traced to the characteristics of the tires. If the tires are inadequate, you cannot possibly benefit fully from other suspension or engine improvements.

The tires we recommend for normal use are regular "street" rubber.

WARNING

Racing tires are not good enough for street use. They have thin, easily bruised sidewalls, are dangerously slippery in cold, damp weather, and lose air easily.

Dunlop K-81, Avon Mk. II and Goodyear Eagles have desirable features. The best size combination is 3.50 X 18 rear and 3.00 X 18 front.

Tire pressure can make a substantial difference in how the bike handles. Too much air in the front will cause the bike to be skitterish and will transmit a lot of shock to your hands and arms. Too little pressure and it will pinch the tube causing a flat. Try 24-26 psi on the front and 26-28 on the rear.

Tube weights can vary by as much as 1.0 lb. (0.45 kg) and there are many good brands available. Get the lightest tube possible (Dunlop). A flat tire resulting from an inferior tube is seldom a problem.

GEARING

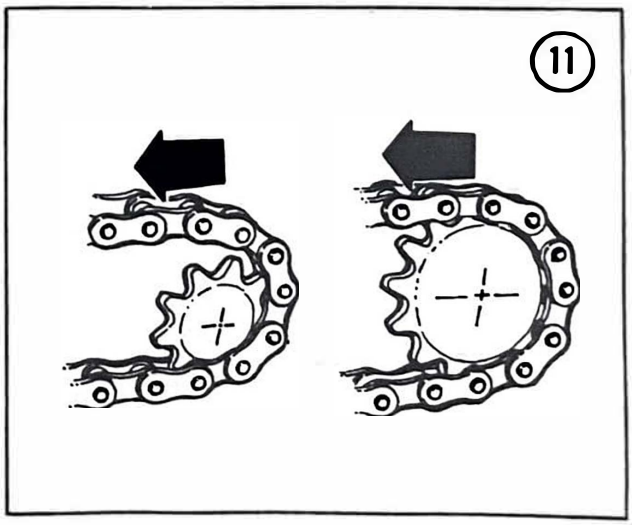
The simple act of changing final gear ratios can have a tremendous effect on the acceleration of a bike or its top speed.

A high ratio (low numerically) has an overdrive effect and can increase top speed or sacrifice acceleration.

A low ratio (high numerically) can substantially increase acceleration by allowing the engine to rev quickly and reach optimum rpm for maximum horsepower.

The ideal gear ratio is one which allows the engine to reach optimum (not peak) rpm at the end of the longest straightaway in high gear. If the engine peaks out too soon, horsepower will fall off and speed will remain constant. Gearing which is too high never allows the engine to develop full power.

Always change gear ratios by changing the rear sprocket. It may be troublesome and more costly to change than the front sprocket, but power will not be lost by having the chain bend too sharply. The risk of the chain lifting off of the smaller sprocket is also eliminated. See **Figure 11**.



FRAME

Drilling and grinding brackets and gussets on the frame should not be attempted. Many holes

drilled in an attempt to lighten the frame may look good to you but will often result in no more than a few ounces of weight removed. If you want a new light-weight frame, Trackmaster or Boyd and Stellings make excellent chrome-moly frames, but the cost may be prohibitive.

REAR SUSPENSION

Shock absorbers are relatively simple devices used to slow down the reaction time of the wheels. Contrary to popular belief, the springs, not the shocks, affect the stiffness of the suspension.

Stock shock absorbers are designed for comfort, not handling. Replace them with heavy-duty adjustable shocks such as Koni, Mulholland or Red Wing.

Adjustable shocks have 2 advantages. First, their damping action can be adjusted to suit your riding style and road conditions. Second, you can progressively increase firmness as the shocks wear, in order to maintain the same damping action as new shocks (this feature alone makes adjustables worth the extra cost).

Any brand rear shock (even stock) should be fitted with 110 lb. (50 kg) chrome-silicon springs for the average rider. You may want to experiment with other spring ratings for optimum performance. See **Table 1**.

Table 1 WHEEL RATES

Suggested wheel rates	
Lightweight road rider	110 lb./in.
Cafe racer	140 lb./in.
Big bike road rider	160 lb./in.
Correction factors	
Very light rider	Sub 10%
Heavy rider (200 lb. +)	Add 10%
Two passenger	Add 15%
Limited wheel travel	Add 10%

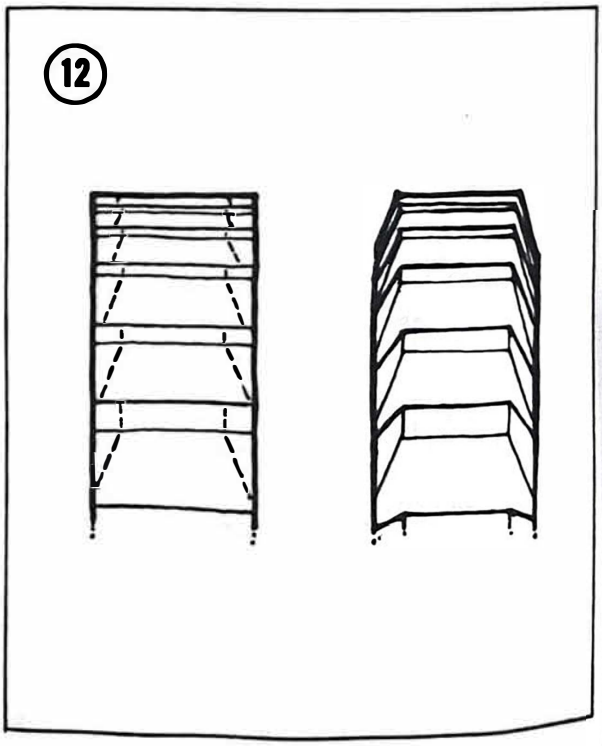
STEERING AND FRONT SUSPENSION

Like most manufacturers, Yamaha uses springs which tend to lose their resiliency rapidly. Change to pre-set chrome-silicon wire springs, such as those manufactured by S & W, which maintain their resiliency and provide a noticeable improvement in handling. Refer to the suspension chapter for installation procedures. While the forks are disassembled, replace the seals and replace the stock oil with 20W Torco fork oil. Try this lighter oil first and compare the results to stock. Oil which is too heavy can make the forks rigid and unyielding.

Red Wing produces a device called a steering dampener which can improve the overall control of the motorcycle at high speeds, on windy roads, or if the front wheel should strike a small object. In effect, this is a small shock absorber which restricts sudden, sharp movement of the forks. The unit bolts onto the forks in a matter of minutes without any special machining or welding. The kit comes with complete installation instructions.

TRANSMISSION

Inspect the transmission to ensure that all of the engagement dogs are in good condition. Bevel the transmission gears to decrease surface area and friction. See **Figure 12**. Then have the



gears and other moving parts microplated at Microplate Co. Transmission life will be increased and friction reduced substantially for a gain in usable power.

While the crankcases are apart, have them Microsealed. This process removes the porosity from the castings, reducing the possibility of air leaks, and at the same time improves the heat transfer capability of the crankcase. This process should also be applied to the barrels. The work can be arranged through most dealers or directly through Microplate. Look in the Yellow Pages under the heading of *Metal Finishing*, or consult with someone familiar with metals.

A special wide-ratio 5- and 6-speed transmission is available from Yamaha to fit most models, although the cost may be prohibitive for street use.

CLUTCH

Heavy-duty Barnett clutch chrome-silicon springs are necessary because the stock springs, like the stock fork springs, tend to weaken quickly. If the clutch plates are worn, switch to Barnett aluminum plates.

NOTE: *When aluminum plates are used, clutch adjustment will change as the engine warms up requiring more frequent than normal adjustment.*

EXHAUST SYSTEM

The stock exhaust system is designed to control engine noise over a wide rpm range without seriously decreasing engine performance. Exhaust gases pass directly through relatively short pipes to matched mufflers.

The engine must have an efficient, tuned exhaust system to fully realize the potential of other modifications. Replacing the stock system with a Denco or Bassani exhaust system can add 10-15% more power without any other modifications except carburetor jetting and a different spark plug.

CAUTION

Never run the engine on the street without some sort of muffler or baffle. It may sound good to you but it only causes a loss in power and increases the risk of engine damage.

CAUTION

Any exhaust system modification must be accompanied by a spark plug and jetting check as described in this chapter.

IGNITION SYSTEM

The stock ignition system consists of a battery, coil, breaker points, condenser, spark plugs, and associated primary and secondary wiring. The following sections describe improvements.

There are some worthwhile and inexpensive changes that can be made to improve the stock ignition system. These include selection of a better distribution system and spark plugs in the correct heat range.

BATTERY

On street-equipped motorcycles, the battery is nearly essential for starting and lighting. But if you can live without the electric starter, nearly 20 lbs. (10 kg) can be eliminated by removal of the starter motor and battery and replacement with a Pacifico battery eliminator. Instructions for its installation are included with the unit.

IGNITION COIL

The stock coil is barely sufficient for a stock engine, let alone one which has been modified, and should be replaced. There are several aftermarket companies who produce high-voltage coils specifically for motorcycles. One such manufacturer is Judson, who produces the Cycletron brand coil. This unit is available through most dealers.

An alternative is to use an automotive type coil the same size as stock. Virtually any automotive coil will have a higher output, so get the cheapest ones possible. When using a high-output coil of any type, be sure to use an automotive ballast resistor to avoid damaging the system. A typical setup is shown in **Figure 13**. The wire from the BATT terminal on the coil

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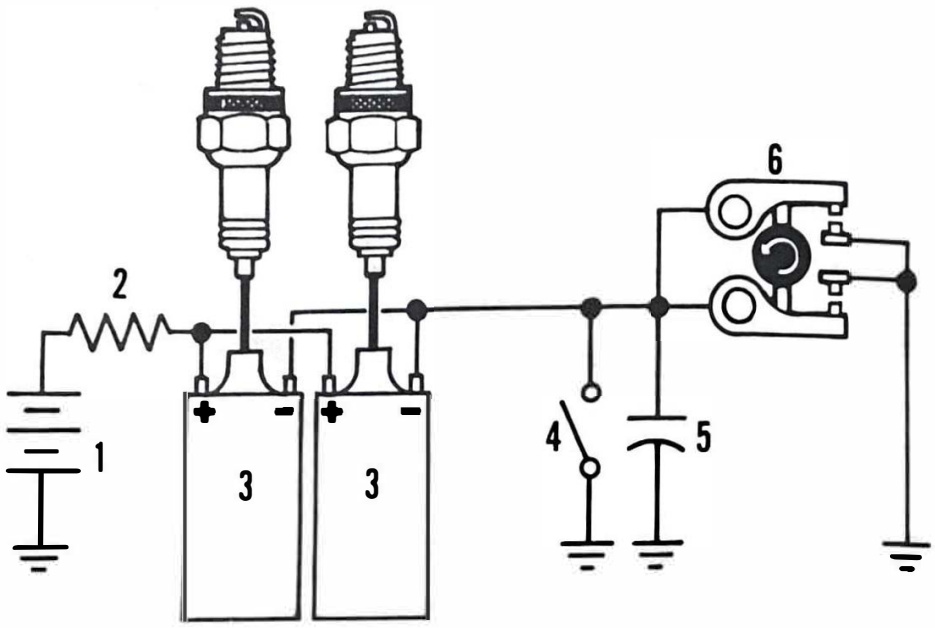

1. Battery
2. Ballast resistor (automotive)
3. Ignition coil (automotive)
4. Kill switch
5. Condenser (automotive)
6. Breaker points

should go to the battery. The wire from the points should go to the DIST terminal of the coil. The spark plug leads go to the center of the coils.

SPARK PLUG

There is nothing wrong with stock plugs for a stock engine, but these plugs may run too hot if the engine has been modified.

Spark plugs are designed to work within a specific heat range. Below 1,000°F (550°C), carbon deposits do not burn off the tip and may form a conducting track which short-circuits the plug. Above 1,500°F (850°C), the plug tip gets so hot it can pre-ignite the fuel mixture like a glow plug. The spark plug operates best when the center electrode is 1,300-1,400°F (700-750°C).

Modified engines usually run hotter and require a "cold" plug that can dissipate heat rapidly. This prevents the center electrode from running hotter than desired. The center electrode and insulating core are made short so that there is a short conduction path to the metal body and the comparatively cool cylinder head. See **Figure 14**.

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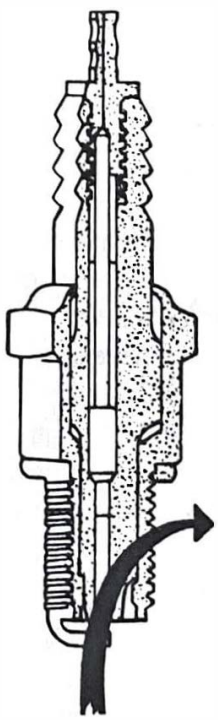
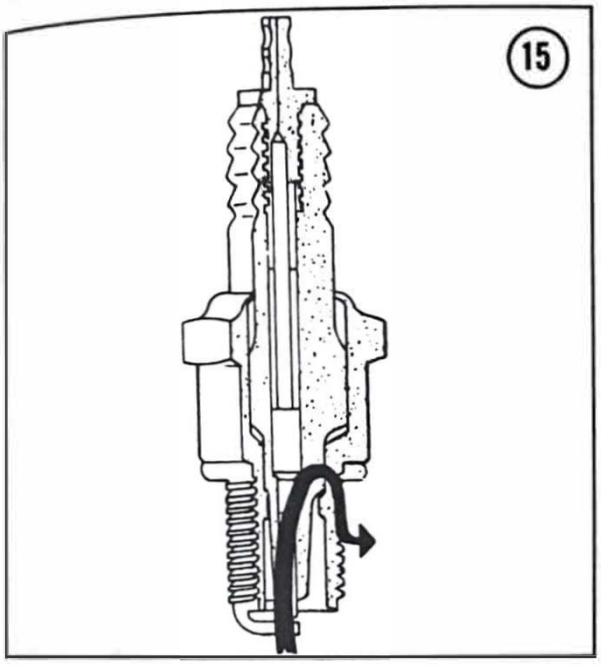


A cold-running engine requires a hot plug that does not quickly dissipate heat. Thus, the central electrode stays hotter. Otherwise, the central electrode temperature would drop below the desired range. The central electrode is made long so that the heat conduction path is long. See **Figure 15**. A modified engine usually requires plugs just slightly colder than stock.



Many products designed, theoretically to intensify the spark, are not necessary. If the engine is properly assembled, tuned normally, and working as it should, none of these "magic" devices are necessary.

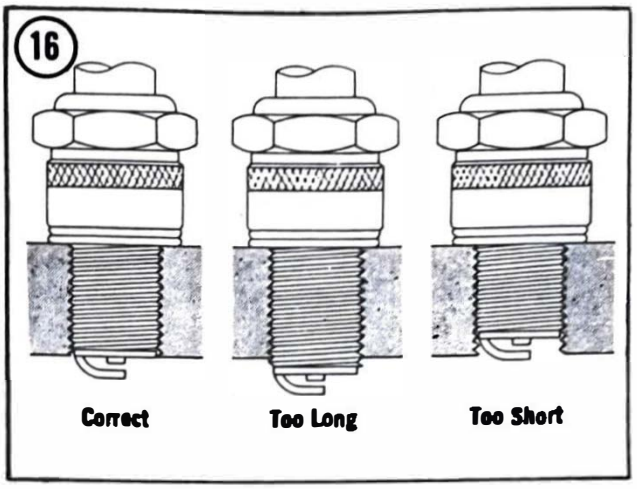
Reach

To ensure proper mixture combustion, check that the spark plugs do not extend into the combustion chambers. See **Figure 16**.

With the cylinder head off, torque each spark plug in place with a new washer. If the end projects no more than approximately 0.050 in. (1.27mm), grind the threaded ends of the plugs down so they are flush with the combustion chamber walls. If the plug extends farther than 0.050 in. (1.27mm) shim it up with spacers from Champion Plugs.

CAUTION

Do not stack normal plug washers, as shims or compression leaks could result.



Selection

To select a proper plug, conduct a plug check as follows:

1. On level ground, accelerate to top speed in third gear, pull in the clutch, and shut off the engine at the same time.
2. Stop the motorcycle with the brakes; do not let it stop under engine compression.
3. Remove the spark plugs and compare their condition to the spark plug conditions illustration in Chapter Two. This way, you will learn the accuracy of the jetting as well as the spark plug heat range.
4. Check the color of the deposits in the exhaust pipe. Spark plug and exhaust pipe deposits are an indication of carburetor adjustment. Be sure the carburetor is properly adjusted and that the deposits are light tan, not gray or black.

Wires

Special silicone ignition wires, with solid steel wire centers, are available to replace the stock wires. If the stock wires are in good condition, keep them even if they are of the resistance type. If the wires show obvious deterioration, install new ones. Old ignition wires are often a source of mysterious misfire problems.

ELECTRONIC IGNITION SYSTEMS

There are a number of special electronic ignition systems available as aftermarket equipment. The best types are transistorized or capac-

itive-discharge (CDI) such as the Cycle See-Dee Unit.

Transistorized ignition systems use a transistor to switch the large primary current to the coil. The original breaker points switch a small transistor control current rather than the larger primary current to increase point life.

Capacitive-discharge ignition systems use transistors in a different way. Closing the breaker points activates a transistorized oscillator which charges a capacitor to high voltage. Opening the breaker points discharges the capacitor through the ignition coil primary and an even higher secondary voltage develops to fire the plug. When the points open again, the capacitor charges for the next spark plug.

Electronic ignition systems can increase the horsepower, acceleration, and gas mileage. They can also make cold/damp weather starting easier, increase point life, and increase spark plug life.

Plug life on a modified 2-stroke engine can be very short. For this reason, a capacitive discharge ignition (CDI) used to increase plug life can be a valuable asset.

Yamaha has a special competition magneto unit to fit most models. There is no special part number for this item but a dealer can still special order the unit from Yamaha Parts Division.

FUEL SYSTEM

The stock fuel system is designed to give reasonable fuel economy, good low end torque, and fair performance over a very wide range. A number of things can be done to vastly improve performance, but fuel economy and engine flexibility may suffer.

It is impossible to evaluate any fuel system changes until the stock system is working right. The first place to start is a good engine tune-up, as described in Chapter Two. Do not touch the fuel system until the ignition system works perfectly.

CARBURETORS

A change in carburetion can add considerable horsepower, particularly if you also install a tuned exhaust system and change port timing.

Little can be done to improve upon the performance of the stock carburetors. Their flow characteristics are well-suited to the engine.

Mid-range and top end performance can be increased slightly by switching to a larger (2-4mm) Mikuni carburetor. A reed valve engine can accept a large carburetor with no fear of "drowning" the engine, because it only admits needed fuel.

Jetting

Altitude and humidity have a marked effect on engine performance and must be compensated for with suitable jet sizes and needle position. Changes in port shape, the exhaust system, camshaft and displacement will also necessitate changes in jetting because they alter the engine's ability to breathe. Correct jetting and adjustment is largely a matter of experience gained through careful trial-and-error tuning.

Before making any alterations in jetting or needle position, conduct a plug check as described under *Spark Plugs* in this chapter. This way, you can learn not only the condition of the jetting but also the suitability of the spark plug heat range.

Always begin jetting with a slightly larger jet than you feel you need; a too-lean mixture often results in piston seizure. Make changes in one-step increments. Do not make a change of 2 sizes. Allow sufficient time to do a thorough job; time spent finding the optimum jetting and adjustments is every bit as important as other engine modifications.

As a rough guideline add one jet size if a modified exhaust system is used. Add one jet size if port timing is changed. It is better to start rich on the jetting and adjust to suit the engine.

AIR CLEANER

The stock paper air cleaner is effective but restrictive. There are many special air cleaners made to fit the stock carburetor. One good brand is the Filtron foam type.

You should never operate your engine without an air cleaner. A clean air cleaner does not rob your engine of enough power to offset its advantages.

The incoming fuel/air charge also supplies lubrication for the lower-end bearings, so clean air is a must or the engine will be damaged in less than a couple of hours. A Ken Maeley air cleaner housing with a Filtron element is a good combination.

ENGINE LUBRICATION

Remove the oil injection unit, pump, and tank for off-road use, and pre-mix the gas and oil. When you put oil in the gasoline, you know it is getting into the engine if the gasoline is. You will never run out of oil while there is still gas, and you will drop 3 lb. (1.4 kg) in the process.

CAUTION

Plug up the oiler hole in the barrel or an air leak and a blown engine could result.

Remove the nylon driving gear found on the side of the outer right-hand case. An alloy casting and gasket will cover the hole left by the oil pump. Two O-rings from either the tachometer drive or speedometer drive cables will slip over the special plugs supplied by Yamaha to fill the holes in their respective castings. A good oil must be used if the pump is eliminated, such as Torco T2R, mixed at 40:1.

CAUTION

Stay away from oil additives in the crankcase or the fuel system. There is a chance they may not be compatible with the additives already in the oil. If there was a miracle ingredient which would materially benefit your engine, the oil suppliers would include it and the engine manufacturers would recommend it. Some additives can even cause the clutch to slip.

CYLINDER HEADS

To eliminate a frequent source of detonation and pre-ignition, make sure there are no sharp edges or burrs in the combustion chamber. In addition, check that the spark plugs do not protrude too far into the chambers. Matching combustion chamber sizes will also improve engine performance.

Extensive modifications are possible and should be considered for maximum power. If you want to go "all-out" on modification, take the head to an experienced performance shop. If piston or ports have been modified, the combustion chambers may be modified to compensate for a compression ratio increase.

CAUTION

Excessively high compression will cause the engine to overheat and burn the piston or spark plug.

Cleaning and Inspection

Heads must be throughly cleaned before any modification or measurement. Remove all carbon from the combustion chambers with a wire brush. Do not wire brush the cylinder seating surfaces. Particularly stubborn deposits can be removed by blasting with glass beads or walnut hulls. Scrape out all dirt from between the fins and wash in solvent.

CAUTION

Do not sandblast the heads; sandblasting is too abrasive and can damage the sealing surfaces.

Changing Compression Ratio

Three ways to change compression ratio are:

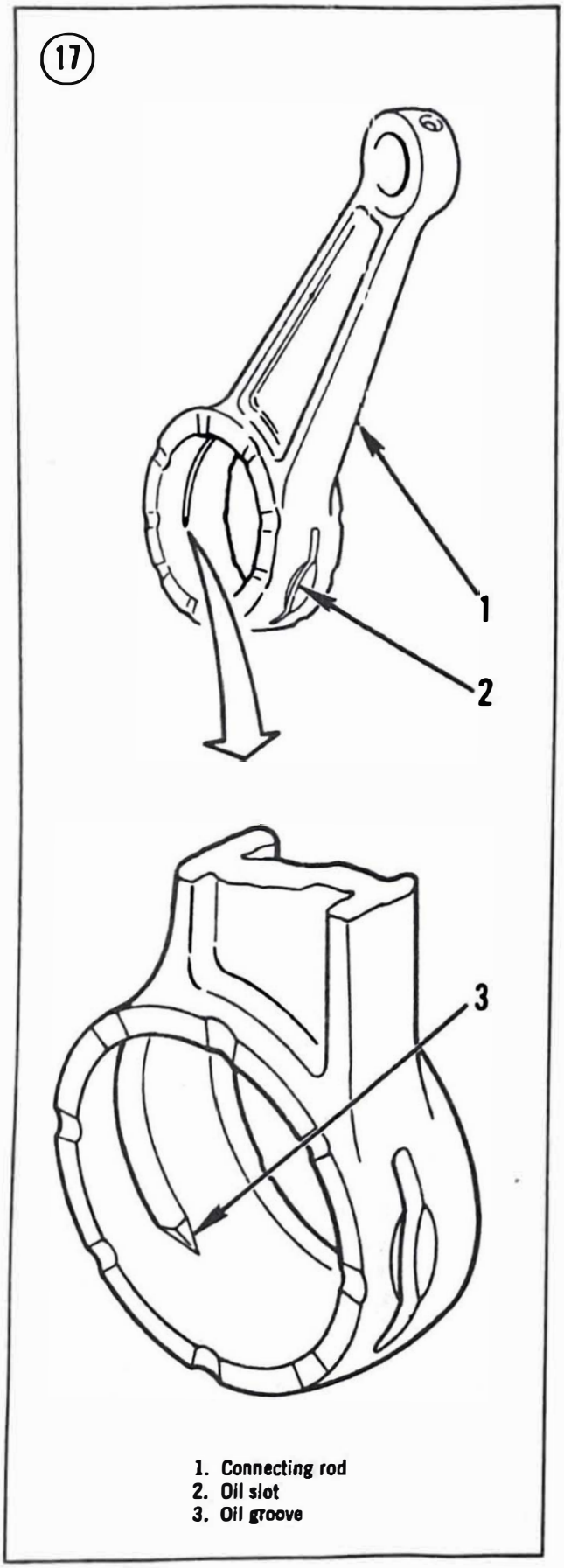
a. Bore
b. Stroke
c. Flycut heads

Flycutting is equivalent to milling the heads on a water-cooled engine. It decreases the volume of the combustion chamber.

Installing a big bore kit or "stroker" crankshaft will also increase the compression ratio. If you flycut the head, you may raise the compression ratio far beyond a desirable or safe limit.

CONNECTING RODS

The oil groove in the rod should be flared (**Figure 17**) to ensure more complete lubrication of the connecting rod big-end bearing. When assembling the crankshaft, refer to the engine chapter and check the alignment of the counterbalance wheels. Make any necessary correction.

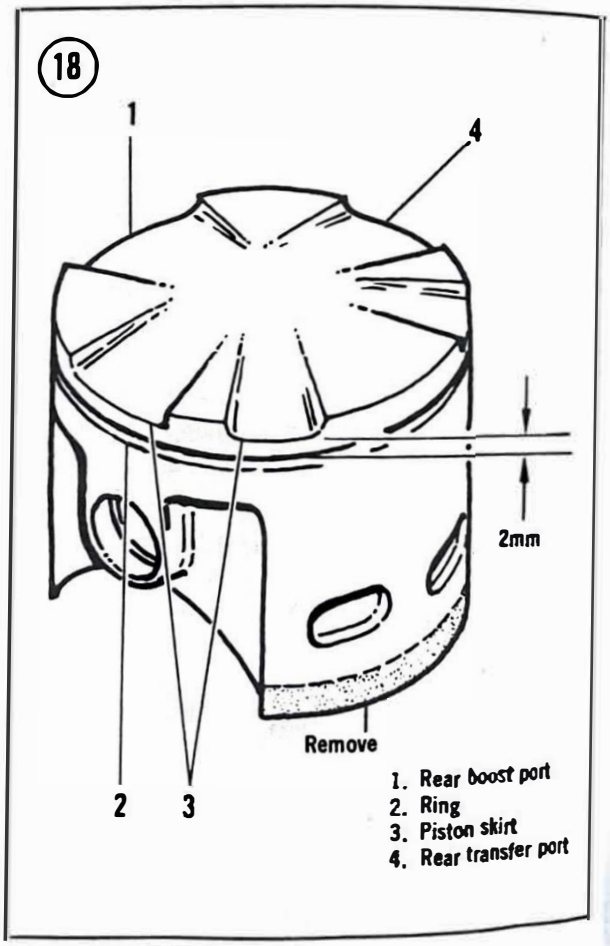


1. Connecting rod
2. Oil slot
3. Oil groove

PISTON

Stock Yamaha pistons can be modified to work well enough so that there is no need to change to an aftermarket type, except for all-out competition.

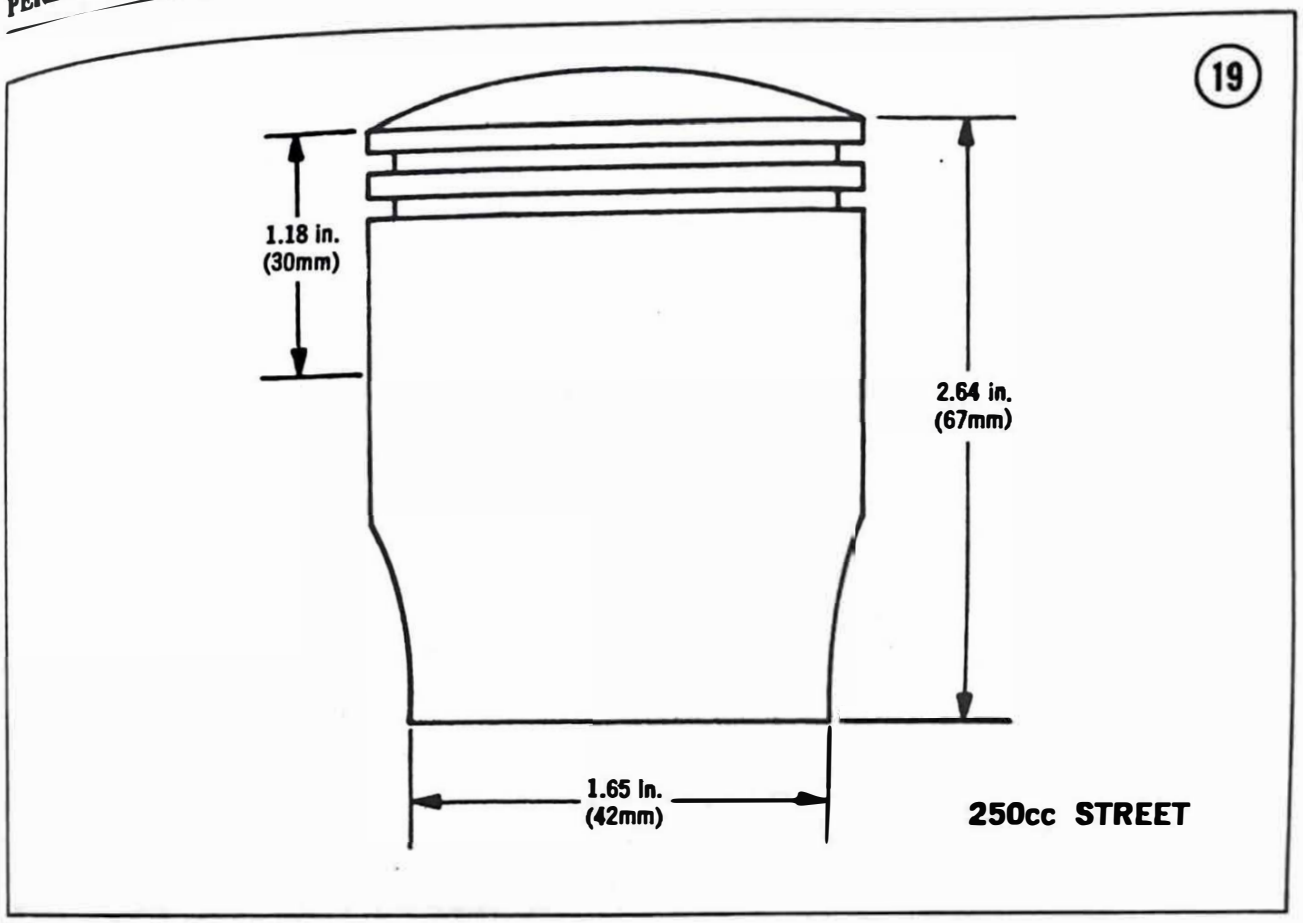
A convenient way to make slight changes to port timing is to modify the top of the piston. The area on top of the piston next to the exhaust port, or transfer ports, may be cut so that exhaust or transfer ports will open earlier and stay open longer. Do not cut the piston closer than 0.08 in. (2mm) to the ring groove. See **Figure 18**. The piston skirt may be shortened so that the intake port will open earlier and stay open longer.

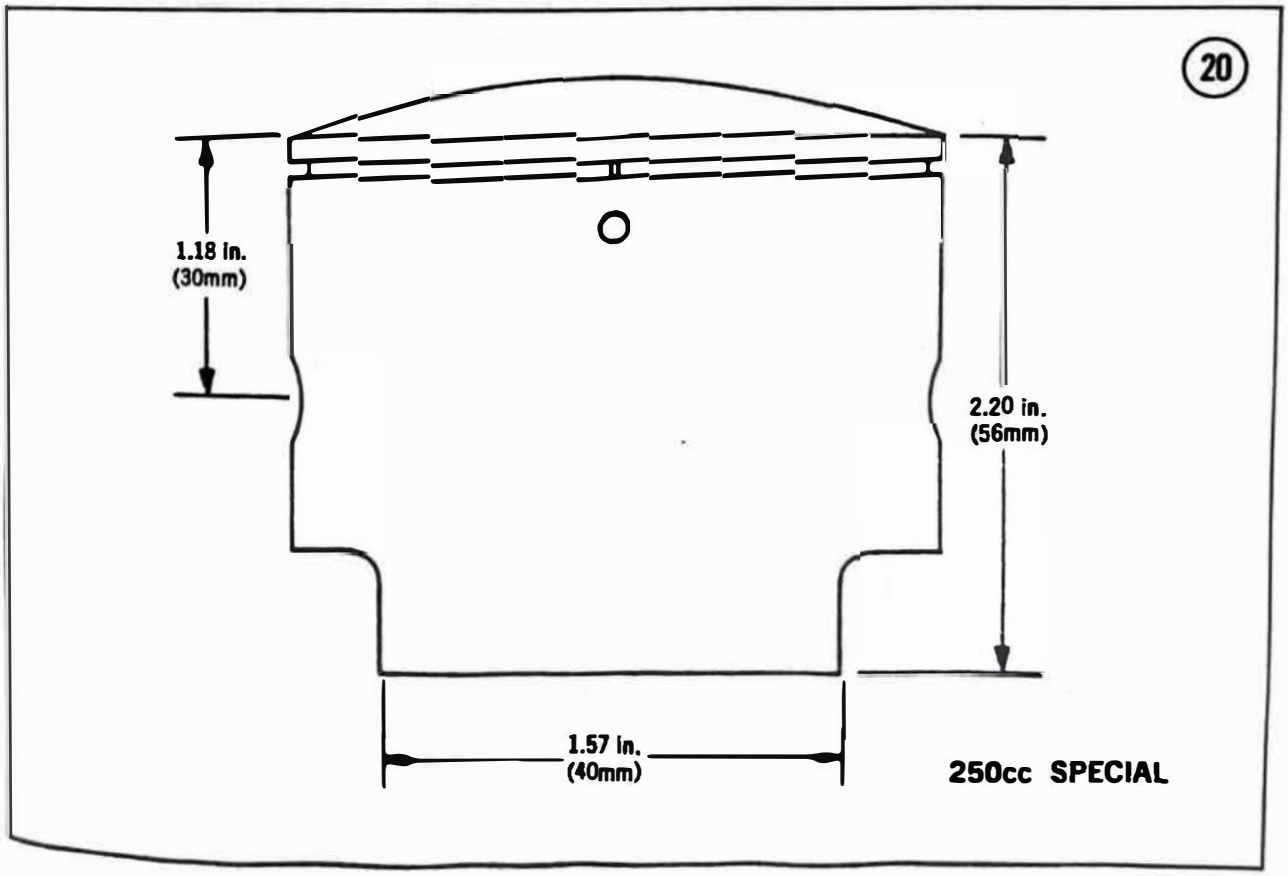


1. Rear boost port
2. Ring
3. Piston skirt
4. Rear transfer port

When shortening the piston skirt, take care not to cut off too much. This will cause the piston to rock in the cylinder, causing damage to the piston and cylinder.

Use the piston diagrams for piston modification dimensions (**Figures 19 through 22**).





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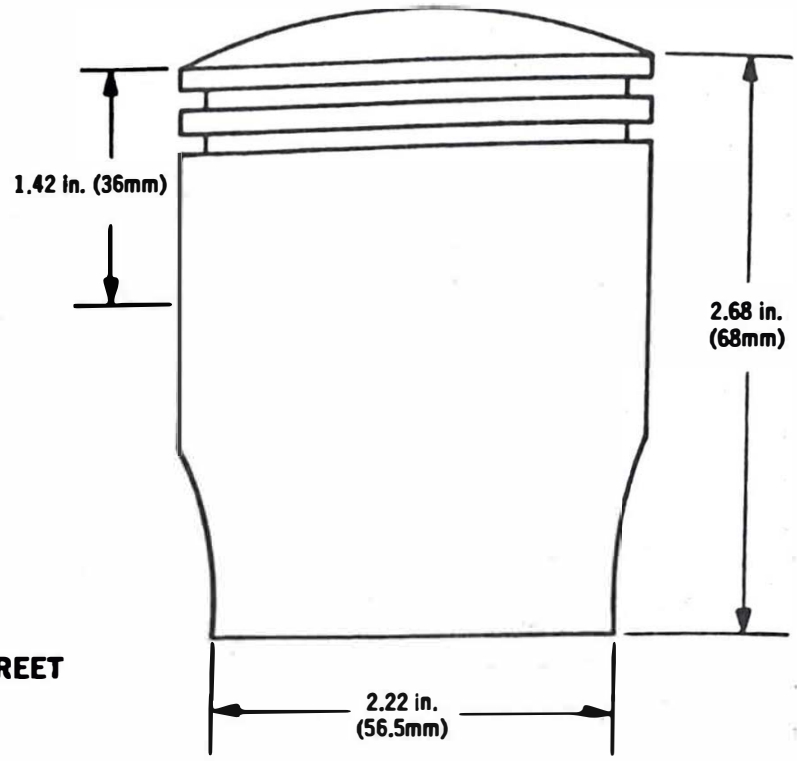

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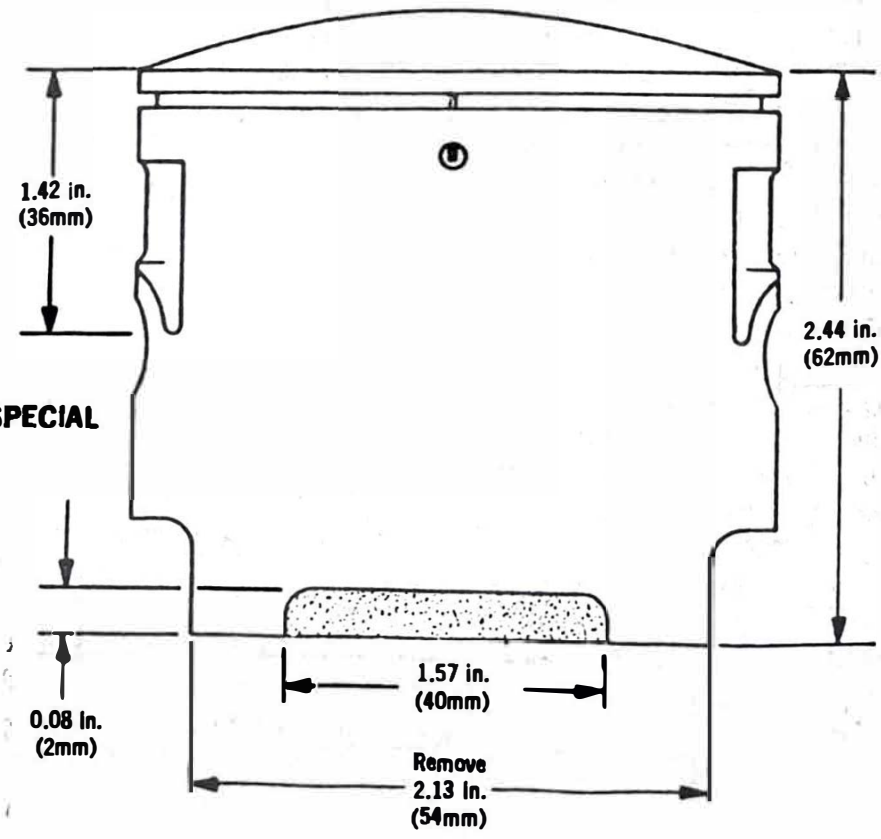
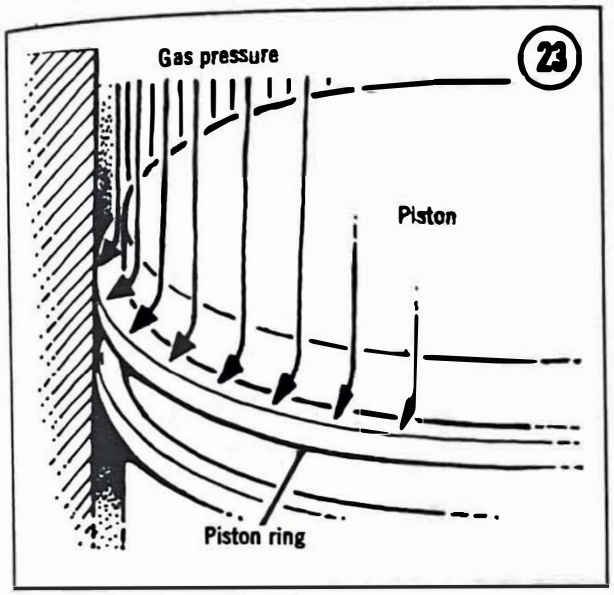


PISTON RINGS

The main purpose of piston rings is to seal gas pressure above the piston. The rings seal when gas pressure forces the rings down against the groove and outward against the cylinder wall. See **Figure 23**.

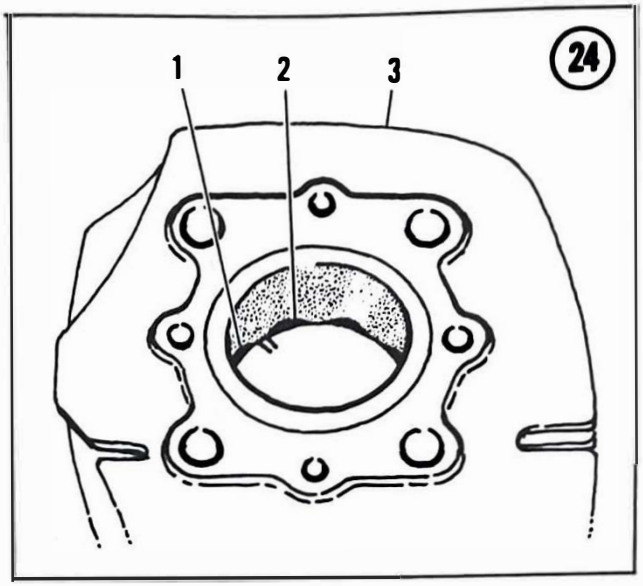


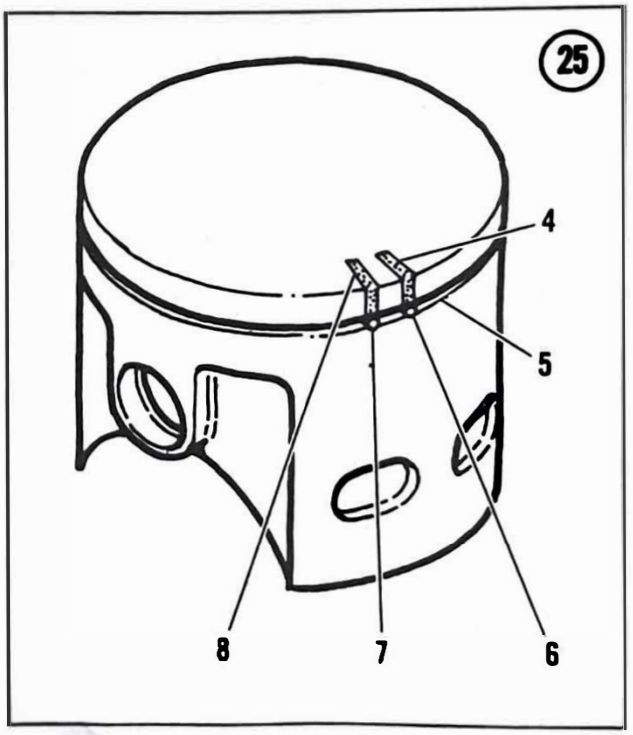
Proper side clearance between the piston groove and the ring is very critical. If clearance is too small, gas pressure does not build behind the ring, and it collapses and fails to seal. Excessive clearance permits the ring to pound out the groove as it moves up and down. Proper clearances for each model are given in Chapter Four under *Piston Rings*.

Replace the standard piston rings with Poppy Super Rings. These rings are virtually unbreakable and will outlast the standard rings by several times. These rings are hard-chrome plated to reduce running friction over stock rings and consequenlty reduce heat. Also, they have inherently better heat transfer properties than standard rings and help dissipate more heat to the cylinder, away from the piston.

Piston ring gap must be located between rear transfer port (2) and rear boost port (1). Refer to **Figures 24 and 25**. If the rear boost port has been widened the piston ring gap may need to be relocated as follows:

1. Use a felt pen to mark top of piston (4) in line with the pin (6).
2. Temporarily place the piston, without rings, on the rod. Temporarily place the cylinder (3) in position on the crankcase.
3. Check that the mark (4) is located between the rear transfer port (2) and rear boost port (1). If the mark is located between the rear transfer port and rear mark is correct, the ring gap need not be relocated. (Omit Steps 4 through 9.)
4. Make another mark (8) on top of the piston.
5. Remove cylinder and piston.
6. Mark upper edge of ring groove (5) in line with the new mark (8).





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7. Fill the ring groove with soft material (aluminum, brass, etc.) to aid in drilling a new pin hole. Be sure that the pin (7) is installed tightly to prevent the ring gap from moving around in cylinder bore and damaging the cylinder and piston.

8. Drill a hole for a press-fit for a new pin at the new mark on the edge of the ring land. Press in a new pin (7).

9. Press in an old pin (6) until it is flush with the bottom of the ring land.

CYLINDER

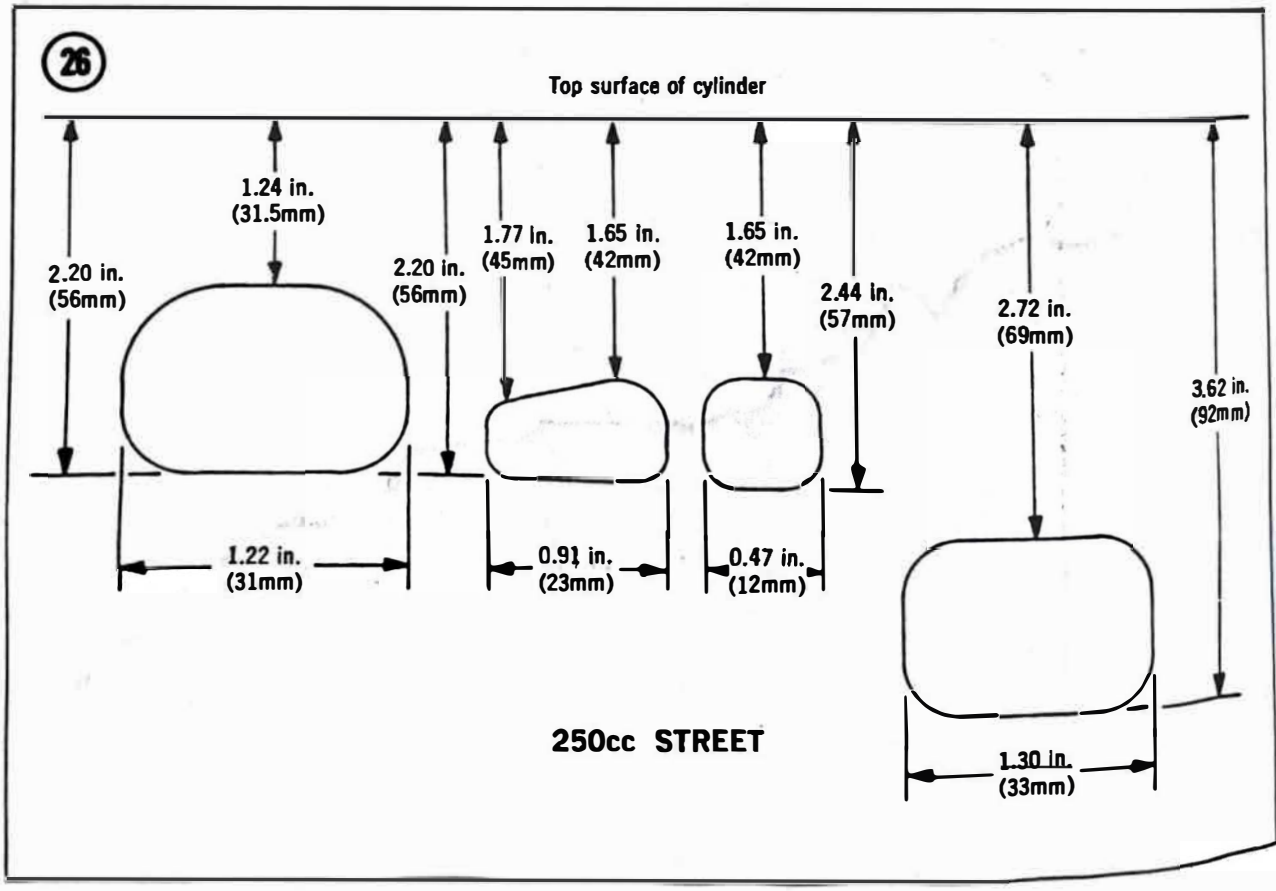
A great deal of power can be created by altering port height, size, and shape but take care unless you have considerable experience with 2-stroke tuning. **Figures 26 through 29** give maximum port dimensions for optimum power. Somewhere between this extreme and the stock dimensions is a good compromise to suit your needs. Modify the cylinder a little at a time but make sure that each port is modified in proportion to the others. It does not do any good to modify the intake, for example, without also modifying the exhaust.

Early 5-port models can be vastly improved by replacing with the entire 7-port top-end of a corresponding later model. This also gives you the benefit of the reed valve setup. An alternative would be to add a Yamaha reed valve kit and create additional "ports" with a high speed grinder as described in the section.

Porting

The width of the ports may be measured in degrees as follows:

1. Draw a circle the same diameter as your cylinder. See **Figure 30**.
2. Use inside calipers to measure the width (X) of the port.
3. Mark a chord (Y) across the circle. The length of chord (Y) should be the same as the width (X) of the port.
4. From the 2 points on the circle where the chord meets the circumference, draw lines to the center of the circle.



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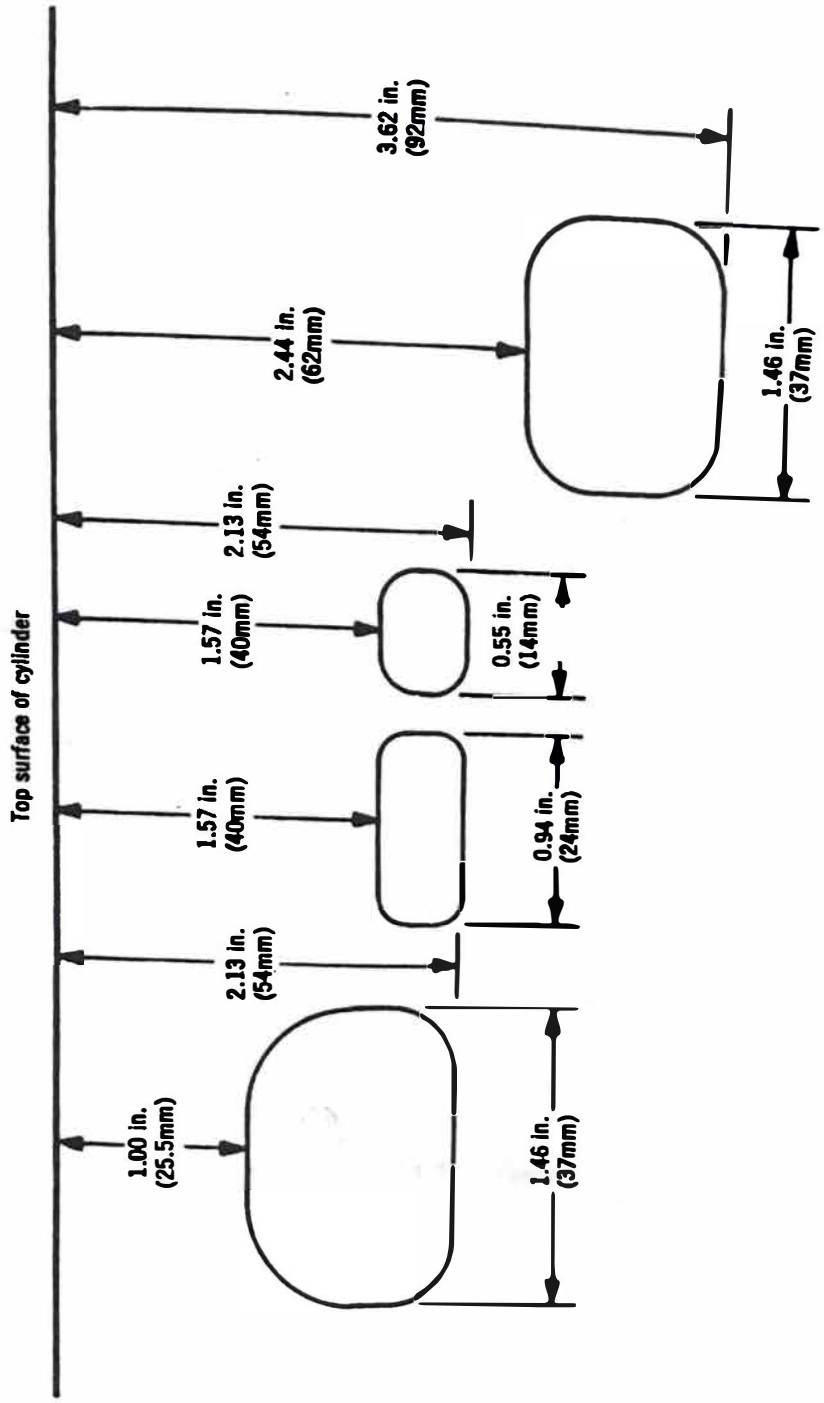

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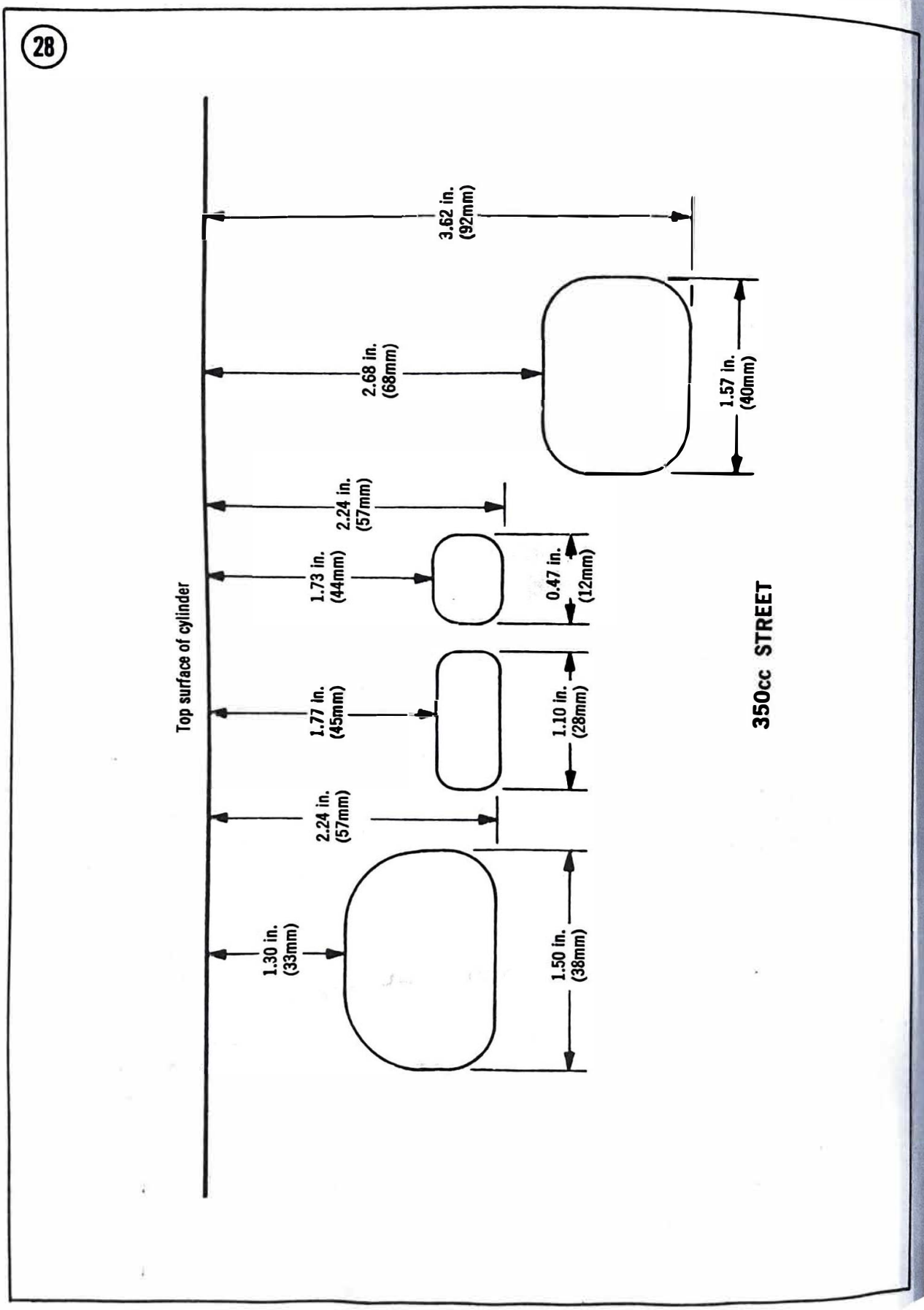
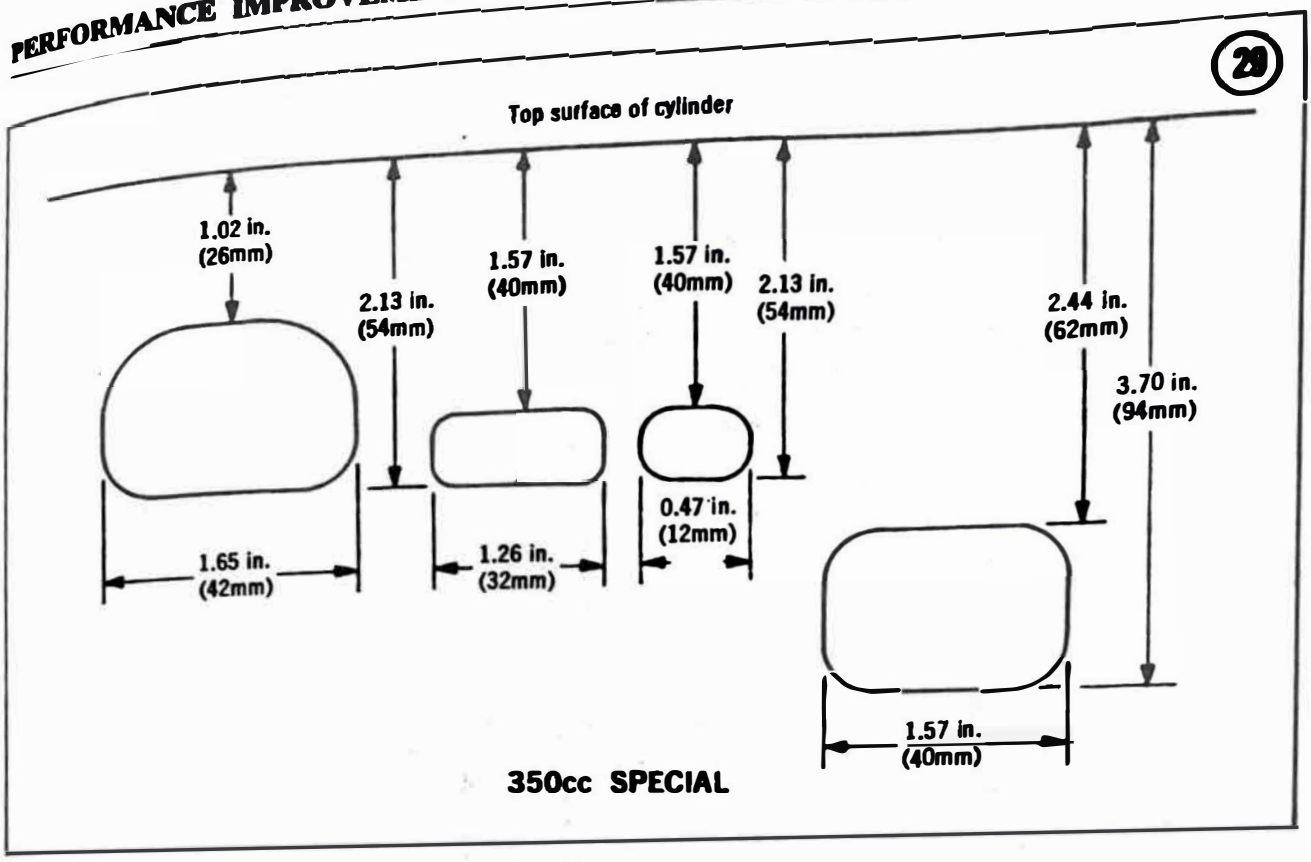
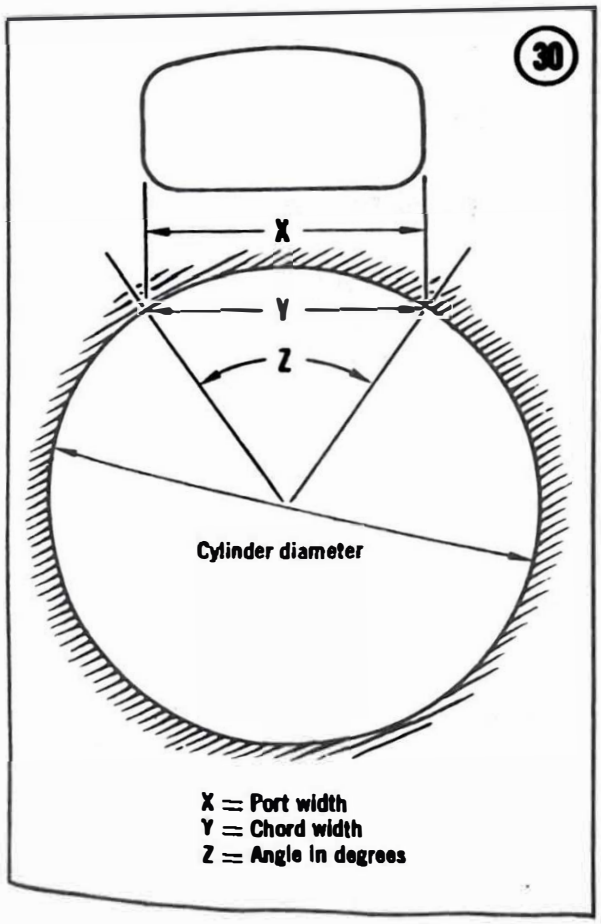






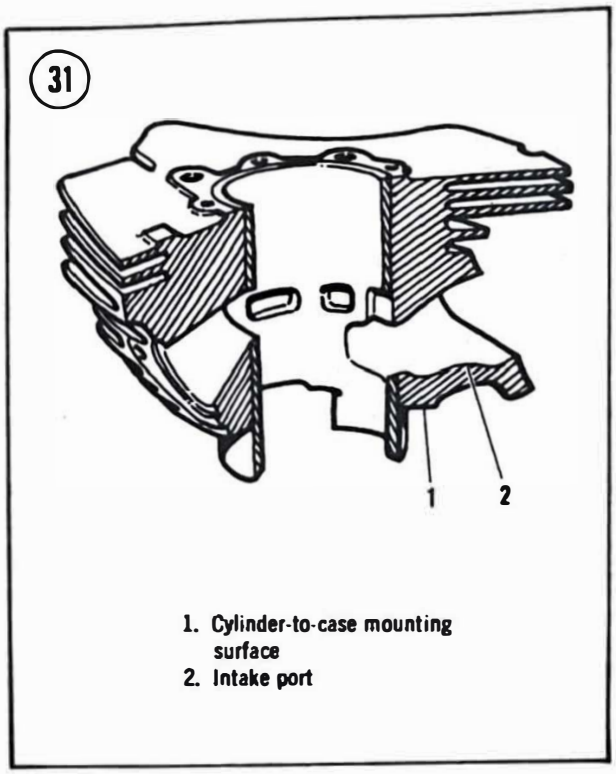
5. Use a protractor to measure the angle (Z) between the 2 lines. This angle is the port width in degrees.

Modifying Intake Port

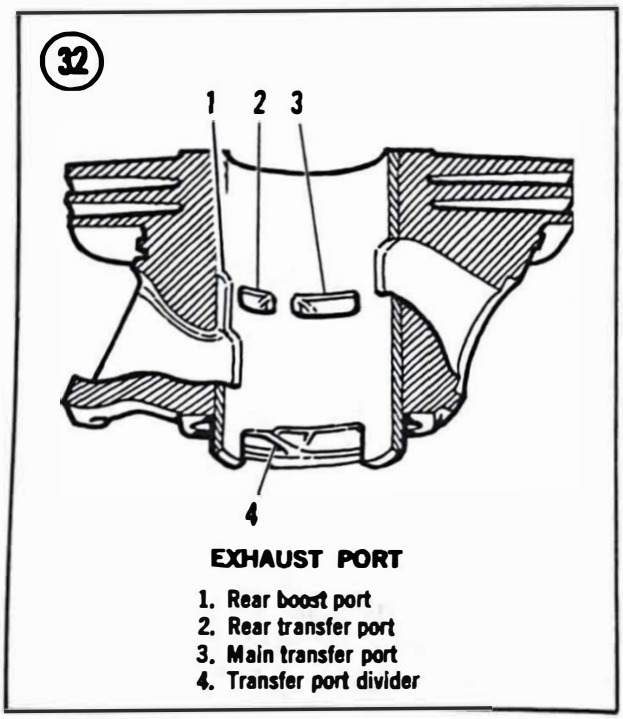
1. Remove casting irregularities such as ridges, steps, lips, etc., from the intake port to provide a smooth, uninterrupted flow of intake gasses.
2. Modification of the intake port will require widening and lowering of the port.
3. When lowering the intake port, be careful not to let the bottom of the port go below the cylinder-to-case mating surface (1). See **Figure 31**.
4. When modifying intake, a port width of more than 75° will have a detrimental effect on piston, ring, and port. A width of 75°-80° works best.

Modifying Exhaust Port

1. Width of the exhaust port should be close to the width of the intake port (i.e., 75°-80°). See **Figure 32**.
2. Bottom of the port should be even with top of the piston when it is at BDC.



1. Cylinder-to-case mounting surface
2. Intake port



EXHAUST PORT

1. Rear boost port
2. Rear transfer port
3. Main transfer port
4. Transfer port divider

3. For low speed running, an exhaust port timing of 105° gives good results.

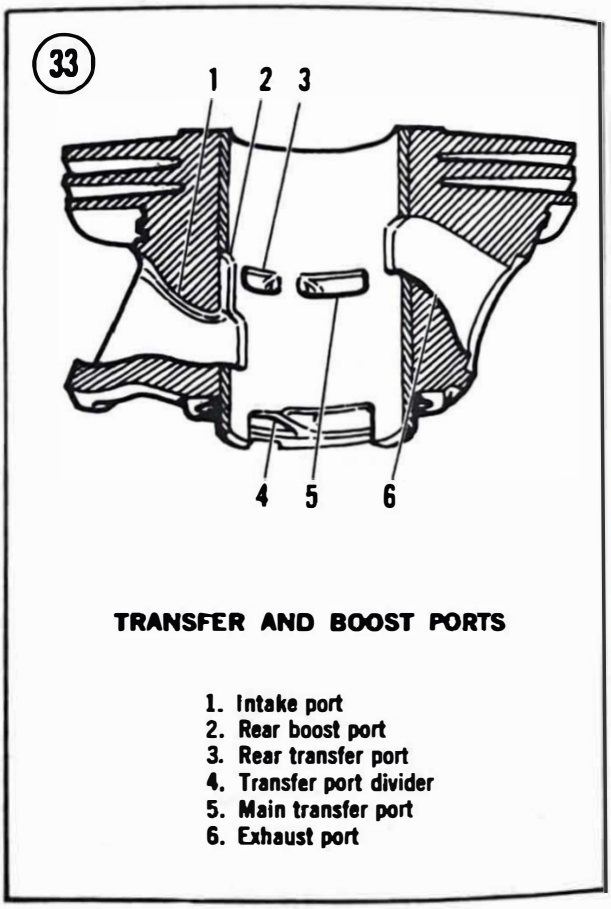
4. Remove casting irregularities such as ridges, steps, lips, etc., from the exhaust port passage (2) to provide a smooth, uninterrupted flow of exhaust gasses.

5. Remove irregularities from the exhaust pipe mating surface so that gas flow from the exhaust passage to the exhaust pipe is smooth and uninterrupted.

6. Polish the exhaust passage to help keep carbon buildup at a minimum.

Modifying Transfer and Boost Ports

Refer to **Figure 33** when modifying the main transfer (3) and rear transfer (2) ports as follows:



TRANSFER AND BOOST PORTS

1. Intake port
2. Rear boost port
3. Rear transfer port
4. Transfer port divider
5. Main transfer port
6. Exhaust port

1. Remove casting irregularities such as ridges, steps, lips, etc., from transfer passages (2, 3) and the boost port (1) to provide a smooth, uninterrupted flow of gasses.

2. The shape and direction of the transfer ports is important. If modifying these ports will alter the direction of the porting, it is best not to. The main transfer port (3) should be raised slightly and, in some cases, widened a little.

3. The rear transfer port (2) should be raised, widened, and in some cases, lowered a little.

4. The transfer port divider (4) should be narrowed, but must not be removed. The flat area of the divider (4) that faces the incoming fuel/air flow offers poor shape for good flow of gasses.

5. The boost port (1) can be raised to the height of the rear transfer ports (2). When widening, be sure to leave at least 0.31 in. (8mm) between the boost port and the transfer port (2) next to it. If the boost port is widened too much, it will be necessary to alter the piston to relocate the ring gap.

SUMMARY

The modifications described offer enough options so that it is possible to alter the Yamaha slightly with just a few dollars and a little time to make it a generally better performer, or to construct a competitive racer.

Remember, begin by improving the handling and braking performance of the motorcycle. These are the first steps to making a motorcycle quicker.

Be critical of the parts and services you purchase. Talk to your dealer; let him know what you are after in terms of performance and how much time and money you are prepared to spend. Dealers have a good information pipeline that includes performance bulletins and sources for components. They may be able to offer you information that was not available at the time this book was written.

Table 2 PERFORMANCE PARTS SUPPLIERS AND MANUFACTURERS

Company	Product/Service
Accel Ignition P.O. Box 142 Branford, Conn. 06405	Ignition components
Advance Cycle Engr. 929 Hyde Park Inglewood, Calif. 90302	Straight cut gears
Advanced Cycle Products 3633 W. MacArthur No. 410 Santa Ana, Calif. 92704	Miscellaneous high-performance items
Akront North American P.O. Box 2307 Anaheim, Calif. 92804	Aluminum rims
Alexander Reynolds Corp. 123 S. Newman St. Hackensack, N.J. 07601	Chain
American Turbo-Pak 15602 Mosher Tustin, CA. 92680	Turbo-charger
Arnaco, Inc. 13431 Saticoy St. No. Hollywood, Calif. 91605	Tunable shock absorbers
Azusa Engineering, Inc. 1542 Industrial Park St. Covina, Calif. 91722	Sprockets
Barnett Tool and Engineering 9920 Freeman Ave. Santa Fe Springs, CA. 90670	High performance clutches, springs, and cables
Bikoni, Ltd. 163 South St. Hackensack, N.J. 07601	Koni tunable shocks
Robert Bosch Corp. 2800 S. 25th Ave. Broadview, Ill. 60153	Electrical components
Boyd & Stellings 2111 So. Grand Ave. Santa Ana, Calif. 92705	Swing arm
Branch, Inc. (Flowmetrics) 7051 Village Dr. Buena Park, CA. 90621	Head porting and polishing
Buchanans Frame Shop 629 E. Garvey Monterey Park, Calif. 91754	Wheels, spokes, frame work
Casler Performance Products 1031 W. Brooks St. Ontario, Calif. 91762	Tires
Chain Tite Fairgrounds Road Manlius, N.Y. 13104	Chain tensioner

(continued)

Table 2 PERFORMANCE PARTS SUPPLIERS AND MANUFACTURERS (continued)

Company	Product/Service
Champion Spark Plug Co. 900 Upton Ave. Toledo, Ohio 43661	Spark plugs
Circle Industries 17901 Arenth Ave. City of Industry, Calif. 91748	Sprockets
Cycle Products West, Inc. 11900 W. Pico Blvd. W. Los Angeles, Calif. 90064	Air/oil fork conversion kits, shock coolers
Daldo/DID Corp. 885 Centennial Ave. Piscataway, N.J. 08854	Aluminum wheels
Denco Industries 4480 E. Enterprise Fremont, Calif. 94538	Exhaust systems
Dicks Cycle West, Inc. 304 Agostino Rd. San Gabriel, Calif. 91776	Cafe racer equipment
Domiracer Distributors, Inc. 5218 Wooster Rd. Cincinnati, Ohio 45226	Cafe racer equipment
Electrofilm 7116 Laurel Canyon Blvd. N. Hollywood, Calif. 91605	Friction reducing coating for moving parts
Forgedtrue Pistons 13623 Pumice St. Santa Fe Springs, Calif. 90670	Big bore pistons, oversize
Hooker Headers 1032 W. Brooks St. Ontario, Calif. 91762	Custom exhaust systems
Joe Hunt Magneto 1724 Crenshaw Blvd. Torrance, Calif. 90501	Magneto
Hurst/Airheart Products 20235 Bahama St. Chatsworth, Calif. 91311	Disc brake conversion kits
Impac Industries Houston 5704 Bellaire Blvd. Houston, Tex. 77081	Polycarbonate clutch levers
International Motorcycles 723 Canoga Ave. Canoga Park, Calif. 91303	Yamaha Hi-Performance modifications
Interpart Corporation 230 Rosecrans Gardena, Calif. 90248	Cafe racer equipment

(continued)

Table 2 PERFORMANCE PARTS SUPPLIERS AND MANUFACTURERS (continued)

Company	Product/Service
Jahns Pistons 2662 Lacy St. Los Angeles, Calif. 90031	Forged pistons
Jardine Header Co. 7142 Belgrave Garden Grove, Calif. 92641	Custom exhaust systems
Judson Research 2239 Donnely Road Conshohocken, Penna. 19428	Cycletron coil
K & N Engineering, Inc. Box 1329-561 Iowa Ave. Riverside, Calif. 92502	Air filters
Kendick Engineering 9520 Desoto Ave. Chatsworth, Calif. 91311	Diaphragm carburetor
Lakewood Cycle 7425 Fulton Ave. No. Hollywood, Calif. 91605	Brake linings
Lectron Products, Inc. 1800 Stephenson Hwy. Troy, Mich. 48084	High performance carburetors
Lester Tire & Wheel 26881 Cannon Rd. Bedford Hts., Ohio 44146	Cast wheels
Maely Enterprises Route 2, Box 758 Corona, Calif. 91720	Air filter
Magnaflux Corp. 7328 W. Lawrence Ave. Chicago, Ill. 60656	Magnetic inspection of parts
Magura U.S.A. Corp. P.O. Box 337 Milroy, PA. 17063	Levers, controls
Marchal America 14622 Southlawn Lane Rockville, Md. 20850	High-output lights
Marubeni Red Wing 200 Park Avenue New York, N.Y. 10017	Shock absorbers, forks
Maxi-Products, Inc. 1518 New Vinion Rd. Kansas City, Mo. 64118	Electronic ignition
Mikuni American Corp. 8910 Mikuni Ave. Northridge, Calif. 91324	Carburetors

(continued)

Table 2 PERFORMANCE PARTS SUPPLIERS AND MANUFACTURERS (continued)

Company	Product/Service
Number 1 Products, Inc. 4931 N. Encinita Ave. Temple City, Calif. 91780	Fork conversion kits
Preston Petty Products 403 N. Main St. Newberg, Ore. 97132	Plastic fenders
Racecrafters International 11908 Radium San Antonio, Tex. 78216	Cafe racer equipment
Red Line Engineering 18257 Parthenia St. Northridge, Calif. 91324	Custom frames
S & S Headers, Inc. 3565 Cadillac Ave. Costa Mesa, Ca. 92626	Custom exhaust systems
S & W Engineered Products 7051 Village Dr. Buena Park, Ca. 90621	Shock and fork springs
Shelby Dowd 19021 S. Figueroa St. Gardena, Calif. 90248	Cast wheels
Sudco International 4653 Leston St., No. 710A Dallas, Tex. 75247	Mikuni carburetors
Sudco International Corp. 1824 E. 22nd Street Los Angeles, Calif. 90058	Mikuni carburetors
Target Products 2724 W. Main St. Alhambra, Calif. 91801	Cafe racer parts
Uni Filter, Inc. 13522 Newhope St. Garden Grove, Calif. 92643	Air filters, control levers
Webco, Inc. Box 429 Venice, Calif. 90291	Mail order catalog sales of many items including: Koni, Mulholland, S & W, Bell, Castrol, Torco, etc.
Whitney Chain Div., Jeffrey Mfg. 237 Hamilton St. Hartford, Conn. 06102	Drive chain
Yamaha Parts Distributors (See your dealer)	Many high-performance items such as expansion chambers, reed valves, air filters, big-bore kits, etc.

APPENDIX

SPECIFICATIONS

This appendix contains specifications and performance figures for the various Yamaha models covered by this book. The tables are arranged in order of increasing engine size. Since there are differences between various models of the same engine size, be sure to consult the correct table for the motorcycle in question.

MODELS DS6 SERIES

Engine	Type	2-stroke, air cooled
	Displacement	15.01 cu. In. (246cc)
	Bore x stroke	2.205 x 1.969 In. (56 x 50mm)
	Number of cylinders	2
	Compression ratio	7.3:1
	Maximum output	30 bhp @ 7,500 rpm
	Maximum torque	21.1 ft.-lb. (2.92 mkg) @ 7,000 rpm
	Starter type	Kickstarter
Fuel System	Carburetor	
	Manufacturer, model	Mikuni, VM26C
	Main jet	100
	Needle jet	N-8
	Jet needle/clip position	4D3/3
	Cutaway	2.0
	Pilot jet	30
	Starter jet	40
	Air screw (No. of turns out)	2¼
	Float level	1.00 in. (25.5mm)
	Fuel tank capacity	2.9 gal. (11 liters)
Lubrication	Engine	Yamaha Autolube
	Oil tank capacity	1.6 qts. (1.5 liters)
Ignition System	Ignition type	Battery Ignition
	Ignition timing	0.071 in. (1.8mm)
	Spark plug type	B-9HC
Electrical Equipment	Generator	Mitsubishi electric, DU100-12
	Battery	12V 5 Ah
	Headlight	12V 35/25W
	Tail/brake lamp	12V 7/23W
	Neutral indicator lamp	12V 3W
	Speedometer lamp	12V 3W
	High beam indicator lamp	12V 1.5W
Transmission System	Clutch type	Wet, multidisc
	Number of speeds, type	5-speed, constant mesh
	Primary reduction ratio	3.250 (65/20)
	Final reduction ratio	2.733 (41/15)
	Transmission gear ratios	
	1st gear	2.545 (28/11)
	2nd gear	1.533 (23/15)
	3rd gear	1.167 (21/18)
	4th gear	0.950 (19/20)
	5th gear	0.773 (17/22)
Steering	Steering angle	38° left and right
	Caster	63°
	Trail	3.5 in. (88.5mm)
Brakes	Front, type	Drum, internal expansion
	Rear, type	Drum, internal expansion

MODELS YDS3, YDS3-C, AND YM1

Engine	Type	2-stroke, air cooled
	Displacement	15 cu. in. (246cc)
	Bore x stroke	2.205 x 1.969 in. (56 x 50mm)
	Number of cylinders	2
	Compression ratio	7.5:1
	Maximum output	28 hp @ 8,000 rpm
	Maximum speed	95-100 mph (150 kmph)
	Starter type	Kickstarter
Fuel System	Carburetor	
	Manufacturer, model	Mikuni, VM24SC
	Main jet	130
	Needle jet	0-0
	Jet needle/clip position	4D4/2
	Cutaway	2.0
	Pilot jet	20
	Starter jet	40
	Air screw (No. of turns out)	1½
	Float level	25mm
	Fuel tank capacity	3.6 gal.(14 liters)
Lubrication	Engine	Yamaha Autolube
	Oil tank capacity	2.0 qts. (1.9 liters)
Ignition System	Ignition timing	0.071 in. (1.8mm)
	Spark plug type	B-8HC
Electrical equipment	Generator	Mitsubishi DV65/6DIL
	Battery	6V 7 Ah
Transmission System	Clutch type	Wet, multidisc
	Number of speeds, type	5-speed, constant mesh
	Transmission gear ratios	
	1st gear	2.545
	2nd gear	1.533
	3rd gear	1.166
	4th gear	0.950
	5th gear	0.773

MODEL YDS5

Engine	Type	2-stroke, air cooled
	Displacement	15 cu. in. (246cc)
	Bore x stroke	2.205 x 1.969 in. (56 x 50mm)
	Number of cylinders	2
	Compression ratio	7.5:1
	Maximum output	29.5 hp @ 8,000 rpm
	Maximum torque	19.68 ft.-lb. (2.72 mkg) @ 7,500 rpm
	Starter type	Electric starter and kickstarter
Fuel System	Carburetor	
	Manufacturer, model	Mikuni, VM26SC
	Main jet	120
	Needle jet	0-5
	Jet needle/clip position	4D3/2
	Cutaway	2.5
	Pilot jet	30
	Starter jet	40
	Air screw (No. of turns out)	1½
	Float level	1.0 in. (25.5mm)
	Fuel tank capacity	4 gal. (15 liters)
Lubrication	Engine	Yamaha Autolube
	Oil tank capacity	2.5 qts. (2.4 liters)
Ignition System	Ignition type	Battery ignition
	Ignition timing	0.071 in. (1.8mm)
	Spark plug type	B-8HC
Electrical Equipment	Generator	Mitsubishi electric CE-GL
	Battery	12V 11 Ah
	Headlight	12V 35/25W
	Tail/brake lamp	12V 8/25W
	Turn signal lamp	12V 8W
	Neutral indicator lamp	12V 3W
	Speedometer lamp	12V 3W
	High beam indicator lamp	12V 3W
Transmission System	Clutch type	Wet, multidisc
	Number of speeds, type	5-speed, constant mesh
	Primary reduction ratio	3.250
	Final reduction ratio	2.733 (41/15)
	Transmission gear ratios	
	1st gear	2.545
	2nd gear	1.533
	3rd gear	1.167
	4th gear	0.950
	5th gear	0.773
Steering	Steering angle	38° left and right
	Caster	63°
	Trail	3.48 in. (88.5mm)
Brakes	Front, type	Drum, internal expansion
	Rear, type	Drum, internal expansion

MODEL DS7

Engine	Type	2-stroke, air cooled
	Displacement	15.07 cu. in. (247cc)
	Bore x stroke	2.126 x 2.126 in. (54 x 54mm)
	Number of cylinders	2
	Compression ratio	7.1:1
	Maximum output	30 bhp @ 7,500 rpm
	Maximum torque	21.1 ft.-lb. (2.92 mkg) @ 7,000 rpm
	Starter type	Primary kickstarter
Fuel System	Carburetor	
	Manufacturer, model	Mikuni, VM26SC
	Main jet	100
	Needle jet	0-0
	Jet needle/clip position	5DP7/4
	Cutaway	2.0
	Pilot jet	40
	Starter jet	100
	Air screw (No. of turns out)	1½
	Float level	15.1mm
	Fuel tank capacity	3.2 gal. (12 liters)
Lubrication	Engine	Yamaha Autolube
	Oil tank capacity	2.1 qts. (2 liters)
Ignition System	Ignition type	Battery ignition
	Ignition timing	0.071 in. (1.8mm)
	Spark plug type	B-9HC
Electrical Equipment	Generator	Mitsubishi electric, AZ2010N
	Battery	12V 5.5 Ah
	Headlight	12V 35/35W
	Tail/brake lamp	12V 8/23W
	Turn signal lamp	12V 8W
	Neutral indicator lamp	12V 3W
	Speedometer lamp	12V 3W
	High beam indicator lamp	12V 2W
	Turn signal indicator lamp	12V 3W
Transmission System	Clutch type	Wet, multidisc
	Number of speeds, type	5-speed, constant mesh
	Primary reduction ratio	3.238 (68/21)
	Final reduction ratio	2.666 (40/15)
	Transmission gear ratios	
	1st gear	2.562 (41/16)
	2nd gear	1.590 (35/22)
	3rd gear	1.192 (31/26)
	4th gear	0.965 (28/29)
	5th gear	0.806 (25/31)
Steering	Steering angle	39°, 30′ left and right
	Caster	62°, 30′
	Trail	4.17 in. (106mm)
Brakes	Front, type	Drum, internal expansion
	Rear, type	Drum, internal expansion

MODELS RD250, RD250A, AND RD250B

Engine	Type	2-stroke, air cooled		
	Displacement	15.07 cu. in. (247cc)		
	Bore x stroke	2.126 x 2.126 in. (54 x 54mm)		
	Number of cylinders	2		
	Compression ratio	6.7:1		
	Maximum output	30 bhp @ 7,500 rpm		
	Maximum torque	21.1 ft.-lb. (2.92 mkg) @ 7,000 rpm		
	Starter type	Kickstarter		
Fuel System	Carburetor	**RD250**	**RD250A**	**RD250B**
	Manufacturer, model	Mikuni, VM28SC	Mikuni, VM28SC	Mikuni, VM28SC
	Main jet	120	120	90
	Needle jet	0-8	0-8	0-8
	Jet needle/clip position	514/3	514/3	514/3
	Cutaway	2.5	2.5	2.5
	Pilot jet	30	30	25
	Starter jet	100	70	70
	Air screw (No. of turns out)	1¾	1¾	1¼
	Float level	0.059 in. (15mm)	0.059 in. (15mm)	0.059 in. (15mm)
	Fuel tank capacity	3.2 gal. (12 liters)	3.2 gal. (12 liters)	3.2 gal. (12 liters)
Lubrication	Engine	Yamaha Autolube		
	Oil tank capacity	2.1 qts. (2 liters)		
Ignition System	Ignition type	Battery ignition		
	Ignition timing	0.079 in. (2.0mm)		
	Spark plug type	8-8HS		
Electrical Equipment		**RD250, RD250A**		**RD250B**
	Generator	Mitsubishi, AZ2010NI		Same
	Battery	12V 5.5 Ah		Same
	Headlight	12V 8/27W		12V 35/25W
	Tail/brake lamp	12V 8/27W		Same
	Turn signal lamp	12V 3W		Same
	Neutral indicator lamp	12V 3W		Same
	Speedometer lamp	12V 3W		Same
	High beam indicator lamp	12V 3W		Same
	Turn signal indicator lamp	12V 3W		Same
Transmission System	Clutch type	Wet, multidisc		
	Number of speeds, type	6-speed, constant mesh		
	Primary reduction ratio	3.238 (68/21)		
	Final reduction ratio	2,666 (40/15)		
	Transmission gear ratios			
	1st gear	2.571 (36/14)		
	2nd gear	1.777 (32/18)		
	3rd gear	1.318 (29/22)		
	4th gear	1.040 (26/25)		
	5th gear	0.888 (24/27)		
	6th gear	0.785 (22/28)		
Steering	Caster	62° 30′		
	Trail	4.17 in. (106mm)		
Brakes	Front, type	Drum, internal expansion		
	Rear, type	Drum, internal expansion		

MODEL YM2

Engine	Type	2-stroke, air cooled
	Displacement	18.6 cu. in. (305cc)
	Bore x stroke	2.36 x 2.12 in. (60 x 54mm)
	Number of cylinders	2
	Compression ratio	7.5:1
	Maximum output	30.5 hp @ 7,000 rpm
	Maximum torque	23.15 ft.-lb. (3.20 mkg) @ 6,500 rpm
	Starter type	Kickstarter
Fuel System	Carburetor	
	Manufacturer, model	Mikuni, VM26SC
	Main jet	110
	Needle jet	0-5
	Jet needle/clip position	403/2
	Cutaway	2.5
	Pilot jet	30
	Starter jet	40
	Air screw (No. of turns out)	1½
	Float level	1 in. (25.5mm)
	Fuel tank capacity	4 gal. (15 liters)
Lubrication	Engine	Yamaha Autolube
	Oil tank capacity	2.5 qts. (2.4 liters)
Ignition System	Ignition type	Battery ignition
	Ignition timing	0.083 in. (2.1mm)
	Spark plug type	B-8HC
Electrical Equipment	Generator	Mitsubishi electric, DU100/12BL
	Battery	12V 5.5 Ah
	Headlight	12V 35/25W
	Tail/brake lamp	12V 8/25W
	Turn signal lamp	12V 8W
	Neutral indicator lamp	12V 3W
	Speedometer lamp	12V 3W
	High beam indicator lamp	12V 3W
Transmission System	Clutch type	Wet, multidisc
	Number of speeds, type	5-speed, constant mesh
	Primary reduction ratio	3.250
	Final reduction ratio	2.500 (40/16)
	Transmission gear ratios	
	1st gear	2.545
	2nd gear	1.533
	3rd gear	1.167
	4th gear	0.950
	5th gear	0.773
Steering	Steering angle	38° left and right
	Caster	63°
	Trail	3.48 in. (88.5mm)
Brakes	Front, type	Drum, internal expansion
	Rear, type	Drum, internal expansion

MODEL R5

Engine	Type	2-stroke, air cooled
	Displacement	21.18 cu. in. (347cc)
	Bore x stroke	2.520 x 2.126 in. (64 x 54mm)
	Number of cylinders	2
	Compression ratio	6.9:1
	Maximum output	36 bhp @ 7,000 rpm
	Maximum torque	20.0 ft.-lb. (3.87 mkg) @ 6,500 rpm
	Starter type	Kickstarter
Fuel System	Carburetor	
	Manufacturer, model	Mikuni, VM28SC
	Main jet	120
	Needle jet	0-0
	Jet needle/clip position	5DP7-4
	Cutaway	2.0
	Pilot jet	40 (30 for R5-C)
	Starter jet	100 (left carburetor only)
	Air screw (No. of turns out)	1¼-1¾
	Float level	0.59 in. (15mm)
	Fuel tank capacity	3.2 gal. (12 liters)
Lubrication	Engine	Yamaha Autolube
	Oil tank capacity	2.1 qts. (2 liters)
Ignition System	Ignition type	Battery ignition
	Ignition timing	0.083 in. (2.1mm)
	Spark plug type	B-9HC (B8HS for R5-C)
Electrical Equipment	Generator	Mitsubishi electric, AZ2010N
	Battery	12V 5.5 Ah
	Headlight	12V 35/35W
	Tail/brake lamp	12V 8/23W
	Turn signal lamp	12V 8W
	Neutral indicator lamp	12V 3W
	Speedometer lamp	12V 3W
	High beam indicator lamp	12V 1.5W (2W for R5-C)
	Turn signal indicator lamp	12V 3W
Transmission System	Clutch type	Wet, multidisc
	Number of speeds, type	5-speed, constant mesh
	Primary reduction ratio	2.869 (66/23)
	Final reduction ratio	2.666 (40/15)
	Transmission gear ratios	
	1st gear	2.562 (41/16)
	2nd gear	1.590 (35/22)
	3rd gear	1.192 (31/26)
	4th gear	0.965 (28/29)
	5th gear	0.806 (25/31)
Frame	Type	Double cradle
	Suspension, front	Telescopic fork
	Suspension, rear	Swing arm
Steering	Steering angle	39° 30′ left and right
	Caster	62° 30′
	Trail	4.17 in. (106mm)
	Minimum turning radius	90.6 in. (2,300mm)
Brakes	Front, type	Drum, internal expansion
	Rear, type	Drum, internal expansion

MODELS RD350, RD350A, RD350B

Engine	Type	2-stroke, air cooled	
	Displacement	21.18 cu. in. (347cc)	
	Bore x stroke	2.520 x 2.126 in. (64 x 54mm)	
	Number of cylinders	2	
	Compression ratio	6.6:1	
	Maximum output	39 hp @ 7,500 rpm	
	Maximum torque	28.0 ft.-lb. (3.87 mkg) @ 7,000 rpm	
	Starter type	Kickstarter	
Fuel System		RD350	RD350A, RD350B
	Carburetor		
	Manufacturer, model	Mikuni, VM28SC	Mikuni, VM28SC
	Main jet	140	140
	Needle jet	0-8	0-8
	Jet needle/clip position	514/3	514/4
	Cutaway	2.5	2.5
	Pilot jet	25	25
	Starter jet	100	70
	Air screw (No. of turns out)	1¾	1¾
	Float level	0.59 in. (15mm)	0.59 in. (15mm)
	Fuel tank capacity	3.2 gal. (12 liters)	3.2 gal. (12 liters)
Lubrication	Engine	Yamaha Autolube	
Ignition System	Ignition type	Battery ignition	
	Ignition timing	0.79 in. (2.0mm)	
	Spark plug type	B-8HS	
Electrical Equipment	Generator	Mitsubishi, AZ2010NI	
	Battery	12V 5.5 Ah	
	Headlight	12V 35/25W	
	Tail/brake lamp	12V 8/27W	
	Turn signal lamp	12V 27W	
	Neutral indicator lamp	12V 3W	
	Speedometer lamp	12V 3W	
	High beam indicator lamp	12V 3W	
	Turn signal indicator lamp	12V 3W	
Transmission System	Clutch type	Wet, multidisc	
	Number of speeds, type	6-speed, constant mesh	
	Primary reduction ratio	2.869 (66/23)	
	Final reduction ratio	2.666 (40/15)	
	Transmission gear ratios		
	1st gear	2.571 (36/14)	
	2nd gear	1.777 (32/18)	
	3rd gear	1.318 (29/22)	
	4th gear	1.040 (26/25)	
	5th gear	0.888 (24/27)	
	6th gear	0.785 (22/28)	
Steering	Caster	62° 30′	
	Trail	4.17 in. (106mm)	
Brakes	Front, type	Disc, hydraulic	
	Rear, type	Drum, internal expansion	

MODEL R3

Engine	Type	2-stroke, air cooled
	Displacement	21.2 cu. in. (348cc)
	Bore x stroke	2.40 x 2.34 in. (61 x 59.6mm)
	Number of cylinders	2
	Compression ratio	7.5:1
	Maximum out put	36 hp @ 7,000 rpm
	Maximum torque	28.0 ft.-lb. (3.87 mkg) @ 6,000 rpm
	Starter type	Kickstarter
Fuel System	Carburetor	
	Manufacturer, model	Mikuni, VM28SC
	Main jet	170
	Needle jet	0-2
	Jet needle/clip position	5D1/3
	Cutaway	2.0
	Pilot jet	30
	Starter jet	40
	Air screw (No. of turns out)	1½
	Float level	1 in. (25.5mm)
	Fuel tank capacity	4 gal. (15 liters)
Lubrication	Engine	Yamaha Autolube
	Oil tank capacity	3.38 qts. (3.2 liters)
Ignition System	Ignition type	Battery ignition
	Ignition timing	0.083 in. (2.1mm)
	Spark plug type	B-9HC
Electrical Equipment	Generator	Mitsubishi electric, DU100-12
	Battery	12V 5 Ah
	Headlight	12V 35/25W
	Tail/brake lamp	12V 7/23W
	Turn signal lamp	12V 8W
	Neutral indicator lamp	12V 3W
	Speedometer lamp	12V 3W
	High beam indicator lamp	12V 1.5W
	Turn signal indicator lamp	12V 3W
Transmission System	Clutch type	Wet, multidisc
	Number of speeds, type	5-speed, constant mesh
	Primary reduction ratio	2.870 (66/23)
	Final reduction ratio	2.730 (41/15)
	Transmission gear ratios	
	1st gear	2.545 (28/11)
	2nd gear	1.60 (24/15)
	3rd gear	1.167 (21/18)
	4th gear	0.950 (19/20)
	5th gear	0.773 (17/32)
Steering	Steering angle	40° left and right
	Caster	63°
	Trail	3.48 in. (88.5mm)
Brakes	Front, type	Drum, internal expansion
	Rear, type	Drum, internal expansion

MODELS YR1, YR2, AND YR2-C

Engine	Type	2-stroke, air cooled	
	Displacement	21.23 cu. in. (348cc)	
	Bore x stroke	2.40 x 2.34 in. (61 x 59.6mm)	
	Number of cylinders	2	
	Maximum output	36 hp @ 7,000 rpm	
	Maximum speed	100-110 mph (173 kmph)	
	Starter type	Kickstarter	
Fuel System		**YR1**	**YR2, YR2-C**
	Carburetor		
	Manufacturer, model	Mikuni, VM28SC	Mikuni, VM28SC
	Main jet	170	170
	Needle jet	0-2	0-2
	Jet needle/clip position	5D1/2	5D1/3
	Cutaway	1.5	2.0
	Pilot jet	30	30
	Starter jet	40	40
	Air screw (no. of turns out)	2¼	1¼
	Float level	1 in. (25.5mm)	1 in. (25.5mm)
	Fuel tank capacity	4 gal. (15 liters)	4 gal. (15 liters)
Lubrication	Engine	Yamaha Autolube	
	Oil tank capacity	3.3 qts. (3.2 liters)	
Ignition System	Ignition type	Battery ignition	
	Ignition timing	0.083 in. (2.1mm)	
	Spark plug type	B-8HC	
Electrical Equipment	Generator	Mitsubishi, DU100/12AR	
	Battery	12V 5.5 ah	
	Headlight	12V 35/25W	
	Tail/brake lamp	12V 8/25W	
	Turn signal lamp	12V 8W	
	Neutral indicator lamp	12V 3W	
	Speedometer lamp	12V 3W	
	High beam indicator lamp	12V 3W	
Transmission System	Clutch type	Wet, multidisc	
	Number of speeds, type	5-speed, constant mesh	
	Primary reduction ratio	2.870	
	Final reduction ratio	2.560 (41/16)	
	Transmission gear ratios		
	1st gear	2.545	
	2nd gear	1.600	
	3rd gear	1.600	
	4th gear	1.168	
	5th gear	0.770	
Steering	Steering angle	40° left and right	
	Caster	63°	
	Trail	3.48 in. (88.5mm)	
Brakes	Front, type	Drum, internal expansion	
	Rear, type	Drum, internal expansion	

MODEL RD400

Engine	Type	2-stroke, air cooled
	Displacement	28.23 cu. in. (398cc)
	Bore x stroke	2.520 x 2.460 in. (64 x 62mm)
	Number of cylinders	2
	Maximum horsepower	43 hp @ 7,500 rpm
	Maximum torque	28 ft.-lb. (3.92 mkg) @ 6,500 rpm
	Compression ratio	6.2:1
	Starter type	Kickstarter
Fuel System	Carburetor	
	Manufacturer, model	Mikuni, VM28SC
	Main jet	115
	Needle jet	P-2
	Jet needle/clip position	5L 1-3
	Cutaway	2.5
	Pilot jet	25
	Starter jet	70
	Air screw (No. of turns out)	1¾
	Float level	0.59 in. (15mm)
	Fuel tank capacity	3.4 gal. (13 liters)
Lubrication	Engine	Yamaha Autolube
Ignition System	Ignition type	Battery ignition
	Ignition timing	0.79 in. (2.0mm)
	Spark plug type	B-8ES
Electrical Equipment	Generator	Mitsubishi, AZ2010NI
	Battery	12V 5.5 Ah
	Headlight	12V 35/25W
	Tail/brake lamp	12V 8/25W
	Turn signal lamp	12V 8W
	Neutral indicator lamp	12V 3W
	Speedometer lamp	12V 3W
	High beam indicator lamp	12V 3W
Transmission System	Clutch type	Wet, multidisc
	Number of speeds, type	6-speed, constant mesh
	Primary reduction ratio	2.870
	Final reduction ratio	2.666 (40/15)
	Transmission gear ratios	
	1st gear	2.571
	2nd gear	1.777
	3rd gear	1.318
	4th gear	1.040
	5th gear	0.888
	6th gear	0.785
Steering	Steering angle	40° left and right
	Caster	63°
	Trail	4.17 in.
Brakes	Front, type	Disc, hydraulic
	Rear, type	Disc, hydraulic

YAMAHA 250-400cc TWINS
Supplement for United Kingdom

This supplement points out special features of bikes delivered to the United Kingdom.

LUBRICANTS AND PETROL

U.K. models use the same lubricants and petrol as U.S. models. **Table 1** provides the recommended capacities and types in Imperial measure.

Table 1
RECOMMENDED LUBRICANTS AND FUEL

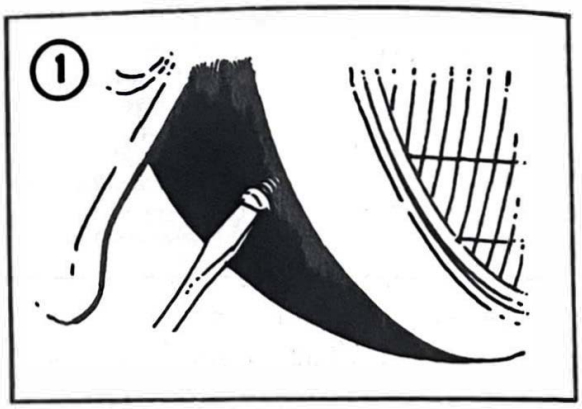
	Capacity	Type
Engine oil	3.5 Imp. pt.	SAE 30 2-stroke engine oil
Gearbox oil	2.6 Imp. pt.	SAE 10W-30 engine oil
Front forks	145cc 4.1 Imp. oz. (per leg)	SAE 10W-30 engine oil
Fuel	3.2 Imp. gal.	85 octane or higher
Brake fluid	—	J-1703

HEADLAMP

U.K. models use a prefocused headlamp bulb and a city (pilot) lamp.

Headlamp Bulb Replacement

1. Remove the screw holding the headlamp rim in place, then remove the headlamp rim and reflector unit (**Figure 1**).
2. The bulb holder is held in place in the reflector by a rubber sleeve. To remove the bulb holder, pry the rubber sleeve back and pull gently outward on the bulb holder (**Figure 2**).

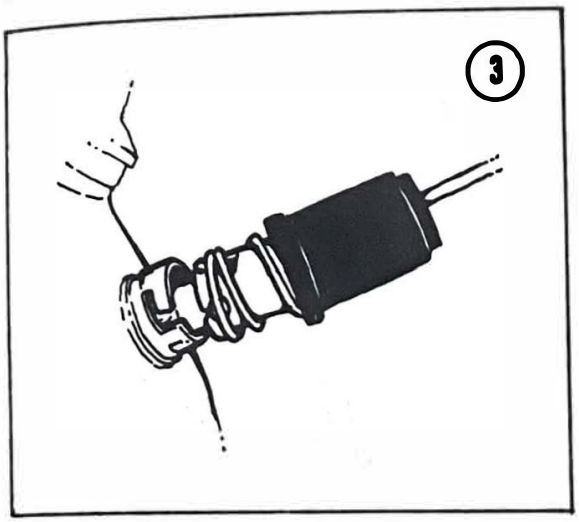


3. The bulb bayonets into the bulb holder. To remove it, push slightly inward and twist gently counterclockwise and pull the bulb out.
4. To install a new bulb, reverse the preceding steps.

City (Pilot) Lamp Bulb Replacement

1. The city (pilot) lamp bulb holder bayonets into the reflector shell. To remove it, push

slightly inward and twist gently to the left and pull it out (**Figure 3**).



2. To remove the bulb, press inward and twist counterclockwise and lift it out (**Figure 3**).
3. To install a new bulb, reverse the preceding steps.

BULB TYPES

Table 2 lists bulbs used in U.K. models.

Table 2 BULB TYPES

Application	Type
Headlamp	35/35W
Tail/stop lamp	8/23W
Turn signal lamps	8W
City (pilot) lamp	3W
Instrument lamps	3W

PERFORMANCE EQUIPMENT

Most of the performance equipment mentioned in Chapter Eight is available in the U.K. from the suppliers listed in **Table 3**. They are quite knowledgeable and can give you additional guidance to help you achieve the performance you desire.

Table 3 PERFORMANCE EQUIPMENT SUPPLIERS

Supplier	Comments
Dixon Racing, Ltd. Farncombe Street Farncombe, Godalming GU7 3BA Telephone: Godalming 28928	S&W suspensions, Lockhart oil coolers
Gus Kuhn Motors, Ltd. 275-7 Clapham Road London SW9 9BJ Telephone: 01-733-1002	Yamaha spares and performance equipment

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NOTES

YAMAHA

250-400cc 2-STROKE TWINS · 1965-1978

SERVICE • REPAIR • PERFORMANCE

DS6 Series	250cc	R3 Series	350cc
DS7	250cc	R5 Series	350cc
RD250 Series	250cc	RD350 Series	350cc
YDS3 Series	250cc	YR1	350cc
YDS5	250cc	YR2 Series	350cc
YM1	250cc	RD400 Series	400cc
YM2 Series	305cc		

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