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**TOOLS AND EQUIPMENT**

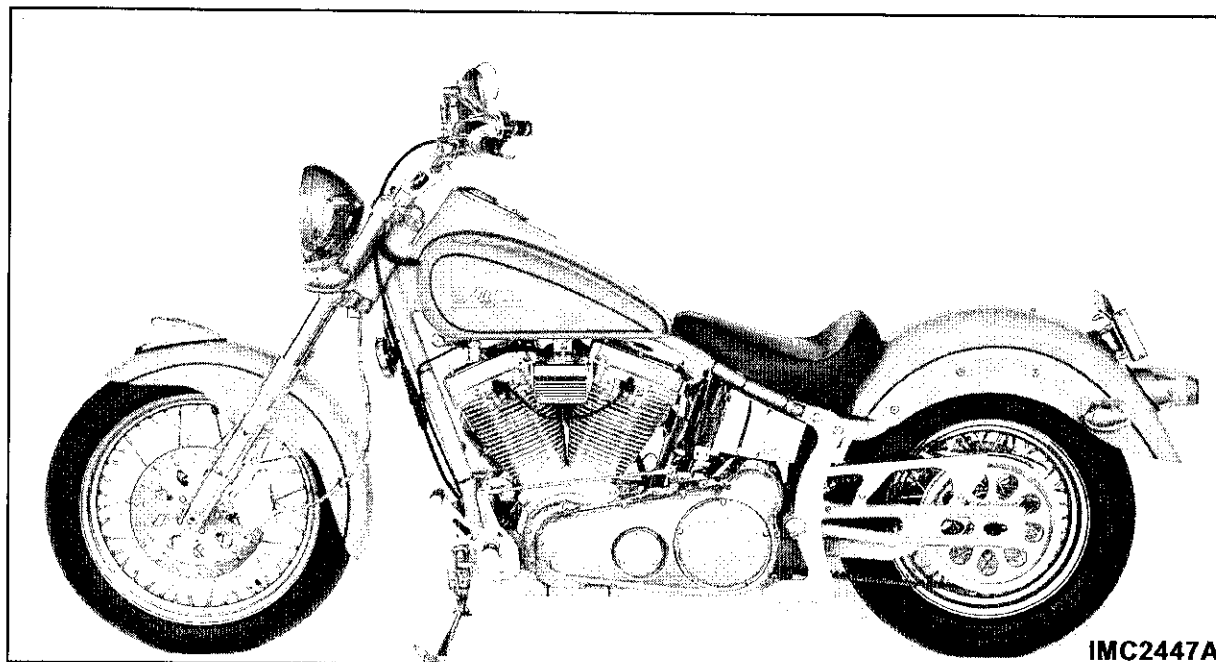
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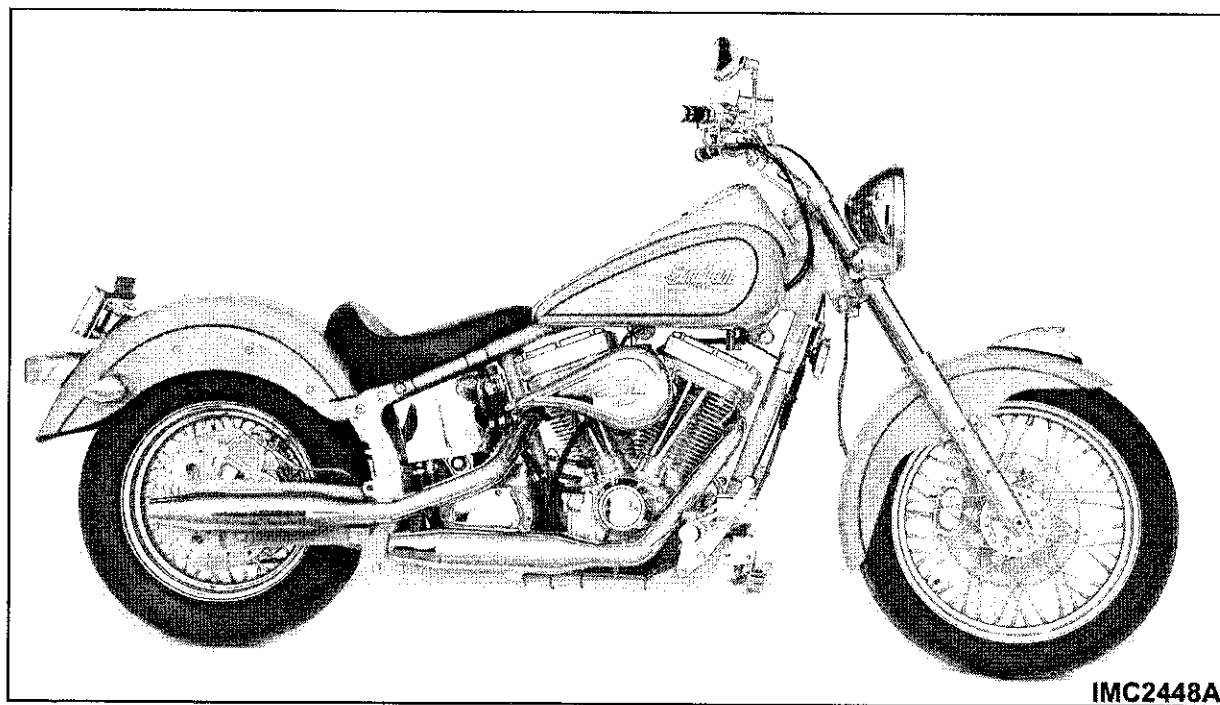
## FEATURES OF THE 2003 INDIAN SCOUT/SPIRIT MOTORCYCLES

The Indian Scout and Spirit motorcycles have a heritage going back to the beginning of the twentieth century. Today, the motorcycles carry forth the tradition and craftsmanship with

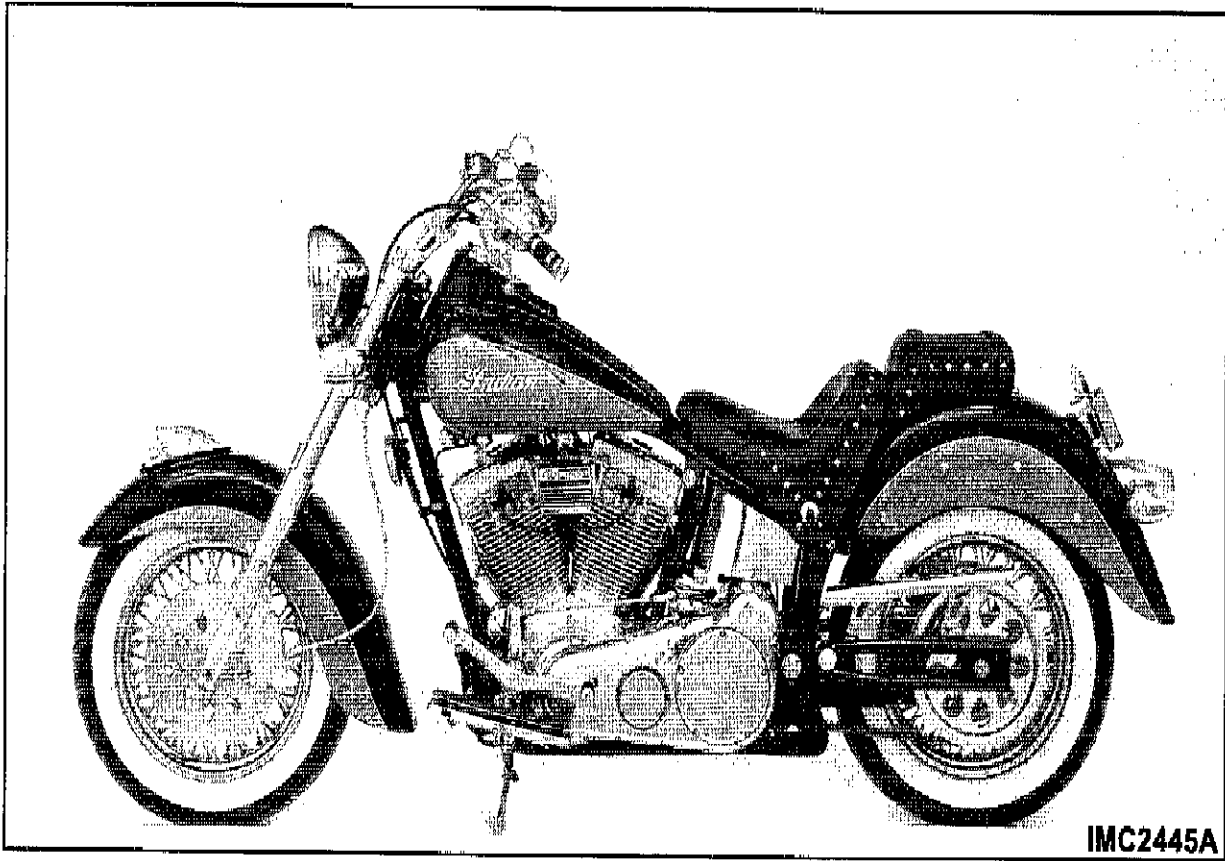
three models each: the Scout with Standard, Deluxe and Springfield models, and the Spirit with Deluxe, Springfield and Roadmaster models.



*Figure 1 — Indian Scout Standard (left side)*

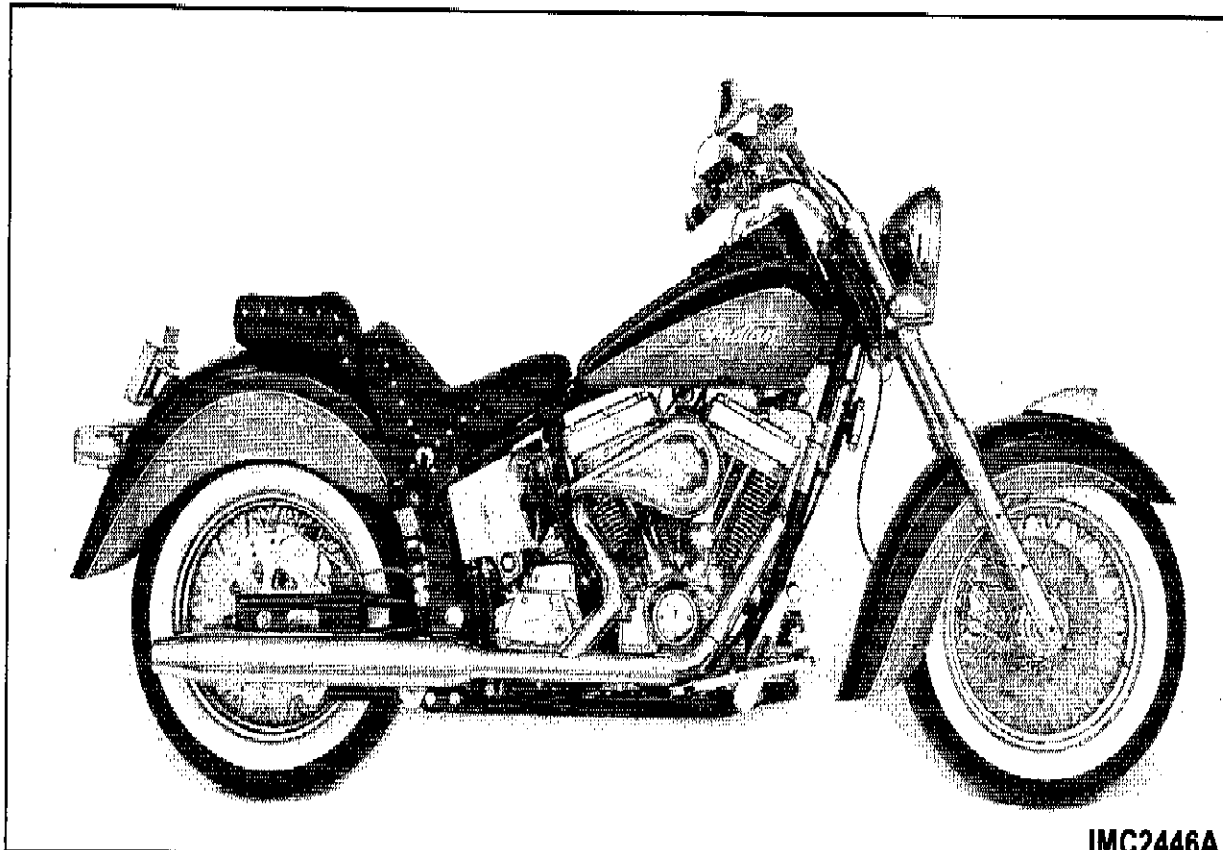


*Figure 2 — Indian Scout Standard (right side)*



IMC2445A

*Figure 3 — Indian Spirit Deluxe (left side)*



IMC2446A

## Component and System Descriptions

### Chassis

**Front suspension** — Scout and Spirit models are fitted with a conventional-style front suspension with hydraulic compression and rebound damping. The upper fork tubes (stanchions) are 41 mm in diameter.

**Steering** — Both the Scout and Spirit models have a 32-degree rake for the front forks. This rake provides a front-wheel trail dimension of 5.25" (Scout) and 5.42" (Spirit) with the standard 100/90-19 and 130/90-16 sized tires, respectively.

**Rear suspension** — The rear swingarm is suspended at the bottom on dual shock absorbers. Spring preload for the shock absorbers is adjustable.

**Brakes** — Single-disc brakes are used on both the front and rear wheels at the left and right sides respectively. Both feature four-piston calipers in combination with 11.5" rotors.

**Wheels and tires** — There are differences in the wheels and tires that are standard equipment on the models. Scout models come equipped with 40-spoke chrome steel wheels. A 19" wheel with a 2.15" rim and 100/90-19 tire is used at the front; whereas, at the rear, a 16" wheel with a 3.5" rim and 130/90-16 tire is used.

Spirit models are equipped with 60-spoke chrome steel wheels. These are 16" wheels with 3.5" rims and are fitted with 130/90-16 tires at both front and rear locations.

**Frame** — The frame is constructed of high-tensile steel and protected with a powder-coated finish. Fitted with the standard rear swingarm and front suspension, the frame provides a wheelbase of 67" for all models.

### Engine and Related Systems

**Basic engine** — The Scout and Spirit models are powered by the S&S Super Stock engine that is a four-cycle, two-cylinder engine with a 45-degree V-configuration. Its bore and stroke give it a displacement of 88 cubic inches. At a compression ratio of 9.4:1, the engine produces 57 hp (Scout) or 62 hp (Spirit).

The piston connecting rods are a fork-and-blade style connected to a common crank pin joining two flywheels. The crank pin is set between the pinion shaft flywheel to the right and the sprocket shaft flywheel to the left. The sprocket shaft drives the compensator sprocket in the primary case at the left side of the motorcycle. The sprocket shaft carries the alternator rotor, between the engine crankcase and the compensator. The pinion shaft drives the camshaft, oil pump and breather valve through gearing at the right side of the engine.

The camshaft actuates the intake and exhaust valves through a valve train that includes roller lifters, pushrods and rocker shaft assemblies. The roller lifters, following the cam lobes, raise the pushrods and rocker arms to open the intake and exhaust valves at the appropriate times in the intake and exhaust cycles.

**Lubrication system** — The lubrication system incorporates a spur gear oil pump located at the back of the cam housing. The pump, which is driven by a worm gear fitted on the pinion shaft, provides positive lubrication to the engine. Mounted on an adapter at the upper front of the crankcase is a full-flow, spin-on type filter to screen the lubricating oil as it circulates through the system.

**Fuel system** — The fuel system includes dual tanks with a total capacity of 5.5 gallons including the 1.2-gallon reserve. Fuel is gravity fed to a S&S Super E carburetor mounted at the right side of the engine between the cylinder heads. The carburetor features a 47.6 mm bore.

**Ignition system** — Combustion is controlled with a computerized electronic ignition system. The system's electronic module and timing sensor controls output to the spark plugs in the cylinders. The ignition rotor, attached to the end of the pinion shaft, in combination with the sensor in the ignition cover, provides the "trigger" signal for the electronic ignition system.

The computerized system simplifies service, eliminating the need for timing adjustments. Timing is preset and electronically controlled.

**Emission controls** — On California-only models, an evaporative system is used. The system consists of a vacuum solenoid (that works in combination with the enricher valve), tank vapor valve, a carbon canister and interconnecting vent and purge lines. Together, these components effectively seal the air intake and fuel system, preventing the escape of hydrocarbons into the atmosphere.

**Exhaust system** — The Scout is equipped with a dual exhaust system with two chrome mufflers. The Spirit is equipped with a single chrome muffler with a dual inlet for the two pipes from the cylinders. Chrome heat shields cover the pipes between the cylinder heads and the muffler(s).

## Engine Component Locations

The following views identify the location of major chassis and engine-related parts and accessories referenced in this manual.

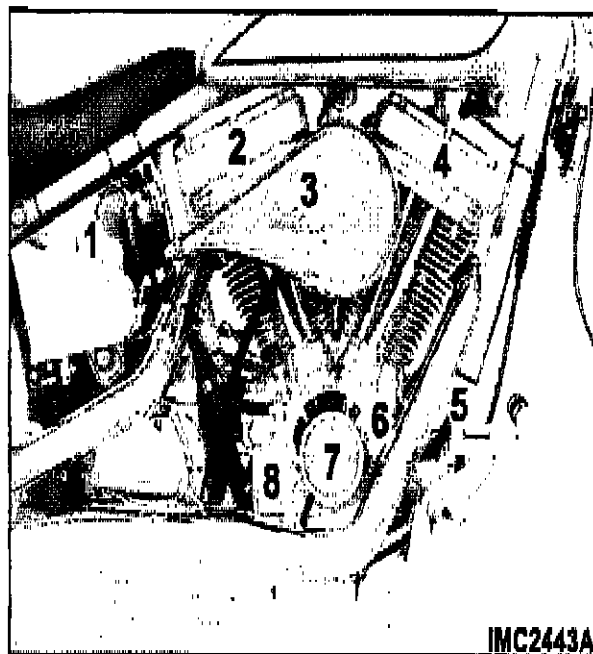


Figure 5 — Indian Scout motorcycle (right side)

1. Oil filler and dipstick
2. Rear cylinder
3. Air cleaner housing cover
4. Front cylinder
5. Oil filter (behind exhaust pipe)
6. Cam cover
7. Ignition cover
8. Oil pump

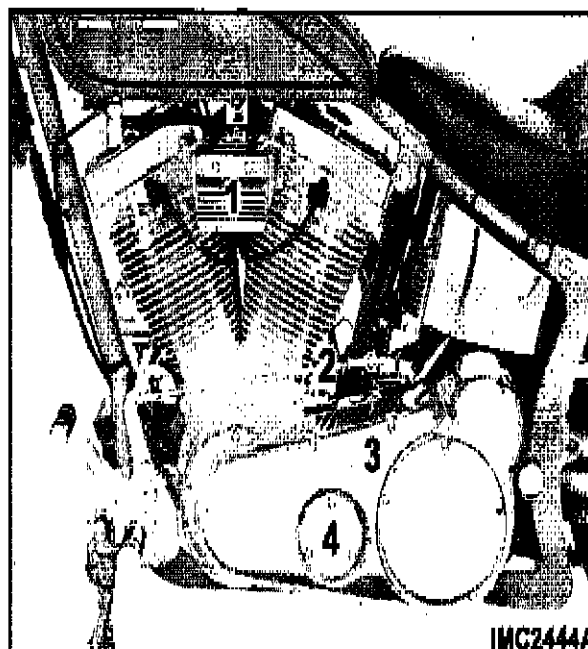


Figure 6 — Indian Scout motorcycle (left side)

1. Ignition coil and upper engine support
2. Transmission shift rod
3. Outer primary housing
4. Primary chain inspection cover

## Transmission and Drive

**Primary drive** — A dual-track drive chain links the engine compensator sprocket with the clutch sprocket. The wet-type clutch utilizes 10 friction plates to transfer engine power smoothly to the transmission. The 24-tooth compensator sprocket, in combination with the 37-tooth clutch sprocket, provides a reduction of 1.54:1.

**Transmission** — The transmission is a proprietary single-countershaft design with input and output drives on the same side. The constant mesh, 5-speed gearing, provides a range of ratios, from 3.24:1 in first gear to 1:1 direct in fifth gear.

**Rear drive** — The rear drive uses a cogged, aramid-reinforced belt, 1-7/16" wide, connecting the transmission output drive sprocket with the rear wheel sprocket. The combination of the 32-cog drive sprocket and 65-cog rear wheel sprocket provides

## MOTORCYCLE IDENTIFICATION

There are three significant identification numbers on the motorcycle. The numbers include the chassis Vehicle Identification Number (VIN) along with individual serial numbers for the engine and transmission.

### Chassis VIN

The primary number used to identify the motorcycle is the chassis VIN. This is a 17-position alphanumeric number conforming to governmental standards for identification of motorized vehicles.

Within the first 11 positions, the number provides information such as vehicle type, make, model, model year, engine, etc. The last six numeric positions identify the build sequence.

**Location** — The VIN is stamped into a plate welded to the front frame tube on the right side near the fork pivot. It is also printed on the mylar certification label affixed to the frame tube just below the VIN plate.

Use the following table to interpret the VIN example.

- Model: All
- Year: All
- VIN example: 5CDNNCAJ\_3G000002

| Position | Description         | Code                                      | Code Description                                                                                                                                                                                                                     |
|----------|---------------------|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1        | WMI                 | 5                                         | Supplied by SAE                                                                                                                                                                                                                      |
| 2        | WMI                 | C                                         | Supplied by SAE                                                                                                                                                                                                                      |
| 3        | WMI                 | D                                         | Supplied by SAE                                                                                                                                                                                                                      |
| 4        | Type                | C<br>N<br>M                               | Motorcycle — Stretched and raked smoothtail (Chief 99–01)<br>Motorcycle — Single downtube monoshock frame (Chief 02 +)<br>Motorcycle — Single downtube smoothtail (Scout/Spirit 01 +)                                                |
| 5        | Line (Model)        | N<br>3<br>X<br>R<br>V<br>T<br>C<br>5<br>A | Chief Standard/Springfield<br>Chief Centennial<br>Chief Deluxe<br>Chief Roadmaster<br>Chief Vintage<br>Scout Standard/Deluxe/Springfield<br>Scout Centennial<br>Spirit Standard/Deluxe/Roadmaster/Springfield<br>Terminator 3, Chief |
| 6        | Engine Type         | B<br>C                                    | Engine 88 CID<br>Engine 100 CID                                                                                                                                                                                                      |
| 7        | Horsepower          | 5<br>A                                    | 85 HP (S&S 88)<br>75 HP (Indian POWERPLUS™ 100)                                                                                                                                                                                      |
| 8        | Engine Make         | 1<br>J                                    | S&S<br>Indian                                                                                                                                                                                                                        |
| 9        | Check Digit         | —                                         |                                                                                                                                                                                                                                      |
| 10       | Model Year          | X<br>Y<br>1<br>2<br>3                     | 1999<br>2000<br>2001<br>2002<br>2003                                                                                                                                                                                                 |
| 11       | Plant               | G                                         | Gilroy manufacturing plant                                                                                                                                                                                                           |
| 12–17    | Production Sequence |                                           | Six-digit production sequence number                                                                                                                                                                                                 |



## Engine Serial Number

**Location** — The six-character engine serial number is stamped into a pad on the left side of the engine crankcase, just above the primary housing and at the base of the front cylinder. A letter is used in the first position to designate the production model year which begins on October 1 of each year. The model year letter is followed by the production sequence number, for example, D00001. Model year production letter assignments are as follow:

A — 2000 model year (starting October 1, 1999)

B — 2001 model year (starting October 1, 2000)

C — 2002 model year (starting October 1, 2001)

D — 2003 model year (starting October 1, 2002)

## Transmission Serial Number

**Location** — The transmission serial number is a seven-position alphanumeric number stamped into the transmission case on the top edge of the starter-mounting flange.

# MAINTENANCE SERVICE, REPAIRS AND SAFETY

This is a complete manual, providing the information necessary to perform full overhaul and rebuild operations in addition to the very routine maintenance service and adjustments. Procedures are included for servicing components and subassemblies off the motorcycle from disassembly, cleaning and inspection to reassembly.

Generally, all specifications including torque values are given in English measurements. Where applicable, however, metric measurements and values are provided.

 **Note:** *Indian Motorcycle Corporation continuously strives for improvements in product design, quality and performance. As a result of running changes made during the production cycle, the information, illustrations and descriptions in this manual may differ from the motorcycle that is in for service.*

For your own safety and proper service of the motorcycle, follow the instructions and warnings contained in this manual. Ignoring them could result in damage to the motorcycle or personal injury to you or others.

### WARNING!

A “warning” indicates the possibility of personal injury to yourself or others if the instructions presented are not followed.

### CAUTION!

A “caution” indicates the possibility of damage to the motorcycle if the instructions presented are not followed.

 **Note:** *A “note” (placed in italic type) indicates information that may be important in understanding the significance of a procedure or useful in performing the maintenance, adjustment or repair procedure.*

## MAINTENANCE

Maintenance requirements for the Indian Chief motorcycle include three levels of service performed at specific mileage intervals. The three levels of service include the following:

**Primary Service** — at 500 miles, 5,000 miles and every 10,000 miles thereafter

**Interval Service** — at 2,500 miles and every 5,000 miles thereafter

**Renewal Service** — at 10,000 miles and every 10,000 miles thereafter

### Primary Service

Perform the following 30 **Primary Service** checks and procedures at 500 miles, 5,000 miles, 15,000 miles and at every 10,000 miles thereafter.

1. Change the engine oil and replace the oil filter (*page 133*).
2. Change the transmission fluid and clean the magnetic drain plug.
3. Check the brake fluid level and condition (*page 76*).
4. Inspect the oil lines (*page 134*) and brake system for leaks (*page 76*).
5. Lubricate the front brake hand lever, throttle control cable, throttle control grip, clutch control cable and clutch control hand lever (*pages 108 and 201*).
6. Clean the magnetic speedometer sensor.
7. Lubricate the kickstand, gear shifter and brake lever bushings.
8. Check the rear brake pedal adjustment (*page 87*).
9. Inspect the brake pads and discs for wear (*pages 77 and 84*).
10. Inspect the inner primary chain (*page 185*).
11. Change the primary drive oil.
12. Check and adjust the rear drive belt (*page 197*).
13. Inspect the clutch control cable and adjust as required (*page 202*).
14. Inspect the air filter and replace it as required (*page 103*).
15. Inspect the fuel filter screen; clean or replace it as required (*page 106*).
16. Check the enrichener operation and adjust it as required (*page 115*).
17. Check the engine idle speed adjustment (*page 117*).
18. Inspect the fuel valve (petcock), fuel lines and fittings for leaks (*pages 106 and 108*).
19. Clean the battery connections (*page 247*).
20. Check the operation of electrical equipment and switches (*page 252*).
21. Check the condition of the spark plugs (*page 14*).
22. Check the ignition timing (*page 130*).

23. Check the tires for proper inflation pressure and for signs of wear (*page 63*).
24. Check wheel spoke tightness (*page 62*).
25. Check the rear shock absorbers and rubber bushings (*page 50*).
26. Check the swingarm pivot bolts for proper tightness (*page 53*).
27. Check the steering head bearing adjustment (*page 40*).
28. Check alignment.
29. Check the tightness of all fasteners, except the engine cylinder head bolts.
30. Conduct a road test.

### Interval Service

Perform the following 14 **Interval Service** checks and procedures at 2,500 miles, 7,500 miles and at every 5,000 miles thereafter.

1. Change the engine oil and replace the oil filter (*page 133*).
2. Clean the tappet screen.
3. Check the level and condition of the transmission fluid (*page 213*).
4. Check the level and condition of the primary oil.
5. Check the battery and clean the battery terminal connections (*page 247*).
6. Inspect the fuel valve (petcock), fuel lines and fittings for leaks (*pages 106 and 108*).
7. Check the operation of the enrichener and throttle.
8. Check the operation of electrical equipment and switches (*page 252*).
9. Check the rear drive belt (*page 197*).
10. Check the brake fluid level and condition (*page 76*).
11. Clean the magnetic speedometer sensor.
12. Inspect the brake pads and discs for wear (*pages 77 and 84*).
13. Check the tires for proper inflation pressure and for signs of wear (*page 63*).
14. Conduct a road test.

## Renewal Service

Perform the following 34 **Renewal Service** checks and procedures at 10,000 miles and at every 10,000 miles thereafter.

1. Change the engine oil and replace the oil filter (*page 133*).
2. Clean the tappet screen.
3. Change the transmission fluid and clean the magnetic drain plug.
4. Replace the brake fluid (*page 91*).
5. Inspect the oil lines and brake system for leaks (*page 76*).
6. Lubricate the front brake hand lever, throttle control cable, throttle control grip, clutch control cable and clutch control hand lever (*pages 108 and 201*).
7. Clean the magnetic speedometer sensor.
8. Lubricate the kickstand, gear shifter and brake lever bushings.
9. Check the rear brake pedal adjustment (*page 87*).
10. Inspect the brake pads and discs for wear (*pages 77 and 84*).
11. Inspect the primary chain for proper adjustment (*page 185*).
12. Change the primary drive oil.
13. Check and adjust the rear drive belt (*page 197*).
14. Inspect the clutch control cable and adjust as required (*page 202*).
15. Inspect the air filter and clean or replace it as required (*page 103*).
16. Inspect the fuel filter screen; clean or replace it as required (*page 106*).
17. Check the enrichener operation and adjust it as required (*page 115*).
18. Check the engine idle speed adjustment (*page 117*).
19. Inspect the fuel valve (petcock), fuel lines and fittings for leaks (*pages 106 and 108*).
20. Clean the battery and clean the battery connections (*page 247*).
21. Check the operation of electrical equipment and switches (*page 252*).
22. Replace the spark plugs (*page 127*).
23. Check the ignition timing (*page 130*).
24. Check the tires for proper inflation pressure and for signs of wear (*page 63*).
25. Check wheel spoke tightness (*page 62*).
26. Check the rear shock absorbers (*page 50*).
27. Check the swingarm pivot bolts for proper tightness (*page 53*).
28. Replace the front fork oil (*page 34*).
29. Lubricate the steering head bearings and check the bearing adjustment (*page 40*).
30. Repack the wheel bearings (*page 60*).
31. Check alignment.
32. Check the tightness of all fasteners, except the engine cylinder head bolts.
33. Inspect the fuel tank mount grommets.
34. Conduct a road test.

## CHASSIS TROUBLESHOOTING

### Brakes

#### Brakes Weak or Do Not Hold Normally

| Problem                                              | Remedy                                                                                                         |
|------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| Master cylinder(s) low on fluid.                     | Refill with recommended brake fluid.                                                                           |
| Brake fade from heat build-up (excessive braking).   | Let brakes cool. Downshift to cause engine braking.                                                            |
| Brake fade due to brake pad hang-up or dragging.     | Inspect caliper/master cylinder. Check brake lever or pedal free-play. Adjust, repair or replace as necessary. |
| Air in hydraulic system.                             | Bleed brakes. Refill with recommended brake fluid.                                                             |
| Master cylinder/caliper pistons/bore worn or seized. | Repair or replace components as necessary.                                                                     |
| Contaminated brake pads (grease/oil).                | Clean and inspect rotors. Replace brake pads.                                                                  |
| Brake pads excessively worn.                         | Clean and inspect rotors. Replace brake pads.                                                                  |
| Brake rotors excessively worn or warped.             | Clean, inspect and replace as necessary.                                                                       |

### Chassis

#### Handling Irregularities

| Problem                                                                                   | Remedy                                                                                    |
|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Motorcycle improperly loaded with excessive equipment or luggage.                         | Eliminate excessive equipment and/or reduce luggage to below gross vehicle weight rating. |
| Damaged tire(s) or improper front/rear tire combination.                                  | Replace front tire and/or rear tire with recommended size and type.                       |
| Irregular front or rear tire wear pattern.                                                | Replace front tire and/or rear tire with recommended size and type.                       |
| Incorrect tire inflation pressure.                                                        | Fill tires to recommended inflation pressure.                                             |
| Rear shock absorber and spring assembly damaged worn or spring rate incorrectly adjusted. | Clean, inspect, adjust, repair or replace components as necessary.                        |
| Loose wheel axle nuts.                                                                    | Tighten to recommended torque specification.                                              |
| Rear wheel out of alignment with front wheel or frame.                                    | Adjust rear wheel to correct alignment.                                                   |
| Excessive wheel bearing end play.                                                         | Clean, inspect and adjust bearings as necessary.                                          |
| Tire and wheel assemblies unbalanced.                                                     | Balance tire and wheel assemblies.                                                        |
| Steering head bearings improperly adjusted.                                               | Clean, inspect and adjust bearings as necessary.                                          |
| Wheel rims and/or tires out-of-round or eccentric with wheel hub.                         | True wheel rims (adjust spokes) and reposition or replace tires as necessary.             |
| Excessive lateral runout of wheel rims and/or tires.                                      | True wheel rims (adjust spokes) and reposition tires.                                     |
| Rear swing arm pivots binding, damaged or seized.                                         | Clean, inspect and repair as necessary.                                                   |

## ENGINE TROUBLESHOOTING

### Symptom-Related Diagnostics

#### Carburetor

Engine floods:

- Excessive pumping of throttle before or while starting
- Fuel valve (petcock) left open while bike is parked

#### Electrical System

Alternator charge rate is below normal:

- Low battery voltage
- Loose or corroded connections
- Excessive periods of idling or low-speed riding

Alternator does not charge:

- Engine ground wire loose or broken
- Loose or broken wires in charging circuit
- Voltage regulator not grounded

#### Engine

Engine knocks or pings:

- Incorrect fuel (use 91 octane or higher)
- Incorrect spark plugs
- Incorrect ignition timing

Engine overheats:

- Insufficient air reaching the cylinders from slow operation
- Insufficient oil supply
- Oil not circulating due to restricted lines, filter or fittings
- Heavy carbon depositing from lugging the engine
- Incorrect ignition timing
- Fuel mixture too lean

Engine starts but runs irregularly or misses:

- Battery low on charge
- Spark plugs in bad condition, have improper gap or are partially fouled
- Incorrect spark plugs
- Spark plug cables in bad condition and shorting
- Damaged wire or loose connection at battery terminals or at coil
- Damaged wire insulation causing short circuit
- Fuel system clogged by water or dirt
- Fuel vent system plugged

Engine difficult to start:

- Battery low on charge
- Spark plugs in bad condition, have improper gap or are partially fouled
- Incorrect spark plugs
- Spark plug cables in bad condition and shorting
- Damaged wire or loose connection(s) at one of the battery terminals or at the coil
- Carburetor not adjusted correctly, especially the enrichener
- Improper engine oil
- Incorrect ignition timing

Engine turns over but does not start:

- Fuel tank empty
- Fuel valve (petcock) in OFF position
- Fuel valve or fuel filter clogged
- Discharged battery or loose battery terminal connections
- Fouled spark plugs
- Engine flooded with fuel from overuse of enrichener
- Throttle held open when enrichener was used
- Spark plug cable connections loose or in bad condition
- Loose or corroded wire or cable connection(s) at coil or battery
- Fuel tank vent plugged or fuel line closed off
- Fuel system clogged by water or dirt

Engine vibrates excessively or seems to vibrate:

- Front engine mount bolts loose
- Rear engine mount bolts loose
- Broken frame
- Rear drive belt badly worn
- Wheels and/or tires damaged or out-of-true
- Vehicle not properly aligned
- Top engine mount loose or broken

Spark plugs foul repeatedly:

- Incorrect spark plugs
- Fuel mixture too rich
- Enrichener used too much

Starter does not operate or does not turn engine over:

- Engine stop switch in OFF position
- Ignition switch not in ON position
- Discharged battery or loose or corroded connections
- Connector to starter loose
- Poor or loose starter ground connection

## Lubrication System

Oil does not return to oil tank:

- Insufficient amount of oil in system
- Oil lines or fittings clogged
- Oil filter clogged
- Inoperative oil pump

Oil leaks from cases, pushrod covers and/or hoses:

- Loose parts
- Incorrect or imperfect seal at gaskets, pushrod cover, washers, etc.
- Restricted oil return line to tank
- Restricted crankcase vent

## Basic Engine Tests

The cylinder leakage and compression checks are basic engine tests that will help determine the overall mechanical condition of the engine and identify problems that can prevent the engine from delivering peak performance.

### Cylinder Leakage Test

With the cylinder leakage test, air pressure is applied to the cylinder. A drop in pressure indicates a leak.

Run the engine to attain normal operating temperature. Stop the engine.

Clean the area around the spark plug with compressed air and remove the spark plug.

Position the piston, in the cylinder being tested, at top dead center (TDC) on the compression stroke.

Remove the air filter and set the throttle and choke in the wide-open position.

Place the transmission in 5th gear and engage the rear brake to prevent the engine from turning over.

Using a cylinder leakdown tester, follow the manufacturer's instructions to perform a leak test on the cylinder (maximum acceptable leakdown rate is 15%). Listen for air escaping at the following locations:

- Exhaust pipe — indicates a defective exhaust valve
- Head gasket — indicates defective head gasket, cylinder head surface or cylinder surface
- Carburetor — indicates defective intake valve
- Crankcase vent — indicates worn piston rings

Air escaping through the valves may indicate incorrect pushrod length. Check that the correct length pushrods are installed in each location.

### Engine Compression Test

The engine compression test provides a quick method to uncover engine faults.

Make sure the battery is fully charged.

Run the engine to attain normal operating temperature. Stop the engine.

Clean the areas around the spark plugs with compressed air and remove the spark plugs.

Remove the air filter and set the throttle in the wide-open position.

Install a compression gauge in the cylinder being tested.

Have an assistant crank the engine at least four complete compression strokes and record the compression readings. Repeat the test on the second cylinder, and compare the readings.

If the highest readings from both cylinders are within specification, 150-195 psi, the engine compression is satisfactory. If the engine compression is not to specification, the cause may be one of the following:

- Worn piston rings — If compression is low on the first stroke, increases on successive strokes, but never achieves specification, the piston rings may be worn. Add a tablespoon of heavy oil into the cylinder and crank the engine to distribute the oil. Repeat the compression test. If the compression readings increase considerably, the rings are worn.
- Faulty valve seating — If compression is uniformly low on all strokes, the valves may not be seated properly. Add a tablespoon of heavy oil into the cylinder and crank the engine to distribute the oil. Repeat the compression test. If the compression readings remain approximately the same, the valves are not seated properly (perform cylinder leakage test). Check that the correct length pushrods are installed in each location.
- Head gasket leak — If compression is uniformly low on all strokes, the head gasket may be leaking.

If the compression readings are below specification, perform the Cylinder Leakage Test.

## EMISSION CONTROL SYSTEM TROUBLESHOOTING

### Evaporative System Checks

Problems with the evaporative emission system are primarily the result from the failure of the air valve to open or close. This can affect the performance of the engine, resulting in poor acceleration and failure to reach highway cruising speeds.

**The air valve door does not open or close:**

- Check the operation of the vacuum solenoid. Replace it if it is malfunctioning.

- Check the vacuum lines to the solenoid for kinks, leaks or other damage. Repair the lines as necessary.
- Check the mechanical linkage between the solenoid and the air valve door for proper setup and operation. Replace any broken or damaged parts.

Problem conditions in the vapor lines and carbon canister are not so obvious and may not affect engine performance in any noticeable way. However, these components must be checked to ensure proper operation of the system. Refer to System Inspection in the EMISSION CONTROL SYSTEM SERVICE section.

## IGNITION SYSTEM TROUBLESHOOTING

### Spark Plug Condition

When removing the spark plugs to check their condition, make a note of the cylinder from which each plug is removed. This will be helpful in identifying a problem cylinder. Refer to the IGNITION SYSTEM SERVICE section for removal and installation instructions.

#### Tools required:

Small file

Wire brush

#### Inspection and Cleaning

Visually inspect the electrodes for erosion and both the electrodes and insulators for the nature of any accumulated deposits. A spark plug with light powder-like brown or tan deposits and very little erosion of the electrodes is a normal condition and the plugs can be reinstalled. However, the following conditions are indicators of problems that need to be corrected.

**Wet sludge-like deposits** — This is an indication of excessive oil entering the cylinder. The cause may be worn rings or valve guides.

**Dry black powder-like deposits** — Deposits of this type are an indicator of incomplete combustion. The cause may be an improper fuel-air mixture, a spark plug with the incorrect heat range or an ignition system that is not functioning properly.

**Eroded electrodes and burned/blistered insulator tips** — This condition indicates plugs that have been subjected to overheating. The cause is typically incorrect ignition timing, a spark plug that is loose or the use of low-grade fuel.

If the spark plugs are acceptable for reinstallation, lightly file the firing gap surfaces of the side and center electrodes, making sure they are clean, square and parallel. Adjust the firing gap to specification and then clean the threads of the plug shell of any dirt and debris. This will ensure good contact with the cylinder head and proper heat dissipation.

### Electronic Ignition Diagnostics

The Indian Scout and Spirit motorcycles are equipped with an electronically controlled ignition system. As such, timing is programmed into the ignition module and does not require the routine adjustments required in past models. However, the following **Thunder Heart Performance Corp.** diagnostic checks can be performed to assess the performance of the system and the functioning of components within the system.

#### Tools required:

5/32" hex bit

13/16" deep-well socket

Pliers

Trigger plate and speedometer sensor tester, 98-056 (with adapter harness)

Ignition module simulator, 98-055

Diagnostic kit (software and cable), 88-990

Laptop/personal computer

## Ignition Cover (Trigger Plate) Check

This test is used to determine if the sensor within the ignition cover is functioning without removing the cover from the motorcycle.

Check to make sure that both the ignition key and the engine stop switches are in the OFF position.

Disconnect the ignition cover (trigger plate) harness connector. This is the triangular-shaped, three-pin connector located between the frame rails under the engine.

Connect the trigger plate and speedometer sensor tester, 98-056, to the connector from the ignition cover, using the adapter harness supplied with the tester.

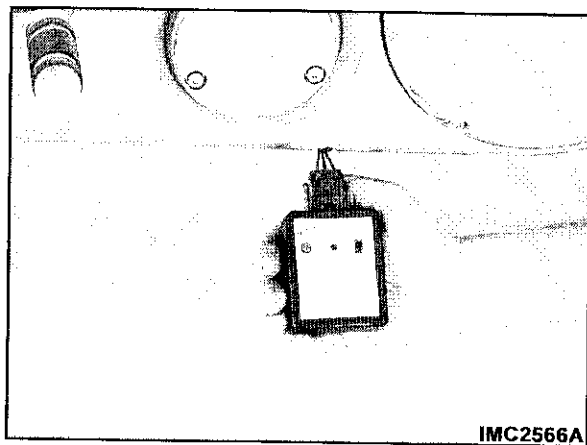


Figure 7 — Trigger plate test connection

**Note:** Check to make sure that the location of the colored wire leads in the adapter harness connector correspond with the color indicators on the tester module. If not, change the wire locations in the adapter harness to match up with the tester.

Turn the tester's power switch on. The power indicator light should be brightly lit. If not, replace the battery in the tester.

With the transmission in neutral, turn both the ignition key switch to the ON position and engine start switch to the RUN position.

Depress the start switch and observe the tester's SENSOR indicator light as the engine turns over.

- **Indicator light cycles on and off** — The sensor in the ignition cover is OK.
- **Indicator light does not cycle on and off** — The sensor in the ignition cover is malfunctioning or there is a problem with the ignition rotor. Replace the cover or rotor as necessary.

Disconnect and remove the tester from the ignition cover connector.

Connect the ignition cover (trigger plate) three-pin terminal to the chassis harness connector.

## Speed Sensor Check

This test is used to determine if the speed sensor is functioning without removing the sensor from the motorcycle.

Check to make sure that both the ignition key and the engine stop switches are in the OFF position.

Connect the trigger plate and speedometer sensor tester, 98-056, to the connector from the speed sensor, using the adapter harness supplied with the tester. This is the flat-shaped, three-pin connector located at the right side of the transmission near the rear frame stanchion.

**Note:** Check to make sure that the location of the colored wire leads in the adapter harness connector correspond with the color indicators on the tester module. If not, change the wire locations in the adapter harness to match up with the tester.

Turn the tester's power switch on. The power indicator light should be brightly lit. If not, replace the battery in the tester. The SENSOR indicator may also be lit depending on the position of the sensor gear.

With the transmission in neutral, move the motorcycle forward slowly and observe the SENSOR indicator while doing so.

- **Indicator light cycles on and off** — The speed sensor is OK.
- **Indicator light does not cycle on and off** — The speed sensor is malfunctioning or it is improperly positioned in the transmission housing and not sensing gear rotation. Check the sensor installation to make sure that it is fully seated in the transmission housing; adjust as necessary. If the installation is OK, remove the sensor from the housing and pass a steel rod back and forth in front of the sensor pickup. The sensor is OK if the tester indicator light cycles on and off. If the indicator light does not cycle, replace the sensor.

Disconnect and remove the tester from the speed sensor connector.

Connect the speed sensor to the chassis harness connector.

## Ignition Coil, Wires and Spark Plugs Operational Check

This operational check substitutes the ignition module tester in place of the motorcycle's ignition cover (trigger plate/cam sensor). The tester simulates the engine operating through a wide range to check the ignition coil, spark wires and spark plugs.

### Procedure

Check to make sure that the ignition key and the engine stop switch are both in the OFF position.

Disconnect the ignition cover (trigger plate) harness connector. This is the triangular-shaped, three-pin connector located between the frame rails under the engine.



Connect the ignition module tester to the harness connector in place of the ignition cover.

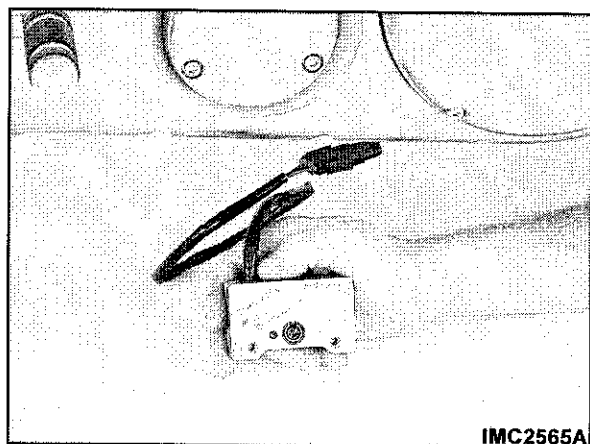


Figure 8 — Ignition module simulator connection

Gently pull the spark plug boots away from the spark plugs. Be very careful not to separate the boots from the wires while pulling.

Clean the spark plug area of the cylinder heads with compressed air.

Remove the spark plugs, using a 13/16" deep-well socket.

Clean and inspect the spark plugs. Then, connect the removed plugs to the ignition wires and ground the plugs to the cylinder heads.

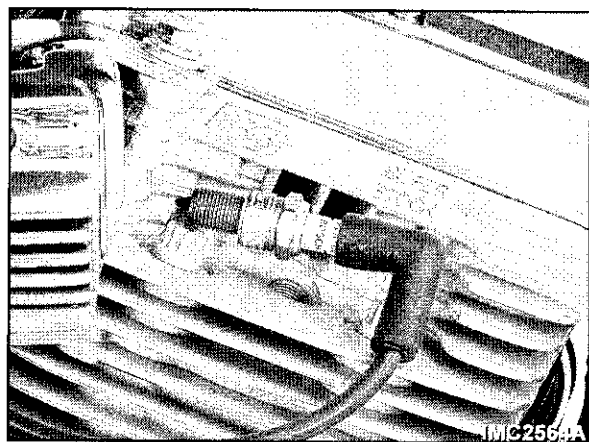


Figure 9 — Spark plug grounded to cylinder head

Turn the ignition key to the ON position and the engine stop switch to the RUN position. The tester will repeatedly cycle the ignition system up and down through a range of 0–6000 rpm.

#### ⚠ WARNING!

**DO NOT** touch the ignition coil, the spark plugs or the spark plug boots. An electrical shock and serious personal injury could result.

Observe the spark produced at the plugs grounded to the cylinder heads.

- **Weak or no spark** — indicates a faulty coil, ignition wire(s) or spark plug(s). The problem could also be a loss of power to the ignition coil.
- **Strong spark** — indicates that the coil, ignition wires or spark plugs are OK, and that a noted system problem may be a poor connection to the ignition cover or a malfunctioning ignition cover.

Turn the ignition key and the engine stop switch to the OFF position.

Disconnect the spark plugs from the plug wires. Apply a very small quantity of anti-seize to the threads of the plugs and install the plugs in the cylinder head, using a 13/16" deep-well socket. Tighten the plugs to 18 foot-pounds. Make sure the threaded caps are tight on the plug terminal and connect the plug wires to the spark plugs.

Disconnect and remove the ignition module tester from the harness connector.

Connect the ignition cover (trigger plate) three-pin terminal to the chassis harness connector.

## Ignition Module Operational Check

A laptop or personal computer and the SmartLink™ diagnostic software by Thunder Heart Performance Corp. can be used to evaluate how the motorcycle's ignition module and system is functioning.

Using the cable supplied with diagnostic kit 88-990, connect the computer to the diagnostic port at the center of the motorcycle's ignition module.

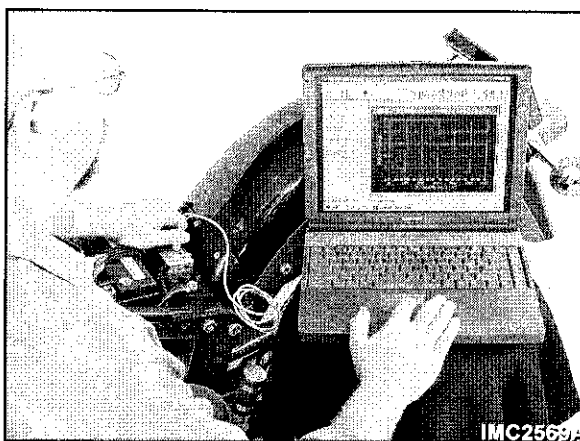
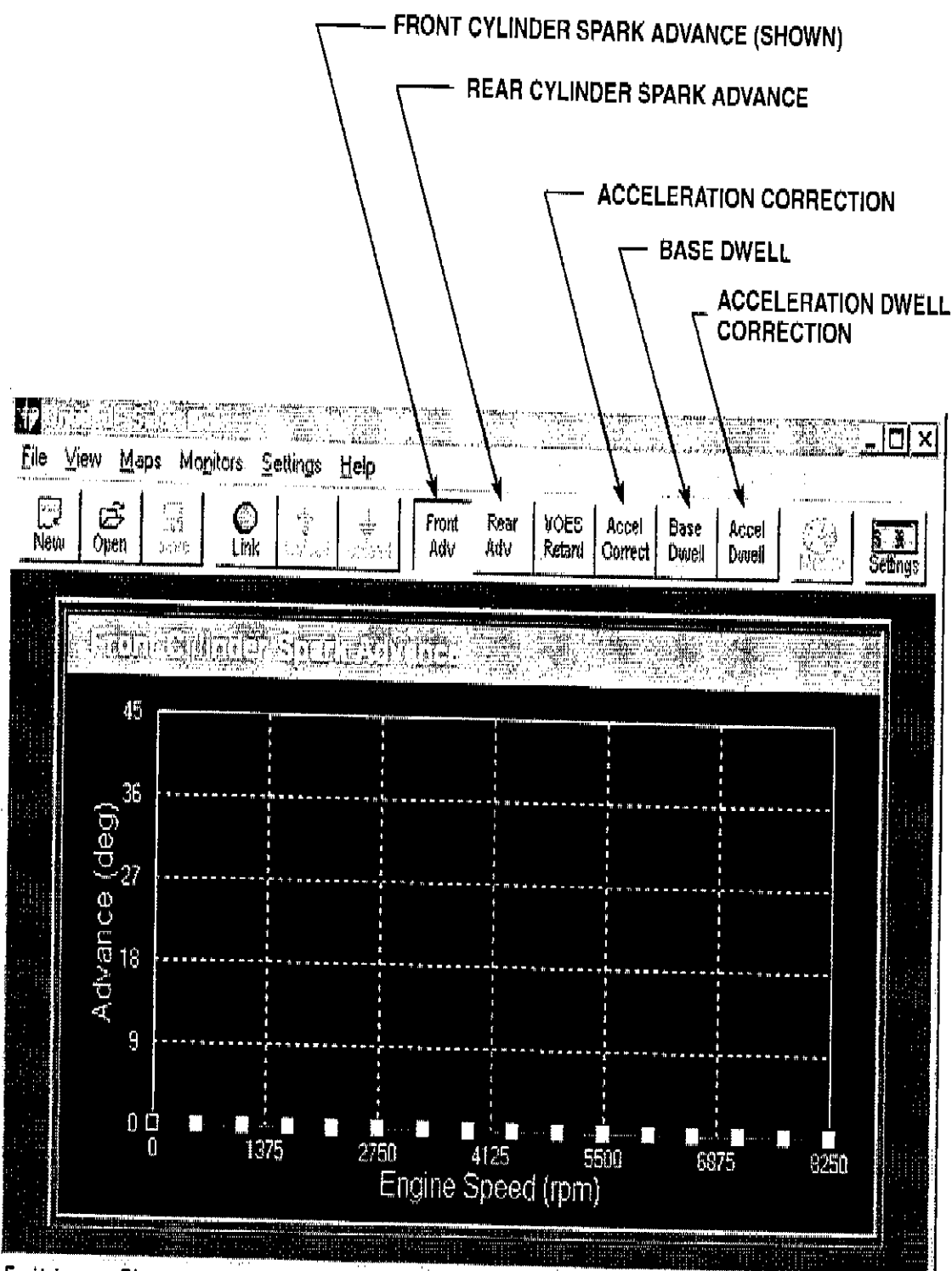


Figure 10 — Ignition module operational check

Load the SmartLink™ software provided with the diagnostic kit into the computer.

Start the engine and observe the operation of the ignition system through the engine's rpm range. System operational checks include:

- Front cylinder spark advance
- Rear cylinder spark advance
- Acceleration correction
- Base dwell
- Acceleration dwell correction



## CARBURETOR TROUBLESHOOTING

### Overflow or Flooding

| Problem                                                                                    | Remedy                                                                                              |
|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| Loose float bowl or damaged float bowl seal ring.                                          | Tighten float bowl screws. Replace seal ring as necessary.                                          |
| Improper fuel level in float bowl.                                                         | Adjust needle actuating tab on float to correct fuel level.                                         |
| Worn or dirty float needle valve or seat.                                                  | Clean or replace needle valve and seat.                                                             |
| Damaged, leaking or saturated float.                                                       | Replace float and adjust fuel level.                                                                |
| Deteriorated fuel causing sticky needle valve.                                             | Drain fuel, replace with fresh fuel, clean or replace needle valve and seat. Adjust float level.    |
| Damaged or leaking float bowl drain plug.                                                  | Tighten drain plug or replace as necessary.                                                         |
| Fuel runs from overflow tube (bottom of float bowl) or vent breather (side of carburetor). | Sticking, damaged or worn needle valve and seat. Clean or replace as necessary. Adjust float level. |

### Poor Fuel Economy

| Problem                                                               | Remedy                                                                                |
|-----------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Damaged or incorrectly seated enrichener control.                     | Replace or correctly seat enrichener control.                                         |
| Incorrect main jet or intermediate jet for tuning set-up or altitude. | Replace with correct main jet or intermediate jet.                                    |
| Loose intermediate or main jet.                                       | Tighten intermediate or main jet.                                                     |
| Dirty air cleaner element.                                            | Clean or replace as required.                                                         |
| Excessive accelerator pump output.                                    | Adjust accelerator pump stroke.<br>Replace accelerator pump nozzle with correct size. |
| Fuel level high in float bowl.                                        | Adjust float level.                                                                   |
| Enrichener valve not seating or is leaking.                           | Adjust, clean or replace.                                                             |
| Plugged air bleeds or passages.                                       | Clean and clear bleeds and passages.                                                  |

**Poor Idle**

| Problem                                                                                    | Remedy                                                                                              |
|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| Damaged or restricted fuel tank vent system.                                               | Repair or unclog vent system.                                                                       |
| Loose float bowl or damaged float bowl seal ring.                                          | Tighten float bowl screws. Replace seal ring as necessary.                                          |
| Improper fuel level in float bowl.                                                         | Adjust needle actuating tab on float to correct fuel level.                                         |
| Worn or dirty float needle valve or seat.                                                  | Clean or replace needle valve and seat.                                                             |
| Damaged, leaking or saturated float.                                                       | Replace float and adjust fuel level.                                                                |
| Deteriorated fuel causing sticky needle valve.                                             | Drain fuel, replace with fresh fuel, clean or replace needle valve and seat. Adjust float level.    |
| Damaged or leaking float bowl drain plug.                                                  | Tighten drain plug or replace as necessary.                                                         |
| Fuel runs from overflow tube (bottom of float bowl) or vent breather (side of carburetor). | Sticking, damaged or worn needle valve and seat. Clean or replace as necessary. Adjust float level. |
| Idle mixture screw setting incorrect.                                                      | Adjust idle mixture screw to specification.                                                         |

**Poor Part Throttle Performance**

| Problem                                               | Remedy                                                                                        |
|-------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Damaged or incorrectly seated enrichener control.     | Replace or correctly seat enrichener control.                                                 |
| Damaged or restricted fuel tank vent system.          | Repair or unclog vent system.                                                                 |
| Air leak between carburetor and cylinder heads.       | Replace gaskets or carburetor-to-manifold seal. Tighten clamp at carburetor base as required. |
| Dirty air cleaner element.                            | Clean or replace as required.                                                                 |
| Little or poor accelerator pump output.               | Verify operation and replace parts as required. Adjust accelerator pump stroke.               |
| Loose main jet or intermediate jet.                   | Tighten main jet or intermediate jet.                                                         |
| Throttle cables misaligned or misrouted.              | Adjust, clean or replace throttle cables.                                                     |
| Plugged air bleeds, jets or passages.                 | Clean and clear bleeds, jets and passages.                                                    |
| Restricted fuel supply passages or fuel supply valve. | Clean and clear as required. Clean screen in tank.                                            |
| Fuel level too low in float bowl.                     | Adjust float level.                                                                           |
| Idle mixture screw setting incorrect.                 | Adjust idle mixture screw to specification.                                                   |

### Poor Full Throttle Performance

| Problem                                                | Remedy                                                                                  |
|--------------------------------------------------------|-----------------------------------------------------------------------------------------|
| Leaks in intake between carburetor and cylinder heads. | Repair leaks or replace parts as required.                                              |
| Damaged or restricted fuel tank vent system.           | Repair or unclog vent system.                                                           |
| Dirty air cleaner element.                             | Clean or replace as required.                                                           |
| Clogged main jet.                                      | Clean and clear the main jet.                                                           |
| Throttle cables misaligned or misrouted.               | Adjust, clean or replace throttle cables.                                               |
| Restricted fuel supply passages or fuel supply valve.  | Clean and clear as required. Clean screen in tank and in-line filter.                   |
| Improper fuel level in float bowl.                     | Adjust float level.                                                                     |
| Enrichener valve not seating or is leaking.            | Adjust, clean or replace.                                                               |
| Worn, dirty or damaged float needle valve or seat.     | Clean or replace needle valve and seat.                                                 |
| Little or poor accelerator pump output.                | Verify operation and replace parts as required.<br>Adjust pump stroke to specification. |

### Carburetor and Exhaust Backfire

| Problem                                                         | Remedy                                                                                                                                                                                                                                                 |
|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Backfire on cold engine with enrichener off.                    | Considered normal. Actuate enrichener until engine warms.                                                                                                                                                                                              |
| Backfire on warm engine.                                        | Excessively lean air/fuel mixture. Check fuel flow to carburetor, blocked or restricted jets and clear or repair as required.<br>Ignition timing incorrect. Adjust or replace components as required.                                                  |
| Incorrect accelerator pump adjustment (stroke begins too late). | Adjust accelerator pump stroke.                                                                                                                                                                                                                        |
| Exhaust backfire with closed throttle on deceleration.          | Air entering exhaust pipes at cylinder head connections or air entering muffler at exhaust joints. Repair or replace components as required.<br>Ignition timing incorrect. Adjust or replace components as required. Set idle mixture screw to factory |

## TRANSMISSION AND DRIVE TROUBLESHOOTING

### Transmission

#### Shifts Hard

| Problem                                                       | Remedy                                                                                                      |
|---------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Primary drive housing overfilled with lubricant.              | Drain and refill with proper amount of lubricant.                                                           |
| Clutch dragging slightly.                                     | Check and adjust clutch and clutch cable.                                                                   |
| Transmission lubricant too heavy (operation in cold weather). | Run until transmission warms. Check for proper type and weight of transmission lubricant. Drain and refill. |
| Shifter return spring (in transmission) bent or broken.       | Repair or replace as necessary.                                                                             |
| Bent or misadjusted shifter rod.                              | Repair, replace or adjust as necessary.                                                                     |
| Internal shift mechanisms damaged, bent or misadjusted.       | Repair, replace or adjust as necessary.                                                                     |
| Shift forks bent or damaged.                                  | Replace as necessary.                                                                                       |
| Worn or damaged internal transmission components.             | Repair, replace and adjust as necessary.                                                                    |

#### Jumps Out of Gear

| Problem                                     | Remedy                          |
|---------------------------------------------|---------------------------------|
| Shifter rod improperly adjusted.            | Adjust as necessary.            |
| Shift forks or shifter improperly adjusted. | Adjust as necessary.            |
| Worn shifter dogs.                          | Replace or adjust as necessary. |
| Shift forks bent.                           | Replace as necessary.           |
| Damaged or worn gears.                      | Replace as necessary.           |

### Clutch

#### Clutch Chatters

| Problem                                     | Remedy                                                  |
|---------------------------------------------|---------------------------------------------------------|
| Friction or steel discs worn or warped.     | Replace as necessary. Check and replace clutch springs. |
| Insufficient primary drive lubricant level. | Fill primary case with proper amount of lubricant.      |

**Clutch Drags or Does Not Release**

| Problem                                | Remedy                                                    |
|----------------------------------------|-----------------------------------------------------------|
| Clutch controls improperly adjusted.   | Adjust as necessary.                                      |
| Primary case lubricant level too high. | Drain and refill with proper amount of lubricant.         |
| Clutch discs warped.                   | Check and replace components as necessary.                |
| Primary chain badly misaligned.        | Verify proper alignment. Replace components as necessary. |
| Damaged clutch assembly.               | Repair or replace components as necessary.                |

**Clutch Slips**

| Problem                              | Remedy                                     |
|--------------------------------------|--------------------------------------------|
| Clutch controls improperly adjusted. | Adjust as necessary.                       |
| Friction discs worn.                 | Check and replace components as necessary. |
| Insufficient clutch spring tension.  | Check and replace components as necessary. |

## ELECTRICAL TROUBLESHOOTING

### Electrical Troubleshooting Charts

#### Alternator

##### Alternator Does Not Charge

| Problem                                    | Remedy                                  |
|--------------------------------------------|-----------------------------------------|
| Voltage regulator not grounded.            | Inspect and repair ground as necessary. |
| Engine ground wire loose or broken.        | Inspect and repair ground as necessary. |
| Faulty voltage regulator.                  | Test and replace as necessary.          |
| Loose or broken wires in charging circuit. | Repair or replace as necessary.         |
| Faulty stator.                             | Test and replace as necessary.          |

##### Alternator Charge Rate Below Normal

| Problem                        | Remedy                                           |
|--------------------------------|--------------------------------------------------|
| Weak or damaged battery.       | Inspect, test, recharge or replace as necessary. |
| Low battery voltage.           | Inspect, test, recharge or replace as necessary. |
| Loose or corroded connections. | Clean and tighten as necessary.                  |
| Faulty regulator.              | Test and replace as necessary.                   |
| Faulty stator.                 | Test and replace as necessary.                   |

#### Starter Motor

##### Starter Motor Does Not Operate or Does Not Turn Engine Over

| Problem                                                                                 | Remedy                                      |
|-----------------------------------------------------------------------------------------|---------------------------------------------|
| Engine stop switch in OFF position.                                                     | Place engine stop switch in RUN position.   |
| Ignition switch in OFF position.                                                        | Place ignition switch in ON position.       |
| Discharged battery.                                                                     | Test, recharge or replace as necessary.     |
| Loose or corroded battery or starter motor connections.                                 | Clean and tighten connections as necessary. |
| Starter control circuit<br>(a) Solenoid faulty<br>(b) Starter relay (under dash) faulty | Replace as necessary.                       |
| Starter shaft pinion gear not engaging.                                                 | Inspect, clean or replace as necessary.     |
| Starter overrunning clutch slipping.                                                    | Inspect and replace as necessary.           |



## Battery Testing

### General

Refer to CHARGING SYSTEM SERVICE for battery removal, installation and inspection procedures.

### Battery Voltmeter Testing

Voltmeter testing provides a general indication of battery condition and calculated percent of charge. Measure the voltage of the battery to determine its charged level. If the Open Circuit Voltage (OCV) reading (battery disconnected) is below 12.6 volts, charge the battery and then recheck voltage after the battery has set for 1–2 hours. If the measured voltage reading is 12.8 volts or above, perform a load test on the battery to determine battery performance.

#### Voltmeter Testing for Battery Charge Condition

| Open Circuit Voltage | State of Charge |
|----------------------|-----------------|
| 13.0                 | 100%            |
| 12.8                 | 75%             |
| 12.5                 | 50%             |
| 12.2                 | 25%             |
| 11.8                 | 0%              |

### Battery Load Testing

The load test measures battery performance under full current load and is the best indicator of battery condition. Load test the battery as follows:

Remove the battery.

#### ⚠ CAUTION!

**Load testing a discharged battery can result in permanent damage.**

Measure the OCV of the battery before load testing. Charge the battery as necessary and let stand for one hour before load testing.

Connect battery load tester leads to the terminals of the battery. Place inductive pickup over negative (black) lead.

#### ⚠ WARNING!

Always turn the battery load tester OFF before connecting leads to battery terminals. Connecting leads with tester ON can cause a spark resulting in a battery explosion and result in serious personal injury.

Load the battery at 50% of the Cold Cranking Amperage (CCA) rating, using the load tester. The voltage reading after 15 seconds of load should be 9.6 volts or above, at 70°F (21°C).

#### ⚠ CAUTION!

To avoid tester or battery damage, do not leave the tester load dial ON for more than approximately 20 seconds.

#### Battery Load Test

| Battery CCA (12V, 24A) | 50% of CCA |
|------------------------|------------|
| 350                    | 175        |

If the battery fails to maintain 9.6 volts for 15 seconds at 70°F (21°C), replace the battery.

Install the battery after testing is complete.

## Battery Charging

### Safety Precautions

Never charge a battery without first reading the battery charger instructions. In addition to the battery manufacturer's charging guidelines, follow these general safety precautions:

- Always wear proper eye, face and hand protection.
- Always charge batteries in a well-ventilated area.
- Make sure the battery charger is OFF before connecting any leads to avoid dangerous sparks.
- Never charge a damaged or frozen battery.
- Always disconnect the battery for charging purposes.
- Connect the red positive (+) lead of the charger to the positive (+) terminal of the battery. Connect the black negative (–) lead of the charger to the negative (–) terminal of the battery.
- Make sure the charger leads are in good condition.
- If the battery becomes HOT, reduce the charging rate or temporarily turn the charger OFF.
- Always turn the charger OFF before disconnecting the charger leads to avoid dangerous sparks.

## Using the Battery Charger

Charge the battery if any of the following conditions exist:

- Vehicle lights are dim.
- Starter motor cranks slowly or sounds weak.
- Battery has not been used for an extended period of time.

### ⚠ WARNING!

Charge the battery in a well-ventilated area. Explosive hydrogen gas can escape the battery during charging. Keep open flames, electrical sparks and smoking materials away from the battery at all times. Failing safety precautions can result in serious personal injury.

### ⚠ CAUTION!

If the battery releases an excessive amount of gas during charging, decrease the charging rate. If the battery is excessively hot, discontinue charging until the battery has cooled. Overheating the battery can cause plate distortion, internal shorting or other damage.

Remove the seat. Refer to Seat Removal and Installation in the FRAME AND ACCESSORIES SERVICE section for procedures.

Perform a voltmeter test to determine the battery state of charge.

Remove the battery from the motorcycle.

Connect the battery charger red positive (+) lead to the positive (+) terminal of the battery.

Connect the battery charger black negative (−) lead to the negative (−) terminal of the battery.

### ⚠ WARNING!

Always turn the battery charger OFF before connecting leads to battery terminals. Connecting leads with charger ON could cause a spark resulting in a battery explosion and can result in serious personal injury.

Set the charging rate and voltage of the battery charger. Follow the charge rate and time recommendations of the battery manufacturer.

## Battery Charging Rate

| Battery Rating | Battery Voltage | 2.1 Amp Charge Rate |
|----------------|-----------------|---------------------|
| 24 Amp Hour    | 12.6            | 1.75 Hours          |
|                | 12.3            | 3.5 Hours           |
|                | 12.0            | 5 Hours             |
|                | 11.8            | 5–10 Hours          |

Turn the battery charger ON.

When finished charging, turn the battery charger to OFF and disconnect the charger leads from the battery terminals.

### ⚠ WARNING!

Always unplug or turn the battery charger OFF before disconnecting the battery leads. Disconnecting the battery leads of the charger with the charger ON can cause a spark, resulting in battery explosion and possible personal injury.

Perform a battery load test as required.

If the battery is satisfactory, install the battery into the motorcycle.

Install the seat. Refer to Seat Removal and Installation in the FRAME AND ACCESSORIES SERVICE section for procedures.

## Ground Path Tests

### Tool required:

Ohm meter

### Battery Ground Cable

Set your meter to ohms (resistance). Place a probe upon the negative post of the battery and the other probe on the bolt holding the battery ground cable to the frame. Resistance should be 0.2 ohms or less. If greater than 0.2 ohms, clean all the connections and test again. If test results are greater than 0.2 ohms, replace the battery cable and test again.

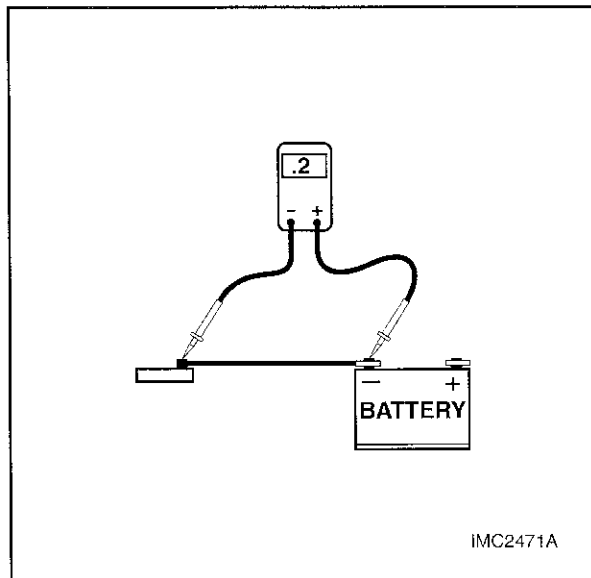


Figure 12 — Battery ground cable test

#### Battery to Starter

Set your meter to ohms (resistance). Place a probe upon the negative post of the battery and the other probe against the starter case. Resistance should be 0.2 ohms or less. A bad ground in the circuit is highly unlikely. If resistance is greater than 0.2 ohms, transfer the probe from the bolt to the transmission case. If higher than 0.2 ohms, clean the ground path between the starter and the transmission. If the connection is 0.2 ohms or less, then transfer the transmission probe to a non-painted area below the transmission. If higher than 0.2 ohms, check the ground path between the transmission and the frame. Be sure the frame is clean where the probe is placed.

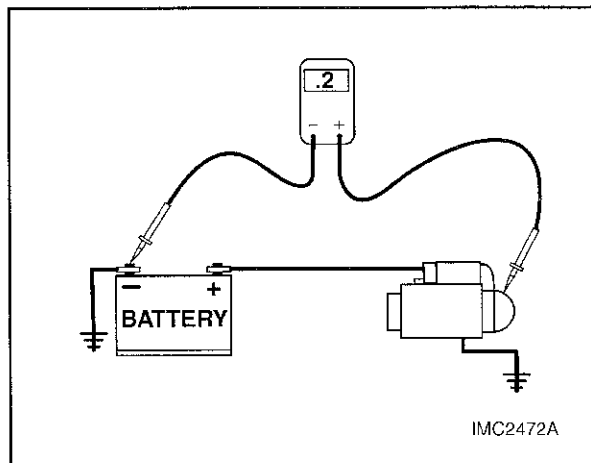


Figure 13 — Battery-to-starter ground test

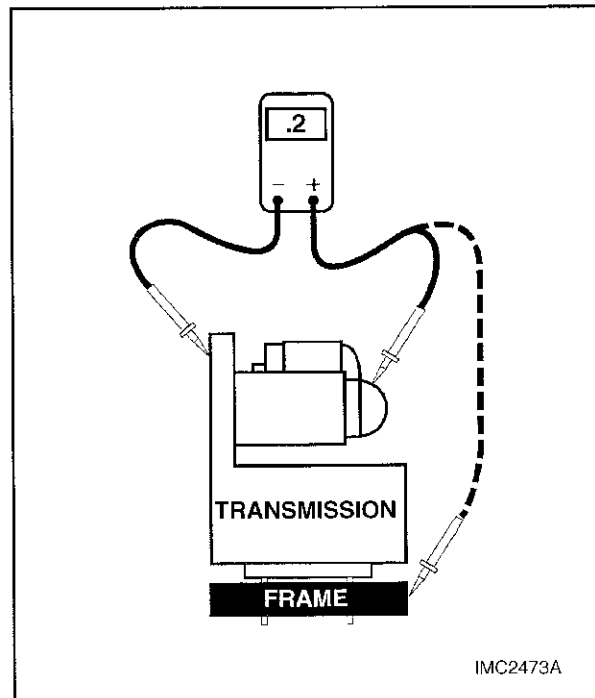


Figure 14 — Starter/transmission ground test

## Current Draw/Leak Test

Perform a "Key-Off Battery Draw" test. With the key turned OFF, connect an ammeter in series between the battery negative terminal and the negative battery lead (with lead disconnected from battery). An alternative is to use an ammeter with an inductive pickup clamped around the negative battery cable (with cable connected).

Check for current flow on a scale that is safe for the ammeter. The ammeter should read zero current flow. If current flow reads zero on a higher scale, recheck on a milliampere scale of the ammeter. The meter should theoretically read zero. If the battery case is slightly contaminated and the meter is very sensitive, you might see a maximum reading of 50 milliamperes draw with a good system. Any current draw higher than 50 milliamperes is suspect, unless a DC power drawing device has been added. Two examples of DCV devices are a clock or alarm.

If DCV devices have been added to the bike, disconnect them and check the circuit.

If current greater than 50 milliamperes is detected and all DCV drawing devices have been disconnected, then perform a leak test on the regulator/alternator.

## Rectifier/Regulator Current Leak Test

Check the battery voltage. To perform this test, the battery must have a charge. With the battery connected to the charging system and the ignition key in the OFF position, disconnect the regulator wire harness at the stator terminal. Place the ammeter on a scale sufficient to read 20 amperes. Place an ammeter probe on one side of the regulator terminal pins. Place the other probe on ground. The ammeter should read zero current flow. If current flow reads zero on the higher scale, recheck on a milliampere scale. There should be no current detected while using the milliampere scale. Transfer the probe to the second regulator terminal pin and perform the test again. If current is detected, the regulator is allowing current flow to ground and will discharge a fully charged battery over a few days. The regulator is defective and will require replacement.

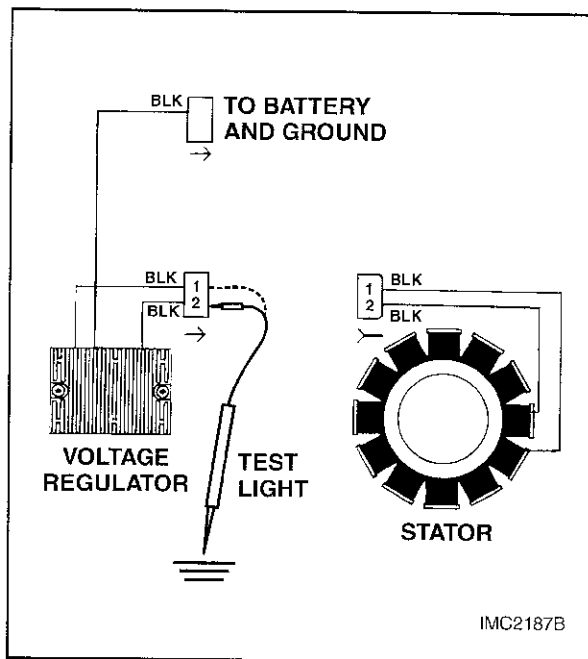


Figure 15 — Rectifier/regulator current leak test

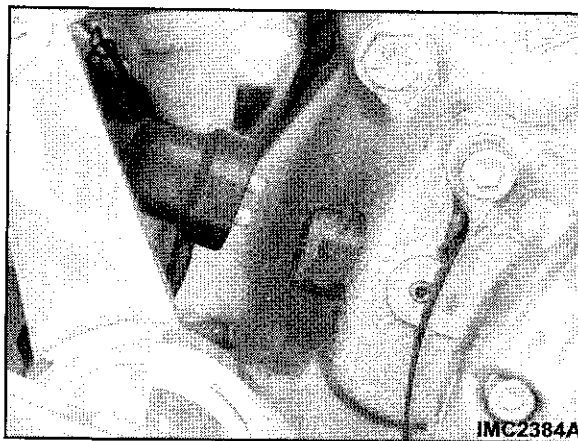


Figure 16 — Alternator stator terminal connection

## Charging System Tests

Charging system tests are helpful in determining if the charging system, during normal motorcycle operation, is capable of meeting electrical power demands, which include ignition, lighting and the use of accessories. The tests are also helpful in isolating the problem to the regulator, the alternator or the circuit wiring.

**Note:** The battery must be in good condition and at a full state of charge prior to conducting the following tests. If not, the results of the tests will be inaccurate and inconclusive.

### System Output Test

#### Measuring Current Output at Specified Voltage

A variation of the current draw test determines what current output the system is capable of producing at a specified 13.0 volts. The alternator is connected to the system for this test.

Locate the black wire (regulator battery supply) from the terminal of the main 30-ampere circuit breaker. Connect a load tester in the circuit with its control set at "no load." Clamp the inductive pickup on the black regulator supply wire. Be sure to follow the tester manufacturer's recommendations for making tester connections and for tester operation.

Conduct the test as follows:

- Make sure the tester control is set to the "no load" position.
- Start the engine and bring its speed up to 2000 rpm. With no load set on the tester, the voltage output reading should not be higher than 15 volts. If the reading is higher, the regulator is malfunctioning or the circuit wiring/connections are poor.

- While observing the voltage output, slowly increase the tester load until a steady 13-volt output reading is obtained.
- Read the current output. It should be at least 18 amperes.
- Bring the rpm to idle and stop the engine.
- Remove the load tester from the battery supply circuit of the regulator and reconnect the black wire to the circuit breaker, using a 3/8" wrench.

### Stator Resistance Test

The stator resistance test checks the stator for a short-to-ground or for a problem within the stator windings, both indicated by low resistance readings.

With the ignition key in the OFF position, disconnect the regulator wire harness at the alternator stator terminal connection.

#### Short-to-Ground Check

Connect the leads of a volt-ohmmeter between one of the terminals at the stator and a good ground at the engine. With the meter set to the ohm's scale, read the resistance. Repeat the procedure, this time with the leads connected between the second stator terminal and ground. Both readings should indicate infinity. If not, there is a short-to-ground in the stator. Replace the stator.

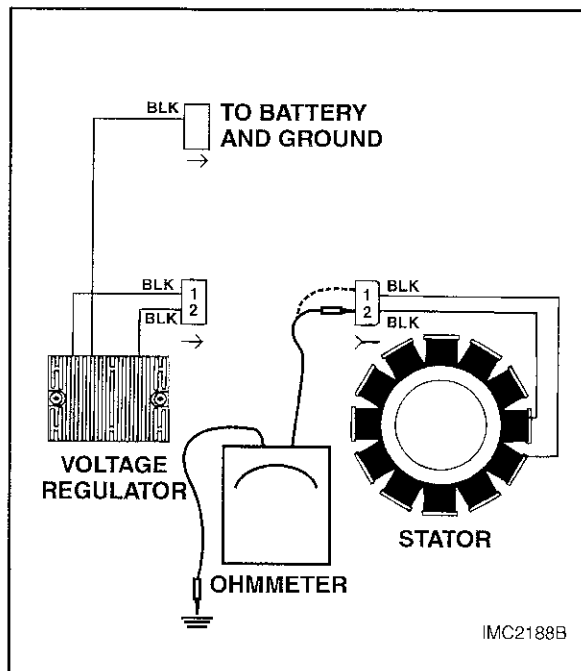


Figure 17 — Stator short-to-ground test

#### Stator Resistance Check

Connect the leads of a volt-ohmmeter between one of the two terminals at the stator. With the meter set to the ohm's scale, the resistance reading should be between 0.1 to 0.2 ohms. If the reading is outside of this range, either below or above, there is a short or open in the stator windings. Replace the stator.

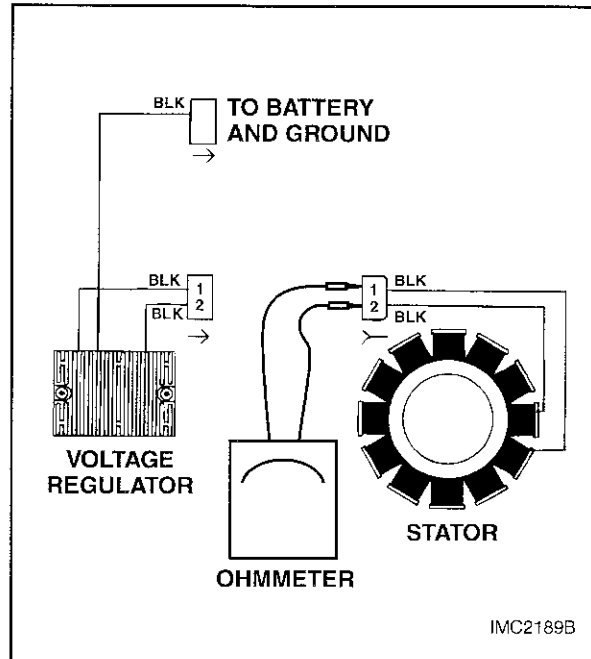


Figure 18 — Stator resistance test

Disconnect and remove the volt-ohmmeter. Reconnect the regulator wire harness to the stator terminals.

### Alternator Output Test

The alternator output test measures the AC voltage output of the alternator without the regulator in the circuit.

With the ignition key in the OFF position, disconnect the regulator wire harness at the alternator stator terminal connection.

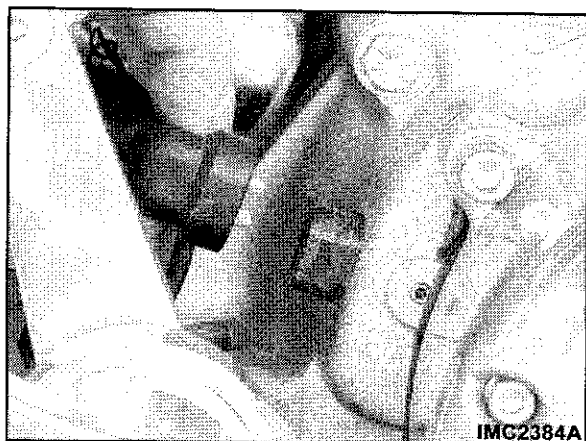


Figure 19 — Alternator stator terminal connection

Connect the leads from a volt-ohmmeter across the stator terminals and set the meter to read AC voltage.

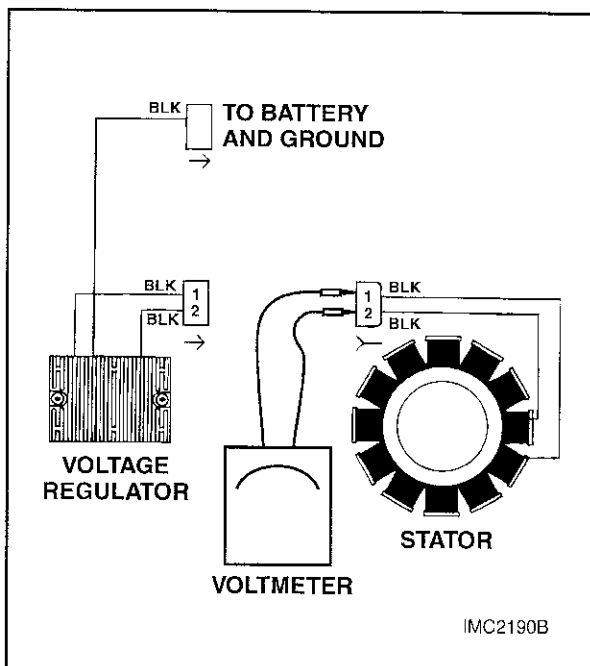


Figure 20 — Alternator AC voltage output test

Start the engine and bring its speed up to 2000 rpm.

Observe the voltage output on the meter. The reading should be within a range of 32 to 40 volts AC. If the output is below 32 volts, the problem is in the alternator.

Test the stator following the procedure in the Stator Resistance Test section. If the stator tests good, the problem is in the alternator rotor. Replace the alternator rotor following the procedure in the CHARGING SYSTEM SERVICE section.

Disconnect the volt-ohmmeter from the stator terminals and reconnect the regulator wire harness.

## Starting System Tests

The following starting system tests are helpful in isolating the cause of a system problem at the solenoid, the starter motor or the circuit wiring.

**Note:** The battery must be in good condition and at a full state of charge prior to conducting the following tests. Also, mechanical parts of the system should be at normal room temperatures. If not, the results of the tests will be inaccurate and inconclusive.

### Starter Current-Draw Test

Make sure that the ignition switch is in the OFF position and the transmission is in NEUTRAL.

To avoid accidental engine starting while conducting the test, carefully twist the spark plug boots and disconnect the plug wires from the spark plugs.

Connect the ammeter, clamping the 1000 amp induction pickup around the positive battery cable near the battery. Be sure to follow the tester manufacturer's recommendations for making tester connections and for tester operation.

Turn the ignition switch to the ON position.

Press the engine START button and observe the ammeter reading. See table below for ranges. If the current draw exceeds the specifications defined in the table, the starter motor or drive may be at fault and in need of repair or replacement. Refer to the STARTING SYSTEM SERVICE section for starter motor or drive removal and installation procedures.

#### CAUTION!

To avoid overheating and damage to the starter motor, do not operate the starter for more than 30 seconds at a time.

Turn the ignition switch to the OFF position. Then, disconnect and remove the ammeter from the motorcycle.

Connect the spark plug wires to the spark plugs.

### Starter Current Draw

| Starter Brand | Acceptable Amps | Out of Spec |
|---------------|-----------------|-------------|
| Compufire     | 240–300         | above 320   |

## Wiring Circuit Tests

Problem conditions within the chassis wiring circuits can result in circuit components operating poorly or not at all. Such conditions can be caused by:

- High resistance in circuits due to corrosion.
- Shorted or grounded circuits from damaged wiring insulation.
- Open circuits from broken wires or connections.

Isolating the cause of a circuit problem requires knowledge of the current path within a circuit as well as the location of control devices and operating components. By referring to the chassis wiring schematics, circuits relating to problem conditions can be identified and tested accordingly with a volt-ohmmeter.

## Electrical Harness Controller

Most electrical problems are most likely due to broken wires, loose connections, or bad crimps at the connection.

- Check the connections first. A loose connector may be your entire problem. Easy fix, plug the connectors together until they lock. Try to pull the plugs apart to see if they are locked together.
- Inspect the pins in the connector. Look at the pins in the connector to see if all the pins are pushed up even. Try to pull the pins out of the socket by the wire with enough force to pull the wire out of a bad crimp, but not hard enough to damage a good crimp.
- Check for broken wires with a multi-meter on continuity to determine if the signal is getting to the source. Start from the wire at the connector with one end of the probe and the other end of the wire at the source with the other probe. You should read zero resistance on the meter. If you don't get a reading or anything above 0.06 ohm, replace the wire.



Figure 21 — Electrical harness controller module

## Diagnostic Strip

The Diagnostics LED is designed to help with finding short to ground problems and protect the module and components from damage. The 3-amp self-resetting fuse will shut down the problem circuit and activate the LED. By observing the lit LED, you then can concentrate in that area for the problem.

**Note:** The LEDs activate in an overload situation only. If the ground is bad or the 12v power is interrupted, the LED is not affected and will not turn on.

**Example Problem:** No brake light when you apply the front brake and no LED on the diagnostic. The brake light does not turn on when the front brake lever is applied. However, the lower rear brake works.

**Problem Fix:** The brake switch power pin (J-4, pin 2) has worked out of the J-4 connector. This is not a short to ground and will not be indicated on the Diagnostics LED.

## Coil

The coil is powered by the kill switch. When you turn the key switch to the ON position, you have to turn the kill switch on to get power to the coil.

**Problem:** No power to the coil.

Make sure the pins are pushed all the way in the connectors and don't push out when plugging the connector into the EHC socket.

### Power at EHC

Start at the J-4 connector by unplugging the J-4 out of the socket. Check pin 3 at the EHC socket. You should have 12v power.

### Handlebar Kill Switch

At the J-4 connector, check continuity on pin 3 and pin 6 with the kill switch in the ON position. You should be getting a closed 0.0 to 0.06 ohm circuit; anything above 0.06 ohm is considered failure and the faulty wire should be replaced. Flip the kill switch to the OFF position and the circuit should open.

### Coil Power Wire

Do the same continuity test as above at pin 6, J-5 and at the coil power wire at the coil. You should be getting 0.0 to 0.06 ohm; anything above 0.06 ohm is considered failure and should be replaced.

## Horn

Horn doesn't work and the Diagnostic LED is not on?

### Horn Signal Routing

The 12v horn power supply starts at the J-3 connector, pin 2. 12v power goes up the handlebar to the horn switch. When the switch is activated, the 12v power is returned back to the J-2 connector, pin 7. The EHC routes this to the J-1 output, pin 4 and J-5, pin 2. The J-1, pin 4 and/or J-5, pin 2 wire goes to the + side of the horn. The negative side of the horn is grounded to the frame somewhere close to the horn.

- Checking the horn switch. Unplug J-3 connector (left handlebar controls) from the EHC. Using a voltage meter set on continuity, probe pin 2 and pin 7 at the handlebar harness. Press the horn switch button. The meter should read 0.0 to 0.06 ohm for a good switch.
- If the meter has no response? Do the same test at the switch at the control. If the meter still has no response, the switch is probably bad and needs to be replaced.

### Ground at the Horn

After the horn switch the EHC distributes the 12v signal from the switch to the horn via the J-1, pin 4 and J-5, pin 2 is returned through the ground side of the horn.

**Note:** You can perform this test with the EHC pin-out diagram to any function you are having trouble with. Just follow the pin-out diagram for the circuit sending power and the return power.

## Resistance Tests

An ohmmeter can be used to check for continuity in circuits and components to find open, shorted or grounded circuits. An ohmmeter can also be used to determine if components and other devices are working properly by measuring resistance levels for comparison with design values.

### ⚠ CAUTION!

**Never use an ohmmeter in a circuit that is powered. Always use an ohmmeter in an unpowered circuit. To isolate the circuit for ohmmeter testing, turn the circuit OFF, or disconnect the power supply before testing. Doing otherwise can damage the ohmmeter and incorrect testing will result.**

## Voltage Tests

With power flowing through the problem circuit, a voltmeter can be used to measure voltage at various points within the circuit. By comparing the voltage measurements, faults caused by open, shorted or high resistance circuits can be located and repaired.

### Power-Side Voltage Drop Test

Connect the red volt-ohmmeter lead to the positive (+) post of the battery. Connect the black voltmeter lead to the power post of the starter. Press the starter button and read the voltmeter.

If the reading is greater than 0.5 volt DC, then insufficient voltage is reaching the starter. Clean the battery terminals, battery cable terminals, starter cable terminals and starter post.

Again, check the voltage drop across the circuit. If the voltage is still 0.5 volt DC or higher, the battery power cable is not carrying sufficient voltage to the starter and needs replacement.

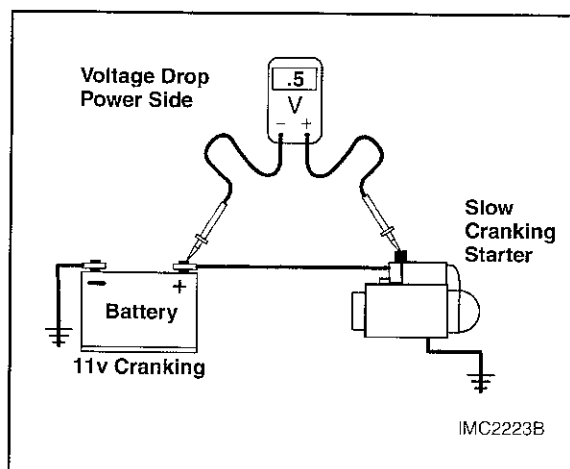


Figure 22 — Power-side voltage drop test



Replace the battery power cable and perform the voltage drop test again.

If the voltage drop is 0.5 volt DC or less, then the cable is operating satisfactory. If greater than 0.5 volt DC, a ground-side voltage drop test must be performed.

### Voltage Drop Test for Slow Cranking Starter

A voltage drop test compares the voltage loss between two points in an operating circuit and displays the difference. The advantage to voltage drop testing is that none of the connections must be disassembled to conduct the test.

First, measure the battery voltage. Set the volt-ohmmeter to read DC voltage. Connect the red volt-ohmmeter lead to the positive (+) post of the battery and the black volt-ohmmeter lead to the negative (-) post of the battery. A maintenance-free battery with 100% charge will read 13.0 volts DC. A lead antimony battery with 100% charge will read 12.7 volts DC. A lead calcium battery with 100% charge will read 12.6 volts DC.

Press the starter button and read the battery cranking voltage displayed on the volt-ohmmeter.

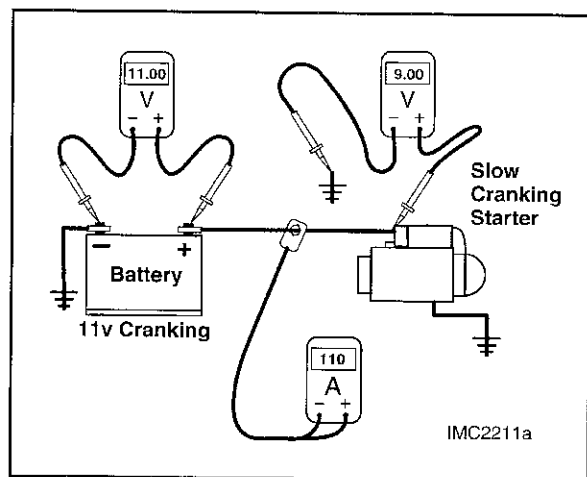


Figure 23 — Voltage drop test for slow cranking starter

### Other Voltage Drop Tests

Voltage drop tests can be performed on starter solenoids, switches, headlights, taillights and brake lights.

The maximum voltage drop for motorcycle circuits are:

- Starter circuit
  - Positive side: 0.5 volt DC
  - Negative side: 0.4 volt DC
  - Starter solenoid: 0.4 volt DC
- Charging circuit
  - Positive side: 0.3 volt, charging at 20 amperes
  - Negative side: 0.1 volt DC
- Headlight, brake light and taillight circuits
  - Positive side: 0.2 volt DC
  - Negative side: 0.2 volt DC

The following illustration shows test hook-up examples for various circuits and components.

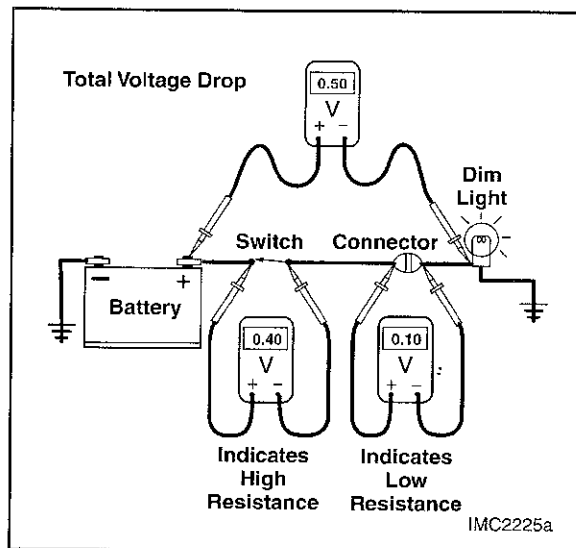


Figure 24 — Other voltage drop tests

## Starter Solenoid Test (Starter Removed)

The starter solenoid can be tested with the starter removed. Use a 12-volt test battery and three jumper wires to make the following test connections:

### ⚠ WARNING!

Battery fluid contains sulfuric acid. Do not allow this fluid to come in contact with eyes, skin or clothing. In case it does, immediately flush the area with water and seek medical attention if necessary.

### ⚠ WARNING!

Batteries produce hydrogen gas, which is both flammable and explosive. Keep flames or sparks away from batteries. Ventilate the area when charging a battery. Always protect your hands and eyes when working with batteries or battery acid. Failure to follow these warnings could result in personal injury.

With the solenoid mounted on the starter motor, disconnect the starter motor cable from the starter terminal on the solenoid and conduct the following checks in a quick, continuous sequence. If the solenoid fails any one of these checks, it is faulty and should be replaced.

Check the "pull in" capability of the solenoid, using a 12-volt test battery and three jumper wires of a suitable gauge and length.

- Connect a jumper wire from the negative battery terminal to the starter terminal of the solenoid.
- Connect a second jumper wire from the negative battery terminal to a good ground on the solenoid housing.
- Connect a third jumper wire from the positive battery terminal to the control circuit terminal. The starter drive pinion should pull into the motor. If not, discontinue the test and replace the solenoid.

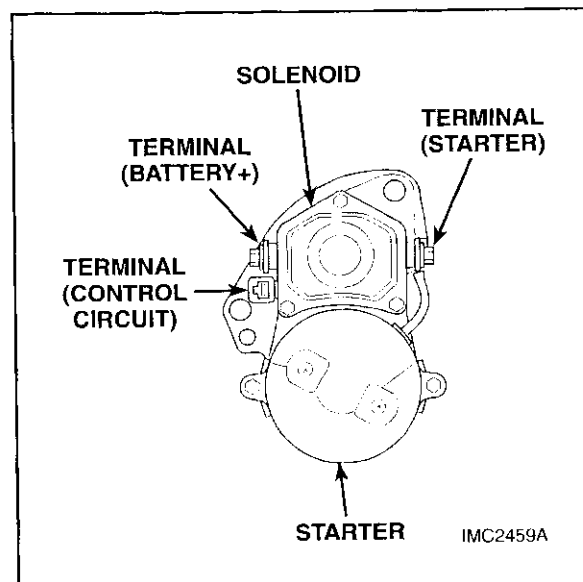


Figure 25 – Starter solenoid terminals

- Next, check the "hold in" capability of the solenoid by changing the connection of the starter terminal jumper wire from the negative battery terminal to the positive terminal. The drive pinion should remain pulled into the starter motor. If not, discontinue the test and replace the solenoid.
- Finally, check the "return" capability of the solenoid by disconnecting the control circuit jumper wire at the battery positive terminal. The drive pinion should release and spring back from the starter motor. If not, replace the solenoid.

Refer to the STARTING SYSTEM SERVICE section as necessary, for solenoid replacement procedures.

## FRONT SUSPENSION SERVICE

### Fork Oil Replacement

#### Tools required:

7/32" hex bit  
1-3/8" wrench/socket  
Motorcycle lift

#### Procedure

Using a lift, raise the front of the motorcycle off the ground and remove the front wheel assembly following the procedure under Front Wheel Removal and Installation in the WHEEL AND TIRE SERVICE section.

Place a drain pan under the fork tubes. Remove the top capscrew, using a 1-3/8" wrench to vent the upper fork tube. Then, remove the damping tube retainer screw and sealing washer from the bottom of each fork, using a 6 mm hex bit.

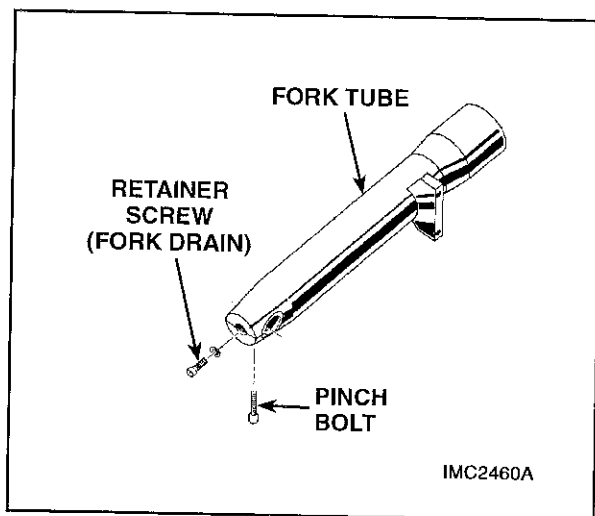


Figure 26 — Fork drain

Allow the oil to drain from the forks. To speed up the process, hold the handlebars steady and gently pull up on the fork sliders to compress the forks and then release, repeating this step until all oil is removed.

Install the bottoming cone retaining screws and sealing washers in the fork sliders and tighten to specification, using a 7/32" hex bit.

### Fork Tube Procedures

#### Tools required:

7/32" hex bit  
1/4" hex bit  
3/8" hex bit and socket  
13/16" open end wrench  
1-3/8" wrench/socket  
Torque wrench  
Motorcycle lift

#### Fork Tube Removal

Using a lift, raise the front of the motorcycle off the ground and remove the front wheel assembly following the procedure under Front Wheel Removal and Installation in the WHEEL AND TIRE SERVICE section.

Remove the front fender and turn signal lights following the procedures in the FRAME AND ACCESSORIES SERVICE section.

Using a 7/32" hex bit, loosen the two mounting screws securing the brake caliper to the left fork assembly.

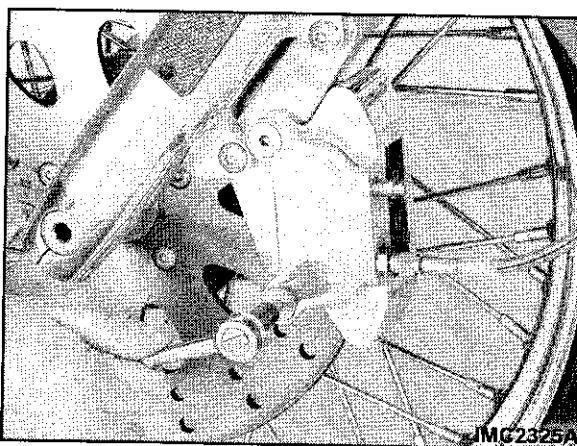


Figure 27 — Caliper removal

Note any shims placed between the caliper and hanger.

Remove the lower caliper mounting screw and mark the shims "lower."

Remove the upper caliper mounting screw and mark the shims "upper."

Using a tie, secure the caliper to the frame in a position out-of-way.

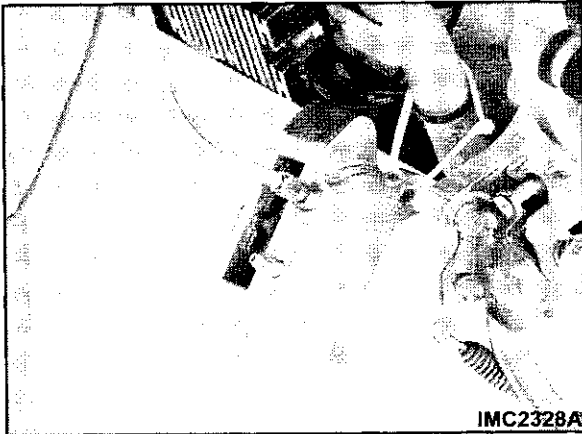


Figure 28 — Caliper secured out-of-way

Remove the front wheel. Refer to the WHEEL AND TIRE SERVICE section for the procedure.

Loosen the fork tube pinch bolts located in the lower fork bracket on each side, using a 1/4" hex bit.

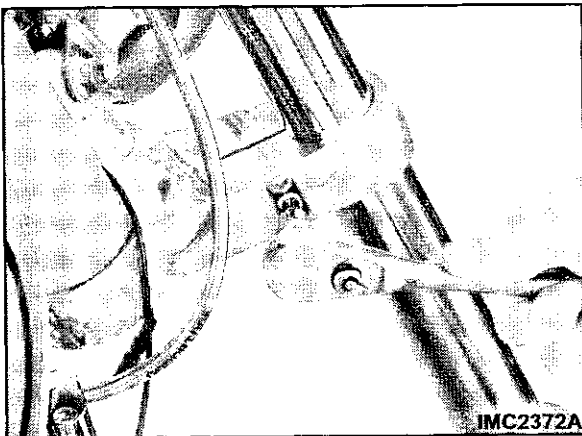


Figure 29 — Loosen fork tube pinch bolts

Support the fork tube and remove the capscrew securing the tube in the upper fork bracket, using a 1-3/8" wrench.

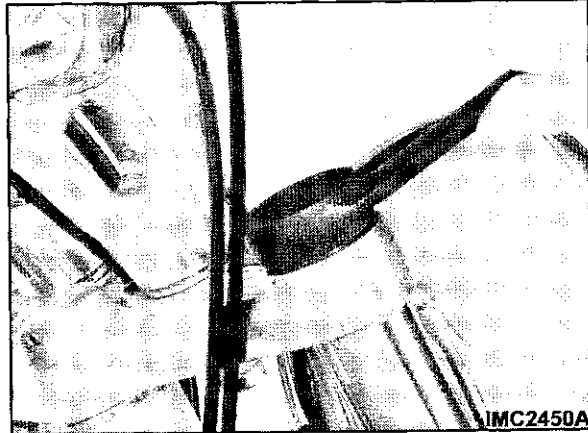


Figure 30 — Removing fork tube capscrew

Slide the fork tube assembly from the upper and lower fork brackets.

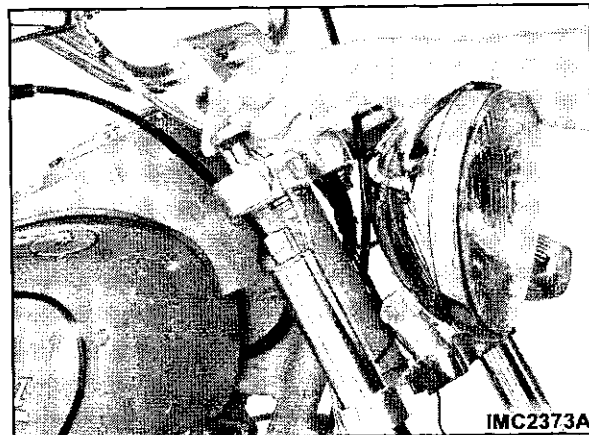


Figure 31 — Removing fork tube assembly

Turn the fork tube upside down in a pan to drain any remaining oil.

Repeat the procedure for the other fork tube assembly.

## Fork Tube Disassembly

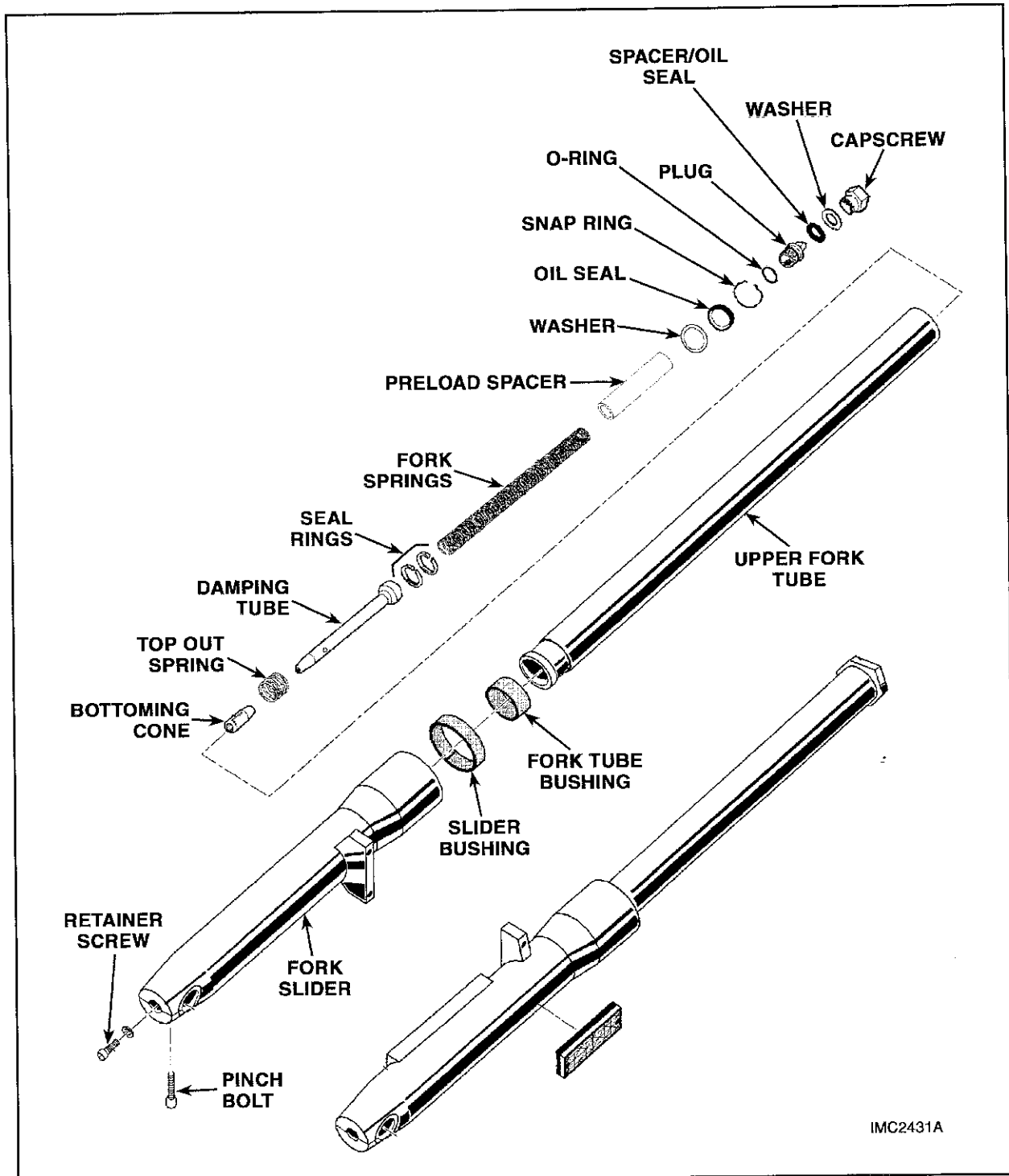


Figure 32 — Fork assembly (Scout/Spirit)

If not already done, remove the pinch bolt from the fork slider, using a 1/4" hex bit. Then, use a 7/32" hex bit to remove the damping tube retaining screw and washer from the fork slider and drain the oil into a suitable container.

Turn the fork tube assembly over and allow any residual oil to drain from the plug port at the top of the fork tube.

**⚠ WARNING!**

Use care when removing the plug from the upper fork tube. The preloaded spring can force parts out rapidly, causing personal injury or injury to others.

Exercising care, slowly remove the plug from the fork tube, using a 13/16" wrench. The plug can pop from the tube as it nears the end of the threads.

Set the plug aside and remove the long preload spacer, washer and spring from the upper fork tube.

Remove the pinch bolt from the fork slider and clamp the axle end of the slider in a soft-jawed vise. DO NOT clamp the assembly at any other point on the fork tube or slider.

**ⓘ CAUTION!**

**Clamping the assembly in a vise at any point other than the axle end can bend, distort or otherwise permanently damage the fork tube or slider.**

With the assembly securely clamped in the vise, remove the damping tube retainer screw and washer, using a 6 mm hex bit. Remove the assembly from the vise.

Remove the dust cover from the top of the fork slider.

Next, remove the snap ring from its groove at the top of the fork slider. Then, remove the upper fork tube, bushings, preload spacer, washer and oil seal together from the fork slider.

**Note:** *The bushings, preload spacer, washer and oil seal are removed together by carefully using the upper fork tube in a "slide hammer" manner.*

Remove the fork spring, damping tube, top out spring and bottoming cone from the fork slider.

Repeat the procedure for the other fork tube assembly. Use care to keep all component parts for each fork assembly together. DO NOT interchange components between the left and right assemblies.

**Fork Tube Cleaning and Inspection**

Thoroughly clean and then inspect all parts of the front fork tube assemblies.

Check the upper fork tube and damping tube to make sure they are not bent. This can be done by placing the parts in V-blocks and while rotating them, using a dial indicator to check for variations.

Inspect the slide surface of the fork tube for scoring, blemishes and any other damage that would prevent a good seal.

Make sure that the two damping tube rings are in good condition.

Inspect the plug O-ring and the fork slider oil seal for wear or damage.

Inspect the fork tube and slider bushings for wear, scoring or other damage.

Make sure that the copper washers for the damping tube retainer screws are in good condition to properly seal and prevent oil leakage.

Prior to assembly, replace all parts found to be worn or damaged during the inspection process.

**Fork Tube Assembly**

Coat all parts of the front fork assembly with fresh oil of the specified type for Indian Scout and Spirit motorcycles.

Check that the rings are properly seated in the ring grooves on the damping tube.

Slide the short top out spring onto the damping tube from the tapered bottom end. With the spring in position, insert the damping tube into the upper fork tube and push it through to the bottom. Use care in this process to make sure the tapered end of the damping tube is properly aligned and passes through the opening at the bottom of the upper fork tube.

Insert the progressive-rate fork spring into the upper fork tube so that it is seated on top of the damping tube. Make sure that the fork spring is inserted with the end having the closely spaced coils against the damping tube.

Insert the preload spacer and washer into the upper fork tube on top of the fork spring.

Check that the O-ring is positioned properly in its groove on the fork tube plug. Push down on the spacer to compress the spring and using a 13/16" wrench, install the plug and washer. Tighten the plug to specification.

If removed, install the bushing on the lower end of the upper fork tube.

Slip the bottoming cone onto the tapered end of the damping tube protruding from the bottom of the upper fork tube.

With the lower bushing and bottoming cone in place, insert the assembled upper fork tube into the fork slider until it bottoms. Use care to ensure that the bottoming cone remains in position at the bottom of the damping tube.

Clamp the axle end of the slider in a soft-jawed vise. DO NOT clamp the assembly at any other point on the fork tube or slider.

**⚠ CAUTION!**

Clamping the assembly in a vise at any point other than the axle end can bend, distort or otherwise permanently damage the fork tube or slider.

With the assembly securely clamped in the vise, check that the bottoming cone and damping tube are properly aligned with the hole at the bottom of the slider. When aligned, have an assistant push the fork tube into the slider to hold the bottoming cone and damping tube in position for installation of the retainer screw.

Apply blue threadlock to the threads of the retainer screw. Then, using a 7/32" hex bit, install the retainer screw and tighten to specification. Remove the assembly from the vise.

Slide the upper bushing onto the fork tube and into position at the top of the slider. Next, place a suitable driver in position over the slider bushing. Gently drive the slider bushing until fully seated. Slip the washer onto the tube.

Lightly lubricate the oil seal with lithium base grease. Place a corner of a thin plastic bag over the top of the upper fork tube. This allows the oil seal to be slid over the tube without being damaged. Slide the oil seal over the bag and down the tube. Carefully drive the oil seal until fully seated.

Install the snap ring into its groove to retain the oil seal.

Loosely install the axle pinch bolt (right fork slider).

Fill the fork assembly through the top of the fork tube plug with 11 ounces of the specified type of fork oil for Indian Scout and Spirit motorcycles.

**Note:** When draining and refilling fork oil without fork disassembly, fill the fork assembly with 10 ounces of the specified fork oil.

## Fork Tube Installation

Slide the fork tube assembly into position in the upper and lower fork brackets.

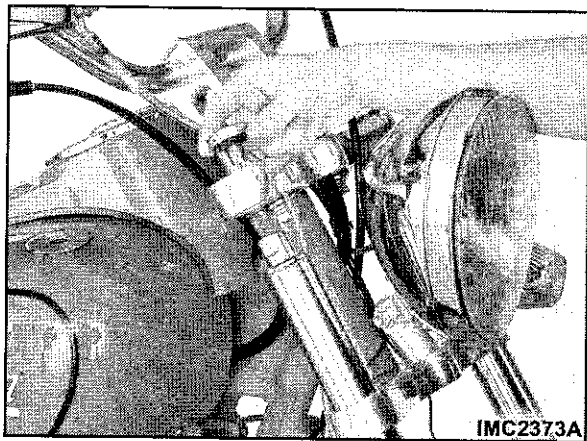


Figure 33 — Installing fork tube assembly

Install the fork tube cap screw, using a 1-3/8" socket, and tighten to specification. DO NOT tighten the pinch screws at this time.

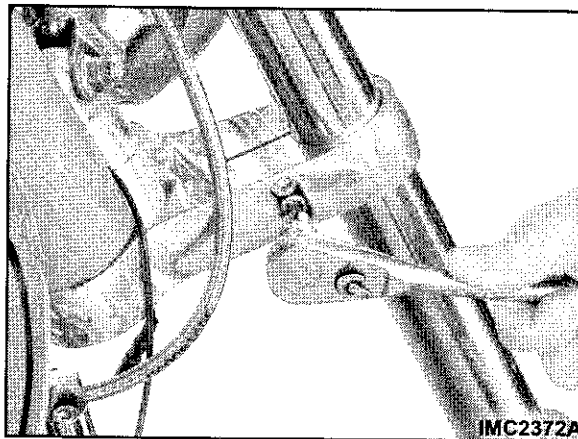


Figure 34 — Tightening fork pinch screws

Install the front tire and wheel assembly. Refer to the procedure in the WHEEL AND TIRE SERVICE section.

Tighten the axle nut to specification, using a 3/8" hex socket. Use a second 3/8" hex bit to hold the axle while tightening the axle nut.

Cut the tie strap securing the caliper to the frame and place the caliper in position on the left fork assembly.

Using a 7/32" hex bit, install the two mounting screws securing the brake caliper to the bracket on the left fork assembly. Reinstall the shims in the proper location. See the Brake Caliper Shimming section for procedures. Tighten the screws to specification.

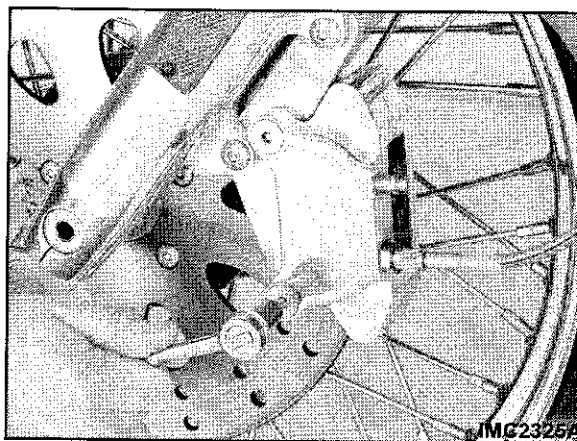


Figure 35 — Installing caliper

Lower the motorcycle to the ground and remove the lift.

## Fork Seating

Apply the front brake.

Press down on the handlebar several times to compress and release the forks. This is done to seat the axle at the bottom of the fork sliders and the fork tubes in the upper and lower fork brackets.

Tighten the four fork tube pinch bolts at the back of the lower fork bracket, using a 1/4" hex bit. Tighten to specification.

Press down on the handlebar a few more times to seat the front wheel axle.

Tighten the right-side axle pinch bolt to specification, using a 1/4" hex bit.

Install the front fender and turn signal lights following the procedures under FRAME AND ACCESSORIES SERVICE.



## STEERING COMPONENT SERVICE

The steering components consist of the upper and lower fork brackets (triple clamp) and the handlebars. The lower fork bracket has an integral stem that is the steering pivot. The stem is supported on bearings in the frame stem tube.

Regularly scheduled maintenance requirements include the inspection and adjustment of the steering stem, and lubrication of the bearings.

### Steering Stem Inspection and Adjustment

#### Tools required:

- Pointer
- Masking tape
- Scale
- Marker
- 5/32" hex bit
- 1/8" hex bit
- 15/16" wrench/socket
- Torque wrench
- Motorcycle lift

#### Inspection and Fall-Away Test

Remove the windshield or any other accessory that may affect the weight of the front fork assembly.

Using a lift, raise the front of the motorcycle just high enough to bring the front wheel off the ground.

Swing the wheel slowly back and forth to get a feeling for any rough spots, tightness or flat spots. Replace the races and bearings if flat spots are found.

**Note:** Flat spotting of a bearing race may occur from a heavy blow, typically from wheelies, collisions with cars, the cycle being dropped from a truck, etc.

Point the front wheel straight ahead.

Cut a piece of masking tape to approximately 10" in length. Place the tape on the front edge of the fender.

Align a pointer tip with the center of the fender and lightly mark the center on the tape.

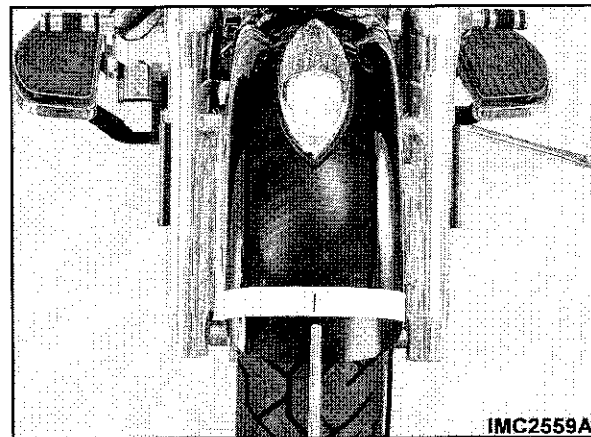


Figure 36 — Pointer with wheel centered and marked

Gently tap the wheel to the right in approximately 1/4" increments. Mark the tape at the point where the wheel starts to fall away by itself.

Return the wheel back to center and perform the same test to the left. Fall-away to the left will occur earlier because of the weight of the brake caliper.

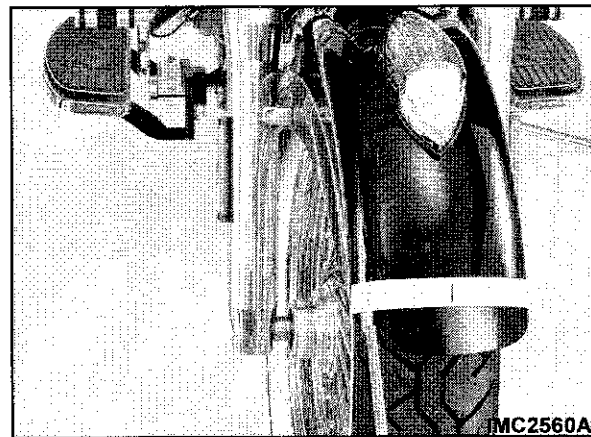


Figure 37 — Left side fall-away

Measure the distance between the two outer marks on the masking tape. This distance (fall-away) should be between 6–10" considering the weight of the fender.

If the fall-away distance is not within the 6–10" limit, adjust the stem bearing preload. Refer to Bearing Preload Adjustment in this section.

If the fall-away distance is OK, install the windshield and any other accessories that were removed for the test.

Lower the motorcycle to the ground and remove the lift.

## Bearing Preload Adjustment

With the motorcycle supported on a lift and the front wheel off the ground, adjust bearing preload using this procedure.

Loosen the four fork tube pinch screws in the lower fork bracket, using a 1/4" hex bit.

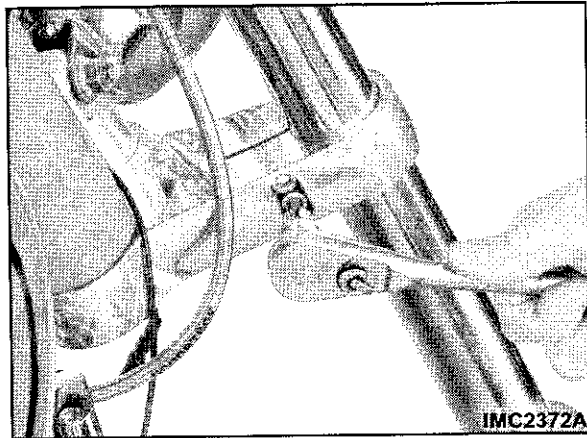


Figure 38 — Loosening fork tube pinch screws

Using a 1/8" hex bit, loosen the two set screws and remove the cover from the fork stem bolt.

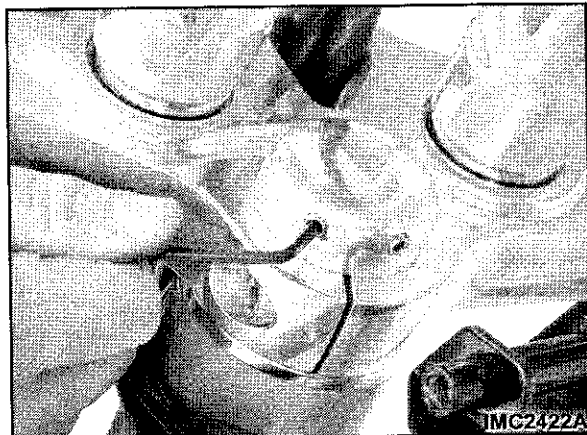


Figure 39 — Removing fork stem bolt cover

Remove the tall-head screw used to lock the stem bolt, using a 5/32" hex bit. DO NOT remove the flat-head screw locking the position of the notched washer.

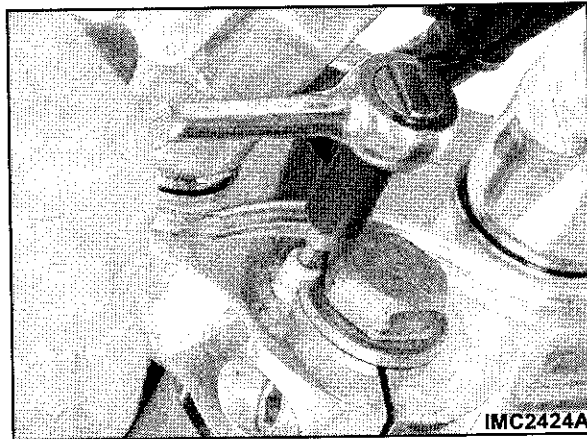


Figure 40 — Removing tall-head lock screw

Slightly loosen, but do not remove the upper triple clamp pinch screw, using a 1/4" hex bit.

Using a 15/16" wrench, tighten or loosen the stem bolt to adjust "fall-away" as required.

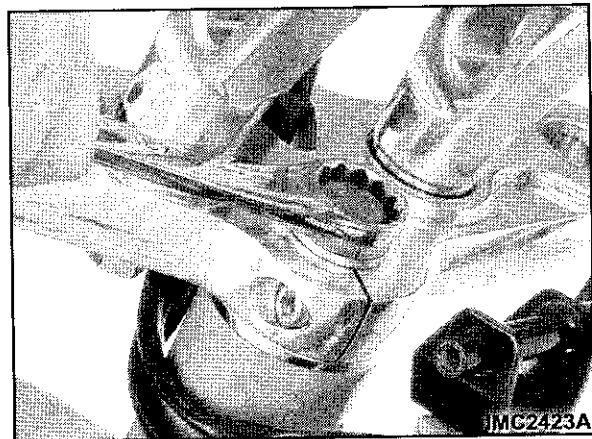


Figure 41 — Adjusting "fall-away"

Recheck fall-away to make sure that it is within limits.

With the adjustment complete, install the tall-head screw to retain the stem bolt, using a 5/32" hex bit. There are three holes over the notched washer in which the screw can be placed. Choose the position that provides a secure lock for the bolt.

Tighten the upper triple clamp pinch screw to specification, using a 1/4" hex bit.

Clean the inside of the stem bolt cover and apply a dab of clear silicone sealant to the inside. Then, install the cover over the stem bolt and tighten the set screws, using a 1/8" hex bit.

Tighten the four fork tube pinch screws in the lower fork bracket to specification, using a 1/4" hex bit.

Check the tightness of the handlebar upper clamp plate screws, using a 1/4" hex bit. Tighten to specification as required.

Install the windshield and any other accessories that were removed. Lower the motorcycle to the ground and remove the lift.

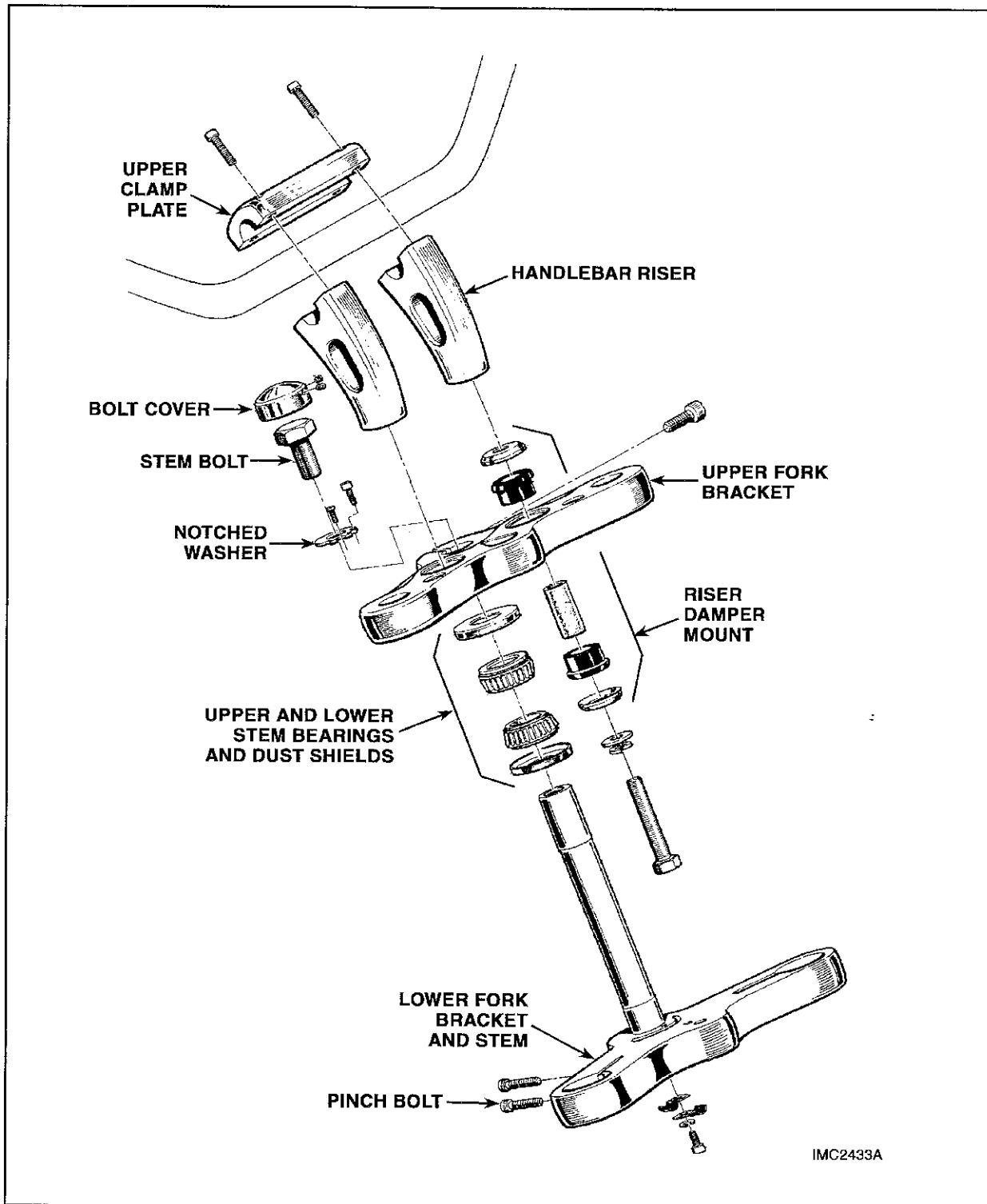


Figure 42 — Steering stem assembly

## Steering Stem Disassembly and Assembly

If either triple clamp, stem or bearings are worn or damaged in any way, the unit can be disassembled and parts replaced as required.

### Tools required:

- 1/8" hex bit
- 5/32" hex bit
- 1/4" hex bit
- 15/16" wrench/socket
- Bearing race remover/installer
- Driver handle
- Hammer
- Torque wrench
- Motorcycle lift

### Triple Clamp Removal

Using a suitable lift, raise the motorcycle so the front wheel is off the ground.

Remove the front wheel following the procedure covered in the WHEEL AND TIRE SERVICE section.

Remove both front fork tubes. Refer to the procedure in the FRONT SUSPENSION SERVICE section.

Using a 1/8" hex bit, loosen the two set screws and remove the cover from the fork stem bolt.

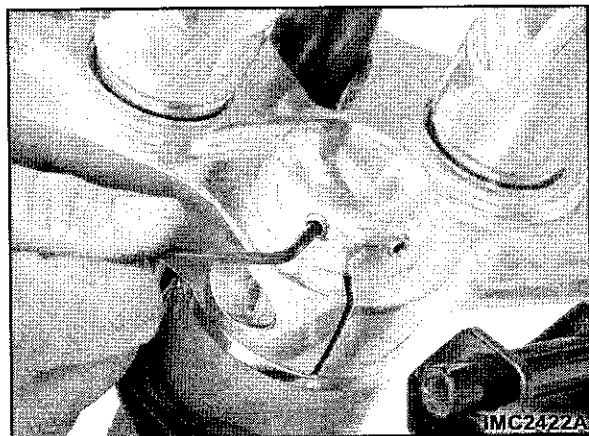


Figure 43 — Removing fork stem bolt cover

Remove the tall-head screw used to lock the stem bolt, using a 5/32" hex bit. DO NOT remove the flat-head screw locking the notched washer.

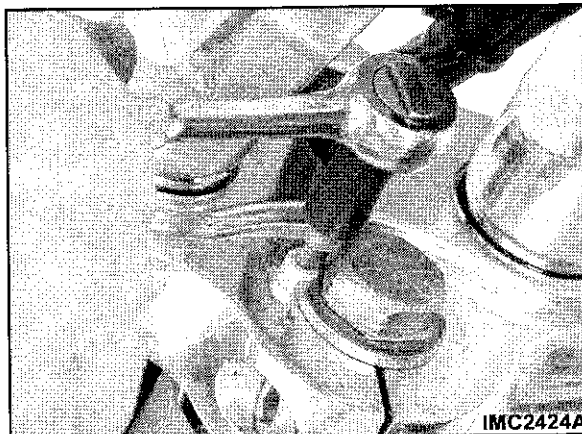


Figure 44 — Removing tall-head lock screw

Remove the fork stem bolt, using a 15/16" wrench.

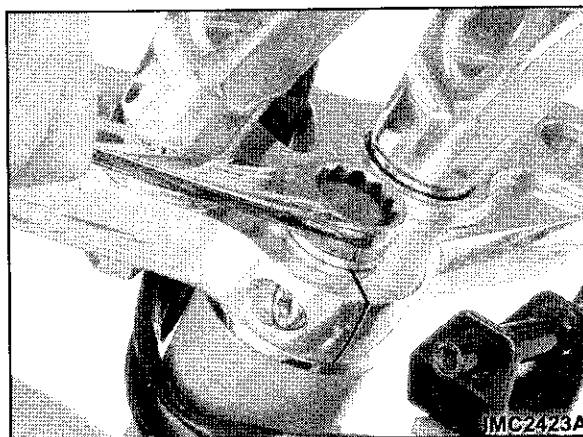


Figure 45 — Removing stem bolt

With the help of an assistant, support the lower triple clamp to prevent it from falling and loosen the upper triple clamp pinch screw, using a 5/16" hex bit.

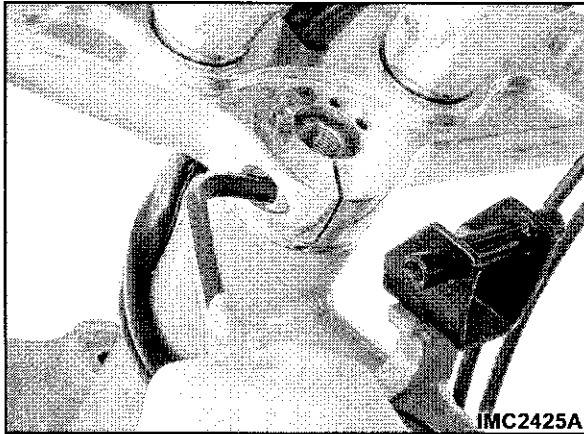


Figure 46 — Loosening upper triple clamp pinch screw

Remove the upper triple clamp and handlebar as an assembly. Place the triple clamp and handlebar in a secure position out-of-way.

**Note:** It is recommended to place heavy padding over the fuel tanks and secure the triple clamp and handlebar in place on the padding.

While supporting the lower triple clamp, remove the dust cover from the stem.

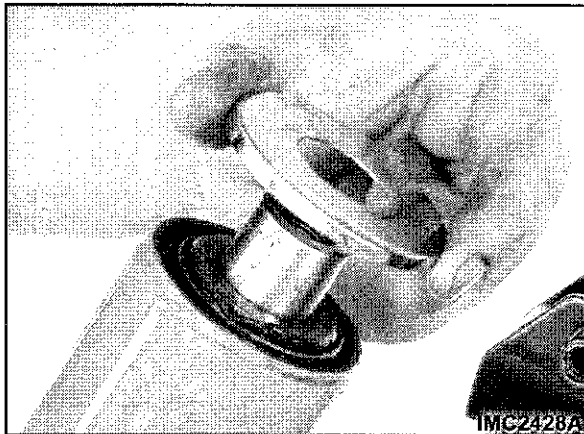


Figure 47 — Removing upper stem bearing dust cover

Slide the lower triple clamp out of the frame. Remove the lower bearing and dust cover from the clamp.

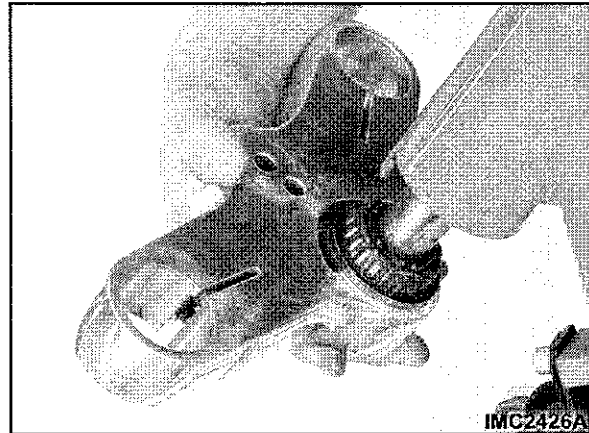


Figure 48 — Lower triple clamp removal

Clean the lower triple clamp.

Clean the upper and lower bearings, using a suitable solvent.

Inspect the upper and lower bearings for wear or other damage. Replace as necessary.

Pack the upper and lower bearings, using a high quality waterproof grease.

Clean the upper and lower bearing races in the frame stem tube, using suitable solvent. Clean the upper and lower bearing races to remove the solvent, using a lint-free shop towel.

Inspect the upper and lower bearing races for wear or damage.

Thoroughly grease the upper and lower bearing races.

Clean and inspect the upper bearing dust cover.

## Stem Bearing Replacement

If any bearing or race requires replacement, replace both the upper and lower bearing and race sets. Matched bearing and race sets are available for service replacement.

### Bearing Race Removal

To remove the upper race from the frame stem tube, place a suitable bearing race remover in position on the upper race. Then, insert the driver handle from the bottom of the stem tube and seat it against the remover.

**Note:** A suitable remover/installer can be obtained from a tool supplier or the bearing manufacturer. These may be multi-piece units with collets that lock onto the race.

With the remover tool and driver handle in position on the upper race, drive the race out through the top of the stem tube.

Remove the lower bearing race using the same method, but driving it out through the bottom of the tube.

### Bearing Race Installation

Apply a light coat of clean engine oil to the outside of the new bearing races.

Place a new race in position at the top of the stem tube with the tapered bearing surface facing up. Use care to ensure that the race is set square with the tube.

Using a suitable installer and handle, drive the race in until it is seated against the shoulder in the tube.

Place a new race in position at the bottom of the stem tube with the tapered bearing surface facing down. Again, seat the race square and against the shoulder in the tube, using the installer and handle to drive it into place.

## Triple Clamp Installation

Place the lower dust cover and bearing over the stem and seat the bearing and cover against the lower triple clamp.

Slide the lower triple clamp and bearing assembly into the frame stem tube.

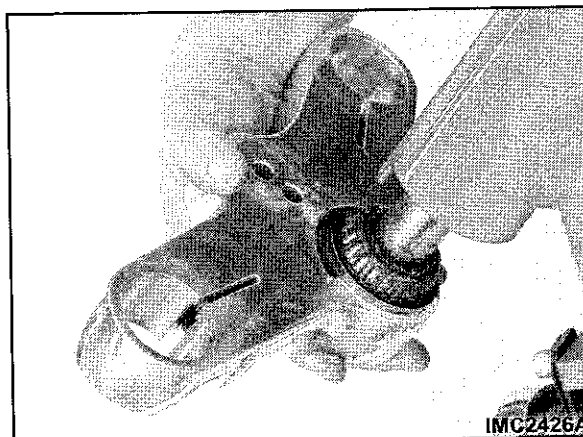


Figure 49 — Installing the lower triple clamp

Install the upper bearing and bearing dust cover over the stem and into position on the upper bearing race.

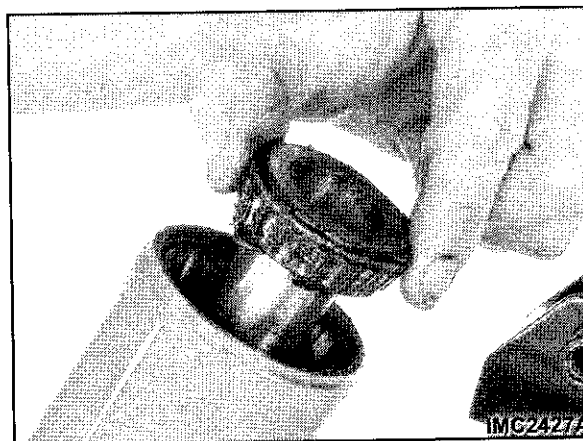


Figure 50 — Installing upper stem bearing

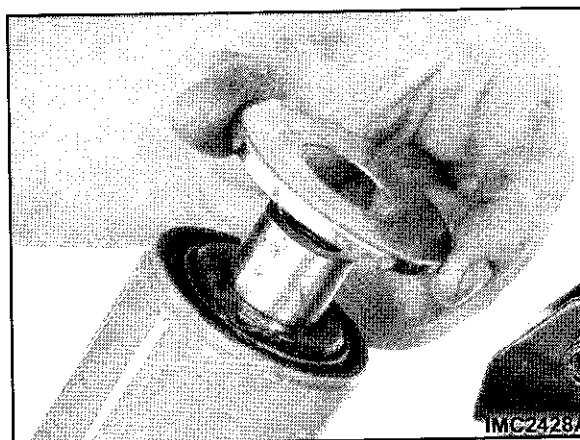


Figure 51 — Installing upper stem bearing dust cover

While still supporting the lower triple clamp and with the help of an assistant, place the upper triple clamp and handlebar assembly in position on the steering stem. Tighten the upper triple clamp screw to specification.

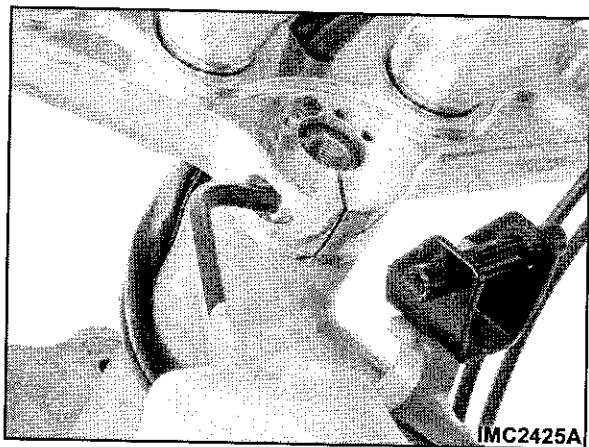


Figure 52 — Tightening upper triple clamp pinch screw

Install the notched washer and fork stem bolt, using a 15/16" wrench. DO NOT tighten the bolt at this time.

**Note:** A front wheel "fall-away" test and bearing adjustment is to be performed after complete installation of the front end components.

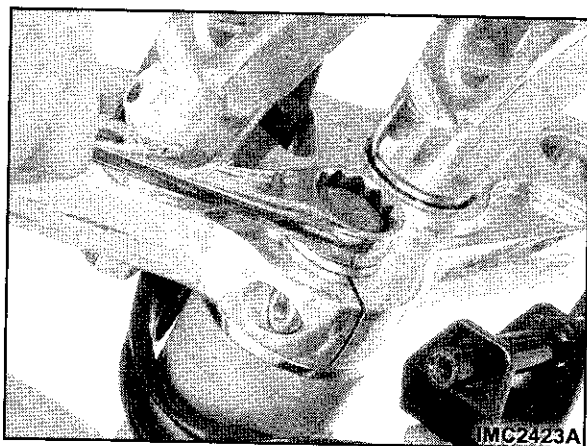


Figure 53 — Installing stem bolt

Install the front suspension fork tubes and the front wheel. Refer to the FRONT SUSPENSION SERVICE section for the procedure.

Install the front wheel following the procedure in the WHEELS AND TIRE SERVICE section.

Adjust the front wheel fall-away following the procedure under Steering Stem Inspection and Adjustment in this section.

Lower the front wheel to the floor and remove the motorcycle lift.

## Fork Seating

Press down on the handlebar several times to compress and release the forks. This is done to seat the axle at the bottom of the fork sliders and the fork tubes in the upper and lower fork triple clamps.

Tighten the four fork tube pinch screws at the back of the lower fork bracket, using a 1/4" hex socket. Tighten the screws to specification.

Press down on the handlebar a few more times to seat the front wheel axle.

Tighten the axle nut to specification, using a 3/8" hex socket. Use a second 3/8" hex bit to hold the axle while tightening the axle nut.

Tighten the axle pinch bolts to specification, using a 1/4" hex bit.

## Handlebar Replacement

The handlebar can be removed as an assembly with switches, brake, clutch and throttle controls remaining in place and positioned out-of-way for service of the steering stem bearings. However, if the handlebar is damaged and in need of replacement, then the switches, wiring, brake, clutch and throttle controls must be removed.

### Tools required:

5/32" hex bit

3/16" hex bit

1/4" hex bit

Torque wrench

### Handlebar Removal

Remove the seat from the motorcycle following the procedures in the FRAME AND ACCESSORIES SERVICE section.

Disconnect the battery cables (negative cable first) at the battery terminals. Refer to the procedure under Battery and Cables in the CHARGING SYSTEM SERVICE section.

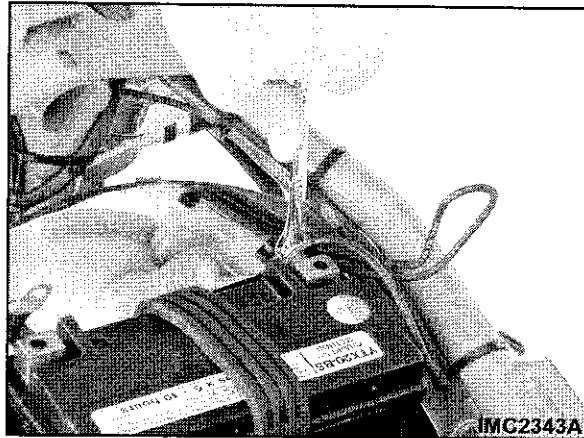


Figure 54 — Disconnecting battery cables

Remove the retaining screws from the clutch lever assembly, using a 5/32" hex bit. Remove the assembly from the handlebar and secure it in a position on the motorcycle where it is out-of-way.

Remove the retaining screws from the brake lever and master cylinder assembly, using a 5/32" hex bit. Remove the assembly from the handlebar. Secure it in a position out-of-way.

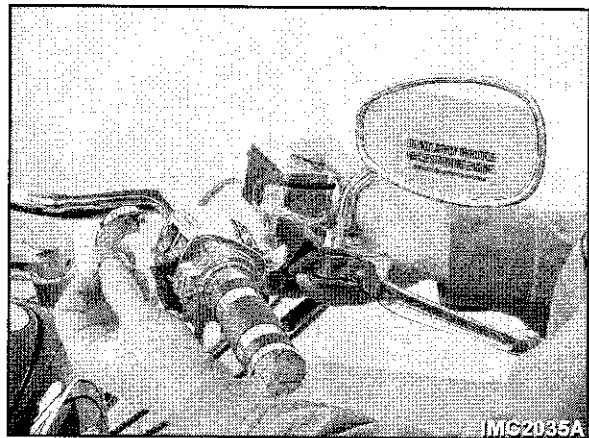


Figure 55 — Brake lever/master cylinder removal

Using a 5/32" hex bit, remove the retaining screws from the throttle/switch housing and carefully separate the housing halves.

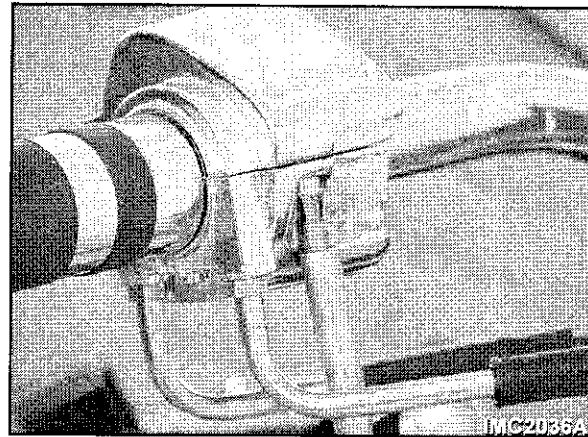


Figure 56 — Throttle/switch housing removal

Remove the ferrules from the throttle cable ends and remove the cable housing from the twist grip. Secure the cable housing to the motorcycle in a position out-of-way.

Remove the LH and RH switch assemblies and wiring harnesses from the handlebar following the procedures in the POWER DISTRIBUTION, LIGHTING AND INSTRUMENT SERVICE section.

Support the handlebar and, using a 1/4" hex bit, slowly loosen the four screws in the upper clamp plate. Carefully lower the handlebar as the screws are being loosened.

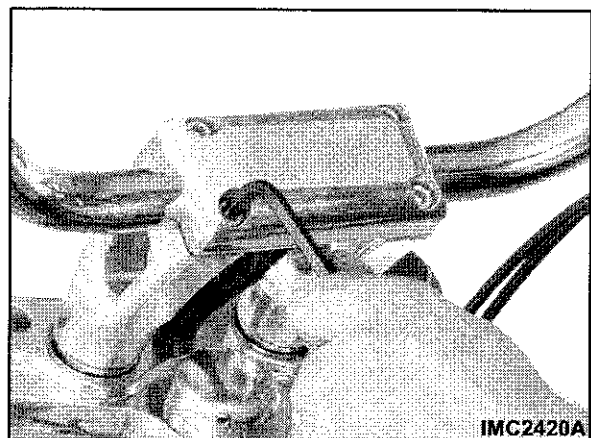


Figure 57 — Removing handlebar upper clamp plate

Remove the screws, upper clamp plate and handlebar from the motorcycle.



## Handlebar Installation

Apply blue threadlock to the threads of the four handlebar clamp screws.

Place the handlebar in position over the clamp base on the upper fork bracket. While supporting the handlebar in position on the clamp base, install the upper clamp plate and retaining screws. Tighten the screws to specification, using a 1/4" hex bit and torque wrench.

Place the throttle cable housing in position over the twist grip at the right side and connect the cable ends with the ferrules.

Install the RH and LH switch assemblies and wiring harnesses following the procedures in the POWER DISTRIBUTION, LIGHTING AND INSTRUMENT SERVICE section. Use care to ensure that the switch wiring harnesses are properly routed through the handlebar, the upper fork clamp and along the frame top tube to the power distribution module.

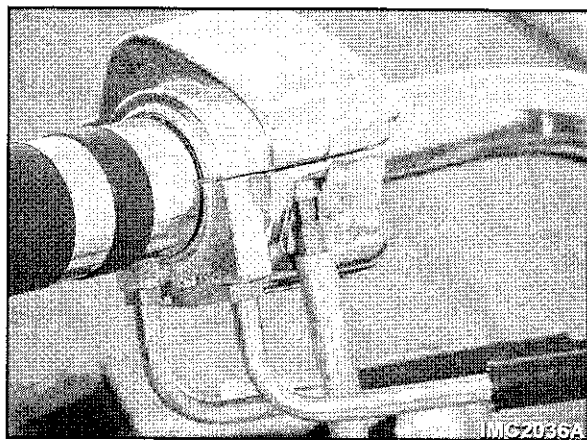


Figure 58 — RH switch assembly installation

Place the brake lever and master cylinder assembly in position at the right side of the handlebar. Install the retaining screws, using a 5/32" hex bit, and tighten the screws to specification.

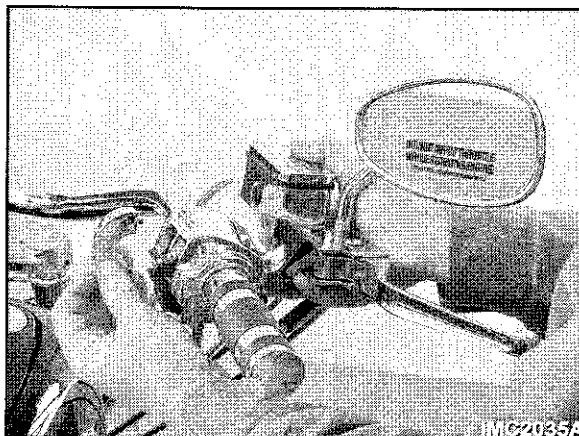


Figure 59 — Brake lever/master cylinder installation

Place the clutch lever assembly in position at the left side of the handlebar and install the retaining screws, using a 5/32" hex bit. Tighten the screws to specification.

Install the headlight assembly in its housing following the procedures in the FRAME AND ACCESSORIES SERVICE section.

Connect the battery cables (positive cable first) at the battery terminals and install the seat. Refer to the procedures under Battery and Cables in the CHARGING SYSTEM SERVICE section.

## REAR SUSPENSION SERVICE

### Shock Absorbers

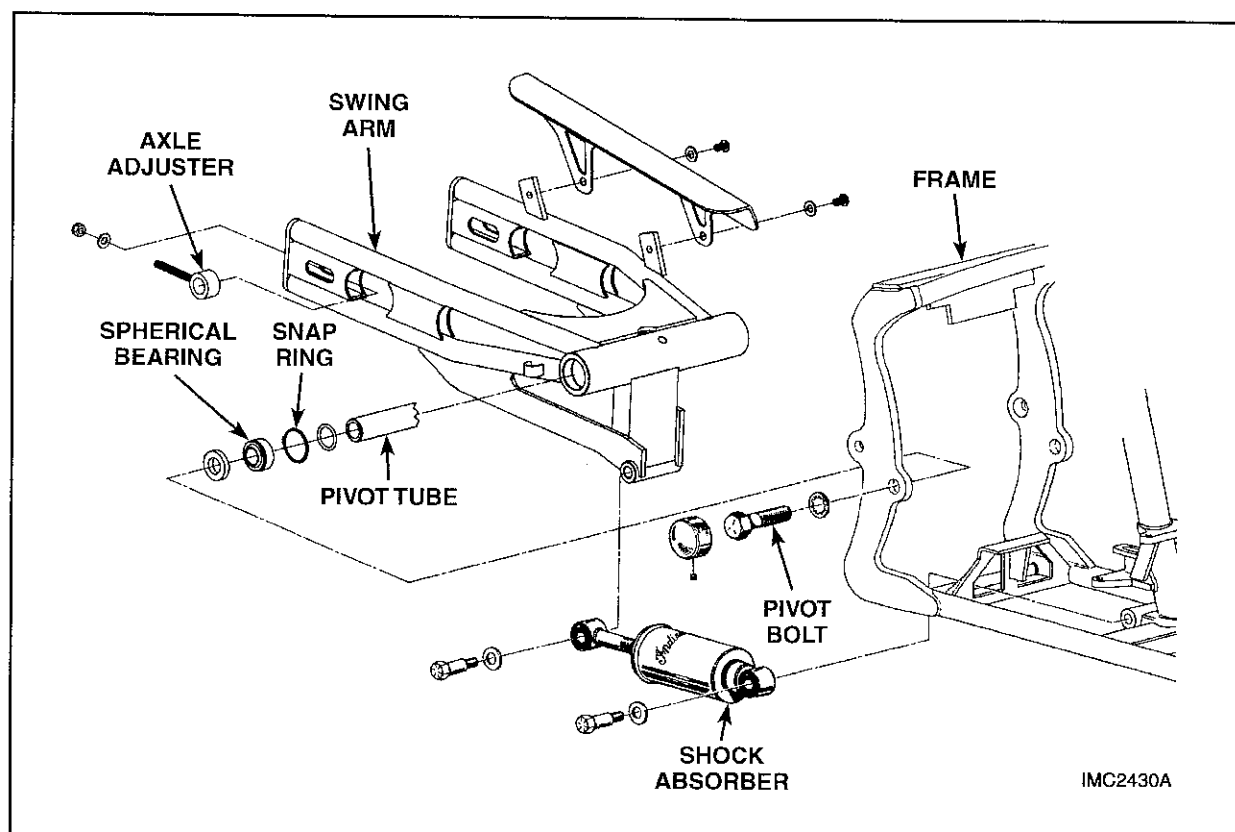


Figure 60 — Rear shock absorber assembly

The Indian Scout and Spirit motorcycles are equipped with two shock absorbers mounted between the frame and swingarm at the bottom of the chassis. If either shock absorber is leaking or damaged, both should be replaced.

#### Tools required:

- 3/4" wrench/socket
- 1-1/16" open-end wrench
- Spanner wrench with 1.7" pin centers
- Torque wrench
- Jack stands or other suitable supports
- Motorcycle lift

#### Shock Absorber Removal

Using a motorcycle lift, raise the motorcycle until the rear wheel is off the ground. Position the lift in a way that allows free access to shock absorbers under the chassis. Once raised, place supports under the rear wheel to prevent the swingarm from dropping once the shock absorber mounting screws have been loosened and removed.

**Note:** Because the lift must be positioned in a way that provides access to the shock absorbers, additional supports or jack stands should be placed under the chassis at the rear to stabilize the motorcycle.

## Shock Absorber Installation

Lubricate the bushing surfaces of the shock absorber mounting screws and apply blue threadlock to the screw threads.

Place the shock absorber(s) in position between the frame and swingarm mounts. Insert the mounting screws and tighten to specification, 115–130 foot-pounds, using a 3/4" socket and torque wrench.

Remove the supports from under the rear wheel or swingarm. Then, lower the motorcycle to the floor and remove the lift.

## Swingarm

### Tools required:

- 3 mm hex bit
- 1/4" dowel rod
- 3/4" wrench/socket
- 1-1/8" wrench
- Torque wrench
- Motorcycle lift

### Swingarm Removal

Remove the rear wheel following the procedure under WHEEL AND TIRE SERVICE.

Using a 3/4" wrench, remove the two shock absorber rear mounting screws at the swingarm.

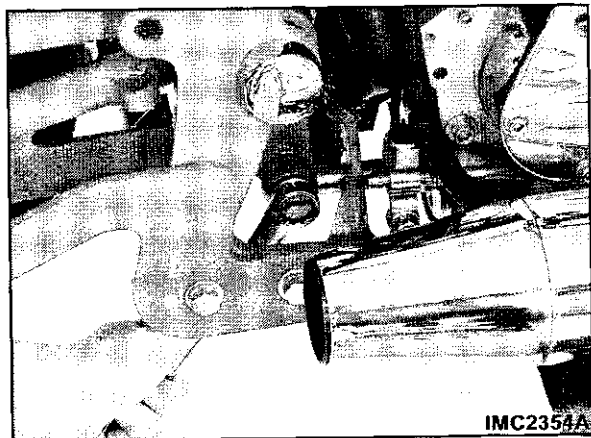


Figure 65 — Removing shock absorber swingarm mounting screw

Remove the chrome pivot bolt covers, using a 3 mm hex bit.

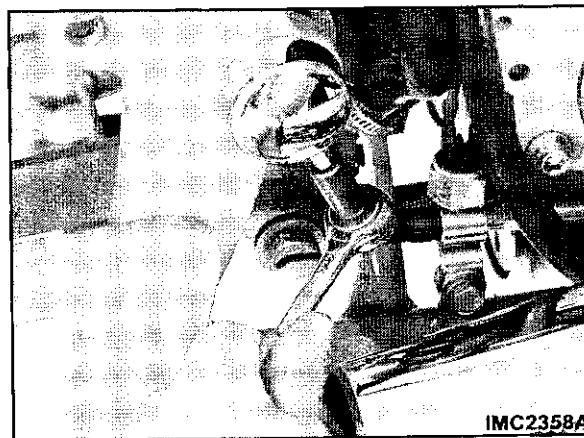


Figure 66 — Removing pivot bolt cover

The bolts are threaded into the pivot tube. To prevent the pivot tube from turning as the bolts are removed, insert a 1/4" dowel rod through the hole at the center of the swingarm cross tube and through the pivot tube. You may have to turn the pivot bolt to align the holes in the pivot tube and swingarm before the dowel rod can be inserted.

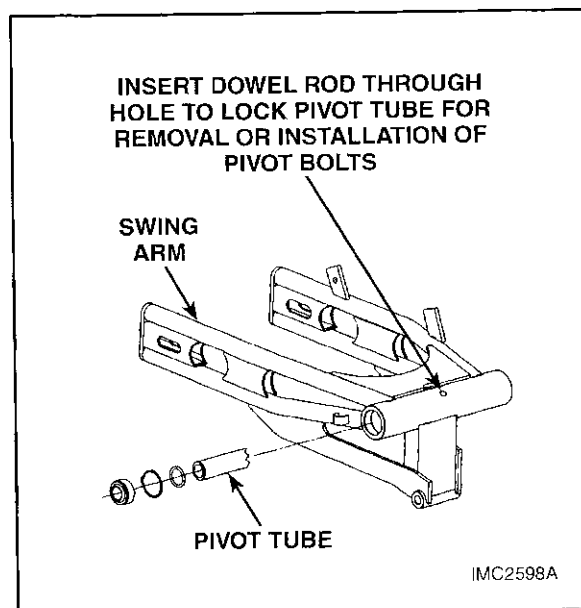


Figure 67 — Locking pivot tube

With the pivot tube locked in place, Loosen and remove the swingarm pivot bolts, using a 1-1/8" wrench.

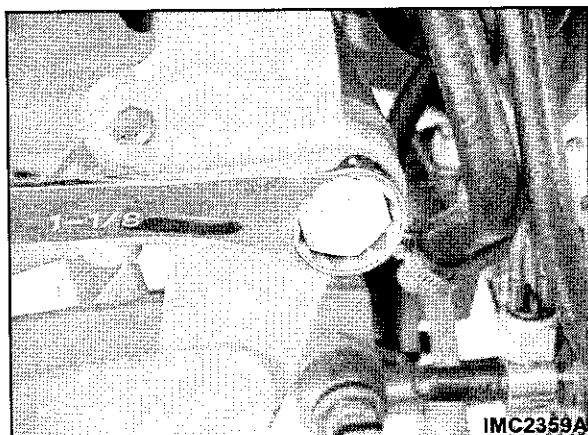


Figure 68 — Removing pivot bolt

While supporting the swingarm, pull the bolts out at frame side and remove the swingarm from the chassis.

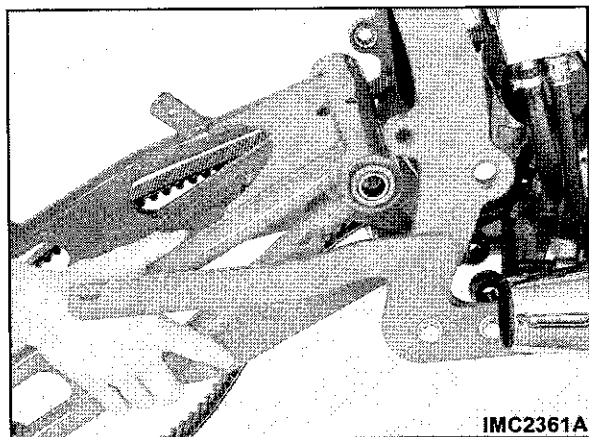


Figure 69 — Removing swingarm

## Swingarm Cleaning and Inspection

Check the swingarm for cracks, bends or other damage. A bent swingarm will affect the tracking and handling of the motorcycle and must be replaced.

The sleeved-spherical design pivot bearings do not require any special periodic maintenance other than cleaning. No lubrication is required. Clean any accumulated dirt from around the swingarm pivot bearings and the bearing bore. Inspect the bearing for wear or damage. The bearings should be reasonably tight yet swivel and rotate freely in the socket. If the bearings are excessively worn and loose, the bearings must be replaced.

## Swingarm Pivot Bearing Replacement

The pivot bearings are a press fit in the swingarm and are retained in position by a snap rings at the outer side of the bearings.

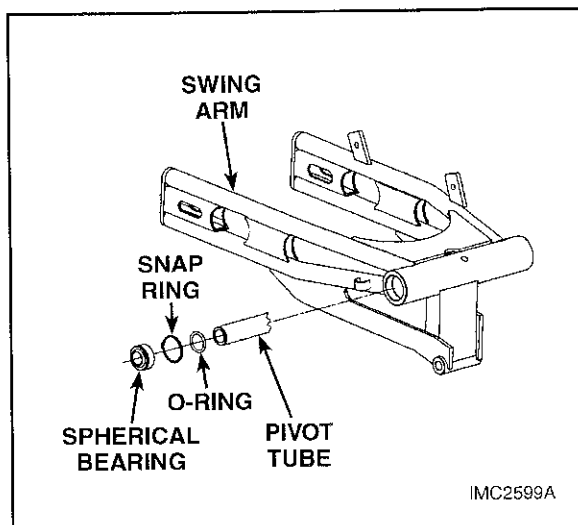


Figure 70 — Pivot bearing

To replace a bearing, use a suitable puller to remove the bearing(s) from the swingarm cross tube bore.

Remove the two O-rings and pivot tube from the swingarm and inspect them for wear or damage. Replace the O-rings and pivot tube as required.

Install a snap ring on the new bearing and place the bearing in position on the swingarm cross tube bore. Using a suitable driver placed over the outer ring of the bearing, press the bearing into the cross tube bore until the snap ring contacts the cross tube.

Repeat the process to replace the bearing on the other side.

## Swingarm Installation

Apply blue threadlock to the threads of the swingarm pivot bolts.

Place the swingarm in position on the chassis and insert the pivot bolts from the outer frame side. Start the bolts into the pivot tube far enough to secure the swingarm in position.

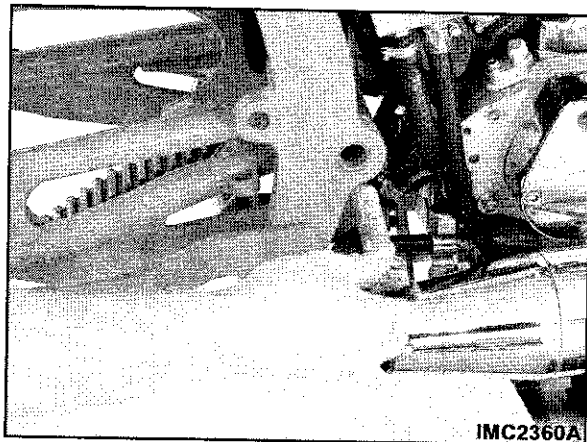


Figure 71 — Installing swingarm and pivot bolts

Insert a 1/4" dowel rod through the swingarm cross tube to lock the pivot tube in place. Then, using a 1-1/8" socket and torque wrench, tighten the pivot bolts to specification, 135–150 foot-pounds. Remove the dowel rod from the cross tube.

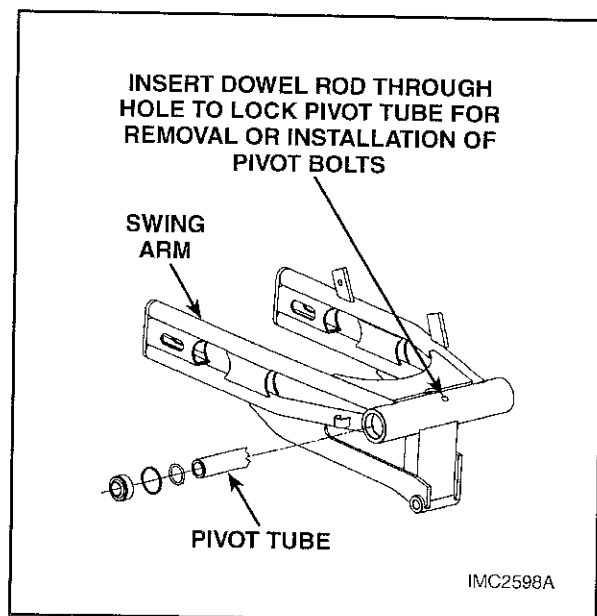


Figure 72 — Locking pivot tube

Apply blue threadlock to the threads of the shock absorbers rear mounting screws.

Place the shock absorber ends in position on the swingarm mounting block and install the mounting screws. Tighten the screws to 115–130 foot-pounds.

Install the rear wheel following the procedure under WHEEL AND TIRE SERVICE.

Lower the motorcycle to the floor and remove the lift.

## WHEEL AND TIRE SERVICE

### Front Wheel Removal and Installation

#### Tools required:

- 1/4" hex bit
- 3/8" hex bit
- Torque wrench
- Motorcycle lift

#### Removal

Raise the motorcycle off the ground, using a suitable lift.

Loosen the axle pinch bolt located on the bottom front of the right fork slider, using a 1/4" hex bit.

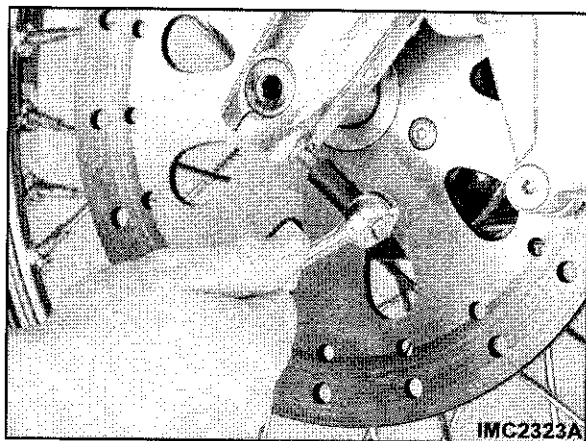


Figure 73 — Loosening pinch screw

Remove the axle nut, lock washer and flat washer from the left side of the axle, using a 3/8" hex bit. Use a 3/8" hex bit to prevent the axle from turning as the axle nut is being removed.

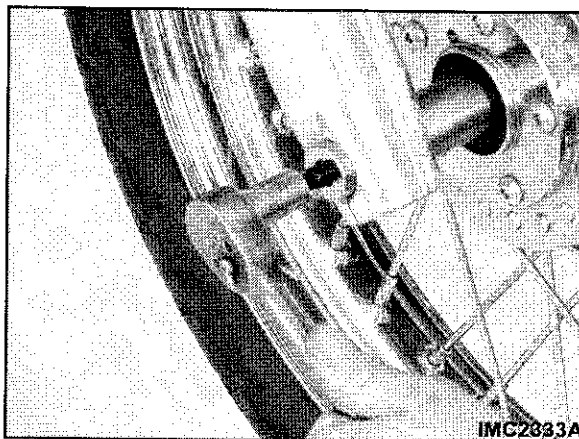


Figure 74 — Axle nut removal

Before removing the axle, note the position of the spacers on each side of the wheel.

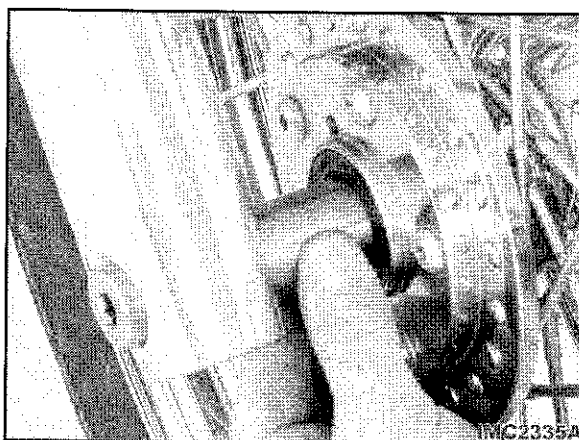


Figure 75 — Note spacer position

Carefully remove the axle from the front wheel and fork sliders. Support the tire and wheel assembly while removing the axle. Remove the wheel assembly from the motorcycle.

**Note:** One method of supporting the wheel and tire assembly for removal of the axle is to adjust the motorcycle lift so that the front wheel is just touching the ground.

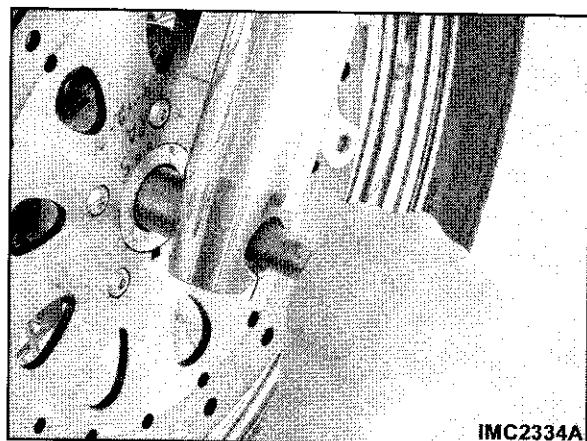


Figure 76 — Removing front axle

When the axle has been removed, place the spacers, washers and nut back on the axle in the proper order, ready for reinstallation.

**Note:** The axle, spacers, washers and nut can be reinstalled in fork sliders for safe keeping until it is time to install the wheel assembly.

## Installation

If installed, remove the nut, washers, axle and spacers from the fork sliders. Clean the parts and then apply a light coating of grease to the axle.

Apply a light coat of grease to the lips of the seals in the wheel hub.

Place the chrome spacer, 1.68" width for Scout/1.125" width for Spirit, into the right-side hub seal, against the wheel bearing (opposite the brake rotor side of the wheel hub).

Insert the threaded end of the axle into and through the right fork slider just far enough to install the 1.75" (Scout) or 1.41" (Spirit) wide spacer on the threaded end. Install the spacer.

Place the wheel and tire assembly in position between the fork sliders with the brake rotor on the left side.

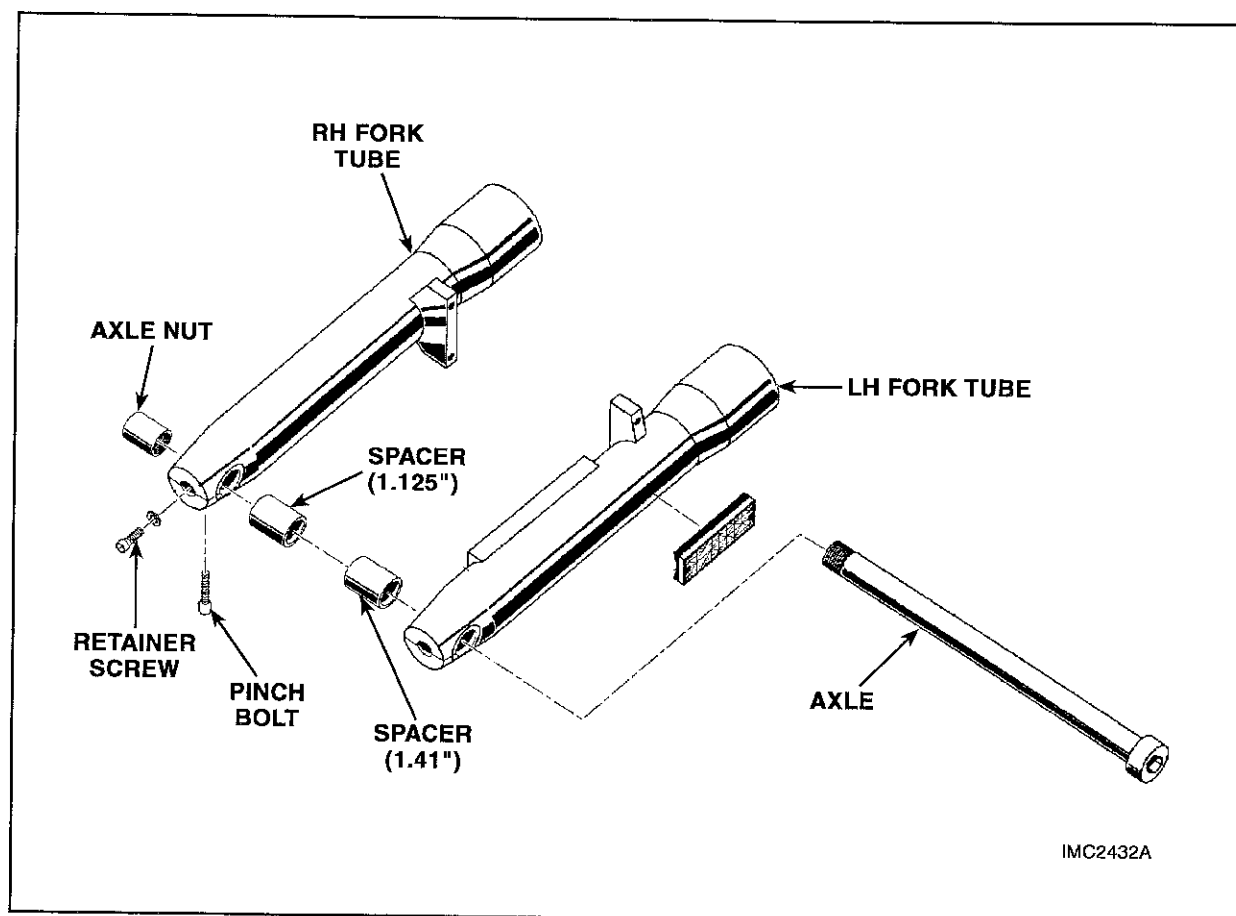


Figure 77 — Front axle and spacers (Spirit dimensions shown)

Align the wheel hub with the axle and slide the axle through the wheel. Install the large spacer onto the axle before the axle is inserted into the left fork slider.

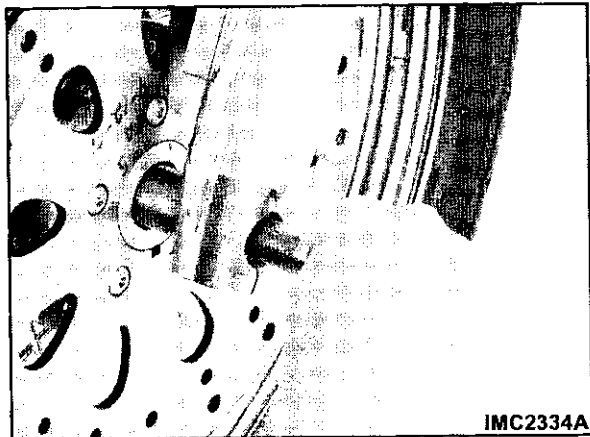


Figure 78 — Installing front axle

Install the flat washer, lock washer and nut onto the threaded end of the axle. DO NOT fully tighten the axle nut or pinch bolt at this time.

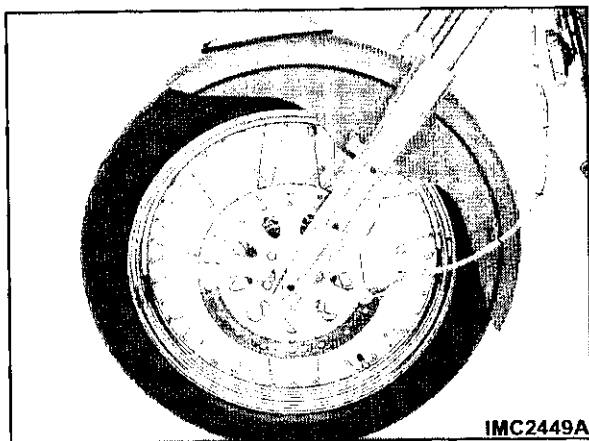


Figure 79 — Wheel/tire installed with axle in place

Lower the motorcycle to the ground and remove the lift.

Press down on the handlebar a few times to seat the front wheel axle.

Tighten the axle nut to specification, using a 3/8" hex bit. Use a 3/8" hex bit to hold the axle while tightening the axle nut.

Tighten the right-side axle pinch bolt to specification, using a 1/4" hex bit.

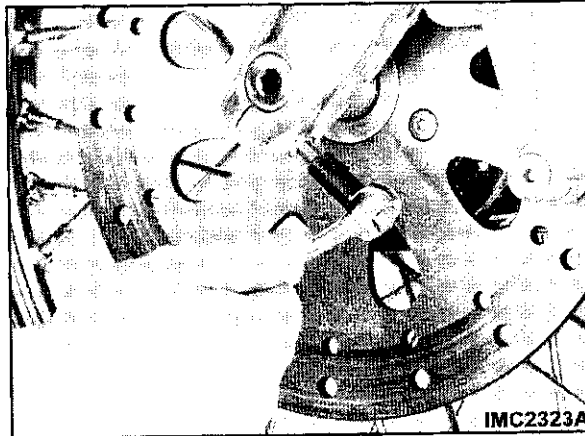


Figure 80 — Tightening axle pinch bolt

## Checking and Adjusting Wheel Bearing End Play

Wheel bearing end play should be checked and adjusted if necessary, after removing and installing the tire and wheel or after replacing components such as bearings, axle or hub.

### ⚠ WARNING!

Wheel bearing end play on all models for both front and rear wheels is 0.003–0.008" (0.0762–0.203 mm). Check end play after tightening the axle nut. Excessive end play can cause handling problems. Lack of adequate end play can result in bearing seizure. Each condition could cause an accident, resulting in serious personal injury.

Using a motorcycle lift, raise the motorcycle so that the wheel being checked for end play is off the ground.

Rotate the wheel several turns to seat the bearings.



Attach a magnetic based dial indicator set onto the outer edge of the brake rotor. Position the dial indicator against the axle center. Zero the indicator.

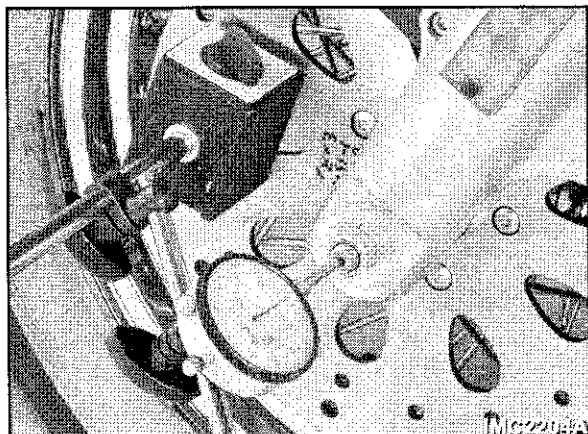


Figure 81 — Dial indicator setup, typical

Move the wheel side-to-side and check for end play. If the end play is not 0.003–0.008" (0.0762–0.203 mm), remove the axle and wheel and use a different bearing spacer as necessary to achieve correct end play.

**Note:** Various bearing spacers are available to control the amount of wheel bearing end play. Refer to the following table.

| Part No. | Thickness                       |
|----------|---------------------------------|
| 17-931   | 0.030–0.033" (0.76–0.84 mm)     |
| 17-932   | 0.015–0.017" (0.38–0.43 mm)     |
| 17-933   | 0.0075–0.0085" (0.190–0.216 mm) |
| 17-934   | 0.0035–0.0045" (0.089–0.114 mm) |
| 17-935   | 0.0015–0.0025" (0.038–0.064 mm) |

Obtain the correct spacer, install the wheel, axle and spacer and tighten the axle to specification.

Check wheel bearing end play again and verify end play is within the specification of 0.003–0.008" (0.0762–0.203 mm).

## Rear Wheel Removal and Installation

### Tools required:

- 7/32" hex bit
- 1/2" wrench/deep-well socket
- 15/16" wrench/socket
- Torque wrench
- Belt tension gauge
- Motorcycle lift

### Removal

Raise the motorcycle off the ground, using a suitable lift.

Using a 6 mm hex bit, remove the two mounting screws securing the brake caliper to the right fork of the swingarm. Secure the caliper to the frame with a tie strap, in a position that is out-of-way.

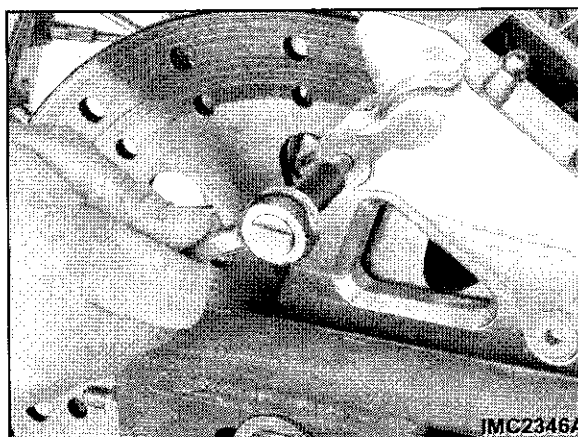


Figure 82 — Removing caliper

Remove the cotter pin and, using a 15/16" wrench, loosen the retaining nut at the right side of the axle. Use a 15/16" wrench to keep the axle from turning as the nut is being removed.

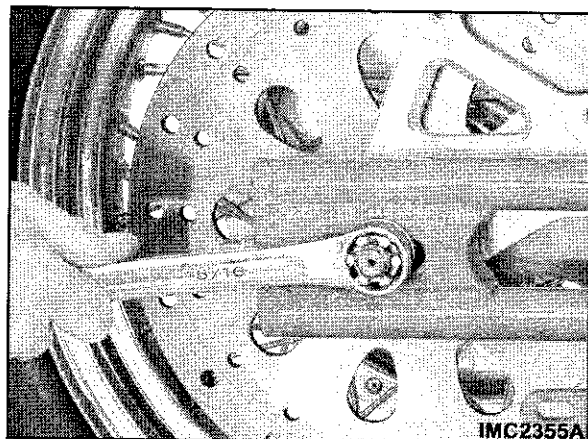


Figure 83 — Axle nut removal

Remove the nut, lock washer and flat washer from the axle.

Before removing the axle, note the position of the spacers on each side of the wheel.

Support the tire and wheel assembly and carefully remove the axle from the rear wheel and swingarm.

**Note:** One method of supporting the wheel and tire assembly for removal of the axle is to adjust the motorcycle lift so that the rear wheel is just touching the ground.

When the axle has been removed, place the spacers, washers and nut back on the axle in the proper order, ready for reinstallation.

**Note:** The axle, spacers, washers and nut can be reinstalled in the swingarm for safe keeping until it is time to install the wheel assembly.

## Installation

If installed, remove the nut, washers, axle and spacers from the swingarm. Clean the parts and then apply a light coating of grease to the axle.

Apply a light coat of grease to the lips of the seals in the wheel hub.

Place the 1/2" wide black powder-coated spacer into the sprocket-side hub seal, against the bearing.

Insert the 1/2" spacer into the seal on the brake-rotor side of the wheel.

Place the wheel and tire assembly in position in the swingarm with the sprocket at the left side of the motorcycle.

Slip the belt over the sprocket.

Insert the axle just through the swingarm at the left. Place the larger 1-1/2" black powder-coated spacer into position between the swingarm and the smaller spacer in the sprocket seal.

Align the wheel hub with the axle and slide the axle all the way through the hub and the swingarm at the right.

Install the flat washer and retaining nut onto the threaded end of the axle.

Adjust the lift to raise the rear wheel off the ground so that the wheel can be rotated to check belt tracking.

Check the belt tracking by rotating the wheel in both forward and rearward directions. The belt should track from side-to-side (right to left in forward direction; left to right in rearward direction) in approximately 15 revolutions. If not, adjust the axle alignment following the procedure in the REAR DRIVE SERVICE section.

Using a 15/16" socket and torque wrench, tighten the rear axle nut to specification and install a new cotter pin.

**Note:** Measure rear wheel bearing end play to make sure end play is within specification. Refer to Checking and Adjusting Wheel Bearing End Play in this section.

Apply blue threadlock to the two brake caliper mounting screws.

Cut the tie strap securing the caliper to the frame and place the brake caliper in position over the brake rotor. Align the brake caliper mounting bosses with the mounting bosses in the caliper mounting bracket on the right fork of the swingarm.

Install the caliper mounting screws, using a  $7/32$ " hex bit, and tighten the screws to specification.

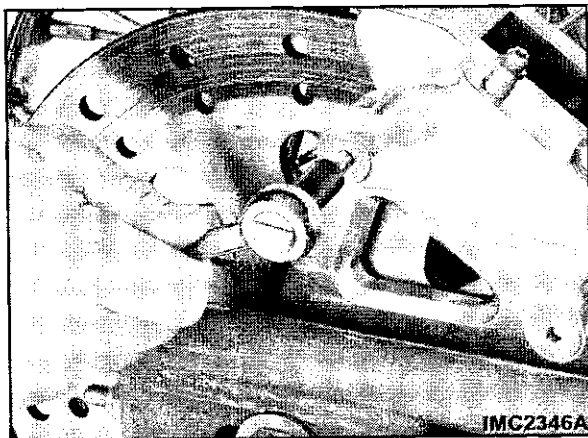


Figure 84 — Installing caliper

Install the rear fender following the procedure in the FRAME AND ACCESSORIES SERVICE section.

Lower the motorcycle to the ground and remove the lift.

## Hub Bearing Cleaning and Inspection

The following procedures apply for both the front and rear wheel hubs.

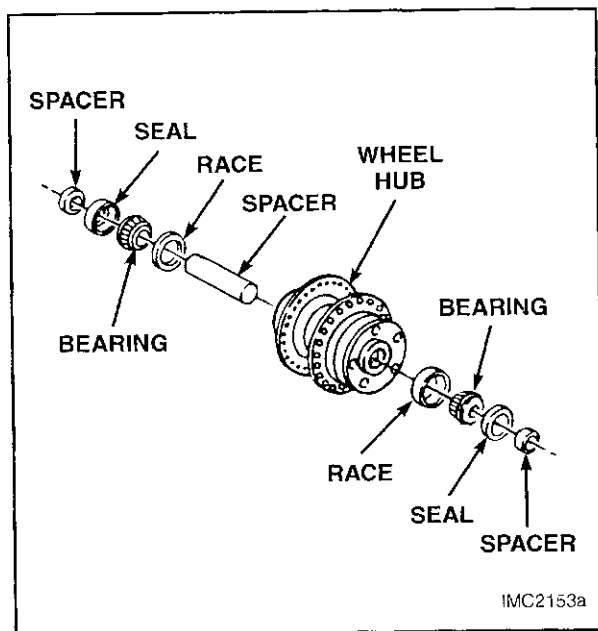


Figure 85 — Hub, bearings and seals (front and rear wheel)

### Tools required:

Seal removal tool (or screwdriver)

Seal driver (or suitably-sized hex socket)

### Seal and Bearing Removal

**Note:** The bearings and mating races are matched sets. DO NOT mix bearings and races. Remove only one bearing at a time to lubricate it and then install it in its original position.

Remove the seal from the left side of the wheel hub, using a seal removal tool or screwdriver. Remove the seal from the left side of the wheel hub, using a seal removal tool. Clean the seal and inspect it for wear or damage. Replace the seal as necessary. Place a small of grease on the seal lip cavity.

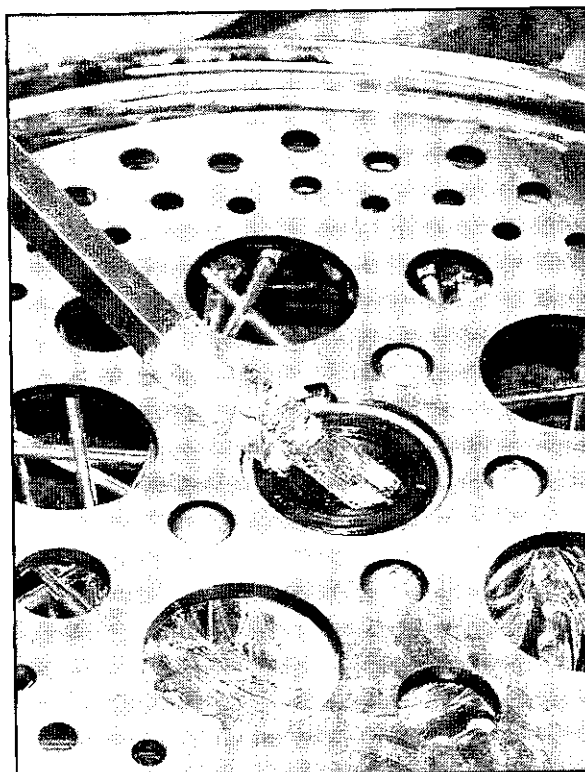


Figure 86 — Removing seal (left side shown)

Pull the bearing from the race. Wash the bearing in solvent to remove the grease.

Wipe the race located in the wheel hub with a rag dipped in solvent. Clean the solvent from the race, using a lint-free cloth.

Inspect the bearing and race for wear or damage. Replace the bearing and race as necessary, using a matched set only.

## Bearing and Seal Installation

If the bearing is suitable for reuse, repack the bearing with a high quality waterproof bearing grease.

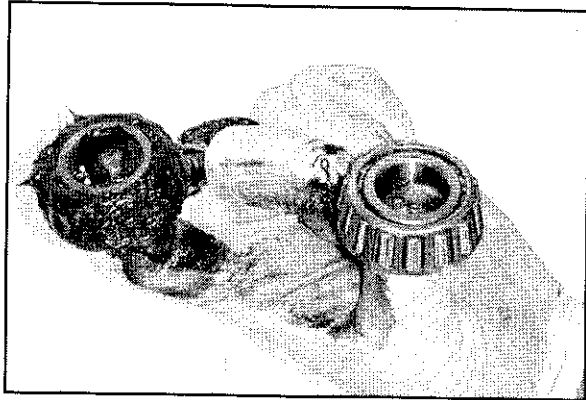


Figure 87 — Repacking wheel bearings

Apply a film of grease to the bearing surface of the race. Then place the greased bearing in position on the race.

Apply a light film of grease on the outer edge of the seal and place the seal in position on the hub. Ensure that the seal is aligned squarely and carefully drive the seal into the wheel hub, using a seal driver or suitable hex socket. Continue to tap the seal inward until it is seated against the bearing.

 **Note:** The diameter of the driver or hex socket should be slightly smaller than the outside diameter of the seal.

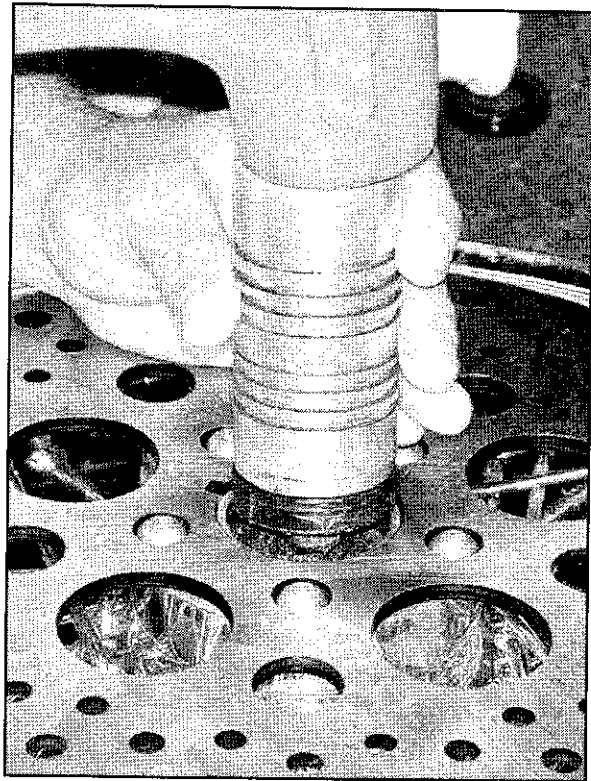


Figure 88 — Installing wheel seal (left side)

Repeat this procedure to clean, inspect and install the bearing and seal on the right side of the hub.

## Wheel Sprocket and Brake Rotor Removal and Installation

### Tools required:

3/16" hex bit

7/32" hex bit

3/8" hex bit

Torque wrench

### Front Wheel Brake Rotor

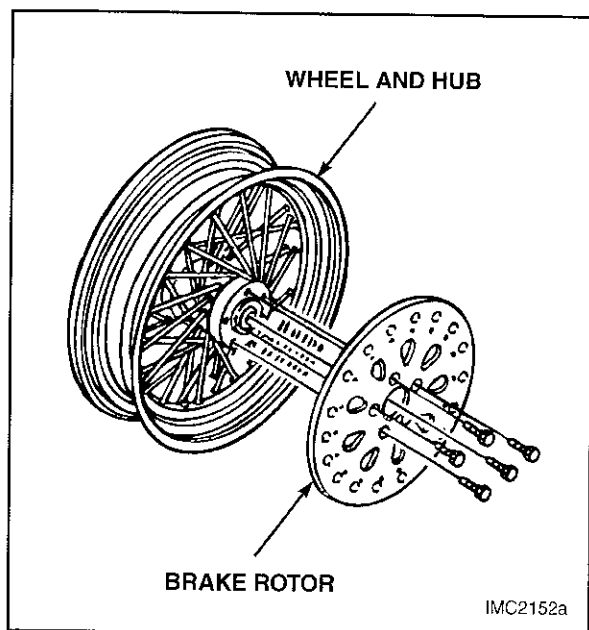


Figure 89 — Front wheel assembly

The brake rotor is attached to the front wheel hub on the left side with five screws.

If the rotor is being removed for resurfacing or for access to the wheel spokes, mark the rotor and wheel so the rotor can be installed in the same position.

Using a 3/16" hex bit, remove the five mounting screws and separate the rotor from the wheel hub.

Clean and inspect the rotor. Resurface or replace it as required. If the rotor is warped, worn beyond acceptable limits or otherwise damaged, it must be replaced.

Place the rotor in position on the wheel hub. If the rotor is being reused, align it in the same position as originally installed.

Apply red threadlock to the threads of the five mounting screws. Install the mounting screws and tighten the screws to 16–24 foot-pounds, using a 3/16" hex bit and torque wrench.

### Rear Wheel Brake Rotor

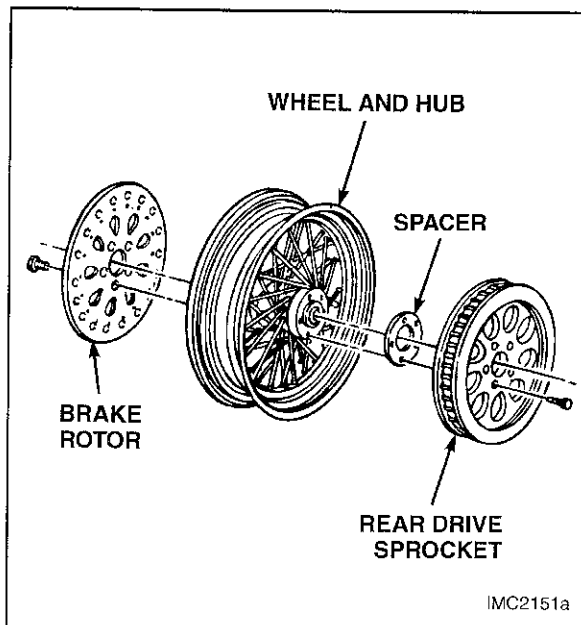


Figure 90 — Rear wheel assembly

The brake rotor is attached to the rear wheel hub on the right side with five screws.

If the rotor is being removed for resurfacing or for access to the wheel spokes, mark the rotor and wheel so the rotor can be installed in the same position.

Using a 7/32" hex bit, remove the five mounting screws and separate the rotor from the wheel hub.

Clean and inspect the rotor. Resurface or replace it as required. If the rotor is warped, worn beyond acceptable limits or otherwise damaged, it must be replaced.

Place the rotor in position on the wheel hub. If the rotor is being reused, align it in the same position as originally installed.

Apply red threadlock to the threads of the five mounting screws. Install the mounting screws and tighten the screws to 30–45 foot-pounds, using a 7/32" hex bit and torque wrench.

## Rear Wheel Sprocket

The wheel sprocket is attached to the rear wheel hub on the left side with five screws.

Using a 3/8" hex bit, remove the five mounting screws and separate the sprocket and spacer from the wheel hub.

Clean and inspect the sprocket. Replace it if it is cracked or damaged.

Place the spacer and sprocket in position on the left side of the wheel hub.

Apply red threadlock to the threads of the five mounting screws and install the screws. Tighten the screws to specification, 55–65 foot-pounds, using a 3/8" hex bit and torque wrench.

## Wheel Rim, Hub and Spokes Inspection

Loose spokes can lead to handling problems, spoke breakage and wheel failure. The procedure below describes adjustments in spoke tension that can be done to both front and rear wheels to correct minor problems. If the inspection shows that there are many spokes loose, re-truing of the wheel may be required.

### Tools required:

- 6 mm open-end or spoke wrench
- Long screwdriver or metal rod
- Motorcycle lift

### Tightening Loose Spokes (Front and Rear Wheels)

Using a lift, raise the motorcycle so that the tires are off the ground.

Starting with the front wheel, tap each spoke in the center with a long screwdriver and note each spoke's tone. Spokes producing a dull or flat tone require tightening. Spokes that are too tight will produce a very high note and should be loosened slightly. Spokes that are properly tightened will produce clear and uniform tones.

**Note:** Spokes are rarely too tight from the factory. In addition, rear wheel spokes typically require more maintenance than the front.

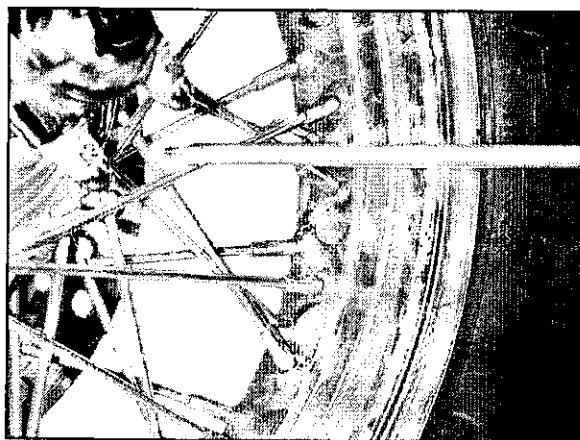


Figure 91 — Tapping spoke and noting tone

When you find a loose spoke, inspect the entire length of the spoke for damage. Carefully inspect the radius and head of the spoke at the hub.

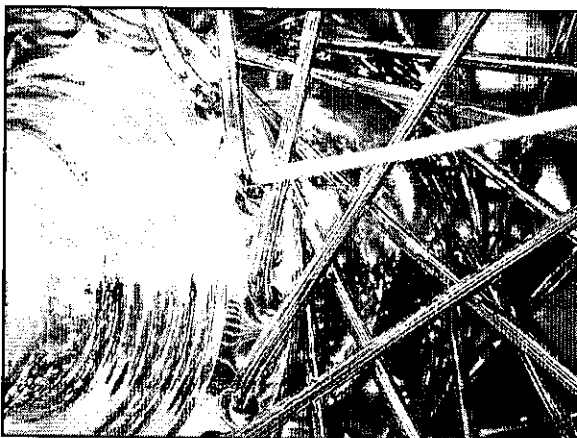


Figure 92 — Checking outside radius for fractures

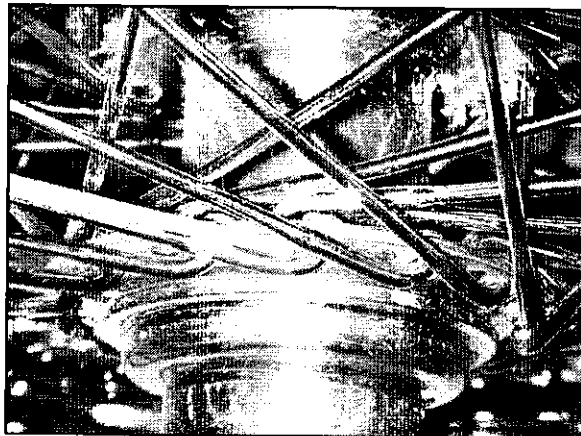


Figure 93 — Checking inside radius for fractures

Tighten spokes that are found to be loose, using a 6 mm open-end wrench. Tap each spoke as it is tightened, noting the tone.

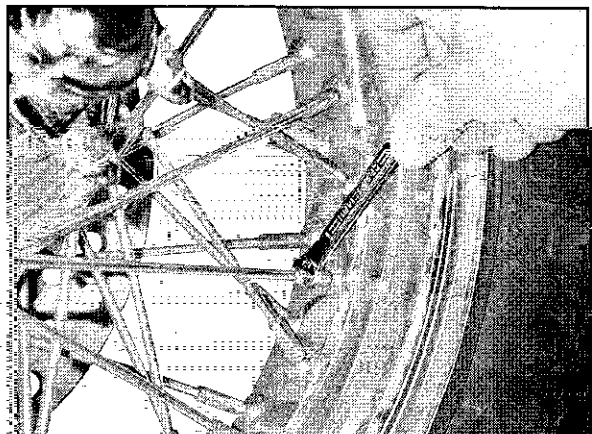


Figure 94 — Tightening spokes

Once the spokes are tight, visually inspect the rim and hub for dents, cracks and out-of-roundness. Replace parts as necessary.

Spin the wheel and note any excessive drag or looseness in the bearings. Refer to Hub Bearings — Cleaning and Inspection in this section if problems are found.

Repeat this procedure to inspect the rear wheel rim, hub and spokes.

## Tire Inspection and Pressure Check

### General Information

Tires are critical to the handling performance of the motorcycle. Tire pressures should be checked weekly and then visually inspected at the first 500-mile check.

Tire wear indicators are required by law. These indicators are located in a minimum of six places on the tread circumference and become visible at a tread depth of approximately 1/16" at which point the tire is considered worn out and should be replaced. The tread wear indicators are located in the tire grooves and appear as a solid band.

Please remember, just because a tire has not reached the tread wear indicators does not mean the tire's handling characteristics are not affected. A rear tire used primarily for touring typically wears in the center creating squared edges. This squared-edge wear pattern may cause an odd feeling when the bike is leaned over in a turn.

The tire should be replaced if any odd handling characteristics are encountered.

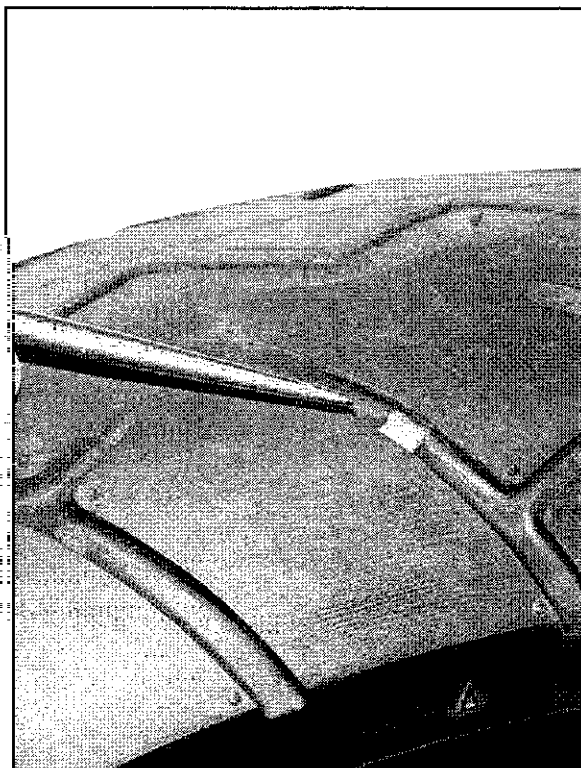


Figure 95 — Wear indicator (painted for clarity)

Front tire wear typically occurs off center and produces steps at the water drain grooves. When leaned over, these steps can cause the handlebars to oscillate producing a weave of the motorcycle. Again, the tire does not have to be worn down to the wear bar indicators for this to occur. Prompt replacement of the tire typically restores handling back to an "as new" condition.

Proper inflation pressure is critical to tire longevity. Low inflation pressure will cause the tire to build up heat and break down the sidewall and tread. In extreme cases, the tire will form a bubble between the cords and rubber. When this occurs, a tread section may tear away from the tire, inducing a vibration that gets progressively worse with speed. The vibration affects handling and can lead to a flat tire at higher speeds, a dangerous situation.

Always adhere to the tire manufacturer's suggested pressures taking into consideration the weight of the motorcycle, weight of passengers and road conditions.

As the tire heats up, air inside the tire expands, raising the tire pressure. Typically, this rise is on the order of two to six psi with the bike fully loaded and traveling at high speeds on a 90-degree day.

Tire inflation pressure recommendations are:

#### Indian Scout

- Michelin Commander 100/90-19 57H Front  
Pressure with single rider — 35 psi (2.461 kgf/cm<sup>2</sup>)  
Pressure at GVWR — 41 psi (2.883 kgf/cm<sup>2</sup>)
- Michelin Commander 130/90-16 73H Rear  
Pressure with single rider — 35 psi (2.461 kgf/cm<sup>2</sup>)  
Pressure at GVWR — 41 psi (2.883 kgf/cm<sup>2</sup>)

#### Indian Spirit

- Michelin Commander MT90 B16 71H Front  
Pressure with single rider — 35 psi (2.461 kgf/cm<sup>2</sup>)  
Pressure at GVWR — 41 psi (2.883 kgf/cm<sup>2</sup>)
- Maxxis whitewall MT90 16F 74H TL Front  
Pressure with single rider — 32 psi (2.25 kgf/cm<sup>2</sup>)  
Pressure at GVWR — 36 psi (2.53 kgf/cm<sup>2</sup>)

- Michelin Commander MT90 B16 74H Rear  
Pressure with single rider — 37 psi (2.6 kgf/cm<sup>2</sup>)  
Pressure at GVWR — 41 psi (2.883 kgf/cm<sup>2</sup>)
- Maxxis whitewall MT90 16F 74H 1L Rear  
Pressure with single rider — 36 psi (2.53 kgf/cm<sup>2</sup>)  
Pressure at GVWR — 36 psi (2.53 kgf/cm<sup>2</sup>)

Tire pressures should be checked when the tires are COLD.

Again, hot tires will show a pressure increase. DO NOT let air out of a hot tire to bring it down to the cold pressure setting. Releasing air will allow the tire to heat even further and possibly lead to failure.

### Tire Inspection

Visually inspect the tire for any cuts, cracks and bubbles on the tread surface and sidewall. Replace the tire if any such damage is found or the tread shows excessive or irregular wear.

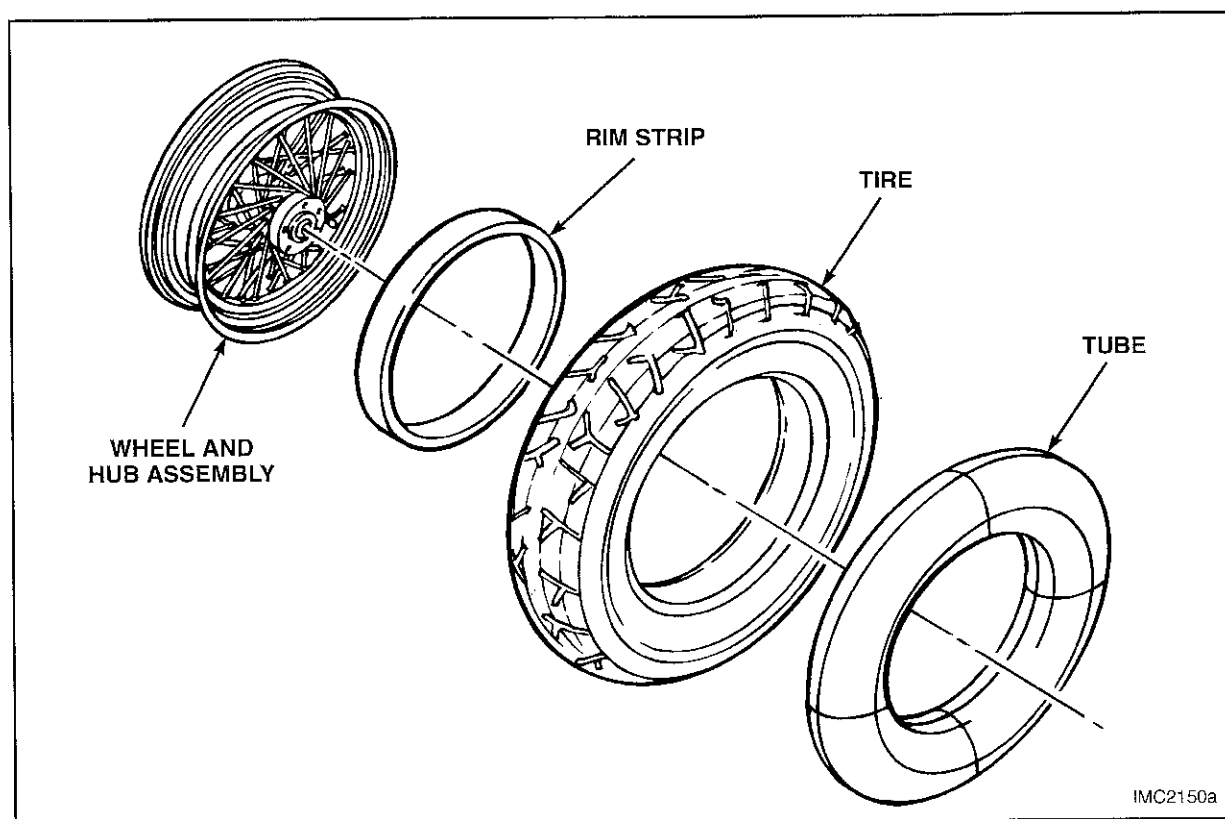


Figure 96 — Tire and tube



## Tire and Tube Replacement

A rim strip, inner tube and tube-type tires are required on wire-spoke (laced) wheels.

### Tools required:

- Tire irons
- Rim protectors
- Valve core remover/installer
- Tire gauge

### Tire Removal

Release the air from the tire and remove the valve core from the tube stem.

With the tire and wheel assembly flat on the ground, break the tire bead away from the rim on the side facing up.

Place a protector on the rim and, using a tire iron, start the bead over the rim. Hold the bead above the rim with the iron.

#### ⚠ CAUTION!

**If the tube is to be reused, exercise care when using the tire irons to avoid pinching the tube and damaging it as the tire is being removed.**

Using a second tire iron and rim protector, start the bead over the rim at a short distance away from the first iron. Continue working around the rim with the second iron until the bead is over the rim for the full circumference of the tire.

Remove the tube from the opening between the rim and tire bead.

Stand the tire and wheel up. Then, working from the other side of the wheel, pry the other bead over the rim, using the tire iron and protector. Use care to support the wheel and prevent it from falling as the tire is being removed.

Remove the rubber rim strip from inside the rim. Discard the rim strip if it is damaged or has deteriorated.

## Tire Installation

Check the wheel rim to ensure that no spokes are protruding through the spoke nuts on the inner surface of the rim. Correct the condition if necessary and then install the rim strip over the spokes.

Apply a coat of rubber lubricant to the bead surfaces of the tire. With the wheel flat on the ground, place the tire in position on the upper edge of the wheel. Be sure the tire is positioned correctly for its designed forward direction of rotation.

Using the tire irons and protectors, pry the lower bead over the rim edge and into the center. Press the bead against the lower seat of the rim.

Partially inflate the tube for easier installation. Align the tube valve stem with the stem hole in the rim and insert the tube into the tire through the opening between the rim and upper bead. Be sure to seat the valve stem in the rim stem hole. Use care when installing the tube and tire to avoid moving the rim strip from its position over the spokes.

Starting opposite the valve stem, place a protector on the rim and, using a tire iron, start the upper bead over the edge and into the rim. Hold the bead in the rim with the iron.

#### ⚠ CAUTION!

**Exercise care when using the tire irons to avoid pinching the tube and damaging it as the tire is being installed.**

Using a second tire iron and rim protector, start the bead over the rim at a short distance away from the first iron. Continue working around the rim with the second iron until the upper bead is in the rim center for the full circumference of the tire. Pressure adjustment may be required to leverage the remaining 12" of tire bead over the rim.

Inflate the tube to the specified pressure to fully seat the beads in the wheel rim.

Release the air from the tire, using the valve core remover. Reinstall the valve core and again inflate the tube to the specified pressure. This process ensures that the tube is properly positioned within the tire.

Inspect the tire bead on both sides to make sure the beads are fully seated against the rim.

## WHEEL LACING

The Indian Scout and Spirit motorcycles are standard equipped with the following types of wheels:

- 19-inch, 40-spoke (Scout front wheel)
- 16-inch, 40-spoke (Scout rear wheel)
- 16-inch, 60-spoke (Spirit front and rear wheels)

The wheel lacing procedure is slightly different for the three configurations. This section includes a procedure for each configuration. However, the procedure for Aligning the Hub and Rim (Truing) at the end of the section applies for all three configurations.

### Lacing 19-Inch, 40-Spoke Wheels

#### General Information

The 19-inch 40-spoke wheels are fitted with hook-type spokes of two lengths and styles, 7-3/4" with a narrow-set hook and 8-1/2" with a wide-set hook. The Spokes are inserted alternately from the outer side of the hub flanges. The 8-1/2" spokes with the wide-set hooks are used in positions where they cross behind the shorter spokes. Each flange of the wheel holds 20 spokes, with 10 of each size alternately positioned.

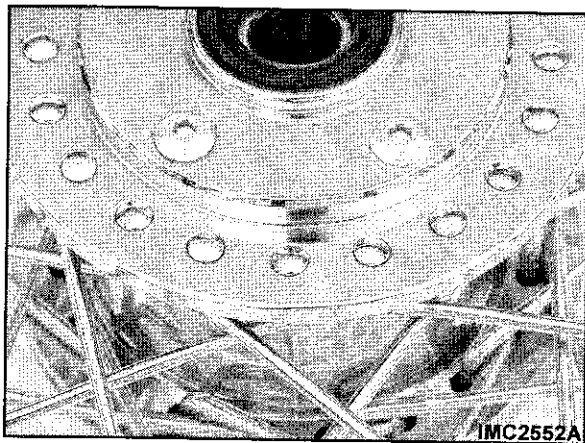


Figure 97 — Straight hub flange (19-inch, 40-spoke wheel)

Holes in the rim are offset in pairs to the right and left of center. In addition, the rim holes are alternately angled in pairs from side-to-side, to accept the clock-wise and counterclockwise installation of the spokes.

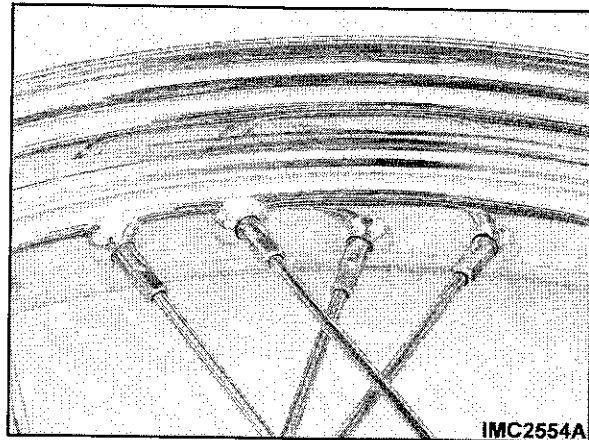


Figure 98 — Offset rim hole arrangement (19-inch, 40-spoke wheel)

For the 19-inch, 40-spoke wheel, the short spokes in the left flange are angled out from the hub in a clockwise pattern and the long spokes in a counterclockwise pattern. This pattern is reversed for the right flange, where the long spokes are angled in a clockwise pattern and the short spokes, counterclockwise.

#### Tools required:

3/16" hex bit

1/4" open-end wrench/spoke wrench

Straightedge

Scale

#### Wheel Lacing Procedure

In this procedure, references to left and right sides of the wheel refer to its mounting on the motorcycle. For the front wheel, the left side is the brake side.

Before disassembling the wheel to replace the hub, rim or spokes, note the spoke positions, the lacing pattern and the rim offset. This will be very important when assembling the hub, spokes and rim.

Also, before disassembling the wheel, measure the rim offset in relation to the brake rotor mounting surface. This must be done at three locations on the rim, 120 degrees apart.

To measure rim offset, place a straightedge against the brake rotor mounting surface and extend it over the rim edge. Using a scale, measure the distance between the rim and the straightedge.

The specified offset for the 19-inch, 40-spoke front wheel is 5/16".

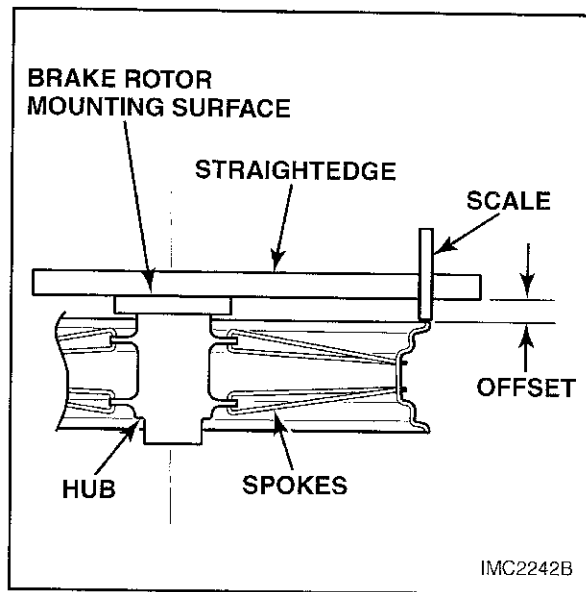


Figure 99 — Measuring wheel rim offset

Repeat the process at two more locations on the rim.

Place the rim in position around the hub on a suitable work surface. Note the position of the valve stem hole. The hole will serve as a reference when assembling the spokes to the rim.

**Note:** When lacing the wheel, it is helpful to place the rim on blocks on the work surface so that the radial center of the rim is aligned with the centerline of the hub.

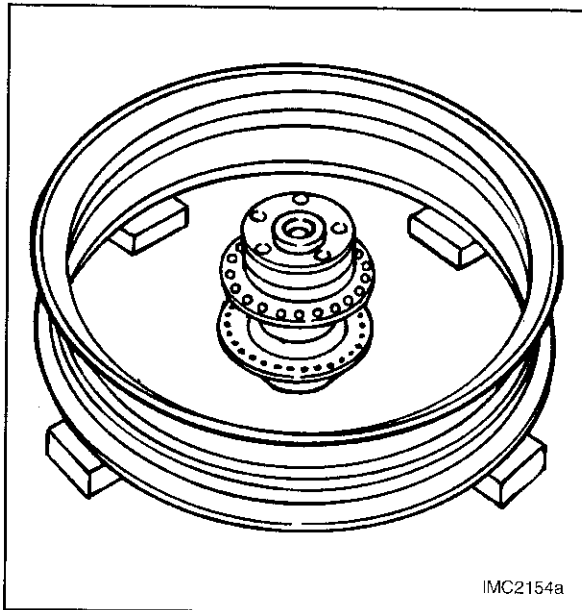


Figure 100 — Wheel lacing setup

Since a properly installed spoke overlaps an adjacent spoke hole, all spokes must be inserted in the hub flanges before any attempt is made to assemble the spokes to the rim. This may be somewhat awkward, but if not done, it will become increasingly difficult to insert spokes the more the wheel is built up.

Starting with the left flange (brake side for front wheel), install the spokes in the hub flanges as follows:

- Insert 10 short spokes through every other hole from the outer side of the left hub flange. Then, insert 10 long spokes through the remaining holes.
- Repeat the process to install the spokes in the right hub flange. Note, however, that the holes in the right flange are offset from those in the left flange to match up with the staggered spacing of holes in the rim. Start by inserting a short spoke in a hole that is offset to the left of a short spoke in the left flange.

With the spokes inserted in both flanges, set the hub assembly back on the work surface in the center of the rim. Position the hub with the left flange down.

**Note:** Gather spokes in the right (upper) flange into small groups and secure them with tape or rubber bands to keep them out of the way while spokes in the left (lower) flange are being assembled to the rim.

Assemble the spokes to the rim as follows:

- Start with the short spokes in the lower hub flange. Insert the first of these spokes, in a clockwise pattern, through the properly angled lower rim hole second to the left of the valve stem hole. Using tape, mark this spoke for reference when later installing the first counterclockwise-angled long spoke.
- Continue with the short spokes, inserting one in every fourth rim hole until all 10 are in place. Loosely install the threaded spoke nipples, threading them on approximately three turns to retain the spokes in their respective rim holes. Twist the hub to the left to reduce the slack in the spokes.
- Next, assemble the long spokes on the lower hub flange. Starting with the long spoke to the right of the above marked short spoke, cross the spoke over the short spoke and insert it in the 14th rim hole to the left of the marked spoke. Properly installed, this spoke will cross over four of the clockwise-angled spokes.
- Continue with the long spokes, inserting one in every fourth rim hole until all 10 are in place. Again, loosely install the threaded spoke nipples, threading them on approximately three turns to retain the spokes in their respective rim holes.
- In a similar manner, repeat the process to install the short spokes and the long spokes in the upper hub flange. However, the cross pattern is reversed. For the right flange, the long spokes are angled out from the hub in a clockwise pattern and short spokes, counterclockwise.

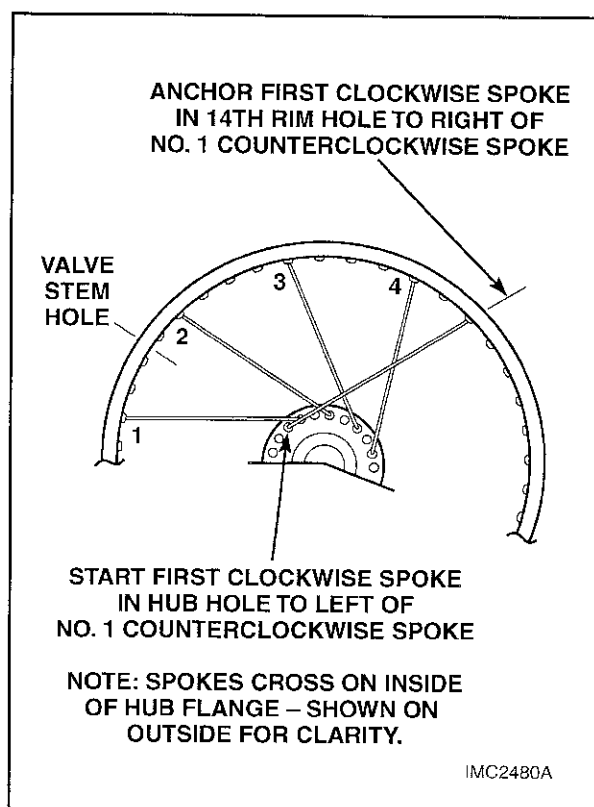


Figure 101 — Typical cross pattern (40-spoke wheel)

With all of the spokes installed, slowly turn the spoke nipples, turning each in by a uniform few turns each time around, until all are loosely seated in the rim hole pockets. Check the hook end of each spoke at the hub flange to ensure that the heads are properly seated.

Before tightening the spokes, check the lateral and radial alignment of the wheel rim following the procedure under Aligning the Hub and Rim (Truing) covered later in this section.

## Lacing 16-Inch 40-Spoke Wheels

### General Information

The 16-inch 40-spoke rear wheels are also fitted with hook-type spokes. Unlike the 19-inch wheel, however, all of the spokes are identical in length and hook bends. The hub flange is also different, a cup shape, flared to the outside. Spokes are inserted alternately from the bottom outer side of the hub flanges, 20 per side for a total of 40.

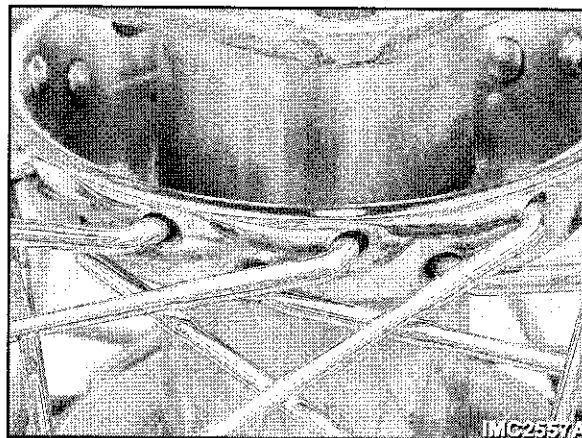


Figure 102 — Cup-shaped hub flange (16-inch, 40-spoke wheel)

Holes in the rim are offset to the right and left of center and staggered between sides. In addition, the staggered rim holes are alternately angled on each side to accept the clockwise and counterclockwise installation of the spokes.

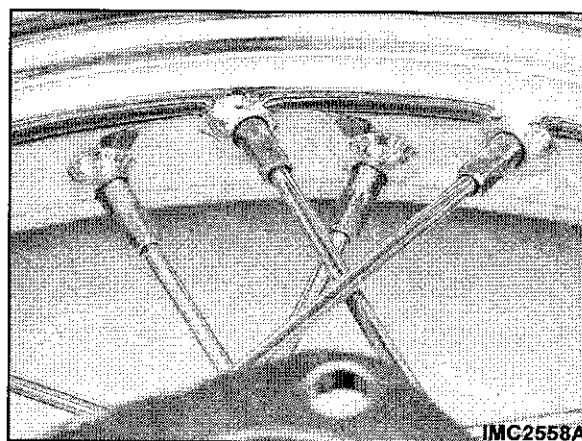


Figure 103 — Staggered offset rim hole arrangement (16-inch, 40-spoke wheel)

For the 16-inch, 40-spoke wheel, the outer row of spokes in the left flange are angled out from the hub in a counterclockwise pattern and inner row in a clockwise pattern. For the right flange, it is reversed. Here, the inner row is angled in a counterclockwise pattern and the outer row is angled clockwise.

### Tools required:

3/16" hex bit  
 1/4" open-end wrench/spoke wrench  
 Straightedge  
 Scale

### Wheel Lacing Procedure

In this procedure, references to left and right sides of the wheel refer to its mounting on the motorcycle. For the rear wheel, the left side is the sprocket side.

Before disassembling the wheel to replace the hub, rim or spokes, note the spoke positions, the lacing pattern and the rim offset. This will be very important when assembling the hub, spokes and rim.

Also, before disassembling the wheel, measure the rim offset in relation to the brake rotor mounting surface. This must be done at three locations on the rim, 120 degrees apart.

To measure rim offset, place a straightedge against the brake rotor mounting surface and extend it over the rim edge. Using a scale, measure the distance between the rim and the straightedge. The specified offset for the 16-inch, 40-spoke rear wheel is 1".

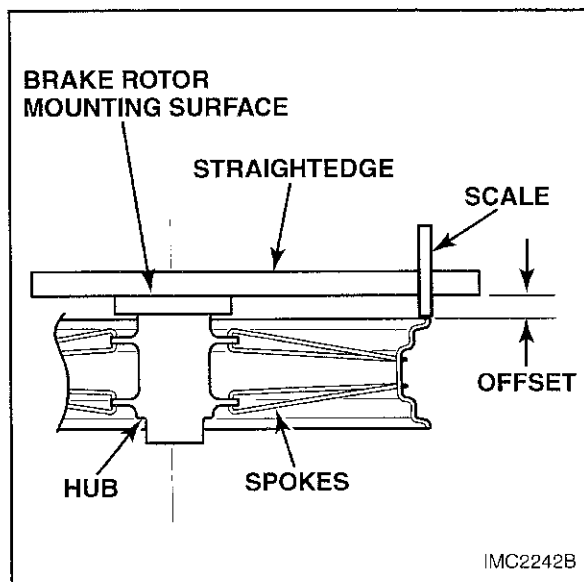


Figure 104 — Measuring wheel rim offset

Repeat the process at two more locations on the rim.

Place the rim in position around the hub on a suitable work surface. Note the position of the valve stem hole. The hole will serve as a reference when assembling the spokes to the rim.

**Note:** When lacing the wheel, it is helpful to place the rim on blocks on the work surface so that the radial center of the rim is aligned with the centerline of the hub.

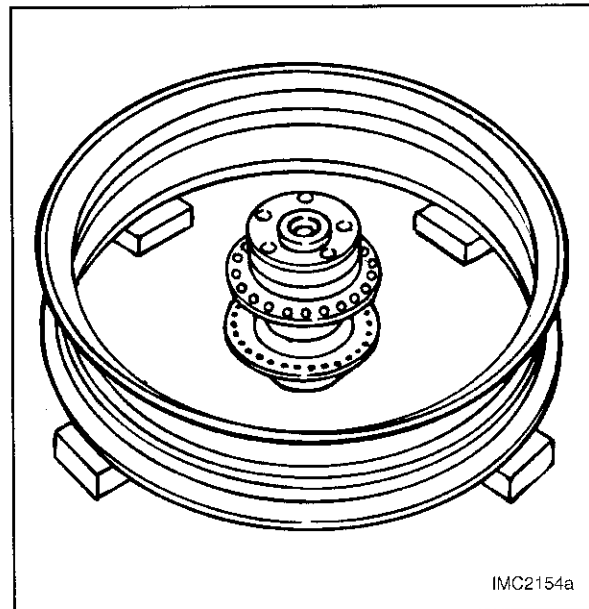


Figure 105 — Wheel lacing setup

Since a properly installed spoke overlaps an adjacent spoke hole, all spokes must be inserted in the hub flanges before any attempt is made to assemble the spokes to the rim. This may be somewhat awkward, but if not done, it will become increasingly difficult to insert spokes the more the wheel is built up.

Starting with the left flange (sprocket side for rear wheel), install the spokes in the hub flanges as follows:

- Starting with the inner row of 10 holes, insert a spoke through every hole from the outer side of the left hub flange. Then, insert spokes in the outer row of 10 holes, also from the outer side of the flange.
- Repeat the process to install the spokes in the right hub flange.

With the spokes inserted in both flanges, set the hub assembly back on the work surface in the center of the rim. Position the hub with the left flange down.

**Note:** Gather spokes in the right (upper) flange into small groups and secure them with tape or rubber bands to keep them out of the way while spokes in the left (lower) are being assembled to the rim.

Assemble the spokes to the rim:

- Start with the spokes in the outer row of the lower hub flange. Insert the first of these spokes, in a counterclockwise pattern, through the properly angled lower rim hole just to the right of the valve stem hole. Using tape, mark this spoke for reference when later installing the first clockwise-angled spoke.
- Continue with this row of spokes, inserting one in every fourth rim hole until all 10 are in place. Loosely install the threaded spoke nipples, threading them on approximately three turns to retain the spokes in their respective rim holes. Twist the hub to the right to reduce the slack in the spokes.
- Next, assemble the inner row of spokes on the lower hub flange. Starting with the spoke to the left of the above marked spoke, cross the spoke over the marked spoke and insert it in the 14th rim hole to the right of the marked spoke. Properly installed, this spoke will cross over four of the counterclockwise-angled spokes.
- Continue with the inner row of spokes, inserting one in every fourth rim hole until all 10 are in place. Again, loosely install the threaded spoke nipples, threading them on approximately three turns to retain the spokes in their respective rim holes.
- In a similar manner, repeat the process to install the inner row of spokes and the outer row of spokes in the upper hub flange. However, the cross pattern is reversed. For the right flange, the inner row is angled in a counterclockwise pattern and the outer row, clockwise.

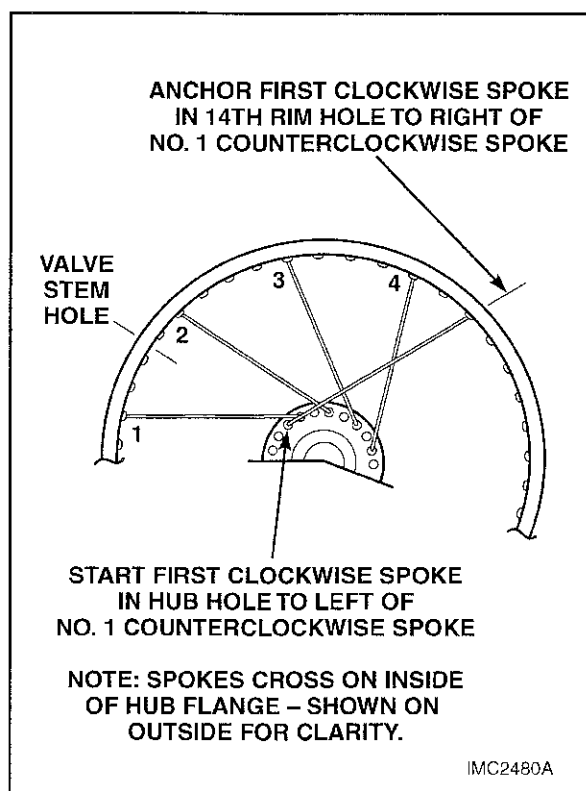


Figure 106 — Typical cross pattern (40-spoke wheel)

With all of the spokes installed, slowly turn the spoke nipples, turning each in by a uniform few turns each time around, until all are loosely seated in the rim hole pockets. Check the hook end of each spoke at the hub flange to ensure that the heads are properly seated.

Before tightening the spokes, check the lateral and radial alignment of the wheel rim following the procedure under *Aligning the Hub and Rim (Truing)* covered later in this section.

## Lacing 16-Inch, 60-Spoke Wheels

This procedure applies for both front and rear wheels on the Indian Spirit motorcycle. References to left and right sides of the wheel refer to its mounting on the motorcycle. For the front wheel, the left side is the brake side. For the rear wheel, the left is the sprocket side.

### Tools required:

- 3/16" hex bit
- 1/4" open-end wrench/spoke wrench
- Straightedge
- Scale

### Wheel Lacing Procedure

Before disassembling the wheel to replace the hub, rim or spokes, note the spoke positions, the lacing pattern and the rim offset. This will be very important when assembling the hub, spokes and rim.

Before disassembling the wheel, measure the rim offset in relation to the brake rotor mounting surface. This must be done at three locations on the rim, 120 degrees apart.

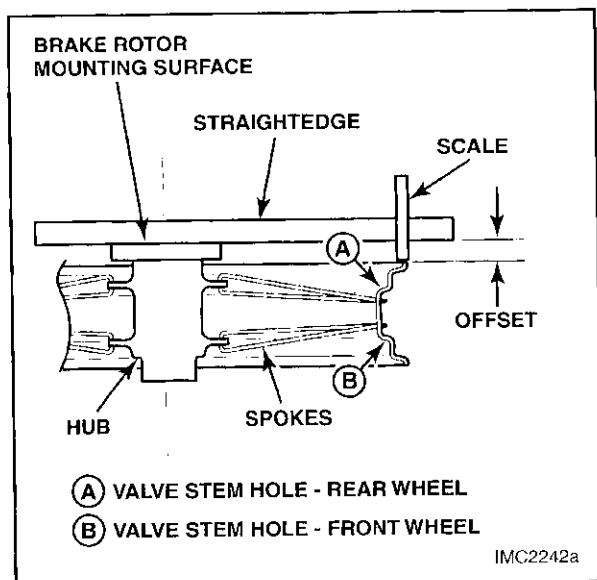


Figure 107 — Measuring wheel rim offset

To measure rim offset, place a straightedge against the brake rotor mounting surface and extend it over the rim edge. Using a scale, measure the distance between the rim and the straightedge. The specified offset is:

- Front wheel —  $29/32$ "
- Rear wheel —  $15/16$ "

Repeat the process at two more locations on the rim.

The 60-spoke wheels are fitted with hook-type spokes, the hook end of which is inserted into the hub flange. Spokes are inserted alternately from the inner and outer sides of the hub flanges. Each flange holds 15 inner and 15 outer spokes of equal length for a total of 30 per side.

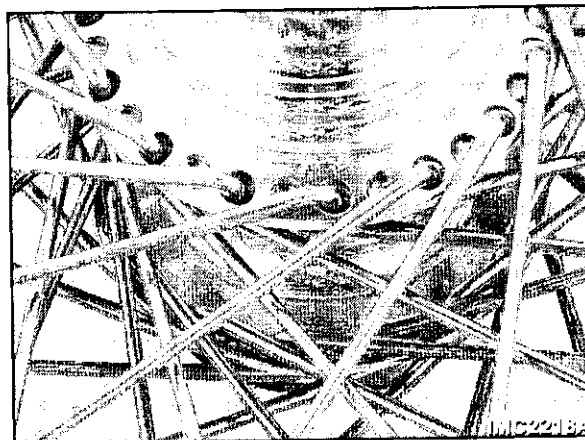


Figure 108 — Hub flange with hook-type spokes

Holes in the rim are offset to the right and left of center and staggered between sides. In addition, the rim holes are alternately angled on each side to accept the clockwise and counterclockwise installation of the spokes.

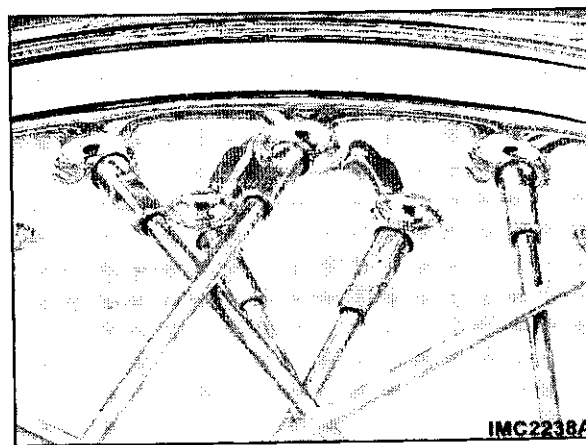


Figure 109 — Offset and angled rim holes

Place the rim in position around the hub on a suitable work surface. Position the rim so that the valve stem hole is facing up. The hole will serve as a point of reference when assembling the spokes to the rim. For the front wheel, the valve stem hole is on the side opposite the brake rotor mounting surface of the hub. For the rear wheel, the stem hole is on the same side of the wheel as the rotor mounting surface.

**Note:** When lacing the wheel, it is helpful to place the rim on 1-1/4" thick blocks on the work surface so that the radial center of the rim is aligned with the centerline of the hub.

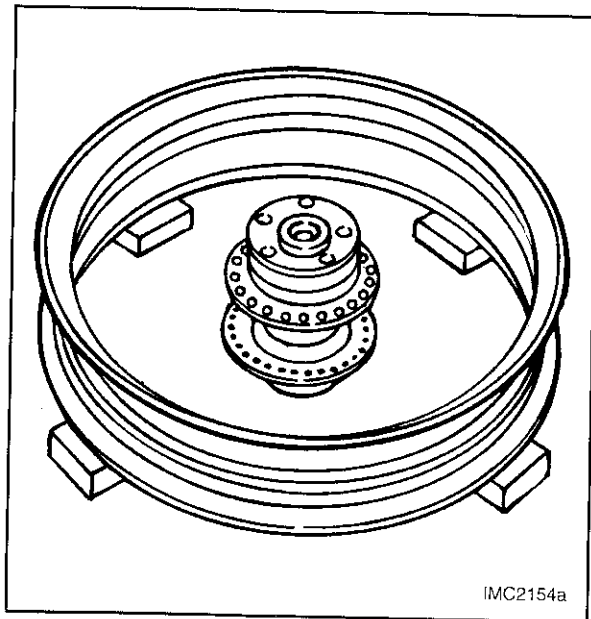


Figure 110 — Wheel lacing setup

Since a properly installed spoke overlaps an adjacent spoke hole, all spokes must be inserted in the hub flanges before any attempt is made to assemble the spokes to the rim. This may be somewhat awkward, but if not done, it will become increasingly difficult to insert spokes the more the wheel is built up.

Starting with the left flange (brake side for front wheel, sprocket side for rear wheel), insert 15 spokes through every other hole from the inner side of the hub flange. Then, insert 15 spokes through the remaining holes from the outer side. You can start with any hole since the flange holes are uniformly drilled with no distinction for inner or outer spokes.

Repeat the process to install the spokes in the right flange. Note, however, that the holes in the right flange are offset from those in the left flange to match up with the staggered spacing of holes in the rim. Start by inserting an inner spoke in a hole that is offset to the left of an inner spoke in the left flange.

With the spokes inserted in both flanges, set the hub assembly back on the work surface in the center of the rim. Position the hub with the left flange down.

**Note:** Gather spokes in the right (upper) flange into small groups and secure them with tape or rubber bands to keep them out of the way while spokes in the left (lower) are being assembled to the rim.

Assemble the spokes to the rim starting with the outer spokes on the lower hub flange. Insert the first of these spokes, in a clockwise pattern, through the properly angled lower hole just to the left of the valve stem hole.

Continue with the outer spokes, inserting one in every other hole in the lower row until all 15 are in place. Loosely install the threaded spoke nipples, threading them on approximately three turns to retain the spokes in their respective rim holes. Twist the hub to the left to reduce the slack in the spokes.

Next, assemble the inner spokes on the lower hub flange. Insert the first of these spokes, in a counter-clockwise direction, starting with a spoke in the properly angled lower hole just to the left of the valve stem hole. The appropriate spoke will cross over six of the outer spokes.

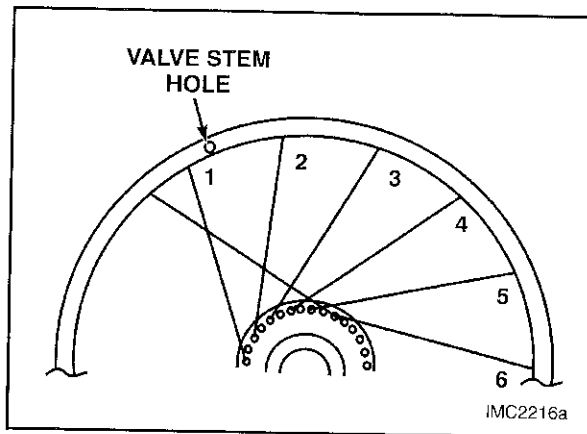


Figure 111 — Proper cross of inner-to-outer spokes (60-spoke wheels)

Continue with the inner spokes, inserting one in every other hole in the lower row until all 15 are in place. Loosely install the threaded spoke nipples, three turns, to retain the spokes in their respective rim holes.

In a similar manner, repeat the process to first install the inner spokes (counterclockwise pattern) and then the outer spokes (clockwise pattern) in the upper hub flange.

With all of the spokes installed, slowly turn the spoke nipples, turning each in by a uniform few turns each time around, until all are loosely seated in the rim hole pockets. Check the hook end of each spoke at the hub flange to ensure that the heads are properly seated.

Before tightening the spokes, check the lateral and radial alignment of the wheel rim following the procedure below.



## Aligning the Hub and Rim (Truing)

### Tools required:

1/4" spoke wrench

3/16" hex bit

Wheel stand with pointer (c.g., Chrome Specialties, No. 400341)

Straightedge

### Alignment Procedure

Starting at the valve stem hole, divide the spokes into 10 groups of four (40-spoke wheel) or six (60-spoke wheel). Then, using tape, mark the center of the four groups that are approximately 90-degrees apart on the rim. These four groups of four/six, which are paired directly across from one another, will be used to establish proper alignment. Spokes in the remaining sets should not be tightened during this initial alignment.

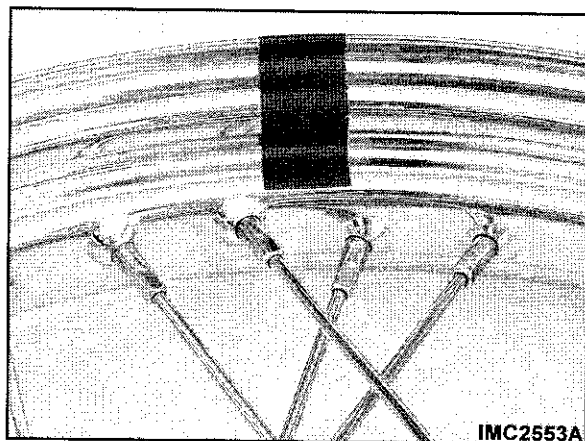


Figure 112 — Marking four-spoke group center (40-spoke wheel)

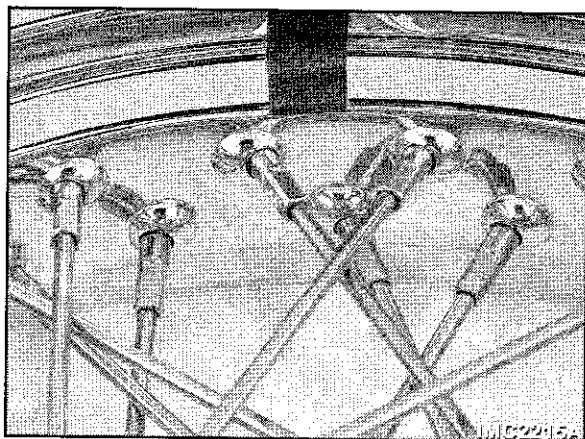


Figure 113 — Marking six-spoke group center (60-spoke wheel)

Mount the wheel assembly in a wheel stand. Make sure that the wheel is secure and can rotate freely.

### Checking and Adjusting Lateral Alignment

For proper alignment, the center of the rim, side-to-side, should be in line with the center of the hub.

With a straightedge placed across the hub at the right side and in line with one of the tape marks, measure the distance between the straightedge and the flat just below the rim edge. Move the straightedge to the left side of the wheel and repeat the procedure for the same point. Compare the measurements. The measurements should be the same for a properly centered rim.

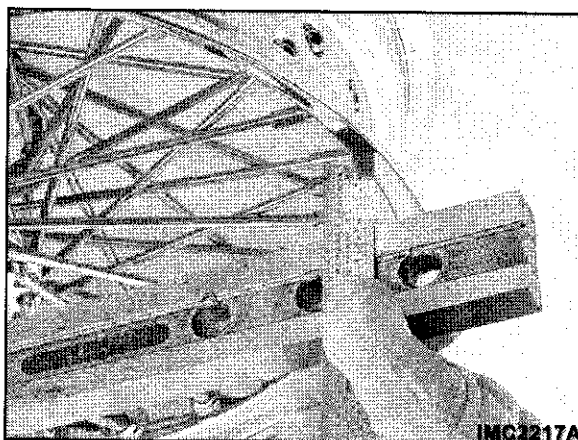


Figure 114 — Measuring lateral clearance

If the measurements are not the same, adjust the spokes in the indicated group, using a  $1/4"$  spoke wrench or a  $3/32"$  hex bit, to center the rim. A spoke wrench is preferred. The hex bit may not seat fully in the socket due to spoke intrusion and can slip out.

- **Right-side measurement greater than left side:**

Indicates that the rim is too far to the left at this point and needs to be moved to the right to center it. To adjust, first loosen the two spokes (40-spoke wheel) or three spokes (60-spoke wheel) on the left side of the rim and then tighten the two/three on the right side. Make the adjustment incrementally, turning all indicated spokes one turn at a time, until the rim is centered.

- **Left-side measurement greater than right side:**

Indicates that the rim is too far to the right at this point and needs to be moved to the left to center it. First loosen the two spokes (40-spoke wheel) or three spokes (60-spoke wheel) on the right side of the rim and then tighten the two/three on the left side. Make the adjustment incrementally, turning all indicated spokes one turn at a time, until the rim is centered.

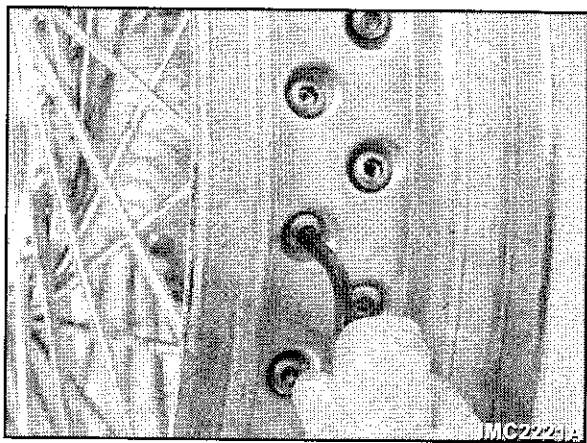


Figure 115 — Adjusting lateral alignment

Repeat this process at the three remaining tape-marked groups.

For spokes outside of the four marked groups, turn the rim nuts in until the head of each just contacts the rim seat, but **DO NOT** tighten at this time.

Now, complete the procedure by checking and adjusting radial alignment.

### Checking and Adjusting Radial Alignment

**Note:** When checking and adjusting radial alignment, it is helpful to tape mark the center of ALL 10 four spoke groups (40-spoke wheels) or six-spoke groups (60-spoke wheel) to help in identifying opposing groups where adjustments are to be made.

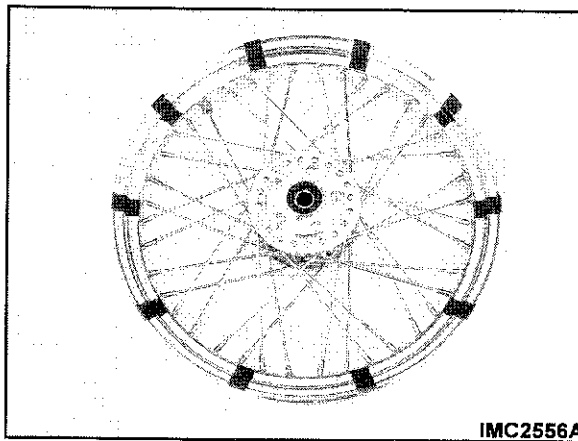


Figure 116 — Spoke group centers (40-spoke wheel)

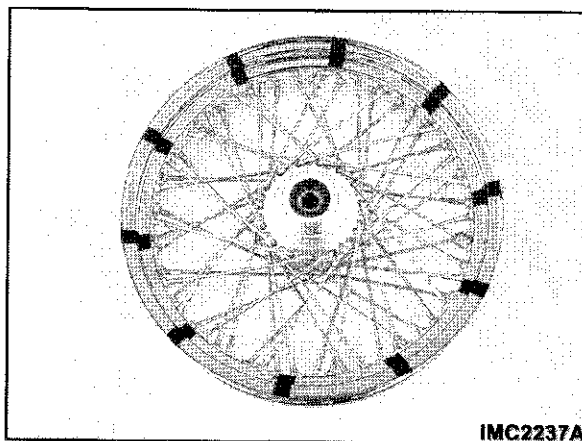


Figure 117 — Spoke group centers (60-spoke wheel)

With the wheel assembly in the stand, position the pointer in line with, but not contacting, the tire bead seat on the rim.

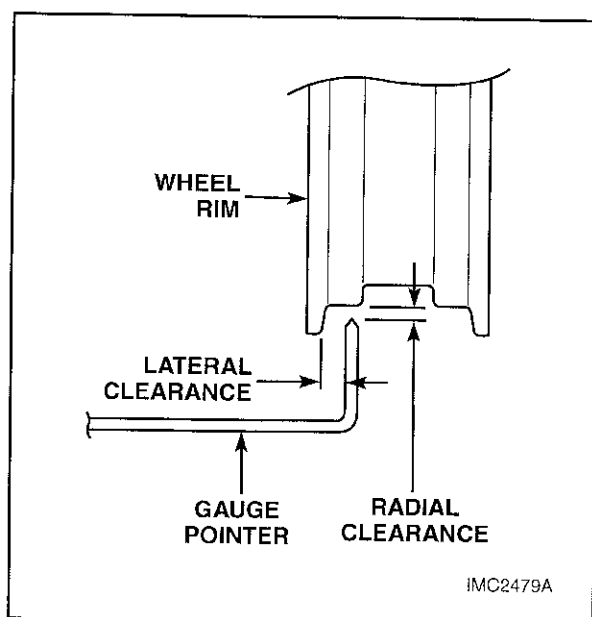


Figure 118 — Wheel alignment check

Slowly turn the rim and check for uniform clearance between the pointer and the tire bead seat. The clearance should not vary by more than  $1/32$ " between high and low spots. If necessary, adjust the spokes to gain uniform clearance.

- Pointer contacts rim (high spot):** Indicates that the rim is too far out from the hub axle center at this point and needs to be moved in. Loosen the four spokes (40-spoke wheel) or six spokes (60-spoke wheel) in the group directly opposite the spoke group where rim contact is made. Next, tighten the four/six spokes in the group where contact is made. Make the adjustment incrementally, turning all indicated spokes one turn at a time, until clearance is gained.
- Excessive pointer clearance (low spot):** Indicates that the rim is too far into the hub axle center at this point and needs to be moved out. Loosen the four spokes (40-spoke wheel) or six spokes (60-spoke wheel) in the group with excessive clearance at the pointer. Next, tighten the four/six spokes in the group directly opposite the group with excessive clearance. Make the adjustment incrementally, turning all indicated spokes, one turn at a time, until the specified clearance is gained.

Using a  $1/4$ " spoke wrench, tighten the spoke nipples on the remaining spokes until all are firmly seated in the rim. Generally, the threaded end of the spokes should not protrude into nor through the hex socket of the spoke nipples. If this occurs, the end of the protruding spoke must be filed flush with the top of the rim nut to avoid damage to the rim flap and inner tube.

### ⚠ CAUTION!

Use care when tightening the spoke nipples to ensure that they are secure but not overly tight which can distort the wheel. Spokes that are not tightened enough can readily work loose, placing more stress on other spokes.

After tightening, recheck the lateral and radial alignment to ensure that it is still within specification.

## BRAKE SYSTEM SERVICE

### Brake Fluid Level and Condition

Brake fluid level and condition must be checked at the 500-mile service interval and thereafter, at each 2500-mile interval.

Indian motorcycles use DOT 5 silicone-based brake fluid, which is purple in color. **Never use DOT 3 or 4 glycol-based brake fluid in this system.** These fluids are not compatible and clots will form in the brake system if mixed. If mixed, the brake system requires flushing and the rubber seals in the caliper and master cylinder require replacement.

#### Tools required:

#2 Phillips screwdriver

1/8" hex bit

### Front Brake Master Cylinder

Clean the top of the master cylinder to remove any dirt or debris.

Remove the reservoir cap from the master cylinder located on the right handlebar, using a #2 Phillips screwdriver.

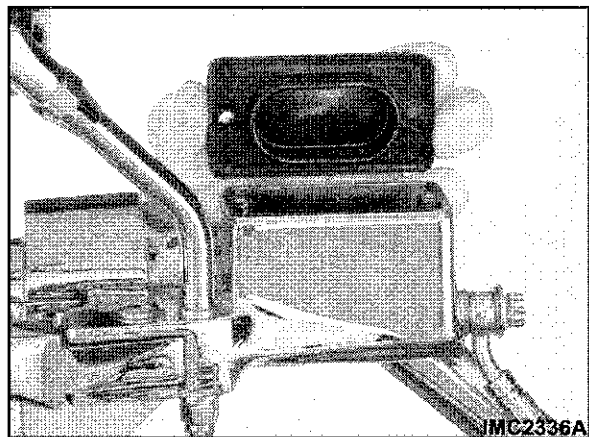


Figure 119 — Front master cylinder cover removal

View the bottom of the reservoir for any debris. Remove the old fluid and flush the system if necessary.

The fluid level should be within 1/4" from the top of the reservoir. Add fluid if needed.

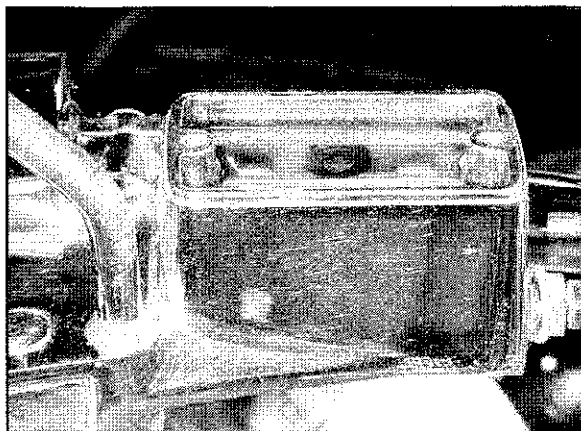


Figure 120 — Brake fluid level

#### ⚠ WARNING!

**USE ONLY DOT 5 BRAKE FLUID.** DOT 5 fluid is silicone based and not compatible with DOT 3, 4 or 5.1. Damage to the brake system will occur if you install any other fluid.

Return the cap and seal to the top of the reservoir. Tighten the cap, using a #2 Phillips screwdriver. Tighten to 10–15 inch-pounds torque.

### Rear Brake Master Cylinder

Clean the top of the master cylinder to remove any dirt or debris.

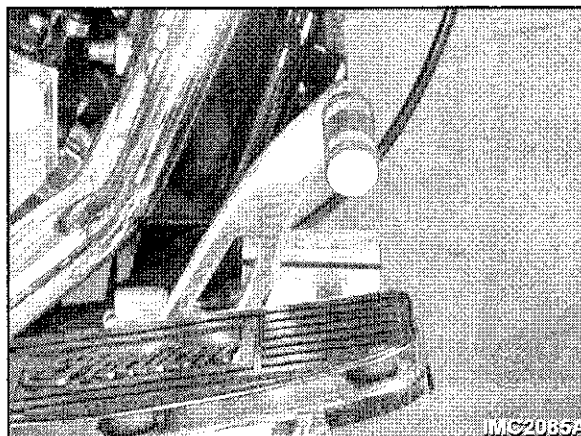


Figure 121 — Rear master cylinder (Spirit)

Remove the cap from the rear brake master cylinder located on the right foot control, using a 1/8" hex bit.

View the bottom of the reservoir for any debris. Remove the old fluid and flush the system if necessary.

The fluid level should be within 1/4" from the top of the reservoir. Add fluid if needed.

### ⚠ WARNING!

**USE ONLY DOT 5 BRAKE FLUID.** DOT 5 fluid is silicone based and not compatible with DOT 3, 4 or 5.1. Damage to the brake system will occur if you install any other fluid.

Return the cap and seal to the top of the reservoir. Tighten the cap to 30–40 inch-pounds torque, using a 1/8" hex bit.

## Brake Pad Replacement

With different riding conditions and habits, brake pad wear can be quite different for each rider. Indian motorcycle has no minimum mileage specification for brake pad wear. If the customer is having trouble with rapid wear, different pad compositions are available through the aftermarket.

Initial inspection of the pads should be performed at 500 miles and subsequent inspection at every 2500 miles. Pads should be replaced when the lining thickness becomes 1/16" or less. Never change just one pad in a caliper. Pads must be replaced in sets.

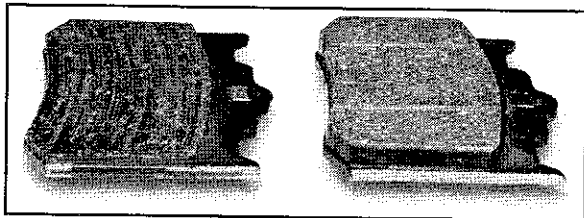


Figure 122 — Brake pad comparison

Check the thickness of the brake pads.

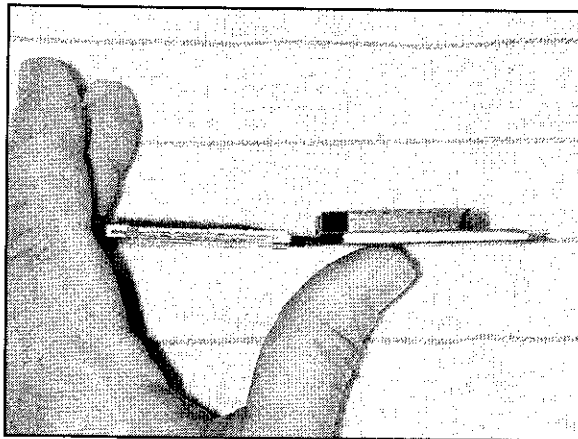


Figure 123 — Checking brake pad thickness

If a pad change is required, an initial "bedding in" is necessary. The bedding in should be performed in the dealer's motorcycle parking lot by the mechanic. If the rear pads are being bedded in, pull the clutch in while braking. This prevents wheel hop.

Bring the motorcycle to 20–30 mph and apply the brakes moderately; do not lock the brakes. Do this 20–30 times and let the brakes cool for 10 minutes. Perform another 5–10 stops without locking the brakes. This process should remove any old pad material from the rotor and help seat the pads. Rotors with deep grooves require more miles on the motorcycle to fully seat the pads.

Check the fluid level in the reservoir. Add DOT 5 hydraulic brake fluid if the level is low. Fill to 1/4" below the top of the reservoir.

### ⚠ WARNING!

**USE ONLY DOT 5 BRAKE FLUID.** DOT 5 fluid is silicone based and not compatible with DOT 3, 4 or 5.1. Damage to the brake system will occur if you install any other fluid.

## Front and Rear Brake Pad Removal and Installation

Assembly and disassembly of the brake pads is similar for both the front brake pads and rear brake pads.

### Tools required:

- 1/8" hex bit
- 7/32" hex bit
- 1/4" hex bit
- #2 Phillips screwdriver
- Large flat-blade screwdriver

### Removal

Remove the two caliper mounting screws, using a 7/32" hex bit. Some motorcycles can be equipped with caliper shims. If equipped, carefully remove only one caliper mounting screw at a time and retain any shims. Do not mix any of the shims. The shims must remain in the same position relative to the caliper.

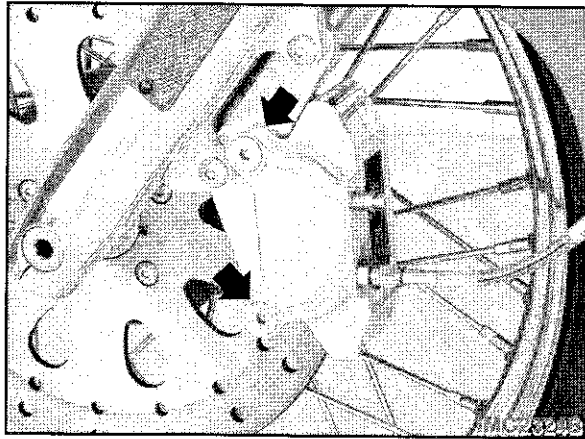


Figure 124 — Caliper mounting shim location, if equipped

Slide the caliper from the mounting bracket and off the brake rotor.

Using a 1/4" hex bit, remove the brake pad retaining pin from the caliper.

Remove the pads from the caliper.

### Installation

Before seating the pistons into the caliper, thoroughly wipe any brake dust, dirt and grime from the pistons. Cleaning greatly reduces the chance of foreign material entering the dust boots and piston seals. Foreign material in the seals can cause leaks and can seize pistons.

Return the used brake pads to the caliper.

Place a spreader between the brake pads. Push the pistons back into the caliper. If the pistons do not seat completely, the master cylinder might be full of fluid. Remove some of the brake fluid from the master cylinder reservoir.

Install new pads into the caliper. Make sure the friction material on each brake pad faces the rotor when installed.

Align the threaded retaining pin with the through hole in each pad. Insert the retaining pin through each hole and thread it into the caliper, using a 1/4" hex bit. Tighten the pin to specification.

Slide the caliper over the rotor and align with the mounting bracket holes. If equipped, slide the shims between the caliper and mounting bracket. Make sure the shims are located at the original mounting positions. Refer to the procedure in this section, Brake Caliper Shimming, if required.

Apply blue threadlock to the two mounting screws.

Insert the caliper mounting screws through the caliper holes and shims (if equipped) and thread them into the mounting bracket. Tighten the mounting screws to specification, using a 7/32" hex bit.

Remove the two reservoir screws, using a 1/8" hex bit for the rear brake master cylinder or #2 Phillips screwdriver for the front brake master cylinder. Check the fluid level in the reservoir. If necessary, add DOT 5 brake fluid to 1/4" below the top of the reservoir.

### **⚠ WARNING!**

**USE ONLY DOT 5 BRAKE FLUID.** DOT 5 fluid is silicone based and not compatible with DOT 3, 4 or 5.1. Damage to the brake system will occur if you install any other fluid.

## Brake Caliper Service

### Tools required:

- 7/32" hex bit
- 7/16" open-end wrench
- 9/16" open-end wrench
- Feeler gauge
- Torque wrench

### Front Caliper Removal and Installation

#### Removal

Loosen the nut securing the front brake line to the caliper, using a 7/16" wrench. Position the brake line out of the way and cover the fitting to prevent contamination.

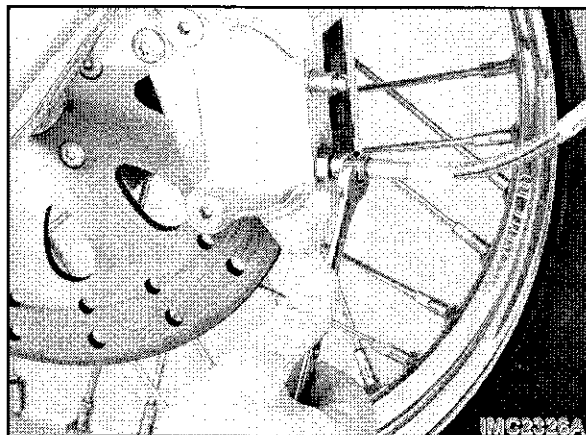


Figure 125 — Disconnecting caliper brake line

Inspect the copper sealing washers at the line fitting and replace as necessary.

Remove the two mounting screws securing the caliper to the bracket on the left fork leg, using a 7/32" hex bit.

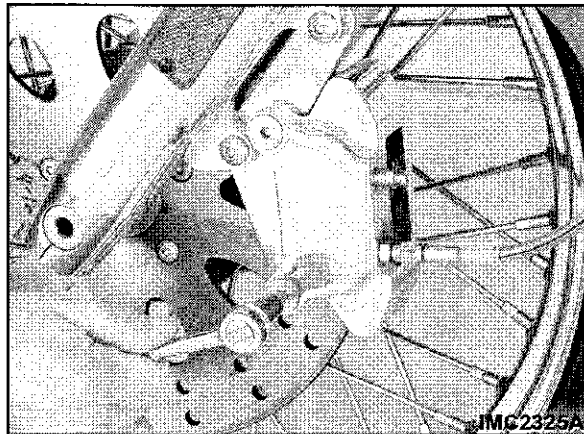


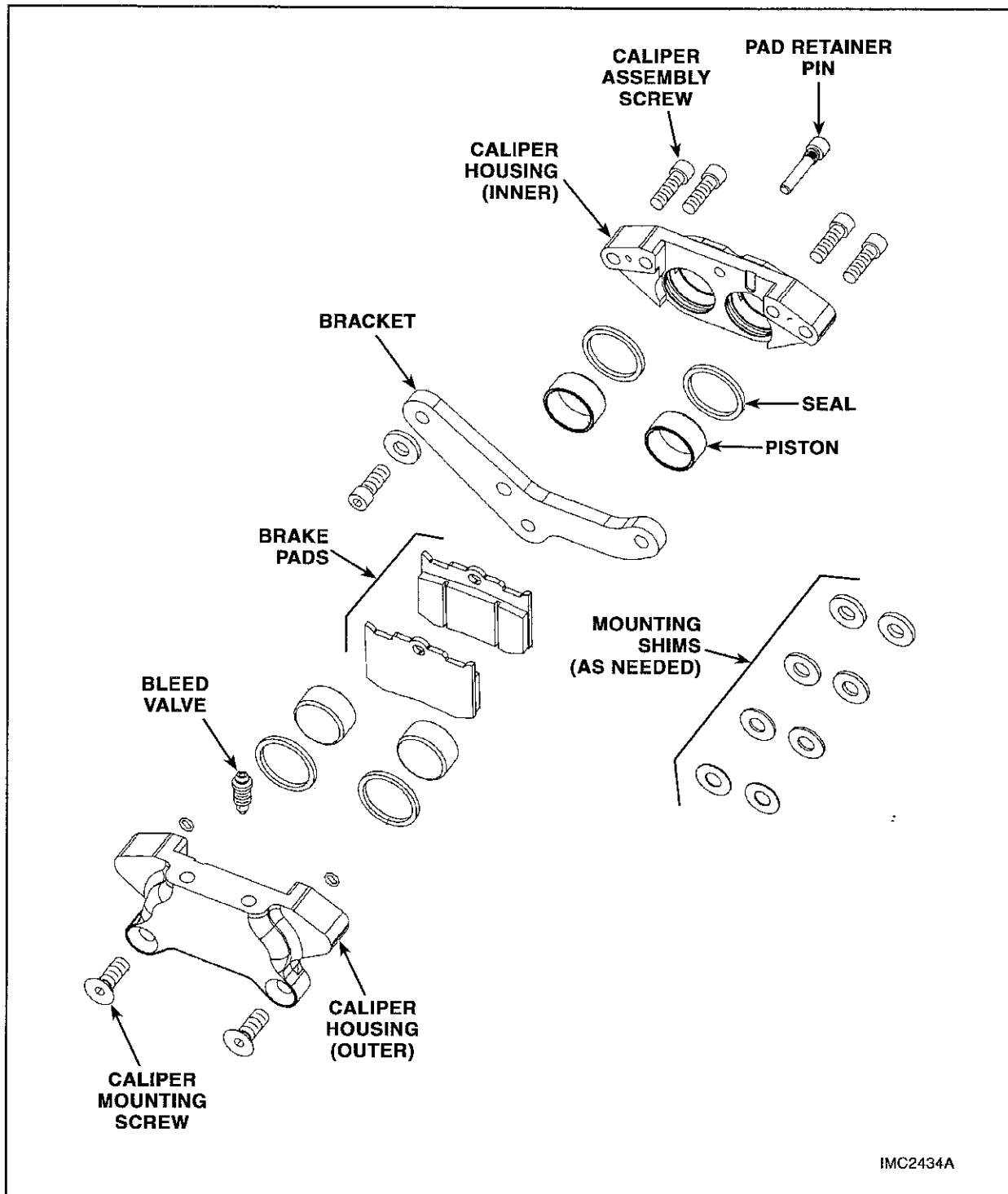
Figure 126 — Front caliper removal

Slide the caliper from the mounting bracket and off the rotor.

Inspect the brake pads for excessive wear and replace as necessary. Refer to Front and Rear Brake Pad Removal and Installation in this section for procedures.

Inspect the caliper dust boots for tears or other damage. Inspect the caliper for leaks in the piston area and between caliper halves. Replace the caliper as necessary.

 **Note:** There are no serviceable components for these calipers. If the caliper is damaged or worn in any way, replace the caliper as a unit.



IMC2434A

*Figure 127 — Front brake caliper assembly*



### Installation

Slide the caliper over the front brake rotor and into position on the mounting bracket on the left fork leg.

Align the screw holes of the mounting bracket and caliper.

Apply blue threadlock to the caliper mounting screws. To secure the caliper, install and tighten the two mounting screws to specification, using a 7/32" hex bit.

Connect the brake line to the caliper banjo fitting, using a 7/16" wrench. If the banjo fitting was removed with the line, place the sealing washers on each side of the banjo fitting and install the screw, using a 9/16" wrench. Tighten the screw to specification.

Bleed the front brake hydraulic system. Refer to Replacing Brake Fluid and Bleeding the Hydraulic System in this section for procedures.

Check for proper brake operation.

## Rear Caliper Removal and Installation

### Removal

Loosen the nut securing the rear brake line to the caliper, using a 7/16" hex bit, and disconnect the line from the banjo fitting. As an alternative, the banjo fitting can be removed along with the line. To do so, remove the screw securing the brake banjo fitting to the caliper, using a 9/16" wrench.

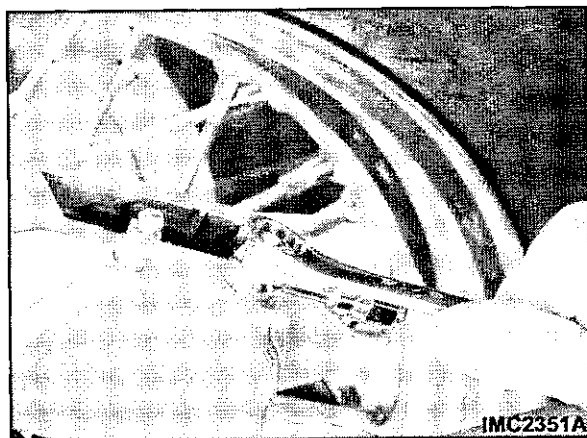


Figure 128 — Rear caliper brake line removal at banjo fitting

Inspect the copper sealing washers at the line fitting and replace as necessary.

Position the brake line out of the way and cover the fitting to prevent contamination.

Remove the two mounting screws securing the caliper to the bracket at the swing arm, using a 7/32" hex bit.

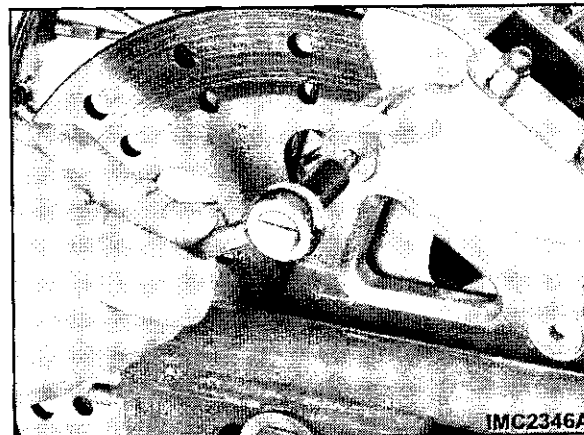


Figure 129 — Removing rear brake caliper

Slide the caliper from the mounting bracket and off the rotor.

Inspect the brake pads for excessive wear and replace as necessary. Refer to Front and Rear Brake Pad Removal and Installation in this section for procedures.

Inspect the caliper dust boots for tears or other damage. Inspect the caliper for leaks in the piston area and between caliper halves. Replace the caliper as necessary.

**Note:** There are no serviceable components for these calipers. If the caliper is damaged or worn in any way, replace the caliper as a unit.

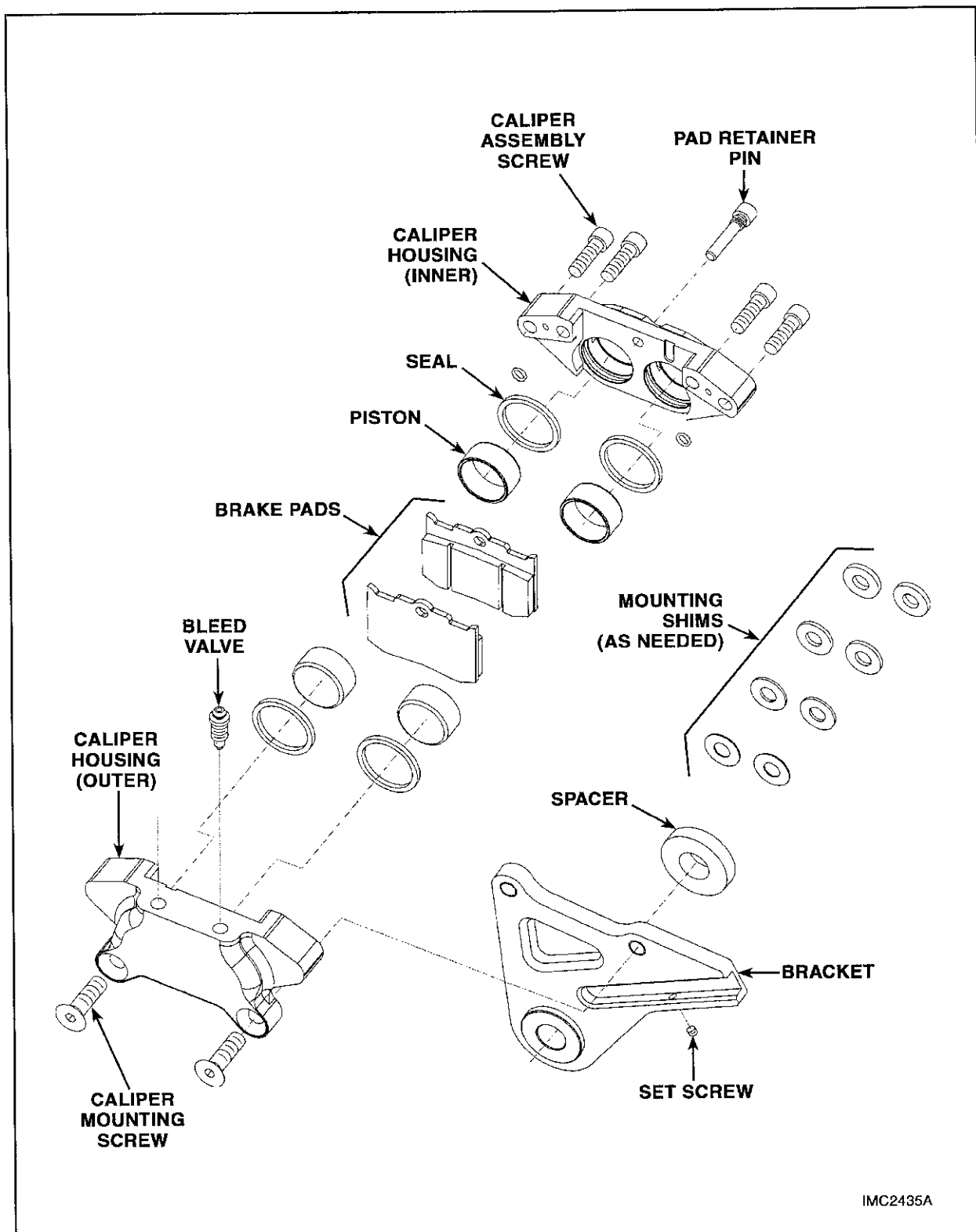


Figure 130 — Rear brake caliper assembly

### Installation

Slide the caliper over the rear brake rotor and into position on the mounting bracket at the swing arm.

Align the screw holes of the mounting bracket and caliper.

Apply blue threadlock to the two mounting screws. To secure the caliper, install and tighten the two mounting screws to specification, using a 7/32" hex bit.

Connect the brake line to the caliper banjo fitting, using a 7/16" wrench. If the banjo fitting was removed with the line, place the sealing washers on each side of the banjo fitting and install the screw, using a 9/16" wrench. Tighten the screw to specification.

Bleed the rear brake hydraulic system. Refer to Replacing Brake Fluid and Bleeding the Hydraulic System in this section for procedures.

Apply the rear brake. This centers the caliper to the rotor. With the brake applied, tighten the set screw on the bottom of the caliper hanger.

Check for proper brake operation.

## Brake Caliper Shimming

### Inspection

Using a feeler gauge, check the caliper-to-rotor clearance at each end of the caliper on the inner and outer sides of the rotor (four points). There should be at least 0.015" clearance between the brake rotor and the caliper at all four points.

**Inner measurement** — If the clearance is less than 0.015" at the two inner measuring points (inner/wheel side of rotor), shim between the caliper and the mounting bracket until the correct clearance is achieved. Shims are available in the following sizes:

- 0.010" thick (part number 97-010)
- 0.030" thick (part number 97-011)
- 0.160" thick (part number 97-012)

**Outer measurement** — If the clearance is less than 0.015" at the two outer measuring points (outer/curb side of rotor), check to see if the caliper is already shimmed and re-adjust as necessary.

### ⚠ WARNING!

If the caliper is not already shimmed and the clearance cannot be increased to 0.015", there is a misalignment condition that **MUST BE CORRECTED**. Contact an authorized Indian service facility for assistance.

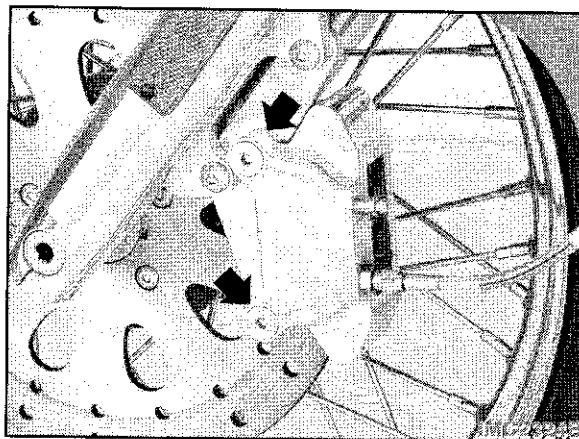


Figure 131 — Shim placement on mounting screws between caliper and mounting bracket

**Variance on same side of caliper** — If the clearances at the two measuring points on the same side of the brake rotor are different, shims can be added at each end to correct the misalignment so long as the difference in shim thicknesses used **DOES NOT** exceed 0.010" between ends. Any further shimming will compromise the clamping torque of the two surfaces.

### ⚠ WARNING!

A misaligned caliper might be evidence of a more serious problem and should be investigated for a possible cause. Contact an authorized Indian service facility for assistance.

When the correct clearance is achieved, apply blue threadlock to the caliper mounting screws and install the screws, using a 7/32" hex bit. Tighten the screws to specification, 25–30 foot-pounds.

Check the operation of the brakes thoroughly before conducting a road test.

## Brake Rotor Service

### Rotor Inspection

Inspect the front and rear brake rotors and check for the following:

- Splits or cracks
- Braking surface unevenness or excessive wear
- Grooving or pitting
- Warping
- Rotor thickness variation

Replace the brake rotor as necessary.

### Rotor Removal and Installation

Refer to the WHEEL AND TIRE SERVICE section for procedures covering the removal and installation of the front and rear brake rotors.

## Master Cylinder Service

### Tools required:

- 1/8" hex bit
- 4 mm hex bit
- 3/16" hex bit
- 7/16" wrench
- 1/2" wrench
- 9/16" wrench
- #2 Phillips screwdriver
- Pliers
- Diagonal cutters

### Front Master Cylinder Removal and Installation

#### Removal

Open the bleeder screw on the front caliper and pump the front brake lever several times to drain the system of brake fluid. Catch the brake fluid in a suitable container. Close the bleeder screw.

Separate the hydraulic brake line at the outlet fitting on the front master cylinder, using a 7/16" wrench.

Support the master cylinder outlet fitting, using a 9/16" wrench, while removing the brake line.

Remove the outlet fitting and copper sealing washer from the master cylinder, using a 9/16" wrench. Inspect the washer and replace as necessary.

Remove the two master cylinder clamp screws, using a 4 mm hex bit. Support the assembly and then remove the screws, clamp and master cylinder.

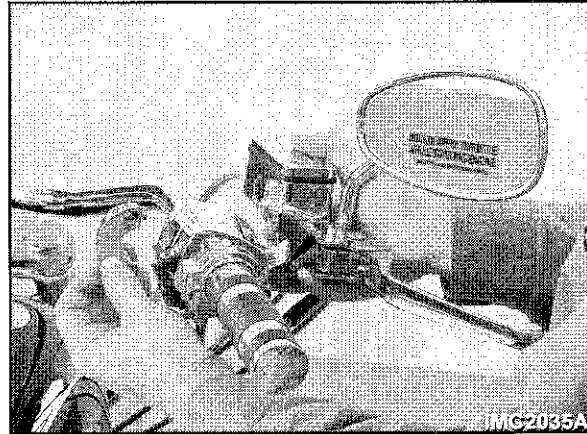


Figure 132 — Front master cylinder removal/installation

Remove the chrome nut and washers securing the right mirror to the master cylinder, using a 1/2" wrench. Remove the mirror.

Remove the snap ring securing the brake lever pivot pin. Slide the brake lever pivot pin out of the master cylinder and lever. Catch the pushrod pivot bushing as the brake lever is removed.

Inspect the nylon brake lever pivot bushing for wear and replace as necessary.

Slide the pushrod out of the dust boot and piston of the master cylinder. Note the orientation of the pushrod. The tab on the pushrod actuates the brake light switch.

Inspect the master cylinder for excessive leaks in the piston/dust boot area.

#### Installation

Insert the pushrod through the dust boot and into the master cylinder piston. Note the orientation of the pushrod switch tab for proper brake light switch operation.

Insert the pushrod pivot bushing into the brake lever so that the hole in the bushing faces the pushrod.

Slide the brake lever into the master cylinder. Make sure that the pushrod pivot bushing engages the pushrod.

Align the pivot hole of the brake lever with the mating hole in the master cylinder. Insert the brake lever pivot pin and install the snap ring to retain.

Install the mirror into the hole provided. Install the lock washer, flat washer and chrome nut and tighten.

Position the master cylinder assembly to the right-side handlebar, install the clamp and two screws and tighten to specification, using a 4 mm hex bit.

Install the outlet fitting with copper sealing washer and tighten to specification, using a 9/16" wrench.

Thread the hydraulic brake line onto the outlet fitting. Tighten the brake line to specification, using a 7/16" wrench.

Add DOT 5 hydraulic brake fluid to the reservoir. Fill to 1/4" below the top of the reservoir.

**⚠ WARNING!**

**USE ONLY DOT 5 BRAKE FLUID.** DOT 5 fluid is silicone based and not compatible with DOT 3, 4 or 5.1. Damage to the brake system will occur if you install any other fluid.

Bleed the system. Refer to Replacing Brake Fluid and Bleeding the System in this section for procedures.

Check for proper brake operation.

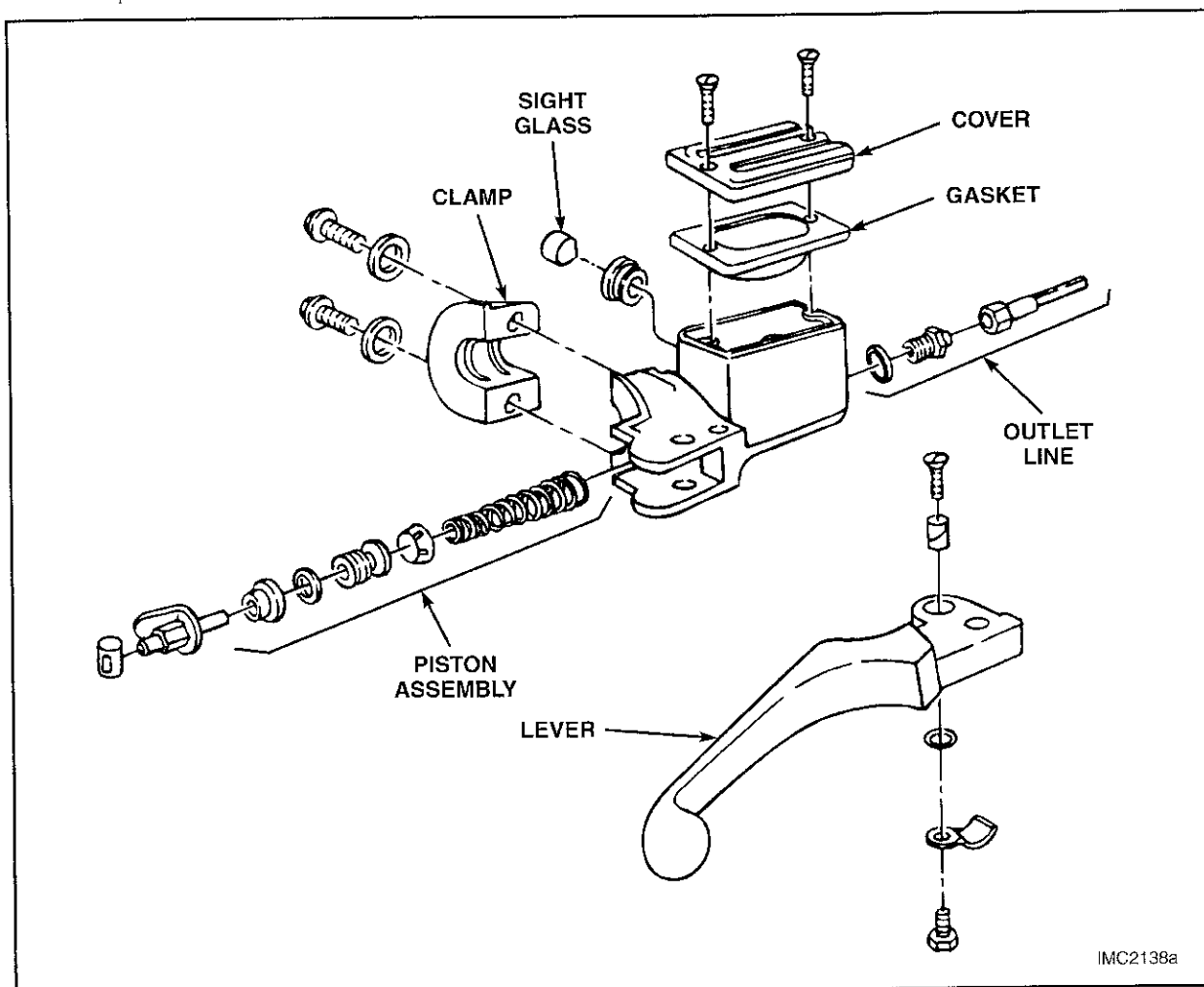


Figure 133 — Front master cylinder assembly

## Rear Master Cylinder Removal and Installation

### Removal

Clean the exterior of the rear master cylinder.

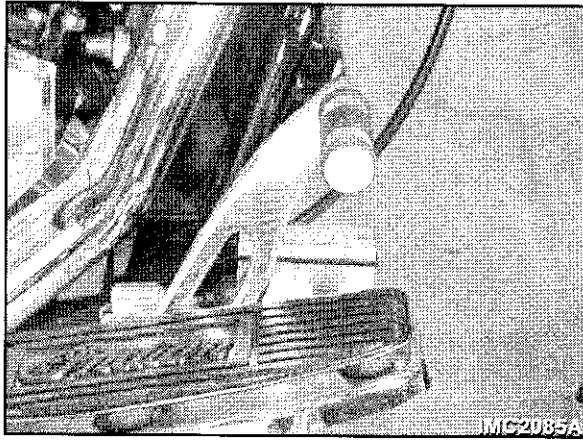


Figure 134 — Rear master cylinder location (Spirit)

Open the bleeder screw on the rear caliper and pump the rear brake pedal several times to drain the system of brake fluid. Catch the brake fluid in a suitable container. Close the bleeder screw.

Using a 9/16" wrench, remove the brake line banjo fitting screw at the master cylinder.

Inspect the copper sealing washers at the fitting and replace as necessary.

Slide the pushrod dust boot off the rear master cylinder.

Remove the two rear master cylinder retaining screws, using a 3/16" hex bit.

Remove the rear master cylinder from its location on the support bracket and off the pushrod.

### Installation

Apply blue threadlock to the two rear master cylinder retaining screws.

Place the rear master cylinder in position on the right foot-control bracket, making sure the pushrod and cylinder piston are properly aligned.

Install the two rear master cylinder retaining screws, using a 3/16" hex bit, and tighten the screws to specification.

Slide the pushrod dust boot over the collar on the master cylinder.

Check and adjust the master cylinder pushrod free play. Refer to Rear Master Cylinder Pushrod Free Play in this section.

Add DOT 5 hydraulic brake fluid to the reservoir. Fill to 1/4" below the top of the reservoir.

### ⚠ WARNING!

**USE ONLY DOT 5 BRAKE FLUID.** DOT 5 fluid is silicone based and not compatible with DOT 3, 4 or 5.1. Damage to the brake system will occur if you install any other fluid.

Bleed the hydraulic brake system. Refer to Replacing Brake Fluid and Bleeding the System in this section for procedures.

Check for proper brake operation.

## Rear Master Cylinder Pushrod Free Play

Grasp the brake pedal and gently move the pedal forward and backward. You should feel a small amount of free play between the pushrod and master cylinder piston. You will not be able to see the air gap since the dust cover blocks the view.

Free play should be 0.030–0.050" at the pedal. Free play is adjusted at the master cylinder pushrod.

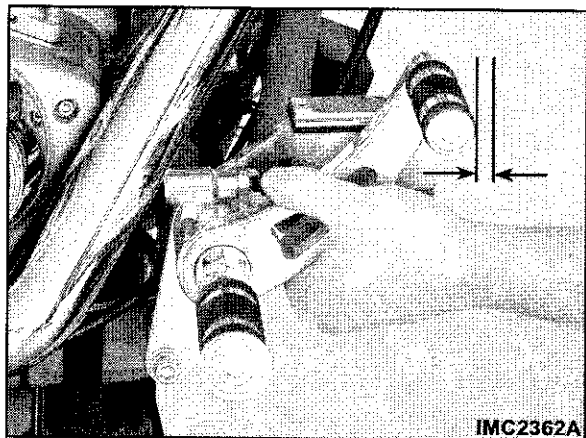


Figure 135 — Checking pushrod free play (Scout)

Excessive free play will allow the pedal to vibrate excessively. No free play can cause the rear brakes to be continually applied.

Adjust the pushrod by loosening the hex nut, using a 1/2" open end wrench. Grasp the pushrod with your finger and turn in a clockwise direction to decrease the play or counterclockwise to increase the play.

Tighten the hex nut, using a 1/2" open end wrench. It is helpful to use a pair of pliers to keep the pushrod from turning while tightening the hex nut.

## Front and Rear Master Cylinder Disassembly and Assembly

### Front Master Cylinder Disassembly

Remove the front master cylinder assembly from the right-side handlebar. Refer to Front Master Cylinder Removal and Installation in this section for procedures.

Remove the front brake lever. Refer to Front Master Cylinder Removal and Installation in this section for procedures.

Pull the pushrod out of the master cylinder. Note the orientation of the pushrod switch tab for proper brake light switch operation.

Remove the dust boot, piston and O-ring, cup and return spring from inside the master cylinder.

### Front Master Cylinder Cleaning and Inspection

Inspect the cover gasket, dust boot, cup and piston O-ring for wear, softening, enlargement, cuts and tears. Replace these parts as necessary.

Examine the cylinder bore for scratches, grooves and excessive wear. If any of these conditions are found, replace the master cylinder assembly.

Make sure the ports in the bottom of the reservoir are clear of debris or sediment.

Make sure the vent holes in the reservoir cover are open.

Thoroughly clean the piston and the master cylinder reservoir and cylinder bore, using a suitable brake cleaning solvent.

### Front Master Cylinder Assembly

Coat the master cylinder bore and all internal parts with DOT 5 hydraulic brake fluid.

Install the spring and cup into the cylinder bore.

Place the O-ring into the groove in the piston and install the assembly into the cylinder bore.

Install the dust boot.

Insert the pushrod through the dust boot into the master cylinder piston. Note the orientation of the pushrod switch tab for proper brake light switch operation.

Install the brake lever assembly. Refer to Front Master Cylinder Removal and Installation in this section for procedures.

Install the master cylinder assembly onto the right-side handlebar. Refer to Front Master Cylinder Removal and Installation in this section for procedures.

Add DOT 5 hydraulic brake fluid to the reservoir. Fill to 1/4" below the top of the reservoir.

### ⚠ WARNING!

**USE ONLY DOT 5 BRAKE FLUID.** DOT 5 fluid is silicone based and not compatible with DOT 3, 4 or 5.1. Damage to the brake system will occur if you install any other fluid.

Bleed the hydraulic brake system. Refer to Replacing Brake Fluid and Bleeding the System in this section for procedures.

Check for proper brake operation.

### Rear Master Cylinder Disassembly

Remove the rear master cylinder assembly from the support bracket. Refer to Rear Master Cylinder Removal and Installation in this section for procedures.

Remove the dust boot and then, remove the snap ring retaining the piston. Remove the piston and O-ring, cup and return spring from inside the master cylinder.

### Rear Master Cylinder Cleaning and Inspection

Inspect the cover gasket, dust boot, cup and piston O-ring for wear, softening, enlargement, cuts and tears. Replace these parts as necessary.

Examine the cylinder bore for scratches, grooves and excessive wear. If any of these conditions are found, replace the master cylinder assembly.

Make sure the ports in the bottom of the reservoir are clear of debris or sediment.

Make sure the vent holes in the reservoir cover are open.

Thoroughly clean the piston and the master cylinder reservoir and cylinder bore, using a suitable brake cleaning solvent.

### Rear Master Cylinder Assembly

Coat the master cylinder bore and all internal parts with DOT 5 hydraulic brake fluid.

Install the spring and cup into the cylinder bore.

Place the O-ring into the groove in the piston and install the assembly into the cylinder bore.

Install the snap ring to retain the piston.

Install the dust boot.

Install the master cylinder assembly onto the support bracket. Refer to Rear Master Cylinder Removal and Installation in this section for procedures.

Add DOT 5 hydraulic brake fluid to the reservoir. Fill to 1/4" below the top of the reservoir.

### ⚠ WARNING!

**USE ONLY DOT 5 BRAKE FLUID.** DOT 5 fluid is silicone based and not compatible with DOT 3, 4 or 5.1. Damage to the brake system will occur if you install any other fluid.

Bleed the hydraulic brake system. Refer to Replacing Brake Fluid and Bleeding the System in this section for procedures.

Check for proper brake operation.

## Hydraulic Brake Line Replacement

### Tools required:

3/16" hex bit

7/16" wrench

9/16" wrench

Diagonal cutters

### Line Inspection

Check for leaks at all front and rear brake line connections and fittings. If leaks are found, tighten the connections as necessary to the following torque specifications:

Front master cylinder fitting (18–20 foot-pounds)

Front brake line fittings (12–15 foot-pounds)

Front caliper 90-degree fitting (8 foot-pounds)

Rear caliper inlet fitting (18–20 foot-pounds)

Rear master cylinder fitting (18–20 foot-pounds)

If leaks are still present, replace the copper sealing washers and apply hydraulic line sealant to the threads of each fitting.

## Front Brake Line Removal and Installation

### Removal

Open the bleeder screw on the front caliper and pump the front brake lever several times to drain the system of brake fluid. Catch the brake fluid in a suitable container.

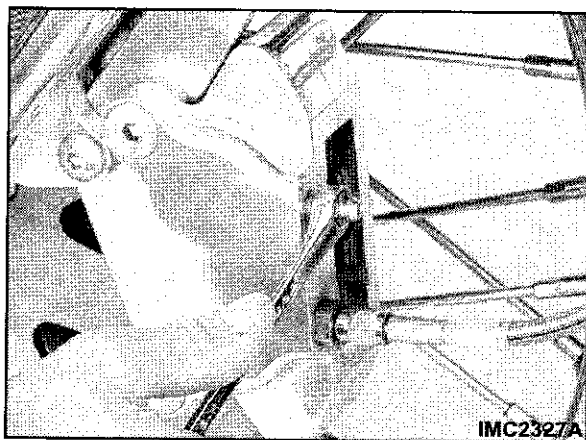


Figure 136 — Opening brake bleeder screw



Cut the tie straps securing the fender light wire to the brake line.

Loosen and remove the brake line clip screw, using a 3/16" hex bit. The clip secures the front brake line to the lower fork triple clamp. Remove the clip from the brake line.

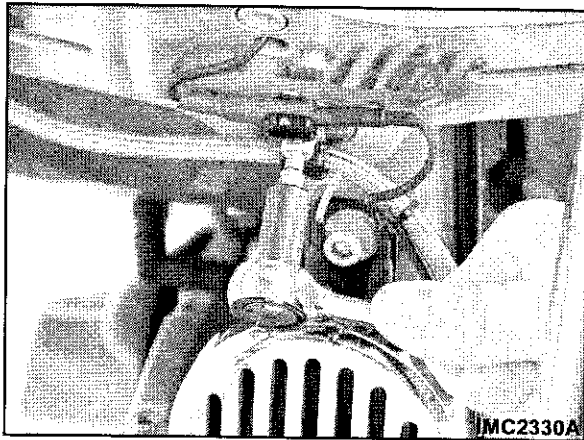


Figure 137 — Loosening brake line clip

Separate the hydraulic brake line at the front caliper, using a 7/16" wrench. The Scout is equipped with a straight outlet fitting which should be held with a 9/16" wrench, to prevent it from turning as the brake line is removed. The Spirit is equipped with a banjo fitting at the front caliper.

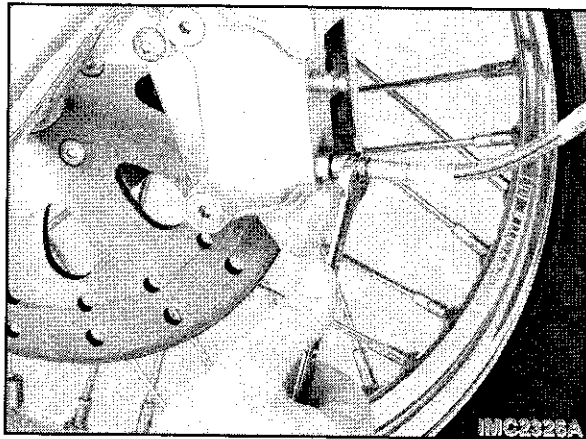


Figure 138 — Disconnecting brake line (Scout)

Separate the brake line from the banjo fitting on the front master cylinder, using a 7/16" wrench.

Remove the line from the motorcycle.

## Installation

Thread the new brake line onto the banjo fitting of the master cylinder and tighten to specification, using a 7/16" wrench.

Route the brake line through the hole (right side) in the upper triple clamp and under the lower triple clamp and down to the front caliper.

Thread the brake line onto the straight fitting (Scout) or banjo fitting (Spirit) at the front caliper and tighten to specification, using a 7/16" wrench. Support the straight fitting (Scout) with a 9/16" wrench, to keep it from turning while tightening the brake line.

Place the brake line retainer clip over the brake line and in position at the bottom of the lower fork triple clamp. Install the clip screw and tighten it, using a 3/16" hex bit.

Make sure all connections are tight and secure.

Secure the fender light wire to the hydraulic line with tie straps.

Add DOT 5 hydraulic brake fluid to the reservoir. Fill to 1/4" below the top of the reservoir.

## ⚠ WARNING!

**USE ONLY DOT 5 BRAKE FLUID.** DOT 5 fluid is silicone based and not compatible with DOT 3, 4 or 5.1. Damage to the brake system will occur if you install any other fluid.

Bleed the hydraulic brake system. Refer to Replacing Brake Fluid and Bleeding the System in this section for procedures.

Check for proper brake operation.

## Rear Brake Line Removal and Installation

The rear brake line includes two sections. The front section extends from the master cylinder at the right foot control to the brake light switch junction block mounted on the right frame rail, just forward of the swingarm. The rear section extends from the switch junction block to the rear caliper.

### Removal (Front and Rear Sections)

Open the bleeder screw on the rear caliper and pump the rear brake pedal several times to drain the system of brake fluid. Catch the brake fluid in a suitable container. Close the bleeder screw.

**Removing the rear section** — Remove the screw securing the brake line banjo fitting to the rear caliper, using a 9/16" wrench. Remove the copper sealing washers. As an alternative, the brake line can be separated from the banjo fitting, using a 7/16" wrench, leaving the banjo fitting on the caliper.

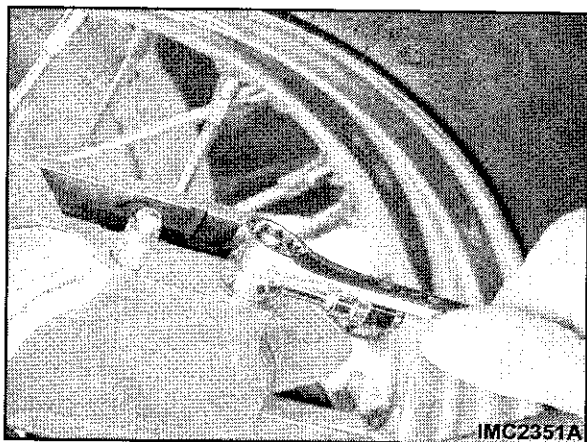


Figure 139 — Disconnecting brake line at rear caliper

Using a 7/16" wrench, disconnect the rear section of the brake line at the brake light switch junction block located on the right frame rail just forward of the swingarm.

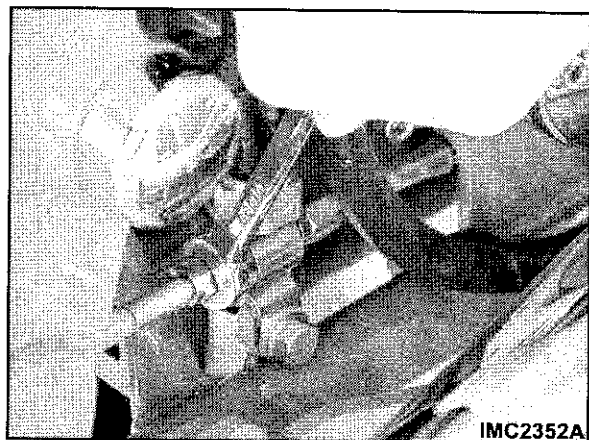


Figure 140 — Disconnecting brake line at junction block

Pull the brake line out of its routing through the retaining loop at the right side of the swingarm and remove the rear section of the line from the motorcycle.

**Removing the front section** — Using a 7/16" wrench, disconnect the front section of the brake line at the brake light switch junction block located on the right frame rail just forward of the swingarm.

Remove the screw securing the brake line banjo fitting to the rear master cylinder at the right foot control, using a 9/16" wrench. Remove the copper sealing washers. As an alternative, the brake line can be separated from the banjo fitting, using a 7/16" wrench, leaving the banjo fitting on the master cylinder.

Cut the tie straps securing the hydraulic line to the frame rail. Then, carefully pull the brake line from its routing at the right side of the frame and remove the front section of the line from the motorcycle.

### Installation (Front and Rear Sections)

**Installing the front section** — Route the new brake line section along the right frame rail from the master cylinder to brake light switch junction block. Make sure the line reaches both front and rear connections.

Place the screw with copper sealing washer through the master cylinder banjo fitting of the brake line. Add the second copper sealing washer onto the screw and thread the screw into the rear master cylinder. Tighten the screw to specification, using a 9/16" wrench. If the banjo fitting was not removed from the master cylinder, connect the line to the banjo fitting, using a 7/16" hex bit.

Connect the other end of the line to the brake light switch junction block, using a 7/16" wrench, and tighten to specification.

Once connected, secure the line with tie straps every four inches along the frame rail.

**Installing the rear section** — Route the new brake line rear section through the retaining loop at the right side of the swingarm. Make sure the line reaches both front and rear connections.

Connect the front end of the line to the brake switch junction block, using a 7/16" wrench.

At the rear end of the line, place the screw with copper sealing washer through the caliper fitting of the brake line. Add the second copper sealing washer onto the screw and thread the screw into the rear caliper. Tighten the screw to specification, using a 9/16" wrench. If the banjo fitting was not removed from the master cylinder, connect the line to the banjo fitting, using a 7/16" hex bit.

**Completing the installation** — Bleed the hydraulic brake system. Refer to Replacing Brake Fluid and Bleeding the System in this section for procedures.

Check for proper brake operation.

## Replacing Brake Fluid and Bleeding the Hydraulic System

Over time, the efficiency of the hydraulic brake system begins to degrade due to moisture. Moisture enters the system through normal heating and cooling cycles during brake operation. DOT 5 silicone brake fluid is non-hygroscopic and does not absorb moisture. However, excessive moisture in the system can cause system damage.

The brake fluid should be replaced and the brakes bled every year to maintain braking efficiency.

Also, the brake fluid should be changed and the system bled when the hydraulic system has been opened due to caliper, brake line or master cylinder service.

### **⚠ WARNING!**

**USE ONLY DOT 5 BRAKE FLUID.** DOT 5 fluid is silicone based and not compatible with DOT 3, 4 or 5.1. Damage to the brake system will occur if you install any other fluid.

Replacing the brake fluid and bleeding the brakes is similar for both front and rear brakes. The following procedure applies to both front and rear brakes.

### Tools required:

- Suction gun
- 1/8" hex bit
- 7/16" wrench
- #2 Phillips screwdriver
- 1/4" diameter clear tubing (30" length)
- Clear catch container
- DOT 5 brake fluid

Clean both the front and rear master cylinders before removing the covers.

Remove the reservoir cover from the front master cylinder, using a #2 Phillips screwdriver.

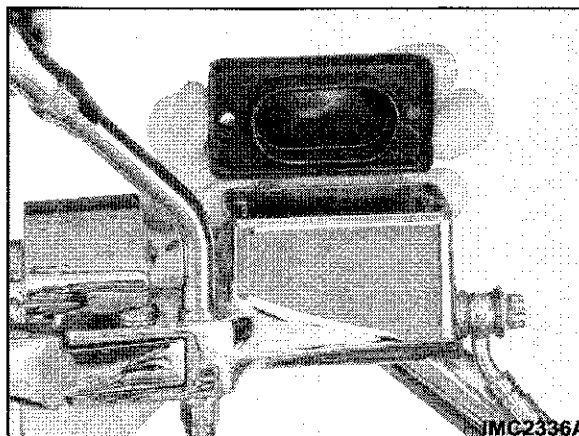


Figure 141 — Front master cylinder cover removal

Insert the suction gun into the reservoir and remove the brake fluid.

Replenish the master cylinder with fresh, clean DOT 5 brake fluid to within 1/4" from the top of the reservoir. Replace the reservoir cover.

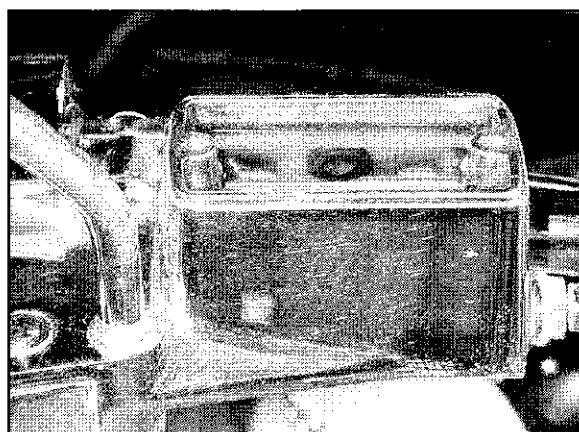


Figure 142 — Brake fluid level

Remove the protective cap from the front caliper bleeder screw and install the 1/4" diameter clear tubing onto the screw.

Place the opposite end of the tube into a clear catch container. Add some DOT 5 brake fluid into the container.

**Note:** When bleeding the front brake hydraulic system, make sure the front forks are facing straight ahead. The caliper must be as vertical as possible to ensure all air can be removed from the system. Also keep the motorcycle in the upright position.

Pump the brake lever once or twice and hold. Loosen the front caliper bleeder screw approximately 1/4 turn, using a 7/16" wrench. Tighten the bleeder screw.

 **Note:** Do not release the brake lever until the bleeder screw is fully closed. Air can reenter the system.

Again, pump the brake lever once or twice and hold. Loosen the bleeder screw approximately 1/4 turn, using a 7/16" wrench. Tighten the bleeder screw.

Remove the reservoir cover and replenish the brake fluid as necessary. Do not let the brake fluid level in the reservoir become too low. Pumping the brake lever with a low fluid level can cause air to reenter the system.

Continue pumping and holding the brake lever and loosening and tightening the bleeder screw. Do this as described, until fresh, clean fluid is coming from the bleed tube and there are no air bubbles.

Squeezing the brake lever should become firm when the brake pads are seated and the hydraulic system is bled of any air.

Remove the reservoir cover and replenish the master cylinder with DOT 5 brake fluid, until the level is 1/4" from the top of the reservoir.

Install the reservoir cover and tighten the screws to specification, using a #2 Phillips screwdriver.

Check for proper brake operation.

Perform the same service on the rear hydraulic system as done for the front brakes. However, to remove the cover from the rear master cylinder requires the use of a 1/8" hex bit instead of the a Phillips screwdriver.

## FRAME AND ACCESSORIES SERVICE

### Seat Removal and Installation

#### Tools required:

5/32" hex bit

5/16" hex bit

#### Removal

Remove the seat from the frame by removing the two chrome button head screws, using a 5/16" hex bit. These screws are located at the seat base on the left and right sides of the motorcycle.

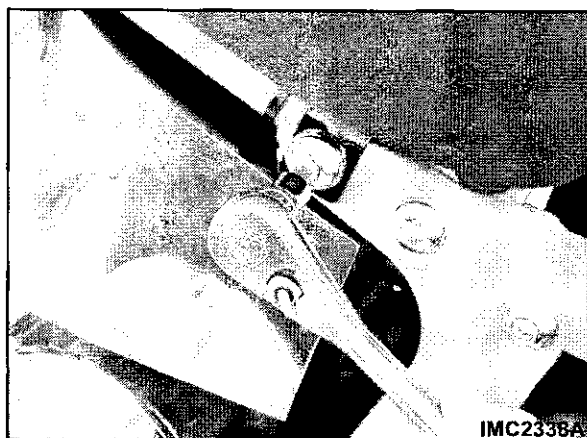


Figure 143 — Removing seat mounting screw

Lift up on the rear of the seat and pull the seat rearward to disengage the seat front retainer bracket from the frame. Remove the seat.

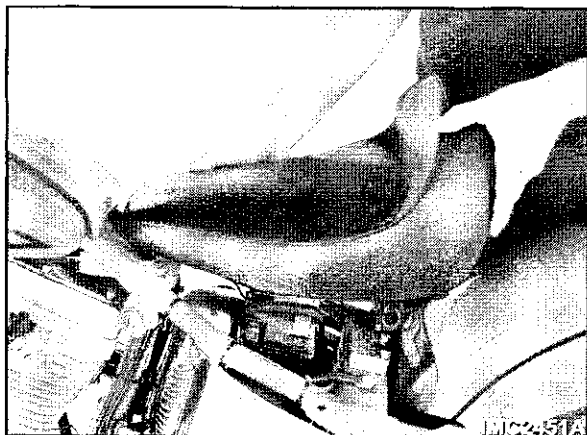


Figure 144 — Removing seat

**Note:** If the motorcycle is equipped with a buddy seat, there will be an additional screw at the center rear of the seat, securing the seat to the fender. Use a 5/32" hex bit to remove this screw.

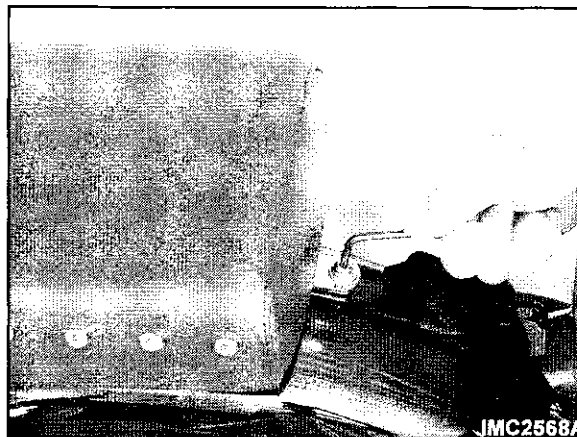


Figure 145 — Removing buddy seat screw

#### Installation

Place the seat in position over the frame making sure the front retainer bracket is hooked under the frame bracket.

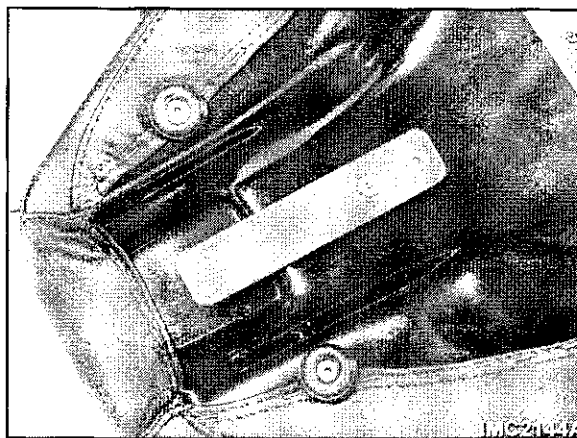


Figure 146 — Seat front retainer bracket

Push down on the seat to align the seat side mounting brackets with the screw holes in the frame. Install the side mounting screws, using a 5/16" hex bit. Tighten the screws to specification.

If the motorcycle is equipped with a buddy seat, install the mounting screw at the rear of the seat assembly, using a 5/32" hex bit.

## Fender Removal and Installation

### Tools required:

- 1/4" hex bit
- 7/32" hex bit
- 5/16" hex bit
- #2 Phillips screwdriver
- Small diagonal cutters
- Torque wrench

### Front Fender Removal

Cut the tie straps securing the fender light wire to the front wheel brake line.

Trace the front fender light wire up to the connector at the base of the lower triple clamp. Loosen the wire retainer and unplug the connector.

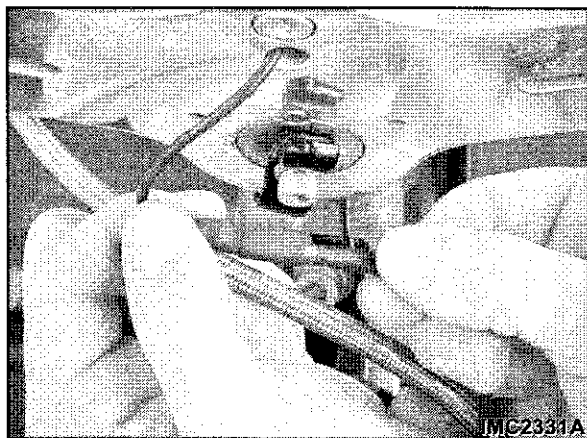


Figure 147 — Unplugging fender light connector

Place suitable protective covering around the fork legs and the fender to protect the fender paint and fork legs from damage.

Loosen the four front fender screws, using a 1/4" hex bit.

With the help of an assistant, support the front fender and remove the four mounting screws from the fork sliders.

Carefully remove the front fender to avoid scratching the paint surface. It is helpful to apply light pressure to the sides of the fender, squeezing them inward just enough to clear the mounting pads on the sliders.

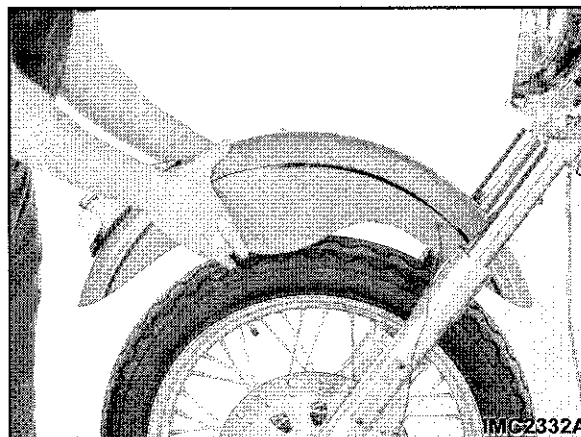


Figure 148 — Removing fender (Scout shown, typical)

### Front Fender Installation

If not already done, cover the fork legs and front fender with a suitable protective covering.

Apply blue threadlock to the first 1/4" of the threads on each of the four mounting screws.

With the help of an assistant, gently guide the front fender between the two fork tube assemblies. Align the fender mounting holes with the mounting holes on the fork sliders.

Install the four mounting screws, using a 1/4" hex bit. Tighten the screws to specification, 22–25 foot-pounds.

Remove the protective covering from the fork tubes and the fender.

Route the fender light wire along the front brake line, securing it with tie straps every six inches. Continue to route the light wire to the retainer at the lower triple clamp. Plug the wire connector into the harness connector for the front fender light and secure it under the retainer.

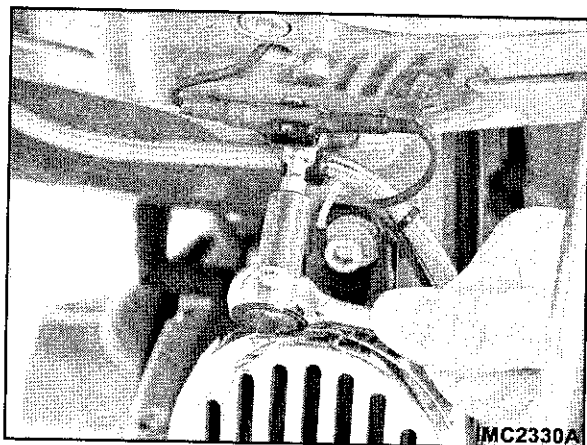


Figure 149 — Tightening retainer clip

Install the headlight from the light housing following the procedure described under Front Turn Signal and Headlight Procedures in this section.

Turn the ignition key to the "on" position and check the function of the front lights.

## Rear Fender Removal

Remove the seat following the instructions described under Seat Removal and Installation in this section.

Cut the tie strap holding the four-pin rear light harness connector to the connector anchor. Disconnect the four-pin connector.

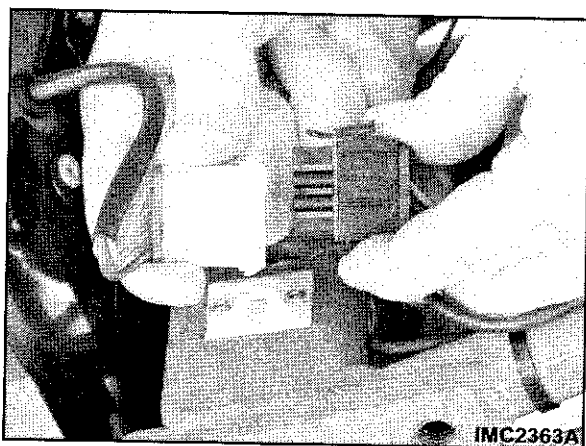


Figure 150 — Unplugging rear fender light harness

For both the Scout and Spirit models, the fender can be removed easily as a complete assembly including the sheet-metal fender, support bracket and taillights. To remove the complete assembly, Loosen the two bracket mounting screws at each side of the chassis a few turns, using a 5/16" hex bit, but DO NOT remove them. Then, with the help of an assistant, support the fender assembly and remove the screws and fender.

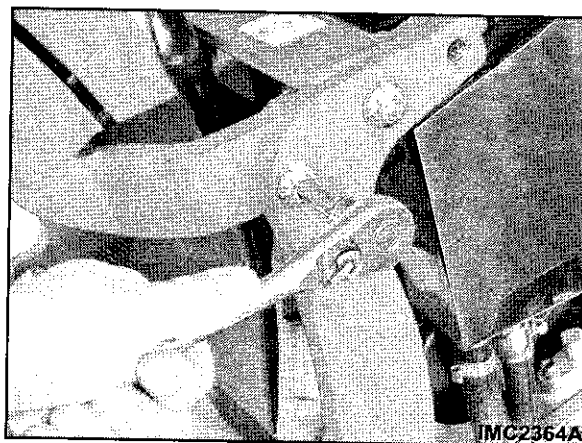


Figure 151 — Removing rear fender bracket mounting screws

To remove the sheet-metal fender only and leave the support bracket mounted to the chassis, the procedure is slightly different for the Scout and Spirit models:

- For the Spirit, there are four mounting screws at each side of the fender. Using a 7/32" hex bit, loosen each screw a few turns, but DO NOT remove them. Then, with the help of an assistant, support the fender assembly and remove the screws and fender.
- For the Scout, the rear turn-signal light assemblies are part of the fender mounting system and must be removed before the fender can be removed. From under the fender, unplug the four-pin connector from the taillight harness. Using a terminal pin extractor tool, remove the turn signal wire terminal from the connector. Then, using a 1/2" open-end wrench, remove the retainer nut and remove the light assembly from the fender. Remove the other turn signal light assembly in the same manner. At this point, the fender is still attached with three mounting screws at each side of the fender. Using a 7/32" hex bit, loosen each screw a few turns, but DO NOT remove them. Then, with the help of an assistant, support the fender assembly and remove the screws and fender.

## Rear Fender Installation

To install the rear fender, reverse the order of removal. Use an assistant to help position and hold the assembly in place as the fasteners are being installed. As applicable, be sure to:

- **Fender and bracket assembly removed** – Apply blue threadlock to the threads of the rear fender support bracket mounting screws and install the two screws at each side of the frame, using a 5/16" hex bit. Tighten the screws to specification.
- **Fender only removed** – Apply blue threadlock to the threads of the rear fender side mounting screws and install the screws at each side of the fender (Spirit, eight screws; Scout, six screws), using a 7/32" hex bit. Tighten the screws to specification. On the Scout, install the turn signal lights.

Connect the rear light harness at the four-pin connector and secure the connector with a tie strap.

Turn the ignition key to the "on" position and check the function of the taillights.

Install the seat following the procedure in this section.

## Dash Removal and Installation

### Tool required:

5/32" hex bit

### Procedure

To remove the dash, remove the screw at the rear of the panel, using a 5/32" hex bit.

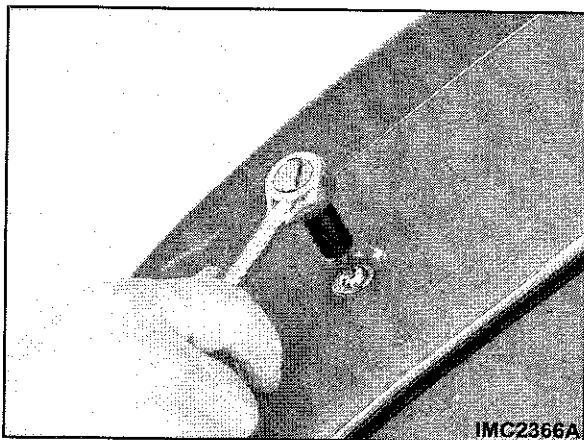


Figure 152 — Removing dash rear retaining screw

Then, using a 5/32" hex bit, remove the screw in the instrument bezel at the front of the dash.

Lift the dash off the fuel tanks and unplug the electrical connections to the speedometer and the warning lights.

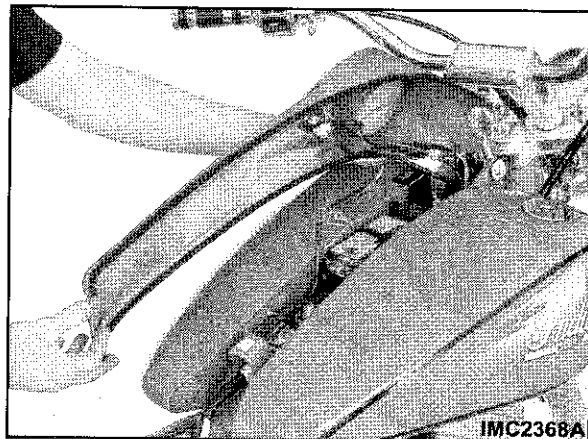


Figure 153 — Removing dash

Install the dash in the reverse order of removal.

## Front Turn Signal and Headlight Procedures

### Tools required:

#2 Phillips screwdriver

5/64" hex bit

3/16" hex bit

9/16" wrench/socket

### Front Turn Signal Lights

#### Bulb Replacement

To replace a front turn signal light bulb, use a #2 Phillips screwdriver to remove the screw and lens.

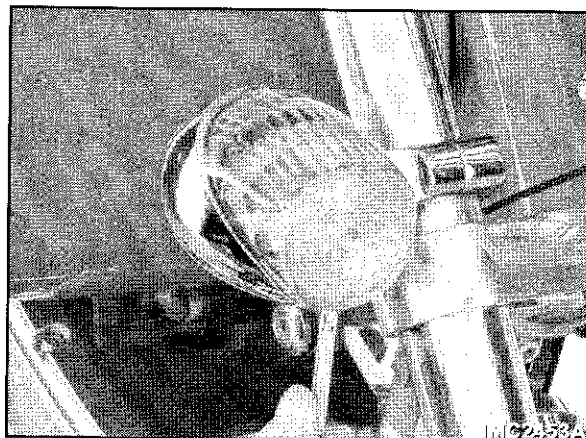


Figure 154 — Removing lens



Remove the old bulb from its socket and replace it with a new one of the specified size.

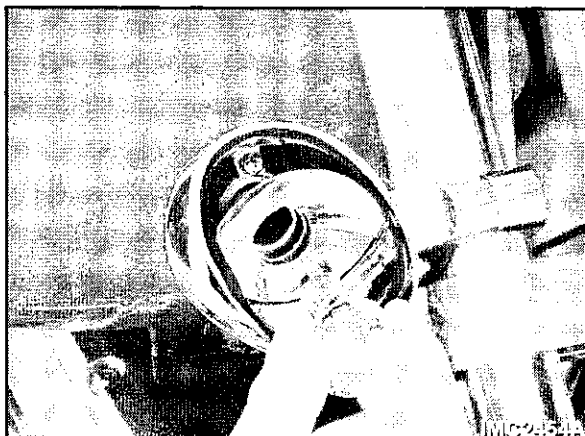


Figure 155 - Replacing bulb

Make sure that the lens gasket is properly seated, then install the lens and retaining screws.

### Housing Removal and Installation

Remove the dash following the procedure in this section.

To remove the front turn signal light housing, unplug the signal light wire connectors either in the area of the fork triple clamps or under the dash, between the fuel tanks at the front of the electronic control module. Refer to Dash Removal and Installation in this section for procedures as necessary.

Carefully pull the harness through its routing, after removing any tie straps or shrink wrap securing the harness.

Using a 3/16" hex bit, remove the two front turn signal light housing mounting screws and remove the housing and clamp bracket.



Figure 156 - Removing clamp and light assembly

To install the housing, reverse the order of removal.

### Headlight Assembly/Bulb Replacement

Remove the headlight and trim ring assembly, using a 5/64" hex bit to remove the two upper screws and a #2 Phillips screwdriver to remove the screw at the bottom of the headlight.

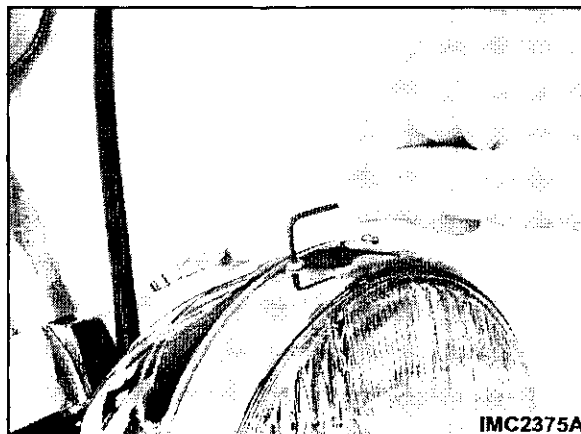


Figure 157 - Removing headlight trim ring screws

Lift the assembly off the headlight housing.

Unplug the harness connector from the bulb holder at the rear of the lens.

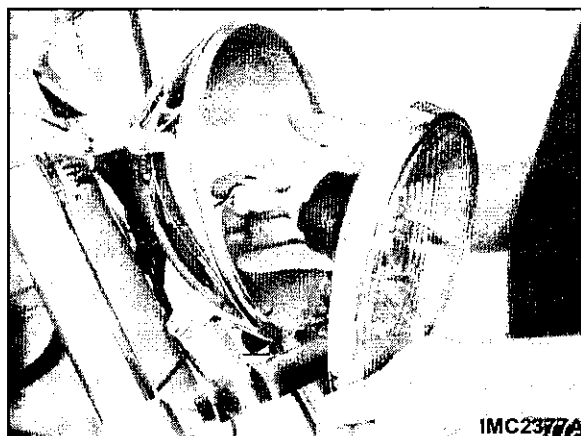


Figure 158 - Unplugging harness connector

Remove the rubber boot from the bulb holder. Release the snap ring and remove the bulb holder from the lens assembly.

Replace the bulb in the holder with the Indian specified type quartz halogen bulb.

Install the headlight and trim ring assembly in the reverse order of disassembly. Apply blue threadlock to the fasteners and tighten to specification.

## Headlight Housing Replacement

Remove the dash to gain access to the headlight harness connector. Refer to Dash Removal and Installation in this section for the procedure.

Remove the headlight and trim ring assembly as necessary. Refer to Headlight Assembly/Bulb Replacement in this section.

Carefully pull the headlight and trim ring from the headlight housing. Unplug the harness connector from the headlight and remove the assembly.

Remove the tie straps along the routing of the headlight assembly harness and unplug the headlight harness connector under the dash between the fuel tanks.

Loosen and remove the headlight housing mounting bolt and nut, using a 5/16" hex bit and 9/16" wrench.

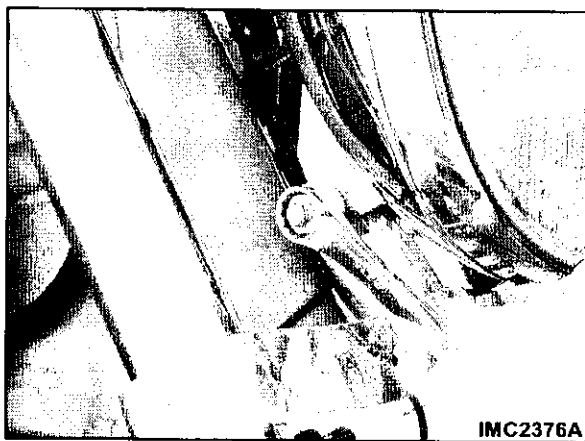


Figure 159 — Removing headlight assembly mounting bolt

Remove the headlight housing from the housing bracket on the lower triple clamp.

Install the headlight housing in the reverse order of removal. Apply blue threadlock to the fasteners as necessary, tighten all fasteners to specification and install new tie straps to secure wiring harnesses.

## Fender-Mounted Light Procedures

### Tools required:

- #2 Phillips screwdriver
- 7/16" socket
- 1/2" wrench/socket
- Small diagonal cutters
- Terminal pin extractor tool

## Front Fender Light

### Bulb Replacement

The bulb is easily replaced by removing the decorative lens cover to gain access to the bulb. Use a #2 Phillips screwdriver to remove the two retaining screws and the cover. Replace the bulb with a new one of the specified type and install the lens cover.



Figure 160 — Lens cover removal

### Housing Removal and Replacement

To remove the fender light housing, remove the front fender following the procedure under Fender Removal and Installation in this section.

From underneath the fender, cut the tie straps that secure the wire lead at the top underside. Pull the lead free of the hole at the left side of the fender and free of the nylon strap blocks.

Using a 1/2" socket, remove the retaining nuts and washers from the mounting bolts. Then remove the housing assembly, rubber gasket and wire lead from the fender.

To install the housing assembly, reverse the order of disassembly. Route the wire lead along the nylon mounting blocks and through the hole at the left side of the fender. Make sure the rubber grommet is in place at the hole. Then secure the lead with new tie straps at the nylon mounting blocks. Tighten the housing retaining nuts to specification.

## Taillight Assembly

For the Scout model, the taillight is mounted in a housing at the center of the fender and the turn signal lights in separate housings at the left and right sides. For the Spirit model, the taillight and turn-signal lights are mounted in a single integral housing at the center of the fender.

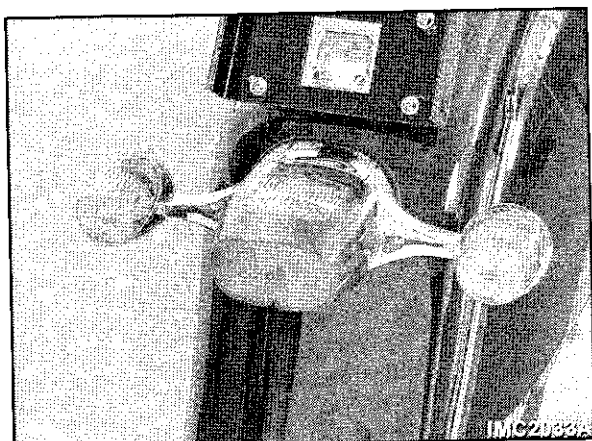


Figure 161 — Integral taillight and turn signal assembly

The bulb replacement procedure is the same for both Scout and Spirit models. However, for the Scout, the procedure for removing and installing a turn signal housing is different.

### Bulb Replacement

Bulbs are easily replaced by removing the respective lens to gain access to the bulb. A single Phillips screw located at the bottom of the lens/housing is used to retain the lens. Use a #2 Phillips screwdriver to remove the screw and lens.

### Housing Removal and Installation

To remove the taillight housing and separate turn signal housings (Scout) or the integral taillight and turn signal housing (Spirit), remove the rear wheel following the procedure in the WHEEL AND TIRE SERVICE section.

**Taillight (Scout and Spirit)** — From underneath the fender, cut the tie straps that secure the wiring harness at the top underside. Use a terminal pin extractor tool to separate the harness wires from the terminal block as necessary. Pull the harness connector free of the rubber splash guard and the nylon strap blocks.

Using a 7/16" socket, remove the retaining nuts and washers from the mounting bolts. Then remove the housing assembly, rubber gasket and wiring harness from the fender.

**Turn Signal Lights (Scout only)** — To remove one or both turn signal housings on the Scout, unplug the four-pin connector from the taillight harness at the rear underside of the fender. Using a terminal pin extractor tool, remove the turn signal wire terminal from the connector. Then, using a 1/2" open-end wrench, remove the retainer nut and remove the light assembly from the fender. Remove the other turn signal light assembly in the same manner.

To install the taillight housing assembly or turn signal lights, reverse the order of removal. Route the wiring harness through the rubber splash guard and secure it with new tie straps at the nylon mounting blocks. Tighten the retaining nuts to specification.

Apply silicone sealant at the rubber gasket and wire junction.

## Floorboard and Buddy Peg Removal and Installation

### Tools required:

- 1/8" hex bit
- 7/16" wrench/socket
- Motorcycle lift

### Floorboard Procedure (Spirit Only)

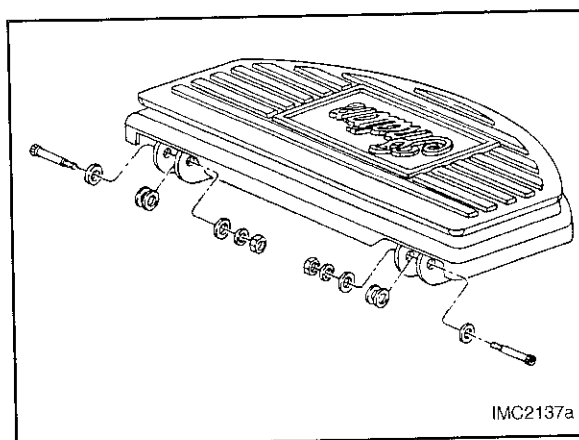


Figure 162 — Floorboard

Each floorboard (left and right) is mounted to a frame bracket with two pivot bolts on the inner edge. A stop screw with jam nut is located in the frame bracket just under the inner edge of the floorboard. The stop screw is used to adjust the mounting angle.

For easier access to remove a floorboard, first raise the motorcycle off the ground, using a suitable lift.

Remove the floorboard pivot bolt nuts, using a 7/16" wrench. Use a 1/8" hex bit to keep each bolt from turning as the nut is being removed. Pull the pivot bolts out and remove the floorboard.

Reverse the order of removal to install the floorboard. If required, loosen the jam nut and adjust the stop screw to the desired height before installing the floorboard.

## Buddy Peg Procedure

The buddy pegs provide folding foot rests for the rear seat passenger. The indexed pegs are mounted in the stanchions at the left and right sides of the frame just forward of the rear wheel. A single mounting screw accessed from inside the frame stanchion retains each peg. Use a 3/8" hex bit to remove the pegs. For installation, apply blue threadlock to the threads and tighten to specification.

## Mirror Assembly Removal, Installation and Adjustment

### Tools required:

- 1/2" wrench/socket
- 5/8" wrench

### Procedure

The mirror assemblies are mounted on the clutch control lever bracket (left side) and brake control lever bracket (right side). The shouldered mirror arm is inserted in the bracket-mounting hole from the top and retained at the bottom with a flat washer, lock washer and chrome cap nut. The cap nut and arm can be removed, using a 1/2" wrench.

The mirror head is mounted at the top of the arm by a 5/8" chrome collar nut. Mirror positioning can be adjusted by loosening the collar and/or cap nuts and repositioning the mirror head and arm as required. After the adjustment is made, tighten the collar and cap nuts to specification.

## Kickstand Removal and Installation

### Tools required:

- 1/4" hex bit
- 5/8" wrench/socket
- Spring pliers
- Motorcycle lift

### Procedure

Using a suitable lift, raise the motorcycle off the ground. Make sure that the lift is positioned in a way that allows full access to the kickstand components. The kickstand can be removed as an assembly, or the lever arm can be removed separately.

To remove the arm of the kickstand only, disconnect and remove the spring from the arm and from the frame bracket, using a spring pliers. Next, remove the arm retaining nut, using a 5/8" wrench, and remove the nut, lock washer, stop and arm from the bracket.

To remove the complete assembly, remove the four mounting screws, using a 1/4" hex bit and remove the assembly from the motorcycle.

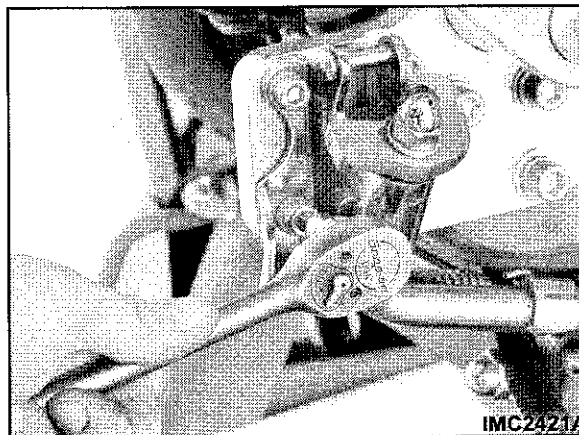


Figure 163 — Removing kickstand assembly (Scout, typical)

To install the kickstand arm or complete assembly, reverse the order of removal. Tighten the nut or mounting screws to specification.

## Chassis Frame Inspection and Repair

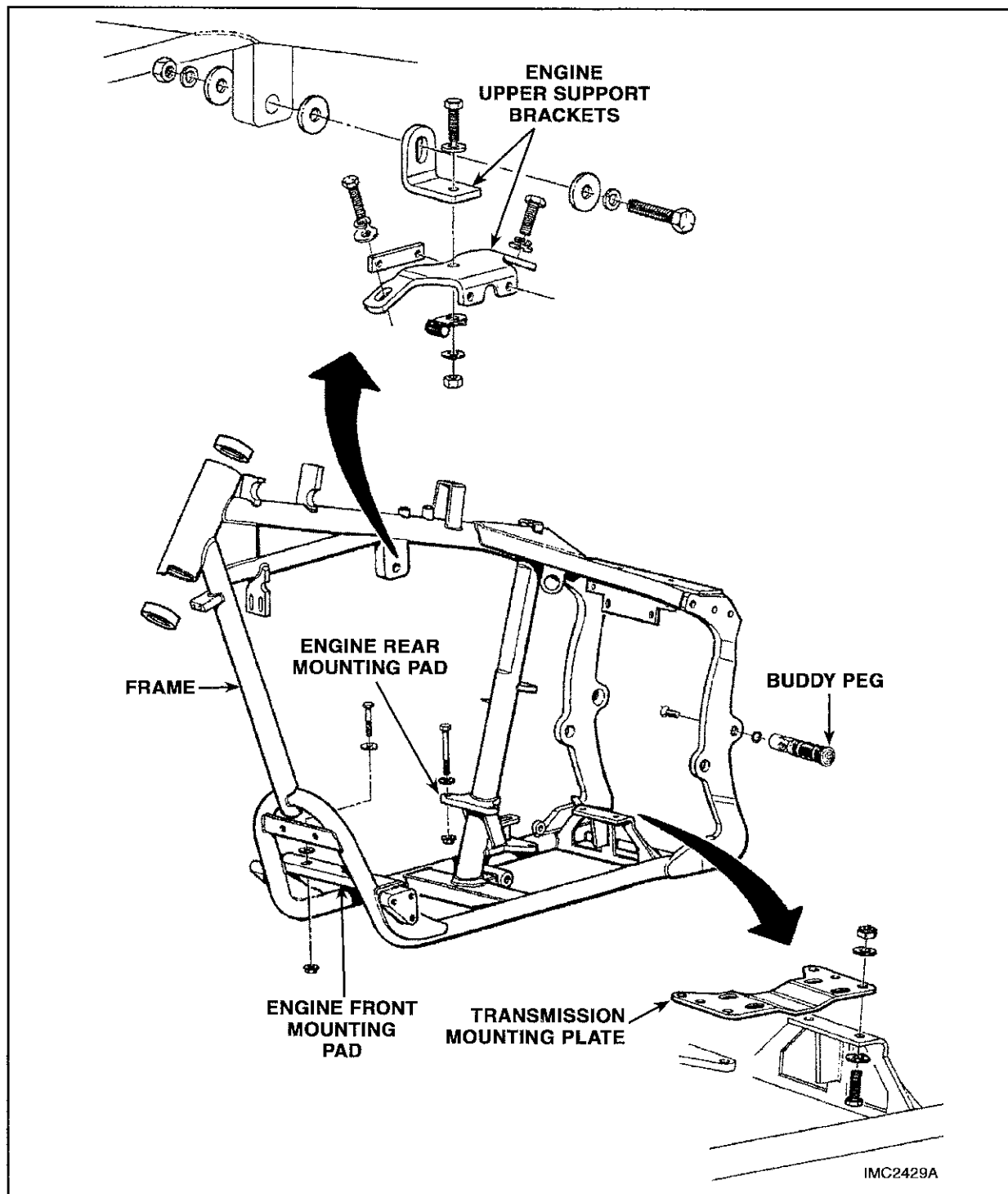


Figure 164 — Indian Scout and Spirit chassis frame

The frame is the backbone of the motorcycle. It is a very durable component requiring little attention providing the motorcycle is properly maintained and ridden under normal operating conditions. Operating components that are not inspected and serviced in accordance with the recommended service intervals can loosen and wear.

Wear can subject the motorcycle frame to undue stress, vibration and eventual failure. Also, a motorcycle that is subjected to extreme operating conditions or one that has been in an accident can have structural damage to the frame in the form of cracks or bends. Whenever these extreme conditions occur, the frame should be thoroughly inspected and repaired as required.

### **Cleaning and Inspection**

Clean the frame thoroughly, removing all accumulated oil, grease and dirt.

Visually inspect all welds and joints. Look closely for signs of cracks, pitting and corrosion.

Look for areas with damaged or peeling paint and subsequent corrosion.

Inspect bearing seats in the steering tube and swingarm pivots for wear, distortion or other damage.

Inspect engine and transmission mounting pads and all mounting brackets to ensure that there is no wear or damage that would prevent a secure and properly aligned mounting of the respective components.

Check frame alignment to ensure that there are no bent tubes which can affect handling and control.

### **Repair**

Severe wear or damage uncovered during cleaning and inspection must be repaired. Slightly bent tubes can be straightened and weld repairs made. However, caution must be exercised whenever heat is applied in the process. The application of extreme heat can weaken the frame and cause early failure if not done properly. Work of this nature should always be done by a qualified technician.

## AIR CLEANER AND FILTER ELEMENT SERVICE

### Air Filter Element Replacement

The air filter element should be checked at regular service intervals to maintain engine breathing efficiency and intake air cleanliness. Inspect the air filter element for excessive dirt build-up at the 500-mile service interval and thereafter, at the 5,000-mile interval for normal conditions. Inspect the air filter element more frequently when the motorcycle is operated in dusty conditions.

#### Tool required:

#2 Phillips screwdriver

### Removal and Cleaning

Remove the air cleaner cover screws, using a Phillips screwdriver and remove the cover.

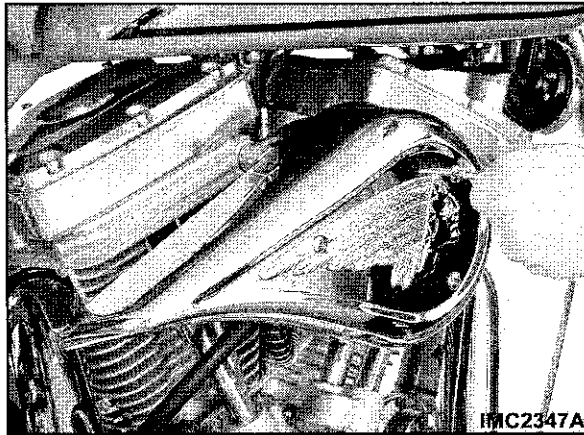


Figure 165 — Removing air cleaner cover

Remove the filter element from the air cleaner base.

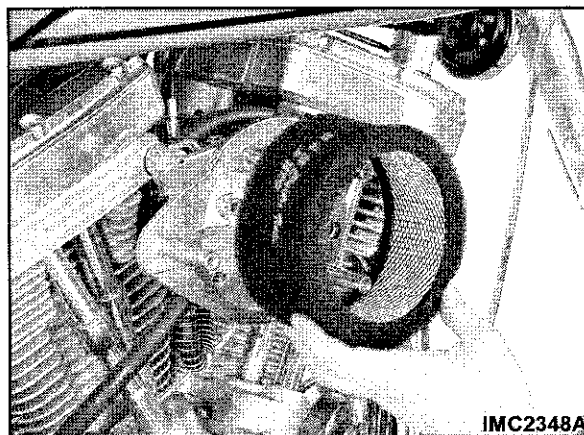


Figure 166 — Removing filter element

Using care, remove the screen from the inside of the foam core. Wash the filter foam in a non-flammable solvent and let the element dry thoroughly.

After it has dried, saturate the foam with fresh air cleaner oil. Work the oil into all surfaces of the foam with your fingers and then, gently squeeze out the excess oil.

#### ⚠ CAUTION!

Use care when squeezing the oil from the foam filter to avoid deforming or damaging it in any way. **DO NOT** wring the foam in the process.

Carefully insert the screen back into the foam filter. Make sure that the screen is seated completely within the foam core with the lips of the foam fully covering the edges of the screen.

### Installation

Place the filter element in position on the air cleaner base. Push inward with enough pressure to force the element over the web at the left side of the base and seat it firmly against the base. Once seated, the filter element will remain in position on the base without being held.

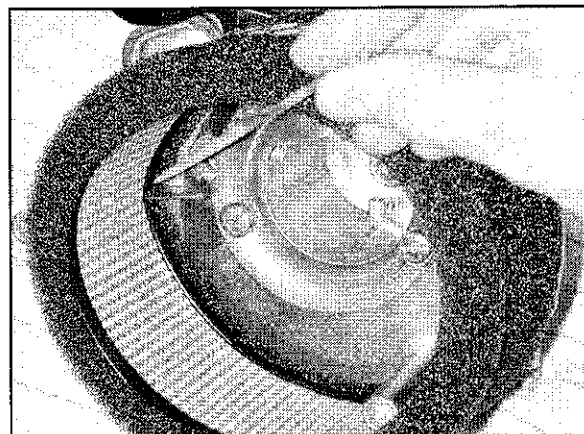


Figure 167 — Filter element seated over web and against base

Apply blue threadlock to the first 1/4" of the cover screws. Place the cover in position over the filter and base and install the screws, using a #2 Phillips screwdriver. Tighten the screws to 7-9 foot-pounds.

## Air Cleaner Assembly Removal and Installation

To gain access to components such as the carburetor or engine for service, remove the air cleaner assembly as described in the following procedure.

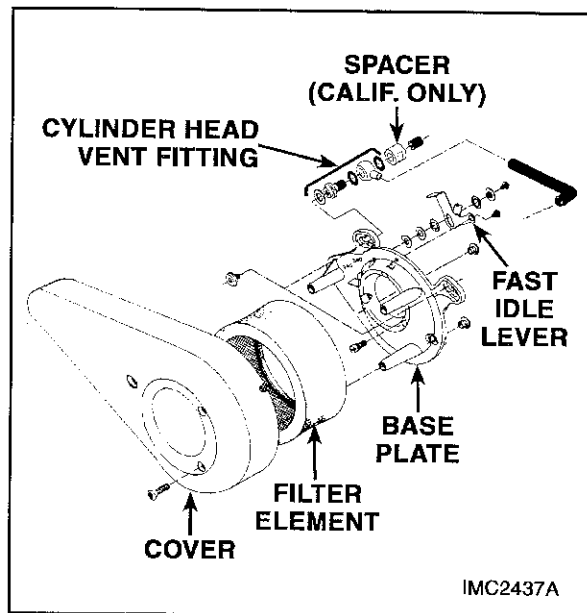


Figure 168 — Air cleaner assembly

### Tools required:

- 3/16" hex bit
- #2 Phillips screwdriver

### Removal

Remove the air cleaner cover screws, using a Phillips screwdriver. Remove the cover and filter element.

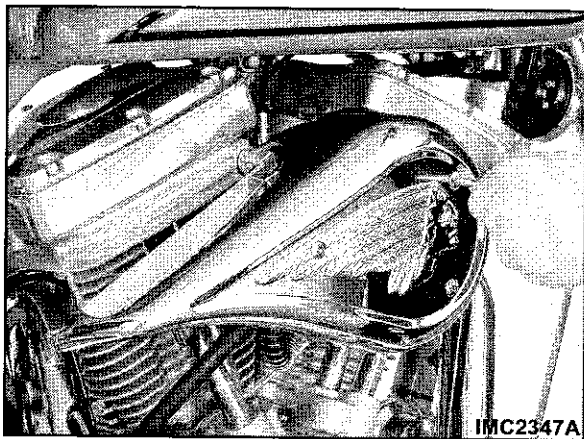


Figure 169 — Removing air cleaner cover

Using a 3/16" hex bit, remove the five screws securing the air cleaner base to the carburetor and the cylinder heads.

On California-only models, disconnect the vacuum line to the air valve solenoid and remove the air valve assembly along with the air cleaner base.

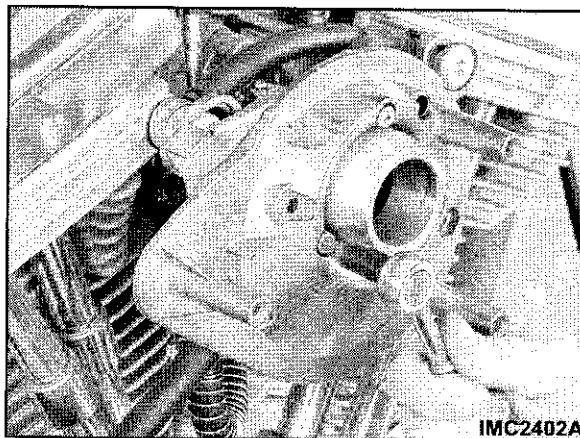


Figure 170 — Removing air cleaner base

### Installation

Place the air cleaner base in position on the carburetor, making sure that the slot in the enricher lever engages the fast idle plunger. Apply blue threadlock to the threads of the screws and start all three through the mounting holes in the base and into the carburetor. Tighten the lower two until they are just snug with the base. DO NOT tighten the upper screw at this time.

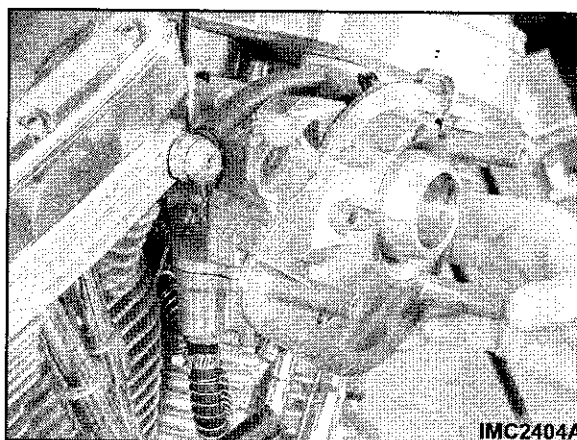


Figure 171 — Installing air cleaner base

Check the alignment of the base flange ears with the cylinder head breather vent fittings. There should be a slight clearance between the flange ears and the vent fittings with shims, but no more than 0.025". If not, replace the shim(s) with those of the proper size to obtain the specified clearance. Shims are available in three sizes, 0.025", 0.050" or 0.075".



**ⓘ CAUTION!**

If the vent fitting shims are too thick, with no clearance, the enricher lever and plunger will bind and not operate properly.

After verifying the clearance, tighten the three screws to specification, 84–108 inch-pounds, using a 3/16" hex bit.

Apply blue threadlock to the threads of the base-to-cylinder head vent fitting screws and install the screws, using a 3/16" hex bit and torque wrench. Make sure that the screws are properly seated within the step on the base flange ears and tighten the screws to specification, 8–12 foot-pounds.

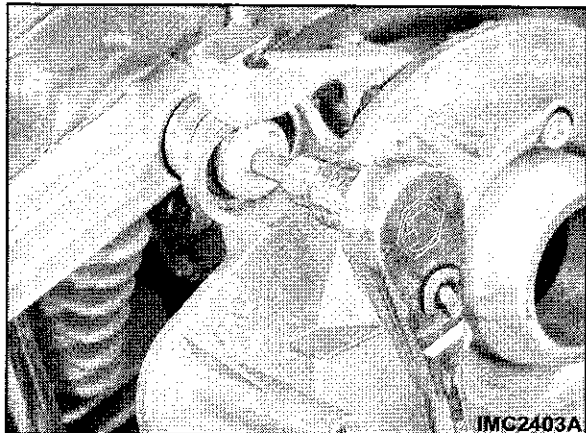


Figure 172 — Installing base-to-cylinder head breather vent fitting screws

Check the operation of the enricher, making sure that it operates freely and does not bind.

Place the filter element in position on the air cleaner base. Push inward with enough pressure to force the element over the web at the left side of the base and seat it firmly against the base.

Once seated, the filter element will remain in position on the base without being held.

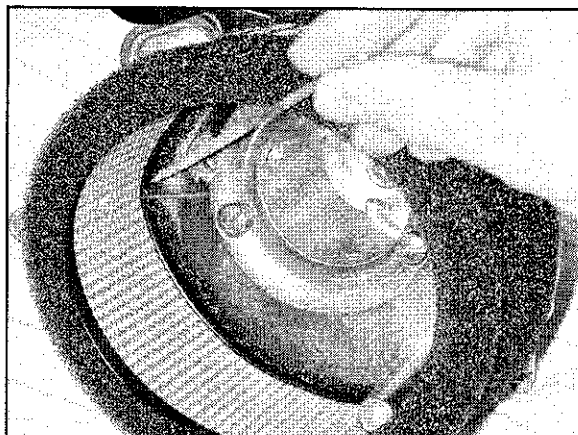


Figure 173 — Filter element seated over web and against base

Apply blue threadlock to the first 1/4" of the cover screws. Place the cover in position over the filter and base and install the screws, using a #2 Phillips screwdriver. Tighten the screws to 7–9 foot-pounds.

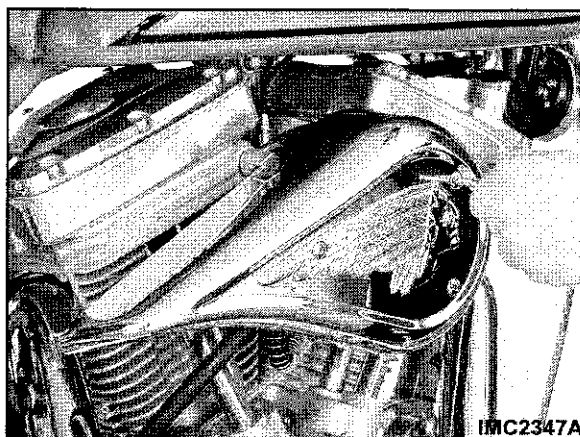


Figure 174 — Installing air cleaner cover

## FUEL SYSTEM SERVICE

### Fuel Filtration Maintenance

#### General Information

Just like the engine, the fuel tank will contain a small amount of debris that needs to be removed. To accomplish this need, the fuel system is equipped with a filter screen in the petcock (fuel supply valve) to trap the particulates. Removal of the petcock to clean the screen is required at the 500-mile mark and at each 5000-mile interval thereafter.

There is a second filter screen in a cartridge in the fuel supply line between the fuel tank and the carburetor to trap any additional contaminants. Cleaning and inspection of this in-line filter is also required at the 500- and 5000-mile intervals and even sooner if operating conditions are severe.

Proper fuel flow to the carburetor is needed to maintain the correct fuel level in the carburetor float bowl. The fuel flow of the stock petcock and filter screen (with no in-line filter) is approximately 61 ounces per minute. Flow with the filter is approximately cut in half to 32 ounces (1 quart) per minute. At 32 ounces per minute, fuel flow is approximately 3–4 times what the engine will consume while accelerating hard in first gear and 10 times what is needed to cruise at 60 mph.

This provides an adequate reserve to maintain the proper fuel level in the carburetor.

However, if the petcock screen becomes restricted, engine acceleration may soften or the engine may cough. At highway speeds, the engine may not receive enough fuel and act like it is running out of gas. Turning the petcock lever to reserve may temporarily correct the problem by allowing more fuel to reach the carburetor. The problem will reappear, however, when the fuel in the tanks reaches the reserve level.

The following procedures “Cleaning the Petcock Filter Screen” and “Cleaning the In-Line Filter” are done in sequence.

#### Tools required:

- 3/4" open-end wrenches (2)
- 1" open-end wrench
- Flat-blade screwdriver

#### Cleaning the Petcock Filter Screen

Place a clamp on the fuel crossover tube located between the left and right fuel tanks.

Turn the petcock (fuel supply valve) to the OFF position.

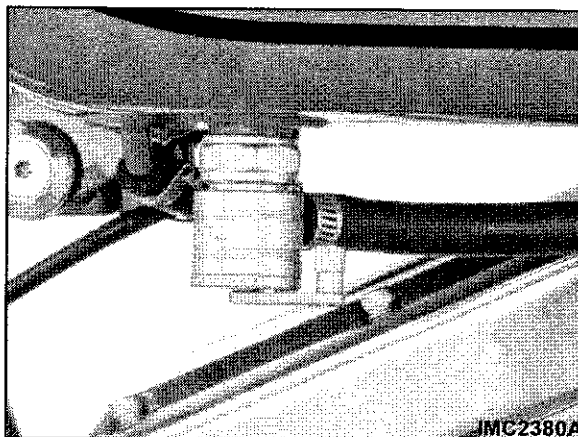


Figure 175 — Fuel petcock (2002 design)

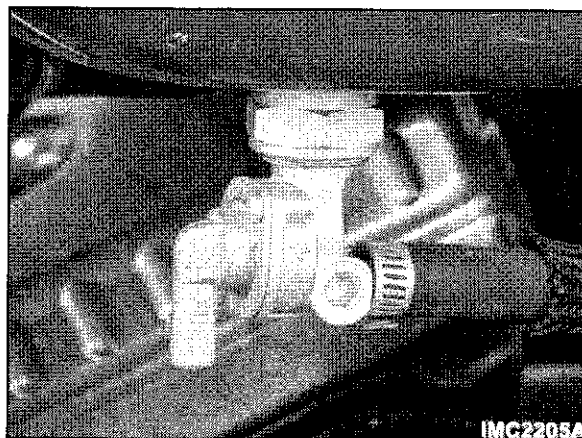


Figure 176 — Fuel petcock (2003 design)

Loosen the clamp on the fuel line at the petcock, using the flat-blade screwdriver, and remove the fuel line from the petcock.

Attach a 3' length of fuel line to the petcock. Drain the fuel from the left tank into an approved gasoline can. Remove the drain line from the petcock.

#### **⚠ WARNING!**

Gasoline is flammable and explosive. Work in a well-ventilated area when draining gasoline and drain it into an approved container for gasoline storage. Failure to follow this warning could result in an explosion and/or fire, which may cause serious personal injury and/or death and damage to the motorcycle.

Loosen the petcock nut, using a 1" open-end wrench, and remove the petcock from the gas tank. Hold the petcock to keep it from turning as the nut is being loosened.

Clean the screen using a tank solvent. Stubborn material can sometimes be removed with carburetor cleaner.

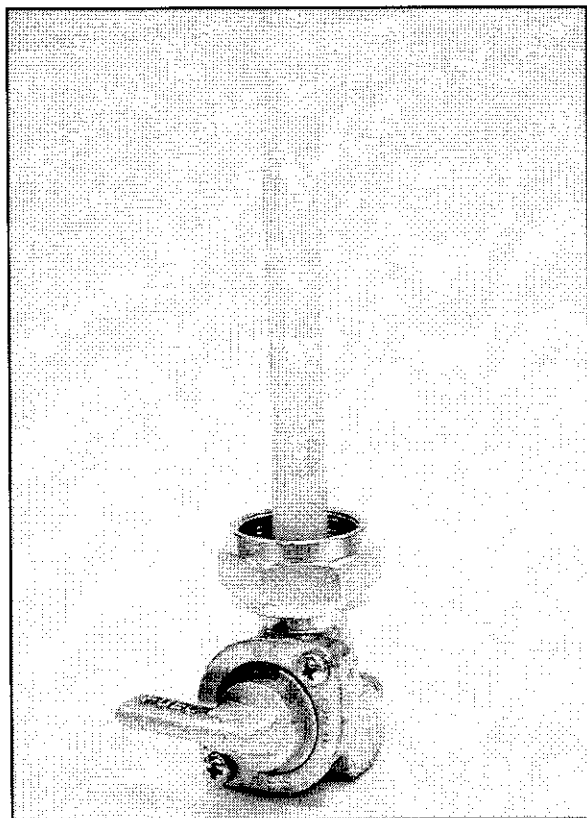


Figure 177 — Petcock screen (2003 design shown, typical)

**Note:** The petcock nut is both left- and right-hand threaded. The gas tank has right-hand threads and the petcock has left-hand threads.

Before installing the cleaned petcock in the gas tank, remove the nut in a clockwise rotation (left-hand threads). Rethread the nut back onto the petcock, 1/2 of a revolution only, using counterclockwise rotation.

Insert the petcock into the tank. Turn the nut clockwise while applying slight upward pressure. This technique should engage an equal amount of threads in both the gas tank and the petcock.

Rotate the petcock lever to the ON position. Tighten the nut to 72 inch-pounds, using a 1" open-end wrench.

## Cleaning the In-Line Fuel Filter

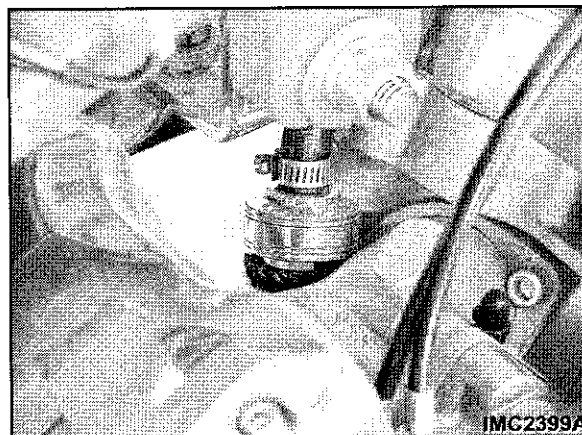


Figure 178 — In-line fuel filter installed

Loosen the clamp on the fuel line at the base of the carburetor, using a flat-blade screwdriver. Slide the clamp back on the fuel line and remove the line from the carburetor fuel inlet port. Then, remove the clamp and spring from the fuel line.

**Note:** The fuel line has already been removed from the petcock outlet port in the preceding procedure.

Pull the fuel line and filter upward and out from between the cylinders.

The filter housing is a two-piece assembly with the housing halves threaded together. Using two 3/4" open-end wrenches, separate the threaded filter housing halves to access the filter screen and spring inside. The fuel line hoses can remain connected to the housing halves.

**Note:** The fuel line hoses are installed with the shorter 9" section and clamp on the inlet port of the filter (side opposite the direction the arrow is pointing). The longer 11" section and clamp is installed on the outlet port of the filter. If the hoses are being replaced, make sure that the proper lengths are used and that the clamps are positioned approximately 1/8" from the ends of the hose and tightened securely.

Clean the screen using a tank solvent. If necessary, use carburetor cleaner to remove stubborn material. Inspect the screen and spring and replace if damaged.

Place the spring first and then the filter screen in the larger housing half (carburetor side). With the screen and spring properly seated, thread the housing halves together. Tighten the halves securely, using the 3/4" open-end wrenches.

Look for the directional arrow on the filter housing. The arrow indicates the direction of fuel flow through the filter.

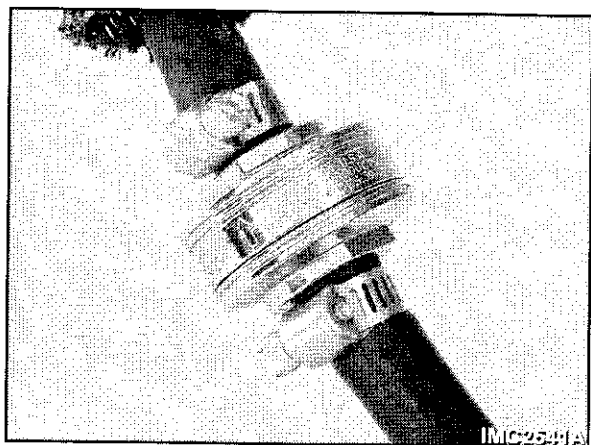


Figure 179 — Fuel flow direction through filter

Place the assembled fuel lines and filter in position on the engine. The longer 11" line is routed between the cylinders, through the chrome circular fuel-line guide and to the carburetor inlet port.

With the filter assembly in place, slide the spring and clamp on the fuel line between the guide and the carburetor. Then, connect the line to the carburetor inlet port and tighten the clamp securely, using a flat-blade screwdriver.

Connect the 9" fuel line to the port on the petcock. Tighten the clamp securely.

Remove the clamp from the cross-over tube.

## Fuel Line Inspection and Replacement

Visually check all fuel line hoses for deterioration, abrasion damage or cuts. Replace the hose sections as necessary with hose of the specified type.

Turn the petcock (fuel supply valve) to the ON position and view all joints for leakage. Tighten the clamp securely at any joint where leakage is found. Replace any clamps that are damaged or do not provide proper tension for a secure connection.

Inspect the petcock for leakage. If the petcock mechanism is leaking, replace the unit.

## Throttle Control Inspection and Maintenance

The Indian motorcycles use a push/pull throttle arrangement. Inspection should be at the 500-mile mark. Lubrication of the cables should be performed yearly, or sooner, if extra effort is detected in operating.

View the throttle cables throughout their entire length. Make sure they are not kinked or chafed. For safety sake replace the cables if any defects are found.

### Tools required:

5/32" (or 4 mm) hex bit

5/16" (or 8 mm) open-end wrench

3/8" open-end wrench

### Throttle Cable Lubrication

Loosen and remove the mounting screws and clamp securing the master cylinder and brake lever assembly, using a 5/32" hex bit.

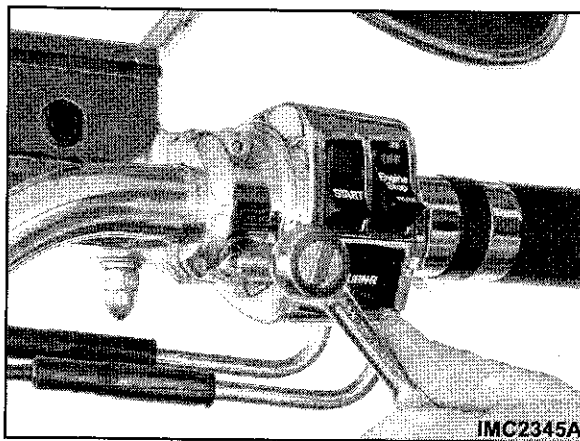


Figure 180 — Removing mounting screws

Remove the assembly and position away from the throttle/switch housing.

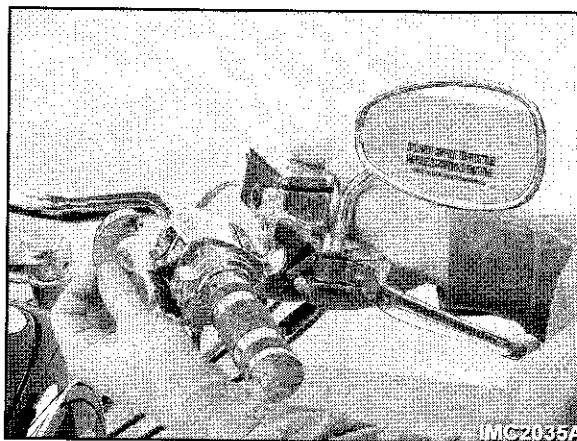


Figure 181 — Removing front brake control

Remove the throttle/switch housing screws, using a  $5/32$ " hex bit. Slowly remove the top housing half, being careful not to inadvertently dislodge the small ferrules from the cable ends.

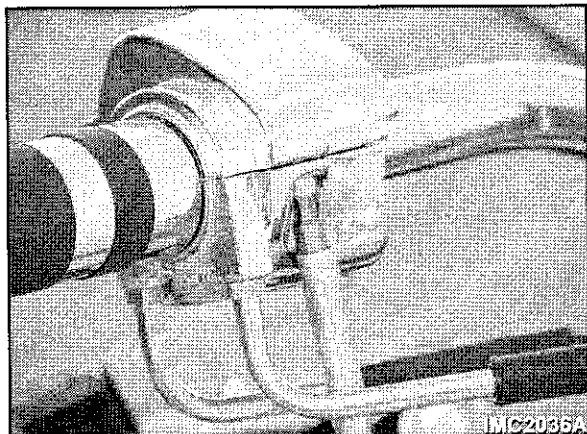


Figure 182 — Removing throttle/switch housing screws

Remove the ferrules from the cables.

At the throttle cable adjustment nut, pull the spring sheath exposing the cable. Install the lube tool onto the cable and sheath. Lubricate the cable with "Champions Choice<sup>®</sup>" brand, or equivalent, spray product.

Lubricate the second throttle cable.

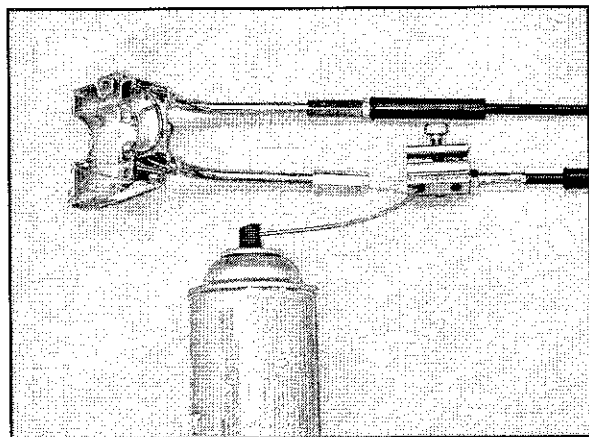


Figure 183 — Lubricating throttle cable

Apply a small amount of blue threadlock to the two throttle/switch housing screws.

Apply a small amount of grease to the cable ferrules and install the ferrules on the cable ends.

Slide the ferrules into the throttle rotator ring and make sure the rotator ring is seated correctly in the lower throttle housing section.

Carefully place the top throttle housing section onto the bottom section. Install the two mounting screws and tighten very lightly. Rotate the throttle, checking for smooth operation.

Align the throttle/switch housing so that the parting line is parallel with the ground.

Tighten the two housing mounting screws, using a  $5/32$ " hex bit.

Again, check for proper throttle rotation.

Apply blue threadlock to the two master cylinder and brake lever assembly clamp screws. Position the brake assembly to the handlebar, install the clamp and two screws. DO NOT tighten the clamp screws at this time.

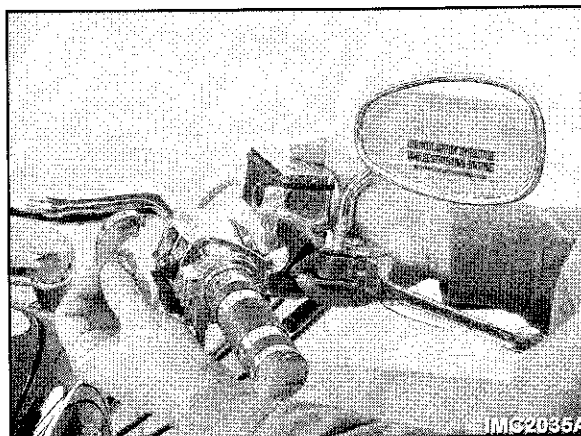


Figure 184 — Installing front brake control

Pull the brake lever to the handlebar and slide the brake assembly into the throttle/switch housing.

#### ⚠ CAUTION!

Failure to pull the lever before sliding can damage the brake light switch.

Release the brake lever. Then, tighten the two brake assembly clamp screws, using a 5/32" hex bit.

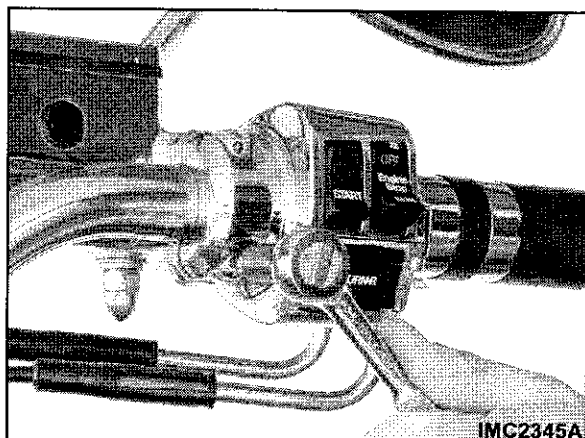


Figure 185 — Installing clamp screws

Check the operation of the brake lever and throttle again.

## Throttle Cable Adjustment

Adjustment of throttle cable free play is accomplished using the threaded adjusters located under the throttle/switch housing.

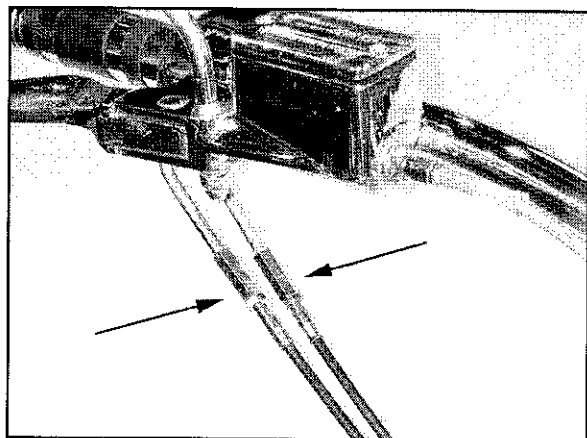


Figure 186 — Throttle cable adjustment

Before adjustment, move the handlebars all the way to the left fork stop and check throttle cable free travel. Rotate the handlebars to the right fork stop and check throttle cable free travel. Determine in which position the throttle has the least free travel and leave the handlebars there.

The front cable opens the throttle plate. Loosen the jam nut on the front cable adjuster, using a 5/16" open-end wrench. If less free travel is needed in the cable, rotate the adjuster to advance toward the cable. Tighten the jam nut. Rotate the throttle and check the free travel. Rotate the handlebars back and forth a few times and again check free travel at the fork stops. Adjust the cable if necessary. There should be a minimal amount of free travel in the throttle.

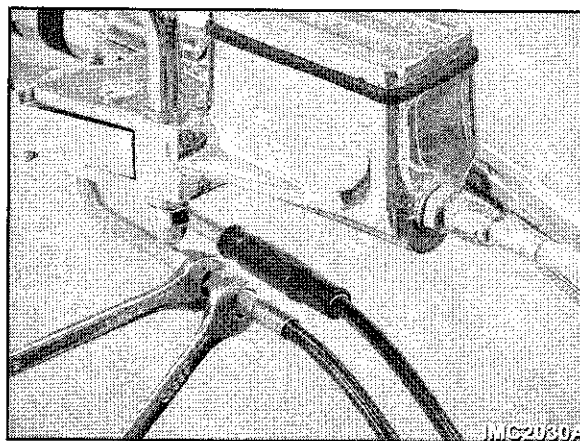


Figure 187 — Adjusting front cable jam nut

Start the engine and let it idle. Move the handlebars left and right to the fork stops. The rpm of the engine should not increase. If it does, loosen the forward throttle cable adjuster until the engine rpm does not rise when the handlebars are turned.

Once the front (carburetor opening) cable has been adjusted, check the free travel of the rear (carburetor closing) cable.

Check the cable connections at the carburetor. Two chrome upright tubes mounted in a bracket retain the cables. The long tube houses the closing cable and has a spring. The spring is there to take up free travel and act as a cushion.

Adjust the cable to compress the spring slightly when the handlebars are positioned straight ahead. The spring will take up any tightening of the cable when the handlebars are turned to the fork stops.

## Fuel Tank Removal and Installation

### Tools required:

- 5/32" hex bit
- 3/16" hex bit
- 1/2" wrench/socket
- #2 Phillips screwdriver
- Torque wrench

## Tank Removal

Remove the seat from the motorcycle following the procedure in the FRAME AND ACCESSORIES SERVICE section.

Disconnect the battery cables (negative cable first) at the battery terminals. Refer to the procedure under Battery and Cables in the CHARGING SYSTEM SERVICE section.

Remove the screw at the rear of the dash panel, using a 5/32" hex bit.

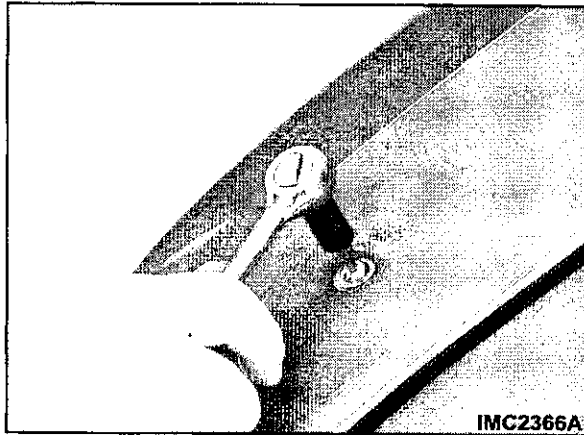


Figure 188 — Dash panel rear retaining screw

Remove the screw in the instrument bezel, using a 5/32" hex bit, and remove the panel.

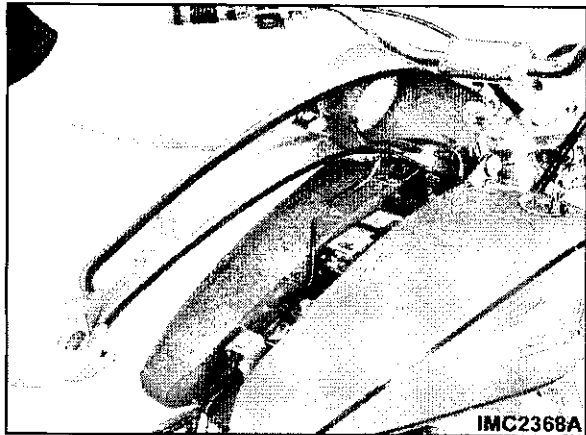


Figure 189 — Removing dash panel

Lift the dash up and disconnect the wire harness connectors from the speedometer and the warning lights.

Drain the fuel from the fuel tanks into a suitable container.

### ⚠ WARNING!

Gasoline is flammable and explosive. Work in a well-ventilated area when draining gasoline and drain it into an approved container for gasoline storage. Failure to follow this warning could result in an explosion and/or fire, which may cause serious personal injury and/or death and damage to the motorcycle.

Disconnect and remove the vent and crossover tubes.

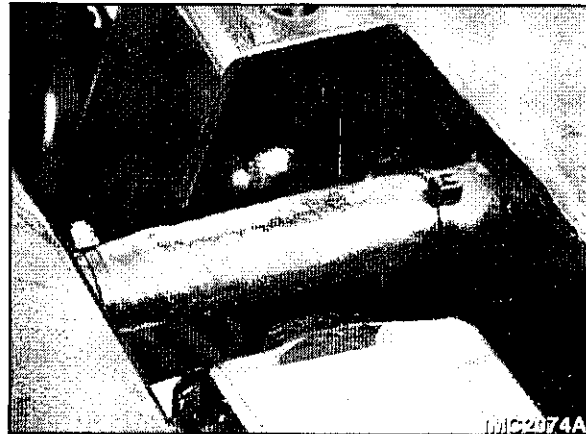


Figure 190 — Fuel vent tube

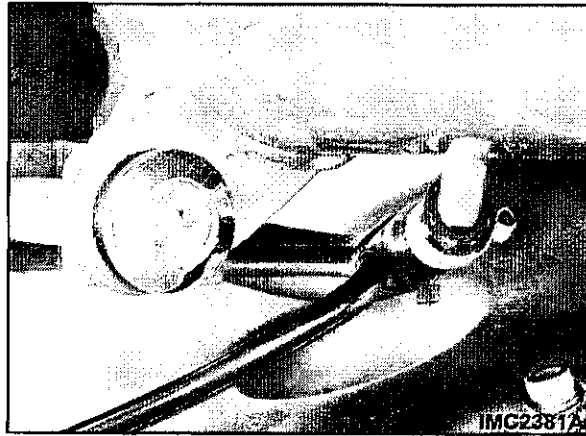


Figure 191 — Fuel crossover tube

**Note:** Either the left, right or both tanks can be removed as required with this procedure.

Using a 3/16" hex bit, remove the bright-finish mounting screw at the lower front of the left fuel tank.

Support the tank and remove the mounting screws at the upper front and center of the left tank, using a 1/2" wrench or socket.

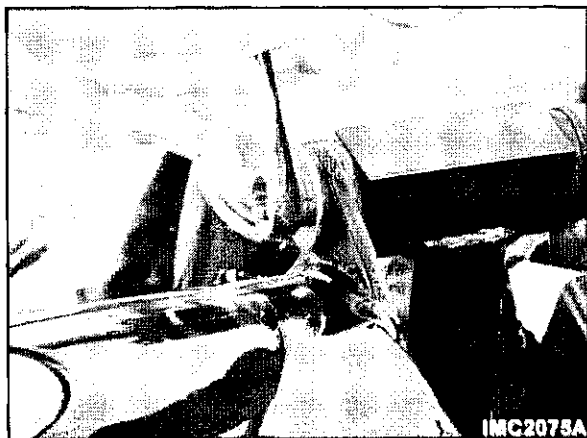


Figure 192 - - Top front mounting screw (left tank)

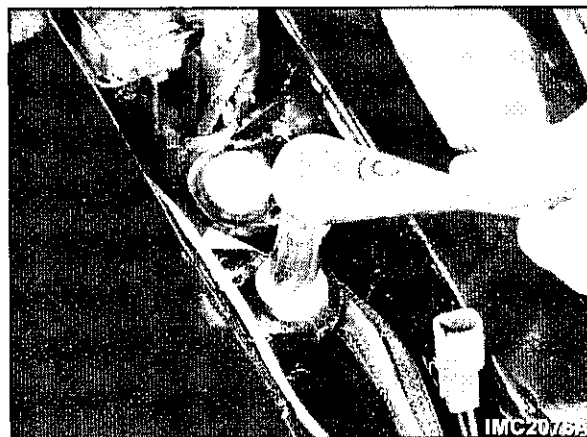


Figure 193 - Center mounting screw (left tank)

Remove the tank from the motorcycle.

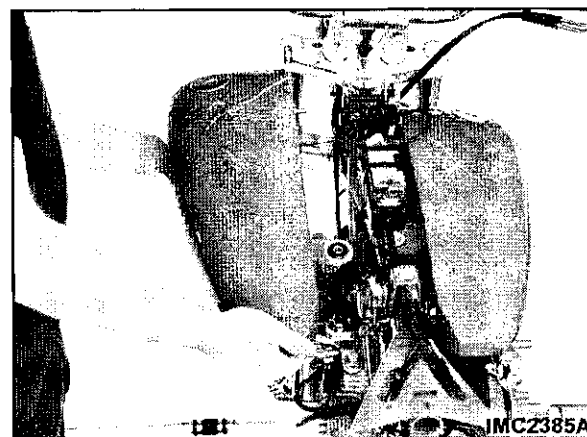


Figure 194 - Removing left fuel tank

Remove the right tank in the same manner by removing the three mounting screws at the lower front, upper front and center.

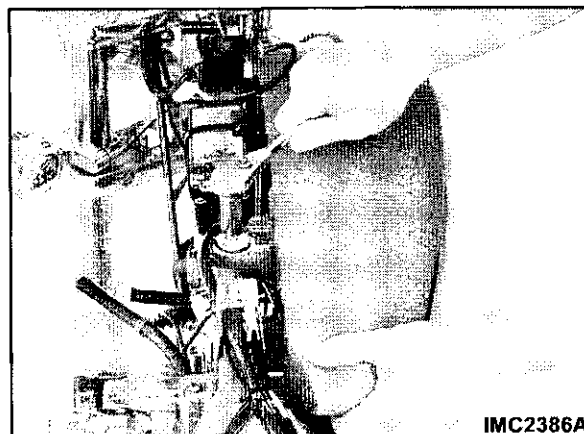


Figure 195 - Removing right fuel tank

## Tank Installation

Place the right fuel tank in position at the side of the upper frame tube.

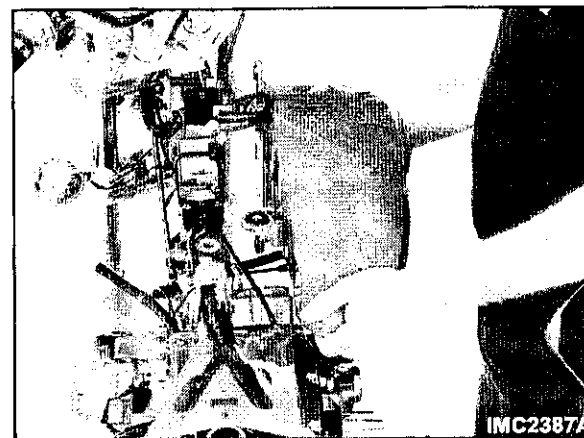


Figure 196 - Placing right tank in position on frame



Install the center and upper front mounting screws and washers, using a  $1/2''$  socket. Tighten the screws to specification.

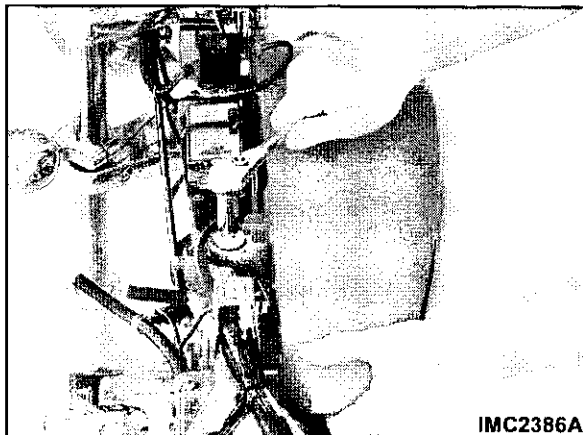


Figure 197 — Installing upper mounting screws

Install the lower front mounting screw and bright-finish collar, using a  $3/16''$  hex bit. Tighten the screw to specification.

Repeat the above steps to install the left fuel tank.

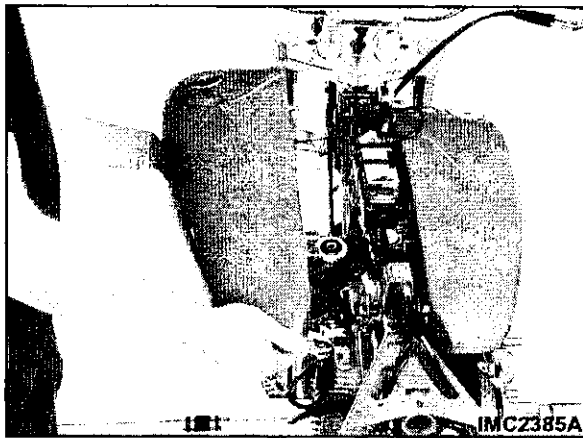


Figure 198 — Installing left fuel tank

Install the vent tube between the fuel tanks at the top. Tighten the clamps securely.

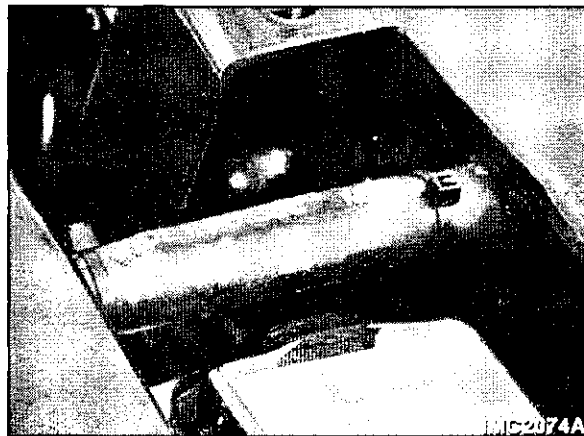


Figure 199 — Fuel vent tube

Install the fuel crossover line between the tanks. Tighten the clamps securely.

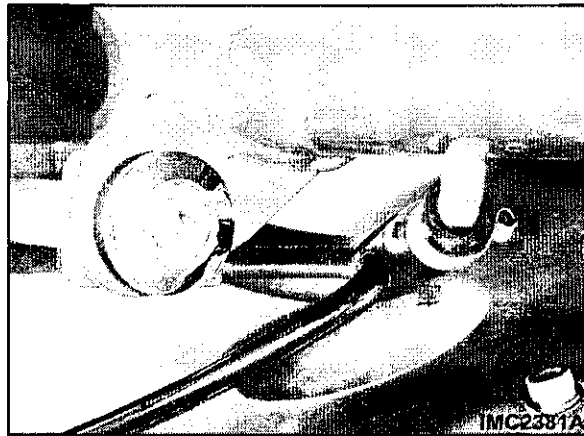


Figure 200 — Fuel crossover tube

Connect the fuel line from the petcock on the left tank to the carburetor.

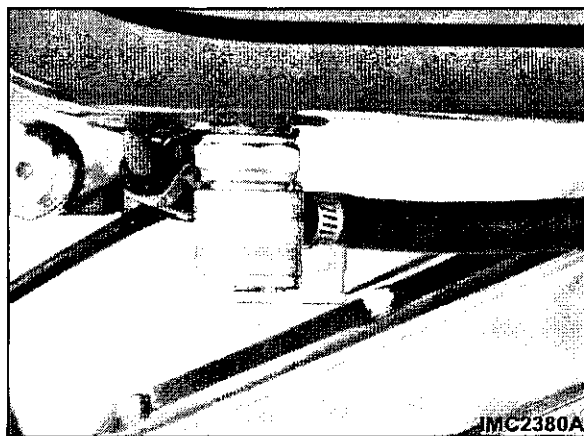


Figure 201 — Petcock (2002 design shown) and fuel supply line

Position the dash close to its mounting and connect the wire harness connectors to the speedometer and the warning lights.

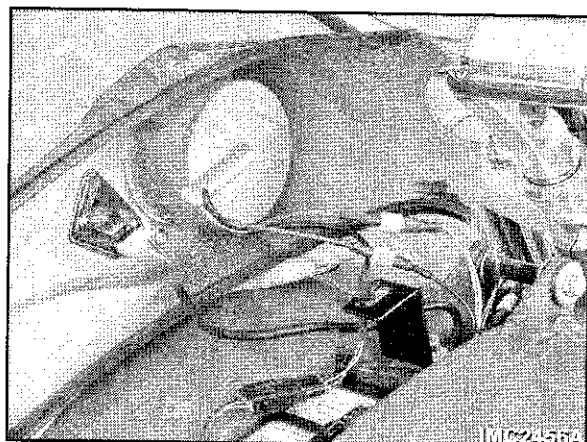


Figure 202 — Speedometer and warning light wiring connections

Position the dash panel over the fuel tanks and secure with the front screw in the instrument bezel and the screw at the rear of the dash, using a 5/32" hex bit.

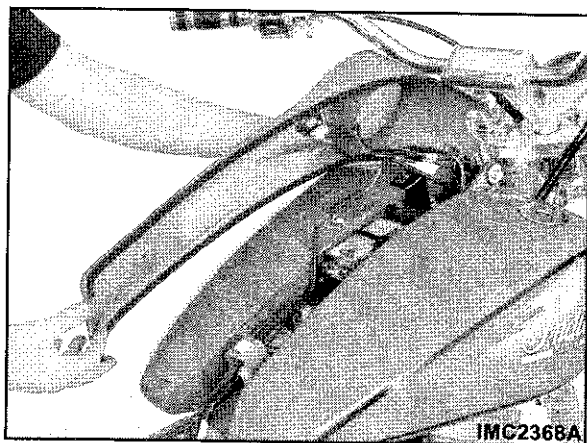


Figure 203 — Installing dash panel

Using a 5/32" hex bit, tighten the rear screw to specification.

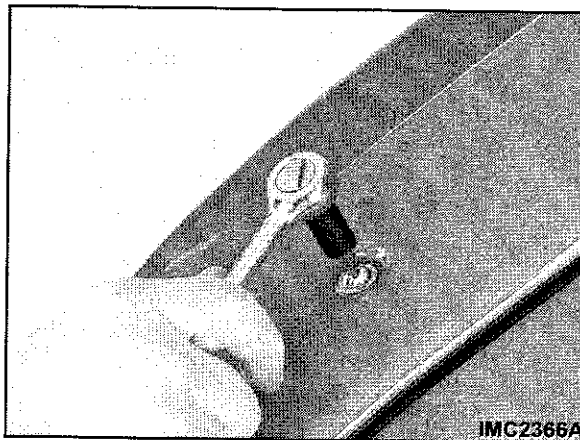


Figure 204 — Installing dash panel rear retaining screw

Reconnect the battery positive cable and then the negative cable to the battery terminals. Refer to the procedure under Battery and Cables in the CHARGING SYSTEM SERVICE section.

Position the seat on the frame and install the two screws to attach the seat to the frame, using a 3/16" hex bit. Tighten the screws to specification.

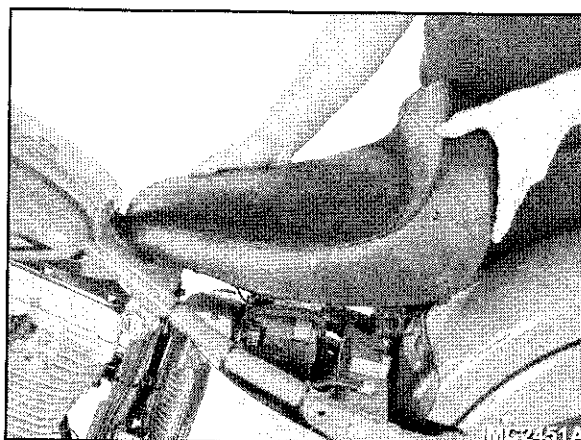


Figure 205 — Installing seat (Scout shown)

## CARBURETOR SERVICE

### S&S Type E Carburetor

Four interdependent systems or circuits provide the appropriate air/fuel mixture for all engine operating ranges. These include the:

- Enrichener (choke) circuit
- Idle circuit
- Main circuit
- Accelerator pump circuit

Each of these circuits operates at different throttle openings or ranges to provide optimum performance.

An important part of the carburetor is the fuel bowl and float. The fuel bowl provides a constant source of fuel for the carburetor circuits to draw from as needed. The major components include the float, needle valve assembly and float bowl.

The float opens and closes the needle valve assembly to maintain a specific fuel level in the float bowl. A high level can cause an overly rich air/fuel mixture. An excessively high level can lead to a flooding condition. A low level can cause lean running conditions such as hesitation, stumbling, missing or lack of power.

### Enrichener (Choke) Circuit

The enrichener (choke) circuit is designed to provide the richer air/fuel mixture required by a cold engine to start and run reliably. As the engine warms, the enrichener becomes less and less required and is gradually shut off. To engage the enrichener, pull the enrichener lever up. A detent keeps the knob in this position. To disengage the enrichener, push the lever down.

The enrichener circuit is designed to work correctly with the throttle closed. Opening the throttle greatly reduces the action of the enrichener.

### Idle Circuit

The idle circuit operates between closed throttle and approximately 1/8 throttle opening. Components of the circuit include the idle mixture and idle speed screws.

The purpose of the idle mixture screw is to “fine-tune” adjustment of the idle mixture, within limitations. A nylon cap covers the head of the pilot screw to prevent tampering and adjustment beyond the preset limits.

### Main Circuit

The main circuit provides the majority of the air/fuel mixture for the engine. Main circuit operation is from just off idle through full (wide open) throttle. Major components of the main circuit include the:

- Throttle shaft assembly
- Pivoting throttle plate
- Main jet
- Intermediate jet

As the throttle is operated, the throttle shaft opens the throttle plate to allow more air and fuel to be delivered to the engine. As the throttle plate is opened further, more fuel is drawn through the main circuit (intermediate and main jets).

### Accelerator Pump Circuit

The accelerator pump injects a metered amount of fuel into the engine when the throttle is opened quickly from a near closed position. This provides an immediate fuel supply to the engine until the main circuit takes over as air flow through the carburetor venturi increases. It can be adjusted to provide the specified amount of fuel.

### Air Leaks

On occasion, the air intake system can develop minor air leaks between the carburetor, intake manifold and cylinder heads. Such air leaks can affect the air/fuel mixture, generally at low throttle positions and can be troublesome at idle. These air leaks, if present, make it difficult to adjust the carburetor and can cause the carburetor to be repaired or replaced unnecessarily. For best carburetor and engine performance, it is important to test for and eliminate all air leaks before carburetor service.

Test for air leaks with the engine warm and idling. Spray WD-40 or similar paint-safe liquid around the connections between the carburetor and the cylinder heads. If engine idle becomes steady or begins surging or missing, an air leak is present and should be corrected. Check engine performance after correcting any air leaks before performing carburetor service.

## Carburetor Removal and Installation

### Tools required:

- 3/16" hex bit
- 5/16" hex bit
- Flat-blade screwdriver
- Phillips screwdriver

### Removal

Turn the petcock (fuel supply valve) lever to the OFF position.

Using a flat-blade screwdriver, loosen the clamp and remove the fuel supply line from the carburetor. Use care to catch and avoid spilling any residual fuel that may be in the fuel line and carburetor.

#### **▲ WARNING!**

Gasoline is flammable and explosive. Work in a well-ventilated area when draining gasoline and drain it into an approved container for gasoline storage. Failure to follow this warning could result in an explosion and/or fire, which may cause serious personal injury and/or death and damage to the motorcycle.

Remove the air cleaner cover screws, using a Phillips screwdriver. Remove the cover and filter element.

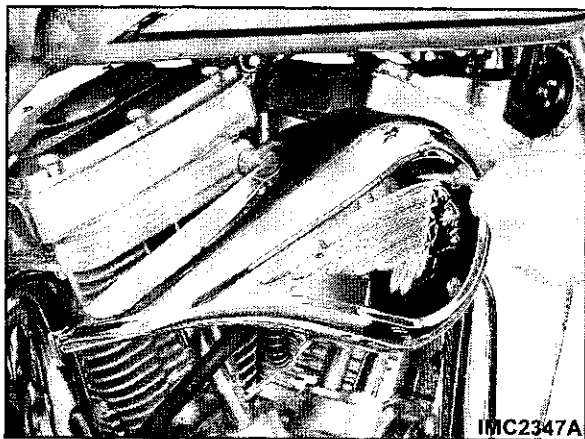


Figure 206 — Removing air cleaner cover

Using a 3/16" hex bit, remove the five screws securing the air cleaner base to the carburetor and the cylinder heads. On California-only models, disconnect the vacuum line to the air valve solenoid and remove the air valve assembly along with the air cleaner base.

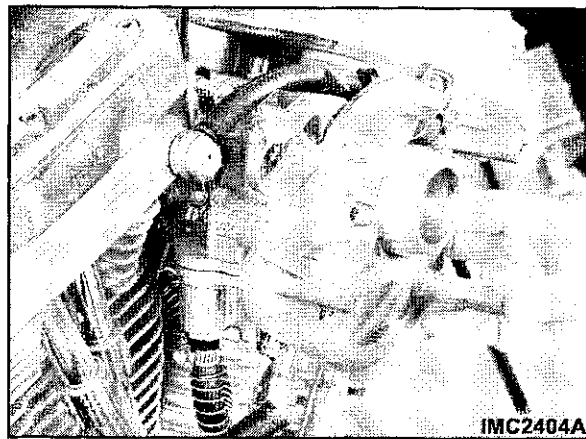


Figure 207 — Removing air cleaner base

Using a flat-blade screwdriver, remove the screw retaining the throttle-control cables bracket to the carburetor. Disconnect the cable ends from the throttle spool.

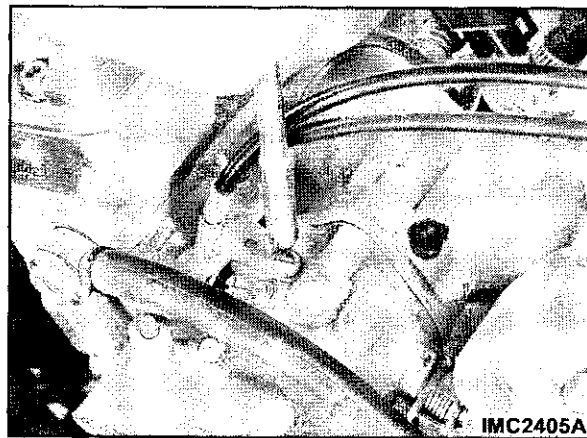


Figure 208 — Disconnecting throttle-control cables

Loosen the two screws securing the carburetor to the intake manifold, using a 5/16" hex bit. Remove the screws and the carburetor.

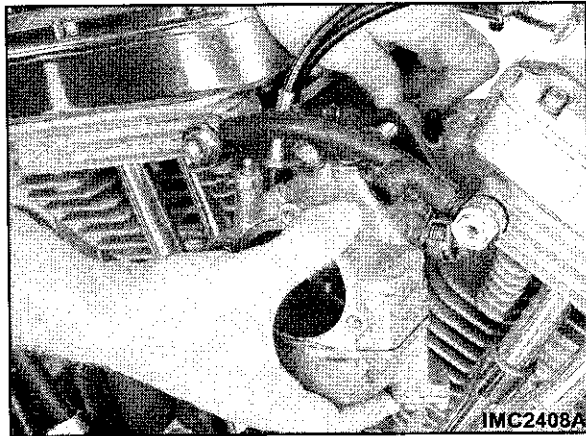


Figure 209 — Removing carburetor

## Installation

Check to make sure that the thin rubber O-ring is in position on the throttle-bore flange on the manifold side of the carburetor.

Place the carburetor in position on the intake manifold and install the two mounting screws, using a 5/16" hex bit. Tighten the screws to specification.

Connect the fuel supply line to the inlet port of the carburetor. Tighten the clamp securely.

Connect the cable end ferrules to the throttle spool and position the bracket on the mounting pad. Install the retaining screw, using a flat-blade screwdriver, and tighten securely.

Install the air cleaner base, filter element and cover following the procedure under Air Cleaner Assembly Removal and Installation in the AIR CLEANER section. It is important to follow the procedure for proper alignment of the base with the carburetor and the cylinder heads.

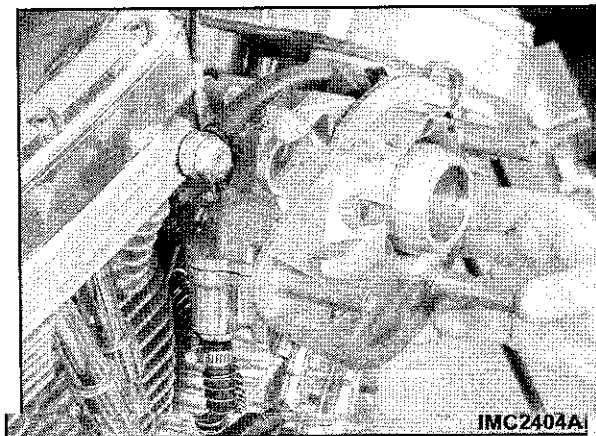


Figure 210 — Installing carburetor base

## Carburetor Maintenance

### Tool required:

Flat-blade screwdriver (1/4" blade width, 12" length)

### Idle Speed and Mixture Adjustment

There are two adjustment screws on the carburetor, the first providing for adjustment of idle speed and the second, idle mixture. The idle speed adjustment screw is located at the side, behind the throttle spool. The brass idle mixture adjustment screw is located at the top of the carburetor.

#### Idle Speed

Start the engine and bring it up to normal operating temperature. Make sure the enrichment lever is fully closed.

The engine should idle between 800–1000 rpm. If the rpm is not within range, turn the adjusting screw clockwise/counterclockwise as required to bring it within range, using a flat-blade screwdriver.

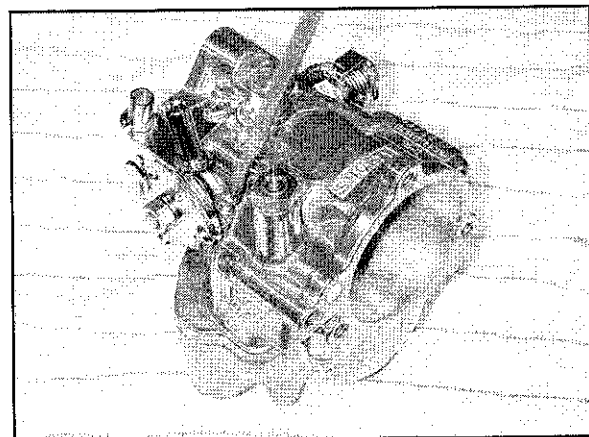


Figure 211 — Idle speed adjustment screw

#### Idle Mixture

With the engine running at idle rpm, adjust the mixture as follows:

- Turn the screw clockwise, slowly leaning the mixture until the engine starts to die out. Make a mental note of this position.
- Turn the screw counterclockwise, slowly enriching the mixture until the engine rpm starts to decrease. At this point, the engine rpm should alternately increase and decrease. Again, mentally note this position.
- Turn the screw back (clockwise) to a position halfway between the two points noted above for the final mixture adjustment.

Typically, this final adjustment (neutral position) is approximately 1/4 to 1/2 turn out from the lean side of the adjustment range and 1-1/4 to 1-3/4 turns out from the fully-seated position of the adjustment screw.

**Note:** If the adjustments are made before the engine is fully warmed, the idle mixture will be rich when the engine reaches operating temperature.

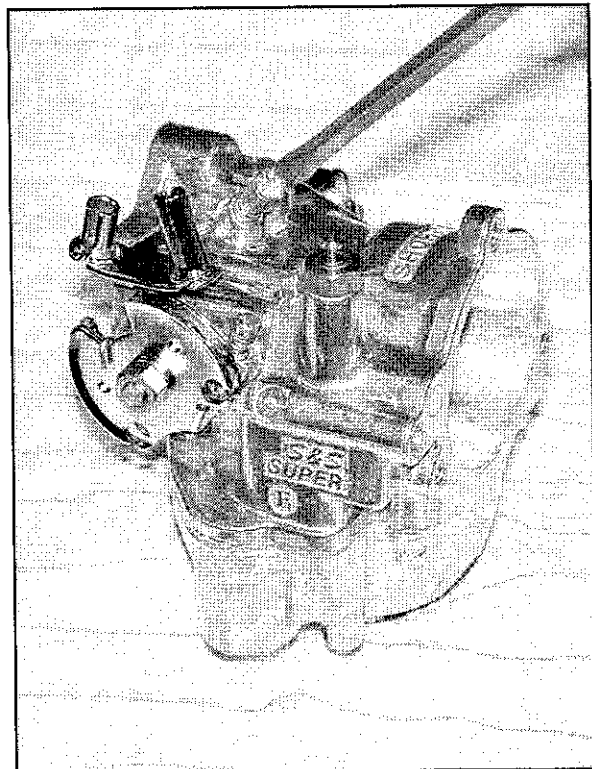


Figure 212 — Idle mixture adjustment screw

## Accelerator Pump Adjustment

The function of the accelerator pump is to improve throttle response when rapidly opening the throttle at low rpm. The adjuster screw, which is located on the right side of the carburetor, regulates the volume of fuel delivered by the accelerator pump. Turning the adjusting screw inward (clockwise) decreases the volume of fuel and turning it outward (counterclockwise) increases the volume.

The procedure for adjusting accelerator pump fuel volume is as follows:

- Turn the pump adjusting screw inward (clockwise) slowly until it gently contacts the pump actuator arm, effectively shutting off the pump. DO NOT use excessive force to seat the screw.
- Rotate the screw outward (counterclockwise) 2 to 2-1/2 turns.
- Start the engine. With the engine warm and at idle, quickly open and close the throttle, noting the response. If the engine hesitates, turn the screw outward (counterclockwise) 1/4 turn and again check the throttle response. Continue with the adjustments in 1/4 turn increments until there is no hesitation as the throttle is quickly opened.
- Road test the motorcycle. Check the throttle response in 500 rpm increments, from idle to approximately 3500 rpm.

The minimum pump stroke is recommended to conserve fuel, prevent spark plug fouling and reduce black smoke emissions from the exhaust pipe(s).

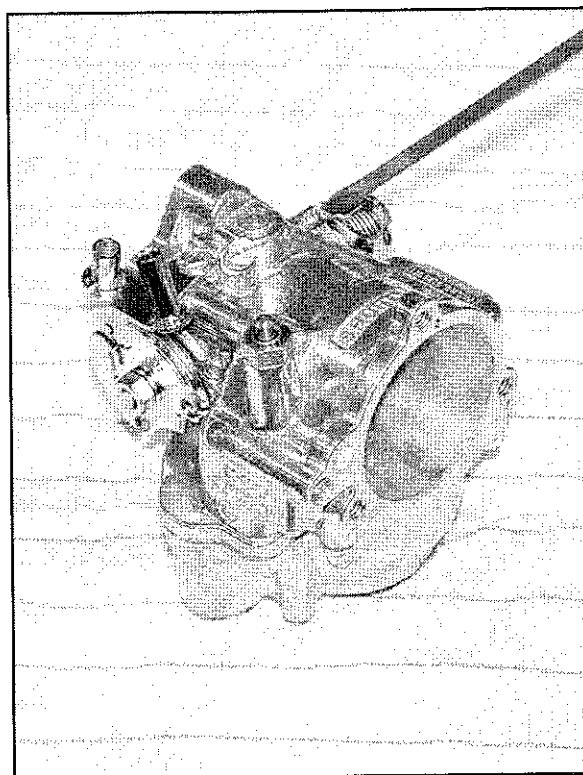


Figure 213 — Accelerator pump adjustment screw

## Carburetor Rebuild

### General Information

The Indian Scout and Spirit motorcycles are equipped with an S&S H-Type carburetor which has a 1-7/8" (47.6 mm) bore and a 1-9/16" (39.6 mm) venturi. This instruction is based on the standard rebuild kit available from Indian Motorcycle Corporation.

Standard jetting at sea level is as follows:

#### California Models

- Idle rpm: 800-1000
- Idle mixture screw: 1-1/4-1-3/4
- Accelerator pump screw: 2-2-1/2
- Intermediate jet: 0.0295"
- Main jet: 0.074"
- Exhaust discs: 6

#### 49-State Models with Carburetor Restrictor

- Idle rpm: 800-1000
- Idle mixture screw: 1-1/4-1-3/4
- Accelerator pump screw: 2-2-1/2
- Intermediate jet: 0.0280"
- Main jet: 0.066"
- Exhaust discs: 6

### Tools required:

- 7/16" hex bit
- 1/2" open-end wrench
- 5/8" wrench/socket
- Flat-blade screwdriver

### Carburetor Disassembly and Assembly

Remove the carburetor from the motorcycle following the procedure in this section.

Remove the four float bowl screws. Three of the screws are close to the float bowl/body parting line. The fourth screw serves the dual purpose of holding the float bowl and the accelerator pump cap.

#### Accelerator Pump

Turn the float bowl upside down and remove the two screws holding the accelerator pump cap. Use care when removing the cap to avoid losing the two steel balls, a spring and two O-rings.

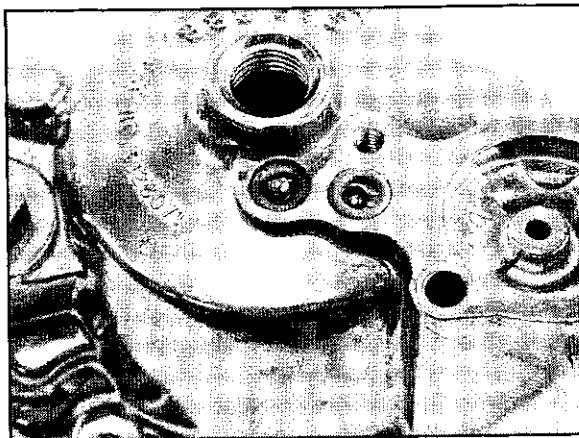


Figure 214 — Accelerator pump cap removed showing two steel balls and O-rings

Remove the steel balls, O-rings and spring.

Using an air hose, direct compressed air through the port closest to the bowl drain plug. On the inside of the float bowl is a brass tube with an O-ring. This is the accelerator pump ejector nozzle. Air should be exiting from the cut in the tip of the ejector nozzle.

Clean the ejector nozzle if necessary.

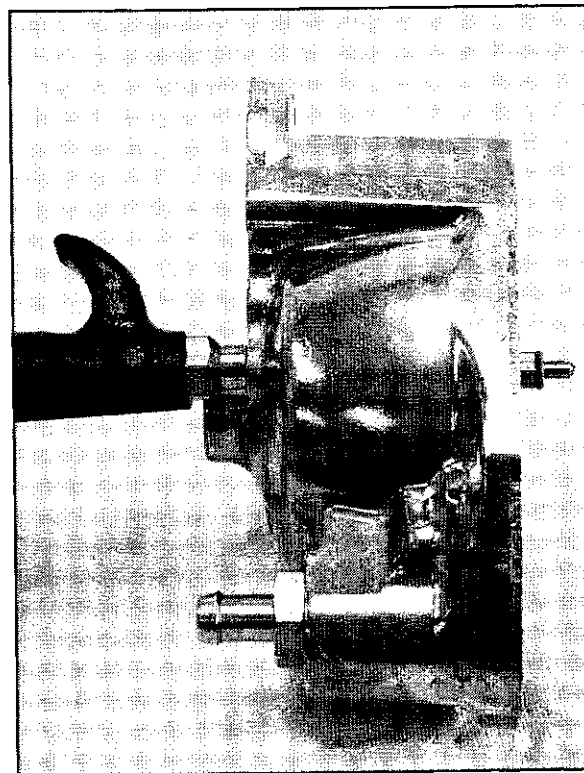


Figure 215 — Directing compressed air through accelerator pump discharge tube

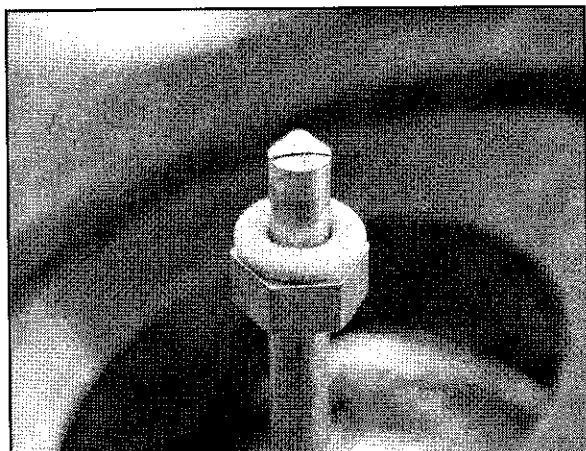


Figure 216 — Accelerator pump discharge tube with O-ring

Place two new O-rings into the accelerator pump cavity.

Place a new spring into the port closest to the bowl drain plug. This is the port that has the ejector nozzle attached to it.

Place two new steel balls into the O-ringed ports.

Remove the diaphragm from the pump cap. There is a spring under the diaphragm. Remove and replace the spring.

Place a new diaphragm into the pump cap. The shiny side goes toward the spring. The printed part number should be facing up and visible when the diaphragm is installed correctly.

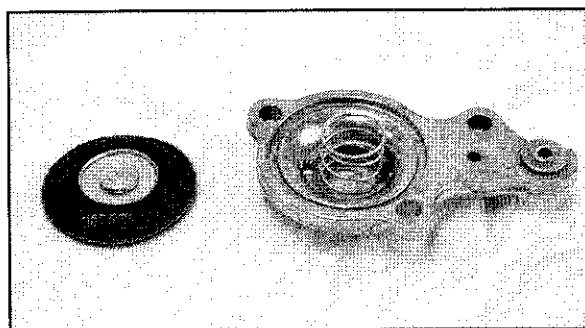


Figure 217 — Diaphragm removed from accelerator pump cap (part number facing up)

Install the pump cap with new diaphragm in the float bowl.

Remove the O-ring on the accelerator pump nozzle and replace it with a new O-ring. Refer to the previous figure.

Remove the accelerator pump pushrod from the upper carburetor body.

Remove and replace the pushrod bellows dust seal. Then, install a new pushrod in the carburetor body.

### Float Assembly

Turn the float bowl over. Using a flat-blade screwdriver, remove the screw holding the float pin. Lift the float and attached needle from the float bowl.

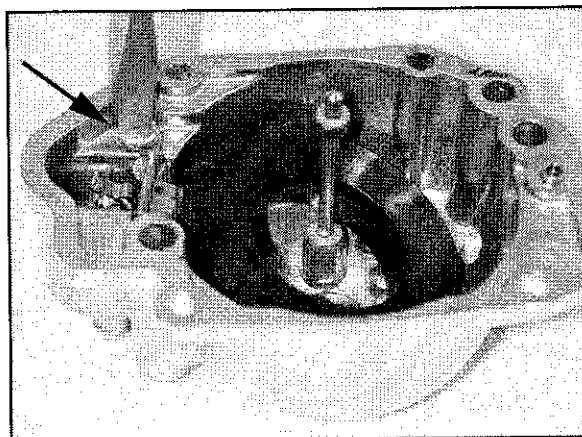


Figure 218 — Float pin retaining screw

Remove the float pin from the float and replace it with a new one.

Remove the needle hanging from the float and replace it with a new one.

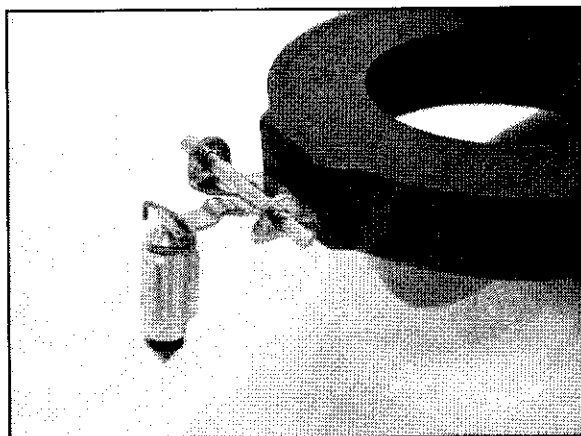


Figure 219 — Float brass needle

Remove the brass needle seat, using a 5/8" wrench. Place a new O-ring on the new needle seat and install it, using a 5/8" wrench.

Insert the float assembly back into the float bowl while carefully slipping the needle into the brass seat. The float pin should fit into the slot of the float bowl. Thread in a new screw to secure the pin to the float bowl.

Check the function of the float. Make sure the float and needle move freely.



### Setting Float Height

Depress the needle and float, making sure the needle is seated. Measure the float height from the top of the bowl to the edge of the float. The measurement is taken from the opposite side of the seat as shown in the following figure.

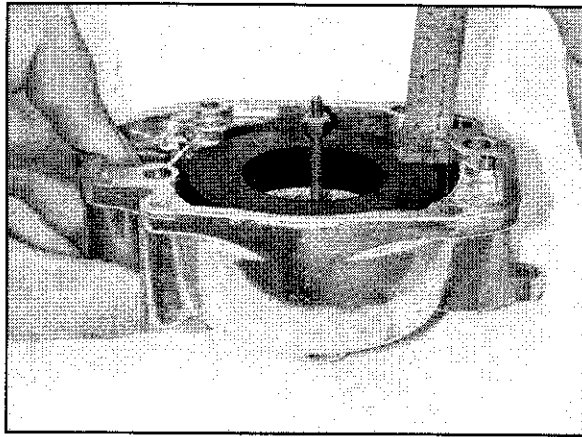


Figure 220 — Float height measurement

The measurement should fall within 1/8" to 3/16". Adjust if necessary. Bend the tab that the float needle attaches to. Bending the tab downward lowers the float (fuel) height. Bending the tab upward raises the float (fuel) height.

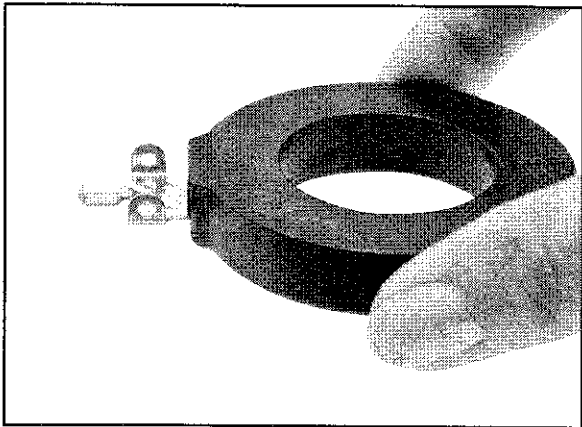


Figure 221 — Fuel height adjustment tab

### Bleed Hole and Port Check

Using compressed air, check the drilled and cast ports of the body to make sure they are not plugged.

#### Intermediate Bleed Hole Check

Remove the gasket from the float bowl and discard it.

Remove the throttle plate from the throttle shaft, using a flat-blade screwdriver.

Place the carburetor body on the work bench with the air inlet side up and the intake manifold mounting surface facing up.

Remove the intermediate jet from the carburetor body. Using compressed air, direct a low volume of air through the port. The air should exit through the three small holes in the roof of the carburetor bore. In the following view, the three small vertical holes are the intermediate jet bleed holes. The small single hole to the upper right of the jet bleed holes is the low-speed mixture port. The large hole to the upper right is the enricher port.

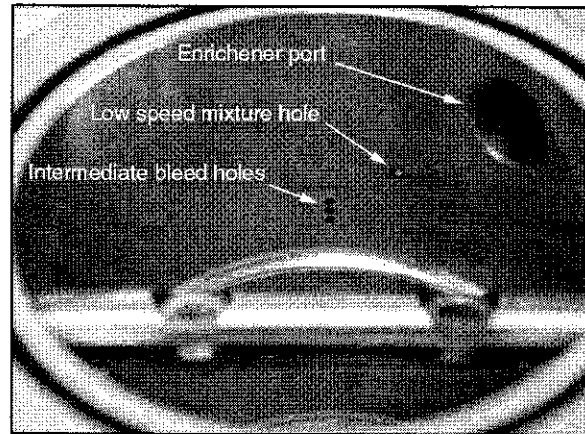


Figure 222 — Intermediate jet bleed holes (lower), idle mixture port (center) and enricher port (upper right)

### Low Speed Port

Remove the idle mixture screw from the carburetor body.

Using compressed air, direct air through the idle mixture port. The air should exit through the single small hole in the roof of the carburetor bore, between the three intermediate jet bleed holes and the large enricher port. The hole is approximately 1/4" from the jet bleed holes.

### Main Jet Port

Using compressed air, direct air through the main jet port. Air should exit from a hole in the float bowl area, approximately 1-1/2" to the right of the main jet port.

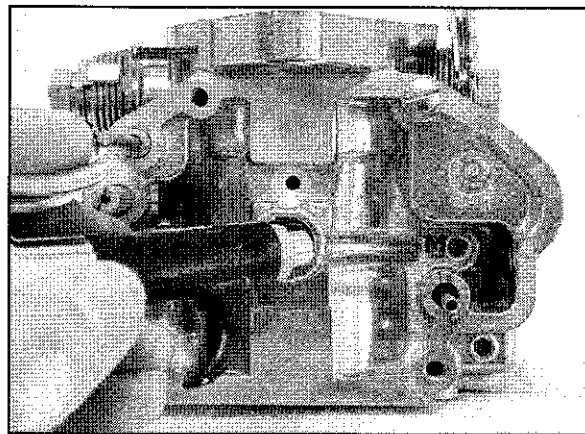


Figure 223 — Directing air through main jet port

### Main Jet Discharge Tube

Make sure that the main jet discharge tube holes are free of debris. Then, install the brass main jet discharge tube in the carburetor body, using a 1/2" wrench.

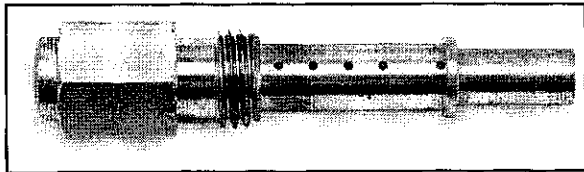


Figure 224 — Main jet discharge tube with five bleed holes

### Enrichener/Fast Idle Port

Remove the enrichener/fast idle plunger nut, using a 1/2" wrench. Remove the plunger assembly from the carburetor body.

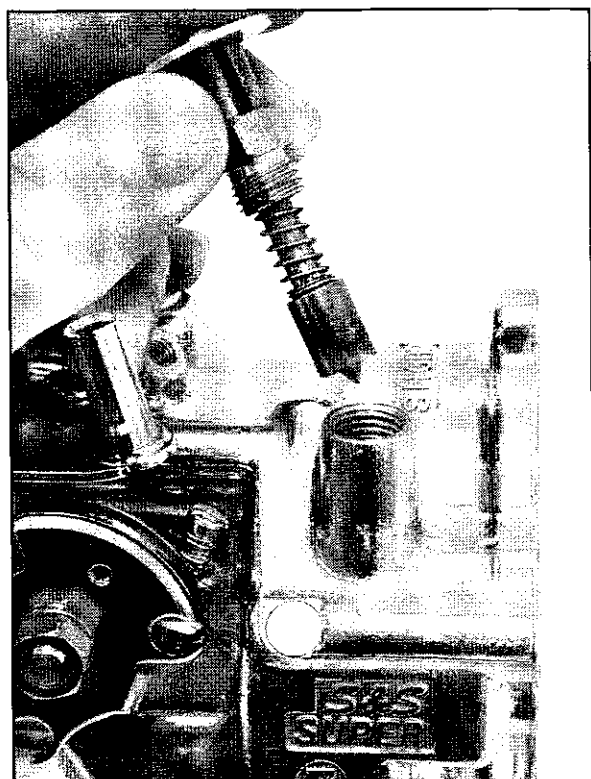


Figure 225 -- Enrichener plunger assembly

Lift the carburetor body up and look through the fast idle port. Make sure the port is free of debris.

There are four holes in the side of the brass tube that supplies fuel to the fast idle port. Make sure these holes are not plugged.

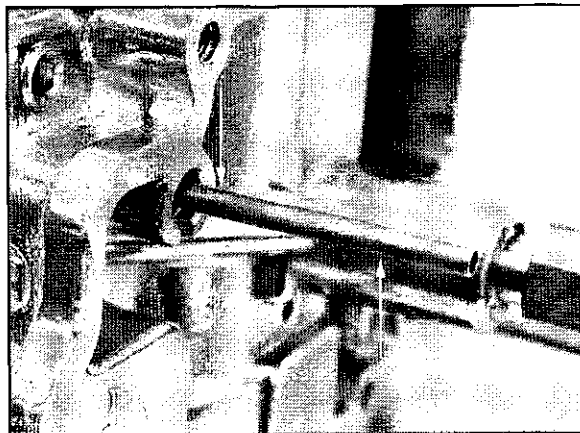


Figure 226 — Brass tube with holes (enrichener fuel pickup)

Insert the enricher/fast idle plunger into the carburetor body, shoulder first. Insert a new spring on the plunger. (On California models, this spring cannot be removed.)

Install the brass plunger nut on the plunger and tighten the nut, using a 1/2" wrench.

Check for smooth operation of the plunger.

### Throttle Shaft

Remove the nuts from each end of the throttle shaft, using a 7/16" hex bit.

Remove the throttle spool and return spring from the shaft.

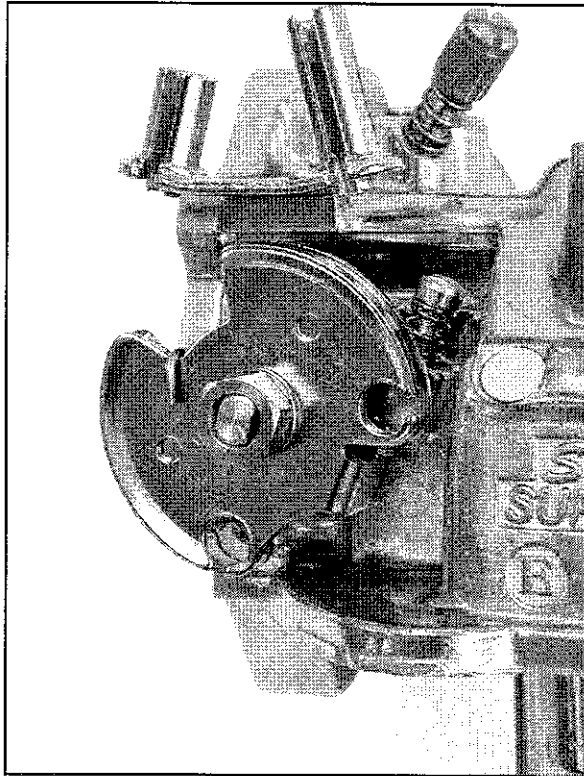


Figure 227 — Throttle spool

Carefully pull the throttle shaft from the carburetor body.

Remove the accelerator pump, actuator arm and spring, and the pump actuator from the throttle shaft.

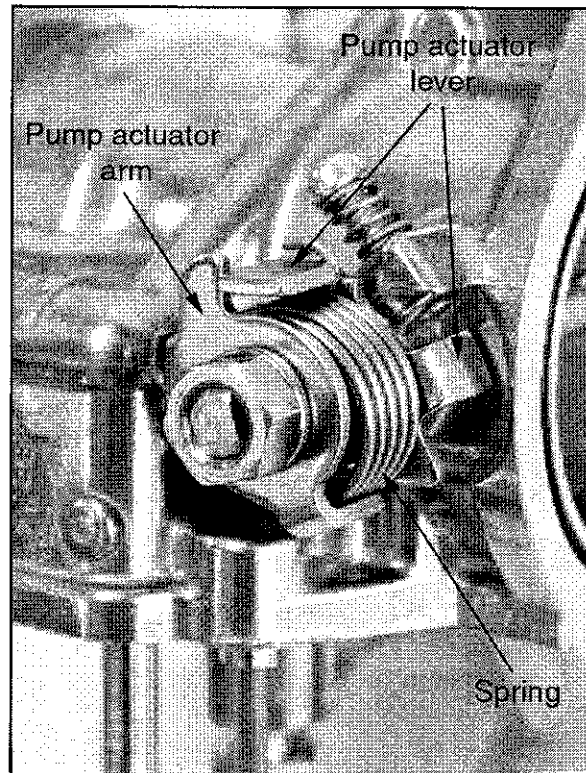


Figure 228 — Accelerator pump actuator assembly

Install a new nylon washer on the throttle shaft.

Install the pump actuator on the throttle shaft, followed by the actuator spring and the accelerator pump actuator.

Install the throttle shaft assembly in the carburetor body. Make sure the shaft is installed in the carburetor from the side that is stamped with the carburetor serial number.

Install the throttle spool spring on the other end of the throttle shaft. Loop the end of the spring over the idle screw boss.

Install the throttle spool on the shaft, making sure that the throttle stop tab is pointing toward the carburetor. Check to see that the throttle stop screw and the tab are in alignment.

Connect the spring end to the throttle spool.

Install new lock washers and new retaining nuts on each end of the throttle shaft. Tighten the nuts securely.

Check the operation of the shaft to make sure that it rotates freely.

Temporarily install a new throttle plate on the throttle shaft. Then, check to make sure the throttle closes fully. Back out the idle stop screw so it is not touching the throttle spool tab.

If the throttle does not close completely, remove the throttle plate, rotate it 180 degrees and temporarily install it again. Check to make sure that the throttle closes fully.

When satisfied that the throttle closes fully, remove the two plate retaining screws and apply blue threadlock to the threads of the screws. Install the screws but DO NOT tighten them at this time.

Rotate the throttle shaft and check for binding between the throttle plate and the carburetor bore.

Also, check to make sure that the throttle closes fully.

Tighten the screws securely and once again, check the operation of the throttle to make sure that it does not bind and the throttle plate closes properly.

### Idle Mixture, Idle Stop and Accelerator Pump Adjustment Screws

Remove and discard the idle mixture screw and spring. Install a new mixture screw and spring. Carefully turn the screw inward (clockwise) until gently seated. Turn the screw outward (counterclockwise) 1-1/2 turns. This is an approximate idle mixture setting.

Remove and discard the idle stop screw and spring. Install a new stop screw and spring. Turn the screw inward until it just touches the throttle spool tab. Turn the screw inward an additional 1/2 turn for a general idle speed setting.

Remove and discard the accelerator pump adjustment screw. Install a new adjustment screw, carefully turning it inward until it gently contacts the pump actuator arm. Back the screw outward 2-1/4 turns for a general accelerator pump setting.

Replace the cable guide screw with a new one.

### Bowl Gasket, Drain Plug and Body O-Rings

Install a new fuel bowl gasket on the carburetor body and install the fuel bowl. Tighten the bowl retaining screws securely, using a flat-blade screwdriver.

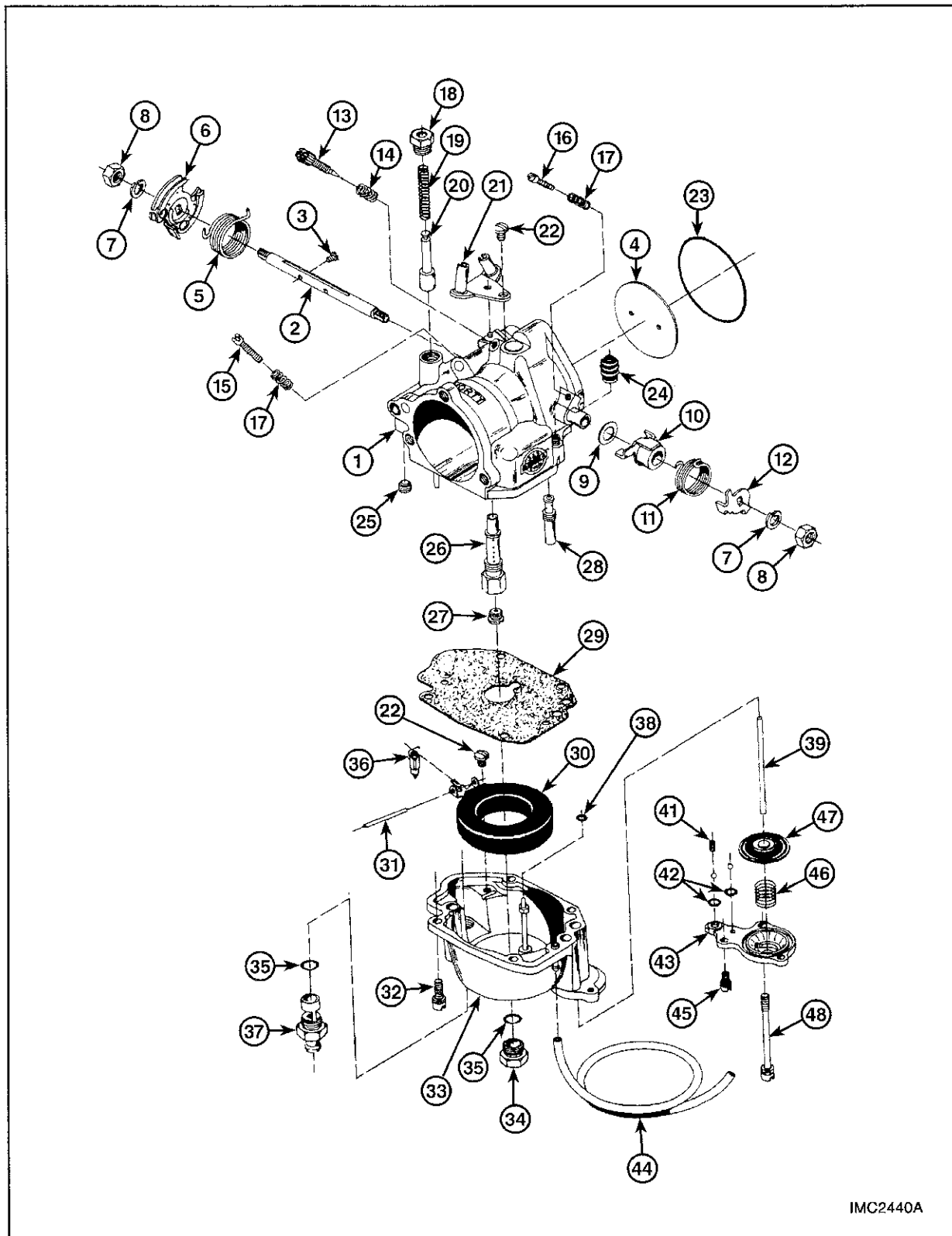
Place a new O-ring on the fuel bowl brass drain plug and install the plug, using a 5/8" wrench.

Remove the carburetor-to-manifold O-ring and replace it with a new one.

Install the carburetor on the motorcycle following the procedure under Carburetor Removal and Installation in this section.

After installation, start the engine and let it warm to operating temperature. Adjust the idle mixture screw, idle speed screw and accelerator pump. Refer to the procedures under Carburetor Maintenance in this section.

## Carburetor Illustration



## Carburetor Exploded View Legend

|                                     |                                       |
|-------------------------------------|---------------------------------------|
| 1. Carburetor body                  | 25. Fuel bowl vent plug               |
| 2. Throttle shaft                   | 26. Main discharge tube               |
| 3. Throttle plate screw             | 27. Main jet                          |
| 4. Throttle plate                   | 28. Intermediate jet                  |
| 5. Throttle return spring           | 29. Fuel bowl gasket                  |
| 6. Throttle spool                   | 30. Fuel float                        |
| 7. Shaft lock washer                | 31. Fuel float pin                    |
| 8. Shaft nut                        | 32. Fuel bowl screw (3)               |
| 9. Shaft nylon washer               | 33. Carburetor fuel bowl assembly     |
| 10. Pump actuator lever             | 34. Fuel bowl plug                    |
| 11. Actuator spring                 | 35. Seat O-ring                       |
| 12. Pump actuator arm               | 36. Float needle valve                |
| 13. Idle mixture screw              | 37. Needle valve seat                 |
| 14. Mixture screw spring            | 38. Ejector nozzle O-ring             |
| 15. Idle speed screw                | 39. Accelerator pump pushrod          |
| 16. Pump adjuster screw             | 40. Ball check                        |
| 17. Idle speed/pump adjuster spring | 41. Ball check spring                 |
| 18. Plunger nut                     | 42. Accelerator pump cap O-ring       |
| 19. Plunger spring                  | 43. Accelerator pump cap assembly     |
| 20. Fast idle plunger               | 44. Overflow hose                     |
| 21. Cable guide assembly            | 45. Accelerator pump cap screw        |
| 22. Float pin screw                 | 46. Accelerator pump diaphragm spring |
| 23. O-ring                          | 47. Accelerator pump diaphragm        |
| 24. Bellows seal                    | 48. Fuel bowl screw (1)               |

## IGNITION SYSTEM SERVICE

### Spark Plug Replacement

#### Tools required:

13/16" hex socket

Pliers

Torque wrench

#### Procedure

Gently pull the spark plug caps away from the spark plugs. Be very careful to not separate the caps from the wires while pulling.

Clean the spark plug area of the cylinder heads with compressed air.

Remove the old spark plugs, using a 13/16" hex socket.

Gap new Bosch WR7DP spark plugs at 0.038–0.043".

Apply a small quantity of anti-seize compound to the spark plug threads.

Install the new spark plugs in the cylinder heads. Using a torque wrench and 13/16" socket, tighten the plugs to specification.

Tighten the threaded caps located on the spark plugs with a pair of pliers.

Connect the spark plug wires to the spark plugs.

### Ignition Coil and Spark Plug Wire Replacement

#### Tools required:

3/16" hex bit

3/8" wrench

#### Coil Removal and Installation

Loosen the chrome coil cover mounting screws, using a 3/16" hex bit. While supporting the coil assembly, remove the screws, coil cover and spacer plate.

Using a 3/8" wrench, remove the retaining nuts and wires from the primary terminals at each end of the coil. Carefully twist and pull to disconnect the spark plug wires from the terminals at the back of the coil. Remove the coil from the motorcycle.

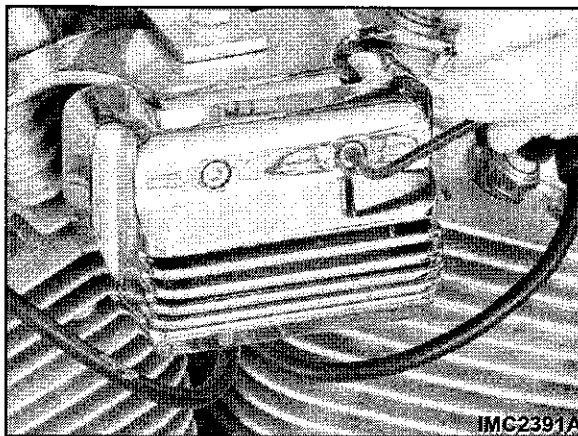


Figure 230 — Coil cover removal

To install, place the coil in position on the engine upper support bracket and temporarily install the mounting screws to hold the coil in position (without cover) while the terminal connections are made.

Plug the spark plug wires into the terminals at the rear of the coil.

Connect the yellow wire to the terminal at the front end of the coil. Install the retaining nut, using a 3/8" wrench.

Connect the red, white and black wires to the terminal at the rear end of the coil and install the retaining nut.

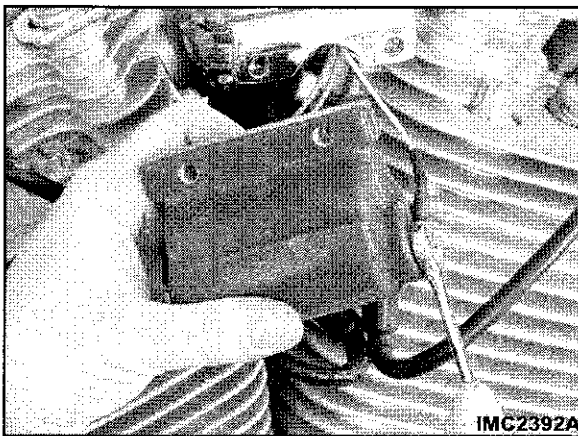


Figure 231 — Connecting coil wires

While supporting the coil, remove the screws and place the spacer and cover in position over the coil. Install the mounting screws and tighten to specification.

### Spark Plug Wire Removal and Installation

The spark plug wires are routed from the plugs at the left side of each cylinder head to the secondary ignition terminals at the back of the coil.

From the left side of the motorcycle, reach behind the coil to the spark plug wire terminals. Carefully twist and pull to separate the terminals from the coil.

Next, carefully twist and pull on the wire terminals to separate the wires from the spark plugs. Pull the wires out from under the upper support bracket.

To install, place the spark plug wires in position between the cylinder heads and under the engine upper support head. Make sure that the terminal ends with the long boots are positioned at the left side and connect the terminals to the spark plugs.

Connect the terminals to the back of the coil. Slide the boot over the terminals to seal the connection at the coil.

### Ignition Trigger Plate/Rotor Removal and Installation

#### Tools required:

- 3/32" hex bit
- 3/16" hex bit
- 5/16" wrench or socket
- Flat-blade screwdriver
- Torque wrench

#### Procedure

Remove the two outer ignition cover screws, using a 3/32" hex bit. Remove the outer cover and discard the gasket.

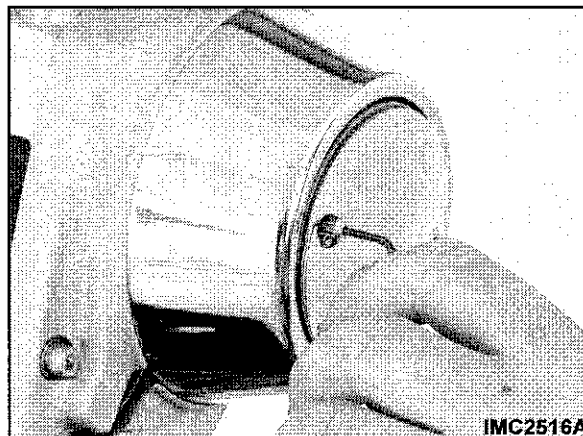


Figure 232 — Removing outer ignition cover screws

Twist the inner ignition cover to the right or left to disengage the hold-down tabs. Remove the inner ignition cover and the tapered flangeless cover. Discard the large circular gasket.

Using a 3/16" hex bit, remove the screws and retainer plate securing the ignition wire harness at the bottom of the cam cover.

Using a flat-blade screwdriver, remove the two cylindrical-head screws retaining the trigger plate to the cam cover. Remove the trigger plate and wire harness.

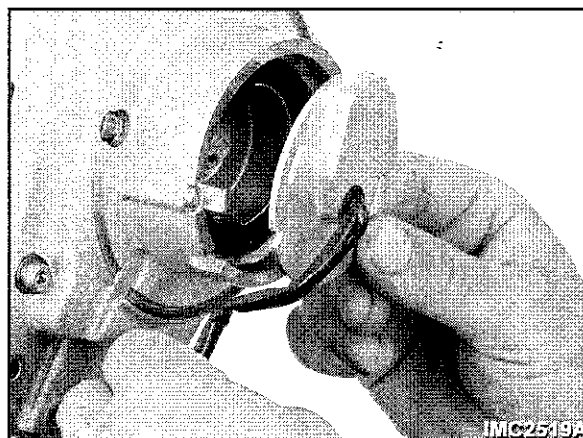


Figure 233 — Removing trigger plate



Remove the screw from the ignition rotor, using a 5/16" socket, and remove the rotor.

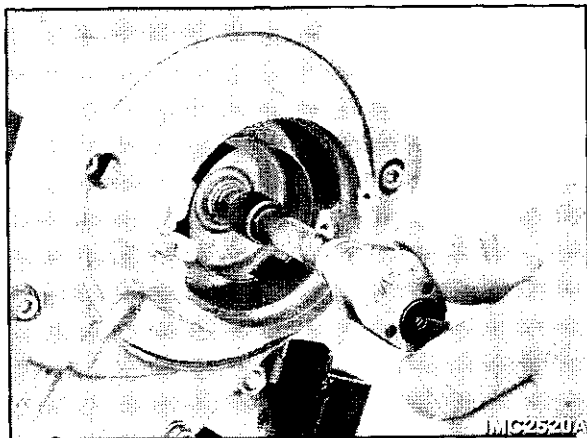


Figure 234 — Removing ignition rotor

Inspect the leads and connector for the sensor sealed in the trigger plate. If damaged, repair or replace as necessary.

Position the rotor on the end of the camshaft with the alignment tab in the shaft slot. Install the screw, using a 5/16" socket. Tighten the screw to specification, 6–8 foot-pounds.

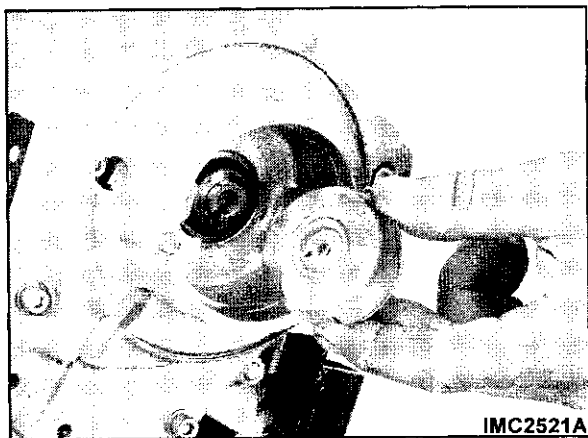


Figure 235 — Installing ignition rotor

Install the trigger plate on the cam cover housing and tighten the two cylindrical-head screws, using a flat-blade screwdriver. Route the wire harness through the channel in the housing and install the retainer plate to secure the harness. Tighten the retainer plate screws to 8–10 foot-pounds, using a 3/16" hex bit.

Place a new gasket and the tapered flangeless cover in position on the cam cover. Then install the inner ignition cover over the flangeless cover and twist it to engage the hold-down tabs.

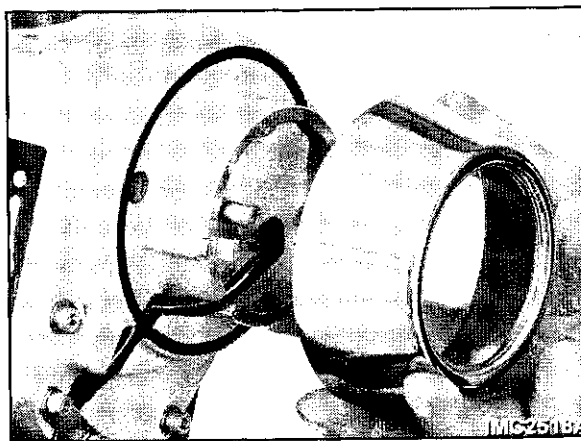


Figure 236 — Installing flangeless cover

Place a new gasket in position and install the outer ignition cover. Apply blue threadlock to the threads of the cover screws and install the screws. Tighten the screws to 10–15 inch-pounds. Do not overtighten the screws.

## Ignition Module Replacement

### Tools required:

7/16" wrench/socket

1/2" wrench/socket

5/32" hex bit

### Procedure

The ignition module is located under the seat on the frame crossmember at the rear of the battery box.

Remove the seat and dash following the instructions in the FRAME AND ACCESSORIES SERVICE section.

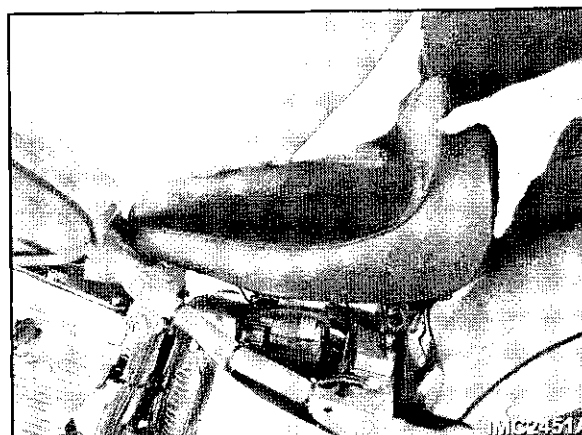


Figure 237 — Access to ignition module

Trace the harness routing from the ignition module to the connectors for the trigger plate and the electronic control module. Remove the red and yellow harness wires from the four-pin connector at the control module, using a suitable tool. Unplug the three-pin connector to the trigger plate. Then, cut the tie straps securing the harness to the frame.

**Note:** The ignition module harness splits into two branches at the center frame tube. One branch is routed down the center tube to the three-pin trigger plate connector below the engine. The second branch leads to the electronic control module between the fuel tanks.

Remove the two module mounting screws, using a 7/16" wrench and remove the module and harness.

To install, reverse the order of removal. Tighten the mounting screws to specification and secure the harness to the frame with tie straps.

## Ignition Timing Check and Adjustment

While ignition timing advance is electronically controlled by the ignition module, the static timing setting can be adjusted and then checked dynamically following the procedures presented here. Static timing that is not set properly (too advanced or retarded) can damage the engine. Timing that is a few degrees retarded can make the engine run sluggish and can cause excessive engine heat and subsequently cause discoloration of the exhaust pipes.

### Tools required:

- 3/32" tee handled hex bit
- 1/4" flat-blade screwdriver
- 3/8" socket
- 13/16" spark plug socket
- Inductive timing light
- Motorcycle lift
- Torque wrench

### Static Timing Procedure

With a suitable motorcycle lift placed under the frame crossmember, raise the rear wheel off the ground.

Remove the seat, following the procedure in the FRAME AND ACCESSORIES SERVICE section.

Remove the timing mark inspection plug from the left side of the engine using, a 3/8" hex bit.

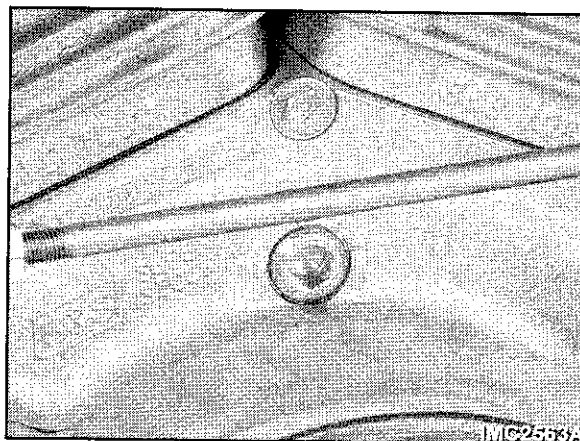


Figure 238 — Timing mark inspection plug

Remove both spark plugs, using a 13/16" spark plug socket.

Remove the outer ignition cover from the right side of the cam gear case, using a 3/32" hex bit.

Twist the inner ignition cover to the right or left to disengage the hold-down tabs. Remove the inner ignition cover. The tapered flangeless cover can remain in place.

Turn the ignition key switch to the "on" position. Observe the red LED on the ignition module located on the upper frame crossmember behind the battery. The red LED should be illuminated.

Shift the transmission in 5th gear. Rotate the rear wheel while watching for the T:F mark to appear in the inspection hole.

**Note:** The "T" in the marking stands for top dead center and the "F" for front cylinder. Similarly, the "T:R" marking identifies top dead center for the rear cylinder.

Align the T:F mark to be centered within the hole. The red LED on the module SHOULD NOT be illuminated. If the LED is still illuminated, rotate the rear wheel until the LED goes out and then observe the position of the T:F mark in relation to the center of the inspection hole.

If adjustment is required, reposition the T:F mark in the center of the inspection hole.

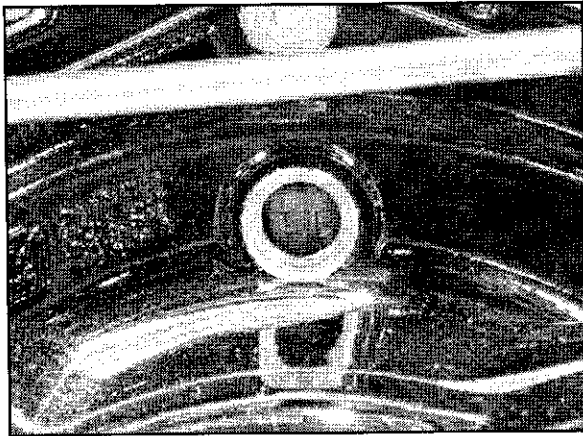


Figure 239 — T:F mark centered in inspection hole

Loosen the sensor plate located on the right side of the engine, using a 1/4" flat-blade screwdriver. With the T:F mark centered in the inspection hole, rotate the sensor plate until the red LED goes out.

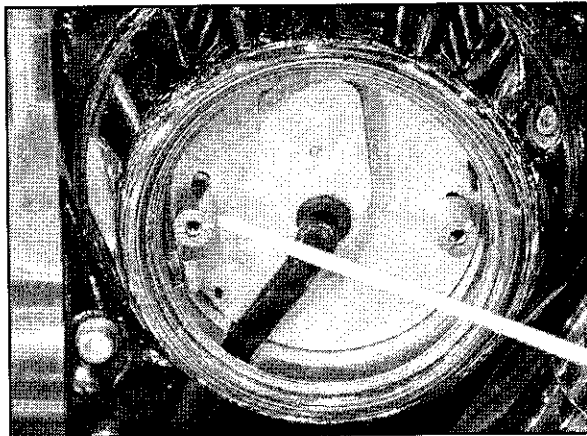


Figure 240 — Trigger plate and screws

Tighten the plate screws to specification, 14 inch-pounds, using a 1/4" flat-blade screwdriver.

With the static timing set, turn the ignition key switch to the "off" position.

Install the inner ignition cover over the flangeless cover and twist it to engage the hold-down tabs.

Apply blue threadlock to the threads of the outer ignition cover screws. Place the cover and gasket in position on the flangeless cover and install the screws. Tighten the screws to specification, 25–30 foot-pounds, using a 3/32" hex bit.

Install the spark plugs in the cylinder heads, using a 13/16" spark plug socket. Tighten the plugs to specification, 11–18 foot-pounds.

Apply blue threadlock to the threads of the inspection hole plug. Install the plug, using a 3/8" socket, and tighten to specification, 25–30 foot-pounds.

Install the seat, following the procedure in the FRAME AND ACCESSORIES SERVICE section.

Lower the motorcycle to the ground and remove the lift.

## Dynamic Timing

Connect an inductive timing light to the front cylinder ignition wire.

Remove the timing mark inspection plug from the left side of the engine, using a 3/8" hex bit.

Remove the outer ignition cover from the right side of the camshaft case, using a 3/32" hex bit. Remove the gasket.

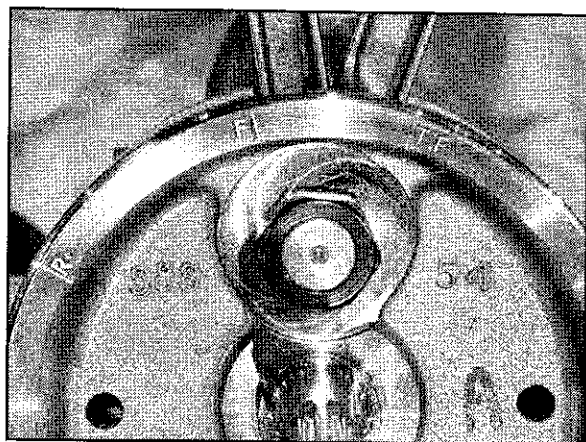
Twist the inner ignition cover to the right or left to disengage the hold-down tabs. Remove the inner ignition cover. The tapered flangeless cover can remain in place.

Turn the ignition key switch to the "on" position. With the transmission in NEUTRAL, start the engine and let it idle for one minute.

**Note:** The Scout/Spirit engine is programmed to be at 34° advance between 2200–3300 rpm, increase to 35° at 3800 rpm and back to 34° at 3800–4400 rpm.

After one minute, increase the engine rpm to 2200–3300 rpm. Aim the timing light at the inspection hole. An "F" mark should be visible through the hole with a 35° advance. Slowly increase rpm up to 3800 and maximum advance; again, the "F" mark should be visible through the inspection hole.

For reference, the following view shows the timing marks as they appear on a removed crankshaft and flywheel assembly.



*Figure 241 — Flywheel with indicated timing marks shown ("R" — rear cylinder, "F" — front cylinder and T:F — top-dead center, front cylinder)*

If the timing mark is not visible as indicated in the above steps, adjustment is required. Loosen the sensor plate located on the right side of the engine, using a 1/4" flat-blade screwdriver. Rotate the plate slightly, tighten the screws and again check the dynamic advance.

Once the correct timing is achieved, stop the engine and turn the ignition key switch to the "off" position. Tighten the sensor plate screws to specification, 14 inch-pounds, using a 1/4" flat-blade screwdriver.

Install the inner ignition cover over the flangeless cover and twist it to engage the hold-down tabs.

Apply blue threadlock to the threads of the outer ignition cover screws and install the cover. Using a 3/32" hex bit, tighten the screws to specification, 25–30 foot-pounds.

Apply blue threadlock to the inspection hole plug. Install the plug, using a 3/8" socket, and tighten to specification.

## LUBRICATION SYSTEM SERVICE

### Engine Oil and Oil Filter Replacement

#### Tools required:

Flat-blade screwdriver

Oil filter wrench

Drain pan

#### Procedure

With the motorcycle resting on the kickstand, place a drain pan under the oil drain hose located at the right rear of the transmission. Using a flat-blade screwdriver, loosen the clamp retaining the drain hose to the frame plug. Remove the hose from the frame plug and allow the oil to drain into the pan.

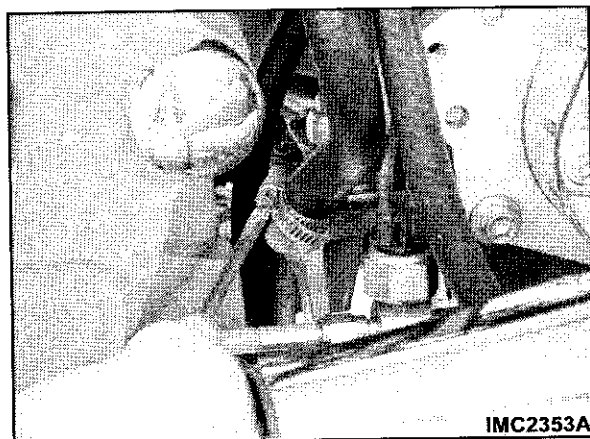


Figure 242 — Opening the oil drain tube

When the oil has completely drained from the oil tank, reconnect the hose to the frame plug and tighten the clamp securely. Clean any residual oil that may have dripped from the hose onto surrounding surfaces of the motorcycle and move the drain pan to the area under the filter.

Next, remove the oil filter, using a proper-sized oil filter wrench. The oil filter, located at the upper front of the engine crankcase, is easily accessed from the left side of the motorcycle.

Inspect the seating surface on the filter mount. Make sure the old filter gasket is not adhered to the seating surface and clean any dirt or debris from the seat and the surrounding area.

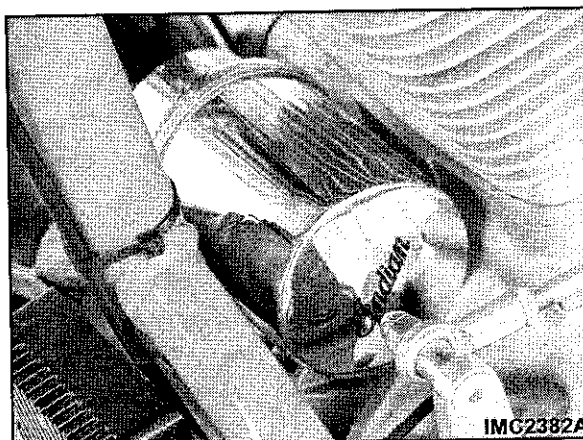


Figure 243 — Engine oil filter

Replace the filter with an Indian-approved part (#96-021). Apply a thin film of oil to the filter threads and to the rubber gasket of the new filter.

Thread the filter onto the filter mount until the gasket contacts the seating surface. Tighten another 1/2 to 3/4 of a revolution, by hand.

Fill the oil tank with 2-1/4 quarts of Indian® 20W-50 SG motorcycle oil, or equivalent. Install the dipstick cap.

Bring the motorcycle to an upright and level position. Remove the dipstick cap and check the oil level. The oil level should be between the high and low marks on the dipstick or even with the bottom of the filler tube. Add oil if necessary.

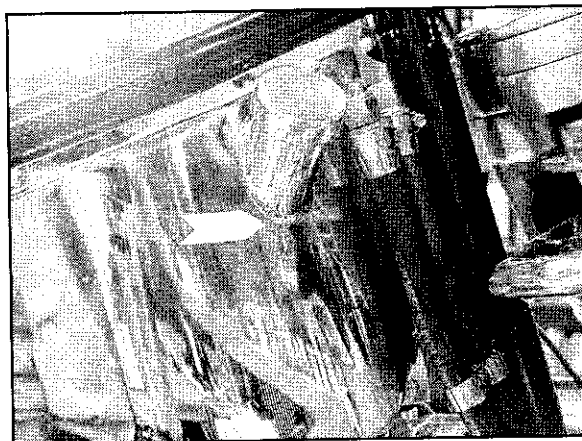


Figure 244 — Proper engine oil level (at bottom of filler tube)

Start the engine and bring it to normal operating temperature and recheck the oil level.

## Cleaning the Tappet Screen

### Tools required:

Flat-blade screwdriver  
Torque wrench

### Procedure

The tappet screen provides coarse filtering of engine oil before reaching the hydraulic tappets. The tappet screen cap is located on the right side of the engine, at the top rear of the crankcase just above the oil pump.

Remove the cap, using a flat-blade screwdriver.

Then, remove the spring and screen from the bore.

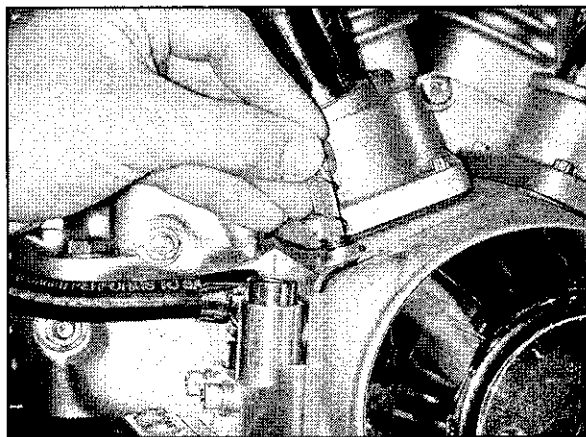


Figure 245 — Removing the tappet screen

Clean the screen with a suitable oil removal product. Inspect the screen for any metal chips. Chips may be removed with brake clean, carburetor clean, etc. If the chips cannot be removed, replace the screen with a new part (#01-185).

Sequence of assembly is as follows:

1. Screen (opening to the bottom)
2. Spring
3. O-ring and cap (Inspect the O-ring before assembly.)

Using a torque wrench and flat-blade screwdriver, tighten the cap to specification.

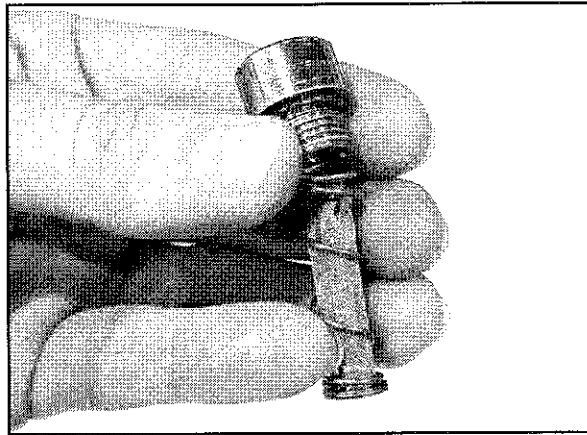


Figure 246 — Tappet screen, spring, O-ring and cap

## Oil Line Inspection and Replacement

Check all oil lines for leakage at the attachment points. There are nine check points.

Oil tank — four points

Oil pump — two points

Oil filter mount — two points

Cam gear case — one point

### Tools required:

Flat-blade screwdriver  
1/4" open-end wrench  
12 mm open-end wrench  
1/2" open-end wrench  
9/16" open-end wrench  
Torque wrench

### Inspection at Oil Tank

The oil tank has four points of inspection. If a leak is found, the 90-degree fitting can be tightened to specification, using a 12 mm wrench. If tightening to specification does not stop the leak, remove the fitting and apply a thread sealant with Teflon<sup>®</sup> to the threads and reinstall the fitting.

The rubber hose attachment points may leak also. Again, if a leak is found, tighten the clamps to specification, using a flat-blade screwdriver.

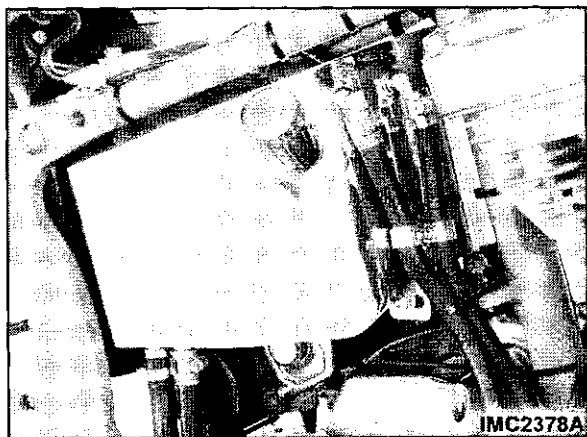


Figure 247 — Oil line connections at tank

### Inspection at Oil Pump and Cam Gear Case

There are two points of inspection at the bottom of the oil pump and one point at the rear of the cam gear case, just above the oil pump. If leaking, the fittings can be tightened to specification, using a 1/2" open-end wrench. If tightening to specification does not stop the leak, remove the fitting and apply a thread sealant with Teflon<sup>®</sup> to the threads. If necessary, tighten the hose clamps, using a flat-blade screwdriver.

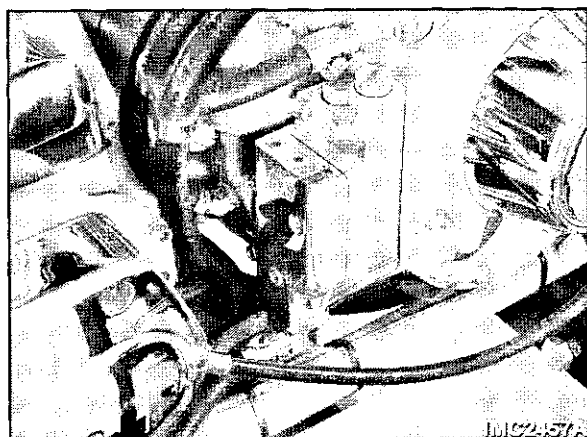


Figure 248 — Pump oil supply fittings and crankcase vent fitting  
(exhaust pipe removed for clarity)

### Inspection at the Oil Filter Adapter

The oil filter adapter has two points of inspection at the bottom. If leaking, tighten the oil fitting(s), using a 9/16" open-end wrench. If necessary, remove the fitting and reapply a thread sealant with Teflon<sup>®</sup> to the threads.

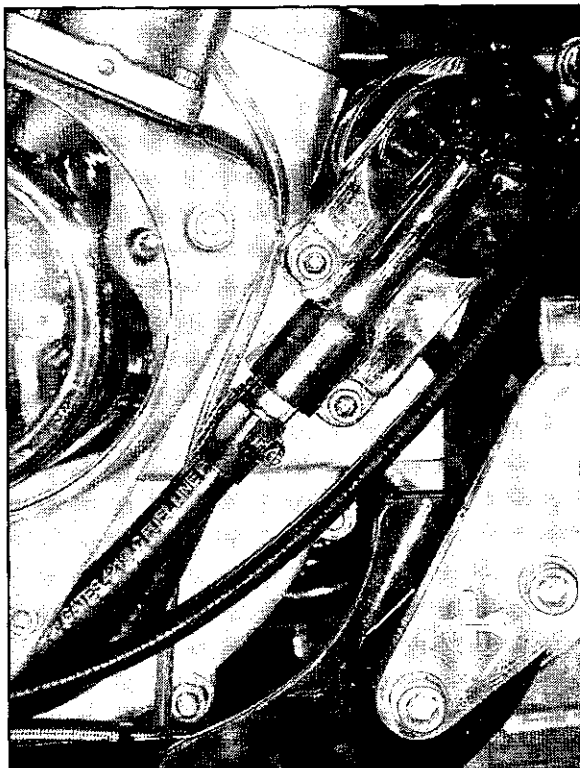


Figure 249 — Oil filter fittings

## Oil Pump Removal and Installation

### Tools required:

- 3/16" hex bit
- 7/16" wrench/socket
- Flat-blade screwdriver
- Torque wrench
- Drain pan
- Motorcycle lift

### Procedure

Remove the tappet screen plug, using a large flat-blade screwdriver or driver bit. Then, remove the spring and tappet screen.

Inspect the screen for damage and discard if necessary.

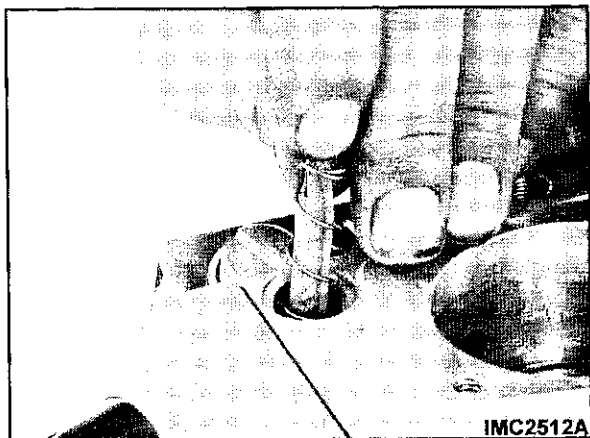


Figure 250 — Removing tappet screen

Loosen the oil pump cover screws with a 3/16" hex bit and remove the four screws.

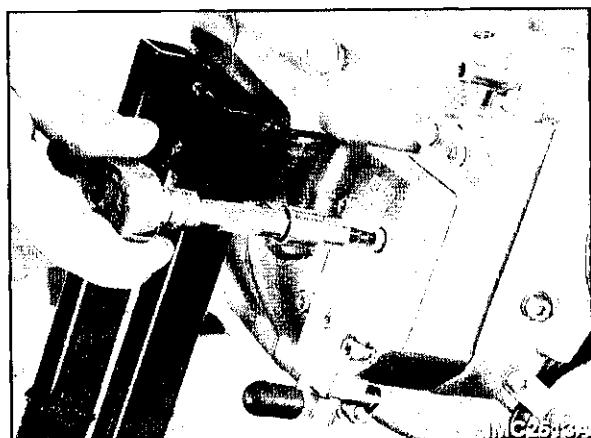


Figure 251 - Removing oil pump cover

Remove the pump cover and gasket from the crankcase. Discard the gasket.

Using a 7/16" socket, remove the two screws at the top of the pump housing.

Remove the pump housing, using care to avoid dropping the four small gears that are in the housing.



Figure 252 - - Removing oil pump cover

Remove and discard the gasket.

Clean and inspect the oil pump for wear and/or damage. Rebuild or replace the pump if necessary.

Place a new gasket on the oil pump mounting surface, using a thin coating of Loctite<sup>®</sup> ULTRA BLACK RTV sealant to hold it in place.

**Note:** The following steps are based on the oil pump shaft and driving gear already having been installed in the cam gear case. If not already installed, the pump can be pre assembled with the shaft and then installed in the cam gear case.

Insert the key for the pump return drive gear in the inner key slot on the pump shaft.

Apply a light coat of clean engine oil to the pump drive and idler shafts and gears to be installed in the pump housing.

Next, pre-assemble the supply and return gears to the idler shaft in the pump housing. Insert the return drive gear in the inner chamber of the housing, making sure the timing mark is aligned with the mark on the return idler gear.



Rotate the drive gear so that the keyway will be aligned with the shaft key when the pump is installed in the next step. The supply drive gear in the outer chamber will be installed later.

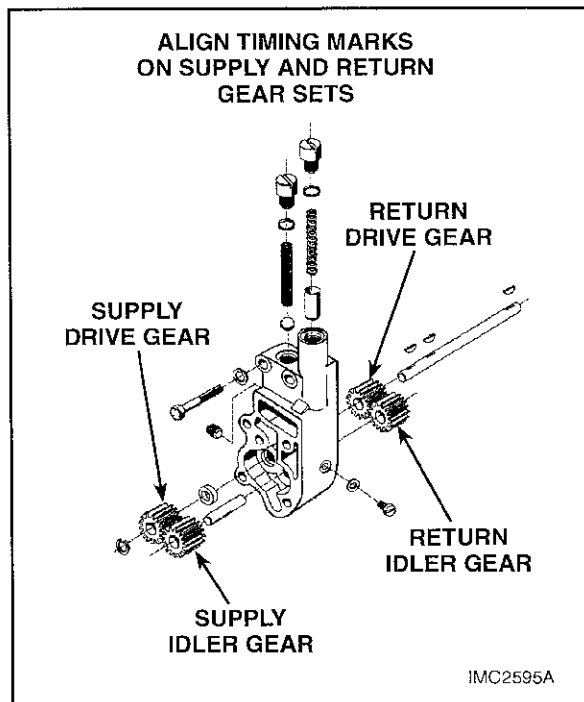


Figure 253 — Oil pump gear arrangement

Carefully slide the pre-assembled pump housing onto the pump shaft, making sure that the drive gear keyway and key are aligned, and continue until it is firmly seated against the cam gear case.

Apply blue threadlock to the threads of the two upper mounting screws and loosely install the screws, using a 7/16" socket.

Insert the key for the pump supply drive gear in the outer key slot on the pump shaft protruding from the housing.

Install the supply drive gear on the shaft, making sure the timing mark aligns with the mark on the supply idler gear in the outer chamber of the housing.

Place a new cover gasket on the oil pump housing, using a thin coating of Loctite® ULTRA BLACK RTV sealant to hold it in place.

Place the cover in position on the pump housing and install the cover screws, using a 3/16" hex bit. Tighten the four cover screws to specification, 8–10 foot-pounds.

Using a 7/16" socket, tighten the two upper housing mounting screws to specification, 65–85 inch-pounds.

Check to make sure that the pump gears rotate easily without binding. If not, loosen the mounting screws, and check for free movement of the gears, and then retighten the screws.

Install the tappet screen, open end down, into the tappet screen bore above the oil pump. Install the spring, O-ring (lubricate before installation) and plug. Using a large flat-blade driver bit, tighten the plug to 8–12 foot-pounds.

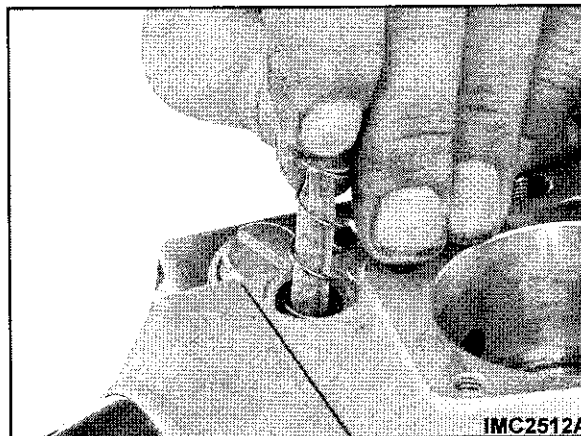


Figure 254 — Installing tappet screen

## Oil Tank Removal and Installation

### Tools required:

- Flat-blade screwdriver
- 1/4" hex bit
- 1/2" wrench/socket
- Torque wrench
- Drain pan
- Motorcycle lift

### Removal

Remove the seat from the motorcycle following the procedure in the FRAME AND ACCESSORIES SERVICE section.

Disconnect the battery cables (negative cable first) at the battery terminals and remove the battery. Refer to the procedure under Battery and Cables in the CHARGING SYSTEM SERVICE section.

With the motorcycle resting on the kickstand, place a drain pan under the oil drain hose located at the right rear of the transmission. Using a flat-blade screwdriver, loosen the clamp retaining the drain hose to the frame plug. Carefully remove the hose from the frame plug and allow the oil to drain into the pan.

Remove the drain pan and position a lift under the frame. Raise the motorcycle to a suitable working height.

Loosen the clamps, using a flat-blade screwdriver, and disconnect the filter return and vent lines at the top right front of the tank. Disconnect the oil pump supply line at the bottom right rear of the tank. Tag the lines for identification and proper reconnecting when the oil tank is installed.

Disconnect the wires at the brake switch terminals and the control circuit wire at the starter solenoid. Pull the three disconnected wires through the battery box and position them out-of-way.

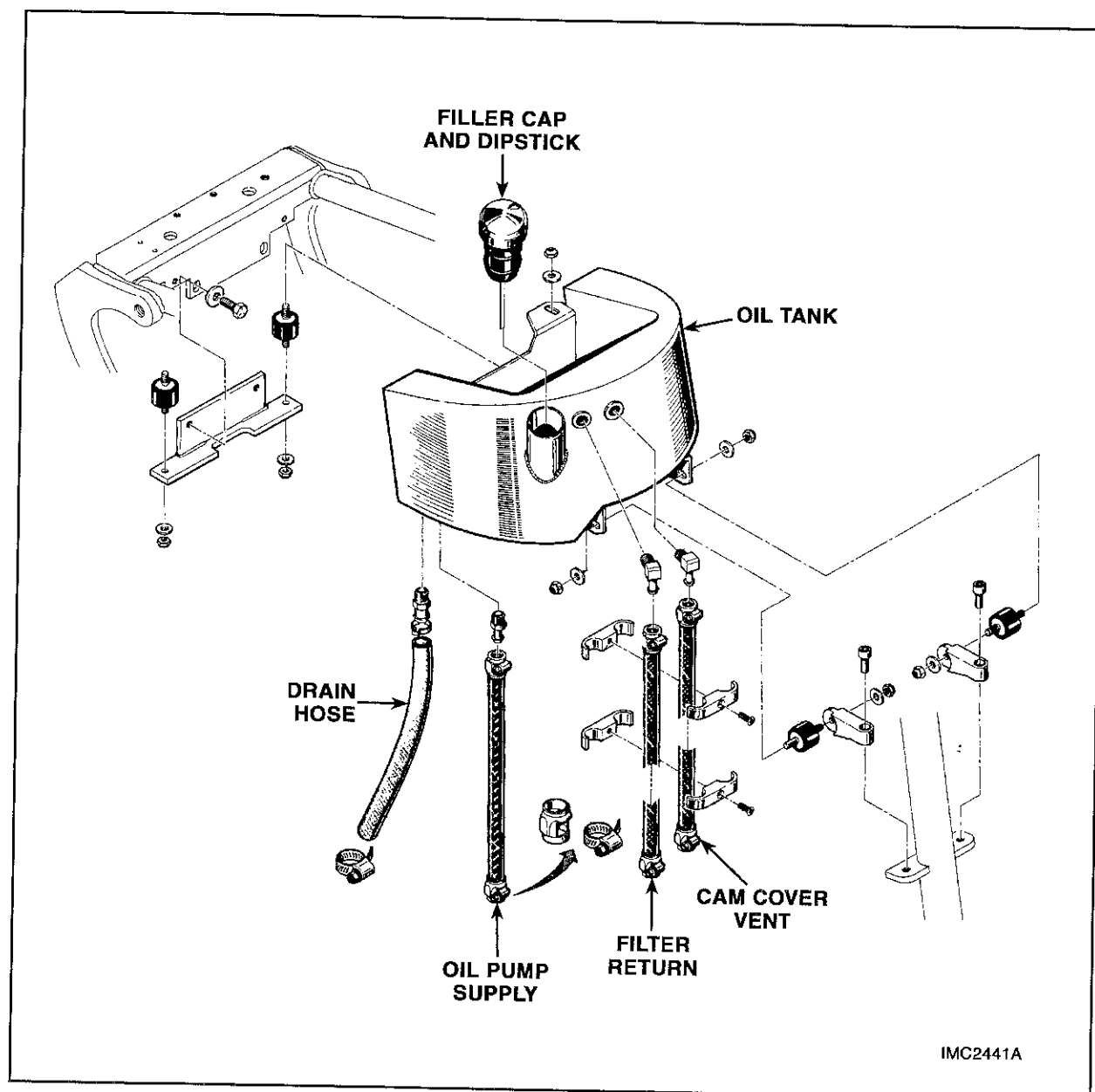


Figure 255 — Oil tank assembly

Using a 1/4" hex bit, remove the two screws attaching the tank brackets to the frame at the front of the oil tank.

Using a 7/16" wrench, remove the two nuts securing the tank to the rubber isolator mounts at the top rear of the tank.

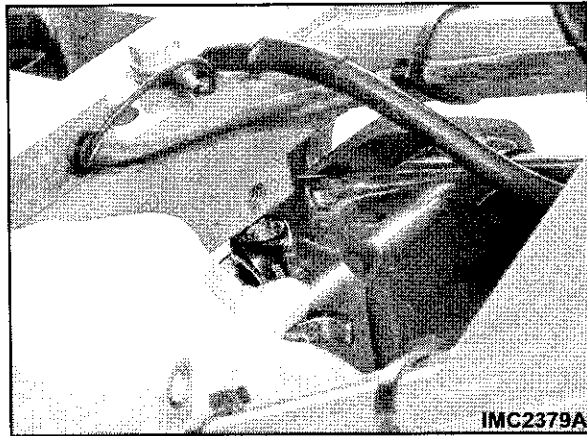


Figure 256 — Removing retaining nut at rear isolator mount

**Note:** While the tank is no longer secured to the mounts, the tank cannot be removed until the rear mounting bracket is removed. This is necessary to provide clearance for removal of the tank from the chassis.

Support the tank and remove the rear mounting bracket from the frame, using a 7/16" wrench.

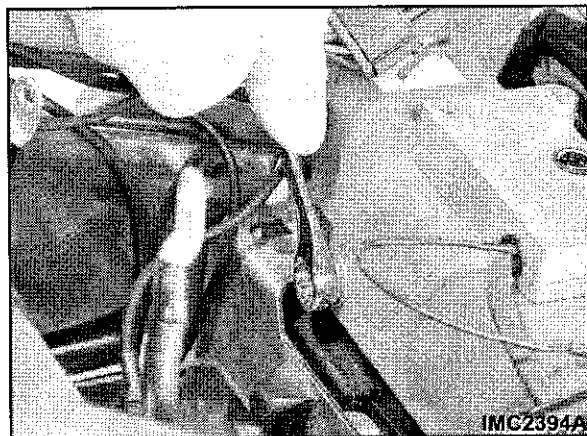


Figure 257 — Removing rear mounting bracket

With the mounting bracket out of the way, the oil tank can now be removed from the chassis.

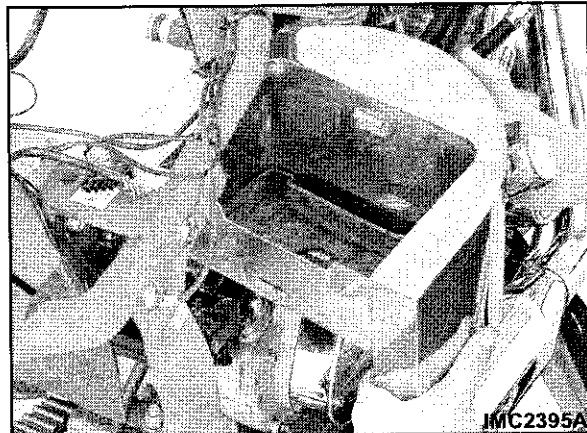


Figure 258 — Removing oil tank

Clean and inspect the tank. Make the needed repair or replace the tank as necessary.

## Installation

Place the oil tank in position with the front brackets resting on the frame mount. Temporarily support the tank in this position until the rear mounting bracket is installed.

Apply blue threadlock to the threads of the two mounting screws and install the rear mounting bracket to the frame, using a 7/16" wrench. Tighten the screws to specification, 14–19 foot-pounds.

Remove the temporary support from the oil tank and position the tank on the bracket isolator mounts at the rear. Install the retaining nuts, using a 7/16" wrench, and tighten to specification, 5–7 foot-pounds.

Apply blue threadlock to the threads of the two front bracket-to-frame mounting screws and install the screws, using a 1/4" hex bit. Tighten the screws to specification, 14–19 foot-pounds.

Route the brake switch and starter control circuits wires through the battery box and make the connections at the brake switch and starter solenoid terminals. Make sure that the wires are properly routed and secured as necessary with tie straps.

Connect the oil lines at the top right front and the bottom right rear of the tank and tighten the clamps securely. Proper connection is as follows:

- Cam gear case vent — top front (inboard)
- Filter return — top front (outboard)
- Oil pump supply — bottom right (forward)
- Oil drain — bottom right (rearward)

Connect the oil tank drain hose to the frame plug and tighten the clamp securely.

Reconnect the battery positive cable and then the negative cable to the battery terminals. Refer to the procedure under Battery and Cables in the CHARGING SYSTEM SERVICE section.

Position the seat on the frame and install the two screws to attach the seat to the frame, using a 3/16" hex bit. Tighten the screws to specification.

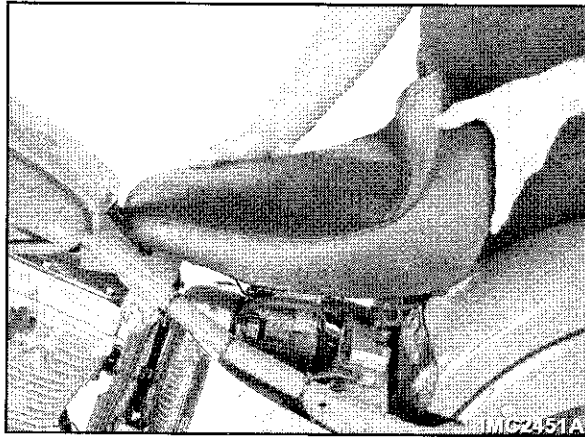


Figure 259 — Installing seat (Scout shown)

Lower the motorcycle to the ground and remove the lift.

Fill the oil tank with 2-1/4 quarts of Indian® 20W-50 SG motorcycle oil, or equivalent. Install the dipstick cap.

Bring the motorcycle to an upright and level position. Remove the dipstick cap and check the oil level. The oil level should be between the high and low marks on the dipstick or even with the bottom of the filler tube. Add oil if necessary.

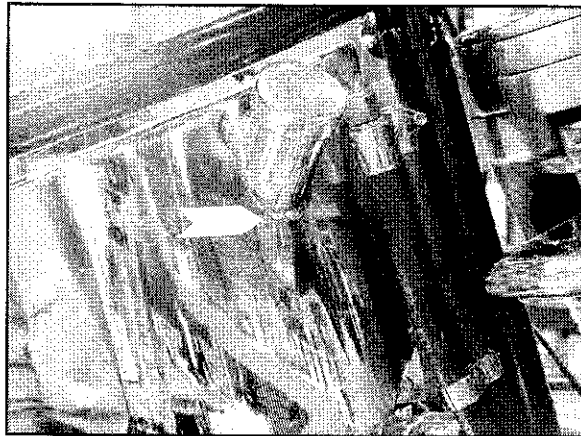


Figure 260 — Proper engine oil level

Start the engine and bring it to normal operating temperature and recheck the oil level.

## EMISSION CONTROL SYSTEM SERVICE

## Evaporative System

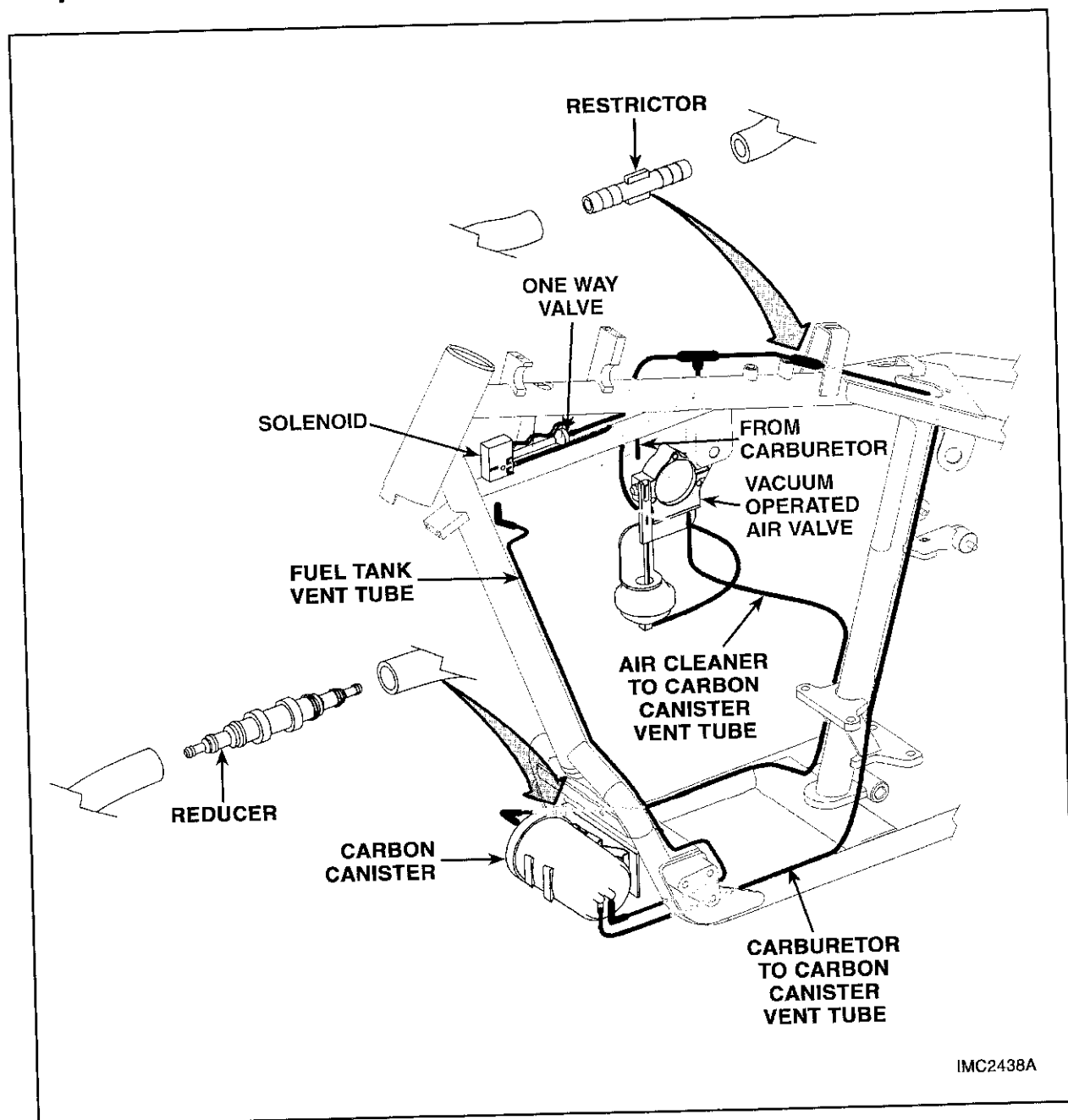


Figure 261 — Evaporative system

## Description

To control emissions in the state of California, Indian motorcycles are equipped with an evaporative emissions control system, meeting regulations set forth by the California Air Resource Board (CARB).

The evaporative system prevents fuel vapors (hydrocarbons) from escaping into the atmosphere. The system consists of an air valve between the air cleaner back plate and the carburetor, tank vapor valve, a carbon canister and interconnecting vent and purge lines.

When the engine is shut down, the air valve at the carburetor intake is closed, blocking the outflow of fuel vapors. Vapors from the carburetor float bowl and fuel tanks are vented through hoses to the carbon canister where they are absorbed and stored by the activated charcoal.

Once started, operating vacuum opens the air valve, drawing fresh air through the charcoal where it picks up stored vapors and delivers them through the purge line to the carburetor.

The system is equipped with a fuel vapor valve in the fuel tank at the vent line inlet. The valve prevents the entrance of liquid fuel into the vent line.

## System Inspection

The evaporative system requires very little maintenance. However, it should be checked at scheduled intervals to ensure that all components are operational and not damaged. Check to see that the air valve moves freely from closed to full open and does not bind. Check the carbon canister for cracks or damage. Vent and purge hoses should be in good condition without cracks or cuts. Also check the hose routings to make sure that they are secure and away from hot engine components.

### **⚠ WARNING!**

Vent and purge hoses contain flammable fuel vapors. Hoses damaged by hot engine components can leak, with possible ignition of escaping vapors and resulting personal injury.

Replace any damaged components.

## Carbon Canister Removal and Installation

### Tools required:

Flat-blade screwdriver

9/16" wrench/socket

Make sure the ignition and engine start switches are turned "off" and disconnect the battery cables (negative cable first) to prevent accidental engine start.

### **⚠ WARNING!**

Batteries produce hydrogen gas, which is both flammable and explosive. Keep flames or sparks away from batteries.

Using a flat-blade screwdriver, remove the clamps and disconnect the vent and purge hoses at the carbon canister.

Remove the two rear mounting bolts, using a 9/16" wrench, and remove the canister from the motorcycle.

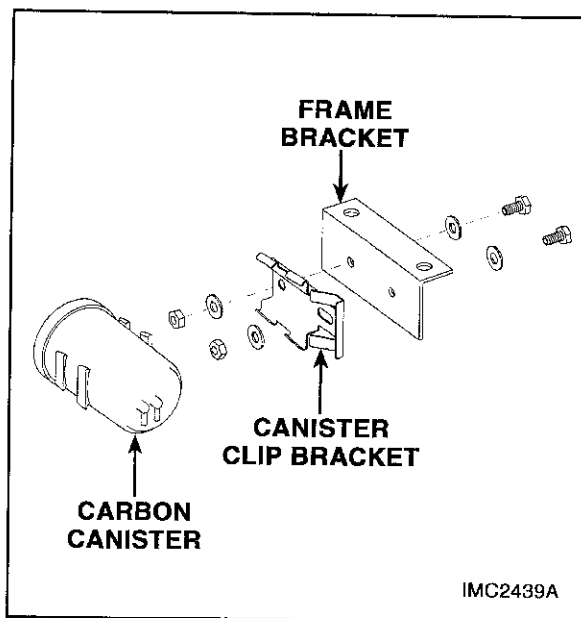


Figure 262 — Air valve solenoid assembly

To install the canister, reverse the order of removal. Tighten the mounting bolts to specification.

## Air Valve Removal and Installation

### Tools required:

1/16" hex bit

5/32" hex bit

The air valve and vacuum diaphragm are removed as an assembly. When the assembly is being removed, the air cleaner must also be removed.

Disconnect the vacuum line from the bottom of the diaphragm.

To remove the air valve and vacuum diaphragm assembly, remove the air cleaner and back plate, following the procedure in the AIR CLEANER SERVICE section. The air valve assembly is held in place by the three air cleaner back plate-to-carburetor mounting screws.

As the back plate is being removed, the air valve will be pulled away from the carburetor. Support the air valve and set the back plate aside.

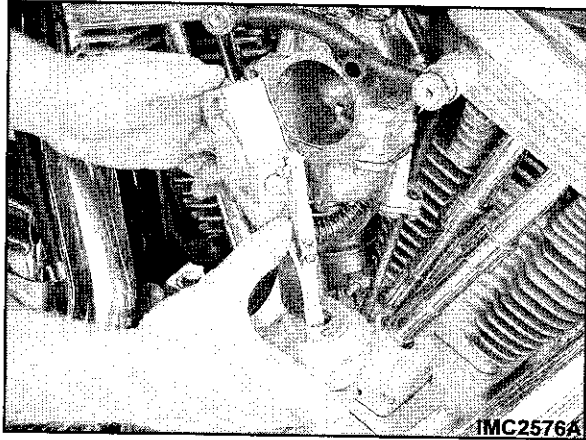


Figure 263 — Removing air valve and diaphragm

Remove and discard the gaskets from each side of the valve. Then, disconnect the vent tube from the bottom of the air valve.

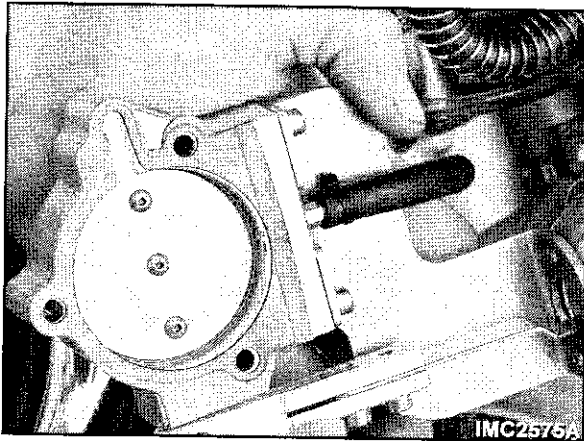


Figure 264 — Air valve and vent tube

Inspect the air valve and vacuum diaphragm for any damaged parts. Make sure the valve closes securely and that the shaft does not bind or stick. Using a hand vacuum pump, check for proper operation of the diaphragm. The actuator rod should move freely and not bind. Repair or replace parts as necessary.

Reverse the procedure to install the air valve and vacuum diaphragm assembly. Install new gaskets between the back plate and carburetor and refer to the AIR CLEANER SERVICE section for proper installation of the back plate to the carburetor and cylinder heads.

## EXHAUST SYSTEM SERVICE

### Muffler, Heat Shields and Exhaust Header

The Indian Scout is equipped with dual exhaust header pipes and mufflers. In comparison, the Indian Spirit is equipped with a Y-shaped header pipe and a single muffler. The following procedures generally apply for both models with the minor differences identified when necessary.

#### Tools required:

- Flat-blade screwdriver
- 1/2" wrench/socket
- Torque wrench

#### Heat Shield Removal and Installation

For the **Scout model**, one chrome heat shield covers each of the separate exhaust headers. The shields are retained with worm-drive type clamps. To remove a shield on either header pipe, loosen the clamps, with a flat-blade screwdriver, and remove the shield.

For the **Spirit model**, there are three sections to the chrome heat shield covering the Y-shaped exhaust header. Two sections cover the header from the cylinder exhaust ports to the intersecting joint just forward of the muffler. The shorter third section covers the joint between the exhaust pipe and muffler. All are retained with worm-drive type clamps.

Use a flat-blade screwdriver to first remove the clamp attaching the shorter section covering the muffler-to-exhaust pipe joint. Then remove the middle and forward sections. The middle section is mounted with two clamps and the forward section with three.

#### Muffler Removal and Installation

Using a flat-blade screwdriver, remove the worm clamp and the chrome heat shield covering the muffler-to-exhaust pipe.

The muffler is attached to the exhaust pipe with a pinch bolt on the muffler inlet. Remove the nut from the pinch bolt, using a 1/2" wrench.

Again using a 1/2" wrench, remove the one mounting bolt (Scout) or two mounting bolts (Spirit) attaching the muffler to the support bracket.

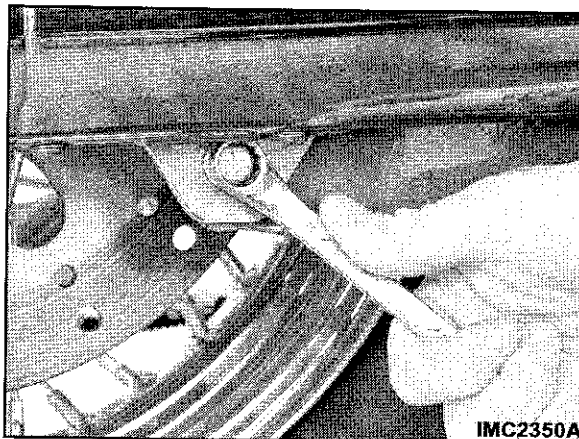


Figure 265 — Removing muffler mounting bolt

Remove the muffler from the exhaust pipe, exercising care to avoid damaging the exhaust pipe assembly.

To install the muffler, reverse the order of disassembly. Tighten the muffler mounting bolts to specification.

#### Exhaust Header Removal and Installation

##### Removal

Remove the muffler as described above.

Using a 1/2" wrench, remove the nuts retaining the exhaust header pipe flanges at the front and rear cylinders. It may be necessary to remove the heat shield(s) to gain access to the mounting nuts.

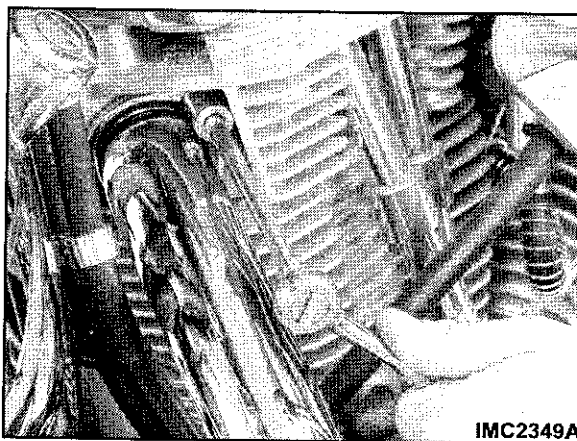


Figure 266 — Removing exhaust header pipe flange retaining nuts



Remove the header from the motorcycle.

 **Note:** The muffler and header can be removed as an assembly by removing the muffler mounting bolts at the support bracket and retaining nuts at the cylinder heads.

### Installation

Install new graphite seals in the exhaust ports of the cylinder head. The taper is positioned facing out.

Place the exhaust header in position with the pipe flanges against the seals in the exhaust ports.

Slide the split ring and flange clamp into position over the studs at the exhaust ports. Install the retaining nuts and tighten to specification.

 **Note:** Some alignment of the pipe flange to the exhaust header pipe may be required.

## ENGINE REMOVAL AND INSTALLATION

### Tools required:

5/64" hex bit  
 5/32" hex bit  
 3/16" hex bit  
 1/4" hex bit  
 5/16" hex bit  
 3/8" hex bit  
 1/2" Wrench/socket  
 9/16" Wrench/socket  
 3/4" Wrench/socket  
 1-1/2" socket  
 Drain pan  
 Engine stand, 1006T (available from JIMS®)  
 Flat-blade screwdriver, medium  
 Phillips screwdriver  
 Oil filter wrench  
 Torque wrench

### Removing Chassis Components and Engine Accessories

Using a 5/16" hex bit, remove the two screws attaching the seat to the frame. Slide the seat rearward and upward to remove.

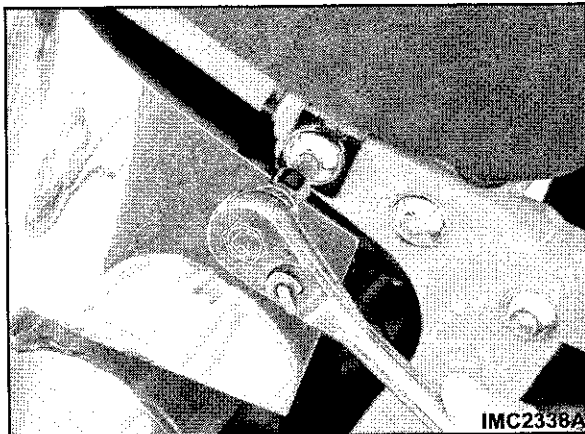


Figure 267 — Removing seat bolt

Disconnect the battery cables (negative cable first) at the battery terminals.

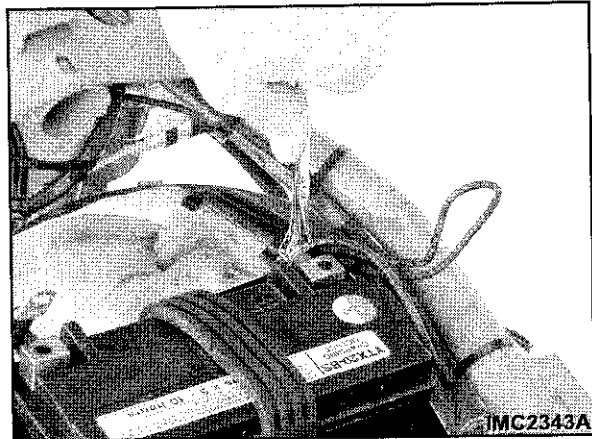


Figure 268 — Disconnecting battery

Remove the screws in the speedometer bezel and at the rear of the dash, using a 5/32" hex bit.

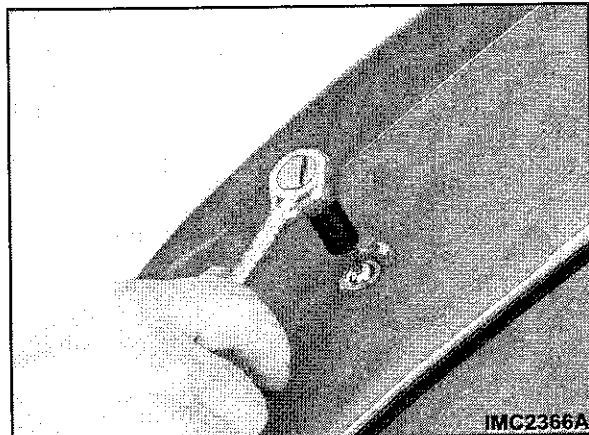


Figure 269 — Dash rear retaining screw

Raise the dash carefully and disconnect the wiring to the instruments. Remove the dash.

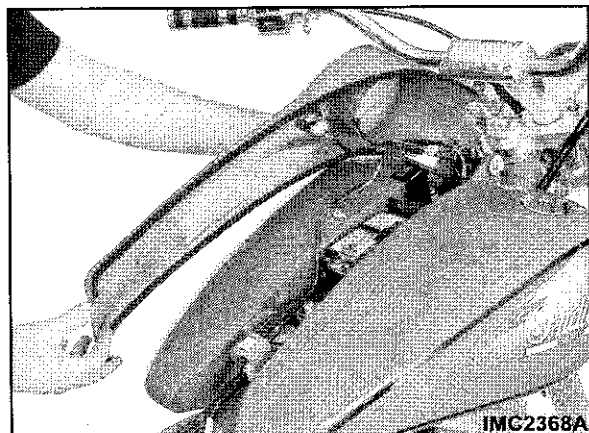


Figure 270 — Removing dash

Drain the fuel from the fuel tanks into a suitable container and then disconnect and remove the vent and crossover tubes.

Using a 3/16" hex bit, remove the two bright-finish mounting screws at the bottom front of the fuel tanks. Then, using a 1/2" wrench, remove the mounting screws at the top center and front of the tanks. Remove the tanks.

**⚠ WARNING!**

Gasoline is flammable and explosive. Work in a well-ventilated area when draining gasoline and drain it into an approved container for gasoline storage. Failure to follow this warning could result in an explosion and/or fire which can cause serious personal injury and/or death and damage to the motorcycle.

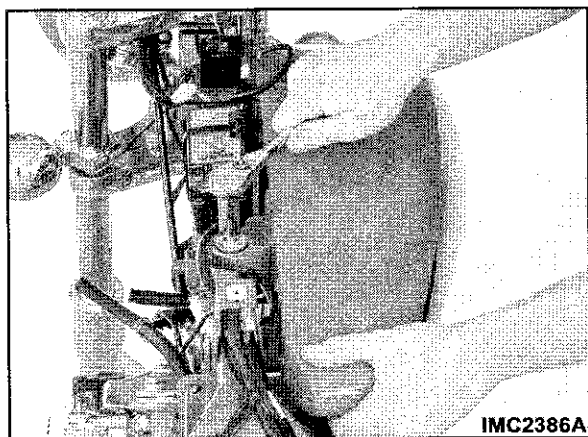


Figure 271 — Removing fuel tanks

Remove the air cleaner cover screws, using a Phillips screwdriver. Remove the cover and filter element.

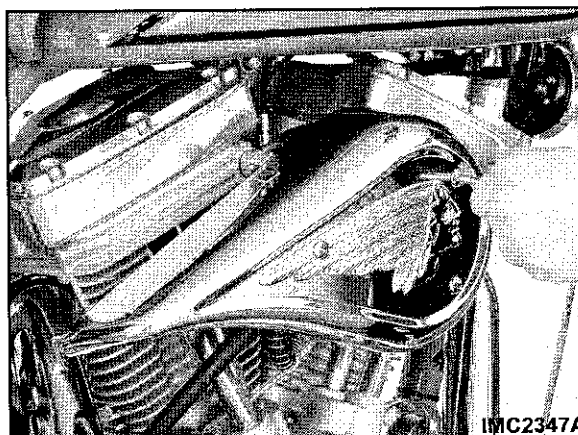


Figure 272 — Removing air cleaner cover

Using a 3/16" hex bit, remove the five screws securing the air cleaner base to the carburetor and the cylinder heads.

On California-only models, disconnect the vacuum line to the air valve diaphragm and remove the air valve assembly along with the air cleaner base.

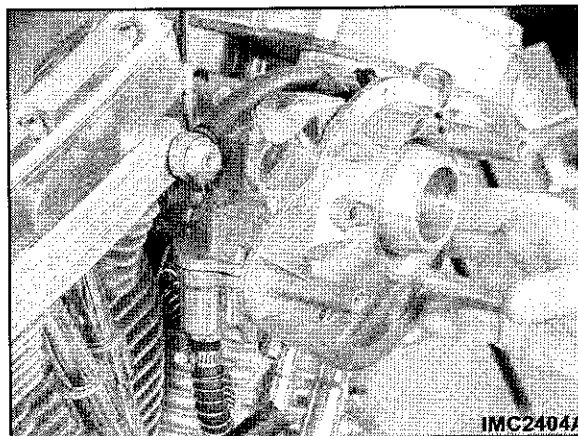


Figure 273 — Removing air cleaner base

Disconnect the throttle-control cables from the carburetor.

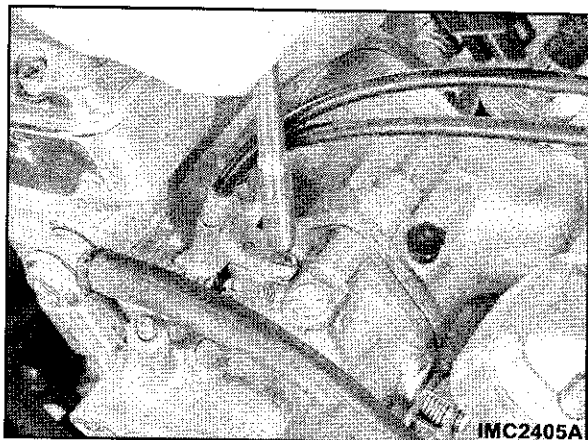


Figure 274 — Disconnecting throttle-control cables

Loosen the two screws securing the carburetor to the intake manifold, using a 5/16" hex bit. Remove the screws and the carburetor.

**Note:** The carburetor mounting screws are accessed from the back of the carburetor (engine left side).

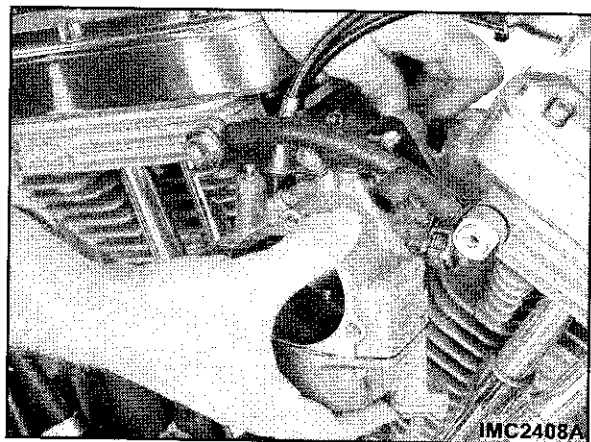


Figure 275 — Removing carburetor

Disconnect the ignition wires from the spark plugs.

Remove the upper support bracket from the cylinder heads and the frame. The ignition coil can remain attached to the bracket.

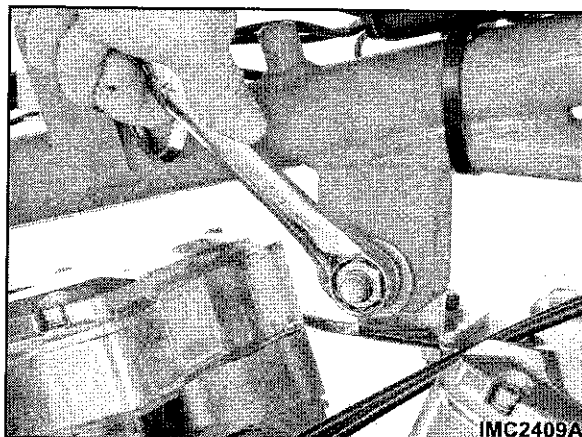


Figure 276 — Removing upper support bracket-to-frame bolt

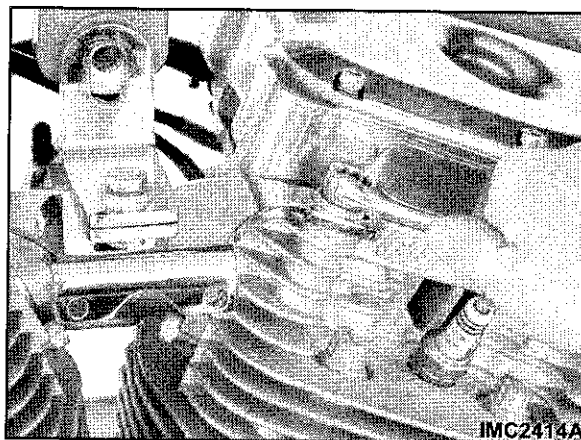


Figure 277 — Removing upper support bracket-to-cylinder head screws

Using a 1/2" wrench, remove the nuts retaining the exhaust pipe at the front and rear cylinder heads. It may be necessary to remove the heat shield(s) to gain access to the mounting nuts.

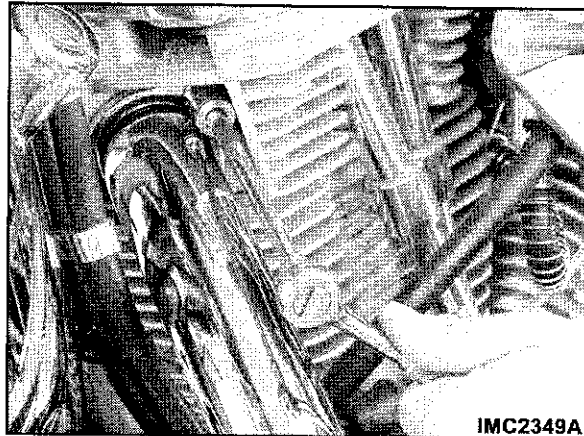


Figure 278 — Exhaust manifold retaining nuts

Using a 1/2" wrench, remove the two bolts retaining the muffler(s) to the bracket. Remove the exhaust pipe(s) assembly.

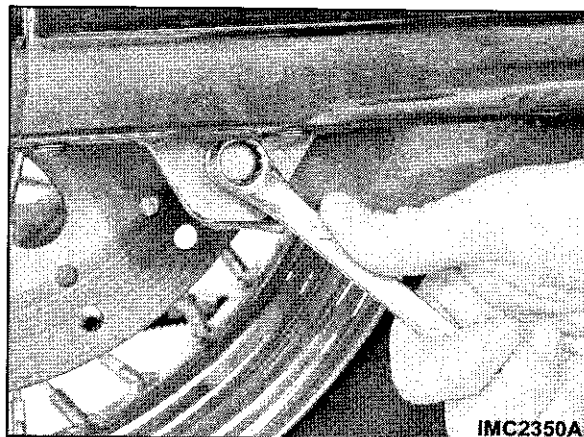


Figure 279 — Muffler retaining bolt

With the above components removed, repairs to the rocker arm/shaft assemblies, cylinder heads, cylinders, pushrods and lifter assemblies, including gasket replacement can be done in chassis as needed. Refer to the following sections for the applicable procedures:

- Rocker Box Procedures
- Pushrod and Tube Removal and Installation
- Cylinder Head Procedures
- Cylinder and Piston Assembly Procedures

## Engine Removal

If the engine is to be removed from the chassis, complete all of the steps listed under Removing Chassis Components and Engine Accessories. Then, continue with the steps below.

Place a drain pan under the drain plug at the bottom of the primary chain housing. Remove the plug, using a 3/4" wrench, and allow the oil to drain from the housing. When completely drained, replace the plug and tighten.

Place a drain pan under the engine drain plug. Remove the plug, using a 1/4" hex bit, and drain any residual oil that may remain in the crankcase. Replace the plug and tighten.

Using a flat-blade screwdriver, loosen the clamps and disconnect the oil lines at the adapter. Then, remove the oil filter and adapter assembly, using a 1/4" hex bit. Remove and discard the filter.

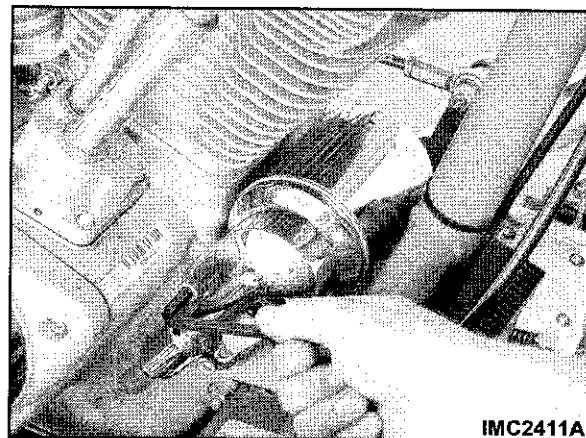


Figure 280 — Removing oil filter adapter

Disconnect the shift rod from the transmission lever, using a 3/16" hex bit.

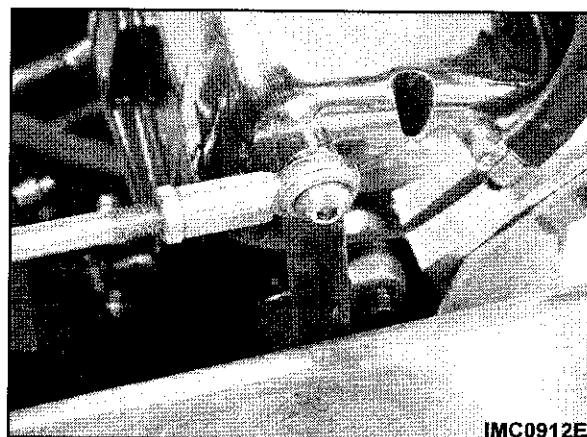


Figure 281 — Transmission shift rod

Spirit models only:

- Using a 5/16" hex bit, remove the mounting screws and remove the kickstand, left floorboard and shift pedal assembly from the frame.
- Remove the right floorboard and brake pedal assembly from the frame, using a 5/16" hex bit. Position and secure the footrest with the master cylinder attached out of way. It is not necessary to remove the brake master cylinder or disconnect the line.

Using a 3/16" hex bit, remove the 15 screws at the perimeter of the outer primary housing. Remove the outer housing. Remove the gasket or rubber seal from the housing and inspect it. Discard the gasket. The rubber seal can be reused if it is not distorted or damaged.

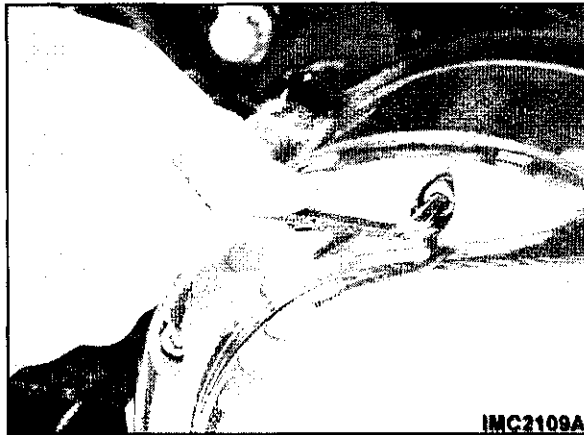


Figure 282 — Removing outer primary housing

Loosen the chain adjuster, using a 9/16" socket, and slide the adjuster down to provide maximum slack in the chain.

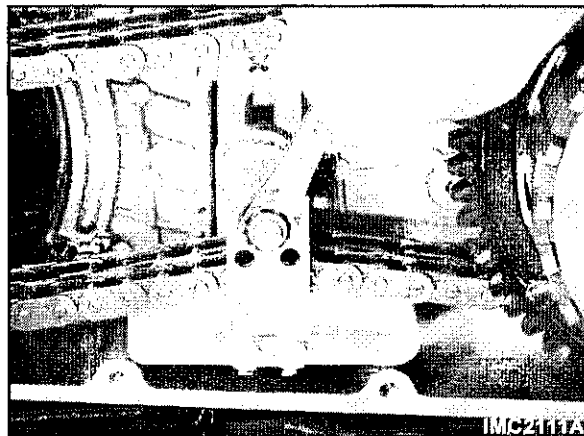


Figure 283 — Compensator sprocket and chain adjuster

Using a 1-1/2" socket, remove the compensator retaining nut and remove the assembly from the sprocket shaft.

Using a 1/2" socket, remove the four primary housing-to-engine mounting screws.

**Note:** The two inner screws are locked by tabbed washers. Bend the tabs back to unlock.

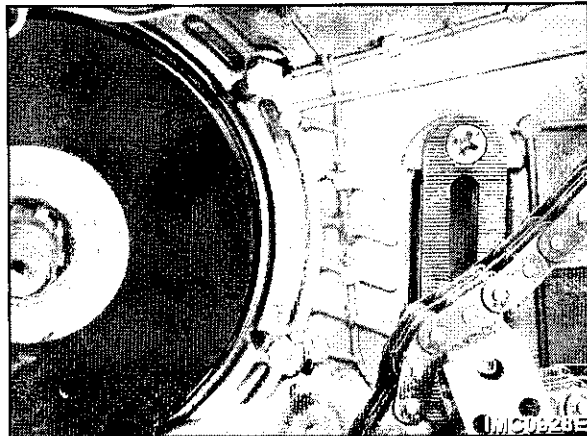


Figure 284 — Primary housing mounting screws

Disconnect the electrical leads from the oil pressure switch, the ignition module and the alternator stator and position them out of way.

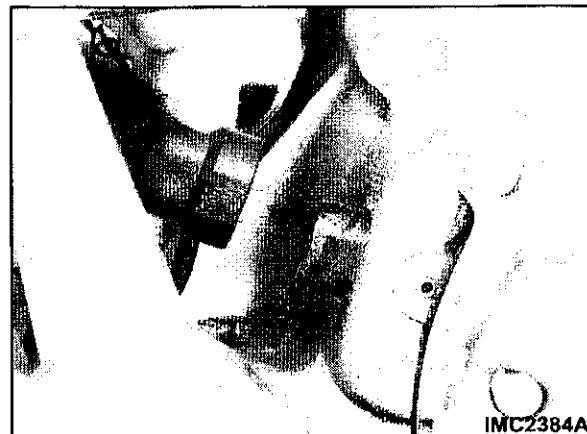


Figure 285 — Disconnecting stator leads

Remove the breather clamps and hoses from the fittings at the breather valve and the bottom of the cam gear case. Disconnect the oil supply line at the oil pump.

Disconnect the oil and vent hoses at the oil tank. Plug the hoses and oil tank fittings to prevent leaks and contamination.

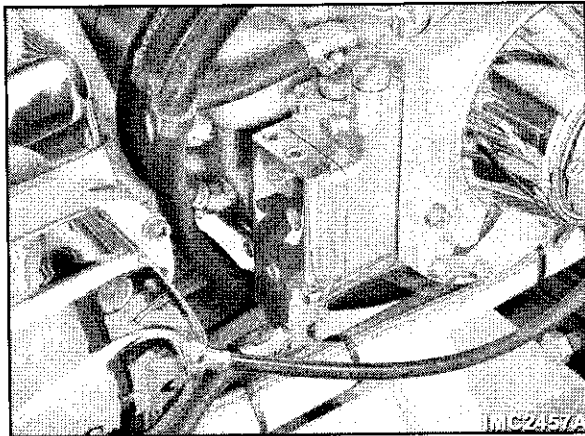


Figure 286 — Breather hoses and oil lines

Remove the front and rear engine mounting bolts, using a 9/16" socket.

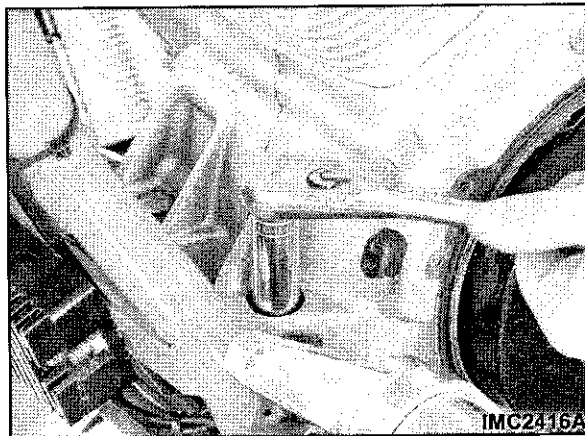


Figure 287 — Removing front engine mounting bolts

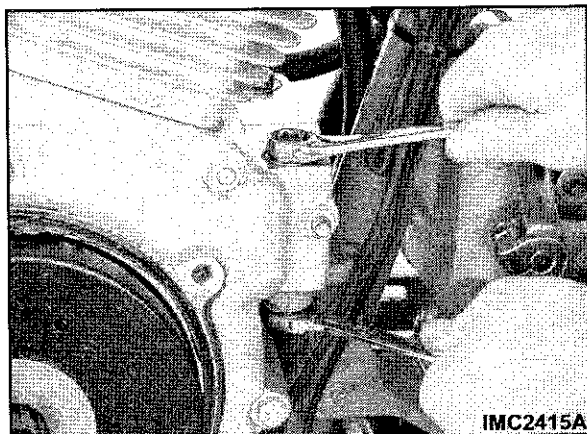


Figure 288 — Removing rear engine mounting bolts

Lift the engine from the chassis and mount it in an engine stand, JIMS® 1006T, for disassembly and repair.

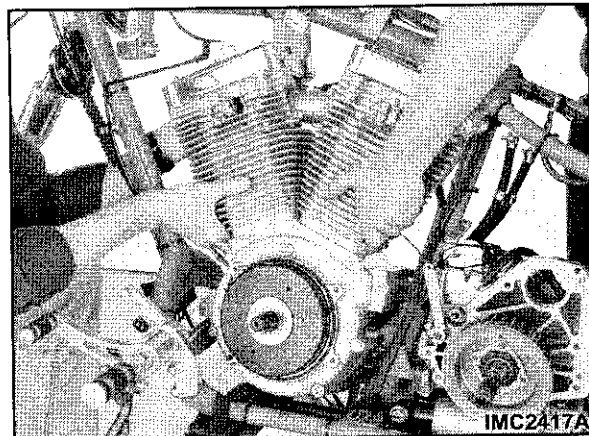


Figure 289 — Installing O-ring on crankcase

## Engine Installation

Install a new rubber O-ring in the groove on the engine-to-primary housing mounting flange on the crankcase.

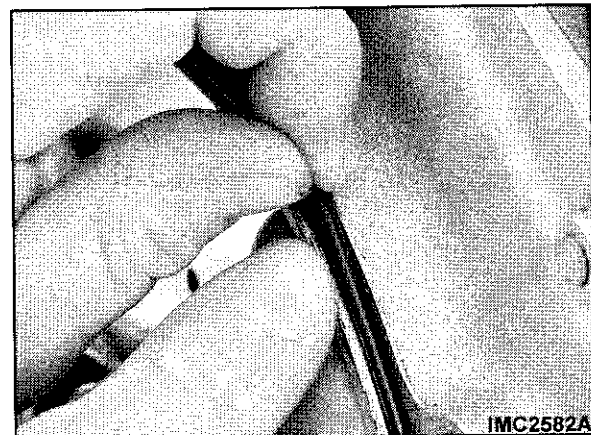


Figure 290 — Installing O-ring on crankcase

Apply a thin coat of Loctite® 598 or Permatex® ULTRA BLACK sealant to the inner seal surface of the inner primary drive housing.



Place the engine in position over the frame mounting pads making sure the sealing surfaces of the engine and primary housing are properly aligned.

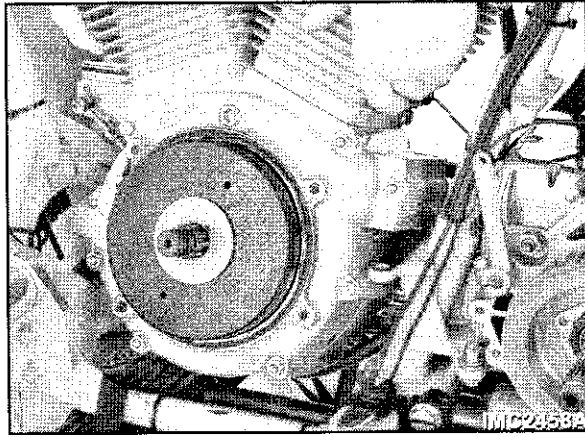


Figure 291 — Positioning engine on frame

Apply a thin coat of blue threadlock to the threads of the four engine mounting bolts. Then, loosely install the bolts. Do not tighten the bolts at this time.

**Note:** If both the engine and transmission have been removed from the frame, refer to the PRIMARY DRIVE section for the procedure covering alignment of the engine, transmission and inner primary drive housing.

Apply a thin coat of blue threadlock to the four inner primary housing-to-engine mounting screw threads. Install the screws and tabbed lockwashers, using a 1/4" hex bit. Tighten the screws to 16–18 foot-pounds and bend the washer tabs up to lock the screws in place.

Using a 9/16" socket and torque wrench, tighten the four engine mounting bolts to 33 foot-pounds.

Adjust the primary chain as follows:

- Move the adjuster up to the top notch and check for slack by pressing down on the chain in the top span.
- If the chain cannot be depressed to the specified 5/16" slack, move the adjuster down to a position where the specified slack is reached. Tighten the adjuster to specification.

Install a new rubber seal if necessary and install the outer primary housing and retaining screws, using a 3/16" hex bit. Tighten the screws to 8–10 foot-pounds.

**Note:** On models equipped with the primary housing rubber seal, the seal can be reused unless otherwise damaged. On models equipped with the primary housing flat gasket, always replace the gasket.

Spirit models only:

- Place the right floorboard and brake pedal assembly in position on the frame. Install the mounting screws, using a 5/16" hex bit, and tighten the screws to specification.
- Install the left floorboard and shift assembly in the same manner.

Apply blue threadlock to the shift rod screw. Connect the shift rod at the transmission, using a 3/16" hex bit. Tighten the screw to 13–19 foot-pounds.

Install the oil filter adapter, using a 1/4" hex bit. Tighten the screws to specification.

Install the breather hoses and clamps on the fittings at the breather valve and the bottom of the cam gear case.

Install the hoses and clamps for the oil pump and oil filter adapter. Tighten the clamps, using a flat-blade screwdriver. Reattach the oil and vent hoses to the oil tank.

Connect the electrical leads to the oil pressure switch, the ignition module and the alternator stator.

Remove the access cover in the outer primary housing, using a 3/16" hex bit. Fill the housing with 30 ounces of Indian primary oil. Replace the cover and tighten the screws to 8–10 foot-pounds.

Apply a thin coat of engine oil to the gasket and install a new oil filter.

Remove the oil fill-tube cap and check the level of oil in the tank. Replenish the oil as necessary and replace the cap.



## Installing Chassis Components and Engine Accessories

Place the upper support bracket in position and install the bracket-to-frame bolt, using a 3/4" socket and torque wrench. Tighten the bolt to specification.

Install the upper support bracket-to-cylinder head screws, using a 9/16" socket. Tighten the screws to specification.

Connect the ignition wires from the coil to the spark plugs.

Place the carburetor and a new O-ring in position on the intake manifold. Connect the enrichener- and throttle-control cables.

Place the air cleaner in position on the carburetor. Install the two screws attaching the assembly to the upper engine support bracket, using a 1/2" socket. Tighten the screws to specification. California-only versions require evaporative system wiring be reconnected.

Place the left fuel tank in position at the side of the upper frame tube and install the two top retaining screws and washers, using a 1/2" socket. Tighten the screws to specification. Install the bottom front retaining screw and bright-finish collar, using a 3/16" hex bit. Tighten the screw to specification.

Repeat the above step to install the right fuel tank.

Install the fuel crossover, vent lines and clamps. Tighten the clamps securely.

Connect the shutoff valve fuel line on the left tank to the carburetor.

Reconnect the wiring and then, position the dash over the fuel tanks and secure the panel with socket-head screws in the instrument bezel and at the rear of the panel. Using a 5/32" hex bit, tighten the rear screw to specification.

Reconnect the battery positive cable and then the negative cable to the battery terminals.

Position the seat on the frame and using a 5/16" hex bit, install the two screws to attach the seat to the frame. Tighten the screws to specification.

## ENGINE DISASSEMBLY AND ASSEMBLY

The procedures covered under Disassembly and Assembly can be done as separate operations with the engine mounted in-chassis or as a complete rebuild with the engine removed from the chassis.

If a complete rebuild is being done, remove the engine from the chassis and mount it in an engine stand, JIMS® 1006T. If a repair involves a specific operation being done in-chassis, find the appropriate procedure(s) in this section and proceed.

### Tool required:

Engine stand, 1006T (available from JIMS®)

## Rocker Box Procedures

The following procedures apply for both the front and rear rocker boxes.

### Tools required:

- 3/16" hex bit
- 1/4" hex bit
- 1/2" wrench/socket
- Torque wrench

### Removal

Using a 3/16" hex bit, remove the six screws retaining the rocker cover.

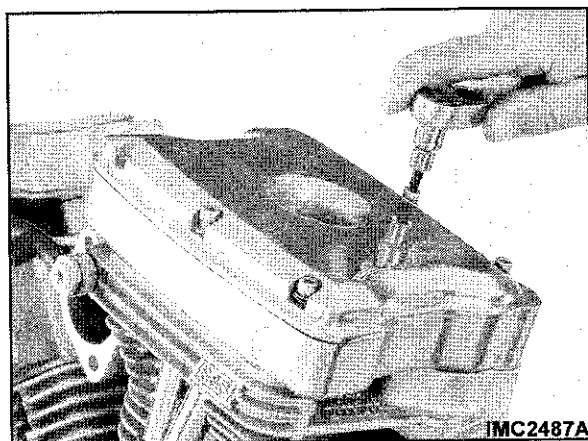


Figure 292 — Removing cover screws

Remove the cover and then remove the outer gasket from the rocker base and the O-ring seal from the center of the rocker shaft assembly.

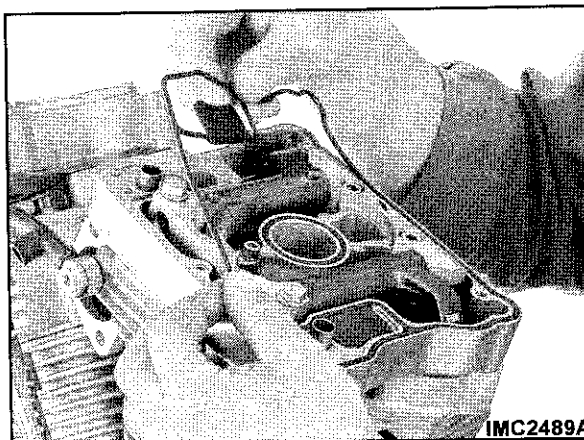


Figure 293 — Removing cover gasket

Inspect the gasket and the O-ring seal. Discard if damaged.

Using a 1/4" hex bit, remove the mounting screws from the left side of the rocker shaft assembly. Then, use a 1/2" wrench and a 3/16" hex bit to remove the screws at the right side and center of the assembly, respectively.

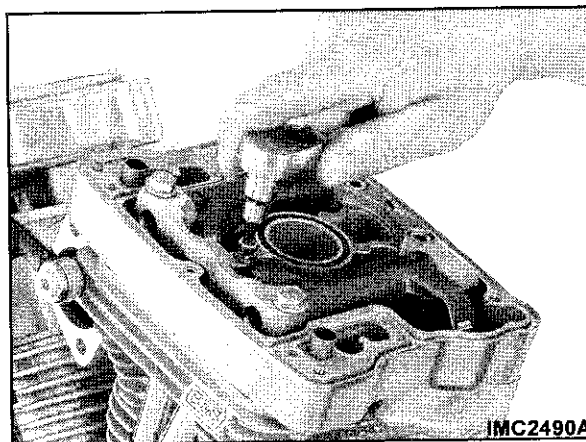


Figure 294 — Removing screws from rocker shaft assembly

If servicing the rocker shaft assembly, turn the sprocket shaft to move the pushrods upward and loosen the bracket from the rocker base. Then, remove the rocker shaft assembly from the base by prying on the support bracket to lift it off.

If the rocker shaft assembly is not being serviced, then continue by removing the four screws from the rocker base at the left side, using a 3/16" hex bit.

Remove the base and rocker shaft assembly as a unit.

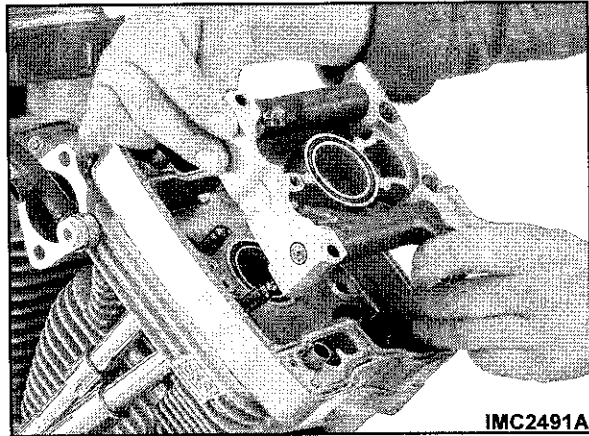


Figure 295 — Removing the rocker shaft assembly

Inspect the rocker arm shafts and bushings for wear. Replace components as necessary. (Skip this step if the rocker arms are not being serviced and the rocker box is being removed as an assembly.)

If the rocker arms are not being serviced, the rocker box base and the rocker arms can be removed as an assembly. After removing the five screws from the rocker bracket, remove the four screws retaining the rocker base to the cylinder head, using a 3/16" hex bit.

Remove the rocker base gaskets and discard them.

## Rocker Shaft Disassembly and Inspection

If not already done, remove the rocker shaft assembly from the base by prying on the support bracket to lift it off the base. There are two dowel pins at the bottom of the support bracket that align the bracket with the base.

Push the shafts out from the end of the support bracket to remove the rocker arms.

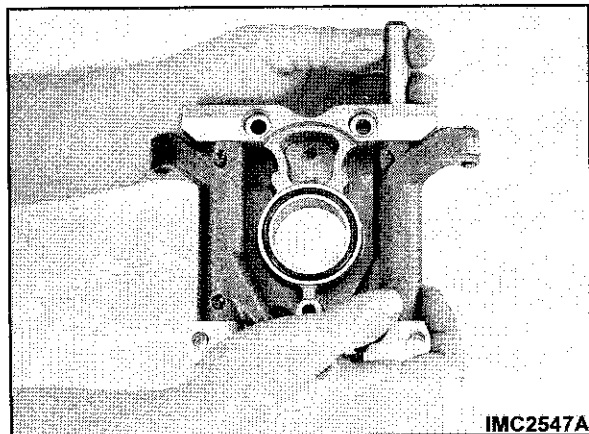


Figure 296 — Removing rocker shaft

Clean and inspect the shafts, rocker arms, bushings and support bracket.

- Check the rocker arms, shafts and support bracket for cracks, nicks or other damage. Check the contact pads and rollers for wear.
- Check the bushings for unusual wear and pitting. Measure bushing bore diameters (see Specifications). Replace as required.
- Measure the shaft diameters at contact points and the bores of the support brackets. Replace if out of specification.

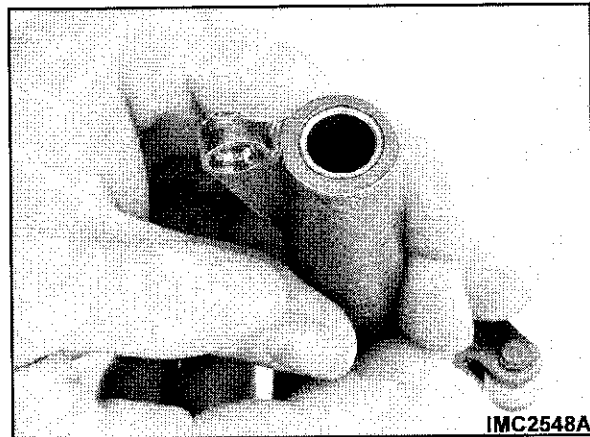
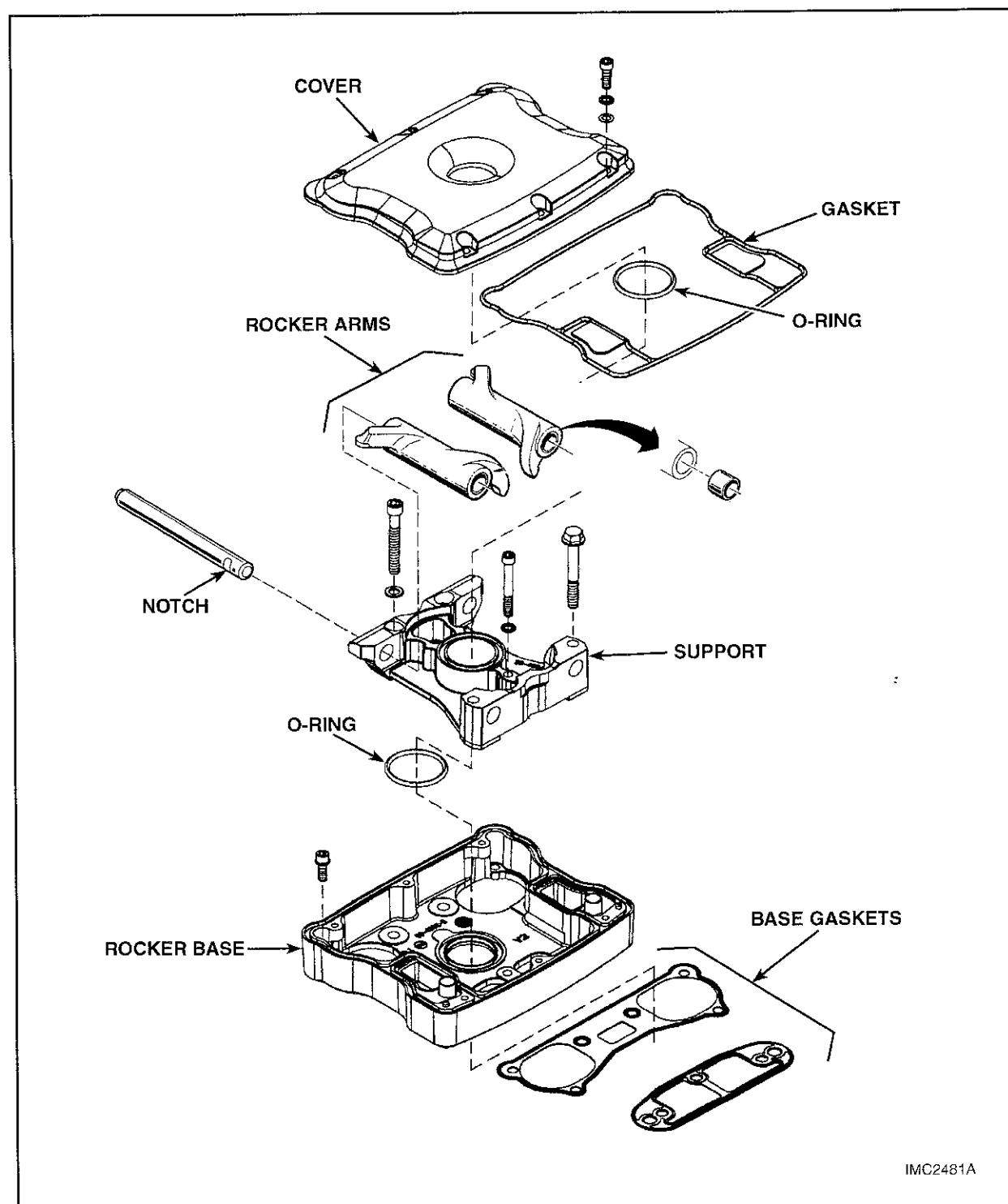


Figure 297 — Inspecting rocker shaft bushings

## Rocker Shaft Assembly

Apply clean engine oil to the rocker shafts. Place the arms in position on the bracket and insert the shafts through the bracket and arm bores.

The notched end of the shafts must be positioned at the pushrod end of the arms, where they interlock with the mounting screws at the right side of the support bracket.



IMC2481A

Figure 298 — Rocker shaft assembly

## Installation

Clean the mating surfaces of the rocker box base and the cylinder head.

Install new rocker base gaskets on the cylinder head.

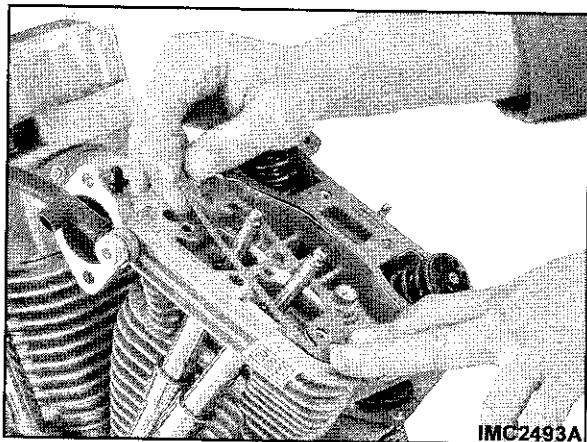


Figure 299 — Installing rocker base gaskets

Place the rocker box base (or base and rocker shaft assembly) in position on the cylinder head. Lubricate the ball ends of the pushrods before installing the rocker shaft assembly.

Lubricate the O-ring seal and install in the groove at the center of the rocker base.

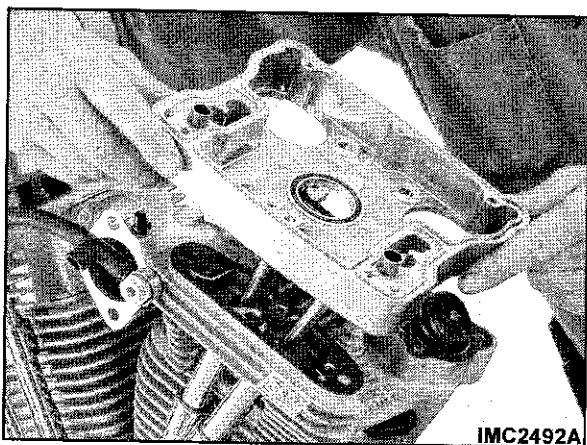


Figure 300 — Installing rocker base

Apply a thin coat of blue threadlock to the four mounting screws and install the screws in the base. Leave the screws loose at this time.

If removed for service, place the rocker shaft assembly in position on the base. Make sure that the two dowel pins are in place and that the slots in the rocker shafts are properly aligned with the mounting screw holes at the right side of the support bracket.

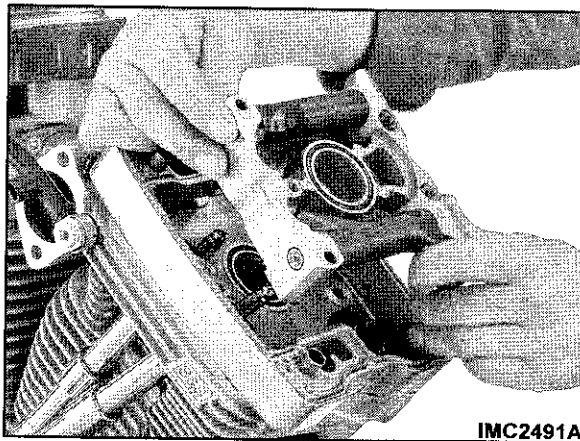


Figure 301 — Installing rocker shaft assembly

Apply a thin coat of blue threadlock to the five mounting screws and loosely install the screws in the support bracket as follows:

- Install the 2-1/4" long screws at the left side of the support bracket, using a 1/4" hex bit.
- Install the 2-1/2" screws at the right side of the bracket, using a 1/2" socket.
- Install the 2" screw in the center, using a 3/16" hex bit.

Next, tighten the screws in the rocker shaft and base to specification. Using a criss-cross pattern, tighten the outer screws in the shaft assembly to 15–18 foot-pounds. Next, tighten the screws in the center of the shaft assembly and the rocker base to 10–13 foot-pounds.

**Note:** As a general reference, screws or bolts should be tightened in a criss-cross pattern unless otherwise specified, whenever applicable.

### ⓘ CAUTION!

The piston must be at TDC (end of compression stroke) when tightening the rocker arm support bracket mounting screws so that there is minimal load on the valve springs.

Lubricate the inner O-ring cover seal and place it in the groove at the center of the rocker shaft support bracket. Then, lubricate the outer cover gasket and place it in the grooves on the rocker base.

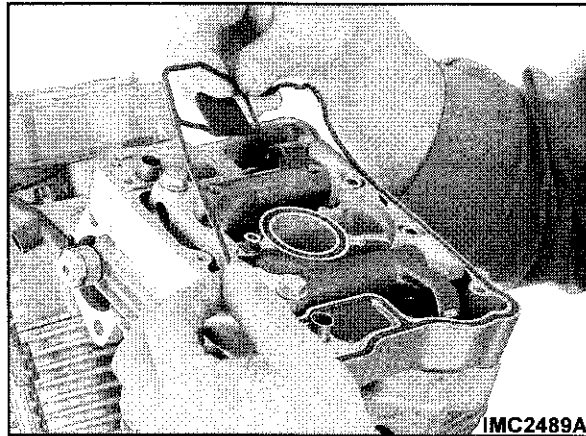


Figure 302 — Installing cover gasket

Place the rocker cover in position on the rocker base.

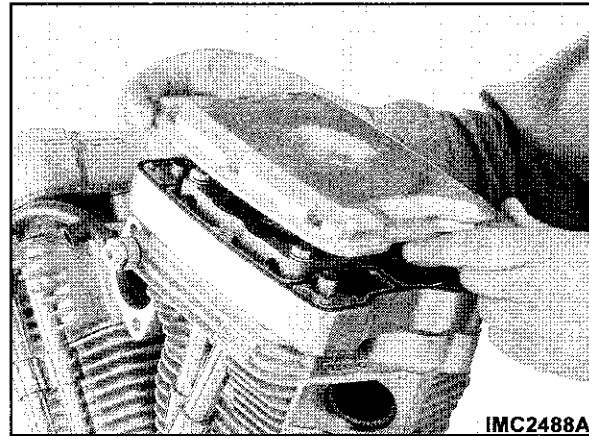


Figure 303 — Installing rocker cover

Apply a thin coat of blue threadlock to the six screws and install them in the cover along with the sealing and backup washers. Using a 3/16" hex bit and torque wrench, tighten the screws to specification, 10–13 foot-pounds.

## Pushrod and Tube Removal and Installation

### Tool required:

Small flat-blade screwdriver

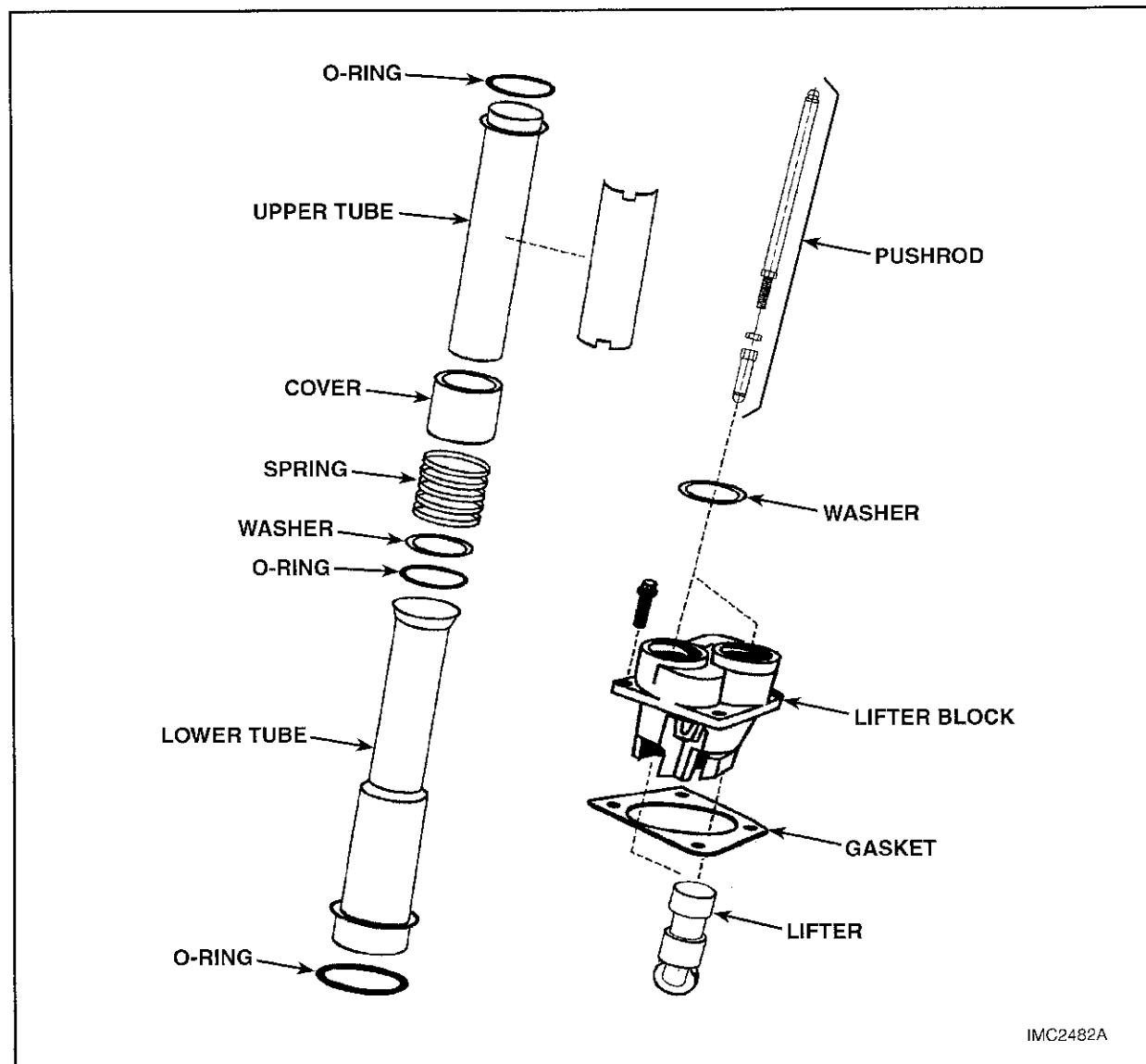


Figure 304 — Pushrod and tube assembly

## Removal

Remove the pushrods from the bores in the cylinder head. Be sure to note and mark the location of each pushrod as it is removed.

**Note:** S&S engines are equipped with adjustable pushrods. These pushrods must be checked and adjusted after the engine is reassembled. Refer to Pushrod Adjustment in this section for procedures.

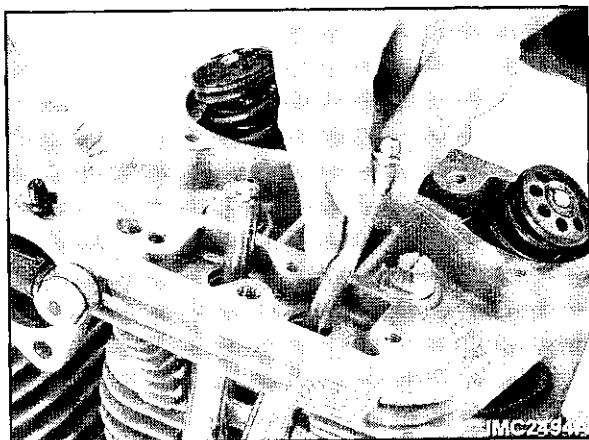


Figure 305 — Removing pushrods

**Note:** Mark the pushrods for reinstallation in the same location.

Insert a small flat-blade screwdriver in the slot at the base of the pushrod clip and pry upward to remove the clip from the pushrod tube.

**Note:** Be careful not to damage the pushrod tube.

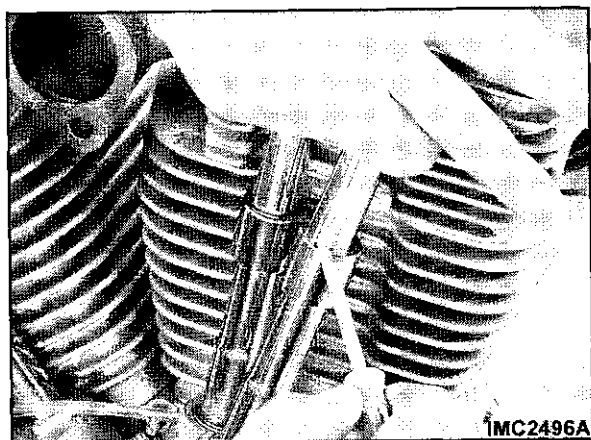


Figure 306 — Removing pushrod tube clip

With spring pressure released, slide the spring cover upward and remove the upper and lower pushrod covers. Remove the rubber O-rings (from each end) and the washer from the tube seat in the lifter block.

Inspect the three O-rings and washer and discard if damaged.

Remove the second pushrod tube repeating the previous steps.

## Installation

Place the flat washer in position on the tube seat of the lifter block.

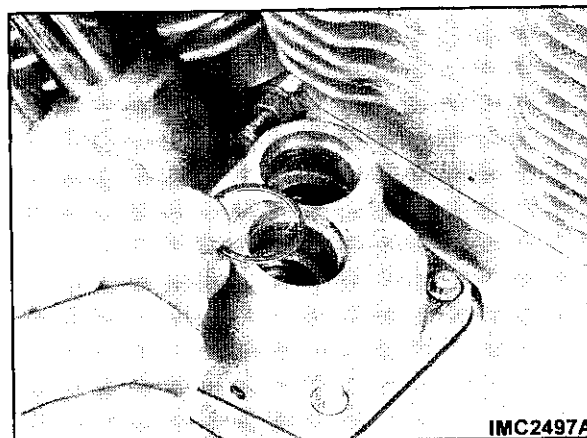


Figure 307 — Installing flat washer in lifter block

Lubricate and place an O-ring in position at the bottom of the lower pushrod tube.

Lubricate and place an O-ring in position at the top of the upper pushrod tube and slide the spring cover, spring, flat washer and lubricated O-ring in position at the lower end of the upper tube. Assemble the lower tube to the upper tube.

Install the assembly in position between the cylinder head seat and the lifter block.

Slide the spring cover down to compress the spring and install the clip.

Repeat the procedure to install the second pushrod tube.

Lubricate and install each pushrod into the bore from which it was removed.

**Note:** S&S engines are equipped with adjustable pushrods. These pushrods must be checked and adjusted after the engine is reassembled. Refer to Pushrod Adjustment in this section for procedures.



## Pushrod Adjustment

The pushrods should be checked and adjusted whenever engine service, such as replacement or removal of rocker arms, rocker shaft assembly, rocker base, cylinder head, lifter block or camshaft has been performed. Incorrectly adjusted pushrods can cause engine misfires, non-firing and lowered engine compression due to incorrect valve closure.

### Tools required:

- 3/8" open-end wrenches (3)
- 7/16" open-end wrenches (3)
- Small flat-blade screwdriver
- Motorcycle lift
- Blue threadlock

### Front and Rear Cylinder Pushrod Adjustment

Place a motorcycle lift under the transmission area of the frame and raise the motorcycle so that the rear wheel is off the ground.

Remove the pushrod tube clip of each pushrod tube, using a small flat-blade screwdriver at the base of the clip. Pry the clip up and out (all pushrods).

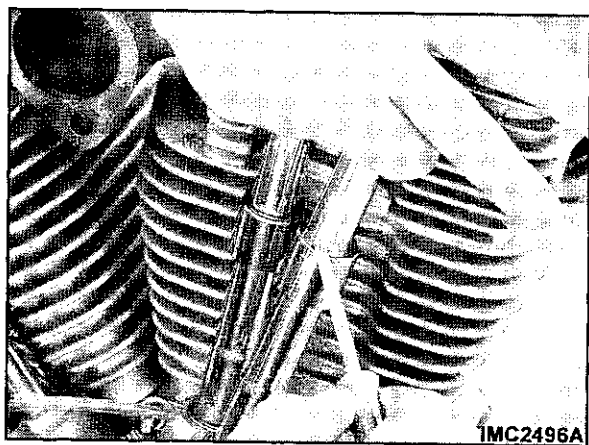


Figure 308 — Removing pushrod tube clip

With spring pressure released, slide the lower pushrod tubes upward to reveal the pushrods. Use elastic bands and clips to hold the lower tubes up and out of the way for adjustment.

Place the transmission into fifth gear and rotate the rear wheel until both front cylinder valve lifters are at the lowest point (end of compression stroke).

### ⚠ WARNING!

Let the lifters bleed down for approximately 10 minutes before rotating the engine. Rotating the engine with unbled lifters can bend valves or pushrods.

Lift the pushrod so that the ball end (top) comes into contact with the socket in the rocker arm. If the pushrod has no play, loosen the pushrod adjustment, using two 7/16" wrenches, depending on type of pushrod. The following picture shows the pushrod hex (1), the middle locknut hex (2) and the ball end adjuster hex (3).

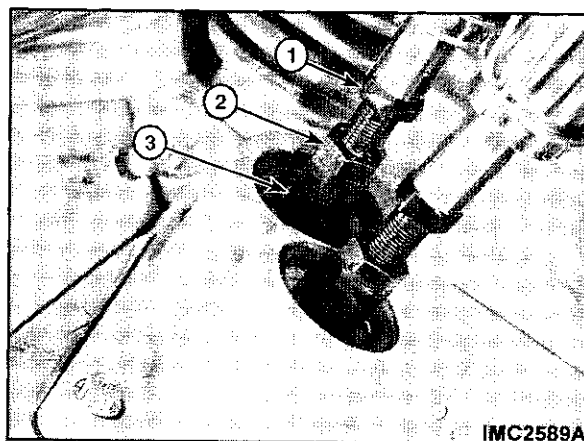


Figure 309 — Adjustment end of pushrod

With pushrod shortened to achieve end play and locknut (2) loose, lengthen the pushrod by holding the ball end adjuster (3), using either a 3/8" or 7/16" wrench, and turning the pushrod (1) with your fingers. Turn until the ball end adjuster comes into contact with the lifter socket. At this stage, there should be no slack (end play) of the pushrod and also no compression of the lifter. This is a zero lash condition.

### ⚠ CAUTION!

For lifters that have not been charged with oil (dry lifter), adjustment past the zero lash setting can cause improper adjustment of pushrod length.

Holding the ball end adjuster (3) in place with a wrench, use a second wrench on the upper pushrod hex (1), and rotate four full turns.

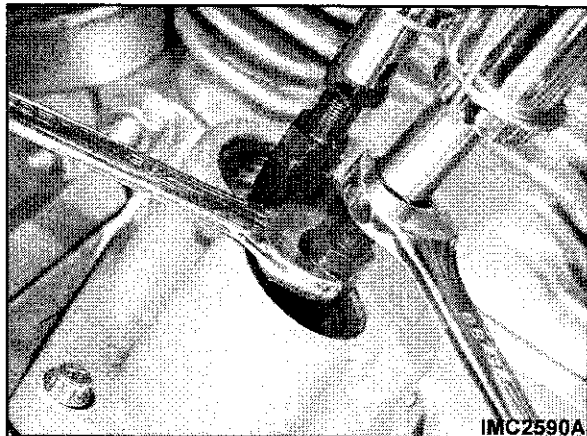


Figure 310 — Adjusting pushrod

Using a third wrench, tighten the middle locknut hex (2) against the ball end adjuster (3). When snug, tighten the locknut an additional  $1/8$  turn. DO NOT overtighten.

Repeat the above procedure for the other front cylinder pushrod.

With adjustment finished, remove the elastic bands and clips supporting the lower pushrod tubes. Lower and place the tubes into position in the lifter block. Install the upper pushrod tube clip to secure.

Perform the same service on the rear cylinder pushrods.

## Cylinder Head Procedures

The following procedures apply for both the front and rear cylinder heads.

### Tools required:

- 1/4" hex bit
- 3/8"-16 bottom tap
- 1/2" wrench
- 1/2" 12-point socket

Brass hammer

Torque wrench

Valve guide tool, 34731-84 (available from JIMS<sup>®</sup>)

Valve guide tool handle, 34740-84 (available from JIMS<sup>®</sup>)

Valve spring compressor tool, 96600-36B (available from JIMS<sup>®</sup>)

Valve spring tester, 1090 (available from JIMS<sup>®</sup>)

Valve stem guide seal protector

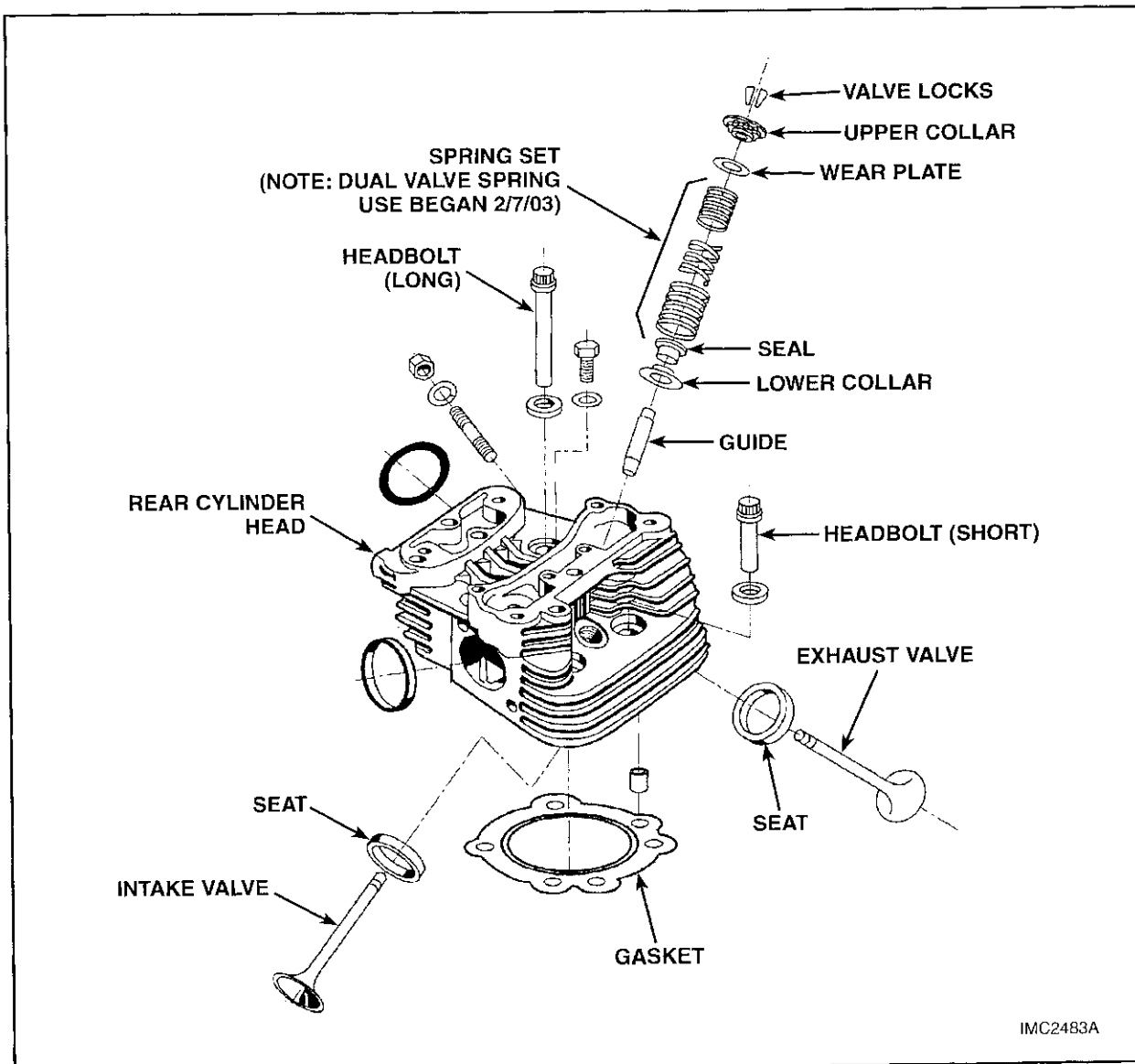


Figure 311 — Cylinder head assembly

## Removal

Remove the rocker box assembly (see Rocker Box Procedures).

Using a 1/4" hex bit, remove the outer intake manifold mounting screws from each cylinder head. Then, loosen and remove the two inner mounting screws and remove the intake manifold.

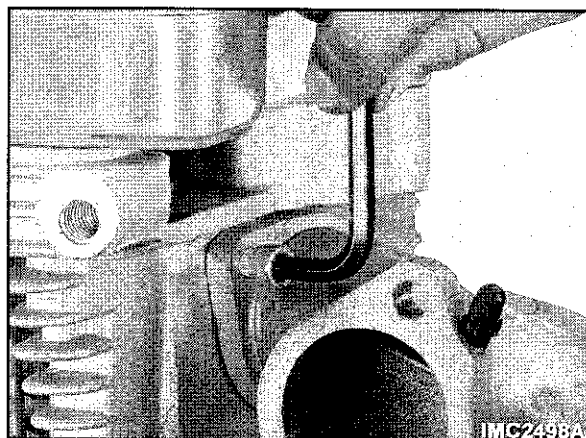


Figure 312 — Removing intake manifold screws

Using a 1/2" 12-point socket, remove the four head bolts from the cylinder studs. In removing the bolts, loosen each bolt 1/4 turn at least twice before completely removing them. This will slowly release pressure on the cylinder and cylinder head and avoid distortion.

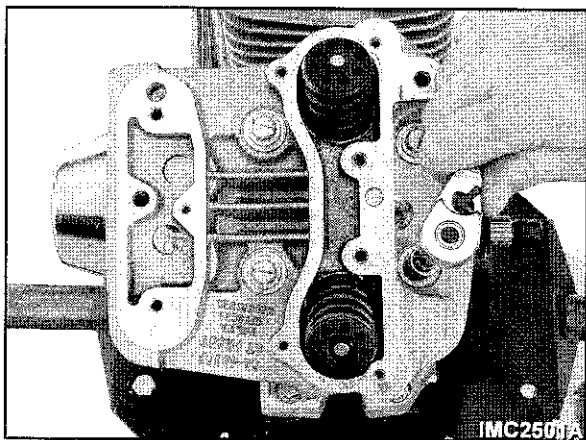


Figure 313 — Removing cylinder head bolts

Remove the cylinder head from the engine.

Remove the gasket and the two dowel pins from the cylinder. Discard the gasket.

## Disassembly

**Note:** As the cylinder head is being disassembled, mark all parts so they may be reinstalled in the same location.

To remove the valves from the cylinder head, mount the valve spring compressor tool, JIMS® 96600-36B, in a vise.

Mount the cylinder head in the tool with the collar flange positioned over the spring and the driving screw centered on the valve head. Turn the driving screw in to compress the valve spring and remove the locks from the top of the valve stem.

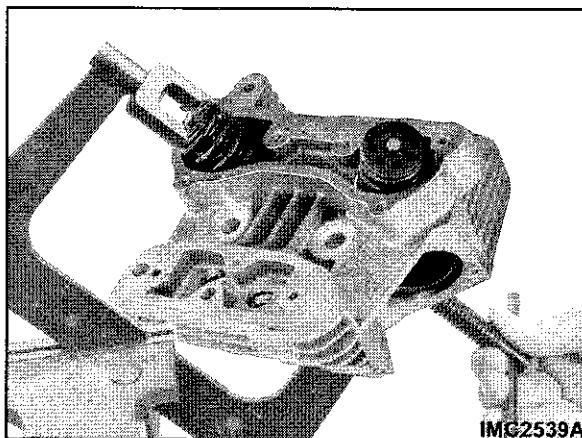


Figure 314 — Valve spring compressor tool setup (typical)

Turn the driving screw out to release pressure on the spring and remove the cylinder from the tool.

Remove the upper collar and spring set from the top of the head. Pull the valve out from the bottom.

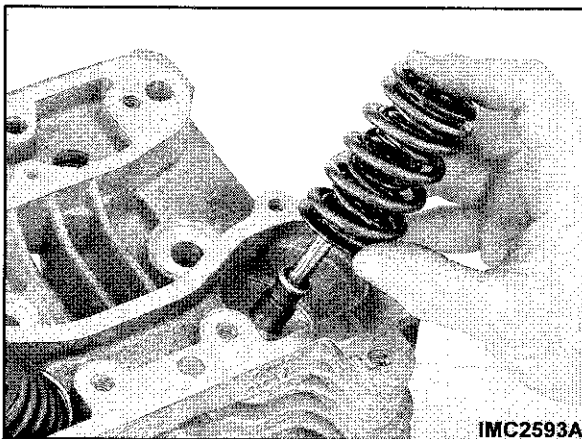


Figure 315 — Removing valve springs

Remove the valve seal and lower collar from the valve guide.

If the valve guide is to be removed, use valve guide tool, JIMS® 34740-84, and a hammer to drive the guide out from the head.

## Cleaning and Inspection

Clean the cylinder head and all associated parts including valves with a suitable non-flammable solvent. Scrape the carbon buildup from any parts using care to avoid damage. Flush with solvent to remove all traces of dirt and debris, making sure that all ports, passages, bores and threads are thoroughly clean. Dry parts with compressed air.

Inspect the valve stems and faces for wear and damage. Also, inspect the valve guides and valve seats.

Measure the following to ensure that wear limits are not exceeded (see Specifications):

- Cylinder head flatness (gasket surface)
- Valve seat width
- Valve stem protrusion from cylinder head
- Valve-to-guide clearance

If removed from the cylinder head, also measure clearances for valve guides and valve seat inserts. Check against specifications.

Refinish the valves, valve seats and guides. Replace parts if required.

Measure valve spring pressure, using a spring tester, JIMS® 1090. Replace springs if not within specification.

## Assembly

If removed, start the valve guide into the guide bore in the cylinder head. Using an arbor press and valve guide tools, JIMS® 34731-84 and 34740-84, press the guide into the head until it is properly seated.

Ream the bore of the new guides to the following specified diameters, then finish hone and thoroughly clean the bores.

- Intake guide bore diameter, 0.3108–0.3128"
- Exhaust guide bore diameter, 0.3115–0.3128"

Recut the valve seats, removing only enough material so the seats are concentric with the new finished guides. Both intake and exhaust seats should be cut to 45° with nominal seat widths of 0.052". To change the seat width to bring it within specification, or raise or lower the seat, cut the lead or trail angles as specified below. Cutting the lead angle will raise and narrow the seat. Cutting the trail angle will lower and narrow the seat.

### Intake valve seats

- Lead angle — 60°
- Seat angle — 45°
- Trail angle — 30°
- Seat width — 0.040–0.062" (0.052" nominal)

### Exhaust valve seats

- Lead angle — 52°
- Seat angle — 45°
- Trail angle — 30°
- Seat width — 0.040–0.062" (0.052" nominal)

Insert the valves and check valve stem runout and protrusion. Runout should not exceed 0.002" and protrusion should be within 1.990–2.024" from the cylinder head.

Apply a small amount of lapping compound to the valve faces and finish lapping the seats and faces. Remove the valves and thoroughly clean all parts, using care to ensure that no residue remains.

Lubricate the valve stem with clean engine oil and insert the appropriate valve into the guide from the bottom of the cylinder head. Place the seal protector tool over the valve stem. Install the lower collar. Lubricate the valve stem seal and seat and install the seal on the valve guide.

**Note:** The intake and exhaust valves are different sizes. The diameter of the intake valve is larger than the exhaust valve. Be sure that each is installed in the correct location.

Place the inner, middle and outer springs and upper collar in position over the valve stem and guide. Then, mount the cylinder head in the valve spring compressor tool, JIMS® 96600-36B.

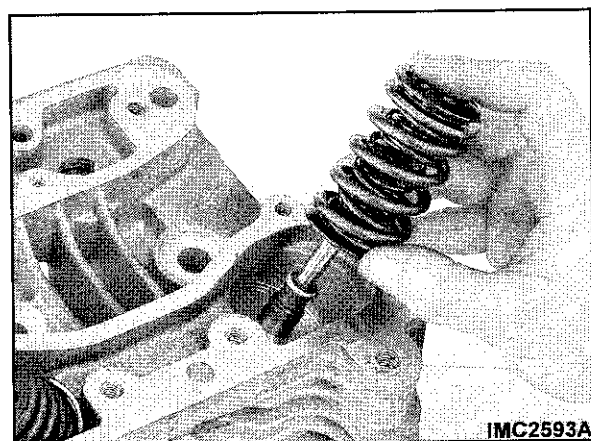


Figure 316 — Installing valve springs

Turn the driving screw in to compress the spring and install the valve locks in the grooves at the top of the valve stem. Turn the driving screw out slowly to release pressure on the spring, making sure that the locks remain in position.

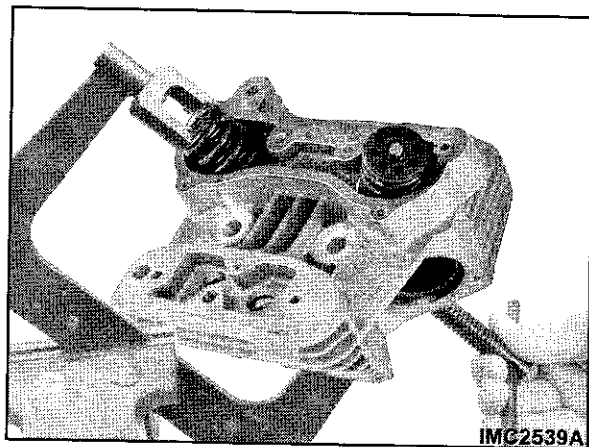


Figure 317 — Valve spring compressor tool setup (typical)

Remove the cylinder head from the tool and repeat the procedure to install the remaining valve.

## Installation

Install the two dowel pins in the cylinder and install a new head gasket, making sure the “fire ring” (wide side of metal) is facing upward.

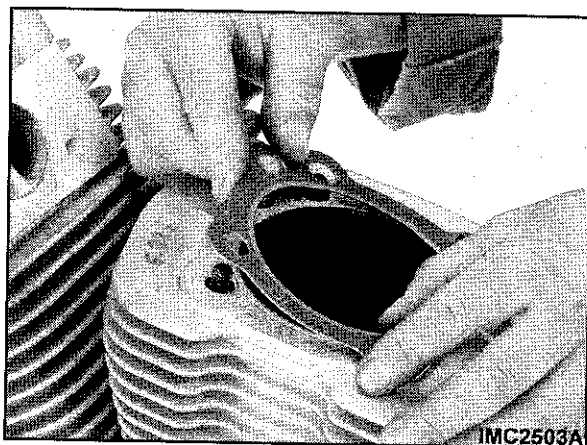


Figure 318 — Installing cylinder head gasket

Place the correct cylinder head in position on the cylinder. Front and rear cylinder heads are different and are marked with a “FRONT” or “REAR” for identification.

## ⚠ CAUTION!

Misalignment of the cylinder head can occur when it is not fully seated over the locating dowels. Ensure that the head is completely seated before installing the head bolts.

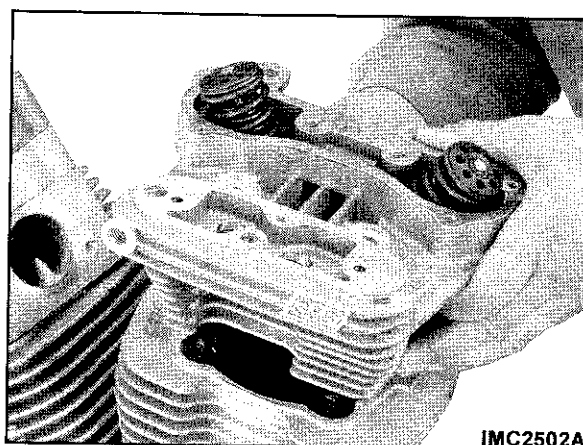


Figure 319 — Installing cylinder head

Apply a light coating of engine oil to the threads and flanges of the head bolts and loosely install the two short and two long head bolts at the proper locations.

Using a 1/2" 12-point socket and torque wrench, tighten the head bolts incrementally in three steps following a diagonal cross-head pattern as follows:

1. Lightly snug all head bolts in sequence.
2. Tighten head bolts to 8 foot-pounds in sequence.
3. Tighten head bolts to 18 foot-pounds in sequence.
4. Turn head bolts an additional 90 degrees (1/4 turn)  $\pm 2$  degrees in sequence.

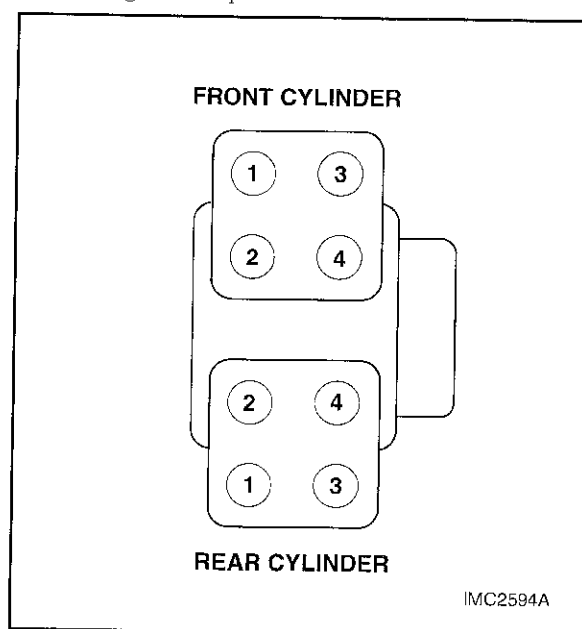


Figure 320 — Cylinder head torque sequence

Install new gaskets and then place the intake manifold in position on the cylinder heads. Install the mounting screws with blue threadlock and tighten to 16–20 foot-pounds.

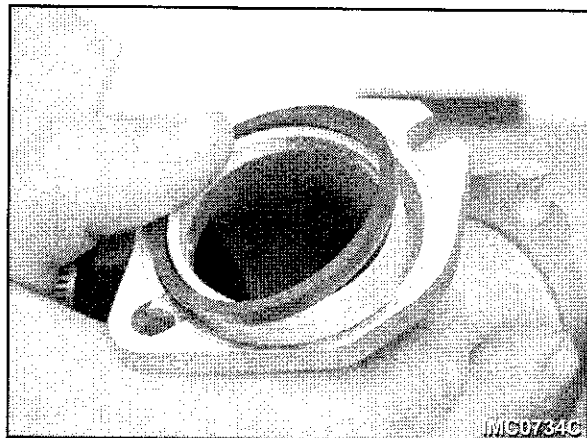


Figure 321 — Installing intake manifold gasket

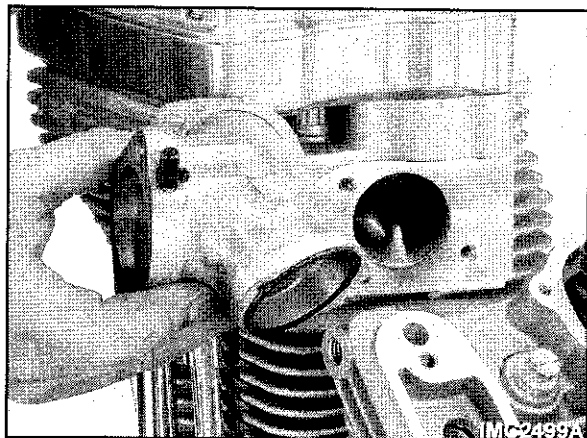


Figure 322 — Installing intake manifold

Install the support bracket (if equipped) between the manifold and the crankcase. Tighten the upper bolts and nut to 16–20 foot-pounds. Tighten the crankcase support nut to 8–12 foot-pounds.

Install the rocker box assembly (see Rocker Box Procedures).

## Cylinder and Piston Assembly Procedures

### Tools required:

- Dental pik, 2361 (available from JIMS®)
- Piston ring compressor, 1236 (available from JIMS®)
- Piston ring expander, 1235 (available from JIMS®)
- Protective tubes for cylinder studs
- Rod alignment tool, 1010 (available from JIMS®)

## Cylinder and Piston Removal

Remove the cylinder heads (see Cylinder Head Procedures).

Turn the sprocket shaft until both pistons are positioned at mid-stroke in the cylinders.

Pull the cylinder from the crankcase and studs. Use care as the piston is pulled from the cylinder so that the piston does not fall hard against the studs. It may be easier if a second technician, using a sprocket wrench, holds the crankshaft from turning and catches the piston as it drops from the cylinder.

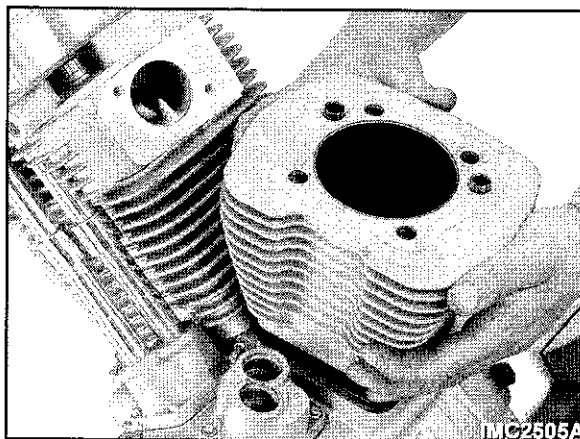


Figure 323 — Removing cylinder

Remove and discard the cylinder base gasket. Then, place protective tubing on the cylinder studs to protect the pistons from damage.

Using pliers, remove the C-clip from each end of the wrist pin. Remove the wrist pin and piston from the connecting rod.

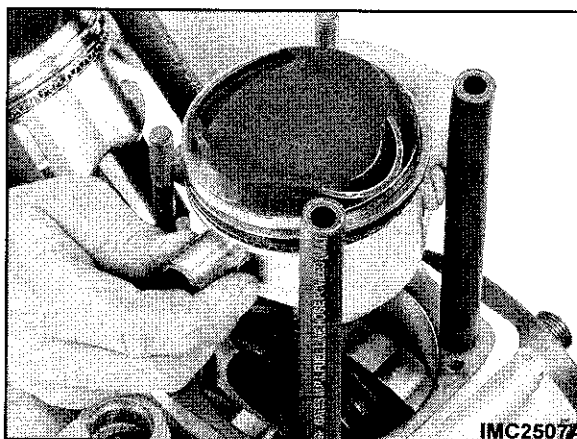


Figure 324 — Removing wrist pin and piston

Insert the rod alignment tool, JIMS® 1010, in the connecting rod wrist pin bore. The tool will hold the rod away from the crankcase and prevent damage to the case and rod.

Repeat the above steps to remove the second cylinder and piston, if required.

## Cylinder Inspection

Check that the cylinder gasket surfaces are free from burrs and scratches.

Check the cylinder-to-cylinder head and cylinder-to-crankcase gasket surfaces for flatness.

Lay a straightedge across each surface and use a feeler gauge to measure any gaps between the straightedge and the surface.

Compare the feeler gauge measurement to the flatness limit (see Specifications). If either surface is not within specification, replace the cylinder and piston.

Use a dial indicator to measure the cylinder bore and record the readings. This procedure will determine if the cylinder bore is worn or out-of-round.

Beginning approximately 0.5 inch from the top of the cylinder, measure along the top ring path. Take front-to-rear and side-to-side measurements. Repeat the measurement procedure for the center and bottom ring paths.

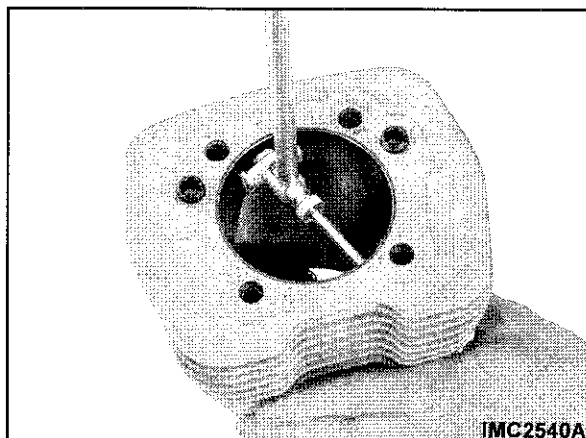


Figure 325 — Checking cylinder bore dimensions (typical)

Compare the measurements to the specified standard bore dimension (see Specifications). If the bore is worn beyond specification, or out-of-round, bore the cylinder to the next size and replace the piston.

## Piston Inspection and Ring Replacement

Use a carbon scraper to remove excessive carbon deposits from the pistons. Take care to avoid scratching the pistons.

Use an appropriate solvent to clean any remaining carbon from the pistons. Blow-dry the pistons with compressed air.

Inspect the pistons for cracks, grooves and burnt spots. Check the wrist pins for pitting and scoring.

Inspect the wrist pin bushing in the connecting rods for wear or damage. Check that wrist pin-to-bushing clearance is within specification (see Specifications). Replace worn parts as required.

Check that the wrist pin-to-piston clearance is within specification (see Specifications). Replace worn parts as required.

Check that the ring gaps of all piston rings are within specifications (see Specifications). Use the piston top surface to square each ring in the cylinder when measuring ring gaps. Replace the rings if the ring gap is not within specification.

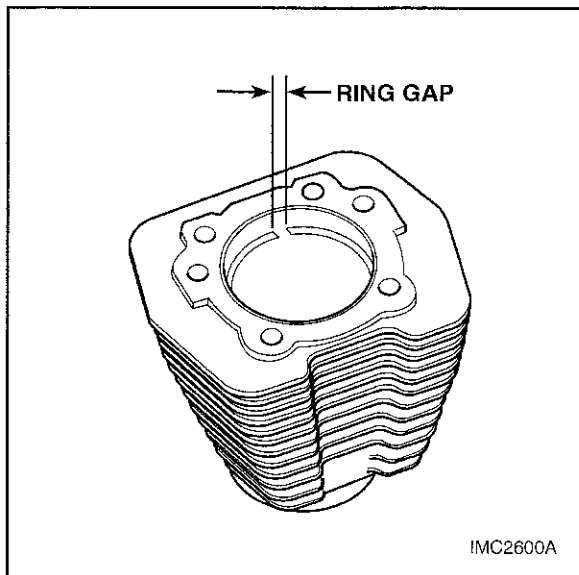


Figure 326 — Checking piston ring gap (typical)

Check the side clearance for each piston ring. Replace the rings, the piston, or both if the ring side clearance is not within specification (see Specifications).

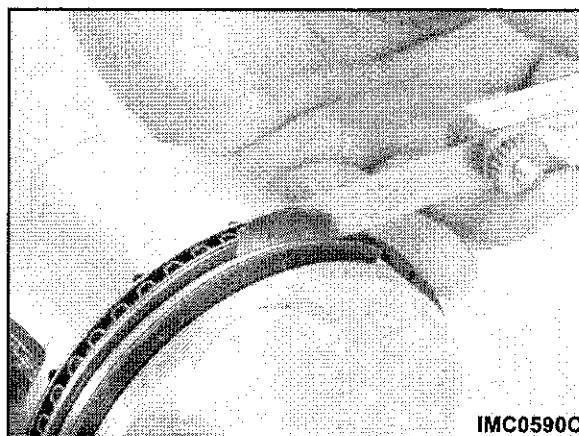


Figure 327 — Checking side clearance, piston ring to land

When installing the piston rings, stagger the ring gaps as shown in the illustration. Do not position any ring gaps in-line with the wrist pin ends.



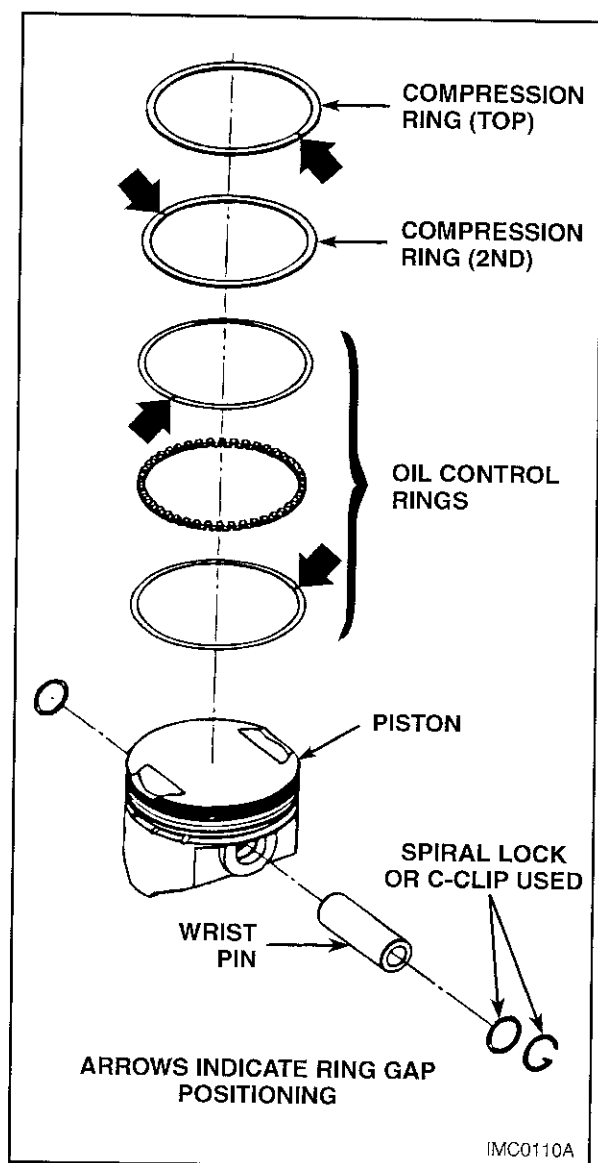


Figure 328 — Positioning ring gaps

Lubricate the rings and ring grooves in the piston with clean engine oil. Use care when installing the rings to avoid scratching the piston crown/lands or damaging the rings in any way.

Install the oil control rings first. Start by placing the separator ring at the center of the groove. Then, place one of the thin oil rings below the separator at the bottom of the groove and the second one above it at the top of the groove. Any of the oil control rings can be installed either side up.

Next, install the compression ring. The side of the ring with the dot must be installed facing up.

The top ring is installed last, with the bevel on the inner edge facing up.

## Piston and Cylinder Installation

Inspect the cylinder head studs to make sure that they are clean and undamaged. If cleaning is necessary, place clean cloths around the connecting rods and in the cylinder bores of the crankcase to protect the crankcase from falling debris. Clean the threads of the cylinder head studs, using carburetor/brake cleaner and a clean cloth. Finally, blow off any remaining debris and excess cleaner with compressed air and then remove the cloths from the crankcase cylinder bores.

Place protective sleeves on the cylinder studs to protect the pistons and rings from damage during installation.

Remove the rod alignment tool from the connecting rod. Lubricate the wrist pin and wrist pin bores in the connecting rod and piston with clean engine oil.

Starting with the front cylinder, place the piston in position on the connecting rod and install the wrist pin. Make sure that the piston is the correct one for the location and is properly oriented. The configurations of the front and rear pistons are different and are identified by "F" and "R" markings respectively, for installation in the correct cylinder. In addition, the pistons must be installed with the arrow pointing to the right (cam side).

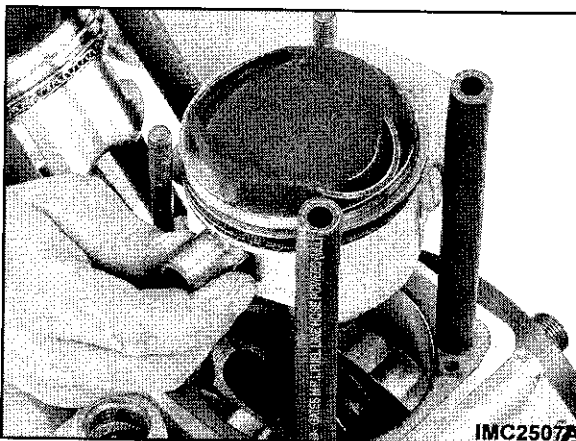


Figure 329 — Installing piston and wrist pin

Install a new C-clip at each side of the piston to retain the wrist pin in the piston bore. Position the clips with the opening (gap) facing up and make sure that they are firmly seated in the grooves.

### ⚠ CAUTION!

Use care when installing the C-clips to avoid distorting or bending them. If distorted or bent, they may not seat completely in the grooves.

Remove the protective sleeves from the cylinder studs.

Make sure the dowel pin is in position on the crankcase and install the cylinder base gasket.

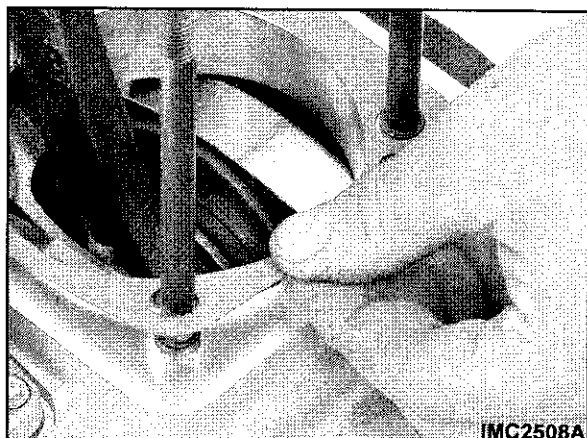


Figure 330 — Installing cylinder base gasket

Lubricate the cylinder bore, pistons and rings with clean engine oil.

Install a piston ring compressor tool, JIMS® 1236, on the piston.

With the piston positioned at mid-stroke, install the cylinder over the piston. Use a sprocket shaft socket to hold the crankshaft from turning during cylinder installation.

**Note:** The cylinders are installed with the indented side facing the cam and the machined notch of the liner facing the adjacent cylinder.

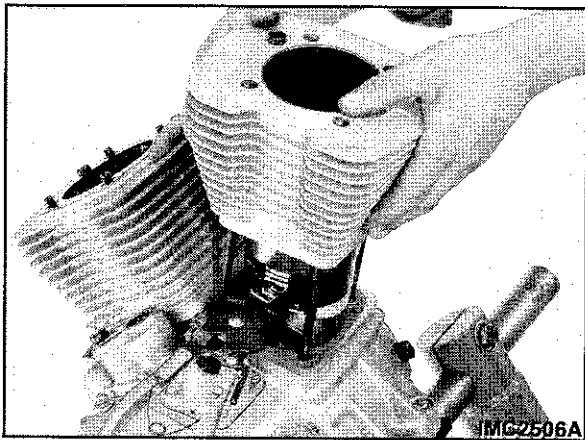


Figure 331 — Installing cylinder

Remove the piston ring compressor and then push the cylinder until it is fully seated on the crankcase.

While holding the cylinder(s) down, rotate the crankshaft to ensure there is no interference and that the rings are properly seated.

Wipe the cylinder clean and install the cylinder head (see Cylinder Head Procedures).

Repeat the above procedure for the second cylinder.

## Alternator Rotor/Stator Removal and Installation

### Tools required:

5/32" hex bit

Torque wrench

### Removal

Remove the alternator rotor from the sprocket shaft. The rotor will be held in place by the force of the integral magnets.

Using a 5/32" hex bit, remove the four socket-head screws retaining the stator to the sprocket side of the crankcase.

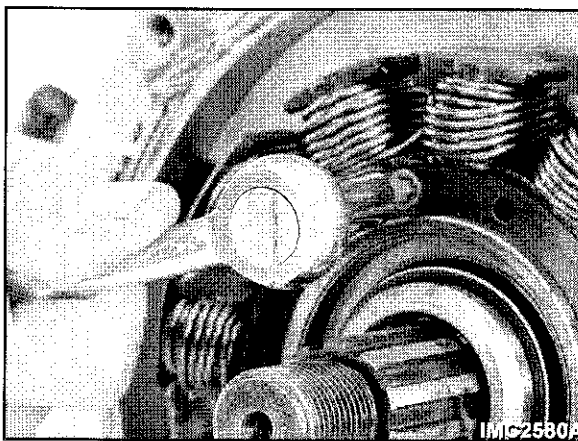


Figure 332 — Removing stator mounting screws

Remove the stator connector setscrew.

Push the stator connector through the housing flange and remove the stator.

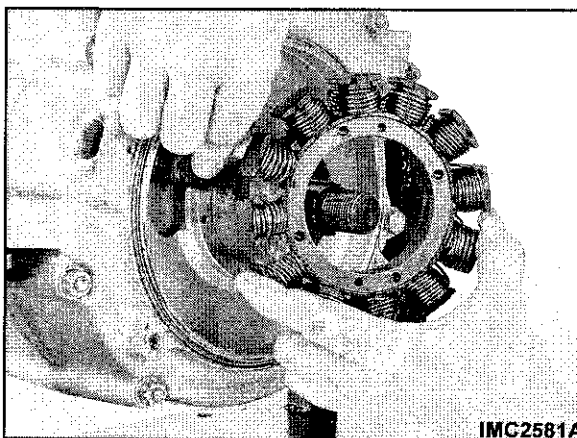


Figure 333 — Removing stator

## Installation

Apply a thin coat of clear RTV sealant around the ribs of the connector. Also apply a thin coat of sealant in the wire recess in the crankcase behind the connector.

Insert the stator connector into its bore in the flange on the sprocket side of the crankcase and press the connector into position.

Apply a thin coating of blue threadlock to the four socket-head screws.

Place the stator in position against the case and install the mounting screws. Using a 5/32" hex bit and torque wrench, tighten the screws to the specification of 8-10 foot-pounds.

Make sure the stator electrical leads are pressed against the crankcase and into the RTV sealant in the wire recess. If not positioned properly, the leads can come in contact with the rotor and become damaged.

Place blue threadlock on the stator plug setscrew. Install and tighten the setscrew to 2 to 2-1/2 turns from lightly seated.

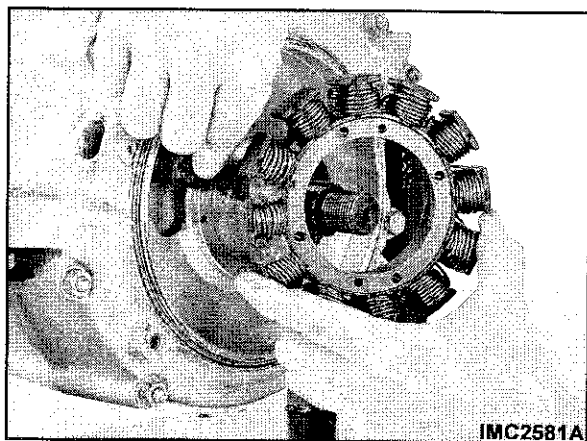


Figure 334 — Installing stator plug setscrew

## Lifter Block Removal and Installation

### Tools required:

1/4" 12-point socket

Torque wrench

### Removal

Remove the rocker box assembly, pushrods and tubes following the procedures in this guide.

Using a 1/4" 12-point socket, remove the four mounting screws from each lifter block and remove the front and rear lifter assemblies from the crankcase.

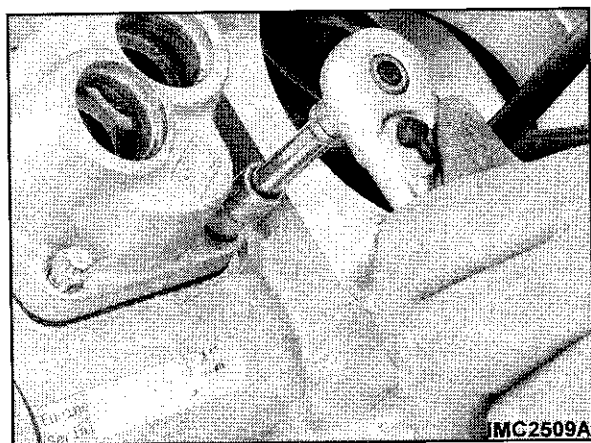


Figure 335 — Removing lifter block screws

Remove and discard the gaskets.

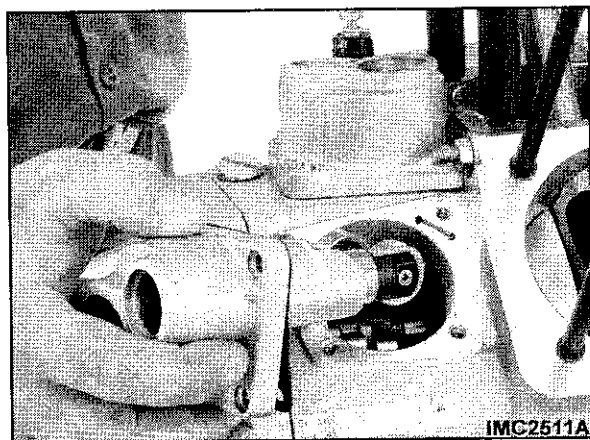


Figure 336 — Removing lifter block assembly

Remove the lifters from the lifter blocks.

Mark the lifters and lifter blocks to ensure that they are reassembled in their original locations.

### Cleaning and Inspection

Clean the lifter blocks with a suitable oil removal product.

Inspect the lifters and lifter blocks for wear or damage. Replace any lifters and lifter blocks that are damaged or show excessive wear.

Clean the lifter roller with an oil-free cleaning solution.

If a lifter is not working properly, or you think that there is dirt in a lifter, replace the lifter.

Place the lifters in a covered container filled with clean engine oil. Store the lifters in this manner until they are reinstalled on the engine.

### Installation

Place a new gasket in position on the crankcase. Make sure that the gasket is properly positioned.

Place the front lifter block assembly in position at the top of the crankcase. Install the tappet-block alignment pins, JIMS® 33443-84, in the lifter block. Install one in the screw hole nearest the oil hole in the block and the other in the screw hole diagonally across from the first.

**Note:** The front and rear blocks are not interchangeable and must be installed in the correct locations.

Apply blue threadlock to the threads of the mounting screws and install the screws in the two open holes, using a 1/4" 12-point socket. Remove the alignment pins and install the two remaining mounting screws. Tighten the screws to 10–12 foot-pounds.

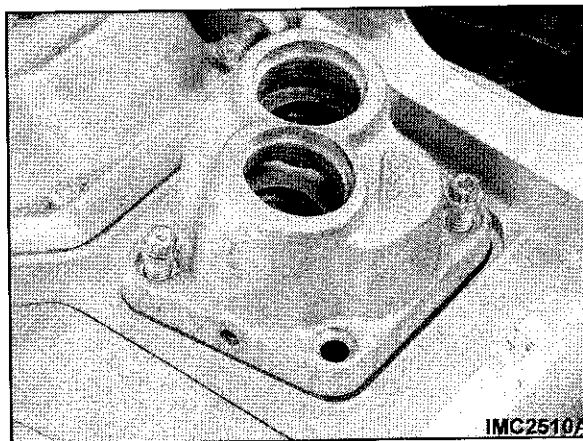


Figure 337 — Installing lifter block assembly

Repeat the process to install the rear lifter block assembly.

## Ignition Trigger Plate/Rotor Removal and Installation

### Tools required:

- 3/32" hex bit
- 3/16" hex bit
- 5/16" wrench/socket
- Flat-blade screwdriver
- Torque wrench

### Procedure

Remove the two outer ignition cover screws, using a 3/32" hex bit. Remove the outer cover and discard the gasket.

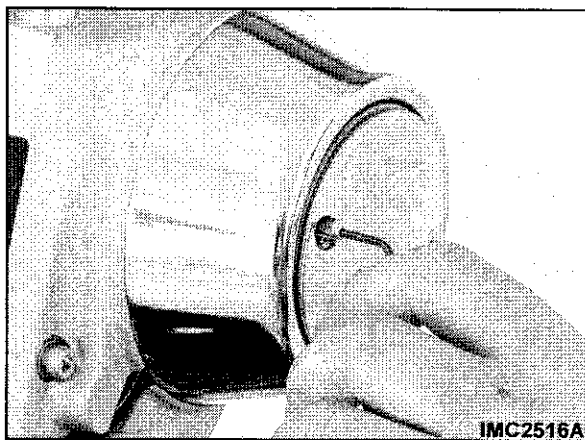


Figure 338 — Removing outer ignition cover screws

Twist the inner ignition cover to the right or left to disengage the hold-down tabs. Remove the inner ignition cover and the tapered flangeless cover. Discard the large circular gasket.

Using a 3/16" hex bit, remove the screws and retainer plate securing the ignition wire harness at the bottom of the cam cover.

Using a flat-blade screwdriver, remove the two cylindrical-head screws retaining the trigger plate to the cam cover. Remove the trigger plate and wire harness.

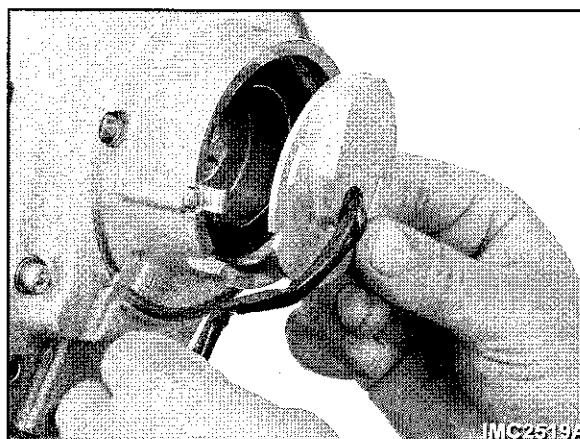


Figure 339 — Removing trigger plate

Remove the screw from the ignition rotor, using a 5/16" socket, and remove the rotor.

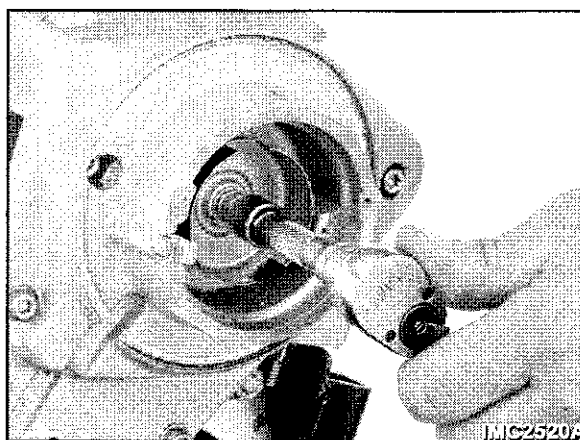


Figure 340 — Removing ignition rotor

Inspect the leads and connector for the sensor sealed in the trigger plate. If damaged, repair or replace as necessary.

Position the rotor on the end of the camshaft with the alignment tab in the shaft slot. Install the screw, using a 5/16" socket. Tighten the screw to specification, 6–8 foot-pounds.

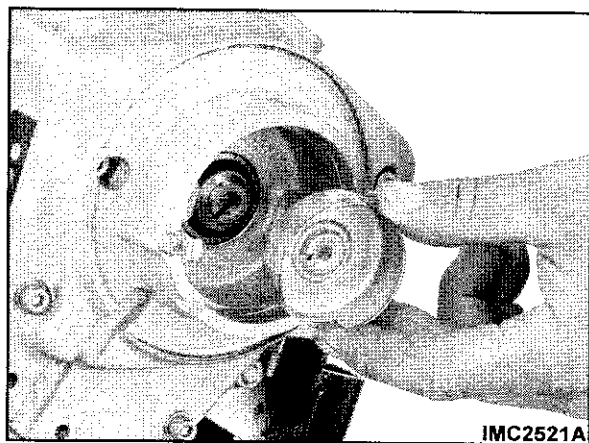


Figure 341 — Installing ignition rotor

Install the trigger plate on the cam cover housing and tighten the two cylindrical-head screws, using a flat-blade screwdriver. Route the wire harness through the channel in the housing and install the retainer plate to secure the harness. Tighten the retainer plate screws to 8–10 foot-pounds, using a 3/16" hex bit.

Place a new gasket and the tapered flangeless cover in position on the cam cover. Then install the inner ignition cover over the flangeless cover and twist it to engage the hold-down tabs.

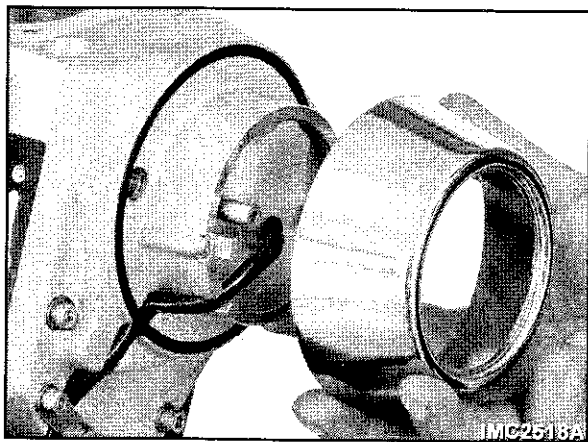


Figure 342 — Installing flangeless cover

Place a new gasket in position and install the outer ignition cover. Apply blue threadlock to the threads of the cover screws and install the screws. Tighten the screws to 10–15 inch-pounds. Do not overtighten the screws.

**Note:** Engine will require retiming.

## Cam, Breather Valve and Pinion Gear Removal and Installation

### Tools required:

3/16" hex bit

Mainshaft sprocket locknut wrench, 94660-37A (available from JIMS®)

Pinion gear nut socket, 94555-55A (available from JIMS®)

Pinion gear installer/puller (available from JIMS®)

Screw, 96830-51-2

Puller, 96830-51-3

Pinion gear locking tool, 2237 (available from JIMS®)

Small hammer and drift

### Removal

Remove the rocker box assemblies, pushrods and tubes, lifter block assemblies and ignition cover and rotor following procedures covered earlier in this section.

Remove the six perimeter screws and washers attaching the cover to the crankcase.

**Note:** The two perimeter screws that also secure the wire harness retainer plate may have been removed with the removal of the trigger plate.

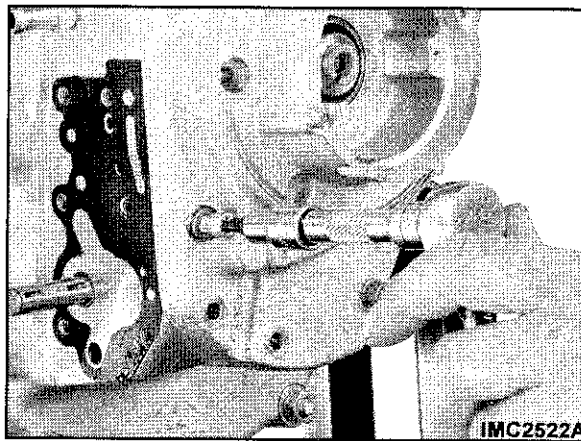


Figure 343 — Removing cam cover

**Note:** If the engine is not being disassembled and only the breather valve or cam is to be removed, then align the timing marks on the gears before removing the breather valve or cam. This makes installation easier.

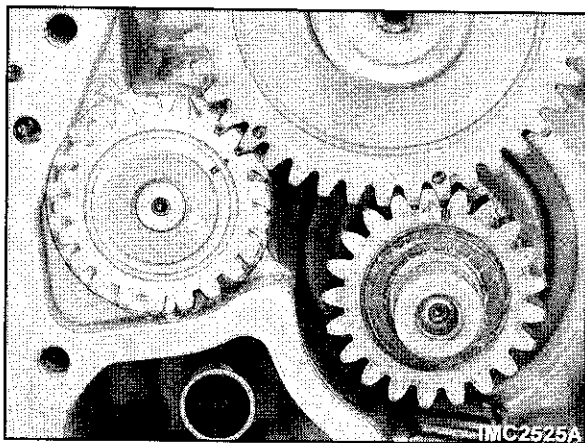


Figure 344 — Timing marks aligned

Pull the cam assembly, shim and thrust washer from the camshaft bearing bore.

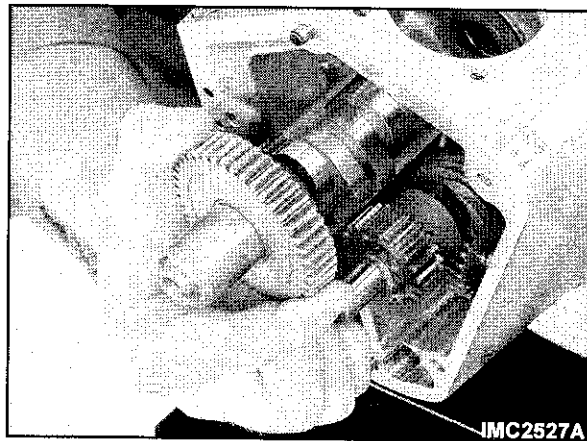


Figure 345 — Removing cam assembly

Remove the thrust washer from the end of the breather valve, and then remove the valve from its bore in the crankcase.

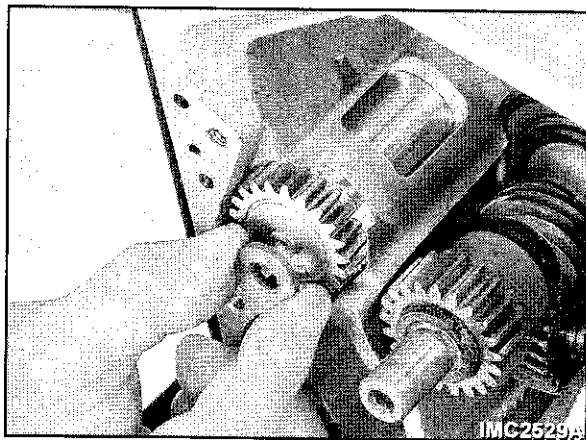


Figure 346 — Removing breather valve thrust washer

To remove the pinion gear nut, the crankshaft must be locked in position. Use a mainshaft sprocket locknut wrench, JIMS® 94660-37A, to keep the crank assembly from turning or use a pinion gear locking tool, JIMS® 2237.

Use the pinion gear nut socket, JIMS® 94555-55A, to loosen and remove the nut.

**Note:** The pinion gear nut is a left-hand thread. To remove, turn the nut in a clockwise direction.

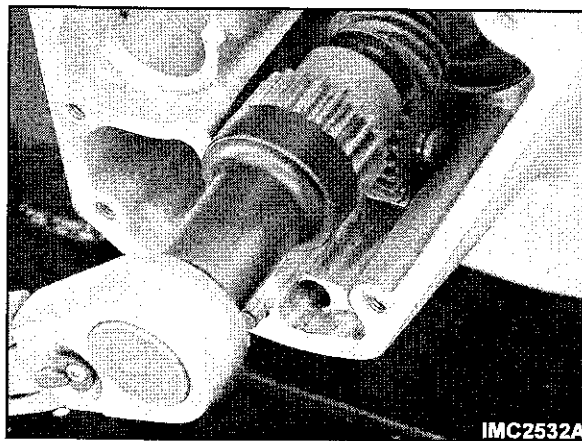


Figure 347 — Removing pinion gear nut

To remove the pinion gear, install the pinion nut puller and screw, JIMS® 96830-51-3 and 96830-51-2, as shown. Remove the gear from the pinion shaft.

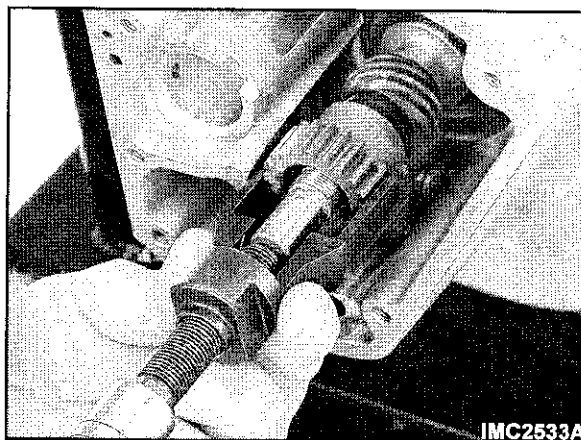


Figure 348 — Removing pinion gear

Use a small hammer and drift to drive out the key from the pinion shaft.

Remove the spacer and oil pump drive gear.



Figure 349 — Removing spacer and oil pump drive gear

Clean and inspect the components and replace as necessary.

## Installation

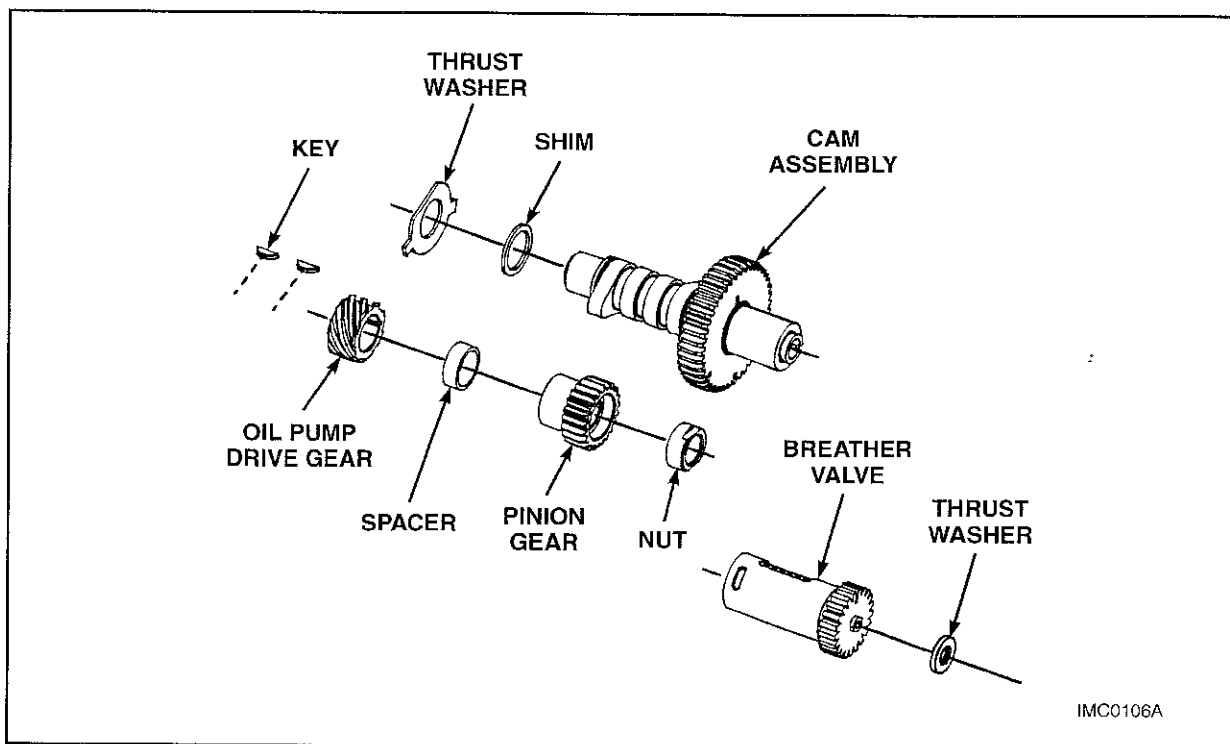


Figure 350 — Pinion shaft, cam and breather valve assemblies

Install the inner key, oil pump gear, spacer, outer key and pinion gear on the pinion shaft.

Apply a thin coating of red threadlock to the threads on the pinion shaft. Make sure the threads of the shaft are thoroughly clean before applying threadlock. Install the nut on the pinion shaft and using the pinion gear nut socket, JIMS® 94555-55A, tighten the nut to 35 foot-pounds.

Use a pinion gear locking tool, JIMS® 2237, to keep the shaft from turning.

**Note:** The pinion gear nut is a left-hand thread. To install, turn the nut in a counterclockwise direction.



Install the shim and thrust washer on the camshaft. Install the thrust washer with the beveled side facing the inside of the case and the flat edge facing the rear lifter block mounting hole.

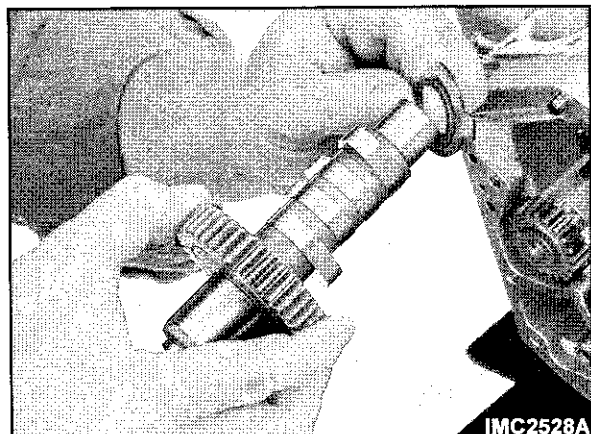


Figure 351 — Installing shim and thrust washer

Lubricate the pilot bearing in the crankcase and the end of the camshaft. Align the timing marks on the pinion and camshaft gears and install the camshaft into the pilot bearing.

Lubricate the breather valve and install the valve in its bore in the crankcase.

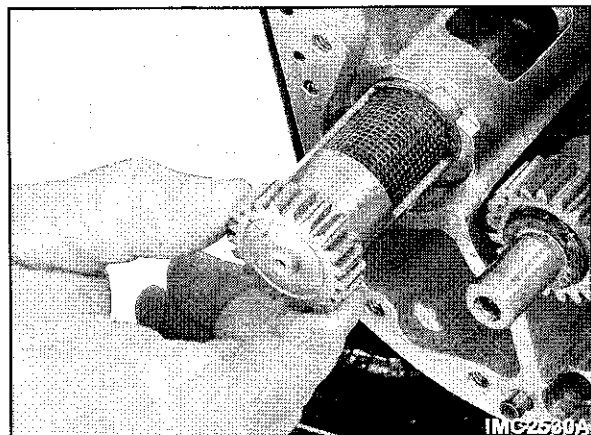


Figure 352 — Installing breather valve

Make sure that the timing marks of the breather valve and camshaft gears are properly aligned.

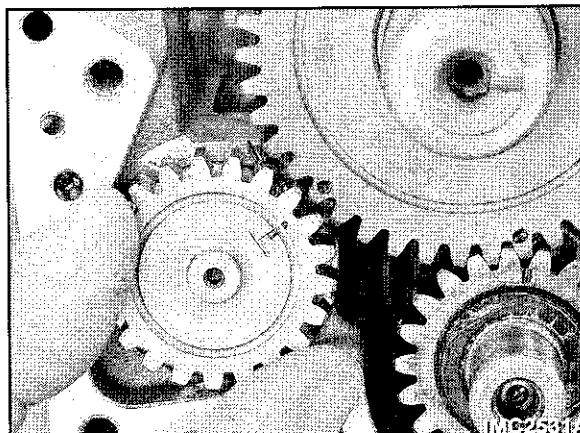


Figure 353 — Timing marks properly aligned

Lubricate and install the thrust washer on the breather valve gear. Lubricate the ends of the cam and pinion shafts.

Check that the two dowel pins are in place on the sealing surface of the cam gear case. Place a new gasket on the gear case.

Apply blue threadlock to the threads of the cam cover mounting screws. Install the cam cover and the six screws around the perimeter of the cover. Tighten the screws to 10–12 foot-pounds. DO NOT tighten the two screws securing the wire harness retainer plate at this time.

Check camshaft end play as follows:

- Slide the camshaft against the cam cover.
- Measure end play with a gap gauge inserted between the camshaft shoulder and shim at the pilot bearing end.
- If end play is not within specification, remove the cam cover and camshaft. Install a properly sized shim to bring the end play within specification and recheck.

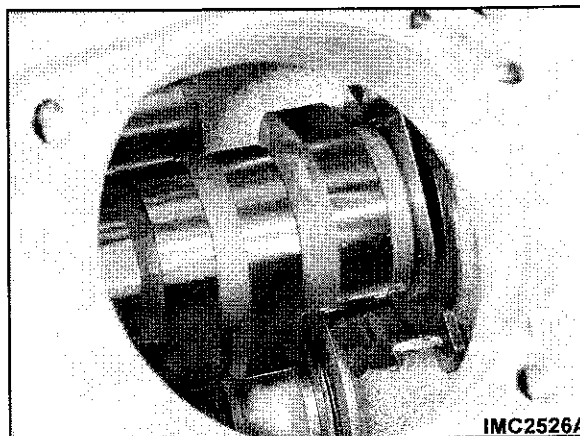


Figure 354 — Measuring camshaft end play

## Crankcase Disassembly and Assembly

### Tools required:

7/16" wrench/socket

1/2" wrench/socket

Brass hammer

Cam bearing tool, 97272-60 (available from JIMS®)

Crank disassembly-removing tool, 1047-T'P  
(available from JIMS®)

Drift

Flywheel rebuilding jig, 1071 (HD 09-1194) (available from JIMS®)

Snap ring pliers

Sprocket shaft bearing installation tool set, 97225-55  
(available from JIMS®)

Sprocket shaft bearing removal tool set, 1045-IS  
(available from JIMS®)

Sprocket shaft holder, 1034 (available from JIMS®)

Sprocket shaft seal installation tool, 39361-69  
(available from JIMS®)

Torque wrench

**Note:** S&S engines use four locator bolts to align the cases. A slight interference fit between bolt and case hole maintains case alignment. These bolts must be driven out, using a drift and hammer.

### Disassembly

Mount the sprocket shaft holder, JIMS® 1034, in a vise. Place the crankcase assembly, sprocket shaft down, in the holder.

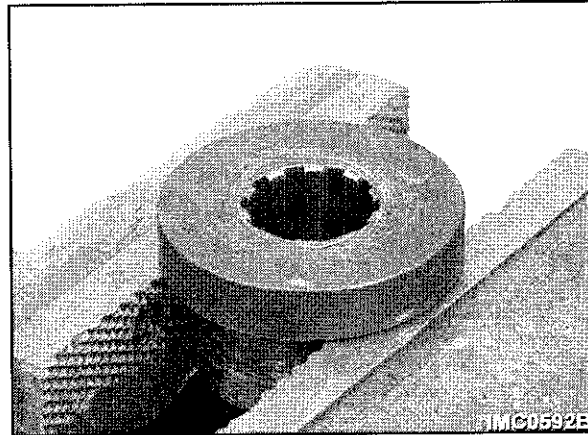


Figure 355 — Sprocket shaft holder mounted in vise

Using a 1/2" socket, remove the four alignment bolts joining the left and right case halves. Four of the case bolts are locator bolts that must be driven out, using a brass hammer and drift.

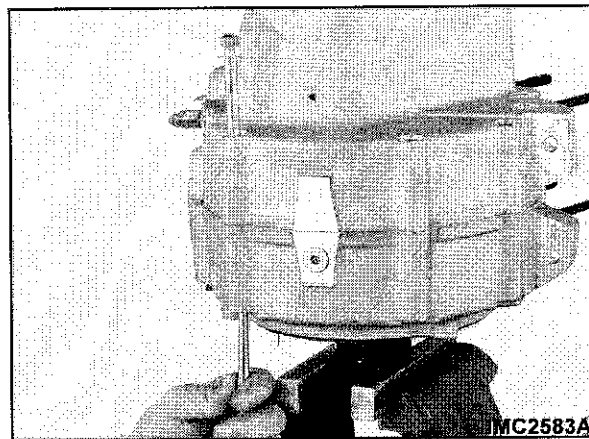


Figure 356 — Driving out locator bolts

## Crankcase Disassembly and Assembly

### Tools required:

7/16" wrench/socket

1/2" wrench/socket

Brass hammer

Cam bearing tool, 97272-60 (available from JIMS®)

Crank disassembly-removing tool, 1047-T'P  
(available from JIMS®)

Drift

Flywheel rebuilding jig, 1071 (HD 09-1194) (available from JIMS®)

Snap ring pliers

Sprocket shaft bearing installation tool set, 97225-55  
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Sprocket shaft bearing removal tool set, 1045-IS  
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Sprocket shaft holder, 1034 (available from JIMS®)

Sprocket shaft seal installation tool, 39361-69  
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Torque wrench

**Note:** S&S engines use four locator bolts to align the cases. A slight interference fit between bolt and case hole maintains case alignment. These bolts must be driven out, using a drift and hammer.

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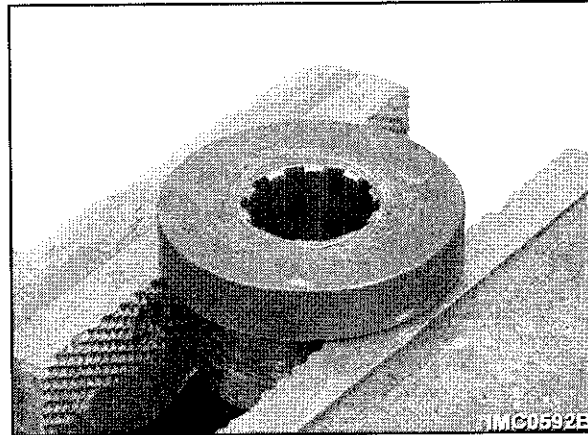


Figure 355 — Sprocket shaft holder mounted in vise

Using a 1/2" socket, remove the four alignment bolts joining the left and right case halves. Four of the case bolts are locator bolts that must be driven out, using a brass hammer and drift.

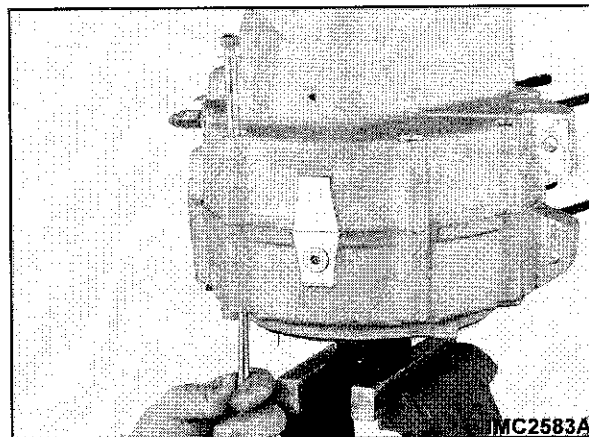


Figure 356 — Driving out locator bolts

 **Note:** Sprocket shaft bearings are a matched set and must be replaced as a set with 2 bearings, 2 outer races and 2 inner races.

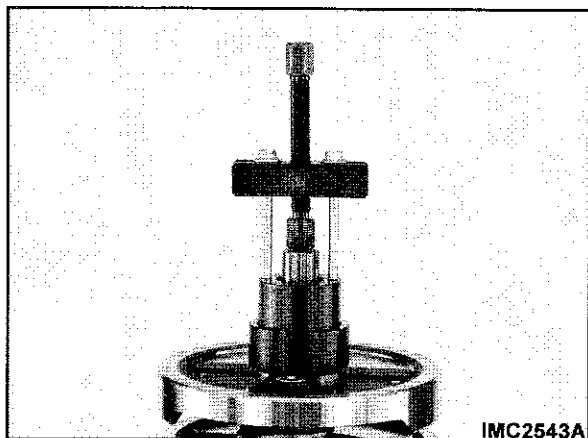


Figure 361 — Removing inner bearing

Remove the flywheel and crank assembly from the rebuilding jig.

## Cleaning and Inspection

Clean the right and left case halves in a suitable cleaning solution to remove all oil, dirt and debris. Dry the case halves with compressed air.

Inspect the mating surfaces of the case halves for nicks and scratches, cracks or other damage. Repair or replace the case, if necessary.

Inspect the cam cover alignment dowels for damage and secure fit in the case.

Apply a thin coating of blue threadlock to the threads of the magnetic drain plug and install the plug and O-ring in the left case half, using a 1/4" hex bit.

Apply a thin coating of Teflon<sup>®</sup> thread dope to the pipe plug and install the plug in the right case half, using a 1/4" hex bit. Tighten the plug to 10 foot-pounds.

Clean and inspect the bearings and races for wear or damage. Replace parts as required.

If removed, install the cam bearing in the right case half. Check that the bearing is fully seated in the case and that it is below the surface of the cam bearing housing.

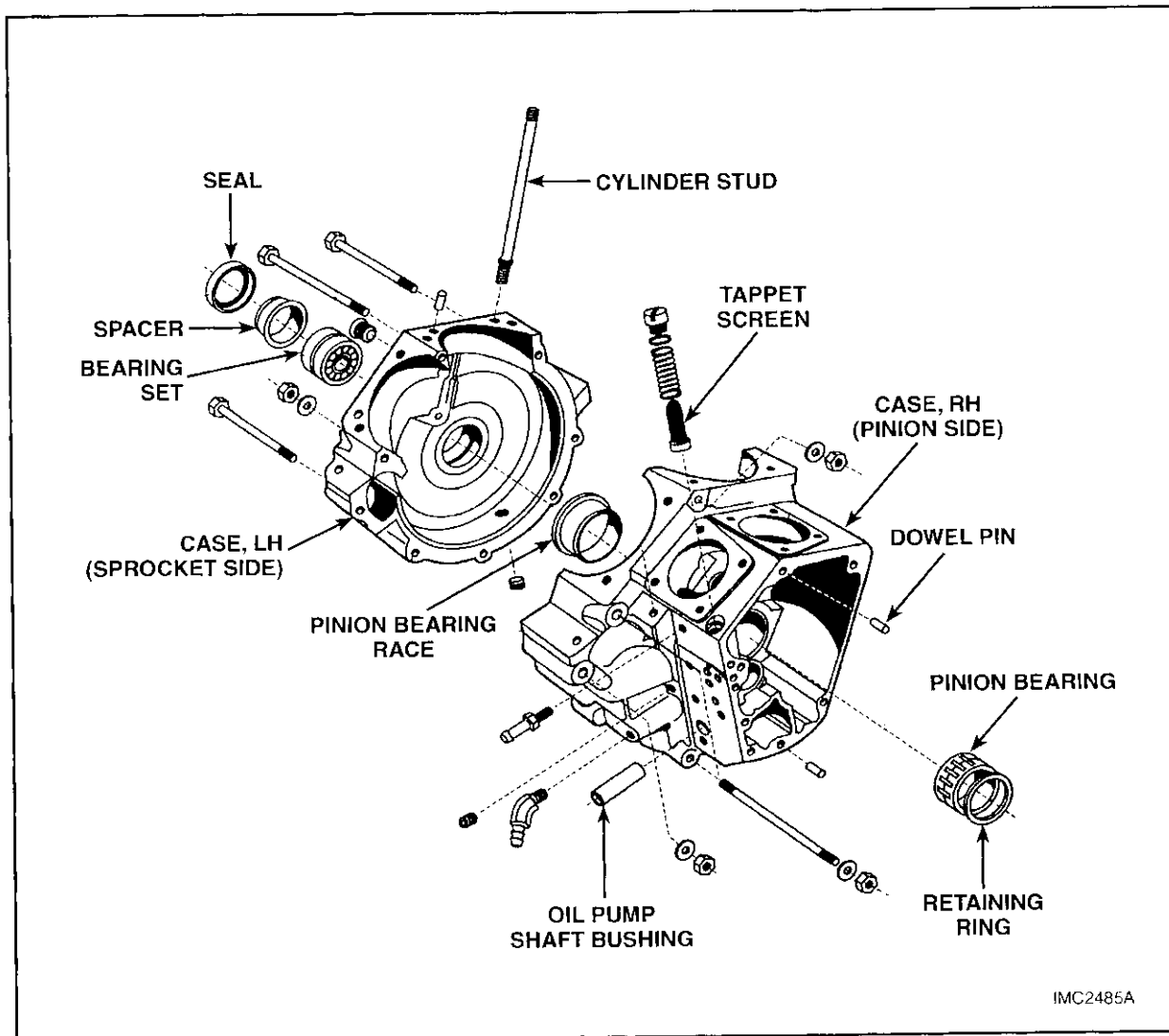


Figure 362 — Crankcase assembly

## Assembly

Inspect the flywheel and crankshaft assembly to make sure runout is within specification.

Mount the flywheel-rebuilding jig, JIMS® 1071, in a vise.

Place the pinion side of the flywheel and crank assembly in the rebuilding jig. The sprocket side of the crankshaft assembly will be facing up.

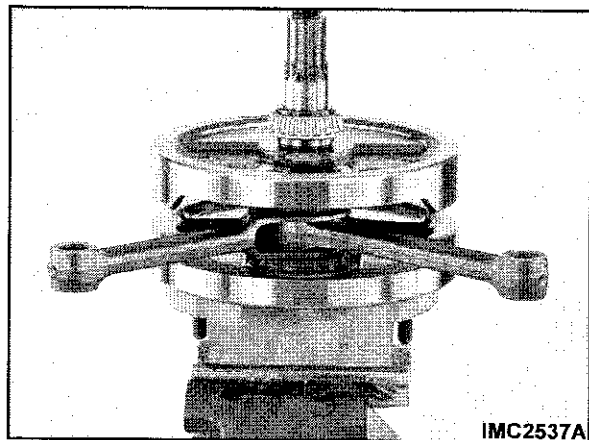


Figure 363 — Flywheel and crank assembly mounted in jig

**Note:** Before reassembling the crankcase, the connecting rods must be aligned with the male connecting rod positioned to the front cylinder and the female connecting rod to the rear cylinder.

Install the inner bearing spacer and race on the sprocket shaft. Lubricate the race.

Place the left case half in position on the sprocket shaft. Make sure that the connecting rods are properly positioned in the cylinder bores.

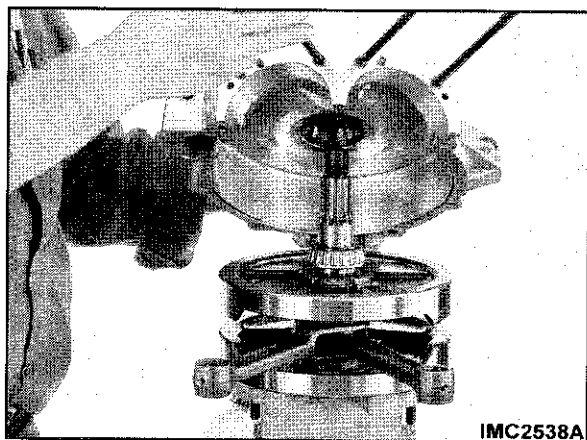


Figure 364 — Placing left case half on sprocket shaft

Install the outer bearing and spacer on the output shaft, using the sprocket shaft bearing installation tool set, JIMS® 97225-55, and the mainshaft sprocket locknut wrench, JIMS® 94660-37A.

- Install the bearing installation tool on the sprocket shaft and turn the screw in until the bearing is snug against the case half.
- Position the locknut wrench on the bearing installation tool. Turn the wrench until the bearing is fully seated in the case.
- Remove the wrench and bearing installation tool.

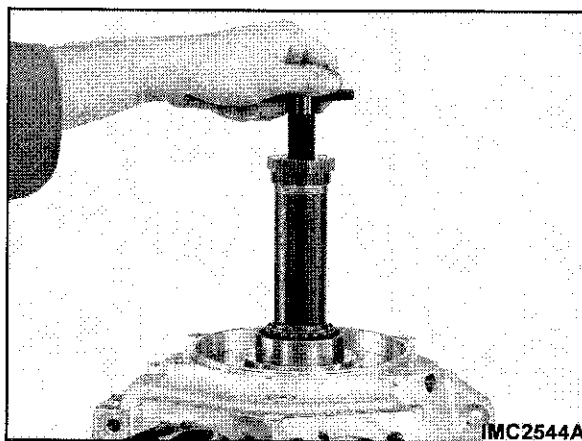


Figure 365 — Pressing bearing against case with tool

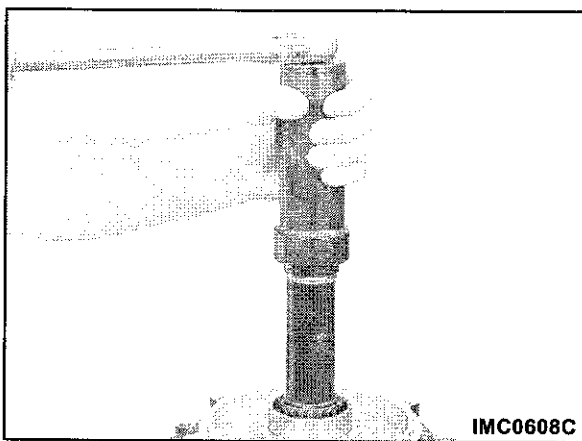


Figure 366 — Seating bearing in case with locknut wrench

Lubricate and install the sprocket shaft spacer and position the seal in the case. The seal must be positioned with the rounded edge facing outward, away from the case.

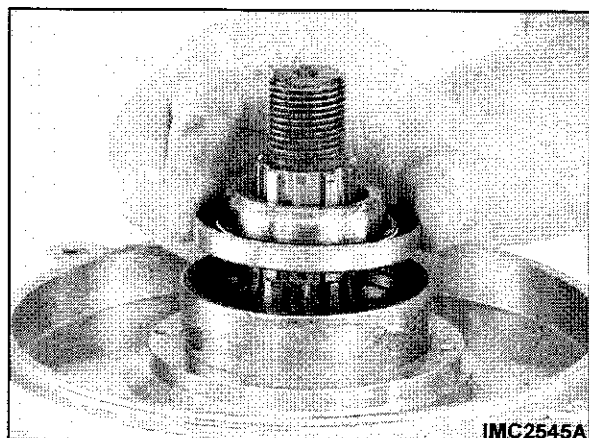


Figure 367 — Placing sprocket shaft seal in position on case

Using the motor sprocket shaft seal installation tool, JIMS® 39361-69, in combination with the bearing installation tool and locknut wrench, drive the seal in until it is fully seated in the case.

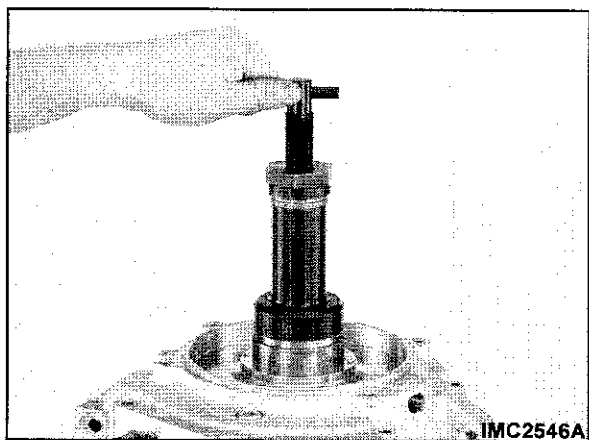


Figure 368 — Seating seal in case

Check end play and then remove the left case half, flywheel and crank assembly from the rebuilding jig.

Remove the rebuilding jig from the vise and install the sprocket shaft holder, JIMS® 1034, in the vise.

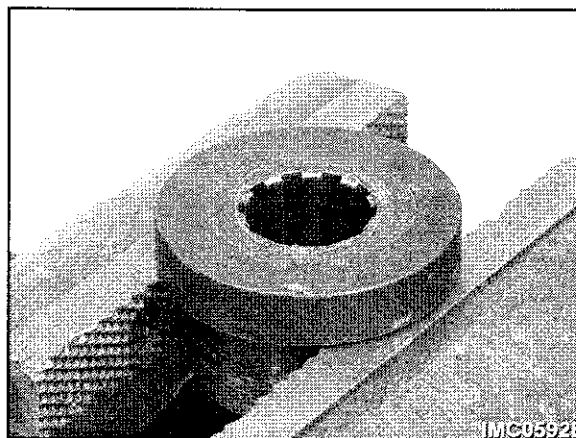


Figure 369 — Sprocket shaft holder mounted in vise

Position the left case half, flywheel and crank assembly in the holder, sprocket shaft down.

Lubricate the pinion shaft and install the pinion shaft bearing. Then lubricate the bearing.

Install the snap ring to retain the bearing.

Apply a bead of Loctite® ULTRA BLACK RTV to the case-mating surface.

Make sure that the connecting rods are centered in the cylinder bores and place the right case half in position on the pinion shaft.

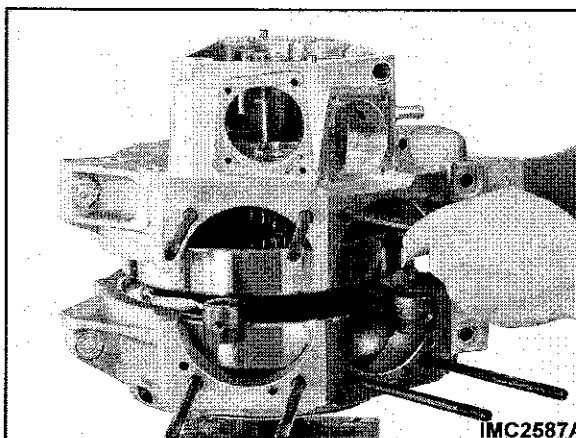


Figure 370 — Installing right case

Apply blue threadlock to the threads of the crankcase bolts and screws.

Thread a nut on one end of each of the three locator bolts with approximately one thread showing above the nut. Then, place the three locator bolts in the proper locations and drive them into the case with a brass hammer. Install the nuts and washers on the other ends of the locator bolts, until they contact the case. DO NOT tighten them until the remaining case bolts are installed.

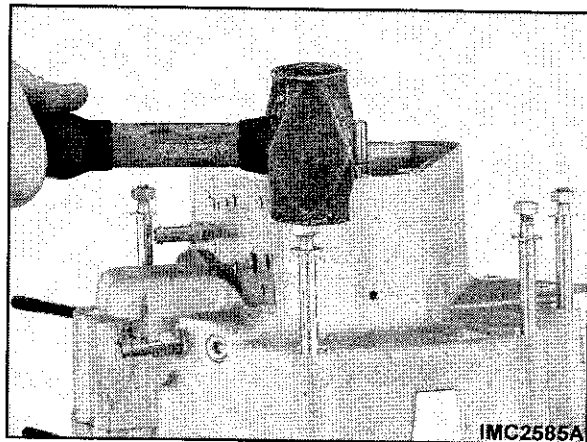


Figure 371 — Driving in locator bolts

Install the 1/4" case bolt from the bottom (sprocket side) and thread the nut on to hold it in place. Then, install the 5/16" case bolt and nut in the through-hole behind the rear cylinder. Finally, install the two 5/16" case screws from the bottom into the threaded case holes.

Tighten the eight case bolts and screws to specification, in a criss-cross pattern, starting with the locator bolts:

- Tighten the case locator bolts and 5/16" screws to 15–18 foot-pounds, using a 1/2" socket.
- Tighten the 1/4" case bolt to 10–12 foot-pounds, using a 7/16" socket.

Remove the assembled crankcase from the sprocket shaft holder and mount it in an engine stand, JIMS® 1006T, for engine assembly.

Wipe off any excess case sealant.



## PRIMARY DRIVE SERVICE

### Primary Chain Inspection

The primary drive chain should be inspected and the primary housing lubricant should be drained and refilled at the first 500-mile (800 km) service interval and thereafter, at the 5,000-mile (8 000 km) service interval.

Inspect the primary chain for excessive wear, looseness or damage. Check for debris in the chain case. Inspect the chain tensioner for wear or damage.

#### Tool required:

3/16" hex bit

For preliminary chain and tensioner inspection, remove the three inspection cover screws, using a 3/16" hex bit.

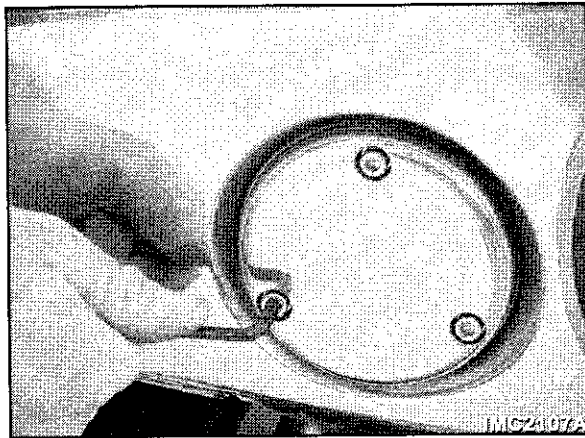


Figure 372 — Chain adjustment inspection cover

Remove the inspection cover and gasket. Discard the gasket.

Inspect the chain for looseness by lifting up on the chain. Inspect the chain for excessive wear or visible damage through the inspection cover. Also, check the tensioner shoe for excessive wear or bracket damage.

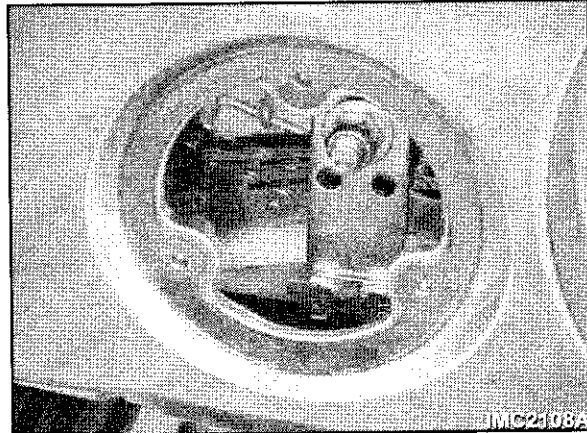


Figure 373 — Chain/tensioner visible through inspection cover

If the chain is excessively worn, loose or damaged, or if the chain slipper or bracket is worn or damaged, remove the primary drive housing for replacement and adjustment.

Reinstall the inspection cover as necessary. Position the cover with new gasket to the primary drive housing. Install the three inspection cover screws and tighten to specification, using a 3/16" hex bit.

## Primary Drive Removal, Installation and Adjustment

The primary chain, compensator and sprocket and clutch assembly and sprocket must be removed as an assembly.

### Tools required:

- 3/16" hex bit
- 1/4" hex bit
- 7/16" wrench/socket
- 1/2" wrench/socket
- 9/16" wrench/socket
- 3/4" thin wall socket
- 10 mm hex socket
- 1-3/16" hex socket
- 1-1/2" hex socket
- Sprocket/clutch locking tool
- Vernier measuring instrument
- Torque wrench
- Drain pan

### Removal

Place a drain pan under the primary drive housing under the drain plug.

Using a 3/4" thin wall socket, remove the drain plug to allow the primary housing lubricant to drain. Inspect the nylon sealing washer on the drain plug for damage and replace as necessary. Apply blue threadlock to the drain plug and reinstall it into the outer primary drive housing and tighten to specification.

Disconnect the shift rod from the shift lever, using a 3/16" hex bit.

Using a 5/16" hex bit, remove the left floorboard mounting screws and remove the kickstand, floorboard and shift pedal assembly (Spirit model only) from the frame.

Using a 3/16" hex bit, remove the 15 screws around the perimeter of the outer primary drive housing.

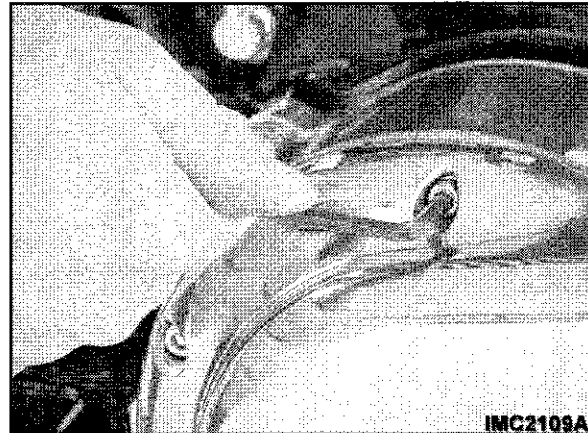


Figure 374 — Removing primary drive housing screws

Remove the outer housing. Remove the gasket from the housing and inspect it. Replace the gasket if it is distorted or damaged. Drain any remaining oil from the housing.

Thoroughly inspect the chain and sprockets for excessive wear. Inspect the chain tensioner for wear or damage. Check for debris in the primary drive housing, such as clutch material or metallic particles. Replace components as necessary.

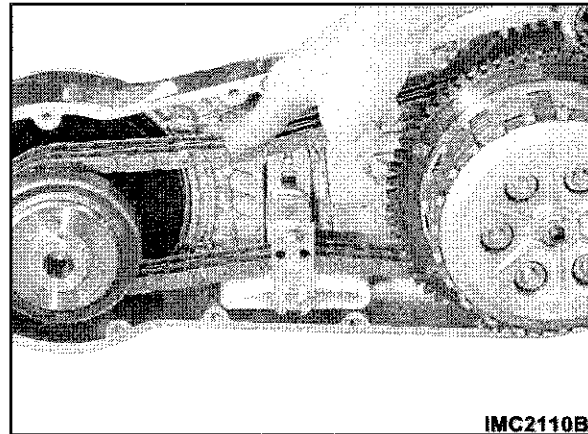


Figure 375 — Inspecting primary drive components

With primary drive components in good condition and chain simply loose, adjust the chain to the required tension. Refer to Primary Drive Chain Adjustment in this section.

**Note:** If the tensioner has been adjusted to its upper limit and the chain cannot be properly adjusted, the chain is excessively worn and must be replaced.

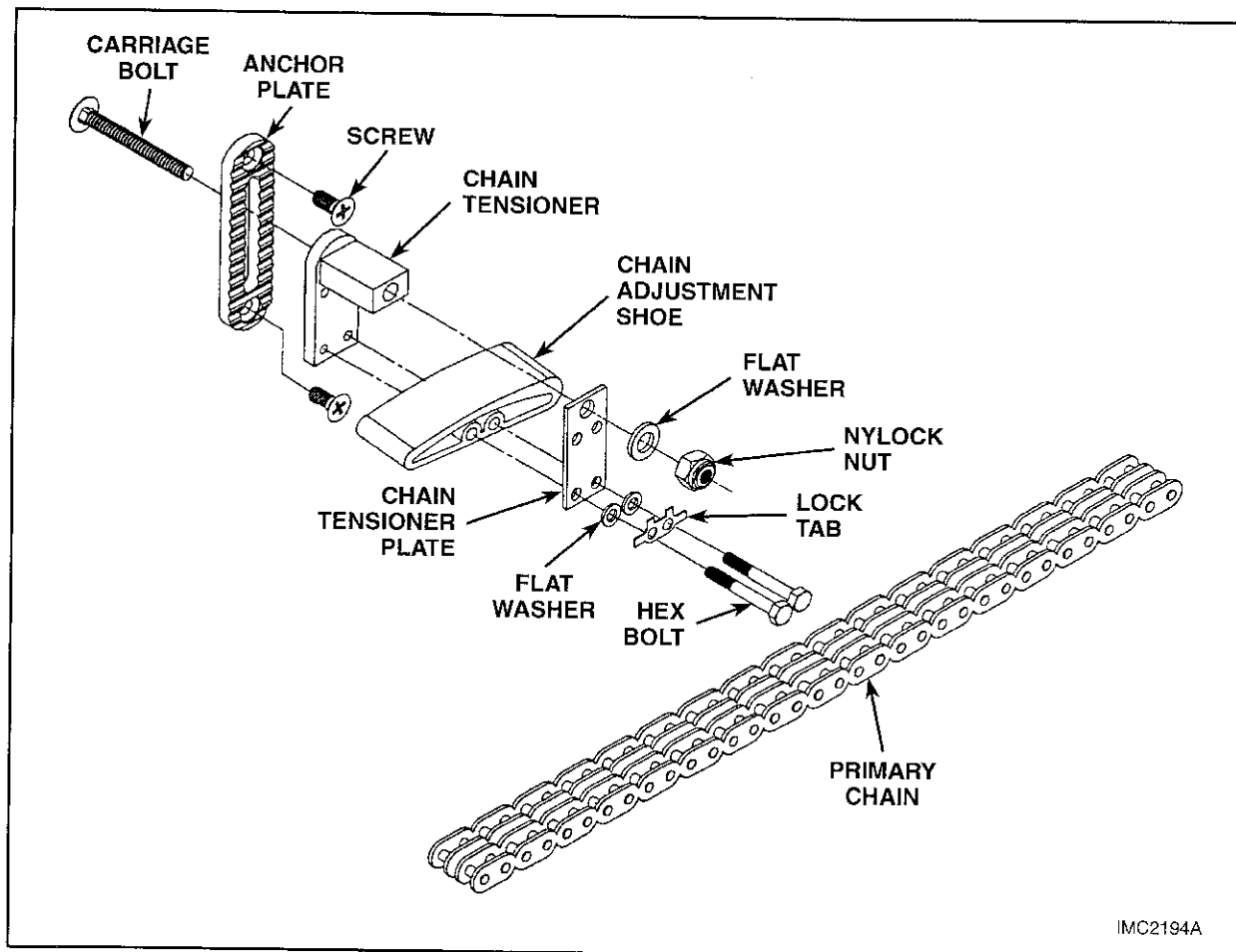


Figure 376 — Chain tensioner assembly

Loosen the chain tensioner nylock nut, using a 9/16" hex socket or wrench.

Slide the tensioner assembly down, to provide maximum slack in the chain.

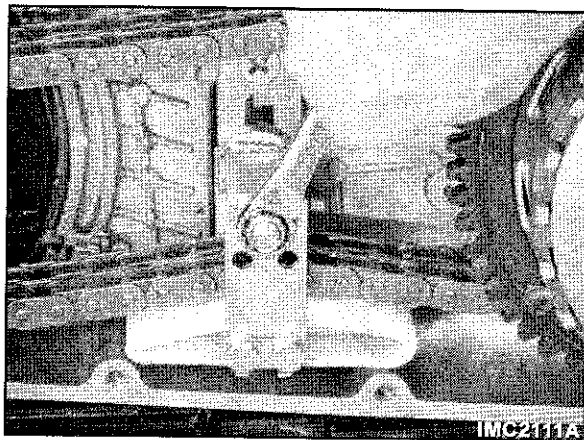


Figure 377 — Removing chain tensioner nylock nut

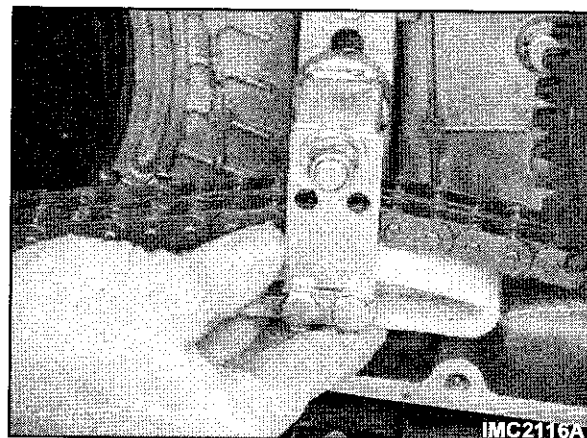


Figure 378 — Sliding tensioner down to loosen chain

Bend over the locking tabs from the two lower bolts. Remove the two lower bolts, using a  $7/16"$  wrench. Remove the upper nylock nut and washer. Separate the chain tensioner plate, the chain adjustment shoe and the chain tensioner. Slip the parts from the primary drive chain.

Using a  $1-1/2"$  hex socket, remove the compensator retaining nut and remove the assembly from the splined crankshaft extension. Use a sprocket/clutch locking tool, placed between the sprockets, to prevent the sprockets from turning while removing the retaining nut.

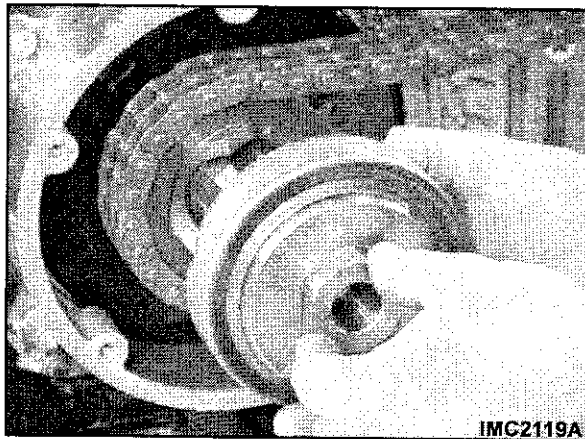


Figure 379 — Removing compensator assembly

### Compensator Spring Cup Inspection

Check the tension in the compensator spring cup. The correct spring height (unloaded) should be a minimum of  $0.600"$ .

**Note:** Position the Vernier measuring instrument (depth gauge) at the base of the compensator spring cup for an accurate measurement of the spring. Replace the compensator spring cup if the spring height is less than  $0.600"$ .

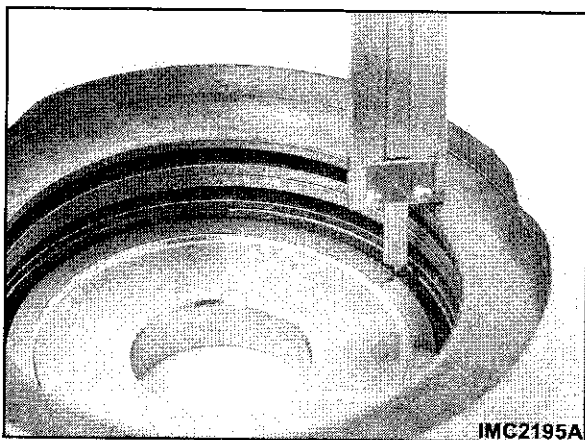


Figure 380 — Measuring spring cup height

Working at the clutch end of the primary chain, remove the six clutch pressure plate retaining screws and springs, using a  $10\text{ mm}$  hex socket.

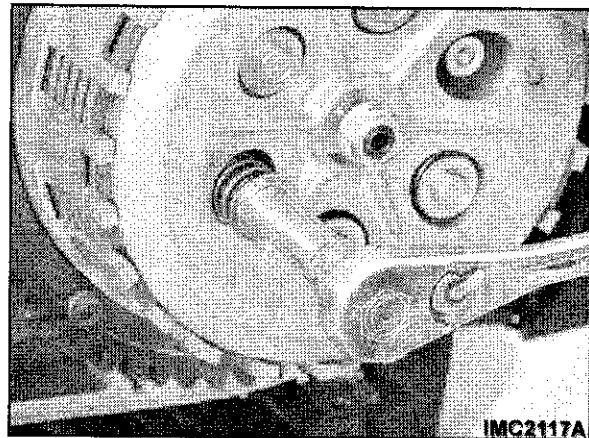


Figure 381 — Removing pressure plate screws and springs

To gain access to the clutch hub retaining nut, remove the pressure plate from the clutch hub and sprocket assembly. Leave the clutch friction and steel discs in place, unless otherwise necessary.

**Note:** It is not necessary to remove the clutch friction and steel discs unless damage or excessive wear is suspected to clutch assembly components. When removing the primary drive chain assembly for servicing other components such as the transmission or engine, leave the clutch discs in place and remove the primary drive assembly as a unit. Refer to the CLUTCH SERVICE section for clutch service procedures as necessary.

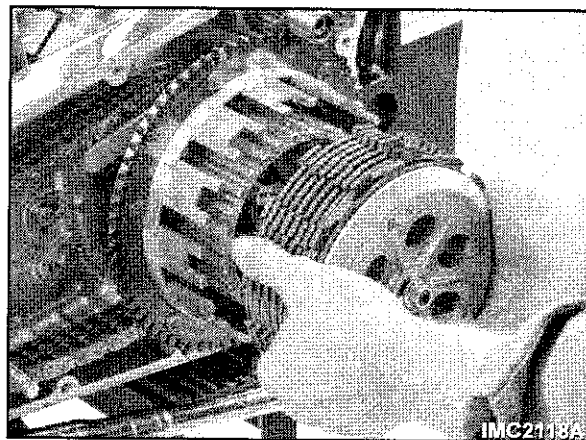


Figure 382 — Remove pressure plate and discs

Remove the clutch hub retaining nut, using a 1-3/16" hex socket.

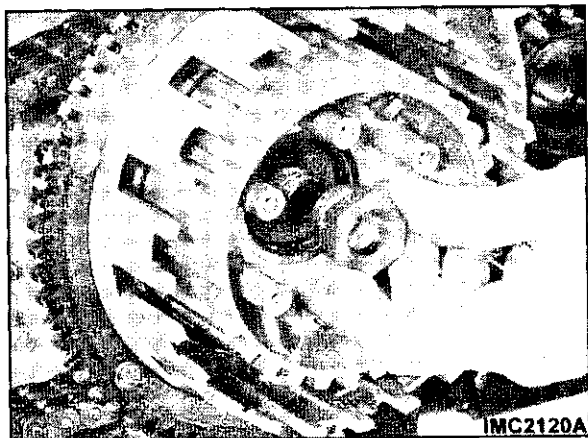


Figure 383 — Remove clutch hub retaining nut

Slide the clutch hub assembly, primary drive chain and engine sprocket off the engine crankshaft and transmission input shaft. Keep the sprockets and chain evenly aligned to ease removal.

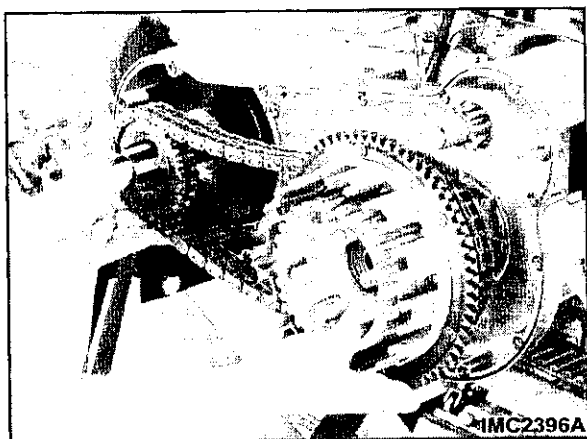


Figure 384 — Removing primary drive chain and sprockets

**Note:** It is not necessary to remove the inner primary drive housing unless the engine, rear drive belt or transmission requires service, or if the inner primary drive housing is damaged or cracked. Perform the following steps as necessary.

Bend over the tab of the lock washer to unlock the starter drive pinion assembly retaining bolt and then remove the bolt, using a 7/16" hex socket.

Remove the starter motor drive pinion assembly from the inner primary drive housing.

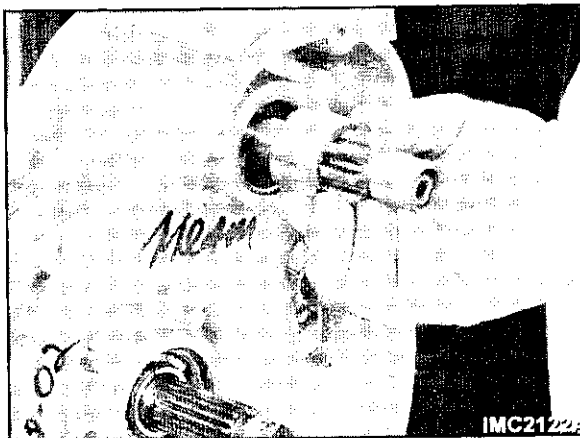


Figure 385 — Removing starter motor drive pinion assembly

Remove the starter motor. Refer to the STARTING SYSTEM SERVICE section for starter motor removal.

Remove the two screws located on the outside and at the front of the inner primary drive housing, using a 1/4" hex bit.

Remove the six screws located on the inside of the inner primary drive housing, using a 1/2" hex socket.

**Note:** The six inside screws are secured by lock tab washers. Bend the tabs back to unlock.

Also, note the positions of the tabbed washers and the location of each screw for proper installation.

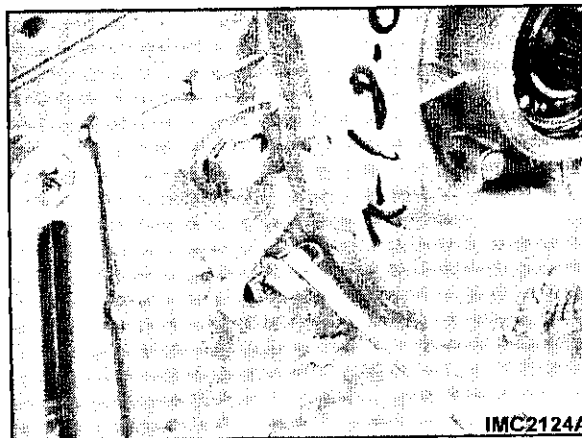


Figure 386 — Bending tabs to unlock

Remove the inner primary drive housing from the engine and transmission flanges. Slide the housing bearing evenly off the transmission input shaft.

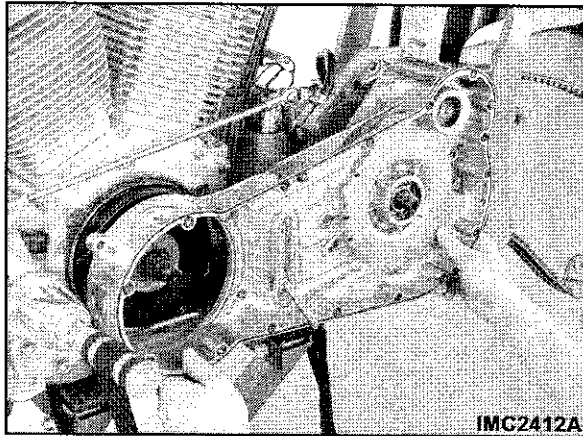


Figure 387 — Removing inner primary drive housing

Remove and discard the O-ring located on the engine-to-inner primary housing mounting flange on the engine crankcase.

If necessary, replace the transmission input shaft oil seal and starter drive pinion oil seal located in the inner primary drive housing. Remove the seals, using a suitable puller. Replace with new seals, using a suitable driver. Apply lubricant to the new seals.

If necessary, replace the transmission input shaft ball bearing located in the inner primary drive housing. Using suitable snap ring pliers, remove the snap ring. Drive the bearing out of the housing, using a suitable driver. If necessary, replace the starter drive pinion bushing, using a suitable driver. Drive a new bushing in flush with the surface of the housing. The bushing should be wiped clean and dry before installation.

## Installation

Install a new O-ring in the groove on the engine-to-inner primary housing mounting flange on the engine crankcase.

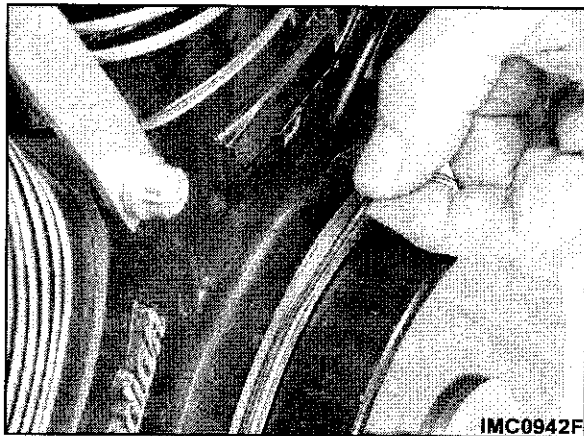


Figure 388 — Installing O-ring

Apply a thin coat of Loctite® 598 or Permatex® Ultrablack sealant to the inner seal surface of the inner primary drive housing and to the inner primary drive housing mounting bosses (eight mounting screw locations on the housing).

Position the inner primary drive housing onto the engine and transmission flanges. Slide the transmission input shaft bearing in the housing evenly over the transmission input shaft. Carefully align the screw holes.

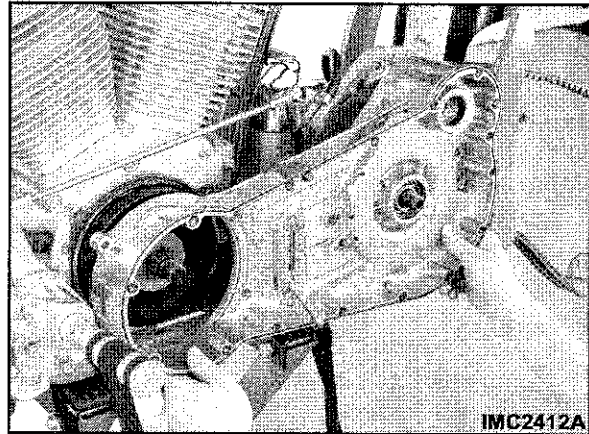


Figure 389 — Positioning inner primary drive housing

Apply a thin coat of blue threadlock to the six inner primary drive screws. Install the screws with tabbed washers into the inner drive housing, noting their proper locations.

**Note:** IMC uses a dry locking compound pre-applied to the thread by the screw manufacturer. The color of the dry threadlock does not equate to a wet Loctite® 242 (blue) or 262 (red) threadlock compound. When reassembling the inner primary, use a blue threadlock compound.

Tighten the six inner screws to specification, using a 1/2" hex socket. To prevent the screws from backing out, bend the tabs of the lock washers back over a flat of each screw.

Apply a thin coat of blue threadlock to the two outside inner primary drive housing screws. Install the two screws to the outside front of the housing and tighten to specification, using a 1/2" hex socket.

Install the starter motor. Refer to the STARTING SYSTEM SERVICE section for starter motor installation.

Install the starter motor drive pinion assembly into the inner primary drive housing. Make sure the splines of the pinion shaft are aligned and engaged with the starter motor splines. Lightly lubricate the assembly before installation.

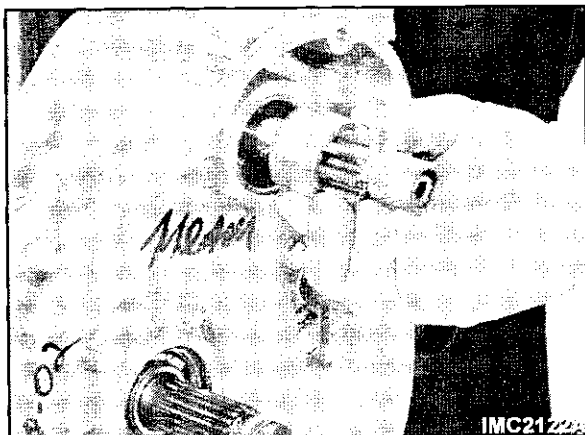


Figure 390 — Installing starter motor drive pinion assembly

Install the starter drive pinion assembly retaining bolt with washers through the drive pinion assembly. Thread the bolt into the starter motor and tighten to specification, using a 7/16" socket. Refer to the STARTING SYSTEM SERVICE section for drive pinion assembly installation.

Slide the large spacer for the engine compensator sprocket onto the splines of the crankshaft and next to the alternator rotor. Assemble the splined crankshaft extension into the engine compensator sprocket. Lightly lubricate components before assembly.

Slide the clutch hub, primary drive chain and engine compensator sprocket onto the engine crankshaft and transmission input shaft. Keep the sprockets and chain evenly aligned to ease installation.

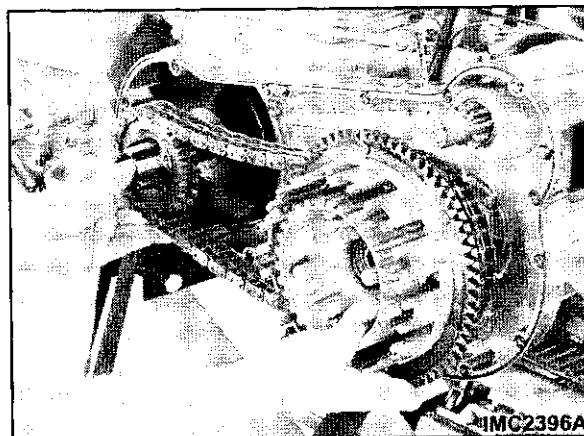


Figure 391 — Installing primary drive chain and sprockets

Apply red threadlock to the threads of the clutch hub retaining nut and then install it on the transmission input shaft. Tighten the nut to specification, using a 1-3/16" hex socket.

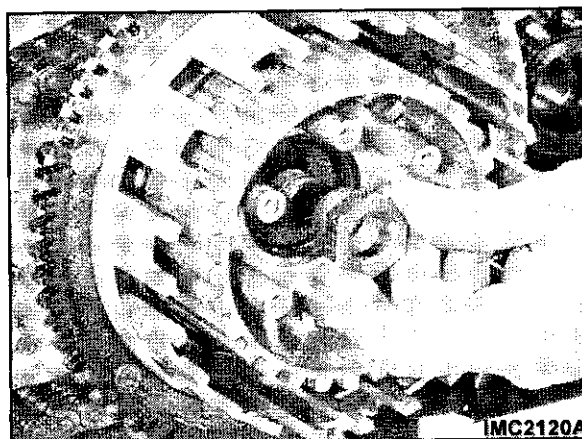


Figure 392 — Installing clutch hub retaining nut



Install the clutch pressure plate onto the clutch hub and sprocket assembly.

**Note:** If the clutch friction and steel discs have been removed, refer to the CLUTCH SERVICE section for installation procedures.

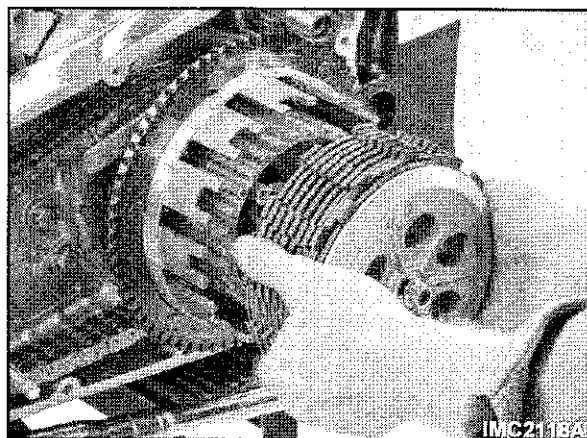


Figure 393 — Installing pressure plate and discs

Loosen the clutch adjuster jam nut and back out the adjuster.

Apply blue threadlock to the threads of the six clutch pressure plate retaining screws. Install the retaining screws and springs and alternately tighten to specification, using a 10 mm hex socket.

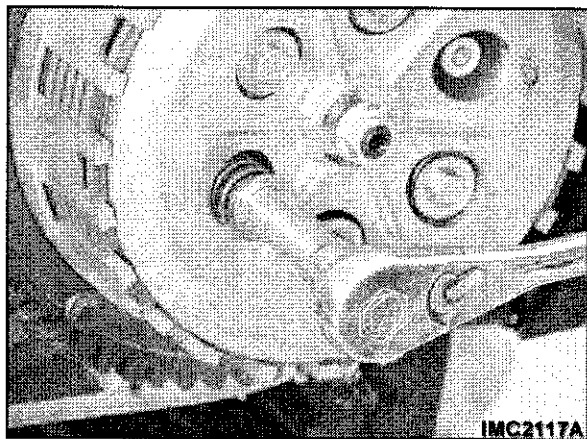


Figure 394 — Installing pressure plate screws and springs

Refer to the CLUTCH SERVICE section for clutch adjustment procedures.

Thoroughly clean the threads of the compensator retaining nut with carburetor/brake cleaner and blow out any remaining debris with compressed air.

Apply red threadlock to the first four threads of the compensator retaining nut in two places, 180 degrees apart.

### ⚠ CAUTION!

Correct application of threadlock to the compensator retaining nut must be achieved. Applying excessive threadlock can cause an incorrect torque reading and cause severe binding of the nut on the sprocket shaft. Inadequate application of threadlock will gradually loosen the nut causing wear and damage in the housing and can lead to component failure.

Install the compensator assembly with retaining nut and machined spacer onto the splined crankshaft extension. Lightly lubricate the components before installation. Thread the nut onto the end of the crankshaft and tighten to specification, using a 1-1/2" hex socket.

Use a sprocket/clutch locking tool, placed between the sprockets, to prevent the sprockets from turning while tightening to 200 foot-pounds torque.

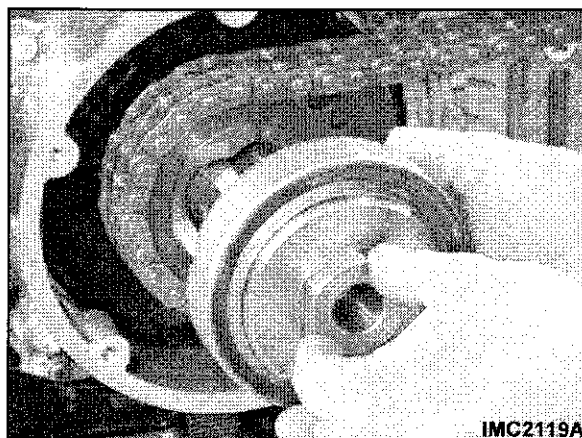


Figure 395 — Installing compensator assembly

Insert the two lower adjuster assembly bolts into the lock tab (lock tabs facing up) and then install the flat washers.

Slide the chain tensioner plate and the chain adjustment shoe over the two bolts.

**Note:** The thinner portion of the chain adjustment shoe must face toward the front of the motorcycle (closest to engine compensator sprocket) when installed.

**Note:** The flat washers should be between the chain tensioner plate and the lock tab. The lock tab should be against the bolt heads.

Slide the chain tensioner behind the primary chain and onto the carriage bolt.

Place the chain adjustment shoe with two bolts and chain tensioner plate under the chain and then, slide the assembly over the carriage bolt.

Loosely tighten the two lower bolts into the chain tensioner. Loosely install the nylock nut and washer onto the carriage bolt.



Tighten the two lower bolts to 72 inch-pounds, using a 7/16" hex socket. Bend the locking tabs over to secure the bolts.

### ⚠ CAUTION!

Do not overtighten the lower bolts. This can crush and distort the chain adjustment shoe and cause chain interference.

## Primary Drive Chain Adjustment

### ⚠ CAUTION!

Excessive slack in the primary chain can cause chain rattle, knocking during acceleration and contact between the chain and primary housing. Severe damage can occur to the housing, the chain and the compensator spring cup. Over-tensioning can stretch the chain and cause damage to the main transmission bearing, loosening of the compensator nut and can cause wear to the primary housing, resulting in component failure.

Push the tensioner assembly upward against the bottom chain run with moderate pressure. Snug down the nylock nut to maintain this position.

**Note:** Make sure the teeth of the anchor plate and chain tensioner are properly engaged and that the dowel pin of the chain tensioner is located in the slot of the anchor plate.

Measure the slack at the middle of the top chain run. The correct amount of slack should be a total up-and-down movement of 9/16" on a cold chain.

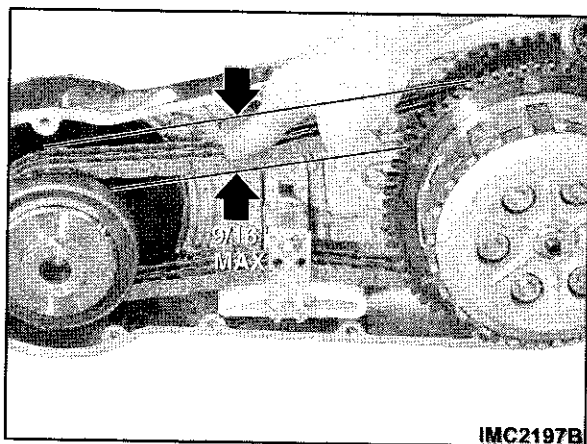


Figure 396 — Checking primary chain slack adjustment

**Note:** If the tensioner has been adjusted to its upper limit and the chain cannot be properly adjusted, the chain is excessively worn and must be replaced.

Loosen the chain adjuster nylock nut and adjust the chain adjustment shoe up or down to achieve the correct amount of slack. At a distance halfway between the compensator sprocket and clutch sprocket, measure the slack in the chain (the distance from the lowest point of the chain to the highest when lifted). The chain deflection should be 9/16" top to bottom.

With proper tension obtained, tighten the nylock nut to 25 foot-pounds, using a 9/16" hex socket.

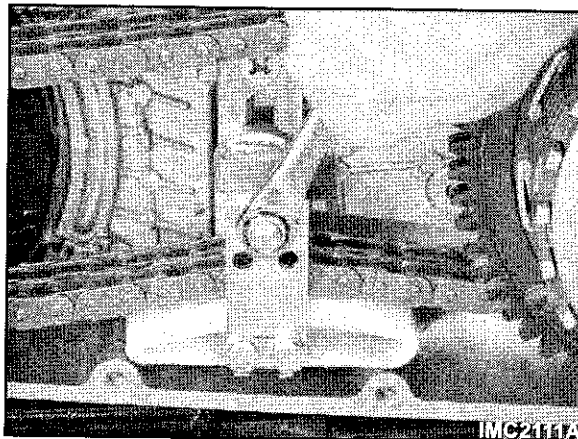


Figure 397 — Tightening chain adjuster nylock nut

Position the inner housing-to-outer housing gasket over the dowel pins in the outer primary drive housing.

**Note:** For primary housings that require the black molded O-ring, the gasket (O-ring) can be reused. If the gasket (O-ring) is damaged, a replacement can be ordered (P/N 09-035).

Thoroughly clean the 15 housing screws with carburetor/brake cleaner.

Position the outer housing to the inner housing and install the 15 screws with washers. Apply blue threadlock to the first four threads of the housing screws before installation.

**Note:** The four shorter screws are located at the engine crankcase end of the housing.

Using a 3/16" hex bit, tighten the 15 screws around the perimeter of the outer primary drive housing. Tighten the screws to specification, starting in the center and working outward in a cross pattern.

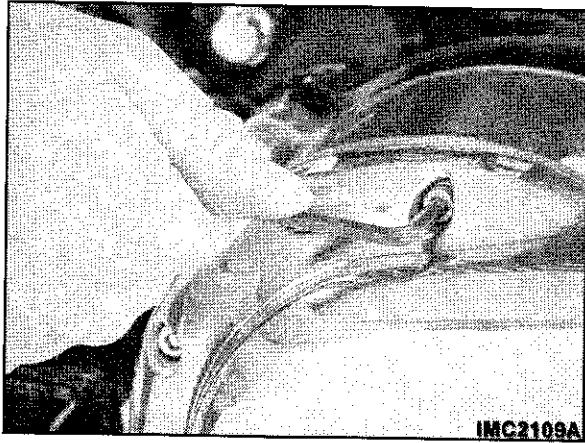


Figure 398 — Tightening primary drive housing screws

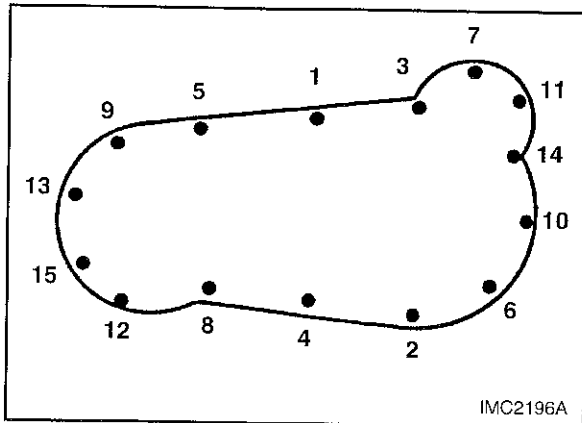


Figure 399 — Housing screw tightening sequence

Remove the three inspection cover screws, inspection cover and gasket. Fill the primary drive housing through the inspection cover opening, using the recommended amount and type of lubricant, 30 ounces of Indian brand primary oil.

Inspect the cover gasket and replace if torn or damaged. Apply blue threadlock to the first four threads of the cover screws. Install the three screws with washers and tighten to specification, using a 3/16" hex bit.

Make sure all fasteners and drain plug are tightened and that no leaks are evident.

Reconnect the shift rod to the shift lever. Apply blue threadlock to the first four threads of the bolt and tighten to 15–18 foot-pounds torque.

## Engine and Transmission Alignment

Use the following procedure to properly align the engine and transmission with the inner primary housing when the engine and/or transmission have been removed for service.

### Tools required:

- 1/2" socket
- 9/16" socket
- 1/4" hex bit
- Torque wrench

### Engine/Transmission Positioning

Place the removed component, engine and/or transmission in position on the respective mounts in the frame. Refer to the following illustration for referenced fastener locations.

- Snug rear engine bolts (1, 2).
- Torque engine inner primary bolts (3, 4, 5, 6) in an X pattern to 18 foot-pounds.
- Torque the transmission primary bolts (7, 8, 9, 10) in an X pattern to 18 foot-pounds.
- Torque rear engine bolts (1, 2) to 33 foot-pounds.
- If needed, add shims to front engine bolts (11, 12).

Available sizes are:

P/N: 97-025, 0.012" shim

P/N: 97-026, 0.030" shim

P/N: 97-027, 0.060" shim

- Torque front engine bolts (11, 12) to 33 foot-pounds.
- If needed, add shims to transmission studs (13, 14, 15, 16).
- Torque the four transmission nuts (13, 14, 15, 16) to 33 foot-pounds.
- If needed, add shims to the transmission fifth nut (17).

Available sizes are:

P/N: 97-001, 0.015" transmission shim

P/N: 97-002, 0.030" transmission shim

P/N: 97-003, 0.040" transmission shim

- Torque transmission fifth nut (17) to 33 foot-pounds.
- As an alignment check, remove the inner primary. The primary should slip off with no binding. If binding is detected, repeat the above procedure.

# Upper Engine Mount Bolt Torque Sequence

- Lightly snug the two engine mount bolts (18, 19). The engine mount must be loose enough to allow movement when tightening bolt (20).

- Torque the upper frame/engine mount bolt (20) to 75 foot-pounds.
- Torque the two 3/8" bolts (18, 19) to 29–31 foot-pounds.

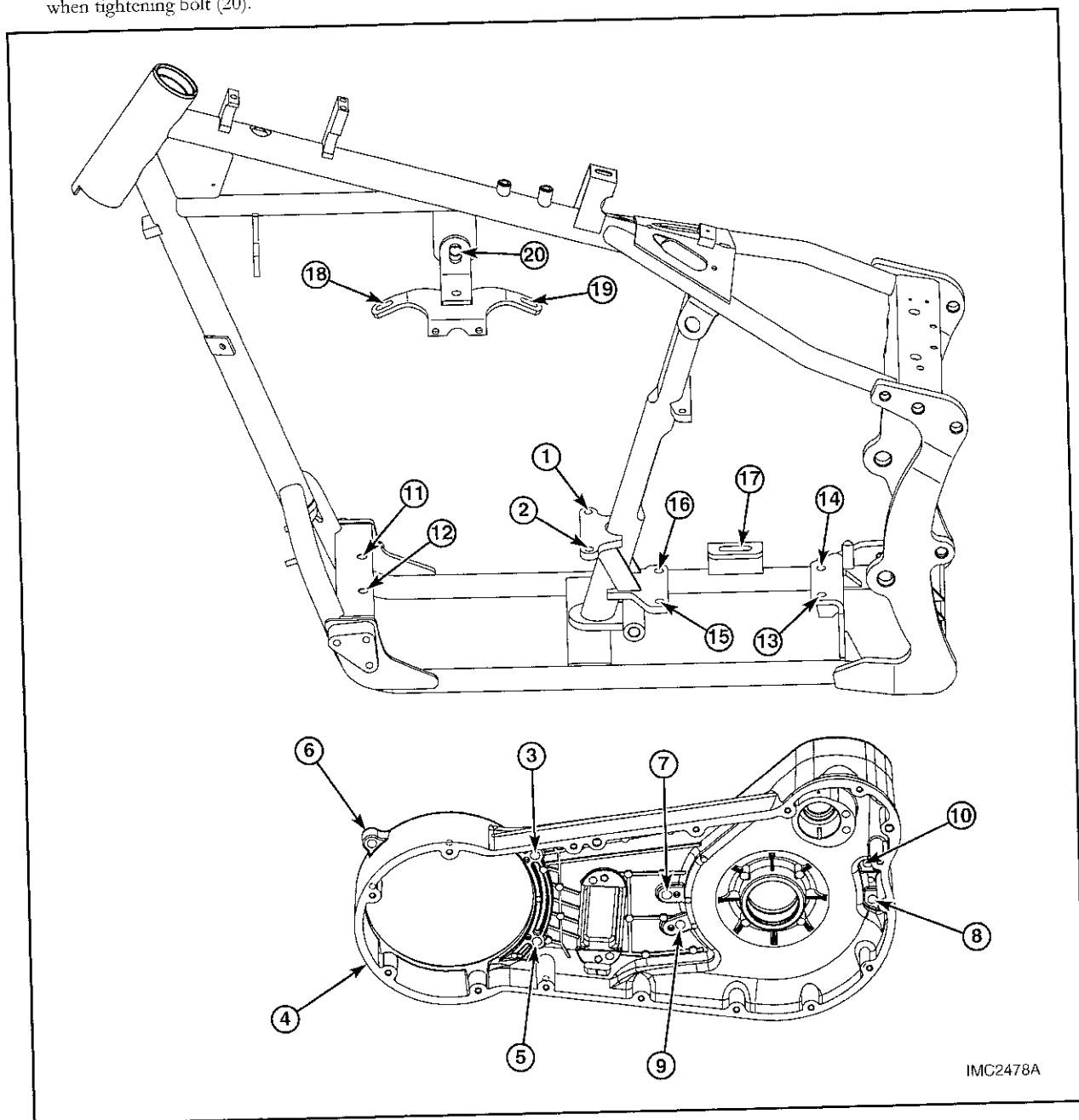


Figure 400 — Engine/transmission mounting bolt torque sequence

## REAR DRIVE SERVICE

### Rear Drive Belt Inspection, Removal and Installation

#### Inspection

The rear drive belt should be inspected and adjusted if necessary, at the first 500-mile (800 km) service interval and thereafter, at the 2,500-mile (4 000 km) service interval.

Inspect the rear drive belt for excessive wear, looseness or damage such as cracks, splits, fraying or separation.

The rear drive belt, if damaged in anyway, can cause the motorcycle to run improperly and the belt and sprockets to wear excessively.

Raise the motorcycle so that the rear wheel is off the ground.

Rotate the rear wheel while inspecting the rear drive belt and sprocket. Inspect for any damage, excessive wear or looseness. Replace or adjust the rear drive belt as necessary.

#### Removal

Raise the motorcycle so that the rear wheel is off the ground.

Remove the rear wheel and swing arm. Refer to the procedures in the WHEEL AND TIRE SERVICE and REAR SUSPENSION SERVICE sections.

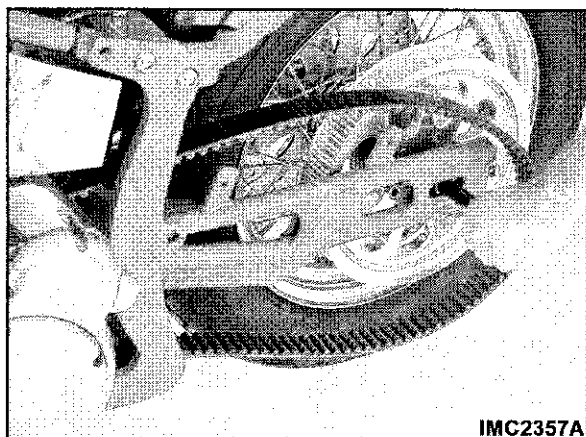


Figure 401 — Remove rear wheel and swing arm

To access the rear drive belt at the transmission sprocket, remove the primary drive components, starter motor and other necessary components following the procedures under PRIMARY DRIVE SERVICE.

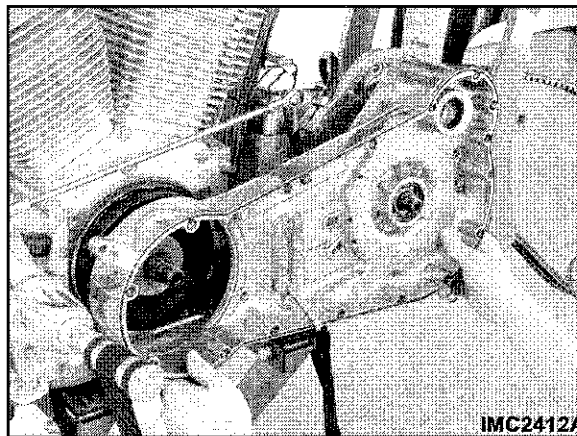


Figure 402 — Remove primary drive components

Slip the rear drive belt from the sprocket on the transmission.

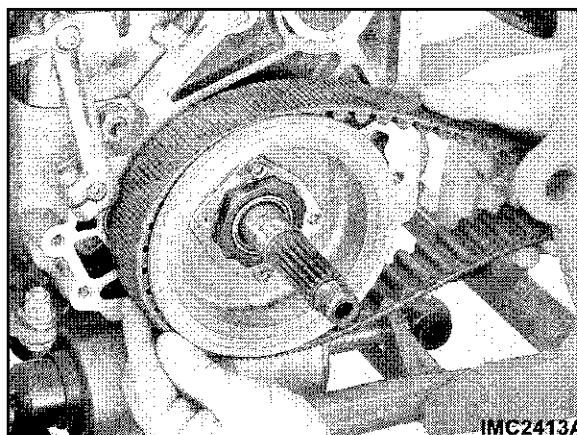


Figure 403 — Slip rear drive belt from transmission sprocket

Inspect the transmission sprocket and rear wheel sprocket for excessive wear or damage. Replace components as necessary.

## Installation

Slip the rear drive belt over the transmission sprocket. Align the cogs in the belt with the cogs in the sprocket.

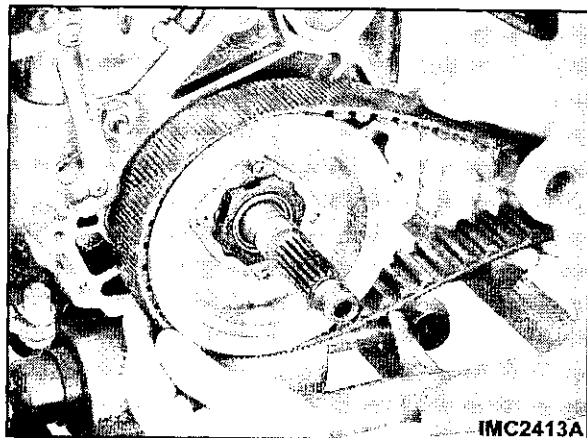


Figure 404 — Installing rear drive belt

Install the primary drive components. Refer to PRIMARY DRIVE SERVICE for procedures.

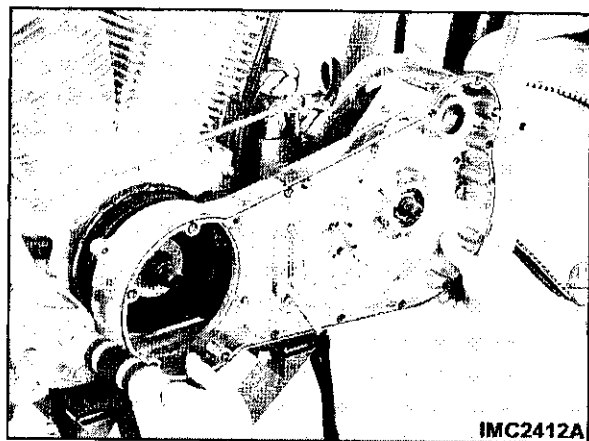


Figure 405 — Install primary drive components

Install the swing arm, rear wheel and all other components. Refer to the REAR SUSPENSION SERVICE and WHEEL AND TIRE SERVICE sections for the procedures.

Slip the rear drive belt over the wheel sprocket.

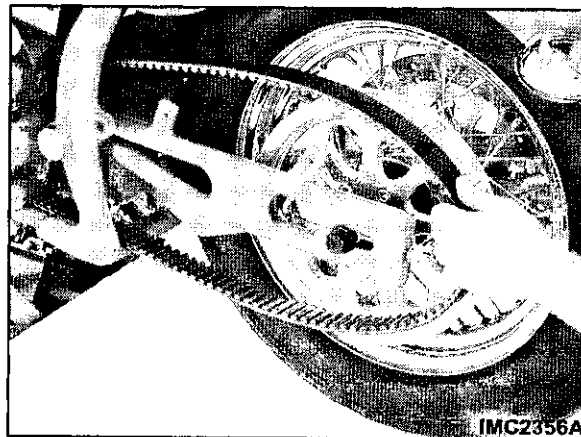


Figure 406 — Installing rear drive belt over wheel sprocket

When reassembled, adjust the rear wheel alignment and rear drive belt tension and deflection.

## Rear Wheel Alignment and Drive Belt Tension Adjustment

The indicators of a misaligned drive belt and rear wheel are screeching or clicking during travel or screeching/chirping during acceleration. Other indicators include the need for early drive belt replacement, and excessive wear on the left or right edges of the belt.

### ⚠ CAUTION!

While belt tension and rear wheel alignment are achieved by adjusting the rear axle, it is important that rear wheel alignment NOT be compromised during these procedures.

### Tools required:

- Belt tension gauge (P/N 99-215)
- 3/16" hex bit
- 1/2" wrench/socket
- 15/16" hex socket
- 15/16" combination wrench
- Axle alignment tool (P/N 99-210)
- Tape measure/steel rule
- Pencil
- Masking tape
- Torque wrench

## Rear Wheel Alignment

The rear wheel must be correctly aligned before belt tension is adjusted.

Remove the plastic thread protectors from the right-hand and left-hand axle adjusting studs.

Remove the cotter pin from the rear axle castle nut and loosen the axle, using a 15/16" hex socket and 15/16" combination wrench.

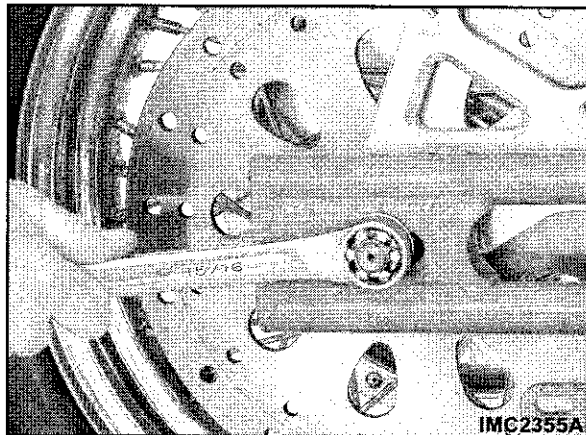


Figure 407 — Loosening rear axle

Start on the left side of the motorcycle. Using the axle alignment tool (P/N 99-210) and adaptor (P/N 99-216) with the extension piece positioned on the swing arm pivot bolt cover, measure the center-to-center distance between the swing arm pivot bolt and the axle. Firmly lock down the T-bolt on the alignment tool.

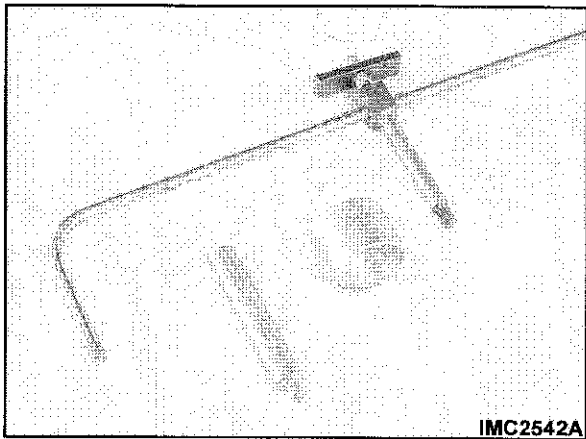


Figure 408 — Alignment tool (P/N 99-210) and adaptor (P/N 99-216)

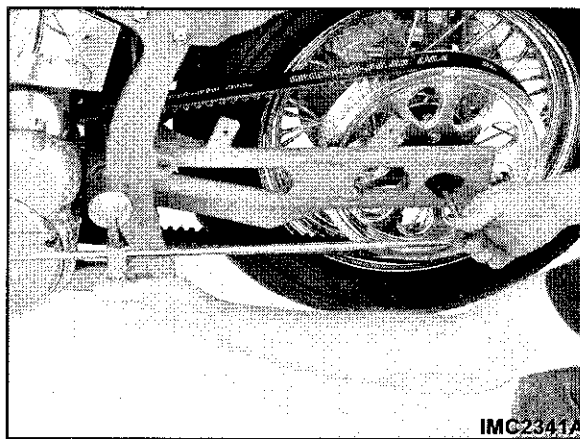


Figure 409 — Measuring left side center-to-center distance

**Note:** For correct wheel alignment, this measurement must be transferred to the right side of the motorcycle.

Move to the right side of the motorcycle. Position the alignment tool on the swing arm pivot bolt cover.

Measure the center-to-center distance between the swing arm pivot bolt and the axle, using the alignment tool.

Compare the measured distances between left and right sides.

If there is any difference between sides, rotate the right side axle adjusting nut, using a 1/2" wrench, until the right side equals the left side.

Recheck side-to-side measurements, using the alignment tool and adjust as necessary.

With the rear wheel properly aligned, adjust belt tension and check belt tracking.

## Drive Belt Tension Adjustment

With the rear wheel correctly aligned, the belt tension can now be adjusted.

On the lower run of the rear drive belt, find a distance halfway between the transmission shaft and the rear axle. This point is approximately 12" ahead of the rear axle center point.

Place a piece of masking tape on the swingarm and mark off the 12", using a pencil.

Using the belt tension gauge (P/N 99-215) aligned with the 12" mark, apply 10 foot-pounds of force on the belt. Measure the distance that the belt deflects upward from the relaxed position.

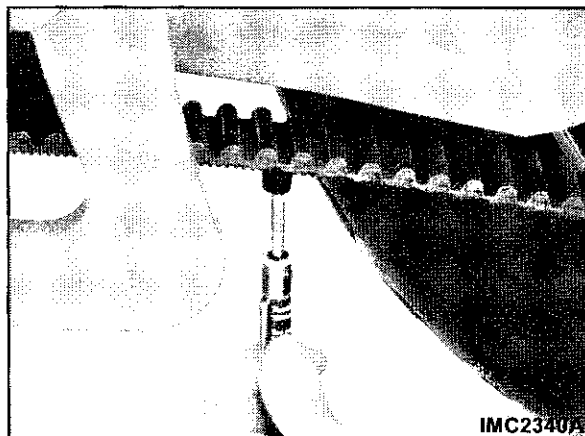


Figure 410 — Measuring belt tension

Rotate the rear wheel one-half revolution, apply tension on the belt, and measure upward belt deflection again. Do this a few more times. Readings might differ, but belt deflection should fall within the 3/8" to 1/2" specification.

If adjustment is required, loosen or tighten the axle adjusting nuts on both sides equally, using a 1/2" wrench. This adjusts rear drive belt tension, while at the same time keeping the axle correctly aligned.

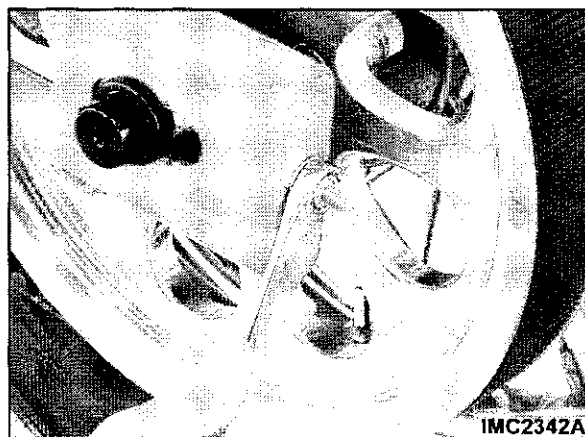


Figure 411 — Rotating axle adjusting nut

### ⚠ CAUTION!

While the tension of the drive belt is achieved by turning the adjusting nuts, the measurement between the axle and swing arm pivot on both sides of the motorcycle **MUST** remain equal. Make sure to turn both adjusting nuts in equal increments.

Recheck the tension of the drive belt in several places by rotating the rear wheel. Readjust the belt tension as necessary.

Tighten the rear axle nut to 60–65 foot-pounds, using a 15/16" hex socket and torque wrench. Install a new cotter pin.

Install the two plastic thread protectors on the axle adjusting studs.

## Rear Drive Belt Tracking

To check for correct alignment of the rear drive belt, rotate the wheel alternately forward and backward, noting the belt travel left to right on the sprocket.

With the belt to the right side of the sprocket, it should take approximately 15 revolutions of the rear wheel for the belt to track to the left. Excessive travel or force to the left or right can cause the belt to ride up on the sprocket flanges which can cause screeching, chirping or clicking and eventual drive belt damage.

### ⚠ WARNING!

In severe cases of excessive drive belt travel or force, the belt can completely ride off the sprocket.

While rotating the rear wheel in a forward direction, view the underside of the belt and sprocket. The belt climbing on the left-hand flange indicates incorrect alignment.

With correct belt alignment, there should be a slight gap to the right of the belt and the belt should not climb either sprocket flange.

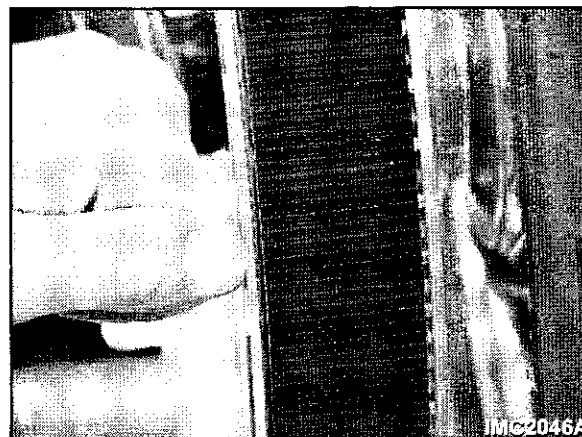


Figure 412 — Checking belt tracking

Spinning the wheel in a reverse rotation causes the belt to slowly track to the right leaving a slight gap to the left.

If drive belt tracking is excessive in either direction, verify correct rear wheel alignment and belt tension, inspect drive components for wear, damage, bending, looseness or misalignment. Replace or repair components as necessary.

## Drive Belt Handling and Storage

The rear drive belt is extremely durable when handled and installed properly. Damage can occur, however, if the incorrect tools are used to remove and install a belt or it is stored improperly.

When removing or installing the belt, always adjust the sprocket centers so that the belt slides easily over the drive sprockets. **DO NOT** use a screwdriver or bar to pry the belt off or onto the sprockets.

When storing or packaging a belt for shipment, **DO NOT** bend the belt forward (teeth closing) in a circle any smaller than 5" in diameter.

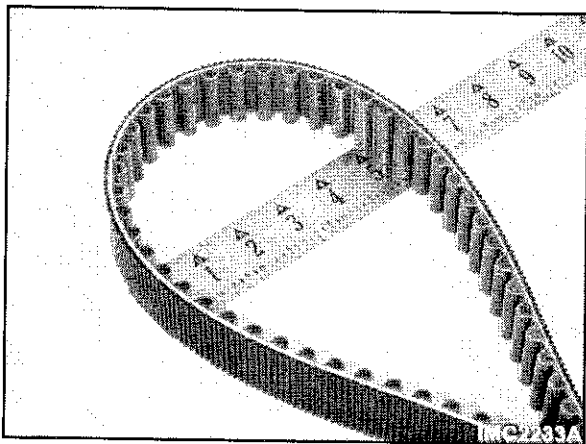


Figure 413 — Minimum forward bend (5" circle)

Similarly, **DO NOT** bend the belt backward (teeth spreading) in a circle any smaller than 10" in diameter.

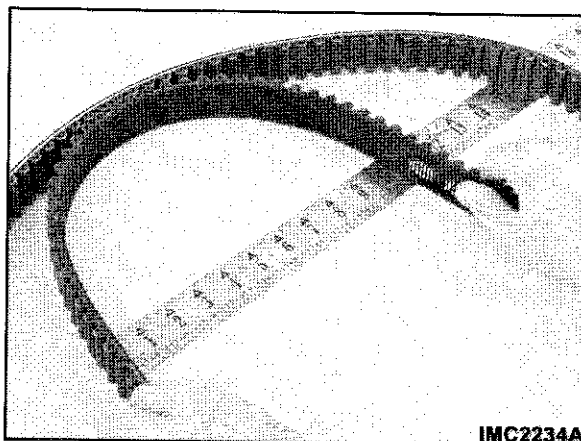


Figure 414 — Minimum backward bend (10" circle)

Bending the belt in circles tighter than the above limits or crimping and twisting the belt can damage the cords and shorten service life.



## CLUTCH SERVICE

The Indian Scout and Spirit motorcycles are equipped with a wet-type clutch that is controlled by a hand lever (on left handlebar) and cable. The clutch assembly incorporates 9 steel discs sandwiched between 10 friction discs keyed to the rear drive sprocket. Procedures for maintaining and servicing the lever, cable and clutch assembly follow.

### Clutch Lever and Cable

#### Tools required:

External snap ring pliers with 0.050" tips

5/32" hex bit

#### Cable Inspection

Inspect the clutch cable throughout the entire length. Make sure it is not kinked or chafed. Replace the cable if it is damaged or does not slide freely due to corrosion or fraying.

#### Lever Removal and Cable Lubrication

Remove the snap ring from the bottom of the clutch lever pivot pin, using an external snap ring pliers.

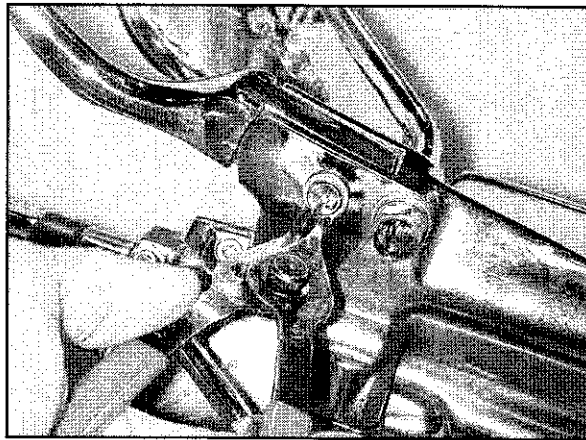


Figure 415 — Snap ring removal

Push up on the pivot pin and pull it from the lever and bracket.

With the pin removed, slowly pull the lever and cable out from the bracket.

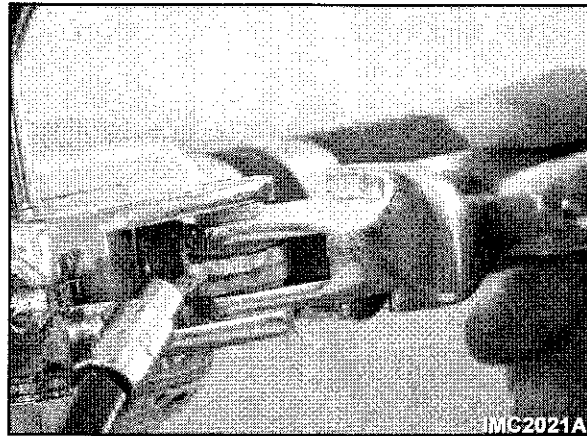


Figure 416 — Clutch lever and cable removal

Remove the nylon cable retaining pin and cable end from the lever. Use care to keep the nylon bushings from falling out of the lever.

Clean and inspect the pivot bushings and pins. Replace any parts that are worn or damaged.

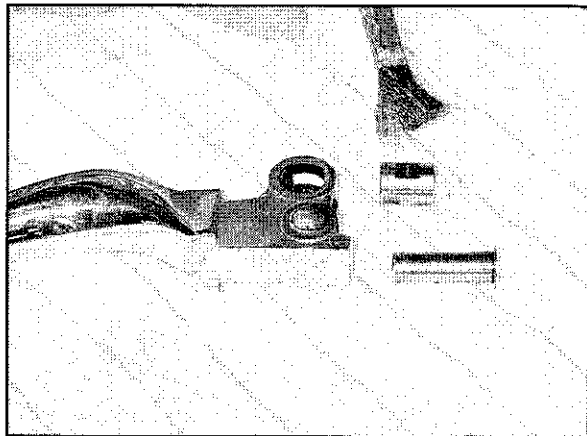


Figure 417 — Lever and pivot pin

Lubricate the cable with a suitable lubricant such as "Champions Choice<sup>®</sup>" brand, or an equivalent product.

Insert the cable end between the nylon pivot bushings in the lever and install the retaining pin.

Place the lever and cable back in the bracket. Align the pivot pin hole in the lever with the hole in the bracket and insert the pin.

Using a snap ring pliers, install the snap ring in its groove at the bottom of the pivot pin.

## Clutch Lever Bracket Removal and Installation

The clutch lever bracket, clutch cable and mirror can easily be removed from the handlebar as an assembly.

Using a 5/32" hex bit, remove the two retaining screws from the bracket clamp. Separate the clamp and bracket halves and remove the assembly from the handlebar.

To install, first apply blue threadlock to the retaining screws. Then, place the clamp and bracket halves in position on the handlebar against the left switch assembly. Install the screws and tighten to specification, using a 5/32" hex bit.

## Clutch Inspection and Adjustment

Proper clutch adjustment is required to ensure proper disengagement and engagement of the clutch. Excessive free travel may not fully disengage the clutch causing rough shifting and may cause the bike to creep forward while at a stop light. Too little free travel or none at all may cause the clutch to slip under acceleration.

The clutch assembly can be visually checked and adjusted by removing the clutch cover from the outer primary housing.

### ⚠ CAUTION!

The normal increase in temperature as the motorcycle is operated affects clearances and clutch adjustment. A clutch adjustment should only be done after the motorcycle has cooled to the normal ambient temperature.

### Tools required:

- 3/16" hex bit
- 5 mm hex bit
- 7/16" wrench
- 1/2" wrench
- 14 mm wrench
- 3/4" thin wall socket
- Drain pan
- Motorcycle lift
- Torque wrench

## Adjustment Procedure

Raise the motorcycle to a comfortable working height, using a lift.

Place a drain pan under the primary drive housing under the drain plug.

Using a 3/4" thin wall socket, remove the drain plug to allow the primary housing lubricant to drain. Inspect the nylon sealing washer on the drain plug for damage and replace as necessary. Apply blue threadlock to the drain plug and reinstall it into the outer primary drive housing and tighten to specification.

**Note:** An alternate method can be used to perform clutch inspection and adjustment without draining the housing lubricant. Leaning the motorcycle to the right while servicing the clutch prevents the need to drain the primary housing lubricant.

Remove the five retaining screws from the clutch cover, using a 3/16" hex bit. Remove the cover and discard the gasket.

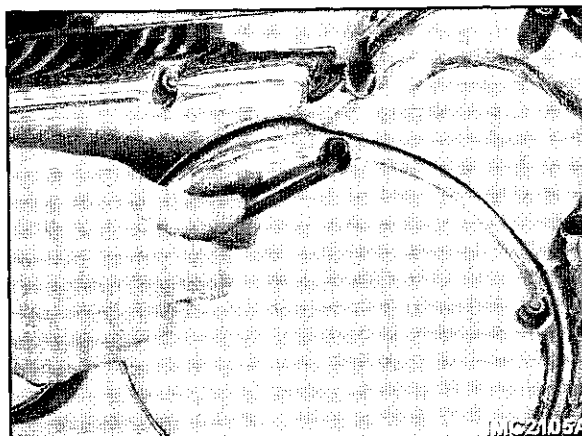


Figure 418 — Clutch cover removal

Slide the rubber boot upward on the clutch cable to access the cable adjuster. The adjuster is located at the front of the frame, midway along the cable.

Loosen the cable adjustment jam nut, using a  $7/16$ " wrench on the jam nut while holding the cable ferrule nut with a  $1/2$ " wrench. Turn the adjuster in all the way for maximum slack in the cable.

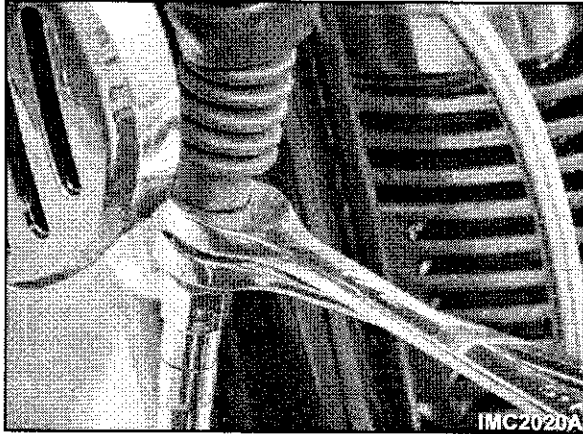


Figure 419 — Clutch cable adjustment

At the clutch assembly, use a 5 mm hex bit to hold the adjustment screw and loosen the jam nut, using a 14 mm wrench. Back the jam nut away from the pressure plate and turn the adjustment screw inward (clockwise) until it gently contacts the transmission pushrod. Then, back the adjustment screw out  $1/2$  to 1 full turn. Use the 5 mm hex bit to hold the screw in this position and tighten the jam nut.

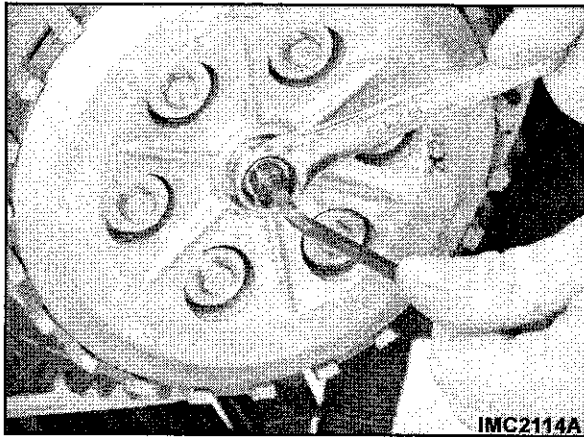


Figure 420 — Clutch adjusting screw and jam nut

Pull the clutch lever on the handlebar several times to free the cable and set the clutch release.

Grasp the cable end ferrule and pull it away from the clutch lever bracket. At the same time, turn the cable adjuster to provide a gap of  $1/16$ – $1/8$ " between the shoulder on the ferrule and the bracket.

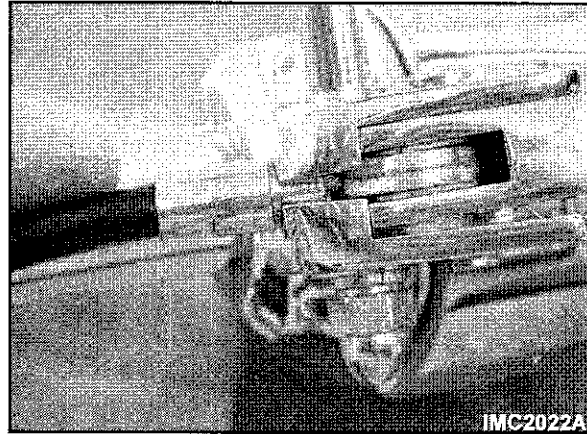


Figure 421 — Clutch cable end ferrule gap

With the cable adjustment within specification, tighten the jam nut on the cable adjuster, using a  $7/16$ " wrench while holding the cable ferrule nut with a  $1/2$ " wrench.

Slide the rubber boot down to cover the adjuster.

Apply blue threadlock to the five clutch cover screws. Place a new gasket in position on the clutch cover and install the cover. Tighten the cover screws to specification, using a  $3/16$ " hex bit.

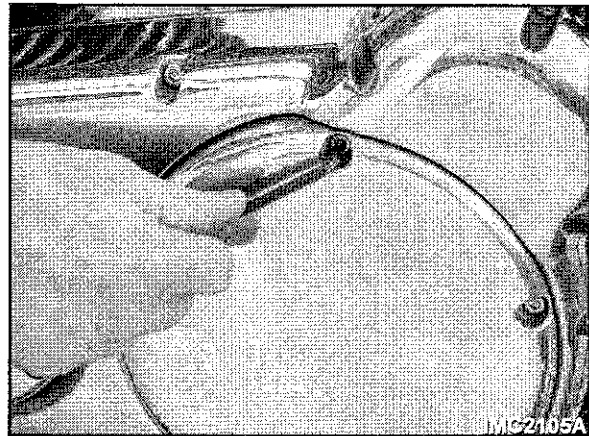


Figure 422 — Clutch cover installation

Using a 3/16" hex bit, remove the chain adjuster access cover from the outer primary housing and discard the gasket.

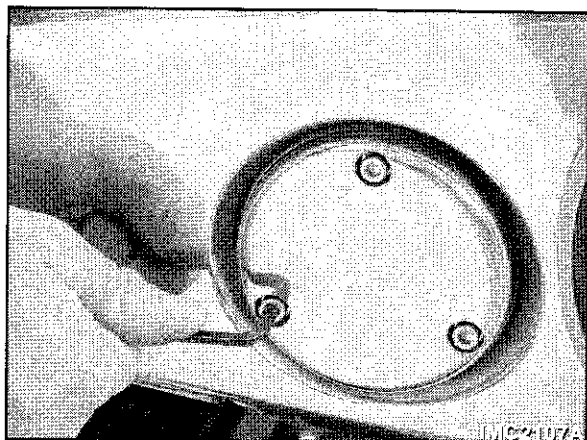


Figure 423 — Chain adjuster access cover removal

Fill the primary housing with 30 ounces of Indian primary oil.

Apply blue threadlock to the three access cover screws. Place a new gasket in position on the housing and install the cover. Tighten the cover screws to specification, using a 3/16" hex bit.

Lower the motorcycle to the ground and remove the lift.

## Clutch Removal and Installation

### Tools required:

- 3/16" hex bit
- 7/16" wrench/socket
- 10 mm socket
- 1/2" wrench/socket
- 9/16" wrench/socket
- 3/4" thin wall socket
- Dental pik
- Drain pan
- Motorcycle lift
- Torque wrench

### Removal

Raise the motorcycle to a comfortable working height, using a lift.

To remove the complete clutch assembly (clutch pack, hub and sprocket case), refer to the PRIMARY DRIVE SERVICE section for instructions. If only the clutch pack requires service, proceed with the following steps.

Place a drain pan under the primary drive housing under the drain plug.

Using a 3/4" thin wall socket, remove the drain plug to allow the primary housing lubricant to drain. Inspect the nylon sealing washer on the drain plug for damage and replace as necessary. Apply blue threadlock to the drain plug and reinstall it into the outer primary drive housing and tighten to specification.

Remove the five retaining screws from the clutch cover, using a 3/16" hex bit. Remove the cover and discard the gasket.

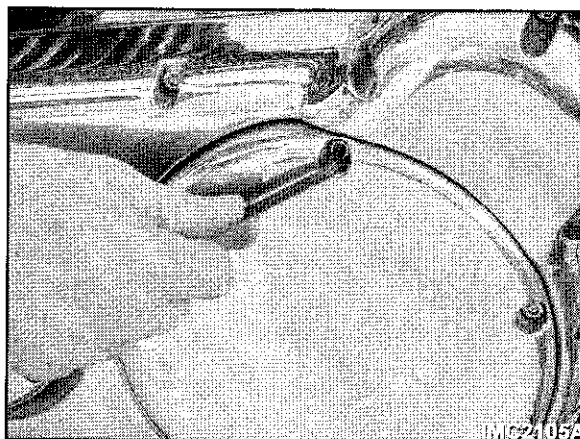


Figure 424 — Clutch cover removal

Remove the six clutch pressure plate retaining screws and springs, using a 10 mm socket.

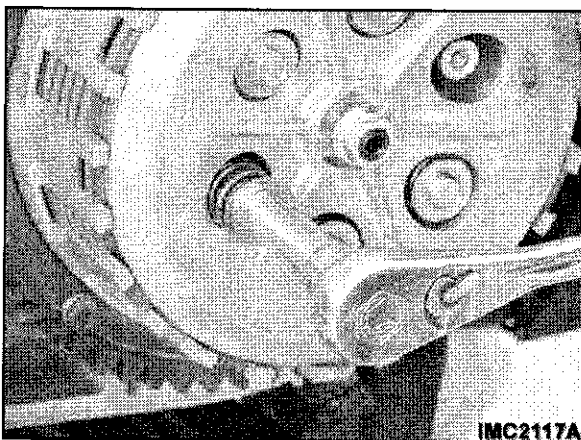


Figure 425 — Removing pressure plate retaining screws (shown with outer primary housing removed — removal not necessary)

Remove the pressure plate.

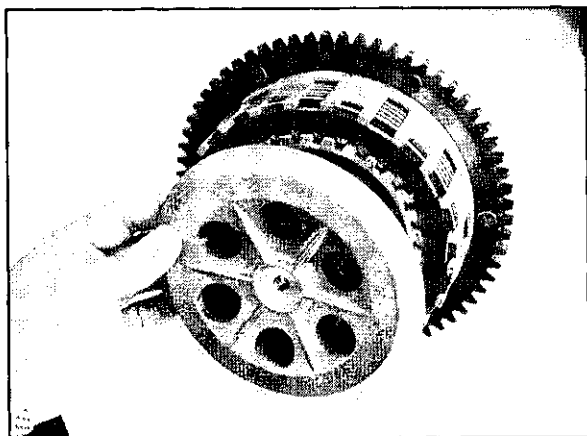


Figure 426 - Removing pressure plate

Remove the 10 friction and 9 steel discs from the clutch hub and sprocket case. A dental pik may be helpful in removing the discs.

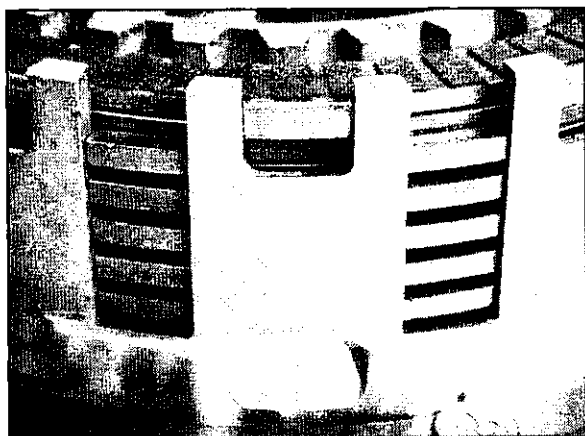


Figure 427 — Friction and steel disc orientation

Remove the judder spring and judder spring seat.

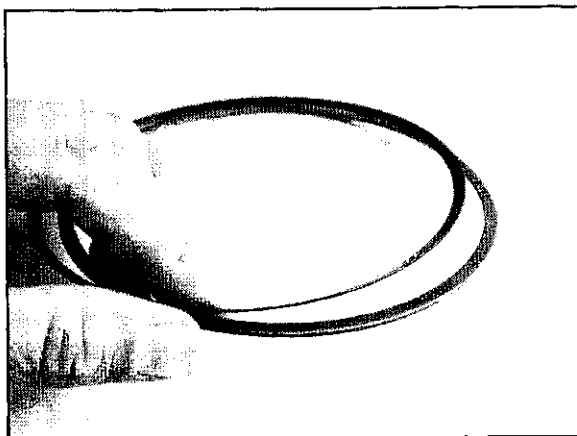


Figure 428 - Judder spring and seat

Clean and inspect the discs, springs and pressure plate following the procedure under Clutch Disassembly and Assembly in this section.

## Installation

**Note:** The following installation procedure applies when only the clutch pack is removed for service. If the complete clutch assembly (clutch pack, hub and sprocket case) is removed, refer to the PRIMARY DRIVE SERVICE section for installation instructions.

Install the judder spring seat first and then the judder spring in position over the hub and against the sprocket case. The concave side of the judder spring faces out.

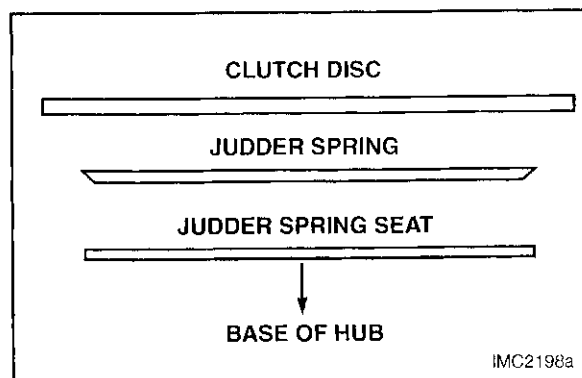


Figure 429 — Judder spring and seat

Install the 10 friction discs and 9 steel discs, alternately, on the hub.

Install the friction spacer disc (2) first. This disc has a larger inside diameter than the remainder of the friction discs (3). A steel disc (1) goes in after the spacer disc.

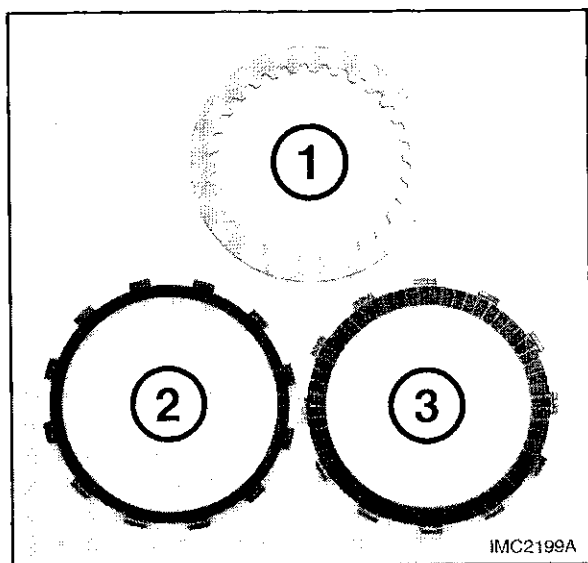


Figure 430 — Steel disc (1), spacer disc (2) and standard friction disc (3)

**Note:** The first disc to be installed is a friction disc. This is a spacer disc that has a larger inside diameter (provides room for the judder spring and seat) than the remaining friction discs. Install a steel disc next. Continue alternating types of discs until all are installed. Align the tabs of the friction discs during installation. The last disc installed should be a friction disc (goes against the pressure plate). Also, the last friction disc should be installed with the tabs offset from the previous friction discs installed.

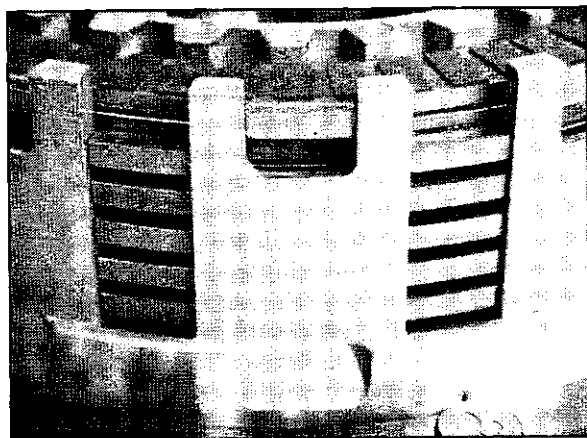


Figure 431 — Disc orientation

Place the pressure plate in position on the clutch hub. If not already done, loosen the clutch adjuster jam nut and back out or remove the adjusting screw.

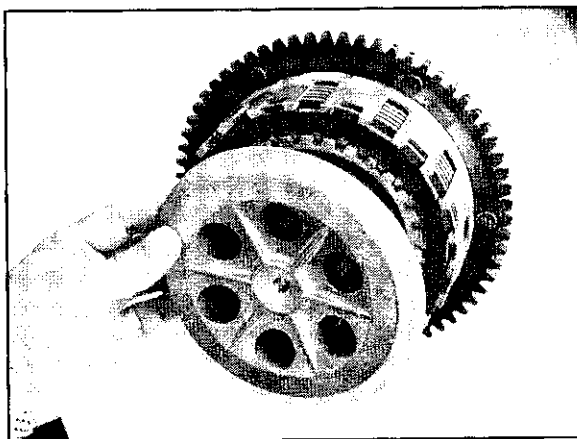


Figure 432 — Installing pressure plate

Apply blue threadlock to the threads of the six clutch pressure plate retaining screws. Install the retaining screws and springs and alternately tighten to specification, using a 10 mm socket.

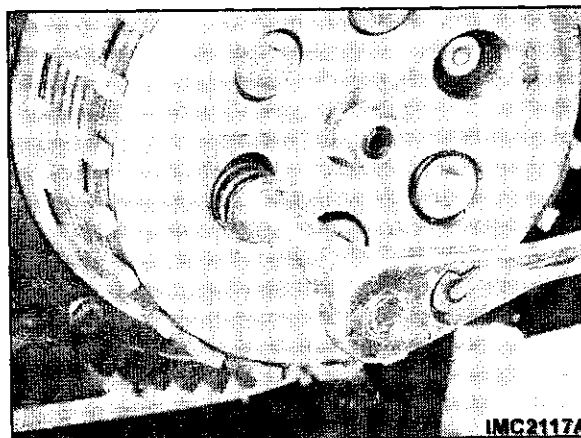


Figure 433 — Installing pressure plate retaining screws (shown with outer primary housing removed — removal not necessary)

Adjust the clutch following the procedures in the Clutch Inspection and Adjustment section.

Apply blue threadlock to the five clutch cover screws. Place a new gasket in position on the clutch cover and install the cover. Tighten the cover screws to specification, using a 3/16" hex bit.

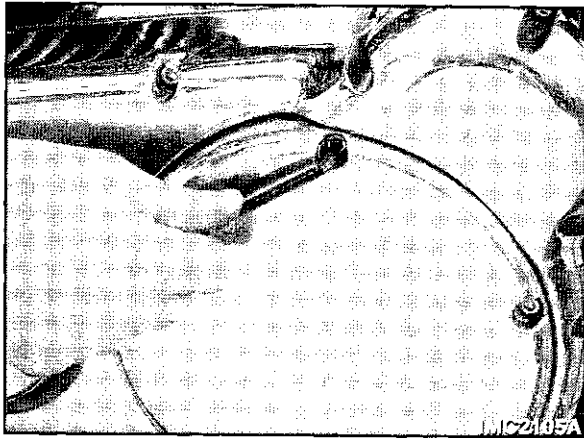


Figure 434 — Clutch cover installation

Using a 3/16" hex bit, remove the chain adjuster access cover from the outer primary housing and discard the gasket.

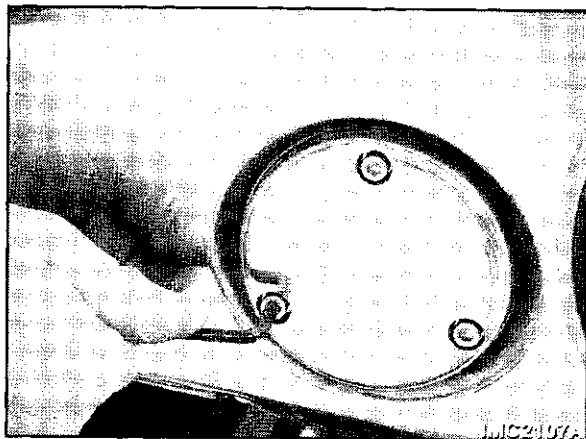


Figure 435 — Chain adjuster access cover removal

Fill the primary housing with 30 ounces of Indian primary oil.

Apply blue threadlock to the three access cover screws. Place a new gasket in position on the housing and install the cover. Tighten the cover screws to specification, using a 3/16" hex bit.

Lower the motorcycle to the ground and remove the lift.

## Clutch Disassembly and Assembly

If the complete clutch assembly (clutch pack, hub and sprocket case) has been removed, it can be serviced by cleaning, inspecting and replacing parts as required.

### Tools required:

- External snap ring pliers
- Internal snap ring pliers
- Bearing remover/installer
- Press

### Cleaning and Inspection

Clean all parts, except the friction discs, with a suitable solvent solution. Rinse the parts and blow dry with compressed air.

Check the friction surfaces of the discs for wear, chipped or missing lining material. Measure the thickness of the friction discs. If the material thickness is below the minimum specified or if any disc is severely damaged, replace both the friction and steel discs.

Check the flatness of the steel discs. If any one is cracked, warped or shows signs of other damage caused by excessive heat, replace both the friction and steel discs.

Check the hub and sprocket case for cracks in the shell and the sprockets for worn, chipped or broken teeth. Rotate the hub within the sprocket case and check for rough spots or looseness in the bearing. Disassemble the hub and replace worn or damaged parts as required.

Inspect the sprocket case for wear in the friction disc tab slots. Deep notches can prevent the discs from separating properly when releasing the clutch. Replace the sprocket case if excessive wear or deep notches are found.

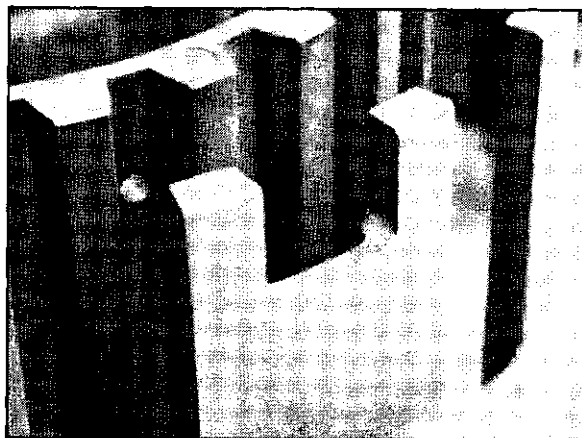


Figure 436 — Check tab slots for wear

Inspect the hub splines for wear. If excessive wear or deep notches are found, replace the hub.

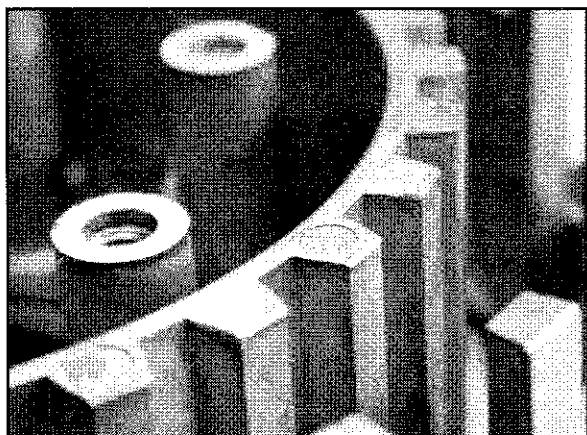


Figure 437 — Check splines for wear

Check the pressure plate and springs for cracks or other damage and replace as required.

## Hub/Sprocket Case Disassembly

**Note:** The disassembly procedure will damage the bearing which then must be replaced. Disassemble the hub and sprocket case only when there is a need to replace worn or damaged parts.

Using an external snap ring pliers, remove the snap ring retaining the bearing on the hub.

### ⚠ WARNING!

**DO NOT** remove the spiral lock ring and washer from the inside bore of the hub. Removing the lock ring can release parts retained under pressure and result in personal injury. If damaged, the hub should be replaced as an assembly.

Place the sprocket case in a press with the primary chain side up. Support the case with blocks placed under the starter ring gear. Be sure to allow room between the case and press plate(s) for removal of the hub.

Place a suitable pilot in position on the inner shaft of the hub and press the hub from the bearing.

Remove the sprocket case from the press. Using an internal snap ring pliers, remove the snap ring retaining the bearing in the sprocket case bore.

Place the sprocket case back in the press, again with the primary chain side up. With a suitable bearing remover or sleeve in position against the outer race, press the bearing from the case.

## Hub/Sprocket Case Assembly

Place the sprocket case in a press with the primary chain side down.

Position a new bearing with its outer race set square to the case bearing bore.

Set a suitable bearing installer or sleeve on the outer race of the bearing and press the bearing into the case bore until it is seated against the shoulder.

Remove the case from the press and install the bearing retaining snap ring, using an internal snap ring pliers.

Again, place the sprocket case in a press with the primary chain side down. Place the case on a sleeve supporting the inner race of the bearing. The placement of the sleeve is important to keep stress off the bearing as the hub is installed during the next step.

Place the shaft end of the hub squarely in position on the bearing. Press the hub through the bearing until it is fully seated against the inner race.

Remove the case from the press and install the bearing retaining snap ring on the hub, using an external snap ring pliers.



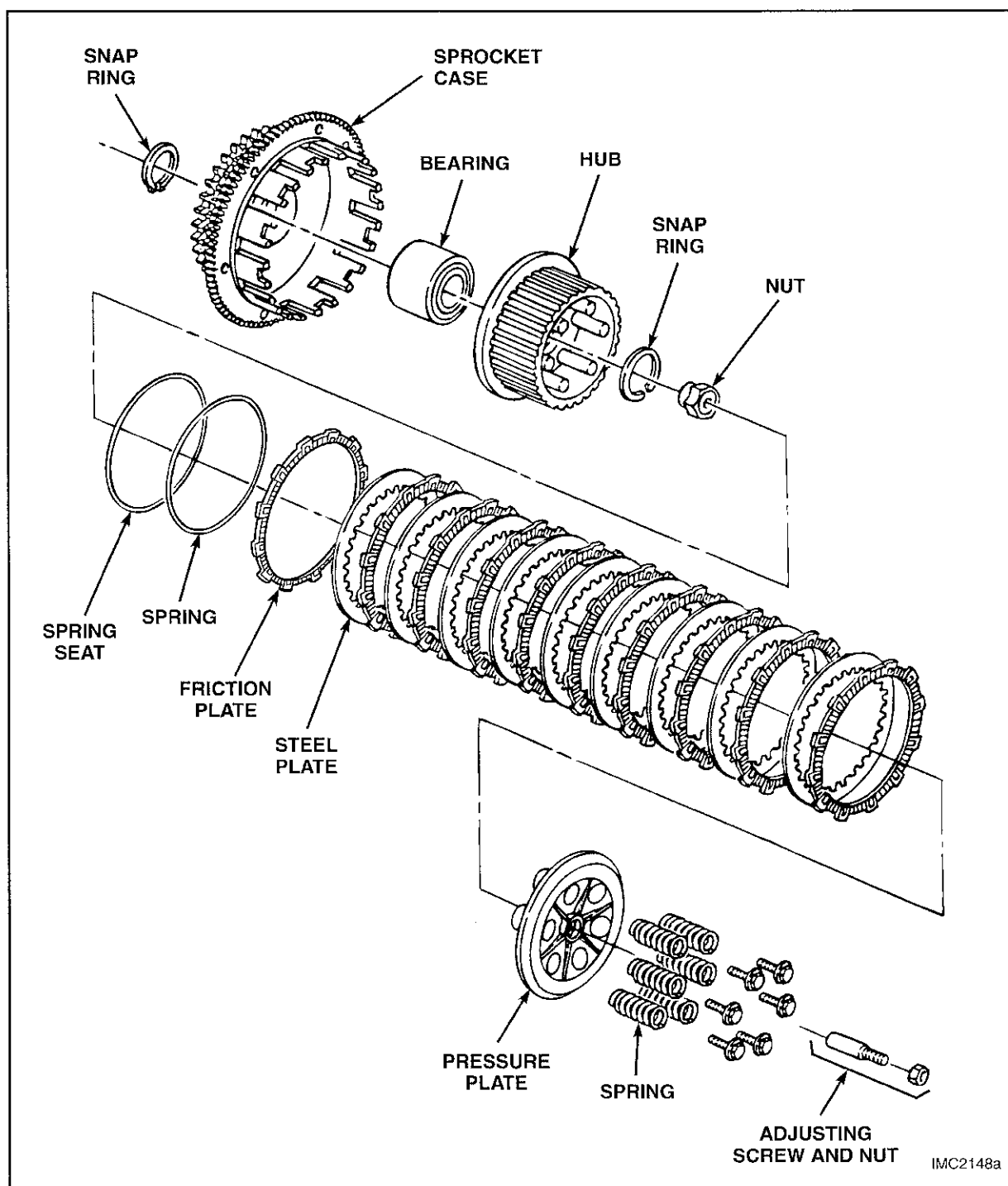


Figure 438 — Clutch assembly

## TRANSMISSION MAINTENANCE

### Transmission Shift Control Linkage Maintenance and Adjustment

Frequent lubrication of the shift rod pivots decreases wear and reduces the effort required to shift the transmission. Many transmissions are blamed for rough shifting when the real reason lies in the bushings being dry or worn out.

#### Tools required:

- 3/16" hex bit
- 1/4" hex bit
- 3/8" hex bit
- 1/2" box-end wrench
- 17 mm box-end wrench
- Torque wrench

#### Shift Rod Rear Pivot Bolt Clearance Check

Before removal of the shift rod pivot bolts, check the clearance between the primary housing and the rear pivot-bolt head. Rock the heel shifter down and hold in that position. The pivot bolt head should not be touching the inner primary housing. Interference at this point can cause hard or missed shifts.

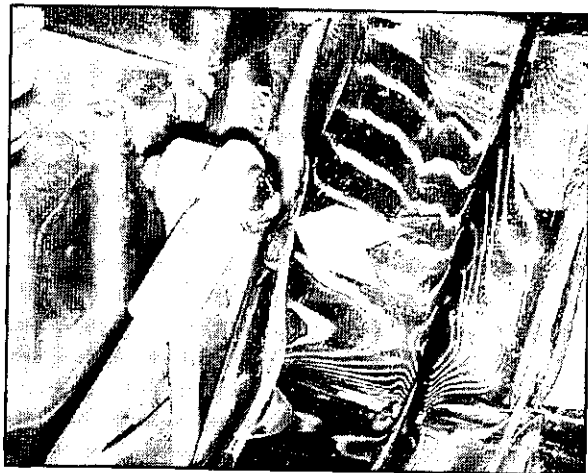


Figure 439 - Pivot bolt head-to-primary housing clearance

If interference is detected, the transmission shift lever may not be seated deeply enough or the lever inclination may not be correct.

Loosen the shift lever pinch bolt, using a 1/4" hex bit. Push the shift lever inward to create clearance between the inner primary housing and pivot bolt head. If this does not provide the necessary clearance, remove the shift lever and index it one spline counterclockwise.

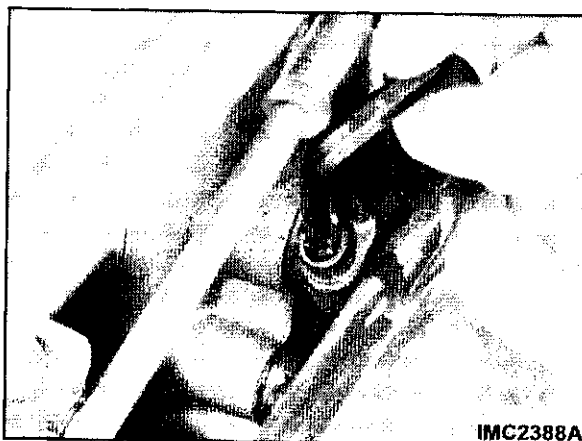


Figure 440 - Repositioning transmission shift lever

Tighten the pinch bolt to specification, 18–20 foot pounds, using a 1/4" hex bit.

## Shift Rod Pivot Bolt Lubrication

Remove the front pivot bolt from the shift rod, using a 3/16" hex bit and a 1/2" wrench.

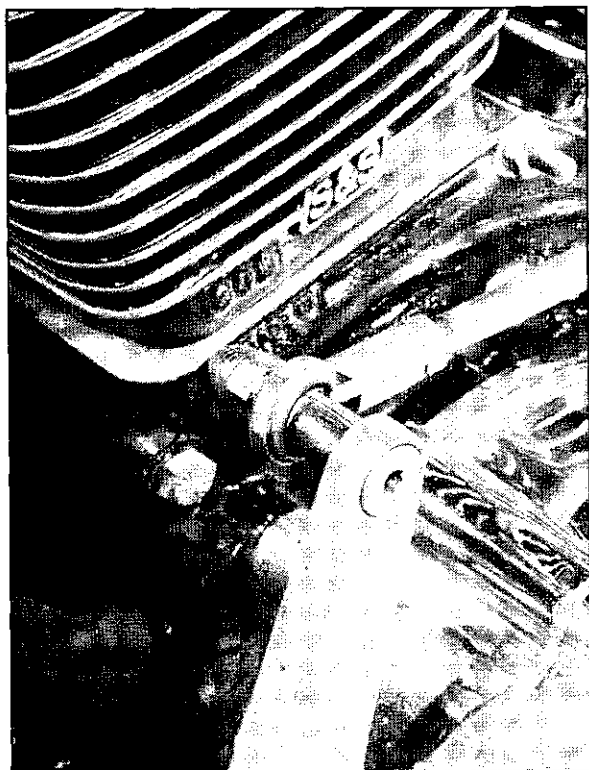


Figure 441 — Shift rod front pivot bolt

Apply grease on the pivot surface of the bolt, being careful not to get any on the threads. Apply blue threadlock to the threads of the retaining nut.

Install the pivot bolt and nut, using a 3/16" hex bit and 1/2" wrench. Tighten to 13–19 foot-pounds.

Remove the rear pivot bolt, using a 3/16" hex bit.

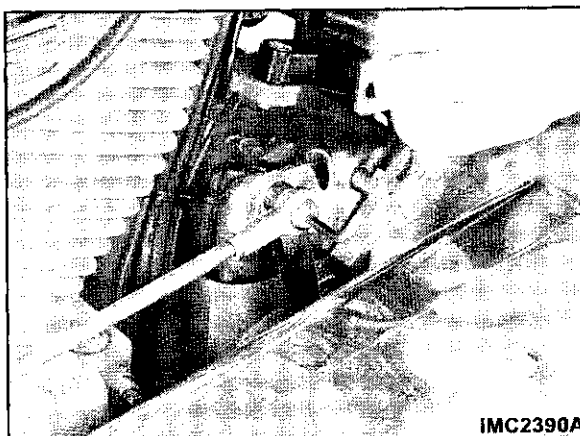


Figure 442 — Removing rear pivot bolt

Apply grease to the bolt's pivot surface, again being careful not to get any grease on the bolt threads.

Apply blue threadlock to the threads and install the pivot bolt. Tighten the bolt to 13–19 foot-pounds, using a 3/16" hex bit and torque wrench.

## Shift Rod Adjustment

The length of the shift rod can be adjusted, if necessary, to provide smooth operation of the foot control with no interference from the floorboard through all transmission shifts.

Loosen the jam nut at the front shift rod pivot-socket, using a 1/2" wrench.

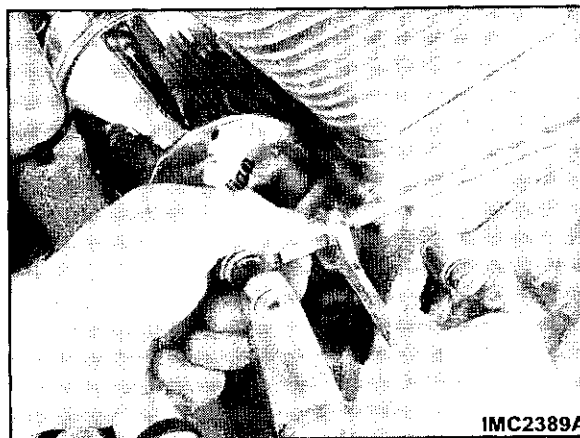


Figure 443 — Loosening jam nut

Remove the front pivot bolt and nut, using a 3/16" hex bit and 1/2" wrench.

Turn the socket end of the shift rod clockwise to shorten, or counterclockwise to lengthen, as required.

**Note:** It may be necessary to loosen the jam nut and adjust the shift rod length at the rear pivot to maintain adequate thread engagement at both socket ends.

Install the front pivot bolt and check the operation of the foot control through the shift points. Remove the pivot bolt and readjust the shift rod length, if necessary.

Tighten the pivot bolt and nut to 13–19 foot-pounds, using a 1/2" wrench, 3/16" hex bit and torque wrench.

Tighten the shift nut jam nut securely, using a 1/2" wrench.

## Shift Pawl Adjustment

Full engagement of the gears may not be achieved without adjustment of the shift pawl.

Remove the seat following the procedure in the FRAME AND ACCESSORIES SERVICE section.

Remove the oil tank to gain access to the shift drum cover. Refer to the LUBRICATION SYSTEM SERVICE section for the procedure.

Remove the shift drum cover from the top of the transmission, using a 3/16" hex bit.

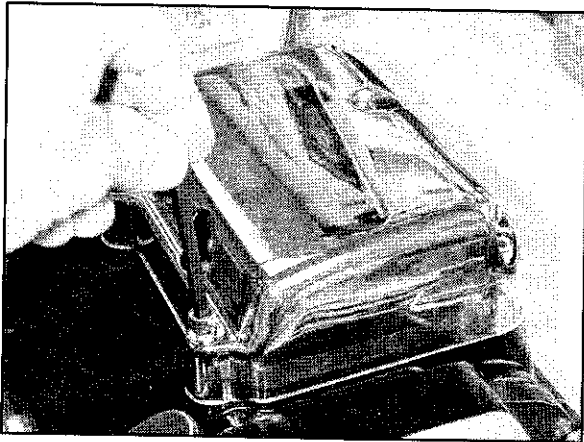


Figure 444 — Removing shift drum cover

Place the transmission in 3rd gear.

Gently rock the shift shaft back and forth noting the lash within the system.

Inside the transmission there should be equal distance between the left pin to the left shift pawl and the right pin to the right shift pawl.

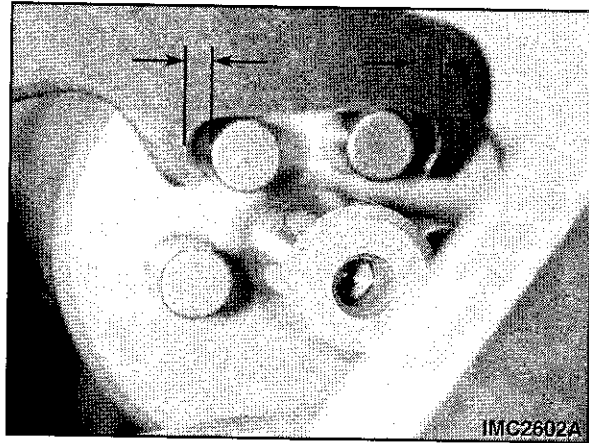


Figure 445 — Equal lash between pin and pawl

If adjustment is needed, loosen the locknut, using a 17 mm box-end wrench.

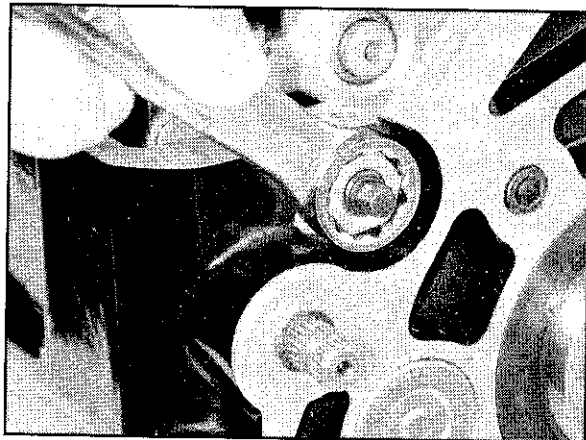


Figure 446 — Loosen locknut (transmission shown removed)

Rotate the adjusting screw to achieve equal distance between the pins and shift pawl by rocking the shift shaft back and forth.

Tighten the locknut to 20–24 foot-pounds torque, while holding the adjusting screw.

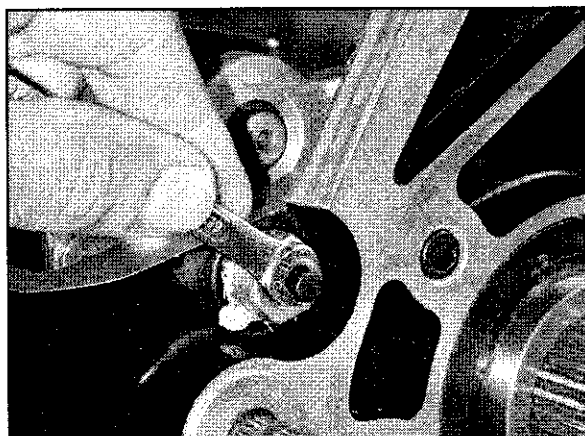


Figure 447 — Tighten locknut (transmission shown removed)

Shift the transmission through all the gears checking for full engagement. Continue to rotate the adjustment screw until full engagement is achieved while up shifting and down shifting.

Apply blue threadlock to the threads of the shift drum cover screws. Place the cover in position over the shift drum and install the screws, using a 3/16" hex bit. Tighten the screws to specification, 10 foot-pounds.

Install the oil tank and then the seat following the instructions in the LUBRICATION SYSTEM SERVICE section and the FRAME AND ACCESSORIES SERVICE section, respectively.

## Transmission Oil Change

Changing the transmission oil regularly will enhance the service life of the transmission. The oil should be changed after the first 500 miles (800 km) of service and at 5,000-mile (8000 km) intervals thereafter when riding under normal conditions.

The fill plug dipstick is located at the front on the chrome right-side housing cover. The magnetic drain plug is also located on the right side of the transmission, in the trapdoor just below the housing cover.

### Tools required:

3/16" hex bit

3/8" hex bit

Drain pan

### Changing the Oil

If equipped (Spirit only), remove the exhaust pipe-to-transmission bracket and fasteners, using a 1/2" wrench and a 1/4" hex bit.

Place a drain pan in position below the right side housing cover.

Remove the drain plug from the trapdoor, using a 5 mm hex bit. Allow the oil to completely drain into the drain pan.

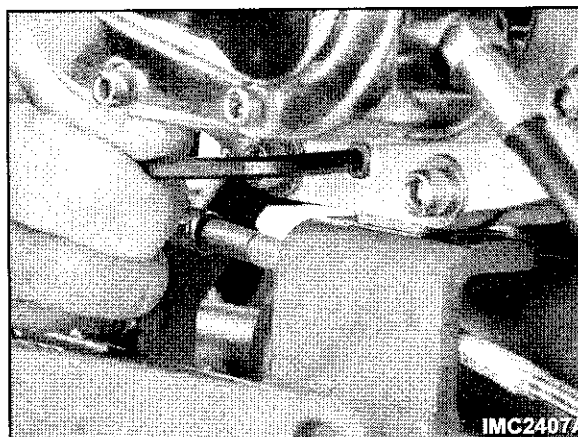


Figure 448 — Drain plug removal (transmission shown removed)

Clean the magnetic drain plug to remove all dirt and foreign material.

Install the drain plug and tighten it securely. It should project slightly above (0.1–0.2") the surface of the trapdoor when it is installed properly.

### ⚠ WARNING!

**Do not over-tighten the magnetic drain plug. When draining and refilling the transmission oil, use care that dirt and debris does not get into the case. DO NOT allow oil to get on the rear wheel, the tires or the brakes. The traction and handling of the motorcycle could be impaired, possibly resulting in personal injury and damage to the motorcycle.**

If equipped (Spirit only), install the exhaust pipe-to-transmission bracket and fasteners, using a 1/2" wrench and a 1/4" hex bit.

Remove the fill plug and fill the transmission with 20–24 ounces of Indian® 80-90W transmission oil, or its equivalent. DO NOT overfill the transmission.

With the motorcycle in a vertical position and on level ground, insert the fill plug dipstick without threading it into the hole and check the oil level. It should be between the notches on the dipstick. If below, add oil to bring it within the notches. Install the threaded fill plug and tighten securely, using a 3/8" hex bit.

Thoroughly wipe the bottom of the frame rail and surrounding parts to remove any spilled oil.

Start the motorcycle and ride it to bring the transmission oil up to normal operating temperature. Stop the motorcycle and with the oil warmed, check to ensure the proper oil level following the procedure below. Add oil if required.

Check for any oil leaks after riding.

### Checking Transmission Oil Level

Make sure the engine is at normal operating temperature.

Place the motorcycle in a full upright position on level ground.

Remove the threaded fill plug dipstick.

Clean the dipstick. Then, place it in the housing and remove it again. DO NOT screw the dipstick into the housing.

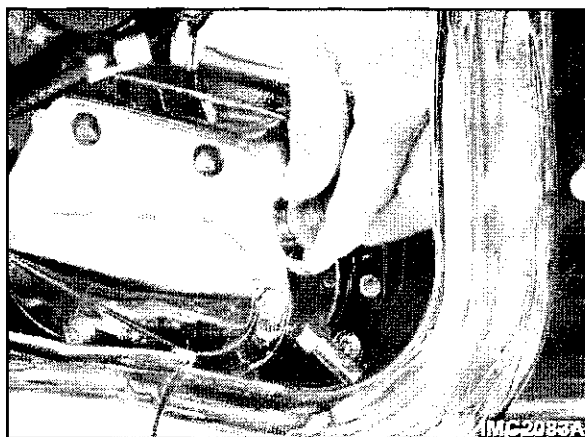


Figure 449 - - Checking transmission oil level

Check the oil level on the dipstick. The level should be between the two notches on the dipstick.

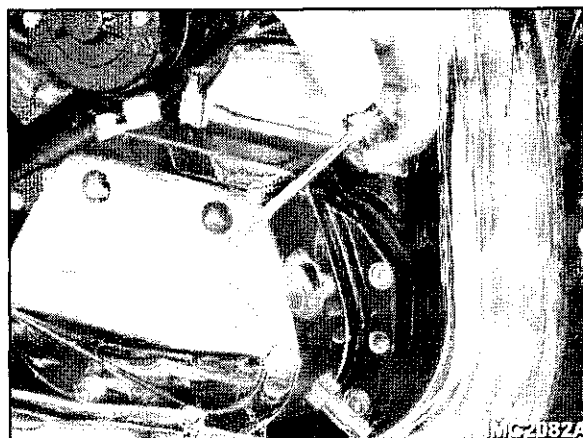


Figure 450 — Fill plug dipstick.

If the oil level is too low, carefully add Indian<sup>®</sup> 80-90W<sup>†</sup> transmission oil, or its equivalent. Once the proper oil level is reached, install the threaded fill plug and tighten securely, using a 3/8" hex bit.

## TRANSMISSION REMOVAL AND INSTALLATION

When it is necessary, the transmission can be removed from the chassis for overhaul or replacement.

### Transmission Removal

Tools required:

5/32" hex bit

3/16" hex bit

1/4" hex bit

5 mm hex bit

10 mm socket

7/16" wrench/socket

1/2" wrench/socket

9/16" wrench/socket

3/4" wrench/socket

15/16" wrench

1 3/16" socket

1 1/2" socket

Flat-blade screwdriver

Snap ring pliers

Torque wrench

Motorcycle lift

Drain pan

### Transmission Removal

Remove the muffler and exhaust pipe from the rear cylinder (Scout), or the muffler and pipes from both cylinders (Spirit) following the procedures in the EXHAUST SYSTEM SERVICE section.

Drain the engine oil from the oil tank, and remove the oil tank following the procedure in the LUBRICATION SYSTEM SERVICE section.

**Note:** If the transmission clutch cover (right side) is to be removed to disconnect the clutch control cable, drain the oil from the transmission before proceeding to the next step.

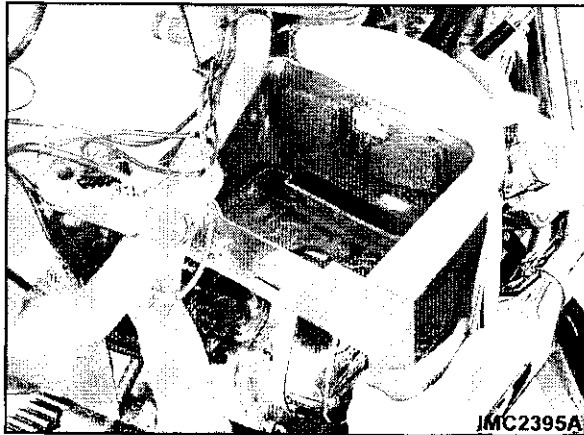


Figure 451 — Removing oil tank.

Using a suitable lift, raise the motorcycle off the ground to a comfortable working height.

Disconnect the clutch control cable by one of the following two methods:

- If the oil has not been drained, disconnect the cable from the handlebar control and the retainer bracket on the frame. This frees the cable to be removed with the transmission.
- If the transmission oil has been drained, remove chrome clutch control cover and secure it out-of-way. Refer to the procedures in the TRANSMISSION OVERHAUL section.

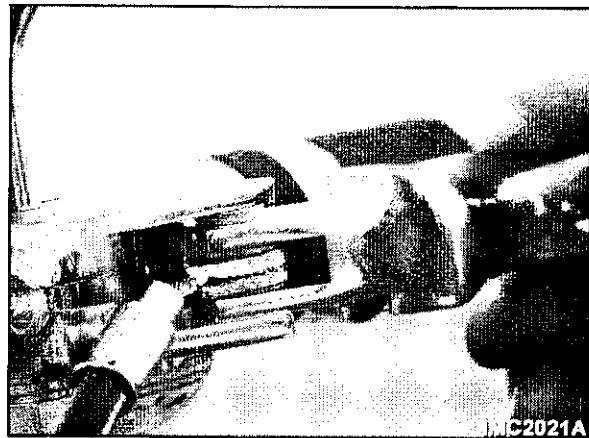


Figure 452 — Disconnecting clutch cable at handlebar control

Remove the shift rod rear pivot bolt, using a 3/16" hex bit.

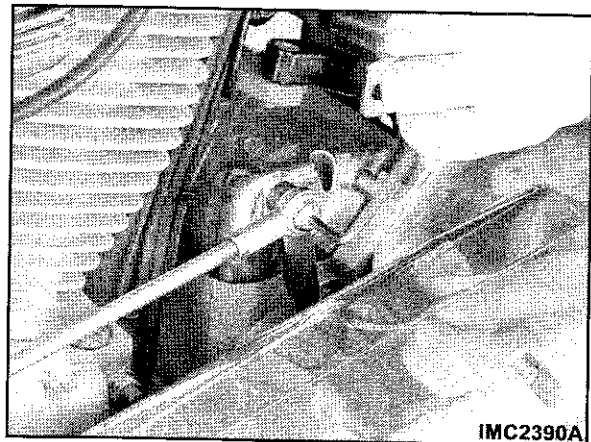


Figure 453 — Removing shift rod pivot bolt

Disconnect the vent hose from the transmission shift drum cover.

Remove the primary drive assembly and inner housing from the chassis. Refer to the procedure under Primary Drive Removal, Installation and Adjustment in the PRIMARY DRIVE SERVICE section.

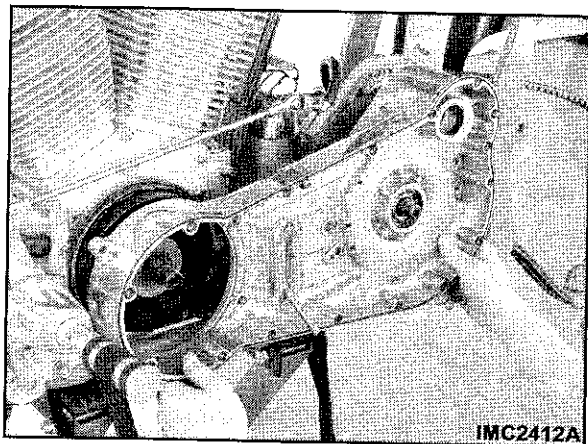


Figure 454 — Removing inner primary drive housing (shown with rear wheel/ swingarm removed; removal not required)

Remove the starter motor. Refer to the STARTING SYSTEM SERVICE section for the removal procedure.

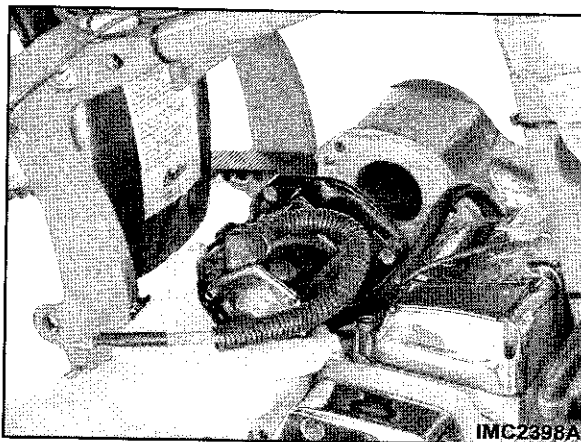


Figure 455 — Removing starter motor

Disengage the speedometer pickup wiring harness connector.

Release the drive belt tension as follows so that the belt can be removed from the transmission sprocket.

Remove the cotter pin from the rear axle castle nut and loosen the axle, using a 15/16" hex socket and 15/16" combination wrench.

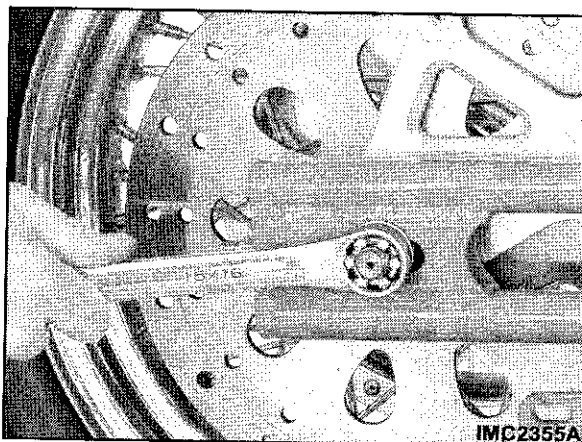


Figure 456 — Loosening rear axle



Loosen the axle adjusting nuts at the ends of the swing arm, using a 1/2" wrench. The nuts should be loosened in equal increments. Make sure that after backing off the adjusting nuts, the axle slides forward on both the right and left sides. Then, remove the belt from the transmission sprocket.

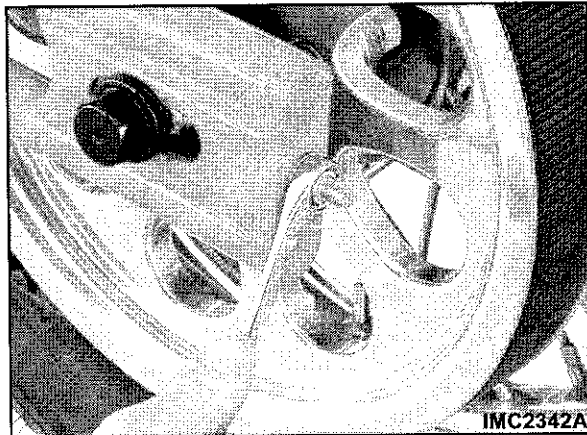


Figure 457 — Loosening axle adjusting nuts

Remove the five transmission mounting nuts from under the frame mounting pad, using a 9/16" wrench.

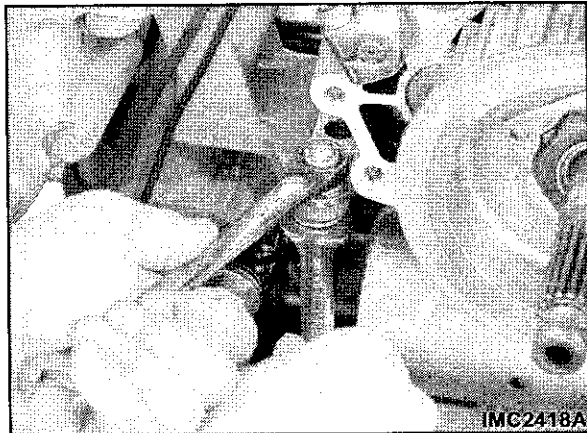


Figure 458 — Removing transmission mounting nuts

Note and mark the location of shims (if used) on the mounting studs between the transmission adapter plate and mounting pad on the frame. The shims must be installed in the same location when the transmission is installed.

Lift the transmission and adapter plate up from the mounting pad and remove it from the motorcycle.

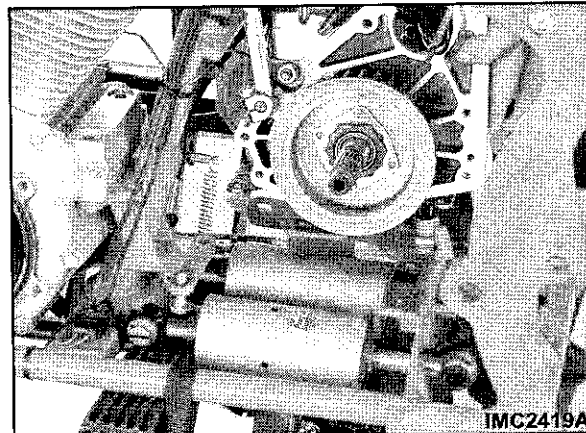


Figure 459 — Removing transmission

## Transmission Installation

Remove any debris from the surface of the transmission mounting pad and place shims (if used) in the proper locations.

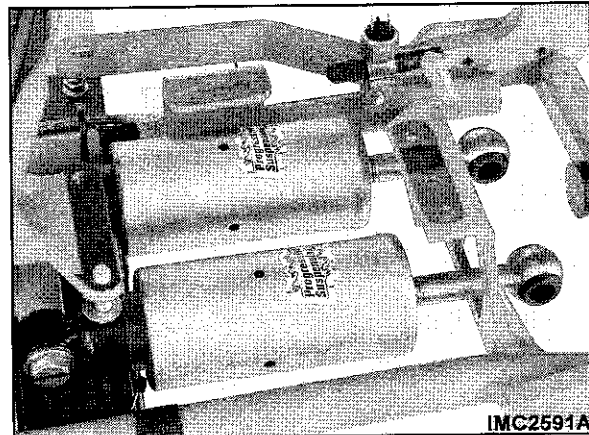


Figure 460 — Transmission mounting pad

Place the transmission in position on the mounting pad, making sure the mounting studs are aligned with the holes and all shims are in place.

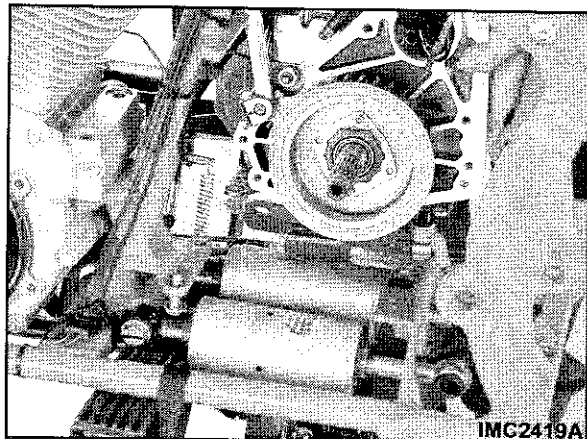


Figure 461 — Installing transmission

Apply blue threadlock to the threads of the transmission mounting flange nuts. Install the bolts and nuts, but **DO NOT** tighten them at this time.

Install the rear drive belt on the transmission sprocket.

Install the starter motor on the transmission end cover flange. Refer to the procedure in the STARTING SYSTEM SERVICE section.

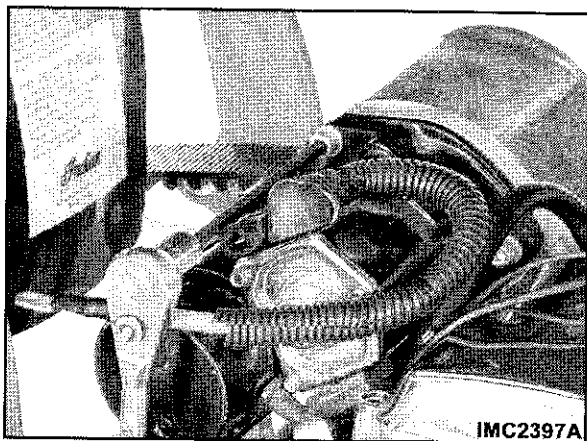


Figure 462 — Installing starter motor

Engage the speedometer pickup wiring harness connector.

Install the inner primary housing and primary drive assembly following the procedure in the PRIMARY DRIVE SERVICE section.

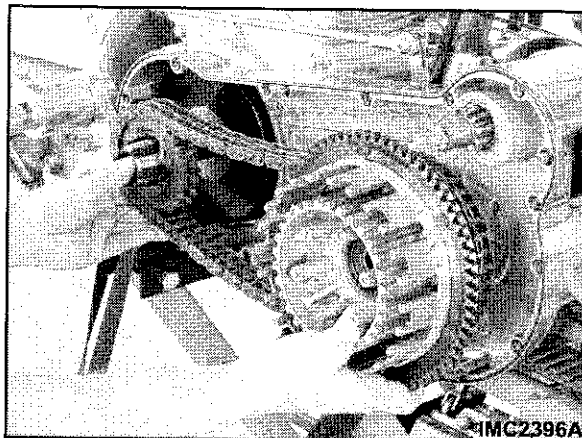


Figure 463 — Installing primary drive chain and sprockets

With the inner primary housing installed, tighten the five transmission flange nuts to specification, using a 9/16" socket and torque wrench.

Adjust the rear drive belt tension, tighten the rear axle nut and install a new cotter pin. Refer to the procedure in the REAR DRIVE SERVICE section.

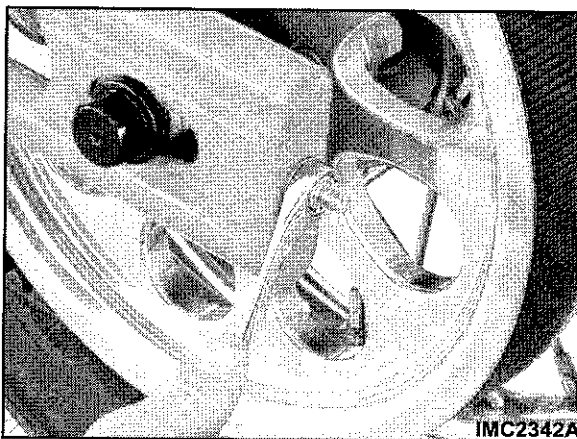
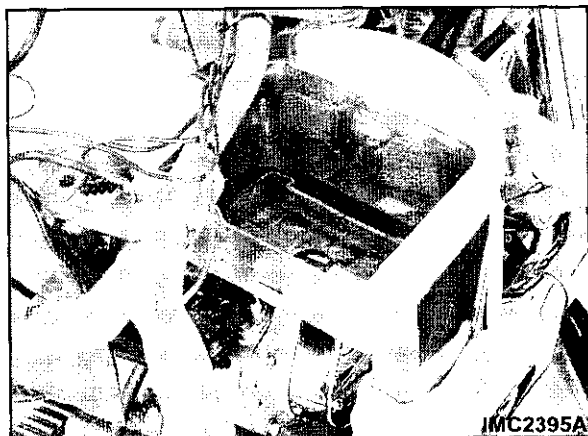


Figure 464 — Adjusting drive belt tension

If removed, connect the clutch control cable to the handlebar control and the frame retainer bracket. If the clutch cover was removed from the transmission, install it following the instructions in the TRANSMISSION OVERHAUL section.

Lower the motorcycle to the ground and remove the lift.

Install the oil tank following the procedure in the LUBRICATION SYSTEM SERVICE section.



*Figure 165 - Installing oil tank*

Remove the fill plug and fill the transmission with 20–24 ounces of Indian<sup>®</sup> 80-90W transmission oil, or its equivalent. DO NOT overfill the transmission.

## TRANSMISSION OVERHAUL

### Tools required:

- 3/16" hex bit socket
- 1/4" hex bit
- 5 mm hex bit socket
- 1-7/8" socket available from JIMS®
- 1-1/16" socket
- Internal retaining ring pliers
- External retaining ring pliers
- Arbor or hydraulic press
- Sprocket locker available from JIMS®
- Mainshaft seal driver available from JIMS®
- Main drive gear seal driver available from JIMS®
- Main bearing remover available from JIMS®
- Main drive gear tool available from JIMS®
- Shaft installer available from JIMS®
- Trapdoor bearing remover and installer available from JIMS®
- Trapdoor puller available from JIMS®
- Main drive gear bearing tool available from JIMS®

### Transmission Disassembly

Place a drain pan under the transmission.

Remove the drain screw from the trapdoor using a 5 mm hex key and drain the oil.

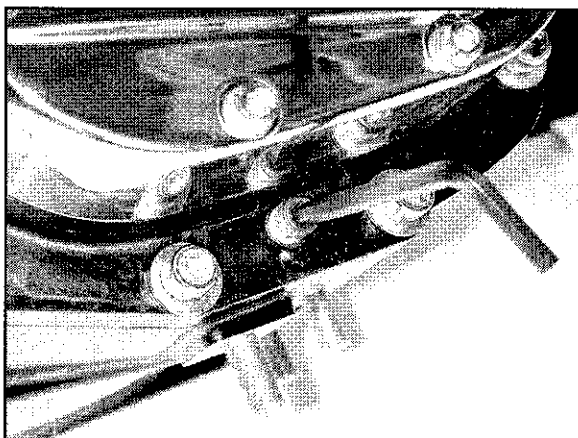


Figure 466 — Remove the drain screw

Remove the six bolts holding the chrome clutch cover on the right end of the transmission, using a 3/16" hex bit socket. Slide the short push rod with umbrella from the mainshaft.

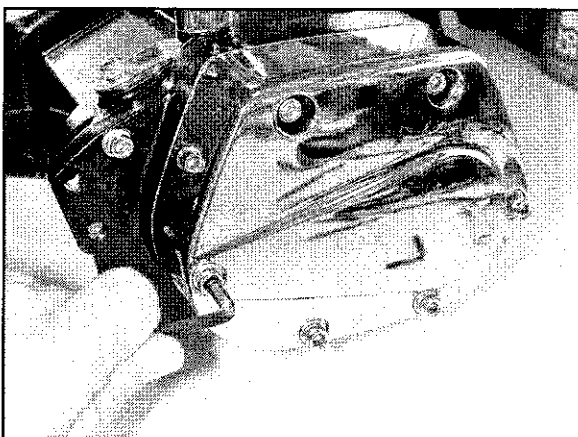


Figure 467 — Removing six clutch cover bolts

Remove the shift drum cover from the top of the transmission, using a  $3/16$ " hex bit socket.

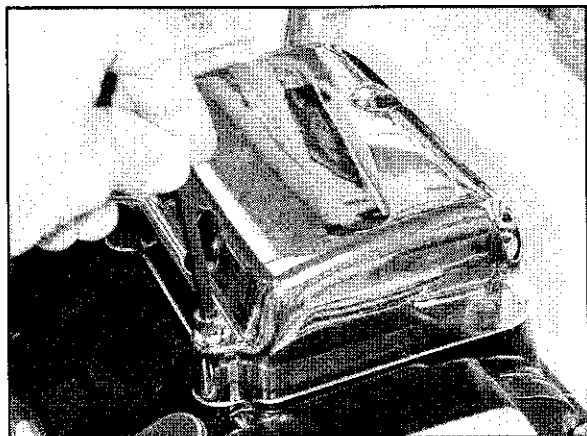


Figure 468 — Removing shift drum cover

Remove the four bolts holding the shift drum supports, using a  $7/16$ " socket.

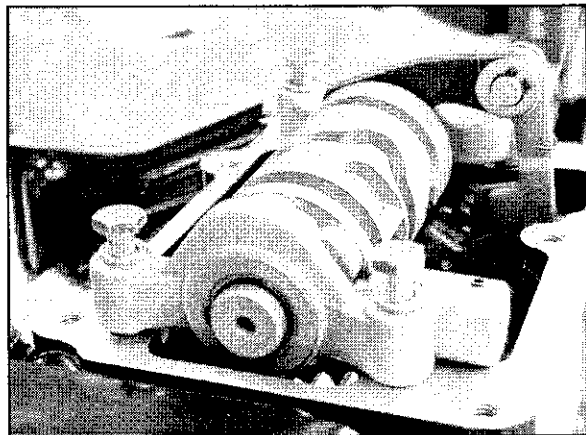


Figure 469 — Removing shift drum supports

Pull the shift pawl away from the pins in the shift drum. Lift the shift drum and end supports from the transmission housing.

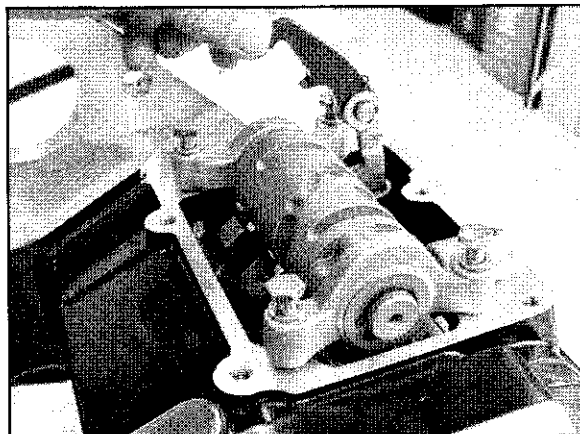


Figure 470 — Remove drum and end supports from housing

From the left side of the transmission remove the locking plate holding the sprocket nut, using a  $3/16$ " hex bit socket.

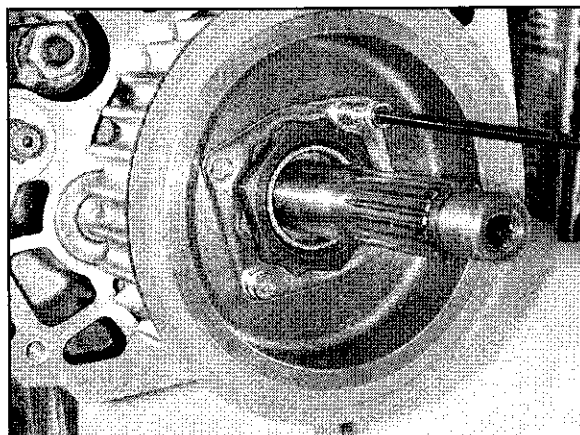


Figure 471 — Remove locking plate

Remove the drive sprocket nut using a 1-7/8" Mainshaft Sprocket Locknut Wrench from JIMS® and pneumatic gun. The sprocket nut has left-hand threads, turn the nut clockwise to loosen. Remove the sprocket from the shaft.

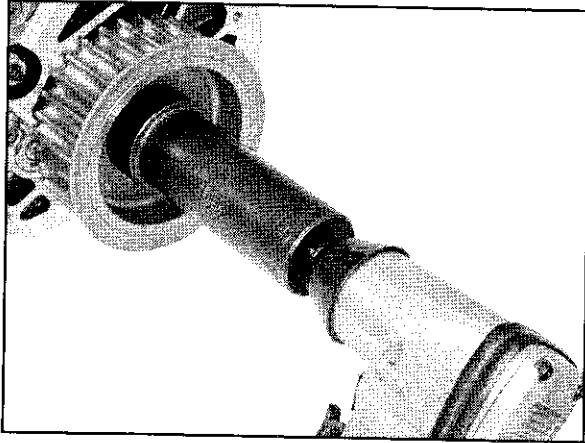


Figure 472 — Removing drive sprocket nut from shaft

From the left side of the transmission remove the set screw holding the shifting fork rod, using a 1/4" hex bit socket.

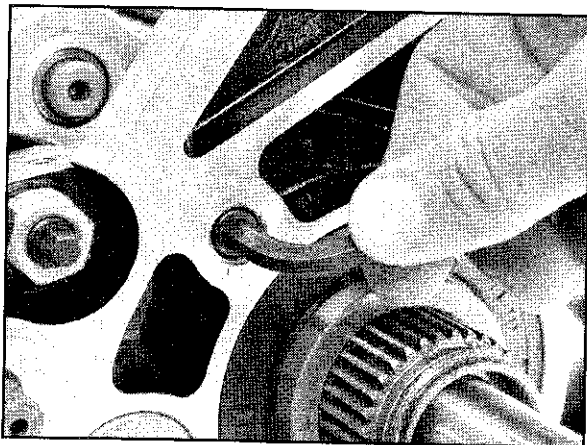


Figure 473 — Remove set screw from left side of transmission

Tap the shift fork rod from the transmission housing using a brass punch.

Loosen the nuts on the end of the mainshaft and countershaft, using a 1-1/16" socket. Do not remove the nuts at this time.

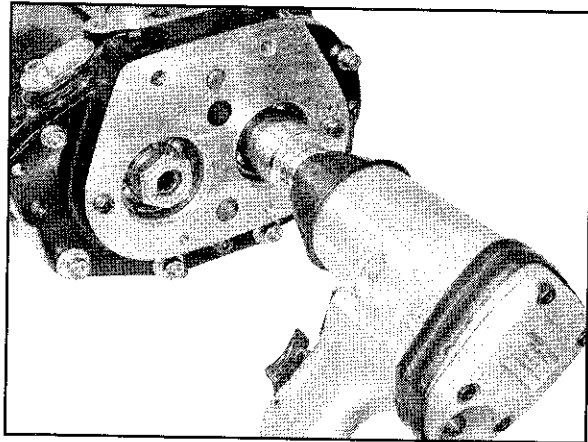


Figure 474 — Loosening mainshaft and countershaft nuts

Remove the six bolts holding the trapdoor to the transmission housing, using 3/16" and 1/4" hex bit sockets.

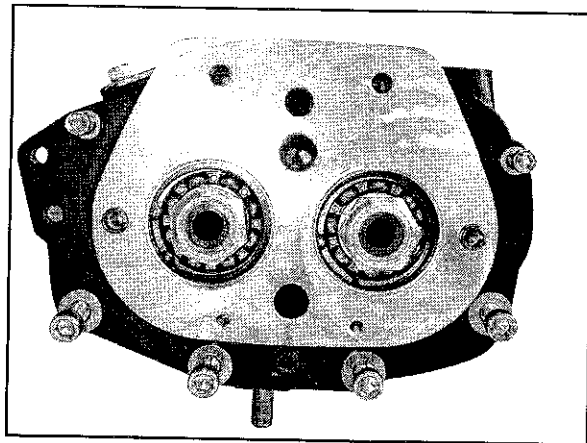


Figure 475 — Remove the trapdoor bolts

Remove the mainshaft and countershaft with all the gears by pulling on the trapdoor. If the trapdoor is stuck, use a JIMS® trapdoor Puller.

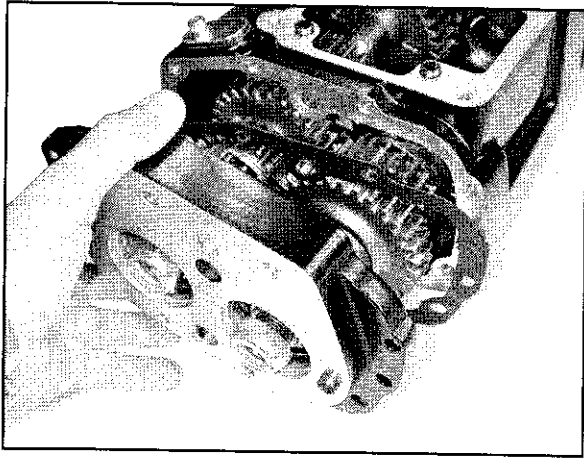


Figure 476 — Removing mainshaft, countershaft and gears

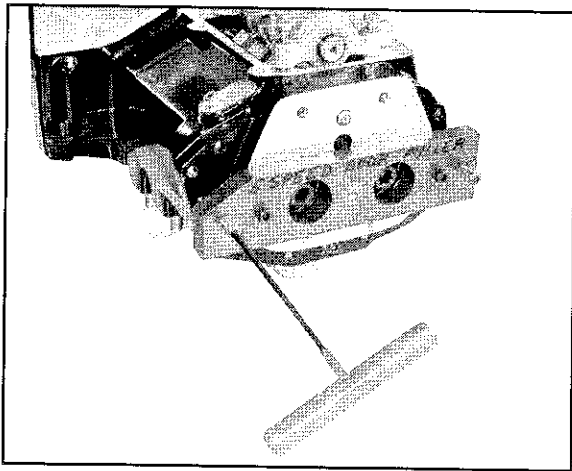


Figure 477 — JIMS® trapdoor Puller

Remove the sprocket spacer from the splined gear (5th gear or main gear) protruding from the left side of transmission. After removal, view the spacer and note chamfer. The chamfer will be placed toward the inside of the transmission during assembly.

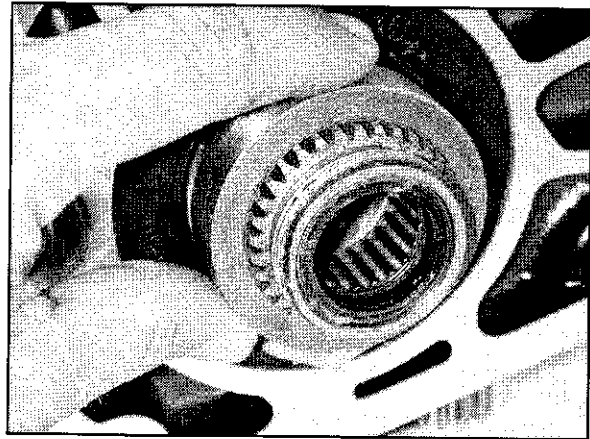


Figure 478 — Removing sprocket spacer from splined gear

### Main Gear (5th Gear) Removal from Case

Remove the main drive gear (5th gear) from the transmission case, using a JIMS® Main Drive Gear tool.

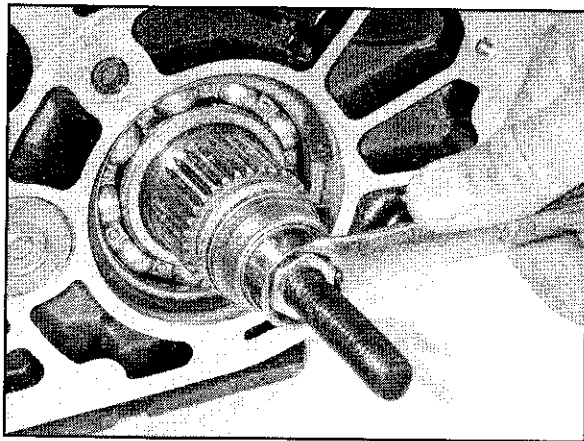


Figure 479 — Setting up JIMS® Main Drive Gear Tool

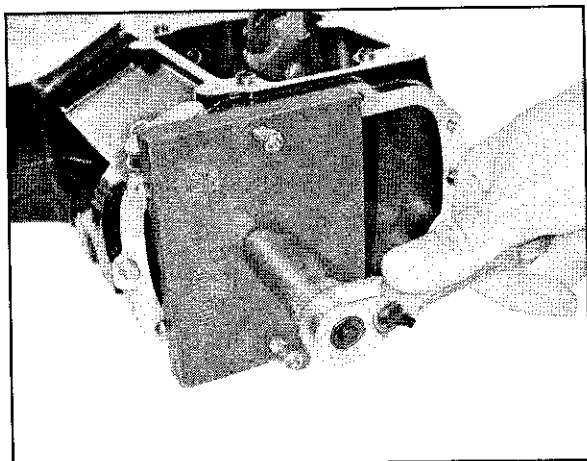


Figure 480 — Removing main drive gear

### Main Gear (5th Gear) Roller Bearing Removal and Replacement

Remove the seal using a seal, puller or large flat-tip screwdriver.

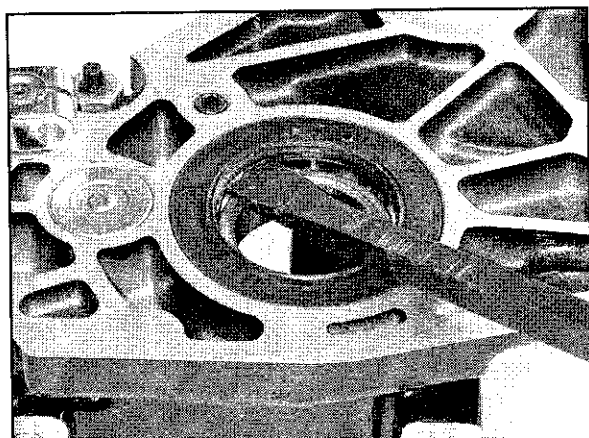


Figure 481 — Removing seal

Spin the bearing and listen for any audible clicking and feel for any rough spots. Replace if damage is found.

Remove the main bearing retaining ring.

Remove the main bearing using a JIMS® 5-Speed Main Bearing Remover or press. The bearing must be replaced after using this tool.

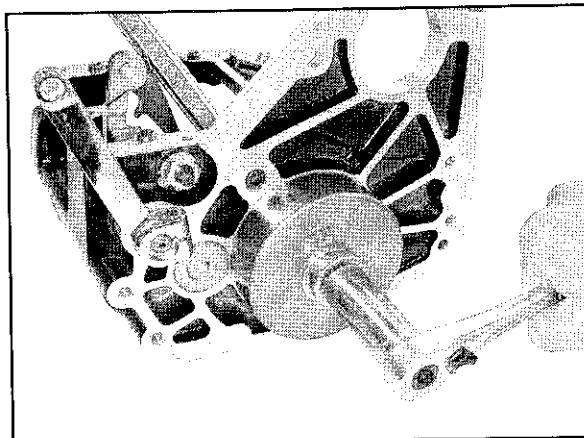


Figure 482 — Removing main bearing

Press the new bearing into the case just past the retaining ring groove. Use a JIMS® 5-Speed Transmission Main Drive Gear Tool. If using a press, select a socket slightly smaller than the bearing outside diameter.

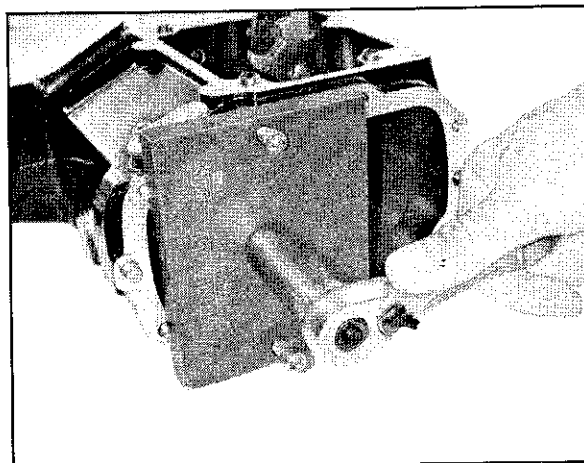


Figure 483 — Setting up tool to install main bearing



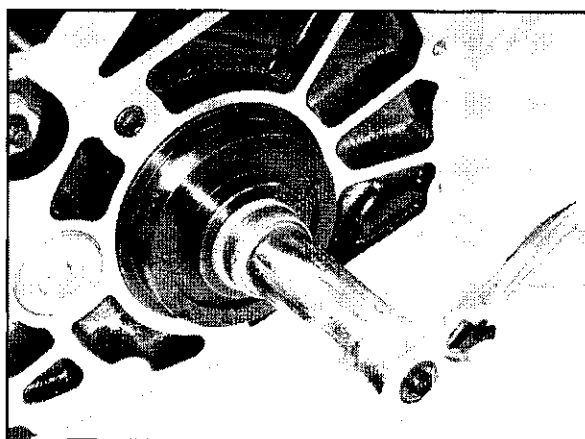


Figure 484 — Pressing in main bearing

Install a new retaining ring with the sharp edge facing out, toward the main seal.

Lubricate the outside and inside diameter of the new main seal with grease and install, using a JIMS<sup>®</sup> Seal Driver for five speeds. Typically the seal can be installed by hand when the seal is lubricated and the case is clean.

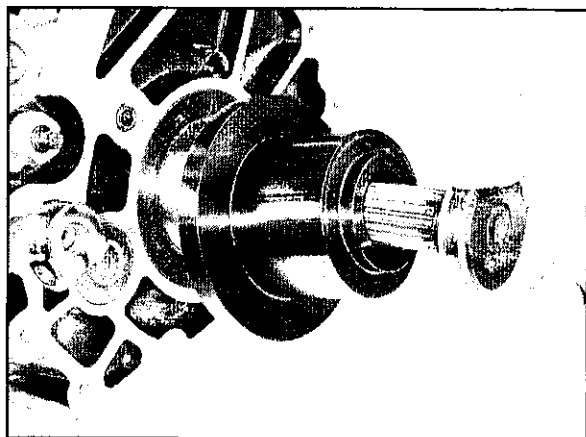


Figure 485 — Setting up JIMS<sup>®</sup> Seal Driver for 5 speeds

The JIMS<sup>®</sup> tool will set the seal to the correct depth.

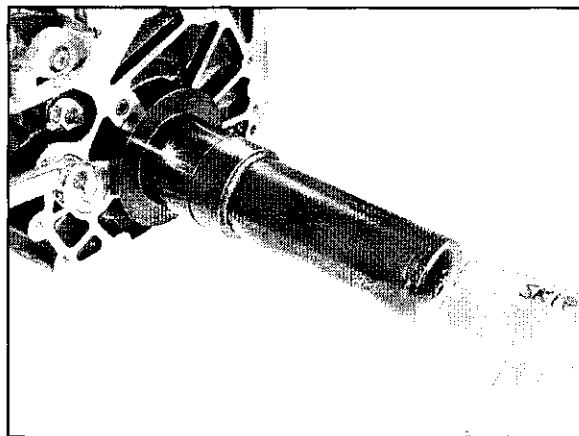


Figure 486 — Installing new main seal

### Case Needle Bearing Inspection and Replacement

Inspect the needle bearing pressed into the left case. Look for any pitting or grooving of the needles. The countershaft spins on this bearing. If it needs to be replaced, press the bearing from the case with a hydraulic press.

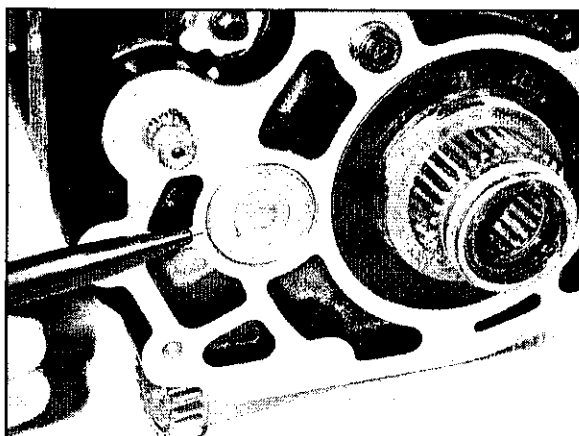


Figure 487 — Inspecting needle bearing at left of case

Lubricate the inside and outer side of the needle bearing with transmission oil. Press the new needle bearing into the case. The bearing will need to be pressed flush or slightly below flush within 0.010" of the case face.

## Main Gear (5th Gear) Needle Bearing Inspection and Replacement

Inspect both main gear (5th gear) needle bearings for pitting or grooving of the needles.

Press both the bearings from the 5th gear, using a hydraulic press.

Lubricate the new bearings with transmission oil and press them into the shaft, using a hydraulic press and a JIMS<sup>®</sup> Main Drive Gear Bearing Tool. Correct bearing installation depth is 0.315–0.340" for the outer bearing. The inner bearing should be installed to a depth of 0.060–0.080". The JIMS<sup>®</sup> tool will set the bearings to the correct depth.

## Main Gear (5th Gear) Installation into Case

Lubricate the main gear surface where it contacts the main bearing with transmission oil.

Place the main gear, splines first, into the bearing from inside the case.

Press the main gear (5th gear) into the transmission case, using a JIMS<sup>®</sup> 5 Speed Main Drive Gear tool.

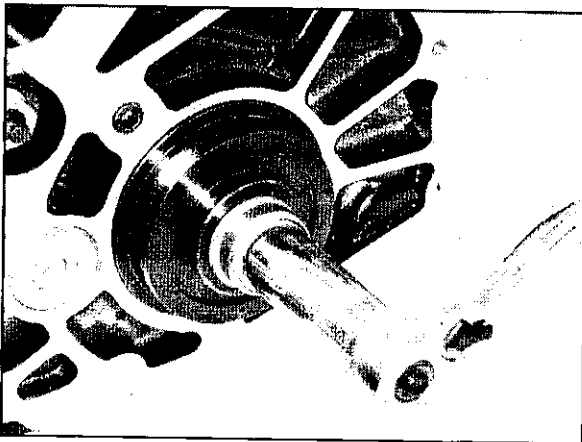


Figure 488 — Installing main gear into case

Lubricate a new quad seal and slip it onto the 5th gear.

## Countershaft and Mainshaft Disassembly

It is important during this disassembly to lay out the pieces in the correct sequence. Use egg cartons to place parts in for ease in assembly.

Inspect each gear's tooth face for chipping, cracking or pitting. Replace if found.

Inspect each gear's shift dogs for rounding of the corners or chipping and replace if found.

Place the trapdoor on the bench with the shafts pointing upward. Place the mainshaft on the left side just as it came from the transmission.

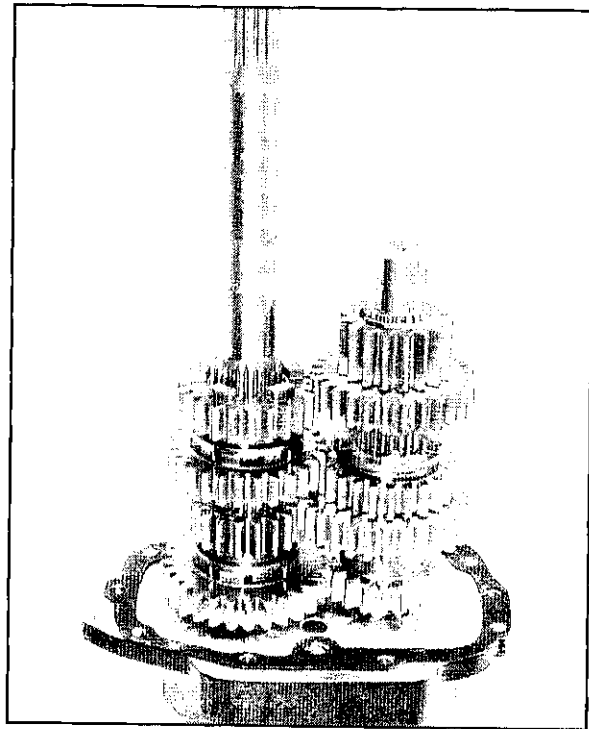


Figure 489 — Place on bench with shafts pointing upward

Remove the top retaining ring from the countershaft. Slip 5th gear from the shaft and inspect for damage.

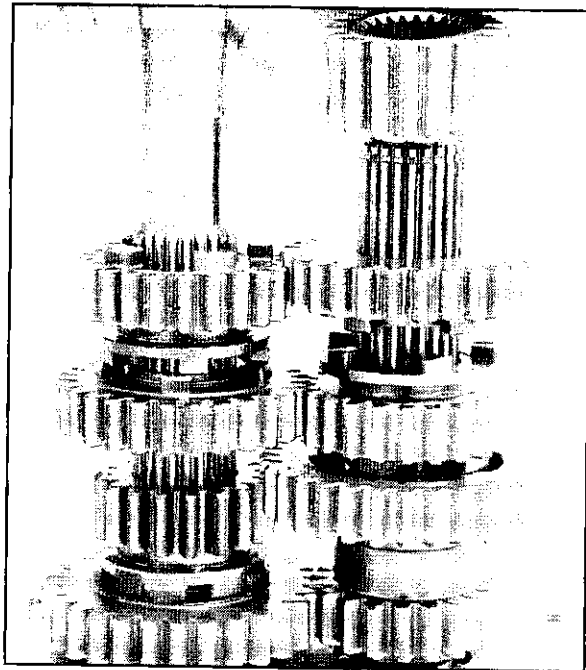


Figure 490 — Removing 5th gear

Slip 2nd gear and thrust washer from the countershaft and inspect each for damage.

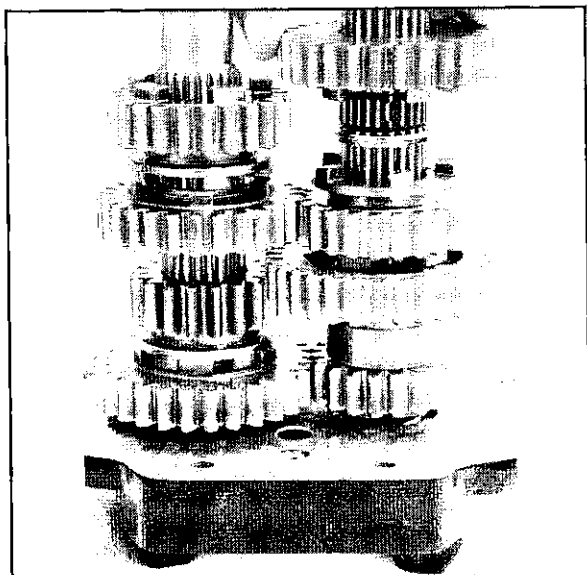


Figure 491 — Removing 2nd gear and thrust washer

Gently pry the split cage roller bearing from the countershaft and inspect the needles for pitting or grooving.

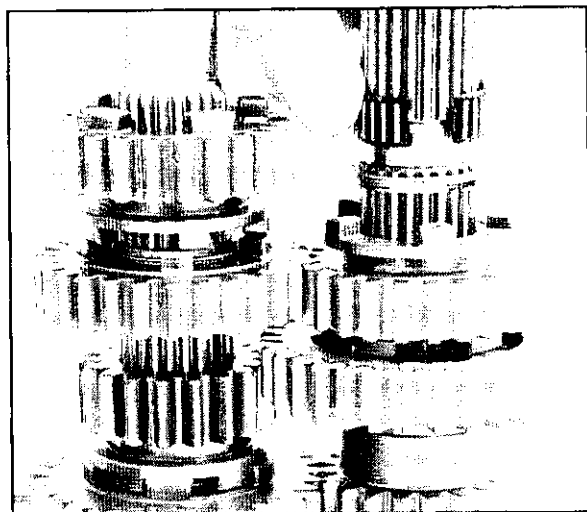


Figure 492 — Removing split cage roller bearing

Remove the 3rd gear retaining ring.

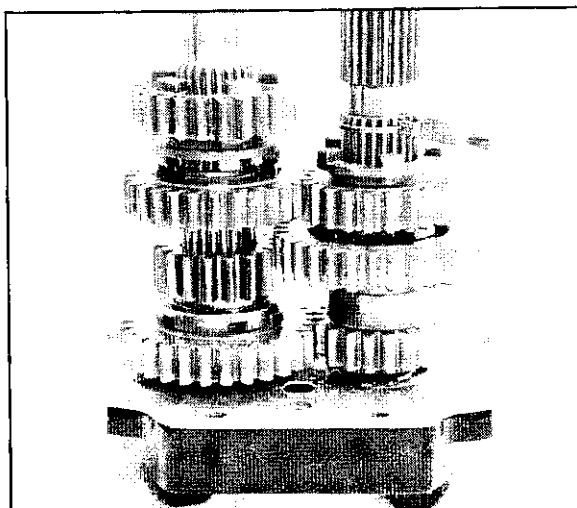


Figure 493 — Removing the 3rd gear retaining ring

Remove the 3rd gear from the countershaft and inspect for damage.

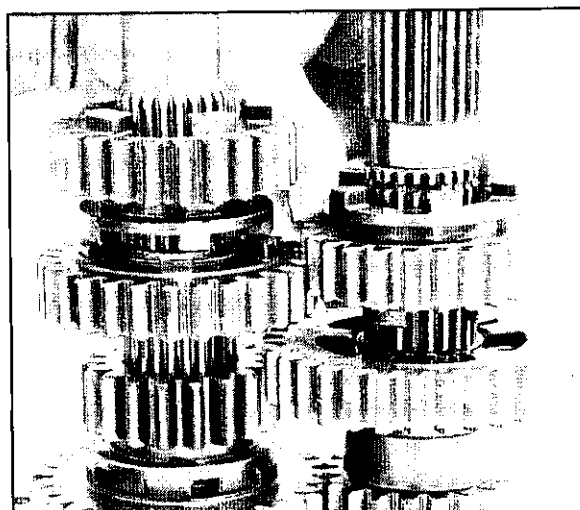


Figure 494 — Removing 3rd gear from countershaft

Slip 2nd gear from the mainshaft and inspect for damage.

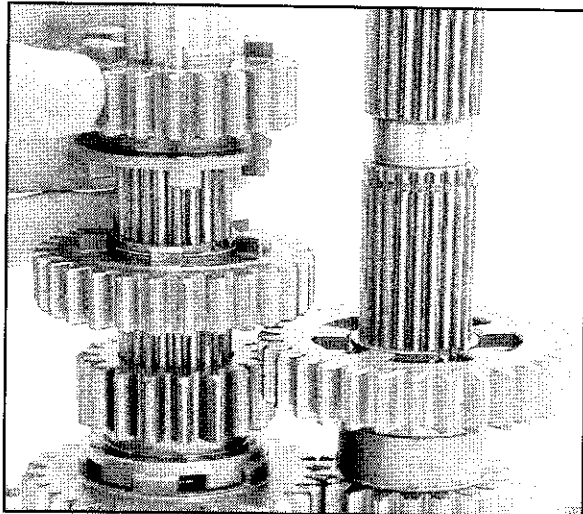


Figure 495 — Removing 2nd gear from mainshaft

Remove the 3rd gear retaining ring and then, remove the thrust washer from the mainshaft.

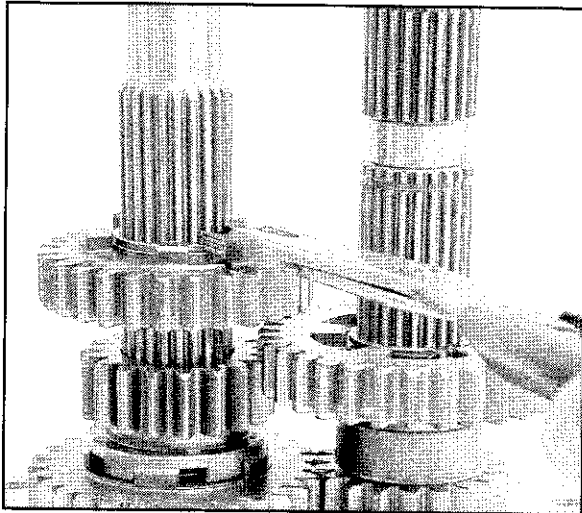


Figure 496 — Removing 3rd gear retaining ring

Slip 3rd gear from the mainshaft and inspect for damage. Remove the retaining ring and thrust washer from the mainshaft.

Gently pry the split cage roller bearing from the mainshaft and inspect the needles for pitting or grooving.

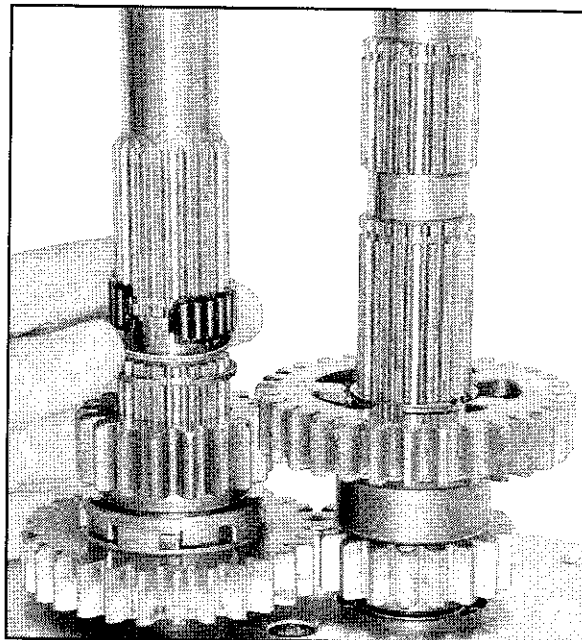


Figure 497 — Removing split cage roller bearing

To provide support for the trapdoor roller bearings, leave the remaining four gears on the shafts. Press the countershaft from the bearing, using JIMS® Transmission Cover (trapdoor) Bearing Remover and Installer. Make sure to catch the shaft and gears as they are removed.

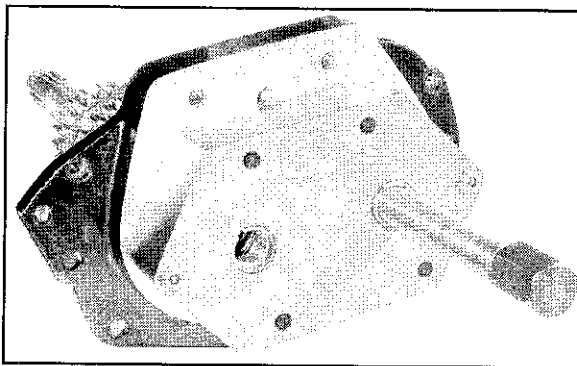


Figure 498 — Pressing countershaft from trap door bearing

Press the mainshaft from the trapdoor bearing, using JIMS® Transmission Cover Bearing Remover and Installer. Make sure to catch the shaft and gears as they are removed. This is a multipurpose tool (see photo below).

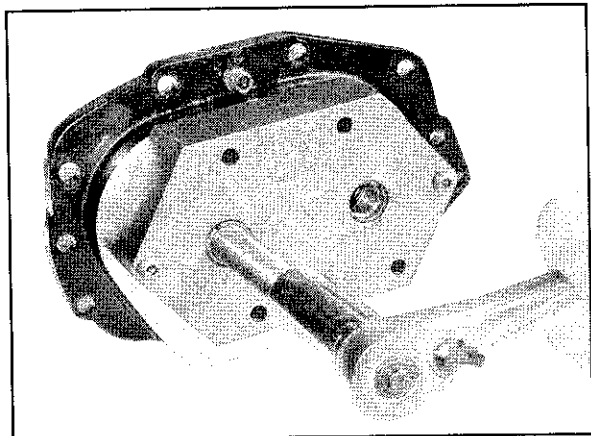


Figure 499 — Pressing mainshaft from the trapdoor bearing

Slip the spacer from the mainshaft followed by 4th gear. Inspect the gear for damage.

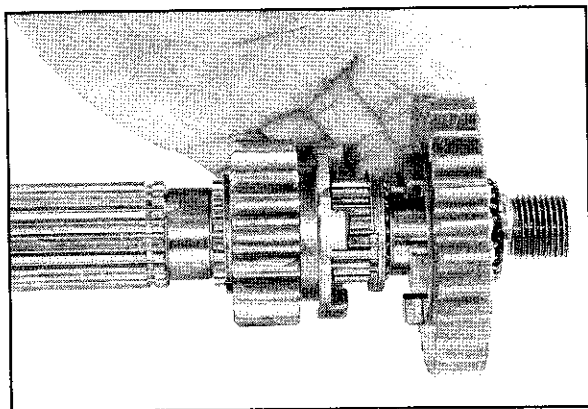


Figure 500 — Remove and inspect 4th gear for damage

Remove the retaining ring from the mainshaft. Slip 1st gear from the mainshaft and inspect for damage.

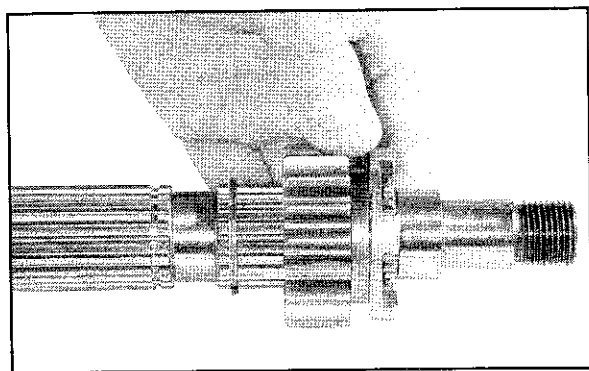


Figure 501 — Remove and inspect 1st gear for damage

Gently pry the split cage roller bearing from the mainshaft and inspect the needles for pitting or grooving.

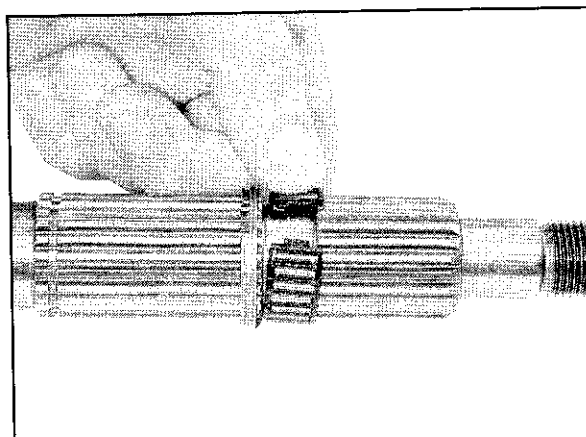


Figure 502 — Remove and inspect split cage roller bearing

Slip the spacer from the countershaft.

Slip 4th gear from the countershaft.

Slip 1st gear from the countershaft.

Inspect both shafts for pitting, grooving and excess wear. Replace as necessary.

## Bearing Removal and Installation in Trapdoor

Spin the bearings noting any roughness and listen for any audible clicking. Replace if found.

Remove the retaining rings from their grooves.

Bearings can be pressed from the trapdoor, using a JIMS® Transmission Cover Bearing Remover and Installer.

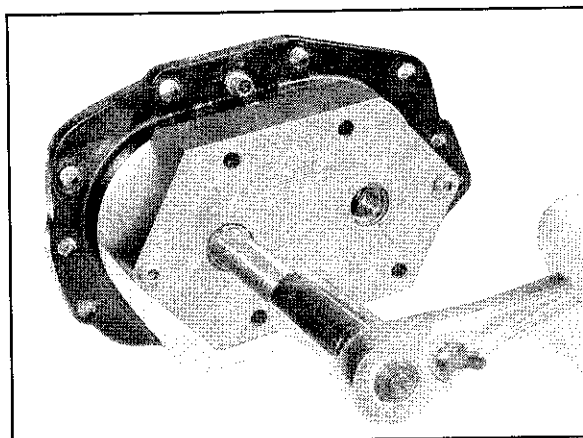


Figure 503 — Pressing mainshaft bearing from trapdoor

Lubricate the outside diameter of each new bearing. Orient the bearing to have the numbers legible from the outside of the trapdoor. Press the bearings into the trapdoor, using a JIMS® Transmission Cover Bearing Remover and Installer.

Make sure the bearings are fully seated.

Install new retaining rings with the sharp edges toward the bearing.

## Shaft Assembly

Coat each of the parts with transmission oil before installation. Install new retaining rings and thrust washers in each location.

## Mainshaft

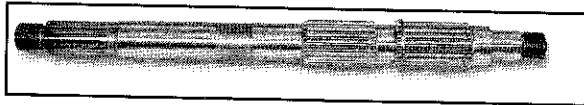


Figure 504 — Mainshaft

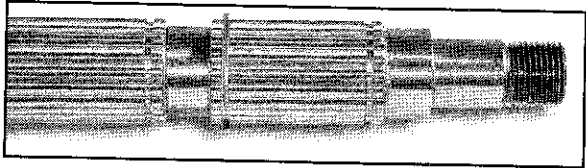


Figure 505 — Trapdoor end of mainshaft

Slip 1st gear onto the trapdoor end of the mainshaft, shift dogs facing toward 4th gear.

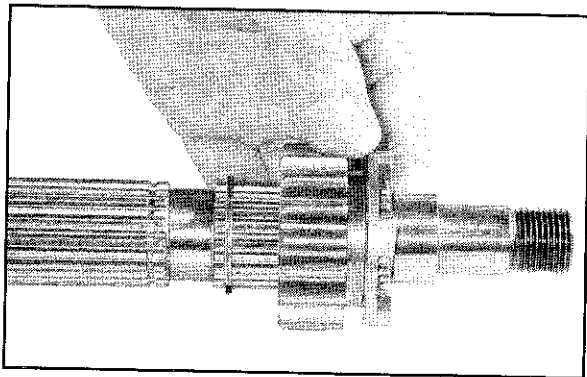


Figure 506 — Slip 1st gear onto trap door end of mainshaft

Place a retaining ring onto the mainshaft capturing 1st gear, using snap ring pliers.

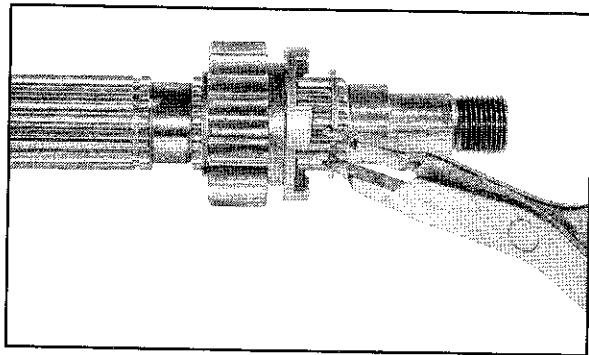


Figure 507 — Installing retaining ring

Slip a thrust washer onto the mainshaft.

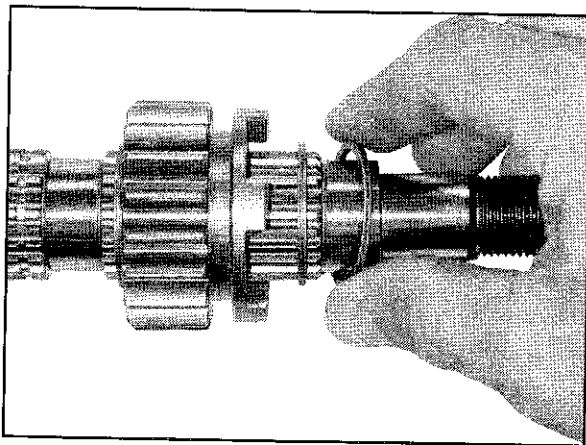


Figure 508 — Installing thrust washer

Install the split cage roller bearing into 4th gear.

Slip 4th gear onto the countershaft with the engagement dogs facing toward 1st gear. Make sure 1st gear and 4th gear dogs engage.

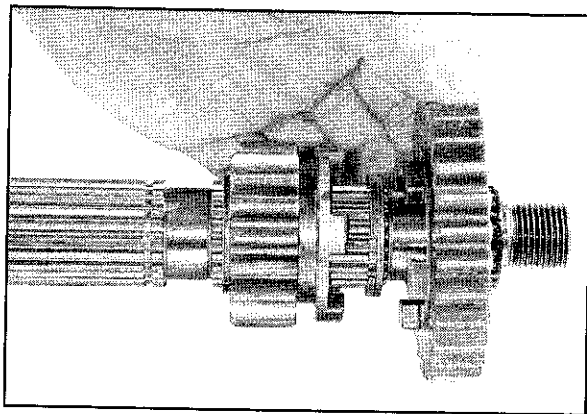


Figure 509 — Slip 4th gear onto countershaft

# Countershaft

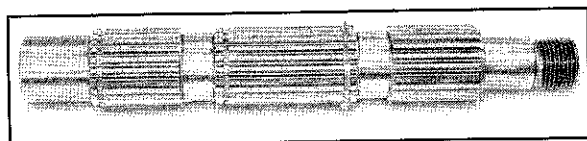


Figure 510 — Countershaft {trapdoor end to right}

Slip a thrust washer onto the countershaft from the trapdoor side of the shaft.

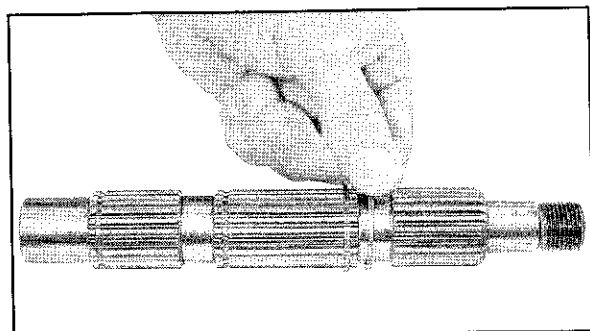


Figure 511 — Installing thrust washer onto countershaft

Slip a split bearing onto the trapdoor side of the countershaft.

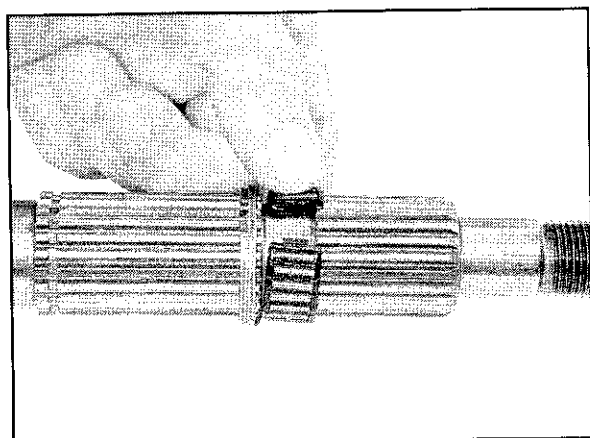


Figure 512 — Installing split bearing onto countershaft

Slip 1st gear onto the countershaft with engagement dogs first.

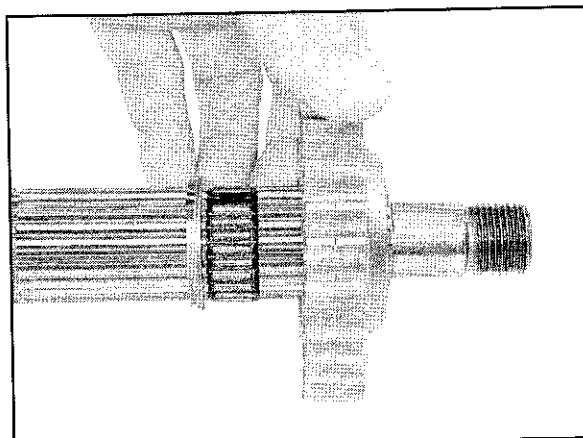


Figure 513 — Installing 1st gear onto countershaft

Slip 4th gear onto the countershaft with spacer side first.

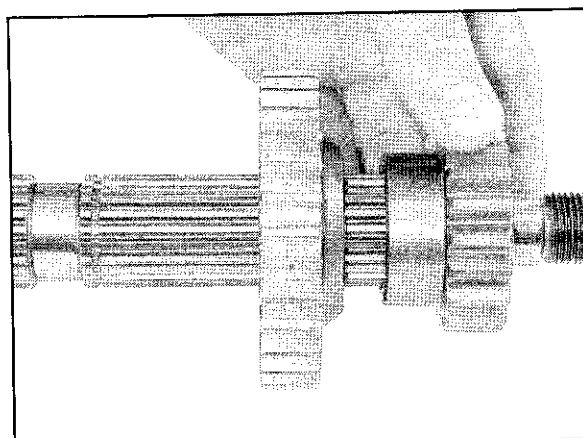


Figure 514 — Installing 4th gear onto countershaft

## Installation of Shafts into Trapdoor

### Mainshaft

Orient the trapdoor on the bench with the alignment pins down and the drain plug hole away from you. If available, place the trapdoor on the JIMS® Transmission Cover Remover and Installer as an aid in assembly.

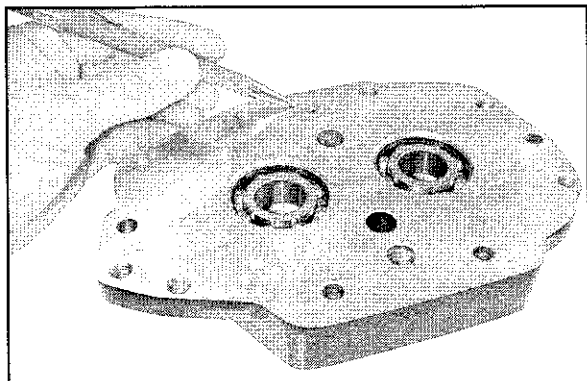


Figure 515 — Oil drain hole with mainshaft bearing to left and countershaft bearing to right

Place a tapered spacer (with step) onto the left side trapdoor bearing with the tapered face toward the trapdoor. The taper allows oil to flow to the bearing.

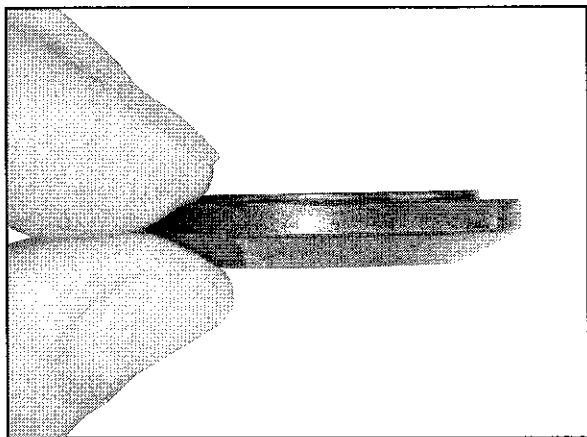


Figure 516 — Mainshaft spacer with step and taper

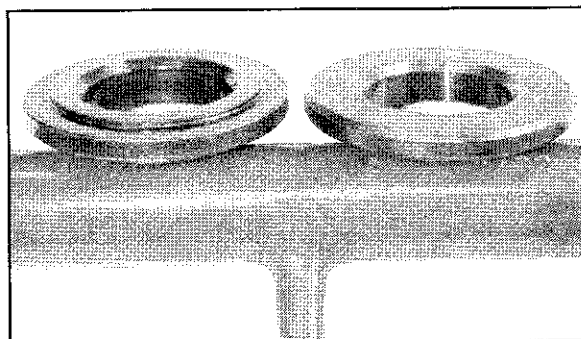


Figure 517 — Stepped spacer and spacer without step

Slip the mainshaft into the tapered spacer (with step) through the left side trapdoor bearing.

Place the countershaft tapered spacer (without step) onto the right trapdoor bearing. The tapered face of the spacer goes toward the bearing. The taper allows oil to flow to the bearing.

Slip the countershaft into the tapered spacer (without step) through the right side trapdoor bearing. Align the mainshaft gears with the countershaft gears.

lay the shafts down on the bench.

Slip a spacer onto each shaft from the trapdoor side.

Using a press, or a JIMS® 5-Speed Transmission Shaft Installer, seat the shafts to the bearings. If using a press, support the inner bearing race with a socket to prevent damage to the bearing.

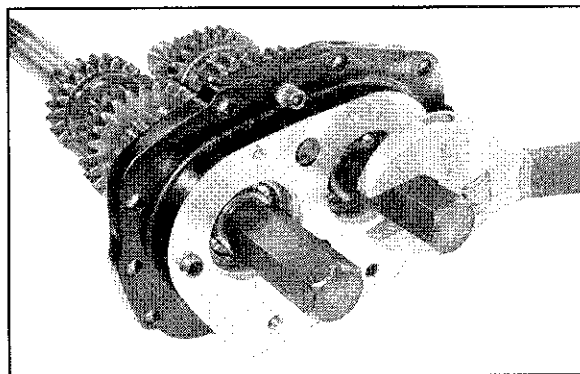


Figure 518 — Seating shafts to bearings

Thread a new nylock nut onto each shaft. Tighten the nuts finger tight.



## Gear Stacking

Place the trapdoor on the bench with the shafts facing upward. Orient the trapdoor with the mainshaft on the left side.

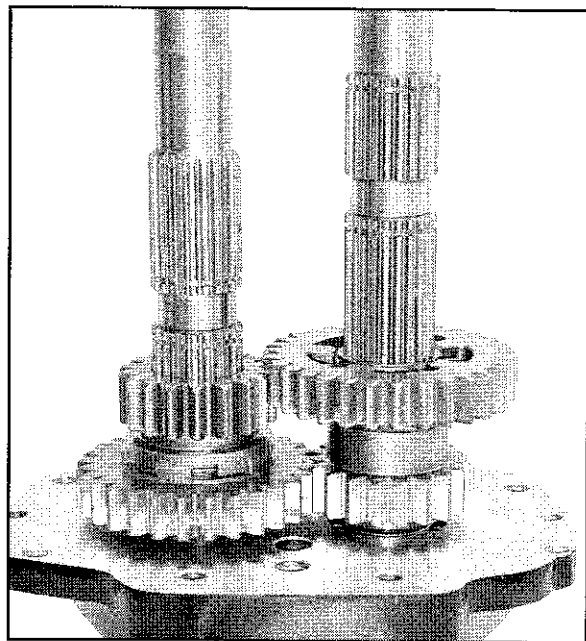


Figure 519 — Mainshaft and countershaft positioning

## Mainshaft

Slip a thrust washer onto the mainshaft followed by a split cage roller bearing.

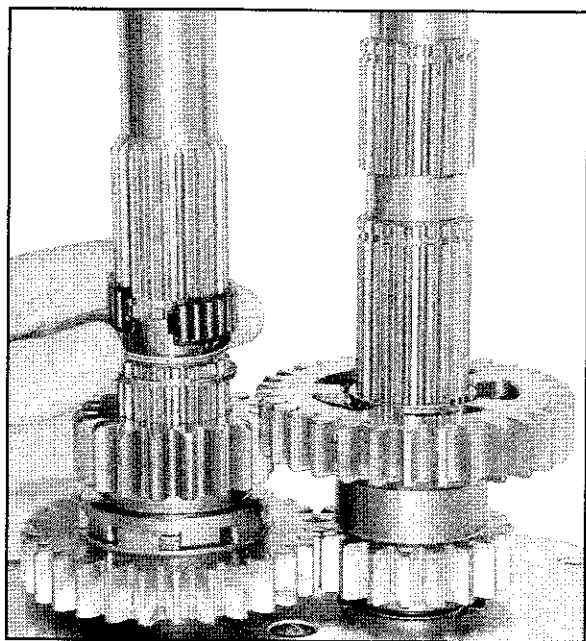


Figure 520 — Installing thrust washer and split bearing

Slip 3rd gear onto the mainshaft with the engagement dogs facing upward (away from trapdoor). Slip another thrust washer onto the mainshaft followed by a retaining ring.

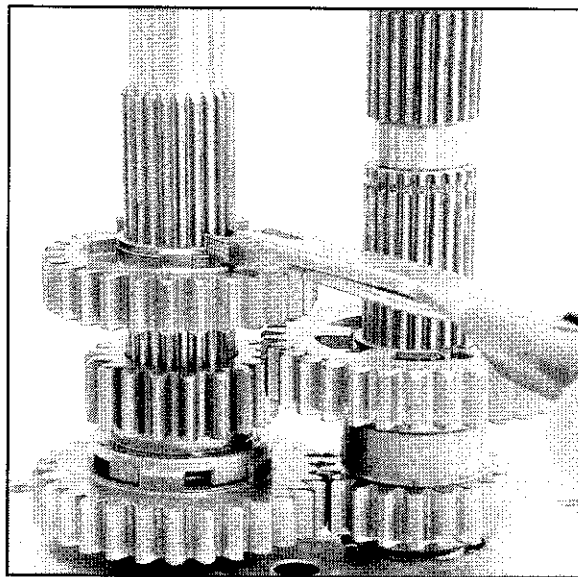


Figure 521 — Installing 3rd gear retaining ring on mainshaft

Slip 2nd gear onto the mainshaft with the shift fork groove toward the trapdoor.

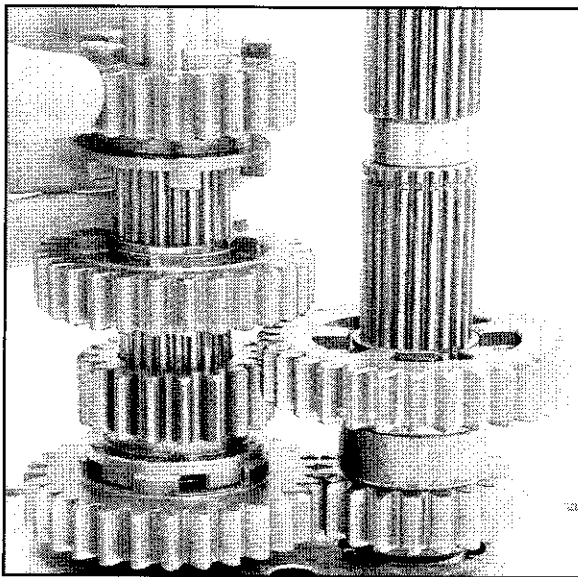


Figure 522 — Groove in gear for shift fork

## Countershaft

Slip 3rd gear onto the countershaft with the shift fork groove facing away from the trapdoor.

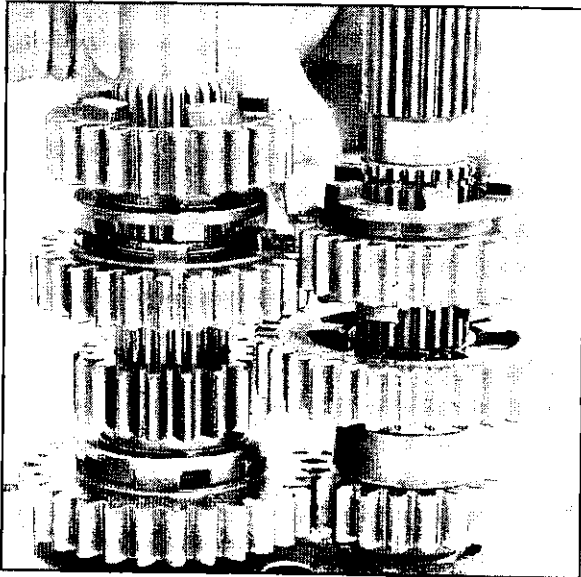


Figure 523 — Installing 3rd gear onto countershaft

Place a retaining ring above 3rd gear followed by a thrust washer.

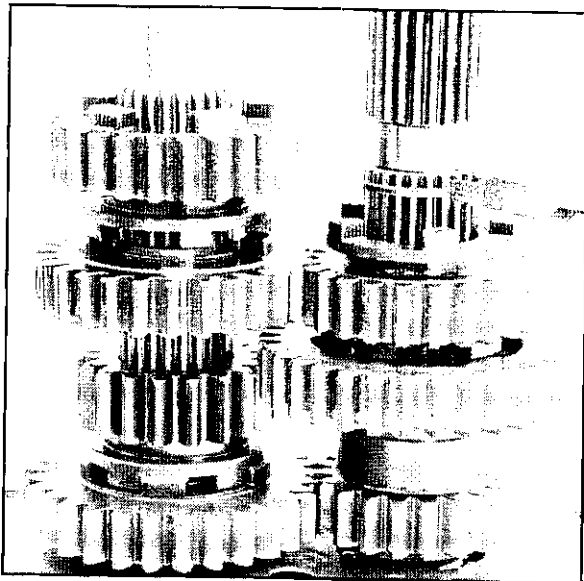


Figure 524 — Installing retaining ring above 3rd gear

Slip a new split cage roller bearing onto the countershaft.

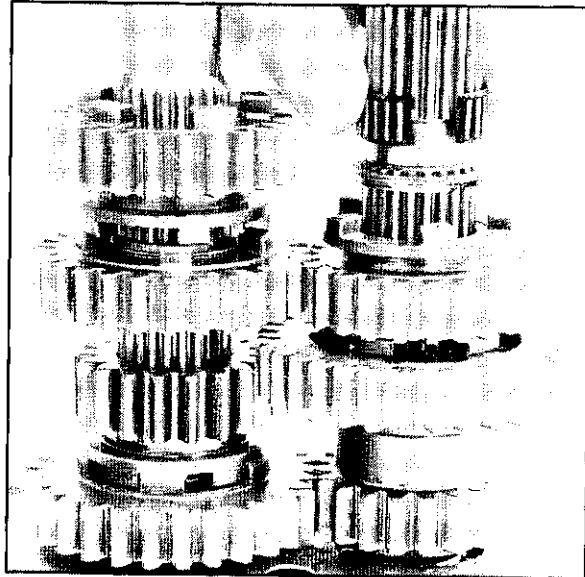


Figure 525 — Installing split bearing onto countershaft

Slip 2nd gear onto the countershaft with engagement dogs toward the trapdoor.

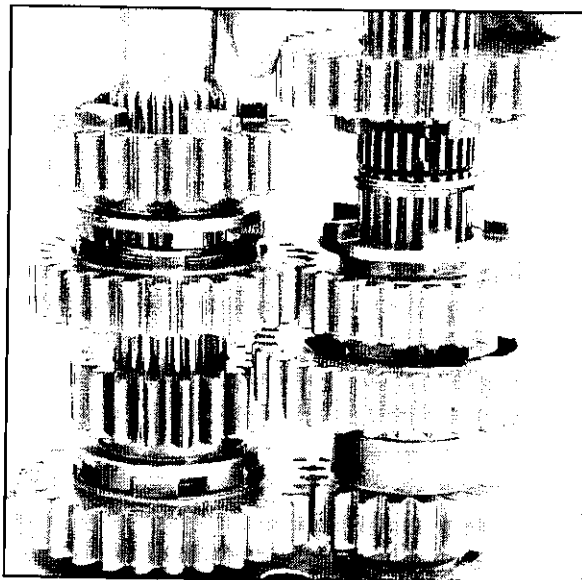


Figure 526 — Installing 2nd gear onto countershaft

Slip 5th gear onto the countershaft followed by a retaining ring.

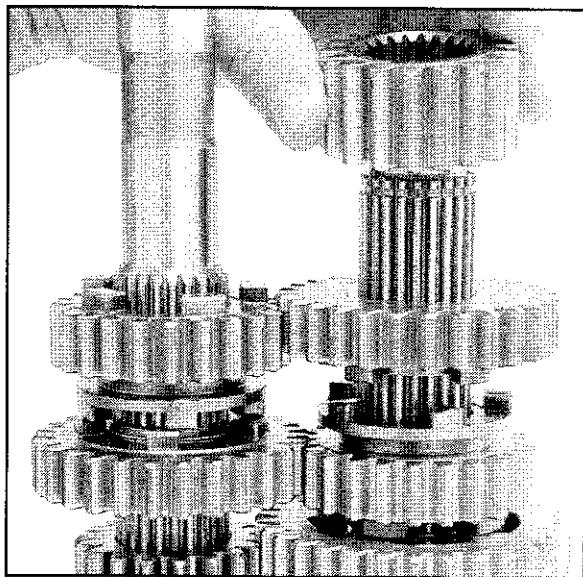


Figure 527 — Installing 5th gear onto countershaft

### Installing Gearset into Transmission Case

Lubricate the pins used to align the trapdoor with the transmission case.

Lubricate the three needle bearings with transmission oil. Two of the bearings are in the main gear (5th gear) and the third is pressed into the case.

Place a new gasket on the trapdoor and align the gasket with the bolt holes.

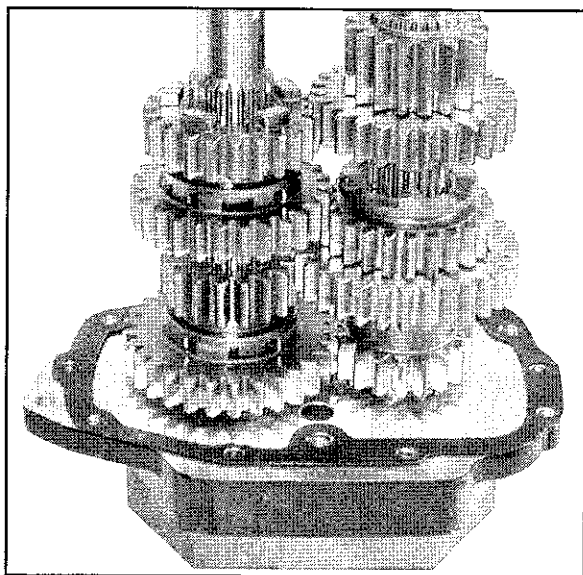


Figure 528 — Install new gasket on trapdoor

With the shafts facing upward, lower the transmission case over the shafts. Align the mainshaft with the main gear and the countershaft with the needle bearing. Align 5th gear of the mainshaft to 5th gear of the countershaft.

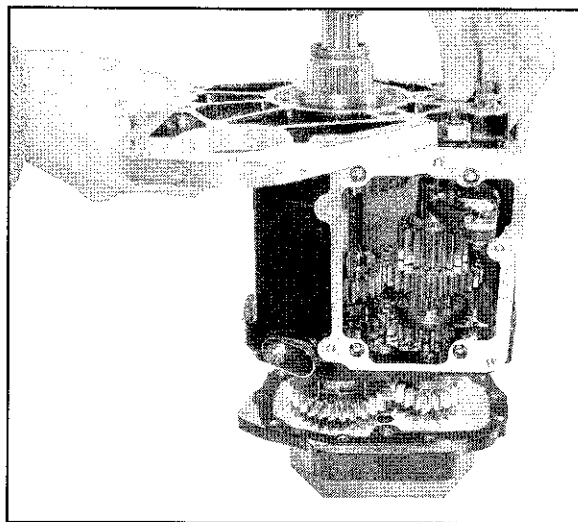


Figure 529 — Installing transmission case over shafts

Check that the alignment pins are aligned with their mating holes in the trapdoor.

Gently tap the trapdoor with a soft-faced hammer until seated against the case.

Apply blue threadlock to the six trapdoor retaining bolts. Install the four lower 5/16" bolts through the trapdoor and thread them into the case. Install the two upper 1/4" bolts through the trapdoor and thread them into the case.

Tighten the 5/16" bolts to 13–16 foot-pounds torque, using a 1/4" hex bit. Tighten the 1/4" bolts to 7–9 foot-pounds torque, using a 3/16" hex bit.

Lock the transmission. Move 3rd gear in either direction on the countershaft to engage either 1st gear or 2nd gear. Rotate the mainshaft by hand clockwise until it stops turning.

Tighten the mainshaft nut to 45–55 foot-pounds torque.

Rotate the countershaft clockwise by hand until it stops turning. Tighten the countershaft nut to 45–55 foot-pounds torque.

Place a new square-cut seal onto the main drive gear (transmission output).

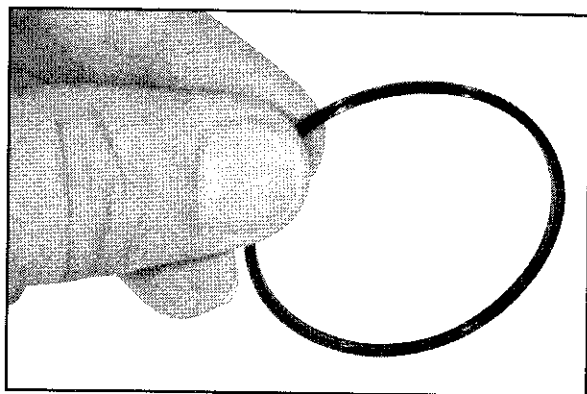


Figure 530 — Square-cut seal

The following figure shows seal location on the main drive gear (transmission output).

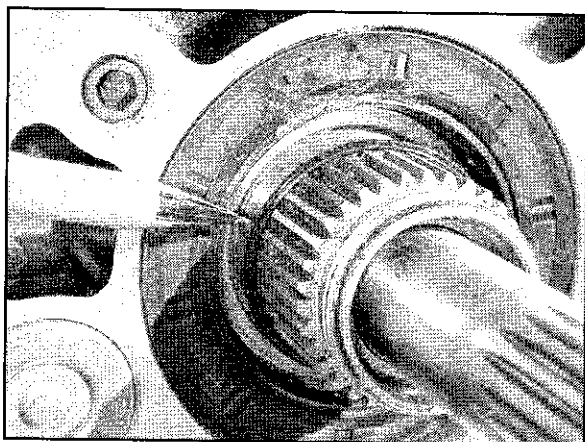


Figure 531 — Seal location on main drive gear

Slip the sprocket spacer onto the main drive gear with large chamfer on spacer facing inward. The chamfer prevents the square-cut seal from being crushed.

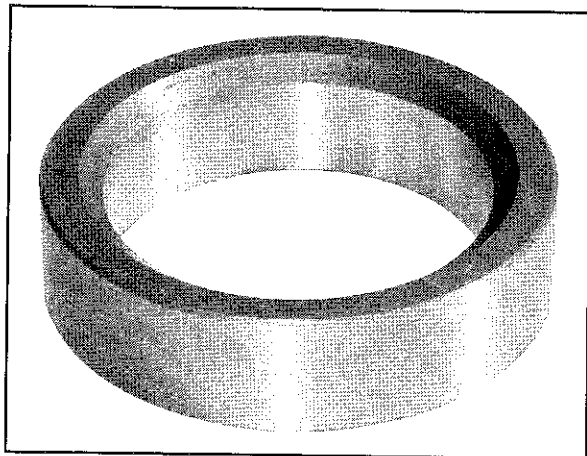


Figure 532 — Sprocket spacer showing chamfer

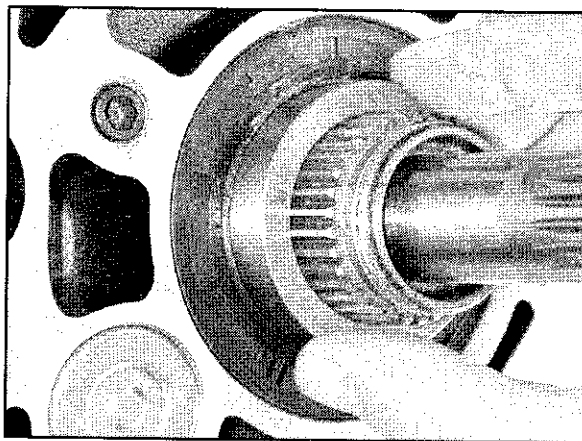


Figure 533 — Installing spacer onto main drive gear

Grease a new main drive gear seal on the inside and outside diameter. Slip the seal over the sprocket spacer.

Slide a JIMS® Seal Driver over the mainshaft (transmission input). Thread the tool guide (with left-hand threads) onto the mainshaft.

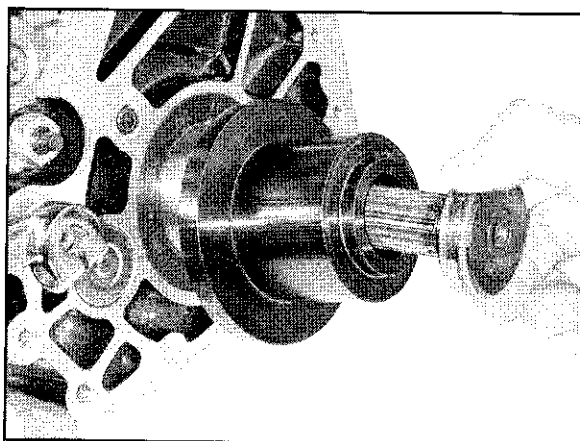


Figure 534 — Installing seal driver and tool guide

Slip the driver over the guide and seat the seal, using a hammer. The tool is designed to set the seal to a depth of 0.050" below the face of the transmission case.

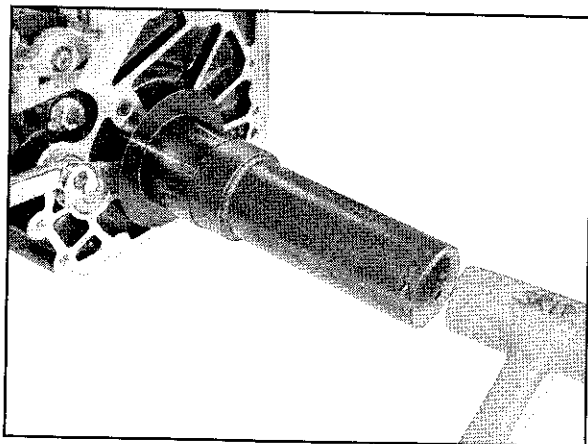


Figure 535 — Driving seal into transmission case

Grease a new mainshaft-to-main drive gear seal. Slip the seal over the mainshaft onto a JIMS® Main Drive Gear Seal Installer. The garter spring of the seal faces toward the transmission case. Slide the bullet nosed sleeve tool over the mainshaft. Prevents seal damage from shaft splines.

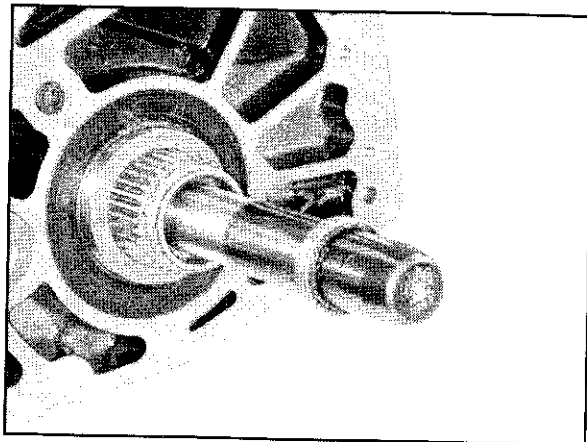


Figure 536 — Installing seal over sleeve tool on mainshaft

Slide the seal off the sleeve and toward the main drive gear (transmission output). Slip the seal driver onto the mainshaft.

Tap the driver with a mallet until the seal is fully seated. The JIMS® driver sets the seal to the correct depth.

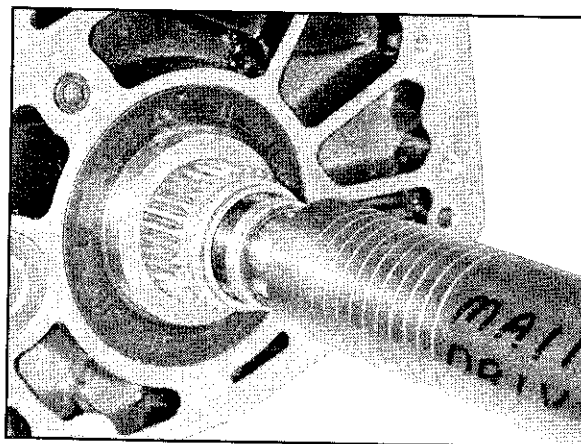


Figure 537 — Drive seal in until fully seated

Grease the short clutch rod/slinger. Slip the rod into the mainshaft from the trapdoor side of the transmission.

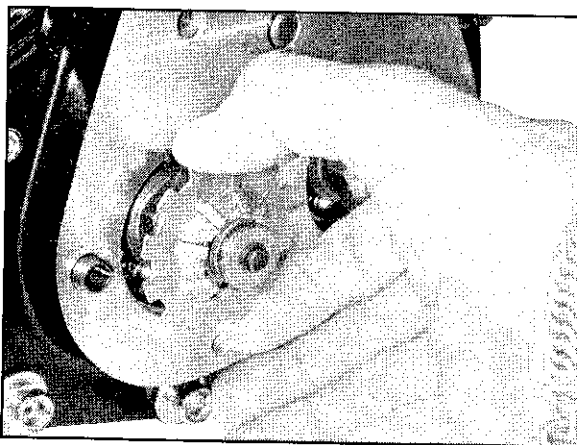


Figure 538 — Slip the rod into the mainshaft

## Shift Fork Inspection and Installation

### Inspection

Check each fork for squareness before installation. Place a carpenter's square against the fork as pictured. Shifting forks can become bent from an accident or excessively hard shifts. Bent forks should be replaced to avoid damage to mating parts.

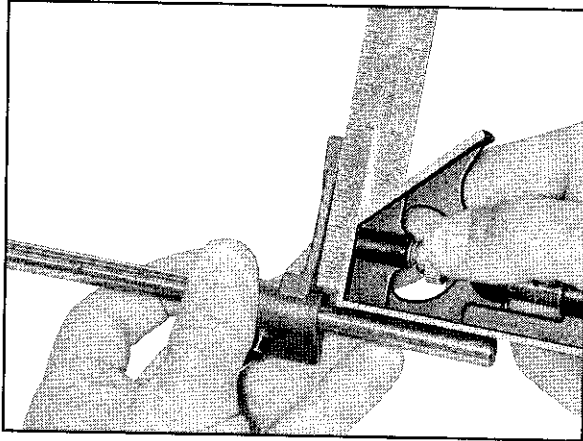


Figure 539 — Check each fork for squareness

Measure the fork width where it fits into the gear groove. Minimum thickness is 0.165". If you find worn or damaged shift forks, check the mating gear groove for wear or damage.

### Installation

Identify shift forks with the pins facing you as follows:

The 1st and 2nd gear fork (shown in middle) has the pin in the middle.

The 3rd and 5th gear fork (shown at right) has the pin offset to the left.

The 4th gear fork (shown at left) has the pin offset to the right.

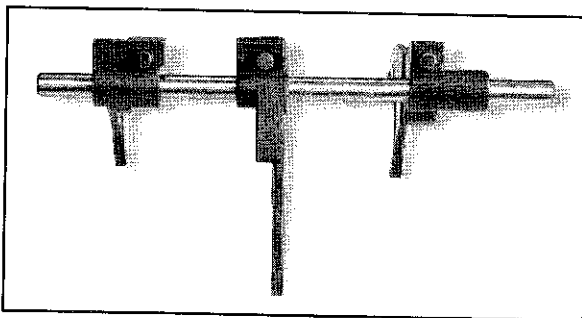


Figure 540 — Shift forks

Orient the transmission with the trapdoor to the left. Load all forks with the pin facing you. Loading sequence is from left to right.

Load the 4th gear fork onto the groove in 1st gear of the mainshaft.

Load the 1st and 2nd gear fork onto the groove in 3rd gear of the countershaft.

Load the 3rd and 5th gear fork onto the groove in 2nd gear of the mainshaft.

Lubricate the shift shaft with transmission oil. Slide the shaft through the hole in the trapdoor while aligning the shift forks to it.

Slide the gears with the forks checking the movements. There should be no binding of any component.

Apply blue threadlock on the shift shaft retaining plug. Run the plug inward until below flush with the case face, using a 1/4" hex bit socket.

### Shift Drum Installation

Orient the shift drum to have the cam plunger to the trapdoor side of the transmission.

Lift the shift pawl upward and place the shift drum under it.

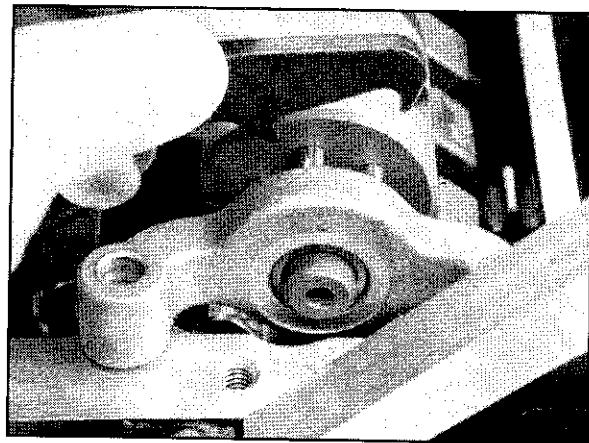


Figure 541 — Lift shift pawl upward

Align the shift fork pins to the grooves in the shift drum. To move the forks and gears you may have to spin the mainshaft.

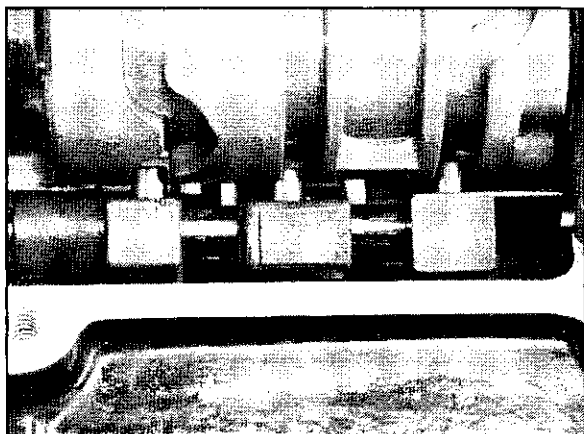


Figure 542 — Align shift fork pins to grooves in shift drum

Seat the shift drum support blocks onto the split pins. The support blocks are counterbored to allow proper seating against the pin.



Figure 543 — Seat shift drum support blocks onto split pins

Slip the A.N. flat washers onto the four 1/4" hex head bolts. Apply blue threadlock to the bolts. Slip the bolts through the support blocks and thread into the transmission case.

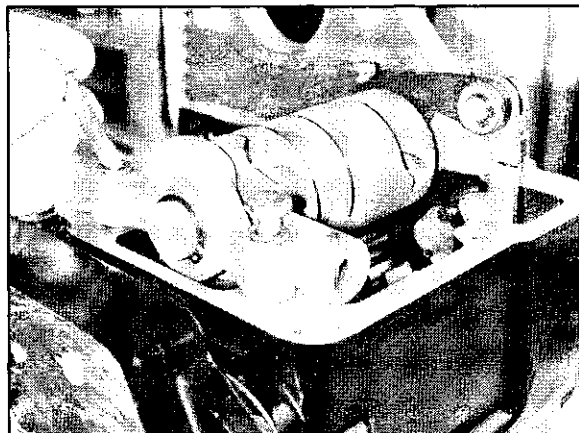


Figure 544 — Installing support block bolts

Tighten the bolts to 7-9 foot-pounds torque, using a 7/16" hex socket.

Check the action of the shift drum, forks and gears. Spin the mainshaft and the shift drum running through all the gears.

### Shift Pawl Adjustment

Full engagement of the gears may not be achieved without adjustment of the shift pawl.

Place the transmission in 3rd gear. Make sure the shift drum plunger is fully seated in the 3rd gear cam.

Gently rock the shift shaft back and forth noting the lash within the system.

Visually observe the distance from the left pin to the left shift pawl and the right pin to the right shift pawl. Compare the two distances.

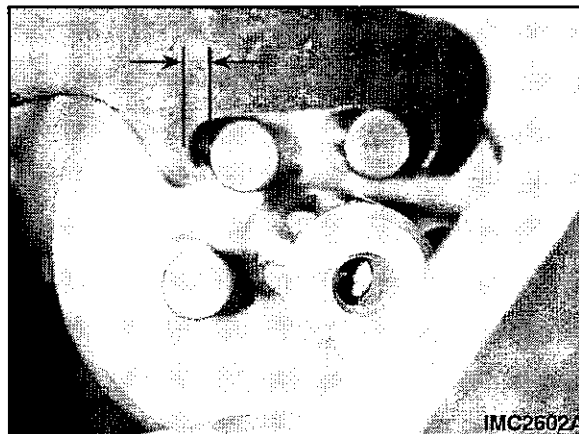


Figure 545 — Compare distances between pin and pawl

If adjustment is needed, loosen the locknut, using a 17 mm socket or box end wrench.

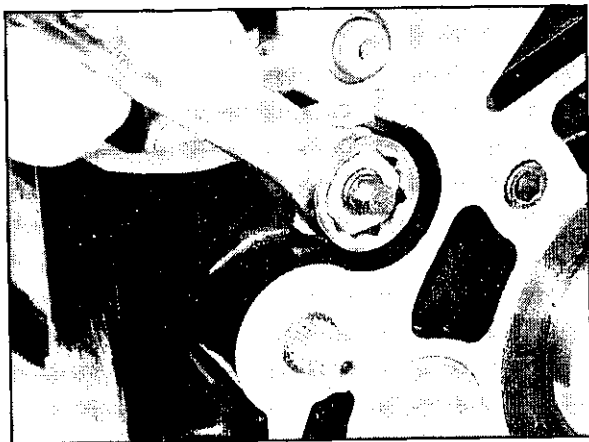


Figure 546 — Loosen locknut

Rotate the adjusting screw to achieve equal distance between the pins and shift pawl.

Tighten the locknut to 20–24 foot-pounds torque, while holding the adjusting screw.

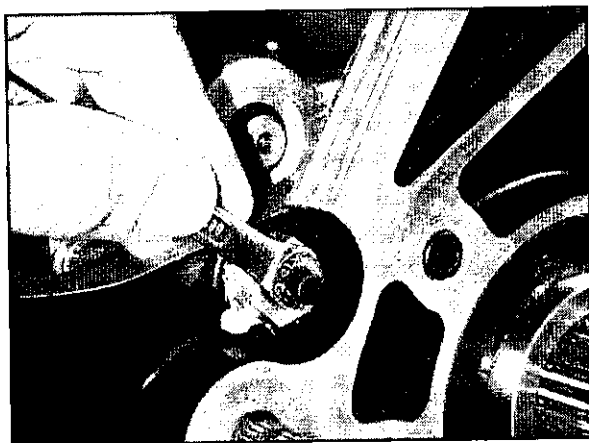


Figure 547 — Tighten locknut

Shift the transmission through all the gears checking for full engagement of the plunger to cam. Continue to rotate the adjustment screw until full engagement is achieved while up shifting and down shifting.

## Clutch Cover Installation

Replace the clutch cable O-ring with a new one. Thread the clutch cable into the clutch cover.

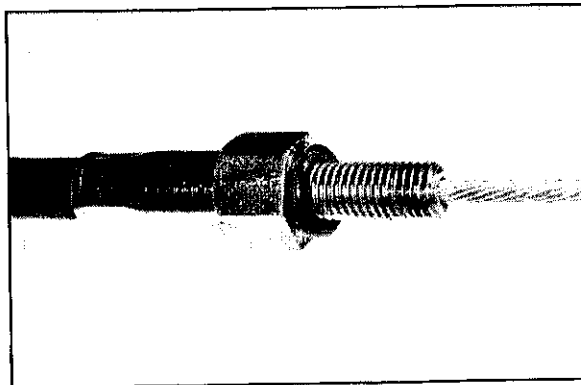


Figure 548 — Clutch cable with new O-ring

Remove the snap ring from the housing. Remove the inner ramp and turn it over.

Lubricate the ramp and three steel ball bearings with grease. Slip the cable ball into the coupling.

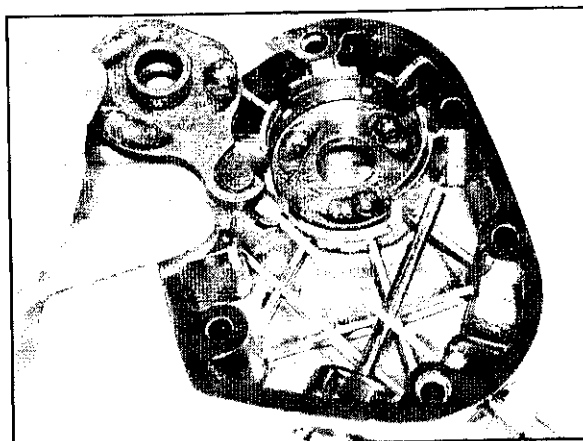


Figure 549 — Lubricate ramp and ball bearings



Flip the ramp back over and place in the original position within the housing.

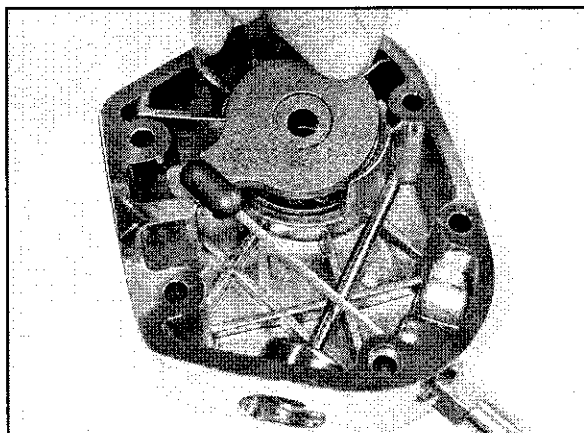


Figure 550 — Placing ramp back into housing

Install a new snap ring in the housing. Make sure the snap ring open ends are captured by the retaining ring groove.

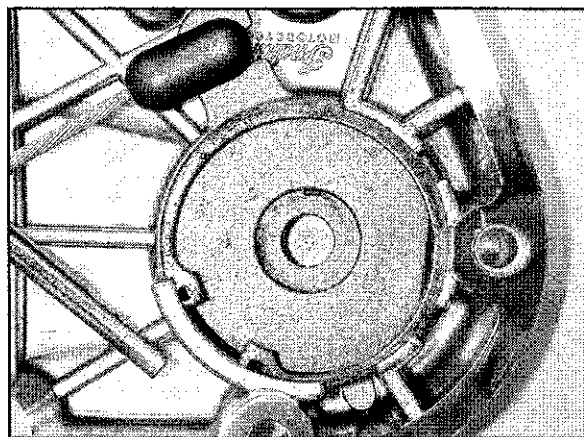


Figure 551 — Snap ring ends captured by groove

Lubricate the split pins pressed into the trapdoor.

Place a new clutch cover gasket on the split pins. Align the split pins to the clutch cover.

Apply blue threadlock to the six button head bolts.

Slip them through the clutch cover and thread into the trapdoor. Tighten the bolts in a cross pattern to 10–12 foot-pounds torque.

## Sprocket Installation

View the sprocket nut and note the machined washer surface on one side of the nut. Opposite the machined washer note the bevel placed on the hex surface. The machined washer surface goes toward the sprocket.

Clean the threads of the sprocket nut and mating threads on the mainshaft with alcohol or brake cleaner.

Apply red threadlock to the threads of the nut.

Slide the rear drive belt sprocket onto the mainshaft. Make sure there is no grease on the threads of the mainshaft. Clean the mainshaft threads if necessary.

Place a JIMS® Sprocket Lock Tool on the sprocket and corresponding pin in the case.

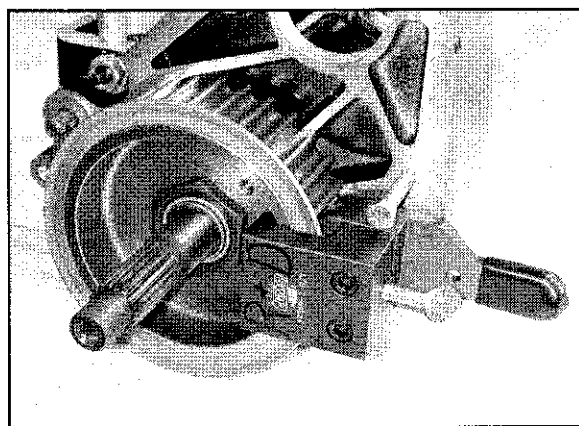


Figure 552 — JIMS® Sprocket Lock Tool installed

Install the sprocket nut. The sprocket nut is left-hand threaded and must be installed counterclockwise. Tighten the sprocket nut to 120–130 foot-pounds torque.

Place the sprocket nut lockplate onto the sprocket. Align the through holes of the lockplate to the threaded holes of the sprocket. If they do not align, tighten the sprocket nut slightly until the holes align.

Apply blue threadlock to the lockplate socket head bolts. Install the bolts and tighten to 13–15 foot-pounds torque.

## STARTING SYSTEM SERVICE

### General Information

The starting system includes the starter motor, the drive pinion assembly, a solenoid for drive engagement, the start switch to activate the system and all of the interconnecting wiring. The starter motor and solenoid are mounted above and to the rear of the transmission on the transmission flange plate. The starter drive pinion is enclosed within the primary case.

Procedures for removal and installation of system components are included in this section. Procedures for testing the system are included under Starting System Tests in the ELECTRICAL TROUBLESHOOTING section.

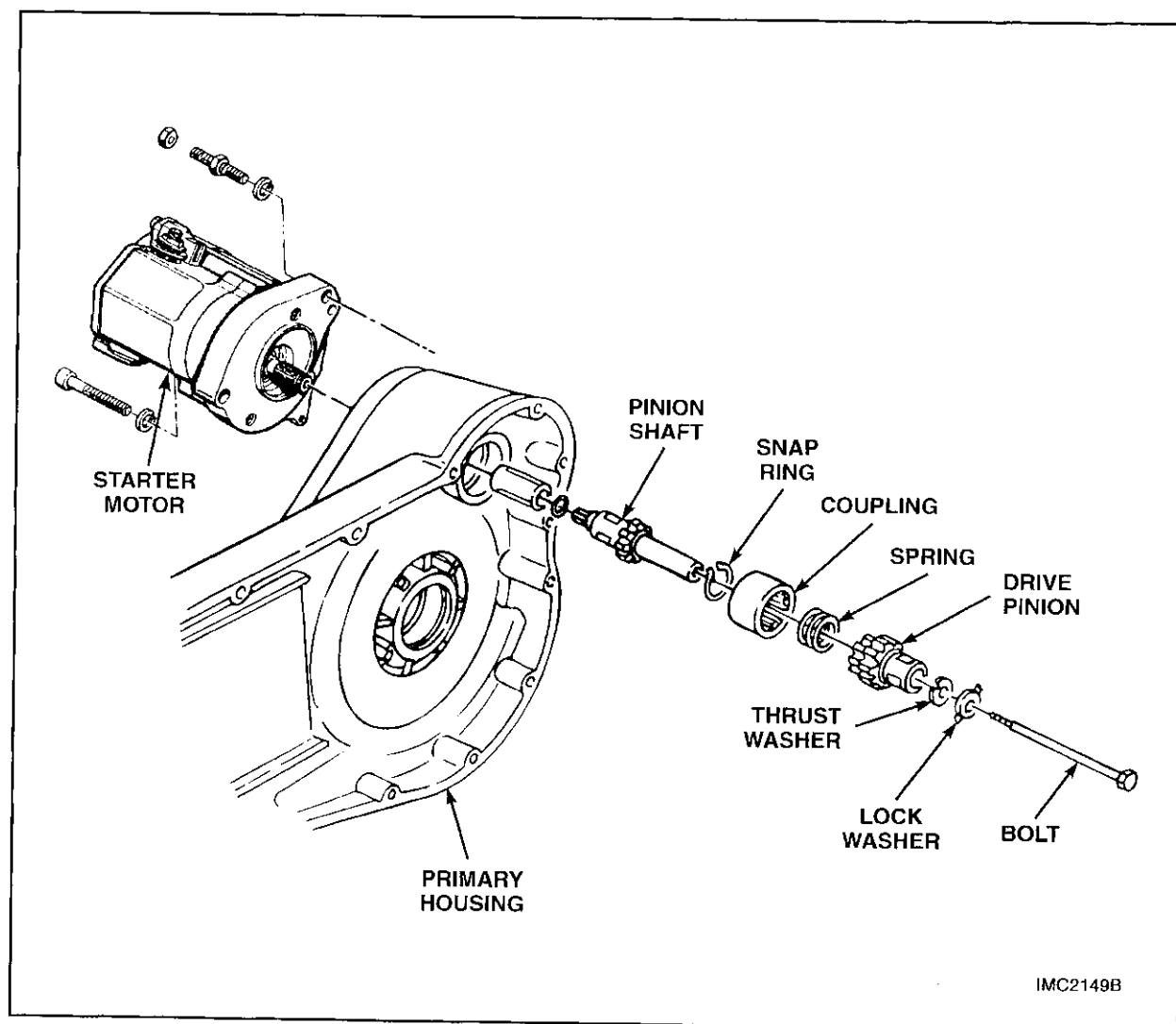


Figure 553 — Starter motor and drive pinion assembly

## Starter Drive Pinion Assembly

### Tools required:

- 3/16" hex bit
- 5/16" hex bit
- 7/16" wrench/socket
- Torque wrench

### Drive Pinion Removal

Disconnect the battery ground cable from the negative battery terminal to prevent an accidental engine start. Refer to the procedure under Battery and Cables in the CHARGING SYSTEM SERVICE section.

Raise the motorcycle off the ground to a suitable working height, using a motorcycle lift.

Disconnect the shift rod from the transmission lever, using a 3/16" hex bit.

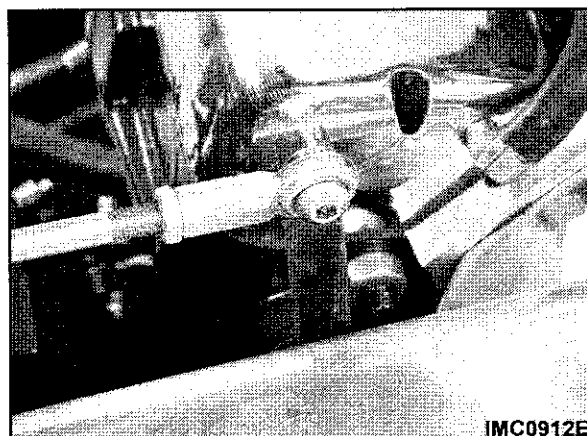


Figure 554 — Transmission shift rod

Place a drain pan under the drain plug at the bottom of the primary chain housing. Remove the plug, using a 3/4" wrench, and allow the oil to drain from the housing. When completely drained, replace the plug and tighten it to specification.

Remove the 15 screws at the perimeter of the outer primary housing, using a 3/16" hex bit. Remove the outer housing half and discard the gasket.

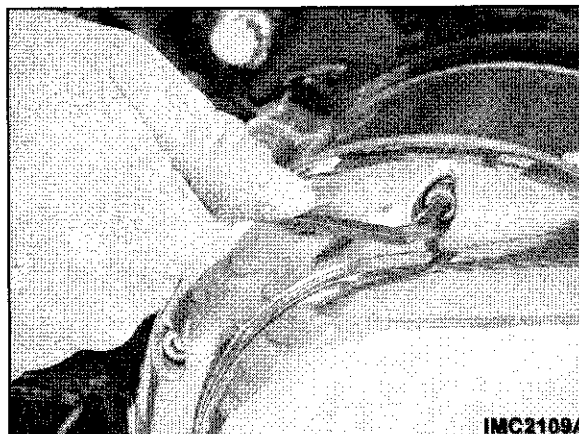


Figure 555 — Outer primary housing removal

Remove the clutch assembly from the transmission output shaft. Refer to the CLUTCH SERVICE section for the procedure.

Using a 7/16" wrench, remove the pinion bolt and remove the drive pinion and shaft assembly from the starter.

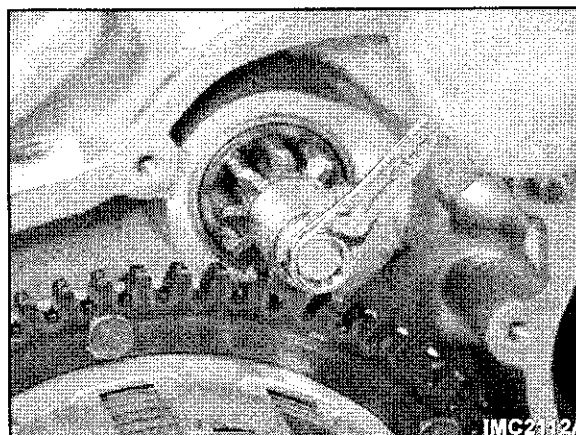


Figure 556 — Drive pinion bolt removal

## Drive Pinion Installation

Place the drive pinion and shaft assembly (pinion, spring, coupling, snap ring and shaft) in the inner primary housing starter bore.



Figure 557 — Drive pinion installation

Slide the lock washer and thrust washer onto the drive pinion bolt. Insert the bolt through the drive pinion assembly and into the starter.

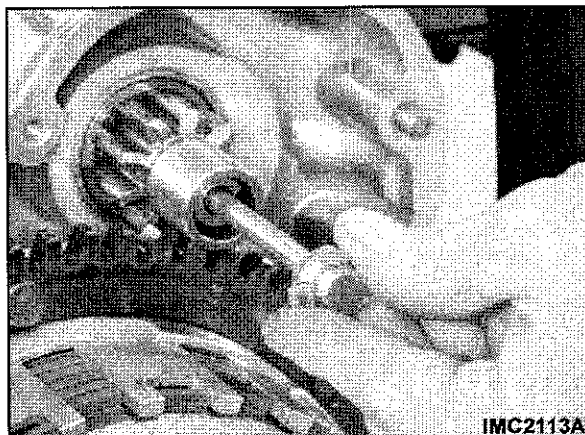


Figure 558 — Drive pinion bolt installation

Using a 7/16" socket and torque wrench, tighten the bolt to specification. When tightened, bend the tab of the outer washer over the bolt head to secure the bolt.

Install the clutch assembly on the transmission output shaft following the procedure in the CLUTCH SERVICE section.

Install a new gasket and install the outer primary housing and retaining screws, using a 3/16" hex bit. Tighten the screws to specification.

Apply blue threadlock to the shift rod screw. Connect the shift rod at the transmission, using a 3/16" hex bit. Tighten the screw to specification.

Lower the motorcycle to the ground. Lower the kickstand and remove the motorcycle lift.

Connect the battery ground cable to the negative battery terminal. Check for proper operation of the starter motor and drive.

## Starter Motor

### Tools required:

- 1/4" hex bit
- 7 mm wrench/socket
- 3/8" wrench/socket
- 7/16" wrench/socket
- 1/2" wrench/socket
- 12 mm wrench/socket
- Flat-blade screwdriver
- Torque wrench

### Starter Removal

Disconnect the battery ground cable from the negative battery terminal to prevent an accidental engine start. Refer to the procedure under Battery and Cables in the CHARGING SYSTEM SERVICE section.

Remove the engine oil tank following the procedure in the LUBRICATION SYSTEM SERVICE section.

Remove the starter drive pinion bolt following the procedure under Starter Drive Pinion in this section.

Disconnect the battery positive cable from the solenoid terminal, using a 12 mm socket. Disconnect the start switch wire lead at the solenoid terminal by unplugging the spade terminal (control circuit).

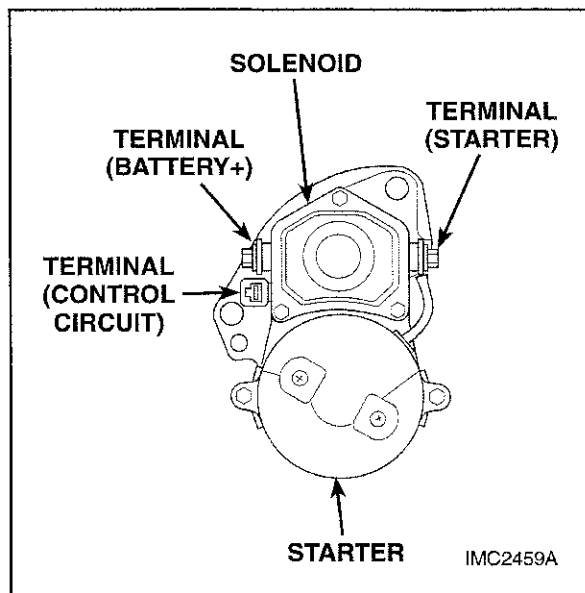


Figure 559 — Starter mounting bolt removal

Remove the mounting screws from the starter, using a 1/4" hex bit, and remove the starter motor from the motorcycle.

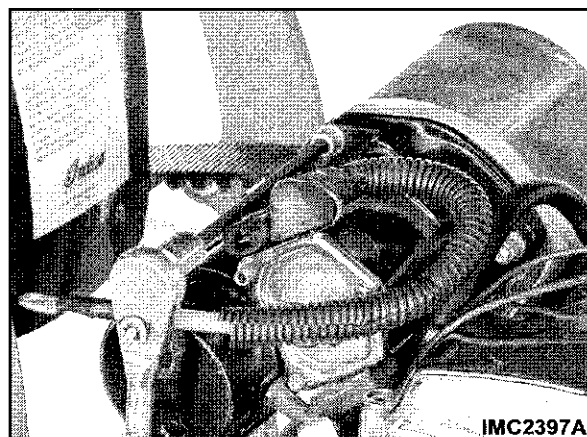


Figure 560 — Starter mounting bolt removal

## Starter Installation

Place the starter motor in position against the transmission end cover flange.

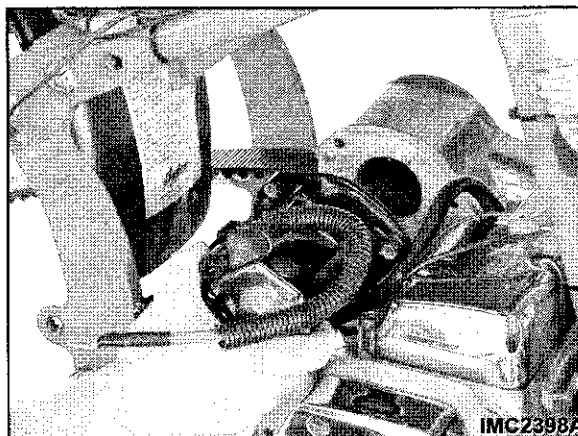


Figure 561 — Installing starter

Apply blue threadlock to the threads of the starter mounting screws. Using a 1/4" hex bit, install the mounting screws at the upper rear and lower front locations. Tighten the screws to specification.

Install the starter drive pinion bolt following the procedure described under Starter Drive Pinion.

Connect the battery positive cable and start switch wire to the terminals on the starter solenoid. Tighten the retaining nuts to specification, using a 12 mm socket.

Connect the battery ground cable to the negative battery terminal. Refer to the procedure under Battery and Cables in the CHARGING SYSTEM SERVICE section.

## Disassembly and Assembly

Generally, it is more cost effective to replace a starter motor assembly (including solenoid) with a new or rebuilt unit than it is to disassemble and repair one. However, a faulty solenoid is easily replaced if necessary using the following procedure.

## Starter Relay

The starter relay is located on the underside of the electronic control module at the top of the frame between the fuel tanks. It is plugged into the module and can be replaced if required.

### Tools required:

5/32" hex bit

Small flat-blade screwdriver

### Starter Relay Replacement

Remove the seat from the motorcycle following the procedure in the FRAME AND ACCESSORIES SERVICE section.

Disconnect the battery cables at the battery terminals, negative cable first. Refer to the procedure under Battery and Cables in the CHARGING SYSTEM SERVICE section.

Remove the screw at the rear of the panel, using a 5/32" hex bit. Remove the screw in the instrument bezel at the front of the panel, using a 5/32" hex bit.

Lift the panel off the fuel tanks, disconnect the electrical wires to the speedometer and the warning lights, and remove the panel from the motorcycle.

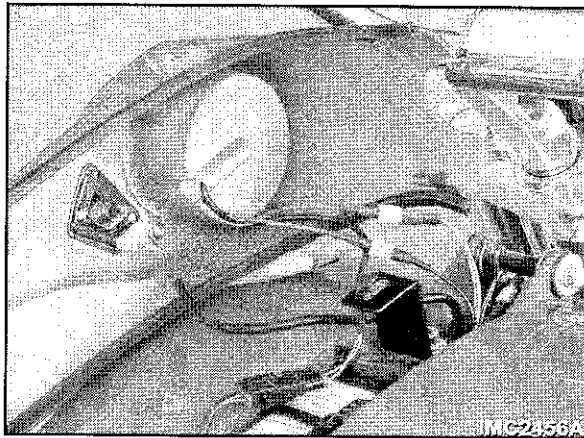


Figure 562 — Speedometer and warning light wiring connectors

Cut the tie strap retaining the control module in its holder. Then, release the tabs at each end and lift the module up to access the relay.

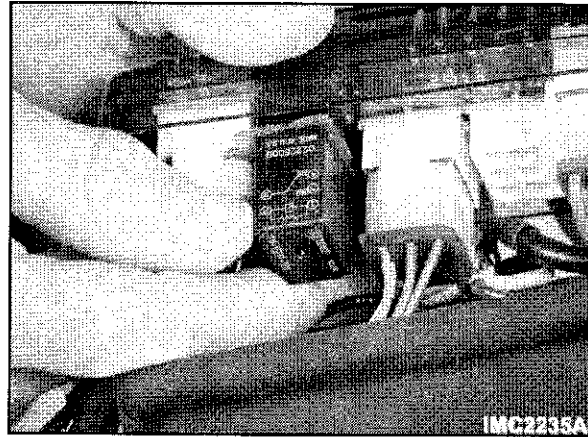


Figure 563 — Starter relay removal

Remove the relay from its socket in the module and replace it with a new one.

Install the module back in the holder, making sure that the end tabs are properly engaged. Install a new tie strap to secure the module.

Connect the electrical wires to the speedometer and warning lights and install the dash panel, using a 5/32" hex bit.

Reconnect the battery positive cable and then the negative cable to the battery terminals. Refer to the procedure under Battery and Cables in the CHARGING SYSTEM SERVICE section. Install the seat after connecting the battery.

## CHARGING SYSTEM SERVICE

### General Information

The charging system includes the alternator assembly, a transistorized voltage regulator, the battery and cables, an ignition switch to energize the system and all of the interconnecting wiring. The system provides electrical power for starting the engine and operating the ignition system as well as power for lighting and accessories. The alternator assembly is located on the engine output shaft behind the compensator sprocket in the primary chain housing. The voltage regulator is mounted to the lower frame gusset in front of the engine. And last, the battery is mounted under the seat, in a steel box which is an integral part of the oil tank.

Procedures for component removal, installation and maintenance are covered in this section. Procedures for testing the system are covered separately under Charging System Tests in the ELECTRICAL TROUBLESHOOTING section.

### Battery and Cables

The 2002 and 2003 Indian Scout and Spirit motorcycles have maintenance free batteries as standard equipment. There is no need to check the electrolyte level or add water. However, the battery terminals still need to be cleaned and checked for tightness at the recommended service intervals.

Tools required:

Flat-blade screwdriver

10 mm wrench

3/16" hex bit

5/16" hex bit

Ratchet wrench and 6" extension

Wire brush

### Cleaning and Inspection

Remove the seat following the procedure in the FRAME AND ACCESSORIES SERVICE section.

#### ⚠ WARNING!

**Battery fluid contains sulfuric acid. Do not allow this fluid to come in contact with eyes, skin or clothing. In case it does, immediately flush the area with water and seek medical attention if necessary.**

#### ⚠ WARNING!

**Batteries produce hydrogen gas, which is both flammable and explosive. Keep flames or sparks away from batteries. Ventilate the area when charging a battery. Always protect your hands and eyes when working with batteries or battery acid. Failure to follow these warnings could result in personal injury.**

Remove the cable screw from the negative terminal of the battery, using a 10 mm wrench, and pull the ground cable away from the negative terminal of the battery.

Remove the cable screw from the positive terminal of the battery, using a 10 mm wrench, and pull the cable and two other wire connections away from the battery terminal.

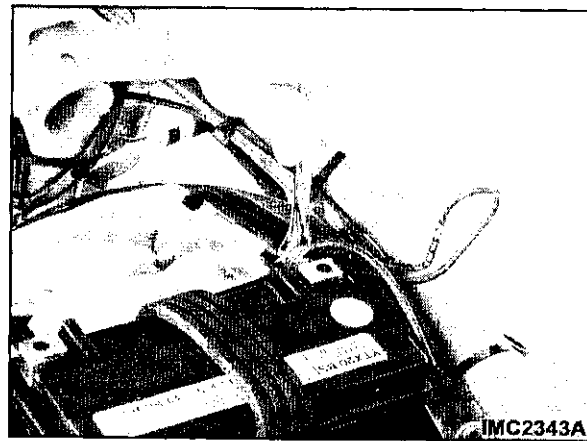


Figure 564 — Disconnecting battery cables

Disconnect and remove the battery hold-down strap from the battery box. Remove the battery from the motorcycle.

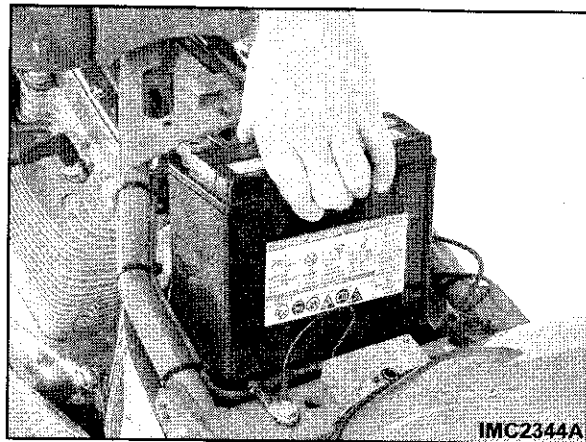


Figure 565 — Battery removal

Clean the battery terminals using a wire brush to remove any oxidation. Use the same procedure to clean any oxidation from the cable ends.

Clean the exterior of the battery, especially the top and terminals, with a solution of baking soda and water to remove any sulfation and accumulated dirt. Rinse thoroughly with water.

Inspect the battery box, especially the tray at the bottom. Clean and/or replace as necessary.

Place the battery back in the box and install the hold-down strap.

Apply a coat of dielectric grease to the positive and negative battery terminals to help prevent corrosion.

Insert the screw through the positive cable end. Thread the screw into the battery positive terminal and tighten to specification.

Insert the screw through the negative cable end and thread it into the battery negative terminal. Tighten the screw to specification.

Install the seat following the procedure in the FRAME AND ACCESSORIES SERVICE section.

## Battery Replacement

The battery and/or cables can be replaced, if necessary, at the time of cleaning and inspection following the above procedure. Remember to always disconnect the ground cable first at the battery terminal when replacing either the positive or the negative cable, or the battery.

## Alternator Replacement

### Tools required:

- 5/32" hex bit
- 3/16" hex bit
- 5/16" hex bit
- 9/16" socket
- 3/4" wrench/socket
- 1-1/2" socket
- Torque wrench
- Motorcycle lift

### Rotor/Stator Removal

Disconnect the battery ground cable from the negative battery terminal to prevent an accidental engine start. Refer to the procedure under Battery and Cables in this section.

Raise the motorcycle off the ground to a suitable working height, using a motorcycle lift.

Disconnect the shift rod from the transmission lever, using a 3/16" hex bit.

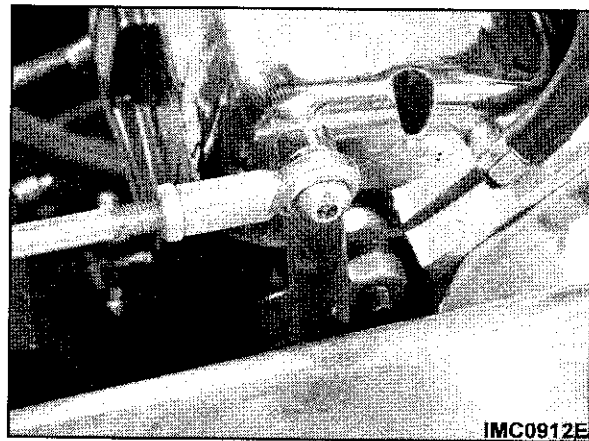


Figure 566 — Transmission shift rod

Using a 5/16" hex bit, remove the left floorboard mounting screws and remove the kickstand, floorboard and shift pedal assembly (Spirit model only) from the frame.

Place a drain pan under the drain plug at the bottom of the primary chain housing. Remove the plug, using a 3/4" wrench, and allow the oil to drain from the housing. When completely drained, replace the plug and tighten to specification.



Remove the 15 screws at the perimeter of the outer primary housing, using a 3/16" hex bit. Remove the outer housing half. Remove the gasket from the housing and discard it.

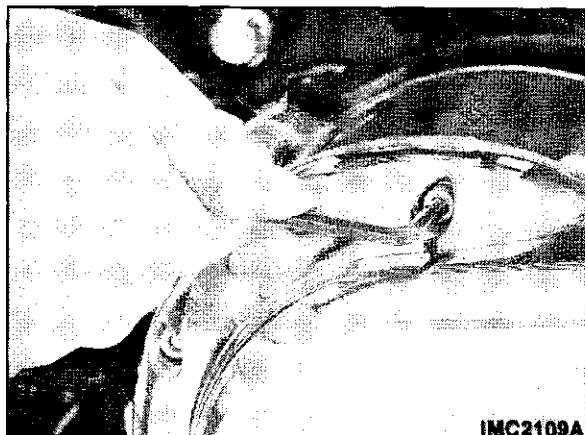


Figure 567 — Outer primary housing removal

Loosen the chain tensioner and remove the tensioner locknut, using a 9/16" socket, and slide the tensioner down to provide maximum slack in the chain.

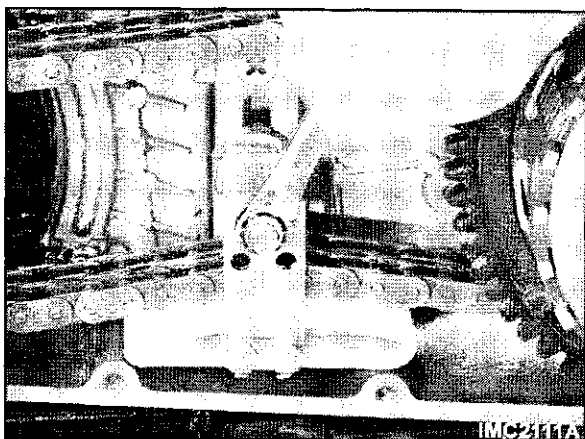


Figure 568 — Loosening the chain tensioner

Using a 1-1/2" socket, remove the compensator retaining nut and remove the assembly from the sprocket shaft. Use a sprocket/clutch locking tool, placed between the sprocket and chain, to prevent the sprocket from turning while removing the retaining nut.

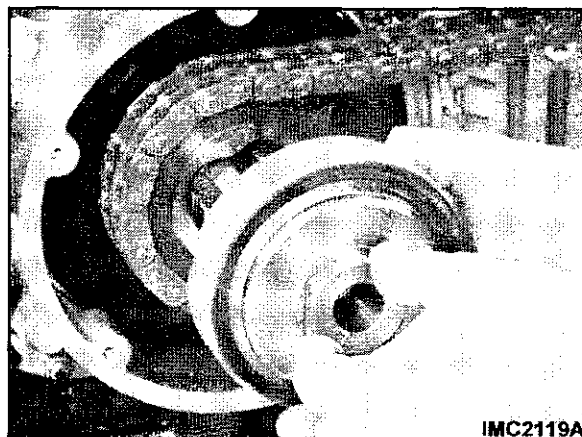


Figure 569 — Compensator sprocket removal

Remove the clutch assembly pressure plate and the clutch hub retaining nut. Slide the clutch hub assembly, primary drive chain, chain tensioner and engine sprocket off the engine crankshaft and the transmission input shaft. Refer to the PRIMARY DRIVE SERVICE section for procedures.

Remove the starter motor drive pinion and starter motor. Refer to the STARTING SYSTEM SERVICE section for procedures.

Remove the inner primary drive housing. Refer to the PRIMARY DRIVE SERVICE section for procedures.

Remove the alternator rotor from the sprocket shaft. The rotor is held in place by the force of the integral magnets.

Using a 5/32" hex bit, remove the four socket-head screws retaining the stator to the sprocket side of the crankcase.

Using a 3/32" hex bit, loosen the set screw retaining the connector in the engine crankcase. Push the stator connector through the crankcase flange and remove the stator.

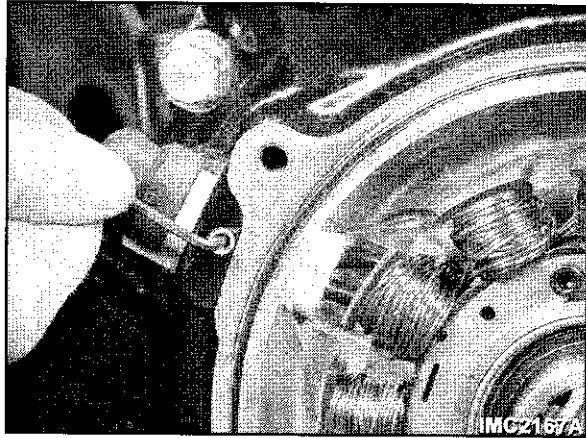


Figure 570 — Stator electrical connector and lead position

### Rotor/Stator Inspection

Clean any oil and accumulated dirt from the rotor and the stator. A mild solution of soap and water will work well for this purpose. Dry the parts thoroughly after cleaning.

Metal particles will be drawn to the parts, particularly the rotor, because of the magnetism. Use a soft brush to remove these particles.

When clean, inspect the rotor and stator for cracks and other damage. Look closely at the stator coil windings for damaged or chafed wires. Replace the rotor or coil if damaged.

### Rotor/Stator Installation

Lubricate the stator connector and the crankcase bore. Insert the stator connector into its bore in the flange on the sprocket side of the crankcase and press the connector into position.

Apply a thin coating of blue threadlock to the four socket-head screws.

Place the stator in position against the case and install the mounting screws. Using a 5/32" hex bit and torque wrench, tighten the screws to specification.

Make sure the stator electrical leads are pressed against the crankcase. If not positioned properly, the leads can come in contact with the rotor and be damaged. Tighten the set screw, using a 3/32" hex bit, to secure the connector in place.

Install the inner primary drive housing, the starter motor and drive pinion and the primary drive chain, sprockets and tensioner. Refer to the PRIMARY DRIVE SERVICE section and the STARTING SYSTEM SERVICE section for procedures.

Place the compensator sprocket assembly in position on the engine crankshaft and seat the primary chain on the sprocket.

Install the compensator retaining nut and tighten to specification, using a 1-1/2" socket and torque wrench. Use a sprocket/clutch locking tool, placed between the sprocket and chain, to prevent the sprocket from turning while installing the retaining nut.

Adjust the primary chain as follows:

- Push the tensioner assembly upward against the bottom chain run with moderate pressure. Lightly tighten the nylock nut to maintain this position.
- At a distance halfway between the compensator sprocket and clutch sprocket, measure the chain deflection/slack (the distance from the lowest point of the chain to the highest when lifted). The specified chain deflection/slack is 9/16", top-to-bottom.
- If the chain deflection is not within specification, reposition the tensioner assembly as necessary to obtain the setting. Then, tighten the adjuster nut to specification. Refer to the PRIMARY DRIVE SERVICE section for more information.

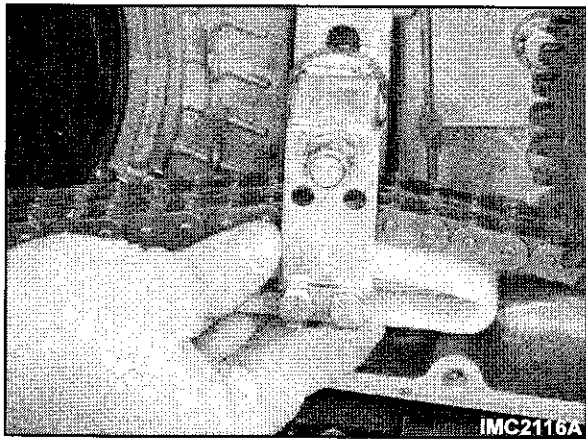


Figure 571 — Positioning the chain adjuster

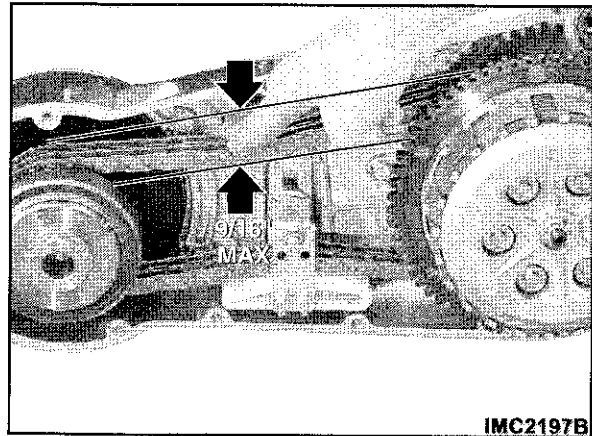


Figure 572 — Measuring primary chain deflection/slack

Install a new gasket and install the outer primary housing and retaining screws, using a 3/16" hex bit. Tighten the screws to specification.

Place the left floorboard, shift pedal assembly and kickstand in position on the frame. Install the mounting screws, using a 5/16" hex bit, and tighten the screws to specification.

Apply blue threadlock to the shift rod screw. Connect the shift rod at the transmission, using a 3/16" hex bit. Tighten the screw to specification.

Lower the motorcycle to the ground. Lower the kickstand and remove the motorcycle lift.

Connect the battery ground cable to the negative battery terminal. Start the engine and check for proper operation of the charging system.

## Voltage Regulator Replacement

The regulator is a non-serviceable part. If it is faulty, it must be removed and replaced.

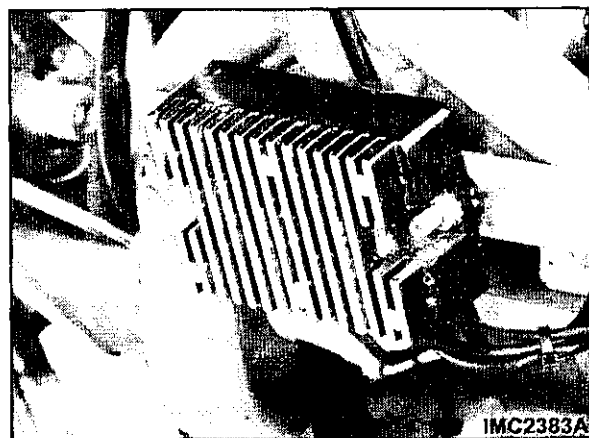


Figure 5-3 — Voltage regulator

### Tools required:

7/16" socket

Motorcycle lift

### Removal and Installation

Disconnect the battery ground cable from the negative battery terminal to prevent an accidental engine start. Refer to the procedure under Battery and Cables in this section.

Raise the motorcycle off the ground to a suitable working height, using a motorcycle lift.

Disconnect the regulator wire leads at the stator connector on the engine crankcase.

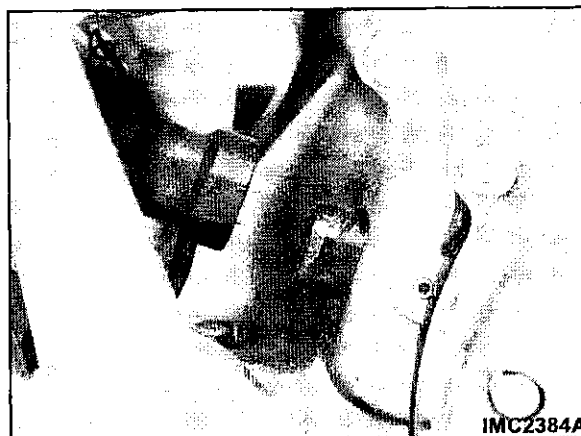


Figure 5-4 — Voltage regulator/stator terminal connection

Disconnect the regulator battery wire lead at the battery positive terminal. Trace the wire routing along the frame, cut the nylock tie straps and remove the wire.

Using a 7/16" socket, remove the nuts and lock washers from the two mounting studs. Remove the regulator from the frame gusset.

To install the regulator, reverse the order of removal. Make sure that the wire to the battery positive terminal is properly routed and secured to the frame with tie straps. Tighten the mounting nuts to specification.

Lower the motorcycle to the ground. Lower the kickstand and remove the motorcycle lift.

Connect the battery ground cable to the negative battery terminal. Start the engine and check for proper operation of the charging system.

## POWER DISTRIBUTION, LIGHTING AND INSTRUMENT SERVICE

### Electrical Equipment Check

The ignition key switch controls the ignition and lights of the motorcycle. It is located on the left side of the motorcycle, just below the seat.

Turn the ignition key switch to the on position. Confirm that the red rear running light and the front fender light and headlamp are illuminated.

### Warning Lights

**Red Dash Light** — The red dash light indicates that the engine oil pressure is too low and/or the engine is NOT RUNNING. To test, start the engine. The light will go out when the engine is running and has attained sufficient oil pressure. Stop the engine.

**Green Dash Light** — The green dash light indicates the transmission is in NEUTRAL. To test, place the transmission in gear. The green dash light will go out. Return the transmission to neutral and the green light will again be illuminated.

### Left Handlebar Switches

Toggle the Lights HI/LO selector. When in the HI position the headlight "high beam" should produce a bright light and the blue dash light should illuminate. Toggle to the LO position and the headlight "low beam" will be energized, producing less light; the blue dash light should be off.

Push the HORN button and confirm that the horn is working and emitting the proper tone.

Push the TURNL button and confirm that both the front and rear turn signal lights on the left side are functioning. The left yellow dash light should blink in unison with the turn signal.

### Right Handlebar Switches

Push the TURNR button and confirm that both the front and rear turn signal lights on the right side are functioning. The right yellow dash light should blink in unison with the turn signal.

Toggle the Engine Stop switch to the engine OFF position. Make sure the green transmission neutral light is on. Pull in the clutch lever in and depress the START button. The engine should not turn over.

Toggle the Engine Stop switch to the RUN position. Make sure the green transmission neutral light is on. Pull the clutch lever in and quickly depress the START button. The engine should turn over.

### Brake Light

Pull the front brake lever in. The rear brake light should illuminate followed by three simultaneous blinks of the left and right amber turn signal lights. Press the rear brake pedal and the rear brake light should illuminate.

### Circuit Breakers

There are four circuit breakers protecting the wiring of the motorcycle. The four are an integral part of the electronic control module for protection of the following circuits:

- Ignition switch and main power
- Engine stop switch and ignition coil
- Head and tail lights
- Brake light, horn and turn signals

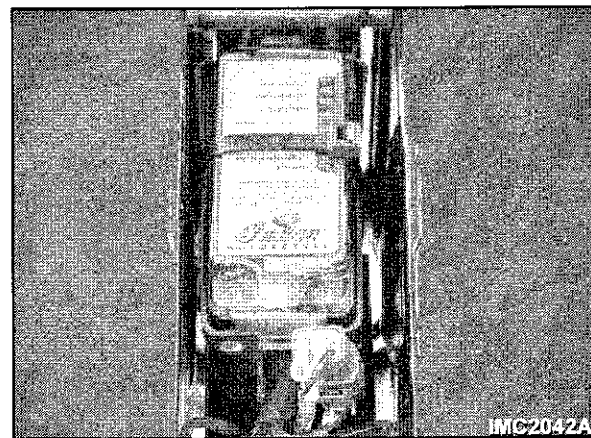


Figure 575 — Electronic control module with integral circuit breakers

When an electrical fault trips a circuit breaker, the breaker automatically resets, returning steady power to the circuit. If the electrical fault is not found and corrected, the circuit breaker will return power to the circuit intermittently. When this happens, the motorcycle will operate erratically and the battery will eventually lose its charge.

### ⚠ WARNING!

To avoid possible damage to the motorcycle and/or personal injury, the cause of an electrical fault must be found and corrected.

The four circuit breakers that are an integral part of the electronic control module are not replaceable. If there is a fault in any one of the four, there is a problem with the control module, and the module must be replaced as an assembly. For instructions, refer to Electronic Control Module, Access and/or Replacement in this section.

## Speedometer and Warning Light Replacement

### Tools required:

5/32" hex bit

Phillips screwdriver

### Dash Panel Removal

To gain access to the speedometer and warning lights, the dash panel must be removed.

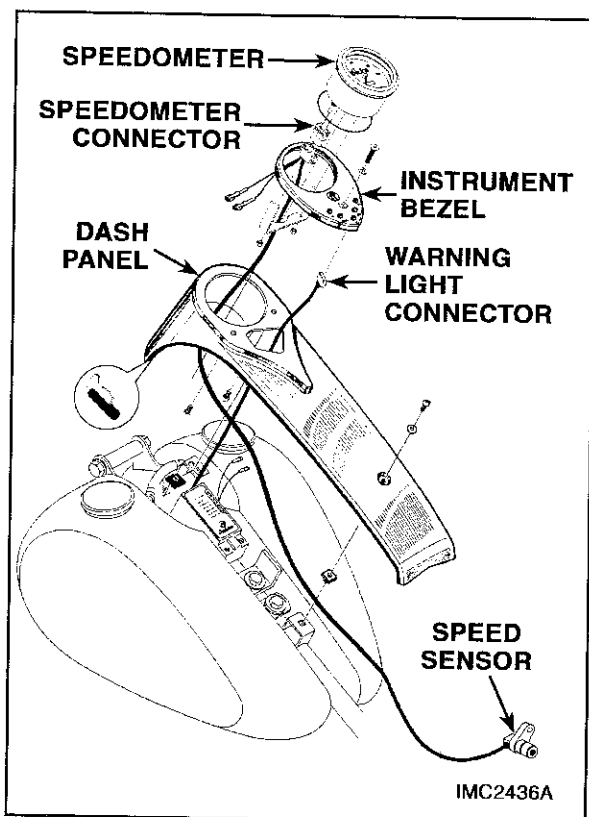


Figure 576 — Dash panel and instruments (2003 model shown)

Remove the seat from the motorcycle following the procedure in the FRAME AND ACCESSORIES SERVICE section.

Disconnect the battery cables at the battery terminals, negative cable first. Refer to the procedure under Battery and Cables in the CHARGING SYSTEM SERVICE section.

Remove the screw at the rear of the panel, using a 5/32" hex bit. Remove the screw in the instrument bezel at the front of the panel, using a 5/32" hex bit.

Lift the panel off the fuel tanks, disconnect the electrical wires to the speedometer and the warning lights, and remove the panel from the motorcycle.

Place a protective pad on the workbench to protect the dash panel as it is being serviced.

### Speedometer

To remove the speedometer, place the dash panel upside down on the pad. Remove the two screws retaining the instrument bezel in the dash panel, using a 5/32" hex bit. Turn the panel over and from underneath, push up on the warning light board to remove the bezel (with speedometer) from the dash panel.

#### 2002 Model Speedometer

For 2002 models, the speedometer is retained in the instrument bezel by a large plastic collar threaded onto the housing. Hold the bezel in one hand and with the other hand, turn the collar counterclockwise to loosen and remove the collar. Push up on the housing to remove the speedometer from the bezel.

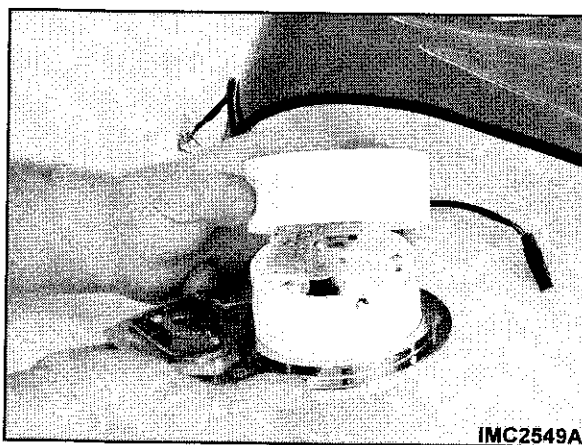


Figure 577 — Removing threaded collar from housing

To install the speedometer assembly, first make sure the O-ring seal is in place in the groove on the inner surface of the bezel speedometer bore.

Insert the assembly in the instrument bezel, making sure that the speedometer face is properly aligned. Press the assembly into the bezel until the upper flange is seated firmly against the bezel surface. Then, thread the collar onto the speedometer housing to secure the assembly in the bezel.

#### 2003 Model Speedometer

For 2003 models, the speedometer is retained in the instrument bezel by two studs and retaining nuts, securing the housing to a bracket. Remove the retaining nuts, using an 11/32" wrench.

Push up on the housing to remove the speedometer from the bezel.

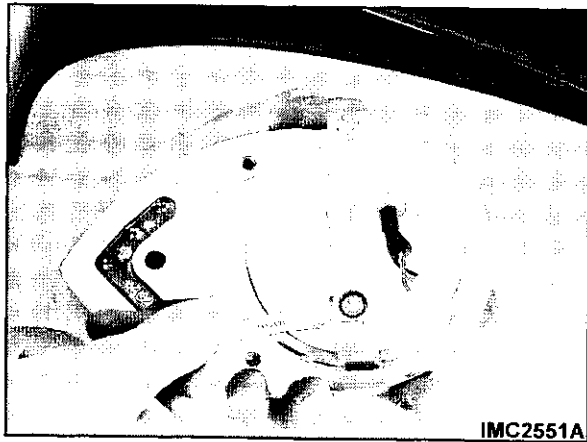


Figure 578 — Removing retaining nuts

To install the speedometer assembly, first make sure the O-ring seal is in place in the groove on the inner surface of the bezel speedometer bore.

Insert the assembly in the instrument bezel, making sure that the speedometer face is properly aligned. Press the assembly into the bezel until the upper flange is seated firmly against the bezel surface and the studs pass through the mounting holes in the bracket. Install the retaining nuts, using an 11/32" wrench, to secure the assembly in the bezel. Do not overtorque. Overtorquing may allow the seal to leak water inside the speedometer. Tighten to 5-1/2 ± 1/2 inch-pounds torque, using a torque screwdriver.

#### Installing the Bezel

Place the bezel in position on the dash panel, making sure that the speedometer wire leads are routed through the hole at the bottom of the panel bore. Press down firmly to seat the bezel in the panel.

Turn the dash panel over and install the two retaining screws, using a 5/32" hex bit.

#### Warning Lights

To replace a warning light assembly, place the dash panel upside down on the pad. Remove the two mounting screws, using a Phillips screwdriver, and remove the assembly from the bezel.

Place the new assembly in position on the bezel, making sure the LED's are seated properly in the bezel holes. Install the two mounting screws, using a Phillips screwdriver.

#### Dash Panel Installation

Place the dash panel in position over the fuel tanks and secure the panel with the socket head screws in the instrument bezel and at rear of the panel. Tighten the screws to specification, using a 5/32" hex bit.

Reconnect the battery positive cable and then the negative cable to the battery terminals. Refer to the procedure under Battery and Cables in the CHARGING SYSTEM SERVICE section.

Place the seat in position on the frame and install the two screws to attach the seat to the frame, using a 5/16" hex bit. Tighten the screws to specification.

### Electronic Control Module, Access and/or Replacement

#### Accessing the Module for Diagnostics

Remove the screw at the rear of the dash panel, using a 5/32" hex bit. Remove the screw in the instrument bezel at the front of the panel, using a 5/32" hex bit.

Place a pad on one of the fuel tanks. Lift the dash panel up and place it to the side on the pad. DO NOT disconnect the wire leads to the speedometer and warning lights.

With the dash panel positioned to the side, the LEDs in the electronic control module can be viewed to check for problem conditions in one of the following eight circuits:

- Aux. power, 3 amps
- Right signal lights
- Left signal lights
- Turn switches, oil, neutral
- Horn
- Brake light
- High/low beam
- Kill switch

Refer to Electronic Control Module Diagnostics in the ELECTRICAL TROUBLESHOOTING section for more information on diagnostic procedures.

After completing the diagnostic steps, place the dash panel in position over the fuel tanks and secure the panel with the socket head screws in the instrument bezel and at the rear of the panel. Tighten the screws to specification, using a 5/32" hex bit.

## Replacing the Module

Remove the seat from the motorcycle following the procedure in the FRAME AND ACCESSORIES SERVICE section.

Disconnect the battery cables at the battery terminals, negative cable first. Refer to the procedure under Battery and Cables in the CHARGING SYSTEM SERVICE section.

Remove the screw at the rear of the panel, using a 5/32" hex bit. Remove the screw in the instrument bezel at the front of the panel, using a 5/32" hex bit.

Lift the panel off the fuel tanks, disconnect the electrical wires to the speedometer and the warning lights, and remove the panel from the motorcycle.

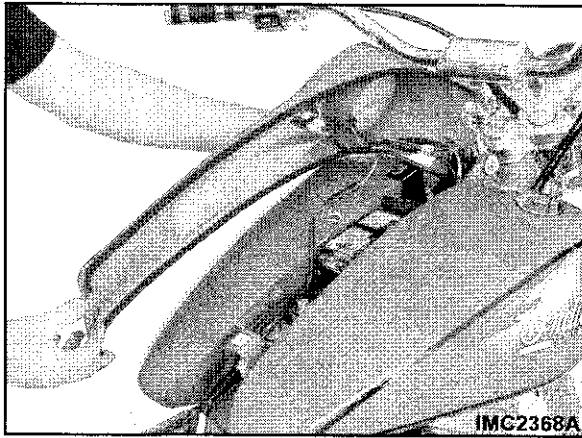


Figure 579 — Removing dash panel

Cut the nylon tie strap retaining the electronic control module, release the tabs at the ends and lift the module from its holder. Unplug the front, rear and handlebar harness connectors and remove the module.

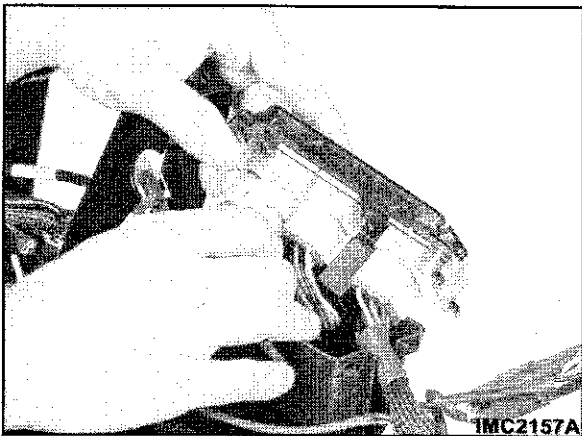


Figure 580 — Removing electronic control module

To install the electronic control module, plug the harness connectors into the respective sockets at the base of the module. Place the module in the holder, making sure that the lockdown tabs are engaged and the module is secured. Install a new nylon tie strap.

Place the dash panel in position over the fuel tanks and secure the panel with the socket head screws in the instrument bezel and at the rear of the panel. Tighten the screws to specification, using a 5/32" hex bit.

Reconnect the battery positive cable and then the negative cable to the battery terminals. Refer to the procedure under Battery and Cables in the CHARGING SYSTEM SERVICE section.

Place the seat in position on the frame and install the two screws to attach the seat to the frame, using a 5/16" hex bit. Tighten the screws to specification.

## Road Light Replacement

Refer to the procedures for replacing bulbs and light housing assemblies in the FRAME AND ACCESSORIES SERVICE section.

## Handlebar Switch Replacement

The following procedure covers the replacement of an individual switch in one of the switch housings as well as the replacement of a complete switch and harness assembly (handlebar grip to electronic control module). Where necessary, differences between left and right assemblies are noted.

### Tools required:

- 5/32" hex bit
- Phillips screwdriver

### Replacing a Switch Only

Remove the seat from the motorcycle following the procedure in the FRAME AND ACCESSORIES SERVICE section.

Disconnect the battery cables at the battery terminals, negative cable first. Refer to the procedure under Battery and Cables in the CHARGING SYSTEM SERVICE section.

### Right Handlebar Switch

Loosen and remove the mounting screws and clamp securing the brake lever assembly, using a 5/32" hex bit. Remove the assembly and position it away from the switch housing.

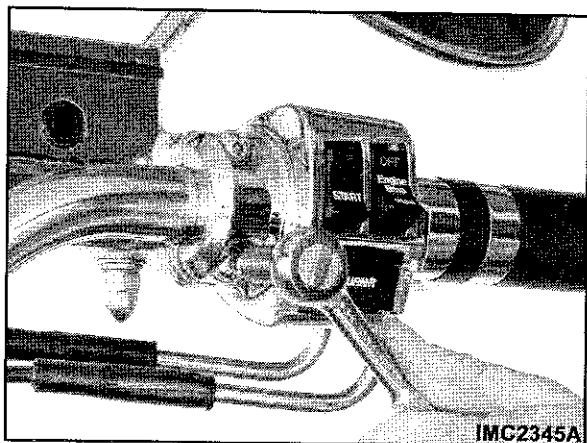


Figure 581 — Removing front brake control

Remove the throttle/switch housing screws, using a 5/32" hex bit. Slowly remove the top housing half and then remove the small ferrules to disconnect the throttle cable ends from the twist grip.

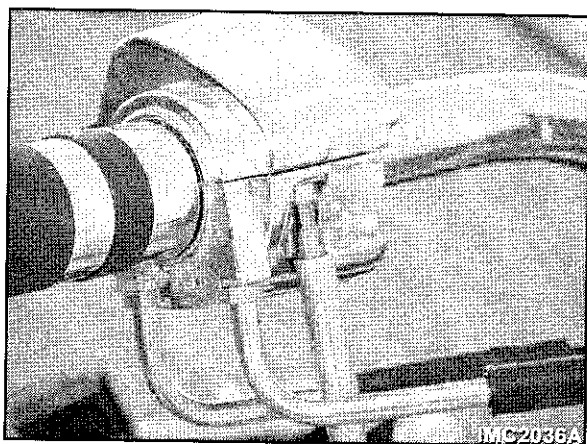


Figure 582 — Remove/install throttle/switch housing screws

Using a Phillips screwdriver, remove the bracket holding the switch harness wiring in the housing. Remove the retainer and remove the malfunctioning switch (starter, engine stop, turn signal or brake light switch) from its socket in the housing.

Cut the switch wires close to the terminals (approximately 1/4") and remove the switch. Strip enough insulation (1/2") from the harness wires for splicing to the new switch and then slide insulating sheaths onto the wire ends. Push the sheaths far enough onto the wires so that stripped wire ends can be spliced to the new switch.

Match the wires from the switch to the proper harness wire ends. Twist the wires together and solder the joint, using rosin core solder. Slide the insulating sheaths back over the spliced joints and install the switch in the housing socket. Then secure the harness to the housing.

Apply a small amount of blue threadlock to the throttle/switch housing mounting screws.

Apply a small amount of grease to the cable ferrules and install the ferrules on the cable ends.

Slide the ferrules into the throttle rotator ring and make sure the rotator ring is seated correctly in the lower throttle housing section.

Carefully place the top throttle housing section onto the bottom section. Install the two mounting screws and tighten very lightly. Rotate the throttle, checking for smooth operation.

Align the throttle switch housing so that the parting line is parallel with the ground.

Tighten the two housing mounting screws, using a 5/32" hex bit.

Again, check for proper throttle rotation.

Apply blue threadlock to the two master cylinder and brake lever assembly clamp screws. Position the brake assembly to the handlebar; install the clamp and two screws. DO NOT tighten the clamp screws at this time.

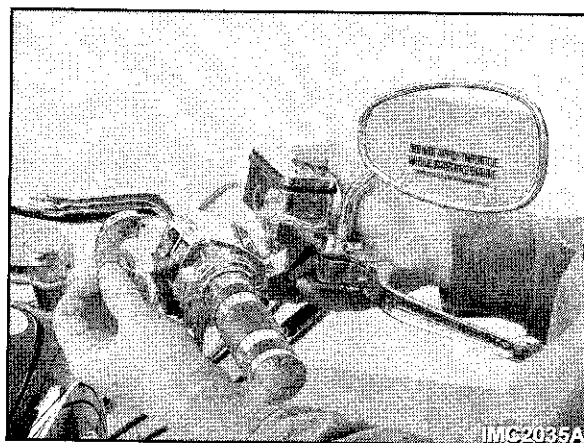


Figure 583 — Installing front brake control

Pull the brake lever to the handlebar and slide the brake assembly into the throttle/switch housing.

### ⚠ CAUTION!

**Failure to pull the lever before sliding can damage the brake light switch.**

Release the brake lever. Then, tighten the two brake assembly clamp screws, using a 5/32" hex bit.



### Left Handlebar Switch

Loosen and remove the mounting screws and clamp securing the clutch lever assembly, using a 5/32" hex bit. Remove the assembly and position it away from the switch housing.

Using a 5/32" hex bit, remove the retaining screws from the switch housing and separate the housing halves.

Using a Phillips screwdriver, remove the bracket holding the switch harness wiring in the housing. Remove the retainer and remove the malfunctioning switch (headlight, horn or turn signal) from its socket in the housing.

Cut the switch wires close to the terminals (approximately 1/4") and remove the switch. Strip enough insulation (1/2") from the harness wires for splicing to the new switch and then slide insulating sheaths onto the wire ends. Push the sheaths far enough onto the wires so that stripped wire ends can be spliced to the new switch.

Match the wires from the switch to the proper harness wire ends. Twist the wires together and solder the joint, using rosin core solder. Slide the insulating sheaths back over the spliced joints and install the switch in the housing socket. Then secure the harness to the housing.

Apply a small amount of blue threadlock to the switch housing mounting screws.

Carefully place the top housing section onto the bottom section. Install the two mounting screws and tighten very lightly. Align the switch housing so that the parting line is parallel with the ground and tighten the two housing mounting screws, using a 5/32" hex bit.

Apply blue threadlock to the two clutch lever assembly clamp screws. Position the assembly to the handlebar; install the clamp and two screws and securely tighten the screws.

### Completing the Installation

Reconnect the battery positive cable and then the negative cable to the battery terminals. Refer to the procedure under Battery and Cables in the CHARGING SYSTEM SERVICE section.

Place the seat in position on the frame and install the two screws to attach the seat to the frame, using a 5/16" hex bit. Tighten the screws to specification.

### Replacing a Switch and Harness Assembly

Remove the seat from the motorcycle following the procedure in the FRAME AND ACCESSORIES SERVICE section.

Disconnect the battery cables at the battery terminals, negative cable first. Refer to the procedure under Battery and Cables in the CHARGING SYSTEM SERVICE section.

Remove the screw at the rear of the dash panel, using a 5/32" hex bit. Remove the screw in the instrument bezel, using a 5/32" hex bit. Lift the dash panel and disconnect the harness leads from the speedometer and warning lights.

Cut the nylon tie strap, release the tabs and lift the electronic control module from its housing.

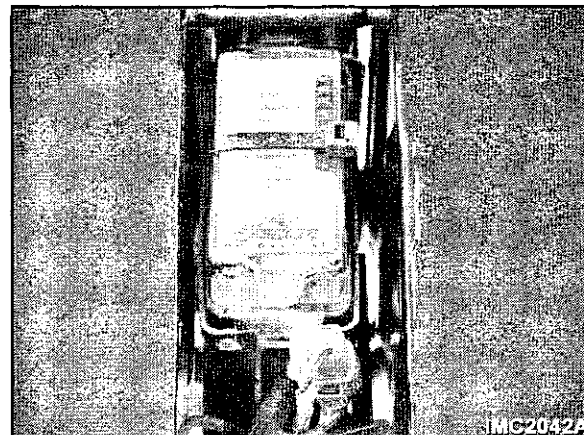


Figure 584 — Electronic control module (installed)

Remove the right and/or left handlebar switch harness connector(s) from the socket(s) in the module.

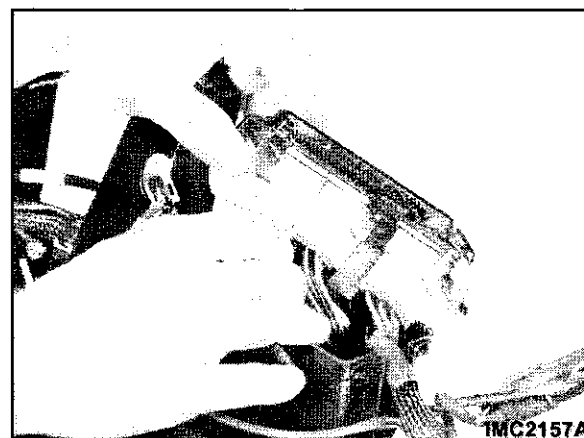


Figure 585 — Disconnecting switch harness

Cut the nylon tie straps retaining the switch harnesses and carefully pull the harnesses free from the frame.

**Note:** Both right and left switch harnesses are routed internally through the handlebars. Since the connectors are too large to fit through the handlebars, the connector blocks must be removed to separate the switches and harnesses from the handlebars.

Remove the right and/or left switch harness wire terminals from the respective connector block. IT IS IMPORTANT to note the color and position of each wire terminal in the blocks and properly tag each terminal for installation.

Loosen and remove the mounting screws and clamp securing the brake lever assembly and/or the clutch control assembly, using a 5/32" hex bit. Remove the required assembly and position away from the switch housing.

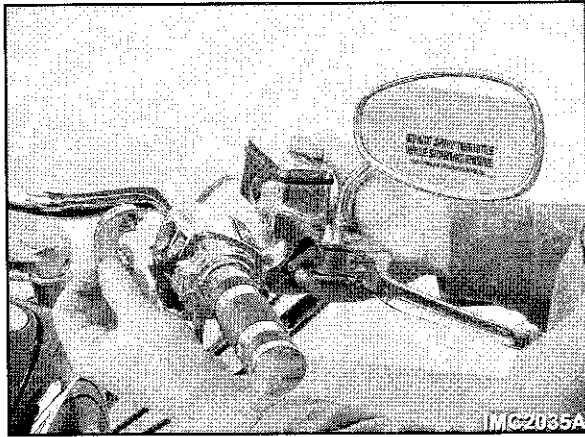


Figure 586 — Removing front brake control

Separate the right and/or left switch housing from the handlebars and remove the switches from the housing as described under Replacing a Switch Only in this section.

Attach a 3' length of suitable flexible cable to the module terminal ends of the handlebar harness. From the switch end, carefully pull the wire harness and cable from its routing through the upper fork tube bracket and internally through the handlebar.

When the harness terminal ends clear the opening at the handlebar grip, disconnect and remove the harness from the cable. Leave the cable in the handlebar for installation of the harness.

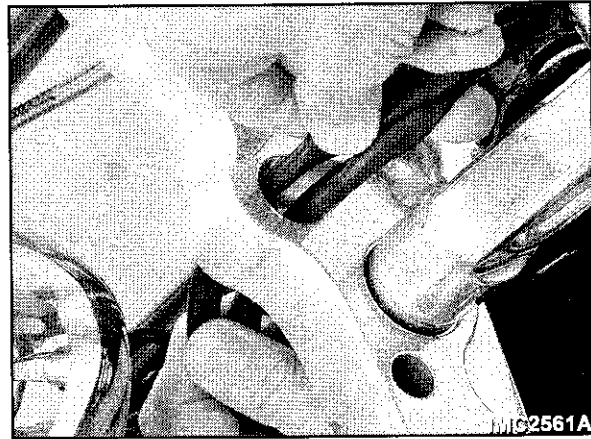


Figure 587 — Harness routing through upper fork bracket

Attach the module terminal end of the new harness to the cable. This is a temporary connection. Use care in making this connection by wrapping the terminals to protect them during installation.

Using the cable, carefully pull the wire harness internally through the handlebar, through the center slot in the upper fork bracket and up to the electronic control module. Install the second harness in the same manner, if required.

Install the wire terminals in the connector block(s) and plug the block(s) into the module. Place the module in the holder, making sure that the lockdown tabs are engaged and the module is secured. Install a new nylon tie strap.

Route the harness(es) along the upper frame rail and secure it with tie straps.

Install the switches in the respective housing sockets. Then secure the harness to the housing.

### Installing the Right Handlebar Switches

Install the switches (start, engine stop, turn signal and brake light) in the respective housing sockets and install the retaining brackets, using a Phillips screwdriver. Then secure the harness to the housing.

Apply a small amount of blue threadlock to the throttle/switch housing mounting screws.

Apply a small amount of grease to the cable ferrules and install the ferrules on the cable ends.

Slide the ferrules into the throttle rotator ring and make sure the rotator ring is seated correctly in the lower throttle housing section.

Carefully place the top throttle housing section onto the bottom section. Install the two mounting screws and tighten very lightly. Rotate the throttle, checking for smooth operation.

Align the throttle switch housing so that the parting line is parallel with the ground.

Tighten the two housing mounting screws, using a 5/32" hex bit.

Again, check for proper throttle rotation.

Apply blue threadlock to the two master cylinder and brake lever assembly clamp screws. Position the brake assembly to the handlebar; install the clamp and two screws. **DO NOT** tighten the clamp screws at this time.

Pull the brake lever to the handlebar and slide the brake assembly into the throttle/switch housing.

#### CAUTION!

**Failure to pull the lever before sliding can damage the brake light switch.**

Release the brake lever. Then, tighten the two brake assembly clamp screws, using a 5/32" hex bit.

### Installing the Left Handlebar Switches

Install the switches (headlight, horn and turn signal) in the respective housing sockets and install the retaining brackets, using a Phillips screwdriver. Then, secure the harness to the housing.

Apply a small amount of blue threadlock to the switch housing mounting screws.

Carefully place the top housing section onto the bottom section. Install the two mounting screws and tighten very lightly. Align the switch housing so that the parting line is parallel with the ground and tighten the two mounting screws, using a 5/32" hex bit.

Apply blue threadlock to the two clutch lever assembly clamp screws. Position the assembly to the handlebar; install the clamp and two screws and securely tighten.

### Completing the Installation

Place the dash panel in position over the fuel tanks and secure the panel with the socket head screws in the instrument bezel and at the rear of the panel. Tighten the screws to specification, using a 5/32" hex bit.

Reconnect the battery positive cable and then the negative cable to the battery terminals. Refer to the procedure under Battery and Cables in the CHARGING SYSTEM SERVICE section.

Place the seat in position on the frame and install the two screws to attach the seat to the frame, using a 5/16" hex bit. Tighten the screws to specification.

## Circuit Wiring Repair

Whenever repairing or replacing a wire in a circuit, it is important that the connections are secure, properly insulated and sealed to prevent corrosion. When replacing a circuit wire, be sure that the replacement wire is of the same type and gauge. Use only rosin core solder for the spliced connections; never acid core solder. Acid core solder IS NOT intended for electrical circuits and will readily corrode in the electrical environment.

Whenever any tie straps used to secure circuit wires and/or harnesses are removed to make repairs, it is important that they be replaced. Wires and harnesses must be routed and secured in a position where they are protected from moving parts or other objects.

## CHASSIS SPECIFICATIONS AND TORQUE VALUES

### Dimensions and Weight

| Item             | Specification — Scout                                             | Specification — Spirit                                            |
|------------------|-------------------------------------------------------------------|-------------------------------------------------------------------|
| Dry weight       | 606 lbs. (275 kg)                                                 | 626 lbs. (284 kg)                                                 |
| GVWR             | 1125 lbs. (511 kg)                                                | 1110 lbs. (503 kg)                                                |
| GAWR             | Front: 360 lbs. (164 kg)<br>Rear: 765 lbs. (348 kg)               | Front: 365 lbs. (166 kg)<br>Rear: 745 lbs. (339 kg)               |
| Seat height      | 27.5 in. (699 mm)                                                 | 28 in. (711 mm)                                                   |
| Handlebar width  | 31.3 in. (795 mm)                                                 | 33.8 in. (859 mm)                                                 |
| Ground clearance | 5.75 in. (146 mm)                                                 | 5.75 in. (146 mm)                                                 |
| Wheelbase        | 67 in. (1702 mm)                                                  | 67 in. (1702 mm)                                                  |
| Overall length   | 96 in. (2438 mm)                                                  | 99.5 in. (2527 mm)                                                |
| Overall width    | 39 in. (991 mm)                                                   | 40 in. (1016 mm)                                                  |
| Overall height   | 50 in. (1270 mm)<br>W/ windshield: 59.5 in. (1511 mm)             | 50.5 in. (1283 mm)                                                |
| Frame rake       | 32 deg.                                                           | 32 deg.                                                           |
| Trail            | 5.25 in. (133.4 mm)                                               | 5.42 in. (137.7 mm)                                               |
| Fuel capacity    | Total: 5.5 U.S. gals. (20.8 L)<br>Reserve: 1.2 U.S. gals. (4.8 L) | Total: 5.5 U.S. gals. (20.8 L)<br>Reserve: 1.2 U.S. gals. (4.8 L) |

### Brakes

| GENERAL DATA        |                                                    |
|---------------------|----------------------------------------------------|
| Item                | Description/Specification                          |
| Brake pad           | EBC, FA 216-HII, P/N 50-005 (front and rear)       |
| Brake pad thickness | 0.205–0.215 in. (new)<br>0.062 in. (worn, minimum) |
| Brake rotor         | Minimum allowed thickness (0.180 in.)              |

| FASTENER TORQUE                                |                                             |
|------------------------------------------------|---------------------------------------------|
| Part                                           | Torque Value                                |
| Banjo adapter                                  | 100 in-lbs                                  |
| Banjo retaining bolt (at caliper)              | 18–20 ft-lbs (front and rear)               |
| Banjo retaining bolt (at rear master cylinder) | 18–20 ft-lbs                                |
| Brake bleeder valve                            | 84 in-lbs                                   |
| Brake caliper mounting bolts                   | 25–30 ft-lbs (front)<br>25–30 ft-lbs (rear) |
| Brake hanger-to-fork bolts                     | 32–35 ft-lbs (front)<br>32–35 ft-lbs (rear) |
| Brake hose, rear (at "I" fitting on frame)     | 100 in-lbs                                  |
| Brake line clamp bolts                         | 13–17 ft-lbs                                |
| Brake rotor mounting bolts                     | 16–24 ft-lbs (front)<br>23–27 ft-lbs (rear) |
| Rear brake caliper/bracket anti-rattle screw   | 7–9 ft-lbs                                  |
| Master cylinder diameter                       | 5/8 in. (front)<br>3/4 in. (rear)           |

## Wheels and Tires

| GENERAL DATA                    |                   |                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Item                            | Model Application | Description/Specification                                                                                                                                                                                                                                                                                                                                                            |
| Wheels                          | Scout             | 2.15 in. x 19 in., 40-spoke (front)<br>3.0 in. x 16 in., 40-spoke (rear)                                                                                                                                                                                                                                                                                                             |
|                                 | Spirit            | 3.5 in. x 16 in., 60-spoke (front and rear)                                                                                                                                                                                                                                                                                                                                          |
| Tires                           | Scout             | Michelin Commander 100/90-19 57H (front),<br>Michelin Commander 130/90-16 73H (rear)                                                                                                                                                                                                                                                                                                 |
|                                 | Spirit            | Michelin Commander MT90 B16 71H (front),<br>Michelin Commander MT90 B16 74H (rear),<br>Maxxis whitewall MT90 16F 74H TL (front and rear)                                                                                                                                                                                                                                             |
| Inner tube                      | Scout             | 3.25/3.50/4.10 in.-19 (front)<br>5.00/5.10 in.-16 (rear)                                                                                                                                                                                                                                                                                                                             |
|                                 | Spirit            | 5.00/5.10 in.-16 (front and rear)                                                                                                                                                                                                                                                                                                                                                    |
| Tire inflation pressures (cold) | Scout             | Michelin Commander 100/90-16 57H and 130/90-16 73H:<br><ul style="list-style-type: none"> <li>With single rider — 35 psi (front and rear)</li> <li>At GVWR — 41 psi (front and rear)</li> </ul>                                                                                                                                                                                      |
|                                 | Spirit            | Michelin Commander MT90 B16 71H and MT90 B16 74H:<br><ul style="list-style-type: none"> <li>With single rider — 35 psi (front), 37 psi (rear)</li> <li>At GVWR — 41 psi (front and rear)</li> </ul> Maxxis whitewall MT90 16F 74H:<br><ul style="list-style-type: none"> <li>With single rider — 32 psi (front), 36 psi (rear)</li> <li>At GVWR — 36 psi (front and rear)</li> </ul> |
| Wheel bearing free play         | Scout and Spirit  | 0.003–0.008 in.                                                                                                                                                                                                                                                                                                                                                                      |

| FASTENER TORQUE                    |                                             |
|------------------------------------|---------------------------------------------|
| Part                               | Torque Value                                |
| Axle retaining nut                 | 50–55 ft-lbs (front)<br>60–65 ft-lbs (rear) |
| Rear axle adjuster nuts            | 7–9 ft-lbs                                  |
| Rear wheel sprocket mounting bolts | 65 ft-lbs                                   |

| CARBURETOR                    |                               |                            |
|-------------------------------|-------------------------------|----------------------------|
| S&S Super E-type, 1-7/8" bore |                               |                            |
| Jetting @ sea level           | California                    | 49 State (with restrictor) |
| Intermediate jet              | .0295"                        | .028"                      |
| Main jet                      | .074"                         | .066"                      |
| Mixture screw                 | 1-1/4 turns from fully seated |                            |
| Idle RPM                      | 950–1050                      |                            |

## Front Fork and Suspension

| FASTENER TORQUE                   |                                                                                            |
|-----------------------------------|--------------------------------------------------------------------------------------------|
| Part                              | Torque Value                                                                               |
| Damping tube retainer screw       | —                                                                                          |
| Drain screw                       | 6–7 ft-lbs                                                                                 |
| Fork covers                       | 8–10 ft-lbs                                                                                |
| Fork stem nut, lower (short/tall) | Tighten as required to achieve correct fall-away.                                          |
| Fork leg cap bolts                | 50 ft-lbs                                                                                  |
| Fork stem lock screw              | 79 in-lbs                                                                                  |
| Fork stem screw                   | Step 1 — Tighten to 45 ft-lbs to seat.<br>Step 2 — Loosen and then retighten to 25 ft-lbs. |
| Fork stem nut cover set screws    | 7–9 ft-lbs                                                                                 |
| Fork tube pinch bolts             | Upper 33–38 ft-lbs<br>Lower 34–36 ft-lbs                                                   |
| Front axle pinch bolt             | 19–23 ft-lbs                                                                               |

## Rear Swingarm and Suspension

| FASTENER TORQUE               |                |
|-------------------------------|----------------|
| Item                          | Torque Value   |
| Shock absorber mounting bolts | 115–130 ft-lbs |
| Swingarm pivot bolts          | 135–150 ft-lbs |

## Frame and Accessories

| FASTENER TORQUE                                       |                                                                             |
|-------------------------------------------------------|-----------------------------------------------------------------------------|
| Part                                                  | Torque Values                                                               |
| Buddy pegs                                            | 78 ft-lbs                                                                   |
| Clutch cable guide screw                              | 22 in-lbs                                                                   |
| Dash bracket screws                                   | 20–24 ft-lbs                                                                |
| Dash panel mounting screws                            | Front: 7–9 ft-lbs<br>Rear: Hand tighten until restrained.                   |
| Floorboard retaining nut                              | 22 in-lbs                                                                   |
| Foot control mounting screws (left/right)             | 30–35 lbs                                                                   |
| Front fender mounting bolts                           | 22–25 ft-lbs                                                                |
| Fuel tank bracket-to-frame screws                     | 13–19 ft-lbs                                                                |
| Fuel tank mounting screws                             | Top front: 19–23 ft-lbs<br>Bottom front: 19–23 ft-lbs<br>Rear: 15–19 ft-lbs |
| Handlebar top clamp screws                            | 30 ft-lbs                                                                   |
| Handlebar riser screws                                | 30 ft-lbs                                                                   |
| Handlebar control mounting screws                     | 7–9 ft-lbs                                                                  |
| Handlebar control screws                              | 40–45 in-lbs                                                                |
| Headlight assembly mounting bolt and nut              | 38–44 ft-lbs                                                                |
| Headlight lens retaining ring screws, 2 screws at top | 8 in-lbs                                                                    |
| Horn mounting screw                                   | 20–24 ft-lbs                                                                |
| Kickstand mounting bolts                              | 20–25 ft-lbs                                                                |
| License plate bracket                                 | 8–10 ft-lbs                                                                 |
| License plate reflector bracket                       | 7–9 ft-lbs                                                                  |
| Mirror mounting nuts                                  | 22 ft-lbs                                                                   |
| Rear drive belt guard screws                          | 13–19 ft-lbs                                                                |
| Rear fender mounting bolts                            | 32–35 ft-lbs                                                                |
| Rear fender support bracket-to-frame screws           | 70–80 ft-lbs                                                                |
| Saddlebag mounting bolts                              | 30 ft-lbs                                                                   |
| Seat mounting screws (side and rear)                  | Side: 25 ft-lbs<br>Rear: 96 in-lbs                                          |
| Speedometer nuts                                      | 5-1/2 ± 1/2 in-lbs                                                          |
| Passenger backrest retaining screws                   | 10 ft-lbs                                                                   |
| Turn signal light retaining nuts (rear)               | 18–20 ft-lbs                                                                |
| Turn signal light bracket retaining screws (front)    | 9–11 ft-lbs                                                                 |

## ENGINE SPECIFICATIONS AND TORQUE VALUES

### General

| GENERAL DATA                      |                                                                                 |
|-----------------------------------|---------------------------------------------------------------------------------|
| Item                              | Description/Specification                                                       |
| Engine                            | S&S Super Stock 4-cycle, 45-degree V                                            |
| Number of cylinders               | 2                                                                               |
| Bore and stroke                   | 3.625 in. x 4.25 in.                                                            |
| Displacement                      | 88 cu-in                                                                        |
| Compression ratio                 | 9.4:1                                                                           |
| Horsepower                        |                                                                                 |
| Scout 49 State (with restrictor)  | 52 @ 5,250 rpm                                                                  |
| Scout California                  | 58 @ 6,000 rpm                                                                  |
| Spirit 49 State (with restrictor) | 56 @ 5,250 rpm                                                                  |
| Spirit California                 | 62 @ 6,000 rpm                                                                  |
| Torque                            |                                                                                 |
| Scout 49 State (with restrictor)  | 59 ft-lb @ 4,000 rpm                                                            |
| Scout California                  | 60 ft-lb @ 3,750 rpm                                                            |
| Spirit 49 State (with restrictor) | 63 ft-lb @ 3,900 rpm                                                            |
| Spirit California                 | 65 ft-lb @ 3,600 rpm                                                            |
| Engine red line                   | 6016 rpm 2002 models<br>6016 rpm 2003 pre 1/15/03<br>5500 rpm 2003 post 1/15/03 |

### Fits and Tolerances

#### Valve Rocker Box Assembly

| Item                               | Standard Fit     | Wear Limits        |
|------------------------------------|------------------|--------------------|
| Rocker arm shaft-to-bushing        | 0.0005–0.002 in. | Exceeds 0.0035 in. |
| Rocker arm shaft-to-shaft supports | 0.0007–0.002 in. | Exceeds 0.0035 in. |
| Rocker arm end play                | 0.003–0.013 in.  | Exceeds 0.025 in.  |



## Cylinder Head and Valves

| Item                                              | Standard Fit      | Wear Limits          |
|---------------------------------------------------|-------------------|----------------------|
| Cylinder head flatness (gasket surface)           | 0.003 in.         | 0.005 in.            |
| Valve guide-to-cylinder head (press fit)          | 0.0015–0.0030 in. | Less than 0.0015 in. |
| Valve seat insert-to-cylinder head (press fit)    | 0.0055–0.0075 in. | Less than 0.0045 in. |
| Valve seats                                       |                   |                      |
| • Intake lead angle                               | 60 deg            | —                    |
| • Intake seat angle                               | 45 deg            | —                    |
| • Intake trail angle                              | 30 deg            | —                    |
| • Intake seat width                               | 0.040–0.062 in.   | 0.090 in.            |
| • Exhaust lead angle                              | 52 deg            | —                    |
| • Exhaust seat angle                              | 45 deg            | —                    |
| • Exhaust trail angle                             | 30 deg            | —                    |
| • Exhaust seat width                              | 0.040–0.070 in.   | —                    |
| Valve stem diameter                               | —                 | —                    |
| Valve stem-to-face runout                         | 0.002 in. max.    | —                    |
| Valve stem protrusion (from cylinder head)        | 1.990–2.024 in.   | Exceeds 2.034 in.    |
| Valve-to guide                                    |                   |                      |
| • Intake                                          | 0.0008–0.0026 in. | Exceeds 0.0035 in.   |
| • Exhaust                                         | 0.0015–0.0033 in. | Exceeds 0.0040 in.   |
| Valve springs                                     |                   |                      |
| • Free length                                     | 2.256 in.         | —                    |
| • Pressure, outer spring, compressed to 1.250 in. | 269 lbs           | —                    |
| • Pressure, inner spring, compressed to 1.437 in. | 47.5 lbs          | —                    |

## Cylinder and Piston Assembly

| Item                        | Standard Fit      | Wear Limits                                         |
|-----------------------------|-------------------|-----------------------------------------------------|
| Cylinder bore               | 3.625 in.         | 0.002 in. max. Taper<br>0.003 in. max. out-of-round |
| Piston-to-cylinder          | 0.0020–0.0025 in. | Exceeds 0.0030 in.                                  |
| Piston rings                |                   |                                                     |
| • Compression rings         |                   |                                                     |
| Gap                         | 0.017–0.025 in.   | Exceeds 0.028 in.                                   |
| Side clearance (top)        | 0.001–0.0045 in.  | Exceeds 0.006 in.                                   |
| Side clearance (2nd)        | 0.001–0.0045 in.  | Exceeds 0.006 in.                                   |
| • Oil control ring          |                   |                                                     |
| Gap                         | 0.015–0.035 in.   | Exceeds 0.050 in.                                   |
| Side clearance              | 0.0016–0.008 in.  | Exceeds 0.009 in.                                   |
| Wrist pin-to-piston         | 0.0005–0.0010 in. | Exceeds 0.002 in.                                   |
| Wrist pin-to-connecting rod | 0.0005–0.0010 in. | Exceeds 0.0020 in.                                  |

## Oil Pump Assembly

| Item                                                        | Description/Specification |
|-------------------------------------------------------------|---------------------------|
| Oil pressure (at normal operating temperature and 2000 rpm) | 12–35 psi                 |

**Crankcase**

| Item                                                | Standard Fit      | Wear Limits          |
|-----------------------------------------------------|-------------------|----------------------|
| Breather gear to crankcase                          | 0.0015–0.003 in.  | Exceeds 0.004 in.    |
| Breather valve gear end play                        | 0.005–0.003 in.   | Exceeds 0.020 in.    |
| Camshaft bearing-to-crankcase (press fit)           | —                 | —                    |
| Camshaft-to-camshaft bearing                        | 0.0005–0.0025 in. | Exceeds 0.005 in.    |
| Camshaft end play                                   | 0.005–0.015 in.   | Exceeds 0.020 in.    |
| Oil pump shaft to bushing                           | 0.0005–0.0025 in. | Exceeds 0.0035 in.   |
| Pinion shaft cup-to-crankcase (press fit)           | 0.003–0.005 in.   | Less than 0.0025 in. |
| Sprocket shaft bearing cup-to-crankcase (press fit) | 0.003–0.005 in.   | Less than 0.003 in.  |

**Cam Cover**

| Item                    | Standard Fit     | Wear Limits       |
|-------------------------|------------------|-------------------|
| Camshaft to bushing     | 0.001–0.002 in.  | Exceeds 0.003 in. |
| Pinion shaft to bushing | 0.001–0.0025 in. | Exceeds 0.003 in. |

**Flywheel and Crank Assembly**

| Item                                  | Standard Fit                | Wear Limits          |
|---------------------------------------|-----------------------------|----------------------|
| Connecting rod-to-crank pin           | 0.001–0.0012 in.            | Exceeds 0.002 in.    |
| Connecting rod-to-flywheel side play  | 0.015–0.035 in.             | Exceeds 0.040 in.    |
| Flywheel and crank assembly end play  | 0.001–0.005 in.             | Exceeds 0.005 in.    |
| Flywheel runout                       | 0.0005–0.001 in. (max. TIR) | 0.002 in. (max. TIR) |
| Pinion shaft-to-bearing               | 0.0004–0.0010 in.           | Exceeds 0.001 in.    |
| Sprocket shaft-to-bearing (press fit) | 0.0005–0.0015 in.           | Less than 0.0005 in. |

**Ignition System**

| Item                                        | Specification      |
|---------------------------------------------|--------------------|
| Battery                                     | 12 volt DC, 230CCA |
| Coil                                        | 3 ohm              |
| Regulator Rectifier                         | 14 volt, 32 amp    |
| Spark plug gap (Bosch Platinum 4216, WR7DP) | 0.038–0.042 in.    |

## Engine Fastener Torque Values

| Part                                               | Torque Value                                     |
|----------------------------------------------------|--------------------------------------------------|
| Air filter back plate fittings (45° elbow)         | Hand tighten and align.                          |
| Air filter back plate-to-cylinder head vent screws | 8–12 ft-lbs                                      |
| Air filter cover screws                            | 80–100 in-lbs                                    |
| Breather valve housing assembly screws             | 8–12 ft-lbs                                      |
| Camshaft cover screws                              | 10–12 ft-lbs                                     |
| Carburetor-to-intake manifold mounting screws      | 14–18 ft-lbs                                     |
| Charcoal canister retaining nuts                   | 7–9 ft-lbs                                       |
| Crank pin nut                                      | 210 ft-lbs                                       |
| Crankcase bolts                                    | 15–18 ft-lbs (1/4 in. bolt 10–12 ft-lbs)         |
| Cylinder head bolts (step torque)                  | (Step 1) Lightly snug bolts in sequence.         |
|                                                    | (Step 2) 8 ft-lbs in sequence                    |
|                                                    | (Step 3) 18 ft-lbs in sequence                   |
|                                                    | (Step 4) Rotate 1/4 turn $\pm$ 2° in sequence.   |
| Cylinder head vent screw                           | 15–20 ft-lbs                                     |
| Cylinder studs                                     | 10 ft-lbs                                        |
| Engine mounting bolts (front/rear)                 | 33 ft-lbs                                        |
| Engine mounting bracket bolts (upper)              | 29–31 ft-lbs (to engine)<br>75 ft-lbs (to frame) |
| Enrichener lever guide screw                       | Hand tighten                                     |
| Exhaust head pipe nuts (flange-to-cylinder)        | 10–12 ft-lbs                                     |
| Exhaust header bracket (to transmission)           | 13–19 ft-lbs                                     |
| Exhaust shield clamps                              | 15 in-lbs                                        |
| Exhaust studs                                      | 8–12 ft-lbs                                      |
| Fuel tank mounting bolts                           | 15–19 ft-lbs (rear)                              |
|                                                    | 19–23 ft-lbs (front, upper/lower)                |
| Hose clamp, fuel line                              | 15 in-lbs                                        |
| Hose clamps, oil tank                              | 10 in-lbs                                        |
| Ignition cover screws                              | 10–15 in-lbs                                     |
| Ignition rotor screw                               | 6–8 ft-lbs                                       |
| Ignition timing plate screws                       | 10–15 ft-lbs                                     |
| Ignition wire guide screws                         | 8–10 ft-lbs                                      |
| Intake manifold screws                             | 16–20 ft-lbs                                     |
| Intake stud                                        | 10–12 ft-lbs                                     |
| Lifter block mounting screws                       | 10–12 ft-lbs                                     |
| Muffler clamp (to head pipe)                       | 10–12 ft-lbs                                     |
| Muffler mounting bolts (to support bracket)        | 13–19 ft-lbs                                     |
| Muffler support bracket bolts (to frame)           | 33 ft-lbs                                        |
| Oil drain/front plug (engine crankcase)            | 10 ft-lbs                                        |
| Oil filter mount screws                            | 13–17 ft-lbs                                     |
| Oil hose guide & separator                         | 14 ft-lbs                                        |
| Oil pressure switch                                | 60–75 in-lbs                                     |
| Oil pump mounting screws                           | Socket head: 8–10 ft-lbs                         |
|                                                    | Hex head: 65–85 in-lbs                           |

| Part                                | Torque Value                                                            |
|-------------------------------------|-------------------------------------------------------------------------|
| Oil tank bracket screws             |                                                                         |
| Front                               | 14–19 ft-lbs                                                            |
| Rear                                | 14–19 ft-lbs                                                            |
| Jam nuts                            | 5–7 ft-lbs                                                              |
| Oil tank hose fittings              |                                                                         |
| Straight, 1/8" NPT x 3/8"           | 150 in-lbs                                                              |
| Straight, 1/4" NPT x 7/16"          | 200 in-lbs                                                              |
| 90°, 1/8" NPT x 3/8"                | 80 in-lbs                                                               |
| Petcock (fuel fitting at tank)      | 30 ft-lbs                                                               |
| Pinion gear nut                     | 35 ft-lbs                                                               |
| Pinion shaft nut                    | 170 ft-lbs                                                              |
| Rocker base mounting screws         | 10–13 ft-lbs                                                            |
| Rocker box cover screws             | 10–13 ft-lbs                                                            |
| Rocker shaft support bracket screws | 10–13 ft-lbs (1/4 in. SHCS)<br>15–18 ft-lbs (5/16 in. SHCS/flange head) |
| Smog vent fitting-to-cylinder head  | 15–20 ft-lbs                                                            |
| Spark plugs                         | 18 ft-lbs                                                               |
| Sprocket shaft nut                  | 310 ft-lbs                                                              |
| Starter jackshaft screw             | 7–9 ft-lbs                                                              |
| Stator mounting screws              | 30–40 in-lbs                                                            |
| Tappet screen plug                  | 8–12 ft-lbs                                                             |
| Timing plug                         | 8–10 ft-lbs                                                             |

## DRIVETRAIN SPECIFICATIONS AND TORQUE VALUES

### Primary, Clutch and Final Drive

| GENERAL DATA                                                       |                                                                                                        |
|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Item                                                               | Description/Specification                                                                              |
| Primary drive                                                      | Chain drive with a wet clutch; 1.54:1 ratio                                                            |
| Engine sprocket                                                    | 24 teeth                                                                                               |
| Clutch sprocket                                                    | 37 teeth                                                                                               |
| Final drive                                                        | Belt drive; 2.03:1 ratio                                                                               |
| Transmission sprocket                                              | 32 teeth                                                                                               |
| Rear wheel sprocket                                                | 65 teeth                                                                                               |
| Final drive belt                                                   | 130 teeth                                                                                              |
| Overall gear ratios (primary through transmission and final drive) | 1st gear — 10.13:1<br>2nd gear — 6.92:1<br>3rd gear — 5.00:1<br>4th gear — 3.85:1<br>5th gear — 3.13:1 |

| FASTENER TORQUE                       |                |
|---------------------------------------|----------------|
| Part                                  | Torque Value   |
| Clutch adjuster rod nut               | 6–10 ft-lbs.   |
| Clutch cover retaining bolts          | 7–9 ft-lbs     |
| Clutch hub nut                        | 51–59 ft-lbs   |
| Clutch pressure plate screws          | 71–84 ft-lbs   |
| Compensating sprocket nut             | 200 ft-lbs     |
| Inner primary housing mounting screws | 16–18 ft-lbs   |
| Outer primary cover screws            | 80–100 in-lbs  |
| Primary chain adjuster screw          | 25 ft-lbs      |
| Primary chain inspection cover        | 8–10 ft-lbs    |
| Primary oil drain plug                | 15 ft-lbs      |
| Sprocket nut                          | 130–150 ft-lbs |

## Transmission

| GENERAL DATA |           |              |        |
|--------------|-----------|--------------|--------|
| Reference    | Mainshaft | Countershaft | Ratio  |
| 1st gear     | 18 teeth  | 31 teeth     | 3.24:1 |
| 2nd gear     | 23 teeth  | 27 teeth     | 2.21:1 |
| 3rd gear     | 27 teeth  | 23 teeth     | 1.60:1 |
| 4th gear     | 19 teeth  | 29 teeth     | 1.23:1 |
| 5th gear     | 32 teeth  | 17 teeth     | 1:1    |

| FITS AND TOLERANCES                                      |                          |             |
|----------------------------------------------------------|--------------------------|-------------|
| Item                                                     | Standard Fit             | Wear Limits |
| Countershaft bearing installation depth (case left side) | Flush to 0.010 in. below | —           |
| Main drive gear seal installation depth                  | 0.050 in. below          | —           |
| Mainshaft 5th gear inner bearing installation depth      | 0.060–0.080 in.          | —           |
| Mainshaft 5th gear outer bearing installation depth      | 0.315–0.340 in.          | —           |

| FASTENER TORQUE                                  |              |
|--------------------------------------------------|--------------|
| Part                                             | Torque Value |
| Chassis plate-to-frame                           | 35–38 ft-lbs |
| Countershaft nut                                 | 45–55 ft-lbs |
| End cover screws                                 | 10–12 ft-lbs |
| Mainshaft nut                                    | 45–55 ft-lbs |
| Shift drum cover screws                          | 10 ft-lbs    |
| Shift drum support block mounting bolts          | 7–9 ft-lbs   |
| Shift pawl adjusting screw locknut               | 20–24 ft-lbs |
| Shift rod jam nut                                | 10–12 ft-lbs |
| Transmission pulley nut, lock plate screws       | 13–15 ft-lbs |
| Transmission shift lever                         | 30–35 ft-lbs |
| Transmission shift rod capscrews/nut             | 13–19 ft-lbs |
| Transmission-to-chassis plate                    | 35–38 ft-lbs |
| Transmission trap door mounting bolts — 1/4 in.  | 7–9 ft-lbs   |
| Transmission trap door mounting bolts — 5/16 in. | 13–16 ft-lbs |

## ELECTRICAL COMPONENT FASTENER TORQUE VALUES

| FASTENER TORQUE                              |              |
|----------------------------------------------|--------------|
| Item                                         | Torque Value |
| Battery terminal screws                      | 60 in-lbs    |
| Coil/cover mounting screws                   | 12–14 ft-lbs |
| Ground cable terminal screw (to frame)       | 17–19 ft-lbs |
| Ignition module screws                       | 8–10 ft-lbs  |
| Ignition switch mounting                     | 15 ft-lbs    |
| Oil pressure switch nut                      | 16–20 in-lbs |
| Regulator rectifier assembly mounting screws | 8–10 ft-lbs  |
| Speedometer pickup screw                     | 7–9 ft-lbs   |
| Starter cable nut (ground-to-starter)        | 15–20 ft-lbs |
| Starter driveshaft (jackshaft) retaining nut | 7–9 ft-lbs   |
| Starter motor cable retaining nuts           | 65–80 in-lbs |
| Starter mount (stud/bolt)                    | 15–20 ft-lbs |

## LUBRICANTS AND FLUIDS

| Part              | Specified Lubricant or Fluid                                    | Quantity                                                 |
|-------------------|-----------------------------------------------------------------|----------------------------------------------------------|
| Engine oil        | 20W-50 SG weight                                                | 2.25 qts. (2.13 L) with filter                           |
| Transmission oil  | 80–90 weight GL5 hypoy oil                                      | 20–24 U.S. ozs. (670–720 cc)                             |
| Fork oil          | 30 weight                                                       | Wet: 10 U.S. ozs. (296 cc)<br>Dry: 11 U.S. ozs. (325 cc) |
| Primary drive oil | Indian <sup>®</sup> Brand Primary Oil 80W-90 hypoy GL4 gear oil | Wet: 22 U.S. ozs. (651 cc)<br>Dry: 30 U.S. ozs. (888 cc) |
| Fuel              | Unleaded gasoline, 91 octane or higher<br>(R+M) / 2             | —                                                        |
| Brake fluid       | D.O.T. 5                                                        | —                                                        |

## SEALANTS AND THREADLOCK COMPOUNDS

### Engine Assembly

**Note:** In some instances, IMC uses a dry thread-locking compound pre-applied by the screw manufacturer. The color of the dry thread lock does not equate to a wet Loctite® 242 (blue) or 262 (red) compound. When reassembling parts use the chart below to determine the appropriate wet thread lock compound.

| Part                                                         | Specified Lubricant or Sealant |
|--------------------------------------------------------------|--------------------------------|
| Breather valve housing assembly screw threads                | Blue threadlock                |
| Camshaft cover screw threads                                 | Blue threadlock                |
| Carburetor-to-manifold screw threads                         | Blue threadlock                |
| Crank pin threads                                            | Red threadlock                 |
| Crankcase bolt threads                                       | Blue threadlock                |
| Crankcase drain/front plug threads                           | Blue threadlock                |
| Crankcase joint (sprocket side-to-pinion side)               | Permatex® ULTRA-BLACK RTV      |
| Cylinder head vent fittings                                  | Blue threadlock                |
| Cylinder stud threads                                        | Blue threadlock                |
| Dowel pins, cylinder-to-crankcase                            | Loctite® 290                   |
| Exhaust stud threads                                         | Red threadlock                 |
| Hose fittings, 90-degree (crankcase, cam cover and oil pump) | Teflon® pipe dope              |
| Ignition cover screw threads                                 | Blue threadlock                |
| Ignition timing plate screw threads                          | Blue threadlock                |
| Lifter block mounting screw threads                          | Blue threadlock                |
| Oil filter mount screw threads                               | Blue threadlock                |
| Oil pump plug thread                                         | Teflon® pipe dope              |
| Oil pressure switch threads                                  | Teflon® pipe dope              |
| Oil pump mounting screw threads                              | Blue threadlock                |
| Pinion shaft threads                                         | Red threadlock                 |
| Rocker arm support screw threads                             | Blue threadlock                |
| Rocker base mounting screw threads                           | Blue threadlock                |
| Rocker box cover screw threads                               | Blue threadlock                |
| Spark plug threads                                           | Anti-seize compound            |
| Sprocket shaft threads                                       | Red threadlock                 |
| Stator connector plug-to-case                                | Silicone seal                  |
| Stator mounting screw threads                                | Blue threadlock                |
| Stator terminal wires-to-crankcase retention                 | Silicone seal                  |



## Chassis Assembly

**Note:** In some instances, IMC uses a dry thread-locking compound pre-applied by the screw manufacturer. The color of the dry thread lock does not equate to a wet Loctite<sup>®</sup> 242 (blue) or 262 (red) compound. When reassembling parts use the chart below to determine the appropriate wet thread lock compound.

| Part                                                    | Specified Lubricant or Sealant                                |
|---------------------------------------------------------|---------------------------------------------------------------|
| Airbox back plate-to-carburetor screw threads           | Blue threadlock                                               |
| Airbox back plate-to-cylinder head vent screw threads   | Blue threadlock                                               |
| Airbox housing cover screw threads                      | Blue threadlock                                               |
| Axle nut (front axle)                                   | Blue threadlock                                               |
| Battery terminal screws                                 | Di electric grease                                            |
| Brake caliper mounting bracket screw threads            | Blue threadlock                                               |
| Brake caliper mounting screw threads                    | Blue threadlock                                               |
| Brake line clamp screw threads                          | Blue threadlock                                               |
| Buddy peg threads                                       | Blue threadlock                                               |
| Charcoal canister retaining nut threads                 | Blue threadlock                                               |
| Clutch adjuster nut threads                             | Blue threadlock                                               |
| Clutch pressure plate screw threads                     | Blue threadlock                                               |
| Clutch cable guide screw threads                        | Blue threadlock                                               |
| Cylinder head vent fittings                             | Blue threadlock                                               |
| Dash panel mounting screw threads (front only)          | Blue threadlock                                               |
| Engine upper mounting bracket bolt threads (to frame)   | Red threadlock                                                |
| Engine upper mounting bracket screw threads (to engine) | Blue threadlock                                               |
| Evaporator door shaft link retaining screw threads      | Blue threadlock                                               |
| Foot control-to-frame mounting screw threads            | Blue threadlock                                               |
| Fork stem cover                                         | Inside cover: Clear RTV<br>Set screw threads: Blue threadlock |
| Fork stem lock screw threads                            | Blue threadlock                                               |
| Front end alignment bolt threads                        | Blue threadlock                                               |
| Front end alignment screw threads                       | Blue threadlock                                               |
| Front fender mounting screw threads                     | Blue threadlock                                               |
| Fuel tank bracket to frame screw threads                | Blue threadlock                                               |
| Fuel tank mounting screw threads                        | Blue threadlock                                               |
| Ground cable terminal screw (to frame)                  | Di electric grease                                            |
| Handlebar clamp screw threads                           | Blue threadlock                                               |
| Handlebar control mounting screw threads                | Blue threadlock                                               |
| Handlebar riser mounting screw threads                  | Blue threadlock                                               |
| Headlight assembly mounting bolt threads                | Blue threadlock                                               |
| Headlight lens retaining ring screw threads             | Blue threadlock                                               |
| Horn mounting screw threads                             | Blue threadlock                                               |
| Ignition module screw threads                           | Blue threadlock                                               |
| Ignition switch mounting screw threads                  | Blue threadlock                                               |
| Kickstand mounting bolt threads                         | Blue threadlock                                               |
| Mirror mounting nut threads                             | Red threadlock                                                |
| Muffler mounting bolt threads (to support bracket)      | Blue threadlock                                               |
| Muffler support bracket screw threads (to frame)        | Blue threadlock                                               |
| Primary chain inspection cover screw threads            | Blue threadlock                                               |

| Part                                                   | Specified Lubricant or Sealant    |
|--------------------------------------------------------|-----------------------------------|
| Primary inner housing-to-transmission screw threads    | Blue threadlock                   |
| Primary inner housing-to-engine/transmission seal      | Loctite® Ultra Black R'IV sealant |
| Primary oil drain plug threads                         | Blue threadlock                   |
| Primary outer housing/cover screw threads              | Blue threadlock                   |
| Rear fender frame bracket mounting screw threads       | Blue threadlock                   |
| Rear fender mounting screw threads                     | Blue threadlock                   |
| Regulator rectifier assembly mounting screws           | Di-electric grease                |
| Saddlebag mounting screw threads                       | Blue threadlock                   |
| Seat mounting screw threads (side and rear)            | Blue threadlock                   |
| Shift rod jam nut threads                              | Blue threadlock                   |
| Sissybar retaining screw threads                       | Blue threadlock                   |
| Starter cable retaining nuts (at starter)              | Di-electric grease                |
| Starter driveshaft (jackshaft) retaining screw threads | Blue threadlock                   |
| Starter mounting stud/bolt threads                     | Blue threadlock                   |
| Shock absorber mounting bolt threads                   | Blue threadlock                   |
| Swingarm pivot bolt threads                            | Blue threadlock                   |
| Transmission shift drum cover screw threads            | Blue threadlock                   |
| Transmission shift rod capscrew/nut threads            | Blue threadlock                   |
| Transmission-to-chassis plate nut threads              | Blue threadlock                   |
| Turn signal retaining nut threads (rear lights)        | Blue threadlock                   |
| Turn signal retaining screw threads (front lights)     | Blue threadlock                   |

# CHASSIS WIRING DIAGRAMS

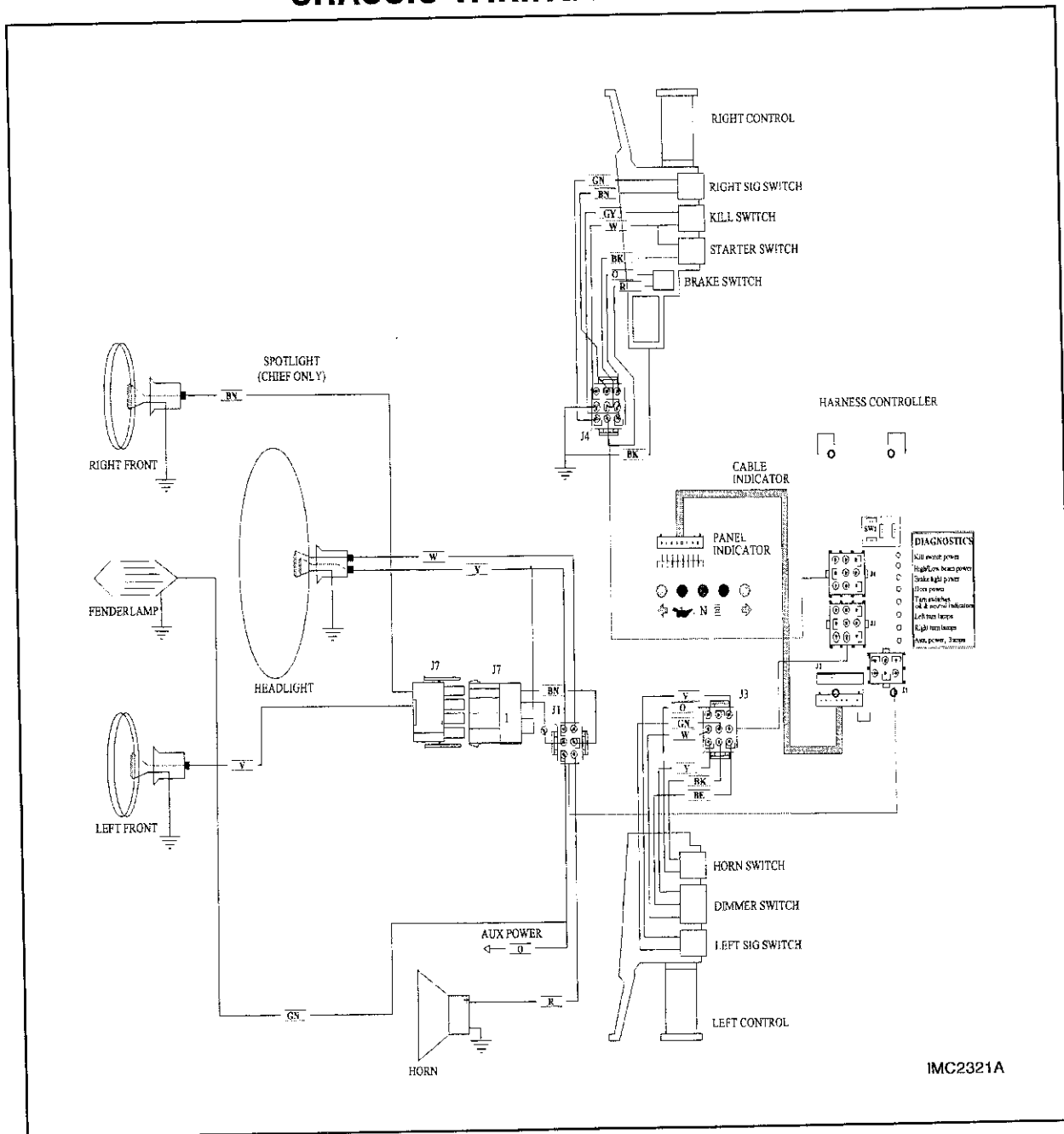


Figure 588 — Front chassis harness diagram

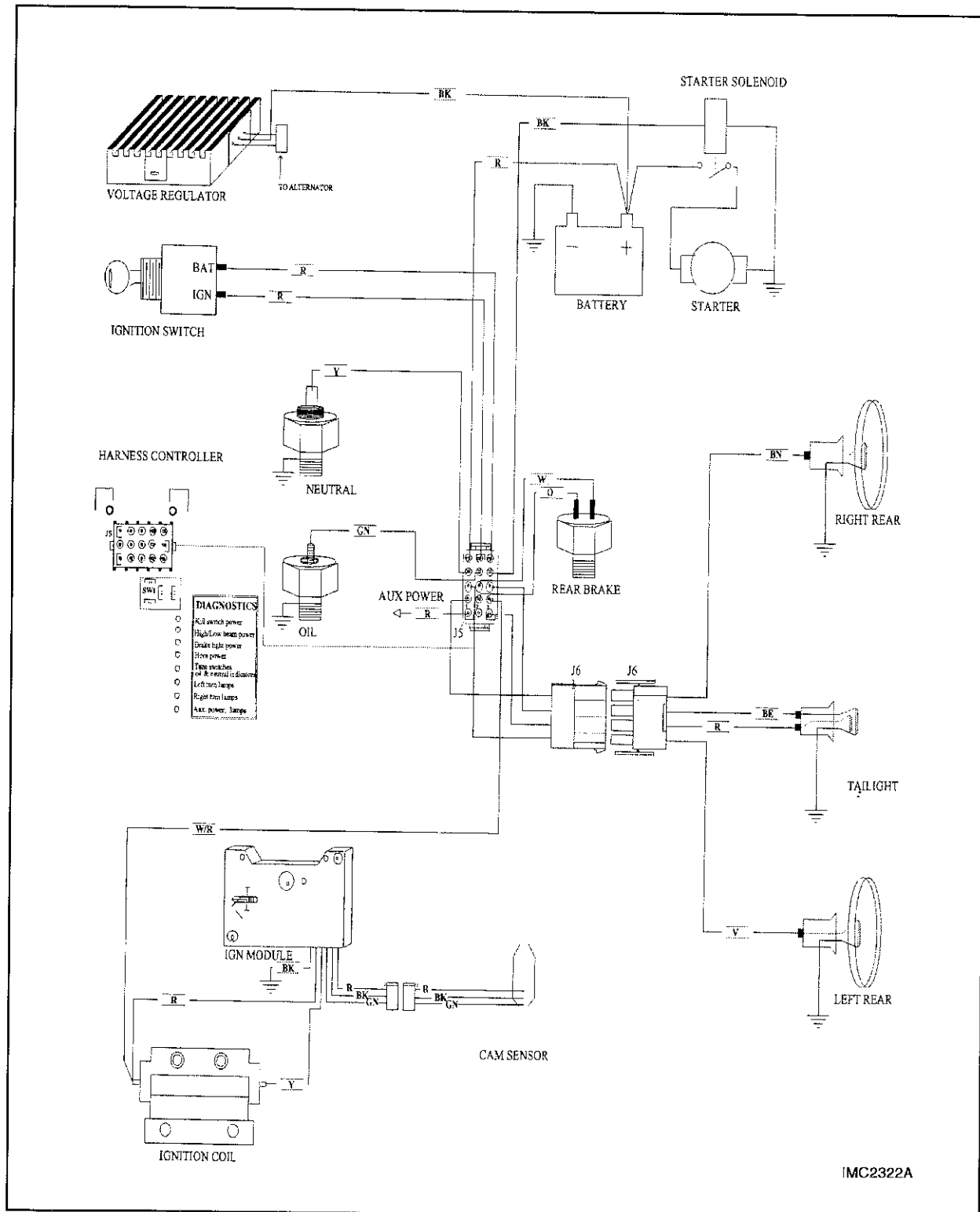
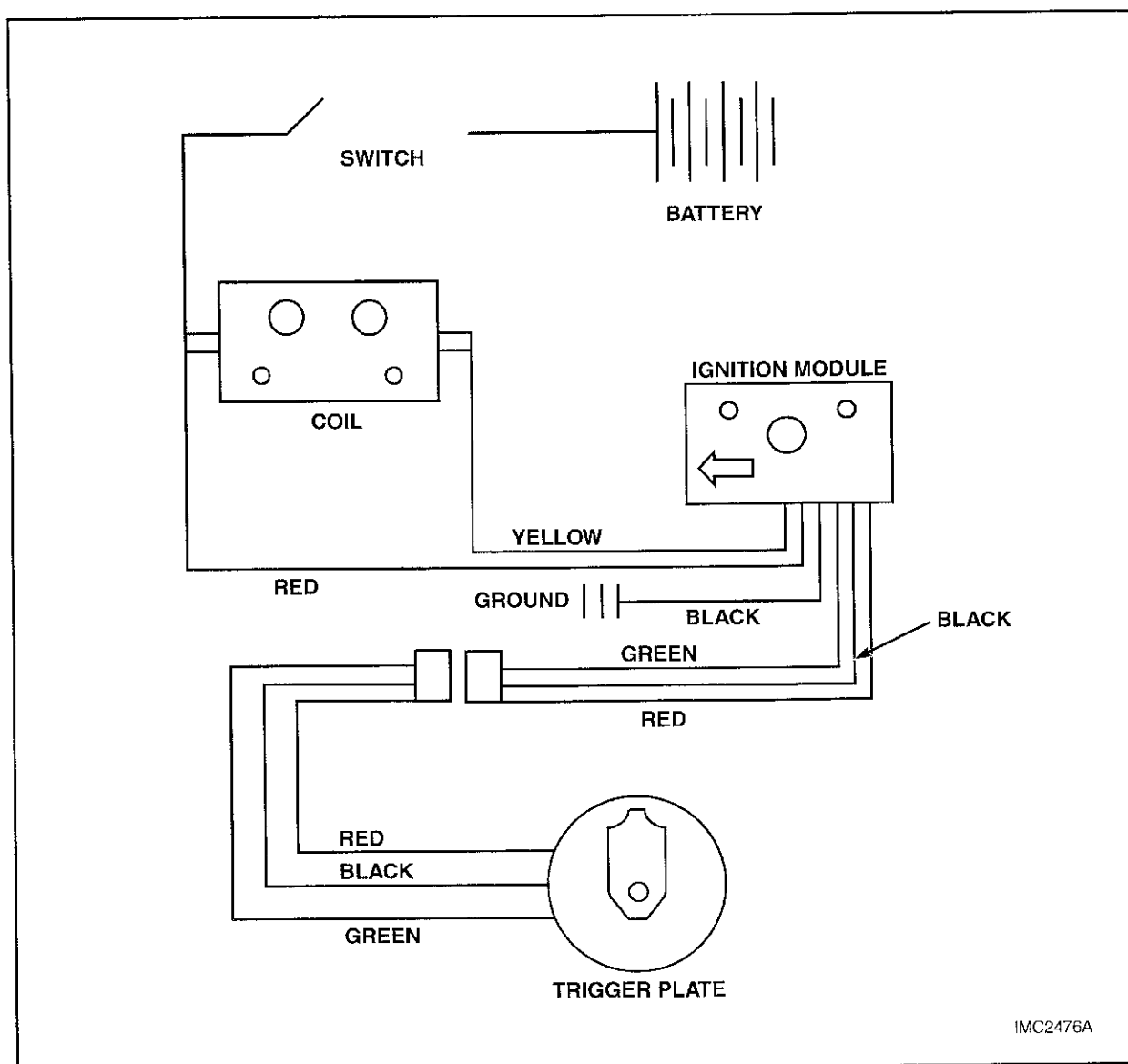


Figure 589 — Rear chassis harness diagram

## IGNITION SYSTEM DIAGRAM

*Figure 590 — S&S Super Stock engine ignition system*

## LUBRICATION FLOW DIAGRAM

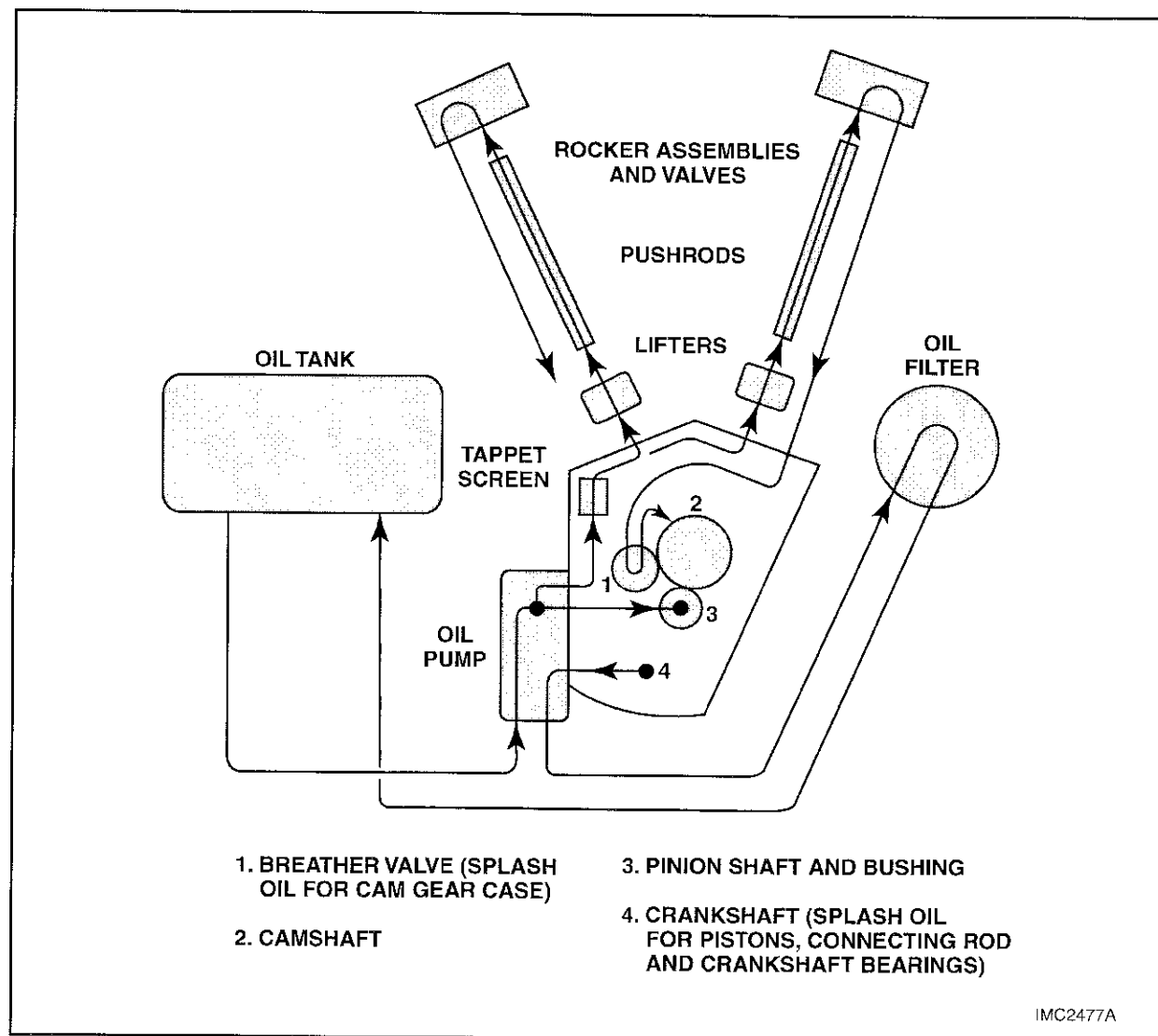


Figure 591 — S&S Super Stock engine lubrication system

In the S&S Super Stock engine lubrication system, the pump draws oil from the tank and supplies the oil to the engine through two pressure ports. Oil is pumped from the first pressure port through the tappet screen, the valve lifters and pushrods to the top of the engine for lubrication of the rocker assemblies and valves. The oil then drains from the rocker boxes through the pushrod tubes to the cam case.

From the second pressure port, oil is pumped through channels in the gear case and cam cover to provide lubricating oil to the pinion shaft, bushing, crankshaft bearings, connecting rods and pistons. Pressure created within the crankcase on piston downstroke then forces oil from the crankcase into the breather valve.

From the breather valve, the oil is sprayed into the cam case to lubricate the cam and pinion gears. Oil accumulating at the bottom of the cam case is picked up by the pump and returned through the filter to the oil tank.

## TRANSMISSION POWER FLOW DIAGRAMS

### Indian 5-Speed Transmission

The 5-speed is a single-countershaft transmission with an output drive gear that rotates freely on the mainshaft input. Both the mainshaft and countershaft incorporate free-rotating gears that are engaged or disengaged by sliding gears splined to the shafts. The sliding gears lock the free-rotating gears to the shafts in combinations that provide neutral and five forward speeds. The positions of the sliding gears (mainshaft 1st, 2nd and countershaft 3rd) are controlled by shift forks in the shift drum assembly.

In the forward speed combinations illustrated below, power flows in through the mainshaft gears, through the countershaft gears and then through the output drive gear (not shown).

**Neutral** — All three sliding gears, 1st, 2nd and 3rd, are disengaged so that there is no transfer of power between the mainshaft and countershaft gears.

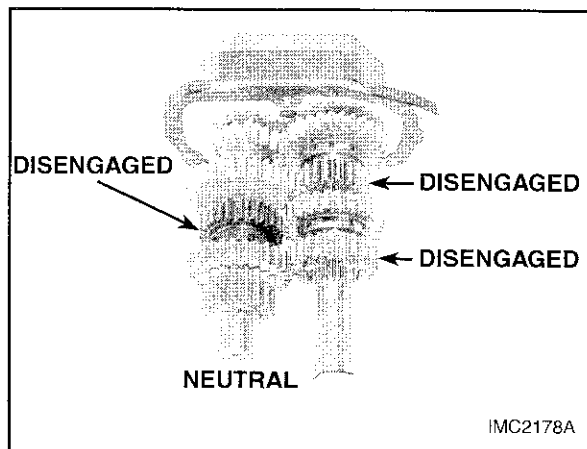


Figure 592 — Transmission in neutral

**1st gear** — On the countershaft, the sliding 3rd gear is engaged with the 1st gear, allowing power to flow through the mainshaft and countershaft 1st gears. The mainshaft sliding 1st and 2nd gears remain disengaged from other gears on the mainshaft.

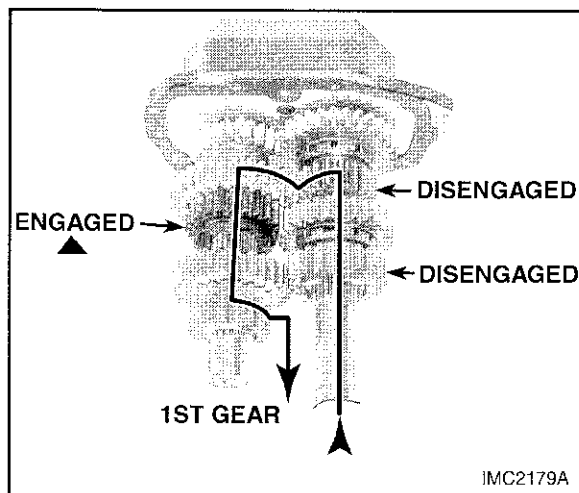


Figure 593 — Power flow in 1st gear

**2nd gear** — The countershaft sliding 3rd gear is disengaged from the 1st gear and moved into engagement with the countershaft 4th gear. Power transfer then occurs between the mainshaft and countershaft 2nd-speed gears. Again, the mainshaft sliding 1st and 2nd gears remain disengaged from other gears on the mainshaft.

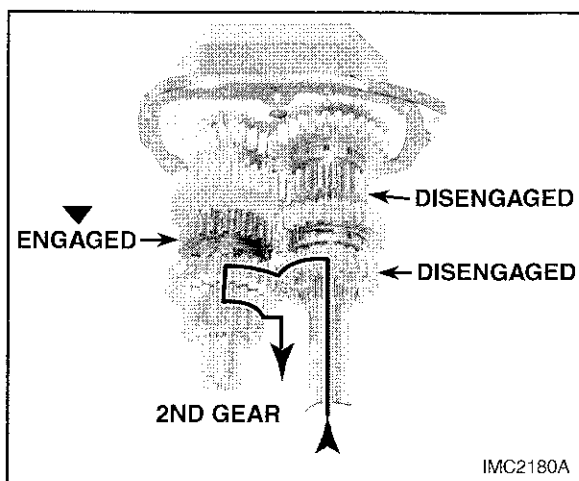


Figure 594 — Power flow in 2nd gear

**3rd gear** — In 3rd gear, the countershaft sliding 3rd gear is disengaged from other countershaft gears. However, on the mainshaft, the sliding 2nd gear is moved into engagement with the 3rd gear, allowing power to flow between the 3rd gears of the mainshaft and countershaft.

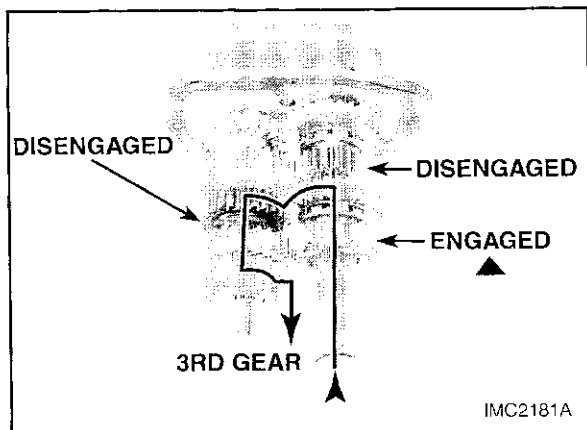


Figure 595 — Power flow in 3rd gear

**4th gear** — Both the 2nd and 3rd sliding gears are disengaged from other gears. The mainshaft sliding 1st gear is moved into engagement with the 4th gear, locking the gear to the mainshaft so that power flows between the 4th-speed gears.

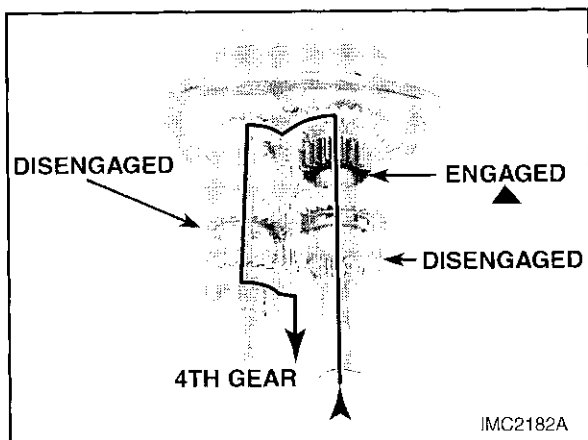


Figure 596 — Power flow in 4th gear

**5th gear** — On the mainshaft, the sliding 1st gear is disengaged from the 4th gear and the sliding 2nd gear is moved into engagement with the output drive gear for direct drive.

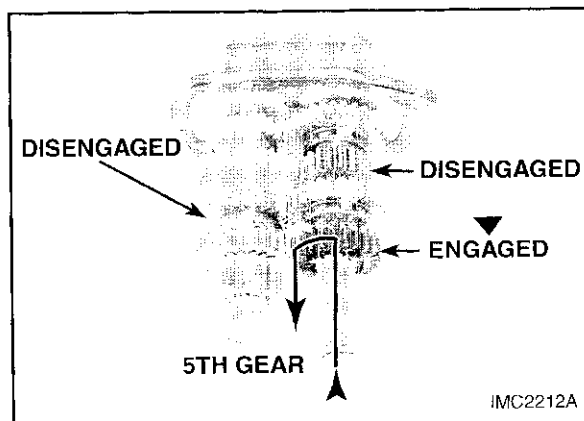


Figure 597 — Power flow in 5th gear



## ENGINE PART AND ASSEMBLY DRAWINGS

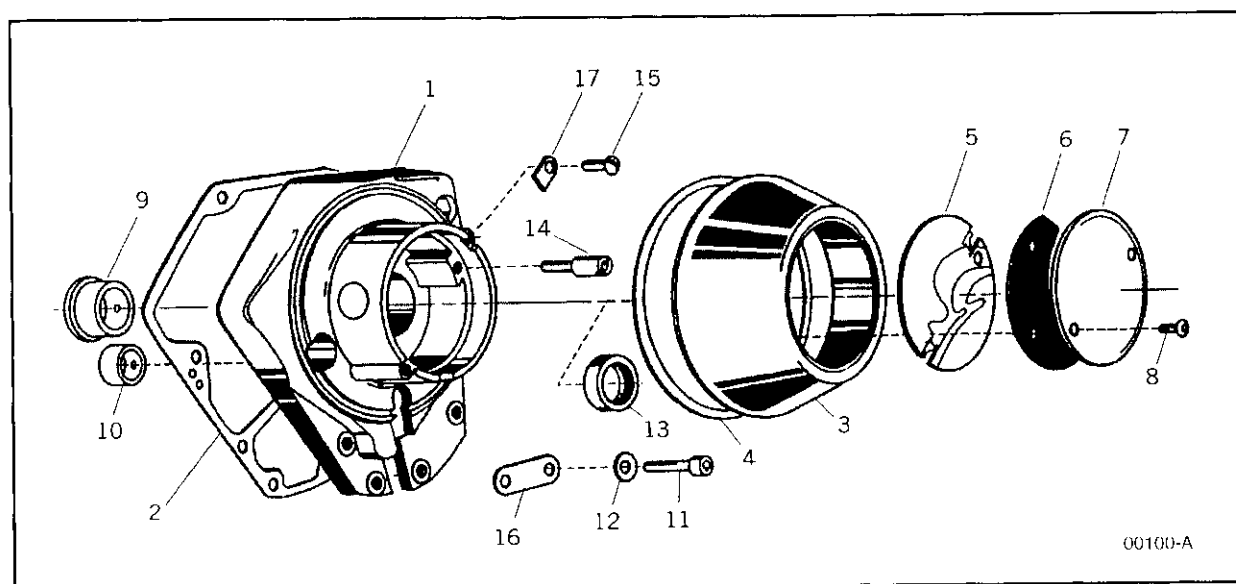


Figure 598 — Camshaft gear case cover

| Item | Part Number | Part Description                                       | Qty. |
|------|-------------|--------------------------------------------------------|------|
| 1    | 00-195      | Cover, camshaft gear case, non-painted                 | 1    |
| 1    | 00-045      | Cover, camshaft gear case, black                       | 1    |
| 2    | 09-007      | Gasket, gear cover                                     | 1    |
| 3    | 00-123      | Cover (flangeless), outer ignition                     | 1    |
| 4    | 00-124      | Gasket, outer ignition cover                           | 1    |
| 5    | 00-047      | Cover, inner ignition                                  | 1    |
| 6    | 00-048      | Gasket, inner ignition cover                           | 1    |
| 7    | 05-022      | Cover, points                                          | 1    |
| 8    | 00-049      | Screws, points cover, 8-32 x 1/2"                      | 2    |
| 9    | 00-050      | Bushing, camshaft                                      | 1    |
| 10   | 00-051      | Bushing, pinion shaft                                  | 1    |
| 11   | 00-052      | Screws, socket head, gear case cover, 1/4"-20 x 1-1/4" | 7    |
| 12   | 00-053      | Washer, flat, 1/4" x 0.474" x 0.050"                   | 1    |
| 13   | 00-054      | Seal, gear case cover                                  | 1    |
| 14   | 00-055      | Screw, timing plate                                    | 2    |
| 15   | 00-056      | Screw, standard pan head                               | 1    |
| 16   | 00-057      | Clip, wire harness                                     | 1    |
| 17   | 00-058      | Clip, outer ignition cover                             | 1    |

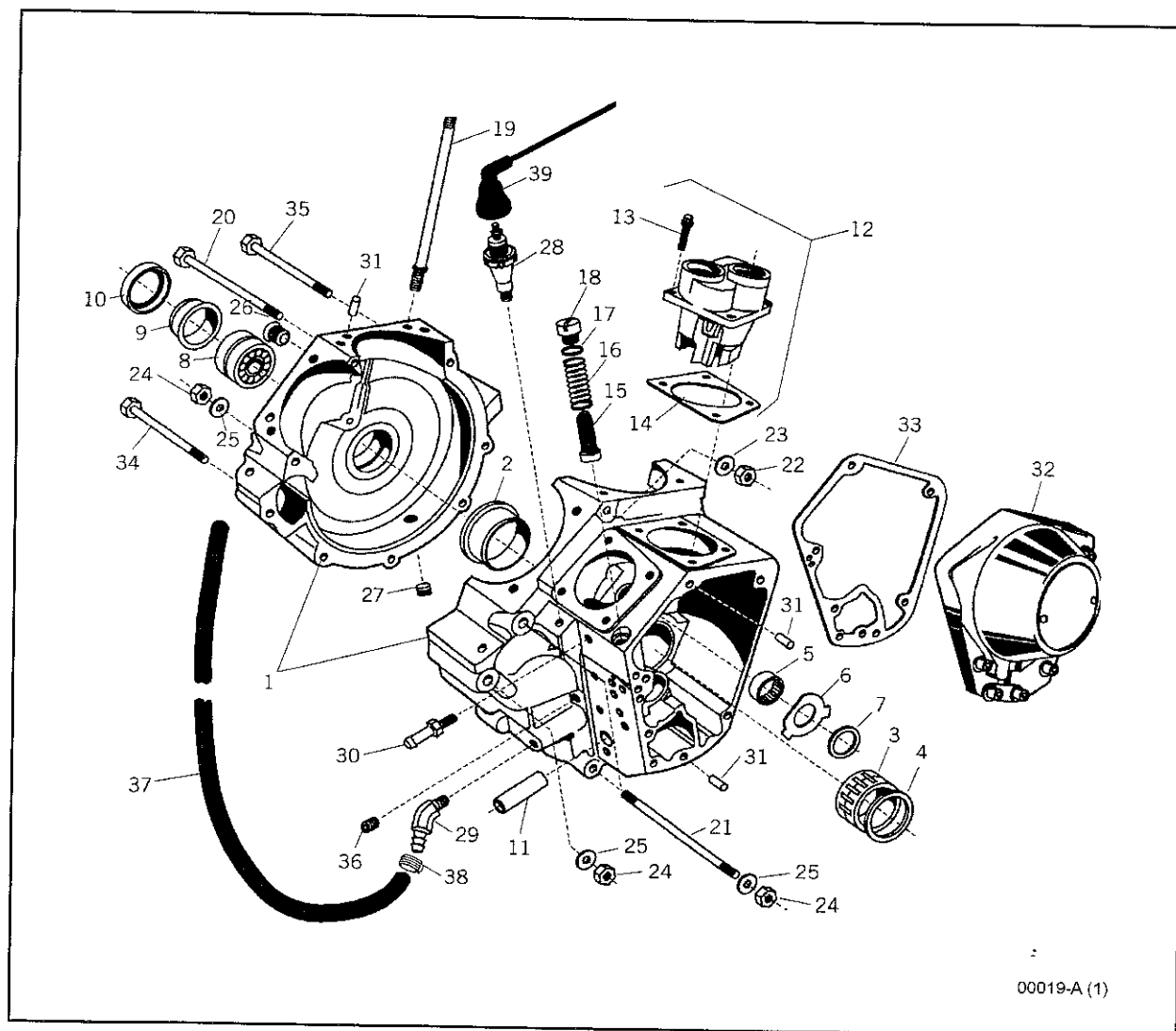


Figure 599 — Crankcase

| Item | Part Number                     | Part Description                               | Qty. |
|------|---------------------------------|------------------------------------------------|------|
| 1    | 00-192                          | Crankcase set, non-painted                     | 1    |
| 1    | 00-186                          | Crankcase set, black                           | 1    |
| 2    | 03-600                          | Race, right main bearing                       | 1    |
| 3    | As follows:<br>03-601<br>03-632 | Bearing assembly, right main<br>Green<br>White | 1    |
| 4    | 03-602                          | Retaining ring, main bearing                   | 1    |
| 5    | 03-603                          | Bearing assembly, camshaft (needle)            | 1    |
| 6    | 03-604                          | Lock washer, cam                               | 1    |

| Item | Part Number                                                   | Part Description                                                     | Qty. |
|------|---------------------------------------------------------------|----------------------------------------------------------------------|------|
| 7    | As follows:<br>03-605<br>03-606<br>03-607<br>03-608<br>03-609 | Thrust washer, cam<br>0.050"<br>0.055"<br>0.060"<br>0.065"<br>0.070" | 1    |
| 8    | 01-351                                                        | Bearing assembly, left main (Timken)                                 | 1    |
| 9    | 03-610                                                        | Spacer, drive sprocket                                               | 1    |
| 10   | 09-050                                                        | Seal, sprocket shaft                                                 | 1    |
| 11   | 03-612                                                        | Bushing, oil pump shaft                                              | 1    |
| 12   | —                                                             | Guide, tappet                                                        | 1    |
| 13   | 03-613                                                        | Screw, 12-point, 1/4"-20 x 7/8"                                      | 4    |
| 14   | As follows:<br>09-005<br>09-006                               | Gaskets, tappet guide<br>Front<br>Rear                               | 2    |
| 15   | 03-614                                                        | Oil screen, crankcase                                                | 1    |
| 16   | 03-615                                                        | Spring, crankcase oil screen (tappet)                                | 1    |
| 17   | 03-542                                                        | O-ring, cover screw                                                  | 1    |
| 18   | 03-541                                                        | Screw, oil screen cover                                              | 1    |
| 19   | 03-617                                                        | Stud, cylinder                                                       | 8    |
| 20   | 03-618                                                        | Bolt, crankcase, 1/4"-28 x 5-1/2"                                    | 1    |
| 21   | 03-619                                                        | Stud, crankcase alignment                                            | 4    |
| 22   | 03-620                                                        | Nut, 1/4"-28                                                         | 1    |
| 23   | 03-550                                                        | Washer, flat                                                         | 1    |
| 24   | 03-622                                                        | Nut, 5/16"-24                                                        | 7    |
| 25   | 03-623                                                        | Washer, flat                                                         | 7    |
| 26   | 03-624                                                        | Plug, timing hole                                                    | 1    |
| 27   | 03-625                                                        | Plug, drain                                                          | 1    |
| 28   | 00-101                                                        | Switch, oil pressure                                                 | 1    |
| 29   | 03-626                                                        | Hose fitting, 45°, 1/4"                                              | 1    |
| 30   | 03-530                                                        | Hose fitting, 1/8"-27 pipe                                           | 1    |
| 31   | 03-628                                                        | Dowel pin, 0.250" dia. x 1/2"                                        | 1    |
| 32   | 00-195                                                        | Camshaft gear cover                                                  | 1    |
| 33   | 09-007                                                        | Gasket, camshaft gear cover                                          | 1    |
| 34   | 03-630                                                        | Bolt, crankcase, 5/16"-24 x 5"                                       | 1    |

| Item | Part Number | Part Description                   | Qty. |
|------|-------------|------------------------------------|------|
| 35   | 03-631      | Bolt, crankcase, 5/16"-18 x 3-1/2" | 2    |
| 36   | 03-528      | Plug, pipe, 1/8"-27                | 1    |
| 37   | 97-040      | Hose, 3/8" x 13-1/2"               | 1    |
| 38   | 96-026      | Clamp, size 170                    | 1    |
| 39   | 94-006      | Rubber boot                        | 1    |

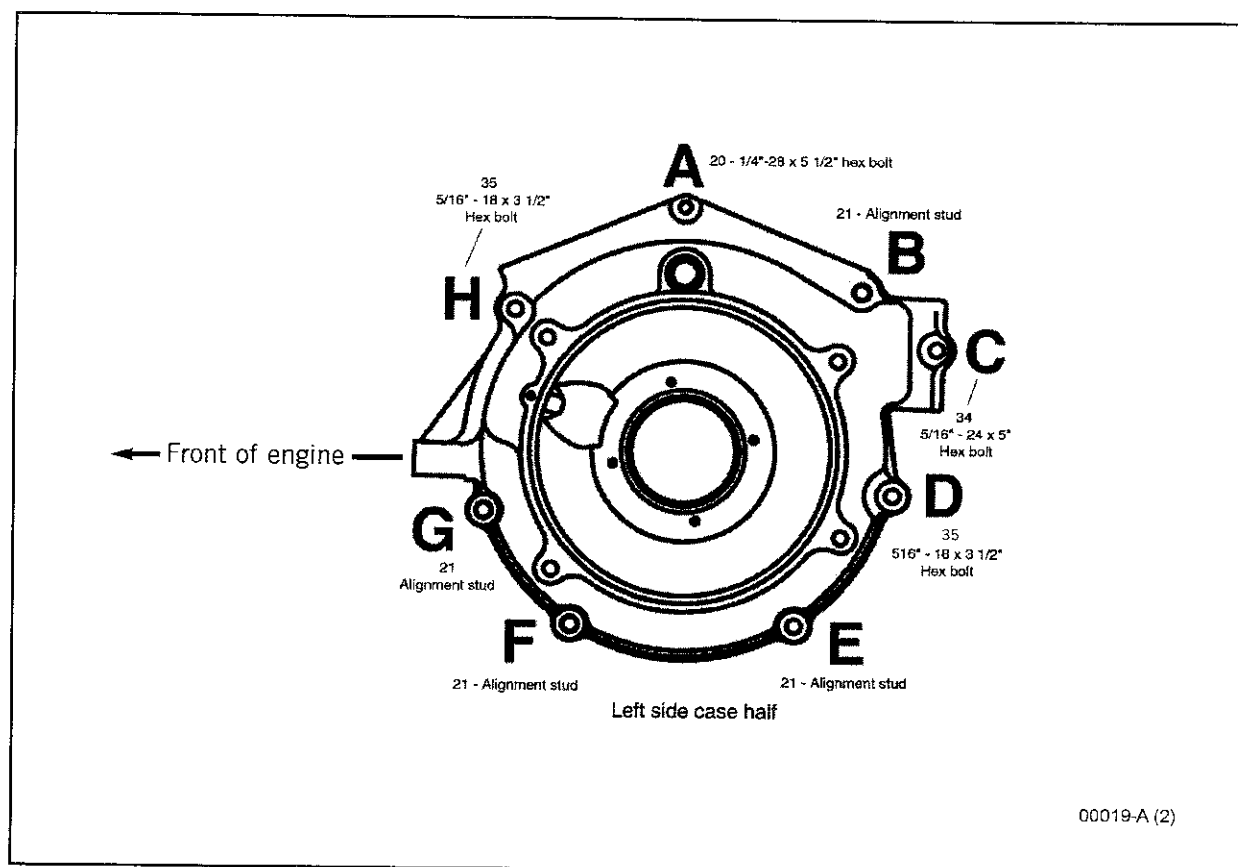
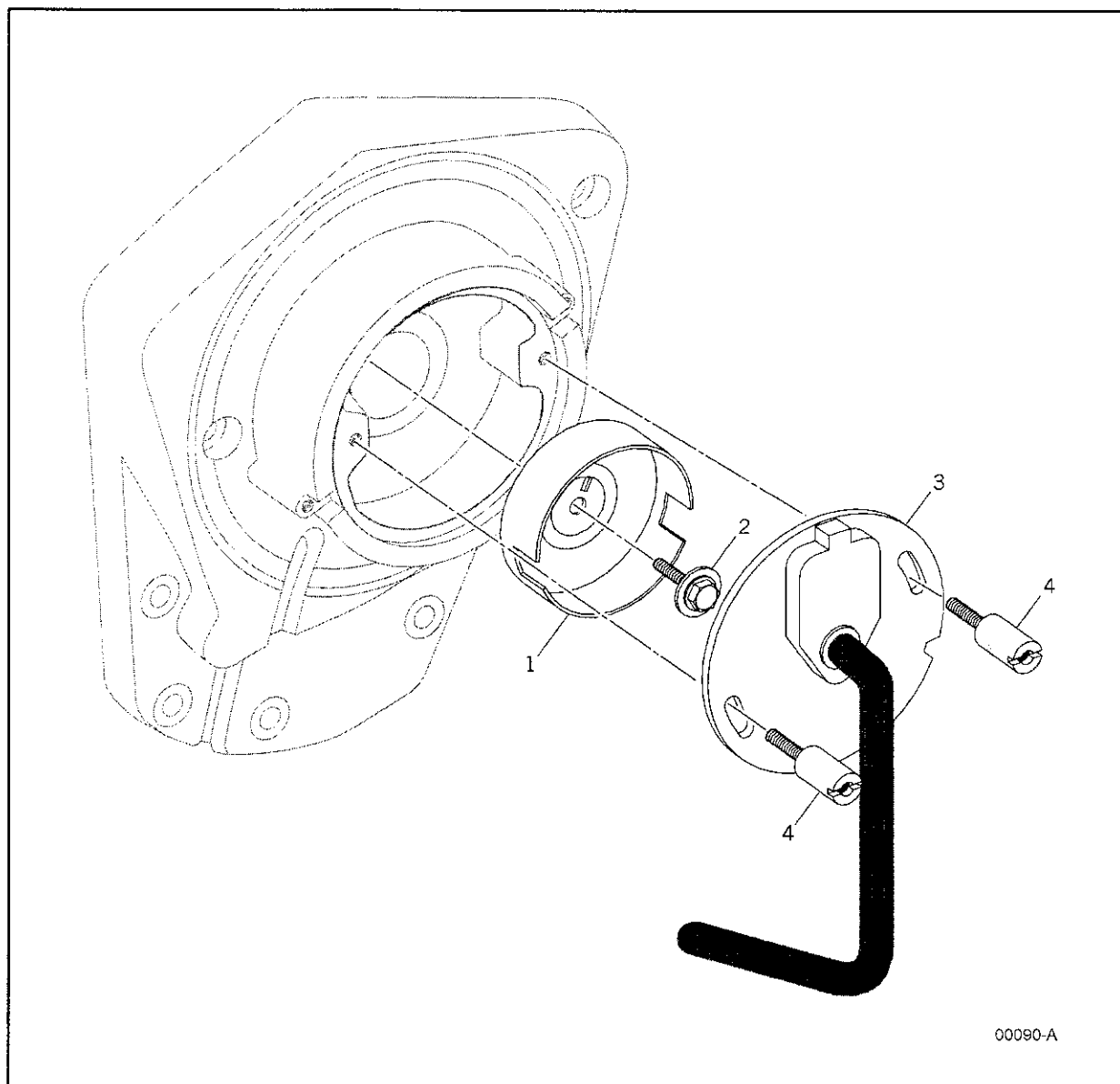


Figure 600 — Crankcase bolts

| Item | Part Number | Part Description                   | Qty. |
|------|-------------|------------------------------------|------|
| 20   | 03-618      | Bolt, crankcase, 1/4"-28 x 5-1/2"  | 1    |
| 21   | 03-619      | Stud, crankcase alignment          | 4    |
| 34   | 03-630      | Bolt, crankcase, 5/16"-24 x 5"     | 1    |
| 35   | 03-631      | Bolt, crankcase, 5/16"-18 x 3-1/2" | 2    |

*Figure 601 — Ignition timing plate*

| Item | Part Number | Part Description      | Qty. |
|------|-------------|-----------------------|------|
| 1    | 00-120      | Rotor cup             | 1    |
| 2    | 00-121      | Screw, ignition rotor | 1    |
| 3    | 94-150      | Timing plate          | 1    |
| 4    | 00-055      | Screw, timing plate   | 2    |

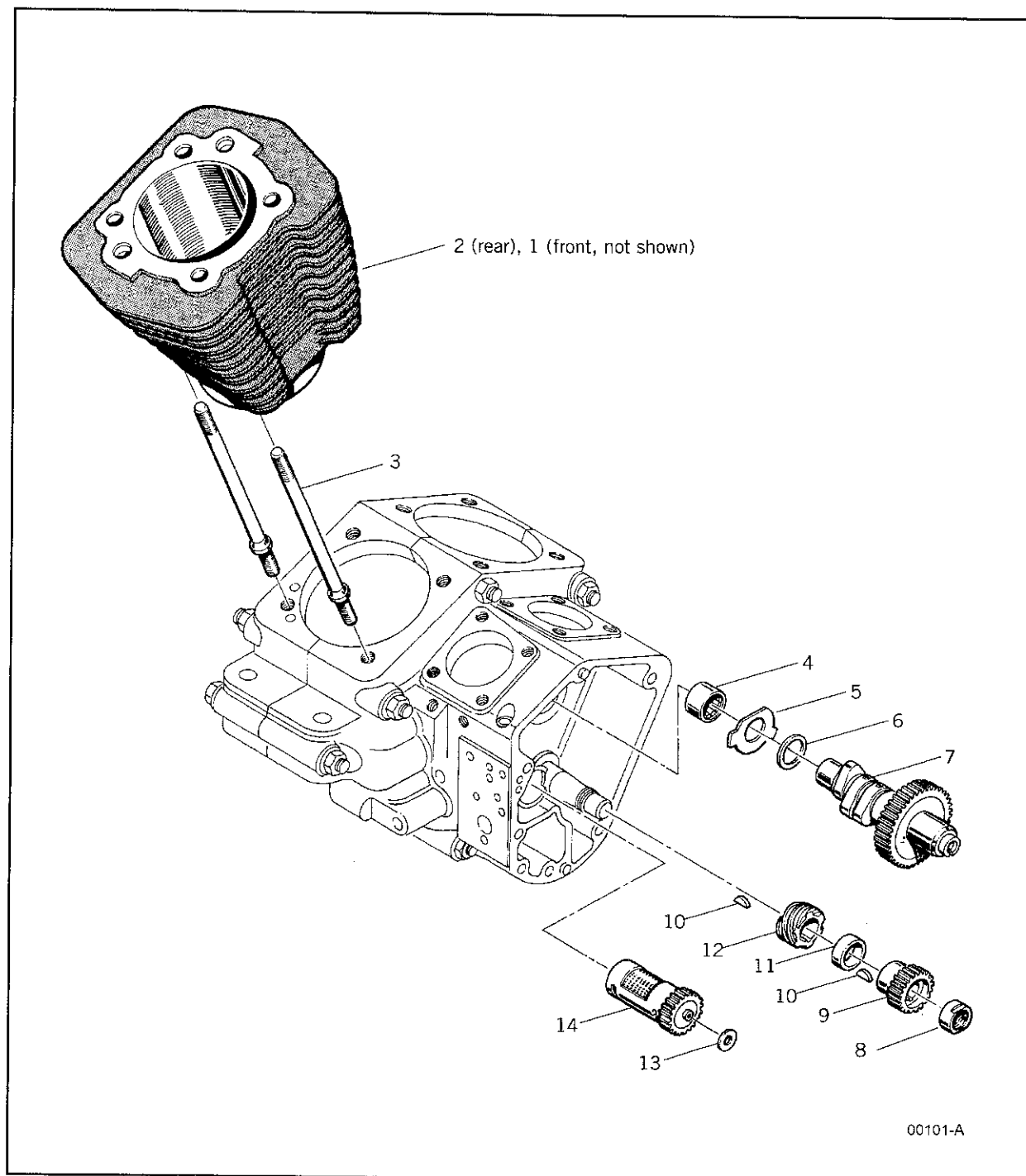


Figure 602 — Front/rear cylinders (rear shown), camshaft and breather valve

| Item | Part Number | Part Description               | Qty. |
|------|-------------|--------------------------------|------|
| 1    | As follows: | Cylinder, front                | 1    |
|      | 00-082      | Non-painted with polished fins |      |
|      | 03-516      | Non-painted                    |      |

| Item | Part Number                                                   | Part Description                                                | Qty. |
|------|---------------------------------------------------------------|-----------------------------------------------------------------|------|
| 2    | As follows:<br>00-083<br>03-517                               | Cylinder, rear<br>Non-painted with polished fins<br>Non-painted | 1    |
| 3    | 03-617                                                        | Stud, cylinder                                                  | 8    |
| 4    | 03-603                                                        | Bearing, needle                                                 | 1    |
| 5    | 03-604                                                        | Lock washer, cam                                                | 1    |
| 6    | As follows:<br>03-605<br>03-606<br>03-607<br>03-608<br>03-609 | Thrust washer<br>0.050"<br>0.055"<br>0.060"<br>0.065"<br>0.070" | 1    |
| 7    | 03-450                                                        | Camshaft                                                        | 1    |
| 8    | 03-423                                                        | Nut, pinion shaft                                               | 1    |
| 9    | 00-005                                                        | Gear, pinion                                                    | 1    |
| 10   | 03-422                                                        | Woodruff key                                                    | 1    |
| 11   | 03-424                                                        | Spacer                                                          | 1    |
| 12   | 03-425                                                        | Gear, oil pump drive                                            | 1    |
| 13   | 01-074                                                        | Thrust washer                                                   | 1    |
| 14   | 01-073                                                        | Gear, breather valve                                            | 1    |

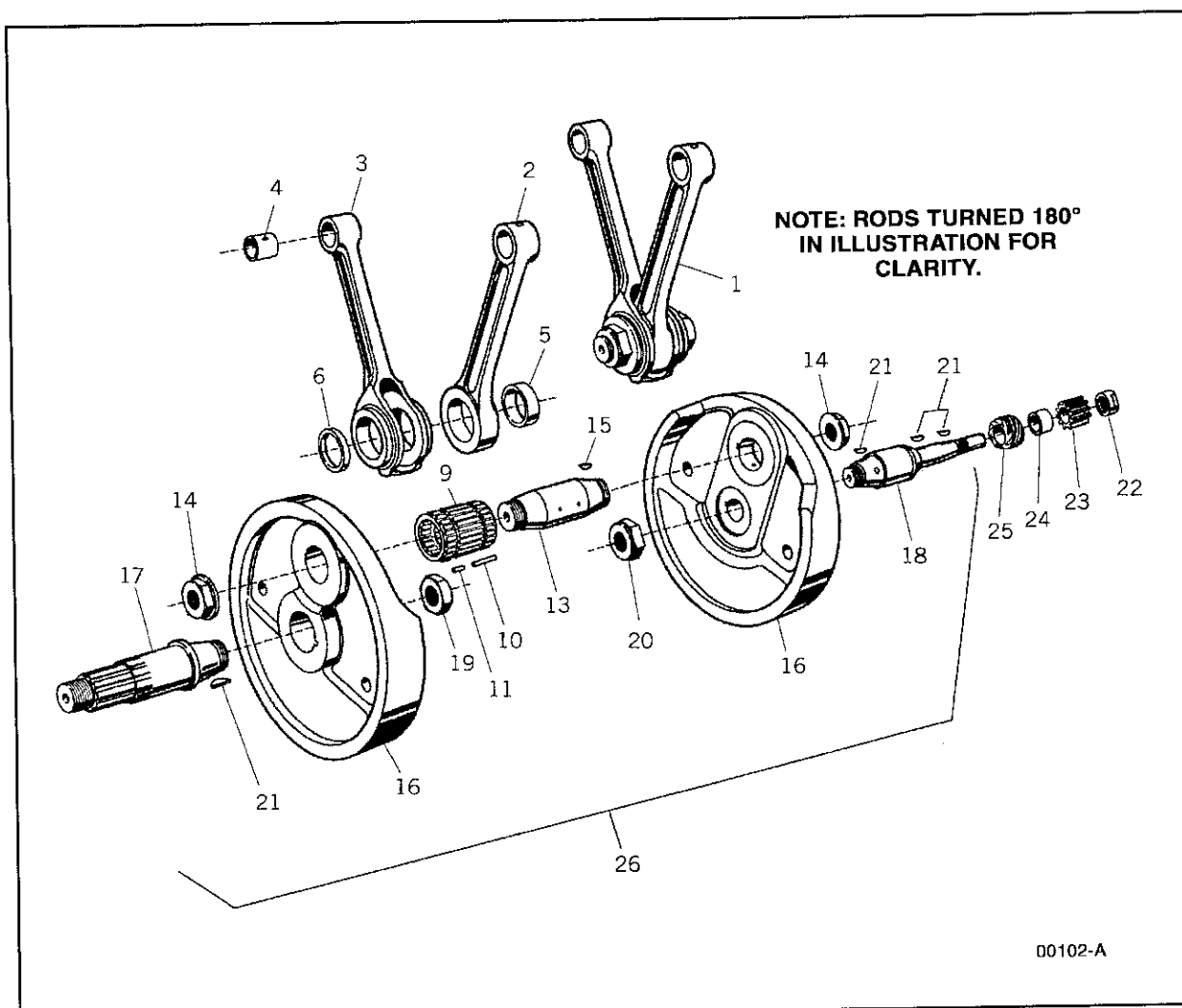
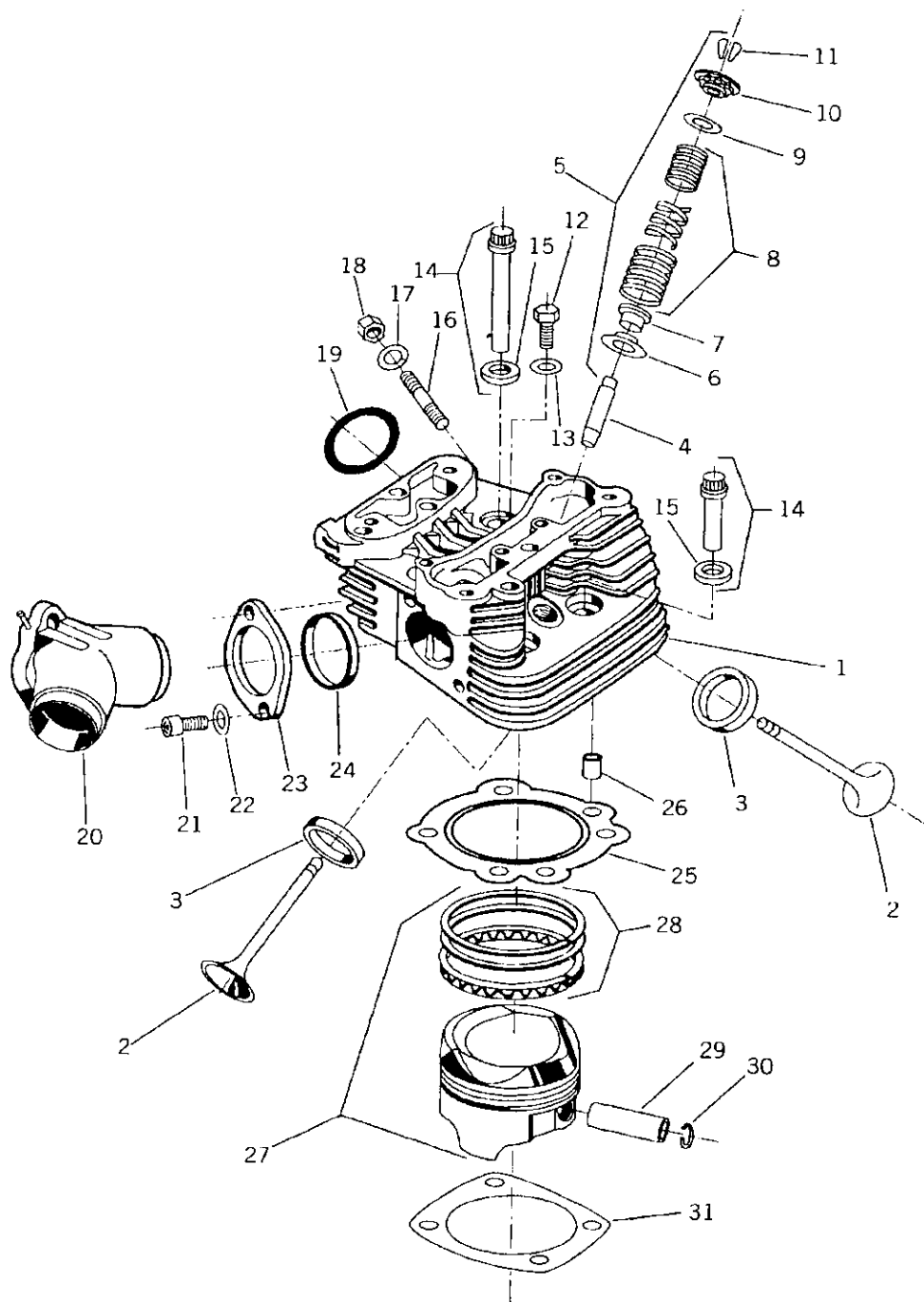


Figure 603 — Flywheel assembly

| Item | Part Number | Part Description                                                  | Qty. |
|------|-------------|-------------------------------------------------------------------|------|
| 1    | 03-400      | Connecting rod set                                                | 1    |
| 2    | 03-401      | Connecting rod assembly, front (rod, races and wrist pin bushing) | 1    |
| 3    | 03-402      | Connecting rod assembly, rear (rod, races and wrist pin bushing)  | 1    |
| 4    | 03-404      | Bushing, connecting rod wrist pin                                 | 1    |
| 5    | 03-405      | Race, front connecting rod                                        | 1    |
| 6    | 03-406      | Race, rear connecting rod                                         | 1    |
| 7    | 03-407      | Race set (items 5 and 6)                                          | 1    |
| 8    | 03-408      | Race and bushing set (items 7 and 4)                              | 1    |
| 9    | 03-409      | Retainer, connecting rod bearing                                  | 1    |
| 10   | 03-410      | Bearing, roller, front connecting rod                             | 1    |



| Item | Part Number | Part Description                     | Qty. |
|------|-------------|--------------------------------------|------|
| 11   | 03-411      | Bearing, roller, rear connecting rod | 1    |
| 12   | 03-412      | Bearing set, roller, connecting rod  | 1    |
| 13   | 03-413      | Crankpin assembly                    | 1    |
| 14   | 03-414      | Nut, crankpin                        | 2    |
| 15   | 03-415      | Key, crankpin                        | 1    |
| 16   | 03-416      | Flywheel set                         | 1    |
| 17   | 03-417      | Sprocket shaft assembly              | 1    |
| 18   | 03-418      | Pinion shaft assembly                | 1    |
| 19   | 03-419      | Nut, sprocket shaft                  | 1    |
| 20   | 03-421      | Nut, pinion shaft                    | 1    |
| 21   | 03-422      | Key, mainshaft                       | 1    |
| 22   | 03-423      | Nut, pinion gear                     | 1    |
| 23   | 00-005      | Gear, pinion (red)                   | 1    |
| 24   | 03-424      | Spacer, pinion gear                  | 1    |
| 25   | 03-425      | Gear, pinion shaft oil pump drive    | 1    |
| 26   | 03-427      | Flywheel assembly                    | 1    |



IMC2603A

*Figure 604 — Pistons and front/rear cylinder heads (front shown)*

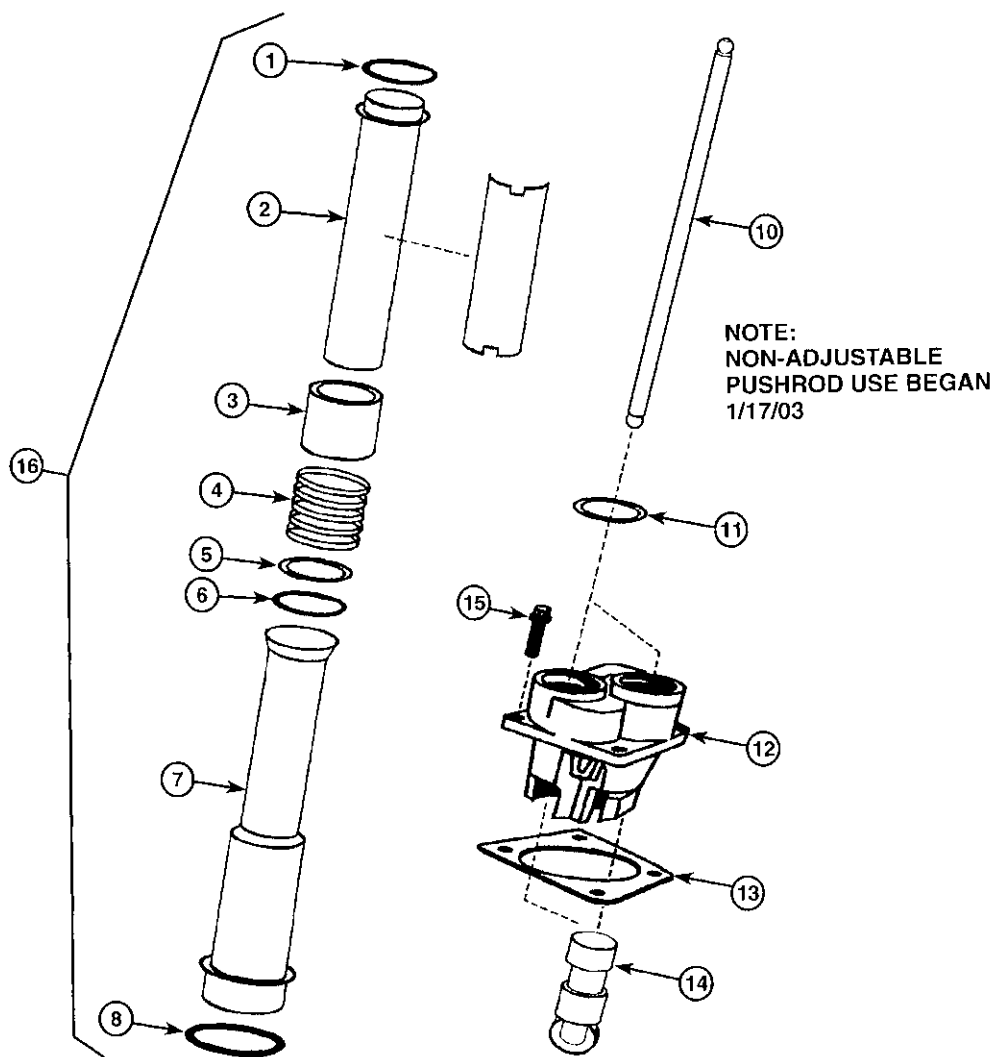
| Item | Part Number                                                             | Part Description                                                                                                                                                                                                            | Qty.                  |
|------|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 1    | As follows:<br>00-078<br>00-079<br>00-197<br>00-199<br>03-512<br>03-513 | Cylinder head, with seats and guides<br>Front, non-painted with polished fins<br>Rear, non-painted with polished fins<br>Front, non-painted<br>Rear, non-painted<br>Front, black<br>Rear, black                             | 2                     |
| 2    | 08-600<br>08-601                                                        | Valve, intake, 2.000" dia.<br>Valve, exhaust, 1.605" dia.                                                                                                                                                                   | 2<br>2                |
| 3    | 08-602<br>08-603                                                        | Valve seat, intake, 2.000" dia.<br>Valve seat, exhaust, 1.605" dia.                                                                                                                                                         | 2<br>2                |
| 4    | 08-604                                                                  | Valve guide, standard                                                                                                                                                                                                       | 4                     |
| 5    | 08-609<br>01-341                                                        | Valve spring kit (3 springs)<br>Dual valve spring kit                                                                                                                                                                       | 4<br>4                |
| 6    | 08-610<br>01-342                                                        | Collar, valve spring bottom, 0.630"<br>Valve spring retainer, lower, dual valve spring kit                                                                                                                                  | 4<br>4                |
| 7    | 08-611                                                                  | Seal, valve guide                                                                                                                                                                                                           | 4                     |
| 8    | 08-612<br>08-613<br>08-614<br>01-343<br>01-344                          | Spring, valve, inner (use ended 2/6/03)<br>Spring, valve, middle (use ended 2/6/03)<br>Spring, valve, outer (use ended 2/6/03)<br>Valve spring, middle, dual valve spring kit<br>Valve spring, outer, dual valve spring kit | 4<br>4<br>4<br>4<br>4 |
| 9    | 08-615<br>01-345                                                        | Wear plate, top collar<br>Valve spring retainer, upper, dual valve spring kit                                                                                                                                               | 4<br>4                |
| 10   | 08-616                                                                  | Top, valve spring                                                                                                                                                                                                           | 4                     |
| 11   | 08-617<br>01-340                                                        | Keeper, valve spring<br>Valve spring keeper, dual valve spring kit                                                                                                                                                          | 4<br>4                |
| 12   | 08-618                                                                  | Bolt, cylinder head mount, 3/8"-16 x 1-1/4"                                                                                                                                                                                 | 2                     |
| 13   | 08-619                                                                  | Washer, flat                                                                                                                                                                                                                | 8                     |
| 14   | 08-621<br>08-622                                                        | Cylinder head bolt, short, 1.690"<br>Cylinder head bolt, long, 3.134"                                                                                                                                                       | 4<br>4                |
| 15   | 08-623                                                                  | Washer, cylinder head bolt                                                                                                                                                                                                  | 8                     |
| 16   | 08-624                                                                  | Stud, exhaust port                                                                                                                                                                                                          | 4                     |
| 17   | 08-625                                                                  | Washer, lock                                                                                                                                                                                                                | 4                     |
| 18   | 08-626                                                                  | Nut, 5/16"-24                                                                                                                                                                                                               | 4                     |
| 19   | 37-205                                                                  | Gasket, exhaust                                                                                                                                                                                                             | 2                     |
| 20   | 08-629                                                                  | Manifold, intake                                                                                                                                                                                                            | 1                     |
| 21   | 08-630                                                                  | Screws, socket head, intake manifold, 5/16"-18 x 1"                                                                                                                                                                         | 4                     |
| 22   | 03-623                                                                  | Washer, flat, 5/16"                                                                                                                                                                                                         | 4                     |
| 23   | 08-632<br>08-633                                                        | Flange, front, intake manifold<br>Flange, rear, intake manifold                                                                                                                                                             | 1<br>1                |

| Item | Part Number      | Part Description                                                                | Qty.   |
|------|------------------|---------------------------------------------------------------------------------|--------|
| 24   | 08-634           | O-ring, intake manifold                                                         | 2      |
| 25   | 08-635           | Gasket, cylinder head                                                           | 2      |
| 26   | 08-637           | Dowel pin                                                                       | 2      |
| 27   | 08-641<br>08-642 | Piston and rings, front set (standard)<br>Piston and rings, rear set (standard) | 1<br>1 |
| 28   | 08-647           | Ring set, piston (standard)                                                     | 2      |
| 29   | 08-650           | Wrist pin, piston                                                               | 2      |
| 30   | 08-651           | C-clip, wrist pin retainer                                                      | 4      |
| 31   | 08-652           | Gasket, cylinder head                                                           | 2      |

The following chart applies to the two following front/rear lifter block assembly illustrations.

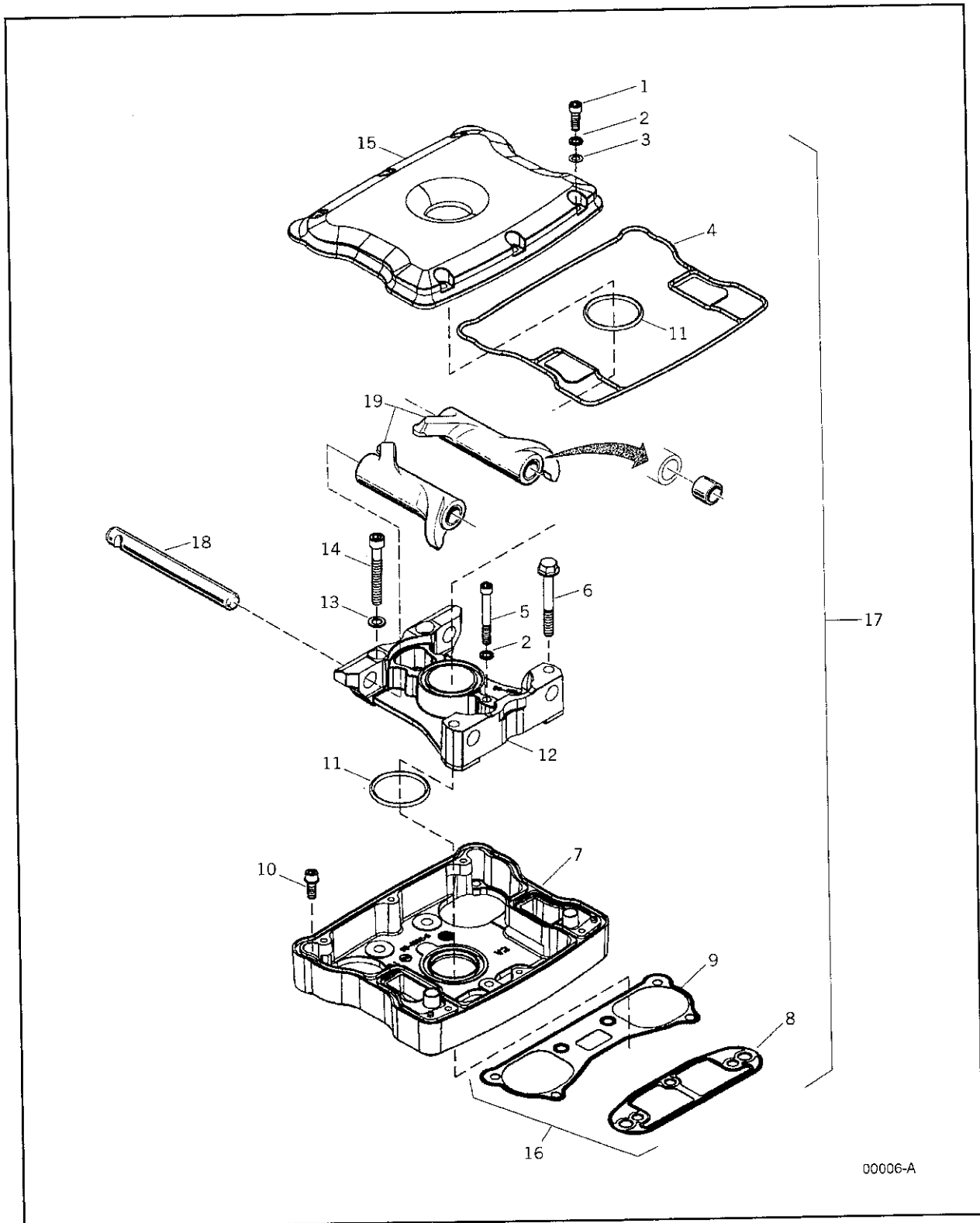
| Item | Part Number                                             | Part Description                                                                                                                                                                                                                                                                                                                                                                  | Qty.                     |
|------|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| 1    | 00-011                                                  | O-ring, upper, 0.675" x 0.135"                                                                                                                                                                                                                                                                                                                                                    | 4                        |
| 2    | 04-103                                                  | Tube, upper push rod                                                                                                                                                                                                                                                                                                                                                              | 4                        |
| 3    | 04-104                                                  | Cup, push rod tube                                                                                                                                                                                                                                                                                                                                                                | 4                        |
| 4    | 04-105                                                  | Spring                                                                                                                                                                                                                                                                                                                                                                            | 4                        |
| 5    | 04-101                                                  | Washer, steel                                                                                                                                                                                                                                                                                                                                                                     | 4                        |
| 6    | 09-623                                                  | O-ring, middle, 0.675" x 0.100"                                                                                                                                                                                                                                                                                                                                                   | 4                        |
| 7    | 04-102                                                  | Tube, lower push rod                                                                                                                                                                                                                                                                                                                                                              | 4                        |
| 8    | 09-264                                                  | O-ring, lower 7/8" x 0.100"                                                                                                                                                                                                                                                                                                                                                       | 4                        |
| 9    | 04-106                                                  | Clip, upper, 3.109"                                                                                                                                                                                                                                                                                                                                                               | 4                        |
| 10   | 01-079<br>08-996<br>08-997<br>08-998<br>08-999          | Push rods, adjustable (set of 4 used until 1/16/03)<br>Push rod, S & S 88CI, front exhaust, 10.450", non adj., blue (began 1/17/03)<br>Push rod, S & S 88CI, rear exhaust, 10.305", non adj., yellow (began 1/17/03)<br>Push rod, S & S 88CI, front intake, 10.170", non adj., green (began 1/17/03)<br>Push rod, S & S 88CI, rear intake, 10.113", non adj., red (began 1/17/03) | 1                        |
| 11   | 00-012                                                  | Washer, steel                                                                                                                                                                                                                                                                                                                                                                     | 4                        |
| 12   | As follows:<br><br>06-201<br>06-202<br>06-206<br>06-205 | Lifter block<br><br>Front, non-painted<br>Rear, non-painted<br>Front, black<br>Rear, black                                                                                                                                                                                                                                                                                        | <br><br>1<br>1<br>1<br>1 |
| 13   | 09-005<br>09-006                                        | Gasket, front lifter block<br>Gasket, rear lifter block                                                                                                                                                                                                                                                                                                                           | 1<br>1                   |
| 14   | 01-080                                                  | Tappet lifter, hydraulic                                                                                                                                                                                                                                                                                                                                                          | 2                        |
| 15   | 03-613                                                  | Screw, 12-point, 1/4"-20 x 7/8"                                                                                                                                                                                                                                                                                                                                                   | 8                        |
| 16   | 01-167                                                  | Cover assembly                                                                                                                                                                                                                                                                                                                                                                    | 2                        |





IMC2482A

Figure 606 -- Front/rear lifter block assembly (non adjustable pushrod)

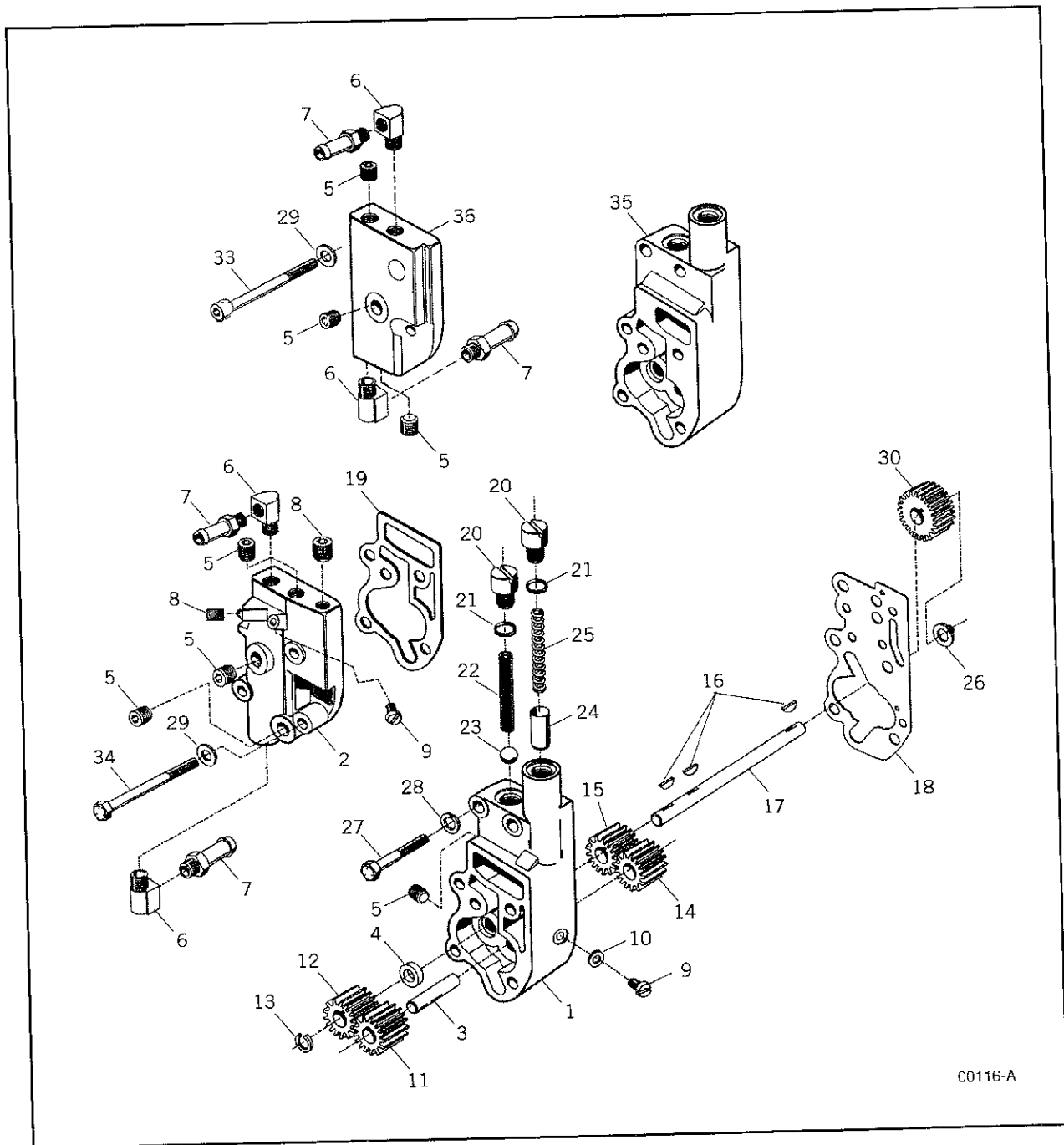


00006-A

Figure 607 — Front/rear cylinder rocker assembly

| Item | Part Number | Part Description                                               | Qty. |
|------|-------------|----------------------------------------------------------------|------|
| 1    | 08-001      | Screws, socket head, with lock patch, 1/4"-20 x 3/4"           | 12   |
| 2    | 08-004      | Washer, flat, 1/4"                                             | 12   |
| 3    | 09-359      | Washer, flat, rubber covered, 1/4"                             | 12   |
| 4    | 09-363      | Seal, rocker cover outer                                       | 2    |
| 5    | 08-031      | Screw, socket head, rocker arm support, 1/4"-20-2"             | 2    |
| 6    | 08-033      | Screw, flange head, rocker arm support, 5/16"-18 x 2-1/4"      | 4    |
| 7    | 08-012      | Housing, base                                                  | 2    |
| 8    | 09-009      | Gasket, base housing, right rocker                             | 2    |
| 9    | 09-010      | Gasket, base housing, left rocker                              | 2    |
| 10   | 08-032      | Screws, socket head, base housing, with washer, 1/4"-20 x 1"   | 12   |
| 11   | 09-360      | O-ring, 1-7/8" outer diameter                                  | 4    |
| 12   | 08-034      | Support, rocker arm                                            | 2    |
| 13   | 08-005      | Washer, flat, 5/16"                                            | 2    |
| 14   | 08-003      | Screw, socket head, rocker arm support, 5/16"-18 x 2-1/4"      | 4    |
| 15   | 08-011      | Cover, rocker box                                              | 2    |
| 16   | 09-362      | Gasket kit, rocker box (items 3, 4, 8, 9 and 11)               | 2    |
| 17   | 00-165      | Rocker box kit                                                 | 2    |
| 18   | 01-199      | Shaft, rocker arm                                              | 4    |
| 19   | 04-108      | Rocker arm, front exhaust/rear intake                          | 2    |
|      | 04-109      | Rocker arm, front intake/rear exhaust                          | 2    |
|      | 04-446      | Non-roller rocker front exhaust/rear intake (use began 7-8-03) | 2    |
|      | 04-447      | Non-roller rocker front intake/rear exhaust (use began 7-8-03) | 2    |





00116-A

Figure 608 — Oil pump

| Item | Part Number | Part Description         | Qty. |
|------|-------------|--------------------------|------|
| 1    | —           | Housing, oil pump (cast) | 1    |
| 2    | 03-526      | Cover, pump              | 1    |
| 3    | 03-527      | Shaft, idler             | 1    |
| 4    | 09-350      | Seal, drive shaft        | 1    |

| Item | Part Number      | Part Description                                             | Qty.   |
|------|------------------|--------------------------------------------------------------|--------|
| 5    | 03-528           | Plug, socket head, 1/8"-27                                   | 1      |
| 6    | 03-529           | Fitting, 90 deg.                                             | 3      |
| 7    | 03-530           | Fitting, supply/return hose, 1/8"-27                         | 3      |
| 8    | 03-531           | Plug, socket head, 1/16"-27                                  | 1      |
| 9    | 03-532           | Screw, slotted pan head, 10-32 x 1/4"                        | 1      |
| 10   | 03-533           | Washer, flat, 0.192" x 0.400" x 1/32"                        | 1      |
| 11   | 03-534           | Gear, supply idler                                           | 1      |
| 12   | 05-535           | Gear, supply drive                                           | 1      |
| 13   | 03-536           | Retaining ring, external                                     | 1      |
| 14   | 03-537           | Gear, return idler                                           | 1      |
| 15   | 03-538           | Gear, return drive                                           | 1      |
| 16   | 03-539           | Key, drive shaft                                             | 1      |
| 17   | 03-540           | Shaft, pump drive                                            | 1      |
| 18   | 09-357<br>09-353 | Gasket, pump housing (paper)<br>Gasket, pump housing (mylar) | 1<br>1 |
| 19   | 09-352<br>09-354 | Gasket, pump cover (paper)<br>Gasket, pump cover (mylar)     | 1<br>1 |
| 20   | 03-541           | Screw, check valve/relief valve cover                        | 2      |
| 21   | 03-542           | O-ring                                                       | 2      |
| 22   | 03-543           | Spring, check valve                                          | 1      |
| 23   | 03-544           | Ball, check valve                                            | 1      |
| 24   | 03-545           | Valve, relief                                                | 1      |
| 25   | 03-546           | Spring, relief valve                                         | 1      |
| 26   | 03-547           | Retaining ring, external                                     | 1      |
| 27   | 03-548           | Screw, pump housing, 1/4"-20 x 1-1/2"                        | 2      |
| 28   | 03-549           | Washer, lock                                                 | 2      |
| 29   | 03-550           | Washer, flat                                                 | 1      |
| 30   | 03-551           | Gear, pump drive                                             | 1      |
| 33   | 03-553           | Screw, socket head, 1/4"-20 x 2-1/4"                         | 1      |
| 34   | —                | Screw, 1/4"-20 x 2-3/4"                                      | 1      |
| 35   | 03-554           | Housing, oil pump (billet)                                   | 1      |
| 36   | 03-555           | Cover, oil pump housing (billet)                             | 1      |

## SPECIAL TOOLS

| Description                                                                                     | JIMS® Tool No.<br>(unless specified otherwise) |
|-------------------------------------------------------------------------------------------------|------------------------------------------------|
| Cam bearing tool (use with 33416-80-1)                                                          | 97272-60                                       |
| Crank assembly removing tool                                                                    | 1047-TP-7                                      |
| • Bolt, four (2007)                                                                             |                                                |
| • Screw (1024)                                                                                  |                                                |
| • Washer, four (2014)                                                                           |                                                |
| Engine stand                                                                                    | 1006T                                          |
| Flywheel rebuilding jig                                                                         | 1071 (Rowe IID 09-1194)                        |
| Ignition diagnostic kit with software and cable<br>(Thunder Heart Performance Corp. SmartLink™) | IMC No. 88-990                                 |
| Ignition module simulator                                                                       | IMC No. 98-055                                 |
| Main drive gear seal installer                                                                  | 2256                                           |
| Main drive gear tool                                                                            | 35316-80                                       |
| Mainshaft seal driver                                                                           | 95660-85                                       |
| Mainshaft sprocket locknut wrench                                                               | 94660-37A                                      |
| Motor sprocket shaft seal installation tool                                                     | 39361-69                                       |
| Pinion gear installer and puller                                                                | 96-830-51 (set)                                |
| • Collar (96880-51-1)                                                                           |                                                |
| • Screw (96-830-51-2)                                                                           |                                                |
| • Puller (96830-51-3)                                                                           |                                                |
| Pinion gear nut socket                                                                          | 94555-55A                                      |
| Piston ring compressor set                                                                      | 1236                                           |
| Piston ring expander tool                                                                       | 1235                                           |
| Race and bearing install tool handle (use with 97272-60)                                        | 33416-80-1                                     |
| Rod alignment tool                                                                              | 1148                                           |
| Shaft installer                                                                                 | 2189                                           |
| Sprocket locker                                                                                 | 2260                                           |
| Sprocket shaft bearing installation tool                                                        | 97225-55 (set)                                 |
| • Main body (97225-55-1)                                                                        |                                                |
| • Slider (97225-55-3)                                                                           |                                                |
| • Nut (1026B)                                                                                   |                                                |
| • Handle (1028)                                                                                 |                                                |
| • Bearing and washers (1047-54)                                                                 |                                                |
| Sprocket shaft bearing removal tool                                                             | 1045-TS (set)                                  |
| • Bearing holder, two-piece (1045-TS-1)                                                         |                                                |
| • Ring (1045-TS-2)                                                                              |                                                |
| • Screw (1024)                                                                                  |                                                |
| • Bolt, two (2012)                                                                              |                                                |
| • Puller bar (2013)                                                                             |                                                |
| • Flat washer, two (2014)                                                                       |                                                |
| Sprocket shaft holder                                                                           | 1034                                           |
| Tappet block alignment tool                                                                     | 33443-84                                       |
| Transmission cover (trapdoor) bearing remover and installer                                     | 1078                                           |

| Description                                                        | JIMS® Tool No.<br>(unless specified otherwise) |
|--------------------------------------------------------------------|------------------------------------------------|
| Transmission cover (trapdoor/5-speed door, JIMS® puller            | 2283                                           |
| Trigger plate and speedometer sensor tester (with adapter harness) | IMC No. 98-056                                 |
| Valve guide seal tool                                              | 34643-84                                       |
| Valve guide tool (use with 34740-84 for installation)              | 34731-84                                       |
| Valve guide tool handle (for removal)                              | 34740-84                                       |
| Valve spring compressor tool                                       | 96600-36B                                      |
| Valve spring tester                                                | 1090                                           |

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Using a 3/4" wrench, remove the shock absorber mounting screws at the frame and swingarm.

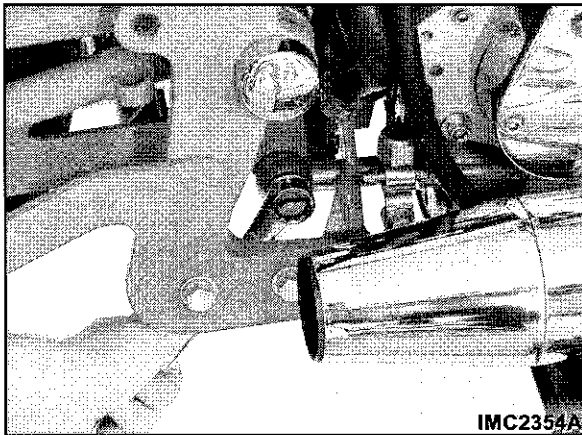


Figure 61 — Removing shock absorber swingarm mounting screw

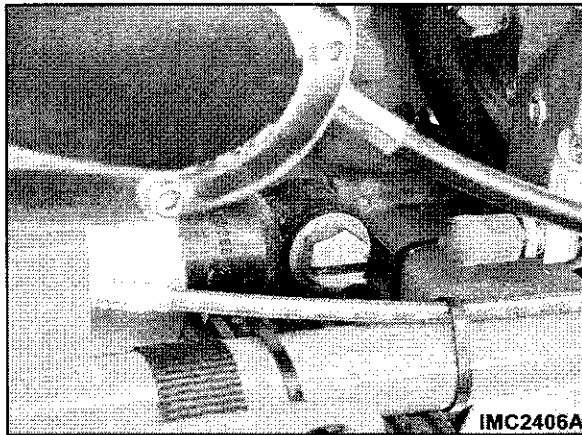


Figure 62 — Shock absorber frame mounting screw

Pull the screws out and remove the shock absorber from the chassis.

Repeat the process to remove the second shock absorber.

### Shock Absorber Inspection and Adjustment

Inspect the shock absorber(s) for any damage to the spring and for oil leaks from the body.

Inspect the rubber bushing on each end of the shock for deterioration. The bushing acts as a cushion between the shock mounting eye and the bolt. Replace the bushings if they are worn or damaged.

Shock absorber spring preload is adjustable. It may be advisable to increase the spring preload if the suspension bottoms frequently, or if heavy loads are to be carried.

To adjust spring preload, loosen the jam nut, using a 1-1/16" open-end wrench.

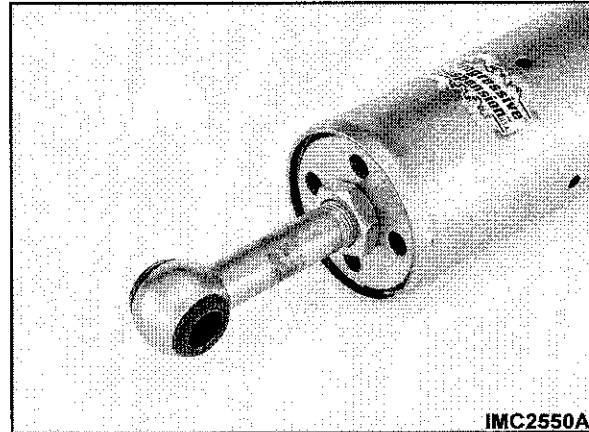


Figure 63 — Shock absorber spring preload adjustment collar and jam nut

Using the spanner wrench with 1.7" pin centers, rotate the preload collar on the body clockwise to decrease preload or counterclockwise to increase preload.

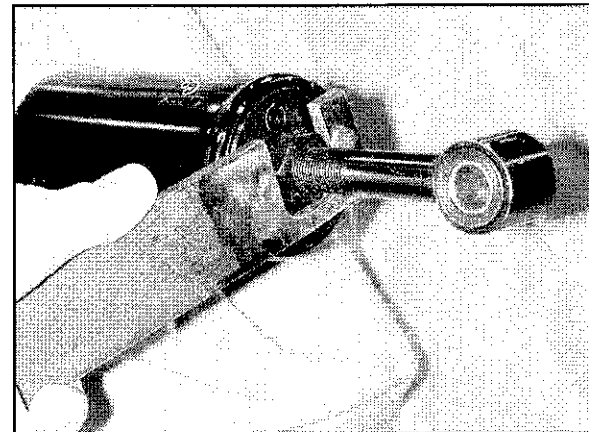


Figure 64 — Rotating adjustment collar with spanner wrench

With adjustment complete, tighten the jam nut against the collar, using a 1-1/16" open-end wrench.