2003 Harley-Davidson®

VRSCA
MODEL

SERVICE MANUAL

P/N 99501-03

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MAINTENANCE TASK AND SERVICE DATA	PRE RIDE	10000 MI 16000 KM	25000 MI 40000 KM	50000 MI 80000 KM	75000 MI 120000 KM	100000 MI 160000 KM	125000 MI 200000 KM	150000 MI 240000 KM	175000 MI 280000 KM	200000 MI 320000 KM	225000 MI 360000 KM	250000 MI 400000 KM	275000 MI 440000 KM	300000 MI 480000 KM	325000 MI 520000 KM	350000 MI 560000 KM	375000 MI 600000 KM	400000 MI 640000 KM	425000 MI 680000 KM	450000 MI 720000 KM	475000 MI 760000 KM	500000 MI 800000 KM
Brake pads and discs for wear *Minimum pad thickness:* varies upon application *Maximum brake disc lateral runout:* 0.3 mm (0.012 in.) (1.10 BRAKE PADS AND DISCS)	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Tire pressure and inspect tire for wear/damage (1.11 TIRES AND WHEELS)	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Rear belt deflection inspection *Deflection:* 6 mm *Specialty tool:* Part No. HD-35381 (1.14 REAR BELT DEFLECTION)	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Rear belt and sprocket (1.15 REAR BELT AND SPROCKETS)		I		I		I		I		I		I		I		I		I		I		I
Steering head bearings (1.17 STEERING HEAD BEARINGS)		A								A				D								
Front fork oil (1.18 FRONT FORK OIL)														R								
Spark plugs *Plug type:* No. 10R12A *Plug gap:* 0.89 mm (0.035 in.) *Plug torque:* 23 Nm (17 ft-lbs) (1.19 SPARK PLUG/COIL)				I		R		I		R		I		R		I		R		I		R
Air filter *Cover screw:* *2.5-3 turns after contact* (1.4 AIRBOX AND AIR FILTER)		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I

Table Code:

A - Adjust.
I - Inspect, and if necessary, correct, adjust, clean or replace.
L - Lubricate with specified lubricant.
R - Replace or change.
T - Tighten to proper torque.
X - Perform.
D - Disassemble (Lube & Inspect).

INSTALLATION/CONNECTION

CAUTION

Attach the cables to the correct battery terminals using the proper torque. Overtightening bolts can damage battery terminals and incorrect connections may damage the motorcycle's electrical system.

⚠WARNING

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion that could result in death or serious injury.

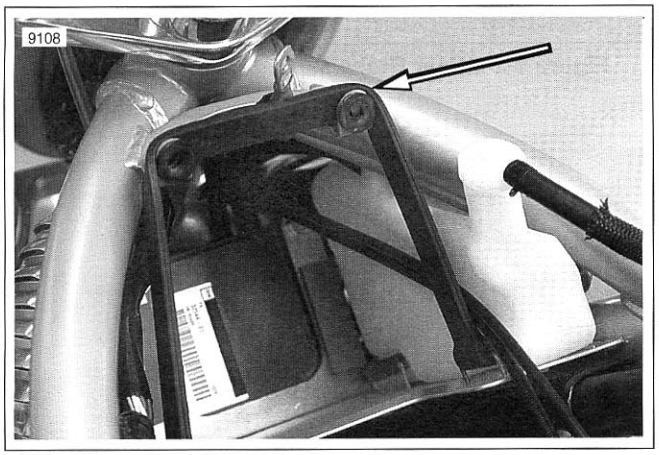


Figure 1-22. Position Hold-down Strap

1. See Figure 1-22. Stretch rubber hold-down strap over airbox cover frame tabs.
2. See Figure 1-20. Install battery with negative terminal on left side. Move hold-down strap over battery case.
3. Attach positive battery cable first. Tighten terminal bolt (2) to 6.8-10.9 Nm (60-96 **in-lbs**).
4. Attach negative battery cable and tighten terminal bolt (1) to 6.8-10.9 Nm (60-96 **in-lbs**).

NOTE

Battery must sit flat on bottom of tray pad. Verify that battery does not sit on front edge of tray pad.

5. Install airbox. See 1.4 AIRBOX AND AIR FILTER.
6. Install maxi-fuse and side cover. Tighten side cover fastener to 11-17 Nm (98-150 **in-lbs**).

STORAGE

⚠WARNING

Store the battery out of the reach of children. Inadequate safety precautions could result in death or serious injury.

CAUTION

The electrolyte in a discharged battery will freeze if exposed to freezing temperatures. Freezing may crack the battery case and buckle battery plates.

If the motorcycle will not be operated for several months, such as during the winter season, remove the battery from the motorcycle and fully charge. See 8.9 BATTERY.

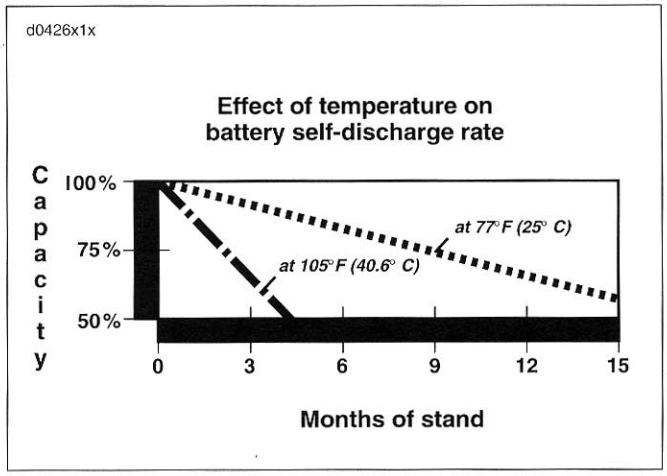


Figure 1-23. Battery Self-Discharge Rate

See Figure 1-23. Self-discharge is a normal condition and occurs continuously at a rate that depends on the ambient temperature and the battery's state of charge. Batteries discharge at a faster rate at higher ambient temperatures. To reduce the self-discharge rate, store battery in a cool (not freezing), dry place.

Charge the battery every month if stored at temperatures below 60° F (16° C). Charge the battery more frequently if stored in a warm area above 60° F (16° C).

NOTE

The BATTERY TENDER PLUS AUTOMATIC BATTERY CHARGER (Part No. 99863-93TA) may be used to maintain battery charge for extended periods of time without risk of overcharging or boiling.

When returning a battery to service after storage, refer to the instructions under 8.9 BATTERY.

7. While holding reservoir cover in place:
   a. Pump clutch hand lever 5 times.
   b. Hold clutch hand lever against handlebar.
   c. Loosen secondary clutch actuator bleed screw.
   d. Watch bleed screw for air bubbles.
   e. Tighten bleeder screw.
   f. Release hand lever.
8. Fill reservoir to FILL LEVEL and repeat the previous step three times or more until only a steady flow of clutch fluid escapes bleeder screw and fluid level in reservoir is at FILL LEVEL with motorcycle in an upright position.

CAUTION

Clutch fluid volume actually increases with clutch wear. Do not overfill reservoir.

9. Test pressure by squeezing clutch hand lever.

NOTE

If continued repetition of procedure does not build pressure in line and maintain FILL LEVEL, there is a leak in the clutch system. If the leak is not visible, remove and check the secondary clutch actuator boot for leakage.

10. Tighten fasteners as follows:
    a. Reservoir banjo bolt to 23-31 Nm (17-23 ft-lbs).
    b. Reservoir cover screws to 0.7-0.9 Nm (6-8 **in-lbs**).
    c. Bleed screw to 9-11 Nm (80-100 **in-lbs**).
    d. Secondary clutch actuator cover fasteners to 6-10 Nm (53-89 **in-lbs**).
11. Test ride motorcycle. Incorrect pressure can cause:
    a. Dragging clutch.
    b. Hard shifting.

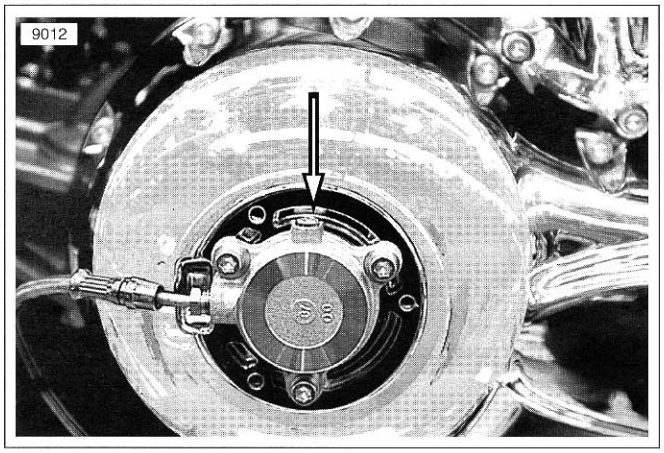


Figure 1-35. Secondary Clutch Actuator Bleed Screw

8. See Figure 1-51. Compare your observations of the plug deposits with the descriptions provided.

   a. A wet, black and shiny deposit on plug base, electrodes and ceramic insulator tip indicates an oil fouled plug. The condition may be caused by one or more of the following: worn pistons, worn piston rings, worn valves, worn valve guides, worn valve seals, a weak battery or a faulty ignition system.

   b. A dry, fluffy or sooty black deposit indicates an air-fuel mixture that is too rich, engine idling for excessive periods of time and/or enrichener usage for excessive periods of time.

   c. A light brown, glassy deposit indicates an overheated plug. This condition may be accompanied by cracks in the insulator or by erosion of the electrodes and is caused by an air-fuel mixture that is too lean, a hot-running engine, valves not seating or improper ignition timing. The glassy deposit on the spark plug is a conductor when hot and may cause high-speed misfiring. A plug with eroded electrodes, heavy deposits or a cracked insulator must be replaced.

   d. A plug with a white, yellow, tan or rusty brown powdery deposit indicates balanced combustion. Clean off spark plug deposits at regular intervals.

9. If the plugs require cleaning between tune-ups, proceed as follows:

   a. Degrease firing end of spark plug using ELECTRICAL CONTACT CLEANER. Dry plug with compressed air.

   b. Use a thin file to flatten spark plug electrodes. A spark plug with sharp edges on its electrodes requires 25-40% less firing voltage than one with rounded edges.

   c. If the plugs cannot be cleaned, replace with No. **10R12A** spark plugs.

10. Check electrode gap with a wire-type feeler gauge. Bend the outside of the electrode so only a slight drag on the gauge is felt when passing it between electrodes. Proper gap measurement is 0.89 mm (0.035 in.).

11. Check condition of threads on cylinder head and plug. If necessary to remove deposits, apply penetrating oil and clean out with a thread chaser.

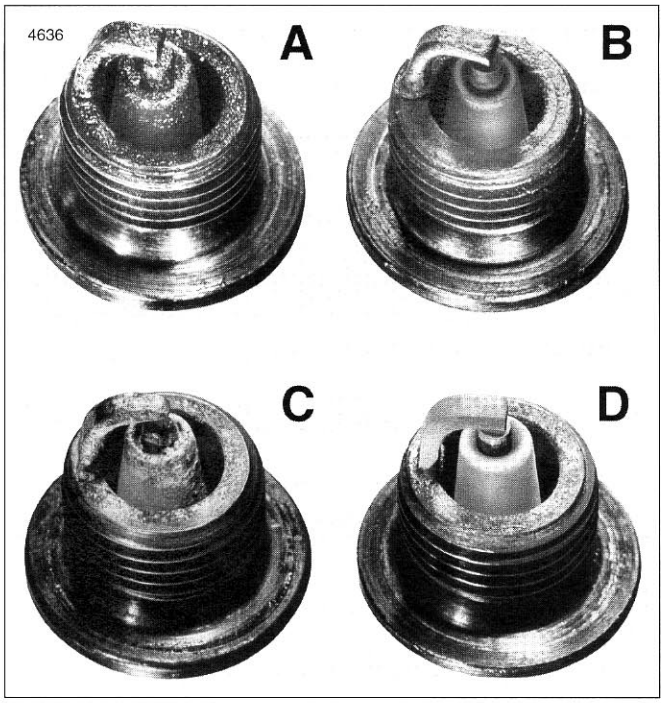


Figure 1-51. Typical Spark Plug Deposits

INSTALLATION

1. Apply LOCTITE ANTI-SEIZE to plug threads. Install and tighten to 23 Nm (17 ft-lbs).

2. Install coil and boot assembly over spark plug with wiring connector facing rear of motorcycle.

3. Insert coil fasteners with long fastener used on left side. Tighten to 9.7 Nm (86 **in-lbs).**

4. Connect connectors [83R] and [83F].

5. Install airbox assembly. See 1.4 AIRBOX AND AIR FILTER.

7. Use a micrometer to measure the thickness of the removed shim. Record measurement in the "Installed Shim Measurement" column on valve lash calculation worksheet. See D.2 VALVE LASH CALCULATION WORKSHEET 1.

CAUTION

Do not use shim stock to adjust valve lash. Shim stock may dislodge and cause severe engine damage.

8. Calculate and record on the valve lash calculation worksheet the "New Shim Lower Limit" and the "New Shim Upper Limit."

9. Calculate and record "Desired Shim Size."

10. Select and record the "Closest Shim Size" replacement shim. See Table D-1. Case 1 Valve Tappet Shims and Table D-2. Case 2 Valve Tappet Shims.

11. Always confirm **new** shim thickness with micrometer. Record for reference.

12. See Figure 1-74. Position **new** shim in spring retainer pocket. Use a magnet to position the shim and carefully push into place with finger.

13. Replace tappet.

14. If the initial lash measurement of the remaining valve exceeds the upper or lower valve lash limits, preform the lash adjustment on the remaining valve.

15. See Figure 1-67. Install cam in alignment with **new** reference marks on drive chain and cam drive gear. Note **new** reference marks from step 2.

16. See Figure 1-75. Cam journal caps are numbered. Install cam journal caps with corresponding number on head, arrow pointing to center of head. Lubricate cam journal and journal cap with oil before placing in position.

17. Tighten cam bearing caps to 10 Nm (89 **in-lbs**).

18. Review the valve lash calculation worksheet and make adjustments to the valves activated by the opposite cam if necessary.

CAUTION

NEVER rotate engine with secondary cam chain tensioner removed. Engine damage and/or loss of correct timing will occur.

19. When second cam has been set aside, the valve lash adjusted, and the cam reinstalled, install secondary cam chain tensioner.

Figure 1-73. Measure Shim

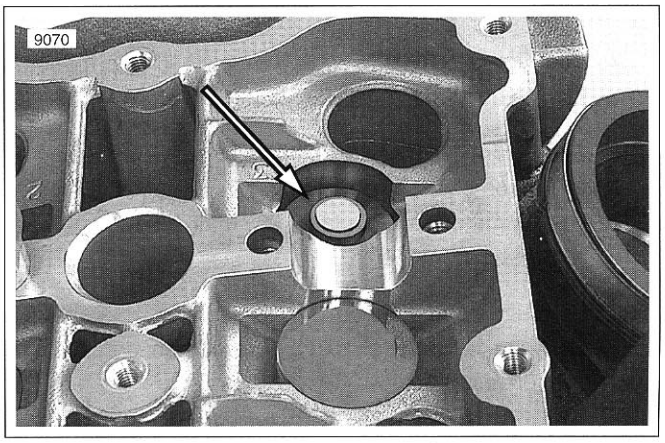


Figure 1-74. Position Shim

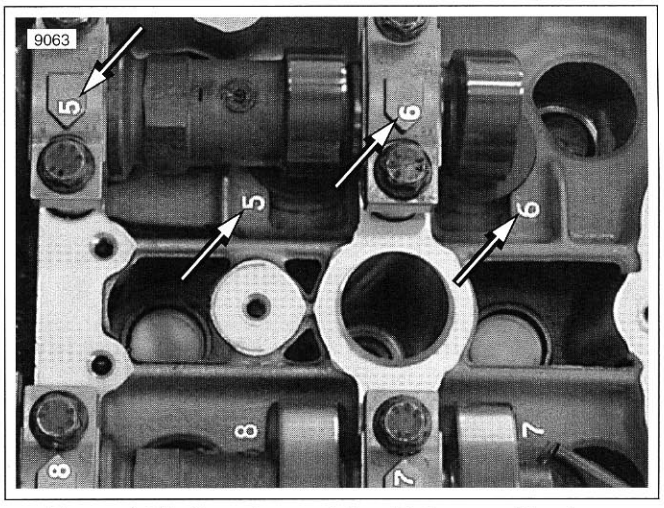


Figure 1-75. Cam Journal Cap Reference Numbers

GENERAL

⚠WARNING

The troubleshooting section of this manual is intended solely as a guide to diagnosing problems. Carefully read the appropriate sections of this manual before performing any work. Observe all cautions and warnings. Failure to observe cautions and warnings could result in death or serious injury.

The following check list of possible operating troubles and their probable causes will be helpful in keeping a motorcycle in good operating condition. More than one of these conditions may be causing the trouble and all should be carefully checked.

NOTES

- *For further troubleshooting information see the VRSCA Electrical Diagnostic Manual.*
- *For troubleshooting the cooling system, review the check list of operating troubles 6.2 COOLANT FLOW.*

ENGINE

Starter Motor Does Not Operate or Does Not Turn Engine Over

1. Ignition switch not in ON position.
2. Engine run switch in OFF position.
3. Maxi-fuse not in place.
4. Discharged battery, loose or corroded connections (solenoid chatters).
5. Starter control circuit, relay, or solenoid faulty.
6. Electric starter shaft pinion gear not engaging or overrunning clutch slipping.
7. Crankshaft locking pin is in place.

Engine Turns Over But Does Not Start

1. Fuel tank empty.
2. Fouled spark plugs.
3. Discharged battery, loose or broken battery terminal connections.
4. Engine lubricant too heavy (winter operation).

NOTE

For cold weather starts, always disengage clutch.

5. Loose wire connection at coil, battery, or plug between ignition module or ECM.
6. Ignition timing incorrect due to faulty coil, ignition module, ECM or sensors.
7. Bank Angle Sensor tripped and ignition switch not cycled OFF then ON.
8. Fuel filter clogged.
9. Sticking or damaged valve.

Starts Hard

1. Spark plugs in bad condition or have improper gap or are partially fouled.
2. Battery nearly discharged.
3. Loose wire connection at one of the battery terminals, coil, or plug between ECM or ignition module.
4. Water or dirt in fuel system.
5. Intake air leak.
6. Fuel tank vent hose and vapor valve plugged, or fuel line closed off, restricting fuel flow.
7. Engine lubricant too heavy (winter operation).

NOTE

For cold weather starts, always disengage clutch.

8. Ignition not functioning properly (possible sensor failure).
9. Faulty ignition coil.
10. Valves sticking or valves too tight.
11. Rotor key sheared.

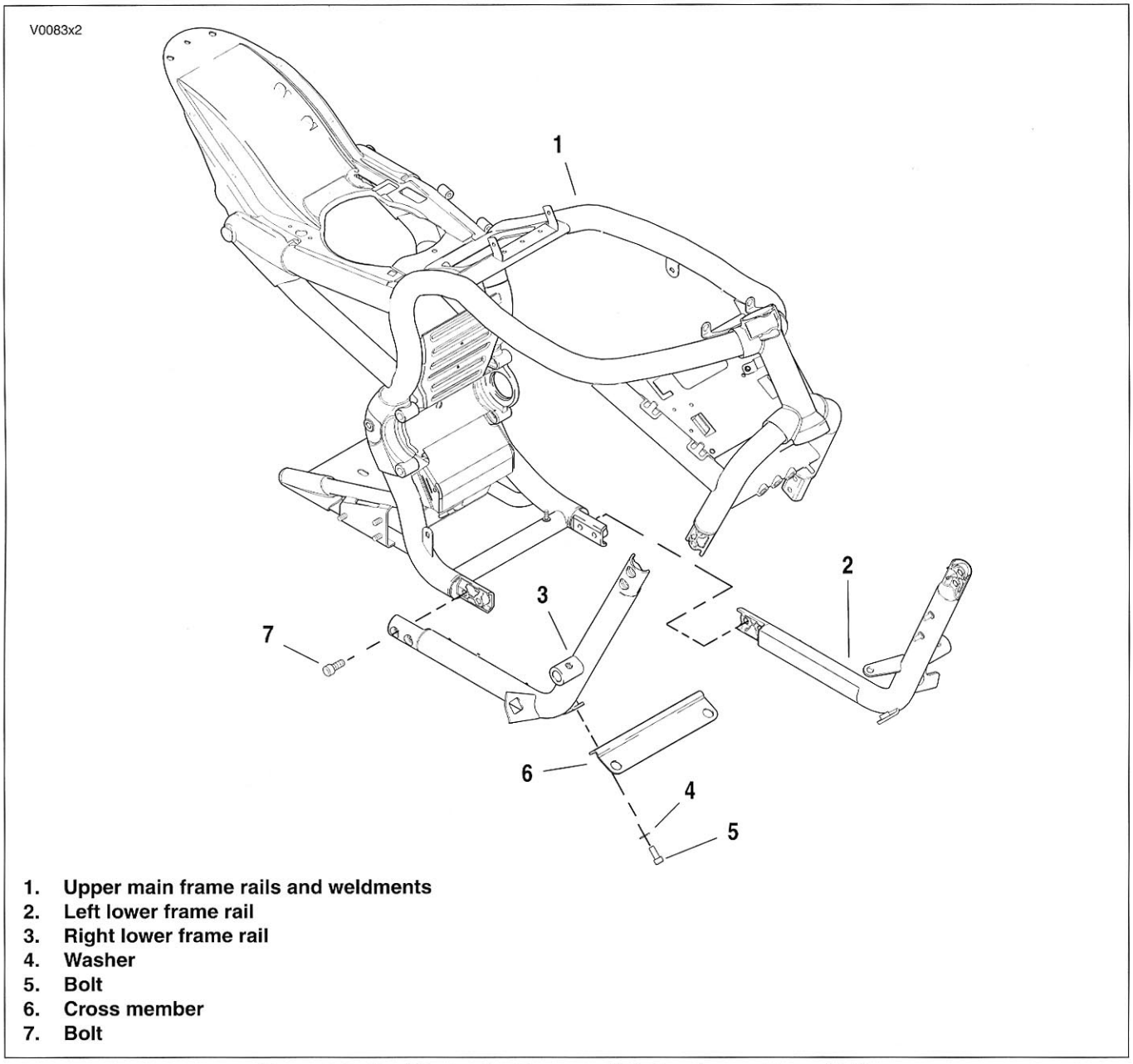
Starts But Runs Irregularly or Misses

1. Spark plugs in bad condition or partially fouled.
2. Spark plug gap too close or too wide.
3. Faulty ignition coil, module, or sensor.
4. Battery nearly discharged.
5. Damaged wire or loose connection at battery terminals, coil, or plug between ignition sensor and module.
6. Intermittent short circuit due to damaged wire insulation.
7. Water or dirt in fuel system or filter.
8. Fuel tank vent system plugged or closed off.
9. Air leak at intake manifold or air filter.
10. MAP sensor inoperative.
11. Loose or dirty ignition module or ECM connector at crankcase.
12. Faulty Sensor(s): Manifold Absolute Pressure (MAP), or Crank Position (CKP).
13. Incorrect valve timing.
14. Weak or broken valve springs.
15. Damaged intake or exhaust valve.

GENERAL

The steel upper hydroformed main rails, joined with stamped sheet metal weldments for the steering head, seat, rear fork pivots, fuel tank shield, and rear fender, are bolted to left and right lower frame rails that complete the frame perimeter.

The rider footrests and foot controls are mounted on the lower frame rails. The passenger footrests are mounted on the rear fork.



1. **Upper main frame rails and weldments**
2. **Left lower frame rail**
3. **Right lower frame rail**
4. **Washer**
5. **Bolt**
6. **Cross member**
7. **Bolt**

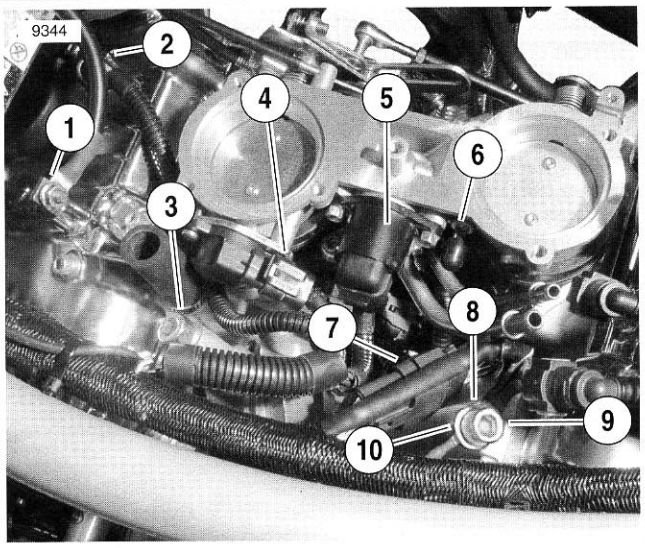
Figure 2-3. Steel Perimeter Frame and Bolt-on Lower Frame Rails

21. See Figure 2-13. Cover front fender with a shop towel or protective cover. On right side, pull rear brake fluid reservoir from radiator cover. Remove two fasteners and washers (2) on each side of radiator cover and remove radiator cover. The radiator cover includes two chrome inlet bezels.

⚠WARNING

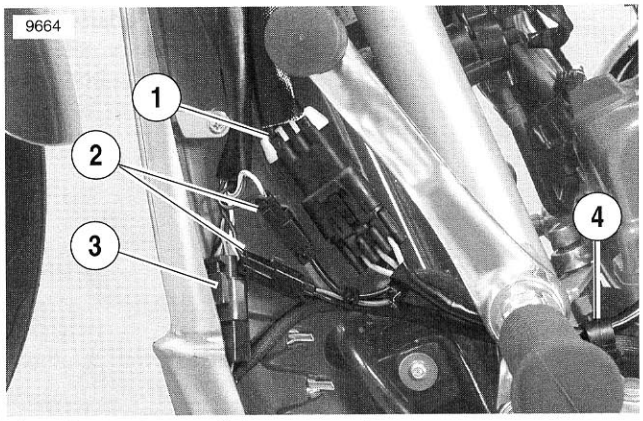
Allow engine to cool before opening the radiator cap to work on the liquid cooling system. Coolant can be extremely hot and at high pressure. Opening a hot cooling system may result in death or serious injury.

22. Place a suitable container under radiator and open pressure cap.
23. See Figure 2-13. Remove drain plug (1) and drain coolant from radiator. Leave container under engine until all coolant has been drained through front cylinder coolant drain plug.
24. Replace radiator drain plug (1) and tighten to 9-11 Nm (80-97 **in-lbs**).
25. Use a long thin screwdriver (Snap-on Part No. SDD1410) to loosen worm drive clamps on radiator hoses.



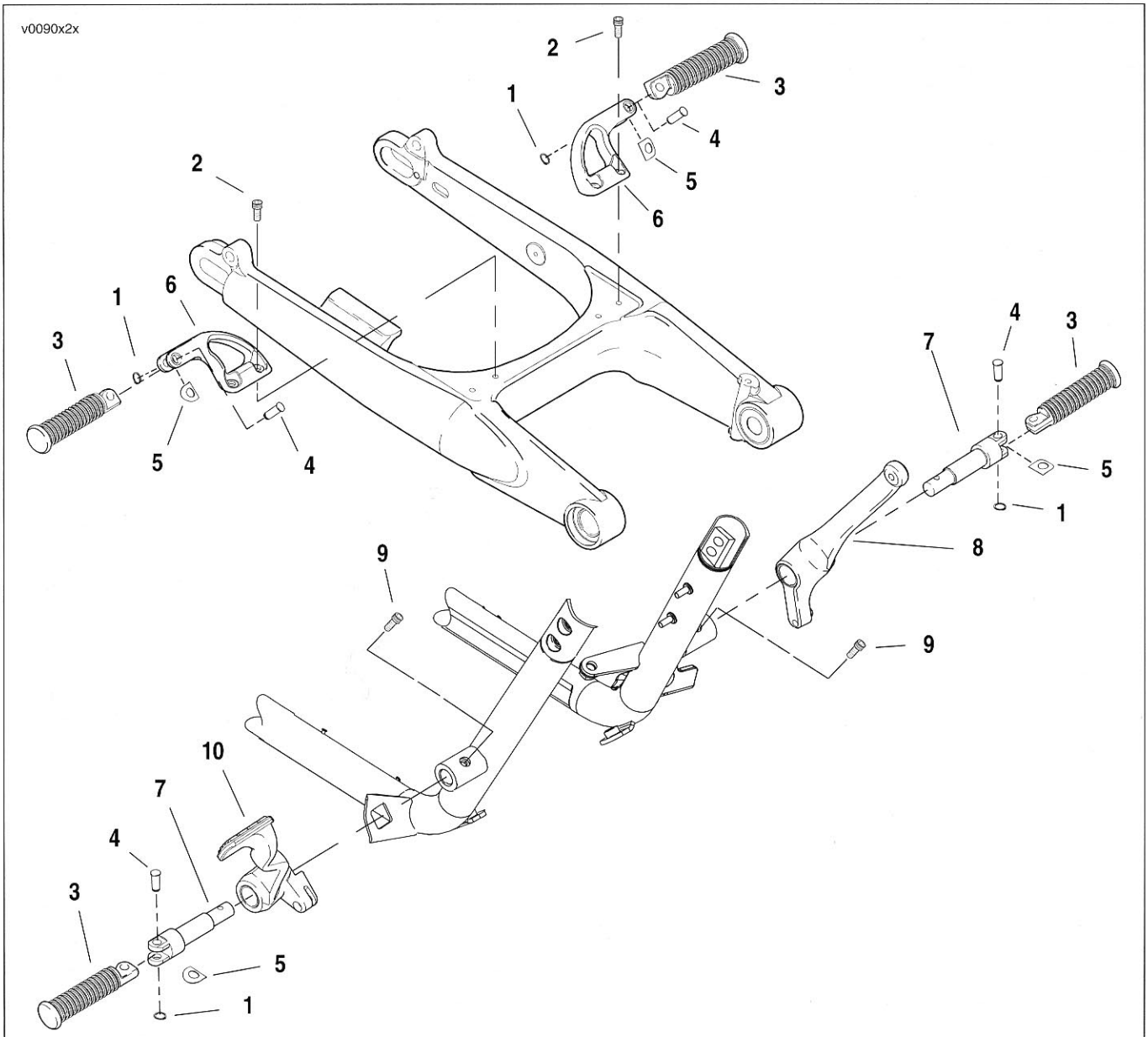
1. **Negative battery cable copper L-bracket**
2. **Front cylinder coil connector**
3. **Regulator ground**
4. **Throttle position sensor connector**
5. **Idle air control actuator connector**
6. **Purge solenoid fitting**
7. **Main engine sensor connector**
8. **GND 1**
9. **GND 2**
10. **Horn ground wire**

Figure 2-11. Wiring Connections



1. **Stator to regulator connector**
2. **Top and bottom fan power connectors**
3. **Crank position sensor connector**
4. **Wiring frame clip**

Figure 2-12. Left Side Wiring Connectors

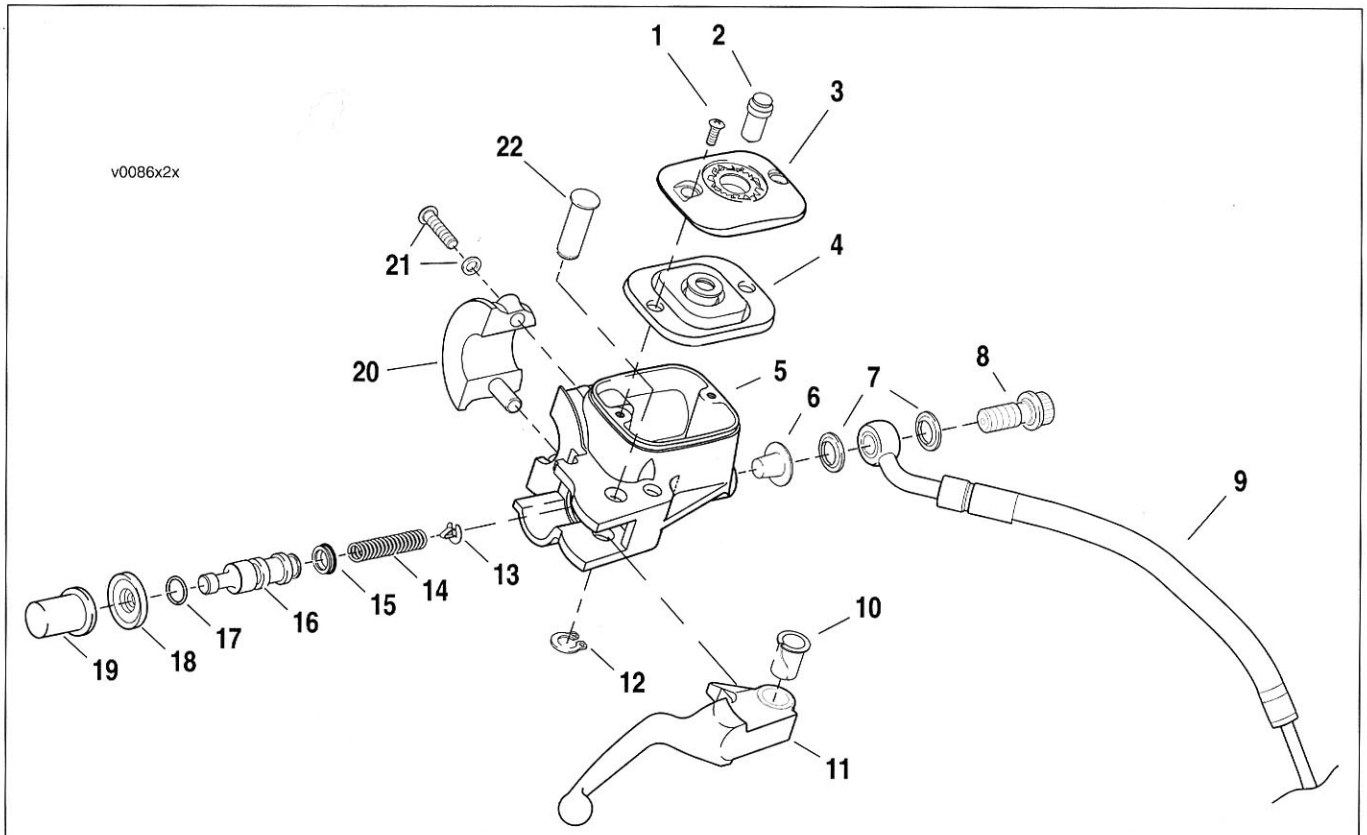


1. Retaining ring
2. Fastener
3. Footrest
4. Clevis pin
5. Spring washer
6. Footrest support
7. Footrest axle
8. Shift lever
9. Retaining bolt
10. Brake pedal

Figure 2-27. Rider and Passenger Foot Rests

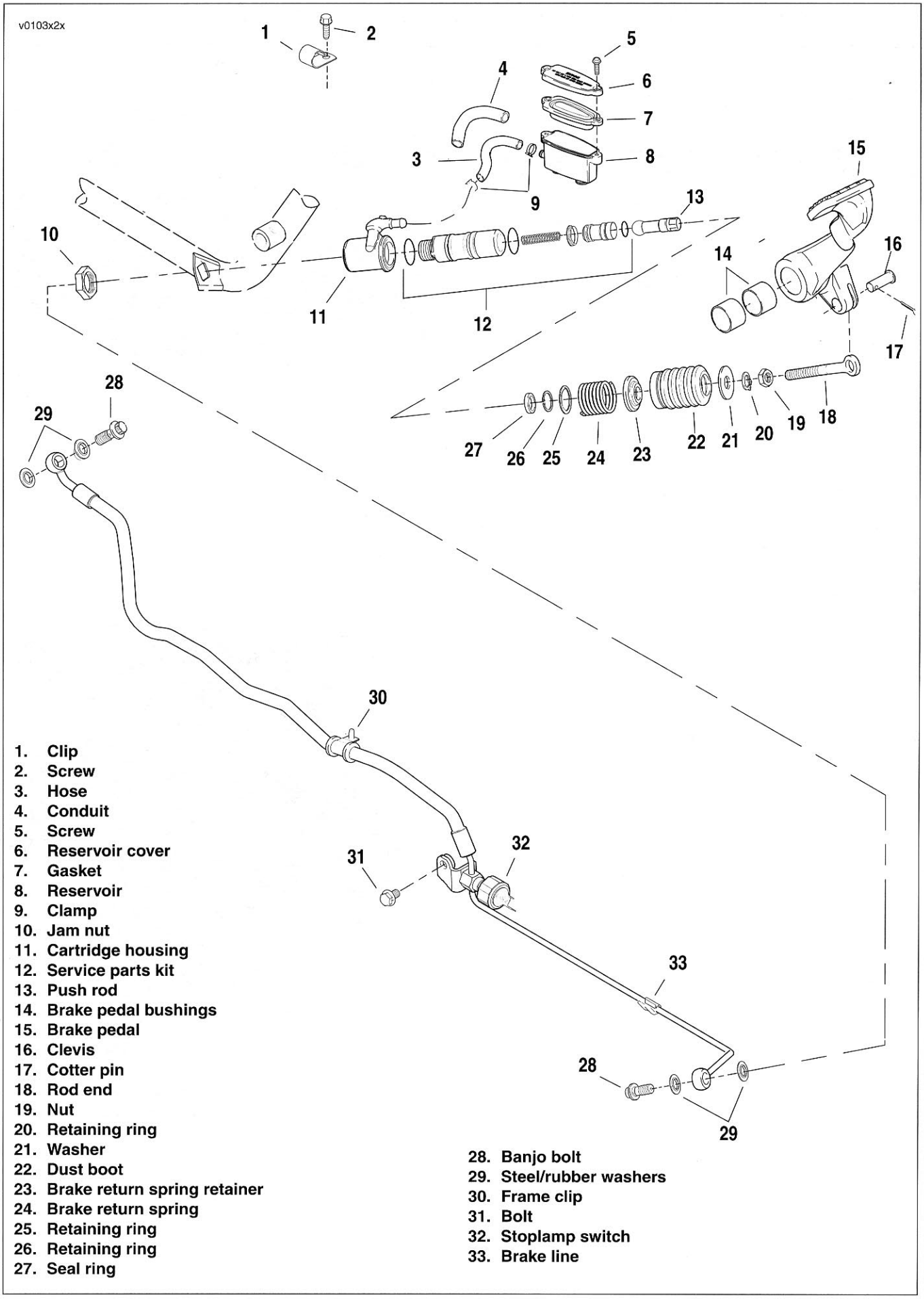
GENERAL

Master cylinders designed for dual disc (two caliper) operation have an 17.5 mm (11/16 inch) bore.



1. Screw
2. Sight glass
3. Cover
4. Gasket
5. Master cylinder reservoir
6. Collar
7. Steel/rubber washers
8. Banjo bolt
9. Brake line
10. Bushing
11. Brake hand lever
12. Retaining ring
13. Spring retainer
14. Spring
15. Primary cup
16. Piston
17. O-ring
18. Wiper
19. Piston cup
20. Handlebar clamp
21. Screw and washer
22. Pivot pin

Figure 2-39. Front Brake Master Cylinder



1. Clip
2. Screw
3. Hose
4. Conduit
5. Screw
6. Reservoir cover
7. Gasket
8. Reservoir
9. Clamp
10. Jam nut
11. Cartridge housing
12. Service parts kit
13. Push rod
14. Brake pedal bushings
15. Brake pedal
16. Clevis
17. Cotter pin
18. Rod end
19. Nut
20. Retaining ring
21. Washer
22. Dust boot
23. Brake return spring retainer
24. Brake return spring
25. Retaining ring
26. Retaining ring
27. Seal ring
28. Banjo bolt
29. Steel/rubber washers
30. Frame clip
31. Bolt
32. Stoplamp switch
33. Brake line

Figure 2-51. Rear Brake Master Cylinder/Reservoir

REMOVAL

1. Remove right side cover and maxi-fuse.
2. Remove rear view mirrors and turn signals.
3. Remove throttle cables from throttle control. See 2.12 THROTTLE CABLES.
4. Remove front brake master cylinder/reservoir, turn signal assembly, and throttle control from right handlebar. See 2.17 FRONT BRAKE MASTER CYLINDER/RESERVOIR.
5. Cut clip holding wiring harness to right handlebar.
6. Remove clutch master cylinder/reservoir, turn signal assembly from left handlebar. See 2.13 CLUTCH MASTER CYLINDER/RESERVOIR.
7. Cut clip holding wiring harness to left handlebar.
8. See Figure 2-61. To free lower end of top handlebar cover, loosen mounting bolts (3) holding headlamp bracket (2) to upper triple clamp (1).
9. See Figure 2-62. Without removing cover, remove fasteners (7) holding top handlebar cover (2) and instrument bezel (1) to lower handlebar cover (6).

CAUTION

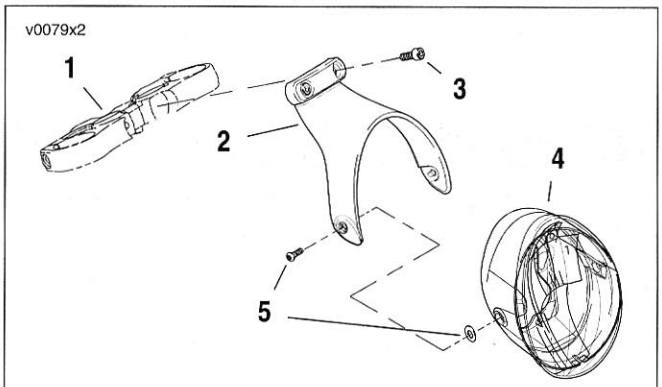
See Figure 2-62. Snap and hook at bottom of bezel holding top cover to lower handlebar cover can be damaged if forced during removal or installation.

10. From headlamp bracket end of cover, gently tilt top handlebar cover (2) and instrument bezel (1) up and back to remove cover and bezel.

NOTE

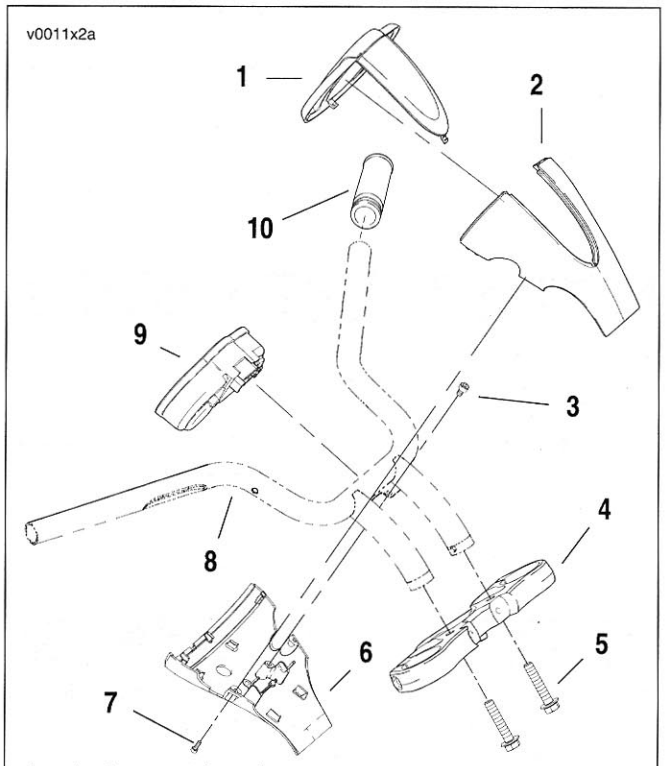
Bezel can remain snapped to upper handlebar cover.

11. Remove wiring harness connector to instrument cluster (9) and remove instrument cluster.
12. Remove fasteners (7) holding lower handlebar cover (6) to handlebars (8).
13. If necessary, remove the handgrip (10).
14. Remove fasteners (5) holding handlebars to upper triple clamp (4). Remove handlebars.



1. **Upper triple clamp**
2. **Headlamp bracket**
3. **Mounting bolt**
4. **Headlamp assembly**
5. **Headlamp assembly fastener and washer**

Figure 2-61. Headlamp Bracket and Headlamp Assembly



1. **Instrument bezel**
2. **Top handlebar cover**
3. **Lower cover fasteners**
4. **Upper triple clamp**
5. **Bolts**
6. **Lower handlebar cover**
7. **Top cover fasteners**
8. **Handlebar**
9. **Instrument cluster**
10. **Handgrip**

Figure 2-62. Handlebar Assembly

INSTALLATION

1. Install wheel into rear fork.
2. Slide drive belt over drive sprocket.
3. Slide brake calipers over front brake disc between brake pads. Lubricate rubber bumper with a detergent spray and slide slot in the caliper over brake anchor weldment on rear fork. Be sure rubber bumper is in place under weldment.
4. Coat axle with LOCTITE® ANTI-SEIZE LUBRICANT and install.
   a. From left side, carefully insert axle through rear fork, left side spacer, drive sprocket, compensator cushion, into wheel assembly.
   b. Continue sliding axle through wheel assembly hub sleeve, right side spacer, brake caliper, and left rear fork. Center right side spacer on wheel bearing to allow axle to pass through. Axle is fully installed when left side cam is tight against rear fork.
   c. Slip on right side axle adjuster. Right side axle adjuster will only fit in a manner that matches position of left side eccentric.
   d. Coat flange of axle nut with LOCTITE® ANTI-SEIZE LUBRICANT and thread on and finger tighten axle nut.

⚠WARNING

Whenever a wheel is installed, BEFORE moving motorcycle, you must pump brake fluid until the pistons push the pads against the brake disc. If you don't pump fluid pressure up again, the brakes will not be available to stop the motorcycle which could result in death or serious injury.

5. Pump brake pedal to move pistons out until they contact both brake pads. Verify piston location against pads.
6. Verify axle alignment and then check belt deflection. See 1.14 REAR BELT DEFLECTION.
7. Use a wrench to rotate rear axle adjuster until drive belt deflection is within specifications.

⚠WARNING

Do not exceed 142 Nm (105 ft-lbs) when tightening the axle nut. Exceeding 142 Nm (105 ft-lbs) will cause the wheel bearings to seize during vehicle operation, which could result in death or serious injury.

8. Tighten axle nut to 129-142 Nm (95-105 ft-lbs).
9. Install snap ring.
10. If belt guard was removed, slide belt guard slots onto rubber grommets. Thread shock mount bolt into belt guard and tighten shock mount bolt to 41-68 Nm (30-50 ft-lbs).
11. Slide debris deflector slots on to its corresponding rubber grommet. Install debris deflector bolt and tighten bolt to 6-10 Nm (53-88 **in-lbs**).
12. Measure belt guard to drive sprocket clearance.
13. If clearance is less than 5 mm (0.197 in.), protect guard/sprocket and adjust as required.
14. Replace maxi-fuse and right side cover.

REMOVAL

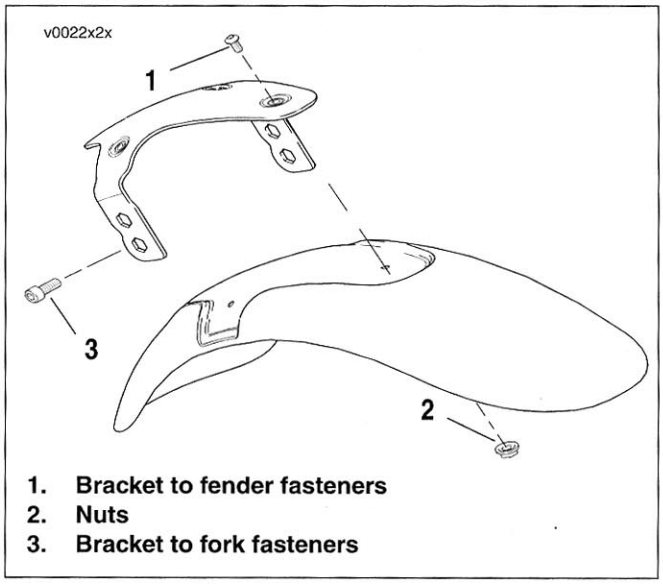
CAUTION

Be careful lifting fenders out of forks or you may scratch the paint. If necessary, cover fender with a clean shop rag to prevent damage.

1. See Figure 2-86. Remove fasteners (3) from front fork and remove fender and bracket.
2. Remove fasteners (1, 2) that hold bracket to fender and separate bracket and fender.

INSTALLATION

1. See Figure 2-86. Attach fender to fender bracket. Tighten fasteners (1, 2) to 4.1-6.8 Nm (36-60 **in-lbs**).
2. Position fender and bracket in front fork and secure with fasteners (3)/ Tighten to 20-26 Nm (15-19 ft-lbs).



1. **Bracket to fender fasteners**
2. **Nuts**
3. **Bracket to fork fasteners**

Figure 2-86. Front Fender

REMOVAL

Belt Guard

1. See Figure 2-99. Unthread left side lower shock mount bolt from belt guard (1) without removing shock mount bolt from rear fork.
2. Pull belt guard (1) rearward off of side rubber grommet (5) and upper rubber grommet (6). If necessary, remove fasteners (3) holding grommets (5, 6) to rear fork.
3. Inspect rubber grommets (5, 6) on the rear fork and remove the bolts and rubber grommets if necessary.

Debris Deflector

1. See Figure 2-99. Remove bolt (3) and washer (4) from the underside of the rear fork near the rear shock mount.
2. Pull the debris deflector (8) rearward off of the lower rubber grommet (7) and remove the debris guard.
3. Inspect the rubber grommet (7) on the rear fork and remove the bolt and rubber grommet if necessary.

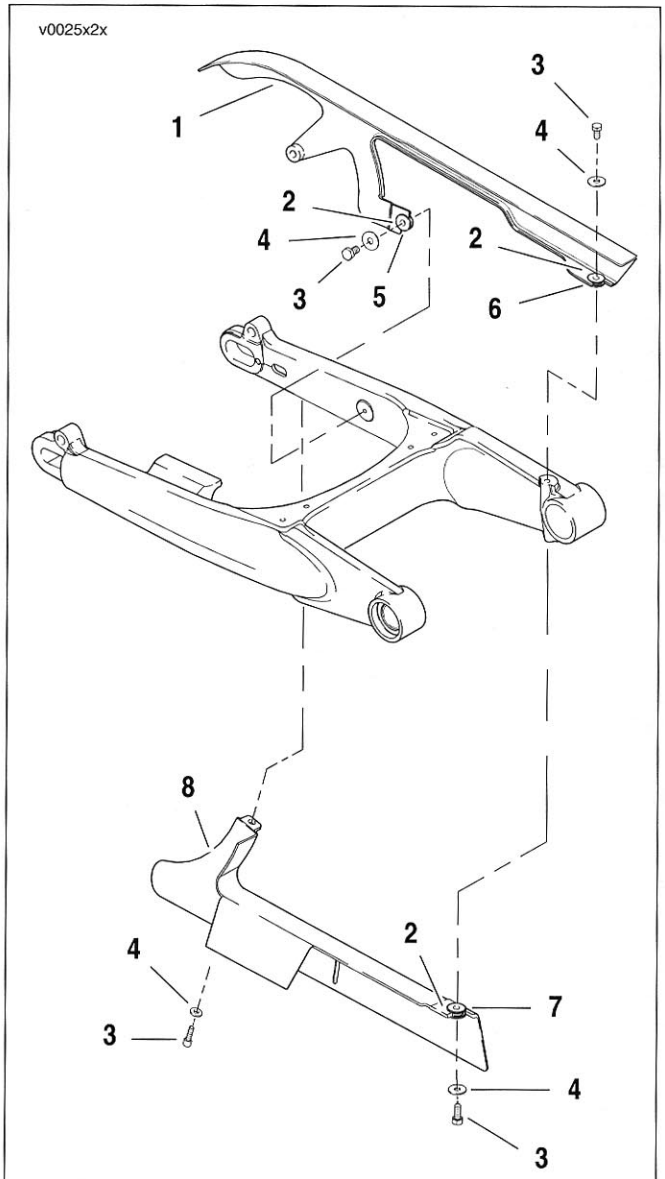
INSTALLATION

Belt Guard

1. See Figure 2-99. If necessary, replace the rubber grommets (5, 6) and bolts. Tighten bolts to 6-10 Nm (53-88 **in-lbs**).
2. Slide the belt guard slots into position on the rubber grommets.
3. Thread lower rear shock mount into thread boss on belt guard. Tighten to 41-68 Nm (31-50 ft-lbs).
4. Measure guard to drive sprocket clearance.
5. If clearance is less than 5 mm (0.197 in.), protect guard/sprocket and adjust as required.

Debris Deflector

1. See Figure 2-99. If necessary, replace rubber grommet (7) and bolt (3). Tighten bolt to 6-10 Nm (53-88 **in-lbs**).
2. Slide debris deflector slot (2) into position on the rubber grommet (7).
3. Thread rear bolt (3) and washer (4) through debris deflector (8) into rear fork. Tighten bolt to 6-10 Nm (53.1-88.5 **in-lbs**).

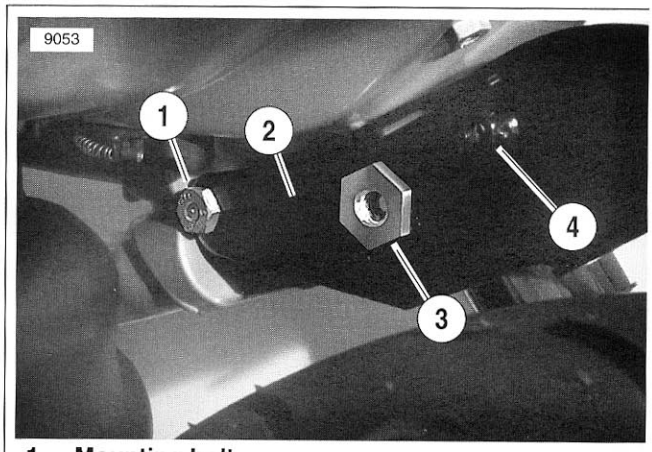


1. **Belt guard**
2. **Slot**
3. **Bolt**
4. **Washer**
5. **Side rubber grommet**
6. **Upper rubber grommet**
7. **Lower rubber grommet**
8. **Debris deflector**

Figure 2-99. Belt Guard/Debris Deflector

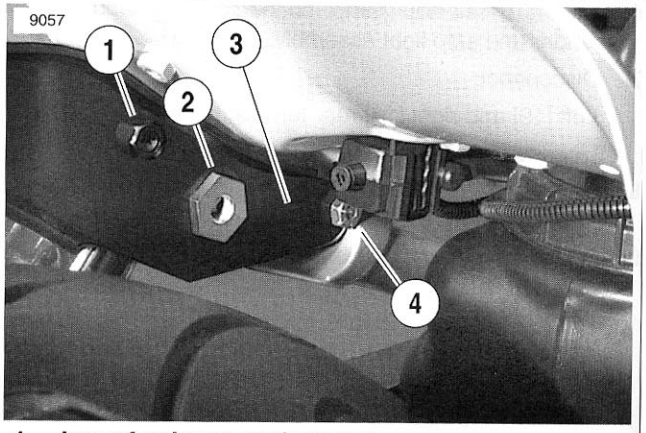
INSTALLATION

1. Install mudflap and stud plate to frame fender weldment. Tighten to 8-12 Nm (70.8-106.2 **in-lbs**).
2. See Figure 2-110. Loosely install both fender support brackets (2). Finger tighten fasteners (1).
3. Insert upper shock mounting nut (3) through support bracket and into frame side rails.
4. Lower motorcycle on rear tire to align rear shock mounting eye with mounting nuts. Install rear shock mounting bolt and spacers. See 2.32 REAR SHOCK ABSORBERS.
5. Tighten fasteners:
   a. Rear shock mounting bolts - 41-68 Nm (30-50 ft-lbs).
   b. Fender support bracket fasteners - 34-41 Nm (25-30 ft-lbs).
6. Install inner fender. Tighten fasteners to 20-26 Nm (15-19 ft-lbs).
7. Route wiring harness for tail/stop lamp, license plate lamp, and turn signals. Install turn signal and license plate bracket assembly. Tighten to 8-12 Nm (71-106 **in-lbs**).
8. Connect:
   a. Left [19] and right [18] rear turn signals.
   b. License plate lamp connector [45].
   c. Tail/stop lamp connector [93].



1. **Mounting bolt**
2. **Fender support bracket**
3. **Upper shock mounting nut**
4. **Inner fender mounting stud**

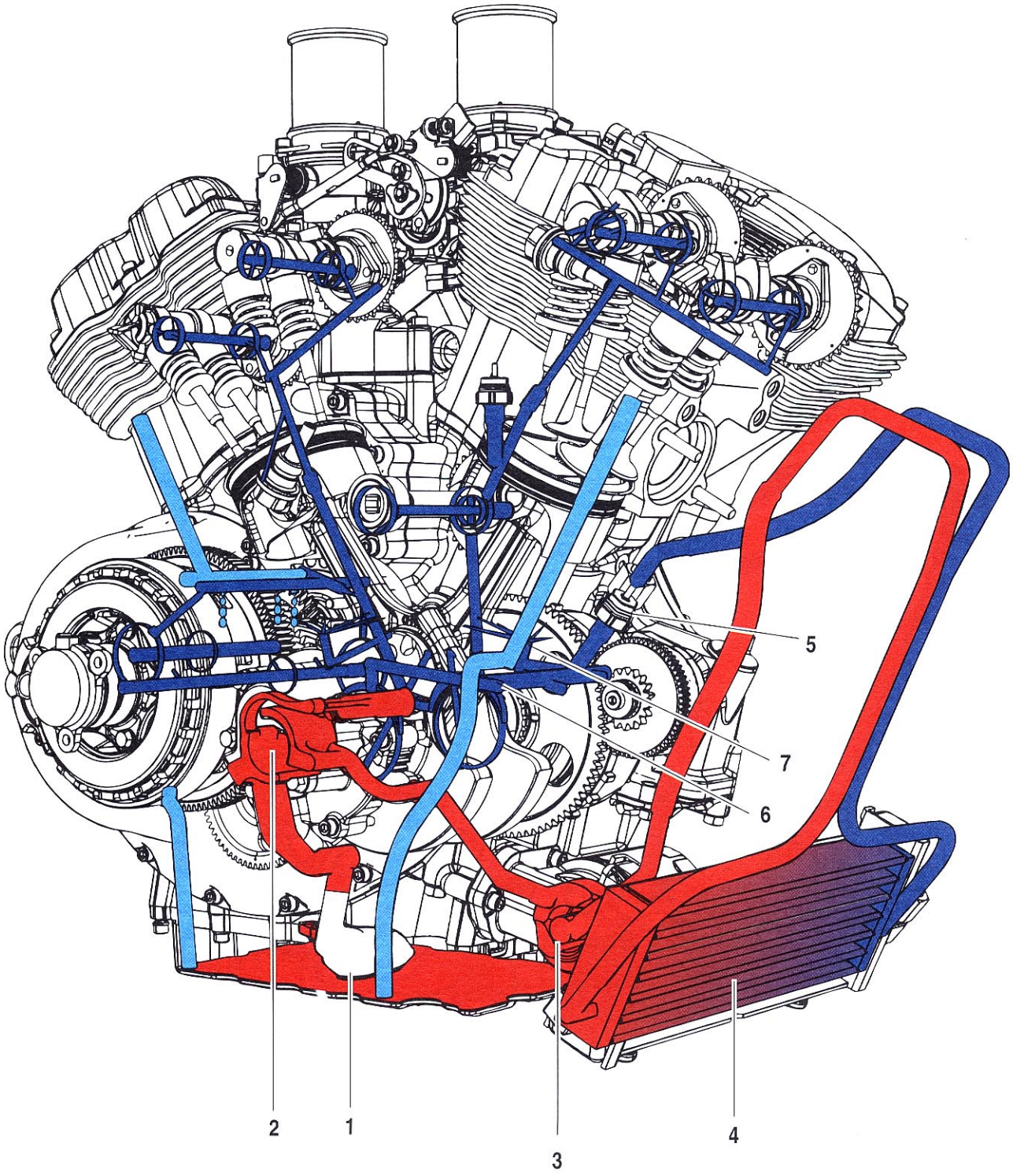
Figure 2-110. Right Side Fender Support Bracket



1. **Inner fender mounting stud**
2. **Lower shock mounting nut**
3. **Fender support bracket**
4. **Mounting bolt**

Figure 2-111. Left Side Fender Support Bracket

vrod_02



Red - Hot Oil
Blue - Cooled Oil
Light Blue - Return Oil

Figure 3-1. Oil Flow A

INSTALLATION

1. Assemble fuel rail and fuel injectors. See 9.9 FUEL RAIL/ FUEL INJECTORS.
2. Connect engine harness at connector [145].
3. Connect engine coolant temperature sensor connector [90] and oil pressure sending unit connector [120].
4. See Figure 3-14. Connect connector [84], front injector and connector [85], rear injector on fuel rail.
5. Supporting fuel rail oriented with fuel tubes toward the left rear, push rear injector into bore in intake runner.
6. Swing fuel rail over and push front injector into intake runner in front cylinder.
7. Rotate rubber boots under fuel rail and install rubber boots over intake runners.
8. Install fasteners through fuel rail into rubber boots. Tighten to 9.7 Nm (85 **in-lbs**).
9. See Figure 3-16. Orient intake clamps as shown.
10. Press throttle body and cables into rubber boots.
11. See Figure 3-17. Tighten intake hose clamps (7) to 1.25 Nm (11 **in-lbs**).
12. See 1.19 SPARK PLUG/COIL. Install spark plugs and coils. Tighten to:
    a. Tighten spark plugs to 23 Nm (17 ft-lbs).
    b. Tighten coil fasteners to 9.7 Nm (85 **in-lbs)**.
13. Attach the idle speed control (IAC) connector.
14. Attach the throttle position (TP) sensor.
15. Install right angle connectors on rigid fuel lines from fuel rail. Push until audible "click" is heard.

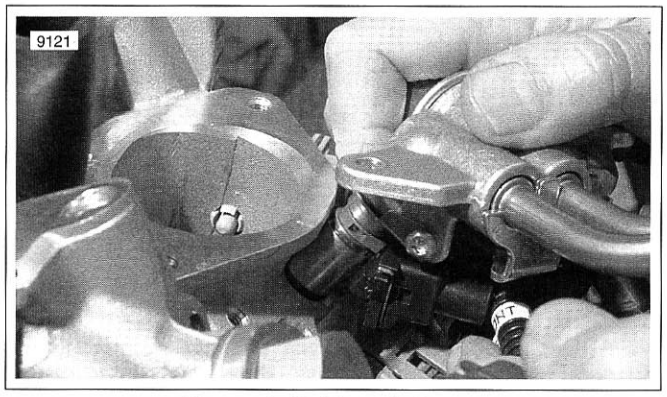


Figure 3-15. Front Injector

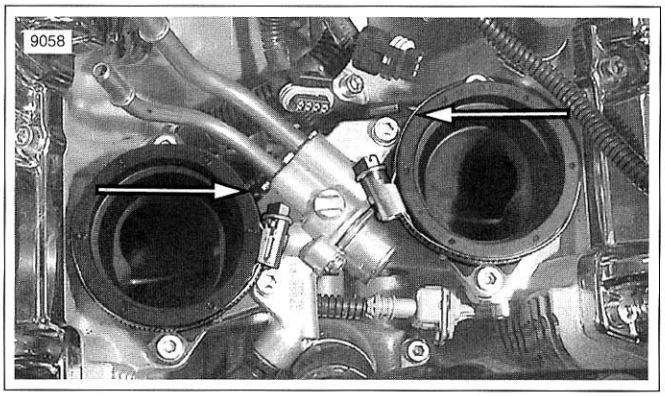
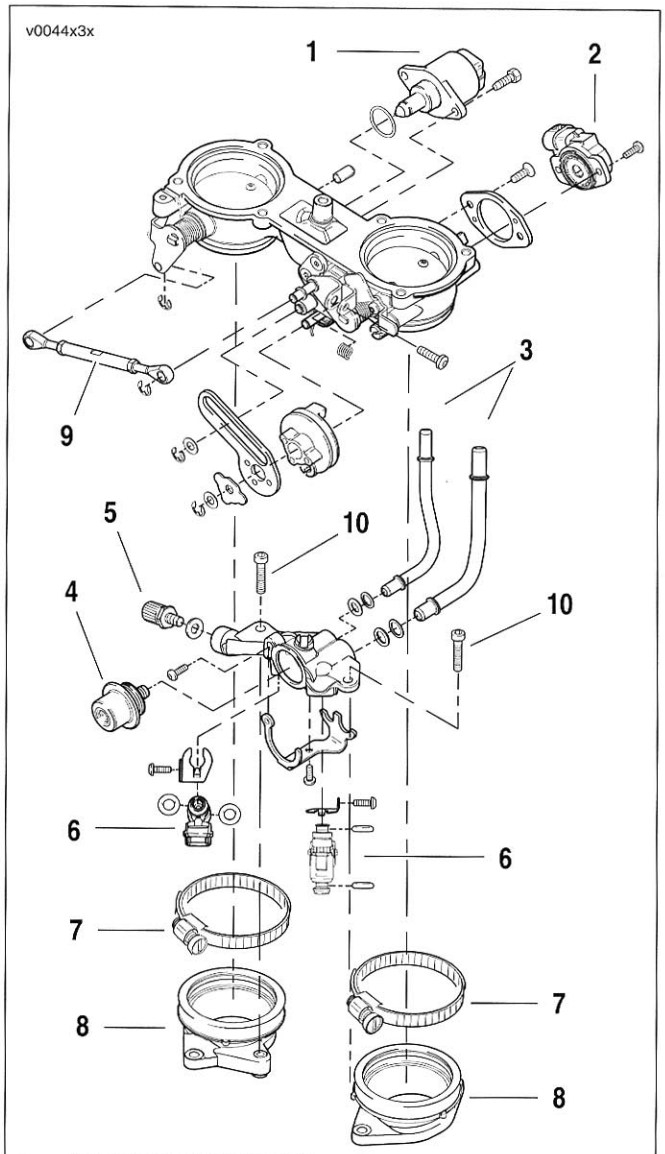


Figure 3-16. Throttle Body Intake Clamps



1. **Idle air control motor**
2. **Throttle position sensor**
3. **Fuel rail**
4. **Fuel pressure regulator**
5. **Fuel pressure check**
6. **Injector**
7. **Hose clamp @ 1.25 Nm (11 in-lbs)**
8. **Rubber boot**
9. **Linkage rod**
10. **Fasteners @ 9.7 Nm (85 in-lbs)**

Figure 3-17. Throttle Body and Fuel Rail

13. See Figure 3-49. Remove and replace the valve guides that do not meet specifications. Position head for removal of valve guide. Use CYLINDER HEAD SUPPORT STAND (HD-39782) with CYLINDER SUPPORT ADAPTER (HD-39782-13) for intake valves and CYLINDER SUPPORT ADAPTER (HD-39782-14) for exhaust valves.

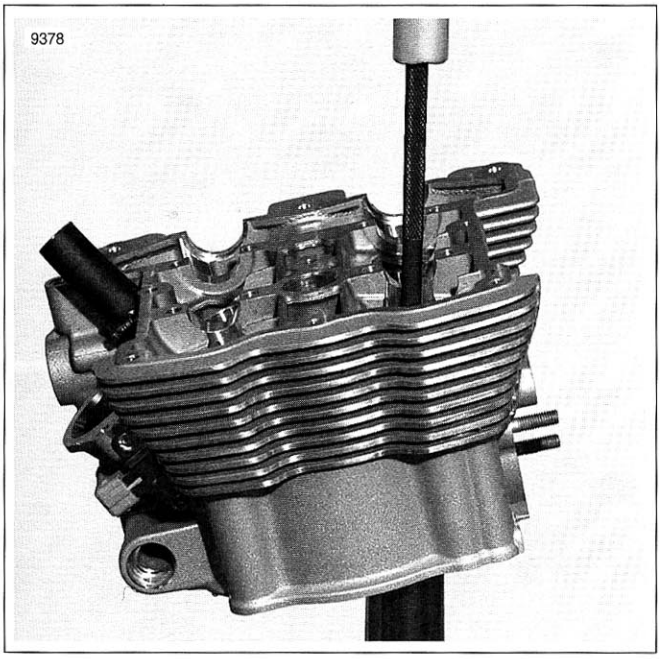


Figure 3-49. Valve Guide Removal

14. See Figure 3-50. Measure cylinder valve guide bore to determine valve guide diameter needed. Select valve guide no larger than 0.051 mm (0.0020 in.) to 0.022 mm (0.00086 in.) over size of cylinder bore.
15. See Figure 3-51. Use VALVE GUIDE REMOVER/INSTALLER (HD-45320) to install valve guide at correct height.

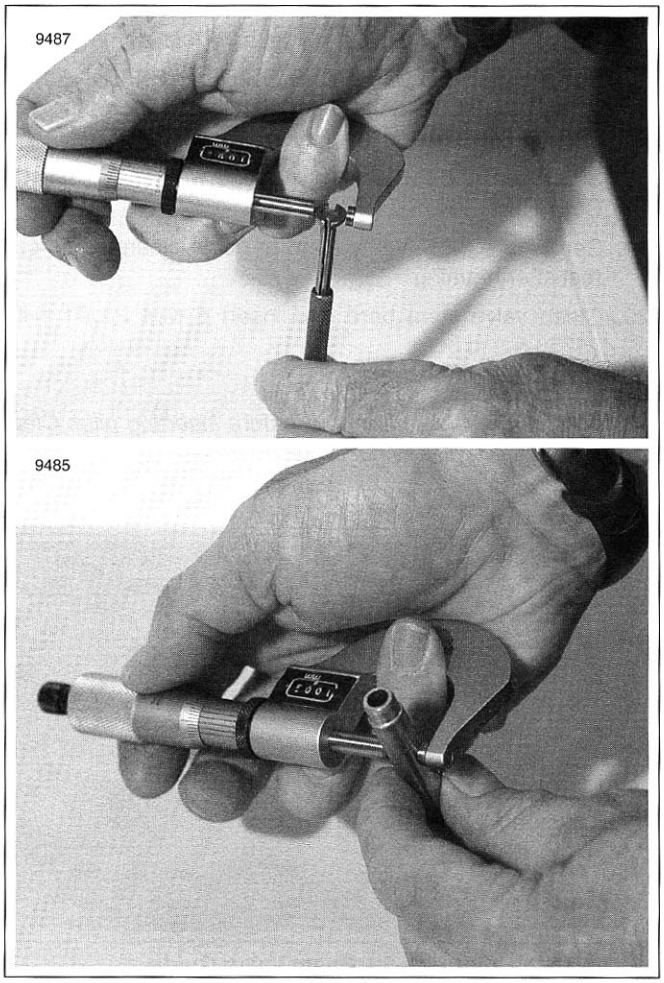


Figure 3-50. Valve Guide Dimensions

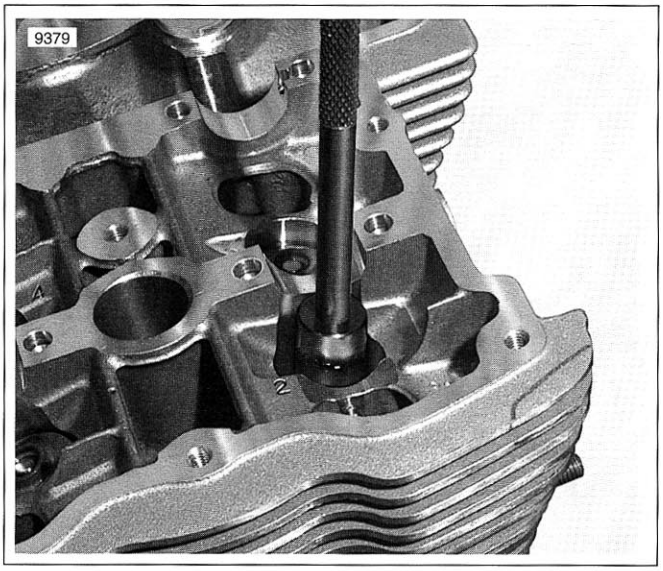


Figure 3-51. Valve Guide Installation

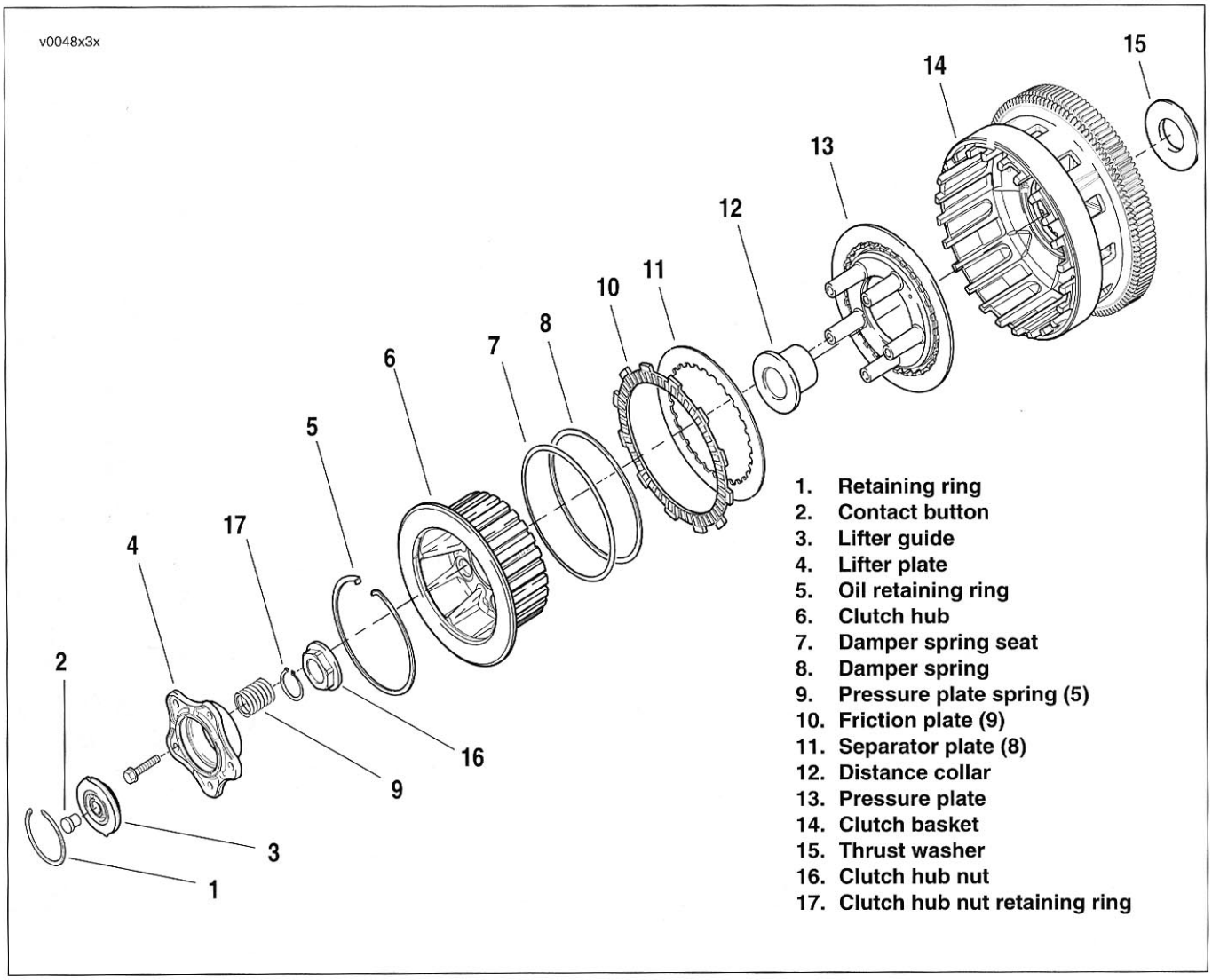


Figure 3-77. Clutch

⚠WARNING

Always wear proper eye protection when installing retaining rings. Use the correct retaining ring pliers. Verify that the tips of the pliers are not damaged or excessively worn. Slippage may propel the ring with enough force to cause eye injury.

4. See Figure 3-78. Remove retaining ring and lifter guide.

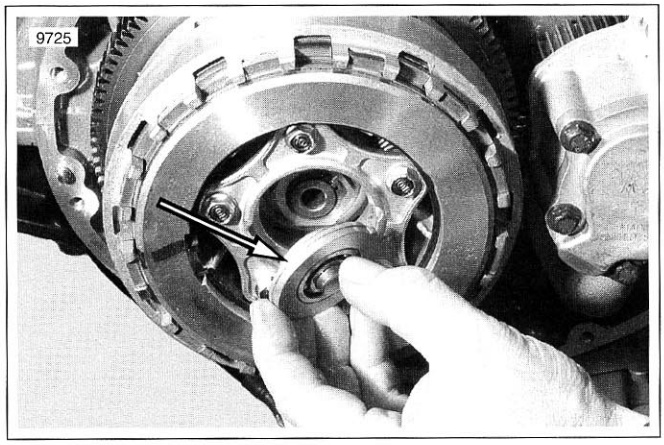


Figure 3-78. Lifter Guide

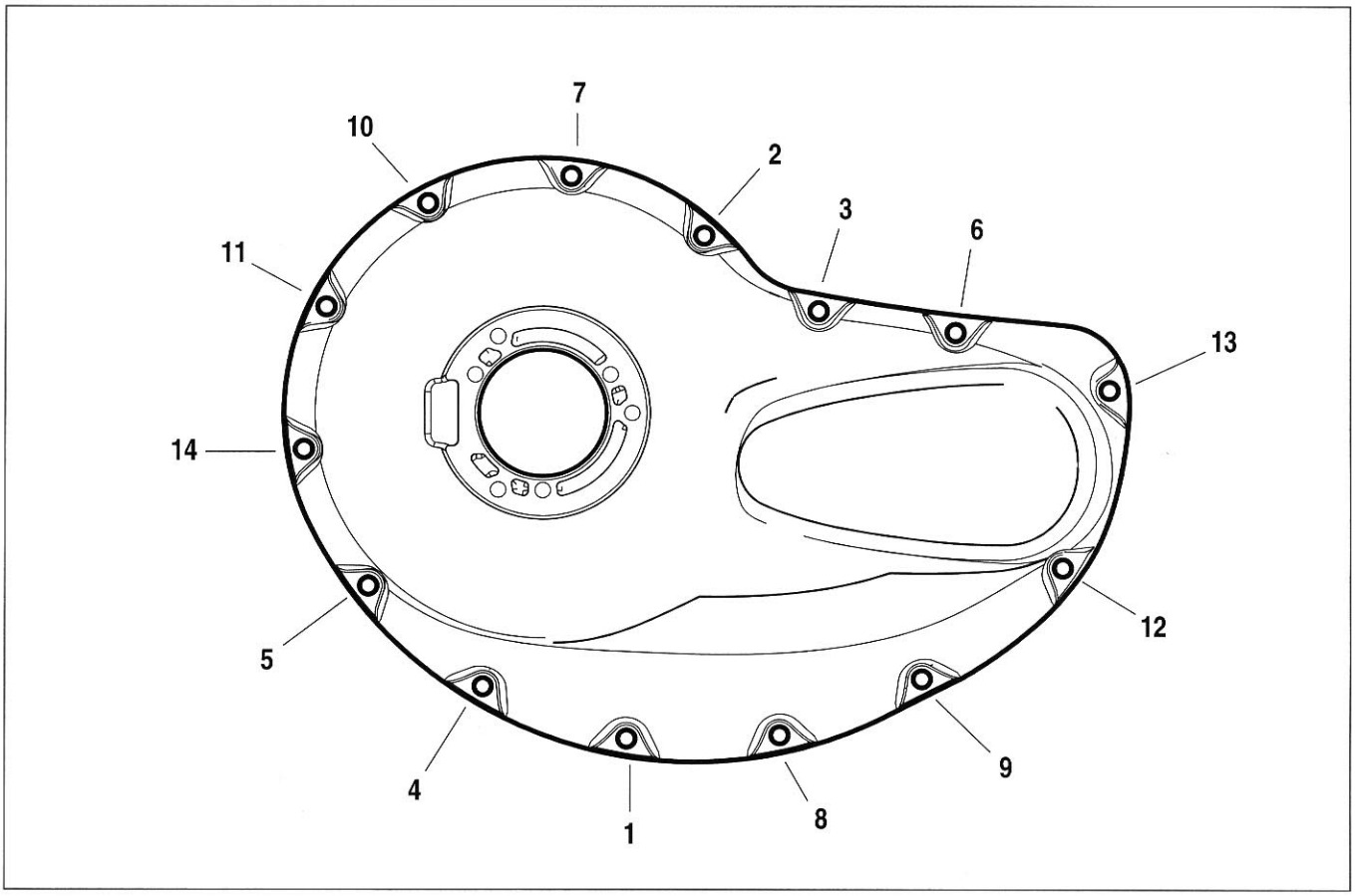


Figure 3-109. Clutch Side Crankcase Cover Torque Sequence @ 9.7 Nm (85 in-lbs)

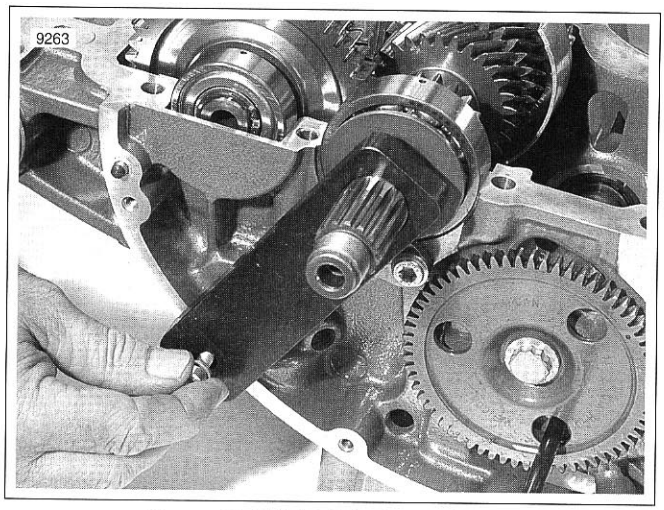


Figure 3-137. Retain Input Shaft

10. See Figure 3-137. Install TRANSMISSION ASSEMBLY RETAINER (HD-45301) on input shaft as shown.

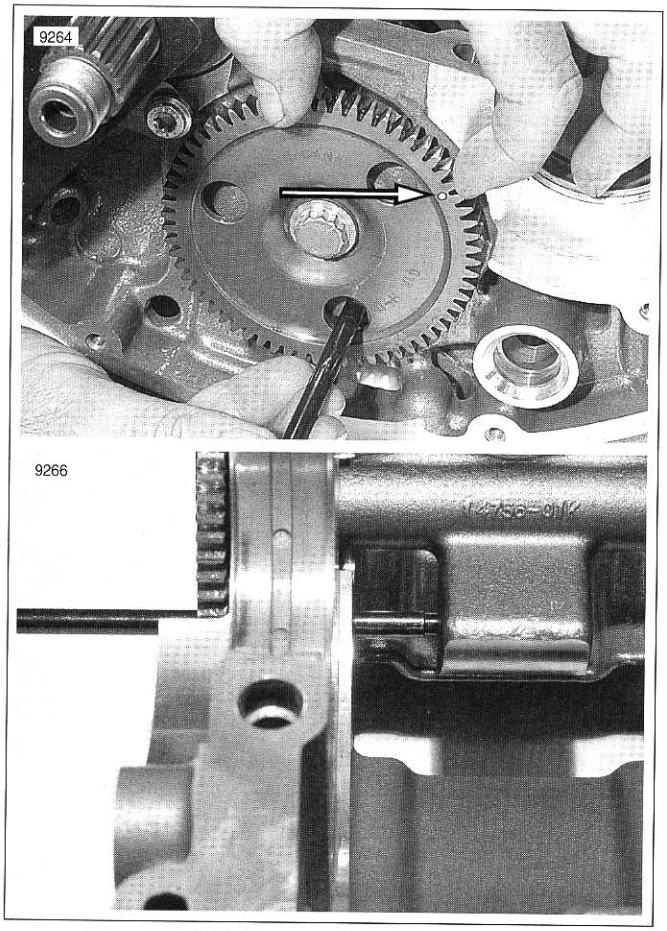


Figure 3-138. Counterbalancer Alignment

11. See Figure 3-138. Install COUNTERBALANCER ALIGNMENT PIN (HD-45311). With the alignment mark in the 2 o'clock position, the case hole and the index hole in the counterbalancer will align.

IMPORTANT NOTE

Crankshaft bearings must be replaced every time the cases are split for service. If the cam drive is not being serviced, crankshaft bearings can be replaced without removing the cam drive chain.

12. Replace the crankshaft bearings at this time. See 3.16 CRANKSHAFT BEARING REPLACEMENT.
13. See Figure 3-139. Lubricate crankshaft bearings, input and output shaft and counterbalancer bearings with Harley-Davidson Motorcycle Oil 20W50. Use Lubriplate No. 105 Assembly Grease (NAPA Part No. 765-2651) on bearing shells.

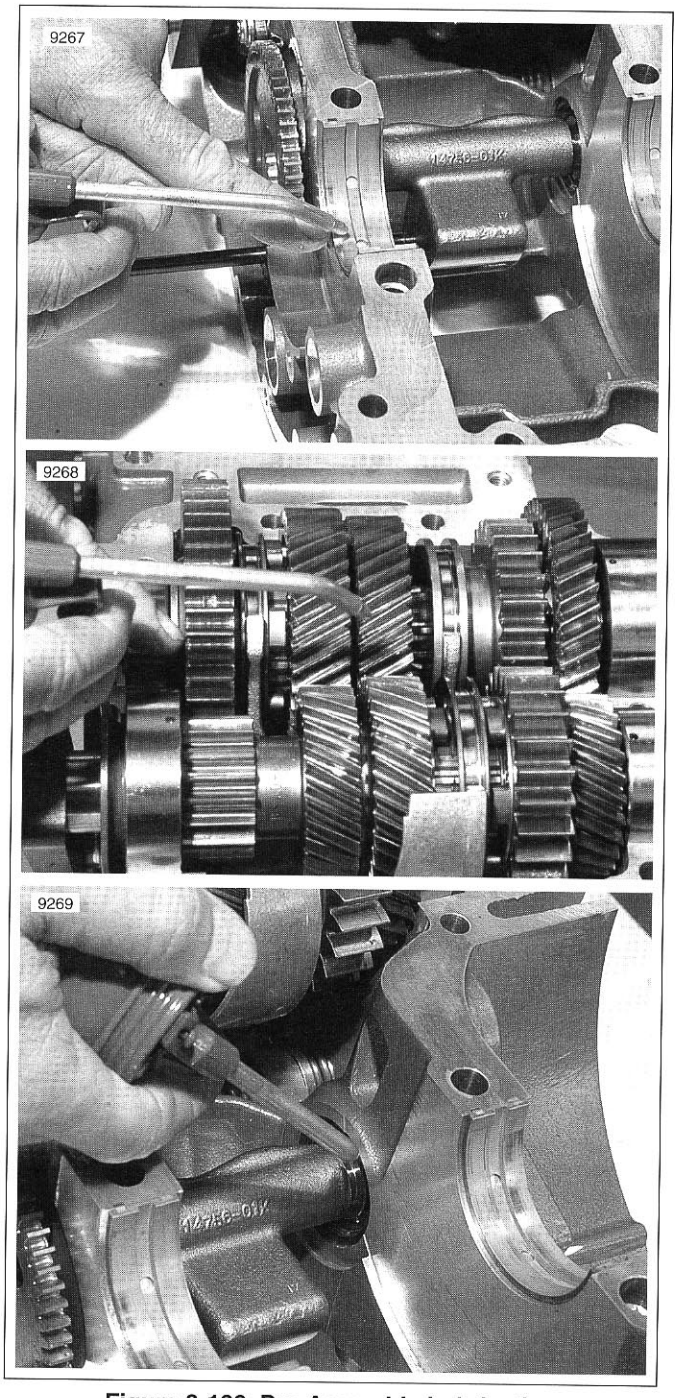


Figure 3-139. Pre-Assembly Lubrication

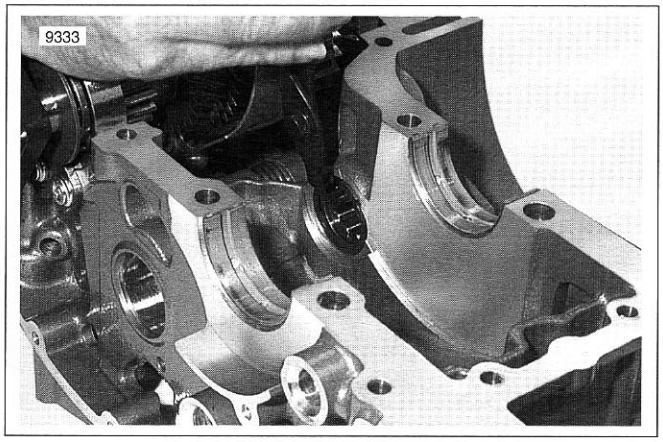


Figure 3-170. Inner Balancer Bearing Installation

5. See Figure 3-170. Install inner retaining ring. Be certain retaining ring is fully seated.

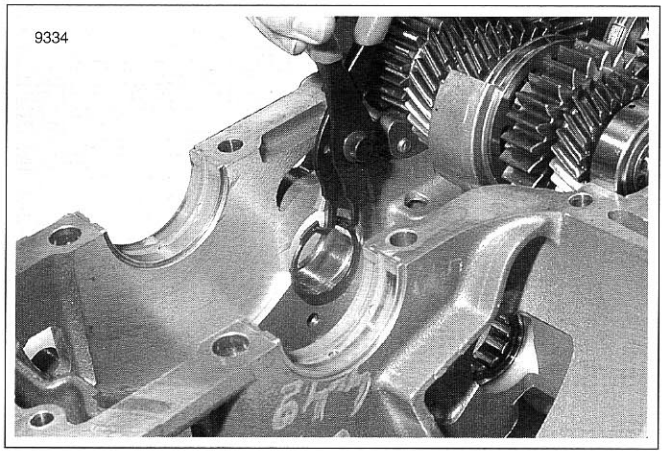


Figure 3-171. Outboard Bearing Inner Retaining Ring Installation

6. See Figure 3-171. Install outboard bearing inner retaining ring. Be certain retaining ring is fully seated.

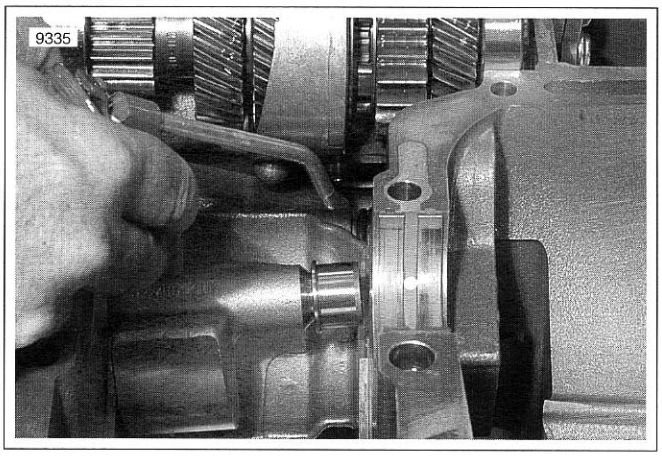


Figure 3-172. Position Counterbalancer

NOTE

Use Harley-Davidson Motorcycle Oil 20W50 to thoroughly lubricate bearing surfaces and case bores before bearing installation process. Use Lubriplate No. 105 Assembly Grease (NAPA Part No. 765-2651) on inner races.

7. See Figure 3-172. Position counterbalancer in case.

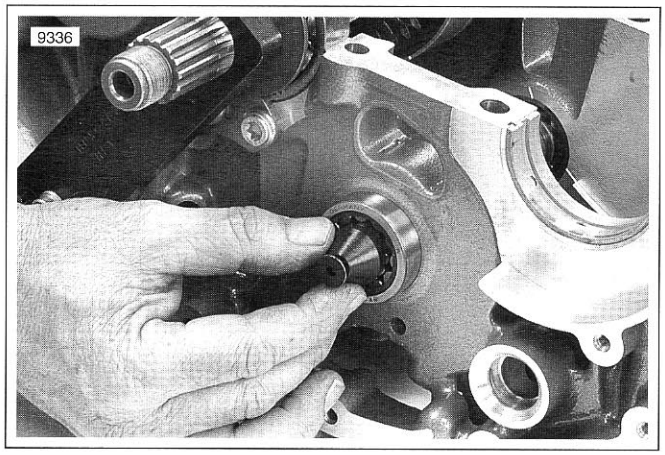


Figure 3-173. Insert Tapered Guide

NOTE

When installing bearings, always drive/push against the side of the bearing with the manufactures lettering/part number.

8. See Figure 3-173. Start bearing by hand. Insert tapered guide from the BALANCER BEARING REMOVER/ INSTALLER TOOLS (HD-45490).

18. Match replacement pistons to replacement liners. See Table 3-19.

Table 3-31. Piston to Cylinder Liner

Liner	Piston
Class I	Class I or Class X
Class II	Class II or Class X

19. See Figure 3-205. Measure piston diameter on thrust surface. Measurement should be between a maximum of 99.961 mm (3.9354 in.) and a minimum of 99.953 mm (3.9351 in.) at the largest point of the piston thrust surface.

NOTE

Piston size could vary 0.0076 mm (0.0003 in.) depending on class of piston.

20. See Figure 3-206. EX on piston top goes toward the exhaust valves. Front piston EX will go toward the front of the engine. Rear piston EX will go toward the rear of the engine.

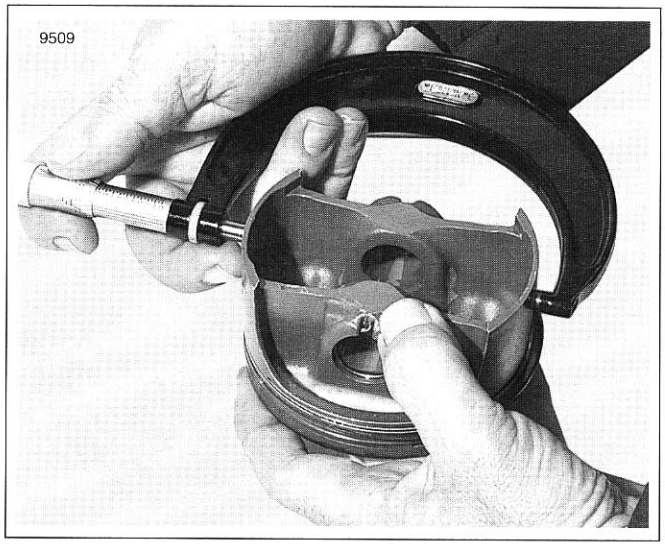


Figure 3-205. Piston Measurement

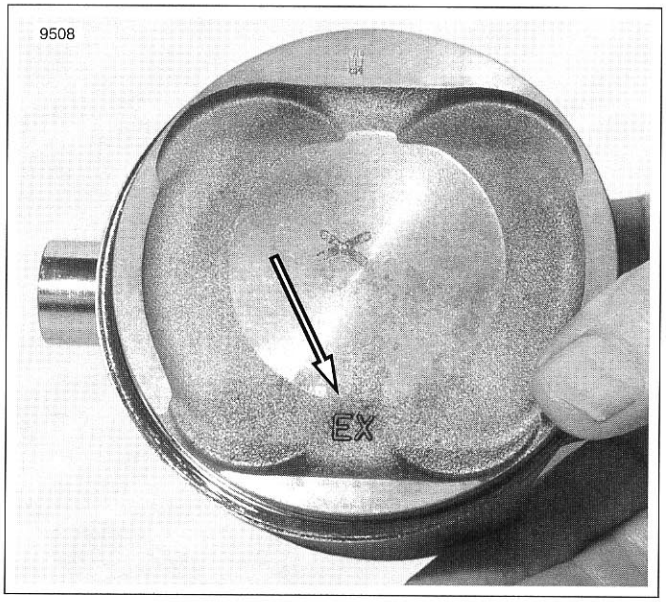


Figure 3-206. Piston Orientation Mark

REPLACEMENT

1. See Figure 3-234. Remove three fasteners and remove oil filter mount.
2. See Figure 3-235. Remove o-ring and discard.
3. Inspect oil passages for debris and dirt. Clean as required.
4. Install **new** o-ring and install oil filter mount.

NOTE

Always replace o-ring when oil filter mount has been removed and/or replaced.

5. Tighten oil filter mount fasteners to 9.7 Nm (85 **in-lbs**).

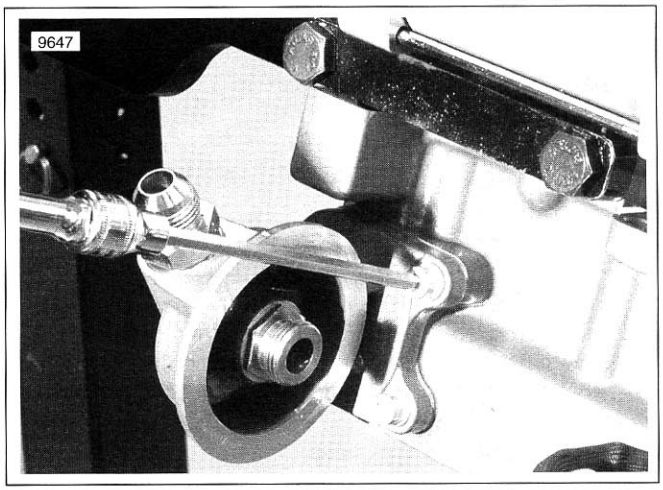


Figure 3-234. Remove Oil Filter Mount Fasteners

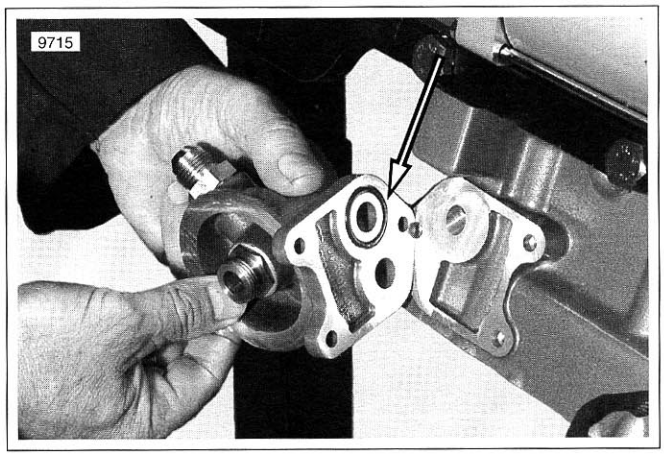


Figure 3-235. Replace O-Ring

20. Lubricate cam journals, lobes, and tappets with Harley-Davidson Motorcycle Oil 20W50. In addition, a thin film of Lubriplate No. 105 Motor Assembly Grease (NAPA Part No. 765-2651) is recommended.

21. See Figure 3-254. Insert front exhaust cam into cylinder head and rotate cam sprocket so single copper link (1) straddles the single dot timing mark labeled EX (2).

22. Insert front intake cam into cylinder head and rotate cam sprocket so single copper link (6) straddles the single dot timing mark labeled IN (5).

23. Install and tighten cam journal caps to 9.7 Nm (85 **in-lbs**).

24. Verify that the single copper links on the front cylinder cam drive chain straddle the single dot timing marks and that the one dot timing line (3) on the exhaust cam and the two dot timing line (4) on the intake cam at the cam cover gasket surface are aligned.

NOTE

Compare lobe positions of each cam shaft to Figure 3-254. If timing marks are correct but camshaft lobes are incorrect, the drive sprocket could be installed incorrectly on the camshaft.

25. Remove TAPPET COMPRESSION TOOL.

26. Install front cylinder cam chain tensioner and tighten to 100 Nm (78 ft-lbs).

27. Check valve lash and adjust as necessary. See 1.22 VALVE LASH.

28. Remove CRANKSHAFT LOCKING PIN (HD-45306).

29. Install the engine timing plug and tighten to 23 Nm (17 ft lbs).

30. Install cam cover and tighten fasteners to 9.7 Nm (86 **in-lbs**) in sequence shown. See 1.22 VALVE LASH.

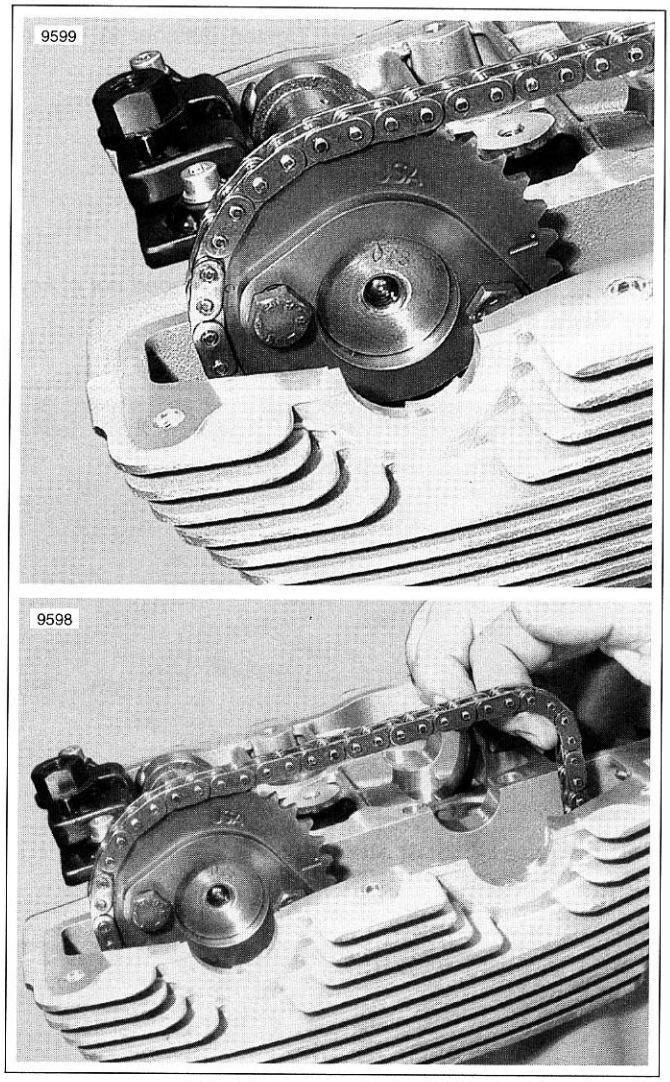


Figure 3-259. Cam Chain Alignment

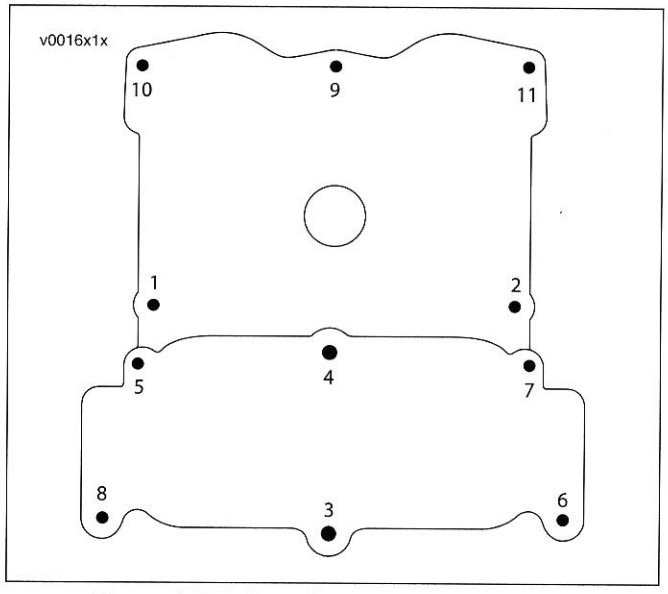
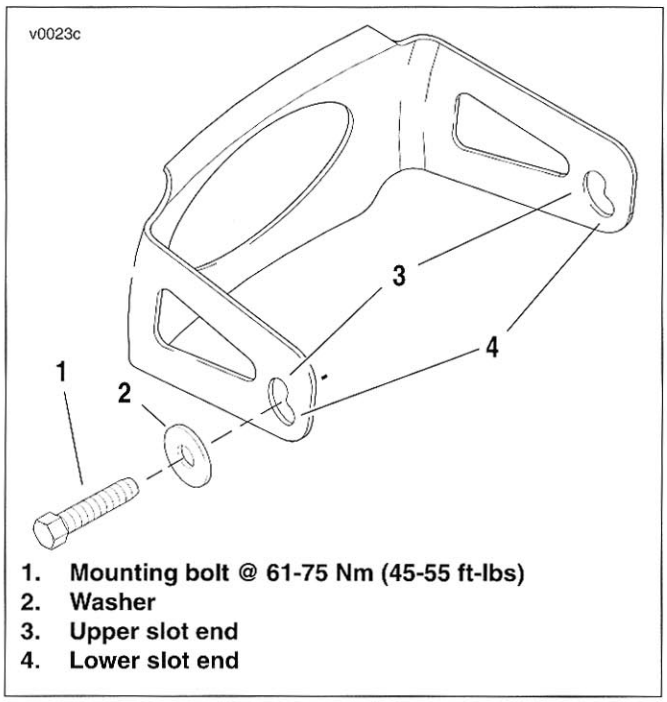


Figure 1-260. Cam Cover Torque Sequence

INSTALLATION

1. Position the fuel tank in the frame and position the fuel tank mounting bracket to the frame.



1. **Mounting bolt @ 61-75 Nm (45-55 ft-lbs)**
2. **Washer**
3. **Upper slot end**
4. **Lower slot end**

Figure 4-7. Fuel Tank Mounting Bracket

2. See Figure 4-7. Loosely thread in the two mounting bolts (1) and washers (2) through the forward lower slot ends (4) of the bracket into the threaded boss on the frame.
3. Evenly press forward and downward on the bracket against the fuel tank until the mounting bolts slide back and up into the upper slot ends (3).
4. Tighten the mounting bolts to 61-75 Nm (45-55 ft-lbs).
5. Connect the fuel module connector while supporting the top plate connector half with the opposite hand.
6. See Figure 4-3. Install the smaller return fuel line (4) and the larger pressure fuel line (3) while supporting the mating port. Press the lines on until the click is heard that indicates engagement.

⚠WARNING

Connecting the fuel lines to the wrong outlet port can result in a reverse flow of gasoline upon start up. Inadequate safety precautions could result in death or injury.

7. Attach the pressure (3) and the return (4) fuel lines to the fuel rail.
8. Press on the vapor vent hose while supporting the mating port with the opposite hand.
9. Install mudflap and stud plate. See 2.36 REAR FENDER/SUPPORTS.
10. Install rear fork. See 2.33 REAR FORK.
11. Install the rear wheel assembly and adjust the drive belt tension. See 2.23 REAR WHEEL.

⚠WARNING

Gasoline is extremely flammable and highly explosive. When servicing the fuel system, do not smoke or allow open flame or sparks in the vicinity. Inadequate safety precautions could result in death or serious injury.

12. Replace the filler boot and fuel the motorcycle as required. Replace the fuel cap.
13. Install airbox. See 1.4 AIRBOX AND AIR FILTER.
14. Connect negative battery cable.
15. Install airbox cover by positioning the airbox cover with the locating pins in the holes on the frame tabs. Turn bail-head fastener 1/4 turn clockwise.
16. Close and latch seat.
17. Replace the maxi-fuse and the side cover.
18. Check fuel system pressure. See 9.10 FUEL PRESSURE TEST.

REMOVAL

NOTE

Before removing the relay, perform diagnostics listed in the VRSCA Electrical Diagnostic Manual.

The starter relay is located beneath the airbox cover in the fuse block.

1. Remove right side cover.
2. See Figure 5-4. Locate and remove maxi-fuse.

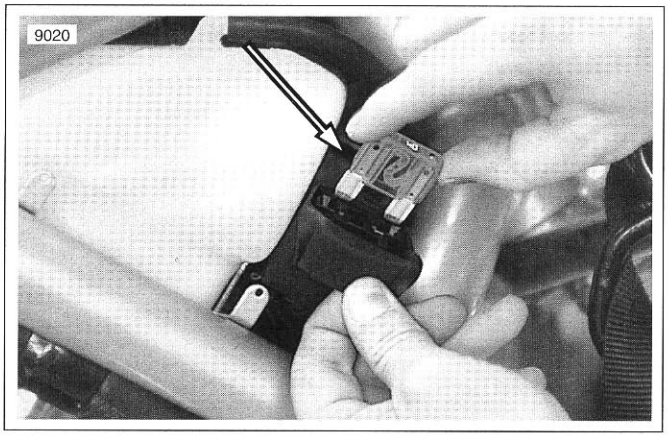


Figure 5-4. Maxi-fuse

3. Unlatch and open seat.
4. Remove the airbox cover. See 1.4 AIRBOX AND AIR FILTER.

⚠WARNING

To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

5. Disconnect the negative battery cable.
6. See Figure 5-5. Locate fuse block behind air cleaner. Pull fuse blocks from tabs on mounting bracket. Tabs on bracket fit into slots on each side of fuse block cover. To remove cover, raise latches slightly to disengage tabs on fuse blocks.
7. Remove gray starter relay from fuse block with single relay.

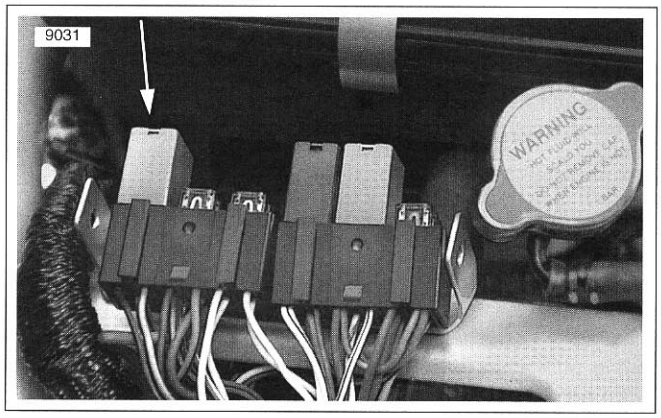


Figure 5-5. Starter Relay (fuse block cover removed)

PRESSURE CAP TEST

PART NO.	SPECIALTY TOOL
HD-45335	Coolant system pressure tester

The pressure cap should be tested for the correct operating range every time the antifreeze is changed or any cooling system maintenance performed.

⚠WARNING

Do not remove the pressure cap when the engine is hot. The cooling system is under pressure and hot coolant and steam may escape causing severe burns. Allow engine to cool before servicing the cooling system.

1. See Figure 6-3. Using a cloth over pressure cap, turn cap 1/4 turn counterclockwise (CCW) to safety stop (2). Let pressure escape. Press down and turn cap to pass over safety stops and remove.
2. Inspect cap for gasket deterioration and broken springs.
3. Turn butterfly valve parallel to boss on COOLANT SYSTEM PRESSURE TESTER (HD-45335) tester head and turn pressure cap adapter onto tester head. Turn butterfly valve perpendicular to seal tester head.

NOTE

To test new caps, wet the upper sealing gasket before turning onto adapter.

4. Turn pressure cap onto adapter. Rotate to safety stops.
5. See Figure 6-4. Pump handle to pressurize pressure limiting valve in cap. Stop pumping when pressure valve in cap opens.
6. Replace pressure cap if:
   a. Leaks below low limit, 96 kPa (14 psi).
   b. Opens above high limit, 124 kPa (18 psi).
   c. Pressure falls rapidly when pressurized within range.
7. Open butterfly valve and remove adaptor and cap.

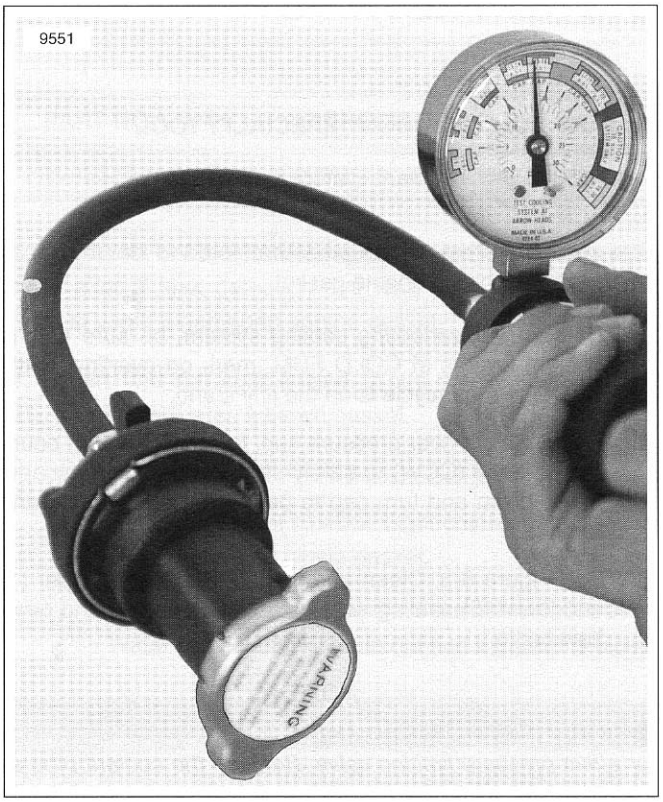
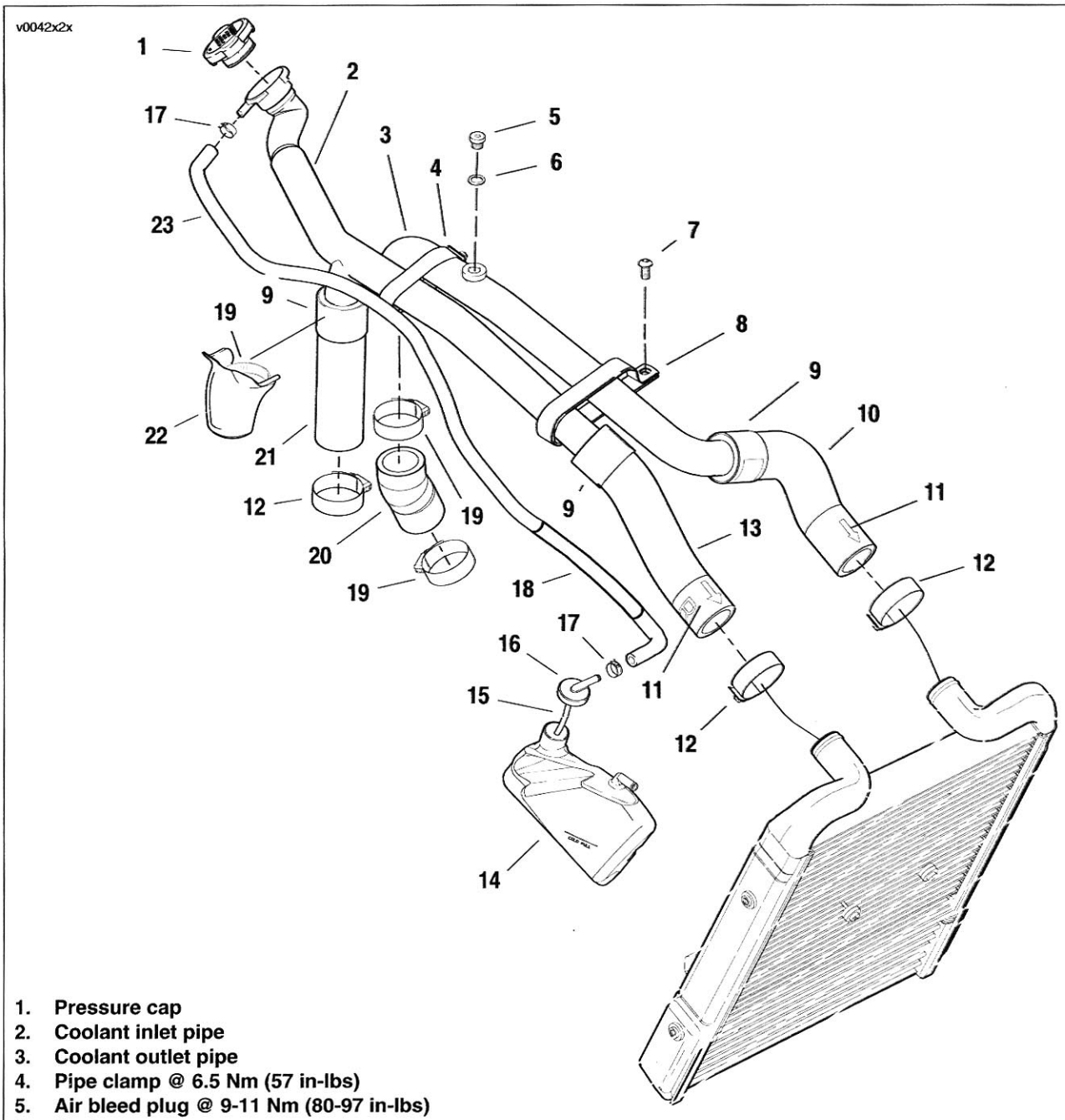


Figure 6-4. Pressure Cap Test



1. Pressure cap
2. Coolant inlet pipe
3. Coolant outlet pipe
4. Pipe clamp @ 6.5 Nm (57 in-lbs)
5. Air bleed plug @ 9-11 Nm (80-97 in-lbs)
6. Seal
7. Fastener
8. P-clamp @ 6-10 Nm (53-88 in-lbs)
9. Shrink clamp
10. Hose - engine coolant outlet pipe to radiator
11. Embossed arrow - top and front
12. Clamp - bright @ 3-4 Nm (27-35 in-lbs)
13. Hose - coolant inlet pipe to radiator
14. Overflow bottle
15. Hose
16. Cap
17. Clamp - overflow hose
18. Sleeve hose
19. Clamp - black @ 3-4 Nm (27-35 in-lbs)
20. Hose
21. Hose
22. Hose cover
23. Overflow hose

Figure 6-16. Coolant Pipes and Hoses

GENERAL

This procedure starts with the input shaft and output shaft removed from the engine. See 3.11 UPPER AND LOWER CRANKCASE SERVICE for removal of input shaft and output shaft.

DISASSEMBLY - 2ND GEAR END

Bearing Removal - 2nd Gear End

PART NO.	SPECIALTY TOOL
HD-45331	Final drive sprocket flange locking tool

1. See Figure 7-1. Remove lock ring from output flange nut.

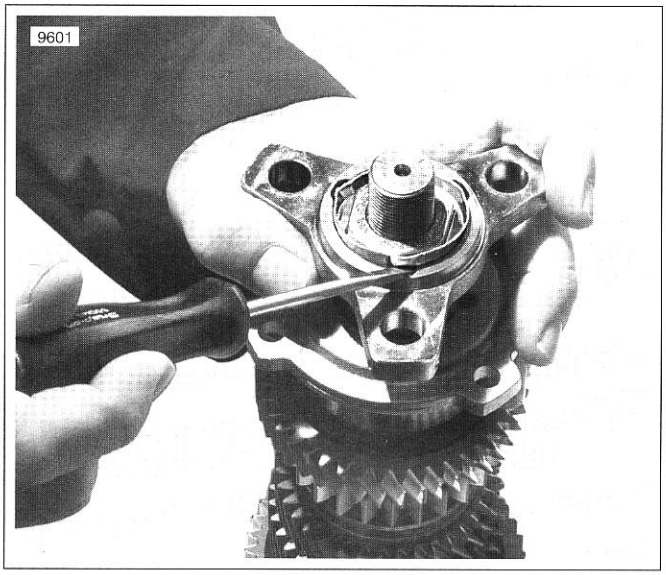


Figure 7-1. Output Shaft Lock Ring

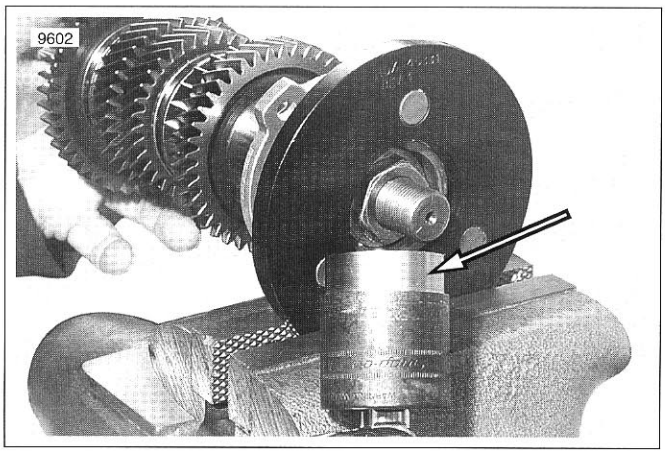


Figure 7-2. Modify Socket for Output Nut Removal

2. See Figure 7-2. Place output shaft in FINAL DRIVE SPROCKET FLANGE LOCKING TOOL (HD-45331) to remove the output shaft nut, use a 30 mm socket cut down to 39.6 mm (1.56 in.) to clear the flange.

NOTE

Output flange nut is one time use only, but do not discard at this time. Retain removed nut to pull flange on shaft during assembly.

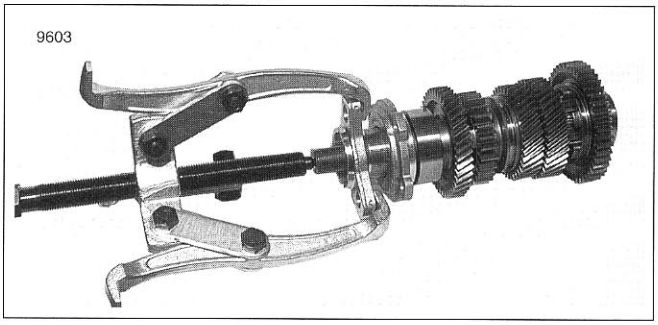


Figure 7-3. Output Drive Flange

3. See Figure 7-3. Remove output shaft drive flange and seal retainer.

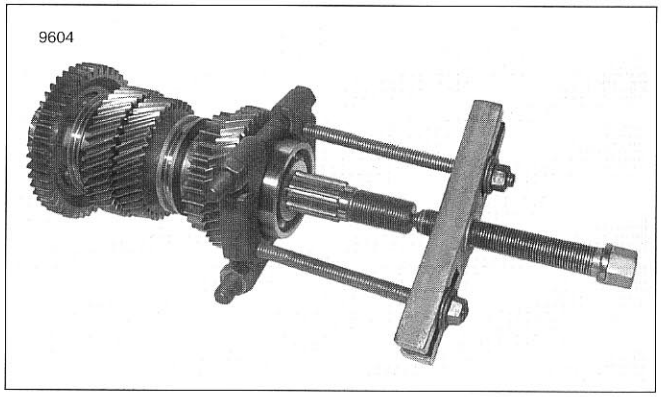


Figure 7-4. Output Shaft Bearing

4. See Figure 7-4. Remove output shaft bearing.

IMPORTANT NOTE

If no further disassembly of this end is needed go to step 5. If further disassembly of this end is needed go to step 13.

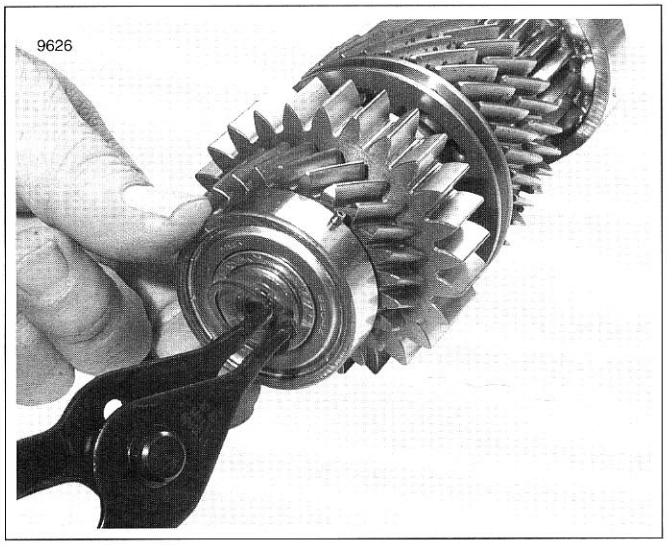


Figure 7-39. 2nd Gear Bearing Retaining Ring

4. See Figure 7-39. Install retaining ring.

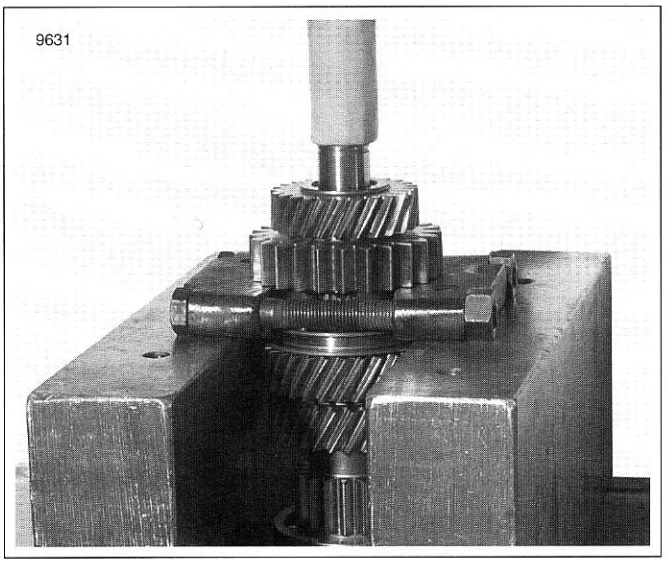


Figure 7-40. 2nd and 5th Gear Removal

5. See Figure 7-40. Place a puller clamp behind 5th gear and press off 2nd and 5th gear. Support the input shaft when removing the gears.

NOTE

2nd gear is an interference fit and MUST be replaced when removed from the input shaft regardless of its condition.

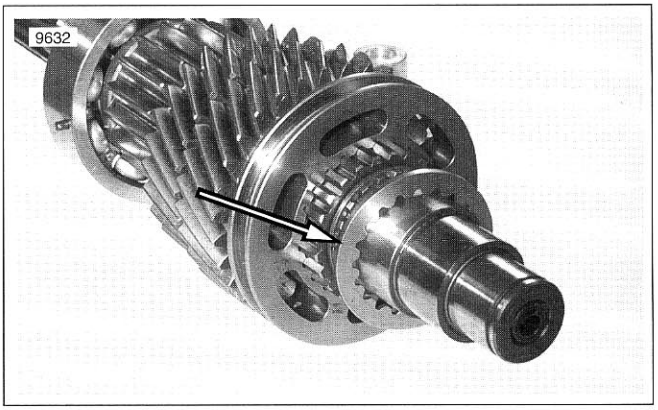


Figure 7-41. Splined Thrust Washer

6. See Figure 7-41. Remove the splined thrust washer.

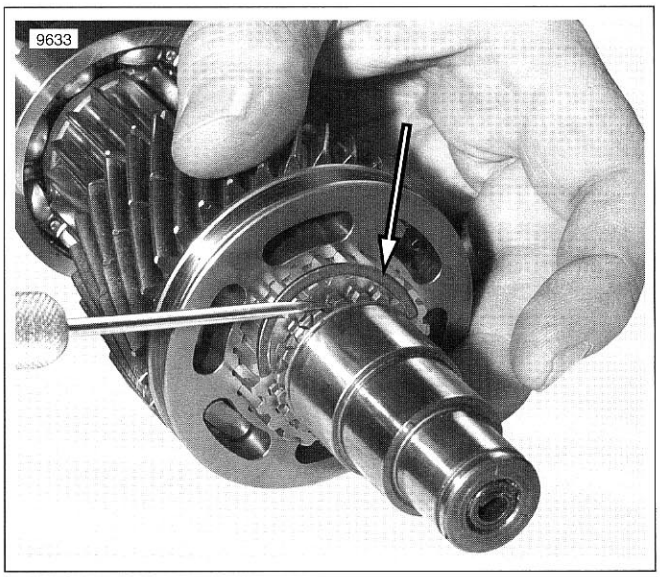


Figure 7-42. Half Moon Keepers

7. See Figure 7-42. Remove half moon keepers.

RELAY/FUSE BLOCK INSTALLATION

1. See Figure 8-1. Slide each relay/fuse block assembly back into relay/fuse block cover. Push relay/fuse block assembly into the cover until cover release tab locks into place.

2. Replace airbox cover. See 1.4 AIRBOX AND AIR FILTER.

3. Turn ignition switch to the FUEL position and close seat. Then turn ignition switch to the LOCK position.

CAUTION

When closing the seat, make sure the ignition switch is in the FUEL position. If the ignition switch is in any other position when the seat is closed, the seat latch mechanism could be damaged.

4. Replace maxi-fuse. See 8.5 MAXI-FUSE.

5. Test the vehicle system that is controlled by the relay or fuse that was replaced.

4. Unscrew the positive battery terminal bolt and remove the battery positive cable from the positive (+) terminal of the battery.
5. Release the battery strap clip and remove the battery from the battery tray.

Cleaning And Inspection

The battery top must be clean and dry. Dirt and electrolyte on top of the battery can cause the battery to self-discharge.

1. Clean the battery top with a solution of baking soda (sodium bicarbonate) and water (5 teaspoons baking soda per quart or liter of water).
2. When the solution stops bubbling, rinse off the battery with clean water.
3. Clean cable connectors and battery terminals using a wire brush or sandpaper; remove any oxidation.
4. Inspect the battery fasteners, clamps, and cables for breakage, loose connections, and corrosion; clean the clamps.
5. Check the battery posts for melting or damage caused by overtightening.
6. Inspect the battery for discoloration, raised top or a warped or distorted case, which might indicate that the battery has been frozen, overheated or overcharged.
7. Inspect the battery case for cracks or leaks.

BATTERY CHARGING

Safety Precautions

Never charge a battery without first reviewing the instructions for the charger being used. In addition to the manufacturer's instructions, follow these general safety precautions:

- **Always wear proper eye, face and hand protection.**
- **Always charge batteries in a well-ventilated area.**
- **Turn the charger OFF before connecting the leads to the battery to avoid dangerous sparks.**
- **Never try to charge a visibly damaged or frozen battery.**
- **Connect the charger leads to the battery; red positive (+) lead to the positive (+) battery terminal and black negative (–) lead to the negative (–) battery terminal. If the battery is still in the vehicle, connect the negative lead to the chassis ground. Be sure the ignition and all electrical accessories are turned off.**
- **Make sure the charger leads to the battery are not broken, frayed, or loose.**
- **If the battery becomes hot, or if violent gassing or spewing of electrolyte occurs, reduce the charging rate or turn off the charger temporarily.**
- **Always turn charger "OFF" before removing charger leads from the battery to avoid dangerous sparks.**

Charging Battery

Charge the battery if any of the following conditions exist:

- **The vehicle lights appear dim.**
- **The electric starter sounds weak.**
- **The battery has not been used for an extended period of time.**

⚠WARNING

Always charge the battery in a well ventilated area. Explosive hydrogen gas escapes from the battery during charging. Keep open flames, electrical sparks and smoking materials away from the battery at all times. Failure to do so could result in death or serious injury.

CAUTION

If the battery releases an excessive amount of gas during charging, decrease the charging rate. If the battery gets hotter than 110° F (43° C) during charging, disconnect the charger and allow the battery to cool. Overheating may result in plate distortion, internal shorting, drying out or other damage.

1. See BATTERY TESTING in this section. Perform a voltmeter test to determine the state of charge. If the battery needs to be charged, proceed to step 2.

CAUTION

Always remove the battery from the motorcycle before charging. Accidental electrolyte leakage will damage motorcycle parts.

2. See BATTERY DISCONNECTION AND REMOVAL in this section. Remove the battery from the motorcycle.
3. Place the battery on a level surface.

⚠WARNING

Always unplug or turn OFF the battery charger before connecting the charger clamps to the battery. Connecting clamps with the charger ON could cause a spark resulting in a battery explosion. A battery explosion may rupture the battery case causing a discharge or spray of sulfuric acid which could result in death or serious injury.

CAUTION

Do NOT reverse the charger connections described in the following steps or the charging system of the motorcycle could be damaged.

4. Connect the red battery charger lead to the positive (+) terminal of the battery.
5. Connect the black battery charger lead to the negative (–) terminal of the battery.

NOTE

If the battery is still in the vehicle, connect the negative (–) lead to the chassis ground. Be sure the ignition and all electrical accessories are turned off.

6. For battery charging rates/times, see Table 8-7. Step away from the battery and turn on the charger.
7. After the battery is fully charged, disconnect the black battery charger lead from the negative (–) terminal of the battery.
8. Disconnect the red battery charger lead from the positive (+) terminal of the battery.
9. Mark the charging date on the battery.

GENERAL

The Turn Signal Security Module (TSSM) is located beneath the passenger seat, mounted in a bracket on the rear fender.

REMOVAL

1. Verify security lamp is not blinking (vehicle is disarmed).
2. Remove maxi-fuse. See 8.5 MAXI-FUSE.
3. Unlock and open seat.
4. See Figure 8-29. Remove fastener (2) and washer (3). Slide passenger seat (1) forward slightly to detach it from the mounting tab on the rear of the fender. Then slide seat back and out from underneath seat strap. Remove passenger seat from motorcycle.
5. See Figure 8-30. Squeeze wiring harness connector release latches (3) and carefully pull wiring harness connector (2) out of connector socket on TSSM (1).
6. Lift up TSSM and slide it out of mounting bracket (4).

INSTALLATION

1. Slide **new** TSSM into mounting bracket. Make sure TSSM slides all the way forward in the bracket.
2. Carefully insert wiring harness connector into TSSM socket. Push connector all the way in until release latches lock in place.

CAUTION

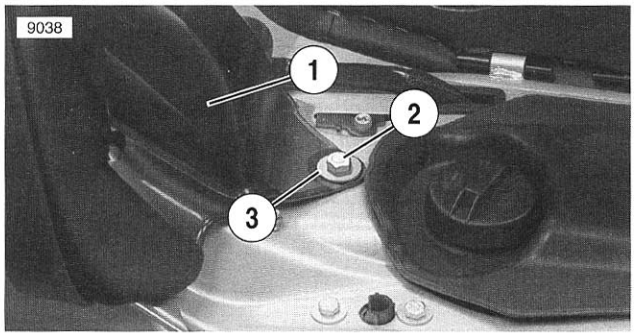
The wiring harness connector is keyed and can only be inserted fully in the TSSM socket one way. DO NOT force the connector into the socket. Doing so can damage the connector and/or socket.

3. See Figure 8-29. Slide passenger seat under seat strap and engage mounting tab on the fender into slot in bottom rear of seat. Make sure TSSM wiring harness is not pinched under seat frame.
4. Attach passenger seat to motorcycle with fastener (2) and washer (3). Tighten to 11-17 Nm (97-150 **in-lbs**).
5. Turn ignition switch to the FUEL position and close seat. Then turn ignition switch to the LOCK position.

CAUTION

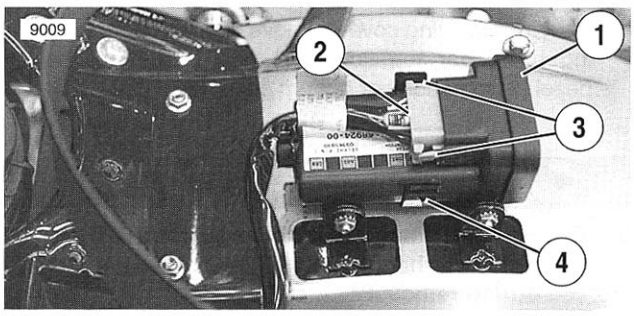
When closing the seat, make sure the ignition switch is in the FUEL position. If the ignition switch is in any other position when the seat is closed, the seat latch mechanism could be damaged

6. Replace maxi-fuse. See 8.5 MAXI-FUSE.



1. **Passenger seat**
2. **Fastener @ 11-17 Nm (97-150 in-lbs)**
3. **Washer**

Figure 8-29. Passenger Seat Attachment



1. **TSSM**
2. **Wiring harness connector**
3. **Connector release latch (2)**
4. **TSSM mounting bracket**

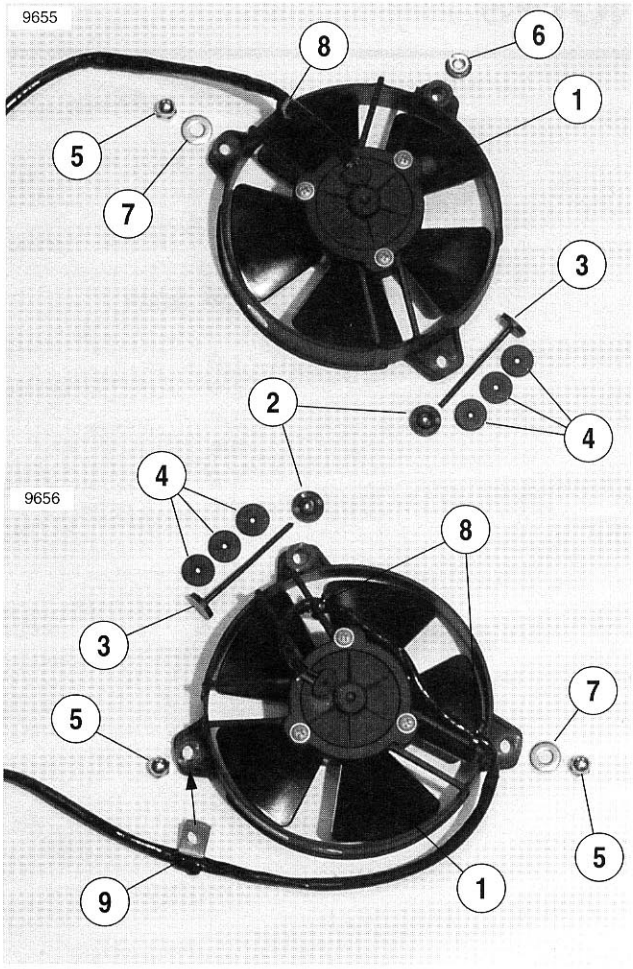
Figure 8-30. Turn Signal Security Module Mounting

INSTALLATION

NOTE

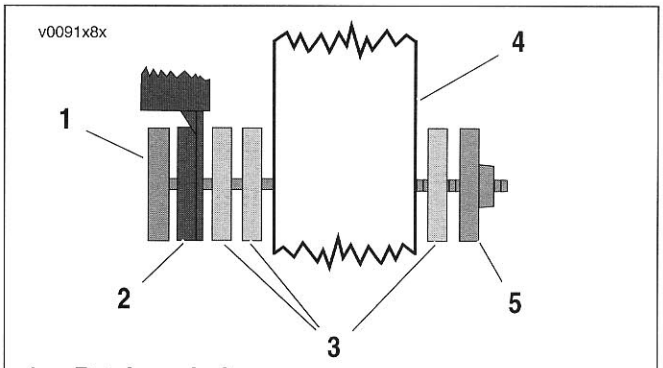
Cooling fans are identical with the exception of the location of cable straps securing wiring harness to cooling fan. Note location(s) of cable strap(s) (8) in Figure 8-44. When installing ***new*** *cooling fan (1), secure wiring harness to cooling fan with cable strap(s) in same location(s), routing harness appropriately.*

1. See Figure 8-44. Note orientation of cooling fans and locations of mounting hardware and cable straps. Mount cooling fan.
   a. Note location of retainer assembly. See Figure 8-45. Pass **new** retainer shaft (1) through mounting hole in cooling fan (2).
   b. Slide two rubber washers (3) on retainer shaft.
   c. Carefully push retainer shaft through opening in cooling fins in radiator core (4).
   d. Install one rubber washer (3) on retainer shaft.
   e. Press retainer (5) on retainer shaft so entire assembly is a snug fit.
   f. Clip off excess length of retainer shaft.
   g. See Figure 8-44. To mount top fan, install acorn nut (5), washer (7) and flange nut (6). To mount bottom fan, install P-clamp (9), acorn nuts (5) and washer (7). Tighten nuts to 4.5-5.5 Nm (40-48 **in-lbs**).
2. Route fan wiring harness to left side of radiator.
3. See Figure 8-43. Slide front cross member (3) onto mounting studs on bottom of radiator (2).
4. Attach front cross member to motorcycle frame with fasteners (4) and washers (5). Tighten to 20-26 Nm (15-19 ft-lbs).
5. Tighten nuts (6) to 19-27 Nm (14-20 ft-lbs).
6. See Figure 8-13. Mount radiator cover (5) with fasteners (3) and washers (4). Tighten to 4.1-6.8 Nm (36-60 **in-lbs**).
7. Connect cooling fan wiring harness connector. Attach all harnesses to left side radiator cover as appropriate, with clips and/or cable straps.
8. See Figure 8-16. Push rear brake master cylinder reservoir into mounting slots in right side of radiator cover.
9. See Figure 8-13. Install left and right radiator trim covers and fasteners. Tighten to 3-4 Nm (26-35 **in-lbs**).
10. Install exhaust system. See 2.7 EXHAUST SYSTEM.
11. Replace maxi-fuse. See 8.5 MAXI-FUSE.
12. Test cooling fan operation. See the VRSCA Electrical Diagnostic Manual .



1. **Fan**
2. **Retainer**
3. **Retainer shaft**
4. **Rubber washer (3)**
5. **Acorn nut @ 4.5-5.5 Nm (40-48 in-lbs)**
6. **Flange nut @ 4.5-5.5 Nm (40-48 in-lbs)**
7. **Washer**
8. **Cable strap**
9. **P-clamp**

Figure 8-44. Cooling Fan Orientation and Mounting



1. **Retainer shaft**
2. **Cooling fan**
3. **Rubber washer (3)**
4. **Radiator core**
5. **Retainer**

Figure 8-45. Retainer Assembly

GENERAL

Refer to the VRSCA Electrical Diagnostic Manual for information on the function and testing of the idle air control (IAC).

REMOVAL

⚠WARNING

Before IAC can be removed, throttle body must be removed from vehicle. Heat must be applied to IAC screws for removal. Heat can only by applied to screws away from fuel. Failure to remove throttle body before applying heat to screws could result in death or serious injury.

1. Remove airbox and air filter. See 1.4 AIRBOX AND AIR FILTER.

CAUTION

If airbox is not to be reinstalled immediately, cover throttle body intakes with tape to prevent contaminates/ objects from falling down the throttle bores. Do not use shop rags or objects that could damage the throttle body butterflies.

2. See Figure 9-11. Cover air intakes (3) to prevent debris from entering cylinders.

⚠WARNING

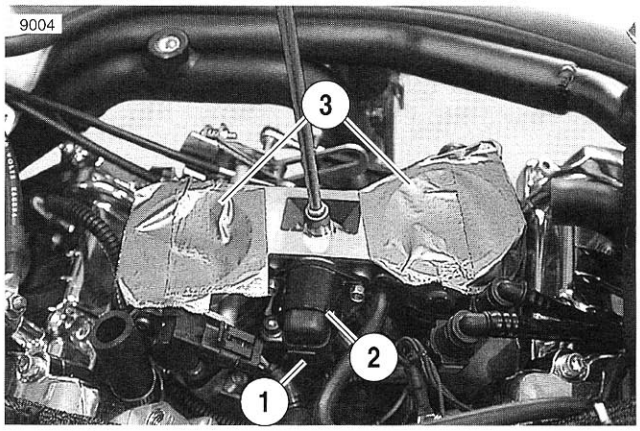
To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

3. Disconnect negative battery cable.
4. Remove throttle body. See 3.9 THROTTLE BODY.
5. Disconnect throttle cables from throttle body.

CAUTION

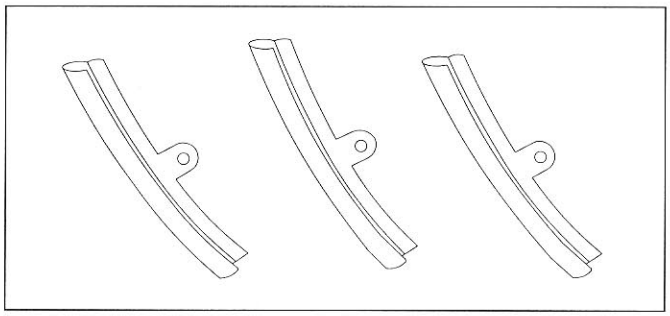
Do not apply excessive heat to idle air control. Apply only enough heat to break LOCTITE® patch on screws. Excessive heat will cause damage to idle air control.

6. See Figure 9-12. Using heat gun, apply heat to idle air control screws (2) to break LOCTITE® patch. Remove screws.
7. Pull IAC (1) and o-ring from throttle body (3).

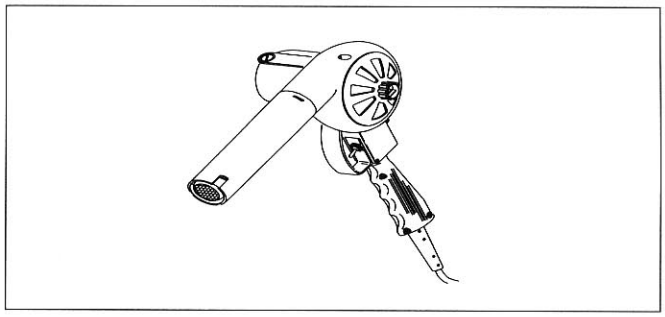


1. **IAC sensor connector [87B]**
2. **Idle air control (IAC)**
3. **Air intakes (covered)**

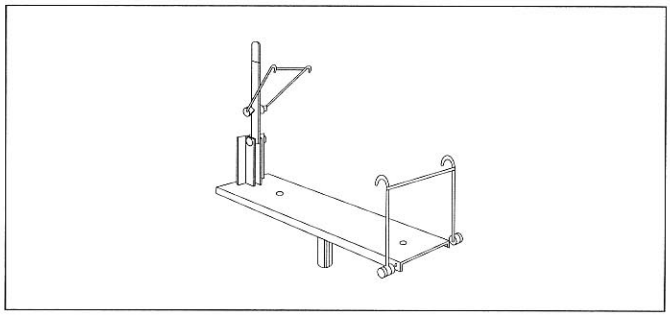
Figure 9-11. IAC Sensor



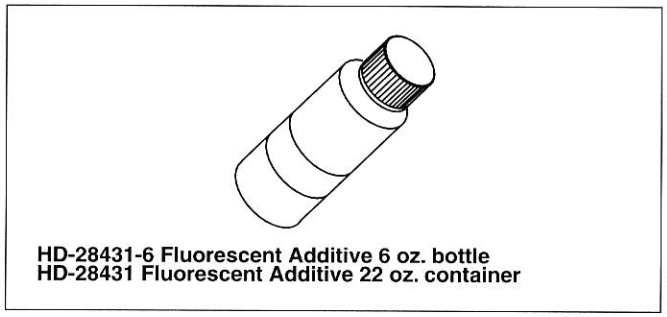
Part No. HD-01289 Rim Protectors



Part No. HD-25070 Robinair Heat Gun

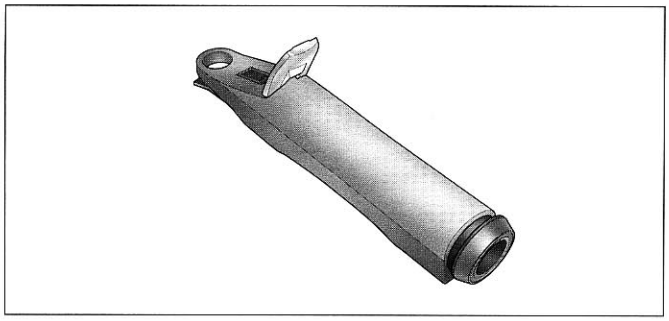


Part No. HD-21000 Tire Spreader

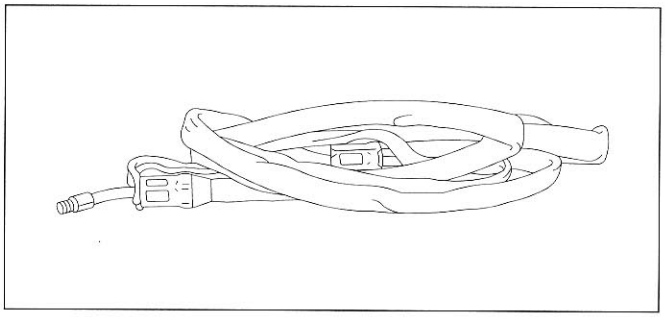


HD-28431-6 Fluorescent Additive 6 oz. bottle
HD-28431 Fluorescent Additive 22 oz. container

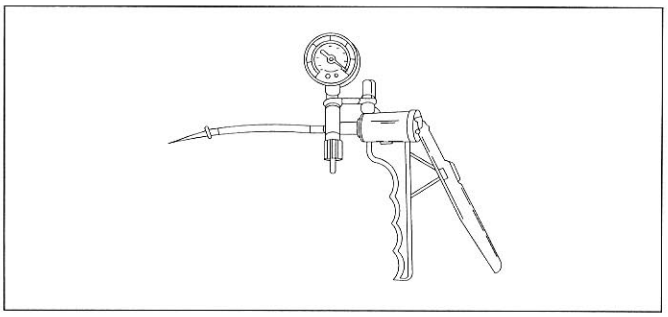
Part No. HD-28431B Black Light Fluorescent Additive. Used with HD-35457.



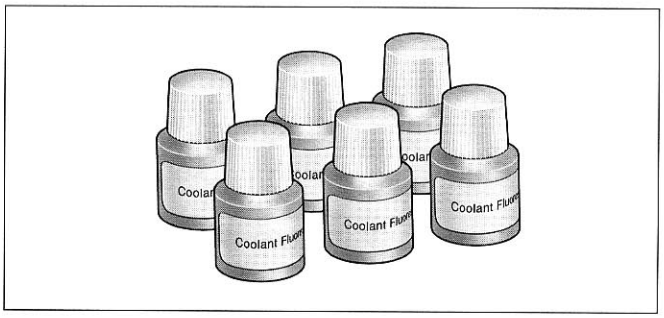
Part No. HD-23568 Coolant Tester - Fahrenheit
Part No. HD-23688 Coolant Tester - Centigrade



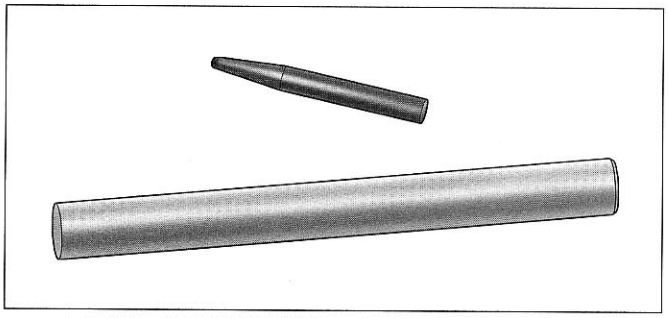
Part No. HD-28700 Tire Bead Expander



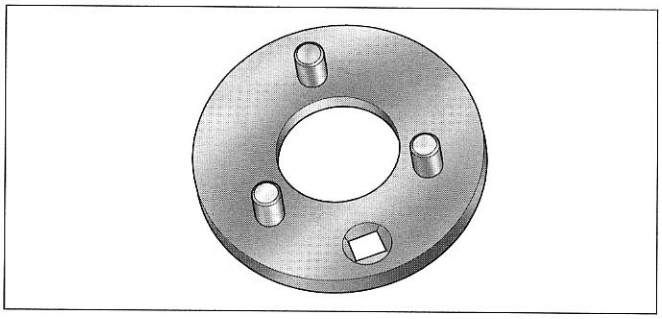
Part No. HD-23738 Vacuum Pump



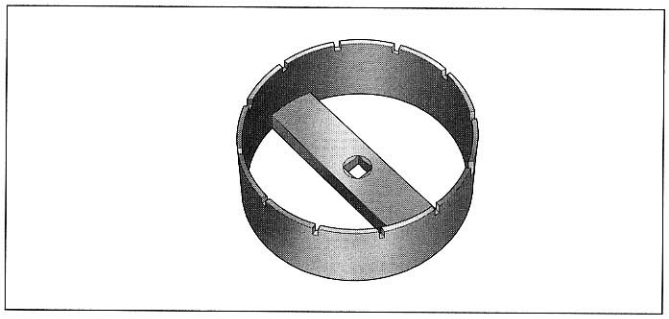
Part No. HD-29545-6 Coolant Leak Dye



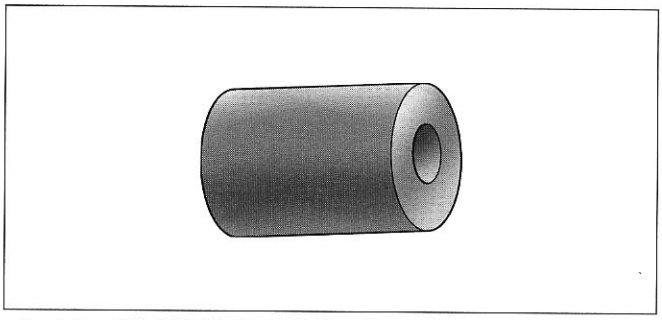
Part No. HD-45322 Valve Guide Sealer Installer



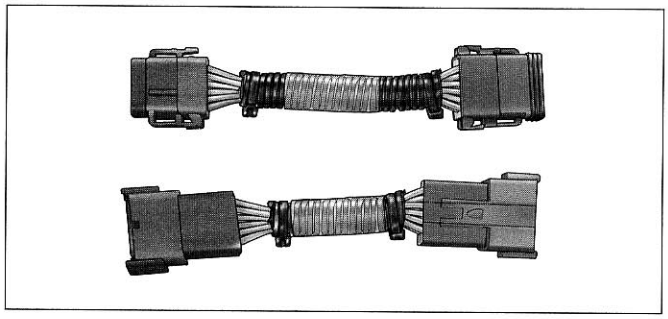
Part No. HD-45331 Final Drive Sprocket Flange Locking Tool



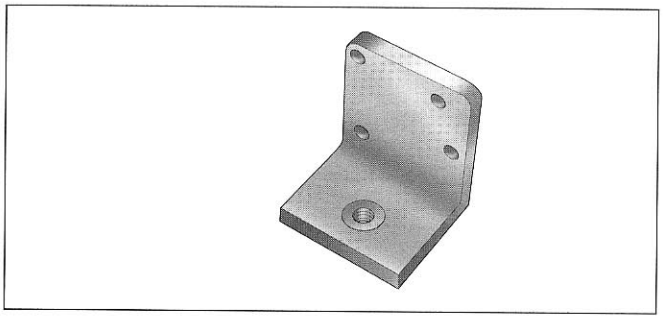
Part No. HD-45324 Fuel Cap Remover/Installer



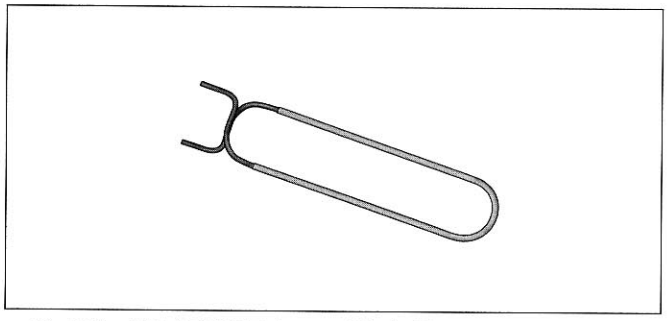
Part No. HD-45332 Final Drive Sprocket Locking Device Installer



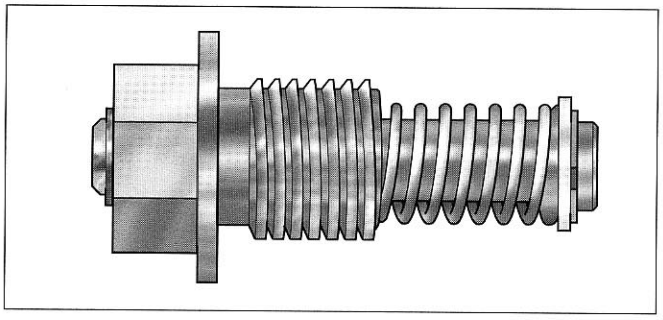
Part No. HD-45325 Jumper Harness



Part No. HD-45333 Cylinder Head Holder



Part No. HD-45326 Primary Chain Tensioner Retainer



Part No. HD-45334 Secondary Chain Measuring Tool

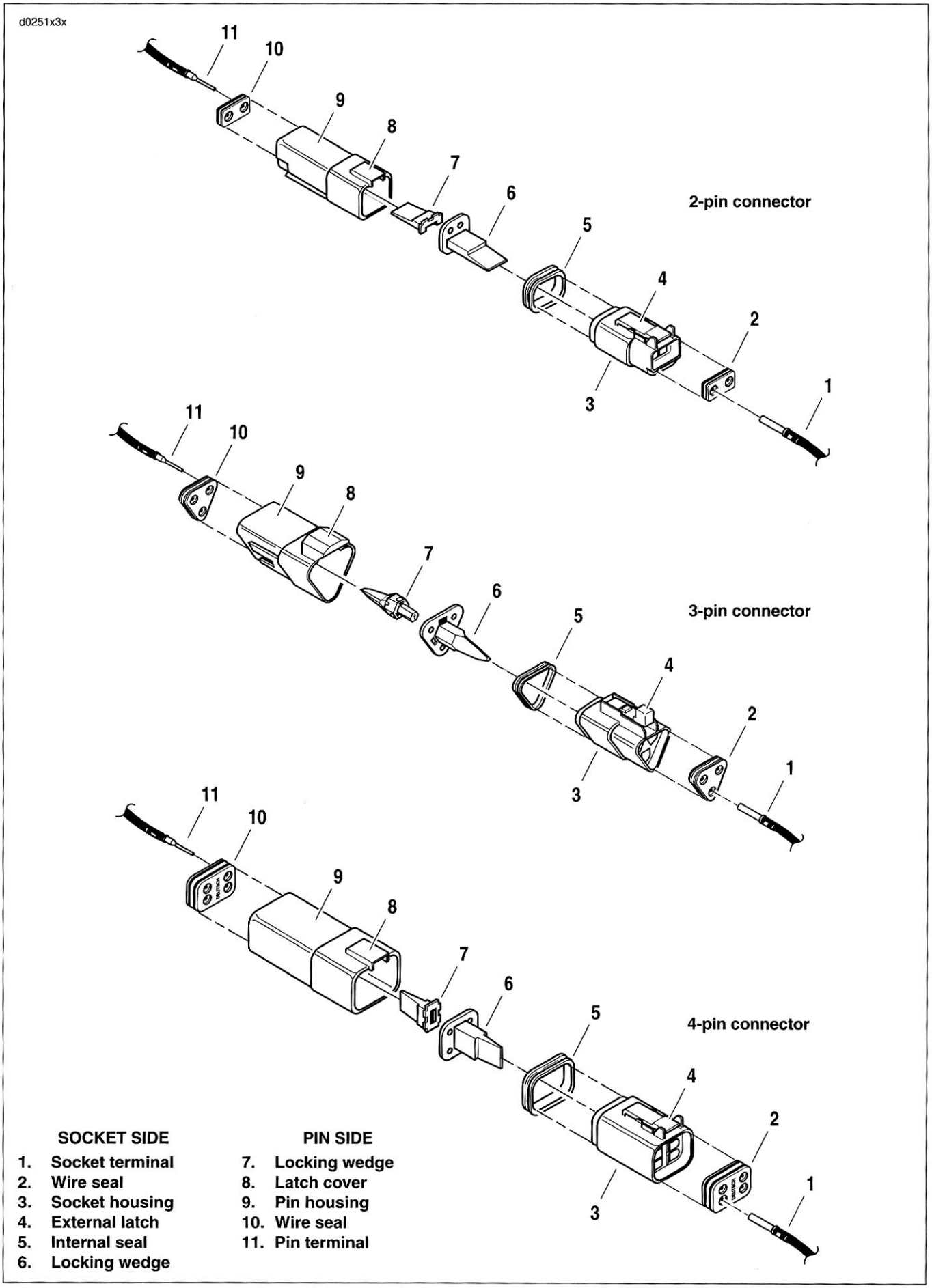
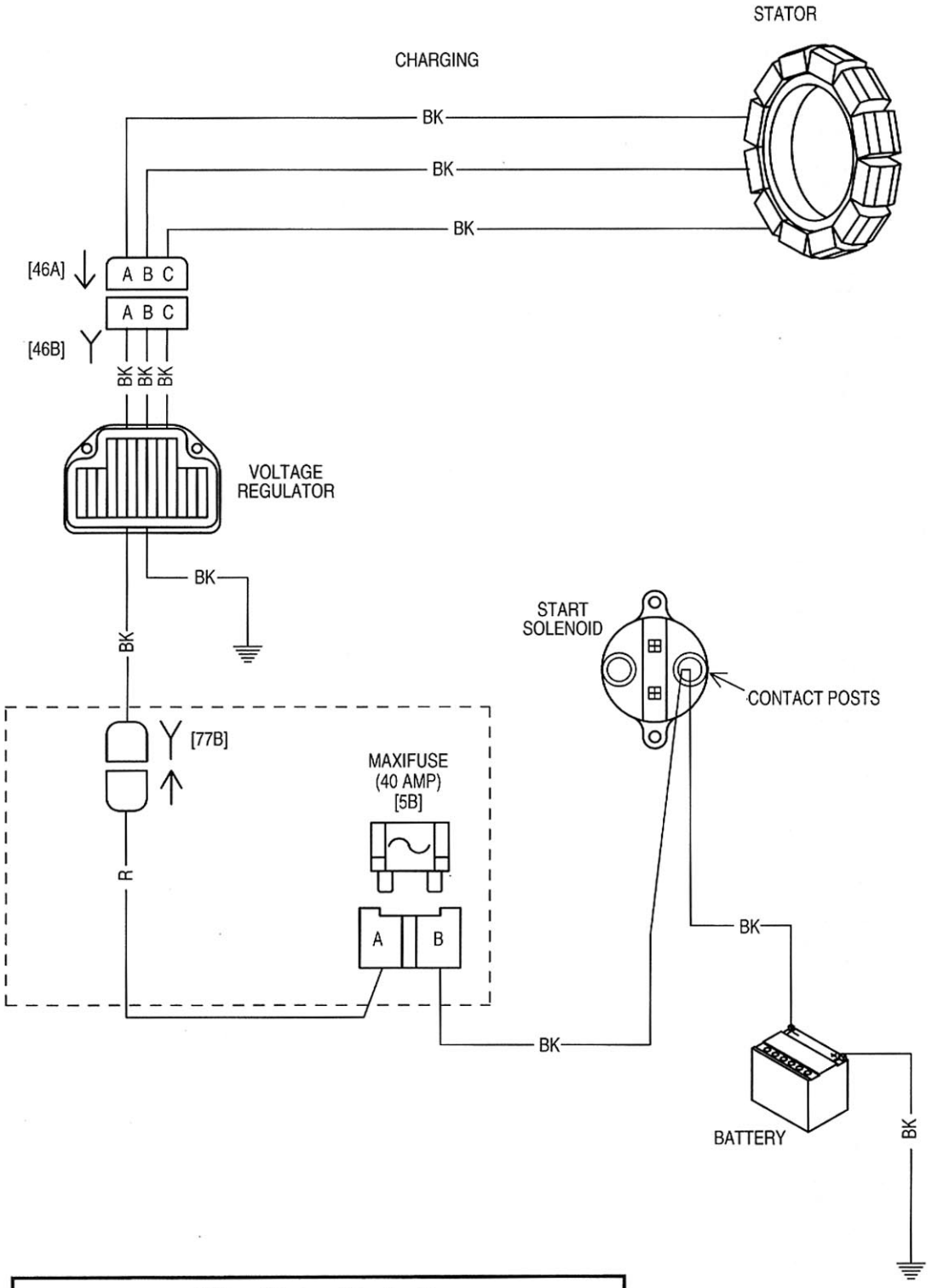


Figure B-13. 2-Pin, 3-pin and 4-pin Deutsch Connectors

Table B-4. Connector Locations

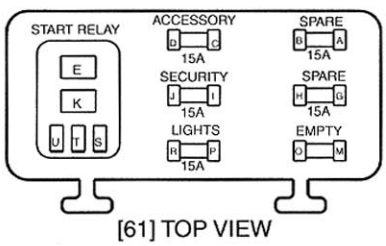
CONNECTOR NO.	DESCRIPTION	TYPE	LOCATION
[5]	main fuse	spade terminals	under right side cover
[18]	right rear turn signal	2-place Multilock	under outer rear fender
[19]	left rear turn signal	2-place Multilock	under outer rear fender
[22]	right hand controls	6-place Deutsch	under handlebar cover
[24]	left hand controls and horn	6-place Deutsch	under handlebar cover
[29]	position lamp (HDI)	2-place Mini-Deutsch	under left side cover
[30]	turn signal/security module	12-place Deutsch	under passenger seat
[31]	front turn signals	6-place Multilock	under handlebar cover
[33]	ignition key switch	3-place Packard	back of ignition switch
[38L]	low beam lamp	2-place Amp	back of headlamp
[38H]	high beam lamp	2-place Amp	back of headlamp
[39]	instrument module (IM)	12-place Mini-Deutsch	under handlebar cover
[45]	license plate lamp	3-place Multilock	under outer rear fender
[46]	voltage regulator to stator	3-place Packard	under left trim cover
[65]	vehicle speed sensor (VSS)	3-place Deutsch	above rear rocker box
[77]	voltage regulator to main harness	1-place Deutsch	behind radiator cover
[78]	electronic control module (ECM)	36-place Packard	under left side cover
[79]	crank position sensor (CKP)	2-place Mini-Deutsch	under left trim cover
[80]	manifold air pressure sensor (MAP)	3-place Packard	front intake passage
[83 F]	front plug top coil	3-place Packard	on top of front rocker box
[83 R]	rear plug top coil	3-place Packard	on top of rear rocker box
[84]	front injector	2-place Packard	throttle body
[85]	rear injector	2-place Packard	throttle body
[87]	idle air control (IAC)	4-place Packard	below air cleaner assembly
[88]	throttle position sensor (TP)	3-place Packard	front of throttle body
[89]	intake air temperature sensor (IAT)	2-place Packard	upper airbox
[90]	engine coolant sensor (ECT)	2-place Packard	water pump housing
[91]	data link connector	4-place Deutsch	under left side cover
[93]	tail lamp	4-place Multilock	under outer rear fender
[95]	purge solenoid	2-place Packard	below seat
[97 T]	cooling fan	2-place Multilock	under left trim cover
[97 B]	cooling fan	2-place Multilock	under left trim cover
[120]	oil pressure switch	post terminal	crankcase between cylinders
[122]	horn	spade terminals	between cylinders, left side
[128A]	starter solenoid coil	spade terminals	behind radiator-left side
[61]	starter relay	5-place Amp	under air box cover, in fuse block
[62]	system relay	5-place Amp	under air box cover, in fuse block
[62]	fan relay	5-place Amp	under air box cover, in fuse block



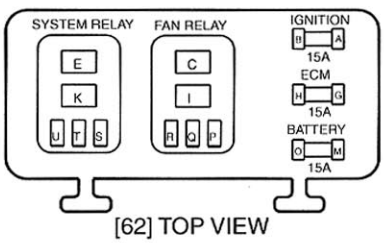
Wire Color Code Key

BK - Black	GN - Green	LT.GN - Light Green
BN - Brown	BE - Blue	PK - Pink
R - Red	V - Violet	TN - Tan
O - Orange	GY - Gray	Wire color-XX/XX-Stripe color
Y - Yellow	W - White	

←	PIN CONNECTOR (A side)
Y	SOCKET CONNECTOR (B side)



[61] TOP VIEW



[62] TOP VIEW