# 2001 HARLEY-DAVIDSON® FLT MODELS SERVICE MANUAL




## OFFICIAL FACTORY MANUAL

Part No. 99483-01

# MAINTENANCE 1

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## GENERAL

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

**⚠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. Improper repair and/or maintenance could result in death or serious injury.**

## ENGINE

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

1. Ignition/Light Key Switch not in IGNITION position.
2. Engine Stop switch in the OFF position.
3. Discharged battery, loose or corroded connections (solenoid chatters).
4. Bank Angle Sensor tripped and Ignition/Light Key Switch not cycled to OFF and then back to IGNITION.
5. Starter control circuit, relay or solenoid faulty.
6. Electric starter shaft pinion gear not engaging or overrunning clutch slipping.

### Engine Turns Over But Does Not Start

1. Fuel tank empty.
2. Fuel supply valve turned to OFF.
3. Fouled spark plugs.
4. Engine flooded with gasoline as a result of over use of enrichener.
5. Fuel valve or filter clogged.
6. Vacuum hose to automatic fuel supply valve disconnected, leaking or pinched.
7. Discharged battery, loose or broken battery terminal connections.
8. Loose wire connection at coil, battery or plug between ignition sensor and module.
9. Spark plug cables in bad condition and shorting, cable connections loose, or cables connected to wrong cylinders.
10. Ignition timing incorrect due to faulty ignition coil, ignition module or sensors (MAP, CMP, CKP and/or BAS).
11. Engine lubricant too heavy (winter operation).

*NOTE*

*Always disengage clutch for cold weather starts.*

12. Sticking or damaged valve or push rod wrong length.
13. Primary cam sprocket key sheared or missing spacer.

### Starts Hard

1. Spark plugs in bad condition, have improper gap or are partially fouled.
2. Spark plug cables in bad condition.
3. Battery nearly discharged.
4. Loose wire connection at one of the battery terminals, ignition coil or plug between ignition sensor and module.
5. Carburetor controls not adjusted correctly.
6. Water or dirt in fuel system and carburetor.
7. Intake air leak.
8. Fuel tank vent hose and vapor valve plugged, or carburetor fuel line closed off and restricting fuel flow.
9. Enrichener valve inoperative.
10. Engine lubricant too heavy (winter operation).

*NOTE*

*Always disengage clutch for cold weather starts.*

11. Ignition not functioning properly (possible sensor failure).
12. Faulty ignition coil.
13. Valves sticking.

### Starts But Runs Irregularly or Misses

1. Spark plugs in bad condition or partially fouled.
2. Spark plug cables in bad condition and leaking.
3. Spark plug gap too close or too wide.
4. Faulty ignition coil, module and/or sensor.
5. Battery nearly discharged.
6. Damaged wire or loose connection at battery terminals, ignition coil, or plug between ignition sensor and module.
7. Intermittent short circuit due to damaged wire insulation.
8. Water or dirt in fuel system, carburetor or filter.
9. Fuel tank vent system plugged or carburetor vent line closed off.
10. Carburetor controls misadjusted.
11. Damaged carburetor.
12. Loose or dirty ignition module connector at crankcase.

13. Faulty MAP, CKP and/or CMP Sensors.
14. Incorrect valve timing.
15. Weak or broken valve springs.
16. Damaged intake or exhaust valve.

### A Spark Plug Fouls Repeatedly

1. Fuel mixture too rich or enrichener left out too long.
2. Incorrect spark plug for the kind of service.
3. Piston rings badly worn or broken.
4. Valve guides or seals badly worn.

### Pre-Ignition or Detonation (Knocks or Pings)

1. Fuel octane rating too low.
2. Faulty spark plugs.
3. Incorrect spark plug for the kind of service.
4. Excessive carbon deposit on piston head or in combustion chamber.
5. Ignition timing advanced due to faulty sensor inputs (MAP, CKP, CMP).

### Overheating

1. Insufficient oil supply or oil not circulating.
2. Insufficient air flow over engine.
3. Heavy carbon deposit.
4. Ignition timing retarded due to faulty MAP, CKP and/or CMP Sensors.
5. Leaking valve.

### Valve Train Noise

1. Low oil pressure caused by oil feed pump not functioning properly or oil passages obstructed.
2. Faulty hydraulic lifters.
3. Bent push rod.
4. Incorrect push rod length.
5. Rocker arm binding on shaft.
6. Valve sticking in guide.
7. Chain tensioner spring or shoe worn.

### Excessive Vibration

1. Wheels and/or tires worn or damaged.
2. Engine/transmission/rear wheel not aligned properly.
3. Primary chain badly worn or links tight as a result of insufficient lubrication or misalignment.
4. Engine to transmission mounting bolts loose.
5. Upper engine mounting bracket loose.
6. Ignition timing incorrect/poorly tuned engine.
7. Internal engine problem.
8. Broken frame.
9. Stabilizer links worn or loose.
10. Rubber mounts loose or worn.
11. Rear fork pivot shaft nuts loose.
12. Front engine mounting bolts loose.

### Check Engine Lamp Illuminates During Operation

1. Fault detected. Check for trouble codes.

## LUBRICATION SYSTEM

### Oil Does Not Return To Oil Pan

1. Oil pan empty.
2. Oil pump not functioning.
3. Restricted oil lines or fittings.
4. Restricted oil filter.
5. O-ring damaged or missing from oil pump/crankcase junction (also results in poor engine performance).

### Engine Uses Too Much Oil Or Smokes Excessively

1. Oil pan overfilled.
2. Restricted oil return line to pan.
3. Restricted breather operation.
4. Restricted oil filter.
5. Piston rings badly worn or broken.
6. Valve guides or seals worn.
7. O-ring damaged or missing from oil pump/crankcase junction (also results in poor engine performance).

### Engine Leaks Oil From Case, Push Rods, Hoses, Etc.

1. Loose parts.
2. Imperfect seal at gaskets, push rod cover, washers, etc.
3. Restricted oil return line to pan.
4. Restricted breather hose to air cleaner.
5. Restricted oil filter.
6. Oil pan overfilled.
7. Rocker housing gasket (bottom) installed upside down.

### Low Oil Pressure

1. Oil pan underfilled.
2. Faulty low oil pressure switch.
3. Oil pump O-ring(s) damaged or missing.
4. Oil pressure relief valve stuck in open position.
5. Ball missing from cam support plate.

### High Oil Pressure

1. Oil pan overfilled.
2. Oil pressure relief valve stuck in closed position.

## ELECTRICAL SYSTEM

### Alternator Does Not Charge

1. Module not grounded.
2. Engine ground wire loose or broken.
3. Faulty regulator-rectifier module.
4. Loose or broken wires in charging circuit.
5. Faulty stator and/or rotor.

### Alternator Charge Rate Is Below Normal

1. Weak or damaged battery.
2. Loose connections.
3. Faulty regulator-rectifier module.
4. Faulty stator and/or rotor.

### Speedometer Operates Erratically

1. Contaminated speedometer sensor (remove sensor and clean off metal particles).
2. Loose connections.

## CARBURETOR

### Carburetor Floods

1. Dirt or other foreign matter between valve and its seat.
2. Inlet valve sticking.
3. Inlet valve and/or valve seat worn or damaged.
4. Float misadjusted.
5. Leaky or damaged float.
6. Excessive “pumping” of hand throttle grip.
7. See TROUBLESHOOTING CHART in Section 4.

## TRANSMISSION

### Transmission Shifts Hard

1. Clutch dragging slightly.
2. Primary chaincase overfilled with lubricant.
3. Corners worn off shifter clutch dogs.
4. Shifter return spring bent or broken.
5. Bent shifter rod.
6. Shifter forks sprung.
7. Transmission lubrication too heavy (winter operation).

### Jumps Out Of Gear

1. Shifter rod improperly adjusted.
2. Shifter drum improperly adjusted or damaged.
3. Shifter engaging parts (inside transmission) badly worn and rounded.
4. Shifter forks bent.
5. Damaged gears.

### Clutch Slips

1. Clutch controls improperly adjusted.
2. Insufficient clutch spring tension.
3. Worn friction discs.

### Clutch Drags Or Does Not Release

1. Clutch controls improperly adjusted.
2. Lubricant level too high in primary chaincase.
3. Primary chain badly misaligned.
4. Clutch discs warped.
5. Insufficient clutch spring tension.

### Clutch Chatters

1. Friction discs or steel discs worn or warped.

## BRAKES

### Brake Does Not Hold Normally

1. Master cylinder reservoir low on fluid.
2. Brake system contains air bubbles.
3. Master or wheel cylinder piston worn or parts damaged.
4. Brake pads contaminated with grease or oil.
5. Brake pads badly worn (1/16 inch minimum lining thickness).
6. Brake disc badly worn or warped.
7. Brake fades due to heat build up – brake pads dragging or excessive braking.
8. Brake drags – insufficient brake pedal free play.

## HANDLING

### Irregularities

1. Improperly loaded motorcycle. Non-standard equipment on the front end such as heavy radio receivers, extra lighting equipment or luggage tends to cause unstable handling.
2. Incorrect air suspension pressure.
3. Damaged tire(s) or improper front-rear tire combination.
4. Irregular or peaked front tire tread wear.

5. Incorrect tire pressure.
6. Shock absorber not functioning normally.
7. Loose wheel axle nuts. Tighten to recommended tightness.
8. Excessive wheel hub bearing play.
9. Rear wheel out of alignment with frame and front wheel.
10. Steering head bearings improperly adjusted. Correct adjustment and replace pitted or worn bearings and races.
11. Tire and wheel unbalanced.
12. Rims and tires out-of-round or eccentric with hub.
13. Rims and tires out-of-true sideways.
14. Shock absorber springs improperly adjusted.
15. Worn engine stabilizer links.
16. Damaged rear engine isolation mounts.
17. Swing arm pivot shaft nut improperly tightened or assembled.

## REPAIR NOTES

General maintenance practices are given in this section. All special tools and torque values are noted at the point of use and all required parts or materials can be found in the appropriate PARTS CATALOG.

### Safety

Safety is always the most important consideration when performing any job. Be sure you have a complete understanding of the task to be performed. Use common sense. Use the proper tools. Don't just do the job – do the job safely.

### Removing Parts

Always consider the weight of a part when lifting. Use a hoist whenever necessary. Do not lift heavy parts by hand. A hoist and adjustable lifting beam or sling are needed to remove some parts. The lengths of chains or cables from the hoist to the part should be equal and parallel, and should be positioned directly over the center of the part. Be sure that no obstructions will interfere with the lifting operation. Never leave a part suspended in mid-air.

Always use blocking or proper stands to support the part that has been hoisted. If a part cannot be removed, verify that all bolts and attaching hardware have been removed. Check to see if any parts are in the way of the part being removed.

When removing hoses, wiring or tubes, always tag each part to ensure proper installation.

### Cleaning

If you intend to reuse parts, follow good shop practice and thoroughly clean the parts before assembly. Keep all dirt out of parts; the unit will perform better and last longer. Seals, filters and covers are used in this vehicle to keep out environmental dirt and dust. These items must be kept in good condition to ensure satisfactory operation.

Clean and inspect all parts as they are removed. Be sure all holes and passages are clean and open. After cleaning, cover all parts with clean lint-free cloth, paper or other material. Be sure the part is clean when it is installed.

Always clean around lines or covers before they are removed. Plug, tape or cap holes and openings to keep out dirt, dust and debris.

### Disassembly and Assembly

Always assemble or disassemble one part at a time. Do not work on two assemblies simultaneously. Be sure to make all necessary adjustments. Recheck your work when finished. Be sure that everything is done.

Operate the vehicle to perform any final check or adjustments. If all is correct, the vehicle is ready to go back to the customer.

### Checking Torques on Fasteners with Lock Patches

To check the torque on a fastener that has a lock patch:

1. Set the torque wrench for the lowest setting in the specified torque range.
2. Attempt to tighten fastener to set torque. If fastener does not move and lowest setting is satisfied (torque wrench clicks), then the proper torque has been maintained.

## REPAIR AND REPLACEMENT PROCEDURES

### Hardware and Threaded Parts

Install helical thread inserts when inside threads in castings are stripped, damaged or not capable of withstanding specified torque.

Replace bolts, nuts, studs, washers, spacers and small common hardware if missing or in any way damaged. Clean up or repair minor thread damage with a suitable tap or die.

Replace all damaged or missing lubrication fittings.

Use Teflon tape on pipe fitting threads.

### Wiring, Hoses and Lines

Replace hoses, clamps, electrical wiring, electrical switches or fuel lines if they do not meet specifications.

### Instruments and Gauges

Replace broken or defective instruments and gauges. Replace dials and glass that are so scratched or discolored that reading is difficult.

### Bearings

Anti-friction bearings must be handled in a special way. To keep out dirt and abrasives, cover the bearings as soon as they are removed from the package.

Wash bearings in a non-flammable cleaning solution. Knock out packed lubricant inside by tapping the bearing against a wooden block. Wash bearings again. Cover bearings with clean material after setting them down to dry. Never use compressed air to dry bearings.

Coat bearings with clean oil. Wrap bearings in clean paper.

Be sure that the chamfered side of the bearing always faces the shoulder (when bearings installed against shoulders). Lubricate bearings and all metal contact surfaces before pressing into place. Only apply pressure on the part of the bearing that makes direct contact with the mating part.

Always use the proper tools and fixtures for removing and installing bearings.

Bearings do not usually need to be removed. Only remove bearings if necessary.

### Bushings

Do not remove a bushing unless damaged, excessively worn or loose in its bore. Press out bushings that must be replaced.

When pressing or driving bushings, be sure to apply pressure in line with the bushing bore. Use a bearing/bushing driver or a bar with a smooth, flat end. Never use a hammer to drive bushings.

Inspect the bushing and the mated part for oil holes. Be sure all oil holes are properly aligned.

### Gaskets

Always discard gaskets after removal. Replace with new gaskets. Never use the same gasket twice. Be sure that gasket holes match up with holes in the mating part.

If a gasket must be made, be sure to cut holes that match up with the mating part. Serious vehicle damage can occur if any flange holes are blocked by the gasket. Use material that is the right type and thickness.

### Lip Type Seals

Lip seals are used to seal oil or grease and are usually installed with the sealing lip facing the contained lubricant. Seal orientation, however, may vary under different applications.

Seals should not be removed unless necessary. Only remove seals if required to gain access to other parts or if seal damage or wear dictates replacement.

Leaking oil or grease usually means that a seal is damaged. Replace leaking seals to prevent overheated bearings.

Always discard seals after removal. Do not use the same seal twice.

### O-Rings (Preformed Packings)

Always discard O-rings after removal. Replace with new O-rings. To prevent leaks, lubricate the O-rings before installation. Apply the same type of lubricant as that being sealed. Be sure that all gasket, O-ring and seal mating surfaces are thoroughly clean before installation.

### Gears

Always check gears for damaged or worn teeth.

Remove burrs and rough spots with a honing stone or crocus cloth before installation. Lubricate mating surfaces before pressing gears on shafts.

### Shafts

If a shaft does not come out easily, check that all nuts, bolts or retaining rings have been removed. Check to see if other parts are in the way before using force.

Shafts fitted to tapered splines should be very tight. If shafts are not tight, disassemble and inspect tapered splines. Discard parts that are worn. Be sure tapered splines are clean, dry and free of burrs before putting them in place. Press mating parts together tightly.

Clean all rust from the machined surfaces of new parts.

### Part Replacement

Always replace worn or damaged parts with new parts.

## CLEANING

### Part Protection

Before cleaning, protect rubber parts (such as hoses, boots and electrical insulation) from cleaning solutions. Use a grease-proof barrier material. Remove the rubber part if it cannot be properly protected.

### Cleaning Process

Any cleaning method may be used as long as it does not result in parts damage. Thorough cleaning is necessary for proper parts inspection. Strip rusted paint areas to bare metal before repainting.

### Rust or Corrosion Removal

Remove rust and corrosion with a wire brush, abrasive cloth, sand blasting, vapor blasting or rust remover. Use buffing crocus cloth on highly polished parts that are rusted.

### Bearings

Remove shields and seals from bearings before cleaning. Clean bearings with permanent shields and seals in solution.

Clean open bearings by soaking them in a petroleum cleaning solution. Never use a solution that contains chlorine.

Let bearings stand and dry. Do not dry using compressed air. Do not spin bearings while they are drying.

# TOOL SAFETY 1.3

## AIR TOOLS

- Always use approved eye protection equipment when performing any task using air-operated tools.
- On all power tools, use only recommended accessories with proper capacity ratings.
- Do not exceed air pressure ratings of any power tools.
- Bits should be placed against work surface before air hammers are operated.
- Disconnect the air supply line to an air hammer before attaching a bit.
- Never point an air tool at yourself or another person.
- Protect bystanders with approved eye protection.

## WRENCHES

- Never use an extension on a wrench handle.
- If possible, always pull on a wrench handle and adjust your stance to prevent a fall if something lets go.
- Never cock a wrench.
- Never use a hammer on any wrench other than a Striking Face wrench.
- Discard any wrench with broken or battered points.
- Never use a pipe wrench to bend, raise, or lift a pipe.

## PLIERS/CUTTERS/PRYBARS

- Plastic or vinyl covered pliers handles are not intended to act as insulation; don't use on live electrical circuits.
- Don't use pliers or cutters for cutting hardened wire unless they were designed for that purpose.
- Always cut at right angles.
- Don't use any prybar as a chisel, punch, or hammer.

## HAMMERS

- Never strike one hammer against a hardened object, such as another hammer.
- Always grasp a hammer handle firmly, close to the end.
- Strike the object with the full face of the hammer.
- Never work with a hammer which has a loose head.
- Discard hammer if face is chipped or mushroomed.
- Wear approved eye protection when using striking tools.
- Protect bystanders with approved eye protection.

## PUNCHES/CHISELS

3. Never use a punch or chisel with a chipped or mushroomed end; dress mushroomed chisels and punches with a file.
4. Hold a chisel or a punch with a tool holder if possible.
5. When using a chisel on a small piece, clamp the piece firmly in a vise, and chip toward the stationary jaw.
6. Wear approved eye protection when using these tools.
7. Protect bystanders with approved eye protection.

## SCREWDRIVERS

- Don't use a screwdriver for prying, punching, chiseling, scoring, or scraping.
- Use the right type of screwdriver for the job; match the tip to the fastener.
- Don't interchange POZIDRIV®, PHILLIPS®, or REED AND PRINCE screwdrivers.
- Screwdriver handles are not intended to act as insulation; don't use on live electrical circuits.
- Don't use a screwdriver with rounded edges because it will slip – redress with a file.

## RATCHETS AND HANDLES

- Periodically clean and lubricate ratchet mechanisms with a light grade oil. Do not replace parts individually; ratchets should be rebuilt with the entire contents of service kit.
- Never hammer or put a pipe extension on a ratchet or handle for added leverage.
- Always support the ratchet head when using socket extensions, but do not put your hand on the head or you may interfere with the action of its reversing mechanism.
- When breaking loose a fastener, apply a small amount of pressure as a test to be sure the ratchet's gear wheel is engaged with the pawl.

## SOCKETS

- Never use hand sockets on power or impact wrenches.
- Select the right size socket for the job.
- Never cock any wrench or socket.

- Select only impact sockets for use with air or electric impact wrenches.
- Replace sockets showing cracks or wear.
- Keep sockets clean.
- Always use approved eye protection when using power or impact sockets.

## STORAGE UNITS

- Don't open more than one loaded drawer at a time. Close each drawer before opening up another.
- Close lids and lock drawers and doors before moving storage units.
- Don't pull on a tool cabinet; push it in front of you.
- Set the brakes on the locking casters after the cabinet has been rolled to your work.

# SCHEDULED MAINTENANCE TABLE 1.4

The scheduled maintenance table beginning on this page lists the maintenance requirements for FL model motorcycles. If you are familiar with the procedures, just reference the table for the recommended maintenance interval as well as the required specifications. On the other hand, if more information is needed, simply turn to the page number in the far right column for detailed service procedures. For your added convenience, the adjacent chart lists the part numbers of the required lubricants.

| Lubricant | Part Number |
|---|---|
| Engine Oil | See Table 1-1. |
| Front Fork Oil | Hydraulic Fork Oil, Type “E”, H-D Part No. 99884-80/16 oz. |
| Silicone Brake Fluid | D.O.T. 5 Hydraulic Brake Fluid, H-D Part No. 99902-77/12 oz. |
| Transmission Lubricant | Semi-Synthetic Transmission Lubricant, Part Nos. 98853-96/case qt., 98852-96/case gal. |
| Chaincase Lubricant | Primary Chaincase Lubricant, Part Nos. 99887-84/qt., 99886-84/gal. |
| Clutch and Throttle Cable Lubricant | Super Oil, Part No. 94968-85TV |
| Steering Head Bearing Lubricant | Special Purpose Grease, Part No. 99857-97/cartridge |
| Electrical Contact Lubricant | Electrical Contact Grease, Part No. 99861-90 |

## SCHEDULED MAINTENANCE TABLE

| Service Operation | 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 | Service Data |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Battery | | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | Visual inspection only. |
| Engine Oil (*) | I | R | I | R | I | R | I | R | I | R | I | R | I | R | I | R | I | R | I | R | I | R | *Oil level* Separate HOT and COLD checks per procedure. *Oil capacity* 4 qt. (3.8 L) per chart in procedure. |
| Engine Oil Filter (*) | | R | | R | | R | | R | | R | | R | | R | | R | | R | | R | | R | Hand tighten 1/2-3/4 turn after gasket contact. |

**R** – Replace or change **I** – Inspect, and if necessary, adjust, clean or replace **L** – Lubricate with specified lubricant

**X** – Perform **T** – Tighten to proper torque (*) – Also perform prior to storage or annually

| Service Operation | 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 | Service Data |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Primary Chain Tension | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | *Deflection* Cold: 5/8-7/8 in. (15.9-22.2 mm) Hot: 3/8-5/8 in. (9.5-15.9 mm) |
| Primary Chain Lubricant | | R | | R | | R | | R | | R | | R | | R | | R | | R | | R | | R | *Lubricant level* 2.75 in. (69.8 mm) below center line of clutch adjuster screw. *Lubricant capacity* 32 oz (946 mL) Part No.'s 99887-84 (qt) 99886-84 (gal) |
| Clutch Adjustment | | X | | X | | X | | X | | X | | X | | X | | X | | X | | X | | X | *Free play at hand lever* 1/16-1/8 in. (1.6-3.2 mm) |
| Transmission Lubricant (*) | | R | I | R | I | R | I | R | I | R | I | R | I | R | I | R | I | R | I | R | I | R | *Lubricant level* Dipstick at FULL with motorcycle level and filler plug resting on threads. *Lubricant capacity* 20-24 oz (590-710 mL) Part No.'s 98853-96 (cs-qt), 98852-96 (cs-gal) *Transmission drain plug torque* 14-21 ft-lbs (19-28 Nm). *Filler plug torque* 25-75 in-lbs (2.8-8.5 Nm). |
| Tire Condition and Pressure | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | See Table 1-3. |

**R** – Replace or change **I** – Inspect, and if necessary, adjust, clean or replace **L** – Lubricate with specified lubricant

**X** – Perform **T** – Tighten to proper torque (*) – Also perform prior to storage or annually

| Service Operation | Preride | 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 | Service Data |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wheel Spokes | | | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | *Spoke nipple torque* 40-50 **in-lbs** (4.5-5.6 Nm) |
| Steering Head Bearing Swing-By | | X | | | | X | | | | X | | | | X | | | | X | | | | X | See Section 2. |
| Lubricate Steering Head Bearings | | | | L | | L | | L | | L | | L | | L | | L | | L | | L | | L | Lubricate through neck fitting with *Special Purpose Grease*, Part No. 99857-97 (cartridge) |
| Disassemble, Inspect and Repack Steering Head Bearings | | | | | | | | | | | | | | | | | | | | | | X | *Lubricant* Part No. 99857-97 (cartridge) See Section 2. |
| Front Fork Oil (*) | | | | | | | | | | R | | | | | | | | R | | | | | *Fork oil (Type E)* Part No. 99884-80 (16 oz) *Capacity:* 9.7 oz. (287 ml) |
| Brake Fluid Reservoir Level and Condition (*) | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | *D.O.T. 5 Brake fluid* Part No.'s 99902-77 (12 oz), 99901-77 (gal) |
| Brake Pad Linings and Discs | | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | *Minimum brake pad thickness* 1/16 in. (1.6 mm) |
| Drive Belt | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | *Deflection* 5/16-3/8 in. (7.9-9.5 mm) in bottom strand with 10 lb (4.5 kg) upward force |
| Rear Swingarm Pivot Shaft Nut | | I | | | | I | | | | I | | | | I | | | | I | | | | I | *Pivot bolt torque* 40-45 ft-lbs (54-61 Nm) |

**R** – Replace or change **I** – Inspect, and if necessary, adjust, clean or replace **L** – Lubricate with specified lubricant

**X** – Perform **T** – Tighten to proper torque (*) – Also perform prior to storage or annually

| Service Operation | Preride | 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 | Service Data |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rear Shock Absorbers | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | See Section 2. |
| Air Cleaner | | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | *Air cleaner cover screw torque:* 3-5 ft-lbs (4-7 Nm) |
| Fuel Tank Filter | | | | | | | | | | I | | | | | | | | I | | | | | *Hex fitting torque* 18 ft-lbs (24 Nm) |
| Fuel Lines | | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | Check for leaks. |
| Enrichener Control | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | |
| Throttle Cables | | IL | | IL | | IL | | IL | | IL | | IL | | IL | | IL | | IL | | IL | | IL | *Lubricant* Part No. 94968-85TV- 1/4 fl. oz. *Handlebar clamp screw torque* 60-80 **in-lbs** (6.8-9.0 Nm) *Switch housing screw torque* 35-45 **in-lbs** (4-5 Nm) |
| Engine Mounts and Stabilizer Link | | | | | | I | | | | I | | | | I | | | | I | | | | I | Verify tightness. |
| Spark Plugs | | I | | I | | R | | I | | R | | I | | R | | I | | R | | I | | R | *Plug type* HD-6R12 *Plug gap* 0.038-0.043 in. (0.97-1.09 mm) *Plug torque* 11-18 ft-lbs (15-24 Nm) |
| Electrical Components | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | I | Check for proper operation. |
| Engine Idle Speed | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | | I | *Idle speed* 950-1050 rpm |

**R** – Replace or change **I** – Inspect, and if necessary, adjust, clean or replace **L** – Lubricate with specified lubricant

**X** – Perform **T** – Tighten to proper torque (*) – Also perform prior to storage or annually

| Service Operation | Preride | 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 | Service Data |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fasteners (Critical Fastener Torque) | | T | | | | T | | | | T | | | | T | | | | T | | | | T | |
| Road Test | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | |

**R** – Replace or change **I** – Inspect, and if necessary, adjust, clean or replace **L** – Lubricate with specified lubricant

**X** – Perform **T** – Tighten to proper torque (*) – Also perform prior to storage or annually

## BATTERY

At every scheduled service interval, inspect the battery as follows:

1. Battery top must be clean and dry. Dirt on the top of the battery may cause the battery to self-discharge at a faster than normal rate.
2. Inspect battery screws, clamps, and cables for breakage, loose connections and corrosion. Clean clamps. Coat terminals with grease.
3. Inspect battery for discoloration, raised top, or warped case which may indicate battery has been overheated or overcharged.
4. Inspect the battery case for cracks or leaks.

*NOTE*

*For charging information, see Section 8.9 BATTERY, BATTERY CHARGING.*

## ENGINE OIL/ENGINE OIL FILTER

At the 1000 mile service interval, and at every 5000 mile service interval thereafter, change the engine oil and engine oil filter as follows:

*NOTE*

*If the motorcycle is ridden hard, under dusty conditions, or in cold weather, the oil and filter should be changed more often.*

1. Ride vehicle until engine is at normal operating temperature.
2. Locate oil filler plug/dipstick on right side of vehicle at top of transmission case. To remove the oil filler plug, pull steadily while moving plug back and forth.
3. Locate oil drain plug at front left side of the oil pan. Remove the oil drain plug and allow oil to drain completely.
4. Inspect the oil drain plug O-ring for cuts, tears or signs of deterioration. Replace as necessary.
5. Remove the oil filter as follows:
   a. Obtain the OIL FILTER WRENCH (HD-42311). The tool allows easy removal of the oil filter without risk of damage to the crankshaft position sensor or cable.
   b. Place the jaws of the wrench over the oil filter with the tool oriented vertically. See Figure 1-1.
   c. Using a 3/8 inch drive with a 4 inch extension, turn wrench in a counterclockwise direction. Do not use with air tools.
6. Clean the oil filter mount flange of any old gasket material.

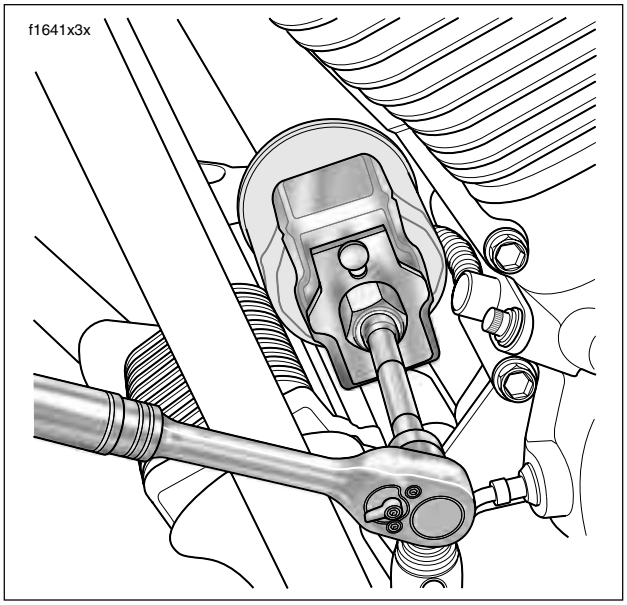



**Figure 1-1. Remove Engine Oil Filter**

7. Lubricate gasket with clean engine oil and install **new** oil filter on filter mount. Hand tighten oil filter 1/2-3/4 turn after gasket first contacts filter mounting surface. Do **NOT** use OIL FILTER WRENCH (HD-42311) for oil filter installation.

*NOTE*

*Use of the new Premium 10 micron synthetic media oil filter is highly recommended, Part No. 63798-99 (Chrome) or 63731-99 (Black).*

8. Install engine oil drain plug and tighten to 14-21 ft-lbs (19-28 Nm).
9. With vehicle resting on jiffy stand, add 3-1/2 quarts (3.3 liters) engine oil as specified in Table 1-1. Use the proper grade of oil for the lowest temperature expected before the next oil change.

### Table 1-1. Recommended Engine Oils

| Harley-Davidson Type | Viscosity | Harley-Davidson Rating | Lowest Ambient Temperature | Cold Weather Starts Below 50˚F (10˚C) |
|---|---|---|---|---|
| HD Multi-grade | SAE 10W40 | HD 360 | Below 40˚F (4˚C) | Excellent |
| HD Multi-grade | SAE 20W50 | HD 360 | Above 40˚F (4˚C) | Good |
| HD Regular Heavy | SAE 50 | HD 360 | Above 60˚F (16˚C) | Poor |
| HD Extra Heavy | SAE 60 | HD 360 | Above 80˚F (27˚C) | Poor |

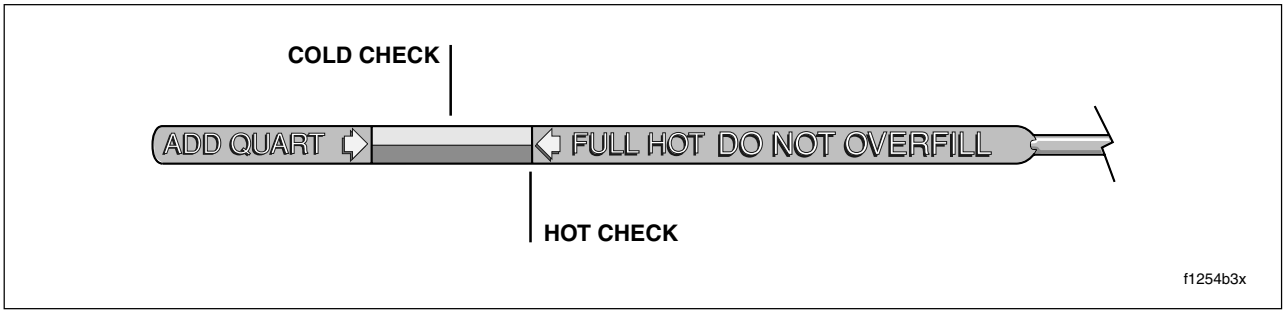



**Figure 1-2. Engine Oil Dipstick**

**CAUTION**

**Oil level cannot be accurately measured on a cold engine. For preride inspection, with motorcycle leaning on jiffy stand on level ground, oil should register on dipstick between arrows when engine is cold. Do NOT add oil to bring the level to the FULL mark on a COLD engine.**

10. Perform engine oil level **COLD CHECK** as follows:
    a. With the vehicle resting on the jiffy stand on level ground, wipe off the dipstick and insert it back into the oil pan with the plug pushed completely into the fill spout.
    b. Remove the dipstick and note the level of the oil. Oil level should register between the two arrows on the dipstick. See Figure 1-2. If oil level is at or below the lower arrow, add only enough oil to bring the level between the two arrows on the dipstick.
11. Perform engine oil level **HOT CHECK** as follows:
    a. Ride vehicle until engine is at normal operating temperature.
    b. With the vehicle resting on the jiffy stand on level ground, allow engine to idle for 1-2 minutes. Turn engine off.
    c. Wipe off the dipstick and insert it back into the oil pan with the plug pushed completely into the fill spout.
    d. Remove the dipstick and note the level of the oil. Add only enough oil to bring the level to the FULL mark on the dipstick. See Figure 1-2. Do not overfill.
12. Start engine and carefully check for oil leaks around drain plug and oil filter.

# PRIMARY CHAIN

At the 1000 mile service interval, and at every 5000 mile service interval thereafter, inspect the primary chain tension and adjust if necessary.

Proceed as follows:

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠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.**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. See Figure 1-3. Using a T27 TORX drive head, remove four screws to free the primary chain inspection cover from the primary chaincase cover.
4. Check the primary chain tension. Push on the upper strand to verify that it has free up and down movement midway between the engine compensating sprocket (front) and the clutch sprocket (rear).

## Table 1-2. Primary Chain Adjustment

| (Free Play) | Inches | Millimeters |
|---|---|---|
| COLD ENGINE | 5/8-7/8 inch | 15.9-22.2 mm |
| HOT ENGINE | 3/8-5/8 inch | 9.5-15.9 mm |

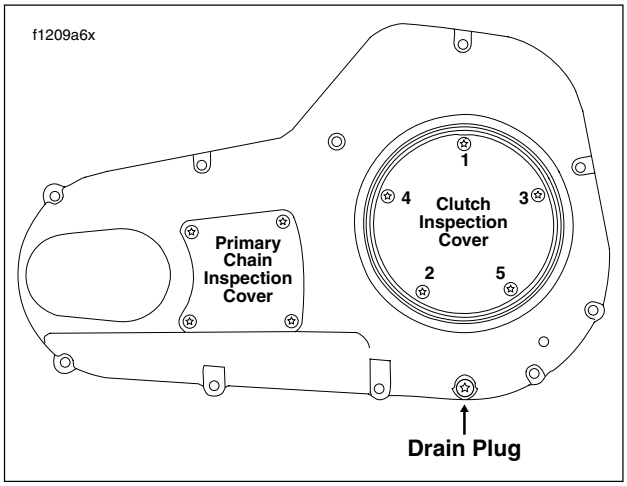



**Figure 1-3. Primary Chaincase Cover**

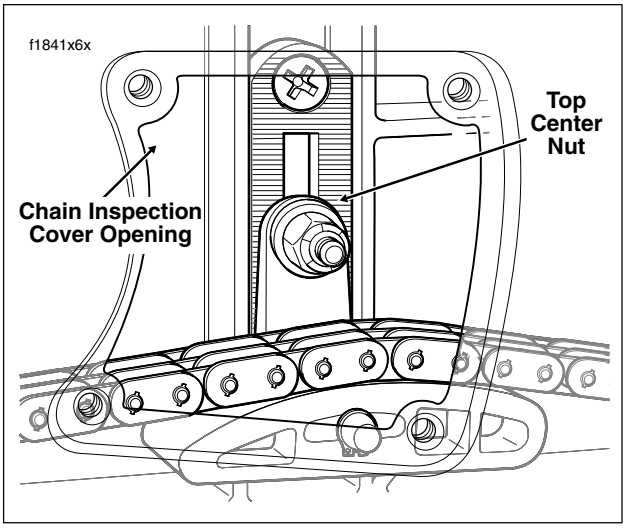



**Figure 1-4. Primary Chaincase Cover**

5. Measure the free play to be sure that it falls within the ranges specified for a hot or cold engine. See Table 1-2.
6. If the chain is too tight or too loose, then adjustment is necessary. Proceed as follows:
   a. Locate the chain tensioner assembly and loosen the top center nut a maximum of two turns. See Figure 1-4.
   b. Raise or lower the chain tensioner assembly as necessary to obtain the specified free play.

*NOTE*

*As chains stretch and wear, they run tighter at one spot than another. Always adjust the free play at the tightest spot in the chain.*

*NOTE*

*Replace the primary chain if it is worn to the point where it cannot be properly adjusted.*

**CAUTION**

**Do not adjust the primary chain tighter than specified. Running a chain that is too tight will result in excessive wear.**

*NOTE*

*Allowing the chain to run loose will cause the motorcycle to jerk when running at low speed resulting in excessive chain and sprocket wear.*

   c. Tighten the top center nut of the chain tensioner assembly to 21-29 ft-lbs (29-39 N-m).

7. Align holes in **new** gasket with holes in the primary chaincase cover. Using a T27 TORX drive head, install four screws to secure primary chain inspection cover to primary chaincase cover. Alternately tighten screws to 50-70 **in-lbs** (6-8 N-m) in a crosswise pattern.

## PRIMARY CHAIN LUBRICANT

At the 1000 mile service interval, and at every 5000 mile service interval thereafter, replace the primary chain lubricant as follows:

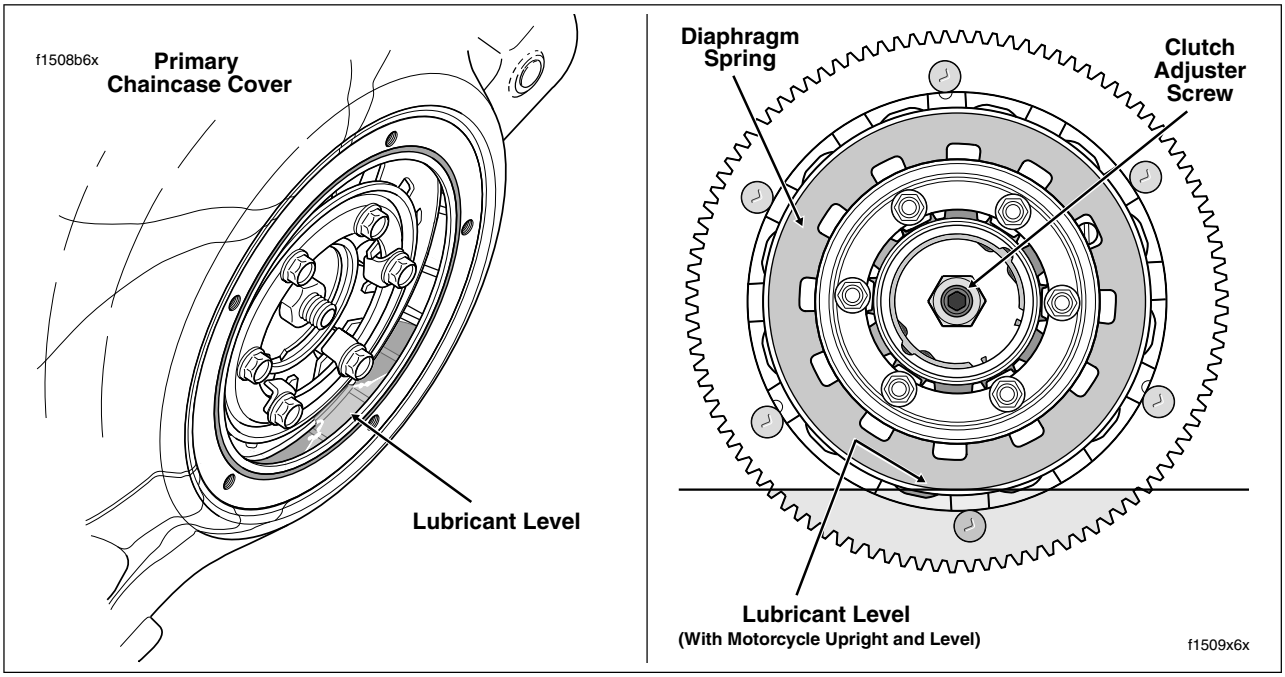



**Figure 1-5. Fill Primary Chaincase With Lubricant**

1. Using a T40 TORX drive head, remove magnetic drain plug at bottom of primary chaincase cover. Drain lubricant into suitable container. See Figure 1-3.
2. Clean drain plug. Apply Loctite Pipe Sealant with Teflon 565 to threads and install plug back into primary chaincase cover. If drain plug has accumulated a lot of debris, inspect the condition of chaincase components.
3. Using a T27 TORX drive head, remove five screws (with captive washers) to free clutch inspection cover from primary chaincase cover.
4. Pour the proper amount and type of primary chaincase lubricant in through the clutch inspection cover opening.

   With the vehicle standing upright, the level of the lubricant must be at the bottom edge of the diaphragm spring or 2-3/4 inches (69.8 mm) from the centerline of the clutch adjuster screw. See Figure 1-5. The primary chaincase capacity is 32 ounces (946 ml). Use only Harley-Davidson PRIMARY CHAINCASE LUBRICANT, Part No. 99887-84 (quart) or Part No. 99886-84 (gallon).

**CAUTION**

**Do not overfill the primary chaincase with lubricant. Overfilling may cause rough clutch engagement, incomplete disengagement, clutch drag and/or difficulty in finding neutral at engine idle.**

5. Remove O-ring from groove in primary chaincase cover. Wipe all lubricant from the O-ring and inspect for cuts, tears or signs of deterioration. Replace as necessary.
6. Swab all lubricant from the O-ring groove in the primary chaincase cover. Install O-ring in groove.

*NOTE*

*If lubricant is not thoroughly removed from both the O-ring and groove, compression of the O-ring during installation of the clutch inspection cover can cause lubricant to be squeezed to the outboard side of the ring groove, resulting in some temporary weepage around the inspection cover.*

7. Using a T27 TORX drive head, install five screws (with captive washers) to secure clutch inspection cover to the primary chaincase cover. Alternately tighten screws to 7-9 ft-lbs (10-12 Nm) in the pattern shown in Figure 1-3.

**⚠WARNING**

**When draining or adding lubricant, do not allow dirt, debris or other contaminants to enter the primary chaincase. Exercise caution so that lubricant does not contact rear wheel, tire and brake components. Such contact can adversely affect traction and may lead to loss of vehicle control, which could result in death or serious injury.**

# CLUTCH ADJUSTMENT

At the 1000 mile service interval, and at every 5000 mile service interval thereafter, adjust the clutch as follows:

**CAUTION**

**Perform the clutch adjustment with the motorcycle at room temperature. The clearance at the adjuster screw will increase as the powertrain temperature increases. If adjuster screw is adjusted while the powertrain is hot, clearance at push rod bearing could be insufficient with powertrain cold and clutch slippage could occur.**

*NOTE*

*Perform adjustment procedure whenever clutch components are replaced during normal servicing. Repeat adjustment after 500 miles (800 km) of use.*

1. Stand vehicle upright and level.
2. Using a T27 TORX drive head, remove five screws (with captive washers) to free clutch inspection cover from primary chaincase cover.
3. See Figure 1-6. Slide rubber boot off cable adjuster. Holding cable adjuster with 1/2 inch wrench, loosen jam nut using a 9/16 inch wrench. Back jam nut away from cable adjuster. Move adjuster toward jam nut to introduce a large amount of free play at hand lever.

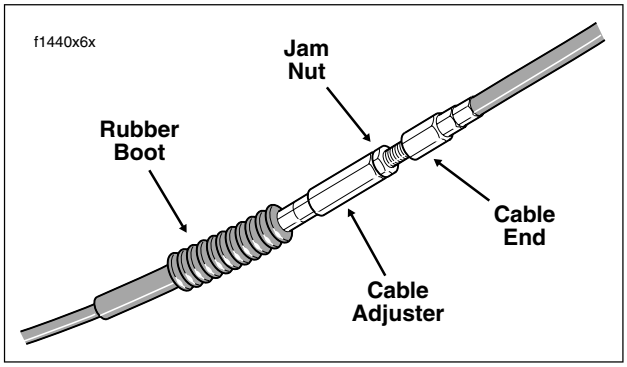



**Figure 1-6. Clutch Cable Adjuster Mechanism**

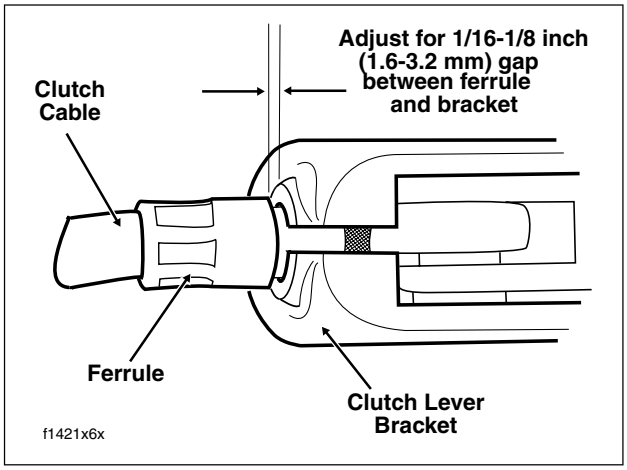



**Figure 1-7. Adjust Clutch Free Play**

4. See Figure 1-5. Loosen locknut on clutch adjuster screw. To take up all free play in push rods, turn screw inward (clockwise) until lightly seated.
5. Back out adjuster screw 1/2 to 1 turn. While holding adjuster screw with an allen wrench, tighten locknut to 6-10 ft-lbs (8-14 Nm).
6. Squeeze clutch lever to maximum limit three times to set ball and ramp release mechanism.
7. Turn cable adjuster away from jam nut until slack is eliminated at hand lever. Pull clutch cable ferrule away from clutch lever bracket to check free play. Turn cable adjuster as necessary to obtain 1/16 to 1/8 inch (1.6-3.2 mm) free play between end of cable ferrule and clutch lever bracket, as shown in Figure 1-7.
8. Hold adjuster with 1/2 inch wrench. Using 9/16 inch wrench, tighten jam nut against cable adjuster. Cover cable adjuster mechanism with rubber boot.
9. Remove O-ring from groove in primary chaincase cover. Wipe all lubricant from the O-ring and inspect for cuts, tears or signs of deterioration. Replace as necessary.
10. Swab all lubricant from the O-ring groove in the primary chaincase cover. Install O-ring in groove.
11. Using a T27 TORX drive head, install five screws (with captive washers) to secure clutch inspection cover to the primary chaincase cover. Alternately tighten screws to 7-9 ft-lbs (10-12 Nm) in the pattern shown in Figure 1-3.

## TRANSMISSION LUBRICANT

At the 1000 mile service interval, and at every 5000 mile service interval thereafter, replace the transmission lubricant as follows:

1. See Figure 1-8 and Figure 1-9. Remove the filler plug from the clutch release cover on the right side of the transmission case. Check the O-ring for tears, cuts or general deterioration. Replace as necessary.
2. Locate transmission drain plug on the right side of the oil pan. Remove the magnetic plug and drain the transmission lubricant into a suitable container.
3. Remove any foreign material from the drain plug. Check the O-ring on the drain plug for tears, cuts or general deterioration. Replace as necessary.
4. Install the transmission lubricant drain plug and tighten to 14-21 ft-lbs (19-28 Nm).

**⚠WARNING**

**When draining or adding lubricant, do not allow dirt, debris or other contaminants to enter the transmission case. Exercise caution so that lubricant does not contact rear wheel, tire and brake components. Such contact can adversely affect traction and may lead to loss of vehicle control, which could result in death or serious injury.**

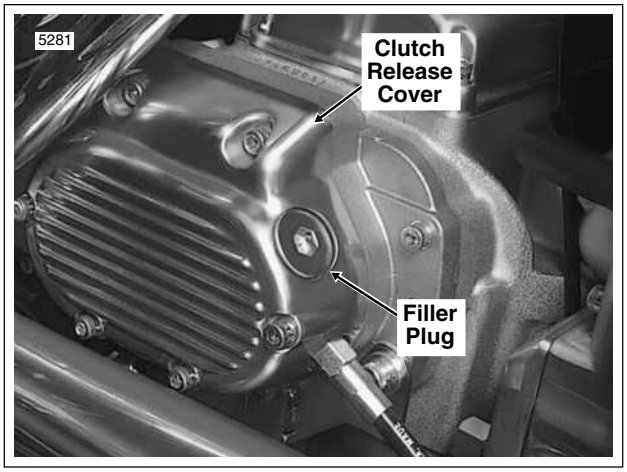



**Figure 1-8. Transmission Case (Right Side)**

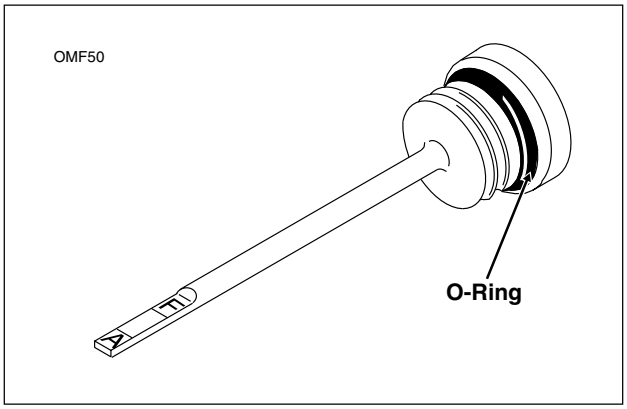



**Figure 1-9. Transmission Lubricant Filler Plug/Dipstick**

5. Fill the transmission with 20-24 oz. (590-710 ml) of transmission lubricant or until the lubricant level on the dipstick of the filler plug is at the F(ULL) mark with the motorcycle in a level, upright position and the filler plug resting on the threads. Use only Harley-Davidson TRANSMISSION LUBRICANT, Part No. 98853-96 (case/quarts), or Part No. 98852-96 (case/gallons).
6. Install the transmission filler plug/dipstick in the clutch release cover. Tighten the plug to 25-75 **in-lbs** (2.8-8.5 Nm).

## TIRES

At every scheduled service interval, inspect the tires as follows:

1. Inspect each tire for punctures, cuts, breaks, and wear. Replace tires before they reach the tread wear indicator bars (1/32 of an inch tread pattern depth remaining).

2. Check tire pressure.

### Table 1-3. Tire Pressure (Cold)

| DUNLOP TIRES ONLY | FRONT | | REAR | |
|---|---|---|---|---|
| | PSI | BARS | PSI | BARS |
| Solo Rider | 36 | 2.5 | 36 | 2.5 |
| Rider & One Passenger | 36 | 2.5 | 40 | 2.8 |

**⚠WARNING**

**Do not inflate tires beyond the maximum inflation pressure specified on tire sidewall. Overinflation can lead to tire failure while vehicle is in operation, which could result in death or serious injury.**

## WHEEL SPOKES

If vehicle has laced wheels, inspect spoke tightness at every 5000 mile service interval. Proceed as follows:

1. Raise wheel off the ground.

**CAUTION**

**If nipples require more than one full turn to tighten spoke, remove tire to check that spoke protrusion has not damaged tube.**

2. Lightly tap each spoke with a spoke wrench. Loose spokes will sound dull and must be tightened. Tighten spokes to 40-50 **in-lbs** (4.5-5.6 Nm). If more than a few spokes are loose, true the entire wheel following the procedure under Section 2.6 TRUING LACED WHEEL.

## STEERING HEAD BEARINGS

At every 5,000 mile (8,000 km) service interval, grease the steering head bearings using *Special Purpose Grease, Part No. 99857-97*. Turn handlebar full right to access the grease fitting at the left side of the steering head. Connect grease gun to fitting and inject grease until it exudes from top and bottom of steering head. See Figure 1-10.

At the 1,000 mile (1,600 km) service interval, and every 10,000 miles (16,000 km) thereafter, check the swing-by following the checking procedure under Section 2.15 STEERING HEAD BEARINGS.

Disassemble the front fork every 50,000 miles (80,000 km), and inspect the steering head bearings for burnelling, scoring, or other damage. Replace and/or repack the bearings as required. See Section 2 for more information.

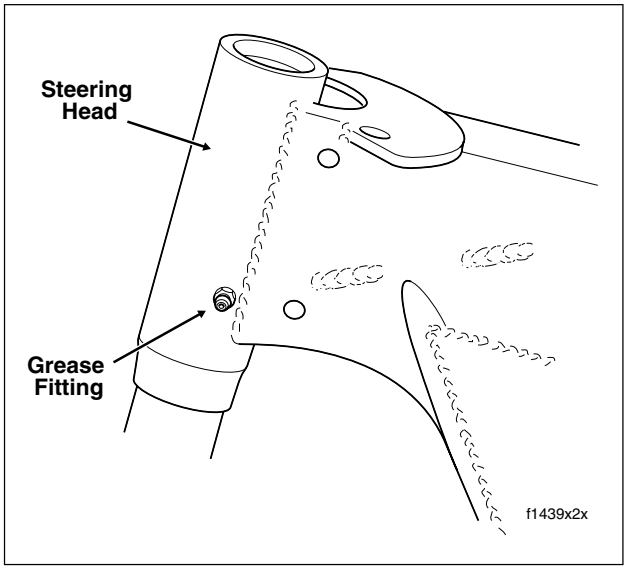



**Figure 1-10. Steering Head Bearing Grease Fitting**

## FRONT FORK OIL

At every 20,000 mile service interval, replace the front fork oil.

*NOTE*

*All air pressure must be bled from front forks before fluid can be drained.*

1. To bleed air pressure from system, remove core from front air valve using Snap-ON tool #GA143A.
2. Remove the drain plug from the bottom of both forks and drain the oil. Reinstall one drain plug.
3. With one drain plug still removed, attach air suspension pump (part #HD-34633) to front air valve and gently pump to assist the draining process.
4. Attach vacuum tool (air operated) to front air valve.
5. Pour specified amount of Harley-Davidson Type E fork oil into clean container.

### Table 1-4. Fork Oil Requirements

| TYPE | AMOUNT |
|---|---|
| Harley-Davidson Type E, Part No. 99884-80 (16 oz.) | 9.7 oz. (287 ml) Each Fork |

6. Obtain a battery vent tube (Part No. 65995-88A) and cut the vent from each end. Insert one end of the tube into the fork oil and the other end against the open drain hole.

**⚠WARNING**

**Do not leave the vacuum tool on for too long or the fork oil will be drawn into the air lines. An insufficient quantity of fork oil can cause unstable handling. Unstable handling may lead to loss of vehicle control, which could result in death or serious injury.**

7. Turn the vacuum tool on just long enough to allow the fork oil to be drawn into the front fork. When the fluid container is empty, reinstall the drain plug and turn the vacuum tool off. Tighten the drain plug to 72-96 **in-lbs** (8-11 Nm).
8. Repeat the process on the opposite fork.

# BRAKE FLUID

At the 1000 mile service interval, and at every 5000 mile service interval thereafter, inspect the brake fluid condition and level. Proceed as follows:

**CAUTION**

**To prevent dirt from entering the master cylinder reservoir, thoroughly clean the cover before removal.**

1. Remove two Phillips screws from cover of master cylinder reservoir. Remove cover (with gasket).
2. Stand the vehicle upright so that the master cylinder reservoir is in a level position. Fluid level should be 1/ 8 inch (3.2 mm) from the top. Add fluid as necessary.

*NOTE*

*Use only D.O.T. 5 SILICONE HYDRAULIC BRAKE FLUID, Part No. 99902-77 (12 oz.) or Part No. 99901-77 (gallon).*

3. Install cover (with gasket) on the master cylinder reservoir. Install two Phillips screws and tighten to 6-8 **in-lbs** (0.7-0.9 Nm).

**⚠WARNING**

**Whenever the brake system is serviced, it should be tested on dry, clean pavement at slow speeds before putting the motorcycle into regular service. Improperly serviced brakes can lead to an accident that could result in death or serious injury.**

# BRAKE PAD LININGS AND DISCS

At every scheduled service interval, inspect the brake pad linings and discs as follows:

### Brake Pad Linings

If brake pad friction material is worn to 0.04 inch (1.02 mm) or less, replace the entire set of pads.

**⚠WARNING**

**For correct and safe brake operation, brake pads must be replaced in sets at the same time. Mismatched brake pads could lead to an accident resulting in death or serious injury.**

### Brake Discs

The minimum brake disc thickness is stamped on the side of the disc.

When checking the brake pads and discs, inspect the brake hoses for correct routing and any signs of damage.

# DRIVE BELT

At every scheduled service interval, inspect the drive belt for damage and check belt adjustment as follows:

*NOTE*

- *Set belt tension at tightest point in belt.*
- *Procedure should be performed with motorcycle cold.*
- *Procedure should be performed with weight of owner on vehicle.*

1. See Figure 1-11. With the rear wheel on the ground and one rider sitting on the motorcycle, use the BELT TENSION GAUGE (Part No. HD-35381) to apply 10 lbs. (4.5 kg) of force at the midpoint of the bottom belt strand. Belt deflection should be 5/16-3/8 inch (7.9-9.5 mm). If belt tension adjustment is necessary, proceed to step 2.
2. See Figure 1-12. Remove the linch pin clip on left side of vehicle and loosen the castle axle nut. To move the axle, turn the adjuster nuts as necessary until the correct belt tension is obtained. Be sure to turn each adjuster nut an equal number of turns to keep the wheel in alignment.

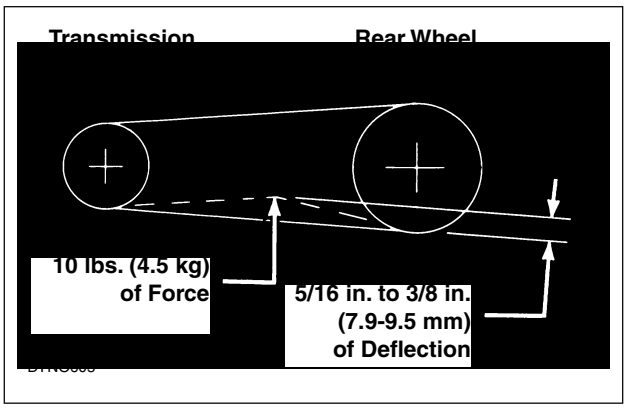



**Figure 1-11. Check and Adjust Belt Deflection**

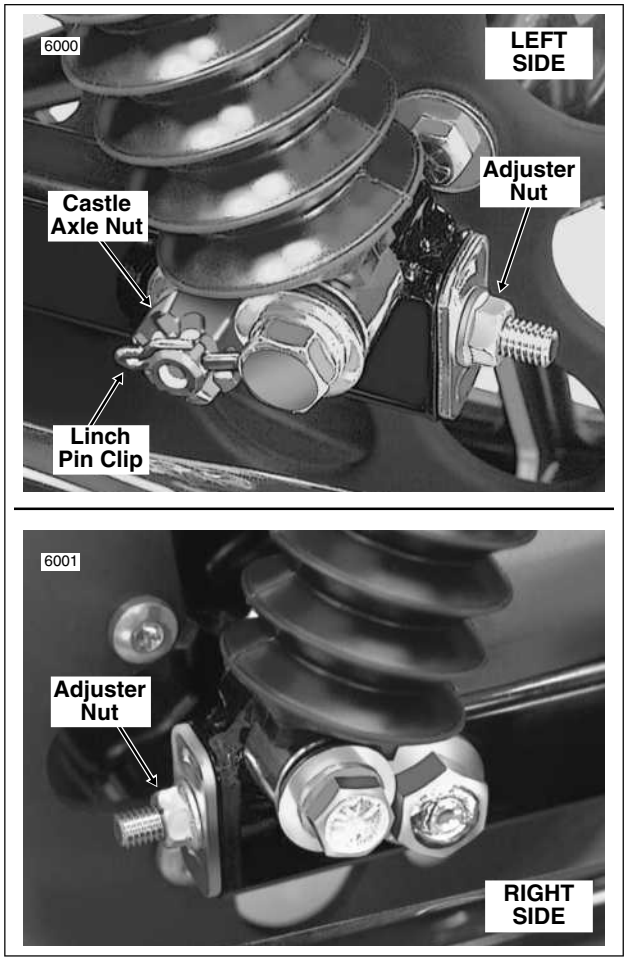



**Figure 1-12. Loosen Axle Nut and Turn Adjuster Nuts**

3. Tighten the castle axle nut to 60 ft-lbs (81 Nm) torque and install the linch pin clip in the axle hole. If necessary, tighten the axle nut further to align the axle hole and nut slot, but do not exceed 65 ft-lbs (88 Nm).
4. Check wheel alignment. See WHEEL ALIGNMENT in Section 2.

## REAR SWING ARM PIVOT SHAFT NUT

At the 1000 mile service interval, and at every 10,000 mile service interval thereafter, inspect the tightness of the rear swingarm pivot shaft fastener as follows:

1. Remove the decorative chrome plugs from the rear swing arm brackets (left and right side of vehicle).
2. See Figure 1-13. Hold right side nut on the pivot shaft and tighten left side locknut to 40-45 ft-lbs (54-61 Nm)
3. Snap the chrome plugs back into the rear swing arm brackets.
4. Verify tightness of four rear swing arm brackets bolts.

## REAR SHOCK ABSORBERS

At the 1000 mile service interval, and at every 5000 mile service interval thereafter, inspect the rear shock absorbers for signs of leakage or damage, and replace if necessary.

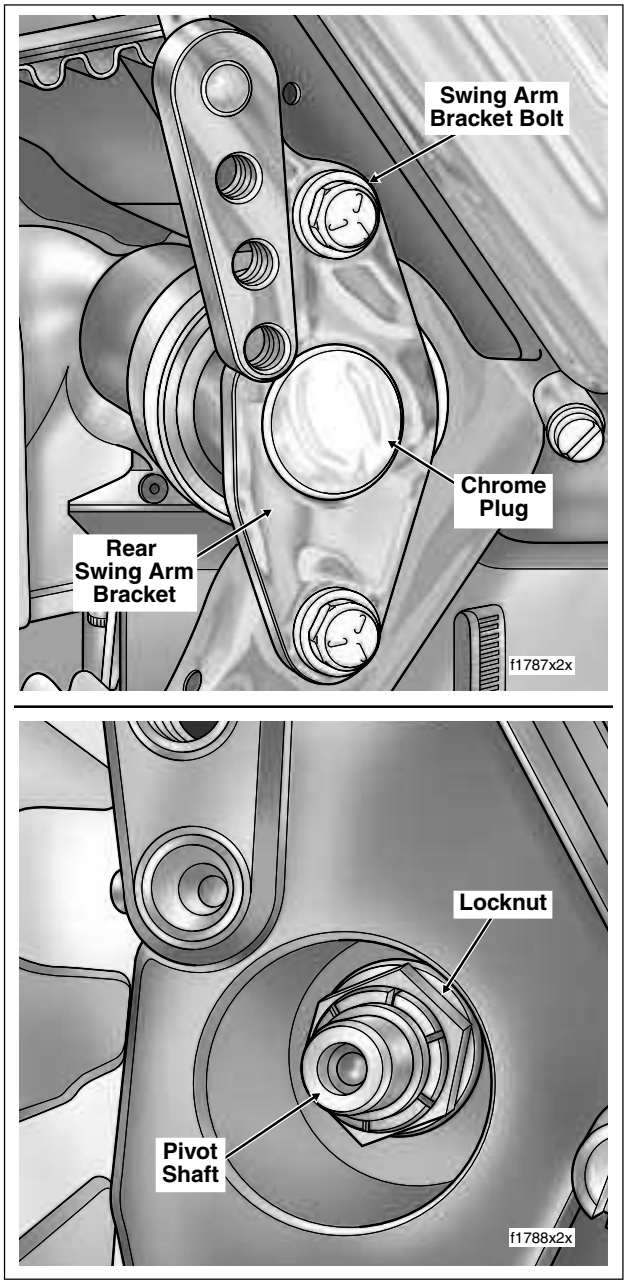



**Figure 1-13. Remove Chrome Plugs and Check Pivot Shaft Locknut Torque**

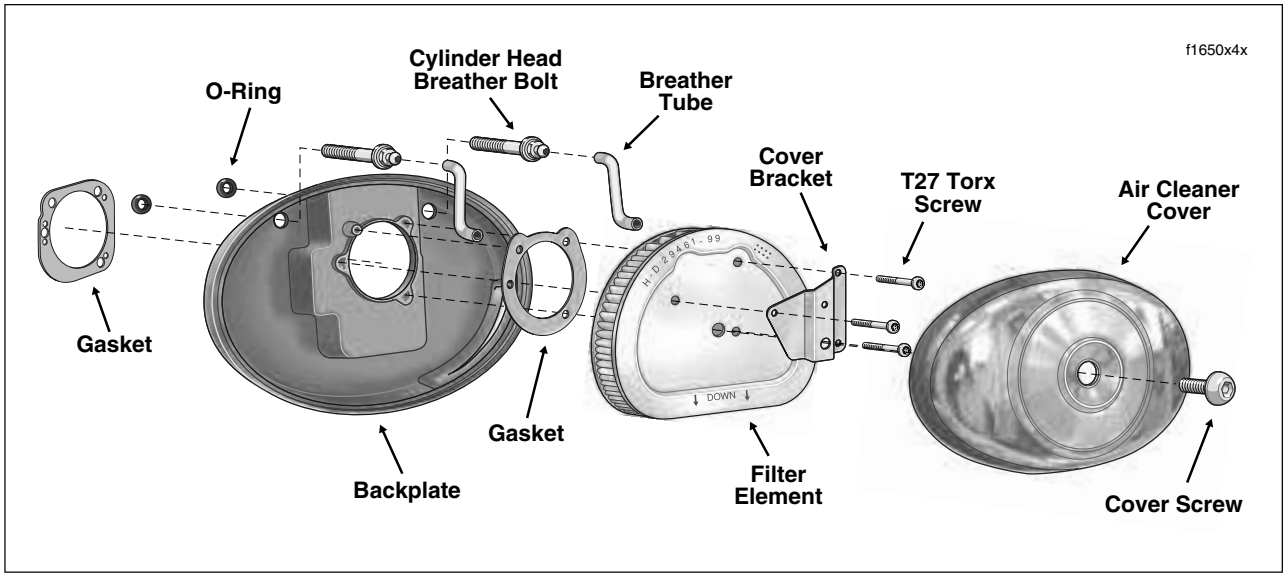



**Figure 1-14. Air Cleaner Assembly (Carbureted)**

## AIR CLEANER (CARBURETED)

At every scheduled service interval, inspect and clean the air cleaner filter element as follows:

1. Remove large allen head socket screw in center of air cleaner cover. Remove air cleaner cover with rubber seal. See Figure 1-14.
2. Remove three T27 TORX screws to release cover bracket from filter element.

**CAUTION**

**Never run the engine with the filter element removed. The filter prevents dirt and dust from entering the engine.**

3. Remove filter element pulling two breather tubes from holes on inboard side.
4. Remove gasket from sleeve on inboard side of filter element. Discard gasket.
5. Remove breather tubes from fittings on two cylinder head breather bolts.
6. Remove two cylinder head breather bolts from backplate using a 7/16 inch deepwell socket.
7. Remove backplate from cylinder heads. On California models, pull EVAP tube (air inlet to charcoal canister) from hole in backplate.
8. Remove two O-rings from grooves around breather bolt holes on inboard side of backplate. Discard O-rings.
9. Remove gasket from inboard side of backplate. Discard gasket.
10. Thoroughly clean air cleaner cover and backplate.
11. Replace the filter element if damaged or if filter media cannot be adequately cleaned.
12. Wash the filter element and breather tubes in warm, soapy water. To remove soot and carbon, soak element for 30 minutes in warm water with mild detergent.

**⚠WARNING**

**Do not use gasoline or solvents to clean the filter element. Volatile or flammable cleaning agents may cause an intake system fire, which could result in death or serious injury.**

**⚠WARNING**

**Compressed air can pierce the skin and cause injury. Never use your hand to check for leaks or to determine air flow rates. Wear safety glasses to shield your eyes from flying dirt and debris. Failure to comply could result in death or serious injury.**

13. Dry the filter element using low pressure compressed air (32 psi/221 kPa maximum). Rotate the element while moving air nozzle up and down the element interior. Do not rap the element on a hard surface.
14. Hold the filter element up to a strong light source. The element can be considered sufficiently clean if light is uniformly visible through the media.
15. Inspect the breather tubes for cuts, tears, holes or signs of deterioration. Replace as necessary. Direct compressed air through the breather tubes to verify that they are not plugged.
16. Install **new** O-rings in grooves around breather bolt holes on inboard side of backplate.

17. Install **new** gasket aligning small holes with plastic pins on inboard side of backplate. On California models, push EVAP tube (air inlet to charcoal cannister) into hole of backplate until stopped by shoulder.
18. Align holes in backplate with those in cylinder heads and install cylinder head breather bolts. Using a 7/16 inch deepwell socket, alternately tighten bolts to 10-12 ft-lbs (13.6-16.3 Nm).
19. With the lettered side facing outward, slide **new** gasket over sleeve on inboard side of filter element.
20. Insert breather tubes about 1/4 inch into holes on inboard side of filter element.
21. Install breather tubes onto fittings of two cylinder head breather bolts.

*NOTE*

*Air cleaner mounting without installation of the breather tubes allows crankcase vapors to be vented into the atmosphere in violation of legal emissions standards.*

22. Place filter element onto backplate so that hole in element fits over boss molded into backplate.
23. Align holes in cover bracket with those in filter element and start three T27 TORX screws. Stamp on cover bracket points to downside. Alternately tighten screws to 20-40 **in-lbs** (2.3-4.5 Nm) in a crosswise pattern.
24. Verify that rubber seal is properly seated around perimeter of air cleaner cover. Install **new** seal if torn or damaged. Fit air cleaner cover into backplate.
25. Apply a small dab of Loctite Medium Strength Threadlocker 243 (blue) to threads of large allen head socket screw. Install screw in center of air cleaner cover. Tighten screw to 3-5 ft-lbs (4.1-6.8 Nm).

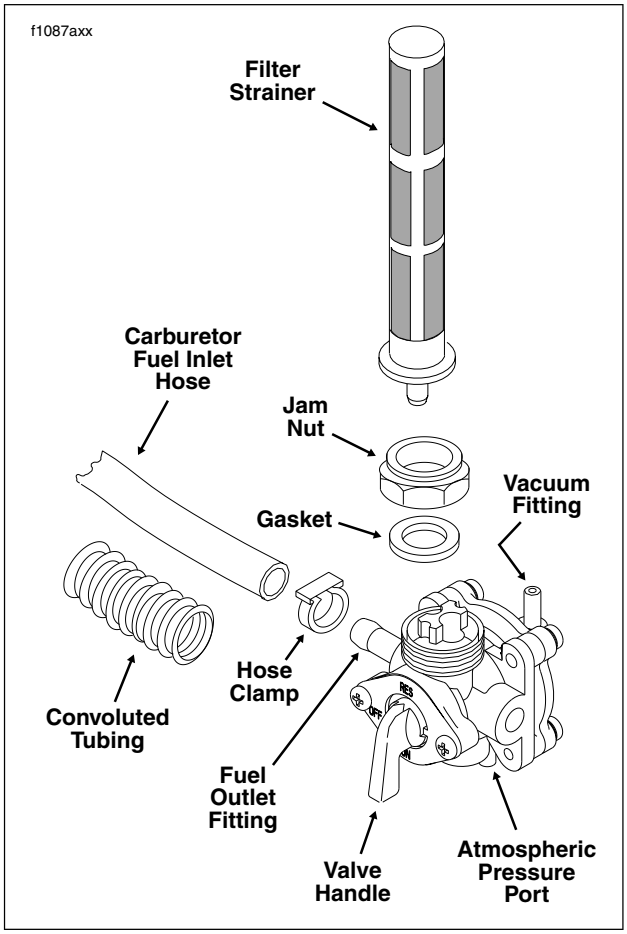



**Figure 1-15. Vacuum Operated Fuel Valve**

## FUEL TANK FILTER (CARBURETED)

At every 20,000 mile service interval, remove and inspect the fuel tank filter as follows:

**⚠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.**

1. Turn the handle of the fuel valve to OFF.

**⚠WARNING**

**A small amount of gasoline may drain from the carburetor fuel inlet hose when disconnected from the fuel valve fitting. Thoroughly wipe up any spilled fuel immediately and dispose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.**

2. Remove the carburetor fuel inlet hose from the fuel outlet fitting at the side of the fuel valve. See Figure 1-15.
3. Remove the intake manifold vacuum hose from the vacuum fitting at the back of the fuel valve.
4. Attach a length of fuel hose to the fuel outlet fitting. The hose must be long enough to reach a suitable gasoline container.
5. Turn the handle of the fuel valve to RES(ERVE).
6. Using the correct hose adapter, connect the Mity-Vac® Hand Pump (HD-23738) to the vacuum fitting.

**CAUTION**

**To avoid damage to the diaphragm of the fuel valve, do not apply a vacuum greater than 10 inches of Mercury (Hg) to the vacuum fitting.**

7. Gently apply a vacuum of 1-10 inches of Mercury (Hg) to the vacuum fitting to get a good flow of gasoline through the valve.
8. When the fuel tank is completely drained, disconnect the Mity-Vac® Hand Pump from the vacuum fitting.

9. Turn the hex jam nut to remove the fuel valve assembly from the fuel tank.

*NOTE*

*The hex jam nut has left handed threads where it mates with the fuel valve assembly.*

10. Turn the hex jam nut clockwise to remove it from the fuel valve.
11. Remove the fuel filter strainer and gasket from the valve head.
12. Clean or replace the fuel filter.
13. Apply Loctite PIPE SEALANT WITH TEFLON to the threads of the fuel valve and fuel tank.
14. Install a **new** gasket on the fuel valve. Install the fuel filter strainer fitting the internal tube into the larger hole in the valve head.
15. Thread the hex jam nut into the fuel tank two full turns. Holding the nut to prevent further rotation, thread the fuel valve into the hex jam nut two full turns.
16. Holding the fuel valve, turn the hex jam nut into the fuel tank in a clockwise direction. Tighten the nut to 18 ft-lbs (24 Nm).

**⚠WARNING**

**Do not thread hex jam nut onto fuel valve more than two turns or fitting may "bottom" on valve, a condition which may result in a gasoline leak. Any gasoline leak is a potential fire hazard that could result in death or serious injury.**

**CAUTION**

**Do not allow dirt or fluids to get into the vacuum hose assembly that connects the fuel valve and VOES to the intake manifold. Contaminants can block the vacuum signal or inhibit free motion of moving parts which could cause the fuel valve to remain open.**

17. Connect the intake manifold vacuum hose to the vacuum fitting at the back of the fuel valve.
18. Connect the carburetor fuel inlet hose to the fuel outlet fitting using a **new** clamp. Crimp the clamp using the proper HOSE CLAMP PLIERS, HD-97087-65B.
19. Turn the handle of the fuel valve to OFF and fill the fuel tank.
20. Open the fuel supply valve and carefully inspect for leaks. Return the valve to the OFF position after the inspection is complete.

*NOTE*

*To start vehicle, turn the valve handle to ON and start engine. No priming or special procedures are required to start fuel flow.*

# FUEL SYSTEM LINES AND FITTINGS

At every scheduled service interval, and after the fuel tank filter has been serviced (if scheduled), inspect the fuel system lines and fittings for leaks.

# ENRICHENER CONTROL

On carbureted vehicles, inspect the enrichener control at every scheduled service interval. Proceed as follows:

The fuel enrichener knob should open, remain open and then close without binding. The knurled plastic nut next to the enrichener knob controls the ease at which the cable slides within the conduit.

If adjustment is needed, proceed as follows:

1. See Figure 1-16. Loosen hex nut at backside of mounting bracket.
2. Move cable assembly free of slot in mounting bracket.
3. Hold cable assembly at flat with adjustable wrench. Hand turn knurled nut counterclockwise to reduce sliding resistance until knob slides inward unaided.
4. Turn knurled nut clockwise to increase sliding resistance until knob remains fully out without holding and then closes with relative ease.
5. Position cable assembly in slot of mounting bracket. Tighten hex nut at backside of mounting bracket.

**CAUTION**

**Do not lubricate the cable or inside of conduit. The cable must have sliding resistance to work properly.**

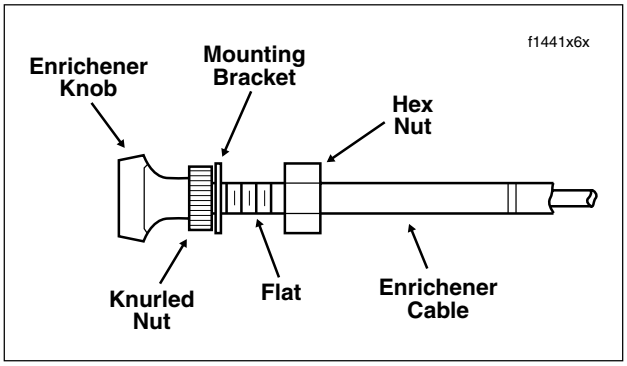



**Figure 1-16. Enrichener Control**

# THROTTLE CABLES

At the 1000 mile service interval, and at every 5000 mile service interval thereafter, lubricate and inspect the throttle and clutch cables as follows:

## Lubrication

**CAUTION**

**Do not remove the switch housing assembly without first placing the 5/32 inch cardboard insert between the brake lever and lever bracket. Removal without the insert may result in damage to the rubber boot and plunger of the Front Stoplight Switch.**

*NOTE*

*Use the eyelet of an ordinary cable strap if the cardboard insert is not available.*

1. Place the cardboard insert between the brake lever and lever bracket. See Figure 1-17.
2. Using a T25 TORX drive head, remove the upper and lower switch housing screws.
3. Using a T27 TORX drive head, loosen the upper screw securing the handlebar clamp to the master cylinder housing. Remove the lower clamp screw with flat washer.
4. Remove the brass ferrules from the notches on the inboard side of the throttle control grip. Remove the ferrules from the cable end fittings. See Figure 1-18.

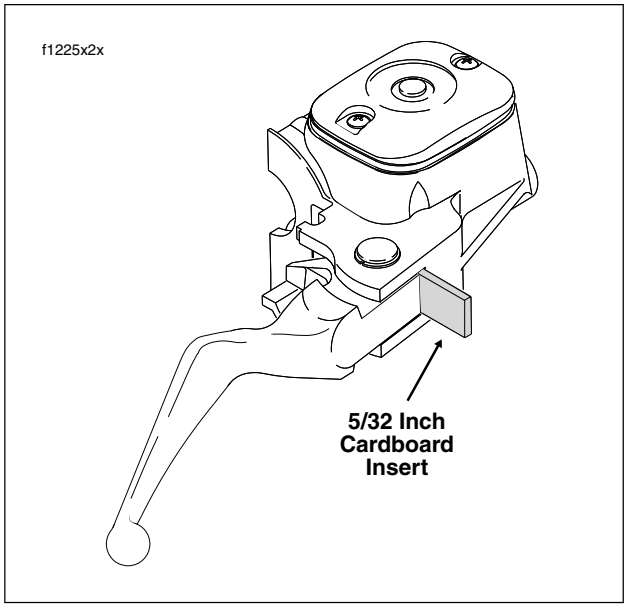



**Figure 1-17. Install Cardboard Insert**

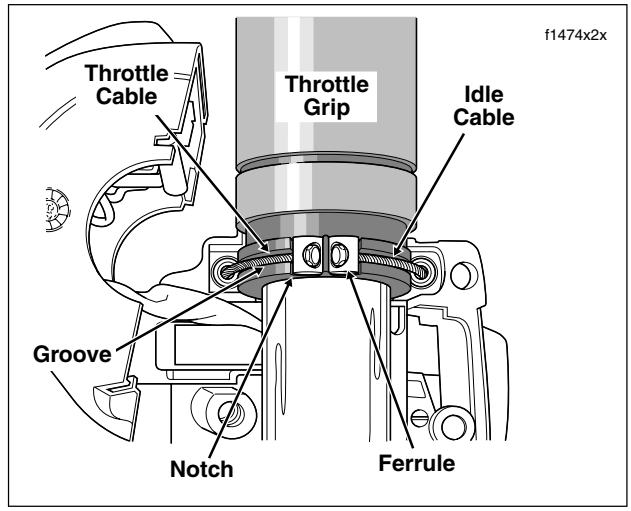



**Figure 1-18. Remove Throttle/Idle Cables**

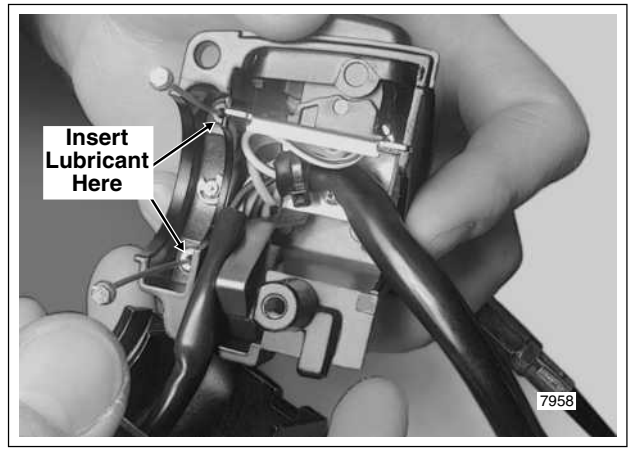



**Figure 1-19. Lubricate Throttle/Idle Cables**

5. Remove the friction shoe from the end of the tension adjuster screw.

*NOTE*

*The friction shoe is a loose fit and may fall out or become dislodged if the lower switch housing is turned upside down or shaken.*

6. Remove the throttle control grip from the end of the handlebar.
7. Move upper switch housing to the side in order to access lower housing.

**⚠CAUTION**

**Lubit-8 Tufoil Chain and Cable Lube contains detergents. Avoid contact with eyes. Keep out of reach of children.**

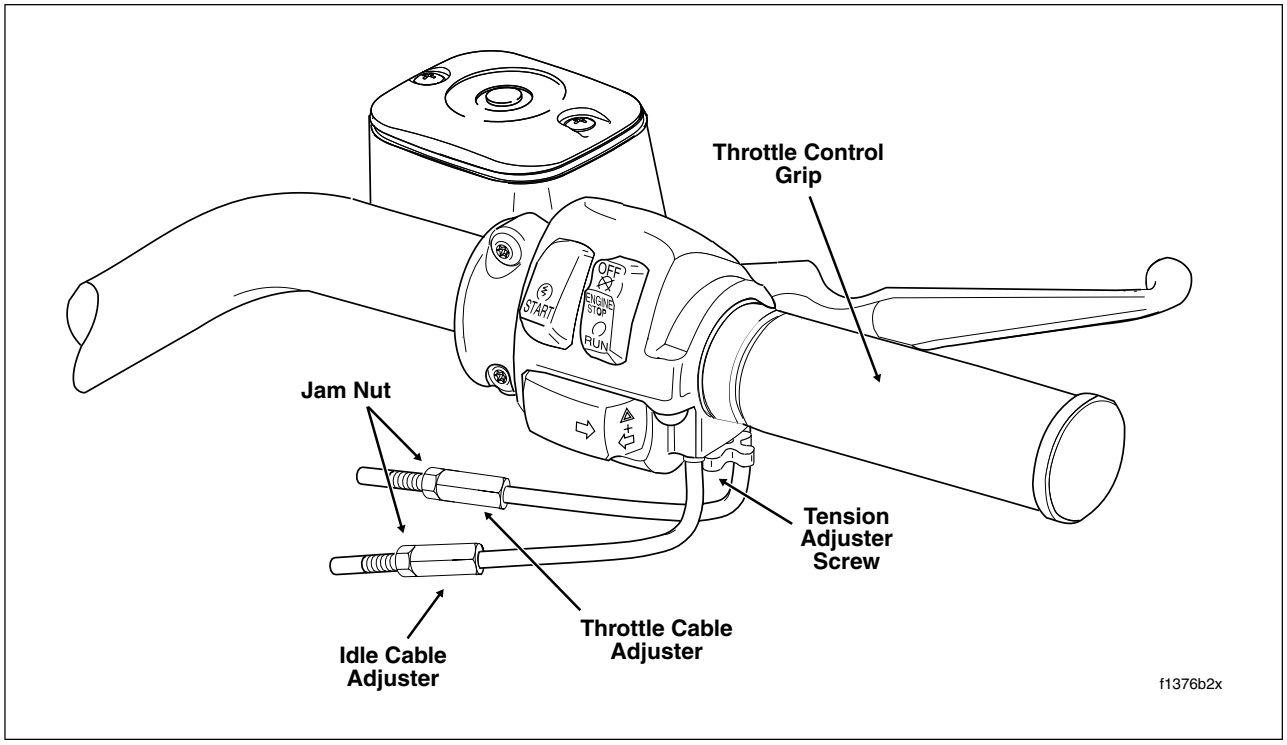



**Figure 1-20. Throttle Cable Assembly - Throttle Side (FLHR/C)**

8. Obtain tube of Lubit-8 Tufoil Chain and Cable Lube (HD Part No. 94968-85TV- 1/4 fl. oz.). Insert pin of tube between throttle cable and cable housing inside lower switch housing. Squeeze tube to squirt a quantity of lubricant into cable housing moving pin around cable OD. See Figure 1-19.
9. Repeat the procedure squirting a quantity of lubricant between the idle cable and cable housing.
10. With the concave side facing upward, install the friction shoe so that the pin hole is over the point of the adjuster screw.

*NOTE*

*The friction shoe is a loose fit and may fall out or become dislodged if the lower switch housing is turned upside down or shaken.*

11. Apply a light coating of graphite to the handlebar.
12. Slide the throttle control grip over the end of the right handlebar until it bottoms against the closed end. Rotate the grip so that the ferrule notches are at the top. To prevent binding, pull the grip back about 1/8 inch (3.2 mm).
13. Position the lower switch housing beneath the throttle control grip. Install the brass ferrules onto the cables so that the end fittings seat in the ferrule recess. Seat the ferrules in their respective notches on the throttle control grip. Verify that the cables are captured in the grooves molded into the grip. See Figure 1-18.
14. Position the upper switch housing over the handlebar and lower switch housing. Verify that the wire harness conduit runs in the depression at the bottom of the handlebar.
15. Start the upper and lower switch housing screws, but do not tighten.
16. Position the brake lever/master cylinder assembly inboard of the switch housing assembly engaging the tab on the lower switch housing in the groove at the top of the brake lever bracket.
17. Align the holes in the handlebar clamp with those in the master cylinder housing and start the lower screw (with flat washer). Position for rider comfort. Beginning with the top screw, tighten the screws to 60-80 **in-lbs** (6.8-9.0 Nm) torque using a T27 TORX drive head.
18. Using a T25 TORX drive head, tighten the lower and upper switch housing screws to 35-45 **in-lbs** (4-5 Nm).

*NOTE*

*Always tighten the lower switch housing screw first so that any gap between the upper and lower housings is at the front of the switch assembly.*

19. Remove the cardboard insert between the brake lever and lever bracket.

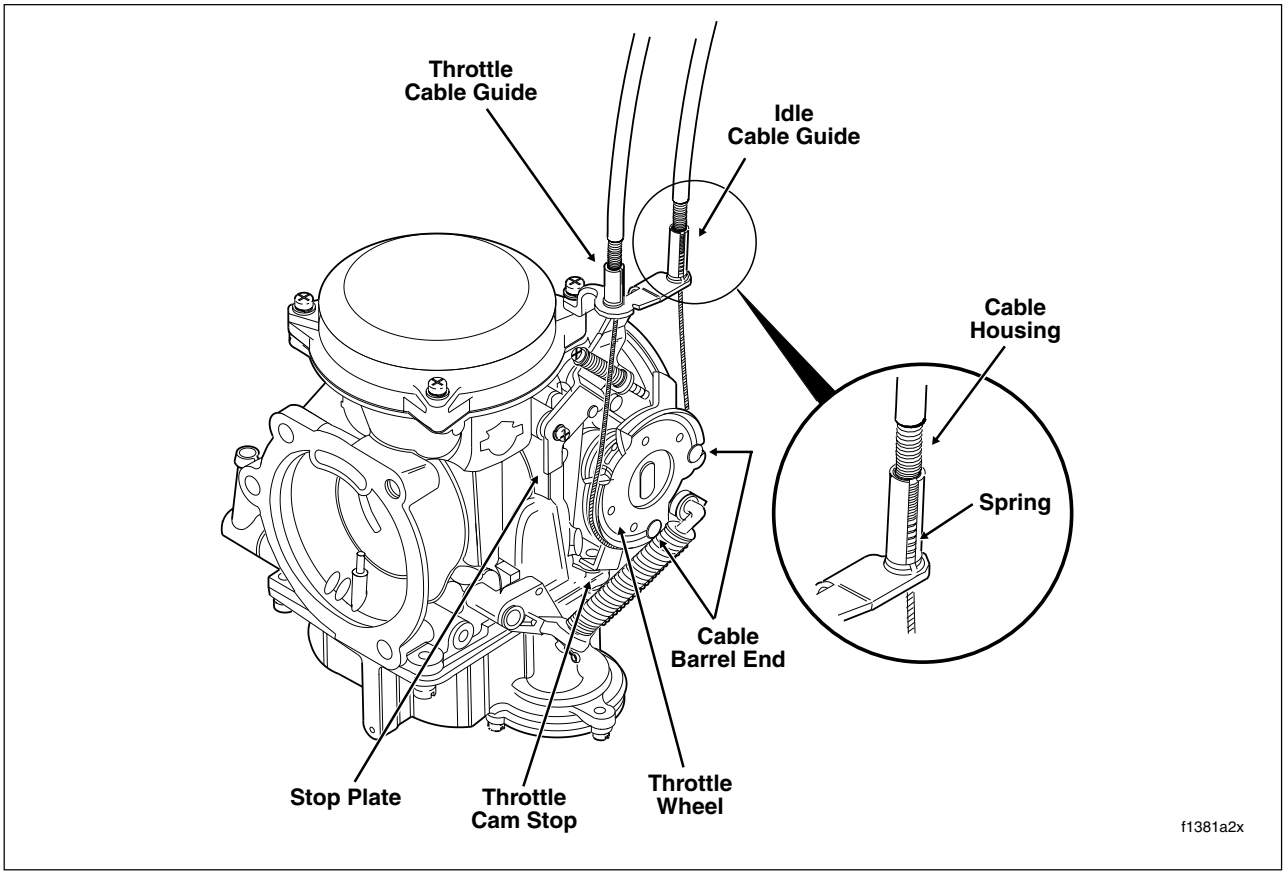



**Figure 1-21. Throttle Cable Assembly - Carburetor Side**

20. Turn the Ignition/Light Key Switch to IGNITION and apply brake lever to test operation of brake lamp.

## Adjustment

*NOTE*

*For throttle and idle cable adjustment on Ultra models, see CRUISE CONTROL in Section 8.*

1. Slide rubber boot off throttle cable adjuster. See Figure 1-20. Holding cable adjuster with a 3/8 inch wrench, loosen jam nut turning in a clockwise direction. Back jam nut away from cable adjuster until it stops. Turn adjuster clockwise until it contacts jam nut. Repeat procedure on idle cable adjuster.
2. Point the front wheel straight ahead. Turn the throttle control grip so that the throttle is wide open (fully counterclockwise) and then hold in position. Now turn the throttle cable adjuster counterclockwise until the throttle cam stop just touches the stop plate on the carburetor. See Figure 1-21. Tighten jam nut against the throttle cable adjuster and then release the throttle control grip. Cover cable adjuster mechanism with rubber boot.
3. Turn the front wheel full right. Turn the idle cable adjuster counterclockwise until the cable housing just touches the spring in the longer cable guide. Work the throttle grip to verify that the throttle cable returns to the idle position when released. If the cable does not return to idle, turn the adjuster clockwise slightly until the correct response is achieved. Tighten jam nut against the idle cable adjuster and cover cable adjuster mechanism with rubber boot.
4. Verify that the throttle control operates freely without binding. With the tension adjuster screw backed off, the throttle control grip must freely return to the closed (idle) position. The throttle control also must open and close freely when the front wheel is turned to both the right and left fork stops.

   If the throttle grip does not return to the idle position freely, check the adjuster screw tension. If the adjuster screw is backed off, inspect the cables for short bends.

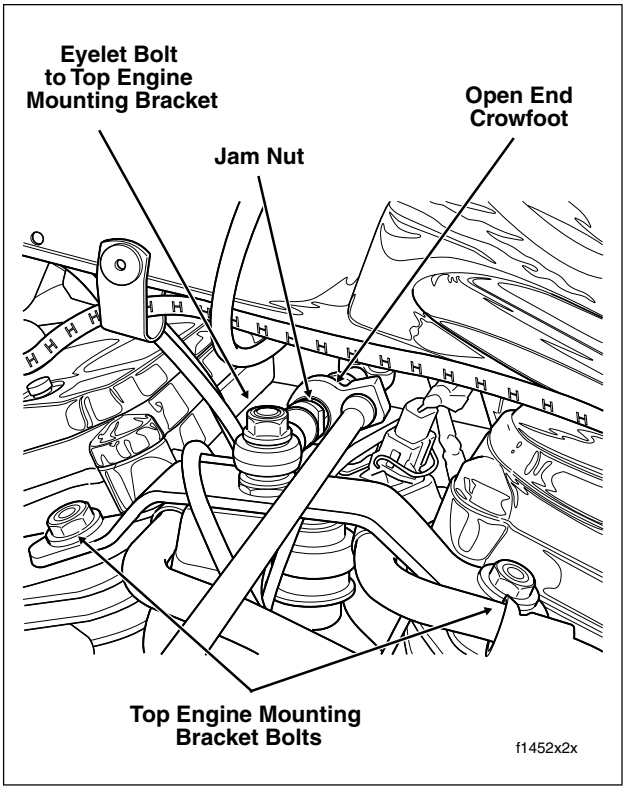



**Figure 1-22. Top Stabilizer Link and Engine Mounting Bracket Bolts (Left Side View)**

# ENGINE MOUNTS

At every 10,000 mile service interval, inspect the engine mounting hardware as follows:

Verify tightness of 15 engine mount fasteners. If any fasteners are found loose, tighten to specification. Replace fasteners if damage is noted.

*NOTE*

*Raise fuel tank to access top engine stabilizer bolts and jam nuts. For carbureted models, see Section 4.7 FUEL TANK, FLHT/C, FLTR, or FLHR, PARTIAL REMOVAL. For fuel injected models, see Section 9.3 FUEL TANK, FLHTC/U-I, FLTR-I, or FLHR/C-I, PARTIAL REMOVAL.*

## Top

- On left side of vehicle, check top engine mounting bracket bolts to front and rear cylinder heads. See Figure 1-22.
- Top stabilizer link - check left eyelet bolt to top engine mounting bracket and left side jam nut. Repeat check on opposite side of vehicle: right side eyelet bolt to frame weldment and jam nut. Verify tightness of jam nuts using Open End Crowfoot (Snap-On FC018).

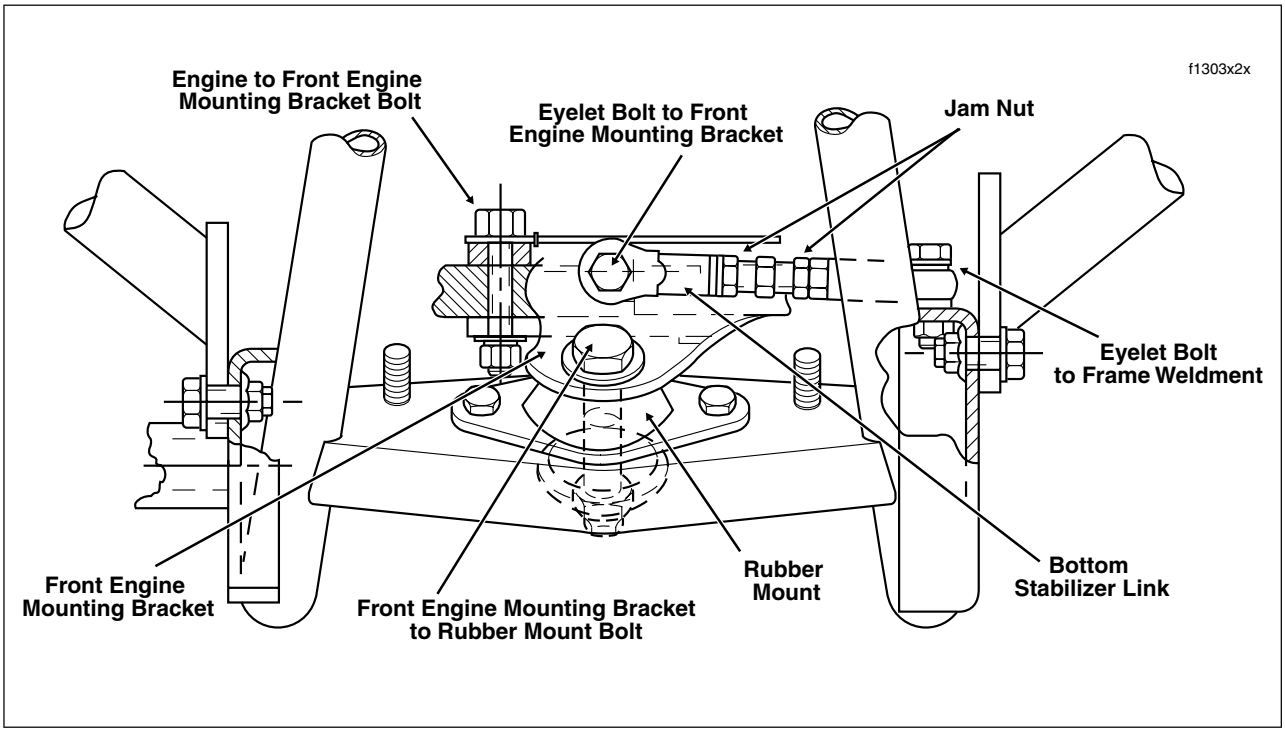



**Figure 1-23. Bottom Stabilizer Link and Front Engine Mount Bolts**

### Bottom

- Bottom stabilizer link - check left eyelet bolt to frame weldment and left side jam nut. Repeat check on opposite side of vehicle: right side eyelet bolt to block on front engine mounting bracket and jam nut. See Figure 1-23. Verify tightness of jam nuts using Open End Crowfoot (Snap-On FC018).
- Check two engine to front engine mounting bracket bolts.
- Check center front engine mounting bracket to rubber mount bolt.
- Check two engine to transmission bolts.

*NOTE*

*Install fuel tank. For carbureted models, see Section 4.7 FUEL TANK, FLHT/C, FLTR, or FLHR, INSTALLATION (AFTER PARTIAL REMOVAL). For fuel injected models, see Section 9.3 FUEL TANK, FLHTC/U-I, FLTR-I, or FLHR/C-I, INSTALLATION (AFTER PARTIAL REMOVAL).*

## SPARK PLUGS

Inspect the spark plugs at every 5000 mile service interval. Replace the spark plugs at every 10,000 mile service interval. Proceed as follows:

The HD-6R12 plug has a resistor element to reduce radio interference originating in the motorcycle ignition system. Only resistor type plugs should be used with the electronic ignition system.

1. Remove plugs and examine immediately. The deposits on the plug base are an indication of the plug efficiency and are a guide to the general condition of rings, valves, carburetor and ignition system. See Figure 1-24.

   a. A wet black and shiny deposit on plug base, electrodes and ceramic insulator tip indicate an oil fouled plug. The condition may be caused by worn rings and pistons, loose valves, weak battery or faulty ignition.

   b. A dry fluffy or sooty black deposit indicates a too rich carburetor air/fuel mixture or long periods of engine idling.

   c. An overheated plug can be identified by a light brown, glassy deposit. This condition may be accompanied by cracks in the insulator or by erosion of the electrodes. This condition is caused by too lean an air/fuel mixture, 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 should be replaced.




**Figure 1-24. Types of Plug Base Deposits**

   d. A plug with a white, yellow or light tan to rusty brown powdery deposit indicates balanced combustion. The deposits may be cleaned off at regular intervals if desired.

**Table 1-5. Spark Plug Data**

| | |
|---|---|
| SIZE | 12 mm |
| GAP | 0.038-0.043 in. (0.97-1.09 mm) |
| TYPE | HD-6R12 (No Substitute) |

2. Set the spark plug gap using a wire-type gauge. Bend the outside of the electrode so only a slight drag on the gauge is felt when passing it between electrodes. Never make adjustments by bending the center electrode. Set gap on all plugs at 0.038-0.043 in. (0.97-1.09 mm)
3. Before installing spark plugs, check condition of threads in cylinder head and on plug. If necessary soften deposits with penetrating oil and clean out with a thread chaser.
4. Install spark plug finger tight and then torque to 11-18 ft-lbs (15-24 Nm).

## ELECTRICAL COMPONENTS

At every scheduled service interval, inspect the operation of all electrical components and switches.

## ENGINE IDLE SPEED

At the 1000 mile service interval, and at every 5000 mile service interval thereafter, inspect the engine idle speed as follows:

*NOTE*

- *The C.V. carburetor has an enrichener circuit that will cause the engine to idle at approximately 1500 rpm with the engine at normal operating temperature and the enrichener knob pulled fully out.*
- *The increase in idle speed is intended to alert the rider that the engine is warmed up to normal operating temperature and the enrichener knob should be pushed all the way in.*
- *Continuing to use the enrichener when the engine is at full operating temperature WILL CAUSE FOULED PLUGS.*
- *TECHNICIAN – Be sure the engine is warmed up to normal operating temperature and the enrichener knob is pushed all the way in BEFORE adjusting engine idle speed. Be aware that because there are variations in individual components, it is possible for a properly warmed up engine to idle at 2000 rpm with the enrichener knob pulled PARTIALLY OUT.*

1. See Figure 1-25. With the engine at normal operating temperature and the enrichener all the way in (enrichener valve closed) adjust the throttle stop screw so the engine idles at 950-1050 rpm.

*NOTE*

*To measure engine rpm on models without tachometers, use a test tachometer connected to the negative ignition coil terminal.*

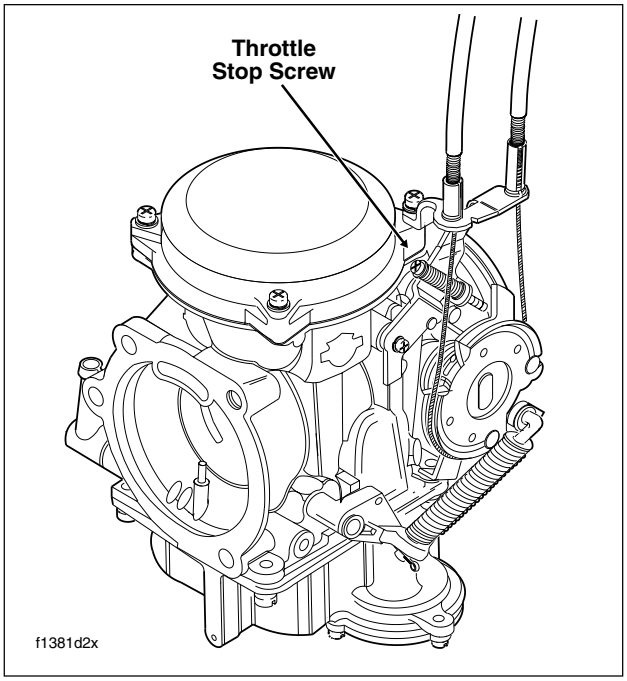



**Figure 1-25. Idle Speed Adjustment**

## FASTENERS

At the 1000 mile service interval, and at every 10,000 mile service interval thereafter, tighten all critical fasteners to service manual specifications:

- Hand controls
- Brake system
- Axle nuts
- Front fork components
- Riser and handlebar fasteners

Replace any damaged or missing hardware.

## ROAD TEST

At every scheduled service interval, perform a road test after all work is complete.

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2.31 Jiffy Stand . . . . . 2-124
2.32 Exhaust System . . . . . 2-126

# SPECIFICATIONS 2.1

## DIMENSIONS (IN.)

| | FLHT/C/U | FLHR/C | FLTR |
|---|---|---|---|
| Wheel Base | 63.5 | 63.5 | 63.5 |
| Overall Length | 93.7/97.5/98.3 | 93.7 | 93.7 |
| Overall Width | 39.0 | 34.45 | 35.75 |
| Road Clearance | 5.12 | 5.12 | 5.12 |
| Overall Height | 61.0 | 55.06 | 55.0 |
| Saddle Height* | 27.3 | 27.3/26.9 | 26.9 |

* With 180 Lb. Rider

## DIMENSIONS (MM)

| | FLHT/C/U | FLHR/C | FLTR |
|---|---|---|---|
| Wheel Base | 1613 | 1613 | 1613 |
| Overall Length | 2380/2476/2497 | 2380 | 2380 |
| Overall Width | 990 | 875 | 908 |
| Road Clearance | 130 | 130 | 130 |
| Overall Height | 1549 | 1398 | 1397 |
| Saddle Height* | 693 | 692.9/682.7 | 682.7 |

* With 81.6 kg Rider

## WEIGHT (LBS.)

| | FLHT/C/U | FLHR/C | FLTR |
|---|---|---|---|
| DRY WEIGHT (as shipped from the factory) | 758/776/788 | 723/710 | 731 |
| GVWR | 1259 | 1259 | 1259 |
| GAWR – Front | 500 | 500 | 500 |
| GAWR – Rear | 827 | 827 | 827 |

*NOTE*

*Gross Vehicle Weight Rating (GVWR) (maximum allowable loaded vehicle weight) and corresponding Gross Axle Weight Ratings (GAWR) are given on a label located on the inside of the right front frame downtube.*

## WEIGHT (KG)

| | FLHT/C/U | FLHR/C | FLTR |
|---|---|---|---|
| DRY WEIGHT (as shipped from the factory) | 344/352/358 | 328.2/322.3 | 331.9 |
| GVWR | 571.6 | 571.6 | 571.6 |
| GAWR – Front | 227 | 227 | 227 |
| GAWR – Rear | 375 | 375 | 375 |

## CAPACITIES (U.S.)

| | FLHT/C/U | FLHR/C | FLTR |
|---|---|---|---|
| Fuel Tank (gallons)<br>Total*<br>Reserve | <br>5<br>0.9 | <br>5<br>0.9 | <br>5<br>0.9 |
| Oil Tank (quarts) with filter | 4 | 4 | 4 |
| Transmission (Ounces, approximate) | 20-24 | 20-24 | 20-24 |
| Front Fork-Each (Ounces) | 9.7 | 9.7 | 9.7 |
| Primary Chaincase (Ounces, approximate) | 32 | 32 | 32 |

* Includes Reserve on Carbureted Models

## CAPACITIES (METRIC)

| | FLHT/C/U | FLHR/C | FLTR |
|---|---|---|---|
| Fuel Tank (liters)<br>Total*<br>Reserve | <br>18.9<br>3.4 | <br>18.9<br>3.4 | <br>18.9<br>3.4 |
| Oil Tank (liters) with filter | 3.78 | 3.78 | 3.78 |
| Transmission (Milliliters) | 591-710 | 591-710 | 591-710 |
| Front Fork-Each (Milliliters) | 287 | 287 | 287 |
| Primary Chaincase (Milliliters) | 946 | 946 | 946 |

* Includes Reserve on Carbureted Models

## TIRE DATA

**⚠WARNING**

**Tires, rims and air valves must be correctly matched to wheel rims. See your Harley-Davidson dealer for service. Mismatching tires, tubes, rims and air valves may result in damage to the tire bead during mounting or may allow the tire to slip on the rim, possibly causing tire failure, which could result in death or serious injury.**

**⚠WARNING**

**Using tires in ways other than those specified below may adversely affect motorcycle stability. Instability may lead to loss of vehicle control, which could result in death or serious injury.**

- **Use tubeless tires on all Harley-Davidson cast and disc wheels.**
- **Tubeless tires fitted with the correct size inner tubes also may be used on all Harley-davidson laced wheels, but protective rubber rim strips must be installed to prevent damage to the inner tubes.**
- **Do not use inner tubes in radial tires. Do not use radial tires on laced wheels.**
- **Always use the correct size tires and tubes. Tire sizes are molded on the tire sidewall. Tube sizes are printed on the tube.**

**⚠WARNING**

**Maximum inflation pressure must not exceed specification on tire sidewall. Exceeding inflation specifications can adversely affect handling or result in tire failure, which could result in death or serious injury.**

| Dunlop Tires Only | Tire Pressure (Cold) | | | |
|---|---|---|---|---|
| | Front | | Rear | |
| | PSI | BARS | PSI | BARS |
| Solo Rider | 36 | 2.5 | 36 | 2.5 |
| Rider & One Passenger | 36 | 2.5 | 40 | 2.8 |

## REAR WHEEL SPROCKET

All Models 70 teeth

## TORQUE VALUES

| Item | ft/in-lbs | Nm |
|---|---|---|
| Front brake disc TORX screws | 16-24 ft-lbs | 22-33 Nm) |
| Front axle nut | 50-55 ft-lbs | 68-75 Nm |
| Front slider cap nuts | 5-11 ft-lbs | 7-15 Nm |
| Front brake caliper mounting bolts | 28-38 ft-lbs | 37.9-51.5 Nm |
| Rear brake disc TORX screws | 30-45 ft-lbs | 41-61 Nm |
| Rear wheel sprocket bolts | 55-65 ft-lbs | 75-88 Nm |
| Rear wheel castle axle nut | 60 ft-lbs | 81 Nm |
| Wheel spokes | 40-50 **in-lbs** | 4.5-5.6 Nm |
| Front engine mount to frame bolts | 33-38 ft-lbs | 45-52 Nm |
| Front engine mounting bracket to rubber mount bolt | 35-45 ft-lbs | 47-61 Nm |
| Voltage regulator locknuts | 7-10 ft-lbs | 10-14 Nm |
| Handlebar clamp to master cylinder housing TORX screws | 70-80 **in-lbs** | 7.9-9.0 Nm |
| Brake caliper bleeder valve | 80-100 **in-lbs** | 9.0-11.3 Nm |
| Rear brake pedal shaft locknut | 15-18 ft-lbs | 20-24 Nm |
| Brake pedal/master cylinder assembly to mounting bracket hex nut | 50 ft-lbs | 67.8 Nm |
| Banjo bolt to master cylinder | 17-22 ft-lbs | 23-30 Nm |
| Banjo bolt to brake caliper | 17-22 ft-lbs | 23-30 Nm |
| Fairing lower U-bolt retainer locknuts | 6 ft-lbs | 8 Nm |
| Fairing lower to engine guard clamp TORX screw | 12 ft-lbs | 16 Nm |
| Front brake master cylinder reservoir cover screws | 6-8 **in-lbs** | 0.7-0.9 Nm |
| Rear brake master cylinder reservoir cover screws | 6-8 **in-lbs** | 0.7-0.9 Nm |
| Brake caliper pad pins | 180-200 **in-lbs** | 20.3-22.6 Nm |
| Brake caliper bridge bolts | 28-38 ft-lbs | 37.9-51.5 Nm |
| Fork oil drain plugs | 72-96 **in-lbs** | 8-11 Nm |

**Continued ...**

# TORQUE VALUES (CONT.'D)

| Item | ft/in-lbs | Nm |
|---|---|---|
| Air suspension hex bolt to fork cap bolt | 8-12 ft-lbs | 11-16 Nm |
| Fork pinch bolts | 40 ft-lbs | 54 Nm |
| Fork stem nut | 50-65 ft-lbs | 68-88 Nm |
| Shock bottom mounting bolt | 35-40 ft-lbs | 47-54 Nm |
| Shock top mounting bolt | 33-35 ft-lbs | 45-48 Nm |
| Rear swingarm bracket bolts | 34-42 ft-lbs | 46-57 Nm |
| Rear swingarm pivot shaft locknut | 40-45 ft-lbs | 54-61 Nm |
| Handlebar clamp to master cylinder housing TORX screws | 60-80 **in-lbs** | 6.8-9.0 Nm |
| Handlebar switch housing TORX screws | 35-45 **in-lbs** | 4-5 Nm |
| Handelbar clamp to clutch lever bracket screws | 60-80 **in-lbs** | 6.8-9.0 Nm |
| Clutch release cover socket head screws | 10-12 ft-lbs | 14-16 Nm |
| Clutch cable fitting | 3-5 ft-lbs | 4-7 Nm |
| Transmission lubricant drain plug | 14-21 ft-lbs | 19-28 Nm |
| Transmission filler plug/ dipstick | 25-75 **in-lbs** | 2.8-8.5 Nm |
| Battery cable bolt | 60-96 **in-lbs** | 6.8-10.9 Nm |
| Tour-Pak mounting bolts | 96-120 **in-lbs** | 10.8-13.5 Nm |
| Fairing lower cap screws | 10-20 **in-lbs** | 1.1-2.3 Nm |
| Inner fairing screws | 45-55 **in-lbs** | 5.1-6.2 Nm |
| Outer fairing screws (below windshield) | 10-13 **in-lbs** | 1.1-1.5 Nm |
| Fairing cap TORX screws | 45-55 **in-lbs** | 5.1-6.2 Nm |
| Speedometer/tachometer gauge bracket socket screws | 5-10 **in-lbs** | 0.6-1.1 Nm |
| Passing lamp bracket fork side TORX bolts | 18 ft-lbs | 24.4 Nm |
| Windshield wellnut screws (FLTR) | 6-13 **in-lbs** | 0.7-1.5 Nm |
| Stud plate acorn nuts (FLTR) | 40-50 **in-lbs** | 4.5-5.7 Nm |
| Short fairing screws (FLTR) | 6-12 **in-lbs** | 0.7-1.4 Nm |
| Long fairing screws (FLTR) | 12-15 **in-lbs** | 1.4-1.7 Nm |

**Continued ...**

| Item | ft/in-lbs | Nm |
|---|---|---|
| Instrument bezel TORX screws (FLTR) | 6-12 **in-lbs** | 0.7-1.4 Nm |
| Fairing bracket/steering head thru bolt (FLTR) | 20-30 ft-lbs | 27.1-40.7 Nm |
| Radio bracket/inner fairing to fairing bracket stud locknuts (FLTR) | 8-12 ft-lbs | 10.8-16.3 Nm |
| Headlamp nacelle handle-bar clamp shroud Phillips screw | 10-20 **in-lbs** | 1.1-2.3 Nm |
| Headlamp nacelle trim strip speednut | 10-20 **in-lbs** | 1.1-2.3 Nm |
| Fork stud acorn nuts | 18 ft-lbs | 24.4 Nm |
| Front fender mounting bolts | 14-18 ft-lbs | 19-24 Nm |
| Rear fender TORX bolts | 19 ft-lbs | 26 Nm |
| Jiffy stand leg stop flange nut | 43-53 ft-lbs | 58-72 Nm |
| Front cylinder head exhaust flange nuts ??? | 120 **in-lbs** | 14 Nm |
| Exhaust pipe TORCA clamps | 45-60 ft-lbs | 61-81 Nm |
| Heat shield worm drive clamps | 20-40 **in-lbs** | 2.3-4.5 Nm |

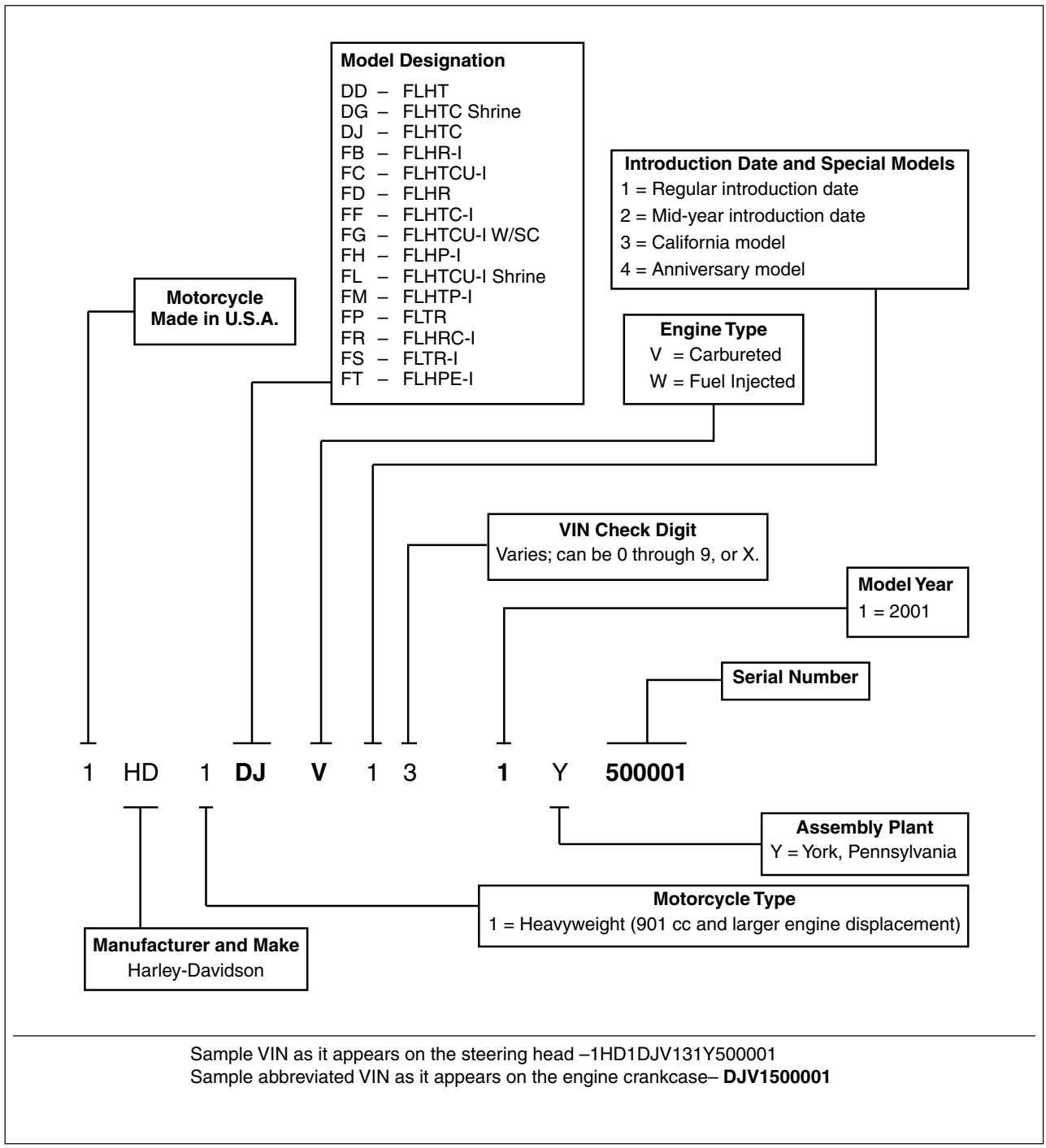
# NOTES

# VEHICLE IDENTIFICATION NUMBER (VIN)

A 17-digit serial number, or Vehicle Identification Number (VIN), is stamped on the right side of the frame backbone at the rear of the steering head (and under the main harness conduit). A label bearing the VIN code is also affixed to the bottom of the right front frame downtube. An abbreviated VIN is stamped between the front and rear cylinders on the left side of the crankcase.

*NOTE*

*Always give the complete VIN when ordering parts or making an inquiry about your motorcycle.*




Sample VIN as it appears on the steering head –1HD1DJV131Y500001
Sample abbreviated VIN as it appears on the engine crankcase– **DJV1500001**

**Vehicle Identification Number (VIN)**

# FRONT WHEEL 2.2

## GENERAL

Maximum tire mileage and good handling qualities are directly related to care given wheels and tires. Wheels and tires should be regularly inspected for wear. If handling problems occur, check TROUBLESHOOTING in Section 1 for possible causes.

Always keep tires inflated to the recommended pressure and balance the wheel whenever a tire or tube is replaced.

## PRELIMINARY INSPECTION

1. Block motorcycle underneath frame so front wheel is raised off the ground.
2. Measure brake disc thickness for excessive wear. Minimum acceptable thickness is stamped on side of disc. Also replace discs if warped or badly scored. Obtain **new** T40 TORX screws if brake discs were removed.
3. Inspect wheel bearing end play as follows:
   a. Mount a magnetic base dial indicator to the brake disc with the contact point on the end of the axle. See Figure 2-1.
   b. Turn the wheel through several rotations, then in a lateral motion, move the wheel back as far as it will go. Holding the wheel in position, zero the dial indicator gauge.

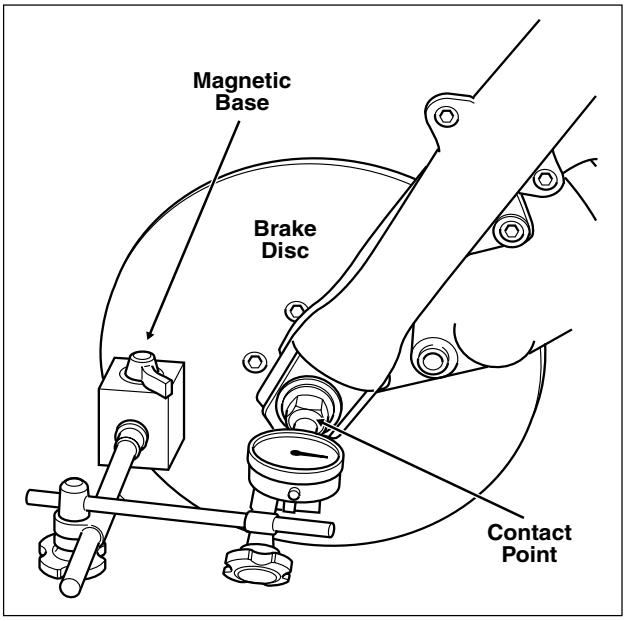



**Figure 2-1. Check Front Wheel End Play**

   c. Move the wheel forward as far as it will go. Note the reading of the dial indicator. The lateral movement or end play must be less than 0.002 inch (0.051 mm).
   d. Repeat the procedure to verify the reading.
   e. If the end play is 0.002 inch (0.051 mm) or more, replace the wheel bearings.
4. If brakes discs and/or bearings do not pass inspection, follow steps under REMOVAL and DISASSEMBLY.

## REMOVAL

1. Remove both the upper and lower mounting bolts from lugs of front fork leg to release brake caliper assembly.
2. Lift caliper upward to remove from brake disc. Allow the caliper to hang loose.
3. Repeat steps 1 and 2 to release caliper on opposite side of wheel.

*NOTE*

*Do not operate the front brake hand lever with the front wheel removed or the caliper pistons may be forced out. Reseating pistons requires disassembly of the caliper.*

4. Insert screwdriver or steel rod through hole in axle on right side of vehicle. While holding axle stationary, remove the axle nut, lockwasher and flat washer on the left side.
5. Loosen the two slider cap nuts at bottom of right side fork leg.
6. With soft mallet, tap axle toward right side of vehicle until loose. Catching external spacers on left and right side, pull axle from hub while supporting wheel.
7. Move wheel to bench area.

## DISASSEMBLY

1. If wheel bearing replacement is necessary, proceed as follows:
   a. Obtain the WHEEL BEARING REMOVER/INSTALLER (HD-44060). Pick out the wheel bearing remover tools for the front wheel. See Figure 2-2.
   b. To prolong service life and ensure smooth operation, sparingly apply graphite lubricant to threads of forcing screw.
   c. Install hex nut, flat washer and Nice bearing on forcing screw. Insert end of forcing screw through hole in bridge.

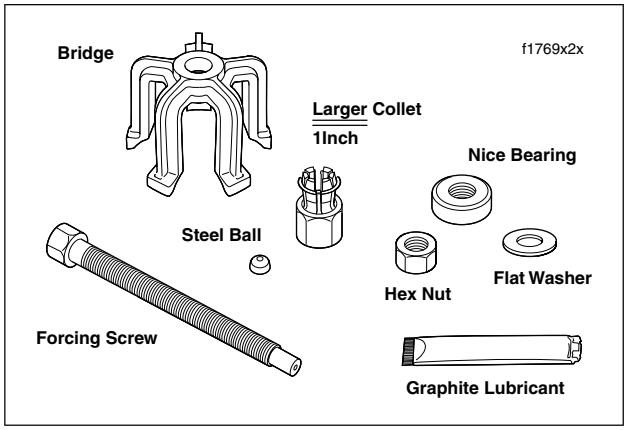



**Figure 2-2. Front Wheel Bearing Remover Tools (Part No. HD-44060)**

d. Install steel ball inside **larger** collet. Install collet at end of forcing screw.

e. Insert collet into bearing ID. Feel for inside edge of bearing using lip at end of collet and then back off slightly.

f. Holding forcing screw to prevent rotation, turn hex on collet until lip makes firm contact with inside edge of bearing. See upper frame of Figure 2-3.

g. Holding forcing screw, turn hex nut until bearing is free. See lower frame of Figure 2-3.

h. Remove spacer sleeve from wheel hub.

i. Repeat procedure to remove bearing on opposite side of wheel. Discard bearings.

2. If brake disc replacement is necessary, use a T40 TORX drive head and remove five screws securing brake disc to hub. Discard TORX screws. Repeat procedure to remove disc on opposite side of wheel. If the wheel is to be assembled with the same discs, mark both the wheel and discs, so that they can be installed in their original positions.

3. If tire replacement is necessary, see Section 2.7 TIRES AND TUBES.

4. If the wheel is laced, and hub, spoke or rim replacement is necessary, loosen all spoke nipples and disassemble hub from rim.

## CLEANING AND INSPECTION

1. Thoroughly clean all parts in solvent.

2. Inspect all parts for damage or excessive wear.

3. Always replace bearing assemblies as a complete set.

4. Inspect brake discs. Replace discs if warped or badly scored. Measure disc thickness for excessive wear. Minimum acceptable thickness is stamped on side of disc.

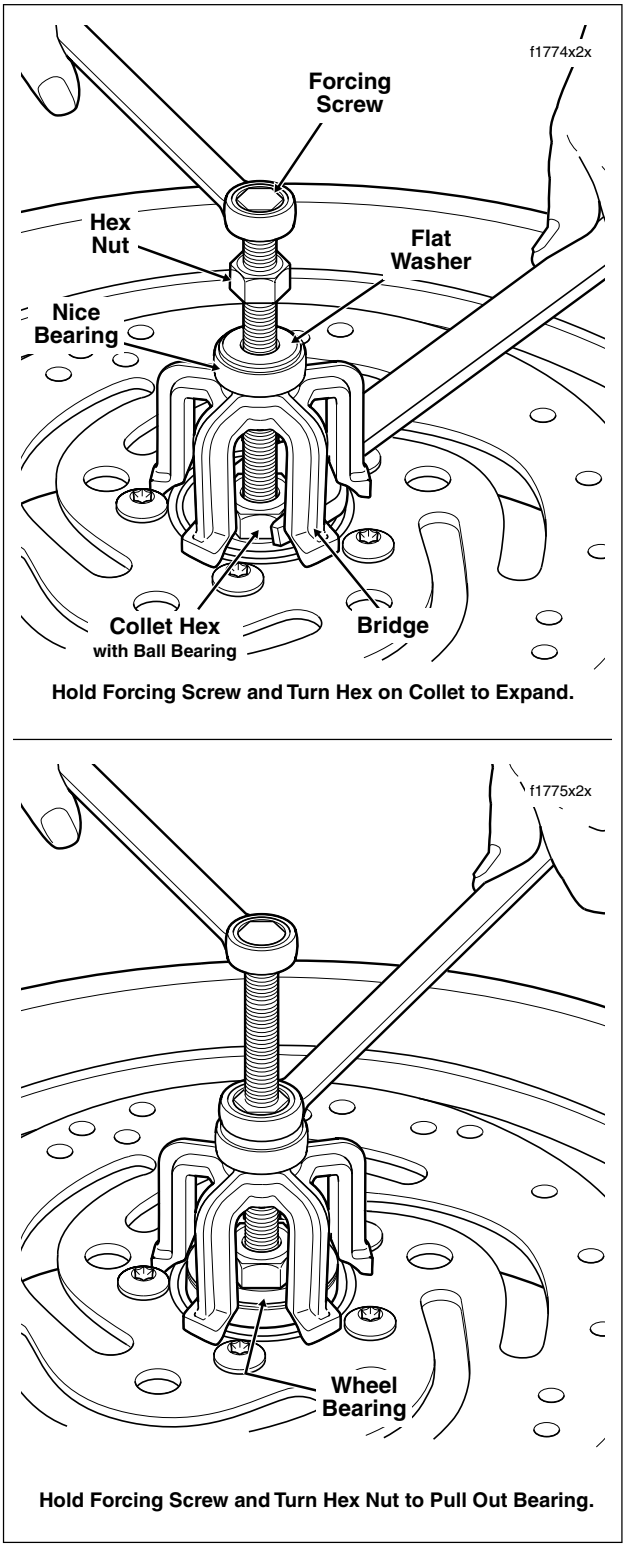



**Figure 2-3. Remove Sealed Wheel Bearings**

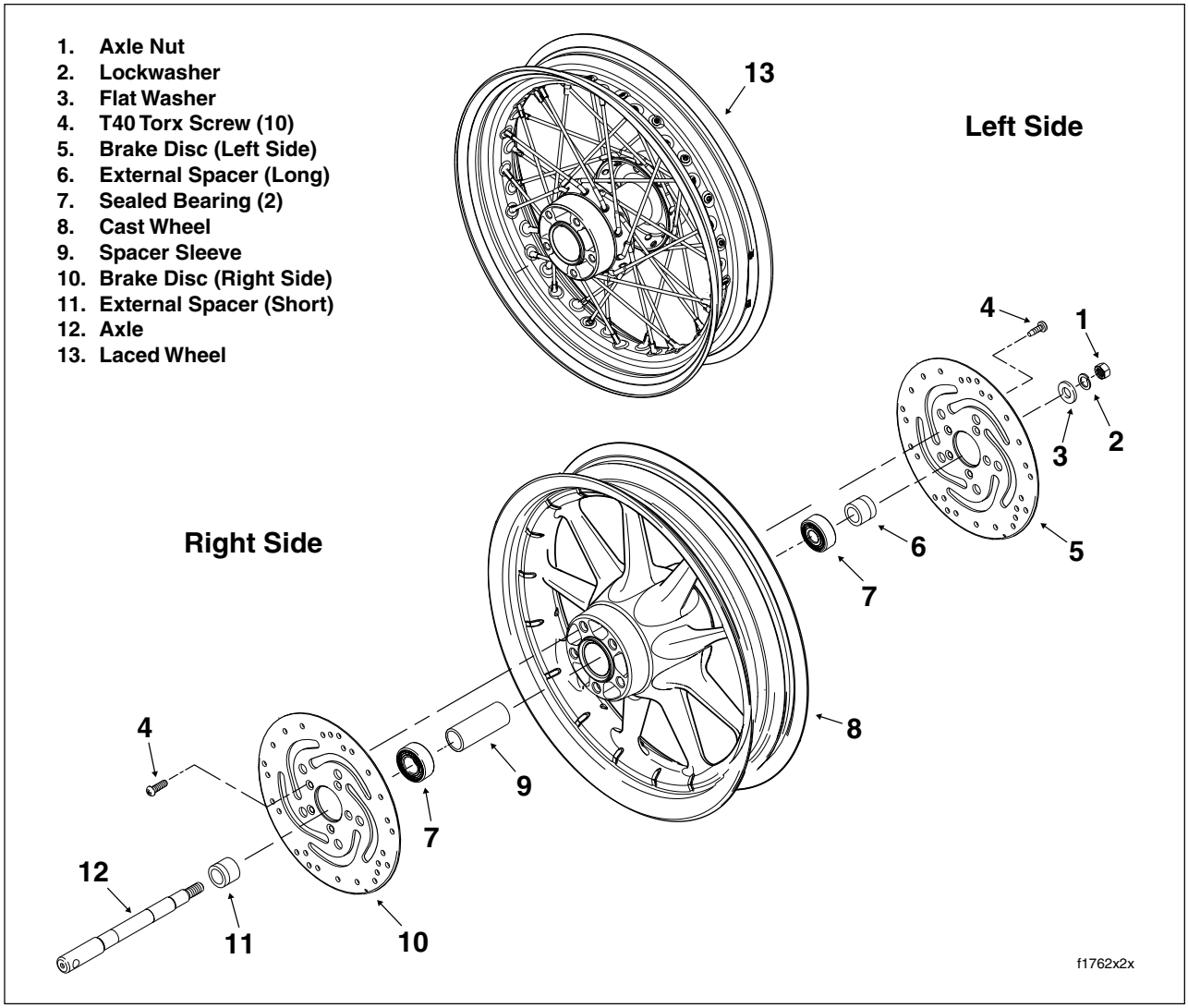



**Figure 2-4. Front Wheel (Exploded View)**

## ASSEMBLY

1. On laced wheels, if the hub and rim were disassembled, assemble the hub, spokes and rim. See Section 2.5 WHEEL LACING - 16 INCH RIM.

**⚠WARNING**

**Do not allow brake fluid or other lubricants to contact the brake disc. Such contact can adversely affect braking ability, which could result in death or serious injury.**

2. Using a T40 TORX drive head, install brake discs on hub using **new** screws. Be sure to install discs in their original positions. Alternately tighten screws to 16-24 ft-lbs (22-33 Nm).
3. Install **new** wheel bearings as follows:

*NOTE*

*Always install first of two bearings on the left side (opposite the valve stem side of the wheel).*

a. Obtain the WHEEL BEARING REMOVER/INSTALLER (HD-44060). Pick out the wheel bearing installer tools for the front wheel. See Figure 2-5.

b. To prolong service life and ensure smooth operation, sparingly apply graphite lubricant to threads of threaded rod.

c. Slide support plate onto threaded rod. Slide rod through hub on the valve stem side of the wheel. See upper frame of Figure 2-6.

d. On opposite side of wheel, slide bearing onto threaded rod with lettered side facing outboard.

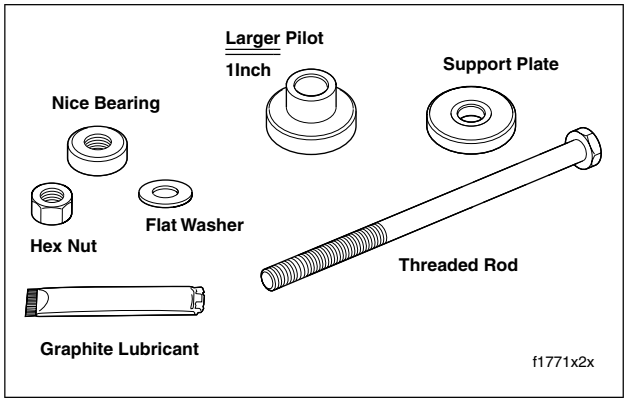



**Figure 2-5. Front Wheel Bearing Installer Tools (Part No. HD-44060)**

e. Install **larger** pilot, Nice bearing, flat washer and hex nut onto rod.

f. Holding threaded rod on opposite side of wheel to prevent rotation, turn hex nut to install bearing. See lower frame of Figure 2-6. Bearing is fully seated when it makes firm contact with the counterbore.

g. Disassemble and remove tool, but leave support plate on threaded rod.

h. Slide threaded rod through installed wheel bearing and hub of wheel.

i. On the valve stem side of the wheel, slide spacer sleeve down threaded rod until it contacts installed wheel bearing.

j. Repeat steps 3(d) through 3(g) to complete installation of second wheel bearing. Bearing is fully seated when hex nut can no longer be turned.

4. Verify that wheel is true. See CHECKING CAST RIM RUNOUT or TRUING LACED WHEEL, whichever applies.

5. Install tube on wheel rim, if applicable. Install tire, if removed. Verify that wheel is balanced.

## INSTALLATION

1. Place wheel into position between forks with the valve stem on the right side of the vehicle.

2. Coat the axle with ANTI-SIEZE LUBRICANT.

3. Supporting wheel, insert threaded end of axle through right fork leg. Push axle through fork, **short** external spacer and wheel hub until it begins to emerge from left side.

4. Push axle through **long** external spacer and left fork leg until axle shoulder contacts external spacer on right fork side.

5. Install flat washer, lock washer and nut over threaded end of axle.

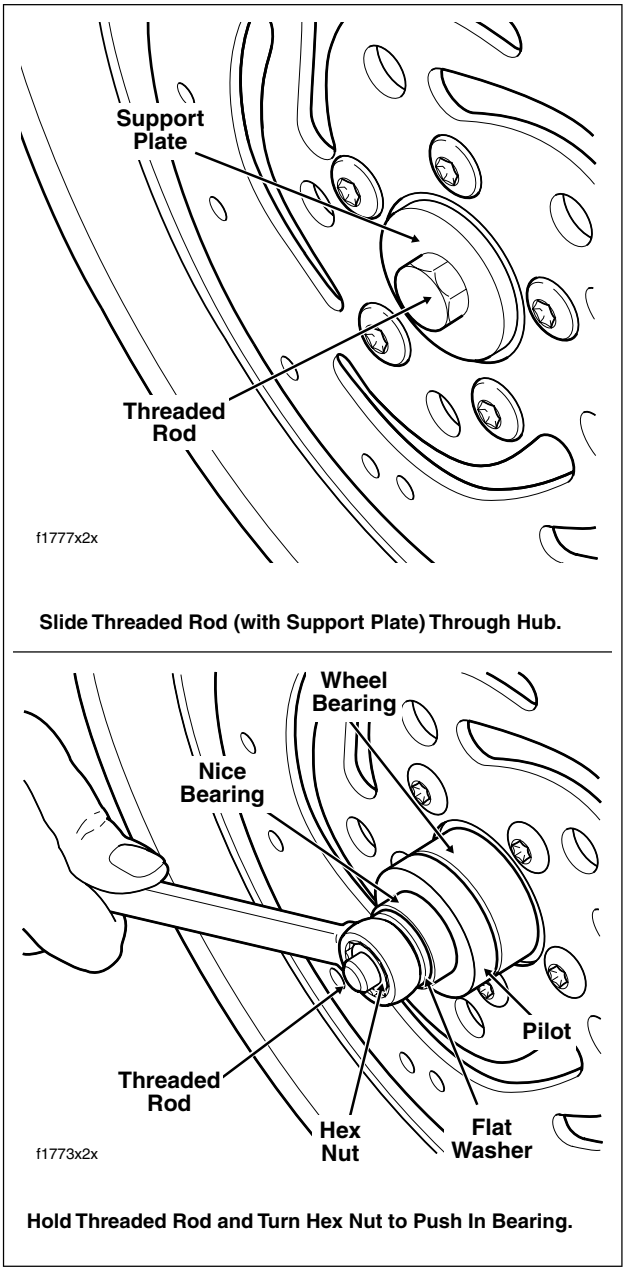



**Figure 2-6. Install Sealed Wheel Bearings**

6. Insert screwdriver or steel rod through hole in axle on right side of vehicle. While holding axle stationary, tighten axle nut to 50-55 ft-lbs (68-75 Nm).

7. Insert 7/16 inch drill bit into hole in axle. See Figure 2-7.

8. Pull fork leg so that it just contacts drill bit, and then tighten slider cap nuts on right side of vehicle to 5-11 ft-lbs (7-15 Nm).

9. Remove drill bit from axle hole.

10. Install brake caliper as follows:

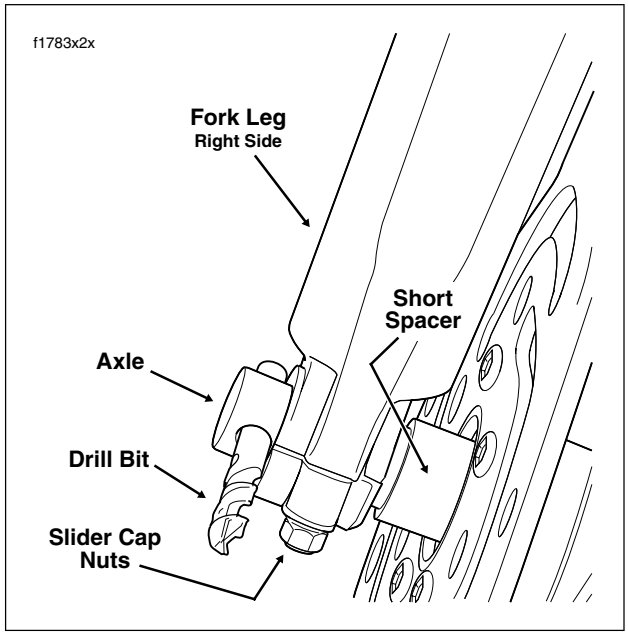



**Figure 2-7. Align Front Wheel**

a. With the bleeder valve topside, position caliper so that brake disc is situated between friction pads. Pry inner and outer brake pads back for additional clearance, if necessary.

b. Align upper mounting hole in caliper with upper mounting lug on fork leg. Loosely install long caliper mounting bolt into upper lug of fork leg.

c. Install short caliper mounting bolt into lower lug of fork leg. Tighten lower mounting bolt to 28-38 ft-lbs (37.9-51.5 Nm).

d. Tighten upper caliper mounting bolt to 28-38 ft-lbs (37.9-51.5 Nm).

e. Repeat step 10 to install caliper on opposite side of wheel.

**⚠WARNING**

**After installation of calipers and BEFORE moving motorcycle, pump front brake hand lever until pistons push pads against the brake discs. If fluid pressure is not pumped up, the brake will not be available the first time it is used, a situation that could result in death or serious injury.**

11. Depress front brake hand lever several times to set brake pads to proper operating position within caliper.

# REAR WHEEL 2.3

## GENERAL

Maximum tire mileage and good handling qualities are directly related to care given wheels and tires. Wheels and tires should be regularly inspected for wear. If handling problems occur, check TROUBLESHOOTING in Section 1 for possible causes.

Always keep tires inflated to the recommended pressure and balance the wheel whenever a tire or tube is replaced.

## PRELIMINARY INSPECTION

1. Block motorcycle underneath frame so rear wheel is raised off the ground.
2. Measure brake disc thickness for excessive wear. Minimum acceptable thickness is stamped on side of disc. Also replace disc if warped or badly scored.
3. Inspect wheel bearing end play as follows:
   a. Mount a magnetic base dial indicator to the brake disc with the dial's contact point on the end of the axle.
   b. Turn the wheel through several rotations, then in a lateral motion, move the wheel back as far as it will go. Holding the wheel in position, zero the dial indicator gauge.
   c. Move the wheel forward as far as it will go. Note the reading of the dial indicator. The lateral movement or end play must be less than 0.002 inch (0.051 mm).
   d. Repeat the procedure to verify the reading.
   e. If the end play is 0.002 inch (0.051 mm) or more, replace wheel bearings.

## REMOVAL

1. Remove saddlebags. See Section SADDLEBAG, REMOVAL.
2. Remove right side muffler as follows:
   a. Open worm drive clamps to remove heat shield from rear header pipe.
   b. Using a bungee cord, tie the muffler to the lower saddlebag support rail.
   c. Loosen TORCA clamp between rear header pipe and muffer.
   d. Remove two bolts (with lockwashers) to detach muffler from the lower saddlebag support rail.
   e. Remove bungee cord to release muffler from lower saddlebag support rail.

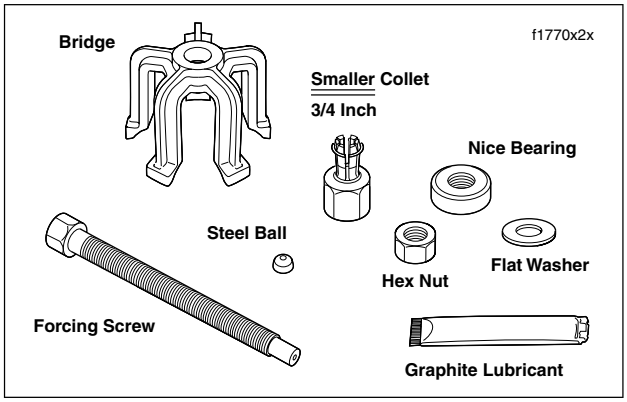



**Figure 2-8. Rear Wheel Bearing Remover Tools (Part No. HD-44060)**

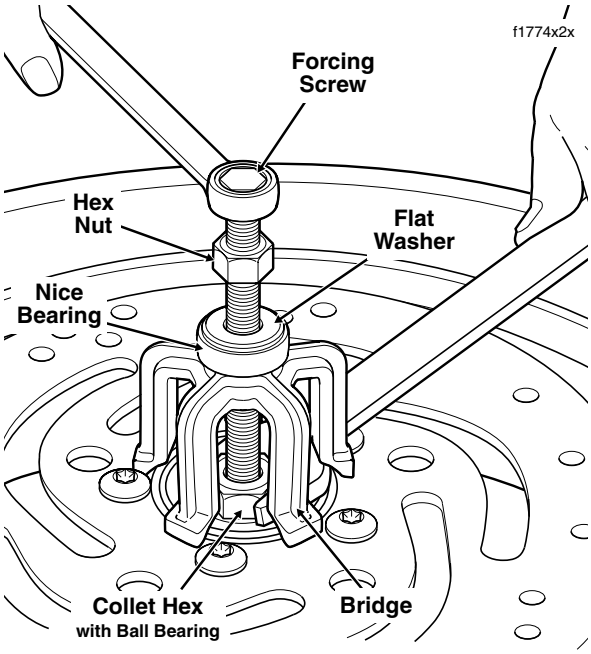
3. Remove linch pin clip, castle axle nut, and spacer washer from left side of axle.
4. Using a soft mallet, gently tap end of axle towards right side to loosen. Catching external spacers on left and right side of hub, pull axle free of rear swing arm.
5. Pull wheel to release brake disc from caliper. Pry inner and outer brake pads back for additional clearance, if necessary. Use a putty knife with a wide thin blade to avoid scoring or scratching the brake disc.
6. Move wheel forward and slip belt off sprocket.
7. Move wheel to bench area.

*NOTE*

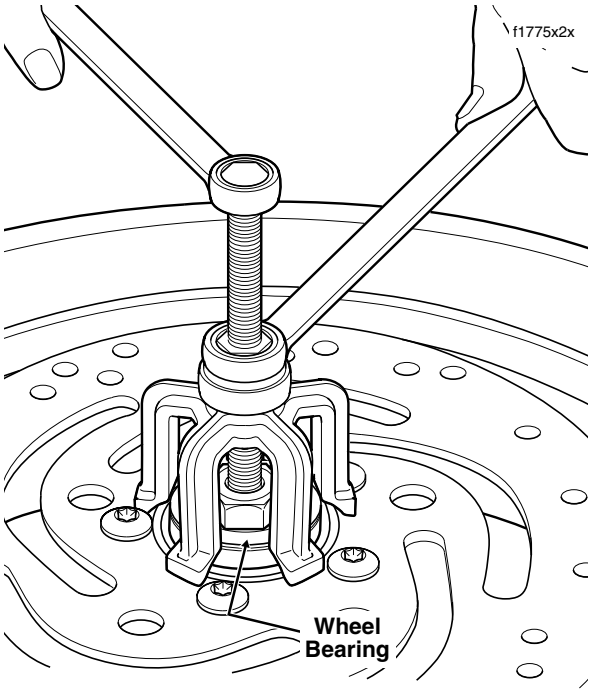
*Do not operate the rear brake pedal with the rear wheel removed or the caliper pistons may be forced out. Reseating pistons requires disassembly of the caliper.*

## DISASSEMBLY

1. If wheel bearing replacement is necessary, proceed as follows:
   a. Obtain the WHEEL BEARING REMOVER/INSTALLER (HD-44060). Pick out the wheel bearing remover tools for the rear wheel. See Figure 2-8.
   b. To prolong service life and ensure smooth operation, sparingly apply graphite lubricant to threads of forcing screw.
   c. Install nut, flat washer and Nice bearing on forcing screw. Insert end of forcing screw through hole in bridge.
   d. Install steel ball inside **smaller** collet. Install collet at end of forcing screw.




Hold Forcing Screw and Turn Hex on Collet to Expand.




Hold Forcing Screw and Turn Hex Nut to Pull Out Bearing.

**Figure 2-9. Remove Sealed Wheel Bearings**

e. Insert collet into bearing ID. Feel for inside edge of bearing using lip at end of collet and then back off slightly.

f. Holding forcing screw to prevent rotation, turn hex on collet until lip makes firm contact with inside edge of bearing. See upper frame of Figure 2-9.

g. Holding forcing screw, turn hex nut until bearing is free. See lower frame of Figure 2-9.

h. Remove spacer sleeve from wheel hub.

i. Repeat procedure to remove bearing on opposite side of wheel. Discard bearings.

2. If brake disc replacement is necessary, use a T45 TORX drive head and remove five screws securing brake disc to hub. If the wheel is to be assembled with the same disc, mark both the wheel and disc, so that it can be installed in its original position.
3. Remove five bolts with flat washers securing sprocket to hub.
4. Remove tire. Remove the tube from the rim, if applicable. See Section 2.7 TIRES AND TUBES.
5. If it is necessary to remove the hub from a laced wheel, loosen all spoke nipples and remove the rim and spokes.

## CLEANING AND INSPECTION

1. Thoroughly clean all parts in solvent.
2. Inspect all parts for damage or excessive wear.
3. Always replace bearing assemblies as a complete set.
4. Inspect brake disc. Replace disc if warped or badly scored. Measure disc thickness for excessive wear. Minimum acceptable thickness is stamped on side of disc.
5. Check the belt sprocket for wear, tooth damage, cracks or pitting. Replace if necessary.
6. On laced wheels, replace spokes, rim or hub if damaged.

## ASSEMBLY

1. On laced wheels, if the hub and rim were disassembled, assemble the hub, spokes and rim. See Section 2.5 WHEEL LACING - 16 INCH RIM.

**⚠WARNING**

**Do not allow brake fluid or other lubricants to contact the brake disc. Such contact can adversely affect braking ability, which could result in death or serious injury.**

2. Using a T45 TORX drive head, install five screws (and locknuts on laced wheels) to secure brake disc to hub. Be sure to install disc in its original position. Use **new** T45 TORX screws after three use cycles. Alternately tighten screws to 30-45 ft-lbs (41-61 Nm).

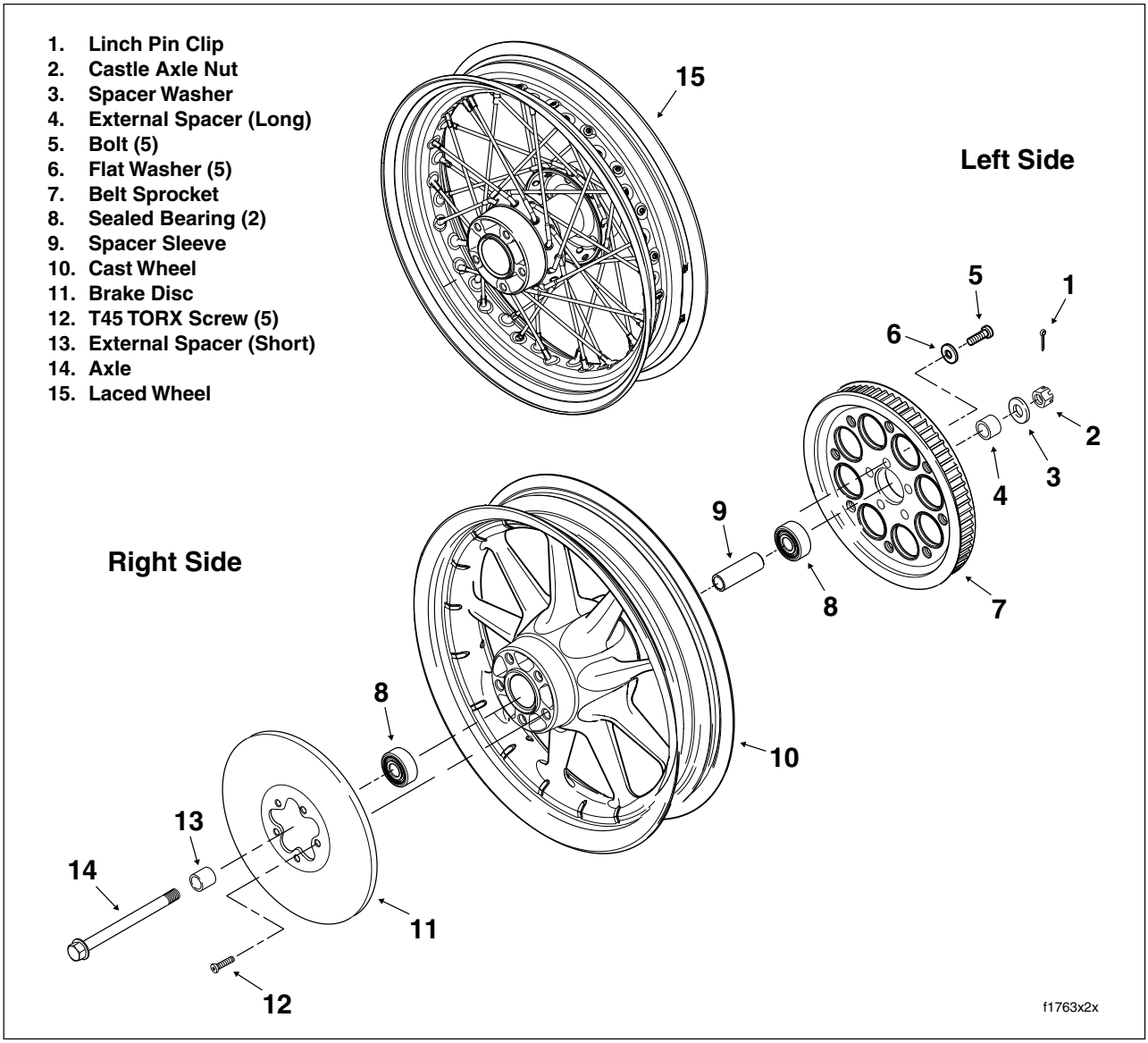



**Figure 2-10. Rear Wheel (Exploded View)**

3. If removed, apply two drops of LOCTITE THREADLOCKER 271 (red) to threads of each of five sprocket bolts. Secure sprocket to hub using bolts with flat washers (and locknuts on laced wheels). Tighten bolts to 55-65 ft-lbs (75-88 Nm).
4. Install **new** wheel bearings as follows:

*NOTE*

*Always install first of two bearings on the right side (the valve stem side of the wheel).*

   a. Obtain the WHEEL BEARING REMOVER/INSTALLER (HD-44060). Pick out the wheel bearing installer tools for the rear wheel. See Figure 2-11.
   b. To prolong service life and ensure smooth operation, sparingly apply graphite lubricant to threads of threaded rod.
   c. Slide support plate onto threaded rod. Slide rod through hub on the sprocket side of the wheel. See upper frame of Figure 2-12.
   d. On the valve stem side of the wheel, slide bearing onto threaded rod with lettered side facing outboard.
   e. Install **smaller** pilot, Nice bearing, flat washer and hex nut onto rod.

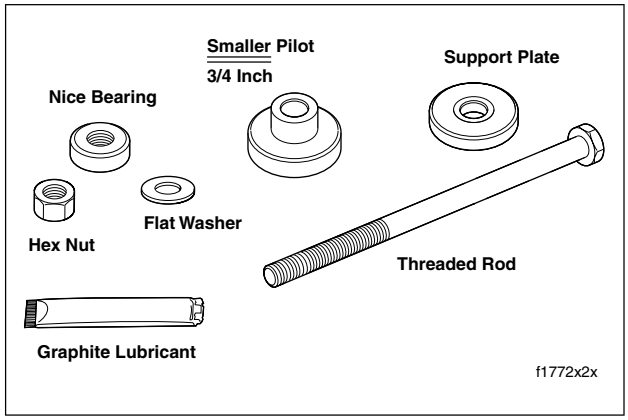



**Figure 2-11. Rear Wheel Bearing Installer Tools (Part No. HD-44060)**

f. Holding threaded rod on opposite side of wheel to prevent rotation, turn hex nut to install bearing. See lower frame of Figure 2-12. Bearing is fully seated when it makes firm contact with the counterbore.

g. Disassemble and remove tool, but leave support plate on threaded rod.

h. Slide threaded rod through installed wheel bearing and hub of wheel.

i. On the other side of the wheel, slide spacer sleeve down threaded rod until it contacts installed wheel bearing.

j. Repeat steps 4(d) through 4(g) to complete installation of second wheel bearing. Bearing is fully seated when hex nut can no longer be turned.

5. Verify that wheel is true. See CHECKING CAST RIM RUNOUT or TRUING LACED WHEEL, whichever applies.

6. Install tube on wheel rim, if applicable. Install tire, if removed. Verify that wheel is balanced.

# INSTALLATION

1. Place wheel in rear swingarm. Slide wheel far enough forward to slip belt over sprocket and then slide the wheel back.

**CAUTION**

**Do not bend or fold belt backward or into loops smaller than 5 inches in diameter. Sharp bending can weaken the belt and cause premature failure.**

2. Seat caliper on anchor weldment of rear swing arm, if removed.

3. Position wheel in swing arm, so that brake disc is centered between brake pads.

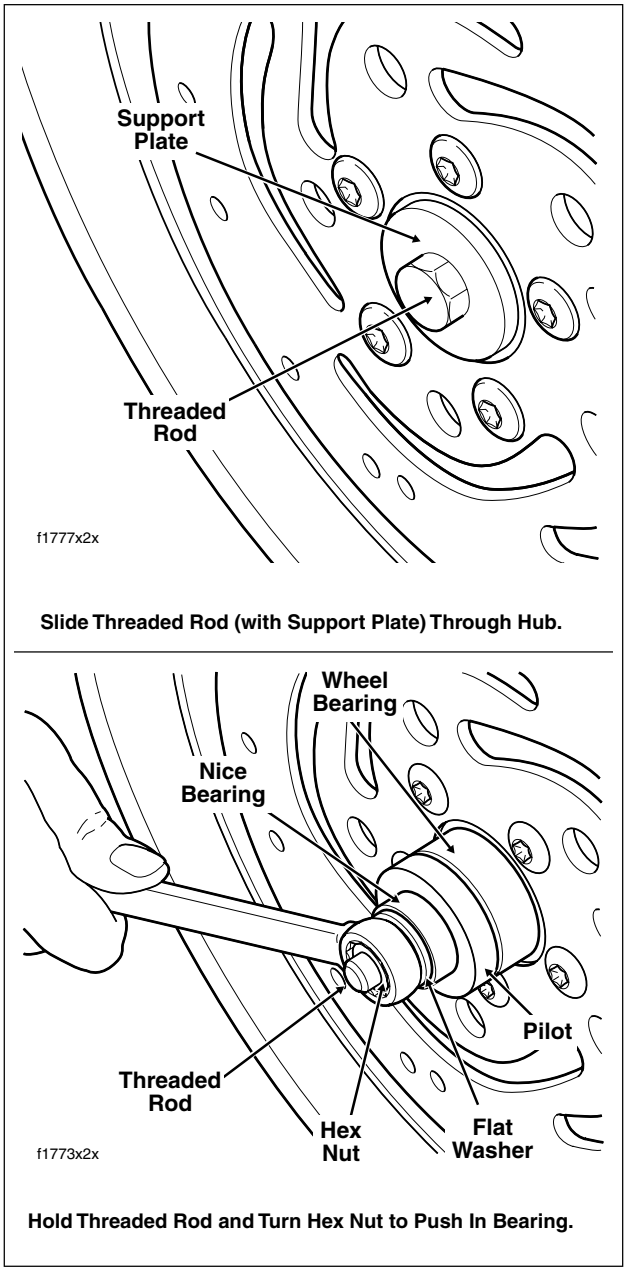



**Figure 2-12. Install Sealed Wheel Bearings**

4. Coat the axle with ANTI-SIEZE LUBRICANT.

5. Slide axle through right side of rear swing arm, caliper bracket and **short** external spacer into wheel hub.

6. When axle emerges from hub on sprocket side of wheel, push axle through **long** external spacer and left side of rear swing arm.

7. Install spacer washer and castle axle nut on threaded end of axle. Tighten castle axle nut to 60 ft-lbs (81 Nm).

**⚠WARNING**

**After installation of caliper and BEFORE moving motorcycle, pump rear brake pedal until pistons push pads against the brake disc. If fluid pressure is not pumped up, the rear brake will not be available the first time it is used, a situation that could result in death or serious injury.**

8. Depress rear brake pedal several times to set brake pads to proper operating position within caliper.
9. Check for proper belt tension. See Section 6.4 SECONDARY DRIVE BELT AND SPROCKETS, ADJUSTMENT AND ALIGNMENT.
10. Check wheel alignment. See Section 2.8 VEHICLE ALIGNMENT.
11. Install the linch pin clip in the axle hole. If necessary, tighten the axle nut further to align the axle hole and nut slot, but do not exceed 65 ft-lbs (88 Nm).
12. Install right side muffler as follows:

*NOTE*

*TORCA muffler clamps have eliminated the need for silicone or graphite tape during assembly. To ensure sealing integrity of muffler clamps and prevent the possibility of leakage, Harley-Davidson recommends that TORCA clamp assemblies be discarded and replaced each time they are removed.*

   a. Slide **new** TORCA clamp onto free end of rear header pipe.
   b. Using a bungee cord, tie muffler to lower saddlebag support rail. Install muffler on rear header pipe. Place TORCA clamp into position between rear header pipe and muffler.
   c. Tighten the two bolts (with lockwashers) to fasten the muffler to the lower saddlebag support rail.

**CAUTION**

**Verify that the exhaust pipes do not contact the vehicle frame or any mounted components. Contact will cancel the effect of the rubber isolation mounts and transmit vibration to the rider via the vehicle frame.**

   d. Verify that exhaust pipes are in alignment and do not contact the vehicle frame or mounted components.
   e. Tighten the TORCA clamp to 45-60 ft-lbs (61-81 Nm).
   f. Open worm drive clamps and install heat shield on rear header pipe. Position clamp so that screw is on the outboard side in the most accessible position.

**CAUTION**

**Verify that the heat shields do not contact the vehicle frame or any mounted components. Contact will cancel the effect of the rubber isolation mounts and transmit vibration to the rider via the vehicle frame.**

   g. Remove bungee cord from muffler.

13. Install saddlebags. See Section 2.22 SADDLEBAG, INSTALLATION.

# CHECKING CAST RIM RUNOUT 2.4

Check cast wheels for lateral and radial runout before installing a new tire or tube.

1. See Figure 2-13. Install arbor in the wheel hub and place wheel in the truing stand. To check rim lateral runout, place a gauge rod or dial indicator near the rim bead. If lateral runout exceeds 3/64 in. (1.19 mm), replace the wheel.
2. See Figure 2-14. Check for radial runout as shown here. Replace the wheel if runout exceeds 1/32 in. (0.79 mm).

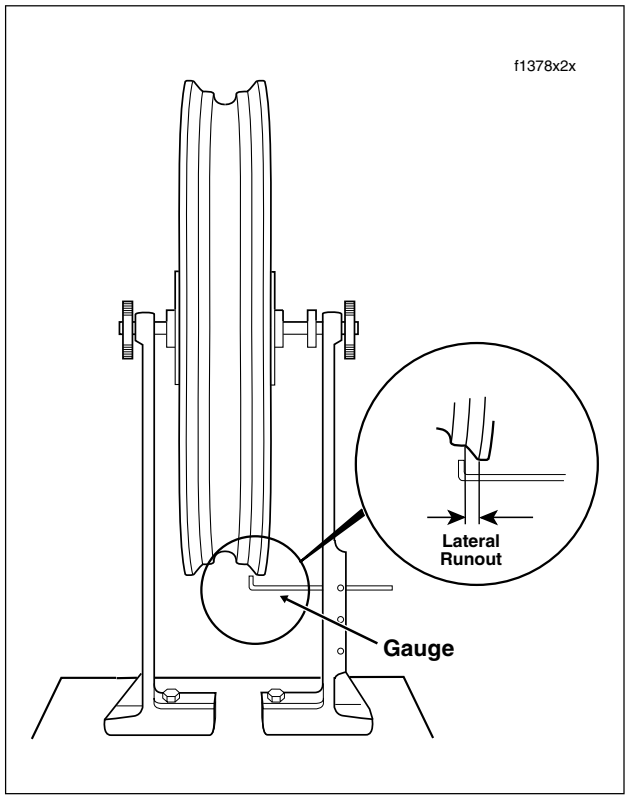



**Figure 2-13. Checking Disc Rim Lateral Runout**

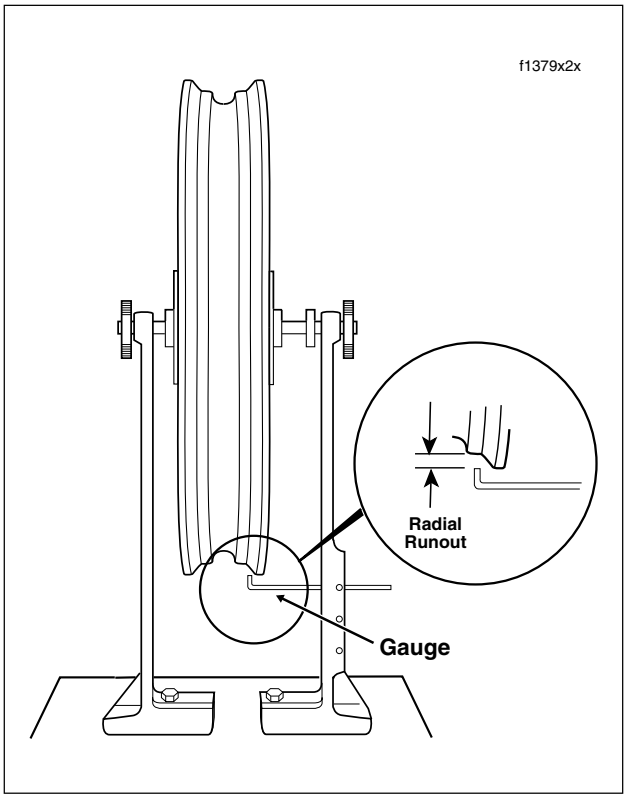



**Figure 2-14. Checking Disc Rim Radial Runout**

# WHEEL LACING - 16 INCH RIM 2.5

## GENERAL

The 16 inch wheel uses only one type of spoke, rather than the separate inner and outer spokes (with differing head angles) seen in the old style.

Exercise caution to avoid mixing old and new parts. The head angle of the spoke is closer to 90 degrees, which makes it very difficult to differentiate from the outer spoke of the old style.

The nipple fitting of the spoke uses a TORX style fastener (instead of the straight slotted) and requires a special T-30 I.P. (TORX Plus) driver (HD-42135) for removal and installation. See A of Figure 2-15. Use of a standard T-30 TORX bit will result in nipple damage.

The 16 inch hub can be easily identified by its aluminum construction. The 16 inch rim can be quickly identified by theshape of the flat around the valve stem. The flat is tombstone shaped on the rim (square shaped on the old style rim). See B and C of Figure 2-15.

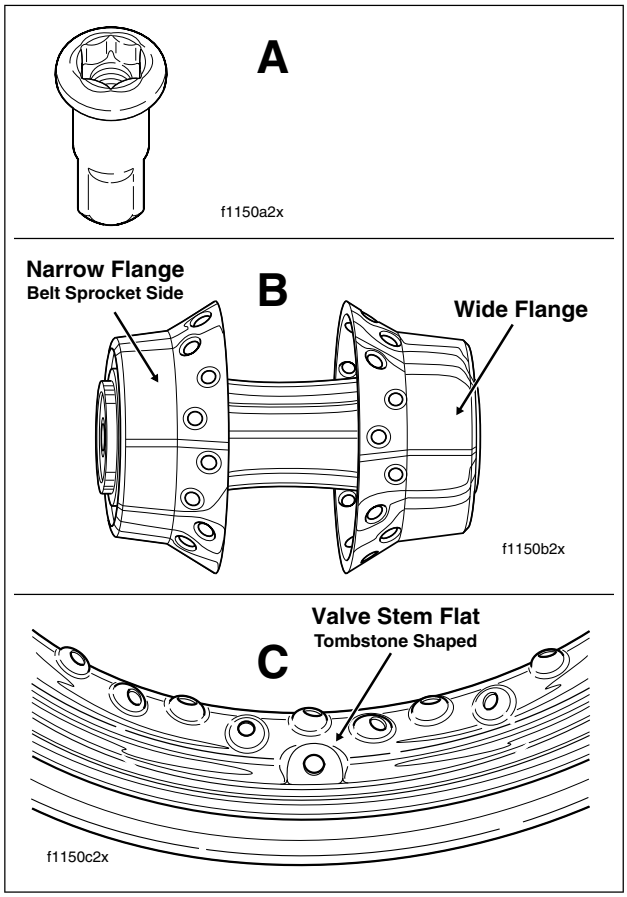



**Figure 2-15. Parts Identification**

## WHEEL LACING

1. If front wheel, place the hub on a table with the wider flange side up. If rear wheel, place hub so that brake disc side (with 5 lug mounting flange) is up. Insert a spoke in each hole of the lower row as shown below. Angle the spokes in a clockwise direction .

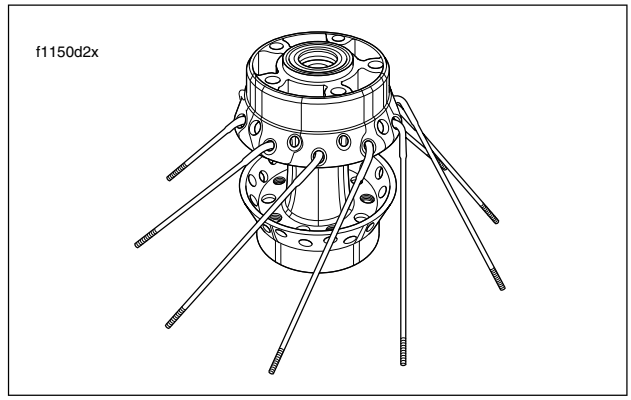



**Figure 2-16. Checking Disc Rim Lateral Runout**

2. Place the rim on the table with the valve stem side up. Using any lower row spoke, place the first spoke into the rim hole to the left of the valve stem hole on the upper half of the rim centerline.

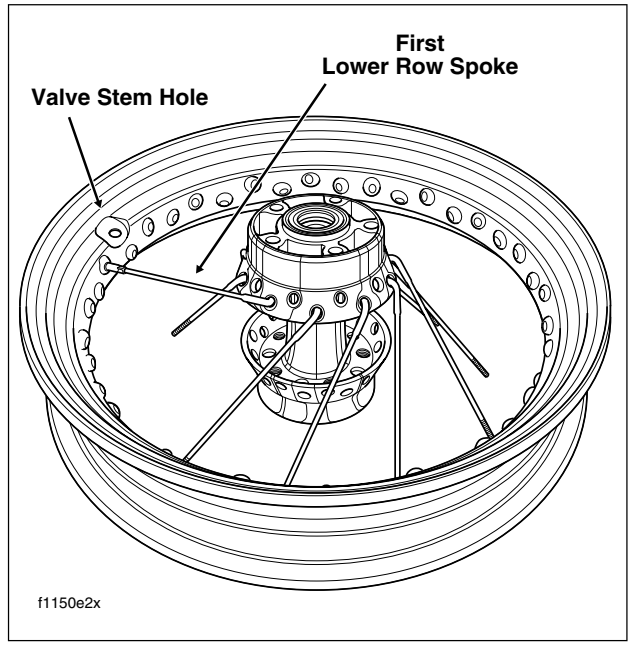



**Figure 2-17. Checking Disc Rim Lateral Runout**

3. Install the rest of the lower row spokes in every fourth hole.

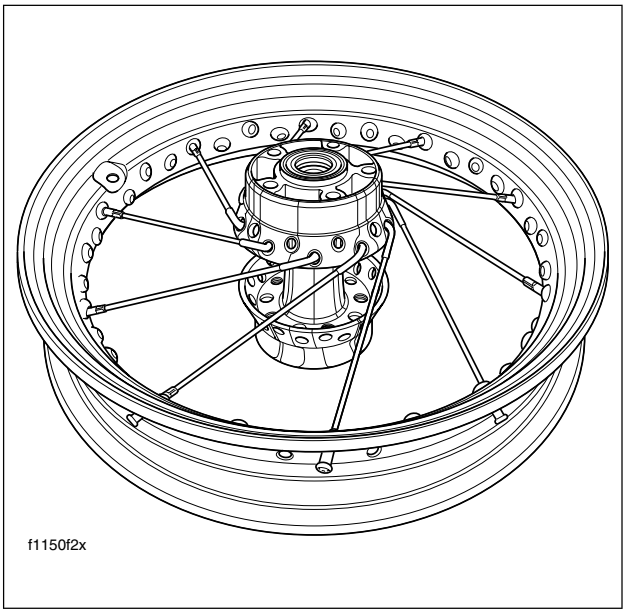



**Figure 2-18. Checking Disc Rim Lateral Runout**

4. Place the first upper row spoke into the hub as shown below. Angle the spoke counterclockwise crossing four lower row spokes. The spoke must enter the hole to the left of the valve stem hole.

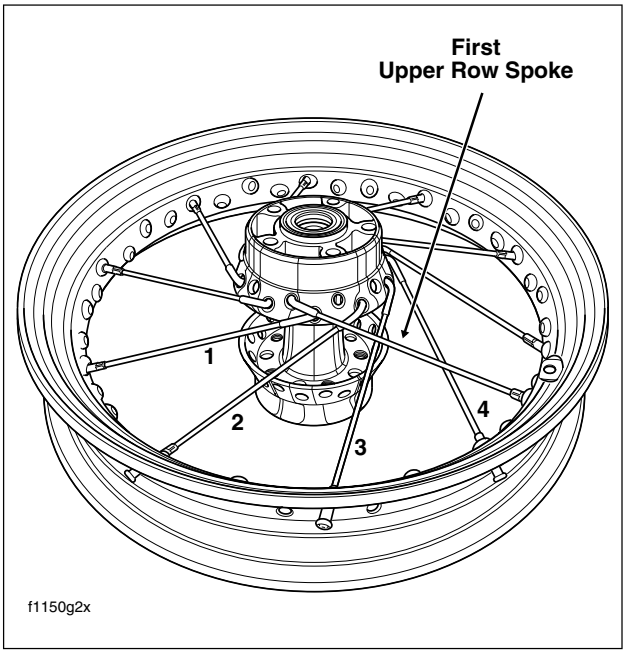



**Figure 2-19. Checking Disc Rim Lateral Runout**

5. Install the nine remaining upper row spokes into every fourth hole remaining above the rim centerline.

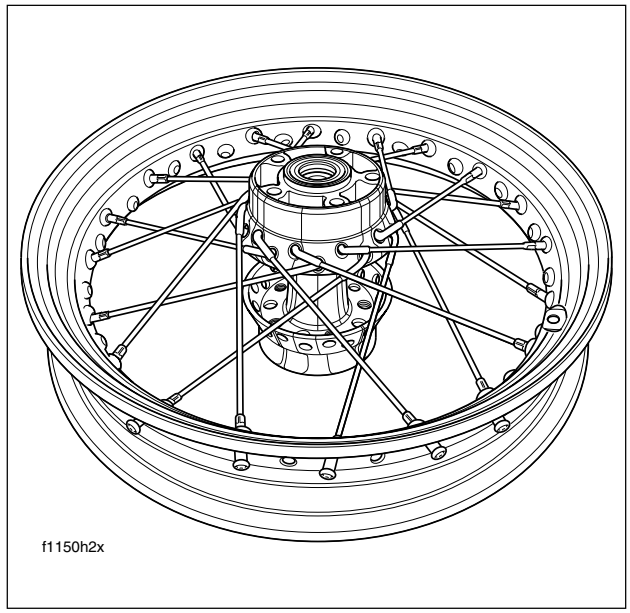



**Figure 2-20. Checking Disc Rim Lateral Runout**

6. Turn the wheel over. Place any lower row spoke into the hub. Angle the spoke clockwise and place into rim hole angled to accept it.

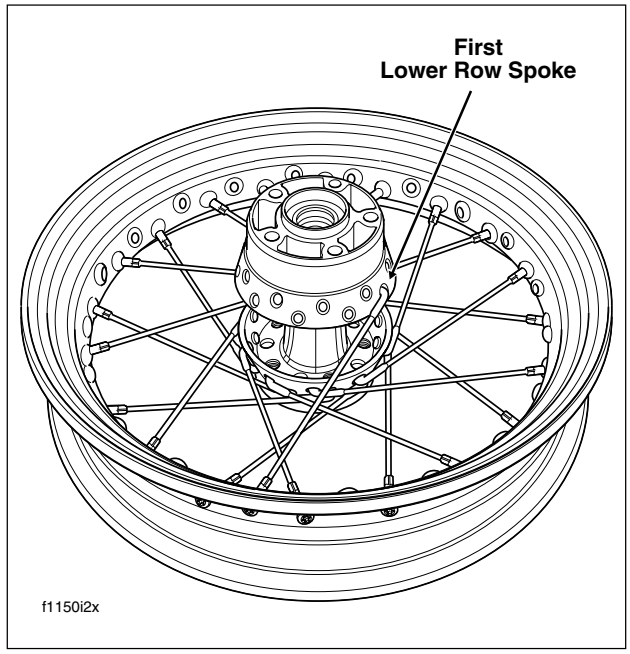



**Figure 2-21. Checking Disc Rim Lateral Runout**

7. Angled clockwise, place the nine remaining lower row spokes into hub and rim.

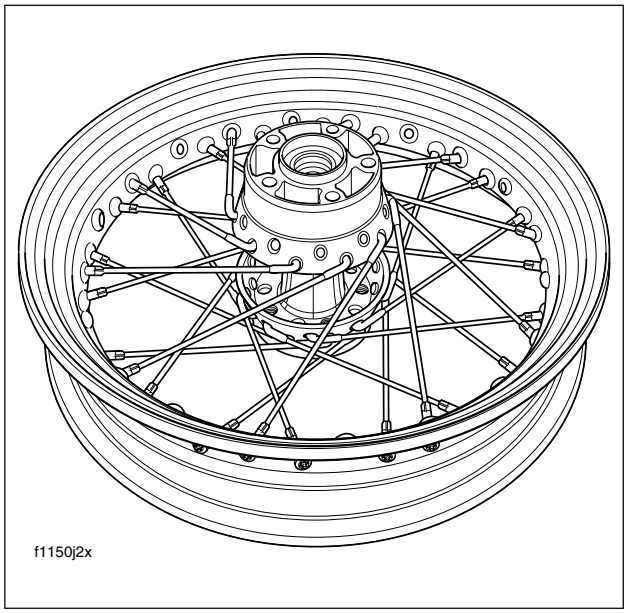



**Figure 2-22. Checking Disc Rim Lateral Runout**

8. Insert any upper row spoke into the hub and angle spoke counterclockwise. Place spoke into appropriate rim hole crossing four lower row spokes.

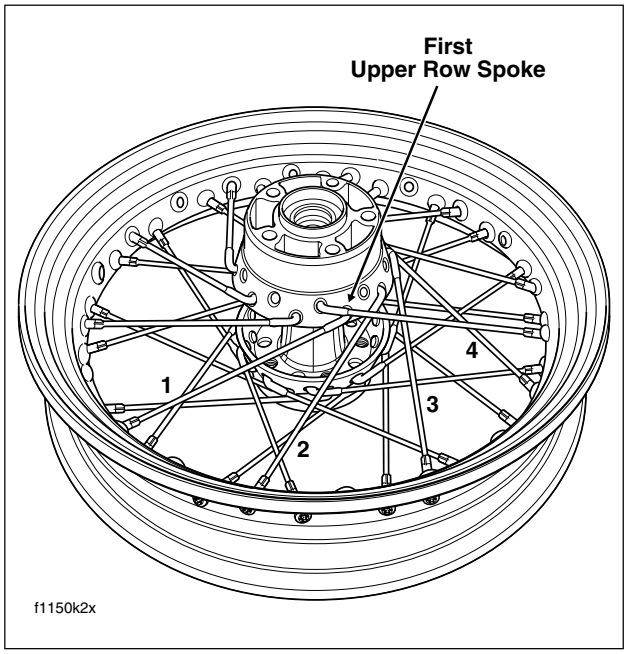



**Figure 2-23. Checking Disc Rim Lateral Runout**

9. Install the nine remaining upper row spokes into hub and rim.

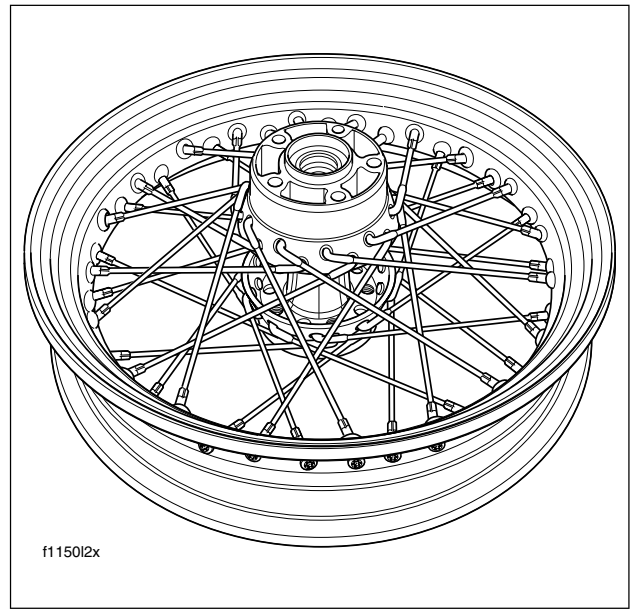



**Figure 2-24. Checking Disc Rim Lateral Runout**

**CAUTION**

**The hub is made of aluminum alloy and should not be clamped in a vise or gripped with pliers, or the hub material may be damaged.**

10. Verify that wheel is true. See Section 2.6 TRUING LACED WHEEL, for truing procedure and spoke torque specification.

## SPOKE TIGHTNESS

Inspect spoke tightness at every 5000 mile service interval. Proceed as follows:

1. Raise wheel off the ground.

**CAUTION**

**If nipples require more than one full turn to tighten spoke, remove tire to check that spoke protrusion has not damaged tube.**

2. Lightly tap each spoke with a spoke wrench. Loose spokes will sound dull and must be tightened. Tighten spokes to 40-50 **in-lbs** (4.5-5.6 Nm). If more than a few spokes are loose, true the entire wheel following the procedure on the next page.

# TRUING LACED WHEEL 2.6

1. Divide the wheel spokes into ten groups of four and mark the center of each group with a piece of tape. The groups should be directly across from one another and approximately 90° apart. Tighten the spokes in these four groups finger tight, leaving all others loose.
2. See Figure 2-26. Install truing arbor in wheel hub and place wheel in WHEEL TRUING STAND, Part No. HD-95500-80. Tighten arbor nuts so hub will turn on its bearings.
3. Lay a straightedge across the hub brake disc flange (valve stem side of dual disc front wheel) and one of the marked spoke groups. Measure the distance from the straightedge to the edge of the rim as shown in Figure 2-25. Be sure to subtract the thickness of the straightedge.

   The offset dimension must be as follows:

   - **Front Wheel**: 1.555- 1.575 inches (39.5- 40.0 mm).
   - **Rear Wheel**: 1.472- 1.492 inches (37.4- 37.9 mm).

If the dimension is not correct, tighten the four spokes accordingly. Use the special T-30 I.P. (TORX Plus) driver (HD-42135). For example, If the measurement on the right rim edge side is less than it should be, loosen the two spokes attached to the hub left side and tighten the two spokes attached to the hub right side. Turn all four spokes an equal number of turns until offset dimension is correct.

**CAUTION**

**Always loosen the appropriate spokes before tightening the other two. Reversing this procedure will cause the rim to become out-of-round.**

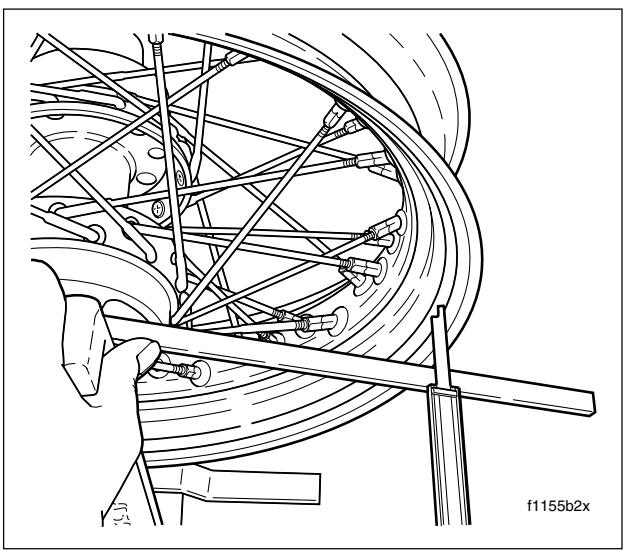



**Figure 2-25. Checking Laced Hub Offset Dimension**

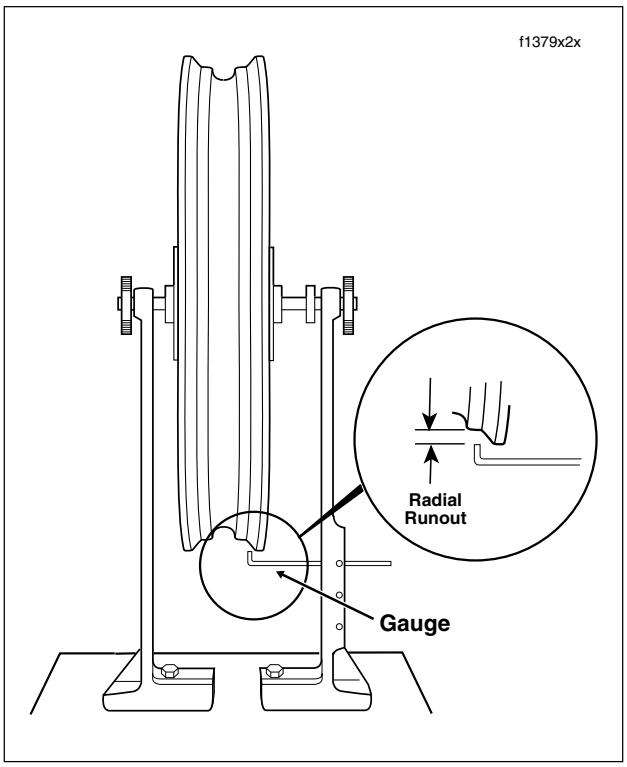



**Figure 2-26. Truing Rim Radially**

**CAUTION**

**Always loosen the appropriate spokes before tightening the other two. Reversing this procedure will cause the rim to become out-of-round.**

4. Repeat Step 3 for all four groups on the wheel.
5. See Figure 2-26. After rim has been trued sideways it must be checked and trued radially. Adjust truing stand gauge to the rim's tire bead seat as shown. The rim should be trued within 1/32 in. (0.79 mm).
6. Spin the rim slowly. If the rim contacts the gauge on or near a marked group of spokes, loosen the spokes in the marked group on the opposite side of the rim. Now tighten the spokes in the group where the rim makes contact. Loosen and tighten spokes an equal number of turns.
7. If the rim contacts the gauge between two marked groups, loosen the spokes in both opposite groups and tighten the spoke groups on the side of the rim that makes contact.

8. When the wheel is centered and trued, start at the valve stem hole and tighten the rest of the spoke nipples one turn at a time until they are snug. Repeat step tightening each spoke nipple to 40-50 **in-lbs** (4.5-5.6 Nm).

**⚠WARNING**

**Do not tighten spokes too tight, or nipples may be drawn through rim, or hub flanges may be distorted. If spokes are left too loose, they will continue to loosen when wheel is put into service. This could adversely affect handling, or cause spoke breakage, possibly leading to loss of vehicle control, which could result in death or serious injury.**

9. File or grind off ends of spokes protruding through nipples to prevent puncturing tube when tire is mounted.

*NOTE*

*After installation of front wheel, visually check the relationship of the front wheel to the fork fender bosses. The front wheel should be approximately centered between the bosses.*

## GENERAL

Tires should be inspected for punctures, cuts, breaks and wear at least weekly.

Whenever a tube type tire is replaced, the tube should also be replaced. Inner tubes should be patched only as an emergency measure. Replace a damaged tube as soon as possible. Inner tubes must be used on all Harley-Davidson laced wheels.

**⚠WARNING**

**Excessively worn tires are more susceptible to penetrations. Always remove tires from service before they reach the tread wear indicator bars (1/32 of an inch tread pattern depth remaining). Worn/unworn tire combinations and worn tires used in wet conditions can adversely affect handling and lead to loss of vehicle control, which could result in death or serious injury.**

**⚠WARNING**

**Tubeless tires may be repaired in the tread area only and then the puncture must be 1/4 inch (6.4 mm) or smaller. Never repair a tire with less than 1/16 inch (1.6 mm) tread depth. All repairs must be made from inside the tire. Use of faulty or defective tires can adversely affect handling and lead to loss of vehicle control, which could result in death or serious injury.**

*NOTE*

*Acceptable repair methods include a patch and plug combination, chemical or hot vulcanizing patches or head-type plugs.*

When repairing tubeless tires, use TIRE SPREADER, Part No. HD-21000 to spread the tire sidewalls.

**⚠WARNING**

**Always check both tire sidewalls for arrows indicating proper forward tire rotation. Some tires require different tire rotation depending on whether tire is used on front or rear wheel. Improper mounting can result in poor tire mileage. In wet weather, improper mounting can adversely affect handling and lead to loss of vehicle control, which could result in death or serious injury.**

## REMOVAL

1. Remove wheel from motorcycle. Let the air out of the tube or tire.




**Figure 2-27. Starting Bead Off Rim**

2. Loosen both tire beads from rim flange. See Figure 2-27. In most cases, a bead breaker machine will be required to loosen the bead from the rim.
3. Using tire tools (not sharp instruments), and RIM PROTECTORS, Part No. HD-01289, start upper bead over edge of rim at valve. Do not use excessive force when starting bead over rim. Bead wires may be damaged ruining the tire. Repeat all around rim until first bead is over rim. Remove the tube.

*NOTE*

*It is not necessary to use tools to remove tubeless tires. Make sure beads are well lubricated before removing from rim.*

4. Push lower bead into rim well on one side and insert tire tool underneath bead from opposite side. Pry bead over rim edge. Remove tire from rim.

*NOTE*

*It is not always necessary to completely remove tire from rim. Removing one side allows the tube to be replaced and allows for inspection of tire.*

## CLEANING AND INSPECTION

1. Clean the inside of tire, rim and tube. If rim is dirty or rusty, clean with a stiff wire brush.

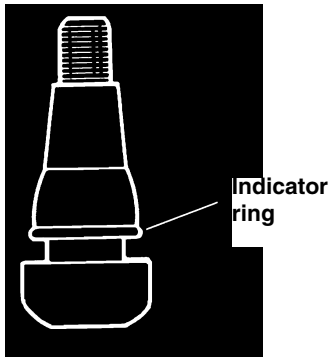



**Figure 2-28. Snap-in Tubeless Tire Valves**

2. Inspect the tire and tube for wear.

## INSTALLATION

**⚠WARNING**

**Use the correct inner tube and tire. See TIRE DATA in SPECIFICATIONS. Use of incorrect tires or tubes can adversely affect handling or result in tire failure, which could result in death or serious injury.**

**⚠WARNING**

**Do not interchange tire valves from one type to another. Always replace valves with the same type as originally furnished, either the threaded valve stem or snap-in type. The rim configuration is designed to fit one type only. Use of the wrong valve can lead to tire failure, which could result in death or serious injury.**

1. On tubeless wheels, damaged or leaking valves must be replaced. To replace a snap-in type valve proceed as follows:

   a. See Figure 2-28. Moisten the valve with water and insert valve stem through rim hole.

   b. Thread plug tool on valve stem and pull valve through rim until all of the indicator ring is visible.

**⚠WARNING**

**Only install original equipment tire valves and valve caps. A valve, or valve and cap combination, that is too long may strike adjacent components, damage the valve and cause rapid tire deflation. Rapid tire deflation can cause loss of vehicle control, which could result in death or serious injury.**




**Figure 2-29. Starting Bead on Rim**




**Figure 2-30. Starting Second Bead on Rim**

**⚠WARNING**

**Aftermarket valve caps that are heavier than the original equipment cap may have clearance at slow speeds, but at high speed the valve/cap will be moved outward by centrifugal force. This movement could cause the valve/cap to strike adjacent components, damage the valve and cause rapid tire deflation. Rapid tire deflation can cause loss of vehicle control, which could result in death or serious injury.**

2. On laced wheels, install a rim strip into the rim well. Make sure no spokes protrude through nipples and be sure to align the valve stem hole in rim strip with hole in rim.

3. Thoroughly lubricate the rim flanges and both beads of the tire with tire lubricant. Install RIM PROTECTORS, Part No. HD-01289 to prevent scarring rims.
4. See Figure 2-29. Starting at the valve stem, start the first bead into the rim well. Work the bead on as far as possible by hand. Use the tire tool to pry the remaining bead over the rim flange. If tire has colored dot on sidewall, it is a balance mark and should be located next to valve stem hole.
5. Inflate tube just enough to round it out. Lubricate thoroughly 360˚ around the tube base. Insert tube in tire with valve stem in hole.
6. See Figure 2-30. Starting 180˚ from valve stem, start the second bead onto the rim. Work the bead onto the rim with tire tools, working toward valve in both directions. Remove the valve core from the rim hole before prying the remaining bead over the rim flange.

   Make sure inner tube valve stem moves in and out freely, then inflate the tire to recommended pressure to seat the bead. See SPECIFICATIONS. Then deflate tire to allow inner tube to smooth out. Inflate again to recommended pressure to seat the bead.
7. Use the BEAD EXPANDER (Part No. HD-28700) to seat beads on tubeless tires.

**⚠WARNING**

**Do not inflate tire over 40 psi (2.8 bars) to seat beads. Inflating tire beyond this point can cause the tire rim assembly to burst, which could result in death or serious injury. If the beads fail to seat, deflate and relubricate the bead and rim. Reinflate to seat beads, but do not exceed 40 psi (2.8 bars).**

**CAUTION**

**When mounting tire and tube on the rim, use extreme care so the inner tube is not pinched.**

## Checking Tire Radial Runout

1. Check runout by turning wheel on axle, measuring amount of radial displacement from a fixed point near the tire. See Figure 2-31.
2. Tire tread runout should be no more than 0.090 in. (2.28 mm) If tire tread runout is more than 0.090 in. (2.28 mm), remove tire from rim and check rim runout to see if rim is at fault. (See CHECKING CAST RIM RUNOUT).

*NOTE*

*Make sure bead is properly seated on rim. Deflate and reseat tire if necessary.*

3. If rim runout is less than 1/32 in. (0.031 in.) (0.79 mm), tire is at fault and should be replaced. If rim turnout is more than 1/32 in. (0.79 mm) correct by replacing cast wheel or truing laced wheel.

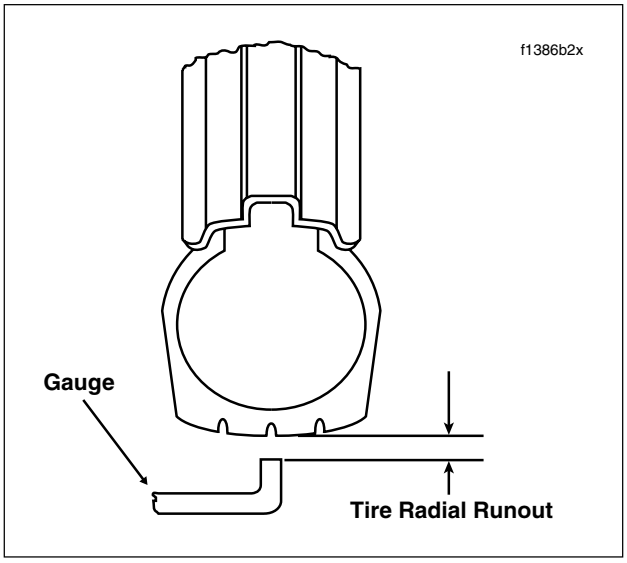



**Figure 2-31. Checking Tire Radial Runout**

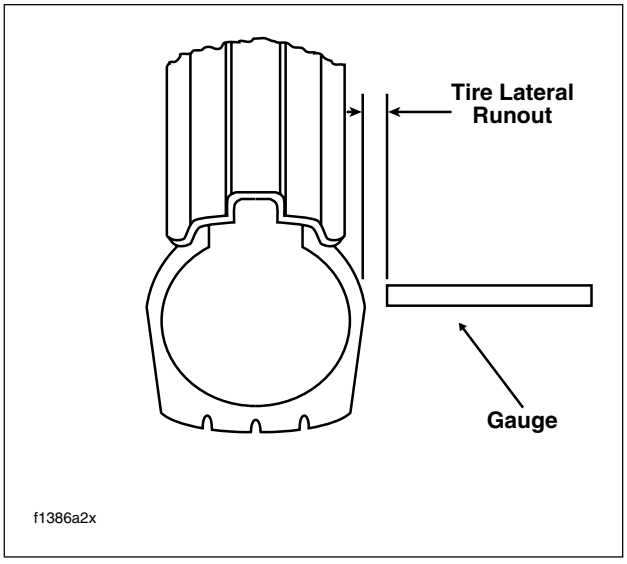



**Figure 2-32. Checking Tire Lateral Runout**

## Checking Tire Lateral Runout

1. Check runout by turning wheel on axle, measuring tread runout. See Figure 2-32.
2. Tire tread runout should be no more than 0.080 in. (2.03 mm). If tire tread runout is more than 0.080 in. (2.03 mm), remove tire from rim and check rim bead runout to see if rim is at fault (see CHECKING CAST RIM RUNOUT).

*NOTE*

*Make sure bead is properly seated on rim. Deflate and reseat tire if necessary.*

3. If rim bead runout is less than 1/32 in. (0.031 in.) (0.79 mm), tire is at fault and should be replaced. If rim bead runout is more than 1/32 in. (0.031 in.), correct by replacing cast wheel or truing laced wheel.

## Wheel Balancing

Wheel balancing is recommended to improve handling and reduce vibration, especially at high road speeds. Cast aluminum wheels require special self-adhesive weights. Gold Color – 1 oz. (28g) weight, 1/2 oz. (14g) weight, Silver Color 1/2 oz. (14g) and 1/4 oz. (7g), and Black 1/4 oz. (7g) weight.

Laced wheels use balance weights which press over the spoke nipples. 1 oz. (28g), 3/4 oz. (21g) and 1/2 oz. (14g) weights are available.

1. Self adhesive wheel weights should be applied to the flat surface of the rim. Make sure that area of application is completely clean, dry and free of oil and grease.

*NOTE*

*If 1 oz. (28g) or more weight must be added at one location, split the amount so that half is applied to each side of the rim.*

2. Remove paper backing from weight and apply 3 drops of Loctite® SUPERBONDER® 420 to the adhesive side of the weight. Place the weight on rim, press firmly in place and hold for 10 seconds. Full adhesive cure takes 8 hours.

3. In most cases, static balancing using WHEEL TRUING STAND, Part No. HD-95500-80, will produce satisfactory results. However, dynamic balancing, utilizing a wheel spinner, should be used to produce finer tolerances for best high and low speed handling characteristics. Follow the instructions supplied with the balance machine you are using. Wheels should be balanced to within 1/2 oz. (14g) at 60 mph (96 km/h). The maximum permissible weight to accomplish balance is 3-1/2 oz. (99g) total.

**⚠WARNING**

**Vehicle alignment is very important to ensure proper handling and vibration control. Follow this procedure carefully and in the sequence given. Failure to do so may lead to loss of vehicle control, which could result in death or serious injury.**

1. Wheels must be true according to specifications. See Section 2.4 CHECKING CAST RIM RUNOUT.
2. Obtain a piece of 1/8 inch (3.175 mm) aluminum welding rod 25 inches (635 mm) long. Grind one end down to a blunt point. Using a pliers, bend the rod as shown in Figure 2-34. Place a snug fitting grommet on the rod to act as a slide measurement indicator.
3. Remove the decorative chrome plug from the rear swingarm bracket.

*NOTE*

*The rear swingarm brackets also serve as passenger footboard brackets.*

4. With the blunt end of the alignment tool inserted in the center of the pivot shaft, slide the rubber grommet down the length of the tool until it is aligned with the center of the rear axle.
5. Repeat steps 3 and 4 on opposite side of vehicle.
6. The measurements between the center of the rear axle and the center of the pivot shaft must be equal on both sides of the vehicle. If the measurements are **not** equal, adjust the rear wheel using the axle adjusters. See Figure 2-33. It is important that the adjustments be made as accurately as possible so that the remaining adjustments are also accurate.
7. Raise the rear of the motorcycle so that the rear wheel rotates freely. Use a center stand or place blocking under the frame.

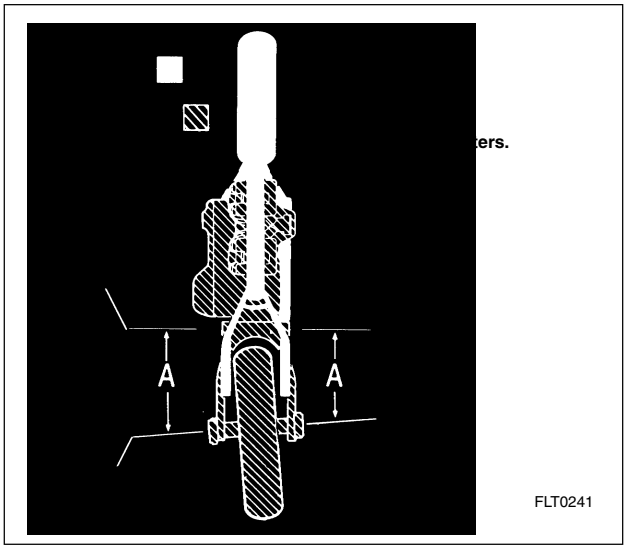



**Figure 2-33. Rear Wheel Misaligned**

8. On left side of vehicle, remove the eyelet to top engine mounting bracket bolt from the top stabilizer link.
9. Remove flange locknuts to free voltage regulator from studs on lower frame cross member. Remove voltage regulator from studs and allow to hang by cables at front of vehicle.
10. Thoroughly loosen the front engine mounting bracket to rubber mount bolt. Thoroughly loosen the two front engine mount to frame bolts. See Figure 2-35.
11. Verify that the front and rear wheels are aligned. If realignment is necessary, use Open End Crowfoot (Snap-On FC018) to loosen the two jam nuts on the bottom stabilizer link. See Figure 2-35. Place a straightedge along each side of the rear wheel and adjust the bottom stabilizer so that the front wheel is centered between the straightedges. See Figure 2-36.

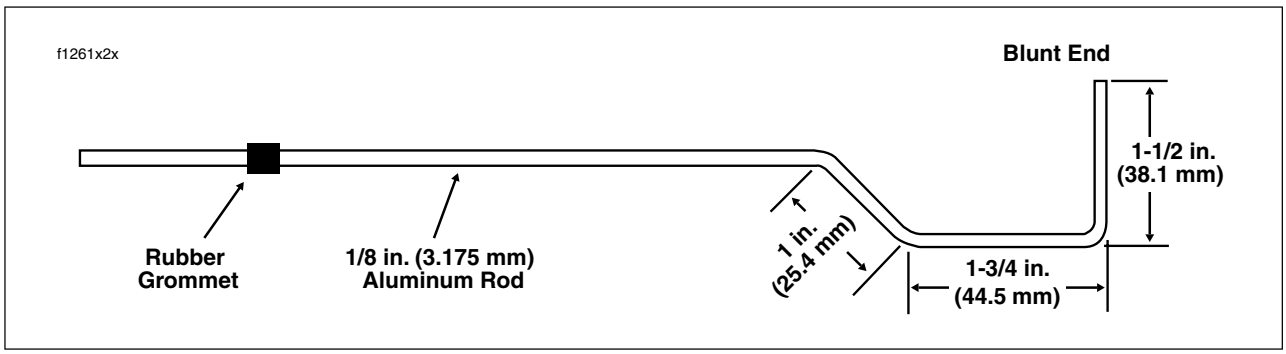



**Figure 2-34. Alignment Tool**

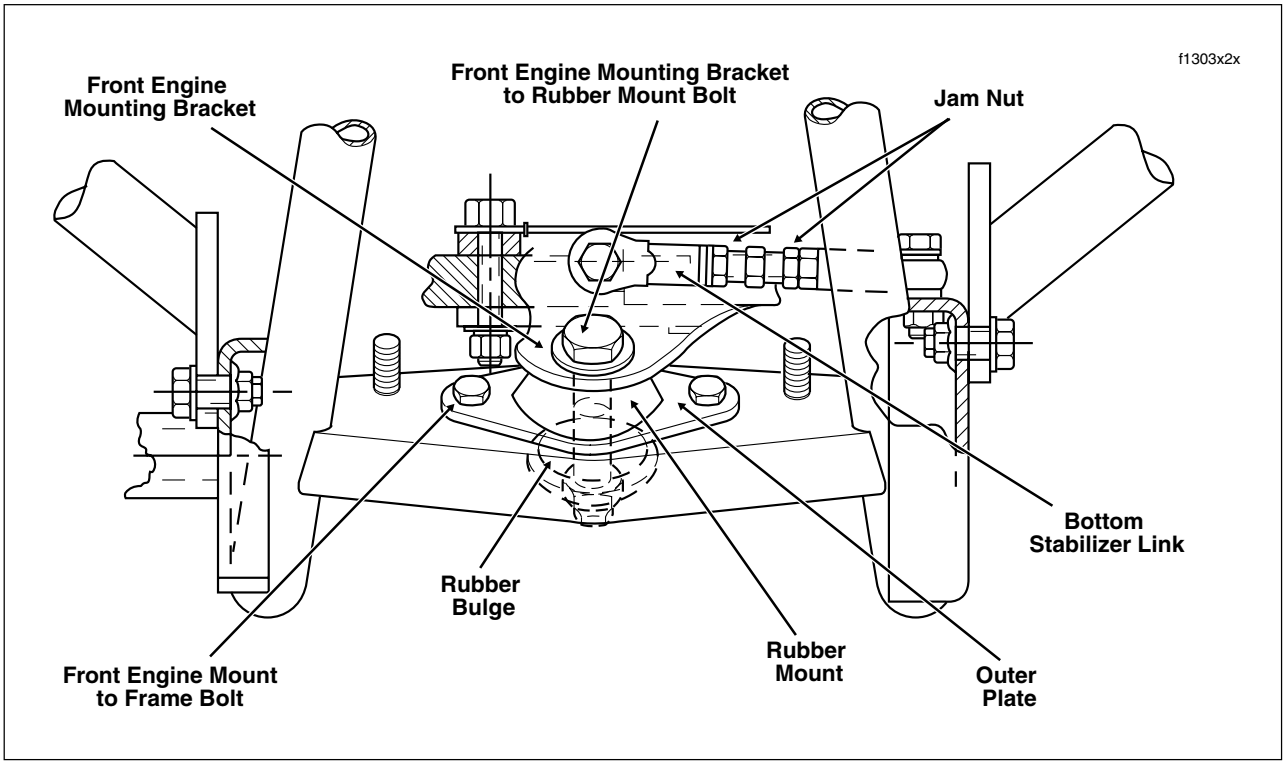



**Figure 2-35. Bottom Stabilizer Link and Front Engine Mount Bolts**

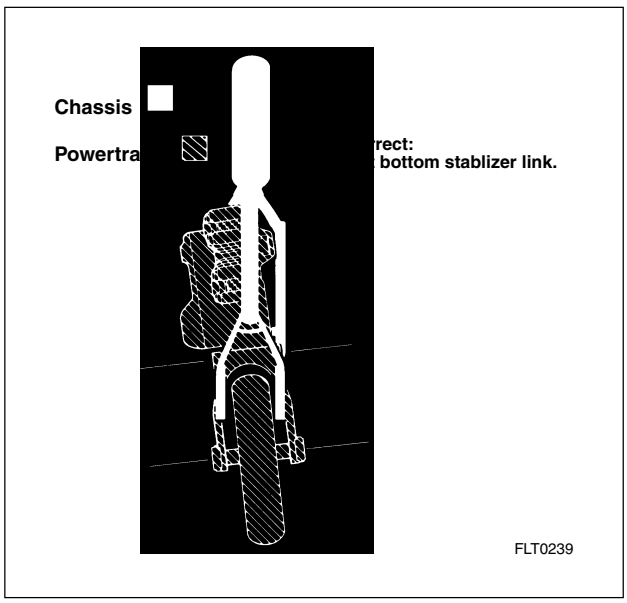



**Figure 2-36. Horizontally Misaligned**

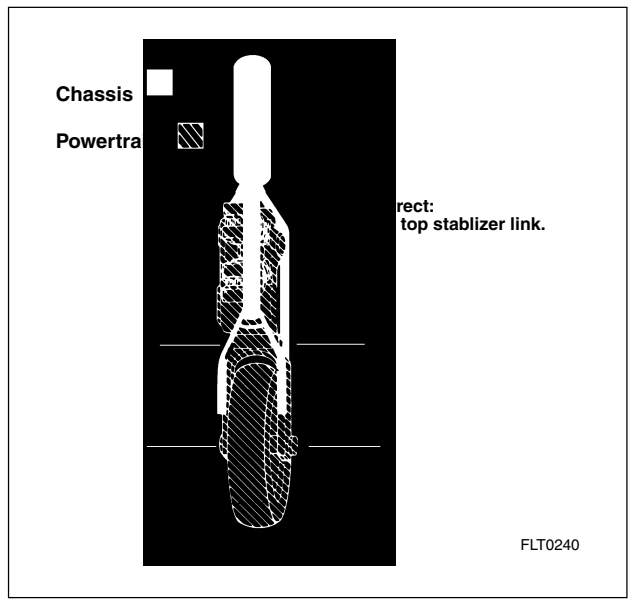



**Figure 2-37. Vertically Misaligned**

12. Using Open End Crowfoot (Snap-On FC018), loosen the two jam nuts on the top stabilizer link. Adjust the top stabilizer so that the bolt removed under step 8 can be reinstalled without pushing the engine to either the left or right. See Figure 2-37.

13. Using Open End Crowfoot (Snap-On FC018), tighten the jam nuts on both the top and bottom stabilizer links. See Figure 2-38 and Figure 2-35.

-

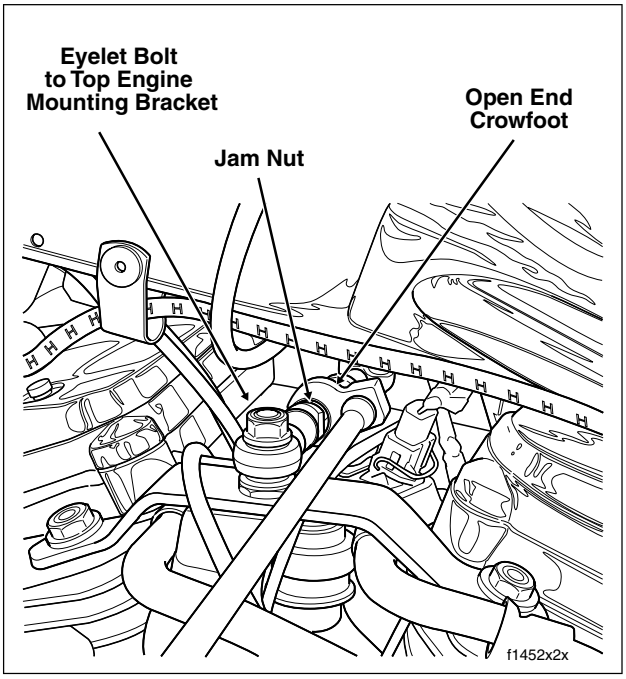



**Figure 2-38. Top Stabilizer Link and Engine Mounting Bracket Bolts (Left Side View)**

14. Install the decorative chrome plugs in the rear swingarm brackets.

15. With the engine weight on the mount, verify that the two front engine mount to frame bolts are loose.

16. Push the outer plate of the front engine mount from side to side until the rubber bulge (below frame cross member) is centered with the outer plate and equally compressed side to side. See Figure 2-39. Tighten the two front engine mount to frame bolts to 33-38 ft-lbs (45-52 Nm).

17. Remove the front engine mounting bracket to rubber mount bolt. Leaving the engine weight on the mount, push the front engine mounting bracket forward or rearward until the rubber bulge (below frame crossmember) is centered with the outer plate and equally compressed forward and rearward. See Figure 2-40.

18. See Figure 2-41. With the mount centered, install the front engine mounting bracket to rubber mount bolt with two flat washers and nut. Be sure that bolt does not bind in engine mounting bracket or front engine mount.

19. Tighten the front engine mounting bracket to rubber mount bolt to 35-45 ft-lbs (47-61 Nm). Check mount alignment after tightening all fasteners.

20. Slide voltage regulator over studs on frame cross member at front of vehicle. Install flange locknuts on studs and tighten to 7-10 ft-lbs (10-14 Nm).

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Strip in Fig. 2-41,
Page 2-26,
From 00 Manual**

**Figure 2-39. Aligning Mount Sideways**

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Page 2-26,
From 00 Manual**

**Figure 2-40. Aligning Mount Front-to-Rear**

**Art Missing,
Strip in Fig. 2-43,
Page 2-26,
From 00 Manual**

**Figure 2-41. Engine Mount Aligned**

21. Remove stand or blocking and lower motorcycle to floor.

*NOTE*

*Check the stabilizers for wear every 10,000 miles (16,000 km).*

# FRONT BRAKE MASTER CYLINDER 2.9

## GENERAL

Master cylinders designed for dual disc (two caliper) operation have an 11/16 inch (17.5 mm) bore, while those that are designed for single disc (one caliper) operation have a 9/16 inch (14.3 mm) bore. The bore size is stamped on the master cylinder assembly inboard of the handlebar clamp bracket. See Figure 2-42.

**⚠WARNING**

**Do not use a 9/16 inch bore master cylinder assembly on dual disc (two caliper) models. Likewise, do not use an 11/16 inch bore master cylinder assembly on single disc (one caliper) models. These master cylinder assemblies are not interchangeable. Using the wrong assembly can adversely affect braking efficiency or result in brake failure, which could result in death or serious injury.**

## REMOVAL/DISASSEMBLY

1. Open bleeder nipple cap on front brake caliper. Install end of a length of clear plastic tubing over caliper bleeder valve, while placing free end in a suitable container. Open bleeder valve about 1/2-turn. Pump brake hand lever to drain brake fluid. Close bleeder valve.
2. Remove bolt and two steel/rubber washers to disconnect fitting of hydraulic brake line from master cylinder. Discard washers.

**CAUTION**

**Do not remove the master cylinder assembly without first placing the 5/32 inch cardboard insert between the brake lever and lever bracket. Removal without the insert may result in damage to the rubber boot and plunger of the Front Stoplight Switch.**

*NOTE*

*Use the eyelet of an ordinary cable strap if the cardboard insert is not available.*

3. Place the cardboard insert between the brake lever and lever bracket. See Figure 2-43.
4. Using a T27 TORX drive head, remove two screws with flat washers to release handlebar clamp from the master cylinder housing. Remove the clamp and brake lever/master cylinder assembly from the handlebar. See Figure 2-44.

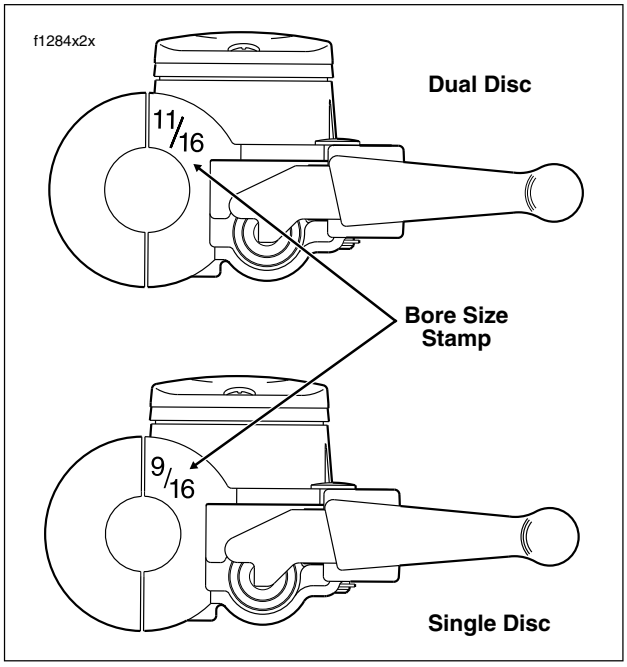



**Figure 2-42. Verify Correct Bore Size Before Use**

5. Remove the cardboard insert (or cable strap eyelet) between the brake lever and lever bracket.

**⚠WARNING**

**Always wear proper eye protection when removing 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.**

6. Remove retaining ring from pivot pin groove at bottom of master cylinder bracket. Discard retaining ring.
7. Remove pivot pin and brake hand lever from master cylinder assembly.
8. Carefully remove wiper with pick or similar tool.
9. Remove piston cap.
10. Remove piston with O-ring and primary cup.
11. Remove spring.

**CAUTION**

**To prevent dirt and other contaminants from entering the master cylinder reservoir, thoroughly clean the cover before removal.**




**Figure 2-43. Install Cardboard Insert Before Removing Master Cylinder Assembly**

12. Remove two Phillips screws, cover and cover gasket from the master cylinder reservoir.

## CLEANING AND INSPECTION

**⚠WARNING**

**Do not use replacement parts from single caliper repair kits (9/16 inch bore) on dual caliper models. Likewise, do not use replacement parts from dual caliper repair kits (11/16 inch bore) on single caliper models. Parts are not interchangeable. Using the wrong replacement parts can adversely affect braking efficiency or result in brake failure, which could result in death or serious injury.**

1. Always reassemble the master cylinder using **new** parts from the correct repair kit (9/16 inch bore- HD Part No. 45006-96B; 11/16 inch bore- HD Part No. 45072-96B).
2. Clean all parts with denatured alcohol or D.O.T. 5 BRAKE FLUID. Do not contaminate with mineral oil or other solvents. Wipe dry with a clean, lint free cloth. Blow out drilled passages and bore with a clean air supply. Do not use a wire or similar instrument to clean drilled passages in bottom of reservoir.

**⚠WARNING**

**Always use denatured alcohol to clean brake system components. Do not use mineral base solvents (such as gasoline and paint thinner) or deterioration of rubber parts may occur after assembly. Deterioration of components may result in premature brake failure, which could result in death or serious injury.**

3. Carefully inspect all parts for wear or damage and replace as necessary.
4. Inspect the piston bore in the master cylinder housing for scoring, pitting or corrosion. Replace the housing if any of these conditions are found.
5. Inspect the outlet port that mates with the brake line fitting. As a critical sealing surface, replace the housing if any scratches, dents or other damage is noted.
6. Inspect the cover gasket for cuts, tears or general deterioration. If gasket and/or sight glass replacement is necessary, proceed as follows:
   a. From inboard side, push sight glass toward top of cover until free.
   b. Pull rubber gasket from cover.
   c. Fit nipple of **new** gasket into hole of cover aligning gasket and cover thru holes.
   d. From bottom of gasket, push flat end of sight glass through nipple until top of glass is flush with top of gasket. Verify that glass is square in bore. If some lubrication is necessary, use a small quantity of clean brake fluid.

## ASSEMBLY/INSTALLATION

1. Fit O-ring into groove on outboard side of piston (pin side). See Figure 2-44.
2. Fit primary cup over lip on inboard side of piston, so that closed side (smaller OD) contacts shoulder.
3. Coat piston bore of master cylinder reservoir with special lubricant supplied in the service parts kit. Also apply the lubricant to OD of installed O-ring and primary cup.
4. Insert metal retainer end of spring into piston bore, so that it seats against counterbore (recess) at bottom.
5. Slide piston over spring.
6. Fit wiper over piston cap so that flat side of wiper contacts cap shoulder.
7. Fit piston cap over piston pin.
8. Press down on wiper until it contacts the counterbore. Larger OD of wiper must be completely seated in groove on outlet side of piston bore.
9. Note that the angular shape of the master cylinder cover makes one side thicker than the other. Install the cover (with gasket) on the master cylinder reservoir, so that the thicker side is positioned above the brake line fitting. Install two Phillips screws to fasten cover to the reservoir, but do not tighten at this time.
10. Align hole in brake hand lever with hole in master cylinder bracket. From the top of the assembly, slide pivot pin through bracket and hand lever.

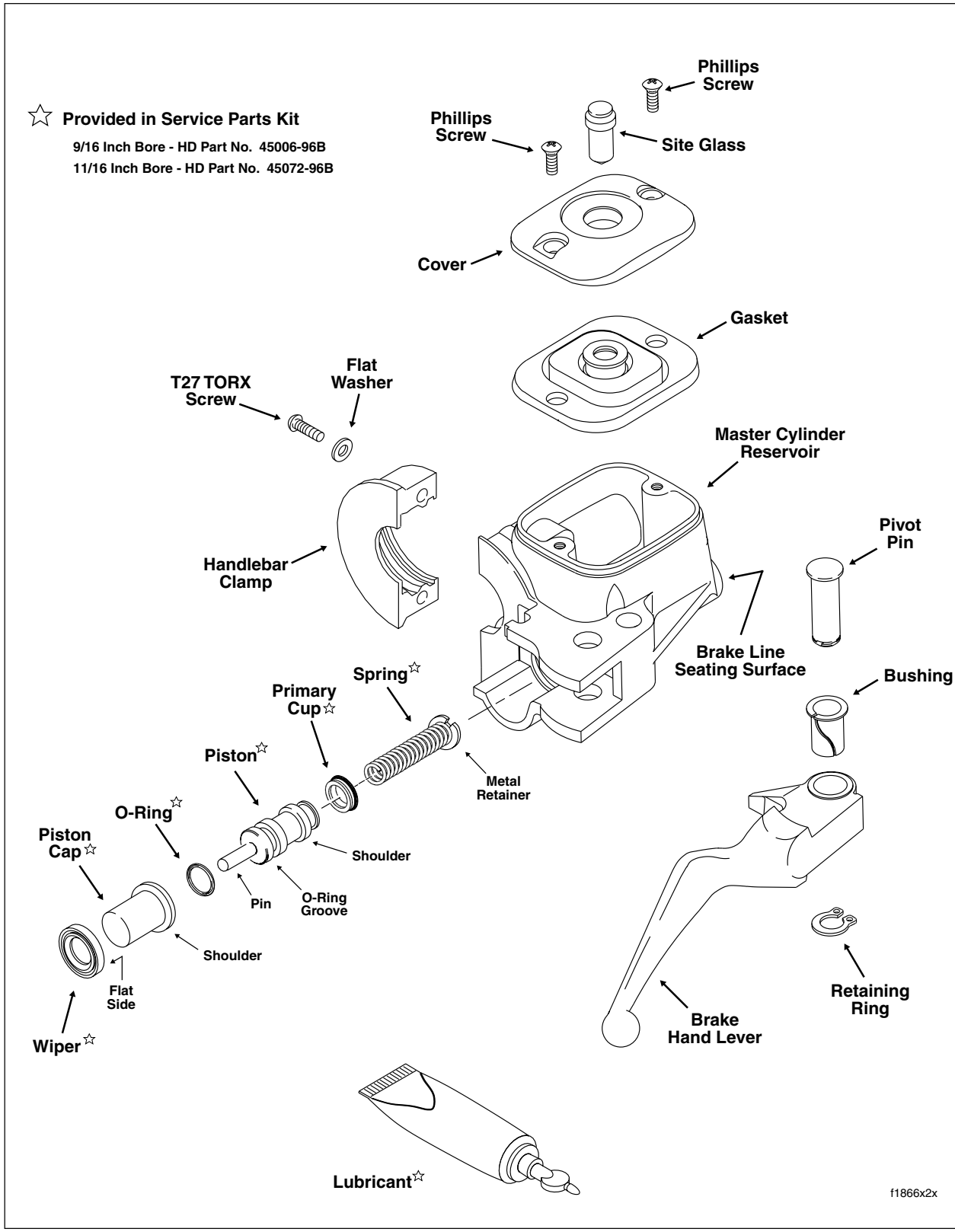



**Figure 2-44. Front Brake Master Cylinder Assembly**

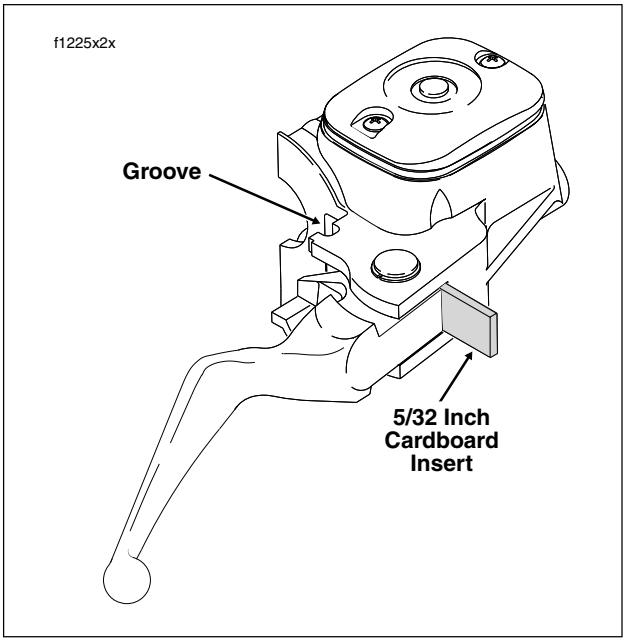



**Figure 2-45. Install Cardboard Insert Before Installing Master Cylinder Assembly**

**⚠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.**

11. Install **new** retaining ring in pivot pin groove. Verify that retaining ring is completely seated in groove.

**CAUTION**

**See Figure 2-45. Do not install the master cylinder assembly without first placing the 5/32 inch cardboard insert between the brake lever and lever bracket. Installation without the insert may result in damage to the rubber boot and plunger of the Front Stoplight Switch.**

12. Place the cardboard insert between the brake lever and lever bracket. Use the eyelet of an ordinary cable strap if the cardboard insert is not available.
13. Position the brake lever/master cylinder assembly inboard of the switch housing assembly engaging the tab on the lower switch housing in the groove at the top of the brake lever bracket. See Figure 2-46.
14. Align the holes in the handlebar clamp with those in the master cylinder housing and start the two screws (with flat washers). Position for rider comfort. Beginning with the top screw, tighten the screws to 70-80 **in-lbs** (7.9-9.0 Nm) torque using a T27 TORX drive head.

**CAUTION**

**To avoid leakage, verify that the steel/rubber washers, banjo bolt, brake line fitting and master cylinder bore are completely clean.**

15. Position **new** steel/rubber washers on each side of hydraulic brake line fitting. Insert bolt through washers and fitting. Thread bolt into master cylinder housing and tighten to 17-22 ft-lbs (23-30 Nm).
16. Install length of clear plastic tubing over caliper bleeder valve, if removed. Place free end of tube in a clean container.
17. Remove the master cylinder cover. Stand the motorcycle upright so that the master cylinder is in a level position.

*NOTE*

*D.O.T. 5 SILICONE HYDRAULIC BRAKE FLUID is non-toxic.*

18. Add D.O.T. 5 SILICONE HYDRAULIC BRAKE FLUID to the master cylinder reservoir until the fluid level is 1/8 inch (3.2 mm) from the top. Do not reuse old brake fluid. Use only D.O.T. 5 fluid from a sealed container.

**⚠WARNING**

**A plugged or covered relief port can cause brake drag or wheel lockup and may lead to loss of vehicle control, which could result in death or serious injury.**

19. Verify proper operation of the master cylinder relief port. Actuate the brake hand lever. A slight spurt of fluid will break the fluid surface in the reservoir compartment if all internal components are working properly.
20. Add brake fluid to the master cylinder reservoir until the fluid level is 1/8 inch (3.2 mm) from the top.

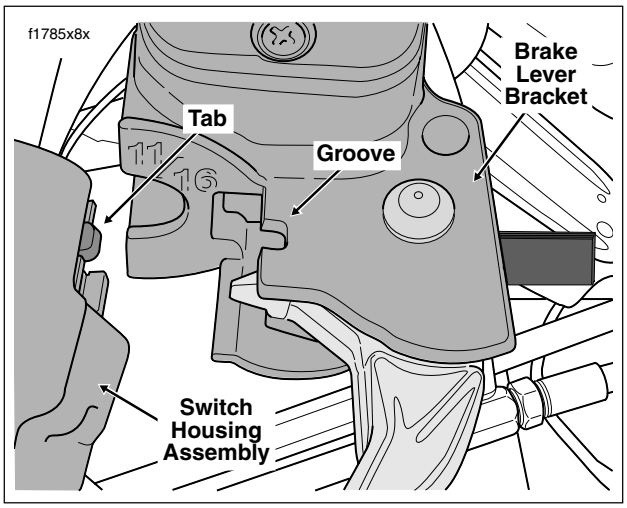



**Figure 2-46. Fit Brake Lever/Master Cylinder to Right Handlebar Switch Housings**

21. Depress and hold the brake hand lever to build up hydraulic pressure.
22. Open bleeder valve about 1/2-turn. Brake fluid will flow from bleeder valve through tubing. Close bleeder valve when brake hand lever has moved 1/2 to 3/4 of its full range of travel. Allow brake hand lever to return slowly to its released position.
23. Repeat Steps 20-22 until all air bubbles are purged.
24. Final tighten the bleeder valve to 80-100 **in-lbs** (9.0-11.3 Nm). Install the bleeder cap.
25. Add brake fluid to the master cylinder reservoir until the fluid level is about 1/8 inch (3.2 mm) from the top.
26. Install cover (with gasket) on the master cylinder reservoir, so that the thicker side is positioned above the brake line fitting. Install two Phillips screws to fasten the cover to the reservoir. Tighten the screws to 6-8 **in-lbs** (0.7-0.9 Nm).
27. With the Ignition/Light Key Switch turned to IGNITION, actuate the front brake hand lever to verify operation of the brake lamp.

**⚠WARNING**

**After completing repairs or bleeding the system, always test motorcycle brakes at low speed. If brakes are not operating properly or braking efficiency is poor, testing at high speeds could result in death or serious injury.**

28. Test ride the motorcycle. If the brake feels spongy, repeat the bleeding procedure.

*NOTE*

*A sight glass enables the rider to visually check the brake fluid level without removing the master cylinder cover. When the reservoir is full, the sight glass is dark. As the fluid level drops, the glass lightens up to indicate this condition to the rider.*

# REAR BRAKE MASTER CYLINDER 2.10

## REMOVAL

### PRELIMINARY INSTRUCTIONS

*NOTE*

*FLHT/C and FLHR/C model vehicles are not equipped with lower fairings. If fairing lowers are absent, proceed to step 5.*

1. Remove two screws from fairing lower cap on right side of vehicle.
2. Hold nut at bottom of fairing lower, and using a T40 TORX drive head, turn inside screw to free assembly from engine guard clamp. Discard rubber washer.
3. Remove two locknuts to free retainer from upper rail of engine guard. From within glove box, remove U-bolt.
4. Remove glove box from fairing lower. Remove fairing lower from vehicle.
5. Cut cable strap holding stator/voltage regulator connector clip to lower frame tube (below cam cover). Pull connector clip toward front of vehicle to release from T-stud on inboard side of frame tube.
6. Remove two allen head socket screws (with lock-washers and flat washers) to release right side front footboard brackets from frame weldment. For best results, approach from left side of vehicle using a 3/8 inch ball allen with extension.
7. Raise lid of right side saddlebag. Grasp bail wire inside saddlebag and rotate each stud 1/4 turn in a counterclockwise direction. Remove bail head studs with flat washers. Remove saddlebag.
8. Gently pull side cover from frame downtube (no tools required).
9. Open bleeder nipple cap on rear brake caliper. Install end of a length of clear plastic tubing over caliper bleeder valve, while placing free end in a suitable container. Open bleeder valve about 1/2-turn. Pump brake pedal to drain brake fluid. Close bleeder valve.

### BRAKE PEDAL/MASTER CYLINDER ASSEMBLY, REMOVAL

1. See PRELIMINARY INSTRUCTIONS on this page.
2. Remove banjo bolt and two steel/rubber washers to disconnect brake line front fitting from master cylinder assembly. Discard washers.
3. Release rear brake line as needed to move front fitting forward far enough to access hex nut. For further instructions See REAR BRAKE LINE, REMOVAL, steps 4-7, in this section.
4. Using 1-1/8 inch wrench, remove hex nut to free brake pedal/master cylinder assembly from mounting bracket.

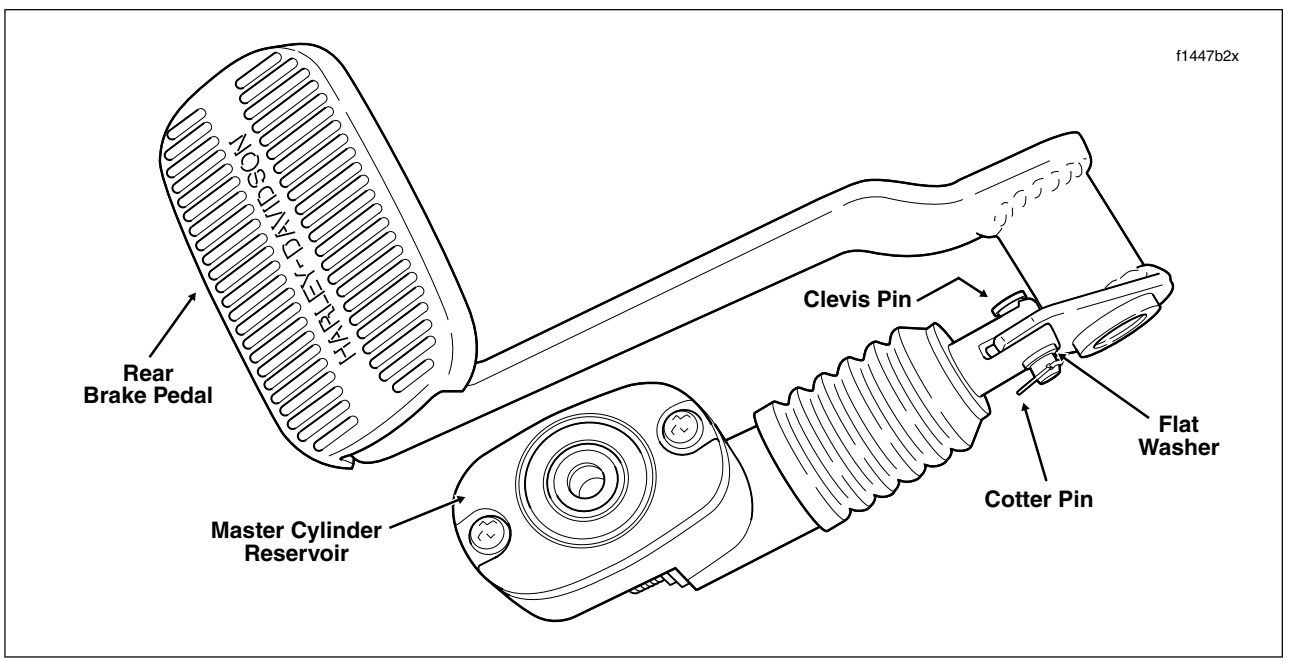



**Figure 2-47. Rear Brake Pedal/Master Cylinder Assembly**

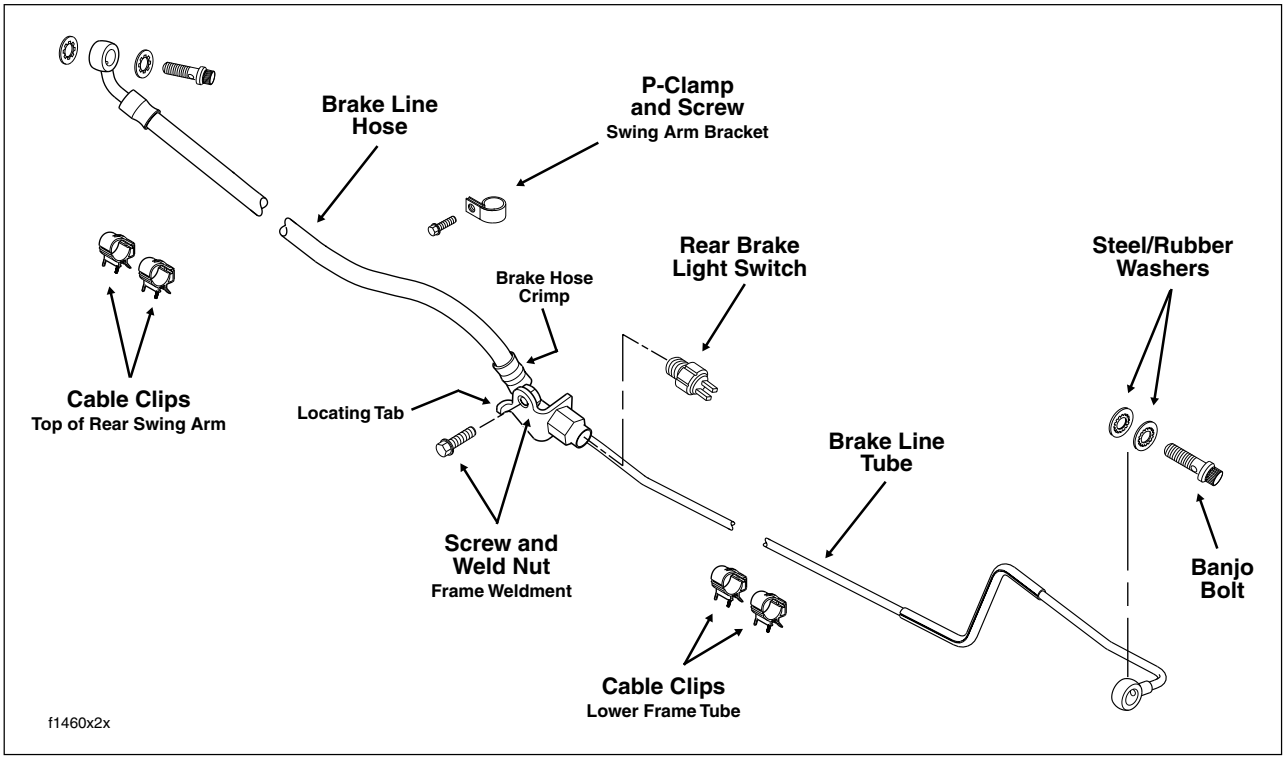



**Figure 2-48. Rear Brake Line Assembly**

5. Remove locknut with flat washer to free brake pedal/master cylinder assembly from pedal shaft. Remove assembly from vehicle. See Figure 2-47.
6. Remove cotter pin and flat washer from clevis pin. Supporting rear brake pedal/master cylinder assembly in vise, tap out clevis pin using a brass drift. Remove master cylinder assembly from brake pedal flange.
7. For further instructions, see MASTER CYLINDER, DISASSEMBLY, in this section.

## BRAKE PEDAL/MASTER CYLINDER ASSEMBLY, INSTALLATION

1. If master cylinder was disassembled, see MASTER CYLINDER, ASSEMBLY, in this section, for instructions.
2. Install master cylinder assembly on brake pedal flange. Supporting brake pedal/master cylinder assembly in vise, tap in clevis pin using a brass drift. Install flat washer and cotter pin on clevis pin. See Figure 2-47.
3. Install brake pedal/master cylinder assembly on pedal shaft. Install flat washer and **new** locknut. Tighten locknut to 15-18 ft-lbs (20-24 Nm).
4. Grease zerk fitting with *Wheel Bearing Grease, Part No. 99856-92,* until a small amount of grease is visible around edges of brake lever.
5. Fit collar on cartridge body into square-shaped hole of mounting bracket. Apply Loctite 242 (blue) to the hex nut threads. Install nut on threaded end of cartridge body until finger tight. Tighten nut to 50 ft-lbs (67.8 Nm) to secure brake pedal/master cylinder assembly to mounting bracket.
6. Position **new** steel/rubber washers on each side of brake line fitting. Insert banjo bolt through washers and fitting. Thread bolt into master cylinder assembly and tighten to 17-22 ft-lbs (23-30 Nm).
7. Secure rear brake line if released during master cylinder removal. For further instructions, see REAR BRAKE LINE, REAR BRAKE LINE, INSTALLATION, steps 4-7, in this section.
8. See FINAL INSTRUCTIONS on the next page.

## REAR BRAKE LINE, REMOVAL

1. See PRELIMINARY INSTRUCTIONS on the previous page
2. Remove banjo bolt and two steel/rubber washers to disconnect brake line front fitting from master cylinder assembly. Discard washers. See Figure 2-48.
3. Open two cable clips on lower frame tube T-studs. Free rear brake line from cable clips.

*NOTE*

*For best results, insert blade of small screwdriver into gap at side of clip and gently rotate end of screwdriver to pop open.*

4. Cut cable strap in front of brake light switch to release brake line, brake light switch wires, voltage regulator cables and engine sensor harness conduit from lower frame tube.
5. Cut cable strap to release voltage regulator cables and sensor harness conduit from brake hose crimp.
6. Remove hex screw to free brake hose P-clamp from rear swing arm bracket (passenger footboard bracket).
7. Remove socket terminals from rear brake light switch spade contacts. Remove hex screw to free brake light switch bracket from frame weldment. Push on bracket to release locating tab from slot in frame weldment.
8. Open two cable clips on rear swing arm T-studs. Free rear brake line hose from cable clips.
9. Remove banjo bolt and two steel/rubber washers to disconnect brake line fitting from rear brake caliper. Discard washers.
10. Feed rear brake line hose forward to area in front of rear swing arm bracket. Remove rear brake line assembly from vehicle.

## REAR BRAKE LINE, INSTALLATION

1. Place rear brake line into approximate position along top of lower right frame tube. From area in front of rear swing arm bracket, feed brake line hose rearward following top of rear swing arm.
2. Position **new** steel/rubber washers on each side of brake line rear fitting. Insert banjo bolt through washers and fitting. Thread bolt into rear brake caliper and tighten to 17-22 ft-lbs (23-30 Nm).
3. Capture rear brake line hose in two cable clips on rear swing arm T-studs. Snap cable clips closed.
4. Index locating tab on brake light switch bracket in slot of frame weldment. Install socket terminals on rear brake light switch spade contacts. Install hex screw to secure brake light switch bracket to frame weldment.
5. Install hex screw to secure brake hose P-clamp to rear swing arm bracket (passenger footboard bracket).
6. Install **new** cable strap to secure engine sensor harness conduit and voltage regulator cables to brake hose crimp. Exercise caution to avoid pinching or kinking hose. Cut any excess cable strap material.
7. Install **new** cable strap in front of brake light switch to secure brake line, brake light switch wires, voltage regulator cables and engine sensor harness conduit to lower frame tube. Cut any excess cable strap material. See Figure 2-49.
8. Capture rear brake line tube in two cable clips on lower frame tube T-studs. Snap cable clips closed.
9. Position **new** steel/rubber washers on each side of brake line front fitting. Insert banjo bolt through washers and fitting. Thread bolt into master cylinder assembly and tighten to 17-22 ft-lbs (23-30 Nm).
10. See FINAL INSTRUCTIONS on this page.

# INSTALLATION

## FINAL INSTRUCTIONS

*NOTE*

*FLHT/C and FLHR/C model vehicles are not equipped with lower fairings. If fairing lowers are absent, proceed to step 7.*

1. Place fairing lower into position on right side of vehicle. Place glove box into fairing lower.
2. Holding screw inside fairing lower, install **new** rubber washer, clamp and locknut to attach fairing bottom to engine guard. Do not tighten locknut.
3. From within glove box, install U-bolt so that it encircles the upper rail of the engine guard. Loosely install retainer and locknuts.
4. Adjust the fairing lower so that ear at top inboard side is approximately 1/4 inch from frame downtube. Verify that fairing lower is square, and then alternately tighten locknuts to 6 ft-lbs (8 Nm).
5. Hold locknut at bottom of fairing lower, and using a T40 TORX drive head, turn inside screw to fasten assembly to engine guard clamp. Tighten screw to 12 ft-lbs (16 Nm).
6. Install two screws to secure fairing lower cap to fairing lower.
7. Insert two allen head socket screws (with lockwashers and flat washers) through frame weldment into right side front footboard brackets. For best results, approach from left side of vehicle using a 3/8 inch ball allen with extension.
8. Pull connector clip on stator/voltage regulator connector toward rear of vehicle to engage T-stud on inboard side of frame tube (below cam cover). Install **new** cable strap to secure connector and clip to lower frame tube. Cut any excess cable strap material.
9. Install length of clear plastic tubing over caliper bleeder valve, if removed. Place free end of tube in a suitable container.
10. Remove the master cylinder cover, if installed. Stand the motorcycle upright so that the master cylinder is in a level position.

*NOTE*

*D.O.T. 5 SILICONE HYDRAULIC BRAKE FLUID is non-toxic.*

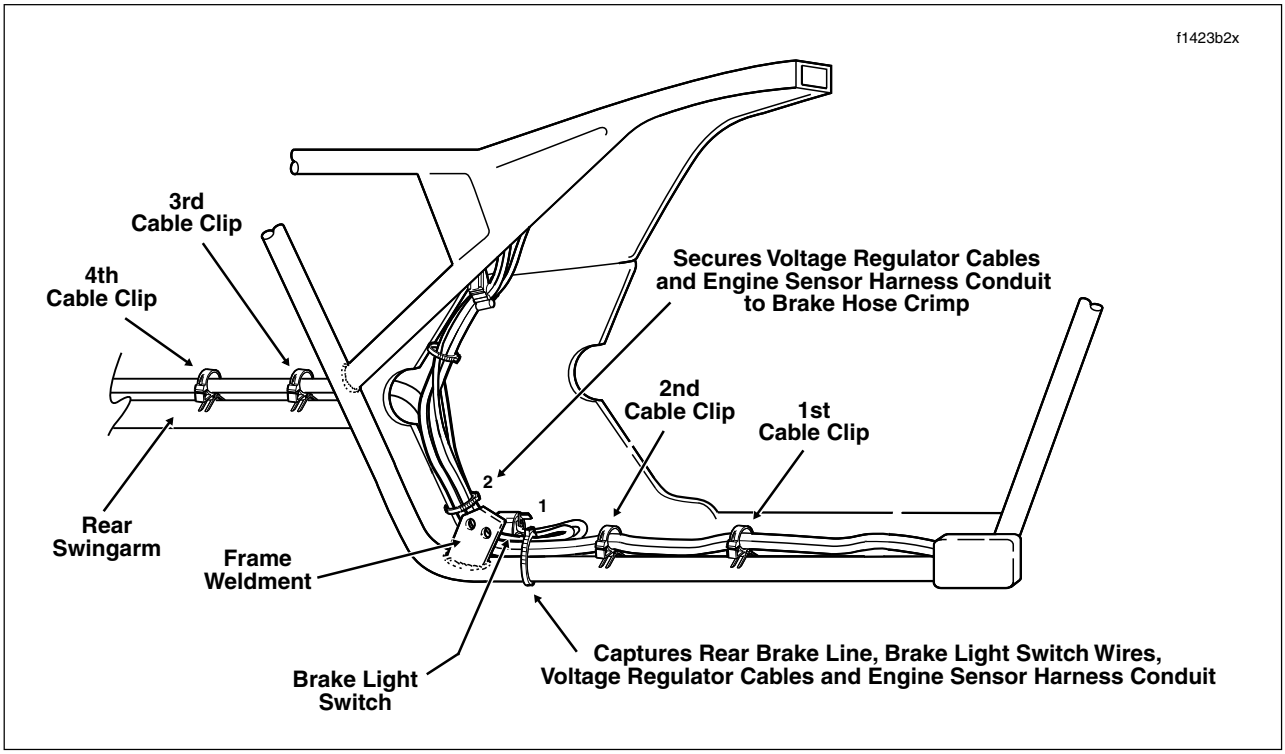



**Figure 2-49. Rear Brake Line Routing (Right Side View)**

11. Add D.O.T. 5 SILICONE HYDRAULIC BRAKE FLUID to the master cylinder reservoir until the fluid level is 1/8 inch (3.2 mm) from the top. Do not reuse old brake fluid. Use only D.O.T. 5 fluid from a sealed container.

**⚠WARNING**

**A plugged or covered relief port can cause brake drag or wheel lockup and may lead to loss of vehicle control, which could result in death or serious injury.**

12. Verify proper operation of the master cylinder relief port. Actuate the rear brake pedal. A slight spurt of fluid will break the fluid surface in the reservoir compartment if all internal components are working properly.
13. Add brake fluid to the master cylinder reservoir until the fluid level is 1/8 inch (3.2 mm) from the top.
14. Depress and hold the rear brake pedal to build up hydraulic pressure.
15. Open bleeder valve about 1/2-turn. Brake fluid will flow from bleeder valve through tubing. Close bleeder valve when rear brake pedal has moved 1/2 to 3/4 of its full range of travel. Allow rear brake pedal to return slowly to its released position.
16. Repeat Steps 13-15 until all air bubbles are purged.
17. Final tighten the bleeder valve to 80-100 **in-lbs** (9.0-11.3 Nm). Install the bleeder cap.
18. Add brake fluid to the master cylinder reservoir until the fluid level is about 1/8 inch (3.2 mm) from the top.
19. Install the cover (with gasket) on the master cylinder reservoir. Install two Phillips screws to fasten the cover to the reservoir. Tighten the screws to 6-8 **in-lbs** (0.7-0.9 Nm).
20. With the Ignition/Light Key Switch turned to IGNITION, actuate the rear brake pedal to verify operation of the brake lamp.

**⚠WARNING**

**After completing repairs or bleeding the system, always test motorcycle brakes at low speed. If brakes are not operating properly or braking efficiency is poor, testing at high speeds could result in death or serious injury.**

21. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required).
22. Position saddlebag on vehicle. Place flat washers on bail head studs. Insert stud through holes in saddlebag and front mounting bracket. When groove at end of stud engages wire form of spring plate on inboard side of bracket, turn stud clockwise 1/4 turn until it snaps in place. Install rear bail head stud in the same manner.
23. Test ride the motorcycle. If the brake feels spongy, repeat the bleeding procedure.

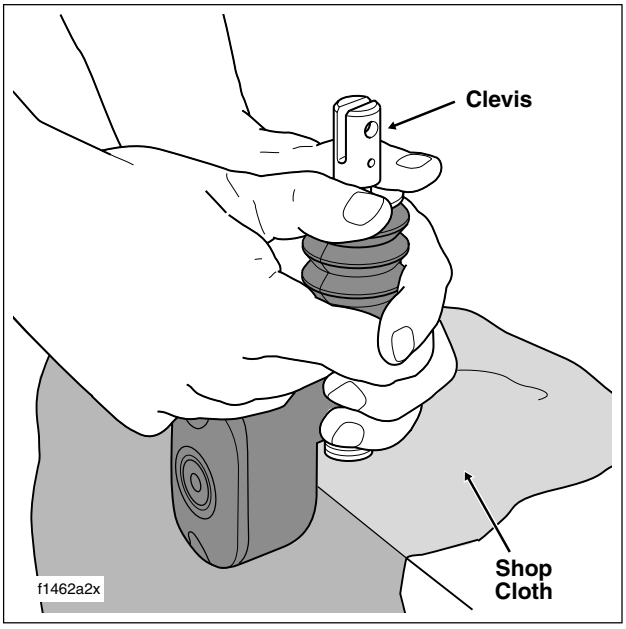



**Figure 2-50. Compress Spring and Remove Clevis**

*NOTE*

*A sight glass enables the rider to visually check the brake fluid level without removing the master cylinder cover. When the reservoir is full, the sight glass is dark. As the fluid level drops, the glass lightens up to indicate this condition to the rider.*

# MASTER CYLINDER

## DISASSEMBLY

*NOTE*

*Do not disassemble the cartridge body. The cartridge body components are not sold separately, so if piston seal leakage is evident, replace the entire cartridge body assembly as described herein.*

1. See BRAKE PEDAL/MASTER CYLINDER ASSEMBLY, REMOVAL, in this section
2. Thoroughly clean exterior of master cylinder assembly with denatured alcohol.
3. Remove spring pin from clevis.
4. Stand master cylinder assembly upright on banjo sealing surface. For best results, suspend reservoir over edge of table. Be sure to lay down a clean shop cloth to protect the sealing surface from damage.
5. Push down on large flat washer to compress spring. While holding the spring in a compressed state, unscrew clevis and then carefully release spring. See Figure 2-50.
6. Remove the large flat washer, dust boot and spring from push rod end of cartridge body. Remove spring and spring retainer from dust boot.
7. Push on threaded end of cartridge body to remove from reservoir adapter. Use hand pressure only. Exercise care to keep cartridge body free of dirt and grease. See Figure 2-51.

**⚠WARNING**

**Always wear proper eye protection when removing 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.**

8. Remove large retaining ring from groove closest to push rod end of cartridge body.
9. Carefully remove two O-rings from outside of cartridge body. Exercise caution to avoid scratching O-ring grooves.
10. Remove small retaining ring from push rod end of cartridge body. Assembly is spring loaded so be sure to hold the parts together as retaining ring is removed.
11. Remove push rod from cartridge body. Remove small retaining ring and washer from push rod.

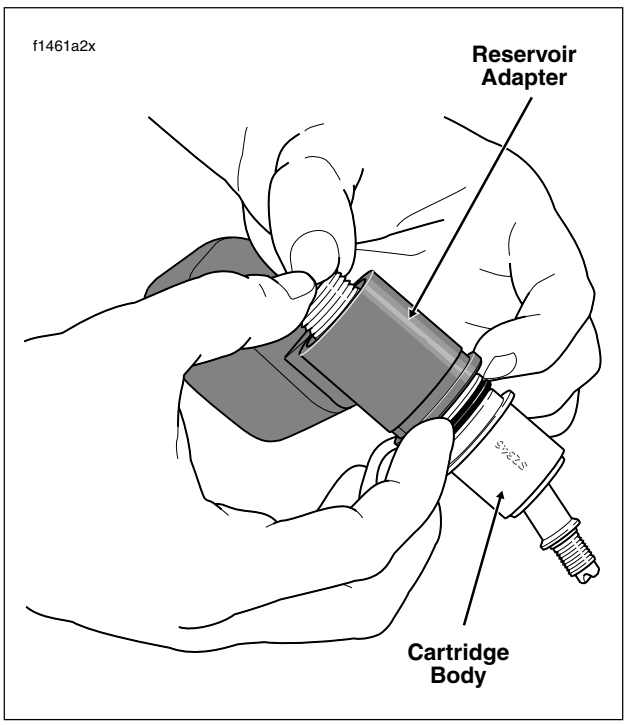
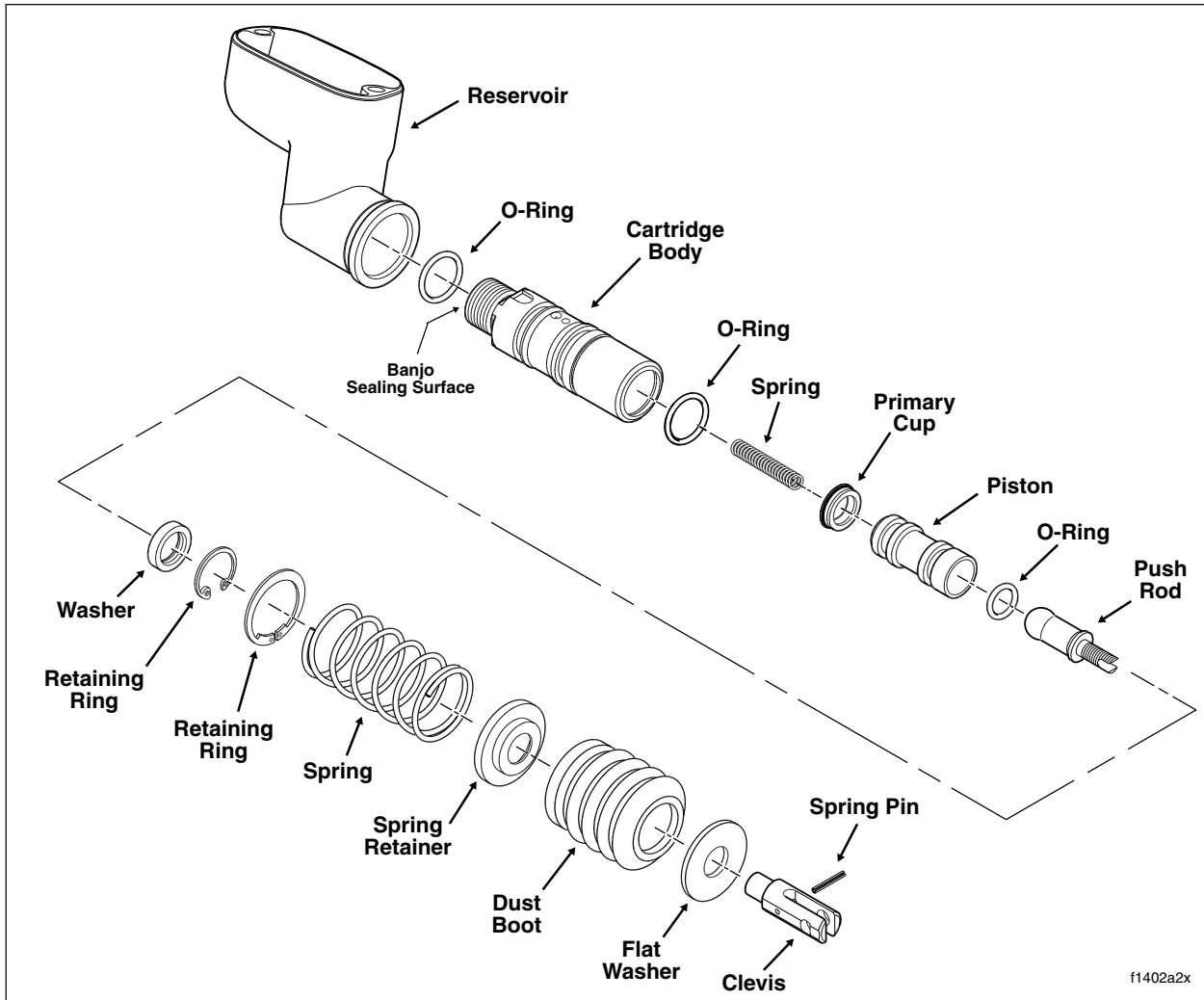



**Figure 2-51. Remove Cartridge From Reservoir Adapter**




| PART | SERVICE KITS (HD Part No.'s) | | | SERVICE PARTS (HD Part No.'s) | | | | |
|---|---|---|---|---|---|---|---|---|
| | 42382-87B | 42454-99 | 41957-97 | 40918-87 | 40920-87 | 44126-87 | 40922-87 | 6366 |
| Reservoir | | ● | | | | | | |
| O-Ring (2) | ● | ● | | | | | | |
| Cartridge Body | ● | | | | | | | |
| Spring (Small) | ● | | | | | | | |
| Primary Cup | ● | | | | | | | |
| Piston | ● | | | | | | | |
| O-Ring (1) | ● | | | | | | | |
| Washer (Small) | ● | | | | | | | |
| Retaining Ring (Small) | ● | | | | | | | |
| Push Rod | | | ● | | | | | |
| Clevis | | | ● | | | | | |
| Spring Pin | | | ● | | | | | |
| Retaining Ring (Large) | | | | ● | | | | |
| Spring (Large) | | | | | ● | | | |
| Spring Retainer | | | | | | ● | | |
| Dust Boot | | | | | | | ● | |
| Washer (Large) | | | | | | | | ● |

**Figure 2-52. Rear Brake Master Cylinder Assembly (Exploded View)**

## CLEANING AND INSPECTION

**WARNING**

**Always use denatured alcohol to clean brake system components. Do not use mineral base solvents (such as gasoline and paint thinner) or deterioration of rubber parts may occur after assembly. Deterioration of components may result in premature brake failure, which could result in death or serious injury.**

1. Clean all metal parts, except the cartridge body assembly, and blow dry with compressed air. Clean all rubber parts using denatured alcohol.
2. Inspect the reservoir adapter bore for scratches. Replace the reservoir if scratches are present.
3. Check the dust boot for cuts or tears. Replace as necessary.
4. Inspect the threads on the cartridge body and push rod. Replace part if threads are damaged.
5. Inspect the spring for cracks or broken coils. Replace as necessary.
6. Inspect O-ring grooves on the cartridge body for dirt. Carefully clean O-ring grooves using a soft cotton cloth moistened with alcohol and allow to dry. Inspect O-ring grooves for scratches. Replace cartridge body if grooves are scratched.
7. Inspect the reservoir cover gasket for cuts, tears or general deterioration. If gasket and/or sight glass replacement is necessary, proceed as follows:
   a. From inboard side, push sight glass toward top of cover until free.
   b. Pull rubber gasket from cover.
   c. Fit nipple of **new** gasket into hole of cover aligning gasket and cover thru holes.
   d. From bottom of gasket, push flat end of sight glass through nipple until top of glass is flush with top of gasket. Verify that glass is square in bore. If some lubrication is necessary, use a small quantity of clean brake fluid.

## ASSEMBLY

1. Slide washer and small retaining ring over threaded end of push rod.

**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.**

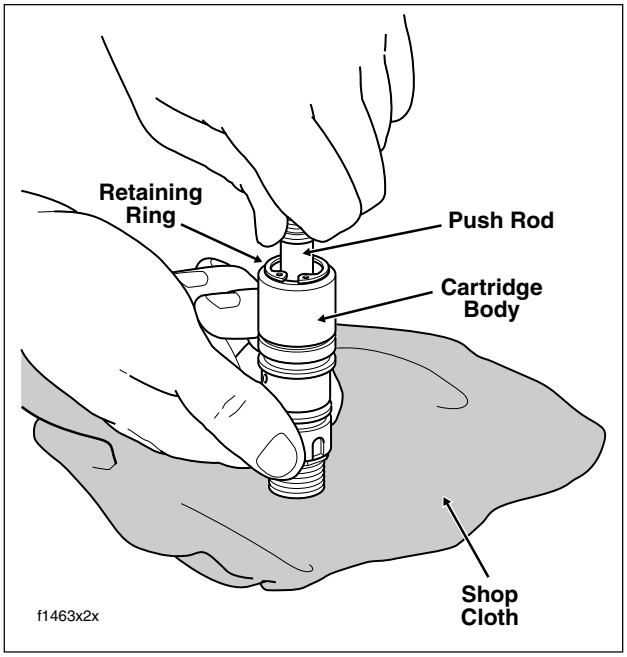



**Figure 2-53. Compress Spring and Install Retaining Ring**

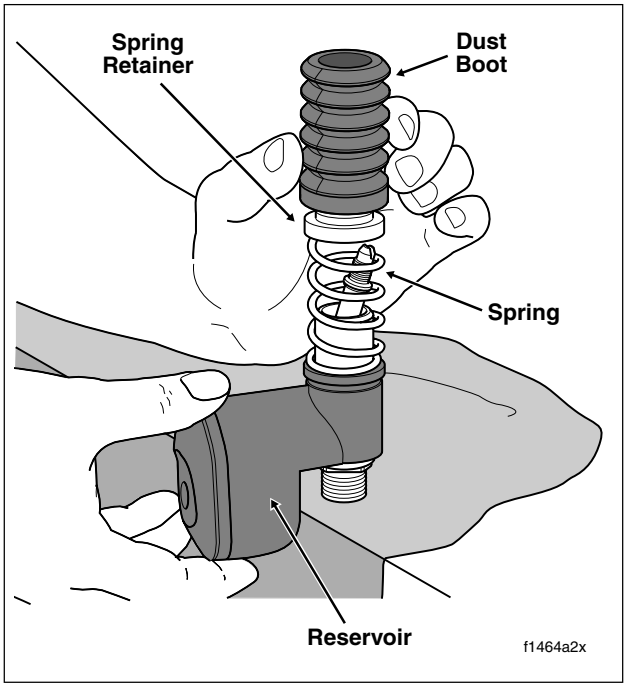



**Figure 2-54. Install Large Spring, Spring Retainer and Dust Boot**

2. Lay down a clean shop cloth to protect the banjo sealing surface from damage. Insert ball end of push rod into piston cup. Pushing down to compress spring, install small retaining ring in groove of cartridge body bore. See Figure 2-53. Verify that retaining ring is completely seated in groove and that push rod rotates freely.

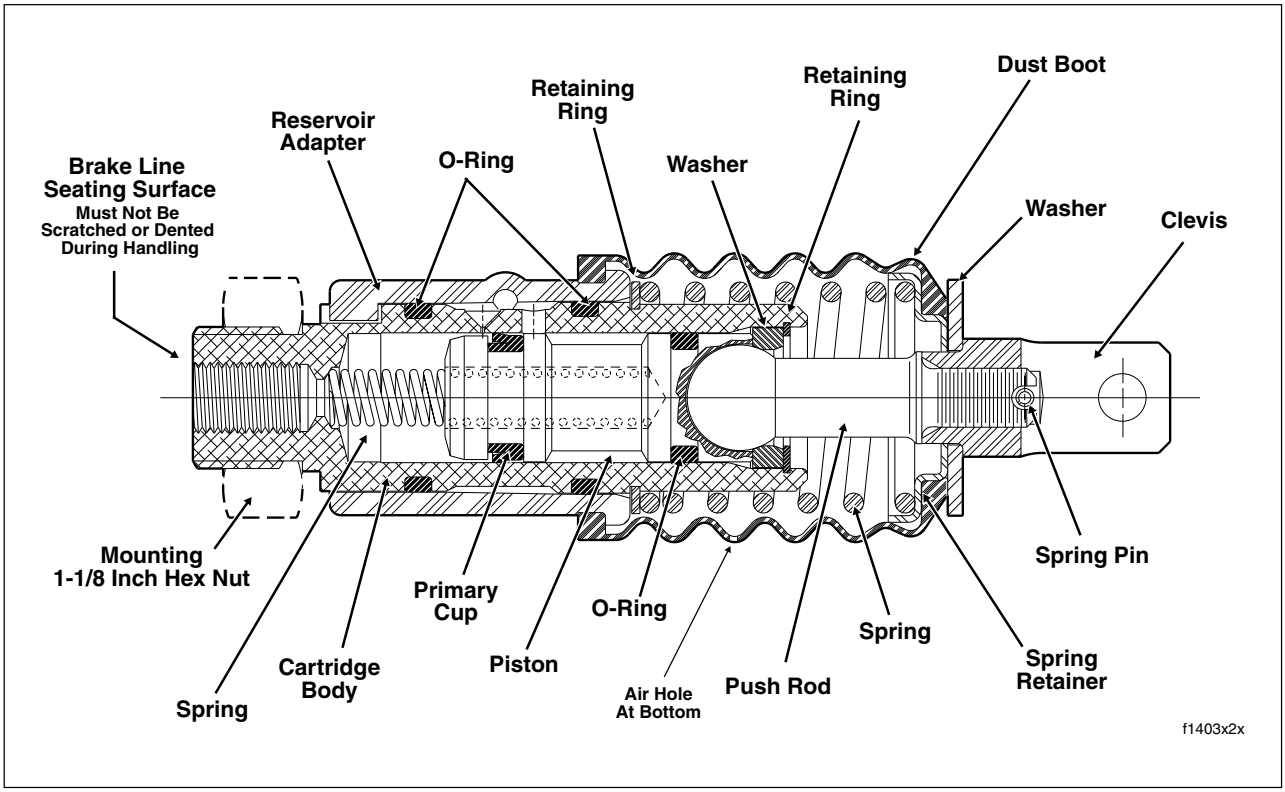



**Figure 2-55. Rear Brake Master Cylinder Assembly (Cross Sectional View)**

3. Lubricate **new** O-rings with D.O.T. 5 SILICONE HYDRAULIC BRAKE FLUID and carefully install in grooves on cartridge body.
4. Wipe bore of reservoir adapter with D.O.T. 5 SILICONE HYDRAULIC BRAKE FLUID.
5. Install large retaining ring in groove closest to push rod end of cartridge body.
6. Insert cartridge body into reservoir adapter indexing tab on adapter in slot on threaded end of cartridge. Use hand pressure only. Cartridge body is fully installed when adapter contacts large retaining ring.
7. Stand master cylinder assembly upright on banjo sealing surface. For best results, suspend reservoir over edge of table. Be sure to lay down a clean shop cloth to protect the sealing surface from damage.
8. Install spring over push rod end of cartridge until it contacts side of large retaining ring. See Figure 2-54.
9. Place concave side of spring retainer on spring end.
10. Slide dust boot over spring and spring retainer.
11. Place large washer on top of spring retainer.
12. Push down on large flat washer to compress spring. While holding the spring in a compressed state, screw on clevis until it bottoms on the push rod.
13. Pull down dust boot as necessary to seat over lip on reservoir adapter.
14. Rotate boot so that hole is at the bottom. Bottom is the side opposite the index tab on reservoir adapter.
15. Align groove on threaded end of push rod with spring pin hole in clevis. If necessary for alignment, back off clevis slightly but do not exceed 1/2 turn
16. Tap spring pin into hole of clevis engaging push rod groove.
17. See BRAKE PEDAL/MASTER CYLINDER ASSEMBLY, INSTALLATION, in this section.

# FRONT BRAKE CALIPER 2.11

## INSPECTION

Check brake pads and discs:

- At every scheduled service interval.
- Whenever the components are removed during normal service procedures.

### BRAKE DISC THICKNESS/WARPAGE

The minimum brake disc thickness is stamped on the side of the disc. Replace disc if excessively worn or badly scored. Maximum brake disc lateral runout or warpage is 0.008 inch (0.20 mm) when measured near the outside diameter. Replace disc if warped beyond specification. For replacement instructions, see Section 2.2 FRONT WHEEL, DISASSEMBLY.

### BRAKE PADS

*NOTE*

*Brake pad inspection can be performed without removing the caliper.*

1. Look up at the back of the right side caliper. See Figure 2-56.
2. Place a thin plastic 6 inch rule against the brake disc and measure the friction material of the brake outer pad. Using a small hand mirror, visually check the friction material of the inner pad.
3. Repeat above checks at the front of the right side caliper. Replace both pads If the friction material above the backing plate on either pad is 0.04 inch (1.02 mm) thick or less.
4. Repeat steps 1-3 on the left side of the vehicle.

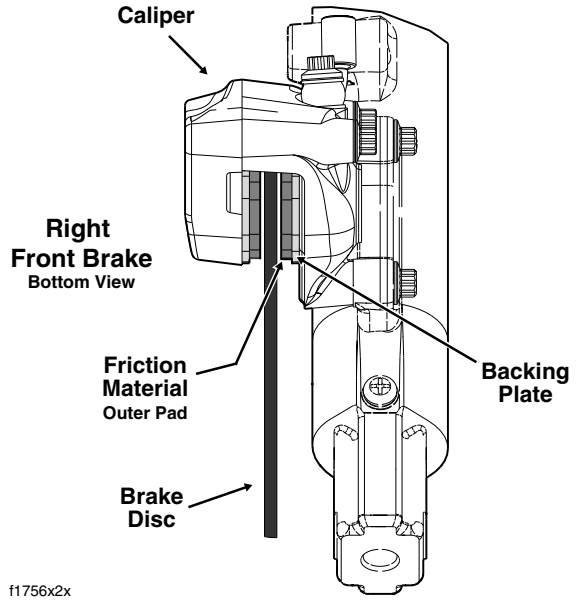
**⚠WARNING**

**Always replace brake pads in pairs. Never replace just one brake pad. Mismatched brake pads can lead to brake system damage and loss of braking performance, which could result in death or serious injury.**

5. See FRONT BRAKE PAD REPLACEMENT on this page.

### BRAKE LINE/HOSE INSPECTION

When checking brake pads and discs, take the time to inspect the brake lines and hoses for damage or wear. Replace as necessary.




**Replace both pads if friction material of either pad is 0.04 inch (1.02 mm) or less above the backing plate.**

**Figure 2-56. Measure Brake Pad Wear**

## FRONT BRAKE PAD REPLACEMENT

### PAD REMOVAL

1. Loosen two pad pins, but do not remove. See Figure 2-57.
2. Remove upper and lower caliper mounting bolts from front fork mounting lugs. Lift caliper upward to remove from brake disc.
3. Remove two Phillips screws to release cover from front master cylinder reservoir.

**CAUTION**

**As the pistons are pushed back into the caliper, fluid level may rise more than 1/8 inch (3.2 mm) and overflow the reservoir. Watch the fluid level as the pistons are retracted and remove fluid from the reservoir if necessary.**

4. Pry back inner and outer brake pads pushing the four pistons back into their bores.

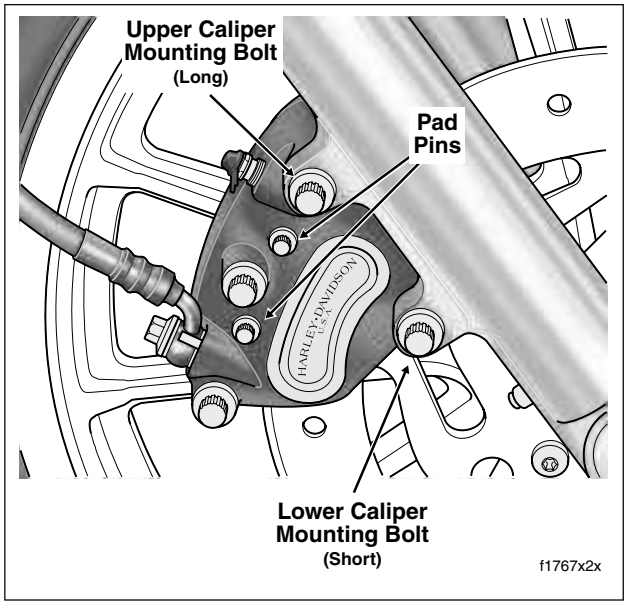



**Figure 2-57. Loosen Pad Pins and Remove Caliper Mounting Bolts (Right Side View)**

5. With the pistons retracted, remove two pad pins and both inner and outer brake pads.

## PAD INSTALLATION

*NOTE*

*Both front calipers (as well as the rear brake caliper) use the same brake pad set.*

1. Install **new** brake pads into caliper with the friction material facing the brake disc opening. Also, be sure that the pad is oriented so that the curved side faces the rear of the vehicle when the caliper is installed. See Figure 2-58.

   Furthermore, note that the backing plate of each brake pad has either one or two tabs. On the right side of the vehicle, the pad with two tabs is installed on the inboard side of the caliper, the pad with the single tab is installed on the outboard side.

   On the left side of the vehicle, the pad location is reversed. Therefore, the pad with the single tab is installed on the inboard side of the caliper, while the pad with two tabs is installed on the outboard side.
2. Install pad pins, but do not fully tighten at this time.
3. Install calipers as follows:
   a. Place caliper over brake disc with bleeder valve topside.
   b. Loosely install long caliper mounting bolt into upper lug of front fork leg.
   c. Install short caliper mounting bolt into lower lug of front fork leg. Tighten lower mounting bolt to 28-38 ft-lbs (37.9-51.5 Nm).
   d. Tighten upper caliper mounting bolt to 28-38 ft-lbs (37.9-51.5 Nm).
   e. Tighten pad pins to 180-200 **in-lbs** (20.3-22.6 Nm).

**⚠WARNING**

**After installation of new pads and BEFORE moving motorcycle, pump front brake hand lever until pistons push pads against the brake discs. If fluid pressure is not pumped up, the brakes will not be available the first time they are used, a situation that could result in death or serious injury.**

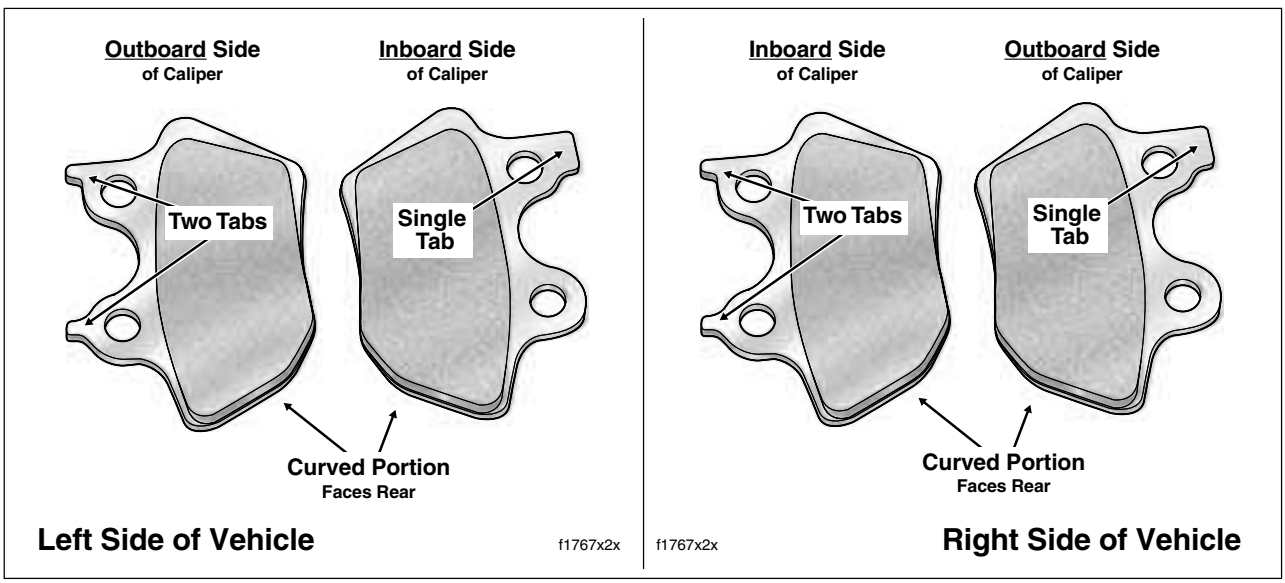



**Figure 2-58. Front Brake Pad Locations**

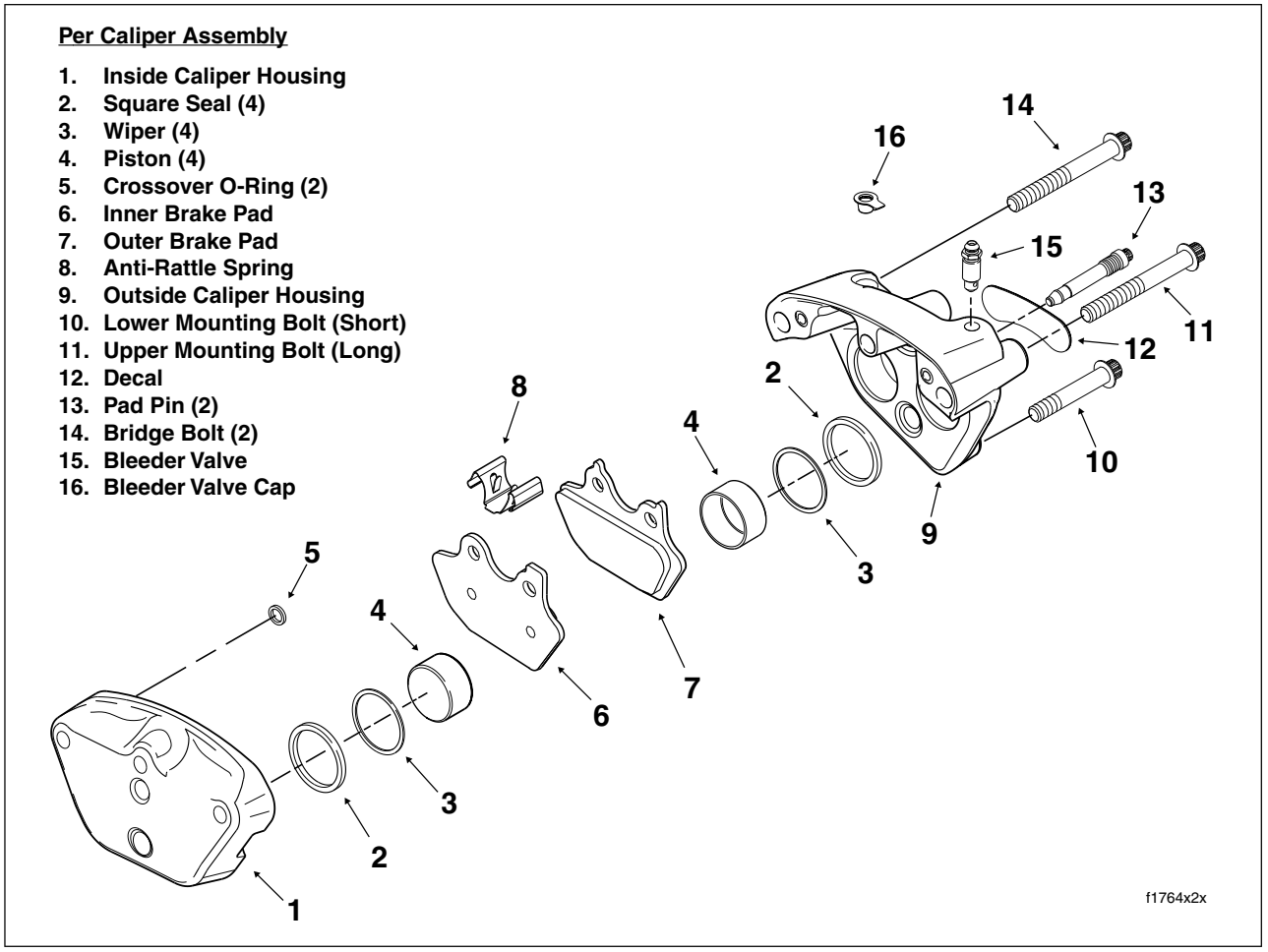



**Figure 2-59. Front Brake Caliper Assembly (Left Side)**

4. Pump brake hand lever until pistons contact brake pads and pads contact brake discs. Verify piston location against pads. If the front wheel is off the ground, rotate wheel to check for excessive brake pad drag.
5. Verify that brake fluid level is 1/8 inch (3.2 mm) below top of reservoir with master cylinder in a level position. Add D.O.T. 5 SILICONE BRAKE FLUID, if necessary.
6. Install master cylinder reservoir cover. Install two Phillips screws to fasten cover to reservoir and tighten to 6-8 **in-lbs** (0.7-0.9 Nm).
7. Test operation of brake lamp with the front brake applied and the Ignition/Light Key Switch turned to IGNITION.

**⚠WARNING**

**After completing repairs or bleeding the system, always test motorcycle brakes at low speed. If brakes are not operating properly or braking efficiency is poor, testing at high speeds may result in death or serious injury.**

8. Test ride the motorcycle. If the brakes feel spongy, bleed the system. See Section 2.13 BLEEDING HYDRAULIC BRAKES.

*NOTE*

*To allow new brake pads to "wear in" properly with the brake disc, avoid making hard stops for the first 100 miles (160 km).*

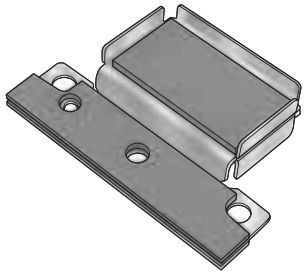
## CALIPER REMOVAL

*NOTE*

*If only replacing brake pads, see FRONT BRAKE PAD REPLACEMENT in this section.*

**CAUTION**

**Damaged banjo bolt surfaces will leak when reassembled. Prevent damage to seating surfaces by carefully removing brake line components.**



Brake Caliper Piston Remover
(Part No. HD-43293A)

**CAUTION**

**To prevent air from escaping through the banjo bolt hole, and to avoid scratching or nicking the banjo seating surface, use only a tapered, rubber tipped nozzle on air hose. Loss of air pressure will keep the pistons from moving, while any damage to the banjo seating surface requires caliper replacement.**

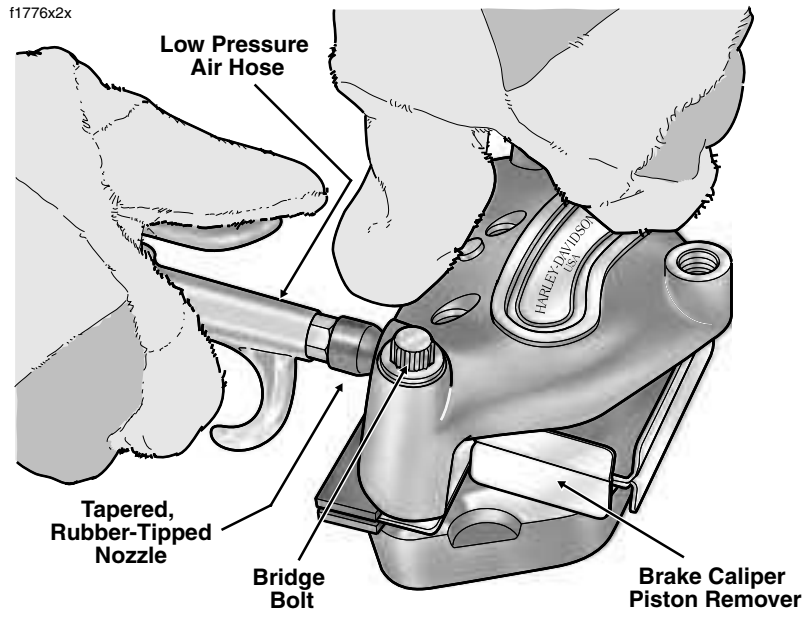



**Figure 2-60. Direct Compressed Air Into Banjo Bolt Hole to Force Pistons From Bores**

1. Remove banjo bolt and two steel/rubber washers to detach front brake line from caliper. Discard washers.
2. Remove upper and lower caliper mounting bolts from front fork mounting lugs. Lift caliper upward to remove from brake disc.

## CALIPER DISASSEMBY

1. See Figure 2-57. Remove two pad pins. Remove brake pads from caliper housings.
2. Remove two bridge bolts and separate inside and outside caliper housings.
3. Remove anti-rattle spring from channel around boss in outside caliper housing.
4. Remove bleeder valve, if damaged.

**⚠CAUTION**

**Pressurized air can blow debris into your face and eyes. Always wear eye protection or a face shield. Failure to do so may result in minor or moderate injury.**

5. Remove four pistons as follows:
   a. Obtain BRAKE CALIPER PISTON REMOVER (Part No. HD-43293A). See inset of Figure 2-60.
   b. Seat tool in outside caliper housing aligning outside holes in tool with bridge bolt holes in housing. Place inside caliper housing over tool aligning bridge bolt holes with outside holes in tool.
   c. Install bridge bolts and tighten securely.
   d. If the bleeder valve was removed, reinstall finger tight or place a gloved finger over the valve hole.
   e. Using a tapered, rubber-tipped nozzle on the air hose (to prevent both loss of air pressure and damage to the banjo seating surface), apply low pressure compressed air into the banjo bolt hole to force pistons into contact with cushion of tool. See Figure 2-60.
   f. Remove bridge bolts and separate caliper housings.
   g. Remove pistons from caliper piston bores. For best results, wiggle pistons slightly while pulling.
6. Remove two crossover O-rings from inside caliper housing. Discard O-rings.

**CAUTION**

**Do not use metal objects to remove parts from caliper piston bores or damage will occur. Damaged pistons or bores will leak when reassembled. Use a wooden toothpick to assist in the removal of parts, if necessary.**

7. Using a wooden toothpick, remove wiper and square seal from each piston bore. Discard wipers and seals. See Figure 2-61.

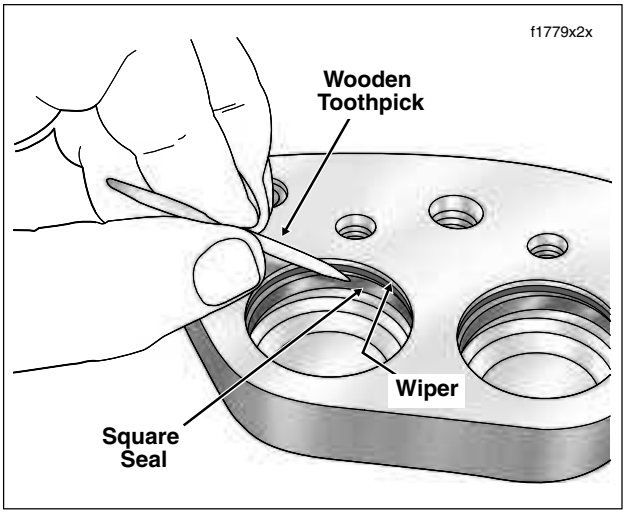



**Figure 2-61. Remove Wipers and Square Seals From Piston Bores**

## CLEANING AND INSPECTION

**⚠WARNING**

**Always use denatured alcohol to clean brake system components. Do not use mineral base solvents (such as gasoline and paint thinner) or deterioration of rubber parts may occur after assembly. Deterioration of components may result in premature brake failure, which could result in death or serious injury.**

1. Clean all parts with denatured alcohol or D.O.T. 5 SILICONE BRAKE FLUID. Wipe parts dry with a clean, lint free cloth. Blow out drilled passages and bores with a clean air supply. Do not use a wire or similar instrument to clean drilled passages.
2. Carefully inspect all components. Replace any parts that appear damaged or worn.
   a. Check pistons for pitting, scratching or corrosion on face and also on ground surfaces.
   b. Inspect caliper piston bore. Replace caliper if bore shows signs of pitting or corrosion. Do not hone bore for reuse.
   c. Always replace wipers, square seals and crossover O-rings after caliper disassembly.

**⚠WARNING**

**Always replace brake pads in pairs. Never replace just one brake pad. Mismatched brake pads can lead to brake system damage and loss of braking performance, which could result in death or serious injury.**

3. Inspect brake pads and discs. See INSPECTION in this section.

## CALIPER ASSEMBLY

1. Install **new** square seals into caliper piston bores.
2. Install **new** wipers into caliper piston bores.

**CAUTION**

**Do not use D.O.T. 5 brake fluid for lubrication or increased lever travel will result.**

3. Lubricate the following areas using a thin film of G.E. VERSILUBE® #G322L SILICONE GREASE (marked “Piston Lube” in the service parts kit):
   - Inside diameter of square seals and wipers.
   - Caliper piston bores.
   - Nose radius and outside diameter of piston.

*NOTE*

*All other surfaces must be kept clean and dry for assembly.*

4. Carefully insert pistons into bores by hand. If resistance is felt, remove piston and verify that both seal and wiper are properly installed.
5. Install **new** crossover O-rings into two grooves on inside caliper housing.
6. Assemble caliper housings as follows:
   a. Install bleeder valve on outside caliper housing, if removed. Tighten valve to 80-100 **in-lbs** (9.0-11.3 Nm). Install bleeder valve cap.
   b. Place outside caliper housing on workbench with decal side down. Place anti-rattle spring in channel around boss with dimple on edge topside. See Figure 2-62.
   c. Mate inside and outside caliper housings and loosely install two bridge bolts.
   d. Verify that anti-rattle spring is still seated.
   e. Tighten bridge bolts to 28-38 ft-lbs (37.9-51.5 Nm).

*NOTE*

*Both front calipers (as well as the rear brake caliper) use the same brake pad set.*

7. Install **new** brake pads into caliper with the friction material facing the brake disc opening. Also, be sure that the pad is oriented so that the curved side faces the rear of the vehicle when the caliper is installed. See Figure 2-58.

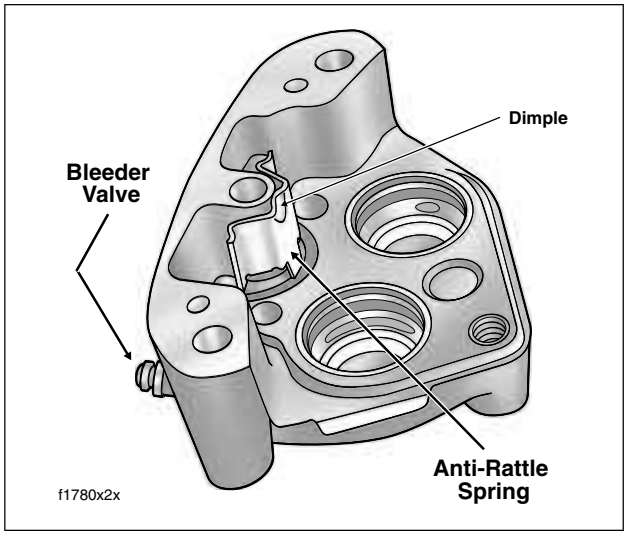



**Figure 2-62. Install Anti-Rattle Spring**

Furthermore, note that the backing plate of each brake pad has either one or two tabs. On the right side of the vehicle, the pad with two tabs is installed on the inboard side of the caliper, the pad with the single tab is installed on the outboard side.

On the left side of the vehicle, the pad location is reversed. Therefore, the pad with the single tab is installed on the inboard side of the caliper, while the pad with two tabs is installed on the outboard side.

8. Install pad pins and tighten to 180-200 **in-lbs** (20.3-22.6 Nm).

*NOTE*

*If pad pins do not fit, verify the following: (1) Proper pad set is being used, not two identical pads. (2) Anti-rattle spring is installed as shown in Figure 2-62. (3) Pads are pushed tight against anti-rattle spring.*

## CALIPER INSTALLATION

1. Install calipers as follows:
   a. Place caliper over brake disc with bleeder valve topside.
   b. Loosely install long caliper mounting bolt into upper lug of front fork leg.
   c. Install short caliper mounting bolt into lower lug of front fork leg. Tighten lower mounting bolt to 28-38 ft-lbs (37.9-51.5 Nm).
   d. Tighten upper caliper mounting bolt to 28-38 ft-lbs (37.9-51.5 Nm).
   e. Repeat step to install second caliper.

**CAUTION**

**To avoid leakage, verify that the washers, banjo bolt, brake line and caliper bore are completely clean.**

2. Connect brake line to caliper using two **new** steel/rubber washers and banjo bolt. Tighten bolt to 17-22 ft-lbs (23.0-29.8).
3. Remove two Phillips screws to release cover from front brake master cylinder reservoir. Verify that brake fluid level is 1/8 inch (3.2 mm) below top of reservoir with master cylinder in a level position. Add D.O.T. 5 SILICONE BRAKE FLUID, if necessary.

**⚠WARNING**

**A plugged or covered relief port can cause brake drag or wheel lockup and may lead to loss of vehicle control, which could result in death or serious injury.**

4. Verify proper operation of the master cylinder relief port. Actuate the brake lever. A slight spurt of fluid will break the surface if all internal components are working properly.

**⚠WARNING**

**After installation of calipers and BEFORE moving motorcycle, pump front brake hand lever until pistons push pads against the brake discs. If fluid pressure is not pumped up, the brake will not be available the first time it is used, a situation that could result in death or serious injury.**

5. Depress front brake hand lever several times to set brake pads to proper operating position within caliper. Bleed brake system. See Section 2.13 BLEEDING HYDRAULIC BRAKES.
6. Install master cylinder reservoir cover. Install two Phillips screws to fasten cover to reservoir and tighten to 6-8 **in-lbs** (0.7-0.9 Nm).
7. Test operation of brake lamp with the front brake applied and the Ignition/Light Key Switch turned to IGNITION.

**⚠WARNING**

**After completing repairs or bleeding the system, always test motorcycle brakes at low speed. If brakes are not operating properly or braking efficiency is poor, testing at high speeds may result in death or serious injury.**

8. Test ride the motorcycle. If the brakes feel spongy, bleed the system again. See Section 2.13 BLEEDING HYDRAULIC BRAKES.

*NOTE*

*To allow new brake pads to "wear in" properly with the brake disc, avoid making hard stops for the first 100 miles (160 km).*

# REAR BRAKE CALIPER 2.12

## INSPECTION

Check brake pads and discs:

- At every scheduled service interval.
- Whenever the components are removed during service procedures.

### BRAKE DISC THICKNESS/WARPAGE

The minimum brake disc thickness is stamped on the side of the disc. Replace disc if excessively worn or badly scored. Maximum brake disc lateral runout or warpage is 0.008 inch (0.2 mm) when measured near the outside diameter. Replace disc if warped beyond specification. For replacement instructions, see Section 2.3 REAR WHEEL, DISASSEMBLY.

### BRAKE PADS

*NOTE*

*Brake pad inspection can be performed without removing the caliper.*

1. Look down at the back of the rear caliper. See Figure 2-63.
2. Place a thin plastic 6 inch rule against the brake disc and measure the friction material of the brake outer pad. Using a small hand mirror, visually check the friction material of the inner pad.
3. Repeat above checks at the front of the rear caliper.

   Replace both pads If the friction material above the backing plate on either pad is 0.04 inch (1.02 mm) thick or less.

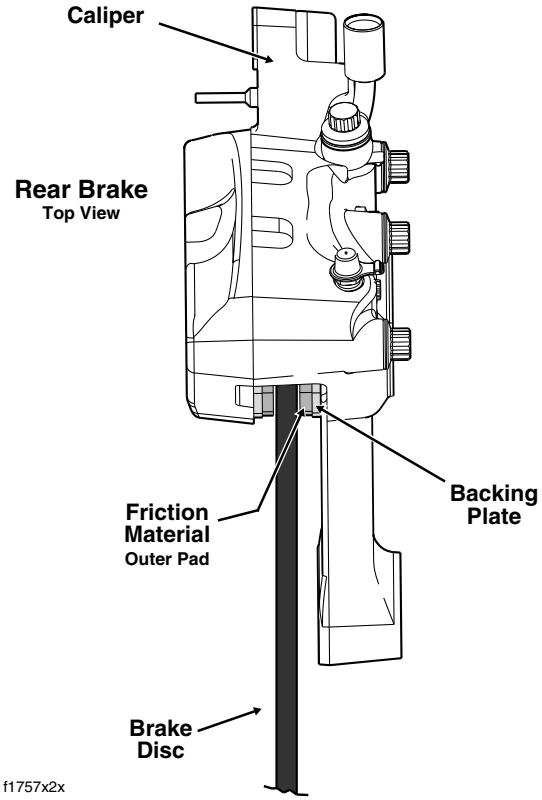
**⚠WARNING**

**Always replace brake pads in pairs. Never replace just one brake pad. Mismatched brake pads can lead to brake system damage and loss of braking performance, which could result in death or serious injury.**

4. See REAR BRAKE PAD REPLACEMENT on this page.

### BRAKE LINE/HOSE INSPECTION

When checking brake pads and discs, take the time to inspect the brake lines and hoses for damage or wear. Replace as necessary.




**Replace both pads if friction material of either pad is 0.04 inch (1.02 mm) or less above the backing plate.**

**Figure 2-63. Measure Brake Pad Wear**

## REAR BRAKE PAD REPLACEMENT

### PAD REMOVAL

1. Remove right side saddlebag. See Section 2.22 SADDLEBAG, REMOVAL.
2. Loosen both pad pins, but do not remove. See Figure 2-64.
3. Remove two Phillips screws to release cover from rear master cylinder reservoir.

**CAUTION**

**As the pistons are pushed back into the caliper, fluid level may rise more than 1/8 inch (3.2 mm) and overflow the reservoir. Watch the fluid level as the pistons are retracted and remove fluid from the reservoir if necessary.**

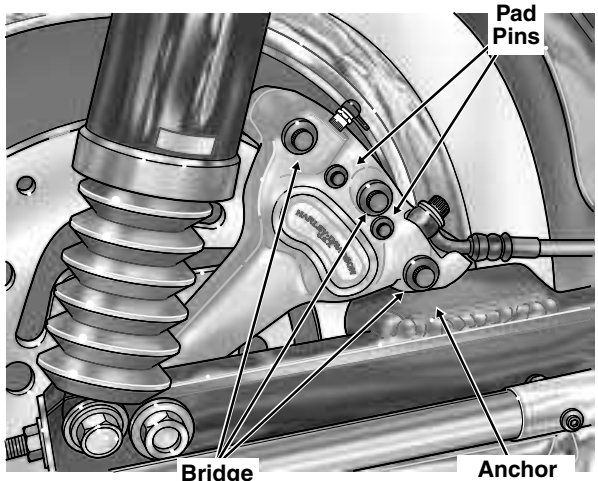



**Figure 2-64. Loosen Both Pad Pins**

4. Pry the inside pad back pushing the pistons into their bores. Use a putty knife with a wide thin blade to avoid scoring or scratching the brake disc.

**CAUTION**

**Do not completely pull pad pins from caliper during the next step. Completely removing pad pins at this time will make assembly difficult.**

5. Once the pistons have been retracted, pull the pad pins part way out until the inside pad drops free. Note the orientation of the pad.

## PAD INSTALLATION

1. Install **new** inside brake pad using the same orientation. Curved portion of pad must face rear of motorcycle.
2. Install pad pins, but do not fully tighten.
3. Pump rear brake pedal to move inside pistons out until they contact inside brake pad.
4. Pry the outside pad back pushing the pistons into their bores. Use a putty knife with a wide thin blade to avoid scoring or scratching the brake disc.
5. Verify that inside pad is captured between brake disc and pistons. Completely remove pad pins to free outside brake pad. Note the orientation of the pad.
6. Install **new** outside brake pad using the same orientation. Curved portion of pad must face rear of motorcycle. If the inside pad moved during the previous step, reinstall.
7. Install two pad pins and tighten to 180-200 **in-lbs** (20.3-22.6 Nm).

**⚠WARNING**

**After installation of new pads and BEFORE moving motorcycle, pump rear brake pedal until pistons push pads against the brake disc. If fluid pressure is not pumped up, the rear brake will not be available the first time it is used, a situation that could result in death or serious injury.**

8. Pump rear brake pedal to move pistons out until they contact both brake pads. Verify piston location against pads.
9. Verify that brake fluid level is 1/8 inch (3.2 mm) below top of reservoir with master cylinder in a level position. Add D.O.T. 5 SILICONE BRAKE FLUID, if necessary. Install master cylinder reservoir cover. Install two Phillips screws to fasten cover to reservoir and tighten to 6-8 **in-lbs** (0.7-0.9 Nm).
10. Install right side saddlebag. See Section 2.22 SADDLEBAG, INSTALLATION.
11. Test operation of brake lamp with the rear brake applied and the Ignition/Light Key Switch turned to IGNITION.

**⚠WARNING**

**After completing repairs or bleeding the system, always test motorcycle brakes at low speed. If brakes are not operating properly or braking efficiency is poor, testing at high speeds may result in death or serious injury.**

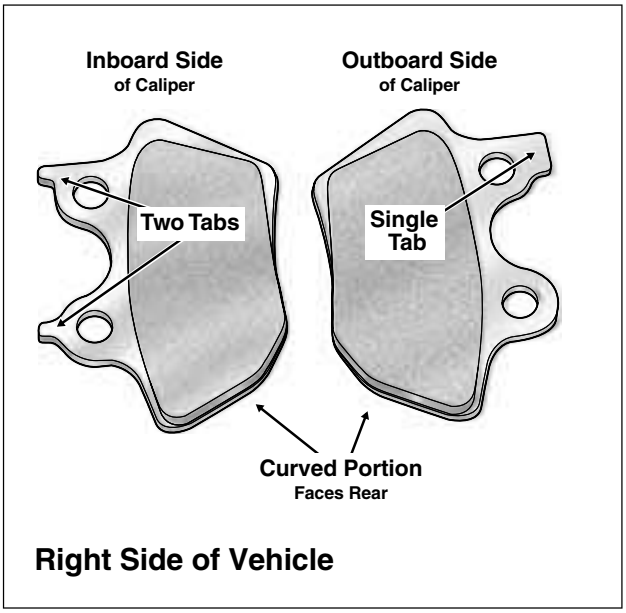



**Figure 2-65. Rear Brake Pad Locations**

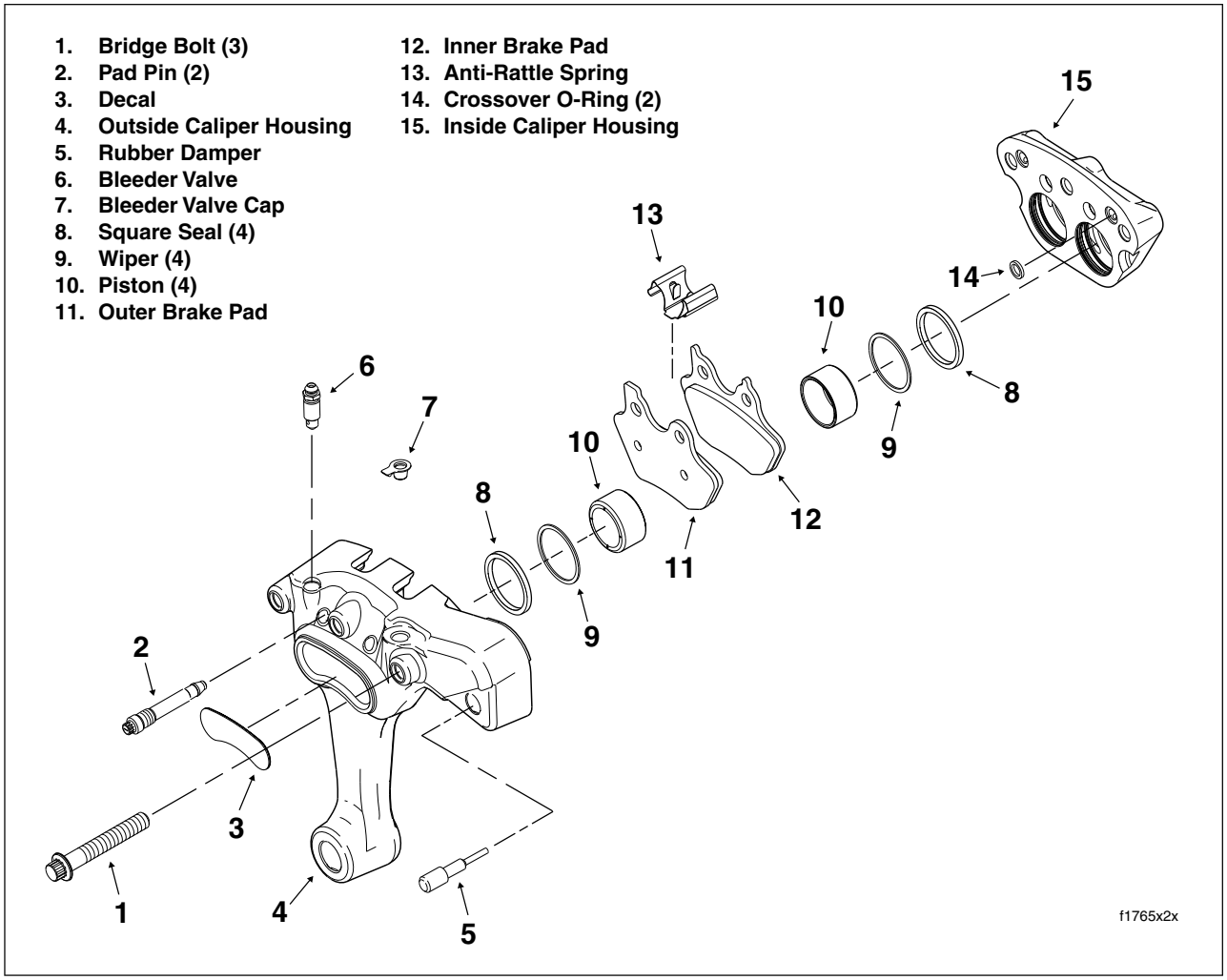



**Figure 2-66. Rear Brake Caliper Assembly (Right Side)**

12. Test ride the motorcycle. If the brakes feel spongy, bleed the system again. See Section 2.13 BLEEDING HYDRAULIC BRAKES.

*NOTE*

*To allow new brake pads to "wear in" properly with the brake disc, avoid making hard stops for the first 100 miles (160 km).*

## CALIPER REMOVAL

*NOTE*

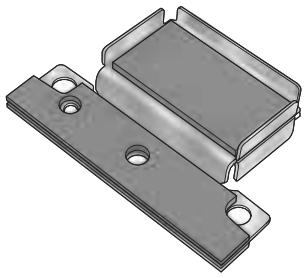
*If only replacing brake pads, see REAR BRAKE PAD REPLACEMENT in this section.*

1. Block motorcycle underneath frame so rear wheel is raised off the ground.
2. Remove saddlebags. See Section 2.22 SADDLEBAG, REMOVAL.

**CAUTION**

**Damaged banjo bolt surfaces will leak when reassembled. Prevent damage to seating surfaces by carefully removing brake line components.**

3. Remove banjo bolt and two steel/rubber washers to detach rear brake line from caliper. Discard washers.
4. Remove right side muffler as follows:
   a. Open worm drive clamps to remove heat shield from rear header pipe.
   b. Using a bungee cord, tie the muffler to the lower saddlebag support rail.
   c. Loosen TORCA clamp between rear header pipe and muffer.



Brake Caliper Piston Remover
(Part No. HD-43293A)

**CAUTION**

**To prevent air from escaping through the banjo bolt hole, and to avoid scratching or nicking the banjo seating surface, use only a tapered, rubber tipped nozzle on air hose. Loss of air pressure will keep the pistons from moving, while any damage to the banjo seating surface requires caliper replacement.**

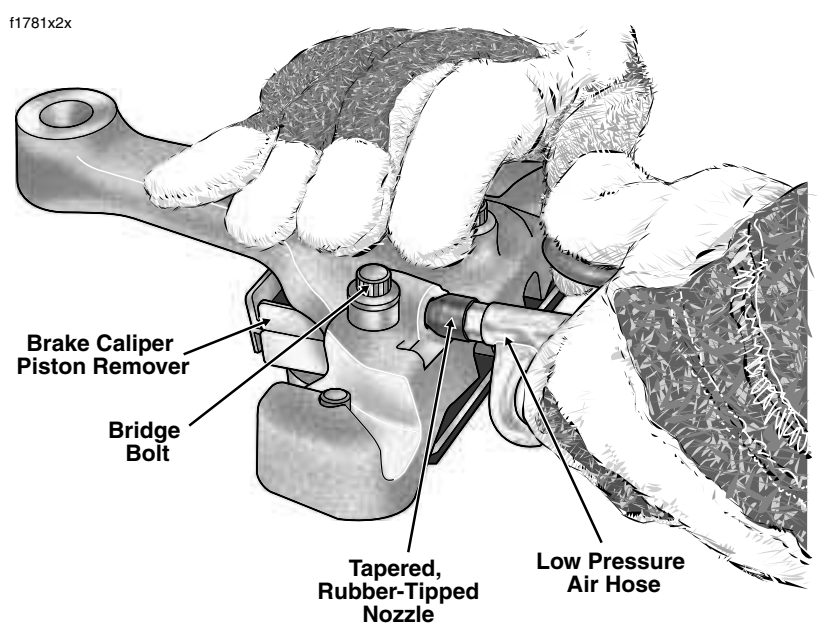



**Figure 2-67. Direct Compressed Air Into Banjo Bolt Hole to Force Pistons From Bores**

d. Remove two bolts (with lockwashers) to detach muffler from the lower saddlebag support rail.

e. Remove bungee cord to release muffler from lower saddlebag support rail.

5. Remove linch pin clip, castle axle nut, and spacer washer from left side of axle.

6. Using a soft mallet, gently tap end of axle towards right side to loosen. Catching external spacers on left and right side of hub, pull axle free of rear swing arm.

7. Pull wheel to release brake disc from caliper. If necessary, pry brake pads back. Use a putty knife with a wide thin blade to avoid scoring or scratching the brake disc.

8. Remove caliper from anchor weldment on rear swing arm.

## CALIPER DISASSEMBLY

1. See Figure 2-64. Remove two pad pins. Remove brake pads from caliper housings.

2. Remove three bridge bolts and separate inside and outside caliper housings.

3. Remove anti-rattle spring from channel around boss in outside caliper housing.

4. If damaged, cut anchor of rubber damper and remove.

5. Remove bleeder valve, if damaged.

**⚠CAUTION**

**Pressurized air can blow debris into your face and eyes. Always wear eye protection or a face shield. Failure to do so may result in minor or moderate injury.**

6. Remove four pistons as follows:

a. Obtain BRAKE CALIPER PISTON REMOVER (Part No. HD-43293A). See inset of Figure 2-67.

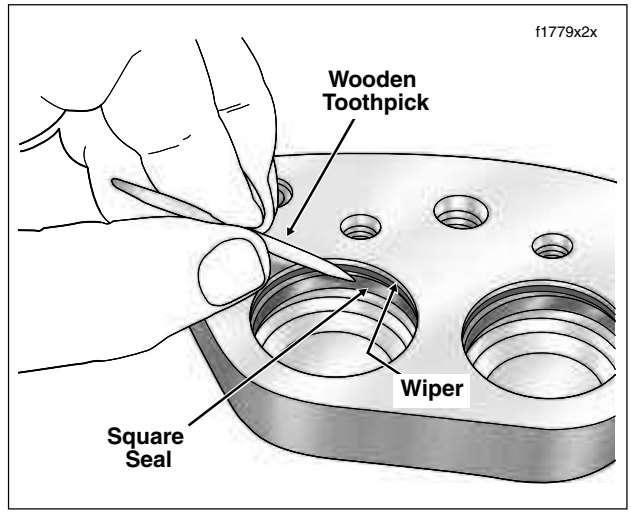



**Figure 2-68. Remove Wipers and Square Seals From Piston Bores**

b. Seat tool in outside caliper housing aligning holes in tool with three bridge bolt holes in housing. Place inside caliper housing over tool aligning bridge bolt holes with three holes in tool.

c. Install bridge bolts and tighten securely.

d. If the bleeder valve was removed, reinstall finger tight or place a gloved finger over the valve hole.

e. Using a tapered, rubber-tipped nozzle on the air hose (to prevent both loss of air pressure and damage to the banjo seating surface), apply low pressure compressed air into the banjo bolt hole to force pistons into contact with cushion of tool. See Figure 2-67.

f. Remove bridge bolts and separate caliper housings.

g. Remove pistons from caliper piston bores. For best results, wiggle pistons slightly while pulling.

7. Remove two crossover O-rings from inside caliper housing. Discard O-rings.

**CAUTION**

**Do not use metal objects to remove parts from caliper piston bores or damage will occur. Damaged pistons or bores will leak when reassembled. Use a wooden toothpick to assist in the removal of parts, if necessary.**

8. Using a wooden toothpick, remove wiper and square seal from each piston bore. Discard wipers and seals. See Figure 2-68.

## CLEANING AND INSPECTION

**⚠WARNING**

**Always use denatured alcohol to clean brake system components. Do not use mineral base solvents (such as gasoline and paint thinner) or deterioration of rubber parts may occur after assembly. Deterioration of components may result in premature brake failure, which could result in death or serious injury.**

1. Clean all parts with denatured alcohol or D.O.T. 5 SILICONE BRAKE FLUID. Wipe parts dry with a clean, lint free cloth. Blow out drilled passages and bores with a clean air supply. Do not use a wire or similar instrument to clean drilled passages.

2. Carefully inspect all components. Replace any parts that appear damaged or worn.

   a. Check pistons for pitting, scratching or corrosion on face and also on ground surfaces.

   b. Inspect caliper piston bore. Replace caliper if bore shows signs of pitting or corrosion. Do not hone bore for reuse.

   c. Check rubber damper for cuts, tears or signs of deterioration.

   d. Always replace wipers, square seals and crossover O-rings after caliper disassembly.

**⚠WARNING**

**Always replace brake pads in pairs. Never replace just one brake pad. Mismatched brake pads can lead to brake system damage and loss of braking performance, which could result in death or serious injury.**

3. Inspect brake pads and discs. See INSPECTION in this section.

## CALIPER ASSEMBLY

1. Install **new** square seals into caliper piston bores.

2. Install **new** wipers into caliper piston bores.

**CAUTION**

**Do not use D.O.T. 5 brake fluid for lubrication or increased lever travel will result.**

3. Lubricate the following areas using a thin film of G.E. VERSILUBE® #G322L SILICONE GREASE (marked “Piston Lube” in the service parts kit):

   - Inside diameter of square seals and wipers.
   - Caliper piston bores.
   - Nose radius and outside diameter of piston.

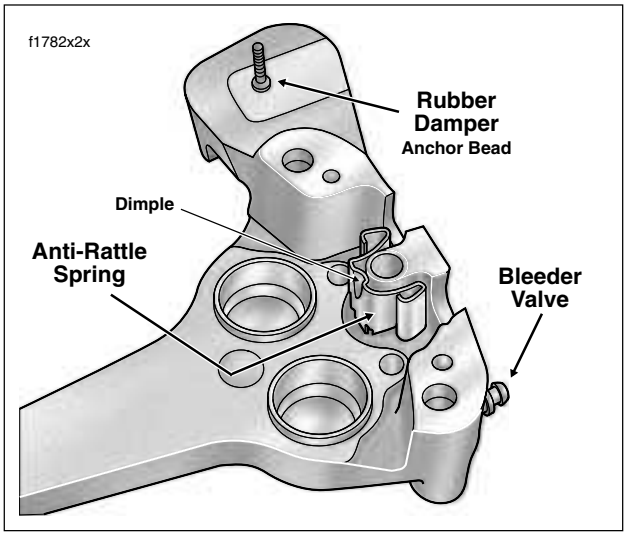



**Figure 2-69. Install Anti-Rattle Spring**

*NOTE*

*All other surfaces must be kept clean and dry for assembly.*

4. Carefully insert pistons into bores by hand. If resistance is felt, remove piston and verify that both seal and wiper are properly installed.
5. Install **new** crossover O-rings into two grooves on inside caliper housing.
6. Assemble caliper housings as follows:
   a. Install bleeder valve on outside caliper housing, if removed. Tighten valve to 80-100 **in-lbs** (9.0-11.3 Nm). Install bleeder valve cap.
   b. Place outside caliper housing on workbench with decal side down. Place anti-rattle spring in channel around boss with dimple on edge topside. See Figure 2-69.
   c. Mate inside and outside caliper housings and loosely install two bridge bolts.
   d. Verify that anti-rattle spring is still seated.
   e. Tighten bridge bolts to 28-38 ft-lbs (37.9-51.5 Nm).
   f. If rubber damper was removed, lubricate anchor of **new** damper with denatured alcohol or glass cleaner and install by pulling rubber bead through hole in outside caliper housing, as shown in Figure 2-69.

*NOTE*

*All calipers (both front and rear) use the same brake pad set.*

7. Install **new** brake pads into caliper with the friction material facing the brake disc opening. Also, be sure that the pad is oriented so that the curved side faces the rear of the vehicle when the caliper is installed. See Figure 2-65.

   Furthermore, note that the backing plate of each brake pad has either one or two tabs. The pad with two tabs is installed on the inboard side of the caliper, the pad with the single tab is installed on the outboard side.
8. Install pad pins and tighten to 180-200 **in-lbs** (20.3-22.6 Nm).

*NOTE*

*If pad pins do not fit, verify the following: (1) Proper pad set is being used, not two identical pads. (2) Anti-rattle spring is installed as shown in Figure 2-69. (3) Pads are pushed tight against anti-rattle spring.*

## CALIPER INSTALLATION

1. Place wheel in rear swingarm. Slide wheel far enough forward to slip belt over sprocket and then slide the wheel back.

**CAUTION**

**Do not bend or fold belt backward or into loops smaller than 5 inches in diameter. Sharp bending can weaken the belt and cause premature failure.**

2. Seat caliper on anchor weldment of rear swing arm.
3. Coat the axle and ID of both wheel bearings with ANTI-SIEZE LUBRICANT.
4. Position wheel in swing arm, so that that brake disc is centered between brake pads.
5. Slide axle through right side of rear swing arm, caliper bracket and **short** external spacer into wheel hub.
6. When axle emerges from hub on sprocket side of wheel, push axle through **long** external spacer and left side of rear swing arm.
7. Install spacer washer and castle axle nut on threaded end of axle. Tighten castle axle nut to 60 ft-lbs (81 Nm).
8. Check for proper belt tension. See Section 6.4 SECONDARY DRIVE BELT AND SPROCKETS, ADJUSTMENT AND ALIGNMENT.
9. Install the linch pin clip in the axle hole. If necessary, tighten the axle nut further to align the axle hole and nut slot, but do not exceed 65 ft-lbs (88 Nm).
10. Install right side muffler as follows:

*NOTE*

*TORCA muffler clamps have eliminated the need for silicone or graphite tape during assembly. To ensure sealing integrity of muffler clamps and prevent the possibility of leakage, Harley-Davidson recommends that TORCA clamp assemblies be discarded and replaced each time they are removed.*

   a. Slide **new** TORCA clamp onto free end of rear header pipe.
   b. Using a bungee cord, tie muffler to lower saddlebag support rail. Install muffler on rear header pipe. Place TORCA clamp into position between rear header pipe and muffler.
   c. Tighten the two bolts (with lockwashers) to fasten the muffler to the lower saddlebag support rail.

**CAUTION**

**Verify that the exhaust pipes do not contact the vehicle frame or any mounted components. Contact will cancel the effect of the rubber isolation mounts and transmit vibration to the rider via the vehicle frame.**

d. Verify that exhaust pipes are in alignment and do not contact the vehicle frame or mounted components.

e. Tighten the TORCA clamp to 45-60 ft-lbs (61-81 Nm).

f. Open worm drive clamps and install heat shield on rear header pipe. Position clamp so that screw is on the outboard side in the most accessible position.

**CAUTION**

**Verify that the heat shields do not contact the vehicle frame or any mounted components. Contact will cancel the effect of the rubber isolation mounts and transmit vibration to the rider via the vehicle frame.**

g. Remove bungee cord from muffler.

**CAUTION**

**To avoid leakage, verify that the washers, banjo bolt, brake line and caliper bore are completely clean.**

11. Connect brake line to caliper using two **new** steel/rubber washers and banjo bolt. Tighten bolt to 17-22 ft-lbs (23.0-29.8).
12. Remove two Phillips screws to release cover from rear brake master cylinder reservoir. Verify that brake fluid level is 1/8 inch (3.2 mm) below top of reservoir with master cylinder in a level position. Add D.O.T. 5 SILICONE BRAKE FLUID, if necessary.

**⚠WARNING**

**A plugged or covered relief port can cause brake drag or lockup, which may result in loss of vehicle control and could result in death or serious injury.**

13. Verify proper operation of the master cylinder relief port. Actuate the brake pedal with the cover removed. A slight spurt of fluid will break the surface if all internal components are working properly.

**⚠WARNING**

**After installation of caliper and BEFORE moving motorcycle, pump rear brake pedal until pistons push pads against the brake disc. If fluid pressure is not pumped up, the rear brake will not be available the first time it is used, a situation that could result in death or serious injury.**

14. Depress rear brake pedal several times to set brake pads to proper operating position within caliper. Bleed brake system. See Section 2.13 BLEEDING HYDRAULIC BRAKES.
15. Install master cylinder reservoir cover. Install two Phillips screws to fasten cover to reservoir and tighten to 6-8 **in-lbs** (0.7-0.9 Nm).
16. Install saddlebags. See Section 2.22 SADDLEBAG, INSTALLATION.
17. Test operation of brake lamp with the rear brake applied and the Ignition/Light Key Switch turned to IGNITION.

**⚠WARNING**

**After completing repairs or bleeding the system, always test motorcycle brakes at low speed. If brakes are not operating properly or braking efficiency is poor, testing at high speeds may result in death or serious injury.**

18. Test ride the motorcycle. If the brakes feel spongy, bleed the system again. See Section 2.13 BLEEDING HYDRAULIC BRAKES.

*NOTE*

*To allow new brake pads to "wear in" properly with the brake disc, avoid making hard stops for the first 100 miles (160 km).*

# BLEEDING HYDRAULIC BRAKES 2.13

## GENERAL

Bleed the hydraulic brake system any time a brake line, master cylinder or brake caliper has been opened or disassembled, or whenever the brake lever/pedal operation feels “spongy.” Bleeding evacuates air from the system leaving only incompressible hydraulic fluid.

*NOTE*

*Harley-Davidson recommends that all brake service be performed by a Harley-Davidson dealer or other qualified technician.*

*NOTE*

*Hydraulic brake fluid bladder-type pressure equipment can be used to fill brake master cylinders through the bleeder valve. Remove master cylinder reservoir cover so that system cannot pressurize. Do not use pressure bleeding equipment when the hydraulic system is sealed with master cylinder reservoir cover and gasket in place.*

1. Install end of a length of plastic tubing over caliper bleeder valve. Place free end of tube in a clean container. See Figure 2-70. Stand motorcycle upright.

**CAUTION**

**To prevent dirt and other contaminants from entering the master cylinder reservoir, thoroughly clean the cover before removal.**

2. Remove the two Phillips screws to release cover from the master cylinder reservoir.
3. Add D.O.T. 5 SILICONE HYDRAULIC BRAKE FLUID to the master cylinder reservoir until the fluid level is 1/8 inch (3.2 mm) from the top. Do not reuse brake fluid.

*NOTE*

*D.O.T. 5 SILICONE HYDRAULIC BRAKE FLUID is non-toxic.*

4. Depress and hold brake lever/pedal to build up hydraulic pressure.
5. Open bleeder valve about 1/2 turn. Brake fluid will flow from bleeder valve through tubing. Close bleeder valve when brake lever/pedal has moved 1/2 to 3/4 of its full range of travel. Allow brake lever/pedal to return slowly to its released position.
6. Repeat Steps 3-5 until all air bubbles are purged.
7. Final tighten the bleeder valve to 80-100 **in-lbs** (9.0-11.3 Nm). Install the bleeder cap.
8. Add brake fluid to the master cylinder reservoir until the fluid level is about 1/8 inch (3.2 mm) from the top. Do not reuse brake fluid.
9. Install the master cylinder reservoir cover. Install two Phillips screws to fasten the cover to the reservoir. Tighten the screws to 6-8 **in-lbs** (0.7-0.9 Nm).

*NOTE*

*Note that the angular shape of the front brake master cylinder reservoir cover makes one side thicker than the other. Install the cover on the master cylinder reservoir so that the thicker side is positioned above the brake line fitting.*

**⚠WARNING**

**After completing repairs or bleeding the system, always test motorcycle brakes at low speed. If brakes are not operating properly or braking efficiency is poor, testing at high speeds could result in death or serious injury.**

10. Test ride motorcycle. Repeat the bleeding procedure if brakes feel spongy.

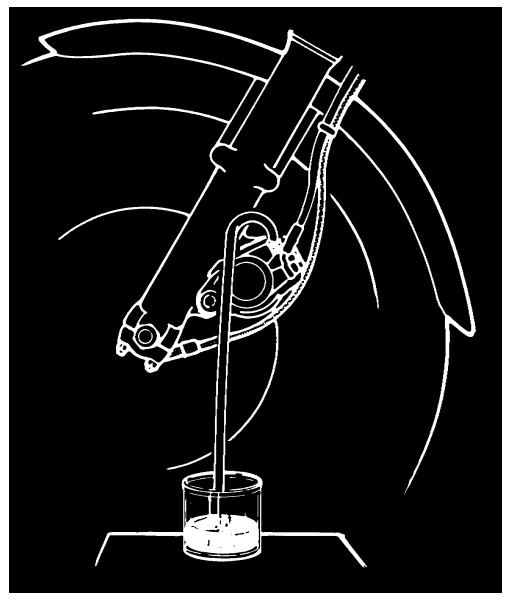


**Figure 2-70. Bleeding Hydraulic System**

## CHANGING FORK OIL

Change the front fork oil at every 20,000 mile (32,000 km) service interval. Two methods of changing the fork oil are presented below.

### Table 2-1. Fork Oil Requirements

| TYPE | AMOUNT |
|---|---|
| Harley-Davidson Type E, Part No. 99884-80 (16 oz.) | 9.7 oz. (287 ml) Each Fork |

### METHOD 1

1. On FLHTC/U models, remove outer fairing and radio. See Section 8.29 PREMIUM SOUND SYSTEM, RADIO, REMOVAL. On FLHT models, remove storage box following steps 3 and 6.

   On FLHR/C models, remove headlamp nacelle. See Section 2.28 WINDSHIELD/HEADLAMP NACELLE (FLHR/C), NACELLE REMOVAL.

   On FLTR models, remove instrument nacelle. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLTR), INSTRUMENT NACELLE, REMOVAL.

2. Place suitable blocking under frame to raise front wheel several inches off the floor. Use an hydraulic center stand on a level surface.

*NOTE*

*All air pressure must be bled from front forks before fluid can be drained.*

3. Locate the front air valve just below the frame cover at the rear right side of the vehicle. Remove core from air valve to bleed air from the front air suspension system. For best results, use Snap-ON tool #GA143A.
4. Depress collar and remove air tube from each banjo fitting. See Figure 2-71.
5. Rotate hex bolts to remove banjo fittings from fork cap bolts. Remove O-rings from hex bolts.
6. Remove the drain plug from the bottom of each fork leg. See Figure 2-72.
7. When the fork oil is fully drained, install the plugs back into the fork legs. Tighten each plug to 72-96 **in-lbs** (8-11 Nm).
8. Using a clear plastic tube and funnel, pour the specified amount of Harley-Davidson Type E Fork Oil into each fork tube.
9. Apply light film of clean engine oil on **new** O-rings. Install O-rings in grooves of hex bolts.

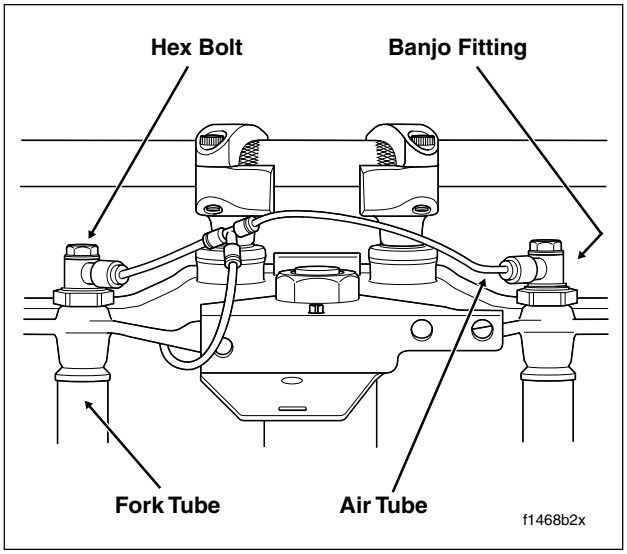



**Figure 2-71. Banjo Bolt Cap Locations**

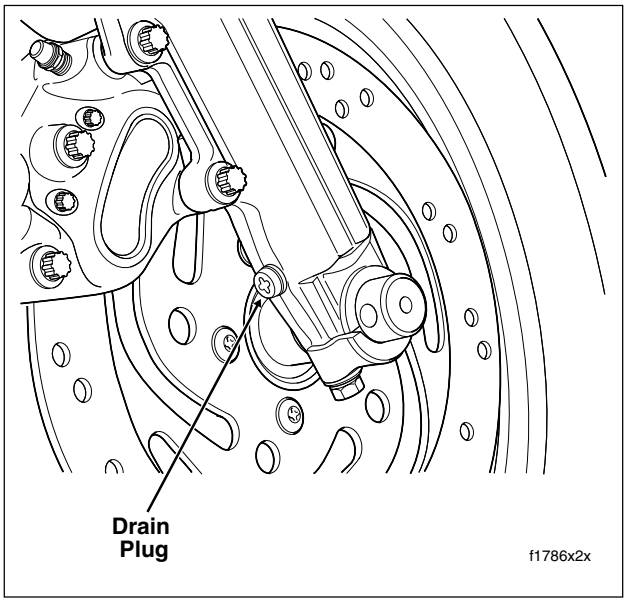



**Figure 2-72. Fork Oil Drain Plug (Right Side)**

10. With air connection facing inboard, rotate hex bolts to install banjo fittings to fork cap bolts. Tighten hex bolts to 8-12 ft-lbs (11-16 Nm).
11. Insert air tubes into banjo air inlet fittings.
12. Pressurize front air suspension system and check for leaks. For recommended air suspension pressures, see Table 2-2. Install protective cap on air valve.

13. On FLHTC/U models, install radio and outer fairing. See Section 8.29 PREMIUM SOUND SYSTEM, RADIO, INSTALLATION. On FLHT models, install storage box following steps 3 and 6.

    On FLHR/C models, install headlamp nacelle. See Section 2.28 WINDSHIELD/HEADLAMP NACELLE (FLHR/C), NACELLE INSTALLATION.

    On FLTR models, install instrument nacelle. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLTR), INSTRUMENT NACELLE, INSTALLATION.

## METHOD 2

*NOTE*

*All air pressure must be bled from front forks before fluid can be drained.*

1. Locate the front air valve just below the frame cover at the rear right side of the vehicle. Remove core from air valve to bleed air from the front air suspension system. For best results, use Snap-ON tool #GA143A.
2. Remove the drain plug from the bottom of each fork leg. See Figure 2-72. Drain the oil and then reinstall just one drain plug.
3. With second drain plug still removed, attach air suspension pump (part #HD-34633) to front air valve. Gently pump to assist the draining process.
4. Attach vacuum tool (air operated) to front air valve.
5. Pour the specified amount of Harley-Davidson Type E fork oil into clean container. Obtain a battery vent tube (Part No. 65995-88A) and cut the vent from each end. Insert one end of the tube into the fork oil and the other end against the open drain hole.

**⚠WARNING**

**Do not leave the vacuum tool on for too long or the fork oil will be drawn into the air lines. An insufficient quantity of fork oil can adversely affect handling and may lead to loss of vehicle control, which could result in death or serious injury.**

6. Turn the vacuum tool on just long enough to allow the fork oil to be drawn into the front fork. When the fluid container is empty, reinstall the drain plug and turn the vacuum tool off. Tighten the drain plug to 72-96 **in-lbs** (8-11 Nm).
7. Repeat the process on the opposite fork.

# REMOVAL/DISASSEMBLY

1. Remove the front wheel and fender. See Section 2.29 FRONT FENDER, REMOVAL.

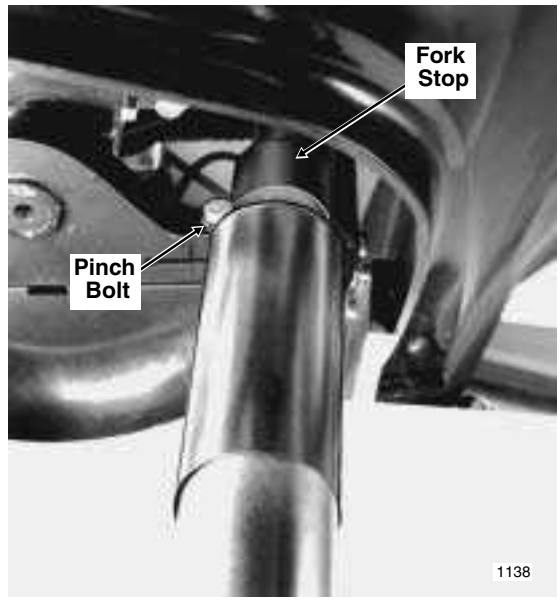



**Figure 2-73. Fork Side Mounting**

2. On FLHTC/U models, remove outer fairing and radio. See Section 8.29 PREMIUM SOUND SYSTEM, RADIO, REMOVAL. On FLHT models, remove storage box following steps 3 and 6.

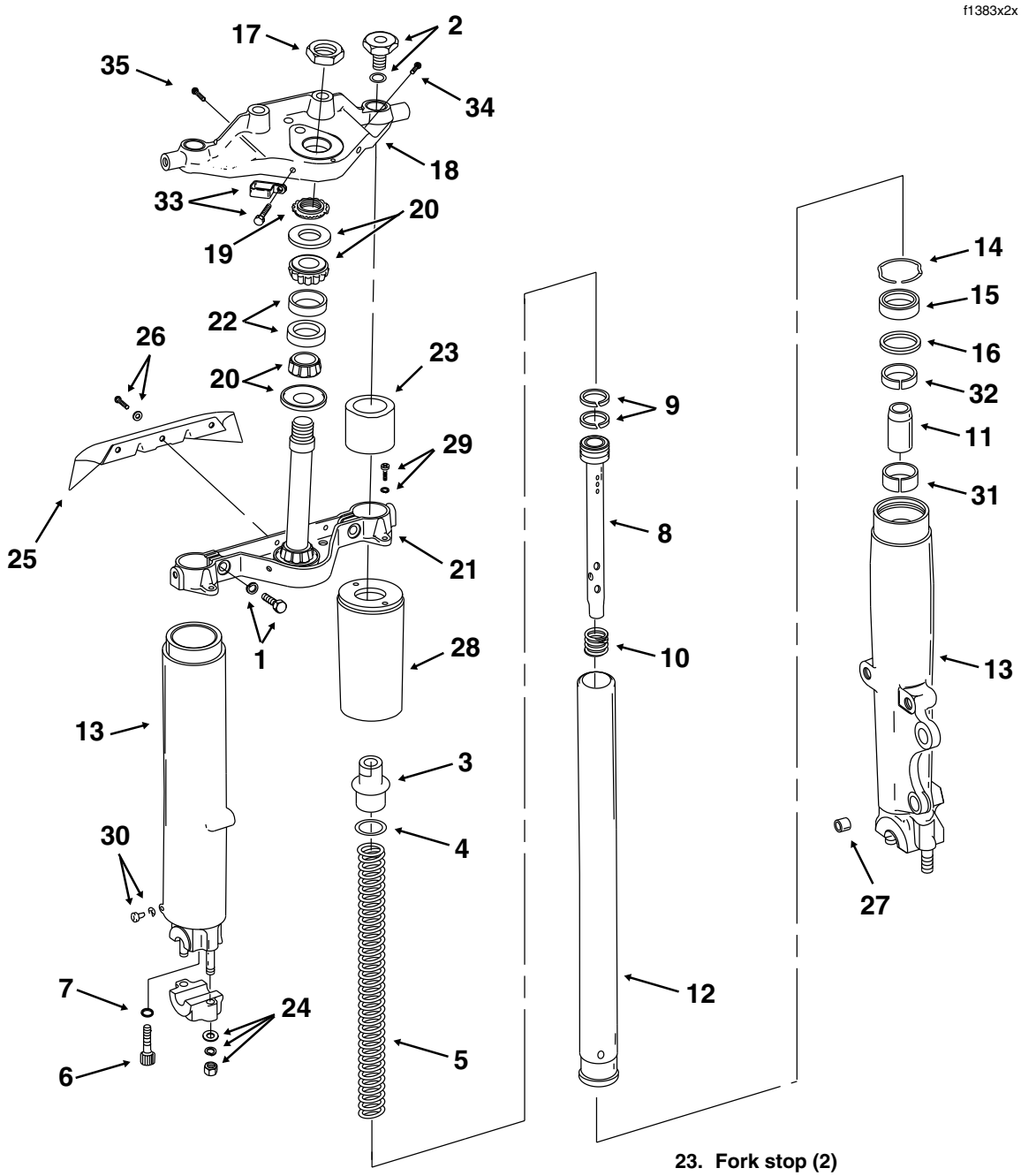
    On FLHR/C models, remove headlamp nacelle. See Section 2.28 WINDSHIELD/HEADLAMP NACELLE (FLHR/C), NACELLE REMOVAL.

    On FLTR models, remove instrument nacelle. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLTR), INSTRUMENT NACELLE, REMOVAL.

3. Locate the front air valve just below the frame cover at the rear right side of the vehicle. Remove core from air valve to bleed air from the front air suspension system. For best results, use Snap-ON tool #GA143A.
4. Rotate hex bolts to remove banjo fittings from fork cap bolts. See Figure 2-71. Remove O-rings from hex bolts.
5. Remove the fork cap bolt and seal from each fork. See Figure 2-73.
6. Loosen the pinch bolts. Using a suitable drift and tapping from the top, drive the fork sides from the brackets and remove the rubber fork stop (2) from each fork.
7. Drain the oil from the fork side.
8. Remove screw (6) and washer (7).

*NOTE*

*Since there is little resistance to rotation when removing socket screw (6), use an air impact wrench for best results.*




1. Pinch bolt and lockwasher (2)
2. Fork cap bolt and seal (2)
3. Fork cap
4. O-ring
5. Spring
6. Screw
7. Washer
8. Damper tube
9. Wear ring (2)
10. Spring
11. Sleeve
12. Fork tube
13. Fork slider
14. Retaining ring
15. Oil seal
16. Washer
17. Fork stem nut
18. Upper bracket
19. Bearing adjuster (star) nut
20. Dust shield and bearing
21. Lower bracket and stem
22. Bearing race
23. Fork stop (2)
24. Slider cap hardware
25. Shield
26. Bolt and lockwasher
27. Bushings (2)
28. Slide cover
29. Screw and lockwasher
30. Drain screw and lockwasher
31. Bushing
32. Bushing
33. Clamp and Screw
34. Handlebar Ground Screw
35. Screw

**Figure 2-74. Front Fork Assembly**

9. Remove the fork cap (3), O-ring (4) and spring (5). Remove retaining ring (14). Separate the fork tube (12) from the fork slider (13) by using the fork tube as a slide hammer. That is, first push fork tube into fork slider and then pull it outward.

10. Continue slide hammer action until fork tube separates from fork slider. Bushing (32), washer (16) and oil seal (15) are all removed with the fork tube.

*NOTE*

*Bushing (31) is slightly larger than bushing (32) and will drive out bushing (32), washer (16) and oil seal (15).*

11. Remove damper tube (8) from fork tube (12). If necessary the damper tube can be pushed out with a small rod inserted through bottom hole of fork tube. Remove the wear rings (9) from the damper tube (8).

## CLEANING AND INSPECTION

1. Replace the springs if they are broken or distorted. Replace any broken or bent parts. Replace all seals and O-rings.

2. Lower bushing on fork tubes should not be removed, unless they are to be replaced. During replacement, expand the new split bushing just enough to fit over fork tube and slide the bushing into the bushing groove.

## ASSEMBLY/INSTALLATION

1. Install the wear rings (9) onto the damper tube (8). Install the spring (10), tube (8) and spring (5) in the fork tube (12).

2. Place the fork tube into the slider (13) and secure it with the washer (7) and bolt (6).

3. Place upper bushing (32), washer (16) and oil seal (15) over the fork tube (12). Be sure that the concave surface of the spacer is down and lettered side of the seal is facing upward. Place FORK SEAL AND BUSHING TOOL, Part No. HD-34634, over fork tube (12). Bushing (32), washer (16) and seal (15) are then seated into the slider bore by lightly tapping the components into place with the installation tool.

4. Install retaining ring (14). See Figure 2-74. Place fork side assemblies into the upper and lower bracket with the rubber sleeves positioned as shown.

5. Pour the specified amount of Harley-Davidson Type E Fork Oil into each fork side. Install the fork cap bolts and seals. Tighten the pinch bolts to 40 ft-lbs.

6. Apply light film of clean engine oil on **new** O-rings. Install O-rings in grooves of hex bolts.

7. With air connection facing inboard, rotate hex bolts to install banjo fittings to fork cap bolts. Tighten hex bolts to 8-12 ft-lbs (11-16 Nm).

8. On FLHTC/U models, install radio and outer fairing. See Section 8.29 PREMIUM SOUND SYSTEM, RADIO, INSTALLATION. On FLHT models, install storage box following steps 3 and 6.

   On FLHR/C models, install headlamp nacelle. See Section 2.28 WINDSHIELD/HEADLAMP NACELLE (FLHR/C), NACELLE INSTALLATION.

   On FLTR models, install instrument nacelle. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLTR), INSTRUMENT NACELLE, INSTALLATION.

9. Install the front fender and wheel. See Section 2.29 FRONT FENDER, INSTALLATION.

# STEERING HEAD BEARINGS 2.15

## LUBRICATION

At every 5,000 mile (8,000 km) service interval, grease the steering head bearings using *Special Purpose Grease, Part No. 99857-97*. Turn handlebar full right to access the grease fitting at the left side of the steering head. Connect grease gun to fitting and inject grease until it exudes from top and bottom of steering head. See Figure 2-75.

At the 1,000 mile (1,600 km) service interval, and every 10,000 miles (16,000 km) thereafter, check the swing-by following the CHECKING procedure below.

Disassemble the front fork every 50,000 miles (80,000 km), and inspect the steering head bearings for burnelling, scoring, or other damage. Replace and/or repack the bearings as required.

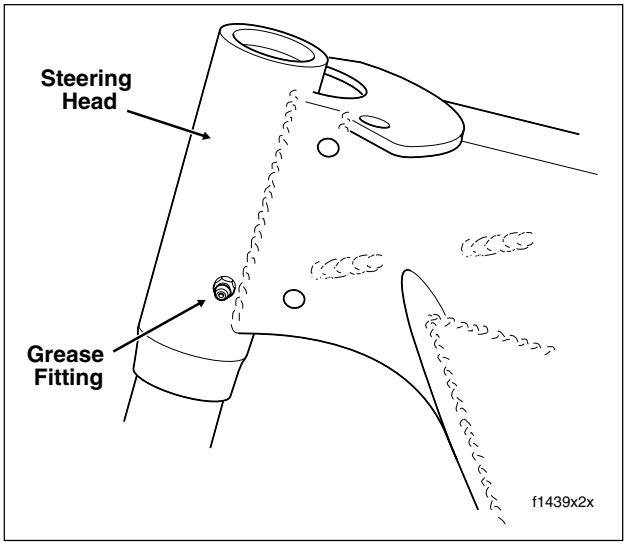



**Figure 2-75. Steering Head Bearing Grease Fitting**

## CHECKING

1. Using an hydraulic center stand on a level surface, raise the vehicle so that the front and rear tires are the same distance from the floor.
2. Verify that motorcycle is in stock configuration. Remove all non-factory accessories, since they can influence front end swing momentum (and lead to improper adjustment).
3. Turn the front wheel until contact is made with the left fork stop and then let go. The wheel should swing right, left, then right and stop. The wheel need not stop near the center or straight-forward position, but it must move to the right making a partial third swing. See frame C of Figure 2-76.
4. To correct a swing pattern that is too short or too long, see ADJUSTMENT below.

## ADJUSTMENT

1. Loosen the pinch bolts on the lower fork bracket and slide the rubber fork stops up slightly on the fork tubes. This will prevent any binding of the front end when the adjustment is made. See Figure 2-73.
2. On FLHT/C/U models, remove outer fairing and radio (storage box on FLHT). On FLHR/C, remove headlamp nacelle. On FLTR models, remove the instrument bezel.
3. Bend tab on lock plate away from flat of fork stem nut. Loosen the fork stem nut. See Figure 2-77.
4. Fashion a bearing adjuster tool using a drill rod 16 inches long. See lower frame of Figure 2-78.

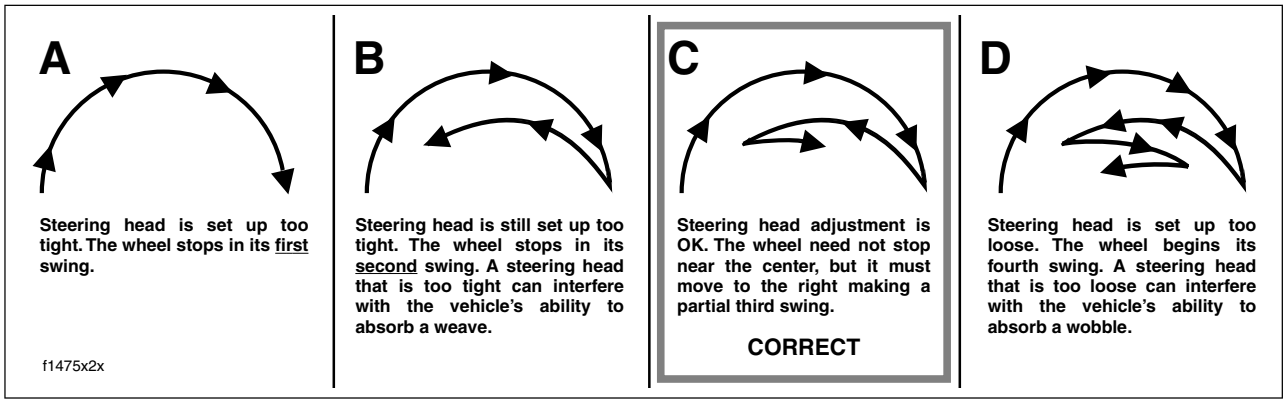



**Figure 2-76. Check Steering Head Bearing Swing-By**

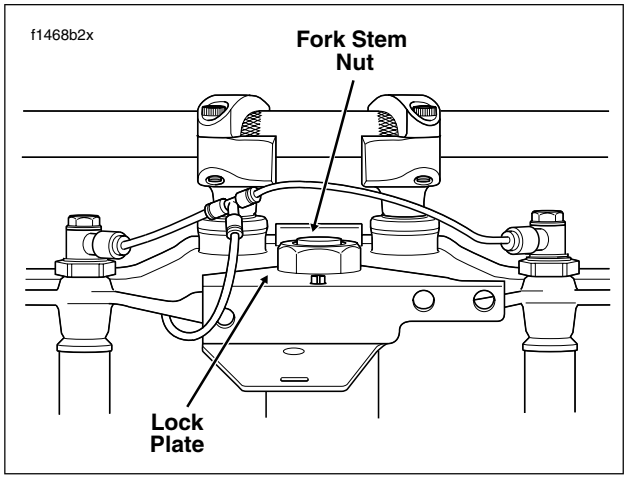



**Figure 2-77. Fork Stem Nut**

To decrease the number of swings, stand on the left side of the vehicle and insert the rod to engage the notches of the bearing adjuster (star) nut under the fork bracket. Push forward to rotate the nut clockwise.

*NOTE*

*Turning the bearing adjuster nut as little as one notch will make a noticeable difference in the swing pattern.*

To increase the number of swings, stand on the right side of the vehicle and insert the rod to engage the notches of the bearing adjuster nut. Push forward to rotate the nut counterclockwise.

5. Tighten the fork stem nut to 50-65 ft-lbs (68-88 Nm). The tightness of the nut will affect the swing pattern.
6. Recheck the swing pattern. See step 3 under CHECKING. Repeat steps 4-6 above until swing pattern is correct.
7. Tighten pinch bolts to 40 ft-lbs (54 Nm) and properly position the rubber fork stops.
8. Verify that the fork stem nut is tightened to 50-65 ft-lbs (68-88 Nm). Bend tab on lockplate against flat of fork stem nut.
9. On FLHT/C/U models, install radio (storage box on FLHT) and outer fairing. On FLHR/C, install headlamp nacelle. On FLTR models, install the instrument bezel.
10. Recheck the swing pattern. See step 3 under CHECKING. Repeat ADJUSTMENT procedure if swing pattern is not correct.

## REMOVAL

1. On FLHT/C/U models, remove the passing lamp bracket, outer fairing and radio (storage box on FLHT). On FLHR/ C, remove headlamp nacelle. On FLTR models, remove the instrument nacelle.

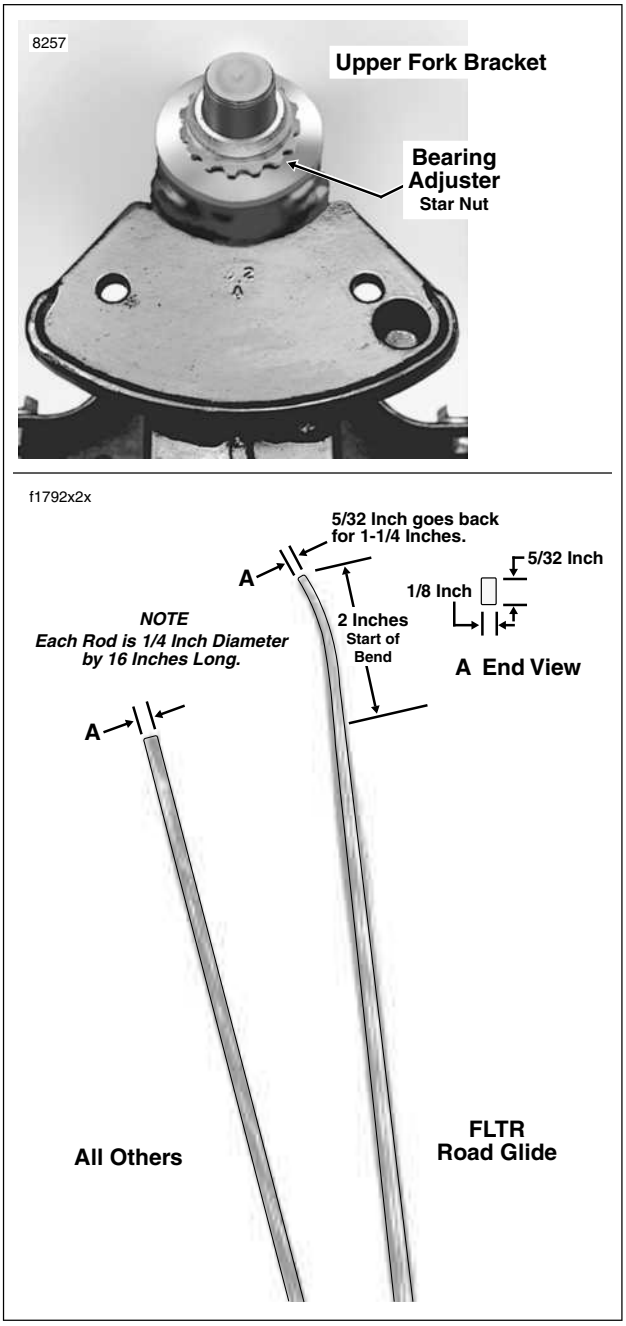



**Figure 2-78. Fashion Steering Head Bearing Adjustment Tool From Drill Rod**

2. Remove the front wheel, fork sides and air suspension components. Remove brake line from lower fork bracket.
3. Bend tab away from flat of fork stem nut. Remove nut.
4. Remove the bearing adjuster and fork stem assembly. See upper frame of Figure 2-78. Remove dust shield and bearing (20) from top of steering head. See Figure 2-74.

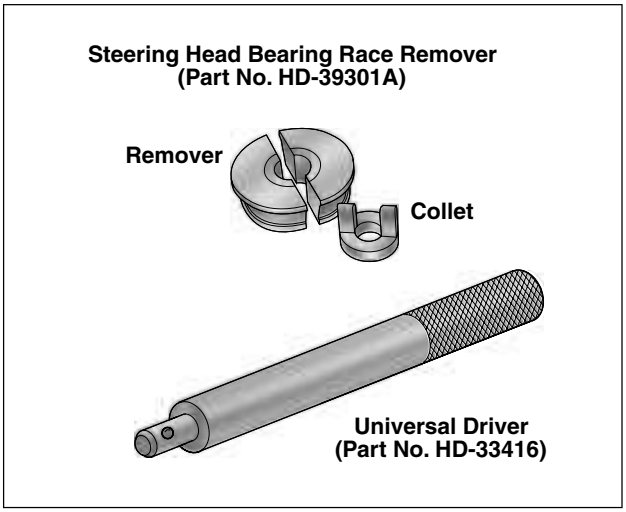



**Figure 2-79. Steering Head Bearing Race Removal Tools**

# INSPECTION

1. Check the bearing races (22) in the steering head. If pitted or grooved, replace both the bearings and races. See Figure 2-74.
2. Turn bearings in races. Replace the bearings if they do not move freely and smoothly. Always replace both races and bearings even if one race and bearing appears good.

## STEERING HEAD BEARING RACE REMOVAL

*NOTE*

*To remove the upper and lower steering head bearing races, use the Steering Head Bearing Race Remover (Part No. HD-39301A) with the Universal Driver (Part No. HD-33416). See Figure 2-79.*

Proceed as follows:

1. With the tapered side down, seat the two-piece remover tool on the upper bearing race leaving a gap in the middle. See Figure 2-80.
2. Install the collet on the driver.
3. Insert the driver at the bottom of the steering head tube, and while holding the remover tool on the race, center the collet in the gap. Tap the driver to remove the upper race.
4. Reverse the tool and repeat the procedure to remove the lower bearing race.

## REMOVING BEARING FROM FORK STEM

1. Chisel cage retaining rollers off bearing on fork stem.
2. Turn the stem (21) upside down while heating the inner race. Race will expand and fall free. See Figure 2-74.

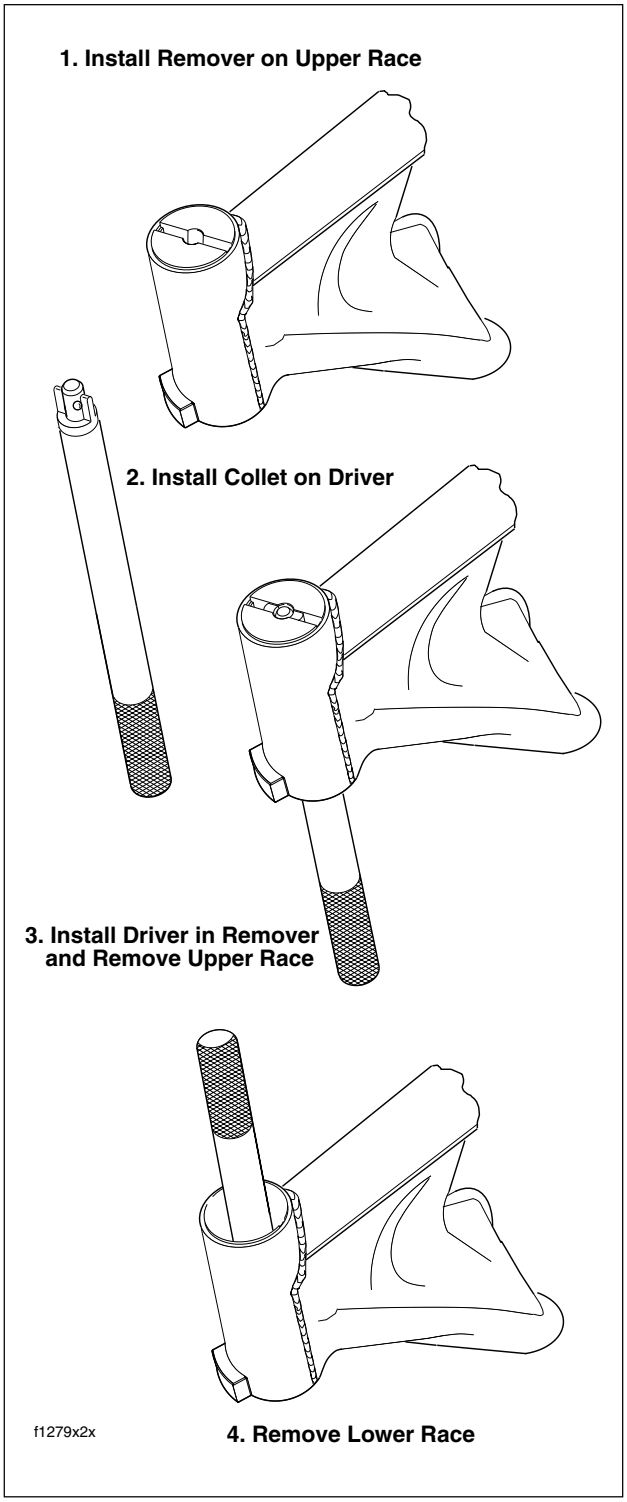



**Figure 2-80. Remove Upper and Lower Steering Head Bearing Races**

## ASSEMBLY

1. Pack **new** bearings with Harley-Davidson SPECIAL PURPOSE GREASE, Part No. 99857-97.
2. See Figure 2-74. Install dust shield (20) on fork stem (21). Use a sleeve that will contact only the inner race of the new bearing, then press the bearing into place on fork stem (21).
3. Install new bearing races (22) in steering head using STEERING HEAD BEARING RACE INSTALLATION TOOL, Part No. HD-39302.

## INSTALLATION

1. See Figure 2-74. Install the fork stem assembly into the steering head. Install the bearings and dust shield. Install the bearing adjuster nut. Snug the adjuster nut down until bearing play is taken up and the fork stem turns freely. Overtightening the nut will cause excessive bearing wear.

**⚠WARNING**

**An improperly adjusted fork stem nut can adversely affect handling and may lead to loss of vehicle control, which could result in death or serious injury.**

2. Install upper fork bracket and fork stem nut. Tighten nut to 50-65 ft-lbs (68-88 Nm). Bend the lockplate tab against the nut flat. See Figure 2-77.
3. Install fork sides, air suspension components, radio (storage box on FLHT), outer fairing and passing lamp bracket. On FLHR/C, install headlamp nacelle. On FLTR models, install the instrument bezel.
4. Install the front wheel and bleed the front brake. Check swing-by under CHECKING in this section.

## GENERAL

All models feature air-adjustable suspension. Air pressure may be varied to suit personal comfort. Lower pressures give a softer ride while higher pressures give a firmer ride. See the table below for the recommended air suspension pressures or refer to the decal inside the right saddlebag.

### Table 2-2. Air Suspension Adjustments

| Loading | Recommended Pressures (PSI) | |
|---|---|---|
| | Front Fork (0-15) | Rear Shocks (0-10) |
| Rider Weight - up to 150 lbs. add: | - | - |
| For each extra 25 lbs. add: | 1.0 | 1.0 |
| Passenger weight - for each 50 lbs. add: | - | 1.5 |
| Luggage Weight - for each 10 lbs. add: | 1.0 | 3.0 |
| Maximum Pressures | 25 | 35 |

*NOTE*

*Using pressures outside the recommended loading range will result in a reduction of available suspension travel and reduced rider comfort. Always adjust pressures with the vehicle on the jiffy stand.*

**CAUTION**

**All air components fill rapidly. Use low air line pressure to avoid possible damage. A small hand or foot operated air pump is the best way to add air to suspension components.**

**CAUTION**

**Use a no-loss air gauge to check air pressure. Check pressure in both front forks and air shocks weekly if in daily use or before each trip if only used occasionally.**

*NOTE*

*An AIR SUSPENSION PUMP AND GAUGE (Part No. HD-34633) is available at your Harley-Davidson dealer.*

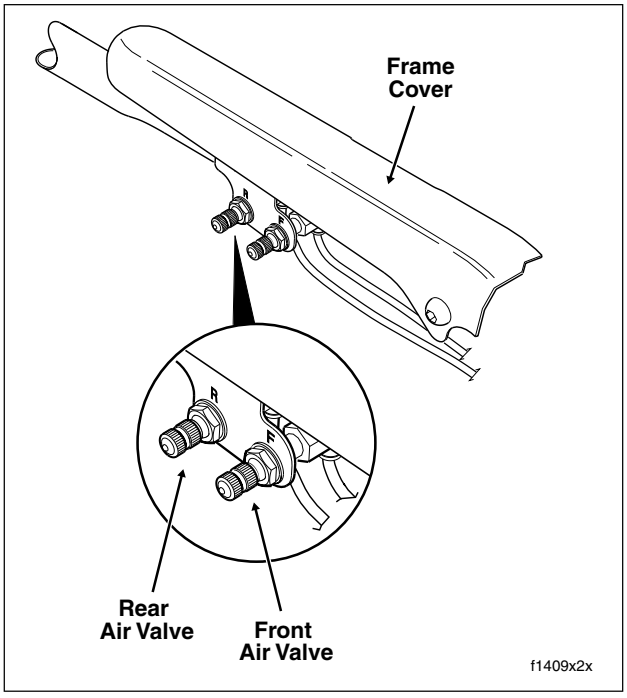



**Figure 2-81. Front/Rear Air Suspension Air Valves (Under Protective Caps)**

**WARNING**

**Exercise caution when bleeding air from the air valves. Moisture combined with lubricant (either from shock assembly or drip oiler in the air compressor lines) may be ejected onto the rear wheel, tire and/or brake components and adversely affect traction and/or braking efficiency, which could result in death or serious injury.**

## FRONT AIR SUSPENSION

Adjust the front fork air suspension pressure by adding or removing air from the air valve located just below the frame cover on the right side of the vehicle. See Figure 2-81.

**CAUTION**

**Front air suspension pressure over 25 psi is not recommended. Damage to air control components can result.**

## REAR AIR SUSPENSION

Adjust the rear shock air suspension pressure by adding or removing air from the air valve located just below the frame cover on the right side of the vehicle. See Figure 2-81.

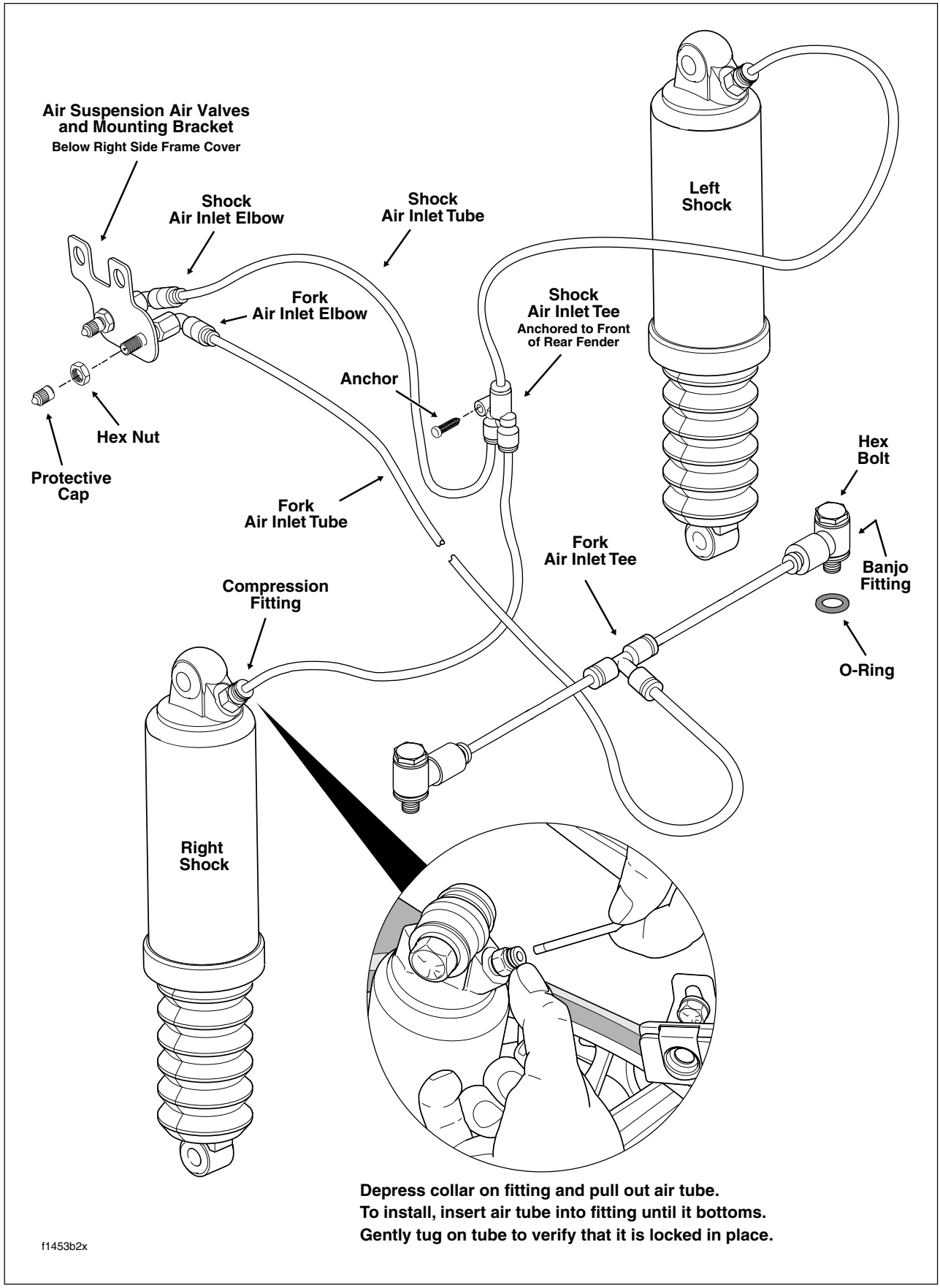



**Figure 2-82. Front/Rear Air Suspension Systems**

**CAUTION**

**Maximum air pressure for rear suspension is 35 psi. Over inflation can damage shock absorbers.**

# FRONT/REAR AIR SUSPENSION REMOVAL/INSTALLATION

Remove and replace components as necessary. Check for air leaks as follows:

## FRONT FORK AIR CONTROL

1. Remove right side saddlebag. See Section 2.22 SADDLEBAG, REMOVAL.
2. Install the no-loss air gauge and set to correct pressure. Remove the gauge and wait overnight.
3. Recheck air pressure, and if a loss of 5-10 pounds is noted, then proceed to step 4.
4. Proceed as follows:

   **FLHR/C:** Remove headlamp nacelle. See Section 2.28 WINDSHIELD/HEADLAMP NACELLE (FLHR/C), NACELLE REMOVAL.

   **FLHT/C/U:** On FLHTC/U models, remove outer fairing and radio. See Section 8.29 PREMIUM SOUND SYSTEM, RADIO, REMOVAL. On FLHT models, remove storage box following steps 3 and 6.

   **FLTR:** Remove instrument nacelle. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLTR), INSTRUMENT NACELLE, REMOVAL.
5. To check for air leaks in the banjo fittings, alternately spray or brush a light film of soapy water around the air inlet fitting, hex bolt head and O-ring. If no leakage is observed in either banjo fitting, move to step 6. If leakage is noted, proceed as follows:

### Banjo fitting:

   a. If leakage is observed at the banjo air inlet fitting, proceed to step 5b. If leakage is noted around the hex bolt head or O-ring, proceed to step 5c.

   b. Remove air tube. Inspect tube end for burrs or damage. If either condition is observed, snip off the end of the tube and insert it back into the banjo air inlet fitting. If air leakage continues, proceed to step 5c.

   c. Remove air tube.

   d. Rotate hex bolt to remove banjo fitting from fork cap bolt. Remove O-ring from hex bolt if leakage was noted at this location. If leakage was noted around hex bolt head or air inlet, obtain **new** banjo fitting.

   e. Apply light film of clean engine oil on **new** O-ring. Install O-ring in groove of hex bolt.

   f. With air connection facing inboard, rotate hex bolt to install banjo fitting to fork cap bolt. Tighten hex bolt to 8-12 ft-lbs (11-16 Nm).

   g. Insert air tube into banjo air inlet fitting.

   h. Pressurize front air suspension system and check for leaks. For recommended air suspension pressures, see Table 2-2. Install protective cap on air valve.

6. Spray or brush a light film of soapy water on the fork air inlet tee. If no leakage is observed, move to step 7. If leakage is noted, proceed as follows:

### Air inlet tee:

   a. Remove air tubes. Inspect the tube ends for burrs or damage. If either condition is observed, snip off the end of the tube and insert it back into the tee. If air leakage continues, proceed to step 6b.

   b. Remove air tubes.

   c. Install air tubes in **new** air inlet tee.

   d. Pressurize front air suspension system and check for leaks. For recommended air suspension pressures, see Table 2-2. Install protective cap on air valve.

7. Remove protective cap from air valve. Spray or brush a light film of soapy water into the valve head and where the air tube enters the air inlet elbow. If leakage is not observed at either location, move to step 8. If leakage is noted, proceed as follows:

### Air valve assembly:

   a. If leakage is at air inlet elbow, proceed to step 7b. If leakage is at valve head, proceed to step 7c.

   b. Remove air tube from air inlet elbow. Inspect the tube ends for burrs or damage. If either condition is observed, snip off the end of the tube and insert it back into the fitting. If air leakage continues, proceed to step 7c.

   c. Remove air tube.

   d. Remove hex nut from valve head. See Figure 2-82.

   e. Push on valve head to free air valve assembly from mounting bracket. See Figure 2-83.

   f. Insert air tube into air inlet elbow of **new** air valve assembly.

   g. From inboard side, insert valve head through hole in mounting bracket. Install hex nut on valve head (flat side facing inboard). Tighten nut.

   h. Pressurize rear air suspension system and check for leaks. For recommended air suspension pressures, see Table 2-2. Install protective cap on air valve.

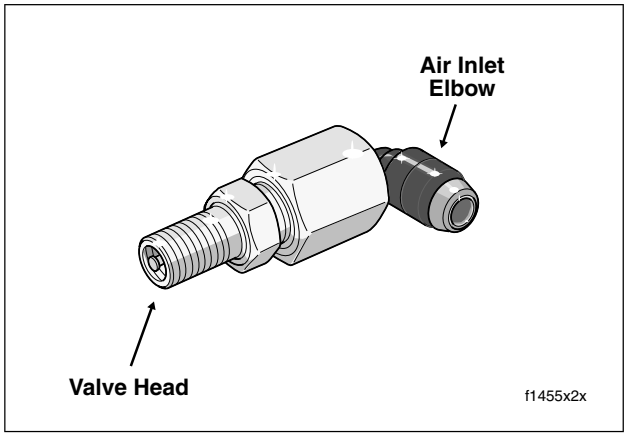



**Figure 2-83. Air Valve Assembly**

8. Partially remove fuel tank. For carbureted models, see Section 4.7 FUEL TANK, PARTIAL REMOVAL, FLHT/C, FLTR, or FLHR. For fuel injected models, see Section 9.3 FUEL TANK, PARTIAL REMOVAL, FLHTC/U-I, FLTR-I, or FLHR/C-I.
9. Inspect air tubes for kinks, cuts, chafing or any damage that may result in air leaks. If no leakage is observed, move to step 10. If tube replacement is necessary, proceed as follows:

### Air tubes:

a. Remove air tube from air inlet tee. Remove opposite end of tube from banjo air inlet fitting or air inlet elbow.

*NOTE*

*If replacing length to air valves, do not cut cable straps or remove P-clamp along right side of steering head. Draw air tube out and then feed **new** air tube in leaving cable straps and clamp in place. See Figure 2-84.*

b. Cut bulk tube to proper length.

c. Insert **new** tube into air inlet tee. Install opposite end of tube in banjo air inlet fitting or air inlet elbow.

d. Pressurize front air suspension system and check for air leaks. For recommended air suspension pressures, see Table 2-2. Install protective cap on air valve.

10. Install fuel tank. For carbureted models, see Section 4.7 FUEL TANK, INSTALLATION (AFTER PARTIAL REMOVAL), FLHT/C, FLTR, or FLHR. For fuel injected models, see Section 9.3 FUEL TANK, INSTALLATION (AFTER PARTIAL REMOVAL), FLHTC/U-I, FLTR-I, or FLHR/C-I.
11. Proceed as follows:

    **FLHR/C:** Install headlamp nacelle. See Section 2.28 WINDSHIELD/HEADLAMP NACELLE (FLHR/C), NACELLE INSTALLATION.

    **FLHT/C/U:** On FLHTC/U models, install radio and outer fairing. See Section 8.29 PREMIUM SOUND SYSTEM, RADIO, INSTALLATION. On FLHT models, install storage box following steps 3 and 6.

    **FLTR:** Install instrument nacelle. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLTR), INSTRUMENT NACELLE, INSTALLATION.
12. Install right side saddlebag. See Section 2.22 SADDLEBAG, INSTALLATION.

## REAR SHOCK AIR CONTROL

1. Remove right side saddlebag. See Section 2.22 SADDLEBAG, REMOVAL.
2. Install the no-loss air gauge and set to correct pressure. Remove the gauge and wait overnight.
3. Recheck air pressure, and if a loss of 5-10 pounds is noted, then proceed to step 4.
4. Remove seat. See Section 2.21 SEAT, REMOVAL.
5. Locate the shock air inlet tee anchored to the front of the rear fender. See Figure 2-82. Spray or brush the tee with a light film of soapy water. If no leakage is observed, move to step 6. If leakage is noted, proceed as follows:

### Air inlet tee:

a. Remove air tubes. Inspect the tube ends for burrs or damage. If either condition is observed, snip off the end of the tube and insert it back into the tee. If air leakage continues, proceed to step 5b.

b. Pull anchor from rear fender hole to release air inlet tee.

c. Remove air tubes.

d. Install air tubes in **new** air inlet tee.

e. Anchor air inlet tee to rear fender.

f. Pressurize rear air suspension system and check for leaks. For recommended air suspension pressures, see Table 2-2. Install protective cap on air valve.

6. Spray or brush a light film of soapy water on the compression fittings at the top of each shock absorber. If no leakage is observed, move to step 7. If leakage is noted, proceed as follows:

### Compression fitting:

a. Remove air tube from compression fitting. Inspect the tube ends for burrs or damage. If either condition is observed, snip off the end of the tube and insert it back into the fitting. If air leakage continues, proceed to step 6b.

b. Remove air tube from compression fitting.

c. Remove compression fitting from shock absorber.

d. Apply PIPE SEALANT WITH TEFLON to the threads of a **new** compression fitting and install in shock absorber.

e. Install air tube in compression fitting.

f. Pressurize rear air suspension system and check for leaks. For recommended air suspension pressures, see Table 2-2. Install protective cap on air valve.

7. Remove protective cap from air valve. Spray or brush a light film of soapy water into the valve head and where the air tube enters the air inlet elbow. If leakage is not observed at either location, move to step 8. If leakage is noted, proceed as follows:

### Air valve assembly:

a. If leakage is at air inlet elbow, proceed to step 7b. If leakage is at valve head, proceed to step 7c.

b. Remove air tube from air inlet elbow. Inspect the tube end for burrs or damage. If either condition is observed, snip off the end of the tube and insert it back into the fitting. If air leakage continues, proceed to step 7c.

c. Remove hex nut from valve head. See Figure 2-82.

d. Push on valve head to free air valve assembly from mounting bracket. See Figure 2-83.

e. Remove air tube from air inlet elbow.

f. Insert air tube into air inlet elbow of **new** air valve assembly.

g. From inboard side, insert valve head through hole in mounting bracket. Install hex nut on valve head (flat side facing inboard). Tighten nut.

h. Pressurize rear air suspension system and check for leaks. For recommended air suspension pressures, see Table 2-2. Install protective cap on air valve.

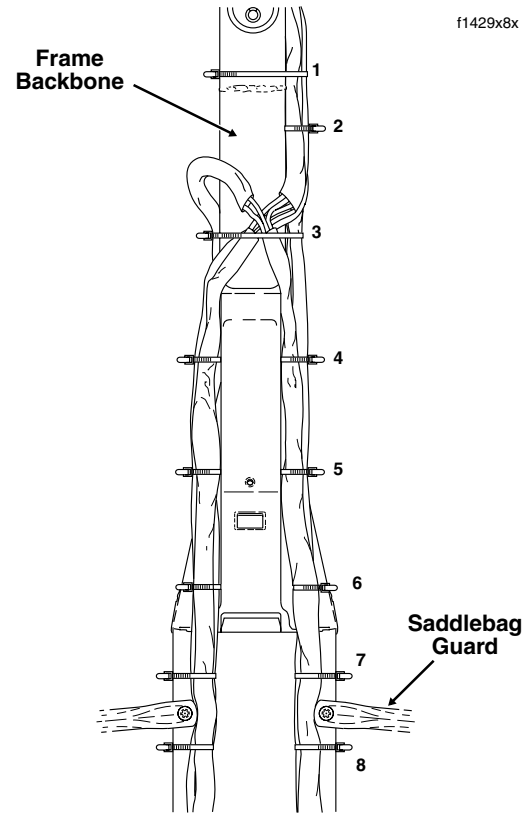
8. Inspect air tubes for kinks, cuts, chafing or any damage that may result in air leaks. If tube replacement is necessary, proceed as follows:

### Air tubes:

a. Remove air tube from air inlet tee. Remove opposite end of tube from shock or air inlet elbow. See Figure 2-82.

b. Cut bulk tube to proper length.

c. Insert **new** tube into air inlet tee. Install opposite end of tube in shock or air inlet elbow.




| | |
|---|---|
| 1 | Encircles coil bracket and frame backbone capturing wire bundles and cables (including throttle and idle cables). |
| 2 | Captures wire bundles and cables only (not anchored). |
| 3 | Encircles frame backbone (just to the rear of the engine stabilizer bracket where wire bundles cross from right to left side of frame backbone) capturing wire bundles and cables. |
| 4 | Captures wire bundles and cables only (not anchored). |
| 5 | Captures wire bundles and cables only (anchored). |
| 6 | Captures wire bundles and cables only (anchored). |
| 7-8 | Captures wire bundles, cables and upper frame tube. |

**Figure 2-84. Feed Air Tube Thru Cable Straps**

d. Pressurize rear air suspension system. For recommended air suspension pressures, see Table 2-2. Install protective cap on air valve.

9. Install seat. See Section 2.21 SEAT, INSTALLATION.

10. Install right side saddlebag. See Section 2.22 SADDLEBAG, INSTALLATION.

# REAR SHOCK ABSORBERS 2.17

## ADJUSTMENT

For the correct air pressure, refer to the decal inside the right saddlebag or see Section 2.16 FRONT/REAR AIR SUSPENSION.

## REMOVAL

*NOTE*

*Place the motorcycle on a hydraulic center stand with the rear wheel raised off the ground.*

1. Raise lid of right side saddle bag. Grasp bail wire inside saddlebag and rotate each stud a full 1/4 turn in a counter-clockwise direction. Remove bail head studs with flat washers. Remove saddlebag.
2. Depress collar on compression fitting to release air tube. See upper frame of Figure 2-85.
3. Turn the upper shock mounting bolt until free. Remove the upper shock mounting bolt (with lockwasher and flat washer). See lower frame of Figure 2-85.
4. Remove the shock bottom bolt (with lockwasher and flat washer) from the rear fork mount. Remove the shock absorber assembly from the vehicle.

## DISASSEMBLY

*NOTE*

*Air shocks are not repairable. Replace the shocks if damaged or worn.*

## CLEANING AND INSPECTION

1. Examine the rubber mounting bushings for cracks or wear. Examine the shock for leaks. The unit should not leak and should compress slightly easier than it extends. Compare the action of the shock with a new one to judge if it is worn. Replace the shock if necessary.
2. Clean and examine the shock mounting hardware. Replace those parts that are worn or damaged.

## ASSEMBLY

*NOTE*

*If the compression fittings were removed, apply PIPE SEALANT WITH TEFLON to the threads before assembly.*

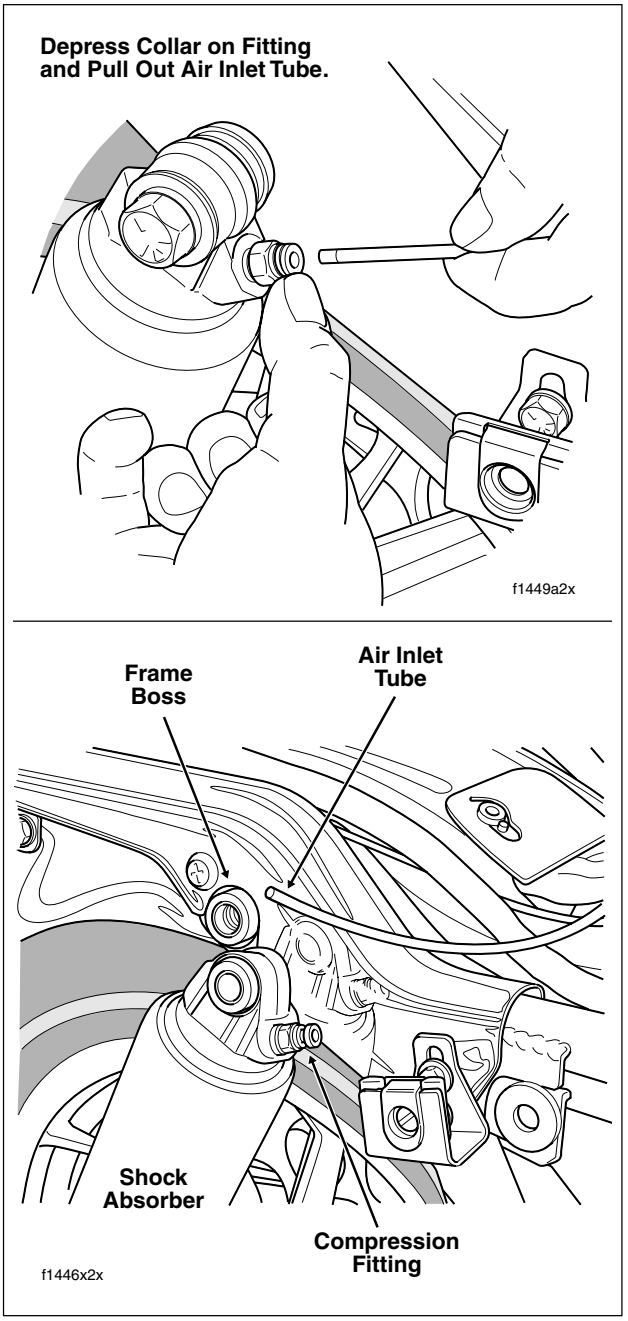



**Figure 2-85. Remove Air Inlet Tube and Upper Shock Mounting Bolt (Right Side View)**

## INSTALLATION

1. Install the lockwasher and flat washer on the shock bottom bolt. Apply two or three drops of Loctite 242 (blue) to the threads. Position bottom end of the shock absorber against the outboard side of the rear fork-mount. Insert the bolt through the shock bottom bushing into the rear fork mount. Tighten the bolt to 35-40 ft-lbs (47-54 Nm).
2. Install the lockwasher and flat washer on the upper shock mounting bolt. Push the bolt through the shock upper bushing.
3. Apply two or three drops of Loctite 242 (blue) to the threads of the upper shock mounting bolt. Turn the upper shock mounting bolt into the frame boss until snug. Tighten the bolt to 33-35 ft-lbs (45-48 Nm).
4. Insert air tube into compression fitting until it bottoms. Gently tug on tube to verify that it is locked in place.
5. Pressurize rear air suspension system and check for leaks. For the correct air pressure, refer to the decal inside the right saddlebag or see Section 2.16 FRONT/REAR AIR SUSPENSION.
6. Position right side saddlebag on vehicle. Place flat washers on bail head studs. Insert stud through holes in saddlebag and front mounting bracket. When groove at end of stud engages wire form of spring plate on inboard side of bracket, turn stud clockwise a full 1/4 turn until it snaps in place. Install rear bail head stud in the same manner.

## REMOVAL

1. Remove the rear wheel. See Section 2.3 REAR WHEEL, REMOVAL.
2. Place the motorcycle on a center stand and support the engine from below with a block of wood.
3. Remove two bolts (with lockwashers) to free rear swingarm brackets from left and right side of vehicle frame.

*NOTE*

*The rear swingarm brackets also serve as passenger footboard brackets.*

4. Holding right side nut (11/16 in. wrench size) within rubber mount, remove left side locknut (3/4 in. wrench) and cup washer from swing arm pivot shaft. See Figure 2-86.
5. From the left side of the vehicle, tap the pivot shaft out of the swing arm using a suitable drift.
6. Remove rubber mounts and nylon spacers from both left and right sides.
7. Remove rear swingarm from transmission case and vehicle frame.

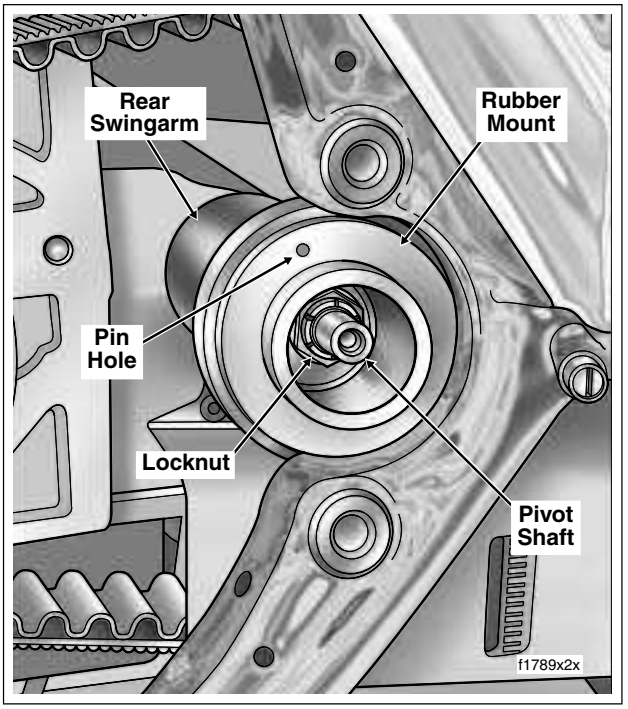



**Figure 2-86. Remove Locknut from Pivot Shaft (Left Side View)**

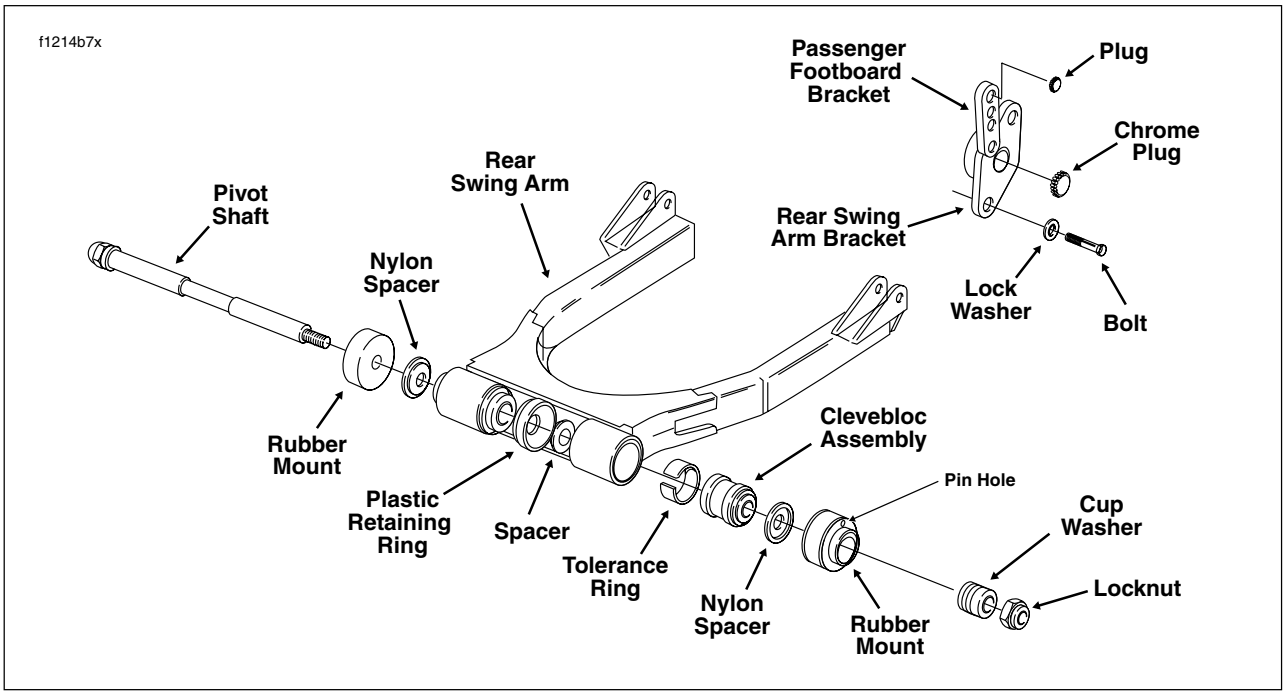



**Figure 2-87. Rear Swing Arm/Pivot Shaft Assembly**




**Figure 2-88. Press Out Clevebloc**




**Figure 2-89. Press In Clevebloc**




**Figure 2-90. Clevebloc in Swing Arm**

## DISASSEMBLY

1. See Figure 2-87. Pry the spacer and plastic retaining ring from one side of the swing arm.
2. Place the swing arm in an arbor or hydraulic press. Place the PRESS COLLAR (from the SWING ARM ASSEMBLY TOOL, Part No. HD-96200-80) on the outside diameter of the swing arm as shown in Figure 2-88.
3. Using a long extension and socket, press the clevebloc out of the swing arm.

*NOTE*

*The clevebloc is a silicone filled bushing. Always press on the clevebloc outer sleeve. Never press directly on the clevebloc because any excessive force may break the seal and cause the silicone to leak out. Follow the assembly and installation instructions carefully. If clevebloc leaks it must be replaced.*

4. Repeat Steps 1-3 on the opposite side of the swing arm.

## ASSEMBLY

1. Place a new tolerance ring on one clevebloc.
2. Using the PRESS PLUG, press the spacer, plastic retaining ring and clevebloc into one side of the swing arm. See Figure 2-89.

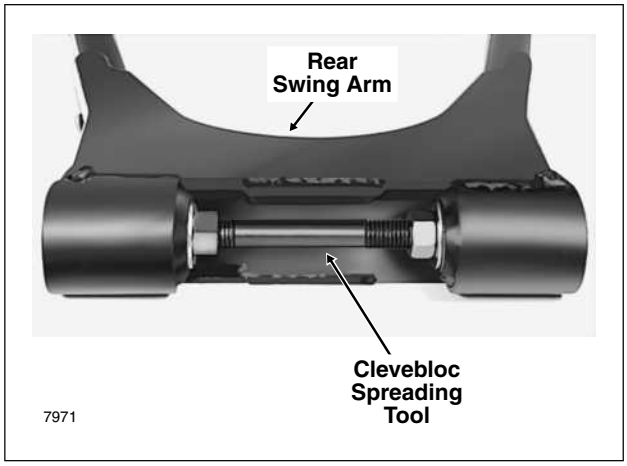



**Figure 2-91. Install Clevebloc Spreading Tool (HD-33805)**

3. When performing the press operation, be sure that the stepped surface on the clevebloc is flush with the mounting surface. See Figure 2-90.
4. Repeat Steps 1-3 on the opposite side of the swing arm. Do not reuse the tolerance ring, always install a new one.

## INSTALLATION

1. Position swing arm at rear of transmission.

   If the transmission boss will not fit back into the swing arm, install the CLEVEBLOC SPREADING TOOL (Part No. HD-33805) between the swing arm cleveblocs as shown in Figure 2-91. Turn nuts spreading cleveblocs apart to approximately 4-9/16 in. (116 mm). Loosen nuts and remove tool.

2. The pivot shaft secures the rear swing arm and transmission to the vehicle frame. See Figure 2-92. Assemble the pivot shaft as follows:

   a. Coat pivot shaft with Loctite ANTI-SEIZE.

   b. Slide rubber mount onto pivot shaft. The small diameter boss on the rubber mount must face outward with the pin hole at the top (so that it aligns with the pin cast in the passenger footboard/rear swingarm bracket).

   c. Slide nylon spacer onto pivot shaft with smaller diameter boss facing inside toward the swing arm.

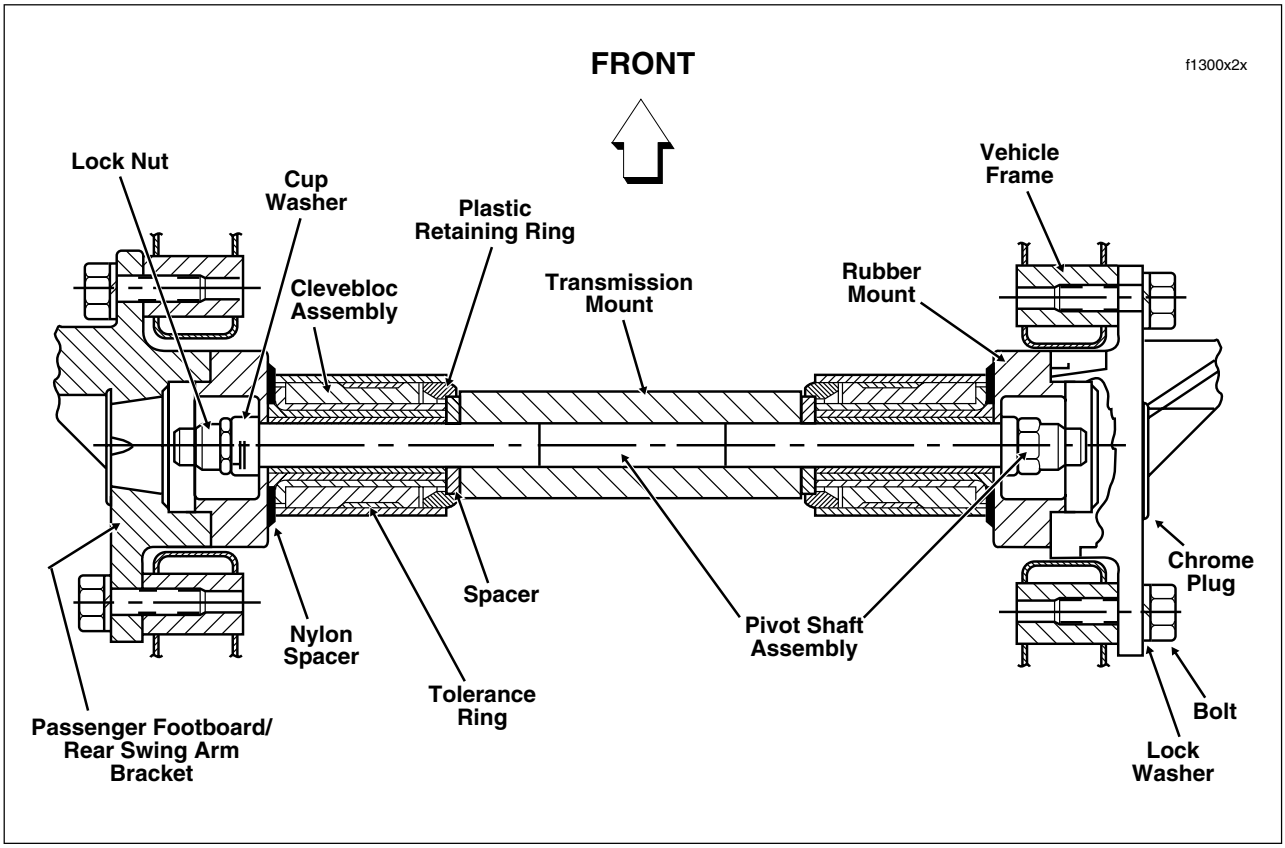
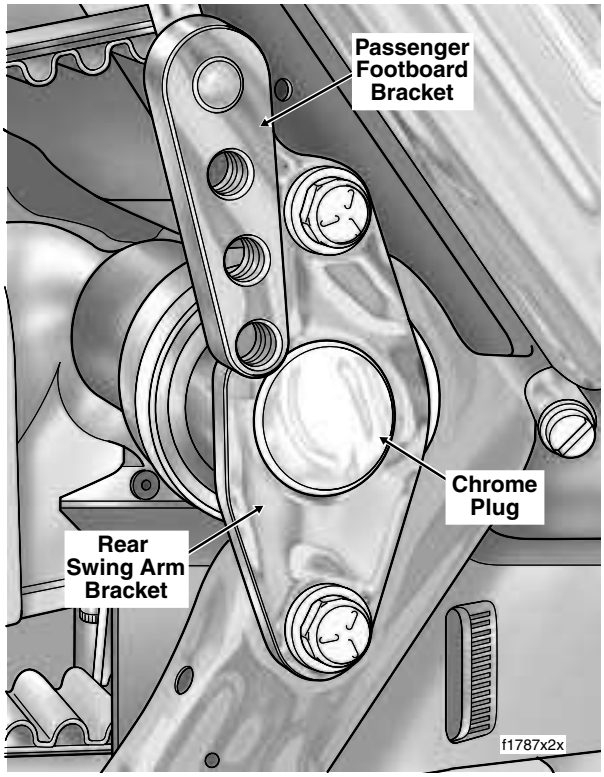



**Figure 2-92. Rear Swing Arm Assembly (Cross Sectional View)**



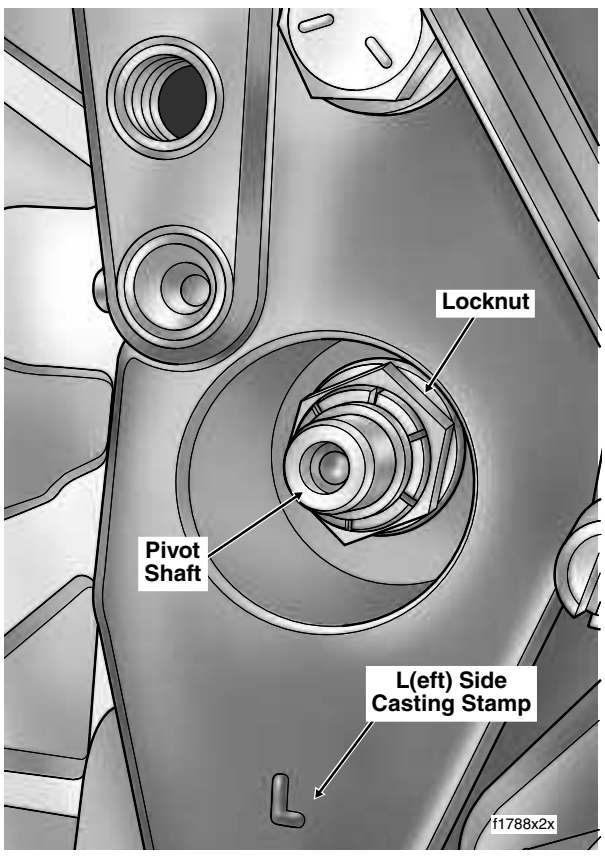




**Figure 2-93. Remove Chrome Plugs and Check Pivot Shaft Locknut Torque (Left Side View)**

d. From right side of vehicle, insert pivot shaft into swing arm and transmission mount.

e. On left side of vehicle, install nylon spacer, rubber mount and cup washer onto pivot shaft. Install nut until finger tight. Remember to properly orient the left side rubber mount and nylon spacer as previously described.

f. Observing “Left” and “Right” stamp on casting, install rear swingarm brackets fitting cast pin in rubber mount hole.

g. Install two bolts (with lock washers) to secure brackets to vehicle frame. Tighten bolts to 34-42 ft-lbs (46-57 Nm).

h. Remove the decorative chrome plugs from rear swingarm brackets. See Figure 2-93.

i. Hold right side nut on the pivot shaft and tighten left side locknut to 40-45 ft-lbs (54-61 Nm).

j. Install the chrome plugs back into rear swingarm brackets.

3. Install the rear wheel. See Section 2.3 REAR WHEEL, INSTALLATION.

4. Adjust the belt tension. See Section 6.4 SECONDARY DRIVE BELT AND SPROCKETS, ADJUSTMENT AND ALIGNMENT.

*NOTE*

*Remove the decorative chrome plugs in the rear swingarm brackets and check the torque on the pivot shaft locknut every 10,000 miles (16,000 km). See Figure 2-93. Holding right side nut, tighten left side locknut to 40-45 ft-lbs (54-61 Nm).*

## ENGINE FRONT RUBBER MOUNT

Inspect the engine front rubber mount every 2500 miles (4000 km). Be sure to examine carefully from the bottom of the motorcycle paying special attention to the area between the large flat metal washer and the bracket on the frame.

Replace the mount if there are any signs of cracking or shearing of the rubber.

Check front mount alignment. See Section 2.8 VEHICLE ALIGNMENT.

# THROTTLE CABLES (NON-ULTRA) 2.19

*NOTE*

*For throttle and idle control cable adjustment or replacement on Ultra models, see Section 8.28 CRUISE CONTROL (FLHTCU, FLTR).*

## ADJUSTMENT

The throttle control must operate freely without binding. With the tension adjuster screw backed off, the throttle control grip must freely return to the closed (idle) position. The throttle control also must open and close freely when the front wheel is turned to both the right and left fork stops. If the throttle grip does not return to the idle position freely, check the adjuster screw tension. If the adjuster screw is backed off, inspect the cables for short bends.

**⚠WARNING**

**Do not overtighten the tension adjuster screw. An overtightened screw will prevent the engine from automatically returning to idle in an emergency situation. This can lead to loss of vehicle control, which could result in death or serious injury.**

1. Slide rubber boot off throttle cable adjuster. See Figure 2-94. Holding cable adjuster with a 3/8 inch wrench, loosen jam nut turning in a clockwise direction. Back jam nut away from cable adjuster until it stops. Turn adjuster clockwise until it contacts jam nut. Repeat procedure on idle cable adjuster.
2. Point the front wheel straight ahead. Turn the throttle control grip so that the throttle is wide open (fully counterclockwise) and then hold in position. Now turn the throttle cable adjuster counterclockwise until the throttle cam stop just touches the stop plate on the carburetor. See Figure 2-95. Tighten jam nut against the throttle cable adjuster and then release the throttle control grip. Cover cable adjuster mechanism with rubber boot.
3. Turn the front wheel full right. Turn the idle cable adjuster counterclockwise until the cable housing just touches the spring in the longer cable guide. Work the throttle grip to verify that the throttle cable returns to the idle position when released. If the cable does not return to idle, turn the adjuster clockwise slightly until the correct response is achieved. Tighten jam nut against the idle cable adjuster and cover cable adjuster mechanism with rubber boot.

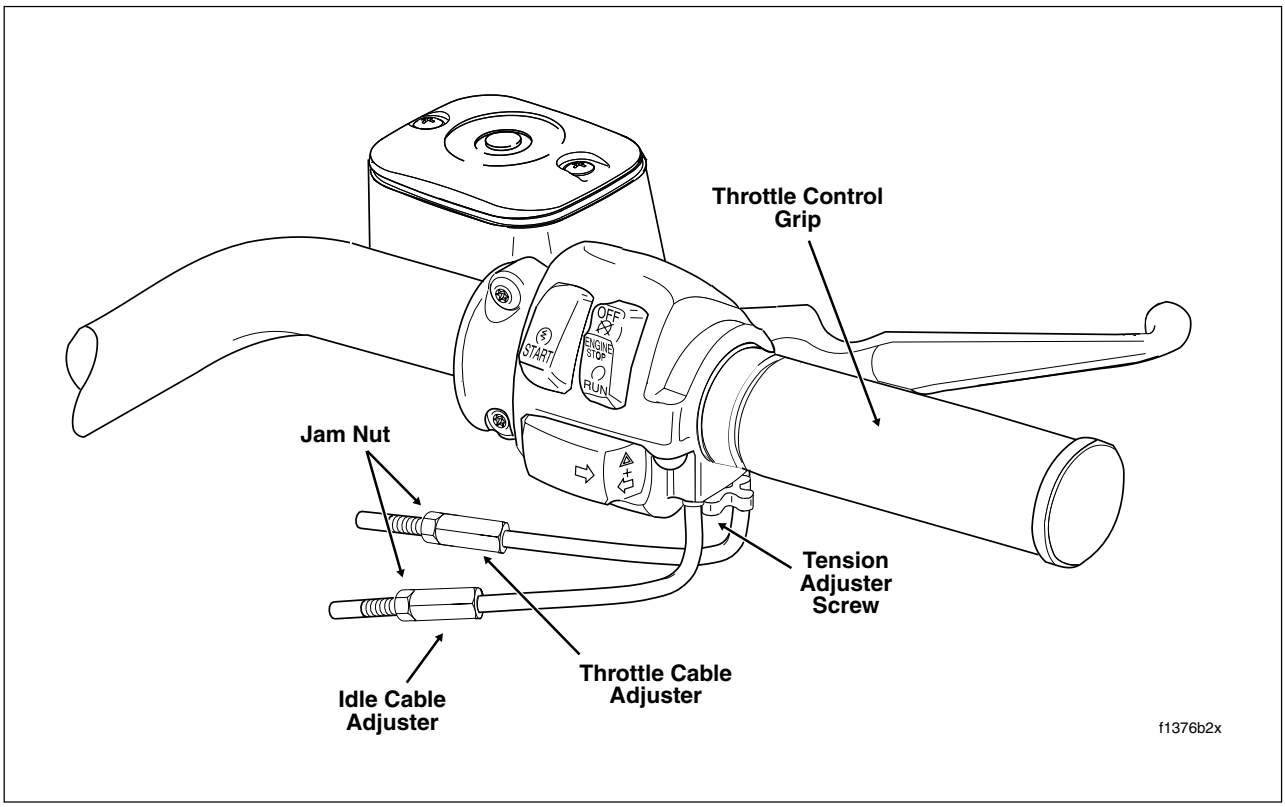



**Figure 2-94. Throttle Cable Assembly - Throttle Side (FLHR/C)**

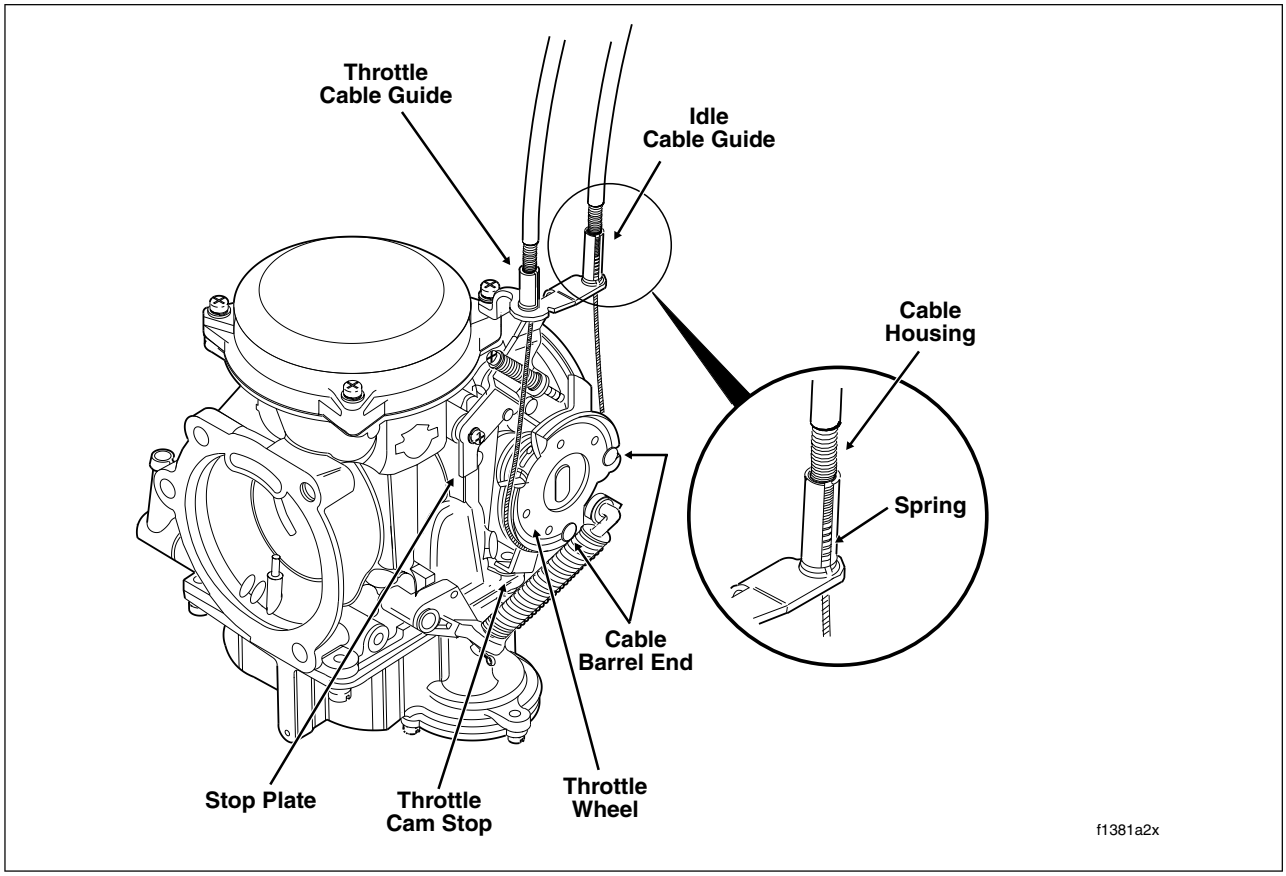



**Figure 2-95. Throttle Cable Assembly - Carburetor Side**

# REMOVAL

## THROTTLE SIDE

**CAUTION**

**Do not remove the switch housing assembly without first placing the 5/32 inch cardboard insert between the brake lever and lever bracket. Removal without the insert may result in damage to the rubber boot and plunger of the Front Stoplight Switch.**

*NOTE*

*Use the eyelet of an ordinary cable strap if the cardboard insert is not available.*

1. Place the cardboard insert between the brake lever and lever bracket. See Figure 2-96.
2. Using a T25 TORX drive head, remove the upper and lower switch housing screws.
3. Using a T27 TORX drive head, loosen the upper screw securing the handlebar clamp to the master cylinder housing. Remove the lower clamp screw with flat washer.

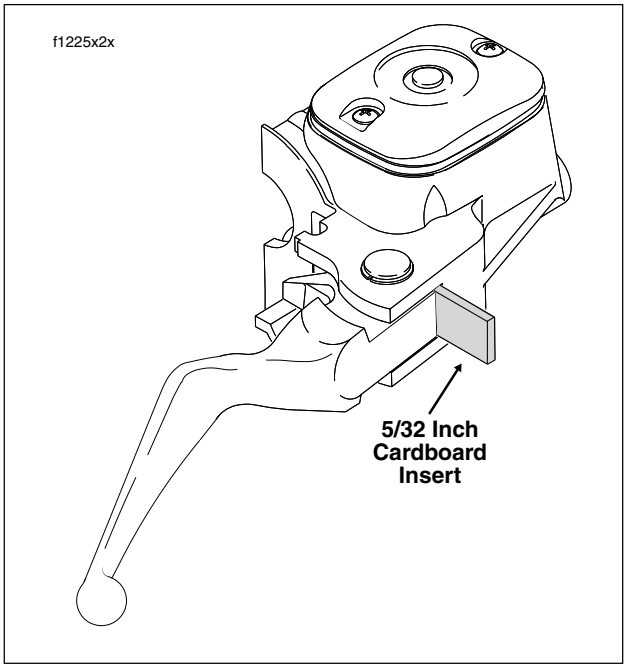



**Figure 2-96. Install Cardboard Insert**

4. Remove the brass ferrules from the notches on the inboard side of the throttle control grip. Remove the ferrules from the cable end fittings.

5. Remove the friction shoe from the end of the tension adjuster screw.

*NOTE*

*The friction shoe is a loose fit and may fall out or become dislodged if the lower switch housing is turned upside down or shaken.*

6. Remove the throttle control grip from the end of the handlebar.

7. Pull the crimped inserts at the end of the throttle and idle control cable housings from the lower switch housing.

   For best results, use a rocking motion while pulling. Place a drop of light oil on the retaining rings, if necessary. Remove the cables from the switch housing.

## CARBURETOR/INDUCTION MODULE SIDE

1. Remove the air cleaner and backplate. For carbureted models, see Section 4.5 AIR CLEANER, REMOVAL. For fuel injected models, see Section 9.4 AIR CLEANER, REMOVAL.

2. Raise fuel tank to access cables in area of frame backbone. For carbureted models, see Section 4.7 FUEL TANK, PARTIAL REMOVAL, FLHT/C, FLTR, or FLHR. For fuel injected models, see Section 9.3 FUEL TANK, PARTIAL REMOVAL, FLHTC/U-I, FLTR-I, or FLHR/C-I.

3. **Carbureted:** Using slots, remove cable barrel ends from holes in throttle wheel and release cable housings from cable guides on carburetor cable bracket. See Figure 2-95.

   Induction Module: Using slot, remove idle and throttle control cables from integral cable guides cast at front of induction module. Using a needle nose pliers, pull cable barrel ends from holes in throttle wheel. See Figure 2-99.

4. Cut and discard 14 inch cable strap capturing frame backbone and coil bracket.

5. Free cables from J-clamp fastened to right side of frame backbone. If present, remove bolt, washer, P-clamp and locknut to release cables from right side of steering head.

# CLEANING AND INSPECTION

1. Clean all parts in a non-flammable cleaning solvent and blow dry with compressed air.

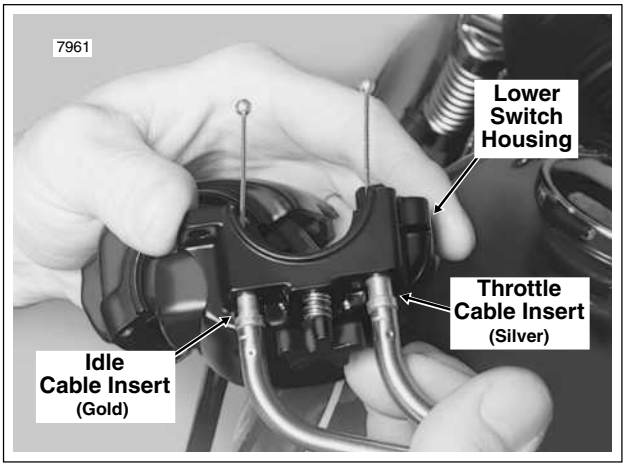



**Figure 2-97. Install Throttle/Idle Control Cables in Lower Switch Housing**

2. Inspect the cables for damage or wear. Replace the cables if frayed, kinked or bent.

3. Obtain tube of Lubit-8 Tufoil Chain and Cable Lube (HD Part No. 94968-85TV- 1/4 fl. oz.). Insert pin of tube between throttle control cable and cable housing. Squirt a few drops of lubricant into cable housing moving pin around cable OD. Repeat the procedure squirting a few drops between the idle control cable and cable housing.

# INSTALLATION

## THROTTLE SIDE

1. Apply a light coating of graphite to the handlebar and inside surface of the switch housings.

2. Push the throttle and idle control cables into the lower switch housing until they snap in place. See Figure 2-97. Proceed as follows:

   Note the different diameter inserts crimped into the end of the throttle and idle control cable housings.

   Push the larger diameter insert (silver) on the throttle cable housing into the larger hole in front of the tension adjuster screw.

   Push the smaller diameter insert (gold) on the idle cable housing into the smaller hole at the rear of the tension adjuster screw.

*NOTE*

*To aid assembly, place a drop of light oil on the retaining rings of the crimped inserts. Always replace the retaining rings if damaged or distorted.*

3. With the concave side facing upward, install the friction shoe so that the pin hole is over the point of the adjuster screw.

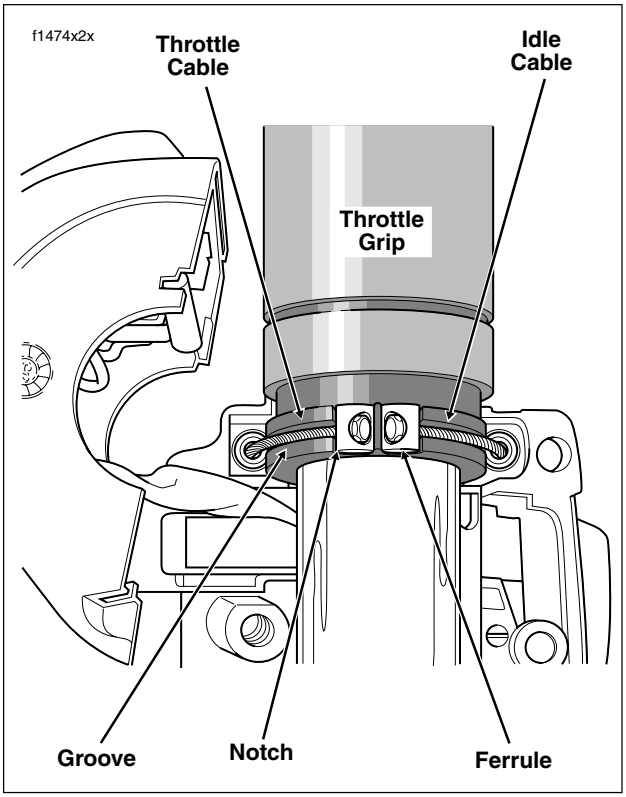



**Figure 2-98. Install Throttle/Idle Control Cables on Throttle Control Grip**

*NOTE*

*The friction shoe is a loose fit and may fall out or become dislodged if the lower switch housing is turned upside down or shaken.*

4. Slide the throttle control grip over the end of the right handlebar until it bottoms against the closed end. Rotate the grip so that the ferrule notches are at the top. To prevent binding, pull the grip back about 1/8 inch (3.2 mm).
5. Position the lower switch housing beneath the throttle control grip. Install the brass ferrules onto the cables so that the end fittings seat in the ferrule recess. Seat the ferrules in their respective notches on the throttle control grip. Verify that the cables are captured in the grooves molded into the grip. See Figure 2-98.
6. Position the upper switch housing over the handlebar and lower switch housing. Verify that the wire harness conduit runs in the depression at the bottom of the handlebar.
7. Start the upper and lower switch housing screws, but do not tighten.
8. Position the brake lever/master cylinder assembly inboard of the switch housing assembly engaging the tab on the lower switch housing in the groove at the top of the brake lever bracket.
9. Align the holes in the handlebar clamp with those in the master cylinder housing and start the lower screw (with flat washer). Position for rider comfort. Beginning with the top screw, tighten the screws to 60-80 **in-lbs** (6.8-9.0 Nm) torque using a T27 TORX drive head.
10. Using a T25 TORX drive head, tighten the lower and upper switch housing screws to 35-45 **in-lbs** (4-5 Nm).

*NOTE*

*Always tighten the lower switch housing screw first so that any gap between the upper and lower housings is at the front of the switch assembly.*

11. Remove the cardboard insert between the brake lever and lever bracket.
12. Turn the Ignition/Light Key Switch to IGNITION and apply brake lever to test operation of brake lamp.

## CARBURETOR/INDUCTION MODULE SIDE

1. Route the throttle and idle cables as follows:

   **FLHT/C:** Route the cables downward following the brake line to the inner fairing. Pass the cables through the inner fairing grommet and then loop them back along the right side of the steering head.

   **FLHR/C:** Route the cables downward following the right handlebar to the handlebar clamp shroud. Pass the cables through the opening in the shroud and then loop them back along the right side of the steering head passing through P-clamp at this location.
2. From the right side of the steering head, route the throttle and idle cables along the right side of the frame backbone. After passing through the J-clamp on the frame backbone, route the cables downward to the carburetor/induction module.
3. **Carbureted:** Install the idle cable housing and spring into the longer cable guide on the carburetor cable bracket. Drawing idle cable downward, fit barrel end into hole in throttle wheel (farthest from cam stop). Install the throttle cable housing into the shorter cable guide inserting barrel end into remaining hole in throttle wheel. See Figure 2-95.

   **Induction Module:** Drawing the idle control cable around the top of the throttle wheel, insert barrel end into upper hole. Draw the throttle control cable around the bottom of the throttle wheel and insert barrel end into lower hole. Using slots, slip throttle and idle control cables into cable guides cast at front of induction module. See Figure 2-99.
4. Tighten cables as necessary to keep barrel ends from dislodging. Verify that cables are seated in channel of throttle wheel. Verify operation by turning throttle grip and observing cable action. Adjust throttle cables as described under ADJUSTMENT.

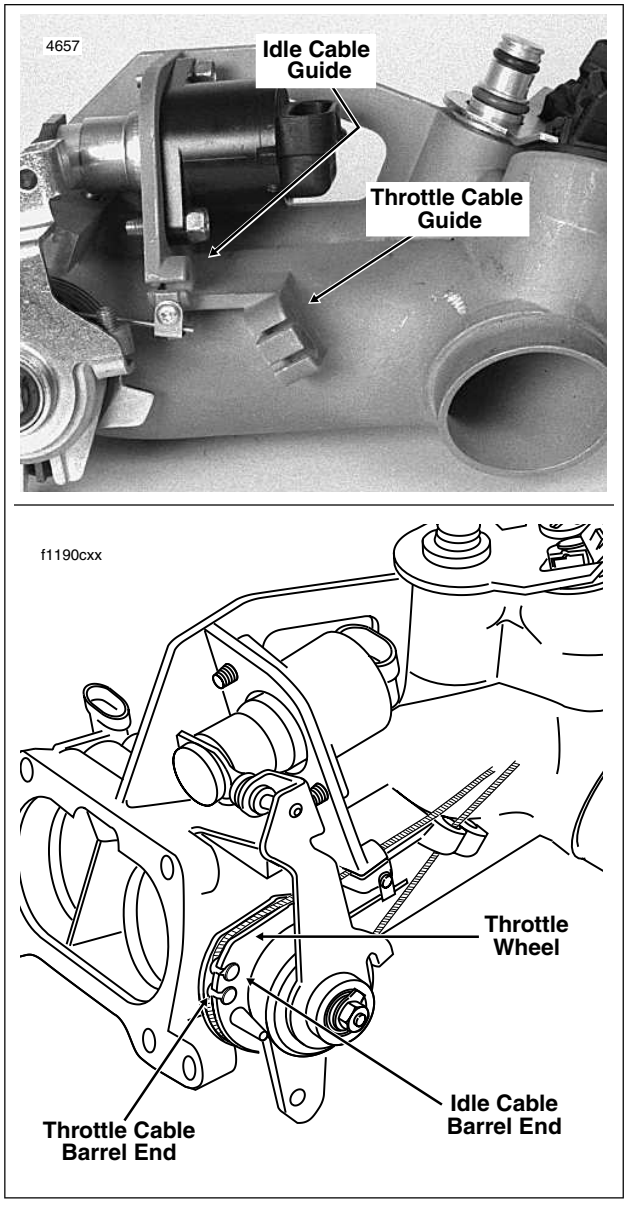



**Figure 2-99. Throttle Cable Assembly (Fuel Injected Models)**

5. From right side of vehicle, insert tapered end of new 14 inch cable strap between ignition coil and coil bracket welded to underside of frame backbone. When cable strap exits left side, raise both ends so that eye is centered above the frame backbone.
6. Verify that the idle and throttle cables, wire bundles, wire harness and frame backbone are captured before mating cable strap ends. Tighten cable strap, but leave loose enough so that one finger can be inserted between strap and frame backbone. **Do not over-tighten.** Cut any excess cable strap material.
7. Install fuel tank. For carbureted models, see Section 4.7 FUEL TANK, INSTALLATION (AFTER PARTIAL REMOVAL), FLHT/C, FLTR, or FLHR. For fuel injected models, see Section 9.3 FUEL TANK, INSTALLATION (AFTER PARTIAL REMOVAL), FLHTC/U-I, FLTR-I, or FLHR/C-I.
8. Install the air cleaner assembly. For carbureted models, see Section 4.5 AIR CLEANER, INSTALLATION. For fuel injected models, see Section 9.4 AIR CLEANER, INSTALLATION.

## LUBRICATION

1. See REMOVAL, THROTTLE SIDE, in this section, steps 1-5.
2. Move upper switch housing to the side in order to access lower housing.

**⚠CAUTION**

**Lubit-8 Tufoil Chain and Cable Lube contains detergents. Keep out of reach of children. Contact with eyes may result in minor or moderate injury.**

3. Obtain tube of Lubit-8 Tufoil Chain and Cable Lube (HD Part No. 94968-85TV- 1/4 fl. oz.). Insert pin of tube between throttle control cable and cable housing inside lower switch housing. Squeeze tube to squirt a quantity of lubricant into cable housing moving pin around cable OD. See Figure 2-100.
4. Repeat the procedure squirting a quantity of lubricant between the idle control cable and cable housing.
5. See INSTALLATION, THROTTLE SIDE, in this section, steps 3-12.
6. Turn the Ignition/Light Key Switch to IGNITION and apply brake lever to test operation of brake lamp.

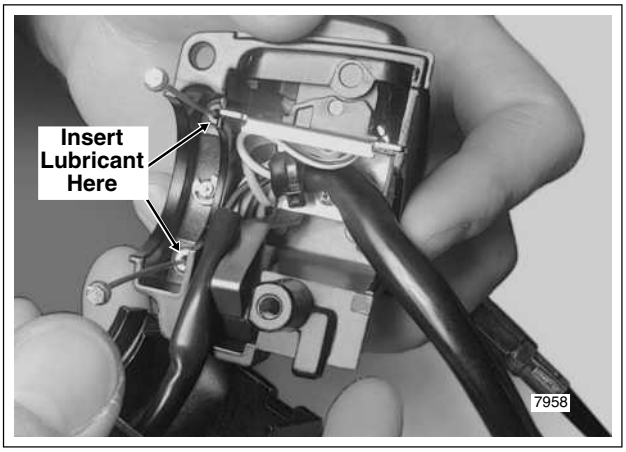



**Figure 2-100. Right Handlebar Lower Switch Housing**

# CLUTCH CABLE 2.20

## ADJUSTMENT

See Section 6.3 CLUTCH, ADJUSTMENT.

## REMOVAL

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**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.**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. To access the clutch release cover assembly, remove the exhaust piping as necessary. See Section 2.32 EXHAUST SYSTEM, REMOVAL.
4. Remove the magnetic drain plug at the bottom right side of the oil pan and drain the transmission lubricant into a suitable container. Remove the filler plug/dipstick.
5. Slide rubber boot off clutch cable adjuster. Holding cable adjuster with 1/2 inch wrench, loosen jam nut using 9/16 inch wrench. Back jam nut away from cable adjuster. Move adjuster toward jam nut to introduce free play at hand lever. See Figure 2-101.
6. Remove retaining ring from pivot pin groove at bottom of clutch lever bracket. Remove pivot pin and clutch hand lever from clutch lever bracket. Remove anchor pin and clutch cable eyelet from clutch hand lever.See Figure 2-102.
7. Remove six socket head screws and washers to free clutch release cover from transmission case. Remove and discard gasket. See Figure 2-103.

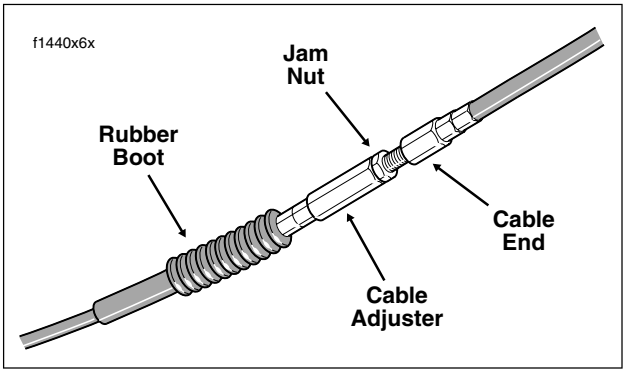



**Figure 2-101. Clutch Cable Adjuster Mechanism**

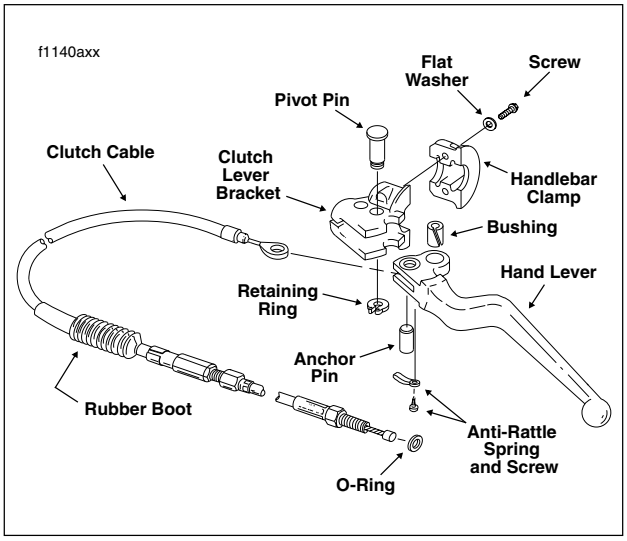



**Figure 2-102. Clutch Hand Lever Assembly**

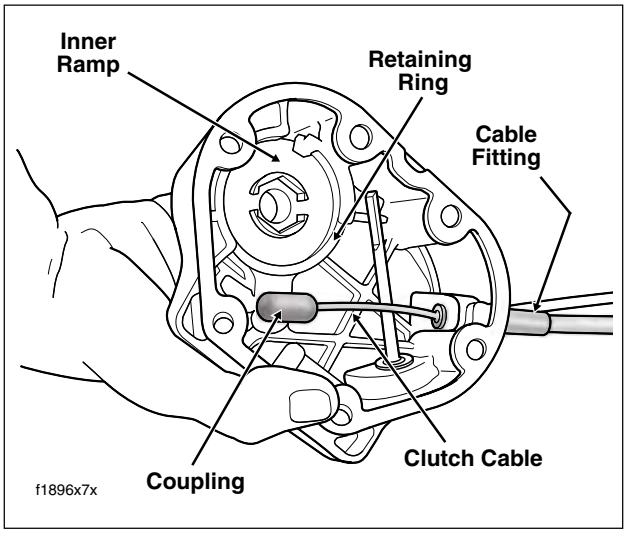



**Figure 2-103. Clutch Release Cover Assembly**

**WARNING**

**Always wear proper eye protection when removing 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.**

8. Remove retaining ring securing ball and ramp mechanism to clutch release cover.

9. Lift inner ramp out of clutch release cover and turn the assembly over so that ball sockets are facing outboard. Remove hook of ramp from button on coupling. Remove coupling from clutch cable end.
10. Remove balls from outer ramp sockets. Remove outer ramp from clutch release cover.
11. Unscrew the cable fitting from the clutch release cover. Remove clutch cable and fitting.
12. Release cable from clamp at the bottom of the timing cover. Cut cable straps as necessary to free clutch cable from frame downtubes. Remove cable from vehicle.

*NOTE*

*If ball and ramp or throwout bearing and clutch pushrod need service, see Section 7.5 CLUTCH RELEASE COVER.*

# INSTALLATION

*NOTE*

*If removed, install two screws (with flat washers) to secure handelbar clamp to clutch lever bracket. See Figure 2-102. Starting with the top screw, tighten screws to 60-80* ***in-lbs*** *(6.8-9.0 Nm).*

1. See Figure 2-102. Insert clutch cable eyelet into groove of clutch hand lever aligning eyelet with hole without bushing. Insert anchor pin through lever and eyelet.
2. Insert lever into groove of clutch lever bracket fitting sleeve at end of cable housing into bore on inboard side of bracket.
3. Align hole in hand lever with hole in bracket and install pivot pin. Install retaining ring in pivot pin groove.
4. Route the clutch cable as follows:

   **FLHT/C/U:** Feed clutch cable through grommet on left side of inner fairing. With outer fairing removed, route cable between left fairing bracket and radio (or storage box) support bracket. Cable strap clutch cable to fairing bracket at this location. Run cable downward along left side of steering head and then route cable between engine guard and front of left frame downtube. Continue downward progression while crossing to right side of vehicle running cable between inboard side of right frame downtube and outboard side of voltage regulator. Use cable strap to secure clutch cable to right frame downtube as shown in Figure 2-104. Following inboard side of frame downtube, route cable between bottom of cam cover and top of lower frame tube to area of clutch release cover.

   **FLHR/C:** Capture clutch cable in clamp secured by upper left passing lamp bracket bolt. See Figure 2-105. Run cable downward along left side of steering head and then route cable between engine guard and front of left frame downtube. Continue downward progression while crossing to right side of vehicle running cable between inboard side of right frame downtube and outboard side of voltage regulator. Use cable strap to secure clutch cable to right frame downtube as shown in Figure 2-104. Following inboard side of frame downtube, route cable between bottom of cam cover and top of lower frame tube to area of clutch release cover.

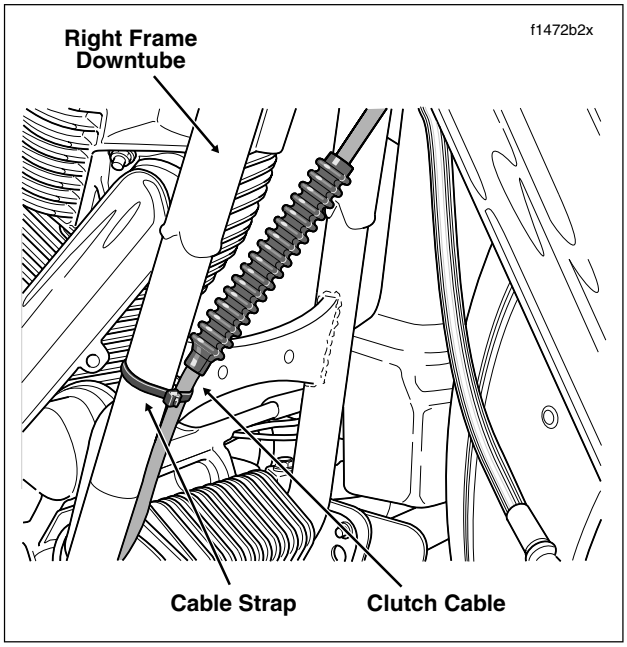



**Figure 2-104. Clutch Cable Routing (Right Side View)**

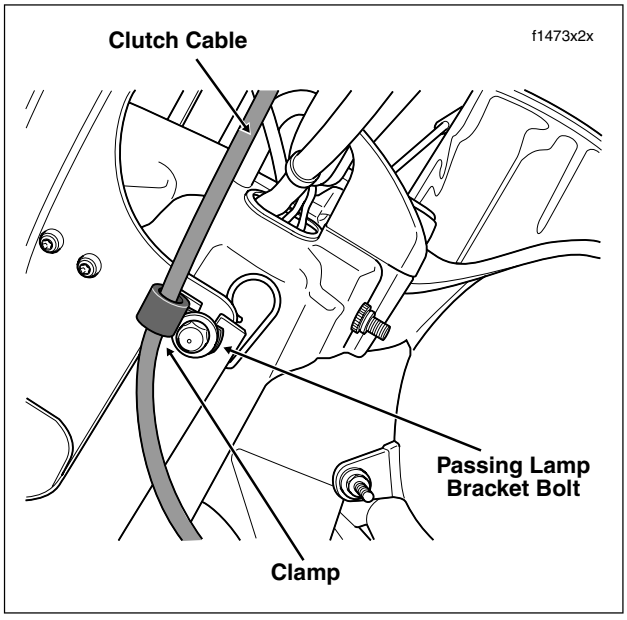



**Figure 2-105. Clutch Cable Routing - FLHR/C (Left Side View)**

5. See Figure 2-103. Install clutch cable fitting into clutch release cover. Replace cable fitting O-ring if damaged or deformed. Do not tighten cable fitting at this time.
6. Place outer ramp in clutch release cover recess with tang in cover slot.
7. Apply a multi-purpose grease to the balls and outer ramp sockets. Place a ball in each of three outer ramp sockets.
8. Hold coupling with button facing outboard. Place cable end in recess of coupling. With ball sockets facing outboard, place hook of inner ramp on button of couplng. Holding inner ramp and coupling together, turn the assembly over.
9. Place inner ramp (ball socket side down) over balls in outer ramp sockets.

**⚠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.**

10. Install the retaining ring so that the opening is to the right of the outer ramp tang slot in the clutch release cover.
11. Verify that the two locating dowels are in place on the right side of the transmission case. Hang a **new** gasket on the dowels.
12. Holding the clutch release cover in position, install six socket head screws. Tighten screws to 10-12 ft-lbs (14-16 Nm).
13. Tighten clutch cable fitting to 3-5 ft-lbs (4-7 Nm).
14. Check the O-ring on the transmission drain plug for tears, cuts or general deterioration. Replace as necessary.

**CAUTION**

**Do not overtighten filler plugs or drain plugs. Overtightening plugs can cause leaks.**

15. Install transmission the drain plug. Tighten the plug to 14-21 ft-lbs (19-28 Nm).
16. Remove the filler plug from the clutch release cover, if installed. See Figure 2-106 and Figure 2-107. Check the O-ring for tears, cuts or general deterioration. Replace as necessary.
17. Fill the transmission with 20-24 oz. (590-710 ml) of transmission lubricant or until the lubricant level on the dipstick of the filler plug is at the F(ULL) mark with the motorcycle in a level, upright position and the filler plug resting on the threads. Use only Harley-Davidson TRANSMISSION LUBRICANT, Part No. 99892-84 (quart) or Part No. 99891-84 (gallon).

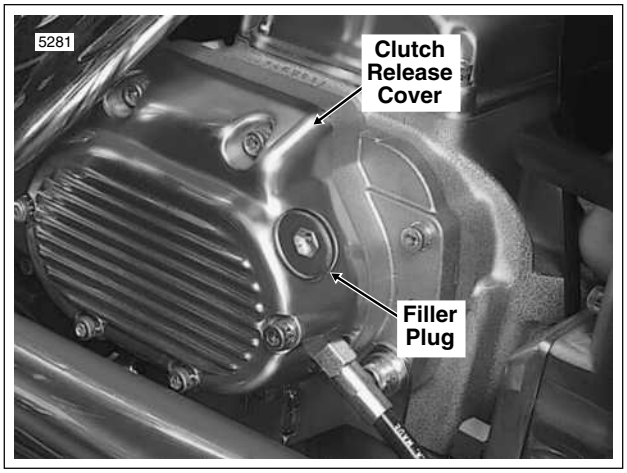



**Figure 2-106. Transmission Case (Right Side)**

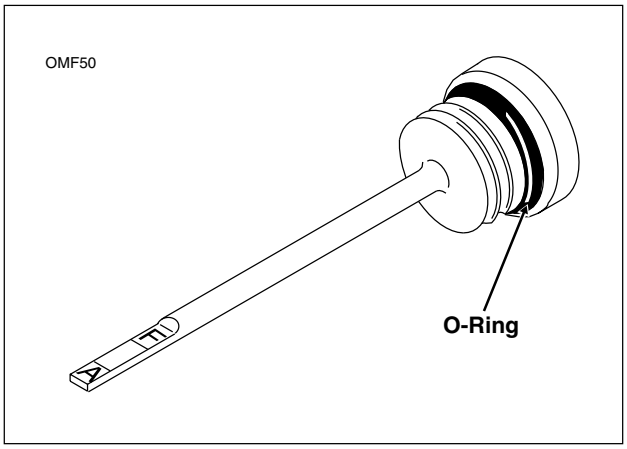



**Figure 2-107. Transmission Lubricant Filler Plug/Dipstick**

18. Install the transmission filler plug/dipstick in the clutch release cover. Tighten the plug to 25-75 **in-lbs** (2.8-8.5 Nm).
19. Adjust the clutch cable. See Section 6.3 CLUTCH, ADJUSTMENT.
20. Install right side exhaust piping. See Section 2.32 EXHAUST SYSTEM, INSTALLATION.
21. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
22. Install seat. See Section 2.21 SEAT, INSTALLATION.

## FLHT

### Removal

1. Remove Phillips screw to detach seat mounting bracket from top of rear fender.
2. Push seat rearward to free tongue at front of seat from slot in frame backbone. See Figure 2-108.
3. Remove seat from frame.

### Installation

1. Place seat on frame backbone.
2. Firmly push front of seat downward and rearward until tongue engages slot in frame backbone. See Figure 2-108.
3. Push seat forward until rear fender seat retention nut is centered in hole of mounting bracket. Install Phillips screw.

*NOTE*

*If seat retention nut is damaged or lost, see SEAT RETENTION NUT REPLACEMENT for instructions.*

**⚠WARNING**

**Pull up on seat to verify that it is properly secured, front and rear. A loose seat may shift during vehicle operation and startle the rider, possibly causing loss of vehicle control resulting in death or serious injury.**

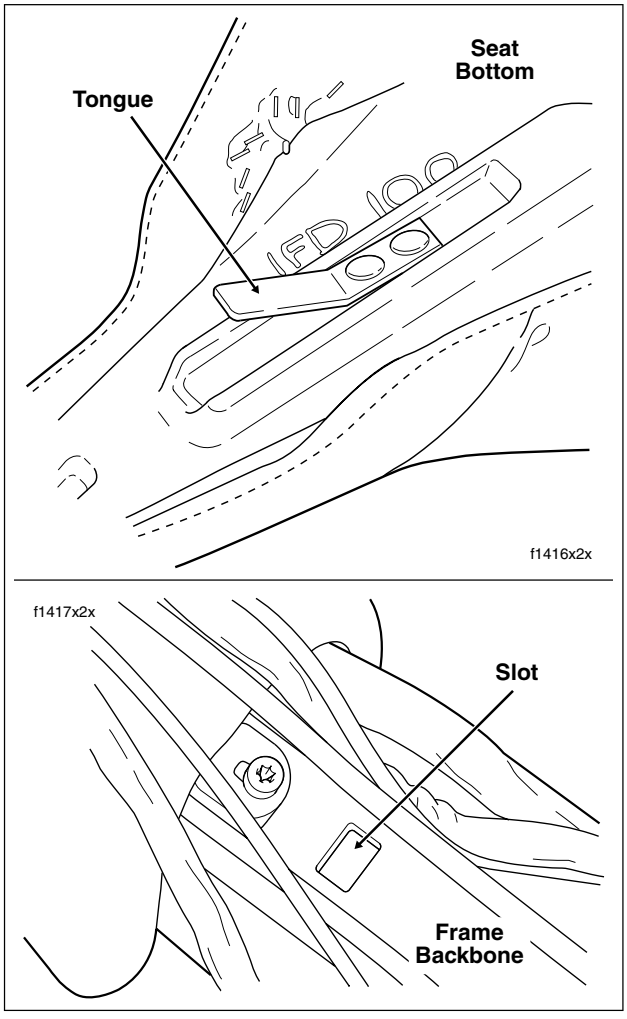



**Figure 2-108. Seat Mounting**

## FLHTC/U

### Removal

1. Open Tour-Pak to move passenger seat backrest out of the way.

*NOTE*

*The Tour-Pak must be positioned to the rear to gain access to the seat mounting bracket screw. If the Tour-Pak is in the forward position, remove Tour-Pak and install in rearward position. See Section 2.23 TOUR-PAK, REMOVAL.*

2. Remove Phillips screw to detach seat mounting bracket from top of rear fender.
3. To protect finish of Tour-Pak, cover rear seat mounting bracket with palm of hand.
4. While pushing seat forward, raise rear of seat until bracket clears top of Tour-Pak. Push seat rearward slightly to free tongue at front of seat from slot in frame backbone. See Figure 2-108.
5. Remove seat from frame.

### Installation

1. Place seat on frame backbone.
2. To protect finish of Tour-Pak, cover rear seat mounting bracket with palm of hand.
3. While raising rear of seat approximately 3 inches, use other hand to firmly push front of seat downward and rearward until tongue engages slot in frame backbone. See Figure 2-108.

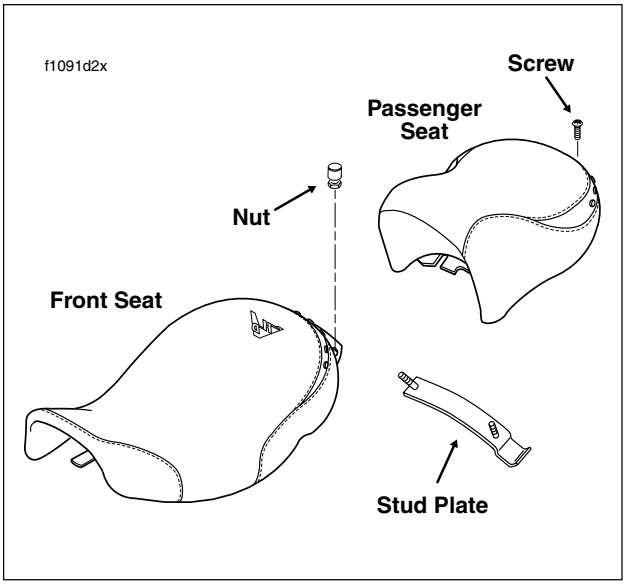



**Figure 2-109. Seat Assembly - FLHR**

4. Push seat forward until rear fender seat retention nut is centered in hole of mounting bracket. Install Phillips screw.

*NOTE*

*If seat retention nut is damaged or lost, see SEAT RETENTION NUT REPLACEMENT for instructions.*

**⚠WARNING**

**Pull up on seat to verify that it is properly secured, front and rear. A loose seat may shift during vehicle operation and startle the rider, possibly causing loss of vehicle control resulting in death or serious injury.**

# FLHR

## Removal

1. Remove Phillips screw to detach passenger seat mounting bracket from top of rear fender. See Figure 2-109. Slightly lift up back of passenger seat and carefully slide toward rear of vehicle to detach from front seat mounting bracket nuts.

*NOTE*

*The FLHR seat can be converted to a solo seat by removal of the passenger section. When the solo seat configuration is desired, turn the passenger seat upside down and locate the chrome plug pressed into the seat frame hole. See Figure 2-110. Remove the plug and press into the seat retention nut hole using finger pressure only.*

2. Using the 5/8 hex, remove two nuts from studs to free front seat mounting bracket from rear fender.
3. Push front seat rearward to free tongue from slot in frame backbone. See Figure 2-108.

## Installation

1. Position front seat on frame with mounting bracket at rear.
2. Firmly push front of seat downward and rearward until tongue engages slot in frame backbone. See Figure 2-108. Push seat forward until studs are centered in slots of mounting bracket.
3. Using the 5/8 hex, install two nuts on studs to secure front seat mounting bracket to rear fender.
4. Install passenger seat fitting slots on passenger seat front mounting bracket between rounded caps and hex of front seat mounting bracket nuts.
5. Push passenger seat forward until rear fender seat retention nut is centered in hole of rear mounting bracket. Install Phillips screw.

*NOTE*

*If seat retention nut is damaged or lost, see SEAT RETENTION NUT REPLACEMENT for instructions.*

**⚠WARNING**

**Pull up on seat to verify that it is properly secured, front and rear. A loose seat may shift during vehicle operation and startle the rider, possibly causing loss of vehicle control resulting in death or serious injury.**

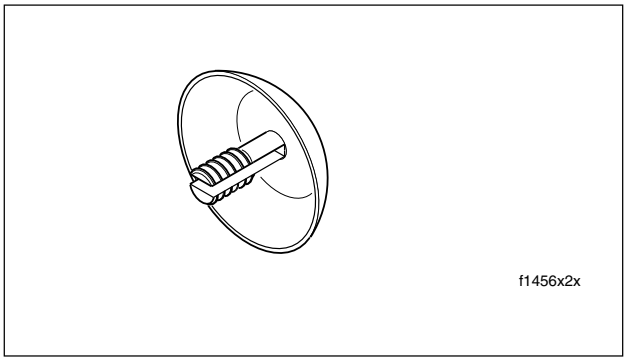



**Figure 2-110. Passenger Seat Retention Nut Plug - FLHR**

# FLHRC

## Removal

1. Remove right side saddlebag. See Section 2.22 SADDLEBAG, REMOVAL.
2. Remove bolt (with flat washer) to remove passenger seat strap and saddlebag front mounting bracket from chrome frame tube cover.
3. Using slots in seat, carefully pull passenger seat strap from seat. See Figure 2-111.
4. Remove Phillips screw to detach seat mounting bracket from top of rear fender.
5. Push seat rearward to free tongue at front of seat from slot in frame backbone. See Figure 2-108.
6. Remove seat from frame.

## Installation

1. Place seat on frame backbone.
2. Firmly push front of seat downward and rearward until tongue engages slot in frame backbone. See Figure 2-108.
3. Push seat forward until rear fender seat retention nut is centered in hole of mounting bracket. Install Phillips screw.

*NOTE*

*If seat retention nut is damaged or lost, see SEAT RETENTION NUT REPLACEMENT for instructions.*

**⚠WARNING**

**Pull up on seat to verify that it is properly secured, front and rear. A loose seat may shift during vehicle operation and startle the rider, possibly causing loss of vehicle control resulting in death or serious injury.**

4. Using slots in seat, route free end of passenger seat strap to right side of vehicle. See Figure 2-111.
5. Insert bolt with flat washer through passenger seat strap and slotted hole of saddlebag front mounting bracket. Insert bolt into forward hole in chrome frame tube cover. Snug saddlebag front mounting bracket bolt, but do not tighten.
6. Install right side saddlebag. See Section 2.22 SADDLEBAG, INSTALLATION.
7. Using an open end/box wrench, tighten saddlebag front mounting bracket bolt.

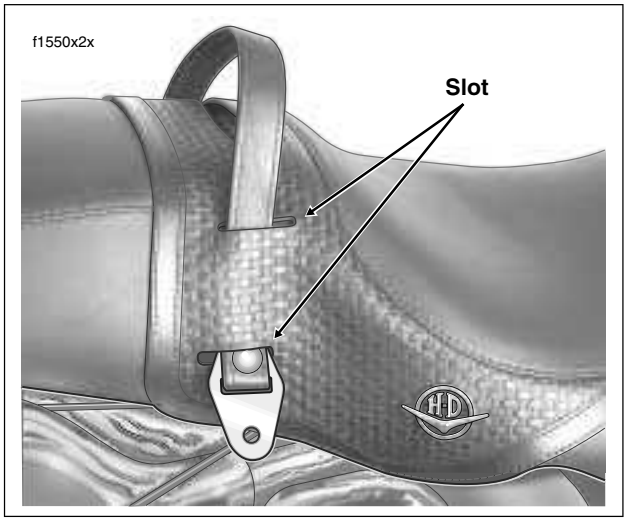



**Figure 2-111. Route Passenger Seat Strap Through Slots in Seat - FLHRC**

# FLTR

## Removal

**CAUTION**

**Removing seat without first removing passenger seat strap will result in damage to rear fender paint.**

1. Remove right side saddlebag. See Section 2.22 SADDLEBAG, REMOVAL.
2. Remove bolt (with flat washer) to remove passenger seat strap and saddlebag front mounting bracket from chrome frame tube cover. Draw free end of passenger seat strap to left side of vehicle.
3. Remove Phillips screw to detach seat mounting bracket from top of rear fender.
4. Push seat rearward to free tongue at front of seat from slot in frame backbone. See Figure 2-108.
5. Remove seat from frame.

## Installation

1. Place seat on frame backbone.
2. Firmly push front of seat downward and rearward until tongue engages slot in frame backbone. See Figure 2-108.
3. Push seat forward until rear fender seat retention nut is centered in hole of mounting bracket. Install Phillips screw.

*NOTE*

*If seat retention nut is damaged or lost, see SEAT RETENTION NUT REPLACEMENT for instructions.*

**⚠WARNING**

**Pull up on seat to verify that it is properly secured, front and rear. A loose seat may shift during vehicle operation and startle the rider, possibly causing loss of vehicle control resulting in death or serious injury.**

4. Draw free end of passenger seat strap to right side of vehicle. Insert bolt with flat washer through passenger seat strap and slotted hole of saddlebag front mounting bracket. Insert bolt into forward hole in chrome frame tube cover. Snug saddlebag front mounting bracket bolt, but do not tighten.
5. Install right side saddlebag. See Section 2.22 SADDLEBAG, INSTALLATION.
6. Using an open end/box wrench, tighten saddlebag front mounting bracket bolt.

## SEAT RETENTION NUT REPLACEMENT

1. Slide retention nut over tapered end of cable strap so that larger OD of nut rests on cable strap eyelet. From bottom of rear fender, feed cable strap up through fender hole.
2. See Figure 2-112. With tab on retention nut seated in notch of fender hole, pull up on cable strap to hold nut snug against underside of rear fender. From the side opposite the tab, slide on the retention washer to lock the position of the retention nut. Remove cable strap.

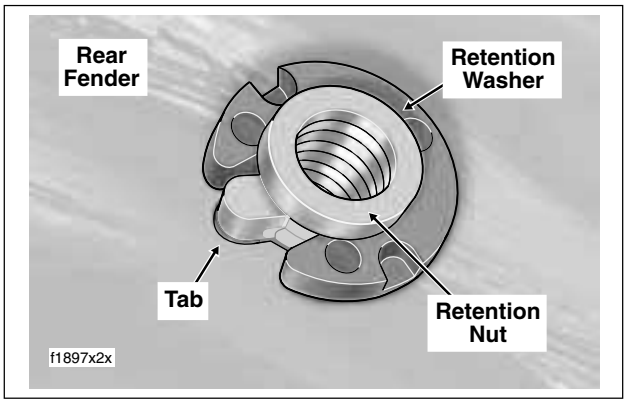



**Figure 2-112. Seat Retention Nut and Washer**

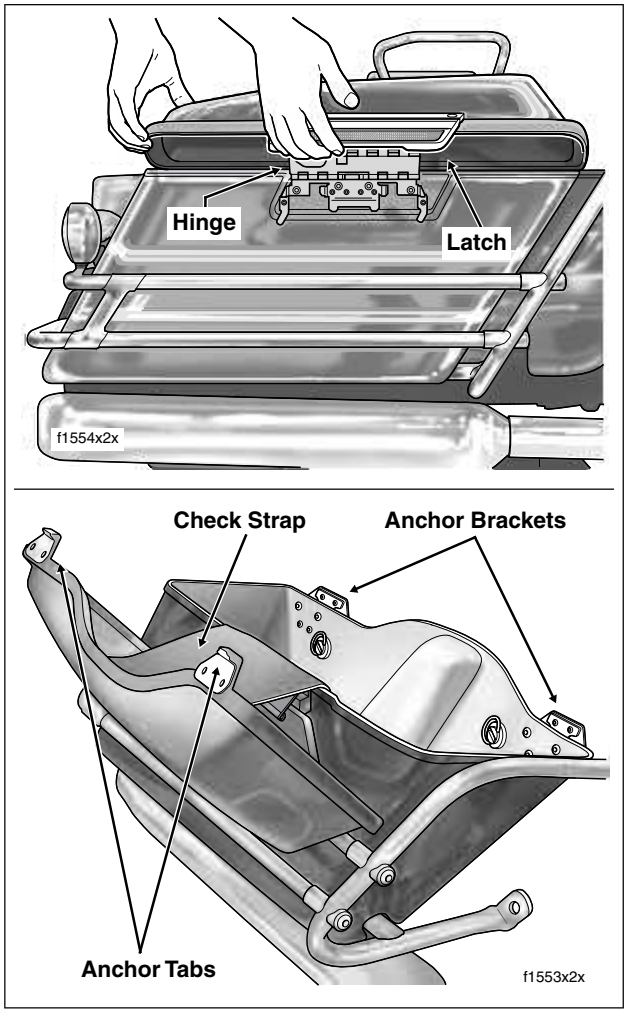



**Figure 2-113. Open Saddlebag (FLHT/C/U, FLTR, FLHR)**

*NOTE*

*Maximum recommended load for each saddlebag is 15 lbs.*

## OPENING

1. Use key to unlock lid latch.
2. Pull bottom of latch outward and then lift upward raising outboard corners of saddlebag lid. See upper frame of Figure 2-113.
3. With top of lid tilted toward motorcycle, carefully lift inboard side of lid upward disengaging front and rear anchor tabs from anchor brackets.

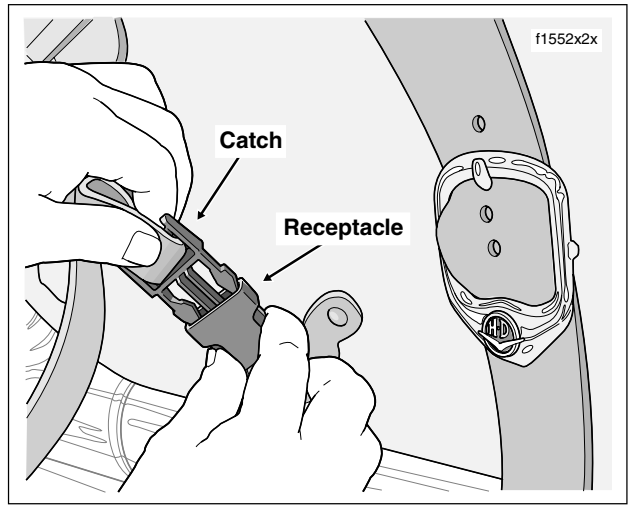



**Figure 2-114. Release Catch to Open Saddlebag (FLHRC)**

4. Pivot lid on latch hinge to open. A nylon check strap suspends the lid in the open position. See lower frame of Figure 2-113.

*NOTE*

*On FLHRC models, simply raise the decorative buckle and press tabs on both sides of catch to release from receptacle. See Figure 2-114. Rotate hinge on outboard side of saddlebag to open and close lid.*

## CLOSING

1. Rotate lid to closed position engaging both anchor tabs with bottom of anchor brackets. Press bottom of latch inward until it snaps closed.

*NOTE*

*On FLHRC models, close lid of saddlebag and insert catches into their respective receptacles until the catch tabs "click."*

2. Use key to lock lid latch.

## REMOVAL

1. Open lid of saddlebag.
2. Grasp bail wire inside saddlebag and rotate each stud a full 1/4 turn in a counter-clockwise direction. Remove bail head studs with flat washers. See Figure 2-115.

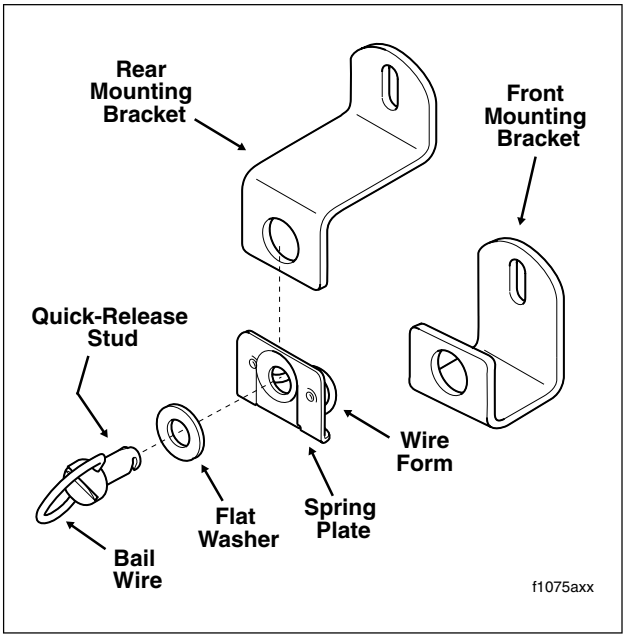



**Figure 2-115. Saddlebag Quick-Release Fasteners**

*NOTE*

*On some HDI vehicles, the bail wire has been removed from the quick release stud. In these cases, turn the stud by engaging the slotted end with a large screwdriver.*

3. Remove saddlebag.

## INSTALLATION

1. Position saddlebag on vehicle.
2. Place flat washers on bail head studs.
3. With groove at end of stud held in a horizontal position, insert stud through holes in saddlebag and front mounting bracket. When groove engages wire form of spring plate on inboard side of bracket, turn stud clockwise a full 1/4 turn until it snaps in place. Install rear bail head stud in the same manner.

*NOTE*

*On some HDI vehicles, the bail wire has been removed from the quick release stud. In these cases, turn the stud by engaging the slotted end with a large screwdriver.*

*NOTE*

*Molded rubber insert at bottom of saddlebag must fit snugly on lower saddlebag support rail. If saddlebag is not fully seated, use an open end/box wrench to loosen bolts securing mounting brackets to saddlebag support and frame. See Figure 2-116. Retighten bolts after seating saddlebag on support rail.*

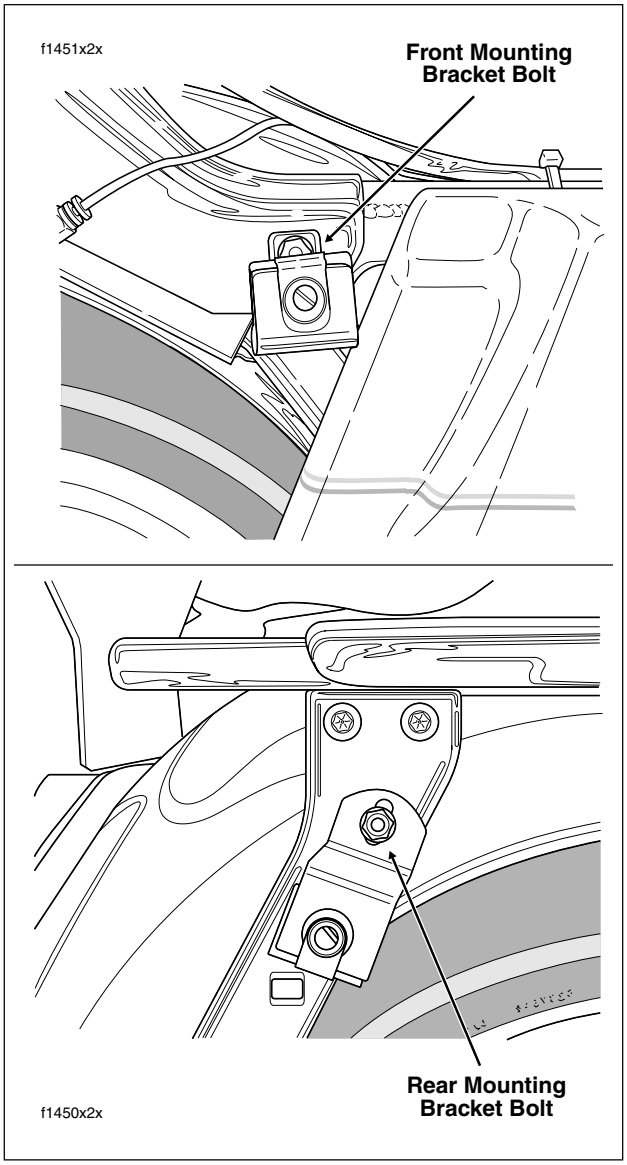
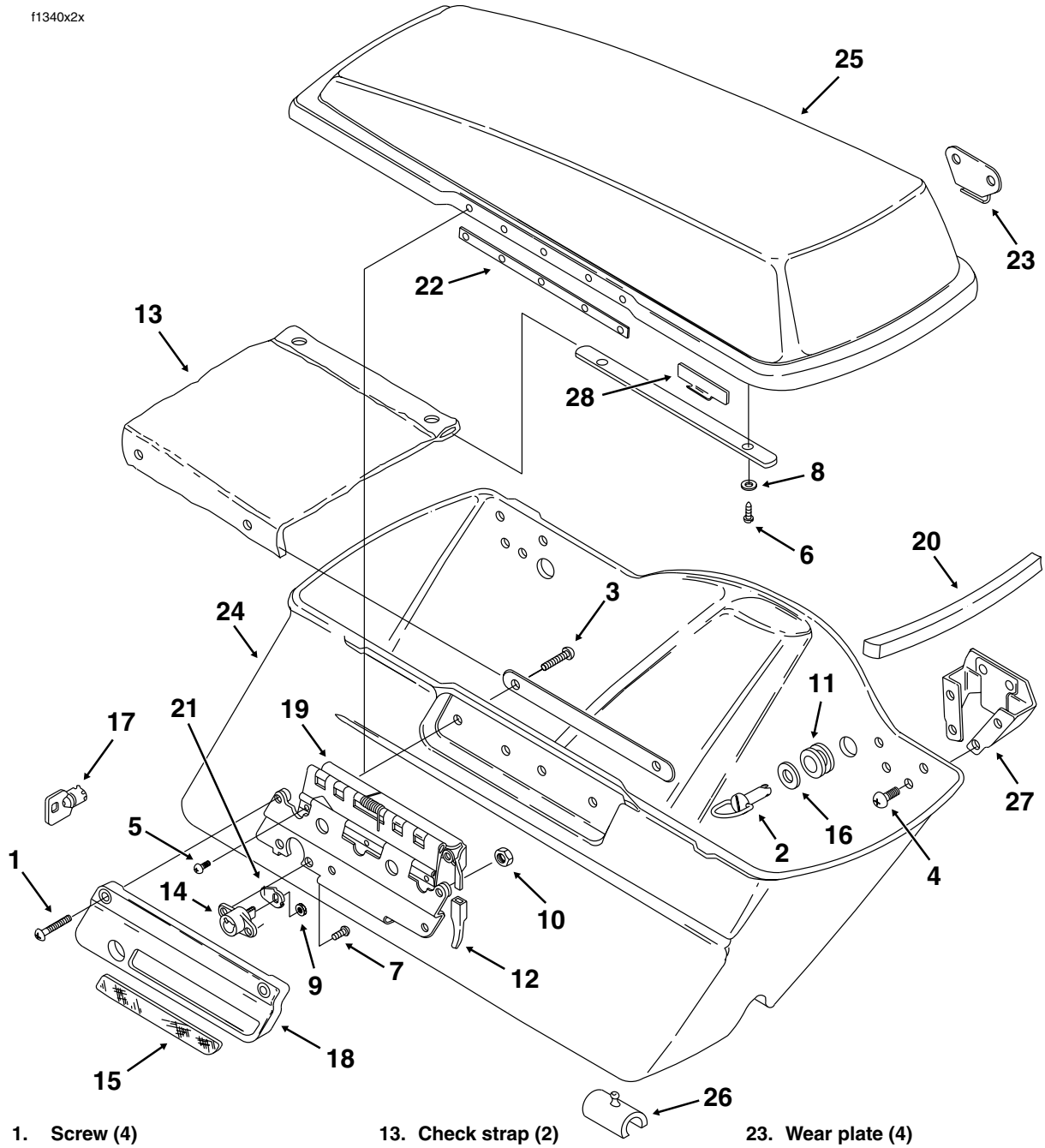



**Figure 2-116. Saddlebag Mounting Bracket Bolts (Right Side View)**

## INSPECTION AND REPAIR

If latch is inoperative or saddlebag or components are worn or damaged, disassemble and replace components as needed. See Figure 2-117.




1. Screw (4)
2. Quick Release Stud (4)
3. Screw (8)
4. Screw (16)
5. Screw (10)
6. Screw (4)
7. Screw (4)
8. Washer (8)
9. Nut (2)
10. Nut (4)
11. Grommet (4)
12. Rub bar left (plastic) (2)
    Rub bar right (plastic) (2)
13. Check strap (2)
14. Lock (2)
15. Reflector, red, right
    Reflector, red, left
16. Washer (4)
17. Key
18. Face plate, right
    Face plate, left
19. Latch, right
    Latch, left
20. Gasket, cover (2)
21. Cam hook (2)
22. Backing plate (2)
23. Wear plate (4)
24. Saddlebag bottom, right
    Saddlebag bottom, left
25. Saddlebag cover, right
    Saddlebag cover, left
26. Cushion (4)
27. Mounting bracket (4)
28. Wear tab (4)
29. Liner, saddlebag (2)
    (not shown)

* Quantities are for two saddlebags.

**Figure 2-117. Saddlebag (Exploded View)**

*NOTE*

*For instructions covering riveted components, such as hinges and catches, refer to the Instruction Sheet included with the RIVET TOOL, HD-39787.*

## FLHTC

### REMOVAL

1. Open Tour-Pak. Remove rubber mat.
2. Rotate knurled lock ring in a counter-clockwise direction to separate pin and socket halves of Radio antenna cable connector. Release cable from two clips at bottom of Tour-Pak.
3. Pull Tour-Pak lights connector [12], 3-place Multilock, from cavity inside Tour-Pak. Depress button and separate pin and socket halves. See Figure 2-118.
4. Pull grommet into Tour-Pak and remove from main harness conduit.
5. Feed main harness conduit and connectors through hole in Tour-Pak. See Figure 2-119.
6. Holding nylon cap locknuts at bottom of Tour-Pak, remove five bolts (with flat washers) to release Tour-Pak from luggage rack. Luggage rack spacers will become free as nuts are removed. Be sure to have a firm grasp on the Tour-Pak as the last bolt is removed. See Figure 2-120.

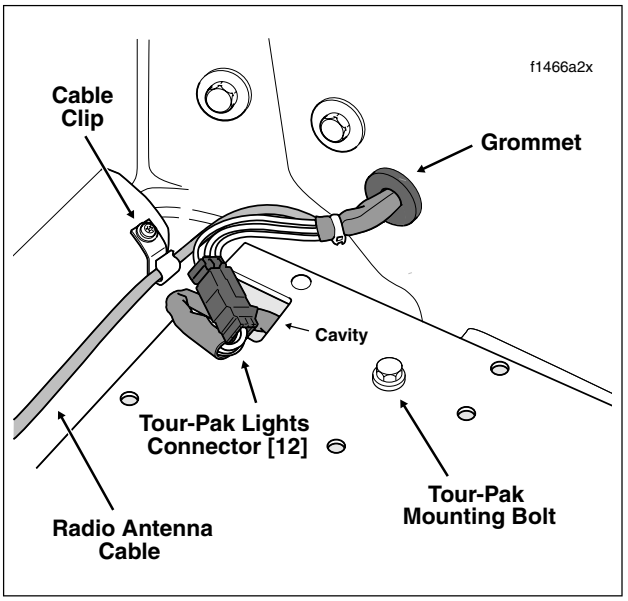



**Figure 2-118. Disconnect Tour-Pak Lights Connector**

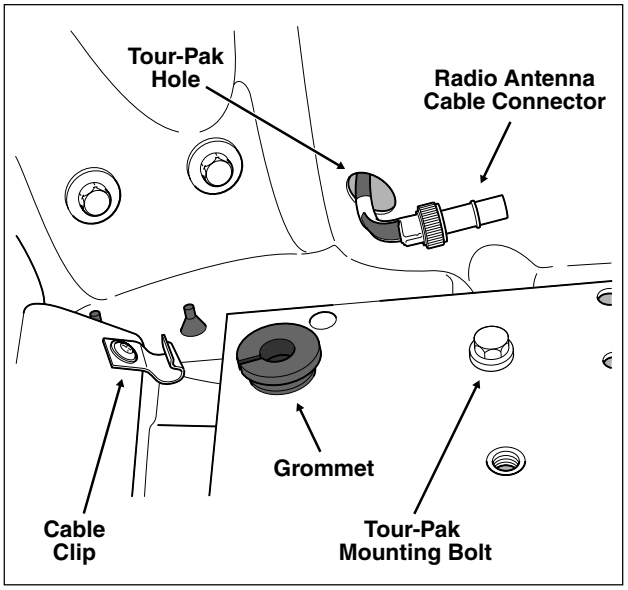



**Figure 2-119. Feed Main Harness Thru Tour-Pak Hole**

### INSTALLATION

1. Place Tour-Pak on luggage rack and open lid.
2. Align rear center hole in Tour-Pak with same hole in luggage rack. Slide 2 inch bolt (with flat washer) through ring terminal of radio antenna ground, and then through Tour-Pak and luggage rack holes. At bottom of luggage rack, install spacer (concave side up) and nylon cap locknut on bolt. With concavity on spacer inline with the rail, hold nut and tighten bolt until snug.

**CAUTION**

**Always install the mounting bolts from inside the Tour-Pak. If the bolts are installed upside down, then the ends of the bolts can tear the molded liner and scratch objects, such as helmets, stored inside the Tour-Pak.**

3. Install remaining 2 inch bolts (with flat washers and nylon cap locknuts) in two front Tour-Pak and luggage rack holes (one each side) in the manner described under step 2 above.
4. Position two spacers between bottom of luggage rack and tabs of license plate bracket. Slide 2-1/4 inch bolts (with flat washers) through two center holes in Tour-Pak and luggage rack, and then through spacers and tabs of license plate bracket. If necessary, loosen two hex bolts at back of license plate bracket to align holes in tabs with bolts. Install flat washers and nylon cap locknuts on bolts and tighten until snug. See inset of Figure 2-120.

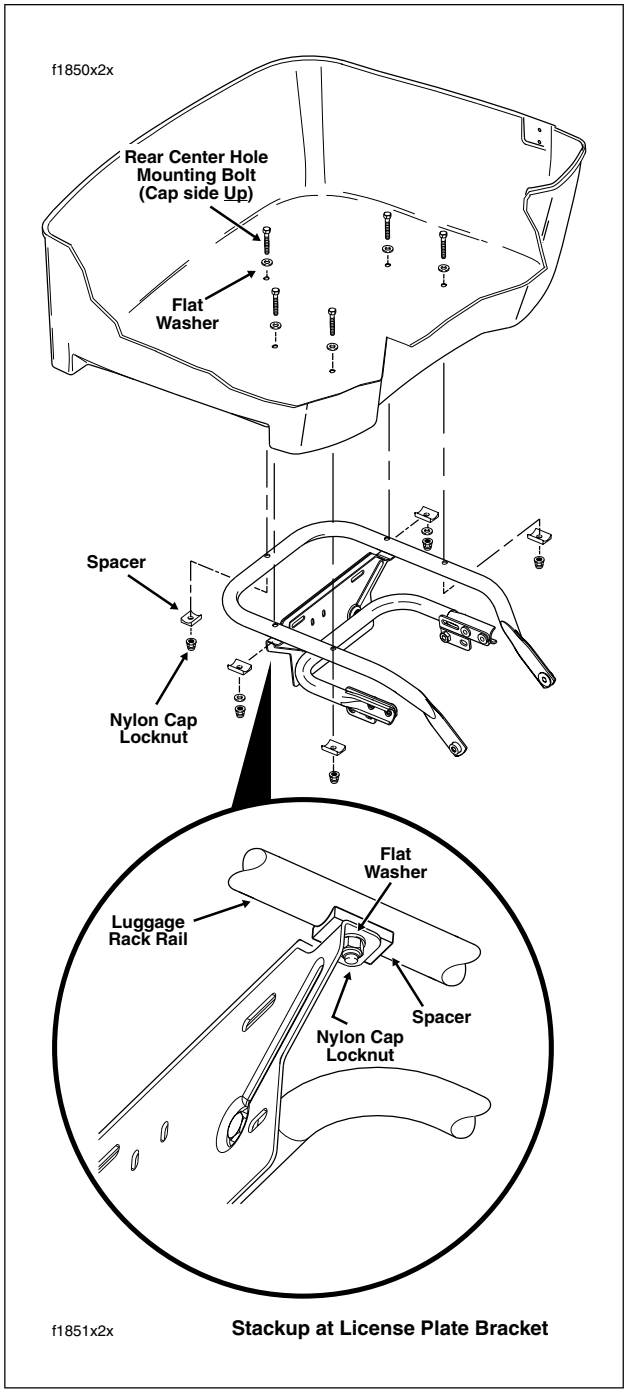



**Figure 2-120. Install Tour-Pak Mounting Bolts**

5. In a crosswise pattern, alternately tighten five bolts to 96-120 **in-lbs** (10.8-13.5 Nm). Be sure that concavity on each spacer is inline with the rail and has not rotated out of position.

6. Standing on left side of vehicle, feed socket connectors and main harness conduit through hole in Tour-pak. Capture conduit in grommet. Install grommet in hole with the larger OD facing inside.

7. Mate pin and socket halves of Tour-pak lights connector [12], 3-place Multilock, and tuck into cavity inside Tour-Pak. See Figure 2-118.

8. Rotate knurled lock ring in a clockwise direction to mate pin and socket halves of Radio antenna cable con-nector. Capture cable in two clips at bottom of Tour-Pak.

9. Install rubber mat. Close Tour-Pak.

# FLHTCU

## REMOVAL

1. Open Tour-Pak. Open map pocket and remove acorn nuts (with flat washers). Remove map pocket and molded liner from Tour-Pak.

2. Depress external latch and rotate housing to release bulb socket from left side of Tour-Pak.

3. Rotate knurled lock ring in a counterclockwise direction to separate pin and socket halves of Radio antenna cable connector. Release cable from two clips at bottom of Tour-Pak.

4. Pull Tour-Pak lights connector [12], 3-place Multilock, from cavity inside Tour-Pak. Depress button and separate pin and socket halves. See Figure 2-118.

5. Pull grommet into Tour-Pak and remove from main harness conduit.

6. Feed main harness conduit and connectors through hole in Tour-Pak. See Figure 2-119.

7. Release rear headset receptacle from bracket at bottom of left side speaker box.

8. Remove trim ring and gently pull on wire harness to draw 6-place Mini-Deutsch connector out of left side speaker box. Depress external latch and use a rocking motion to separate pin and socket halves.

9. Moving to right side of vehicle, disconnect 1-place CB antenna cable connector. Release cable from two clips at bottom of Tour-Pak. See Figure 2-121.

10. Pull right side grommet into Tour-Pak and remove from CB antenna cable. Feed CB antenna cable through hole in Tour-Pak.

11. Remove trim ring and gently pull on wire harness to draw 6-place Mini-Deutsch connector out of right side speaker box. Depress external latch and use a rocking motion to separate pin and socket halves.

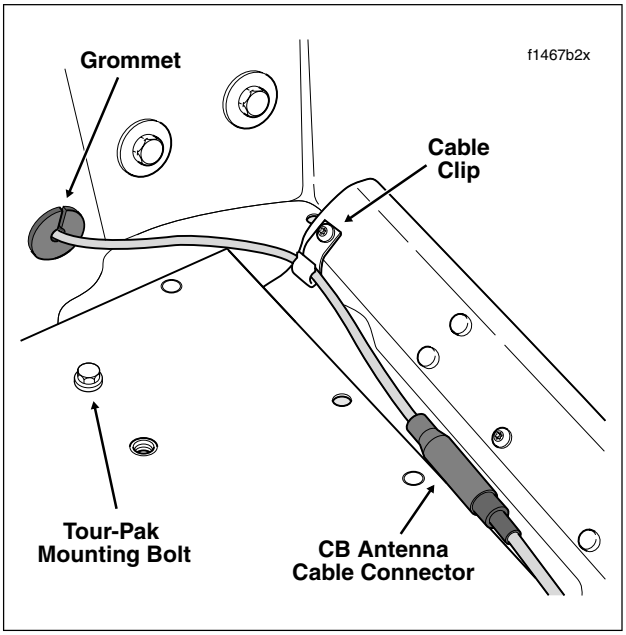



**Figure 2-121. Disconnect CB Antenna Cable Connector**

12. Holding nylon cap locknuts at bottom of Tour-Pak, remove five bolts (with flat washers) to release Tour-Pak from luggage rack. Luggage rack spacers will become free as nuts are removed. Be sure to have a firm grasp on the Tour-Pak as the last bolt is removed. See Figure 2-120.

## INSTALLATION

1. Place Tour-Pak on luggage rack and open lid.
2. Align rear center hole in Tour-Pak with same hole in luggage rack. Slide 2 inch bolt (with flat washer) through ring terminal of radio antenna ground, and then through Tour-Pak and luggage rack holes. At bottom of luggage rack, install spacer (concave side up) and nylon cap locknut on bolt. With concavity on spacer inline with the rail, hold nut and tighten bolt until snug.

**CAUTION**

**Always install the mounting bolts from inside the Tour-Pak. If the bolts are installed upside down, then the ends of the bolts can tear the molded liner and scratch objects, such as helmets, stored inside the Tour-Pak.**

3. Install remaining 2 inch bolts (with flat washers and nylon cap locknuts) in two front Tour-Pak and luggage rack holes (one each side) in the manner described under step 2 above.
4. Position two spacers between bottom of luggage rack and tabs of license plate bracket. Slide 2-1/4 inch bolts (with flat washers) through two center holes in Tour-Pak and luggage rack, and then through spacers and tabs of license plate bracket. If necessary, loosen two hex bolts at back of license plate bracket to align holes in tabs with bolts. Install flat washers and nylon cap locknuts on bolts and tighten until snug. See inset of Figure 2-120.
5. In a crosswise pattern, alternately tighten five bolts to 96-120 **in-lbs** (10.8-13.5 Nm). Be sure that concavity on each spacer is inline with the rail and has not rotated out of position.
6. On right side of vehicle, mate pin and socket halves of 6-place Mini-Deutsch connector. Feed connector back up into right side speaker box pressing trim ring into hole.
7. Pass CB antenna cable through hole in Tour-Pak. Capture cable in grommet. Install grommet in hole with the larger OD facing inside.
8. Mate pin and socket halves of 1-place CB antenna cable connector. Capture cable in two clips at bottom of Tour-Pak. See Figure 2-121.
9. Moving to left side of vehicle, mate pin and socket halves of 6-place Mini-Deutsch connector. Feed connector back up into left side speaker box pressing trim ring into hole.
10. Capture rear headset receptacle in bracket at bottom of left side speaker box.
11. Feed socket connectors and main harness conduit through hole in Tour-pak. Capture conduit in grommet. Install grommet in hole with the larger OD facing inside.
12. Mate pin and socket halves of Tour-pak lights connector [12], 3-place Multilock, and tuck into cavity inside Tour-Pak. See Figure 2-118.
13. Rotate knurled lock ring in a clockwise direction to mate pin and socket halves of Radio antenna cable connector. Capture cable in two clips at bottom of Tour-Pak.
14. Install bulb socket on left side of Tour-pak.
15. Install molded liner in Tour-Pak. Install map pocket and secure using acorn nuts (with flat washers). Close Tour-Pak.

## SIDE MARKER LIGHTS FLHTC/U

*NOTE*

*All domestic model Tour-Paks are equipped with side marker lights. Ultra models also have a wrap-around rear light assembly that contains two 2-filament lamps. One filament is a supplemental brake light and the other a supplemental tail lamp.*

### BULB/LENSE REPLACEMENT

1. Open Tour-Pak.
2. On Ultra models, open map pocket and remove acorn nuts (with flat washers). Remove map pocket and molded liner from Tour-Pak.
3. Remove three T15 TORX screws to release lens at side of Tour-Pak.
4. Using the blade of an X-Acto knife or small screwdriver, gently pry up three eyelets on inboard side of mounting bracket. See Figure 2-122. Remove eyelets and then remove mounting bracket from lense. Discard eyelets if damaged.
5. Remove bulb from socket and discard. Install **new** bulb in socket.
6. Align holes in mounting bracket with those in lense. Push three eyelets through mounting bracket holes into bosses of lense. Use **new** eyelets if damaged.
7. Place lense assembly into position at side of Tour-Pak, but exercise caution to avoid pinching or kinking wires. Note that center rib on inboard side of lense has a stepped area for routing of the top wire. See Figure 2-122.
8. From inside Tour-Pak, install three T15 TORX screws.
9. On Ultra models, install molded liner in Tour-Pak. Install map pocket and secure using acorn nuts (with flat washers).
10. Close Tour-Pak.

### REMOVAL

1. Remove Tour-Pak. See Section 2.23 TOUR-PAK, REMOVAL, either FLHTC or FLHTCU. Move Tour-Pak to bench area.
2. Open Tour-Pak. Holding Phillips screw inside Tour-Pak (rear right corner), remove flange nut at bottom to release loading coil bracket. Remove Phillips screw with external tooth lockwasher.

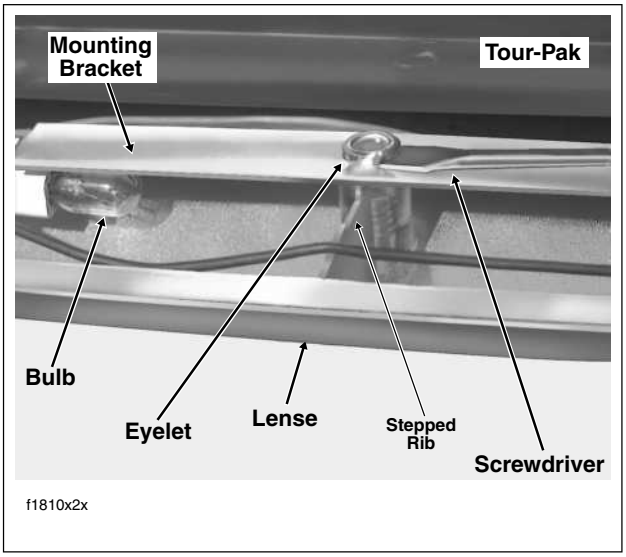



**Figure 2-122. Remove Eyelets to Release Mounting Bracket From Lense**

3. Close Tour-Pak. Turn Tour-Pak over and remove remaining six flange nuts at bottom.
4. Place Tour-Pak topside up and open lid. Reach inside Tour-Pak and remove metal plate pulling threaded studs from holes at bottom.
5. Locate 2-place Multilock connector in channel at bottom of Tour-Pak. Remove masking tape if necessary. See Figure 2-123.
6. Depress button on socket side of Multilock connector and separate pin and socket halves.
7. Remove three T15 TORX screws to release lens at side of Tour-Pak.
8. Compress grommet at side of Tour-Pak and push through hole to outboard side. Feed conduit and socket through hole to release side marker light assembly.

### INSTALLATION

1. Feed socket and conduit of **new** side marker light assembly through hole at side of Tour-Pak.
2. Compress grommet on conduit and install in hole.
3. Place lense assembly into position at side of Tour-Pak, but exercise caution to avoid pinching or kinking wires. Note that center rib on inboard side of lense has a stepped area for routing of the top wire. See Figure 2-122.

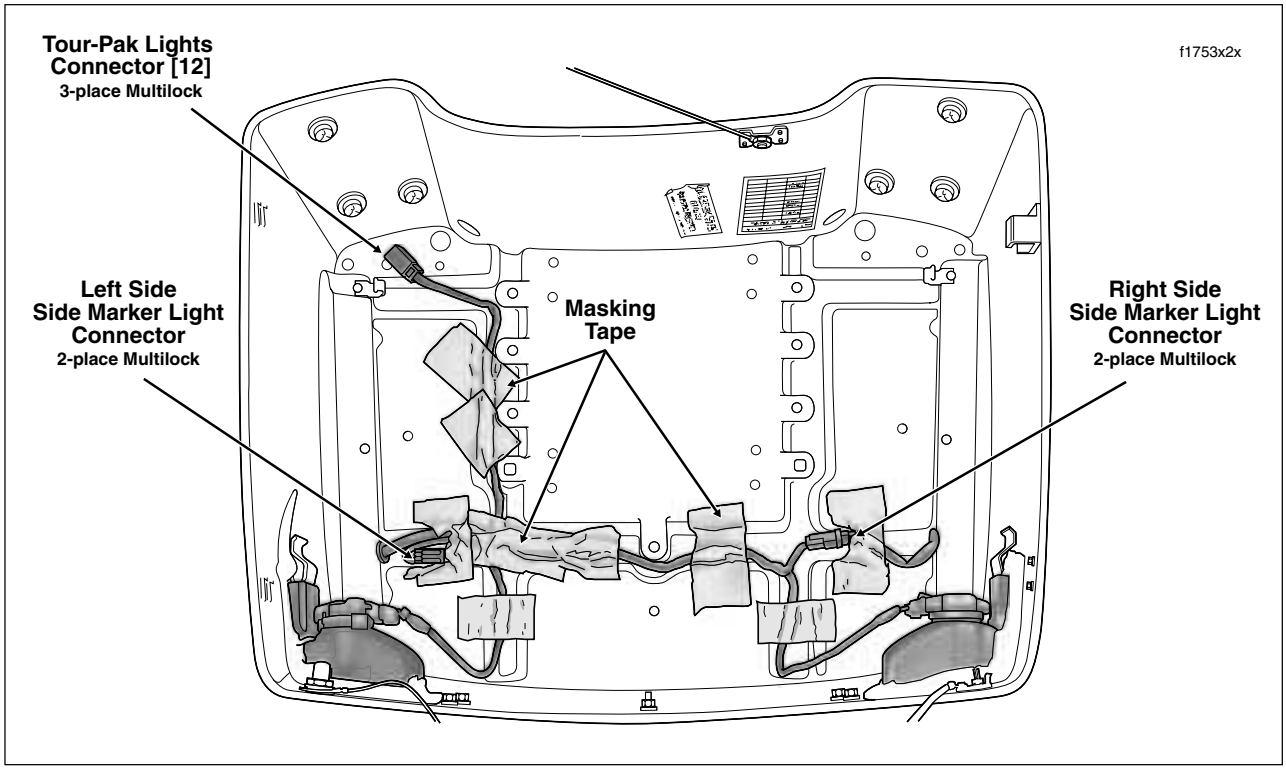



**Figure 2-123. Side Marker Light Connectors and Conduit**

4. From inside Tour-Pak, install three T15 TORX screws.
5. Mate pin and socket halves of 2-place Multilock connector. Be sure that connector and conduit are positioned in channel at bottom of Tour-Pak.

**CAUTION**

**If conduit and connector are not completely captured in channel at bottom of Tour-Pak, installation of metal plate can pinch wires or damage connector.**

6. Place masking tape over channel to secure position of connector and conduit. See Figure 2-123.
7. With the square cut positioned at the front left corner, install metal plate at bottom of Tour-Pak so that threaded studs exit holes at bottom.
8. Place loading coil into position aligning hole in bracket with hole in rear right corner of metal plate. Slide Phillips screw (with external tooth lockwasher) through holes. At bottom of Tour-Pak, install flange nut on Phillips screw.
9. Close lid and turn Tour-Pak over. Install six flange nuts on threaded studs of metal plate.
10. Install Tour-Pak on vehicle. See Section 2.23 TOUR-PAK, INSTALLATION, either FLHTC or FLHTCU.

# WRAP-AROUND LIGHT ASSEMBLY FLHTCU

## BULB REPLACEMENT

1. Open Tour-Pak.
2. Open map pocket and remove acorn nuts (with flat washers). Remove map pocket and molded liner from Tour-Pak.
3. Depress external latch and rotate bulb socket to release from lens.
4. Remove bulb from socket and discard.
5. Install **new** bulb in socket.
6. Rotate bulb socket to install in lens.
7. Install molded liner in Tour-Pak. Install map pocket and secure using acorn nuts (with flat washers).
8. Close Tour-Pak.

## REMOVAL

1. Open Tour-Pak. Open map pocket and remove acorn nuts (with flat washers). Remove map pocket and molded liner from Tour-Pak.

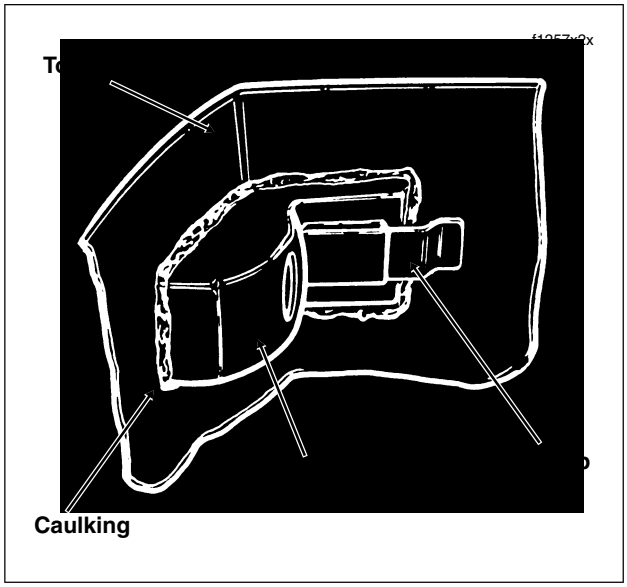



**Figure 2-124. Wrap-Around Light Assembly**

2. Depress external latch and rotate housing to release bulb sockets from both sides of Tour-Pak.
3. Disconnect 1-place CB antenna cable connector on right side of Tour-Pak. Release cable from rear clip at bottom of Tour-Pak.
4. Remove Keps nut, ring terminal and flat washer from loading coil stud.
5. Holding Phillips screw, remove flange nut at bottom of Tour-Pak to release loading coil bracket. Remove Phillips screw (with external tooth lockwasher) and loading coil from vehicle.
6. Using a 2.5 mm allen head wrench, remove loading coil stud. Remove CB antenna mast from lamp housing.
7. On left side of Tour-Pak, rotate knurled lock ring in a counter-clockwise direction to separate pin and socket halves of Radio antenna cable connector. Release cable from rear clip at bottom of Tour-Pak.
8. Remove jam nut from Radio antenna cable connector at back of Tour-Pak. Remove internal tooth lockwasher, ring terminal and large flat washer from connector.
9. Install jam nut back onto connector. Thread a 1/2 in.-20 UNF nut onto connector until contact is made with jam nut. Turn jam nut to in a counter-clockwise direction to remove connector stud from radio antenna mast. Remove mast from lamp housing.
10. Remove caulking from around light bar. Remove four flange nuts and metal clips to free light bar from Tour-Pak. See Figure 2-124.

## INSTALLATION

1. Install light bar, metal clips and flange nuts to secure light bar to Tour-Pak. Inside Tour-Pak, use RTV silicone sealer (Part No. 99710-88) to seal perimeter of light bar. See Figure 2-124.
2. Install radio antenna mast into lamp housing. Thread connector stud into mast. Turn 1/2 in.-20 UNF nut (installed on connector during removal) in a clockwise direction to tighten.
3. Remove 1/2 in.-20 UNF nut and jam nut. Install large flat washer, ring terminal and internal tooth lockwasher onto connector. Reinstall jam nut and tighten.
4. Rotate knurled lock ring in a clockwise direction to mate pin and socket halves of Radio antenna cable con-nec-tor. Capture cable in rear clip at bottom of Tour-Pak.
5. On right side of Tour-Pak, install CB antenna mast into lamp housing. Install stud into mast and tighten with 2.5 mm allen head wrench.
6. Place loading coil into position aligning hole in bracket with hole in rear right corner of Tour-Pak. Slide Phillips screw (with external tooth lockwasher) through holes. At bottom of Tour-Pak, install flange nut on Phillips screw.
7. Install flat washer, ring terminal and Keps nut onto loading coil stud. Tighten Keps nut.
8. Mate pin and socket halves of 1-place CB antenna cable connector. Capture antenna cable in rear clip at bottom of Tour-Pak.
9. Install bulb sockets on both sides of Tour-pak.
10. Install molded liner in Tour-Pak. Install map pocket and secure using acorn nuts. Close Tour-Pak.
11. Install SWR meter. Check SWR following procedure in Section 8 and when the antenna is adjusted, remove the SWR meter and tighten the antenna connector at the transceiver.

# PASSENGER BACKREST FLHTCU

## REMOVAL

1. Open Tour-Pak. Open map pocket and remove acorn nuts (with flat washers). Remove map pocket and molded liner from Tour-Pak.
2. Remove two locknuts and backplate to detach center backrest from Tour-Pak cover. See Figure 2-125.
3. Remove two locknuts and backplate to detach right side backrest from cover.
4. Remove two locknuts to detach left side backrest from cover.
5. Remove backrest.

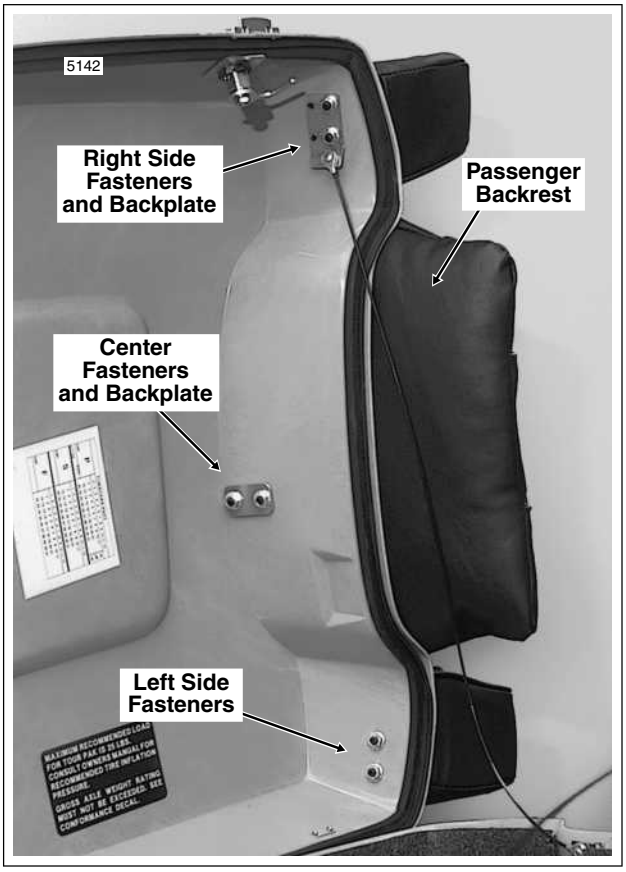



**Figure 2-125. Tour-Pak Cover (Underside)**

## INSTALLATION

1. Position backrest against Tour-Pak cover.
2. From inside Tour-Pak, install two locknuts with backplate to attach center backrest to cover.
3. Install two locknuts and backplate to attach right side backrest to cover.
4. Install two locknuts to attach left side backrest to cover.
5. Install molded liner in Tour-Pak. Install map pocket and secure using acorn nuts (with flat washers). Close Tour-Pak.

# SPEAKER BOX FLHTCU

## REMOVAL

1. Remove trim ring and gently pull on wire harness to draw 6-place Mini-Deutsch connector out of speaker box. Depress external latch and use a rocking motion to separate pin and socket halves.
2. Open Tour-Pak. Open map pocket and remove acorn nuts (with flat washers). Remove map pocket and molded liner from Tour-Pak.
3. Remove three bolts with flat washers to free speaker box from Tour-Pak.

## INSTALLATION

1. Install three bolts with flat washers to secure speaker box to Tour-Pak.
2. Install molded liner in Tour-Pak. Install map pocket and secure using acorn nuts (with flat washers). Close Tour-Pak.
3. Mate pin and socket halves of 6-place Mini-Deutsch connector. Feed connector back up into speaker box pressing trim ring into hole.

## REMOVAL

1. Remove two screws from fairing lower cap. See Figure 2-126.
2. Hold locknut at bottom of fairing lower, and using a T40 TORX drive head, turn inside screw to free assembly from engine guard clamp. Discard rubber washer.
3. Remove two locknuts to free retainer from upper rail of engine guard. From within glove box, remove U-bolt.
4. Remove glove box from fairing lower. Remove fairing lower from vehicle.
5. Repeat steps 1-4 on other side of vehicle.

## INSTALLATION

1. Place fairing lower into position on vehicle. Place glove box into fairing lower.
2. Holding screw inside fairing lower, install **new** rubber washer, clamp and locknut to attach fairing bottom to engine guard. Do not tighten locknut.
3. From within glove box, install U-bolt so that it encircles the upper rail of the engine guard. Loosely install retainer and locknuts.
4. Adjust the fairing lower so that ear at top inboard side is approximately 1/4 inch from frame downtube. Verify that fairing lower is square, and then alternately tighten locknuts to 6 ft-lbs (8 Nm).
5. Hold locknut at bottom of fairing lower, and using a T40 TORX drive head, turn inside screw to fasten assembly to engine guard clamp. Tighten screw to 12 ft-lbs (16 Nm).
6. Install two screws to secure fairing lower cap to fairing lower. Tighten screws to 10-20 **in-lbs** (1.1-2.3 Nm).
7. Repeat steps 1-6 on other side of vehicle.

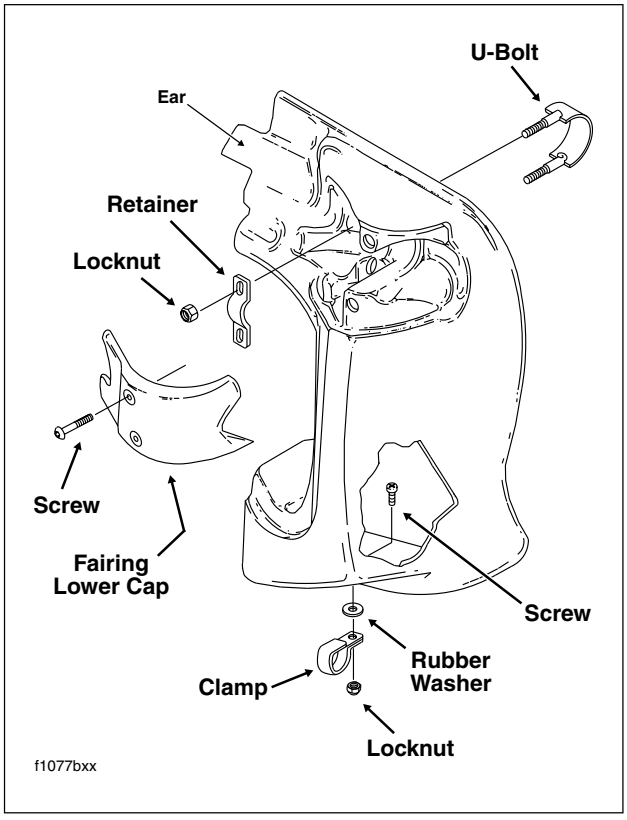



**Figure 2-126. Fairing Lower (Right Side) - FLHTCU**

## OUTER FAIRING/WINDSHIELD

### REMOVAL

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠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.**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. Remove the outer fairing as follows:
   a. Standing at the front of the vehicle, use a T27 TORX drive head to remove the three outer fairing screws (with flat washers) just below the wind-shield. See Figure 2-127.
   b. Moving to the inner fairing side, use a T25 TORX drive head to remove the two fairing screws just above the wind deflectors on the left and right side.
   c. Turn the handlebar to the right and remove the outer fairing screw reaching in below the fairing cap. Turn the handlebar to the left and remove the fairing screw on the opposite side.
   d. Tilting the outer fairing toward the front, squeeze the two external tabs to remove the wire connector at the back of the headlamp assembly.
   e. Lift the fairing (with headlamp assembly) off the motorcycle.

**CAUTION**

**Since the outer fairing screws hold the windshield in place, the windshield may fall to the floor if not removed.**

4. Remove the windshield.

### INSTALLATION

1. Place the windshield in position on the inner fairing aligning the slots with the threaded inserts.
2. Install the outer fairing as follows:
   a. Place the fairing (with headlamp assembly) on the motorcycle installing the wire connector at the back of the headlamp assembly.
   b. Using a T27 TORX drive head, start the three outer fairing screws (with flat washers) just below the windshield.

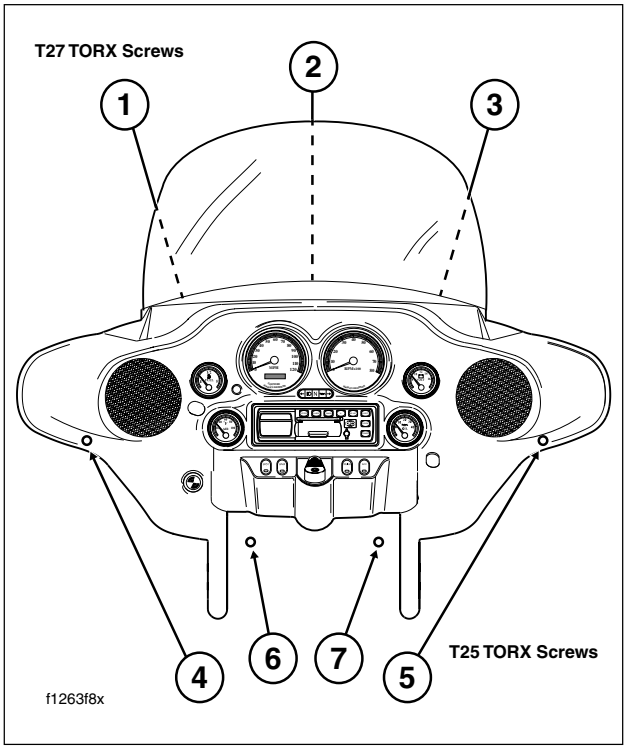



**Figure 2-127. Outer Fairing TORX Screw Locations**

   c. Moving to the inner fairing side, use a T25 TORX drive head to start the two fairing screws just above the wind deflectors on both the left and right side.
   d. Turn the handlebar to the left and reaching in below the fairing cap, start the next fairing screw. Turn the handlebar to the right and start the fairing screw on the opposite side.
   e. Alternately tighten the four fairing screws on the inner fairing side to 45-55 **in-lbs** (5.1-6.2 Nm).
   f. Moving to the front of the vehicle, tighten the outer fairing screws below the windshield to 10-13 **in-lbs** (1.1-1.5 Nm).
3. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
4. Install seat. See Section 2.21 SEAT, INSTALLATION.

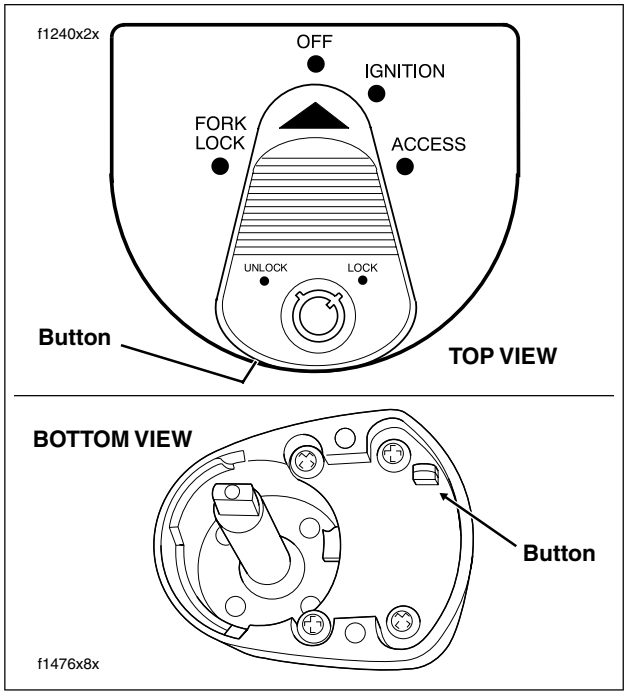



**Figure 2-128. Ignition Switch Knob Release Button**

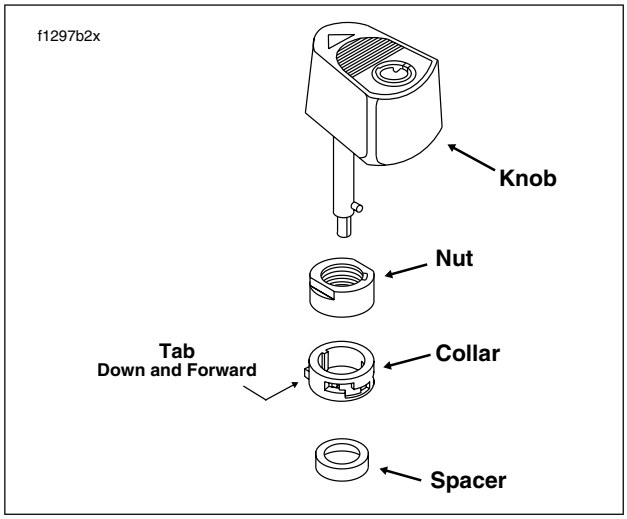



**Figure 2-129. Ignition Switch Knob Assembly (FLHT/C/U)**

# FAIRING CAP

## REMOVAL

1. See Figure 2-128. To remove the ignition switch knob, first turn the Ignition Switch key to UNLOCK and then turn the knob to ACCESS. Depress the release button at bottom (left side) with a small screwdriver, and while pushing key down, turn 60 degrees in a counter-clockwise direction. Lift and remove knob.
2. Using a 7/8 inch wrench on flats, loosen switch nut and remove from threaded post of ignition switch housing. Remove collar and spacer. See Figure 2-129.
3. Using a T27 TORX drive head, remove the two screws (with flat washers) that secure fairing cap to left and right sides of inner fairing.
4. Gently remove the decal plate by pulling tabs from slots in fairing cap. If necessary, raise the fairing cap slightly to facilitate removal.
5. With the forks turned fully to the left, disconnect the Fairing switch connector [105], 12-place Multilock (black), from behind right side of fairing cap. Depress the button on the socket terminal side of the connector (plug) to pull apart the pin and socket halves.
6. Remove the fairing cap from the motorcycle. See Figure 2-130.

## INSTALLATION

1. Verify that the rubber grommets are installed on each side of the fairing cap. Barbs on cap fit into holes in grommets. See Figure 2-130.
2. Connect the Fairing switch connector [105], 12-place Multilock (black), on the right side of fairing cap.
3. With the forks turned fully to the left, install fairing cap over ignition switch housing. Install decal plate fitting tabs in slots of fairing cap. Plate snaps in place when properly installed. Exercise care to avoid breaking tabs. Replace plate if tabs are broken.

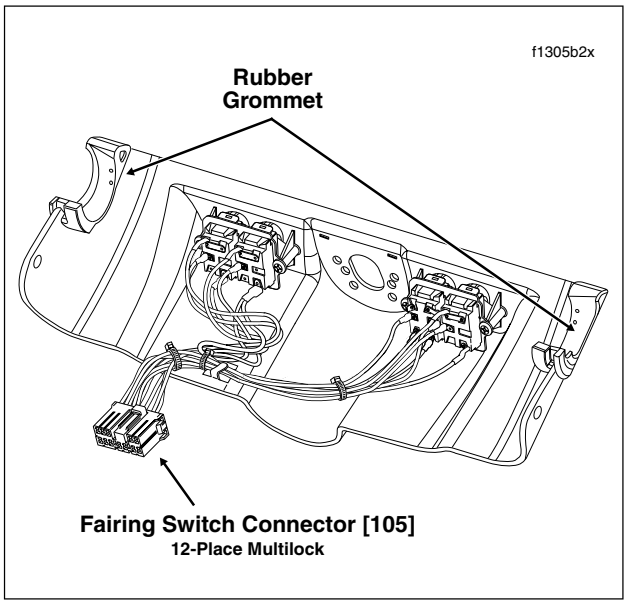



**Figure 2-130. Fairing Cap Assembly (FLHT/C/U)**

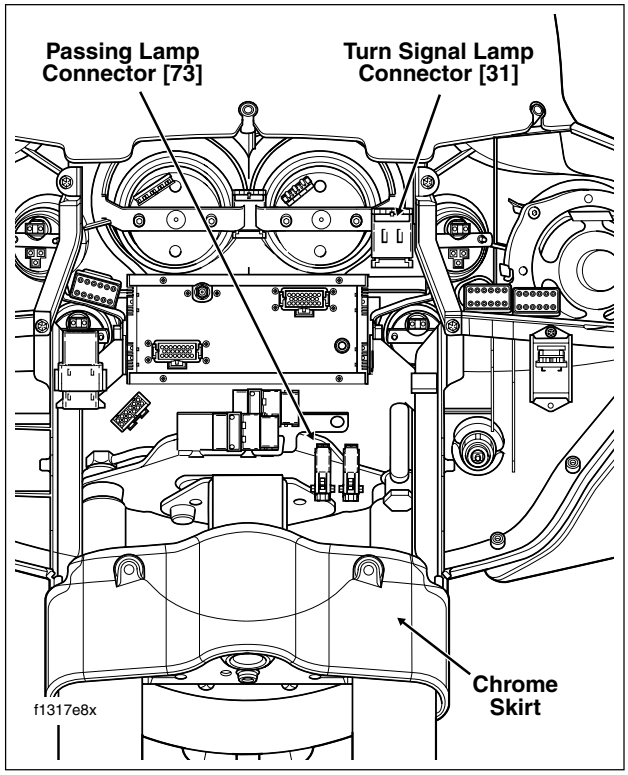



**Figure 2-131. Inner Fairing (Front View)**

4. Using a T27 TORX drive head, start two fairing cap screws (with flat washers). Verify that grommets in fairing cap fully capture handlebar along with throttle and clutch cables.
5. Slide spacer over threaded post of ignition switch housing until it contacts decal plate. Slide collar over post with the tab side down (and forward). Install nut, and using a 7/8 inch wrench on flats, tighten until snug.
6. With the red arrow pointing toward the ACCESS position, install the ignition switch knob. Turn key clockwise to UNLOCK position and then turn knob to OFF.
7. Using a T27 TORX drive head, tighten two fairing cap screws to 45-55 **in-lbs** (5.1-6.2 Nm).

# INNER FAIRING

## REMOVAL

1. Remove the outer fairing. See OUTER FAIRING/WINDSHIELD, REMOVAL, in this section.
2. At rear left side of inner fairing, unthread rubber boot to free odometer reset switch. Pull switch from hole in inner fairing.
3. Locate passing lamp (2-place Multilock) and front turn signal lamp (6-place Multilock) connectors. Depress button on the socket terminal side and pull apart pin and socket halves of both connectors. See Figure 2-131.
4. Using a T40 TORX drive head, remove four bolts to release passing lamp bracket from fork. Remove passing lamp assembly from the vehicle.
5. Remove the fairing cap. See FAIRING CAP, REMOVAL, in this section.
6. Remove chrome skirt.
7. Slide rubber boot off clutch cable adjuster. Holding cable adjuster with 1/2 inch wrench, loosen jam nut using a 9/16 inch wrench. Back jam nut away from cable adjuster. Move adjuster toward jam nut to introduce free play at hand lever.

**⚠WARNING**

**Always wear proper eye protection when removing 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.**

8. Remove retaining ring from pivot pin groove at bottom of clutch lever bracket.
9. Remove pivot pin and clutch hand lever from clutch lever bracket.
10. Remove anchor pin and clutch cable eyelet from clutch hand lever.
11. Feed clutch cable through inner fairing grommet to front of vehicle.
12. Remove the grommet from the inner fairing.




**Figure 2-132. Install Cardboard Insert**

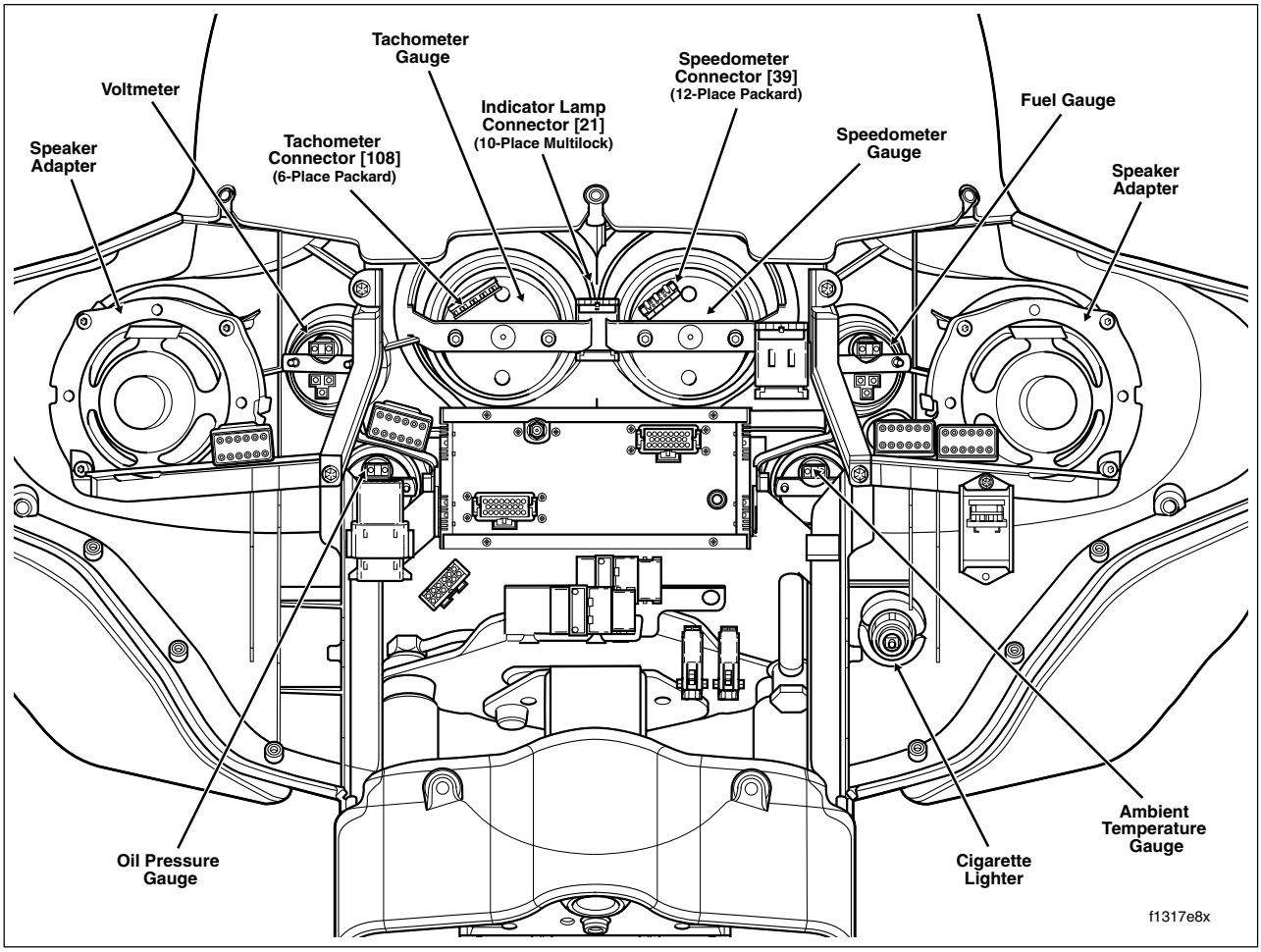



**Figure 2-133. Inner Fairing Connections (FLHTC/U)**

**CAUTION**

**Do not remove the switch housing assembly without first placing the 5/32 inch cardboard insert between the brake lever and lever bracket. Removal without the insert may result in damage to the rubber boot and plunger of the Front Stoplight Switch.**

*NOTE*

*Use the eyelet of an ordinary cable strap if the cardboard insert is not available.*

13. Place the cardboard insert between the brake lever and lever bracket. See Figure 2-132.
14. Using a T25 TORX drive head, remove the upper and lower switch housing screws.
15. Using a T27 TORX drive head, loosen the upper screw securing the handlebar clamp to the master cylinder housing. Remove the lower clamp screw with flat washer.
16. Remove the brass ferrules from the notches on the inboard side of the throttle control grip. Use a needle nose pliers for best results. Remove the ferrules from the cable end fittings.
17. Remove the friction shoe from the end of the tension adjuster screw (non Ultra models only).

*NOTE*

*The friction shoe is a loose fit and may fall out or become dislodged if the lower switch housing is turned upside down or shaken.*

18. Remove the throttle control grip from the end of the handlebar.
19. Pull the crimped inserts at the end of the throttle and idle control cable housings from the lower switch housing. For best results, use a rocking motion while pulling. Place a drop of light oil on the retaining rings, if necessary.

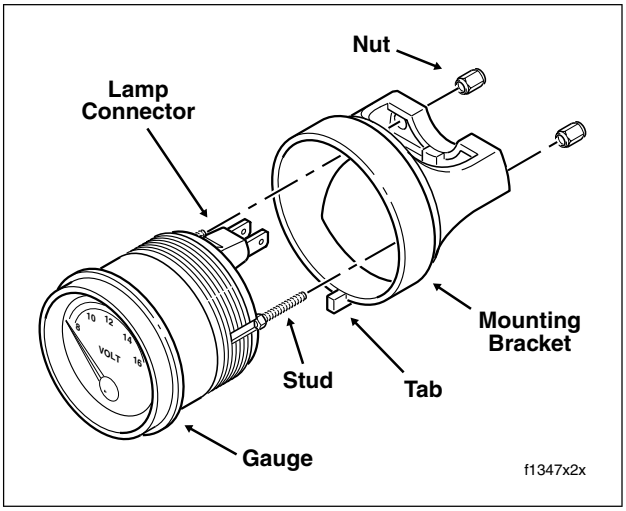



**Figure 2-134. Voltmeter Gauge Assembly**

20. Remove the throttle and idle control cables from the switch housing and feed through inner fairing grommet to front of vehicle.
21. Remove the grommet from the inner fairing.
22. See Figure 2-133. Moving back to the front of the vehicle, disconnect the socket terminals from the spade contacts on the:
    - Cigarette lighter
    - Speakers (both sides)
23. Using a T25 TORX drive head, remove the three screws to release the speaker adapter from the inner fairing (both sides).
24. Remove cigarette lighter from socket. Holding socket, unscrew outer shell. Remove socket and outer shell from the fairing.
25. Pull the interconnect wire harness connectors from the:
    - Voltmeter
    - Fuel Gauge
26. Cut cable strap to release indicator lamps connector between speedometer and tachometer brackets.
27. Separate pin and socket halves of speedometer, tachometer and indicator lamps connectors (12-place Packard, 6-place Packard and 10-place Multilock, respectively).

*NOTE*

*Depress clear plastic latch on secondary lock to release connector at back of speedometer.*

*Tachometer connector is a friction fit with no external latches; to avoid damage to wire terminals, pull on connector housing to remove.*

28. Remove allen head socket screws to free mounting brackets from back of tachometer and speedometer gauges. Remove gauges from inner fairing.
29. Remove hex nuts from studs at back of voltmeter and fuel gauges. Remove mounting brackets. See Figure 2-134. Remove gauges from inner fairing.
30. Release four paddles to free indicator bulb housing from lense assembly. See Figure 2-135. Remove lense assembly from inner fairing.
31. Spread shroud at bottom of inner fairing (along with legs of fairing brackets) to remove from dowels in lower fork bracket. Raise inner fairing (with fairing brackets) high enough to access lower row of gauges.
32. On Classic and Ultra models, pull the interconnect wire harness connectors from the:
    - Oil Pressure Gauge
    - Ambient Air Temperature Gauge
33. Remove hex nuts from studs at back of ambient air temperature and oil pressure gauges. Remove mounting brackets. Remove gauges from inner fairing.
34. Remove four socket head screws to free inner fairing from fairing brackets. See Figure 2-136.
35. Raise inner fairing further (along with fairing brackets) and then tilt inner fairing toward rear of vehicle to work free of radio nose seal.
36. Raise and remove inner fairing leaving fairing brackets, radio and interconnect harness on the vehicle.

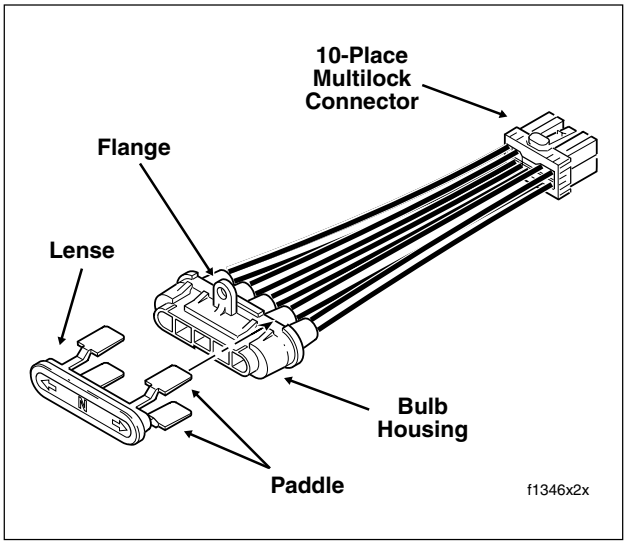



**Figure 2-135. Indicator Lense/Bulb Assembly**

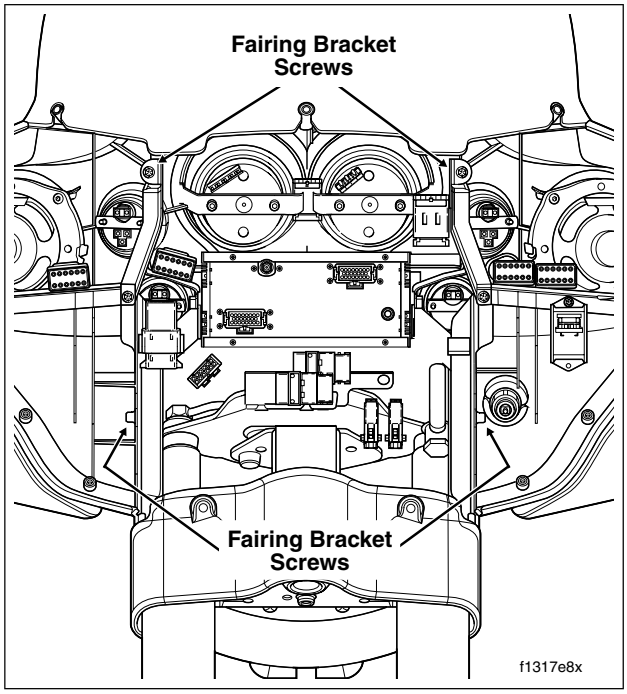



**Figure 2-136. Remove Fairing Bracket Screws**

## INSTALLATION

**CAUTION**

**Exercise caution to avoid scratching paint on fuel tank and fairing lowers.**

1. Lower inner fairing over handlebars keeping fairing brackets, radio and interconnect harness at front. Halfway into position, tilt inner fairing forward over front of radio. With radio positioned in inner fairing, verify that nose seal is not distorted, compressed or pinched.
2. On Classic and Ultra models, install ambient air temperature and oil pressure gauges in inner fairing. Slide mounting brackets over studs on gauges. Verify that tab on bracket engages slot at bottom of inner fairing bore. Loosely install hex nuts on studs. Verify that gauge is properly aligned and then tighten nuts securely. Install the interconnect wire harness connectors to the gauges.
3. Spread shroud at bottom of inner fairing (along with legs of fairing brackets) and install on dowels in lower fork bracket.
4. Start four socket head screws to attach inner fairing to fairing brackets. See Figure 2-136.
5. Place lense assembly in inner fairing. Note position of oil icon to be sure that lense is right side up. Engage all four paddles on lense assembly with tabs on indicator bulb housing. Be sure that flange on bulb housing faces upward. See Figure 2-135.
6. Slide rubber cushion down body of tachometer and speedometer gauges, if removed. Install speedometer and tachometer gauges in inner fairing.
7. Align holes in mounting brackets with those at back of speedometer and tachometer gauges. Be sure that tab at bottom of each bracket engages slot in inner fairing bore. Loosely install two allen head socket screws. Verify that gauge is properly aligned and then tighten screws to 5-10 **in-lbs** (0.6-1.1 Nm).
8. Mate pin and socket halves of speedometer, tachometer and indicator lamps connectors (12-place Packard, 6-place Packard and 10-place Multilock, respectively). Tuck the indicator lamps connector between the speedometer and tachometer brackets. Install **new** cable strap to secure connector in place.

*NOTE*

*Install connector at back of speedometer until clear plastic latch on secondary lock "clicks" into the locked position.*

*Take note of the offset terminal when mating pin and socket halves of tachometer connector. Using the thumbs of both hands, push on each side of connector until tight. Connector is a friction fit with no external latches.*

9. Install voltmeter and fuel gauges in inner fairing. Install mounting brackets so that tab engages slot at bottom of inner fairing bore. See Figure 2-134. Loosely install hex nuts on studs. Verify that gauge is properly aligned and then tighten nuts securely. Install the interconnect wire harness connectors to the gauges.
10. From rider side of inner fairing, slide socket of cigarette lighter through bore in fairing. Thread outer shell onto socket until tight. Install cigarette lighter in socket.
11. Using a T25 TORX drive head, install the three screws to secure the speaker adapters to the inner fairing (both sides). Be sure to capture fairing support brace with lower outboard screw. The screw hole on the lower inboard side is not used.
12. Connect the socket terminals onto the spade contacts of the:
    - Speakers (both sides) - the socket terminal of the wire that is **not** green is installed on the spade contact above the red dot.
    - Cigarette lighter - connect the orange wire terminal to the center socket spade contact, the black wire terminal to the outer shell contact.
13. Install the two grommets in the inner fairing.
14. Feed the throttle and idle control cables through inner fairing grommet (right side).

15. With the concave side facing upward, install the friction shoe so that the pin hole is over the point of the adjuster screw (non Ultra models only).

*NOTE*

*The friction shoe is a loose fit and may fall out or become dislodged if the switch housing is turned upside down or shaken.*

16. Push the throttle and idle control cables into the lower switch housing until they snap in place. Proceed as follows:

    Note the different diameter inserts crimped into the end of the throttle and idle control cable housings.

    Push the larger diameter insert (silver) on the throttle cable housing into the larger hole in front of the tension adjuster screw, if provided.

    Push the smaller diameter insert (gold) on the idle cable housing into the smaller hole at the rear of the tension adjuster screw, if provided.

*NOTE*

*To aid assembly, place a drop of light oil on the retaining rings of the crimped inserts. Always replace the retaining rings if damaged or distorted.*

17. Slide the throttle control grip over the end of the right handlebar until it bottoms against the closed end. Rotate the grip so that the ferrule notches are at the top. To prevent binding, pull the grip back about 1/8 inch (3.2 mm).

18. Position the lower switch housing beneath the throttle control grip. Install the brass ferrules onto the cables so that the end fittings seat in the ferrule recess. Seat the ferrules in their respective notches on the throttle control grip. Verify that the cables are captured in the grooves molded into the grip. See Figure 2-137.

19. Position the upper switch housing over the handlebar and lower switch housing.

20. Verify that the wire harness conduit runs in the depression at the bottom of the handlebar. Be sure that the upper switch housing harness will not be pinched under the handlebar when the switch housing screws are tightened.

21. Start the upper and lower switch housing screws, but do not tighten.

**CAUTION**

**See Figure 2-132. Do not remove the 5/32 inch cardboard insert (or cable strap eyelet) wedged between the brake lever and lever bracket. Removal will result in damage to the rubber boot and plunger of the Front Stoplight Switch during installation of the master cylinder assembly.**

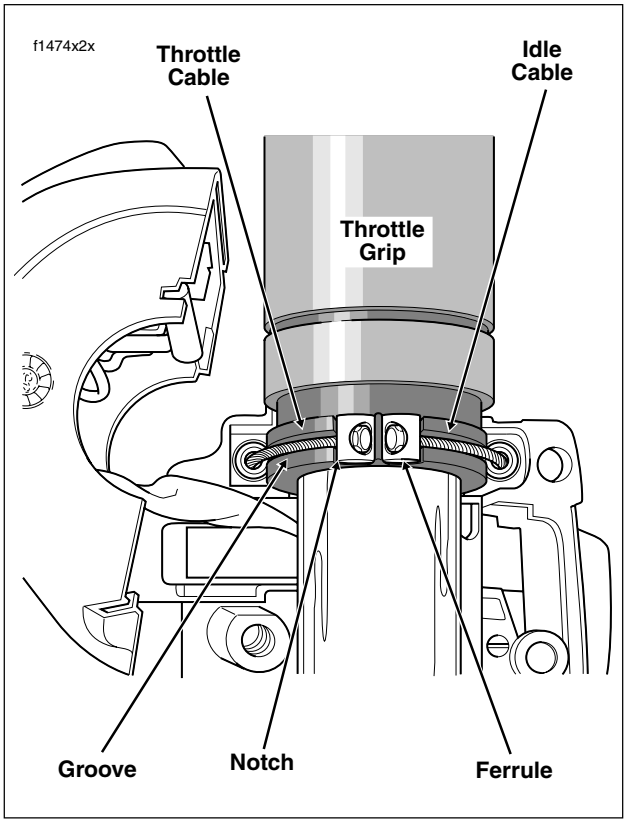



**Figure 2-137. Install Throttle/Idle Control Cables on Throttle Control Grip**

22. Position the brake lever/master cylinder assembly inboard of the switch housing assembly engaging the tab on the lower switch housing in the groove at the top of the brake lever bracket.

23. Align the holes in the handlebar clamp with those in the master cylinder housing and start the two screws (with flat washers). Position for rider comfort. Beginning with the top screw, tighten the screws to 60-80 **in-lbs** (6.8-9.0 Nm) using a T27 TORX drive head.

24. Using a T25 TORX drive head, tighten the lower and upper switch housing screws to 35-45 **in-lbs** (4-5 Nm).

*NOTE*

*Always tighten the lower switch housing screw first so that any gap between the upper and lower housings is at the front of the switch.*

25. Remove the cardboard insert between the brake lever and lever bracket.

26. Feed clutch cable through inner fairing grommet (left side).

27. Insert cable eyelet into groove of clutch hand lever aligning eyelet with hole without bushing. Insert anchor pin through lever and eyelet.
28. Insert lever into groove of clutch lever bracket fitting sleeve at end of cable housing into bore on inboard side of bracket.
29. Align hole in hand lever with hole in bracket and install pivot pin.

**⚠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.**

30. Install retaining ring in pivot pin groove.
31. Adjust the clutch. See Section 6.3 CLUTCH, ADJUSTMENT.
32. Install the fairing cap. See FAIRING CAP, INSTALLATION, in this section.
33. Install chrome skirt aligning holes with dowels in lower fork bracket. Using a T40 TORX drive head, start two lower passing lamp bracket bolts.
34. Slide lower slots of passing lamp bracket onto lower TORX bolts. Start two upper TORX bolts in fork. Alternately tighten four bolts to 18 ft-lbs (24.4 Nm).
35. Mate pin and socket halves of passing lamp (2-place Multilock) and front turn signal lamp (6-place Multilock) connectors. Route conduit over chrome skirt at corners.
36. Slide odometer reset switch through hole in inner fairing. Install rubber boot to secure.
37. Install the outer fairing. See OUTER FAIRING/WINDSHIELD, INSTALLATION, in this section.

## WINDSHIELD ONLY

### REMOVAL

1. Standing in front of vehicle, locate five Phillips screws at base of windshield. Alternately loosen and then completely remove screws (with plastic flat washers).
2. Remove windshield from outer fairing.
3. Carefully remove wellnuts from holes in outer fairing. See Figure 2-138. Exercise caution to avoid pushing wellnuts into fairing during removal procedure. Inspect wellnuts for cuts, tears or signs of deterioration. Replace as necessary.

### INSTALLATION

1. Preinstall hardware on windshield as follows:
   a. Slide plastic flat washers onto Phillips screws, if removed.
   b. Slide Phillips screws through holes in decal to orient hardware in slots of windshield.

*NOTE*

*If installing **new** windshield, poke holes in decal from inboard side of windshield. Punching holes from outboard side will dislocate or tear decal on windshield.*

   c. Start wellnuts onto Phillips screws.

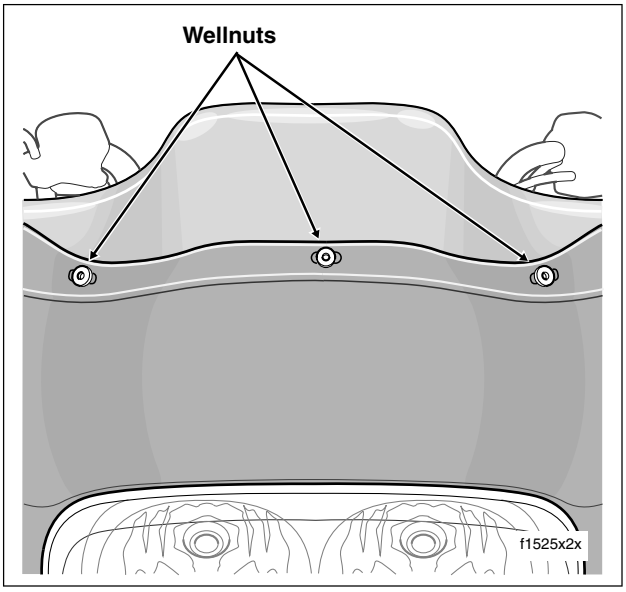



**Figure 2-138. Remove Wellnuts From Outer Fairing**

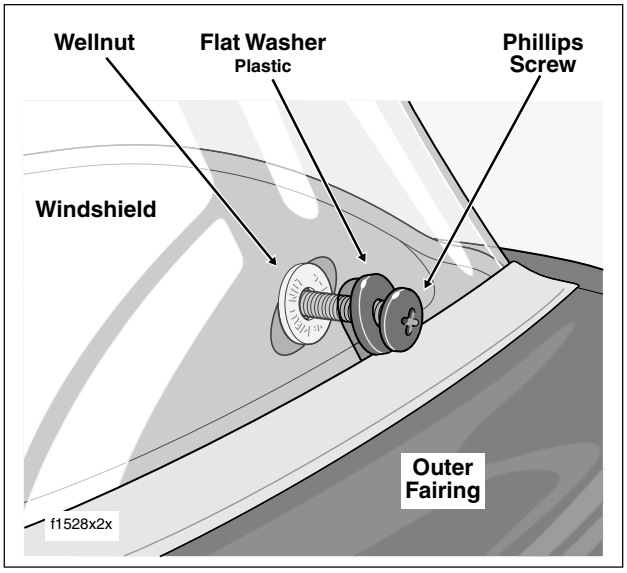



**Figure 2-139. Install Windshield (Decal Removed for Illustration Purposes)**

2. Moving to front of vehicle, push wellnuts into holes in outer fairing. See Figure 2-139.
3. Starting with center screw, alternately tighten the five Phillips screws to 6-13 **in-lbs** (0.7-1.5 Nm).

## OUTER FAIRING

### REMOVAL

*NOTE*

*Leave windshield in place during outer fairing removal.*

1. Place protective material on top of front fender to protect paint from scratches or other damage.
2. Standing on left side of vehicle, use a T25 TORX drive head to remove screw just below glove compartment. See Figure 2-140.
3. Remove screw at edge of fairing outboard of the left speaker.
4. Loosen top left and right screws just outboard of the fuel and volt gauges, respectively.
5. Remove screw at edge of fairing outboard of the right speaker.
6. Remove screw just below right side glove compartment.

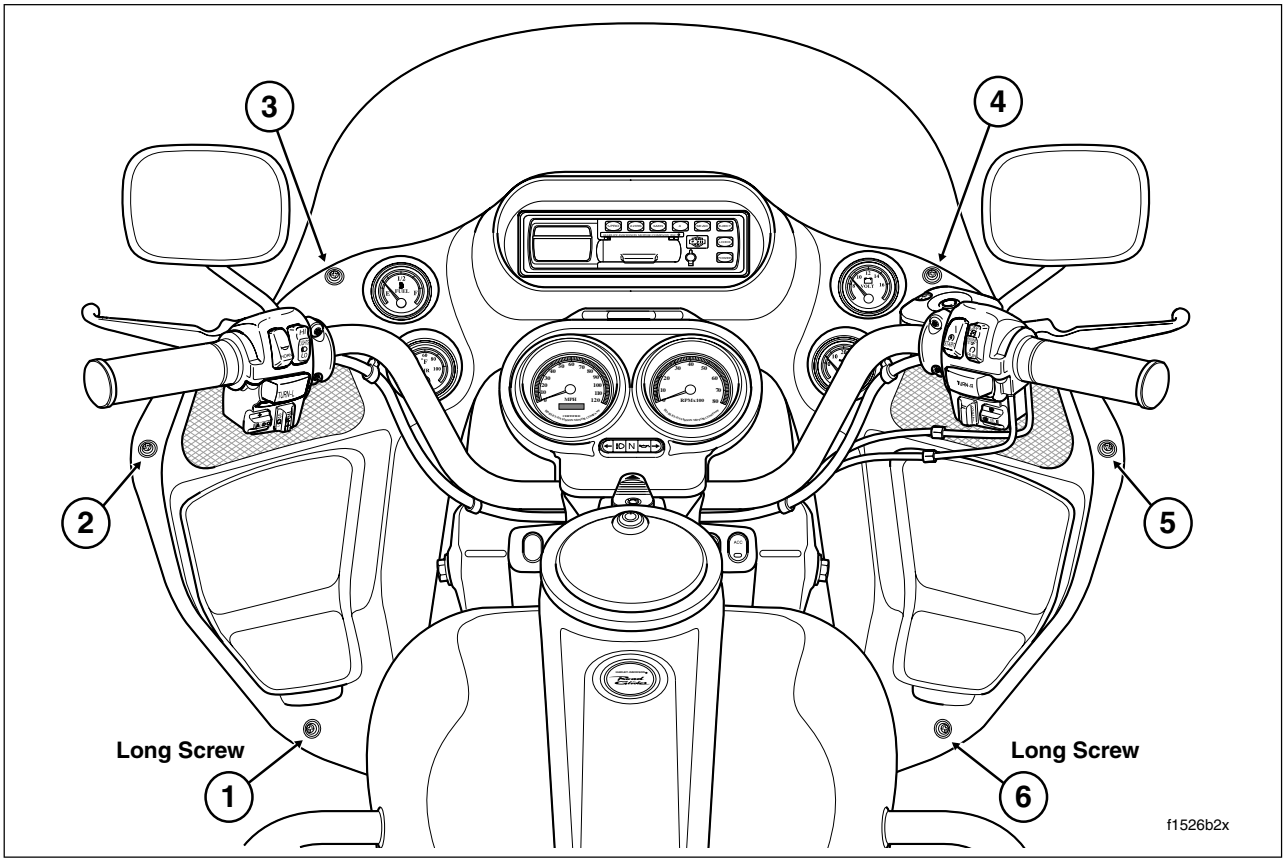



**Figure 2-140. Remove Six Outer Fairing Screws**

7. In area of front turn signal lamp, remove two acorn nuts and washer plate from studs. Push on ends of studs to release stud plate from inboard side of right fairing support. Repeat step to remove stud plate from left fairing support. See Figure 2-141.
8. Remove top left and right screws just outboard of the fuel and volt gauges, respectively (previously loosened).
9. Raise outer fairing slightly and then rest on protective fender pad.
10. Squeeze two external tabs to disconnect headlamp harness connector.

## INSTALLATION

1. Place protective material on top of front fender to protect paint from scratches or other damage.
2. Rest outer fairing on protective fender pad and connect headlamp harness connector.
3. Place outer fairing into position against inner fairing. Two slots in outer fairing must fully engage hooks on radio bracket. Move harness conduit and wiring as necessary to ensure full engagement between outer and inner fairing.

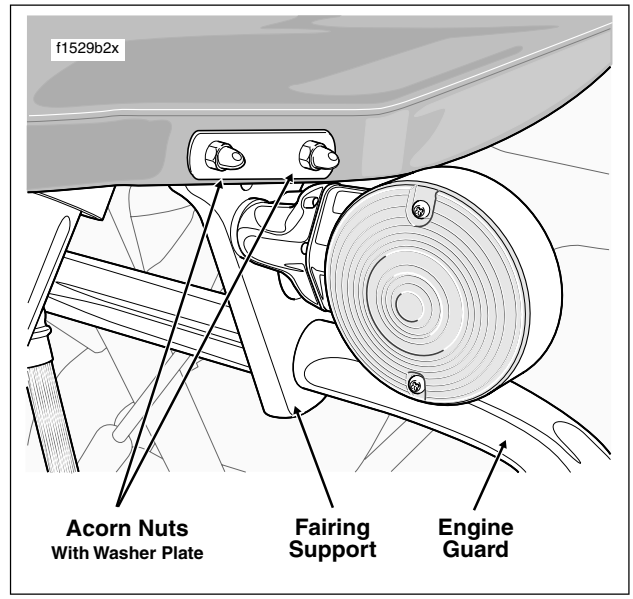



**Figure 2-141. Remove Acorn Nuts to Release Stud Plate (Left Side View)**

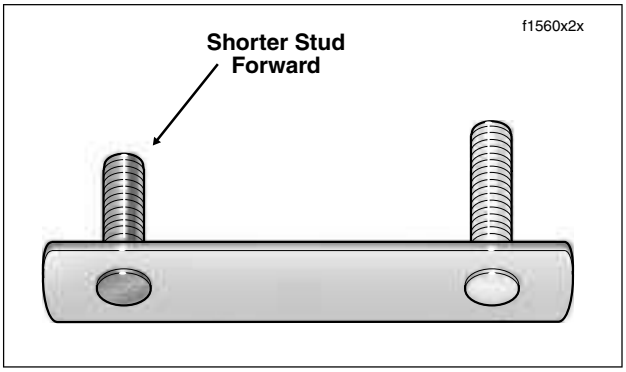



**Figure 2-142. Stud Plate**

4. Move to side of outer fairing to verify that alignment tabs are properly engaged. Alignment tabs on inner fairing must be positioned outboard of those on the outer fairing. Repeat step on opposite side of vehicle.
5. Using a T25 TORX drive head, start the top right and left screws just outboard of the volt and fuel gauges, respectively. Mounting bosses on inner fairing are painted white for easier alignment of holes.
6. Standing on the left side of the vehicle, turn handlebar to access inboard side of left fairing support. With shorter stud in the forward position, slide studs on stud plate through holes in fairing support and then through holes in both inner and outer fairing. See Figure 2-142.
7. Install washer plate (chromed side out) and acorn nuts on studs. Tighten acorn nuts to 40-50 **in-lbs** (4.5-5.7 Nm). See Figure 2-141.
8. Repeat steps 6 and 7 to install stud plate on right side of vehicle.
9. Install the first of two long screws just below the right side glove compartment.
10. Install screw at edge of fairing outboard of the right speaker.
11. Moving to left side of vehicle, install the second of two long screws just below the glove compartment.
12. Install screw at edge of fairing outboard of the left speaker.
13. Alternately tighten four short fairing screws to 6-12 **in-lbs** (0.7-1.4 Nm). Alternately tighten two long fairing screws to 12-15 **in-lbs** (1.4-1.7 Nm).

# BEZEL

## REMOVAL

1. Using a T25 TORX drive head, remove screw on left and right side of instrument bezel. See Figure 2-143.
2. Use thumbs to push tab at rear of bezel from slot above ignition switch. Gently raise free side of bezel until tabs at front of instrument nacelle become disengaged from slot at front of bezel (concealed behind decorative adhesive strip).
3. See Figure 2-144. Disconnect instruments from main harness.
   - Speedometer connector [39], 12-place Packard.

*NOTE*

*Depress clear plastic latch on secondary lock to release connector at back of speedometer.*

   - Tachometer connector [108], 6-place Packard.

*NOTE*

*Tachometer connector is a friction fit with no external latches; to avoid damage to wire terminals, pull on connector housing to remove.*

4. Cut cable strap between speedometer and tachometer brackets and disconnect the following connector from jumper harness.
   - Indicator Lamps connector [21], 10-place Multilock.
5. Remove bezel from vehicle.

## INSTALLATION

1. See Figure 2-144. Looking into the instrument nacelle, connect the following connector to jumper harness.

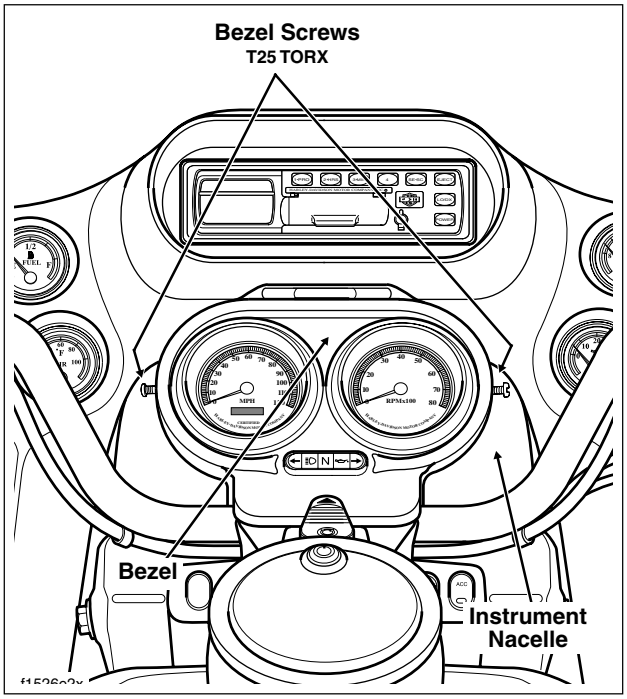



**Figure 2-143. Remove Instrument Bezel Screws**

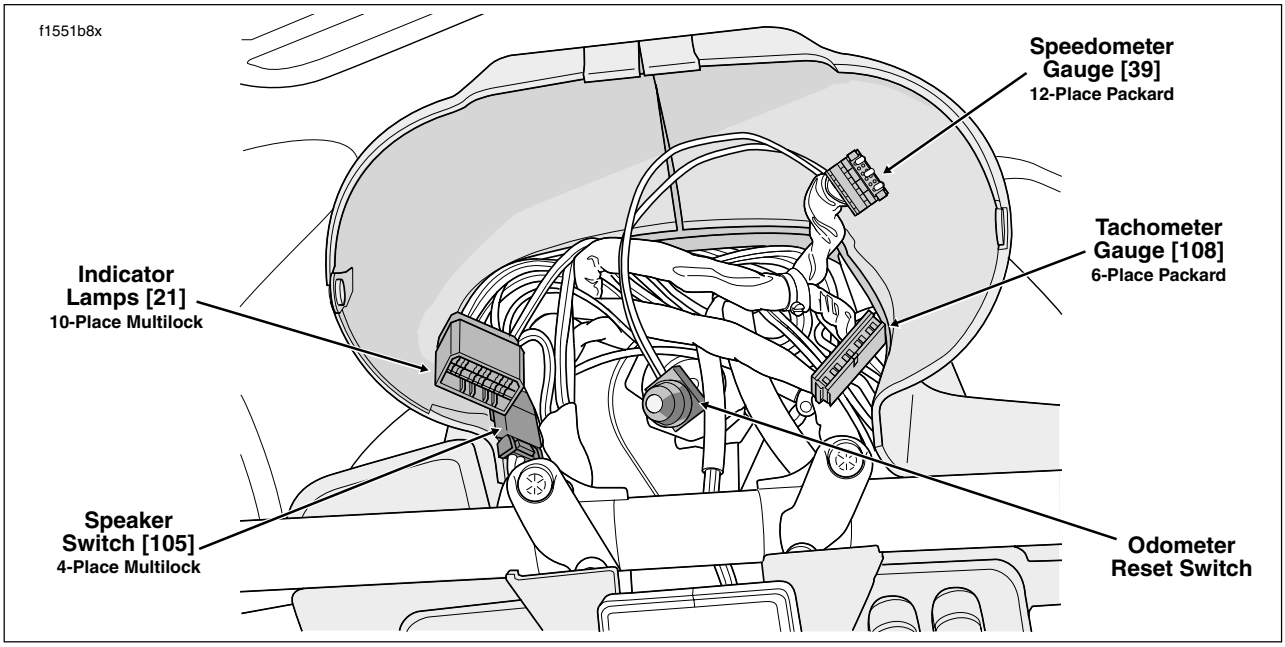



**Figure 2-144. Instrument Nacelle (Bezel Removed)**

- Indicator Lamps connector [21], 10-place Multilock.

  Position connector between speedometer and tachometer brackets and secure using **new** cable strap. Cut any excess cable strap material.

2. Connect instruments to main harness.

   - Speedometer connector [39], 12-place Packard.

*NOTE*

*Install connector at back of speedometer until clear plastic latch on secondary lock "clicks" into the locked position.*

   - Tachometer connector [108], 6-place Packard.

*NOTE*

*Take note of the offset terminal when mating pin and socket halves of tachometer connector. Using the thumbs of both hands, push on each side of connector until tight. Connector is a friction fit with no external latches.*

3. Verify that left and right sides of instrument nacelle are properly mated. Pins on left side of nacelle must fully engage holes on right.

4. Insert tab at rear of bezel into slot of instrument nacelle (just above ignition switch). Holding left and right sides of nacelle together, place bezel over instrument nacelle flange. When properly mated, tabs at front of instrument nacelle engage lip in slot at front of bezel (behind decorative adhesive strip).

*NOTE*

*If tabs do not properly engage slot at front of bezel, then a loose fit will result. Remove decorative adhesive strip by gently prying up outer edges, and using a flat bladed screwdriver, carefully raise tabs so that they engage lip in slot. If damaged, install **new** decorative adhesive strip.*

5. Using a T25 TORX drive head, install screw on each side of bezel. Tighten screws to 6-12 **in-lbs** (0.7-1.4 Nm). See Figure 2-143.

# INSTRUMENT NACELLE

## REMOVAL

1. Remove bezel. See BEZEL, REMOVAL, in this section.
2. At lower right side of instrument nacelle, unthread rubber boot to free odometer reset switch. Pull switch from hole in instrument nacelle.
3. Pull throttle cable clip from hole on upper right side of instrument nacelle.
4. To remove the ignition switch knob, first turn the Ignition Switch key to UNLOCK and then turn the knob to ACCESS. Depress the release button at bottom (left side) with a small screwdriver, and while pushing key down, turn 60 degrees in a counter-clockwise direction. Lift and remove knob. See upper frame of Figure 2-145.
5. Using a 7/8 inch wrench on flats, loosen switch nut and remove from threaded post of ignition switch housing. Remove collar and spacer. See lower frame of Figure 2-145.

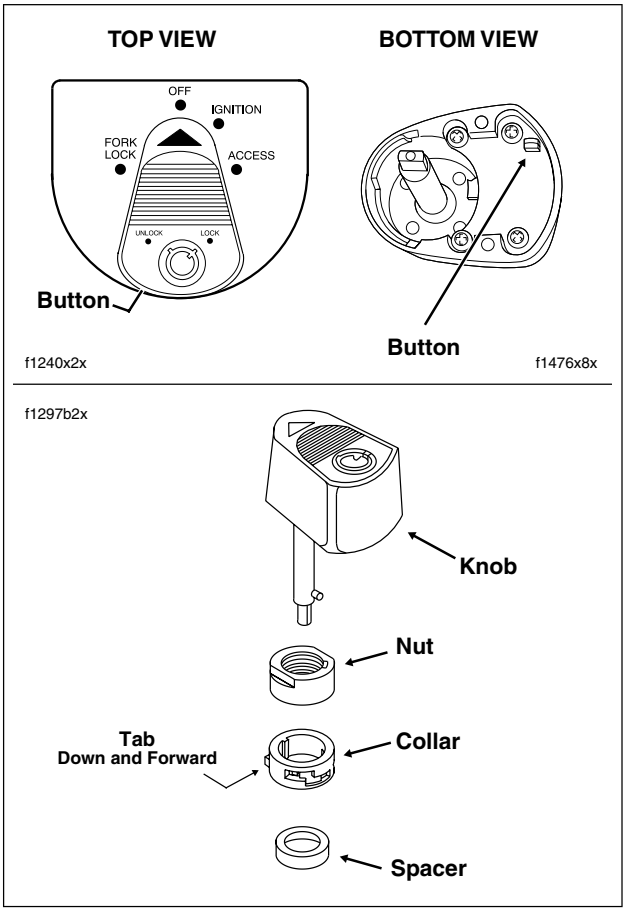



**Figure 2-145. Ignition Switch Knob Release Button**

6. Remove the switch position plate from threaded post of ignition switch housing.
7. See Figure 2-144. Disconnect speaker switch from jumper harness as follows:
   - Depress button on plug side of Speaker Switch connector [105], 4-place Multilock, and pull apart pin and socket halves.
8. Using a T40 TORX drive head, remove two bolts (with flat washers) to release left side of instrument nacelle from fork side. Carefully remove left side instrument nacelle from vehicle. See Figure 2-147.
9. Remove the outer fairing. See OUTER FAIRING, REMOVAL, in this section.
10. Carefully pull wire bundles and conduit from tunnel of fairing bracket, allowing the bundles to hang naturally. Cut cable straps at front corners of radio bracket to release interconnect harness, if necessary.
11. See Figure 2-146. Disconnect jumper harness from interconnect harness as follows:
    - Indicator Lamps connector [21], 10-place Multilock.
    - Instrument nacelle switch connector [105], 12-place Multilock.
12. Using a T40 TORX drive head, remove two bolts (with flat washers) to release right side of instrument nacelle from fork side.
13. To pull right side of instrument nacelle from vehicle, draw free end of jumper harness through tunnel of fairing bracket to rear of inner fairing. See Figure 2-147.

## INSTALLATION

1. To install right side of instrument nacelle, feed free end of jumper harness through tunnel of fairing bracket to front of inner fairing (beneath radio).
2. See Figure 2-146. Standing at front of vehicle, connect jumper harness to interconnect harness as follows:
   - Instrument nacelle switch connector [105], 12-place Multilock.
   - Indicator Lamps connector [21], 10-place Multilock.

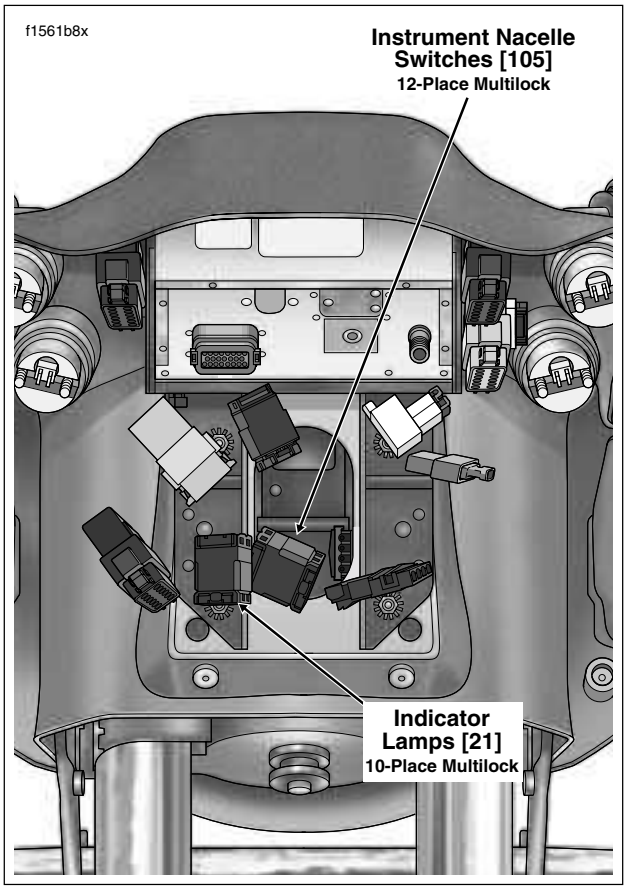
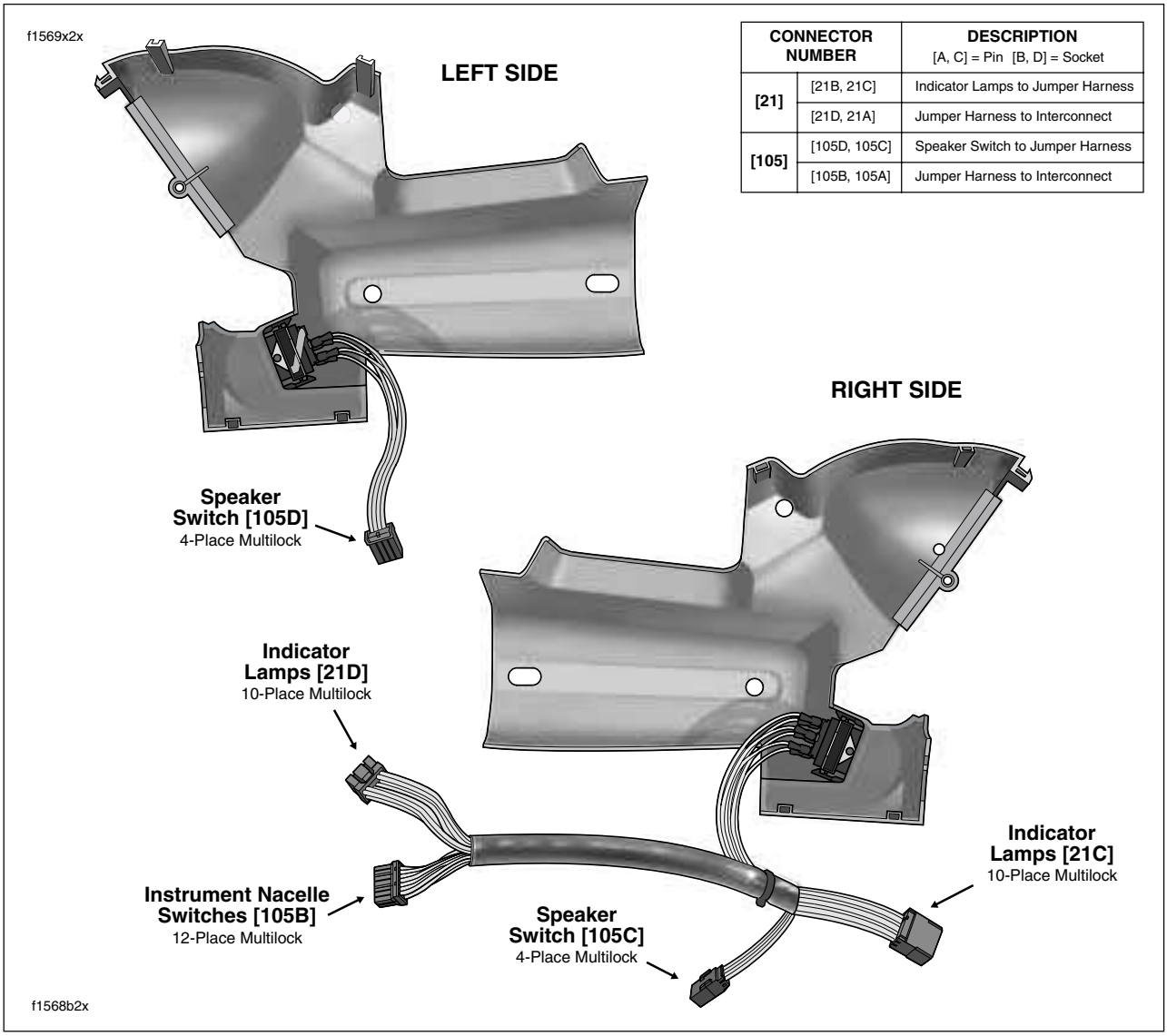



**Figure 2-146. Interconnect Harness Connectors**




| CONNECTOR NUMBER | | DESCRIPTION [A, C] = Pin [B, D] = Socket |
|---|---|---|
| [21] | [21B, 21C] | Indicator Lamps to Jumper Harness |
| | [21D, 21A] | Jumper Harness to Interconnect |
| [105] | [105D, 105C] | Speaker Switch to Jumper Harness |
| | [105B, 105A] | Jumper Harness to Interconnect |

**Figure 2-147. Instrument Nacelle Halves**

3. Carefully tuck wire bundles and conduit into tunnel of fairing bracket. Using holes at front corners of radio bracket, install two **new** cable straps to capture interconnect harness below radio. Cut excess cable strap material.
4. Install the outer fairing. See OUTER FAIRING, INSTALLATION, in this section.
5. Carefully place instrument nacelle on vehicle. Verify that left and right sides of nacelle are properly mated. Four pins on left side of nacelle must fully engage holes on right.
6. Using a T40 TORX drive head, install two bolts (with flat washers) to fasten left side instrument nacelle to fork side. Be sure to capture clutch cable clip when installing upper bolt.
7. Using a T40 TORX drive head, install two bolts (with flat washers) to fasten right side instrument nacelle to fork side.
8. Install the switch position plate over threaded post of ignition switch housing. Tabs on plate fit in holes at top of instrument nacelle.
9. Slide spacer over threaded post of ignition switch housing until it contacts switch position plate. Slide collar over post with the tab side down (and forward). Install nut, and using a 7/8 inch wrench on flats, tighten until snug. See lower frame of Figure 2-145.
10. With the red arrow pointing toward the ACCESS position, install the ignition switch knob. Turn key clockwise to UNLOCK position and then turn knob to OFF.

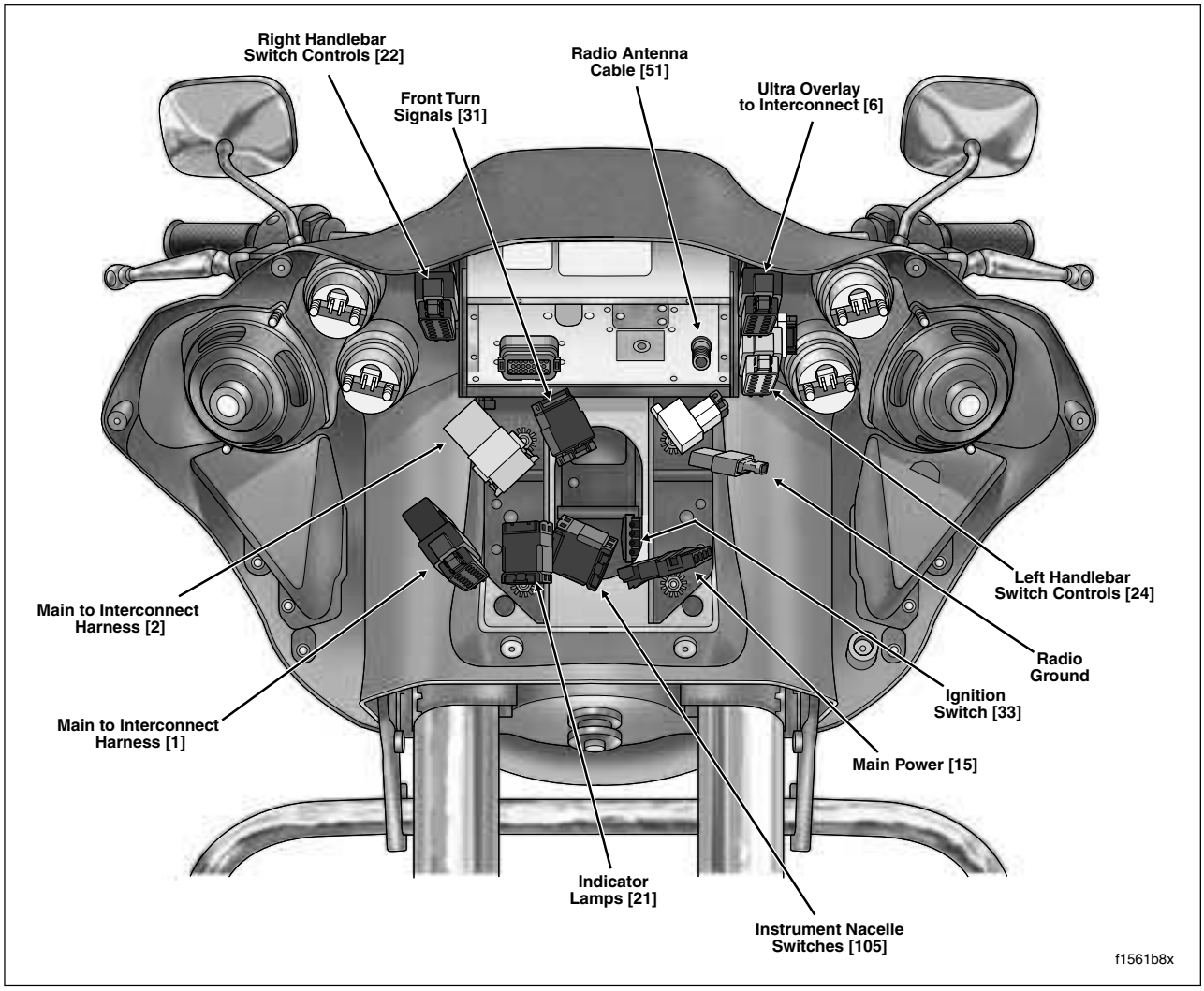



**Figure 2-148. Inner Fairing Connections (FLTR)**

11. Connect speaker switch to jumper harness as follows:
    - Looking into instrument nacelle, mate pin and socket halves of Speaker Switch connector [105], 4-place Multilock. See Figure 2-144.
12. Slide odometer reset switch through hole at lower right side of instrument nacelle. Install rubber boot to secure.
13. Capture throttle cables in cable clip. Insert cable clip into hole in upper right side of instrument nacelle.
14. Install bezel. See BEZEL, INSTALLATION, in this section.

# INNER FAIRING

## REMOVAL

1. Remove bezel. See BEZEL, REMOVAL, in this section.
2. At lower right side of instrument nacelle, unthread rubber boot to free odometer reset switch. Pull switch from hole in instrument nacelle.
3. Remove the outer fairing. See OUTER FAIRING, REMOVAL, in this section.
4. Carefully pull wire bundles and conduit from tunnel of fairing bracket, allowing the bundles to hang naturally. Cut cable straps at front corners of radio bracket to release interconnect harness, if necessary.
5. Draw free end of main harness (branch terminating in function switch and speedometer and tachometer connectors) from instrument nacelle through tunnel of fairing bracket to front of inner fairing.
6. See Figure 2-146. Disconnect jumper harness from interconnect harness as follows:

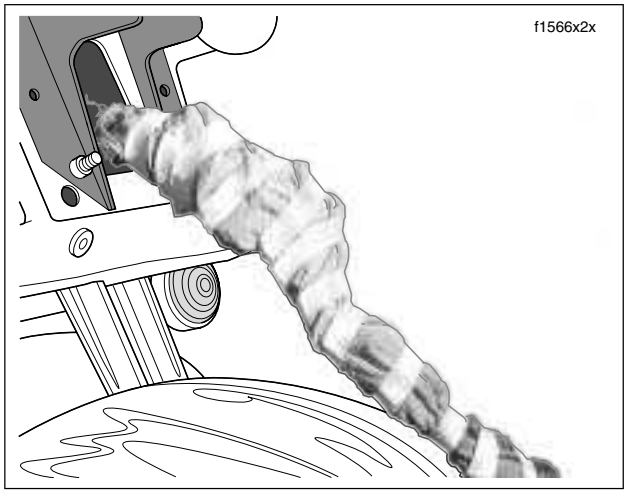



**Figure 2-149. Wrap Harness Bundle in Shop Towels**

- Indicator Lamps connector [21], 10-place Multilock.
- Instrument nacelle switch connector [105], 12-place Multilock.

7. See Figure 2-148. Disconnect main harness from interconnect harness as follows:
   - Main to interconnect harness connector [1], 12-place Deutsch (black); below radio (right side).
   - Main to interconnect harness connector [2], 12-place Deutsch (gray); T-stud on front of right radio bracket (right side).
   - Main power connector [15], 4-place Packard (black); below radio.
   - Radio antenna cable connector [51]; back of radio (left side).
8. See Figure 2-148. Disconnect ignition switch from main harness as follows:
   - Ignition switch connector [33], 4-place Packard (black); inside fairing bracket tunnel (left side).
9. See Figure 2-148. Disconnect ultra overlay harness from interconnect harness as follows:
   - Ultra overlay to interconnect connector [6], 12-place Deutsch (black); T-stud on left side of radio bracket.
10. See Figure 2-148. Disconnect handlebar switch controls, front turn signals and radio ground from interconnect harness as follows:
    - Left handlebar switch controls connector [24], 12-place Deutsch (gray); T-stud on left side of radio bracket.
    - Right handlebar switch controls connector [22], 12-place Deutsch (black); T-stud on right side of radio bracket.
    - Front turn signal connector [31], 6-place Multilock; below radio (right side).
    - Radio ground; single spade and socket terminal.
11. Release turn signal conduit from flexible clips on both sides of inner fairing and draw wires downward to free conduit from slots at bottom.
12. Cut cable straps as necessary to release jumper harness, main harness, ultra overlay harness and handlebar switch control conduit from interconnect harness.
13. Place protective material on top of front fender to protect paint from scratches or other damage.
14. Draw the jumper harness, main harness, ultra overlay harness and handlebar switch control conduit as far forward as possible, resting the connectors of the longer harnesses on the front fender.
15. Tightly wrap clean shop towels around the harness bundle (capturing all connectors) and secure with masking tape. See Figure 2-149.
16. Remove four locknuts to release radio bracket (and inner fairing) from from studs of fairing bracket. See Figure 2-150.
17. Lift inner fairing (with attached radio bracket) from fairing bracket studs and move to bench area.
18. To remove fairing bracket, proceed as follows:
    a. Remove shop towels and masking tape from around the harness bundle. Separate jumper harness, main harness and ultra overlay harness. Separate ignition switch and handlebar switch control conduit.
    b. Pull jumper harness, ignition switch and handlebar switch control conduit through opening at top of fairing bracket.
    c. Pull main harness and ultra overlay harness through opening on right side of fairing bracket.
    d. Remove locknuts and bolts to release fairing bracket from holes at rear of steering head.

## INSTALLATION

1. If fairing bracket is installed, move to step 2. To install fairing bracket, proceed as follows:
   a. Route main harness, ultra overlay harness and radio ground wire through opening on right side of fairing bracket. See Figure 2-151.
   b. Align holes in fairing bracket with those at rear of steering head. Standing on right side, insert bolts until they exit fairing bracket on left side of vehicle. Install locknuts and tighten to 20-30 ft-lbs (27.1-40.7 Nm).
   c. Route jumper harness, ignition switch and handlebar switch control conduit through opening at top of fairing bracket. See Figure 2-151.

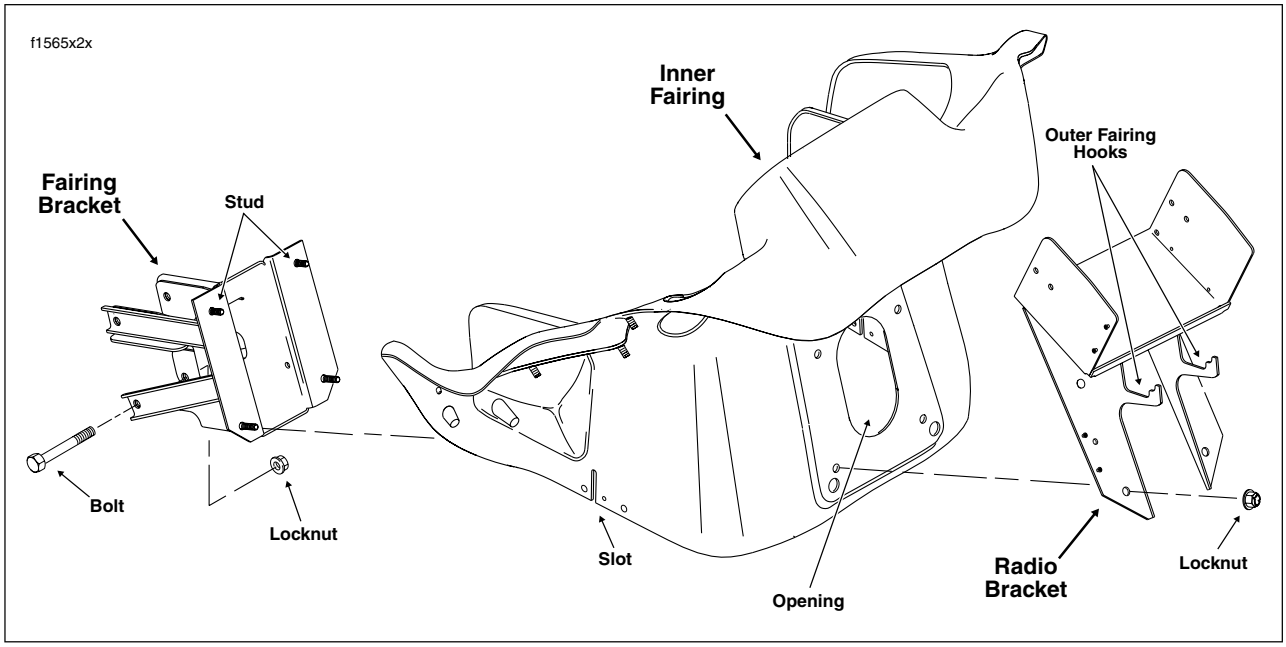



**Figure 2-150. Inner Fairing Assembly**

d. Draw wire harnesses and conduit out tunnel of fairing bracket and pull as far forward as possible. Tightly wrap clean shop towels around the harness bundle and secure with masking tape. See Figure 2-149.

2. Place protective material on top of front fender to protect paint from scratches or other damage. Rest inner fairing (with attached radio bracket) on front fender.

3. Place inner fairing over four fairing bracket studs while feeding end of harness bundle through opening beneath radio. See Figure 2-150. Verify that sides of inner fairing are positioned outboard of both fairing supports (on engine guards).

4. Install four locknuts to secure radio bracket and inner fairing to fairing bracket studs. Tighten locknuts to 8-12 ft-lbs (10.8-16.3 Nm).

5. Draw the harness bundle as far forward as possible, resting the end of the bundle on the front fender. See Figure 2-149.

6. Remove shop towels and masking tape from around the harness bundle. Separate jumper harness, main harness, ultra overlay harness and handlebar switch control conduit.

7. On both sides of inner fairing, route turn signal conduit through slots at bottom. Draw conduit and connectors upward toward front of vehicle and mate pin and socket halves. Capture turn signal conduit in flexible clip on both sides of inner fairing.

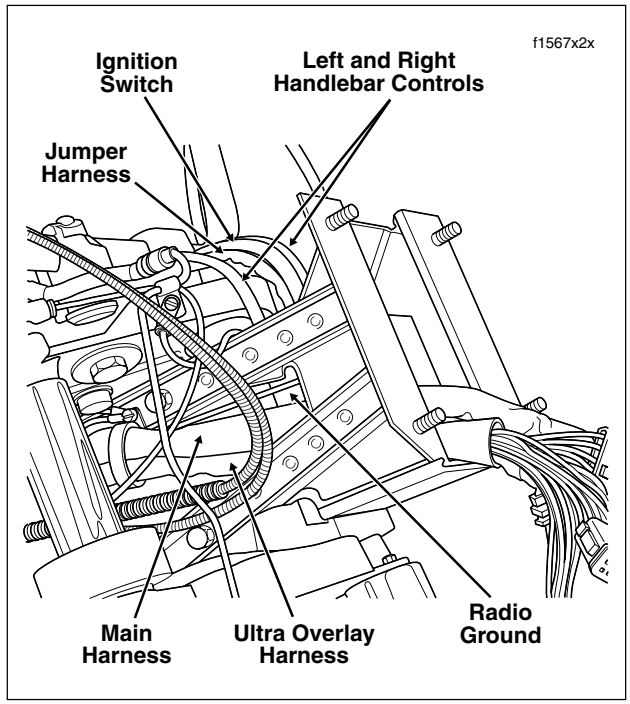



**Figure 2-151. Route Harnesses Thru Fairing Bracket**

8. See Figure 2-148. Connect handlebar switch controls, front turn signals and radio ground to interconnect harness as follows:

- Left handlebar switch controls connector [24], 12-place Deutsch (gray); T-stud on left side of radio bracket.
- Right handlebar switch controls connector [22], 12-place Deutsch (black); T-stud on right side of radio bracket.
- Front turn signal connector [31], 6-place Multilock; below radio (right side).
- Radio ground; single spade and socket terminal.

9. See Figure 2-148. Connect ultra overlay harness to interconnect harness as follows:
   - Ultra overlay to interconnect connector [6], 12-place Deutsch (black); T-stud on left side of radio bracket.
10. See Figure 2-148. Connect main harness to interconnect harness as follows:
    - Main to interconnect harness connector [1], 12-place Deutsch (black); below radio (right side).
    - Main to interconnect harness connector [2], 12-place Deutsch (gray); T-stud on front of right radio bracket (right side).
    - Main power connector [15], 4-place Packard (black); below radio.
    - Radio antenna cable connector [51]; back of radio (left side).
11. See Figure 2-148. Connect ignition switch to main harness as follows:
    - Ignition switch connector [33], 4-place Packard (black); inside fairing bracket tunnel (left side).
12. See Figure 2-148. Connect jumper harness to interconnect harness as follows:
    - Indicator Lamps connector [21], 10-place Multilock.
    - Instrument nacelle switch connector [105], 12-place Multilock.
13. Feed free end of main harness (branch terminating in function switch and speedometer and tachometer connectors) from front of inner fairing through tunnel of fairing bracket to instrument nacelle.
14. Carefully tuck wire bundles and conduit into tunnel of fairing bracket. Using holes at front corners of radio bracket, install two **new** cable straps to capture interconnect harness below radio. Cut excess cable strap material.
15. Install the outer fairing. See OUTER FAIRING, INSTALLATION, in this section.
16. Slide odometer reset switch through hole at lower right side of instrument nacelle. Install rubber boot to secure.
17. Install bezel. See BEZEL, INSTALLATION, in this section.

# GLOVE BOX DOOR/HINGE

## REMOVAL

1. Remove the outer fairing. See OUTER FAIRING, REMOVAL, in this section.
2. To access glove box door fasteners, pull out screw cap cover below hinge.
3. Holding locknuts at front of inner fairing, use a T25 TORX drive head to loosen hinge screws.

*NOTE*

*Late model vehicles may have a nut plate in lieu of locknuts and flat washers.*

4. Hold glove box door closed as hinge screws are completely removed. If not held closed, door will pop open as spring loaded hinge is released and door may be dropped to the floor.
5. If hinge replacement is necessary, remove plastic barrels to release hinge from door.

## INSTALLATION

1. Place spring inside hinge inserting spring pin into closest hole. With coil and one spring pin positioned inside hinge, second spring pin is outside.
2. Place hinge into position capturing free end of external spring pin between ribs molded into glove box door.
3. Install plastic barrels to hold hinge in door. Slot in barrel prevents interference with spring pin installed between ribs of door. Push barrels in until tight.

*NOTE*

*Install **new** glove box door bumpers in inner fairing if deteriorated or missing.*

4. Place glove box door into position against inner fairing. Holding locknuts (with flat washers) at front of inner fairing, use a T25 TORX drive head to tighten hinge screws.

*NOTE*

*Late model vehicles may have a nut plate in lieu of locknuts and flat washers.*

5. To conceal glove door fasteners, snap screw cap cover into place below hinge.
6. Install the outer fairing. See OUTER FAIRING, INSTALLATION, in this section.

# WINDSHIELD/HEADLAMP NACELLE (FLHR/C) 2.28

## WINDSHIELD REMOVAL

1. See Figure 2-152. Use a finger to raise the wireform latch springs on each side of the windshield.
2. Standing at the front of the vehicle, gently pull the top of the windshield until the upper notches on the side brackets are free of the upper grommets.
3. Carefully raise the windshield until the lower notches in the side brackets are free of the lower grommets.
4. Remove windshield from vehicle.

## WINDSHIELD INSTALLATION

**CAUTION**

**To avoid scratching headlamp nacelle or passing lamp support, be sure that notches on each bracket of the windshield are firmly seated on a rubber grommet.**

1. Lower the windshield into position carefully inserting the side brackets between the headlamp nacelle and the passing lamp supports until the bottom notches are seated on the lower grommets.
2. Standing at the front of the vehicle, gently push the top of the windshield toward the rear until the upper notches fully engage the upper grommets. See Figure 2-152.
3. Push down on the wireform latch springs so that they overhang the rubber grommets. If some adjustment is necessary, loosen the retaining bolts and rotate the latch springs into the proper position.

## NACELLE REMOVAL

1. Remove the windshield. See WINDSHIELD REMOVAL on this page.
2. Remove the Phillips screw at the bottom of the headlamp door (chrome ring). Remove the headlamp door.
3. Remove the seven Phillips screws to free the headlamp housing from the headlamp nacelle.

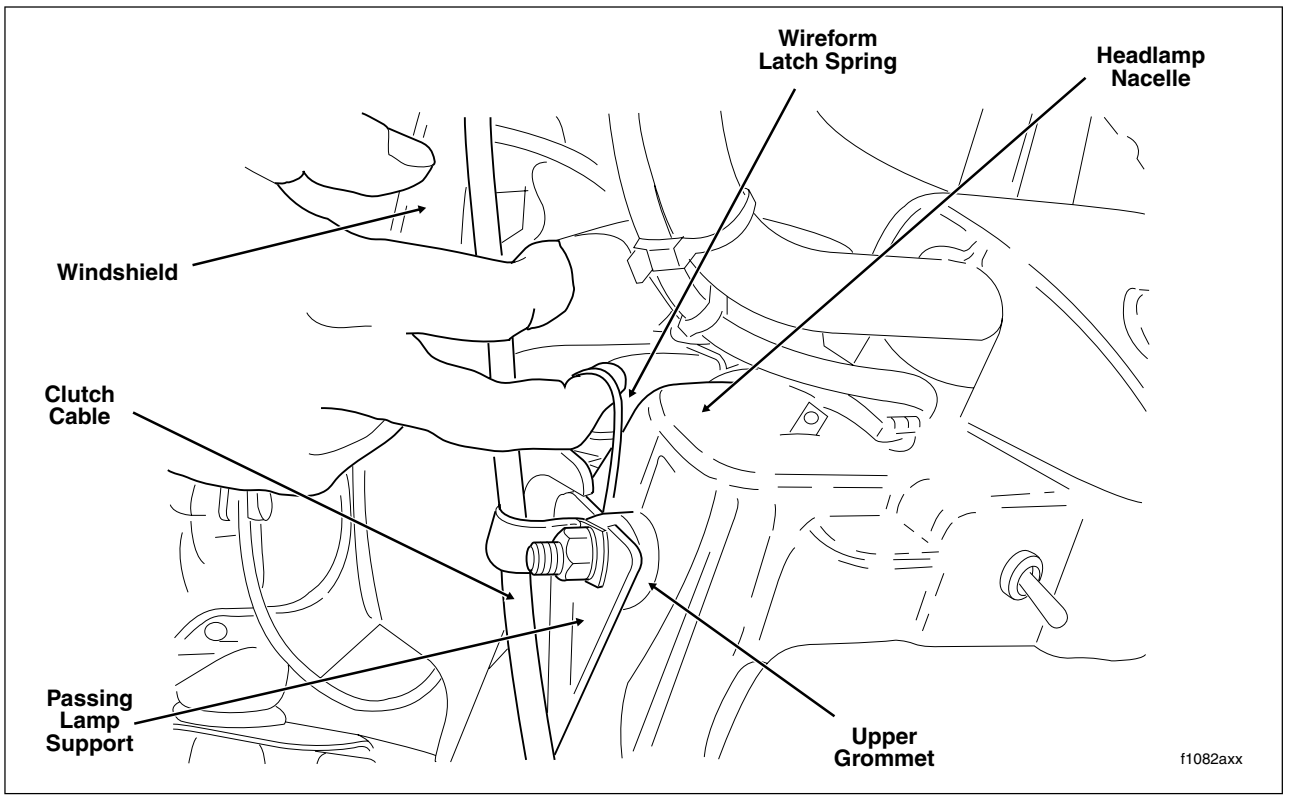



**Figure 2-152. Windshield (Left Side View)**

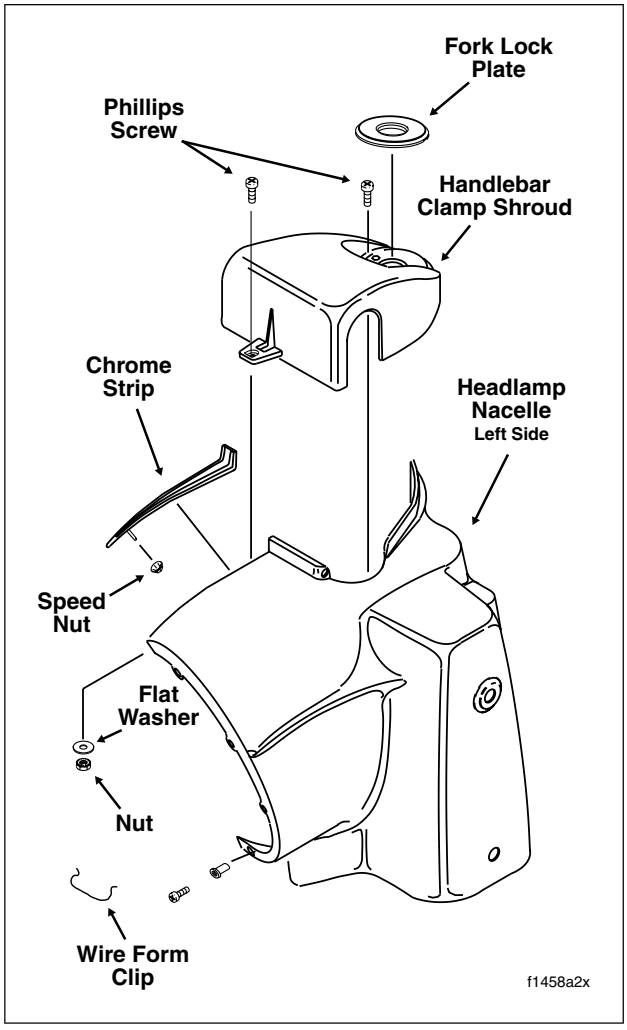



**Figure 2-153. Headlamp Nacelle Assembly**

4. Squeeze the two external tabs (if present) to remove the wire connector at the back of the headlamp bulb. Remove the headlamp housing assembly from the vehicle.
5. Reaching inside the headlamp nacelle, remove the speed nut to release the chrome strip at the top of the nacelle. See Figure 2-153.
6. Remove the wire form clip holding the halves of the nacelle together at the bottom.
7. Carefully pry off the fork lock plate at the rear of the handlebar clamp shroud. Remove two Phillips screws beneath the lock plate.
8. Loosen the Phillips screw from tab at the front of the handlebar clamp shroud (but do not remove).
9. Remove the two acorn nuts from the left side fork studs. Remove acorn nuts from the right side fork studs.
10. Cover the front fender with suitable material to protect the fender paint. Remove the passing lamp bracket from the left and right side fork studs and carefully set on front fender.
11. Remove the grommets (and clutch cable clamp) from the left and right side fork studs.
12. Raise the handlebar clamp shroud slightly, and while separating the halves of the headlamp nacelle, remove the shroud from the vehicle. See Figure 2-154.
13. Carefully pull the halves of the headlamp nacelle from the left and right side fork studs (while pulling apart the pin and socket halves of the Accessory Switch and Passing Lamp Switch connectors).

## NACELLE INSTALLATION

1. Fit halves of the headlamp nacelle together engaging the holes in the nacelle with the left and right side fork studs. Mate the pin and socket halves of the Accessory Switch and Passing Lamp Switch connectors.
2. Part the halves of the headlamp nacelle slightly. With the flatwasher on the handlebar clamp shroud facing the inside surface of the nacelle, slide the Phillips screw down the gap and position the shroud over the flange at the top of the nacelle. See Figure 2-154. With the halves of the nacelle mated, tighten the Phillips screw to 10-20 **in-lbs** (1.1-2.3 Nm).
3. Install the wire form clip to secure the halves of the nacelle together at the bottom.
4. Install two Phillips screws to secure the handlebar clamp shroud to the fork lock mechanism. Install the fork lock plate.
5. Inserting the weld stud on the chrome strip into the hole at the top of the headlamp nacelle, reach inside the nacelle to install a **new** speednut. Tighten the speednut to 10-20 **in-lbs** (1.1-2.3 Nm).
6. Install the grommets on the left and right side fork studs.

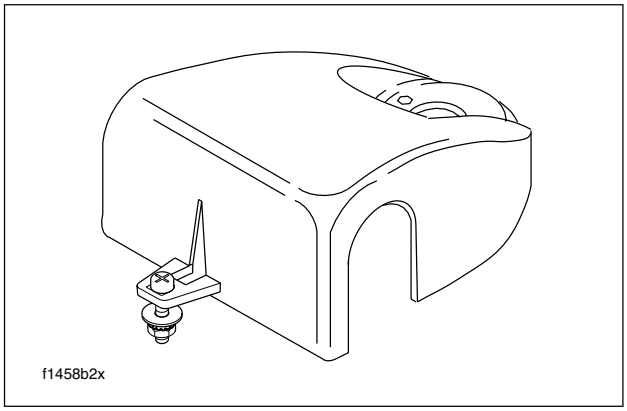



**Figure 2-154. Handlebar Clamp Shroud**

7. Slide the passing lamp bracket onto the left and right side fork studs. Verify that the four grommets are in place on the inboard side of the passing lamp brackets.
8. Install the acorn nuts on the fork studs and tighten to 18 ft-lbs (24.4 Nm). Be sure to capture the clutch cable clamp on the upper left stud before installing the acorn nut.
9. Install the wire connector at the back of headlamp bulb.
10. Align holes in headlamp housing with those in headlamp nacelle (headlamp door bracket at bottom). Install the seven Phillips screws.
11. Fit the square-shaped portion of the headlamp door spring into the slot at the top of the headlamp housing and then snap the headlamp door (chrome ring) into place. Install the Phillips screw at the bottom of the headlamp door.
12. Install the windshield. See WINDSHIELD INSTALLATION, in this section.

## REMOVAL

1. **FLHT/C/U:** Remove the outer fairing. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL. Locate front fender tip lamp connector (2-place Multilock) on inboard side of left fairing bracket. See Figure 2-155.

   **FLHR:** Remove the Phillips screw at the bottom of the headlamp door (chrome ring). Remove the headlamp door. Remove the seven Phillips screws to free the headlamp housing from the headlamp nacelle. Squeeze the two external tabs (if present) to remove the wire connector at the back of the headlamp bulb. Remove the headlamp housing assembly from the vehicle. Locate the front fender tip lamp connector (black 2-place Multilock). See Figure 2-156.

2. Depress the button on the socket terminal side of the connector and pull apart the pin and socket halves.

3. Draw socket connector down between chrome skirt and upper fork bracket to fender area.

4. Carefully cut cable strap to release front fender tip lamp wire from brake line hose.

5. Place the motorcycle on a hydraulic center stand with the front wheel raised off the ground.

6. Remove both the upper and lower mounting bolts from lugs of front fork leg to release brake caliper assembly. Lift caliper upward to remove from brake disc and allow to hang loose. Repeat step to release caliper on opposite side of wheel.

*NOTE*

*Do not operate the front brake hand lever with the front wheel removed or the caliper pistons may be forced out. Reseating pistons requires disassembly of the caliper.*

7. Insert screwdriver or steel rod through hole in axle on right side of vehicle. While holding axle stationary, remove the axle nut, lockwasher and flat washer on the left side.

8. Loosen the two slider cap nuts at bottom of right side fork leg.

9. With soft mallet, tap axle toward right side of vehicle until loose. Pull axle from hub while supporting wheel. Remove wheel.

10. Bend tabs on lockplates away from flats of four fender mounting bolts. Remove fender mounting bolts and lockplates. Remove fender from vehicle.

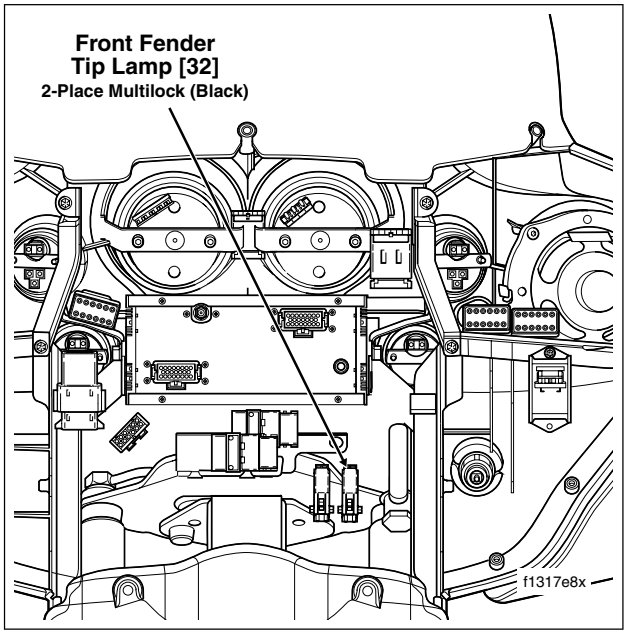



**Figure 2-155. Inner Fairing (FLHT/C/U)**

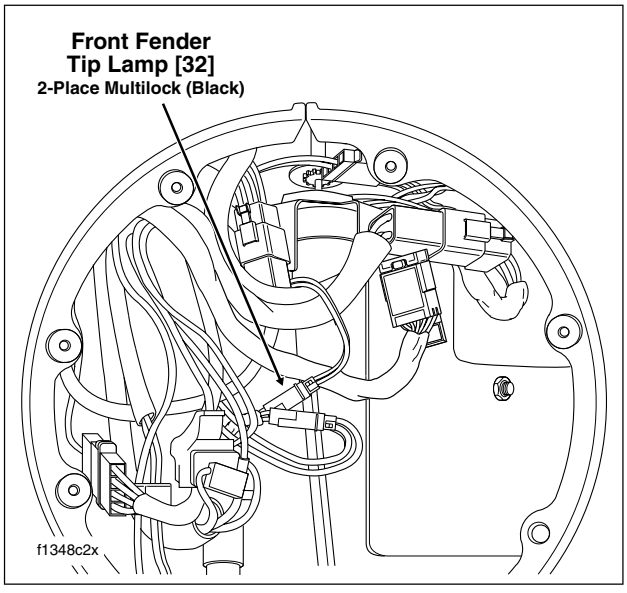



**Figure 2-156. Headlamp Nacelle (FLHR)**

## INSTALLATION

1. Align mounting holes in fender and lockplates with those in fork tubes. Install four fender mounting bolts and tighten to 14-18 ft-lbs (19-24 Nm). Bend tabs on lockplates against flats of fender mounting bolts.

2. Route socket connector upward between chrome skirt and upper fork bracket to inboard side of left fairing bracket (FLHT/C/U) or headlamp nacelle (FLHR). Mate pin and socket halves of front fender tip connector.

3. Place wheel into position between forks with the valve stem on the right side of the vehicle.

4. Coat the axle with ANTI-SIEZE LUBRICANT.

5. Supporting wheel, insert threaded end of axle through right fork. Push axle through fork, external spacer and wheel hub until it begins to emerge from left side.

6. Push axle through external spacer and left fork until axle shoulder contacts external spacer on right fork side.

7. Install flat washer, lock washer and nut over threaded end of axle.

8. Insert screwdriver or steel rod through hole in axle on right side of vehicle. While holding axle stationary, tighten axle nut to 50-55 ft-lbs (68-75 Nm).

9. Insert 7/16 inch drill bit into hole in axle.

10. Pull fork leg so that it just contacts drill bit, and then tighten slider cap nuts on right side of vehicle to 5-11 ft-lbs (7-15 Nm).

11. Remove drill bit from axle hole.

12. Install brake caliper as follows:

    a. With the bleeder valve topside, position caliper so that brake disc is situated between friction pads. Now align upper mounting hole in caliper with upper mounting lug on fork leg.

    b. Loosely install long caliper mounting bolt into upper lug of front fork leg.

    c. Install short caliper mounting bolt into lower lug of front fork leg. Tighten lower mounting bolt to 28-38 ft-lbs (37.9-51.5 Nm).

    d. Tighten upper caliper mounting bolt to 28-38 ft-lbs (37.9-51.5 Nm).

    e. Repeat step 12 to install caliper on opposite side of wheel.

13. Install **new** cable strap to secure front fender tip lamp wire to brake line hose.

14. **FLHT/C/U:** Install the outer fairing. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.

    **FLHR:** Install wire connector at the back of the headlamp bulb. Align holes in headlamp housing with those in headlamp nacelle. Install seven Phillips screws. Install the headlamp door (chrome ring) and door screw.

## REMOVAL

1. Place the motorcycle on a hydraulic center stand with the rear wheel raised off the ground.
2. Remove seat. See Section 2.21 SEAT, REMOVAL.
3. Remove rear wheel. See Section 2.3 REAR WHEEL, REMOVAL.
4. Disconnect the Rear fender lights connector anchored at the front of the rear fender. Depress the button on the socket terminal side and pull apart the pin and socket halves. Release anchor from fender hole. See Figure 2-157.
5. Release shock air inlet tee by pulling anchor from rear fender hole.
6. Gently pull side cover from frame downtube (no tools required). Repeat step on opposite side of vehicle.
7. Remove four screws (two on FLHR/C and FLTR) to release license plate bracket from luggage rack.
8. Standing on left side of vehicle, use a T40 TORX drive head to release front of rear fender from battery box. See Figure 2-158.

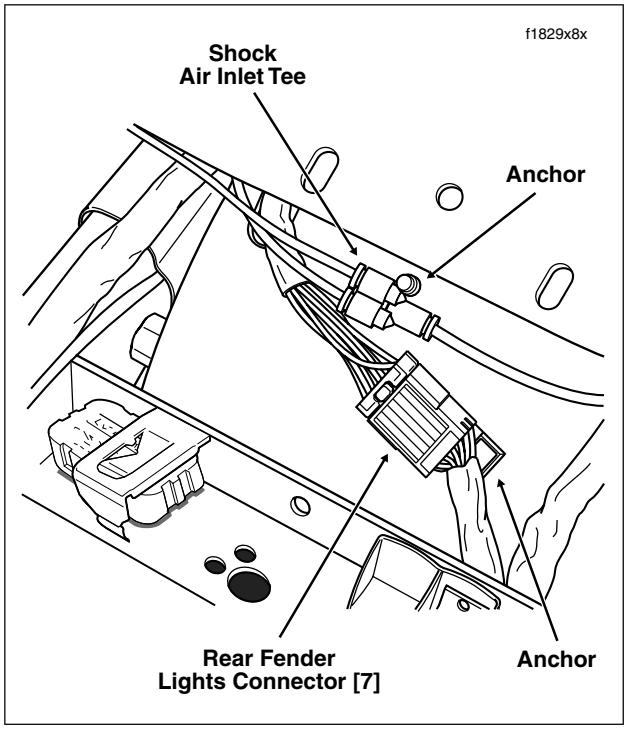



**Figure 2-157. Rear Fender (Top View)**

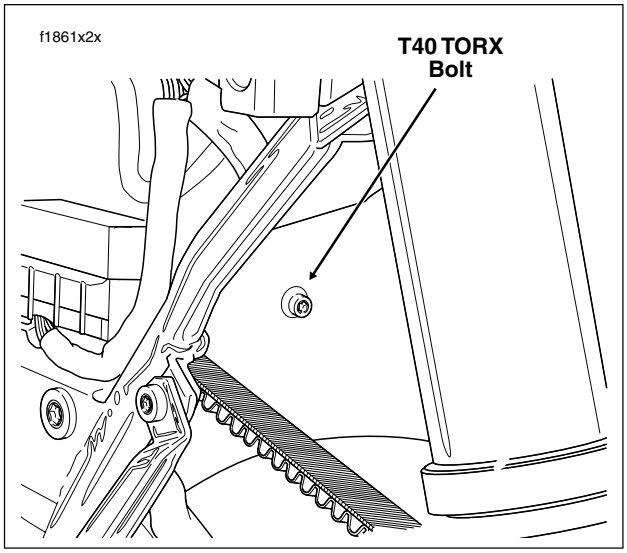



**Figure 2-158. Rear Fender Front Mounting Bolt (Left Side View)**

9. At rear of vehicle, remove inside bolt (and flange nut) to release rear bumper support rail from saddlebag support bracket and saddlebag support rail. Repeat step on opposite side of vehicle. See Figure 2-159.
10. Reaching under bumper, remove nut (with flat washer) to free bumper bracket from weld stud on fender. Remove bumper from vehicle.
11. Using a T40 TORX drive head, remove fender side mounting bolt located just below side cover grommet. Repeat step on opposite side of vehicle. See Figure 2-161.

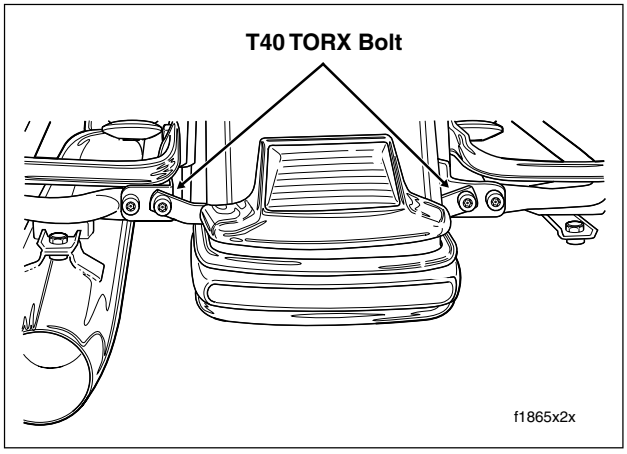



**Figure 2-159. Release Bumper From Saddlebag Rail**

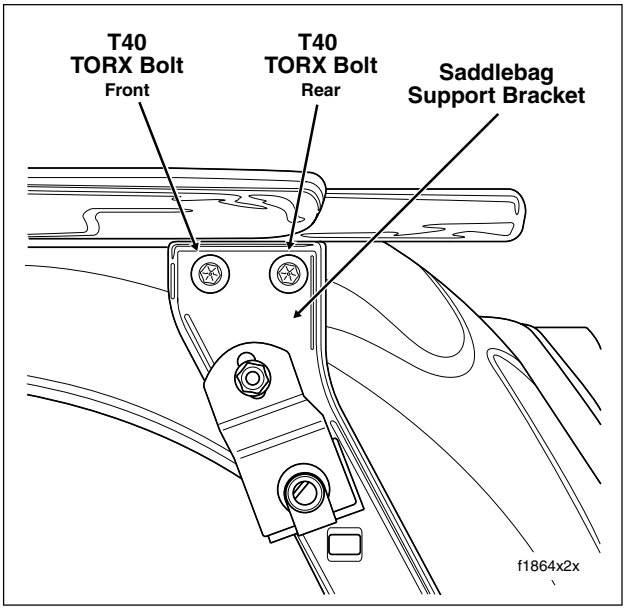



**Figure 2-160. Saddlebag Support Bracket Bolts (Left Side View)**

12. Using a T40 TORX drive head, remove upper rear bolt from saddlebag support bracket. Repeat step on opposite side of vehicle. See Figure 2-160.

13. Remove upper front bolt from saddlebag support bracket. Repeat step on opposite side of vehicle. Be aware that rear fender will drop when the forward bolts are removed.

14. Exercising caution to avoid scratching fender paint on luggage rack or other bracketry, carefully roll the fender out. See Figure 2-162. If necessary, have one person spread the saddlebag support brackets while the fender is rolled out.

## INSTALLATION

1. Exercising caution to avoid scratching fender paint on luggage rack or other bracketry, carefully roll the fender in. See Figure 2-162. If necessary, have one person spread the saddlebag support brackets while the other rolls the fender in.

2. Engaging hole of fender rear spacer nut, use a T40 TORX drive head to start upper front bolt in saddlebag support bracket. Repeat step on opposite side of vehicle. See Figure 2-160.

3. Start upper rear bolt in saddlebag support bracket. Repeat step on opposite side of vehicle.

4. Standing on left side of vehicle, start bolt securing front of rear fender to battery box. See Figure 2-158.

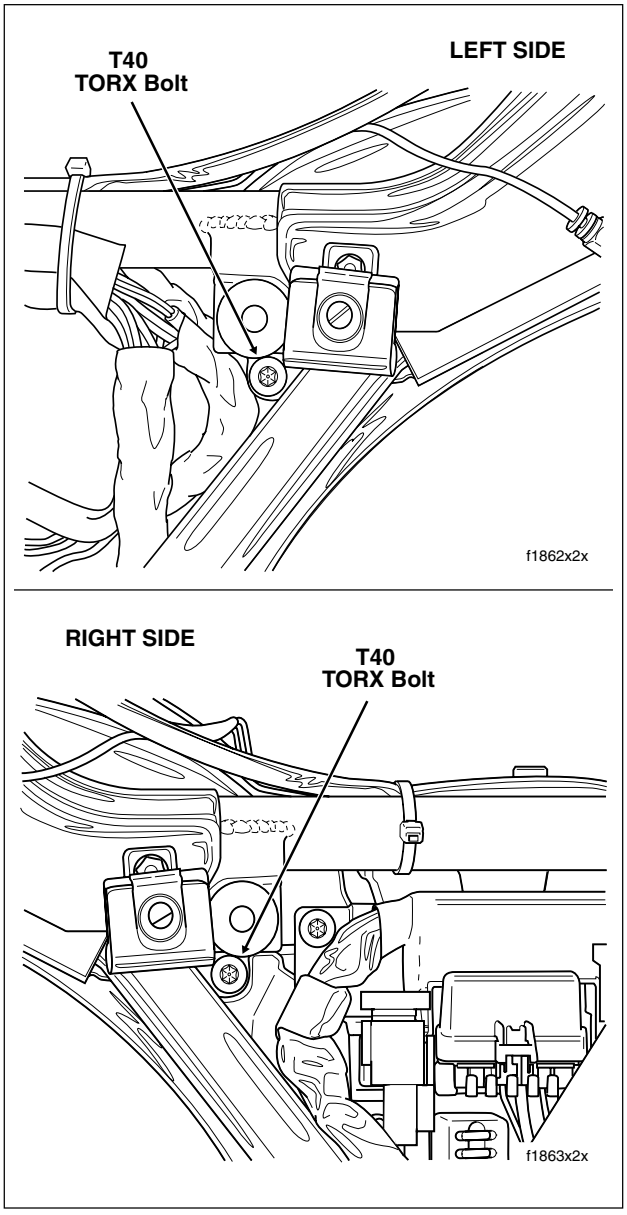



**Figure 2-161. Rear Fender Side Mounting Bolts**

5. Engaging hole in frame and fender front spacer nut, start fender side mounting bolt located just below side cover grommet. Repeat step on opposite side of vehicle. See Figure 2-161.

6. Reaching under rear fender, hang bumper bracket on fender weld stud. Install flat washer and start nut on stud.

7. Start inside bolt (with flange nut) to fasten rear bumper support rail to saddlebag support bracket and saddlebag support rail. Repeat step on opposite side of vehicle. See Figure 2-159.

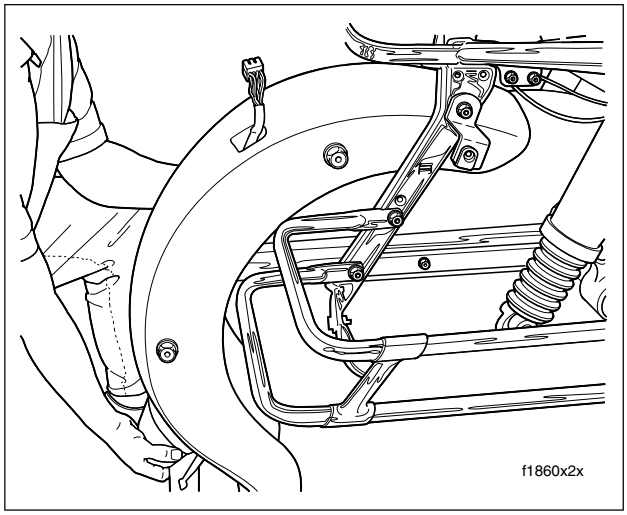



**Figure 2-162. Carefully Roll Out Rear Fender**

8. Alternately tighten all rear fender T40 TORX bolts to 19 ft-lbs (26 Nm). Tighten nut on fender weld stud to secure bumper bracket.
9. Install four screws (two on FLHR/C and FLTR) to secure license plate bracket to luggage rack.
10. Mate pin and socket halves of Rear fender lights connector and snap anchor in rear fender hole. See Figure 2-157.
11. Install anchor of shock air inlet tee in rear fender hole.
12. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required). Repeat step on opposite side of vehicle.
13. Install rear wheel. See Section 2.3 REAR WHEEL, INSTALLATION.
14. Install seat. See Section 2.21 SEAT, INSTALLATION.

# JIFFY STAND 2.31

## GENERAL

The vehicle is equipped with a jiffy stand (or side stand) that locks when placed in the full forward position (down) with the full weight of the vehicle resting on it.

**⚠WARNING**

**Without the full weight of the motorcycle resting on the jiffy stand, any vehicle movement can cause the jiffy stand to retract slightly from the full forward position. If the jiffy stand is not in the full forward or lock position when the full vehicle weight is rested on it, the vehicle could fall over, which could result in death or serious injury.**

**⚠WARNING**

**Always park the vehicle on a firm, level surface. The weight of the vehicle can cause it to fall over, which could result in death or serious injury.**

**⚠WARNING**

**Be sure jiffy stand is fully retracted before riding. If jiffy stand is not fully retracted during vehicle operation, unexpected contact with the road surface can distract the rider. While the jiffy stand will retract upon contact, the momentary disturbance and/or rider distraction can lead to loss of vehicle control resulting in death or serious injury.**

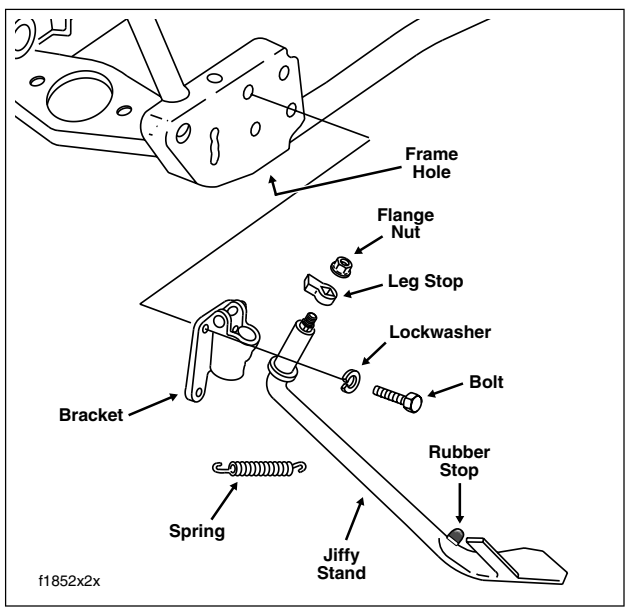



**Figure 2-163. Jiffy Stand Assembly**

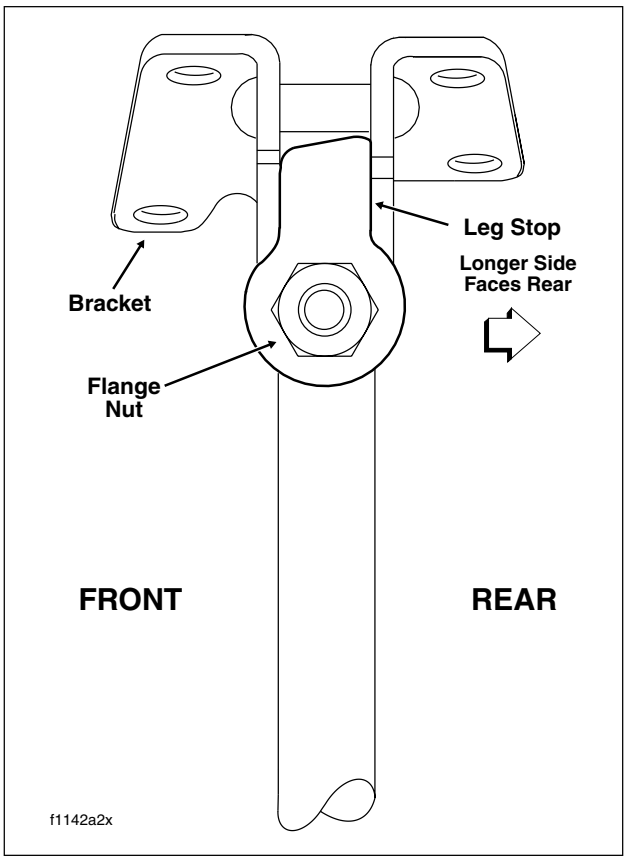



**Figure 2-164. Leg Stop Orientation (Full Forward Position)**

## REMOVAL

**⚠WARNING**

**Securely block vehicle under frame to be sure that vehicle will not fall when jiffy stand is removed. Inadequate safety precautions could result in death or serious injury.**

1. Block motorcycle under frame, so that vehicle is securely upright and level. Jiffy stand should be able to move through its full range of travel without the weight of the vehicle resting on it.
2. See Figure 2-163. Move jiffy stand to the retracted position (up). Remove flange nut and leg stop from threaded end of jiffy stand leg.
3. Move jiffy stand to the full forward position (down). Grasping end of spring as close to frame tube as possible, twist and turn end with needle nose pliers to unhook from frame hole. Remove jiffy stand leg from bracket.

4. Inspect jiffy stand assembly for worn or damaged parts. Replace parts as necessary.

## INSTALLATION

1. Lubricate the jiffy stand leg with SUPER OIL WITH TEFLON, Part No. 94968-85TV. Restrict the application to the area of the jiffy stand leg that rotates within the bracket.
2. Insert threaded end of jiffy stand up through bottom of bracket. With jiffy stand in the full forward position, partially place spring end into frame hole. Rap spring with a rubber mallet to fully seat in hole.

*NOTE*

*Verify that opposite end of spring enters hole at front of leg weldment. If end enters hole from rear, spring coil will rub on leg when jiffy stand is exercised.*

3. Holding jiffy stand at the full forward position, install leg stop over threaded end with the stamped “side down.” Install flange nut and tighten to 43-53 ft-lbs (58-72 Nm).

**⚠WARNING**

**If leg stop is installed incorrectly, excess wear may cause the vehicle to fall over when rested on the jiffy stand, which could result in death or serious injury.**

4. Verify that the longer side of the leg stop faces the rear of the vehicle. See Figure 2-164.

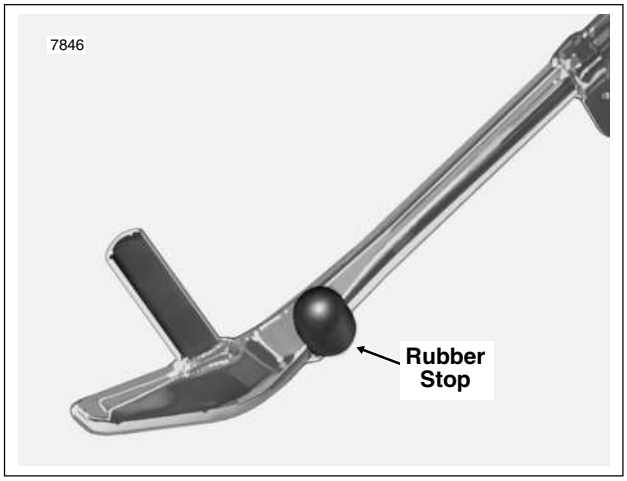



**Figure 2-165. Jiffy Stand**

5. Extend and retract jiffy stand leg several times to verify proper operation. Jiffy stand should swing freely to the fully extended and fully retracted positions.
6. Move jiffy stand to the full forward position. Carefully remove support blocking from beneath motorcycle frame and rest motorcycle on jiffy stand.

**CAUTION**

**Verify that rubber stop is in place on prong of jiffy stand. Without the rubber stop, the stand will make hard contact with the lower frame tube when retracted, possibly resulting in chipping or nicking of the powder coat. Replace rubber stop if torn or deteriorated. See Figure 2-165.**

## REMOVAL

1. Remove saddlebags. See Section 2.22 SADDLEBAG, REMOVAL.
2. See Figure 2-167. Open worm drive clamps to remove six heat shields from exhaust pipes. Mark the location of the heat shields to ensure proper assembly.
3. Using a bungee cord, tie the muffler on the left side of the vehicle to the lower saddlebag support rail.
4. Remove the exhaust flange nuts to release the front and rear header pipes from the cylinder head studs. For best results, use impact wrench with long 1/2 inch swivel socket.
5. See Figure 2-166. Loosen the four TORCA clamps as follows:

   Right side of vehicle

   - front header pipe to rear header pipe
   - rear header pipe to right side muffler

   Left side of vehicle

   - rear header pipe to crossover pipe
   - crossover pipe to left side muffer

*NOTE*

*To facilitate removal, spray PB Blaster or other suitable penetrating oil in and around joints of exhaust pipes. For best results, be sure to allow sufficient time for the penetrating oil to work.*

6. Remove four bolts (with lockwashers) to detach left and right side mufflers from the lower saddlebag support rails.
7. Standing on right side of vehicle, remove muffler from Y-shaped rear header pipe.
8. Remove Keps nut to release bracket tab from slot in exhaust support bracket.
9. Remove Y-shaped rear header pipe from front header pipe, crossover pipe (to left side muffler) and rear cylinder head. Remove bracket tab from slot in TORCA clamp.
10. Remove bolt (with flat washer and locknut) from transmission clamp on front header pipe. Use a channel lock to open clamp and then remove from header pipe and transmission bracket. Remove front header pipe exhaust flange from front cylinder head.
11. Moving to left side of vehicle, remove crossover pipe from left side muffler.
12. Remove bungee cord to release left side muffler from lower saddlebag support rail.
13. Remove and discard gaskets from front and rear exhaust ports. Discard TORCA clamp bolt assemblies-one time usage only.

*NOTE*

*TORCA muffler clamps have eliminated the need for silicone or graphite tape during assembly. To ensure sealing integrity of muffler clamps and prevent the possibility of leakage, Harley-Davidson recommends that muffler clamp assemblies be discarded and replaced each time they are removed.*

## INSTALLATION

*NOTE*

*Always loosely assemble exhaust system on vehicle before following tightening procedure. Assemble as follows:*

1. Install **new** gaskets in both the front and rear cylinder head exhaust ports (with the tapered side out).
2. Install transmission clamp onto transmission side cover (clutch release cover), if removed.
3. Install front header pipe exhaust flange onto front cylinder head. Start flange nuts on cylinder head studs.
4. Engaging transmission bracket, capture front header pipe in transmission clamp. Use a channel lock to close clamp, if necessary. Finger tighten clamp bolt (with flat washer and locknut).
5. Slide a **new** TORCA clamp onto free end of front header pipe.
6. Install rear header pipe onto rear cylinder head and front header pipe. Start flange nuts on cylinder head studs. Move TORCA clamp into position between front and rear header pipes.
7. Slide **new** TORCA clamps onto free ends of rear header pipe. TORCA clamp to crossover pipe is special in that it has slot for bracket tab to exhaust support bracket.
8. Slide right side muffler onto rear header pipe. Finger tighten two bolts (with lockwashers) to attach muffler to lower saddlebag support rail. Place TORCA clamp into position between rear header pipe and right side muffler.
9. Moving to left side of vehicle, install crossover pipe onto remaining end of rear header pipe (above starter). Place TORCA clamp into position between rear header pipe and crossover pipe.
10. Fit bracket tab into slot of TORCA clamp engaging stud in slot of exhaust support bracket. Start Keps nut on stud.
11. Slide **new** TORCA clamp onto free end of crossover pipe.
12. Using a bungee cord, tie left side muffler to lower saddlebag support rail. Install left side muffler on crossover pipe. Place TORCA clamp into position between crossover pipe and left side muffler. Finger tighten bolts to attach muffler to saddlebag support rail.

**CAUTION**

**Verify that the exhaust pipes do not contact the vehicle frame or any mounted components. Contact will cancel the effect of the rubber isolation mounts and transmit vibration to the rider via the vehicle frame.**

13. Tighten the exhaust system as follows:

    a. Tighten the top nut of the front cylinder head exhaust flange to 9-18 **in-lbs** (1-2 Nm). Tighten the lower nut to 120 **in-lbs** (14 Nm). Final tighten the top nut to 120 **in-lbs** (14 Nm).

    b. Repeat step (a.) on the exhaust flange nuts of the rear cylinder.

    c. Tighten the transmission clamp bolt.

    d. Tighten the two bolts (with lockwashers) to fasten the right side muffler to the lower saddlebag support rail.

    e. Tighten the two bolts (with lockwashers) to fasten the left side muffler to the lower saddlebag support rail.

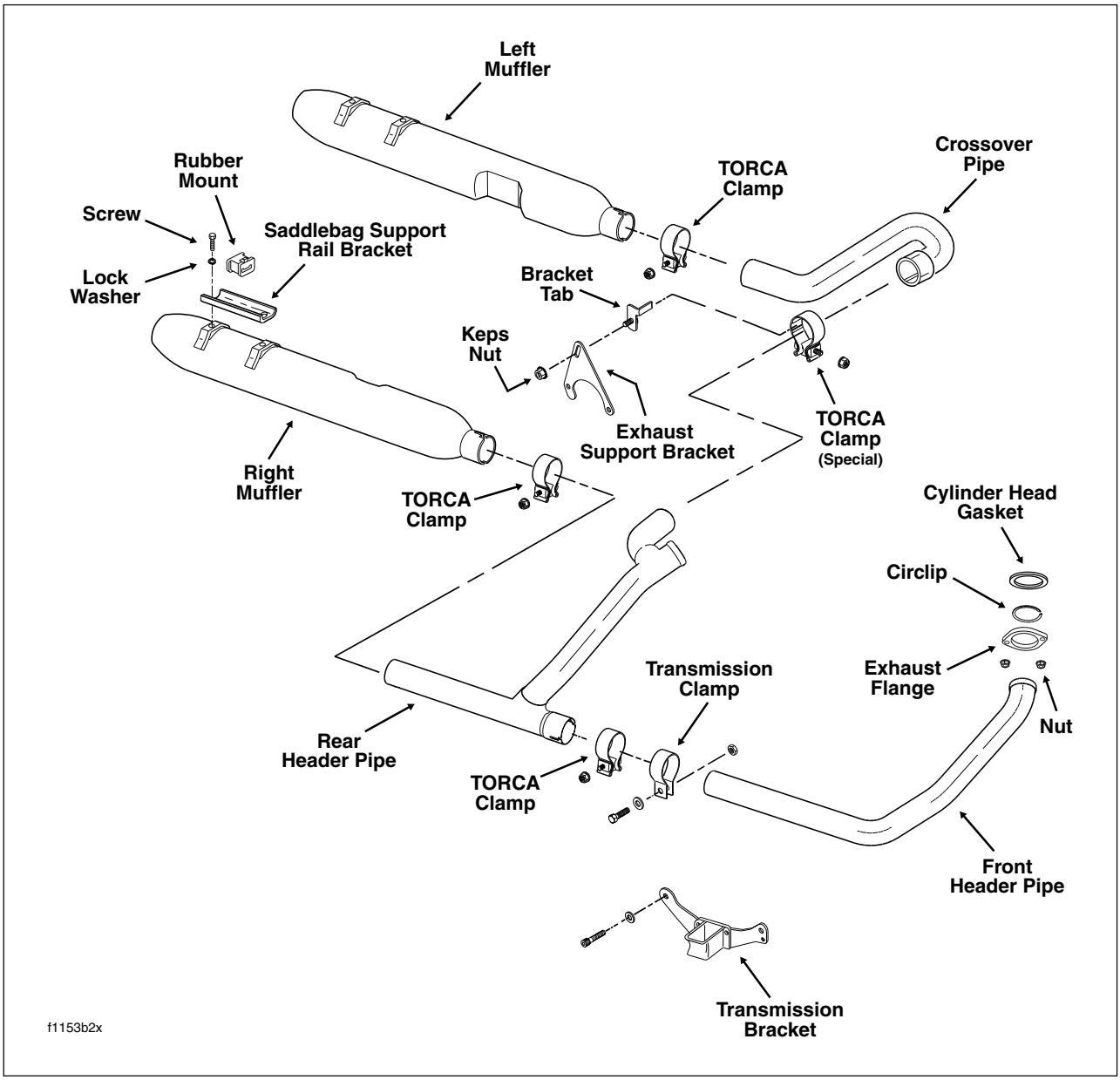



**Figure 2-166. Exhaust System (without Heat Shields)**

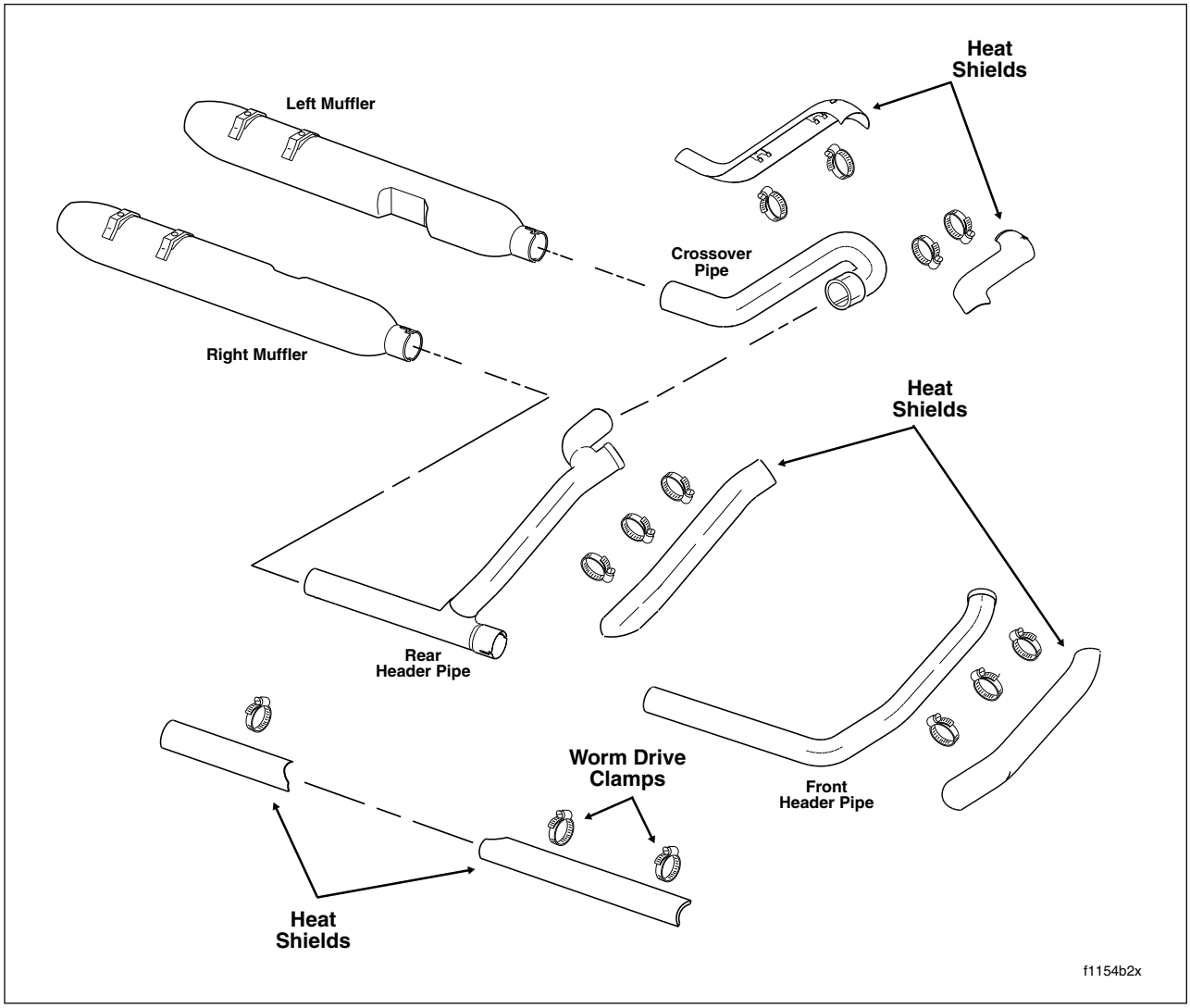



**Figure 2-167. Heat Shields**

f. Verify that all exhaust pipes are in alignment and do not contact the vehicle frame or mounted components.

g. Tighten the four TORCA clamps to 45-60 ft-lbs (61-81 Nm) in the following order:

- crossover pipe to left side muffer
- rear header pipe to right side muffer
- front header pipe to rear header pipe
- rear header pipe to crossover pipe

14. Tighten Keps nut securing bracket tab to exhaust support bracket.

15. Open worm drive clamps and install six heat shields on exhaust pipes as marked during removal. See Figure 2-167. Position each clamp so that screw is on the outboard side in the most accessible position and then tighten to 20-40 **in-lbs** (2.3-4.5 Nm).

**CAUTION**

**Verify that the heat shields do not contact the vehicle frame or any mounted components. Contact will cancel the effect of the rubber isolation mounts and transmit vibration to the rider via the vehicle frame.**

16. Remove bungee cord from left side muffler.

17. Install saddlebags. See Section 2.22 SADDLEBAG, INSTALLATION.

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# SPECIFICATIONS 3.1

## MANUFACTURING TOLERANCES

| General | |
|---|---|
| Number of cylinders | 2 |
| Type | 4-cycle, 45˚V$^2$, air-cooled |
| Torque | 82 ft-lbs (111 Nm) @ 3500 rpm, shorty dual exhaust |
| Bore | 3.75 in. (95.25 mm) |
| Stroke | 4.00 in. (101.6 mm) |
| Piston displacement (approx.) | 88 cu. in. (1450 cc) |
| Compression ratio | 9.0:1 |
| Combustion chamber | 5.187 cu. in. (85 cc) bathtub |
| Cam system | Twin cams, chain driven with spring loaded tensioners |
| Max. sustained engine speed | 5500 rpm |
| Idle speed | 1000 rpm +/- 50 |
| Weight | 165 lbs (74.8 kg) |

| Ignition System | |
|---|---|
| Type | Sequential, non waste spark, MAP-N control |
| Ignition timing: 1050 rpm (Hot Idle) | 20$^o$-30$^o$ |
| Spark plug size | 12 mm |
| Spark plug type | Harley-Davidson 6R12 |
| Spark plug gap | 0.038-0.043 in. (0.97-1.09 mm) |
| Spark plug torque | 11-18 ft-lbs (15-24 Nm) |

| Oiling System | |
|---|---|
| Pump | Twin gerotor, dual scavenge, crank mounted and driven, internal oil pump, dry sump |
| Pressure | 30-38 psi (207-262 kN/m$^2$) at 2000 rpm and normal operating temperature of 230$^o$ F (110$^o$ C) |
| Filtration | 10 micron media, filtered between pump and engine |

| Rocker Arm | IN. | MM |
|---|---|---|
| Shaft fit in bushing (loose) | 0.0005-0.0020 | 0.013-0.051 |
| End clearance | 0.003-0.013 | 0.08-0.033 |
| Bushing fit in rocker arm (tight) | 0.002-0.004 | 0.051-0.102 |

| Rocker Arm Shaft | IN. | MM |
|---|---|---|
| Shaft fit in rocker arm support plate (loose) | 0.0007-0.0022 | 0.018-0.056 |

| Hydraulic Lifter | IN. | MM |
|---|---|---|
| Fit in crankcase (loose) | 0.0008-0.0020 | 0.02-0.05 |

| Cylinder Head | IN. | MM |
|---|---|---|
| Valve guide in head (tight) | 0.0020-0.0033 | .0060.051-0.084 |
| Valve seat in head (tight) | 0.003-0.0045 | 0.076-0.114 |
| Head gasket surface (flatness) | 0.006 | 0.0152 |

| Valve | IN. | MM |
|---|---|---|
| Fit in guide: exhaust | 0.0015-0.0033 | 0.038-0.084 |
| Fit in guide: intake | 0.0008-0.0026 | 0.020-0.066 |
| Seat width | 0.040-0.062 | 1.02-1.58 |
| Stem protrusion from cylinder head boss | 1.990-2.024 | 50.55-51.41 |

| Valve Spring | Outer | Inner |
|---|---|---|
| Closed | 72-92 lbs @ 1.751-1.848 in. | 38-49 lbs @ 1.577-1.683 in. |
| | 33-42 kg @ 44.45-46.9 mm | 17-22 kg @ 40.1-42.8 mm |
| Open | 183-207 lbs @ 1.282-1.378 in. | 98-112 lbs @ 1.107-1.213 in. |
| | 83-94 kg @ 32.6-35.0 mm | 44-51 kg @ 28.1-30.8 mm |
| Free length | 2.105-2.177 in. | 1.926-1.996 in. |
| | 53.47-55.3 mm | 48.9-50.7 mm |

| Piston | IN. | MM |
|---|---|---|
| Fit in cylinder | 0.0006-0.0017 | 0.015-0.043 |
| Ring end gap: | | |
| Top compression ring | 0.010-0.020 | 0.25-0.51 |
| 2nd compression ring | 0.014-0.024 | 0.36-0.61 |
| Oil control ring | 0.010-0.050 | 0.25-1.27 |
| Ring side clearance: | | |
| Top compression ring | 0.0012-0.0037 | 0.030-0.094 |
| 2nd compression ring | 0.0012-0.0037 | 0.030-0.094 |
| Oil control ring | 0.0031-0.0091 | 0.079-0.23 |
| Piston pin fit (loose) | 0.0003-0.0005 | 0.008- 0.013 |

## MANUFACTURING TOLERANCES (CONT.)

| Connecting Rod | IN. | MM |
|---|---|---|
| Piston pin fit (loose) | 0.0003-0.0007 | 0.008-0.018 |
| Side play between flywheels | 0.005-0.015 | 0.13-0.38 |
| Connecting rod to crankpin (loose) | 0.0004-0.0017 | 0.0102-0.0432 |

| Flywheel | IN. | MM |
|---|---|---|
| Runout (flywheels at rim) | 0.000-0.010 | 0.0-0.25 |
| Runout (shaft at flywheel) | 0.000-0.002 | 0.0-0.05 |
| End play | 0.001-0.005 | 0.03-0.13 |

| Sprocket Shaft (Timken) Bearing | IN. | MM |
|---|---|---|
| Cup fit in crankcase (tight) | 0.003-0.005 | 0.08-0.13 |
| Cone fit on shaft (tight) | 0.005-0.0015 | 0.013-0.038 |

| Crankshaft (Roller) Bearing | IN. | MM |
|---|---|---|
| Roller bearing fit (loose) | 0.0002-0.0015 | 0.005-0.038 |
| Crankshaft runout | 0.0-0.003 | 0.0-0.076 |
| Bearing fit in crankcase (tight) | 0.0018-0.0021 | 0.046-0.053 |
| Bearing inner race on crankshaft (tight) | 0.0009-0.0012 | 0.023-0.031 |

## TORQUE VALUES

| Item | ft/in-lbs | NM |
|---|---|---|
| Breather cover bolts | 90-120 **in-lbs** | 10-14 Nm |
| Cam cover screws | 90-120 **in-lbs** | 10-14 Nm |
| Cam position sensor cover screws | 20-30 **in-lbs** | 2.3-3.4 Nm |
| Cam position sensor screw | 50-80 **in-lbs** | 6-9 Nm |
| Cam support plate screws | 90-120 **in-lbs** | 10-14 Nm |
| Bearing retainer plate screws | 20-30 **in-lbs** | 2-3 Nm |
| Crank sprocket flange bolt | 15 ft-lbs, loosen one full turn, 24 ft-lbs | 20.3 Nm, loosen one full turn, 32.5 Nm |
| Primary cam sprocket flange bolt | 15 ft-lbs, loosen one full turn, 34 ft-lbs | 20.3 Nm, loosen one full turn, 46.1 Nm |
| Crank position sensor screw | 90-120 **in-lbs** | 10-14 Nm |
| Transmission housing to crankcase bolts | 15 ft-lbs, 30-35 ft-lbs | 20 Nm, 41-48 Nm |
| Crankcase to front engine mounting bracket bolts | 33-38 ft-lbs | 45-52 Nm |
| Crankcase bolts | 10 ft-lbs, 15-19 ft-lbs | 14 Nm, 20-26 Nm |
| Cylinder head bolts | 7-9 ft-lbs, 12-14 ft-lbs + 90° turn | 9-12 Nm, 16-19 Nm + 90° turn |
| Cylinder studs | 10-20 ft-lbs | 14-27 Nm |
| Engine oil drain plug | 14-21 ft-lbs | 19-28 Nm |
| Lifter cover screws | 90-120 **in-lbs** | 10-14 Nm |
| Oil pan screws | 7-9 ft-lbs | 9-12 Nm |
| Oil filter | 1/2-3/4 turn after gasket contact | |
| Oil filter mount | 90-120 **in-lbs** | 10-14 Nm |
| Crankcase oil fittings/plugs | 10-12 ft-lbs | 14-16 Nm |
| Oil hose cover screws | 7-9 ft-lbs | 10-12 Nm |
| Oil pressure sending unit | 8-10 ft-lbs | 11-14 Nm |
| Rocker arm support plate bolts | 18-22 ft-lbs | 24-30 Nm |
| Rocker cover bolts | 15-18 ft-lbs | 20-24 Nm |
| Rocker housing bolts | 10-14 ft-lbs | 14-19 Nm |
| Spark plugs | 11-18 ft-lbs | 15-24 Nm |
| Stator screws | 30-40 **in-lbs** | 4-5 Nm |
| Upper engine mounting bracket:<br>To cylinder heads<br>To top stabilizer link | <br>28-35 ft-lbs<br>18-22 ft-lbs | <br>38-48 Nm<br>24-30 Nm |
| Sensor harness to crankcase screw | 20-30 **in-lbs** | 2-3 Nm |

# SERVICE WEAR LIMITS 3.2

## GENERAL

Wear limits can be used as a guide when deciding whether to reuse engine parts. Replace used parts whenever the following wear limits are exceeded.

| Rocker Arm/ Rocker Arm Shaft | REPLACE IF WEAR EXCEEDS | |
|---|---|---|
| | IN. | MM |
| Shaft fit in bushing (loose) | 0.0035 | 0.089 |
| End clearance | 0.025 | 0.635 |
| Shaft fit in rocker arm support plate (loose) | 0.0035 | 0.089 |

| Hydraulic Lifter | REPLACE IF WEAR EXCEEDS | |
|---|---|---|
| | IN. | MM |
| Fit in crankcase | 0.003 | 0.08 |
| Roller fit | 0.0015 | 0.038 |
| Roller end clearance | 0.015 | 0.38 |

| Cam Support Plate | REPLACE IF WEAR EXCEEDS | |
|---|---|---|
| | IN. | MM |
| Cam chain tensioner shoe | 0.080-0.090 | 2.03-2.29 |
| | 1/2 thickness of shoe | |
| Cam support plate warpage | 0.010 | 0.25 |
| Crankshaft bushing fit | 0.0008-0.001 | 0.0203-0.0254 |

| Cylinder Head | REPLACE IF | |
|---|---|---|
| | IN. | MM |
| Valve guide in head (tight) | Less than 0.002 | Less than 0.051 |
| Valve seat in head (tight) | Less than 0.002 | Less than 0.0051 |
| Head warpage | More than 0.006 | More than 0.15 |

| Cylinder | REPLACE IF WEAR EXCEEDS | |
|---|---|---|
| | IN. | MM |
| Taper | 0.002 | 0.05 |
| Out of round | 0.003 | 0.08 |
| Warpage of gasket or O-ring surfaces: top | 0.006 | 0.15 |
| Warpage of gasket or O-ring surfaces: base | 0.008 | 0.20 |

| Cylinder Bore | REPLACE IF WEAR EXCEEDS | |
|---|---|---|
| | IN. | MM |
| Standard | 3.753 | 95.326 |
| 0.005 in. oversize | 3.758 | 95.453 |
| 0.010 in. oversize | 3.763 | 95.580 |
| 0.020 in. oversize | 3.773 | 95.834 |
| 0.030 in. oversize | 3.783 | 96.088 |

| Piston | | REPLACE IF WEAR EXCEEDS | |
|---|---|---|---|
| | | IN. | MM |
| Fit in cylinder (loose) | | 0.0053 | 0.135 |
| Piston pin fit (loose) | | 0.001 | 0.025 |
| Ring end gap | Top compression | 0.030 | 0.76 |
| | 2nd compression | 0.034 | 0.86 |
| | Oil control ring rails | 0.050 | 1.27 |
| Ring side clearance | Top compression | 0.0045 | 0.11 |
| | 2nd compression | 0.0045 | 0.11 |
| | Oil control ring rails | 0.010 | 0.25 |

| Connecting Rod | REPLACE IF WEAR EXCEEDS | |
|---|---|---|
| | IN. | MM |
| Piston pin fit (loose) | 0.001 | 0.025 |
| Side play between flywheels | 0.020 | 0.51 |
| Fit on crankpin (loose) | 0.002 | 0.05 |

| Flywheel | REPLACE IF WEAR EXCEEDS | |
|---|---|---|
| | IN. | MM |
| Runout (flywheels at rim) | 0.015 | 0.38 |
| Runout (shaft at flywheel) | 0.003 | 0.08 |
| End play | 0.006 | 0.15 |

# NOTES

## FUEL

Use a good quality leaded or unleaded gasoline (91 pump octane or higher). Octane rating is usually posted on the pump.

**CAUTION**

**Using gasolines with alcohol additives (such as methanol) can cause rubber components within the fuel system to fail or result in engine damage.**

### GASOLINE/ALCOHOL BLENDS

Harley-Davidson motorcycles were designed to give the best performance using unleaded gasoline. Some fuel suppliers sell gasoline/alcohol blends as a fuel. The type and amount of alcohol added to the fuel is important.

- DO NOT USE GASOLINES CONTAINING METHANOL. Using gasoline/methanol blends will result in starting and driveablility deterioration and damage to critical fuel system components.
- ETHANOL is a mixture of 10% ethanol (Grain alcohol) and 90% unleaded gasoline. Gasoline/ethanol blends can be used in your motorcycle if the ethanol content does not exceed 10%.
- REFORMULATED OR OXYGENATED GASOLINES (RFG): “Reformulated gasoline” is a term used to describe gasoline blends that are specifically designed to burn cleaner than other types of gasoline. Your motorcycle will run normally using this type of gas.

You may find that some gasoline blends adversely affect the starting, driveability or fuel efficiency of your bike. If you experience one or more of these problems, we recommend you try a different brand of gasoline or gasoline with a higher octane rating.

## LUBRICATION

### CHECKING ENGINE OIL LEVEL

**CAUTION**

**Oil level cannot be accurately measured on a cold engine. For preride inspection, with motorcycle leaning on jiffy stand on level ground, oil should register on dipstick between arrows when engine is cold. Do NOT add oil to bring the level to the FULL mark on a COLD engine.**

1. Perform engine oil level **COLD CHECK** as follows:
   a. With the vehicle resting on the jiffy stand on level ground, wipe off the dipstick and insert it back into the oil pan with the plug pushed completely into the fill spout.
   b. Remove the dipstick and note the level of the oil. Oil level should register between the two arrows on the dipstick. See Figure 3-1. If oil level is at or below the lower arrow, add only enough oil to bring the level between the two arrows on the dipstick.
2. Perform engine oil level **HOT CHECK** as follows:
   a. Ride vehicle until engine is at normal operating temperature.
   b. With the vehicle resting on the jiffy stand on level ground, allow engine to idle for 1-2 minutes. Turn engine off.
   c. Wipe off the dipstick and insert it back into the oil pan with the plug pushed completely into the fill spout.
   d. Remove the dipstick and note the level of the oil. Add only enough oil to bring the level to the FULL mark on the dipstick. See Figure 3-1. Do not overfill.

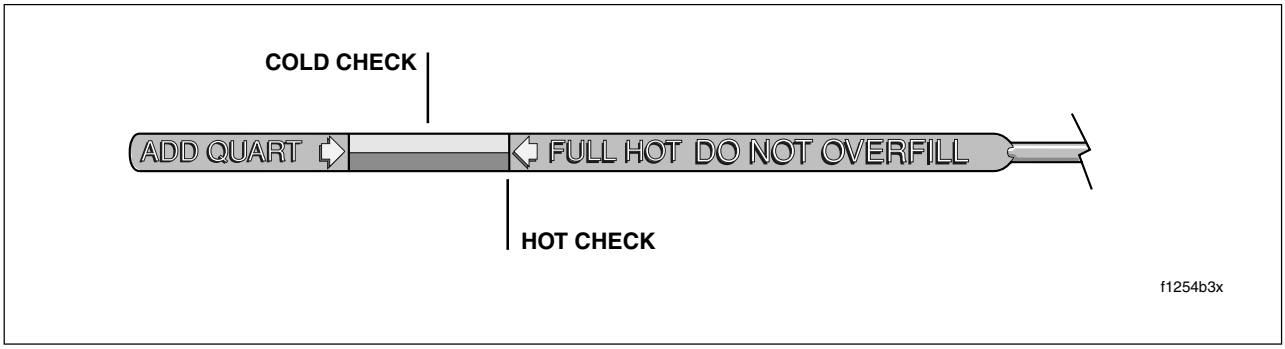



**Figure 3-1. Engine Oil Dipstick**

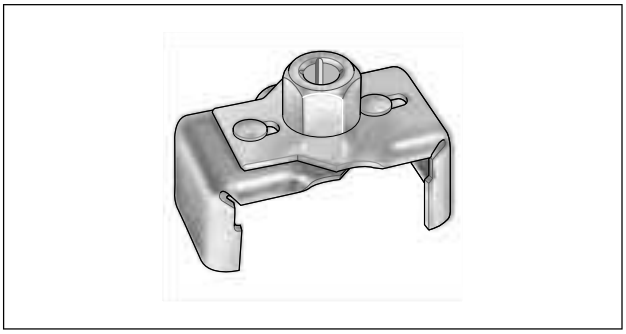


**Figure 3-2. Oil Filter Wrench (Part No. HD-42311)**

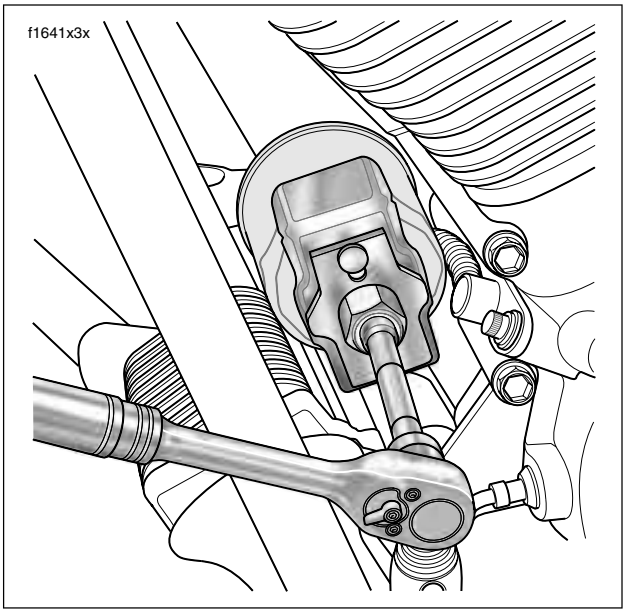



**Figure 3-3. Remove Engine Oil Filter**

## CHANGING ENGINE OIL AND FILTER

*NOTE*

*Change engine oil and filter after first 1000 miles (1609 km) of service and then seasonally or at 5000 mile (8046 km) intervals thereafter. If motorcycle is ridden hard, under dusty conditions or in cold weather, change engine oil and filter more often.*

1. Ride vehicle until engine is at normal operating temperature.
2. Locate oil filler plug/dipstick on right side of vehicle at top of transmission case. To remove the oil filler plug, pull steadily while moving plug back and forth.
3. Locate oil drain plug at front left side of the oil pan. Remove the oil drain plug and allow oil to drain completely.
4. Inspect the oil drain plug O-ring for cuts, tears or signs of deterioration. Replace as necessary.
5. Remove the oil filter as follows:
   a. Obtain the OIL FILTER WRENCH (HD-42311). The tool allows easy removal of the oil filter without risk of damage to the crankshaft position sensor or cable.
   b. Place the jaws of the wrench over the oil filter with the tool oriented vertically. See Figure 3-3.
   c. Using a 3/8 inch drive with a 4 inch extension, turn wrench in a counterclockwise direction. Do not use with air tools.
6. Clean the oil filter mount flange of any old gasket material.
7. Lubricate gasket with clean engine oil and install **new** oil filter on filter mount. Hand tighten oil filter 1/2-3/4 turn after gasket first contacts filter mounting surface. Do **NOT** use OIL FILTER WRENCH (HD-42311) for oil filter installation.

*NOTE*

*Use of the **new** Premium 10 micron synthetic media oil filter is highly recommended, Part No. 63798-99 (Chrome) or 63731-99 (Black).*

8. Install engine oil drain plug with O-ring. Tighten plug to 14-21 ft-lbs (19-28 Nm).
9. With vehicle resting on jiffy stand, add 3-1/2 quarts (3.3 liters) engine oil as specified in Table 3-1. Use the proper grade of oil for the lowest temperature expected before the next oil change.

### Table 3-1. Recommended Engine Oils

| Harley-Davidson Type | Viscosity | Harley-Davidson Rating | Lowest Ambient Temperature | Cold Weather Starts Below 50˚F (10˚C) |
|---|---|---|---|---|
| HD Multi-grade | SAE 10W40 | HD 360 | Below 40˚F (4˚C) | Excellent |
| HD Multi-grade | SAE 20W50 | HD 360 | Above 40˚F (4˚C) | Good |
| HD Regular Heavy | SAE 50 | HD 360 | Above 60˚F (16˚C) | Poor |
| HD Extra Heavy | SAE 60 | HD 360 | Above 80˚F (27˚C) | Poor |

**CAUTION**

**Oil level cannot be accurately measured on a cold engine. For preride inspection, with motorcycle leaning on jiffy stand on level ground, oil should register on dipstick between arrows when engine is cold. Do NOT add oil to bring the level to the FULL mark on a COLD engine.**

10. Perform engine oil level **COLD CHECK** as follows:

a. With the vehicle resting on the jiffy stand on level ground, wipe off the dipstick and insert it back into the oil pan with the plug pushed completely into the fill spout.

b. Remove the dipstick and note the level of the oil. Oil level should register between the two arrows on the dipstick. See Figure 3-1. If oil level is at or below the lower arrow, add only enough oil to bring the level between the two arrows on the dipstick.

11. Perform engine oil level **HOT CHECK** as follows:

a. Ride vehicle until engine is at normal operating temperature.

b. With the vehicle resting on the jiffy stand on level ground, allow engine to idle for 1-2 minutes. Turn engine off.

c. Wipe off the dipstick and insert it back into the oil pan with the plug pushed completely into the fill spout.

d. Remove the dipstick and note the level of the oil. Add only enough oil to bring the level to the FULL mark on the dipstick. See Figure 3-1. Do not overfill.

12. Start engine and carefully check for oil leaks around drain plug and oil filter.

## WINTER LUBRICATION

Combustion in an engine produces water vapor. During starting and warm-up in cold weather, especially in freezing temperatures, the vapor condenses to water before the crankcase is hot enough to exhaust it through the breather system. If the engine is run long enough for the crankcase to become thoroughly heated, the water returns to vapor and is then exhausted.

An engine used for only short trips, and seldom allowed to thoroughly warm up, accumulates increasing amounts of water in the oil pan. Water mixed with oil forms a sludge that causes accelerated engine wear. In freezing temperatures, the water becomes slush or ice, which may clog oil lines and result in engine failure.

Always change the engine oil more often in winter. If the engine is used for short runs, change the oil even more frequently. The farther below freezing the temperature drops the more often the oil should be changed.

## OIL PRESSURE INDICATOR LAMP

The **red** OIL PRESSURE indicator lamp illuminates to indicate improper circulation of the engine oil. The lamp illuminates when the ignition is first turned on (before the engine is started), but should be extinguished once the engine is running.

**CAUTION**

**Check the engine oil level if the oil pressure indicator lamp remains illuminated. If the oil level is normal, stop the engine immediately. Do not ride the vehicle until the probem is located and corrected.**

If the indicator lamp is not extinguished, it may be the result of a low oil level or diluted oil supply. In freezing weather, the oil feed and return lines can clog with ice or sludge. A defect in the lamp wiring, faulty oil pressure sending unit, damaged oil pump, plugged oil filter element, incorrect oil viscosity, broken or weak spring in the oil pressure relief valve and/or damaged or incorrectly installed O-rings in the engine may also cause the indicator lamp to remain on.

To troubleshoot the problem, always check the engine oil level first. If the oil level is OK, determine if oil returns to the pan from the oil return hose. If oil does not return, shut off the engine until the problem is located and corrected.

To check the engine oil pressure, proceed as follows:

1. Verify engine oil level. See CHECKING ENGINE OIL LEVEL in this section.

2. Locate the oil pressure sending unit at the front right side of the crankcase.

3. On FLHR/C models, pull wire socket from terminal of oil pressure sending unit. On FLHT/C/U models, pull external latch outward and use rocking motion to remove Packard connector.

4. On FLHR/C models, use a 15/16 inch Open End Crow Foot (Snap-On FC30B) to remove oil pressure sending unit from crankcase. On FLHT/C/U models, use 1-1/16 inch Open End Crow Foot (Snap-On FC34A).

5. Start OIL PRESSURE GAUGE ADAPTER (HD-96921-110) into crankcase bore. Using a 5/8 inch open end wrench, turn adapter until snug. See Figure 3-4.

6. Moving to left side of vehicle, route banjo fitting and hose of OIL PRESSURE GAUGE (HD-96921-52B) over shifter lever and oil filter to right side of engine. See Figure 3-5.

7. Slide washer on banjo bolt and insert through banjo fitting on gauge. Install second washer on bolt and thread into adapter until snug.

8. Run vehicle or simulate road running until engine is at normal operating temperature, approximately 230° F. (110° C.). Gauge reading will not be accurate if engine is not completely warmed.

9. Verify that oil pressure is 30-38 psi (207-262 $kN/m^2$) at 2000 rpm.

10. Remove banjo bolt (and washers) from adapter. Remove gauge from vehicle and then remove adapter from crankcase.

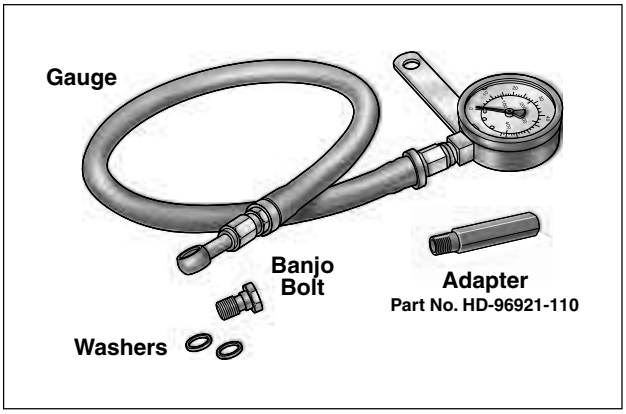



**Figure 3-4. Oil Pressure Gauge (Part No. HD-96921-52B)**

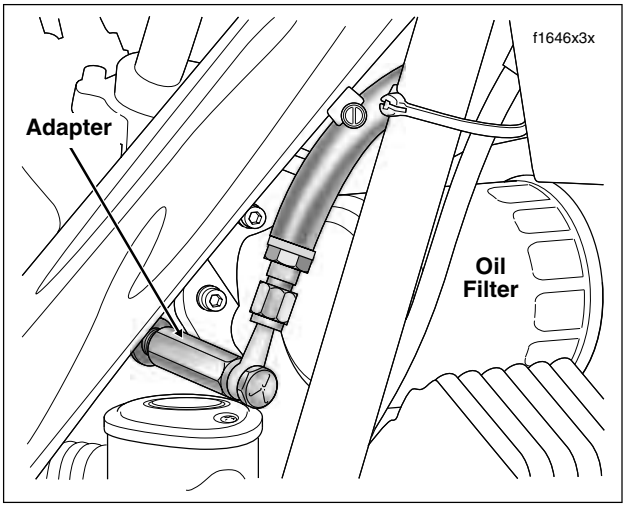



**Figure 3-5. Install Adapter and Oil Pressure Gauge**

*NOTE*

*If reusing oil pressure sending unit, apply Loctite Pipe Sealant with Teflon 565 to threads.*

11. Start oil pressure sending unit into crankcase bore. On FLHR/C models, use a 15/16 inch Open End Crow Foot (Snap-On FC30B) to tighten switch to 8-10 ft-lbs (11-14 Nm). On FLHT/C/U models, use 1-1/16 inch Open End Crow Foot (Snap-On FC34A).

12. Attach wire socket (Packard connector on FLHT/C/U models) to oil pressure sending unit.

*NOTE*

*If wire socket terminal requires replacement, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.4 SEALED BUTT SPLICE CONNECTORS.*

13. Test oil pressure sending unit for proper operation.

## ENGINE OIL FLOW

**CAUTION**

**The oiling system is carefully designed for optimum efficiency. All oil holes and passageways are specially sized. Exercise caution to avoid enlarging oil holes during cleaning. Any modification of the oiling system will adversely affect oil pressure or cooling and lubrication efficiency.**

### Oil Feed (Figures 3-6, 3-7)

Oil flows from the oil pan through a passageway at the front of the transmission housing into a flexible hose clamped to the lower fitting (A1) at the rear right side of the crankcase.

Running through a passageway in the crankcase, the oil exits a hole in the crankcase flange (B2) and enters a hole on the inboard side of the cam support plate. Passing through a channel in the cam support plate (A3), the oil enters the feed side of the oil pump. See OIL PUMP OPERATION. The feed gerotors of the pump direct the flow up a second channel in the cam support plate (A4).

A drilling in this channel connects to a pressure relief valve mounted in the bypass port of the cam support plate (A5). When the oil pressure exceeds the setting of the valve spring (35 psi), the orifice opens to bypass excess oil back to the feed side of the pump (A3).

Oil not returned to the feed side exits a hole on the inboard side of the cam support plate and passes through a hole in the crankcase flange (B6). Flowing through a passageway in the crankcase, where a reading is taken by the oil pressure sending unit (B7), the oil exits the lower hole in the oil filter mount (D8).

After circulating through the oil filter, the flow of oil is directed back into the crankcase through the upper hole in the oil filter mount (D9). Exiting a passageway in the crankcase through a hole in the crankcase flange (B10), the flow of oil reenters the cam support plate.

Filtered oil is then routed to the top and bottom ends of the engine, as described below.

### Top End (Figures 3-6, 3-7)

Oil passes through a channel in the cam support plate exiting the inboard side through two holes near the top (A11, A12). Entering two holes in the crankcase flange (B13, B14), one leading to the front cylinder and the other to the rear, the oil travels through passageways in the crankcase to the hydraulic lifter bores (D15).

Exiting a hole in each lifter bore (E16), the oil flows around the lifter and enters a hole at the side of the lifter body. As the chamber inside the lifter body is filled, the push rod socket rises to achieve the no-lash fit of the valve train components. The flow of oil then exits a hole centered in the lifter socket and runs up the hollow push rods.

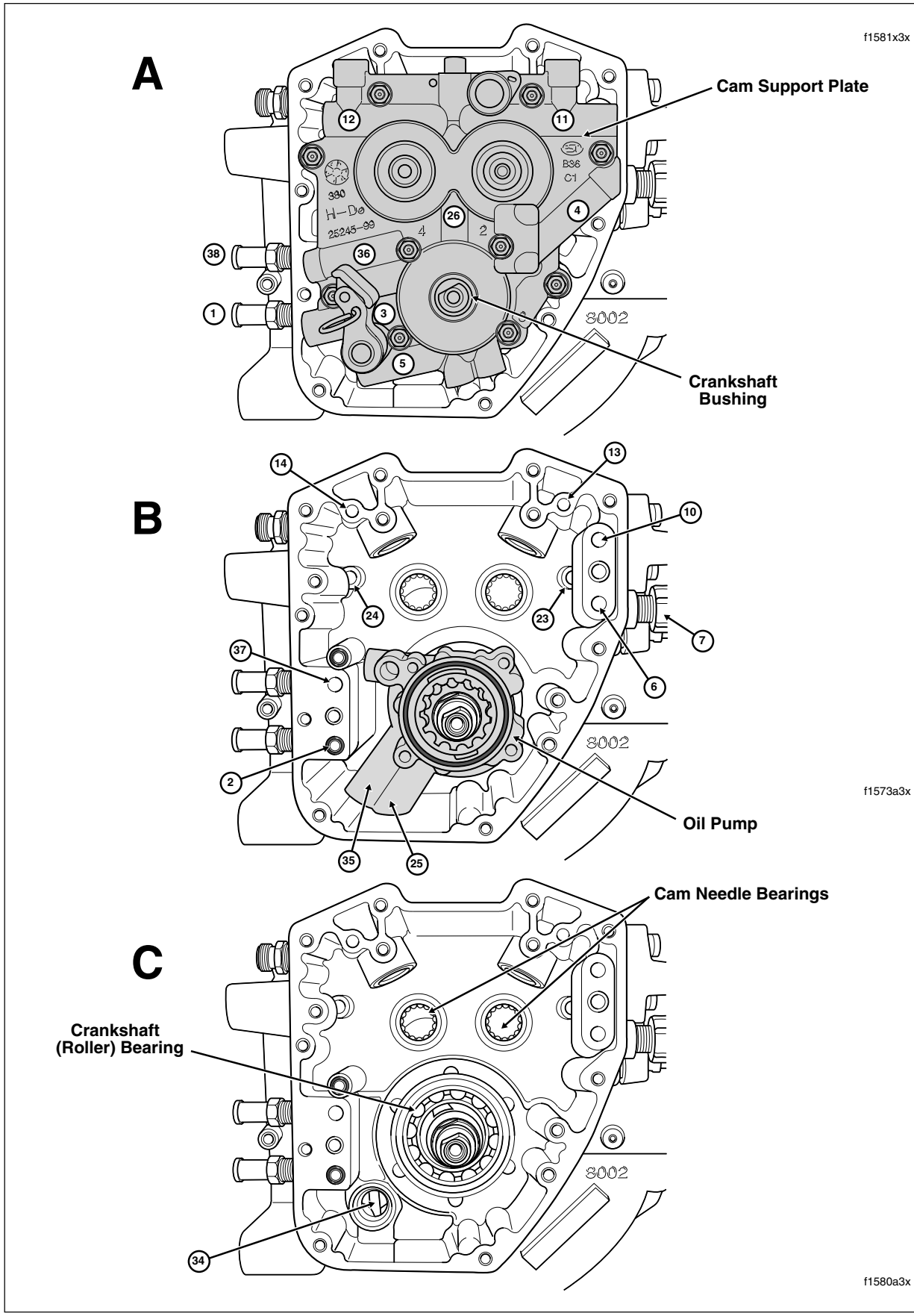



**Figure 3-6. Engine Oil Flow - Cam Support Plate/Right Crankcase Half**

*NOTE*

*Note that there is one additional hole drilled into the inside lifter bores- while the oblong hole circulates oil around the lifter body as described, the round hole (E17) feeds oil to the piston jets in the flywheel compartment.*

Exiting holes at the top of the hollow push rods, oil enters a hole at the bottom of the intake and exhaust rocker arms. Lubricating the rocker arm bushings, oil flows down the rocker arm shafts and exits a pin hole in the outboard side of each rocker arm housing (F18) where it sprays the valve springs and the top of the valve stem.

Oil runs down to the low side of the rocker housing and enters the exhaust valve spring pocket where a drain hole (G19) leads to a passageway in the cylinder head casting.

Oil exits the bottom of the cylinder head and passes through a ring dowel (H20) on the “down side” of the cylinder flange. The oil runs through a vertical passageway in the cylinder, passes through a second ring dowel on the “down side” of the cylinder deck (I21) and enters the left crankcase half.

Flowing through a horizontal passageway in the left crankcase half (J22), oil runs through a third ring dowel (K23) to the right crankcase half where it travels through another passageway before emptying into the cam compartment (B23, B24).

Oil collecting in the cam compartment is picked up by one of two scavenge lobes on the oil pump (B25).

## Bottom End (Figures 3-6, 3-7, 3-8)

Oil travels down the center passage of the cam support plate (A26) and sprays out through pin holes on each side of the casting to lubricate both the primary and secondary cam chains. Oil also passes through a hole in the crankshaft bushing where the flow enters a drilling in the crankshaft (L27).

Oil runs down the center of the crankshaft and then up a cross drilling into the right side of the flywheel. The flow exits a drilling in the crank pin bore, enters the crank pin and then sprays out through three holes to lubricate the lower rod bearing set.

The oil splash and mist created by the action of the flywheel lubricates the crankshaft (roller) bearing and the camshaft needle bearings in the right crankcase half. Oil running down the outboard wall in the left crankcase half enters a drilling (M28) that feeds the sprocket shaft (Timken) bearing set.

Since the oil mist also lubricates the cylinder walls, three holes on each side of the piston (in the area of the third ring land) evacuate excess oil scraped from the walls on the piston downstroke.

The piston jets (N29), which receive a supply of oil from the intake lifter bores, spray the underside of the piston for cooling of the piston crown and skirt area. A check valve in each jet opens only when the oil pressure reaches 12-15 psi, at which point the engine is operating above idle speed. At idle speeds (9-12 psi), the valve remains closed to prevent over oiling and to ensure proper system operating pressure.

Oil spray from each piston jet also enters a hole at the bottom of each pin boss (O30) for lubrication of the piston pin. Another hole at the top of the connecting rod (D31) allows a portion of the oil to reach the upper rod bushing.

Surplus oil falls back to the bottom of the flywheel compartment where it collects in the sump area (P32). Oil in the sump is drawn to the cam compartment through an internal channel (P33, C34) that connects with the second scavenge lobe of the oil pump (B35).

## Oil Return (Figures 3-6, 3-8)

The “dual kidney” designation given to the oil pump refers to its two scavenging functions, whereby it simultaneously draws oil from both the cam and flywheel compartments.

Oil sucked up by the scavenge lobes passes through the scavenge gerotors of the oil pump and is directed through a return channel in the cam support plate (A36). See OIL PUMP OPERATION.

Exiting a hole on the inboard side of the cam support plate, the oil enters a hole in the crankcase flange (B37).

The oil flows through a passageway in the crankcase and exits the upper fitting at the rear right side of the crankcase (A38). Passing through a flexible hose connection, the flow of oil runs through a passageway at the front of the transmission housing (Q39) before emptying into the oil pan at the front of the baffle (R40).

The oil flows to the rear of the oil pan along each side of the baffle. Spring tension holds the unit tight against the bottom of the pan to prevent oil from entering or escaping around the perimeter of the baffle. At the back of the oil pan, the oil enters the open side of the baffle where it is redirected forward. The baffle plates slow the circulation of the oil through the pan to enhance cooling.

Oil pickup occurs in the front compartment of the baffle where a passageway in the casting (S41) directs the flow upward. Passing through a second passageway in the transmission housing (Q42), the flow of oil enters the flexible hose connection (A1) to repeat the circuit.

Also note that a third flexible hose clamped to a fitting behind the rear lifter cover connects the cam compartment with the oil pan via a third drilling in the transmission case. This crankcase breather connection provides the pressure balance necessary for oil circulation.

## Oil Pump Operation

The oil pump consists of a housing containing two gerotor gear sets, one feed and the other scavenge. Driven by the crankshaft, the feed gerotor set distributes oil to the engine, while the scavenge gerotor set draws oil from the cam and flywheel compartments and returns it to the oil pan.

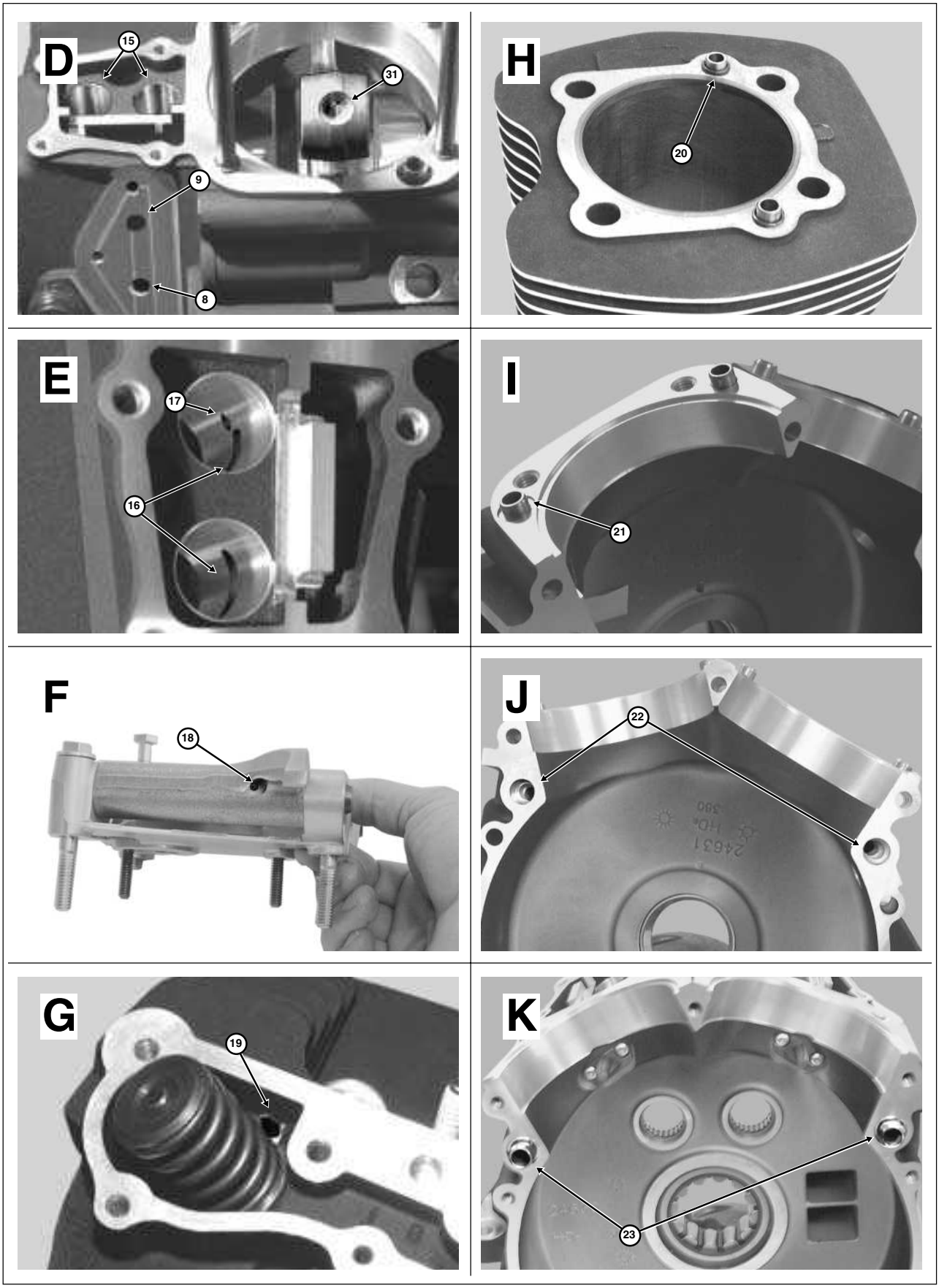



**Figure 3-7. Engine Oil Flow - Top End**

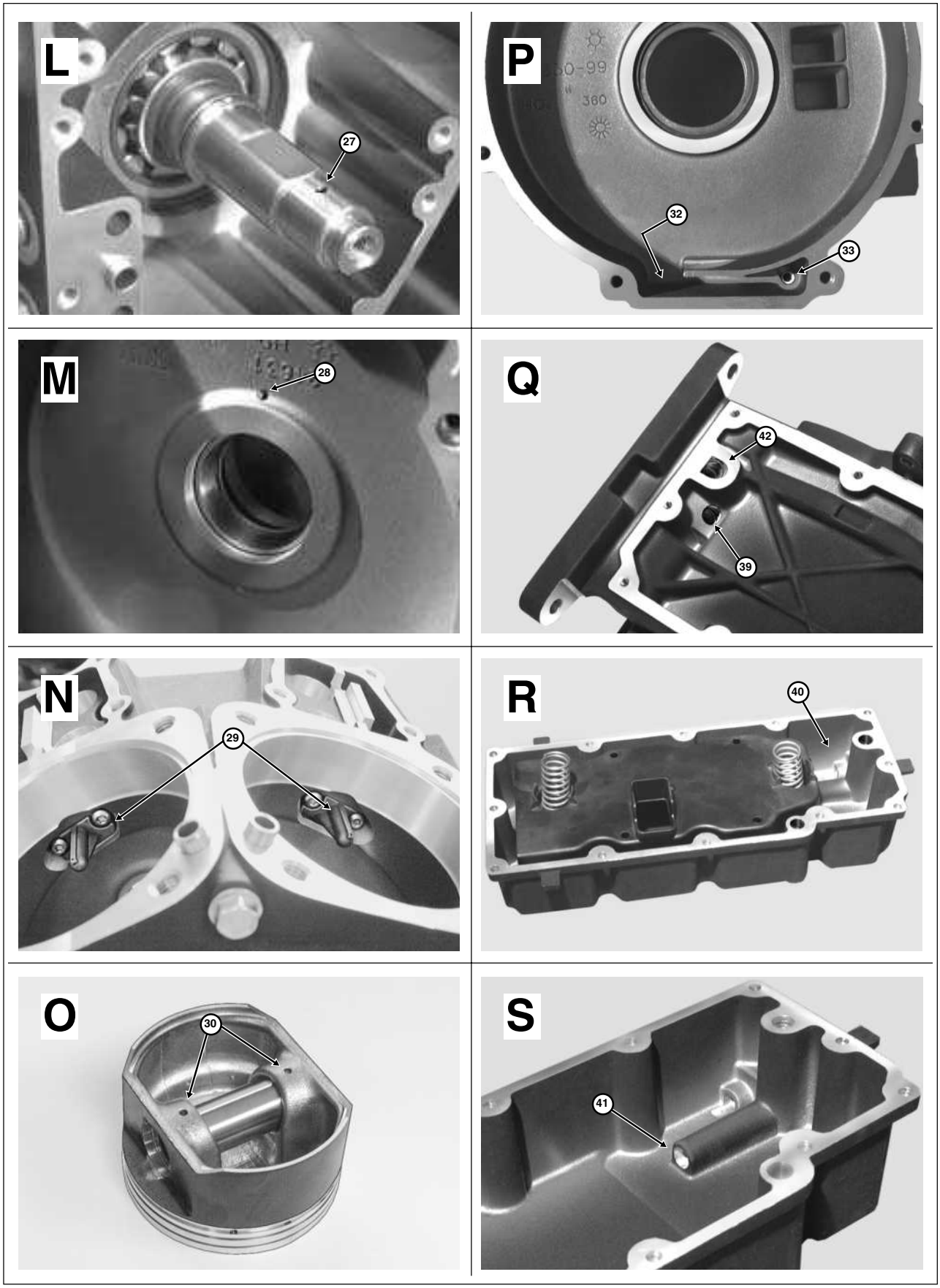



**Figure 3-8. Engine Oil Flow - Bottom End**

Each gerotor gear set has two parts, an inner and outer gerotor. The inner and outer gerotors have fixed centers that are slightly offset to one another. Also, the inner gerotor has one less tooth.

As the crankshaft rotates, the cavity between the inner and outer gerotors on the inlet side of the pump increases in volume. This creates a vacuum causing oil to be drawn in. The cavity continues to increase until the volume is equivalent to that of the missing tooth on the inner gerotor. Also note that the inlet and outlet sides of the pump are sealed by the tips and lobes of the inner and outer gerotors. See A of Figure 3-9.

Continued rotation moves the pocket of oil to the outlet side of the pump. In this area, the cavity decreases in volume as the gerotor teeth mesh causing the oil to be squeezed out the discharge port. As the cavity on the outlet side is emptied, a second seal formed by the tips and lobes of the inner and outer gerotors prevents oil on the outlet side (high pressure) from being transferred to the inlet side (low pressure). See B of Figure 3-9.

In operation, the gerotors provide a continuous flow of oil. See C of Figure 3-9.

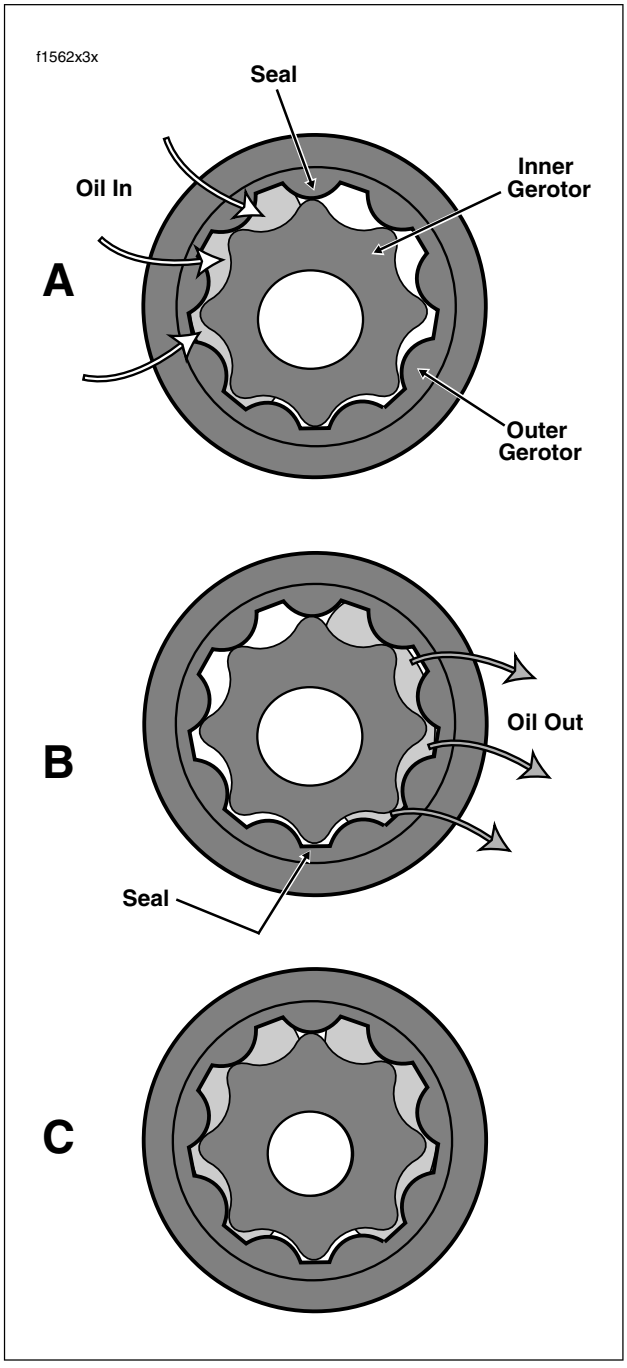



**Figure 3-9. Gerotor Operation**

## Breather Operation

*NOTE*

*The crankcase breather system relieves crankcase pressure produced by the downstroke of the pistons and allows crankcase vapors vacated from each cylinder to be directed into the air filter element. Through effective recirculation of crankcase vapors, the system serves to eliminate the pollutants normally discharged from the crankcase.*

As each piston pushes downward on its power and intake stroke, displaced air in the flywheel compartment is vented through the crankshaft roller bearing into the cam compartment and then up the push rod covers into the rocker housing.

Air rushes under the rocker arm support plate, which is elevated slightly, and passes through an opening at the bottom of the plate to enter the breather baffle compartment.

In the baffle compartment, the flow of air passes upward through the oil filter gauze, where the oil is removed from the air. Two pin holes in the rocker arm support plate act as drain holes to rid the baffle compartment of the oil separated from the air.

Passing through the oil filter gauze, the flow of air passes through the umbrella valve into the breather compartment. The flaps of the umbrella valve only allow air to be vented one way, rising to allow the passage of air, but then falling back into place to seal the vent holes as the flow of air stops.

In the breather compartment, the flow of air reverses direction passing downward through holes aligned in the breather baffle, rocker arm support plate and rocker housing. Exiting the rocker housing, the air enters a passageway cast into the top of the cylinder head. Proper orientation of the rocker housing gasket is critical for effective sealing of this passageway.

Flowing through the cylinder head passageway, the air passes through a drilling in the air cleaner backplate bolt and then through a breather tube into the air filter element.

*NOTE*

*Air cleaner mounting without installation of the breather tubes allows crankcase vapors to be vented into the atmosphere in violation of legal emissions standards.*

## GENERAL

Three basic levels of service are presented in this section: top end overhaul, bottom end overhaul and subassembly service and repair. The manner in which these instructions are used depends upon the level of disassembly required.

## TOP END OVERHAUL

If servicing only cylinder head components, pistons, cylinders and/or upper rod bushings, see Section 3.5 STRIPPING MOTORCYCLE FOR SERVICE, and then proceed to Section 3.10 TOP END OVERHAUL, DISASSEMBLY. During top end disassembly, the engine may be left in the chassis for service.

*NOTE*

*If the engine is to be removed from the chassis, see Section 3.7 REMOVING ENGINE FROM CHASSIS in lieu of Section 3.5 STRIPPING MOTORCYCLE FOR SERVICE.*

In the top end disassembly instructions, references are made to Section 3.12 SUBASSEMBLY SERVICE AND REPAIR for service of all top end subassemblies.

To rebuild the engine after a top end overhaul is complete, perform the steps under Section 3.10 TOP END OVERHAUL, ASSEMBLY, immediately following the disassembly instructions. Then, refer to Section 3.6 ASSEMBLING MOTORCYCLE AFTER STRIPPING to complete the project.

*NOTE*

*For clarity, all artwork in this section shows the engine removed from the chassis for service.*

## BOTTOM END OVERHAUL

Bottom end service may require either partial or complete disassembly of the engine. Servicing components in the cam compartment requires only partial disassembly, while servicing those in the flywheel compartment requires complete disassembly. An easy rule to remember is that any time the crankcase halves must be split, complete disassembly needs to occur. The cam compartment can be accessed through removal of the cam cover making complete engine disassembly unnecessary.

During bottom end service that requires complete disassembly, the engine must be removed from the chassis and placed in an engine stand. To begin, see Section 3.7 REMOVING ENGINE FROM CHASSIS.

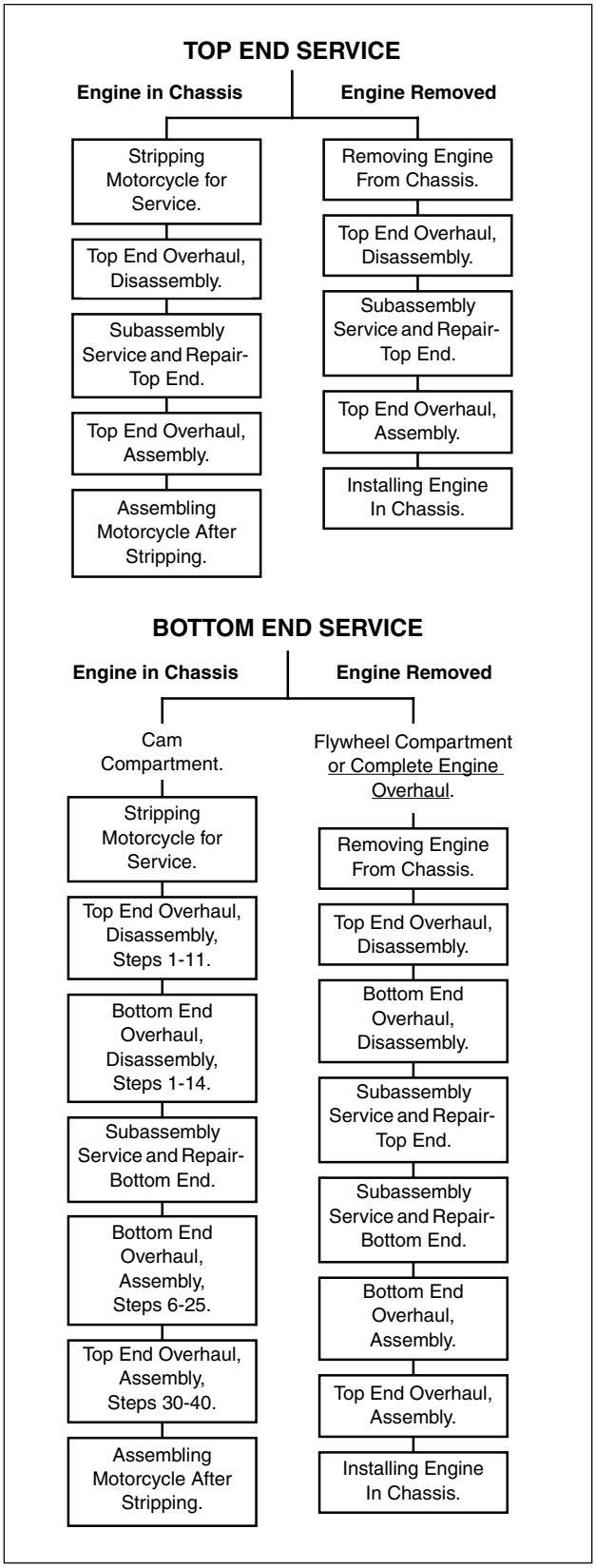



**Figure 3-10. Top/Bottom End Service**

After the motorcycle has been stripped and the engine removed, follow all of the steps under Section 3.10 TOP END OVERHAUL, DISASSEMBLY. When finished, continue with disassembly of the bottom half by performing those steps listed under Section 3.11 BOTTOM END OVERHAUL, DISASSEMBLY.

As with the top end disassembly instructions, references are made to Section 3.12 SUBASSEMBLY SERVICE AND REPAIR for service of bottom end subassemblies.

Since it is standard practice to inspect and clean all oil passages when the engine is completely disassembled, a detailed explanation of the engine oil circuit is presented under Section 3.3 GENERAL INFORMATION, ENGINE OIL FLOW.

To rebuild the engine after a bottom end overhaul is complete, perform the steps under Section 3.11 BOTTOM END OVERHAUL, ASSEMBLY, and then proceed to Section 3.10 TOP END OVERHAUL, ASSEMBLY, to rebuild the upper end.

Once the engine is assembled, refer to Section 3.8 INSTALLING ENGINE IN CHASSIS to complete the project.

The flow charts on the preceding page show how the same subsections are used for various levels of service.

## SUBASSEMBLY SERVICE AND REPAIR

Finally, if the task entails servicing of only one particular subassembly, then move directly to Section 3.12 SUBASSEMBLY SERVICE AND REPAIR for all service instructions.

For example, if just installing new cams, then refer to Section 3.12 SUBASSEMBLY SERVICE AND REPAIR, CAM SUPPORT PLATE.

The steps under Section 3.10 TOP END OVERHAUL and Section 3.11 BOTTOM END OVERHAUL that need to be followed for the removal and installation of the cam support plate are given.

Furthermore, detailed instructions for disassembling, cleaning, inspecting, replacing and assembling cam support plate components are provided.

*NOTE*

*If performing top end service (or both cam compartment and top end), follow steps 1-22. If servicing cam compartment components only, perform steps 1-13.*

1. Drain and remove fuel tank. Proceed as follows:

   **Carbureted:** See Section 4.7 FUEL TANK, COMPLETE REMOVAL, FLHT/C, FLTR, or FLHR.

   **Fuel Injected:** See Section 9.3 FUEL TANK, COMPLETE REMOVAL, FLHTC/U-I, FLTR-I, or FLHR/C-I.

2. Raise lid of left side saddle bag. To free saddlebag from mounting brackets on saddlebag support and frame cover, grasp bail wire inside saddlebag and rotate each stud a full 1/4 turn in a counterclockwise direction. Remove bail head studs with flat washers. Remove saddlebag.

3. Gently pull left side cover from frame downtubes (no tools required).

4. On Ultra models, hold locknut at bottom of left fairing lower, and using a T40 TORX drive head, turn inside screw to free assembly from engine guard clamp. Discard rubber washer.

5. Repeat steps 2-4 to remove saddlebag, side cover and fairing lower on right side of vehicle.

6. Remove the air cleaner and backplate. Proceed as follows:

   **Carbureted:** See Section 4.5 AIR CLEANER, REMOVAL.

   **Fuel Injected:** See Section 9.4 AIR CLEANER, REMOVAL.

7. Cut cable strap holding stator/voltage regulator connector clip to lower frame tube (below cam cover). Pull connector clip toward front of vehicle to release from T-stud on inboard side of frame tube.

8. Remove two allen head socket screws (with lockwashers and flat washers) to release right side front footboard brackets from frame weldment. For best results, approach from left side of vehicle using a 3/8 inch ball allen with extension.

9. Remove exhaust system in two sections as follows:

   a. Open two worm drive clamps to release heat shield over rear header pipe to crossover pipe connection (above starter).

   b. Loosen TORCA clamp between rear header pipe and crossover pipe. Remove Keps nut and pull bracket tab from slots in TORCA clamp and exhaust support bracket.

   c. Spray PB Blaster or other suitable penetrating oil in and around joint between rear header pipe and crossover pipe.

   d. Moving to left side of vehicle, remove two bolts (with lockwashers) to detach left side muffler from the lower saddlebag support rail.

   e. Pull and twist on crossover pipe to remove left side exhaust from vehicle. For best results, be sure to allow sufficient time for the penetrating oil to work.

   f. Remove TORCA clamp assembly from crossover pipe and discard.

*NOTE*

*To ensure sealing integrity of TORCA clamps and prevent the possibility of leakage, Harley-Davidson recommends that TORCA assemblies be discarded and replaced each time they are removed.*

   g. Moving to right side of vehicle, open two worm drive clamps and release heat shield from front header pipe. Using an impact wrench with long 1/2 inch swivel socket, remove two exhaust flange nuts to release front header pipe from studs of front cylinder head. Slide exhaust flange down header pipe to improve clearance around exhaust port.

   h. Open two worm drive clamps and release heat shield from rear header pipe. Remove two exhaust flange nuts to release rear header pipe from studs of rear cylinder head.

   i. Open two worm drive clamps to release heat shield over front header pipe to rear header pipe connection (outboard of transmission side cover).

   j. Remove bolt (with flat washer and locknut) from transmission clamp on front header pipe. Use a channel lock to open clamp and then remove from header pipe and transmission bracket.

   k. Remove two bolts (with lockwashers) to detach right side muffler from the lower saddlebag support rail.

   l. Depressing rear brake pedal, remove right side exhaust from vehicle.

   m. Remove and discard gaskets from front and rear exhaust ports.

10. Moving to left side of vehicle, pull boots on spark plug cables to release from spark plug and ignition coil terminals. Release cables from two cable clips on underside of frame backbone.

11. Remove spark plugs.

12. Pull external latch outward and use rocking motion to remove electrical connector from left side of ignition coil.
13. Remove two bolts with lockwashers to free ignition coil from bracket welded to underside of frame backbone. Remove nut plate and ignition coil.
14. Remove connections to carburetor or induction module. Proceed as follows:

**Carbureted:**

a. Standing on left side of vehicle, pull external latch outward and use rocking motion to remove electrical connector from manifold absolute pressure (MAP) sensor at top of intake manifold.

b. Loosen hex nut at backside of horn bracket and release enrichener cable assembly from slot.

**Fuel Injected:**

a. Depress wire form and use rocking motion to detach electrical connectors from fuel injectors.

b. Disconnect intake air temperature sensor. Simultaneously spread both external latches to remove connector.

c. Disconnect throttle position sensor and idle speed control actuator. Pull external latch outward and use rocking motion to remove connectors.

d. Pull back boot to reveal engine temperature sensor at back of front cylinder. Pull external latch outward and use rocking motion to remove connector. Release engine temperature sensor conduit from cable clip at back of horn bracket.

e. Tuck free ends of EFI wire harness under main wire harness on frame backbone to keep conduit and connectors out of the way.

15. Remove idle and throttle control cables as follows:

    **Carbureted:** Using slots, remove cable ball ends from holes in throttle barrel and release cable housings from cable guides on carburetor cable bracket.

    **Fuel Injected:** Using slot, remove idle and throttle control cables from cable guides cast at front of induction module. Using a needle nose pliers, pull cable ball ends out of retainer plate and throttle barrel.

16. Free idle and throttle control cables from J-clamp fastened to right side of frame backbone. Move cables up and out of the way.
17. On Ultra models, remove E-clip to release the cruise cable housing from cable guide cast at front of induction module. Push the plastic end fitting on the cruise cable to the outboard side to release from wheel pin. Move cable up and out of the way.
18. Remove intake manifold/carburetor or induction module. Proceed as follows:

**Carbureted:**

a. Standing on right side of engine, remove allen head socket screws from front and rear cylinder head flange adapters. For best results, use a long 1/4 inch ball allen head socket with end driver 4 inches long.

b. On left side, just loosen allen head socket screws from flange adapters. Slots in flanges make removal of the screws unnecessary.

c. Remove intake manifold/carburetor from right side of engine.

**Fuel Injected:**

a. Standing on right side of engine, remove allen head socket screws from front and rear cylinder head flange adapters. For best results, use a long 1/4 inch ball allen head socket with end driver 4 inches long.

b. On left side, just loosen hex head bolts (1/2 inch) from flange adapters. Slots in flanges make removal of the bolts unnecessary.

c. Remove induction module from right side of vehicle.

19. Standing on left side of vehicle, remove two bolts (with flat washers) to release top engine mounting bracket from cylinder heads.
20. Leaving ground wire ring terminal in place, detach socket terminal of yellow lead from spade contact at back of horn.
21. Moving to right side of vehicle, hold bottom nut and turn allen head socket screw topside to release stabilizer link from frame weldment.
22. Remove horn, top engine mounting bracket and stabilizer link as an assembly.

# ASSEMBLING MOTORCYCLE AFTER STRIPPING 3.6

*NOTE*

*If top end service was performed (or both cam compartment and top end), follow steps 1-20. If only cam compartment components were serviced, perform steps 8-19.*

1. Install intake manifold/carburetor or induction module. Proceed as follows:

**Carbureted:**

a. With the counterbore facing outward, slide cylinder head flange adapters onto outlet ports of intake manifold. The flange adapters are not inter-changeable. Look next to the slotted bolt hole for a stamp that indicates F(ront) and R(ear) cylinder.

b. Place a **new** seal in each flange adapter with the beveled side in against the counterbore.

c. Standing on right side of engine, slide intake manifold toward installed position so that open-ended slots on flange adapters begin to engage allen head socket screws on left side.

d. Align fixed holes in flange adapters with those in cylinder heads and start allen head socket screws. For best results, use a long 1/4 inch ball allen head socket with end driver 4 inches long.

e. Use air cleaner backplate as a template in properly situating intake manifold/carburetor. Align holes in air cleaner backplate with those in cylinder heads and install cylinder head breather bolts. Alternately snug bolts using a 7/16 inch deepwell socket.

f. Tighten allen head socket screws in fixed holes of flange adapters until snug. Moving to left side of engine, tighten screws to 6-10 ft-lbs (8-14 Nm).

g. Remove breather bolts to detach backplate from front and rear cylinders.

h. Tighten allen head socket screws in fixed holes of flange adapters to 6-10 ft-lbs (8-14 Nm).

**Fuel Injected:**

a. With the counterbore facing outward, slide cylinder head flange adapters onto outlet ports of induction module. The flange adapters are not inter-changeable. Look next to the slotted bolt hole for a stamp that indicates F(ront) and R(ear) cylinder.

b. Place a **new** seal in each flange adapter with the beveled side in against the counterbore.

c. Standing on right side of engine, slide induction module toward installed position so that open-ended slots on flange adapters begin to engage hex head bolts on left side.

d. Align fixed holes in flange adapters with those in cylinder heads and start allen head socket screws. For best results, use a long 1/4 inch ball allen head socket with end driver 4 inches long.

e. Use air cleaner backplate as a template in properly situating induction module. Align holes in air cleaner backplate with those in cylinder heads and install cylinder head breather bolts. Alternately snug bolts using a 7/16 inch deepwell socket.

f. Tighten allen head socket screw in fixed holes of flange adapters until snug. Moving to left side of engine, tighten hex head bolts to 6-10 ft-lbs (8-14 Nm).

g. Remove breather bolts to detach backplate from front and rear cylinders.

h. Tighten allen head socket screws in fixed holes of flange adapters to 6-10 ft-lbs (8-14 Nm).

2. Install horn, top engine mounting bracket and stabilizer link as an assembly. Proceed as follows:

a. Moving to right side of vehicle, hold bottom nut and turn allen head socket screw topside to secure stabilizer link to frame weldment.

b. Attach socket terminal of yellow lead to spade contact at back of horn.

c. Standing on left side of vehicle, install two bolts (with flat washers) to secure top engine mounting bracket to front and rear cylinder heads.

3. On Ultra models, position cruise cable housing in cable guide cast at front of induction module. Install **new** E-clip on cable housing to lock position of cable. Holding cam lever assembly to prevent rotation, slide groove in plastic end fitting over cap of wheel pin. Push on end fitting until it snaps in place.

4. Route idle and throttle control cables through J-clamp fastened to right side of frame backbone.

5. Install idle and throttle control cables as follows:

**Carbureted:** Install the idle cable housing and spring into the longer cable guide on the carburetor cable bracket. Drawing idle cable downward, fit ball end into hole in throttle barrel (farthest from cam stop). Install the throttle cable housing into the shorter cable guide inserting ball end into remaining hole in throttle barrel.

**Induction Module:** Drawing the idle control cable around the top of the throttle barrel, insert ball end into upper hole in retainer plate. Draw the throttle control cable around the bottom of the throttle barrel and insert ball end into lower hole. Using slots, slip throttle and idle control cables into cable guides cast at front of induction module.

6. Adjust cables as necessary to keep ball ends from dislodging. Verify that cables are seated in channel of throttle barrel. Verify operation by turning throttle grip and observing cable action.

7. Install connections to carburetor or induction module. Standing on left side of vehicle, proceed as follows:

### Carbureted:

a. Moving to left side of vehicle, install electrical connector to manifold absolute pressure (MAP) sensor at top of intake manifold.

b. Position enrichener cable assembly in slot of horn bracket with hex nut on inboard side. Tighten hex nut to 20-35 **in-lbs** (2.3-4.0 Nm).

### Fuel Injected:

a. Install electrical connectors to fuel injectors. Injector cables are tagged F(ront) and R(ear) to ensure correct assembly. Push connector halves together until latches “click.” Grooves in female spade connector must be aligned with tabs in male spade housing.

b. Install electrical connectors to intake air temperature sensor, throttle position sensor and idle speed control actuator. Push connector halves together until slot on latch of female spade connector fully engages tab on male spade housing.

c. Moving to left side of vehicle, install electrical connector to engine temperature sensor at back of front cylinder. Capture connector conduit in cable clip at back of horn bracket. Pull boot over sensor to keep out dirt and debris.

8. Install exhaust system as follows:

a. Install **new** gaskets in both the front and rear cylinder head exhaust ports (with the tapered side out).

b. Place right side exhaust into position on vehicle and start two exhaust flange nuts to secure front header pipe to studs of front cylinder head.

c. Start two bolts (with lockwashers) to secure right side muffler to the lower saddlebag support rail.

d. Start two exhaust flange nuts to secure rear header pipe to studs of rear cylinder head.

e. Engaging transmission bracket, capture front header pipe in transmission clamp. Use a channel lock to close clamp, if necessary. Finger tighten clamp bolt (with flat washer and locknut).

*NOTE*

*To ensure sealing integrity of TORCA clamps and prevent the possibility of leakage, Harley-Davidson recommends that TORCA assemblies be discarded and replaced each time they are removed.*

f. Moving to left side of vehicle, slide **new** TORCA clamp assembly onto crossover pipe.

g. Twist and push left side exhaust onto crossover pipe.

h. Start two bolts (with lockwashers) to secure left side muffler to the lower saddlebag support rail.

i. Returning to left side of vehicle, position TORCA clamp between rear header pipe and crossover pipe. Fit bracket tab into slot of TORCA clamp engaging stud in slot of exhaust support bracket. Start Keps nut on stud.

**CAUTION**

**Verify that the exhaust pipes do not contact the vehicle frame or any mounted components. Contact will cancel the effect of the rubber isolation mounts and transmit vibration to the rider via the vehicle frame.**

j. Tighten the exhaust system as follows:

- Using a long 1/2 inch swivel socket, tighten the top nut of the front cylinder head exhaust flange to 9-18 **in-lbs** (1-2 Nm). Tighten the lower nut to 120 **in-lbs** (14 Nm). Final tighten the top nut to 120 **in-lbs** (14 Nm).
- Repeat above step on the exhaust flange nuts of the rear cylinder.
- Tighten the transmission clamp bolt.
- Tighten the two bolts (with lockwashers) to fasten the right side muffler to the lower saddlebag support rail.
- Tighten the two bolts (with lockwashers) to fasten the left side muffler to the lower saddlebag support rail.
- Verify that all exhaust pipes are in alignment and do not contact the vehicle frame or mounted components.
- Tighten the TORCA clamp between the rear header pipe and crossover pipe to 45-60 ft-lbs (61-81 Nm).
- Tighten Keps nut securing bracket tab to exhaust support bracket.

**CAUTION**

**Verify that the heat shields do not contact the vehicle frame or any mounted components. Contact will cancel the effect of the rubber isolation mounts and transmit vibration to the rider via the vehicle frame.**

*NOTE*

*Position worm drive clamps so that screws are on the outboard side in the most accessible position.*

k. Open worm drive clamps and install heat shields as follows:

- Over front header pipe (below exhaust port).
- Over rear header pipe (below exhaust port).

- Over front header pipe to rear header pipe connection (outboard of transmission side cover).
- Over rear header pipe to crossover pipe connection (above starter).

l. Position each worm drive clamp so that screw is on the outboard side in the most accessible position and then tighten to 20-40 **in-lbs** (2.3-4.5 Nm).

9. Insert two allen head socket screws (with lockwashers and flat washers) through frame weldment into right side front footboard brackets. For best results, approach from left side of vehicle using a 3/8 inch ball allen with extension.
10. Pull connector clip on stator/voltage regulator connector toward rear of vehicle to engage T-stud on inboard side of frame tube (below cam cover). Install **new** cable strap to secure connector and clip to lower frame tube. Cut any excess cable strap material.
11. Install the air cleaner and backplate. Proceed as follows:

    **Carbureted:** See Section 4.5 AIR CLEANER, INSTALLATION.

    **Fuel Injected:** See Section 9.4 AIR CLEANER, INSTALLATION.
12. On Ultra models, place fairing lower into position on right side of vehicle. Holding T40 TORX screw inside fairing lower, install **new** rubber washer, clamp and locknut to attach fairing bottom to engine guard. Do not tighten locknut.
13. Align barbed studs in right side cover with grommets in frame downtubes and push firmly into place (no tools required).
14. Position right side saddlebag on vehicle. Place flat washers on bail head studs. With groove at end of stud held in a horizontal position, insert stud through holes in saddlebag and front mounting bracket. When groove engages wire form of spring plate on inboard side of bracket, turn stud clockwise a full 1/4 turn until it snaps in place. Install rear bail head stud in the same manner.
15. Repeat steps 12-14 to install side cover, saddlebag and fairing lower on left side of vehicle.
16. Install spark plugs in front and rear cylinder heads. Install the plugs finger tight and then tighten to 11-18 ft-lbs (15-24 Nm).
17. Install ignition coil and spark plug cables as follows:

    a. Position ignition coil in recess of coil bracket welded to underside of frame backbone. Coil connections must face rear of vehicle.

    b. Align holes in nut plate with holes at front of coil bracket. Insert bolts (with lockwashers) through bracket and ignition coil into nut plate. Tighten bolts to 5-10 ft-lbs (7-14 Nm).

    c. Install spark plug cables onto spark plug and ignition coil terminals. Install spark plug cable to rear cylinder onto right side coil connection. Install spark plug cable to front cylinder onto left side coil connection. Ignition coil terminal connections are stamped F(ront) and R(ear) to ensure proper assembly. Capture spark plug cables in two cable clips on underside of frame backbone.

    d. Install electrical connector to left side of ignition coil.
18. Install the fuel tank. Proceed as follows:

    **Carbureted:** See Section 4.7 FUEL TANK, INSTALLATION (AFTER COMPLETE REMOVAL), FLHT/C, FLTR, or FLHR.

    **Fuel Injected:** See Section 9.3 FUEL TANK, INSTALLATION (AFTER COMPLETE REMOVAL), FLHTC/U-I, FLTR-I, or FLHR/C-I.
19. On Ultra models, hold locknut at bottom of fairing lower, and using a T40 TORX drive head, turn inside screw to fasten assembly to engine guard clamp. Tighten screw to 12 ft-lbs (16 Nm). Repeat step on opposite side of vehicle.
20. Adjust idle and throttle control cables as follows:

    **Non-Ultra:** See THROTTLE CABLES (NON-ULTRA), ADJUSTMENT, in Section 2.

    **Ultra:** See CRUISE CONTROL, CABLE ADJUSTMENT, in Section 8.

1. Drain and remove fuel tank. Proceed as follows:

   **Carbureted:** See Section 4.7 FUEL TANK, COMPLETE REMOVAL, FLHT/C, FLTR, or FLHR.

   **Fuel Injected:** See Section 9.3 FUEL TANK, COMPLETE REMOVAL, FLHTC/U-I, FLTR-I, or FLHR/C-I.

2. Remove the primary chaincase. See Section 6.5 PRIMARY CHAINCASE, REMOVAL, steps 2-18.

3. Remove left side saddlebag. See Section 2.22 SADDLEBAG, REMOVAL.

4. Gently pull left side cover from frame downtubes (no tools required).

5. On Ultra models, hold locknut at bottom of left fairing lower, and using a T40 TORX drive head, turn inside screw to free assembly from engine guard clamp. Discard rubber washer.

6. Repeat steps 3-5 to remove saddlebag, side cover and fairing lower on right side of vehicle.

7. Remove the air cleaner and backplate. Proceed as follows:

   **Carbureted:** See Section 4.5 AIR CLEANER, REMOVAL.

   **Fuel Injected:** See Section 9.4 AIR CLEANER, REMOVAL.

8. Carefully cut two cable straps holding stator/voltage regulator connector/clip and cables to lower frame tube. See upper frame of Figure 3-11. Pull connector clip toward rear of vehicle to release from T-stud on inboard side of frame tube. Remove clip from connector.

9. Remove two allen head socket screws (with lockwashers and flat washers) to release right side front footboard brackets from frame weldment. For best results, approach from left side of vehicle using a 3/8 inch ball allen with extension.

10. Remove exhaust system in two sections as follows:

    a. Open two worm drive clamps to release heat shield over rear header pipe to crossover pipe connection (above starter).

    b. Loosen TORCA clamp between rear header pipe and crossover pipe. Remove Keps nut and pull bracket tab from slots in TORCA clamp and exhaust support bracket.

    c. Spray PB Blaster or other suitable penetrating oil in and around joint between rear header pipe and crossover pipe.

    d. Moving to left side of vehicle, remove two bolts (with lockwashers) to detach left side muffler from the lower saddlebag support rail.

    e. Pull and twist on crossover pipe to remove left side exhaust from vehicle. For best results, be sure to allow sufficient time for the penetrating oil to work.

    f. Remove TORCA clamp assembly from crossover pipe and discard.

*NOTE*

*To ensure sealing integrity of TORCA clamps and prevent the possibility of leakage, Harley-Davidson recommends that TORCA assemblies be discarded and replaced each time they are removed.*

    g. Moving to right side of vehicle, open two worm drive clamps and release heat shield from front header pipe. Using an impact wrench with long 1/2 inch swivel socket, remove two exhaust flange nuts to release front header pipe from studs of front cylinder head. Slide exhaust flange down header pipe to improve clearance around exhaust port.

    h. Open two worm drive clamps and release heat shield from rear header pipe. Remove two exhaust flange nuts to release rear header pipe from studs of rear cylinder head.

    i. Open two worm drive clamps to release heat shield over front header pipe to rear header pipe connection (outboard of transmission side cover).

    j. Remove bolt (with flat washer and locknut) from transmission clamp on front header pipe. Use a channel lock to open clamp and then remove from header pipe and transmission bracket.

    k. Remove two bolts (with lockwashers) to detach right side muffler from the lower saddlebag support rail.

    l. Depressing rear brake pedal, remove right side exhaust from vehicle.

    m. Remove and discard gaskets from front and rear exhaust ports.

11. Remove connections to carburetor or induction module. Proceed as follows:

**Carbureted:**

    a. Moving to left side of vehicle, pull external latch outward and use rocking motion to remove electrical connector from manifold absolute pressure (MAP) sensor at top of intake manifold.

    b. Loosen hex nut at backside of horn bracket and release enrichener cable assembly from slot.

**Fuel Injected:**

    a. Depress wire form and use rocking motion to detach electrical connectors from fuel injectors.

b. Disconnect intake air temperature sensor. Simultaneously spread both external latches to remove connector.

c. Disconnect throttle position sensor and idle speed control actuator. Pull external latch outward and use rocking motion to remove connectors.

d. Moving to left side of vehicle, pull back boot to reveal engine temperature sensor at back of front cylinder. Pull external latch outward and use rocking motion to remove connector. Release engine temperature sensor conduit from cable clip at back of horn bracket.

e. Tuck free ends of EFI wire harness under main wire harness on frame backbone to keep conduit and connectors out of the way.

12. Remove idle and throttle control cables as follows:

    **Carbureted:** Using slots, remove cable ball ends from holes in throttle barrel and release cable housings from cable guides on carburetor cable bracket.

    **Fuel Injected:** Using slot, remove idle and throttle control cables from cable guides cast at front of induction module. Using a needle nose pliers, pull cable ball ends out of retainer plate and throttle barrel.

13. Free idle and throttle control cables from J-clamp fastened to right side of frame backbone. Move cables up and out of the way.

14. On Ultra models, remove E-clip to release the cruise cable housing from cable guide cast at front of induction module. Push the plastic end fitting on the cruise cable to the outboard side to release from wheel pin. Move cable up and out of the way.

15. Moving to left side of vehicle, pull boots on spark plug cables to release from spark plug and ignition coil terminals. Release cables from two cable clips on underside of frame backbone.

16. Remove spark plugs.

17. Pull external latch outward and use rocking motion to remove electrical connector from left side of ignition coil.

18. Remove two bolts with lockwashers to free ignition coil from bracket welded to underside of frame backbone. Remove nut plate and ignition coil.

19. Moving to right side of vehicle, remove two allen head socket screws to release oil hose cover.

20. Using a side cutters, cut and remove clamps on engine side of oil hoses. Pull hoses from crankcase fittings.

21. Cut and remove clamp on breather hose behind rear lifter cover. Pull hose from crankcase fitting and tuck behind transmisson to engine flange to keep out of the way.

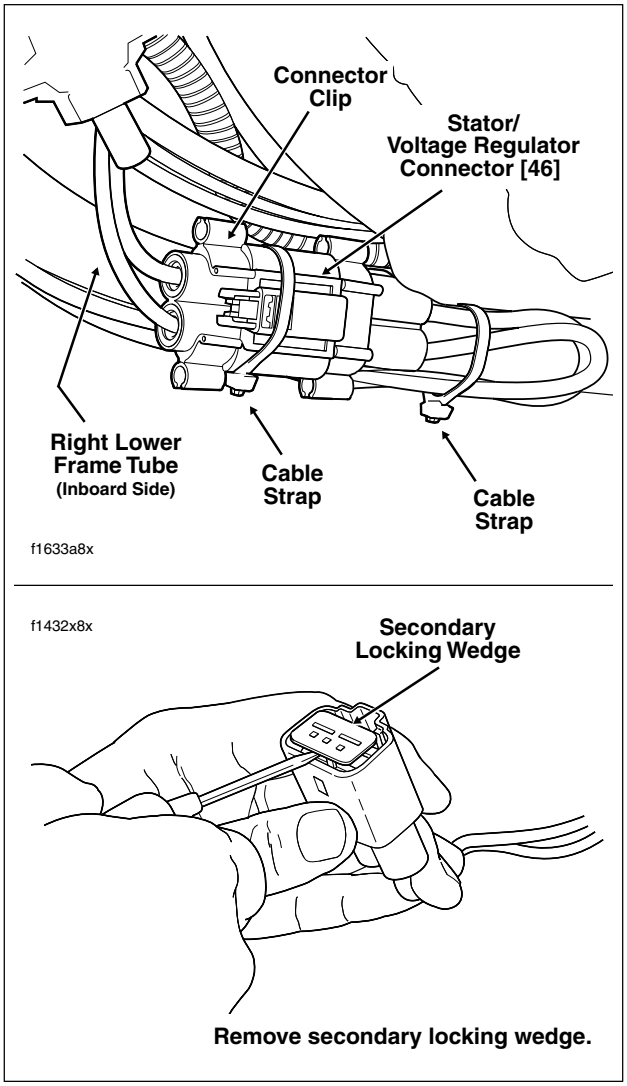



**Figure 3-11. Stator/Voltage Regulator Connector**

22. Depress external latch and use a rocking motion to separate pin and socket halves of stator/voltage regulator connector. Looking into socket housing, note the three holes on one side of the secondary locking wedge. Insert the blade of a small screwdriver between the socket housing and the locking wedge on this side of the connector. See lower frame of Figure 3-11. Gently pivot the end of the screwdriver to pop up the wedge. Prying on the opposite side may damage the secondary lock. Lift terminal latches inside socket housing and back out sockets through wire end of connector.

23. Open two cable clips on inboard side of lower frame crossmember. Free stator/voltage regulator cables from cable clips.

*NOTE*

*For best results, insert blade of small screwdriver into gap at side of clip and gently rotate end of screwdriver to pop open.*

24. Draw stator connector sockets and cables to left side of engine. Coil cable lengths so that they are out of the way and will not be pinched or cut during engine removal.

25. Remove flange locknuts to free voltage regulator from studs on lower frame cross member. Remove voltage regulator from studs and allow to hang by cables at front of vehicle.

26. Locate engine sensor harness connectors in area of right side cover. Release conduit from flexible cable clip at side of electrical bracket, if present. Separate pin and socket halves of oil pressure sending unit, camshaft position sensor and crankshaft position sensor connectors. Camshaft position sensor is present on fuel injected models only.

27. Feed engine sensor harness conduit and connectors forward through opening between frame downtube and bottom front corner of battery box.

28. Cut anchored cable strap to release conduit from frame downtube (inboard of passenger footboard bracket). Cut cable strap to release conduit from brake hose crimp.

29. Following frame downtube, draw conduit and connectors downward to inboard side of rear brake light switch. If more clearance is needed, remove screw to release rear brake line clamp from passenger footboard bracket.

30. Open two cable clips on lower frame tube T-studs and release conduit.

*NOTE*

*For best results, insert blade of small screwdriver into gap at side of clip and gently rotate end of screwdriver to pop open.*

31. Coil engine sensor harness conduit and tape to crankcase. If harness is not out of the way, it may be damaged during engine removal.

32. Place jack under oil pan at rear of vehicle. Using a block of wood to distribute pressure across the length of the casting, raise the jack until firm contact is made with the bottom of the oil pan.

33. Standing on left side of vehicle, remove two bolts (with flat washers) to release top engine mounting bracket from cylinder heads.

34. Leaving ground wire ring terminal in place, detach socket terminal of yellow lead from spade contact at back of horn.

35. Moving to right side of vehicle, hold bottom nut and turn allen head socket screw topside to release stabilizer link from frame weldment.

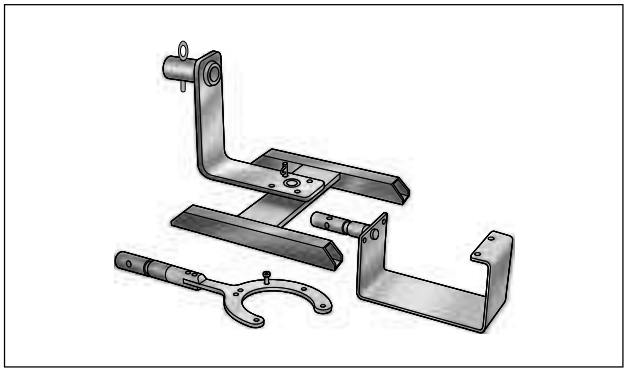


**Figure 3-12. Engine/Transmission Bench Stand (Part No. HD-42310)**

36. Remove horn, top engine mounting bracket and stabilizer link as an assembly.

37. Remove four bolts (with flat washers) to free rear of crankcase from transmission housing. Loosen and remove bolts in a crosswise pattern.

38. Remove two bolts (with flat washers) to free front of crankcase from front engine mounting bracket.

39. Wrap rear master cylinder reservoir with foam padding or bubble pack.

40. Cover lower frame tubes (both left and right side) with foam padding or bubble pack. Split loom conduit or a half shell of PVC tubing will also produce good results. Protection is necessary to prevent nicks or paint damage to left frame tube and chafing, cutting or kinking of the brake line, wire cables and conduit at the top of the right frame tube.

41. Cover rocker covers of front and rear cylinders with foam padding or bubble pack.

**⚠CAUTION**

**The engine weighs approximately 165 pounds (74.8 kg). Use a suitable lifting device, if necessary. Exercise caution to avoid personal injury.**

42. Move engine forward far enough to clear two ring dowels in lower flange of transmission housing. Raise engine and remove from right side of vehicle. Exercise caution to avoid contact with rear brake master cylinder reservoir and brake line, wire cables and conduit at top of lower frame tube.

43. Using the TWIN CAM 88 CRADLE (HD-42310-2), install engine in BENCH STAND (HD-42310) or ROLLING STAND (HD-43682). See Figure 3-12.

44. Remove intake manifold/carburetor or induction module. Proceed as follows:

### Carbureted:

a. Standing on right side of engine, remove allen head socket screws from front and rear cylinder head flange adapters. For best results, use a long 1/4 inch ball allen head socket with end driver 4 inches long.

b. On left side, just loosen allen head socket screws from flange adapters. Slots in flanges make removal of the screws unnecessary.

c. Remove intake manifold/carburetor from right side of engine.

### Fuel Injected:

a. Standing on right side of engine, remove allen head socket screws from front and rear cylinder head flange adapters. For best results, use a long 1/4 inch ball allen head socket with end driver 4 inches long.

b. On left side, just loosen hex head bolts (1/2 inch) from flange adapters. Slots in flanges make removal of the bolts unnecessary.

c. Remove induction module from right side of vehicle.

45. Remove the rotor as follows:

**⚠CAUTION**

**The high-output rotor is used on fuel injected vehicles, FLHRC-I excepted. Since the high-output rotor contains magnets that are considerably more powerful than those used on low-output rotors, the ROTOR RE-MOVER/ INSTALLER and SHAFT PROTECTOR SLEEVE (HD-41771) must be used to prevent parts damage and possible hand injury during removal and installation.**

### High Output Rotor - 45 Amp

a. Verify that threads of engine sprocket shaft are clean, especially of old Loctite material. Thread the Shaft Protector Sleeve onto the shaft.

b. Turn thumbscrews of Rotor Remover/Installer into threaded holes in rotor face.

c. Rotate handle of forcing screw in a clockwise direction to remove rotor from shaft.

### Low Output Rotor - 38Amp

**CAUTION**

**Do not strike or drop rotor. Damage to magnet adhesive may result in rotor failure.**

a. Fabricate wire hooks or use the ends of two allen wrenches to carefully pull rotor at holes in rotor face.

b. Pull rotor from stator. Magnets in rotor cause some resistance during removal.

46. Remove stator as follows:

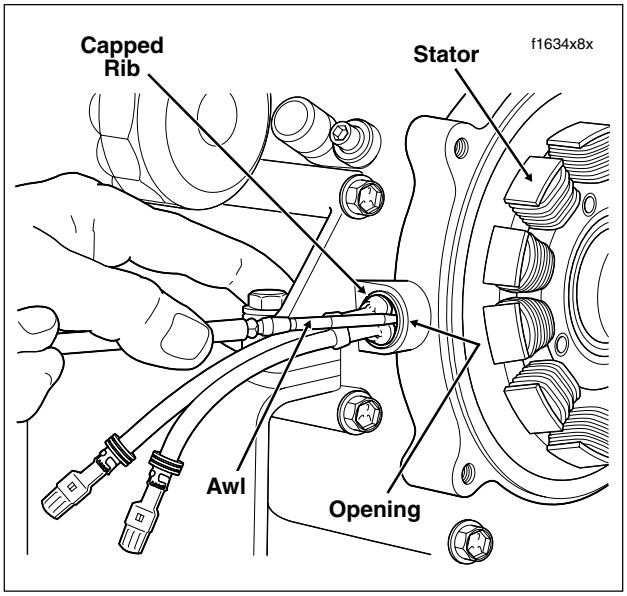



**Figure 3-13. Remove Grommet From Crankcase**

a. Using a T27 TORX drive head, remove four screws to free stator from crankcase. Discard screws.

b. Using point of awl, carefully lift capped rib on grommet away from crankcase and then insert into bore between grommet and casting. See Figure 3-13. Tilt awl slightly squirting denatured alcohol or glass cleaner into opening. Repeat this step at one or two other locations around grommet.

c. While pushing on capped rib from outside of crankcase, draw grommet through bore by pulling on cable stop with needle nose pliers. Rock grommet back and forth to facilitate removal, if necessary. Exercise caution to avoid damaging ribs on grommet if stator is to be reused.

47. Remove the oil filter as follows:

a. Obtain the OIL FILTER WRENCH (HD-42311). The tool allows easy removal of the oil filter without risk of damage to the crankshaft position sensor or cable.

b. Place the jaws of the wrench over the oil filter with the tool oriented vertically.

c. Using a 3/8 inch drive with a 4 inch extension, turn wrench in a counterclockwise direction until loose. Do not use with air tools.

48. Remove oil filter mount as follows:

a. Carefully bend corners on lockplate away from heads of top and bottom bolts in oil filter mount. Remove top and bottom bolts, lockplate and flat washers. Discard lockplate.

b. Remove middle bolt with flat washer to free filter mount from crankcase.

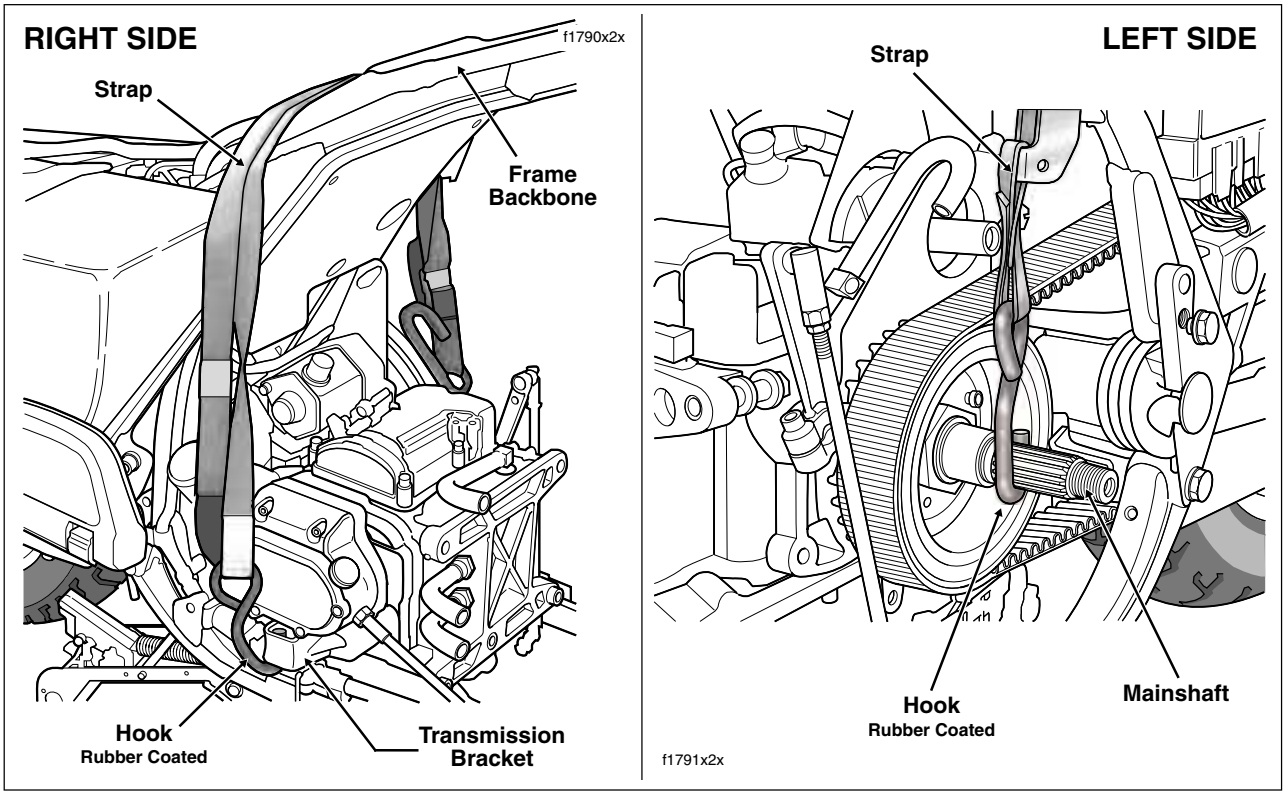



**Figure 3-14. Secure Transmission Using Transmission Bracket and Mainshaft**

c. Remove two O-rings from inboard side of filter mount. Discard O-rings.

49. Remove spark plugs from front and rear cylinder heads.

*NOTE*

*Remove and clean the oil pan under any of the following conditions:*

- *Metal debris is found in the engine or crankcase.*
- *Oil contamination is suspected.*
- *A complete engine overhaul is being performed as a result of a major engine failure.*
- *The engine is being replaced with a new one.*

50. To remove the oil pan, proceed as follows:

a. Use a tie down strap to hold the transmission. Lay strap over frame backbone placing one rubber coated hook through the transmission bracket on the right side of the vehicle and the other around the mainshaft on the left. Using buckle, tighten strap until taut. See Figure 3-14.

b. Lower and remove jack under oil pan.

c. Locate oil drain plug at front of the oil pan. See Figure 3-15. Remove the plug and allow oil to drain completely.

d. Locate transmission drain plug on right side of the oil pan. See Figure 3-15. Remove the plug and drain the transmission lubricant into a suitable container.

e. Alternately loosen and then remove the twelve allen head socket screws to release the oil pan from the transmission housing. Follow the pattern shown in Figure 3-15.

f. Remove gasket from oil pan and discard.

*NOTE*

*If oil pan was drained and removed, start at step 1. If oil pan was neither drained nor removed, move to step 13.*

1. Coat gasket surface of oil pan with a thin coat of HYLOMAR® gasket sealer.
2. Place gasket on oil pan and allow sealer to dry until tacky.
3. Position oil pan under transmission housing and start the twelve allen head socket screws. Tighten each screw about two turns after initial thread engagement.
4. Inspect the oil pan gasket to verify that it is properly positioned.
5. Alternately tighten the oil pan screws to 7-9 ft-lbs (9-12 Nm) following the pattern shown in Figure 3-15.
6. Remove any foreign material from magnet of oil drain plug. Also check the O-ring for tears, cuts or general deterioration. Replace as necessary.
7. Install the engine oil drain plug in front of the oil pan. Tighten plug to 14-21 ft-lbs (19-28 Nm).
8. Remove the transmission filler plug from the clutch release cover on the right side of the transmission case. Check the O-ring for tears, cuts or general deterioration. Replace as necessary.
9. Remove any foreign material from magnet of transmission drain plug. Also check the O-ring for tears, cuts or general deterioration. Replace as necessary.
10. Install the transmission lubricant drain plug in right side of the oil pan and tighten to 14-21 ft-lbs (19-28 Nm).

**⚠WARNING**

**When draining or adding lubricant, do not allow dirt, debris or other contaminants to enter the transmission case. Exercise caution so that lubricant does not contact rear wheel, tire and brake components. Such contact can adversely affect traction and may lead to loss of vehicle control, which could result in death or serious injury.**

11. Fill the transmission with 20-24 oz. (590-710 ml) of transmission lubricant or until the lubricant level on the dipstick of the filler plug is at the F(ULL) mark with the motorcycle in a level, upright position and the filler plug resting on the threads. Use only Harley-Davidson TRANSMISSION LUBRICANT, Part No. 98853-96 (quart) or Part No. 98852-96 (gallon).
12. Install the transmission filler plug/dipstick in the clutch release cover. Tighten the plug to 25-75 **in-lbs** (2.8-8.5 Nm).

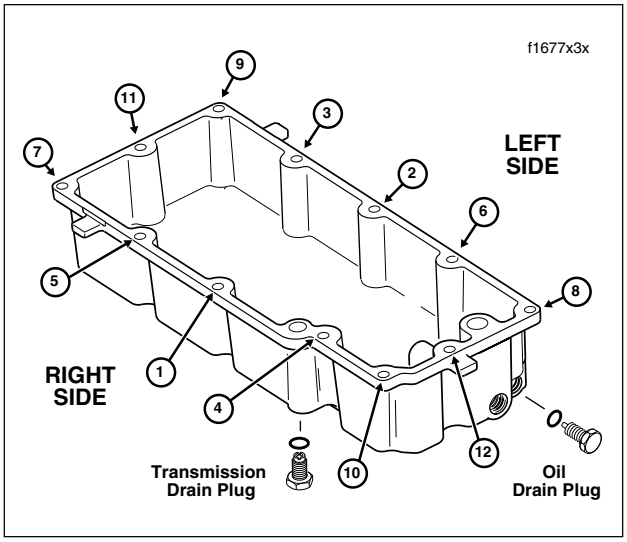



**Figure 3-15. Oil Pan Torque Sequence**

13. Place jack under oil pan at rear of vehicle. Using a block of wood to distribute pressure across the length of the casting, raise the jack until firm contact is made with the bottom of the oil pan.
14. Remove strap from frame backbone disengaging hooks from mainshaft and transmission bracket.
15. Install spark plugs in front and rear cylinder heads. Install the plugs finger tight and then tighten to 11-18 ft-lbs (15-24 Nm).
16. Install oil filter mount as follows:
    a. Install two **new** O-rings on inboard side of filter mount.
    b. Place flat washers in recessed bolt holes at top and bottom of filter mount flange.
    c. Align holes in lockplate with holes in flat washers.
    d. Slide two hex head bolts through lockplate, flat washers and filter mount flange. Apply Locktite 243 (blue) to threads of installed bolts.

**CAUTION**

**To avoid cross threading tapped holes, exercise care when starting hex head bolts in crankcase.**

    e. Align holes in filter mount flange with holes in crankcase and tighten bolts until snug.
    f. Install flat washer on remaining bolt, apply Locktite 243 (blue) to threads and install in middle hole of filter mount flange.

g. Starting at the top, alternately tighten three hex head bolts to 90-120 **in-lbs** (10.2-13.6 Nm). Re-tighten middle bolt when done.

h. To prevent rotation, carefully bend outside corners of lockplate against heads of top and bottom bolts.

17. Clean oil filter mount flange of any old gasket material. Lubricate gasket of **new** oil filter with clean engine oil and install on filter mount. Hand tighten oil filter 1/2-3/4 turn after gasket first contacts filter mounting surface. Do **NOT** use OIL FILTER WRENCH (HD-42311) for oil filter installation.

*NOTE*

*Use of the new Premium 10 micron synthetic media oil filter is highly recommended, Part No. 63798-99 (Chrome) or 63731-99 (Black).*

18. Install stator as follows:

a. From inside crankcase, feed socket terminals and stator cable through hole in crankcase.

b. Thoroughly lubricate grommet with denatured alcohol or glass cleaner. To avoid leakage, ribs of grommet must be free of dirt and oily residue.

c. Carefully grasp cable stop behind grommet with a needle nose pliers. Push grommet into crankcase bore while carefully pulling on outside cable. Installation is complete when cable stop contacts casting and capped rib of grommet exits crankcase bore.

d. If necessary, carefully run awl around edge of capped rib so that it rests flat against seating surface on crankcase.

**CAUTION**

**Do not reuse T27 TORX screws. The threads of the screws contain a locking compound in pellet form. When the screw is started, the pellet breaks releasing the compound.**

e. Using a T27 TORX drive head, install four **new** screws to fasten stator to crankcase. Alternately tighten screws to 30-40 **in-lbs** (3.4-4.5 Nm).

f. Coil stator connector cable lengths so that they are out of the way and will not be pinched or cut during engine installation.

19. Install the rotor as follows:

**⚠CAUTION**

**The high-output rotor is used on fuel injected vehicles, FLHRC-I excepted. Since the high-output rotor contains magnets that are considerably more powerful than those used on low-output rotors, the ROTOR RE-MOVER/ INSTALLER and SHAFT PROTECTOR SLEEVE (HD-41771) must be used to prevent parts damage and possible hand injury during removal and installation.**

### High Output Rotor - 45 Amp

a. Install the Shaft Protector Sleeve and Rotor Remover/Installer, if removed.

*NOTE*

*The Shaft Protector Sleeve not only protects the threads from the splines of the rotor, but acts as a guide to ensure that the rotor is properly centered.*

b. Center ball on forcing screw in recess at end of engine sprocket shaft. Rotate the handle of the tool in a counterclockwise direction to ease rotor into position over stator.

c. Loosen thumbscrews and remove Rotor Remover/ Installer. Remove Shaft Protector Sleeve.

d. Install the shaft extension on the engine sprocket shaft. (No alternator rotor spacer is provided.)

### Low Output Rotor - 38 Amp

a. Slide rotor over stator with the concave side inboard.

**⚠CAUTION**

**When installing rotor, keep fingers away from edge that mates with crankcase. Since rotor is magnetized, as it nears the crankcase it may be pulled in with considerable force, resulting in pinched fingers or other hand injury.**

b. Install the 0.020 inch (0.508 mm) thick alternator rotor spacer and the shaft extension on the engine sprocket shaft.

20. Install intake manifold/carburetor or induction module. Proceed as follows:

### Carbureted:

a. With the counterbore facing outward, slide cylinder head flange adapters onto outlet ports of intake manifold. The flange adapters are not interchangeable. Look next to slotted bolt hole for stamp that indicates F(ront) and R(ear) cylinder.

b. Place a **new** seal in each flange adapter with the beveled side in against the counterbore.

c. Standing on right side of engine, slide intake manifold toward installed position so that open-ended slots on flange adapters begin to engage allen head socket screws on left side.

d. Align fixed holes in flange adapters with those in cylinder heads and start allen head socket screws. For best results, use a long 1/4 inch ball allen head socket with end driver 4 inches long.

e. Use air cleaner backplate as a template in properly situating intake manifold/carburetor. Align holes in air cleaner backplate with those in cylinder heads and install cylinder head breather bolts. Alternately snug bolts using a 7/16 inch deepwell socket.

f. Tighten allen head socket screws in fixed holes of flange adapters until snug. Moving to left side of engine, tighten screws to 6-10 ft-lbs (8-14 Nm).

g. Remove breather bolts to detach backplate from front and rear cylinders.

h. Tighten allen head socket screws in fixed holes of flange adapters to 6-10 ft-lbs (8-14 Nm).

**Fuel Injected:**

a. With the counterbore facing outward, slide cylinder head flange adapters onto outlet ports of induction module. The flange adapters are not inter-changeable. Look next to the slotted bolt hole for a stamp that indicates F(ront) and R(ear) cylinder.

b. Place a **new** seal in each flange adapter with the beveled side in against the counterbore.

c. Standing on right side of engine, slide induction module toward installed position so that open-ended slots on flange adapters begin to engage hex head bolts on left side.

d. Align fixed holes in flange adapters with those in cylinder heads and start allen head socket screws. For best results, use a long 1/4 inch ball allen head socket with end driver 4 inches long.

e. Use air cleaner backplate as a template in properly situating induction module. Align holes in air cleaner backplate with those in cylinder heads and install cylinder head breather bolts. Alternately snug bolts using a 7/16 inch deepwell socket.

f. Tighten allen head socket screw in fixed holes of flange adapters until snug. Moving to left side of engine, tighten hex head bolts to 6-10 ft-lbs (8-14 Nm).

g. Remove breather bolts to detach backplate from front and rear cylinders.

h. Tighten allen head socket screws in fixed holes of flange adapters to 6-10 ft-lbs (8-14 Nm).

21. Cover rocker covers of front and rear cylinders with foam padding or bubble pack.

22. Cover lower frame tubes (both left and right side) with foam padding or bubble pack. Split loom conduit or a half shell of PVC tubing will also produce good results. Protection is necessary to prevent nicks or paint damage to left frame tube and chafing, cutting or kinking of the brake line, wire cables and conduit at the top of the right frame tube.

23. Wrap rear master cylinder reservoir with foam padding or bubble pack.

24. Remove engine from BENCH STAND (HD-42310) or ROLLING STAND (HD-43682) and set on floor on right side of chassis.

**⚠CAUTION**

**The engine weighs approximately 165 pounds (74.8 kg). Use a suitable lifting device, if necessary. Exercise caution to avoid personal injury.**

25. Raise engine and install in chassis from right side of vehicle setting front of crankcase onto front engine mounting bracket. Engine must be set forward far enough to clear two ring dowels in lower flange of transmission housing. Exercise caution to avoid contact with rear brake master cylinder reservoir and brake line, wire cables and conduit at top of lower right frame tube.

26. Move engine rearward to fully engage two ring dowels in lower flange of transmission housing.

27. Secure the engine as follows:

    a. Hand tighten four bolts (with flat washers) to secure transmission housing to rear of crankcase.

    b. Hand tighten two bolts (with flat washers) to secure front of crankcase to front engine mounting bracket.

    c. Tighten the four transmission housing to crankcase bolts to 15 ft-lbs (20.3 Nm) in the sequence shown in Figure 3-16.

*NOTE*

*For best results, use Open End Crowfoot (Snap-On FC018) on upper left and upper right transmission housing to crankcase bolts.*

    d. Following the same sequence, final tighten the four transmission housing to crankcase bolts to 30-35 ft-lbs (40.7-47.5 Nm).

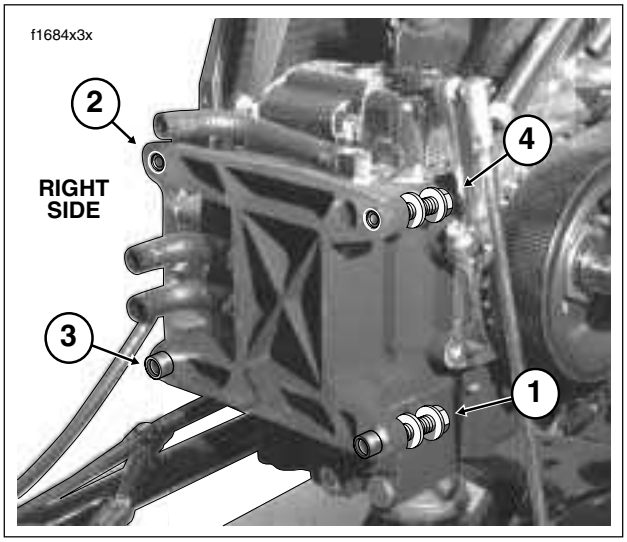



**Figure 3-16. Transmission Housing to Crankcase Torque Sequence**

e. Tighten the two crankcase to front engine mounting bracket bolts to 33-38 ft-lbs (44.8-51.5 Nm).

28. Install horn, top engine mounting bracket and stabilizer link as an assembly. Proceed as follows:

    a. Moving to right side of vehicle, hold bottom nut and turn allen head socket screw topside to secure stabilizer link to frame weldment.

    b. Attach socket terminal of yellow lead to spade contact at back of horn.

    c. Standing on left side of vehicle, install two bolts (with flat washers) to secure top engine mounting bracket to front and rear cylinder heads.

29. Lower and remove jack under oil pan.

30. Slide voltage regulator over studs on frame cross member at front of vehicle. Install flange locknuts on studs and tighten to 7-10 ft-lbs (10-14 Nm).

31. Uncoil cable lengths and draw stator connector sockets and cables to right side of engine capturing cables in two cable clips on inboard side of lower frame crossmember.

32. Feed each socket into wire end of stator/voltage regulator connector until it “clicks” in place. Verify that sockets will not back out of chambers; a slight tug on each wire will confirm that it is locked. Insert secondary locking wedge into socket housing and press down until it snaps in place. Insert socket housing into pin housing.

33. Uncoil engine sensor harness conduit and attach cable clip, if removed. Allowing conduit to hang below lower frame tube, slide T20 TORX screw through holes in cable clip and start screw into threaded hole at front of crankcase. Tighten screw to 20-30 **in-lbs** (2.3-3.4 Nm).

34. Route engine sensor harness connectors and conduit rearward along top of lower frame tube to inboard side of rear brake light switch.

35. Draw engine sensor harness connectors and conduit upward following frame downtube to right side of battery box. Feed connectors and conduit through opening between frame downtube and bottom front corner of battery box (to area of right side cover).

36. Install **new** anchored cable strap to secure engine sensor harness conduit (and voltage regulator cables) to frame downtube (inboard of passenger footboard bracket). Install **new** cable strap to secure conduit (and voltage regulator cables) to brake hose crimp. Cut any excess cable strap material.

37. Install screw to secure rear brake line clamp to passenger footboard bracket, if removed.

38. Capture conduit in two cable clips on lower frame tube T-studs. Snap cable clips closed.

*NOTE*

*The cable clips also capture the voltage regulator cables and rear brake line.*

39. Mate pin and socket halves of oil pressure sending unit and crankshaft position sensor connectors. To prevent improper mating of 2-place Mini-Deutsch connectors, crankshaft position sensor has pin housing on engine sensor harness side, while oil pressure sending unit has socket housing.

    On fuel injected models, mate pin and socket halves of camshaft position sensor connector.

40. Capture conduit to engine sensor harness in flexible clamp at side of electrical bracket, if present.

41. Slide **new** clamp onto free end of breather hose behind rear lifter cover. Install hose onto crankcase fitting. Crimp clamp using HOSE CLAMP PLIERS (HD-97087-65B).

42. Slide **new** clamps onto free ends of oil hoses. Install hoses onto crankcase fittings. Crimp clamps.

43. Install two allen head socket screws to secure oil hose cover to transmission and engine housings. Longer screw goes to engine housing. Alternately tighten screws to 7-9 ft-lbs (10-12 Nm).

44. Install ignition coil and spark plug cables as follows:

    a. Position ignition coil in recess of coil bracket welded to underside of frame backbone. Coil connections must face rear of vehicle.

    b. Align holes in nut plate with holes at front of coil bracket. Insert bolts (with lockwashers) through bracket and ignition coil into nut plate. Tighten bolts to 5-10 ft-lbs (7-14 Nm).

    c. Install spark plug cables onto spark plug and ignition coil terminals. Install spark plug cable to rear cylinder onto right side coil connection. Install spark plug cable to front cylinder onto left side coil connection. Ignition coil terminal connections are stamped F(ront) and R(ear) to ensure proper assembly. Capture spark plug cables in two cable clips on underside of frame backbone.

    d. Install electrical connector to left side of ignition coil.

45. On Ultra models, position cruise cable housing in cable guide cast at front of induction module. Install **new** E-clip on cable housing to lock position of cable. Holding cam lever assembly to prevent rotation, slide groove in plastic end fitting over cap of wheel pin. Push on end fitting until it snaps in place.

46. Route idle and throttle control cables through J-clamp fastened to right side of frame backbone.

47. Install idle and throttle control cables as follows:

**Carbureted:** Install the idle cable housing and spring into the longer cable guide on the carburetor cable bracket. Drawing idle cable downward, fit ball end into hole in throttle barrel (farthest from cam stop). Install the throttle cable housing into the shorter cable guide inserting ball end into remaining hole in throttle barrel.

**Induction Module:** Drawing the idle control cable around the top of the throttle barrel, insert ball end into upper hole in retainer plate. Draw the throttle control cable around the bottom of the throttle barrel and insert ball end into lower hole. Using slots, slip throttle and idle control cables into cable guides cast at front of induction module.

48. Tighten cables as necessary to keep ball ends from dislodging. Verify that cables are seated in channel of throttle barrel. Verify operation by turning throttle grip and observing cable action.
49. Install connections to carburetor or induction module. Standing on left side of vehicle, proceed as follows:

### Carbureted:

a. Moving to left side of vehicle, install electrical connector to manifold absolute pressure (MAP) sensor at top of intake manifold.

b. Position enrichener cable assembly in slot of horn bracket with hex nut on inboard side. Tighten hex nut to 20-35 **in-lbs** (2.3-4.0 Nm).

### Fuel Injected:

a. Install electrical connectors to fuel injectors. Injector cables are tagged F(ront) and R(ear) to ensure correct assembly.

b. Install electrical connectors to intake air temperature sensor, throttle position sensor and idle speed control actuator.

c. Moving to left side of vehicle, install electrical connector to engine temperature sensor at back of front cylinder. Capture connector conduit in cable clip at back of horn bracket. Pull boot over sensor to keep out dirt and debris.

50. Install the primary chaincase. See Section 6.5 PRIMARY CHAINCASE, INSTALLATION, steps 1-29.
51. Install exhaust system as follows:

a. Install **new** gaskets in both the front and rear cylinder head exhaust ports (with the tapered side out).

b. Place right side exhaust into position on vehicle and start two exhaust flange nuts to secure front header pipe to studs of front cylinder head.

c. Start two bolts (with lockwashers) to secure right side muffler to the lower saddlebag support rail.

d. Start two exhaust flange nuts to secure rear header pipe to studs of rear cylinder head.

e. Engaging transmission bracket, capture front header pipe in transmission clamp. Use a channel lock to close clamp, if necessary. Finger tighten clamp bolt (with flat washer and locknut).

*NOTE*

*To ensure sealing integrity of TORCA clamps and prevent the possibility of leakage, Harley-Davidson recommends that TORCA assemblies be discarded and replaced each time they are removed.*

f. Moving to left side of vehicle, slide **new** TORCA clamp assembly onto crossover pipe.

g. Twist and push left side exhaust onto crossover pipe.

h. Start two bolts (with lockwashers) to secure left side muffler to the lower saddlebag support rail.

i. Returning to left side of vehicle, position TORCA clamp between rear header pipe and crossover pipe. Fit bracket tab into slot of TORCA clamp engaging stud in slot of exhaust support bracket. Start Keps nut on stud.

**CAUTION**

**Verify that the exhaust pipes do not contact the vehicle frame or any mounted components. Contact will cancel the effect of the rubber isolation mounts and transmit vibration to the rider via the vehicle frame.**

j. Tighten the exhaust system as follows:

- Using a long 1/2 inch swivel socket, tighten the top nut of the front cylinder head exhaust flange to 9-18 **in-lbs** (1-2 Nm). Tighten the lower nut to 120 **in-lbs** (14 Nm). Final tighten the top nut to 120 **in-lbs** (14 Nm).
- Repeat above step on the exhaust flange nuts of the rear cylinder.
- Tighten the transmission clamp bolt.
- Tighten the two bolts (with lockwashers) to fasten right side muffler to lower saddlebag support rail.
- Tighten the two bolts (with lockwashers) to fasten left side muffler to lower saddlebag support rail.
- Verify that all exhaust pipes are in alignment and do not contact the vehicle frame or mounted components.
- Tighten the TORCA clamp between the rear header pipe and crossover pipe to 45-60 ft-lbs (61-81 Nm).
- Tighten Keps nut securing bracket tab to exhaust support bracket.

**CAUTION**

**Verify that the heat shields do not contact the vehicle frame or any mounted components. Contact will cancel the effect of the rubber isolation mounts and transmit vibration to the rider via the vehicle frame.**

*NOTE*

*Position worm drive clamps so that screws are on the outboard side in the most accessible position.*

k. Open worm drive clamps and install heat shields as follows:

- Over front header pipe (below exhaust port).
- Over rear header pipe (below exhaust port).
- Over front header pipe to rear header pipe connection (outboard of transmission side cover).
- Over rear header pipe to crossover pipe connection (above starter).

l. Position each worm drive clamp so that screw is on the outboard side in the most accessible position and then tighten to 20-40 **in-lbs** (2.3-4.5 Nm).

52. Insert two allen head socket screws (with lockwashers and flat washers) through frame weldment into right side front footboard brackets. For best results, approach from left side of vehicle using a 3/8 inch ball allen with extension.

53. Install connector clip onto stator/voltage regulator connector. Pull clip toward front of vehicle to engage T-stud on inboard side of frame tube. Insert **new** cable strap through slot in frame weldment and secure connector and clip to lower frame tube. Using **new** cable strap, secure looped cables on pin side of connector to lower frame tube. Cut any excess cable strap material. See Figure 3-17.

54. Install the air cleaner and backplate. Proceed as follows:

    **Carbureted:** See Section 4.5 AIR CLEANER, INSTALLATION.

    **Fuel Injected:** See Section 9.4 AIR CLEANER, INSTALLATION.

55. On Ultra models, place fairing lower into position on right side of vehicle. Holding T40 TORX screw inside fairing lower, install **new** rubber washer, clamp and locknut to attach fairing bottom to engine guard. Do not tighten locknut.

56. Align barbed studs in right side cover with grommets in frame downtubes and push firmly into place (no tools required).

57. Install right side saddlebag. See Section 2.22 SADDLEBAG, INSTALLATION.

58. Repeat steps 55-57 to install side cover, saddlebag and fairing lower on left side of vehicle.

59. Install the fuel tank. Proceed as follows:

    **Carbureted:** See Section 4.7 FUEL TANK, INSTALLATION (AFTER COMPLETE REMOVAL), FLHT/C, FLTR, or FLHR.

    **Fuel Injected:** See Section 9.3 FUEL TANK, INSTALLATION (AFTER COMPLETE REMOVAL), FLHTC/U-I, FLTR-I, or FLHR/C-I.

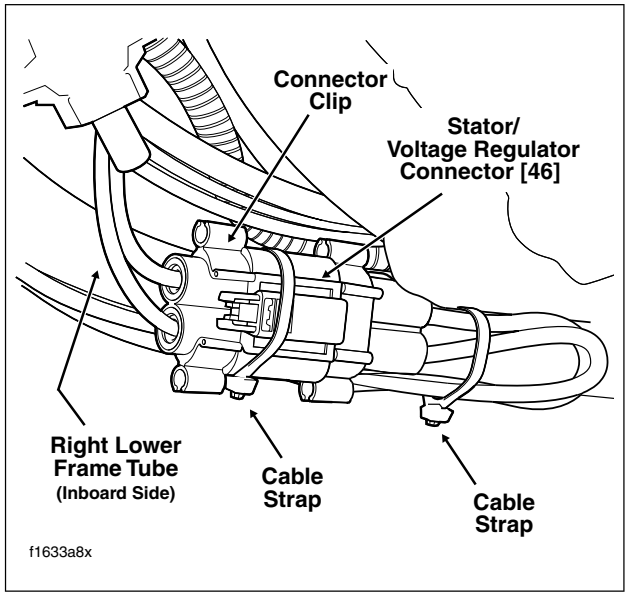



**Figure 3-17. Stator/Voltage Regulator Connector**

60. On Ultra models, hold locknut at bottom of fairing lower, and using a T40 TORX drive head, turn inside screw to fasten assembly to engine guard clamp. Tighten screw to 12 ft-lbs (16 Nm). Repeat step on opposite side of vehicle.

61. Adjust idle and throttle control cables as follows:

    **Non-Ultra:** See Section 2.19 THROTTLE CABLES (NON-ULTRA), ADJUSTMENT.

    **Ultra:** See Section 8.28 CRUISE CONTROL (FLHTCU, FLTR), CABLE ADJUSTMENT.

*NOTE*

*If oil pan was **not** drained, move to step 63.*

62. With vehicle resting on jiffy stand, add 3-1/2 quarts (3.3 liters) engine oil as specified in Table 3-2. Use the proper grade of oil for the lowest temperature expected before the next oil change.

## Table 3-2. Recommended Engine Oils

| Harley-Davidson Type | Viscosity | Harley-Davidson Rating | Lowest Ambient Temperature | Cold Weather Starts Below 50˚F (10˚C) |
|---|---|---|---|---|
| HD Multi-grade | SAE 10W40 | HD 360 | Below 40˚F (4˚C) | Excellent |
| HD Multi-grade | SAE 20W50 | HD 360 | Above 40˚F (4˚C) | Good |
| HD Regular Heavy | SAE 50 | HD 360 | Above 60˚F (16˚C) | Poor |
| HD Extra Heavy | SAE 60 | HD 360 | Above 80˚F (27˚C) | Poor |

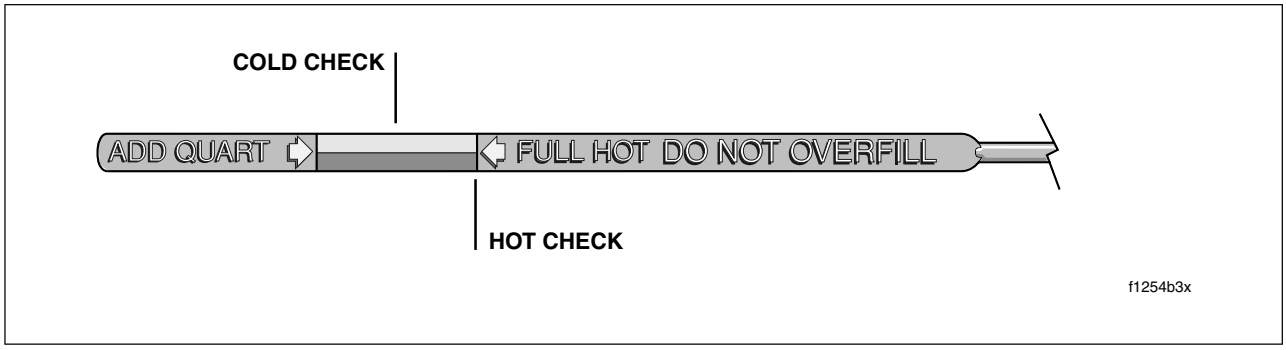


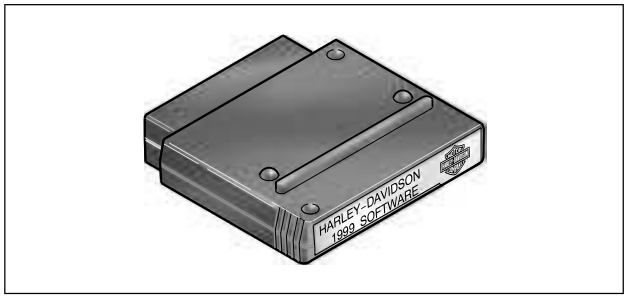

**Figure 3-18. Engine Oil Dipstick**

**CAUTION**

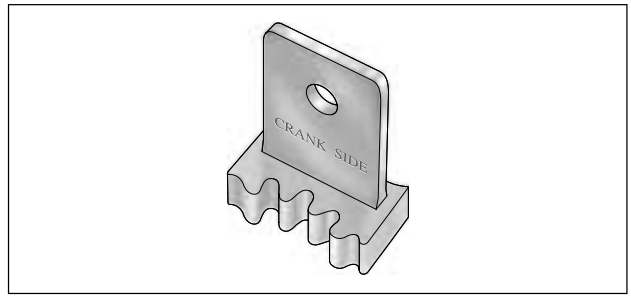
**Oil level cannot be accurately measured on a cold engine. For preride inspection, with motorcycle leaning on jiffy stand on level ground, oil should register on dipstick between arrows when engine is cold. Do NOT add oil to bring the level to the FULL mark on a COLD engine.**

63. Perform engine oil level **COLD CHECK** as follows:
    a. With the vehicle resting on the jiffy stand on level ground, wipe off the dipstick and insert it back into the oil pan with the plug pushed completely into the fill spout.
    b. Remove the dipstick and note the level of the oil. Oil level should register between the two arrows on the dipstick. See Figure 3-18. If oil level is at or below the lower arrow, add only enough oil to bring the level between the two arrows on the dipstick.
64. Perform engine oil level **HOT CHECK** as follows:
    a. Ride vehicle until engine is at normal operating temperature.
    b. With the vehicle resting on the jiffy stand on level ground, allow engine to idle for 1-2 minutes. Turn engine off.
    c. Wipe off the dipstick and insert it back into the oil pan with the plug pushed completely into the fill spout.
    d. Remove the dipstick and note the level of the oil. Add only enough oil to bring the level to the FULL mark on the dipstick. See Figure 3-18. Do not overfill.
65. Start engine and carefully check for oil leaks around drain plug and oil filter.

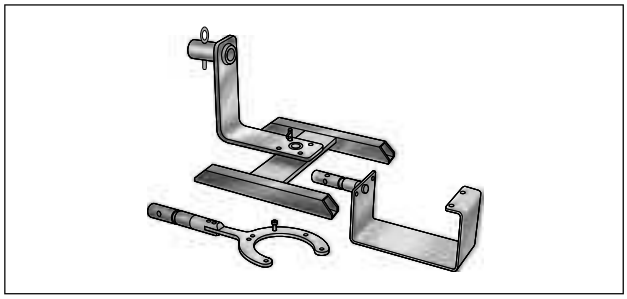
# SPECIAL TOOLS (FOR SERVICING OF THE TWIN CAM 88 ENGINE) 3.9



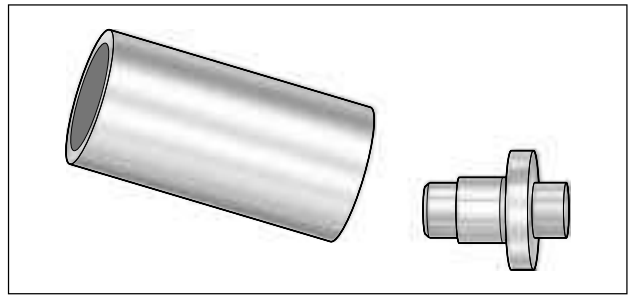

**Part No. HD-41325-95C Scanalyzer Cartridge**



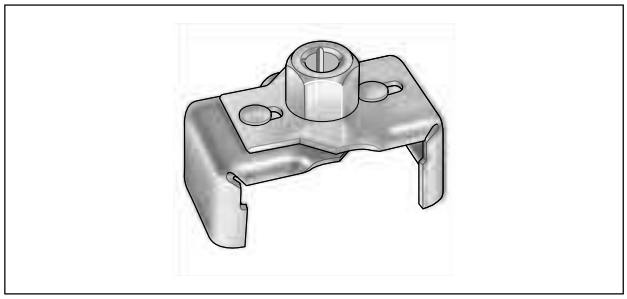

**Part No. HD-42314 Crankshaft/Camshaft Sprocket Locking Tool**



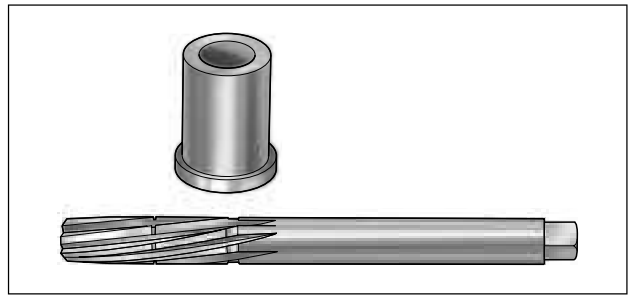
**Part No. HD-42310 Engine/Transmission Bench Stand**



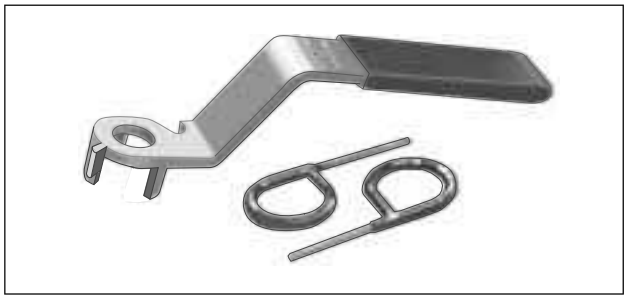
**Part No. HD-42315 Crankshaft Bushing Remover/Installer**



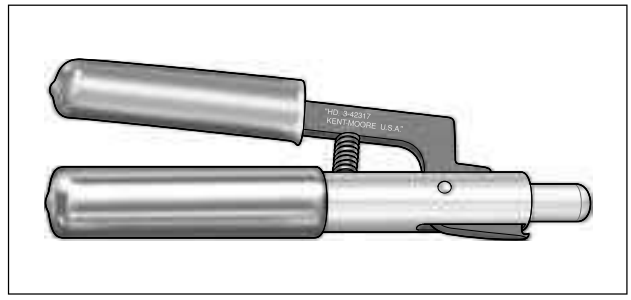
**Part No. HD-42311 Oil Filter Wrench**



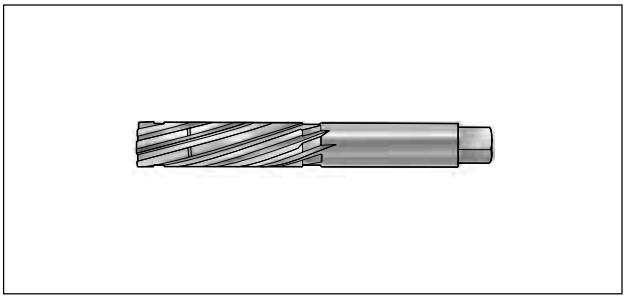
**Part No. HD-42316 Crankshaft Bushing Reamer**



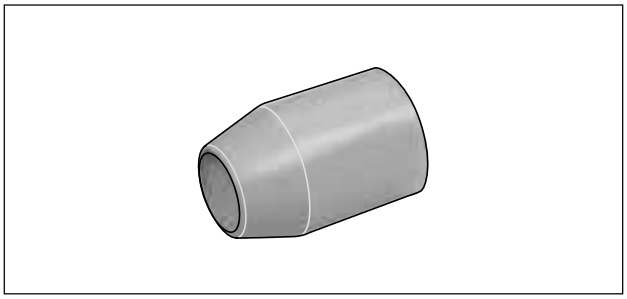
**Part No. HD-42313 Cam Chain Tensioner Unloader With Retention Pins**



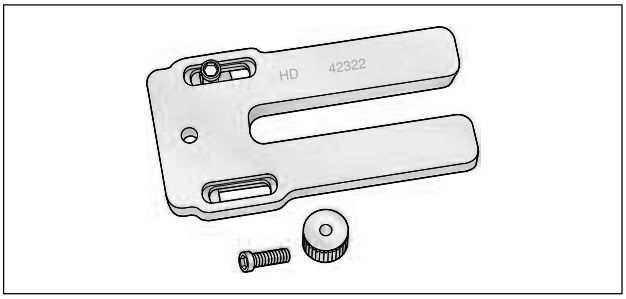

**Part No. HD-42317 Piston Pin Circlip Remover/Installer**



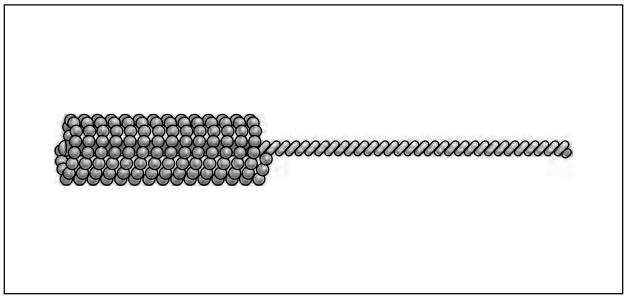
Part No. HD-42318 Connecting Rod Bushing Reamer



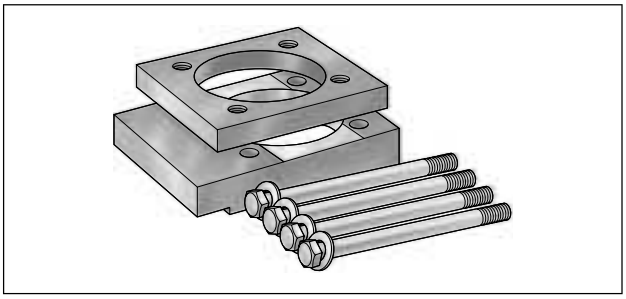
Part No. HD-42326 Crankshaft Guide



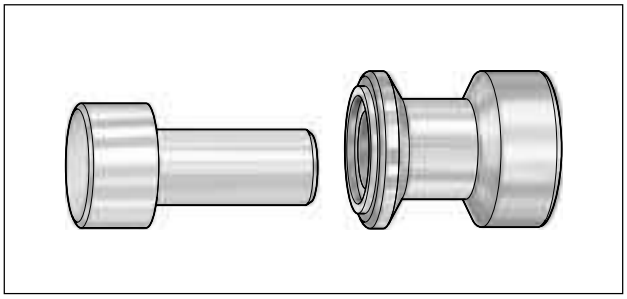

Part No. HD-42322 Piston Support Plate (Non-Essential)



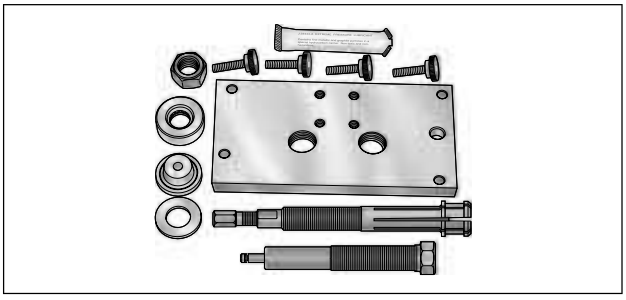
Part No. HD-42569 Connecting Rod Bushing Hone



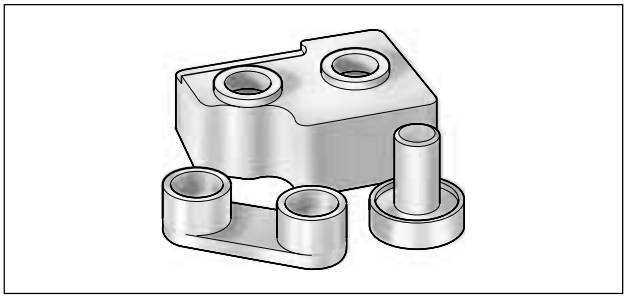
Part No. HD-42324 Cylinder Torque Plates



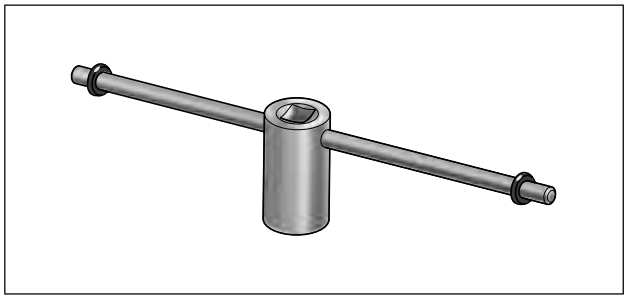
Part No. HD-42720 Crankshaft (Roller) Bearing Remover/Installer



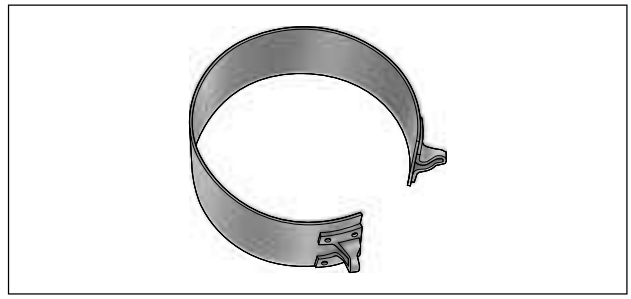
Part No. HD-42325 Camshaft Needle Bearing Remover/Installer



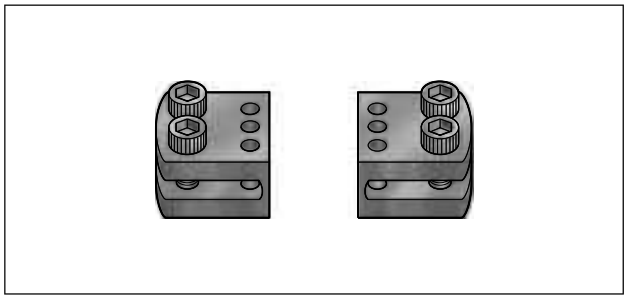
Part No. HD-43644 Camshaft/Camshaft Bearing Remover/Installer



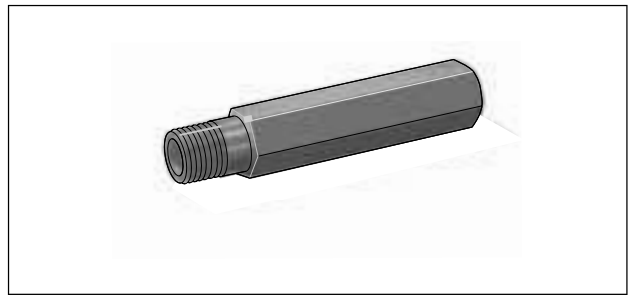
**Part No. HD-43645 Reamer Handle/Drive Socket**



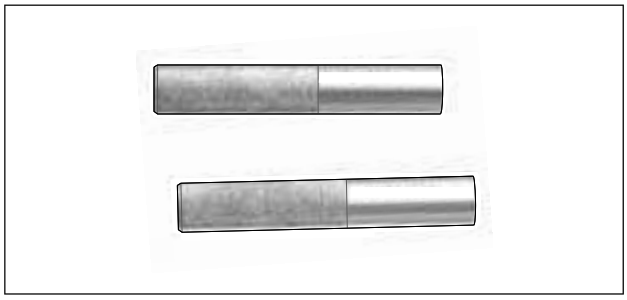
**Part No. HD-96333-103 Piston Ring Compressor Band**
**(Included With Parent Tool HD-96333-51C)**



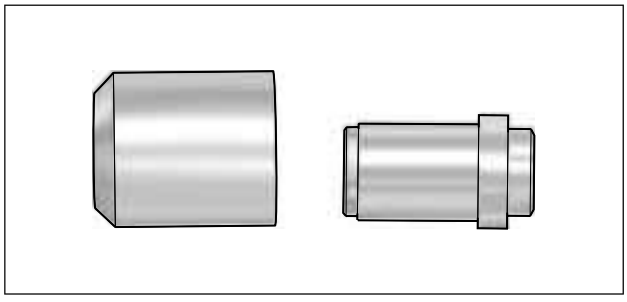
**Part No. HD-43720 Timken Bearing Lock Ring Claws**



**Part No. HD-96921-110 Oil Pressure Gauge Adapter**
**(Included With Parent Tool HD-96921-52B)**



**Part No. HD-95952-1 Connecting Rod Clamping Tool**
**(Included With Parent Tool HD-95952-33B)**



**Part No.'s HD-95984-99 and HD-95986-99**
**Connecting Rod Bushing Remover/Installer**
**(Included With Parent Tool HD-95970-32D)**

## SPECIAL TOOLS

**Scanalyzer Diagnostic Application Cartridge Upgrade** (HD-41325-95C). Plugged into the Scanalyzer, the application cartridge provides electrical diagnostics for all vehicles equipped with the Twin Cam 88 engine, both carbureted and fuel injected. Also contains the software necessary for diagnosing problems on all earlier fuel injected models, as well as the XL 1200 Sport ignition.

**Engine/Transmission Bench Stand** (HD-42310). Bench stand supports cradles for either engine or transmission work. Cradles allow engine/transmission to be oriented vertically, horizontally or at 45 degree angle. Rolling stand (HD-43682) with drip tray also available.

**Oil Filter Wrench** (HD-42311). Allows easy removal of the oil filter without risk of damage to the crankshaft position sensor or cable. Not used for filter installation.

**Cam Chain Tensioner Unloader** (HD-42313). Retracts both the primary and secondary cam chain tensioners. Two retention pins hold the tensioner assemblies in the retracted position to keep the chains unloaded.

**Crankshaft/Camshaft Sprocket Locking Tool** (HD-42314). Simultaneously locks both the crank and primary cam sprockets so that flange bolts can be properly tightened during assembly.

**Crankshaft Bushing Remover/Installer** (HD-42315). Removes and installs crankshaft bushing in cam support plate.

**Crankshaft Bushing Reamer** (HD-42316). Properly sizes crankshaft bushing after replacement.

**Piston Pin Circlip Remover/Installer** (HD-42317). Removes and installs piston pin circlips.

**Connecting Rod Bushing Reamer** (HD-42318). Sizes upper connecting rod bushing after replacement.

**Piston Support Plate** (HD-42322). Supports and holds piston and connecting rod assembly during piston pin removal, cylinder installation, etc.

**Cylinder Torque Plates** (HD-42324). Simulates assembled cylinder for accurately measuring wear, taper and out-of-round conditions, as well as for boring and honing.

**Camshaft Needle Bearing Remover/Installer** (HD-42325). Removes and installs camshaft needle bearings in right crankcase half.

**Crankshaft Guide** (HD-42326). Placed over end of crankshaft, facilitates assembly of crankcase and prevents damage to crankshaft (roller) bearing in right crankcase half.

**Connecting Rod Bushing Hone** (HD-42569). Used to achieve final surface finish of upper connecting rod bushings after reaming.

**Crankshaft (Roller) Bearing Remover/Installer** (HD-42720). Removes and installs crankshaft (roller) bearing in right crankcase half.

**Camshaft/Camshaft Bearing Remover/Installer** (HD-43644). Removes and installs both front and rear camshafts in cam support plate. Also used for cam bearing installation.

**Reamer Handle/Drive Socket** (HD-43645). Drive socket attaches to lug of both upper connecting rod bushing and crankshaft bushing reamers while handle allows easy rotation of reamer for proper sizing.

**Timken Bearing Lock Ring Claws** (HD-43720). Maintains the integrity of the Timken bearing set by allowing removal and installation of lock ring in left crankcase bore.

**Connecting Rod Clamping Tool** (HD-95952-1). Secures upper connecting rod during bushing replacement, reaming and honing. Included with parent tool HD-95952-33B.

**Connecting Rod Bushing Remover/Installer** (HD-95984-99 and HD-95986-99). Removes and installs upper con-necting rod bushings. Included with parent tool HD-95970-32D.

**Piston Ring Compressor Band** (HD-96333-103). Used to compress piston rings during cylinder installation. Included with parent tool HD-96333-51C.

**Oil Pressure Gauge Adapter** (HD-96921-110). Permits use of current gauge when checking oil pressure on Twin Cam 88 engines. Included with parent tool HD-96921-52B.

## DISASSEMBLY

1. Use low pressure spray to thoroughly clean exterior surfaces of engine prior to disassembly. Dirt caked on cooling fins and other areas can fall into crankcase bore or stick to subassemblies as parts are removed. Abrasive particles can damage machined surfaces or plug oil passageways.

*NOTE*

*Rocker cover and rocker housing bolts have both an internal and external hex, which allows the bolts to be removed with either a short 3/16 inch allen wrench (tight spaces), or a 7/16 inch socket or open end/box wrench (open spaces). See Figure 3-19. The internal hex is necessary if the engine is left in the chassis for service. In these cases, the short 3/16 inch allen wrench is indispensable when removing the rocker cover and rocker housing bolts on the left side of the engine (particularly the rear) where there is close proximity to the frame. A dimple or cavity cast into the left side of the upper frame crossmember also aides in removing the rocker arm support plate assembly.*

2. Alternately loosen the six rocker cover bolts following the pattern shown in A of Figure 3-21. Remove the rocker cover bolts.

*NOTE*

*Although this section may seem to focus on rear cylinder disassembly, it is assumed that each step performed at the rear is automatically repeated on the front cylinder.*

3. Remove the rocker cover and gasket. Discard the gasket.

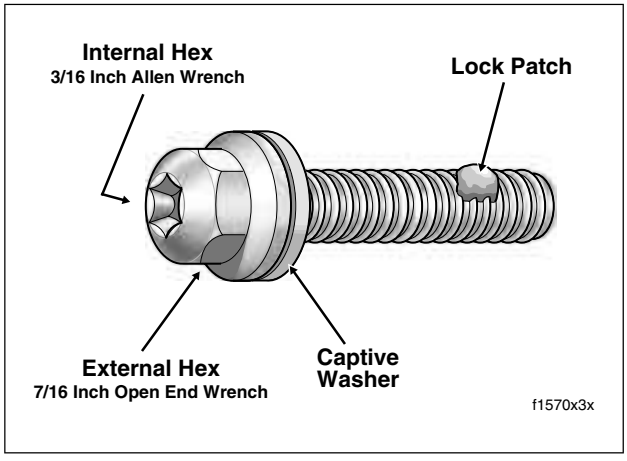



**Figure 3-19. Rocker Cover Bolt (1-1/4 Inch)**

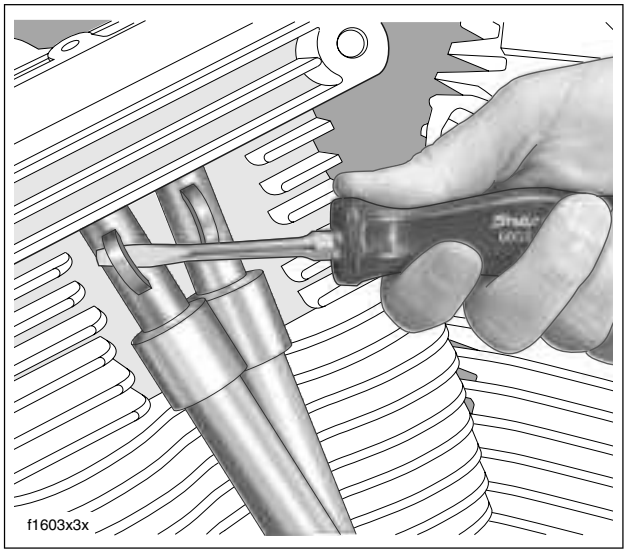



**Figure 3-20. Remove Spring Cap Retainer**

4. Remove two bolts to release breather cover and baffle assembly. See B of Figure 3-21. Remove the breather cover and baffle assembly from the rocker arm support plate. See Section 3.12 SUBASSEMBLY SERVICE AND REPAIR, BREATHER ASSEMBLY.

5. Insert the blade of a small screwdriver into cast loop of spring cap retainer (at top of upper push rod cover), and while pushing down on spring cap, rotate bottom of screwdriver toward outboard side to remove. See Figure 3-20. Repeat step on second push rod cover.

6. Collapse upper and lower push rod covers.

7. To remove the rocker arm support plate, **both** lifters of the cylinder being serviced must be on the base circle (or lowest position) of the cam.

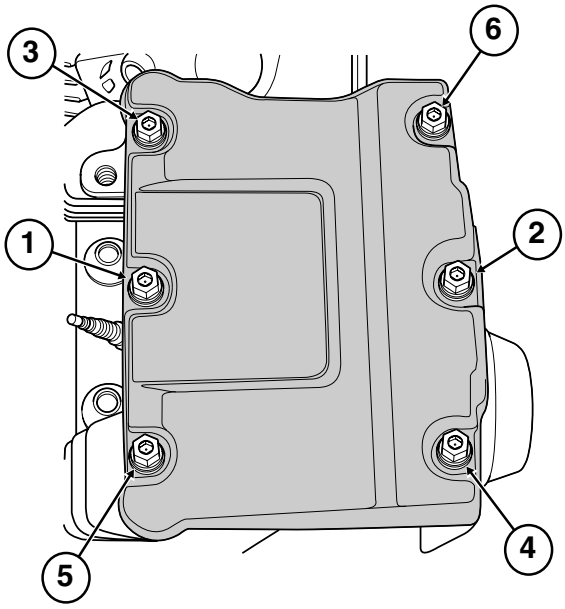
**CAUTION**

**Removing the rocker arms with the valve train loaded can result in bent push rods, damaged bushings or warped support plate.**

To find the base circle, it is first necessary to rotate the engine. Based on the level of disassembly required, three methods of engine rotation are presented below.

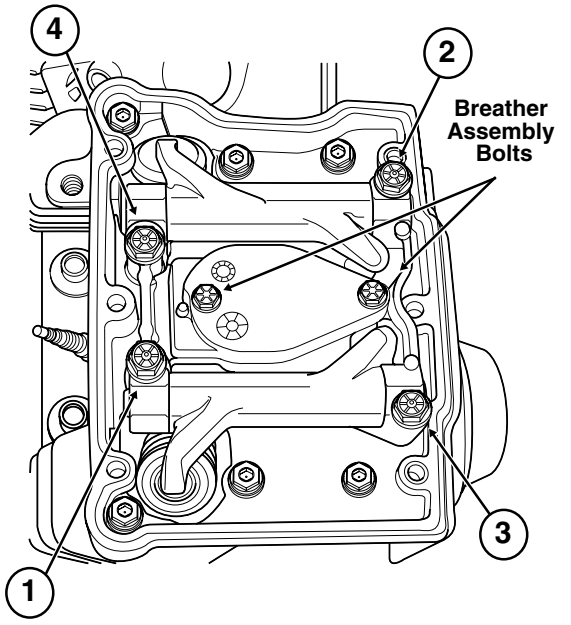
a. With primary cover installed - Remove spark plugs. With vehicle on center stand, place the trans-mission in 5th gear and rotate rear wheel in a clockwise direction (as viewed from right side) until the base circle is found. See step 7(d) to find the base circle.

f1575x3x



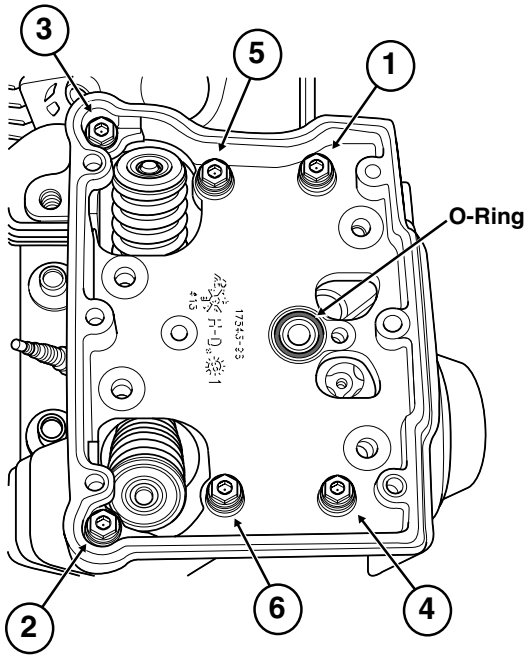

**A** Loosen Six Rocker Cover Bolts.

f1572x3x



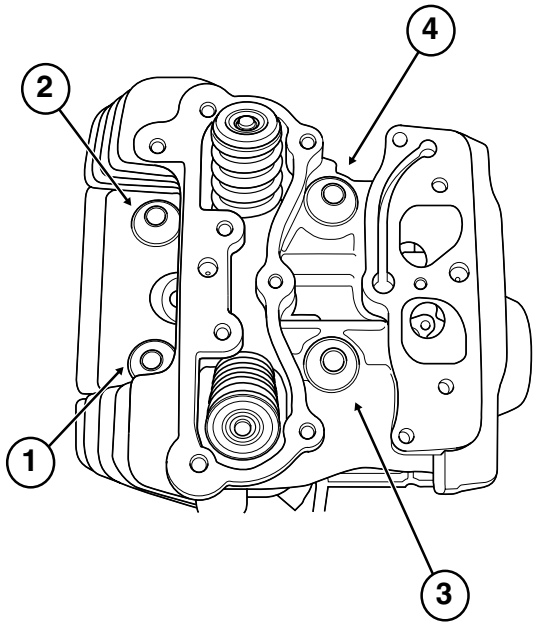

**B** Remove Two Breather Assembly Bolts. Alternately Loosen Four Rocker Arm Bolts 1/4 Turn in Pattern Shown.

f1578x3x




**C** Loosen Six Rocker Housing Bolts.

f1579x3x




**D** Alternately Loosen Four Cylinder Head Bolts 1/4 Turn in Pattern Shown.

**Figure 3-21. Top End Disassembly (Rear Cylinder Shown)**

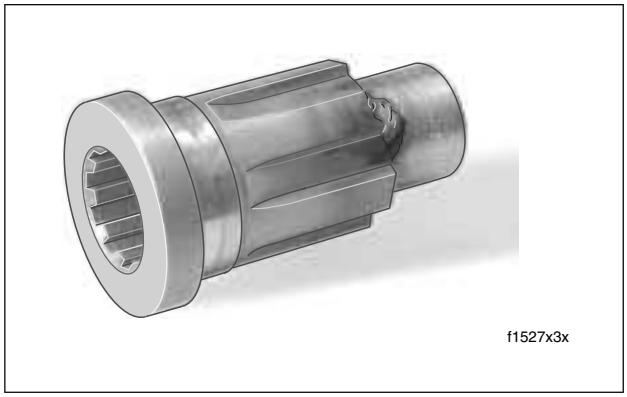



**Figure 3-22. Sprocket Shaft Engine Rotation Tool**

b. With primary cover removed - Remove spark plugs. Remove primary cover. Place the transmission in neutral. Fit a 1-1/2 inch socket on the compensating sprocket shaft nut. Rotate nut in a counterclockwise direction until the base circle is found. See step 7(d) to find the base circle.

**CAUTION**

**Do not attempt to rotate engine by removing cam cover and placing socket on crank or primary cam sprocket flange bolt. Head of flange bolt can break off possibly resulting in damage to flywheel or camshaft.**

c. With engine mounted in engine stand - Fashion tool as follows: Obtain used or discarded compensating sprocket shaft extension (HD-40266-85). Weld a 13/16 inch socket with a 1/2 inch drive to inboard side of extension. See Figure 3-22. Install tool on sprocket shaft and rotate in a counterclockwise direction until the base circle is found. See step 7(d) to find the base circle.

d. Finding the base circle: Using one of the methods above, rotate engine until piston is at Top Dead Center (TDC) of compression stroke. To accomplish this, first raise lower push rod cover to access intake lifter (inside hole of lifter cover). Place index finger on top of the intake lifter. While rotating engine, feel lifter rise (valve open) and fall (valve closed). Now place finger tightly over spark plug hole and rotate engine again. In the compression stroke, air will be forced out against your finger until the piston reaches the TDC position. Stop engine rotation when the flow of air through the spark plug hole stops. Direct the beam of a small flashlight into spark plug hole to verify piston is at TDC. Both intake and exhaust valves are now closed and the push rods are in the unloaded position.

8. Following the pattern shown in B of Figure 3-21, alternately loosen each of the four rocker arm support plate bolts just 1/4 turn. Continue turning the bolts in these increments until loose.

9. When the rocker arm support plate bolts are free of the cylinder head, lift the support plate assembly from the rocker housing. See Section 3.12 SUBASSEMBLY SERVICE AND REPAIR, ROCKER ARM ASSEMBLY.

*NOTE*

*Always service each cylinder separately. After the first cylinder is serviced the engine must be rotated to find the base circle on the second cam. Service on the remaining cylinder can then proceed.*

10. Remove the intake and exhaust push rods. Tag the push rods as they are removed, so that they can be installed in their original locations. Also take note of their orientation to be able to discern top from bottom at time of installation.

11. Remove push rod covers from cylinder head and lifter cover bores. Remove three O-rings from push rod covers and discard. If O-ring is missing from upper push rod cover, be sure to dislodge it from the cylinder head bore.

12. Using a crosswise pattern, remove the four allen head socket screws to release the lifter cover. Remove the lifter cover and gasket. Discard the gasket.

13. Remove the anti-rotation pin. Remove the hydraulic lifters. Tag lifters as they are removed, so that they can be installed in their original locations. Also take note of their orientation (by observing location of the oil hole) to be able to discern front from rear at time of installation.

14. Place the lifters in clean plastic bags to keep out dust, dirt and debris. See Section 3.12 SUBASSEMBLY SERVICE AND REPAIR, PUSH RODS/LIFTERS/COVERS.

15. Remove O-ring from groove around breather baffle hole in rocker housing. Discard the O-ring.

16. Following the pattern shown in C of Figure 3-21, alternately loosen the six rocker housing bolts. Remove the rocker housing bolts.

17. Remove the rocker housing and gasket. Discard the gasket.

**CAUTION**

**To prevent distortion of the cylinder head, cylinder and cylinder studs, gradually loosen the cylinder head bolts in the specified pattern.**

18. Following the pattern shown in D of Figure 3-21, alternately loosen each of the four cylinder head bolts just 1/4 turn. Continue turning the bolts in these increments until loose. Remove the cylinder head bolts.

19. Remove cylinder head and head gasket. Discard the gasket. See Section 3.12 SUBASSEMBLY SERVICE AND REPAIR, CYLINDER HEAD.

20. Remove O-rings from two ring dowels in cylinder flange. Discard the O-rings.

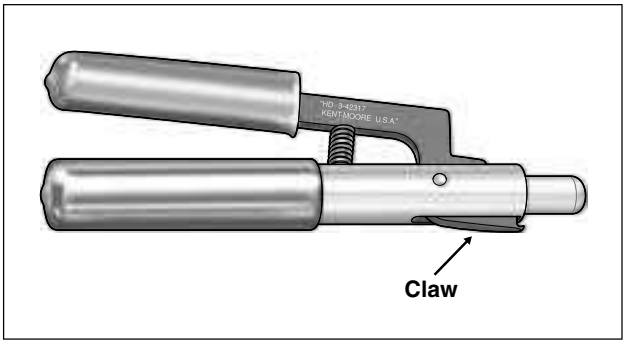



**Figure 3-23. Piston Pin Circlip Remover/Installer (Part No. HD-42317)**

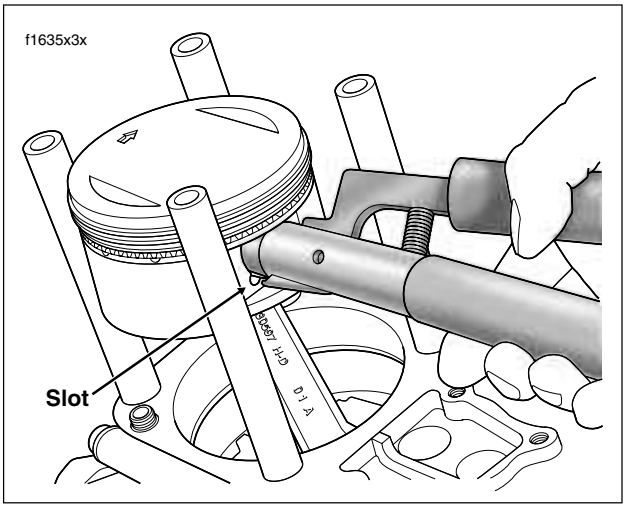



**Figure 3-24. Remove Piston Pin Circlip**

*NOTE*

*Save the cylinder head gasket and ring dowel O-rings for use with the TORQUE PLATES (HD-42324) if measuring, boring or honing of the cylinder is required.*

21. Raise the cylinder just enough to place clean shop towels under the piston. This will prevent any dirt or debris, such as broken ring pieces, from falling into the crankcase bore.

**CAUTION**

**Exercise caution to avoid bending the cylinder studs. Even a slight bend or nick can cause a stress riser leading to stud failure.**

22. Carefully remove the cylinder to avoid bending the cylinder studs. As the piston becomes free of the cylinder, hold it upright to prevent it from striking the studs or dragging across the stud thread area. Mark the cylinder “F(ront)” or “R(ear)” to identify location.

23. Slide plastic tubing, rubber hose or conduit over each cylinder stud. Material approximately 6 inches (152 mm) long with an I.D. of 1/2 inch (12.70 mm) will protect cylinder studs and piston from damage.

24. Remove O-ring seal from the bottom of the cylinder liner. Discard O-ring seal. See Section 3.12 SUBASSEMBLY SERVICE AND REPAIR, CYLINDER.

25. Remove O-ring from ring dowel on “downside” of cylinder deck. Discard the O-ring.

**⚠CAUTION**

**Always wear proper eye protection when removing circlips. Slippage may propel the ring with enough force to cause eye injury.**

26. Verify that clean shop towels are properly positioned over the crankcase bore to prevent the piston pin circlip from falling into the crankcase.

27. Remove the piston pin circlip as follows:

    a. Insert the PISTON PIN CIRCLIP REMOVER/INSTALLER (HD-42317) into the piston pin bore until claw on tool is positioned in slot of piston (directly under circlip). See Figure 3-24.

    b. Squeeze the handles of the tool together and pull from bore. In the event that the circlip should fly out, hold a shop towel over the bore during removal. Remove circlip from claw and discard.

*NOTE*

*It is not necessary to remove <u>both</u> piston pin circlips during piston removal. Leave the second circlip in the pin bore.*

28. Remove the piston pin. If piston pin is difficult to remove, use PISTON PIN REMOVER (HD-42320). See Figure 3-25. Proceed as follows:

    a. Remove acorn nut and spacer from rod end of tool.

    b. Slide rod end through piston pin. Install spacer and acorn nut to end of rod.

    c. Position rubber-coated tips of tool on flat each side of pin bore.

    d. Turn handle in a clockwise direction until piston pin is pulled free of bore. See Figure 3-26.

29. Remove the piston. Be sure to hold the rod shank upright to prevent it from striking the crankcase. Place a piece of foam-type water pipe insulation around each rod (about 3 inches long with a 2-1/4 inch O.D. and a 1 inch I.D.) to prevent damage if contact should occur.

30. Turn the piston over and mark the pin boss with the letters “F(ront)” or “R(ear)” to identify location. See Section 3.12 SUBASSEMBLY SERVICE AND REPAIR, PISTON, and UPPER CONNECTING ROD,.

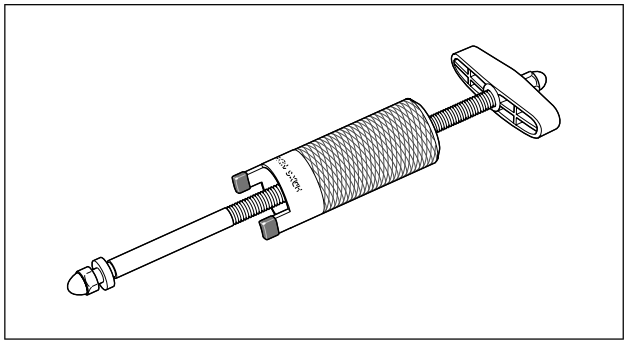


**Figure 3-25. Piston Pin Remover (Part No. HD-42320)**

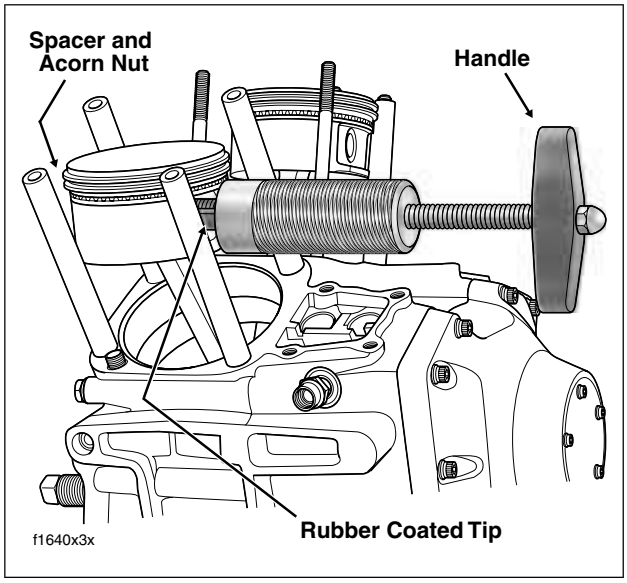



**Figure 3-26. Remove Piston Pin**

31. If performing a top end overhaul only, see Section 3.12 SUBASSEMBLY SERVICE AND REPAIR, TOP END, before proceeding to Section 3.10 TOP END OVERHAUL, ASSEMBLY, which follows. If performing a complete engine overhaul, see Section 3.11 BOTTOM END OVERHAUL, DISASSEMBLY.

# ASSEMBLY

*NOTE*

*Although this section may seem to focus on rear cylinder assembly, it is assumed that each step performed at the rear is automatically repeated on the front cylinder.*

1. Slide plastic tubing, rubber hose or conduit over each cylinder stud, if removed. Material approximately 6 inches (152 mm) long with an I.D. of 1/2 inch (12.70 mm) will protect cylinder studs and piston from damage.
2. Apply clean H-D 20W50 engine oil to piston pin, piston bosses and upper connecting rod bushing.
3. Remove water pipe insulation from rod shank.
4. Place piston over rod end so that the arrow stamped at the top of the piston points toward the front of the engine.
5. Insert piston pin through pin bore and upper connecting rod bushing. Push pin until it contacts circlip installed in opposite pin boss.

**CAUTION**

**Do not reuse piston pin circlips. The circlips may weaken during removal causing them to break or dislodge during engine operation, a condition that will result in engine damage.**

6. Place clean shop towels over the cylinder and lifter bores to prevent the piston pin circlip from falling into the crankcase. Verify that the circlip groove is clean and free of dirt and grime.
7. Install **new** piston pin circlip with the PISTON PIN CIRCLIP REMOVER/INSTALLER (HD-42317). Proceed as follows:
   a. Slide circlip down nose of tool until it contacts claw. Lightly squeeze handles of tool to capture circlip in claw.
   b. Releasing pressure on handles, rotate circlip so that the end gap is centered at top of tool and then recapture in claw.
   c. Tilt the circlip forward until the end gap contacts nose of tool. See upper frame of Figure 3-27.
   d. Insert the tool into the piston pin bore until claw is aligned with slot in piston.
   e. Firmly push the tool into the piston pin bore until it bottoms. Release handles and remove tool.
   f. Inspect the circlip to verify that it is fully seated in the groove.

**CAUTION**

**O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong O-ring will have the same results. Since many O-rings are similar in size and appearance, always use new O-rings keeping them packaged until use to avoid confusion.**

8. Install **new** O-ring over “downside” cylinder deck ring dowel (that is, rear dowel on rear cylinder, front dowel on front cylinder). Apply a very thin film of clean H-D 20W50 engine oil to O-ring before installation. Verify that O-ring is properly seated in groove.
9. Install **new** O-ring seal at the bottom of the cylinder liner. Apply a very thin film of clean H-D 20W50 engine oil to O-ring before installation.

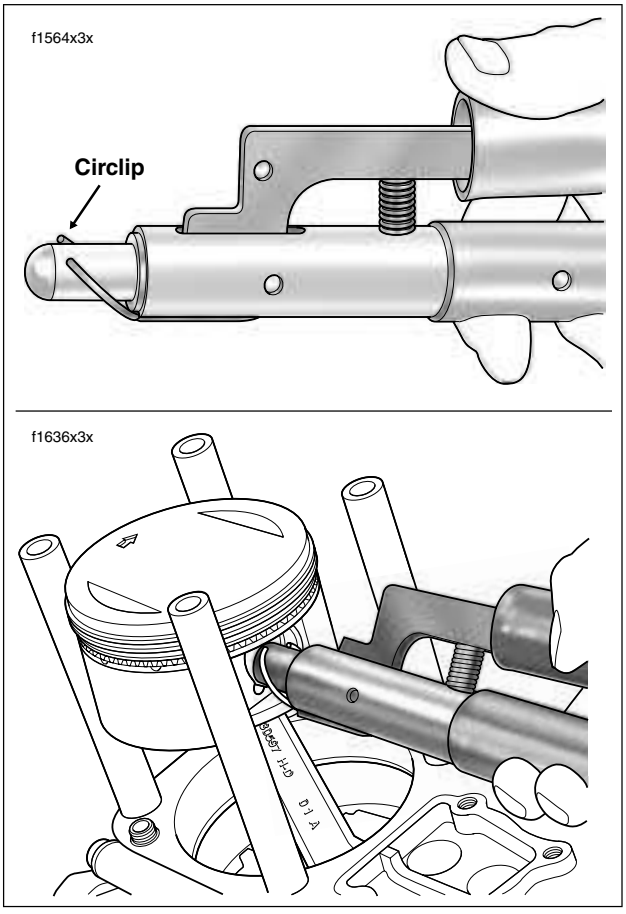



**Figure 3-27. Install Piston Pin Circlip**

*NOTE*

*Excessive lubrication of cylinder sleeve O-ring seal will result in oil weepage between cylinder and crankcase as engine is run, a condition that may be incorrectly diagnosed as an oil leak.*

10. Verify that the piston ring end gaps are staggered. Rotate each ring to position the gap 90 to 180 degrees from the gap in the ring above it.

11. Apply clean H-D 20W50 engine oil to piston, piston rings and cylinder bore.

12. Remove plastic tubing or rubber hose from cylinder studs. Rotate engine until piston is at top dead center. If necessary, see step 32 for methods of engine rotation.

13. Install the PISTON SUPPORT PLATE (HD-42322). Proceed as follows:

    a. Slide both adjustable knobs on tool down slots away from forked end. Tighten knobs when contact is made with flats at end of slots.

    b. With the forked end of the tool pointing towards the center of the engine and the adjustable knobs facing downward, capture shank of connecting rod in fork. Lay tool on cylinder deck so that adjustable knobs contact wall of cylinder bore.

    c. Rotate engine until piston skirt is centered and firmly seated on top of support plate. See Figure 3-29.

14. Install cylinder as follows:

    a. Obtain the PISTON RING COMPRESSOR (HD-96333-51C).

    b. Fit tabs on pliers into slots of ring compressor band (HD-96333-103). The arrow stamped on the band indicates the side that faces up, so disregard the word “bottom.” Place band around piston. Press the lever on the right side of the pliers to open the jaws for band expansion.

    c. Orient tool so that the top of the band is positioned between the top compression ring and the piston crown. Tightly squeeze handles of tool to compress piston rings. The racheting action of the tool allows release of the handles after the rings are compressed.

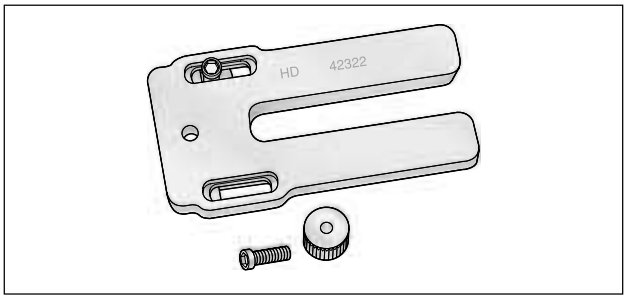



**Figure 3-28. Piston Support Plate (Part No. HD-42322)**

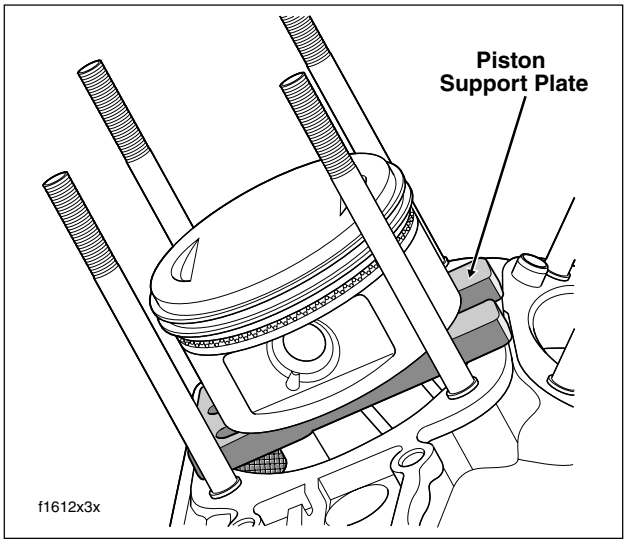



**Figure 3-29. Install Piston Support Plate**

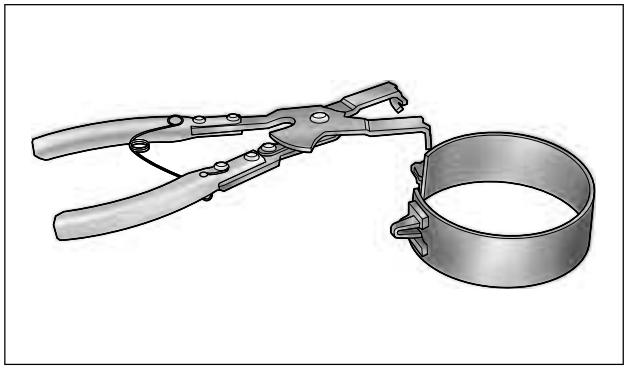


**Figure 3-30. Piston Ring Compressor (Part No. HD-96333-51C)**

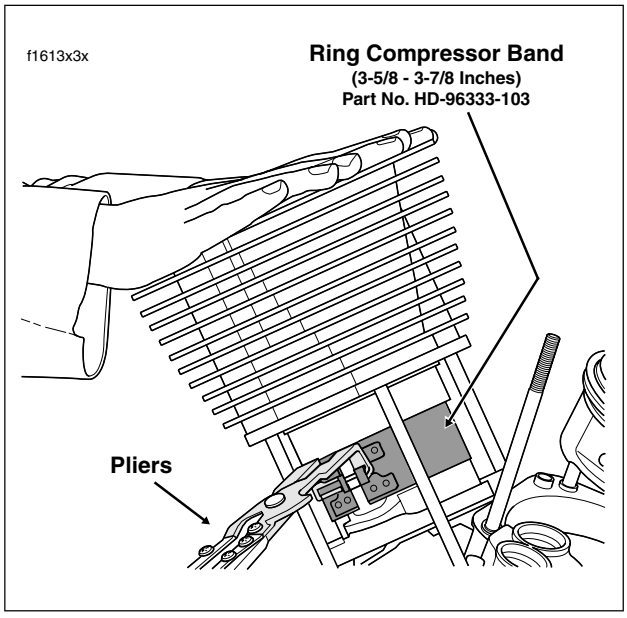



**Figure 3-31. Install Cylinder**

d. Note that the cylinders should have been marked with the letters “F(ront)” or “R(ear)” to identify location. With the indent in the cooling fins facing the right side of the engine, gently slide cylinder over the cylinder studs and the piston crown resting it on the top of the ring compressor band.

e. Place the palms of both hands at the top of the cylinder. Push down on the cylinder with a sharp, quick motion to pass the piston ring area. See Figure 3-31.

f. Rotate the engine slightly to raise piston off support plate. Remove pliers from band and then remove band from around shank of connecting rod. Remove piston support plate.

g. Remove shop towels from around the crankcase bore exercising caution to keep out any dirt or debris.

h. Carefully set the cylinder over the two ring dowels in the cylinder deck. Push down on the cylinder until it is fully seated in the crankcase bore.

*NOTE*

*To hold the first cylinder in position while installing the second, install threaded cylinders (HD-95952-1) from CONNECTING ROD CLAMPING TOOL (HD-95952-33B) onto cylinder studs with the knurled side down. This will prevent the piston rings from raising the cylinder as the engine is rotated to bring the other piston into position for installation of the second cylinder. See Figure 3-32.*

**CAUTION**

**O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong O-ring will have the same results. Since many O-rings are similar in size and appearance, always use new O-rings keeping them packaged until use to avoid confusion.**

15. Install **new** O-rings over two ring dowels at the top of the cylinder. Apply a very thin film of clean H-D 20W50 engine oil to O-rings before installation.

**CAUTION**

**To ensure proper head gasket alignment, install new O-rings over cylinder ring dowels before installing the head gasket. Improper head gasket alignment will cause leaks.**

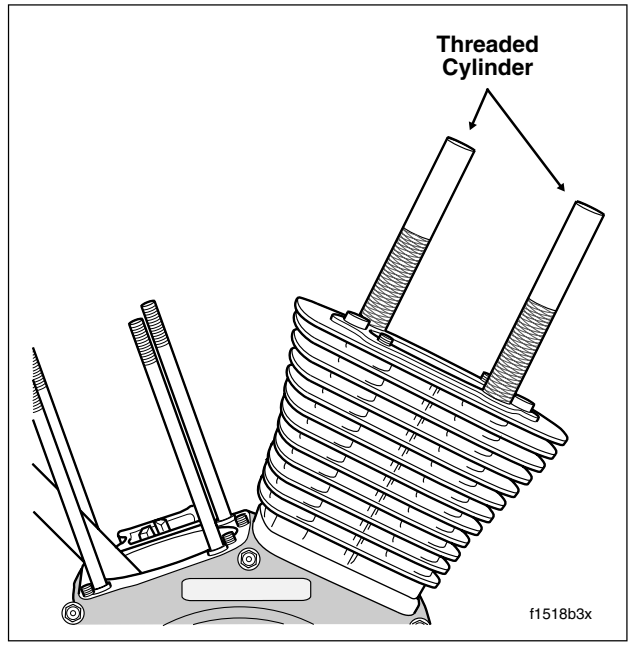



**Figure 3-32. Install Threaded Cylinders to Studs (Part No. HD-95952-1)**

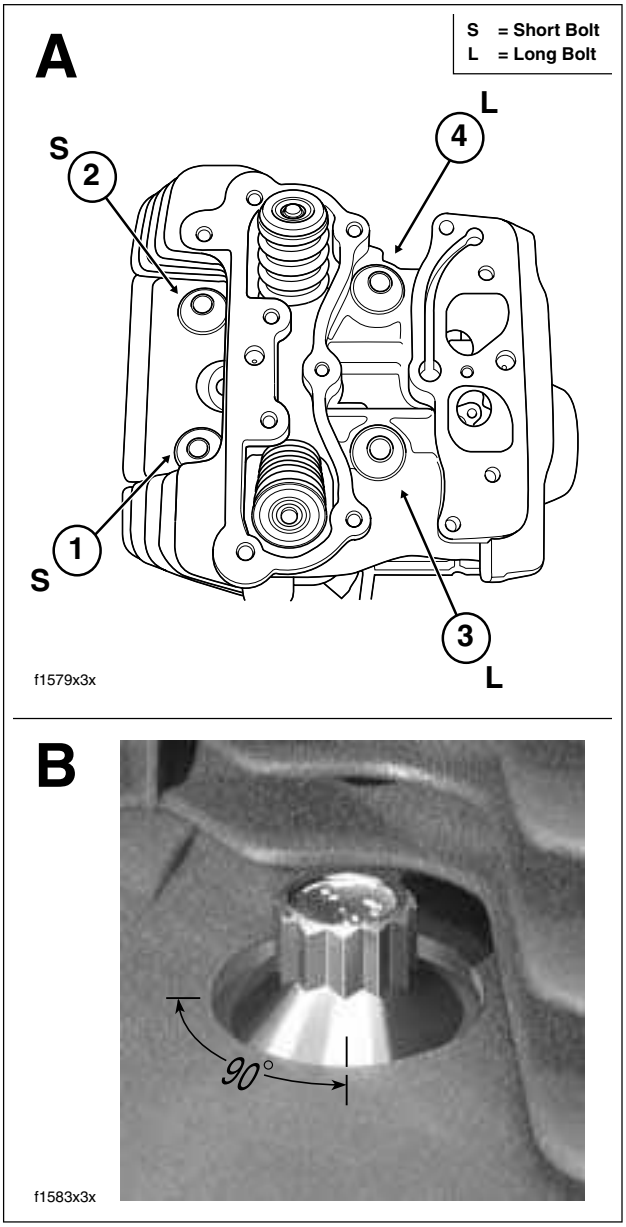



**Figure 3-33. Cylinder Head Torque Sequence and Bolt Size (Rear Cylinder Shown)**

16. Place the head gasket over the ring dowels with the part number topside.
17. Note that the word “Front” or “Rear” is cast into the top of the cylinder head to ensure proper installation. With the indent in the cooling fins facing the right side of the engine (for accommodation of the push rods and covers), carefully set the cylinder head over the two ring dowels in the cylinder flange. To avoid damage to machined surfaces or the ring dowels, lower the cylinder head at an angle that closely approximates the angle of the crankcase.

**CAUTION**

**Thoroughly clean and lubricate the threads of the cylinder head bolts before installation. Friction caused by dirt and grime will result in a false torque indication.**

18. Lightly coat the threads and bottom face of the cylinder head bolts in clean H-D 20W50 engine oil. Wipe off any excess oil.
19. Start the cylinder head bolts onto the cylinder studs, two short bolts on the left side of the engine, two long bolts on the right.
20. Tighten the four cylinder head bolts as follows:

**CAUTION**

**Improperly tightened cylinder head bolts may result in gasket leaks, stud failure and distortion of the cylinder and/or cylinder head.**

a. Alternately turn each cylinder head bolt until finger tight.

b. Tighten the cylinder head bolts to 7-9 ft-lbs (9.5-12.2 Nm) in the sequence shown in A of Figure 3-33.

c. Following the same sequence, tighten each bolt to 12-14 ft-lbs (16.3-18.9 Nm).

d. Using a grease pencil, mark a straight line on the cylinder head bolt continuing the line over onto the cylinder head.

e. Using the marks as a guide, turn each bolt 1/4 turn or 90 degrees. See B of Figure 3-33. Be sure to tighten the cylinder head bolts in the sequence shown in A of Figure 3-33.

21. Install a **new** rocker housing gasket on the cylinder head flange.

**CAUTION**

**Even though all bolt holes (rocker housing, rocker arm support plate and breather assembly) may appear to be in alignment, the rocker housing gasket may be installed upside down. An upside down gasket will result in an open breather channel causing an oil leak when the vehicle is started, possibly resulting in engine and/or property damage.**

22. Verify that the rocker housing gasket is installed correctly by noting that the breather channel is concealed. See Figure 3-34.
23. With the indent facing forward, place the rocker housing into position aligning the holes in the housing with those in the gasket.

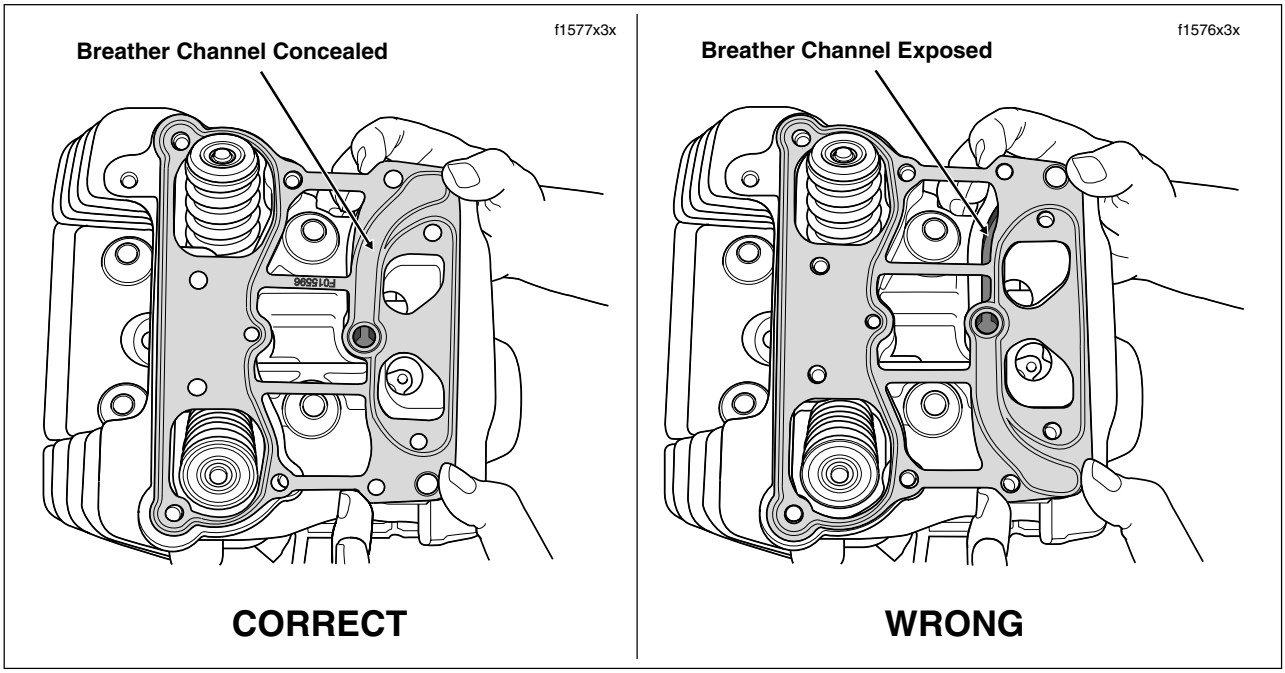



**Figure 3-34. Install Rocker Housing Gasket (Rear Cylinder Shown)**

24. Apply a small dab of Loctite Medium Strength Threadlocker 243 (blue) to threads of six rocker housing bolts. Start the rocker housing bolts, two long bolts on the left side of the engine, four intermediate bolts in the interior. Alternately tighten the bolts to 10-14 ft-lbs (13.6-19.0 Nm) in the pattern shown in Figure 3-35.

*NOTE*

*Rocker housing and rocker cover bolts have both an internal and external hex, which allows the bolts to be installed with either a short 3/16 inch allen wrench (tight spaces), or a 7/16 inch socket or open end/box wrench (open spaces). If the engine is left in the chassis for service, the short 3/16 inch allen wrench is indispensable when installing the rocker housing and rocker cover bolts on the left side of the engine (particularly the rear) where there is close proximity to the frame.*

*NOTE*

*If the engine was left in the chassis for service, final tighten the rear left rocker housing bolt (rear cylinder) using a torque wrench with a 1/4 inch drive. Since this tool may not be available in foot-pounds, tighten the bolt to 120-168* ***in-lbs****.*

**CAUTION**

**O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong O-ring will have the same results. Since many O-rings are similar in size and appearance, always use <u>new</u> O-rings keeping them packaged until use to avoid confusion.**

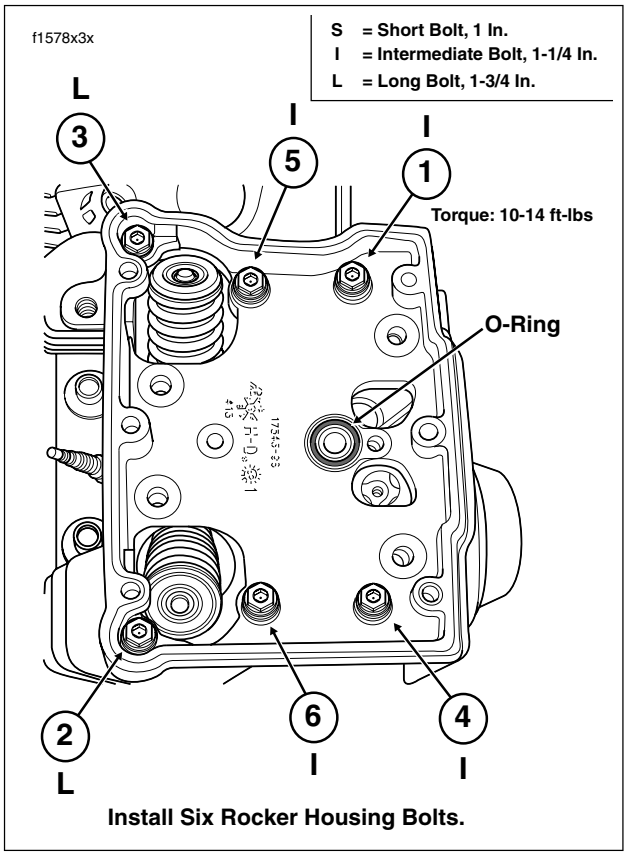



**Figure 3-35. Rocker Housing Torque Sequence and Bolt Size (Rear Cylinder Shown)**

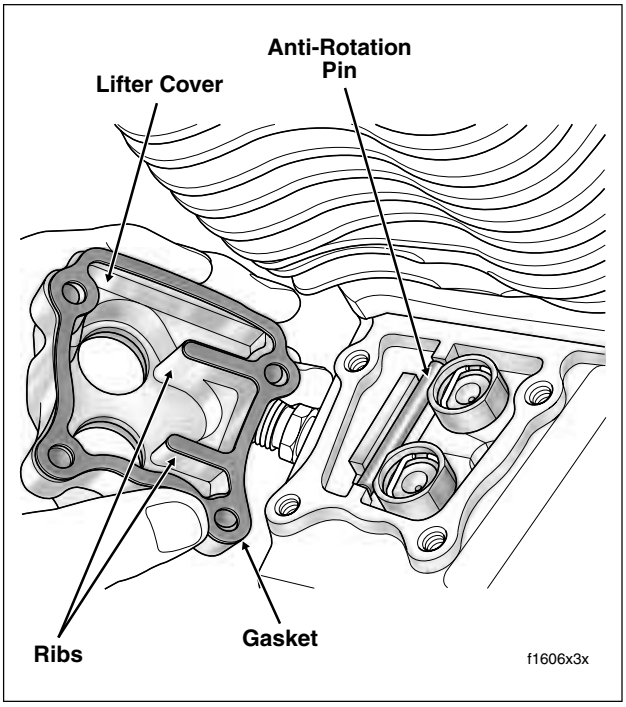



**Figure 3-36. Install Lifters and Lock Position With Anti-Rotation Pin**

25. Install **new** O-ring in groove around breather baffle hole in rocker housing. Apply a thin film of clean H-D 20W50 engine oil to O-ring before installation. See Figure 3-35.
26. Install the hydraulic lifters in the crankcase bores with the flats facing forward and rearward. To preserve existing wear patterns, orientation of the oil hole (inboard or outboard) should have been noted during disassembly. To avoid damage, do not drop lifters onto cam lobes.
27. Place anti-rotation pin on the machined flat between the blocks cast into the crankcase. See Figure 3-36.
28. Install a **new** lifter cover gasket aligning the holes in the gasket with those in the cover.

**CAUTION**

**Movement or loss of the anti-rotation pin can result in lifter rotation causing catastrophic engine damage.**

29. Install the lifter cover and start the four allen head socket screws (1/4 x 1 inch). During installation, verify that the anti-rotation pin is held in place by the ribs cast into the inboard side of the lifter cover. See Figure 3-36. Tighten the lifter cover screws to 90-120 **in-lbs** (10.2-13.6 Nm) in a crosswise pattern.
30. Hand compress the push rod cover assembly and fit the O-ring end of the lower push rod cover into the lifter cover bore. Expanding the assembly, fit the O-ring end of the upper push rod cover into the cylinder head bore.

## Table 3-3. Push Rod/Cover Locations

| Cylinder | Cover and Push Rod* | Lifter Cover Bore | Cylinder Head/ Rocker Housing Bore |
|---|---|---|---|
| Front | Intake | Inside | Rear |
| | Exhaust | Outside | Front |
| Rear | Intake | Inside | Front |
| | Exhaust | Outside | Rear |

* Push Rods Are Color Coded - Intake (Silver), Exhaust (Black)

Do **not** install the spring cap retainers at this time. To ensure proper installation, take note of Table 3-3.

31. Install the push rods in their original positions. Be sure to remove any tags that may have been used for marking location and orientation. To ensure proper installation, take note of Table 3-3. For example, if reassembling the rear cylinder, slide the intake push rod (silver) through the front hole in the rocker housing engaging the lifter socket in the inside hole of the lifter cover. Slide the exhaust push rod (black) through the rear hole in the rocker housing engaging the lifter socket in the outside hole of the lifter cover.
32. To install the rocker arm support plate, **both** lifters of the cylinder being serviced must be on the base circle (or lowest position) of the cam.

**CAUTION**

**Installing the rocker arms and rotating the engine with the valve train loaded can result in bent push rods and/ or valve damage.**

To find the base circle, it is first necessary to rotate the engine. Based on the level of disassembly, three methods of engine rotation are presented below.

a. With primary cover installed - Remove spark plugs. With vehicle on center stand, place the trans-mission in 5th gear and rotate rear wheel in a clockwise direction (as viewed from right side) until the base circle is found. See step 32(d) to find the base circle.

b. With primary cover removed - Remove spark plugs. Remove primary cover. Place the transmission in neutral. Fit a 1-1/2 inch socket on the compensating sprocket shaft nut. Rotate nut in a counterclockwise direction until the base circle is found. See step 32(d) to find the base circle.

**CAUTION**

**Do not attempt to rotate engine by removing cam cover and placing socket on crank or primary cam sprocket flange bolt. Head of flange bolt can break off possibly resulting in damage to flywheel or camshaft.**

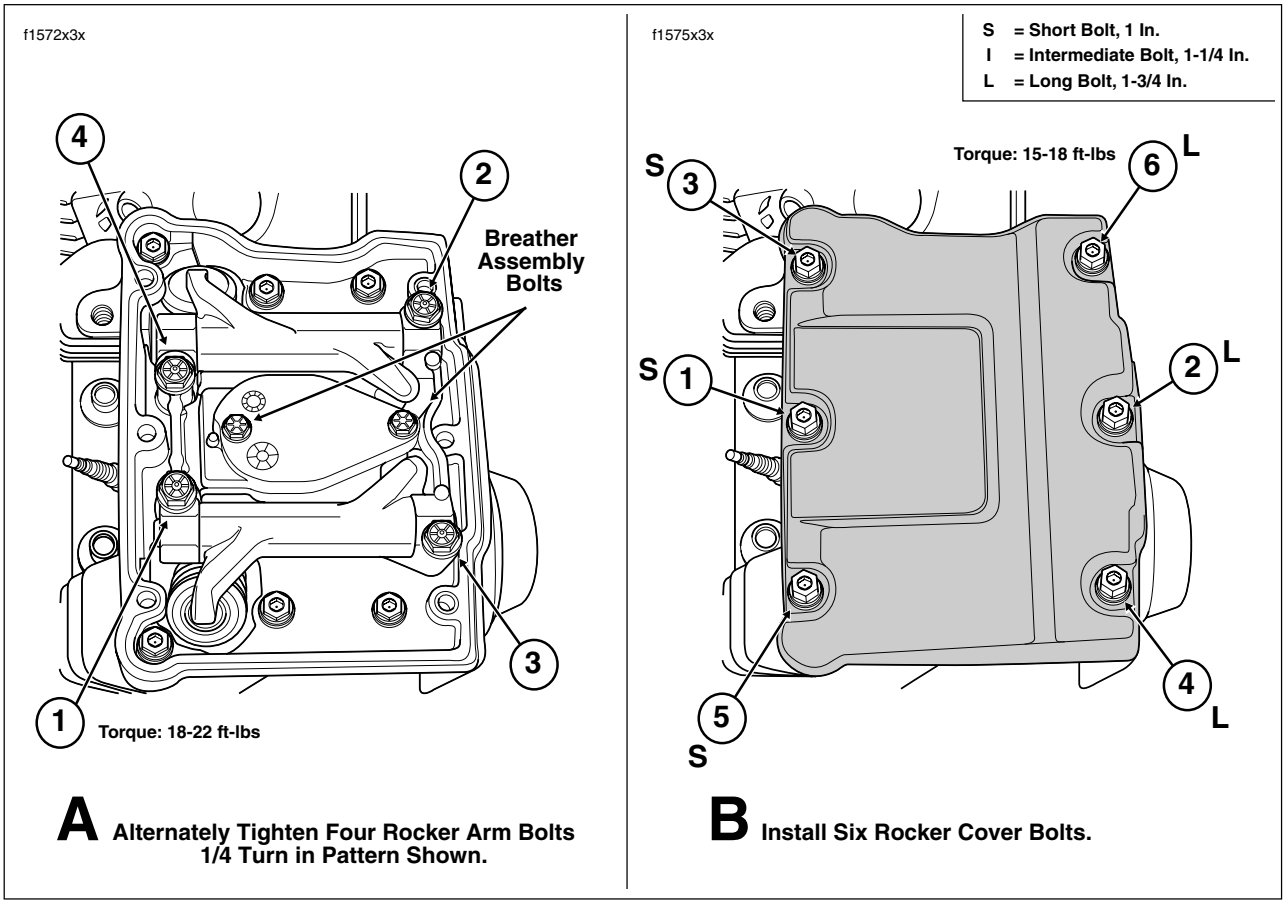



**Figure 3-37. Rocker Arm/Rocker Cover Torque Sequence and Bolt Size (Rear Cylinder Shown)**

c. With engine mounted in engine stand - Fashion tool as follows: Obtain used or discarded compensating sprocket shaft extension (HD-40266-85). Weld a 13/16 inch socket with a 1/2 inch drive to inboard side of extension. See Figure 3-22. Install tool on sprocket shaft and rotate in a counterclockwise direction until the base circle is found. See step 32(d) to find the base circle.

d. Finding the base circle: Using one of the methods above, rotate engine until piston is at Top Dead Center (TDC) of compression stroke. To accomplish this, first raise lower push rod cover to access intake lifter (inside hole of lifter cover). Place index finger on top of the intake lifter. While rotating engine, feel lifter rise (valve open) and fall (valve closed). Now place finger tightly over spark plug hole and rotate engine again. In the compression stroke, air will be forced out against your finger until the piston reaches the TDC position. Stop engine rotation when the flow of air through the spark plug hole stops. Direct the beam of a small flashlight into spark plug hole to verify piston is at TDC. Both intake and exhaust valves are now closed and the push rods are in the unloaded position.

33. Place the rocker arm support plate assembly into the rocker housing. Start the four rocker arm support plate bolts into the cylinder head.

34. Following the pattern shown in A of Figure 3-37, alternately tighten each of the four rocker arm support plate bolts just 1/4 turn. Continue turning the bolts in these increments until snug. Following the same numerical sequence, tighten the bolts to 18-22 ft-lbs (24.4-29.8 Nm).

*NOTE*

*If the engine was left in the chassis for service, final tighten the rocker arm support plate bolt on the rear left side of the rear cylinder using a 3/8 inch drive torque wrench with a 1/2 inch flank drive "dog bone" torque adapter (Snap-On FRDH161). Since any extension can act as a torque multiplier, the torque wrench must be perpendicular to the torque adapter when the bolt is tightened. The 90 degree orientation between the tools cancels the multiplier effect and prevents the bolt from being over-tightened. If the adapter is kept inline with the torque wrench, the multiplier effect is in force and distortion of the rocker housing will occur.*

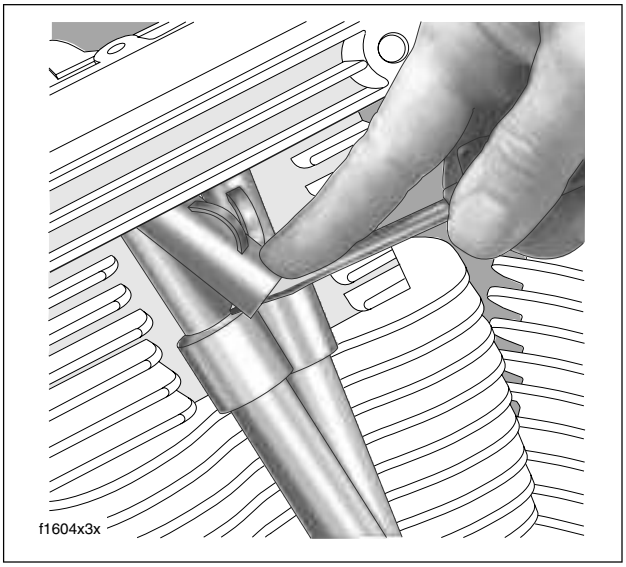



**Figure 3-38. Install Spring Cap Retainer**

35. Lift up lower push rod covers and verify that both push rods spin freely.

*NOTE*

*Always service each cylinder separately. After the first cylinder is serviced the engine must be rotated to find the base circle on the second cam. Service on the remaining cylinder can then proceed.*

36. Complete installation of the push rod covers as follows:
    a. Verify that the O-ring ends of the upper and lower push rod covers fit snugly into the cylinder head and lifter cover bores.
    b. Lodge the upper edge of spring cap retainer into the cylinder head bore leaving the bottom edge free.
    c. Insert blade of small screwdriver between bottom edge of spring cap retainer and top of spring cap.
    d. While simultaneously depressing spring cap with tip of screwdriver, use forefinger to slide bottom edge of spring cap retainer down shaft towards tip of screwdriver blade. As spring cap reaches its full length of travel, spring cap retainer should be in approximate position against upper push rod cover. See Figure 3-38.

*NOTE*

*For best results, be sure that screwdriver, spring cap and spring cap retainer are free of grease and oil.*

    e. Verify that spring cap retainer is seated tightly against upper push rod cover.

37. Install two bolts to secure breather cover and baffle assembly to cylinder head. Alternately tighten bolts to 90-120 **in-lbs** (10.2-13.6 Nm).

38. Install a **new** rocker cover gasket on the rocker housing flange. Place the rocker cover into position aligning the holes in the cover with those in the gasket.

39. Apply a small dab of Loctite Medium Strength Threadlocker 243 (blue) to threads of six rocker cover bolts. Start the rocker cover bolts, three short bolts on the left side of the engine, three long bolts on the right. Tighten the bolts to 15-18 ft-lbs (20.3-24.4 Nm) in the pattern shown in B of Figure 3-37.

*NOTE*

*If the engine was left in the chassis for service, final tighten the three rocker cover bolts on the left side of the rear cylinder using a 3/8 inch drive torque wrench with a 7/16 inch flank drive "dog bone" torque adapter (Snap-On FRDH141). Since any extension can act as a torque multiplier, the torque wrench must be perpendicular to the torque adapter when the bolts are tightened. The 90 degree orientation between the tools cancels the multiplier effect and prevents the bolts from being over-tightened. If the adapter is kept inline with the torque wrench, the multiplier effect is in force and distortion of the rocker cover will occur.*

40. If engine was left in the chassis for service, see Section 3.6 ASSEMBLING MOTORCYCLE AFTER STRIPPING. If engine was removed for service, see Section 3.8 INSTALLING ENGINE IN CHASSIS.

## DISASSEMBLY

1. See Section 3.10 TOP END OVERHAUL, DISASSEMBLY. If performing a complete engine overhaul, reference steps 1-30. If only servicing cam compartment components, see steps 1-11.

*NOTE*

*The cam support plate, lifter cover and crankshaft position sensor mount all use the same short allen head socket screw (1/4 x 1 inch). Only the cam cover uses the longer screw (1/4 x 1-1/4 inches). For ease of assembly, do not mix short and long screws. Store long screws inside cam cover to avoid confusion. The short screws are interchangeable.*

2. Remove the ten allen head socket screws to release the cam cover. Remove and discard the cam cover gasket.

   If the model is fuel injected (cam position sensor present), wrap the cover in foam padding or bubble pack and allow it to hang by the cam position sensor conduit. If convenience or necessity requires complete removal of the cam cover, then proceed as follows:

   a. Remove allen head socket screw to free crank position sensor mount from forward left side of crankcase. Pull sensor from bore. Remove O-ring from groove on sensor body. Discard O-ring.

   b. Draw sensor cable under oil filter mount to right side of crankcase.

   c. Pull wire socket from terminal of oil pressure sending unit (Packard connector on FLHT/C/U models).

   d. Remove T20 TORX screw from threaded hole at front of crankcase to release cable conduit and clip.

   e. If engine was left in the chassis for service, see Section 3.7 REMOVING ENGINE FROM CHASSIS, steps 26-30, for instructions on releasing the engine sensor harness.

3. Using a colored marker, mark one of the links of the primary cam chain. Maintaining the original direction of rotation during assembly may prolong service life.

4. Remove the flange bolt and flat washer from the crank sprocket. See Figure 3-39.

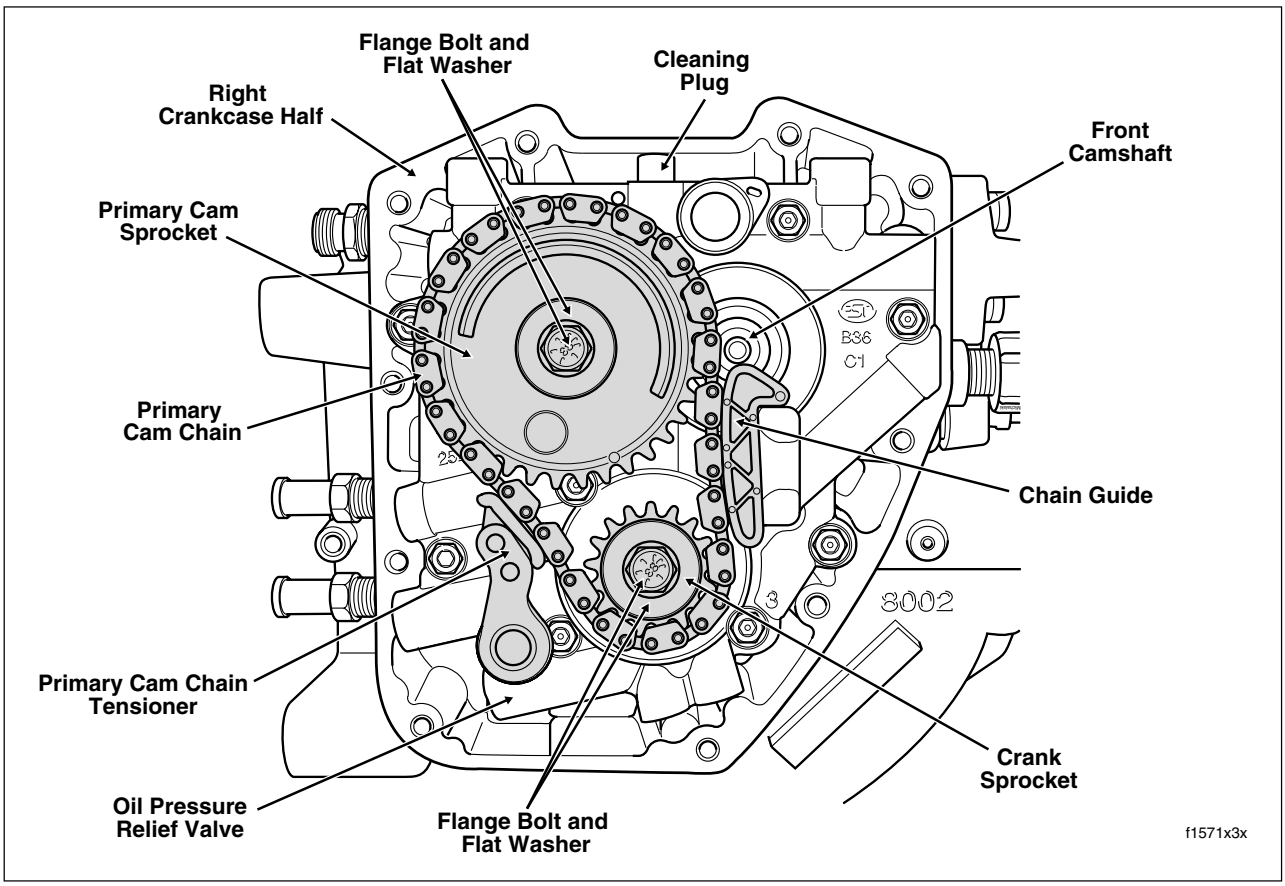



**Figure 3-39. Cam Support Plate Assembly**

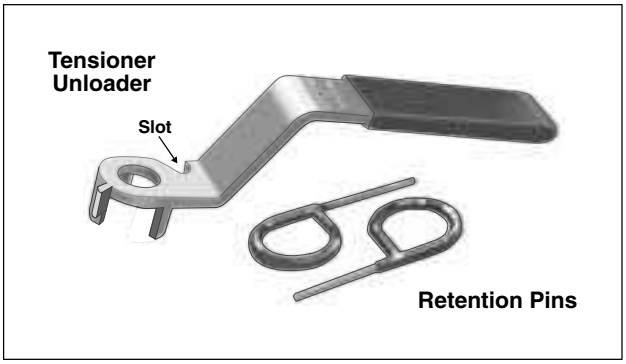



**Figure 3-40. Cam Chain Tensioner Unloader with Retention Pins (Part No. HD-42313)**

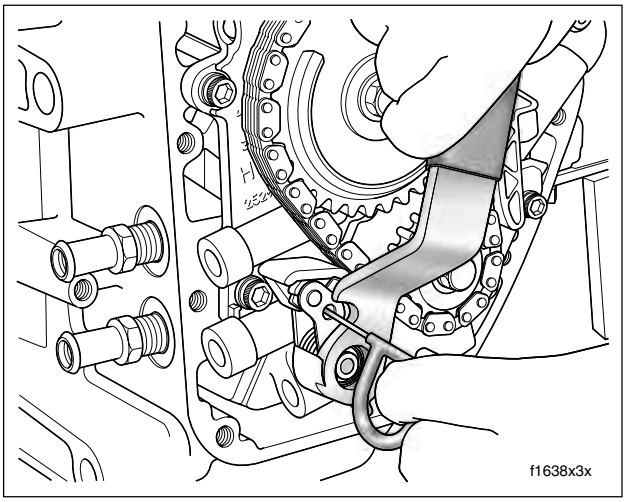



**Figure 3-41. Retract Primary Cam Chain Tensioner**

5. Remove the flange bolt and flat washer from the primary cam sprocket.

*NOTE*

*If too much loctite, or perhaps the wrong loctite, was used to install the primary cam sprocket flange bolt, it may be very difficult to remove. In these cases, break down loctite using heat from a small propane torch. Apply flame evenly around bolt head in a circular motion, but not for so long as to turn bolt blue. Do not direct heat at chain tensioner assembly and other components or damage will result. Other methods of removal, such as use of a large breaker bar, also may result in damage to chain drive and other components.*

**⚠WARNING**

**Use extreme caution when operating propane torch. Read the manufacturers instructions carefully before use. Do not direct open flame or heat toward any fuel system component. Extreme heat can cause fuel ignition and explosion. Inadequate safety precautions could result in death or serious injury.**

6. Using the CAM CHAIN TENSIONER UNLOADER (HD-42313), retract the primary cam chain tensioner as follows:

   a. With the handle pointing toward the front of the cam support plate, place cup of tool over spring coil. Correctly positioned, the slot in the tool should be adjacent to the hole in the tensioner. See Figure 3-41.

   b. Rotate the handle of the tool in a counterclockwise direction until the hole in the tensioner is aligned with the hole in the boss of the cam support plate.

   c. Insert a retention pin through the hole in the tensioner and into the hole in the cam support plate.

7. Insert small pry bar (seal remover) between inboard side of primary cam sprocket and cam support plate. Working around its circumference, carefully ease primary cam sprocket off splines of rear camshaft until loose.

8. Ease off crank sprocket with a slightly smaller pry bar (seal remover). Remove the primary cam sprocket, primary cam chain and crank sprocket.

9. Remove the primary cam sprocket spacer from the rear camshaft.

10. Squeeze tabs to remove chain guide from between blocks cast into cam support plate.

11. Following the pattern shown in B of Figure 3-47, alternately loosen and then remove the four allen head socket screws to release the cam support plate from the oil pump flange.

12. Following the pattern shown in A of Figure 3-47, alternately loosen and then remove the six allen head socket screws to release the cam support plate from the crankcase flange.

13. Two ring dowels in crankcase flange locate cam support plate (lower rear, upper front). See Figure 3-42. Insert small pry bar (seal remover) between inboard side of cam support plate and crankcase flange in area adjacent to ring dowels. Alternately work each side free and then carefully ease cam support plate from end of crankshaft. See Section 3.12 SUBASSEMBLY SERVICE AND REPAIR, CAM SUPPORT PLATE.

**⚠CAUTION**

**Do not pull the retention pin from the primary cam chain tensioner after removal of the cam support plate. With 35-40 pounds of spring pressure behind the tensioner, allowing it to accelerate through its full length of travel will result in spring stretching and/or cracking of the tensioner shoe. Furthermore, if the tensioner should contact fingers or other parts of the hand, minor or moderate injury may occur.**

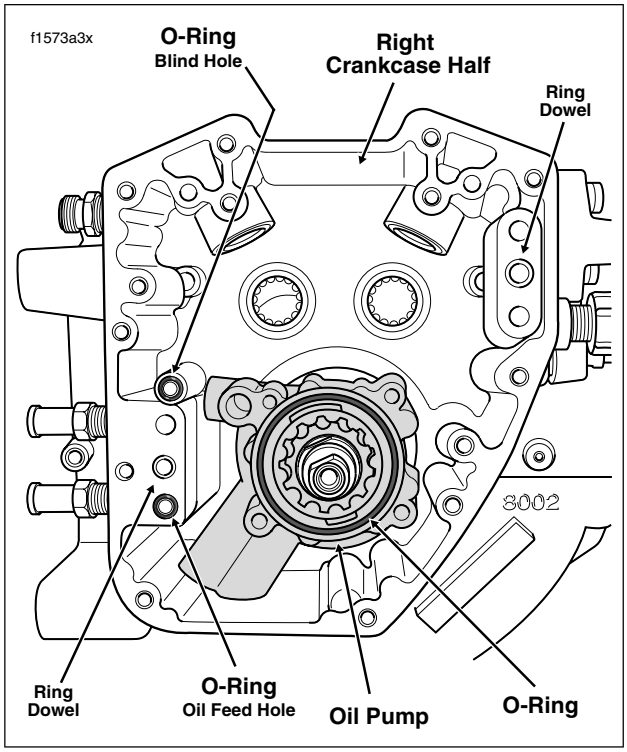



**Figure 3-42. Oil Pump Assembly**

14. Remove O-ring from groove around oil feed hole in crankcase flange (directly below rear ring dowel). Remove O-ring from groove around blind hole in boss (directly above oil return hole in crankcase flange). Discard O-rings. See Figure 3-42.
15. Pull oil pump from crankshaft. Remove O-ring from outboard side of oil pump housing. Remove O-ring from scavenge port stub. Discard O-rings. See Section 3.12 SUBASSEMBLY SERVICE AND REPAIR, OIL PUMP.
16. Moving to left side of engine, remove the nine crankcase bolts in the sequence shown in Figure 3-45.

**⚠CAUTION**

**Never move or lift the crankcase by grasping the cylinder studs. The crankcase is too heavy to be carried in this manner and may be dropped. Dropping the crankcase may result in parts damage and minor or moderate injury.**

17. Rotate crankcase in the engine stand so that the cam cover flange is facing straight upward. Tap crankcase with a rubber mallet (or soft hammer) to loosen case halves. Lift right crankcase half off end of crankshaft.
18. Remove O-rings from two ring dowels in split line face of right case half. Discard the O-rings.
19. See Section 3.12 SUBASSEMBLY SERVICE AND REPAIR, CRANKCASE.

# ASSEMBLY

**CAUTION**

**O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong O-ring will have the same results. Since many O-rings are similar in size and appearance, always use new O-rings keeping them packaged until use to avoid confusion.**

1. Install **new** O-rings over two ring dowels in split line face of right case half. Apply a very thin film of clean H-D 20W50 engine oil to O-rings before installation.
2. With the right crankcase half resting on the cam cover flange, apply a bead of sealant (approximately 0.056 inch wide) to the split line face. For best results, use a non-hardening gasket sealer, such as CRANKCASE SEALANT (HD-99650-81) or 3M #800.
3. To facilitate assembly and prevent damage to the crankshaft (roller) bearing in the right crankcase half, place CRANKSHAFT GUIDE (HD-42326) over end of crankshaft until it contacts shoulder on shaft. Mate case halves sliding bearing roller in right crankcase half over end of crankshaft. Remove tool. See Figure 3-44.
4. Start the nine crankcase bolts and tighten as follows:
   a. Alternately turn each crankcase bolt until finger tight.
   b. Tighten the crankcase bolts to 10 ft-lbs (13.6 Nm) in the sequence shown in Figure 3-45.
   c. Following the same sequence, tighten each bolt to 15-19 ft-lbs (20.3-25.8 Nm).
5. Install oil pump as follows:

**CAUTION**

**O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong O-ring will have the same results. Since many O-rings are similar in size and appearance, always use new O-rings keeping them packaged until use to avoid confusion.**

   a. Install **new** O-ring on scavenge port stub of oil pump housing. Apply a very thin film of clean H-D 20W50 engine oil to O-ring before installation.
   b. Slide oil pump housing onto crankshaft fitting O-ring on scavenge port stub into crankcase bore at back of cam compartment. Firmly push on scavenge port stub with thumb to be sure that it is snug in bore. Inspect O-ring on stub to verify that it is not pinched or distorted.
   c. Separate the gerotor gears into two sets, one wide (scavenge) and the other narrow (feed).

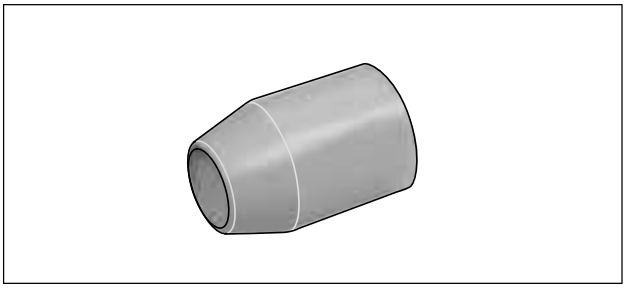


**Figure 3-43. Crankshaft Guide (Part No. HD-42326)**

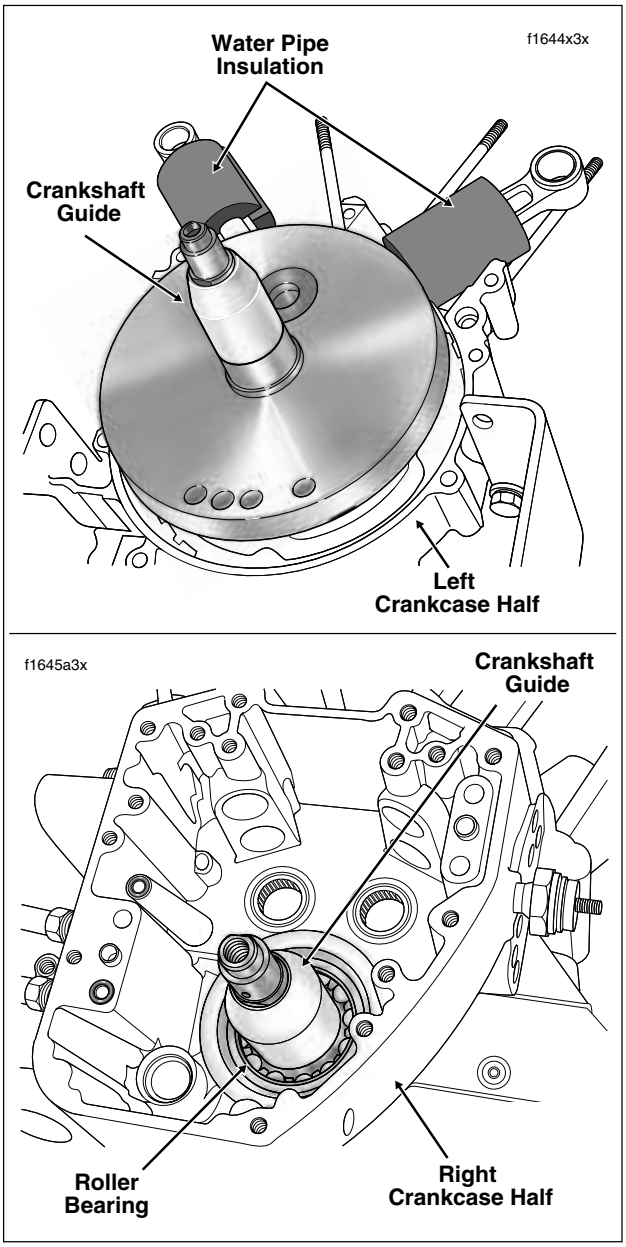



**Figure 3-44. Install Crankshaft Guide to Protect Crankshaft (Roller) Bearing**

*NOTE*

*Lubricate parts with clean H-D 20W50 engine oil during assembly.*

d. Fit the smaller of the **wide** gerotor gears into the larger. Slide the wide gerotor set down the crankshaft until it bottoms in the oil pump housing.

e. Slide the first of two separator plates down the crankshaft until it contacts the wide gerotor set. Install wave washer and second separator plate.

f. Fit the smaller of the **narrow** gerotor gears into the larger. Slide the narrow gerotor set down the crankshaft until it contacts the separator plate.

**CAUTION**

**O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong O-ring will have the same results. Since many O-rings are similar in size and appearance, always use new O-rings keeping them packaged until use to avoid confusion.**

g. Install **new** O-ring in groove on outboard side of oil pump housing. See Figure 3-42. Apply a very thin film of clean H-D 20W50 engine oil to O-ring before installation.

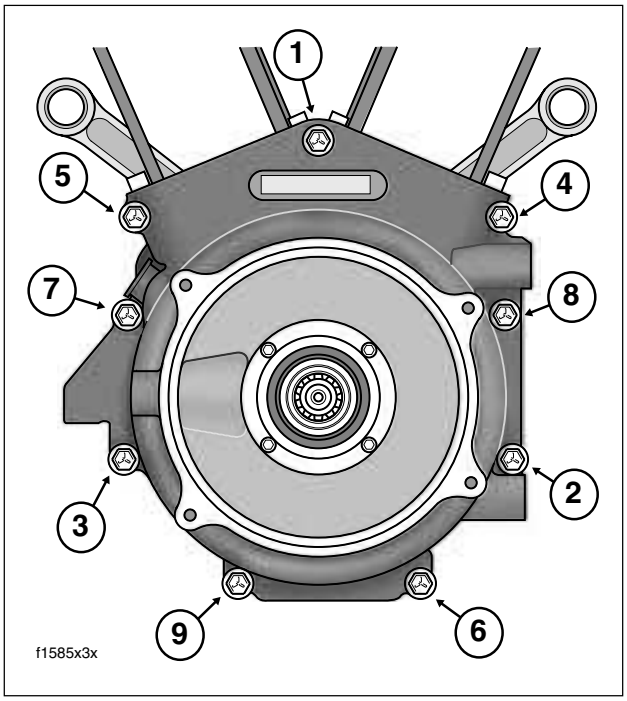



**Figure 3-45. Crankcase Torque Sequence (Left Side View)**

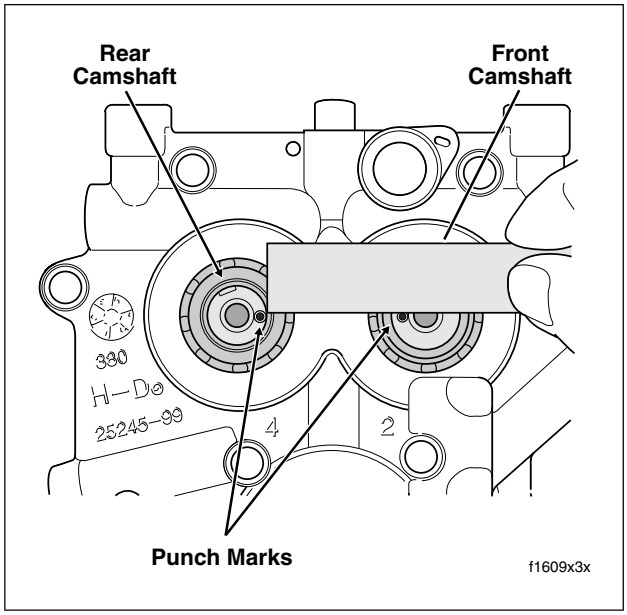



**Figure 3-46. Verify Alignment of Punch Marks on Front and Rear Camshafts**

6. Install **new** O-ring in groove around oil feed hole in crankcase flange (directly below rear ring dowel). Install **new** O-ring around blind hole in boss (directly above oil return hole in crankcase flange). Apply a thin film of H-D 20W50 engine oil to O-rings before installation.
7. If not retracted, place cup of CAM CHAIN TENSIONER UNLOADER (HD-42313) over spring coil of secondary cam chain tensioner positioning finger on tool between tensioner and shoe. Rotate tool in a counterclockwise direction inserting retention pin through hole in boss on **primary cam chain side** of cam support plate. Pin engages hooks on tensioner to hold it in the retracted position. For best results, place cam support plate in a vise using brass jaw inserts to prevent casting damage.
8. Lubricate cam needle bearings with clean H-D 20W50 engine oil.
9. Using a straightedge, verify that the punch marks on the ends of the front and rear camshafts are in alignment. See Figure 3-46. If necessary, rotate camshafts in order to make this observation.
10. Aligning bushing in cam support plate with end of crankshaft, slide cam support plate over crankshaft onto two ring dowels in crankcase flange. Use a rubber mallet to fully seat cam support plate on ring dowels.
11. Install the six allen head socket screws (1/4 x 1 inch) to secure the cam support plate to the crankcase flange. Tighten screws to 90-120 **in-lbs** (10.2-13.6 Nm) in the pattern shown in A of Figure 3-47.

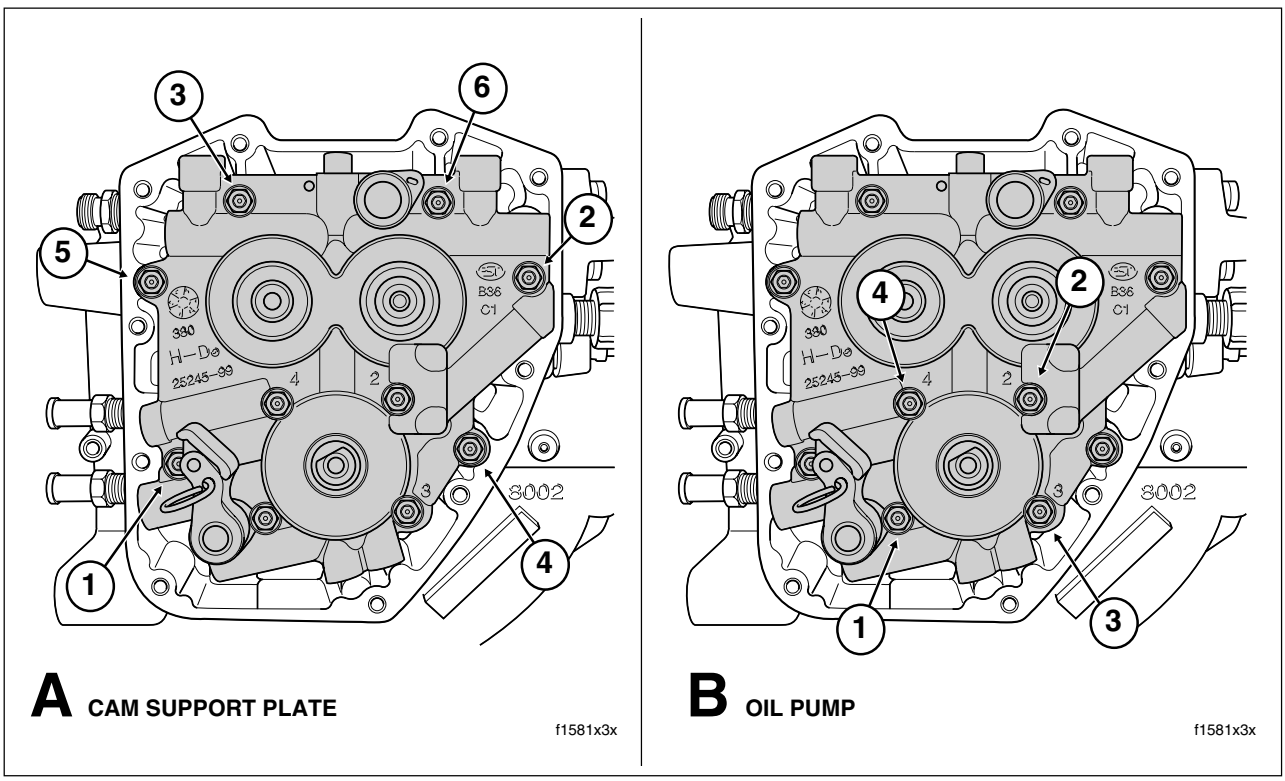



**Figure 3-47. Cam Support Plate/Oil Pump Torque Sequence**

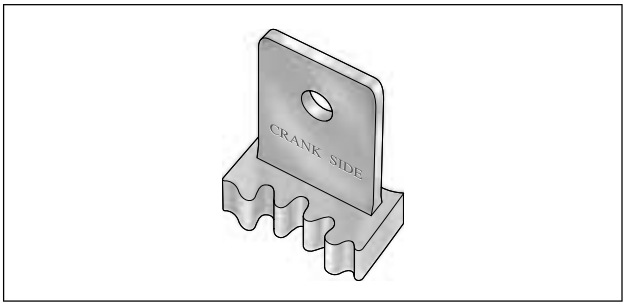



**Figure 3-48. Crankshaft/Camshaft Sprocket Locking Tool (Part No. HD-42314)**

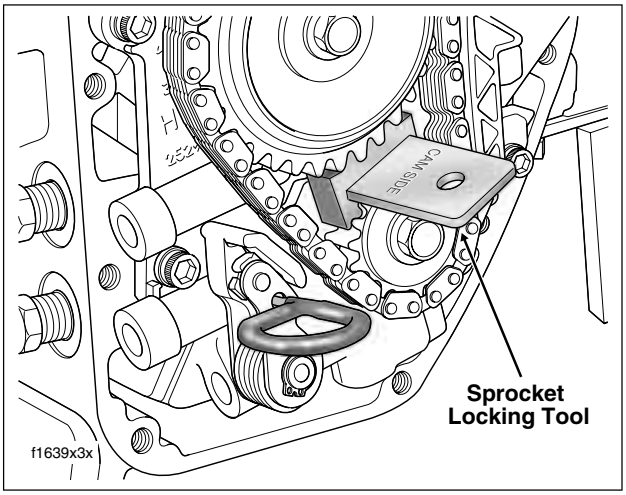



**Figure 3-49. Lock Crank and Primary Cam Sprockets Before Tightening Flange Bolts**

12. Start the four allen head socket screws (1/4 x 1 inch) to secure the cam support plate to the oil pump flange. Turn the screws until the caps just contact the cam sup port plate and then back them out 1/4 turn. While rotating the engine, enabling the pump to find its natural center, tighten the screws until snug. Final tighten the screws to 90-120 **in-lbs** (10.2-13.6 Nm) in the pattern shown in B of Figure 3-47. Numbers cast adjacent to the bolt holes also indicate the oil pump torque pattern.

*NOTE*

*For methods of engine rotation, see Section 3.10 TOP END OVERHAUL, DISASSEMBLY, step 7.*

13. Pull retention pin from hole in cam support plate to release secondary cam chain tensioner.
14. Squeeze tabs and install chain guide between blocks cast into cam support plate.
15. Install primary cam sprocket spacer onto rear camshaft.
16. If using the original cam support plate, camshafts, primary cam sprocket, crank sprocket and flywheel assembly, then move to step 17. However, if any of these parts have been replaced, then proceed as follows:
    a. Install primary cam sprocket onto splines of rear camshaft. Install long flange bolt with thicker flat washer to secure sprocket to end of camshaft.
    b. Install crank sprocket onto crankshaft. Install short flange bolt with smaller diameter flat washer (that is, washer from bulk inventory) to secure sprocket to end of crankshaft.

*NOTE*

*Use of smaller diameter flat washer with crank sprocket flange bolt allows room on sprocket face for placement of straightedge under step 16(e).*

    c. To prevent rotation, position the CRANKSHAFT/ CAMSHAFT SPROCKET LOCKING TOOL (HD-42314) between the crank and primary cam sprockets. See Figure 3-49. The handle of the tool is stamped “Crank” and “Cam” to ensure proper orientation. Tighten the crank and primary cam sprocket flange bolts to 15 ft-lbs (20.3 Nm). Remove the sprocket locking tool.
    d. Push on rear camshaft to remove end play.
    e. Place a straightedge across the crank and primary cam sprocket faces. Try to insert a 0.010 inch feeler gauge between the straightedge and each sprocket face. See Figure 3-50. If the feeler gauge does not fit at either location, then proceed to step 16(f).

       On the other hand, if the crank sprocket is “proud” (that is, rises above the face of the primary cam sprocket) more than 0.010 inch, remove the flange bolt and primary cam sprocket, and noting the part number stamped on the existing spacer, replace it with the next larger size. See spacer sizes listed in Table 3-4. Replace the spacer with the next smaller size only if the primary cam sprocket is “proud” (rises above the face of the crank sprocket) more than 0.010 inch. Return to step 15 to repeat the check with the new spacer installed.

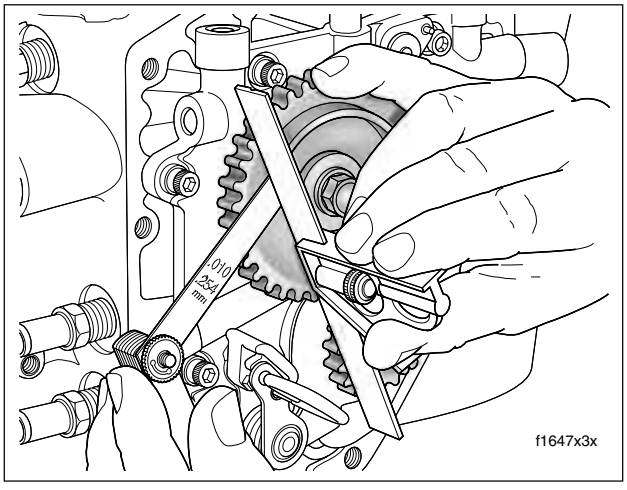



**Figure 3-50. Check Alignment of Crank and Primary Cam Sprocket Faces**

## Table 3-4. Primary Cam Sprocket Spacers

| Spacer Size | H-D Part Number |
|---|---|
| 0.287 | 25722-00 |
| 0.297 | 25723-00 |
| 0.307 | 25721-00 |
| 0.317 | 25719-00 |
| 0.327 | 25717-00 |

f. Remove both crank and primary cam sprockets. Discard smaller diameter flat washer obtained from bulk inventory.

17. Install the primary cam chain and sprocket assembly as follows:
    a. Place the primary cam sprocket in the cam chain. Hold the sprocket allowing the chain to hang loose. Rotate the sprocket so that the punch mark on the sprocket root faces straight downward.

*NOTE*

*To maintain the original direction of rotation, verify that the colored mark placed on the chain link is facing opposite the cam support plate during installation.*

    b. Place the crank sprocket in the opposite end of the chain with the punch mark on the sprocket tooth facing straight upward.
    c. Maintaining the position of the sprockets on the chain with the punch marks in alignment, start the primary cam sprocket onto the splines of the rear camshaft. Apply a thin film of clean H-D 20W50 engine oil to the splines before installation.
    d. Maintaining the position of the crank sprocket on the chain, rotate the primary cam sprocket in a clockwise direction until the flat on the crank sprocket is aligned with the flat on the crankshaft. Install the crank sprocket.
18. Rotate the primary cam sprocket in a clockwise direction until the punch mark on the root is aligned with the punch mark on the crank sprocket tooth. Lay a straightedge across the centerline of the crank and primary cam sprocket flange bolt holes to verify that the punch marks are in alignment. See Figure 3-51.

*NOTE*

*If the punch marks are not in alignment, then the sprockets must be removed and reinstalled. The vehicle will not run properly if the sprockets are misaligned by even one tooth.*

*NOTE*

*Both crank and primary cam sprocket flange bolts are specially hardened, while the flat washers are of a special diameter and thickness. Therefore, use only genuine Harley-Davidson parts when replacement is necessary. The crank and primary cam sprocket flange bolts and flat washers are* ***NOT*** *interchangeable.*

19. Install crank sprocket and primary cam sprocket flange bolts and flat washers as follows:
    a. Apply Loctite Primer 7649 (P/N 98968-99) to threads of flange bolts.
    b. Apply one drop of Loctite High Strength Threadlocker 262 (red) to threads of flange bolts.
    c. Apply a thin film of clean H-D 20W50 engine oil to both sides of flat washers.
    d. Install short flange bolt with thinner flat washer to secure crank sprocket to end of crankshaft.
    e. Install long flange bolt with thicker flat washer to secure primary cam sprocket to end of camshaft.

*NOTE*

*Exercise caution to avoid mixing oil on washer with threadlocker on bolt or sealing integrity may be compromised.*

    f. Position CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL (HD-42314) between the crank and primary cam sprockets to prevent rotation. See Figure 3-49. The handle of the tool is stamped “Crank” and “Cam” to ensure proper orientation.
    g. Alternately tighten the crank and primary cam sprocket flange bolts to 15 ft-lbs (20.3 Nm).
    h. Loosen each flange bolt one full turn.
    i. Tighten the crank sprocket flange bolt to 24 ft-lbs (32.5 Nm).

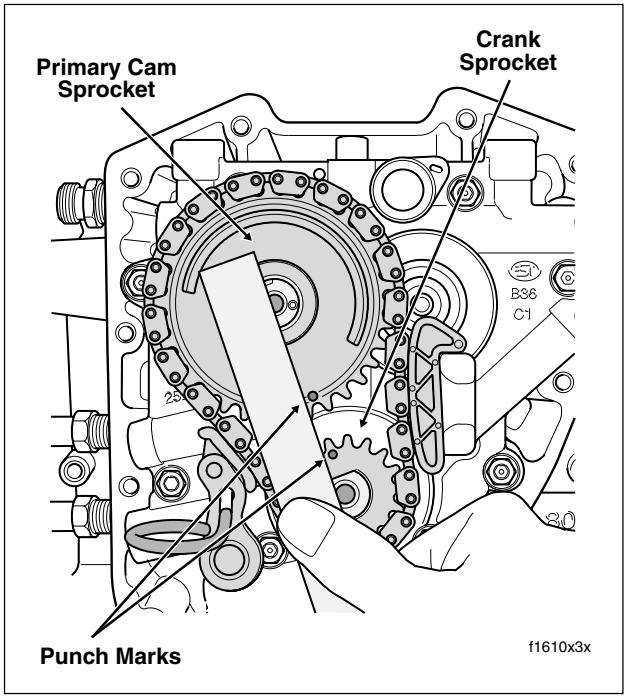



**Figure 3-51. Verify Alignment of Crank and Primary Cam Sprocket Punch Marks**

j. Tighten the primary cam sprocket flange bolt to 34 ft-lbs (46.1 Nm).

k. Remove the sprocket locking tool.

**⚠CAUTION**

**Ease the primary cam chain tensioner into the unloaded position using the proper tool. Do not pull the retention pin to unload the tensioner or the pin may be damaged. Furthermore, if the tensioner should contact fingers or other parts of the hand, minor or moderate injury may occur.**

20. Hold the retracted primary cam chain tensioner with the CAM CHAIN TENSIONER UNLOADER (HD-42313), pull retention pin from hole in cam support plate and ease the assembly into the unloaded position.

21. Apply clean H-D 20W50 engine oil to crank and primary cam sprockets.

22. Align holes in **new** cam cover gasket with those in the crankcase flange.

23. Install the cam cover using ten allen head socket screws (1/4 x 1-1/4 inches). Alternately tighten screws to 90-120 **in-lbs** (10.2-13.6 Nm) following the pattern shown in Figure 3-52.

    If the model is fuel injected (cam position sensor present), and cam cover assembly was completely removed, then proceed as follows:

    a. Draw crank position sensor cable under oil filter mount to front left side of crankcase.

    b. Install **new** O-ring in groove on sensor body. Apply a very thin film of clean H-D 20W50 engine oil to O-ring before installation.

    c. Push sensor into bore aligning hole in sensor mount with hole in spot face. Install allen head socket screw (1/4 x 1 inch) and tighten to 90-120 **in-lbs** (10.2-13.6 Nm).

    d. Returning to right side of crankcase, attach wire socket to terminal of oil pressure sending unit (Packard connector on FLHT/C/U models).

    e. Capturing conduit in cable clip, start T20 TORX-screw into threaded hole at front of crankcase. Tighten screw to 20-30 **in-lbs** (2.3-3.4 Nm).

    f. If engine was left in the chassis for service, see Section 3.8 INSTALLING ENGINE IN CHASSIS, steps 33-40, for instructions on routing the engine sensor harness.

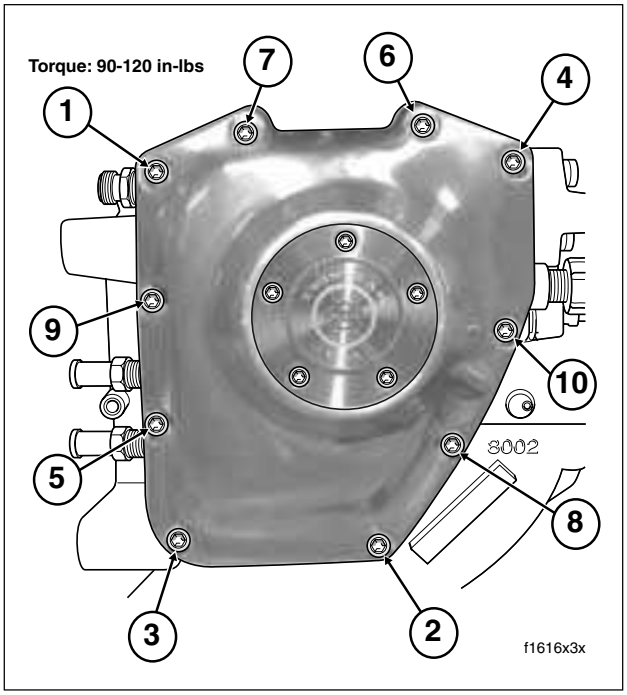



**Figure 3-52. Cam Cover Torque Sequence**

24. If performing a complete engine overhaul, see Section 3.10 TOP END OVERHAUL, ASSEMBLY, steps 1-40. If only cam compartment components were serviced, just see steps 29-38.

# NOTES

**Legend:**

1. Bolt
2. Bolt
3. Rocker Cover
4. Breather Bolt
5. Rocker Cover Gasket
6. Breather Cover
7. Breather Cover Gasket
8. Umbrella Valve
9. Breather Baffle
10. Filter Element
11. Breather Baffle Gasket
12. Rocker Arm Bolt
13. Rocker Arm Support Plate
14. Rocker Arm Bushing
15. Rocker Arm
16. Rocker Arm Shaft
17. Rocker Arm
18. Breather Baffle O-Ring
19. Rocker Housing Bolt
20. Rocker Housing Bolt
21. Rocker Housing
22. Rocker Housing Gasket
23. O-Ring
24. Upper Push Rod Cover
25. Spring Cap Retainer
26. Spring Cap
27. Spring
28. Flat Washer
29. O-Ring
30. Lower Push Rod Cover
31. O-Ring
32. Lifter Cover Screw
33. Lifter Cover
34. Anti-Rotation Pin
35. Lifter Cover Gasket
36. Hydraulic Lifter
37. Push Rod

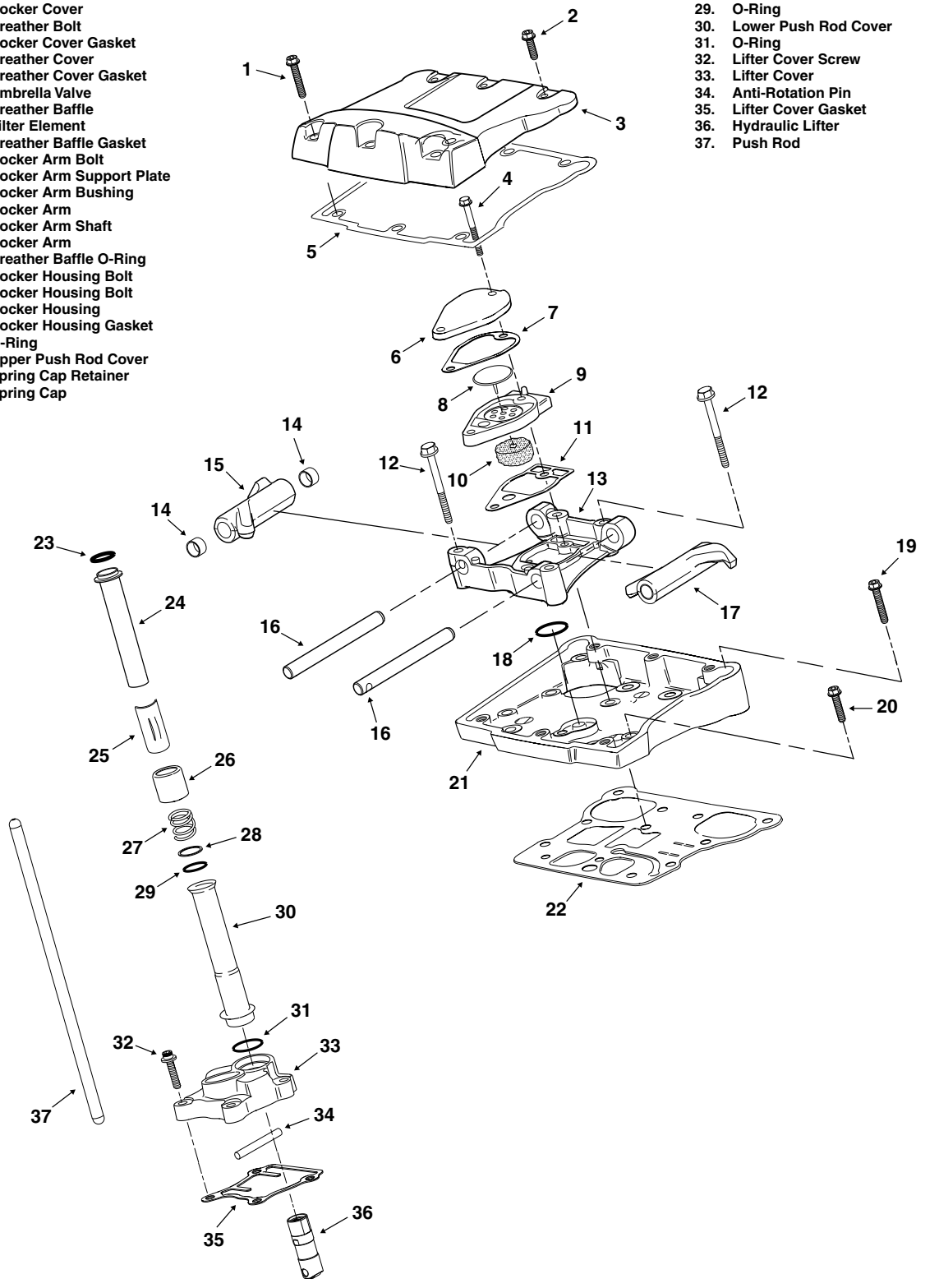



**Figure 3-53. Rocker Arm/Breather/Lifter Assemblies (Exploded View)**

# TOP END

# BREATHER ASSEMBLY

## Removal

1. See Section 3.10 TOP END OVERHAUL, DISASSEMBLY, steps 1-4.

## Disassembly

1. Remove two bolts from the breather assembly.
2. Remove the breather cover and gasket. Remove the breather baffle and gasket. Discard gaskets.
3. Pull filter element from bore on inboard side of breather baffle. Pull stem of umbrella valve from hole at top of breather baffle. Discard both filter element and umbrella valve.

## Cleaning and Inspection

1. Clean all parts in a non-volatile cleaning solution or solvent.
2. Thoroughly dry all parts with low pressure compressed air.

## Assembly

1. Insert stem of **new** umbrella valve through center hole at top of breather baffle. Carefully pull rubber bead on stem through hole in baffle. Use denatured alcohol or glass cleaner to lubricate stem, if necessary. Verify that rubber bead is pulled completely through hole and resides on bottom side of baffle.
2. Press **new** filter element into bore at bottom of baffle. Hole in filter element accommodates umbrella valve stem.
3. Place breather baffle gasket on a clean flat surface. Aligning holes, place breather baffle, cover gasket and breather cover on top. Slide two screws through stackup to keep assembly together until time of installation.

## Installation

1. See Section 3.10 TOP END OVERHAUL, ASSEMBLY, steps 37-40.

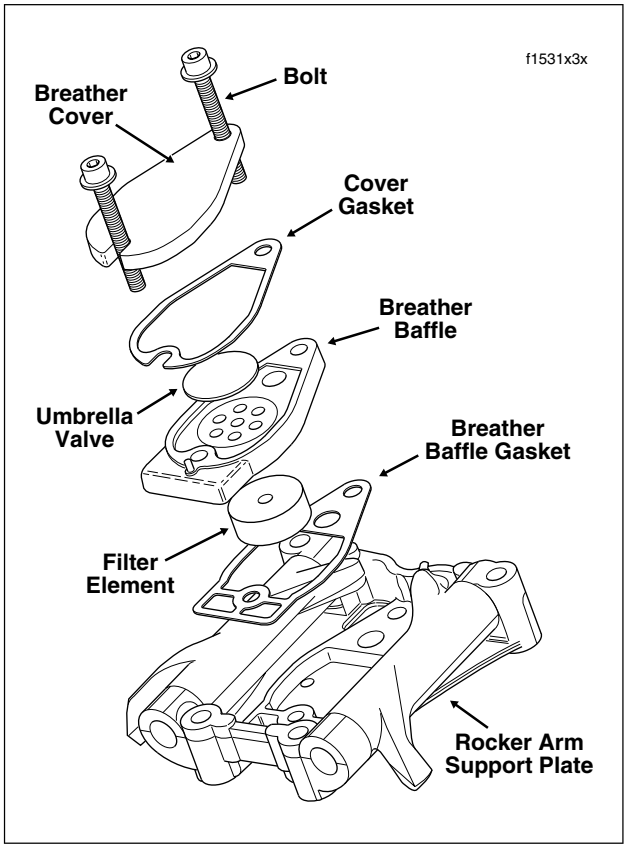



**Figure 3-54. Breather Assembly**

# ROCKER ARM ASSEMBLY

## Removal

1. See Section 3.10 TOP END OVERHAUL, DISASSEMBLY, steps 1-9.

## Disassembly

1. Remove the four bolts from the rocker arm support plate. If necessary, slightly wiggle the two bolts on the push rod side (right) to disengage them from the notches in the rocker arm shafts.
2. Using a hammer and brass drift, tap left side of rocker arm shafts so that the notched ends exit the rocker arm support plate first. Mark the shafts so that they are installed in their original locations at time of assembly.
3. Remove the rocker arms from the rocker arm support plate. Mark the rocker arms to indicate location.

## Cleaning and Inspection

1. Clean all parts in a non-volatile cleaning solution or solvent. Thoroughly dry with low pressure compressed air.
2. Check rocker arms for uneven wear or pitting where contact is made with the valve stem tips. Check for concave wear where rocker arms contact the push rod ends. Replace rocker arm if excessive wear is found at either location.
3. Verify that oil holes in rocker arms and rocker arm support plate are clean and open.
4. Inspect rocker arm shafts for scratches, burrs, scoring or excessive wear. Replace as necessary.

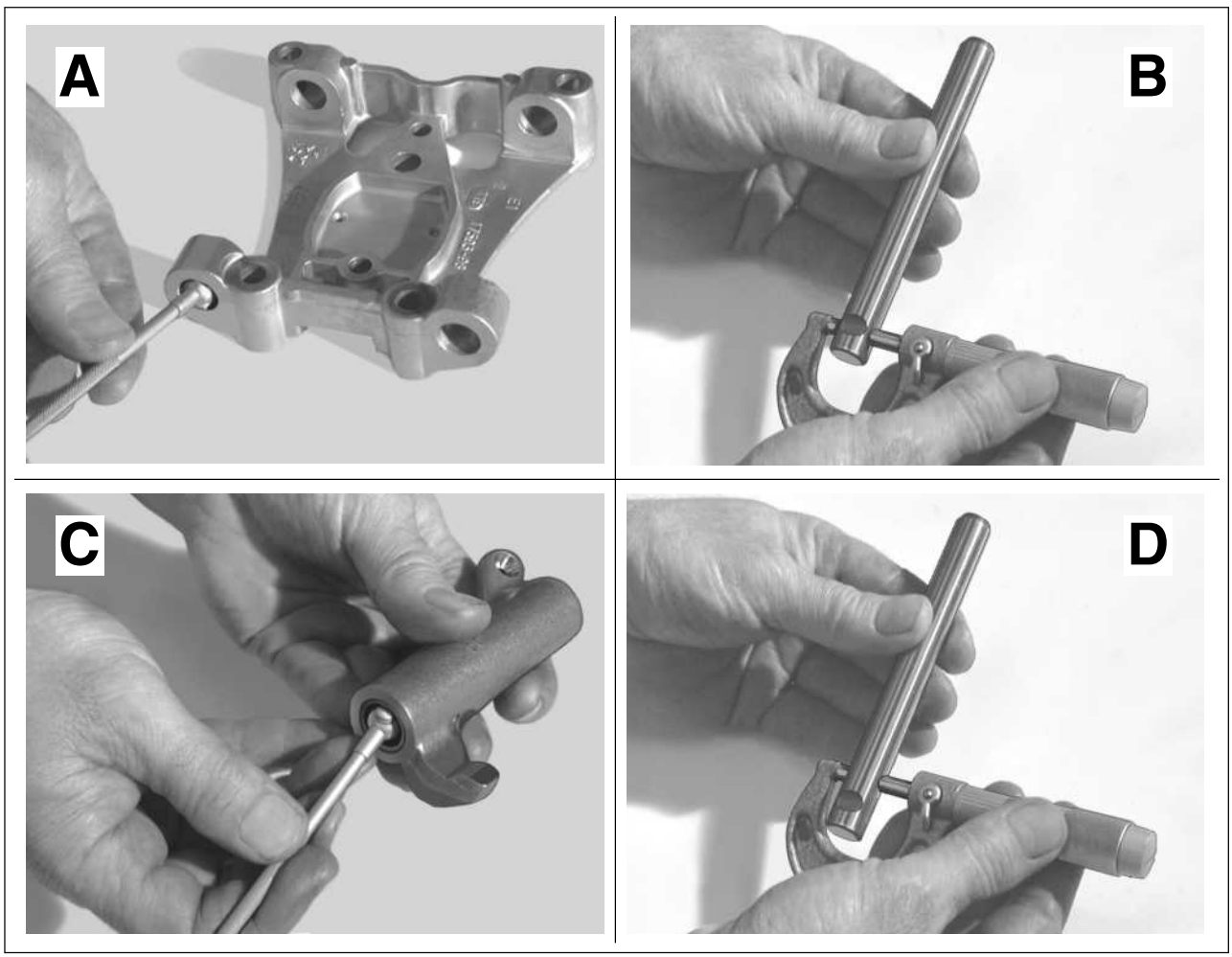



**Figure 3-55. Measure Rocker Arm Assembly for Wear**

5. Measure the inside diameter of the rocker arm support plate bore. See A of Figure 3-55. Measure the outside diameter of the rocker arm shaft where it fits in the bore. See B of Figure 3-55. Repeat the measurement on opposite side of support plate and shaft. Replace the shaft or support plate if any measurement equals or exceeds 0.0035 inch (0.089 mm).

6. Measure the inside diameter of the rocker arm bushing. See C of Figure 3-55. Measure the outside diameter of the rocker arm shaft where it rides in the bushing. See D of Figure 3-55. Repeat the measurement on opposite side of rocker arm and shaft. Replace the shaft or bushings if any measurement equals or exceeds 0.0035 inch (0.089 mm).

7. To replace rocker arm bushings, proceed as follows:

   a. Obtain a 9/16”-18 (14.29 mm) tap. Turn tap into bushing until tight. Place rocker arm under ram of arbor press with tap at bottom. Slide a discarded rocker arm shaft through open end of rocker arm until contact is made with tap. Using shaft as driver (and untapped bushing as pilot), press against shaft until both tap and bushing are free. See upper frame of Figure 3-56. Repeat step to remove second bushing.

   b. Using a suitable driver, press **new** bushing into side of rocker arm until flush with casting. See center frame of Figure 3-56. Be sure to orient bushing so that split line faces top of rocker arm. Repeat step to install second bushing.

   c. Lock rocker arm in a vise using brass jaw inserts or shop towels to prevent casting damage. Insert tapered end of ROCKER ARM BUSHING REAMER (HD-94804-57) into rocker arm using the far side bushing as a pilot. See lower frame of Figure 3-56. Rotate reamer until the closest bushing is reamed, and then continuing in the same direction, ream the far side bushing.

*NOTE*

*If short reamer is used, rotate tool while backing reamer out of first bushing. Inserting tool in opposite end of rocker arm, ream second bushing using reamed bushing as pilot.*

## Assembly

1. Place the rocker arms into position on the rocker arm support plate.

2. Push the un-notched ends of the rocker arm shafts into the right side of the support plate and then into the rocker arms. As they approach their fully installed positions, rotate the shafts so that the notches are aligned with the bolt holes in the support plate.

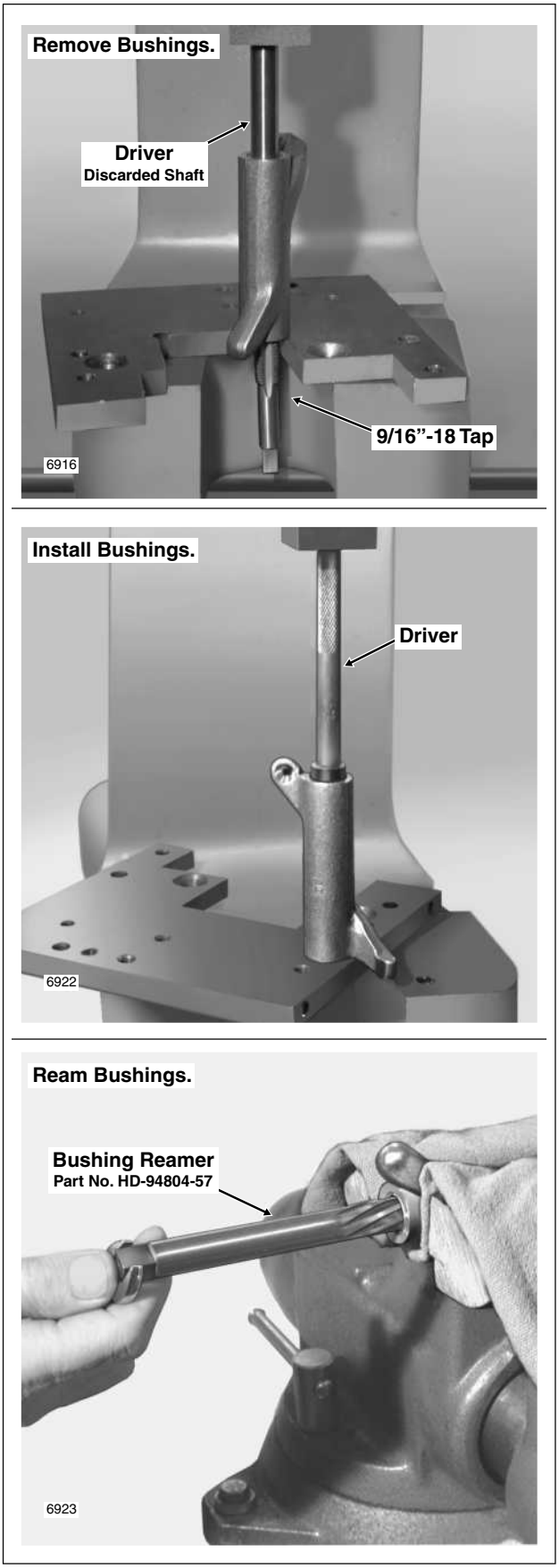



**Figure 3-56. Replace Rocker Arm Bushings**

3. To check for proper end play, insert a feeler gauge between the rocker arm and support plate. See Figure 3-57. Repeat measurement on other rocker arm. Replace the rocker arm, rocker arm support plate, or both if end play exceeds 0.025 inch (0.635 mm).
4. Install the four bolts in the rocker arm support plate. For proper assembly, remember that the two bolts on the push rod side (right) must engage the notches in the rocker arm shafts.

## Installation

1. See Section 3.10 TOP END OVERHAUL, ASSEMBLY, steps 32-40.




**Figure 3-57. Check End Play**

# PUSH RODS/LIFTERS/COVERS

## Removal

1. See Section 3.10 TOP END OVERHAUL, DISASSEMBLY, steps 1-14.

## Disassembly

1. With the exception of the lifter covers, all parts should have been disassembled and marked during the removal procedure. Disassemble the lifter covers as follows:
   a. Separate upper and lower push rod covers.
   b. Remove O-ring from seat at bottom of lower push rod cover. Discard O-ring.
   c. Remove O-ring from seat at top of upper push rod cover. Slide O-ring, flat washer, spring and spring cap from body of upper push rod cover. Discard O-rings.

## Cleaning and Inspection

1. Scrape old gasket material from the lifter cover flange. Old gasket material left on mating surfaces will cause leaks.
2. With the exception of the hydraulic lifters, clean all parts in a non-volatile cleaning solution or solvent. Verify that the O-ring seats and contact surfaces of the push rod covers are completely clean.
3. Thoroughly dry all parts with low pressure compressed air. Verify that all oil holes are clean and open.
4. Verify that the hydraulic lifter rollers turn freely and are free of flat spots, scuff marks and pitting. If flat spots exist, examine the cam lobe on which the lifter operates.
5. Inspect the lifter socket for signs of wear. Verify that the plunger of the hydraulic lifter is fully extended up against the C-clip. Use index finger to pump plunger to verify lifter operation.
6. Examine the push rods. Replace any push rods that are bent, dented, broken or discolored. Replace the rod if the ball ends show signs of excessive wear or damage.
7. Cover all parts with a clean plastic sheet to protect them from dust and dirt.

## Assembly

1. With the exception of the lifter covers, all parts will be assembled during the installation procedure. Assemble the lifter covers as follows:

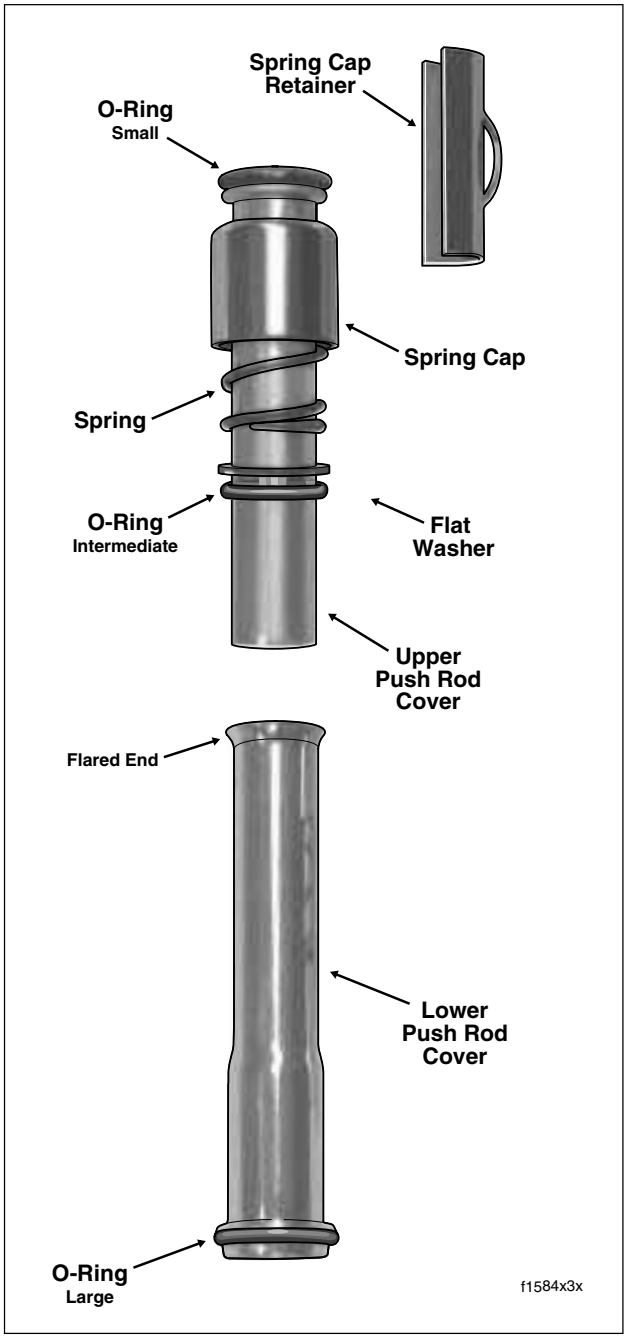



**Figure 3-58. Push Rod Cover Assembly**

**CAUTION**

**O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong O-ring will have the same results. Since many O-rings are similar in size and appearance, always use new O-rings keeping them packaged until use to avoid confusion.**

a. Obtain three **new** o-rings- small, intermediate and large.

b. Install small O-ring on seat at the top of the upper push rod cover.

*NOTE*

*Apply a very thin film of clean H-D 20W50 engine oil to O-rings before installation.*

c. Slide the spring cap, spring, flat washer and intermediate size O-ring onto the body of the upper push rod cover. Move parts up body until spring cap contacts upper O-ring seat.

d. Fit the straight end of the upper push rod cover into the flared end of the lower push rod cover.

e. Install large O-ring on seat at bottom of lower push rod cover.

## Installation

1. See Section 3.10 TOP END OVERHAUL, ASSEMBLY, steps 26-40.

# NOTES

**Legend:**

1. Tapered Keepers
2. Spring Retainer
3. Inner Spring
4. Outer Spring
5. Valve Stem Seal
6. Spring Seat
7. Valve Guide
8. Cylinder Head Bolt
9. Cylinder Head Bolt
10. Cylinder Head
11. Valve Seat
12. Valve
13. Cylinder Head Gasket
14. Cylinder
15. O-Ring
16. Ring Dowel
17. O-Ring Seal
18. Cylinder Stud
19. Piston
20. Piston Pin
21. Circlip
22. Top Compression Ring
23. Second Compression Ring
24. Oil Rail
25. Oil Rail Spacer

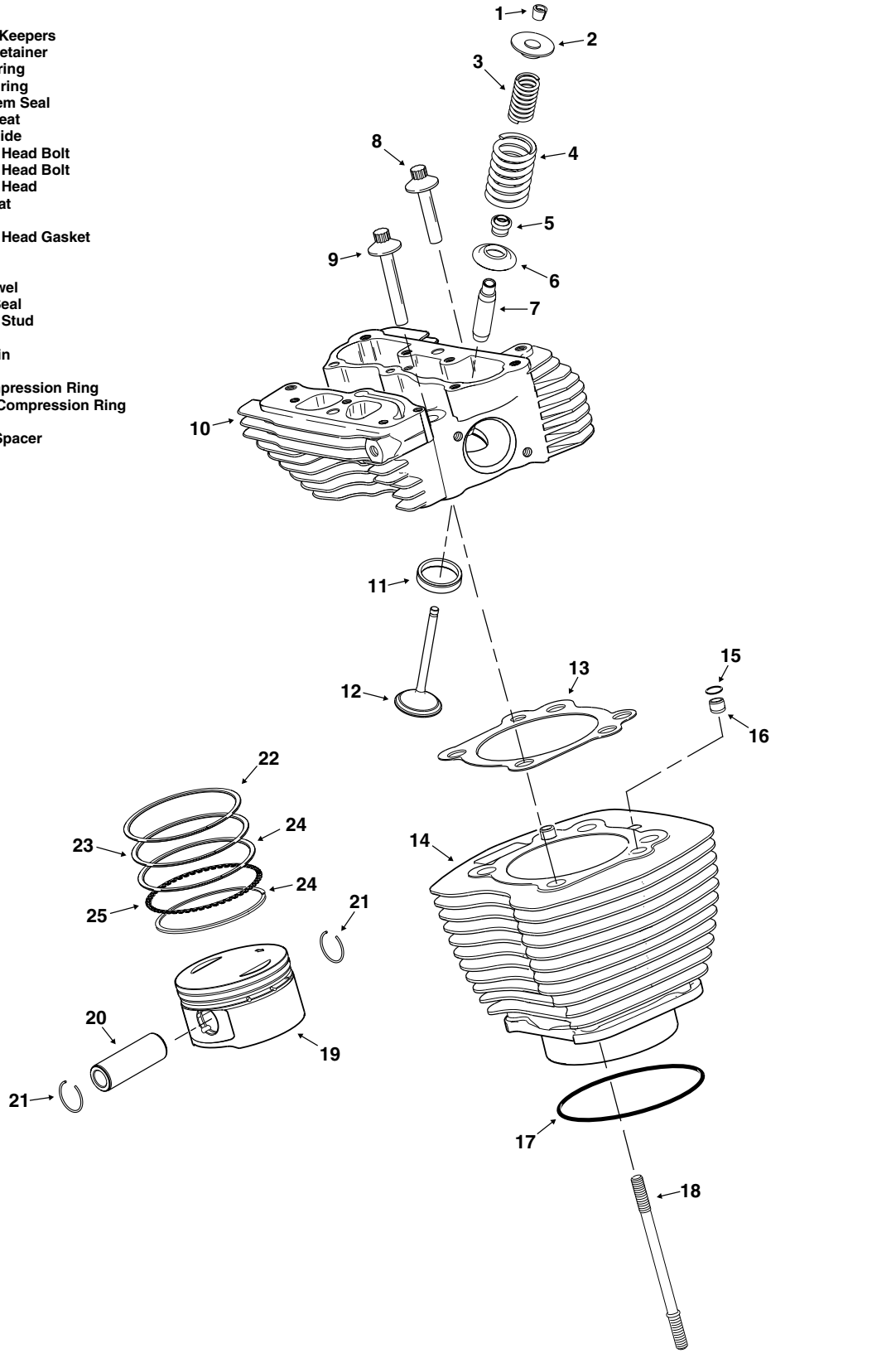



**Figure 3-59. Cylinder Head/Cylinder/Piston Assemblies (Exploded View)**

# CYLINDER HEAD

## Removal

1. See Section 3.10 TOP END OVERHAUL, DISASSEMBLY, steps 1-11 and 15-20.

## Disassembly

1. Before proceeding with the disassembly procedure, determine if cylinder head reconditioning is necessary. Proceed as follows:
   a. Raise valve ports of cylinder head to strong light source. If light is visible around edges of seats, then move to step 2 to recondition cylinder head.
   b. Fill ports at top of cylinder head with solvent. Wait ten full seconds and then check for leakage into combustion chamber. If solvent leakage into combustion chamber is evident, then move to step 2 to recondition cylinder head.

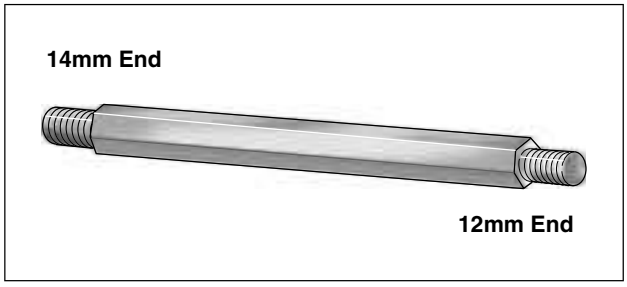



**Figure 3-60. Cylinder Head Holding Fixture (Part No. HD-39786)**

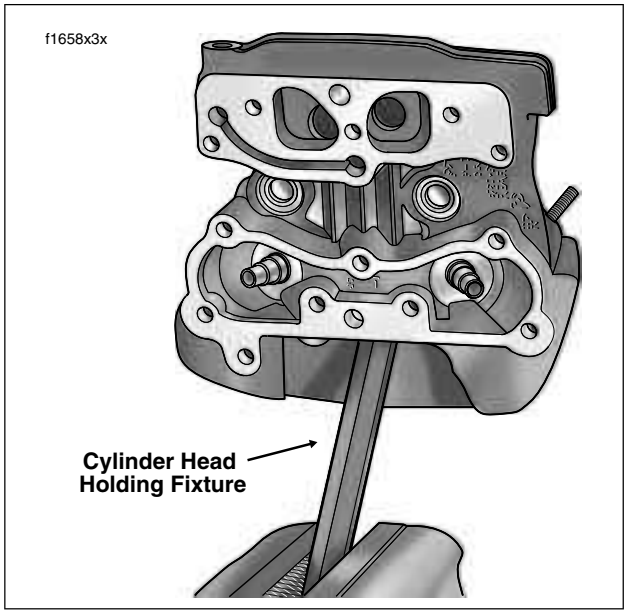



**Figure 3-61. Install Cylinder Head Holding Fixture in Vise**

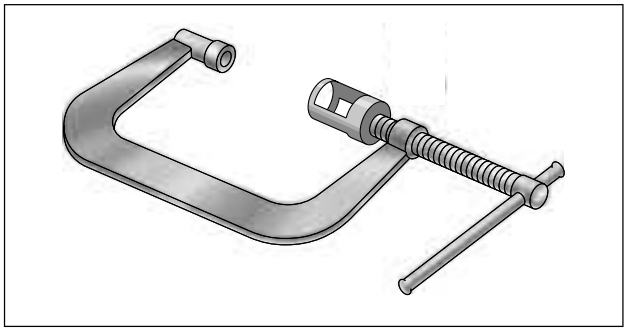


**Figure 3-62. Valve Spring Compressor (Part No. HD-34736B)**

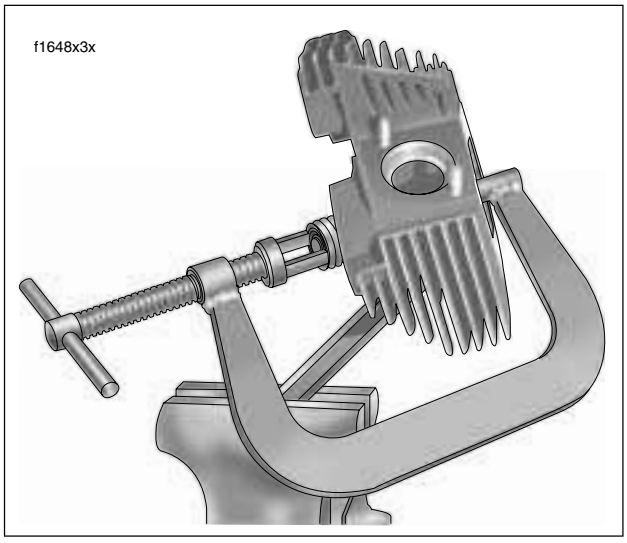



**Figure 3-63. Compress Valve Springs**

2. Obtain the CYLINDER HEAD HOLDING FIXTURE (HD-39786) and proceed as follows:
   a. Note that both ends of the fixture are threaded, one end at 14mm and the other at 12mm. Thread the 12mm end of the tool into the spark plug hole of the cylinder head.
   b. Clamp tool in vise at a 45 degree angle (or one that offers a comfortable working position). See Figure 3-61.
3. Obtain the VALVE SPRING COMPRESSOR (HD-34736B) and proceed as follows:
   a. Place tool over cylinder head so that the blunt end is centered on the valve head and adapter at end of forcing screw is seated on the valve spring retainer. See Figure 3-63.
   b. Rotate forcing screw to compress valve springs.
   c. If spring retainer has not broken free of tapered keepers, give head of tool a sharp tap with a soft mallet. Using magnetic rod or small screwdriver, remove the keepers from the valve stem groove.

d. Rotate forcing screw to release the valve spring compression.

4. Remove the spring retainer and inner and outer valve springs.
5. Slide the valve from the valve guide.
6. Using pliers, twist and remove the valve stem seal from the top of the valve guide. Discard the valve stem seal.
7. Remove the spring seat from the cylinder head.
8. Mark the bottom of the valve “F(ront)” or “R(ear)” to indicate the cylinder head from which it was removed. Also, separate and tag tapered keepers, valve springs, spring retainers and spring seats so that they are installed on the same valve at time of assembly.
9. Repeat steps 3-8 to remove the other valve components.
10. Release the cylinder head holding fixture from the vise and then remove the tool from the spark plug hole.

## Cleaning and Inspection

### Cleaning

1. Remove old gasket material from cylinder head. Gasket material left on sealing surfaces will cause leaks.
2. Remove all carbon deposits from combustion chamber and machined surfaces of cylinder head. Exercise caution to avoid removing any metal material. For best results, use an air tool with a **worn** wire brush. Scraping may result in scratches or nicks.
3. To soften stubborn deposits, soak the cylinder head in a chemical solution, such as GUNK HYDRO-SEAL or other carbon and gum dissolving agent. Repeat step 2 as necessary.

**CAUTION**

**Do not use glass or sand to bead blast surfaces exposed to the engine oil. Bead blasting materials become lodged in the pores of the casting where they cannot be removed through ordinary cleaning methods. Only after the engine is put into use will heat expansion cause this material to be released, and the resulting oil contamination will accelerate wear and lead to engine failure. If bead blasting must be employed, use wallnut shells or other soft non-damaging abrasive that can be digested in the engine oil.**

**CAUTION**

**Be aware that bead blasting materials may also enter threaded holes adversely affecting fastener engagement and torque indication. Carefully cover all threaded holes if bead blasting is employed.**

4. Thoroughly clean the cylinder head, spring retainers, tapered keepers, valves, inner and outer valve springs and spring seats in a non-volatile cleaning solution or solvent. Follow up with a thorough wash in hot soapy water. Blow dry with compressed air.

### Inspection

### Cylinder Head

1. Check for scratches and nicks on all gasket sealing surfaces.
2. With the combustion chamber side facing upward, set a straightedge diagonally across the length of the cylinder head intersecting the upper and lower corners of the gasket surface. Slide a feeler gauge beneath the straightedge to check the head for warpage. Checking the opposite diagonal, repeat the procedure to verify that the gasket surface is flat (especially if a head gasket was blown). Discard the head if any low spot is 0.005 inch or greater.
3. Verify that oil passageways are open and clean.

### Valve Guides

1. Inspect external surfaces for cracks (particularly the combustion chamber side). Replace the guide if any cracks are found.
2. To verify cleanliness of valve guides, lightly hone bore using the VALVE GUIDE HONE (HD-34723) and then scrub with the VALVE GUIDE CLEANING BRUSH (HD-34751) to remove any dust or debris. Polish the valve stem with fine emery cloth or steel wool to remove carbon buildup, and then check valve stem to guide clearance as follows:

   Carefully measure the inside diameter of the valve guide using an inside ball micrometer. Measure the outside diameter of the valve stem with an outside micrometer. The valve stem and/or guide are excessively worn if the clearance exceeds the limits shown in Table 3-5. Repeat measurements with a new valve to determine if the guide must be replaced.

**Table 3-5. Service Wear Limits**

| Valve | Valve Stem to Guide Clearance |
|---|---|
| Intake | 0.0035 inch (0.089 mm) |
| Exhaust | 0.0040 inch (0.102 mm) |

### Valves

1. Replace the valve if there is evidence of burning or cracking.
2. Inspect the end of the valve stem for pitting or uneven wear. Replace the valve if either of these conditions are found.

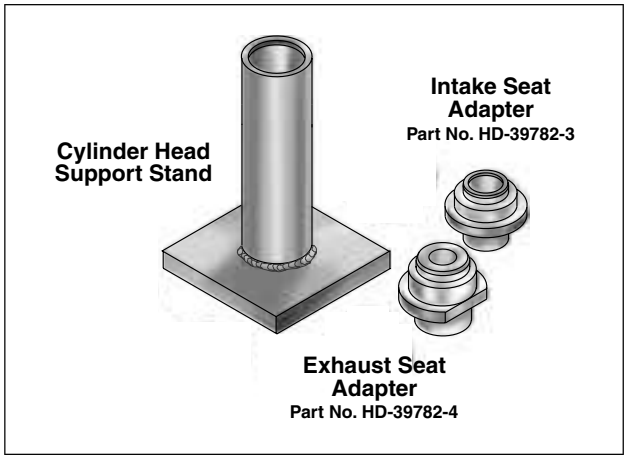



**Figure 3-64. Cylinder Head Support Stand (Part No. HD-39782)**

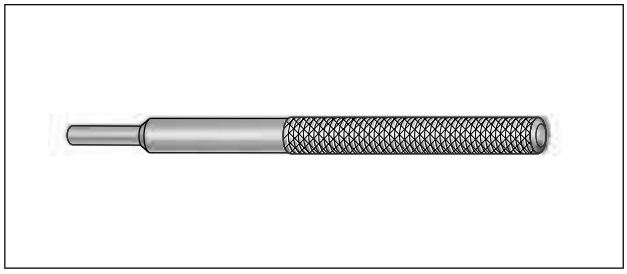


**Figure 3-65. Valve Guide Driver (Part No. HD-34740)**

3. Inspect for burrs around the valve stem keeper groove. Remove burrs with a fine tooth file if found.
4. To determine if the valve stem is excessively worn, see INSPECTION, VALVE GUIDES, step 2.

### Valve Springs

1. Inspect springs for broken or discolored coils. Replace springs if either of these conditions are found.
2. Set the intake and exhaust valve springs on a level surface and use a straightedge to check for proper squareness and height.
3. Check free length of inner and outer springs using a dial vernier caliper or load test with the VALVE SPRING TESTER (HD-96796-47). Replace springs if free length or compression force do not meet specifications. See Section 3.1 SPECIFICATIONS.

### Tapered Keepers

1. Inspect parts for damage or rust pits. Replace as necessary.
2. Inspect inboard side of tapered keepers for excessive wear. Upraised center must be pronounced and fit snugly in valve stem groove. Place keepers into groove and verify that they grip tightly without sliding.

### Valve Seats

1. Inspect seats for cracking, chipping or burning. Replace seats if any evidence of these conditions are found.
2. Check seats for recession by measuring valve stem protrusion. See VALVE AND SEAT REFACING, in this section, steps 5-6.

## VALVE GUIDE REPLACEMENT

### Removal

*NOTE*

*If valve guide replacement is necessary, always install new guide before refacing valve seat.*

1. Obtain the CYLINDER HEAD SUPPORT STAND (HD-39782) and proceed as follows:
   a. Insert sleeve of intake or exhaust seat adapter into tube at top of support stand. See Figure 3-64.
   b. Position cylinder head so that valve seat is centered on seat adapter. Support stand ensures that valve guide and seat are perpendicular. If perpendicularity is not achieved, the cylinder head valve guide bore will be damaged during the press procedure.

**CAUTION**

**Do not press out the valve guide from the bottom of the cylinder head. Carbon buildup on the combustion chamber side of the guide can deeply gouge the cylinder head bore diminishing the likelihood of achieving the proper interference fit and possibly requiring replacement of the cylinder head casting.**

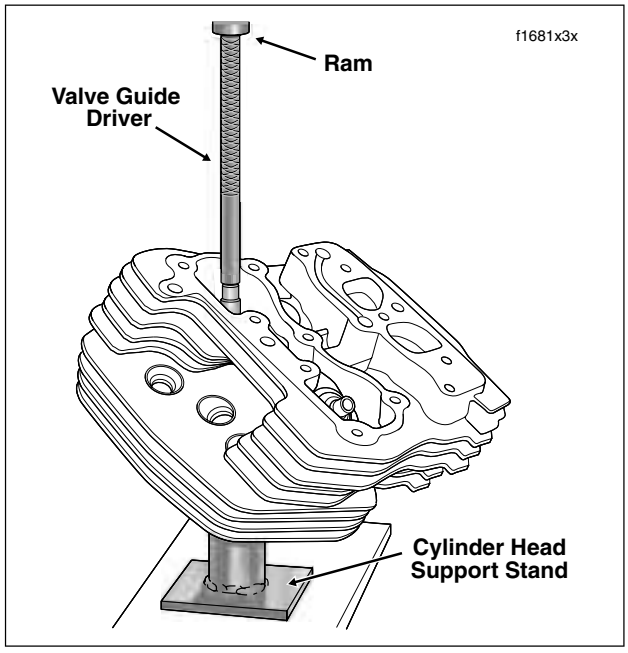



**Figure 3-66. Remove Valve Guide**

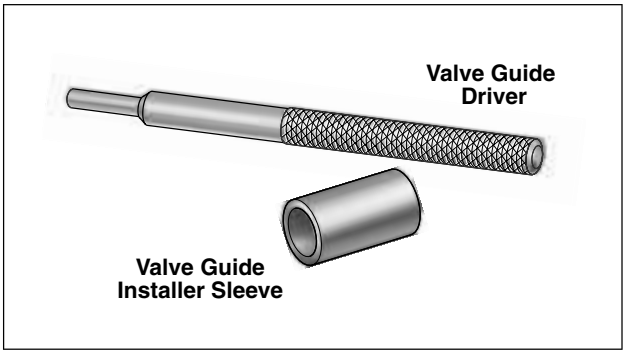



**Figure 3-67. Valve Guide Driver (Part No. HD-34740) and Valve Guide Installer Sleeve (Part No. HD-34731)**

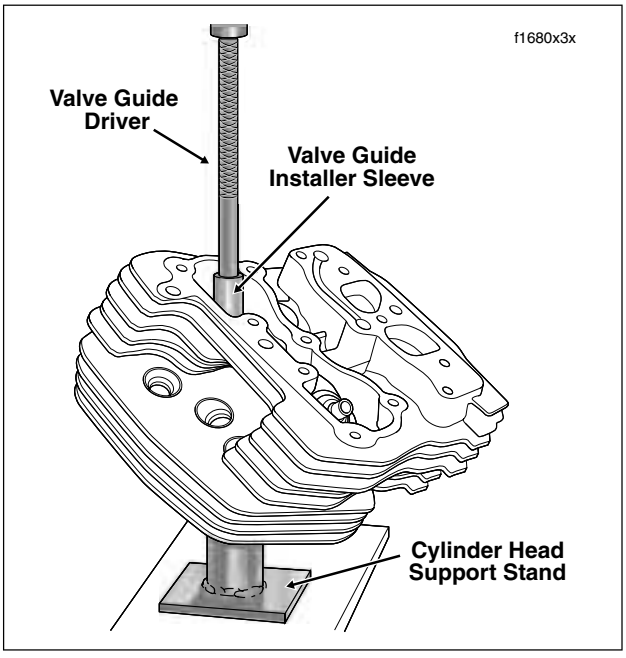



**Figure 3-68. Install Valve Guide**

2. At the top of the cylinder head, insert VALVE GUIDE DRIVER (HD-34740) into valve guide bore until stopped by shoulder.
3. Center valve guide driver under ram of arbor press. Apply pressure until valve guide drops free of cylinder head. Discard the valve guide. See Figure 3-66.

## Installation

1. Measure the outside diameter of a **new** standard valve guide, and then measure the cylinder head valve guide bore. The valve guide should be 0.0020-0.0033 inch (0.051-0.084mm) larger than the bore.

   If clearance is not within specification, then select one of the following oversize guides - 0.001 inch (0.025mm), 0.002 inch (0.05mm) or 0.003 inch (0.08mm).

*NOTE*

*Since some material is typically removed when the guide is pressed out, it is normal to go to the next larger size for the proper interference fit.*

2. Measure cylinder head bore and outside diameter of selected oversize guide to verify correct interference fit.
3. Obtain the CYLINDER HEAD SUPPORT STAND (HD-39782), VALVE GUIDE DRIVER (HD-34740) and VALVE GUIDE INSTALLER SLEEVE (HD-34731). Proceed as follows:
   a. Insert sleeve of intake or exhaust seat adapter into tube at top of support stand. Position cylinder head so that valve seat is centered on seat adapter. Support stand ensures that valve guide and seat are perpendicular. If perpendicularity is not achieved, cylinder head valve guide bore will be damaged during the press procedure.
   b. Apply Vaseline to lightly lubricate external surfaces of valve guide. Spread lubricant so that thin film covers entire surface area.
   c. At top of cylinder head, start valve guide into bore.
   d. Place installer sleeve over valve guide, and then insert tapered end of valve guide driver into installer sleeve.
   e. Center valve guide driver under ram of arbor press and apply pressure only until valve guide is started in bore and then back off ram slightly to allow guide to center itself. See Figure 3-68.

**CAUTION**

**Always back off ram to allow the valve guide to find center. Pressing guide into cylinder head in one stroke can bend driver, break guide, distort cylinder head casting and/or damage cylinder head valve guide bore.**

   f. Verify that support stand and driver are square. Center driver under ram and press valve guide further into bore, but then back off ram again to allow valve guide to find center.
   g. Repeat step 3f and then apply pressure to driver until installer sleeve contacts machined area of cylinder head.
4. Obtain the CYLINDER HEAD HOLDING FIXTURE (HD-39786) and proceed as follows:
   a. Thread the 12mm end of the tool into the spark plug hole of the cylinder head.
   b. Clamp tool in vise at a 45 degree angle (or one that offers a comfortable working position).

*NOTE*

*Valve guides must be reamed to within 0.0005 - 0.0001 inch (0.013 - 0.0025mm) of finished size.*

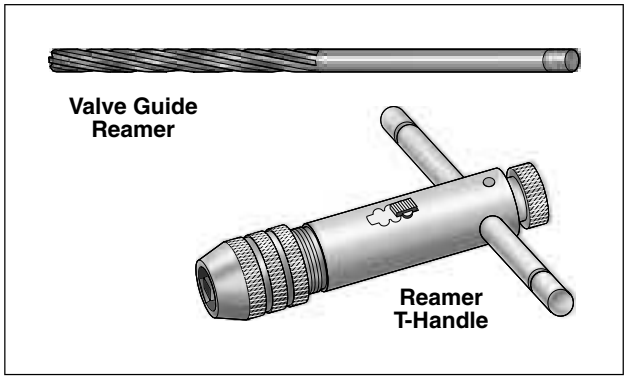



**Figure 3-69. Valve Guide Reamer (Part No. HD-39932) and Reamer T-Handle (Part No. HD-39847)**

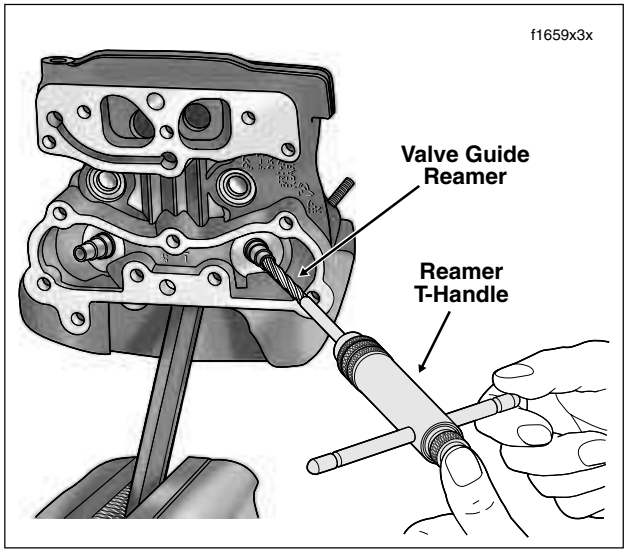



**Figure 3-70. Ream Valve Guide Bore**

5. Obtain the VALVE GUIDE REAMER (HD-39932), REAMER T-HANDLE (HD-39847) and REAMER LUBRICANT (HD-39964). Proceed as follows:
   a. Install T-handle on reamer.
   b. Apply a liberal amount of reamer lubricant to valve guide bore and bit of reamer. Start bit of reamer into bore at top of cylinder head.
   c. Placing thumb on drive socket of reamer T-handle, apply slight pressure on reamer while rotating in a clockwise direction. See Figure 3-70. Squirt additional lubricant onto reamer and into guide as necessary.

**CAUTION**

**For best results, do not push on reamer or apply pressure to the reamer handle. While excessive pressure results in a rough cut, bore will be tapered if pressure is not centrally applied.**

   d. Continue rotating reamer T-handle until entire bit has passed through valve guide bore and shank of reamer rotates freely.

**CAUTION**

**Never back reamer out of valve guide or bore will be damaged.**

   e. Remove T-handle from reamer, and carefully pulling on bit, draw shaft of reamer out combustion chamber side of valve guide.

**CAUTION**

**Abrasive particles can damage machined surfaces and plug oil passageways possibly resulting in engine failure.**

6. Direct compressed air into the valve guide bore to remove any metal shavings or debris.
7. Clean valve guide bore with the VALVE GUIDE CLEANING BRUSH (HD-34751).
8. Obtain the VALVE GUIDE HONE (HD-34723) and REAMER LUBRICANT (HD-39964). Proceed as follows:
   a. Install hone in a high speed electric drill.
   b. Apply reamer lubricant to finishing stones of hone and valve guide bore.
   c. Start finishing stones of hone into bore.
   d. Activating the drill, move the entire length of the finishing stone arrangement forward and backward through the bore for 10 to 12 complete strokes. See Figure 3-72. Work for a crosshatch pattern of approximately 60˚.

**CAUTION**

**Abrasive particles can damage machined surfaces and plug oil passageways possibly resulting in engine failure.**

9. Direct compressed air into the valve guide bore to remove any debris and then clean with the VALVE GUIDE CLEANING BRUSH (HD-34751). See Figure 3-74.

*NOTE*

*Always verify valve stem to valve guide clearance after honing, since a worn reamer may cut the bore undersize.*

10. Measure the inside diameter of the valve guide with an inside ball micrometer. Measure the outside diameter of the valve stem with an outside micrometer. The valve stem may be excessively worn or the valve guide bore undercut if the clearance is not within the limits (low end preferable) shown in Table 3-6.

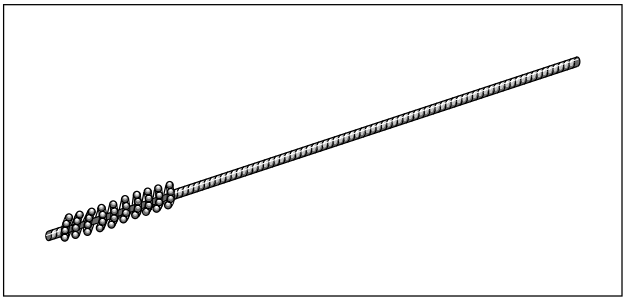


**Figure 3-71. Valve Guide Hone (Part No. HD-34723)**

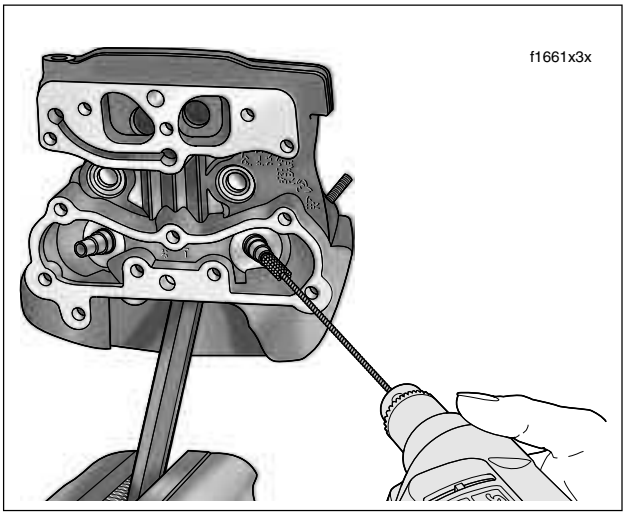



**Figure 3-72. Hone Valve Guide Bore**

## Table 3-6. New Parts Limits

| Valve | Valve Stem to Guide Clearance |
|---|---|
| Intake | 0.0008 - 0.0026 inch (0.020-0.066 mm) |
| Exhaust | 0.0015 - 0.0033 inch (0.038-0.084 mm) |

11. Using cleaning solvent, thoroughly clean cylinder head and valve guide bore. Scrub valve guide bore with the VALVE GUIDE CLEANING BRUSH (HD-34751). For best results, use a thin engine oil and clean valve guide bore with the type of swabs or patches found in gun cleaning kits. Continue to wipe bore until clean cloth shows no evidence of dirt or debris. Follow up with a thorough wash in hot soapy water. Blow dry with compressed air.

## VALVE AND SEAT REFACING

*NOTE*

*Verify correct valve stem to valve guide clearance before refacing. See Table 3-6. If new guides must be installed, complete that task before refacing valves and seats.*

1. Hold the valve firmly against a wire wheel in a bench grinder. Remove all carbon deposits from the valve head, face and stem, but exercise caution to avoid removing any metal. Carbon left on the stem may affect alignment in the valve refacer. Polish the valve stem with steel wool or crocus cloth to remove any marks that might be left by the wire wheel.

2. Install valve (both intake and exhaust) in a valve refacer set to a 45 degree angle. The valve refacer is required equipment, since accuracy in matching the angle of the valve face with the angle of the valve seat is critical.

   Do not remove any more metal than is necessary to clean up and true the valve face. Removing metal reduces the service life of the valve. The amount of grinding needed to retrue the valve is a clear indication of its condition. Discard the valve if it cannot be quickly refaced while maintaining a good margin. Valves that do not clean up quickly are either warped, excessively worn or too deeply pitted to be used.

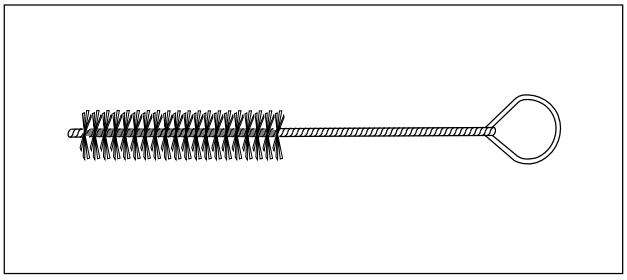


**Figure 3-73. Valve Guide Brush (Part No. HD-34751)**

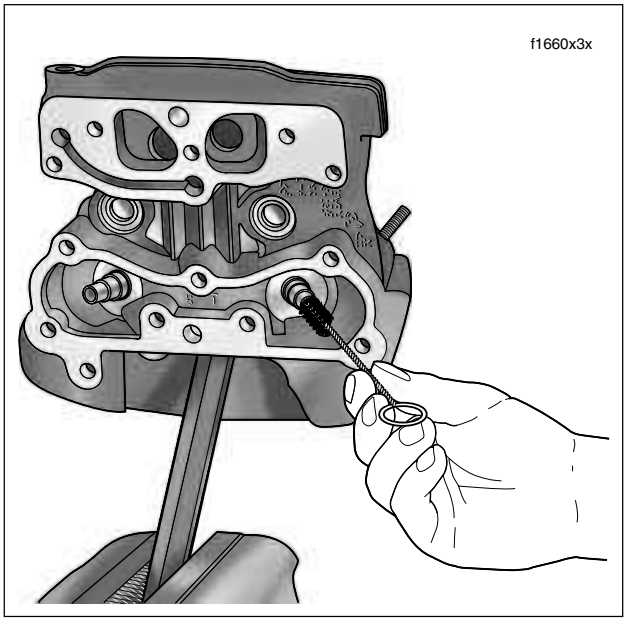



**Figure 3-74. Scrub Valve Guide Bore**

Obtain a **new** valve if grinding leaves the margin less than 0.0313 inch (0.795mm). A valve in this condition does not seat normally, burns easily and may crack or cause pre-ignition.

3. Obtain the CYLINDER HEAD HOLDING FIXTURE (HD-39786) and proceed as follows:
   a. Thread the 12mm end of the tool into the spark plug hole of the cylinder head.
   b. Clamp tool in vise at a 45 degree angle (or one that offers a comfortable working position).
4. Obtain the NEWAY VALVE SEAT CUTTER SET (HD-35758A) and cut valve seat angle to 46°. Do not remove any more metal than is necessary to clean up the seat (that is, to provide a uniform finish and remove pitting).

*NOTE*

*If using a grinding stone, verify that stone is properly dressed and grind valve seat at a 45° angle. Do not grind the seat too long (only a few seconds are required) and do not apply too much pressure to the grinding stone. If a hand held grinder is used, support the weight of the grinder to avoid excess pressure on the grinding stone.*

5. From the bottom of the cylinder head, insert the valve stem into the valve guide. Push on bottom of valve until it contacts the valve seat.
6. Placing finger at bottom of valve to keep valve seated, use a dial vernier caliper to check the distance from the top of the valve stem to the machined area on the cylinder head. See Figure 3-75.

   Seat wear and valve refacing causes the valve stem protrusion to change. If valve stem protrusion exceeds 2.034 inches (51.66mm), but is less than 2.064 inches (52.43mm), obtain the short service replacement valve. Service replacement valves are 0.030 inch (0.76mm) shorter than the standard valve.

   If protrusion exceeds 2.064 inches (52.43mm), then use the existing valve, but replace the valve seat.

**CAUTION**

**Do not shorten the valve by grinding on the end of the stem. Grinding replaces the hardened case with mild steel which results in accelerated wear.**

7. Remove valve from cylinder head. Using a small brush, apply DYKEM Steel blue dye or similar product to valve seat. Allow dye to thoroughly dry.
8. Apply a fine grinding compound sparingly around the entire valve face.
9. Insert the valve stem into the valve guide. Push on bottom of valve until it contacts the valve seat.
10. Obtain the VALVE LAPPING TOOL (HD-96550-36A) and proceed as follows:

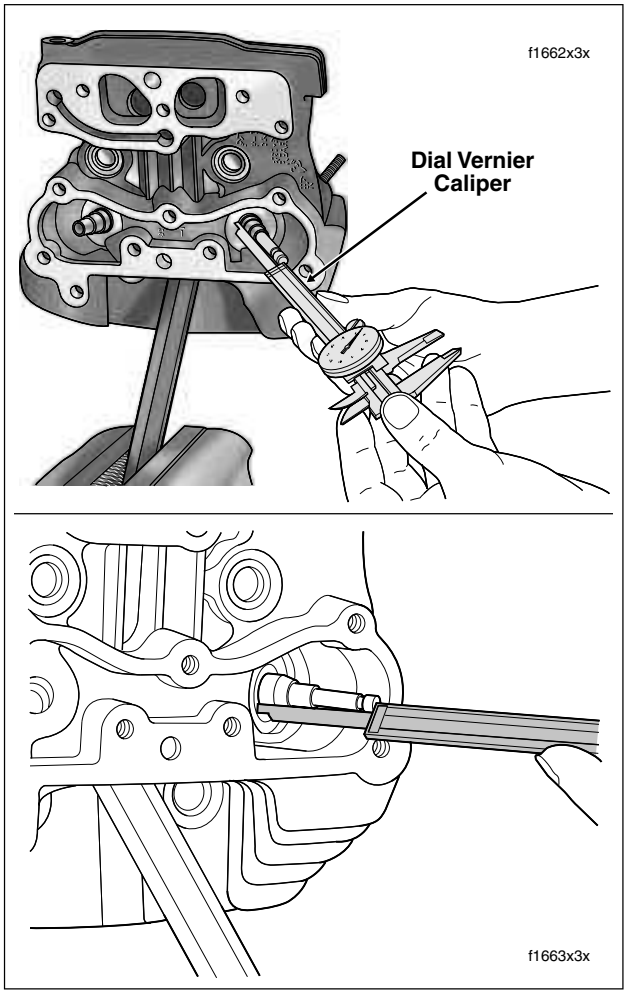



**Figure 3-75. Measure Valve Stem Protrusion**

   a. Attach suction cup at end of tool to valve head.
   b. Holding shank of tool between the palms of both hands, oscillate the tool back and forth a few times. See Figure 3-77. Raise tool and rotate valve 1/3 of a turn before setting it back on the valve seat.
   c. Repeat step 10b until valve has been rotated one complete revolution.
11. Remove the valve from the cylinder head and thoroughly clean the valve and valve seat insert of any lapping compound.
12. Carefully inspect the mating surfaces under a good light. A properly lapped valve will show a gray, frosty seating surface located either in the center of the valve face or somewhat towards the head end. The lapped surface should extend evenly and completely around the entire valve face circumference.

Likewise, inspection of the valve seat should show an unbroken lapped finish of uniform width. If the seat is not concentric with the valve guide, then the cutter (or stone) will remove more material in one spot than another. Carbon deposits may have caused the guide to be pressed in crooked, the guide may be cracked, or the grinding stone (if used) may not have been properly dressed.

*NOTE*

*If necessary, repeat the lapping procedure. If the results are still not acceptable, then recut or regrind the valve seat or replace the valve guide.*

13. Inspect the contact pattern on the valve to be sure area is 0.040-0.062 inch (1.02-1.57 mm) wide and two-thirds of the way towards the outer edge of the valve face. See Figure 3-78. If necessary, modify the seat pattern as follows:

    a. Use the 31° angle cutter (or stone) to lower the valve seat surface and reduce its width.

    b. Use the 60° angle cutter (or stone) to raise the valve seat surface and reduce its width.

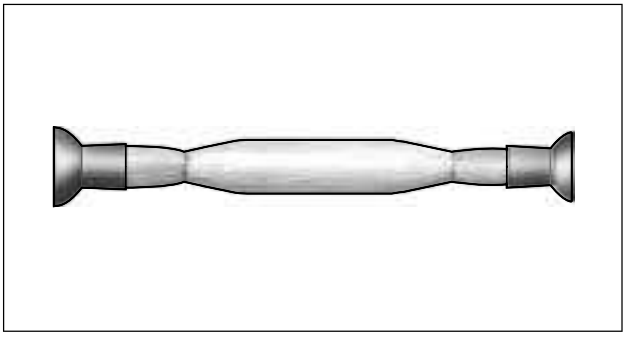


**Figure 3-76. Valve Lapping Tool (Part No. HD-96550-36A)**

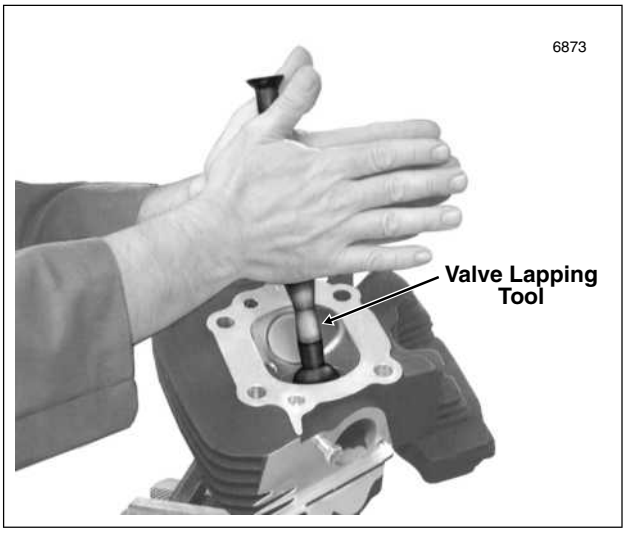



**Figure 3-77. Oscillate Tool to Lap Valve**

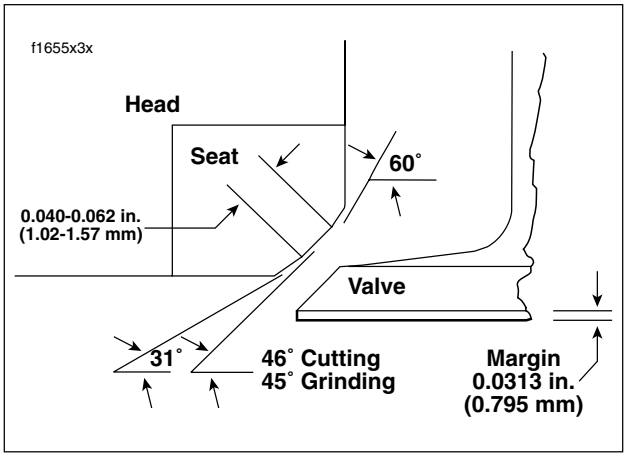



**Figure 3-78. Valve Seat Angles**

    c. Use the 46° angle cutter (or 45° stone) to widen the valve seat surface.

14. Using a magic marker, mark three equally spaced vertical lines across the valve face and then insert the valve back into the cylinder head.

15. Without the use of any lapping compound, attach suction cup of VALVE LAPPING TOOL (HD-96550-36A) to valve head, and holding shank of tool between the palms of both hands, oscillate the tool back and forth a few times.

16. Remove the valve and perform a final inspection of the contact pattern. If necessary, return to step 13.

17. Remove the valve from the cylinder head. Use contact cleaner to thoroughly clean magic marker and/or dye from valve face and seat, if present.

18. Release the cylinder head holding fixture from the vise and then remove the tool from the spark plug hole.

19. To confirm quality of valve and seat refacing work, proceed as follows:

    a. Insert valve in guide, and holding valve to seat, raise port to strong light source. If light is visible around edge of seat, then valves and seats must be reconditioned.

    b. Holding valve to seat, fill port at top of cylinder head with solvent. Wait ten full seconds and then check for leakage into combustion chamber. If solvent leakage into combustion chamber is evident, then valves and seats must be reconditioned.

20. Clean valves, cylinder head and valve seats in solvent. Follow up with a thorough wash in hot soapy water. Blow dry with compressed air.

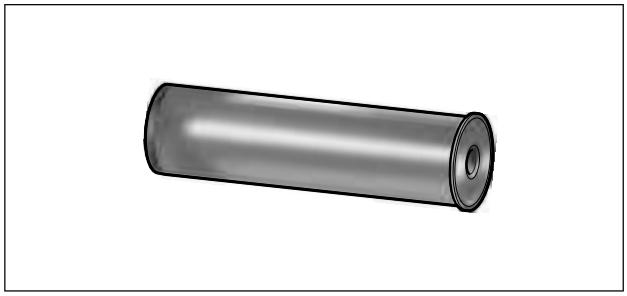


**Figure 3-79. Valve Stem Seal Installer (Part No. HD-34643A)**

## Assembly

1. Obtain the CYLINDER HEAD HOLDING FIXTURE (HD-39786) and proceed as follows:
   a. Thread the 12mm end of the tool into the spark plug hole of the cylinder head.
   b. Clamp tool in vise at a 45 degree angle (or one that offers a comfortable working position).
2. Slide spring seat over valve guide until it contacts the machined area on the cylinder head casting. Use a little grease to hold the spring seat in position, if necessary.

*NOTE*

*At the time of disassembly, all parts should have been marked or tagged so that they are installed on the same valve (and in the same head).*

3. Run the VALVE GUIDE CLEANING BRUSH (HD-34751) through the valve guide bore to verify cleanliness.
4. Using TORCO MPZ or another suitable product, apply a liberal amount of engine assembly lube to valve stem.
5. From the bottom of the cylinder head, insert the valve stem into the valve guide.
6. To distribute the assembly lube evenly around the valve stem and guide, hand spin the valve as it is installed. Work the valve back and forth in the bore to verify that it slides smoothly and seats properly.
7. Remove the valve and apply a second coat of assembly lube to the valve stem. Install the valve in the valve guide.
8. Retract the valve so that the stem is not visible above the top of the valve guide.
9. Using denatured alcohol or other suitable degreaser, thoroughly clean external surface of valve guide until completely free of grease and oil.

**CAUTION**

**Do not apply Locktite to inside of valve stem seal or top of valve guide or valve may stick to seal resulting in loss of compression and valve sticking.**

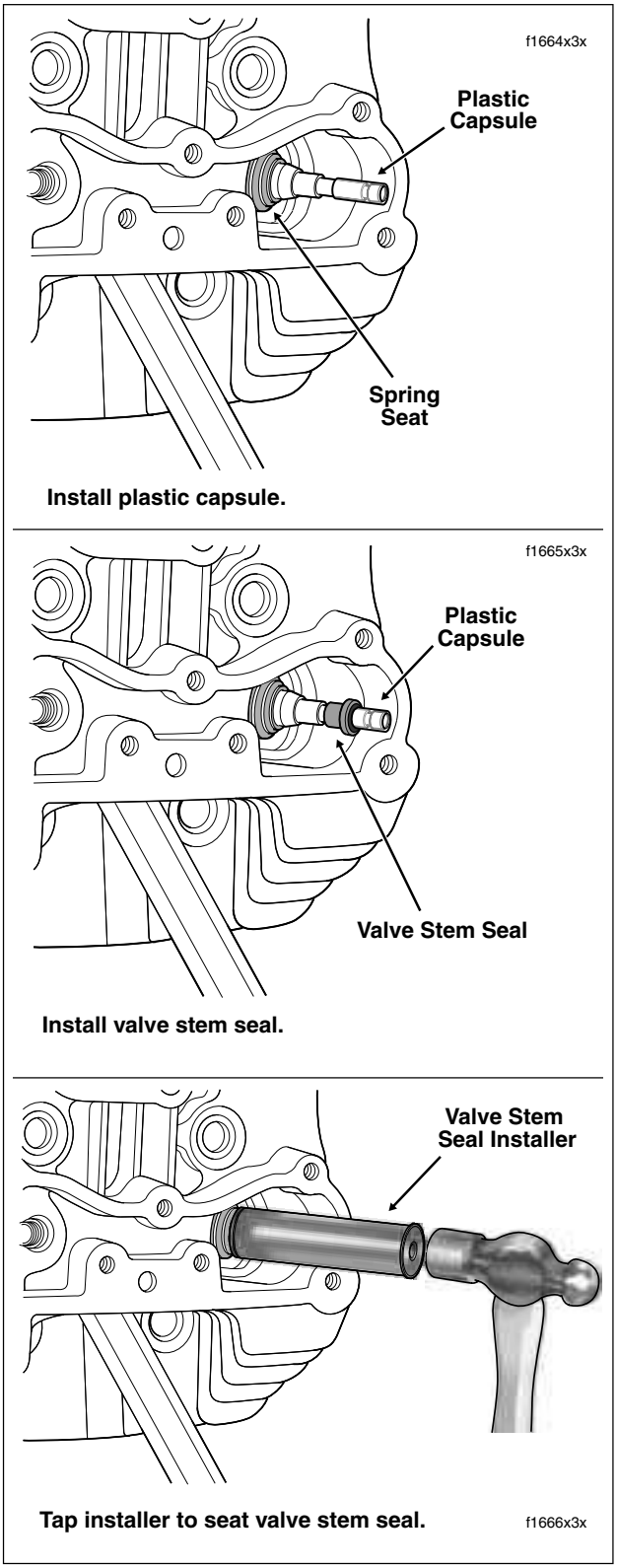



**Figure 3-80. Install Valve Stem Seal**

10. Obtain tube of Locktite RC/620 (green) High Temperature Retaining Compound. Carefully apply Locktite to valve stem seal seating surface on outside diameter of valve guide. Exercise caution to keep compound out of valve guide bore.

**CAUTION**

**Failure to install plastic capsule will cause the valve stem seal to catch the edge of the valve stem keeper groove. The resulting damage will lead to leakage around the valve stem, excessive oil consumption and valve sticking.**

11. Push on bottom of valve until it contacts the valve seat. Placing finger at bottom of valve to keep valve seated, slide plastic capsule over valve stem tip and keeper groove. See upper frame of Figure 3-80.

12. Apply a very thin film of clean H-D 20W50 engine oil to capsule. Slide **new** valve stem seal over capsule and down valve stem until contact is made with top of valve guide. See center frame of Figure 3-80. Remove capsule from valve stem tip.

**CAUTION**

**To avoid damaging the valve stem seal and/or cracking the valve guide, always use the proper valve stem seal installer tool. Use of an ordinary socket will damage the seal or guide, resulting in leakage around the valve stem, excessive oil consumption and valve sticking.**

13. Obtain the VALVE STEM SEAL INSTALLER (HD-34643A) and proceed as follows:

    a. Slide the installer tool over the valve stem seal using valve stem as pilot. The tool bore allows insertion of the valve stem, while the counterbore fits over the valve stem seal.

**CAUTION**

**Repeated blows on installer after seal is in place will cause seal distortion resulting in leakage around the valve stem, excessive oil consumption and valve sticking.**

    b. Using a small hammer, gently tap the end of the tool until it lightly bottoms on the installed spring seat. See lower frame of Figure 3-80. For best results, brace the cylinder head with chest area to prevent movement during seal installation.

*NOTE*

*If an arbor press is the preferred method of valve stem seal installation, use the VALVE STEM SEAL INSTALLER (HD-34643A) with the VALVE GUIDE DRIVER (HD-34740). See Figure 3-81.*

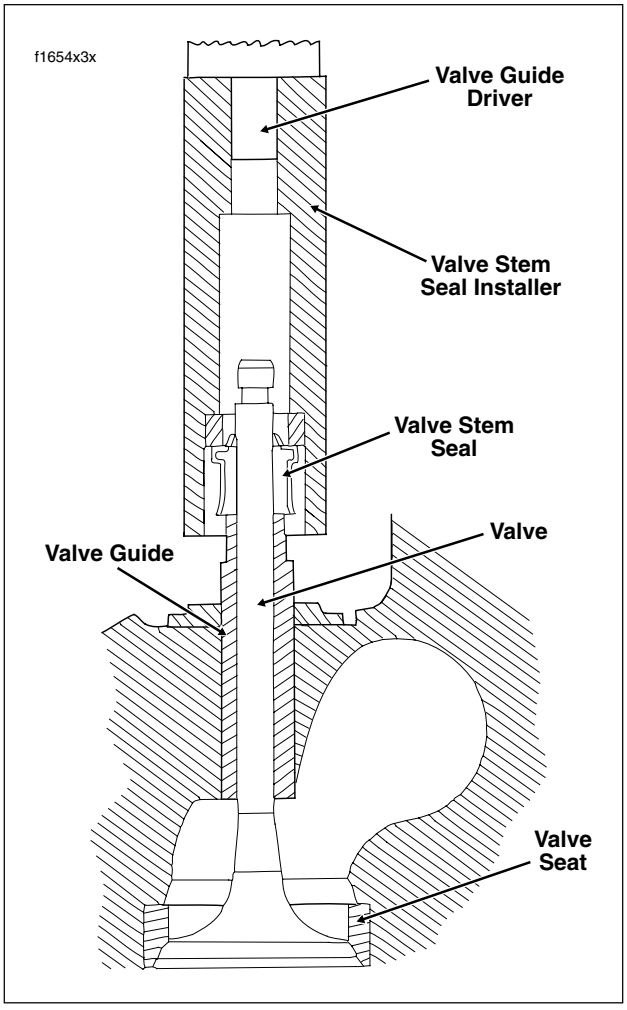



**Figure 3-81. Using Arbor Press to Install Valve Stem Seal**

**CAUTION**

**Removing the valve after seal installation will cause the valve stem seal to catch the edge of the valve stem keeper groove. The resulting damage will lead to leakage around the valve stem, excessive oil consumption and valve sticking.**

14. Apply a liberal amount of assembly lube to valve stem tip and keeper groove.

15. Install the inner and outer valve springs over the valve guide. Fit the spring retainer on top of the inner and outer valves springs. Like the spring seat, the smaller diameter flange fits inside the inner valve spring. The larger diameter flange separates the inner and outer springs.

16. Obtain the VALVE SPRING COMPRESSOR (HD-34736B) and proceed as follows:

a. Place tool over cylinder head so that the blunt end is centered on the valve head and adapter at end of forcing screw is seated on the valve spring retainer.

**CAUTION**

**Over-compressing the valve spring can damage the valve stem seal resulting in leakage around the valve stem, excessive oil consumption and valve sticking.**

b. Rotate forcing screw to compress valve springs.

c. With the tapered side down, fit the keepers into the valve stem groove. For best results, apply a dab of grease to the inboard side of the keepers before installation and use a magnetic rod for easy placement.

d. Arranging tapered keepers so that the gaps are evenly spaced, turn forcing screw to release valve spring compression.

17. Tap the end of the valve stem once or twice with a soft mallet to ensure that tapered keepers are tightly seated in the valve stem groove.

18. Repeat steps 1-17 to install the other valve components.

19. Release the cylinder head holding fixture from the vise and then remove the tool from the spark plug hole.

20. Cover the cylinder head to protect it from dust and dirt until time of installation.

## Installation

See Section 3.10 TOP END OVERHAUL, ASSEMBLY, steps 15-25 and 30-40.

# CYLINDER

## Removal

1. See Section 3.10 TOP END OVERHAUL, DISASSEMBLY, steps 1-11 and 15-25.

## Cleaning and Inspection

### CLEANING

1. Scrape old gasket material from the machined surface at the top of the cylinder. Old gasket material left on the mating surface will cause leaks.
2. Clean cylinder in a non-volatile cleaning solution or solvent. Thoroughly dry with low pressure compressed air. Verify that oil passageways are clean and open.
3. Inspect the cylinder bore for defects or damage in the ring travel area. Replace cylinders that are severely scored, scuffed, scratched, burnt or gouged.
4. Using Magnaflux Dye Penetrant, inspect the cylinder for cracks. If no cracks are found, thoroughly wash cylinder to remove traces of dye.
5. Use a file to carefully remove any nicks or burrs from the machined surfaces of the cylinder.
6. Using a feeler gauge and straightedge, check the machined surfaces for flatness. The head gasket surface must be flat within 0.006 inch (0.15 mm), while the bottom O-ring seal surface must be flat within 0.008 inch (0.20 mm). Replace the cylinder (and piston) if either surface is not within specification.

### INSPECTION

**CAUTION**

**Failure to use the cylinder torque plates can produce measurements that vary by as much as 0.001 inch (0.025 mm), possibly resulting in the use of parts that are not suitable for service.**

1. To simulate an assembled cylinder for accurately measuring cylinder taper and out-of-round conditions, as well as for boring, honing or deglazing, obtain the CYLINDER TORQUE PLATES (HD-42324). Install the torque plates as follows:
   a. Remove O-ring seal from clinder sleeve, if installed.
   b. Install used O-rings around two ring dowels at top of cylinder, if removed. Place used head gasket over dowels.
   c. Install brass jaws or shop towels around teeth of vise to prevent damage to tool. Clamp stepped side of lower plate in vise with the simulated split line (machined strip) facing away.

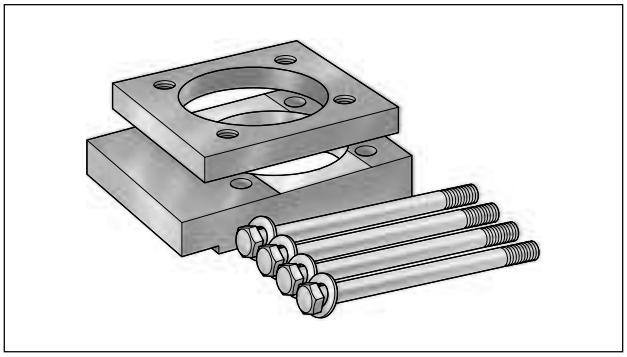


**Figure 3-82. Cylinder Torque Plates (Part No. HD-42324)**

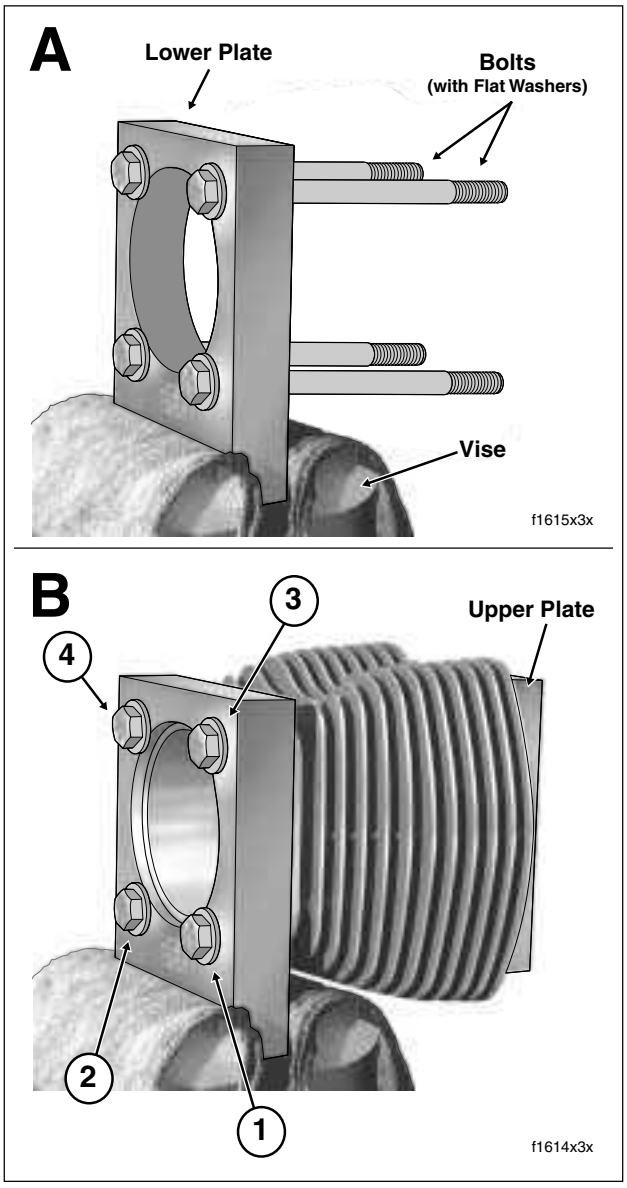



**Figure 3-83. Install Cylinder to Torque Plates**

d. Slide four bolts (with flat washers) all the way through holes of lower plate until washers contact outboard side. See A of Figure 3-83.

e. Slide cylinder down bolts with the indent in the cooling fins facing upward.

f. With the two ring dowels and head gasket in place, align holes in upper plate with ends of bolts. Blind holes in upper plate accommodate ring dowels in cylinder. Alternately tighten four bolts into upper plate in a crosswise pattern until snug.

g. Tighten the bolts to 7-9 ft-lbs (9.5-12.2 Nm) in the sequence shown in B of Figure 3-83.

h. Following the same sequence, tighten each bolt to 12-14 ft-lbs (16.3-18.9 Nm).

i. Using a grease pencil, mark a straight line on one of the bolts continuing the line over onto the lower plate. Repeat step for remaining three bolts.

j. Using the marks as a guide, turn each bolt 1/4 turn or 90 degrees. Be sure to tighten the bolts in the sequence shown in B of Figure 3-83.

k. For purposes of inspection, remove the assembly from the vise and place on bench top.

2. See Figure 3-84. Using an inside micrometer or dial bore gauge, check cylinder bore for out-of round and taper. Proceed as follows:

   a. At the top of the piston ring travel zone (starting about 0.50 inch or 12.70 mm from the top of the cylinder), measure the cylinder diameter at two locations- parallel and perpendicular to the crankshaft. Write the readings down.

   b. Repeat the two measurements at the center of the piston ring travel zone.

   c. Repeat the measurements again at the bottom of the bore at a point below the piston ring travel zone.

   d. Rebore the cylinder if the parallel and perpendicular measurements at either the top, middle or bottom of the bore vary by more than 0.003 inch (0.008 mm), which indicates an out-of-round condition.

      Rebore the cylinder if the top, middle and bottom bore diameters either parallel or perpendicular to the crankshaft vary by more than 0.002 inch (0.058 mm), which indicates excessive taper.

**CAUTION**

**Maximum cylinder wear occurs at the very top of top ring travel. Minimum wear occurs below ring travel. Failure to measure the cylinder at these points may result in a faulty decision regarding the suitability of the cylinder for continued use.**

3. If cylinders are not scuffed or scored, and are not worn beyond the service limits described under step 2(d), see DEGLAZING CYLINDER on this page.

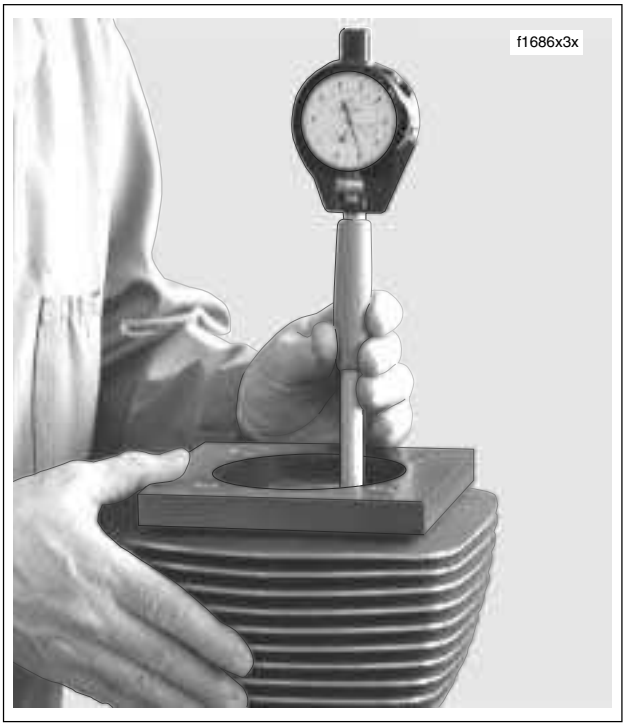



**Figure 3-84. Measure for Out-of-Round and Taper**

On the other hand, if cylinders are worn beyond the service limits, then they must be rebored and/or honed to accept the next standard oversize piston. See BORING AND HONING CYLINDER on the next page.

## DEGLAZING CYLINDER

*NOTE*

*Deglazing removes wear patterns, minor scuff marks and scratches without enlarging the bore diameter.*

1. Lightly swab the cylinder bore with a cloth dipped in clean engine oil.

2. Obtain a 240 grit flexible ball-type deglazing tool with a bristle tip or finishing stone arrangement able to produce a 60˚ cross hatch pattern.

3. Install the deglazing tool in a slow-speed drill. The speed at which the tool rotates determines the speed at which it must be stroked up and down the bore to produce the desired cross hatch pattern.

4. Starting at the bottom of the cylinder, move the deglazing tool up and down the entire length of the cylinder bore for 10 to 12 complete strokes.

5. Stop to examine the cylinder bore and/or take measurements. A precise 60˚ cross hatch pattern in the piston travel area is the most important.

**CAUTION**

**The angular cross hatch pattern ensures an even flow of oil onto the cylinder walls and promotes longer cylinder, piston and ring life. An Improper crosshatch pattern will result in insufficient oil retention and possible piston seizure and/or high oil consumption.**

**CAUTION**

**Failure to remove all abrasive particles may result in premature cylinder, piston and ring wear and possible engine failure.**

6. Thoroughly wash the cylinder bore with liquid dishwashing soap and warm water to remove all abrasive particles and residual grit. Continue cleaning until a clean cloth shows no evidence or dirt or debris.
7. Hot rinse the cylinder and dry with moisture free compressed air. Immediately apply a thin film of clean engine oil to prevent rusting.
8. With the cylinder at room temperature, check the piston clearance in the cylinder in which the piston will run. See PISTON, INSPECTION, step 5.

### BORING AND HONING CYLINDER

1. Bore the cylinder to 0.003 inch (0.08 mm) under the desired finished size. See Table 3-7.

**CAUTION**

**An improper crosshatch pattern or too fine a hone will result in insufficient oil retention and possible piston seizure and/or high oil consumption.**

2. Hone the cylinder to its finished size using a 280 grit rigid hone.
3. Stop frequently to examine the cylinder bore and/or take measurements. Remember, a precise 60˚ cross hatch pattern in the piston travel area is important.
4. Thoroughly wash the cylinder bore with liquid dishwashing soap and warm water to remove all abrasive particles and residual grit. Continue cleaning until a clean cloth shows no evidence or dirt or debris.

**Table 3-7. Oversize Pistons**

| Piston | Cylinder Bore Finished Size |
|---|---|
| Standard | 3.75025 in. ± 0.00025 in. (95.256 ± 0.00635 mm) |
| 0.005 In. (0.13 mm) **Oversize** | 3.75525 in. ± 0.00025 in. (95.383 ± 0.00635 mm) |
| 0.010 In. (0.25 mm) **Oversize** | 3.76025 in. ± 0.00025 in. (95.510 ± 0.00635 mm) |
| 0.020 In. (0.51 mm) Oversize | 3.77025 in. ± 0.00025 in. (95.764 ± 0.00635 mm) |
| 0.030 In. (0.76 mm) **Oversize** | 3.78025 in. ± 0.00025 in. (96.018 ± 0.00635 mm) |
| Example: A 0.005 in. (0.13 mm) oversize piston will have the proper running clearance with a cylinder bore size of 3.75525 in. ± 0.00025 in. (95.383 ± 0.00635 mm). | |

5. Hot rinse the cylinder and dry with moisture free compressed air. Immediately apply a thin film of clean engine oil to prevent rusting.
6. With the cylinder at room temperature, check the piston clearance in the cylinder in which the piston will run. See PISTON, INSPECTION, step 5.

## Installation

1. See Section 3.10 TOP END OVERHAUL, ASSEMBLY, steps 8-25 and 30-40.

# PISTON

## Removal

1. See Section 3.10 TOP END OVERHAUL, DISASSEMBLY, steps 1-11 and 15-30.

## Disassembly

## Piston Rings, Removal

**⚠WARNING**

**Always wear proper eye protection when removing the compression rings. Slippage may propel the ring with enough force to cause eye injury.**

1. Carefully remove first and second compression rings using the proper piston ring expander (Snap-On PRS8).
2. Using your fingers, remove the top and bottom oil rails from the third ring groove. Remove the expander spring.
3. Discard the piston rings.

## Cleaning and Inspection

### Cleaning

**CAUTION**

**Do not sand blast or glass bead blast pistons. Bead blasting rounds off ring lands and will result in oil contamination leading to accelerated wear.**

1. To remove all carbon and combustion deposits, soak the pistons in a special detergent that will not corrode aluminum. Maintain the temperature of the cleaning solution well below 212° F. (100° C.).
2. Thoroughly rinse the pistons and dry with moisture free compressed air.
3. Clean the oil drain holes leading from the oil control ring groove to the underside of the piston crown. Run a small bristle brush through the passageways to ensure their cleanliness, but be careful not to damage or enlarge the holes. Do not use a wire brush.
4. Verify that all other oil holes are clean and open.

**CAUTION**

**Exercise care to avoid scratching the sides of the piston ring grooves.**

5. Thoroughly clean the three piston ring grooves of all carbon deposits. A broken compression ring properly ground to a sharp chisel-like edge may be used for this purpose.
6. Using Magnaflux Dye Penetrant, inspect the piston for surface cracks. Pay special attention to the area around the pin bores, ring lands and oil drain holes beneath the piston crown. If no cracks are found, thoroughly wash piston to remove traces of dye.

### Inspection

1. Lightly oil a good piston pin and insert it into the piston pin bore to feel for the proper interference fit. The pin should slide in and out without binding, but also without pivoting or rocking. Replace piston and/or pin if clearance exceeds 0.001 in. (0.025 mm).
2. Carefully inspect the pistons for damage or excessive wear. Discard pistons with cracked, broken or bent ring lands. Check the piston skirt for cracks, gouges, deep scratches or heavy scoring. Check the piston heads for evidence of burning, etching or melting. Look for marks or imprints caused by contact with valves. Pistons with superficial wear marks, minor scratching or mild scoring may continue to be used.
3. Run your index finger around the edge of the piston crown to feel for dings, nicks or burrs. Lightly file the edge of the crown to remove any defects.

**CAUTION**

**Worn ring grooves result in high oil consumption and blow-by of exhaust gases. Blow-by of exhaust gases contaminates the engine oil supply with acids and leaves sludge in the crankcase. It also reduces engine efficiency by weakening the combustion seal necessary for efficient transfer of energy to the piston.**

4. Measure the piston ring side clearance as follows:
   a. Insert the edge of a new ring into the piston ring groove. Insert a feeler gauge between the upper surface of the ring and the ring land. See Figure 3-85.

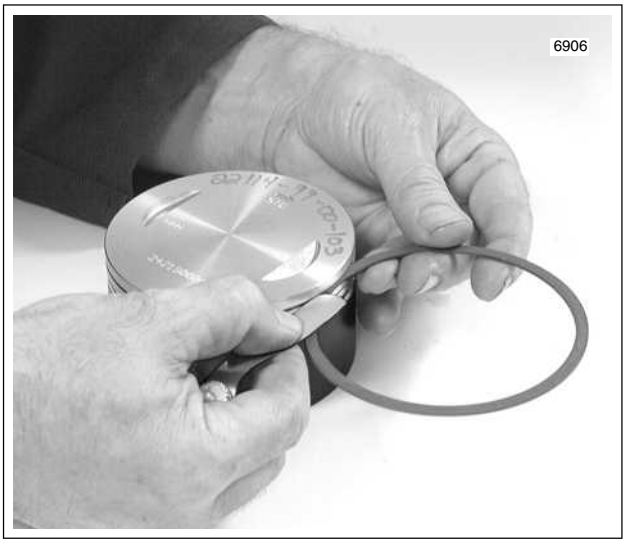



**Figure 3-85. Measure Piston Ring Side Clearance**




**Figure 3-86. Measure Piston for Running Clearance**

b. Since the grooves wear unevenly, repeat this check at several locations around the piston groove circumference.

c. Discard the piston if the side clearance of either compression ring exceeds 0.0045 in. (0.11 mm). Discard the piston if the oil control ring side clearance exceeds 0.010 in. (0.25 mm).

5. Measure the piston running clearance. Proceed as follows:

*NOTE*

*Check the piston clearance in the cylinder in which the piston will run. The torque plates must be installed on the cylinder and it must be deglazed and suitable for continued service.*

a. Holding outside micrometer, measure piston skirt diameter across the thrust faces (perpendicular to piston pin bore). Start below the bottom ring land and move piston towards bottom of skirt. Micrometer will be loose, then tight (about 1/2 inch from bottom), and then loose again. See Figure 3-86.

b. Measure the piston skirt at the tightest spot and then transfer that measurement to dial bore gauge.

c. Using a grease pencil, mark the top, middle and bottom of the piston ring travel zone in the cylinder bore. Measure at markings in cylinder parallel and perpendicular to crankshaft.

**CAUTION**

**Do not check piston running clearance immediately after honing or deglazing cylinder. Since heat will cause measurements to vary by as much as 0.002 inch, both piston and cylinder must be at room temperatures.**

d. Replace piston and/or cylinder if running clearance exceeds 0.0016 in. (0.041 mm).

## Assembly

## Piston Rings, Installation

*NOTE*

*Always use new piston rings. Piston rings take a definite set and must not be reused if the engine has been operated. Always deglaze (or hone) the cylinder before installing new rings. Ring sets are available to fit oversize pistons.*

1. Before placing each ring on the piston, perform the following check.

**CAUTION**

**Insufficient ring end gap may cause the ends to abut at engine operating temperatures, resulting in ring breakage, cylinder scuffing and/or piston seizure.**

**CAUTION**

**Excessive ring end gap results in high oil consumption and blow-by of exhaust gases. While blow-by contaminates the oil supply and leaves sludge in the crankcase, it also reduces engine efficiency by weakening the combustion seal necessary for efficient transfer of energy to the piston.**

2. Insert the new ring into the cylinder, square it in the bore using the top of the piston and measure the ring end gap with a feeler gauge. See Figure 3-87. Do not use the ring if the end gap does not fall within the following specifications.

### Table 3-8. Ring End Gap

| Ring Type | Ring End Gap |
|---|---|
| Top compression ring | 0.010 in. (0.25 mm) - 0.020 in. (0.51 mm) |
| 2nd compression ring | 0.014 in. (0.36 mm) - 0.024 in. (0.61 mm) |
| Oil control ring rails | 0.010 in. (0.25 mm) - 0.050 in. (1.27 mm) |

*NOTE*

*Ring end gap dimensions also apply to oversize rings. Replace ring if end gap exceeds specification. If end gap is under specification, filing is permissible.*

3. Use compressed air to remove any dirt or dust that may have settled in the oil drain holes and piston ring grooves.

4. Install piston rings as follows:

a. Apply clean H-D 20W50 engine oil to three piston ring grooves.

b. Install expander spring into third ring groove. Spiral bottom oil rail into space below expander spring positioning the gap 90 degrees from the gap in the expander spring. Spiral top oil rail into space above expander spring positioning gap 180 degrees from the gap in the bottom oil rail.

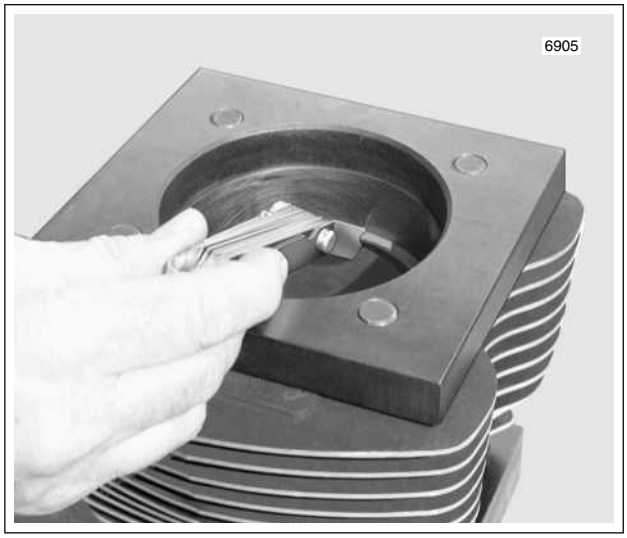



**Figure 3-87. Measure Ring End Gap**

**CAUTION**

**Use the proper piston ring spreader to prevent excessive ring twist and expansion. Over expansion may cause the ring to crack opposite the ring gap. Damaged or distorted rings result in blow-by of exhaust gases, increased oil consumption and lower service life on valves and other components.**

**CAUTION**

**Installing the second compression ring upside down will cause oil to be scraped up into the combustion chamber resulting in excessive oil consumption and low service life on valves and other components.**

c. Carefully install the two top compression rings using the proper piston ring expander (Snap-On PRS8). Install the second compression ring first making sure that the dot (punch mark) near the ring gap faces the piston crown.

d. Rotate the three piston rings using the palms of both hands. The rings must rotate freely without sticking.

e. Stagger the ring gaps around the piston. If necessary, rotate each ring to position the gap 90 degrees from the gap in the ring above it.

## Installation

1. See Section 3.10 TOP END OVERHAUL, ASSEMBLY, steps 1-24 and 29-38.

# UPPER CONNECTING ROD

## Removal

1. See Section 3.10 TOP END OVERHAUL, DISASSEMBLY, steps 1-11 and 15-30.

## Disassembly/Assembly

*NOTE*

*Service of connecting rods is limited to replacement of the upper bushing. Damage to connecting rods or lower bushing service requires replacement of the flywheel assembly.*

## Upper Connecting Rod Bushing

### Removal

*NOTE*

*Replace the upper rod bushing if the piston pin to rod bushing clearance exceeds 0.001 inch (0.025 mm).*

**CAUTION**

**Place clean shop towels in and around the crankcase bore to prevent chips and shavings from falling into the crankcase.**

1. Obtain the CONNECTING ROD CLAMPING TOOL (HD-95952-33B) and proceed as follows:
   a. Slide clamp over connecting rod so that slots engage cylinder head studs. See Figure 3-89. Exercise caution to avoid scratching or bending studs.
   b. With the knurled side up, install threaded cylinders (HD-95952-1) onto studs to secure position of clamp.
   c. Alternately turn each clamp thumbscrew a few turns to gradually fix position of connecting rod. Turning only one thumbscrew will move rod off-center, while tightening second thumbscrew can cause rod to flex or bend.
2. Obtain the CONNECTING ROD BUSHING REMOVER/INSTALLER (HD-95970-32D) and proceed as follows:
   a. Sparingly apply graphite lubricant to threads of rod to prolong service life and ensure smooth operation.
   b. Slide receiver cup (HD-95984-99) onto threaded rod with the closed side facing hex nut.
   c. Insert threaded rod through upper rod bushing.
   d. Slide remover side of driver (HD-95986-99) down threaded rod. The driver is stamped to ensure proper orientation.
   e. Slide Nice bearing and flat washer down threaded rod until it contacts driver.

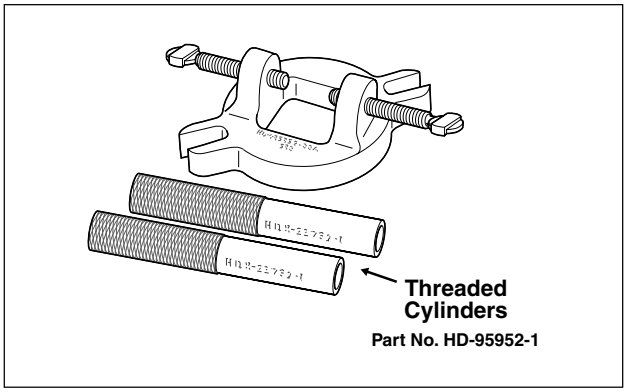



**Figure 3-88. Connecting Rod Clamping Tool (Part No. HD-95952-33B)**

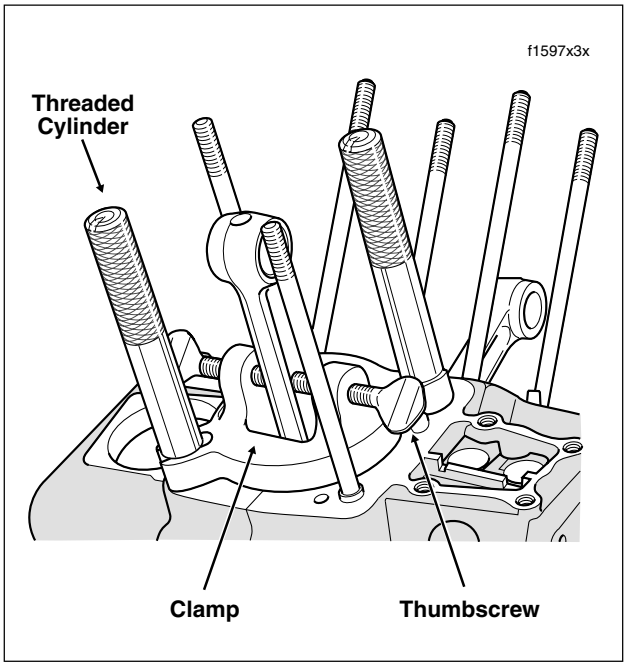



**Figure 3-89. Install Connecting Rod Clamping Tool**

   f. Thread the hex cylinder onto rod until assembly is snug. See upper frame of Figure 3-91.
   g. Holding nut at end of threaded rod with a 5/8 inch box wrench, turn hex cylinder with a 5/8 inch socket until bushing is free.
   h. Unthread hex cylinder from rod. Remove flat washer, Nice bearing and driver. Remove threaded rod from bushing bore.
   i. Remove bushing from receiver cup and discard.

### Installation

1. Obtain the CONNECTING ROD BUSHING REMOVER/INSTALLER (HD-95970-32D) and proceed as follows:

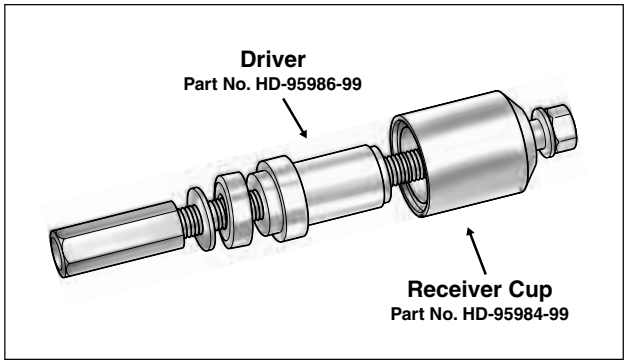



**Figure 3-90. Connecting Rod Bushing Remover/Installer (Part No. HD-95970-32D)**

a. Slide receiver cup (HD-95984-99) onto threaded rod with the closed side facing hex nut.

b. Insert threaded rod through upper rod bushing bore.

c. Slide **new** bushing down threaded rod. Start bushing into bore. Verify that center of slot in bushing is aligned with oil hole at top of rod. Also, be sure that bushing is square in bore and not cocked. See center frame of Figure 3-91.

d. Slide installer side of driver (HD-95986-99) down threaded rod until shoulder contacts bushing. The driver is stamped to ensure proper orientation.

e. Slide Nice bearing and flat washer down threaded rod until it contacts driver.

f. Thread the hex cylinder onto rod until assembly is snug.

g. Holding nut at end of threaded rod with a 5/8 inch box wrench, turn hex cylinder with a 5/8 inch socket until collar on driver bottoms against connecting rod. See lower frame of Figure 3-91.

h. Unthread hex cylinder from rod and remove flat washer, Nice bearing and driver. Remove threaded rod from bushing bore, but exercise caution to avoid scratching or gouging bushing.

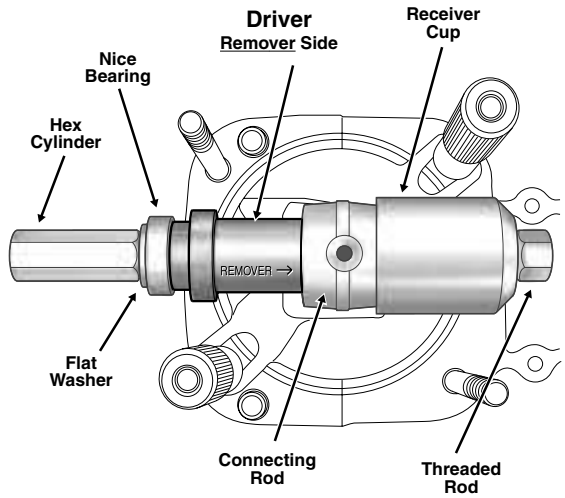
## Reaming Upper Rod Bushing

1. Obtain the CONNECTING ROD BUSHING REAMER (HD-42318) and REAMER HANDLE/DRIVE SOCKET (HD-43645). Proceed as follows:

   a. Carefully insert bit of reamer into upper connecting rod bushing. Do not apply lubricant to reamer or bushing. Ream the bushing dry or cut will not be accurate.

   b. Install handle/drive socket on reamer lug. See Figure 3-93.

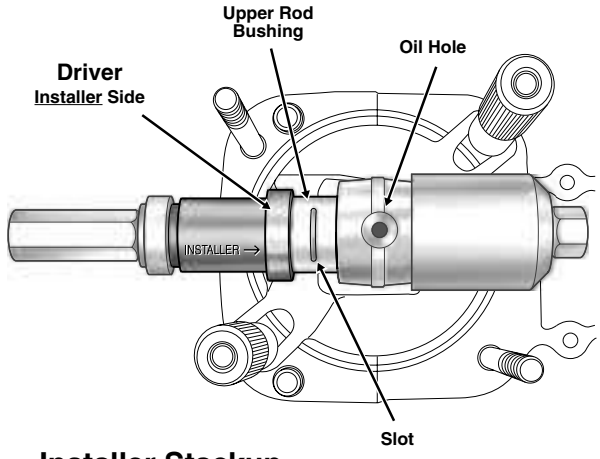
   c. Placing thumb on drive socket, apply slight pressure on reamer while rotating handle/drive socket in a clockwise direction.




**Remover Stackup**

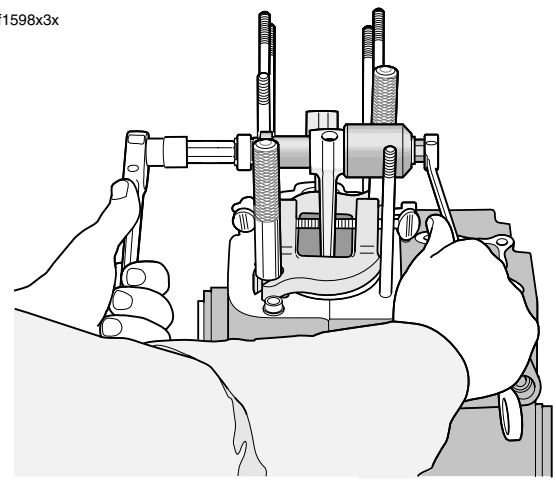
f1601x3x

f1602x3x




**Installer Stackup**

f1598x3x



**Hold hex nut on threaded rod with 5/8 inch box. Turn cylinder hex with 5/8 inch socket.**

**Figure 3-91. Remove/Install Connecting Rod Bushing**

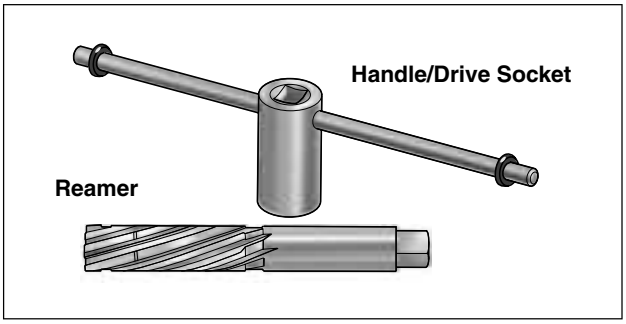



**Figure 3-92. Connecting Rod Bushing Reamer (Part No. HD-42318) and Handle/Drive Socket (Part No. HD-43645)**

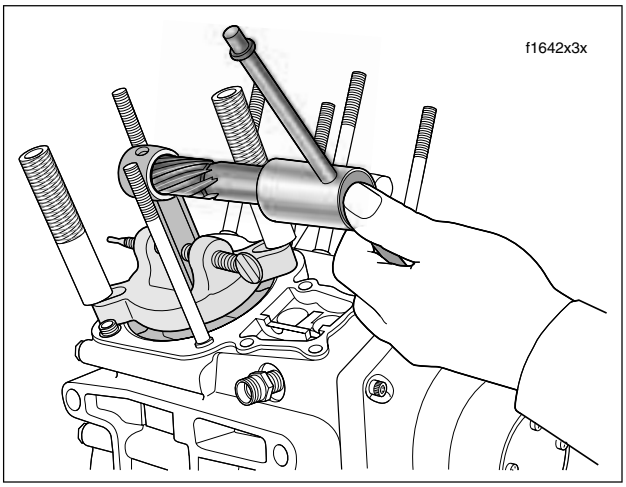



**Figure 3-93. Ream Connecting Rod Bushing**

**CAUTION**

**For best results, do not push on reamer or apply pressure to the reamer handle. While excessive pressure results in a rough cut, bushing bore will be tapered if pressure is not centrally applied.**

d. Continue rotating handle/drive socket until entire bit has passed through bushing and shank of reamer rotates freely in the bore.

**CAUTION**

**Never back reamer out of connecting rod or bushing will be damaged.**

e. Remove handle/drive socket, and carefully pulling on bit, draw shaft of reamer out of connecting rod bushing.

**CAUTION**

**Abrasive particles can damage machined surfaces and plug oil passageways possibly resulting in engine failure.**

2. Using contact cleaner or cleaning solvent, thoroughly wipe upper connecting rod and bushing of any metal shavings or debris.

## Honing Upper Rod Bushing

1. Obtain the CONNECTING ROD BUSHING HONE (HD-42569) and REAMER LUBRICANT (HD-39964). Proceed as follows:
   a. Install hone in a high speed electric drill.
   b. Apply reamer lubricant to finishing stones of hone and inside of upper connecting rod bushing.
   c. Start finishing stones of hone into bushing.
   d. Activating the drill, move the entire length of the finishing stone arrangement forward and backward through the bushing bore for 10 to 12 complete strokes. See Figure 3-95. Work for a crosshatch pattern of approximately 60˚.

**CAUTION**

**Abrasive particles can damage machined surfaces and plug oil passageways possibly resulting in engine failure.**

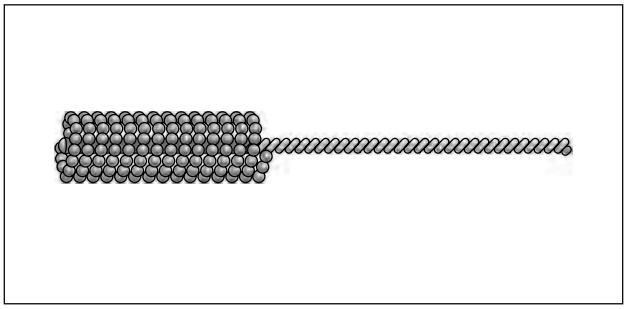


**Figure 3-94. Connecting Rod Bushing Hone (Part No. HD-42569)**

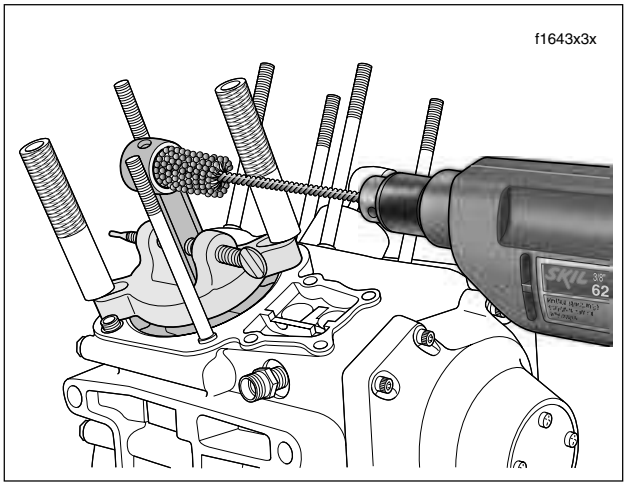



**Figure 3-95. Hone Connecting Rod Bushing**

2. Using contact cleaner or cleaning solvent, thoroughly wipe upper connecting rod and bushing of any metal shavings or debris. Continue wiping until a clean cloth shows no evidence of dirt or debris.
3. Lightly oil a good piston pin and insert it into the upper connecting rod bushing bore to feel for the proper interference fit. The pin should slide in and out of the bushing without binding, but also without pivoting or rocking.
4. Remove shop towels exercising caution that shavings, chips and other debris do not fall into crankcase.

## Installation

See Section 3.10 TOP END OVERHAUL, ASSEMBLY, steps 1-25 and 30-40.

**Legend:**

1. T20 TORX Screw
2. Cam Position Sensor Cover
3. Screw
4. Cam Cover
5. Cam Cover Gasket
6. Primary Cam Chain
7. Flange Bolt
8. Flat Washer
9. Primary Cam Sprocket
10. Spacer
11. Retaining Ring
12. Primary Cam Chain Tensioner
13. Flange Bolt
14. Flat Washer
15. Crank Sprocket
16. Crankshaft Bushing
17. Roll Pin
18. Oil Pressure Relief Valve
19. Valve Spring
20. Chain Guide
21. Screw
22. Cam Support Plate
23. Secondary Cam Chain Tensioner
24. Retaining Ring
25. O-Ring
26. Cleaning Plug
27. Retaining Ring
28. Rear Cam (Roller) Bearing
29. Front Cam (Ball) Bearing
30. Bearing Retainer Plate
31. T20 TORX Screw
32. Secondary Cam Chain
33. Roller Bearing Inner Race
34. Thrust Washer
35. O-Ring
36. Rear Camshaft
37. Front Camshaft
38. Feed Gerotor Set
39. Separator Plate
40. Wave Washer
41. Scavenge Gerotor Set
42. O-Ring
43. Oil Pump Housing
44. O-Ring (Scavenge Port Stub)
45. O-Ring (Oil Feed Hole)
46. O-Ring (Blind Hole)
47. Right Crankcase Half

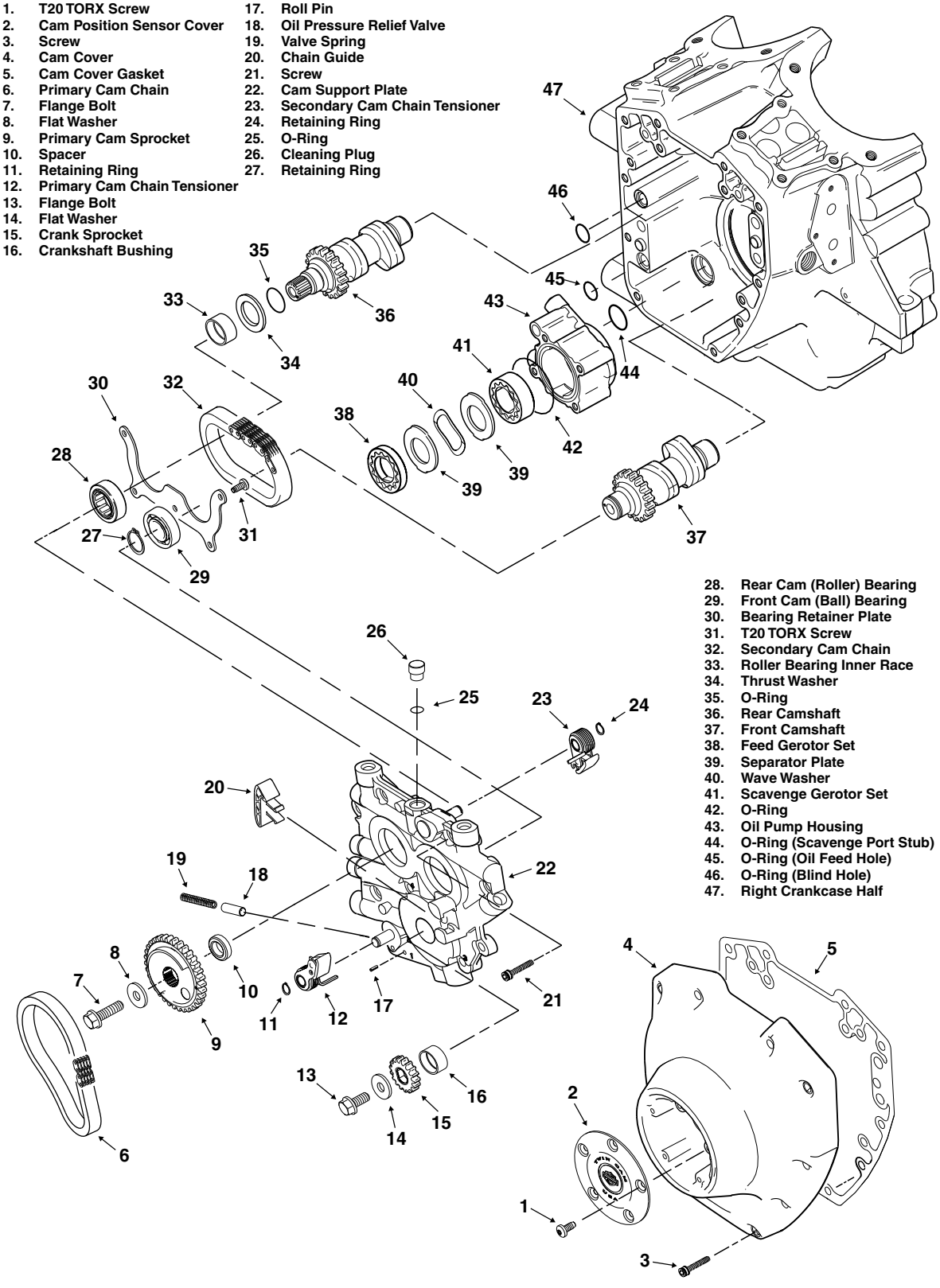



**Figure 3-96. Cam Support Plate/Oil Pump Assemblies (Exploded View)**

# BOTTOM END

# CAM SUPPORT PLATE

## Removal

1. See Section 3.10 TOP END OVERHAUL, DISASSEMBLY, steps 1-11.

*NOTE*

*When removing the cam support plate, it is not necessary to disturb the lifter assemblies if a method is devised to prevent the hydraulic lifters from dropping into the cam compartment. One such method is provided in the following step. Leaving the lifter assemblies intact simplifies the procedure, since the lifter cover, gasket, anti-rotation pin and hydraulic lifters can be left in place.*

2. Fashion lifter holding tool as follows:
   a. Obtain a large binder clip (available at any office supply store). Squeeze wireforms to remove from binder clip. See upper frame of Figure 3-97.
   b. Compress wireform slightly and insert free ends into outer and inner lifter cover bores so that legs engage walls of both hydraulic lifter sockets. See lower frame of Figure 3-97.
3. See Section 3.11 BOTTOM END OVERHAUL, DISASSEMBLY, steps 1-14.

## Disassembly/Assembly

**⚠CAUTION**

**Do not pull the retention pins from the primary or secondary cam chain tensioners with the chains and sprockets removed. With 35-40 pounds of spring pressure behind the tensioner, allowing it to accelerate through its full length of travel will cause spring stretching and/or cracking of the tensioner shoe, damage which requires replacement of the assembly. Furthermore, if the tensioner should contact fingers or other parts of the hand, minor or moderate injury may occur.**

*NOTE*

*If the retention pins interfere with cleaning or service procedures, hold the retracted cam chain tensioner with the CAM CHAIN TENSIONER UNLOADER (HD-42313), pull the retention pin and ease the assembly into the unloaded position.*

## Crankshaft Bushing

### Removal

1. Obtain the CRANKSHAFT BUSHING REMOVER/INSTALLER (HD-42315).
2. Center support tube under ram of arbor press.
3. Center crankshaft bushing in cam support plate over support tube. Be sure that the primary cam chain side of the cam support plate is facing upward.

**CAUTION**

**If the crankshaft bushing is pressed out the primary cam chain side, the bore will be damaged by the knurled edge of the bushing. Damage to the bore requires replacement of the cam support plate.**

4. Insert remover side of driver into crankshaft bore so that shoulder on tool is seated on edge of bushing. See upper frame of Figure 3-99.
5. Press on driver until collar of tool contacts cam support plate. Remove bushing from support tube and discard.

### Installation

1. Obtain the CRANKSHAFT BUSHING REMOVER/INSTALLER (HD-42315).
2. Center support tube under ram of arbor press.

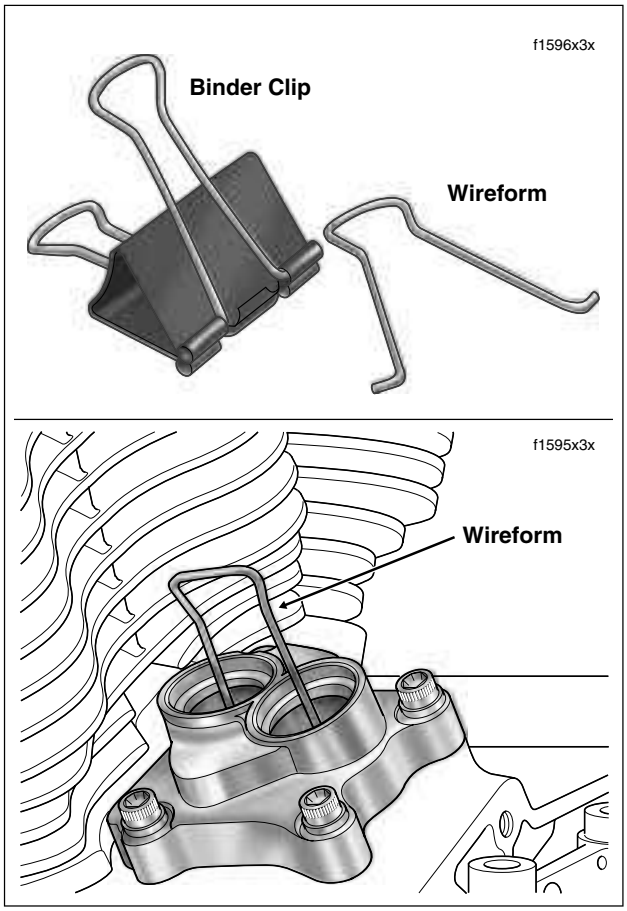



**Figure 3-97. Fashion Tool to Hold Hydraulic Lifters**

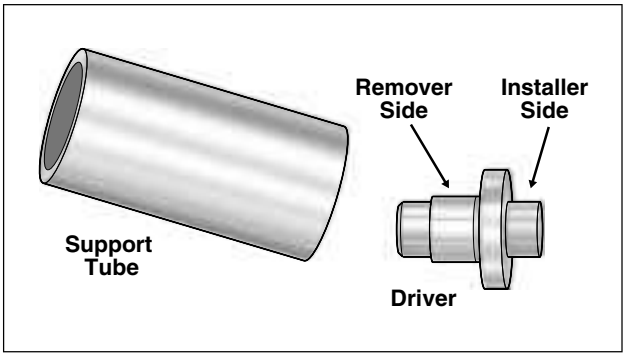



**Figure 3-98. Crankshaft Bushing Remover/Installer (Part No. HD-42315)**

3. Turn cam support plate over so that secondary cam chain side is facing upward.
4. Start **new** bushing into bore with the knurled edge topside. Be sure that hole in bushing is aligned with oil hole in bushing bore.

**CAUTION**

**If the crankshaft bushing is pressed in from the primary cam chain side, or from the secondary cam chain side with the knurled edge of the bushing down, the bushing bore will be damaged. Damage to the bore requires replacement of the cam support plate.**

5. Center crankshaft bushing bore over support tube.
6. Insert installer side of driver into bushing. See lower frame of Figure 3-99.
7. Press on driver until collar of tool makes firm contact with cam support plate.
8. Ream the crankshaft bushing following the directions below.

## Reaming Crankshaft Bushing

*NOTE*

*A **new** crankshaft bushing must be reamed for proper size and alignment. If crankcase halves are not split, ream the bushing using a spare right case half to avoid further engine disassembly.*

1. Slide cam support plate onto two ring dowels in crankcase flange.
2. Install six allen head socket screws (1/4 x 1 inch) to secure cam support plate to crankcase flange. Alternately tighten screws until snug.
3. Obtain the CRANKSHAFT BUSHING REAMER (HD-42316) and REAMER HANDLE/DRIVE SOCKET (HD-43645). Proceed as follows:

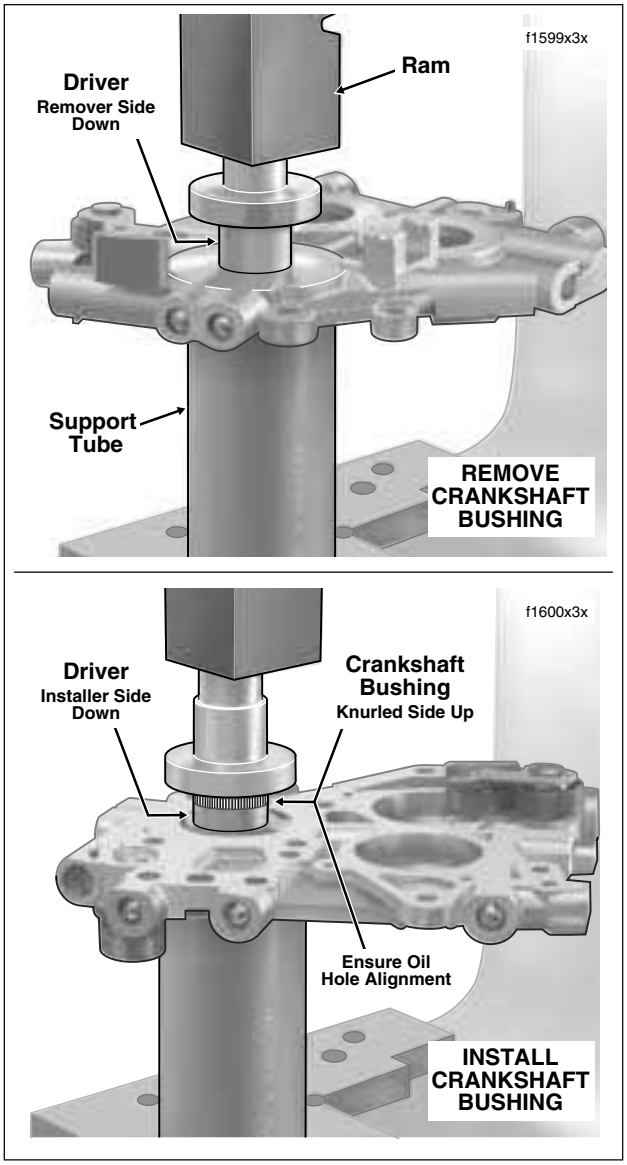



**Figure 3-99. Remove/Install Crankshaft Bushing in Cam Support Plate**

a. From flywheel compartment side, carefully insert tapered end of reamer pilot into crankshaft roller bearing until it stops. See left frame of Figure 3-101.
b. Slide reamer through pilot starting bit into crankshaft bushing in cam support plate. Do not apply lubricant to reamer or bushing. Ream the bushing dry or cut will not be accurate.
c. Install handle/drive socket on reamer lug. See right frame of Figure 3-101.
d. Placing thumb on drive socket, apply slight pressure on reamer while rotating handle/drive socket in a clockwise direction.

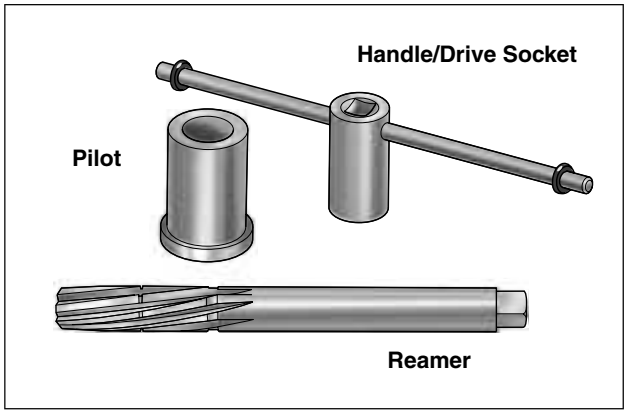



**Figure 3-100. Crankshaft Bushing Reamer (Part No. HD-42316) and Handle/Drive Socket (Part No. HD-43645)**

**CAUTION**

**For best results, do not push on reamer or apply pressure to the reamer handle. While excessive pressure results in a rough cut, bushing bore will be tapered if pressure is not centrally applied.**

e. Continue rotating handle/drive socket until entire bit has passed through bushing and shank of reamer rotates freely in the bore.

**CAUTION**

**Never back reamer out flywheel side of crankcase or crankshaft bushing will be damaged.**

f. Remove handle/drive socket, and carefully pulling on bit, draw shaft of reamer out of bushing on cam side of crankcase.

g. Remove pilot from crankshaft roller bearing. Tap on pilot using a soft rubber mallet, if necessary.

4. Remove the allen head socket screws to release the cam support plate from the crankcase flange.

**CAUTION**

**Abrasive particles can damage machined surfaces and plug oil passages possibly resulting in engine failure.**

5. Using a small screwdriver, carefully pry cleaning plug from top of cam support plate. Thoroughly flush right crankcase half and cam support plate in cleaning solvent to remove any metal shavings or debris. Blow dry with compressed air. Install cleaning plug in cam support plate replacing O-ring if torn or damaged.

## Camshafts/Camshaft Bearings

### Removal

1. Place cup of CAM CHAIN TENSIONER UNLOADER (HD-42313) over spring coil of secondary cam chain tensioner positioning finger on tool between tensioner and shoe. See Figure 3-102. Rotate tool in a counterclockwise direction inserting retention pin through hole in boss on **primary cam chain side** of cam support plate. Pin engages hooks on tensioner to hold it in the retracted position. For best results, place cam support plate in a vise using brass jaw inserts to prevent casting damage.

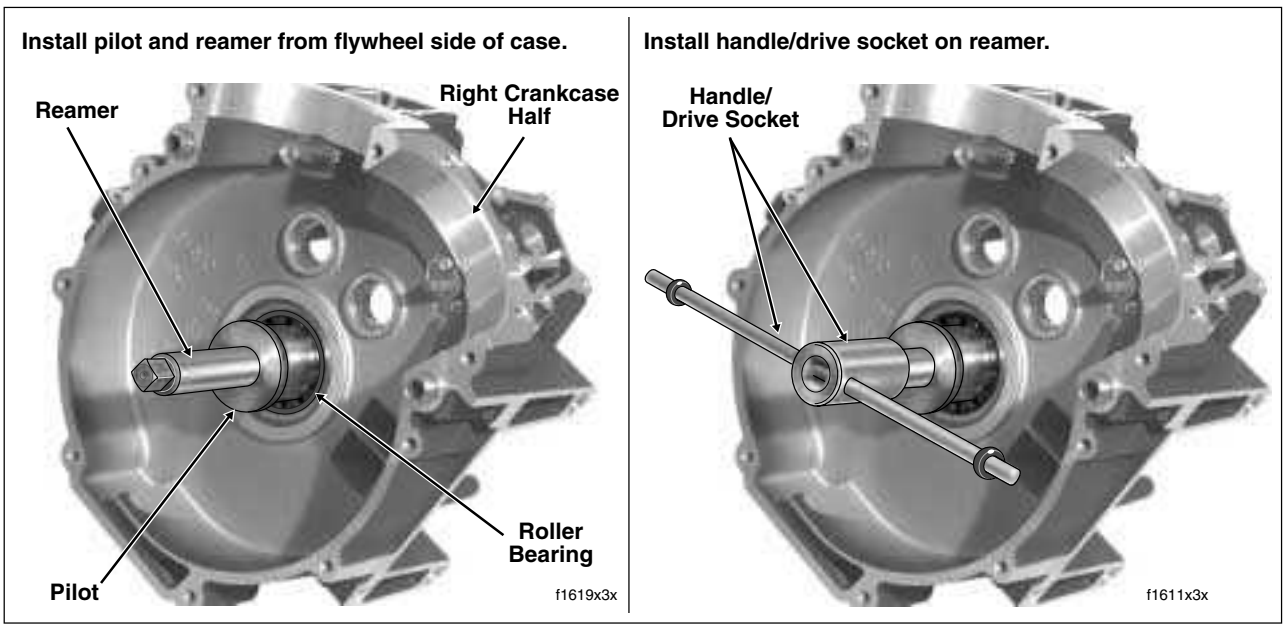



**Figure 3-101. Ream Crankshaft Bushing**

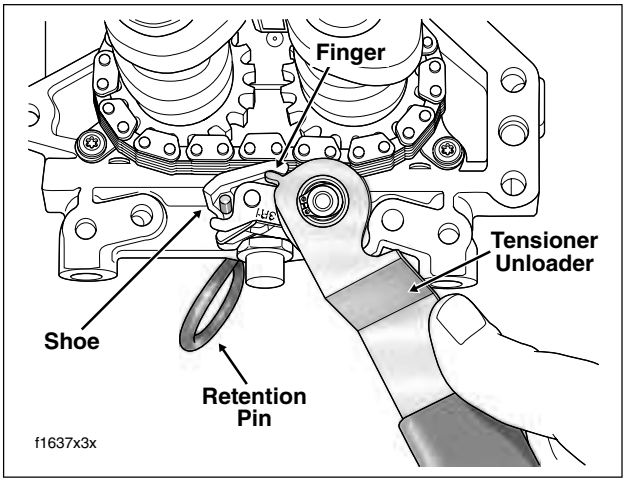



**Figure 3-102. Retract Secondary Cam Chain Tensioner**

**⚠WARNING**

**Always wear proper eye protection when removing 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.**

2. Remove retaining ring from groove at end of front camshaft. Discard retaining ring.
3. Remove four T20 TORX screws to free bearing retainer plate from inboard side of cam support plate.
4. Using a colored marker, mark one of the links of the secondary cam chain. Maintaining the original direction of rotation during assembly may prolong service life of chain.
5. With the primary cam chain side facing upward, place cam support plate on parallel blocks under ram of arbor press.
6. Obtain the CAMSHAFT/CAMSHAFT BEARING REMOVER/INSTALLER (HD-43644). See Figure 3-103.

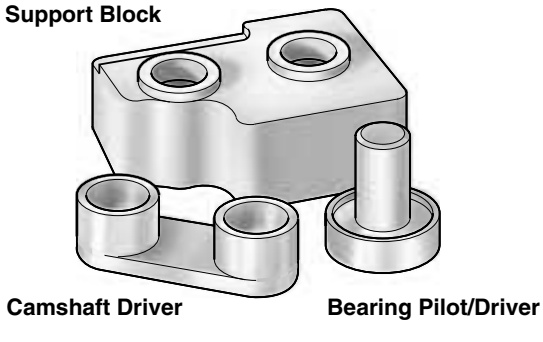
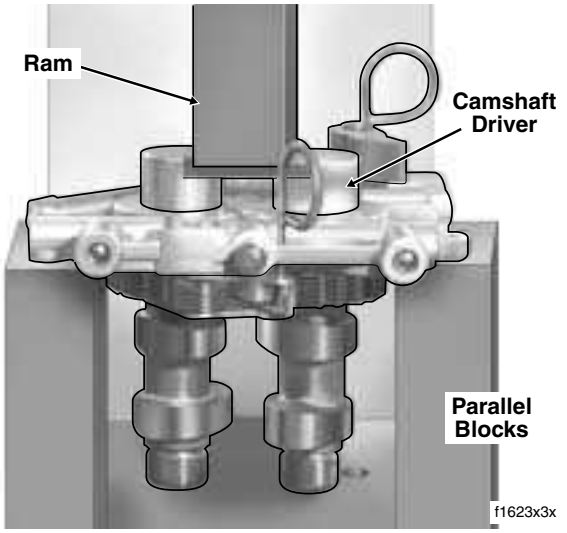



**Figure 3-103. Camshaft/Camshaft Bearing Remover/Installer (Part No. HD-43644)**

**Press out camshafts (with bearings).**




**Remove bearing from front camshaft.**

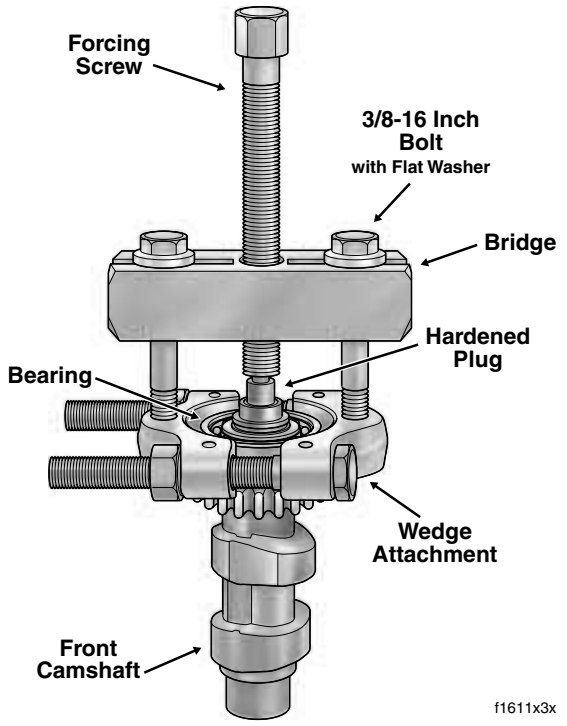



**Figure 3-104. Remove Camshafts/Front Cam Bearing**

**CAUTION**

**Since the bearing fit to the camshafts is tighter than its fit in the support plate, any attempt to remove the camshafts without the bearings will result in damage to the cam support plate and bearing retainer plate, if installed.**

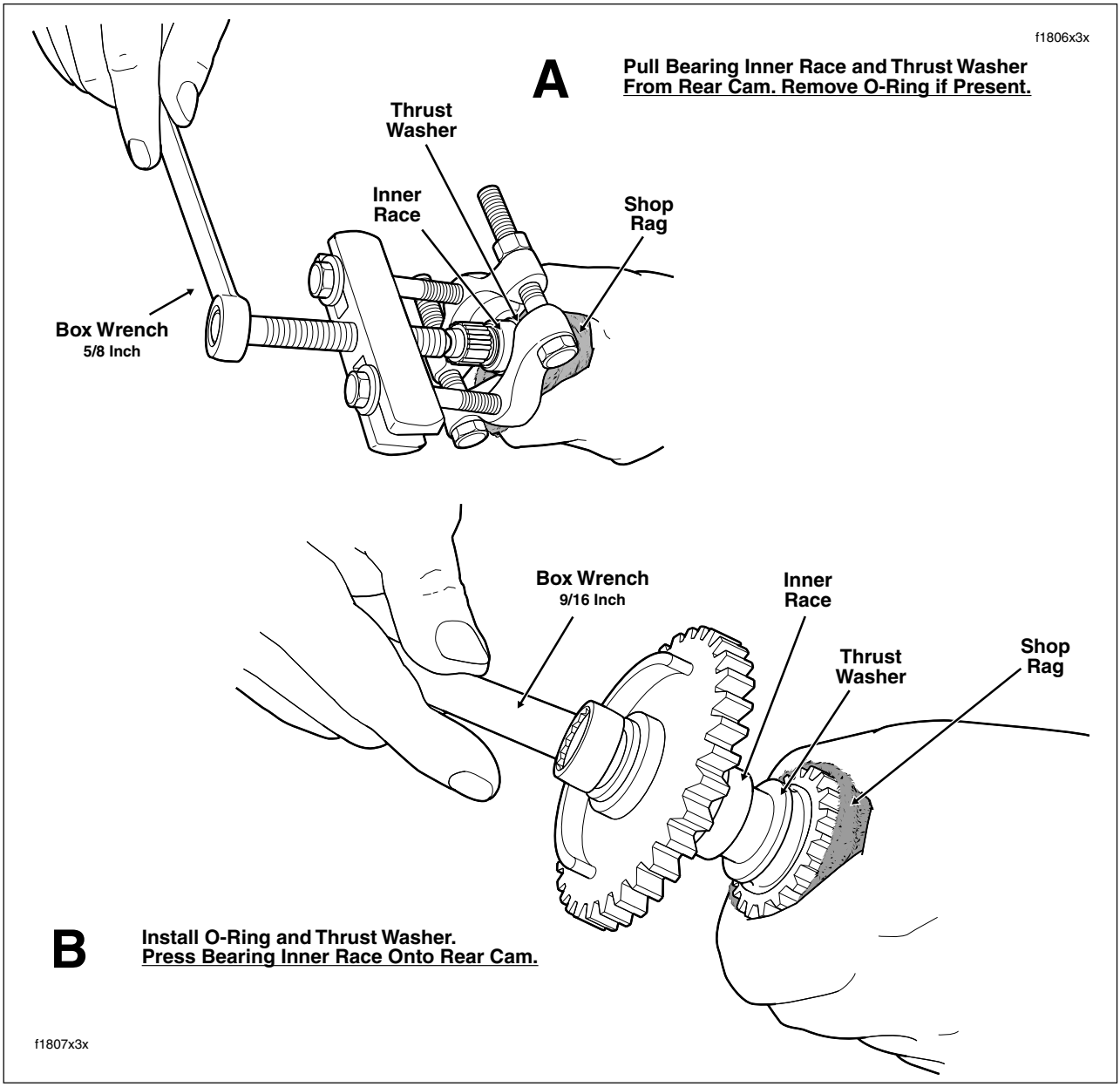



**Figure 3-105. Remove/Install Bearing Inner Race (With O-Ring and Thrust Washer) Onto Rear Camshaft**

**CAUTION**

**Cam bearings may be a loose fit in the cam support plate. To avoid possible damage, be aware that camshaft and bearing assemblies may drop out at start of press procedure.**

7. Fit cups of camshaft driver over ends of front and rear camshafts, so that contact is made with the bearing inner races. Centering driver under ram at a point midway between the camshafts, simultaneously press both camshafts (with attached bearings) from the cam support plate. See upper frame of Figure 3-104.
8. Remove secondary cam chain from cam sprockets.
9. If reusing front camshaft, remove bearing as follows:
   a. Position WEDGE ATTACHMENT (HD-95637-46A) on inboard side of front camshaft bearing and turn hex nuts an equal number of turns to draw halves of wedge together.

b. Obtain two 3/8-16 inch bolts 3-1/2 inches long (with flat washers). Install flat washers on bolts. Obtain bridge, forcing screw and hardened plug from MAINSHAFT BEARING INNER RACE PULLER/ INSTALLER (HD-34902B).

c. Slide one bolt into channel on each side of bridge so that flat washer is between bridge and bolt head. Thread bolts into wedge attachment an equal number of turns.

d. Sparingly apply graphite lubricant to threads of forcing screw to prolong service life and ensure smooth operation. Start forcing screw into center hole of bridge.

**CAUTION**

**Failure to use hardened plug may result in damage to forcing screw and/or camshaft.**

e. Place cupped side of hardened plug against end of camshaft. Thread forcing screw into bridge until the steel ball at the end of the screw makes firm contact with hardened plug.

f. Verify that the tool assembly is square so that the bearing is not cocked during removal. See lower frame of Figure 3-104. Turn forcing screw until bearing is pulled free of camshaft. Discard bearing.

10. If reusing rear camshaft, remove roller bearing assembly as follows:

a. Slide roller bearing from end of rear camshaft. Since bearing is a loose fit on cam, no pressing tools are required.

b. Install tools as you would to remove the bearing from the front camshaft, but position cup of wedge inboard of the thrust washer.

c. Wrap a shop rag around camshaft to get a firm grip and also to protect hand from sharp edges of sprocket.

d. Using a 5/8 inch box wrench, turn forcing screw until bearing inner race and thrust washer are pulled free of camshaft. See A of Figure 3-105. A light interference fit allows the parts to be removed with little effort. Discard inner race and thrust washer.

e. If present, remove O-ring from grinding relief groove in camshaft. Groove is on the splined end between the machined area and the secondary cam sprocket. Discard O-ring.

*NOTE*

*Since the O-ring is not used in production, it will only be found if the cams were serviced at the dealer level.*

## Installation

1. Obtain new rear cam roller bearing kit (Part No. 8983). See Figure 3-106.

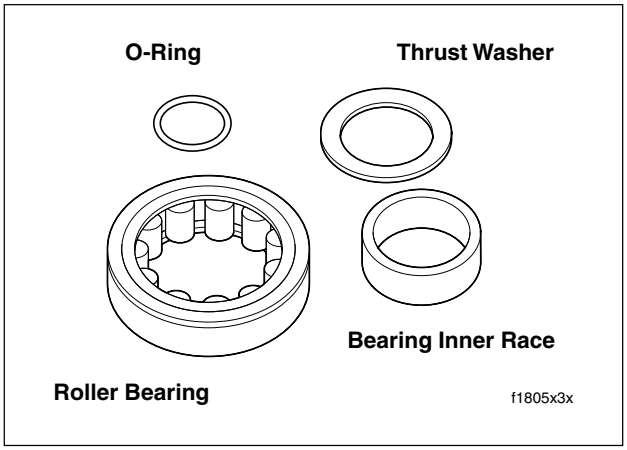



**Figure 3-106. Rear Cam Roller Bearing Kit (P/N 8983)**

2. Install O-ring, thrust washer and bearing inner race onto rear camshaft as follows:

a. To properly locate thrust washer, first install O-ring in grinding relief groove. Groove is on the splined end between the machined area and the secondary cam sprocket. Exercise caution to avoid stretching or breaking the O-ring. Since the O-ring is not sold separately, damage will require purchase of a new roller bearing kit.

**CAUTION**

**The thrust washer will be offset to one side if the O-ring is not installed in the grinding relief groove. Damage to the bearing cage can occur if the thrust washer is not properly centered.**

b. Slide thrust washer down rear camshaft until centered over O-ring in grinding relief groove.

c. Slide bearing inner race down rear camshaft until contact is made with shoulder of machined area.

d. Install primary cam sprocket spacer and sprocket on camshaft and secure using thicker flat washer and long flange bolt.

*NOTE*

*If not enough of the splined shaft is exposed to install the sprocket, leave out the spacer and proceed to step 2(e). Once the bearing inner race has been started onto the machined area, remove the flange bolt, washer and sprocket, and then reassemble using the spacer. Repeat step 2(e) to fully install bearing inner race.*

e. Wrap a shop rag around camshaft to get a firm grip and also to protect hand from sharp edges of sprocket. Using a 9/16 inch box wrench, turn flange bolt in a clockwise direction. Bearing inner race is fully installed when it makes firm contact with the thrust washer. See B of Figure 3-105.

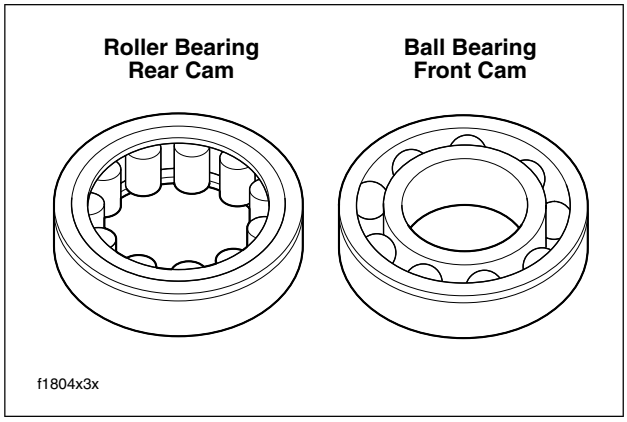



**Figure 3-107. Cam Bearings**

f. Verify that the thrust washer is locked in place and cannot be rotated. If necessary, install shaft in vise using brass jaw inserts, and further tighten flange bolt until the desired result is achieved.

g. Remove flange bolt, flat washer, sprocket and spacer.

**CAUTION**

**Always install new bearings. Only use genuine Harley-Davidson bearings. Reusing old bearings or using bearings from a supplier other than Harley-Davidson will result in engine damage.**

3. Obtain the CAMSHAFT/CAMSHAFT BEARING REMOVER/INSTALLER (HD-43644).
4. With the secondary cam chain side facing upward, place cam support plate on support block, so that outer races of bearings are properly supported. Note that one corner of the support block is contoured to accommodate the chain guide blocks cast into the front of the support plate.
5. Center **new** bearing over bearing bore with the lettered side up. Slide pilot shaft of bearing driver through bearing into hole of support block.

*NOTE*

*Be aware that the front and rear cam bearings are no longer interchangeable. The rear bearing is now the roller type, while the front remains the ball bearing kind. See Figure 3-107.*

6. Center bearing driver under ram of arbor press. Press on driver until bearing makes firm contact with counterbore in cam support plate. See upper frame of Figure 3-109. Repeat steps to install second bearing.

*NOTE*

*Bearings may be a press to loose fit. If deemed necessary, clean bearing OD and apply Loctite Low Strength Threadlocker 242 (Blue) before installation, but exercise caution to avoid getting compound on rollers or bearing ID.*

7. Apply a small dab of Loctite Medium Strength Threadlocker 243 (blue) to threads of four bearing retainer plate screws. Using a T20 TORX drive head, secure bearing retainer plate to cam support plate. Tighten screws to 20-30 **in-lbs** (2.3-3.4 Nm) in a crosswise pattern. Verify that hole in retainer plate is properly aligned with secondary cam chain oiler.
8. Place cam support plate back on support block, if removed. Block properly supports inner races of bearings as camshafts are installed.
9. Align punch marks on teeth of secondary cam sprockets (outboard faces). See Figure 3-108. Using a colored marker, carefully mark the punch mark locations on the inboard side of the sprocket teeth. These marks are needed to observe proper orientation of the camshafts when they are pressed into the bearings.

*NOTE*

*If installing **new** camshafts, verify that the alpha character stamped on the inboard ends of the shafts correspond to the model being serviced (A= carbureted, B= fuel injected).*

10. Place the secondary cam chain around the sprockets of both the front and rear camshafts. To maintain the original direction of rotation, be sure that the colored mark placed on the chain link during disassembly is facing opposite the cam support plate during installation.
11. Orient the camshafts so that they are positioned on opposite ends of the chain, and then verify that the colored marks placed on the inboard side of the sprocket teeth are still in alignment.

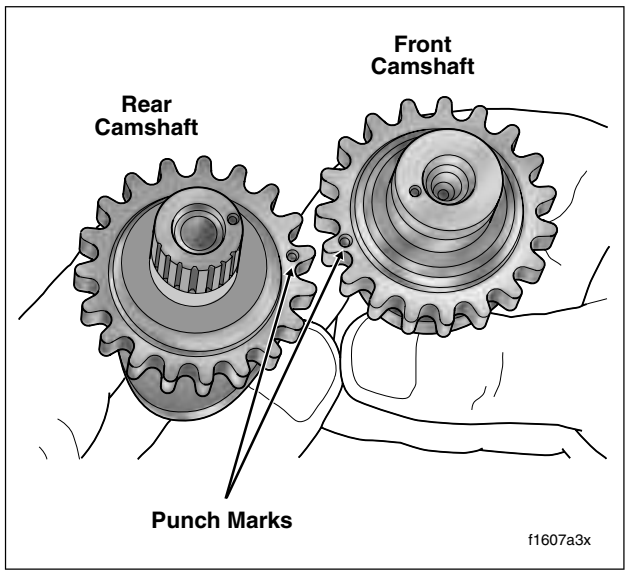
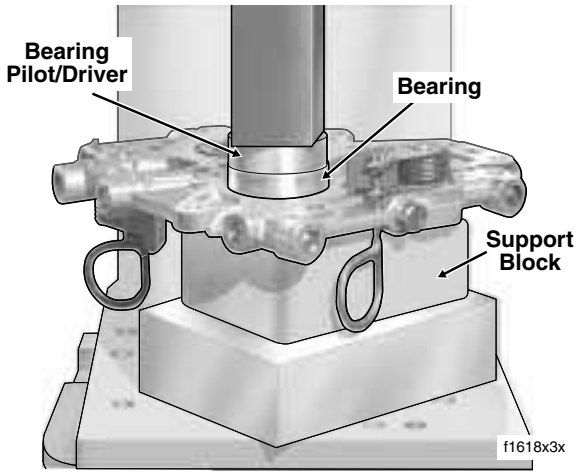
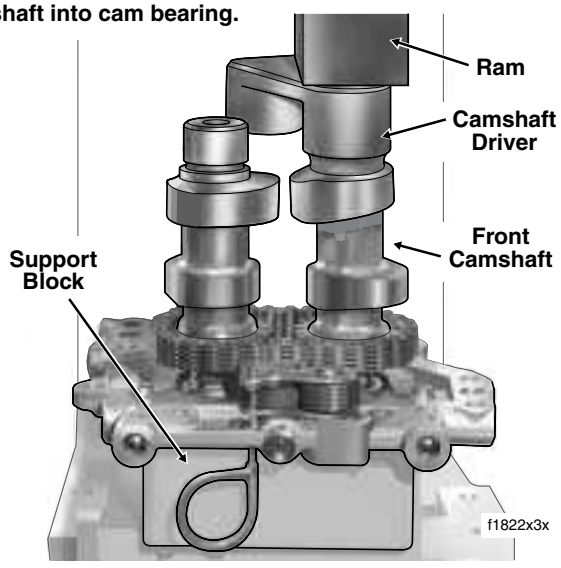



**Figure 3-108. Align Punch Marks on Teeth of Camshaft Sprockets**

**Press bearings into cam support plate.**




**Center front camshaft under ram. Start front camshaft into cam bearing.**




**While applying pressure to front camshaft, wiggle rear camshaft to guide inner race between bearing rollers.**

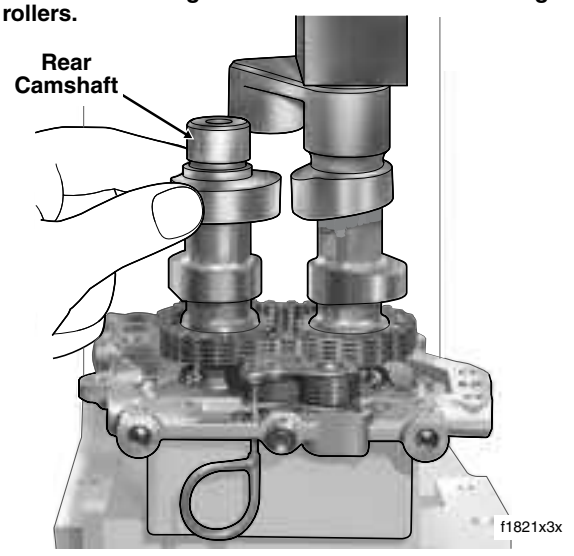



**Figure 3-109. Install Cam Bearings/Camshafts**

12. Maintaining the position of the camshafts on the chain with the colored marks in alignment, place the sprocket ends of the camshafts into the bearings.

*NOTE*

*Do not mix camshafts during the press procedure. The rear camshaft, which can be identified by the splined shaft, must go into the roller bearing at the rear of the cam support plate.*

13. Place cup of camshaft driver over end of front camshaft **only**.

**CAUTION**

**Verify that splined end of rear camshaft has been started into support block. Damage to the camshaft and/or support block can occur if end of camshaft catches top of block during the press procedure.**

*NOTE*

*To reduce the likelihood of such contact occuring, use 7/8 inch drill bit to enlarge rear cam bore in support block. For best results, radius top inside edge of bore after drilling.*

**CAUTION**

**Be sure that the tensioner shoe is clear of the secondary cam chain during the press procedure. Contact can result in damage that requires replacement of the tensioner assembly.**

14. Center end of front camshaft under ram and slowly apply pressure to driver just to **start** front camshaft into bearing ID. See center frame of Figure 3-109.

**CAUTION**

**If rear camshaft is not properly aligned, edge of installed inner race can catch on bearing rollers. Bearing damage can result if contact occurs during the press procedure.**

15. Slowly apply pressure to driver on front camshaft, while wiggling rear camshaft as necessary to guide inner race between bearing rollers. See lower frame of Figure 3-109.

16. When inner race on rear cam is started into roller bearing, apply pressure to driver until front camshaft is fully seated. If necessary, keep finger pressure at top of rear camshaft to ensure that assembly remains square and inner race moves to installed position in roller bearing.

17. Since the punch marks on the secondary sprockets cannot be observed once the camshafts are pressed into the bearings, note that the outboard ends of the shafts have a second set of punch marks. Using a straightedge, verify that these punch marks are in alignment. See Figure 3-110. If they are not, then the camshafts must be removed and reinstalled (with a new bearing set).

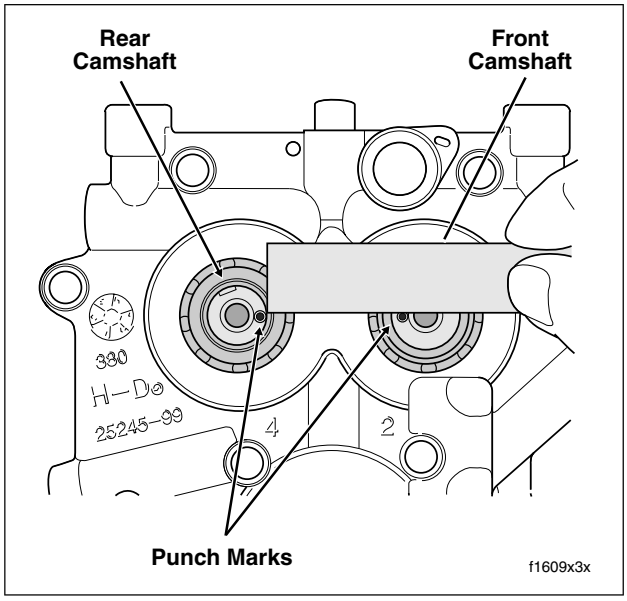



**Figure 3-110. Verify Alignment of Punch Marks on Ends of Camshafts**

**⚠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.**

18. Install **new** retaining ring in groove at end of front camshaft.

## Cam Chain Tensioners

### Removal

**⚠CAUTION**

**Do not pull the retention pins from the primary or secondary cam chain tensioners with the chains and sprockets removed. With 35-40 pounds of spring pressure behind the tensioner, allowing it to accelerate through its full length of travel will cause spring stretching and/or cracking of the tensioner shoe, damage which requires replacement of the assembly. Furthermore, if the tensioner should contact fingers or other parts of the hand, minor or moderate injury may occur.**

1. If retracted, hold the cam chain tensioner with the CAM CHAIN TENSIONER UNLOADER (HD-42313), pull the retention pin and ease the assembly into the unloaded position.

**⚠WARNING**

**Always wear proper eye protection when removing 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.**

2. Remove retaining ring from groove in tensioner post. Discard retaining ring.
3. Slide cam chain tensioner assembly from post disengaging spring pin from hole in cam support plate.




**Figure 3-111. Cam Chain Tensioner Shoe Wear**

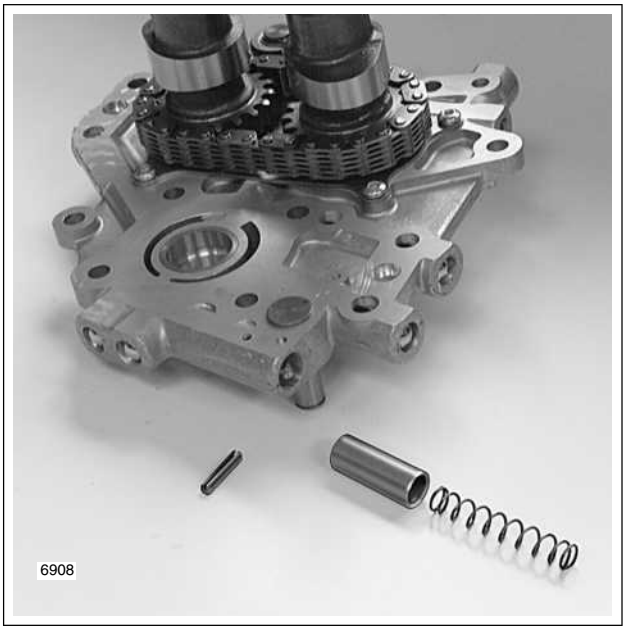



**Figure 3-112. Oil Pressure Relief Valve Assembly**

### Installation

1. Slide cam chain tensioner assembly onto post inserting spring pin into hole in cam support plate.

**⚠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.**

2. Install **new** retaining ring in groove of post. Verify that the ring is fully seated in the groove.
3. If retracted prior to disassembly, place cup of CAM CHAIN TENSIONER UNLOADER (HD-42313) over spring coil of cam chain tensioner assembly. Retract the tensioner inserting a retention pin through hole in boss on the **primary cam chain side** of cam support plate.

## Oil Pressure Relief Valve

### Removal

1. Remove the primary cam chain tensioner assembly. See CAM CHAIN TENSIONERS, REMOVAL.
2. Secure the cam support plate in a vise with access to the roll pin. Be sure to install a pair of brass jaw inserts in the vise to avoid damage to the casting.
3. Using a 1/8 inch punch with a small hammer, carefully tap roll pin from pin hole in cam support plate. Discard roll pin.
4. Remove spring and valve body from bypass port.

### Installation

1. Secure the cam support plate in a vise. Be sure to install a pair of brass jaw inserts to avoid damage to the casting.
2. Lubricate valve body with clean H-D 20W50 engine oil. Slide valve body into bypass port of cam support plate with the open side facing outward.
3. Slide spring into bypass port until seated in open side of valve body.
4. Start **new** roll pin into hole in cam support plate. Compress spring in port using the blade of a small screwdriver.
5. Holding spring compressed, tap roll pin into cam support plate until it approaches pin hole on opposite side.
6. Remove screwdriver to release spring. Verify that spring is straight and square in bore.
7. Using a 1/8 inch punch with a small hammer, carefully tap roll pin until flush with casting.
8. Install the primary cam chain tensioner assembly. See CAM CHAIN TENSIONERS, INSTALLATION, on this page.

## Cam Needle Bearings

### Removal

1. Obtain the CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER (HD-42325).
2. Remove four button fasteners from threaded holes in support plate, if installed. See Figure 3-113.

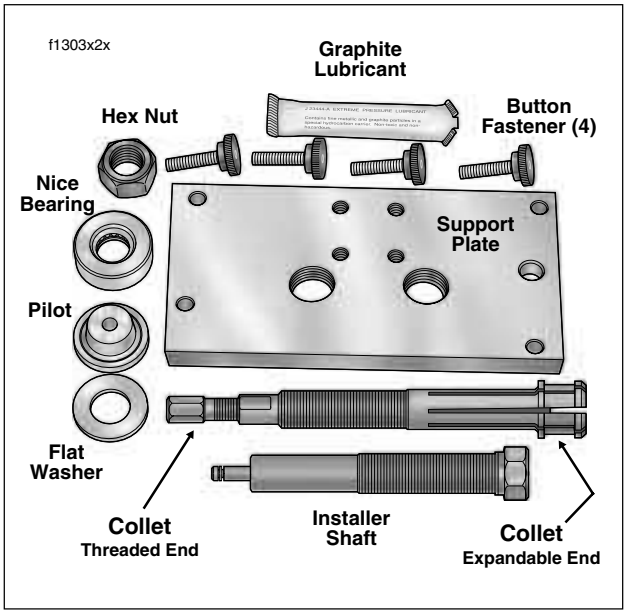



**Figure 3-113. Camshaft Needle Bearing Remover/Installer (HD-42325)**

3. Sparingly apply graphite lubricant to threads of collet to prolong service life and ensure smooth operation.
4. Slide collet through support plate so that threaded end exits stamped side of plate.
5. Aligning two large holes in support plate with needle bearing bores, hang right side of plate on ring dowel in crankcase flange.
6. Align four holes at corners of support plate with threaded holes in crankcase flange. Install button fasteners in these holes to secure support plate to crankcase. See upper frame of Figure 3-114.
7. Center expandable end of collet in bearing bore and slide Nice bearing and flat washer on threaded end. Start hex nut on threaded end.
8. Push expandable end of collet through bearing bore into flywheel compartment. Feel for inside edge of needle bearing using end of collet and then back off slightly.
9. Holding collet to prevent lateral movement, finger tighten hex nut until Nice bearing contacts support plate.
10. Using a 7/16 inch open end wrench, hold flat on collet to prevent rotation. Using a second 7/16 inch open end wrench, expand collet by turning hex at end of shaft in a clockwise direction. See center frame of Figure 3-114. Expandable end of collet makes contact with needle bearing ID.
11. Using a 15/16 inch open end wrench, turn hex nut in a clockwise direction until bearing is free. If necessary, hold flat on collet to prevent rotation. See lower frame of Figure 3-114.
12. Remove four button fasteners and pull support plate from crankcase.
13. Holding flat on collet, turn hex at end of shaft in a counterclockwise direction to close collet. Remove and discard needle bearing.
14. Remove hex nut, flat washer and Nice bearing from threaded end of collet. Pull collet from support plate.
15. Return to step 1 to remove second needle bearing.

### Installation

1. Obtain the CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER (HD-42325).
2. Sparingly apply graphite lubricant to threads of installer shaft to prolong service life and ensure smooth operation.
3. Thread installer shaft into stamped side of support plate until threads begin to emerge from opposite side.
4. Install pilot at end of installer shaft.
5. Place **new** needle bearing on pilot with lettered side facing shoulder.

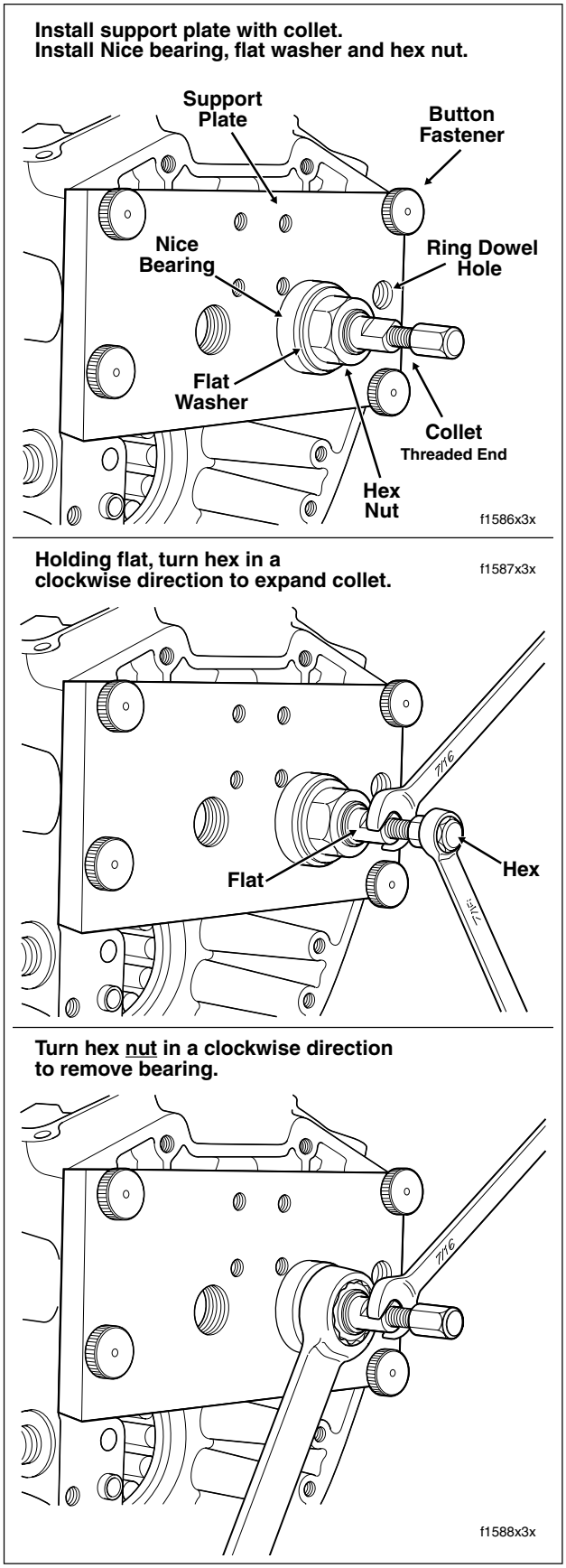
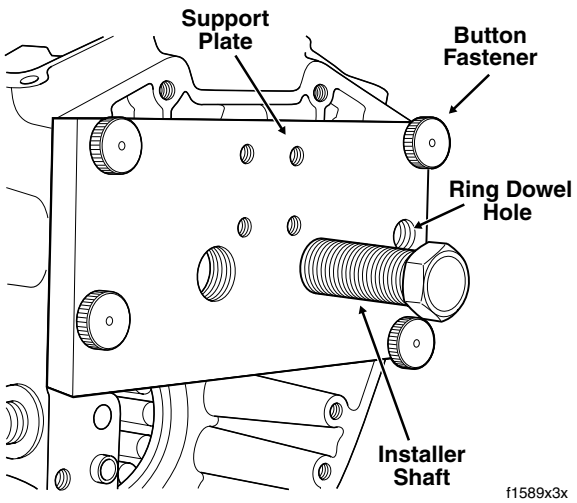



**Figure 3-114. Remove Cam Needle Bearing**

**Install support plate with installer shaft (and pilot).**




**Turn hex on installer shaft in a clockwise direction to install bearing.**

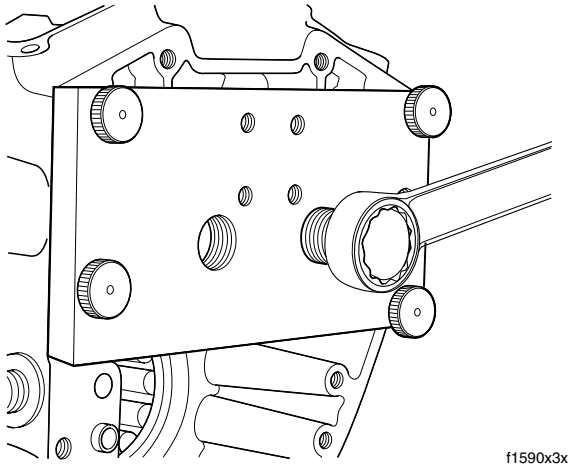



**Figure 3-115. Install Cam Needle Bearing**

6. Aligning two large holes in support plate with needle bearing bores, hang right side of plate on ring dowel in crankcase flange.
7. Align four holes at corners of support plate with threaded holes in crankcase flange. Install button fasteners in these holes to secure support plate to crankcase. See upper frame of Figure 3-115.
8. Using 15/16 inch open end wrench, turn hex at end of installer shaft in a clockwise direction until resistance is felt. See lower frame of Figure 3-115.
9. Turn end of installer shaft in a counterclockwise direction until pilot is free of needle bearing bore.
10. Remove four button fasteners and pull support plate and installer shaft from crankcase.
11. Remove pilot from installer shaft. Unthread installer shaft from support plate.
12. Return to step 1 to install second needle bearing.
13. Thread four button fasteners into threaded holes in support plate to prevent loss.

## Cleaning and Inspection

1. Using a small screwdriver, carefully pry cleaning plug from top of cam support plate. See Figure 3-116.
2. Thoroughly flush cam support plate with a non-volatile cleaning solution or solvent and then blow dry with low pressure compressed air.
3. Reinstall cleaning plug replacing O-ring if damaged or deteriorated.
4. Verify that all oil holes are clean and open.

**CAUTION**

**Exercise caution to avoid enlarging the oil holes or oil pressure will be adversely affected.**

## Installation

1. See Section 3.11 BOTTOM END OVERHAUL, ASSEMBLY, steps 6-23.
2. Remove wireforms to release hydraulic lifters.
3. See Section 3.10 TOP END OVERHAUL, ASSEMBLY, steps 30-40.




**Figure 3-116. Remove Cleaning Plug**

# OIL PUMP

## Removal

1. See Section 3.10 TOP END OVERHAUL, DISASSEMBLY, steps 1-11.

*NOTE*

*When removing the cam support plate, it is not necessary to disturb the lifter assemblies if a method is devised to prevent the hydraulic lifters from dropping into the cam compartment. One such method is provided in the following step. Leaving the lifter assemblies intact simplifies the procedure, since the lifter cover, gasket, anti-rotation pin and hydraulic lifters can be left in place.*

2. Fashion lifter holding tool as follows:
   a. Obtain a large binder clip (available at any office supply store). Squeeze wireforms to remove from binder clip. See upper frame of Figure 3-97.
   b. Compress wireform slightly and insert free ends into outer and inner lifter cover bores so that legs engage walls of both hydraulic lifter sockets. See lower frame of Figure 3-97.
3. See Section 3.11 BOTTOM END OVERHAUL, DISASSEMBLY, steps 1-15.

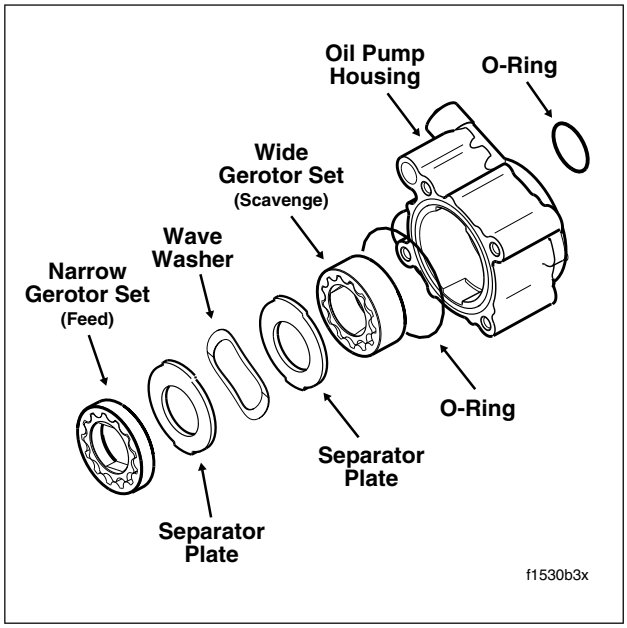



**Figure 3-117. Oil Pump Assembly**

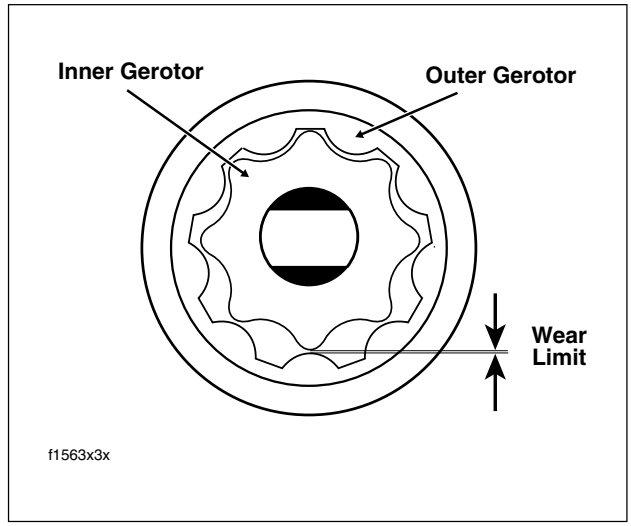



**Figure 3-118. Measure Gerotor Sets for Wear**

## Cleaning and Inspection

1. Clean all parts in a non-volatile cleaning solution or solvent.
2. Thoroughly dry all parts with low pressure compressed air. Verify that all oil passages are clean and open.
3. Look for scoring, gouging or cracking caused by foreign material that may have passed through the oil pump.
4. Look for grooves or scratches on the cam support plate, which serves as the outboard side of the oil pump.
5. Check for excessive wear or damage on lobes of outer gerotor gears and between lobes on inner gerotor gears.
6. Mesh pieces of one gerotor set together as shown in Figure 3-118. Use a feeler gauge to determine clearance between tips of lobes on inner and outer gerotors. The maximum allowable clearance is 0.004 inch (0.10 mm). Replace gerotors as a set if clearance exceeds specification. Inspect second gerotor set in the same manner.
7. Measure thickness of feed gerotors (narrow set) with a micrometer. Replace the set if they are not exactly the same thickness.

## Installation

1. See Section 3.11 BOTTOM END OVERHAUL, ASSEMBLY, steps 5-23.
2. Remove wireforms to release hydraulic lifters.
3. See Section 3.10 TOP END OVERHAUL, ASSEMBLY, steps 30-40.

**Legend:**

f1574c3x

1. Spiral Lock Ring
2. Crankshaft (Roller) Bearing
3. Ring Dowel
4. Cam Needle Bearing
5. Oil Inlet Fitting
6. Oil Outlet Fitting
7. Right Crankcase Half
8. O-Ring
9. Piston Jet
10. T20 TORX Screw
11. Ring Dowel
12. O-Ring
13. Plug
14. O-Ring
15. Oil Filter Mount
16. Oil Filter Adapter
17. Flat Washer
18. Bolt
19. Lockplate
20. Oil Filter
21. Crankcase Bolt
22. Ring Dowel
23. O-Ring
24. Left Crankcase Half
25. Sprocket Shaft (Timken) Bearing Cone
26. Sprocket Shaft (Timken) Bearing Cup
27. Lock Ring
28. Spacer Ring
29. Oil Seal
30. Sprocket Shaft Spacer

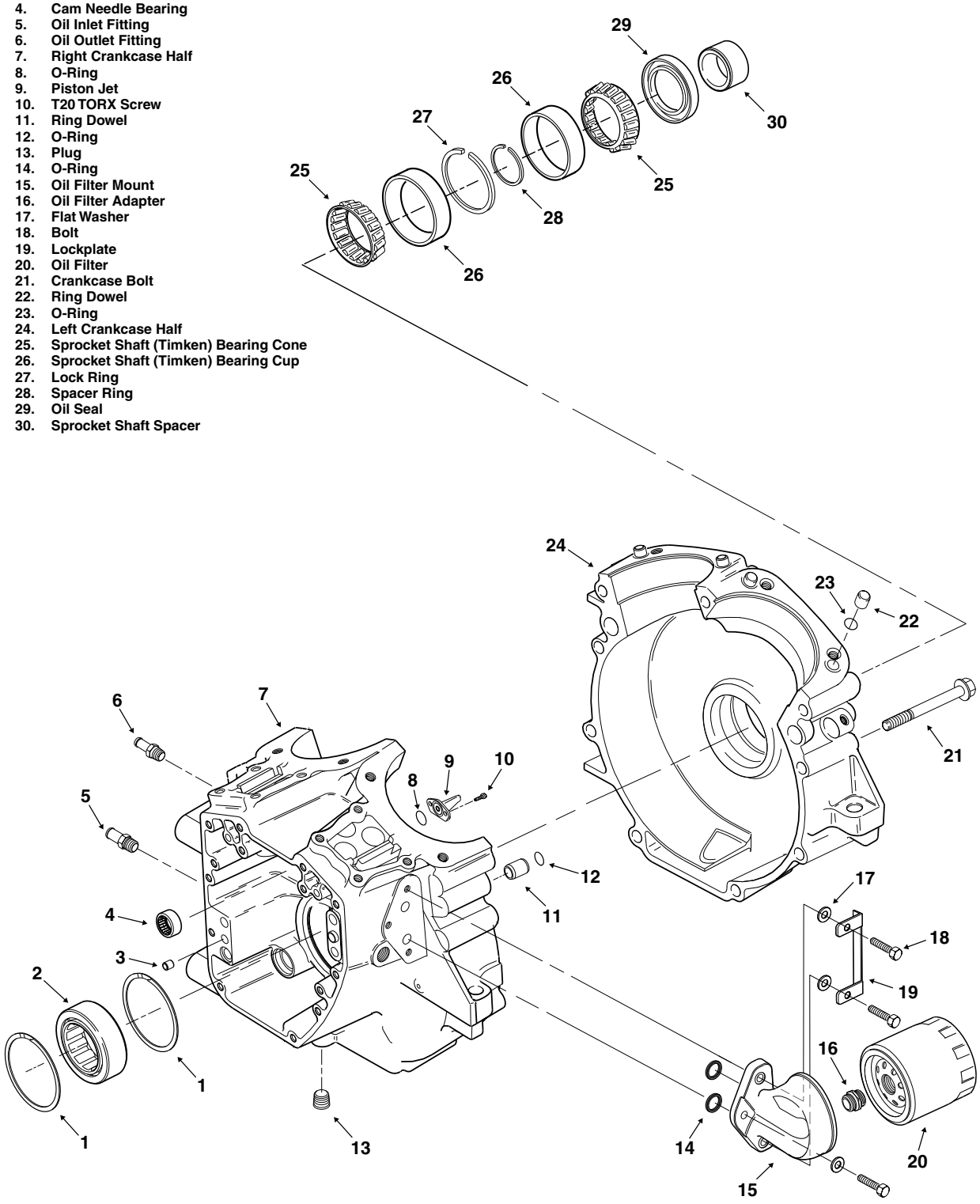



**Figure 3-119. Crankcase Assembly (Exploded View)**

# CRANKCASE

## Removal

1. See Section 3.10 TOP END OVERHAUL, DISASSEMBLY, steps 1-30.
2. See Section 3.11 BOTTOM END OVERHAUL, DISASSEMBLY, steps 1-18.

## Disassembly/Assembly

## RIGHT CRANKCASE HALF

## Crankshaft (Roller) Bearing

### Removal

1. Using a small screwdriver, push end of spiral lock ring towards bearing bore working tip of screwdriver under edge of ring. Raise end of ring until free of ring groove. Work around circumference of ring to alternately pull spirals from ring groove. Discard ring.
2. Turn crankcase over. Repeat step 1 to remove spiral lock ring from ring groove on opposite side of bearing bore.
3. Obtain the CRANKSHAFT (ROLLER) BEARING REMOVER/INSTALLER (HD-42720) and proceed as follows:
   a. Place support tube on hydraulic press table with the remover side up. Note that the sides of the support tube are stamped to ensure proper orientation. See A of Figure 3-121.
   b. With the outboard side of the right crankcase half facing upward, position crankshaft (roller) bearing over support tube.
   c. Slide pilot/driver through bearing into support tube. See B of Figure 3-121.

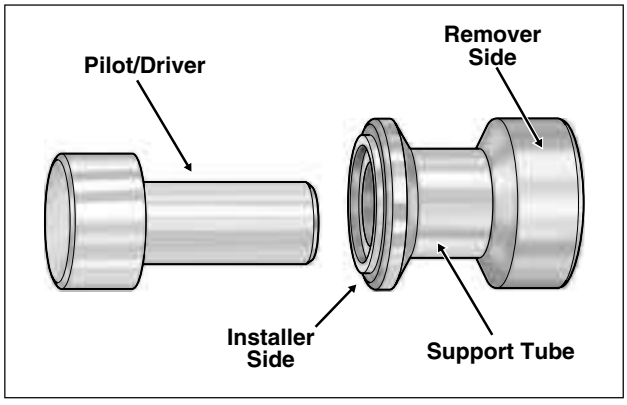



**Figure 3-120. Crankshaft (Roller) Bearing Remover/Installer (Part No. HD-42720)**

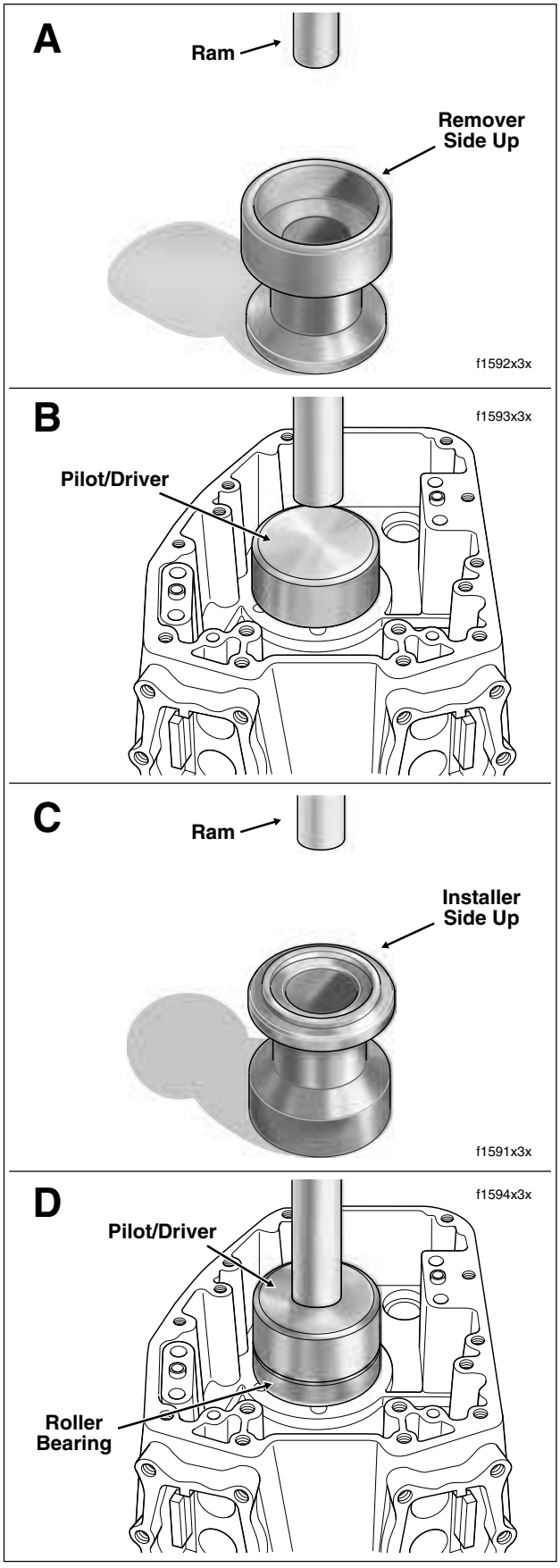



**Figure 3-121. Remove/Install Crankshaft (Roller) Bearing in Right Crankcase Half**

d. Center pilot/driver under ram of press. Apply pressure to pilot/driver until bearing is free.

e. Remove crankcase, pilot/driver and bearing from support tube. Discard bearing.

### Installation

1. Obtain the CRANKSHAFT (ROLLER) BEARING REMOVER/INSTALLER (HD-42720) and proceed as follows:
   a. Spread a thin film of clean engine oil on O.D. of **new** bearing.
   b. Turn support tube over so that the installer side is up. See C of Figure 3-121. The sides of the support tube are stamped to ensure proper orientation.
   c. With the outboard side of the right crankcase half facing upward, position crankshaft bearing bore over support tube.
   d. Start roller bearing in bearing bore.
   e. Slide pilot/driver through bearing into support tube. See D of Figure 3-121.
   f. Center pilot/driver under ram of press. Apply pressure to pilot/driver until resistance is felt.
   g. Remove pilot/driver from crankcase. Remove crankcase from support tube.
   h. Verify that roller bearing is properly positioned between the spiral lock ring grooves.
2. Start bottom end of **new** spiral lock ring into ring groove of bearing bore. Alternately work around circumference of ring feeding each spiral into the ring groove a section at a time. When complete, verify that spiral lock ring is fully seated in the groove.
3. Turn crankcase over. Repeat step 2 to install **new** spiral lock ring into ring groove on opposite side of bearing bore.

## Piston Jets

### Removal

1. Remove two T20 TORX screws to free piston jet from crankcase.
2. Remove O-ring from groove in mounting flange of jet. Discard O-ring.

### Installation

**CAUTION**

**O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong O-ring will have the same results. Since many O-rings are similar in size and appearance, always use new O-rings keeping them packaged until use to avoid confusion.**

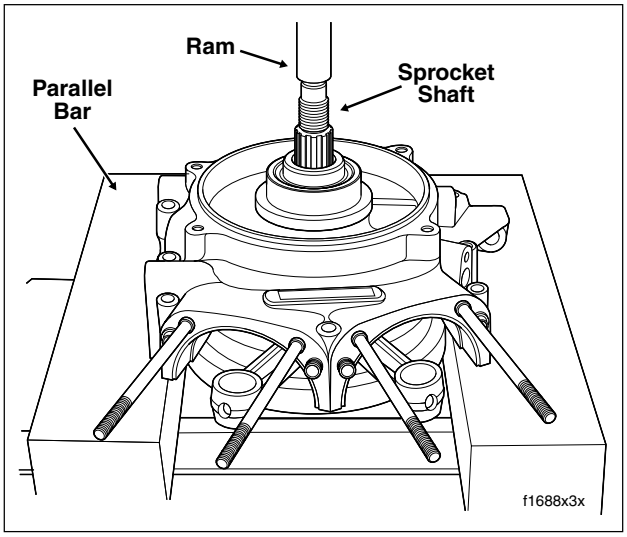



**Figure 3-122. Press Flywheel Assembly From Crankcase**

1. Install **new** O-ring in groove of jet mounting flange. Apply a very thin film of clean H-D 20W50 engine oil to O-ring before installation.
2. Apply Loctite Low Strength Threadlocker 222 (purple) to threads of two T20 TORX screws.
3. With the jet pointed upward, install TORX screws to secure piston jet to crankcase. Tighten the screws to 20-30 **in-lbs** (2.3-3.4 Nm).

# LEFT CRANKCASE HALF

## Sprocket Shaft (Timken) Bearing

### Removal

**CAUTION**

**Never move or lift the crankcase by grasping the cylinder studs. The crankcase is too heavy to be carried in this manner and may be dropped. Dropping the crankcase may result in parts damage and minor or moderate injury.**

1. Place left crankcase half (with attached flywheel and connecting rod assembly) on table of hydraulic press supporting inboard side of case on parallel bars. See Figure 3-122.
2. Center sprocket shaft under ram of press. Press on end of sprocket shaft until flywheel assembly is free.
3. Move crankcase half and flywheel assembly to bench area.
4. Remove spacer ring from sprocket shaft of flywheel assembly.
5. Remove sprocket shaft spacer from oil seal in crankcase half.

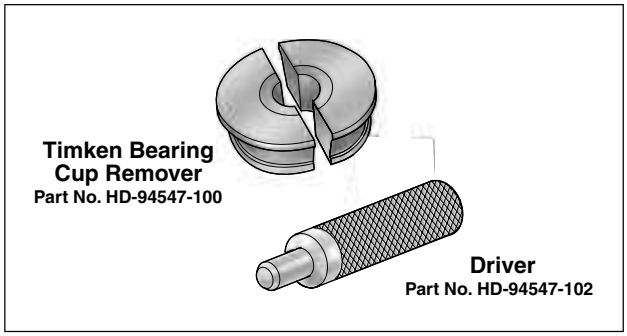



**Figure 3-123. Sprocket Shaft Timken Bearing Cup Remover and Driver**

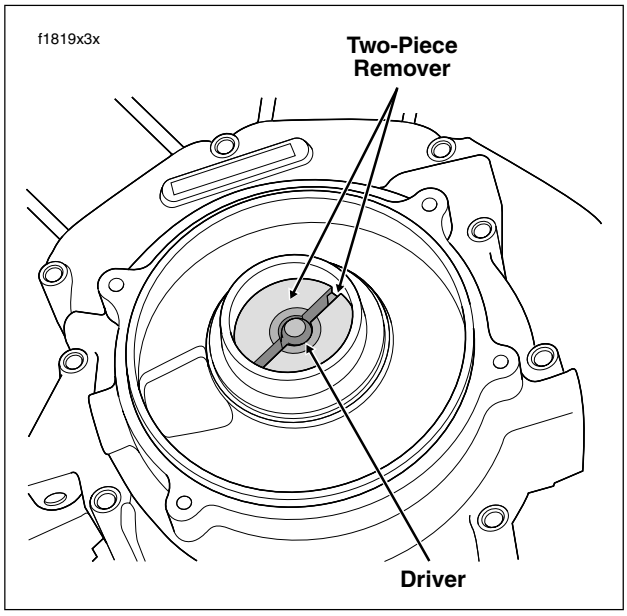



**Figure 3-124. Remove Bearing Cups From Bore**

6. With the inboard side facing upward, use a suitable drift to tap oil seal and outer bearing cone from crankcase bore.
7. Remove bearing cups as follows:
   a. Obtain SPROCKET SHAFT TIMKEN BEARING CUP REMOVER (HD-94547-100) and DRIVER (HD-94547-102). See Figure 3-123.
   b. Place the left crankcase half on a flat surface with the outboard side up.
   c. With the tapered side down, seat the two-piece remover tool on the outer bearing cup leaving a gap in the middle.
   d. While holding the remover tool on the cup, insert the driver from the opposite side of the crankcase, so that the nose of the driver is centered in the gap. See Figure 3-124.
   e. Turn the case over so that the driver side is up.
   f. Place left crankcase half on table of hydraulic press supporting case on parallel bars.
   g. Center driver under ram of press. Press on end of driver until outer bearing cup is free.
   h. To remove the inner bearing cup, place the case on a flat surface with the inboard side up. Repeat steps 7(c)-7(g).
8. Remove lock ring from groove in crankcase bore. Proceed as follows:
   a. Place the crankcase half on a flat surface with the outboard side facing upward.
   b. Obtain the two TIMKEN BEARING LOCK RING CLAWS (HD-43720). See Figure 3-125.
   c. With the gap in the lock ring being the 12 o'clock position, place the two claws so that the slotted sides engage the inside edge of the lock ring at the 10 and 2 o'clock positions.
   d. Using a 9/64 inch allen head, tighten the screws to fix the position of the claws on the lock ring.
   e. Inserting the tips of a large retaining ring pliers (Snap on PR-56A) into one hole in each claw, compress the lock ring and remove it from the crankcase bore. See Figure 3-126.

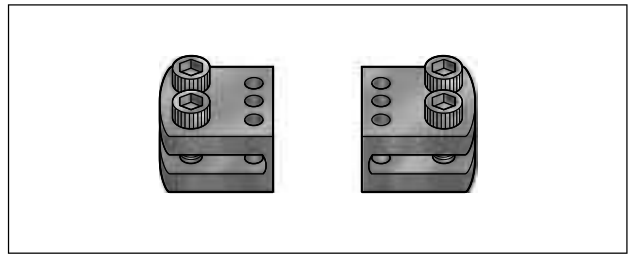


**Figure 3-125. Timken Bearing Lock Ring Claws (Part No. HD-43720)**

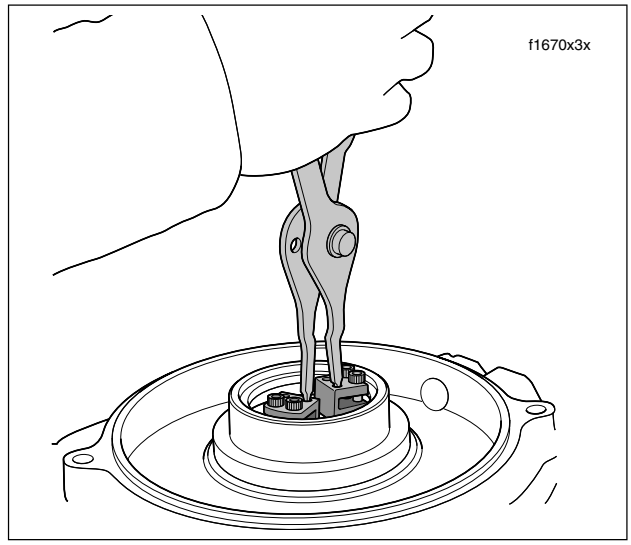



**Figure 3-126. Remove Lock Ring From Bore**

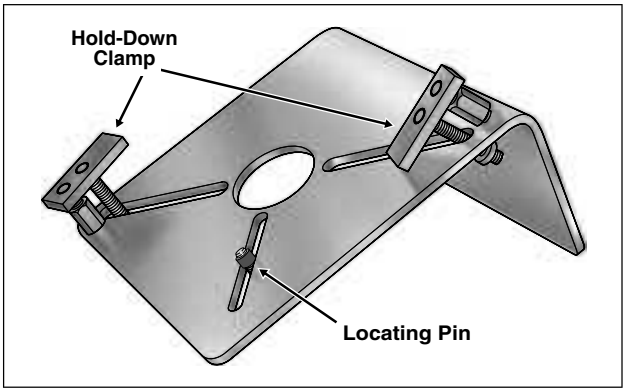



**Figure 3-127. Flywheel Fixture (Part No. HD-44358)**

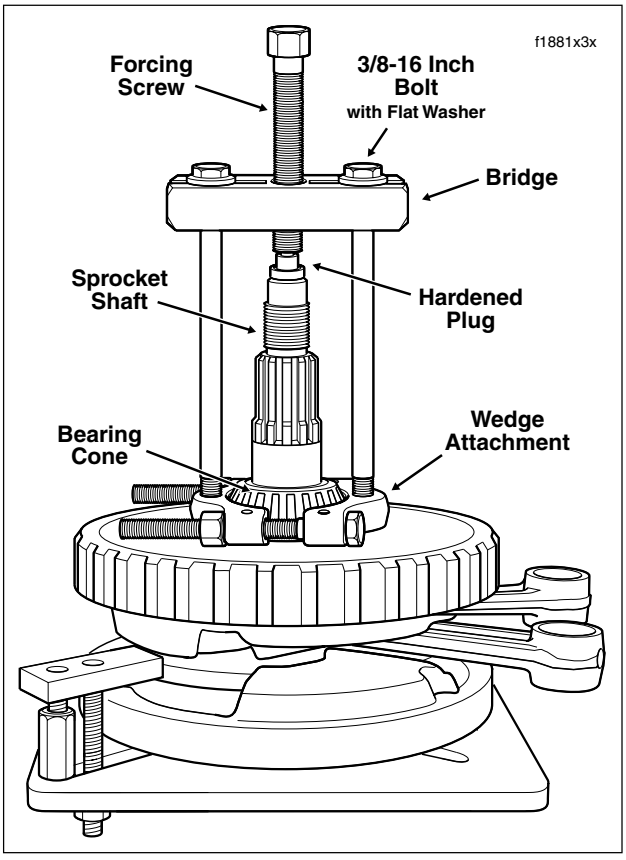



**Figure 3-128. Remove Bearing Cone From Sprocket Shaft**

f. Loosen allen head screws and remove claws from lock ring.

9. If reusing flywheel, remove bearing cone as follows:
   a. Obtain FLYWHEEL SUPPORT FIXTURE (HD-44358). See Figure 3-127. Install brass jaws or shop towels around teeth of vise to prevent damage to tool. Clamp tool in vise with the round hole topside.
   b. Insert crankshaft end through hole resting flywheel assembly on fixture. Slide knurled locating pin down slot in tool to engage crank pin hole. Hand tighten locating pin.
   c. Slide hold-down clamp down slot to engage inboard side of right flywheel half, and then hand tighten knurled nut at bottom to secure. Repeat step to secure hold-down clamp on opposite side of flywheel.

*NOTE*

*For proper clamping force, hold-down clamp must not be tilted. Rotate hex on outboard stud until clamp is level.*

   d. Position WEDGE ATTACHMENT (HD-95637-46A) on inboard side of sprocket shaft bearing cone and turn hex nuts an equal number of turns to draw halves of wedge together.
   e. Obtain two 3/8-16 inch bolts 6-1/2 inches long (with flat washers). Install flat washers on bolts. Obtain bridge, forcing screw and hardened plug from MAINSHAFT BEARING INNER RACE PULLER/INSTALLER (HD-34902B).
   f. Slide one bolt into channel on each side of bridge so that flat washer is between bridge and bolt head. Thread bolts into wedge attachment an equal number of turns. See Figure 3-128.
   g. Sparingly apply graphite lubricant to threads of forcing screw to prolong service life and ensure smooth operation. Start forcing screw into center hole of bridge.

**CAUTION**

**Failure to use hardened plug may result in damage to forcing screw and/or sprocket shaft.**

   h. Place cupped side of hardened plug against end of sprocket shaft. Thread forcing screw into bridge until the steel ball at the end of the screw makes firm contact with hardened plug.
   i. Verify that the tool assembly is square so that the bearing is not cocked during removal. See Figure 3-128. Turn forcing screw until bearing is pulled free of sprocket shaft.

10. Discard the oil seal and the entire Timken bearing set-two bearing cones, two bearing cups, spacer ring and lock ring.

## Installation

1. Obtain **new** Timken bearing set and install lock ring as follows:
   a. Place the left crankcase half on a flat surface with the outboard side facing upward.

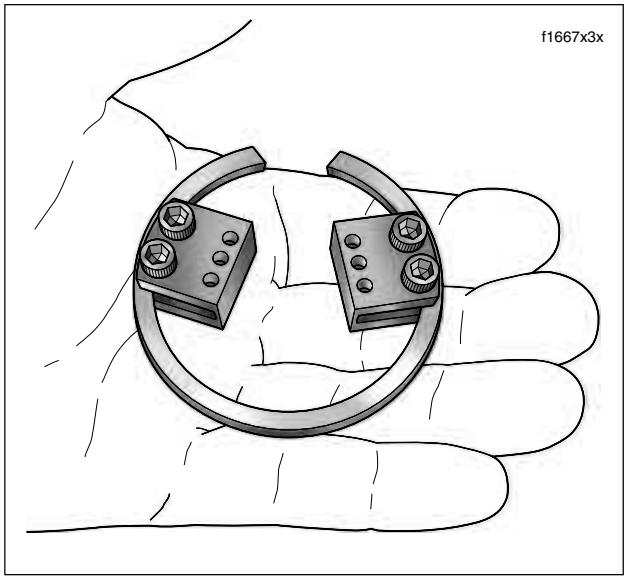



**Figure 3-129. Install Claws on Lock Ring**

b. Obtain the two TIMKEN BEARING LOCK RING CLAWS (HD-43720).

c. With the gap in the lock ring being the 12 o'clock position, place the two claws so that the slotted sides engage the inside edge of the lock ring at the 10 and 2 o'clock positions. See Figure 3-129.

d. Using a 9/64 inch allen head, tighten the screws to fix the position of the claws on the lock ring.

e. Inserting the tips of a large retaining ring pliers (Snap on PR-56A) into one hole in each claw, compress the lock ring and install in groove of crankcase bore.

f. Verify that the gap in the lock ring is centered below the oil hole at the top of the ring groove. Move lock ring if not properly centered.

g. Loosen allen head screws and remove claws from lock ring.

2. Obtain the SPROCKET SHAFT TIMKEN BEARING CUP INSTALLER (HD-39458). See Figure 3-130. Proceed as follows:

   a. Set support tube on table of hydraulic press with the larger O.D. topside.

*NOTE*

*Smaller O.D. of support tube is used to install bearing cups in Sportster models. Verify that the Sportster pilot/driver is not installed in opposite end of support tube or procedure will be interrupted as the two pilot/drivers make contact.*

   b. Center bearing cup on top of support tube with the lettered side up.

   c. With the inboard side up, position crankcase half over tool so that it rests flat on bearing cup.

   d. Start second bearing cup into bearing bore with the lettered side down.

   e. Slide pilot/driver through bore (and both bearing cups) into support tube.

   f. Center pilot/driver under ram of hydraulic press and apply pressure until both bearing cups make firm contact with installed lock ring. See Figure 3-131.

3. Perform first end play check by simulating assembly as follows:

   a. Fashion dummy sprocket shaft. Obtain parts used on Evolution models prior to introduction of one-piece flywheel assembly and weld sprocket shaft nut (HD-24017-80) to threads on inboard side of sprocket shaft (HD-23909-80). See Figure 3-132.

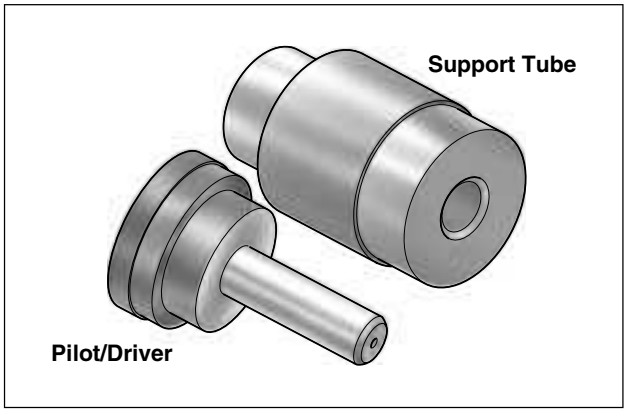



**Figure 3-130. Sprocket Shaft Timken Bearing Cup Installer (Part No. HD-39458)**

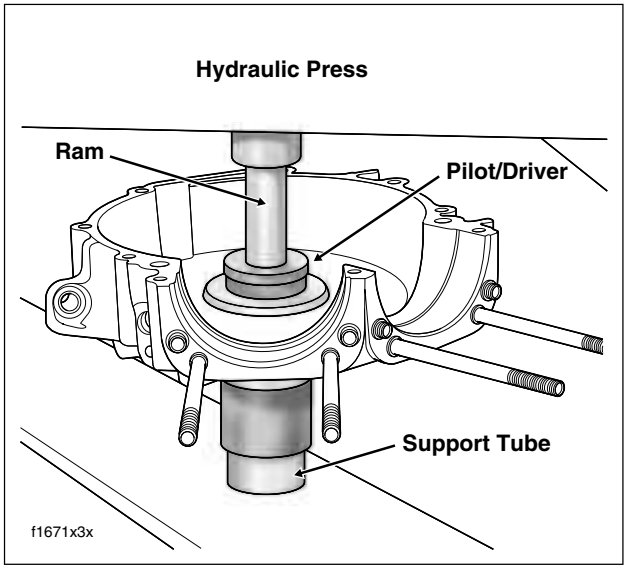



**Figure 3-131. Press Bearing Cups Into Bore**

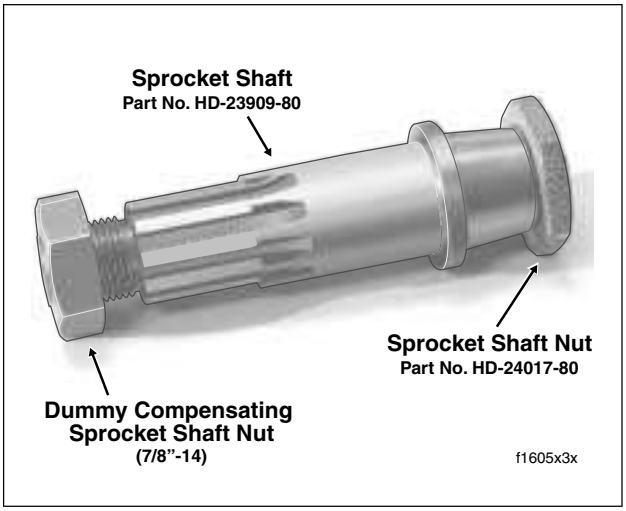



**Figure 3-132. Dummy Sprocket Shaft and Nut**

*NOTE*

*Dummy sprocket shaft should be sufficiently polished so that it only requires the thumbs of both hands to lightly press on bearing cone.*

b. Obtain a dummy compensating sprocket shaft nut (HD-40392-91 or 7/8"-14 nut from hardware store), spacer sleeve and flat washer. To ensure complete thread engagement when nut is installed, spacer sleeve must be about 2-1/4 inches long with a 1-3/4 inch O.D. and a 1-1/4 inch I.D. Flat washer must be large enough to allow nut to rest flat against spacer sleeve. :

c. Clamp welded sprocket shaft nut in vise so that the dummy sprocket shaft points straight up.

d. With the tapered side up, slide bearing cone over end of dummy sprocket shaft. Using the thumbs of both hands, lightly press on bearing cone until it bottoms against shoulder.

e. With the outboard side up, carefully place left crankcase half over dummy shaft so that it rests flat on installed bearing cone.

f. Slide **new** spacer ring over dummy shaft until it contacts bearing cone.

g. Place **new** bearing cone over dummy shaft with the tapered side down.

h. Install spacer sleeve, flat washer and dummy compensating sprocket shaft nut. Tighten nut to 150-165 ft-lbs (203-224 Nm).

i. Mount a dial indicator on the case half. Set the indicator contact point on the end of the dummy sprocket shaft. See Figure 3-133.

j. Standing on a stool for leverage, if necessary, firmly push down on the case as far as it will go while rotating it back and forth.

k. Holding the case down, zero the dial indicator gauge.

l. Firmly pull up on the case as far as it will go while rotating it back and forth. Stand on a stool for leverage, if necessary.

m. Holding the case up, note the reading of the dial indicator. Repeat procedure to verify the reading.

## Table 3-9. Timken Bearing Spacer Rings

| Spacer Sizes | | H-D Part Number |
|---|---|---|
| Inches | Millimeters | |
| 0.0905 - 0.0895 | 2.299 - 2.273 | 9110 |
| 0.0925 - 0.0915 | 2.350 - 2.324 | 9120 |
| 0.0945 - 0.0935 | 2.400 - 2.375 | 9121 |
| 0.0965 - 0.0955 | 2.451 - 2.426 | 9122 |
| 0.0985 - 0.0975 | 2.502 - 2.476 | 9123 |
| 0.1005 - 0.0995 | 2.553 - 2.527 | 9124 |
| 0.1025 - 0.1015 | 2.604 - 2.578 | 9125 |
| 0.1045 - 0.1035 | 2.654 - 2.629 | 9126 |
| 0.1065 - 0.1055 | 2.705 - 2.680 | 9127 |
| 0.1085 - 0.1075 | 2.756 - 2.731 | 9128 |
| 0.1105 - 0.1095 | 2.807 - 2.781 | 9129 |
| 0.1125 - 0.1115 | 2.858 - 2.832 | 9130 |
| 0.1145 - 0.1135 | 2.908 - 2.883 | 9131 |
| 0.1165 - 0.1155 | 2.959 - 2.934 | 9132 |
| 0.1185 - 0.1175 | 3.010 - 2.985 | 9133 |
| 0.1205 - 0.1195 | 3.061 - 3.035 | 9134 |




**Figure 3-133. Check Flywheel End Play**

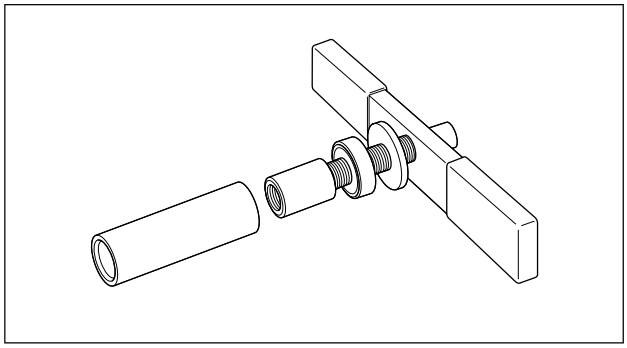


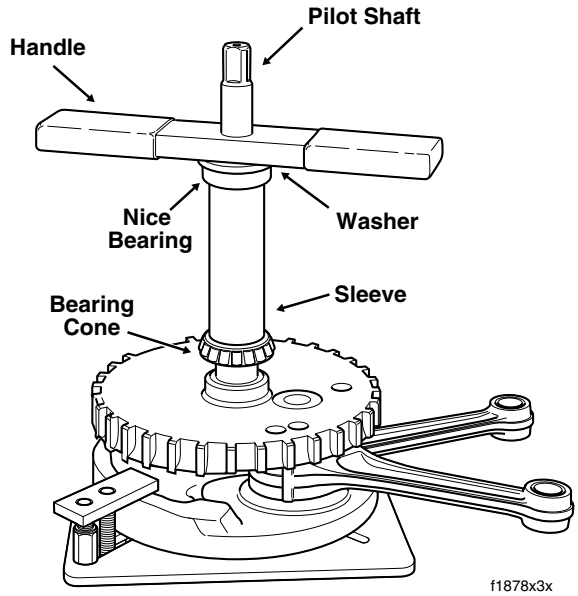
**Figure 3-134. Sprocket Shaft Timken Bearing Cone Installer (Part No. HD-97225-55B)**

n. If the end play falls between 0.003 and 0.007 inch (0.076-0.178 mm), proceed to step 4.

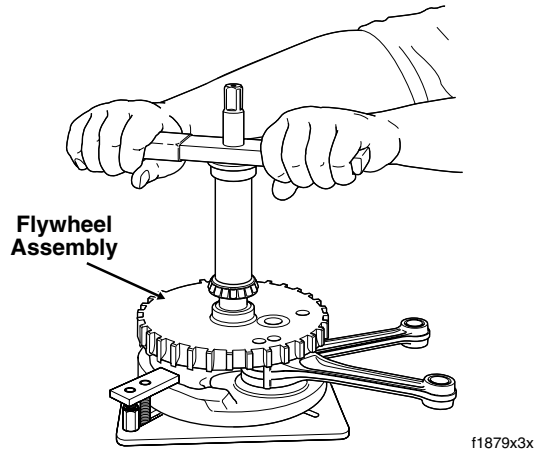
If end play is not within specification, remove dummy compensating sprocket shaft nut, flat washer, spacer sleeve, bearing cone and spacer ring. Measure spacer ring with dial vernier caliper and then replace it with one of those listed in Table 3-9. Install thinner spacer ring for less end play, thicker spacer ring for more end play. Return to step 3(f) to repeat end play check.

4. Remove dummy compensating sprocket shaft nut, flat washer and spacer sleeve. Carefully remove all Timken bearing parts from dummy sprocket shaft.
5. Clamp FLYWHEEL SUPPORT FIXTURE (HD-44358) in vise with the round hole topside. Insert crankshaft end through hole resting flywheel assembly on fixture. Secure flywheel assembly using locating pin and hold-down clamps as described under REMOVAL, steps 9(a) through 9(c).
6. Place **new** bearing cone over sprocket shaft with the tapered side up.
7. Obtain the SPROCKET SHAFT TIMKEN BEARING CONE INSTALLER (HD-97225-55B). See Figure 3-134. Assemble tool as described below.
   a. Thread pilot onto sprocket shaft until contact is made with shoulder.
   b. Sparingly apply graphite lubricant to threads of pilot shaft to prolong service life and ensure smooth operation.
   c. Slide sleeve over pilot until it contacts bearing cone.
   d. Slide Nice bearing and large flat washer over pilot until contact is made with sleeve.
   e. Thread handle onto pilot shaft. See upper frame of Figure 3-135.
8. Rotate handle of tool in a clockwise direction until bearing cone bottoms on shoulder of sprocket shaft. See center frame of Figure 3-135.
9. Remove handle, flat washer, Nice bearing, sleeve and pilot from sprocket shaft.

**1. Install Inner Bearing Cone On Sprocket Shaft. Assemble Sprocket Shaft Bearing Cone Installer.**




**2. Press Inner Bearing Cone Onto Sprocket Shaft.**




**3. Press Outer Bearing Cone Onto Sprocket Shaft.**

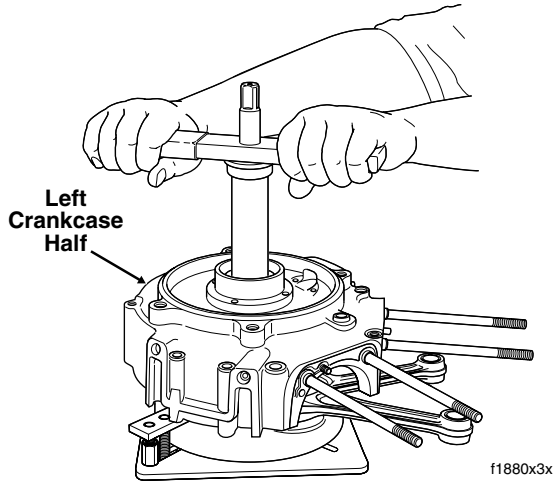



**Figure 3-135. Press Inner and Outer Bearing Cones Onto Sprocket Shaft**

10. Carefully place crankcase half over sprocket shaft so that it rests flat on installed bearing cone.
11. Slide spacer ring selected under step 3(n) over sprocket shaft until it contacts bearing cone.
12. Place second bearing cone over sprocket shaft with the tapered side down.
13. Assemble SPROCKET SHAFT TIMKEN BEARING CONE INSTALLER (HD-97225-55B) onto sprocket shaft following procedure outlined under step 7.

**CAUTION**

**While installing outer bearing cone, carefully observe position of connecting rods. If necessary, stop frequently to verify that rods are still free. If rods happen to move out of cylinder bore area, they will be bent by the crankcase during the press procedure. Bent connecting rods require replacement of the flywheel assembly.**

14. Rotate handle of tool in a clockwise direction until bearing cone makes firm contact with spacer ring. Inner and outer bearing cones must be tight against spacer ring for correct bearing clearance. See lower frame of Figure 3-135.
15. Remove handle, flat washer, Nice bearing, sleeve and pilot from sprocket shaft.
16. Perform second end play check as follows:
    a. Gently tap case half to verify that it moves freely under its own weight. Pull up and push down on case to verify that there is no noticeable up and down movement.
    b. Install spacer sleeve, flat washer and dummy compensating sprocket shaft nut first used under step 3(h). Tighten nut to 150-165 ft-lbs (203-224 Nm).
    c. Mount a dial indicator on the case half. Set the indicator contact point on the end of the sprocket shaft. See Figure 3-133.
    d. Standing on a stool for leverage, if necessary, firmly push down on the case as far as it will go while rotating it back and forth.
    e. Holding the case down, zero the dial indicator gauge.
    f. Firmly pull up on the case as far as it will go while rotating it back and forth. Stand on a stool for leverage, if necessary.
    g. Holding the case up, note the reading of the dial indicator. Repeat the procedure to verify the reading.
    h. If the end play falls between 0.001 and 0.005 inch (0.025-0.127 mm), proceed to step 17.

    If end play is not within specification, restart procedure with new Timken bearing set.

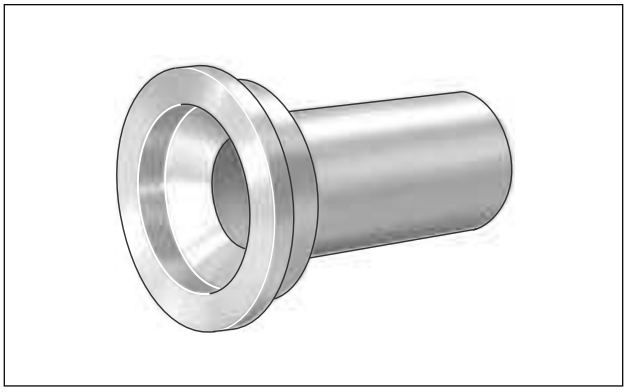


**Figure 3-136. Sprocket Shaft Oil Seal Installer (Part No. HD-39361A)**

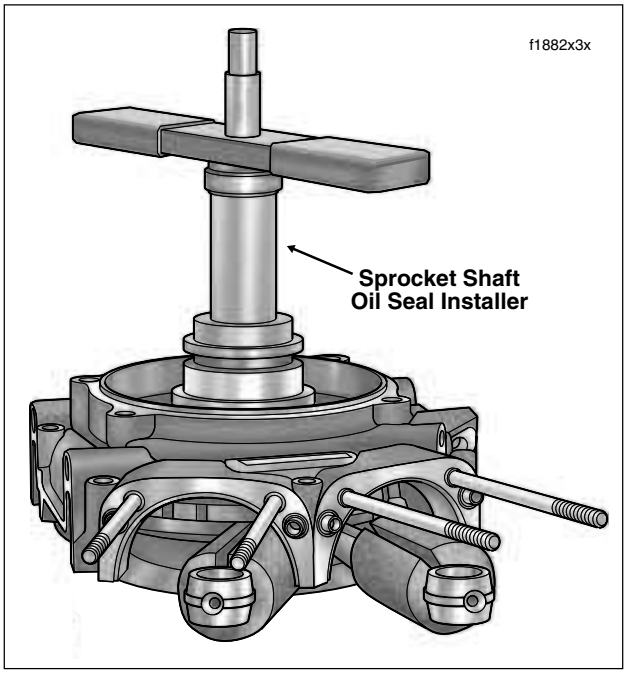



**Figure 3-137. Install Oil Seal In Bore**

17. Remove dummy compensating sprocket shaft nut, flat washer and spacer sleeve.
18. Lubricate bearing cones with clean H-D 20W50 engine oil.
19. To install **new** oil seal into bearing bore, obtain pilot, Nice bearing, large flat washer and handle from SPROCKET SHAFT TIMKEN BEARING CONE INSTALLER (HD-97225-55B) and proceed as follows:
    a. Verify that seal lip garter spring is in place on both sides of seal.
    b. Thread pilot onto sprocket shaft until contact is made with shoulder.

c. With the lettering facing outside, slide oil seal over pilot until it contacts bearing bore.

d. Slide SPROCKET SHAFT OIL SEAL INSTALLER (HD-39361A) over pilot until it contacts oil seal. See Figure 3-136.

e. Slide Nice bearing and large flat washer over pilot until contact is made with seal installer.

f. Thread handle onto pilot shaft.

g. Rotate handle in a clockwise direction until oil seal installer makes firm contact with crankcase stator mount. See Figure 3-137.

h. Remove handle, flat washer, Nice bearing, seal installer and pilot from sprocket shaft.

20. Slide sprocket shaft spacer over end of sprocket shaft. Push spacer into oil seal until seated against outer bearing cone.

## Cylinder Studs

### Removal

1. Thread a 3/8”-16 nut onto cylinder stud.
2. Thread a second nut onto stud until it contacts the first.
3. Placing wrench on first nut installed, remove stud.

### Installation

1. Start stud in cylinder deck with the collar side down.
2. Thread a 3/8”-16 nut onto cylinder stud.
3. Thread a second nut onto stud until it contacts the first.
4. Turning second nut installed, tighten stud to 10-20 ft-lbs (14-27 Nm).

## Pipe Plug and Oil Fittings

### Removal

1. Turn hex on oil fittings in a counterclockwise direction until free.
2. Turn pipe plug in a counterclockwise direction until free.

### Installation

1. Apply Loctite Pipe Sealant with Teflon 565 to threads.
2. Turn hex on oil fittings in a clockwise direction until snug. Tighten fittings to 10-12 ft-lbs (13.6-16.3 Nm).
3. Install pipe plug. Tighten pipe plug to 10-12 ft-lbs (13.6-16.3 Nm).

## Cleaning and Inspection

1. Scrape old gasket material from the crankcase flanges. Old gasket material left on mating surfaces will cause leaks.
2. Clean all parts in a non-volatile cleaning solution or solvent.
3. Thoroughly dry all parts with low pressure compressed air.
4. Verify that all oil holes and passageways are clean and open.
5. Check ring dowels for looseness, wear or damage. Replace as necessary.
6. Use a file to carefully remove any nicks or burrs from machined surfaces.
7. Clean out tapped holes and clean up damaged threads.
8. Check the top of the crankcase for flatness with a straightedge and feeler gauge. Replace if warped.
9. Spray all machined surfaces with clean engine oil.

## Installation

1. See Section 3.11 BOTTOM END OVERHAUL, ASSEMBLY, steps 1-23.
2. See Section 3.10 TOP END OVERHAUL, ASSEMBLY, steps 1-40.

# FLYWHEEL/CONNECTING ROD ASSEMBLY

## Removal

1. See Section 3.10 TOP END OVERHAUL, DISASSEMBLY, steps 1-30.
2. See Section 3.11 BOTTOM END OVERHAUL, DISASSEMBLY, steps 1-18.
3. See Section 3.12 SUBASSEMBLY SERVICE AND REPAIR, CRANKCASE, LEFT CRANKCASE HALF, SPROCKET SHAFT (TIMKEN) BEARING, REMOVAL.

## Inspection

1. Replace the flywheel/connecting rod assembly if any of the following conditions are noted:

**CAUTION**

**Do not attempt to straighten connecting rods. Straightening rods will damage both the upper bushing and lower bearing.**

- Connecting rods are bent or twisted.
- Connecting rods do not fall under their own weight or are in a bind.

*NOTE*

*Bluing on connecting rods is considered a normal condition.*

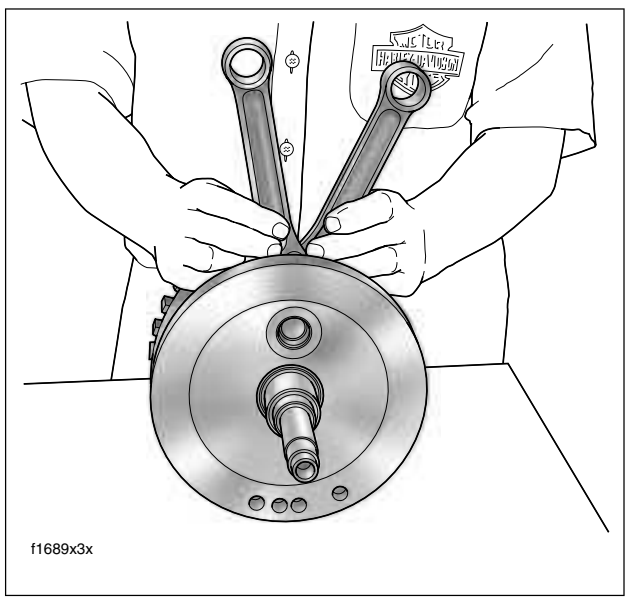



**Figure 3-138. Check Connecting Rod Bearing Clearance**

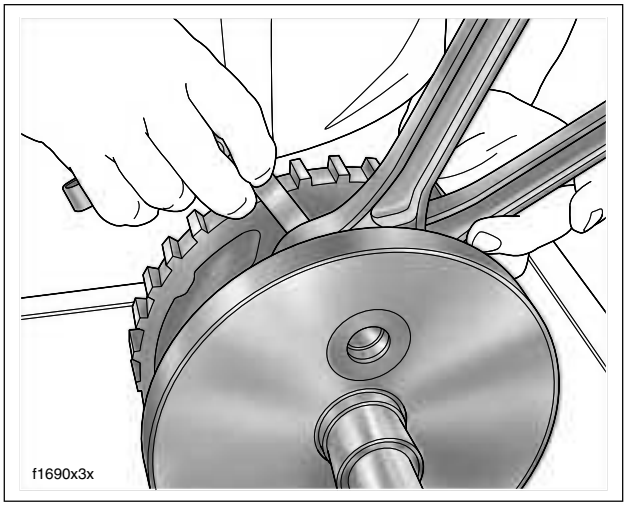



**Figure 3-139. Check Connecting Rod Side Play**

- The crankshaft (roller) bearing inner race is burnelled, burnt, scored, blued or damaged.

2. Orient the assembly as shown in Figure 3-138. Holding the shank of each rod just above the bearing bore, pull up and down on the connecting rods. Any discernable up and down movement indicates excessive lower bearing clearance. Replace the flywheel/connecting rod assembly.
3. Insert a feeler gauge between the thrust washer and the outboard side of the connecting rod. See Figure 3-139. Replace the assembly if rod side play exceeds 0.020 inch (0.51 mm).

*NOTE*

*If the flywheel or connecting rods need to be replaced, then they must be replaced together as one assembly. Return the flywheel/connecting rod assembly to the factory for service or replacement.*

## Installation

1. See Section 3.12 SUBASSEMBLY SERVICE AND REPAIR, CRANKCASE, LEFT CRANKCASE HALF, SPROCKET SHAFT (TIMKEN) BEARING, INSTALLATION.
2. See Section 3.11 BOTTOM END OVERHAUL, ASSEMBLY, steps 1-23.
3. See Section 3.10 TOP END OVERHAUL, ASSEMBLY, steps 1-40.

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# FUEL SYSTEM 4


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# SPECIFICATIONS 4.1

## CVH CARBURETOR JET SIZES

| FL Model | Main Fuel Jet No. | Slow Fuel Jet No. |
|---|---|---|
| 49 state | 190 | 45 |
| HDI | 195 | 45 |
| California | 190 | 45 |

## FUEL TANK CAPACITY

| FL Model | English | Metric |
|---|---|---|
| Total | 5.0 Gallons | 18.9 liters |
| Reserve | 0.9 Gallons | 3.4 liters |

## TORQUE VALUES

| Item | ft/in-lbs | Nm |
|---|---|---|
| Enrichener cable mounting bracket hex nut | 20-35 **in-lbs** | 2.3-4.0 Nm |
| Cylinder head breather bolts | 10-12 ft-lbs | 13.6-16.3 Nm |
| Air cleaner cover bracket screws | 20-40 **in-lbs** | 2.3-4.5 Nm |
| Air cleaner cover screw | 3-5 ft-lbs | 4.1-6.8 Nm |
| Fuel valve hex jam nut | 18 ft-lbs | 24 Nm |
| Fuel tank rear mounting bolt | 6 ft-lbs | 8 Nm |
| Fuel tank front mounting bolts | 15-18 ft-lbs | 20-24 Nm |
| Battery hold-down clamp bolt | 15-20 ft-lbs | 20-27 Nm |

# FUEL SYSTEM TROUBLESHOOTING 4.2

## CARBURETOR TROUBLESHOOTING

### OVERFLOW

| Check for: | Remedy: |
|---|---|
| 1. Restricted fuel tank vent system. | 1. Correct restricted hose. Replace vapor valve. |
| 2. Loose float bowl screws. | 2. Tighten screws. |
| 3. Damaged float bowl O-ring. | 3. Replace O-ring. |
| 4. Damaged or leaking float assembly. | 4. Replace float assembly. |
| 5. Particle contamination in fuel inlet fitting cavity. | 5. Clean and clear cavity and fuel supply tract. |
| 6. Worn or dirty inlet valve or seat. | 6. Clean or replace valve and clean seat. |
| 7. Improper fuel level in float bowl. | 7. Adjust float tab for correct fuel level. |

### POOR IDLING

| Check for: | Remedy: |
|---|---|
| 1. Idle speed improperly adjusted. | 1. Adjust operating idle speed. |
| 2. Inlet system air leak (faster idling). | 2. Correct as required. |
| 3. Loose low speed jet. | 3. Tighten jet. |
| 4. Contaminated or plugged low speed system. | 4. Clean contaminants and clear passages. |
| 5. Enrichener valve not seated or leaking. | 5. Adjust, clean or replace. |
| 6. Leaking accelerator pump. | 6. Repair. |

### POOR FUEL ECONOMY

| Check for: | Remedy: |
|---|---|
| 1. Excessive use of enrichener system. | 1. Limit system use. |
| 2. Enrichener valve not seated or leaking. | 2. Adjust, clean or replace. |
| 3. Dirty air cleaner element. | 3. Clean or replace as required. |
| 4. Restricted fuel tank vent system. | 4. Correct restricted hose. Replace vapor valve. |
| 5. High speed riding style. | 5. Modify riding habits. |
| 6. Idle speed improperly adjusted. | 6. Adjust operating idle speed. |
| 7. Loose jets. | 7. Tighten jets. |
| 8. Fuel level too high. | 8. Adjust float level. |
| 9. Plugged or restricted bowl vent. | 9. Clean and clear passages. |
| 10. Worn or damaged needle or needle jet. | 10. Replace needle or needle jet. |
| 11. Vacuum piston assembly malfunction. | 11. See Vacuum Piston Troubleshooting. |
| 12. Plugged air jets or passages. | 12. Clean and clear passages. |
| 13. Excessive accelerator pump output. | 13. Check and clean accelerator pump bypass orifice. |

### POOR ACCELERATION

| Check for: | Remedy: |
|---|---|
| 1. Throttle cables misaligned. | 1. Adjust throttle cables. |
| 2. Inlet system air leak. | 2. Correct as required. |
| 3. Restricted fuel tank vent system. | 3. Correct restricted hose. Replace vapor valve. |
| 4. Restricted fuel supply passages. | 4. Correct and clear restriction. |
| 5. Plugged bowl vent or overflow. | 5. Clean and clear passages. |
| 6. Enrichener valve not seated or leaking. | 6. Adjust, clean or replace. |
| 7. Worn or damaged needle or needle jet. | 7. Replace assembly. |
| 8. Vacuum piston malfunction. | 8. See Vacuum Piston Troubleshooting. |
| 9. Plugged jets or passages. | 9. Clean and clear as required. |
| 10. Fuel level (float chamber) too low. | 10. Adjust float level. |
| 11. Accelerator pump leaking or no output. | 11. Repair as necessary. |

| HARD STARTING | |
|---|---|
| **Check for:** | **Remedy:** |
| 1. Enrichener system plugged, not properly functioning or improperly operated. | 1. Clean, adjust, or replace; or read Owner's Manual. |
| 2. Inlet system air leak. | 2. Correct as required. |
| 3. Restricted fuel supply. | 3. Check fuel supply and/or passages. Verify that vacuum operated fuel valve is functional. |
| 4. Fuel overflow. | 4. See Overflow Troubleshooting. |
| 5. Plugged slow jet or passages. | 5. Clean and clear jet or passages. |

| POOR PERFORMANCE ON ROAD | |
|---|---|
| **Check for:** | **Remedy:** |
| 1. Idle speed improperly adjusted. | 1. Adjust operating idle speed. |
| 2. Inlet system air leak. | 2. Correct as required. |
| 3. Restricted fuel tank vent system. | 3. Correct restricted hose. Replace vapor valve. |
| 4. Dirty or damaged air cleaner element. | 4. Clean or replace. |
| 5. Enrichener valve not seated or leaking. | 5. Adjust, clean or replace. |
| 6. Restricted fuel supply tract. | 6. Correct and clear restriction. |
| 7. Plugged bowl vent or overflow. | 7. Clean and clear passages. |
| 8. Loose or plugged fuel and air jets or passages. | 8. Clean, clear and correct as required. |
| 9. Worn or damaged needle or needle jet. | 9. Replace assembly. |
| 10. Vacuum piston assembly malfunction. | 10. See Vacuum Piston Troubleshooting. |
| 11. Accelerator pump inoperative. | 11. Repair as required. |

| POOR HIGH SPEED PERFORMANCE | |
|---|---|
| **Check for:** | **Remedy:** |
| 1. Inlet system air leak. | 1. Clean or replace. |
| 2. Enrichener valve not seated or leaking. | 2. Adjust, clean or replace. |
| 3. Restricted fuel tank vent system. | 3. Correct restricted hose. Replace vapor valve. |
| 4. Restricted fuel supply tract. | 4. Correct and clean restriction. |
| 5. Dirty or damaged air cleaner element. | 5. Clean or replace. |
| 6. Plugged bowl, vent or overflow. | 6. Clean and clear passages. |
| 7. Worn or damaged needle or needle jet. | 7. Replace assembly. |
| 8. Vacuum piston assembly malfunction. | 8. See Vacuum Piston Troubleshooting. |
| 9. Loose or plugged main jets or passages. | 9. Tighten, clean, clear as required. |
| 10. Improper fuel level. | 10. Adjust float level. |
| 11. Accelerator pump inoperative. | 11. Repair as required. |

## VACUUM PISTON ASSEMBLY TROUBLESHOOTING

### PISTON DOES NOT RAISE PROPERLY

| Check for: | Remedy: |
|---|---|
| 1. Enrichener valve open, not seated or leaking. | 1. Adjust, clean or replace. |
| 2. Piston atmosphere vent blocked. | 2. Clear vent. |
| 3. Diaphragm cap loose, damaged or leaking. | 3. Tighten or replace cap. |
| 4. Spring binding. | 4. Correct or replace spring. |
| 5. Diaphragm pinched at lip groove. | 5. Reposition diaphragm lip. |
| 6. Torn diaphragm. | 6. Replace piston diaphragm assembly. |
| 7. Piston binding. | 7. Clean piston slides and body or replace piston. |
| 8. Piston vacuum passage plugged. | 8. Clean and clear passage. |

### PISTON DOES NOT CLOSE PROPERLY

| Check for: | Remedy: |
|---|---|
| 1. Spring damaged. | 1. Replace spring. |
| 2. Piston binding. | 2. Clean piston slides and body or replace piston. |
| 3. Piston diaphragm ring dirty or damaged. | 3. Clean or replace piston. |

*NOTE*

*For service of fuel injected models, refer to SECTION 9 for detailed instructions.*

## GENERAL

The carburetor is a constant velocity, gravity fed type with a float operated inlet valve, a variable venturi, a throttle stop screw for idle speed adjustment and a fuel enrichment system for starting. See Figure 4-1.

The fuel enrichment circuit will cause engine idle speed to increase to approximately 2000 rpm with enrichener knob pulled out fully and engine running at normal operating temperature. With enrichener knob pulled out partially and engine running at normal operating temperature, engine idle speed will also increase above normal idle speed. The increase in idle speed is intended to alert the rider that engine is warmed up, and that enrichener knob should be pushed in all the way. Continued use of enrichener after engine is warmed up may cause fouled spark plugs.

Idle and transfer ports provide a balanced fuel mixture during the transition period from stop to mid-range. A vacuum piston controls venturi opening.

The carburetor is specifically designed to control exhaust emissions. All jets are fixed. The idle mixture has been preset at the factory.

The idle mixture screw is recessed in the carburetor casting. The opening is sealed with a plug because it is intended that the idle mixture be non-adjustable.

*NOTE*

*Adjusting mixture setting by procedures other than specified in this section may be in violation of Federal or State regulations.*

This system partially compensates for changes in the mixture that are normally caused by changes in altitude. Because atmospheric pressure decreases as altitude increases, the pressure difference in the upper and lower chambers is reduced, which provides less fuel to the engine.

The carburetor is equipped with an accelerator pump. The accelerator pump system uses sudden throttle openings (rapid accelerations) to quickly inject fuel into carburetor venturi to provide extra fuel for smooth acceleration.

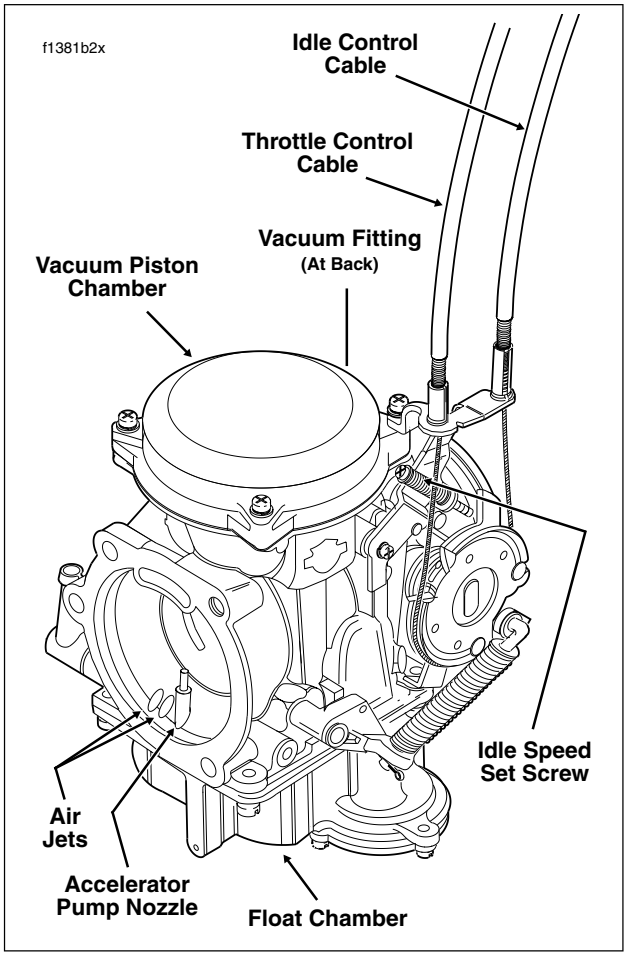



**Figure 4-1. CVH Carburetor**

## OPERATION

### Enrichener

The enrichener knob, located under the left side of the fuel tank, controls opening and closing of the enrichener circuit in the carburetor. The enrichener knob can be adjusted to any position, from full-in to full-out.

**CAUTION**

**Never accelerate the engine above 2500 RPM immediately after a cold start. Allow the engine to run slowly for 15-30 seconds. This will allow the engine to warm up and let oil reach all surfaces needing lubrication. Extended idling with enrichener in the full out position for a period longer than 30 seconds is not recommended.**

*NOTE*

- *H-D CV carburetors have an enrichener circuit that will cause the engine to idle at approximately 2000 rpm with the engine at normal operating temperature and the enrichener knob pulled fully out.*
- *The increase in idle speed is intended to alert the rider that the engine is warmed up to normal operating temperature and the enrichener knob should be pushed all the way in.*
- *Continuing to use the enrichener when the engine is at full operating temperature WILL CAUSE FOULED SPARK PLUGS.*

**CAUTION**

**Pay close attention to the vehicle's warm-up time. Either excessive or insufficient use of the enrichener may cause poor performance, erratic idle, poor fuel economy and spark plug fouling.**

*NOTE*

*The following starting and operating instructions for all carbureted motorcycles should be viewed as recommenda-tions only. They may be modified for individual vehicles.*

## Cool Engine

### Outside Temperature Cooler than 60˚ F

Turn the fuel valve to the ON position. BE SURE THAT THE THROTTLE IS CLOSED. Pull the enrichener knob to the “full out” position. Turn the Ignition/Light Key Switch knob to the IGNITION position. Turn the Engine Stop Switch to the RUN position. Press the Engine Start Switch to operate the electric starter.

1. After initial 15-30 second warm-up, ride for 3 minutes or 2 miles with enrichener knob in full out position.
2. After 3 minutes or 2 miles, push the enrichener knob in to the 1/2 way position. Ride 2 minutes or 2 miles.
3. After 2 minutes or 2 miles, push the enrichener knob fully in.

*NOTE*

*If outside temperature is cooler than 20˚ F it may be necessary to pump the throttle control grip 2 or 3 times.*

### Outside Temperature Warmer than 60˚ F

Turn the fuel valve to the ON position. BE SURE THAT THE THROTTLE IS CLOSED. Pull the enrichener knob to the “full out” position. Turn the Ignition/Light Key Switch knob to the IGNITION position. Turn the Engine Stop Switch to the RUN position. Press the Engine Start Switch to operate the electric starter.

1. After the initial 15-30 second warm-up, ride for 1 minute or 1/2 mile with enrichener knob in full out position.

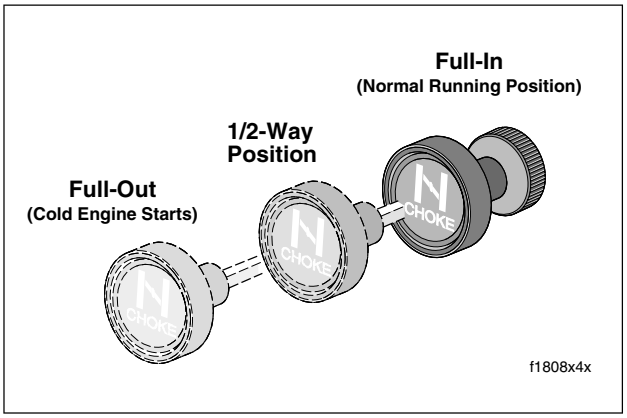



**Figure 4-2. Set the Enrichener Knob**

2. After 1 minute or 1/2 mile, push the enrichener knob in to the 1/2 way position. Ride 1 minute or 1/2 mile.
3. After 1 minute or 1/2 mile, push the enrichener knob fully in.

## Warm Climate Or Hot Engine

Turn the fuel valve to the ON position. Turn the Ignition/Light Key Switch knob to the IGNITION position. Turn the Engine Stop Switch to the RUN position. Open throttle 1/8 - 1/4 turn. Press the Engine Start Switch to operate the electric starter. DO NOT USE ENRICHENER.

*NOTE*

*If the engine does not start after a few turns or if one cylinder fires weakly but engine does not start, it is usually because of an over-rich (flooded) condition. This is especially true of a hot engine. If the engine is flooded, push enrichener knob in all the way, turn ignition on and operate starter with throttle wide open. DO NOT "pump" the throttle while turning over the engine.*

# ADJUSTMENTS

## Slow Idle

*NOTE*

*Make certain the enrichener knob is pushed all the way in before adjusting engine idle. The CV carburetor enrichener-circuit will cause the engine idle speed to increase to between 1500 and 2000 rpm with the enrichener knob pulled out fully and the engine at normal operating temperature. (With the enrichener knob pulled out partially and normal engine operating temperature, the engine idle speed will increase above normal idle speed (950-1050 rpm) to approximately 2000 rpm maximum with the enrichener knob pulled out fully). The increase in idle speed is intended to alert the rider that the engine is warmed-up and the enrichener knob should be pushed all the way in. Continued use of the enrichener, after engine is at normal operating temperature, may cause fouled spark plugs.*

With the engine at normal operating temperature and the enrichener all the way in (enrichener valve closed) adjust the throttle stop screw so the engine idles at 1000 rpm.

*NOTE*

*Use a test tachometer, connected to negative ignition coil terminal to measure engine rpm on models without tachometers.*

## Enrichener Control

Check fuel enrichener operation. The fuel enrichener knob should open, remain open and then close without binding. The knurled plastic nut next to the enrichener knob controls the ease at which the cable slides within the conduit.

If adjustment is needed:

1. See Figure 4-3. Loosen hex nut at backside of mounting bracket.
2. Move cable assembly free of slot in mounting bracket.
3. Hold cable assembly at flat with adjustable wrench. Hand turn knurled nut counterclockwise to reduce sliding resistance until knob slides inward unaided.
4. Turn knurled nut clockwise to increase sliding resistance until knob remains fully out without holding and then closes with relative ease.

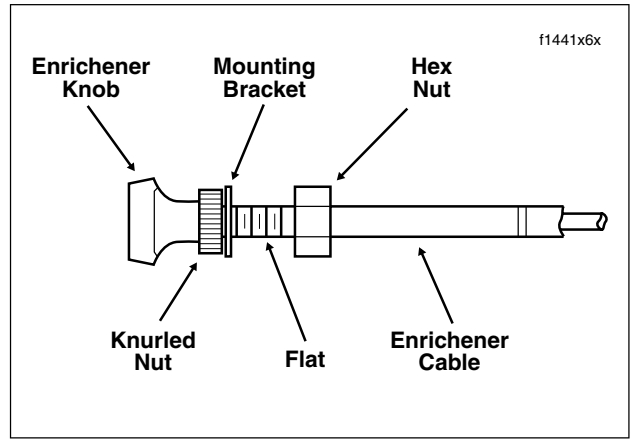



**Figure 4-3. Enrichener Control**

5. Position enrichener cable assembly in slot of mounting bracket with hex nut on inboard side. Tighten hex nut to 20-35 **in-lbs** (2.3-4.0 Nm).

**CAUTION**

**Do not lubricate the cable or inside of conduit. The cable must have sliding resistance to work properly.**

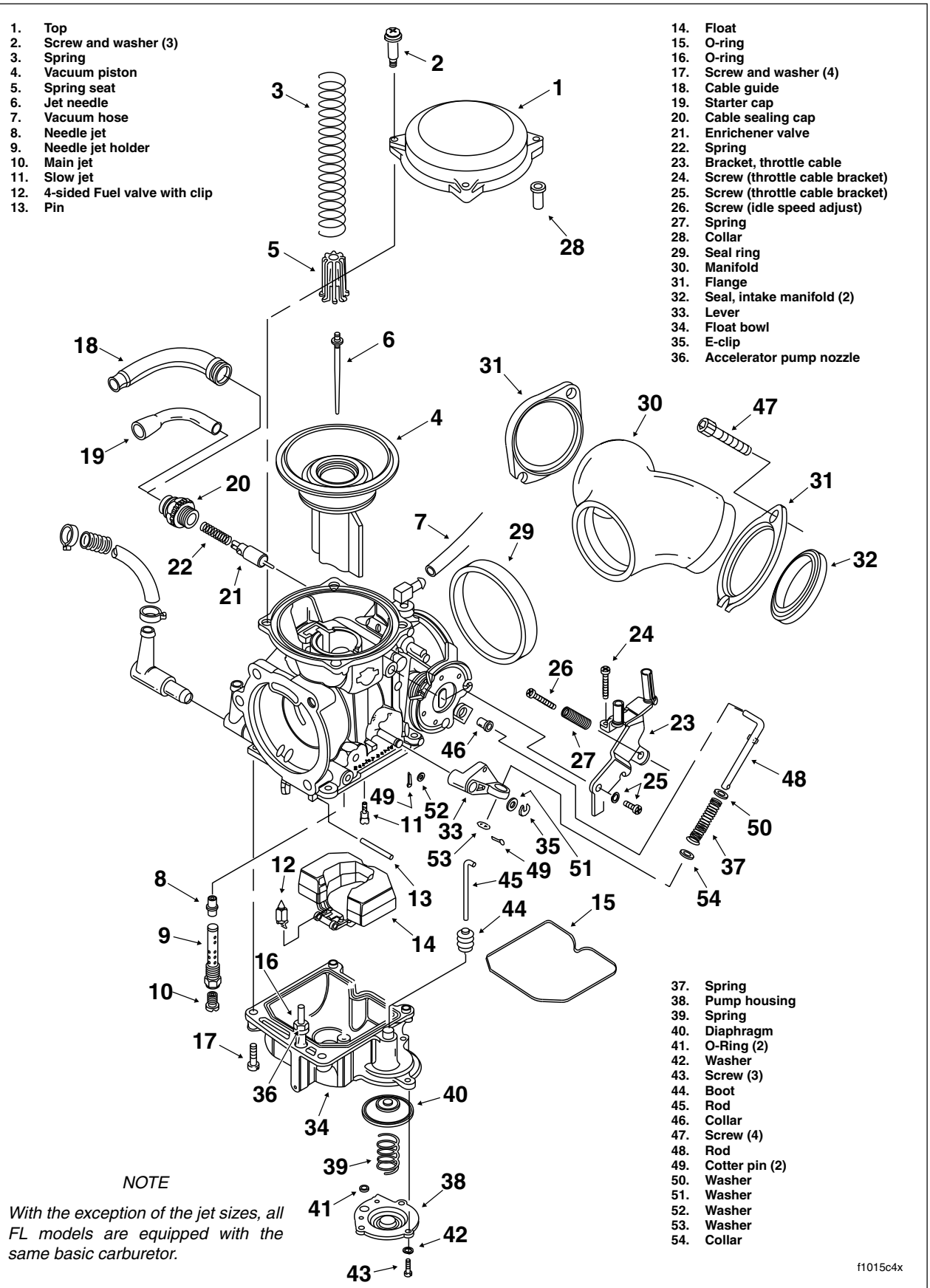



**Figure 4-4. Carburetor**

## REMOVAL

**⚠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.**

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠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.**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. Remove air cleaner assembly. See Section 4.5 AIR CLEANER, REMOVAL.
4. Locate the fuel enrichener knob under the left side of the fuel tank, and loosen hex nut at backside of mounting bracket. Slide cable assembly free of slot in mounting bracket.
5. Rotate handle on fuel valve to the horizontal position to shut the gasoline supply to the carburetor OFF.

**⚠WARNING**

**Some gasoline will drain from the fuel inlet hose when disconnected from the carburetor. Thoroughly wipe up any spilled fuel immediately. Dispose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.**

6. Using a side cutters, cut clamp and remove fuel inlet hose from fitting at side of carburetor.

*NOTE*

*On California models, pull purge tube from fitting on same side of carburetor.*

7. Gently work carburetor free of seal ring on intake manifold.

**⚠WARNING**

**As the carburetor is removed, be sure to keep assembly upright as the float bowl contains gasoline. Tilting the carburetor or turning it upside down will cause the gasoline to drain onto surrounding area. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.**




**Figure 4-5. Remove Enrichener Cable**

8. Using a needle nose pliers, carefully pull idle cable barrel from hole in throttle wheel farthest from throttle cam stop (upper inboard hole). Pull throttle cable barrel from remaining hole in throttle wheel. Release idle and throttle cables from guides in throttle cable bracket.
9. Pull vacuum hose elbow from fitting on inboard side of carburetor.
10. Carefully remove carburetor while drawing enrichener cable to right side of vehicle.
11. Keeping carburetor upright, move to bench area. Without tilting carburetor or turning upside down, remove four Phillips screws at bottom to remove float bowl from carburetor body. Carefully pour gasoline in float bowl into a suitable container. Loosely install screws to fasten float bowl to carburetor body.

## INSTALLATION

1. If loose, tighten four Phillips screws at bottom to secure float bowl to carburetor body.
2. Place carburetor into approximate position on right side of vehicle while feeding enrichener cable over to left side.
3. Push vacuum hose elbow onto fitting on inboard side of carburetor.
4. Install sleeve on throttle cable housing into shorter cable guide on throttle cable bracket. Drawing throttle cable downward, fit barrel end into hole in throttle wheel closest to throttle cam stop (lower outboard hole). Install sleeve and spring on idle cable housing into longer cable guide inserting barrel end into remaining hole in throttle wheel (upper inboard hole).

5. Verify that cables are fully seated in channel of throttle wheel, and using cable adjusters at handlebar, tighten cables as necessary to keep barrel ends from dislodging. Verify operation by turning throttle grip and observing cable action.

*NOTE*

*The fit between the carburetor and seal ring is tight. Prior to assembly, lubricate mating surfaces with liquid dishwashing soap or tire mounting lube.*

6. Lubricate inside diameter of seal ring. Also apply a light film of lubricant to carburetor housing where casting comes into contact with seal ring. Gently work carburetor into seal ring.
7. Slide **new** clamp onto free end of fuel inlet hose. Install hose onto fitting at side of carburetor. Crimp clamp using HOSE CLAMP PLIERS (HD-97087-65B).

*NOTE*

*On California models, push purge tube onto fitting on same side of carburetor.*

8. Moving to left side of vehicle, slide threaded portion of enrichener cable into slot of mounting bracket. Flat on threads must face rear of vehicle for script on en-richener knob to be right side up. With the external tooth lockwasher and hex nut positioned on the inboard side of the mounting bracket, tighten hex nut to 20-35 **in-lbs** (2.3-4.0 Nm).
9. Adjust throttle cables. See Section 2.19 THROTTLE CABLES (NON-ULTRA), ADJUSTMENT.
10. Install air cleaner assembly. See Section 4.5 AIR CLEANER, INSTALLATION.
11. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
12. Install seat. See Section 2.21 SEAT, INSTALLATION.
13. Rotate handle of fuel valve clockwise to the vertical position and carefully inspect for leaks. Return the valve to the OFF position when finished.
14. Adust the engine idle speed. See Section 4.3 ENRICHENER, ADJUSTMENTS.

## DISASSEMBLY - TOP END

1. Placing a 14mm open end wrench on hex, loosen plastic fitting at enrichener bore of carburetor housing. See Figure 4-5. Rotate enrichener cable in a counterclockwise direction to unthread fitting and remove valve assembly.
2. Remove gold Phillips screw (with lockwasher) at side of carburetor to release throttle cable bracket. Remove gold Phillips screw (with top collar) to free throttle cable bracket from carburetor top. Set bracket aside.

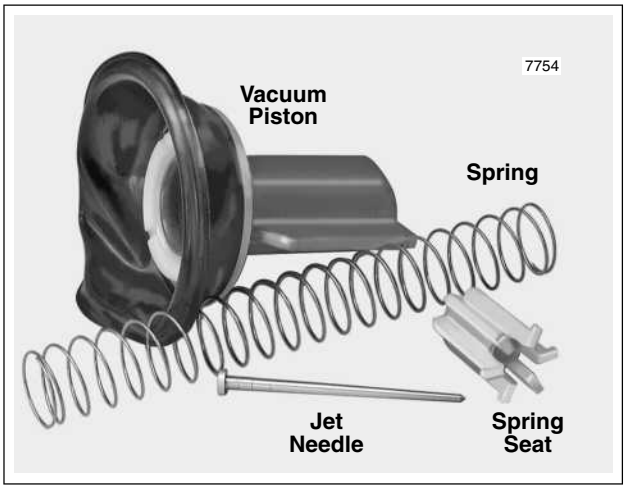



**Figure 4-6. Carburetor- Top End**

3. Remove three remaining top screws to release carburetor top from body.
4. Remove vacuum piston spring. Carefully raise diaphragm to remove vacuum piston assembly. Remove spring seat and jet needle from vacuum piston bore. See Figure 4-6.

## DISASSEMBLY - BOTTOM END

1. Turn carburetor upside down and remove four Phillips screws loosely installed at bottom. Remove float bowl from carburetor body.

*NOTE*

*Since accelerator pump rod is now loose, remove from hole in lever at side of carburetor body.*

**CAUTION**

**Tapping the float pin out from the squared pedestal side will result in damage that requires carburetor replacement**

2. Using a small center punch and hammer, carefully tap float pin from holes in pedestals. The rounded pedestal has an interference fit to ensure that the float pin is securely held, so always tap out the pin in the direction of the cast-in arrow (that is, from the interference side). See Figure 4-7.
3. Remove float and fuel valve. Carefully slide clip on fuel valve from tab on float. Remove wireform clip from groove in fuel valve. See A of Figure 4-8.
4. Using slot at top, turn main jet with flat tip screwdriver to unthread from needle jet holder. If necessary, hold hex on needle jet holder with a 5/16 inch wrench to prevent rotation. See Figure 4-10.
5. Using a 5/16 inch wrench, turn hex on needle jet holder to unthread from main jet bore.

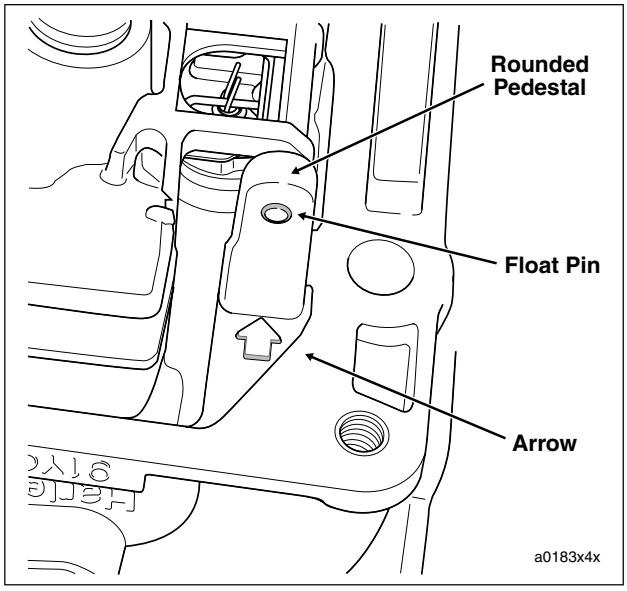



**Figure 4-7. Remove Float Pin in Direction of Arrow**

6. Turn carburetor right side up to drop out needle jet, which is loose in main jet bore. See B of Figure 4-8.
7. Insert thin bladed flat tip screwdriver into slow jet bore, and using slot at top of slow jet, unthread to remove. See Figure 4-10 and C of Figure 4-8.
8. Disassemble accelerator pump from float bowl. See Figure 4-9. Proceed as follows:
   a. Remove rubber boot from post at top of accelerator pump upper housing.
   b. Turn float bowl upside down. Alternately loosen and then remove three Phillips screws (with lockwashers) to release accelerator pump lower housing.
   c. Remove spring and diaphragm from accelerator pump upper housing. Remove two O-rings from lower housing.

# CLEANING AND INSPECTION

## Carburetor Housing

1. Clean all internal air/fuel passages in carburetor housing with carburetor cleaner. Blow out passages using low pressure compressed air. Proceed as follows:

**⚠WARNING**

**Compressed air can pierce the skin and cause injury. Never use your hand to check for leaks or to determine air flow rates. Wear safety glasses to shield your eyes from flying dirt and debris. Failure to comply could result in death or serious injury.**

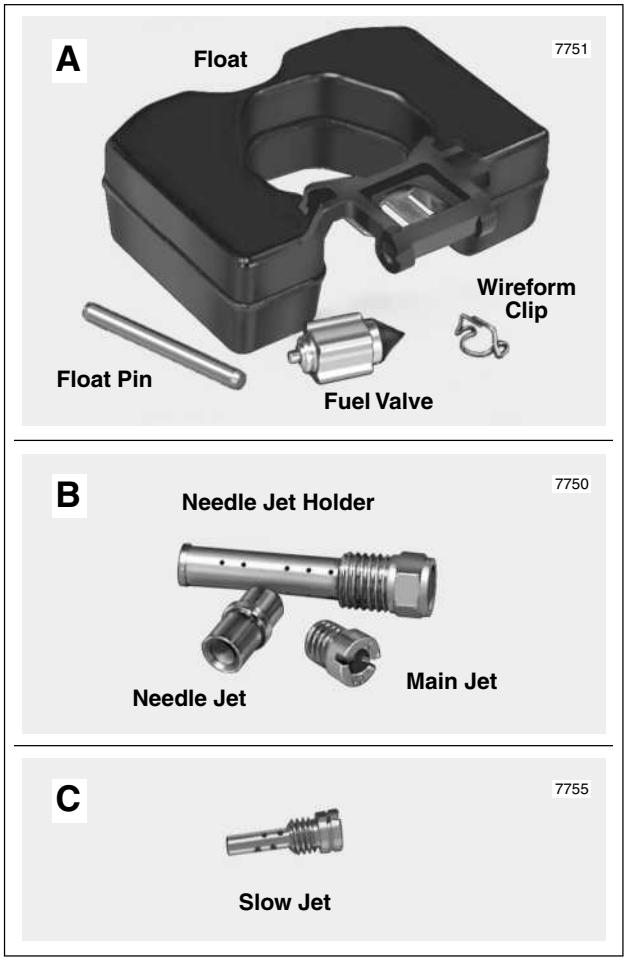



**Figure 4-8. Carburetor- Bottom End**

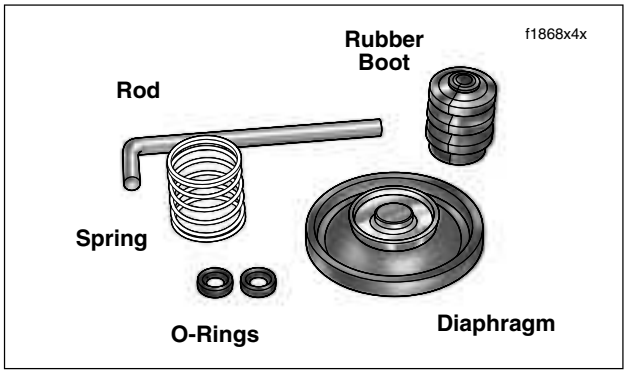



**Figure 4-9. Accelerator Pump Components**

### Slow Speed Circuit

a. Spray carburetor cleaner into air inlet hole of slow speed circuit. See A of Figure 4-11. While spraying, verify that solution exits slow jet bore at bottom of carburetor housing. See B of Figure 4-11. Placing gloved finger over slow jet bore, verify that solution

exits four pin holes just inboard of the throttle plate, as well as the single pin hole outboard of the throttle plate.

b. Using a tapered, rubber-tipped nozzle on the air hose (to prevent both loss of air pressure and to avoid scratching or nicking the bore), apply low pressure compressed air into air inlet hole to blow carburetor cleaner out of slow jet bore. Placing gloved finger over slow jet bore, blow carburetor cleaner out of pin holes inboard and outboard of throttle plate.

### Main Circuit

a. Plugging main jet hole in carburetor throat, spray carburetor cleaner into air inlet hole of main circuit. See A of Figure 4-11. While spraying, verify that solution exits main jet bore at bottom of carburetor housing. See B of Figure 4-11.

b. Using a tapered, rubber-tipped nozzle on the air hose (to prevent both loss of air pressure and to avoid scratching or nicking the bore), apply low pressure compressed air into air inlet hole to blow carburetor cleaner out of hole in carburetor throat. Placing gloved finger over hole in carburetor throat, blow carburetor cleaner out of main jet bore at bottom of carburetor housing.

### Float Bowl Vent

a. Spray carburetor cleaner into air inlet hole of float bowl vent. See A of Figure 4-11. While spraying, verify that solution exits two holes in float bowl chamber at bottom of carburetor housing. See B of Figure 4-11.

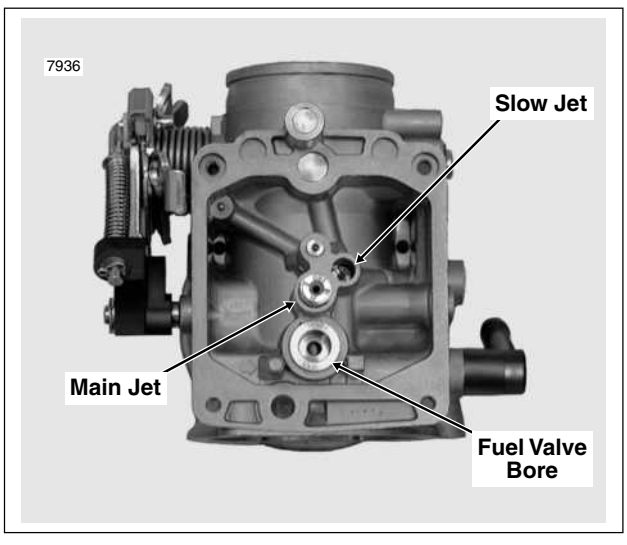



**Figure 4-10. Carburetor Housing**

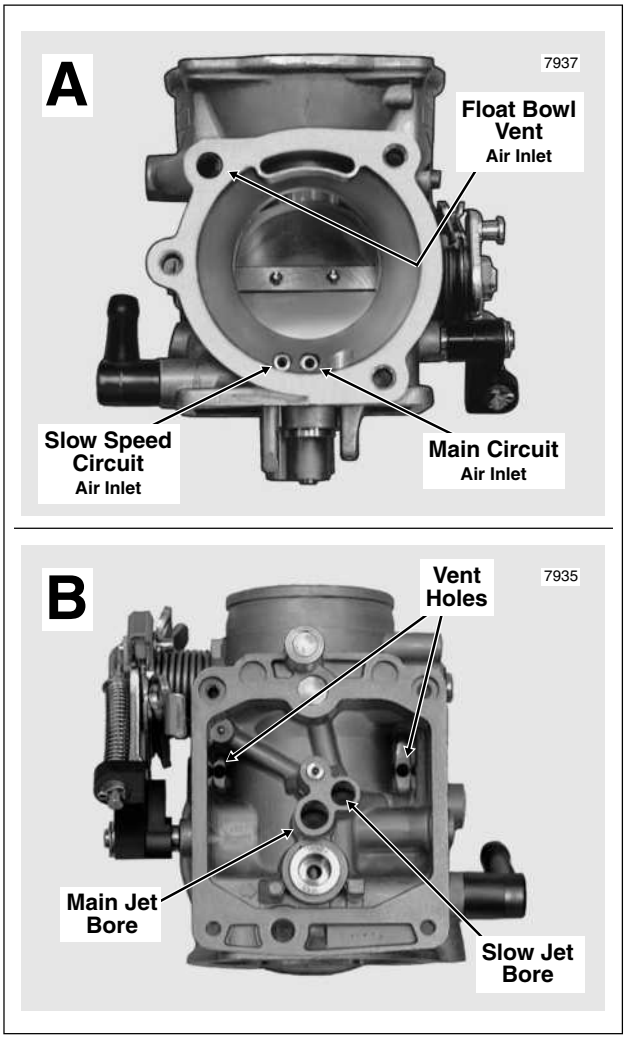



**Figure 4-11. Clean Air/Fuel Passages in Carburetor**

b. Using a tapered, rubber-tipped nozzle on the air hose (to prevent both loss of air pressure and to avoid scratching or nicking the bore), apply low pressure compressed air into air inlet hole of float bowl vent to blow carburetor cleaner out of holes in float bowl chamber.

## Top End Components

1. Thorougly clean all loose parts (except diaphragm) with carburetor cleaner. See Figure 4-6. Blow dry using low pressure compressed air.

**⚠WARNING**

**Compressed air can pierce the skin and cause injury. Never use your hand to check for leaks or to determine air flow rates. Wear safety glasses to shield your eyes from flying dirt and debris. Failure to comply could result in death or serious injury.**

2. Inspect parts as follows:
   a. Hold vacuum piston up to strong light source. Examine diaphragm for pin holes, cuts, tears or pinching. Replace if any damage is found.
   b. Examine passage at bottom of vacuum piston bore. Verify that passage is clean and open.
   c. Examine vacuum piston spring for stretching, kinking, distortion or other damage. Inspect spring seat for cracks. Replace parts if necessary.
   d. Examine slides at sides of vacuum piston to verify that surfaces are clean and smooth. Clean or buff out any rough surfaces.
   e. Examine tip of jet needle for grooves or scratches. Needle should be completely straight, while surface condition at taper should be smooth and even. Replace needle if necessary.

## Bottom End Components

1. Thorougly clean all loose parts with carburetor cleaner. See Figure 4-8. Blow dry using low pressure compressed air.

**⚠WARNING**

**Compressed air can pierce the skin and cause injury. Never use your hand to check for leaks or to determine air flow rates. Wear safety glasses to shield your eyes from flying dirt and debris. Failure to comply could result in death or serious injury.**

2. Inspect parts as follows:
   a. Inspect O-ring in groove of float bowl for cuts, tears or signs of deterioration. Replace O-ring if distorted or if sealing surface is damaged.
   b. Inspect float pin for damage or distortion. Replace float pin if corroded, nicked or bent.
   c. Clean float and inspect for cracks or other damage. Submerge float in a glass of water. Replace float if not water tight.
   d. Depress pin on fuel valve to verify that it returns to the full-out position. Thoroughly clean valve with carburetor cleaner if pin is dirty or sticks. Inspect rubber cone on valve for dirt, cracks, hardening or wear. Inspect wireform clip for distortion. Replace fuel valve assembly if any of these conditions are found.
   e. Inspect fuel valve seat in carburetor housing for dirt, damage or corrosion. Replace carburetor if seat damage or corrosion is present.
   f. Verify cleanliness of main jet, needle jet holder and needle jet. Verify that orifices in needle jet holder are clean and open. Replace parts if damaged.
   g. Verify cleanliness of slow jet. Be sure that all orifices are clean and open. Replace jet if damaged.

### Accelerator Pump

   h. Inspect the accelerator pump diaphragm for holes, cuts, tears or cracks. Replace diaphragm if deformed or damaged.
   i. Examine spring for stretching, kinking or distortion. Replace if any damage is found.
   j. Inspect the accelerator pump rod for straightness. Replace the rod if bent.
   k. Inspect rubber boot and two O-rings for cuts, tears or signs of deterioration. Replace if necessary.

# ASSEMBLY - TOP END

1. Install vacuum piston into carburetor body. Slides on piston are offset, so piston will fit into slide track groove only one way. If vacuum piston does not fit, rotate assembly 180°.
2. Insert jet needle into vacuum piston bore, so that it enters center hole at bottom. In the installed position, head of needle contacts boss at bottom of vacuum piston bore, while length of shaft resides in main jet bore.
3. With the legged side down, slide spring seat over top of needle in vacuum piston bore. Slide spring over spring seat.
4. Verify that lip on edge of diaphragm is seated in groove of carburetor flange.

*NOTE*

*Diaphragm expands when in contact with fuel. If diaphragm is difficult to seat in groove because of this condition, allow diaphragm to dry before attempting to install.*

5. Fit free end of spring over boss on inboard side of carburetor top, and keeping spring straight, align holes in top with those in flange.
6. Holding top to flange, check for proper diaphragm seal by pushing up on vacuum piston (from intake side) and releasing. If diaphragm is sealed correctly, very slight resistance should be felt when pushing up, and piston should be slow to extend. If piston movement is restricted, spring is cocked. Lift up on top and then lower carefully keeping spring coils straight.
7. Install three black top screws in holes furthest from throttle wheel. Alternately tighten screws until snug.
8. Slide gold top collar into remaining hole in carburetor top. With end of idle screw resting against idle cam stop, align holes in throttle cable bracket with those in carburetor body and top cover. To prevent bending bracket or cam stop, first install gold Phillips screw (with lockwasher) at side of carburetor. At carburetor top, install remaining Phillips screw.

9. Carefully insert enrichener valve into carburetor bore. Start threaded end of plastic fitting into bore, and then rotate cable in a clockwise direction to install. Exercising caution to avoid damaging the plastic construction, tighten fitting using a 14mm open end wrench. See Figure 4-5.

## ASSEMBLY - BOTTOM END

1. Place needle jet into main jet bore. See Figure 4-10. Be sure end with chamfered edge and larger ID goes in first.
2. Insert needle jet holder into main jet bore, and using a 5/16 inch wrench, turn hex until snug.
3. Thread main jet into needle jet holder. Using slot at top of main jet, tighten with flat tip screwdriver until snug.
4. Insert slow jet into slow jet bore. See Figure 4-10. Insert thin bladed flat tip screwdriver into bore, and using slot at top of slow jet, tighten until snug.
5. Install wireform clip into groove on pin side of fuel valve, if removed. Using wireform clip, carefully hang fuel valve onto tab of float, so that tip of rubber cone hangs flush with top of float (the top being the side opposite the pivot arm).
6. Place float into cavity of carburetor inserting fuel valve into bore between pedestals. See Figure 4-10.

**CAUTION**

**Tapping the float pin in from the rounded pedestal side will result in damage that requires carburetor replacement.**

7. Insert float pin through squared pedestal and pivot arm of float into rounded pedestal. Since the rounded pedestal has an interference fit to ensure that the float pin is securely held, always install pin from the loose side (in the direction opposite the cast-in arrow). Using a small center punch and hammer, carefully tap float pin until ends are flush with outboard sides of pedestals.
8. Perform float level check as follows:
   a. Place carburetor on a clean flat surface with the intake manifold side down. See A of Figure 4-12.
   b. Tilt the carburetor 15° to 20° in a counter-clockwise direction until float comes to rest. See B of Figure 4-12.

*NOTE*

*The measurements will be incorrect if the carburetor is tilted less than 15 ° or more than 20 °.*

   c. Using a dial vernier caliper or dial caliper depth gauge, measure the distance from the face of the carburetor flange to the outboard edge of the float. Be careful not to push on float while measuring.

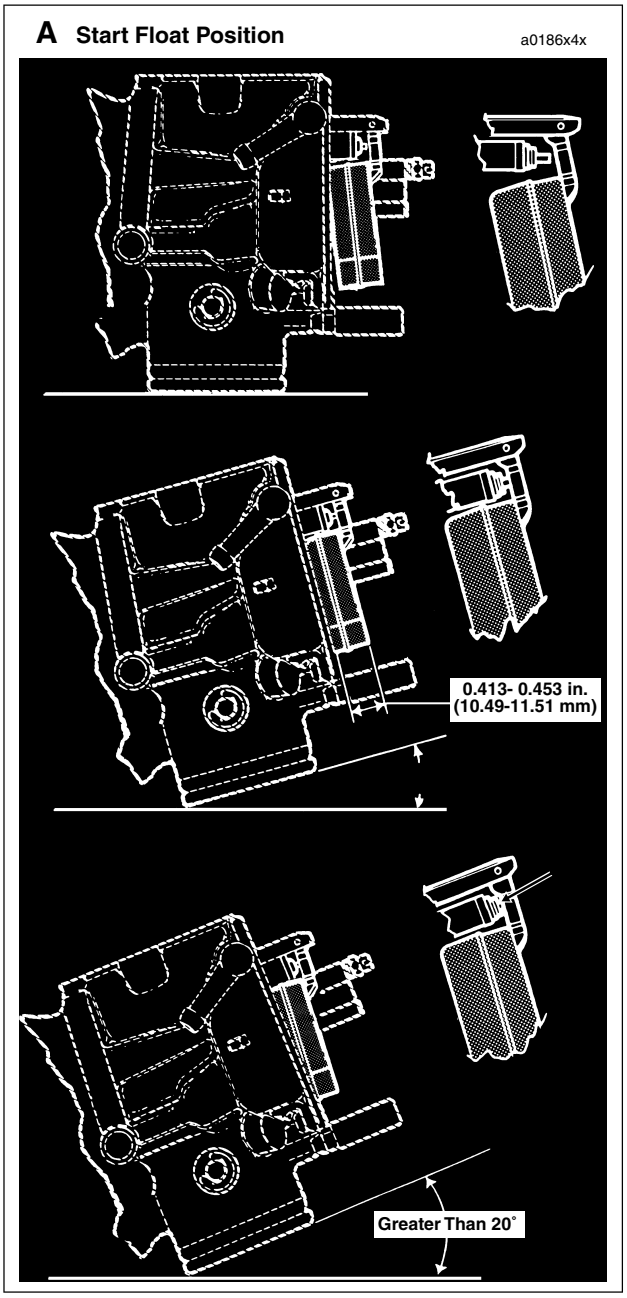



**Figure 4-12. Float Check and Adjustment**

   d. If the measurement is between 0.413 inch and 0.453 inch (10.49 -11.51 mm), then the float level is within specification. Proceed to step 9.
   e. If the float level is not within specification, remove the float, and referencing the table below, carefully bend the tab slightly to adjust the float level. For example, to increase the float measurement, bend the tab toward the carburetor body. This will have the affect of decreasing the amount of gas in the float bowl after assembly.

## Table 4-1. Float Level Tab

| Float Measurement | Bend Tab | Amount of Gas in Float Bowl |
|---|---|---|
| To Increase | Toward Carburetor Body | Decreased |
| To Decrease | Away From Carburetor Body | Increased |

f. Install float and check float level again. Repeat procedure as necessary until float level is within specification.

9. Install new O-ring into groove of float bowl, if removed. Be sure to thoroughly clean groove before O-ring installation.
10. Assemble accelerator pump as follows:
    a. With the flat side toward the casting, install two O-rings into counterbores of accelerator pump lower housing.
    b. Install diaphragm into accelerator pump upper housing. Verify that lip on edge of diaphragm is fully seated in groove.
    c. Place spring onto spring seat at center of installed diaphragm.
    d. Keeping spring straight, mate upper and lower housings of accelerator pump. Install three Phillips screws (with lockwashers).
    e. Install rubber boot onto post at top of accelerator pump upper housing.
    f. Hook accelerator pump rod into hole on inboard side of lever at side of carburetor body.
11. Install float bowl at bottom of carburetor body engaging free end of accelerator pump rod in hole of rubber boot.
12. Install four Phillips screws to secure float bowl at bottom of carburetor body. Tighten screws until snug.

# AIR CLEANER 4.5

*NOTE*

*For fuel injected models, refer to SECTION 9 for air cleaner removal and installation instructions.*

## GENERAL

The air cleaner prevents foreign material from entering the carburetor and engine, trapping airborne dust and dirt in the filter element. Service the air cleaner filter element every 5,000 miles (8,000 km), or more often if the motorcycle is run in a dusty environment.

## REMOVAL

1. Remove large allen head socket screw in center of air cleaner cover. Remove air cleaner cover with rubber seal. See Figure 4-13.
2. Remove three T27 TORX screws to release cover bracket from filter element.
3. Remove filter element pulling two breather tubes from holes on inboard side.
4. Remove gasket from sleeve on inboard side of filter element. Discard gasket.
5. Remove breather tubes from fittings on two cylinder head breather bolts.
6. Remove two cylinder head breather bolts from backplate using a 7/16 inch deepwell socket.
7. Remove backplate from cylinder heads. On California models, pull clean air inlet tube (to charcoal canister) from hole in backplate.
8. Remove two O-rings from grooves around breather bolt holes on inboard side of backplate. Discard O-rings.
9. Remove gasket from inboard side of backplate. Discard gasket.

## CLEANING AND INSPECTION

1. Thoroughly clean air cleaner cover and backplate.
2. Replace the filter element if damaged or if filter media cannot be adequately cleaned.

**⚠WARNING**

**Do not use gasoline or solvents to clean the filter element. Volatile or flammable cleaning agents may cause an intake system fire, which could result in death or serious injury.**

3. Wash the filter element and breather tubes in warm, soapy water. To remove soot and carbon, soak element for 30 minutes in warm water with mild detergent.

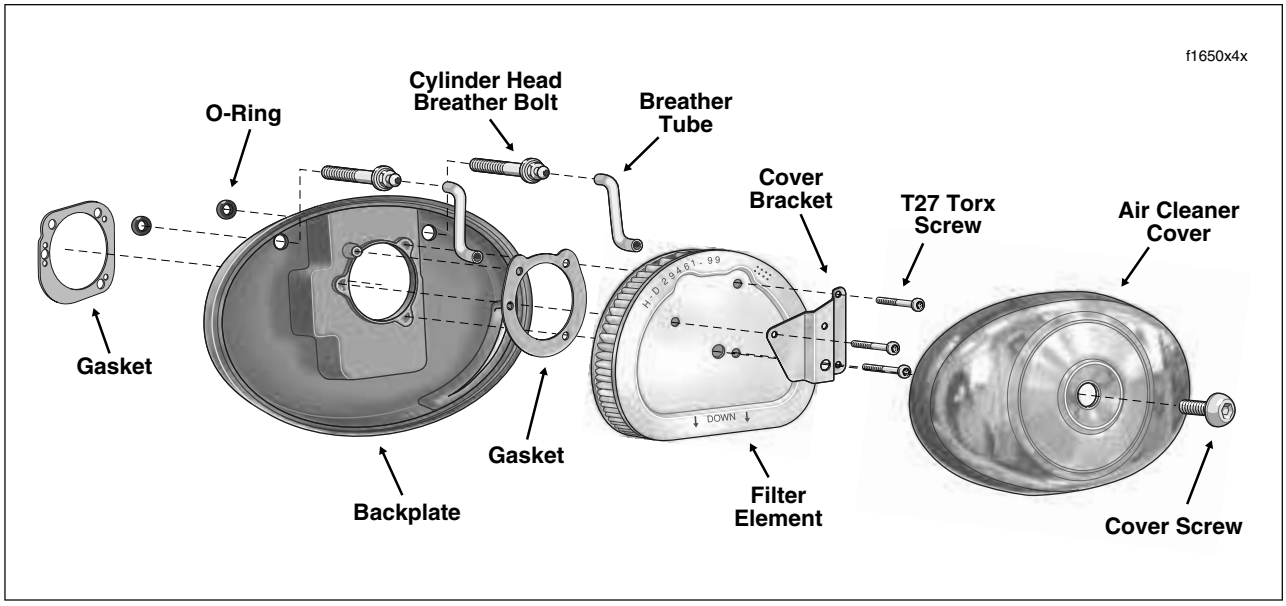



**Figure 4-13. Air Cleaner Assembly (Carbureted)**

**⚠WARNING**

**Compressed air can pierce the skin and cause injury. Never use your hand to check for leaks or to determine air flow rates. Wear safety glasses to shield your eyes from flying dirt and debris. Failure to comply could result in death or serious injury.**

1. Dry the filter element using low pressure compressed air (32 psi/221 kPa maximum). Rotate the element while moving air nozzle up and down the element interior. Do not rap the element on a hard surface.
2. Hold the filter element up to a strong light source. The element can be considered sufficiently clean if light is uniformly visible through the media.
3. Inspect the breather tubes for cuts, tears, holes or signs of deterioration. Replace as necessary. Direct compressed air through the breather tubes to verify that they are not plugged.

## INSTALLATION

1. Install **new** O-rings in grooves around breather bolt holes on inboard side of backplate.
2. Install **new** gasket aligning small holes with plastic pins on inboard side of backplate. On California models, push clean air inlet tube (to charcoal canister) into hole of backplate until stopped by shoulder.
3. Align holes in backplate with those in cylinder heads and install cylinder head breather bolts. Using a 7/16 inch deepwell socket, alternately tighten bolts to 10-12 ft-lbs (13.6-16.3 Nm).
4. With the lettered side facing outward, slide **new** gasket over sleeve on inboard side of filter element.
5. Insert breather tubes about 1/4 inch into holes on inboard side of filter element.
6. Install breather tubes onto fittings of two cylinder head breather bolts.

*NOTE*

*Air cleaner mounting without installation of the breather tubes allows crankcase vapors to be vented into the atmosphere in violation of legal emissions standards.*

7. Place filter element onto backplate so that hole in element fits over boss molded into backplate.
8. Align holes in cover bracket with those in filter element and start three screws. Stamp on cover bracket points to downside. Using a T27 TORX drive head, alternately tighten screws to 20-40 **in-lbs** (2.3-4.5 Nm) in a crosswise pattern.
9. Verify that rubber seal is properly seated around perimeter of air cleaner cover. Replace seal if cut, torn or shows signs of deterioration.
10. Fit air cleaner cover into backplate. Apply a small dab of Loctite Medium Strength Threadlocker 243 (blue) to threads of large allen head socket screw. Install screw in center of air cleaner cover. Tighten screw to 3-5 ft-lbs (4.1-6.8 Nm).

# VACUUM OPERATED FUEL VALVE 4.6

## GENERAL

A fuel supply valve is located under the fuel tank on the left side of the vehicle. The gasoline supply to the carburetor is dependent upon the position of the valve handle as well as the internal workings of the vacuum-operated valve.

Turn the 3-position valve handle down to the fully vertical position to turn the main fuel supply ON. Turn the handle up to the fully vertical position to access the RES(ERVE) supply. Move the handle to the horizontal position to shut the gasoline supply to the carburetor OFF. Always leave the valve in the OFF position when the engine is not running.

Gasoline will not flow through the fuel valve until the following conditions are met:

1. The valve handle must be turned to the ON or RES(ERVE) position.
2. A vacuum of approximately 0.5-1.0 inches of Mercury (Hg) must be applied to the vacuum fitting at the back of the fuel valve.

In service, the vacuum fitting is connected to the intake manifold. The partial vacuum applied at the fitting creates a difference in pressure between the front side of the diaphragm (which is vented to the atmosphere via the bottom fitting on the fuel valve) and the rear. This pressure differential causes the diaphragm to move against an internal spring, thereby opening an orifice that enables the flow of gasoline to the carburetor. When the vacuum at the vacuum fitting is removed, the internal spring pressure closes the orifice, which effectively halts the supply of fuel to the carburetor.

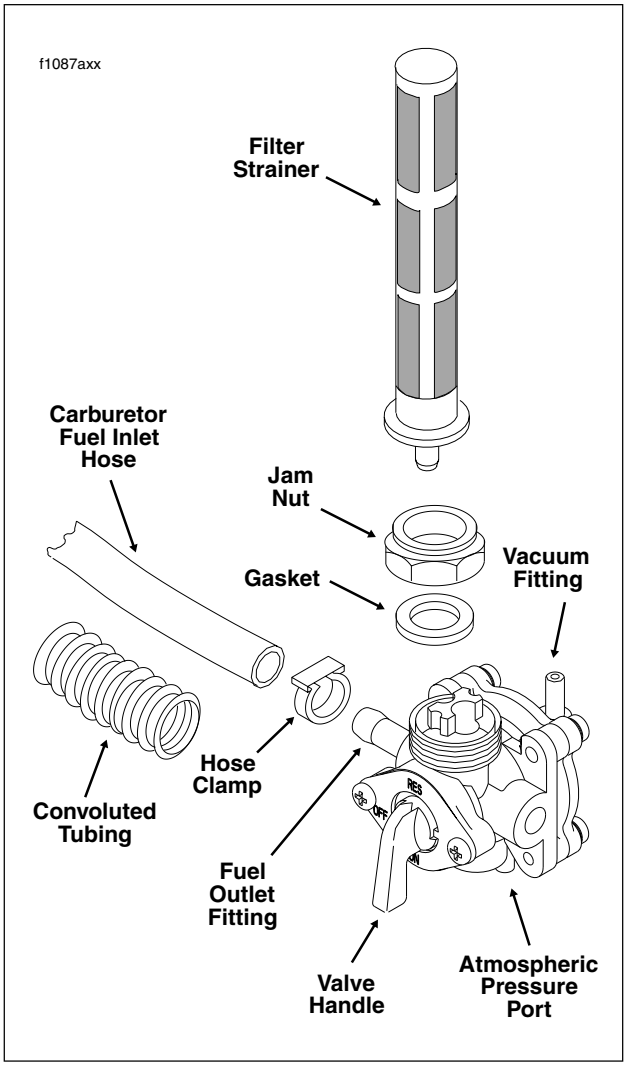



**Figure 4-14. Vacuum Operated Fuel Valve**

## TROUBLESHOOTING

If the fuel valve is not functioning properly, refer to the troubleshooting chart on the next page.

### Removal

#### Draining Fuel Tank

**⚠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.**

1. Turn the handle of the fuel valve to OFF.

**⚠WARNING**

**A small amount of gasoline may drain from the carburetor fuel inlet hose when disconnected from the fuel valve fitting. Thoroughly wipe up any spilled fuel immediately and dispose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.**

2. Using a side cutters, cut clamp and remove the carburetor fuel inlet hose from the fuel outlet fitting at the side of the fuel valve. See Figure 4-14. Drain free end of hose into a suitable container.

3. Remove the intake manifold vacuum hose from the vacuum fitting at the back of the fuel valve.
4. Attach a length of fuel hose to the fuel outlet fitting. The hose must be long enough to reach a suitable gasoline container.
5. Turn the handle of the fuel valve to RES(ERVE).
6. Using the correct hose adapter, connect the Mity-Vac® Hand Pump (HD-23738) to the vacuum fitting.

**CAUTION**

**To avoid damage to the diaphragm of the fuel valve, do not apply a vacuum greater than 25 inches of Mercury (Hg) to the vacuum fitting.**

7. Gently apply a vacuum of 1-10 inches of Mercury (Hg) to the vacuum fitting to get a good flow of gasoline through the valve.
8. When the fuel tank is completely drained, disconnect the Mity-Vac® Hand Pump from the vacuum fitting.
9. Turn the hex jam nut to remove the fuel valve assembly from the fuel tank.

*NOTE*

*The hex jam nut has left handed threads where it mates with the fuel valve assembly.*

10. Turn the hex jam nut clockwise to remove it from the fuel valve.
11. Remove the fuel filter strainer and gasket from the valve head. Discard the gasket.

## Cleaning and Inspection

1. Clean or replace the fuel filter strainer.
2. Flush the tank to remove all dirt. See Section 4.7 FUEL TANK, CLEANING AND INSPECTION.

## Installation

1. Apply Loctite PIPE SEALANT WITH TEFLON to the threads of the fuel valve and fuel tank
2. Install a **new** gasket on the fuel valve. Install the fuel filter strainer fitting the internal tube into the larger hole in the valve head.
3. Thread the hex jam nut into the fuel tank two full turns. Holding the nut to prevent further rotation, thread the fuel valve into the hex jam nut two full turns.
4. Holding the fuel valve, turn the hex jam nut into the fuel tank in a clockwise direction. Tighten the nut to 18 ft-lbs (24 Nm).

**⚠WARNING**

**Do not thread hex jam nut onto fuel valve more than two turns or fitting may "bottom" on valve, a condition which may result in a gasoline leak. Any gasoline leak is a potential fire hazard that could result in death or serious injury.**

### Table 4-2. Troubleshooting Vacuum Operated Fuel Valve

| Problem | Cause | Solution |
|---|---|---|
| 1. Vacuum valve not opening. | 1.1 Hose not connected to vacuum fitting. | 1.1.1 Connect hose to vacuum fitting. |
| | 1.2 Leaking diaphragm. | 1.2.1 Replace diaphragm. |
| | 1.3 Hose connected to atmospheric pressure port. | 1.3.1 Connect hose to vacuum fitting. |
| | 1.4 Vacuum hose assembly pinched or cracked. | 1.4.1 Replace vacuum hose assembly. |
| 2. Vacuum valve does not close. | 2.1 Damaged sealing surface on valve side of diaphragm. | 2.2.1 Replace diaphragm. |
| | 2.2 Plugged vacuum fitting. | 2.2.2 Clean as necessary. |
| | 2.3 Broken or missing internal spring. | 2.3.1 Replace entire valve assembly. |
| 3. Valve leaks gasoline at atmospheric pressure port. | 3.1 Leaking diaphragm. | 3.1.1 Replace diaphragm. |
| | 3.2 Loose diaphragm housing screws. | 3.2.1 Tighten screws. |

**CAUTION**

**Do not allow dirt or fluids to get into the vacuum hose assembly that connects the fuel valve and VOES to the intake manifold. Contaminants can block the vacuum signal or inhibit free motion of moving parts which could cause the fuel valve to remain open.**

5. Connect the intake manifold vacuum hose to the vacuum fitting at the back of the fuel valve.
6. Slide **new** clamp onto free end of carburetor fuel inlet hose. Install hose onto fuel outlet fitting at side of fuel valve. Crimp clamp using HOSE CLAMP PLIERS (HD-97087-65B).
7. Turn the handle of the fuel valve to OFF and fill the fuel tank.
8. Open the fuel supply valve and carefully inspect for leaks. Return the valve to the OFF position after the inspection is complete.

*NOTE*

*To start vehicle, turn the valve handle to ON and start engine. No priming or special procedures are required to start fuel flow.*

## DIAPHRAGM REPLACEMENT

*NOTE*

*There may be some fuel leakage during this procedure. Place a shop rag under the valve to catch any fuel.*

1. Turn the handle of the fuel valve to OFF and remove the intake manifold vacuum hose from the vacuum fitting.
2. Remove the carburetor fuel inlet hose from the fuel outlet fitting on the valve body.
3. Turn the hex jam nut just enough (approximately 1/8 turn) to allow the valve body to be rotated.
4. Turn the valve body to the right until back of valve is accessible and then tighten hex jam nut to prevent fuel leakage.
5. Remove four black screws with captured lockwashers to release the diaphragm cover.
6. Remove the diaphragm cover and coil spring. Note the orientation of the original diaphragm as it sits in the diaphragm frame. The replacement diaphragm must fit in the frame the same way.
7. See Figure 4-15. Remove the diaphragm frame from the valve body. Press the small end of the diaphragm through the frame to remove the diaphragm assembly.

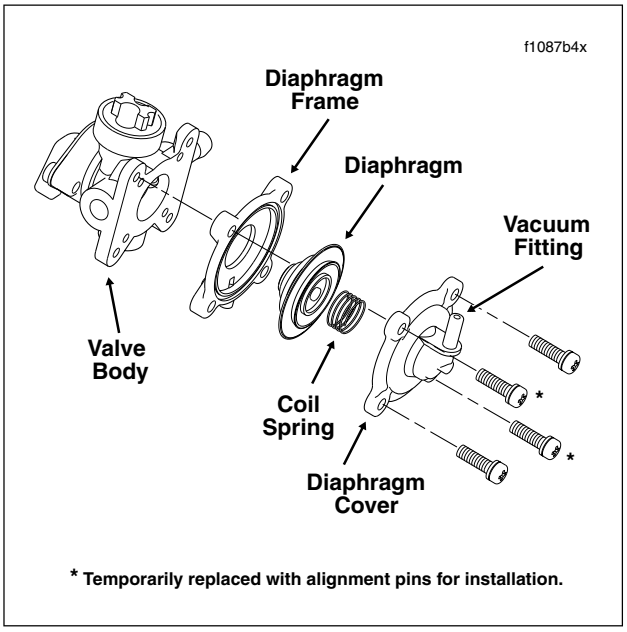



**Figure 4-15. Fuel Valve Components**

*NOTE*

*Diaphragm will install easily if small end is pinched in half when inserted into frame.*

8. Install the **new** diaphragm into the frame. Verify that the edges of the diaphragm are seated in the grooves in the frame.
9. Install the two alignment pins (provided in the service kit) into the top left and bottom right holes of the fuel valve body and hand tighten a few turns.
10. Slide the diaphragm frame over the alignment pins and up against the valve body, small end of the diaphragm first. Be sure the atmospheric pressure port points downward.

*NOTE*

*Do not attempt to assemble the diaphragm frame with spring and cover without installation of the alignment pins. Install frame on pins first, then position spring and cover.*

11. While holding diaphragm frame firmly against valve body, place coil spring and diaphragm cover over the alignment pins and then slide them into position. Since its position must not be disturbed, verify that the diaphragm is still seated in the frame grooves.
12. Install two screws in the open holes of the diaphragm cover. Tighten screws to 18.5 **in-lbs** (2.1 Nm).
13. Remove alignment pins and install remaining two cover screws. Tighten screws to 18.5 **in-lbs** (2.1 Nm).
14. Perform vacuum test on fuel valve to verify operation.

## Vacuum Test

1. Connect PLASTIC MITY-VAC® HAND PUMP, Part No. HD-23738, vacuum line and suitable vacuum fitting to the vacuum port of the petcock.
2. Run a section of clear fuel line from the fuel outlet fitting on the valve body to a gas can.
3. Turn the fuel valve to ON.
4. Pull 25 in. Hg vacuum and release. Check for fuel flow while applying vacuum and verify that fuel stops flowing shortly after vacuum is released.
5. Repeat Step 4 five times, each time checking for fuel flow at vacuum and no fuel flow shortly after vacuum is released. On fifth application of vacuum, pause with vacuum applied, and check for slow leaks. Release vacuum.
6. Turn the fuel valve to OFF.
7. If no leaks were present, go to Step 8. If leaks were present, repeat replacement procedure.
8. Disconnect hand held vacuum pump and fuel line.
9. Loosen hex jam nut 1/8 turn and rotate valve to the left. Tighten hex jam nut.
10. Position **new** hose clamp on carburetor fuel inlet hose and install hose to fuel outlet fitting on valve body.
11. Install the intake manifold vacuum hose to the vacuum fitting.

*NOTE*

*For fuel injected models, see Section 9.3 FUEL TANK ASSEMBLY for removal and installation instructions.*

## FLHT/C, FLTR

### Complete Removal

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠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.**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.

**⚠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.**

3. Drain the fuel tank. See Section 4.6 VACUUM OPERATED FUEL VALVE, DRAINING FUEL TANK, steps 1-8.

4. Carefully cut anchored cable strap securing main harness bundles, fuel level sender conduit, and fuel vapor vent tube to left frame tube.

5. Open console door. Remove two Allen head screws inboard of rubber bumpers. These screws secure console to clip nuts on the canopy bracket.

6. Remove Allen head screw to detach flange at rear of console from bracket welded to fuel tank.

7. Disconnect 2-place Multilock connector in front of battery to release fuel level sender from main harness. See Figure 4-16.

8. Lay a clean shop cloth on forward part of rear fender. Remove filler cap from neck of fuel tank. Remove console and lay upside down on shop cloth. Reinstall filler cap.

9. Pull fuel vapor vent tube from fitting on filler neck of fuel tank.

10. Using a T40 TORX drive head, remove two fuel tank front mounting bolts (with flat washers) from left and right side of frame. Remove bolt (with flat washer) to free rear of fuel tank from frame backbone.

**⚠WARNING**

**A small amount of gasoline may drain from the crossover hose when disconnected from the fuel tank. Thoroughly wipe up any spilled fuel immediately and dispose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.**

11. Using a side cutters, cut clamp from one end of crossover hose beneath fuel tank. Drain free end of hose into a suitable container.

12. Remove fuel tank from vehicle.

**CAUTION**

**Do not remove the center nut that holds the yellow wire terminal to the top plate of the fuel level sender or the sensor float device will drop into the fuel tank.**

13. Remove the five screws (with seals) around the outer edge of the canopy. Remove the canopy (with attached fuel level sender) from vehicle. Remove gasket.

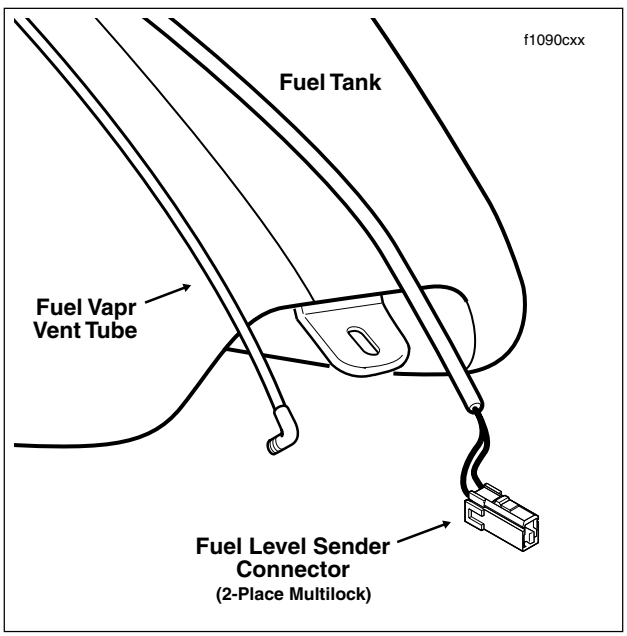



**Figure 4-16. Fuel Level Sender Connector**

**⚠WARNING**

**Even with the fuel tank completely drained, a small amount of gasoline may leak from the bore when the fuel supply valve is loosened or removed. Thoroughly wipe up any spilled fuel immediately and dispose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.**

14. Turn the hex jam nut to remove the fuel valve assembly from the fuel tank, if necessary.

## CLEANING AND INSPECTION

**⚠WARNING**

**An open flame or spark may cause a fuel tank explosion if all traces of fuel are not purged from the tank. Use extreme caution when servicing fuel tanks. Inadequate safety precautions could result in death or serious injury.**

**⚠WARNING**

**To assist in loosening deposits, use only non-ferrous metal balls (such as lead pellets) with fuel tank cleaning solutions. The use of ferrous materials may cause a spark, which can then ignite fuel vapors inside the tank. The resulting flames or explosion could result in death or serious injury.**

1. Plug fuel tank openings.
2. Fill the tank with commercial cleaning solvent or a soap and water solution.
3. Shake the tank to agitate the cleaning agent. If necessary, non-ferrous metallic balls or pellets may be added to the tank to help loosen deposits.
4. Thoroughly flush the fuel tank after cleaning. Allow tank to air dry.
5. Inspect the fuel lines and hoses for cuts, cracks or general deterioration. Replace as necessary.

*NOTE*

*The fuel line passes through a grommet located in a bracket under the top of the engine mount.*

6. Inspect the rubber mounts and bumpers for wear and deterioration. Replace as necessary.
7. Inspect the tank for leaks and other damage. Replace damaged tanks that cannot be successfully repaired.

## Installation (After Complete Removal)

1. Install fuel valve assembly onto fuel tank, if removed. See Section 4.6 VACUUM OPERATED FUEL VALVE, INSTALLATION.

**CAUTION**

**Exercise caution to avoid pinching wire harness between fuel tank and vehicle frame. Wire damage may result in electrical problems.**

2. Work fuel tank into position aligning front flange holes with those in frame.
3. Slide **new** clamp onto free end of crossover hose. Running hose beneath frame backbone, install hose onto fitting at bottom front of fuel tank. Crimp clamp using HOSE CLAMP PLIERS (HD-97087-65B).
4. Slide **new** clamp onto free end of carburetor fuel inlet hose. Install hose onto fuel outlet fitting at side of fuel valve. Crimp clamp.
5. Install the intake manifold vacuum hose onto the vacuum fitting at the back of the fuel valve.
6. Using a T40 TORX drive head, start fuel tank front mounting bolts (with flat washers) into left and right side of frame.
7. Install bolt (with flat washer) to secure rear of fuel tank to frame backbone. Tighten bolt to 6 ft-lbs (8 Nm).
8. Tighten fuel tank front mounting bolts to 15-18 ft-lbs (20-24 Nm).
9. Align holes in the canopy gasket with those in the fuel tank.
10. Hold canopy upright so that float on fuel level sender is extended. Insert float of sending unit into left side of fuel tank. Align holes in canopy with those in gasket.

**⚠WARNING**

**Always use new screws when installing the canopy. Reusing old canopy screws may compromise sealing integrity resulting in gas leaks. Gas leakage can cause fire or explosion which could result in death or serious injury.**

11. Hand start five screws in perimeter of canopy. Alternately tighten screws in a crosswise pattern.
12. Connect fuel vapor vent tube to fitting on filler neck of fuel tank.
13. Remove filler cap. Position console on canopy. Route cables from beneath console as shown in Figure 4-17. Be sure that hoses and wires are not pinched by the console during installation. Reinstall filler cap.

14. Install Allen head screw to fasten rear flange of console to welded bracket on fuel tank.

15. Open door on console. Install two Allen head screws to secure front of console to clip nuts on canopy bracket.

16. Connect the fuel level sender to the main harness. Locate the 2-place Multilock connector in front of battery. Press pin and socket halves of connector together until they snap in place. See Figure 4-16.

17. Snap anchor of **new** cable strap into hole on left side of frame. Tighten cable strap to capture main harness bundles, fuel level sender conduit, and fuel vapor vent tube along left frame tube. Cut any excess cable strap material.

*NOTE*

*Route fuel overflow hose inboard of wire bundles on right side of frame, but do not capture in cable straps. See Figure 4-17.*

18. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).

19. Install seat. See Section 2.21 SEAT, INSTALLATION.

20. Turn the handle of the fuel valve to OFF and fill the fuel tank.

21. Open the fuel valve and carefully inspect for leaks. Return the valve to the OFF position after the inspection is complete.

## Partial Removal

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠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.**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.

3. Carefully cut anchored cable strap securing main harness bundles, fuel level sender conduit, and fuel vapor vent tube to left frame tube.

4. Open console door. Remove two Allen head screws inboard of rubber bumpers. These screws secure console to clip nuts on the canopy bracket.

5. Remove Allen head screw to detach flange at rear of console from bracket welded to fuel tank.

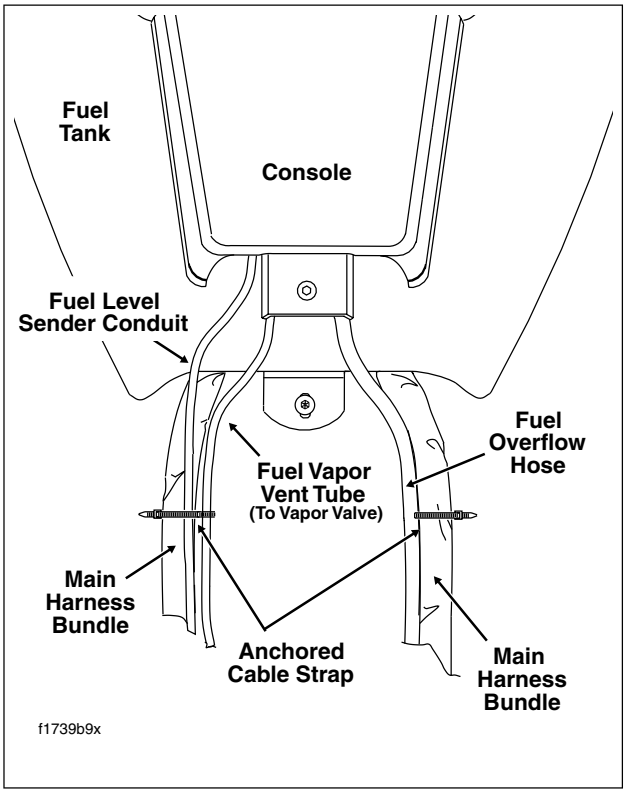



**Figure 4-17. Console Cable/Hose Routing -FLHT/C, FLTR (Top View)**

6. Disconnect 2-place Multilock connector in front of battery to release fuel level sender from main harness. See Figure 4-16.

7. Lay a clean shop cloth on forward part of rear fender. Remove filler cap from neck of fuel tank. Remove console and lay upside down on shop cloth. Reinstall filler cap.

8. Pull fuel vapor vent tube from fitting on filler neck of fuel tank.

9. Using a T40 TORX drive head, remove two fuel tank front mounting bolts (with flat washers) from left and right side of frame. Remove bolt (with flat washer) to free rear of fuel tank from frame backbone.

10. Raise the fuel tank approximately 2 inches. Unplug spark plug cables from ignition coil. Move the fuel tank crossover hose to the rear of the ignition coil, so that the tank can be raised an additional 2-3 inches. Move fuel tank straight back and rest on frame backbone.

11. Obtain three 1 x 2 inch wooden blocks. Raise the front of the fuel tank off the frame backbone by placing one block in the recess centered at the bottom of the tank. At the rear of the tank, place two blocks in the recess, one block on top of the other.

## Installation (After Partial Removal)

1. Remove wooden blocks and move fuel tank toward its installed position. Half way down, move fuel tank cross-over hose in front of ignition coil and connect spark plug cables. To facilitate cable routing and prevent possible chafing, install the spark plug cable to the front cylinder onto the left side coil connection. Work fuel tank into position aligning front flange holes with those in frame.

**CAUTION**

**Exercise caution to avoid pinching the wiring harness between the fuel tank and vehicle frame. Wire damage may result in electrical problems.**

2. Using a T40 TORX drive head, start fuel tank front mounting bolts (with flat washers) into left and right side of frame.
3. Install bolt (with flat washer) to secure rear of fuel tank to frame backbone. Tighten bolt to 6 ft-lbs (8 Nm).
4. Tighten fuel tank front mounting bolts to 15-18 ft-lbs (20-24 Nm).
5. Connect fuel vapor vent tube to fitting on filler neck of fuel tank.
6. Remove filler cap. Position console on canopy. Route cables from beneath console as shown in Figure 4-17. Be sure that hoses and wires are not pinched by the console during installation. Reinstall filler cap.
7. Install Allen head screw to fasten rear flange of console to welded bracket on fuel tank.
8. Open door on console. Install two Allen head screws to secure front of console to clip nuts on canopy bracket.
9. Connect the fuel level sender to the main harness. Locate the 2-place Multilock connector in front of battery. Press pin and socket halves of connector together until they snap in place. See Figure 4-16.
10. Snap anchor of **new** cable strap into hole on left side of frame. Tighten cable strap to capture main harness bundles, fuel level sender conduit, and fuel vapor vent tube along left frame tube. Cut any excess cable strap material.

*NOTE*

*Route fuel overflow hose inboard of wire bundles on right side of frame, but do not capture in cable straps. See Figure 4-17.*

11. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
12. Install seat. See Section 2.21 SEAT, INSTALLATION.

# FLHR

## Complete Removal

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**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.**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.

**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.**

3. Drain the fuel tank. See Section 4.6 VACUUM OPERATED FUEL VALVE, DRAINING FUEL TANK, steps 1-8.
4. Carefully cut anchored cable strap securing main harness bundles, instrument console conduit, and fuel vapor vent tube to left frame tube.
5. Remove acorn nut and Phillips screw from instrument console. Remove console.

**CAUTION**

**When removing instrument console, exercise caution to avoid damaging speedometer unit. Wrap console in a clean, dry shop towel. Secure to top of rear fender using bungee cords to prevent any possible damage.**

6. Remove console mounting bolt from slot at top of canopy.
7. Pull fuel vapor vent tube from fitting on canopy.
8. At bottom left side of fuel tank, bend back flexible clamp to free fuel gauge conduit. Gently pull on conduit to draw 3-place Multilock out of tunnel. Disconnect fuel gauge from main harness.
9. Using a T40 TORX drive head, remove two fuel tank front mounting bolts (with flat washers) from left and right side of frame. Remove bolt (with flat washer) to free rear of fuel tank from frame backbone.

**⚠WARNING**

**A small amount of gasoline may drain from the crossover hose when disconnected from the fuel tank. Thoroughly wipe up any spilled fuel immediately and dispose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.**

10. Using a side cutters, cut clamp from one end of crossover hose beneath fuel tank. Drain free end of hose into a suitable container.
11. Remove fuel tank from vehicle.
12. Examine tank. See CLEANING AND INSPECTION, in this section.
13. Turn the hex jam nut to remove the fuel valve assembly from the fuel tank, if necessary.

## Installation (After Complete Removal)

1. Install fuel valve assembly onto fuel tank, if removed. See Section 4.6 VACUUM OPERATED FUEL VALVE, INSTALLATION.

**CAUTION**

**Exercise caution to avoid pinching the wiring harness between the fuel tank and vehicle frame. Wire damage may result in electrical problems.**

2. Work fuel tank into position aligning front flange holes with those in frame.
3. Slide **new** clamp onto free end of crossover hose. Running hose beneath frame backbone, install hose onto fitting at bottom front of fuel tank. Crimp clamp using HOSE CLAMP PLIERS (HD-97087-65B).
4. Slide **new** clamp onto free end of carburetor fuel inlet hose. Install hose onto fuel outlet fitting at side of fuel valve. Crimp clamp.
5. Install the intake manifold vacuum hose onto the vacuum fitting at the back of the fuel valve.
6. Using a T40 TORX drive head, start fuel tank front mounting bolts (with flat washers) into left and right side of frame.
7. Install bolt (with flat washer) to secure rear of fuel tank to frame backbone. Tighten bolt to 6 ft-lbs (8 Nm).
8. Tighten fuel tank front mounting bolts to 15-18 ft-lbs (20-24 Nm).
9. Connect fuel gauge to main harness. At bottom left side of fuel tank, mate pin and socket halves of 3-place Multilock connector. Feed connector into tunnel capturing conduit in flexible clamp at bottom of tank.
10. Connect fuel vapor vent tube to fitting on canopy.
11. Slide head of console mounting bolt into slot at top of canopy. Align hole in console with mounting bolt and place into position. When routing cables from beneath console, be sure that hoses and wires are not pinched.
12. Install acorn nut on mounting bolt and tighten. Install and tighten Phillips screw to secure rear of console.
13. Snap anchor of **new** cable strap into hole on left side of frame. Tighten cable strap to capture main harness bundles, instrument console conduit, and fuel vapor vent tube along left frame tube. Cut any excess cable strap material.

*NOTE*

*Route fuel overflow hose inboard of wire bundles on right side of frame, but do not capture in cable straps. See Figure 4-17.*

14. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
15. Install seat. See Section 2.21 SEAT, INSTALLATION.
16. Turn fuel valve handle to OFF position. Fill fuel tank.
17. Open fuel valve and carefully inspect for leaks. Return valve to OFF position after the inspection is complete.

## Partial Removal

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠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.**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. Carefully cut anchored cable strap securing main harness bundles, instrument console conduit, and fuel vapor vent tube to left frame tube.
4. Remove acorn nut and Phillips screw from instrument console.

**CAUTION**

**When removing instrument console, exercise caution to avoid damaging speedometer unit. Wrap console in a clean, dry shop towel. Secure to top of rear fender using bungee cords to prevent any possible damage.**

5. Remove console mounting bolt from slot at top of canopy.
6. Pull fuel vapor vent tube from fitting on canopy.

7. At bottom left side of fuel tank, bend back flexible clamp to free fuel gauge conduit. Gently pull on conduit to draw 3-place Multilock out of tunnel. Disconnect fuel gauge from main harness.
8. Using a T40 TORX drive head, remove two fuel tank front mounting bolts (with flat washers) from left and right side of frame. Remove bolt (with flat washer) to free rear of fuel tank from frame backbone.
9. Raise the fuel tank approximately 2 inches. Unplug spark plug cables from ignition coil. Move the fuel tank crossover hose to the rear of the ignition coil, so that the tank can be raised an additional 2-3 inches. Move fuel tank straight back and rest on frame backbone.
10. Obtain three 1 x 2 inch wooden blocks. Raise the front of the fuel tank off the frame backbone by placing one block in the recess centered at the bottom of the tank. At the rear of the tank, place two blocks in the recess, one block on top of the other.

## Installation (After Partial Removal)

1. Remove wooden blocks and move fuel tank toward its installed position. Half way down, move fuel tank crossover hose in front of ignition coil and connect spark plug cables. To facilitate cable routing and prevent possible chafing, install the spark plug cable to the front cylinder onto the left side coil connection.
2. Work fuel tank into position aligning front flange holes with those in frame.

**CAUTION**

**Exercise caution to avoid pinching the wiring harness between the fuel tank and vehicle frame. Wire damage may result in electrical problems.**

3. Using a T40 TORX drive head, start fuel tank front mounting bolts (with flat washers) into left and right side of frame.
4. Install bolt (with flat washer) to secure rear of fuel tank to frame backbone. Tighten bolt to 6 ft-lbs (8 Nm).
5. Tighten fuel tank front mounting bolts to 15-18 ft-lbs (20-24 Nm).
6. Connect fuel gauge to main harness. At bottom left side of fuel tank, mate pin and socket halves of 3-place Multilock connector. Feed connector into tunnel capturing conduit in flexible clamp at bottom of tank.
7. Connect fuel vapor vent tube to fitting on canopy.
8. Slide head of console mounting bolt into slot at top of canopy. Align hole in console with mounting bolt and place into position on fuel tank. When routing cables from beneath console, be sure that hoses and wires are not pinched.
9. Install acorn nut on mounting bolt and tighten. Install and tighten Phillips screw to secure rear of console.
10. Snap anchor of **new** cable strap into hole on left side of frame. Tighten cable strap to capture main harness bundles, instrument console conduit, and fuel vapor vent tube along left frame tube. Cut any excess cable strap material.

*NOTE*

*Route fuel overflow hose inboard of wire bundles on right side of frame, but do not capture in cable straps. See Figure 4-17.*

11. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
12. Install seat. See Section 2.21 SEAT, INSTALLATION.

# EVAPORATIVE EMISSIONS CONTROL SYSTEM 4.8

## CALIFORNIA MODELS ONLY

### General

Harley-Davidson motorcycles sold in the state of California are equipped with an evaporative (EVAP) emissions control system. In conformance with California Air Resource Board (CARB) regulations, the EVAP system prevents both fuel and crankcase vapors from escaping into the atmosphere. See Figure 4-18.

The EVAP system functions as follows:

- The fuel vapor vent tube connected to a fitting on the filler neck (canopy on FLHR/C models) allows fuel vapors in the fuel tank to be vented through the vapor valve to the charcoal canister. If the vehicle is tipped, the vapor valve also prevents the loss of gasoline through the vent tube.
- When the engine is running, negative pressure (vacuum) created at the carburetor venturi draws the fuel vapors stored in the charcoal canister through the purge tube to the carburetor where they are burned as part of the normal combustion process.
- Fuel vapors emanating from the carburetor throat are drawn to the charcoal canister through the clean air inlet tube connected to the inboard side of the air cleaner backplate. Crankcase vapors passing from the breather tubes into the air filter element follow the fuel vapors to the charcoal canister. These vapors, after passing through the charcoal canister, also travel through the purge tube to the carburetor where they are burned.
- When the engine is not running, the gravity-operated baffle plate at the air cleaner air inlet port closes to prevent fuel and crankcase vapors from escaping into the atmosphere.

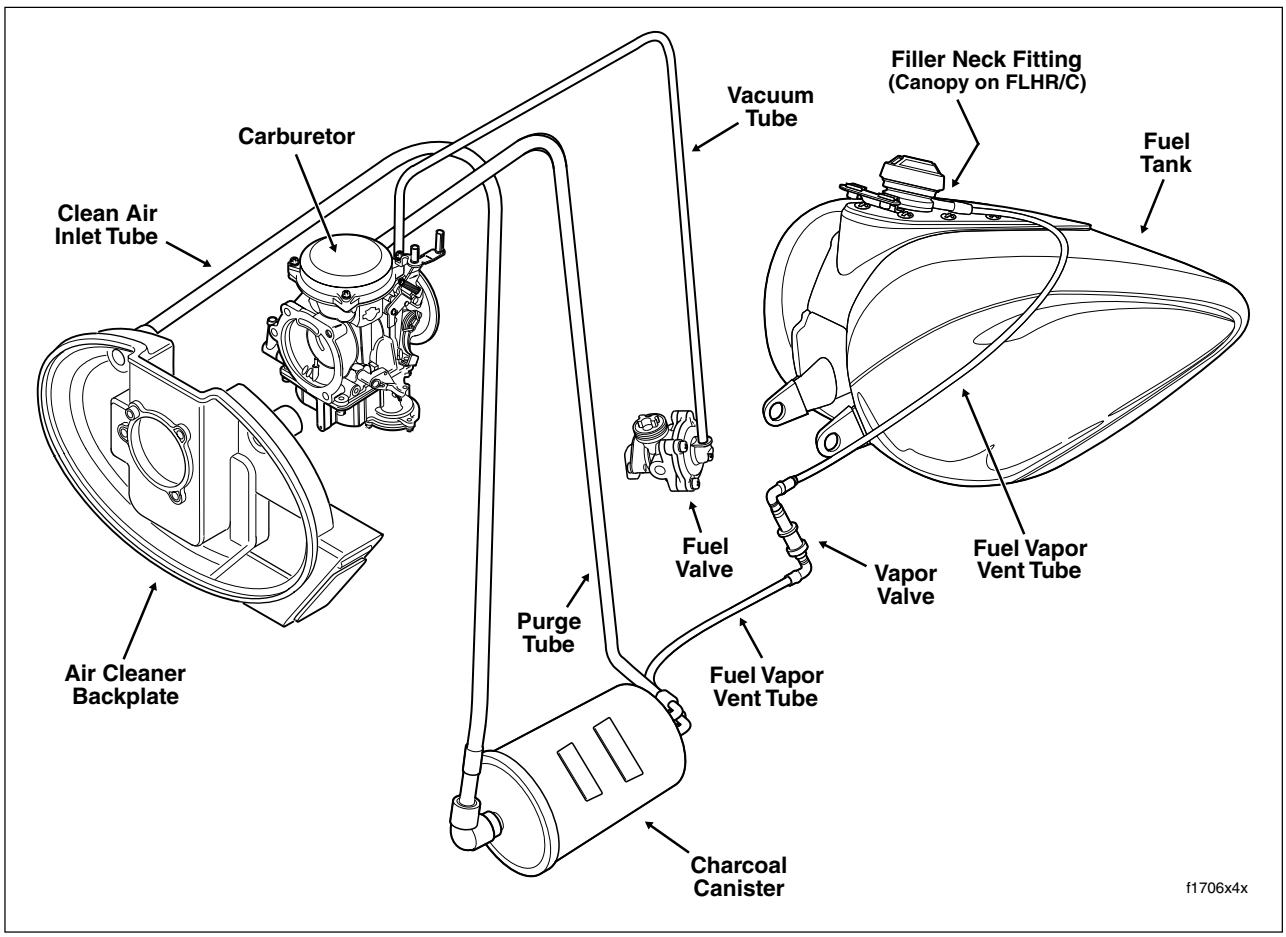



**Figure 4-18. California Evaporative Emissions Control System Schematic**

**⚠WARNING**

**Verify that the evaporative emissions tubes/hoses do not contact hot exhaust or engine parts. Tubes/hoses contain flammable vapors that can be ignited if damaged, possibly causing fire or explosion which could result in death or serious injury.**

# TROUBLESHOOTING

The EVAP system has been designed to operate with a minimum of maintenance. Check that all tubes/hoses are correctly routed and properly connected. Also, verify that the tubes/hoses are not pinched or kinked.

# VAPOR VALVE

*NOTE*

*On 49 State models, the charcoal canister is absent and the bottom tube of the vapor valve is vented to the atmosphere.*

## Removal

1. Remove seat. See Section 2.21 SEAT, REMOVAL.
2. Remove left side saddlebag. See Section 2.22 SADDLEBAG, REMOVAL.
3. Gently pull side cover from frame downtubes (no tools required).
4. Locate vapor valve attached to frame cross member in front of battery box (left side). See Figure 4-19.
5. Cut cable strap to release vapor valve from mounting bracket.
6. Remove 135˚ elbow from neck at top of vapor valve.
7. On California models, raise vapor valve slightly and pull hose fitting on vent tube from bottom fitting on vapor valve.

*NOTE*

*On 49 State models, just pull out vapor valve with bottom vent tube attached. Remove hose fitting on vent tube from bottom fitting of vapor valve.*

## Installation

1. Hold vapor valve in its approximate position on left side of mounting bracket (with long necked end at the top). On California models, install hose fitting on vent tube to bottom fitting of vapor valve.

*NOTE*

*On 49 State models, attach hose fitting on vent tube to bottom fitting on vapor valve. Insert vapor valve through opening above fuse block bracket (upper weldment between downtubes), and hold in its approximate position on left side of mounting bracket.*

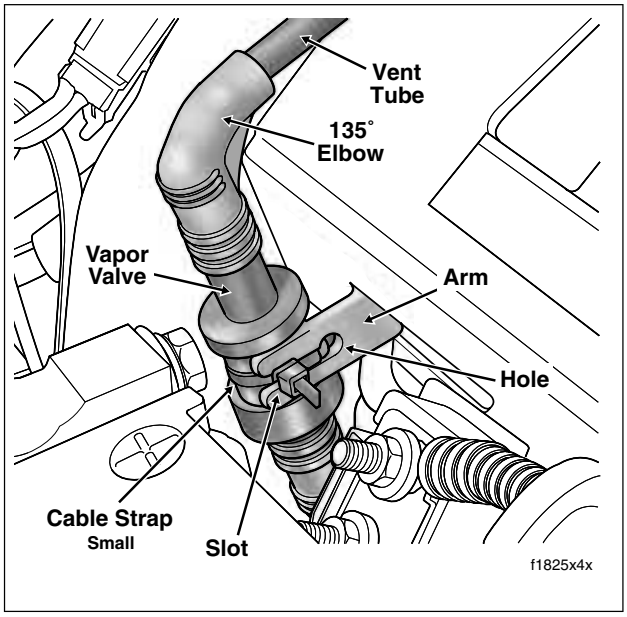



**Figure 4-19. Vapor Valve Mounting Bracket**

2. From right side of bracket, insert end of small cable strap (P/N 10065) through hole in arm and then around body of vapor valve. Mate ends of cable strap and pull tight engaging strap in slot of arm. Cut any excess cable strap material. See Figure 4-19.
3. Install free end of 135˚ elbow onto neck at top of vapor valve.
4. Verify that vapor valve is completely vertical. Momentarily push on top of vapor valve to verify that it returns to the completely vertical position.

**⚠WARNING**

**Verify that the vent tubes do not contact hot exhaust or engine parts. Tubes contain flammable vapors that can be ignited if damaged, possibly causing fire or explosion, which could result in death or serious injury.**

5. Recheck bottom vent tube routing to be sure that hose fittings are not pinched or kinked, and that there is no contact with the drive belt. For California models, see Figure 4-21.

   On 49 State models, verify that vent tube at bottom of vapor valve is routed through opening above fuse block bracket (upper weldment between downtubes) to outboard side. Orient vent tube so that it runs downward along the back of the forward frame downtube, where the free end is then tucked into opening at front of lower weldment (containing side cover grommet).

6. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required).
7. Install left side saddlebag. See Section 2.22 SADDLEBAG, INSTALLATION.
8. Install seat. See Section 2.21 SEAT, INSTALLATION.

# CHARCOAL CANISTER

## Removal

1. Remove rear fender. See Section 2.30 REAR FENDER, REMOVAL.

**⚠WARNING**

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

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. Unthread bolt and remove battery positive cable (red) from battery positive (+) terminal.
4. Using a T40 TORX drive head, loosen bolt to move lip of hold-down clamp off edge of battery. Remove battery from battery box.
5. Reaching into battery box, pry plastic retaining pin out of hole on left side.
6. Pull clean air inlet hose (connection to air cleaner backplate) off fitting on right side of charcoal canister.
7. At rear of vehicle (on left side), center a flashlight on drive belt and direct the beam forward. Note the two hose connections on the left side of the canister. See Figure 4-20.
8. Reaching in on left side of vehicle, pull tubes from left side of canister.
9. With the handle of a rubber mallet, rap canister inward toward left side of vehicle until tongue at top of canister is free of grooves in bottom of battery box. From right side of vehicle, pull canister out of opening between battery box and frame member.

## Installation

1. With tongued side up, slide canister into cavity using opening between battery box and right side frame member. Start tongue into grooves on left side of battery box. Push the canister toward the right side of the vehicle until fully engaged. Snap plastic retaining pin into hole at bottom of battery box (left side).

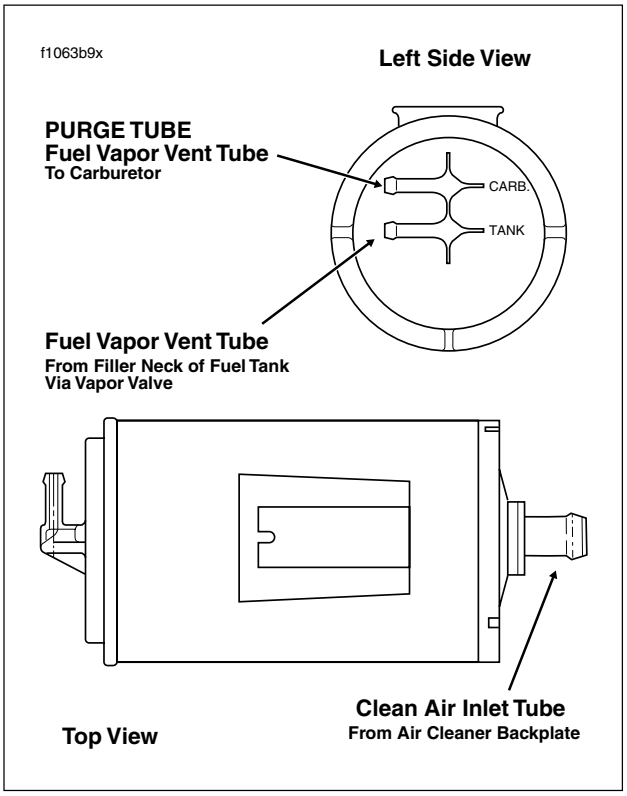



**Figure 4-20. Charcoal Canister**

2. Attach tubes to fittings on left side of canister. Install the purge tube to the carburetor onto the top fitting stamped “CARB,” the fuel vapor vent tube from the fuel tank (via the vapor valve) to the bottom fitting stamped “TANK.”
3. Attach clean air inlet tube (connection to air cleaner backplate) to fitting on right side of canister.
4. Place battery in battery box, terminal side forward.

**⚠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, which could result in death or serious injury.**

5. Insert bolt through battery positive cable (red) into threaded hole of battery positive (+) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
6. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
7. Rotate the hold-down clamp so that the lip (with rubber pad) rests on the edge of the battery. Using a T-40 TORX drive head, tighten the clamp bolt to 15-20 ft-lbs (20-27 Nm).

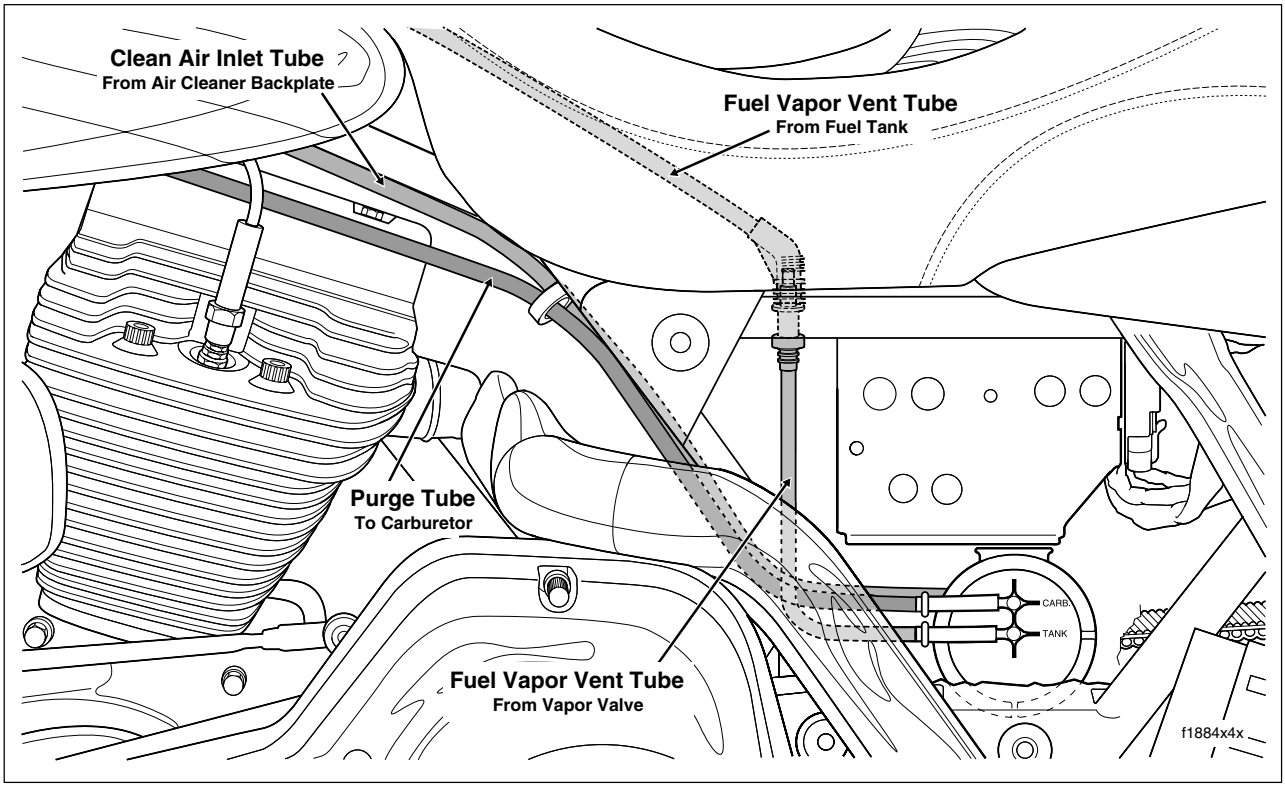



**Figure 4-21. Charcoal Canister Tube/Hose Routing (Left Side View)**

8. Install rear fender. See Section 2.30 REAR FENDER, INSTALLATION.

## Charcoal Canister Hose Routing

**⚠WARNING**

**Verify that the vent tubes do not contact hot exhaust or engine parts. Tubes contain flammable vapors that can be ignited if damaged, possibly causing fire or explosion, which could result in death or serious injury.**

### Purge Tube:

From top fitting on left side of charcoal canister (stamped “CARB”), purge tube is routed forward where it runs under frame crossmember, and then angles upward between crossmember and inner primary housing. Captured in clip anchored in hole at front of crossmember (rear and inboard of cruise hole), purge tube goes over crossover pipe, runs along left side of rear cylinder rocker cover and into tunnel of fuel tank. It then crosses to right side of vehicle just to the rear of the top engine mounting bracket, where it connects to a fitting on the carburetor. See Figure 4-21.

### Fuel Vapor Vent Tube:

From bottom fitting on left side of charcoal canister (stamped “TANK”), vent tube is routed forward and then upward in front of battery box to bottom fitting on vapor valve mounted to rear of upper frame crossmember.

Another section connected to top fitting of vapor valve follows the inboard side of the main harness bundle, where it is captured in anchored cable strap on left side of frame backbone before passing under console pod/instrument console to fitting on filler neck of fuel tank (canopy on FLHR).

### Clean Air Inlet Tube:

From 90˚ elbow connector on right side of charcoal canister, clean air inlet tube runs forward under frame crossmember and then upward (inboard of starter connections) following angle of crossmember, where it is routed over crossover pipe and rear cylinder rocker cover into tunnel of fuel tank on right side of frame backbone. Tube turns right just to the rear of the top engine mounting bracket, where it connects to fitting on inboard side of air cleaner backplate.

*NOTE*

*The clean air inlet tube is absent on fuel injected models, so the fitting on the right side of the canister terminates in a 90˚ elbow connector (the free end pointing down).*

# NOTES

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# SPECIFICATIONS 5.1

## STARTER

| Item | Specification |
|---|---|
| Free (no load) speed | 3000 rpm (min.) @ 11.5 V |
| Free (no load) current | 90 amp (max.) @ 11.5V |
| Stall torque | 8.0 ft-lbs (10.8 Nm) @ 2.4 V |

## SERVICE WEAR LIMITS

| Item | IN. | MM |
|---|---|---|
| Brush length minimum | 0.433 | 11 |
| Commutator diameter minimum | 1.141 | 29 |

## TORQUE VALUES

| Item | ft/in-lbs | Nm |
|---|---|---|
| Thru-bolts | 39-65 **in-lbs** | 4.4-7.3 Nm |
| End cover mounting bracket | 50-60 **in-lbs** | 5.6-6.8 Nm |
| End cover center screw | 90-110 **in-lbs** | 10.2-12.4 Nm |
| Battery cable terminal bolts | 60-96 **in-lbs** | 6.8-10.9 Nm |
| Starter front and rear mounting screws | 13-20 ft-lbs | 18-27 Nm |
| Oil filler spout allen head socket screws | 7-9 ft-lbs | 9-12 Nm |
| Starter jackshaft bolt | 7-9 ft-lbs | 9-12 Nm |

# STARTER SYSTEM 5.2

## GENERAL

The starter is made up of an armature, field winding assembly, solenoid, drive assembly, idler gear, and drive housing.

The starter motor torque is increased through gear reduction. The gear reduction consists of the drive pinion on the armature, an idler gear, and a clutch gear in the drive housing. The idler gear is supported by rollers and the clutch gear is part of the overrunning clutch/drive assembly.

The overrunning clutch is the part which engages and drives the clutch ring gear. It also prevents the starter from overrunning. The field windings are connected in series with the armature through brushes and commutator segments.

The starter relay is a non-repairable part and must be replaced if it malfunctions.

### Operation (Figure 5-1)

When the starter switch is pushed, the starter relay is activated and battery current flows into the pull-in winding and the hold-in winding, to ground.

The magnetic forces of the pull-in and hold-in windings in the solenoid, pull the plunger and cause it to shift to the left, so that the pinion gear is engaged with the clutch ring gear. At the same time, the main solenoid contacts are closed and battery current flows directly through the field windings to the armature and to ground. Simultaneously, the pull-in winding is opened.

The current continues flowing through the hold-in winding, keeping the main solenoid contacts closed. At this point the starter begins to crank the engine.

After the engine has started, the pinion gear turns freely on the pinion shaft through the action of the overrunning clutch which prevents the armature overrunning by the rotation of the clutch ring gear.

When the starter switch is released, the current of the hold-in winding is fed through the main solenoid contacts and the direction of the current in the pull-in winding is reversed. The solenoid plunger is returned to its original position by the return spring, disengaging the pinion gear from the clutch ring gear.

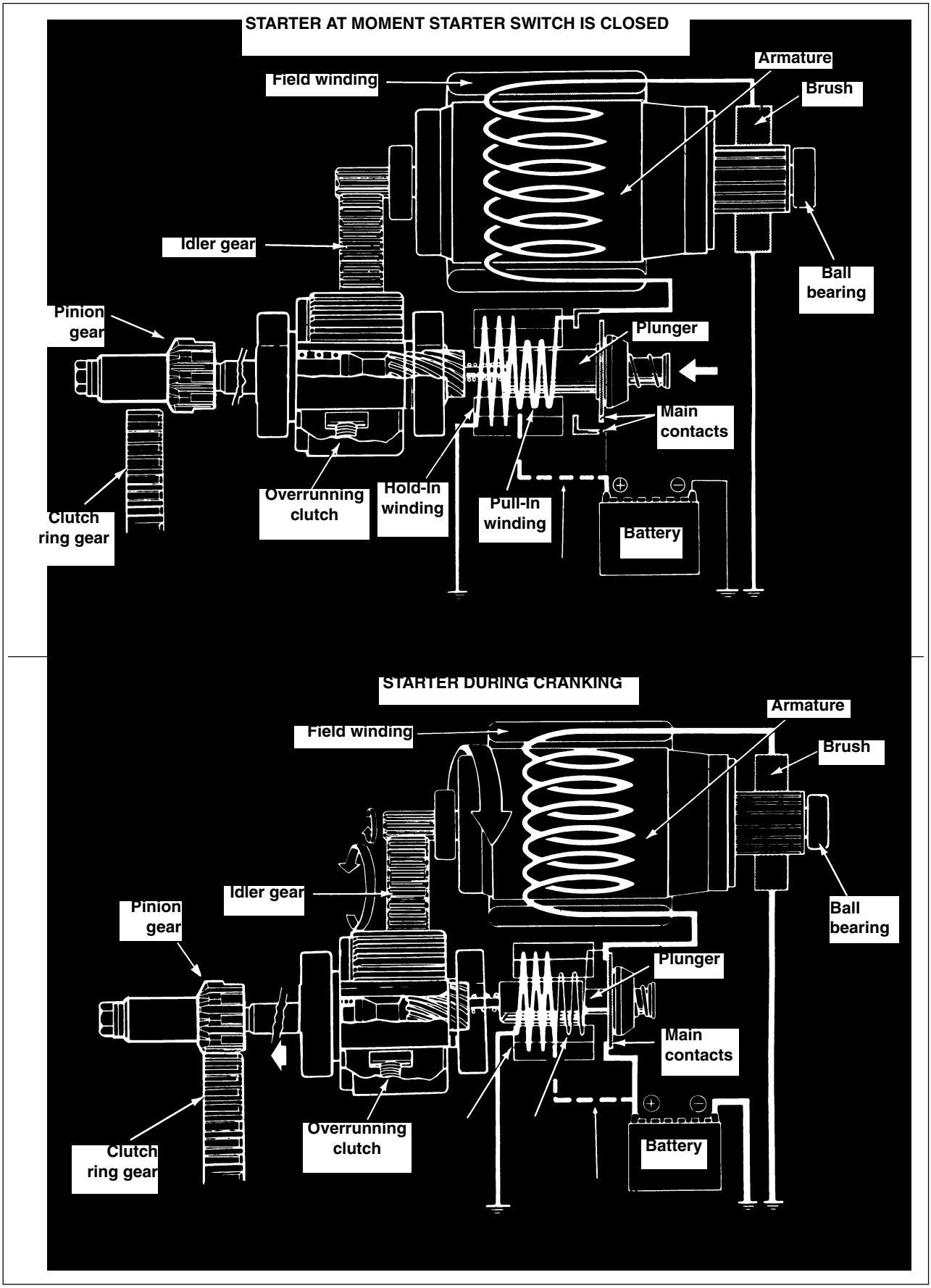



**Figure 5-1. Starter Operation**

# STARTER RELAY 5.3

## REMOVAL

1. Remove left side saddlebag. See Section 2.22 SADDLEBAG, REMOVAL.
2. Gently pull side cover from frame downtubes (no tools required).
3. Pull fuse blocks from tabs on mounting panel. Tabs on panel fit into slots on each side of fuse block cover. To remove cover, raise latches slightly to disengage tabs on fuse blocks.
4. Remove relay from front fuse block. See Figure 5-2.
5. See RELAY/STARTER TESTS which follow.

## INSTALLATION

1. Install **new** relay in front fuse block.
2. Slide cover over fuse blocks until latches fully engage tabs on blocks. Slide fuse blocks into position on mounting panel. Tabs on panel fit into slots on each side of fuse block cover.
3. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required).
4. Install left side saddlebag. See Section 2.22 SADDLEBAG, INSTALLATION.

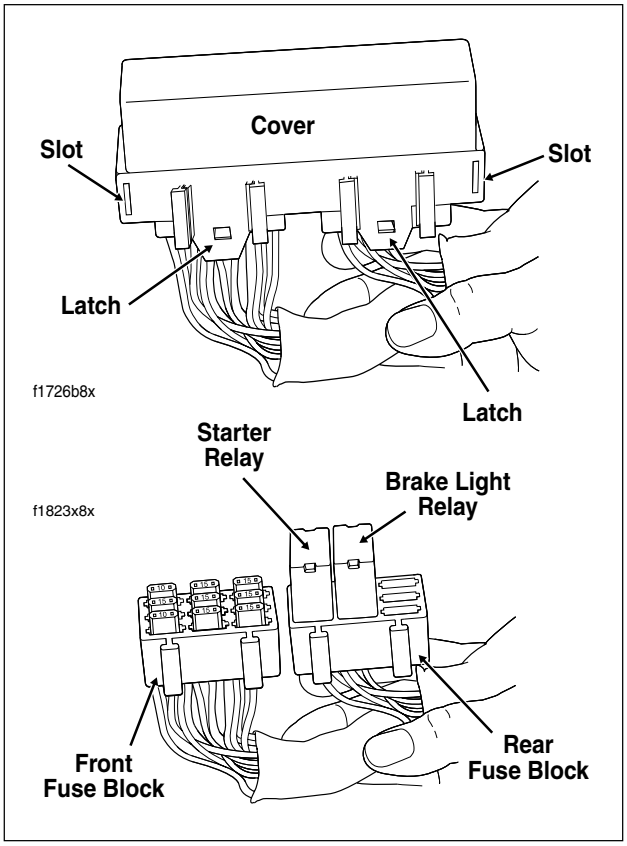



**Figure 5-2. Locate Relays Under Left Side Cover**

# STARTER 5.4

## REMOVAL

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠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.**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. Remove the primary chaincase cover. See Section 6.5 PRIMARY CHAINCASE, REMOVAL, steps 3-8.
4. Bend tab on lockplate away from head of jackshaft bolt.
5. Holding pinion gear to prevent rotation, remove the jackshaft bolt with lockplate and thrust washer.
6. From right side of vehicle, remove starter front mounting screw with lockwasher. Remove rear mounting screw with lockwasher and disconnect battery negative and chassis ground cable ring terminals.
7. Pull back rubber boot and remove locknut from starter post. Remove main circuit breaker and battery positive cable ring terminals from starter post.
8. Depress external latch and pull solenoid connector from top of starter housing.
9. Locate oil filler plug/dipstick on right side of vehicle at top of transmission case. To remove the oil filler plug, pull steadily while moving plug back and forth.

**CAUTION**

**If vehicle is upright and level, some loss of engine oil will occur as filler spout is removed. A small amount of oil also may be lost when the vehicle is resting on the jiffy stand.**

10. Place oil drip tray beneath oil filler spout.
11. Remove four allen head socket screws to release oil filler spout from transmission housing. Remove and discard filler spout gasket.
12. Remove the starter from the right side of the vehicle, carefully sliding it through the space between the exhaust pipe and side cover.

*NOTE*

*If necessary, remove allen screw and chrome decorative trim to facilitate starter removal.*

13. Remove the coupling from the starter motor output shaft, if necessary.
14. Before disassembly, perform tests on the assembled starter. See DISASSEMBLY, TESTING AND REPAIR in this section.

## INSTALLATION

1. Inspect the retaining ring within the output shaft coupling for damage or distortion. Replace as necessary. With the counterbore on the outboard side, install the coupling on the starter motor output shaft, if removed.
2. If removed, install allen screw to fasten chrome decorative trim to starter. From right side of vehicle, place starter in its installed position.
3. Install starter front mounting screw with lockwasher. Slide chassis ground and battery negative cable ring terminals onto rear mounting screw (with lockwasher) and install.
4. Alternately tighten starter front and rear mounting screws to 13-20 ft-lbs (18-27 Nm).
5. Install battery positive cable and main circuit breaker ring terminals onto starter post. Install locknut. Pull down rubber boot over terminal connections on starter post.
6. Align holes in **new** gasket with those in oil filler spout. Install the four allen head socket screws to fasten filler spout to transmission housing. Alternately tighten screws to 7-9 ft-lbs (9-12 Nm).
7. Snap solenoid connector to terminal at top of starter housing.
8. Slide lockplate and thrust washer onto jackshaft bolt, if removed. Insert bolt into jackshaft bore.
9. Insert key on lockplate through slot in thrust washer and into keyway on jackshaft. Thread the jackshaft bolt into the starter shaft making sure that the lockplate key remains in the keyway.
10. Holding pinion gear to prevent rotation, tighten jackshaft bolt to 7-9 ft-lbs (9-12 N-m). Bend tab on lockplate against flat of bolt head to secure.
11. Install the primary chaincase cover. See Section 6.5 PRIMARY CHAINCASE, INSTALLATION, steps 20-31.
12. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
13. Check engine oil and add as necessary. See Section 3.3 GENERAL INFORMATION, CHANGING ENGINE OIL AND FILTER, steps 10-11.

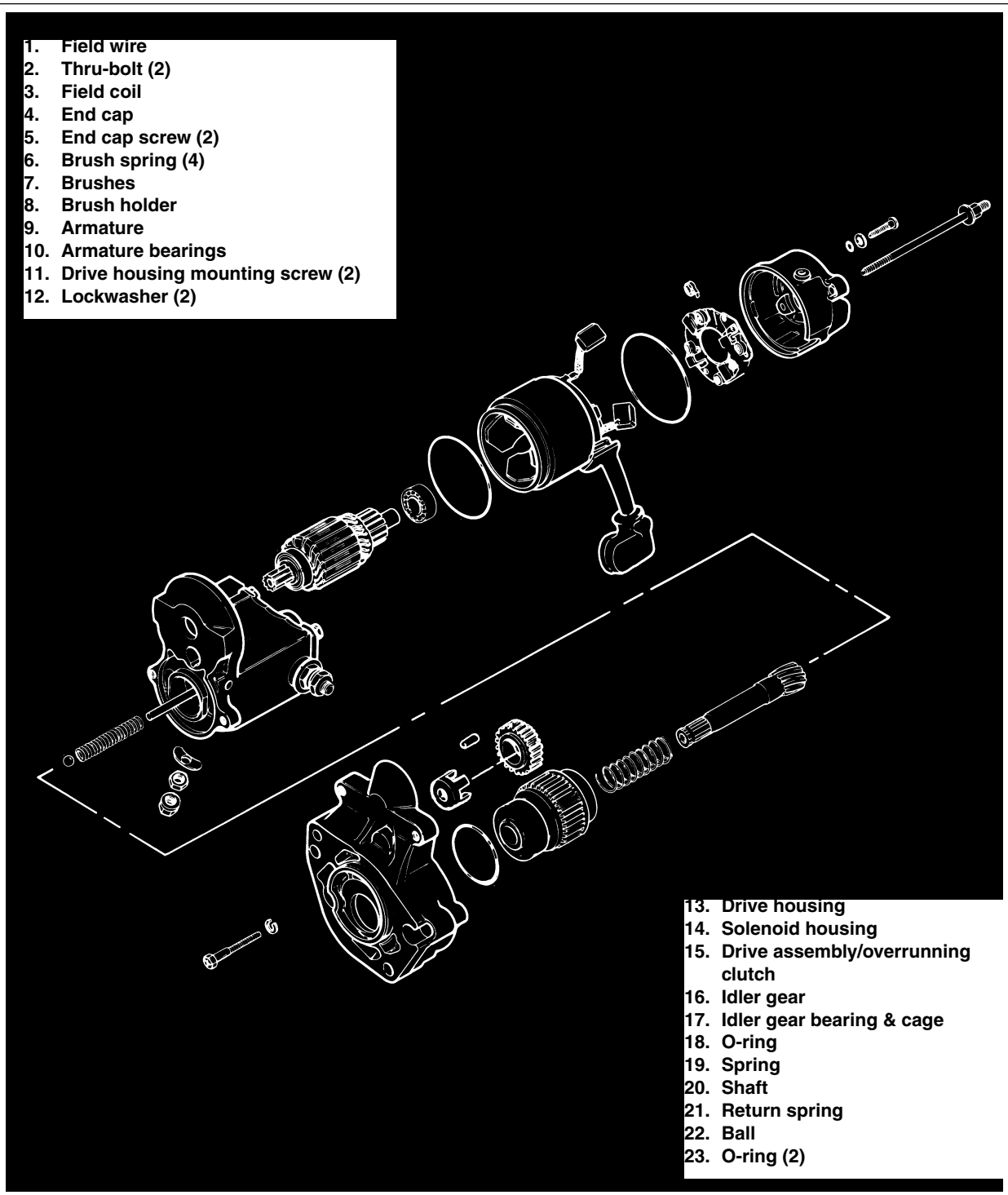



**Figure 5-3. Starter**

14. Start engine and carefully check for leaks around oil filler spout.
15. Install seat. See Section 2.21 SEAT, INSTALLATION.

# DISASSEMBLY, TESTING AND REPAIR

1. See Figures 5-3 and 5-4. Disconnect field wire (1).

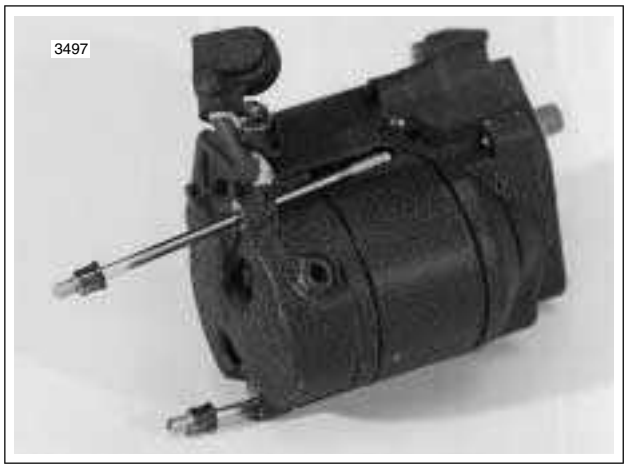



**Figure 5-4. Remove Thru-Bolts**

2. See Figures 5-3 and 5-5. Remove thru-bolts (2). Remove field coil (3) and cap (4).




**Figure 5-5. Remove Field Coil and Cap**

3. See Figures 5-6 and 5-7. Remove the end cap screws and cap.




**Figure 5-6. Remove End Capscrews and O-Rings**

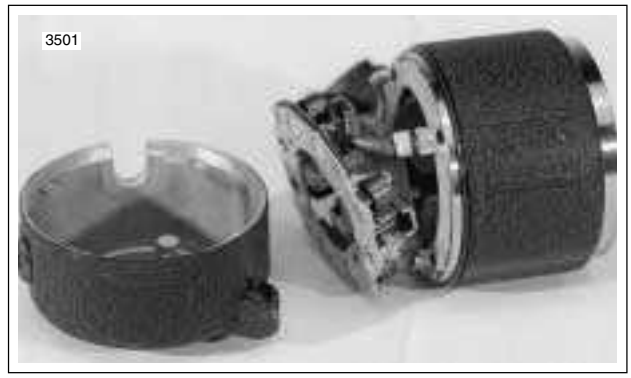



**Figure 5-7. Remove End Cap**

4. See Figures 5-3 and 5-8. Disengage brush springs (6) and pull field coil brushes (7) out of brush holders (8).




**Figure 5-8. Remove Brush Holder**

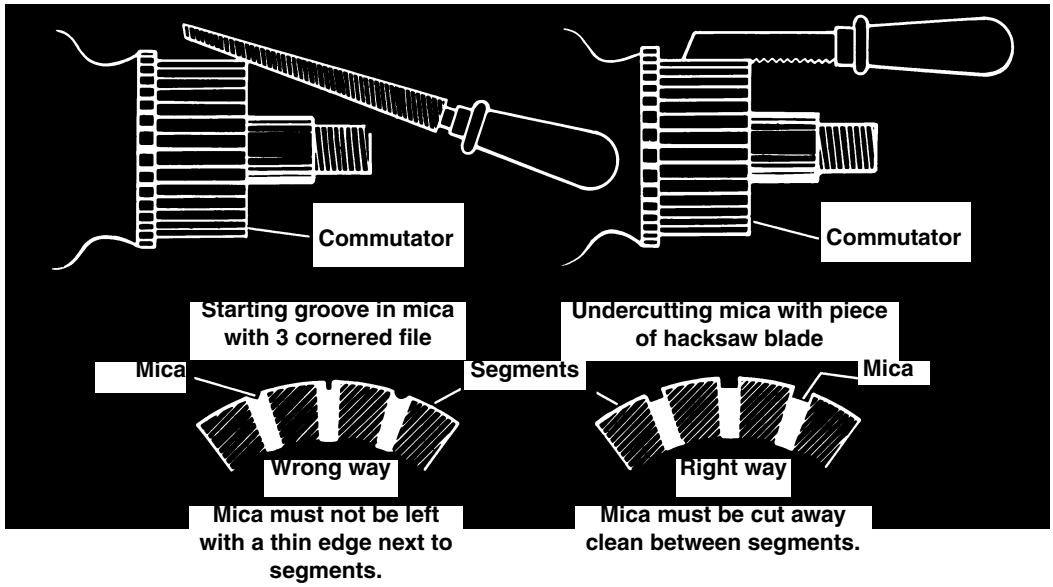



**Figure 5-9. Undercutting the Mica Separators**

5. Check the brush length. Brushes less than 0.433 inch (11 mm) long should be replaced.

*NOTE*

- *Replace brushes in sets of four only.*
- *Field coil and brush holder brushes are attached to field coil and brush holder. To replace brushes, replace field coil and brush holder.*

6. See Figure 5-3. Remove armature (9).

7. Place armature in lathe or truing stand and check runout of commutator. Commutators with more than 0.015 in. (0.38 mm) of runout should be replaced or machined on a lathe. Commutators should be replaced when diameter is less than 1.141 in. (29.98 mm).

8. Check depth of mica on commutator. If undercut is less than 0.008 in. (0.20 mm), use an undercutting machine to undercut the mica to 1/32 in. (0.79 mm) deep. The slots should then be cleaned to remove any dirt or copper dust.

9. See Figure 5-9. If an undercutting machine is not available, undercutting can be done satisfactorily using a thin hacksaw blade. After undercutting, lightly sand the armature with crocus cloth to remove any burrs.

**CAUTION**

**Do not use sandpaper or emery cloth on commutator. The abrasive grit may remain on commutator segments and could cause excessive brush wear.**

10. See Figure 5-10. Check for SHORTED ARMATURE with a growler. Place armature on growler. Hold a thin steel strip (hacksaw blade) against armature core and slowly turn armature. A shorted armature will cause the steel strip to vibrate and be attracted to the core. Shorted armatures should be replaced.




**Figure 5-10. Shorted Armature Test Using Growler**

11. See Figure 5-11. Check for a GROUNDED ARMATURE with an ohmmeter or continuity tester. Touch one probe to any commutator segment, and the other probe to the armature core. There should be no continuity (infinite ohms). If there is any continuity the armature is grounded and should be replaced.

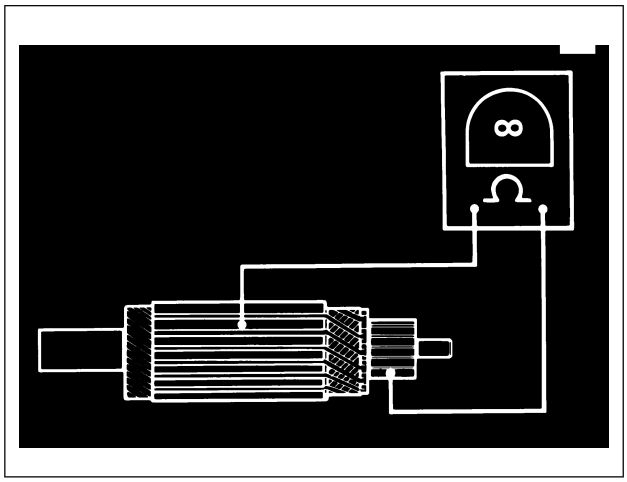


**Figure 5-11. Grounded Armature Test**

12. See Figure 5-12. Check for OPEN ARMATURE with an ohmmeter or continuity tester. Check for continuity between all commutator segments. There should be continuity (0 ohms) at all test points. No continuity at any test point indicates armature is open and should be replaced.

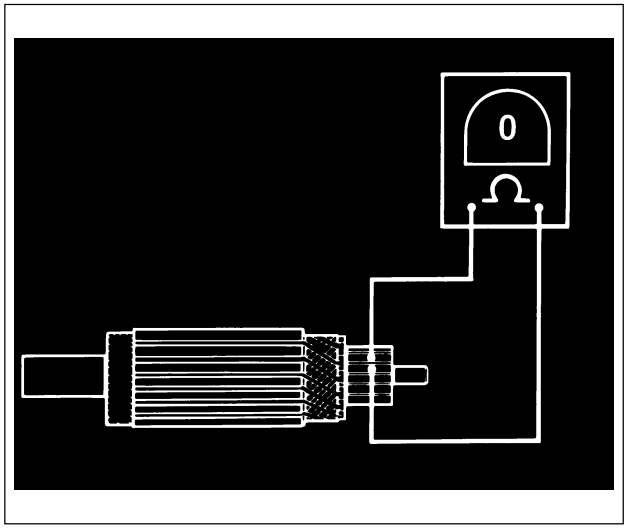


**Figure 5-12. Armature Open Test**

13. See Figure 5-13. Check for GROUNDED FIELD WINDING with an ohmmeter or continuity tester. Touch one probe to the frame, and the other probe to each of the brushes attached to the field winding. There should be no continuity (infinite ohms). If there is any continuity at either brush, the field winding(s) are grounded and the field frame should be replaced.

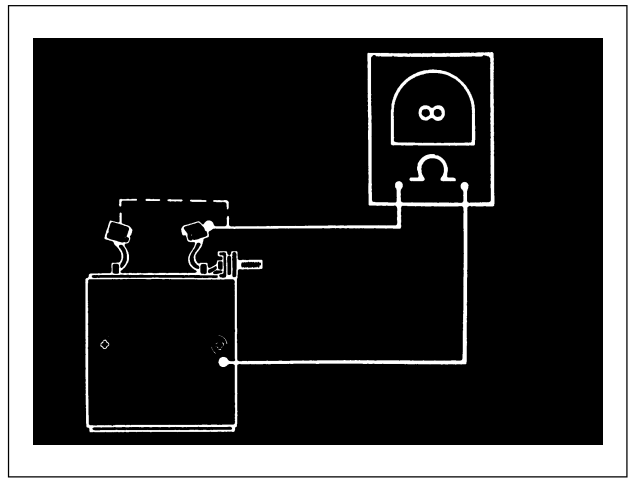


**Figure 5-13. Grounded Field Test**

14. See Figure 5-14. Check for OPEN FIELD WINDING with an ohmmeter or continuity tester. Touch one probe to the field wire, and the other probe to each of the brushes attached to the field coils. There should be continuity. If there is no continuity at either brush, the field winding(s) are open and the field frame should be replaced.

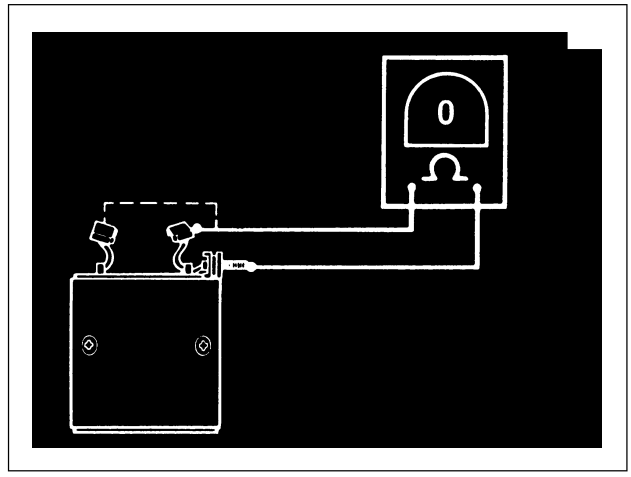


**Figure 5-14. Open Field Test**

15. See Figure 5-15. Test BRUSH HOLDER INSULATION with an ohmmeter or continuity tester. Touch one probe to holder plate and the other probe to each of the positive (insulated) brush holders. There should be no continuity (infinite ohms). If there is continuity at either brush holder, the brush holder assembly should be replaced. Touch one probe to the non-insulated brush holders and the other probe to the holder plate. If you measure any resistance, the brush holder must be replaced.

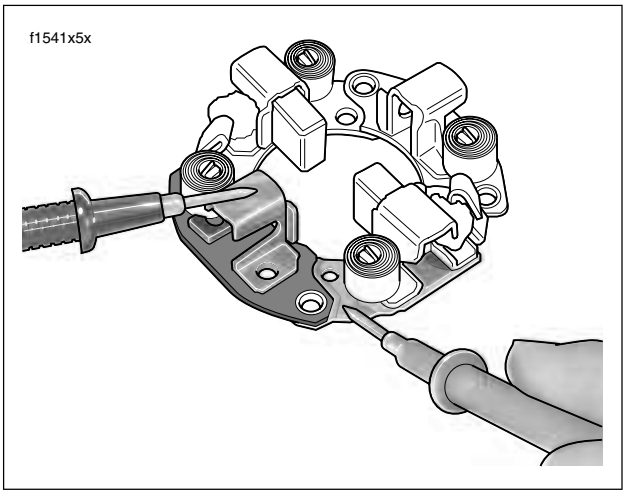



**Figure 5-15. Brush Holder Insulation Test**

16. Check armature bearings (10) and replace if necessary. See Figure 5-3.

*NOTE*

*Spring (21) and ball (22) are loose in shaft gear end. See Figure 5-3.*

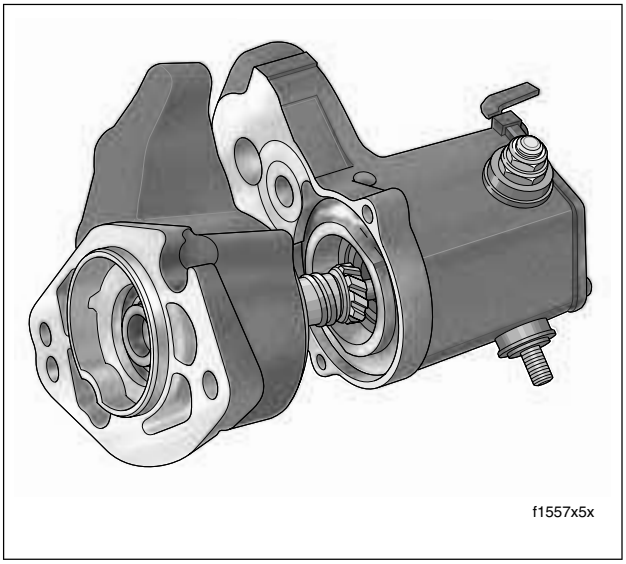



**Figure 5-16. Remove Drive Housing**

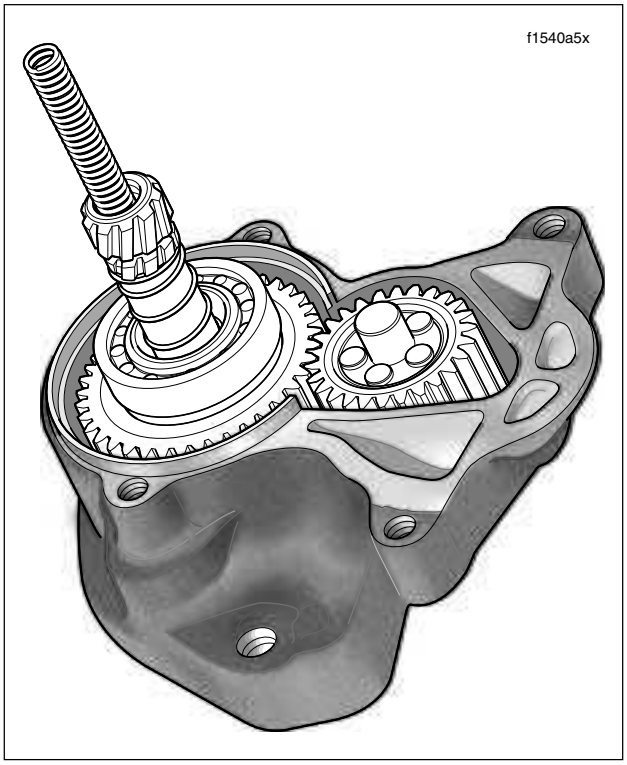



**Figure 5-17. Drive Housing Assembly**




**Figure 5-18. Clutch Assembly**

17. See Figures 5-3, 5-16 and 5-17. Remove the two drive housing mounting screws (11) and washers (12). Remove drive housing (13) from solenoid housing (14).

18. See Figures 5-3 and 5-18. Remove drive (15), idler gear (16) and idler gear bearing (17) from drive housing (13). O-ring (18) is in groove in drive housing.

19. Remove spring (19) and shaft (20).

# ASSEMBLY

1. See Figure 5-3. Replace O-rings (18, 23).

**CAUTION**

**Do not use solvents to clean drive assembly/over-running clutch (15). It is lubricated and sealed. If you use a solvent to clean it, the lubricant will be washed out and the clutch will fail.**

2. Clean, inspect and lubricate drive assembly components. Lubricate parts with high temperature grease such as LUBRIPLATE 110.
3. When installing drive assembly components, open end of idler bearing cage (17) faces toward solenoid.
4. When installing drive housing (13) to solenoid housing (14) use new O-ring (18). Be sure to install return spring (21) and ball (22).
5. Lubricate armature bearings (10) with high temperature grease such as LUBRIPLATE 110. Install armature (9) and field coil (3) to solenoid housing (14).
6. Replace brush springs (6), if necessary. Install brushes (7) and brush holder (8).
7. Install end cover (4) with screw (5).
8. Install thru-bolts (2).
9. Connect solenoid wire (1) to terminal.

# STARTER SOLENOID 5.5

## GENERAL

The starter solenoid is a switch designed to open and close the starting circuit electromagnetically. The switch consists of contacts and a winding around a hollow cylinder containing a movable plunger. When the winding is energized by the battery, the magnetism produced pulls the plunger into the coil. The plunger moves against two main switch contacts, closing the circuit.

## DISASSEMBLY

1. See Figure 5-19. Remove screws and washers. Clip comes off with screw.
2. Remove cover and gasket. Discard gasket.
3. Plunger can now be removed from solenoid housing.

## ASSEMBLY

1. Replace wire connection hardware as necessary.
2. Apply a light coat of Lubriplate® 110 to plunger shaft. Install plunger in solenoid housing.
3. Install **new** gasket. Place cover in position and install screws, washers and clip.

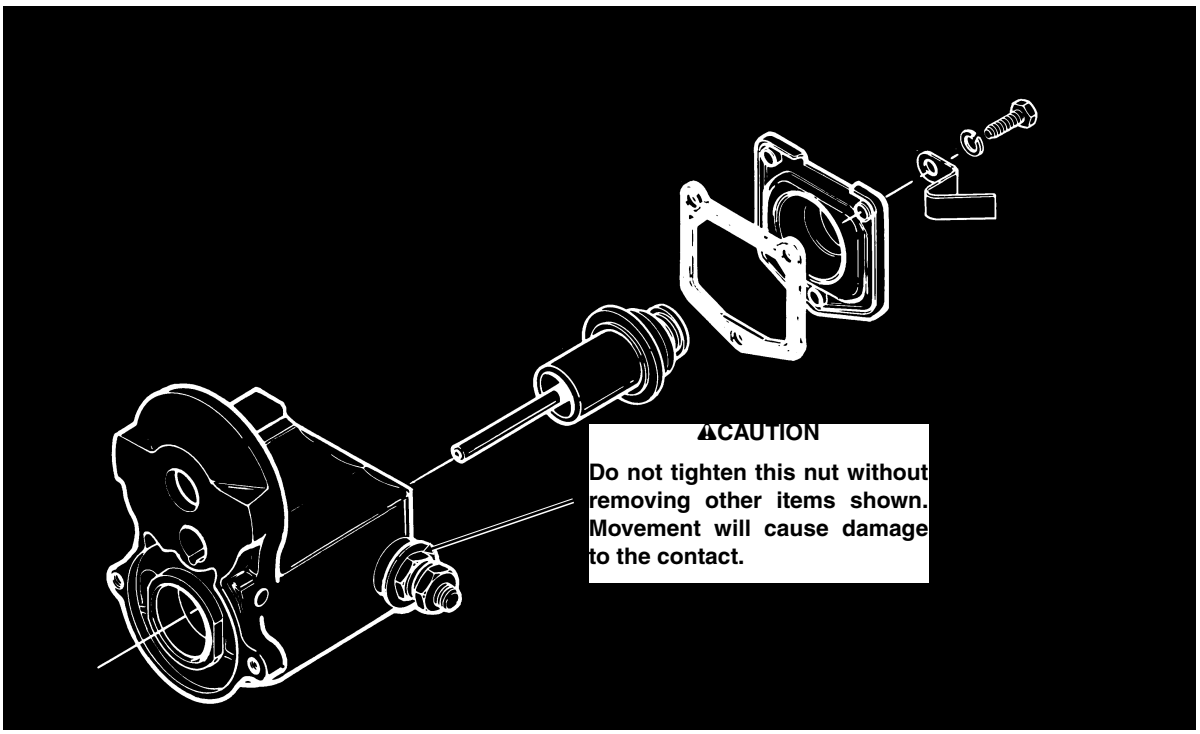



**Figure 5-19. Starter Solenoid**

# STARTER JACKSHAFT 5.6

## REMOVAL/DISASSEMBLY

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠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.**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. See Figure 5-20. Remove the primary chaincase cover. Remove the clutch assembly, primary chain and compensating sprocket components as a single assembly. See Section 6.5 PRIMARY CHAINCASE, REMOVAL, steps 3-15.

*NOTE*

*If only the jackshaft bolt, thrust washer, lockplate, pinion gear and/or spring require servicing, then the primary chain and clutch assembly may be left in place.*

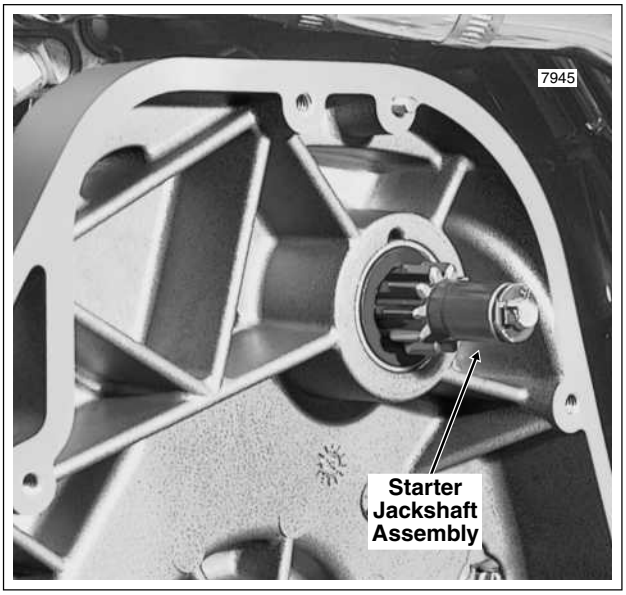



**Figure 5-20. Primary Chaincase**

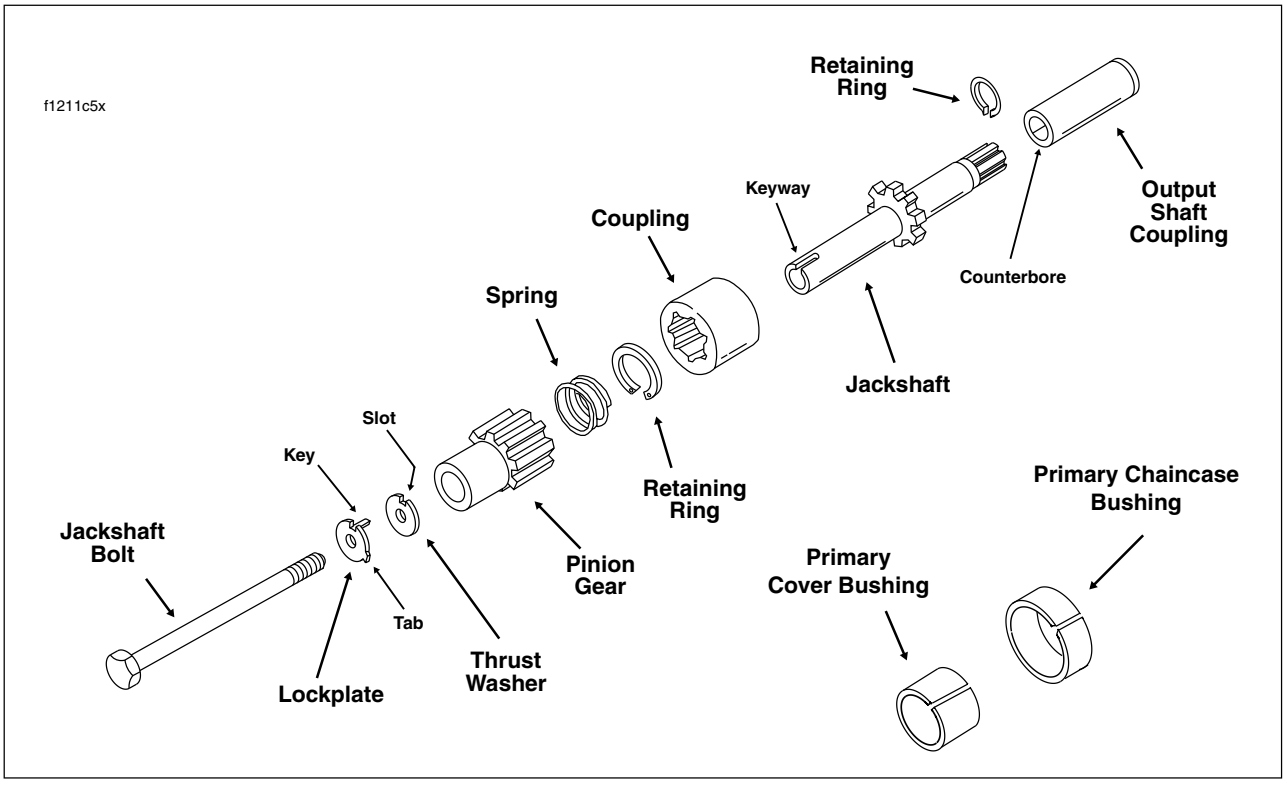



**Figure 5-21. Starter Jackshaft Assembly**

4. Bend tab on lockplate away from head of jackshaft bolt. See Figure 5-21.
5. Holding pinion gear to prevent rotation, remove the jackshaft bolt with lockplate and thrust washer.
6. Carefully pull jackshaft assembly from the primary chaincase bore.
7. Remove the pinion gear from the jackshaft.
8. Remove the coupling from the jackshaft. Remove the spring from the coupling.

**CAUTION**

**Do not force the output shaft coupling through the oil seal in the primary chaincase or the resulting damage will require seal replacement.**

9. From right side of vehicle, remove starter front mounting screw with lockwasher. Remove rear mounting screw with lockwasher and disconnect battery negative and chassis ground cable ring terminals.
10. Pull back rubber boot and remove locknut from starter post. Remove main circuit breaker and battery positive cable ring terminals from starter post.
11. Depress external latch and pull solenoid connector from top of starter housing.
12. Remove the starter from the right side of the vehicle, carefully sliding it through the space between the exhaust pipe and side cover.

*NOTE*

*If necessary, remove allen screw and chrome decorative trim to facilitate starter removal.*

13. Remove the coupling from the starter motor output shaft.

# ASSEMBLY/INSTALLATION

*NOTE*

*To replace the jackshaft bushings and/or seals in the primary chaincase or primary chaincase cover, see Section 6.5 PRIMARY CHAINCASE, DISASSEMBLY.*

1. Inspect the retaining ring within the output shaft coupling for damage or distortion. Replace as necessary. With the counterbore on the outboard side, install the coupling on the starter motor output shaft.
2. If removed, install allen screw to fasten chrome decorative trim to starter. From right side of vehicle, place starter in its installed position.
3. Install starter front mounting screw with lockwasher. Slide chassis ground and battery negative cable ring terminals onto rear mounting screw (with lockwasher) and install.
4. Alternately tighten starter front and rear mounting screws to 13-20 ft-lbs (18-27 Nm).
5. Install battery positive cable and main circuit breaker ring terminals onto starter post. Install locknut. Pull down rubber boot over terminal connections on starter post.
6. Snap solenoid connector to terminal at top of starter housing.
7. Inspect the retaining ring within the coupling for damage or distortion. Replace as necessary.
8. Insert narrow end of jackshaft into shallow side of coupling until gear face contacts installed retaining ring. (Look at position of retaining ring within coupling to determine shallow side.)
9. Slide spring over narrow end of jackshaft until it contacts retaining ring.
10. Slide pinion gear over narrow end of jackshaft until it contacts spring.
11. Slide lockplate and thrust washer onto jackshaft bolt, if removed. Insert bolt into jackshaft bore.
12. Gently insert jackshaft assembly into primary chaincase so that splined end of shaft engages coupling on starter output shaft.
13. Insert key on lockplate through slot in thrust washer and into keyway on jackshaft. Thread the jackshaft bolt into the starter shaft making sure that the lockplate key remains in the keyway.
14. Holding pinion gear to prevent rotation, tighten jackshaft bolt to 7-9 ft-lbs (9-12 N-m). Bend tab on lockplate against flat of bolt head to secure.
15. Install the clutch, primary chain, and compensating sprocket components. Install the primary chaincase cover. See Section 6.5 PRIMARY CHAINCASE, INSTALLATION, steps 9-31.
16. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
17. Install seat. See Section 2.21 SEAT, INSTALLATION.

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# DRIVE 6

# SPECIFICATIONS 6.1

## OVERALL GEAR RATIOS

Overall gear ratios indicate the number of engine revolutions required to drive the rear wheel one revolution.

| Gear | EFI Domestic | All Others |
|---|---|---|
| 1 | 10.81 | 10.11 |
| 2 | 7.45 | 6.96 |
| 3 | 5.29 | 4.95 |
| 4 | 4.13 | 3.86 |
| 5 | 3.37 | 3.15 |

## CHAINS AND BELTS

### Primary Chain Adjustments

| Free Play | Inches | Millimeters |
|---|---|---|
| COLD Engine | 5/8-7/8 inch | 15.9-22.2 mm |
| HOT Engine | 3/8-5/8 inch | 9.5-15.9 mm |

### Primary Chaincase Lubrication

| | Quart | Gallon |
|---|---|---|
| Part Number | 99887-84 | 99886-84 |

*NOTE*

*The above figure specifying the amount of Primary Chaincase Lubricant is intended for reference purposes only. For proper filling instructions, See Section 6.5 PRIMARY CHAINCASE, LUBRICATION, steps 3-7.*

### Rear Belt Adjustment

| | Inches | Millimeters |
|---|---|---|
| Deflection | 5/16-3/8 in. at 10 lbs force | 7.9-9.5 mm at 4.5 kg force |

## SPROCKETS

| Number of Teeth | | |
|---|---|---|
| Sprocket | EFI Domestic | All Others |
| Engine | 24 | 25 |
| Clutch | 37 | 36 |
| Transmission | 32 | 32 |
| Rear wheel | 70 | 70 |

## CLUTCH

| Clutch | Description |
|---|---|
| Type | Wet-multiple disc |
| Clutch lever free play | 1/16-1/8 in. |
| | 1.6-3.2 mm |
| Clutch screw adjustment | loosen 1/2-1 turn after lightly seating |

## TORQUE VALUES

| Item | ft/in-lbs | Nm |
|---|---|---|
| Primary chain tensioner shoe nut | 21-29 ft-lbs | 29-39 N-m |
| Primary chain inspection cover screws | 50-70 **in-lbs** | 6-8 N-m |
| Clutch adjuster screw locknut | 6-10 ft-lbs | 8-14 Nm |
| Clutch inspection cover screws | 7-9 ft-lbs | 10-12 Nm |
| Clutch diaphragm spring retainer to clutch hub bolts | 90-110 **in-lbs** | 10.2-12.4 Nm |
| Rear wheel castle axle nut | 60 ft-lbs | 81 Nm |
| Rear swingarm pivot shaft locknut | 40-45 ft-lbs | 54-61 Nm |
| Passenger footboard bracket bolts | 34-42 ft-lbs | 46-57 Nm |
| Shock bottom mounting bolt | 35-40 ft-lbs | 47-54 Nm |
| Rear header pipe to cross-over pipe TORCA clamp | 45-60 ft-lbs | 61-81 Nm |

**Continued ...**

## TORQUE VALUES (CONT.'D)

| Item | ft/in-lbs | Nm |
|---|---|---|
| Exhaust pipe worm drive clamp screws | 20-40 **in-lbs** | 2.3-4.5 Nm |
| Mainshaft sprocket nut | 50 ft-lbs, then 30° to 40° | 68 Nm, then 30° to 40° |
| Mainshaft sprocket nut lockplate socket head screws | 90-110 **in-lbs** | 10-12 Nm |
| Rear wheel sprocket bolts | 55-65 ft-lbs | 75-88 Nm |
| Primary chaincase to crankcase and transmission | 18-21 ft-lbs | 24-28 Nm |
| Front and rear starter mounting screws | 13-20 ft-lbs | 18-27 N-m |
| Starter jackshaft bolt | 7-9 ft-lbs | 9-12 N-m |
| Engine compensating sprocket nut | 150-165 ft-lbs | 203-224 Nm |
| Clutch hub mainshaft nut | 70-80 ft-lbs | 95-108 Nm |
| Primary chaincase cover allen head socket screws | 7-9 ft-lbs | 9-12 N-m |

## PRIMARY CHAIN ADJUSTMENT

Check the primary chain tension after the first 1000 miles (1600 km) and then every 5000 miles (8000 km) thereafter. Proceed as follows:

1. See Figure 6-1. Using a T27 TORX drive head, remove four screws to free the primary chain inspection cover from the primary chaincase cover.
2. Check the primary chain tension. Push on the upper strand to verify that it has free up and down movement midway between the engine compensating sprocket (front) and the clutch sprocket (rear).
3. Measure the free play to be sure that it falls within the ranges specified for a hot or cold engine:

### Table 6-1. Primary Chain Adjustment

| (Free Play) | Inches | Millimeters |
|---|---|---|
| COLD ENGINE | 5/8-7/8 inch | 15.9-22.2 mm |
| HOT ENGINE | 3/8-5/8 inch | 9.5-15.9 mm |

4. If the chain is too tight or too loose, then adjustment is necessary. Proceed as follows:
   a. Locate the chain tensioner assembly and loosen the top center nut a maximum of two turns. See Figure 6-2.
   b. Raise or lower the chain tensioner assembly as necessary to obtain the specified free play.

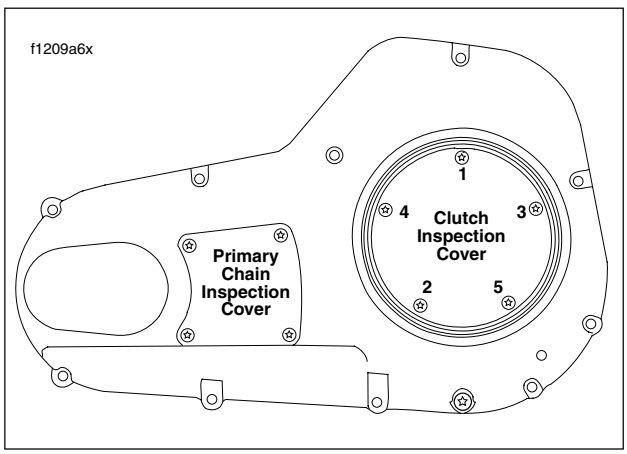



**Figure 6-1. Primary Chaincase Cover**

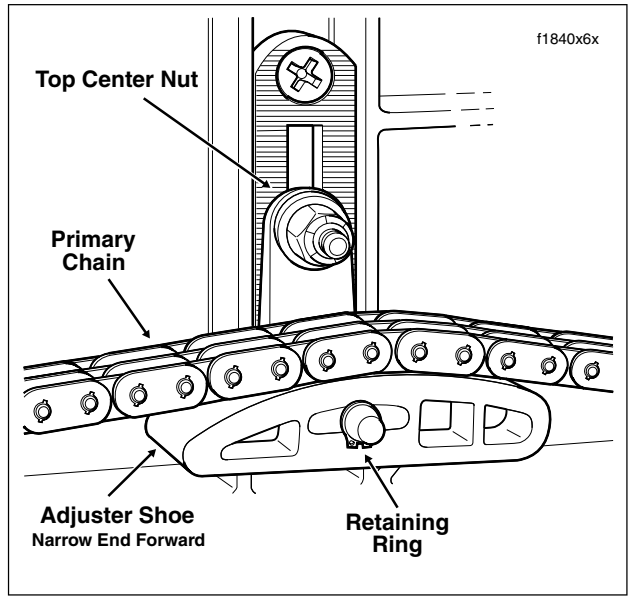



**Figure 6-2. Chain Tensioner Assembly**

*NOTE*

*As chains stretch and wear, they run tighter at one spot than another. Always adjust the free play at the tightest spot in the chain.*

*NOTE*

*Replace the primary chain if it is worn to the point where it cannot be properly adjusted.*

**CAUTION**

**Do not adjust the primary chain tighter than specified. Running a chain that is too tight will result in excessive wear.**

   c. Tighten the top center nut of the chain tensioner assembly to 21-29 ft-lbs (29-39 N-m).

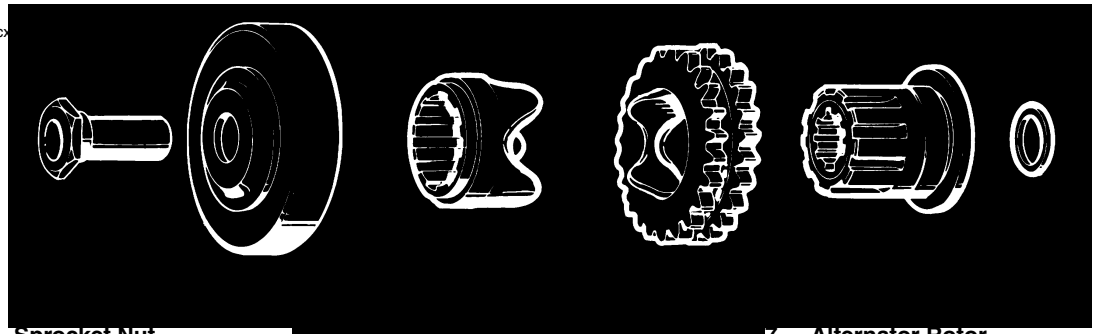
5. Align holes in **new** gasket with holes in the primary chaincase cover. Using a T27 TORX drive head, install four screws to secure primary chain inspection cover to primary chaincase cover. Alternately tighten screws to 50-70 **in-lbs** (6-8 N-m) in a crosswise pattern.

## ADJUSTER SHOE REPLACEMENT

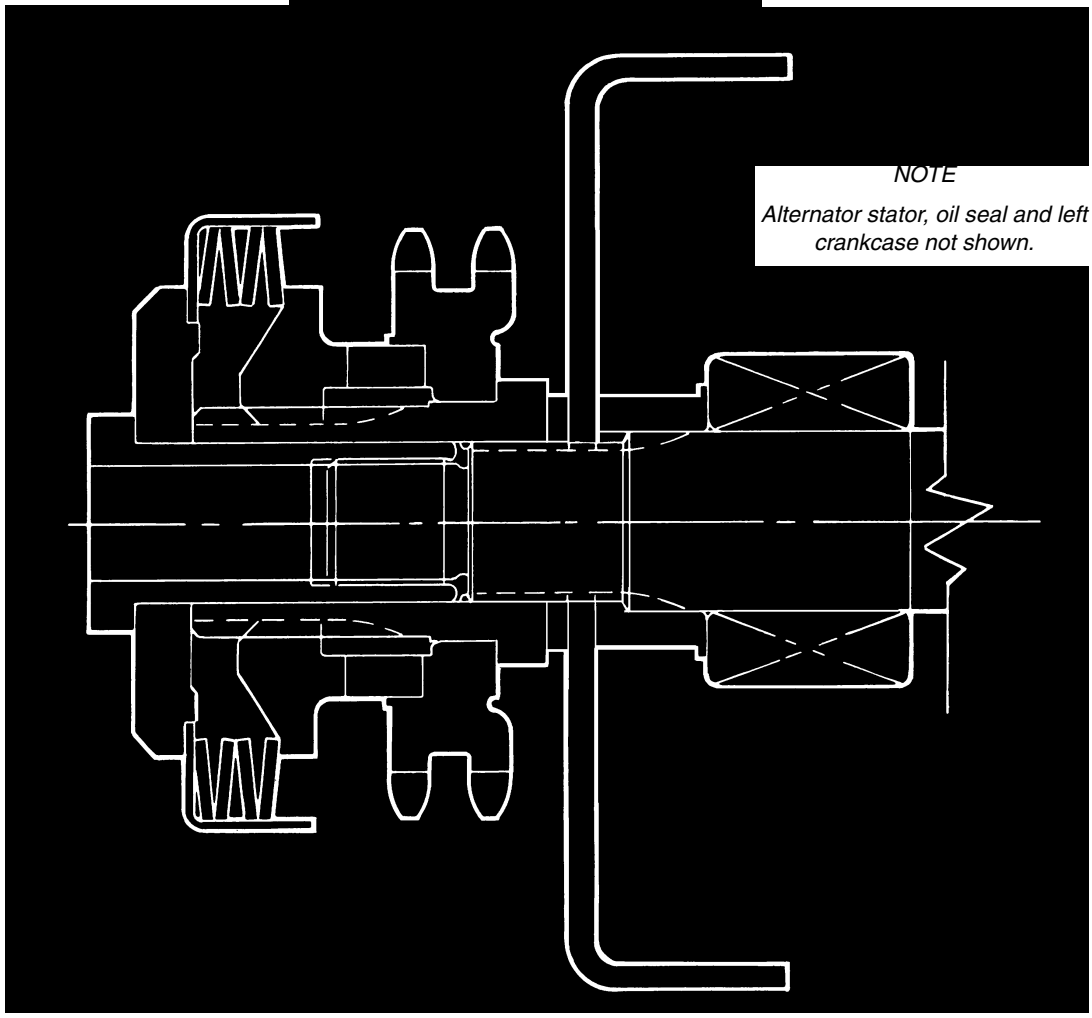
If the nylon adjuster shoe is worn or damaged, replace as follows:

1. Remove the primary chaincase cover. See Section 6.5 PRIMARY CHAINCASE, REMOVAL, steps 1-8.

f1096cx



1. Sprocket Nut
2. Sprocket Cover
3. Sliding Cam
4. Compensating Sprocket
5. Shaft Extension
7. Alternator Rotor
8. Sprocket Shaft Spacer
9. Engine Sprocket Shaft



*NOTE*

*Alternator stator, oil seal and left crankcase not shown.*

**Figure 6-3. Compensating Sprocket Components**

2. Loosen top center nut from captured bolt of chain tensioner assembly. See Figure 6-2.
3. Lower the chain tensioner assembly until the adjuster shoe just contacts the inner primary housing.

**⚠WARNING**

**Always wear proper eye protection when removing 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. Remove retaining ring from nub and pull adjuster shoe from chain tensioner. Discard adjuster shoe and retaining ring.

5. Slide **new** adjuster shoe onto chain tensioner. Be sure that the narrow end of the shoe is at the front, the wider end at the rear.

**⚠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.**

6. To lock position of adjuster shoe, install **new** retaining ring onto nub of chain tensioner. Verify that retaining ring is fully seated in the groove.

7. Raise or lower the chain tensioner assembly as necessary to obtain the specified free play. See PRIMARY CHAIN ADJUSTMENT, steps 2-4.

8. Tighten the top center nut of the chain tensioner assembly to 21-29 ft-lbs (29-39 N-m).

9. Install the primary chaincase cover. See Section 6.5 PRIMARY CHAINCASE, INSTALLATION, steps 20-31.

## DISASSEMBLY

See Section 6.5 PRIMARY CHAINCASE, REMOVAL, steps 1-16.

## CLEANING AND INSPECTION

1. Periodically inspect the primary chain for cracked, broken or badly worn links. Replace as necessary.

2. Inspect compensating sprocket components for damage or wear. Replace parts as necessary.

3. Inspect clutch sprocket for damage or wear. If broken or damaged teeth are found, the clutch shell and sprocket assembly must be replaced.

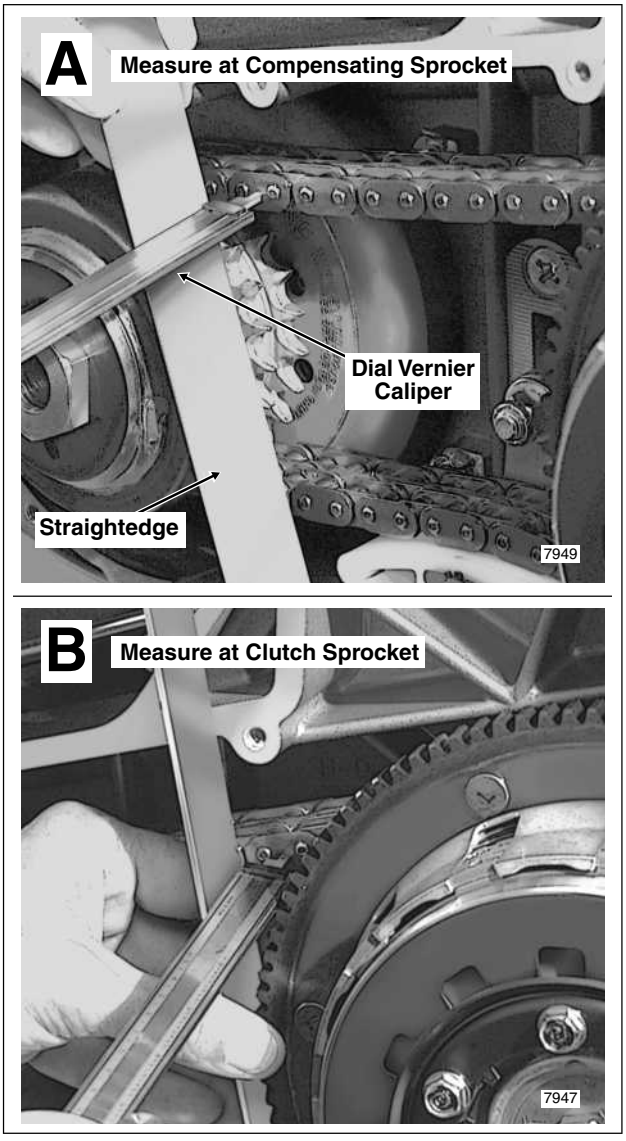



**Figure 6-4. Check Sprocket Alignment**

### Sprocket Alignment (Figure 6-3, 6-4)

The engine compensating sprocket is aligned with the clutch sprocket by a spacer installed between the alternator rotor and shaft extension (low output rotor only). Reinstall the same thickness spacer removed or determine the correct spacer size as follows:

1. With the primary chaincase cover removed, verify that the primary chain tension is properly adjusted. See PRIMARY CHAIN ADJUSTMENT in this section.

2. At both the engine compensating sprocket and clutch sprocket sides, push the primary chain inward as far as it will go.

3. Place a straightedge vertically across the flanges (cover gasket surface) near the engine compensating sprocket.
4. Using a dial vernier caliper, measure the distance from the straightedge to the chain link sideplate. Measure as close to the engine compensating sprocket as possible and record the measurement. See A of Figure 6-4.
5. Repeat the measurement on the clutch sprocket side. See B of Figure 6-4.

   For proper primary chain alignment, the difference between the two measurements must not exceed 0.030 inch (0.76 mm). If the measurement is not within specification, install the appropriate variable thickness spacer on the engine sprocket shaft between the alternator rotor and shaft extension. See the adjacent table for the various spacer thicknesses.

### Table 6-2. Alternator Rotor Spacers

| Inches | Millimeters | Part Number |
|---|---|---|
| 0.010 | 0.25 | 35850-84 |
| 0.020 | 0.51 | 35851-84 |
| 0.030 | 0.76 | 35852-84 |
| 0.060 | 1.52 | 24032-70 |
| 0.090 | 2.29 | 24033-70 |
| 0.120 | 3.05 | 24034-70 |
| 0.150 | 3.81 | 24035-70 |
| 0.180 | 4.57 | 24036-70 |
| 0.210 | 5.33 | 24037-70 |

## ASSEMBLY

See Section 6.5 PRIMARY CHAINCASE, INSTALLATION, steps 8-31.

## ADJUSTMENT

**CAUTION**

**Perform the clutch adjustment with the motorcycle at room temperature. The clearance at the adjuster screw will increase as the power train temperature increases. If adjuster screw is adjusted while the powertrain is hot, clearance at push rod bearing could be insufficient with power train cold and clutch slippage could occur.**

For proper operation, perform the following clutch adjustment after the first 1000 miles (1600 km) and then every 5000 miles (8000 km) thereafter.

*NOTE*

*Perform adjustment procedure whenever clutch components are replaced. Repeat adjustment after first 500 miles (800 km) of use.*

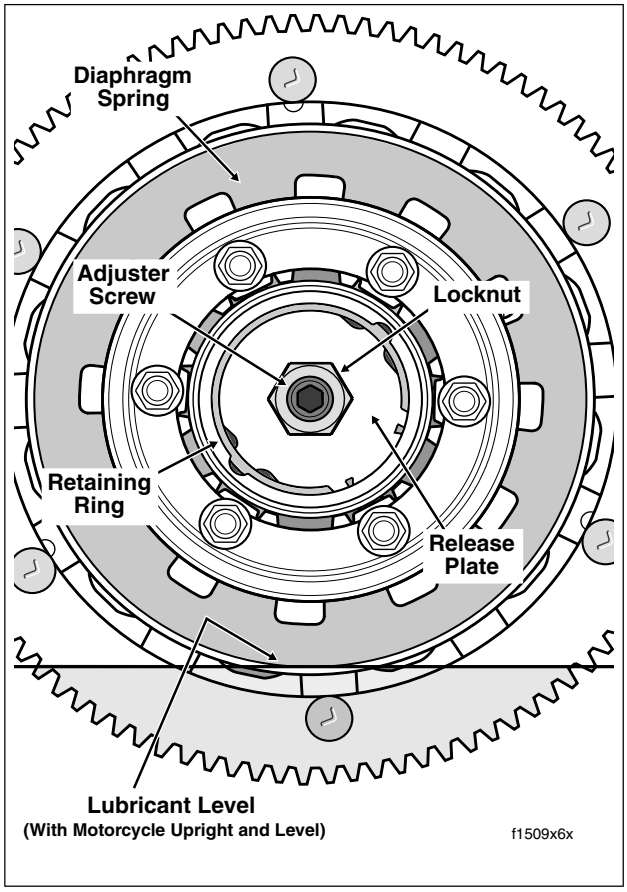



**Figure 6-5. Clutch Adjustment**

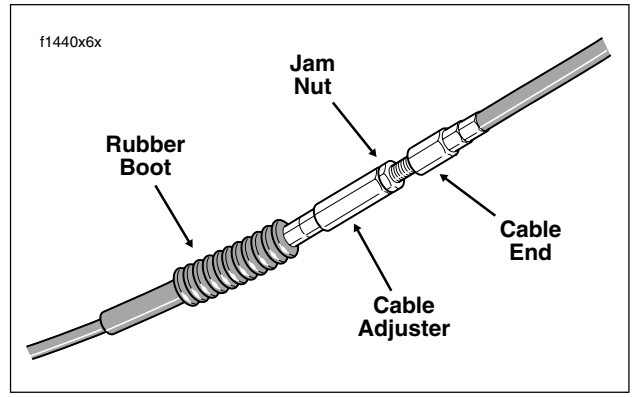



**Figure 6-6. Clutch Cable Adjuster Mechanism**

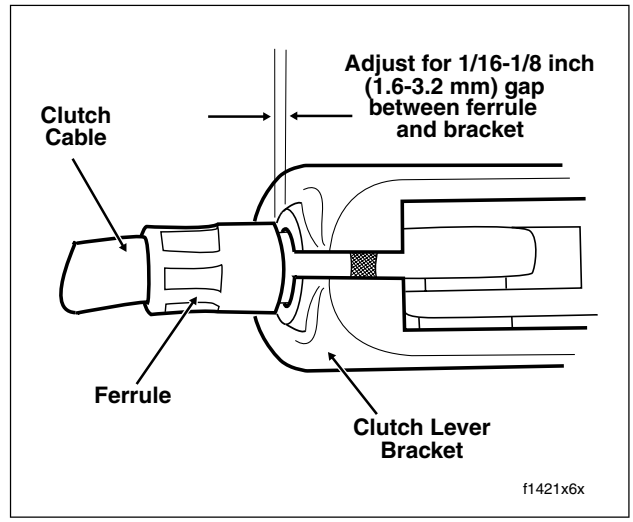



**Figure 6-7. Adjust Clutch Free Play**

1. Stand vehicle upright and level.
2. Using a T27 TORX drive head, remove five screws (with captive washers) to free clutch inspection cover from primary chaincase cover.
3. See Figure 6-6. Slide rubber boot off cable adjuster. Holding cable adjuster with 1/2 inch wrench, loosen jam nut using a 9/16 inch wrench. Back jam nut away from cable adjuster. Move adjuster toward jam nut to introduce a large amount of free play at hand lever.
4. See Figure 6-5. Loosen locknut on clutch adjuster screw. To take up all free play in push rods, turn screw inward (clockwise) until lightly seated.
5. Back out adjuster screw 1/2 to 1 turn. While holding adjuster screw with an allen wrench, tighten locknut to 6-10 ft-lbs (8-14 Nm).

6. Squeeze clutch lever to maximum limit three times to set ball and ramp release mechanism.
7. Turn cable adjuster away from jam nut until slack is eliminated at hand lever. Pull clutch cable ferrule away from clutch lever bracket to check free play. Turn cable adjuster as necessary to obtain 1/16 to 1/8 inch (1.6-3.2 mm) free play between end of cable ferrule and clutch lever bracket, as shown in Figure 6-7.
8. Hold adjuster with 1/2 inch wrench. Using 9/16 inch wrench, tighten jam nut against cable adjuster. Cover cable adjuster mechanism with rubber boot.
9. Remove O-ring from groove in primary chaincase cover. Wipe all lubricant from the O-ring and inspect for cuts, tears or signs of deterioration. Replace as necessary.
10. Swab all lubricant from the O-ring groove in the primary chaincase cover. Install O-ring in groove.

*NOTE*

*If lubricant is not thoroughly removed from both the O-ring and groove, compression of the O-ring during installation of the clutch inspection cover can cause lubricant to be squeezed to the outboard side of the ring groove, resulting in some temporary weepage around the inspection cover.*

11. Using a T27 TORX drive head, install five screws (with captive washers) to secure clutch inspection cover to the primary chaincase cover. Alternately tighten screws to 7-9 ft-lbs (10-12 Nm) in the pattern shown in Figure 6-1.

# REMOVAL/INSTALLATION

To remove the clutch without disassembly, see Section 6.5 PRIMARY CHAINCASE, REMOVAL, steps 1-16.

For installation instructions, see Section 6.5 PRIMARY CHAINCASE, INSTALLATION, steps 8-31.

*NOTE*

*If only the clutch pack is to be disassembled, see PARTIAL DISASSEMBLY below, a procedure that can be performed on the motorcycle without removing the clutch shell or hub.*

*For complete disassembly of the clutch, which includes clutch pack disassembly and bearing replacement, see COMPLETE DISASSEMBLY.*

## PARTIAL DISASSEMBLY

### CLUTCH PACK ONLY

1. Remove the primary chaincase cover. See Section 6.5 PRIMARY CHAINCASE, REMOVAL, steps 1-8.
2. Remove six bolts to release diaphragm spring retainer from clutch hub. See Figure 6-9.
3. Remove diaphragm spring retainer, diaphragm spring and pressure plate from clutch hub.

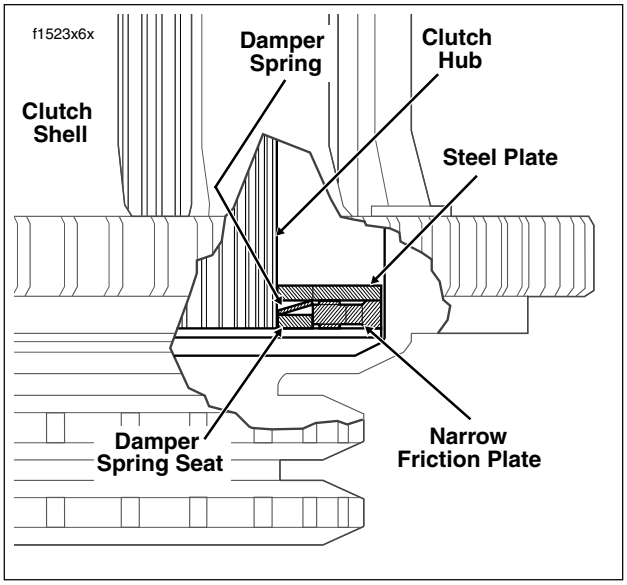


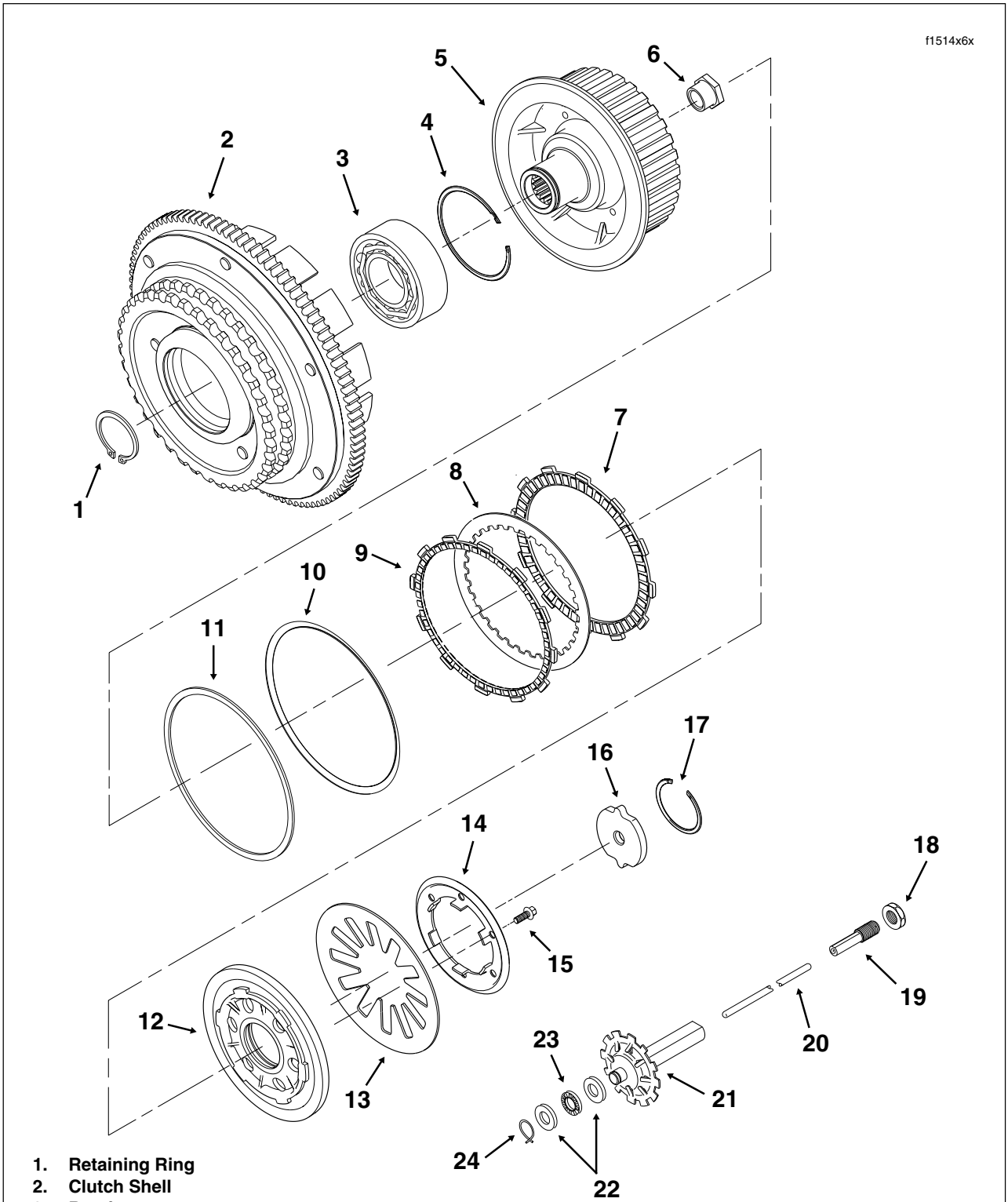

**Figure 6-8. Clutch Pack Stack-Up (Cut-Away View)**

4. Remove friction plates, steel plates, damper spring and damper spring seat from clutch hub.
5. See CLEANING AND INSPECTION, in this section.

## ASSEMBLY

### CLUTCH PACK ONLY

1. Install the narrow friction plate on the clutch hub engaging tabs on plate with slots in clutch shell.
2. Install damper spring seat on clutch hub so that it seats inboard of narrow friction plate.
3. Install damper spring on clutch hub with the concave side up (facing opposite damper spring seat). See Figure 6-8.
4. Install a steel plate and then a friction plate on the clutch hub. Install seven remaining sets in the same manner, alternating between steel plates and friction plates.
5. Install pressure plate on clutch hub aligning holes in plate with threaded bosses on hub.
6. Seat diaphragm spring in recess of pressure plate with the concave side down.
7. Align holes in diaphragm spring retainer with threaded bosses on clutch hub. Tabs on spring retainer contact flats on inboard side of bosses.
8. Install six bolts to secure diaphragm spring retainer to clutch hub. Alternately tighten bolts to 90-110 **in-lbs** (10.2-12.4 Nm).
9. Install the primary chaincase cover. See Section 6.5 PRIMARY CHAINCASE, INSTALLATION, steps 20-31.




1. Retaining Ring
2. Clutch Shell
3. Bearing
4. Retaining Ring
5. Clutch Hub
6. Mainshaft Nut
7. Friction Plate (9)
8. Steel Plate (8)
9. Narrow Friction Plate
10. Damper Spring
11. Damper Spring Seat
12. Pressure Plate
13. Diaphragm Spring
14. Diaphragm Spring Retainer
15. Bolt (6)
16. Release Plate
17. Retaining Ring
18. Locknut
19. Adjuster Screw
20. Push Rod
21. Oil Slinger
22. Thrust Washer (2)
23. Throw Out Bearing
24. Retaining Ring

**Figure 6-9. Clutch Assembly**

# CLEANING AND INSPECTION

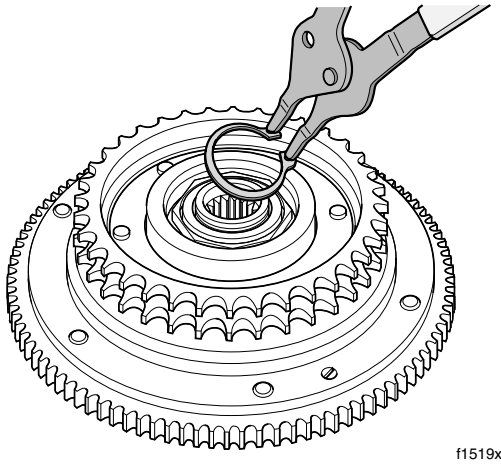
1. Wash all parts in cleaning solvent, except for friction plates and bearing, if removed. Blow dry with compressed air.
2. Check **friction plates** as follows:
   - Wipe all lubricant from the friction plates. Measure the thickness of each plate with a dial caliper or micrometer. If the thickness of any plate is less than 0.143 inch (3.62 mm), discard the friction plates and replace with an entirely new set.
   - Look for worn or damaged fiber surface material (both sides).

*NOTE*

*Replace all nine friction plates with an entirely new set if any individual plate shows evidence of wear or damage.*

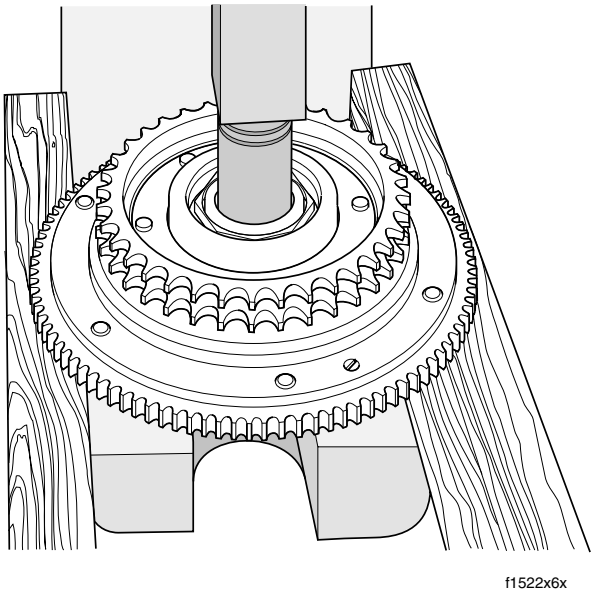
3. Check **steel plates** as follows:
   - Discard any plate that is grooved or bluish in color. Blue plates are likely warped or distorted.
   - Check each plate for distortion. Lay the plate on a precision flat surface. Insert a feeler gauge between the plate and the flat surface in several places. Replace any steel plate that is warped more than 0.006 inch (0.15 mm).
4. See Figure 6-9. Holding the clutch hub, rotate the clutch shell to check bearing for smoothness. Replace the bearing if it runs rough or binds.
5. Check the primary chain sprocket and the starter ring gear on the clutch shell. Replace the clutch shell if either sprocket or ring gear are badly worn or damaged.
6. Check the slots that mate with the clutch plates on both the clutch shell and hub. Replace shell or hub if slots are worn or damaged.
7. Check the diaphragm spring and diaphragm spring retainer for cracks or bent tabs. Obtain a new diaphragm spring or diaphragm spring retainer if either condition exists.

**Remove retaining ring from clutch hub.**



f1519x6x

**Press clutch hub from bearing.**



f1522x6x

**Figure 6-10. Remove Clutch Hub from Clutch Shell**

# COMPLETE DISASSEMBLY

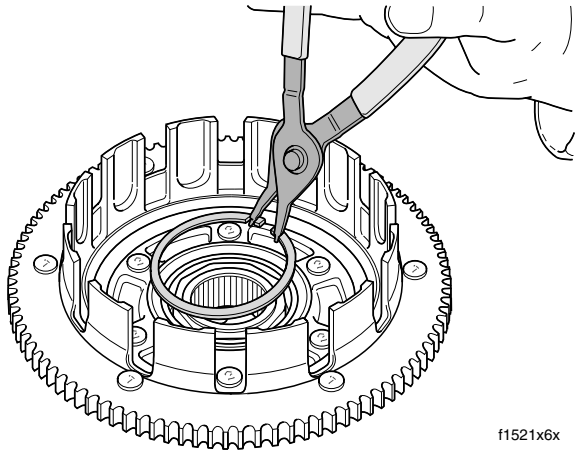
## CLUTCH PACK AND BEARING

1. Remove the clutch assembly from the vehicle. See Section 6.5 PRIMARY CHAINCASE, REMOVAL, steps 1-16.
2. Remove six bolts to release diaphragm spring retainer from clutch hub. See Figure 6-9.
3. Remove diaphragm spring retainer, diaphragm spring and pressure plate from clutch hub.
4. Remove friction plates, steel plates, damper spring and damper spring seat from clutch hub.

**CAUTION**

**To avoid possible bearing damage, do not disassemble the clutch shell and hub assembly unless the bearing, hub or shell require replacement. Replace the bearing if disassembled.**

**Remove retaining ring from clutch shell.**




**Press bearing from clutch shell.**

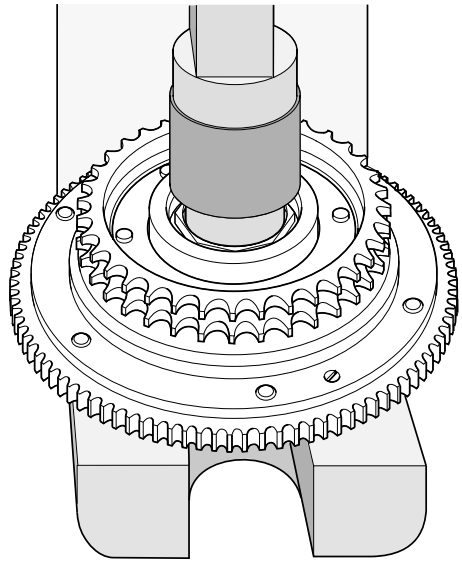



**Figure 6-11. Remove Bearing from Clutch Shell**

**⚠WARNING**

**Always wear proper eye protection when removing 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.**

5. With the sprocket side up, remove retaining ring from clutch hub groove. See upper frame of Figure 6-10.
6. Supporting clutch shell in same orientation, use arbor press and a suitable press plug to press hub from bearing in clutch shell. See lower frame of Figure 6-10.
7. Turn clutch shell over so that the sprocket side is down. Remove retaining ring from groove in clutch shell bore. See upper frame of Figure 6-11.
8. Turn clutch shell over so that sprocket side is up. Using arbor press and a suitable press plug, press on inner race to remove bearing from clutch shell bore. See lower frame of Figure 6-11.
9. See CLEANING AND INSPECTION, in this section.

## ASSEMBLY

### CLUTCH PACK AND BEARING

1. Orient clutch shell in arbor press with sprocket side down. Be sure to support clutch shell bore on sprocket side. Using a suitable press plug, press against outer race until bearing contacts shoulder in clutch shell bore.

**⚠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.**

*NOTE*

*Note that one side of the retaining ring is beveled. Always install the ring with the beveled side opposite the bearing.*

2. Install retaining ring in groove of clutch shell bore, so that the flat side of the ring is in towards the bearing, the beveled side out.
3. Center hub in bearing. Be sure that bearing inner race is supported with sleeve on sprocket side. Press hub into bearing until hub shoulder contacts bearing inner race.
4. Turn assembly over so that the sprocket side is up. Install retaining ring in groove of clutch hub.
5. Place clutch assembly on bench oriented with the sprocket side down.
6. Soak all friction and steel plates in PRIMARY CHAINCASE LUBRICANT for at least 5 minutes.
7. Install the narrow friction plate on the clutch hub engaging tabs on plate with slots in clutch shell. See Figure 6-12.
8. Install damper spring seat on clutch hub so that it seats inboard of narrow friction plate.
9. Install damper spring on clutch hub with the concave side up (facing opposite damper spring seat). See Figure 6-8.

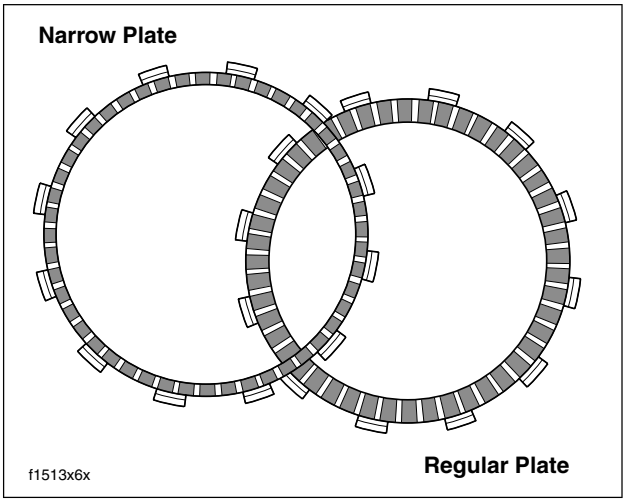



**Figure 6-12. Chain Tensioner Assembly**

10. Install a steel plate and then a friction plate on the clutch hub. Install seven remaining sets in the same manner, alternating between steel plates and friction plates.

11. Install pressure plate on clutch hub aligning holes in plate with threaded bosses on hub.

12. Seat diaphragm spring in recess of pressure plate with the concave side down.

13. Align holes in diaphragm spring retainer with threaded bosses on clutch hub. Tabs on spring retainer contact flats on inboard side of bosses.

14. Install six bolts to secure diaphragm spring retainer to clutch hub. Alternately tighten bolts to 90-110 **in-lbs** (10.2-12.4 Nm).

15. Install clutch assembly on vehicle. See Section 6.5 PRIMARY CHAINCASE, INSTALLATION, steps 8-31.

## ADJUSTMENT AND ALIGNMENT

Belt tension is set at the factory and should be checked after the first 1000 miles (1600 km) and every 2500 miles (4000 km) thereafter.

1. See Figure 6-13. With the rear wheel on the ground and one rider sitting on the motorcycle, use the BELT TENSION GAUGE (Part No. HD-35381) to apply 10 lbs. (4.5 kg) of force at the midpoint of the bottom belt strand. Belt deflection should be 5/16-3/8 inch (7.9-9.5 mm). If belt tension adjustment is necessary, proceed to step 2.
2. See Figure 6-14. Remove the linch pin clip on left side of vehicle and loosen the castle axle nut. To move the axle, turn the adjuster nuts as necessary until the correct belt tension is obtained. Be sure to turn each adjuster nut an equal number of turns to keep the wheel in alignment.
3. Tighten the castle axle nut to 60 ft-lbs (81 Nm) torque and install the linch pin clip in the axle hole. If necessary, tighten the axle nut further to align the axle hole and nut slot, but do not exceed 65 ft-lbs (88 Nm).
4. Check wheel alignment. See WHEEL ALIGNMENT in Section 2.

## INSPECTION

1. Inspect the edges of the belt for cuts or unusual wear patterns. While some beveling of the outside edge is common, and by itself is not usually harmful, it is an indication of sprocket misalignment.
2. Inspect the outside ribbed surface of the belt for signs of stone puncture. Since it is not always easy to observe this type of damage, look closely.

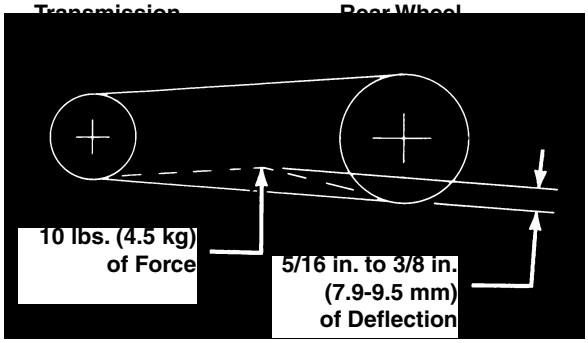



**Figure 6-13. Check and Adjust Belt Deflection**

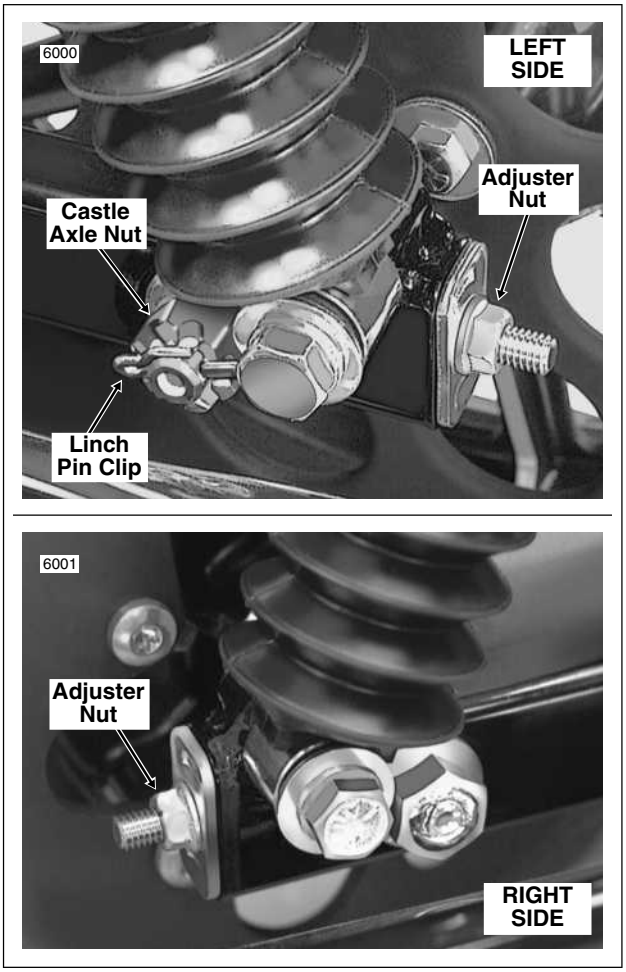



**Figure 6-14. Loosen Axle Nut and Turn Adjuster Nuts**

3. On the inside of the belt, inspect the roots of the belt teeth to see if the tensile cords are exposed. See upper frame of Figure 6-15. The tensile cords are covered by a layer of nylon facing and another layer of polyethylene. Once these layers are worn through, the tensile cords become visible. Visible tensile cords are an indication that the transmission sprocket tooth tip diameter is severely worn. Furthermore, belt failure is imminent, since the tooth tips will continue to scratch away at the tensile cords until the belt is completely worn through.

*NOTE*

*During initial operation, the thin coating of polyethylene will wear off as it is burnished into the belt fabric. This is a normal condition and not an indication of belt wear.*

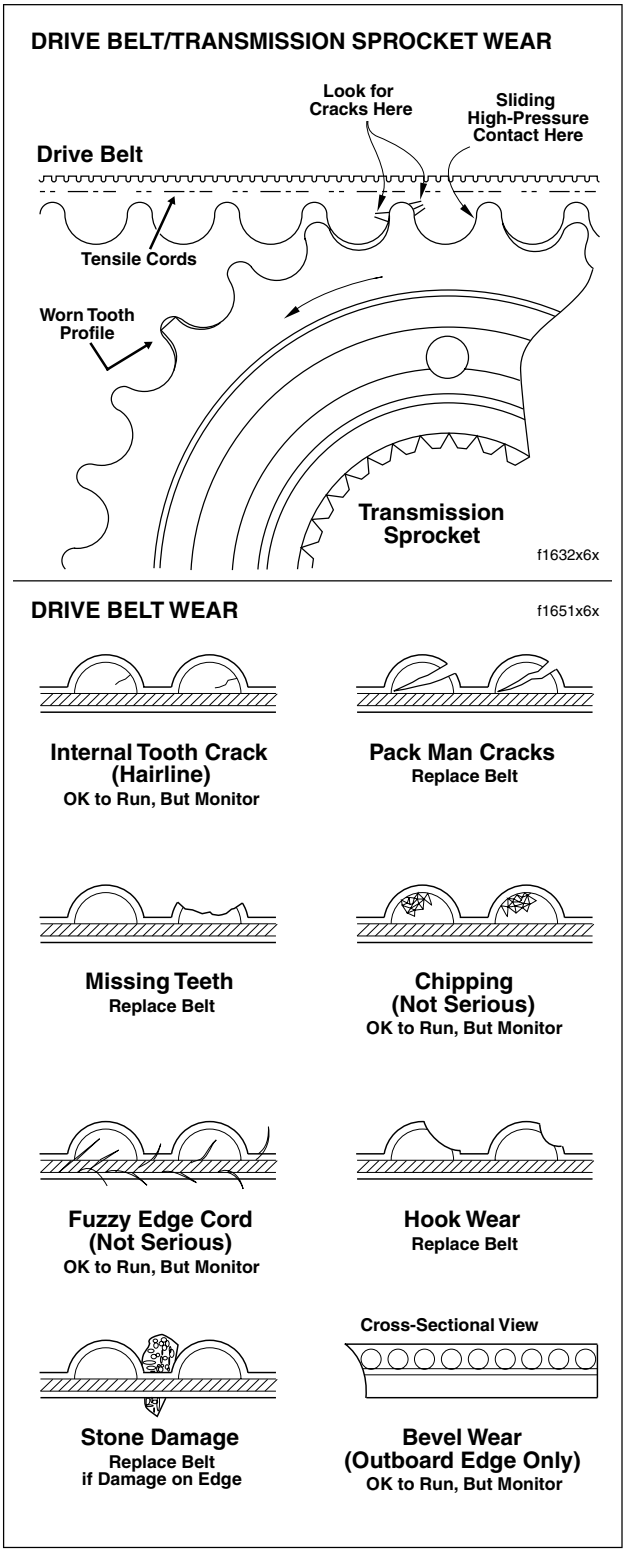



**Figure 6-15. Drive Belt/Transmission Sprocket Wear**

4. Look for signs of cracking at the base of the belt teeth where contact may be made with the “corners” of worn transmission sprocket teeth. See upper frame of Figure 6-15. Replace the belt if cracking is evident.

*NOTE*

*If the belt is replaced for reasons other than stone damage, the transmission and/or rear wheel sprockets also should be replaced. Use of worn or damaged sprockets will severely affect belt service life.*

5. For common types of belt wear and damage, see lower frame of Figure 6-15.

# REPLACEMENT

## Removal

1. Remove saddlebags. See Section 2.22 SADDLEBAG, REMOVAL.
2. See Figure 6-16. On left side of vehicle, remove exhaust system as follows:
   a. Using a bungee cord, tie the left side muffler to the lower saddlebag support rail.
   b. Open two worm drive clamps to release heat shield over rear header pipe to crossover pipe connection (above starter).
   c. Spray PB Blaster or other suitable penetrating oil in and around joint between rear header pipe and crossover pipe.
   d. Loosen TORCA clamp between rear header pipe and crossover pipe. Remove Keps nut and pull bracket tab from slots in TORCA clamp and exhaust support bracket.
   e. Remove two bolts (with lockwashers) to detach left side muffler from the lower saddlebag support rail.
   f. Pull and twist on crossover pipe to remove left side exhaust from vehicle. For best results, be sure to allow sufficient time for the penetrating oil to work.
   g. Remove bungee cord to release left side muffler from lower saddlebag support rail.
3. See Figure 6-14. Remove the linch pin clip on the left side of the vehicle and loosen the castle axle nut. To move the axle forward, turn the adjuster nuts as necessary until the belt tension is relieved. Be sure to turn each adjuster nut an equal number of turns to keep the wheel in alignment.
4. Remove the primary chaincase assembly. See Section 6.5 PRIMARY CHAINCASE, REMOVAL.
5. See upper frame of Figure 6-17. Remove two bolts (with lockwashers) to free the passenger footboard bracket from the left side of the vehicle frame. Remove the decorative chrome plug from the right side passenger footboard bracket.

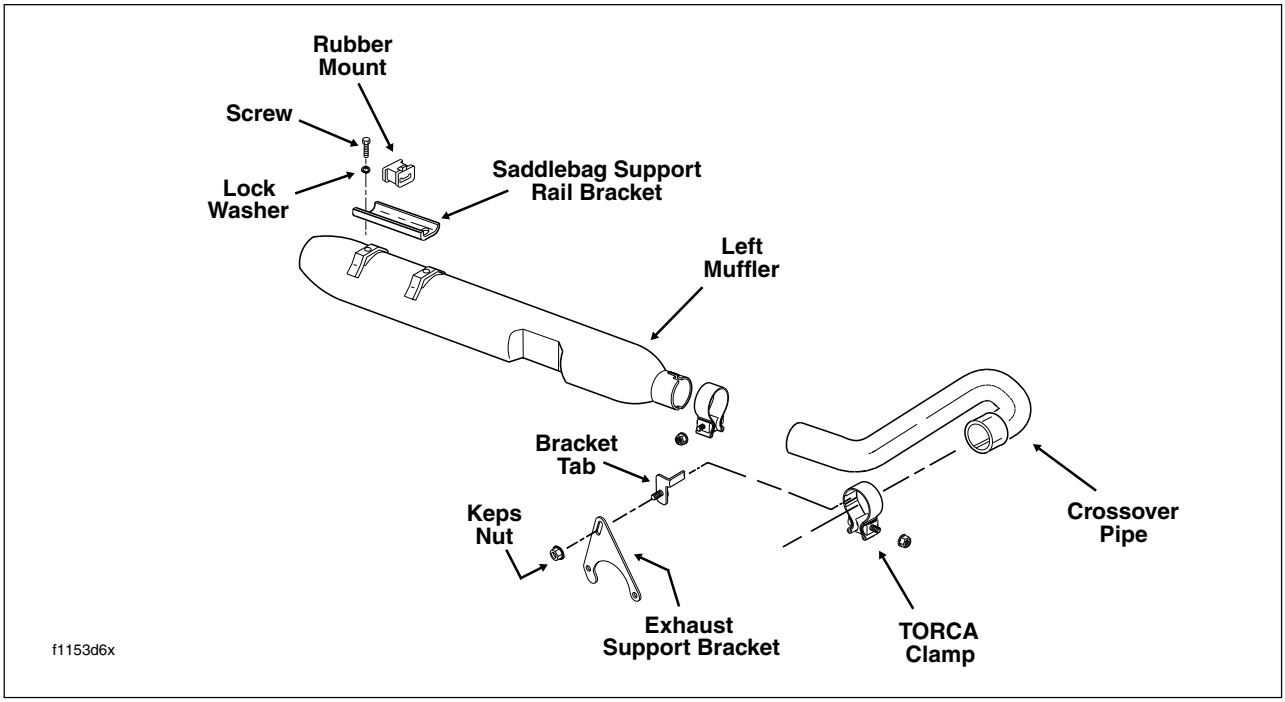



**Figure 6-16. Remove Left Side Exhaust Piping**

*NOTE*

*The passenger footboard brackets also serve as rear swing-arm brackets.*

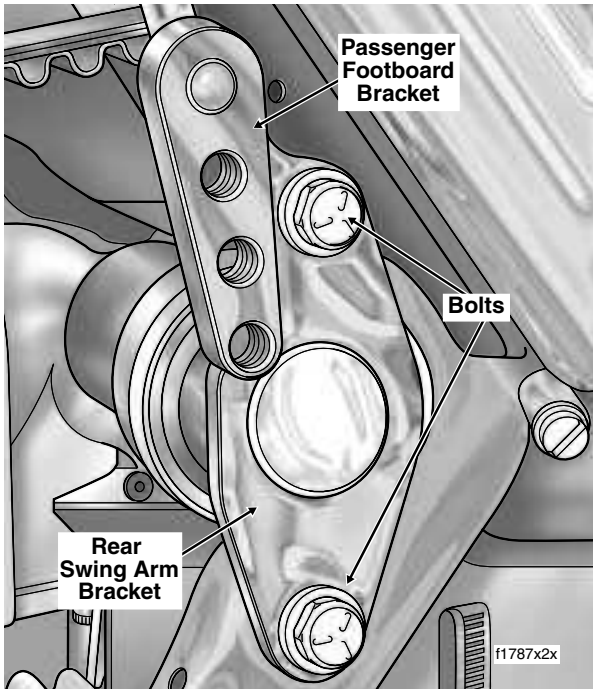
6. Holding right side nut (11/16 inch wrench size) through footboard bracket bore, remove left side locknut (3/4 inch wrench) and cup washer from swing arm pivot shaft.
7. From the left side of the vehicle, retract the pivot shaft as necessary to create a gap for belt removal. Lightly tap the pivot shaft using a suitable drift, if necessary.
8. Remove the rubber mount and nylon washer.
9. Remove the shock bottom bolt (with lockwasher and flat washer) from the rear fork mount.
10. Remove the old belt from the transmission and rear wheel sprockets.

## Installation

**CAUTION**

**Handle the drive belt with care. Never form belts into a loop smaller than five inches (127 mm) diameter. Do not bend the belt backward. Back bending will occur if the belt is rolled up. Sharp bending may weaken the belt resulting in premature failure. Install the belt in the same direction of rotation as when it was removed.**

1. Install the **new** belt on the rear wheel and transmission sprockets.
2. From the right side of the vehicle, tap the pivot shaft into position using a suitable drift.
3. On the left side of the vehicle, slide nylon washer on pivot shaft with smaller diameter boss facing inside toward the swing arm.
4. Install rubber mount on pivot shaft. The small diameter boss on the rubber mount must face outward so that the hole aligns with the pin cast in the passenger footboard bracket. See lower frame of Figure 6-17.
5. Install cup washer and locknut on pivot shaft.
6. Hold right side nut on the pivot shaft and tighten left side locknut to 40-45 ft-lbs (54-61 Nm).
7. Install passenger footboard bracket fitting cast pin in rubber mount hole. Install two bolts (with lock washers) to secure bracket to vehicle frame. Tighten bolts to 34-42 ft-lbs (46-57 Nm).
8. On the right side of the vehicle, install the decorative chrome plug in the passenger footboard bracket.
9. Install the lockwasher and flat washer on the shock bottom bolt. Apply two or three drops of Loctite 242 (blue) to the threads. Position bottom end of the shock absorber against the outboard side of the rear fork mount. Insert the bolt through the shock bottom bushing into the rear fork mount. Tighten the bolt to 35-40 ft-lbs (47-54 Nm).



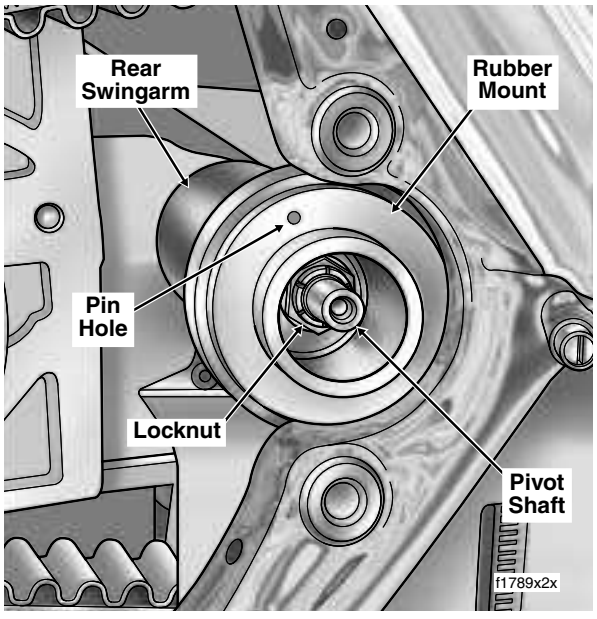




**Figure 6-17. Remove Passenger Footboard Bracket to Access Pivot Shaft (Left Side View)**

10. Adjust the belt tension as described under ADJUSTMENT AND ALIGNMENT in this section.
11. When belt tension is properly adjusted, tighten the castle axle nut to 60 ft-lbs (81 Nm) torque and install the linch pin clip in the axle hole. If necessary, tighten the axle nut further to align the axle hole and nut slot, but do not exceed 65 ft-lbs (88 Nm).
12. Check wheel alignment. See WHEEL ALIGNMENT in Section 2.
13. Install the primary chaincase assembly. See Section 6.5 PRIMARY CHAINCASE, INSTALLATION.
14. See Figure 6-16. On left side of vehicle, install exhaust system as follows:

    a. Using a bungee cord, tie left side muffler to lower saddlebag support rail.

*NOTE*

*To ensure sealing integrity of TORCA clamps and prevent the possibility of leakage, Harley-Davidson recommends that TORCA assemblies be discarded and replaced each time they are removed.*

    b. Slide **new** TORCA clamp assembly onto crossover pipe.

    c. Twist and push left side exhaust onto crossover pipe.

    d. Start two bolts (with lockwashers) to secure left side muffler to the lower saddlebag support rail.

    e. Position TORCA clamp between rear header pipe and crossover pipe. Fit bracket tab into slot of TORCA clamp engaging stud in slot of exhaust support bracket. Start Keps nut on stud.

**CAUTION**

**Verify that the exhaust pipes do not contact the vehicle frame or any mounted components. Contact will cancel the effect of the rubber isolation mounts and transmit vibration to the rider via the vehicle frame.**

    f. Tighten the exhaust system as follows:

- Tighten the two bolts (with lockwashers) to fasten the left side muffler to the lower saddlebag support rail.

*NOTE*

*Verify that all exhaust pipes are in alignment and do not contact the vehicle frame or mounted components.*

- Tighten the TORCA clamp between the rear header pipe and crossover pipe to 45-60 ft-lbs (61-81 Nm).
- Tighten Keps nut securing bracket tab to exhaust support bracket.

**CAUTION**

**Verify that the heat shields do not contact the vehicle frame or any mounted components. Contact will cancel the effect of the rubber isolation mounts and transmit vibration to the rider via the vehicle frame.**

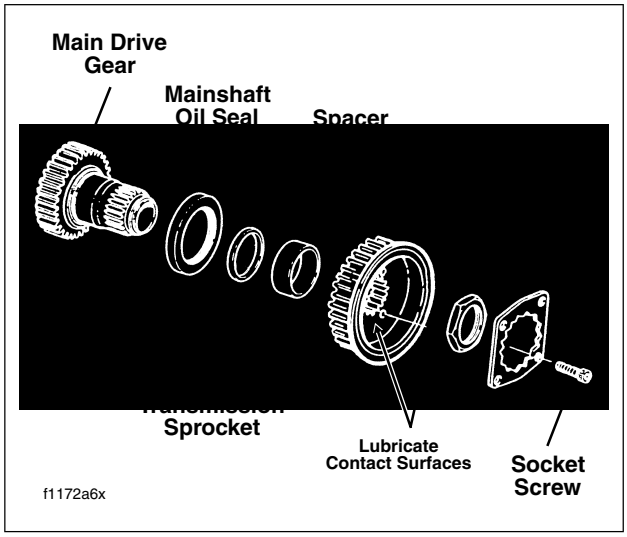



**Figure 6-18. Transmission Sprocket Components**

*NOTE*

*Position worm drive clamps so that screws are on the outboard side in the most accessible position.*

g. Open worm drive clamps and install heat shield over rear header pipe to crossover pipe connection (above starter).

h. Position each worm drive clamp so that screw is on the outboard side in the most accessible position and then tighten to 20-40 **in-lbs** (2.3-4.5 Nm).

i. Remove bungee cord from muffler.

15. Install saddlebags. See Section 2.22 SADDLEBAG, INSTALLATION.

# TRANSMISSION SPROCKET

## Removal

1. Remove the primary chaincase assembly. See Section 6.5 PRIMARY CHAINCASE, REMOVAL.
2. Remove the linch pin clip and loosen the castle axle nut on the left side of the rear wheel. Turn each adjuster nut an equal number of turns until the belt tension is relieved. Remove the belt from the transmission sprocket.
3. See Figure 6-18. Remove the two socket screws and lockplate to free the sprocket nut.

*NOTE*

*The transmission sprocket nut has left handed threads. Turn the nut clockwise to remove from the main drive gear.*

4. Remove the sprocket nut. Use an air impact wrench for best results.

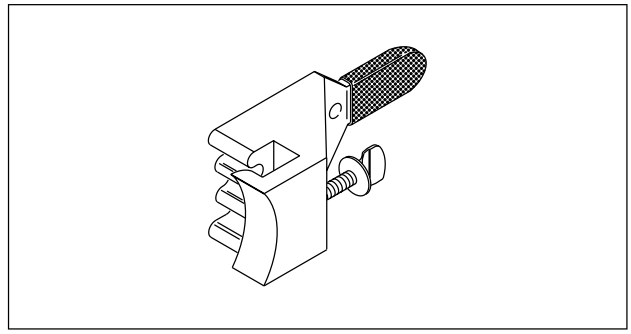


**Figure 6-19. Final Drive Sprocket Locking Tool (Part No. HD-41184)**

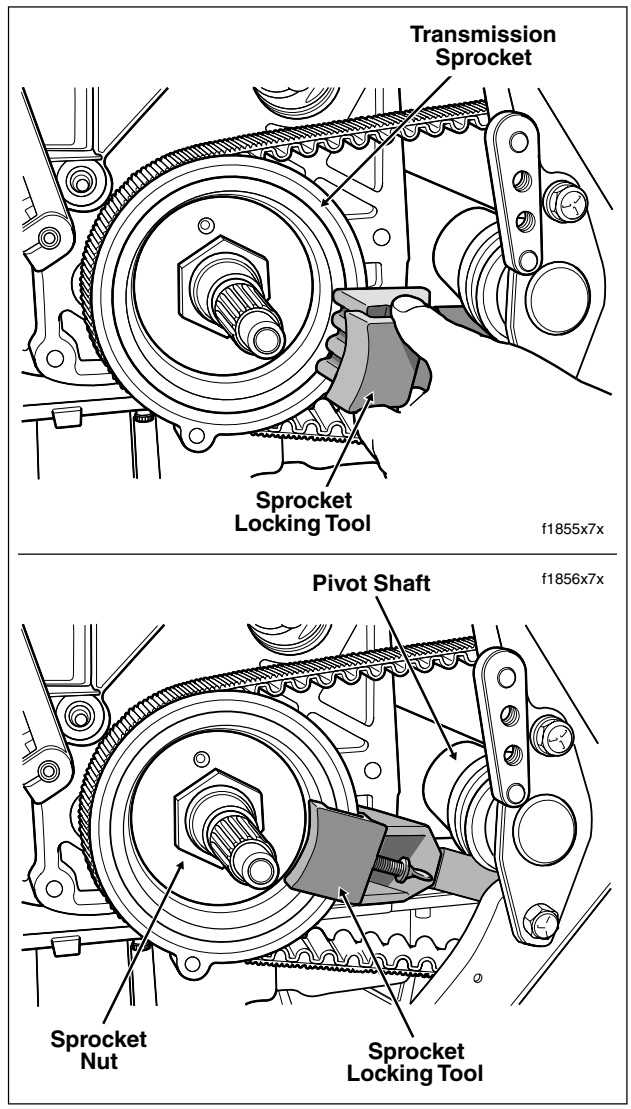



**Figure 6-20. Install Final Drive Sprocket Locking Tool**

## Cleaning and Inspection

1. Using a non-volatile cleaning solvent, thoroughly clean the transmission sprocket of all grease and dirt.
2. Carefully inspect the sprocket for cracks or other damage.
3. Inspect the sprocket for heavy pitting, which indicates a high degree of abrasive wear.
4. Look for “sharp” corners at the top of each sprocket tooth, particularly where the flank joins the top radius. A smooth transition should exist between the flank and radius. While worn teeth will appear to have an edge across the face width of the tooth, heavily worn teeth will have a flat across the top. If the flat is 1/8 inch (3 mm) wide or more, replace the transmission sprocket and drive belt. See upper frame of Figure 6-15.

## Installation

1. Install the transmission sprocket (with belt) on the main drive gear.
2. To install the sprocket nut, follow the appropriate procedure based on whether a new or used nut is being installed.

**CAUTION**

**Exercise caution to avoid getting oil on the threads of the sprocket nut or the integrity of the lock patch may be compromised.**

**New sprocket nut:** smear a small quantity of clean engine oil on the inside face of both the sprocket nut and the sprocket. Limit the application to where the surfaces of the two parts contact each other. Install the sprocket nut until finger tight.

*NOTE*

*The transmission sprocket nut has left handed threads. Turn the nut counterclockwise to install.*

**Used sprocket nut:** apply Loctite 262 (red) to the threads of the sprocket nut. Also smear a small quantity of Loctite or clean engine oil on the inside face of both the sprocket nut and the sprocket. Limit the application to where the surfaces of the two parts contact each other. Install the sprocket nut until finger tight.

3. Lock transmission sprocket with the FINAL DRIVE SPROCKET LOCKING TOOL (Part No. HD-41184).

   Insert handle of tool below pivot shaft inboard of bottom frame tube and attach to sprocket. Snug thumbscrew to lock position of tool on sprocket. See Figure 6-19 and Figure 6-20.

4. See Figure 6-21 and Figure 6-22. Install pilot of MAINSHAFT LOCKNUT WRENCH (Part No. HD-94660-37B) on threaded end of mainshaft. Slide sleeve of locknut wrench over pilot and onto sprocket nut. Tighten sprocket nut to 50 ft-lbs (68 Nm). As the nut is tightened the handle of the sprocket locking tool rises to contact the pivot shaft, thereby preventing sprocket/mainshaft rotation.
5. Scribe a straight line on the transmission sprocket nut continuing the line over onto the transmission sprocket as shown in Figure 6-23. Tighten the transmission sprocket nut an additional 30° to 40°.

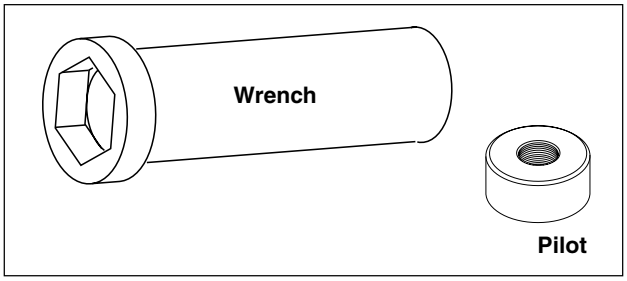



**Figure 6-21. Mainshaft Locknut Wrench/Pilot (Part No. HD-94660-37B )**

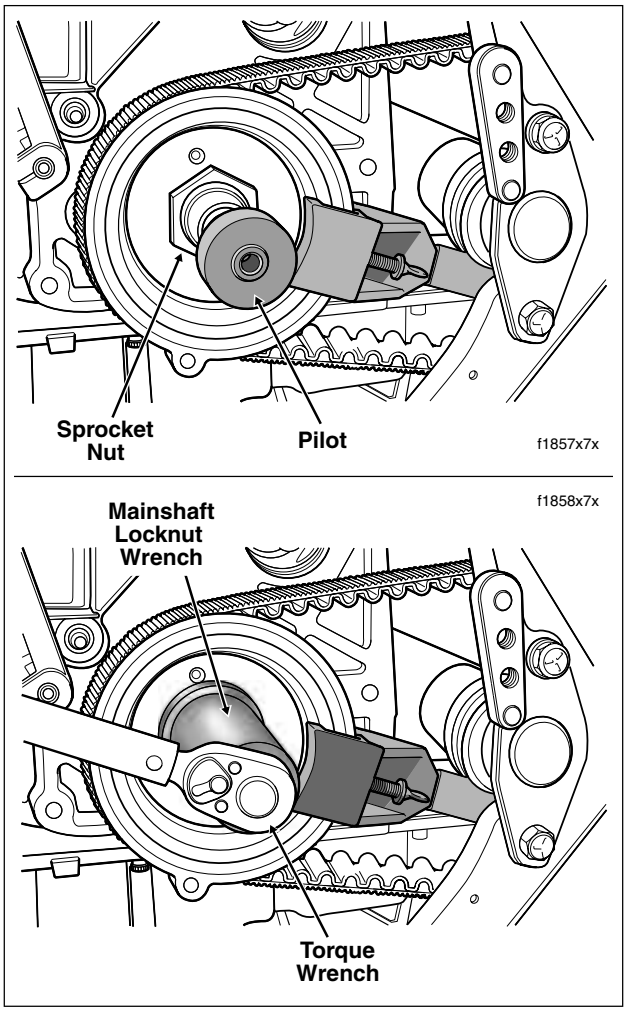



**Figure 6-22. Install Mainshaft Locknut Pilot/Wrench and Torque Sprocket Nut**

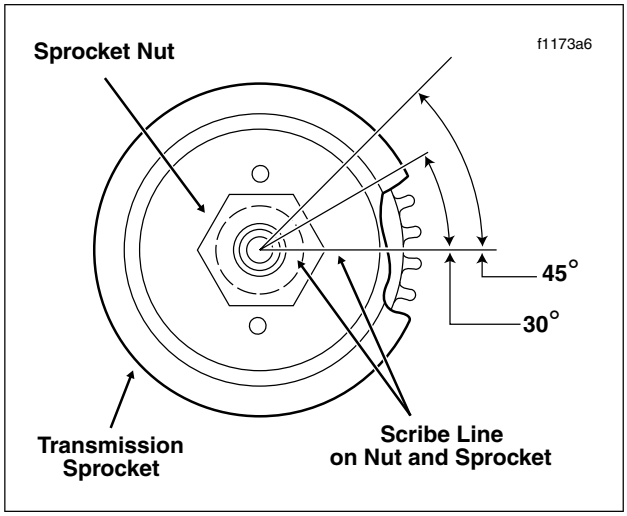



**Figure 6-23. Tighten/Secure Sprocket Nut**

6. Install lockplate over nut so that two diagonally opposite holes align with two tapped holes in sprocket. To find the best fit, lockplate can be rotated to a number of positions and can be placed with either side facing sprocket.
7. If holes in lockplate do not align with those in sprocket, tighten sprocket nut as necessary (up to the 45° maximum) until sprocket and lockplate holes are in alignment. See Figure 6-23.

**CAUTION**

**Maximum allowable tightening of sprocket nut is 45° of counterclockwise rotation after a torque of 50 ft-lbs (68 Nm). Do not loosen sprocket nut to align holes or nut will be under tightened.**

8. Insert two socket head screws through lockplate into sprocket holes. Tighten screws to 90-110 **in-lbs** (10-12 Nm). 6.5 PRIMARY CHAINCASE

*NOTE*

*The socket head screws have a thread locking compound that allows them to be reused up to three times. The fourth time the screws are removed, replace with **new** screws (H-D Part No. 3594).*

9. Adjust the belt tension. See ADJUSTMENT AND ALIGNMENT in this section.
10. Install primary chaincase assembly. See Section 6.5 PRIMARY CHAINCASE, INSTALLATION.

# REAR WHEEL SPROCKET

## Removal

1. Remove rear wheel. See Section 2.3 REAR WHEEL, REMOVAL.
2. Remove five bolts with flat washers securing sprocket to hub.

## Cleaning and Inspection

1. Using a non-volatile cleaning solvent, thoroughly clean the rear wheel sprocket of all grease and dirt.
2. Carefully inspect the sprocket for cracks or other damage.
3. Inspect each sprocket tooth for large chrome chips having sharp edges. Look for gouges caused by contact with a hard object. If large enough, both of these conditions will leave a corresponding pattern in the belt face and are cause for rear sprocket replacement.
4. Without obvious damage, rear wheel sprocket replacement may be a subjective decision based on general appearance. Using medium pressure, drag a scribe or the sharp point of a knife blade across the root of a groove. Even though the plating is lightest in the root area, a knife point should not penetrate the chrome. If the blade slides across the chrome plating without digging in, then the chrome is still good. On the other hand, if you can feel the scribe digging in and it leaves a visible mark, then the chrome plating has worn off and the bare aluminum is being cut. Loss of chrome is cause for rear sprocket replacement.

## Installation

1. Apply two drops of LOCTITE THREADLOCKER 271 (red) to threads of each of five sprocket bolts. Secure sprocket to hub using bolts with flat washers (and locknuts on laced wheels). Tighten bolts to 55-65 ft-lbs (75-88 Nm).
2. See Section 2.3 REAR WHEEL, INSTALLATION.

# PRIMARY CHAINCASE 6.5

## GENERAL

The primary chaincase is a sealed housing containing the primary chain, clutch, engine compensating sprocket, chain tensioner assembly, alternator and starter drive mechanism.

## LUBRICATION

Change the primary chaincase lubricant after the first 1000 miles (1600 km) and every 5000 miles (8000 km) thereafter.

1. Using a T40 TORX drive head, remove magnetic drain plug at bottom of primary chaincase cover. Drain lubricant into suitable container. See Figure 6-24.
2. Clean drain plug. Apply Loctite Pipe Sealant with Teflon 565 to threads and install plug back into primary chaincase cover.
3. Using a T27 TORX drive head, remove five screws (with captive washers) to free clutch inspection cover from primary chaincase cover.
4. Pour the proper amount and type of primary chaincase lubricant in through the clutch inspection cover opening.

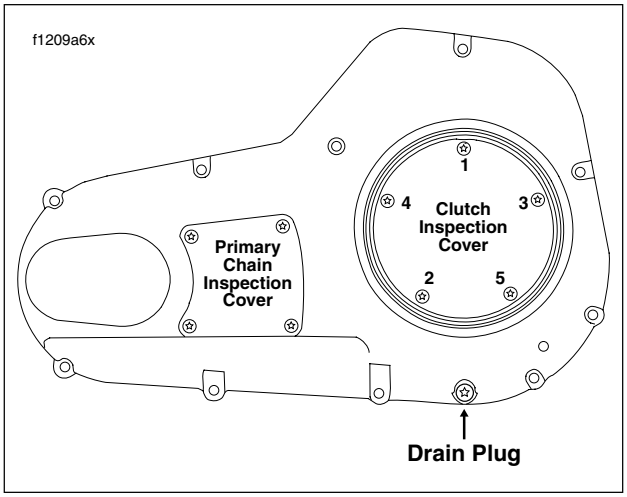



**Figure 6-24. Primary Chaincase Cover**

With vehicle standing upright, the level of the lubricant must be at the bottom edge of the diaphragm spring or 2-3/4 inches (69.8 mm) from the centerline of the clutch adjuster screw. See Figure 6-25. Use only Harley-Davidson PRIMARY CHAINCASE LUBRICANT, Part No. 99887-84 (quart) or Part No. 99886-84 (gallon). The capacity is 32 ounces (946 ml).

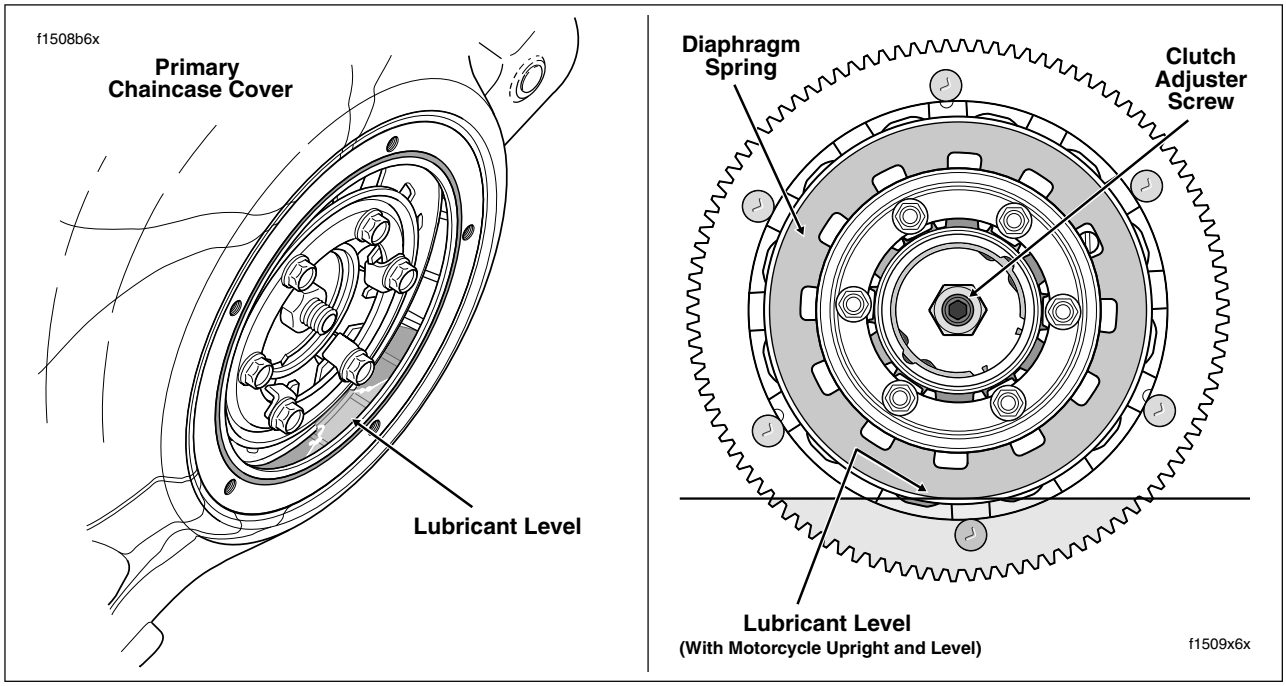



**Figure 6-25. Fill Primary Chaincase With Lubricant)**

*NOTE*

*If new clutch discs are being installed, or if the lubricant has been wiped from serviceable discs, submerge the discs in PRIMARY CHAINCASE LUBRICANT for a minimum of five minutes before installation.*

**CAUTION**

**Do not overfill the primary chaincase with lubricant. Overfilling may cause rough clutch engagement, incomplete disengagement, clutch drag and/or difficulty in finding neutral at engine idle.**

5. Remove O-ring from groove in primary chaincase cover. Wipe all lubricant from the O-ring and inspect for cuts, tears or signs of deterioration. Replace as necessary.
6. Swab all lubricant from the O-ring groove. Install O-ring in primary chaincase cover.

*NOTE*

*If lubricant is not thoroughly removed from both the O-ring and groove, compression of the O-ring during installation of the clutch inspection cover can cause lubricant to be squeezed to the outboard side of the ring groove, resulting in some temporary weepage around the inspection cover.*

7. Using a T27 TORX drive head, install five screws (with captive washers) to secure clutch inspection cover to the primary chaincase cover. Alternately tighten screws to 7-9 ft-lbs (10-12 Nm) in the pattern shown in Figure 6-24.

## REMOVAL

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠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.**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. Standing on left side of vehicle, use a T40 TORX drive head to remove magnetic drain plug at bottom of primary chaincase cover. Drain lubricant into suitable container. Clean drain plug. If plug has accumulated a lot of debris, inspect the condition of chaincase components.
4. Remove socket screw with lockwasher to remove passenger footboard from mounting bracket.
5. Remove allen head socket screw (with lockwasher and flat washer) to release front footboard forward bracket from frame weldment. For best results, approach from opposite side of vehicle using a 3/8 inch ball allen. To free front footboard rear bracket from frame weldment and jiffy stand bracket, remove lower hex bolt (with lockwasher) and upper hex bolt (with lockwasher and locknut).

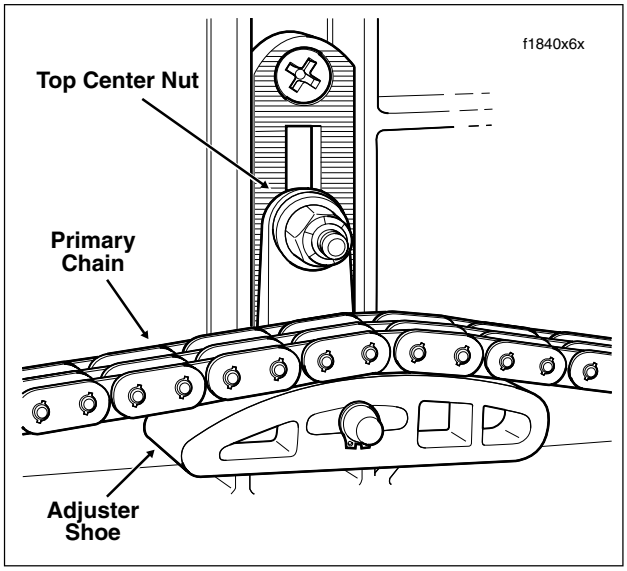



**Figure 6-26. Chain Tensioner Assembly**

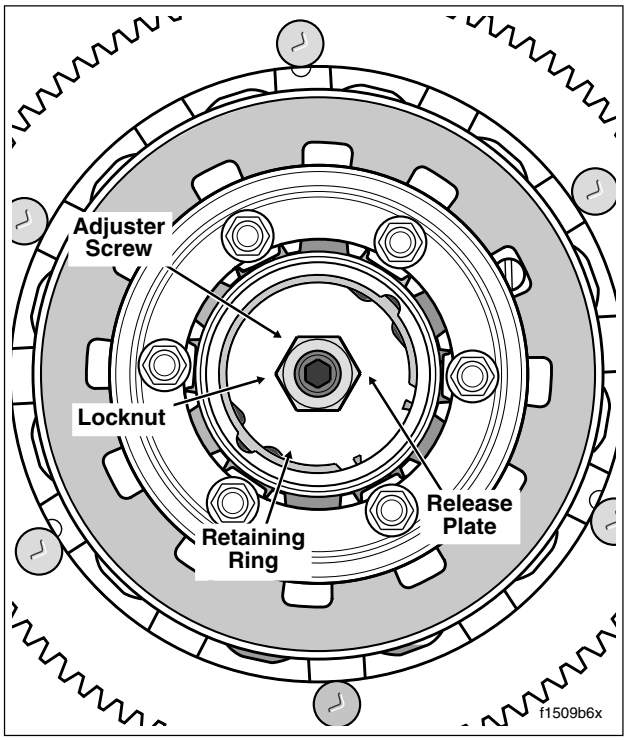



**Figure 6-27. Install Mainshaft Locknut Pilot/Wrench and Torque Sprocket Nut**

6. Remove locknut, lockwasher and flat washer to free shifter rod from shifter lever.
7. Remove socket head screw from each shifter lever (both toe and heel). Loosen and pull levers from splined shaft. Mark splines on shaft and levers as they are removed to assist in assembly. Remove rubber spacer from splined shaft.

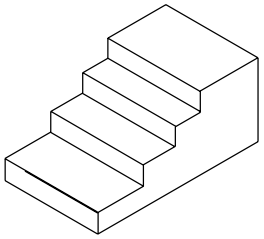
8. Remove ten allen head socket screws (with captive washers) from primary chaincase cover. Remove primary chaincase cover from vehicle.
9. Loosen top center nut from captured bolt of chain tensioner assembly. See Figure 6-26. Lower the chain tensioner assembly as required, so that the adjuster shoe rests flat on casting of primary chaincase.

**⚠WARNING**

**Always wear proper eye protection when removing 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.**

10. Remove retaining ring and pull release plate (with locknut and adjuster screw) from clutch hub. See Figure 6-27.
11. Obtain the PRIMARY DRIVE LOCKING TOOL (HD-41214). See Figure 6-28.

    With the flat side against the upper strand of the primary chain, insert stepped side of tool into teeth of engine compensating sprocket. Using a breaker bar and 1-1/2 inch socket, turn the sprocket nut in a counterclockwise direction. Once the stepped area of the tool is drawn into the sprocket, rotation of the primary drive is stopped. Continue turning sprocket nut until loose. See Figure 6-29.



**CAUTION**

**Do not place the tool on the lower strand of the primary chain. Rotation of either the compensating sprocket nut or clutch hub nut causes tool to exert enough force to break or shatter the nylon adjuster shoe.**

**Figure 6-28. Primary Drive Locking Tool (Part No. HD-41214)**

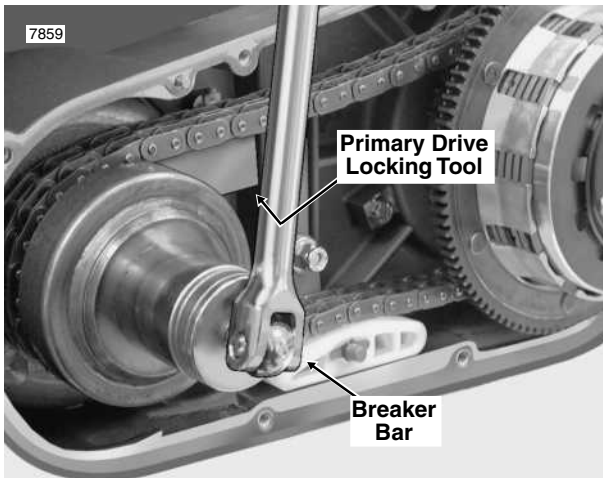



**Figure 6-29. Place Primary Drive Locking Tool and Loosen Compensating Sprocket Nut**

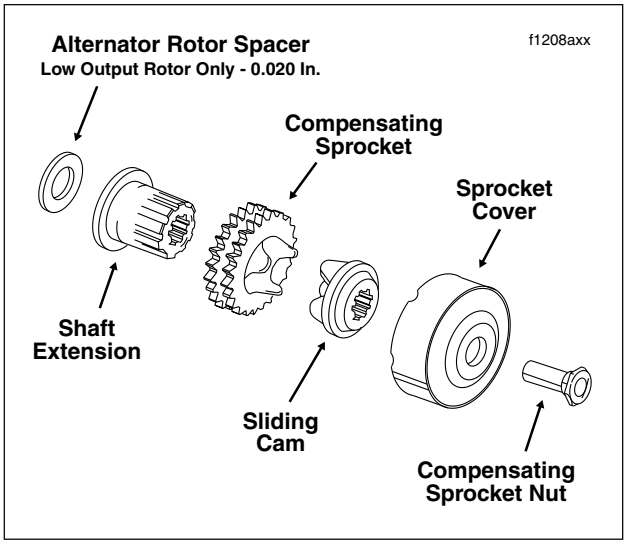



**Figure 6-30. Engine Compensating Sprocket Assembly**

*NOTE*

*If too much loctite, or perhaps the wrong loctite, was used to install the engine compensating sprocket nut, it may be very difficult to remove. In these cases, break down loctite using heat from a small propane torch. Apply flame evenly around nut head in a circular motion, but not for so long as to turn nut blue. Do not direct heat at chain tensioner assembly and other components or damage will result. If unable to loosen sprocket nut with breaker bar after applying heat, use air impact wrench as the last alternative.*

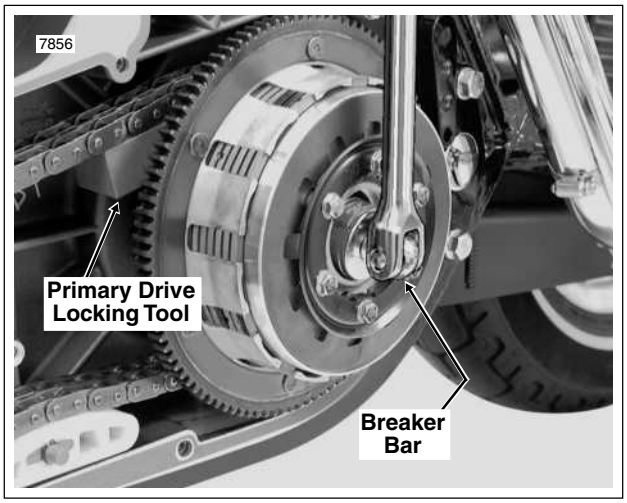



**Figure 6-31. Place Primary Drive Locking Tool and Loosen Clutch Hub Mainshaft Nut**

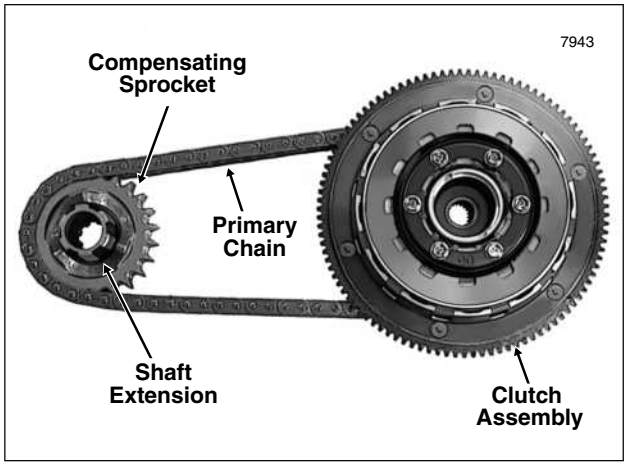



**Figure 6-32. Remove Clutch Assembly, Primary Chain, Compensating Sprocket and Shaft Extension**

**⚠WARNING**

**Use extreme caution when operating propane torch. Read the manufacturers instructions carefully before use. Do not direct open flame or heat toward any fuel system component. Extreme heat can cause fuel ignition and explosion. Inadequate safety precautions could result in death or serious injury.**

12. Reverse the position of the primary drive locking tool. With the flat side against the upper strand of the primary chain, insert stepped side of tool into teeth of clutch sprocket. Using a breaker bar and 1-3/16 inch socket, turn the clutch hub mainshaft nut in a clockwise direction until loose. See Figure 6-31.

*NOTE*

*Clutch hub mainshaft nut has left handed threads.*

13. Remove the primary drive locking tool. Remove the clutch hub mainshaft nut and engine compensating sprocket nut.
14. Remove sprocket cover and sliding cam. See Figure 6-30.
15. Remove clutch, primary chain, compensating sprocket and shaft extension as a single assembly. See Figure 6-32.
16. Remove the alternator rotor spacer from the engine sprocket shaft, if present.

*NOTE*

*The alternator rotor spacer is only present on those vehicles with the 38 amp low output rotor.*

17. Bend tab on lockplate away from head of jackshaft bolt. Holding pinion gear to prevent rotation, remove the jackshaft bolt with lockplate and thrust washer. Carefully pull jackshaft assembly from primary chaincase bore.
18. From right side of vehicle, remove starter front mounting screw with lockwasher. Remove rear mounting screw with lockwasher, but do not disconnect battery negative and chassis ground cable ring terminals.
19. Returning to left side of vehicle, remove two bolts (with flat washers) from outside edge of primary chaincase.
20. Using a chisel and hammer, bend tabs on lockplates away from heads of 5 inside bolts. Remove bolts (with lockplates) to free primary chaincase from crankcase and transmission housings. Remove primary chaincase from vehicle.
21. Remove O-ring from crankcase lip and discard.

# INSPECTION AND REPAIR

1. Inspect the primary chaincase for cracks or other damage. Replace as necessary.
2. Check the mainshaft bearing. Bearing must rotate freely without drag. Replace the bearing if necessary. Replace the lip seal. See MAINSHAFT BEARING AND LIP SEAL on this page.

*NOTE*

*Also check the bearing inner race on the mainshaft. Replace the race if scored or excessively worn. See MAINSHAFT BEARING INNER RACE in this section.*

3. Check the starter jackshaft bushing in the primary chaincase. Check the jackshaft bushing in the primary chaincase cover. Replace the bushings if they are damaged or excessively worn (i.e., through the teflon and copper coatings into the steel backing). Replace the lip seal. See STARTER JACKSHAFT BUSHING AND LIP SEAL - PRIMARY CHAINCASE in this section.
4. Check the shifter bracket bushings in the primary chaincase. Replace the bushings if necessary. See SHIFTER BRACKET BUSHINGS in this section.

# DISASSEMBLY

## MAINSHAFT BEARING AND LIP SEAL

### REMOVAL

**⚠WARNING**

**Always wear proper eye protection when removing 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.**

1. Remove retaining ring from groove on clutch side of primary chaincase. Turn the chaincase over to trans-mission side.

2. Pull lip seal from bearing bore on transmission side of primary chaincase. Use a seal remover or rolling head pry bar for best results. Remove retaining ring from groove on same side of chaincase.

**CAUTION**

**Failure to provide proper support will cause the casting to crack or break around the outside diameter of the boss. Any damage to the casting requires replacement of the primary chaincase.**

3. Place primary chaincase in arbor press with the transmission side up. Be sure to properly support boss on clutch side to avoid damage to casting.

4. Center bearing under ram, and using a suitable driver, carefully press out bearing applying pressure to the outer race.

## INSTALLATION

1. Inspect the bearing bore to verify that it is clean and smooth.

**⚠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.**

2. Install retaining ring in groove on transmission side of primary chaincase. Verify that the retaining ring is fully seated in the groove.

3. Apply a thin film of clean H-D 20W50 engine oil to bearing bore and O.D. of **new** bearing.

**CAUTION**

**Failure to provide proper support will cause the casting to crack or break around the outside diameter of the boss. Any damage to the casting requires replacement of the primary chaincase.**

4. Place primary chaincase in arbor press with the clutch side up. Be sure to properly support boss on trans-mission side to avoid damage to casting.

5. Place bearing over bore with the lettered side up. Center bearing under ram, and using a suitable driver, apply pressure to the outer race until bearing makes contact with the installed retaining ring.

6. Install second retaining ring to lock position of bearing in bore on clutch side of chaincase. Verify that retaining ring is fully seated in the groove.

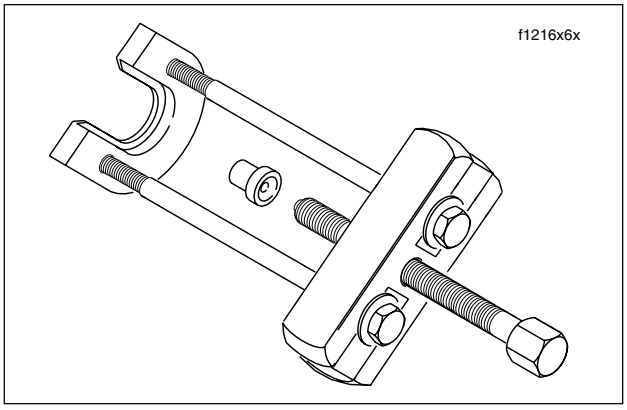



**Figure 6-33. Mainshaft Bearing Inner Race Remover (Part No. HD-34902B)**

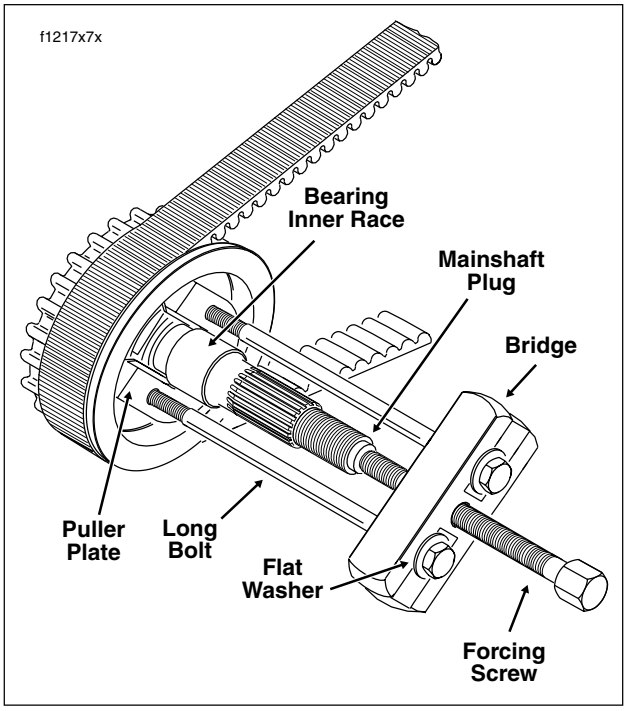



**Figure 6-34. Pull Mainshaft Bearing Inner Race**

7. Turn chaincase over, so that the transmission side is up. With the open (lip garter spring) side facing the bearing, press fit a **new** lip seal into the bore until it makes contact with the installed retaining ring. Be sure to support bearing outer race on clutch side during the press procedure. Verify that seal is square in the bore and completely seated around its circumference.

8. Lubricate the bearing and lip seal with multi-purpose grease or clean H-D 20W50 engine oil.

## MAINSHAFT BEARING INNER RACE

*NOTE*

*The bearing inner race must be properly positioned on the mainshaft to align with the bearing outer race in the primary chaincase. To remove and install the bearing inner race, use the combination MAINSHAFT BEARING INNER RACE REMOVER/INSTALLER, Part No. HD-34902B. See Figure 6-33 and Figure 6-35.*

### REMOVAL

1. Install small flat washers on two long bolts of puller tool. Slide one bolt into channel on each side of bridge so that washer is between bridge and bolt head. Thread bolts into stamped side of U-shaped puller plate an equal number of turns.
2. Sparingly apply graphite lubricant to threads of forcing screw to ensure smooth operation. Thread forcing screw into center hole of bridge.
3. Position U-shaped puller plate between bearing inner race and sprocket nut. See Figure 6-34.
4. Install mainshaft plug into end of transmission mainshaft. Thread the forcing screw into the bridge until the steel ball at the end of the screw seats in the cavity of the mainshaft plug. Verify that the tool assembly is square so that the bearing is not cocked during removal.
5. Continue turning the forcing screw until the bearing inner race is pulled free of the mainshaft.

### INSTALLATION

1. See Figure 6-36. Chamfered edge first, slide the bearing inner race onto the transmission mainshaft.
2. Thread extension shaft onto end of mainshaft.

*NOTE*

*Extension shaft has left handed threads, so turn counterclockwise to install.*

3. See Figure 6-36. Slide installer tube over extension shaft until it contacts bearing inner race. Sparingly apply graphite lubricant to threads of extension shaft to ensure smooth operation.
4. Place both large flat washers over threaded portion of extension shaft until they contact installer tube. Install large hex nut onto extension shaft.
5. With a wrench on flats at threaded end of extension shaft, hold shaft stationary while turning hex nut in a clockwise direction. In this manner, press race onto shaft so inside edge is 0.100 in. (2.54 mm) from main drive gear.
6. Lubricate the race with multi-purpose grease or clean engine oil.

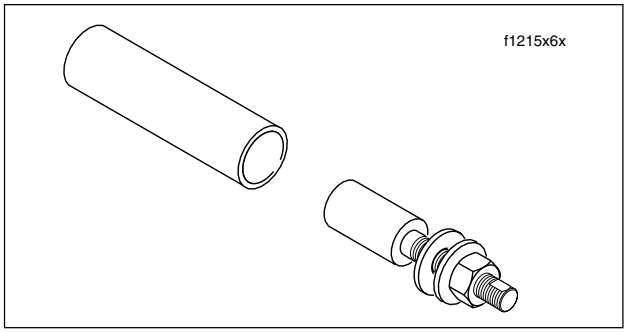



**Figure 6-35. Mainshaft Bearing Inner Race Installer (Part No. HD-34902B)**

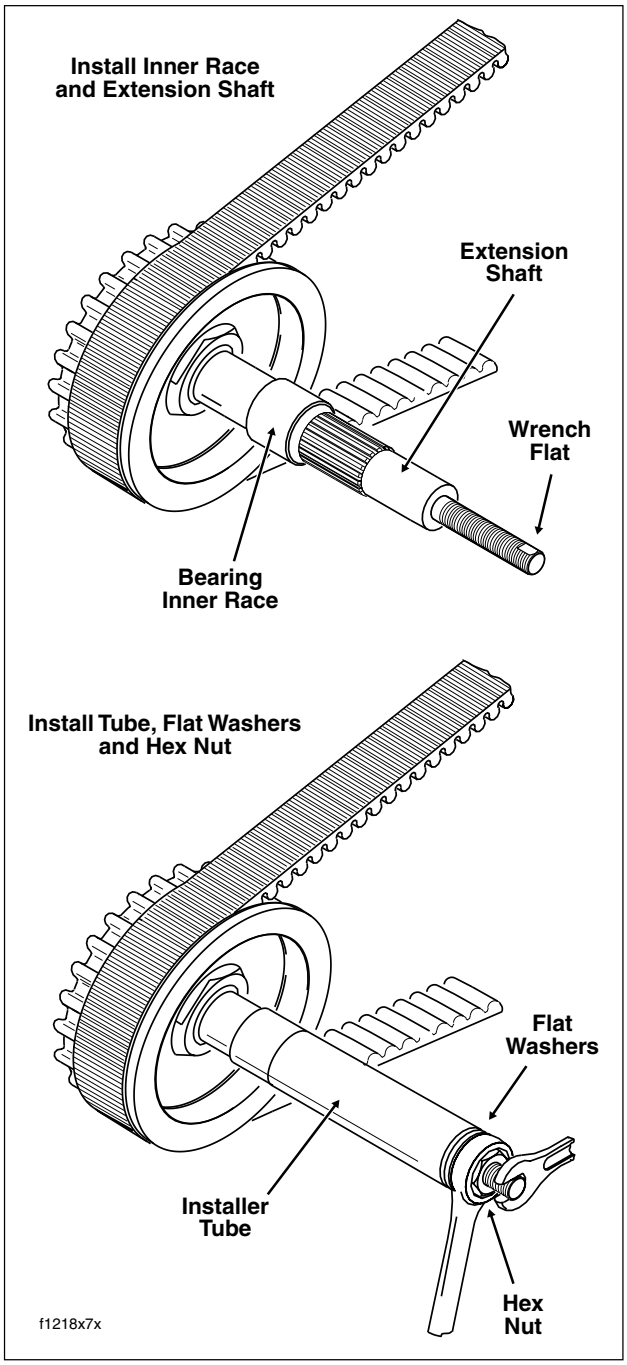



**Figure 6-36. Press Bearing Inner Race onto Mainshaft**

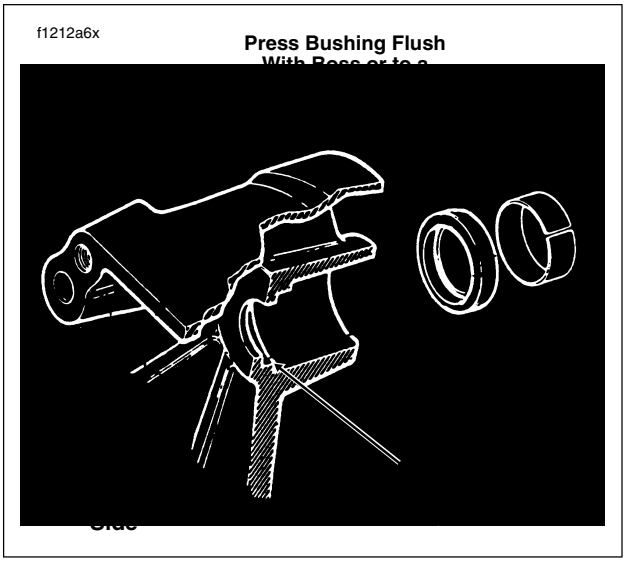



**Figure 6-37. Install Jackshaft Seal and Bushing in Primary Chaincase**

## STARTER JACKSHAFT BUSHING AND LIP SEAL - PRIMARY CHAINCASE

### REMOVAL

1. Remove bushing from jackshaft bore of primary chaincase. For best results, use a bushing/bearing puller with expandable collet and slide hammer.
2. Remove lip seal from bore.

### INSTALLATION

1. Inspect the bushing bore to verify that it is clean and smooth. Place primary chaincase in arbor press with the clutch side up. Support forward part of case so that it lies flat on transmission mounting flanges.
2. With the open (lip garter spring) side facing up, press fit a **new** lip seal into the jackshaft bore until it makes solid contact with the shoulder on the transmission side. Verify that the seal is square in the bore and completely seated around its circumference.
3. See Figure 6-37. Press **new** bushing into bore. Bushing must be flush with boss or at a depth not exceeding 0.010 in. (0.76 mm).
4. Lubricate the bushing and seal lip with multi-purpose grease or clean engine oil.

## STARTER JACKSHAFT BUSHING - PRIMARY CHAINCASE COVER

### REMOVAL

1. Remove bushing from jackshaft bore of primary chaincase cover. For best results, use a bushing/bearing puller with expandable collet and slide hammer.
2. Inspect the bushing bore to verify that it is clean and smooth.

### INSTALLATION

1. Using a T27 TORX drive head, remove five screws (with captive washers) to free clutch inspection cover from primary chaincase cover.
2. Place primary chaincase cover in arbor press. Support forward part of case so that it lies flat around the clutch inspection cover bore.
3. Press **new** bushing into bore. Bushing must be flush with boss or at a depth not exceeding 0.010 in. (0.76 mm).
4. Lubricate the bushing with multi-purpose grease or clean engine oil.

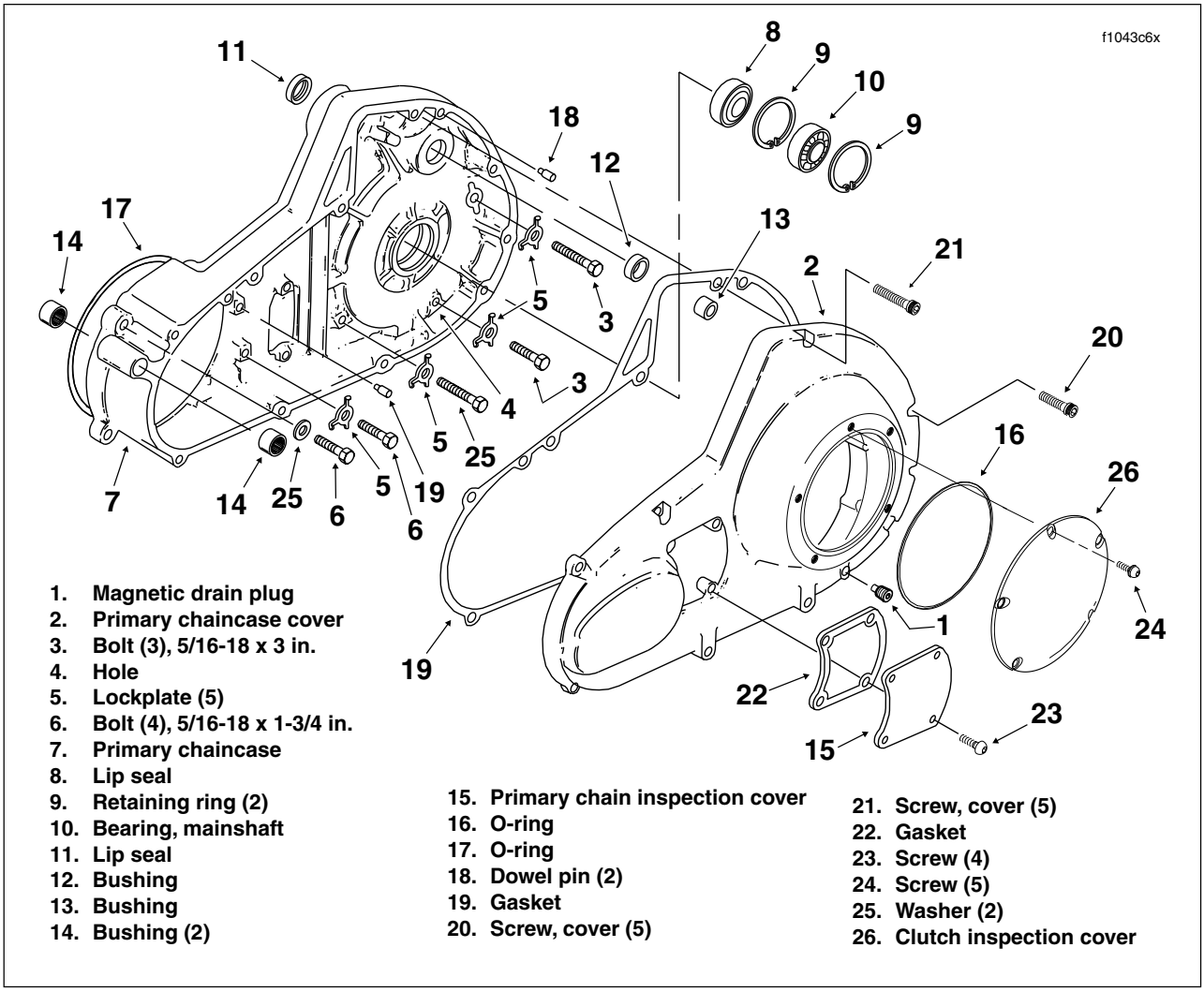
## SHIFTER BRACKET BUSHINGS

### REMOVAL

1. Remove spacer and shifter shaft assembly from shifter bracket bore of primary chaincase.
2. Using an arbor press, press bushings from bore. Inspect the bushing bore to verify that it is clean and smooth.

### INSTALLATION

1. Place primary chaincase in arbor press.
2. Press **new** bushing into each end of bore. Installed bushings must be flush to 0.010 inch (0.76 mm) **above outer edge** of bore.
3. Install shifter shaft in shifter bracket bore. Install spacer on shifter shaft.
4. Assemble primary chaincase. See Section 6.5 PRIMARY CHAINCASE, INSTALLATION, on the next page.




1. Magnetic drain plug
2. Primary chaincase cover
3. Bolt (3), 5/16-18 x 3 in.
4. Hole
5. Lockplate (5)
6. Bolt (4), 5/16-18 x 1-3/4 in.
7. Primary chaincase
8. Lip seal
9. Retaining ring (2)
10. Bearing, mainshaft
11. Lip seal
12. Bushing
13. Bushing
14. Bushing (2)
15. Primary chain inspection cover
16. O-ring
17. O-ring
18. Dowel pin (2)
19. Gasket
20. Screw, cover (5)
21. Screw, cover (5)
22. Gasket
23. Screw (4)
24. Screw (5)
25. Washer (2)
26. Clutch inspection cover

**Figure 6-38. Primary Chaincase Assembly**

## INSTALLATION

1. Install **new** O-ring on lip of crankcase.

**CAUTION**

**Failure to apply silicone sealer to the bolts and bolt holes on the inboard side of the primary chaincase may result in oil leakage after assembly.**

2. On the crankcase/transmission side of the primary chaincase, apply silicone sealer (black RTV) to the following areas:
   - Around the two rear primary chaincase to crankcase bolt holes. See B in left frame of Figure 6-39.
   - Around the three primary chaincase to transmission bolt holes. See right frame of Figure 6-39.

   Also apply the silicone sealer to the threads of the five fasteners installed in these holes.

**CAUTION**

**The mainshaft splines may damage the sealing surface of the lip seal if the protector sleeve is not used.**

3. Place the seal protector sleeve (from the MAIN DRIVE GEAR SEAL INSTALLER, HD-41405) over the mainshaft splines. Lightly lubricate the sleeve with clean engine oil.
4. Place the primary chaincase into position against the crankcase and transmission housings. Remove the seal protector sleeve from the mainshaft.
5. See A in left frame of Figure 6-39. Start two forward bolts (1-3/4 inches with flat washers) to fasten outside edge of primary chaincase to front of crankcase.

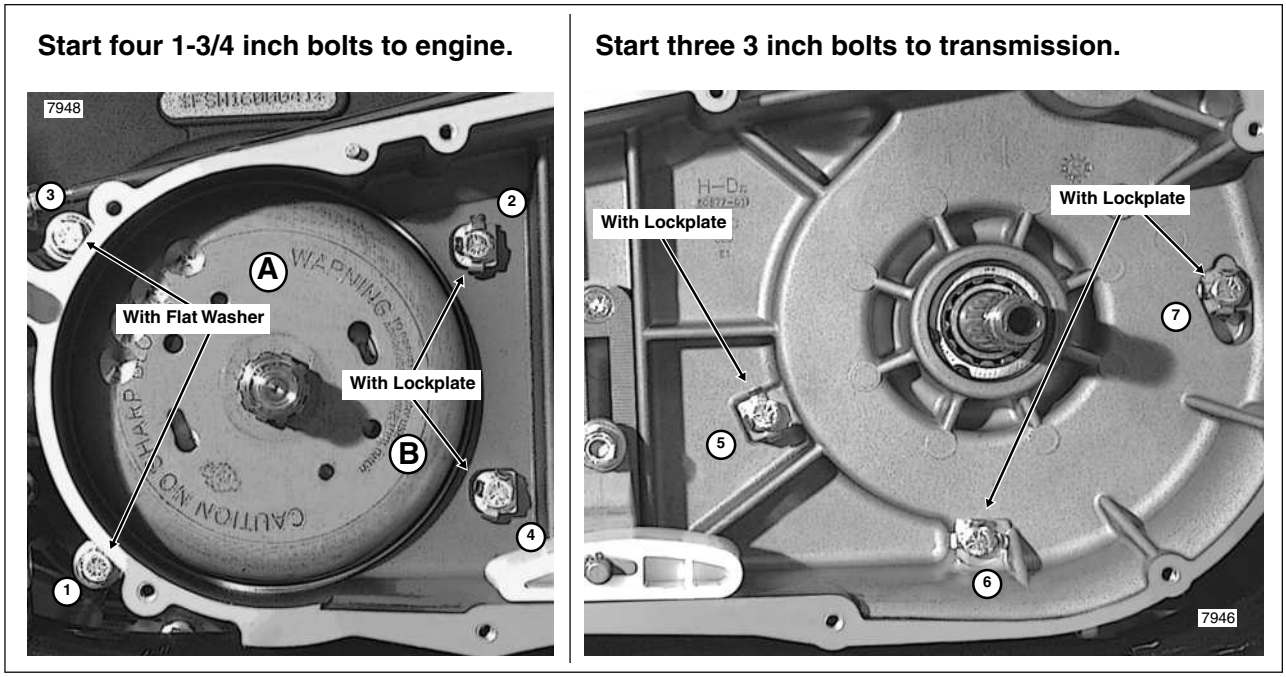



**Figure 6-39. Primary Chaincase Screw Size and Torque Sequence**

See B in left frame of Figure 6-39. From within the primary chaincase, start two forward bolts (1-3/4 inches with lockplates) to fasten primary chaincase to rear of crankcase.

See right frame of Figure 6-39. From within the primary chaincase, start three rearward bolts (3 inches with lockplates) to fasten primary chaincase to front and rear of transmission.

Tighten the seven bolts to 18-21 ft-lbs (24-28 Nm) in the numerical sequence shown in Figure 6-39.

Bend one tab on each lockplate against the flat of the bolt head to secure.

6. On right side of vehicle, install the front starter mounting screw with lockwasher. Install rear mounting screw and lockwasher (with chassis ground and battery negative cable ring terminals). Alternately tighten front and rear starter mounting screws to 13-20 ft-lbs (18-27 N-m).

7. Returning to left side of vehicle, gently insert jackshaft assembly into primary chaincase so that splined end of shaft engages coupling on starter output shaft. Insert key on lockplate through slot in thrust washer and into keyway on jackshaft. Thread the jackshaft bolt into the starter shaft making sure that the lockplate key remains in the keyway. Holding pinion gear to prevent rotation, tighten jackshaft bolt to 7-9 ft-lbs (9-12 N-m). Bend tab on lockplate against flat of bolt head to secure.

8. Install alternator rotor spacer on engine sprocket shaft, if present. See Figure 6-30.

*NOTE*

*The alternator rotor spacer is only present on those vehicles with the 38 amp low output rotor.*

9. Install the clutch, primary chain, compensating sprocket and shaft extension as a single assembly. See Figure 6-32. Start clutch assembly on the mainshaft, while placing the shaft extension on the engine sprocket shaft. The clutch hub and shaft extension are splined, so a slight rotation of the chain drive will aid in lining up the splines.

10. Place sliding cam over shaft extension. Slide sprocket cover over sliding cam. See Figure 6-30.

11. Apply two drops of LOCTITE® 262 to the threads of the engine compensating sprocket nut. Install nut and hand tighten in a clockwise direction.

12. Apply two drops of LOCTITE® 262 to the threads of the clutch hub mainshaft nut. Install nut and hand tighten in a **counterclockwise** direction.

*NOTE*

*Clutch hub mainshaft nut has left handed threads.*

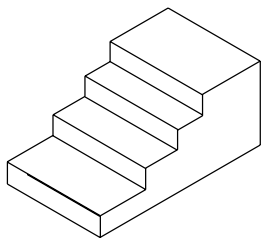
13. Obtain the PRIMARY DRIVE LOCKING TOOL (HD-41214). See Figure 6-40.

With the flat side against the upper strand of the primary chain, insert stepped side of tool into teeth of clutch sprocket. Verify that adjuster shoe of chain tensioner assembly rests flat on casting of primary chaincase, and then using a torque wrench and 1-1/2 inch socket, tighten sprocket nut to 150-165 ft-lbs (203-224 Nm). See Figure 6-41.

*NOTE*

*Once the stepped area of the tool is drawn into the sprocket, rotation of the primary drive is stopped.*

14. Reverse the position of the primary drive locking tool. With the flat side against the upper strand of the primary chain, insert stepped side of tool into teeth of engine compensating sprocket. Using a torque wrench and 1-3/16 inch socket, tighten clutch hub mainshaft nut to 70-80 ft-lbs (95-108 Nm). See Figure 6-42.
15. Remove the primary drive locking tool.
16. Install release plate (with locknut and adjuster screw) into clutch hub bore. The word “OUT” is stamped on the release plate to indicate the outboard side.



**CAUTION**

**Do not place the tool on the lower strand of the primary chain. Rotation of either the compensating sprocket nut or clutch hub nut causes tool to exert enough force to break or shatter the nylon adjuster shoe.**

**Figure 6-40. Primary Drive Locking Tool (Part No. HD-41214)**

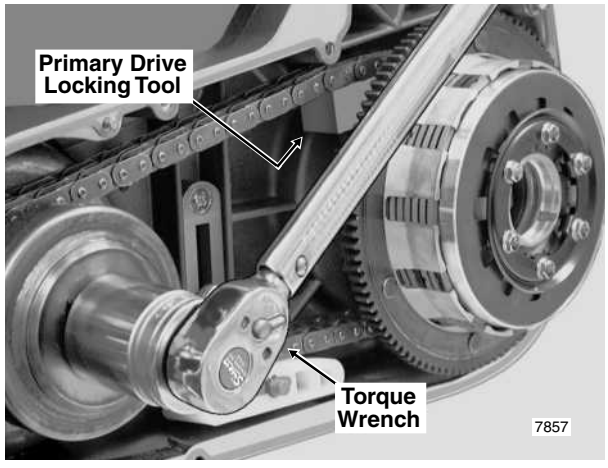



**Figure 6-41. Place Primary Drive Locking Tool and Torque Compensating Sprocket Nut**

**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.**

17. Install retaining ring in clutch hub bore to lock release plate in position. Verify that the retaining ring is completely seated in the groove.
18. Adjust clutch. See Section 6.3 CLUTCH, ADJUSTMENT, steps 3-8.
19. Adjust primary chain tension. See Section 6.2 PRIMARY CHAIN AND SPROCKETS, PRIMARY CHAIN ADJUSTMENT, steps 2-4.
20. Remove old gasket from flange of primary chaincase and discard. Thoroughly clean gasket surface. Hang **new** gasket on dowels in primary chaincase flange.
21. Start ten allen head socket screws (five long, five short) with flat washers to install primary chaincase cover. Tighten screws to 7-9 ft-lbs (9-12 N-m) in the numerical sequence shown in Figure 6-43.
22. Apply Loctite Pipe Sealant with Teflon 565 to threads, and using a T40 TORX drive head, install magnetic drain plug back into primary chaincase cover.
23. Using a T27 TORX drive head, remove five screws (with captive washers) to free clutch inspection cover from primary chaincase cover, if installed.
24. Pour the proper amount and type of primary chaincase lubricant in through the clutch inspection cover opening.

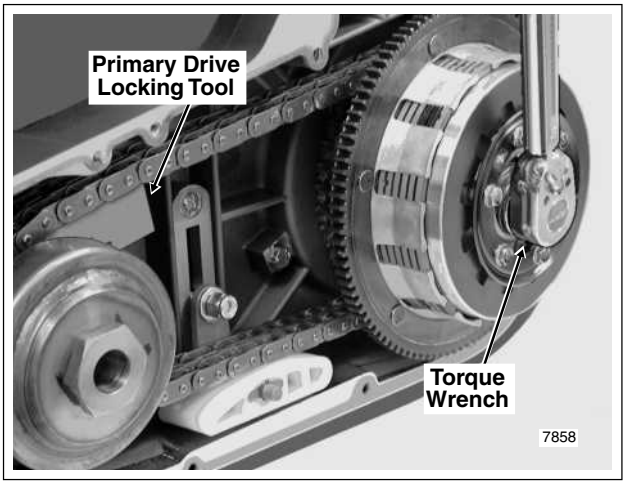



**Figure 6-42. Place Primary Drive Locking Tool and Torque Clutch Hub Mainshaft Nut**

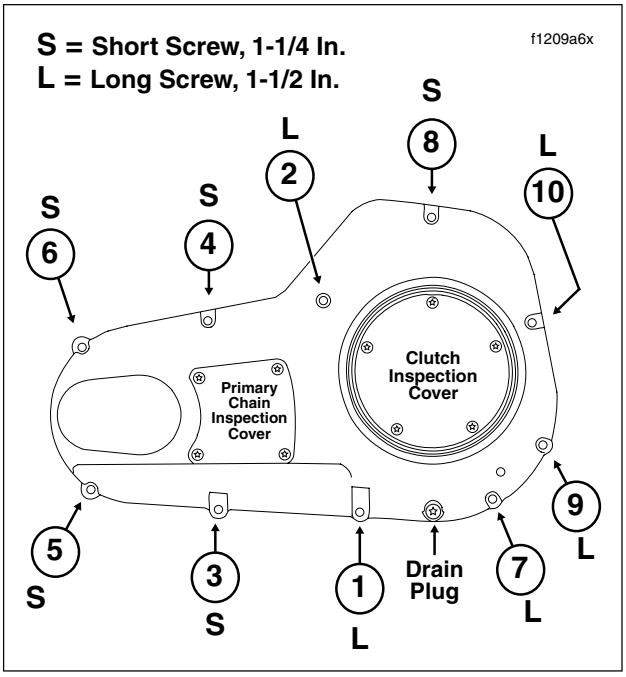



**Figure 6-43. Primary Chaincase Cover Torque Sequence and Screw Size**

With the vehicle standing upright, the level of the lubricant must be at the bottom edge of the diaphragm spring or 2-3/4 inches (69.8 mm) from the centerline of the clutch adjuster screw. See Figure 6-44. The primary chaincase capacity is 32 ounces (946 ml). Use only Harley-Davidson PRIMARY CHAINCASE LUBRICANT, Part No. 99887-84 (quart) or Part No. 99886-84 (gallon).

*NOTE*

*If new clutch discs are being installed, or if the lubricant has been wiped from serviceable discs, submerge the discs in PRIMARY CHAINCASE LUBRICANT for a minimum of five minutes before installation.*

**CAUTION**

**Do not overfill the primary chaincase with lubricant. Overfilling may cause rough clutch engagement, incomplete disengagement, clutch drag and/or difficulty in finding neutral at engine idle.**

25. Remove O-ring from groove in primary chaincase cover. Wipe all lubricant from the O-ring and inspect for cuts, tears or signs of deterioration. Replace as necessary.
26. Swab all lubricant from the O-ring groove. Install O-ring in primary chaincase cover.

*NOTE*

*If lubricant is not thoroughly removed from both the O-ring and groove, compression of the O-ring during installation of the clutch inspection cover can cause lubricant to be squeezed to the outboard side of the ring groove, resulting in some temporary weepage around the inspection cover.*

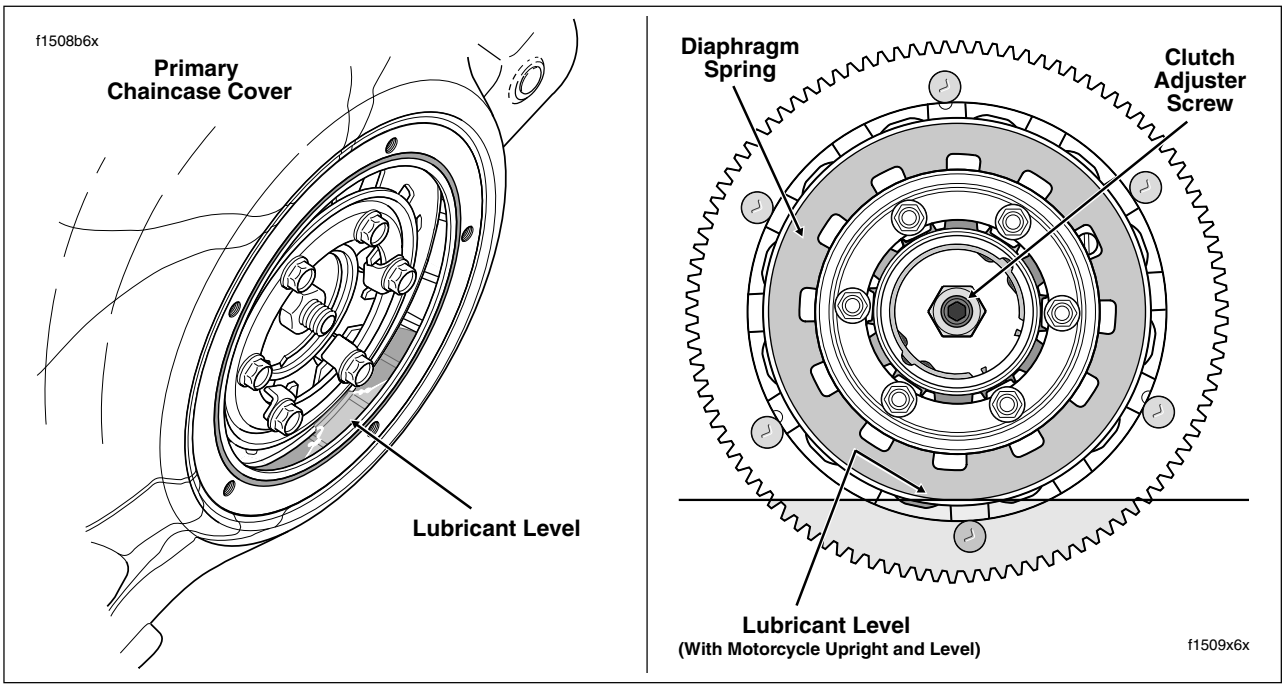



**Figure 6-44. Fill Primary Chaincase With Lubricant)**

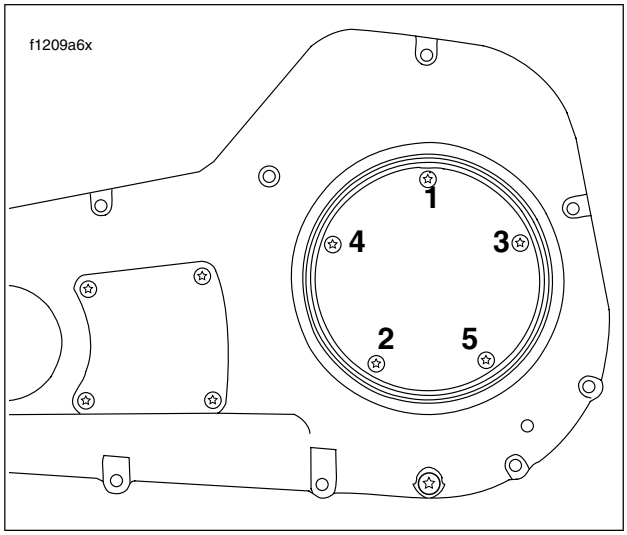



**Figure 6-45. Clutch Inspection Cover Torque Sequence**

27. Using a T27 TORX drive head, install five screws (with captive washers) to secure clutch inspection cover to the primary chaincase cover. Alternately tighten screws to 7-9 ft-lbs (10-12 Nm) in the pattern shown in Figure 6-45.

28. Install rubber spacer onto splined shaft of shifter lever assembly. Set the shifter levers down, so that the Harley-Davidson script on the rubber ped is topside. Now look at the socket head screw hole. If the hole is countersunk at the bottom, then it is the inboard shifter lever (toe). If the hole is countersunk at the top, it is the outboard shifter lever (heel). Install the levers onto the splined shaft taking note to align marks placed on splines during disassembly. Install two socket head screws to fasten levers to shaft.

29. Install flat washer, lockwasher and locknut to fasten shifter rod to shifter lever.

30. Install socket screw with lockwasher to fasten passenger footboard to mounting bracket.

31. Insert allen head socket screw (with lockwasher and flat washer) through frame weldment into front footboard forward bracket. For best results, approach from opposite side of vehicle using a 3/8 inch ball allen with extension.

    At front footboard rear bracket, slide upper hex bolt through frame weldment, jiffy stand bracket and footboard bracket thru hole. Install lockwasher and locknut. Slide lower hex bolt through frame weldment and jiffy stand bracket into threaded hole of footboard bracket. Alternately tighten footboard fasteners.

*NOTE*

*Since the height of the front and rear footboards are adjustable, check footboards on right side of vehicle to verify proper mounting holes.*

32. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).

33. Install seat. See Section 2.21 SEAT, INSTALLATION.

# NOTES

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# TRANSMISSION 7

# SPECIFICATIONS 7.1

## TRANSMISSION DATA

| TRANSMISSION | DATA |
|---|---|
| Type | 5-speed forward - constant mesh |
| Transmission lubricant | Part No. 98853-96 (case/quarts) Part No. 98852-96 (case/gallons) |
| Capacity (dry) | 24 oz. |
| | 710 ml |
| Capacity (wet) | Approximately 20-24 oz. |
| | 590-710 ml |

| GEAR | Internal Gear Ratios (Domestic, HDI and Swiss) |
|---|---|
| First | 3.21 |
| Second | 2.21 |
| Third | 1.57 |
| Fourth | 1.23 |
| Fifth | 1.00 |

*NOTE*

*All FL model vehicles are provided with "High Contact Ratio" (HCR) gears. Transmissions with HCR gears are identified with a "9" prefix added to the model year portion of the transmission number. For example, "995172001" indicates a transmission with HCR gears, while "94172001" identifies a transmission with grooved gears. The transmission number is located on the right side of the transmission case behind the shifter or top cover.*

**CAUTION**

**Do not mix (mate) HCR gears with gears having the groove. Both gears will be damaged if such a mix occurs.**

| ENGINE OIL | DATA |
|---|---|
| Capacity (dry) | 4 quarts |
| | 3.8 liters |
| Capacity (wet) | Approximately 3-1/2 quarts |
| | 3.3 liters |

**CAUTION**

**A bent jiffy stand, modified suspension or uneven parking area can cause dipstick to indicate a false low oil condition.**

## SERVICE WEAR LIMITS

| SHIFTER FORKS | IN. | MM |
|---|---|---|
| Shifter fork to cam groove end play | 0.0017-0.0019 | 0.043-0.048 |
| Shifter fork to gear groove end play | 0.0010-0.0110 | 0.025-0.279 |

| MAINSHAFT TOLERANCE | IN. | MM |
|---|---|---|
| Mainshaft runout | 0.000-0.003 | 0.000-0.08 |
| Mainshaft end play | none | none |
| 1st gear clearance | 0.0000-0.0080 | 0.000-0.203 |
| 2nd gear clearance | 0.0000-0.0800 | 0.000-2.032 |
| 3rd gear end play | 0.0050-0.0420 | 0.127-1.067 |
| 3rd gear clearance | 0.0003-0.0019 | 0.008-0.048 |
| 4th gear end play | 0.0050-0.0310 | 0.127-0.787 |
| 4th gear clearance | 0.0003-0.0019 | 0.008-0.048 |

| MAIN DRIVE GEAR (5TH) | IN. | MM |
|---|---|---|
| Bearing fit in transmission case (loose) | 0.0003-0.0017 | 0.008-0.043 |
| Fit in bearing (tight) | 0.0009 | 0.023 |
| Fit in bearing (loose) | 0.0001 | 0.0025 |
| Fit on mainshaft | 0.0001-0.0009 | 0.0025-0.023 |
| End play | none | none |

## SERVICE WEAR LIMITS (CONT.'D)

| SIDEDOOR BEARINGS | IN. | MM |
|---|---|---|
| Fit in side door (tight) | 0.0014-0.0001 | 0.036-0.0025 |
| Fit on countershaft (tight) | 0.0008 | 0.020 |
| Fit on countershaft (loose) | 0.00001 | 0.0003 |
| Fit on mainshaft (tight) | 0.0007 | 0.018 |
| Fit on mainshaft (loose) | 0.0001 | 0.0025 |

| COUNTERSHAFT TOLERANCE | IN. | MM |
|---|---|---|
| Countershaft runout | 0.000-0.003 | 0.00-0.08 |
| Countershaft end play | none | none |
| 1st gear clearance | 0.0003-0.0019 | 0.008-0.048 |
| 1st gear end play | 0.0050-0.0039 | 0.127-0.099 |
| 2nd gear clearance | 0.0003-0.0019 | 0.008-0.048 |
| 2nd gear end play | 0.0050-0.0440 | 0.127-1.118 |
| 3rd gear clearance | 0.0000-0.0080 | 0.000-0.203 |
| 4th gear clearance | 0.0000-0.0080 | 0.000-0.203 |
| 4th gear end play | 0.0050-0.0390 | 0.127-0.991 |
| 5th gear clearance | 0.0000-0.0080 | 0.000-0.203 |
| 5th gear end play | 0.0050-0.0040 | 0.127-0.102 |

| SHIFTER DOG GEARS | MINIMUM CLEARANCE | MAXIMUM CLEARANCE |
|---|---|---|
| 2nd-5th | 0.035 in. | 0.139 in. |
| | 0.89 mm | 3.53 mm |
| 2nd-3rd | 0.035 in. | 0.164 in. |
| | 0.89 mm | 4.17 mm |
| 1st-4th | 0.035 in. | 0.152 in. |
| | 0.89 mm | 3.86 mm |
| 1st-3rd | 0.035 in. | 0.157 in. |
| | 0.89 mm | 3.99 mm |

## TORQUE VALUES

| Item | ft/in-lbs | Nm |
|---|---|---|
| Shifter linkage rod locknuts | 20-24 ft-lbs | 27-33 Nm |
| Detent arm pivot screw to right support block | 84-108 **in-lbs** | 9.5-12.2 Nm |
| Shifter cam support block screws | 7-9 ft-lbs | 9-12 Nm |
| Transmission top cover socket head screws | 7-9 ft-lbs | 9-12 Nm |
| Neutral switch | 10-15 ft-lbs | 14-20 Nm |
| Clutch release cover socket head screws | 10-12 ft-lbs | 14-16 Nm |
| Clutch cable fitting | 3-5 ft-lbs | 4-7 Nm |
| Transmission lubricant drain plug | 14-21 ft-lbs | 19-28 Nm |
| Transmission filler plug/dipstick | 25-75 **in-lbs** | 2.8-8.5 Nm |
| Transmission side door<br>5/16 inch screws<br>1/4 inch screws | <br>13-16 ft-lbs<br>7-9 ft-lbs | <br>18-22 Nm<br>9-12 Nm |
| Mainshaft/countershaft locknuts | 45-55 ft-lbs | 61-75 Nm |
| Transmission sprocket nut | 50 ft-lbs, then 30° to 40° | 67.8 Nm, then 30° to 40° |
| Transmission sprocket nut lockplate screws | 90-110 **in-lbs** | 10.2-12.4 Nm |
| Oil pan bolts | 7-9 ft-lbs | 9-12 Nm |
| Transmission-to-engine mounting bolts | 15 ft-lbs, then 30-35 ft-lbs | 20.3 Nm, then 40.7-47.5 Nm |
| Oil hose cover | 7-9 ft-lbs | 10-12 Nm |
| Rear swingarm bracket bolts | 34-42 ft-lbs | 46-57 Nm |
| Rear swingarm pivot shaft locknut | 40-45 ft-lbs | 54-61 Nm |
| Shifter lever to shifter shaft socket head screw | 18-22 ft-lbs | 24-30 Nm |
| Engine oil drain plug | 14-21 ft-lbs | 19-28 Nm |

# TRANSMISSION POWER FLOW 7.2

## GENERAL

See Figure 7-1. The 5-speed transmission consists of two parallel shafts supporting five gears each. The longer, or mainshaft, also supports the clutch and serves as the input shaft. The shorter shaft is called the countershaft.

Each gear on the mainshaft is in constant mesh with a corresponding gear on the countershaft. Each of these five pairs of gears makes up a different speed in the transmission.

The transmission gears are divided into two types, gears that are splined and rotate with the shaft, and freewheeling gears that ride on bearings and spin freely on the shaft. A splined gear always meshes with a freewheeling gear. Also, three of the splined gears are able to slide sideways on the shaft. These sliding gears are used to change transmission speeds. The projections (or dogs) on the sides of the sliding gears, engage dogs on adjacent freewheeling gears, transmitting power through the transmission.

Gear shifting is accomplished by three forks which fit into grooves machined into the hubs of the three sliding gears. The position of the shifter forks is controlled by a drum-shaped shifter cam located on the top of the transmission.

### Neutral

Power is introduced to the transmission through the clutch. In neutral, with the clutch engaged, the mainshaft 1st and 2nd gears are rotating, but no power is transferred to the countershaft since countershaft 1st and 2nd are freewheeling gears.

### 1st Gear

When the transmission is shifted into first gear, countershaft 3rd, which rotates with the countershaft, engages countershaft 1st, which has been spinning freely on the countershaft driven by mainshaft 1st.

Now countershaft 3rd is no longer freewheeling, but locked to the countershaft causing the countershaft and countershaft 5th to turn. Countershaft 5th transmits the power to the main drive gear and the sprocket.

### 2nd Gear

Second gear is engaged when countershaft 3rd is shifted out of countershaft 1st and engages countershaft 2nd. This locks countershaft 2nd to the countershaft to complete the power flow as shown.

### 3rd Gear

Two shifter forks are used to make the shift from second to third. One fork moves countershaft 3rd out of countershaft 2nd to its neutral position, while another fork engages mainshaft 2nd with mainshaft 3rd. This locks mainshaft 3rd to the mainshaft to complete the power flow as shown.

### 4th Gear

The shift into fourth is made when mainshaft 2nd is disengaged from mainshaft 3rd and mainshaft 1st engages mainshaft 4th, locking it to the mainshaft.

### 5th Gear

The shift from fourth to fifth gear occurs when mainshaft 1st is shifted out of mainshaft 4th, and mainshaft 2nd is shifted directly into the main drive gear. Mainshaft 2nd lock the main drive gear to the mainshaft resulting in a direct one-to-one drive ratio from the clutch to the sprocket.

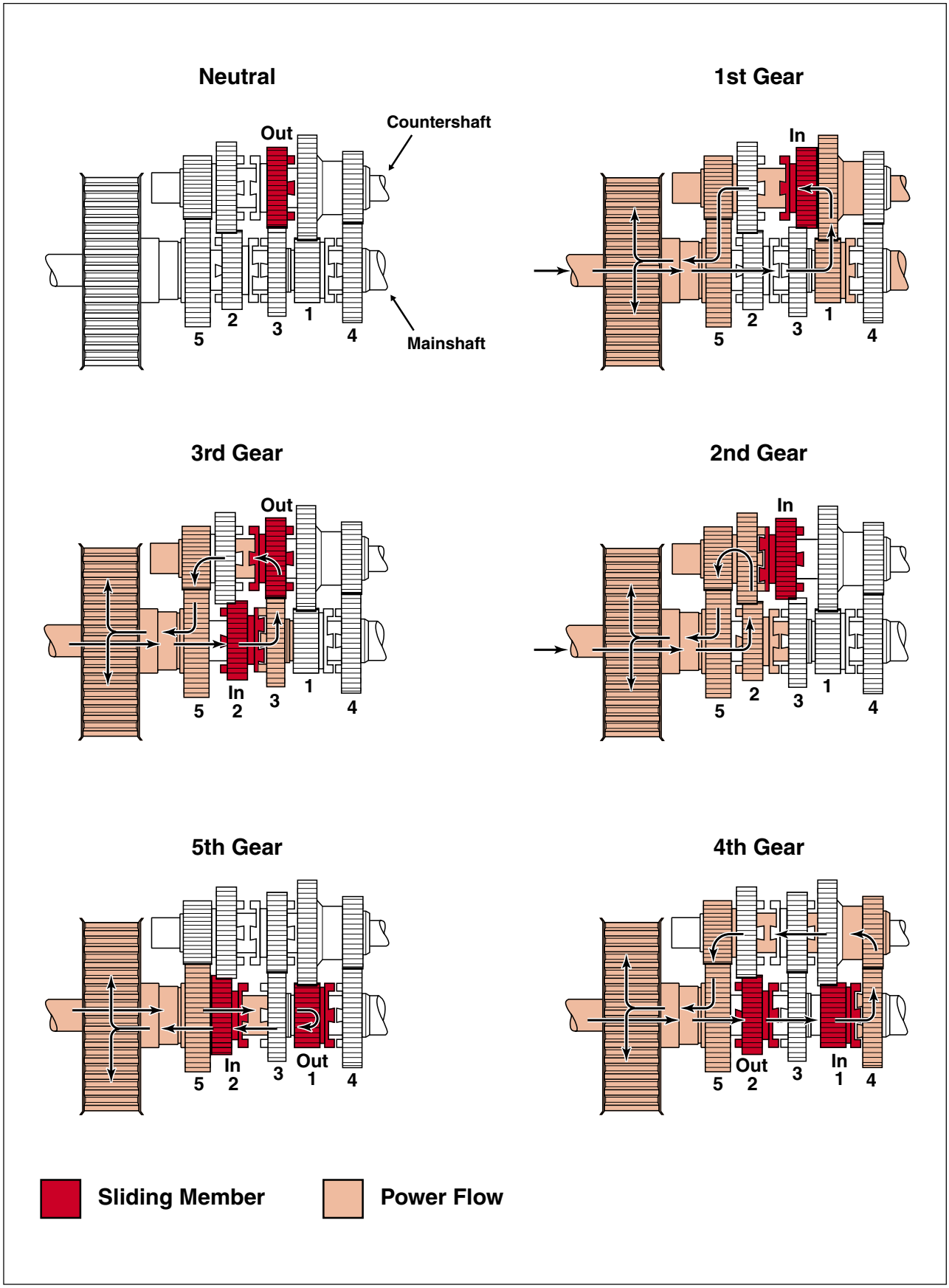



Figure 7-1. Transmission Power Flow Schematic

# SHIFTER LINKAGE 7.3

## ADJUSTMENT

If operating problems exist, check the shifter linkage for wear, interference or adjustment. If adjustment is necessary, see SHIFTER LINKAGE below. If problems persist, see the checks under Section 1.1 TROUBLESHOOTING, TRANSMISSION, along with the repair procedures in this section.

### Shifter Linkage

The shifter linkage is set at the factory and should not need adjustment under normal circumstances. However, if full engagement or full lever travel is not achieved, adjust the linkage rod as follows:

**CAUTION**

**To ensure proper gear engagement and avoid possible damage to transmission, the shifter lever should not contact the footboard when shifting. A minimum clearance of 3/8 inch (9.5 mm) between shifter lever and footboard must be maintained to accommodate engine movement when running.**

1. Remove locknut, lockwasher and flat washer to free front end of shifter rod from shifter lever. See Figure 7-2.

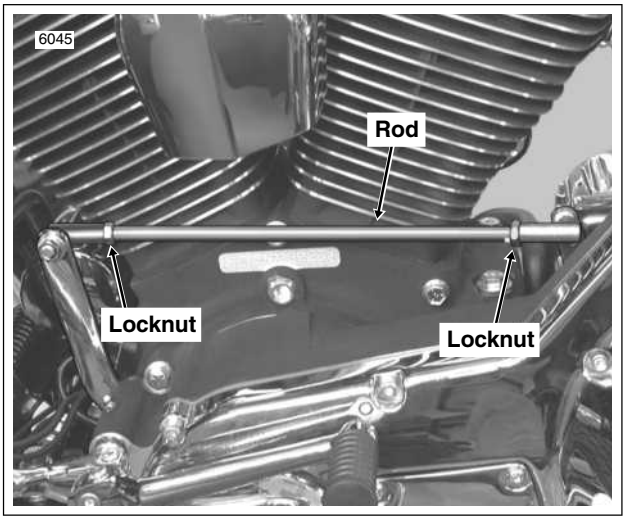



**Figure 7-2. Shifter Linkage Adjustment**

2. Loosen locknuts and adjust rod as necessary.
3. Install flat washer, lockwasher and locknut to fasten front end of shifter rod to shifter lever.
4. Tighten locknuts to 20-24 ft-lbs (27-33 Nm).

# SHIFTER CAM ASSEMBLY/SHIFTER FORKS 7.4

## DISASSEMBLY

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠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.**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. Remove the exhaust piping as required. See Section 2.32 EXHAUST SYSTEM, REMOVAL.
4. Remove the magnetic drain plug at the bottom right side of the oil pan and drain the transmission lubricant into a suitable container. Remove the fill plug/dipstick.
5. Using fingers and flat tip screwdriver, remove two elbow connectors from neutral switch studs. Using 7/8 inch box end wrench, remove neutral switch and O-ring from transmission top cover. Remove preformed vent hose from the top cover fitting, if necessary.
6. Remove the five socket head screws from the trans-mission top cover. Remove the top cover from the transmission case. Remove and discard the cover gasket.

**CAUTION**

**Pulling shifter cam assembly from dowels allows left support block to rotate freely, which can cause screws and washers to drop into transmission case if left loosely installed.**

7. See Figure 7-3. Remove the four hex head screws (with flat washers) to free the right and left shifter cam support blocks. Raise shifter pawl and lift shifter cam assembly from dowels on deck of transmission case.
8. See CLEANING AND INSPECTION, steps 2 and 3, on the next page. If necessary, disassemble shifter cam assembly as follows:

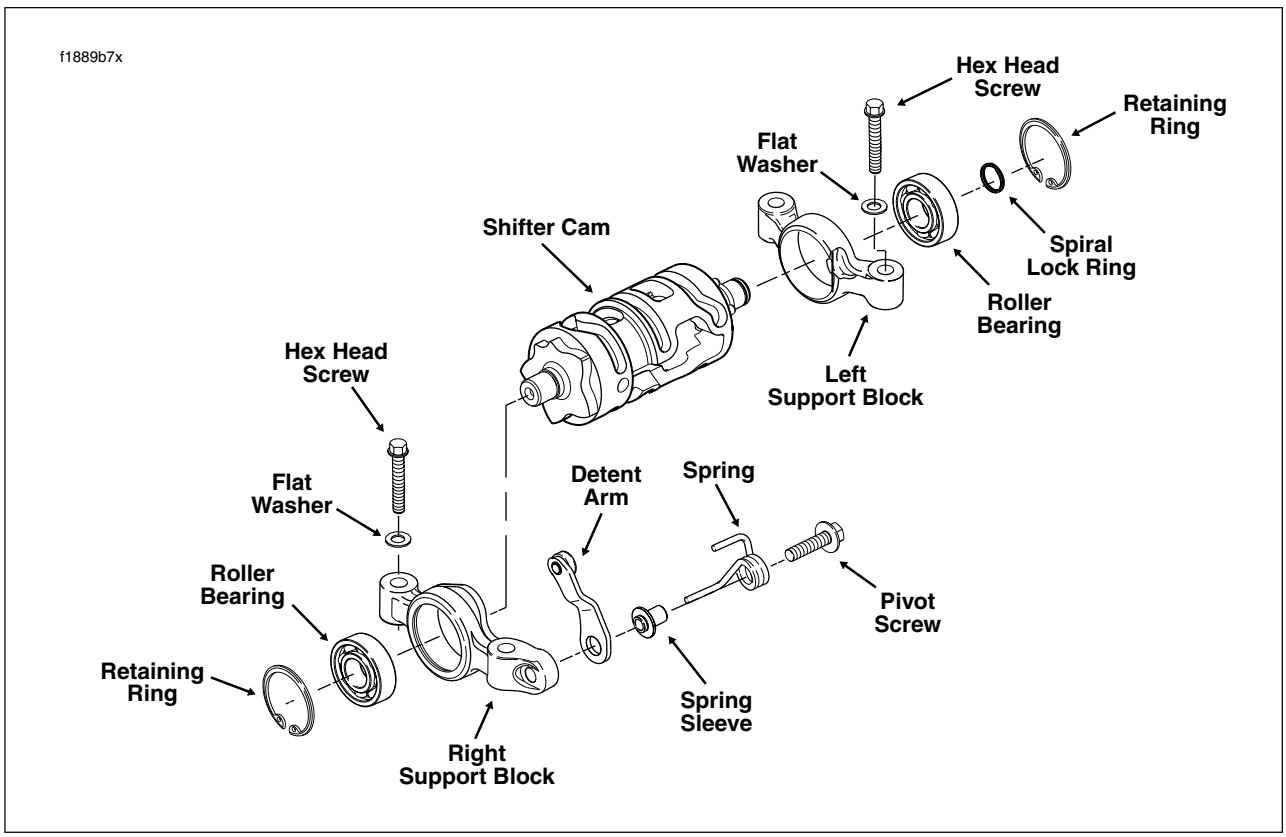



**Figure 7-3. Shifter Cam Assembly**

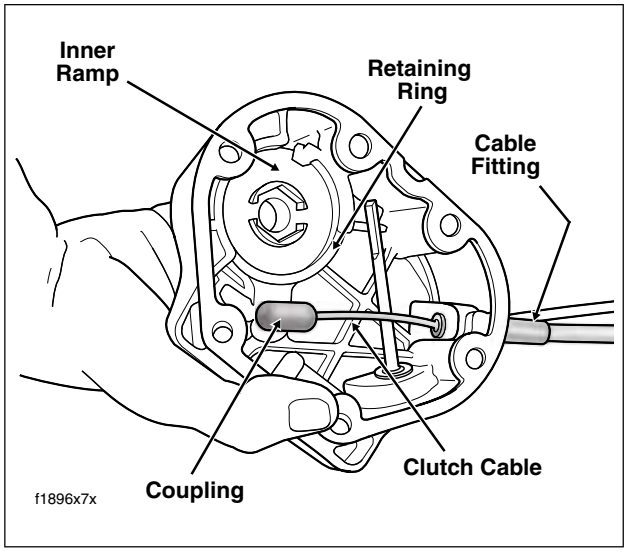



**Figure 7-4. Clutch Release Cover Assembly**

**⚠WARNING**

**Always wear proper eye protection when removing 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.**

a. Retract detent arm and slide right support block off end of shifter cam. Remove pivot screw to release detent arm, spring sleeve and spring. Remove and discard retaining ring. Press against inner race of roller bearing to remove from support block. Discard roller bearing.

b. Moving to opposite side, remove spiral lock ring from groove at left end of shifter cam. Using a small knife, push on end of spiral lock ring working tip of blade under edge of ring. Raise end of ring until free of ring groove. Work around circumference of ring to alternately pull spirals from ring groove. Discard ring.

c. Slide left support block off end of shifter cam. Remove and discard retaining ring. Press against inner race of roller bearing to remove from support block. Discard roller bearing.

9. Slide rubber boot off clutch cable adjuster. Holding cable adjuster with 1/2 inch wrench, loosen jam nut using a 9/16 inch wrench. Back jam nut away from cable adjuster. Move adjuster toward jam nut to introduce a large amount of free play at hand lever.

10. Remove six socket head screws to free clutch release cover from transmission side door. Remove and discard gasket.

11. Remove retaining ring and lift inner ramp out of clutch release cover. Turn the inner ramp over so that ball sockets are facing outboard. Remove hook of ramp from button on coupling. Remove coupling from clutch cable end. See Figure 7-4.

12. Unscrew the cable fitting from the clutch release cover. Remove clutch cable and fitting.

13. Remove the fork shaft from the hole on the right side of the transmission case. See Figure 7-5. Remove the shifter forks from the mainshaft and countershaft gear grooves.

14. To replace the transmission gears or side door bearings, see Section 7.6 MAINSHAFT/COUNTERSHAFT. To replace the main drive gear, see Section 7.7 MAIN DRIVE GEAR.

## CLEANING AND INSPECTION

**⚠WARNING**

**Compressed air can pierce the skin and cause injury. Never use your hand to check for leaks or to determine air flow rates. Wear safety glasses to shield your eyes from flying dirt and debris. Failure to comply could result in death or serious injury.**

1. Clean all parts with solvent (except left and right support blocks if roller bearings installed). Blow dry with low pressure compressed air.

2. Inspect roller bearings. Verify that bearings rotate freely without sticking.

3. Inspect the shifter cam for cracks or wear. Inspect the ends for grooves or pitting. Install **new** roller bearings whenever the shifter cam is replaced.

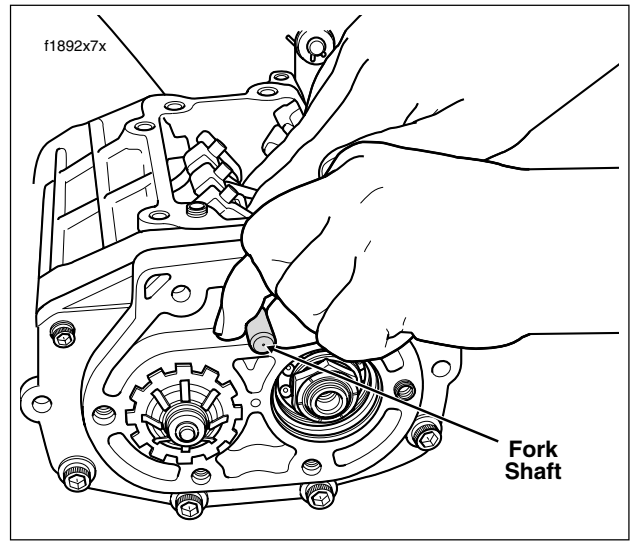



**Figure 7-5. Remove Fork Shaft/Shifter Forks (Right Side View)**

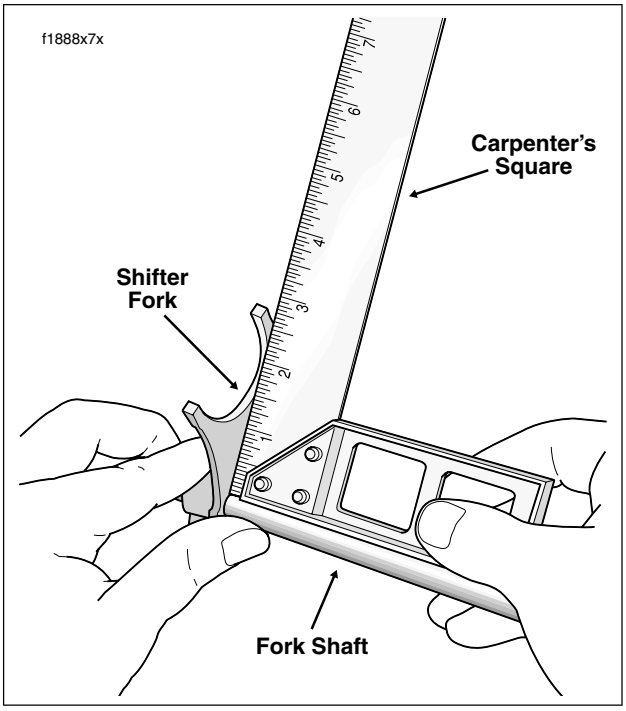



**Figure 7-6. Check Shifter Forks for Squareness**

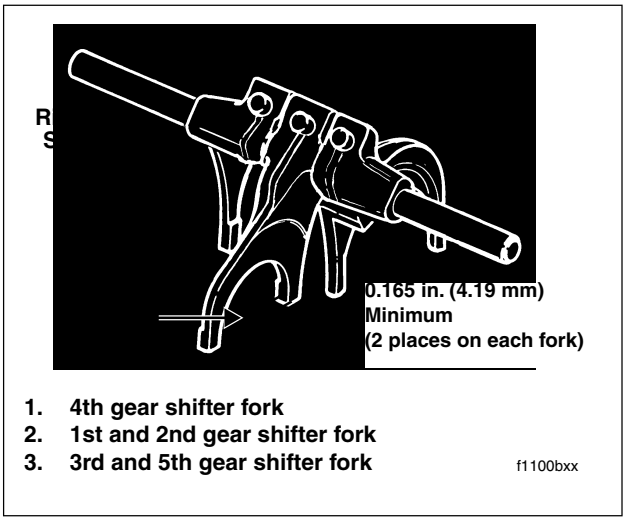



**Figure 7-7. Shifter Fork Identification**

4. Check the shifter fork shaft. Replace if bent or damaged.
5. Using a small carpenter's square, verify that the shifter fork shafts are square. If a fork does not rest directly on the square, then it is bent and must be replaced. See Figure 7-6.
6. Inspect the shifter forks for wear. With a micrometer or dial caliper, measure the width of the forks where they contact the gear fork grooves. Replace any fork that measures less than 0.165 inch (4.19 mm). See Figure 7-7.
7. Inspect the neutral switch. Depress plunger and observe the action. Plunger should spring back without binding. Switch is non-repairable and must be replaced if defective. See ASSEMBLY, step 11.

## ASSEMBLY

1. See upper frame of Figure 7-8. Find the shifter fork with the centered pin. Holding the fork so that the pin is positioned at the rear of the transmission case, install the fork in the countershaft gear fork groove. See Figure 7-9.

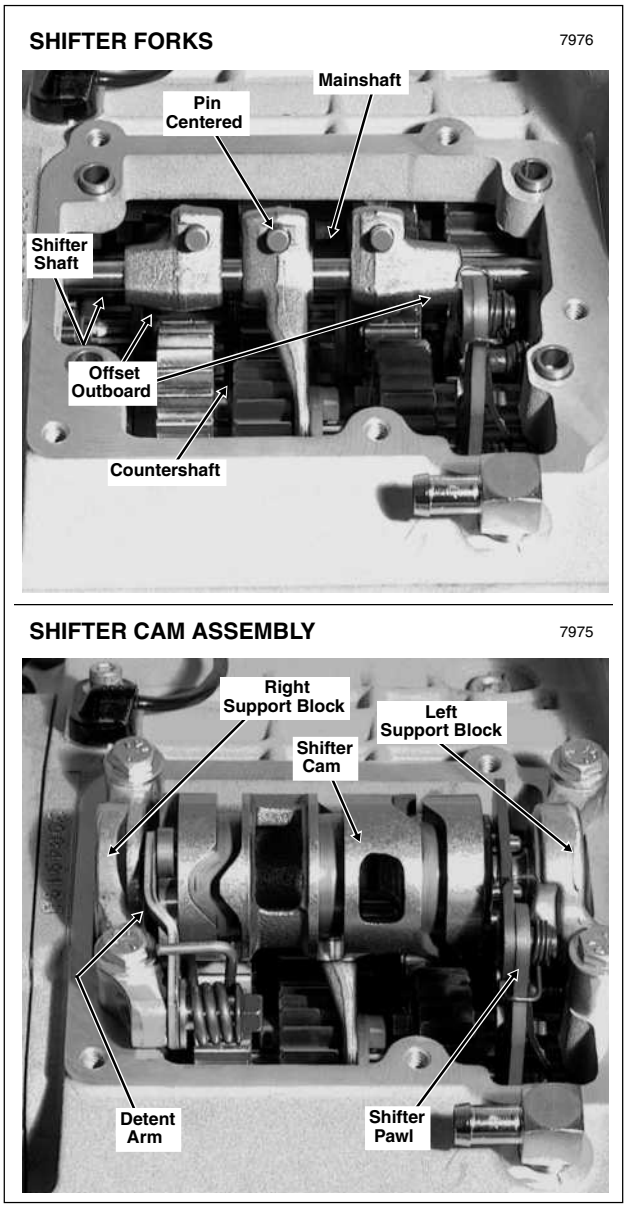



**Figure 7-8. Install Shifter Forks/Shifter Cam**

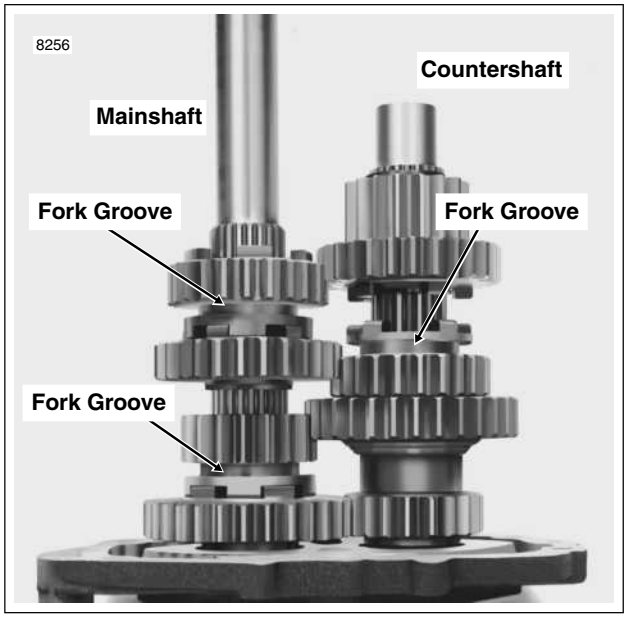



**Figure 7-9. Shifter Fork Groove Locations**

2. Slide the two outer forks into the mainshaft gear fork grooves so that the pins are positioned on the inside (offset outboard). After installation, the pins of all three forks should be in alignment.
3. Insert the fork shaft into the hole on the right side of the transmission case. Slide the shaft through the shifter forks and into the drilling on the left side of the case. See Figure 7-5.
4. Check the sliding movement of the forks and gears. All parts should move freely without binding.

**⚠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.**

5. If disassembled, assemble shifter cam assembly as follows:
   a. Place left support block under ram of arbor press. Center **new** roller bearing over bore with the lettered side up. Using a suitable driver, press against outer race until bearing makes firm contact with the counterbore. Install **new** retaining ring with the flat side in against the bearing (beveled side out). See upper frame of Figure 7-10.
   b. Place left support block onto end of shifter cam. Start bottom end of **new** spiral lock ring into ring groove. Alternately work around circumference of ring feeding each spiral into the ring groove a section at a time. When complete, verify that spiral lock ring is fully seated in the groove.
   c. Place right support block under ram of arbor press. Center **new** roller bearing over bore with the lettered side up. Using a suitable driver, press against outer race until bearing makes firm contact with the counterbore. Install **new** retaining ring with the flat side in against the bearing (beveled side out). See lower frame of Figure 7-10.
   d. Hold spring so that ends are pointing to the right. Insert long end of spring sleeve into right side of spring. Insert pivot screw into left side of spring sleeve. With roller facing screw head, slide detent arm onto short end of spring sleeve positioning arm between spring ends. Start pivot screw into threaded hole in right support block positioning support block between spring ends. Tighten pivot screw to 84-108 **in-lbs** (9.5-12.2 Nm). Retract detent arm and slide right support block onto end of shifter cam. See Figure 7-11.

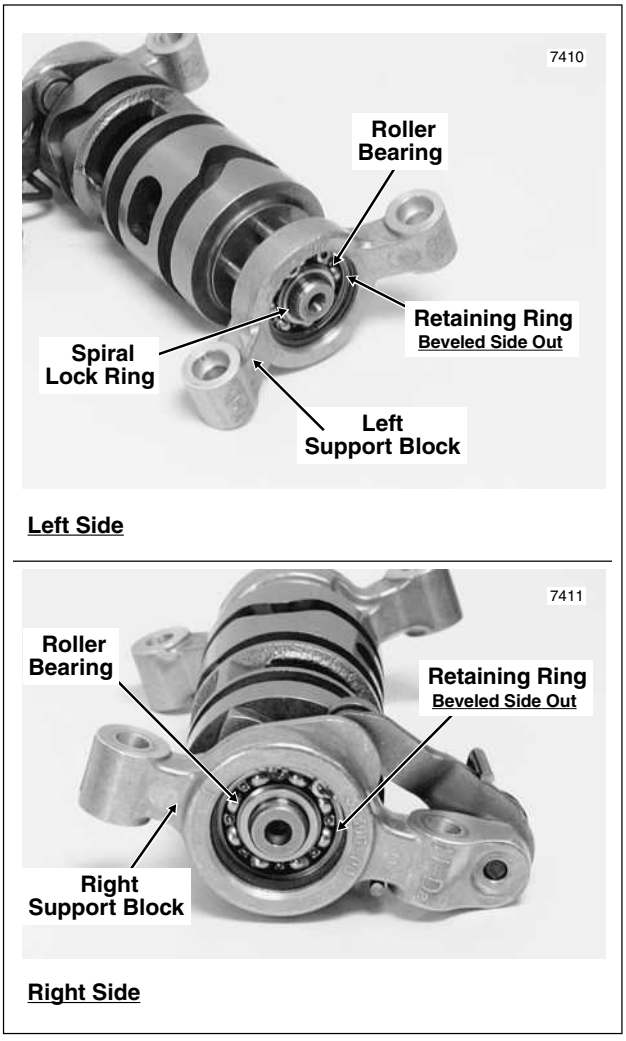



**Figure 7-10. Shifter Cam Assembly**

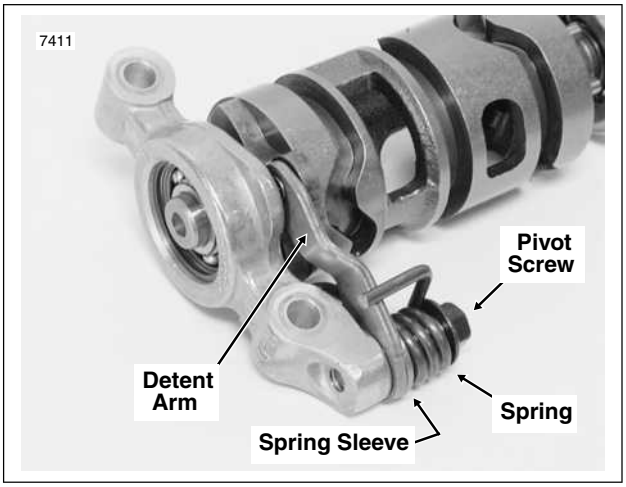



**Figure 7-11. Shifter Cam Assembly**

6. To ensure proper location, verify that four locating dowels are in place on the deck of the transmission case.
7. Raise the shifter cam pawl and place the shifter cam assembly over the locating dowels. While aligning the holes in the support blocks with the dowels on the deck of the transmission case, slide the shifter forks as necessary so that the fork pins engage the channels in the shifter cam. See Figure 7-12 and lower frame of Figure 7-8.
8. Hand start the hex head screws (with flat washers) to fasten the right and left support blocks to the transmission case. Alternately tighten the four support block screws to 7-9 ft-lbs (9-12 Nm) in a crosswise pattern.

*NOTE*

*Check the gear engagement and clearance in every gear to make sure assembly and alignment is correct.*

9. Obtain a **new** top cover gasket and align the holes with those in the transmission case. Align the holes in the top cover with those in the gasket. Install the five socket head screws and tighten to 7-9 ft-lbs (9-12 Nm). The long screw is installed in the center hole on the left side of the top cover.
10. Install preformed vent hose to top cover fitting, if removed.

*NOTE*

*Whenever the transmission top cover is removed, be sure to install neutral switch after top cover installation to ensure proper switch engagement.*

11. Install the neutral switch in the transmission top cover as follows:
    a. Roll the vehicle back and forth to verify that the transmission is in NEUTRAL.
    b. Lubricate O-ring with clean transmission oil.
    c. Using 7/8 inch box end wrench, install neutral switch with O-ring in the transmission top cover. Tighten to 10-15 ft-lbs (14-20 Nm).
    d. Install the two elbow connectors on neutral switch studs.

*NOTE*

*The neutral switch is not polarity sensitive, so the elbow connectors can be attached to either stud.*

12. See Figure 7-4. Install clutch cable fitting into clutch release cover. Do not tighten at this time.

*NOTE*

*Replace cable fitting O-ring if damaged or deformed.*

13. Hold clutch cable coupling with button facing outboard. Place cable end in recess of coupling. With ball sockets facing outboard, place hook of inner ramp on button of coupling. Holding inner ramp and coupling together, turn the assembly over. Place inner ramp (ball socket side down) over balls in outer ramp sockets. Install the retaining ring so that the opening is above and to the right of the outer ramp tang slot in the clutch release cover.
14. Verify that the two locating dowels are in place on the transmission side door. Hang a **new** gasket on the dowels.
15. Holding clutch release cover in position against transmission side door, install six socket head screws. Alternately tighten screws to 10-12 ft-lbs (14-16 Nm) in the sequence shown in Figure 7-13.
16. Tighten clutch cable fitting to 3-5 ft-lbs (4-7 Nm).

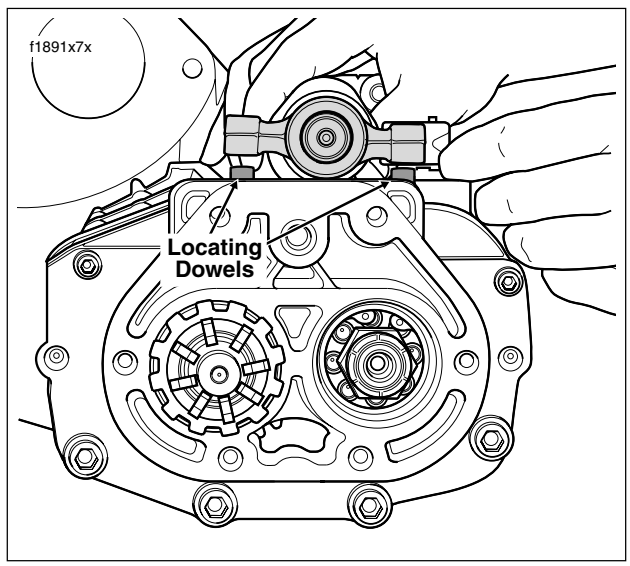



**Figure 7-12. Place Support Blocks on Locating Dowels**

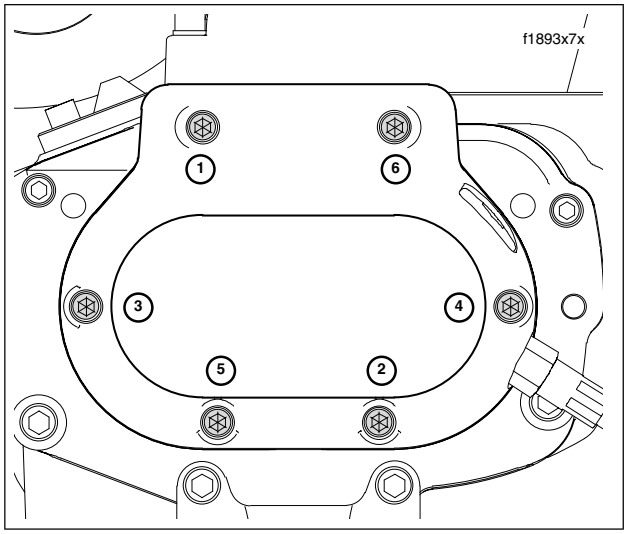



**Figure 7-13. Clutch Release Cover Torque Sequence**

17. Check the O-ring on the transmission lubricant drain plug for tears, cuts or general deterioration. Replace as necessary.

**CAUTION**

**Do not overtighten filler or drain plugs. Overtightening plugs may cause leaks.**

18. Install the transmission lubricant drain plug and tighten to 14-21 ft-lbs (19-28 Nm).
19. Fill the transmission with 20-24 oz. (590-710 ml) of transmission lubricant or until the lubricant level on the dipstick of the filler plug is at the F(ULL) mark with the motorcycle in a level, upright position and the filler plug resting on the threads. Use only Harley-Davidson TRANSMISSION LUBRICANT, Part No. 98853-96 (case/quarts), or Part No. 98852-96 (case/gallons).
20. Install the transmission filler plug/dipstick in the clutch release cover. Tighten the plug to 25-75 **in-lbs** (2.8-8.5 Nm).
21. Adjust the clutch cable. See Section 6.3 CLUTCH, ADJUSTMENT.
22. Install the exhaust piping. See Section 2.32 EXHAUST SYSTEM, INSTALLATION.
23. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
24. Install seat. See Section 2.21 SEAT, INSTALLATION.

# CLUTCH RELEASE COVER 7.5

## REMOVAL/DISASSEMBLY

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠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.**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. To access the clutch release cover assembly, remove the exhaust piping as necessary. See Section 2.32 EXHAUST SYSTEM, REMOVAL.
4. Remove the magnetic drain plug at the bottom right side of the oil pan and drain the transmission lubricant into a suitable container. Remove the filler plug/dipstick.
5. Slide rubber boot off clutch cable adjuster. Holding cable adjuster with 1/2 inch wrench, loosen jam nut using 9/16 inch wrench. Back jam nut away from cable adjuster. Move adjuster toward jam nut to introduce a large amount of free play at hand lever.
6. Remove six socket head screws to free clutch release cover from transmission side door. Remove and discard gasket.

**⚠WARNING**

**Always wear proper eye protection when removing 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.**

7. Remove retaining ring securing ball and ramp mechanism to clutch release cover.
8. See Figure 7-14. Lift inner ramp out of clutch release cover. Turn the inner ramp over so that ball sockets are facing outboard. Remove hook of ramp from button on coupling. Remove coupling from clutch cable end.
9. Remove balls from outer ramp sockets. Remove outer ramp from clutch release cover.
10. Unscrew the cable fitting from the clutch release cover. Remove clutch cable and fitting.

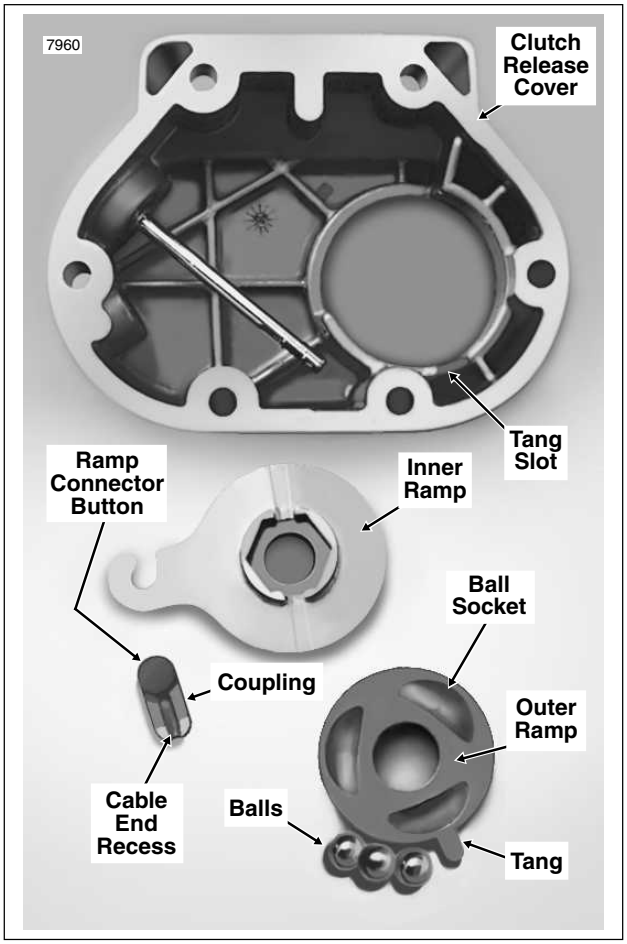



**Figure 7-14. Clutch Release Cover Assembly**

## CLEANING AND INSPECTION

1. Wash the ball and ramp components in cleaning solvent.
2. Inspect the three balls and the ball socket surfaces on the inner and outer ramps for wear, pitting, surface breakdown and other damage. Replace parts as necessary.
3. Check fit of the inner ramp hub in the outer ramp. Replace both parts if excessive wear is noted.
4. Check clutch cable end for frayed or worn ends. Replace cable if damaged or worn.
5. See Figure 7-14. Check the recess in the clutch release cover casting where the inner and outer ramps are retained. There should be no wear/lips worn into the bore that would catch the ramps and cock them, causing improper clutch adjustment.

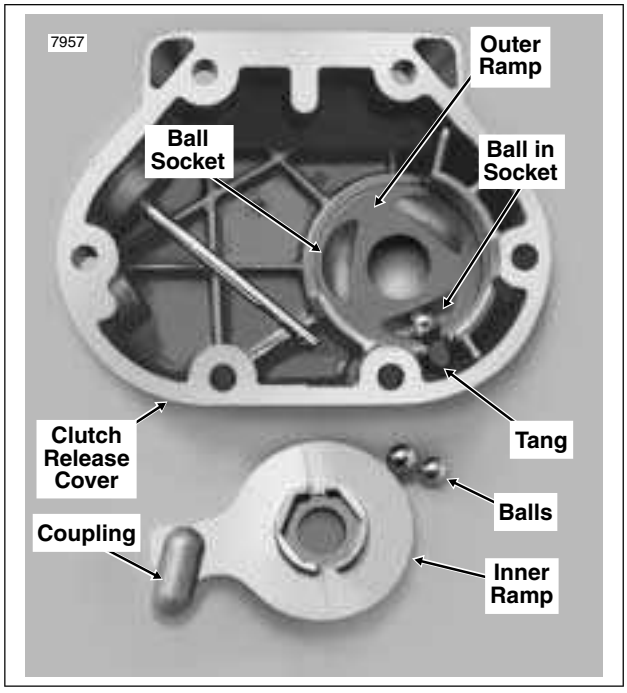



**Figure 7-15. Install Outer Ramp and Balls**

## ASSEMBLY/INSTALLATION

1. Install clutch cable fitting into clutch release cover. Do not tighten cable fitting at this time.

   *NOTE*

   *Replace cable fitting O-ring if damaged or deformed.*

2. See Figure 7-15. Place outer ramp in clutch release cover recess with tang in cover slot.
3. Apply a multi-purpose grease to the balls and outer ramp sockets. Place a ball in each of three outer ramp sockets.
4. Hold coupling with button facing outboard. Place cable end in recess of coupling. With ball sockets facing outboard, place hook of inner ramp on button of couplng. Holding inner ramp and coupling together, turn the assembly over.
5. Place inner ramp (ball socket side down) over balls in outer ramp sockets.

**⚠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.**

6. Install the retaining ring so that the opening is above and to the right of the outer ramp tang slot in the clutch release cover.
7. Verify that the two locating dowels are in place on the transmission side door. Hang a **new** gasket on the dowels.
8. Holding clutch release cover in position, install six socket head screws. Tighten screws to 10-12 ft-lbs (14-16 Nm) in the sequence shown in Figure 7-13.
9. Tighten clutch cable fitting to 3-5 ft-lbs (4-7 Nm).
10. Check the O-ring on the transmission lubricant drain plug for tears, cuts or general deterioration. Replace as necessary. Install the transmission lubricant drain plug and tighten to 14-21 ft-lbs (19-28 Nm).

**CAUTION**

**Do not overtighten filler or drain plugs. Overtightening plugs may cause leaks.**

11. Remove the filler plug from the clutch release cover, if installed. See Figure 7-16 and Figure 7-17. Check the O-ring for tears, cuts or general deterioration. Replace as necessary.
12. Fill the transmission with 20-24 oz. (590-710 ml) of transmission lubricant or until the lubricant level on the dipstick of the filler plug is at the F(ULL) mark with the motorcycle in a level, upright position and the filler plug resting on the threads. Use only Harley-Davidson TRANSMISSION LUBRICANT, Part No. 98853-96 (case/quarts), or Part No. 98852-96 (case/gallons).
13. Install the transmission filler plug/dipstick in the clutch release cover. Tighten the plug to 25-75 **in-lbs** (2.8-8.5 Nm).
14. Adjust the clutch cable. See Section 6.3 CLUTCH, ADJUSTMENT.

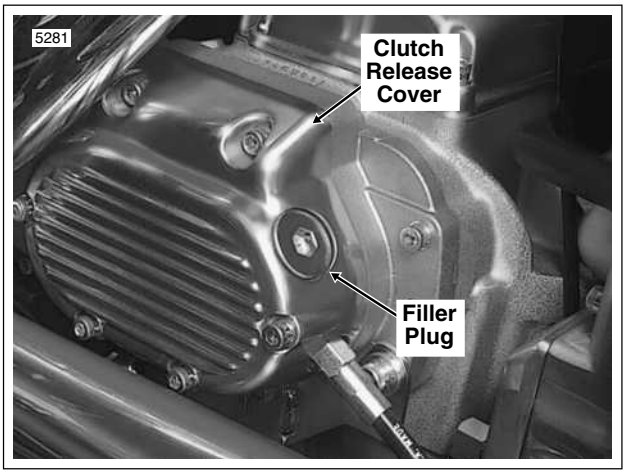



**Figure 7-16. Transmission Case (Right Side)**

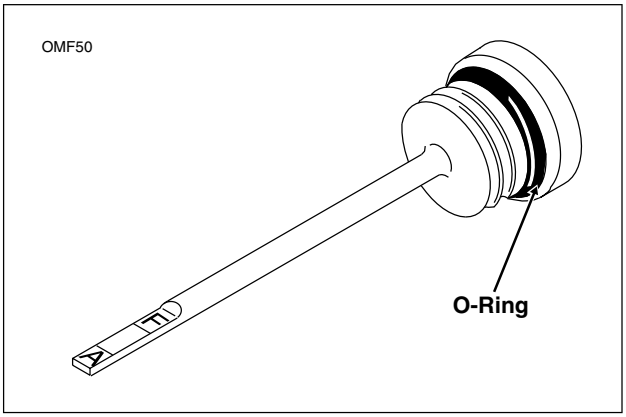



**Figure 7-17. Transmission Lubricant Filler Plug/Dipstick**

15. Install the exhaust piping. See Section 2.32 EXHAUST SYSTEM, INSTALLATION.
16. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
17. Install seat. See Section 2.21 SEAT, INSTALLATION.

## REMOVAL

*NOTE*

*Leave the transmission case in the frame unless the case itself requires replacement. For illustration purposes, some photographs may show the case removed.*

1. Remove the shifter cam and shifter fork assemblies. See Section 7.4 SHIFTER CAM ASSEMBLY/SHIFTER FORKS, DISASSEMBLY.
2. Remove the primary chaincase cover. Remove clutch assembly, primary chain, and compensating sprocket components. Remove the starter jackshaft assembly and primary chaincase. See Section 6.5 PRIMARY CHAINCASE, REMOVAL.
3. Remove oil filler spout and starter. See Section 5.4 STARTER, REMOVAL, steps 6-12.
4. Remove the bearing inner race from the transmission mainshaft. See Section 6.5 PRIMARY CHAINCASE, MAINSHAFT BEARING INNER RACE, REMOVAL.
5. Remove the oil slinger assembly (with two-piece push rod and clutch release bearing components).
6. Lock the transmission. This can be accomplished by manually engaging the shifter dogs of any two gears (mainshaft or countershaft) with the shifter dogs of an adjacent gear and then turning the mainshaft counter-clockwise.
7. Remove the locknut from both the mainshaft and countershaft. Use an air impact wrench for best results. See Figure 7-18. Remove the spacer from each shaft.
8. Remove the six socket head screws (bottom four with flat washers) to free both the side door and transmission bracket from the transmission case. Pull the side door, mainshaft and countershaft from the transmission case as a single assembly. Remove and discard the door gasket. See Figure 7-19.

*NOTE*

*DO NOT USE A HAMMER TO REMOVE THE SIDE DOOR. If the side door sticks or binds on the locating dowels, gently pry open using the indents at each side of the door. See Figure 7-19.*

9. To remove the main drive gear, refer to Section 7.7 MAIN DRIVE GEAR, REMOVAL, steps 6-11.

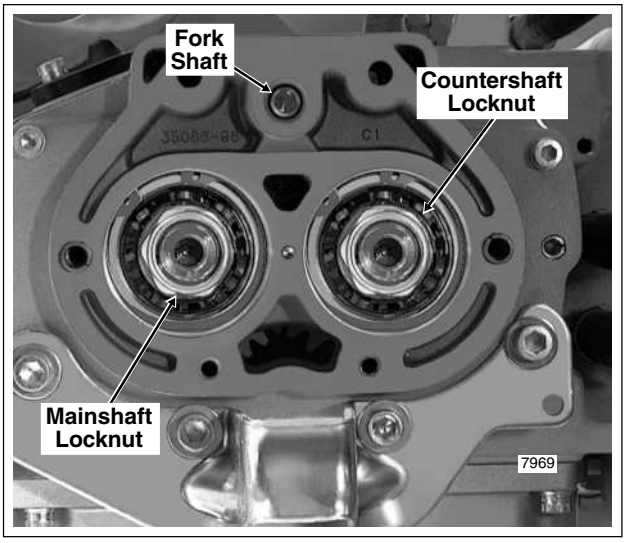



**Figure 7-18. Remove Transmission Side Door**

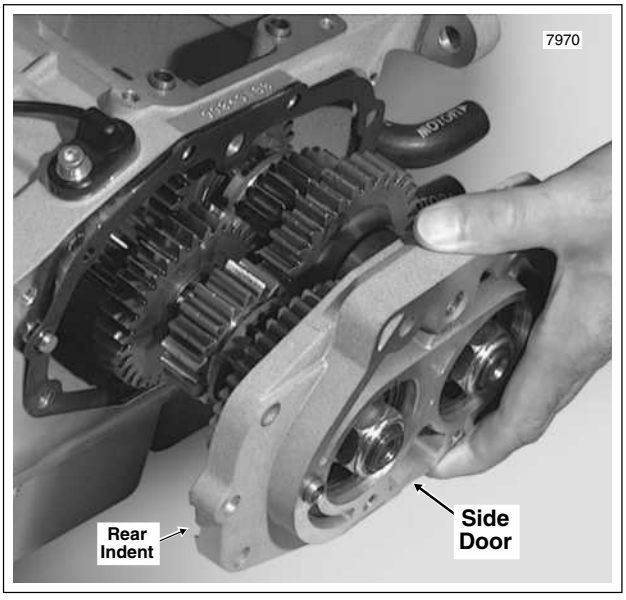



**Figure 7-19. Transmission Side Door**

## DISASSEMBLY

**⚠WARNING**

**Always wear proper eye protection when removing 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.**

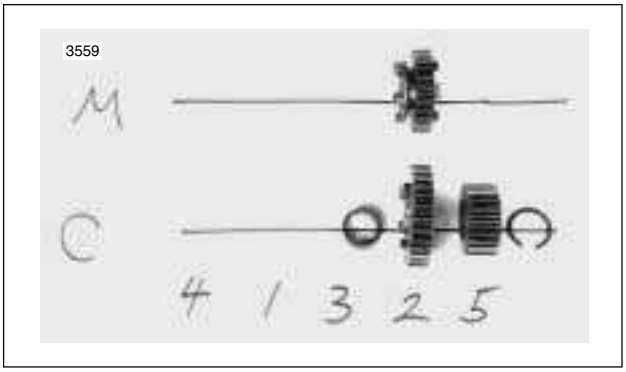



**Figure 7-20. Note Gear Location During Disassembly**

*NOTE*

*Use the TRANSMISSION SHAFT RETAINING RING PLIERS, Part No. J-5586, to remove all mainshaft and countershaft retaining rings. Note each gear and its location as it is removed. See Figure 7-20.*

1. Position the assembly on a bench with the side door down, mainshaft on the left hand side.
2. See A in Figure 7-21. Working from the end of the countershaft toward the side door, remove the retaining ring from the countershaft.
3. Remove the countershaft 5th gear.
4. Remove the countershaft 2nd gear and thrust washer.
5. See B in Figure 7-21. Gently pull apart the split cage bearing and remove.
6. Remove the retaining ring and the countershaft 3rd gear.
7. See C in Figure 7-21. Moving to the mainshaft, remove the mainshaft 2nd gear.
8. See D in Figure 7-21. Remove the upper retaining ring and thrust washer.

*NOTE*

*For best results, move the lower retaining ring toward the side door. The mainshaft 3rd gear will move down the shaft for easy access to the upper retaining ring.*

9. Remove the mainshaft 3rd gear.
10. Remove the thrust washer and lower retaining ring.
11. See E in Figure 7-21. Gently pull apart the split cage bearing and remove.
12. Leave both the mainshaft and countershaft 1st gears and the mainshaft and countershaft 4th gears on their respective shafts.

**CAUTION**

**Supporting the gears is necessary to provide support for the side door bearing inner races. Failure to support the gears will result in bearing damage.**

13. Support the countershaft 1st gear and press out the countershaft.
14. Remove the mainshaft 1st gear.
15. Support the mainshaft 4th gear and press out the mainshaft.
16. Remove the spacer from the mainshaft. Remove the mainshaft 4th gear, thrust washer and retaining ring. Remove the split cage bearing from the mainshaft race.
17. Remove the spacer from the countershaft. Remove the countershaft 4th gear and the countershaft 1st gear. Remove the thrust washer and retaining ring. Gently pull apart the split cage bearing and remove.

## CLEANING AND INSPECTION

1. Clean all parts in cleaning solvent and blow dry with compressed air.
2. Check gear teeth for damage. Replace the gears if they are pitted, scored, rounded, cracked or chipped.
3. Inspect the engaging dogs on the gears. Replace the gears if the dogs are rounded, battered or chipped.
4. Inspect the side door bearings. Bearings must rotate freely without drag. Replace the bearings if pitted or grooved. Proceed as follows:
   a. Remove the retaining rings and press the bearings out of the side door.

**CAUTION**

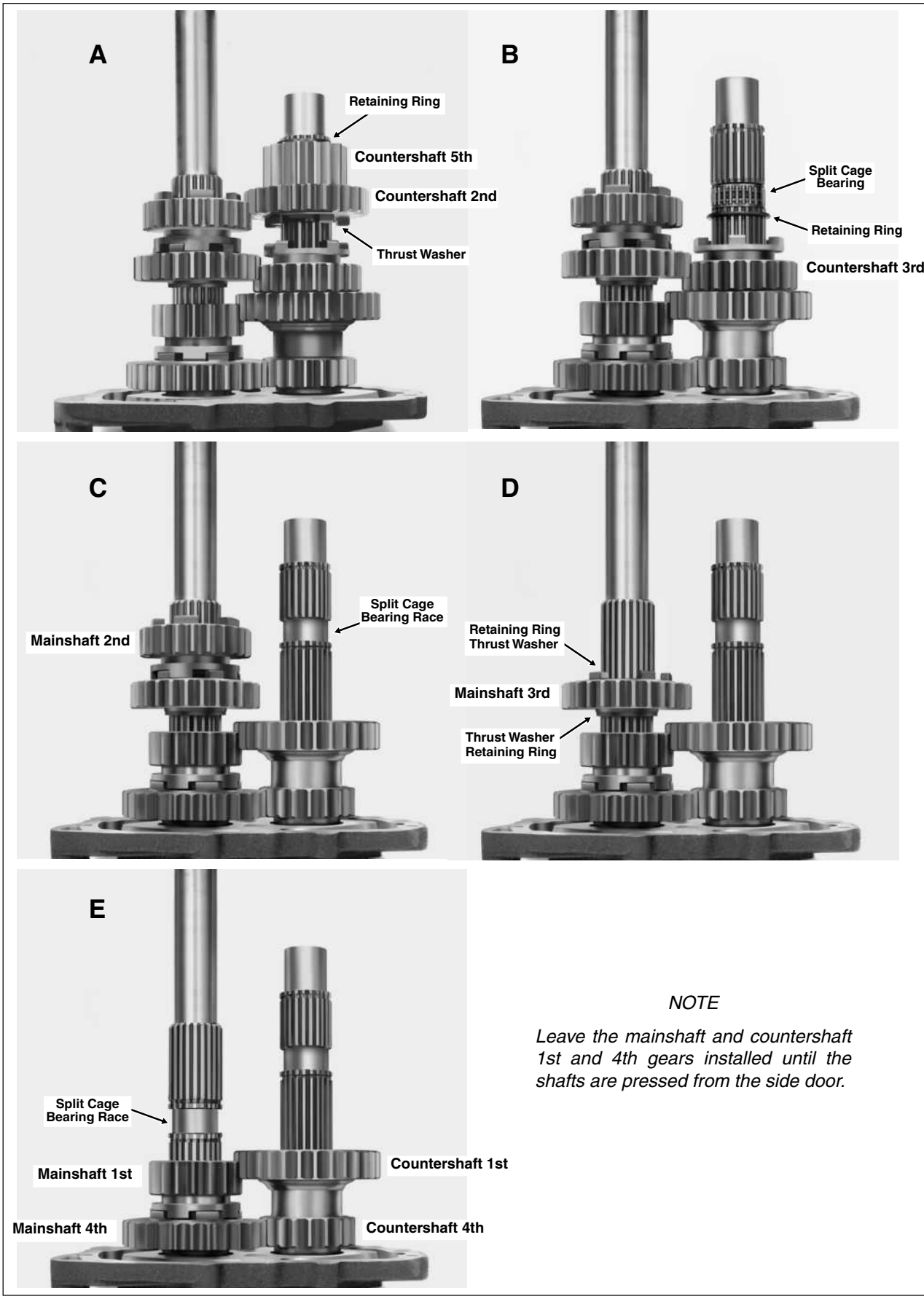
**To avoid side door damage, use a flat plate for support when pressing in new bearings.**

   b. When installing new bearings, always press on the bearing OD marked with the number stamp. The number stamp must face toward the outside surface of the side door. Use a flat plate to support the inboard side of the side door at the bearing bores.

*NOTE*

*Note that one side of the retaining rings are beveled. Always install the ring with the beveled side opposite the bearing. Side doors using the beveled retaining rings are marked with a “drill-point” hole between the bearing bores. See Figure 7-23.*

   c. Install **new** retaining rings with the flat side in towards the bearing, the beveled side out.




*NOTE*

*Leave the mainshaft and countershaft 1st and 4th gears installed until the shafts are pressed from the side door.*

**Figure 7-21. Mainshaft/Countershaft Disassembly**

# ASSEMBLY

**⚠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.**

**⚠WARNING**

**Always use new retaining rings when assembling the mainshaft and countershaft. Reusing retaining rings can cause the transmission to become "locked" during vehicle operation, a situation which could result in death or serious injury.**

*NOTE*

*Use the TRANSMISSION SHAFT RETAINING RING PLIERS, Part No. J-5586, to install all mainshaft and countershaft retaining rings.*

1. Install a **new** retaining ring in the groove closest to the side door end of the mainshaft. Slide the thrust washer onto the side door end of the mainshaft until it contacts the retaining ring. Lightly coat the split cage bearing with oil and install in the mainshaft race next to the thrust washer.
2. See Figure 7-22. Install mainshaft 4th gear over the split cage bearing with the shifter dogs up. From the opposite end of the shaft, slide on the mainshaft 1st gear with the shifter fork groove facing the side door end of the shaft.
3. Install a **new** retaining ring in the groove closest to the side door end of the countershaft. Slide the thrust washer onto the side door end of the countershaft until it contacts the retaining ring. Lightly coat the split caged bearing with oil and install in the countershaft race next to the thrust washer.
4. See Figure 7-22. Install countershaft 1st gear over the split caged bearing with the taper on the ID facing down (flat side up). From the same end of the shaft, slide on the countershaft 4th gear so that the sleeve contacts the taper of the countershaft 1st gear.

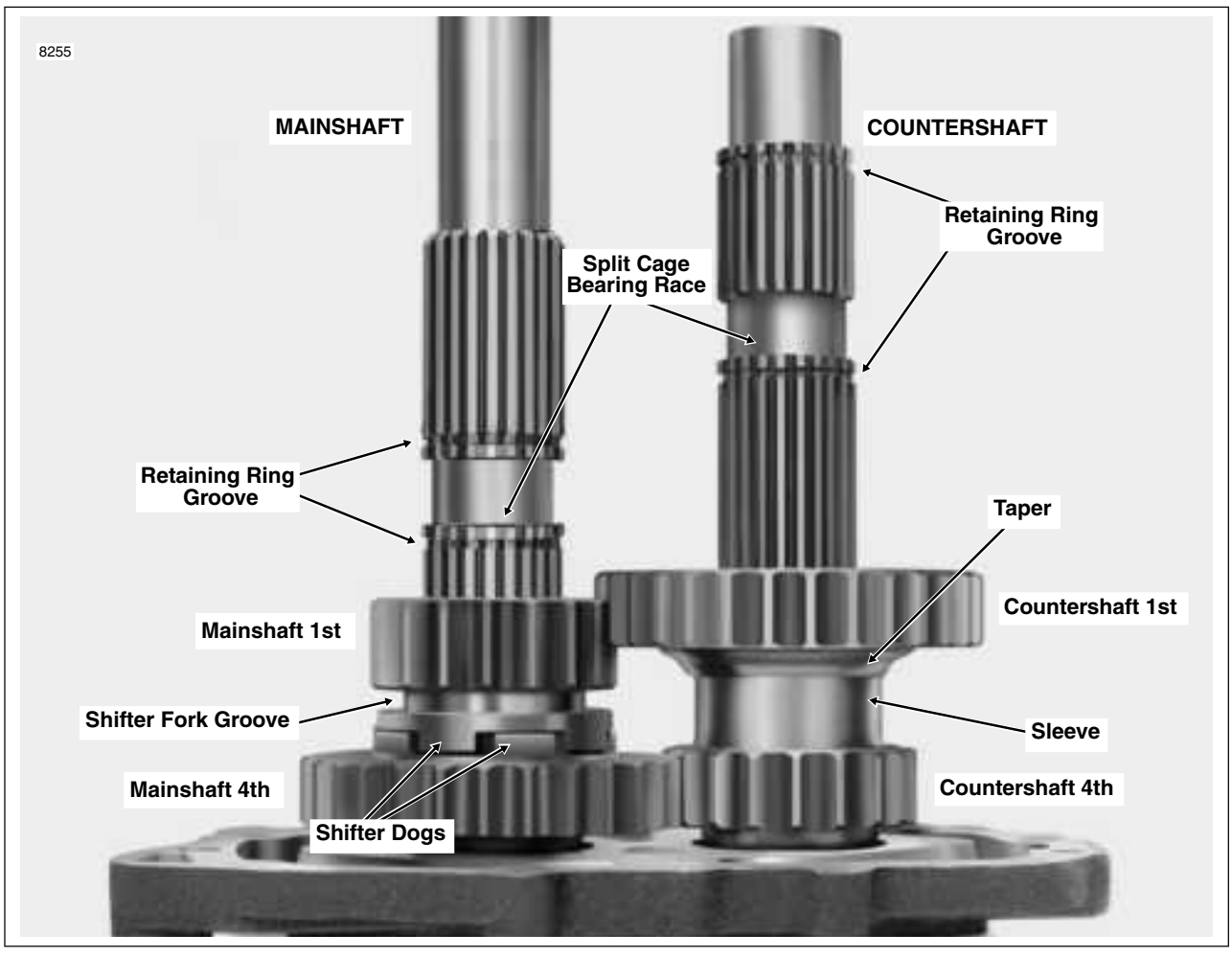



**Figure 7-22. Install Mainshaft and Countershaft 1st and 4th Gears**

5. See Figure 7-25. Slide the spacers onto the shafts with the tapered side facing the side door end. Note that the mainshaft spacer has a shoulder while the countershaft spacer does not.

**CAUTION**

**Failure to support the inner races while pressing shafts through the side door bearings will result in bearing damage.**

6. Place the side door in an arbor press. Support the inner bearing races with a suitable socket. Starting with the mainshaft, press the shafts into the bearings. With the shafts properly pressed into the side door, the spacers will have no end play. Be sure to install the mainshaft to the left of the fork shaft hole (when viewing the side door from the top).
7. Install a spacer and locknut on the threaded end of each shaft and tighten the nuts until finger tight. See Figure 7-23. Final tightening is performed under INSTALLATION, steps 4 and 5.

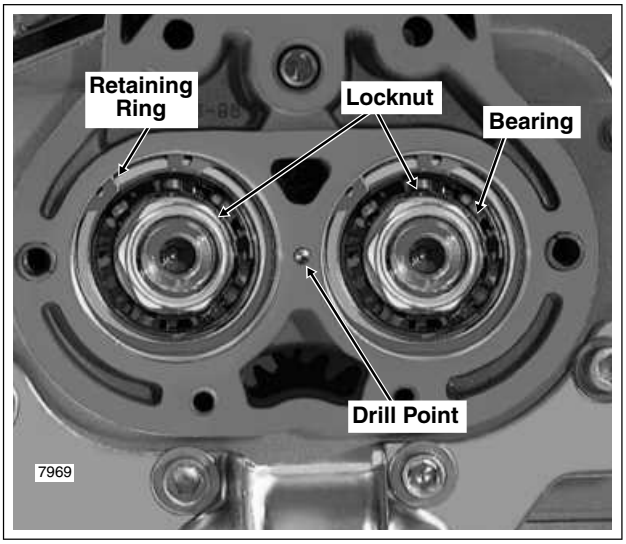



**Figure 7-23. Side Door Bearings**

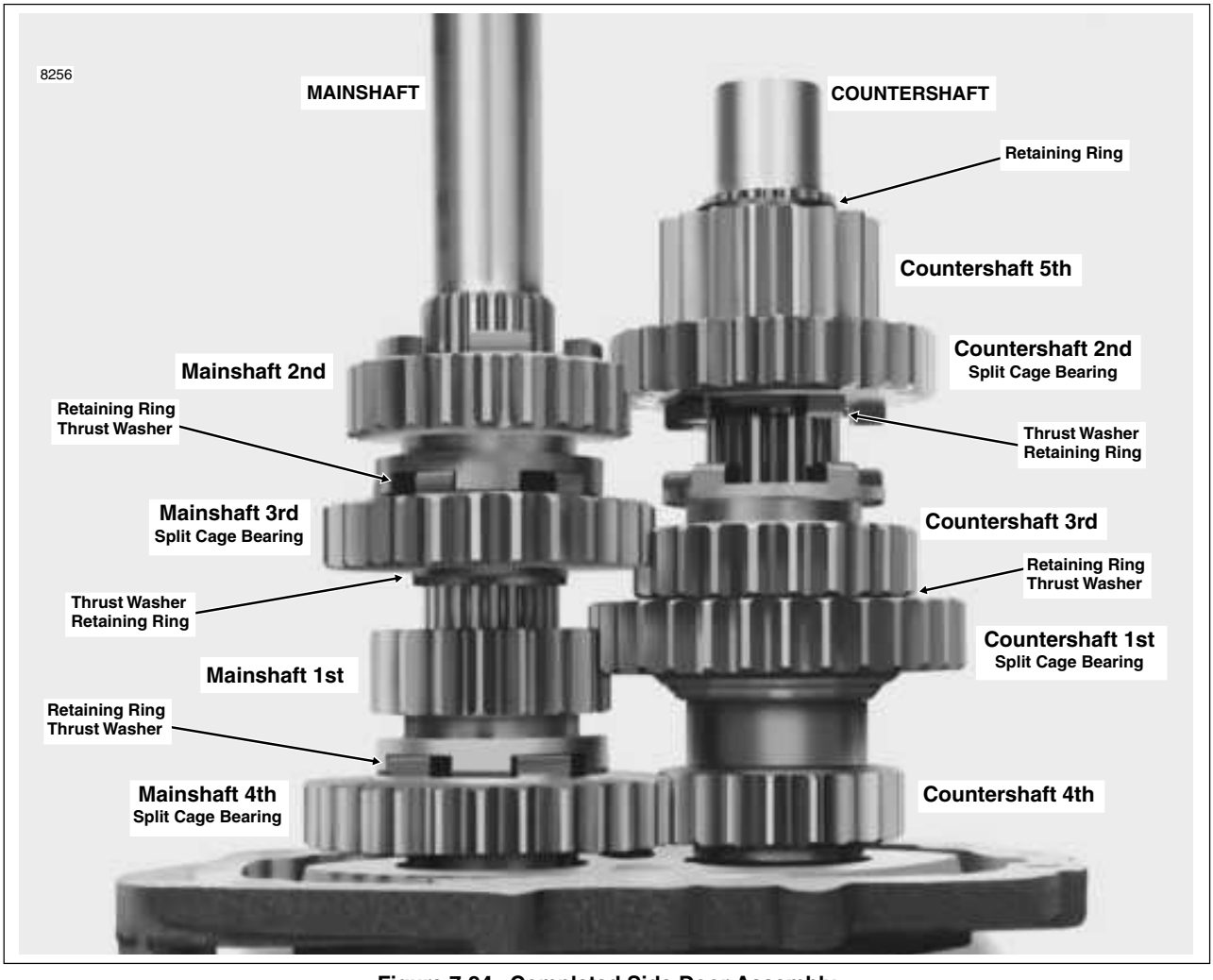



**Figure 7-24. Completed Side Door Assembly**

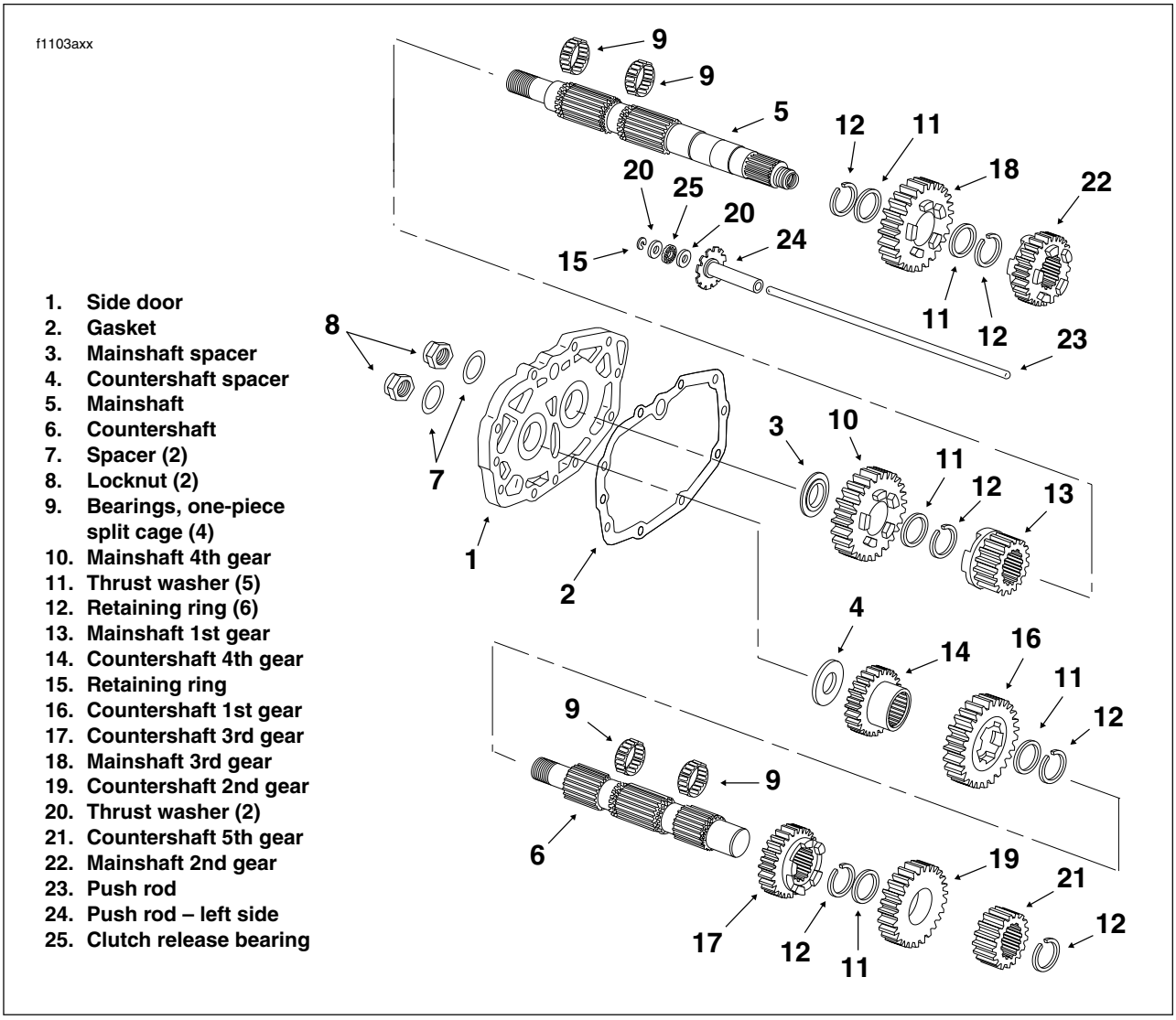



**Figure 7-25. Side Door, Mainshaft and Countershaft Assembly (Exploded View)**

8. See Figure 7-24. Install countershaft 3rd gear with the shifter fork groove facing opposite the side door.
9. Install a **new** retaining ring in the groove just above the mainshaft 1st gear. Slide a thrust washer down the mainshaft until it contacts the retaining ring. Lightly coat a split caged bearing with oil and install in the mainshaft race next to the thrust washer. Place mainshaft 3rd gear over the bearing. Install a second thrust washer and a **new** retaining ring above the gear
10. Install a **new** retaining ring in the groove above the countershaft 3rd gear. Slide a thrust washer down the countershaft until it contacts the retaining ring. Lightly coat a split caged bearing with oil and install in the countershaft race next to the thrust washer. Install the countershaft 2nd gear over the bearing with the shifter dogs facing the side door end of the shaft.
11. Slide the countershaft 5th gear down the countershaft until it contacts the countershaft 2nd gear. Install a **new** retaining ring in the groove above the countershaft 5th gear.
12. Install the mainshaft 2nd gear on the shaft with the shifter fork groove towards the side door.

    The final assembly appears as shown in Figure 7-24.

*NOTE*

*Install the main drive gear, if removed. See Section 7.7 MAIN DRIVE GEAR, INSTALLATION.*

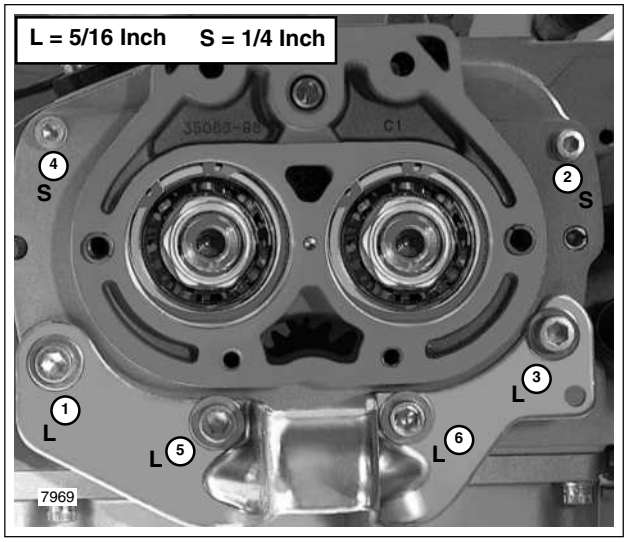



**Figure 7-26. Side Door Screw Size and Torque Sequence**

## INSTALLATION

1. Verify that the two locating dowels are in place on the right side of the transmission case. Hang a **new** gasket on the dowels. Install the assembled side door in the transmission case. See Figure 7-19.
2. Install the four 5/16 inch screws (with flat washers) to fasten transmission bracket and bottom of side door to the transmission case. Install the two 1/4 inch screws to fasten the top of the side door to the transmission case. Alternately tighten six screws until snug.
3. Resetting the torque wrench as necessary, tighten the four 5/16 inch screws to 13-16 ft-lbs (18-22 Nm) and the two 1/4 inch screws to 7-9 ft-lbs (9-12 Nm) in the sequence shown in Figure 7-26.
4. Lock the transmission. This can be accomplished by manually engaging the shifter dogs of any two gears (mainshaft or countershaft) with the shifter dogs of an adjacent gear and then turning the mainshaft locknut counterclockwise.
5. With the transmission locked, tighten the mainshaft and countershaft locknuts to 45-55 ft-lbs (61-75 Nm). See Figure 7-23.
6. Install the oil slinger assembly (with two-piece push rod and clutch release bearing components).
7. Install shifter cam and fork assemblies. See Section 7.4 SHIFTER CAM ASSEMBLY/SHIFTER FORKS, ASSEMBLY.
8. Install the bearing inner race on the transmission mainshaft. See Section 6.5 PRIMARY CHAINCASE, MAINSHAFT BEARING INNER RACE, INSTALLATION.
9. Install the starter and oil filler spout. See Section 5.4 STARTER, INSTALLATION, steps 1-3 and 5-7.
10. Install the primary chaincase and starter jackshaft assembly. Install the clutch assembly, primary chain, and compensating sprocket components. Install the primary chaincase cover. See Section 6.5 PRIMARY CHAINCASE, INSTALLATION.

## REMOVAL

*NOTE*

*Leave the transmission case in the frame unless the case itself requires replacement. For illustration purposes, some photographs may show the case removed.*

1. Remove the shifter cam and shifter fork assemblies. See Section 7.4 SHIFTER CAM ASSEMBLY/SHIFTER FORKS, DISASSEMBLY.
2. Remove the primary chaincase cover. Remove the clutch assembly, primary chain, and compensating sprocket components. Remove the starter jackshaft assembly and primary chaincase. See Section 6.5 PRIMARY CHAINCASE, REMOVAL.
3. Remove oil filler spout and starter. See Section 5.4 STARTER, REMOVAL, steps 6-12.
4. Remove the bearing inner race from the transmission mainshaft. See Section 6.5 PRIMARY CHAINCASE, MAINSHAFT BEARING INNER RACE, REMOVAL.
5. See Figure 7-27. Remove the six socket head screws (bottom four with flat washers) to free both the side door and transmission bracket from the transmission case. Pull the side door, mainshaft and countershaft from the transmission case as a single assembly. Remove and discard the door gasket.

*NOTE*

*DO NOT USE A HAMMER TO REMOVE THE SIDE DOOR. If the side door sticks or binds on the locating dowels, gently pry open using the indents at each side of the door. See Figure 7-27.*

6. Remove the two socket screws and lockplate to free the sprocket nut. Remove the sprocket nut. Use an air impact wrench for best results.

*NOTE*

*The transmission sprocket nut has left handed threads. Turn the nut clockwise to remove from the main drive gear.*

7. Remove the linch pin clip and loosen the castle axle nut on the left side of the rear wheel. Turn each adjuster nut an equal number of turns until the belt tension is relieved. Remove the belt from the transmission sprocket.
8. Remove the transmission sprocket, spacer sleeve, mainshaft oil seal and quad seal.

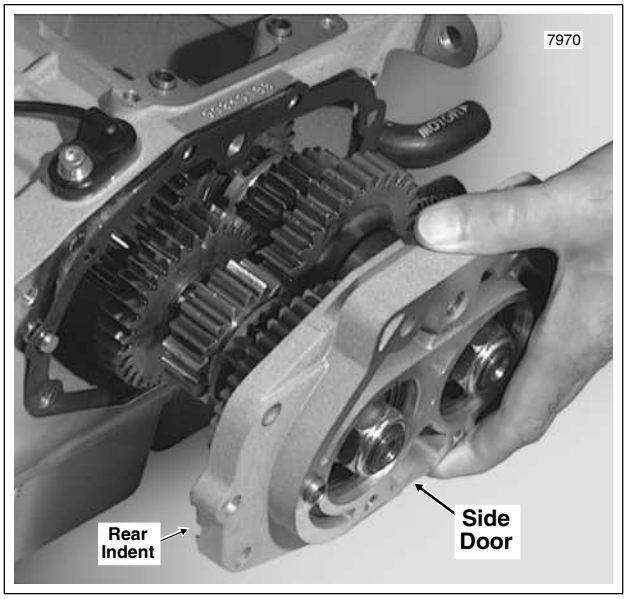



**Figure 7-27. Remove Transmission Side Door**

**⚠WARNING**

**Always wear proper eye protection when removing 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.**

9. Remove the retaining ring from the roller bearing bore.
10. Pull the main drive gear using HD-35316A, MAIN DRIVE GEAR REMOVER AND INSTALLER. See instructions provided with the tool.
11. Using a block of wood and a hammer, remove the roller bearing from the transmission case. Discard the bearing.

*NOTE*

*Always replace the main drive gear bearing when the main drive gear is removed. The bearing will be damaged during the removal procedure.*

## CLEANING AND INSPECTION

1. Clean all parts in solvent except the transmission case and needle bearings. Blow dry with compressed air.

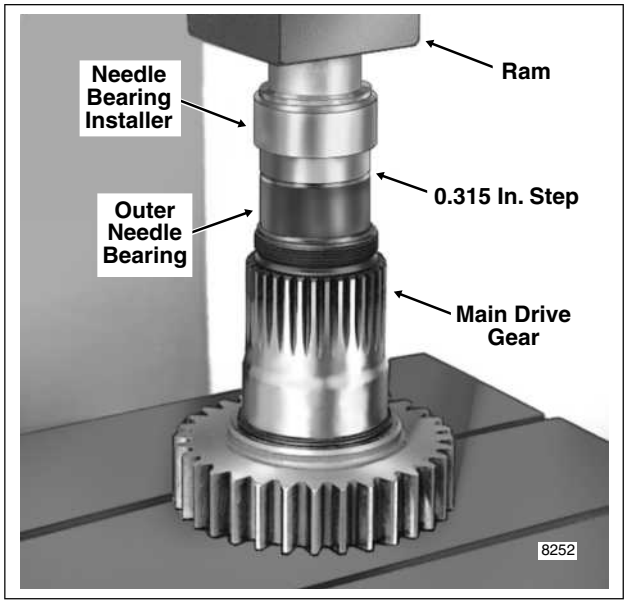



**Figure 7-28. Press Clutch Side Needle Bearing into Main Drive Gear**

**CAUTION**

**The transmission case and needle bearings must not be cleaned. Normal cleaning methods will wash dirt or other contaminants into the bearing case (behind the needles) and lead to bearing failure.**

2. When replacing seals, lightly coat outside diameter of seal with Loctite RETAINING COMPOUND No. 609.
3. Inspect the main drive gear for pitting and wear. Replace if necessary.
4. Replace the sprocket if the teeth are rounded or damaged.
5. Inspect the needle bearings on the inside of the main drive gear. If the mainshaft race surface appears pitted or grooved, replace the needle bearings.

## Needle Bearing Replacement

*NOTE*

*If the main drive gear needle bearings and/or oil seal need to be replaced, proceed as follows.*

1. Remove old oil seal and needle bearings.

*NOTE*

*To install the main drive gear needle bearings and seal, use the INNER/OUTER MAIN DRIVE GEAR NEEDLE BEARING and SEAL INSTALLER, Part No. HD- 37842A.*

2. See Figure 7-28. Install outer (clutch side) needle bearing using an arbor press and the 0.315 inch step end of tool HD-37842A as shown. The tool will bottom on the gear when the correct depth is obtained.
3. See Figure 7-29. Turn over tool and press on oil seal using the 0.080 inch step (garter spring side toward main drive gear).

*NOTE*

*An alternative method is provided which allows the oil seal to be pressed into place after installation of the main drive gear. For detailed information, see Section 7.7 MAIN DRIVE GEAR, INSTALLATION, step 14.*

4. See Figure 7-30. Turn over the main drive gear in the arbor press. Using the step a second time (0.080 inch step), press in inner (transmission side) needle bearing.

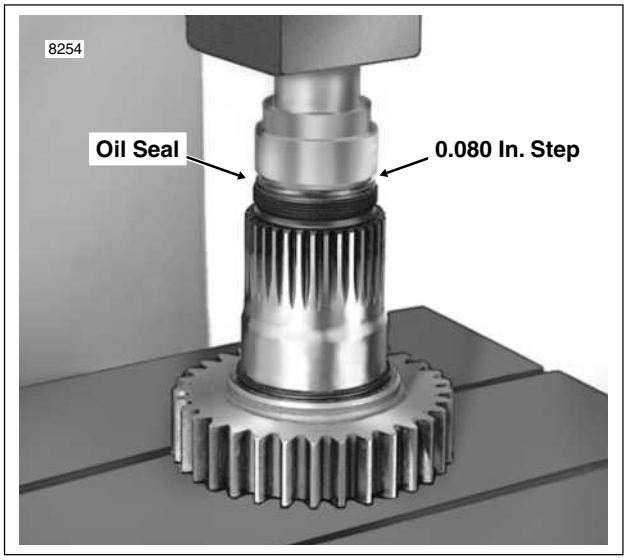



**Figure 7-29. Press Oil Seal on Main Drive Gear**

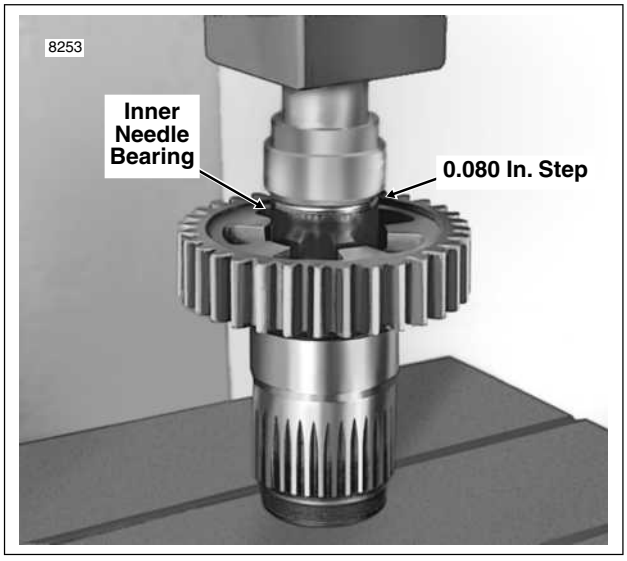



**Figure 7-30. Press Transmission Side Needle Bearing into Main Drive Gear**

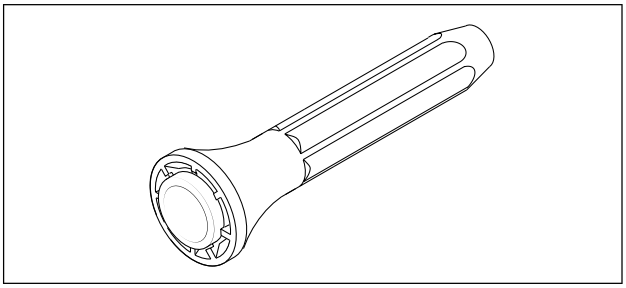


**Figure 7-31. Main Drive Gear Large Oil Seal Installer (Part No. HD-41496)**

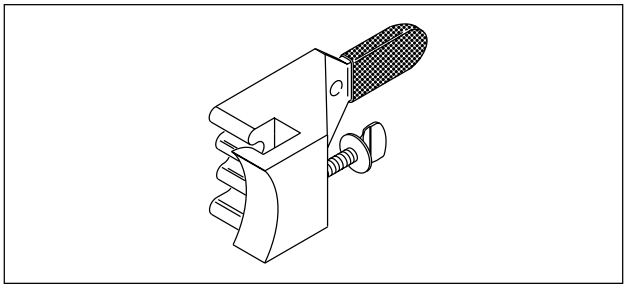


**Figure 7-33. Final Drive Sprocket Locking Tool (Part No. HD-41184)**

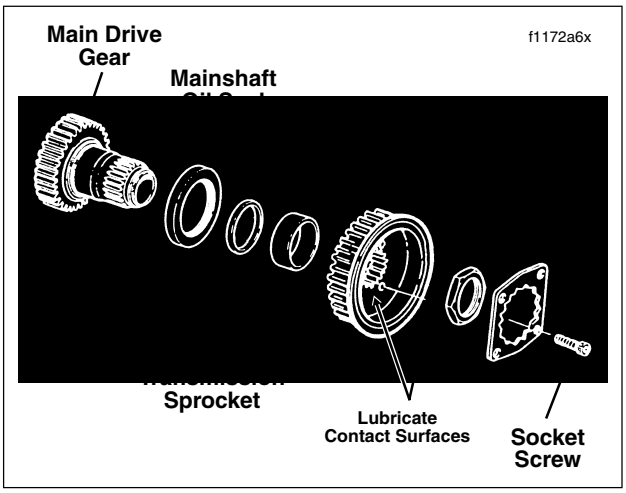



**Figure 7-32. Install Transmission Sprocket Components**

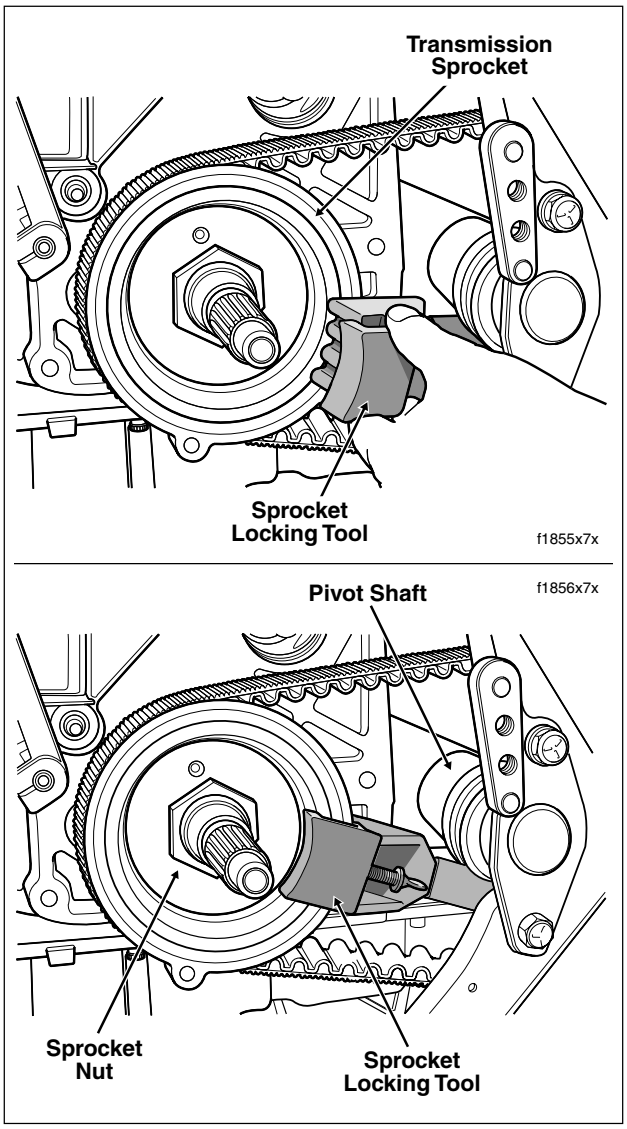



**Figure 7-34. Install Final Drive Sprocket Locking Tool**

## INSTALLATION

1. Install a **new** main drive gear bearing. The bearing must be flush with the case outer surface to a maximum depth of 0.030 inch (0.76 mm). Use the MAIN DRIVE GEAR REMOVER/INSTALLER (Part No. HD-35316A). To prevent damage, always apply force to the bearing outer race during installation. Install a **new** retaining ring with the beveled edge facing outward. Install the main drive gear in the transmission case using the special tool.
2. Verify that the two locating dowels are in place on the right side of the transmission case. Hang a **new** gasket on the dowels. Inserting the mainshaft through the main drive gear, place the side door against the case. Tighten the 5/16 inch mounting screws to 13-16 ft-lbs (18-22 Nm). Tighten the 1/4 inch screw to 7-9 ft-lbs (9-12 Nm).
3. See Figure 7-31 and Figure 7-32. With the garter spring side out (toward the transmission case), place a **new** seal on lip of MAIN DRIVE GEAR LARGE OIL SEAL INSTALLER (Part No. HD-41496). Slide the tool over the mainshaft so that it is positioned squarely over the bearing bore in the transmission housing. Hand press the seal into the bore; a rubber mallet may be used to lightly tap the driver, if necessary. Install the quad seal.
4. Apply a small amount of the appropriate H-D transmission lubricant to outside diameter of spacer sleeve.

5. Install spacer sleeve on the main drive gear with chamfer facing inboard. Install the transmission sprocket. Install the belt on the sprocket as the sprocket is installed on the main drive gear.

6. Install the sprocket nut. The procedure is based on whether a new or used nut is being installed.

**CAUTION**

**Exercise caution to avoid getting oil on the threads of the sprocket nut or the integrity of the lock patch may be compromised.**

**New sprocket nut:** smear a small quantity of clean engine oil on the inside face of both the sprocket nut and the sprocket. Limit the application to where the surfaces of the two parts contact each other. Install the sprocket nut until finger tight.

*NOTE*

*The transmission sprocket nut has left handed threads. Turn the nut counterclockwise to install on the main drive gear.*

**Used sprocket nut:** apply Loctite 262 (red) to the threads of the sprocket nut. Also smear a small quantity of Loctite or clean engine oil on the inside face of both the sprocket nut and the sprocket. Limit the application to where the surfaces of the two parts contact each other. Install the sprocket nut until finger tight.

7. Lock transmission sprocket with FINAL DRIVE SPROCKET LOCKING TOOL, Part No. HD-41184. Insert handle of tool below pivot shaft inboard of bottom frame tube and attach to sprocket. Snug thumbscrew to lock position of tool on sprocket. See Figure 7-33 and Figure 7-34.

8. See Figure 7-35 and Figure 7-36. Install pilot of MAINSHAFT LOCKNUT WRENCH (Part No. HD-94660-37B) on threaded end of mainshaft. Slide sleeve of locknut wrench over pilot and onto sprocket nut. Tighten sprocket nut to 50 ft-lbs. As the nut is tightened the handle of the sprocket locking tool rises to contact the pivot shaft, thereby preventing sprocket/mainshaft rotation.

9. Scribe a straight line on the transmission sprocket nut continuing the line over onto the transmission sprocket as shown in Figure 7-37. Tighten the transmission sprocket nut an additional 30° to 40°.

10. Install lockplate over nut so that two diagonally opposite holes align with two tapped holes in sprocket. To find the best fit, lockplate can be rotated to a number of positions and can be placed with either side facing sprocket.

11. If holes in lockplate do not align with those in sprocket, tighten sprocket nut as necessary (up to the 45° maximum) until sprocket and lockplate holes are in alignment. See Figure 7-37.

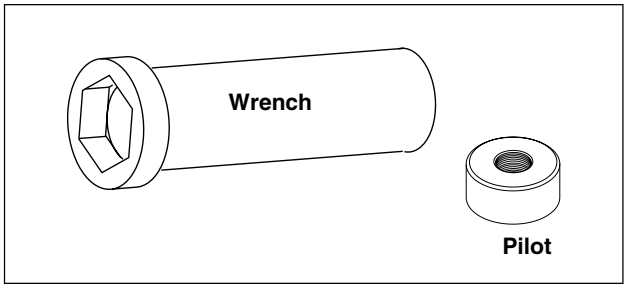



**Figure 7-35. Mainshaft Locknut Wrench/Pilot (Part No. HD-94660-37B )**

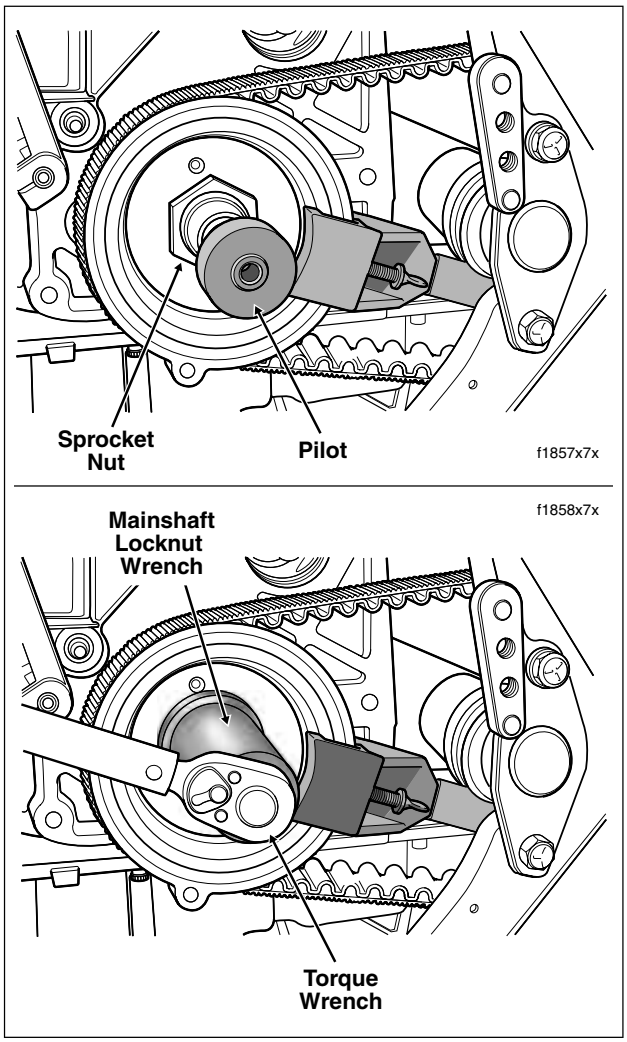



**Figure 7-36. Install Mainshaft Locknut Pilot/Wrench and Torque Sprocket Nut**

**CAUTION**

**Maximum allowable tightening of sprocket nut is 45° of counterclockwise rotation after a torque of 50 ft-lbs. Do not loosen sprocket nut when attempting to align holes.**

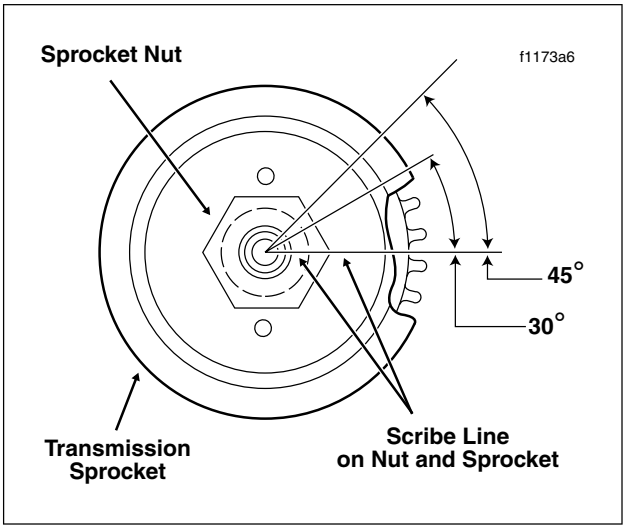



**Figure 7-37. Tighten/Secure Sprocket Nut**

12. Insert two socket head screws through lockplate into sprocket holes. Tighten screws to 90-110 **in-lbs**.

*NOTE*

*The socket head screws have a thread locking compound that allows them to be reused up to three times. The fourth time the screws are removed, replace with **new** screws (H-D Part No. 3594).*

13. Adjust the belt tension. See Section 6.4 SECONDARY DRIVE BELT AND SPROCKETS, ADJUSTMENT AND ALIGNMENT.

14. If the main drive gear oil seal was not installed with the needle bearings (or if a faulty seal is discovered with the main drive gear installed in the transmission case), an alternative method is provided using the MAIN DRIVE GEAR SEAL INSTALLER, HD-41405. See Figure 7-38.

*NOTE*

*If a serviceable seal is already installed, proceed to step 15.*

To install the oil seal with the main drive gear in the transmission case, proceed as follows:

a. Verify that the garter spring is in place on the lip of the oil seal.

b. Place the seal protector sleeve over the end of the mainshaft. Lightly lubricate the protector sleeve and seal ID with clean transmission oil.

c. Squarely seat the oil seal on the seal protector sleeve with the garter spring facing the transmission case. See Figure 7-39.

d. Using the seal driver, hand press the seal onto the mainshaft. A rubber mallet may be used to lightly tap the driver, if necessary.

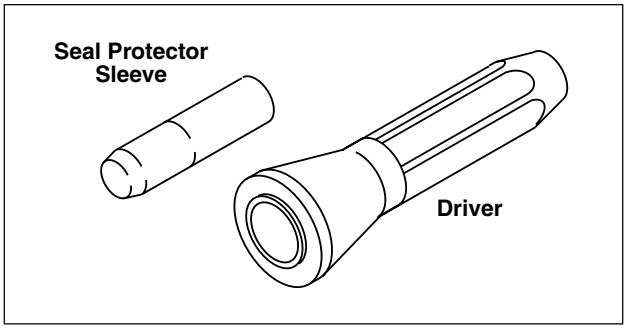



**Figure 7-38. Main Drive Gear Seal Installer (Part No. HD-41405 )**

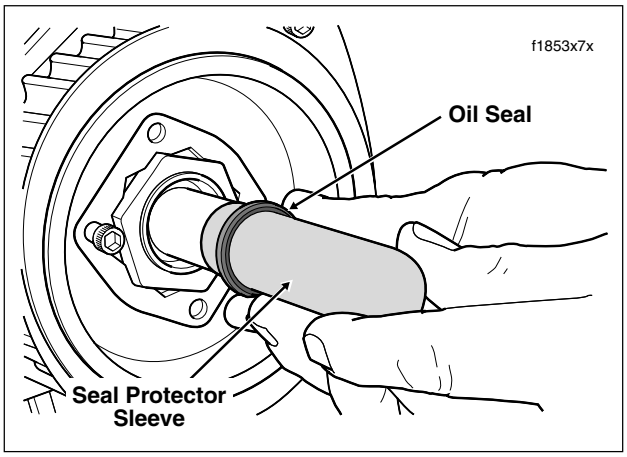



**Figure 7-39. Slide Protector Sleeve/Oil Seal on Mainshaft**

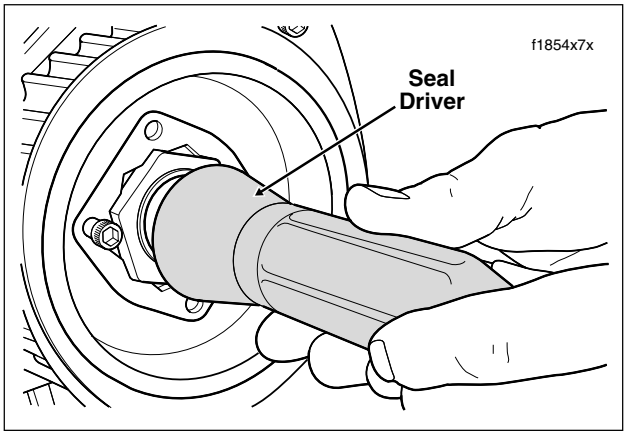



**Figure 7-40. Install Oil Seal Using Driver**

15. Install the bearing inner race on the transmission mainshaft. See Section 6.5 PRIMARY CHAINCASE, MAINSHAFT BEARING INNER RACE, INSTALLATION.

16. Install shifter cam and fork assemblies. See Section 7.4 SHIFTER CAM ASSEMBLY/SHIFTER FORKS, ASSEMBLY.

17. Install the starter and oil filler spout. See Section 5.4 STARTER, INSTALLATION, steps 1-3 and 5-7.

18. Install the primary chaincase and starter jackshaft assembly. Install the clutch assembly, primary chain, and compensating sprocket components. Install the primary chaincase cover. See Section 6.5 PRIMARY CHAINCASE, INSTALLATION.

## Countershaft Needle Bearing Replacement

1. Find a suitable bearing driver 1-1/4 inch (31.75 mm) in diameter.

2. From the outside of the transmission case place the needle bearing open end first next to the bearing bore. Hold the driver squarely against the closed end of the bearing and tap the bearing into place. The bearing is properly positioned when it is driven inward flush with the outside surface of the case or to a maximum depth of 0.030 inch (0.76 mm).

3. Lubricate the bearing with TransLube.

# TRANSMISSION CASE/OIL PAN 7.8

## GENERAL

Removal of the transmission case and/or oil pan is only necessary if one or both require replacement. The transmission case and oil pan can be removed as an assembly if the transmission case must be replaced.

If necessary, the oil pan can be removed without removing the transmission case. Once the rear wheel is removed, the oil pan can be slid out from the rear.

## REMOVAL

### Transmission Case and Oil Pan

1. See Figure 7-41. Remove both the engine oil and transmission lubricant drain plugs from the oil pan. Drain the fluids into suitable containers.
2. Remove the mainshaft and countershaft assemblies. See Section 7.6 MAINSHAFT/COUNTERSHAFT, REMOVAL.

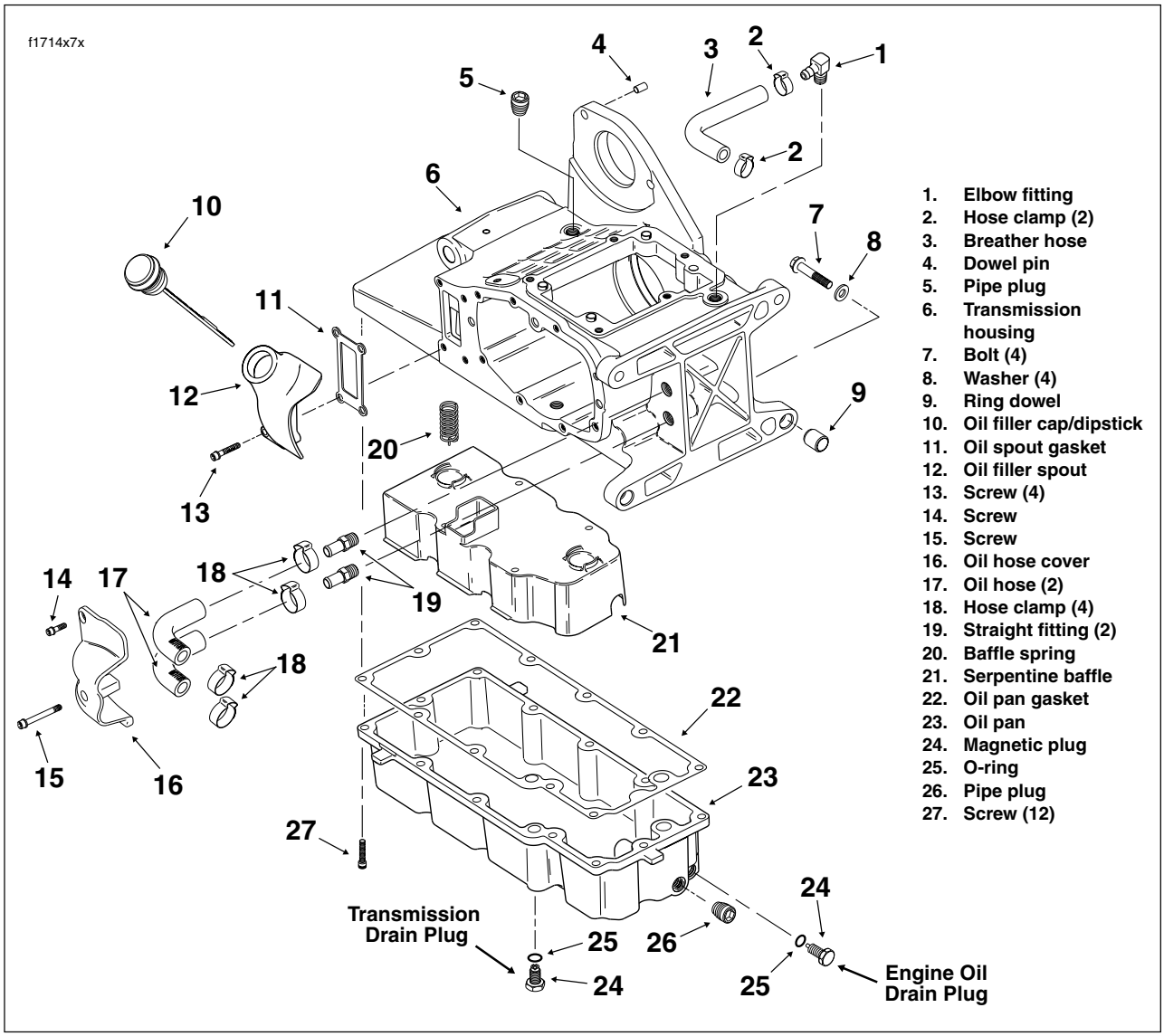



**Figure 7-41. Install Mainshaft and Countershaft 1st and 4th Gears**

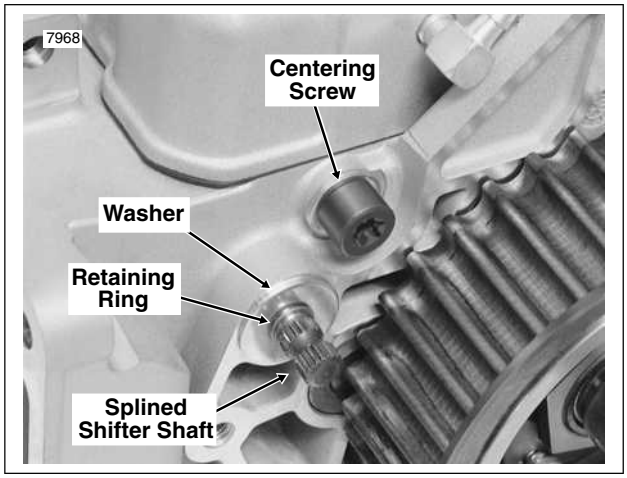



**Figure 7-42. Shifter Pawl Centering Screw**

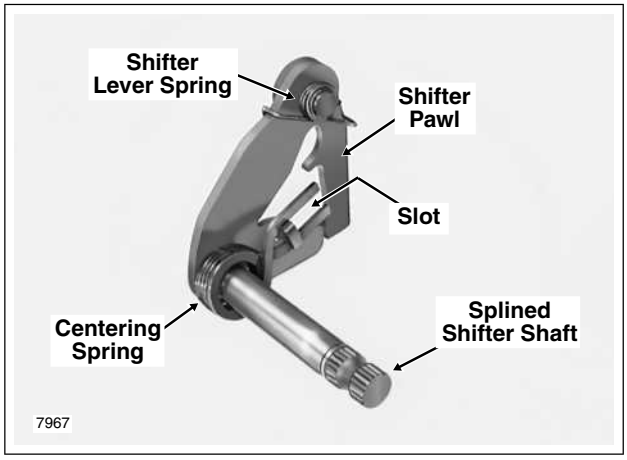



**Figure 7-43. Shifter Pawl Assembly**

3. Remove the linch pin clip and loosen the castle axle nut on the left side of the rear wheel. Turn each adjuster nut an equal number of turns until the belt tension is relieved. Remove the belt from the transmission sprocket.

*NOTE*

*The main drive gear and bearing may be removed with the transmission case in the frame. See Section 7.7 MAIN DRIVE GEAR, REMOVAL.*

4. Remove the socket screw from the shifter lever. Remove the lever from the splined end of the shifter shaft. Mark splines on shaft and lever as they are removed to assist in assembly. See Figure 7-42.

5. Using a T50 TORX drive head, turn the centering screw out until it clears the centering spring slot of the shifter pawl assembly. Remove the retaining ring and flat washer from the splined end of the shifter shaft. See Figure 7-43. Push on end of shaft to free shifter pawl assembly from transmission case.

6. Remove two allen head socket screws to release oil hose cover. See Figure 7-41.

7. Using a side cutters, cut and remove clamps on transmission side of oil supply and return hoses. Pull hoses from fittings on transmission housing.

8. Cut and remove clamp on transmission side of crankcase breather hose. Pull hose from fitting on transmission housing.

9. Place the motorcycle on a center stand and support the engine from below with a block of wood.

10. Remove socket screw with lockwasher to free right and left side passenger footboards from rear swingarm brackets.

11. Remove two bolts (with lockwashers) to free rear swingarm brackets from left and right side of vehicle frame.

12. Holding right side nut (11/16 inch wrench size) within rubber mount, remove left side locknut (3/4 inch wrench) and cup washer from swing arm pivot shaft. See Figure 7-44.

13. From the left side of the vehicle, tap the pivot shaft out of the swing arm using a suitable drift.

14. Remove four bolts (with flat washers) to free front of transmission from rear of crankcase. Loosen and remove bolts in a crosswise pattern. Move transmission rearward until two ring dowels in lower flange are free of crankcase.

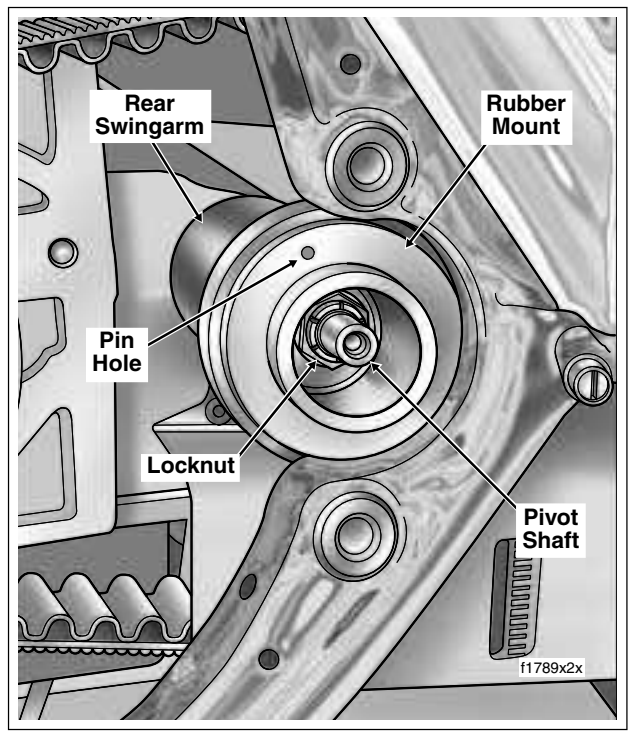



**Figure 7-44. Remove Locknut from Pivot Shaft (Left Side View)**

*NOTE*

*If the main drive gear was not removed from the transmission case, then it may be removed at this time. See Section 7.7 MAIN DRIVE GEAR, REMOVAL.*

15. Remove the transmission case from the right side of the vehicle.

*NOTE*

*If removal is difficult, remove the twelve socket head bolts to separate the transmission case from the oil pan. For best results, use a long 3/16 inch ball hex socket driver. Holes in the lower frame crossmember allow access to bolts which would not otherwise be accessible.*

## Oil Pan Only

*NOTE*

*Perform the following procedure if only the oil pan must be removed.*

1. See Figure 7-45. Remove both the engine oil and transmission lubricant drain plugs from the oil pan. Drain the fluids into suitable containers.
2. Install lifting strap around frame backbone, and using overhead jack, support vehicle from the top.
3. Remove rear wheel. See Section 2.3 REAR WHEEL, REMOVAL.
4. With a long 3/16 inch ball hex socket driver (Snap-On stock number FABL6 or equal), remove the twelve socket head bolts from the bottom of the oil pan.

*NOTE*

*Holes in the frame crossmember allow access to bolts which would not otherwise be accessible.*

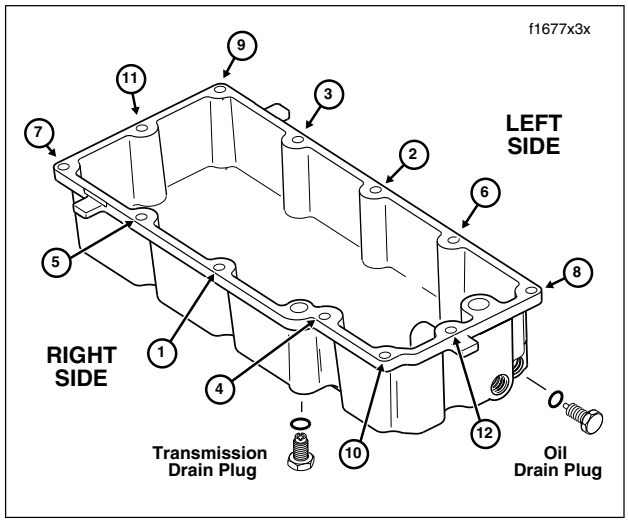



**Figure 7-45. Oil Pan Torque Sequence**

**CAUTION**

**Remove the engine oil dipstick before attempting to slide the oil pan rearward. Contact with the oil pan will result in damage to the dipstick.**

5. Slide oil pan rearward and remove from underside of transmission.

# CLEANING AND INSPECTION

1. Clean all parts in solvent except the transmission case and needle bearings. Blow dry with compressed air.

**CAUTION**

**The transmission case and needle bearings must not be cleaned. Normal cleaning methods will wash dirt or other contaminants into the bearing case (behind the needles) and lead to bearing failure.**

2. Inspect the shifter pawl and centering spring for wear. Replace pawl if ends are damaged. Replace centering spring if elongated.
3. Inspect the shifter lever spring. Replace the spring if it fails to hold the pawl on the cam pins.
4. Thoroughly clean the oil pan with solvent, if removed.
5. Inspect the hoses for nicks, cuts or general deterioration. Replace as necessary. Used compressed air to verify that hoses and fittings are unobstructed.

# INSTALLATION

## Oil Pan Only

*NOTE*

*The following procedure describes installation of the oil pan with the transmission case mounted in the motorcycle frame. Follow the applicable steps to install the oil pan with the transmission case removed from the motorcycle frame.*

1. Coat gasket surface of oil pan with a thin coat of HYLOMAR® gasket sealer.
2. Place gasket on oil pan and allow sealer to dry until tacky.
3. It is normal for the baffle springs to hold the oil pan away from transmission housing. Use a long screwdriver to compress the springs as the pan enters the housing. Exercise caution to avoid cocking or distorting the springs.

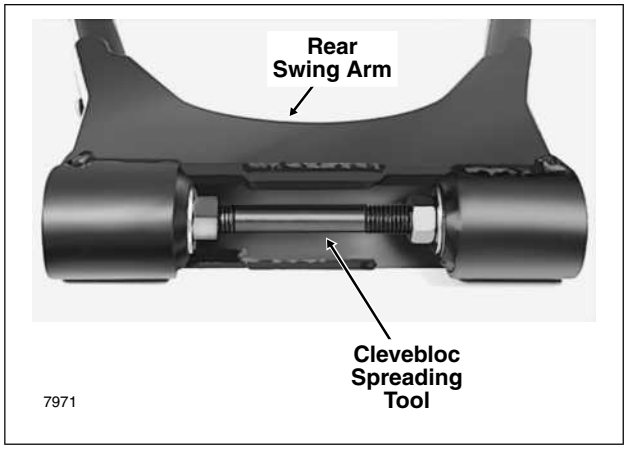



**Figure 7-46. Install Clevebloc Spreading Tool (HD-33805)**

4. Position oil pan under transmission and install the twelve oil pan bolts, but only tighten about two turns after initial thread engagement.

**CAUTION**

**Inspect the oil pan gasket to ensure that gasket is properly positioned. If gasket was moved out of position, remove bolts and repeat step 3 to ensure that gasket is properly positioned.**

5. Tighten the oil pan bolts to 7-9 ft-lbs (9-12 Nm) following the numerical sequence shown in Figure 7-45.
6. Install rear wheel. See Section 2.3 REAR WHEEL, INSTALLATION.
7. Remove lifting strap to release frame backbone from overhead jack.

## Transmission Case and Oil Pan

*NOTE*

*If the main drive gear was assembled prior to mounting of the transmission, place belt on transmission sprocket as transmission is placed in position.*

1. From right side of vehicle, place the transmission case (with oil pan) in the motorcycle frame. Move transmission forward until two ring dowels in lower flange fully engage holes in crankcase. Support the engine and transmission, so that they do not sag at their mating surfaces.
2. Install the transmission-to-engine mounting bolts as follows:
   a. Using a crosswise pattern, **hand tighten** four bolts (with flat washers) to secure transmission housing to rear of crankcase.

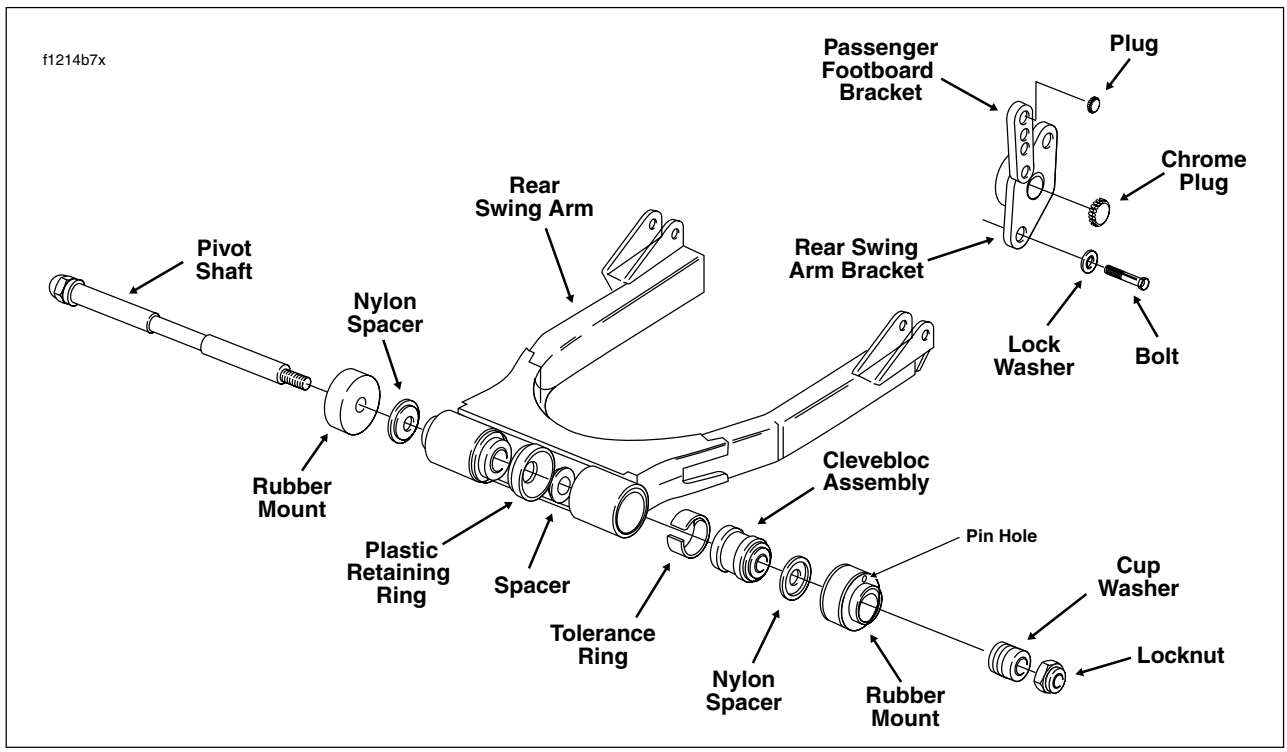



**Figure 7-47. Rear Swing Arm/Pivot Shaft Assembly**

b. Alternately tighten the four bolts to 15 ft-lbs (20.3 Nm) in the same crosswise pattern.

*NOTE*

*For best results, use Open End Crowfoot (Snap-On FC018) on upper left and upper right transmission housing to crankcase bolts.*

c. Following the same pattern, final tighten the four transmission housing to crankcase bolts to 30-35 ft-lbs (40.7-47.5 Nm).

3. Slide **new** clamps onto free ends of oil supply and return hoses. See Figure 7-41. Install hoses onto transmission fittings. Using the Hose Clamp Pliers (HD-41137), crimp clamps.
4. Slide **new** clamp onto free end of crankcase breather hose. Install hose onto transmission fitting. Crimp clamp using HOSE CLAMP PLIERS (HD-97087-65B).
5. Install two allen head socket screws (with captive washers) to secure oil hose cover to transmission and engine housings. Longer screw goes to engine housing. Alternately tighten screws to 7-9 ft-lbs (10-12 Nm).
6. Position swing arm at rear of transmission. If transmission boss will not fit back into the swing arm, install CLEVEBLOC SPREADING TOOL (Part No. HD-33805) between swing arm cleveblocs as shown in Figure 7-46. Turn nuts spreading cleveblocs apart to approximately 4-9/16 inch (116 mm). Loosen nuts and remove tool.
7. The pivot shaft secures the rear swing arm and transmission to the vehicle frame. See Figure 7-47. Assemble the pivot shaft as follows:

   a. Coat pivot shaft with Loctite ANTI-SEIZE. Slide rubber mount onto pivot shaft. The small diameter boss on the rubber mount must face outward with the pin hole at the top (so that it aligns with the pin cast in the passenger footboard/rear swingarm bracket).

   b. Slide nylon spacer onto pivot shaft with smaller diameter boss facing inside toward the swing arm.

   c. From right side of vehicle, insert pivot shaft into swing arm and transmission mount.

   d. On left side of vehicle, install nylon spacer, rubber mount and cup washer onto pivot shaft. Install nut until finger tight. Remember to properly orient the left side rubber mount and nylon spacer as previously described.

   e. Observing “Left” and “Right” stamp on casting, install rear swingarm brackets fitting cast pin in rubber mount hole. Install two bolts (with lock washers) to secure brackets to vehicle frame. Tighten bolts to 34-42 ft-lbs (46-57 Nm).

   f. Remove the decorative chrome plugs from rear swingarm brackets. See Figure 7-48. Hold right side nut on the pivot shaft and tighten left side locknut to 40-45 ft-lbs (54-61 Nm). Install chrome plugs back into rear swingarm brackets.

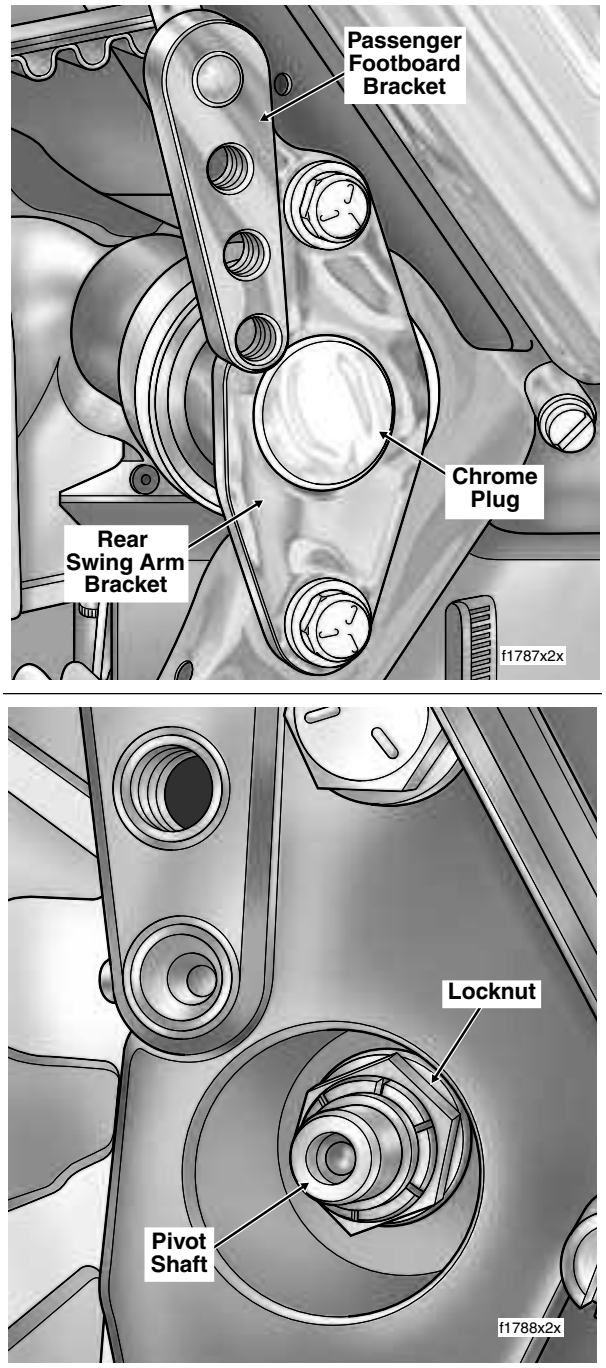



**Figure 7-48. Remove Chrome Plugs and Check Pivot Shaft Locknut Torque**

*NOTE*

*Remove the chrome plugs and check the torque on the pivot shaft locknut every 10,000 miles (16,000 km). See Figure 7-48.*

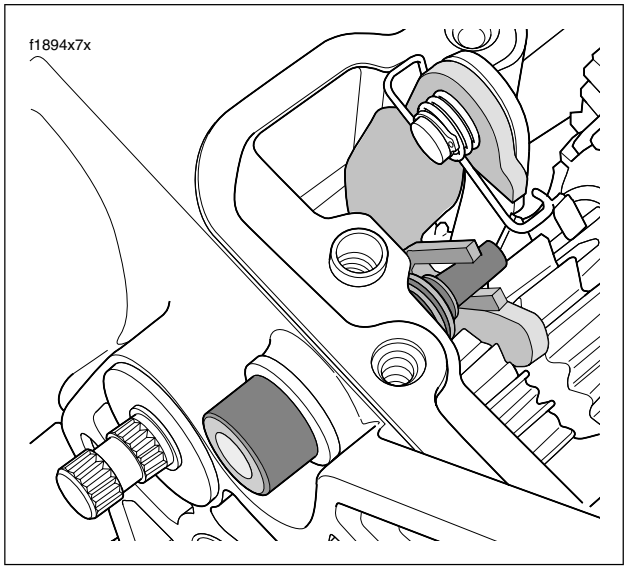



**Figure 7-49. Shifter Pawl Assembly**

8. Slide splined end of shifter shaft through sleeved bore until it protrudes from left side of case. Install flat washer and retaining ring on splined end of shaft. Hold the shifter pawl assembly inside the transmission case so that the centering spring slot is aligned with the centering screw. Using a T50 TORX drive head, tighten centering screw until snug. See Figure 7-49.
9. Install the shifter lever onto the splined end of the shifter shaft taking note to align marks placed on splines during disassembly. Install socket head screw and tighten to 18-22 ft-lbs (24-30 Nm). Make sure screw registers in slot of shifter lever.
10. Install the mainshaft and countershaft assemblies. See Section MAINSHAFT AND COUNTERSHAFT, INSTALLATION.
11. Install belt on transmission sprocket.

**CAUTION**

**Carefully follow steps 12-13 to align the engine and transmission. Misalignment may cause rapid chain wear and transmission damage.**

12. Install the primary chaincase. See Section 6.5 PRIMARY CHAINCASE, INSTALLATION, steps 1-5.
13. Adjust the belt tension. See Section 6.4 SECONDARY DRIVE BELT AND SPROCKETS, ADJUSTMENT AND ALIGNMENT.
14. Complete installation of the primary chaincase. Install the starter jackshaft assembly. Install the clutch assembly, primary chain, and compensating sprocket components. Install the primary chaincase cover. See Section 6.5 PRIMARY CHAINCASE, INSTALLATION, steps 6-29.
15. Install the right and left side passenger footboards to the rear swingarm brackets.
16. Install engine oil drain plug and tighten to 14-21 ft-lbs (19-28 Nm).
17. Add engine oil. See Section 3.3 GENERAL INFORMATION, CHANGING ENGINE OIL AND FILTER, steps 9-12.

# NOTES

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# ELECTRICAL 8

# SPECIFICATIONS 8.1

## IGNITION TIMING

| ALL FL Models | |
|---|---|
| RANGE | TDC - 50˚ BTDC |
| START | TDC |

## ALTERNATOR SYSTEM

Output Voltage @ 3600 rpm14.3-14.7

FLHR, FLHR-I, FLHRC-I, FLHT, FLHTC, FLTR

Amperes 38 amp

FLHTC-I, FLHTCU-I, FLTR-I

Amperes 45 amp

## BATTERY

Voltage 12V

Amperes – 28 AH @ 20 Hour Rate

## FUSES

| Circuit | Rating (Amperes) | Color | Terminal Type |
|---|---|---|---|
| Main | 40 | - | Threaded Posts |
| **System Fuses** | | | |
| Radio Power | 10 | Red | Blade |
| Brakes/Cruise | 15 | Blue | Blade |
| P& A | 10 | Red | Blade |
| Radio Memory | 15 | Blue | Blade |
| Security System (Hazard 4-Way Flasher) | 15 | Blue | Blade |
| Accessory | 15 | Blue | Blade |
| Instruments | 15 | Blue | Blade |
| Ignition | 15 | Blue | Blade |
| Lights | 15 | Blue | Blade |
| **EFI Fuses** | | | |
| Fuel Pump | 15 | Blue | Blade |
| ECM Power | 5 | Tan | Blade |

## SPARK PLUG

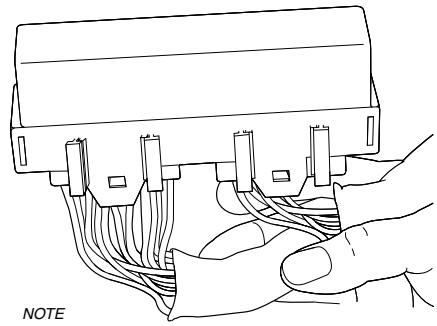
| Part No. | No. | Size | Gap |
|---|---|---|---|
| 32317-86A | 6R12 | 12 mm | 0.038-0.043 in. 0.97-1.09 mm |

*NOTE*

*Be sure spark plugs are gapped to specification before installation.*

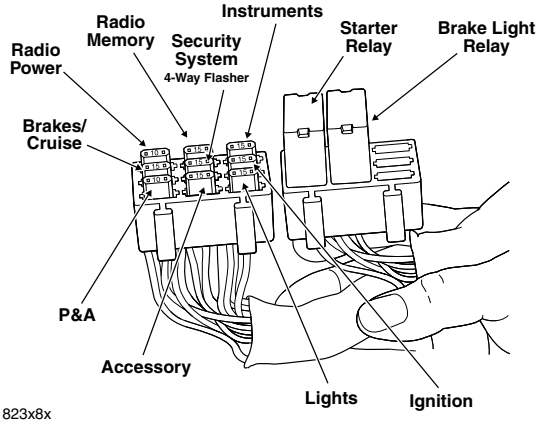
**Fuse Blocks (Under Left Side Cover)**

f1726b8x



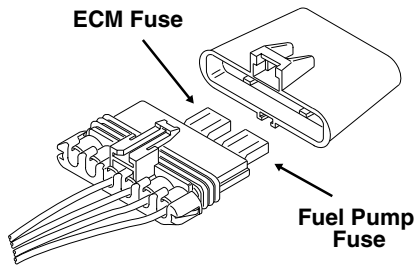
*NOTE*

*Radio power and radio memory fuses are absent from FLHR/C and FLHT models.*




f1823x8x

**EFI Fuse Holder (Under Right Side Cover)**




f1084axx

**Figure 8-1. Fuse Locations**

# TORQUE VALUES

| Item | ft/in-lbs | Nm |
|---|---|---|
| Ignition module socket head screws | 15-21 **in-lbs** | 1.7-2.4 Nm |
| MAP sensor TORX screw | 20-30 **in-lbs** | 2.3-3.4 Nm |
| Ignition coil bracket bracket bolts | 5-10 ft-lbs | 7-14 Nm |
| Spark plug | 11-18 ft-lbs | 15-24 Nm |
| Stator to crankcase TORX screws | 30-40 **in-lbs** | 3.4-4.5 Nm |
| Battery cable bolt | 60-96 **in-lbs** | 6.8-10.9 Nm |
| Voltage regulator locknuts | 7-10 ft-lbs | 10-14 Nm |
| 40 amp circuit breaker terminal nuts | 20-30 **in-lbs** | 2.3-3.4 Nm |
| Battery hold-down clamp TORX bolt | 15-20 ft-lbs | 20-27 Nm |
| Signal mounting bracket locknut | 18 ft-lbs | 24.4 Nm |
| Fork stud acorn nuts | 18 ft-lbs | 24.4 Nm |
| Tail lamp lense screws | 20-24 **in-lbs** | 2.3-2.7 Nm |
| Tail lamp circuit board/ plastic bracket | 40-48 **in-lbs** | 4.5-5.4 Nm |
| Rear fender tip lamp nuts | 20-24 **in-lbs** | 2.3 - 2.7 Nm |
| Front fender tip lamp nuts | 20-24 **in-lbs** | 2.3 - 2.7 Nm |
| Ignition switch to triple clamp screws | **40-45 in-lbs** | 4.5-5.1 Nm |
| Fairing cap TORX screws | 45-55 **in-lbs** | 5.1-6.2 Nm |
| Ignition switch button head screws | 18-23 **in-lbs** | 2.0-2.6 Nm |
| Instrument bezel TORX screws | 6-12 **in-lbs** | 0.7-1.4 Nm |
| Handlebar clamp to master cylinder housing screws | 60-80 **in-lbs** | 6.8-9.0 Nm |
| Lower and upper handle-bar switch housing TORX screws | 35-45 **in-lbs** | 4-5 Nm |
| Handlebar clamp to clutch lever bracket TORX screws | 60-80 **in-lbs** | 6.8-9.0 Nm |
| Neutral switch | 10-15 ft-lbs | 14-20 Nm |
| Horn stud flange nut (10mm) | 80-100 **in-lbs** | 9.0-11.3 Nm |
| Horn bracket acorn nut to rubber mount stud | 110 **in-lbs** | 12.4 Nm |
| 2 inch diameter gauge nuts | 5-10 **in-lbs** | 0.6-1.1 Nm |
| Tachometer bracket socket screws | 5-10 **in-lbs** | 0.6-1.1 Nm |
| | | **Continued ...** |

| Item | ft/in-lbs | Nm |
|---|---|---|
| Speedometer speed sensor screw | 7-9 ft-lbs | 9-12 Nm |
| Speedometer bracket socket screws | 5-10 **in-lbs** | 0.6-1.1 Nm |
| Console mounting bolt acorn nut | 80-100 **in-lbs** | 9-11 Nm |
| Fuel level sender plate screws | 18-22 **in-lbs** | 2.0-2.5 Nm |
| Cruise module locknuts | 9-11 ft-lbs | 12-15 Nm |
| Radio to support bracket socket screws | 45-60 **in-lbs** | 5.1-6.8 Nm |

# BULB CHART 8.2

| BULB CHART | | | | |
|---|---|---|---|---|
| **Lamp Description, All Lamps 12V** | **Number of Bulbs Required** | **Current Draw (Amperage)** | **Wattage** | **Harley-Davidson Part No.** |
| HEADLAMP | | | | |
| FLHT/C/U, FLHR/C | 1 | 4.58/5 | 55/60 | 67697-81 |
| FLTR | 2 | 4.58/5 | 55/60 | 67697-81 |
| POSITION LAMP (HDI) | 1 | .32 | 3.9 | 53438-92 |
| PASSING LAMPS | | | | |
| (DOM) | 2 | 2.50 | 30 | 68674-69 |
| (HDI) | 2 | 2.92 | 35 | 68847-98 |
| TAIL AND STOP LAMP | 1 | | | |
| Tail Lamp | | .59 | 7 | 68168-89A |
| Stop Lamp | | 2.25 | 27 | 68168-89A |
| Tail Lamp (HDI) | | .42 | 5 | 68169-90A |
| Stop Lamp(HDI) | | 1.75 | 21 | 68169-90A |
| License Plate (HDI) | 1 | .37 | 5.2 | 53436-97 |
| TURN SIGNAL LAMP | | | | |
| Front/Running | 2 | 2.25/.59 | 27/7 | 68168-89 |
| Front (HDI) | 2 | 1.75 | 21 | 68163-84 |
| Rear | 2 | 2.25 | 27 | 68572-64B |
| Rear (HDI) | 2 | 1.75 | 21 | 68163-84 |
| TOUR-PAK SIDE LAMPS * | 4 | .3 | 3.7 | 53439-79 |
| FENDER TIP LAMPS * | 2 | .3 | 3.7 | 53439-79 |
| INSTRUMENT PANEL LAMPS | | | | |
| FLHT/C/U, FLTR | | | | |
| High Beam | 1 | .15 | 2.1 | 68024-94 |
| Oil Pressure | 1 | .15 | 2.1 | 68024-94 |
| Neutral | 1 | .15 | 2.1 | 68024-94 |
| Turn Signal | 2 | .15 | 2.1 | 68024-94 |
| GAUGE LAMPS | | | | |
| FLHT/C/U, FLTR | | | | |
| Speedometer ** | | | | |
| Tachometer ** | | | | |
| Voltmeter | 1 | .24 | 3.4 | 67445-00 |
| Oil Pressure Gauge | 1 | .24 | 3.4 | 67445-00 |
| Air Temperature Gauge | 1 | .24 | 3.4 | 67445-00 |
| Fuel Gauge | 1 | .24 | 3.4 | 67445-00 |
| Engine ** | | | | |
| INSTRUMENT PANEL/ GAUGE LAMPS | | | | |
| FLHR/C | | | | |
| High Beam ** | | | | |
| Oil Pressure ** | | | | |
| Neutral ** | | | | |
| Turn Signal ** | | | | |
| Fuel Gauge ** | | | | |
| Speedometer ** | | | | |
| Odometer ** | | | | |
| Engine ** | | | | |

* Not Applicable to HDI

** LED Illuminated. LEDs are not repairable. Assembly must be replaced if LED fails.

# NOTES

# IGNITION MODULE 8.3

## REMOVAL

1. Remove right side saddlebag. See Section 2.22 SADDLEBAG, REMOVAL.
2. Gently pull side cover from frame downtubes (no tools required).
3. Push Data Link connector (pin side of 4-place Deutsch) up to disengage small end of slot on attachment clip from T-stud on side of battery box. Lift connector off T-stud.
4. Depress external latches on socket housing and use a rocking motion to separate pin and socket halves of both Connector [10] Black and Connector [11] Gray. See Figure 8-2.
5. Remove two allen head socket screws to free ignition module from battery box.

## INSTALLATION

1. Align holes in ignition module with threaded holes in side of battery box. Install two allen head socket screws and tighten to 15-21 **in-lbs** (1.7-2.4 Nm).
2. Install Connector [10] Black and Connector [11] Gray onto the ignition module. Align tabs on socket housing with grooves on pin housing and push connector halves together until latches “click.” Connectors are color coded for proper installation.
3. Place large end of slot on attachment clip of Data Link connector over T-stud on side of battery box. Push connector toward wire end to engage small end of slot.

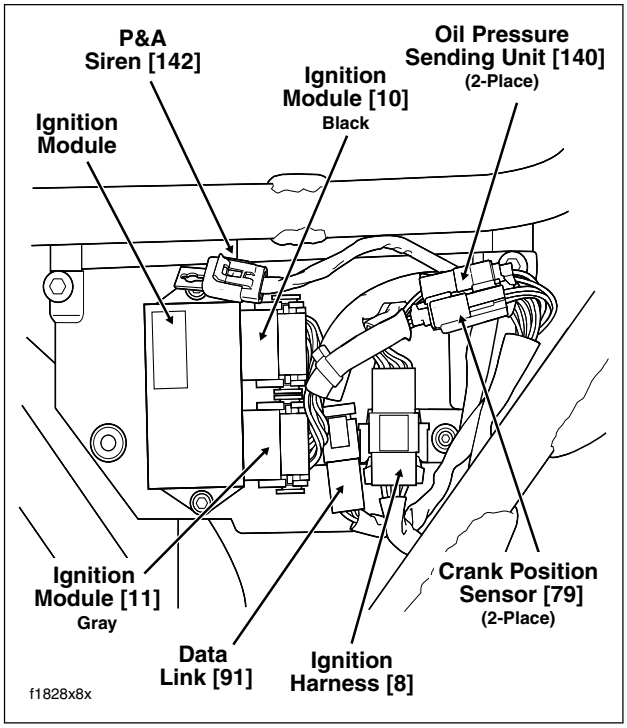



**Figure 8-2. Ignition Module (Under Right Side Cover)**

4. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required).
5. Install right side saddlebag. See Section 2.22 SADDLEBAG, INSTALLATION.

## MANIFOLD ABSOLUTE PRESSURE SENSOR

### Removal

1. Partially remove fuel tank. See Section 4.7 FUEL TANK, PARTIAL REMOVAL, FLHT/C, FLTR, or FLHR.
2. Pull external latch outward and use rocking motion to remove electrical connector.
3. Remove T20 TORX screw to release retaining clip from intake manifold. See Figure 8-3.
4. Carefully pull pressure port (enveloped in rubber seal) from hole in intake manifold.
5. If reusing sensor, inspect condition of rubber seal. Replace the seal if it is cut, torn or shows signs of deterioration.

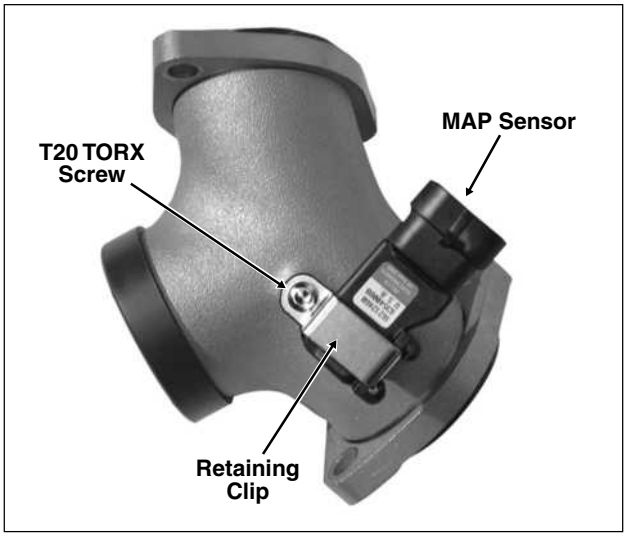



**Figure 8-3. Intake Manifold**

### Installation

1. Install rubber seal on pressure port, if removed.
2. With port side down, slide end of retaining clip in slot at side of sensor. Aligning hole in retaining clip with threaded hole in intake manifold, carefully press pressure port into bore,
3. Install T20 TORX screw and tighten to 20-30 **in-lbs** (2.3-3.4 Nm). See Figure 8-3.
4. Align latch on socket housing with locking tab on pin housing and push connector halves together until latch clicks.
5. Install fuel tank. See Section 4.7 FUEL TANK, INSTALLATION (AFTER PARTIAL REMOVAL), FLHT/C, FLTR, or FLHR.

## CAMSHAFT POSITION SENSOR

See Section 9.2 SENSORS, CAMSHAFT POSITION SENSOR.

## CRANKSHAFT POSITION SENSOR

See Section 9.2 SENSORS, CRANKSHAFT POSITION SENSOR.

# IGNITION COIL 8.5

## REMOVAL

1. Partially remove fuel tank. For carbureted models, see Section 4.7 FUEL TANK, PARTIAL REMOVAL, FLHT/C, FLTR, or FLHR. For fuel injected models, see Section 9.3 FUEL TANK, PARTIAL REMOVAL, FLHTC/U-I, FLTR-I, or FLHR/C-I.
2. Pull external latch outward and use rocking motion to remove electrical connector from left side of ignition coil.
3. Unplug spark plug cables from coil terminal connections.
4. Remove two bolts with lockwashers to free coil from bracket. Remove nut plate. Remove ignition coil.

## INSTALLATION

1. Position **new** ignition coil in recess of coil bracket welded to underside of frame backbone. Coil connections must face rear of vehicle.
2. Align holes in nut plate with holes at front of coil bracket. Insert bolts (with lockwashers) through bracket and ignition coil into nut plate. Tighten bolts to 5-10 ft-lbs (7-14 Nm).
3. Install spark plug cable to rear cylinder onto right side coil connection. Install spark plug cable to front cylinder onto left side coil connection. Ignition coil terminal connections are stamped F(ront) and R(ear) to ensure proper assembly.
4. Verify that spark plug cables are captured in J-clamp on left side of frame backbone.
5. Align latch on socket housing with locking tab on pin housing and push connector halves together until latch clicks.
6. Install fuel tank. For carbureted models, see Section 4.7 FUEL TANK, INSTALLATION (AFTER PARTIAL REMOVAL), FLHT/C, FLTR, or FLHR. For fuel injected models, see Section 9.3 FUEL TANK, INSTALLATION (AFTER PARTIAL REMOVAL), FLHTC/U-I, FLTR-I, or FLHR/C-I.

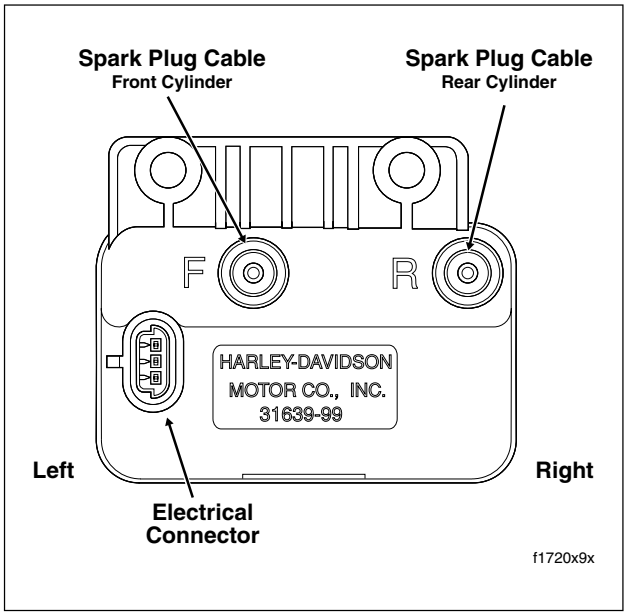



**Figure 8-4. Ignition Coil (Rear View)**

# SPARK PLUGS/SPARK PLUG CABLES 8.6

## SPARK PLUGS

Inspect spark plugs at 5000 miles (8000 km) and replace at 10,000 miles (16,000 km).

The number 6R12 plug is supplied as original equipment and is the only plug that should be used. The resistor plug reduces radio interference created by the ignition system and will not adversely affect performance or fuel economy.

### REMOVAL

1. Remove spark plug cables. See SPARK PLUG CABLES on the next page.
2. Remove spark plug using a 5/8 inch spark plug socket.

### INSPECTION

See Figure 8-5. Examine plugs as soon as they have been removed. The deposits on the plug base are an indication of the plug efficiency and are a guide to the general condition of rings, valves, carburetor and ignition system.

a. A wet black and shiny deposit on plug base, electrodes and ceramic insulator tip indicate an oil fouled plug. The condition may be caused by worn rings and pistons, loose valves or seals, weak battery or faulty ignition.

b. A dry fluffy or sooty black deposit indicates a too rich carburetor air-fuel mixture or long periods of engine idling. Excessive use of the enrichener may also cause this condition.

c. An overheated plug can be identified by a light brown, glassy deposit. This condition may be accompanied by cracks in the insulator or by erosion of the electrodes. This condition is caused by too lean an air-fuel mixture, 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 should be replaced.

d. A plug with white, yellow or light tan to rusty brown powdery deposit indicates balanced combustion. The deposits may be cleaned off at regular intervals if desired.

### CLEANING

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




**Figure 8-5. Types of Plug Base Deposits**

2. 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.
3. Adjust spark plug gap. See ADJUSTMENT below.

### ADJUSTMENT

Use only a wire-type gauge. Bend the outside electrode so only a slight drag on the gauge is felt when passing it between electrodes. Never make adjustments by bending the center electrode. Set gap on all plugs at 0.038-0.043 in. (0.97-1.09 mm).

### INSTALLATION

1. Before installing spark plugs, check condition of threads in cylinder head and on plug. If necessary soften deposits with penetrating oil and clean out with a thread chaser.
2. Apply a very light coating of ANTISEIZE LUBRICANT to spark plug threads. Install spark plug. Tighten spark plug to 11-18 ft-lbs (15-24 Nm).

   If a torque wrench is not available, finger-tighten spark plug and then using a spark plug wrench, tighten plug an additional 1/4-turn.

3. Connect spark plug cables to spark plugs. Make sure boots/caps are secured properly.
4. Check engine idle speed, and adjust if necessary.

# SPARK PLUG CABLES

Resistor-type high-tension cables have a carbon-impregnated fabric core (instead of solid wire) for radio noise suppression and improved reliability of electronic components. Use the exact replacement cable for best results.

## REMOVAL

**⚠WARNING**

**Never disconnect a spark plug cable with the engine running. Doing so will result in an electric shock from the ignition system that could result in death or serious injury.**

**CAUTION**

**When disconnecting a spark plug cable from the spark plug terminal, always grasp and pull on the rubber boot at the end of the cable assembly (as close to the spark plug terminal as possible). Pulling on the cable portion will damage the carbon core.**

1. Disconnect spark plug cables from ignition coil and spark plug terminals.

## INSPECTION

1. Check cables for cracks or loose terminals.
2. Check spark plug cable resistance with an ohmmeter. Resistance must be as follows:

### Table 8-1. Spark Plug Cable Resistance

| Position | Cable Length | Resistance (Ohms) |
|---|---|---|
| Front /Rear | 20 Inches (508mm) | 5,000 - 11,666 |

3. Replace cables that are worn or damaged, or that do not meet resistance specifications.
4. Check cable boots/caps for cracks or tears. Also check for loose fit on ignition coil and spark plugs. Replace boots/caps if defects are noted.

## INSTALLATION

1. Connect spark plug cables to ignition coil and spark plugs.
2. Make sure boots/caps are secured properly; this will provide the necessary moisture-proof environment for the ignition coil and spark plug terminals.

## REMOVAL

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠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.**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. Remove the primary chaincase cover. Remove the clutch, primary chain, compensating sprocket and shaft extension as a single assembly. See Section 6.5 PRIMARY CHAINCASE, REMOVAL, steps 3-15.
4. Remove the alternator rotor spacer, if present.

**⚠CAUTION**

**The high-output rotor is used on fuel injected vehicles, FLHR/C-I excepted. Since the high-output rotor contains magnets that are considerably more powerful than those used on low-output rotors, the ROTOR RE-MOVER/INSTALLER and SHAFT PROTECTOR SLEEVE (HD-41771) must be used to prevent parts damage and possible hand injury during removal and installation.**

1. Remove the rotor as follows:

### High Output Rotor - 45 Amp

a. Verify that threads of engine sprocket shaft are clean, especially of old Loctite material. Thread the Shaft Protector Sleeve onto the shaft. See Figure 8-6.

b. Turn thumbscrews of Rotor Remover/Installer into threaded holes in rotor face.

c. Rotate handle of forcing screw in a clockwise direction to remove rotor from shaft.

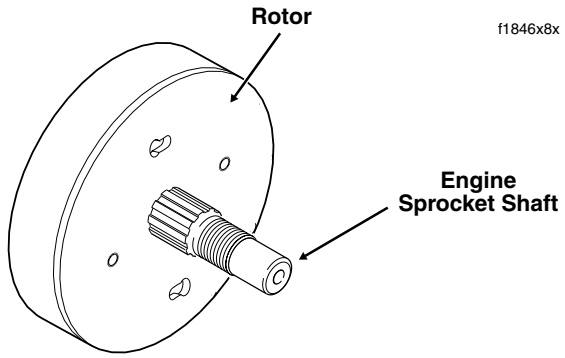
### Low Output Rotor - 38 Amp

**CAUTION**

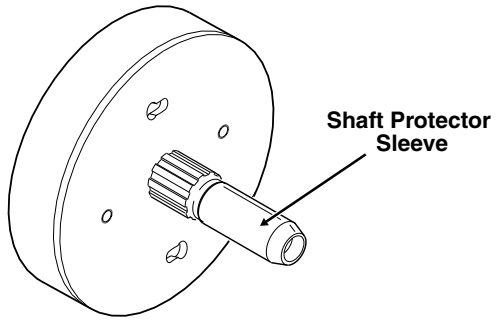
**Do not strike or drop rotor. Damage to magnet adhesive may result in rotor failure.**

a. Fabricate wire hooks or use the ends of two allen wrenches to carefully pull rotor at holes in rotor face.

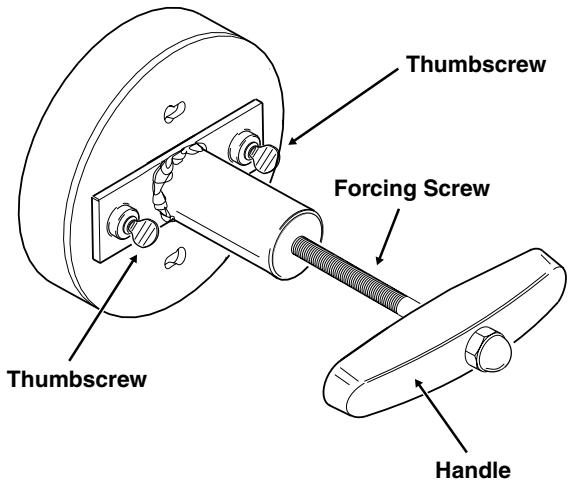
b. Pull rotor from stator. Magnets in rotor cause some resistance during removal.




**1. Clean Sprocket Shaft Threads.**




**2. Install Shaft Protector Sleeve.**




**3. Install Rotor Remover/Installer. Rotate Handle in a Clockwise Direction.**

**Figure 8-6. Remove Rotor from Engine Sprocket Shaft**

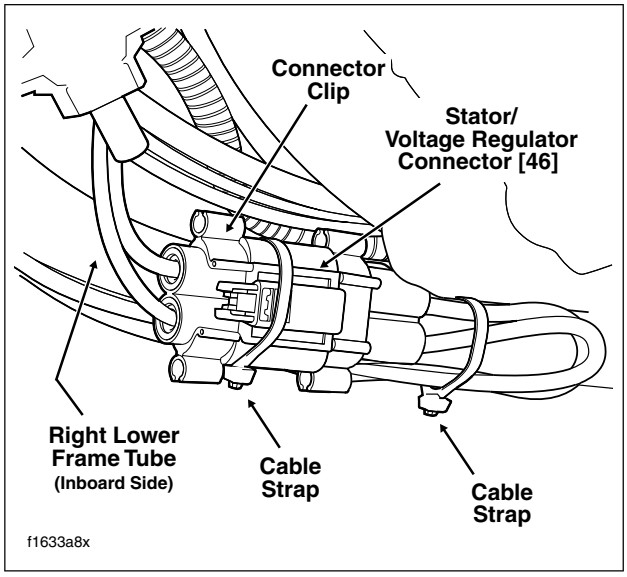



**Figure 8-7. Stator/Voltage Regulator Connector**

2. Moving to right side of vehicle, carefully cut two cable straps holding stator/voltage regulator connector/clip and cables to lower frame tube. See Figure 8-7. Pull connector clip toward rear of vehicle to release from T-stud on inboard side of frame tube. Remove clip from connector.

3. Depress the external latch and use a rocking motion to separate pin and socket halves of connector. Looking into the socket housing, note the three holes on one side of the secondary locking wedge. See Figure 8-8.

   Insert the blade of a small screwdriver between the socket housing and the locking wedge on this side of the connector. Gently pivot the end of the screwdriver to pop up the wedge. Prying on the opposite side may damage the secondary lock. Lift terminal latches inside socket housing and back out sockets through wire end of connector.

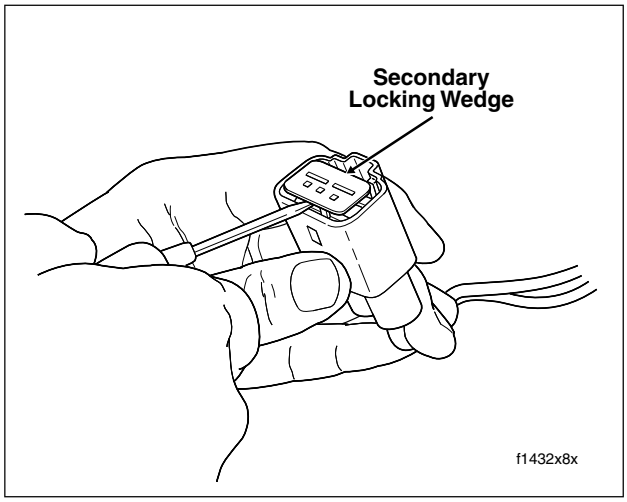



**Figure 8-8. Remove Secondary Locking Wedge**

4. Open two cable clips on inboard side of lower frame crossmember. Free stator/voltage regulator cables from cable clips.

*NOTE*

*For best results, insert blade of small screwdriver into gap at side of clip and gently rotate end of screwdriver to pop open.*

5. Draw stator connector sockets and cables to left side of engine.
6. Using a T27 TORX drive head, remove four screws to free stator from crankcase. Discard screws.
7. Using point of awl, carefully lift capped rib on grommet away from crankcase and then insert into bore between grommet and casting. See Figure 8-9. Tilt awl slightly squirting denatured alcohol or glass cleaner into opening. Repeat this step at one or two other locations around grommet.
8. While pushing on capped rib from outside of crankcase, draw grommet through bore by pulling on cable stop with needle nose pliers. Rock grommet back and forth to facilitate removal, if necessary. Exercise caution to avoid damaging ribs on grommet if stator is to be reused.

## CLEANING AND INSPECTION

1. Check inside of rotor and remove any metal fragments captured by magnets.
2. Clean the rotor using a petroleum solvent. Clean the stator and grommet by wiping it with a clean cloth.

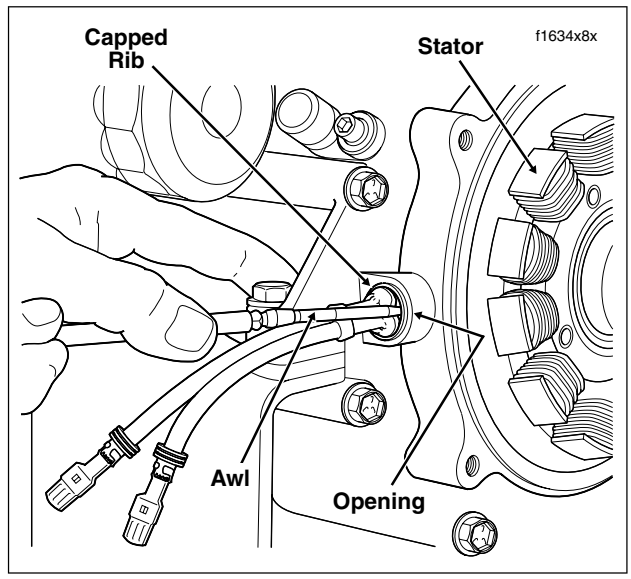



**Figure 8-9. Remove Grommet From Crankcase**

## INSTALLATION

1. From inside crankcase, feed socket terminals and stator cable through hole in crankcase.
2. Thorougly lubricate grommet with denatured alcohol or glass cleaner. Ribs of grommet must be clean and free of dirt and oily residue.
3. Carefully grasp cable stop behind grommet with a needle nose pliers. Push grommet into crankcase bore while carefully pulling on outside cable. Installation is complete when cable stop contacts casting and capped rib of grommet exits crankcase bore.
4. If necessary, carefully run awl around edge of capped rib so that it rests flat against seating surface on crankcase.

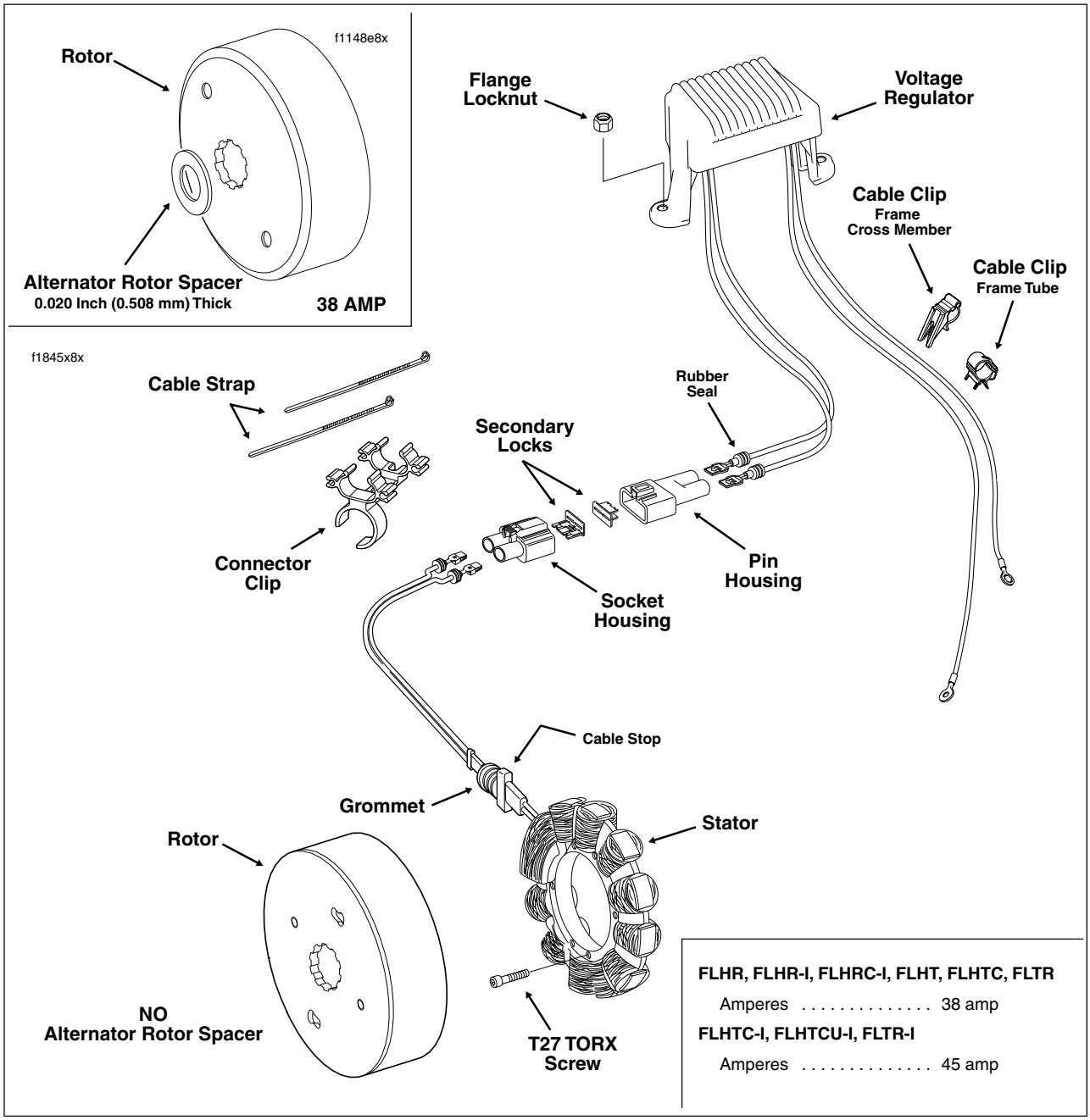



**Figure 8-10. Stator/Voltage Regulator Assemblies - 45 AMP**

**CAUTION**

**Do not reuse T27 TORX screws. The threads of the screws contain a locking compound in pellet form. When the screw is started, the pellet breaks releasing the compound.**

5. Using a T27 TORX drive head, install four **new** screws to fasten stator to crankcase. Alternately tighten screws to 30-40 **in-lbs** (3.4-4.5 Nm).
6. Install the rotor as follows:

### High Output Rotor - 45 Amp

a. Install the Shaft Protector Sleeve and Rotor Remover/Installer, if removed. See Figure 8-6.

*NOTE*

*The Shaft Protector Sleeve not only protects the threads from the splines of the rotor, but acts as a guide to ensure that the rotor is properly centered.*

b. Center ball on forcing screw in recess at end of engine sprocket shaft. Rotate the handle of the tool in a counterclockwise direction to ease rotor into position over stator.

c. Loosen thumbscrews and remove Rotor Remover/Installer. Remove Shaft Protector Sleeve.

d. Install the shaft extension on the engine sprocket shaft. (No alternator rotor spacer is provided.)

### Low Output Rotor - 38 Amp

a. Slide rotor over stator with the concave side inboard.

**⚠CAUTION**

**When installing rotor, keep fingers away from edge that mates with crankcase. Since rotor is magnetized, as it nears the crankcase it may be pulled in with considerable force, resulting in pinched fingers or other hand injury.**

b. See inset of Figure 8-10. Install the 0.020 inch (0.508 mm) thick alternator rotor spacer and the shaft extension on the engine sprocket shaft.

7. Draw stator connector sockets and cables to right side of vehicle capturing cables in two cable clips on inboard side of lower frame crossmember.
8. Feed each socket into wire end of stator/voltage regulator connector until it “clicks” in place. Verify that sockets will not back out of chambers; a slight tug on each wire will confirm that it is locked. Insert secondary locking wedge into socket housing and press down until it snaps in place. Insert socket housing into pin housing.
9. Install connector clip onto stator/voltage regulator connector. Pull clip toward front of vehicle to engage T-stud on inboard side of frame tube. Insert **new** cable strap through slot in frame weldment and secure connector and clip to lower frame tube. Using **new** cable strap, secure looped cables on pin side of connector to lower frame tube. Cut excess cable strap material. See Figure 8-7.

**CAUTION**

**A machined surface at the bottom of the crankcase has an edge sharp enough to chafe or cut the voltage regulator cables. To avoid electrical problems, be sure there is enough clearance to prevent powertrain movement from causing cable damage.**

10. Install the clutch, primary chain, compensating sprocket and shaft extension as a single assembly. Install the primary chaincase cover. See Section 6.5 PRIMARY CHAINCASE, INSTALLATION, steps 9-33.
11. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
12. Install seat. See Section 2.21 SEAT, INSTALLATION.

# VOLTAGE REGULATOR 8.8

## REMOVAL

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠WARNING**

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

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. Unthread bolt and remove battery positive cable (red) from battery positive (+) terminal.
4. Using a T40 TORX drive head, loosen bolt to move lip of hold-down clamp off edge of battery. Remove battery from battery box.
5. Remove terminal nut from left side ground post in front of battery box. Remove internal tooth ring terminal (with black shrink tube). See Figure 8-11.
6. Remove terminal nut from silver post of 40 amp circuit breaker. Remove ring terminal (with yellow shrink tube).
7. Standing on right side of vehicle, release cables from clip at front of battery box.

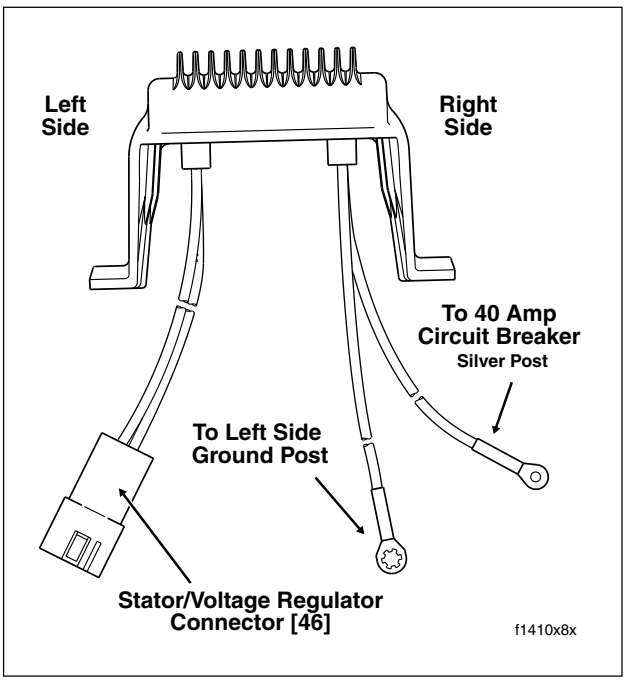



**Figure 8-11. Voltage Regulator**

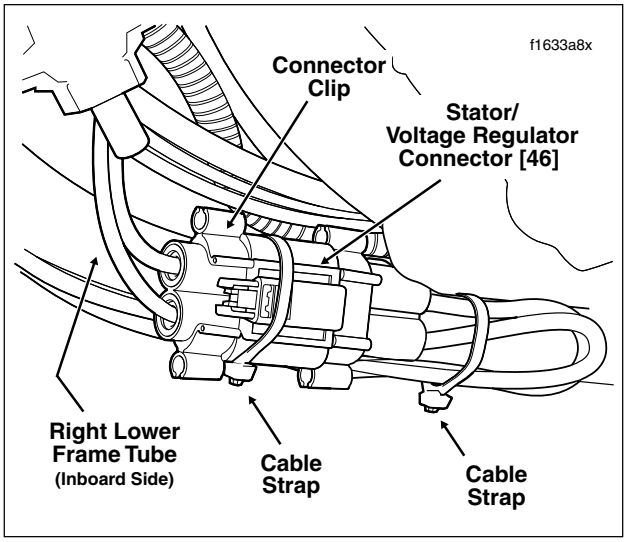



**Figure 8-12. Stator/Voltage Regulator Connector**

8. Cut five cable straps at locations shown in illustration at bottom of Figure 8-13.
9. Open two cable clips on lower frame tube T-studs. Free voltage regulator cables from cable clips.

*NOTE*

*For best results, insert blade of small screwdriver into gap at side of clip and gently rotate end of screwdriver to pop open.*

10. Pull connector clip toward rear of vehicle to release from T-stud on inboard side of frame tube. Remove clip from connector. Depress the external latch and use a rocking motion to separate pin and socket halves of connector. See Figure 8-12.
11. Open two cable clips on outboard side of lower frame crossmember. Free stator/voltage regulator cables from cable clips.
12. Remove flange locknuts to free voltage regulator from studs on lower frame cross member. Remove voltage regulator and cables from vehicle.

## INSTALLATION

1. Slide voltage regulator over studs on frame cross member at front of vehicle. Install flange locknuts on studs and tighten to 7-10 ft-lbs (10-14 Nm).
2. Route cables (with pin connector) on left side of voltage regulator (AC alternator input) through two cable clips at front of lower frame cross member. Run cables below lower frame cross member toward cam cover following inboard side of right lower frame tube.

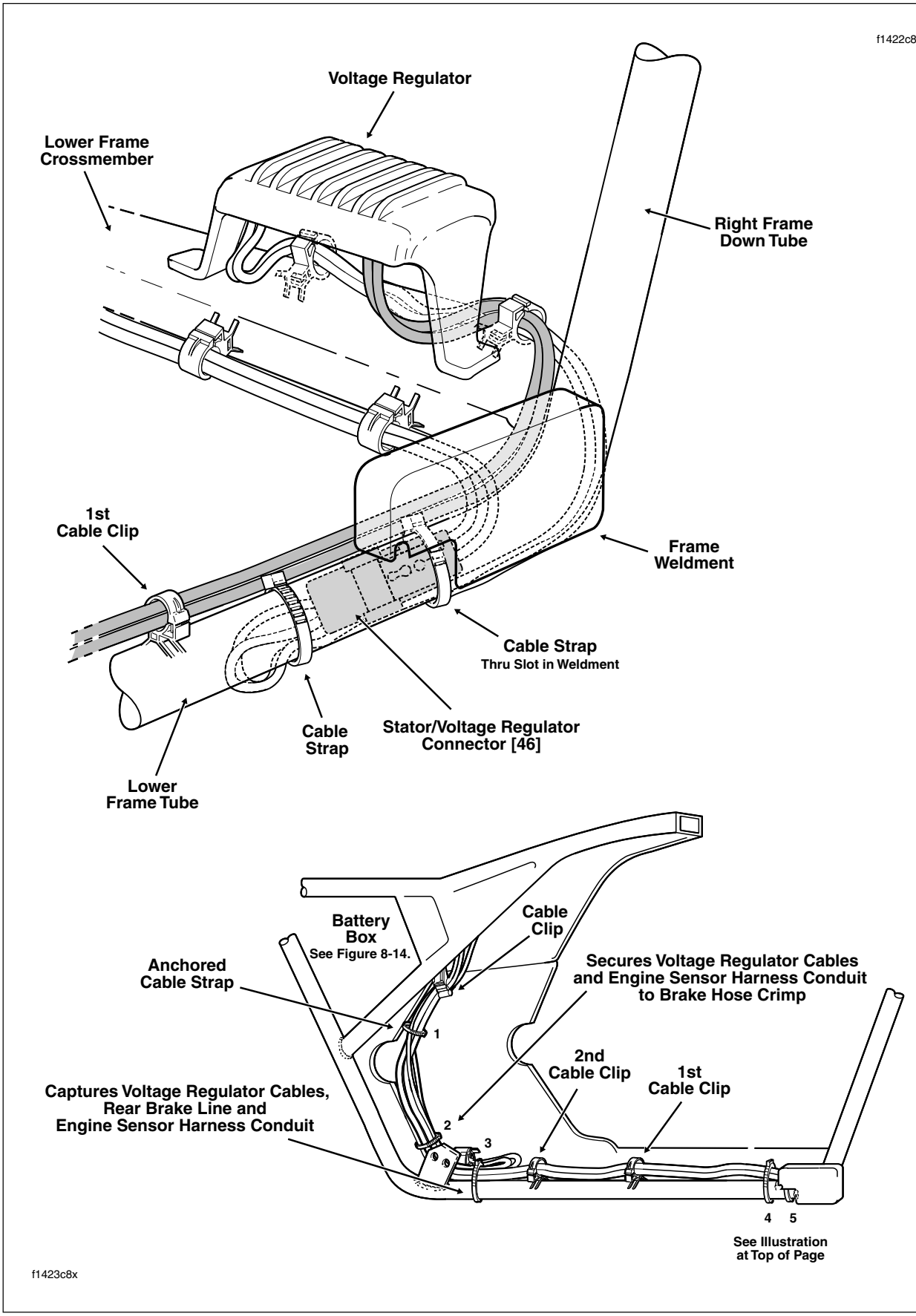



**Figure 8-13. Voltage Regulator Cable Routing (Right Side View)**

3. Mate pin and socket housings of stator/voltage regulator connector. Push halves together until the latch “clicks.”
4. Install connector clip onto stator/voltage regulator connector. Pull clip toward front of vehicle to engage T-stud on inboard side of frame tube. Insert **new** cable strap through slot in frame weldment and secure connector and clip to lower frame tube. Using **new** cable strap, secure looped cables on pin side of connector to lower frame tube. Cut excess cable strap material. See illustration at top of Figure 8-13.

**CAUTION**

**A machined surface at the bottom of the crankcase has an edge sharp enough to chafe or cut the voltage regulator cables. To avoid electrical problems, be sure there is enough clearance to prevent powertrain movement from causing cable damage.**

5. Route cables (with ring terminals) on right side of voltage regulator (DC output) through cable clip at front of lower frame cross member. Run cables above lower frame cross member toward rear of vehicle following top of right lower frame tube.
6. Secure cables along top of lower frame tube using two cable clips on frame tube T-studs. Snap each clip closed after capturing cables.

*NOTE*

*The cable clips also capture the engine sensor harness conduit and rear brake line.*

7. At rear of lower frame tube, route cables along inboard side of rear brake light switch bracket and then upward along rear of starter through opening at front of battery box. Capture cables in clip on T-stud at battery box location.
8. Install internal tooth ring terminal (with black shrink tube) against painted surface on left side ground post in front of battery box. Install other ring terminal (with yellow shrink tube) on silver post of 40 amp circuit breaker. Install terminal nuts and tighten to 20-30 **in-lbs** (2.3-3.4 Nm). See Figure 8-14.
9. Install three **new** cable straps at locations shown in illustration at bottom of Figure 8-13. Hole in frame at rear location requires anchored type cable strap.

**CAUTION**

**Verify that there is enough clearance between voltage regulator cables and bottom rear screw of oil filler spout. Move cables behind brake line and cable strap to brake hose crimp. Failure to do so may result in cable wear or damage resulting in electrical problems.**

10. Place battery into battery box, terminal side forward.

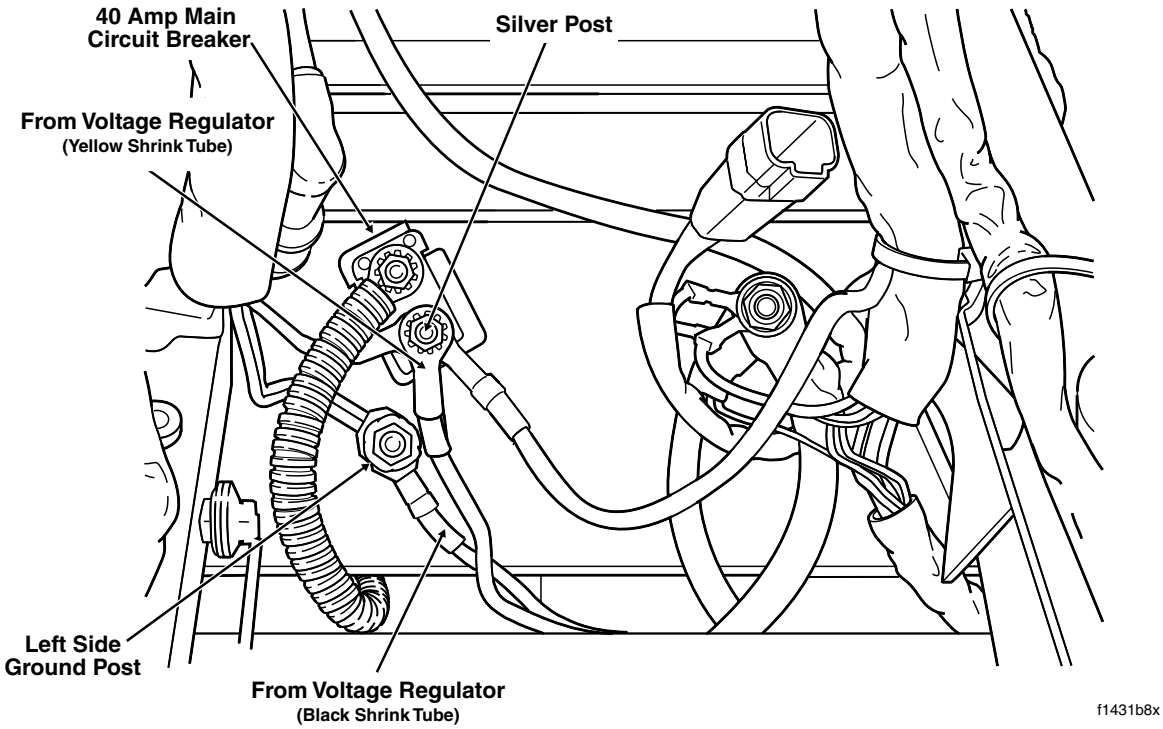



**Figure 8-14. Electrical Connections - Upper Frame Cross Member (Under Seat)**

**⚠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 which could result in death or serious injury.**

11. Insert bolt through battery positive cable (red) into threaded hole of battery positive (+) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
12. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
13. Rotate the hold-down clamp so that the lip (with rubber pad) rests on the edge of the battery. Using a T40 TORX drive head, tighten the clamp bolt to 15-20 ft-lbs (20-27 Nm).
14. Load test charging system.
15. Install seat. See Section 2.21 SEAT, INSTALLATION.

## GENERAL

All batteries are permanently sealed, maintenance-free, valve-regulated, lead/calcium and sulfuric acid batteries. The batteries are shipped pre-charged and ready to be put into service. Do not attempt to open these batteries for any reason.

**⚠WARNING**

**All batteries contain electrolyte. Electrolyte is a sulfuric acid solution that is highly corrosive and can cause severe chemical burns. Avoid contact with skin, eyes, and clothing. Avoid spillage. Always wear protective face shield, rubberized gloves and protective clothing when working with batteries. A warning label is attached to the top of the battery. See Figure 8-15 and Figure 8-16. Never remove warning label from battery. Failure to read and understand all precautions contained in warning label before performing any service on batteries could result in death or serious injury.**

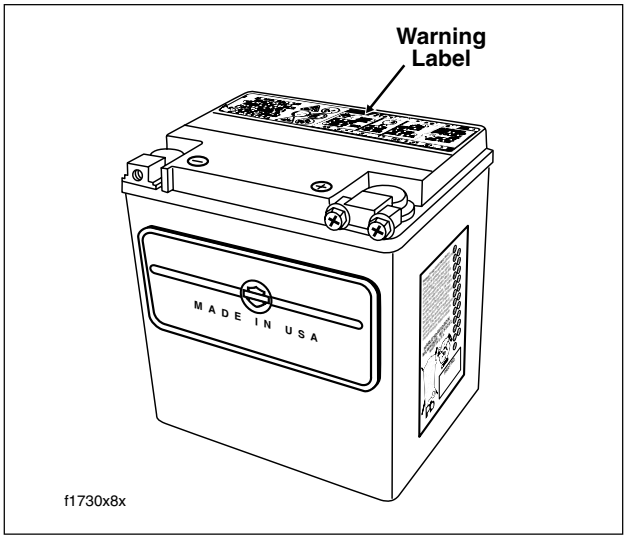



**Figure 8-15. Maintenance-Free Battery**

### Table 8-2. Antidote

| | |
|---|---|
| **External -** | **Flush with water** |
| **Internal -** | **Drink large quantities of milk or water, followed by milk of magnesia, vegetable oil or beaten eggs. Call doctor immediately.** |
| **Eyes -** | **Flush with water, get immediate medical attention.** |

## VOLTMETER TEST

See Table 8-3. The voltmeter test provides a general indicator of battery condition. Check the voltage of the battery to verify that it is in a 100% fully charged condition. If the open circuit (disconnected) voltage reading is below 12.6V, charge the battery and then recheck the voltage after the battery has set for one to two hours. If the voltage reading is 12.8V or above, perform the LOAD TEST described in this section.




**Figure 8-16. Battery Warning Label**

**Table 8-3. Voltmeter Test**

| Voltage (OCV) | State of Charge |
|---|---|
| 12.8 | 100% |
| 12.6 | 75% |
| 12.3 | 50% |
| 12.0 | 25% |
| 11.8 | 0% |

## DISCONNECTION AND REMOVAL

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠WARNING**

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

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. Unthread bolt and remove battery positive cable (red) from battery positive (+) terminal.
4. Using a T-40 TORX drive head, loosen bolt to move lip of hold-down clamp off edge of battery. Remove battery from battery box.

## CLEANING AND INSPECTION

1. Battery top must be clean and dry. Dirt and electrolyte on top of the battery can cause battery to self-discharge. Clean battery top with a solution of baking soda (sodium bicarbonate) and water (5 teaspoons baking soda per quart or liter of water). When the solution stops bubbling, rinse off the battery with clean water.
2. Clean cable connectors and battery terminals using a wire brush or sandpaper. Remove any oxidation.
3. Inspect the battery screws, clamps and cables for breakage, loose connections and corrosion. Clean clamps.
4. Check the battery posts for melting or damage caused by overtightening.
5. 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.
6. Inspect the battery case for cracks or leaks.

## BATTERY CHARGING

### SAFETY PRECAUTIONS

Never charge a battery without first reviewing the in-structions 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 (+) terminal and black negative (–) lead to the negative (–) terminal. If the battery is still in the vehicle, connect the negative lead to the chassis ground. Be sure that the ignition and all electrical accessories are turned off.**
- **Make sure that 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 the 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:

- Vehicle lights appear dim.
- Electric starter sounds weak.
- 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, discontinue charging and allow the battery to cool. Overheating may result in plate distortion, internal shorting, dryout or other damage.**

## Table 8-4. Battery Charging Rates/Estimated Times

| Battery Amp-Hour | State of Charge | | 3 Amp Charger | 6 Amp Charger | 10 Amp Charger | 20 Amp Charger |
|---|---|---|---|---|---|---|
| | Voltage Reading | % of Charge | | | | |
| TOURING 28 | 12.8 V | 100% | - | - | - | - |
| | 12.6 V | 75% | 2.5 hours | 1.25 hours | 45 minutes | 25 minutes |
| | 12.3 V | 50% | 5 hours | 2.5 hours | 1.5 hours | 50 minutes |
| | 12.0 V | 25% | 7.5 hours | 3.75 hours | 2.25 hours | 70 minutes |
| | 11.8 V | 0% | 10 hours | 5 hours | 3 hours | 1.5 hours |

The figures listed above assume that the battery is charging at room temperature. If warmer than room temperature, use a slightly shorter charging time. If colder, use a slightly longer charging time.

The use of constant current chargers to charge sealed maintenance-free batteries is not recommended. Any overcharge will cause dry-out and premature battery failure. If a constant current charger is the only type available, do **not** exceed the charge times listed above and do **not** continue charging the battery if it gets hot. When charging, never exceed 15 volts for more than 30 minutes.

1. Perform a voltmeter test to determine the state of charge. See VOLTMETER TEST, in this section. If 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. Remove the battery from the motorcycle. See DISCONNECTION AND REMOVAL in this section. 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.**

3. Connect the red battery charger lead to the positive (+) terminal of the battery.
4. 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 that the ignition and all electrical accessories are turned off.*

5. Step away from the battery and turn on the charger. See the charging instructions in Table 8-4.

**⚠WARNING**

**Always unplug or turn OFF the battery charger before disconnecting the charger clamps from the battery. Disconnecting 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.**

6. After the battery is fully charged, disconnect the black battery charger lead to the negative (–) terminal of the battery.
7. Disconnect the red battery charger lead to the positive (+) terminal of the battery.
8. Mark the charging date on the battery.
9. Perform a load test to determine the condition of the battery. See LOAD TEST below.

## LOAD TEST

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

**CAUTION**

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

1. Always fully charge the battery before testing or test readings will be incorrect. See CHARGING BATTERY, in this section. Load testing a discharged battery can also result in permanent battery damage.

2. After charging, allow battery to stand for at least one hour before testing.

**WARNING**

**Always turn the battery load tester OFF before connecting the tester cables to the battery terminals. Connecting tester cables with the load tester 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.**

3. Connect tester leads to battery posts and place induction pickup over negative (black) cable. See Figure 8-17.

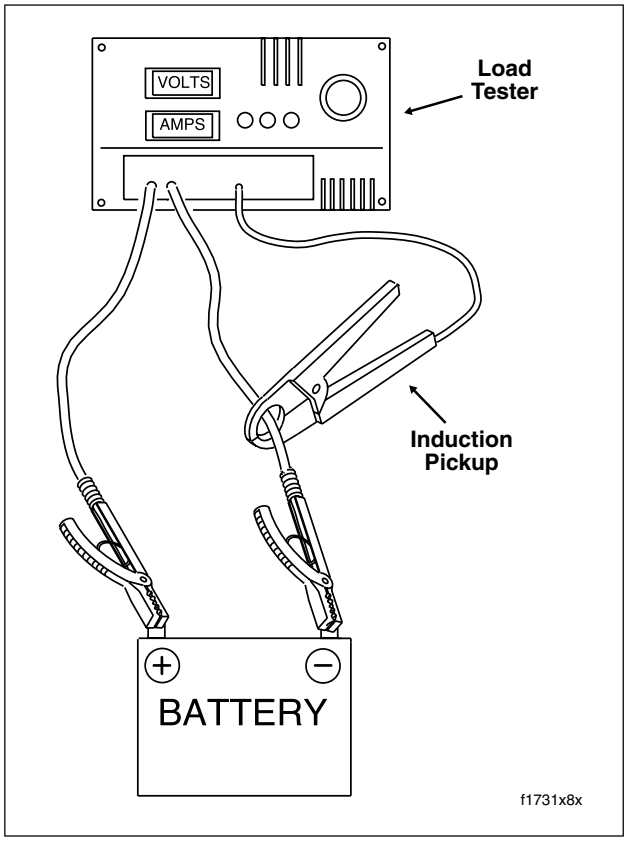



**Figure 8-17. Load Test Battery**

**CAUTION**

**To avoid load tester and/or battery damage, do not leave the load tester switch turned ON for more than 20 seconds.**

4. Referencing Table 8-4, load battery at 50% of CCA rating using the load tester. Voltage reading after 15 seconds should be 9.6V or more at 70°F. (21°C).

**Table 8-5. Battery Load Test**

| COLD CRANKING AMPERAGE (CCA) | 100% | 50% |
|---|---|---|
| TOURING | 300 | 150 |

**WARNING**

**Always turn the battery load tester OFF before disconnecting the tester cables from the battery terminals. Disconnecting tester cables with the load tester 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.**

5. Install the battery on the motorcycle. See INSTALLATION AND CONNECTION below.

## BATTERY CABLE ROUTING

**WARNING**

**Hole on left side of frame crossmember is used for cruise cable routing only. Use of the hole for battery cable routing can result in contact with hot exhaust pipe causing melting or burning of the cable insulation, damage that can lead to driveability problems or fire hazard, conditions which could result in death or serious injury.**

Route all battery cables through opening between tray of battery box and bottom of frame cross member. See Figure 8-18.

## INSTALLATION AND CONNECTION

1. Place the fully charged battery into the battery box, terminal side forward.

**CAUTION**

**Connect the cables to the correct battery terminals or damage to the motorcycle electrical system will occur.**

**⚠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 which could result in death or serious injury.**

**CAUTION**

**Overtightening bolts can damage battery terminals.**

1. Insert bolt through battery positive cable (red) into threaded hole of battery positive (+) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
2. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
3. Apply a light coat of petroleum jelly or corrosion retardant material to both battery terminals.
4. Rotate the hold-down clamp so that the lip (with rubber pad) rests on the edge of the battery. Using a T-40 TORX drive head, tighten the clamp bolt to 15-20 ft-lbs (20-27 Nm).
5. Install seat. See Section 2.21 SEAT, INSTALLATION.

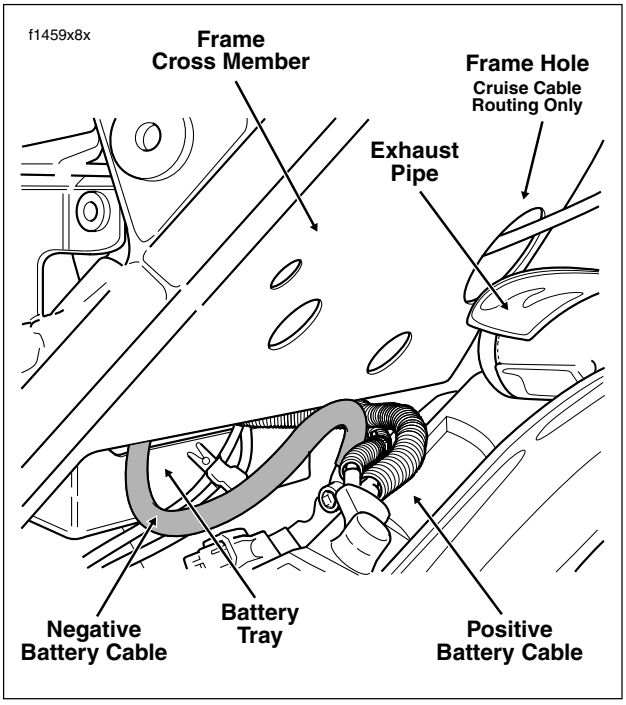



**Figure 8-18. Battery Cable Routing (Right Side View)**

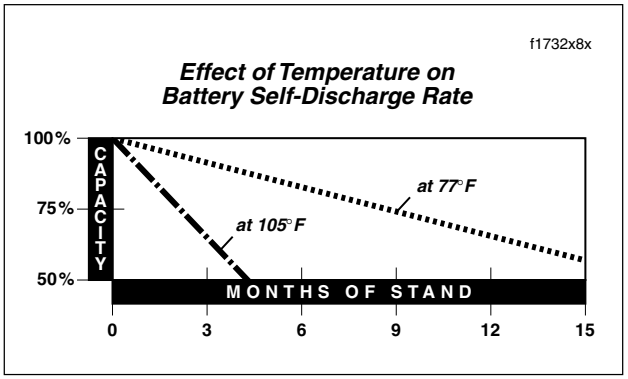



**Figure 8-19. Battery Self-Discharge Rate**

# 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 CHARGING BATTERY, in this section.

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. See Figure 8-19.

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 H-D Battery Tender Automatic Battery Charger (P/N 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 CHARGING BATTERY, in this section.

# HEADLAMP (FLHR/C, FLHT/C/U) 8.10

## HEADLAMP ASSEMBLY

### REMOVAL

1. Remove the Phillips screw at the bottom of the headlamp door (chrome ring). Remove the headlamp door.
2. **FLHT/C/U:** Remove the four TORX screws to free the headlamp housing from the fairing.

   **FLHR/C:** Remove the seven Phillips screws to free the headlamp housing from the headlamp nacelle.
3. Squeeze the two external tabs (if present) to remove the wire connector at the back of the headlamp bulb. Remove the headlamp housing assembly from the vehicle.

### INSTALLATION

1. Install the wire connector at the back of headlamp bulb.
2. **FLHT/C/U:** Align holes in headlamp housing with those in fairing (headlamp door bracket at bottom). Install the four TORX screws.

   **FLHR/C:** Align holes in headlamp housing with those in headlamp nacelle (headlamp door bracket at bottom). Install the seven Phillips screws.
3. Fit the square-shaped portion of the headlamp door spring into the slot at the top of the headlamp housing and then snap the headlamp door (chrome ring) into place. Install the Phillips screw at the bottom of the headlamp door.

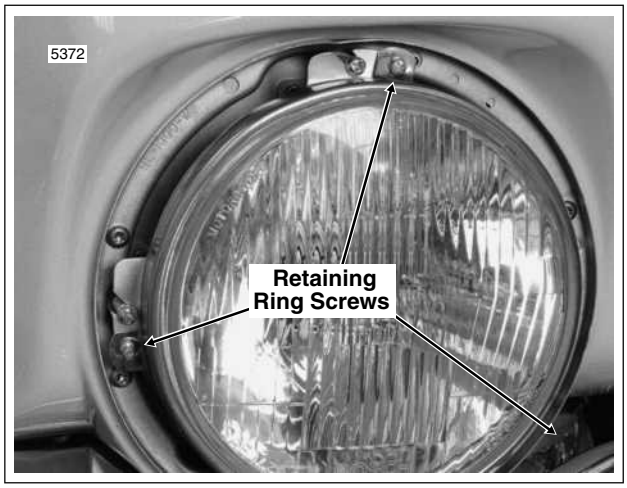



**Figure 8-20. Remove Retaining Ring Screws (FLHT/C/U Model Shown)**

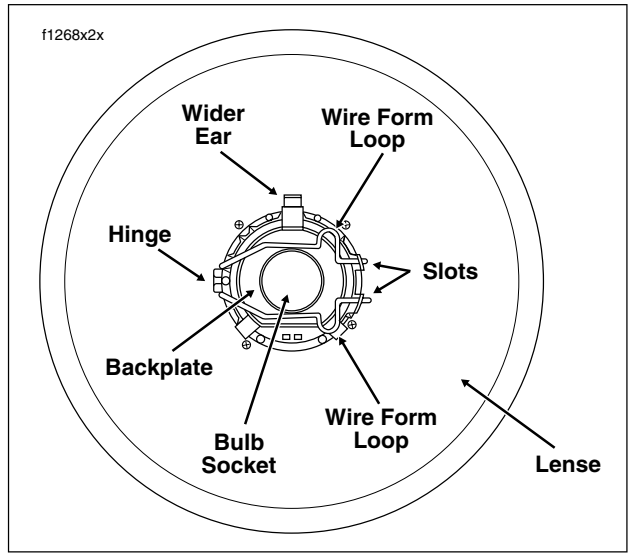



**Figure 8-21. Headlamp Lense/Bulb Assembly (Rear View)**

## HEADLAMP BULB REPLACEMENT

The headlamp is a replaceable bulb (and not a sealed beam). Made of quartz glass filled with Halogen gas, the bulb is very delicate and must be handled with care.

*NOTE*

*When replacement is required, use only the specified bulb available from your Harley-Davidson dealer. Improper wattage or bulb may cause charging system problems.*

1. Remove the Phillips screw at the bottom of the headlamp door (chrome ring). Remove the headlamp door.
2. Remove the three Phillips screws to free the retaining ring from the headlamp housing. See Figure 8-20. Carefully remove the lense and bulb assembly.
3. Squeeze the two external tabs (if present) to remove the wire connector at the back of the headlamp bulb. Remove the lense and bulb assembly from the vehicle.
4. Remove the rubber boot at the back of the lense.
5. Push down on loops of wire form to free ends from slots on lense insert. See Figure 8-21. Use hinge to swing wire form out of the way.

**⚠WARNING**

**The bulb contains Halogen gas under pressure. Wear adequate eye protection and handle the bulb carefully. Inadequate safety precautions could result in death or serious injury.**

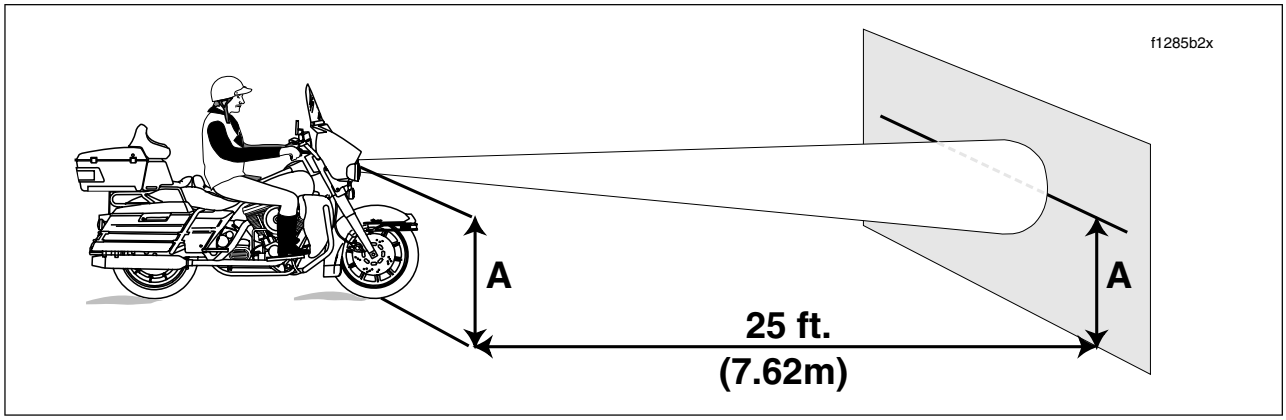



**Figure 8-22. Check Headlamp Alignment**

6. Remove and discard bulb.

**CAUTION**

**Never touch the quartz bulb with your fingers. Fingerprints will etch the glass and cause premature bulb failure. Always wrap the bulb in paper or a clean dry cloth during handling.**

7. Install **new** bulb in lense. Rotate bulb as necessary so that backplate makes full contact with lense insert.

*NOTE*

*Wider ear on backplate should point toward the top of the lense. The top can be determined by the position of the headlamp door bracket, which is at the bottom (on the opposite side).*

8. Use hinge to place wire form over socket at back of bulb. Press down on loops so ends of wire form engage slots on lense insert.
9. Install rubber boot at back of lense tucking outer edge into headlamp housing.
10. Install the wire connector at the back of headlamp bulb.
11. Fit lense and bulb assembly into headlamp housing. Align holes in retaining ring with those in headlamp housing. Install the three Phillips screws.
12. Fit the square-shaped portion of the headlamp door spring into the slot at the top of the headlamp housing and then snap the headlamp door (chrome ring) into place. Install the Phillips screw at the bottom of the headlamp door.

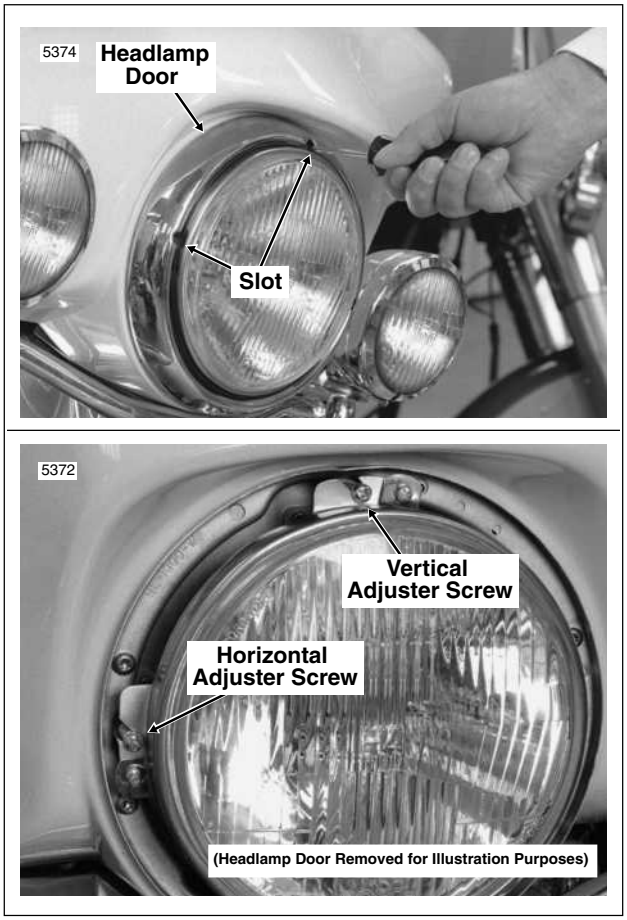



**Figure 8-23. Adjust Headlamp Alignment (FLHT/C/U Model Shown)**

## HEADLAMP ADJUSTMENT

Check headlamp beam for proper height and lateral alignment.

**⚠WARNING**

**DO NOT modify the ignition/light key switch wiring to disable the automatic-on headlamp feature. High visibility is an important safety consideration for motorcycle riders. Ensure that the headlamp is on at all times. Failure to do so could result in death or serious injury.**

1. Verify correct front and rear tire inflation pressure.
2. Place the motorcycle on a level floor or pavement in an area with minimum light.
3. See Figure 8-22. Point the front of the motorcycle toward a screen or wall which is 25 feet (7.62 m) from where patch of front tire contacts floor (i.e. - directly below front axle).
4. Draw a horizontal line on screen or wall that is exactly the same height above the floor as the headlamp center.
5. Have a person whose weight is roughly the same as that of the principal rider sit on the motorcycle seat. The weight of the rider will compress the vehicle suspension slightly.
6. Stand the motorcycle upright with both tires resting on the floor and with the front wheel held in straight alignment (directly forward).
7. Turn the Ignition/Light Key Switch to IGNITION. Set the Light Switch on the left handlebar to Hi(gh) beam.
8. Check the light beam for proper height alignment. The center of the main beam of light should be even with the horizontal line on the screen or wall.
9. Check the light beam for proper lateral alignment. The main beam of light should be directed straight ahead (i.e., equal area of light to right and left of center).

*NOTE*

*The headlamp adjustment can be performed without removing the headlamp door (chrome ring).*

10. If the headlamp alignment requires adjustment, use slots in headlamp door to insert Phillips screw driver between headlamp housing and rubber gasket. Turn the vertical adjuster screw as necessary to adjust the headlamp vertically. Turn the horizontal adjuster screw to adjust the headlamp horizontally. See Figure 8-23.

## HEADLAMP ASSEMBLY

### REMOVAL

1. Remove the outer fairing. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLTR), OUTER FAIRING, REMOVAL.
2. Move outer fairing assembly to bench area.
3. Squeeze two external tabs to disconnect headlamp harness connectors from bulb contacts.

**CAUTION**

**Wrap electrical tape around blade of screwdriver to prevent damage to tabs of transparent lense cover.**

4. From inboard side of outer fairing, release top of transparent lense cover from slots in fairing by gently depressing two tabs with blade of screwdriver. Depress two bottom tabs and remove lense cover from fairing.
5. Depress mounting clips on three hex adjuster studs and pull headlamp assembly out front of outer fairing. See Figure 8-24.

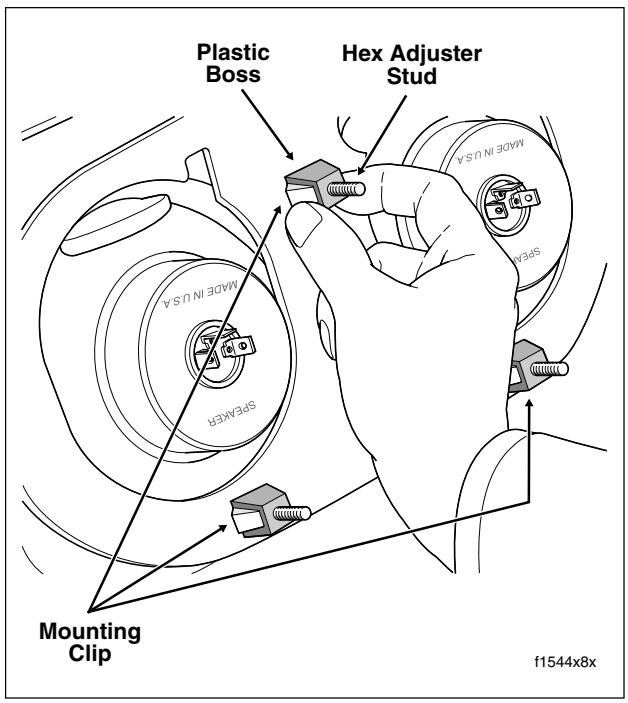



**Figure 8-24. Depress Mounting Clips**

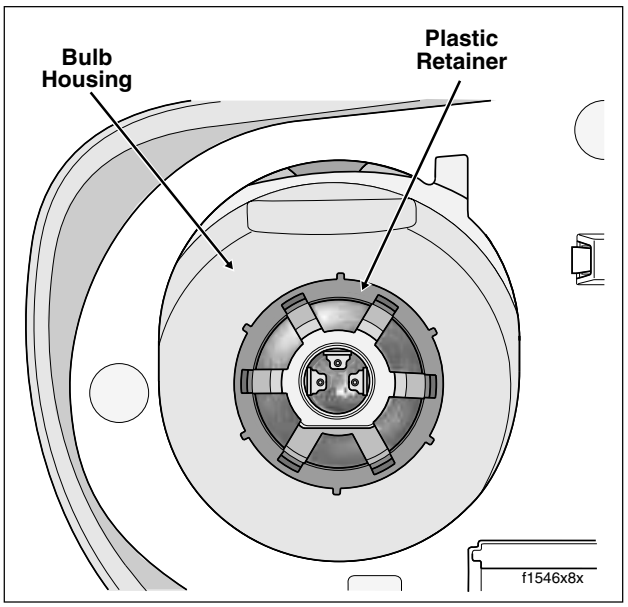



**Figure 8-25. Remove Retainer to Release Bulb**

### INSTALLATION

1. Align hex adjuster studs with plastic bosses on inboard side of outer fairing. Push headlamp assembly into position until mounting clips engage bosses.
2. Carefully snap bottom tabs of transparent lense cover into bottom slots of outer fairing. Carefully snap upper tabs of lense cover into upper slots of fairing.
3. Install headlamp harness connectors onto bulb contacts.
4. Install the outer fairing. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLTR), OUTER FAIRING, INSTALLATION.

## HEADLAMP BULB REPLACEMENT

The headlamp is a replaceable bulb (and not a sealed beam). Made of quartz glass filled with Halogen gas, the bulb is very delicate and must be handled with care.

*NOTE*

*When replacement is required, use only the specified bulb available from your Harley-Davidson dealer. Improper wattage or bulb may cause charging system problems.*

### REMOVAL

1. Remove the outer fairing. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLTR), OUTER FAIRING, REMOVAL.
2. Move outer fairing assembly to bench area.

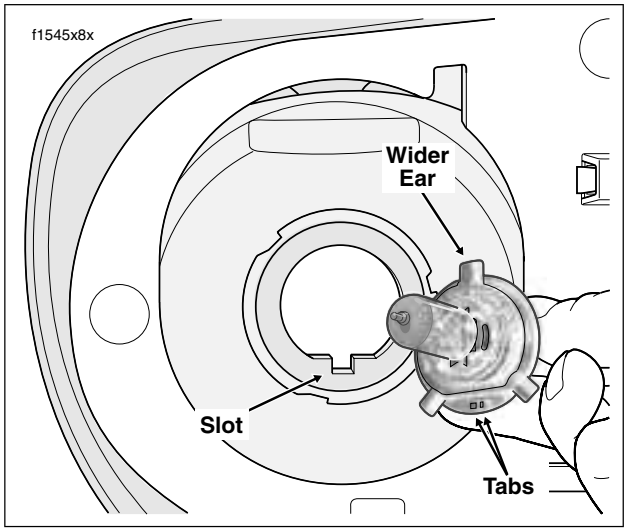



**Figure 8-26. Install New Bulb in Bulb Housing**

3. Squeeze two external tabs to disconnect headlamp harness connector from bulb contacts.
4. Remove rubber boot at back of bulb housing.
5. Rotate plastic retainer in a counter-clockwise direction to remove from bulb housing flange. See Figure 8-25.

**⚠WARNING**

**The bulb contains Halogen gas under pressure. Wear adequate eye protection and handle the bulb carefully. Inadequate safety precautions could result in death or serious injury.**

6. Remove and discard bulb.

## INSTALLATION

**CAUTION**

**Never touch the quartz bulb with your fingers. Fingerprints will etch the glass and cause premature bulb failure. Always wrap the bulb in paper or a clean dry cloth during handling.**

1. Install **new** bulb in bulb housing. Orient bulb so that wider ear on backplate is topside and then push bottom of backplate so that tabs on outboard side fit snugly in slot of bulb housing. See Figure 8-26.
2. Place plastic retainer over bulb housing flange and rotate in a clockwise direction until tight. See Figure 8-25.
3. Install rubber boot over retainer until flush with base of bulb socket.
4. Connect headlamp harness connector to bulb contacts.
5. Install the outer fairing. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLTR), OUTER FAIRING, INSTALLATION.

# HEADLAMP ADJUSTMENT

Check headlamp beam for proper height and lateral alignment.

**⚠WARNING**

**DO NOT modify the ignition/light key switch wiring to disable the automatic-on headlamp feature. High visibility is an important safety consideration for motorcycle riders. Ensure that the headlamp is on at all times. Failure to do so could result in death or serious injury.**

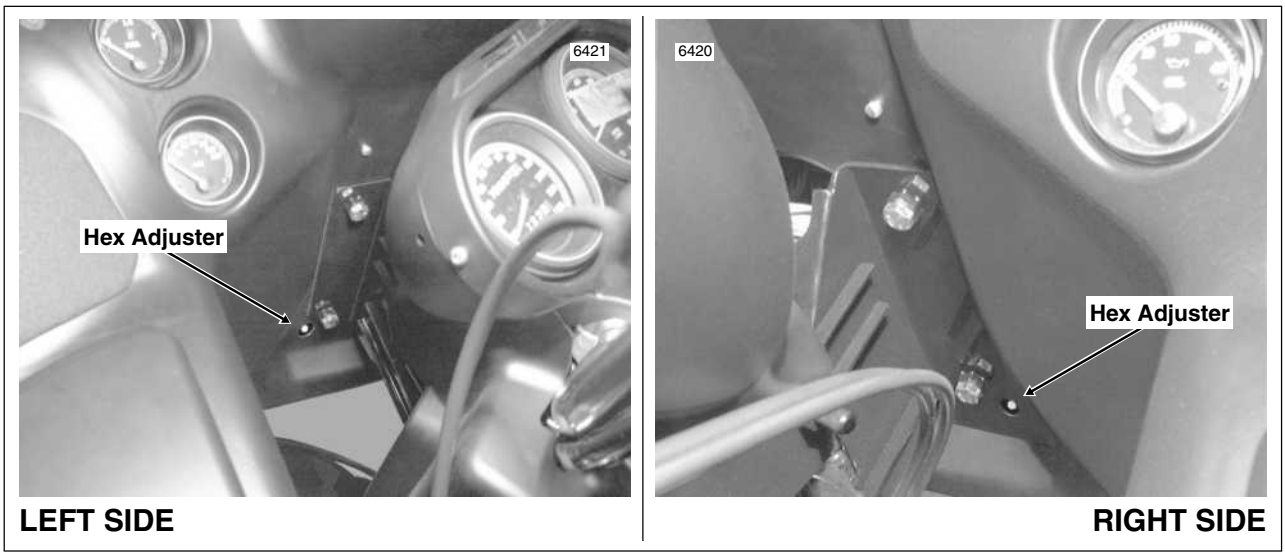



**Figure 8-27. Headlamp Adjustment (FLTR)**

1. Verify correct front and rear tire inflation pressure.
2. Place the motorcycle on a level floor or pavement in an area with minimum light.
3. See Figure 8-22. Point the front of the motorcycle toward a screen or wall which is 25 feet (7.62 m) from where patch of front tire contacts floor (i.e. - directly below front axle).
4. Draw a horizontal line on screen or wall that is exactly the same height above the floor as the headlamp center.
5. Have a person whose weight is roughly the same as that of the principal rider sit on the motorcycle seat. The weight of the rider will compress the vehicle suspension slightly.
6. Stand the motorcycle upright with both tires resting on the floor and with the front wheel held in straight alignment (directly forward).
7. Turn the Ignition/Light Key Switch to IGNITION. Set the Light Switch on the left handlebar to Hi(gh) beam.
8. Check the light beam for proper height alignment. The center of the main beam of light should be even with the horizontal line on the screen or wall.
9. Check the light beam for proper lateral alignment. The main beam of light should be directed straight ahead (i.e., equal area of light to right and left of center).
10. Locate the hex adjusters near the bottom edge of the inner fairing. See Figure 8-27. Turning the adjusters causes the double headlamp housing to pivot around its upper mount.
11. Using a 4.5 mm, 1/4 inch drive socket (Snap-On TMM4.5) and flexible driver (Snap-On TM62B), adjust the headlamp horizontally by turning either the left or right side adjuster. Turn both adjusters equally to adjust the headlamp vertically. Adjuster rotation moves the headlamp beam as follows:

## Table 8-6. FLTR Hex Adjuster Rotation

| Hex Adjuster | Rotation | Beam Movement |
|---|---|---|
| Left Only | CW | To the Right |
| Right Only | CCW | |
| Left Only | CCW | To the Left |
| Right Only | CW | |
| Left and Right Equally | CW | Upward |
| Left and Right Equally | CCW | Downward |

CW= Clockwise CCW= Counter-Clockwise

# PASSING LAMPS 8.12

## ADJUSTMENT

1. Using a long shank ball end socket (Snap-on® FABL5), remove two screws to release turn signal lamp from mounting bracket. See Figure 8-28. Use hole in passing lamp bracket to access inboard screw.
2. Insert flare nut socket (Snap-on® FRX181) at bottom of turn signal mounting bracket and loosen locknut on stud.
3. Move lamp and swivel block to obtain the desired position.

*NOTE*

*Passing lamps should shine straight ahead with the center of the main light beam even with a horizontal line drawn on a wall 25 feet (7.6 m) away. The line on the wall should be at the same height as the center of the passing lamps with the rider mounted.*

4. Using flare nut socket, tighten locknut to 18 ft-lbs (24.4 Nm).

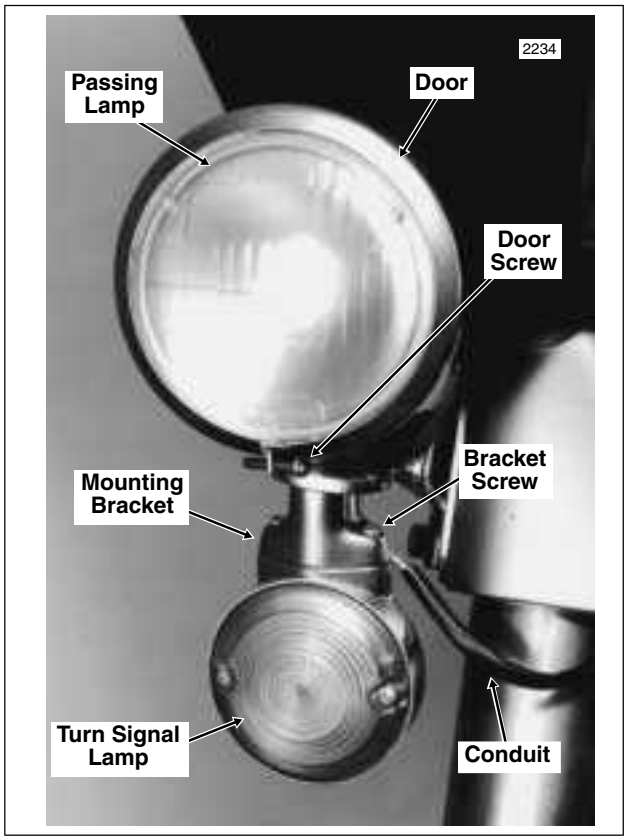



**Figure 8-28. Passing Lamp and Turn Signal**

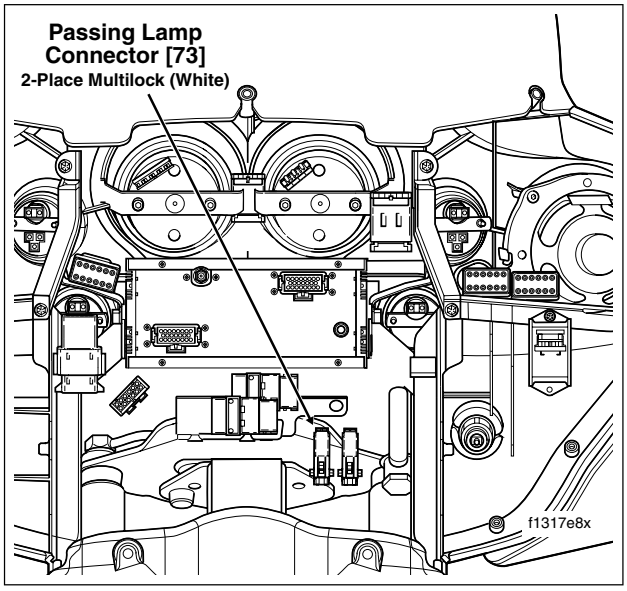



**Figure 8-29. Passing Lamp Connector Location (FLHT/C/U)**

5. Using long shank ball end socket, start two screws to secure turn signal lamp to mounting bracket. Verify that conduit fits in slot at back of bracket and is not pinched as screws are tightened.

## PASSING LAMP BULB

### REMOVAL

1. Remove door screw and door. See Figure 8-28.
2. Loosen Phillips screws and disconnect two wire terminals from back of sealed beam unit.

### INSTALLATION

1. Connect two wire terminals at back of **new** sealed beam unit and tighten Phillips screws.
2. Install sealed beam in housing. Install door and door screw.

## PASSING LAMP BRACKET

### REMOVAL

1. **FLHT/C/U:** Remove the outer fairing. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL. Locate passing lamp connector (2-place Multilock) next to top fork bracket. See Figure 8-29.

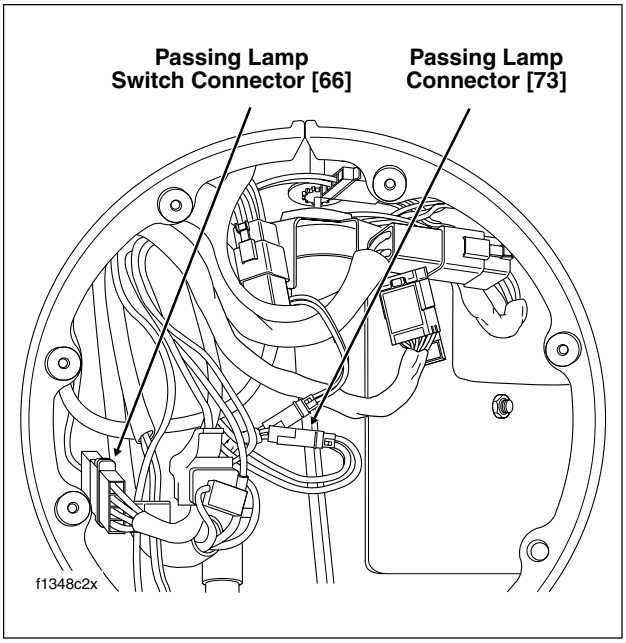



**Figure 8-30. Headlamp Nacelle (FLHR/C)**

**FLHR/C:** Remove the Phillips screw at the bottom of the headlamp door (chrome ring). Remove the headlamp door. Remove the seven Phillips screws to free the headlamp housing from the headlamp nacelle. Squeeze the two external tabs (if present) to remove the wire connector at the back of the headlamp bulb. Remove the headlamp housing assembly from the vehicle. Locate passing lamp connector (2-place Multilock). See Figure 8-30.

2. Depress the button on the socket terminal side of the connector and pull apart the pin and socket halves.

3. Remove terminals of two Gray/Black wires from socket housing.

*NOTE*

*For instructions on properly removing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, REMOVING SOCKET/PIN TERMINALS.*

4. Using a long shank ball end socket (Snap-on® FABL5), remove two screws to release turn signal lamps from mounting brackets. See Figure 8-28. Use holes in passing lamp bracket to access inboard screws.

5. Obtain two equal lengths of strong flexible wire for use as mechanics wire. Feed wire through opening in socket terminal and then loop back twisting end until tightly coiled around longer strand as shown in Figure 8-31. Repeat step with remaining socket terminal.

*NOTE*

*Be sure that mechanics wire is of sufficient strength to pull terminals through conduit without breaking. Wire lengths must also be long enough so that free ends are not lost in conduit when pulled.*

6. Carefully pull wires to draw socket terminals through conduit. For best results, pull one wire at a time.

7. Unravel mechanics wire to release socket terminals.

8. Insert flare nut socket (Snap-on® FRX181) at bottom of turn signal mounting bracket and remove locknut from stud. Remove the turn signal mounting bracket and clamp block.

9. Remove passing lamp (with Belleville washer and swivel block) from the passing lamp bracket.

10. Using a T-40 TORX drive head, remove two upper passing lamp bracket bolts from fork. Loosen two lower bolts and remove bracket from fork.

## INSTALLATION

1. Slide slots of passing lamp bracket onto lower bolts in fork. Start two upper bolts. Using a T-40 TORX drive head, tighten bolts to 18 ft-lbs (24.4 Nm).

2. If removed, slide swivel block and Belleville washer down Gray/Black wire onto passing lamp stud. Be sure that rounded side of swivel block and concave side of Belleville washer face passing lamp.

3. Feed Gray/Black wire of passing lamp through slot at top of passing lamp bracket and insert threaded stud into forward slot. Slide clamp block (rounded side up), turn signal mounting bracket and locknut up Gray/Black wire onto passing lamp stud at bottom of bracket.

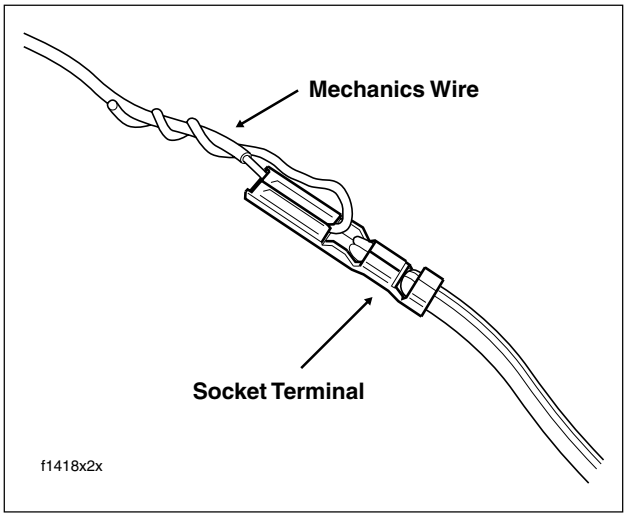



**Figure 8-31. Fix Mechanics Wire to Socket Terminals**

4. Using flare nut socket (Snap-on® FRX181), tighten locknut to 18 ft-lbs (24.4 Nm).
5. Reattach mechanics wire to socket terminals and carefully pull ends of mechanics wire to draw socket terminals back through conduit. For best results, pull one wire at a time.
6. Carefully remove mechanics wire to avoid damage to terminals.
7. Install terminals of two Gray/Black wires into socket housing.

*NOTE*

*For instructions on properly installing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, INSTALLING SOCKET/PIN TERMINALS.*

8. Mate pin and socket halves of passing lamp connector.
9. Turn Ignition/Light Key Switch to IGNITION and test for proper operation and alignment. Adjust if necessary.
10. Using a long shank ball end socket (Snap-on® FABL5), start two screws to secure turn signal lamp to mounting bracket. Verify that conduit fits in slot at back of bracket and is not pinched as screws are tightened. Use hole in passing lamp bracket to access inboard screw.
11. **FLHT/C/U:** Route passing lamp conduit over chrome skirt at corners and position connector next to top fork bracket. Install the outer fairing. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.

    **FLHR/C:** Install wire connector at the back of the headlamp bulb. Align holes in headlamp housing with those in headlamp nacelle (headlamp door bracket at bottom). Install seven Phillips screws.

# PASSING LAMP

## REMOVAL

1. See PASSING LAMP BRACKET, REMOVAL, in this section, steps 1-8, but follow instructions for one lamp instead of two.

## INSTALLATION

1. Lay old passing lamp next to **new** passing lamp and cut Gray/Black wire to length.
2. Strip 3/16 inch of insulation off **new** lamp wire and crimp on **new** socket terminal.

*NOTE*

*For instructions on crimping wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, CRIMPING INSTRUCTIONS.*

3. See PASSING LAMP BRACKET, INSTALLATION, in this section, steps 2-13.

# TAIL LAMP ASSEMBLY 8.13

## TAIL LAMP

### REMOVAL

1. Remove two Phillips screws from lense to release tail lamp assembly from chrome plastic bracket at back of rear fender. Carefully pull tail lamp assembly from bracket. See left side of Figure 8-32.
2. Depress button at bottom of 4-place Multilock socket to release tail lamp assembly from pin housing. See right side of Figure 8-32.

### INSTALLATION

1. Orient 4-place Multilock socket so that the release button is at the bottom and insert into pin housing until it "clicks." Properly routed, the tail lamp conduit should be inboard of both the fender tip lamp and left turn signal lamp conduit as shown in Figure 8-32.
2. Place tail lamp into position against chrome plastic bracket tucking conduit into cavity below pin housing.

**CAUTION**

**Over tightening screws can crack the lense or result in scratching of the fender paint.**

3. Align holes in lense with those in chrome plastic bracket and install two Phillips screws. Tighten screws to 20-24 **in-lbs** (2.3-2.7 Nm).
4. Turn the Ignition/Light Key Switch to IGNITION and test lamp for proper operation.

## CIRCUIT BOARD/TAIL LAMP BRACKET ASSEMBLY

### REMOVAL

1. Remove two Phillips screws from lense to release tail lamp assembly from chrome plastic bracket at back of rear fender. Carefully pull tail lamp assembly from bracket. See left side of Figure 8-32.
2. Depress button at bottom of 4-place Multilock socket to release tail lamp assembly from pin housing. See right side of Figure 8-32.
3. Depress buttons to remove four remaining Multilock sockets from pin housing. See Figure 8-33.

   All remaining release buttons are at the top, with the exception of the rear fender lights harness socket, where

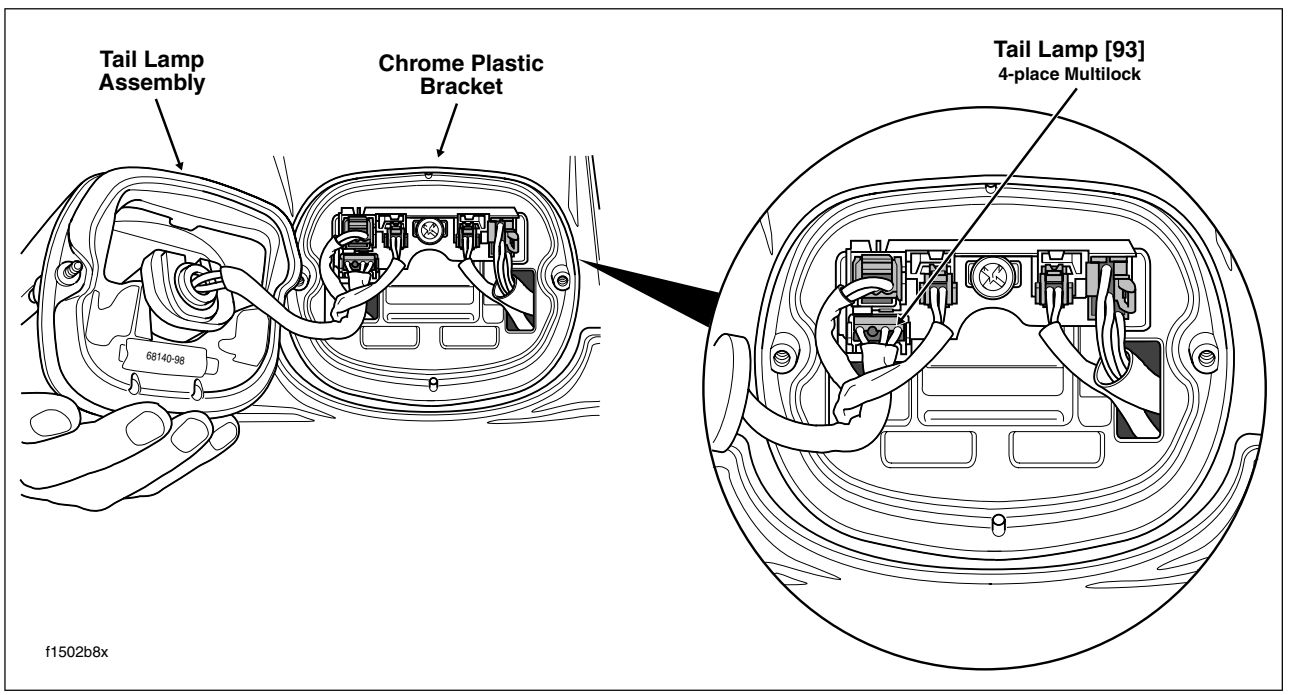



**Figure 8-32. Remove Tail Lamp and Depress Button to Release Socket**

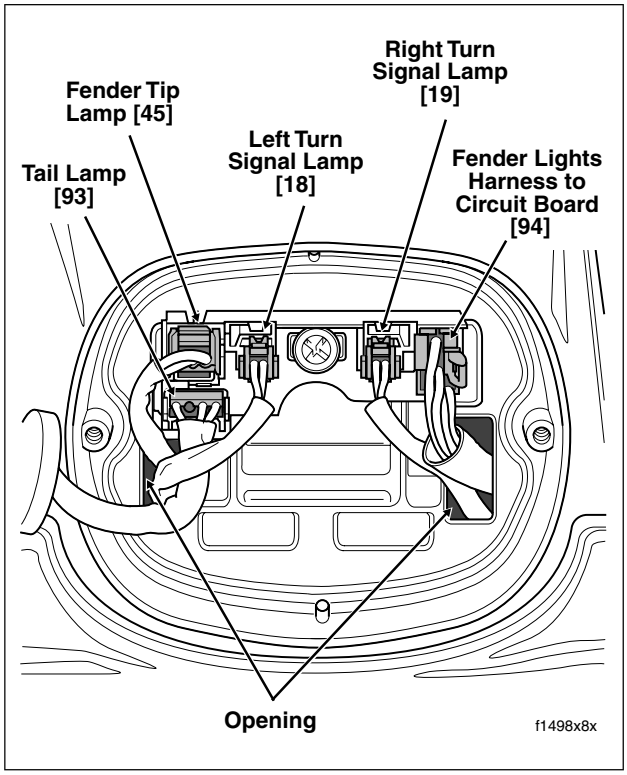



**Figure 8-33. Rear Fender Lights Assembly**

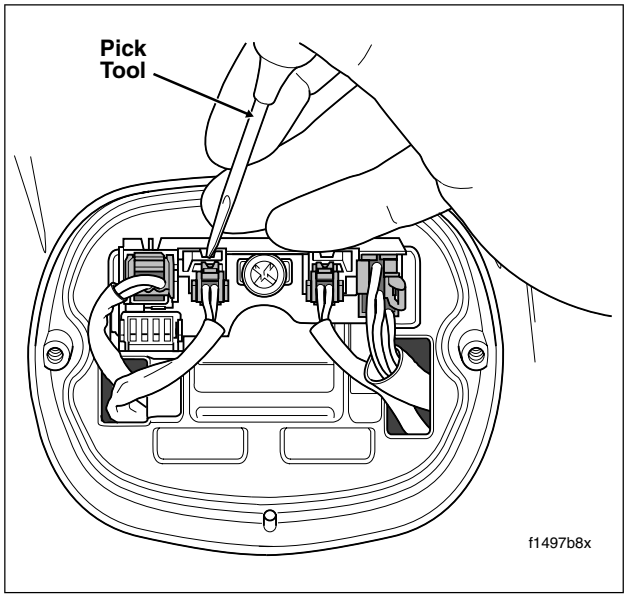



**Figure 8-34. Release Left Turn Signal Lamp Socket**

the button is on the outboard side. To release socket housings of left and right turn signal lamps, use a pick or small screwdriver to depress top release button as shown in Figure 8-34.

4. Remove large Phillips screw and pull pin housing with attached circuit board (and gasket) from chrome plastic bracket. Two tabs at back of pin housing fit into holes in bracket.
5. Remove chrome plastic bracket. Use both thumbs to push bracket upward until it becomes free of fender and then pull out of fender hole.
6. Feed Multilock sockets through openings to inboard side of bracket. See Figure 8-33. For best results, free the smaller sockets first.

## INSTALLATION

1. Feed Multilock sockets through openings to outboard side of chrome plastic bracket. See Figure 8-33. For best results, feed the larger sockets first.
2. Fit bottom of bracket into fender hole and then push down to align center hole in bracket with clip nut on fender flange.
3. Place pin housing over circuit board, if removed. See Figure 8-35.
4. Snap tabs at back of pin housing into holes in plastic bracket.

**CAUTION**

**Over tightening screw can crack the plastic bracket or result in scratching of the fender paint.**

5. Install large Phillips screw to secure pin housing, circuit board and plastic bracket to fender flange. Tighten screw to 40-48 **in-lbs** (4.5-5.4 Nm).

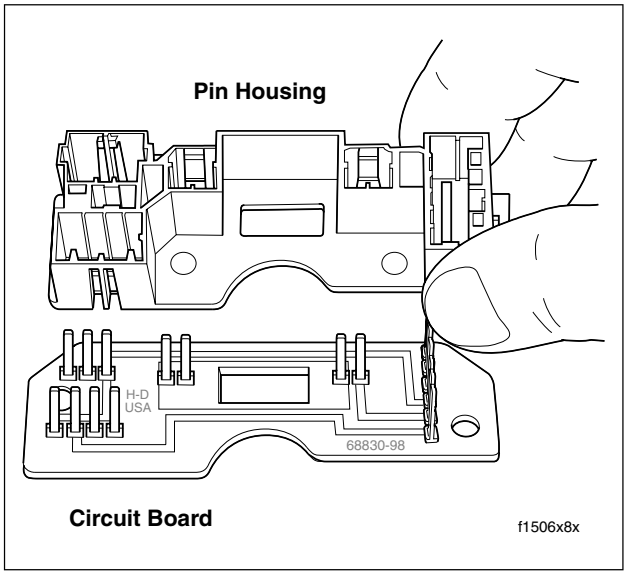



**Figure 8-35. Place Pin Housing Over Circuit Board**

6. Install each socket into pin housing until it “clicks.” Install rear fender tip lamp and both left and right turn signal lamp sockets so that the release buttons are at the top. Install the rear fender lights harness socket with the button on the outboard side and the tail lamp socket with the button at the bottom.
7. Verify that rear fender tip lamp and left turn signal lamp conduit are positioned on the outboard side of the tail lamp conduit as shown in Figure 8-33.
8. Place tail lamp into position against chrome plastic bracket tucking tail lamp conduit into cavity below pin housing.

**CAUTION**

**Over tightening screws can crack the lense or result in scratching of the fender paint.**

9. Align holes in lense with those in chrome plastic bracket and install two Phillips screws. Tighten screws to 20-24 **in-lbs** (2.3 - 2.7 Nm).
10. Turn the Ignition/Light Key Switch to IGNITION and test lamp for proper operation.

# FENDER TIP LAMPS 8.14

## FRONT FENDER TIP LAMP

### REMOVAL

1. Insert blade of small screwdriver into slot at top of fender tip lamp lense. Rotate end of screwdriver to unsnap lense from lamp bracket.
2. Remove gasket from fender tip lamp bracket, if present.
3. Holding Keps nuts at inboard side of rear fender, remove two Phillips screws to release fender tip lamp bracket.
4. Depress button on socket terminal side of 2-place Multilock connector to release fender tip lamp assembly from jumper harness. See Figure 8-38.

### INSTALLATION

1. Mate pin and socket halves of 2-place Multilock connector to attach front fender tip lamp assembly to jumper harness. See Figure 8-38.
2. With wires routed along bottom left side, place fender tip lamp bracket into position aligning holes in bracket with those in fender.

**CAUTION**

**Over tightening screws can crack the bracket or result in scratching of the fender paint.**

3. Slide Phillips screws through bracket and fender holes and install Keps nuts. Holding nuts at inboard side of fender, tighten screws to 20-24 **in-lbs** (2.3 - 2.7 Nm).
4. Place gasket into position on fender tip lamp bracket, if present.
5. Insert tab at bottom of lense into slot of fender tip lamp bracket. Apply thumb pressure at top of lense until it snaps into place.
6. Turn the Ignition/Light Key Switch to IGNITION and test lamp for proper operation.

## FRONT FENDER TIP LAMP JUMPER HARNESS

### REMOVAL

1. **FLHT/C/U:** Remove the outer fairing. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL. Locate front fender tip lamp connector (2-place Multilock) next to top fork bracket. See Figure 8-36.

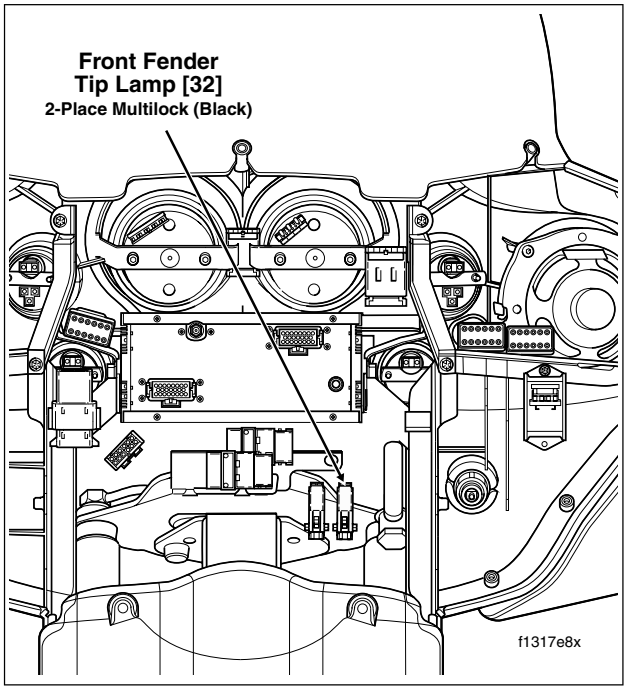



**Figure 8-36. Inner Fairing (FLHT/C/U)**

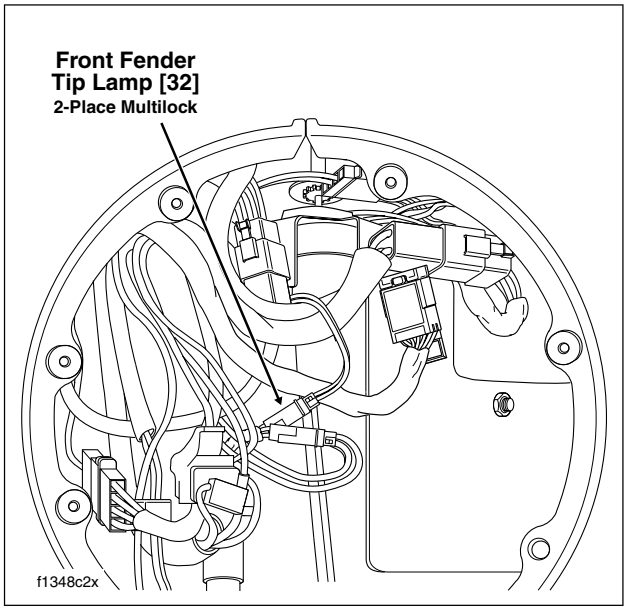



**Figure 8-37. Headlamp Nacelle (FLHR)**

**FLHR:** Remove the Phillips screw at the bottom of the headlamp door (chrome ring). Remove the headlamp door. Remove the seven Phillips screws to free the headlamp housing from the headlamp nacelle. Squeeze

the two external tabs (if present) to remove the wire connector at the back of the headlamp bulb. Remove the headlamp housing assembly from the vehicle. Locate the front fender tip lamp connector (black 2-place Multilock). See Figure 8-37.

2. Depress the button on the socket terminal side of the connector and pull apart the pin and socket halves.
3. Draw socket connector down between chrome skirt and upper fork bracket to fender area.
4. Carefully cut cable strap to release front fender tip lamp wire from brake line hose.
5. Remove terminals from socket housing.

*NOTE*

*For instructions on properly removing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, REMOVING SOCKET/PIN TERMINALS.*

6. Place the motorcycle on a hydraulic center stand with the front wheel raised off the ground.
7. Remove the front wheel. See Section 2.2 FRONT WHEEL, REMOVAL.
8. From inboard side of front fender, remove two nuts to release trim strip from left side of fender. See Figure 8-39.
9. Pull wire lead and Multilock socket terminals through grommet to inboard side of fender. See Figure 8-40. Reaching under left side of fender, release wire from three weld clips.
10. Feed wire lead and Multilock socket terminals through oblong hole to outboard side of fender.

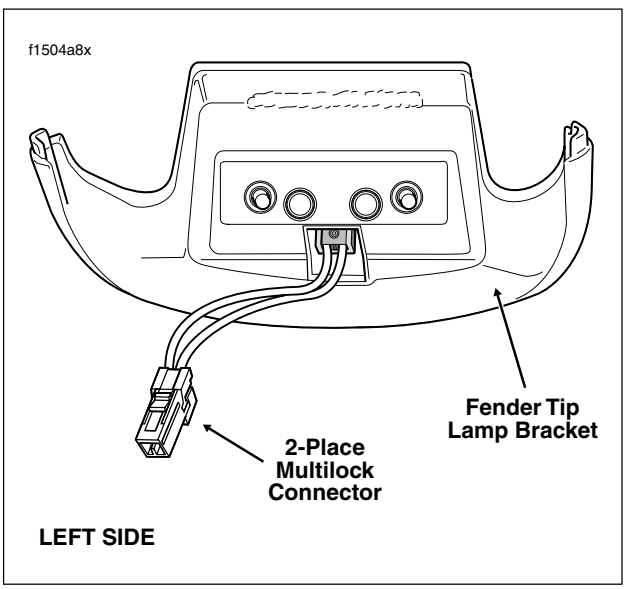



**Figure 8-38. Fender Tip Lamp Assembly**

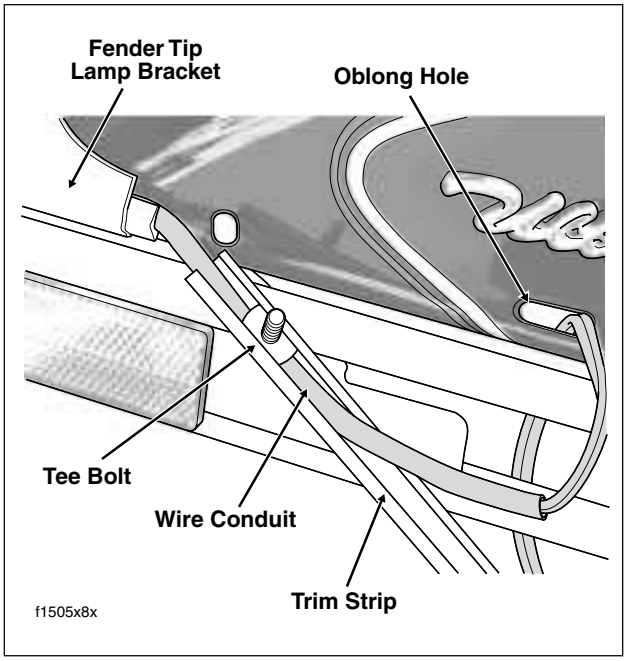



**Figure 8-39. Install Conduit in Trim Strip**

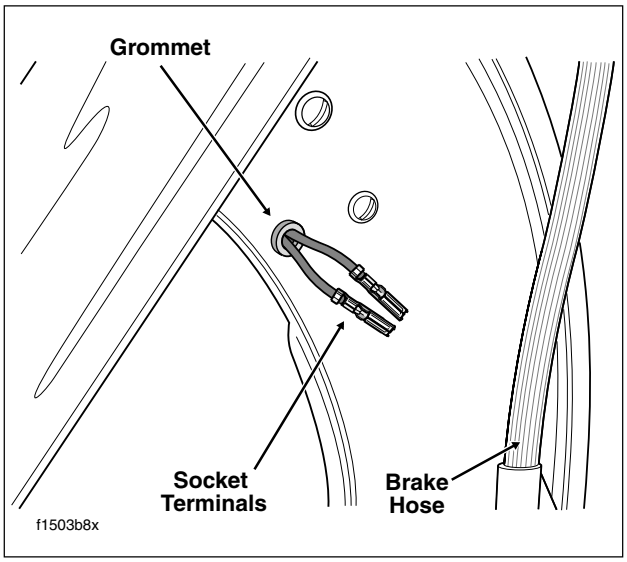



**Figure 8-40. Pull Fender Tip Lamp Wires and Terminals Through Fender Grommet**

11. Insert blade of small screwdriver into slot at top of fender tip lamp lense. Rotate end of screwdriver to unsnap lense from lamp bracket.
12. Remove gasket from fender tip lamp bracket, if present.
13. Holding Keps nuts at inboard side of front fender, remove two Phillips screws to release fender tip lamp bracket.

14. Depress button on socket terminal side of 2-place Multilock connector to release fender tip lamp assembly from jumper harness. See Figure 8-38.

## INSTALLATION

1. Mate pin and socket halves of 2-place Multilock connector to attach front fender tip lamp assembly to jumper harness. See Figure 8-38.
2. With wires routed along bottom left side, place fender tip lamp bracket into position aligning holes in bracket with those in fender.

**CAUTION**

**Over tightening screws can crack the bracket or result in scratching of the fender paint.**

3. Slide Phillips screws through bracket and fender holes and install Keps nuts. Holding nuts at inboard side of fender, tighten screws to 20-24 **in-lbs** (2.3 - 2.7 Nm).
4. Place gasket into position on fender tip lamp bracket, if present.
5. Insert tab at bottom of lense into slot of fender tip lamp bracket. Apply thumb pressure at top of lense until it snaps into place.
6. Route wire conduit inside trim strip and slide front tee bolt over conduit. See Figure 8-39. Verify that second tee bolt is in position at rear of trim strip.
7. Feed Multilock socket terminals and wire lead through oblong hole to inboard side of fender.
8. While removing slack from wire lead on outboard side of fender, align tee bolts with fender holes. Wtih trim strip positioned against left side of fender, reach under fender and install nuts on tee bolts.
9. Pull Multilock socket terminals and wire lead through grommet to outboard side of fender. See Figure 8-40. Reaching under left side of fender, capture wire in three weld clips.
10. Install terminals into socket housing.

*NOTE*

*For instructions on properly installing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, INSTALLING SOCKET/PIN TERMINALS.*

11. Route socket housing upward behind chrome skirt to area of top fork bracket (FLHT/C/U) or headlamp nacelle (FLHR). Mate pin and socket halves of front fender tip lamp connector.
12. Install the front wheel. See Section 2.2 FRONT WHEEL, INSTALLATION.
13. Install **new** cable strap to secure front fender tip lamp wire to brake line hose. Cut any excess cable strap material.
14. **FLHT/C/U:** Install the outer fairing. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.

    **FLHR:** Install wire connector at the back of the headlamp bulb. Align holes in headlamp housing with those in headlamp nacelle. Install seven Phillips screws. Install the headlamp door (chrome ring) and door screw.
15. Turn Ignition/Light Key Switch to IGNITION and test lamp for proper operation.

# REAR FENDER TIP LAMP

## REMOVAL

1. Remove two Phillips screws from lense to release tail lamp assembly from chrome plastic bracket at back of rear fender. Carefully pull tail lamp assembly from bracket.
2. Depress button at bottom of 4-place Multilock socket to release tail lamp assembly from pin housing. See Figure 8-41.
3. Depress button at top of 3-place Multilock socket to release fender tip lamp assembly from pin housing.
4. Feed 3-place Multilock socket through opening in chrome plastic bracket to inboard side of rear fender. Reaching under left side of rear fender, release conduit from two cable clips anchored on T-studs.

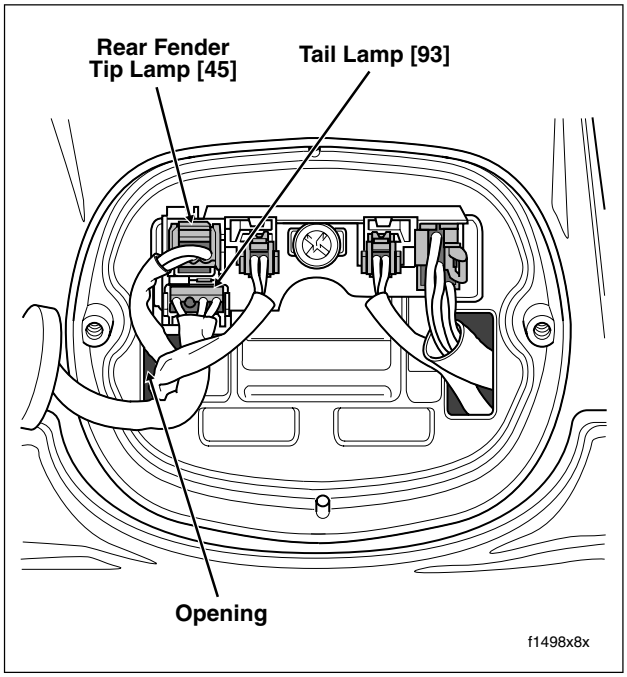



**Figure 8-41. Depress Button to Release Socket From Pin Housing**

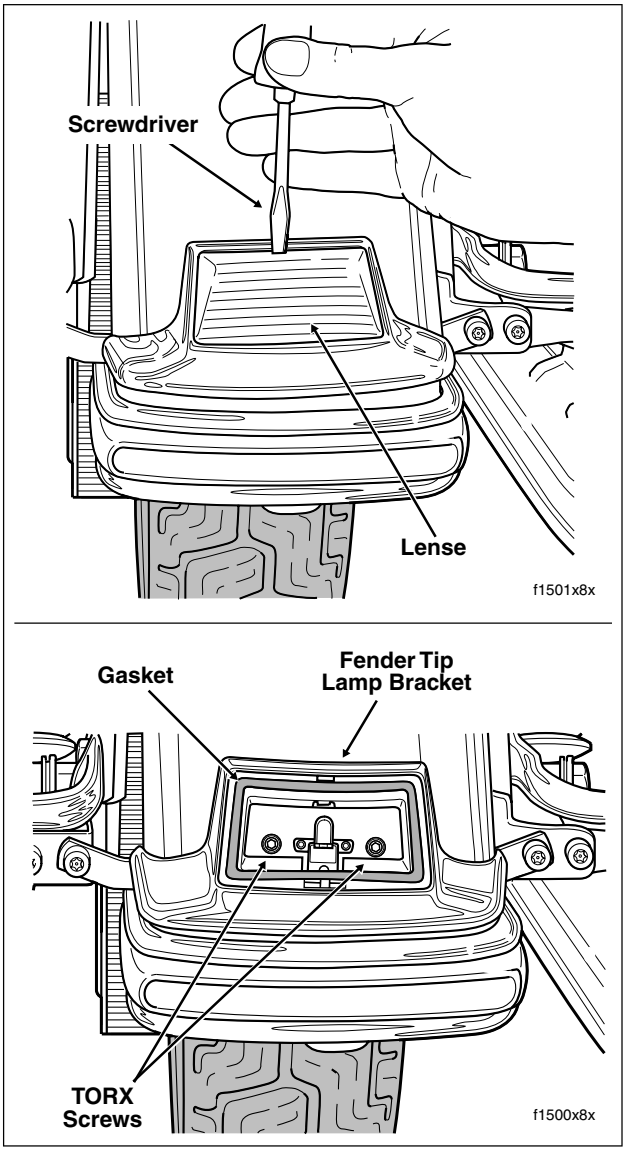



**Figure 8-42. Remove Rear Fender Tip Lamp Lense and Bracket**

5. Insert blade of small screwdriver into slot at top of fender tip lamp lense. Rotate end of screwdriver to unsnap lense from lamp bracket. See upper frame of Figure 8-42.

6. Remove gasket from fender tip lamp bracket, if present. See lower frame of Figure 8-42.

7. Holding nuts at inboard side of rear fender, remove two TORX screws to release fender tip lamp bracket.

8. Draw conduit and 3-place Multilock socket out through bottom fender hole. See Figure 8-43.

9. Remove terminals from socket housing.

*NOTE*

*For instructions on properly removing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, REMOVING SOCKET/PIN TERMINALS.*

## INSTALLATION

1. Place **new** fender tip lamp assembly next to discarded unit and cut wires to proper length.

2. Crimp **new** socket terminals onto fender tip lamp wires.

*NOTE*

*For instructions on crimping wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, CRIMPING INSTRUCTIONS.*

3. Install terminals into socket housing.

### Table 8-7. Rear Fender Tip Lamp [45]

| Wire Color | Chamber Number |
|---|---|
| Black | 1 |
| Not Used | 2 |
| Black | 3 |

*NOTE*

*For instructions on properly installing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, INSTALLING SOCKET/PIN TERMINALS.*

4. Feed 3-place Multilock socket and conduit through bottom fender hole. See Figure 8-43.

5. Place fender tip lamp bracket into position aligning holes in bracket with those in fender. Slide TORX screws through bracket and fender holes and install nuts.

6. Place gasket into position on fender tip lamp bracket, if present. See lower frame of Figure 8-42.

7. Insert tab at bottom of lense into slot of fender tip lamp bracket. Apply thumb pressure at top of lense until it snaps into place.

8. Reaching under left side of rear fender, capture conduit in two cable clips anchored on T-studs. Feed 3-place Multilock socket through opening on left side of chrome plastic bracket to outboard side of rear fender.

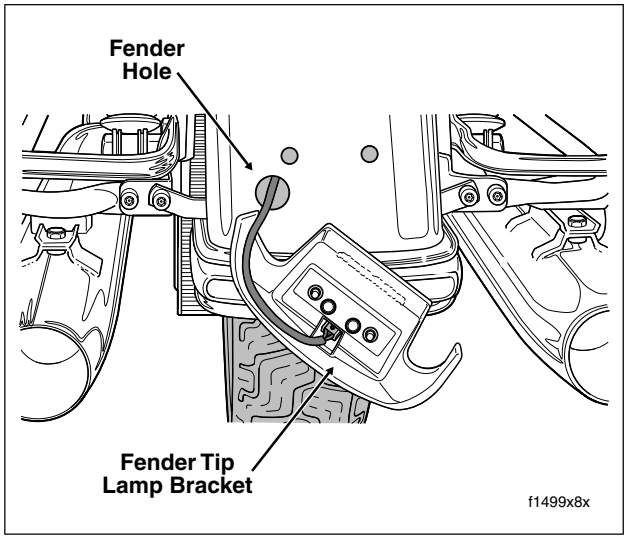



**Figure 8-43. Feed Fender Tip Lamp Socket and Conduit Through Fender Hole**

9. Orient 3-place Multilock socket so that the release button is at the top and insert into pin housing until it “clicks.”

10. To install tail lamp assembly, orient 4-place Multilock socket so that the release button is at the bottom and insert into pin housing until it “clicks.” Verify that rear fender tip lamp and left turn signal lamp conduit are positioned on the outboard side of the tail lamp conduit as shown in Figure 8-41.

11. Place Tail Lamp into position against chrome plastic bracket tucking tail lamp conduit into cavity below pin housing.

**CAUTION**

**Over tightening screws can crack the lense or result in scratching of the fender paint.**

12. Align holes in lense with those in chrome plastic bracket and install two Phillips screws. Tighten screws to 20-24 **in-lbs** (2.3 - 2.7 Nm).

13. Turn the Ignition/Light Key Switch to IGNITION and test lamp for proper operation.

# TURN SIGNAL LAMPS 8.15

## GENERAL

*NOTE*

*If the turn signal does not light after bulb replacment, check the wiring, the handlebar switch and the electronic self-cancelling turn signal module.*

### FLHT/C/U, FLHR/C

The front turn signals are mounted to a light bar at the front of the vehicle. The rear turn signals are mounted to a light bar at the rear of the vehicle.

## BULB REPLACEMENT

1. See Figure 8-44. Remove the Phillips screws to release the amber lense. While pushing in the bulb, rotate 1/4 turn in a counterclockwise direction.

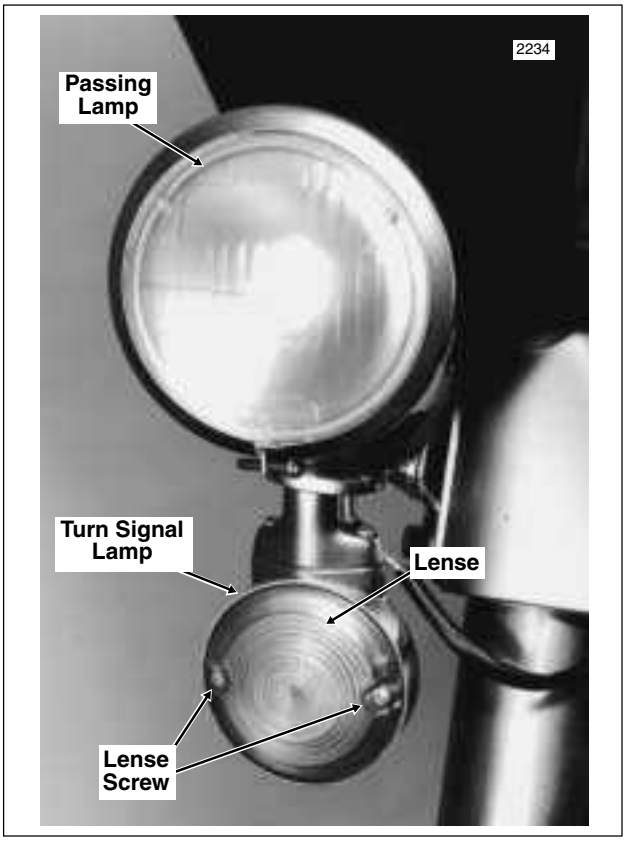



**Figure 8-44. Front Turn Signal Lamp**

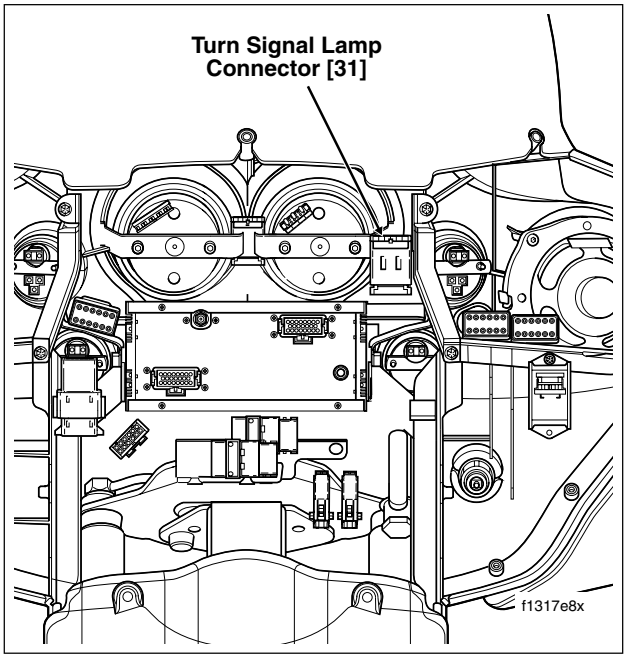



**Figure 8-45. Inner Fairing (FLHT/C/U)**

2. Verify that contacts in socket are clean. Replace the bulb and install the lense. See Section 8.2 BULB CHART, if necessary.

## FRONT TURN SIGNAL LAMP

### REMOVAL

1. **FLHT/C/U:** Remove the outer fairing. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL. Locate front turn signal connector (6-place Multilock) on inboard side of left fairing bracket. See Figure 8-45.

   **FLHR/C:** Remove the Phillips screw at the bottom of the headlamp door (chrome ring). Remove the headlamp door. Remove the seven Phillips screws to free the headlamp housing from the headlamp nacelle. Squeeze the two external tabs (if present) to remove the wire connector at the back of the headlamp bulb. Remove the headlamp housing assembly from the vehicle. Locate the front turn signal connector (black 6-place Multilock) anchored to connector bracket. See Figure 8-46.

2. Depress the button on the socket terminal side of the connector and pull apart the pin and socket halves.

3. Remove appropriate terminals from socket housing.

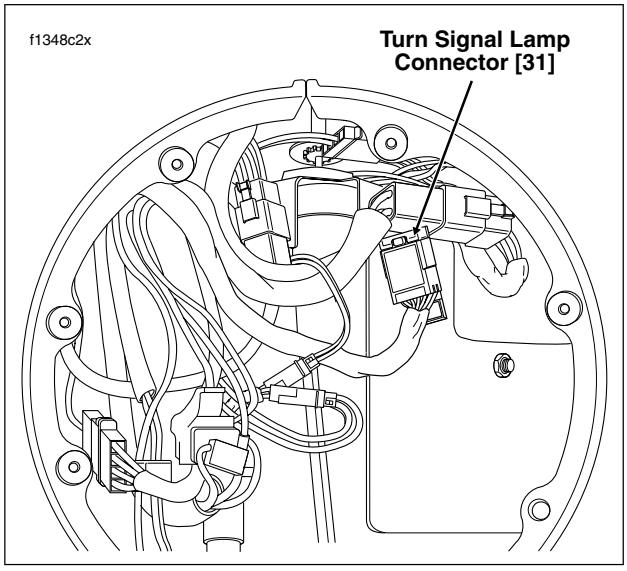



**Figure 8-46. Headlamp Nacelle (FLHR/C)**

## Table 8-8. Front Turn Signal Lamps [31]

| Left Side | | Right Side | |
|---|---|---|---|
| **Wire Color** | **Chamber** | **Wire Color** | **Chamber** |
| Blue (DOM) | 4 | Black | 1 |
| Violet/Brown | 5 | Violet/Brown | 2 |
| Black | 6 | Blue (DOM) | 3 |

*NOTE*

*For instructions on properly removing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, REMOVING SOCKET/PIN TERMINALS.*

4. Using a long shank ball end socket (Snap-on® FABL5), remove two screws to release turn signal lamps from mounting brackets. Use holes in passing lamp bracket to access inboard screws.
5. Obtain three equal lengths of strong flexible wire for use as mechanics wire. Feed wire through opening in socket terminal and then loop back twisting end until tightly coiled around longer strand as shown in Figure 8-47. Repeat step with remaining socket terminals.

*NOTE*

*Be sure that mechanics wire is of sufficient strength to pull terminals through conduit without breaking. Wire lengths must also be long enough so that free ends are not lost in conduit when pulled.*

6. Carefully pull wires to draw socket terminals through both sections of conduit. For best results, pull one wire at a time.
7. Unravel mechanics wire to release socket terminals.

## INSTALLATION

1. Lay old turn signal lamp next to **new** turn signal lamp and cut wires to length.
2. Strip 3/16 inch of insulation off **new** lamp wires and crimp on **new** socket terminals.

*NOTE*

*For instructions on crimping wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, CRIMPING INSTRUCTIONS.*

3. Reattach mechanics wire to socket terminals and carefully pull ends of mechanics wire to draw socket terminals back through conduit.
4. Carefully remove mechanics wire to avoid damage to terminals.
5. Install terminals into socket housing.

*NOTE*

*For instructions on properly installing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, INSTALLING SOCKET/PIN TERMINALS.*

6. Using a long shank ball end socket (Snap-on® FABL5), start two screws to secure turn signal lamp to mounting bracket. Verify that conduit fits in slot at back of bracket and is not pinched as screws are tightened. Use hole in passing lamp bracket to access inboard screw.
7. Mate pin and socket halves of front turn signal connector.

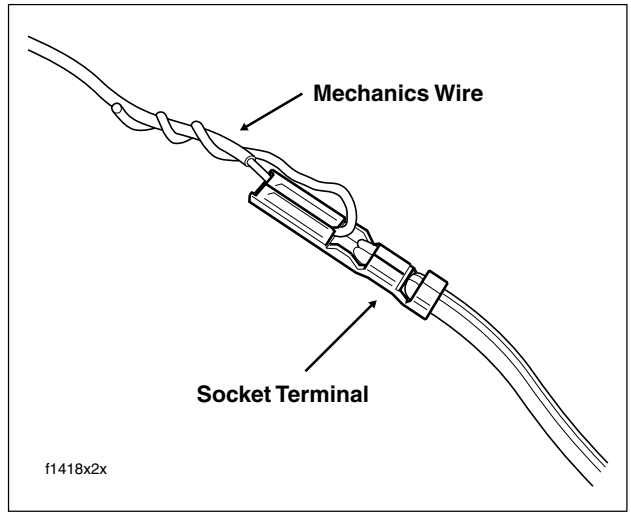



**Figure 8-47. Fix Mechanics Wire to Socket Terminals**

8. **FLHT/C/U:** Route conduit over chrome skirt at corners and position connector on inboard side of left fairing bracket. Install the outer fairing. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.

   **FLHR/C:** Attach connector to anchor on connector bracket. Install wire connector at the back of the headlamp bulb. Align holes in headlamp housing with those in headlamp nacelle. Install seven Phillips screws. Install the headlamp door (chrome ring) and door screw.

9. Turn Ignition/Light Key Switch to IGNITION and test for proper operation.

# REAR TURN SIGNAL LAMP

## REMOVAL

1. Remove two Phillips screws from lense to release tail lamp assembly from chrome plastic bracket at back of rear fender. Carefully pull tail lamp assembly from bracket.
2. Depress button at bottom of 4-place Multilock socket to release tail lamp assembly from pin housing. See Figure 8-48.
3. Depress button at top of 2-place Multilock socket to release turn signal lamp assembly from pin housing. To release socket housing, use a pick or small screwdriver to depress release button as shown in Figure 8-49.
4. Feed 2-place Multilock socket through opening in chrome plastic bracket to inboard side of rear fender. Reaching under rear fender, release conduit from cable clip anchored on T-stud.
5. Draw conduit and 2-place Multilock socket out through fender hole just below chrome plastic bracket. See Figure 8-49.
6. Raise lid of saddle bag on same side of vehicle. Grasp bail wire inside saddlebag and rotate each stud 1/4 turn in a counter-clockwise direction. Remove bail head studs with flat washers. Remove saddlebag.
7. Remove two socket head screws to release turn signal lamp assembly from bracket. For best results, insert a long shank ball end socket (Snap-on® FABL5) through round hole at back of rear turn signal lamp bracket. Draw conduit and 2-place Multilock socket out through same hole to remove turn signal lamp assembly from vehicle.
8. Remove terminals from socket housing.

*NOTE*

*For instructions on properly removing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, REMOVING SOCKET/PIN TERMINALS.*

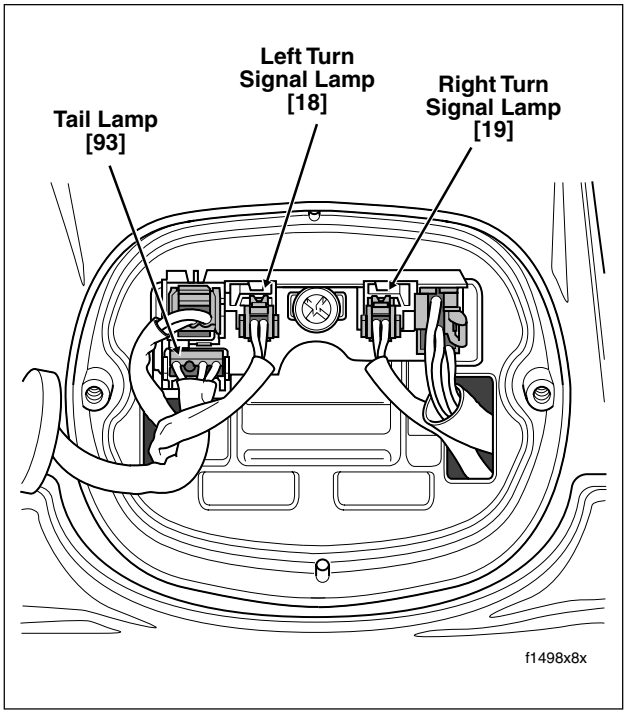



**Figure 8-48. Release Tail Lamp Socket**

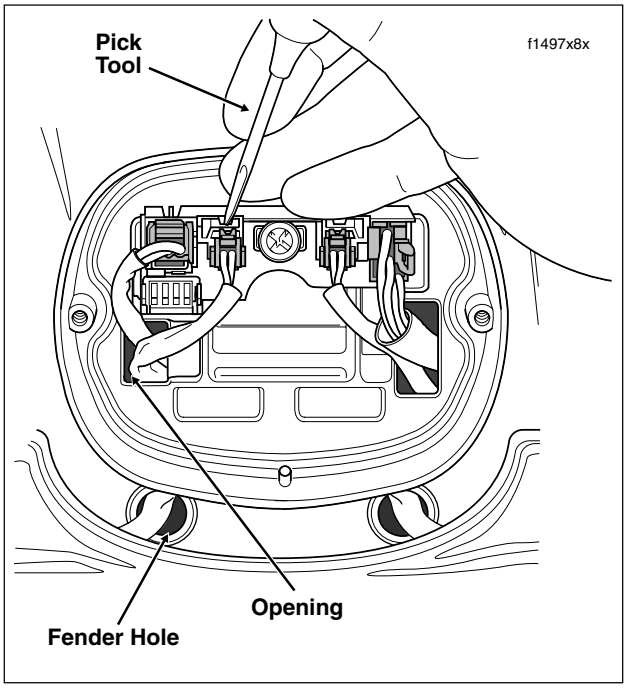



**Figure 8-49. Release Left Turn Signal Lamp Socket**

## INSTALLATION

1. Place **new** turn signal lamp assembly next to discarded unit and cut wires to proper length.

2. Crimp **new** socket terminals onto turn signal lamp wires.

*NOTE*

*For instructions on crimping wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, CRIMPING INSTRUCTIONS.*

3. Install terminals into socket housing.

## Table 8-9. Rear Turn Signal Lamps [18/19]

| Wire Color | Chamber Number |
|---|---|
| Violet/Brown | 1 |
| Black | 2 |

*NOTE*

*For instructions on properly installing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, INSTALLING SOCKET/PIN TERMINALS.*

4. Align holes in turn signal lamp assembly with those in bracket and install two socket head screws. For best results, insert a long shank ball end socket (Snap-on® FABL5) through round hole at back of rear turn signal lamp bracket.
5. Route 2-place Multilock socket through same hole at back of rear turn signal lamp bracket, and then feed socket through fender hole just below chrome plastic bracket. See Figure 8-49.
6. Reaching under rear fender, capture conduit in cable clip anchored on T-stud. Feed 2-place Multilock socket through opening in chrome plastic bracket to outboard side of rear fender.
7. Orient 2-place Multilock socket so that the release button is at the top and insert into pin housing until it “clicks.”
8. To install tail lamp assembly, orient 4-place Multilock socket so that the release button is at the bottom and insert into pin housing until it “clicks.” Verify that rear fender tip lamp and left turn signal lamp conduit are positioned on the outboard side of the tail lamp conduit as shown in Figure 8-48.
9. Place tail lamp into position against chrome plastic bracket tucking tail lamp conduit into cavity below pin housing.

**CAUTION**

**Over tightening screws can crack the lense or result in scratching of the fender paint.**

10. Align holes in lense with those in chrome plastic bracket and install two Phillips screws. Tighten screws to 20-24 **in-lbs** (2.3 - 2.7 Nm).
11. Turn the Ignition/Light Key Switch to IGNITION and test lamp for proper operation.
12. Position saddlebag on vehicle. Place flat washers on bail head studs. With groove at end of stud held in a horizontal position, insert stud through holes in saddlebag and front mounting bracket. When groove engages wire form of spring plate on inboard side of bracket, turn stud clockwise a full 1/4 turn until it snaps in place. Install rear bail head stud in the same manner.

# TURN SIGNAL/SECURITY MODULE 8.16

*NOTE*

*The turn signal/security module also houses the bank angle sensor.*

## REMOVAL

*IMPORTANT NOTE*

*If equipped with the optional "Harley-Davidson Factory Security System," verify that security status lamp in speedometer face is not flashing before proceeding (security system disarmed).*

1. Remove seat. See Section 2.21 SEAT, REMOVAL.
2. Locate the turn signal/security module inside cavity of frame weldment at rear of battery box. See Figure 8-50.
3. Depress tab at front of spring clip and lift to release legs from holes in weldment.
4. Remove turn signal module from cavity and disconnect 8-place Deutsch connector [30].

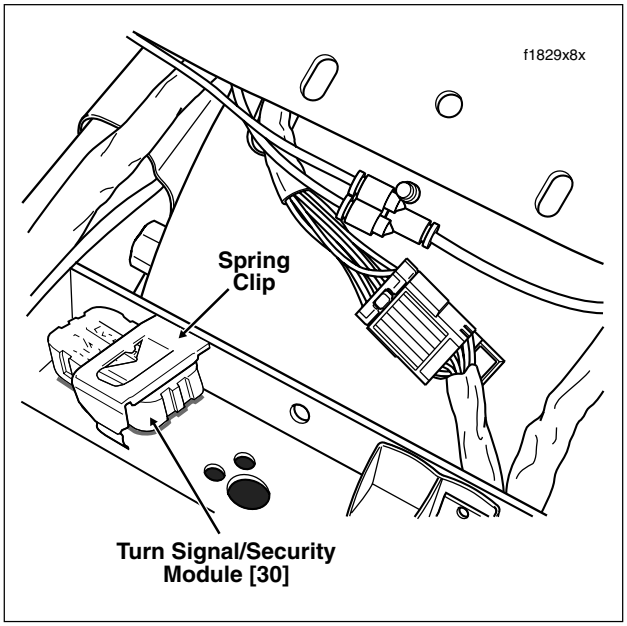



**Figure 8-50. Turn Signal/Security Module**

## INSTALLATION

1. Connect 8-place Deutsch connector [30] to **new** turn signal/security module and install into cavity of frame weldment at rear of battery box.
2. Insert legs of spring clip into holes in weldment and push down until tab at front snaps in place.
3. Install seat. See Section 2.21 SEAT, INSTALLATION.
4. Test all turn signal functions. Test all security system functions, if so equipped.

**⚠WARNING**

**DO NOT modify the ignition/light key switch wiring to disable the automatic-on headlamp feature. High visibility is an important safety consideration for motorcycle riders. Ensure that the headlamp is on at all times. Failure to do so could result in death or serious injury.**

## FLHT/C/U (Domestic)

### REMOVAL

1. Remove the outer fairing. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL.
2. To remove the ignition switch knob, first turn the Ignition Switch key to UNLOCK and then turn the knob to ACCESS. Depress the release button at bottom (left side) with a small screwdriver, and while pushing key down, turn 60 degrees in a counter-clockwise direction. Lift and remove knob. See Figure 8-51.

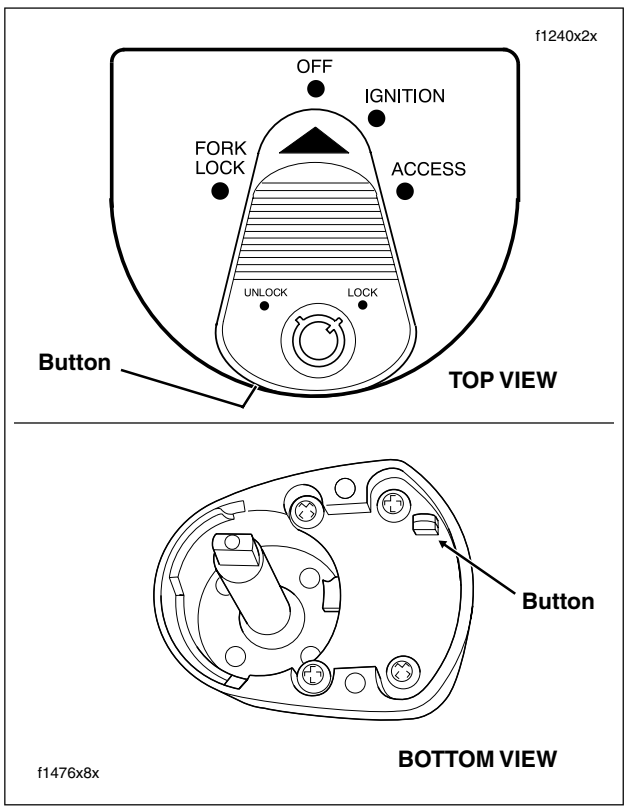



**Figure 8-51. Ignition Switch Knob Release Button**

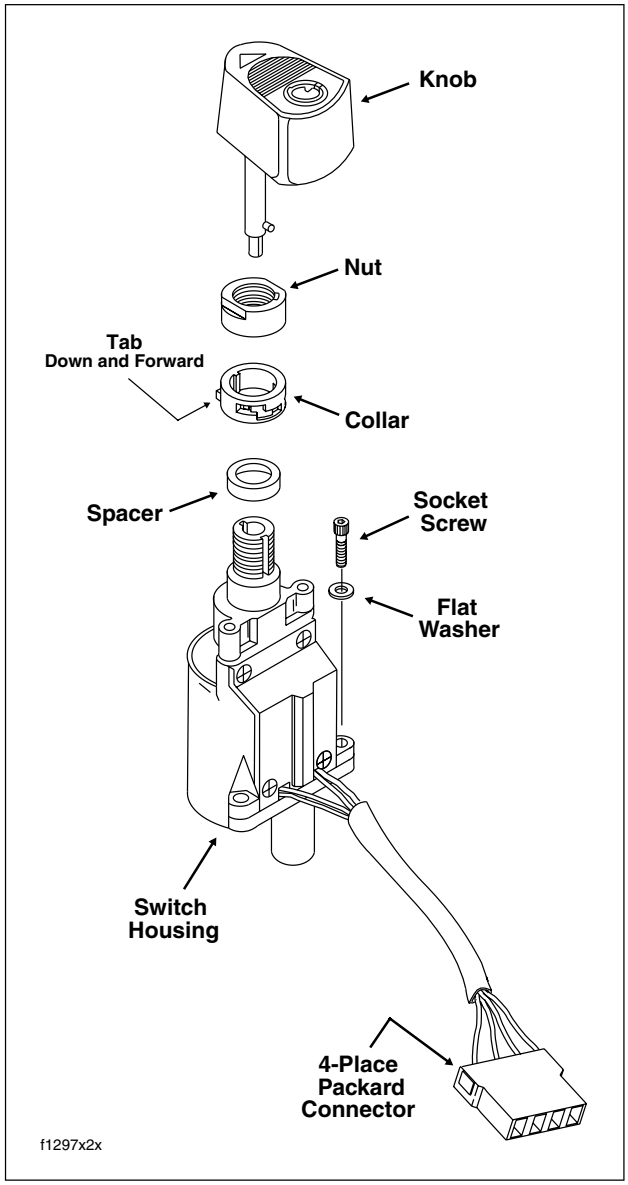



**Figure 8-52. Ignition Switch Assembly (Domestic)**

3. Using a 7/8 inch wrench on flats, loosen switch nut and remove from threaded post of ignition switch housing. Remove collar and spacer. See Figure 8-52.
4. Using a T27 TORX drive head, remove the two screws (with flat washers) that secure fairing cap to left and right sides of inner fairing.
5. Remove the decal plate by pulling tabs from slots in fairing cap. If necessary, raise the fairing cap slightly to facilitate removal.

6. With the forks turned fully to the left, disconnect the Fairing switch connector [105], 12-place Multilock (black), from behind right side of fairing cap. Depress the button on the plug side of the connector to pull apart the pin and socket halves.
7. Remove the fairing cap from the motorcycle. See Figure 8-53.
8. Locate the Ignition switch connector [33], 4-place Packard (black), next to the top fork bracket. Separate the pin and socket halves. See Figure 8-54.
9. Remove the socket screws (with flat washers) and lift the switch housing from the triple clamp bore. Route the Ignition switch connector to rear of inner fairing and remove switch housing from the vehicle.

## INSTALLATION

1. Slide base of ignition switch into bore of triple clamp. Install screws (with flat washers) and tighten to **40-45 in-lbs** (4.5-5.1 Nm).
2. Route the Ignition switch connector [33], 4-place Packard (black), to front of inner fairing so that it is positioned next to the top fork bracket. Mate pin and socket halves.
3. Verify that the rubber grommets are installed on each side of the fairing cap. Barbs on cap fit into holes in grommets.
4. Connect the Fairing switch connector [105], 12-place Multilock (black), on the right side of fairing cap.
5. With the forks turned fully to the left, install fairing cap over ignition switch housing.

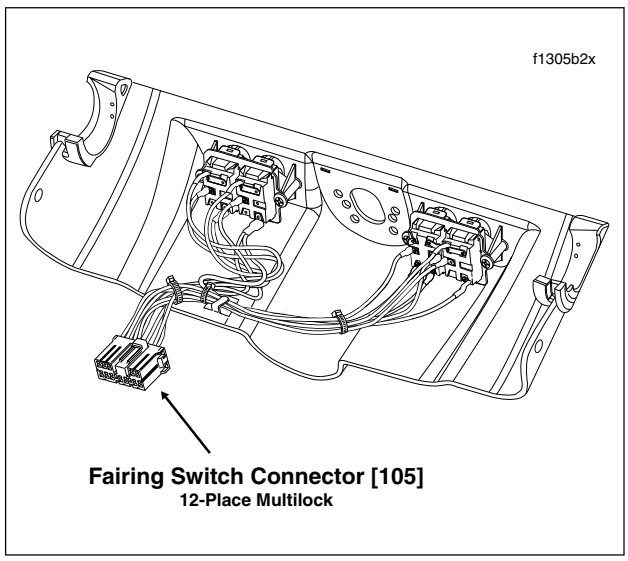



**Figure 8-53. Fairing Cap Assembly (FLHT/C/U)**

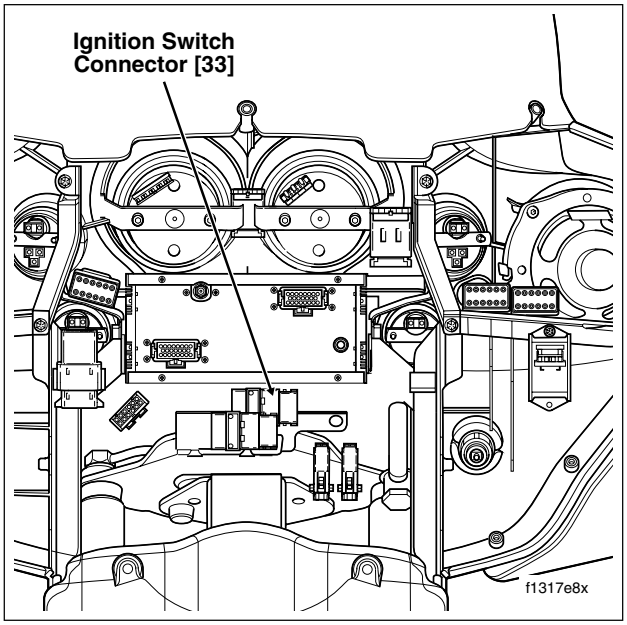



**Figure 8-54. Ignition Switch Connector Location (FLHT/C/U)**

6. Install decal plate fitting tabs in slots of fairing cap. Plate snaps in place when properly installed. Exercise care to avoid breaking tabs. Replace plate if tabs are broken.
7. Using a T27 TORX drive head, start two fairing cap screws (with flat washers). Verify that grommets in fairing cap fully capture handlebar along with throttle and clutch cables.
8. Slide spacer over threaded post of ignition switch housing until it contacts decal plate. Slide collar over post with the tab side down (and forward). Install nut, and using a 7/8 inch wrench on flats, tighten until snug.
9. With the red arrow pointing toward the ACCESS position, install the ignition switch knob. Turn key clockwise to UNLOCK position and then turn knob to OFF.
10. Using a T27 TORX drive head, tighten two fairing cap screws to 45-55 **in-lbs** (5.1-6.2 Nm).
11. Verify operation of both the ignition switch and fork lock assemblies.
12. Install the outer fairing. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.

# FLHT/C/U (International)

## REMOVAL

1. Remove the outer fairing. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL.

2. Peel back the decal from the top of the ignition switch knob and discard. See Figure 8-55.
3. Pull out the four aluminum tamper-proof plugs with a stud extractor or Easy-Out. If necessary, carefully drill out plugs using a 3/8 inch or 9.5mm bit, but exercise caution to avoid damaging hex in button head allen screws.
4. Remove the four button head allen screws from the ignition switch knob. Remove the knob from the ignition switch housing. Remove the gaskets from the surface of the fairing cap, if present.
5. Using a T27 TORX drive head, remove the two screws (with flat washers) that secure fairing cap to left and right sides of inner fairing.
6. Remove the plate by pulling tabs from slots in fairing cap. If necessary, raise the fairing cap slightly to facilitate removal.
7. With the forks turned fully to the left, disconnect the Fairing switch connector [105], 12-place Multilock (black), from behind right side of fairing cap. Depress the button on the plug side of the connector to pull apart the pin and socket halves. See Figure 8-53.
8. Remove the fairing cap from the motorcycle. See Figure 8-53.
9. Locate the Ignition switch connector [33], 4-place Packard (black), next to the top fork bracket. Separate the pin and socket halves. See Figure 8-54.
10. Reaching in at side of inner fairing, use a 3/16 inch bit (with long shank) to carefully drill out the two break-away screws at the base of the ignition switch housing. To avoid chatter marks or other damage, be sure to use a center punch to make a pilot hole.
11. Using a pliers, remove the shafts of the break-away screws.
12. Route the Ignition switch connector to rear of inner fairing and remove switch housing from the triple clamp bore.

## INSTALLATION

1. Slide base of ignition switch housing into bore of triple clamp.
2. Route the Ignition switch connector [33], 4-place Packard (black), to front of inner fairing so that it is positioned next to the top fork bracket. Mate pin and socket halves.

**CAUTION**

**Verify that the threads in the triple clamp and ignition switch housing are clean and in good condition. Dirty and/or damaged threads may cause the heads of the break away screws to snap off before the switch housing is properly tightened.**

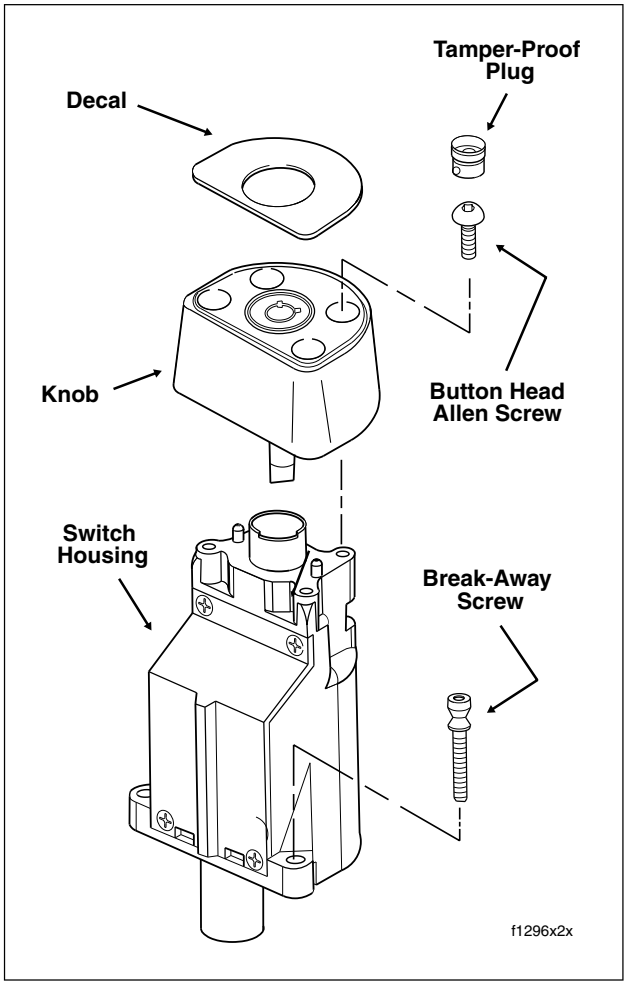



**Figure 8-55. gnition Switch Assembly (International)**

**CAUTION**

**Exercise care to avoid losing heads of screws in vehicle. Vibration may cause captured heads to scratch finished surfaces, chafe wires or cause other damage.**

3. Install **new** break-away screws at base of ignition switch housing. Turn screws in a clockwise direction until heads snap off.
4. Verify that the rubber grommets are installed on each side of the fairing cap. Barbs on cap fit into holes in grommets.
5. Connect the Fairing switch connector [105], 12-place Multilock (black), on the right side of fairing cap.
6. With the forks turned fully to the left, install fairing cap over ignition switch housing.
7. Install plate fitting tabs in slots of fairing cap. Plate snaps in place when properly installed. Exercise care to avoid breaking tabs. Replace plate if tabs are broken.

8. If provided, place gaskets over the switch housing so that they rest flat on the fairing cap.
9. Using a T27 TORX drive head, start two fairing cap screws (with flat washers). Verify that grommets in fairing cap fully capture handlebar along with throttle and clutch cables. Tighten fairing cap screws to 45-55 **in-lbs** (5.1-6.2 Nm).
10. With the flat side of the ignition switch knob facing the front of the vehicle, insert the lock shaft into the switch housing bore. Loosely install the four button head allen screws.
11. Alternately tighten the two front button head allen screws to 18-23 **in-lbs** (2.0-2.6 Nm). While keeping the lock centered in the switch housing, alternately tighten the two rear screws to a maximum of 18-23 **in-lbs** (2.0-2.6 Nm).
12. Verify operation of both the ignition switch and fork lock assemblies.
13. Install four **new** tamper-proof aluminum plugs into bores of ignition switch knob. Be sure that pilot mark on each plug faces upward.
14. Install a **new** decal.
15. Install the outer fairing. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.

# FAIRING CAP SWITCHES (FLHTC/U) 8.18

## REMOVAL

1. See Figure 8-56. To remove the ignition switch knob, first turn the Ignition Switch key to UNLOCK and then turn the knob to ACCESS. Depress the release button at bottom (left side) with a small screwdriver, and while pushing key down, turn 60 degrees in a counter-clockwise direction. Lift and remove knob.
2. Using a 7/8 inch wrench on flats, loosen switch nut and remove from threaded post of ignition switch housing. Remove collar and spacer.
3. Using a T27 TORX drive head, remove the two screws (with flat washers) that secure fairing cap to left and right sides of inner fairing.
4. Gently remove the decal plate by pulling tabs from slots in fairing cap. If necessary, raise the fairing cap slightly to facilitate removal.
5. With the forks turned fully to the left, disconnect the Fairing switch connector [105], 12-place Multilock (black), from behind right side of fairing cap. Depress the button on the socket terminal side of the connector (plug) to pull apart the pin and socket halves.
6. Remove the fairing cap from the motorcycle. See Figure 8-57.
7. Bend back the flexible clamp to release switch wires from the inboard side of the fairing cap. Carefully cut cable straps to free wires from bundles.
8. Using a T25 TORX drive head, remove two screws to release switch bracket.
9. Gently pry two latches on bracket outward to release tabs on switch. Remove switch from bracket. See Figure 8-58.
10. If replacing Cruise or Speaker Switch, cut Black/Green wire lead halfway between Cruise and Speaker Switch terminals.
11. Follow the wires of the faulty switch to the socket housing, or reference Figure 8-59 and Table 8-10 for the applicable chamber numbers. For wire location purposes, numbers are stamped into the secondary locks of both the pin and socket housings.
12. Remove the appropriate terminals from the socket housing.

*NOTE*

*For instructions on properly removing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, REMOVING SOCKET/PIN TERMINALS.*

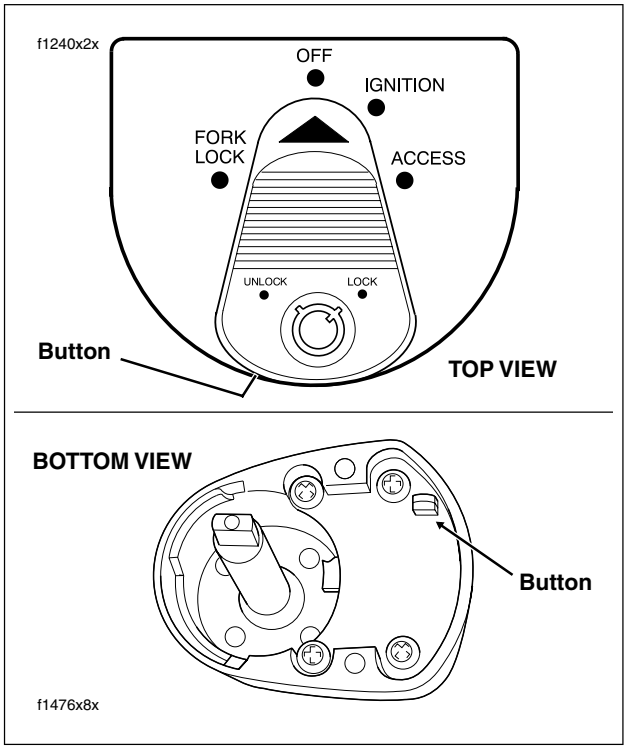



**Figure 8-56. Ignition Switch Knob Release Button**

## INSTALLATION

1. Feeding wires through bracket, place **new** switch into position. Engage tabs on switch in slots of latches and then gently bend tabs upward to lock position of switch in bracket.
2. Install terminals into socket housing.

*NOTE*

*For instructions on properly installing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, INSTALLING SOCKET/PIN TERMINALS.*

3. If Cruise or Speaker Switch was replaced, butt splice Black/Green wire lead between Cruise and Speaker Switch terminals.

*NOTE*

*For detailed butt splicing information, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.4 SEALED BUTT SPLICE CONNECTORS.*

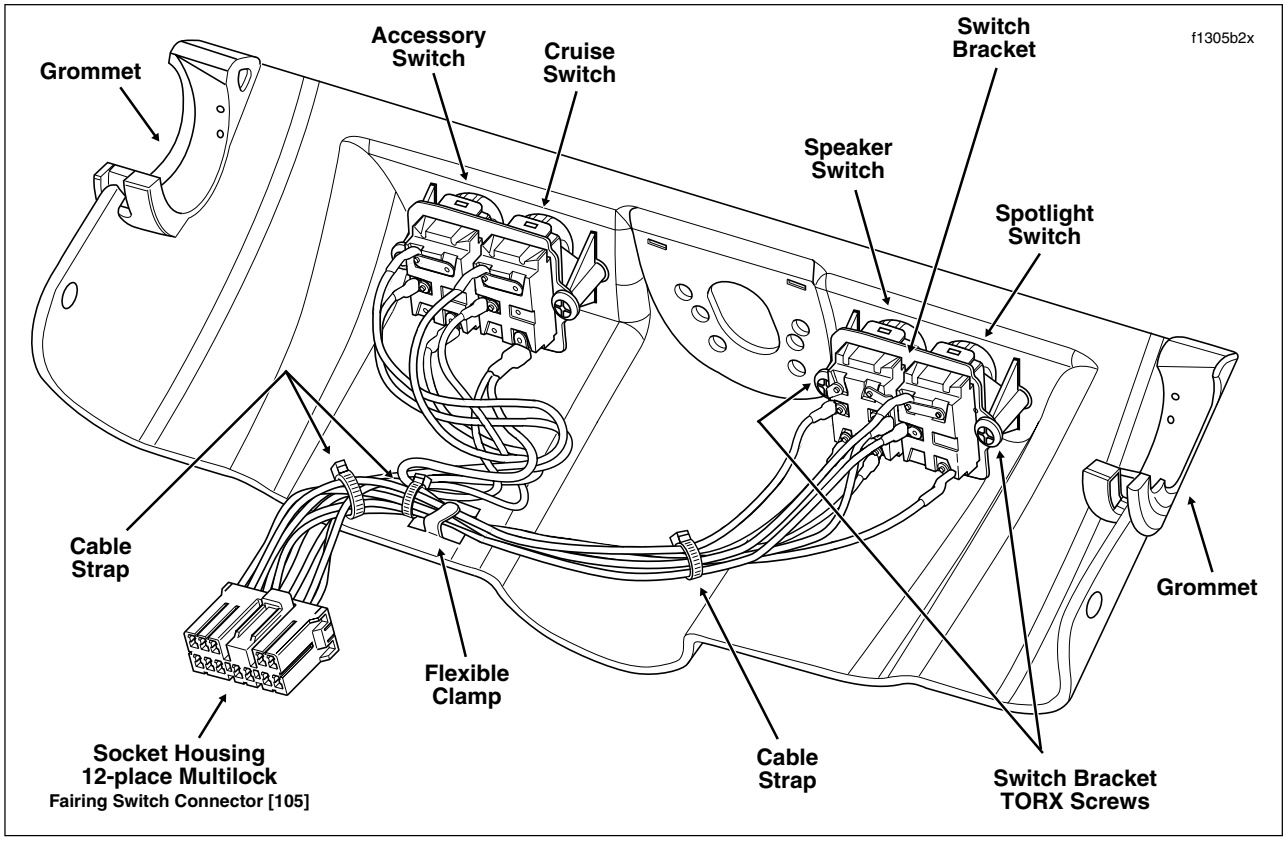



**Figure 8-57. Fairing Cap (Inboard Side) - Ultra Model Shown**

4. Using a T25 TORX drive head, install two screws to secure switch bracket to fairing cap.
5. Install **new** cable straps to capture wire bundles and then secure switch wires to the fairing cap using the flexible clamp. Route the wires as shown in Figure 8-57.
6. Verify that the rubber grommets are installed on each side of the fairing cap. Barbs on cap fit into holes in grommets.
7. Connect the Fairing switch connector [105], 12-place Multilock (black), on the right side of fairing cap.
8. With the forks turned fully to the left, install fairing cap over ignition switch housing. Install decal plate fitting tabs in slots of fairing cap. Plate snaps in place when properly installed. Exercise care to avoid breaking tabs. Replace plate if tabs are broken.
9. Using a T27 TORX drive head, start two fairing cap screws (with flat washers). Verify that grommets in fairing cap fully capture handlebar along with throttle and clutch cables.
10. Slide spacer over threaded post of ignition switch housing until it contacts decal plate. Slide collar over post with the tab side down (and forward). Install nut, and using a 7/8 inch wrench on flats, tighten until snug.

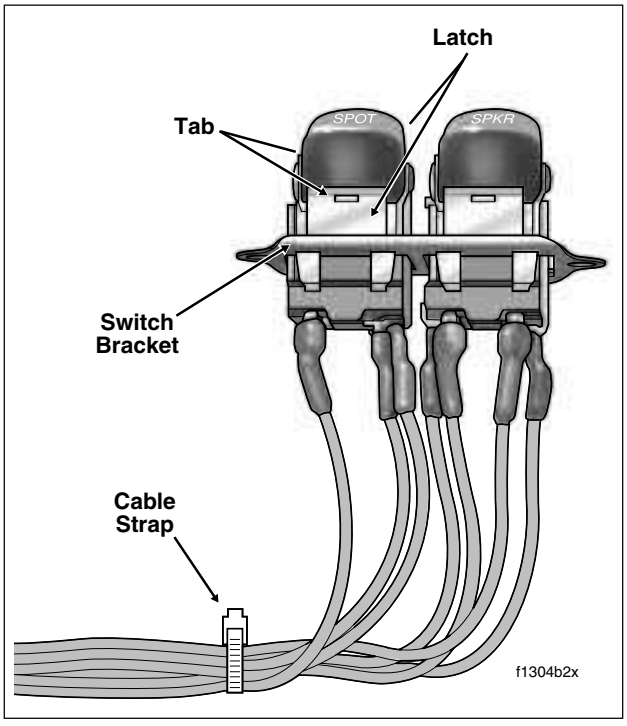



**Figure 8-58. Bend Latches Outward to Release Tabs**

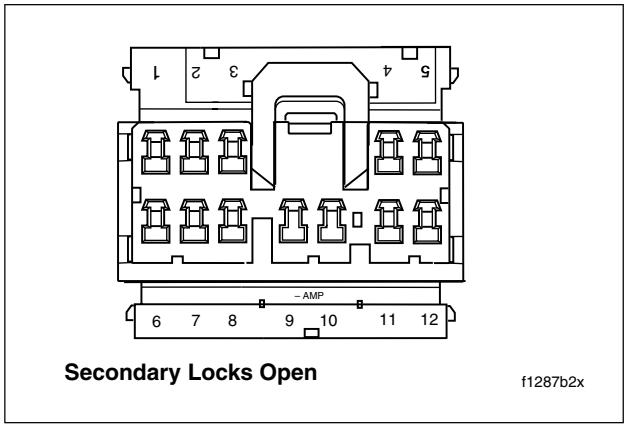



**Figure 8-59. Numbers Stamped on Secondary Locks (Socket Housing Shown)**

## Table 8-10. Fairing Cap Switches [105]

| Switch | Wire Color | Chamber Number | |
|---|---|---|---|
| Accessory | Orange/Red | 1 | |
| | Orange | 2 | |
| | Black | 3 | |
| Cruise Ultra Only | Orange/Violet | 4 | |
| | Red/Green | 5 | |
| | Black/Green (Double Lugged) | 12 | To Speaker Switch |
| Spot | Yellow | 6 | |
| | Gray/Black | 7 | |
| | Black | 8 | |
| Speaker Ultra Only | Orange/Blue | 9 | |
| | Violet/Orange | 10 | |
| | Brown/Orange | 11 | |
| | Black/Green | To Cruise Switch | |

11. With the red arrow pointing toward the ACCESS position, install the ignition switch knob. Turn key clockwise to UNLOCK position and then turn knob to OFF.

12. Using a T27 TORX drive head, tighten two fairing cap screws to 45-55 **in-lbs** (5.1-6.2 Nm).

# INSTRUMENT NACELLE SWITCHES (FLTR) 8.19

## REMOVAL

1. Using a T25 TORX drive head, remove screw on left and right side of instrument bezel.
2. Use thumbs to push tab at rear of bezel from slot above ignition switch. Gently raise free side of bezel until tabs at front of instrument nacelle become disengaged from slot at front of bezel (concealed behind decorative adhesive strip).
3. See Figure 8-60. Disconnect instruments from main harness.
   - Speedometer connector [39], 12-place Packard.

*NOTE*

*Depress clear plastic latch on secondary lock to release connector at back of speedometer.*

   - Tachometer connector [108], 6-place Packard.

*NOTE*

*Tachometer connector is a friction fit with no external latches; to avoid damage to wire terminals, pull on connector housing to remove.*

4. Cut cable strap between speedometer and tachometer brackets and disconnect the following connector from jumper harness.
   - Indicator Lamps connector [21], 10-place Multilock.
5. Remove bezel from vehicle.
6. To remove the ignition switch knob, first turn the Ignition Switch key to UNLOCK and then turn the knob to ACCESS. Depress the release button at bottom (left side) with a small screwdriver, and while pushing key down, turn 60 degrees in a counter-clockwise direction. Lift and remove knob. See upper frame of Figure 8-61.
7. Using a 7/8 inch wrench on flats, loosen switch nut and remove from threaded post of ignition switch housing. Remove collar and spacer. See lower frame of Figure 8-61.
8. Remove the switch position plate from threaded post of ignition switch housing.
9. Follow instructions based on location of defective switch.

## LEFT SIDE SWITCH

a. See Figure 8-60. Depress button on plug side of Speaker Switch connector [105], 4-place Multilock, and pull apart pin and socket halves.

b. Using a T40 TORX drive head, remove two bolts (with flat washers) to release left side of instrument nacelle from fork side. Leaving right side on vehicle, move left side of nacelle to bench area. See Figure 8-66.

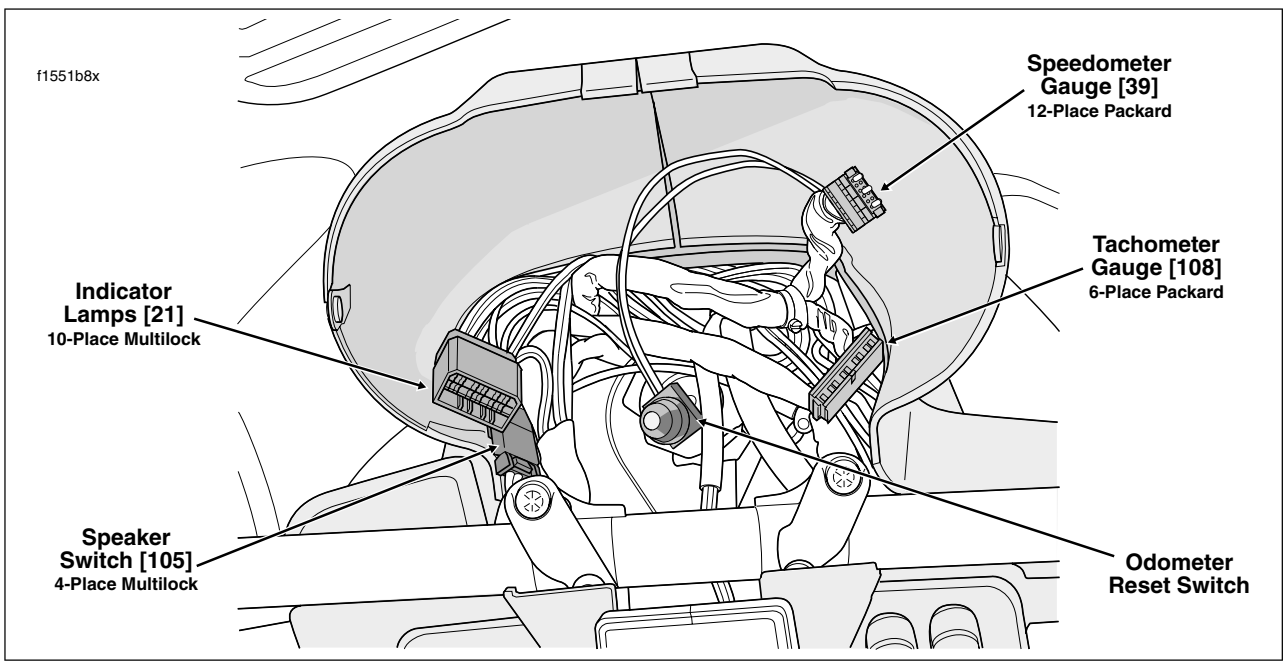



**Figure 8-60. Instrument Nacelle (Bezel Removed)**

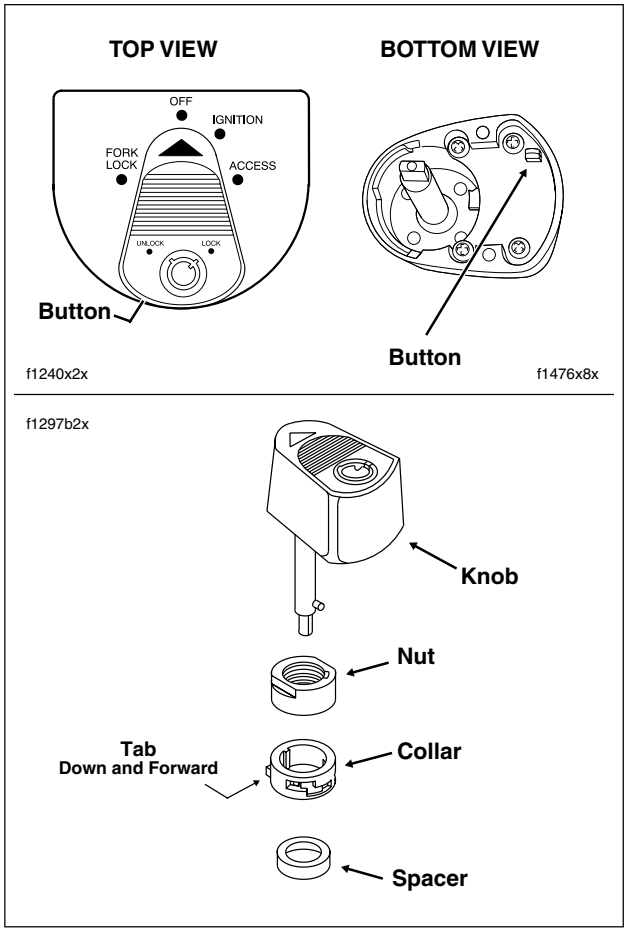



**Figure 8-61. Ignition Switch Knob Release Button**

c. Gently bend back molded retainer to release switch bracket assembly from instrument nacelle.

d. Carefully pry two latches on bracket outward to release tabs on switch. Remove switch from bracket. See Figure 8-63.

## RIGHT SIDE SWITCH

a. At lower right side of instrument nacelle, unthread rubber boot to free odometer reset switch. Pull switch from hole in instrument nacelle.

b. Pull throttle cable clip from hole on upper right side of instrument nacelle.

c. Remove the outer fairing. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLTR), OUTER FAIRING, REMOVAL.

d. Carefully pull wire bundles and conduit from tunnel of fairing bracket, allowing the bundles to hang naturally. If necessary, cut cable straps at front corners of radio bracket to release interconnect harness.

e. See Figure 8-62. Disconnect jumper harness from interconnect harness as follows:

- Indicator Lamps connector [21], 10-place Multilock.
- Instrument nacelle switch connector [105], 12-place Multilock.

f. Using a T40 TORX drive head, remove two bolts (with flat washers) to release right side of instrument nacelle from fork side.

g. To pull right side of instrument nacelle from vehicle, draw free end of jumper harness through tunnel of fairing bracket to rear of inner fairing. Leaving left side of nacelle on vehicle, move right side of nacelle to bench area. See Figure 8-66.

h. Carefully pry back molded retainer to release switch bracket assembly from instrument nacelle.

i. Carefully pry two latches on bracket outward to release tabs on switch. Remove switch from bracket. See Figure 8-63.

j. Cut cable strap to separate Cruise and Accessory switch wires, if present. Cut cable strap on inboard side of jumper harness conduit.

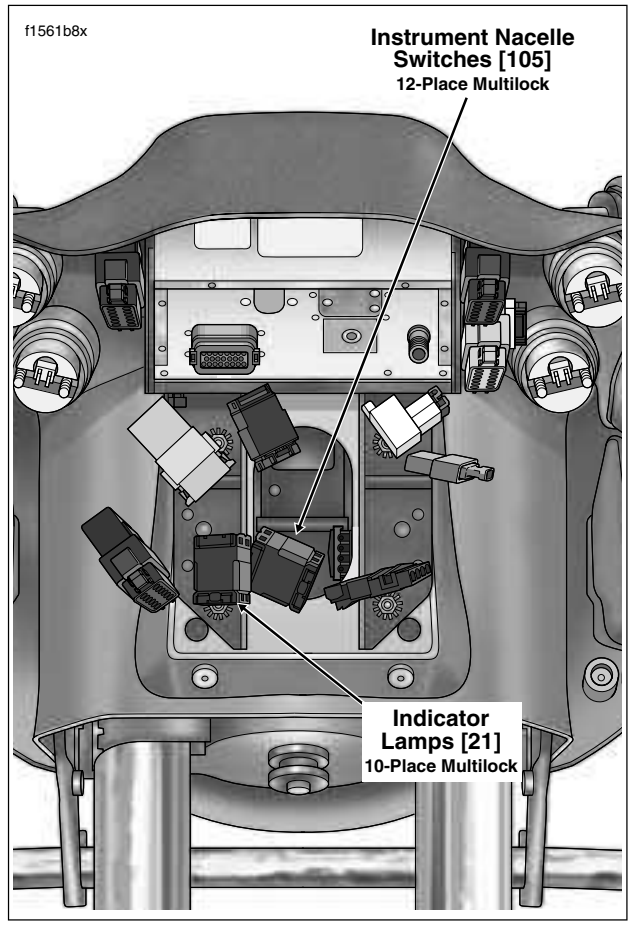



**Figure 8-62. Interconnect Harness Connectors**

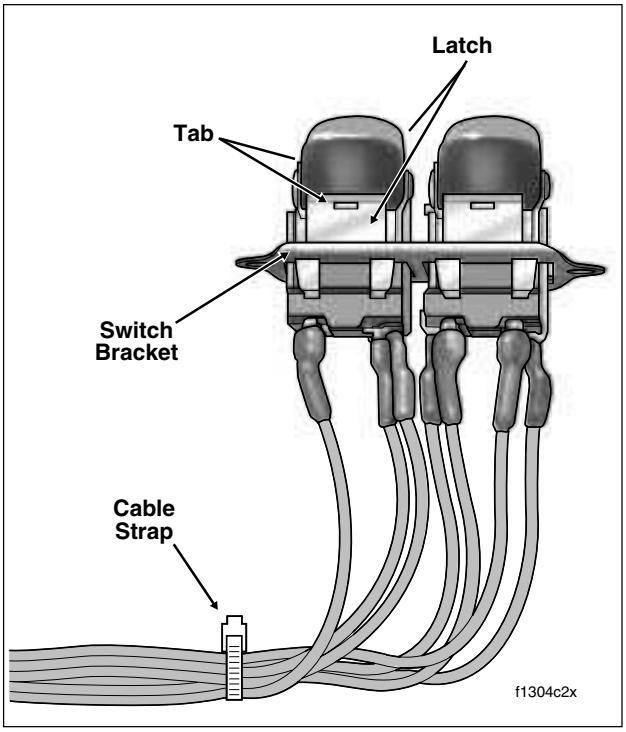



**Figure 8-63. Bend Latches Outward to Release Tabs**

k. Follow the wires of the faulty switch to the socket housing, or reference Figure 8-64 and Table 8-11 for the applicable chamber numbers. For wire location purposes, numbers are stamped into the secondary locks of both the pin and socket housings.

l. Remove the appropriate terminals from the socket housing.

*NOTE*

*For instructions on properly removing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, REMOVING SOCKET/PIN TERMINALS.*

m. Obtain equal lengths of strong flexible wire for use as mechanics wire. Feed wire through opening in socket terminal and then loop back twisting end until tightly coiled around longer strand as shown in Figure 8-65. Repeat step with remaining socket terminals.

*NOTE*

*Be sure that mechanics wire is of sufficient strength to pull terminals through conduit without breaking. Wire lengths must also be long enough so that free ends are not lost in conduit when pulled.*

n. Carefully pull wires to draw socket terminals through conduit. For best results, pull one wire at a time.

o. Unravel mechanics wire to release socket terminals.

# INSTALLATION

1. Follow instructions based on location of defective switch.

## LEFT SIDE SWITCH

a. Feeding wires through switch bracket, place **new** switch into position. Engage tabs on switch in slots of latches and then gently bend tabs upward to lock position of switch in bracket.

b. Snap switch bracket into molded retainer in instrument nacelle.

c. Carefully place instrument nacelle on vehicle. Using a T40 TORX drive head, install two bolts (with flat washers) to fasten instrument nacelle to fork side. Be sure to capture clutch cable clip when installing upper bolt.

### Table 8-11. Right Side Instrument Nacelle Switches [105B]

| Switch | Wire Color | Chamber Number | |
|---|---|---|---|
| Accessory | Orange/Red | 1 | |
| | Orange | 2 | |
| | Black | 3 | |
| Cruise | Orange/Violet | 4 | |
| | Red/Green | 5 | |
| | Black/Green (Double Lugged) | 12 | Also Chamber 4 of Speaker Switch Pin Connector [105C]. |

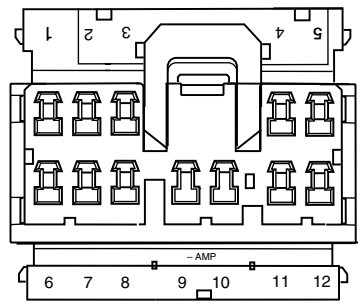



**Figure 8-64. Numbers Stamped on Secondary Locks (Socket Housing Shown)**

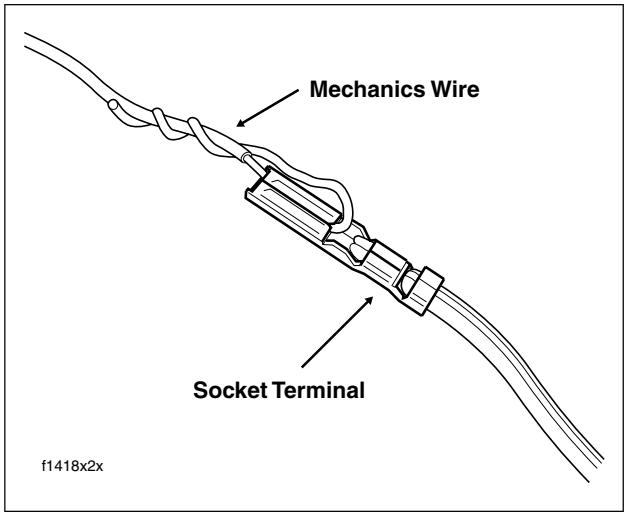



**Figure 8-65. Fix Mechanics Wire to Socket Terminals**

d. Mate pin and socket halves of Speaker Switch connector [105], 4-place Multilock. See Figure 8-60.

e. Move to RIGHT SIDE SWITCH, step 2.

## RIGHT SIDE SWITCH

a. Feeding wires through switch bracket, place **new** switch into position. Engage tabs on switch in slots of latches and then gently bend tabs upward to lock position of switch in bracket. See Figure 8-63.

b. Reattach mechanics wire to socket terminals of **new** switch and carefully pull ends of mechanics wire to draw socket terminals back through conduit. For best results, pull one wire at a time.

c. Carefully remove mechanics wire to avoid damage to terminals.

d. Install terminals into socket housing.

*NOTE*

*For instructions on properly installing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, INSTALLING SOCKET/PIN TERMINALS.*

e. Snap switch bracket into molded retainer in instrument nacelle.

f. Install **new** cable strap on inboard side of jumper harness conduit. Install **new** cable strap capturing Cruise and Accessory switch wires. See Figure 8-63.

g. To install right side of instrument nacelle, feed free end of jumper harness through tunnel of fairing bracket to front of inner fairing (beneath radio).

h. See Figure 8-62. Standing at front of vehicle, connect jumper harness to interconnect harness as follows:

- Instrument nacelle switch connector [105], 12-place Multilock.
- Indicator Lamps connector [21], 10-place Multilock.

i. Carefully tuck wire bundles and conduit into tunnel of fairing bracket. Using holes at front corners of radio bracket, install two **new** cable straps to capture interconnect harness below radio. Cut excess cable strap material.

j. Install the outer fairing. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLTR), OUTER FAIRING, INSTALLATION.

k. Carefully place instrument nacelle on vehicle. Using a T40 TORX drive head, install two bolts (with flat washers) to fasten instrument nacelle to fork side.

l. Slide odometer reset switch through hole at lower right side of instrument nacelle. Install rubber boot to secure.

m. Capture throttle cables in cable clip. Insert cable clip into hole in upper right side of instrument nacelle.

2. Install the switch position plate over threaded post of ignition switch housing. Tabs on plate fit in holes at top of instrument nacelle.

3. Slide spacer over threaded post of ignition switch housing until it contacts switch position plate. Slide collar over post with the tab side down (and forward). Install nut, and using a 7/8 inch wrench on flats, tighten until snug. See lower frame of Figure 8-61.

4. With the red arrow pointing toward the ACCESS position, install the ignition switch knob. Turn key clockwise to UNLOCK position and then turn knob to OFF.

5. See Figure 8-60. Looking into the instrument nacelle, connect the following connector to jumper harness.

   - Indicator Lamps connector [21], 10-place Multilock.

     Position connector between speedometer and tachometer brackets and secure using **new** cable strap. Cut any excess cable strap material.

6. Connect instruments to main harness.

   - Speedometer connector [39], 12-place Packard.

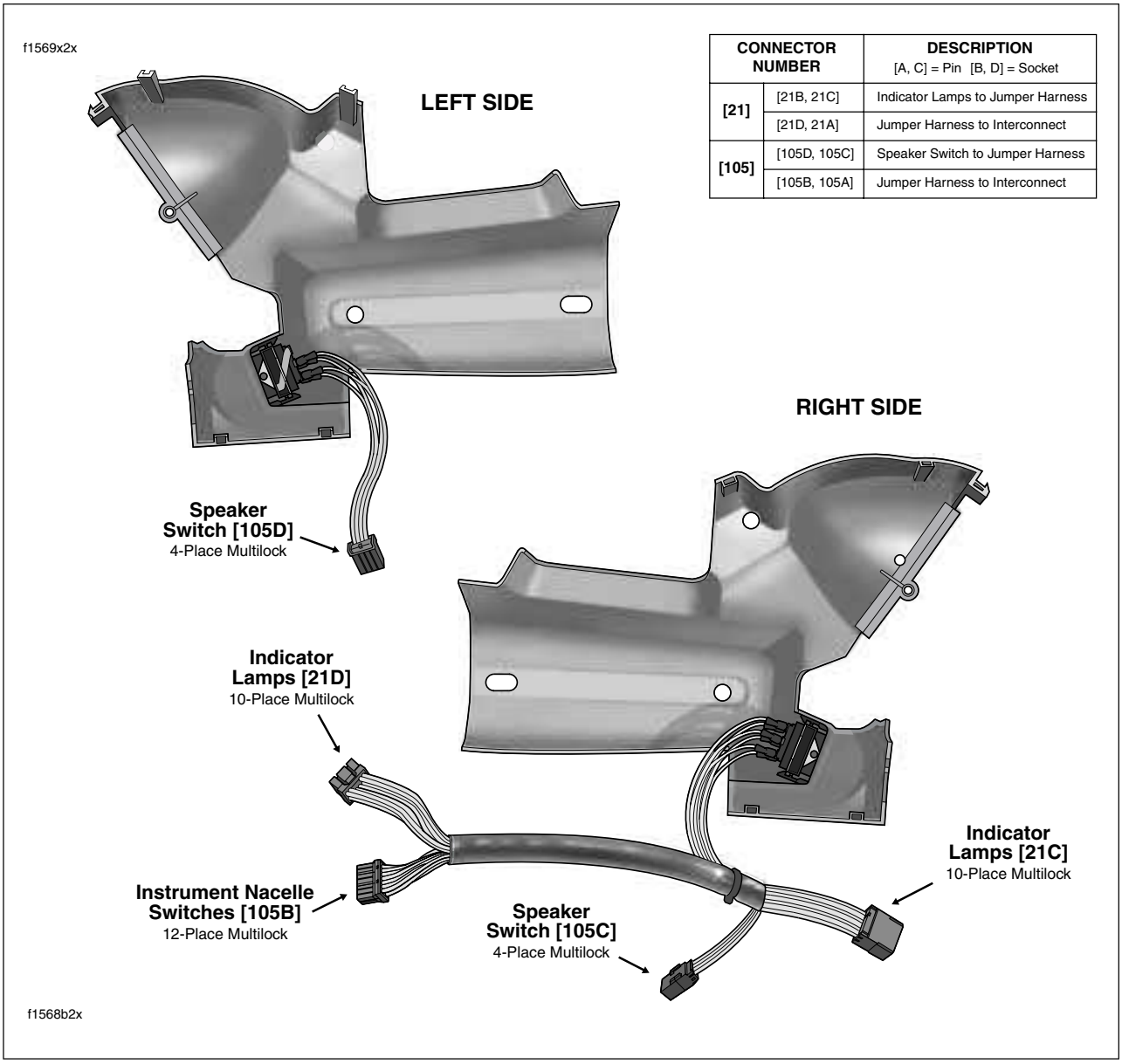
*NOTE*

*Install connector at back of speedometer until clear plastic latch on secondary lock "clicks" into the locked position.*

- Tachometer connector [108], 6-place Packard.

*NOTE*

*Take note of the offset terminal when mating pin and socket halves of tachometer connector. Using the thumbs of both hands, push on each side of connector until tight. Connector is a friction fit with no external latches.*




| CONNECTOR NUMBER | | DESCRIPTION [A, C] = Pin [B, D] = Socket |
|---|---|---|
| [21] | [21B, 21C] | Indicator Lamps to Jumper Harness |
| | [21D, 21A] | Jumper Harness to Interconnect |
| [105] | [105D, 105C] | Speaker Switch to Jumper Harness |
| | [105B, 105A] | Jumper Harness to Interconnect |

**Figure 8-66. Instrument Nacelle Halves**

7. Verify that left and right sides of instrument nacelle are properly mated. Pins on left side of nacelle must fully engage holes on right.

8. Insert tab at rear of bezel into slot of instrument nacelle (just above ignition switch). Holding left and right sides of nacelle together, place bezel over instrument nacelle flange. When properly mated, tabs at front of instrument nacelle engage lip in slot at front of bezel (behind decorative adhesive strip).

*NOTE*

*If tabs do not properly engage slot at front of bezel, then a loose fit will result. Remove decorative adhesive strip by gently prying up outer edges, and using a flat bladed screwdriver, carefully raise tabs so that they engage lip in slot. If damaged, install **new** decorative adhesive strip.*

9. Using a T25 TORX drive head, install screw on each side of bezel. Tighten screws to 6-12 **in-lbs** (0.7-1.4 Nm).

# HANDLEBAR SWITCHES 8.20

## GENERAL

The handlebar switches are of rugged construction and feature a superior seal to protect electrical contacts and components from dirt and moisture in harsh environments.

The basic switch configuration is the “Road King.” The Road King switches have no specialized functions. Other switches, referred to as the Classic and Ultra, have additional functions, such as sound system controls, cruise control, etc., which cause them to differ from the Road King switches. To accommodate these added functions, special lower switch housings are provided.

*NOTE*

*Regardless of model or option, all vehicles use the same upper switch housings. The vehicles and their switch configurations are as follows:*

### Table 8-12. Handlebar Switches

| | | |
|---|---|---|
| **Road King** | | |
| FLHR | FLHRC-I | |
| **Classic** | | |
| FLHT | FLHTC | FLHTC-I |
| **Ultra** | | |
| FLHTCU-I | FLTR | FLTR-I |

*NOTE*

*To replace or repair individual switches in either the right or left handlebar switch assemblies, see SWITCH REPAIR/REPLACEMENT in this section.*

## REMOVAL

*NOTE*

*While there are three different switch configurations for FL models (Road King, Classic and Ultra), the removal procedures are the same. To simplify these instructions, only the Road King switch configuration is represented in the photographs and illustrations which follow.*

### RIGHT HANDLEBAR CONTROLS

**CAUTION**

**Do not remove the switch housing assembly without first placing the 5/32 inch cardboard insert between the brake lever and lever bracket. Removal without the insert may result in damage to the rubber boot and plunger of the Front Stoplight Switch.**

*NOTE*

*Use the eyelet of an ordinary cable strap if the cardboard insert is not available.*

1. Place the cardboard insert between the brake lever and lever bracket. See Figure 8-67.
2. Using a T27 TORX drive head, remove the two screws with flat washers securing the handlebar clamp to the master cylinder housing. Remove the brake lever/master cylinder assembly and clamp from the handlebar.
3. Using a T25 TORX drive head, remove the upper and lower switch housing screws.
4. Remove the friction shoe from the end of the tension adjuster screw (non Ultra models only).

*NOTE*

*The friction shoe is a loose fit and may fall out or become dislodged if the lower switch housing is turned upside down or shaken.*

5. Remove the brass ferrules from the notches on the inboard side of the throttle control grip. Remove the ferrules from the cable end fittings.
6. Remove the throttle control grip from the end of the handlebar.
7. Pull the crimped inserts at the end of the throttle and idle control cable housings from the lower switch housing. For best results, use a rocking motion while pulling. Place a drop of light oil on the retaining rings, if necessary. Remove the cables from the switch housing.




**Figure 8-67. Install Cardboard Insert**

## LEFT HANDLEBAR CONTROLS

1. Using a T27 TORX drive head, remove the two screws with flat washers securing the handlebar clamp to the clutch lever bracket. Remove the clutch hand lever assembly and clamp from the handlebar.
2. Using a T25 TORX drive head, remove the upper and lower switch housing screws.
3. Remove the grip sleeve from the end of the handlebar, if damaged.

# INSTALLATION

*NOTE*

*While there are three different switch configurations for FL models (Road King, Classic and Ultra), the installation procedures are the same. To simplify these instructions, only the Road King switch configuration is represented in the photographs and illustrations which follow.*

## RIGHT HANDLEBAR CONTROLS

1. With the concave side facing upward, install the friction shoe so that the pin hole is over the point of the adjuster screw (non Ultra models only).

*NOTE*

*The friction shoe is a loose fit and may fall out or become dislodged if the switch housing is turned upside down or shaken.*

2. Push the throttle and idle control cables into the lower switch housing until they snap in place. Proceed as follows:

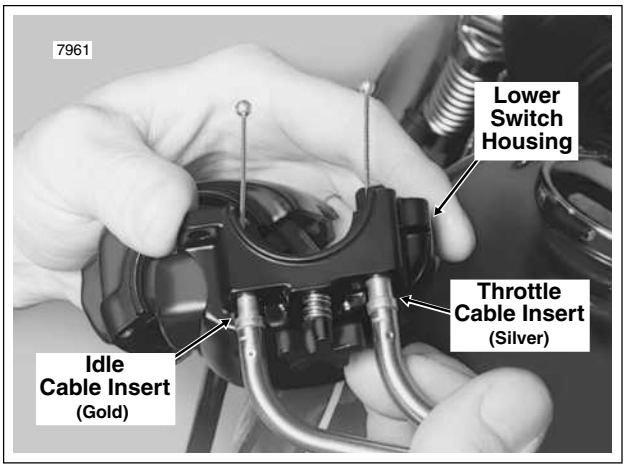



**Figure 8-68. Install Throttle/Idle Control Cables in Lower Switch Housing**

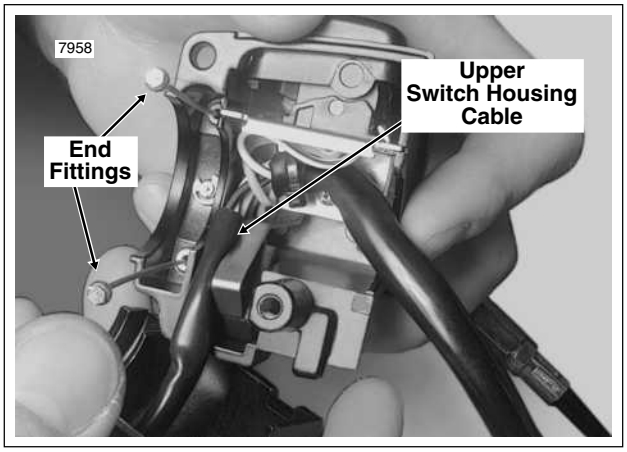



**Figure 8-69. Route Cable to Upper Switch Housing**

Note the different diameter inserts crimped into the end of the throttle and idle control cable housings. See Figure 8-68.

Push the larger diameter insert (silver) on the throttle cable housing into the larger hole in front of the tension adjuster screw.

Push the smaller diameter insert (gold) on the idle cable housing into the smaller hole at the rear of the tension adjuster screw.

*NOTE*

*To aid assembly, place a drop of light oil on the retaining rings of the crimped inserts. Always replace the retaining rings if damaged or distorted.*

3. Route the cable to the upper switch housing as shown in Figure 8-69.
4. Slide the throttle control grip over the end of the right handlebar until it bottoms against the closed end. Rotate the grip so that the ferrule notches are at the top. To prevent binding, pull the grip back about 1/8 inch (3.2 mm).
5. Position the lower switch housing beneath the throttle control grip. Install the brass ferrules onto the cables so that the end fittings seat in the ferrule recess. Seat the ferrules in their respective notches on the throttle control grip. Verify that the cables are captured in the grooves molded into the grip. See Figure 8-70.
6. Position the upper switch housing over the handlebar and lower switch housing.
7. Verify that the wire harness conduit runs in the depression at the bottom of the handlebar. Be sure that the upper switch housing harness will not be pinched under the handlebar when the switch housing screws are tightened.
8. Start the upper and lower switch housing screws, but do not tighten.

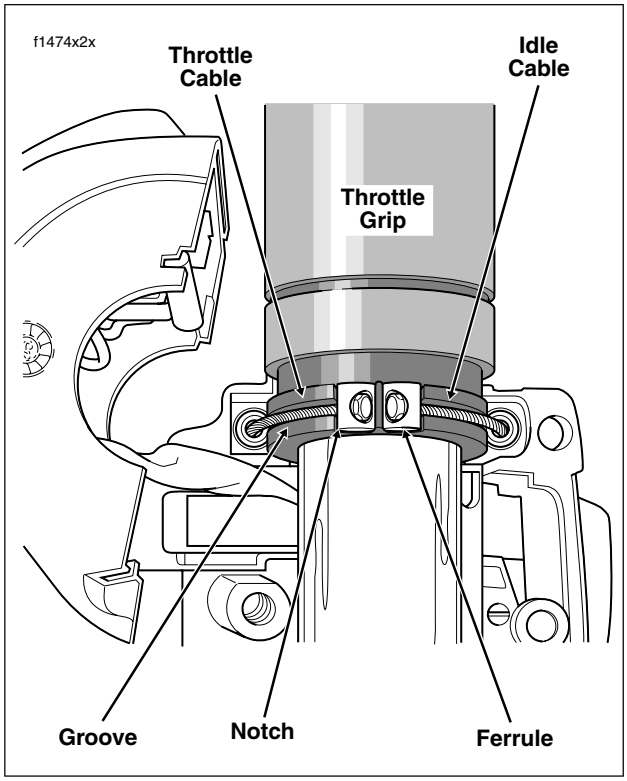



**Figure 8-70. Install Throttle/Idle Control Cables on Throttle Control Grip**

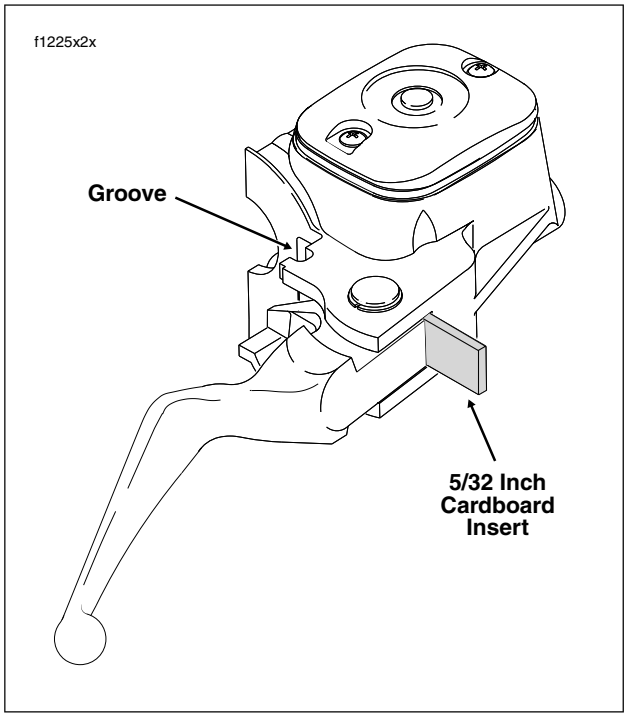



**Figure 8-71. Leave Cardboard Insert in Place**

**CAUTION**

**See Figure 8-71. Do not remove the 5/32 inch cardboard insert (or cable strap eyelet) wedged between the brake lever and lever bracket. Removal will result in damage to the rubber boot and plunger of the Front Stoplight Switch during installation of the master cylinder assembly.**

9. Position the brake lever/master cylinder assembly inboard of the switch housing assembly engaging the tab on the lower switch housing in the groove at the top of the brake lever bracket. See Figure 8-72.
10. Align the holes in the handlebar clamp with those in the master cylinder housing and start the two screws (with flat washers). Position for rider comfort. Beginning with the top screw, tighten the screws to 60-80 **in-lbs** (6.8-9.0 Nm) using a T27 TORX drive head.
11. Using a T25 TORX drive head, tighten the lower and upper switch housing screws to 35-45 **in-lbs** (4-5 Nm).

*NOTE*

*Always tighten the lower switch housing screw first so that any gap between the upper and lower housings is at the front of the switch.*

12. Remove the cardboard insert between the brake lever and lever bracket.

    The completed assembly appears as shown in Figure 8-75.
13. Test the switches for proper operation.
14. If necessary, secure wire harness conduit to handlebar using **new** cable strap. Position cable strap approximately 4-5 inches from handlebar clamp. Cut any excess cable strap material.

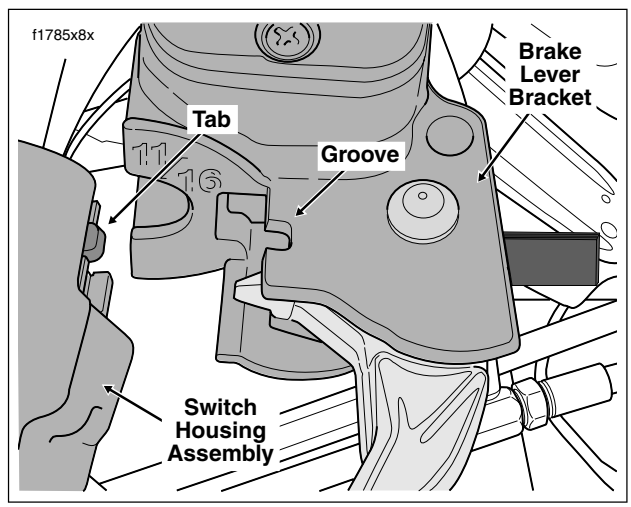



**Figure 8-72. Fit Brake Lever/Master Cylinder to Right Handlebar Switch Housings**

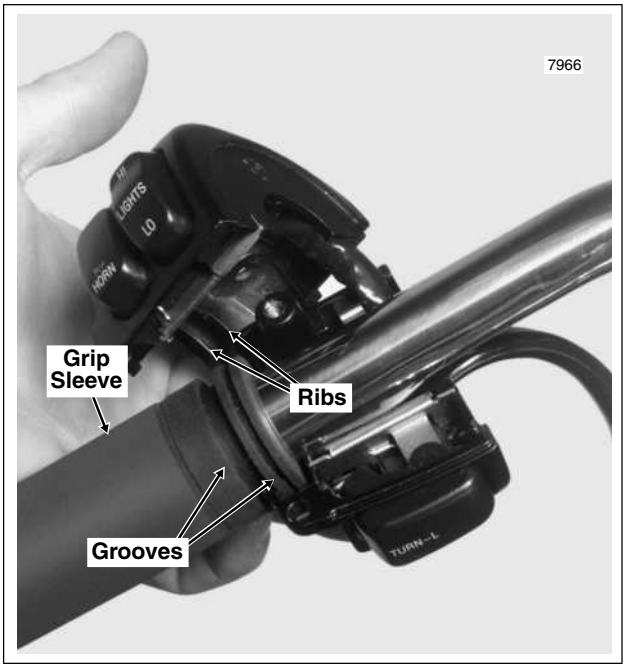



**Figure 8-73. Install Left Handlebar Switch Housings**

## LEFT HANDLEBAR CONTROLS

1. If the grip sleeve was removed, thoroughly clean handlebar to remove all adhesive residue. Pour adhesive into **new** grip. Roll grip to evenly distribute adhesive on inside surfaces. Install grip on handlebar with a twisting motion.
2. Install upper and lower switch housings on handlebar. Be sure that ribs on outboard side of switch housings fit in grooves molded into grip. See Figure 8-73.
3. Verify that the wire harness conduit runs in the groove at the bottom of the handlebar. Be sure that the upper switch housing harness will not be pinched under the handlebar when the switch housing screws are tightened.
4. Start the upper and lower switch housing screws, but do not tighten.
5. Position the clutch hand lever assembly inboard of the switch housing assembly engaging the tab on the lower switch housing in the groove at the bottom of the clutch lever bracket. See Figure 8-74.
6. Align the holes in the handlebar clamp with those in the clutch lever bracket and start the two screws (with flat washers). Position for rider comfort. Beginning with the top screw, tighten the screws to 60-80 **in-lbs** (6.8-9.0 Nm) using a T27 TORX drive head.

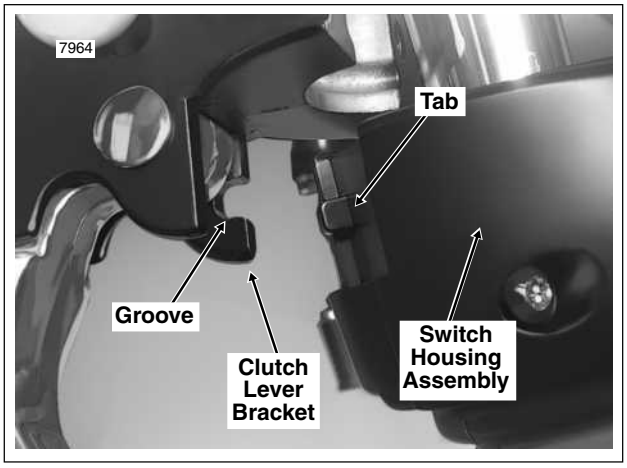



**Figure 8-74. Fit Clutch Lever Bracket to Left Handlebar Switch Housings**

7. Using a T25 TORX drive head, tighten the lower and upper switch housing screws to 35-45 **in-lbs** (4-5 Nm).

*NOTE*

*Always tighten the lower switch housing screw first so that any gap between the upper and lower housings is at the front of the switch.*

The completed assembly appears as shown in Figure 8-75.

8. Test the switches for proper operation.
9. If necessary, secure wire harness conduit to handlebar using **new** cable strap. Position cable strap approximately 4-5 inches from handlebar clamp. Cut any excess cable strap material.

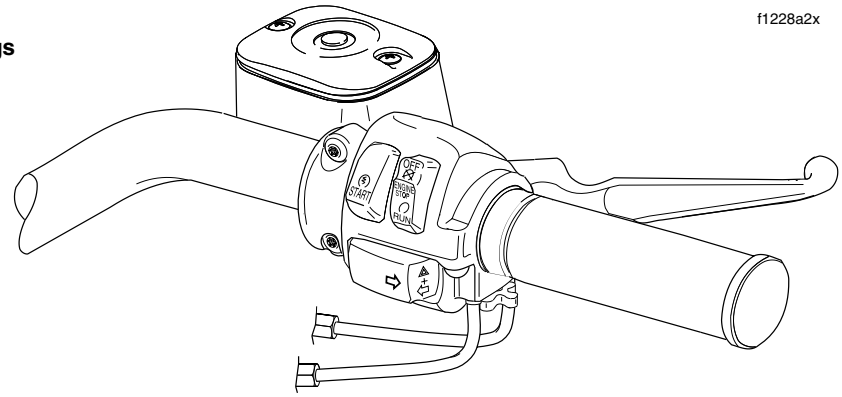
**Right Handlebar Switch Housings**

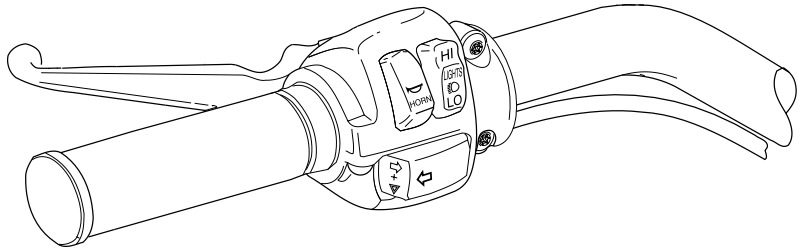
Upper Switch Housing:

- Engine Start Switch
- Engine Stop Switch: Off/Run

Lower Switch Housing:

- Turn-Right Signal Switch
- Front Stoplight Switch




**Left Handlebar Switch Housings**

Upper Switch Housing:

- Horn Switch
- Light Switch: Hi(gh) and Lo(w) Beam

Lower Switch Housing:

- Turn-Left Signal Switch

**Figure 8-75. Road King Handlebar Switch Assemblies**

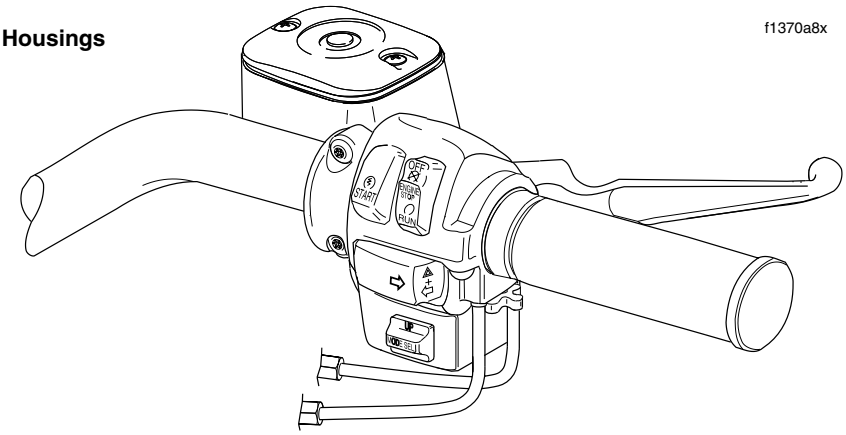
**Right Handlebar Switch Housings**

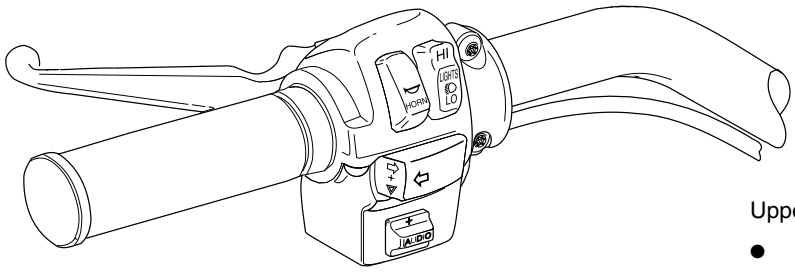
Upper Switch Housing:

- Engine Start Switch
- Engine Stop Switch: Off/Run

Lower Switch Housing:

- Turn-Right Signal Switch
- Front Stoplight Switch
- Mode Select Switch: UP/DN




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**Left Handlebar Switch Housings**

Upper Switch Housing:

- Horn Switch
- Light Switch: Hi(gh) and Lo(w) Beam

Lower Switch Housing:

- Turn-Left Signal Switch
- Audio Control Switch: +/-

**Figure 8-76. Classic Handlebar Switch Assemblies**

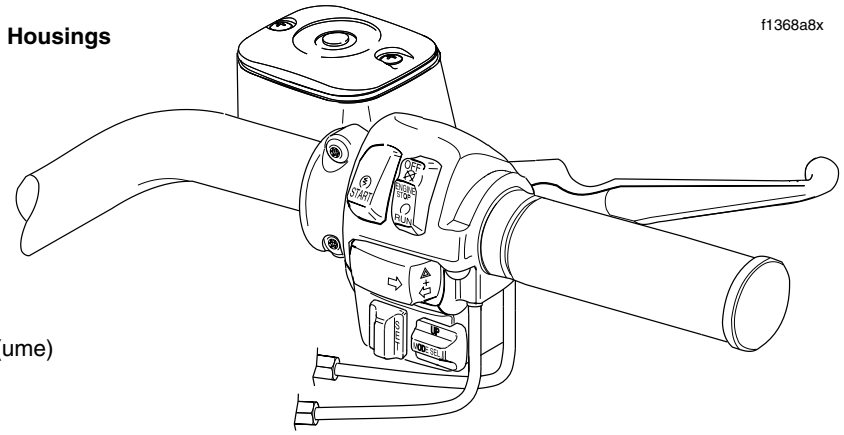
**Right Handlebar Switch Housings**

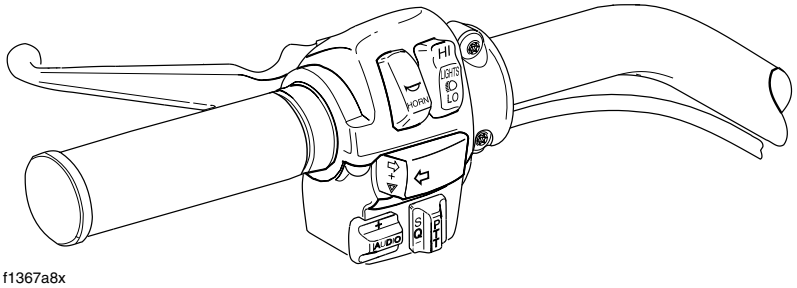
Upper Switch Housing:

- Engine Start Switch
- Engine Stop Switch: Off/Run

Lower Switch Housing:

- Turn-Right Signal Switch
- Front Stoplight Switch
- Mode Select Switch: UP/DN
- Cruise Control Switch: Set/Res(ume)




**Left Handlebar Switch Housings**

Upper Switch Housing:

- Horn Switch
- Light Switch: Hi(gh) and Lo(w) Beam

Lower Switch Housing:

- Turn-Left Signal Switch
- Audio Control Switch: +/-
- Squelch Control and Driver P(ush) T(o) T(ransmit) Switch: SQ-/PTT/SQ+

**Figure 8-77. Ultra Handlebar Switch Assemblies**

# SWITCH REPAIR/REPLACEMENT

## RIGHT SIDE HANDLEBAR SWITCHES DISASSEMBLY

**CAUTION**

**Do not remove the switch housing assembly without first placing the 5/32 inch cardboard insert between the brake lever and lever bracket. Removal without the insert may result in damage to the rubber boot and plunger of the Front Stoplight Switch.**

*NOTE*

*Use the eyelet of an ordinary cable strap if the cardboard insert is not available.*

1. Place the cardboard insert between the brake lever and lever bracket.
2. Using a T25 TORX drive head, remove the upper and lower switch housing screws.
3. If replacing lower housing switches, proceed to step 4. If replacing upper housing switches, proceed to step 8.
4. Using a T27 TORX drive head, loosen the upper screw securing the handlebar clamp to the master cylinder housing. Remove the lower clamp screw with flat washer.
5. Remove the brass ferrules from the notches on the inboard side of the throttle control grip. Remove the ferrules from the cable end fittings.
6. Remove the friction shoe from the end of the tension adjuster screw (non Ultra models only).

*NOTE*

*The friction shoe is a loose fit and may fall out or become dislodged if the lower switch housing is turned upside down or shaken.*

7. Remove the throttle control grip from the end of the handlebar.
8. See SPECIFIC REPAIR PROCEDURES, UPPER SWITCH HOUSINGS for upper switch housing switches, LOWER SWITCH HOUSINGS for lower switch housing switches.

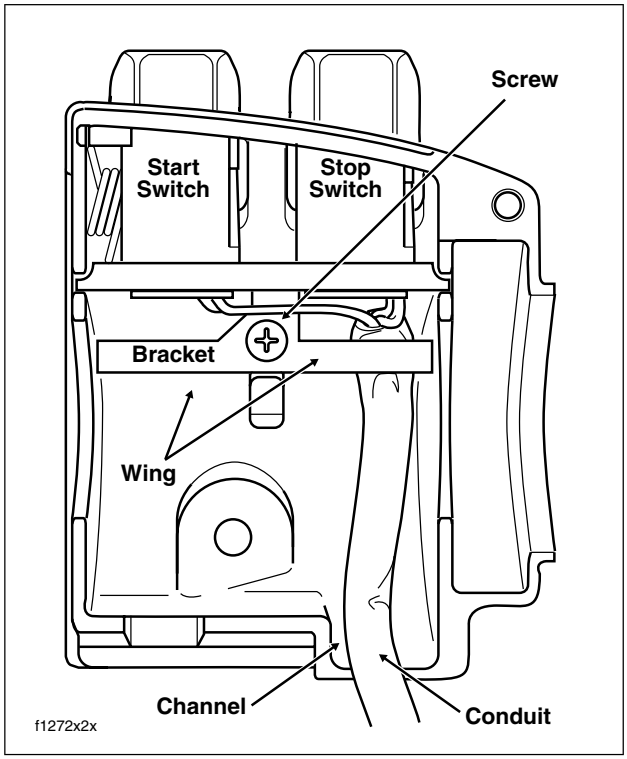



**Figure 8-78. Upper Right Handlebar Switch Housing (Without Splices)**

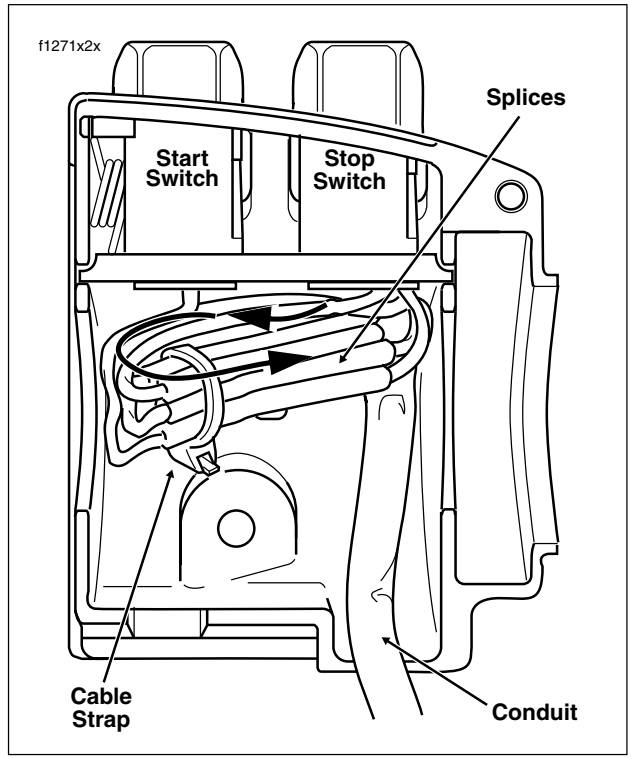



**Figure 8-79. Upper Right Handlebar Switch Housing (With Splices)**

## LEFT SIDE HANDLEBAR SWITCHES DISASSEMBLY

1. Using a T25 TORX drive head, remove the upper and lower switch housing screws.
2. If replacing lower housing switches, proceed to step 3. If replacing upper housing switches, proceed to step 4.
3. Using a T27 TORX drive head, loosen the upper screw securing the handlebar clamp to the clutch lever bracket. Remove the lower clamp screw with flat washer.
4. See SPECIFIC REPAIR PROCEDURES, UPPER SWITCH HOUSINGS for upper switch housing switches, LOWER SWITCH HOUSINGS for lower switch housing switches.

# SPECIFIC REPAIR PROCEDURES

*NOTE*

*Regardless of model or option, all vehicles use the same upper switch housings.*

## UPPER SWITCH HOUSINGS

*NOTE*

*Replace the Engine Stop and Engine Start Switches as a single assembly even if only one switch is determined to be faulty.*

### RIGHT SIDE HANDLEBAR (ALL MODELS)

- **Engine Stop Switch: OFF/RUN**
- **Engine Start Switch**

[Continued from RIGHT SIDE HANDLEBAR SWITCHES, DISASSEMBLY, in this section.]

1. From inside the switch housing, remove the Phillips screw to release the bracket. Remove the bracket and switch assembly from the housing. See Figure 8-78.
2. Move cable conduit from beneath wing of bracket. Cut wires 1/4 inch from old switches. Discard old switch and bracket assembly.
3. Slide conduit forward over severed ends of switch wires and cut off 1/2 inch of conduit material. Push conduit back to access switch wires.
4. Separate **new** Engine Stop Switch and Start Switch wires into two bundles.

*NOTE*

*Replacement Stop Switch and Start Switch wires are cut to length (2-1/2 inches and 2 inches, respectively) and partially stripped.*

5. See GENERAL REPAIR PROCEDURES in this section.
6. Loop switch wires so that spliced lengths are positioned as shown in Figure 8-79. Route wires downstream of splices beneath wing on Engine Stop Switch side of bracket as seen in Figure 8-78.

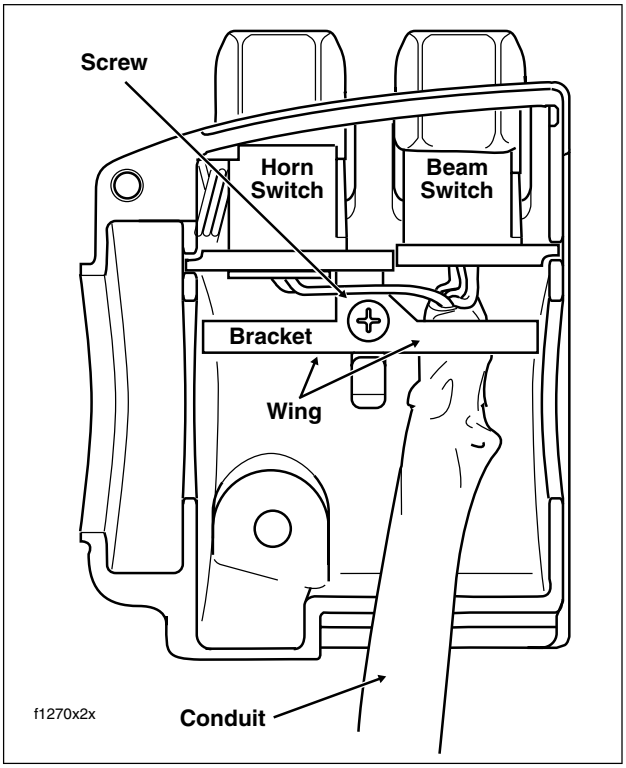



**Figure 8-80. Upper Left Handlebar Switch Housing (Without Splices)**

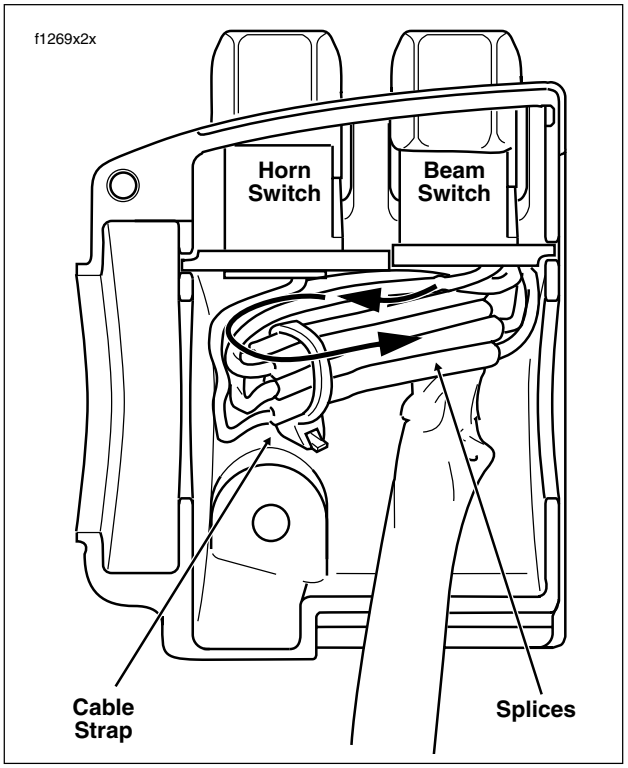



**Figure 8-81. Upper Left Handlebar Switch Housing (With Splices)**

7. Install a **new** 7 inch cable strap beneath wing on Engine Start Switch side of bracket and capture wire splices.
8. Place switch assembly into upper housing aligning hole in bracket with threaded hole in boss. Be sure that bracket is fully seated. The step at the edge of the boss captures the bottom edge of the bracket, while tabs on each side of the bracket fit in slots cast into the housing.
9. Install Phillips screw to secure bracket inside housing. Verify that wing on Engine Stop Switch side of bracket captures edge of conduit as shown in Figure 8-78.
10. Securely tighten cable strap to draw splices to bracket. Remove any excess cable strap material.
11. See RIGHT SIDE HANDLEBAR SWITCHES, ASSEMBLY, in this section.

*NOTE*

*Replace the Horn and High/Low Beam Switches as a single assembly even if only one switch is determined to be faulty.*

## LEFT SIDE HANDLEBAR (ALL MODELS)

- **Hi(gh) and Lo(w) Beam Switch**
- **Horn Switch**

[Continued from LEFT SIDE HANDLEBAR SWITCHES, DISASSEMBLY, in this section.]

1. See Figure 8-80. From inside the switch housing, remove Phillips screw to release the bracket. Remove the bracket and switch assembly from the housing.
2. Move cable conduit from beneath wing of bracket. Cut wires 1/4 inch from old switches. Discard old switch and bracket assembly.
3. Slide conduit forward over severed ends of switch wires and cut off 1/2 inch of conduit material. Push conduit back to access switch wires.
4. Separate new Horn and High/Low Beam Switch wires into two bundles.

*NOTE*

*Replacement High/Low Beam Switch and Horn Switch wires are cut to length (2-1/2 inches and 2 inches, respectively) and partially stripped.*

5. See GENERAL REPAIR PROCEDURES in this section.
6. Loop switch wires so that spliced lengths are positioned as shown in Figure 8-81. Route wires downstream of splices beneath wing on High/Low Beam Switch side of bracket as seen in Figure 8-80.
7. Install a **new** 7 inch cable strap beneath wing on Horn Switch side of bracket and capture wire splices.
8. Place switch assembly into upper housing aligning hole in bracket with threaded hole in boss. Be sure that bracket is fully seated. The step at the edge of the boss captures the bottom edge of the bracket, while tabs on each side of the bracket fit in slots cast into the housing.

9. Install Phillips screw to secure bracket inside housing. Verify that wing on High/Low Beam Switch side of bracket captures edge of conduit as shown in Figure 8-80.
10. Securely tighten cable strap to draw splices to bracket. Remove any excess cable strap material. See Figure 8-81.
11. See LEFT SIDE HANDLEBAR SWITCHES, ASSEMBLY, in this section.

## LOWER SWITCH HOUSINGS

### RIGHT SIDE HANDLEBAR

### PRELIMINARY INSTRUCTIONS

[Continued from RIGHT SIDE HANDLEBAR SWITCHES, DISASSEMBLY, in this section.]

1. From inside the switch housing, carefully cut cable strap to free conduit from the turn signal switch bracket.
2. Remove the Phillips screw to release the turn signal switch bracket. Remove the bracket and switch assembly from the housing.

*NOTE*

*On Classic and Ultra models, pull the conduit back to introduce some slack in the wires or the tight fit of the bundle will prevent removal of the turn signal switch bracket.*

- **Turn-Right Signal Switch (All Models)**

1. Cut wires 1-1/2 inches from old switch. Discard old switch assembly.

*NOTE*

*Replacement Turn-Right Signal Switch wires are cut to length (1-1/2 inches) and partially stripped.*

2. See GENERAL REPAIR PROCEDURES in this section.
3. See FINAL INSTRUCTIONS in this section.

- **Front Stoplight Switch (All Models)**

1. Carefully remove the wedge between the switch and switch housing, if present. To remove the switch from the housing, depress the plunger and slowly rotate switch upward while rocking slightly.
2. Cut wires 1 inch from old switch. Discard old switch.

*NOTE*

*Replacement Stoplight Switch wires are cut to length (2-1/2 inches) and partially stripped.*

3. See GENERAL REPAIR PROCEDURES in this section.
4. Carefully depress plunger against inside wall of switch housing. With thumb over plunger bore, move switch into the installed position in the switch housing cavity. When plunger is positioned against thumb, slowly rotate switch downward while rocking slightly. Release the plunger only after switch is properly positioned in the cavity.

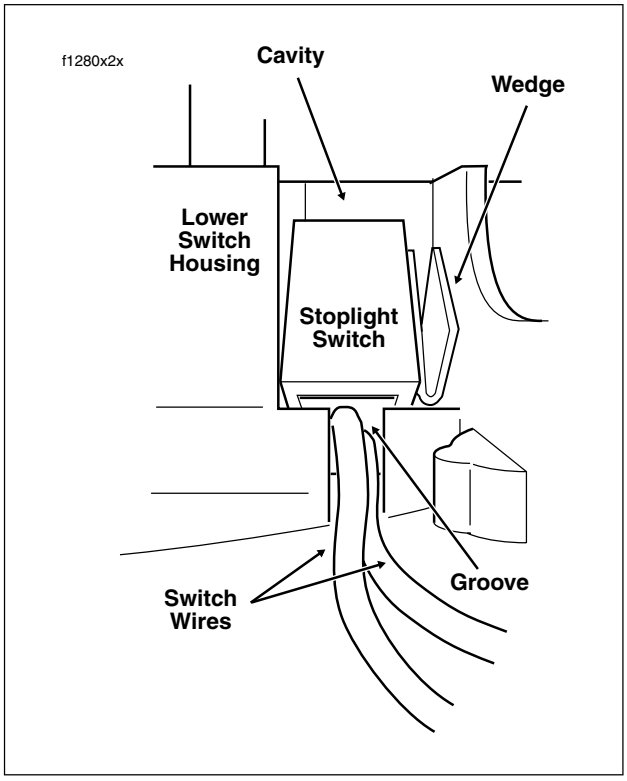



**Figure 8-82. Install Stoplight Switch**

5. Verify that the plunger is square in the bore and that the boot is not compressed, collapsed or torn. If necessary, gently work the plunger in and out until boot is fully extended.
6. Push down on switch so that it bottoms against housing and wires run in groove at base of cavity. With the concave side facing outward, insert wedge between switch and outboard side of switch housing. See Figure 8-82.
7. Push wedge down until it also bottoms against housing. Verify that the plunger is still square in the bore and then place a drop of RTV Silicone Sealant on upper corner of wedge.
8. See Final Instructions, in this section.

- **Mode Select Switch (Classic and Ultra Models)**

1. Pull keycap from switch shaft.
2. Remove two lower bracket screws. Pull bracket and switch from switch housing. See Figure 8-83.
3. Cut wires 1-1/4 inches from old switch. Discard switch assembly.

*NOTE*

*Replacement Mode Select Switch wires are cut to length (2-1/4 inches) and partially stripped.*

4. See GENERAL REPAIR PROCEDURES in this section.

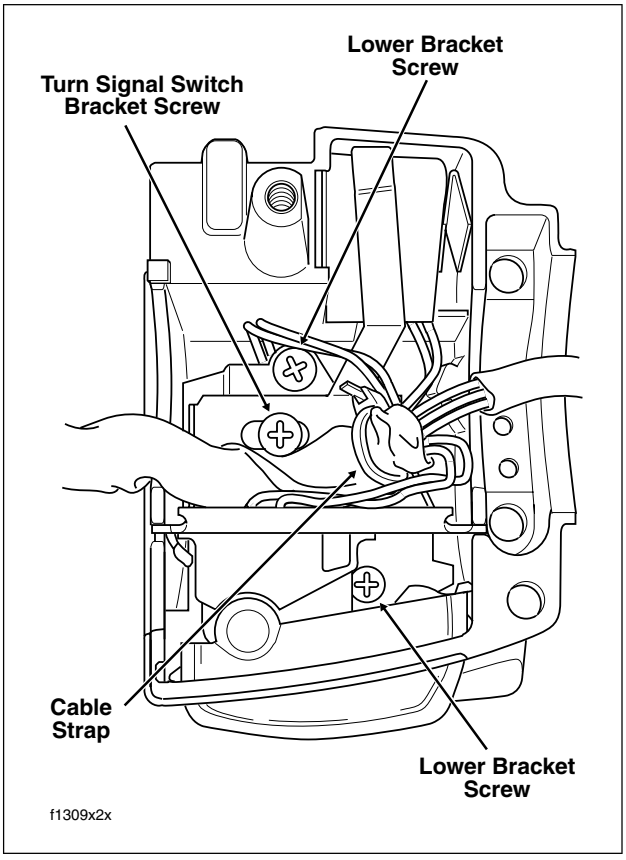



**Figure 8-83. Lower Right Handlebar Switch Housing (Without Splices) - Classic/Ultra Models**

5. Fit new switch into cavity so that it sits on edge in a vertical position (gray/white wire topside). Properly installed, the switch is captured by blocks cast into the lower housing. Verify that the switch shaft is aligned for proper keycap operation.
6. Place the lower bracket into the housing (with the weld nut side down), but keep the splices above the bracket. Verify that the slots in the upper step of the bracket engage two tabs on switch body.
7. Install shorter screw to secure front side of lower bracket to threaded boss. Install longer rear screw. To engage threaded hole in casting, use thru hole in lower step of bracket on Classic models, thru hole in upper step on Ultra.
8. Install keycap on switch shaft.
9. See FINAL INSTRUCTIONS on the next page..

- **Cruise Control Switch (Ultra Models)**

1. Pull keycap from switch shaft.
2. Remove two lower bracket screws. Pull bracket and switch from switch housing. See Figure 8-83.
3. Cut wires 1-1/2 inches from old switch. Discard switch assembly.

*NOTE*

*Replacement Cruise Control Switch wires are cut to length (2 inches) and partially stripped.*

4. See GENERAL REPAIR PROCEDURES in this section.
5. Fit new switch into cavity so that it sits in a horizontal position (blue/black wire towards master cylinder). Properly installed, the switch is captured by blocks cast into the lower housing. Verify that the switch shaft is aligned for proper keycap operation.
6. Place the lower bracket into the housing (with the weld nut side down), but keep the splices above the bracket. Properly positioned, the lower step of the bracket should be positioned over the Cruise Control Switch (hori-zontally oriented). Slots in the upper step engage two tabs on the body of the Tuning Control Switch (vertically oriented with gray/white wire topside).
7. Install shorter screw to secure front side of lower bracket to threaded boss. Install longer rear screw. To engage threaded hole in casting, use thru hole in upper step of bracket.
8. Note lettering for proper orientation and gently push keycap onto switch shaft.
9. See FINAL INSTRUCTIONS on the next page.

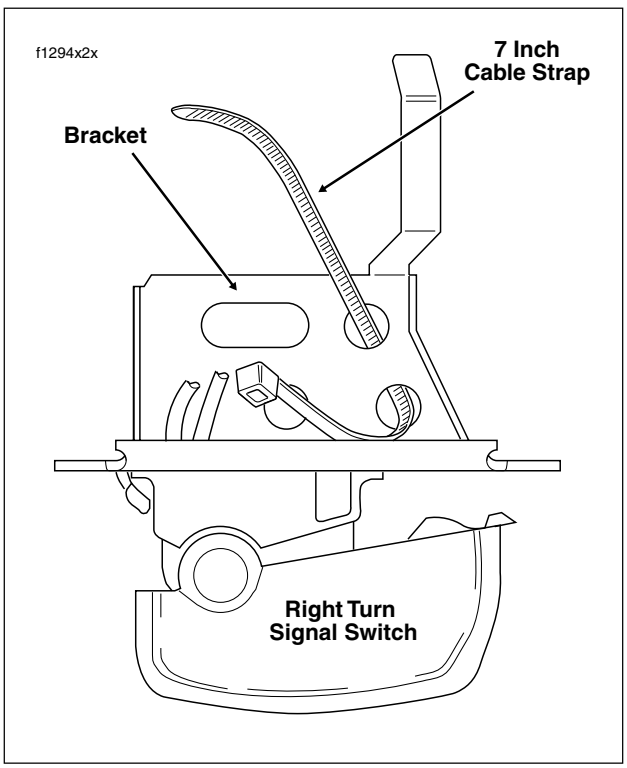



**Figure 8-84. Insert Cable Strap in Switch Bracket**

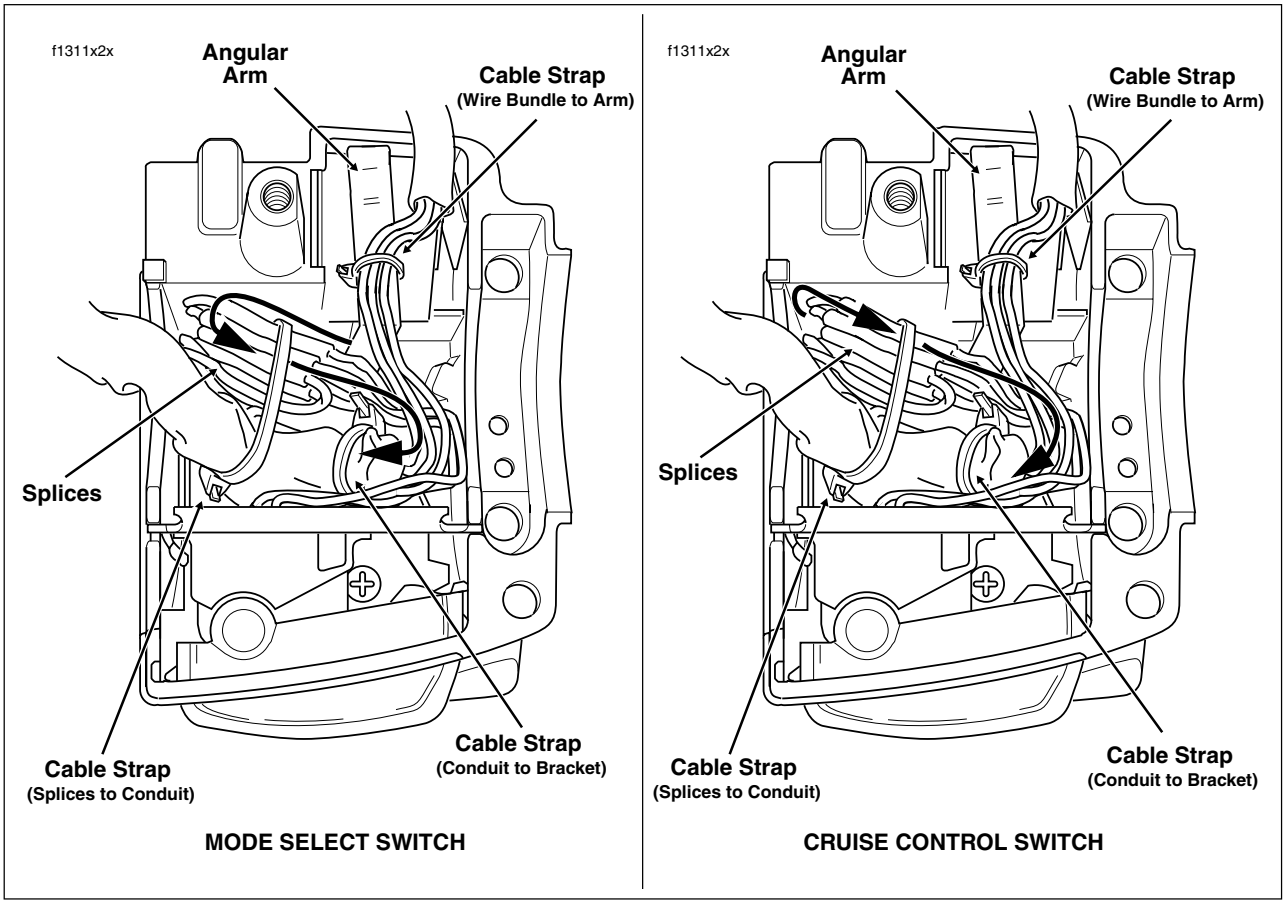



**Figure 8-85. Lower Right Handlebar Switch Housing (With Splices) - Classic/Ultra Models**

## FINAL INSTRUCTIONS

1. Insert tapered end of **new** 7 inch cable strap into round hole in turn signal switch bracket and then feed back through using the adjacent hole. Reserve the oblong hole for the bracket screw. See Figure 8-84.

*NOTE*

*Be sure that all splices are positioned above the turn signal switch bracket.*

2. Place the turn signal switch assembly into the housing aligning the oblong hole in the bracket with the threaded hole in the boss (lower bracket weld nut on Classic and Ultra models). Be sure that bracket is fully seated. Tabs on each side of bracket are captured in slots cast into switch housing.
3. Start Phillips screw to secure bracket inside housing.

**CAUTION**

**If routed incorrectly, wires may be pinched by casting or handlebar resulting in switch failure.**

4. Loop switch wires so that spliced lengths are positioned as shown in Figure 8-85.
5. Capturing conduit about 1/4 inch from end, securely tighten cable strap to draw conduit to bracket. Remove any excess cable strap material.
6. Install second 7 inch cable strap capturing conduit and wire splices. Securely tighten cable strap to draw splices to conduit. Remove any excess cable strap material.
7. Tighten Phillips screw to secure bracket inside housing.
8. Route wire bundle to upper switch housing by gently pressing conduit into channel next to angular arm of bracket. Secure bundle to arm using third cable strap. Cut any excess cable strap material. If necessary, bend angular arm of bracket downward to firmly secure Front Stoplight Switch in installed position.
9. See RIGHT SIDE HANDLEBAR SWITCHES, ASSEMBLY, in this section.

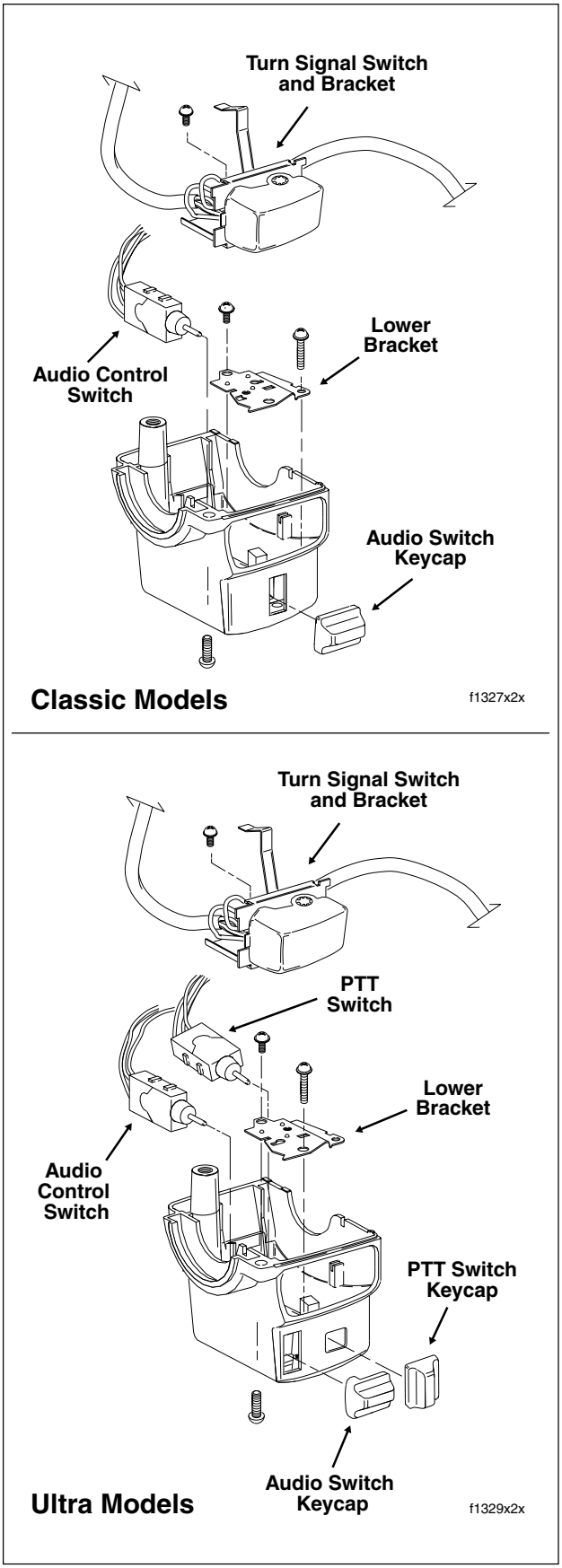



Figure 8-86. Lower Left Handlebar Switch Assemblies (Exploded View)

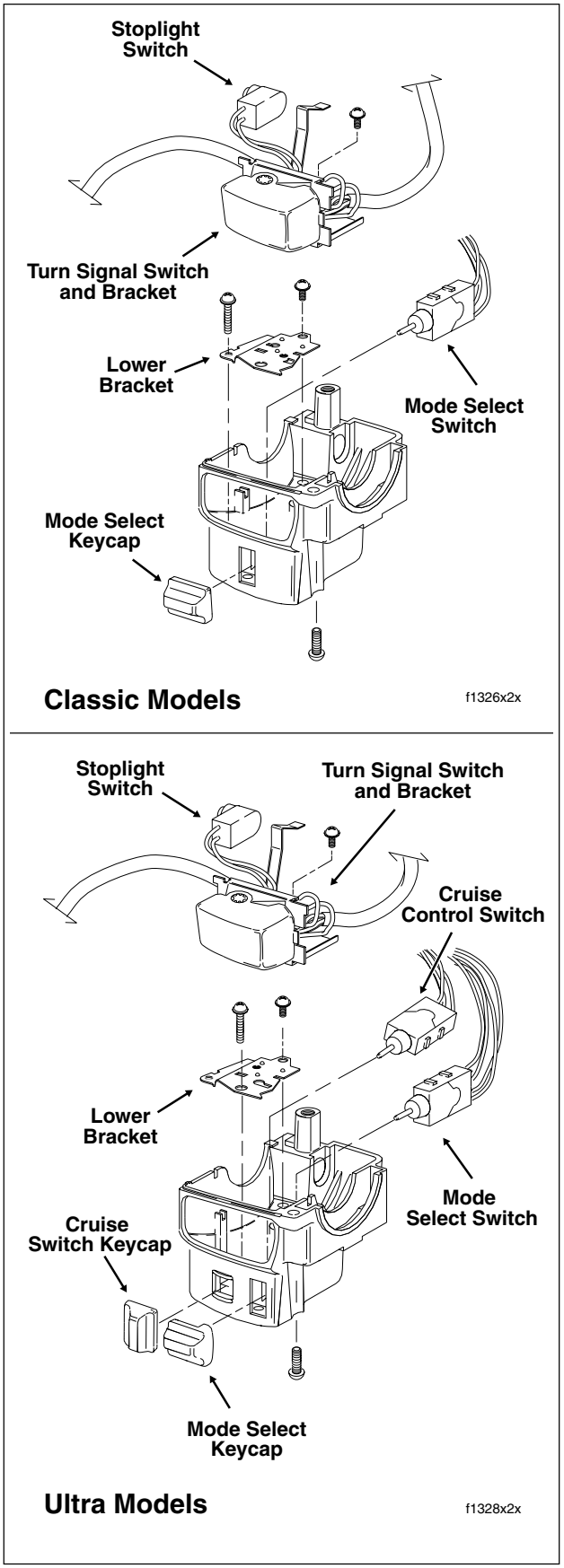



Figure 8-87. Lower Right Handlebar Switch Assemblies (Exploded View)

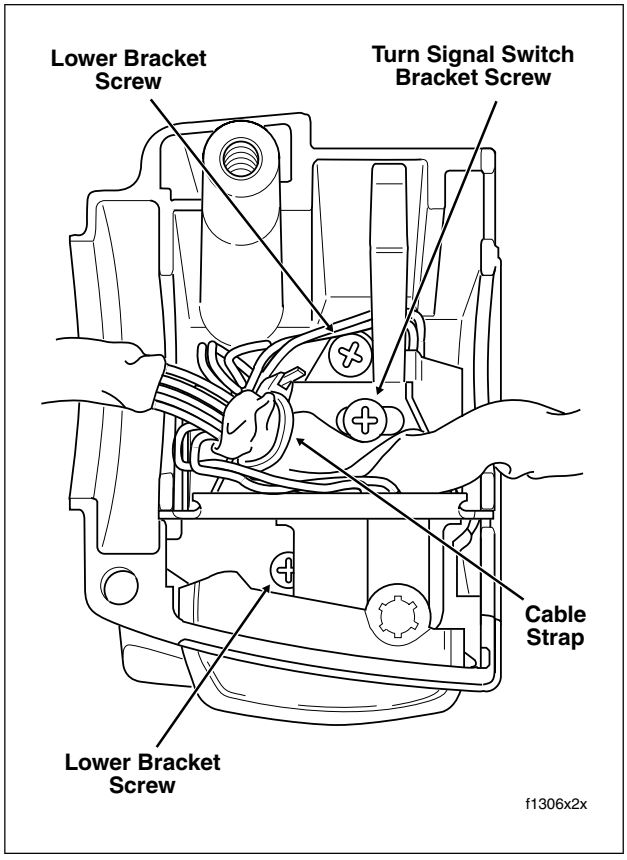



**Figure 8-88. Lower Left Handlebar Switch Housing (Without Splices) - Classic/Ultra Models**

## LEFT SIDE HANDLEBAR

### PRELIMINARY INSTRUCTIONS

[Continued from LEFT SIDE HANDLEBAR SWITCHES, DISASSEMBLY, in this section.]

1. From inside the switch housing, carefully cut cable strap to free conduit from the turn signal switch bracket.
2. Remove the Phillips screw to release the turn signal switch bracket. Remove the bracket and switch assembly from the housing.

*NOTE*

*On Classic and Ultra models, pull the conduit back to introduce some slack in the wires or the tight fit of the bundle will prevent removal of the switch bracket.*

- **Turn-L(eft) Signal Switch (All Models)**

1. Cut wires 1-1/2 inches from old switch. Discard old switch assembly.

*NOTE*

*Replacement Turn-Left Signal Switch wires are cut to length (1-1/2 inches) and partially stripped.*

2. See GENERAL REPAIR PROCEDURES in this section.
3. See FINAL INSTRUCTIONS on the next page.

- **Audio Control Switch (Classic and Ultra Models)**

1. Pull keycap from switch shaft.
2. Remove two lower bracket screws. See Figure 8-88. Pull bracket and switch from switch housing.
3. Cut wires 1-1/4 inches from old switch. Discard switch assembly.

*NOTE*

*Replacement Audio Control Switch wires are cut to length (2-1/4 inches) and partially stripped.*

4. See GENERAL REPAIR PROCEDURES in this section.
5. Fit new switch into cavity so that it sits on edge in a vertical position (gray/green wire topside). Properly installed, the switch is captured by blocks cast into the lower housing. Verify that the switch shaft is aligned for proper keycap operation.
6. Place the lower bracket into the housing (with the weld nut side down), but keep the splices above the bracket. Verify that the slots in the upper step of the bracket engage two tabs on switch body.
7. Install shorter screw to secure front side of lower bracket to threaded boss. Install longer rear screw. To engage threaded hole in casting, use thru hole in lower step of bracket on Classic models, thru hole in upper step on Ultra.
8. Note lettering for proper orientation and gently push keycap onto switch shaft.
9. See FINAL INSTRUCTIONS on the next page.

- **CB Push-To-Transmit Switch (Ultra Models)**

1. Pull keycap from switch shaft.
2. Remove two lower bracket screws. See Figure 8-88. Pull bracket and switch from switch housing.
3. Cut wires 1-1/2 inches from old switch. Discard switch assembly.

*NOTE*

*Replacement Push-to-Transmit Switch wires are cut to length (2 inches) and partially stripped.*

4. See GENERAL REPAIR PROCEDURES in this section.

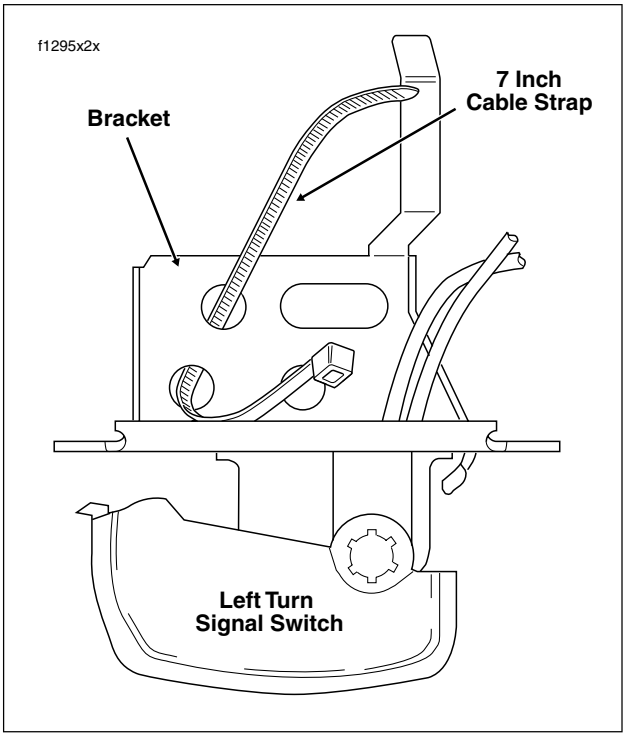



**Figure 8-89. Insert Cable Strap in Switch Bracket**

5. Fit new switch into cavity so that it sits in a horizontal position (brown/black wire toward clutch bracket). Properly installed, the switch is captured by blocks cast into the lower housing.
6. Keeping splices above the bracket, install the lower bracket (weld nut side down) so that the lower step is positioned over the Push-to-Transmit Switch (hori-zontally oriented). Slots in the upper step engage two tabs on body of Volume Control Switch (vertically oriented with gray wire topside).
7. Install shorter screw to secure front side of lower bracket to threaded boss. Install longer rear screw. To engage threaded hole in casting, use thru hole in upper step of bracket.
8. Note lettering for proper orientation and gently push key-cap onto switch shaft.
9. See Final Instructions below.

## FINAL INSTRUCTIONS

1. Insert tapered end of **new** 7 inch cable strap into round hole in turn signal switch bracket and then feed back through using the adjacent hole. Reserve the oblong hole for the bracket screw. See Figure 8-89.

*NOTE*

*Be sure that all splices are positioned above the turn signal switch bracket.*

2. Place the turn signal switch assembly into the housing aligning the oblong hole in the bracket with the threaded hole in the boss (on Classic and Ultra, lower bracket weld nut replaces boss). Be sure that bracket is fully seated. Tabs on each side of bracket are captured in slots cast into switch housing.
3. Start Phillips screw to secure bracket inside housing.

**CAUTION**

**If routed incorrectly, wires may be pinched by casting or handlebar resulting in switch failure.**

4. Loop switch wires so that spliced lengths are positioned as shown in Figure 8-90.
5. Capturing conduit about 1/4 inch from end, securely tighten cable strap to draw conduit to bracket. Remove any excess cable strap material.
6. Tighten Phillips screw to secure bracket inside housing.
7. Route wire bundle to upper switch housing below and then forward of the main wire harness positioning conduit in channel next to angular arm of bracket. See Figure 8-90. Secure bundle to arm using **new** cable strap. Cut any excess cable strap material.

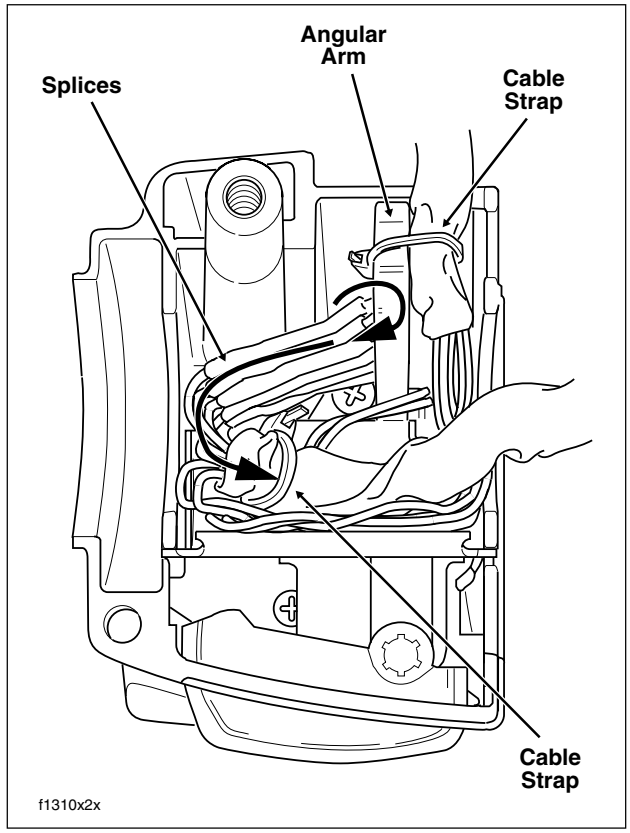



**Figure 8-90. Lower Left Handlebar Switch Housing (With Splices) - Classic/Ultra Models**

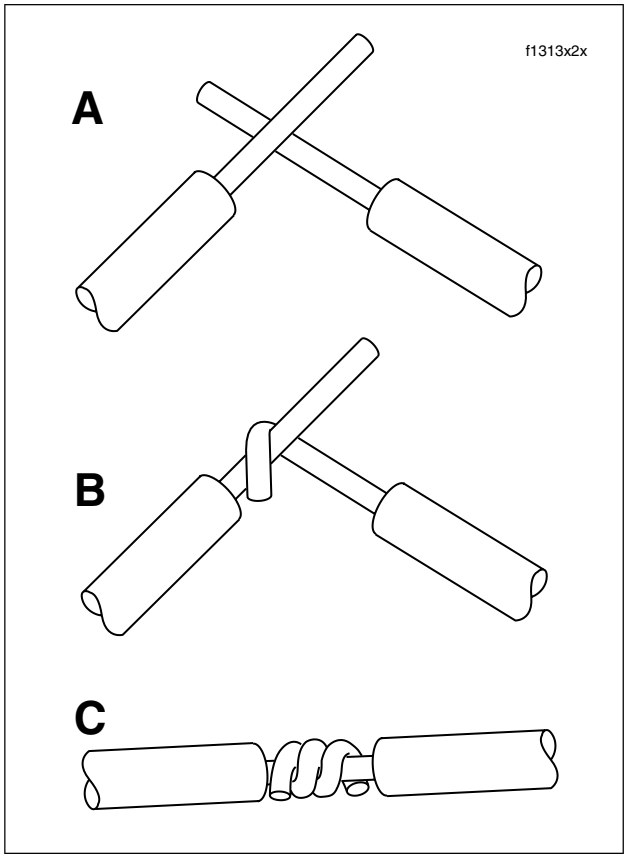



**Figure 8-91. Splice Switch Wires**

8. See LEFT SIDE HANDLEBAR SWITCHES, ASSEMBLY, on the next page.

## GENERAL REPAIR PROCEDURES

1. To better access wires and avoid damaging conduit with radiant heating device, push conduit back and secure with extra 7 inch cable strap in kit.
2. Strip 1/2 inch of insulation off switch wires. Twist stripped ends of switch wires until all strands are tightly coiled.
3. Cut dual wall heat-shrink tubing (supplied in kit) into one inch segments. Slide tubing over each wire of new switch assembly.
4. Matching wire colors, mate old and new switch wires and splice as follows:
   a. Hold the wires so that the stripped ends cross as shown in A of Figure 8-91. Note that the wire on the left is on top and two-thirds of its stripped length lies beyond the point where they intersect. Looking at the other wire, only 1/3 of its stripped length lies beyond the intersection point.
   b. Holding the wires together at their juncture, start the splice by tightly twisting the top one-third length of the right hand wire over the left as shown in B of Figure 8-91.
   c. Tightly coil the remaining two-thirds of the left hand wire around the right with the results shown in C of Figure 8-91.
   d. Solder the spliced connections.

   *NOTE*

   *For best results, do one wire at a time.*
5. Center the heat-shrink tubing over the soldered splices.

**⚠WARNING**

**Use extreme caution when operating the UltraTorch UT-100 or any other radiant heating device. Read the manufacturers instructions carefully before use. Always keep hands away from tool tip area and heat shrink attachment. Avoid directing the heat toward any fuel system component. Extreme heat can cause fuel ignition/explosion. Avoid directing heat toward any electrical system component other than the connectors on which heat shrink work is being performed. Be sure to turn the "ON/OFF" switch to the "OFF" position after use. Inadequate safety precautions could result in death or serious injury.**

6. See Figure 8-92. Using the UltraTorch UT-100, Robinair Heat Gun with heatshrink attachment or other suitable radiant heating device, uniformly heat the heat-shrink tubing to insulate and seal the soldered connections. Apply heat just until the meltable sealant exudes out both ends of the tubing and it assumes a smooth cylindrical appearance.

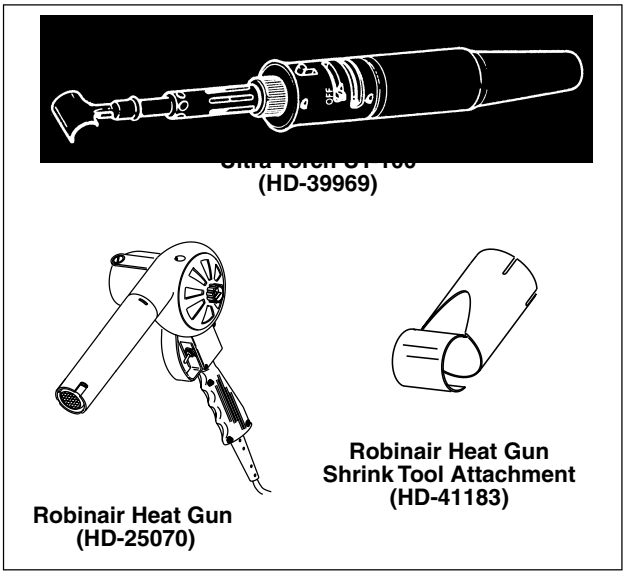



**Figure 8-92. Radiant Heating Devices**

**CAUTION**

**Electrically connected solder outside the tubing may cause a short to ground resulting in switch failure.**

7. Inspect the melted sealant for solder beads. Excess solder or heat may force some solder out with the melted sealant. Use a small needle nose pliers to remove any solder found. Briefly heat the connection to reseal the tubing if solder beads were removed. Use less solder or reduce heating time or intensity when doing subsequent splices.
8. Cut cable strap compressing conduit and move to its original position.

## RIGHT SIDE HANDLEBAR SWITCHES ASSEMBLY

1. If replacing lower housing switches, proceed to step 2. If replacing upper housing switches, proceed to step 9.
2. With the concave side facing upward, install the friction shoe so that the pin hole is over the point of the adjuster screw (non Ultra models only).

*NOTE*

*The friction shoe is a loose fit and may fall out or become dislodged if the lower switch housing is turned upside down or shaken.*

3. Slide the throttle control grip over the end of the right handlebar until it bottoms against the closed end. Rotate the grip so that the ferrule notches are at the top. To prevent binding, pull the grip back about 1/8 inch (3.2 mm).
4. Position the lower switch housing beneath the throttle control grip. Install the brass ferrules onto the cables so that the end fittings seat in the ferrule recess. Seat the ferrules in their respective notches on the throttle control grip. Verify that the cables are captured in the grooves molded into the grip.
5. Position the upper switch housing over the handlebar and lower switch housing. Verify that the wire harness conduit runs in the depression at the bottom of the handlebar.
6. Start the upper and lower switch housing screws, but do not tighten.
7. Position the brake lever/master cylinder assembly inboard of the switch housing assembly engaging the tab on the lower switch housing in the groove at the top of the brake lever bracket.
8. Align the holes in the handlebar clamp with those in the master cylinder housing and start the lower screw (with flat washer). Position for rider comfort. Beginning with the top screw, tighten the screws to 60-80 **in-lbs** (6.8-9.0 Nm) using a T27 TORX drive head.
9. Using a T25 TORX drive head, tighten the lower and upper switch housing screws to 35-45 **in-lbs** (4-5 Nm).

*NOTE*

*Always tighten the lower switch housing screw first so that any gap between the upper and lower housings is at the front of the switch assembly.*

10. Remove the cardboard insert between the brake lever and lever bracket.
11. Test the switches for proper operation.

## LEFT SIDE HANDLEBAR SWITCHES ASSEMBLY

1. If replacing lower housing switches, proceed to step 2. If replacing upper housing switches, proceed to step 6.
2. Install upper and lower switch housings on handlebar. Be sure that ribs on outboard side of switch housings fit in grooves molded into grip. Verify that the wire harness conduit runs in the depression at the bottom of the handlebar.
3. Start the upper and lower switch housing screws, but do not tighten.
4. Position the clutch hand lever assembly inboard of the switch housing assembly engaging the tab on the lower switch housing in the groove at the bottom of the clutch lever bracket.
5. Align the holes in the handlebar clamp with those in the clutch lever bracket and start the lower screw (with flat washer). Position for rider comfort. Beginning with the top screw, tighten the screws to 60-80 **in-lbs** (6.8-9.0 Nm) using a T27 TORX drive head.
6. Using a T25 TORX drive head, tighten the lower and upper switch housing screws to 35-45 **in-lbs** (4-5 Nm).

*NOTE*

*Always tighten the lower switch housing screw first so that any gap between the upper and lower housings is at the front of the switch assembly.*

7. Test the switches for proper operation.

# STOPLIGHT SWITCHES 8.21

## FRONT STOPLIGHT SWITCH

To replace the front stoplight switch, refer to Section 8.20 HANDLEBAR SWITCHES, SWITCH REPAIR/REPLACEMENT.

## REAR STOPLIGHT SWITCH

The switch is mounted in a tee in the rear brake line. The tee is attached to a frame weldment on the right lower frame tube. If the stoplight fails to light when the rear brake is applied, check the bulb. If bulb is OK, check the continuity of the brake light wires. If brake light wires are good, check the stoplight switch for continuity with pedal depressed. Replace the switch if defective. See Section 2.10 REAR BRAKE MASTER CYLINDER, REAR BRAKE LINE, REMOVAL, REMOVAL/INSTALLATION.

*NOTE*

*The front and rear stoplight switches "trigger" a relay that connects 12 vdc to the stoplights. The stoplight (brake light) relay is located under the seat.*

*NOTE*

*On Ultra models the stoplight switches also disengage the cruise control when either switch closes.*

# NEUTRAL SWITCH 8.22

## GENERAL

A two terminal neutral switch (normally closed) is mounted to the transmission top cover. When the transmission is in NEUTRAL and the Ignition/Light Key Switch is in the IGNITION position, the neutral indicator lamp illuminates to indicate this condition to the rider.

## REMOVAL

**CAUTION**

**Cover transmission top cover with masking tape to prevent damage to chrome.**

1. Using fingers and flat tip screwdriver, remove two elbow connectors from neutral switch studs.
2. Using 7/8 inch box and open end wrench, remove neutral switch and O-ring from transmission top cover.

*NOTE*

*If neutral switch connector is damaged, replace using Part No.'s 72405-98BK or 72405-98TN with a heat-sealed butt splice connector. For detailed butt splicing information, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.4 SEALED BUTT SPLICE CONNECTORS.*

## INSTALLATION

*NOTE*

*If transmission top cover has been removed, be sure to install neutral switch after top cover installation to ensure proper switch engagement.*

1. Roll the vehicle back and forth to verify that the transmission is in NEUTRAL.
2. Lubricate O-ring with clean transmission oil.

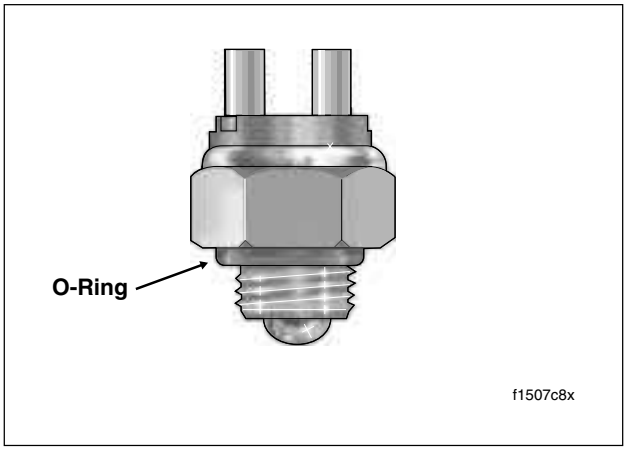



**Figure 8-93. Neutral Switch Assembly**

3. Using 7/8 inch box and open end wrench, install neutral switch with O-ring in the transmission top cover. Tighten to 10-15 ft-lbs (14-20 Nm).
4. Using fingers and a flat tip screwdriver, install the two elbow connectors on neutral switch studs.

*NOTE*

*The neutral switch is not polarity sensitive, so the elbow connectors can be attached to either stud.*

5. Test neutral switch for proper operation as follows:
   a. Turn the Ignition/Light Key Switch to the IGNITION position.
   b. Verify that neutral indicator lamp illuminates.
6. Remove masking tape from transmission top cover.

# HORN 8.23

## TROUBLESHOOTING

1. If the horn does not sound or fails to function satisfactorily, check for the following conditions.
   - Discharged battery
   - Loose, frayed or damaged wiring leading to horn terminal
2. If battery has a satisfactory charge and wiring appears to be in good condition, check for the following:
   - Poor ground to frame through mounting hardware or ground wire (see Steps 3-6 below)
   - Inoperative horn switch (see Steps 3-6 below)
3. Disconnect the YELLOW/BLACK wire at the horn. Connect a voltmeter as follows:
   - Positive (+) lead to wire terminal
   - Negative (–) lead to ground
4. Turn ignition switch ON. Depress horn switch. If battery voltage is present, horn or horn grounding is faulty. If battery voltage is not present, either horn switch or wiring to horn is faulty.
5. Connect an ohmmeter across the horn terminals. The resistance measured must be 45-66 ohms. Replace horn if measured resistance is outside range given.
6. If the horn is faulty, then it must be replaced as an assembly. The horn is not repairable. If the horn switch is faulty, replace the switch. See Section 8.20 HANDLEBAR SWITCHES, SWITCH REPAIR/REPLACEMENT.

## REMOVAL

1. Locate the horn below the fuel tank on the left side of the vehicle.
2. Remove acorn nut and flat washer to free horn assembly from rubber mount stud.
3. Remove elbow terminals from horn spade contacts.
4. Remove flange nut (10mm) from circular recess at back of horn bracket. Remove horn from chrome horn cover.

## INSTALLATION

1. Fit horn into chrome cover so that stud at back slides through hole in horn bracket. Apply two drops of LOCTITE THREADLOCKER 222 (Purple) to threads of horn stud.

**CAUTION**

**Overtightening the flange nut can cause permanent horn damage resulting in reduced volume and tone quality.**

2. Install flange nut (10mm) on horn stud and tighten to 80-100 **in-lbs** (9.0-11.3 Nm).
3. Install elbow terminals onto horn spade contacts.

*NOTE*

*The horn is not polarity sensitive. Elbow terminals may be attached to either spade contact.*

4. Install horn bracket onto rubber mount stud. Install flat washer and acorn nut onto stud. Tighten acorn nut to 110 **in-lbs** (12.4 Nm).

# CIGARETTE LIGHTER (FLHTCU, FLTR) 8.24

Ultra and FLTR models are equipped with a cigarette lighter. The lighter is located on the left side of the inner fairing.

## TROUBLESHOOTING

1. Ignition/light key switch must be ON or in ACCESSORY position for lighter operation.
2. If lighter does not work, substitute a known good lighter element.
3. If lighter is still inoperative, check for 12 vdc at center socket contact and ground at outer shell contact.
4. Refer to applicable Wiring Diagram at rear of manual if 12 vdc or ground are not present. Use voltage checks to isolate problem.

## REMOVAL

1. Remove the outer fairing. On FLHTCU models, see Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL. On FLTR models, see Section 2.27 UPPER FAIRING/WINDSHIELD (FLTR), OUTER FAIRING, REMOVAL.
2. Disconnect the socket terminals from the spade contacts on the cigarette lighter.
3. Remove lighter from socket. Holding socket, unscrew outer shell. Remove socket and outer shell from the fairing.

## INSTALLATION

1. From rider side of inner fairing, slide socket of **new** cigarette lighter through bore in fairing. Thread outer shell onto socket until tight. Install cigarette lighter in socket.
2. Connect the socket terminals onto the spade contacts of the cigarette lighter. Connect the orange wire terminal to the center socket spade contact, the black wire terminal to the outer shell contact.
3. Install the outer fairing. On FLHTCU models, see Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION. On FLTR models, see Section 2.27 UPPER FAIRING/WINDSHIELD (FLTR), OUTER FAIRING, INSTALLATION.

## GAUGES- 2 INCH DIAMETER

### Fuel Level, Ambient Air Temperature, Voltmeter, Oil Pressure

### REMOVAL

1. Remove outer fairing. Proceed as follows:

   **FLHT/C/U:** See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL.

   **FLTR:** See Section 2.27 UPPER FAIRING/WINDSHIELD (FLTR), OUTER FAIRING, REMOVAL.
2. Pull interconnect wire harness connectors from the gauge and lamp.
3. Remove hex nuts from studs. Remove mounting bracket.
4. Remove gauge from inner fairing.

### INSTALLATION

1. Install gauge in inner fairing.
2. Slide mounting bracket over studs. Verify that tab on bracket engages slot at bottom of inner fairing bore. See Figure 8-94.
3. Loosely install hex nuts on studs. Verify that gauge is properly aligned and then tighten nuts to 5-10 **in-lbs** (0.6-1.1 Nm).
4. Install interconnect wire harness connectors (gauge and lamp).
5. Install outer fairing. Proceed as follows:

   **FLHT/C/U:** See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.

   **FLTR:** Section 2.27 UPPER FAIRING/WINDSHIELD (FLTR), OUTER FAIRING, INSTALLATION.

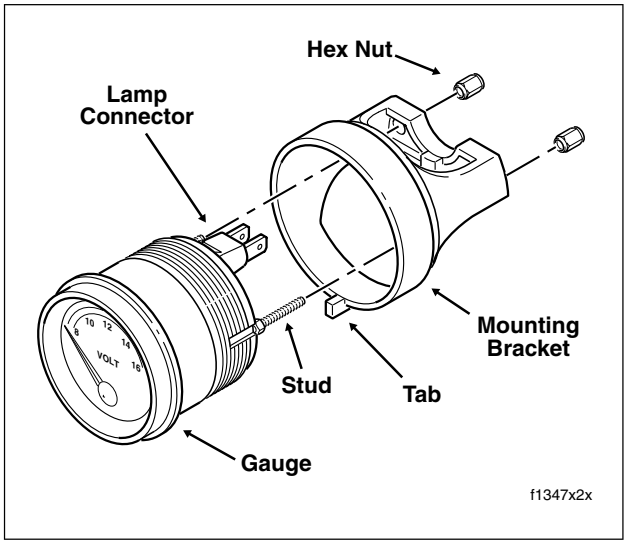



**Figure 8-94. Voltmeter Gauge Assembly**

## GAUGES- 4 INCH DIAMETER

### TACHOMETER

### REMOVAL

1. Proceed as follows:

   **FLHT/C/U:** Remove the outer fairing. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL.

   **FLTR:** Remove instrument bezel. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLTR), BEZEL, REMOVAL, steps 1-2.
2. Disconnect tachometer gauge from main harness. Tachometer connector [108], 6-place Packard, is a friction fit with no external latches; to avoid damage to wire terminals, pull on connector housing to remove.
3. Cut cable strap to release indicator lamps connector [21], 10-place Multilock, between speedometer and tachometer brackets.
4. Remove two allen head socket screws to free tachometer bracket from back of tachometer gauge.
5. Push tachometer gauge toward rear of vehicle to remove from inner fairing (FLHT/C/U) or bezel (FLTR) bore.
6. Remove rubber cushion from tachometer body.

### INSTALLATION

1. Slide rubber cushion down tachometer body until it contacts back of tachometer face.
2. Insert tachometer gauge into inner fairing (FLHT/C/U) or bezel (FLTR) bore.
3. Align holes in tachometer bracket with those at back of tachometer gauge. Be sure that tab at bottom of bracket engages slot in inner fairing or bezel. Loosely install two allen head socket screws. Verify that gauge is properly aligned and then tighten screws to 5-10 **in-lbs** (0.6-1.1 Nm).

4. Connect tachometer gauge to main harness. Tachometer connector [108], 6-place Packard, is a friction fit with no external latches. Take note of the offset terminal when mating pin and socket halves, and using the thumbs of both hands, push on each side of connector until tight.
5. Fit indicator lamps connector [21], 10-place Multilock, into space between speedometer and tachometer brackets. Install **new** cable strap to secure connector in place. Cut any excess cable strap material.
6. Proceed as follows:

   **FLHT/C/U:** Install outer fairing. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.

   **FLTR:** Install instrument bezel. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLTR), BEZEL, INSTALLATION, steps 1-2.

# SPEEDOMETER SPEED SENSOR

## REMOVAL

1. Remove seat. See Section 2.21 SEAT, REMOVAL.
2. Locate the speed sensor connector [65] in front of the battery (3-place Deutsch). Push the connector down to unsnap attachment clip from T-stud on the frame cross member. Depress external latch and use a rocking motion to separate pin and socket halves.
3. See Figure 8-95. Locate the sensor mounted below the starter on the right side of the transmission case. Remove the bolt to free the sensor from the case.
4. Remove the sensor (with cable and connector) from the vehicle.

## INSTALLATION

1. See Figure 8-95. Inspect the speed sensor O-ring for cuts, tears or general deterioration. Replace as necessary.
2. Insert the sensor into the transmission case and install the bolt. Tighten the bolt to 7-9 ft-lbs (9-12Nm).
3. Connect the speed sensor connector [65] in front of the battery (3-place Deutsch). Insert the socket housing into the pin housing until it snaps in place. Place large end of the slot on the attachment clip over the T-stud on the frame cross member. Push the connector assembly upward to engage the small end of the slot.

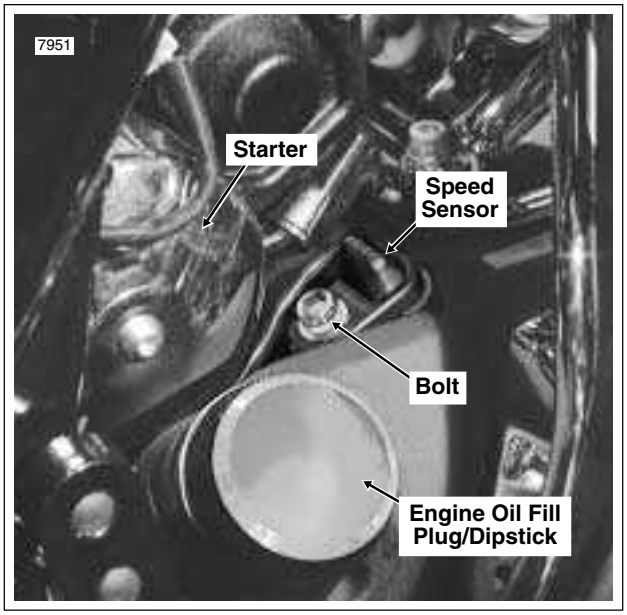



**Figure 8-95. Speedometer Speed Sensor Location**

# SPEEDOMETER

## REMOVAL

1. Proceed as follows:

   **FLHT/C/U:** Remove the outer fairing. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL.

   **FLTR:** Remove instrument bezel. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLTR), BEZEL, REMOVAL, steps 1-2.
2. Disconnect speedometer gauge from main harness. Depress clear plastic latch on secondary lock to release speedometer connector [39], 12-place Packard.
3. Cut cable strap to release indicator lamps connector [21], 10-place Multilock, between speedometer and tachometer brackets.
4. Remove two allen head socket screws to free speedometer bracket from back of speedometer gauge.
5. Push speedometer gauge toward rear of vehicle to remove from inner fairing (FLHT/C/U) or bezel (FLTR) bore.
6. Remove rubber cushion from speedometer body.

## INSTALLATION

1. Slide rubber cushion down speedometer body until it contacts back of speedometer face.
2. Insert speedometer gauge into inner fairing (FLHT/C/U) or bezel (FLTR) bore.
3. Align holes in speedometer bracket with those at back of speedometer gauge. Be sure that tab at bottom of bracket engages slot in bezel. Loosely install two allen head socket screws. Verify that gauge is properly aligned and then tighten screws to 5-10 **in-lbs** (0.6-1.1 Nm).

4. Connect speedometer gauge to main harness. Install speedometer connector [39], 12-place Packard, until clear plastic latch on secondary lock “clicks” into the locked position.
5. Fit indicator lamps connector [21], 10-place Multilock, into space between speedometer and tachometer brackets. Install **new** cable strap to secure connector in place. Cut any excess cable strap material.
6. Proceed as follows:

   **FLHT/C/U:** Install outer fairing. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.

   **FLTR:** Install instrument bezel. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLTR), BEZEL, INSTALLATION, steps 1-2.

# INDICATOR LAMPS

## REMOVAL

1. Proceed as follows:

   **FLHT/C/U:** Remove the outer fairing. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL.

   **FLTR:** Remove instrument bezel. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLTR), BEZEL, REMOVAL, steps 1-2.
2. Cut cable strap to release indicator lamps connector [21], 10-place Multilock, between speedometer and tachometer brackets.
3. Disconnect indicator lamps from jumper harness. Depress button on plug side of connector and pull apart pin and socket halves.
4. On FLHT/C/U models, remove tachometer gauge to access indicator lamp assembly. See GAUGES- 4 INCH DIAMETER, TACHOMETER, REMOVAL, in this section.
5. Release four paddles to free indicator bulb housing from lense assembly. See Figure 8-96. Remove lense assembly from inner fairing (FLHT/C/U) or bezel (FLTR), if damaged.
6. To replace indicator lamp bulbs, carefully remove rubber boot from bulb housing. Remove bulb from socket in boot.

## INSTALLATION

1. Install **new** bulb in socket. Install boot in bulb housing.
2. Place lense assembly in inner fairing (FLHT/C/U) or bezel (FLTR), if removed. Note position of oil icon to be sure that lense is right side up.
3. Engage all four paddles on lense assembly with tabs on indicator bulb housing. Be sure that flange on bulb housing faces upward.

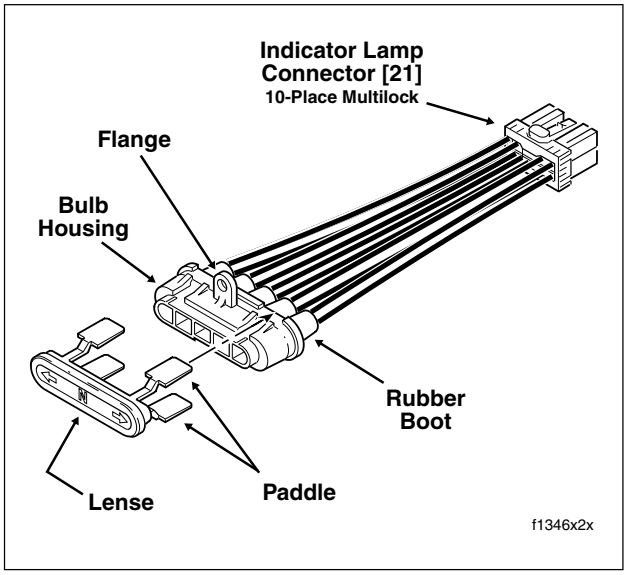



**Figure 8-96. Indicator Lamp Assembly**

4. Connect indicator lamps to jumper harness. Mate pin and socket halves of 10-place Multilock connector [21].
5. On FLHT/C/U models, install tachometer gauge. See GAUGES- 4 INCH DIAMETER, TACHOMETER, INSTALLATION, in this section.
6. Fit indicator lamps connector into space between speedometer and tachometer brackets. Install **new** cable strap to secure connector in place. Cut any excess cable strap material.
7. Proceed as follows:

   **FLHT/C/U:** Install outer fairing. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.

   **FLTR:** Install instrument bezel. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLTR), BEZEL, INSTALLATION, steps 1-2.

## FUEL GAUGE

### REMOVAL

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠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.**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. At bottom left side of fuel tank, bend back flexible clamp slightly to free fuel gauge conduit. Gently pull on conduit to draw 4-place Multilock out of tunnel.
4. Depress button on socket terminal side of connector and pull apart pin and socket halves.
5. Remove terminals from pin housing.

*NOTE*

*For instructions on properly removing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, REMOVING SOCKET/PIN TERMINALS.*

6. Remove the gauge cap on the top left side of the fuel tank. Do not twist the cap during removal. Hold the cap firmly and pull upward just far enough to free the cap from the fuel tank.

*NOTE*

*If fuel injected model, proceed directly to step 8.*

7. Free terminal boots from between pegs at back of gauge. See Figure 8-97. Pull male plug from female terminal boot. Grasping crimped ends, gently wiggle terminal to separate pin and socket halves. Repeat step on second booted terminal. Roll female terminal boot back for better access to wire terminal, if necessary.
8. To remove fuel gauge from vehicle, feed conduit and pin terminals up into drain tube of fuel tank while carefully raising cap.
9. If reusing gauge, inspect rubber seal for tears, cuts or general deterioration. Replace seal if necessary. Install **new** seal so that flat side contacts edge of gauge.

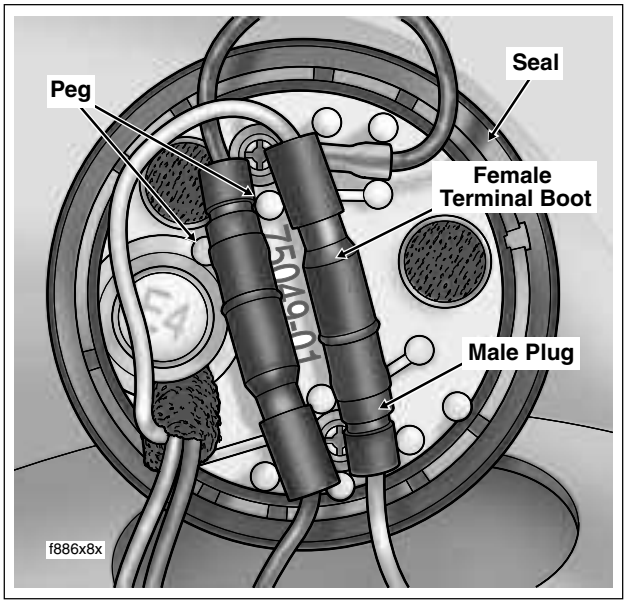



**Figure 8-97. Fuel Gauge - FLHR**

### INSTALLATION

1. Place **new** fuel gauge assembly next to discarded unit and cut wires to proper length.
2. Crimp **new** pin terminals onto fuel gauge wires.

*NOTE*

*For instructions on crimping wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, CRIMPING INSTRUCTIONS.*

*NOTE*

*If fuel injected model, proceed directly to step 4.*

3. Matching wire color, mate pin and socket halves of booted terminals. Install male plug to keep out dirt and moisture. Position booted terminals between pegs at back of fuel gauge. See Figure 8-97.
4. While carefully lowering cap, feed conduit down into drain tube until pin terminals exit hole at bottom of fuel tank. Gently pull wires (to remove slack) while installing the fuel gauge cap on the fuel tank. Do not twist the cap during installation. Hold the cap firmly and press downward until it snaps in place.
5. Install terminals into pin housing of 4-place Multilock.

**Table 8-13. Fuel Gauge [117]**

| Wire Color | | Chamber Number |
|---|---|---|
| Fuel Injected | Carbureted | |
| Orange | Orange | 1 |
| Yellow/White | - | 2 |
| - | - | 3 |
| Black | Black | 4 |

*NOTE*

*For instructions on properly installing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, INSTALLING SOCKET/PIN TERMINALS.*

6. At bottom left side of fuel tank, mate pin and socket halves of 4-place Multilock connector. Feed connector into tunnel capturing conduit in flexible clamp at bottom of tank.
7. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
8. Install seat. See Section 2.21 SEAT, INSTALLATION.

## SPEEDOMETER SPEED SENSOR

### REMOVAL

1. Remove seat. See Section 2.21 SEAT, REMOVAL.
2. Locate the speed sensor connector [65] in front of the battery (3-place Deutsch). Push the connector down to unsnap attachment clip from T-stud on the frame cross member. Depress external latch and use a rocking motion to separate pin and socket halves.
3. See Figure 8-98. Locate the sensor mounted below the starter on the right side of the transmission case. Remove the bolt to free the sensor from the case.
4. Remove the sensor (with cable and connector) from the vehicle.

### INSTALLATION

1. See Figure 8-98. Inspect the speed sensor O-ring for cuts, tears or general deterioration. Replace as necessary.
2. Insert the sensor into the transmission case and install the bolt. Tighten the bolt to 7-9 ft-lbs (9-12Nm).
3. Connect the speed sensor connector [65] in front of the battery (3-place Deutsch). Insert the socket housing into the pin housing until it snaps in place. Place large end of the slot on the attachment clip over the T-stud on the frame cross member. Push the connector assembly upward to engage the small end of the slot.
4. Install seat. See Section 2.21 SEAT, INSTALLATION.

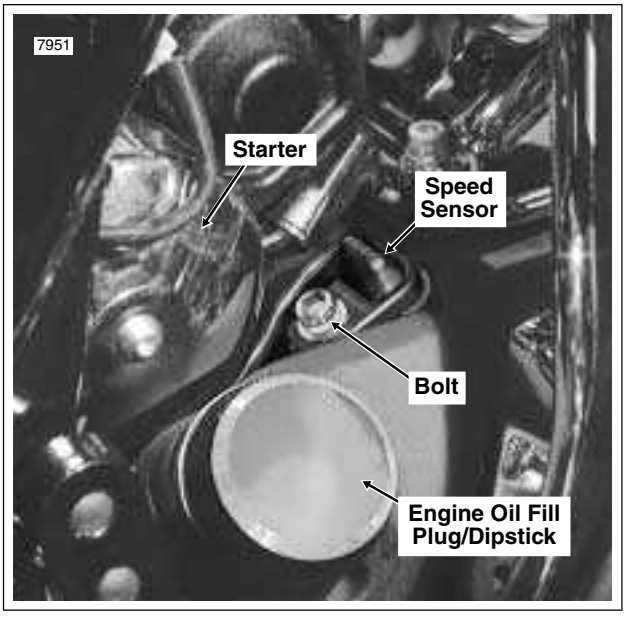



**Figure 8-98. Speedometer Speed Sensor Location**

## SPEEDOMETER

### REMOVAL

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠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.**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. Remove acorn nut and Phillips screw (with flat washer) from instrument console.
4. Lay a clean shop towel on forward part of rear fender. Lift the instrument console from fuel tank and lay upside down on shop towel.
5. If necessary, bend back the flexible metal clip to free the harness conduit from the bottom of the console.
6. Remove the Speedometer Connector [39] (12-place Mini-Deutsch) from the back of the speedometer. Depress the external latches and use a rocking motion to separate the pin and socket halves.
7. See Figure 8-99. Gently pry the three latches upward to release the lock ring from the back of the speedo-meter.
8. Turn the console over and remove the speedometer from the top side.
9. Remove gasket from console speedometer bore.

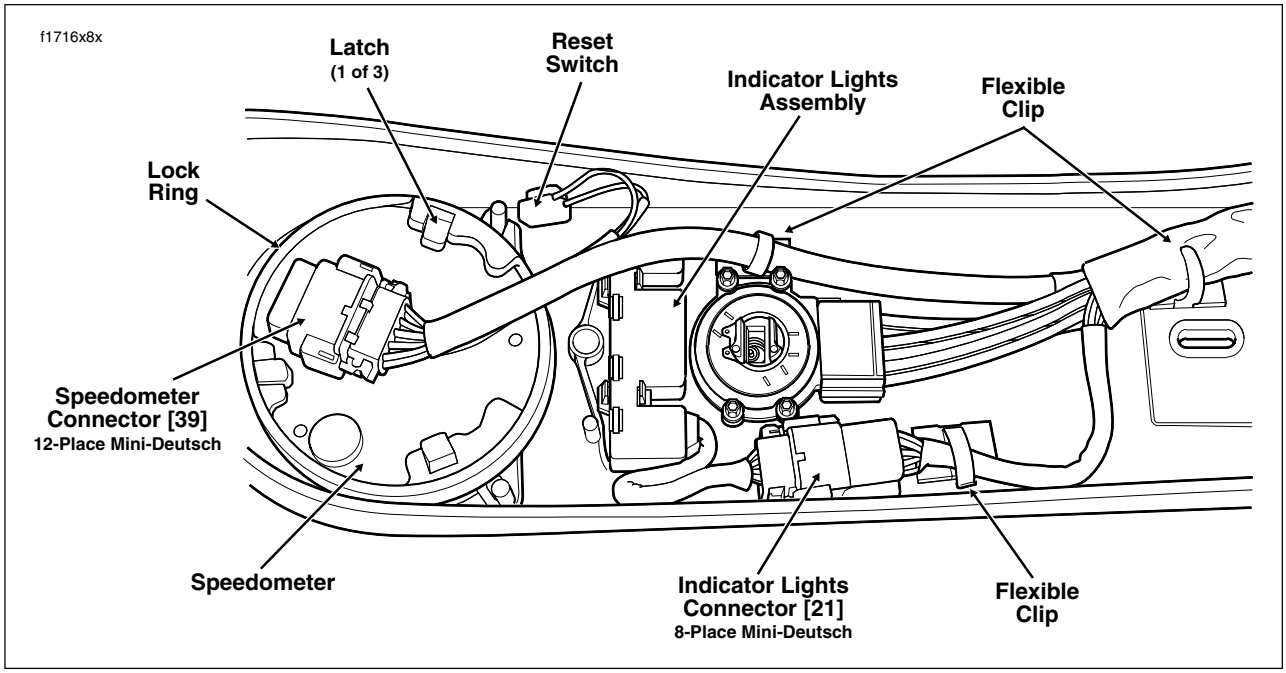



**Figure 8-99. Instrument Console Assembly (FLHR/C)**

## INSTALLATION

1. Lubricate the groove in the rubber speedometer gasket with isopropyl alcohol or glass cleaner. Place the gasket into position around the console speedometer bore.
2. From the top side of the console, feed the speedometer into the gasket. Lubricate the gasket with isopropyl alcohol or glass cleaner, if necessary. The speedometer should fit snugly against the gasket without movement.
3. Turn the console over. Place the lock ring over the back of the speedometer aligning the two slots with the console bosses. Press the latches down until they lock into position.
4. Install the Speedometer Connector [39] (12-place Mini-Deutsch) at the back of the speedometer. Aligning tabs on socket housing with grooves on pin housing, push connector halves together until the latches “click.”
5. If released, position the speedometer harness so that it runs the length of the console on the left side. Bend the flexible metal clip to capture the harness conduit. See Figure 8-99.
6. Slide head of console mounting bolt into slot on fuel tank, if removed. Align hole in console with mounting bolt and place into position over fuel tank.
7. Install acorn nut on mounting bolt and tighten to 80-100 **in-lbs** (9-11 Nm). Install Phillips screw (with flat washer) and tighten securely.
8. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
9. Install seat. See Section 2.21 SEAT, INSTALLATION.

# INDICATOR LIGHTS

*NOTE*

*All FLHR/C models are now equipped with Light Emitting Diodes (LED’s) in lieu of indicator lamps. The indicator light assembly is not serviceable. If one LED is bad, the indicator light assembly must be replaced.*

## REMOVAL

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠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.**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. Remove acorn nut and Phillips screw (with flat washer) from instrument console.
4. Lay a clean shop towel on forward part of rear fender. Lift the instrument console from fuel tank and lay upside down on shop towel.

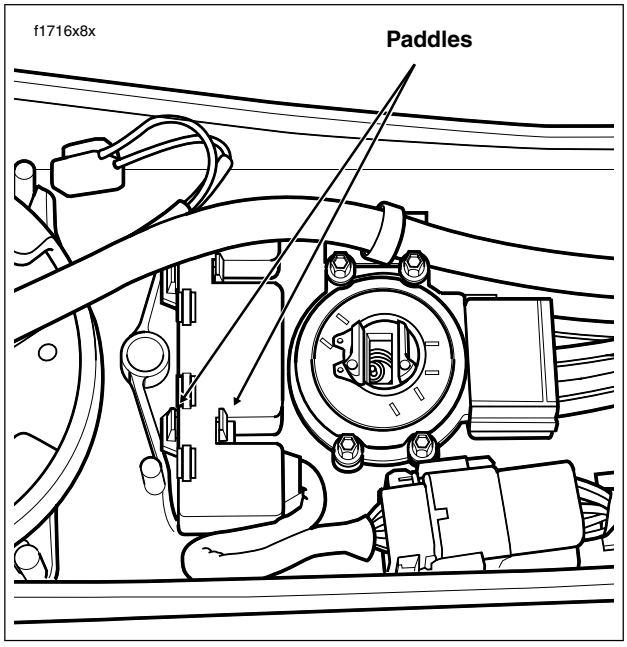



**Figure 8-100. Release Paddles to Free Indicator Lights Assembly (FLHR/C)**

5. Disconnect the Indicator Lights Connector [21] (8-place Mini-Deutsch) at back of console. Depress the external latches and use a rocking motion to separate pin and socket halves.
6. Remove indicator lights assembly from console as follows:
   a. Insert the blade of a large screwdriver under rear corner of indicator lights assembly.
   b. Using thumb and index finger, squeeze front and rear paddles on same side of assembly while rotating screwdriver. See Figure 8-100.
   c. When one side of assembly becomes free, repeat procedure on opposite side to release unit from console.

## INSTALLATION

1. Install indicator lights assembly into console as follows:
   a. Place assembly into position in console engaging four paddles in slots of indicator light assembly.
   b. While pushing down on assembly with thumbs, push up on lense on outboard side of console until assembly fits snugly.
2. Connect the Indicator Lights Connector [21] (8-place Mini-Deutsch) at back of console. Align tabs on socket housing with grooves on pin housing, and push connector halves together until the latches “click.”
3. Slide head of console mounting bolt into slot on fuel tank, if removed. Align hole in console with mounting bolt and place into position over fuel tank.
4. Install acorn nut on mounting bolt and tighten to 80-100 **in-lbs** (9-11 Nm). Install Phillips screw (with flat washer) and tighten securely.
5. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
6. Install seat. See Section 2.21 SEAT, INSTALLATION.

# FUEL LEVEL SENDER (CARBURETED) 8.27

*NOTE*

*For replacement of the fuel level sender on fuel injected models, see Section 9.3 FUEL TANK ASSEMBLY, FUEL LEVEL SENDER.*

## ALL MODELS (EXCEPT FLHR)

*NOTE*

*For fuel gauge replacement, see Section 8.25 GAUGES/ INSTRUMENTS (FLHT/C/U, FLTR).*

### REMOVAL

1. Turn the handle of the fuel valve to OFF.
2. Drain the fuel tank. See Section 4.6 VACUUM OPERATED FUEL VALVE, DRAINING FUEL TANK.
3. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠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.**

4. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.

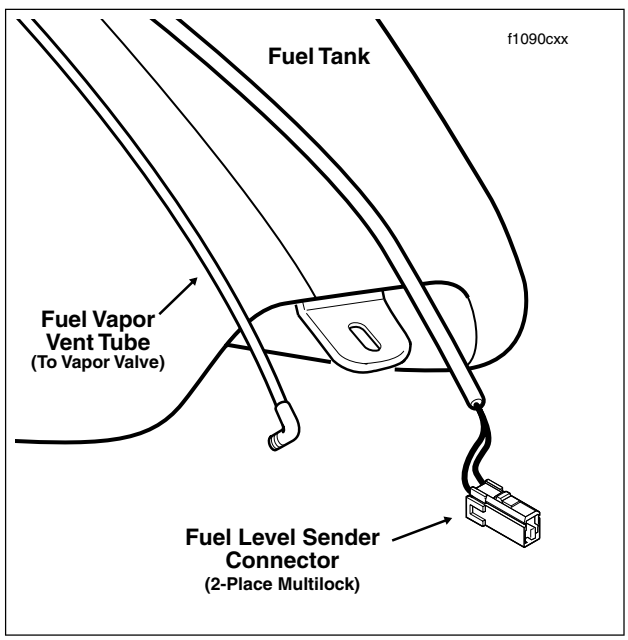



**Figure 8-101. Fuel Level Sender Connector**

5. Carefully cut anchored cable strap securing main harness bundles, fuel level sender conduit, and fuel vapor vent tube to left frame tube.
6. Open console door. Remove two Allen head screws inboard of rubber bumpers. These screws secure console to clip nuts on the canopy bracket.
7. Remove Allen head screw to detach flange at rear of console from bracket welded to fuel tank.
8. Unsnap two-place electrical connector in front of battery to disconnect fuel level sender from the main harness. See Figure 8-101. Depress the button on the socket terminal side and pull apart the pin and socket halves.
9. Lay a clean shop cloth on forward part of rear fender. Remove filler cap from neck of fuel tank. Remove console and lay upside down on shop cloth. Reinstall filler cap.
10. Pull fuel vapor vent tube from nipple on filler neck of fuel tank.

**CAUTION**

**Do not remove the center nut that holds the yellow wire terminal to the top plate (canopy) of the fuel level sender or the sensor float device will drop into the fuel tank.**

11. Remove the five screws (with seals) around the outer edge of the canopy. Remove the canopy (with attached fuel level sender) from vehicle. Remove gasket.

### INSTALLATION

1. Align the holes in a **new** gasket with those in the fuel tank.
2. Hold the canopy upright so that the float of the fuel level sender is extended. Insert float into left side of fuel tank. Align holes in canopy with those in gasket.

**⚠WARNING**

**Always use new screws when installing the fuel level sender. Reusing old canopy screws may compromise sealing integrity resulting in gas leaks. Gas leakage can cause fire or explosion which could result in death or serious injury.**

3. Hand start five **new** screws in perimeter of canopy. Alternately tighten screws in a crosswise pattern.

*NOTE*

*Check sender unit screws for proper sealing devices. Screws must have a bonded seal on underside of head. Replace screws if seal is missing or damaged.*

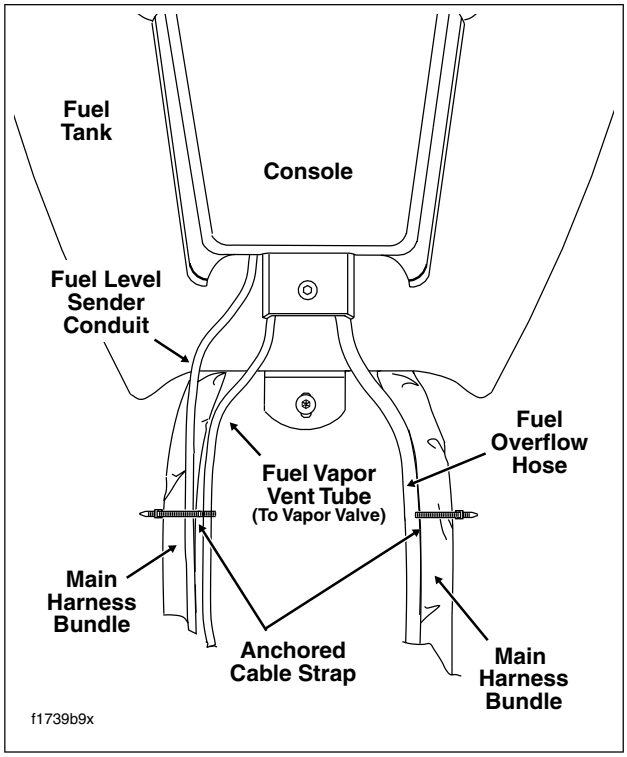



**Figure 8-102. Console Cable/Hose Routing - FLHT/C, FLTR (Top View)**

4. Connect fuel vapor vent tube to nipple on filler neck of fuel tank.
5. Remove filler cap. Position console on canopy. Route cables from beneath console as shown in Figure 8-102. Be sure that hoses and wires are not pinched by the console during installation. Reinstall filler cap.
6. Install Allen head screw to fasten rear flange of console to welded bracket on fuel tank.
7. Open door on console. Install two Allen head screws to secure front of console to clip nuts on canopy bracket.
8. Connect the fuel level sender to the main harness. Locate the two-place electrical connector in front of battery. Press pin and socket halves of connector together until they snap in place. See Figure 8-101.
9. Snap anchor of **new** cable strap into hole on left side of frame. Tighten cable strap to capture main harness bundles, fuel level sender conduit, and fuel vapor vent tube along left frame tube. See Figure 8-102. Cut any excess cable strap material.
10. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
11. Install seat. See Section 2.21 SEAT, INSTALLATION.
12. Turn the handle of the fuel valve to OFF and fill the fuel tank.

# FLHR ONLY

## REMOVAL

1. Turn the handle of the fuel valve to OFF.
2. Drain the fuel tank. See Section 4.6 VACUUM OPERATED FUEL VALVE, DRAINING FUEL TANK.
3. Remove fuel gauge. See Section 8.26 GAUGES/INSTRUMENTS (FLHR/C), FUEL GAUGE, REMOVAL.
4. Using a T15 TORX drive head, remove the five screws (with sealing washers) around the outer edge of the sender plate. See Figure 8-103.

**CAUTION**

**Exercise care to avoid bending float arm during removal. A bent float arm can result in erroneous gauge readings.**

5. Gently pull on wires to raise sender plate slightly. With plate unseated, rotate in a clockwise direction until cut on outer edge (accommodates drain tube) faces forward. Carefully lift fuel level sender assembly from fuel tank. See Figure 8-104.

## INSTALLATION

1. Hold the fuel level sender assembly upright so that the float is extended and cut on outer edge of plate (accommodates drain tube) is facing the rear of the vehicle. Insert the float into the fuel tank, and then gently lower the fuel level sender assembly into position aligning holes in sender plate with those in bore.

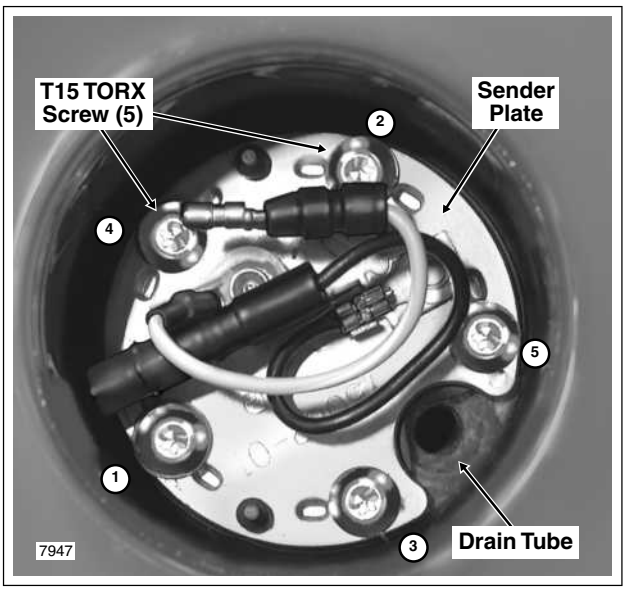



**Figure 8-103. Sender Plate Torque Sequence - FLHR**

**⚠WARNING**

**Always use new screws when installing the fuel level sender. Reusing old screws may compromise sealing integrity resulting in gas leaks. Gas leakage can cause fire or explosion which could result in death or serious injury.**

2. Start five **new** screws (with sealing washers) in perimeter of sender plate.

*NOTE*

*Check screws for proper sealing devices. Screws must have a seal on underside of head. Replace screws if seal is missing or damaged.*

3. Using a T15 TORX drive head, alternately tighten the screws to 18-22 **in-lbs** (2.0-2.5 Nm) in the sequence shown in Figure 8-103.
4. Install fuel gauge. See Section 8.26 GAUGES/INSTRUMENTS (FLHR/C), FUEL GAUGE, INSTALLATION.
5. Fill the fuel tank. Verify that the handle of the fuel valve is in the OFF position before filling.

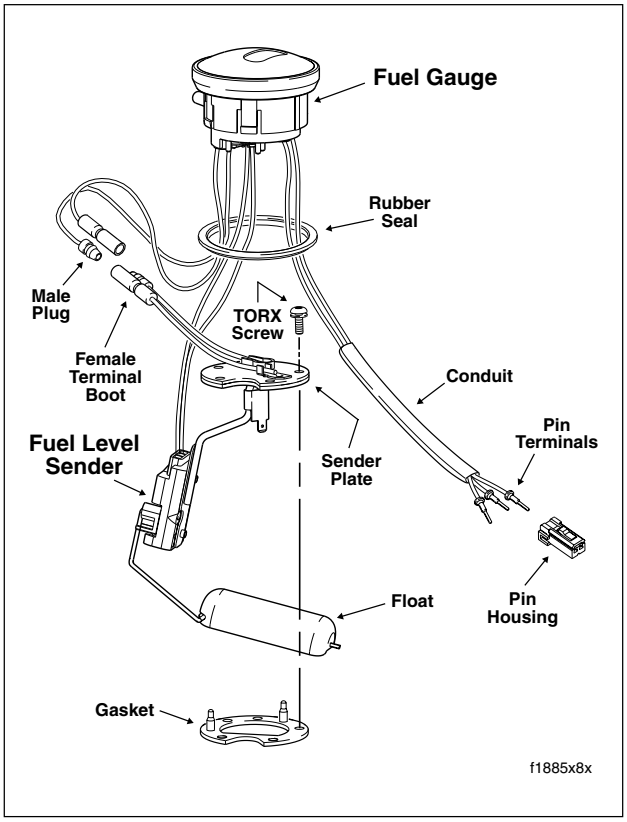



**Figure 8-104. Fuel Level Gauge/Sender - FLHR**

# CRUISE CONTROL (FLHTCU, FLTR) 8.28

## GENERAL

The Cruise Control system provides automatic vehicle speed control. The electronics and stepper motor are contained in a control module mounted under the left side cover. The stepper motor actuates the cruise control cable through a gear train and ribbon reel.

## SYSTEM OPERATION

To engage and disengage the cruise control system, proceed as follows:

1. While riding in fourth or fifth gear, turn the fairing cap Cruise ON/OFF Switch to the ON position. See Figure 8-105. A lamp in the switch illuminates to indicate that the system is activated.

   Power (12 vdc) is supplied to the cruise control module through a 15 amp fuse located in the fuse block mounted under the left side cover.

2. With the motorcycle traveling at the desired “cruise” speed (30 mph/48 km/h to 85 mph/137 km/h), momentarily push the Cruise SET/RESUME switch to SET. See Figure 8-106.

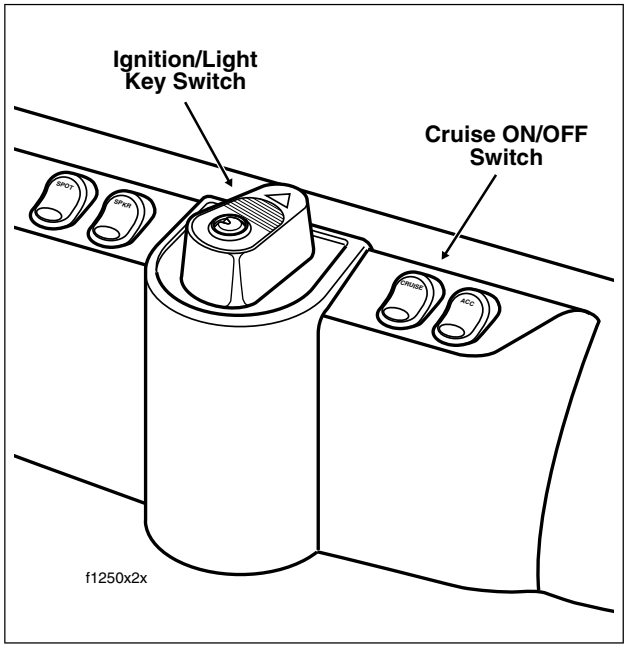



**Figure 8-105. Fairing Cap (FLHTCU)**

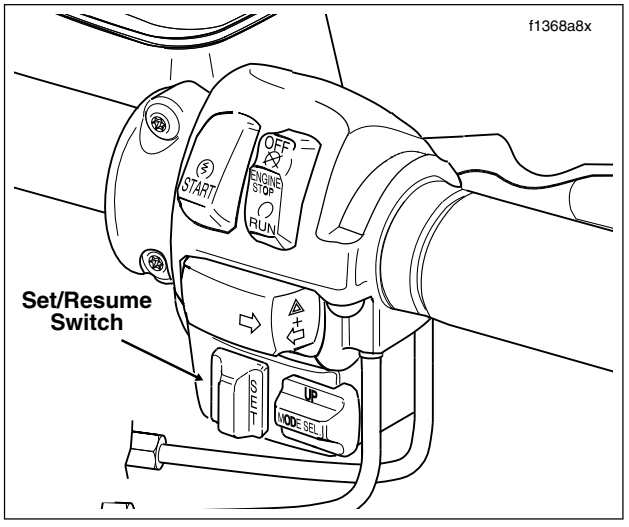



**Figure 8-106. Right Handlebar Switch Assembly**

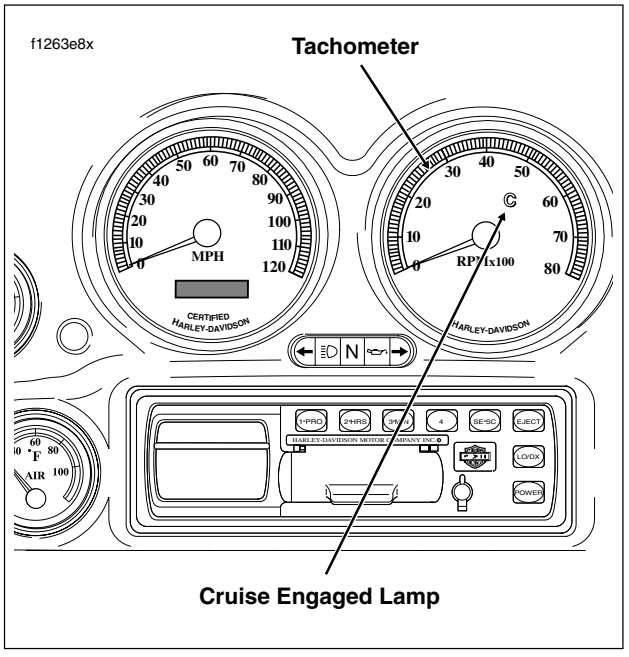



**Figure 8-107. Instrument Panel (FLHTCU)**

The cruise control module “reads” the speedometer output speed signal to establish the desired vehicle speed. The module then sends a signal to the stepper motor which drives the ribbon reel to take up the slack in the cruise cable. The green Cruise Engaged Lamp (capital letter “C”) on the tachometer gauge illuminates to indicate that the cruising speed is locked in. See Figure 8-107.

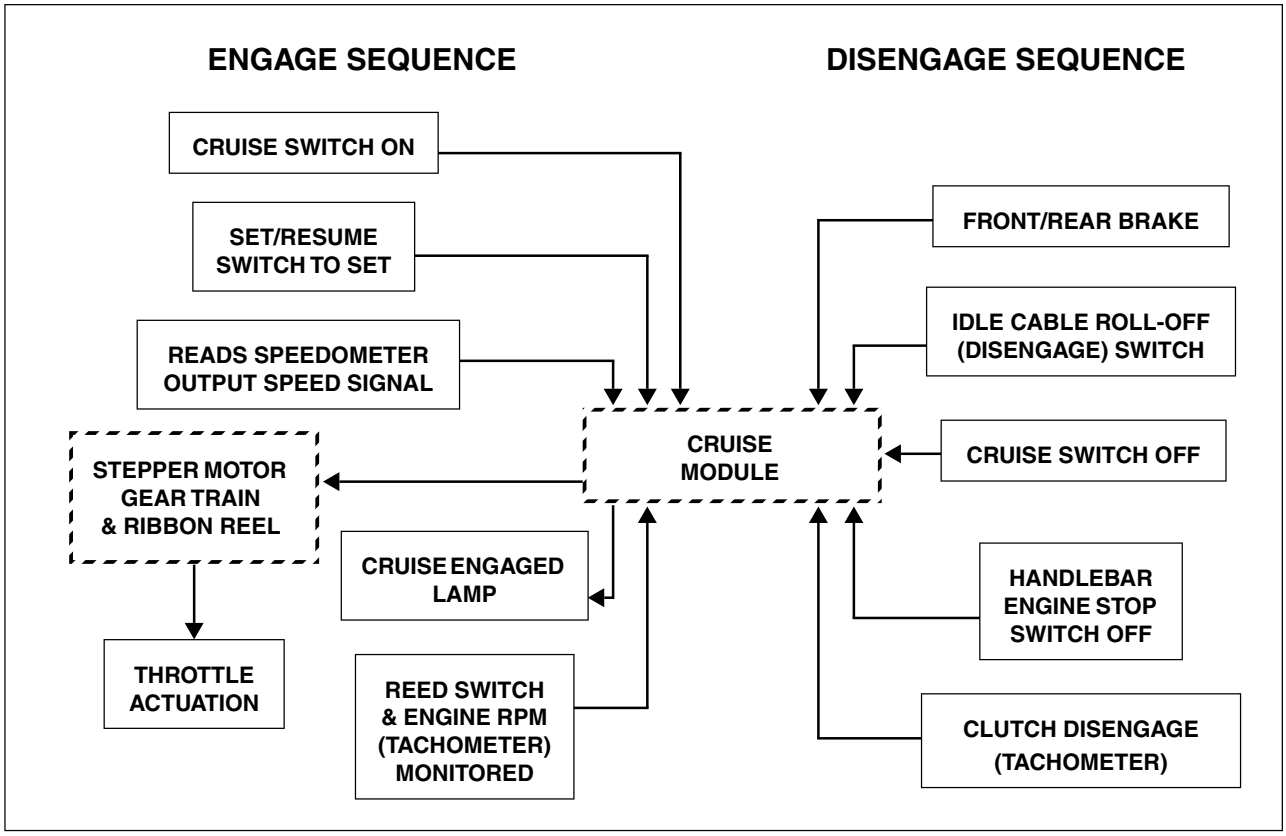



**Figure 8-108. Cruise System Diagram**

3. The cruise control module monitors both the engine RPM and the speedometer output speed signal. The module signals the stepper motor to open or close the throttle to keep the speedometer output speed signal constant. The engine RPM is monitored to detect engine overspeed, a condition which automatically causes cruise disengagement.

4. The cruise control automatically disengages (stepper motor drives cruise cable to the full-out position) whenever the cruise control module receives one of the following inputs:

   a. Front or rear brake is applied.

   b. Throttle is “rolled back” or closed, thereby actuating idle cable roll-off (disengage) switch.

   c. Motorcycle clutch is disengaged (module senses too great an increase in RPM).

   d. Fairing cap Cruise ON/OFF Switch placed in the OFF position.

   e. Handlebar mounted Engine Stop Switch placed in the OFF position. (This removes tachometer input signal which results in module disengagement.)

   f. Handlebar mounted Cruise SET/RESUME switch is pushed to SET and held in that position until vehicle speed drops below 30 mph (48 km/h).

*NOTE*

*If the vehicle speed is above 30 mph (48 km/h) when the Cruise SET/RESUME Switch is released, then the cruise system automatically re-engages.*

## CABLE ADJUSTMENT

*NOTE*

*Always adjust the cables in the sequence presented below, that is, throttle and then idle cable. The cruise cable only requires adjustment if the cruise module or cruise cable are removed or replaced, and then it must be adjusted last using the CABLE LASH INITIALIZATION routine on the next page.*

### THROTTLE CABLE

1. With handlebar in straight ahead position, idle cable adjusted to full slack and throttle control grip turned to wide open throttle (WOT), adjust pull open cable to obtain full throttle opening at carburetor.

2. Twist throttle grip to full closed position. Check that idle stop-screw is touching idle stop with handlebar in straight ahead position, and while turning handlebar from “lock-to-lock”.

*NOTE*

*If idle stop-screw is not touching carburetor, adjust (loosen) pull-open cable just enough so that idle stop-screw is touching idle stop through full lock-to-lock handlebar movement. Also check that cruise cable has slack and is not opening throttle. Loosen cruise cable if required.*

3. Rotate throttle grip to WOT and release. Throttle must return to idle position freely. If it does not, check for incorrect cable routing, damaged cables or binding in the throttle grip.

## IDLE CABLE

1. Raise lid of left side saddle bag. To free saddlebag from mounting brackets, grasp bail wire inside saddlebag and rotate each stud a full 1/4 turn in a counter-clockwise direction. Remove bail head studs with flat washers. Remove saddlebag.
2. Gently pull side cover from frame downtubes (no tools required).
3. Lift the locking latch and remove the cruise module connector [17]. With idle cable still adjusted to full slack position, connect ohmmeter to violet/yellow and orange/violet leads on connector [17A].
4. Ohmmeter must indicate infinity (switch contacts open). If ohmmeter indicates continuity, the roll-off switch may be shorted and entire cable must be replaced.
5. With handlebar in straight ahead position, adjust idle cable until approximately 0.06 inch (1.5 mm) of freeplay exists at the outside diameter (OD) of the throttle grip.
6. With light force, rotate the throttle grip toward the closed position. The ohmmeter must indicate continuity. If it does not, decrease freeplay at throttle grip by adjusting the idle cable to obtain continuity while maintaining some freeplay at the throttle grip.
7. While holding the throttle grip (with light force) in the closed position, turn handlebar from “lock-to-lock”. Ohmmeter must indicate continuity throughout handlebar movement.
8. With handlebar in straight ahead position, rotate throttle grip to WOT and release. Throttle must return to idle position freely.
9. Repeat Step 8 with handlebar at full left and right positions. If throttle does not return to idle position freely, loosen idle cable slightly and repeat steps 6-9.
10. Install cruise module connector [17] and engage locking latch.
11. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required).
12. Position left side saddlebag on vehicle. Place flat washers on bail head studs. With groove at end of stud held in a horizontal position, insert stud through holes in saddlebag and front mounting bracket. When groove engages wire form of spring plate on inboard side of bracket, turn stud clockwise a full 1/4 turn until it snaps in place. Install rear bail head stud in the same manner.

## CABLE LASH INITIALIZATION

With the elimination of the mechanical cruise cable adjuster, the tolerance stack-ups are intended to result in a cable that is too long. The extra cable length is then taken up upon execution of the Cable Lash Initialization routine. During the routine, the system calculates the number of “motor steps” the cable is pulled before the throttle plates are moved (a maximum of 200 motor steps equivalent to 1.2 inches or 31mm). This information is then stored in permanent memory.

*NOTE*

*Perform the initialization routine whenever the cruise module, cruise cable or throttle body are removed or replaced. For best results, be sure the engine is at normal operating temperature.*

To set the correct cable lash, proceed as follows:

a. Push the Cruise Switch on the right handlebar to RESUME and hold.
b. Turn the fairing cap Cruise ON/OFF switch to ON.
c. Turn the Ignition/Light Key Switch to IGNITION.
d. Start the engine. The green Cruise Engaged Lamp (capital letter “C”) on the tachometer gauge will illuminate. Wait 3 seconds for the lamp to go off.
e. Release the Cruise Switch from the RESUME position.
f. Push the Cruise Switch to RESUME and hold. Cruise will pull in cable until change in RPM is detected. The number of motor steps required to rev the engine is stored in memory.
g. After engine revs and Cruise Engaged Lamp is extinguished, release the Cruise Switch from the RESUME position.
h. Turn the Ignition/Light Key Switch to OFF.

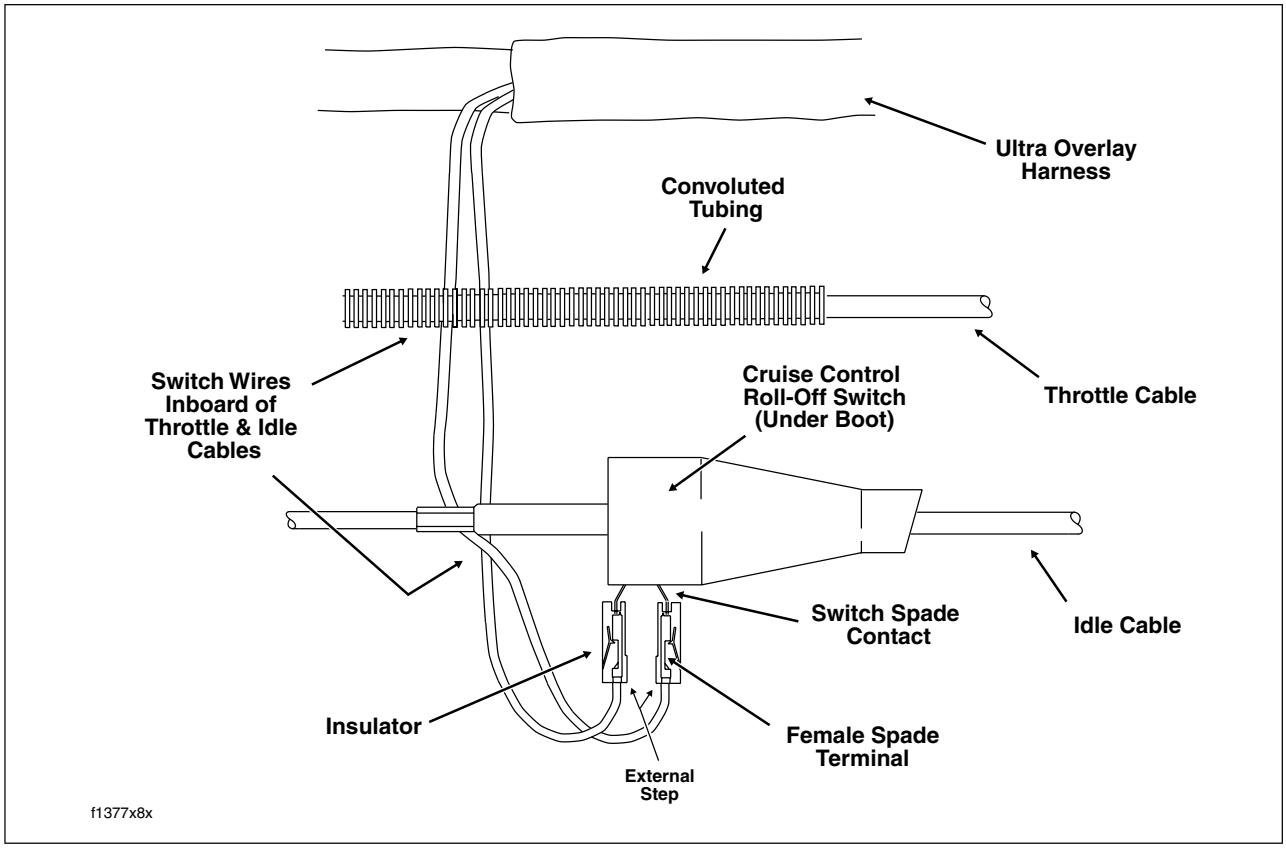



**Figure 8-109. Throttle/Idle Cable Configuration (Right Side View)**

# THROTTLE/IDLE CABLES

*NOTE*

*While the same throttle cable is used on all FL model vehicles, the idle cable of "cruise" models is provided with a cruise roll-off (disengage) switch.*

## REMOVAL

1. See Section 2.19 THROTTLE CABLES (NON-ULTRA), REMOVAL, THROTTLE SIDE.
2. Remove the air cleaner and backplate. For carbureted models, see Section 4.5 AIR CLEANER, REMOVAL. For fuel injected models, see Section 9.4 AIR CLEANER, REMOVAL.
3. Raise fuel tank to access cables in area of frame backbone. For carbureted models, see Section 4.7 FUEL TANK, PARTIAL REMOVAL, FLHT/C, FLTR, or FLHR. For fuel injected models, see Section 9.3 FUEL TANK, PARTIAL REMOVAL, FLHTC/U-I, FLTR-I, or FLHR/C-I.
4. Locate the cruise control roll-off switch plumbed into the idle control cable on the right side of the vehicle. See Figure 8-109. Push rubber boot on switch forward to access spade type wire terminals.
5. Remove both female spade type terminals from spade contacts on cruise control roll-off switch.
6. **Carbureted:** Using slots, remove cable barrel ends from holes in throttle wheel and release cable housings from cable guides on carburetor cable bracket.

   **Induction Module:** Using slot, remove idle and throttle control cables from integral cable guides cast at front of induction module. Using a needle nose pliers, pull cable barrel ends out of holes in throttle wheel.
7. Cut and discard 14 inch cable strap capturing frame backbone and coil bracket.
8. Free cables from J-clamp fastened to right side of frame backbone.

## INSTALLATION

1. See Section 2.19 THROTTLE CABLES (NON-ULTRA), INSTALLATION, THROTTLE SIDE.

2. Route the throttle and idle cables downward following the brake line to the inner fairing. Pass the cables through the inner fairing grommet and then loop them back along the right side of the steering head.
3. From the right side of the steering head, route the throttle and idle cables along the right side of the frame backbone. After passing through the J-clamp on the frame backbone, route the cables downward to the carburetor/induction module.
4. Use a pliers to straighten spade contacts of cruise roll-off switch if bowed or bent back. The contacts must be parallel and line up perpendicular to the idle cable.
5. Separate the cruise roll-off switch wires so that the ends are free up to the point where they enter the wire harness conduit. Now route the leads straight down inboard of both the idle and throttle cables.
6. Slide the insulators onto the switch spade contacts (polarity is not a factor). For maximum insertion, be sure that the external step on the insulators face each other. See Figure 8-109.
7. Fit the rubber boot over the cruise control roll-off switch. An oval cut in the boot accommodates the switch spade terminal connections.
8. Orient the idle cable so that the insulators are at the bottom.
9. Install convoluted tubing on throttle cable from front to rear. Open the split that runs the length of the tubing, and from the vicinity of the switch, feed the tubing back until it contacts the J-clamp fastened to the bottom of the frame backbone.
10. Position the throttle cable between the idle cable (bottom) and the wire harness (top).
11. **Carbureted:** Install the idle cable housing and spring into the longer cable guide on the carburetor cable bracket. Drawing idle cable downward, fit barrel end into hole in throttle wheel (farthest from cam stop). Install the throttle cable housing into the shorter cable guide inserting barrel end into remaining hole in throttle wheel.

    **Induction Module:** Drawing the idle cable around the top of the throttle wheel, insert barrel end into upper hole. Draw the throttle cable around the bottom of the throttle wheel and insert barrel end into lower hole. Using slots, slip throttle and idle cables into cable guides cast at front of induction module.

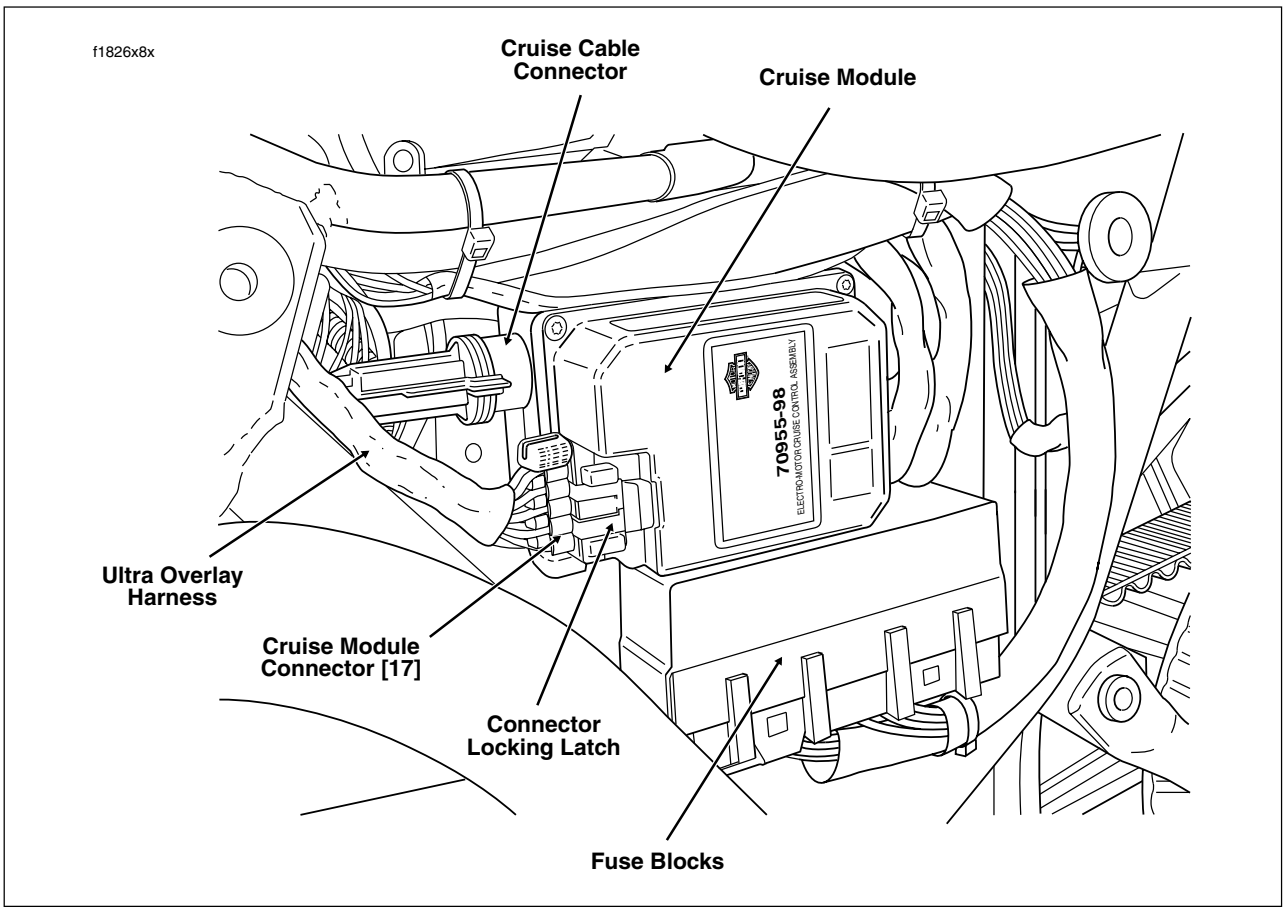



**Figure 8-110. Cruise Control Module (Under Left Side Cover)**

12. Tighten cables as necessary to keep barrel ends from dislodging. Verify that cables are seated in channel of throttle wheel. Verify operation by turning throttle grip and observing cable action.

13. From right side of vehicle, insert tapered end of new 14 inch cable strap between ignition coil and coil bracket welded to underside of frame backbone. When cable strap exits left side, raise both ends so that eye is centered above the frame backbone.

14. Verify that the idle and throttle cables, wire bundles, wire harness and frame backbone are captured before mating cable strap ends. Tighten cable strap, but leave loose enough so that one finger can be inserted between strap and frame backbone. **Do not over-tighten.** Cut any excess cable strap material.

15. Install fuel tank. For carbureted models, see Section 4.7 FUEL TANK, INSTALLATION (AFTER PARTIAL REMOVAL), FLHT/C, FLTR, or FLHR. For fuel injected models, see Section 9.3 FUEL TANK, INSTALLATION (AFTER PARTIAL REMOVAL), FLHTC/U-I, FLTR-I, or FLHR/C-I.

16. Install backplate and air cleaner assembly. For carbureted models, see Section 4.5 AIR CLEANER, INSTALLATION. For fuel injected models, see Section 9.4 AIR CLEANER, INSTALLATION.

17. Adjust the throttle and idle cables. Be sure to use the cable adjustment procedure for Ultra models. See CABLE ADJUSTMENT, in this section.

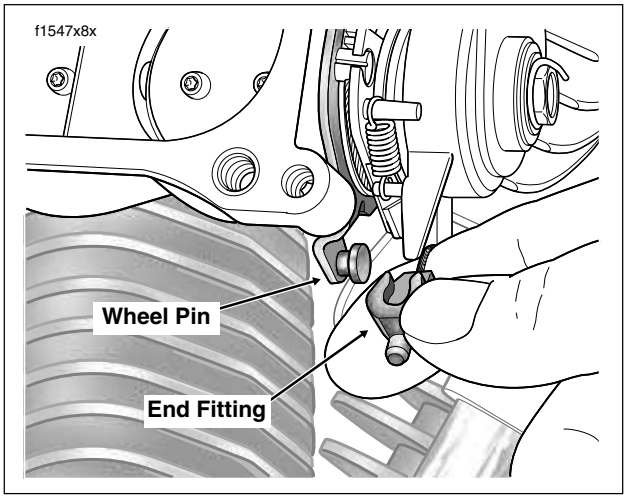



**Figure 8-111. Remove End Fitting From Wheel Pin**

## CRUISE CABLE

### REMOVAL

1. Remove the air cleaner and backplate. For carbureted models, see Section 4.5 AIR CLEANER, REMOVAL. For fuel injected models, see Section 9.4 AIR CLEANER, REMOVAL.
2. Remove the E-clip to release the cable housing from the carburetor or throttle body cable guide.
3. Push the plastic end fitting on the cruise cable to the outboard side to release from wheel pin. See Figure 8-111.

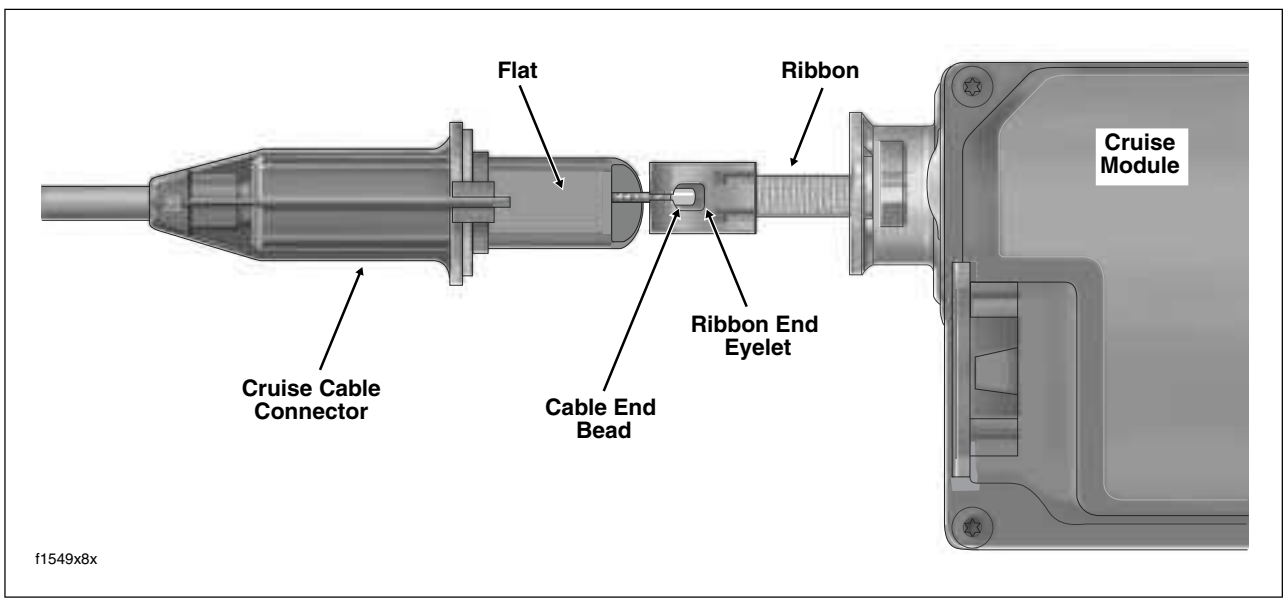



**Figure 8-112. Remove Cable End Bead From Ribbon End Eyelet**

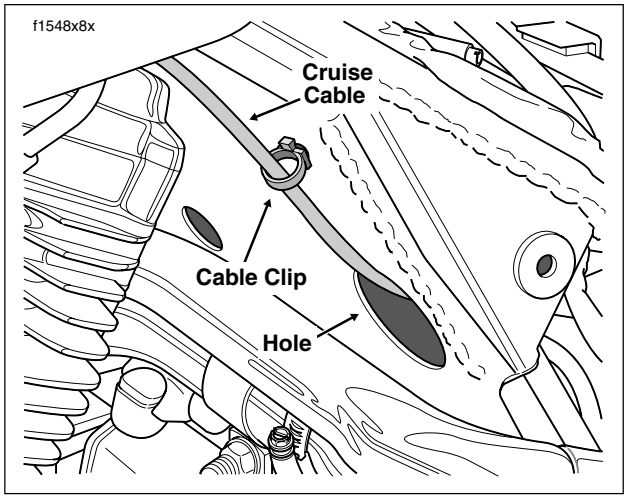



**Figure 8-113. Cruise Cable Routing (Left Side)**

4. Raise lid of left side saddle bag. To free saddlebag from mounting brackets, grasp bail wire inside saddlebag and rotate each stud a full 1/4 turn in a counter-clockwise direction. Remove bail head studs with flat washers. Remove saddlebag.
5. Gently pull side cover from frame downtubes (no tools required).
6. To release cruise cable, pull anchored cable clip from hole in frame crossmember. See Figure 8-113.
7. Carefully pull cruise cable out from beneath fuel tank.
8. Rotate cruise cable connector in a counter-clockwise direction to detach from cruise module. See Figure 8-110.
9. Pull the cable out of the connector and remove the cable end bead from the ribbon end eyelet. See Figure 8-112.
10. Pull cruise cable and connector from hole in frame cross member.

## INSTALLATION

1. From left side of vehicle, route the cruise cable forward over the top engine stabilizer and then down between cylinder heads to the carburetor or induction module.
2. Position the cruise cable housing in the cable guide. Install **new** E-clip on cable housing to lock position of cable.
3. Feed cruise cable connector through hole in frame cross member. See Figure 8-113.

**CAUTION**

**Be sure that the ribbon is not twisted. A twisted ribbon may adversely affect performance or even prevent cruise operation.**

4. With the hole in the ribbon end eyelet and the flat on the cable connector housing facing outboard, fit cable end bead into ribbon end eyelet. See Figure 8-112.
5. Verify that bead, eyelet and ribbon are lined up correctly. On right side of vehicle, gently pull on end fitting to remove cable slack.
6. Insert cruise cable connector into cruise module and rotate in a clockwise direction until tabs on connector fully engage grooves or detentes in cruise module housing.
7. Capture cruise cable in cable clip and anchor in hole of frame crossmember. See Figure 8-113.
8. Adjust the throttle and idle cables. See CABLE ADJUSTMENT, in this section.
9. Holding cam lever assembly to prevent rotation, slide groove in plastic end fitting over cap of wheel pin. Push on end fitting until it snaps in place. See Figure 8-111.
10. Install backplate and air cleaner assembly. For carbureted models, see Section 4.5 AIR CLEANER, INSTALLATION. For fuel injected models, see Section 9.4 AIR CLEANER, INSTALLATION.
11. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required).
12. Position left side saddlebag on vehicle. Place flat washers on bail head studs. With groove at end of stud held in a horizontal position, insert stud through holes in saddlebag and front mounting bracket. When groove engages wire form of spring plate on inboard side of bracket, turn stud clockwise a full 1/4 turn until it snaps in place. Install rear bail head stud in the same manner.

# CRUISE CONTROL MODULE

## REMOVAL

1. See CRUISE CABLE. REMOVAL, in this section, steps 1-7.
2. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠WARNING**

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

3. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
4. Unthread bolt and remove battery positive cable (red) from battery positive (+) terminal.
5. Using a T40 TORX drive head, loosen bolt to move lip of hold-down clamp off edge of battery. Remove battery from battery box.

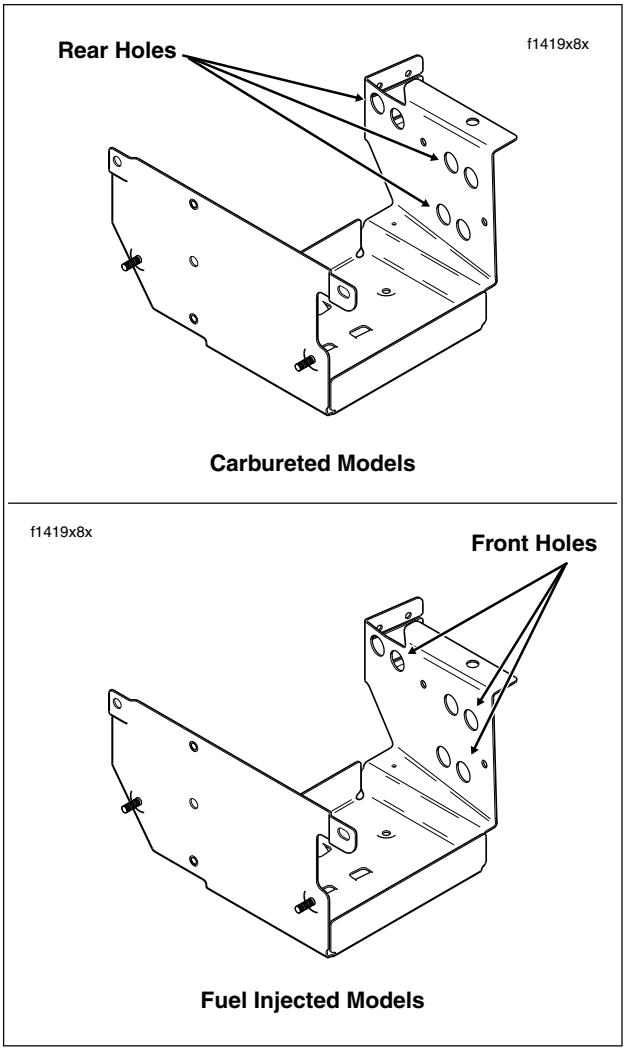



**Figure 8-114. Cruise Module Mounting**

6. See Figure 8-110. Lift the locking latch and remove the cruise module connector [17].
7. From inside battery box, remove the two front and one rear locknut from cruise module mounting studs. Carefully pull cruise module from battery box while drawing cruise cable connector and cable through hole in frame cross member. Exercise caution to avoid losing grommets on studs.

## INSTALLATION

1. Install grommets onto studs at rear of **new** cruise module.
2. While feeding cruise cable through hole in frame cross member, place the cruise module into position on left side of battery box. Use rear holes of battery box on carbureted models, front holes on fuel injected models. See Figure 8-114.
3. Install locknuts on front and rear mounting studs. Tighten locknuts to 9-11 ft-lbs (12-15 Nm).
4. Install cruise module connector [17] and engage locking latch.
5. From left side of vehicle, route the cruise cable forward over the top engine stabilizer and then down between cylinder heads to the carburetor or induction module.
6. Position the cruise cable housing in the cable guide. Install **new** E-clip to secure.
7. See CRUISE CABLE, INSTALLATION, in this section, steps 7-12.
8. Place battery in battery box, terminal side forward. Rotate hold-down clamp so that lip (with rubber pad) rests on edge of battery and tighten clamp bolt.

**⚠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 which could result in death or serious injury.**

9. Insert bolt through battery positive cable (red) into threaded hole of battery positive (+) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
10. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
11. Install seat. See Section 2.21 SEAT, INSTALLATION.

# ULTRA OVERLAY HARNESS

For instructions on replacement of the Ultra Overlay Harness, see Section 8.30 WIRING HARNESSES AND CABLES (FLHT/C/U), ULTRA OVERLAY HARNESS.

# CRUISE CONTROL SWITCHES

## FAIRING CAP

See Figure 8-115. For instructions on replacement of the CRUISE ON/OFF SWITCH, see Section 8.18 FAIRING CAP SWITCHES (FLHTC/U), or Section 8.19 INSTRUMENT NACELLE SWITCHES (FLTR).

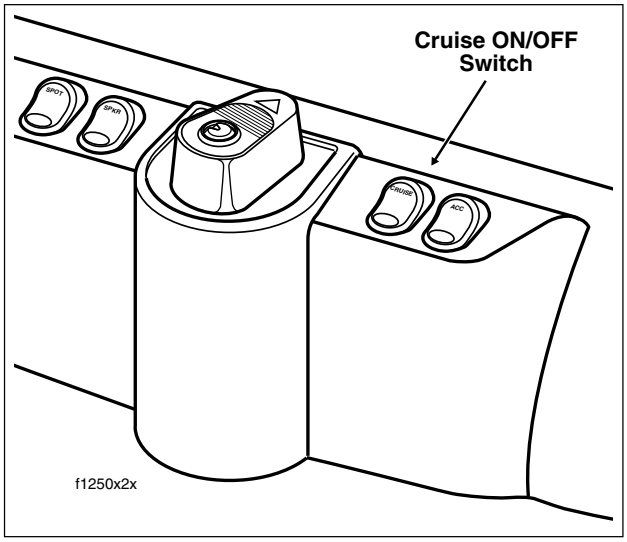



**Figure 8-115. Fairing Cap**

## HANDLEBAR

See Figure 8-116. For instructions on replacement of the handlebar mounted CRUISE SET/RESUME switch, see Section 8.20 HANDLEBAR SWITCHES, SWITCH REPAIR/REPLACEMENT.

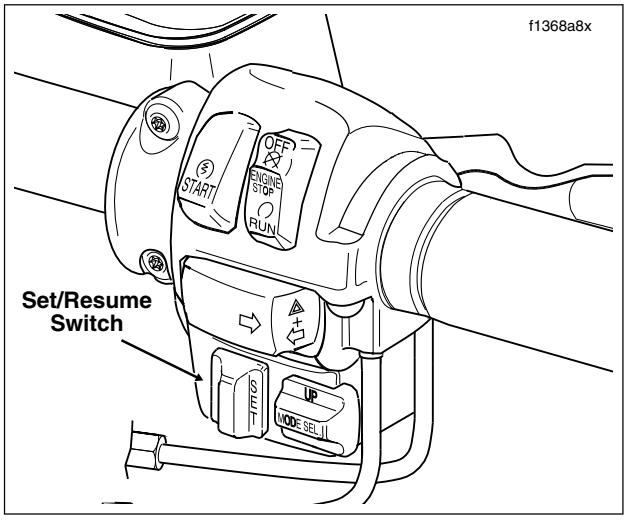



**Figure 8-116. Right Handlebar Switch Assembly**

## RADIO (FLHTC/U)

### REMOVAL

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠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.**

**CAUTION**

**To prevent possible damage to the sound system, always verify that the Ignition/Light Key Switch is in the OFF position before disconnecting the battery negative cable from the battery terminal.**

2. Verify that the Ignition/Light Key Switch is in the OFF position. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. Remove the outer fairing. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL.

*NOTE*

*To separate pin and socket halves of Radio connectors [27] and [28], use thumbnail to pull down external latch before pulling socket from pin side. See Figure 8-117.*

4. See Figure 8-118. Separate pin and socket halves of the following connectors:
   a. Radio connector [27], 23-place Amp (black).
   b. Radio Antenna Cable connector [51].
   c. Radio connector [28], 23-place Amp (gray). *Ultra models only.*
   d. CB Antenna Cable connector [50]. Rotate knurled nut counterclockwise until free. *Ultra models only.*

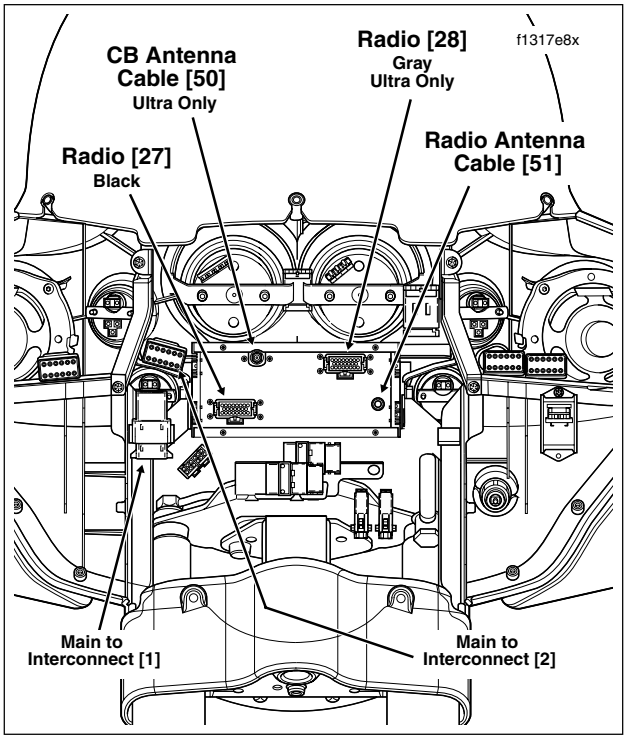



**Figure 8-118. Radio Connections - FLHTCU**

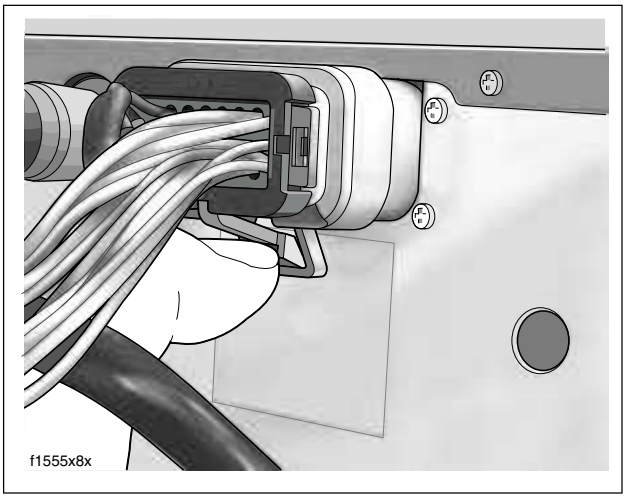



**Figure 8-117. Pull Down Latch to Free Radio Connector**

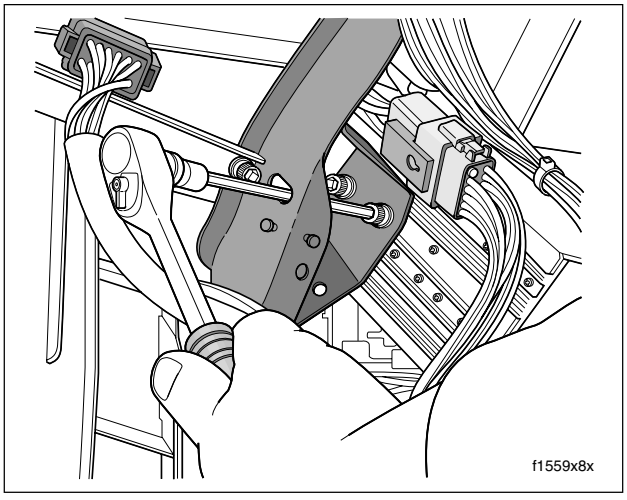



**Figure 8-119. Release Carrier from Fairing Brackets**

5. To better access radio bracket screws, move the following connectors from their fixed locations:

   a. Main to interconnect harness connector [1], 12-place Deutsch (black); T-stud at front of right fairing bracket. *Classic and Ultra models.*

   b. Main to interconnect harness connector [2], 12-place Deutsch (gray); T-stud to right radio support bracket. *Classic and Ultra models.*

6. Using a long shank ball end socket (Snap-on® FABL6E), remove four screws to release radio from left and right radio support brackets. Use oblong holes in fairing brackets to access screws. See Figure 8-119.

7. Pull out radio. If radio nose seal gets caught on radio support brackets, rock back and forth until free.

## INSTALLATION

1. Position radio between radio support brackets so that top of nose seal is flush with top of support brackets. Tilt rear of radio upward at a 45˚ angle and push into approximate position. If radio nose seal gets caught on radio support brackets, rock back and forth while pushing. If necessary, spray nose seal with contact cleaner and repeat step.

2. Before pushing radio into cut of inner fairing, verify that nose seal is not distorted, compressed or pinched.

3. Align threaded inserts in radio sides with oblong holes in left and right radio support brackets. Starting with the rear screws, install four socket screws to fasten radio to brackets. Tighten screws to 45-60 **in-lbs** (5.1-6.8 Nm).

4. See Figure 8-118. Mate pin and socket halves of the following connectors:

   a. Radio connector [27], 23-place Amp (black).

   b. Radio Antenna Cable connector [51].

   c. Radio connector [28], 23-place Amp (gray). *Ultra models only.*

   d. CB Antenna Cable connector [50]. Insert pin and rotate knurled nut clockwise until tight. *Ultra models only.*

5. Return the following connectors to their fixed locations:

   a. Main to interconnect harness connector [1], 12-place Deutsch (black); T-stud at front of right fairing bracket. *Classic and Ultra models.*

   b. Main to interconnect harness connector [2], 12-place Deutsch (gray); T-stud to right radio support bracket. *Classic and Ultra models.*

6. Install outer fairing. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.

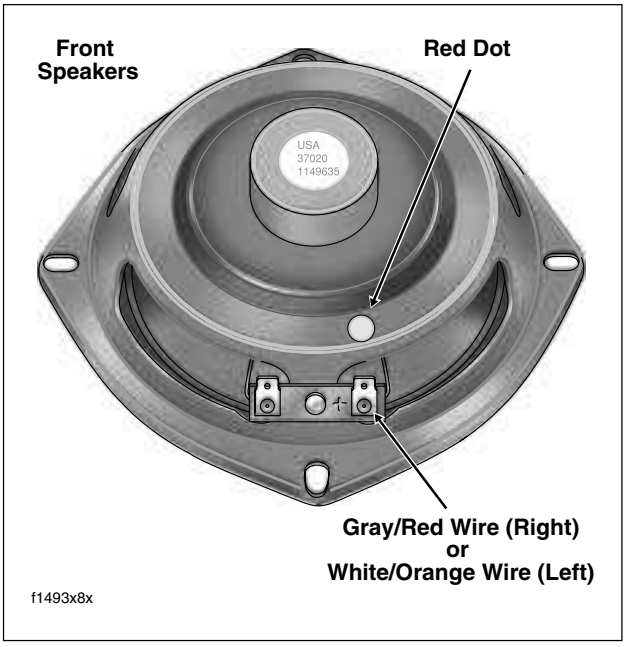



**Figure 8-120. Install Socket Terminals on Spade Contacts**

**CAUTION**

**To prevent possible damage to the sound system, always verify that the Ignition/Light Key Switch is in the OFF position before connecting the battery negative cable to the battery terminal.**

7. Verify that the Ignition/Light Key Switch is in the OFF position. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).

8. Install seat. See Section 2.21 SEAT, INSTALLATION.

# FRONT FAIRING SPEAKERS

## REMOVAL

1. Remove the outer fairing. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL.

2. Carefully pull the socket terminals from the speaker spade contacts.

3. Using a T25 TORX drive head, remove three screws to release the speaker adapter assembly from the inner fairing.

4. Using a flat bladed screwdriver, carefully pry speaker from adapter.

## INSTALLATION

1. With the grille side down, align the holes in the speaker with those in the adapter. Be sure that the speaker spade contacts are at the top left side of the adapter, the top being the side with the widest edge. Snap speaker into adapter.
2. If speaker grille is loose, apply 3M-847 adhesive (HD Part No. 99618-60) to outer edge of adapter ring. Install grille on adhesive.
3. Install speaker adapter assembly into inner fairing location (widest edge of adapter at the top).
4. Install two long screws to secure top of speaker adapter assembly to inner fairing. Capturing fairing support brace, install short screw in lower outboard hole. The screw hole on the lower inboard side is not used.
5. Using a T25 TORX drive head, tighten the lower speaker screw to 22-28 **in-lbs** (2.5-3.2 Nm). Tighten the two upper speaker screws to 35-50 **in-lbs** (4.0-5.7 Nm).
6. Install the socket terminals onto the speaker spade contacts. Be sure that the socket terminal of the wire that is **not** green is installed on the contact above the red dot. See Figure 8-120.
7. Install the outer fairing. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.

# CONSOLE POD ASSEMBLY

*NOTE*

*The following instructions may also be used for replacement of the chrome fuel tank console on which the pod is mounted.*

## REMOVAL

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

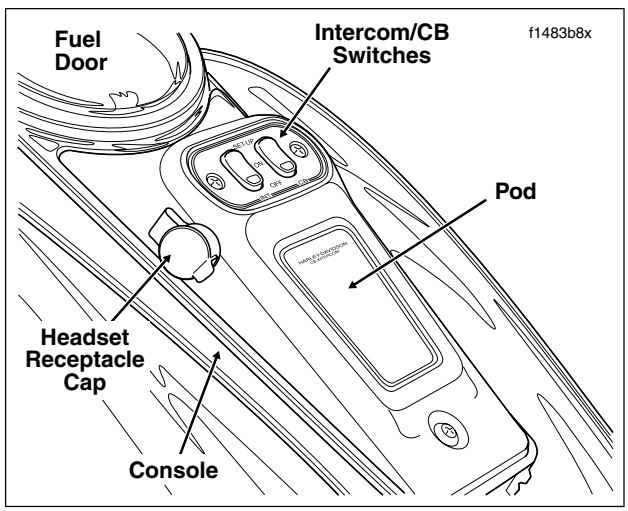



**Figure 8-121. Console Pod Assembly**

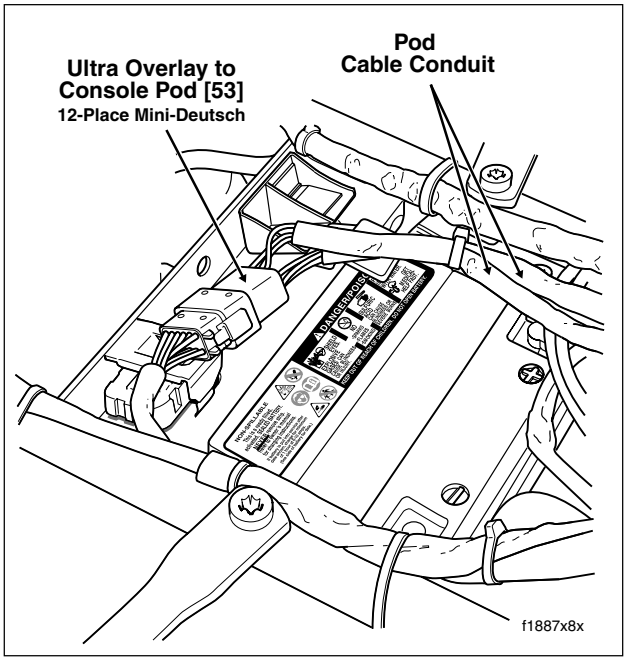



**Figure 8-122. Disconnect Console Pod Connector**

**⚠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.**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. Remove left side saddlebag. See Section 2.22 SADDLEBAG, REMOVAL.
4. Gently pull side cover from frame downtubes (no tools required).
5. Carefully cut anchored cable strap securing console pod conduit, main harness bundles and fuel pump/fuel level sender conduit to frame backbone. Cut cable strap securing console pod conduit to left frame tube (in front of saddlebag rail).
6. Open fuel door on console. Remove two Allen head screws inboard of rubber bumpers. These screws secure console to clip nuts on the canopy bracket.
7. Remove Allen head screw to detach flange at rear of console from bracket welded to fuel tank.
8. Lay a clean shop towel on forward part of the rear fender. Remove filler cap from neck of fuel tank. Remove console and lay upside down on shop towel. Reinstall filler cap.
9. Bend back flexible clamp to release pod cable conduit from bottom of console.

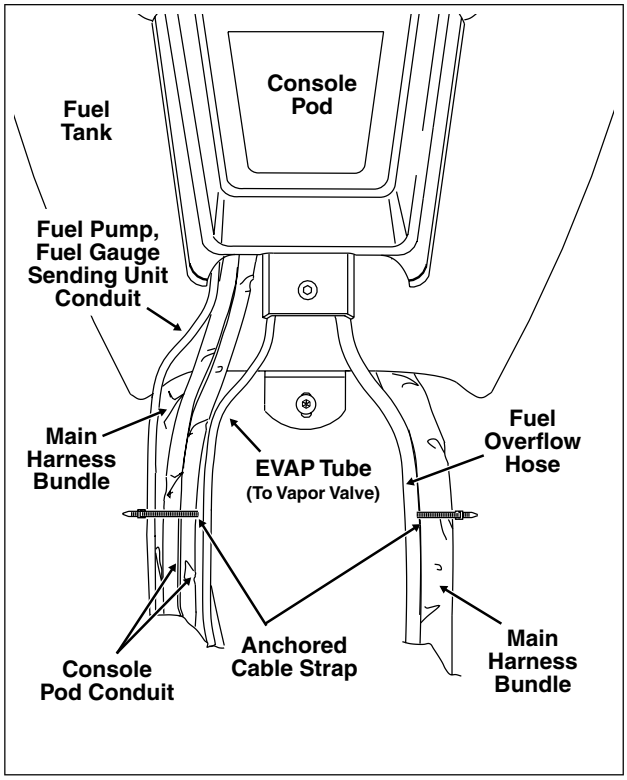



**Figure 8-123. Console Pod Cable/Hose Routing (Top View)**

10. Release Ultra Overlay to Console Pod Connector [53], 12-place Mini-Deutsch, from attachment clip anchored in hole at rear of battery box (between electrical relays). See Figure 8-122. Depress external latches and use a rocking motion to separate pin and socket halves.
11. Remove three Allen head screws (with Keps nuts) to release pod from console.

## INSTALLATION

1. Feed pin housing and conduit through top of console seating pod in recess. Install three Allen head screws (with Keps nuts) to secure pod to console. Capture conduit in flexible clamp at bottom of console.

**⚠WARNING**

**Exercise caution to avoid pinching or kinking the fuel overflow hose when console is installed. A blocked hose can cause excess gasoline to remain above the filler neck insert, while fuel expansion can cause an overfilled tank to overflow through the filler cap vent. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.**

2. Remove filler cap. Place console over filler neck onto canopy. Route cables from beneath console as shown in Figure 8-123. Be sure that hoses and wires are not pinched by the console during installation. Reinstall filler cap.
3. Install Allen head screw to fasten rear flange of console to welded bracket on fuel tank.
4. Open fuel door on console. Install two Allen head screws to secure front of console to clip nuts on canopy bracket.
5. Snap anchor of **new** cable strap into hole on left side of frame backbone. Tighten cable strap to capture console pod conduit, main harness bundles and fuel pump/fuel level sender conduit. See Figure 8-123. Install remaining cable strap to secure console pod conduit to left frame tube (in front of saddlebag rail). Cut any excess cable strap material.
6. Mate pin and socket halves of Ultra Overlay to Console Pod Connector [53], 12-place Mini-Deutsch. Install connector onto attachment clip anchored in hole at rear of battery box (between electrical relays).
7. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
8. Install seat. See Section 2.21 SEAT, INSTALLATION.
9. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required).
10. Install left side saddlebag. See Section 2.22 SADDLEBAG, INSTALLATION.

# INTERCOM/CB SWITCHES

*NOTE*

*Intercom and CB Switches are not replaced separately. If either switch is faulty, replace the entire switch assembly as described below.*

## REMOVAL

1. Remove console pod. See CONSOLE POD ASSEMBLY, REMOVAL, on the preceding page.
2. Cut three cable straps to separate Intercom/CB Switch conduit from Headset Receptacle conduit.
3. Remove terminals 1 through 5 from pin housing of 12-place Mini-Deutsch connector.

*NOTE*

*For instructions on properly removing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.1 DEUTSCH ELECTRICAL CONNECTORS, REMOVING/INSTALLING PINS.*

4. Remove Intercom/CB Switch assembly from pod.

## INSTALLATION

1. Feed wire terminal end of **new** Intercom/CB Switch assembly through opening at top of pod.
2. Install terminals 1 through 5 into pin housing of 12-place Mini-Deutsch connector.

### Table 8-14. Intercom/CB Switches [53A]

| Wire Color | Chamber Number |
|---|---|
| Orange/Violet | 1 |
| White/Red | 2 |
| White/Violet (or W/R with green tape) | 3 |
| Violet/Gray | 4 |
| Black | 5 |

*NOTE*

*For instructions on properly installing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.1 DEUTSCH ELECTRICAL CONNECTORS, REMOVING/INSTALLING PINS.*

3. Install three cable straps to secure Intercom/CB Switch conduit to Headset Receptacle conduit.
4. Install console pod. See CONSOLE POD ASSEMBLY, INSTALLATION, in this section.
5. Test Intercom/CB Switch functions.

# FRONT HEADSET RECEPTACLE

## REMOVAL

1. Remove console pod. See CONSOLE POD ASSEMBLY, REMOVAL, in this section.
2. Cut three cable straps to separate Intercom/CB Switch conduit from Headset Receptacle conduit.
3. Remove terminals 6 through 12 from pin housing of 12-place Mini-Deutsch connector.

*NOTE*

*For instructions on properly removing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.1 DEUTSCH ELECTRICAL CONNECTORS, REMOVING/INSTALLING PINS.*

4. Raise Headset Receptacle cap. Place pin punch in either notch of lock ring and rotate in a counter-clockwise direction. See Figure 8-124. Remove lock ring and cap from Headset Receptacle. Remove Headset Receptacle from pod.

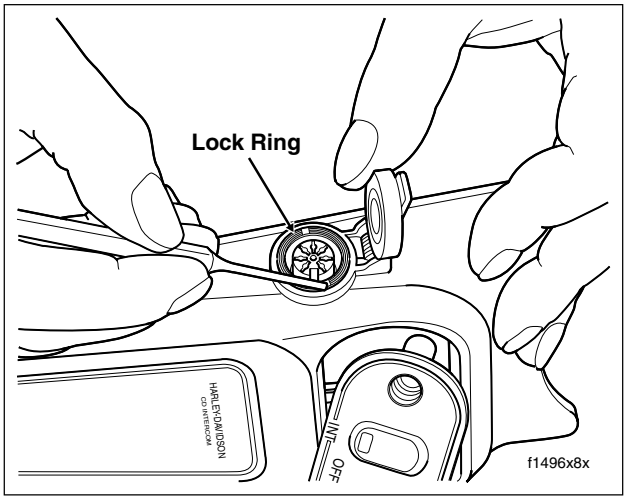



**Figure 8-124. Remove Lock Ring from Receptacle Using Pin Punch**

## INSTALLATION

1. Insert threaded end of Headset Receptacle through hole in side of pod.
2. Place receptacle cap over end of Headset Receptacle so that it seats in recess of pod.
3. Open cap and thread lock ring onto Headset Receptacle. Place pin punch in either notch of lock ring and rotate in a clockwise direction until tight.
4. Install terminals 6 through 12 into pin housing of 12-place Mini-Deutsch connector.

### Table 8-15. Front Headset Receptacle

| Wire Color | Chamber Number |
|---|---|
| Blue/Yellow | 6 |
| Yellow/Black | 7 |
| Yellow/White | 8 |
| Yellow/Red | 9 |
| Black | 10 |
| Red | 11 |
| Black (Thick Insulation) | 12 |

*NOTE*

*For instructions on properly installing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.1 DEUTSCH ELECTRICAL CONNECTORS, REMOVING/INSTALLING PINS.*

5. Install three cable straps to secure Intercom/CB Switch conduit to Headset Receptacle conduit.
6. Install console pod. See CONSOLE POD ASSEMBLY, INSTALLATION, in this section.
7. Test operation of Headset Receptacle.

# REAR HEADSET RECEPTACLE

See Section 8.30 WIRING HARNESSES AND CABLES (FLHT/C/U), ULTRA OVERLAY HARNESS.

# REAR PASSENGER SWITCHES

## REMOVAL

*NOTE*

*Right and left side replacement passenger switch assemblies are interchangeable.*

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠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.**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. Open Tour-Pak.
4. Using a T10 TORX drive head, remove four screws and pull speaker grille from speaker box.
5. Remove speaker from speaker box and carefully pull socket terminals from speaker spade contacts.
6. Remove trim ring and gently pull on wire harness to draw 6-place Mini-Deutsch connector out of speaker box.
7. Depress external latch on socket housing side and use a rocking motion to separate pin and socket halves of Mini-Deutsch connector.
8. Draw socket half of Mini-Deutsch connector back into speaker box and pull out through speaker hole.
9. Using a T25 TORX drive head, remove two screws to release switch bracket from inside of speaker box. Remove bracket using slot to free switch wires. See Figure 8-125.
10. Pull switch housing assembly, wire harness conduit, speaker terminals and Mini-Deutsch socket from speaker box using switch housing hole on outboard side.

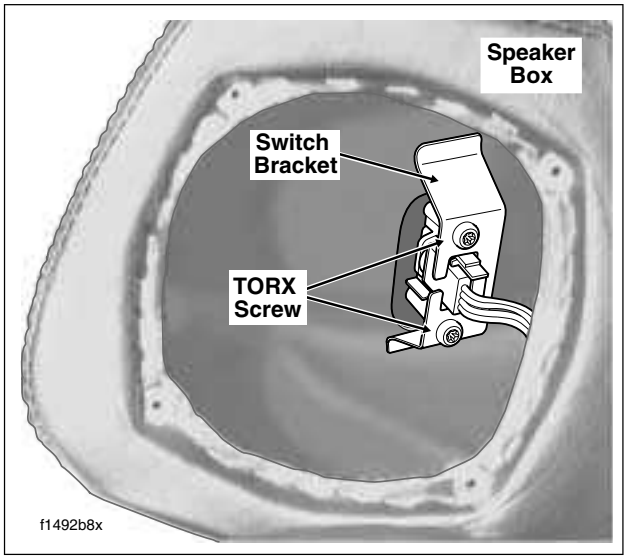



**Figure 8-125. Remove Passenger Switch Assembly (Right Side Speaker Box Shown)**

11. Carefully pull keycap from switch shaft. Remove switch from switch housing.
12. Remove terminals 1 through 4 from socket housing.

*NOTE*

*For instructions on properly removing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.1 DEUTSCH ELECTRICAL CONNECTORS, REMOVING/INSTALLING SOCKETS.*

13. Pulling one wire at a time, remove four wires from conduit.

## INSTALLATION

1. Pushing one wire at a time, feed four wires of **new** switch through conduit.
2. Install terminals 1 through 4 into socket housing.

### Table 8-16. Rear Passenger Switches

| Wire Color | Chamber Number |
|---|---|
| Pink/White | 1 |
| Gray/White | 2 |
| Violet/Black | 3 |
| * Orange/Black | 4 |

* Mates to O/BK on [41A], BN/W on [42A].

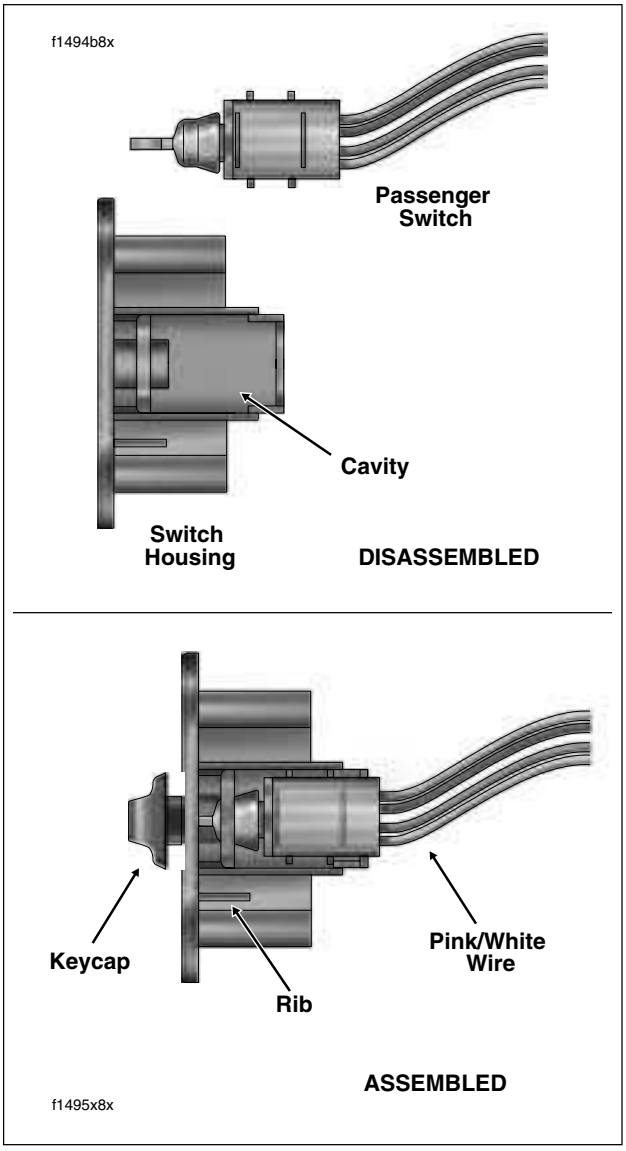



Figure 8-126. Install Switch in Housing

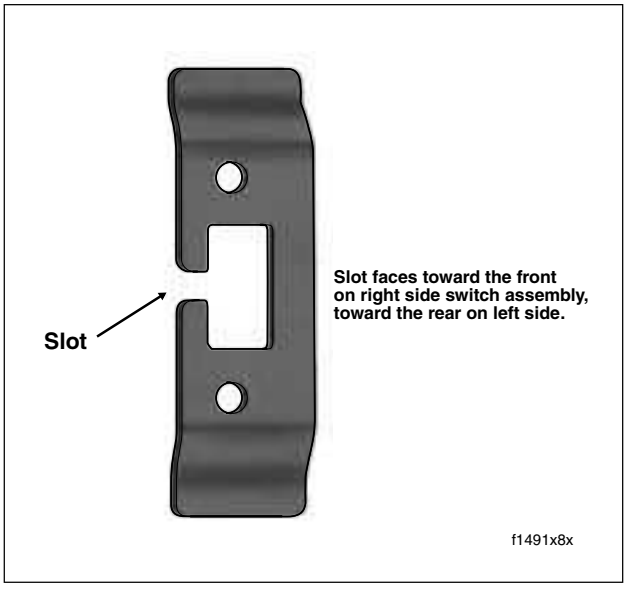



Figure 8-127. Properly Orient Switch Bracket

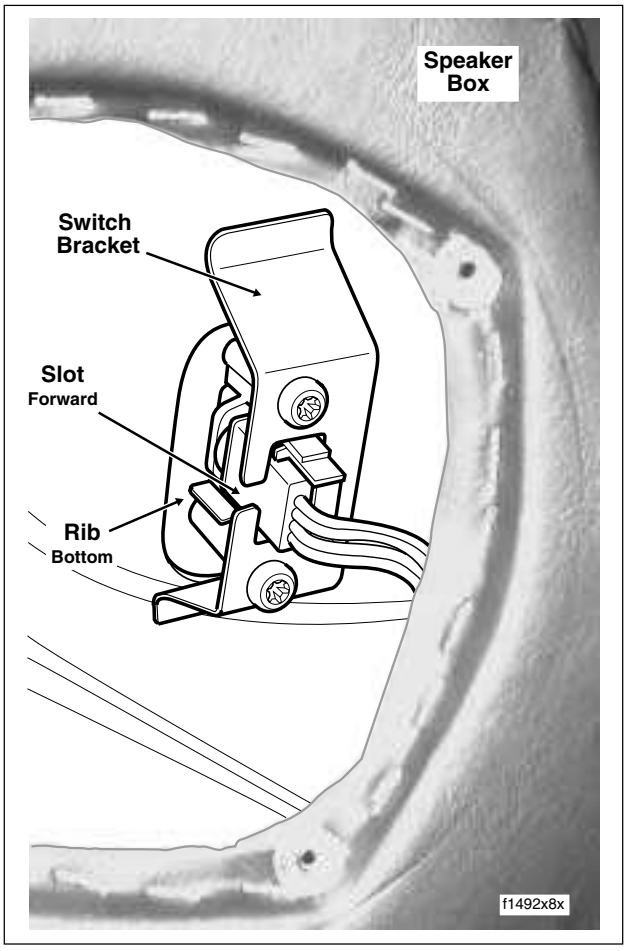



Figure 8-128. Install Passenger Switch Assembly (Right Side Speaker Box Shown)

*NOTE*

*For instructions on properly installing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.1 DEUTSCH ELECTRICAL CONNECTORS, REMOVING/INSTALLING SOCKETS.*

3. With the Pink/White wire at the bottom, place switch in cavity of switch housing. Bottom of the assembly is determined by location of rib on switch housing. See Figure 8-126.

4. Note lettering for proper orientation and gently push keycap onto switch shaft. When orienting keycap, re-member that bottom of assembly is determined by location of switch housing rib.

5. Feed Mini-Deutsch socket connector, speaker terminals and conduit through switch housing hole on outboard side of speaker box until switch housing backplate contacts speaker box. Pull harness out through speaker hole.
6. Reaching into speaker box, align holes in bracket with holes in switch housing. Using a T25 TORX drive head, install two bracket screws.

*NOTE*

*To align bracket and switch housing holes, slot in bracket must face toward the front on right side assembly and toward the rear on left side. Switch also must be square in cavity of switch housing or bracket will not fit. See Figure 8-127 and Figure 8-128.*

7. Feed Mini-Deutsch socket through speaker hole into speaker box and pull out through harness hole on inboard side.
8. Mate pin and socket halves of Mini-Deutsch connector. Feed connector back up into speaker box pressing trim ring into hole.
9. Install socket terminals onto speaker spade contacts. On right side of vehicle, install socket terminal of the solid Green wire onto contact next to the red dot. On left side, install socket terminal of the solid Brown wire onto contact next to the red dot.
10. Align holes in speaker grille with those in speaker and slide four TORX screws through grille and speaker holes.
11. With spade contacts at bottom rear corner, position speaker/grille assembly against speaker box. Thread four screws into speaker box and tighten using a T10 TORX drive head.
12. Close Tour-Pak cover.
13. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
14. Test switch for proper operation.
15. Install seat. See Section 2.21 SEAT, INSTALLATION.

# REAR SPEAKERS

## REMOVAL

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠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.**

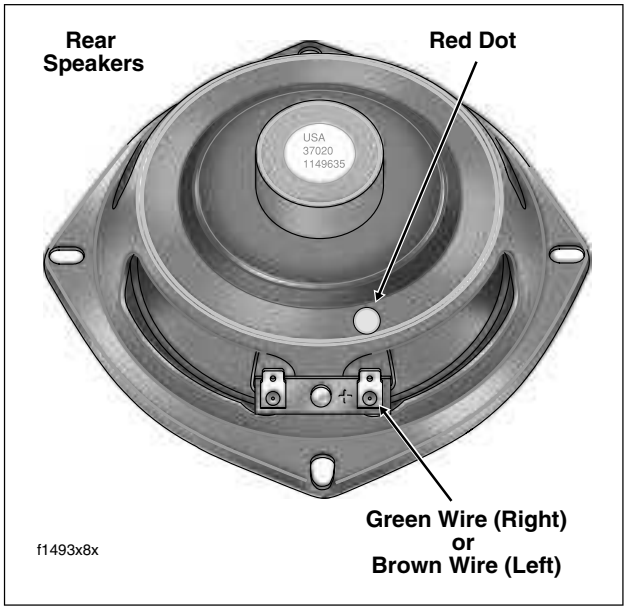



**Figure 8-129. Install Socket Terminals on Spade Contacts**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. Open Tour-Pak.
4. Using a T10 TORX drive head, remove four screws and pull speaker grille from speaker box.
5. Remove speaker from speaker box and carefully pull socket terminals from speaker spade contacts.

## INSTALLATION

1. Install socket terminals onto speaker spade contacts. On right side of vehicle, install socket terminal of the solid Green wire onto contact next to the red dot. On left side, install socket terminal of the solid Brown wire onto contact next to the red dot. See Figure 8-129.
2. Align holes in speaker grille with those in speaker and slide four TORX screws through grille and speaker holes.
3. With spade contacts at bottom rear corner, position speaker/grille assembly against speaker box. Thread four screws into speaker box and tighten using a T10 TORX drive head.
4. Close Tour-Pak cover.
5. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
6. Install seat. See Section 2.21 SEAT, INSTALLATION.
7. Test speaker for proper operation.

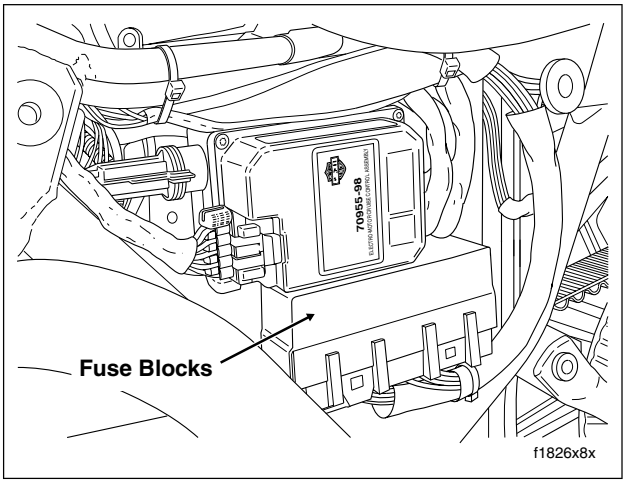



**Figure 8-130. Left Side Cover Removed - FLHTCU-I**

# FUSE BLOCKS

## REMOVAL

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠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.**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. Remove left side saddlebag. See Section 2.22 SADDLEBAG, REMOVAL.
4. Gently pull side cover from frame downtubes (no tools required).
5. Pull fuse blocks from tabs on mounting panel. Tabs on panel fit into slots on each side of fuse block cover. To remove cover, raise latches slightly to disengage tabs on fuse blocks. See Figure 8-130.
6. Remove the fuses from the block. See Figure 8-131.
7. Look into the top of the fuse block (fuse side). Since two tangs anchor each terminal in the fuse block, take note of the two larger cavities on each side of the socket terminal.
8. With the flat edge against the inside of the block, insert the pick (Snap-On TT600-3) into one of the cavities until it stops. Pivot the end of the pick toward the terminal to depress the tang. Remove the tool and repeat the procedure on the opposite side. Gently tug on wire to pull terminal from chamber.
9. Repeat steps 7 and 8 to remove remaining terminals from fuse block.

## INSTALLATION

1. Use a thin flat blade, like that on an X-Acto knife, and carefully bend the tangs outward away from the terminal body.
2. Push the lead into the chamber at the wire end of the fuse block. A click is heard when the terminal is properly seated. Gently tug on the wire end to verify that the terminal is locked in place and will not back out of the chamber.
3. Repeat steps 1 and 2 to install remaining terminals in fuse block.
4. Install fuses in fuse block. See Figure 8-131.
5. Slide cover over fuse blocks until latches fully engage tabs on blocks. Slide fuse blocks into position on mounting panel. Tabs on panel fit into slots on each side of fuse block cover.
6. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
7. Install seat. See Section 2.21 SEAT, INSTALLATION.
8. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required).

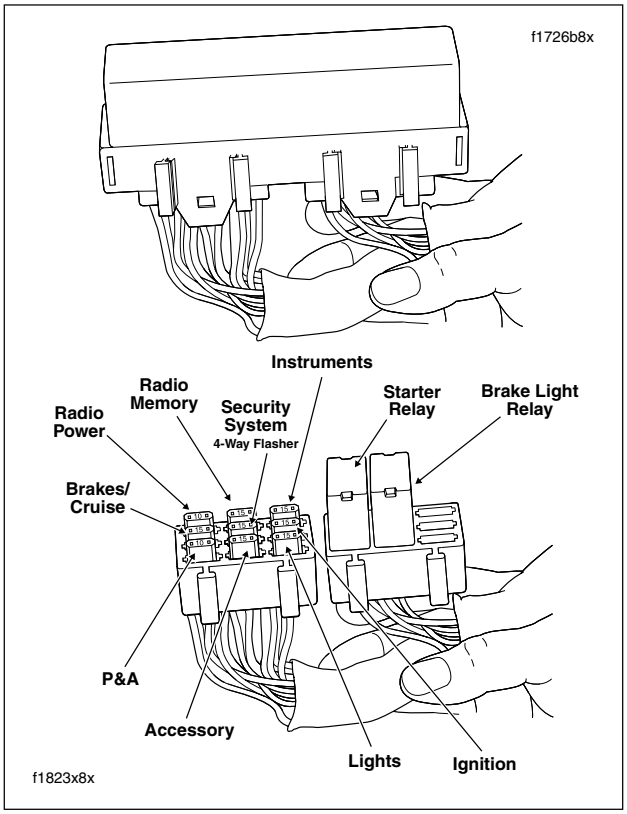



**Figure 8-131. Fuse Blocks**

9. Install left side saddlebag. See Section 2.22 SADDLEBAG, INSTALLATION.

# CB LOADING COIL

## REMOVAL

1. Open Tour-Pak. Open map pocket and remove acorn nuts. Remove map pocket and molded liner from Tour-Pak.
2. Disconnect 1-place CB antenna cable connector on right side of Tour-Pak. Release cable from rear clip at bottom of Tour-Pak.
3. Remove Keps nut, ring terminal and flat washer from loading coil stud.
4. Holding Phillips screw, remove flange nut at bottom of Tour-Pak to release loading coil bracket. Remove loading coil from vehicle (with Phillips screw, external tooth lockwasher and flange nut).

## INSTALLATION

1. Place **new** loading coil into position aligning hole in bracket with hole in Tour-Pak. Holding flange nut under Tour-Pak, install Phillips screw with external tooth lockwasher.
2. Mate pin and socket halves of 1-place CB antenna cable connector. Capture antenna cable in rear clip at bottom of Tour-Pak.
3. Install flat washer, ring terminal and Keps nut onto loading coil stud. Tighten hex nut.
4. Install molded liner in Tour-Pak. Install map pocket and secure using acorn nuts. Close Tour-Pak.
5. Check SWR and adjust (if necessary) following SWR Adjustment procedure in this section. Remove SWR meter, plug in antenna connector and tighten antenna connector stud.

## ULTRA OVERLAY HARNESS

For removal and installation instructions, see Section 8.30 WIRING HARNESSES AND CABLES (FLHT/C/U), ULTRA OVERLAY HARNESS.

## RADIO ANTENNA CABLE

For removal and installation, see Section 8.30 WIRING HARNESSES AND CABLES (FLHT/C/U), RADIO ANTENNA CABLE.

## CB ANTENNA CABLE

For removal and installation, see Section 8.30 WIRING HARNESSES AND CABLES (FLHT/C/U), CB ANTENNA CABLE.

## MAIN HARNESS

### REMOVAL

1. Remove fuel tank to access cables in area of frame backbone. For carbureted models, see Section 4.7 FUEL TANK, COMPLETE REMOVAL, FLHT/C, FLTR. For fuel injected models, see Section 9.3 FUEL TANK, COMPLETE REMOVAL, FLHTC/U-I, FLTR-I.
2. Unthread bolt and remove battery positive cable (red) from battery positive (+) terminal. (Battery negative cable already removed under FUEL TANK, COMPLETE REMOVAL.)
3. Using a T-40 TORX drive head, loosen bolt to move lip of hold-down clamp off edge of battery. Remove battery from battery box.
4. Raise lid of left side saddlebag. Grasp bail wire inside saddlebag and rotate each stud a full 1/4 turn in a counter-clockwise direction. Remove bail head studs with flat washers. Remove saddlebag.
5. Gently pull left side cover from frame downtubes (no tools required).
6. Repeat steps 4-5 to remove right side saddlebag and side cover.
7. Remove the outer fairing and windshield. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL.
8. See Figure 8-132. Remove the following wire harness connectors from their retaining devices and disconnect pin and socket halves:
   a. Main to interconnect harness connector [1], 12-place Deutsch (black); T-stud on front of right fairing bracket.
   b. Main to interconnect harness connector [2], 12-place Deutsch (gray); T-stud on top of right radio support bracket.
   c. Ignition switch connector [33], 4-place Packard (black); front of top fork bracket (below radio).
   d. Main power connector [15], 4-place Packard (black); anchored to front of top fork bracket (below radio).
   e. Radio antenna cable connector [51]; back of radio (left side).
   f. Speedometer connector [39], 12-place Packard; inner fairing (back of speedometer).
   g. Tachometer connector [108], 6-place Packard; inner fairing (back of tachometer).
9. Remove screw, ground wire ring terminal and P-clamp to release main harness and wire bundles from top fork bracket. Cut two cable straps at this location.

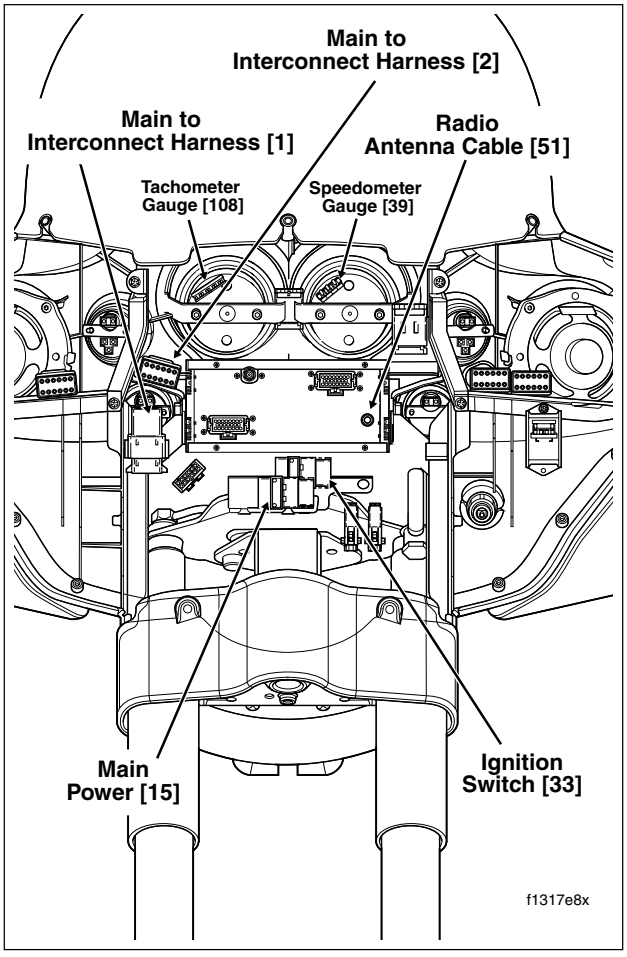



**Figure 8-132. Main Harness Connectors**

10. Remove screw, ground wire ring terminal and P-clamp to release main harness and wire bundles from right side of steering head. Cut two cable straps at this location.
11. Carefully pull inner fairing connectors under right side of fairing cap drawing main harness over to left side of vehicle.
12. Moving towards the rear, carefully cut cable straps securing main harness and wire bundles to frame backbone and upper frame tubes. See Figure 8-137.
13. Open Tour-Pak. Open map pocket and remove acorn nuts. Remove map pocket and molded liner from Tour-Pak.
14. Depress external latch and remove bulb socket from left side of Tour-pak.

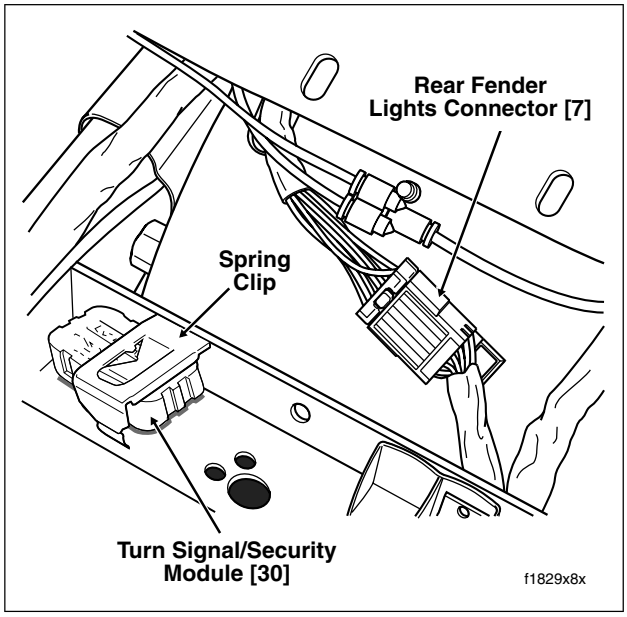



**Figure 8-133. Rear Fender (Under Seat)**

15. Rotate knurled ring in a counterclockwise direction to separate pin and socket halves of Radio antenna cable connector [51]. Release cable from two clips at bottom of Tour-Pak.
16. Depress button and separate pin and socket halves of Tour-pak lights connector [12], 3-place Multilock, inside Tour-pak.
17. Pull grommet into Tour-pak and remove from main harness conduit.
18. Pull main harness conduit and connectors through hole at front of Tour-Pak. Cut cable strap to release conduit from luggage rack rail.
19. Disconnect the Rear fender lights connector [7], 8-place Multilock, anchored at the front of the rear fender. Depress the button on the socket terminal side and pull apart the pin and socket halves. See Figure 8-133.
20. Pull anchors on rubber molding from holes in frame weldment at rear of battery box, and then push ignition keyswitch relay down to free relay and molding from weldment.
21. Locate the turn signal/security module inside cavity of frame weldment at rear of battery box. See Figure 8-133. Depress tab at front of spring clip and lift to release legs from holes in weldment. Remove turn signal module from cavity and disconnect 8-place Deutsch connector [30].
22. Draw rear fender lights connector, ignition keyswitch relay, and turn signal/security module connector and conduit to left side of vehicle.
23. Remove terminal nut from left side ground post in front of battery box. Remove internal tooth ring terminals (with black shrink tube).
24. Remove Keps nut from silver post of main 40 amp circuit breaker (left side of upper frame cross member). Disconnect voltage regulator and EFI power leads (internal tooth ring terminals with yellow shrink tube). See Figure 8-136.

    Remove Keps nut from copper post of main 40 amp circuit breaker. Disconnect main power lead (internal tooth ring terminal with convoluted tubing).

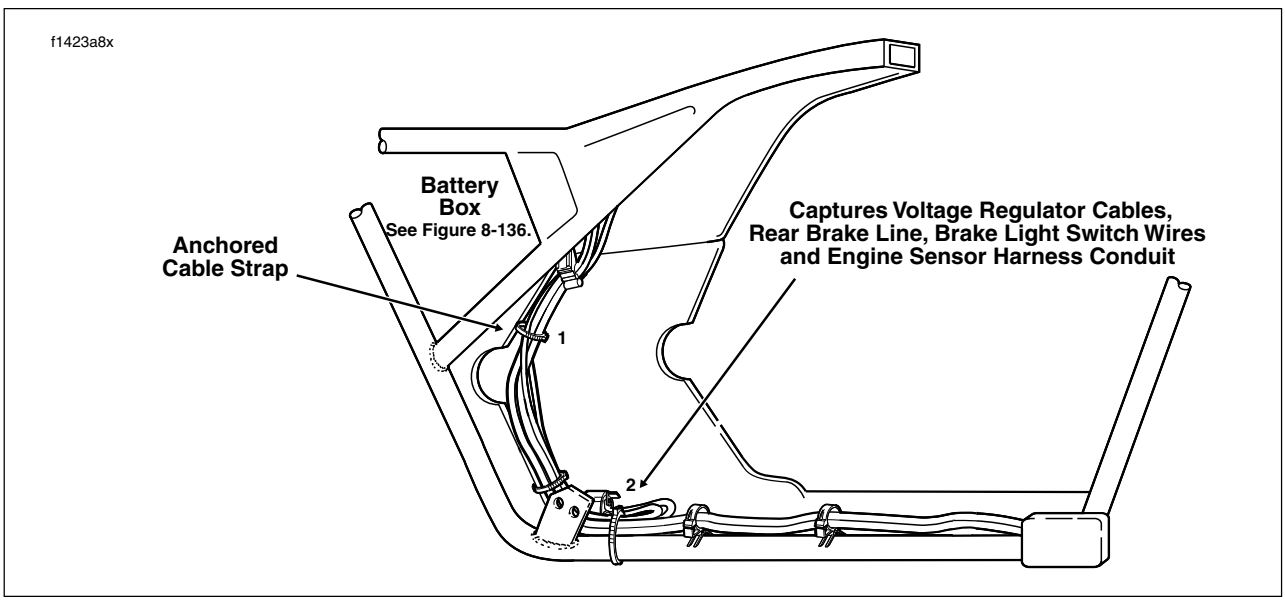



**Figure 8-134. Frame Cable Straps (Right Side View)**

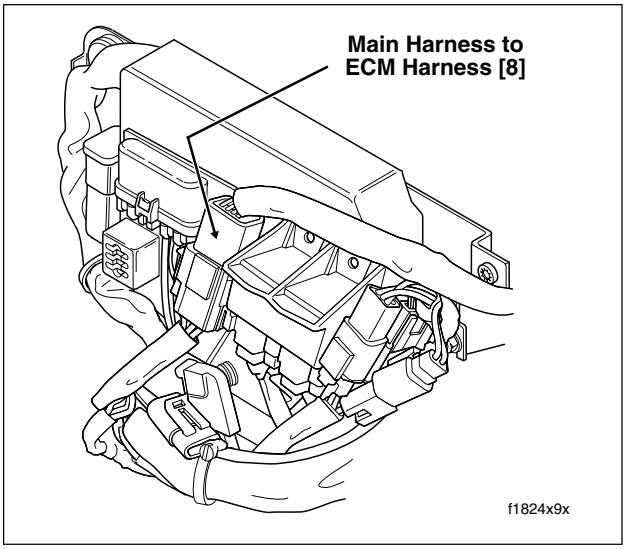



**Figure 8-135. Electrical Bracket Assembly (Under Right Side Cover)**

Bend tab on mounting clip away from circuit breaker and remove.

25. Moving to the right side of the vehicle, pull two socket terminals from spade contacts on rear brake light switch.
26. Depress external latch and pull solenoid connector from top of starter housing.
27. Gently pull terminals from neutral switch.
28. Cut anchored cable strap to release starter solenoid, neutral switch and other wiring from frame downtube. Cut cable strap to release rear brake light switch wires from lower frame tube. See Figure 8-134.
29. Push Main harness to ECM (or ignition) harness connector [8] rearward to unsnap attachment clip from T-stud on electrical bracket. Depress external latches and use a rocking motion to separate pin and socket halves. See Figure 8-135.
30. Remove Accessory connector [4] from anchor on frame cross member in front of battery box. See Figure 8-136.
31. Remove terminal nut from right side ground post in front of battery box. Remove two internal tooth ring terminals.
32. Carefully pull main harness connectors up into battery box. Draw connectors out of battery box laying harness along right side of frame backbone.
33. Pull socket terminal from spade contact on horn.

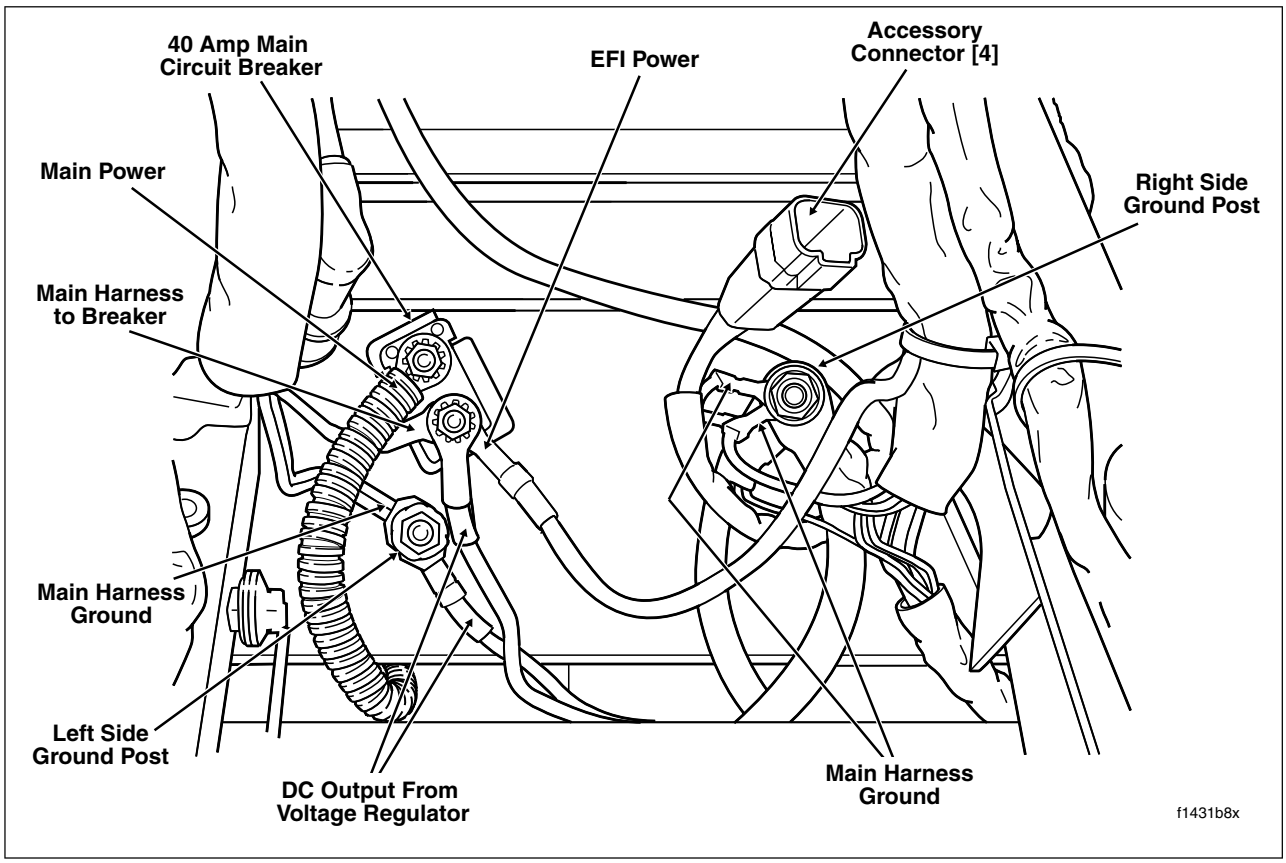



**Figure 8-136. Electrical Connections - Upper Frame Cross Member (Under Seat)**

34. Pull fuse blocks from tabs on mounting panel. Tabs on panel fit into slots on each side of fuse block cover.
35. From inside battery box, remove the two front and one rear locknut from cruise module mounting studs. Lower cruise module to create an opening for withdrawal of the main harness.
36. If present, carefully cut remaining cable straps to free main harness from frame backbone and other wire harness bundles.
37. Push anchor toward right side of vehicle to release main harness from T-stud at center of frame backbone.
38. Feed the main harness into battery box while pulling branches out through opening at front of cruise module.

## INSTALLATION

1. Move to left side of vehicle. Except for the branches terminating in the fuse block, rear fender lights connector, ignition keyswitch relay, and turn signal/security module connector, feed main harness conduit and connectors through opening at front of cruise module while also pulling harness out of battery box. Draw harness forward along left side of frame backbone crossing to right side above the engine stabilizer bracket. Feed branch with Deutsch and Packard connectors under right side of fairing cap to front of inner fairing. Draw other length down right side of frame backbone to battery box.
2. Locate anchor on main harness. Push anchor toward left side of vehicle to secure main harness to T-stud at center of frame backbone.
3. Install socket terminal on horn spade contact. From right side of vehicle, conduit is routed beneath frame backbone to horn.
4. On right side of vehicle, carefully feed branch of main harness into battery box. Route branch through opening at front of battery box and then downward along rear of starter to inboard side of rear brake light switch.
5. On frame cross member in front of battery box, install internal two tooth ring terminals on right side ground post. Install terminal nut.
6. Install Accessory connector [4] on anchor of frame cross member.
7. Routing cable conduit to rear of frame downtube, mate pin and socket halves of Main harness to ECM (or ignition) harness connector [8]. Push connector forward to snap attachment clip onto T-stud on electrical bracket.
8. Routing lead under chrome starter cover, install terminals on neutral switch.
9. Snap solenoid connector to terminal at top of starter housing.
10. Install two socket terminals onto spade contacts of Brake light switch.
11. Install two cable straps at locations shown in Figure 8-134. Hole in frame at rear location requires anchored type cable strap. Cut excess cable strap material.
12. Snap main 40 amp circuit breaker into mounting clip on left side of upper frame cross member. Place ring terminals of voltage regulator (yellow shrink tube) and EFI power leads onto silver post. Install Keps nut. See Figure 8-136.

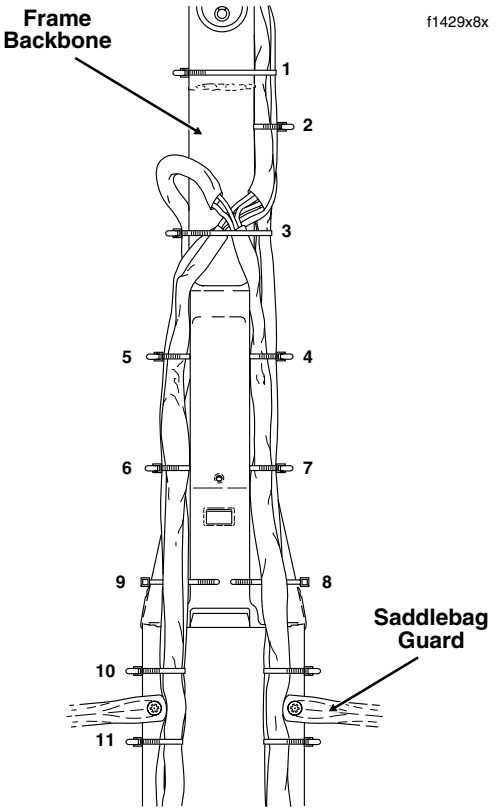
    Place main power lead (ring terminal with convoluted tubing) on copper post. Install Keps nut.
13. Install ring terminals onto left side ground post in front of battery box. Install terminal nut.
14. Moving to left side of vehicle, route the branches terminating in the rear fender lights connector, ignition keyswitch relay, and turn signal/security module connector through opening between rear of battery box and front of rear fender.
15. Fit rubber molding onto ignition keyswitch relay, if removed. From bottom of frame weldment at rear of battery box, feed relay assembly up through rectangular shaped hole. Install anchors on molding into holes in weldment.
16. Connect 8-place Deutsch connector [30] to turn signal/security module and install into cavity of frame weldment. Insert legs of spring clip into holes in weldment and push down until tab at front snaps in place.
17. Mate pin and socket halves of rear fender lights connector [7], 8-place Multilock, anchored at the front of the rear fender.
18. Install grommets onto studs at rear of cruise module, if removed. Place the cruise module into position on left side of battery box. Use rear holes of battery box on carbureted models, front holes on fuel injected models. Install locknuts on front and rear mounting studs. Tighten locknuts to 9-11 ft-lbs (12-15 Nm).
19. Slide fuse blocks into position on mounting panel. Tabs on panel fit into slots on each side of fuse block cover.
20. Feed socket connectors and main harness conduit through hole at front of Tour-pak. Capture cable and conduit in grommet. Install grommet in hole with the larger OD facing upward.
21. Mate pin and socket halves of Tour-pak lights connector [12], 3-place Multilock, and tuck into cavity inside Tour-pak.
22. Rotate knurled ring in a clockwise direction to mate pin and socket halves of Radiontenna cable connector [51]. Capture cable in two clips at bottom of Tour-Pak.
23. Install bulb socket on left side of Tour-pak.
24. Install **new** cable strap to secure main harness conduit to luggage rack rail.
25. Install molded liner in Tour-Pak. Install map pocket and secure using acorn nuts. Close Tour-Pak.

26. See Figure 8-132. At front of inner fairing, mate pin and socket halves of the following wire harness connectors and fix positions using retaining devices, if present:
    a. Main to interconnect harness connector [1], 12-place Deutsch (black); T-stud on front of right fairing bracket.
    b. Main to interconnect harness connector [2], 12-place Deutsch (gray); T-stud on top of right radio support bracket.
    c. Ignition switch connector [33], 4-place Packard (black); front of top fork bracket (below radio).
    d. Main power connector [15], 4-place Packard (black); anchored to front of top fork bracket (below radio).
    e. Radio antenna cable connector [51]; back of radio (left side).
    f. Speedometer connector [39], 12-place Packard; inner fairing (back of speedometer).
    g. Tachometer connector [108], 6-place Packard; inner fairing (back of tachometer).
27. Capture main harness conduit, wire bundles and cables in P-clamp. Install ring terminal of ground wire on screw and fasten P-clamp to top fork bracket.
28. On right side of vehicle, capture main harness conduit, wire bundles and cables in second P-clamp. Install ring terminal of ground wire on screw and fasten P-clamp to right side of steering head.
29. Install cable straps on each side of P-clamps at both locations. Cut any excess cable strap material.
30. From right side of vehicle, insert tapered end of new 14 inch cable strap between ignition coil and coil bracket welded to underside of frame backbone. When cable strap exits left side, raise both ends so that eye is centered above the frame backbone.

    Verify that wire bundles, cables, frame backbone and idle and throttle cables are captured before mating cable strap ends. Tighten cable strap, but leave loose enough so that one finger can be inserted between strap and frame back-bone. **Do not over tighten.** Cut any excess cable strap material.
31. Install remaining cables straps as shown in Figure 8-137.
32. Install the windshield and outer fairing. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.
33. Place battery in battery box, terminal side forward. Rotate hold-down clamp so that lip (with rubber pad) rests on edge of battery and tighten clamp bolt.

**⚠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 which could result in death or serious injury.**




| | |
|---|---|
| 1 | Encircles coil bracket and frame backbone capturing wire bundles and cables (including throttle and idle cables). |
| 2 | Captures wire bundles and cables only (not anchored). |
| 3 | Encircles frame backbone (just to the rear of the engine stabilizer bracket where wire bundles cross from right to left side of frame backbone) capturing wire bundles and cables. |
| 4-5 | Captures wire bundles and cables only (not anchored). |
| 6-7 | Captures wire bundles and cables only (anchored). |
| 8-9 | Captures wire bundles and cables only (anchored). |
| 10-11 | Captures wire bundles, cables and upper frame tube. |

**Figure 8-137. Install Cable Straps**

34. Insert bolt through battery positive cable (red) into threaded hole of battery positive (+) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
35. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
36. Align barbed studs in left side cover with grommets in frame downtubes and push firmly into place (no tools required).

37. Position left side saddlebag on vehicle. Place flat washers on bail head studs. With groove at end of stud held in a horizontal position, insert stud through holes in saddlebag and front mounting bracket. When groove engages wire form of spring plate on inboard side of bracket, turn stud clockwise a full 1/4 turn until it snaps in place. Install rear bail head stud in the same manner.
38. Repeat steps 36-37 to install right side saddlebag and side cover.
39. Install fuel tank. For carbureted models, see Section 4.7 FUEL TANK, INSTALLATION (AFTER COMPLETE REMOVAL), FLHT/C, FLTR. For fuel injected models, see Section 9.3 FUEL TANK, INSTALLATION (AFTER COMPLETE REMOVAL), FLHTC/U-I, FLTR-I.

# INTERCONNECT HARNESS

## REMOVAL

1. Remove the seat. See Section 2.21 SEAT, REMOVAL.

**⚠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.**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. Remove the outer fairing and windshield. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL.

*NOTE*

*When referencing inner fairing connector locations, the term "fairing bracket" refers to either the left or right vertical support, while the term "support brace" refers to either the left or right horizontal support. References to left and right in these instructions refer to left and right side of vehicle.*

4. Remove the wire harness connectors from their retaining devices, if present, and disconnect pin and socket halves. See Figure 8-138. Starting at the lower left side of the inner fairing, work in a counterclockwise direction as follows.
   a. Main power connector [15], 4-place Packard (black); anchored to top fork bracket (below radio).
   b. Passing lamps connector [73], 2-place Multilock (black); left side of top fork bracket (floating).
   c. Ambient temperature sensor connector [107]; 3-place Multilock (black); anchored at front of left fairing bracket. *Classic and Ultra models only.*
   d. Low fuel module connector [106]; 6-place Multilock (black); front of left fairing support brace. *Classic and Ultra models only.*
   e. Ultra overlay connector [6], 12-place Deutsch (black); T-stud at top of left fairing support brace (outboard side). *Ultra models only.*
   f. Left handlebar switch controls connector [24], 12-place Deutsch (black); T-stud on top of left fairing support brace (inboard side).
   g. Front turn signal connector [31], 6-place Multilock (black); inboard side of left fairing bracket (floating).
   h. Front fender tip lamp connector [32], 2-place Multilock (black); next to top fork bracket (floating).
   i. Indicator lamps [21]; 10-place Multilock (black/white); between speedometer and tachometer gauges.
   j. Radio connector [27], 23-place Amp (black); back of radio (right side). *Classic and Ultra models only.*
   k. Main to interconnect harness connector [2], 12-place Deutsch (gray); T-stud on top of right radio support bracket.
   l. Main to interconnect harness connector [1], 12-place Deutsch (black); T-stud on front of right fairing bracket.
   m. Right handlebar switch controls connector [22], 12-place Deutsch (black); T-stud on top of right fairing support brace.
   n. Fairing cap switch connector [105], 12-place Multilock (black); right side of radio next to top fork bracket (floating).
5. See Figure 8-139. Disconnect the socket terminals from the spade contacts on the:
   - Cigarette lighter.
   - Speakers - *Classic and Ultra models only.*
   - Fuel gauge [117] and lamp [116].
   - Ambient temperature gauge [115] and lamp [114] - *Classic and Ultra models only.*
   - Voltmeter gauge [111] and lamp [110].
   - Oil pressure gauge [113] and lamp [112] - *Classic and Ultra models only.*
6. Release convoluted tubing by removing anchor from hole at top of left fairing bracket. For best results, squeeze anchor with needle nose pliers before pulling. Feed ends of interconnect to mid section (area between left and right fairing brackets) and remove the harness from the vehicle.

## INSTALLATION

1. Place the interconnect harness into position at back of tachometer and speedometer gauges.

*NOTE*

*When referencing inner fairing connector locations, the term "fairing bracket" refers to either the left or right vertical support, while the term "support brace" refers to either the left or right horizontal support. References to left and right in these instructions refer to left and right side of vehicle.*

2. Route convoluted tubing along inboard side of left fairing bracket. Snap anchor into hole at top of fairing bracket.
3. Snap anchors of two **new** cable straps into holes of speedometer and tachometer brackets. Tighten cable straps capturing wire bundles of interconnect harness. Cut any excess cable strap material.
4. Route ends of interconnect harness behind left and right fairing brackets to area of support braces.
5. Mate the pin and socket halves of the following wire connectors and fix positions using retaining devices, if present:

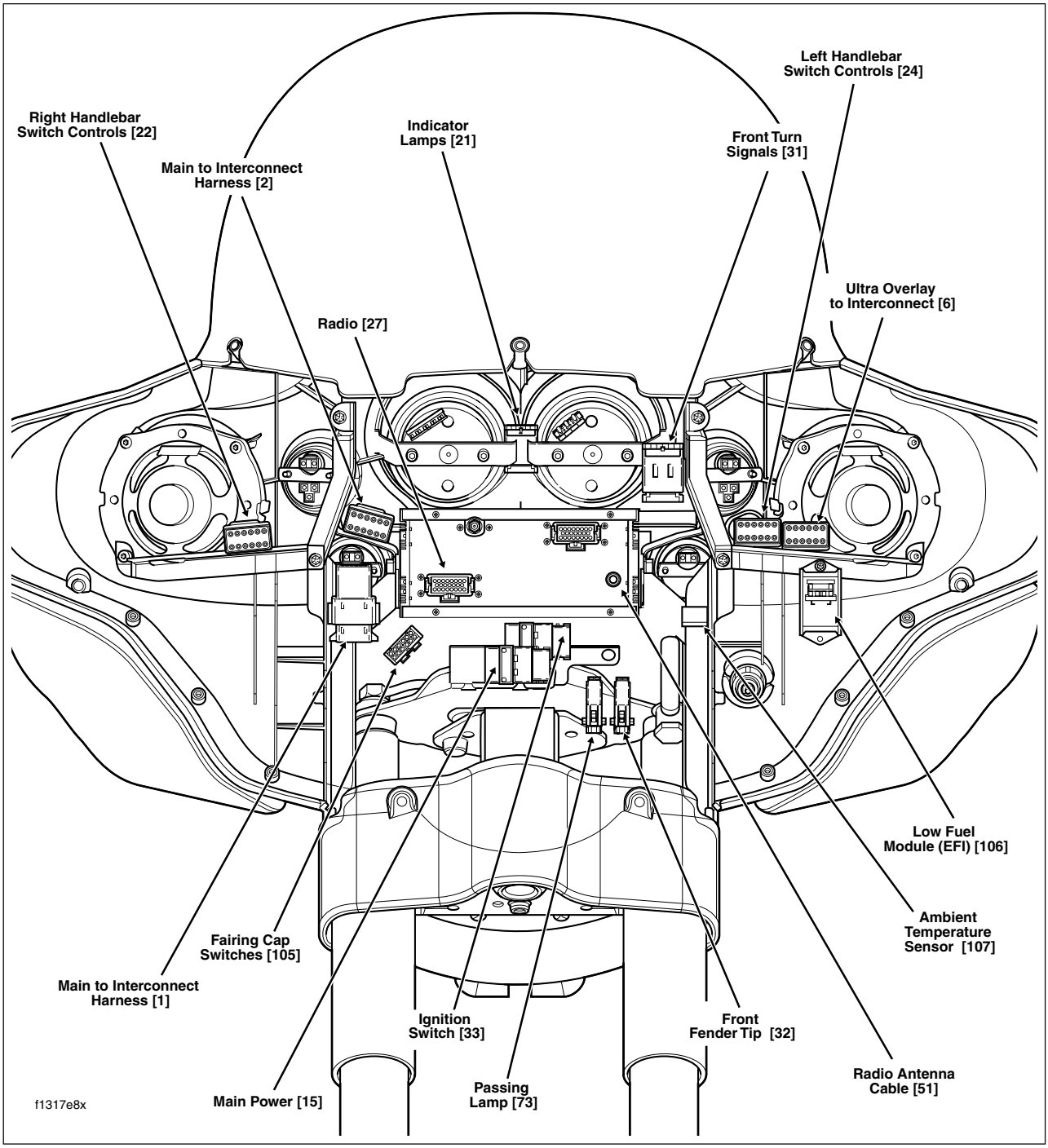



**Figure 8-138. Inner Fairing - Interconnect Harness Connectors (FLHTC/U)**

a. Indicator lamps [21]; 10-place Multilock (black/white); between speedometer and tachometer gauges.

b. Main power connector [15], 4-place Packard (black); anchored to top fork bracket (below radio).

c. Passing lamps connector [73], 2-place Multilock (black); left side of top fork bracket (floating).

d. Ambient temperature sensor connector [107]; 3-place Multilock (black); anchored at front of left fairing bracket. *Classic and Ultra models only.*

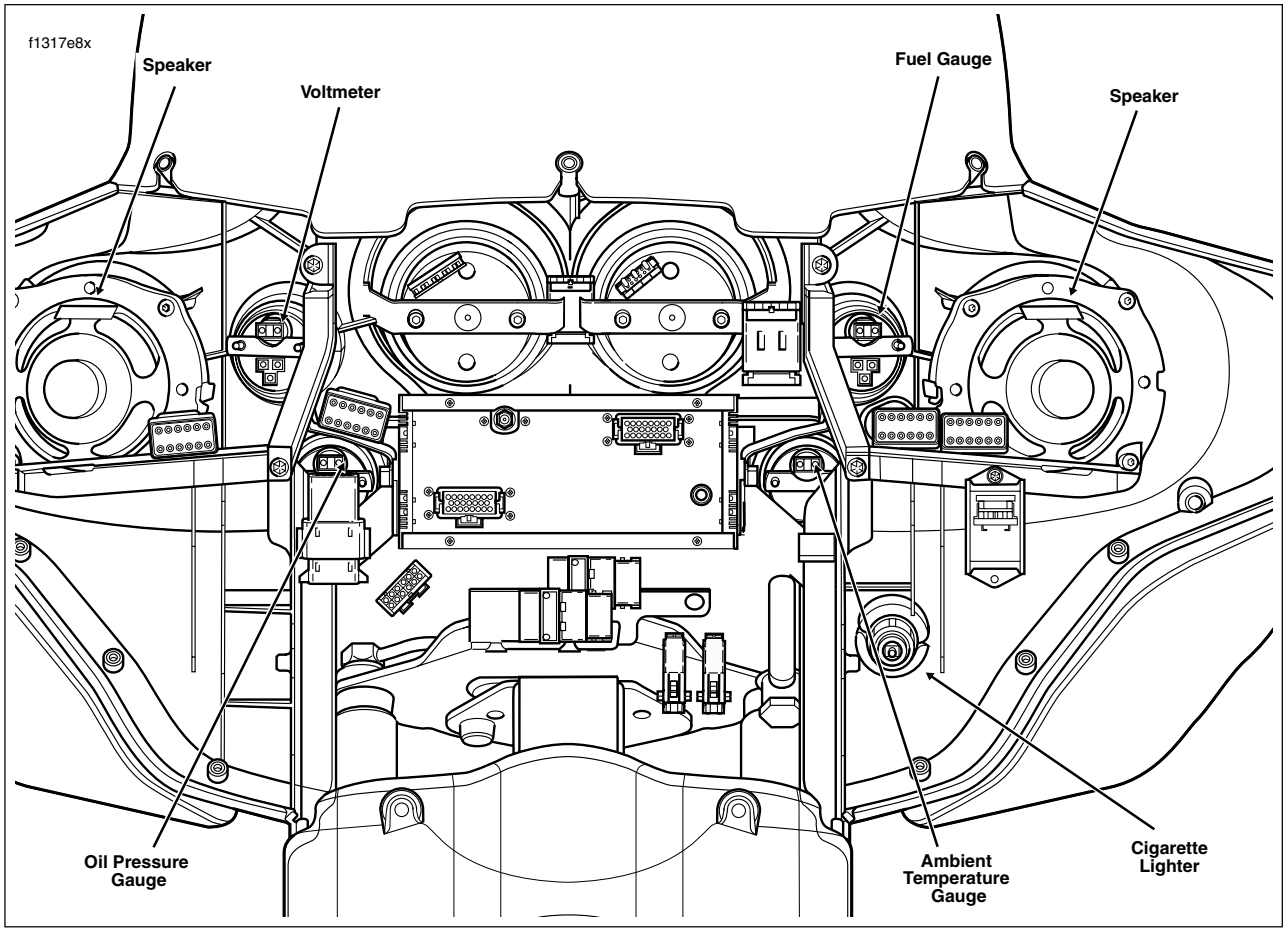



**Figure 8-139. Inner Fairing - Interconnect Harness Connectors (FLHTC/U)**

e. Low fuel module connector [106]; 6-place Multilock (black); front of left fairing support brace. *Classic and Ultra models only.*

f. Ultra overlay connector [6], 12-place Deutsch (black); T-stud at top of left fairing support brace (outboard side). *Ultra models only.*

g. Left handlebar switch controls connector [24], 12-place Deutsch (black); T-stud on top of left fairing support brace (inboard side).

h. Front turn signal connector [31], 6-place Multilock (black); inboard side of left fairing bracket (floating).

i. Front fender tip lamp connector [32], 2-place Multilock (black); next to top fork bracket (floating).

j. Radio connector [27], 23-place Amp (black); back of radio (right side). *Classic and Ultra models only.*

k. Main to interconnect harness connector [2], 12-place Deutsch (gray); T-stud on top of right radio support bracket.

l. Main to interconnect harness connector [1], 12-place Deutsch (black); T-stud on front of right fairing bracket.

m. Right handlebar switch controls connector [22], 12-place Deutsch (black); T-stud on top of right fairing support brace.

n. Fairing cap switch connector [105], 12-place Multilock (black); right side of radio next to top fork bracket (floating).

6. Connect the socket terminals onto the spade contacts of the:

- Cigarette lighter - connect the orange wire socket terminal to the center spade contact, the black wire socket terminal to the shell contact.
- Speakers (both sides) - the socket terminal of the wire that is **not** green must be installed on the spade contact above the red dot. *Classic and Ultra models only.*
- Fuel gauge [117] and lamp [116].
- Ambient temperature gauge [115] and lamp [114] - *Classic and Ultra models only.*
- Voltmeter gauge [111] and lamp [110].

- Oil pressure gauge [113] and lamp [112] - *Classic and Ultra models only.*

7. Install the windshield and outer fairing. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.
8. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
9. Install the seat. See Section 2.21 SEAT, INSTALLATION.

# ULTRA OVERLAY HARNESS

## REMOVAL

1. Remove fuel tank to access cables in area of frame backbone. For carbureted models, see Section 4.7 FUEL TANK, COMPLETE REMOVAL, FLHT/C, FLTR. For fuel injected models, see Section 9.3 FUEL TANK, COMPLETE REMOVAL, FLHTC/U-I, FLTR-I.
2. Raise lid of right side saddle bag. Grasp bail wire inside saddlebag and rotate each stud a full 1/4 turn in a counter-clockwise direction. Remove bail head studs with flat washers. Remove saddlebag.
3. Gently pull side cover from frame downtubes (no tools required).
4. Repeat steps 2 and 3 on left side of vehicle.
5. See Figure 8-140. Lift the locking latch and remove the Cruise module connector [17].
6. Release Console Pod Connector [53], 12-place Mini-Deutsch, from attachment clip anchored in hole at rear of battery box. See Figure 8-141. Depress external latches and use a rocking motion to separate pin and socket halves.

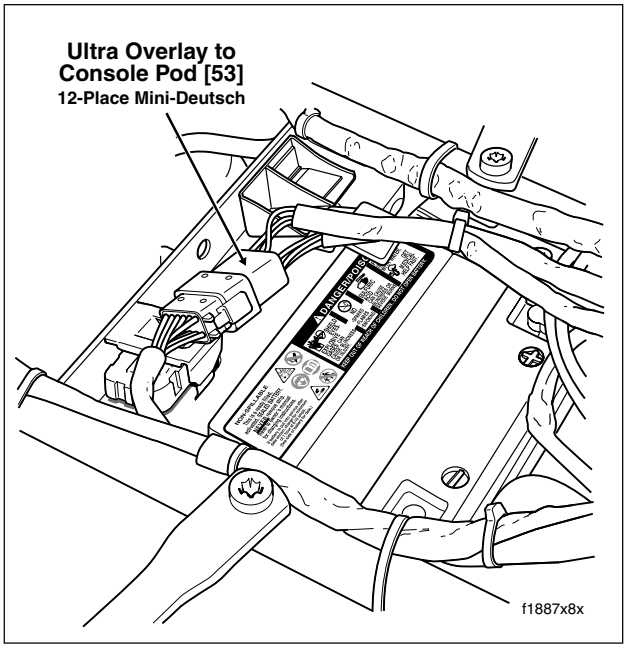



**Figure 8-140. Disconnect Console Pod Connector**

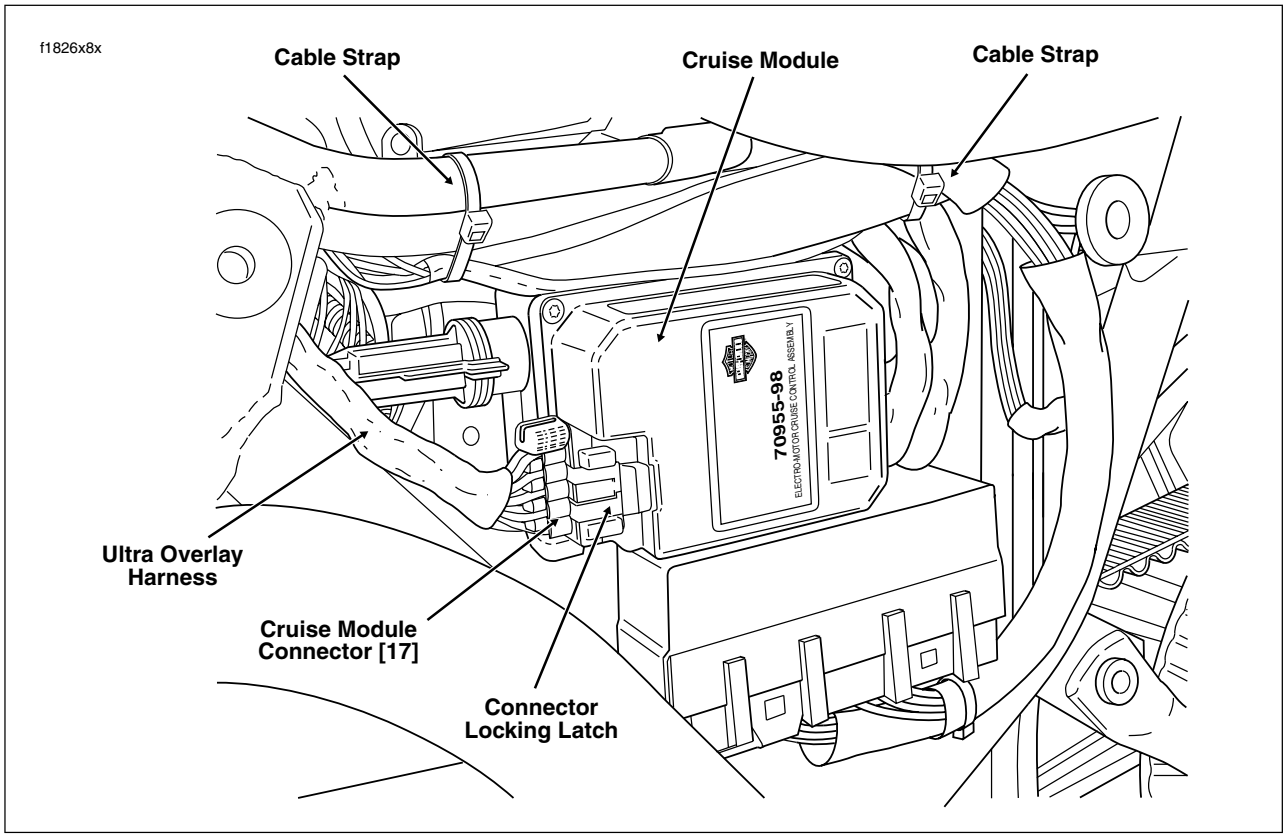



**Figure 8-141. Cruise Control Module (Under Left Side Cover)**

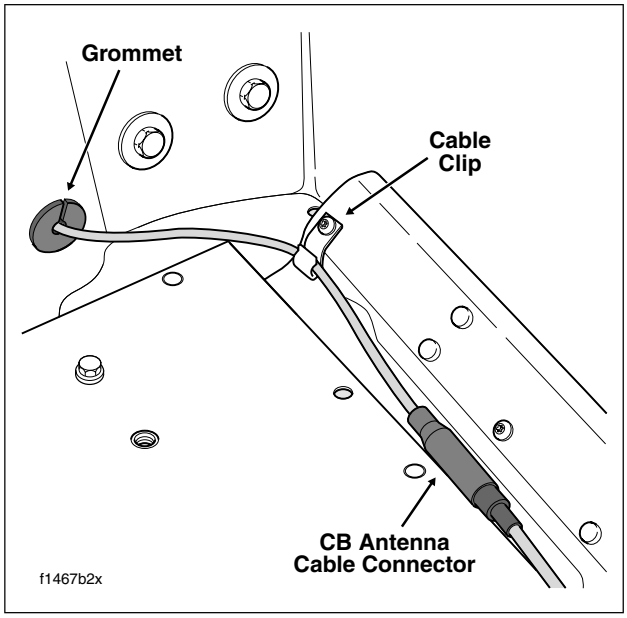



**Figure 8-142. Disconnect CB Antenna Cable Connector**

7. Remove trim ring and gently pull on wire harness to draw Rear Left Speaker/Passenger Controls Connector [42], 6-place Mini-Deutsch, out of speaker box. Depress external latch and use a rocking motion to separate pin and socket halves.

8. Release rear headset receptacle from bracket at bottom of left side speaker box. Release spring from hole in receptacle wire jacket.

9. Open Tour-Pak. Open map pocket and remove acorn nuts. Remove map pocket and molded liner from Tour-Pak.

10. Separate pin and socket halves of CB Antenna cable connector [50]. Release cable from clip at bottom of Tour-Pak. See Figure 8-142.

11. Pull right side grommet into Tour-Pak and remove from CB antenna cable. Feed CB antenna cable through hole at front of Tour-Pak.

12. Remove trim ring and gently pull on wire harness to draw Rear Right Speaker/Passenger Controls Connector [41], 6-place Mini-Deutsch, out of speaker box. Depress external latch and use a rocking motion to separate pin and socket halves.

13. Remove the outer fairing and windshield. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL.

14. See Figure 8-143. Disconnect pin and socket halves of the following connectors:

    a. CB antenna cable connector [50], back of radio (right side).

    b. Ultra overlay to interconnect connector [6], 12-place Deutsch (black); T-stud on top of left fairing support brace (outboard side).

    c. Radio connector [28], 23-place Amp (gray); back of radio (left side).

15. Remove screw, ground wire ring terminal and P-clamp to release cruise harness and wire bundles from right side of steering head. Cut two cable straps at this location.

16. Remove screw, ground wire ring terminal and P-clamp to release Ultra overlay harness and wire bundles from top fork bracket. Cut two cable straps at this location.

17. Locate the cruise control roll-off switch plumbed into the idle cable on the right side of the vehicle. See Figure 8-144. Push rubber boot on switch forward. Remove terminals from spade contacts on cruise control roll-off switch.

18. Carefully cut cable straps securing Ultra overlay harness and wire bundles to frame backbone, left and right frame tubes and luggage rack rails. Remove Ultra overlay harness from vehicle. See Figure 8-145.

## INSTALLATION

1. Place **new** Ultra overlay harness on vehicle following original routing. Note that the Ultra overlay harness follows the main harness as it is routed to the rear left and right side of the vehicle.

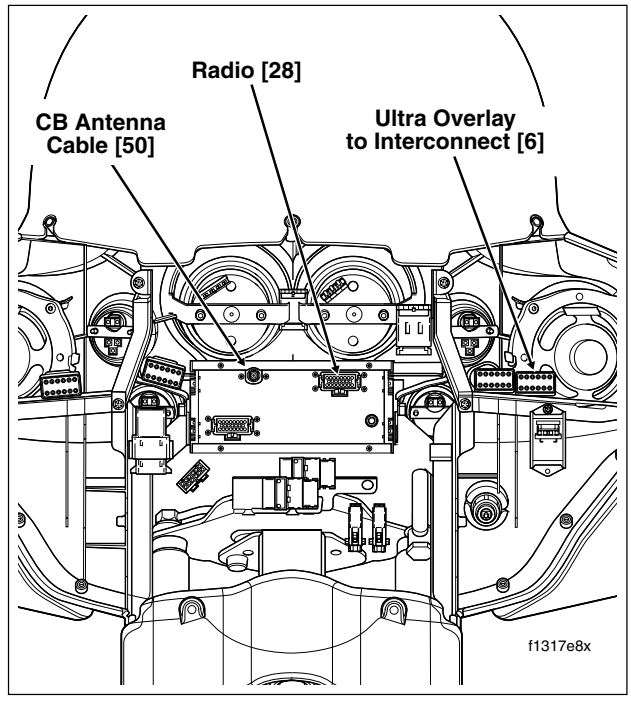



**Figure 8-143. Ultra Overlay Harness Connectors**

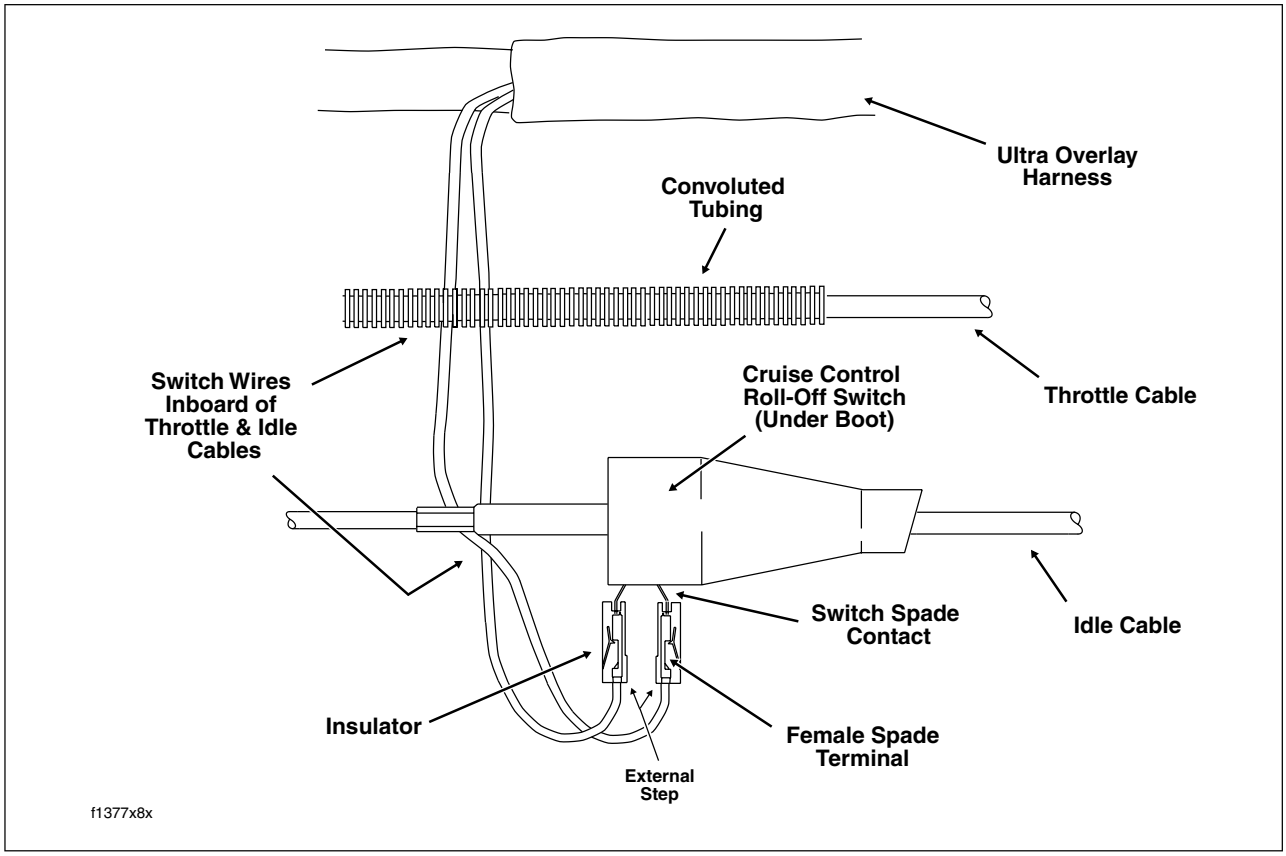
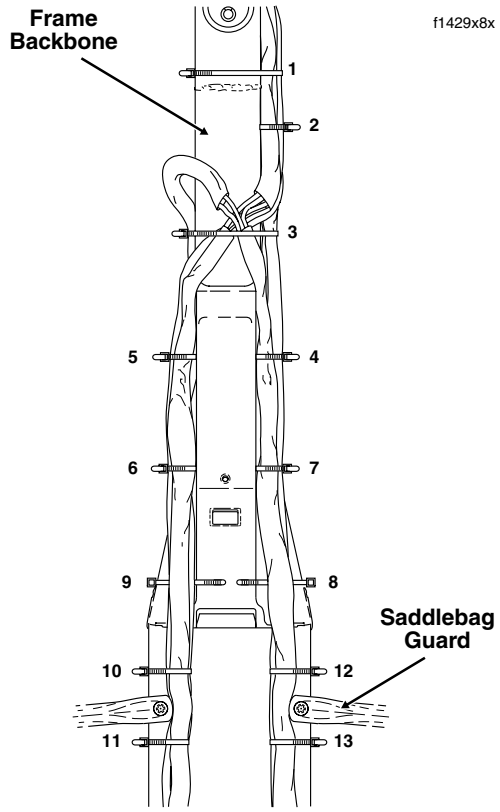



**Figure 8-144. Throttle/Idle Cable Configuration (Right Side View)**

Specifically, from the clamp on the top fork bracket, the Ultra overlay harness is routed under the fairing cap where it passes through a second clamp on the right side of the steering head. The harness then runs along the right side of the frame backbone, where a branch crosses to the left side just above the engine stabilizer bracket. From this point, each branch follows its respective side of the frame backbone, runs along the inboard side of the upper frame tube and then continues up the luggage rack rail.

2. See Figure 8-143. Standing at front of vehicle, mate pin and socket halves of the following wire harness connectors:
   a. CB antenna cable connector [50], back of radio (right side).
   b. Ultra overlay to interconnect connector [6], 12-place Deutsch (black); T-stud on top of left fairing support brace (outboard side).
   c. Radio connector [28], 23-place Amp (gray); back of radio (left side).
3. At front of inner fairing, capture Ultra overlay harness conduit, wire bundles and cables in P-clamp. Install ring terminal of ground wire on screw and fasten clamp to top fork bracket.
4. On right side of vehicle, capture Ultra overlay harness conduit, wire bundles and cables in second P-clamp. Install ring terminal of ground wire on screw and fasten clamp to right side of steering head.
5. Install cable straps on each side of P-clamps at both locations. Cut any excess cable strap material.
6. Install cruise roll-off switch as follows:
   a. Separate the cruise roll-off switch wires so that the ends are free up to the point where they enter the wire harness conduit. Now route the leads straight down inboard of both the idle and throttle cables.
   b. Slide the insulators onto the switch spade contacts (polarity is not a factor). For maximum insertion, be sure that the external step on the insulators face each other. See Figure 8-144.
   c. Fit the rubber boot over the cruise control roll-off switch. An oval cut in the boot accommodates the switch spade terminal connections.
   d. Orient the idle cable so that the insulators are at the bottom.

7. Mate pin and socket housings of Rear Right Speaker/Passenger Controls Connector [41], 6-place Mini-Deutsch. Feed connector back up into speaker box pressing trim ring into hole.
8. Pass CB antenna cable connector [50] through hole at front of Tour-Pak. Capture cable in grommet. Install grommet in hole with the larger OD facing inside.
9. Mate pin and socket halves of CB antenna cable connector. Capture antenna cable in clip at bottom of Tour-Pak. See Figure 8-142.
10. Moving to left side of vehicle, feed Cruise module connector [17] through opening at front of cruise module. Install cruise module connector [17] and engage locking latch.
11. Mate pin and socket halves of Console Pod Connector [53], 12-place Mini-Deutsch. Install connector onto attachment clip anchored in hole at rear of battery box. See Figure 8-141.
12. Mate pin and socket housings of Rear Left Speaker/Passenger Controls Connector [42], 6-place Mini-Deutsch. Feed connector back up into speaker box pressing trim ring into hole.
13. Attach spring to rear headset receptacle using hole in wire jacket. Capture headset receptacle in bracket at bottom of left side speaker box.
14. From right side of vehicle, insert tapered end of new 14 inch cable strap between ignition coil and coil bracket welded to underside of frame backbone. When cable strap exits left side, raise both ends so that eye is centered above the frame backbone.
15. Verify that wire bundles, cables, frame backbone and idle and throttle cables are captured before mating cable strap ends. Tighten cable strap, but leave loose enough so that one finger can be inserted between strap and frame back-bone. **Do not over tighten.** Cut any excess cable strap material.
16. Install remaining cables straps as shown in Figure 8-145.
17. Install the outer fairing and windshield. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.
18. Align barbed studs in right side cover with grommets in frame downtubes and push firmly into place (no tools required).
19. Position right side saddlebag on vehicle. Place flat washers on bail head studs. With groove at end of stud held in a horizontal position, insert stud through holes in saddlebag and front mounting bracket. When groove engages wire form of spring plate on inboard side of bracket, turn stud clockwise a full 1/4 turn until it snaps in place. Install rear bail head stud in the same manner.
20. Repeat steps 18 and 19 on left side of vehicle.




| | |
|---|---|
| 1 | Encircles coil bracket and frame backbone capturing wire bundles and cables (including throttle and idle cables). |
| 2 | Captures wire bundles and cables only (not anchored). |
| 3 | Encircles frame backbone (just to the rear of the engine stabilizer bracket where wire bundles cross from right to left side of frame backbone) capturing wire bundles and cables. |
| 4-5 | Captures wire bundles and cables only (not anchored). |
| 6-7 | Captures wire bundles and cables only (anchored). |
| 8-9 | Captures wire bundles and cables only (anchored). |
| 10-13 | Captures wire bundles, cables and upper frame tube. |

**Figure 8-145. Install Cable Straps**

21. Install fuel tank. For carbureted models, see Section 4.7 FUEL TANK, INSTALLATION (AFTER COMPLETE REMOVAL), FLHT/C, FLTR. For fuel injected models, see Section 9.3 FUEL TANK, INSTALLATION (AFTER COMPLETE REMOVAL), FLHTC/U-I, FLTR-I.

# RADIO ANTENNA CABLE

## REMOVAL

1. Remove fuel tank to access cables in area of frame backbone. For carbureted models, see Section 4.7 FUEL TANK, COMPLETE REMOVAL, FLHT/C, FLTR. For fuel injected models, see Section 9.3 FUEL TANK, COMPLETE REMOVAL, FLHTC/U-I, FLTR-I.
2. Raise lid of left side saddle bag. Grasp bail wire inside saddlebag and rotate each stud a full 1/4 turn in a counter-clockwise direction. Remove bail head studs with flat washers. Remove saddlebag.
3. Gently pull side cover from frame downtubes (no tools required).
4. Remove the outer fairing and windshield. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL.
5. Locate Radio antenna cable connector [51], back of radio (left side), and disconnect. See Figure 8-146. Carefully cut cable where it exits main harness conduit.
6. Remove screw, ground wire ring terminal and P-clamp to release wire bundles from top fork bracket. Cut two cable straps at this location.
7. Remove screw, ground wire ring terminal and P-clamp to release wire bundles from right side of steering head. Cut two cable straps at this location.
8. Carefully cut cable straps securing main harness conduit to frame backbone, left frame tube and luggage rack rail. See Figure 8-149.
9. Open Tour-Pak. Open map pocket and remove acorn nuts. Remove map pocket and molded liner from Tour-Pak.

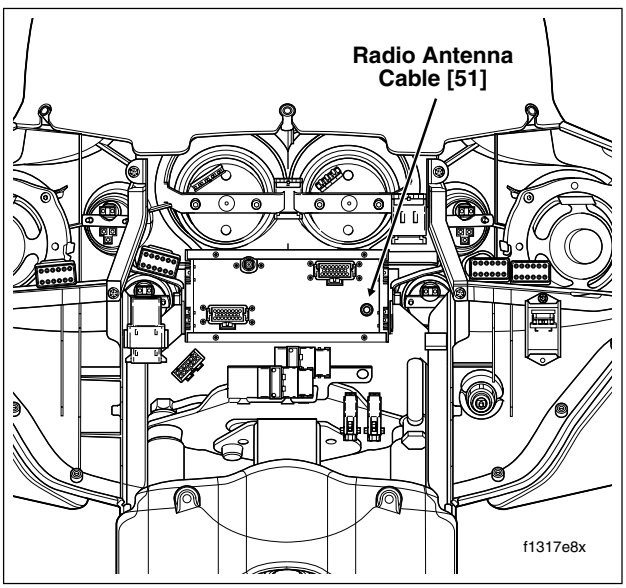



**Figure 8-146. Radio Antenna Cable Connector (Inner Fairing)**

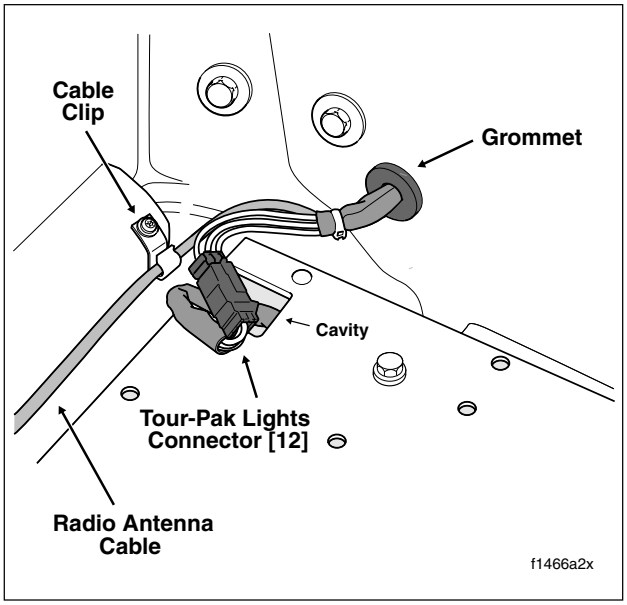



**Figure 8-147. Disconnect Tour-Pak Lights Connector**

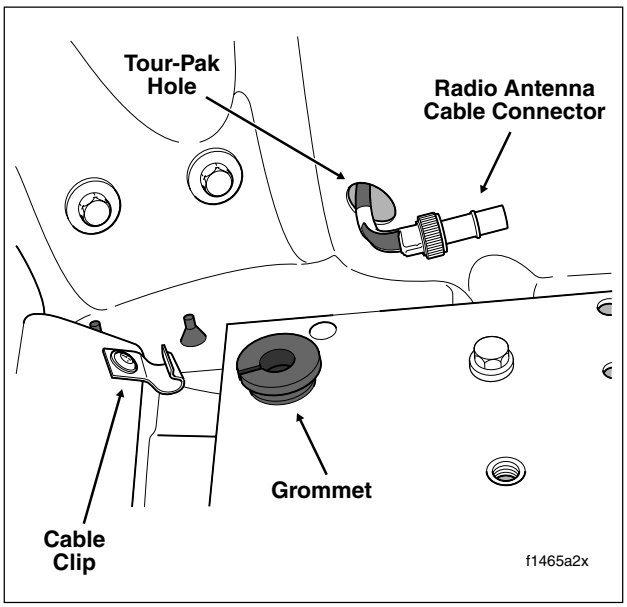



**Figure 8-148. Feed Main Harness Thru Tour-Pak Hole**

10. Depress external latch and remove bulb socket from left side of Tour-Pak.
11. Rotate knurled ring in a counterclockwise direction to separate pin and socket halves of Radio antenna cable connector. Release cable from two clips at bottom of Tour-Pak.
12. Depress button and separate pin and socket halves of Tour-Pak lights connector [12], 3-place Multilock, inside Tour-Pak. See Figure 8-147.

13. Pull grommet into Tour-Pak and remove from main harness conduit.

14. Pull main harness conduit and Multilock socket through hole at front of Tour-Pak. See Figure 8-148.

15. Carefully cut Radio antenna cable where it exits main harness conduit.

## INSTALLATION

1. Place **new** Radio antenna cable on vehicle following original routing. Note that the cable follows that portion of the main harness routed to the rear left side of the vehicle.

   Specifically, from the clamp on the top fork bracket, the Radio antenna cable is routed under the fairing cap where it passes through a second clamp on the right side of the steering head. The cable then runs along the right side of the frame backbone, where it crosses to the left side just above the engine stabilizer bracket. From this point, the cable follows the left side of the frame backbone, runs along the inboard side of the upper frame tube and then continues up the luggage rack rail where it passes through the hole at the front of the Tour-Pak.

2. Feed main harness conduit (with Multilock socket) and Radio antenna cable connector through hole at front of Tour-Pak. Capture Radio antenna cable and conduit in grommet. Install grommet in hole with the larger OD facing inside.

3. Mate pin and socket halves of Tour-Pak lights connector [12], 3-place Multilock, and tuck into cavity inside Tour-Pak. See Figure 8-147.

4. Rotate knurled ring in a clockwise direction to mate pin and socket halves of Radio antenna cable connector. Capture cable in two clips at bottom of Tour-Pak.

5. Install bulb socket on left side of Tour-Pak.

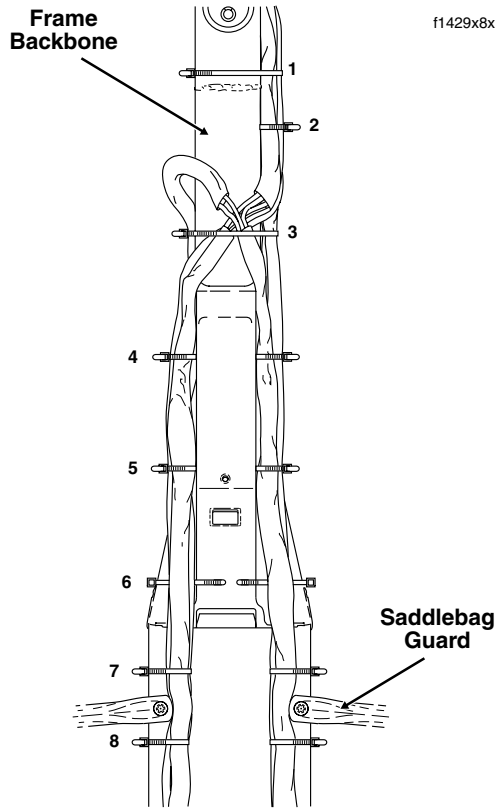
6. Install molded liner in Tour-Pak. Install map pocket and secure using acorn nuts. Close Tour-Pak.

7. At front of inner fairing, connect Radio antenna cable connector [51] to back of radio (left side). See Figure 8-146.

8. Capture Radio antenna cable and wire bundles in P-clamp. Install ring terminal of ground wire on screw and fasten clamp to top fork bracket.

9. On right side of vehicle, capture Radio antenna cable and wire bundles in second P-clamp. Install ring terminal of ground wire on screw and fasten clamp to right side of steering head.

10. Install cable straps on each side of P-clamps at both locations. Cut any excess cable strap material.




| | |
|---|---|
| 1 | Encircles coil bracket and frame backbone capturing wire bundles and cables (including throttle and idle cables). |
| 2 | Captures wire bundles and cables only (not anchored). |
| 3 | Encircles frame backbone (just to the rear of the engine stabilizer bracket where wire bundles cross from right to left side of frame backbone) capturing wire bundles and cables. |
| 4 | Captures wire bundles and cables only (not anchored). |
| 5 | Captures wire bundles and cables only (anchored). |
| 6 | Captures wire bundles and cables only (anchored). |
| 7-8 | Captures wire bundles, cables and upper frame tube. |

**Figure 8-149. Install Cable Straps**

11. From right side of vehicle, insert tapered end of new 14 inch cable strap between ignition coil and coil bracket welded to underside of frame backbone. When cable strap exits left side, raise both ends so that eye is centered above the frame backbone.

    Verify that wire bundles, cables, frame backbone and idle and throttle cables are captured before mating cable strap ends. Tighten cable strap, but leave loose enough so that one finger can be inserted between strap and frame back-bone. **Do not over tighten.** Cut any excess cable strap material.

12. Install remaining cables straps as shown in Figure 8-149.
13. Install the outer fairing and windshield. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.
14. Align barbed studs in left side cover with grommets in frame downtubes and push firmly into place (no tools required).
15. Position left side saddlebag on vehicle. Place flat washers on bail head studs. With groove at end of stud held in a horizontal position, insert stud through holes in saddlebag and front mounting bracket. When groove engages wire form of spring plate on inboard side of bracket, turn stud clockwise a full 1/4 turn until it snaps in place. Install rear bail head stud in the same manner.
16. Install fuel tank. For carbureted models, see Section 4.7 FUEL TANK, INSTALLATION (AFTER COMPLETE REMOVAL), FLHT/C, FLTR. For fuel injected models, see Section 9.3 FUEL TANK, INSTALLATION (AFTER COMPLETE REMOVAL), FLHTC/U-I, FLTR-I.

# CB ANTENNA CABLE

## REMOVAL

1. Remove fuel tank to access cables in area of frame backbone. For carbureted models, see Section 4.7 FUEL TANK, COMPLETE REMOVAL, FLHT/C, FLTR. For fuel injected models, see Section 9.3 FUEL TANK, COMPLETE REMOVAL, FLHTC/U-I, FLTR-I.
2. Raise lid of right side saddle bag. Grasp bail wire inside saddlebag and rotate each stud a full 1/4 turn in a counter-clockwise direction. Remove bail head studs with flat washers. Remove saddlebag.
3. Gently pull side cover from frame downtubes (no tools required).
4. Remove the outer fairing and windshield. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL.
5. Locate CB antenna cable connector [50] at back of radio (right side). Rotate knurled ring in a counterclockwise direction to disconnect. See Figure 8-150. Carefully cut cable where it exits Ultra overlay harness conduit.
6. Remove screw, ground wire ring terminal and P-clamp to release wire bundles from top fork bracket. Cut two cable straps at this location.
7. Remove screw, ground wire ring terminal and P-clamp to release wire bundles from right side of steering head. Cut two cable straps at this location.

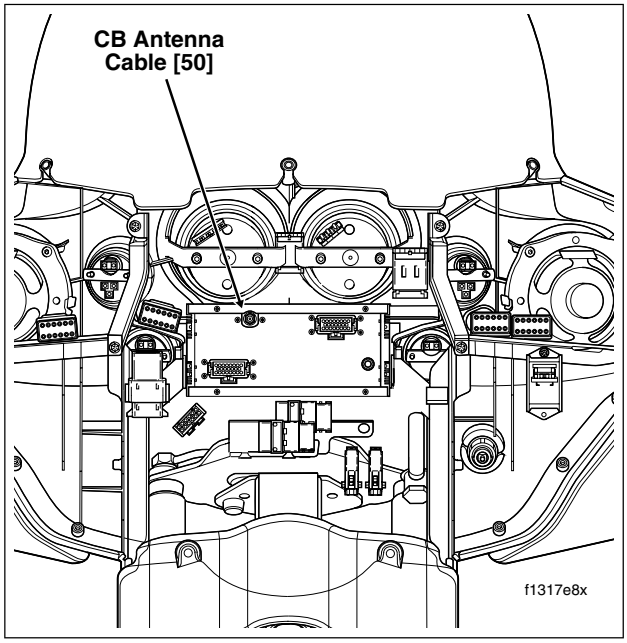



**Figure 8-150. CB Antenna Cable Connector (Inner Fairing)**

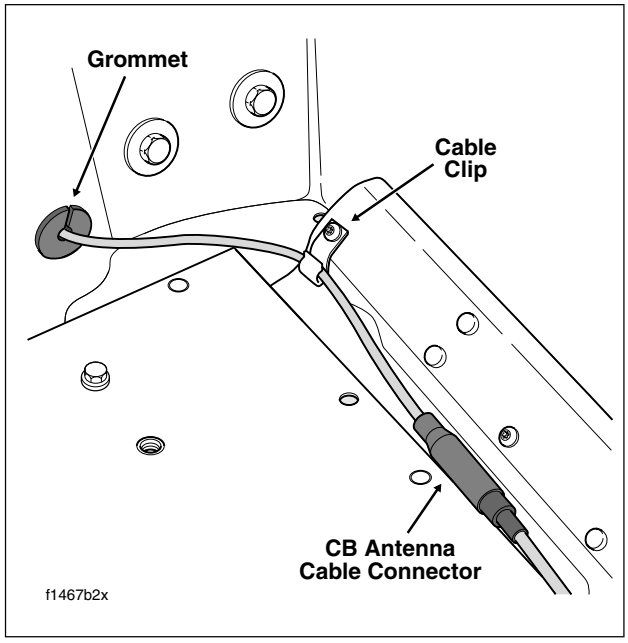



**Figure 8-151. CB Antenna Cable Connector (Tour-Pak)**

8. Carefully cut cable straps securing Ultra overlay harness conduit to frame backbone, right frame tube and luggage rack rail. See Figure 8-152.
9. Open Tour-Pak. Open map pocket and remove acorn nuts. Remove map pocket and molded liner from Tour-Pak.
10. Separate pin and socket halves of CB Antenna cable connector [50]. Release cable from clip at bottom of Tour-Pak. See Figure 8-151.
11. Pull right side grommet into Tour-Pak and remove from CB antenna cable. Feed CB antenna cable through hole at front of Tour-Pak.
12. Carefully cut CB antenna cable where it exits Ultra overlay harness conduit.

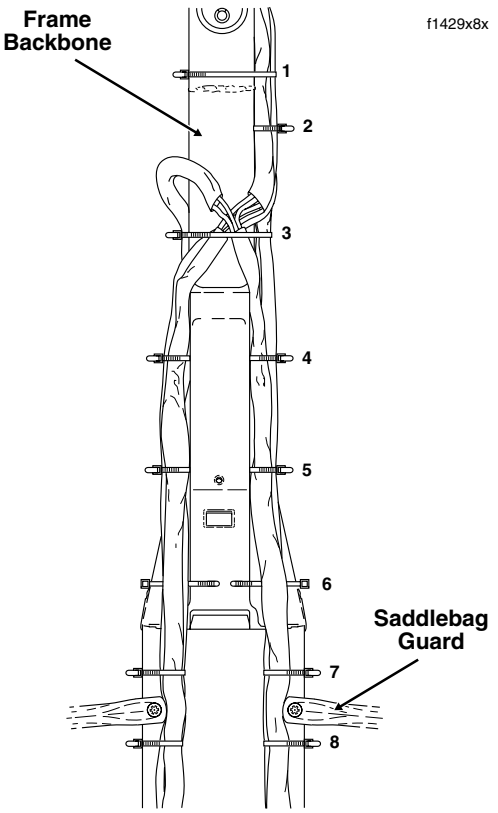
## INSTALLATION

1. Place **new** CB antenna cable on vehicle following original routing. Note that the cable follows that portion of the Ultra overlay harness routed to the rear right side of the vehicle.

   Specifically, from the clamp on the top fork bracket, the CB antenna cable is routed under the fairing cap where it passes through a second clamp on the right side of the steering head. From this point, the cable follows the right side of the frame backbone, runs along the inboard side of the upper frame tube and then continues up the luggage rack rail where it passes through the hole at the front of the Tour-pak.

2. Pass CB antenna cable connector [50] through hole at front of Tour-Pak. Capture cable in grommet. Install grommet in hole with the larger OD facing inside.
3. Mate pin and socket halves of CB antenna cable connector. Capture antenna cable in clip at bottom of Tour-Pak. See Figure 8-151.
4. Install molded liner in Tour-Pak. Install map pocket and secure using acorn nuts. Close Tour-Pak.
5. At front of inner fairing, rotate knurled ring to connect CB antenna cable connector [50] to back of radio (right side). See Figure 8-150.
6. Capture CB antenna cable and wire bundles in P-clamp. Install ring terminal of ground wire on screw and fasten clamp to top fork bracket.
7. On right side of vehicle, capture CB antenna cable and wire bundles in second P-clamp. Install ring terminal of ground wire on screw and fasten clamp to right side of steering head.
8. Install cable straps on each side of P-clamps at both locations. Cut any excess cable strap material.
9. From right side of vehicle, insert tapered end of new 14 inch cable strap between ignition coil and coil bracket welded to underside of frame backbone. When cable strap exits left side, raise both ends so that eye is centered above the frame backbone.

   Verify that wire bundles, cables, frame backbone and idle and throttle cables are captured before mating cable strap ends. Tighten cable strap, but leave loose enough so that one finger can be inserted between strap and frame back-bone. **Do not over tighten.** Cut any excess cable strap material.
10. Install remaining cables straps as shown in Figure 8-152.
11. Install the outer fairing and windshield. See Section 2.26 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.
12. Align barbed studs in right side cover with grommets in frame downtubes and push firmly into place (no tools required).
13. Position right side saddlebag on vehicle. Place flat washers on bail head studs. With groove at end of stud held in a horizontal position, insert stud through holes in saddlebag and front mounting bracket. When groove engages wire form of spring plate on inboard side of bracket, turn stud clockwise a full 1/4 turn until it snaps in place. Install rear bail head stud in the same manner.
14. Install fuel tank. For carbureted models, see Section 4.7 FUEL TANK, INSTALLATION (AFTER COMPLETE REMOVAL), FLHT/C, FLTR. For fuel injected models, see Section 9.3 FUEL TANK, INSTALLATION (AFTER COMPLETE REMOVAL), FLHTC/U-I, FLTR-I.




| | |
|---|---|
| 1 | Encircles coil bracket and frame backbone capturing wire bundles and cables (including throttle and idle cables). |
| 2 | Captures wire bundles and cables only (not anchored). |
| 3 | Encircles frame backbone (just to the rear of the engine stabilizer bracket where wire bundles cross from right to left side of frame backbone) capturing wire bundles and cables. |
| 4 | Captures wire bundles and cables only (not anchored). |
| 5 | Captures wire bundles and cables only (anchored). |
| 6 | Captures wire bundles and cables only (anchored). |
| 7-8 | Captures wire bundles, cables and upper frame tube. |

**Figure 8-152. Install Cable Straps**

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# FUEL INJECTION 9

# ELECTRICAL BRACKET ASSEMBLY 9.1

## GENERAL

See Figure 9-1. The electrical bracket assembly is mounted beneath the side cover on the right side of the vehicle. Rubber boots anchored to the electrical bracket isolate the ECM from engine vibrations. The electrical bracket assembly carries the following components:

- Data Link Connector
- Fuses/Fuse Holders
- Electronic Control Module (ECM)
- Barometric Pressure Sensor
- Main Harness to ECM Harness Connector
- Fuel Pump Relay
- ECM Power Relay
- Camshaft Position Sensor Connector
- Crankshaft Position Sensor Connector
- Oil Pressure Sending Unit Connector
- Optional Siren Connector

## SIDE COVER

### REMOVAL

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠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.**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.

*NOTE*

*All vehicles feature quick-release fasteners to facilitate saddlebag removal and installation.*

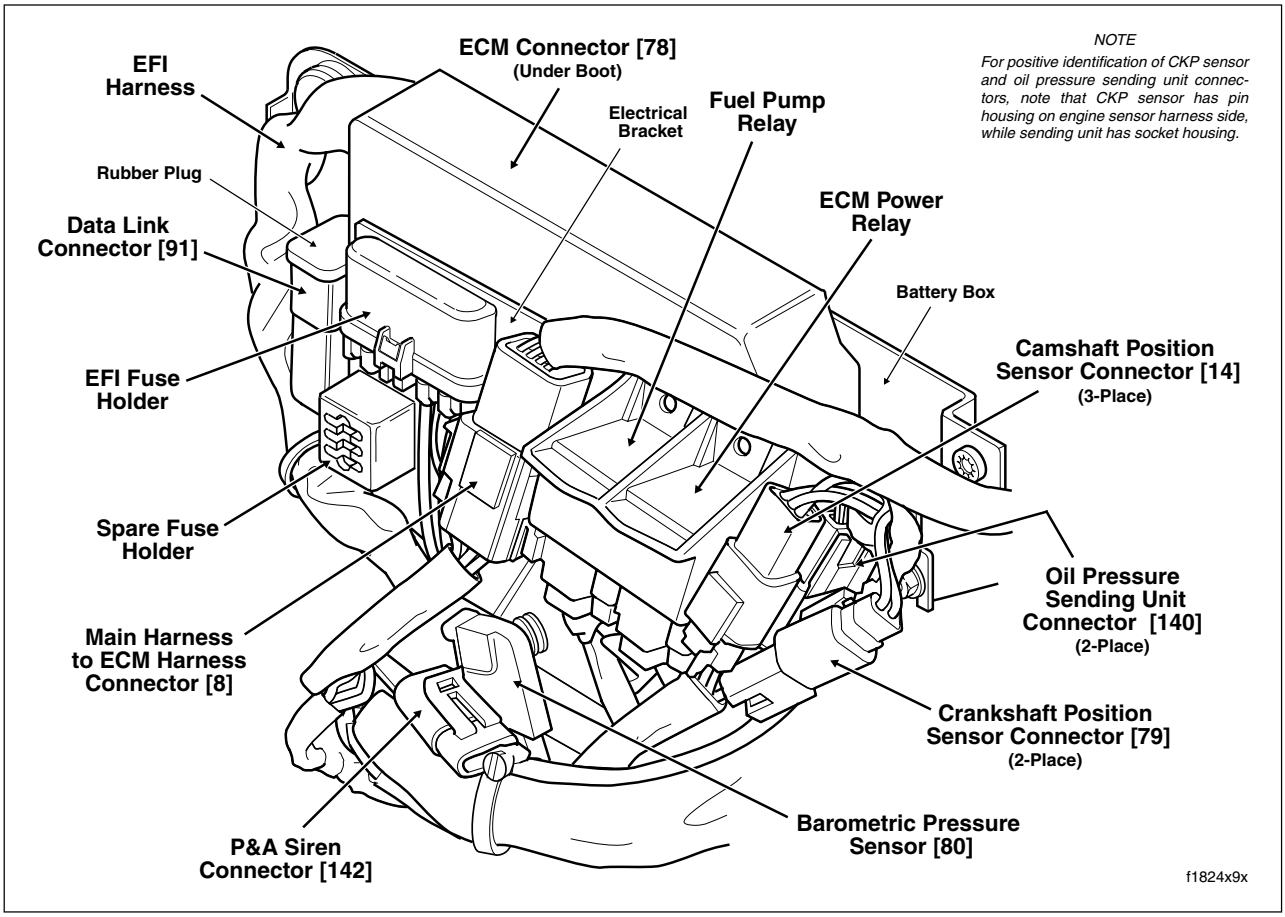



**Figure 9-1. Electrical Bracket Assembly**

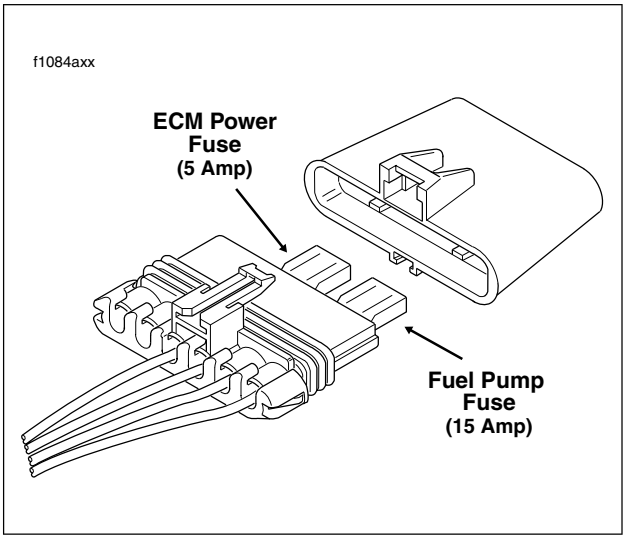



**Figure 9-2. Fuse Holder**

3. Raise lid of right side saddle bag. To free saddlebag from mounting brackets on saddlebag support and frame, grasp bail wire inside saddlebag and rotate each stud a full 1/4 turn in a counter-clockwise direction. Remove bail head studs with flat washers. Remove saddlebag.
4. Gently pull side cover from frame downtubes (no tools required).

### INSTALLATION

1. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required).
2. Position right side saddlebag on vehicle. Place flat washers on bail head studs. With groove at end of stud held in a horizontal position, insert stud through holes in saddlebag and front mounting bracket. When groove engages wire form of spring plate on inboard side of bracket, turn stud clockwise a full 1/4 turn until it snaps in place. Install rear bail head stud in the same manner.
3. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
4. Install seat. See Section 2.21 SEAT, INSTALLATION.

## DATA LINK CONNECTOR

### GENERAL

The Check Engine Lamp indicates the existence of a fault condition. Turn the Ignition Switch to OFF and proceed as follows:

### REMOVAL

1. See SIDE COVER, REMOVAL, steps 3 and 4.
2. Note the Data Link connector (pin side of 4-place Deutsch) on the electrical bracket. See Figure 9-1. Push connector up to disengage small end of slot on attachment clip from T-stud on bracket. Lift connector off T-stud.
3. Remove rubber protective plug from open end of Data Link connector.
4. Mate pin and socket halves to connect wire harness to diagnostics device. Push the connector halves together until the latches “click.”

### INSTALLATION

1. Depress the external latch and use a rocking motion to separate pin and socket halves of Data Link connector.
2. Install protective plug over pin side of connector.
3. Place large end of slot on attachment clip over T-stud on electrical bracket. Push connector toward wire end to engage small end of slot.
4. See SIDE COVER, INSTALLATION, on this page, steps 1 and 2.

## ELECTRICAL RELAYS

### REMOVAL

1. See SIDE COVER, REMOVAL, steps 3 and 4.
2. Remove spade plug from bottom of selected relay. See Figure 9-1. Since the position of the relays may be reversed, check the wire tags for positive identification.
3. Using a needle nose pliers, carefully pull on tab to release relay from rubber molding.

### INSTALLATION

1. Place a finger on the rubber molding to hold it in position and push on top of relay until seated.
2. Install spade plug at bottom of **new** relay.
3. See SIDE COVER, INSTALLATION, on this page, steps 1 and 2.

## FUSES

### REMOVAL

1. See SIDE COVER, REMOVAL.
2. Pull fuse holder assembly upward to release cover from metal prong on electrical bracket. See Figure 9-1.
3. Depress latch and pull cover from fuse holder body.

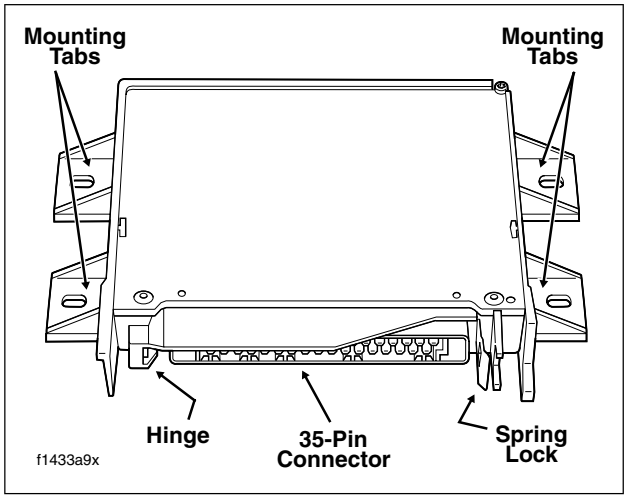



**Figure 9-3. Electronic Control Module (ECM)**

4. Pull fuses from slots in fuse holder body and inspect for damage. Replace either fuse if the element is burned or broken. Automotive type ATO fuses are used.

*NOTE*

*A spare fuse holder on the electrical bracket holds one extra 5 amp and 15 amp fuse.*

### INSTALLATION

1. Insert fuse, whether 5 amp (ECM) or 15 amp (Fuel Pump), in the appropriate slot. See Figure 9-2.
2. Slide cover over fuse holder body until latch clicks.
3. Slide fuse holder assembly downward so that groove at back of cover fully engages prong on electrical bracket.
4. See SIDE COVER, INSTALLATION.

## ELECTRONIC CONTROL MODULE

### REMOVAL

1. See SIDE COVER, REMOVAL.

**CAUTION**

**Always remove electrical bracket before disconnecting 35-place ECM connector. Removing connector with bracket installed may result in pin damage.**

2. Remove two nuts to detach electrical bracket and ECM from studs on right side of battery box. Place assembly on rear footboard.
3. Pull back rubber boot to reveal 35-place harness connector. Gently pull back spring lock on ECM to disengage locking tab on connector housing. Work that side of connector free. Disengage hook on opposite side of connector housing from hinge on ECM. See Figure 9-3.
4. Remove mounting tabs on ECM from four boots anchored to electrical bracket.

### INSTALLATION

**CAUTION**

**Always install 35-place ECM connector before mounting electrical bracket. Attaching connector with bracket installed may result in pin damage.**

1. Place hook on 35-place connector into hinge on ECM. Push connector onto male spade contacts of ECM until locking tab on opposite side of connector housing fully engages slot of ECM spring lock. Pull rubber boot over connector to keep out dirt and moisture.
2. With backside of both electrical bracket and ECM facing upward, insert mounting tabs on ECM into four boots anchored to electrical bracket.
3. Slide slotted tabs on electrical bracket over studs on side of battery box. Install nuts and tighten to 5-10 ft-lbs (6.8-13.6 Nm).
4. See SIDE COVER, INSTALLATION.

## BAROMETRIC PRESSURE SENSOR

### REMOVAL

1. See SIDE COVER, REMOVAL.
2. Pull external latch outward and use rocking motion to remove connector.
3. Pull atmospheric pressure port (enveloped in rubber seal) from hole in electrical bracket.

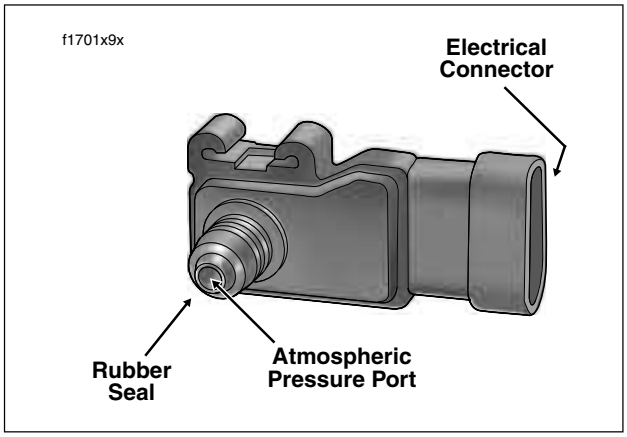



**Figure 9-4. Barometric Pressure Sensor**

4. If replacing sensor, remove and save rubber seal if condition is good. Replace the seal if it is cut, torn or shows signs of deterioration.

### INSTALLATION

1. Install rubber seal on atmospheric pressure port, if removed.
2. Align latch on socket housing with locking tab on pin housing and push connector halves together until latch clicks.
3. Insert atmospheric pressure port (enveloped in rubber seal) into hole in electrical bracket. See Figure 9-4.
4. See SIDE COVER, INSTALLATION.

## EFI WIRE HARNESS

### REMOVAL

1. See Section 9.3 FUEL TANK ASSEMBLY, FUEL TANK, COMPLETE REMOVAL, FLHTC/U-I, FLTR-I, or FLHR/C-I.
2. See Section 9.4 AIR CLEANER ASSEMBLY, AIR CLEANER, REMOVAL.
3. Unthread bolt and remove battery positive cable (red) from battery positive (+) terminal. (Battery negative cable already removed under FUEL TANK, COMPLETE REMOVAL.)
4. Using a T40 TORX drive head, loosen bolt to move lip of hold-down clamp off edge of battery. Remove battery from battery box.
5. Raise lid of right side saddle bag. Grasp bail wire inside saddlebag and rotate each stud 1/4 turn in a counterclockwise direction. Remove bail head studs with flat washers. Remove saddlebag.
6. Gently pull side cover from frame downtubes (no tools required).

*NOTE*

*Draw all EFI wire harness connectors to right side of vehicle as they are disconnected.*

7. Standing on right side of vehicle, remove idle speed control actuator, throttle position sensor and intake air temperature sensor connectors. Pull external latch(es) outward and use rocking motion to remove connectors. See Figure 9-5.
8. Depress wire form to remove front and rear fuel injector connectors. See Figure 9-5.
9. Moving to left side of vehicle, pull back boot to reveal engine temperature sensor at back of front cylinder. Pull external latch outward and remove connector. Cut cable strap to release conduit from horn bracket.
10. Pull external latch outward and use rocking motion to remove electrical connector from left side of ignition coil.

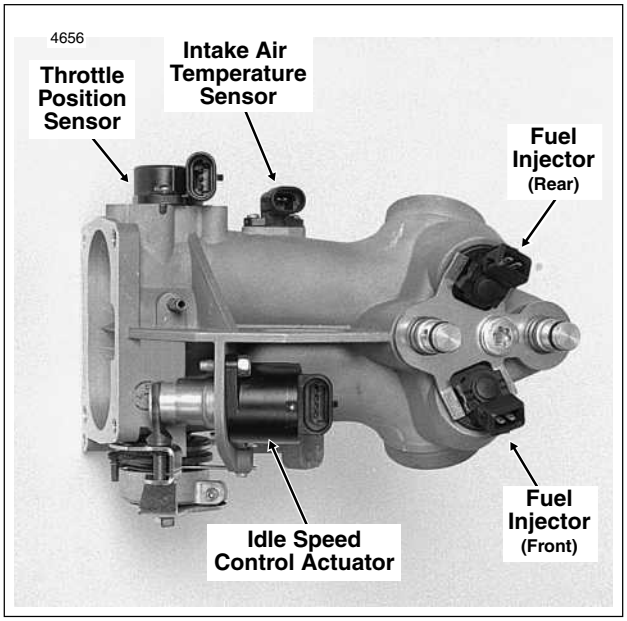



**Figure 9-5. Induction Module Assembly (Top View)**

11. Carefully cut cable straps to free EFI wire harness from right side of frame backbone and main wire harness bundle.
12. Push EFI harness upward to unsnap attachment clip from T-stud on right side of frame backbone.
13. Cut two cable straps to release EFI wire harness from bottom corners of electrical bracket.
14. Release conduit from flexible cable clip at side of electrical bracket, if present. Separate pin and socket halves of oil pressure sending unit, camshaft position sensor and crankshaft position sensor connectors. See Figure 9-7.
15. Pull anchors on rubber molding from holes in electrical bracket to release ECM power and fuel pump relays.
16. Pull external latch outward and use rocking motion to remove electrical connector from barometric pressure sensor.
17. Push Data Link connector upward to disengage attachment clip from T-stud on electrical bracket.
18. Push Main harness to ECM harness connector rearward to unsnap attachment clip from T-stud on electrical bracket. Depress external latches and use a rocking motion to separate pin and socket halves.
19. Pull fuse holder upward to release cover from metal prong on electrical bracket. See Figure 9-7.
20. Remove two nuts to detach electrical bracket (and ECM) from studs on right side of battery box.
21. Pull back boot to reveal 35-place ECM harness connector. Gently pull back spring lock on ECM to disengage locking tab on connector housing. Work that side of connector free. Disengage hook on opposite side of connector housing from hinge on ECM. See Figure 9-3.

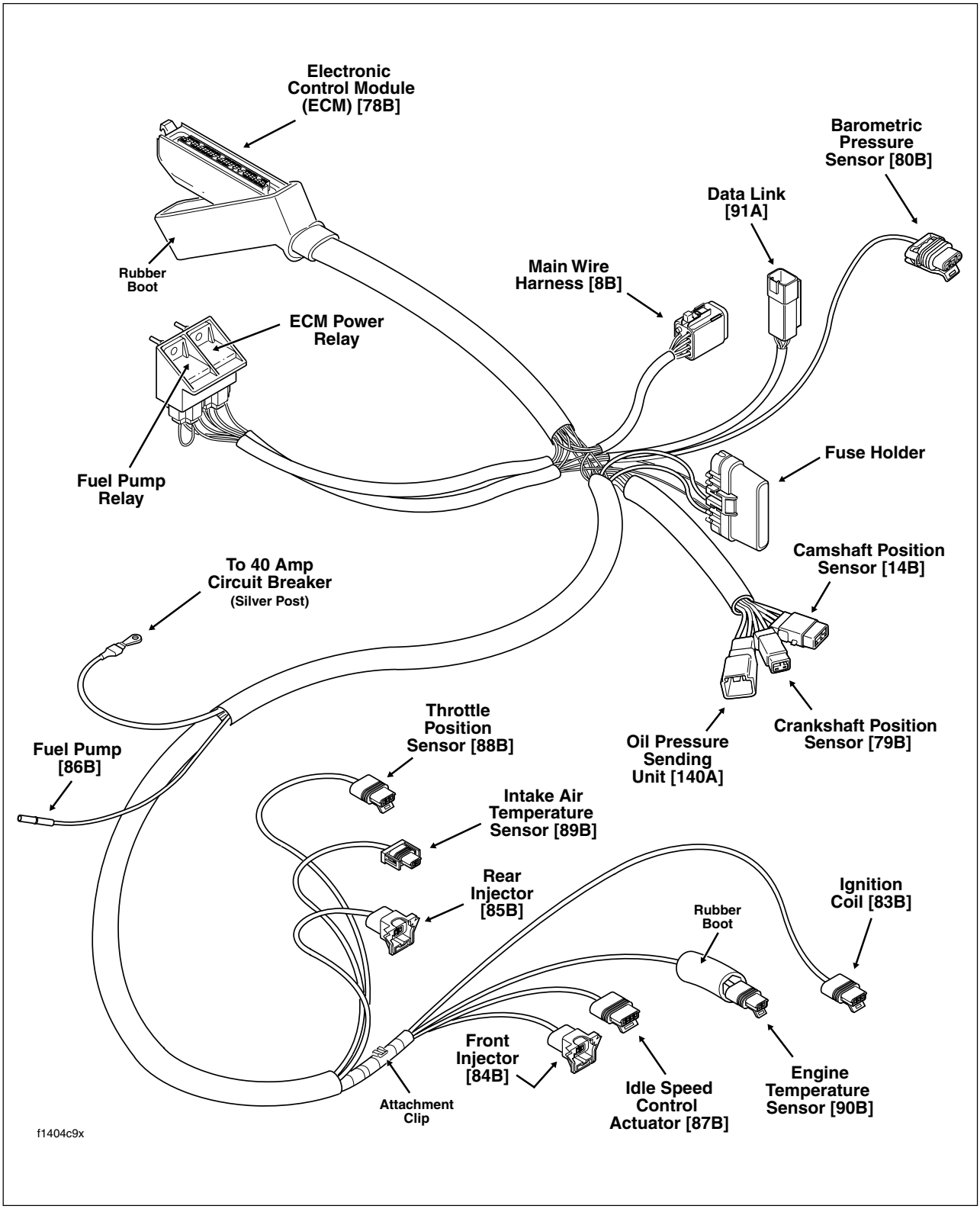



**Figure 9-6. EFI Wire Harness Connectors**

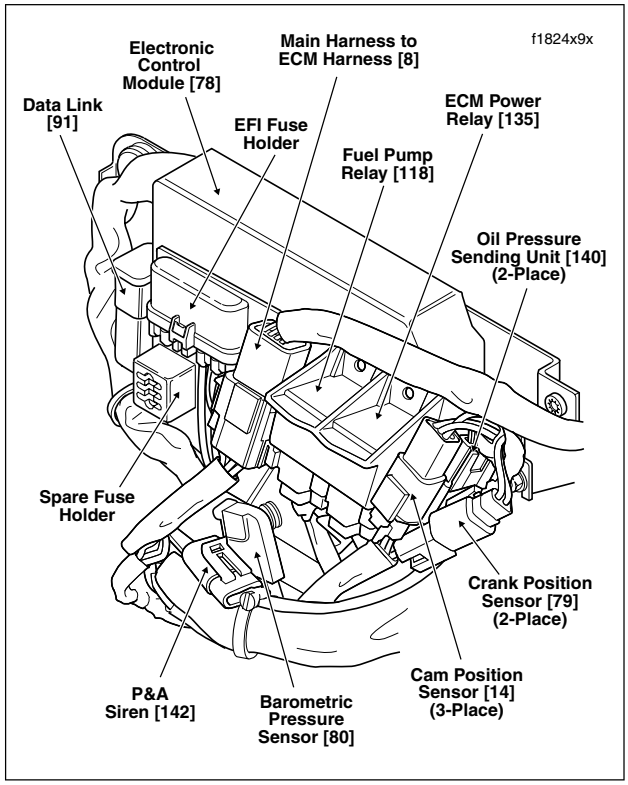



**Figure 9-7. Electrical Bracket Assembly**

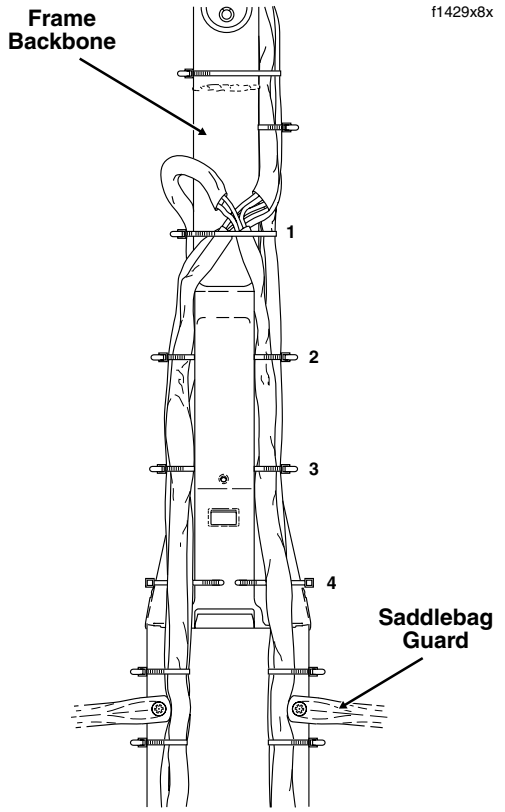
22. Remove Keps nut from silver post of main 40 amp circuit breaker (left side of upper frame cross member). Remove red wire ring terminal.
23. To remove EFI wire harness from vehicle, carefully draw sensor connectors and conduit down along right side of frame backbone and then out through opening between rear of frame crossmember and bottom front corner of battery box.

## INSTALLATION

1. Standing on right side of vehicle, carefully feed sensor connectors and conduit (but not conduit to engine sensor harness) up through opening between rear of frame crossmember and bottom front corner of battery box.
2. Draw sensor connectors and conduit up along right side of frame backbone just below the main wire harness bundle. Secure attachment clip on EFI wire harness to T-stud on right side of frame backbone.
3. Install front and rear fuel injector connectors. Injector cables are tagged F(ront) and R(ear) to ensure correct assembly.
4. Moving to left side of vehicle, install electrical connector onto engine temperature sensor at back of front cylinder. Install **new** cable strap to secure connector conduit to horn bracket. Pull boot over sensor to keep out dirt and debris.
5. Install ignition coil connector routing conduit over throttle cables and spark plug wires.
6. Install idle speed control actuator, throttle position sensor and intake air temperature sensor connectors. See Figure 9-5.
7. Install red wire ring terminal onto silver stud of main 40 amp circuit breaker (on upper frame cross member). Install Keps nut and tighten securely.
8. Place hook on 35-place connector into hinge on ECM. Push connector onto male spade contacts of ECM until locking tab on opposite side of connector housing fully engages slot of ECM spring lock.
9. Slide slotted tabs on electrical bracket over studs on side of battery box. Install nuts and tighten securely.
10. Install electrical connector onto barometric pressure sensor.
11. Check wire tags for positive identification of ECM power and fuel pump relays and then install anchors on rubber molding into holes in electrical bracket. See Figure 9-7.
12. Verify that protective plug is installed in Data Link connector. Place large end of slot on attachment clip over T-stud on electrical bracket. Push connector toward wire end to engage small end of slot.
13. Mate pin and socket housings of Main harness to ECM harness connector. Place attachment clip over T-stud on electrical bracket. Push connector toward wire end to engage small end of slot.
14. Slide fuse holder assembly downward so that groove at back of cover fully engages prong on electrical bracket.
15. Mate pin and socket halves of oil pressure sending unit, camshaft position sensor and crankshaft position sensor connectors. See Figure 9-7. To prevent improper mating of 2-place Mini-Deutsch connectors, crankshaft position sensor has pin housing on engine sensor harness side, while the oil pressure sending unit has a socket housing.
16. Capture conduit to engine sensor harness in flexible cable clip at side of electrical bracket, if present.
17. Using holes at bottom corners of electrical bracket, secure EFI harness using two **new** cable straps. Cut any excess cable strap material. Install other cables straps as shown in Figure 9-8.
18. Place battery in battery box, terminal side forward. Rotate hold-down clamp so that lip (with rubber pad) rests on edge of battery and tighten clamp bolt.

**⚠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 producing personal injury and/or property damage.**




1 Encircles frame backbone (just to the rear of the engine stabilizer bracket where wire bundles cross from right to left side of frame backbone) capturing wire bundles and cables.

2 Captures wire bundles and cables only (not anchored).

3 Captures wire bundles and cables only (anchored).

4 Captures wire bundles and cables only (anchored).

**Figure 9-8. Install Cable Straps**

19. Insert bolt through battery positive cable (red) into threaded hole of battery positive (+) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
20. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required).
21. Position right side saddlebag on vehicle. Place flat washers on bail head studs. With groove at end of stud held in a horizontal position, insert stud through holes in saddlebag and front mounting bracket. When groove engages wire form of spring plate on inboard side of bracket, turn stud clockwise a full 1/4 turn until it snaps in place. Install rear bail head stud in the same manner.
22. See Section 9.3 FUEL TANK ASSEMBLY, FUEL TANK, INSTALLATION (AFTER COMPLETE REMOVAL), FLHTC/U-I, FLTR-I, or FLHR/C-I.
23. See Section 9.4 AIR CLEANER ASSEMBLY, AIR CLEANER, INSTALLATION.
24. Start vehicle and verify proper operation without setting trouble codes.

## EFI WIRE HARNESS CONNECTOR TERMINAL REPAIR

In lieu of the standard pick tool, use a one inch safety pin when removing Packard pull to seat terminals. For detailed information, refer to APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.3 PACKARD ELECTRICAL CONNECTORS.

## GENERAL

Seven sensors inform the ECM of the environmental and engine operating factors influencing fuel and spark requirements. The sensors are as follows:

- Barometric Pressure Sensor
- Throttle Position Sensor
- Intake Air Temperature Sensor
- Bank Angle Sensor
- Camshaft Position Sensor
- Crankshaft Position Sensor
- Engine Temperature Sensor

### BAROMETRIC PRESSURE SENSOR

See Section 9.1 ELECTRICAL BRACKET ASSEMBLY, BAROMETRIC PRESSURE SENSOR.

### THROTTLE POSITION SENSOR

See Section 9.5 INDUCTION MODULE ASSEMBLY, THROTTLE POSITION SENSOR.

### INTAKE AIR TEMPERATURE SENSOR

See Section 9.5 INDUCTION MODULE ASSEMBLY, INTAKE AIR TEMPERATURE SENSOR.

### BANK ANGLE SENSOR

See Section 8.16 TURN SIGNAL/SECURITY MODULE.

## CAMSHAFT POSITION SENSOR

### REMOVAL

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠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.**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. Raise lid of right side saddle bag. Grasp bail wire inside saddlebag and rotate each stud 1/4 turn in a counterclockwise direction. Remove bail head studs with flat washers. Remove saddlebag.
4. Gently pull side cover from frame downtubes (no tools required).
5. Release conduit from flexible clamp at side of electrical bracket, if present. Separate pin and socket halves of oil pressure sending unit, camshaft position sensor and crankshaft position sensor connectors. See Figure 9-7.
6. Feed engine sensor harness conduit and connectors forward through opening between frame downtube and bottom front corner of battery box.
7. Cut anchored cable strap to release conduit from frame downtube (inboard of passenger footboard bracket). Cut cable strap to release conduit from brake hose crimp.
8. Following frame downtube, draw conduit and connectors downward to inboard side of rear brake light switch. If more clearance is needed, remove screw to release rear brake line clamp from passenger footboard bracket.
9. Open two cable clips on lower frame tube T-studs and release conduit.

*NOTE*

*For best results, insert blade of small screwdriver into gap at side of clip and gently rotate end of screwdriver to pop open.*

10. Remove T20 TORX screw from threaded hole at front of crankcase to release cable clip and conduit. Remove cable clip from conduit.
11. Pull wire socket from terminal of oil pressure sending unit. On Ultra models, pull external latch outward and use rocking motion to remove Packard connector.
12. Carefully draw conduit and connectors forward along top of lower frame tube, and then up between rear brake master cylinder reservoir and frame downtube to area of rear brake pedal.
13. Remove terminals from pin housing of 3-place Mini-Deutsch connector.

*NOTE*

*For instructions on properly removing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.1 DEUTSCH ELECTRICAL CONNECTORS, REMOVING/INSTALLING PINS.*

14. Remove five T20 TORX screws to release camshaft position sensor cover from cam cover.
15. Remove allen head socket screw and spacer to free camshaft position sensor mount from cam cover. Pull sensor from bore. See Figure 9-9.
16. Obtain a length of strong flexible wire for use as mechanics wire.

*NOTE*

*Be sure that mechanics wire is of sufficient strength to pull terminals and cable through conduit without breaking. Wire length must also be long enough so that free end is not lost in conduit when pulled.*

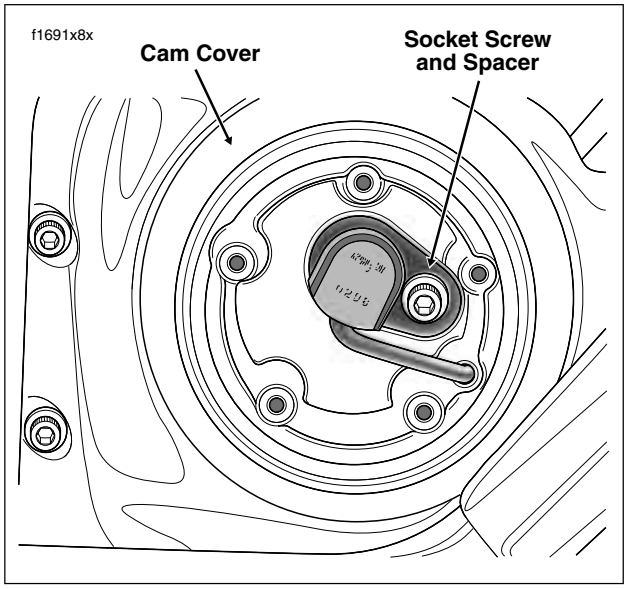



**Figure 9-9. Remove Sensor Mount Socket Screw**

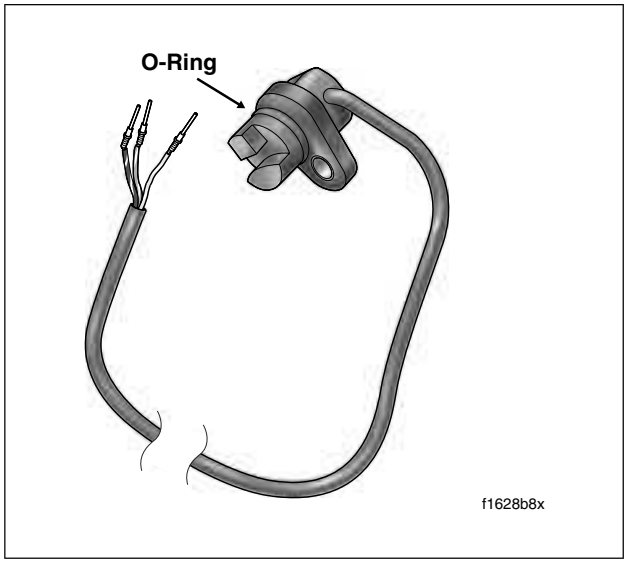



**Figure 9-10. Camshaft Position Sensor**

17. Attach mechanics wire to pin side of camshaft position sensor cable and pull sensor to draw cable and pin terminals through conduit. When terminals exit conduit, remove mechanics wire and pull cable and pin terminals through channel in cam cover. See Figure 9-10.

## INSTALLATION

1. Place **new** camshaft position sensor next to discarded unit and cut wires to proper length.
2. Crimp **new** pin terminals on camshaft position sensor wires.

*NOTE*

*See APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.1 DEUTSCH ELECTRICAL CONNECTORS, SOLID BARREL CONTACT CRIMPING INSTRUCTIONS.*

3. Install **new** O-ring in groove on sensor body. Apply a thin film of clean H-D 20W50 engine oil to O-ring before installation. See Figure 9-10.
4. Push pin terminals and cable through channel to outboard side of cam cover.
5. Push sensor into bore aligning hole in sensor mount with threaded hole in cam cover. Install allen head socket screw with spacer and tighten to 50-80 **in-lbs** (5.6-9.0 Nm). See Figure 9-9.
6. Install five T20 TORX screws to secure camshaft position sensor cover to cam cover. Tighten screws to to 20-30 **in-lbs** (2.3-3.4 Nm).
7. Locate end of mechanics wire exiting conduit and attach to pin side of camshaft position sensor cable. Carefully pull pin terminals and cable back through conduit and then remove mechanics wire.
8. Install terminals into pin housing of 3-place Mini-Deutsch connector. See the table below for pin locations and wire colors.

### Table 9-1. Camshaft Position Sensor [14]

| Wire Color | Chamber Number |
|---|---|
| Red/White | 1 |
| Green/White | 2 |
| Black/White | 3 |

*NOTE*

*For instructions on properly installing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.1 DEUTSCH ELECTRICAL CONNECTORS, REMOVING/INSTALLING PINS.*

9. Draw conduit and connectors downward between rear brake master cylinder reservoir and frame downtube to inboard side of lower frame tube.
10. Attach wire socket (Packard connector on Ultra models) to oil pressure sending unit.
11. Allowing conduit to hang below frame tube, attach cable clip. Slide T20 TORX screw through holes in cable clip and start screw into threaded hole at front of crankcase. Tighten screw to 20-30 **in-lbs** (2.3-3.4 Nm).
12. Route engine sensor harness connectors and conduit rearward along top of lower frame tube to inboard side of rear brake light switch.

13. Draw engine sensor harness connectors and conduit upward following frame downtube to right side of battery box. Feed connectors and conduit through opening between frame downtube and bottom front corner of battery box (to area of right side cover).

14. Install **new** anchored cable strap to secure engine sensor harness conduit (and voltage regulator cables) to frame downtube (inboard of passenger footboard bracket). Install **new** cable strap to secure conduit (and voltage regulator cables) to brake hose crimp. Cut any excess cable strap material.

15. Install screw to secure rear brake line clamp to passenger footboard bracket, if removed.

16. Capture conduit in two cable clips on lower frame tube T-studs. Snap cable clips closed.

*NOTE*

*The cable clips also capture the voltage regulator cables and rear brake line.*

17. Mate pin and socket halves of oil pressure sending unit, camshaft position sensor and crankshaft position sensor connectors. See Figure 9-7. To prevent improper mating of 2-place Mini-Deutsch connectors, crankshaft position sensor has pin housing on engine sensor harness side, while oil pressure sending unit has socket housing.

18. Capture conduit to engine sensor harness in flexible clamp at side of electrical bracket, if present.

19. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required).

20. Position right side saddlebag on vehicle. Place flat washers on bail head studs. With groove at end of stud held in a horizontal position, insert stud through holes in saddlebag and front mounting bracket. When groove engages wire form of spring plate on inboard side of bracket, turn stud clockwise a full 1/4 turn until it snaps in place. Install rear bail head stud in the same manner.

21. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).

22. Install seat. See Section 2.21 SEAT, INSTALLATION.

# CRANKSHAFT POSITION SENSOR

## REMOVAL

1. See CAMSHAFT POSITION SENSOR, REMOVAL, steps 1-12.

2. Remove terminals from pin housing of 2-place Mini-Deutsch connector.

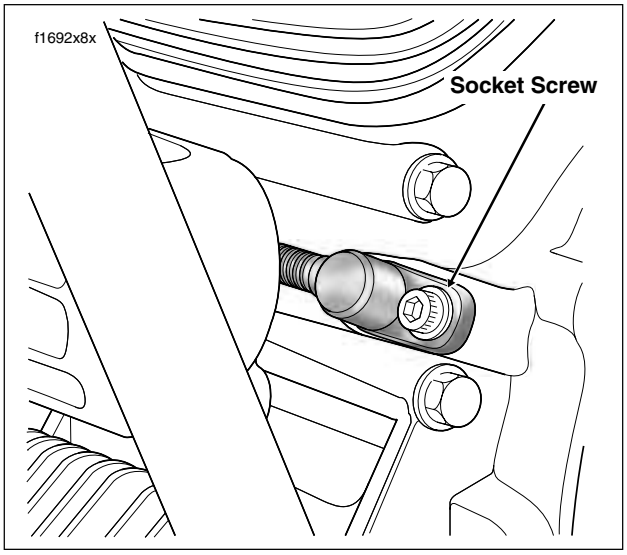



**Figure 9-11. Remove Sensor Mount Socket Screw**

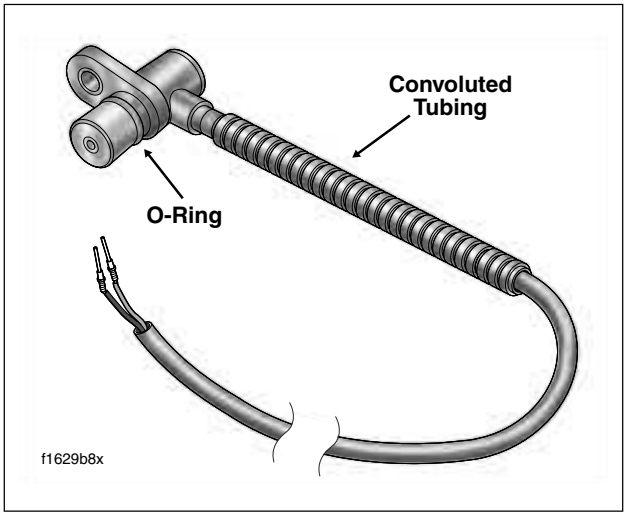



**Figure 9-12. Crankshaft Position Sensor**

*NOTE*

*For instructions on properly removing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.1 DEUTSCH ELECTRICAL CONNECTORS, REMOVING/INSTALLING PINS.*

3. Obtain a length of strong flexible wire for use as mechanics wire.

*NOTE*

*Be sure that mechanics wire is of sufficient strength to pull terminals and cable through conduit without breaking. Wire length must also be long enough so that free end is not lost in conduit when pulled.*

4. Attach mechanics wire to pin side of crankshaft position sensor cable and carefully draw cable and pin terminals through conduit. When pin terminals exit conduit, remove mechanics wire.
5. Moving to left side of vehicle, remove allen head socket screw to free crankshaft position sensor mount from forward left side of crankcase. Pull sensor from bore. See Figure 9-11.
6. Carefully pull sensor to draw cable and pin terminals under oil filter mount to left side of crankcase. See Figure 9-12.
7. Remove convoluted tubing from crankshaft position sensor cable.

### INSTALLATION

1. Place **new** crankshaft position sensor next to discarded unit and cut wires to proper length.
2. Crimp **new** pin terminals on crankshaft position sensor wires.

*NOTE*

*See APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.1 DEUTSCH ELECTRICAL CONNECTORS, SOLID BARREL CONTACT CRIMPING INSTRUCTIONS.*

3. Install convoluted tubing onto crankshaft position sensor cable. See Figure 9-12.
4. Standing on left side of vehicle, route crankshaft position sensor cable under oil filter mount to right side of crankcase.
5. Install **new** O-ring in groove on sensor body. Apply a thin film of clean H-D 20W50 engine oil to O-ring before installation.
6. Push sensor into bore aligning hole in sensor mount with hole in spot face. Install allen head socket screw and tighten to 90-120 **in-lbs** (10.2-13.6 Nm). See Figure 9-11.
7. Moving to right side of vehicle, locate end of mechanics wire exiting conduit and attach to pin side of crankshaft position sensor cable. Carefully pull pin terminals and cable back through conduit and then remove mechanics wire.
8. Install terminals into pin housing of 2-place Mini-Deutsch connector. See the table below for pin locations and wire colors.

## Table 9-2. Crankshaft Position Sensor [79]

| Wire Color | Chamber Number |
|---|---|
| Red | 1 |
| Black | 2 |

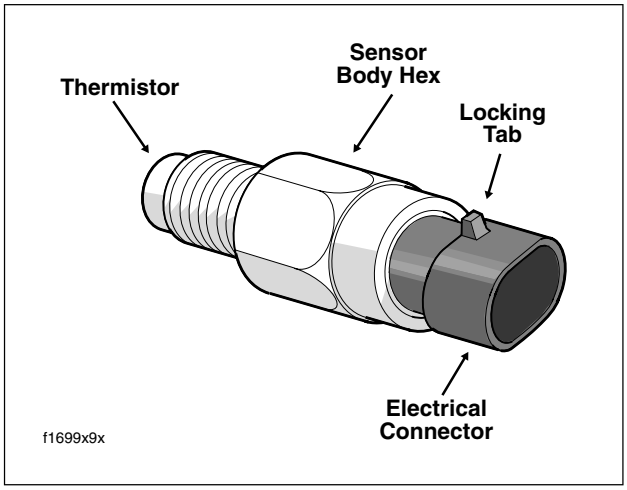



**Figure 9-13. Engine Temperature Sensor**

*NOTE*

*For instructions on properly installing wire terminals, see APPENDIX B, ELECTRICAL CONNECTOR SERVICE AND REPAIR, SECTION B.1 DEUTSCH ELECTRICAL CONNECTORS, REMOVING/INSTALLING PINS.*

9. Draw conduit and connectors downward between rear brake master cylinder reservoir and frame downtube to inboard side of lower frame tube.
10. See CAMSHAFT POSITION SENSOR, INSTALLATION, in this section, steps 10-22.

# ENGINE TEMPERATURE SENSOR

### REMOVAL

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠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.**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. On left side of vehicle, pull back boot to reveal engine temperature sensor at back of front cylinder.
4. Pull external latch outward and use rocking motion to remove connector.
5. Slide a 3/4 inch deepwell socket over the sensor hex and turn counter-clockwise to loosen. See Figure 9-13. When sensor turns easily, pull out the deepwell socket and remove sensor by hand.

## Installation

1. Hand start threaded end of **new** temperature sensor into cylinder head bore.
2. Slide 3/4 inch deepwell socket over sensor hex and tighten to 10-12 ft-lbs (14-16 Nm).
3. Align latch on socket housing with locking tab on pin housing and push connector halves together until latch clicks.
4. Pull boot over sensor to keep out dirt and debris.
5. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
6. Install seat. See Section 2.21 SEAT, INSTALLATION.

# FUEL TANK ASSEMBLY 9.3

## GENERAL

See Figure 9-14. The fuel pump, fuel filter canister and fuel level sender are attached to the canopy for easy removal and installation. The act of raising the canopy automatically removes these items, thereby eliminating those tasks which used to be performed by reaching inside the fuel tank. This arrangement minimizes the possibility of dropping or losing parts inside the tank, or adding contaminants (such as grease and oil) to the fuel supply.

The fuel tank assembly consists of the following components:

- Fuel Tank
- Canopy
- Fuel Filter Canister
- Fuel Pump
- Fuel Level Sender
- Low Fuel Level Warning Lamp
- Fuel Supply/Return Check Valves

## FLHTC/U-I, FLTR-I

### COMPLETE REMOVAL

**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.**

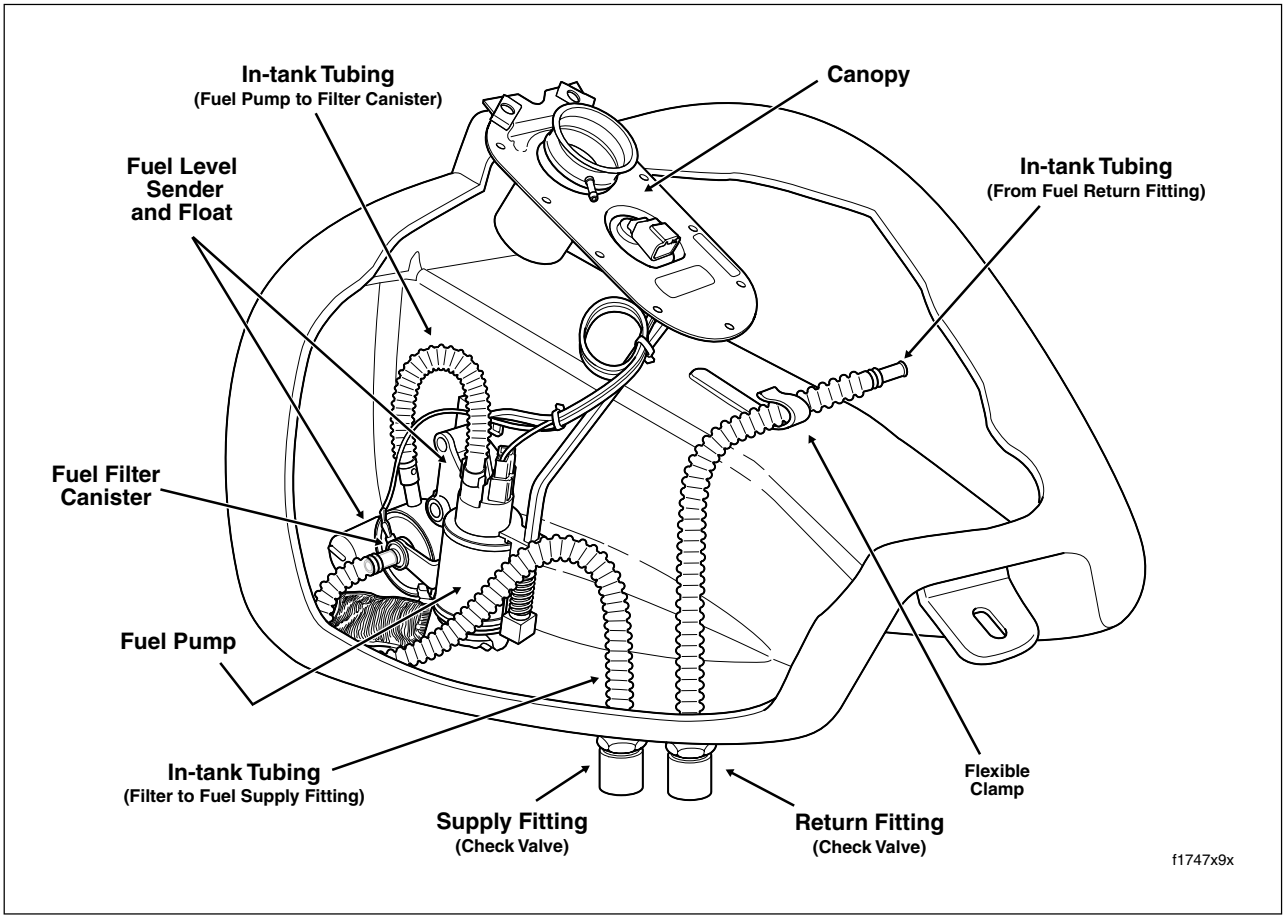



**Figure 9-14. Fuel Tank Assembly (FLHTC/U-I, FLTR-I)**

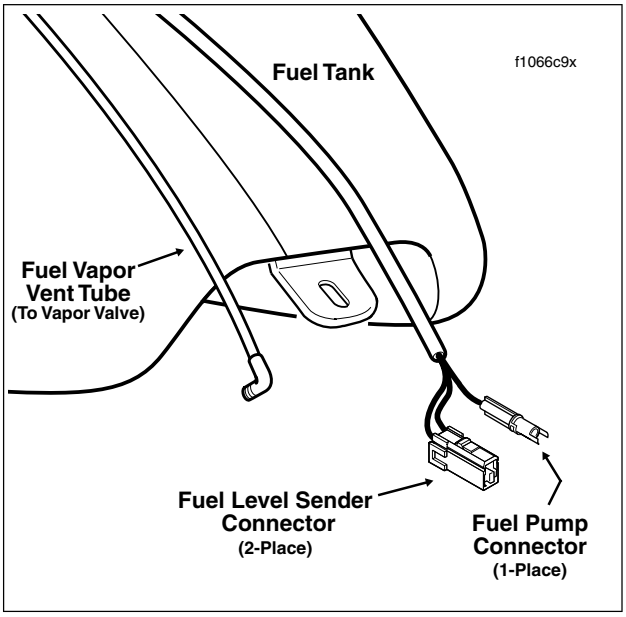



**Figure 9-15. Fuel Pump/Fuel Level Sender Main Harness Connectors**

**⚠WARNING**

**Gasoline will drain from the crossover hose when disconnected from the fuel tank. Thoroughly wipe up any spilled fuel immediately. Dispose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.**

**CAUTION**

**Do not kink crossover hose or crimp shut using pliers or similar tool. Damage to the rigid inner lining will occur.**

1. Drain fuel tank as follows:

Obtain a short section of hose (5/16 inch I.D.). Insert bolt in one end of hose and install hose clamp to ensure that end is securely plugged. Using a side cutters, cut clamp from one end of crossover hose beneath fuel tank. Quickly replace crossover hose on fuel tank fitting with open end of short hose while directing flow of gasoline from free end of crossover hose into suitable container.

2. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠WARNING**

**The gasoline in the fuel supply line downstream of the fuel pump is under high pressure (43.5 psi). To avoid an uncontrolled discharge or spray of gasoline, always purge the system of high pressure gas before the fuel supply line is disconnected. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.**

3. Purge the fuel supply lines of high pressure gas. Proceed as follows:

   a. Disconnect fuel pump from main harness. Locate the black one-place electrical connector in front of battery. Pull both external latches outward to separate pin and socket halves. See Figure 9-15.

   b. Start the engine and allow the vehicle to run.

   c. When the engine stalls, operate starter for 3 seconds to remove remaining fuel from fuel lines.

**⚠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.**

4. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.

5. Carefully cut anchored cable strap securing main harness bundles, console pod conduit (Ultra models only), fuel pump/fuel level sender conduit, and fuel vapor vent tube to left frame tube.

6. Open console door. Remove two Allen head screws inboard of rubber bumpers. These screws secure console pod to clip nuts on the canopy bracket.

7. Remove Allen head screw to detach flange at rear of console pod from bracket welded to fuel tank.

8. Disconnect 2-place Multilock connector in front of battery to release fuel level sender from main harness. See Figure 9-15.

9. Lay a clean shop cloth on forward part of rear fender. Remove filler cap from neck of fuel tank. Remove console pod and lay upside down on shop cloth. Reinstall filler cap.

10. Pull fuel vapor vent tube from nipple on filler neck of fuel tank.

**⚠WARNING**

**A small amount of gasoline may drain from the fuel supply and return lines when disconnected from the fuel tank. Thoroughly wipe up any spilled fuel immediately. Dispose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.**

11. Pull up on chrome sleeve of quick-connect fitting (forward fitting on left side of fuel tank) and pull down on fuel supply line to disconnect. Repeat step to release fuel return line (rearward fitting). See Figure 9-16.

*NOTE*

*If fairing lowers are absent, proceed to step 15.*

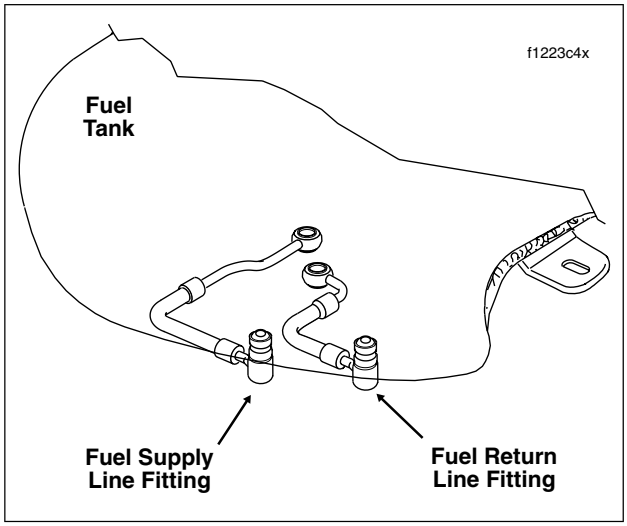



**Figure 9-16. Fuel Supply/Return Line Fittings**

12. Remove two screws from fairing lower cap.
13. Remove two locknuts to free retainer from upper rail of engine guard. From within glove box, remove U-bolt. Remove glove box from fairing lower.
14. Repeat steps 12 and 13 on opposite side of vehicle.
15. Using a T40 TORX drive head, remove two fuel tank front mounting bolts (with flat washers) from left and right side of frame. Remove bolt (with flat washer) to free rear of fuel tank from frame backbone.
16. Remove fuel tank from vehicle.

## INSTALLATION (AFTER COMPLETE REMOVAL)

**CAUTION**

**Exercise caution to avoid pinching the wiring harness between the fuel tank and vehicle frame. Wire damage may result in electrical problems.**

1. Work fuel tank into position aligning front flange holes with those in frame.
2. Slide **new** clamp onto free end of crossover hose. Running hose beneath frame backbone, install hose onto fitting at bottom front of fuel tank (after removing temporary plug). Crimp clamp.
3. Using a T40 TORX drive head, start fuel tank front mounting bolts (with flat washers) into left and right side of frame.
4. Install bolt (with flat washer) to secure rear of fuel tank to frame backbone. Tighten bolt to 6 ft-lbs (8 Nm).
5. Tighten fuel tank front mounting bolts to 15-18 ft-lbs (20-24 Nm).

*NOTE*

*If fairing lowers are absent, proceed to step 9.*

6. Place glove box into fairing lower. From within glove box, install U-bolt so that it encircles the upper rail of the engine guard. Loosely install retainer and locknuts.
7. Adjust fairing lower so that ear at top inboard side is approximately 1/4 inch from frame downtube. Tighten locknuts to 6 ft-lbs (8 Nm). Install two screws to secure fairing lower cap to fairing lower.
8. Repeat steps 6 and 7 on opposite side of vehicle.

**⚠WARNING**

**To avoid an uncontrolled discharge or spray of gasoline, always be sure the quick-connect fittings are properly mated. A slight tug on the fuel supply and return lines will verify this condition. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.**

9. Pull up on chrome sleeve of quick-connect fitting (forward fitting on left side of tank) and insert neck of fuel supply line fitting. While pushing up on bottom of fuel supply line fitting, pull down on chrome sleeve until it “clicks” into the locked position. Tug on fuel supply line to be sure that it will not come free. Repeat step to install fuel return line (rearward fitting).
10. Connect fuel vapor vent tube to nipple on filler neck of fuel tank.
11. Remove filler cap. Position console pod on canopy. Route cables from beneath console pod as shown in Figure 9-17. Be sure that hoses and wires are not pinched by the console pod during installation. Reinstall filler cap.
12. Install Allen head screw to fasten rear flange of console pod to welded bracket on fuel tank.
13. Open door on console pod. Install two Allen head screws to secure front of console pod to clip nuts on canopy bracket.
14. Connect the fuel pump and fuel level sender to the main harness. Locate the one-place (pump) and 2-place (sender) electrical connectors in front of battery. See Figure 9-15. Press pin and socket halves of connectors together until they snap in place.
15. Snap anchor of **new** cable strap into hole on left side of frame. Tighten cable strap to capture main harness bundles, console pod conduit (Ultra models only), fuel pump/fuel level sender conduit, and fuel vapor vent tube along left frame tube. See Figure 9-17. Cut any excess cable strap material.

*NOTE*

*Route fuel overflow hose inboard of wire bundles on right side of frame, but do not capture in cable straps.*

16. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).

17. To synchronize the ECM and idle speed control actuator, Key ON for 5 seconds and then Key OFF for 10 seconds. Repeat this step a second time.

*NOTE*

*"Key ON" means only that the Ignition/Light Key Switch is turned to IGNITION and the handlebar Engine Stop Switch is in the RUN position (although the engine is NOT running).*

18. Install seat. See Section 2.21 SEAT, INSTALLATION.

## PARTIAL REMOVAL

**⚠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.**

1. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠WARNING**

**The gasoline in the fuel supply line downstream of the fuel pump is under high pressure (43.5 psi). To avoid an uncontrolled discharge or spray of gasoline, always purge the system of high pressure gas before the fuel supply line is disconnected. Inadequate safety precautions could result in death or serious injury.**

2. Purge the fuel supply lines of high pressure gas. Proceed as follows:

   a. Disconnect fuel pump from main harness. Locate the black one-place electrical connector in front of battery. Pull both external latches outward to separate pin and socket halves. See Figure 9-15.

   b. Start the engine and allow the vehicle to run.

   c. When the engine stalls, operate starter for 3 seconds to remove remaining fuel from fuel lines.

**⚠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. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.

4. Carefully cut anchored cable strap securing main harness bundles, console pod conduit (Ultra models only), fuel pump/fuel level sender conduit, and fuel vapor vent tube to left frame tube.

5. Open console door. Remove two forward Allen head screws inboard of rubber bumpers. These screws secure console pod to clip nuts on the canopy bracket.

6. Remove one Allen head screw to detach flange at rear of console pod from bracket welded to fuel tank.

7. Disconnect 2-place Multilock connector in front of battery to release fuel level sender from main harness. See Figure 9-15.

8. Lay a clean shop towel on forward part of rear fender. Remove filler cap from neck of fuel tank. Remove console pod and lay upside down on shop towel. Reinstall filler cap.

9. Pull fuel vapor vent tube from fitting on filler neck of fuel tank.

**⚠WARNING**

**A small amount of gasoline may drain from the fuel supply and return lines when disconnected from the fuel tank. Thoroughly wipe up any spilled fuel immediately. Dispose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.**

10. Pull up on chrome sleeve of quick-connect fitting (forward fitting on left side of fuel tank) and pull down on fuel supply line to disconnect. Repeat step to release fuel return line (rearward fitting). See Figure 9-16.

*N OTE*

*If fairing lowers are absent, proceed to step 14.*

11. Remove two screws from fairing lower cap.

12. Remove two locknuts to free retainer from upper rail of engine guard. From within glove box, remove U-bolt. Remove glove box from fairing lower.

13. Repeat steps 11 and 12 on opposite side of vehicle.

14. Using a T40 TORX drive head, remove two fuel tank front mounting bolts (with flat washers) from left and right side of frame. Remove bolt (with flat washer) to free rear of fuel tank from frame backbone.

15. Remove two bolts with flat washers to free rear end of fuel tank from frame. Remove fuel tank front mounting bolt (with flat washers and locknut).

16. Raise the fuel tank approximately 2 inches. Unplug the spark plug cable from the front cylinder and move the fuel tank crossover hose to the rear of the ignition coil, so that the tank can be raised an additional 2-3 inches. Move fuel tank straight back and rest on frame backbone.
17. Obtain several 1 x 2 inch wooden blocks. Raise front and rear of fuel tank off the frame backbone by placing blocks in tunnel at bottom of tank.

## INSTALLATION (AFTER PARTIAL REMOVAL)

1. Remove wooden blocks and move fuel tank toward its installed position. While positioning fuel tank, move crossover hose in front of ignition coil and connect spark plug cable to front cylinder. Work fuel tank into position aligning front flange holes with those in frame.
2. Using a T40 TORX drive head, start fuel tank front mounting bolts (with flat washers) into left and right side of frame.
3. Install bolt (with flat washer) to secure rear of fuel tank to frame backbone. Tighten bolt to 6 ft-lbs (8 Nm).
4. Tighten fuel tank front mounting bolts to 15-18 ft-lbs (20-24 Nm).

*NOTE*

*If fairing lowers are absent, proceed to step 8.*

5. Place glove box into fairing lower. From within glove box, install U-bolt so that it encircles the upper rail of the engine guard. Loosely install retainer and locknuts.
6. Adjust fairing lower so that ear at top inboard side is approximately 1/4 inch from frame downtube. Tighten locknuts to 6 ft-lbs (8 Nm). Install two screws to secure fairing lower cap to fairing lower.
7. Repeat steps 5 and 6 on opposite side of vehicle.

**⚠WARNING**

**To avoid an uncontrolled discharge or spray of gasoline, always be sure the quick-connect fittings are properly mated. A slight tug on the fuel supply and return lines will verify this condition. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.**

8. Pull up on chrome sleeve of quick-connect fitting (forward fitting on left side of tank) and insert neck of fuel supply line fitting. While pushing up on bottom of fuel supply line fitting, pull down on chrome sleeve until it “clicks” into the locked position. Tug on fuel supply line to be sure that it will not come free. Repeat step to install fuel return line (rearward fitting).
9. Connect fuel vapor vent tube to fitting on filler neck of fuel tank.
10. Remove filler cap. Position console pod on canopy. Route cables from beneath console pod as shown in Figure 9-17. Be sure that hoses and wires are not pinched by the console pod during installation. Reinstall filler cap.
11. Install Allen head screw to fasten rear flange of console pod to welded bracket on fuel tank.
12. Open door on console pod. Install two Allen head screws inboard of rubber bumpers to secure front of console pod to clip nuts on canopy bracket.
13. Connect the fuel pump and fuel level sender to the main harness. Locate the one-place (pump) and 2-place (sender) electrical connectors in front of battery. See Figure 9-15. Mate pin and socket halves of connectors.
14. Snap anchor of **new** cable strap into hole on left side of frame. Tighten cable strap to capture main harness bundles, console pod conduit (Ultra models only), fuel pump/fuel level sender conduit, and fuel vapor vent tube along left frame tube. Cut any excess cable strap material. See Figure 9-17.

*NOTE*

*Route fuel overflow hose inboard of wire bundles on right side of frame, but do not capture in cable straps.*

15. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
16. To synchronize the ECM and idle speed control actuator, Key ON for 5 seconds and then Key OFF for 10 seconds. Repeat this step a second time.

*NOTE*

*“Key ON” means only that the Ignition/Light Key Switch is turned to IGNITION and the handlebar Engine Stop Switch is in the RUN position (although the engine is NOT running).*

17. Install seat. See Section 2.21 SEAT, INSTALLATION.

# FLHR/C-I

## COMPLETE REMOVAL

1. See Section 9.3 FUEL TANK ASSEMBLY, FUEL TANK, COMPLETE REMOVAL, FLHTC/U-I, FLTR-I, steps 1-4.
2. Carefully cut anchored cable strap securing main harness bundles, instrument console conduit, fuel pump/fuel level sender conduit, and fuel vapor vent tube to left frame tube.
3. Remove acorn nut and Phillips screw (with large flat washer) from instrument console. Remove console.

**CAUTION**

**Exercise caution to avoid damaging speedometer unit when removing instrument console. Wrap console in a clean, dry shop towel. Secure to top of rear fender using bungee cords to prevent any possible damage.**

4. Remove console mounting bolt from slot at top of canopy.
5. Pull fuel vapor vent tube from fitting on canopy.
6. Disconnect 2-place Multilock connector in front of battery to release fuel level sender from main harness. See Figure 9-15.
7. At bottom left side of fuel tank, bend back flexible clamp to free fuel gauge conduit. Gently pull on conduit to draw 4-place Multilock out of tunnel. Disconnect fuel gauge from main harness.

**⚠WARNING**

**A small amount of gasoline may drain from the fuel supply and return lines when disconnected from the fuel tank. Thoroughly wipe up any spilled fuel immediately. Dispose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.**

8. Pull up on chrome sleeve of quick-connect fitting (forward fitting on left side of fuel tank) and pull down on fuel supply line to disconnect. Repeat step to release fuel return line (rearward fitting).
9. Using a T40 TORX drive head, remove two fuel tank front mounting bolts (with flat washers) from left and right side of frame. Remove bolt (with flat washer) to free rear of fuel tank from frame backbone.
10. Remove fuel tank from vehicle.

## INSTALLATION (AFTER COMPLETE REMOVAL)

1. Work fuel tank into position aligning front flange holes with those in frame.
2. Slide **new** clamp onto free end of crossover hose. Running hose beneath frame backbone, install hose onto fitting at bottom front of fuel tank (after removing temporary plug). Crimp clamp.
3. Using a T40 TORX drive head, start fuel tank front mounting bolts (with flat washers) into left and right side of frame.
4. Install bolt (with flat washer) to secure rear of fuel tank to frame backbone. Tighten bolt to 6 ft-lbs (8 Nm).
5. Tighten fuel tank front mounting bolts to 15-18 ft-lbs (20-24 Nm).

**⚠WARNING**

**To avoid an uncontrolled discharge or spray of gasoline, always be sure the quick-connect fittings are properly mated. A slight tug on the fuel supply and return lines will verify this condition. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.**

6. Pull up on chrome sleeve of quick-connect fitting (forward fitting on left side of tank) and insert neck of fuel supply line fitting. While pushing up on bottom of fuel supply line fitting, pull down on chrome sleeve until it “clicks” into the locked position. Tug on fuel supply line to be sure that it will not come free. Repeat step to install fuel return line (rearward fitting).
7. Connect fuel vapor vent tube to fitting at top of canopy.
8. Slide head of console mounting bolt into slot at top of canopy. Align hole in console with mounting bolt and place into position.
9. Install acorn nut on mounting bolt and tighten. Install Phillips screw (with large flat washer) and tighten.
10. Connect fuel pump and fuel level sender to main harness. Locate the one-place (pump) and 2-place (sender) electrical connectors in front of battery. Mate pin and socket halves of connectors. See Figure 9-15.
11. Connect fuel gauge to main harness. At bottom left side of fuel tank, mate pin and socket halves of 4-place Multilock connector. Feed connector into tunnel capturing conduit in flexible clamp at bottom of tank.
12. Snap anchor of **new** cable strap into hole on left side of frame. Tighten cable strap to capture main harness bundles, instrument console conduit, fuel pump/fuel level sender conduit, and fuel vapor vent tube along left frame tube. Cut any excess cable strap material. See Figure 9-17.

*NOTE*

*Route fuel overflow hose inboard of wire bundles on right side of frame, but do not capture in cable straps.*

13. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
14. To synchronize the ECM and idle speed control actuator, Key ON for 5 seconds and then Key OFF for 10 seconds. Repeat this step a second time.

*NOTE*

*“Key ON” means only that the Ignition/Light Key Switch is turned to IGNITION and the handlebar Engine Stop Switch is in the RUN position (although the engine is NOT running).*

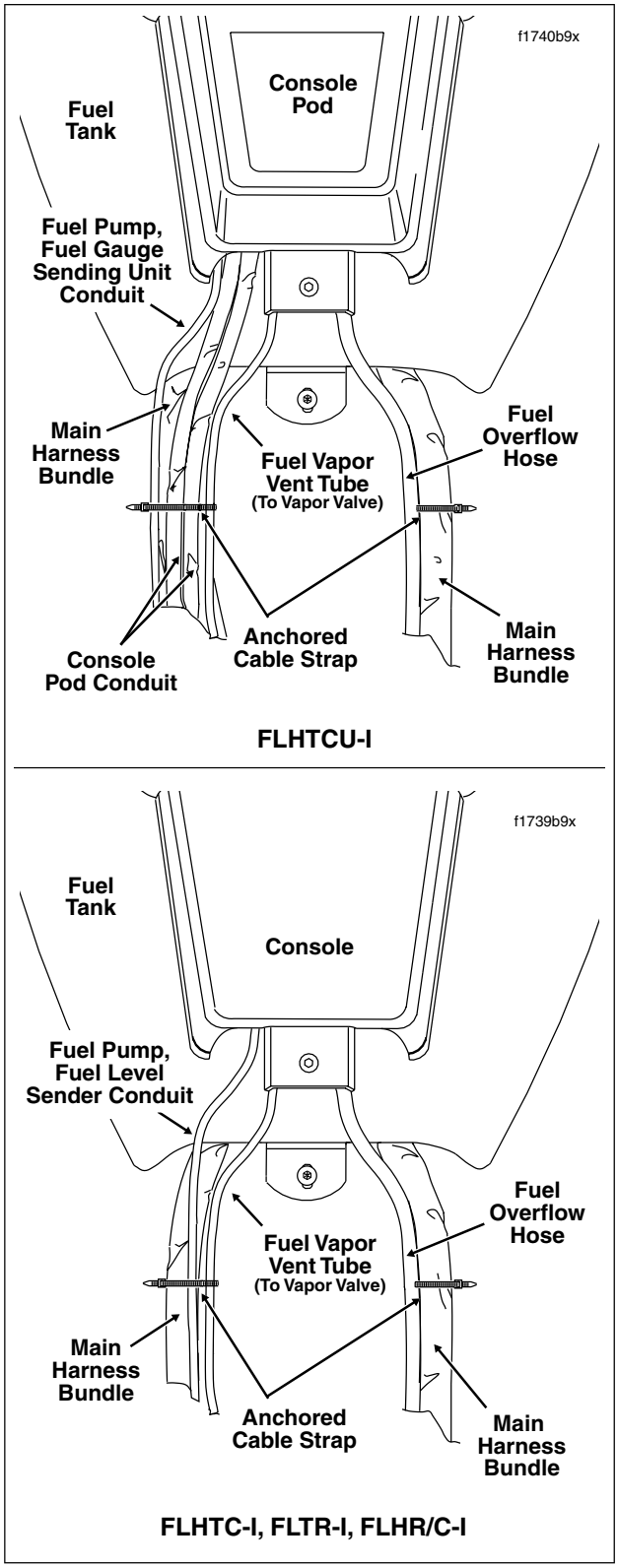



**Figure 9-17. Console Pod Cable/Hose Routing (Top View)**

15. Install seat. See Section 2.21 SEAT, INSTALLATION.

## PARTIAL REMOVAL

1. See Section 9.3 FUEL TANK ASSEMBLY, FUEL TANK, PARTIAL REMOVAL, FLHTC/U-I, FLTR-I, steps 1-3.
2. Carefully cut anchored cable strap securing main harness bundles, instrument console conduit, fuel pump/fuel level sender conduit, and fuel vapor vent tube to left frame tube.
3. Remove acorn nut and Phillips screw (with large flat washer) from instrument console. Remove console.

**CAUTION**

**When removing instrument console, exercise caution to avoid damaging speedometer unit. Wrap console in a clean, dry shop towel. Secure to top of rear fender using bungee cords to prevent any possible damage.**

4. Remove console mounting bolt from slot at top of canopy.
5. Pull fuel vapor vent tube from fitting on canopy.
6. Disconnect 2-place Multilock connector in front of battery to release fuel level sender from main harness. See Figure 9-15.
7. At bottom left side of fuel tank, bend back flexible clamp to free fuel gauge conduit. Gently pull on conduit to draw 4-place Multilock out of tunnel. Disconnect fuel gauge from main harness.

**⚠WARNING**

**A small amount of gasoline will drain from the fuel supply and return lines when disconnected from the fuel tank. Thoroughly wipe up any spilled fuel immediately. Dispose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.**

8. Pull up on chrome sleeve of quick-connect fitting (forward fitting on left side of fuel tank) and pull down on fuel supply line to disconnect. Repeat step to release fuel return line (rearward fitting). See Figure 9-16.
9. Using a T40 TORX drive head, remove two fuel tank front mounting bolts (with flat washers) from left and right side of frame. Remove bolt (with flat washer) to free rear of fuel tank from frame backbone.
10. Raise the fuel tank approximately 2 inches. Unplug the spark plug cable from the front cylinder and move the fuel tank crossover hose to the rear of the ignition coil, so that the tank can be raised an additional 2-3 inches. Move fuel tank straight back and rest on frame backbone.

11. Obtain several 1 x 2 inch wooden blocks. Raise front and rear of fuel tank off the frame backbone by placing blocks in tunnel at bottom of tank.

## INSTALLATION (AFTER PARTIAL REMOVAL)

1. Remove wooden blocks and move fuel tank toward its installed position. While positioning fuel tank, move crossover hose in front of ignition coil and connect spark plug cable to front cylinder.
2. Work fuel tank into position aligning front flange holes with those in frame.
3. Using a T40 TORX drive head, start fuel tank front mounting bolts (with flat washers) into left and right side of frame.
4. Install bolt (with flat washer) to secure rear of fuel tank to frame backbone. Tighten bolt to 6 ft-lbs (8 Nm).
5. Tighten fuel tank front mounting bolts to 15-18 ft-lbs (20-24 Nm).

**⚠WARNING**

**To avoid an uncontrolled discharge or spray of gasoline, always be sure the quick-connect fittings are properly mated. A slight tug on the fuel supply and return lines will verify this condition. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.**

6. Pull up on chrome sleeve of quick-connect fitting (forward fitting on left side of tank) and insert neck of fuel supply line fitting. While pushing up on bottom of fuel supply line fitting, pull down on chrome sleeve until it "clicks" into the locked position. Tug on fuel supply line to be sure that it will not come free. Repeat step to install fuel return line (rearward fitting).
7. Connect fuel vapor vent tube to fitting at top of canopy.
8. Slide head of console mounting bolt into slot at top of canopy. Align hole in console with mounting bolt and place into position.
9. Install acorn nut on mounting bolt and tighten. Install Phillips screw (with large flat washer) and tighten.
10. Connect fuel pump and fuel level sender to main harness. Locate the one-place (pump) and 2-place (sender) electrical connectors in front of battery. Mate pin and socket halves of connectors. See Figure 9-15.
11. Connect fuel gauge to main harness. At bottom left side of fuel tank, mate pin and socket halves of 4-place Multilock connector. Feed connector into tunnel capturing conduit in flexible clamp at bottom of tank.
12. Snap anchor of **new** cable strap into hole on left side of frame. Tighten cable strap to capture main harness bundles, instrument console conduit, fuel pump/fuel level sender conduit, and fuel vapor vent tube along left frame tube. Cut any excess cable strap material. See Figure 9-17.

*NOTE*

*Route fuel overflow hose inboard of wire bundles on right side of frame, but do not capture in cable straps.*

13. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
14. To synchronize the ECM and idle speed control actuator, Key ON for 5 seconds and then Key OFF for 10 seconds. Repeat this step a second time.

*NOTE*

*"Key ON" means only that the Ignition/Light Key Switch is turned to IGNITION and the handlebar Engine Stop Switch is in the RUN position (although the engine is NOT running).*

15. Install seat. See Section 2.21 SEAT, INSTALLATION.

# CONSOLE POD/CANOPY

## FLHTC/U-I, FLTR-I

### REMOVAL

**⚠WARNING**

**Gasoline will drain from the crossover hose when disconnected from the fuel tank. Thoroughly wipe up any spilled fuel immediately. Dispose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.**

**CAUTION**

**Do not kink crossover hose or crimp shut using pliers or similar tool. Damage to the rigid inner lining will occur.**

1. Drain fuel tank as follows:

   Obtain a short section of hose (5/16 inch I.D.). Insert bolt in one end of hose and install hose clamp to ensure that end is securely plugged. Cut clamp from one end of crossover hose beneath fuel tank. Quickly replace crossover hose on fuel tank fitting with open end of short hose while directing flow of gasoline from free end of crossover hose into suitable container.
2. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠WARNING**

**The gasoline in the fuel supply line downstream of the fuel pump is under high pressure (43.5 psi). To avoid an uncontrolled discharge or spray of gasoline, always purge the system of high pressure gas before the fuel supply line is disconnected. Inadequate safety precautions could result in death or serious injury.**

3. Purge the fuel supply lines of high pressure gas. Proceed as follows:

   a. Unsnap the one-place electrical connector in front of battery to disconnect fuel pump from main harness. Simultaneously pull both external latches outward to separate pin and socket halves. See Figure 9-15.

   b. Start the engine and allow the vehicle to run.

   c. When the engine stalls, operate starter for 3 seconds to remove remaining fuel from fuel lines.

**⚠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.**

4. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.

5. Carefully cut anchored cable strap securing main harness bundles, console pod conduit (Ultra models only), fuel pump/fuel level sender conduit, and fuel vapor vent tube to left frame tube.

6. Open console door. Remove two Allen head screws inboard of rubber bumpers. These screws secure console pod to clip nuts on the canopy bracket.

7. Remove Allen head screw to detach flange at rear of console pod from bracket welded to fuel tank.

8. Disconnect 2-place Multilock connector in front of battery to release fuel level sender from main harness. See Figure 9-15.

9. Lay a clean shop towel on forward part of the rear fender. Remove filler cap from neck of fuel tank. Remove console pod and lay upside down on shop towel. Reinstall filler cap.

10. Carefully ease fuel vapor vent tube from fitting on filler neck of fuel tank.

11. At top of canopy, depress button on socket side of 3-place Mini-Deutsch connector and remove fuel tank harness from vehicle.

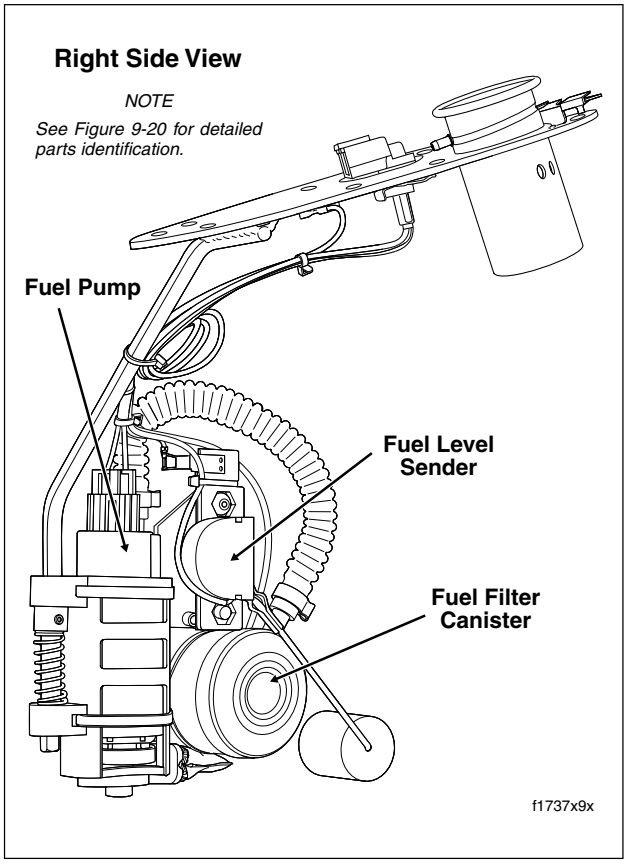



**Figure 9-18. Pump/Filter/Fuel Level Sender Assembly (FLHTC/U-I, FLTR-I)**

12. Using a T20 TORX bit, remove ten TORX screws around the outer edge of the canopy.

13. Raise canopy to access fitting on left side of fuel filter canister (outlet port). Using a side cutters, cut hose clamp and remove convoluted tube from fitting. Exercise caution to avoid cutting or damaging tube.

14. Remove canopy from fuel tank (with attached fuel filter canister, fuel pump and fuel level sender). See Figure 9-18. Remove and discard canopy gasket.

## INSTALLATION

1. Obtain **new** canopy gasket. Note that one end of gasket is wider than the other. With the wider end toward the front of the vehicle, align the holes in the gasket with those in the fuel tank.

**CAUTION**

**If float rod of fuel level sender contacts pump-to-filter tube after assembly, erroneous gauge readings will result.**

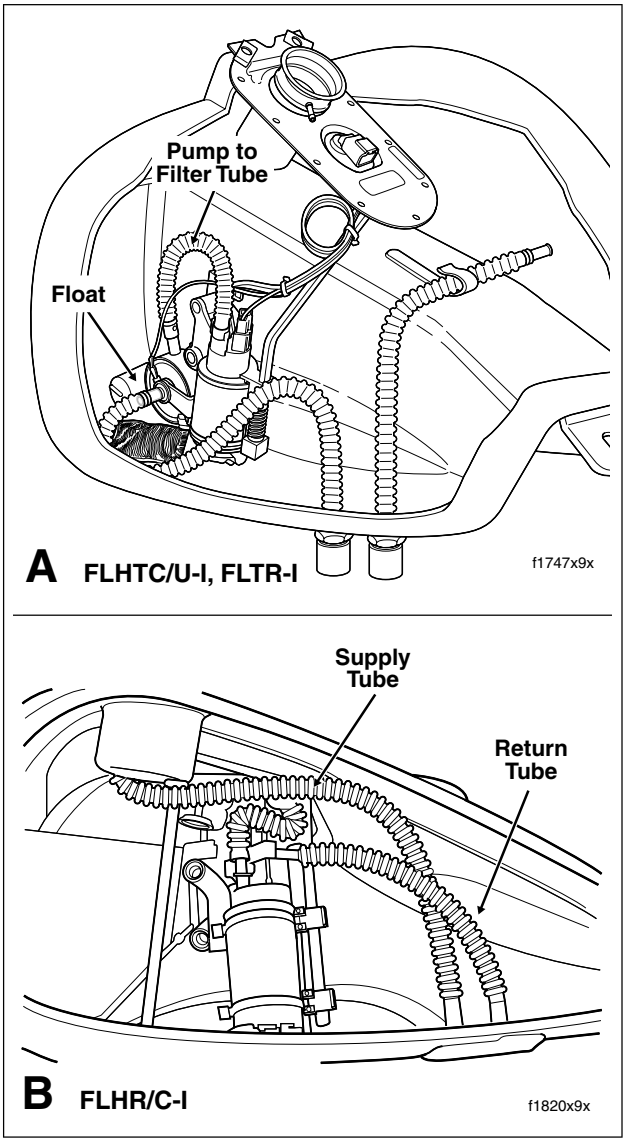



**Figure 9-19. Verify Routing of In-Tank Tubes**

2. Hold canopy upright by fuel filler neck, so that float rod on fuel level sender is extended. Raise float rod to determine if contact is made with pump-to-filter tube. See A of Figure 9-19.

*NOTE*

*If contact is made, remove hose clamp from filter inlet port and turn tube as necessary to coil or twist away from float rod. Install new hose clamp at filter inlet port when finished.*

**CAUTION**

**Exercise care to avoid bending float rod of fuel level sender during installation. A bent float rod will result in erroneous gauge readings.**

3. Partially insert assembly into forward left side cavity of fuel tank.

**CAUTION**

**Carefully inspect end of convoluted tube for cuts, tears, holes or other damage. Replace tube if any damage is found. Even the smallest hole can cause a reduction in fuel pressure.**

4. Slide **new** hose clamp onto free end of convoluted tube. Install tube onto fitting on left side of fuel filter canister (outlet port). Crimp clamp.
5. Fully insert assembly into fuel tank until fuel pump is resting flat on the bottom. While pushing down on the canopy to activate the bottom-sensing spring, align holes in canopy with those in gasket.

**⚠WARNING**

**Always use new sealing screws when installing canopy. Reusing old canopy screws can compromise sealing integrity and result in gas leaks. Gasoline is extremely flammable and highly explosive. Reusing old canopy screws could result in death or serious injury.**

6. Hand start ten **new** TORX screws in perimeter of canopy. Using a T20 TORX bit, alternately tighten screws to 15-20 **in-lbs** (1.7-2.3 Nm) in a crosswise pattern.
7. Connect fuel vapor vent tube to fitting on filler neck of fuel tank.
8. Mate pin and socket halves of 3-place Mini-Deutsch connector to install fuel tank harness at top of canopy.
9. Remove filler cap. Position console pod on canopy. Route cables from beneath console pod as shown in Figure 9-17. Be sure that hoses and wires are not pinched by the console pod during installation. Reinstall filler cap.
10. Install Allen head screw to fasten rear flange of console pod to welded bracket on fuel tank. Be sure that hoses and wires are not pinched by the console pod, but make a clean exit via the rounded cuts on each side of the flange.
11. Open door on console pod. Install two Allen head screws to secure front of console pod to clip nuts on canopy bracket.
12. Connect the fuel pump and fuel level sender to the main harness. Locate the one-place (pump) and 2-place (sender) electrical connectors in front of battery. See Figure 9-15. Mate pin and socket halves of connectors.
13. Snap anchor of **new** cable strap into hole on left side of frame. Tighten cable strap to capture main harness bundles, console pod conduit (Ultra models only), fuel pump/fuel level sender conduit, and fuel vapor vent tube along left frame tube. See Figure 9-17. Cut any excess cable strap material.

14. Slide **new** clamp onto free end of crossover hose. Running hose beneath frame backbone, install hose onto fitting at bottom front of fuel tank. Crimp clamp.
15. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
16. To synchronize the ECM and idle speed control actuator, Key ON for 5 seconds and then Key OFF for 10 seconds. Repeat this step a second time.

*NOTE*

*"Key ON" means only that the Ignition/Light Key Switch is turned to IGNITION and the handlebar Engine Stop Switch is in the RUN position (although the engine is NOT running).*

17. Install seat. See Section 2.21 SEAT, INSTALLATION.

# INSTRUMENT CONSOLE/CANOPY

## FLHR/C-I

### REMOVAL

**⚠WARNING**

**Gasoline will drain from the crossover hose when disconnected from the fuel tank. Thoroughly wipe up any spilled fuel immediately. Dispose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.**

**CAUTION**

**Do not kink crossover hose or crimp shut using pliers or similar tool. Damage to the rigid inner lining will occur.**

1. Drain fuel tank as follows:

   Obtain a short section of hose (5/16 inch I.D.). Insert bolt in one end of hose and install hose clamp to ensure that end is securely plugged. Cut clamp from one end of crossover hose beneath fuel tank. Quickly replace crossover hose on fuel tank fitting with open end of short hose while directing flow of gasoline from free end of crossover hose into suitable container.
2. Remove seat. See Section 2.21 SEAT, REMOVAL.

**⚠WARNING**

**The gasoline in the fuel supply line downstream of the fuel pump is under high pressure (43.5 psi). To avoid an uncontrolled discharge or spray of gasoline, always purge the system of high pressure gas before the fuel supply line is disconnected. Inadequate safety precautions could result in death or serious injury.**

3. Purge the fuel supply lines of high pressure gas. Proceed as follows:

   a. Unsnap the one-place electrical connector in front of battery to disconnect fuel pump from main harness. Simultaneously pull both external latches outward to separate pin and socket halves. See Figure 9-15.

   b. Start the engine and allow the vehicle to run.

   c. When the engine stalls, operate starter for 3 seconds to remove remaining fuel from fuel lines.

**⚠WARNING**

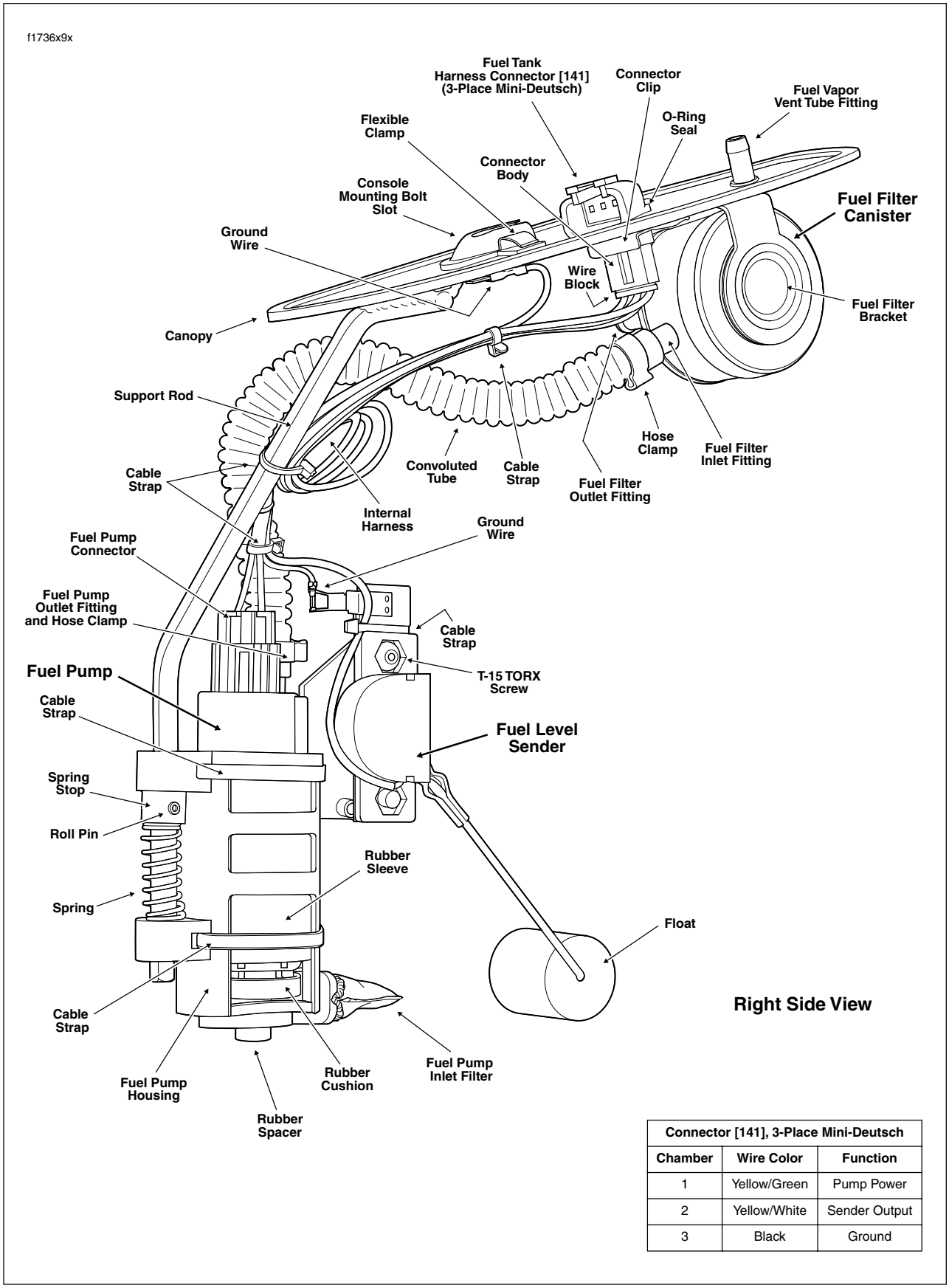
**To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.**

4. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
5. Carefully cut anchored cable strap to release main harness bundles, instrument console conduit, fuel pump/fuel level sender conduit, and fuel vapor vent tube from left frame tube.
6. Remove acorn nut and Phillips screw (with large flat washer) from instrument console. Remove console from fuel tank.

**CAUTION**

**Exercise caution to avoid damaging speedometer unit when removing instrument console. Wrap console in a clean, dry shop towel. Secure to top of rear fender using bungee cords to prevent any possible damage.**

7. Remove console mounting bolt from slot at top of canopy.
8. Pull fuel vapor vent tube from fitting at top of canopy.
9. Bend back flexible clamp at top of canopy to free fuel tank harness. Depress button on socket side of 3-place Mini-Deutsch connector and remove harness from vehicle.
10. Using a T20 TORX bit, remove ten TORX screws around the outer edge of the canopy.
11. Raise canopy slightly to access fitting on left side of fuel filter canister (outlet port). Using a side cutters, cut hose clamp and remove convoluted tube from fitting. Exercise caution to avoid cutting or damaging tube.
12. Remove canopy from fuel tank (with attached fuel filter canister, fuel pump and fuel level sender). Remove and discard canopy gasket. See Figure 9-20.




| Connector [141], 3-Place Mini-Deutsch | | |
|---|---|---|
| **Chamber** | **Wire Color** | **Function** |
| 1 | Yellow/Green | Pump Power |
| 2 | Yellow/White | Sender Output |
| 3 | Black | Ground |

**Figure 9-20. In-Tank Fuel Pump/Filter/Fuel Level Sender Assembly (FLHR/C-I)**

### INSTALLATION

1. Obtain **new** canopy gasket. Note that one end of gasket is wider than the other. With the wider end toward the front of the vehicle, align the holes in the gasket with those in the fuel tank.

**CAUTION**

**Exercise care to avoid bending float rod of fuel level sender during installation. Be sure to position float rod to the right of the fuel gauge drain tube or it will be bent during installation of the canopy. A bent float rod will result in erroneous gauge readings.**

2. Hold canopy upright so that float rod on fuel level sender is extended. Partially insert assembly into forward left side cavity of fuel tank keeping the float rod positioned to the right of the fuel gauge drain tube.

**CAUTION**

**If float rod of fuel level sender contacts supply tube after assembly, erroneous gauge readings will result.**

3. Looking into the fuel tank, verify that supply tube is routed toward the rear, so that it passes under and behind the return tube before coming forward at the top of the tunnel. Contact with the return tube (which is retained by weld clip) will hold the supply tube back away from the float rod assembly. See B of Figure 9-19.

**CAUTION**

**Carefully inspect end of convoluted tube for cuts, tears, holes or other damage. Replace tube if any damage is found. Even the smallest hole can cause a reduction in fuel pressure.**

4. Slide **new** hose clamp onto free end of convoluted tube. Install tube onto fitting on left side of fuel filter canister (outlet port). Crimp clamp.

5. Fully insert assembly into fuel tank until fuel pump is resting flat on the bottom. While pushing down on the canopy to activate the bottom-sensing spring, align holes in canopy with those in gasket.

**⚠WARNING**

**Always use new sealing screws when installing canopy. Reusing old canopy screws can compromise sealing integrity and result in gas leaks. Gasoline is extremely flammable and highly explosive. Reusing old canopy screws could result in death or serious injury.**

6. Hand start ten **new** TORX screws in perimeter of canopy. Using a T20 TORX bit, alternately tighten screws to 15-20 **in-lbs** (1.7-2.3 Nm) in a crosswise pattern.

7. Connect fuel vapor vent tube to fitting at top of canopy.

8. Mate pin and socket halves of 3-place Mini-Deutsch connector to install fuel tank harness at top of canopy. Capture harness conduit in flexible clamp.

9. Slide head of console mounting bolt into slot. Align hole in console with mounting bolt and place into position over canopy.

10. Install acorn nut on mounting bolt and tighten. Install Phillips screw (with large flat washer) and tighten.

11. Connect fuel pump and fuel level sender to main harness. Locate the one-place (pump) and 2-place (sender) electrical connectors in front of battery. Mate pin and socket halves of connectors. See Figure 9-15.

12. Snap anchor of **new** cable strap into hole on left side of frame. Tighten cable strap to capture main harness bundles, instrument console conduit, fuel pump/fuel level sender conduit, and fuel vapor vent tube along left frame tube. Cut any excess cable strap material.

13. Slide **new** clamp onto free end of crossover hose. Running hose beneath frame backbone, install hose onto fitting at bottom front of fuel tank. Crimp clamp.

14. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).

15. To synchronize the ECM and idle speed control actuator, Key ON for 5 seconds and then Key OFF for 10 seconds. Repeat this step a second time.

*NOTE*

*"Key ON" means only that the Ignition/Light Key Switch is turned to IGNITION and the handlebar Engine Stop Switch is in the RUN position (although the engine is NOT running).*

16. Install seat. See Section 2.21 SEAT, INSTALLATION.

## FUEL FILTER CANISTER

Replace the fuel filter canister every 50,000 miles. Proceed as follows:

### REMOVAL

1. See CONSOLE POD/CANOPY, REMOVAL (FLHTC/U-I, FLTR-I), or INSTRUMENT CONSOLE/CANOPY, REMOVAL (FLHR/C-I).

2. Using a side cutters, cut hose clamp and remove convoluted tube from inlet port of fuel filter canister. Exercise caution to avoid cutting or damaging tube.

*NOTE*

*Convoluted tube was removed from outlet port of fuel filter canister during canopy removal.*

3. Release fuel filter canister as follows:

**FLHR/C-I**: Using a small screwdriver, gently pry on slotted side of bracket to disengage teeth from groove in outlet port. Pull on canister until rounded side of bracket becomes free of depression at side of canister. Discard fuel filter canister.

**FLHTC/U-I, FLTR-I**: Remove retaining ring from groove in outlet port. Pull outlet port from hole in filter bracket. Discard fuel filter canister.

### INSTALLATION

**CAUTION**

**Do not replace tubes inside of fuel tank with ordinary bulk hose. All internal lines must be replaced with the special original equipment convoluted nylon tubes. Bulk hose will degrade when immersed in gasoline (particularly stale gasoline), resulting in contamination of the fuel supply. Use of contaminated fuel will cause starting and driveability problems and possible vehicle damage.**

1. If present, remove and discard plastic caps from fittings of **new** fuel filter canister.
2. Install fuel filter canister as follows:

   **FLHR/C-I**: Install fuel filter canister so that rounded side of bracket fits in depression at side of canister. Firmly push on canister until teeth on slotted side of bracket fully engage groove in outlet port.

   **FLHTC/U-I, FLTR-I**: Slide outlet port of fuel filter canister through hole in filter bracket of fuel pump housing. Install retaining ring in groove of outlet port.

**CAUTION**

**Carefully inspect end of convoluted tube for cuts, tears, holes or other damage. Replace tube if any damage is found. Even the smallest hole can cause a reduction in fuel pressure.**

3. Slide **new** hose clamp onto free end of convoluted tube (from fuel pump). Install tube onto fitting of fuel filter canister (inlet port). Since the diameter of the fitting is larger than the outlet port, use a little denatured alcohol or glass cleaner to aid installation. Crimp clamp.
4. See CONSOLE POD/CANOPY, INSTALLATION (FLHTC/U-I, FLTR-I), or INSTRUMENT CONSOLE/CANOPY, INSTALLATION (FLHR/C-I).

# FUEL PUMP

## Removal

1. See CONSOLE POD/CANOPY, REMOVAL (FLHTC/U-I, FLTR-I), or INSTRUMENT CONSOLE/CANOPY, REMOVAL (FLHR/C-I).
2. Depress external latch and remove electrical connector at top of fuel pump.
3. Remove T15 TORX screw and pull fuel level sender from post on bracket of fuel pump housing.
4. Using a side cutters, cut hose clamp and pull convoluted tube from fuel pump outlet port. Exercise caution to avoid cutting or damaging tube (and cracking or breaking outlet port).
5. On FLHTC/U-I and FLTR-I models, remove retaining ring from groove in outlet port of fuel filter canister. Pull outlet port from hole in filter bracket.
6. Using a 1/8 inch punch with a small hammer, carefully tap roll pin from pin hole in spring stop and support rod.
7. Slide fuel pump housing assembly, spring and spring stop from support rod. Discard fuel pump and housing assembly. Retain spring, spring stop and roll pin.
8. Inspect the condition of the fuel pump wiring. If the wiring needs to be replaced, see FUEL PUMP WIRING on the next page.

### INSTALLATION

1. Slide end of support rod through square holes at top and bottom of **new** fuel pump housing assembly. Before end of rod enters square hole at bottom, slide spring stop and spring onto end of support rod.
2. Align hole in spring stop with hole in support rod. Start roll pin into hole in spring stop. Using a small hammer, tap roll pin into spring stop, and then through support rod, until it approaches pin hole on opposite side. Obtain a 1/8 inch punch and carefully tap roll pin until end is flush with plastic construction.
3. On FLHTC/U-I and FLTR-I models, slide outlet port of fuel filter canister through hole in filter bracket of fuel pump housing. Install retaining ring in groove of outlet port. Verify that socket terminal of ground wire is fully installed on spade contact of retaining ring.

**CAUTION**

**Carefully inspect end of convoluted tube for cuts, tears, holes or other damage. Replace tube if any damage is found. Even the smallest hole can cause a reduction in fuel pressure.**

4. Slide **new** hose clamp onto free end of convoluted tube (to fuel filter canister inlet). Install tube onto outlet port of fuel pump. Crimp clamp, but exercise caution to avoid cracking or breaking outlet port.
5. Align two holes in fuel level sender with threaded hole and post on bracket of fuel pump housing. Install T15 TORX screw in upper hole and tighten to 25-45 **in-lbs** (2.8-5.1 Nm).

6. Install electrical connector at top of fuel pump. Gently tug on connector to verify that external latch is locked and connector will not come free of terminals.

7. See CONSOLE POD/CANOPY, INSTALLATION (FLHTC/U-I, FLTR-I), or INSTRUMENT CONSOLE/CANOPY, INSTALLATION (FLHR/C-I).

# FUEL PUMP WIRING

**CAUTION**

**Do not replace the special teflon coated fuel pump wiring with ordinary bulk wire. Ordinary insulation materials may deteriorate when in contact with gasoline.**

## REMOVAL

1. See CONSOLE POD/CANOPY, REMOVAL (FLHTC/U-I, FLTR-I), or INSTRUMENT CONSOLE/CANOPY, REMOVAL (FLHR/C-I).

2. Depress external latch and remove electrical connector at top of fuel pump.

3. Cut three cable straps to free fuel pump wiring from fuel level sender wire.

4. Remove socket terminals from spade contacts welded to both underside of canopy and at top of fuel level sender. On FLHTC/U-I and FLTR-I models, remove third socket terminal from spade contact on fuel filter canister retaining ring.

5. Remove two socket terminals from 3-place Mini-Deutsch connector on canopy. Proceed as follows:

   a. At underside of canopy, take note of the rectangular opening or window on each side of the connector body. Now take note of the tab inside each window.

   b. Obtain two safety pins. On each side of connector body, insert a safety pin between body and wire block until end of each pin appears in window. To disengage tabs from windows, gently pull on one safety pin while pushing on the other. See upper frame of Figure 9-21. With tabs released, gently tug on wires to release wire block from connector body.

**CAUTION**

**Once pulled from the wire block, the socket cannot be returned to its chamber without causing damage to the wire crimp and/or terminal. Therefore, do not disturb the socket if the wire is not to be removed.**

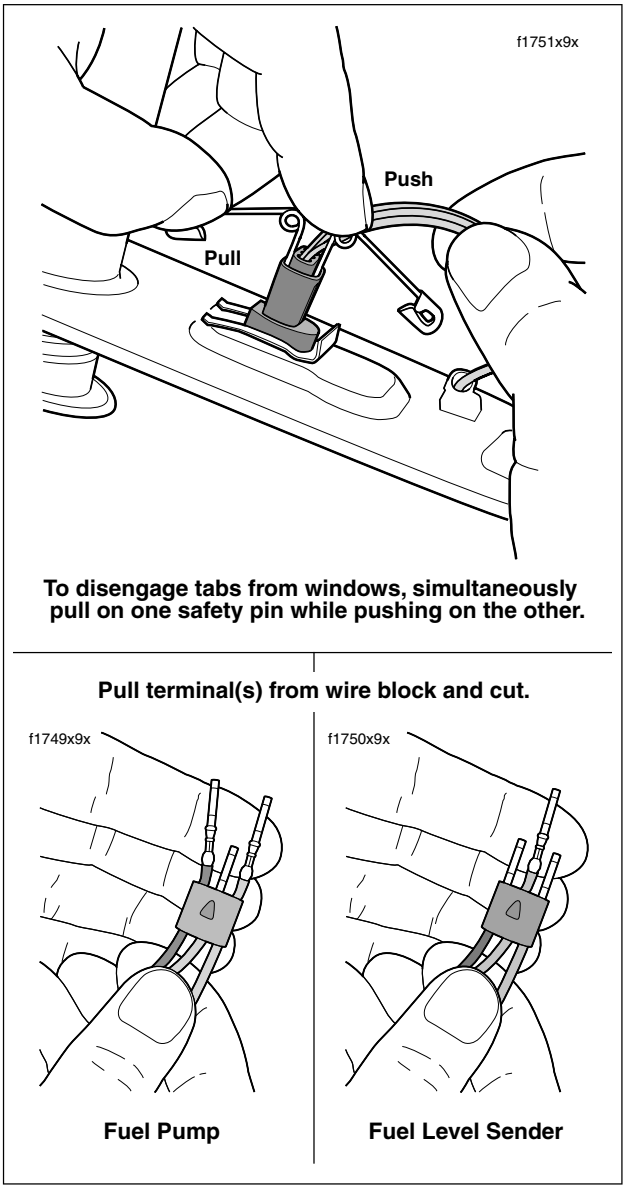



**Figure 9-21. Remove Wire Block and Cut Terminals**

   c. Leaving the terminal of the center wire in place, pull the socket terminals of the other wires out of the wire block. See lower frame of Figure 9-21. Cut off socket terminals and back wires out of wire block.

   d. Insert wire block back into connector body until tabs lock in windows. One corner of wire block and connector body is square to prevent improper installation.

## INSTALLATION

1. Insert socket terminals of **new** wiring into wire block. For wire locations, take note of the table in the corner of Figure 9-20.

*NOTE*

*A series of dots are cast into the wire end of the block to indicate wire location, one dot indicating chamber 1, two dots chamber 2, three dots chamber 3. (Wire location numbers are also stamped below the terminals inside the Mini-Deutch pin housing.)*

2. Gently tug on wires to verify that they will not back out of wire block.
3. Loop wires as shown in Figure 9-18 or Figure 9-20. Install three **new** cable straps at the locations described below. Be sure to cut any excess cable strap material.
   - 2 inches below Mini-Deutsch connector body capturing three wires exiting wire block and ground wire to canopy spade contact.
   - 2 inches below first cable strap securing loop of same four wires to fuel pump support rod.
   - 1-1/2 inches above fuel pump connector capturing butt splice connector and both fuel level sender (yellow/white) and fuel pump (yellow/green) wires.
4. Install socket terminals on spade contacts welded to both underside of canopy and at top of fuel level sender. On FLHTC/U-I and FLTR-I models, install third socket terminal onto spade contact on fuel filter canister retaining ring.
5. Install electrical connector at top of fuel pump. Gently tug on connector to verify that external latch is locked and connector will not come free of terminals.
6. See CONSOLE POD/CANOPY, INSTALLATION (FLHTC/U-I, FLTR-I), or INSTRUMENT CONSOLE/CANOPY, INSTALLATION (FLHR/C-I).

# FUEL LEVEL SENDER

## REMOVAL

1. See CONSOLE POD/CANOPY, REMOVAL (FLHTC/U-I, FLTR-I), or INSTRUMENT CONSOLE/CANOPY, REMOVAL (FLHR/C-I).
2. Remove socket terminal from spade contact welded to top of fuel level sender.
3. Carefully cut three cable straps to free fuel level sender wire from fuel pump wiring.
4. Remove T15 TORX screw and pull fuel level sender from post on bracket of fuel pump housing.
5. Remove socket terminal from 3-place Mini-Deutsch connector on canopy. Proceed as follows:
   a. At underside of canopy, take note of the rectangular opening or window on each side of the connector body. Now take note of the tab inside each window.
   b. Obtain two safety pins. On each side of connector body, insert a safety pin between body and wire block until end of each pin appears in window. To disengage tabs from windows, gently pull on one safety pin while pushing on the other. See upper frame of Figure 9-21. With tabs released, gently tug on wires to release wire block from connector body.

**CAUTION**

**Once pulled from the wire block, the socket cannot be returned to its chamber without causing damage to the wire crimp and/or terminal. Therefore, do not disturb the socket if the wire is not to be removed.**

   c. Pull the socket terminal of the center wire out of the wire block. See lower frame of Figure 9-21. Cut off the socket terminal and back the wire out of the wire block.
   d. Insert wire block back into connector body until tabs lock in windows. One corner of wire block and connector body is square to prevent improper installation.

## INSTALLATION

1. Insert socket terminal of **new** fuel level sender into center chamber of wire block. Gently tug on wire to verify that it will not back out of wire block.
2. Loop wires as shown in Figure 9-18 or Figure 9-20. Install three **new** cable straps at the locations described below. Be sure to cut any excess cable strap material.
   - 2 inches below Mini-Deutsch connector body capturing three wires exiting wire block and ground wire to canopy spade contact.
   - 2 inches below first cable strap securing loop of same four wires to fuel pump support rod.
   - 1-1/2 inches above fuel pump connector capturing butt splice connector and both fuel level sender (yellow/white) and fuel pump (yellow/green) wires.
3. Align two holes in fuel level sender with threaded hole and post on bracket of fuel pump housing. Install T15 TORX screw in upper hole and tighten to 25-45 **in-lbs** (2.8-5.1 Nm).
4. Install socket terminal onto spade contact welded to top of fuel level sender.
5. See CONSOLE POD/CANOPY, INSTALLATION (FLHTC/U-I, FLTR-I), or INSTRUMENT CONSOLE/CANOPY, INSTALLATION (FLHR/C-I).

## CANOPY CONNECTOR/O-RING

### REMOVAL

1. See CONSOLE POD/CANOPY, REMOVAL (FLHTC/U-I, FLTR-I), or INSTRUMENT CONSOLE/CANOPY, REMOVAL (FLHR/C-I).
2. At underside of canopy remove wire block from connector body as described under FUEL LEVEL SENDER, REMOVAL, steps 5a-5b, on the preceding page.
3. Slide connector clip from slots on connector body. Remove connector body from canopy.
4. Remove O-ring from groove on connector body.

### INSTALLATION

1. Apply a very thin film of clean H-D 20W50 engine oil to O-ring. Install O-ring in groove of connector body.
2. Fit connector body into hole at top of canopy. At underside of canopy, install connector clip engaging slots in connector body.
3. Insert wire block back into connector body until tabs lock in windows. One corner of wire block and connector body is square to prevent improper installation.
4. See CONSOLE POD/CANOPY, INSTALLATION (FLHTC/U-I, FLTR-I), or INSTRUMENT CONSOLE/CANOPY, INSTALLATION (FLHR/C-I).

## FUEL SUPPLY/RETURN CHECK VALVES

*NOTE*

*The in-tank check valves are housed in the quick-connect fittings. The check valves prevent the fuel tank from draining when the external supply and return lines are disconnected.*

### REMOVAL

1. See CONSOLE POD/CANOPY, REMOVAL (FLHTC/U-I, FLTR-I), or INSTRUMENT CONSOLE/CANOPY, REMOVAL (FLHR/C-I).

**⚠WARNING**

**A small amount of gasoline may drain from the fuel supply and return lines when disconnected from the fuel tank. Thoroughly wipe up any spilled fuel immediately. Dispose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.**

2. Pull up on chrome sleeve of quick-connect fitting and pull down on fuel supply or return line to disconnect. The fuel supply line is attached to the forward fitting on the left side of the tank, the fuel return line to the rearward fitting. See Figure 9-16.

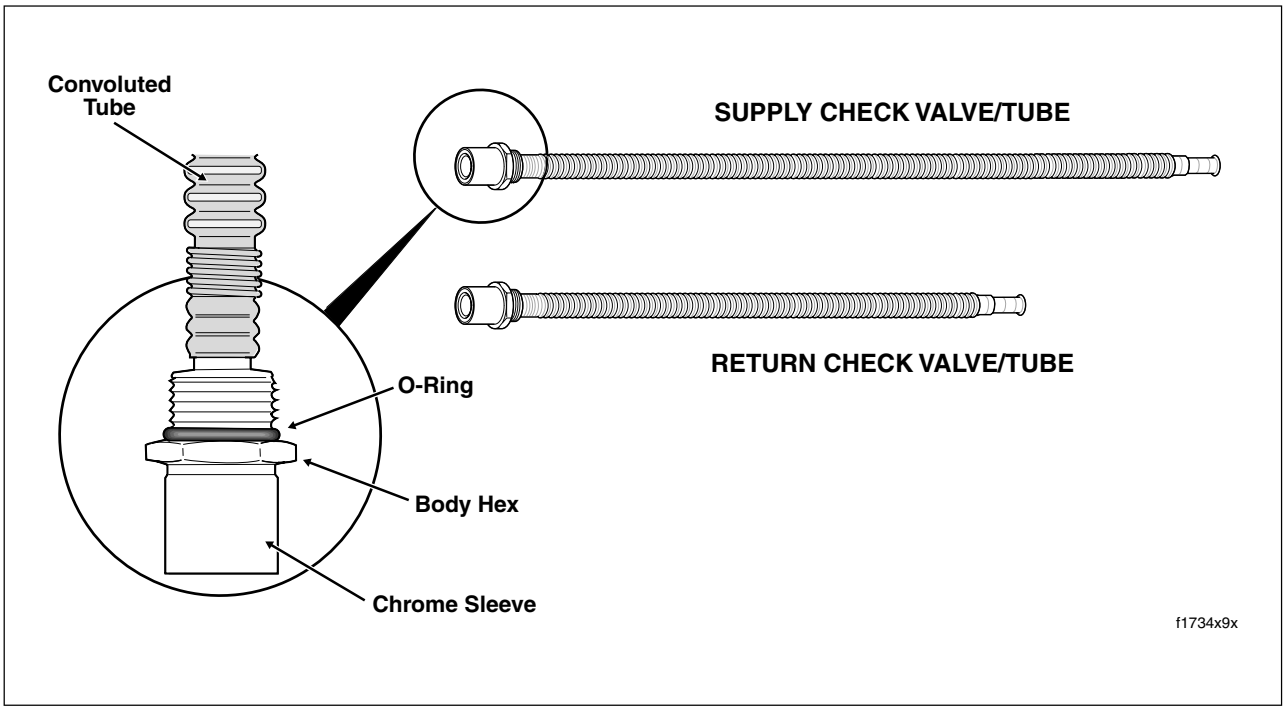



**Figure 9-22. Supply/Return Check Valves (Quick-Connect Fittings)**

**⚠WARNING**

**A small amount of gasoline may drain from the fuel tank when the quick-connect fitting is removed. Thoroughly wipe up any spilled fuel immediately. Dispose of rags in a suitable manner. Inadequate safety precautions could result in death or serious injury.**

3. If replacing the fuel return tube/fitting, reach into fuel tank and free the convoluted tube from weld clip at the top of the tunnel.

   If replacing the fuel supply tube/fitting, proceed to step 4, since the convoluted tube was removed from the outlet port of the fuel filter canister during canopy removal.

4. Slide a 7/8 inch deepwell socket over chrome sleeve engaging hex on quick-connect fitting. See Figure 9-22. Looking down at top of fuel tank, rotate fitting in a clockwise direction until it turns easily. Remove the fitting by hand drawing convoluted tube out through hole at bottom of fuel tank.

## INSTALLATION

**CAUTION**

**Carefully inspect convoluted tube for cuts, tears, holes or other damage. Replace tube (with attached quick-connect fitting) if any damage is found. Even the smallest hole can cause a reduction in fuel pressure.**

1. Apply a very thin film of clean H-D 20W50 engine oil to **new** O-ring. Slide O-ring down convoluted tube until contact is made with hex on **new** quick-connect fitting. See Figure 9-22.

*NOTE*

*Supply and return fittings can be identified by the length of the attached tube. The fitting with the longer tube is the supply, the fitting with the shorter tube is the return. See Figure 9-22.*

2. Feeding convoluted tube through hole at bottom of fuel tank, hand thread quick-connect fitting into bore. Looking down at top of fuel tank, rotate fitting in a counterclockwise direction until snug.

3. Slide a 7/8 inch deepwell socket over chrome sleeve engaging hex on quick-connect fitting. Tighten fitting to 220-225 **in-lbs** (24.9-25.4 Nm).

4. If the return tube/fitting was replaced, reach into fuel tank and capture convoluted tube in flexible weld clip at top of tunnel. Tube must direct the return flow into right side lobe of fuel tank.

   If the supply tube/fitting was replaced, proceed to step 5. Convoluted tube is installed on outlet port of fuel filter canister during canopy installation.

5. See CONSOLE POD/CANOPY, INSTALLATION (FLHTC/U-I, FLTR-I), or INSTRUMENT CONSOLE/CANOPY, INSTALLATION (FLHR/C-I).

# AIR CLEANER ASSEMBLY 9.4

## GENERAL

The air cleaner assembly consists of the following components:

- Air Cleaner
- Filter Element
- Backplate
- Charcoal Canister (California Models Only)

## AIR CLEANER

### REMOVAL

1. Remove large allen head socket screw in center of air cleaner cover. Remove air cleaner cover with rubber seal. See Figure 9-23.
2. Remove four T27 TORX screws to release cover bracket from filter element.
3. Remove filter element pulling two breather tubes from holes on inboard side.
4. Remove gasket from sleeve on inboard side of filter element. Discard gasket.
5. Remove breather tubes from fittings on two cylinder head breather bolts.
6. Remove two cylinder head breather bolts from backplate using a 7/16 inch deepwell socket.
7. Remove backplate from cylinder heads.
8. Remove two O-rings from grooves around breather bolt holes on inboard side of backplate. Discard O-rings.
9. Remove gasket from inboard side of backplate. Discard gasket.

### INSTALLATION

1. Install **new** O-rings in grooves around breather bolt holes on inboard side of backplate.
2. Install **new** gasket aligning small holes and slots with plastic pins and tabs on inboard side of backplate.
3. Align holes in backplate with those in cylinder heads and install cylinder head breather bolts. Using a 7/16 inch deepwell socket, alternately tighten bolts to 10-12 ft-lbs (13.6-16.3 Nm).
4. Slide **new** gasket over sleeve on inboard side of filter element.
5. Insert breather tubes about 1/4 inch into holes on inboard side of filter element.
6. Install breather tubes onto fittings of two cylinder head breather bolts.

*NOTE*

*Breather tubes allow crankcase vapors to be directed into the air filter element. By providing effective recirculation of crankcase vapors, the tubes serve to eliminate the pollutants normally discharged from the crankcase. Air cleaner mounting without installation of the breather tubes allows crankcase vapors to be vented into the atmosphere in violation of legal emissions standards.*

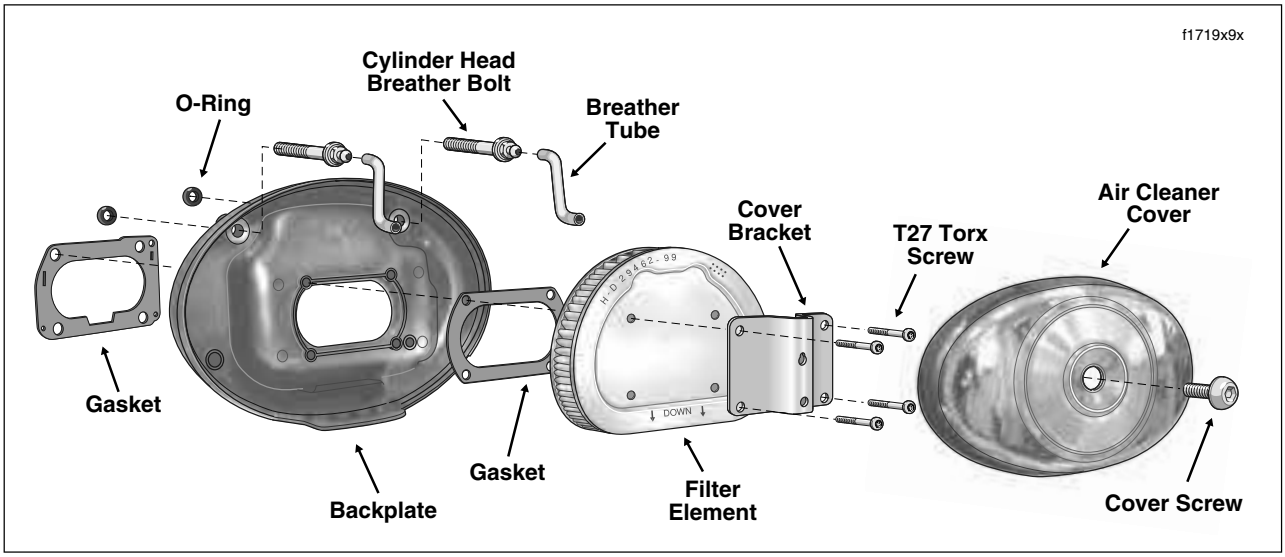



**Figure 9-23. Air Cleaner Assembly**

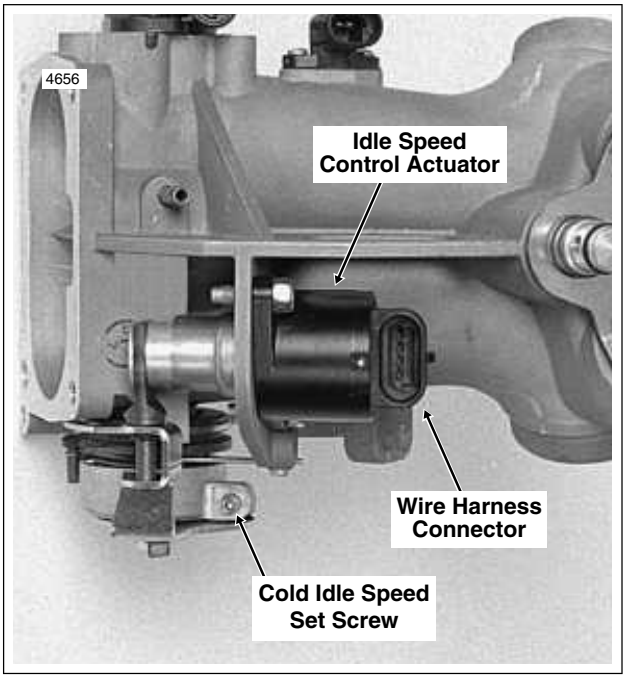



**Figure 9-24. Induction Module (Top View)**

7. Place filter element against backplate. Stamp on element points to downside.
8. Align holes in cover bracket with those in filter element and start four screws. Stamp on cover bracket points to downside. Using a T27 TORX drive head, alternately tighten screws to 20-40 **in-lbs** (2.3-4.5 Nm) in a crosswise pattern.
9. Verify that rubber seal is properly seated around perimeter of air cleaner cover. Replace seal if cut, torn or shows signs of deterioration.
10. Fit air cleaner cover into backplate. Apply a small dab of Loctite Medium Strength Threadlocker 243 (blue) to threads of large allen head socket screw. Install screw in center of air cleaner cover. Tighten screw to 3-5 ft-lbs (4.1-6.8 Nm).

## COLD IDLE SPEED ADJUSTMENT

*NOTE*

*All sensors and actuators must be in proper working order and the engine must be in good condition in order for this procedure to have correct and consistent results.*

1. Remove right side saddlebag. See Section 2.22 SADDLEBAG, REMOVAL.
2. Gently pull side cover from frame downtubes (no tools required).
3. Remove rubber plug from open end of Data Link connector and plug in Scanalyzer (HD-41325).
4. With the Engine Stop/Run Switch in the RUN position, turn the Ignition Light/Key Switch to ON.
5. While observing TP voltage under the Data Monitor Menu of the Scanalyzer, turn the Ignition Light/Key Switch back to the OFF position. Note that the TP voltage drops, increases and then stops just before electrical power is interrupted.

   If the Scanalyzer display stops between 0.64 and 0.68 volts, then the cold idle speed does **not** need to be adjusted. Proceed directly to WARM-SLOW IDLE SPEED ADJUSTMENT on the next page.
6. If the TP voltage is out of range, then proceed as follows:
   a. Remove air cleaner and backplate assembly. See AIR CLEANER, REMOVAL, steps 1-9.
   b. With the Engine Stop/Run Switch in the RUN position, turn the Ignition Light/Key Switch to ON and then back to the OFF position. The idle speed control actuator retracts, and then moves out to the parked position.
   c. Unplug the wire harness connector from the idle speed control actuator. See Figure 9-24.
   d. With the Engine Stop/Run Switch in the RUN position, turn the Ignition Light/Key Switch to ON.
   e. While observing TP voltage under the Data Monitor Menu of the Scanalyzer (or Breakout Box and DVOM), use a T10 TORX drive head to adjust the cold idle speed set screw until reading is between 0.64 and 0.68 volts. Be sure not to move the idle speed lever while turning the screw.

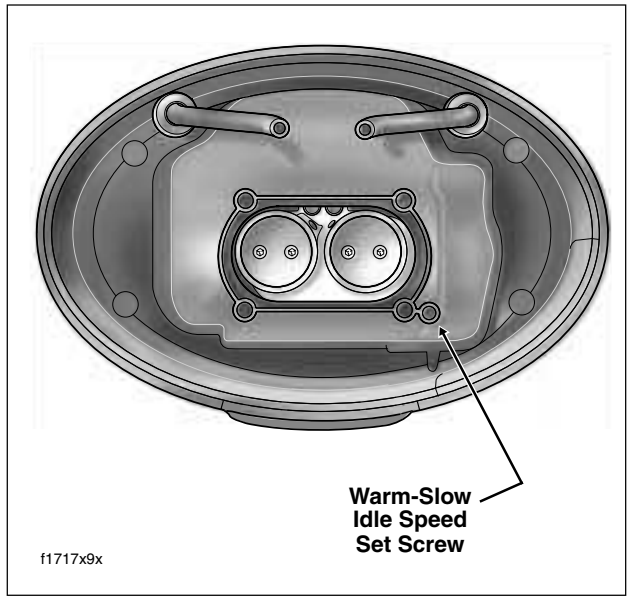



**Figure 9-25. Air Cleaner Backplate**

*NOTE*

*Gently open the throttle to better access the cold idle speed set screw. After making the adjustment, gently roll the throttle closed and recheck the TP voltage reading.* ***DO NOT*** *allow throttle to "snap shut" or the idle speed control actuator may move (resulting in an unwanted voltage change that requires the adjustment procedure be restarted).*

### WARM-SLOW IDLE SPEED ADJUSTMENT

*NOTE*

*For proper adjustment, always check/set cold idle speed adjustment before proceeding.*

1. If cold idle speed was adjusted, install air cleaner backplate. See AIR CLEANER, INSTALLATION, steps 1-3.

   If cold idle speed adjustment was not necessary, remove air cleaner cover and filter. See AIR CLEANER, REMOVAL, steps 1-4.

2. Start vehicle and run until both engine and primary oil reach operating temperature (fully warm). Using the Scanalyzer, verify that engine temperature is 250˚F. (121˚ C.) or higher. This step is very important or adjustment will be incorrect.

**CAUTION**

**To ensure proper charging at idle, maintain an idle speed of approximately 950-1050 RPM. Insufficient idle speed may drain the battery in excessive idle situations, resulting in insufficient voltage to the ECM, ignition coil and fuel pump (which can result in a variety of operating problems).**

3. To adjust the warm-slow idle speed, locate the set screw through the hole in the air cleaner backplate (lower right corner of the intake air inlet). See Figure 9-25.

*NOTE*

*For best results, use the Scanalyzer (HD-41325) or an external tachometer with an inductive pickup.*

4. Using a T10 TORX drive head, set idle speed at 950-1050 RPM. Turn the set screw clockwise to increase OR counter-clockwise to decrease idle speed.

5. When idle speed is set, turn the Ignition/Light Key Switch to OFF.

6. Complete air cleaner installation. See AIR CLEANER, INSTALLATION, steps 4-10.

*NOTE*

*Installation of air cleaner cover may affect idle speed.*

7. Verify correct idle speed after assembling air cleaner. Repeat adjustment procedure if necessary.

   Following the **final** idle speed adjustment, remove both 5 amp and 15 amp fuses (ECM power and fuel pump) for at least one minute. See FUSES, REMOVAL. This step is necessary to clear the ECM memory of the previously learned minimum throttle position.

8. Reinstall both 5 amp and 15 amp fuses. See FUSES, INSTALLATION.

9. With the Engine Stop/Run Switch in the RUN position, turn the Ignition Light/Key Switch to ON, and wait until the CHECK ENGINE LAMP goes out.

10. Turn the Ignition Light/Key Switch to OFF and wait approximately 10 seconds for the ECM relay to disconnect. The idle speed control actuator stops in the extended position, and the Scanalyzer screen displays "No Response."

11. Start engine and run until both engine and primary oil are fully warm.

12. Verify that engine temperature is 250˚F. (121˚ C.) or higher. Check that hot idle speed is 950-1050 RPM.

13. Turn the Ignition/Light key Switch to OFF. Unplug the Scanalyzer and install rubber plug into open end of Data Link Connector.

14. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required).

15. Install right side saddlebag. See Section 2.22 SADDLEBAG, INSTALLATION.

## CHARCOAL CANISTER
## (CALIFORNIA MODELS ONLY)

### REMOVAL

1. Remove rear fender. See Section 2.30 REAR FENDER, REMOVAL.

**⚠WARNING**

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

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.

3. Unthread bolt and remove battery positive cable (red) from battery positive (+) terminal.

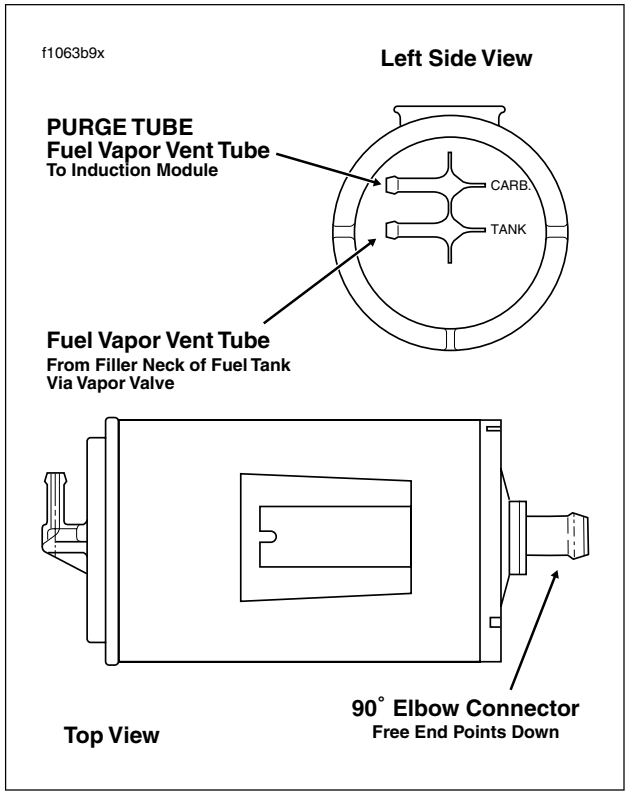



**Figure 9-26. Charcoal Canister**

4. Using a T40 TORX drive head, loosen bolt to move lip of hold-down clamp off edge of battery. Remove battery from battery box.
5. Reaching into battery box, pry plastic retaining pin out of hole on left side.
6. At rear of vehicle (on left side), center a flashlight on drive belt and direct the beam forward. Note the two tube connections on the left side of the canister. See Figure 9-26.
7. Reaching in on left side of vehicle, pull tubes from left side of canister.
8. With the handle of a rubber mallet, rap canister inward toward left side of vehicle until tongue at top of canister is free of grooves in bottom of battery box. From right side of vehicle, pull canister out of opening between rear wheel and frame member.
9. Pull 90˚ elbow connector from fitting on right side of charcoal canister.

## INSTALLATION

1. Install 90˚ elbow connector onto fitting on right side of charcoal canister.
2. With tongued side up, slide canister into cavity beneath battery box using opening between rear wheel and right side frame member. Start tongue into grooves on left side of battery box. Push the canister toward the right side of the vehicle until fully engaged. Snap plastic retaining pin into hole at bottom of battery box (left side).
3. Attach tubes to fittings on left side of canister. Install the purge tube to the induction module onto the top fitting stamped “CARB,” the fuel vapor vent tube from the fuel tank (via the vapor valve) to the bottom fitting stamped “TANK.”

*NOTE*

*The clean air inlet tube is absent on fuel injected models, so the fitting on the right side of the canister terminates in a 90˚ elbow connector (the free end pointing down).*

4. Place battery in battery box, terminal side forward.

**⚠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, which could result in death or serious injury.**

5. Insert bolt through battery positive cable (red) into threaded hole of battery positive (+) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
6. Insert bolt through battery negative cable (black) into threaded hole of battery negative (-) terminal. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
7. Rotate the hold-down clamp so that the lip (with rubber pad) rests on the edge of the battery. Using a T-40 TORX drive head, tighten the clamp bolt to 15-20 ft-lbs (20-27 Nm).
8. Install rear fender. See Section 2.30 REAR FENDER, INSTALLATION.

# INDUCTION MODULE ASSEMBLY 9.5

## GENERAL

See Figure 9-27. The Induction Module Assembly consists of the following components:

- Induction Module
- Fuel Supply/Return Lines
- Fuel Injectors
- Fuel Pressure Regulator
- Intake Air Temperature Sensor
- Throttle Position Sensor
- Idle Speed Control Actuator
- Cam Lever Assembly

## INDUCTION MODULE

### REMOVAL

1. Partially remove fuel tank. See Section 9.3 FUEL TANK ASSEMBLY, FUEL TANK, PARTIAL REMOVAL, either FLHTC/U-I, FLTR-I or FLHR/C-I.
2. Remove air cleaner and backplate. See Section 9.4 AIR CLEANER ASSEMBLY, AIR CLEANER, REMOVAL.
3. Pull purge tube from port at top of induction module (California models only).
4. Using slots, remove idle and throttle cables from integral cable guides cast at front of induction module. Using a needle nose pliers, pull cable barrel ends from holes in throttle wheel. See Figure 9-28.
5. On FLHTCU-I and FLTR-I models, remove the E-clip to release the cruise cable housing from the cable guide cast at front of induction module. Using slot, remove cruise cable from cable guide. Push the plastic end fitting on the cruise cable to the outboard side to release from wheel pin.
6. Depress wire form and use rocking motion to detach electrical connectors from fuel injectors.
7. Disconnect intake air temperature sensor. Simultaneously spread both external latches to separate.
8. Disconnect throttle position sensor and idle speed control actuator. Pull external latch outward and use rocking motion to separate connector halves.

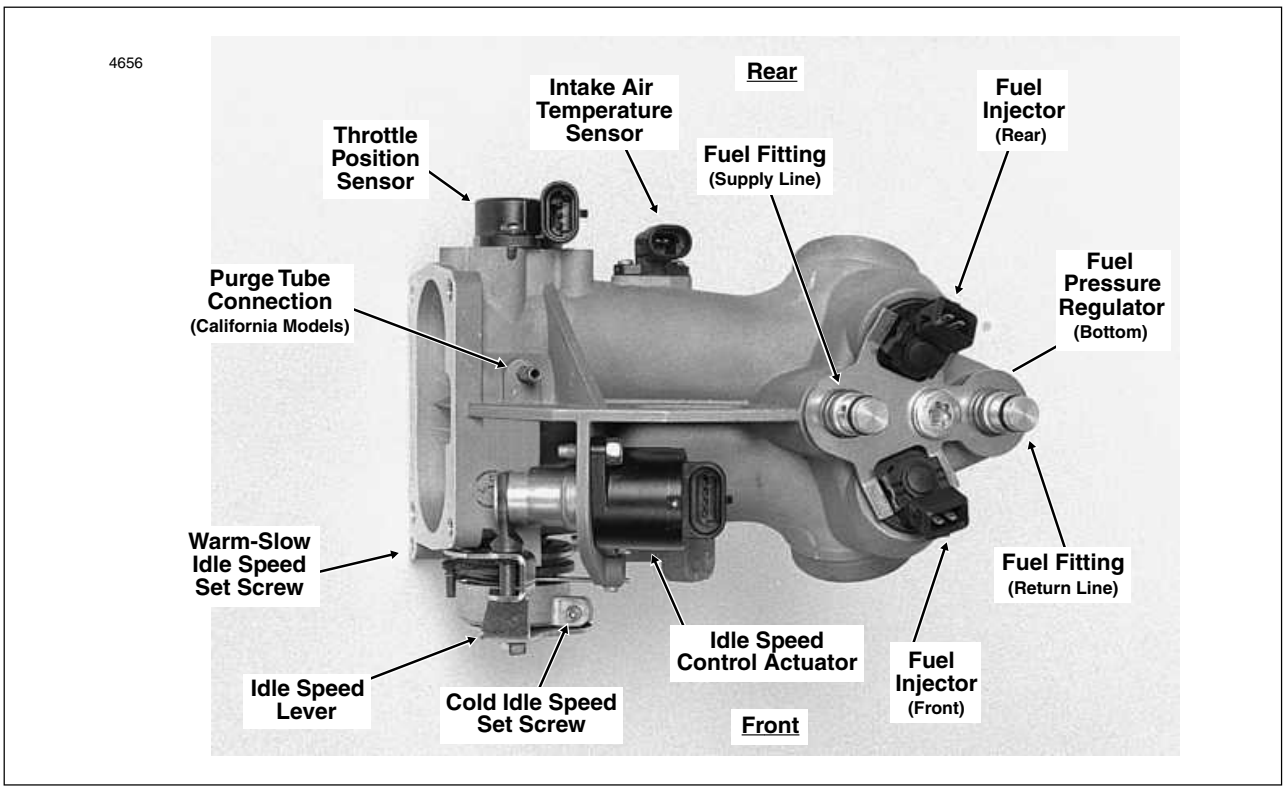



**Figure 9-27. Induction Module Assembly**

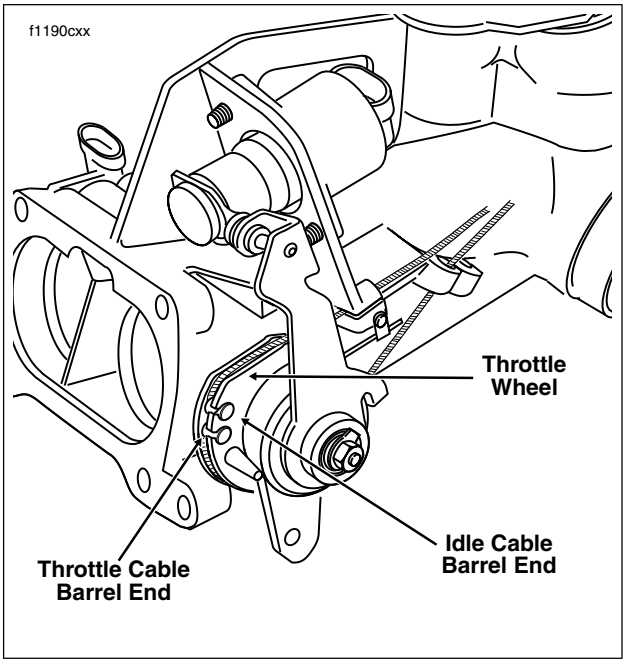



**Figure 9-28. Throttle Cable Barrel Ends**

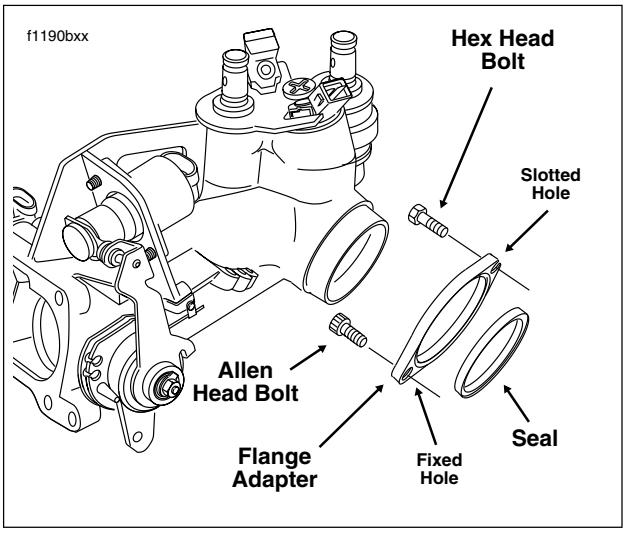



**Figure 9-29. Install Flange Adapters and Seals**

9. On right side of vehicle, remove Allen head bolts from front and rear cylinder head flange adapters. For best results, use a 1/4 inch ball Allen bit with end driver 4 inches long.
10. On left side of vehicle, loosen hex head bolts (1/2 inch) from front and rear cylinder head flange adapters.
11. Slide induction module out from the right side. Use caution around horn bracket to prevent damage to fuel lines.
12. Remove flange adapters from outlet ports of induction module. Remove seals from flange adapters. Discard seals.

## INSTALLATION

1. Orientate the induction module as shown in Figure 9-27. With the counterbore facing outward, slide cylinder head flange adapters onto outlet ports of induction module. See Figure 9-29. The flange adapters are not interchangeable. Look next to the slotted bolt hole for a stamp that indicates F(ront) and R(ear) cylinder.
2. Place a **new** seal in each flange adapter with the beveled side in against the counterbore.
3. Standing on right side of vehicle, slide induction module toward installed position so that open-ended slots on flange adapters begin to engage hex head bolts on left side. Use caution around horn bracket to prevent damage to fuel lines.
4. Drawing the idle cable (pull-close) around the top of the throttle wheel, insert barrel end into upper hole. Draw the throttle cable (pull-open) around the bottom of the throttle wheel and insert barrel end into lower hole. Using slots, slip throttle and idle cables into cable guides cast at front of induction module. See Figure 9-30. Tighten cables as necessary to keep barrel ends from dislodging. Verify that cables are seated in channel of throttle wheel. Verify operation by turning throttle grip and observing cable action.
5. On FLHTCU-I and FLTR-I models, hold cam lever assembly to prevent rotation and slide groove in cruise cable end fitting over cap of wheel pin. Push on end fitting until it snaps in place. Use slot to slip cruise cable into cable guide cast at front of induction module. See Figure 9-30. Install **new** E-clip on cable housing to lock position of cable.
6. Align fixed holes in flange adapters with those in cylinder heads and start Allen head bolts. For best results, use a 1/4 inch Allen head with end driver 4 inches long.

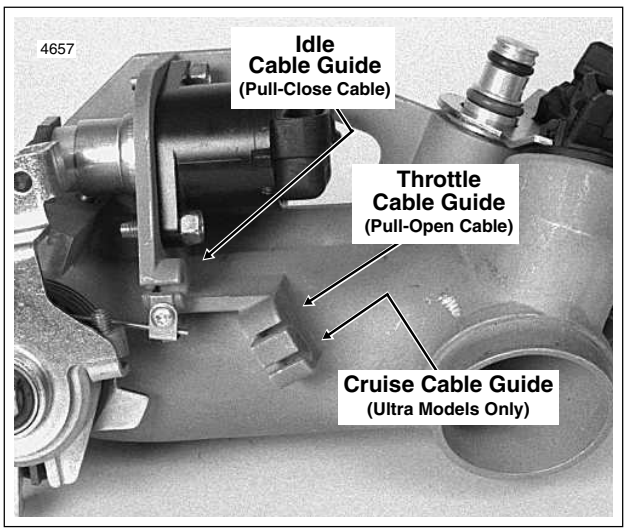



**Figure 9-30. Slip Cables Into Cable Guides**

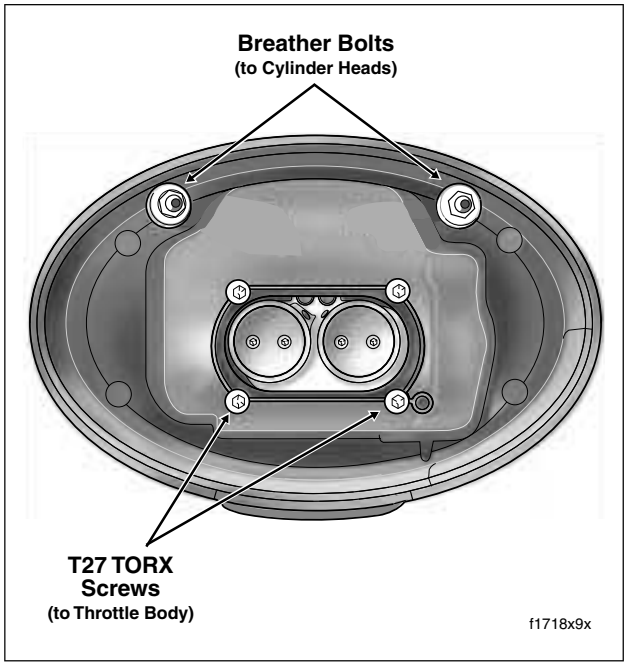



**Figure 9-31. Air Cleaner Backplate**

7. Use air cleaner backplate as template in properly situating induction module. Start two special breather bolts in breather ports to attach top of backplate to front and rear cylinder heads. See Figure 9-31. Start four T27 TORX screws to attach backplate to face of throttle body.
8. Standing on right side of vehicle, insert Allen head bolts in flange adapters and tighten until snug. Moving to left side of vehicle, tighten hex head bolts to 6-10 ft-lbs (8-14 Nm).
9. Remove breather bolts and T27 TORX screws to detach backplate from throttle body and front and rear cylinders.
10. Tighten Allen head bolts in front and rear flange adapters to 6-10 ft-lbs (8-14 Nm).
11. Install electrical connectors on fuel injectors. Injector cables are tagged F(ront) and R(ear) to ensure correct assembly. Push connector halves together until latches “click.” Grooves in female spade connector must be aligned with tabs in male spade housing.
12. Connect intake air temperature sensor, throttle position sensor and idle speed control actuator. Push connector halves together until slot on latch of female spade connector fully engages tab on male spade housing.
13. Connect purge tube to port at top of induction module (California models only). See Figure 9-27.
14. Install fuel tank. See Section 9.3 FUEL TANK ASSEMBLY, FUEL TANK, INSTALLATION (AFTER PARTIAL REMOVAL), FLHTC/U-I, FLTR-I, or FLHR/C-I.
15. Install backplate and air cleaner. See Section 9.4 AIR CLEANER ASSEMBLY, AIR CLEANER, INSTALLATION.
16. Check throttle and idle control cable adjustment. Check cruise cable adjustment.

# FUEL SUPPLY/RETURN LINES

**⚠WARNING**

**The gasoline in the fuel supply line downstream of the fuel pump is under high pressure (43.5 psi). To avoid an uncontrolled discharge or spray of gasoline, always purge the system of high pressure gas before the fuel supply line is disconnected. Inadequate safety precautions could result in death or serious injury.**

## REMOVAL

1. Partially remove fuel tank. See Section 9.3 FUEL TANK ASSEMBLY, FUEL TANK, PARTIAL REMOVAL, FLHTC/U-I, FLTR-I, or FLHR/C-I.

**⚠WARNING**

**A small amount of gasoline will drain from the external fuel supply and return lines when disconnected from the fuel tank. Thoroughly wipe up any spilled fuel immediately. Dispose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.**

*NOTE*

*Check valves in the fuel tank fittings impede any further fuel seepage once external fuel lines have drained.*

2. Pull up on chrome sleeve of quick-connect fitting (forward fitting on left side of fuel tank) and pull down on fuel supply line to disconnect. Repeat step to release fuel return line (rearward fitting). See Figure 9-32.
3. Raise fuel tank approximately 2 inches. Move the fuel tank crossover hose to the rear of the ignition coil, so that the tank can be raised an additional 2-3 inches. Move fuel tank straight back slightly and rest on frame backbone.
4. Obtain several 1 x 2 inch wooden blocks. Raise the front and rear of the fuel tank off the frame backbone by placing blocks in the recess centered at the bottom of the tank.
5. Remove nut from bolt securing stabilizer link (Hyme Joint) to top engine mounting bracket (left side of vehicle). Remove bolt with flat washer and move stabilizer link forward to access banjo style fittings at top of induction module.

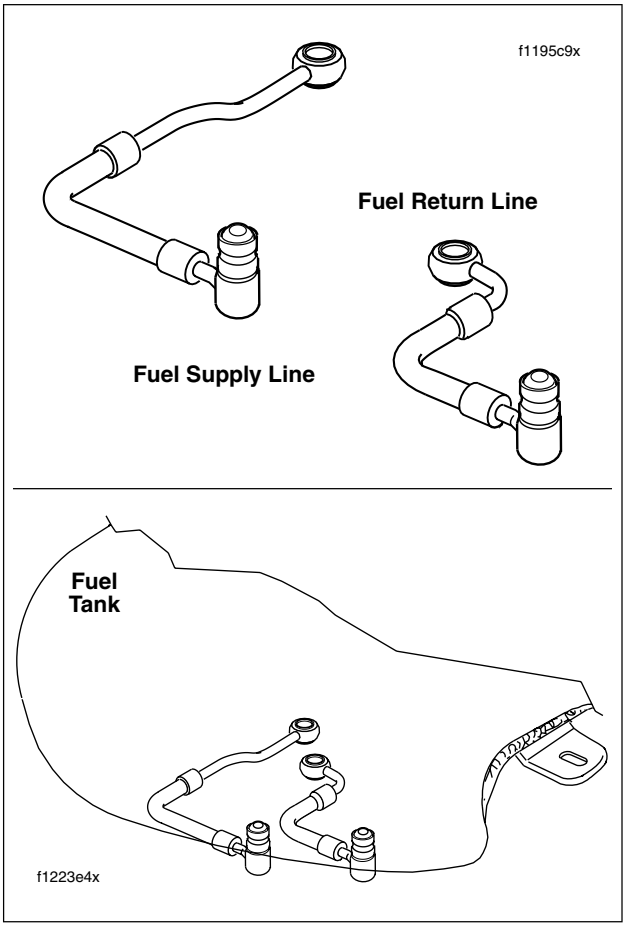



**Figure 9-32. Fuel Supply/Return Lines (Left Side View)**

**⚠WARNING**

**A small amount of gasoline will drain from the external fuel supply and return lines when disconnected from the induction module. Thoroughly wipe up any spilled fuel immediately. Dispose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.**

**⚠CAUTION**

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

6. Remove external retaining ring from groove at top of fuel fittings on induction module. Discard retaining rings.
7. Lift the supply and return lines off fuel fittings.

## INSTALLATION

1. Inspect upper and lower O-rings on fuel fittings of induction module. Look for cuts, tears or general deterioration. Replace the O-rings if they have taken a definite set. See Figure 9-33.
2. Apply a thin coat of clean engine oil to O-rings.
3. Slide ring end of fuel supply and return lines over fuel fittings on induction module. The longer fuel supply line goes to the fitting on the right side of the module; the short return line goes to the left side fitting.

**⚠CAUTION**

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

4. Install a **new** external type retaining ring in the groove at the top of each fuel fitting.
5. Pull up on chrome sleeve of quick-connect fitting (forward fitting on left side of tank) and insert neck of fuel supply line fitting. While pushing up on bottom of fuel supply line fitting, pull down on chrome sleeve until it “clicks” into the locked position. Tug on fuel supply line to be sure that it will not come free. Repeat step to install fuel return line (rearward fitting).
6. Install flat washer on stabilizer bolt. Insert bolt through stabilizer link and top engine mounting bracket (left side of vehicle). Install nut on bolt and tighten to 18-22 ft-lbs (24-30 Nm).
7. Install fuel tank. See Section 9.3 FUEL TANK ASSEMBLY, FUEL TANK, INSTALLATION (AFTER PARTIAL REMOVAL), FLHTC/U-I, FLTR-I, or FLHR/C-I.

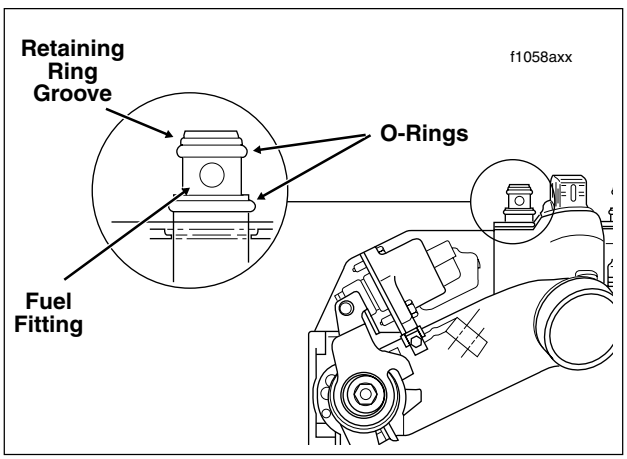



**Figure 9-33. Induction Module**

# FUEL INJECTORS

## REMOVAL

1. Partially remove fuel tank. See Section 9.3 FUEL TANK ASSEMBLY, FUEL TANK, PARTIAL REMOVAL, FLHTC/U-I, FLTR-I, or FLHR/C-I.
2. Depress wire form and use rocking motion to detach electrical connector from fuel injector.
3. Remove TORX sleeve bolt from retainer plate at top of induction module. Remove retainer plate. See Figure 9-34.

**CAUTION**

**Injector removal without use of the special tool may result in damage to the plastic construction.**

4. Remove fuel injectors from throttle body bore. It is necessary to overcome the resistance of two injector O-rings to free from throttle body. For best results, use special tool (HD-41320). See Figure 9-35.
5. Inspect injector O-rings for cuts, tears or general deterioration. Replace the O-rings if they have taken a definite set. See Figure 9-36.
6. Inspect injector screen for accumulations of dirt. Clean as necessary.

## INSTALLATION

1. Apply a thin coat of clean engine oil to injector O-rings. See Figure 9-36.
2. Loosely install injectors into throttle body bore. Injectors are directional so use retainer plate as template.

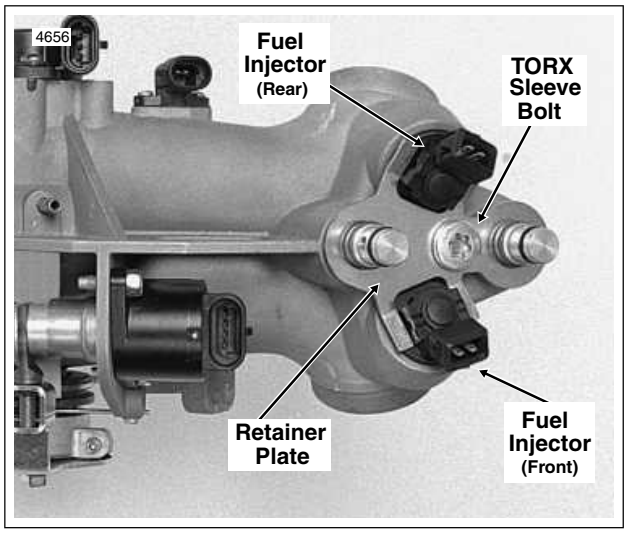



**Figure 9-34. Remove Fuel Injector**

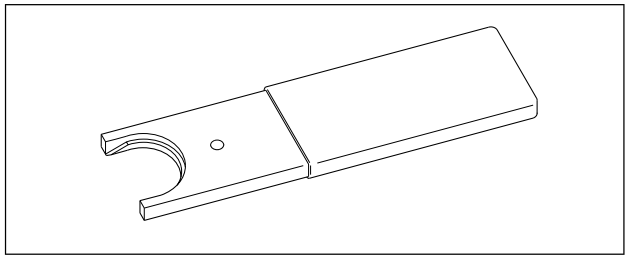


**Figure 9-35. Fuel Injector Remover (HD-41320)**

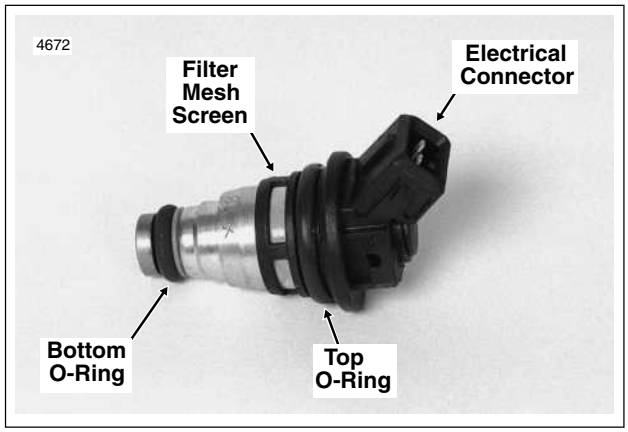



**Figure 9-36. Fuel Injector**

3. Install retainer plate orientating injectors as required to fit. Snap injectors into throttle body bore.
4. Install TORX sleeve bolt to secure retainer plate at top of induction module. See Figure 9-34.

*NOTE*

*Fuel pressure regulator bracket bolt at bottom of induction module threads into TORX sleeve bolt topside.*

5. Tighten TORX sleeve bolt to 35 **in-lbs** (3.9 Nm).
6. Install electrical connector on fuel injector. Injector cables are tagged F(ront) and R(ear) to ensure correct assembly. Push connector halves together until latches “click.” Grooves in female spade connector (harness) must be aligned with tabs in male spade connector (injector housing).
7. Install fuel tank. See Section 9.3 FUEL TANK ASSEMBLY, FUEL TANK, INSTALLATION (AFTER PARTIAL REMOVAL), FLHTC/U-I, FLTR-I, or FLHR/C-I.

# FUEL PRESSURE REGULATOR

## REMOVAL

1. Partially remove fuel tank. See Section 9.3 FUEL TANK ASSEMBLY, FUEL TANK, PARTIAL REMOVAL, FLHTC/U-I, FLTR-I, or FLHR/C-I.

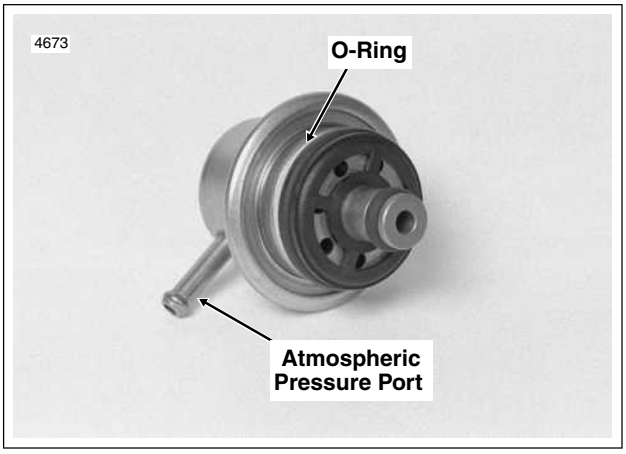



**Figure 9-37. Fuel Pressure Regulator**

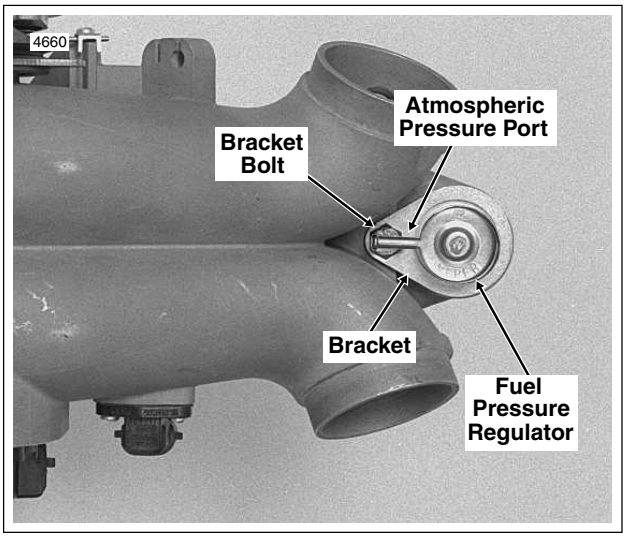



**Figure 9-38. Install Fuel Pressure Regulator (Bottom View)**

2. Remove TORX sleeve bolt from retainer plate at top of induction module. See Figure 9-34.

**⚠WARNING**

**A small amount of gasoline will drain from the fuel pressure regulator when removed from the throttle body. Thoroughly wipe up any spilled fuel immediately. Dispose of rags in a suitable manner. Gasoline can be extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.**

3. Pull out fuel pressure regulator. It is necessary to overcome the resistance of one O-ring to free from throttle body.
4. Inspect regulator O-ring for cuts, tears or general deterioration. See Figure 9-37. Replace O-ring if it has taken a definite set.

### INSTALLATION

1. Install bracket on fuel pressure regulator. Rotate pressure regulator so atmospheric pressure port is centered over bolt head in bracket.
2. Apply a thin coat of clean engine oil to regulator O-ring.
3. Slide regulator and bracket bolt into throttle body bores. See Figure 9-38.
4. Install TORX sleeve bolt to secure both retainer plate and fuel pressure regulator. Fuel pressure regulator bracket bolt threads into TORX sleeve bolt. Tighten TORX sleeve bolt to 35 **in-lbs** (3.9 Nm).
5. Install fuel tank. See Section 9.3 FUEL TANK ASSEMBLY, FUEL TANK, INSTALLATION (AFTER PARTIAL REMOVAL), FLHTC/U-I, FLTR-I, or FLHR/C-I.

## INTAKE AIR TEMPERATURE SENSOR

### REMOVAL

1. See INDUCTION MODULE, REMOVAL, in this section.
2. Remove two TORX screws from intake air temperature sensor. Remove sensor from throttle housing. See Figure 9-39.

### INSTALLATION

1. Place **new** gasket against mounting flange of intake air temperature sensor. Insert sensor in throttle housing with electrical connector facing upward. See Figure 9-40.
2. Install TORX screws to fasten sensor to throttle housing. Tighten screws to 6 **in-lbs** (0.7 Nm).
3. See INDUCTION MODULE, INSTALLATION, in this section.

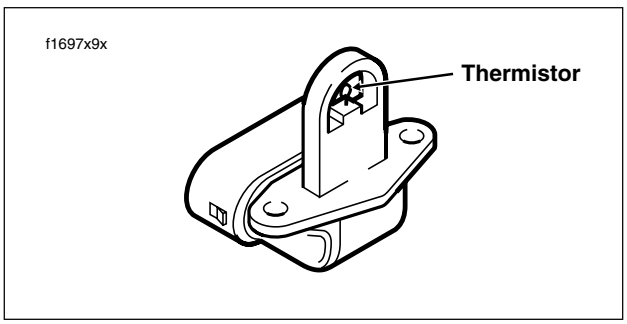



**Figure 9-39. Intake Air Temperature Sensor**

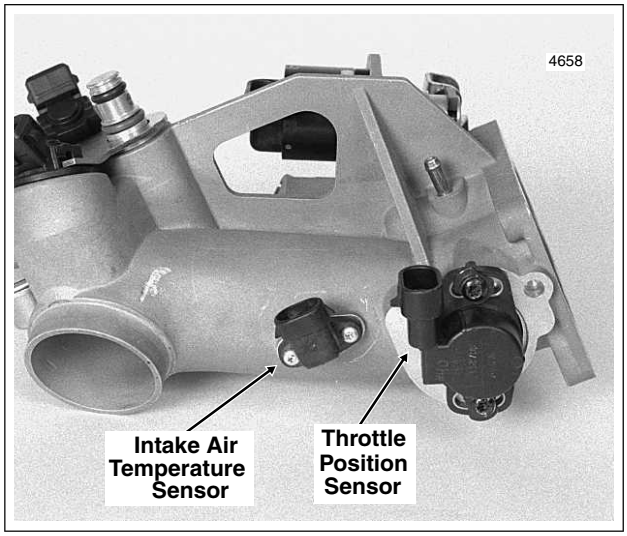



**Figure 9-40. Induction Module (Rear View)**

# THROTTLE POSITION SENSOR

## REMOVAL

1. Remove air cleaner and backplate. See Section 9.4 AIR CLEANER ASSEMBLY, AIR CLEANER, REMOVAL.
2. Run vehicle until engine reaches normal operating temperature.
3. With the engine still running, disconnect the idle speed control actuator connector from the wiring harness. Pull external latch outward and use a rocking motion to remove connector.

*NOTE*

*For correct results, the ISC actuator connector must be removed while the engine is running.*

4. Turn the Ignition/Light Key Switch to OFF.
5. Remove right side saddlebag. See Section 2.22 SADDLEBAG, REMOVAL.
6. Gently pull side cover from frame downtubes (no tools required).
7. Install the breakout box (HD 41198) between ECM and EFI wiring harness.
8. Turn the Ignition/Light Key Switch to ON, but do not start the engine.
9. Using a DVOM (HD-39978, Fluke 78 Multimeter, millivolt setting), measure the throttle position sensor voltage between ECM pins 16 and 30 on the Breakout Box. NOTE and RECORD this **warm-slow idle** reading. See Figure 9-41.
10. Using a T10 TORX drive head, turn the warm-slow idle speed set screw in a counter-clockwise direction until the throttle plates are fully closed in their bores. See Figure 9-42. If necessary, loosen the throttle cables to ensure adequate slack. Also take care to ensure that the lever screw does not contact the ISC actuator. If it does, then back off the lever screw one full turn.
11. Turn the Ignition/Light Key Switch to ON, but do not start the engine.
12. Open throttle and release, allowing it to close. Using a DVOM (HD-39978, Fluke 78 Multimeter) measure the throttle position sensor voltage between ECM pins 16 and 30 on Breakout Box. NOTE and RECORD this **throttle fully-closed** reading. See Figure 9-41.
13. Disconnect the throttle position sensor connector from the wiring harness. See Figure 9-42. Pull external latch outward and use a rocking motion to remove connector.

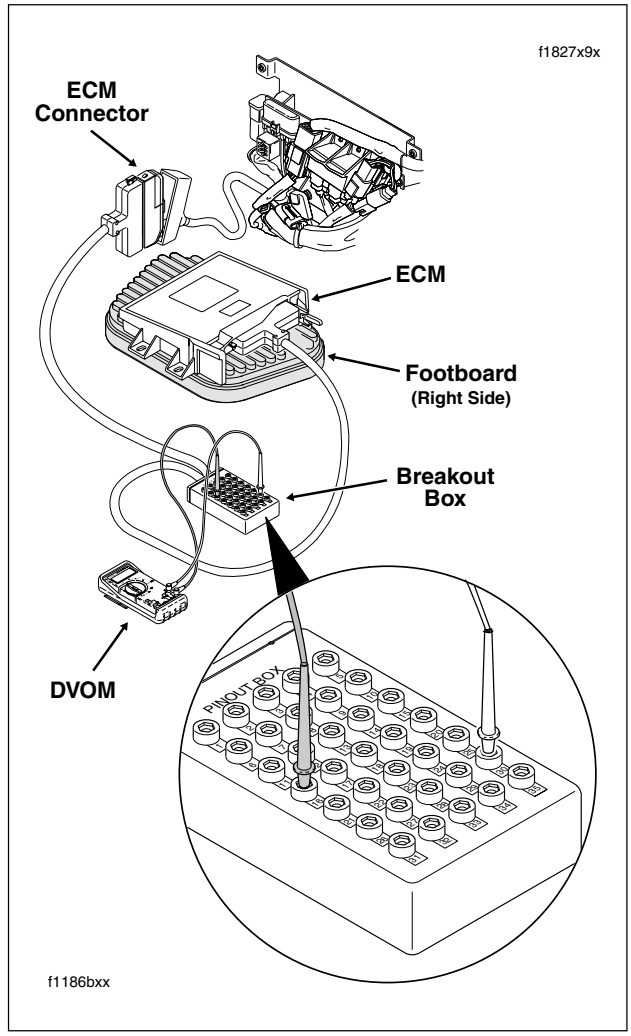



**Figure 9-41. Breakout Box Installation**

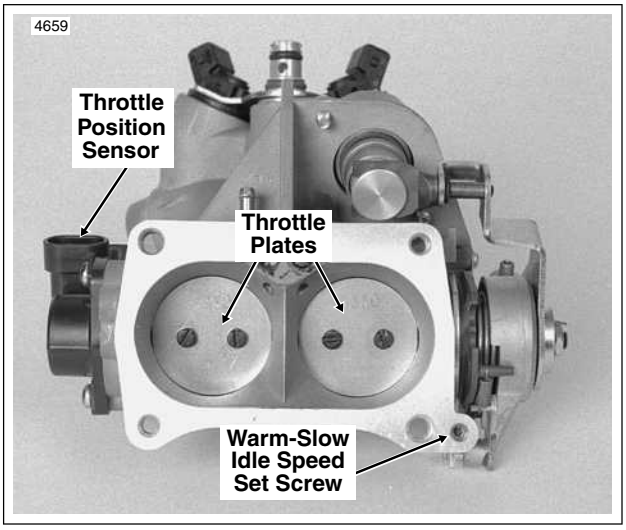



**Figure 9-42. Induction Module (Right Side View)**

14. Using a small vise grips, carefully remove two attachment screws (with flat washers) to detach the throttle position sensor from the induction module.

### INSTALLATION

1. Start attachment screws (with flat washers) to fasten throttle position sensor to throttle housing. Leave the screws just loose enough to allow sensor rotation. Connect the sensor to the wiring harness connector. Push connector halves together until slot on latch of female spade connector fully engages tab on male spade housing.

*NOTE*

*Do not use the Scanalyzer, since the resolution is not sufficient to read this voltage to three decimal places.*

2. While carefully holding the throttle plates at the fully closed position, rotate the throttle position sensor until the **throttle fully-closed** voltage value is obtained (as taken at step 12 under REMOVAL).

*NOTE*

*Best performance will be obtained using the original voltage value, but if the value is not reliable due to sensor damage, then use 0.275 v (275 mv).*

3. Firmly holding the sensor body to prevent further rotation, tighten the sensor attachment screws to 18 **in-lbs** (2.0 Nm).

4. Open throttle and release, allowing it to close. Verify that the **throttle fully-closed** voltage reading (taken in step 12 under REMOVAL) has not changed. If the voltage has changed, loosen the sensor attachment screws and return to step 2.

5. If it was necessary to back off the lever screw one full turn to prevent contact with the ISC actuator, then return the lever screw to its former position.

6. Using a T10 TORX drive head, turn the warm-slow idle speed set screw in a clockwise direction until the original throttle position sensor **warm-slow idle** voltage value is obtained (as taken at step 9 under REMOVAL).

7. Connect the ISC actuator to the wiring harness connector. Push connector halves together until slot on latch of female spade connector fully engages tab on male spade housing.

8. Using the throttle lever mechanism, open and close the throttle plates to check for proper operation. Be sure that the mechanism operates smoothly without binding or sticking. Check throttle cable adjustment; refer to Section 2, if necessary.

9. Turn the Ignition/Light Key Switch to ON (without starting engine) for a minimum of 10 seconds and then turn the switch back to OFF for a minimum of 10 seconds. Repeat this step at least one more time to ensure that the proper ISC actuator pre-set is established.

10. Install backplate and air cleaner. See Section 9.4 AIR CLEANER ASSEMBLY, AIR CLEANER, INSTALLATION.

*NOTE*

*Installation of air cleaner cover may affect idle speed.*

11. Verify idle speed adjustments. See Section 9.4 AIR CLEANER ASSEMBLY, COLD IDLE SPEED ADJUSTMENT and WARM-SLOW IDLE SPEED ADJUSTMENT.

## IDLE SPEED CONTROL ACTUATOR

### REMOVAL

1. Remove air cleaner and backplate. See Section 9.4 AIR CLEANER ASSEMBLY, AIR CLEANER, REMOVAL.

2. Partially remove fuel tank. See Section 9.3 FUEL TANK ASSEMBLY, FUEL TANK, PARTIAL REMOVAL, FLHTC/U-I, FLTR-I, or FLHR/C-I.

3. Standing on the left side of the motorcycle, remove the two 8 mm ISC actuator TORX mounting screws using a 1/4 in. drive, 12 in. extension with a swivel, and another 4 in. extension. See Figure 9-43.

*NOTE*

*The front fuel injector connector may need to be removed for clearance. Route extension above top motor mount and between the throttle cables and the front cylinder head.*

4. Bend tab on lockplate away from flat of 10 mm nut on throttle shaft. Turn idle speed lever mechanism counterclockwise until throttle plates are in the fully open position and then remove 10 mm nut, lockplate and spacer from end of throttle shaft. Discard lockplate.

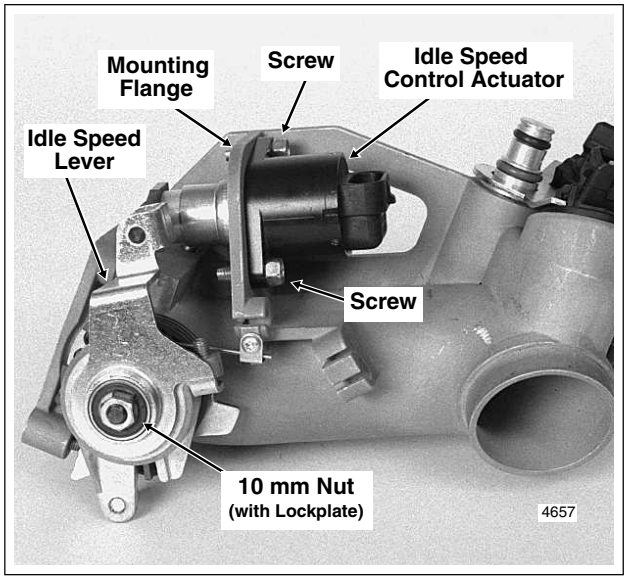



**Figure 9-43. Induction Module (Front View)**

5. Remove idle speed lever from throttle shaft disengaging lever from spring clip of idle speed control actuator. See Figure 9-44.
6. Remove ISC actuator from mounting flange. See Figure 9-43.
7. Remove wire harness connector from ISC actuator.

### INSTALLATION

1. See Figure 9-43. Insert **new** ISC actuator in mounting flange with electrical connector facing upward. Install the wire harness connector onto the ISC actuator.
2. Coat threads of two **new** 8 mm TORX screws with Loctite 222 (Purple). Fasten ISC actuator to mounting flange with TORX screws. Tighten screws to 12 **in-lbs** (1.4 Nm).
3. Install **new** idle speed lever onto throttle shaft with flat section of lever positioned between spring clip of actuator.
4. Install spacer and **new** lockplate onto end of throttle shaft. Start 10 mm nut onto throttle shaft.
5. Open the throttle and insert a brass drift or plastic screwdriver handle into one of the throttle bores (to keep it open and prevent shaft from rotating) and tighten nut to 25 **in-lbs** (2.8 mm). Bend tab on lockplate so that it rests tightly against flat of nut. Remove brass drift or plastic screwdriver handle from throttle bore.
6. Install fuel tank. See Section 9.3 FUEL TANK ASSEMBLY, FUEL TANK, INSTALLATION (AFTER PARTIAL REMOVAL), FLHTC/U-I, FLTR-I, or FLHR/C-I.
7. Install backplate and air cleaner assembly. See Section 9.4 AIR CLEANER ASSEMBLY, AIR CLEANER, INSTALLATION.

*NOTE*

*Installation of air cleaner cover may affect idle speed.*

8. Verify idle speed adjustments. See Section 9.4 AIR CLEANER ASSEMBLY, COLD IDLE SPEED ADJUSTMENT and WARM-SLOW IDLE SPEED ADJUSTMENT.

## CAM LEVER ASSEMBLY

### REMOVAL

1. Remove right side saddlebag. See Section 2.22 SADDLEBAG, REMOVAL.
2. Gently pull side cover from frame downtubes (no tools required).
3. Install the breakout box (HD 41198) between ECM and EFI wiring harness.
4. Remove air cleaner and backplate. See Section 9.4 AIR CLEANER ASSEMBLY, AIR CLEANER, REMOVAL.
5. Leaving the battery negative cable installed, partially remove fuel tank. See Section 9.3 FUEL TANK ASSEMBLY, FUEL TANK, PARTIAL REMOVAL, FLHTC/U-I, FLTR-I, or FLHR/C-I.
6. With the Ignition/Light Key Switch in the OFF position, unplug the wire harness connector from the ISC actuator.

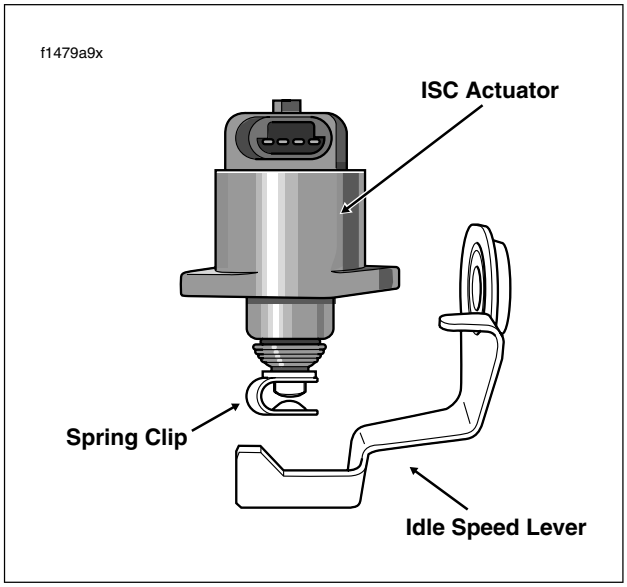



**Figure 9-44. ISC Actuator and Idle Speed Lever Assemblies (Top View)**

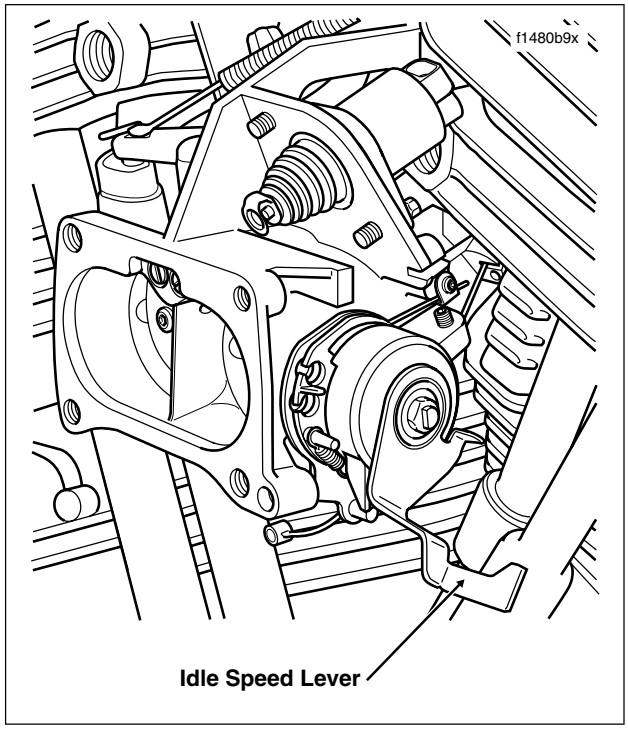



**Figure 9-45. Install Idle Speed Lever Backwards and Measure Throttle Position Sensor Voltage**

7. Turn the Ignition/Light Key Switch to ON, but do not start engine.
8. Using a DVOM (HD-39978, Fluke 78 Multimeter), measure the throttle position sensor voltage between ECM pins 16 and 30 on Breakout Box. See Figure 9-41. NOTE and RECORD this reading.
9. Remove 10 mm nut, lockplate, spacer and idle speed lever from throttle shaft.
10. Reinstall idle speed lever **backwards** and then install spacer and nut on throttle shaft. See Figure 9-45. Open the throttle and insert a brass drift or plastic screwdriver handle into one of the throttle bores (to keep it open and prevent shaft from rotating). Tighten 10 mm nut. Remove brass drift or plastic screwdriver handle from throttle bore.
11. Turn the Ignition/Light Key Switch to ON, but do not start engine.
12. Using a DVOM (HD-39978, Fluke 78 Multimeter), measure the throttle position sensor voltage between ECM pins 16 and 30 on Breakout Box. See Figure 9-41. NOTE and RECORD this **warm-slow idle** reading.
13. Using slots, remove idle and throttle cables from integral cable guides cast at front of induction module. Using a needle nose pliers, pull cable barrel ends from holes in throttle wheel (cam lever assembly).
14. Remove spring retainer screw and spring retainer from the induction module. See Figure 9-46.
15. Remove 10 mm nut, spacer, idle speed lever, spacer, spring pin, cam assembly and spacer from the throttle shaft. See Figure 9-47.

*NOTE*

*Spring pin is located between flat of throttle shaft and shaft lever. See Figure 9-46.*

## INSTALLATION

1. Install **new** spacer and **new** cam assembly onto throttle shaft.

*NOTE*

*Cam assembly is shipped assembled and consists of the cam lever assembly, throttle return spring, shaft lever (with cold idle speed set screw) and lever retaining spring.*

2. See Figure 9-46. Loosely install **new** spring retainer to induction module with spring retainer screw. Place end of throttle return spring into spring retainer. Tighten spring retainer screw.
3. Install **new** spring pin between flat of throttle shaft and shaft lever. See Figure 9-46.

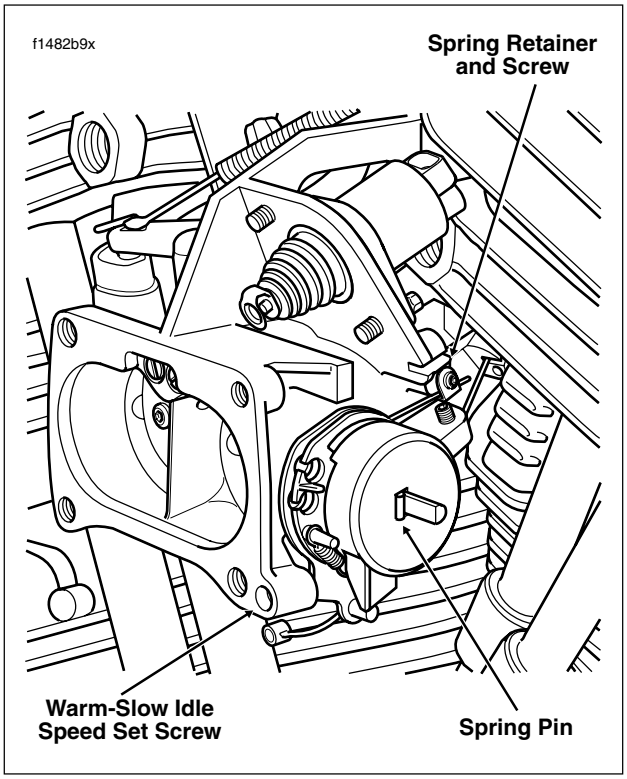



**Figure 9-46. Install Cam Lever Assembly**

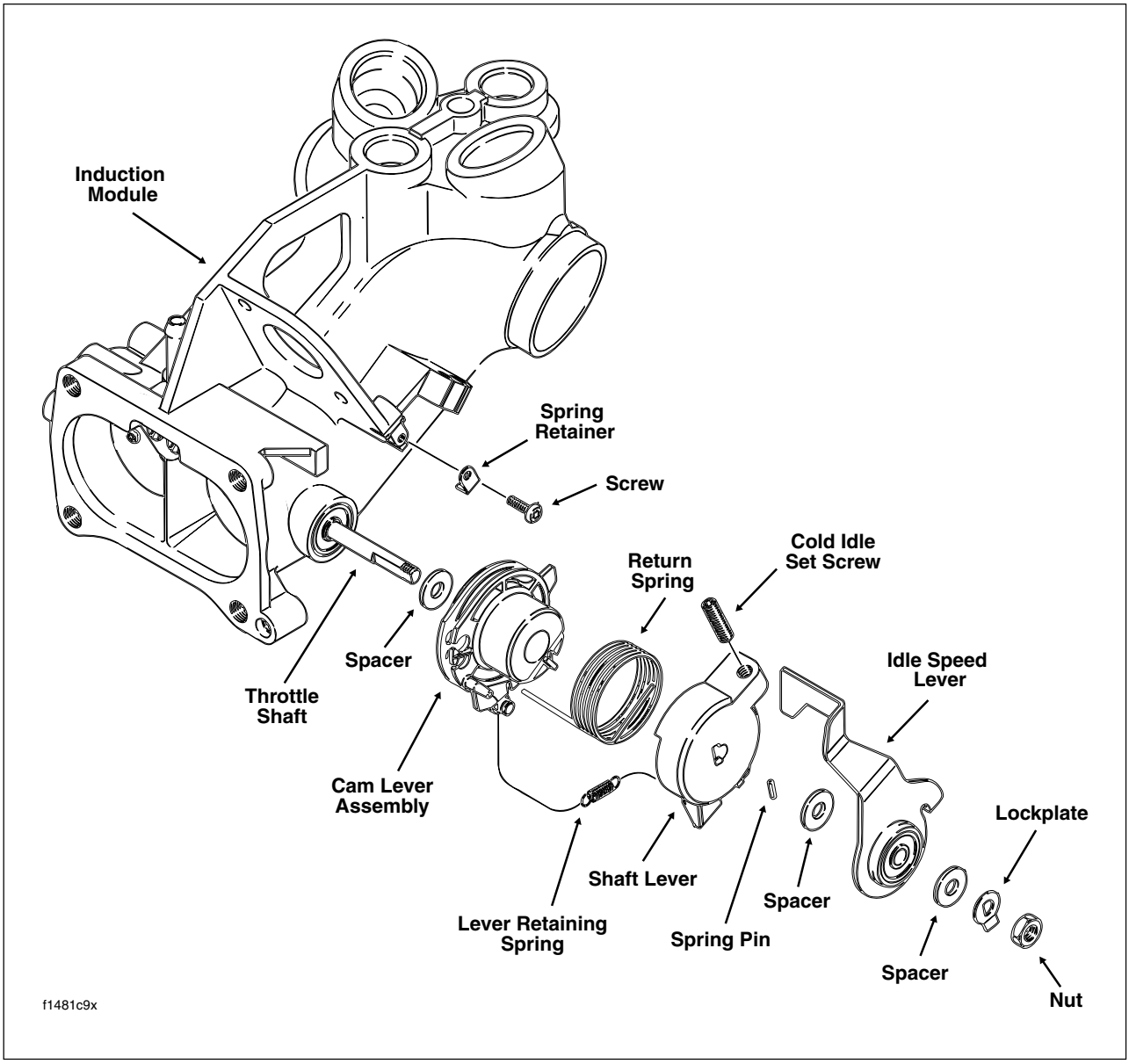



**Figure 9-47. Cam Lever Assembly**

4. Install **new** spacer onto throttle shaft. Install idle speed lever **backwards** and then install spacer and **new** 10 mm nut on throttle shaft. See Figure 9-45. Open the throttle and insert a brass drift or plastic screwdriver handle into one of the throttle bores (to keep it open and prevent shaft from rotating). Tighten 10 mm nut. Remove brass drift or plastic screwdriver handle from throttle bore.
5. Adjust **warm-slow idle** throttle position sensor voltage to match reading taken in Step 12 under CAM LEVER ASSEMBLY, REMOVAL. Adjustments are made by turning warm-slow idle speed set screw using a T10 TORX drive head. See Figure 9-46.
6. Drawing the idle cable around the top of the throttle wheel, insert barrel end into upper hole. Draw the throttle cable around the bottom of the throttle wheel and insert barrel end into lower hole. Using slots, slip throttle and idle cables into cable guides cast at front of induction module. Tighten cables as necessary to keep barrel ends from dislodging. Verify that cables are seated in channel of throttle wheel.
7. Adjust the throttle cables. See Section 2.19 THROTTLE CABLES, ADJUSTMENT.

8. Remove nut, spacer and idle speed lever. Install idle speed lever onto throttle shaft in correct position (flat section of lever positioned between spring clip of actuator). Install spacer and lockplate onto end of throttle shaft. Start 10 mm nut onto shaft.
9. Open the throttle and insert a brass drift or plastic screwdriver handle into one of the throttle bores (to keep it open and prevent shaft from rotating) and tighten nut to 25 **in-lbs** (2.8 mm). Remove screwdriver after nut is tightened.
10. Bend tab on lockplate so that it rests tightly against flat of nut.
11. Turn the Ignition/Light Key Switch to ON, but do not start engine. Measure the throttle position sensor voltage between pins 16 and 30 on the breakout box using a DVOM (Fluke 78 multimeter, HD-39978). NOTE this reading.
12. Using a T10 TORX drive head, adjust the cold idle speed set screw (on the shaft lever) until the reading is the same as that taken in Step 8 under CAM LEVER ASSEMBLY, REMOVAL.
13. With the Ignition/Light Key Switch in the OFF position, plug the wire harness connector into the ISC actuator.
14. Disconnect breakout box between ECM and EFI wiring harness. Install ECM.
15. Install fuel tank. See Section 9.3 FUEL TANK ASSEMBLY, FUEL TANK, INSTALLATION (AFTER PARTIAL REMOVAL), FLHTC/U-I, FLTR-I, or FLHR/C-I.
16. Install backplate and air cleaner assembly. See Section 9.4 AIR CLEANER ASSEMBLY, AIR CLEANER, INSTALLATION.
17. Verify idle speed adjustments. See Section 9.4 AIR CLEANER ASSEMBLY, COLD IDLE SPEED ADJUSTMENT and WARM-SLOW IDLE SPEED ADJUSTMENT.

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# APPENDICES

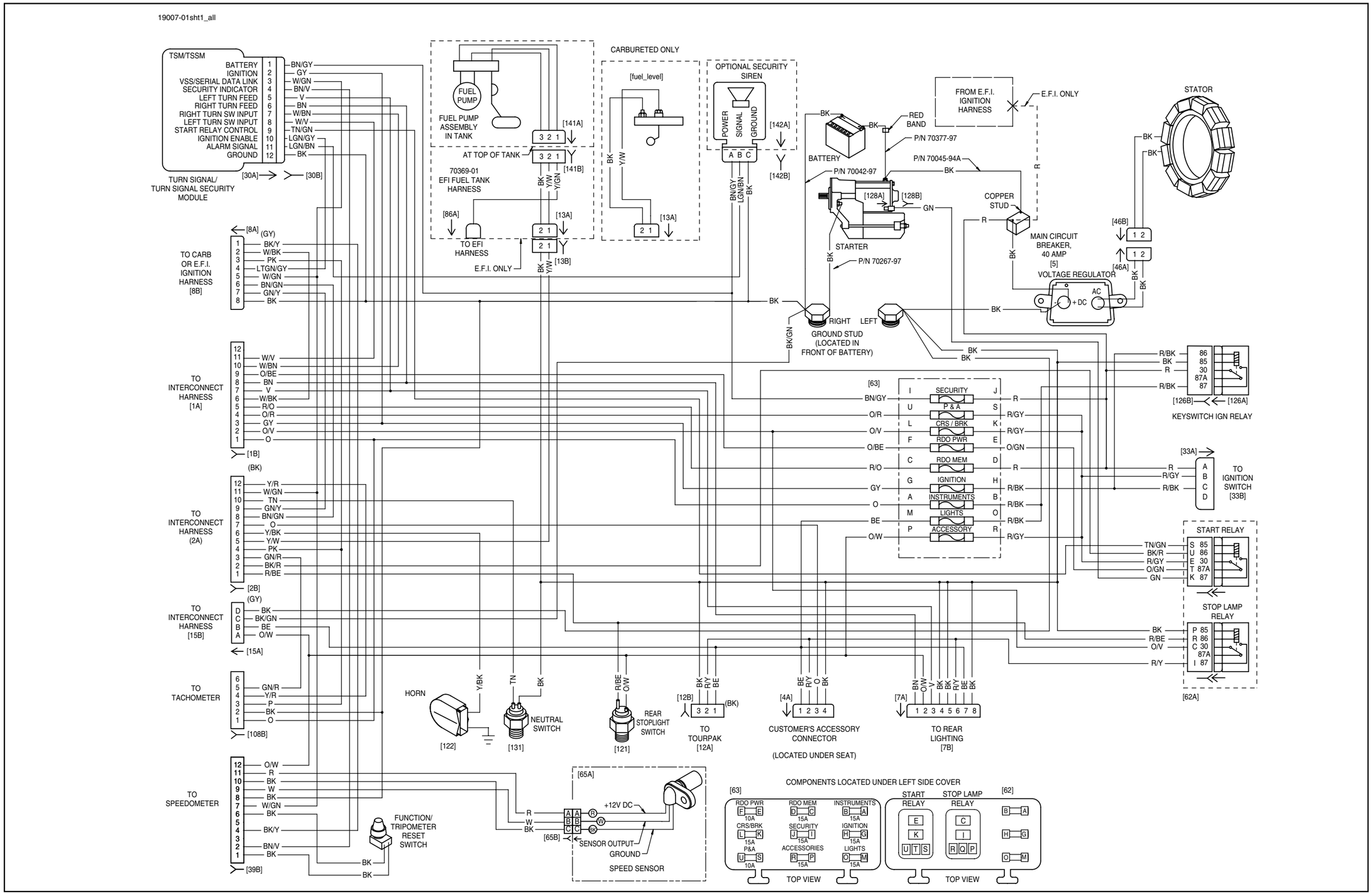



**Figure A-1. 2001 FLHTP-I (Domestic and International Models), Main Wiring Diagram**

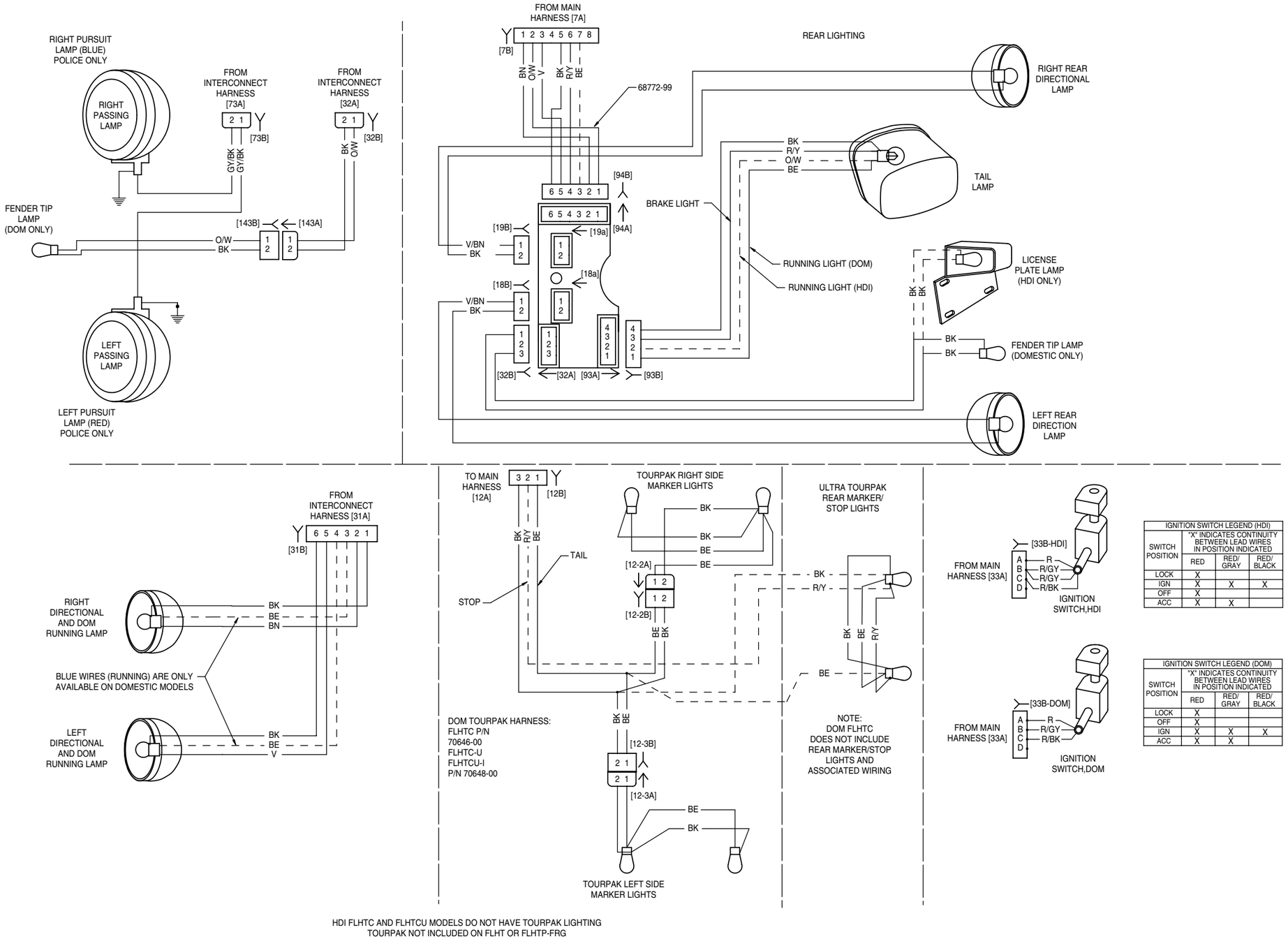



**Figure A-2. 2001 FLHTP-I Wiring Diagram (Domestic and International Models), Ignition Switch, Tail Lamp, Pursuit Lamps and Directional Lamps**

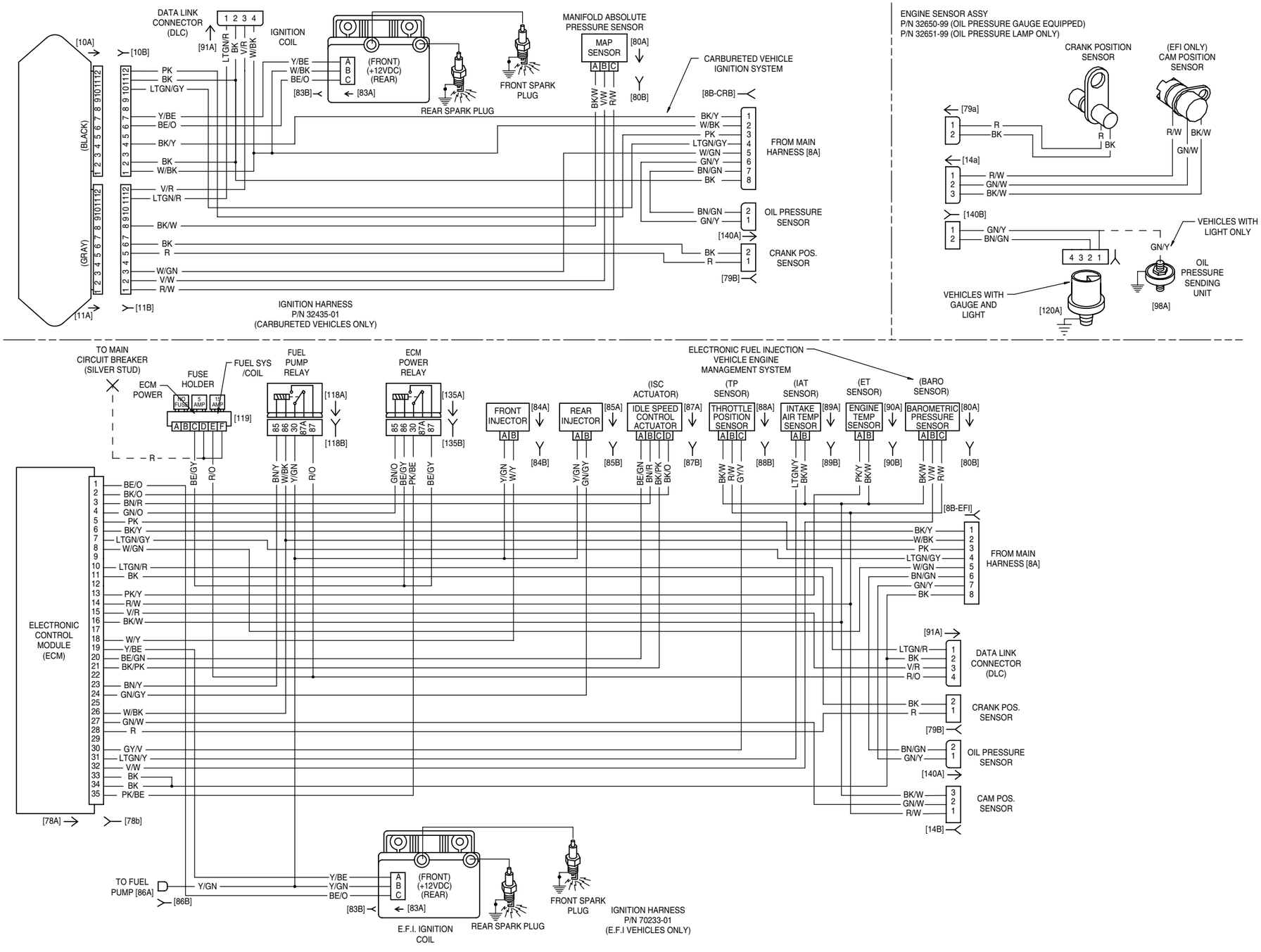



**Figure A-3. 2001 FLHTP-I Wiring Diagram (Domestic and International Models), Ignition Harness**

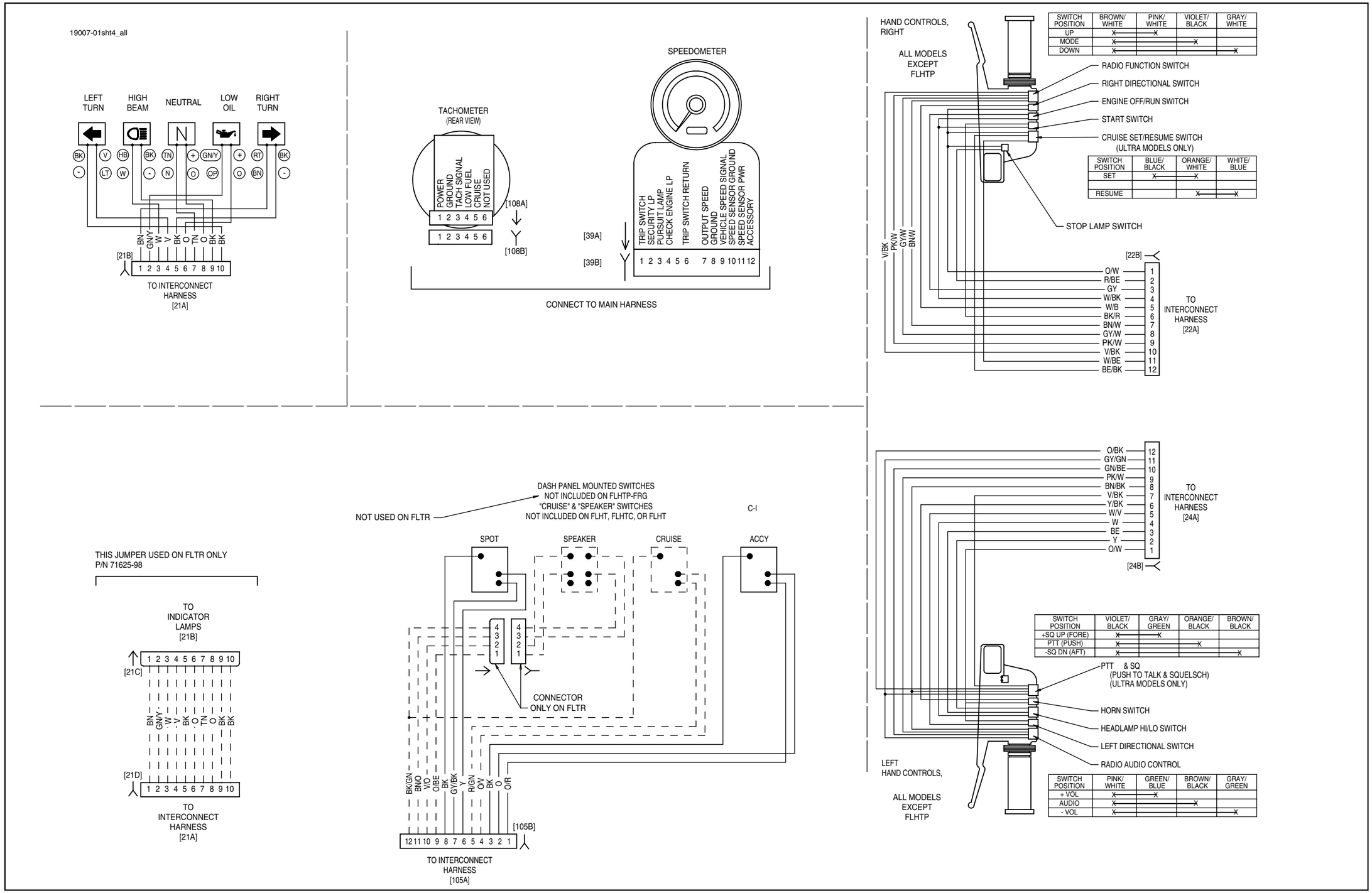



**Figure A-4. 2001 FLHTP-I Wiring Diagram (Domestic and International Models), Speedometer, Tachometer and Indicator Lights**

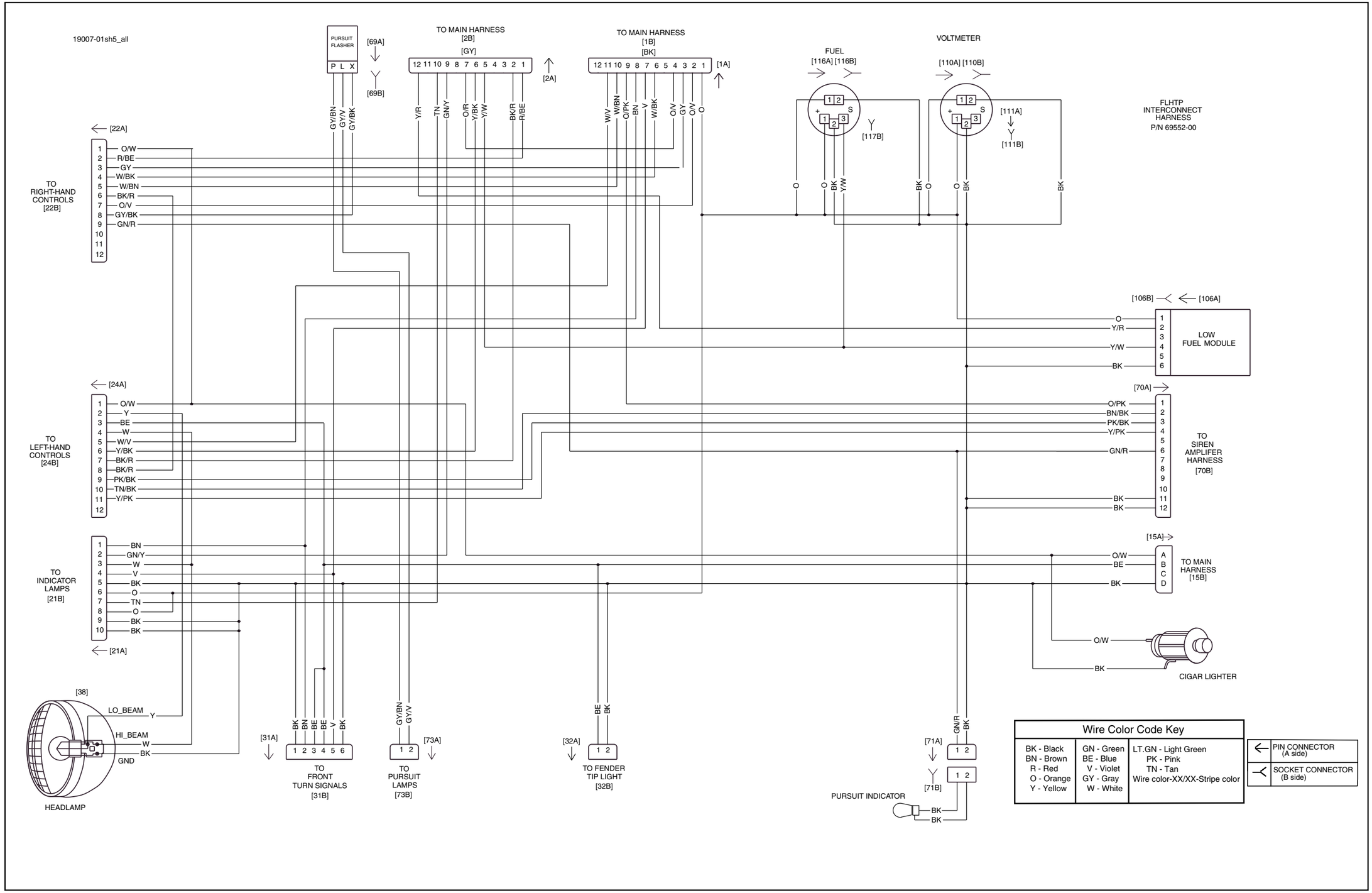



**Figure A-5. 2001 FLHTP-I Wiring Diagram (Domestic and International Models), Interconnect Harness**

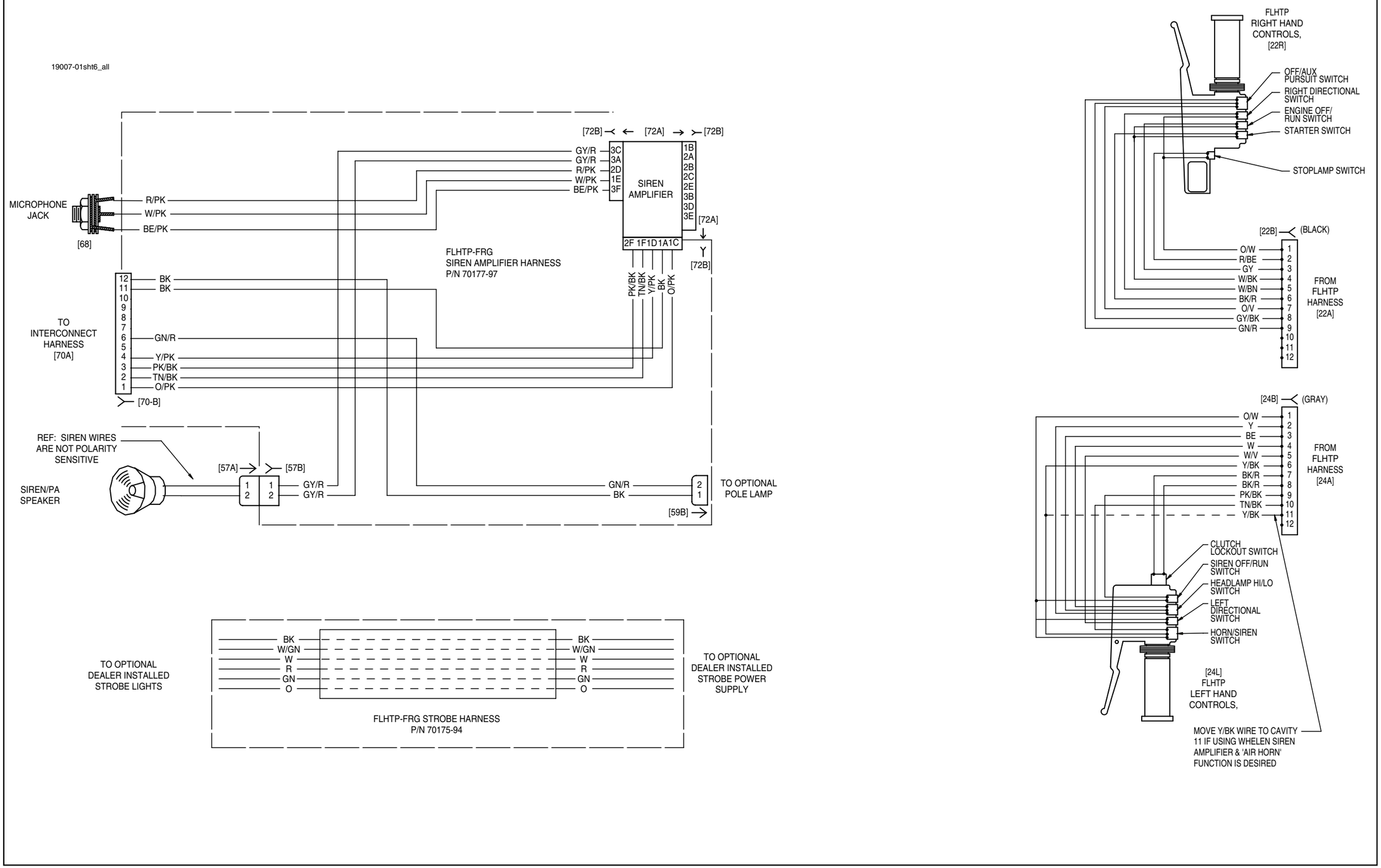



**Figure A-6. 2001 FLHTP-I Wiring Diagram (Domestic and International Models), Siren, Strobe Harness, Hand Controls**

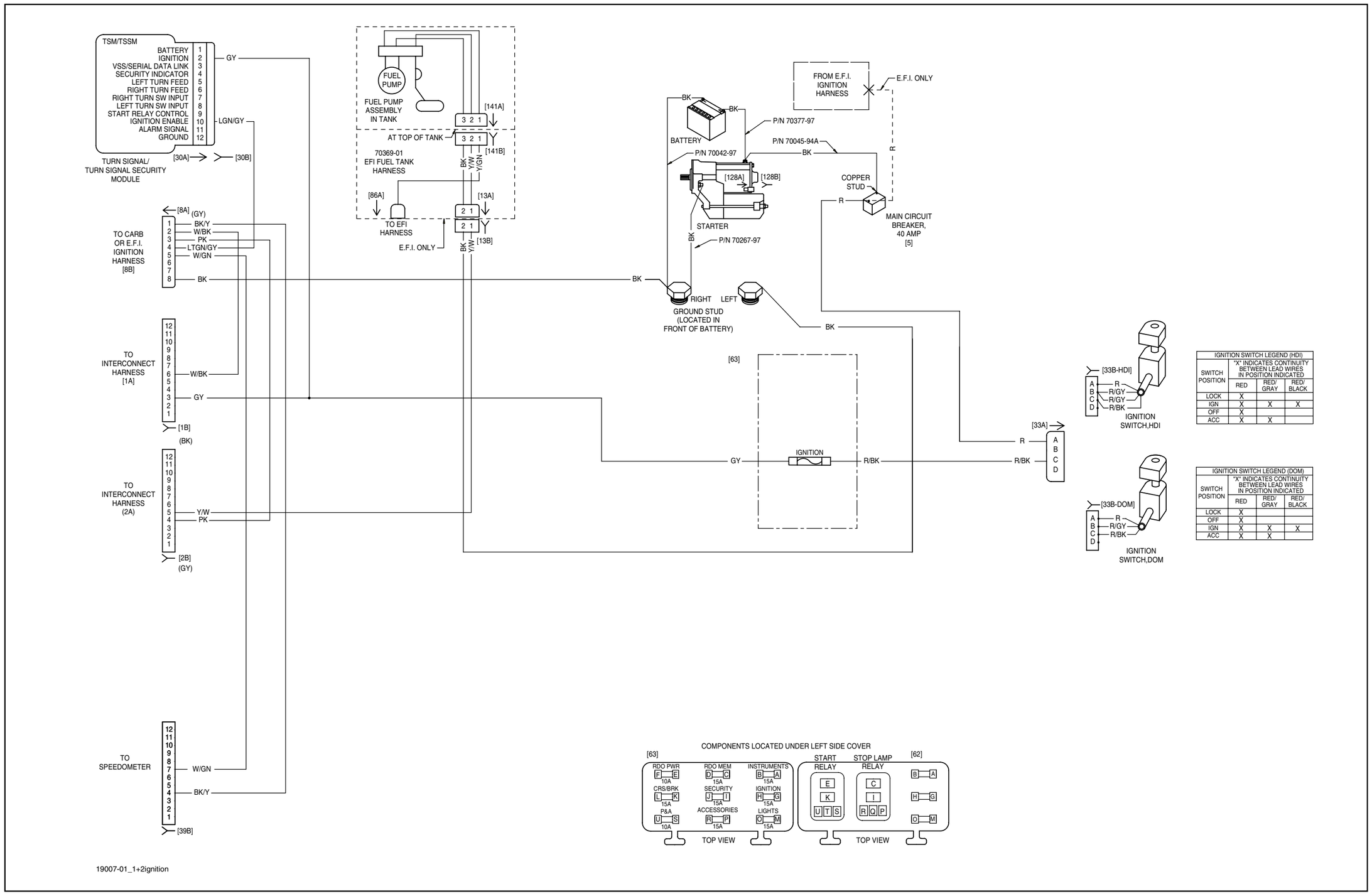



**Figure A-7. 2001 FLHTP-I Wiring Diagram (Domestic and International Models), Ignition Circuit (Sheet 1 of 3)**

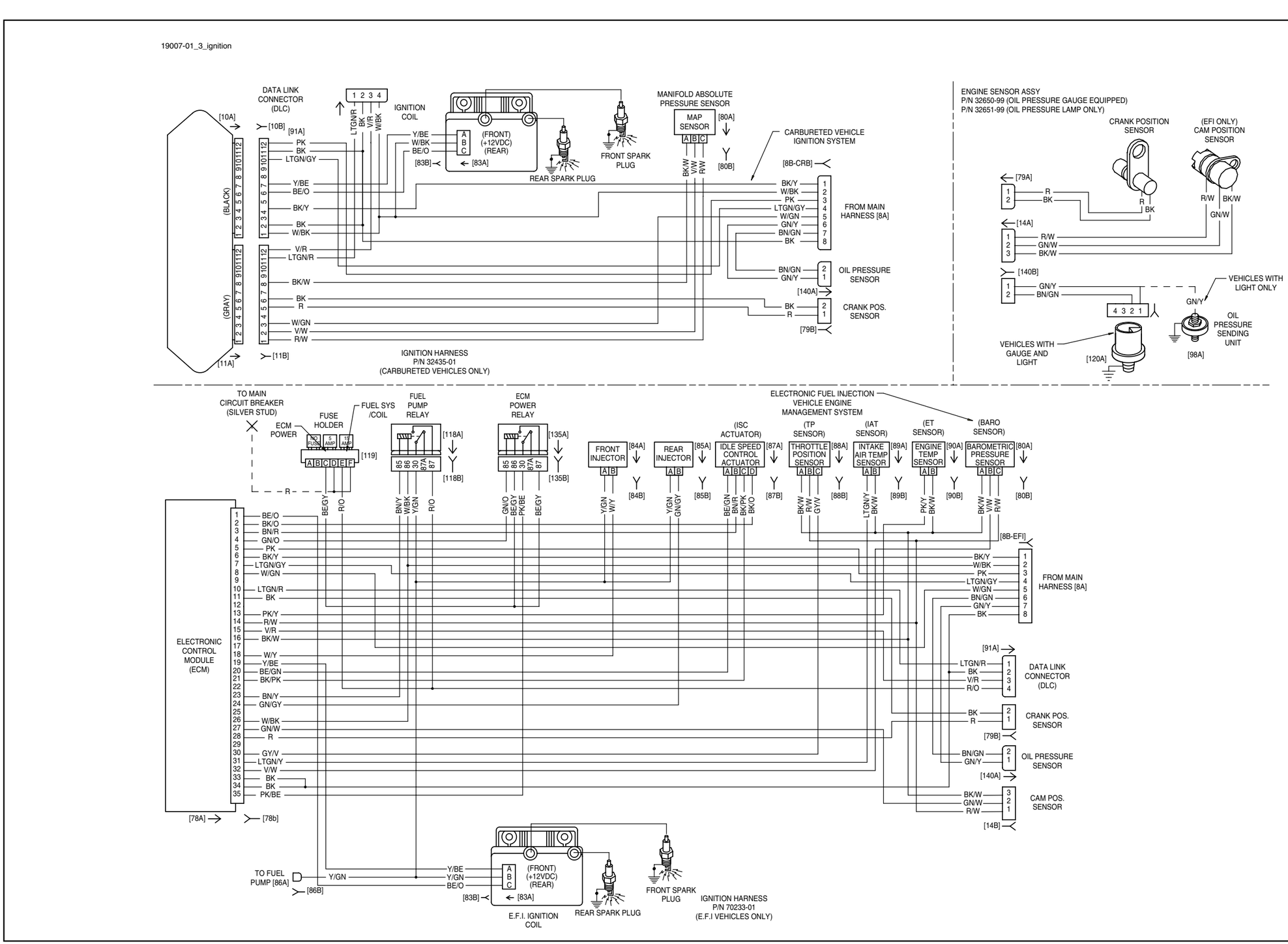



**Figure A-8. 2001 FLHTP-I Wiring Diagram (Domestic and International Models), Ignition Circuit (Sheet 2 of 3)**

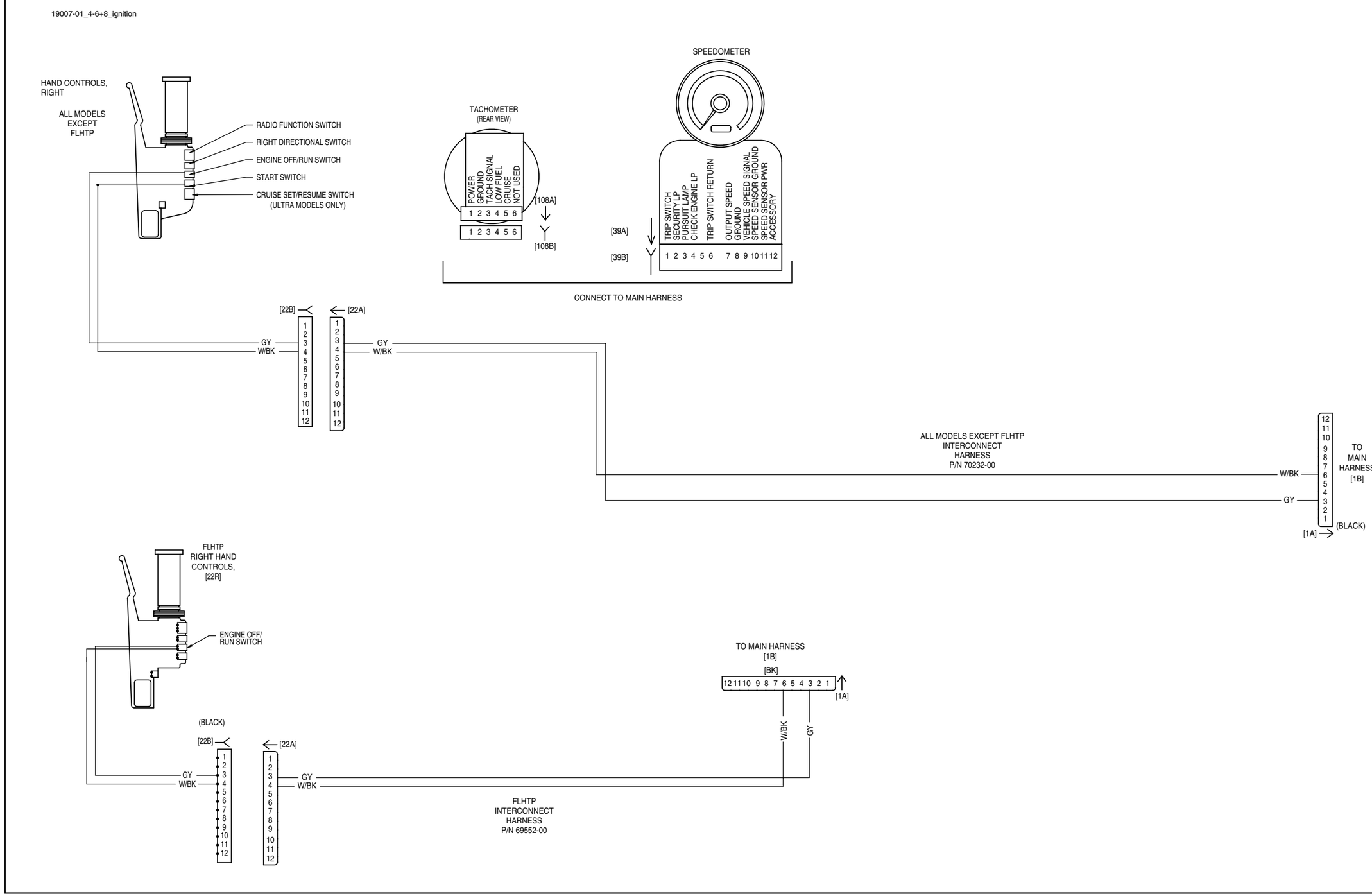



**Figure A-9. 2001 FLHTP-I Wiring Diagram (Domestic and International Models), Ignition Circuit (Sheet 3 of 3)**

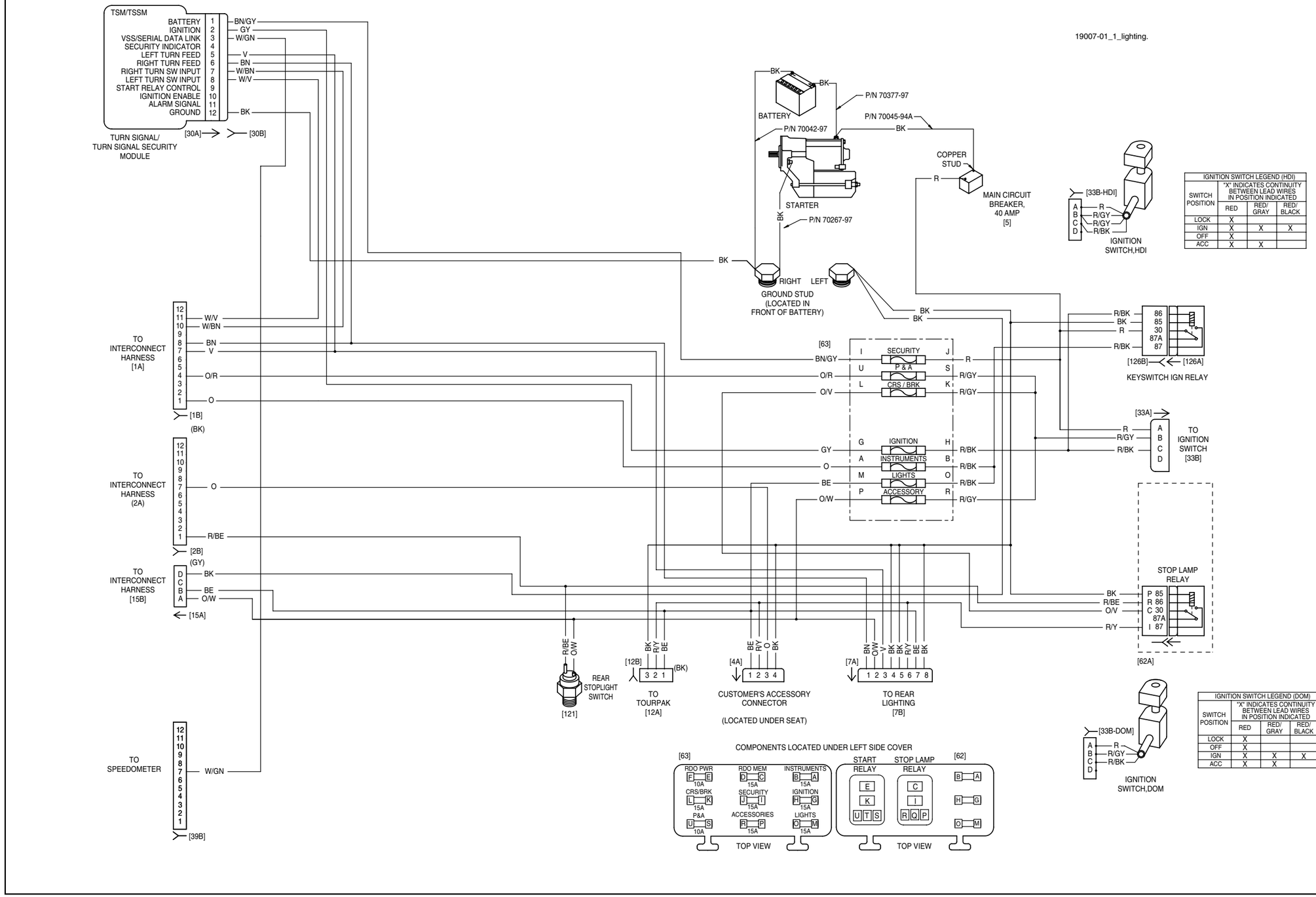



**Figure A-10. 2001 FLHTP-I Wiring Diagram (Domestic and International Models), Lights Circuit (Sheet 1 of 4)**

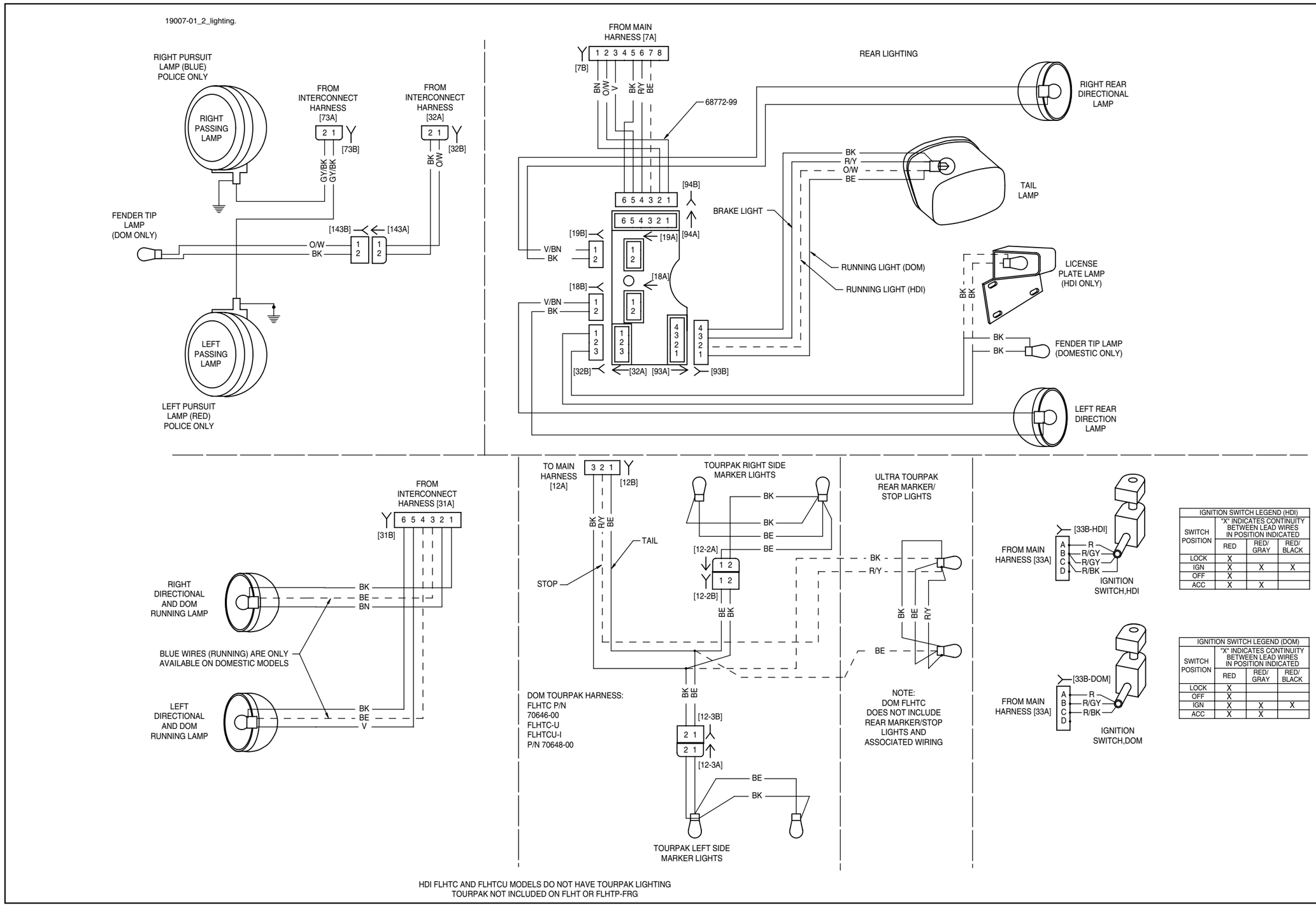



**Figure A-11. 2001 FLHTP-I Wiring Diagram (Domestic and International Models), Lights Circuit (Sheet 2 of 4)**

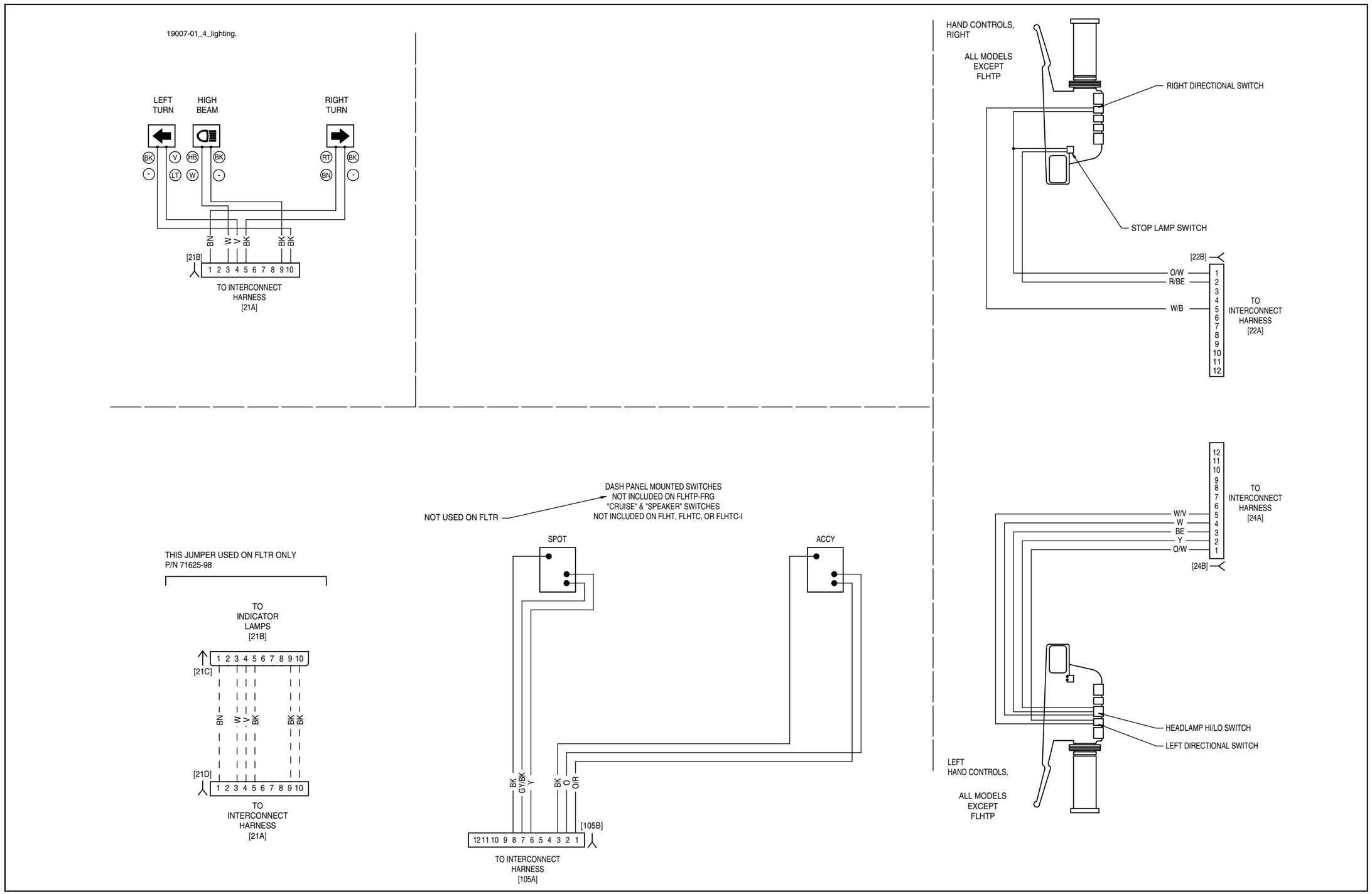



**Figure A-12. 2001 FLHTP-I Wiring Diagram (Domestic and International Models), Lights Circuit (Sheet 3 of 4)**

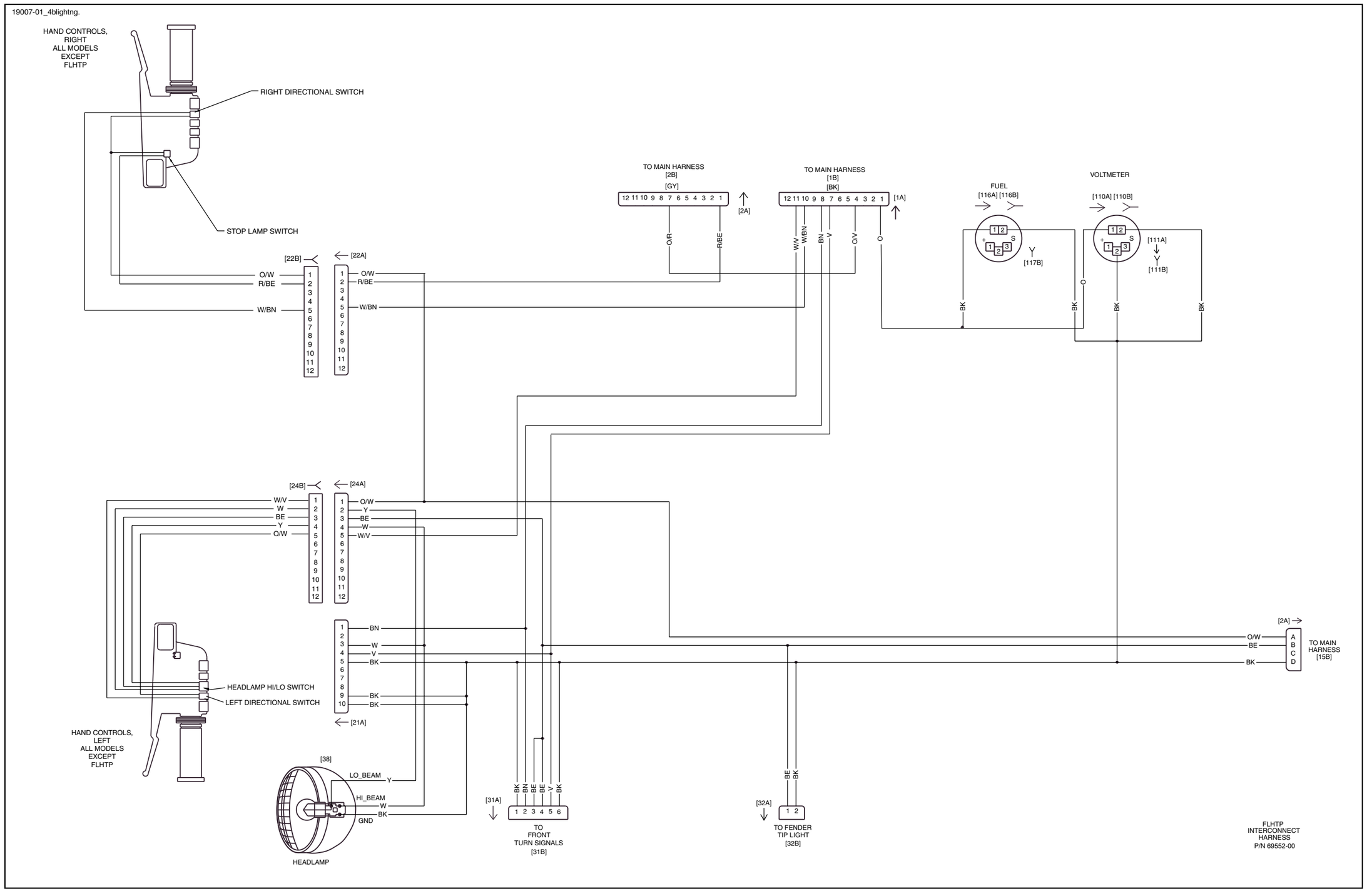



**Figure A-13. 2001 FLHTP-I Wiring Diagram (Domestic and International Models), Lights Circuit (Sheet 4 of 4)**

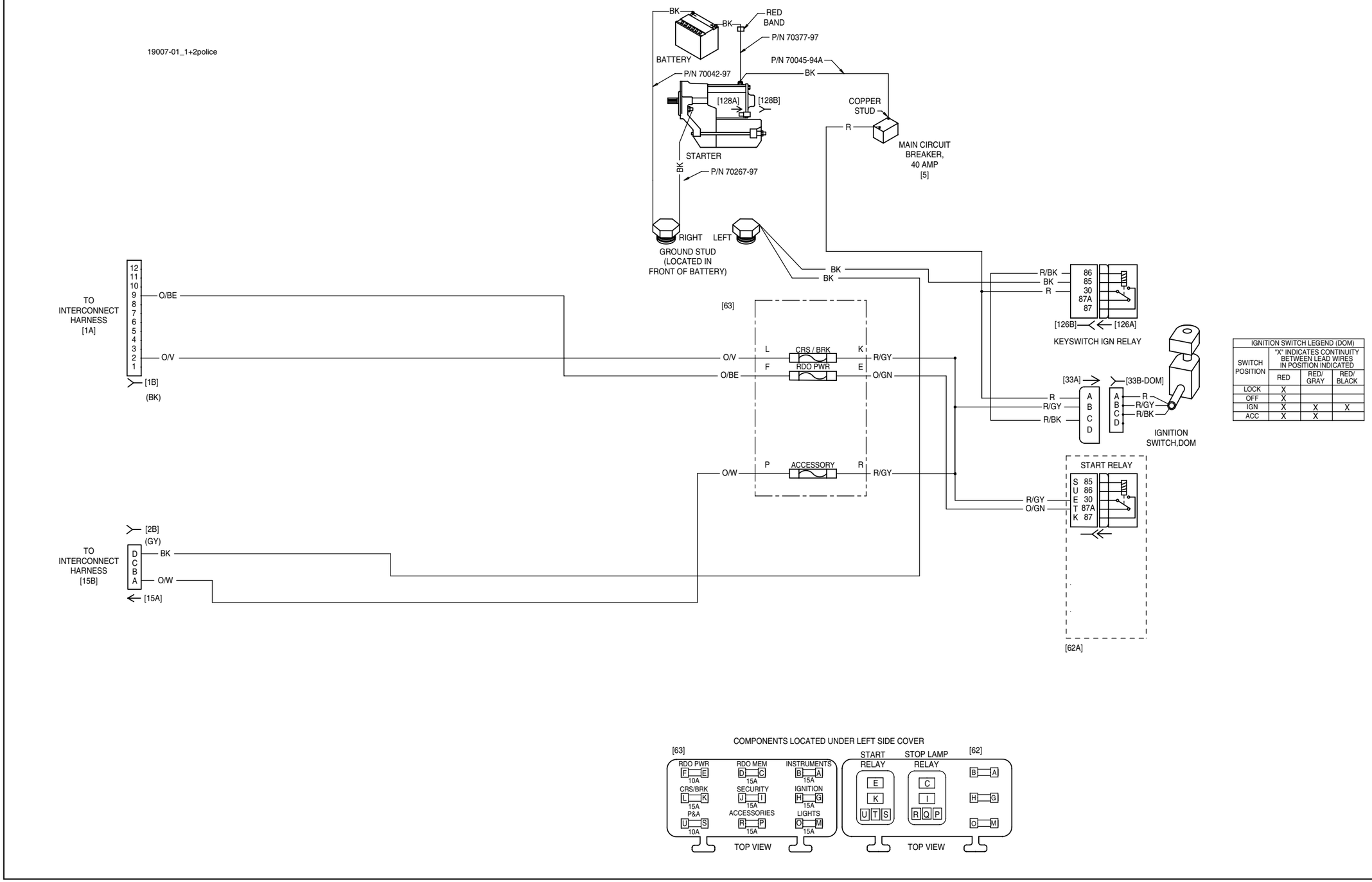



**Figure A-14. 2001 FLHTP-I Wiring Diagram (Domestic and International Models), Police Equipment (Sheet 1 of 3)**

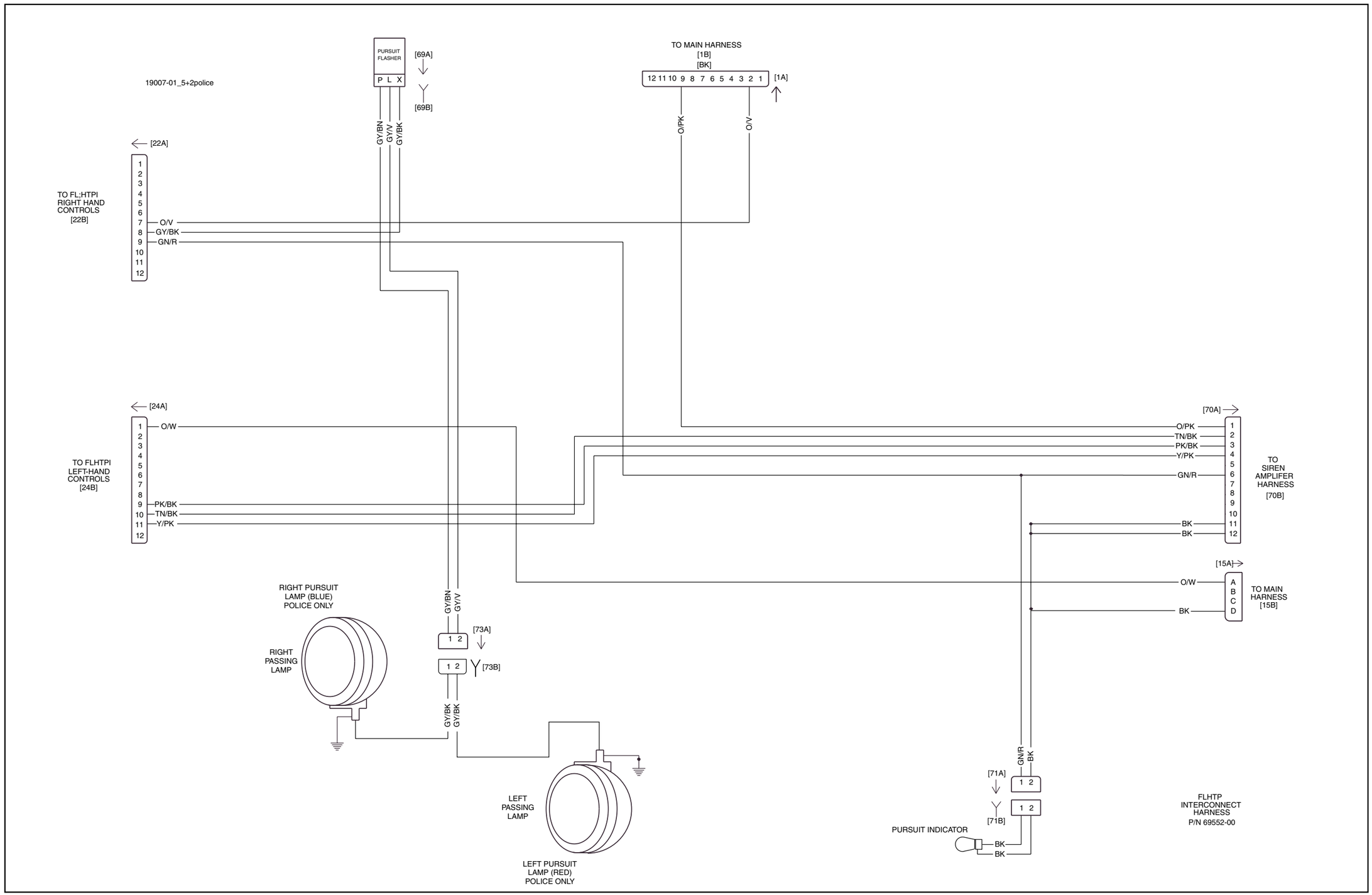



**Figure A-15. 2001 FLHTP-I Wiring Diagram (Domestic and International Models), Police Equipment (Sheet 1 of 3)**

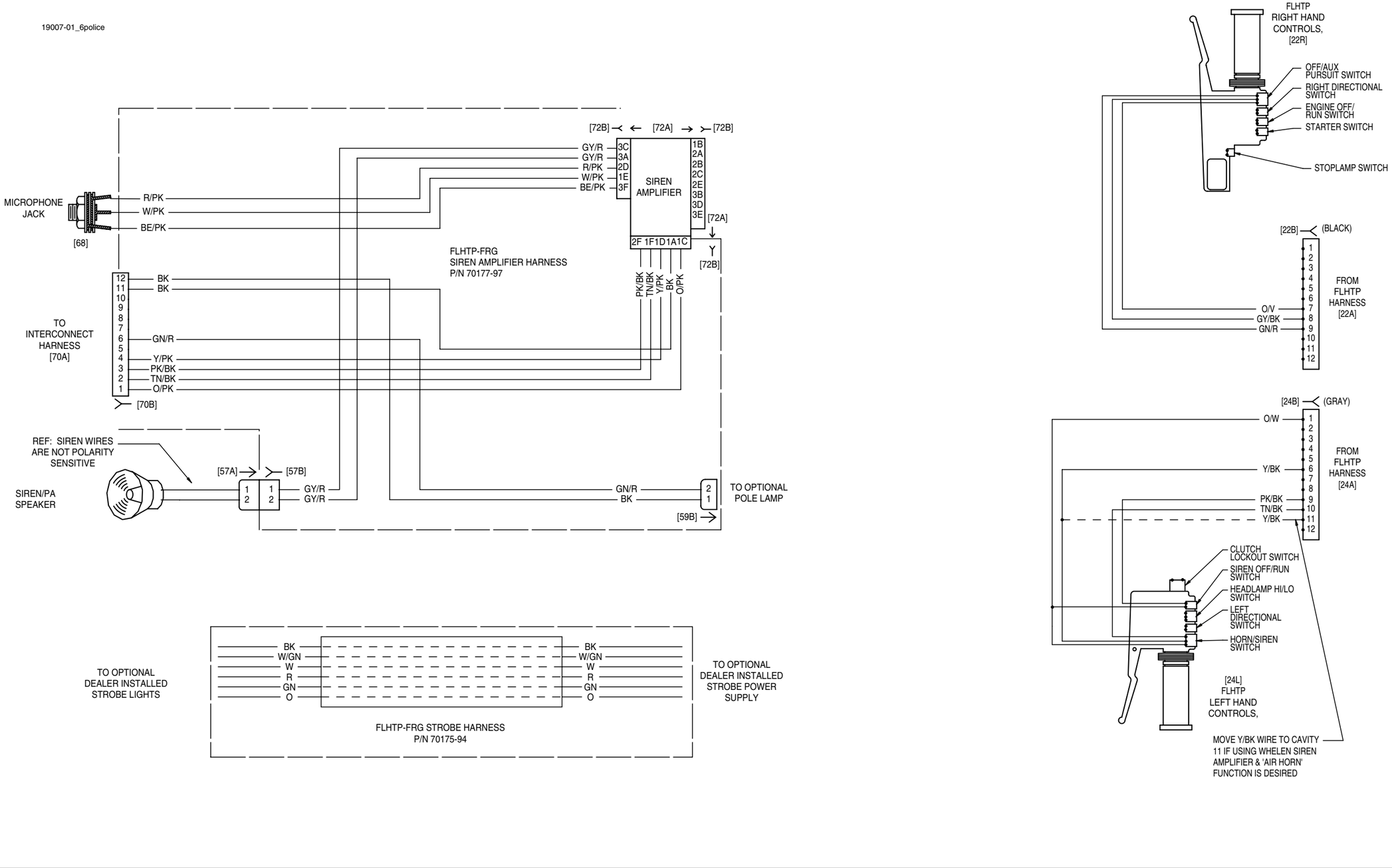



**Figure A-16. 2001 FLHTP-I Wiring Diagram (Domestic and International Models), Police Equipment (Sheet 3 of 3)**

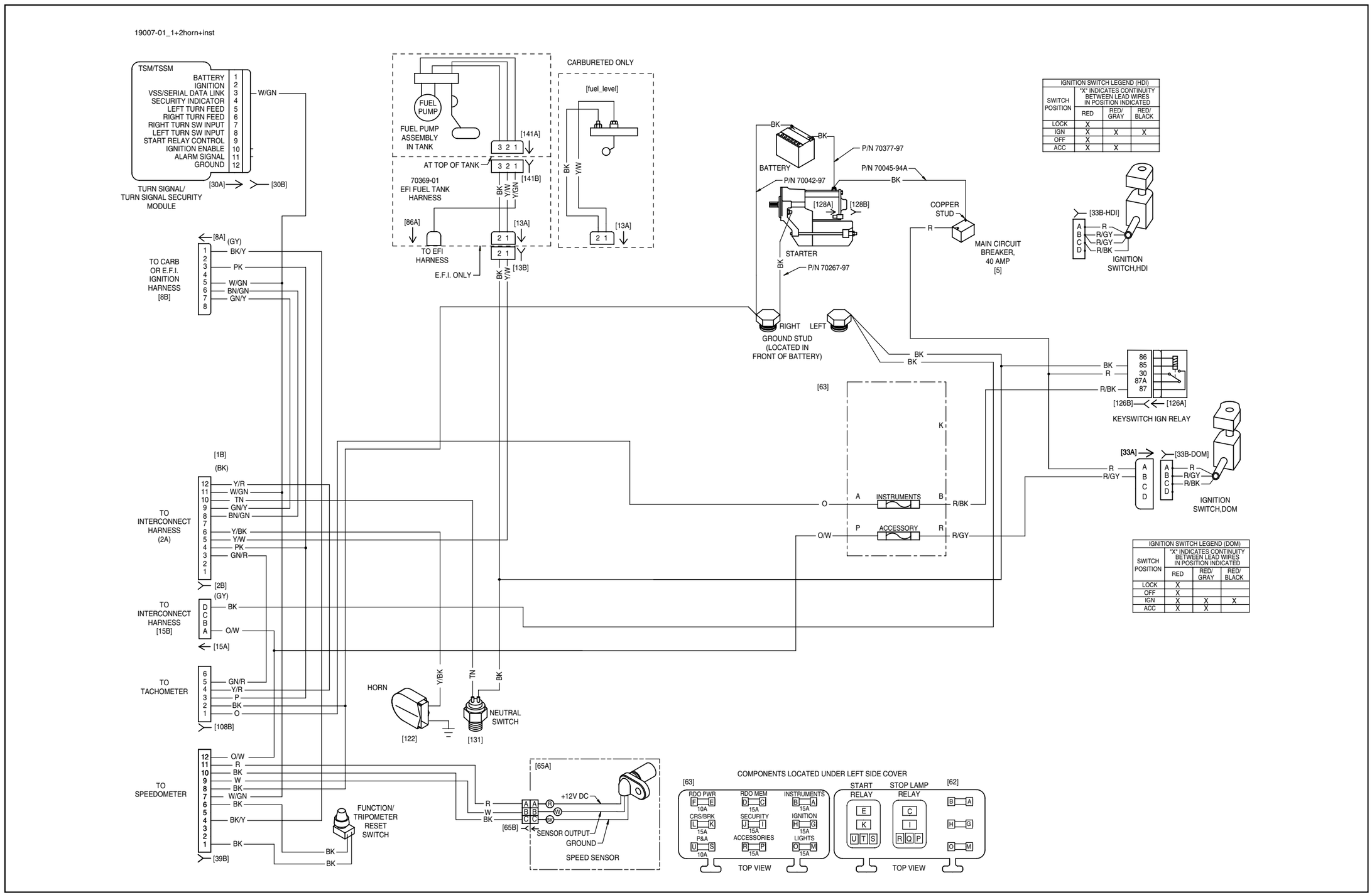



**Figure A-17. 2001 FLHTP-I Wiring Diagram (Domestic and International Models), Horn and Instruments (Sheet 1 of 4)**

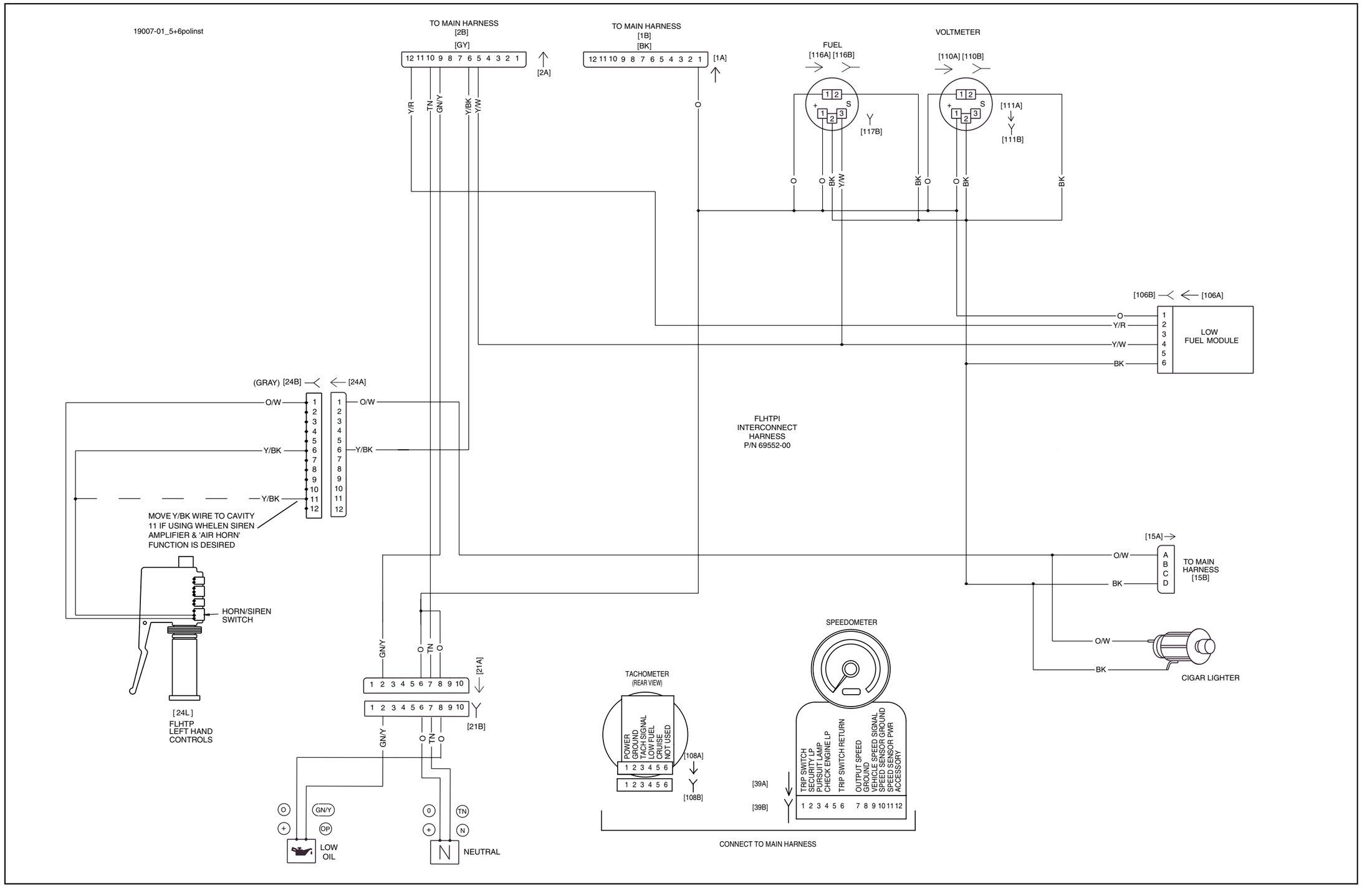
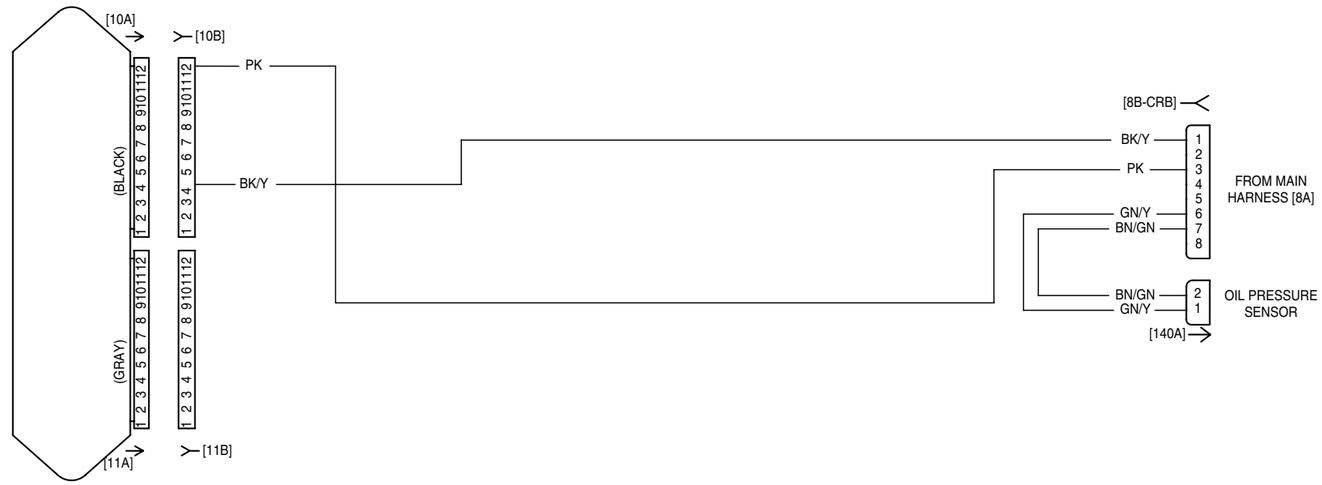



**Figure A-18. 2001 FLHTP-I Wiring Diagram (Domestic and International Models), Horn and Instruments (Sheet 2 of 4)**




ENGINE SENSOR ASSY
P/N 32650-99 (OIL PRESSURE GAUGE EQUIPPED)
P/N 32651-99 (OIL PRESSURE LAMP ONLY)

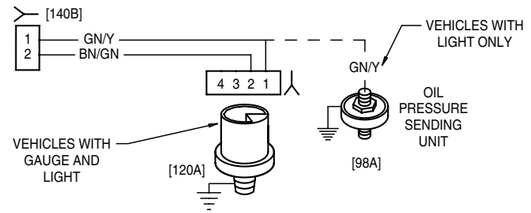






**Figure A-19. 2001 FLHTP-I Wiring Diagram (Domestic and International Models), Horn and Instruments (Sheet 3 of 4)**

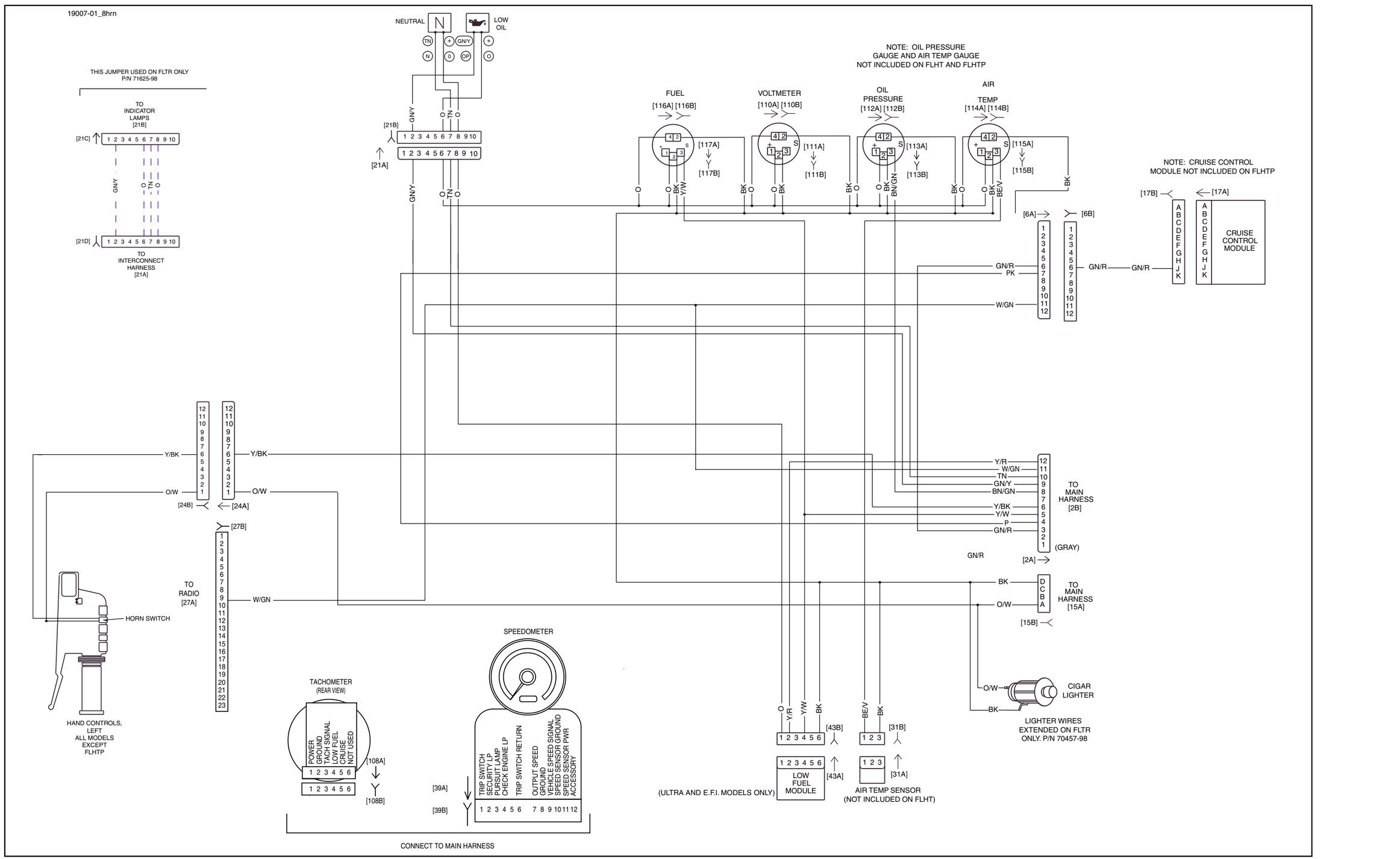



**Figure A-20. 2001 FLHTP-I Wiring Diagram (Domestic and International Models), Horn and Instruments (Sheet 4 of 4)**

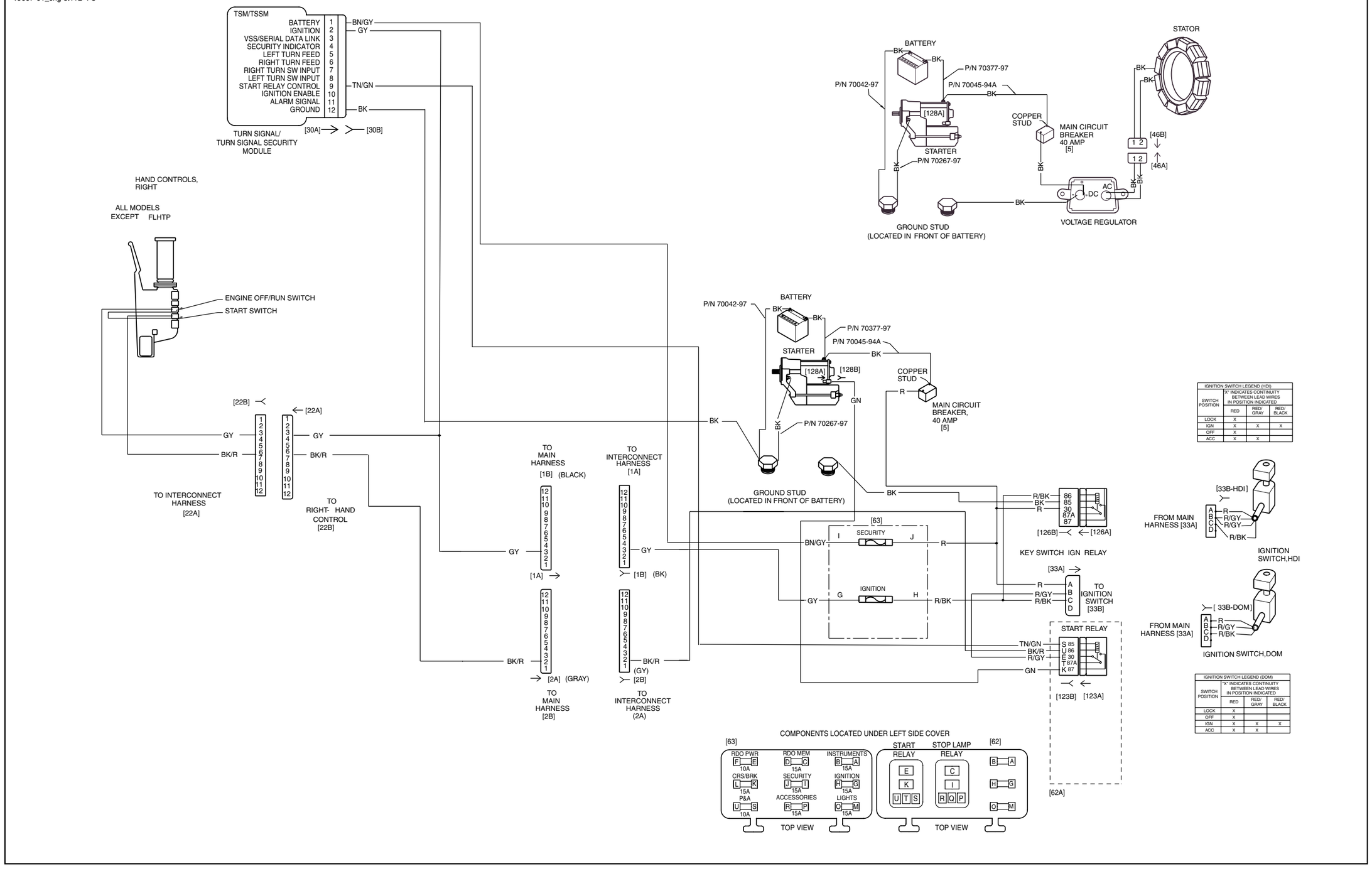



**Figure A-21. 2001 FLHTP-I Wiring Diagram (Domestic and International Models), Starting and Charging Circuits**

19007-01_pst2

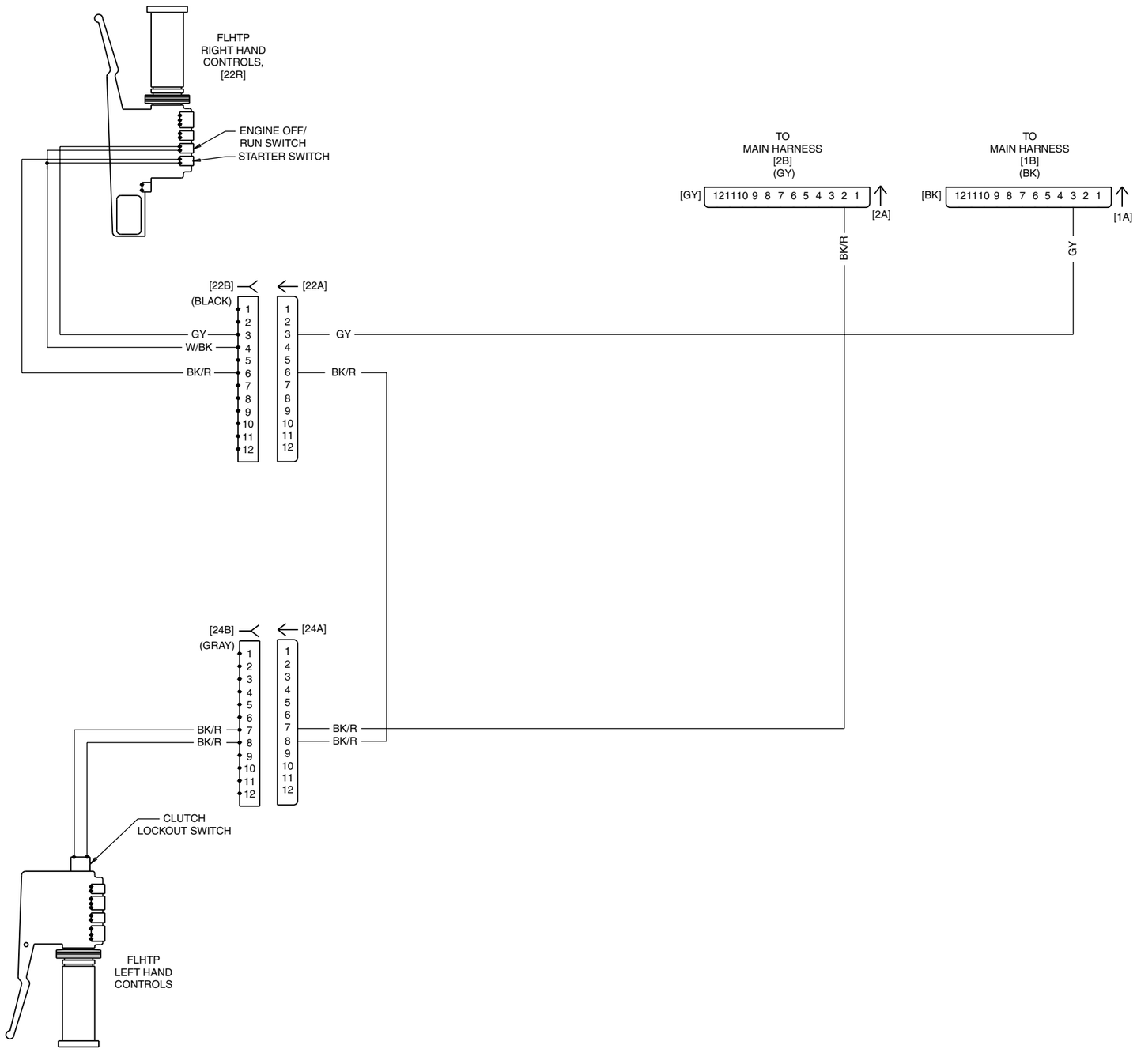



**Figure A-22. 2001 FLHTP-I Wiring Diagram (Domestic and International Models), Starting Circuit**

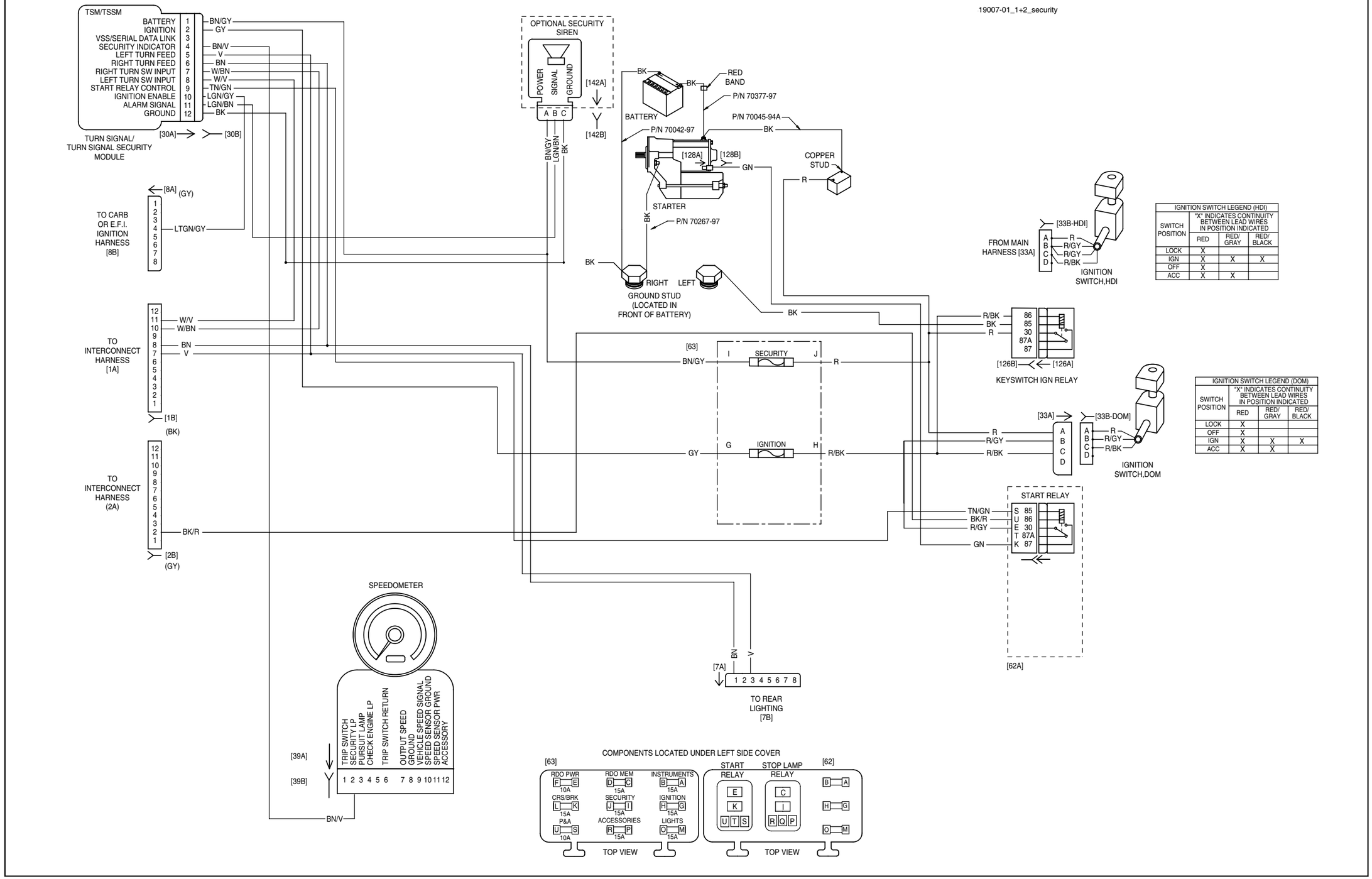



**Figure A-23. 2001 FLHTP-I Wiring Diagram (Domestic and International Models), Security Circuit (Sheet 1 of 3)**

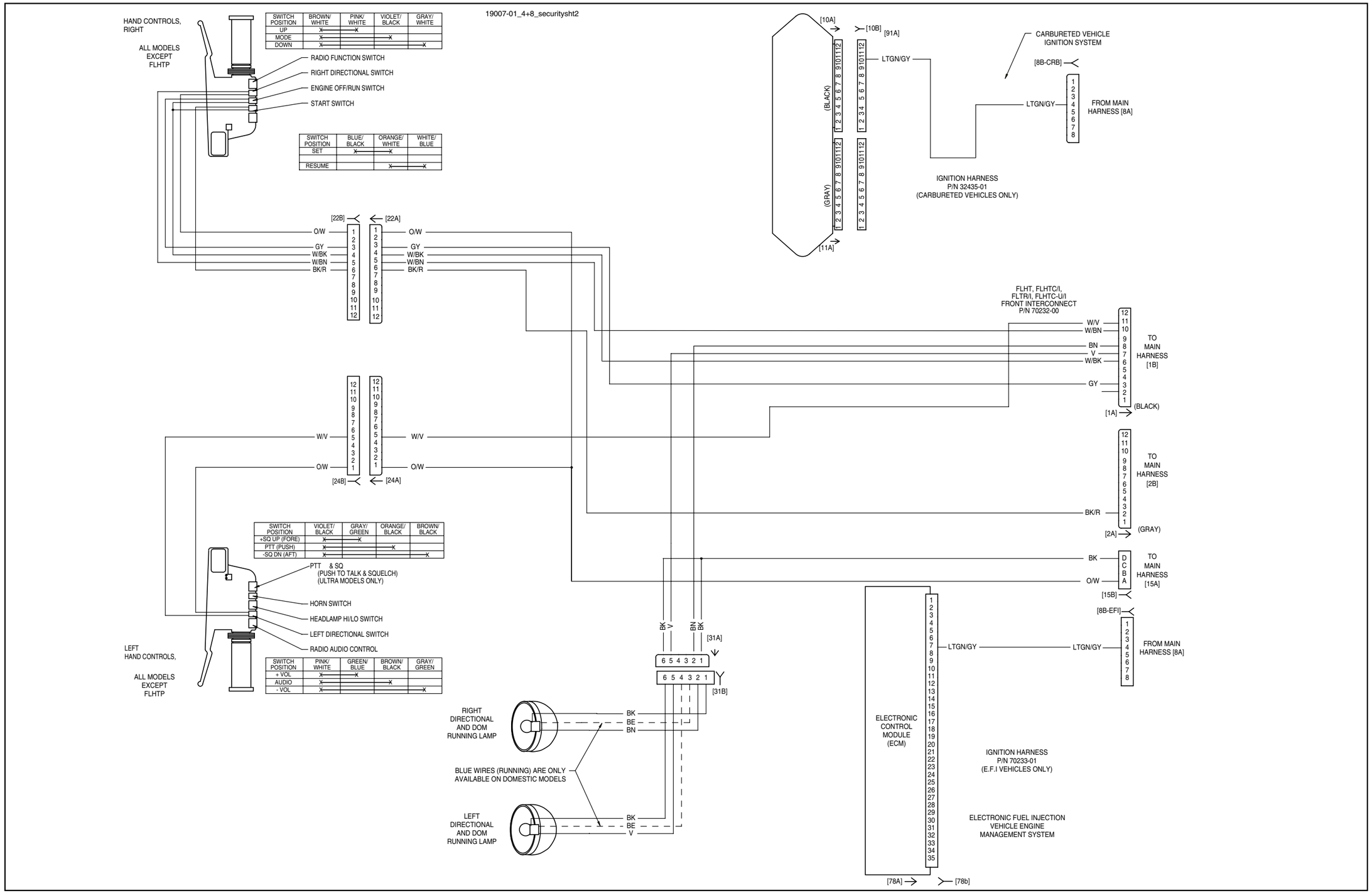



**Figure A-24. 2001 FLHTP-I Wiring Diagram (Domestic and International Models), Security Circuit (Sheet 2 of 3)**

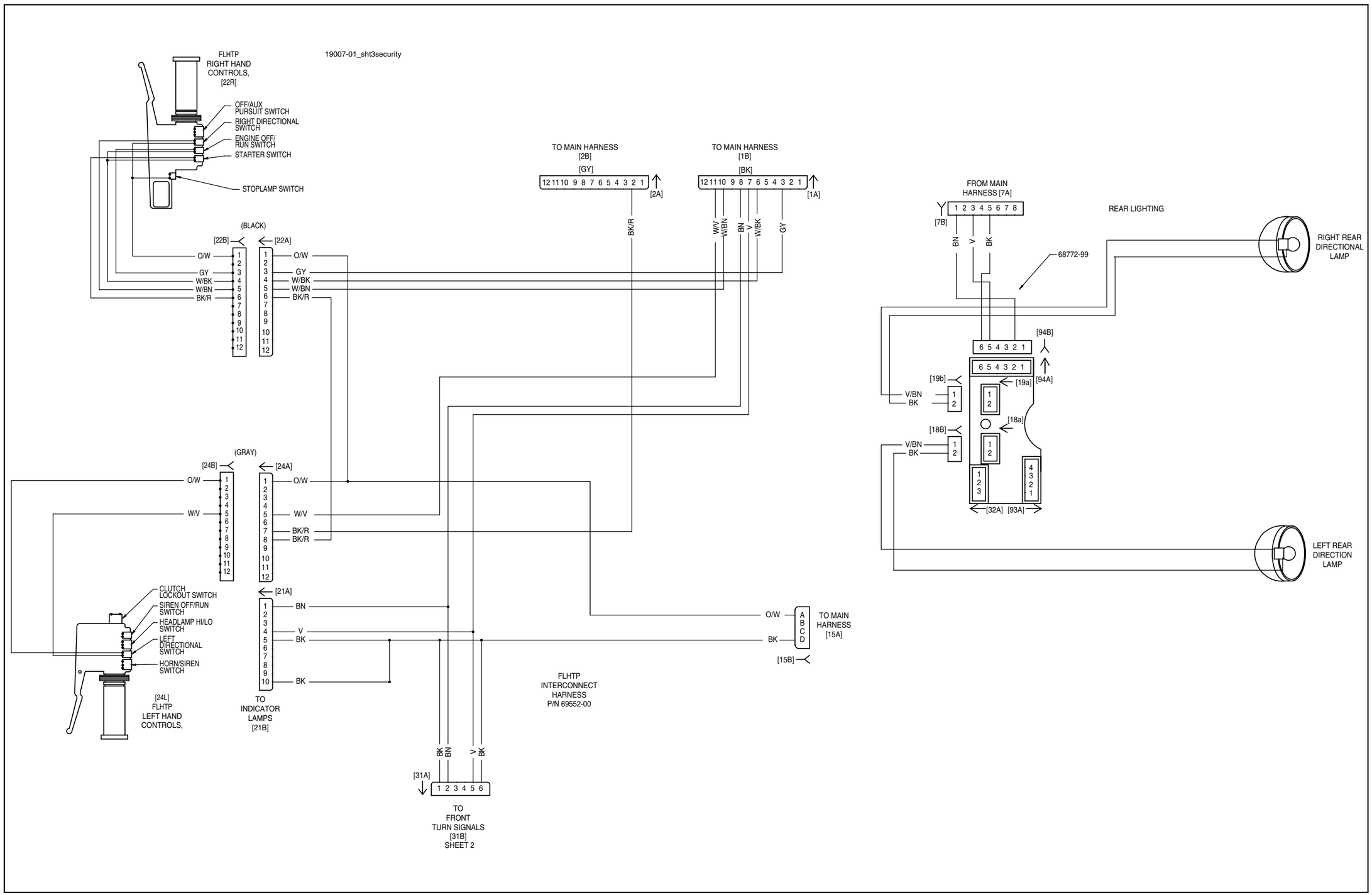



**Figure A-25. 2001 FLHTP-I Wiring Diagram (Domestic and International Models), Security Circuit (Sheet 3 of 3)**

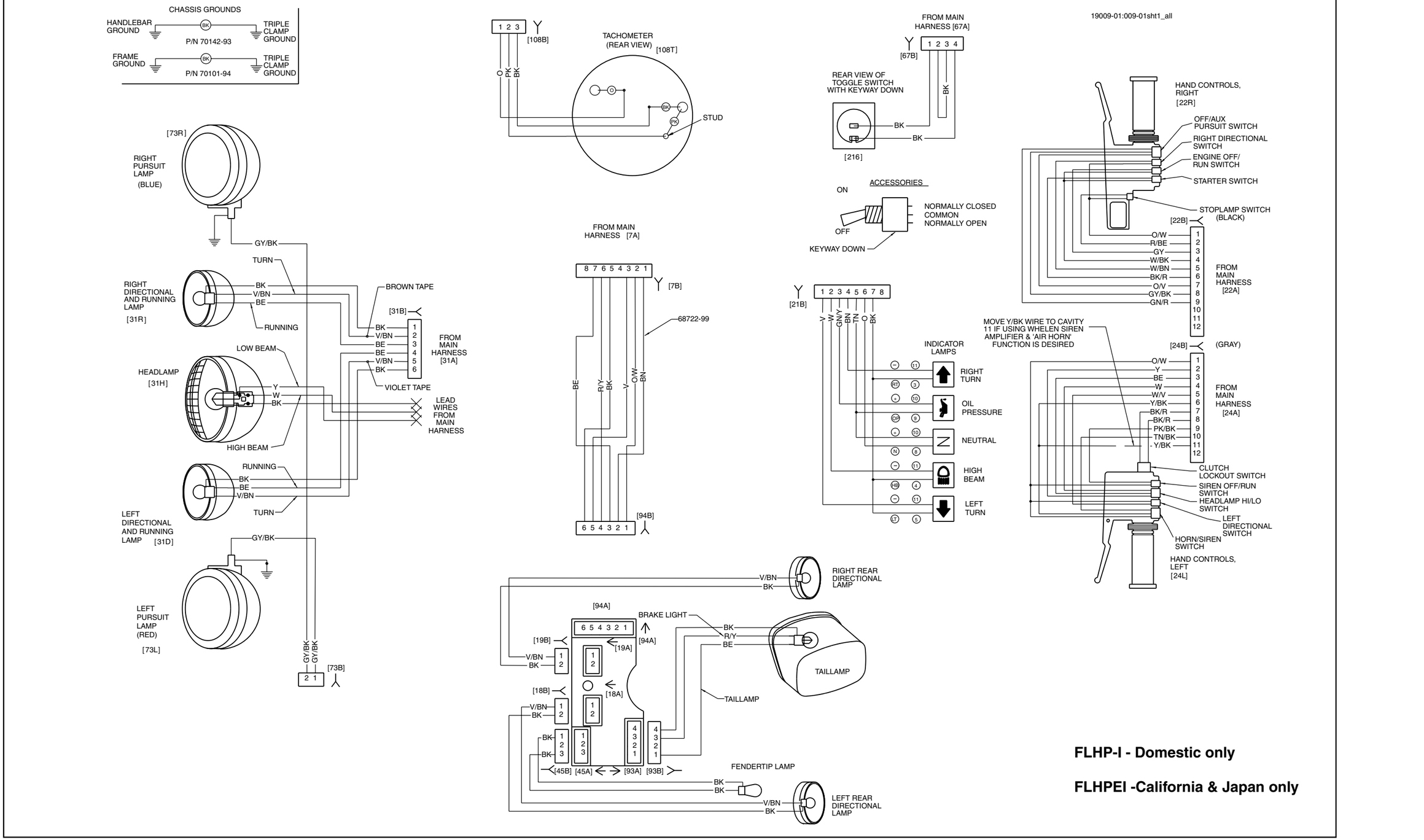



**Figure A-26. 2001 All FLHPI/FLHPEI Models (See Above for Destination) Wiring Diagram, Hand Controls, Lights, Speedometer and Indicator Lamps**

19009-01:009-01sht2_all

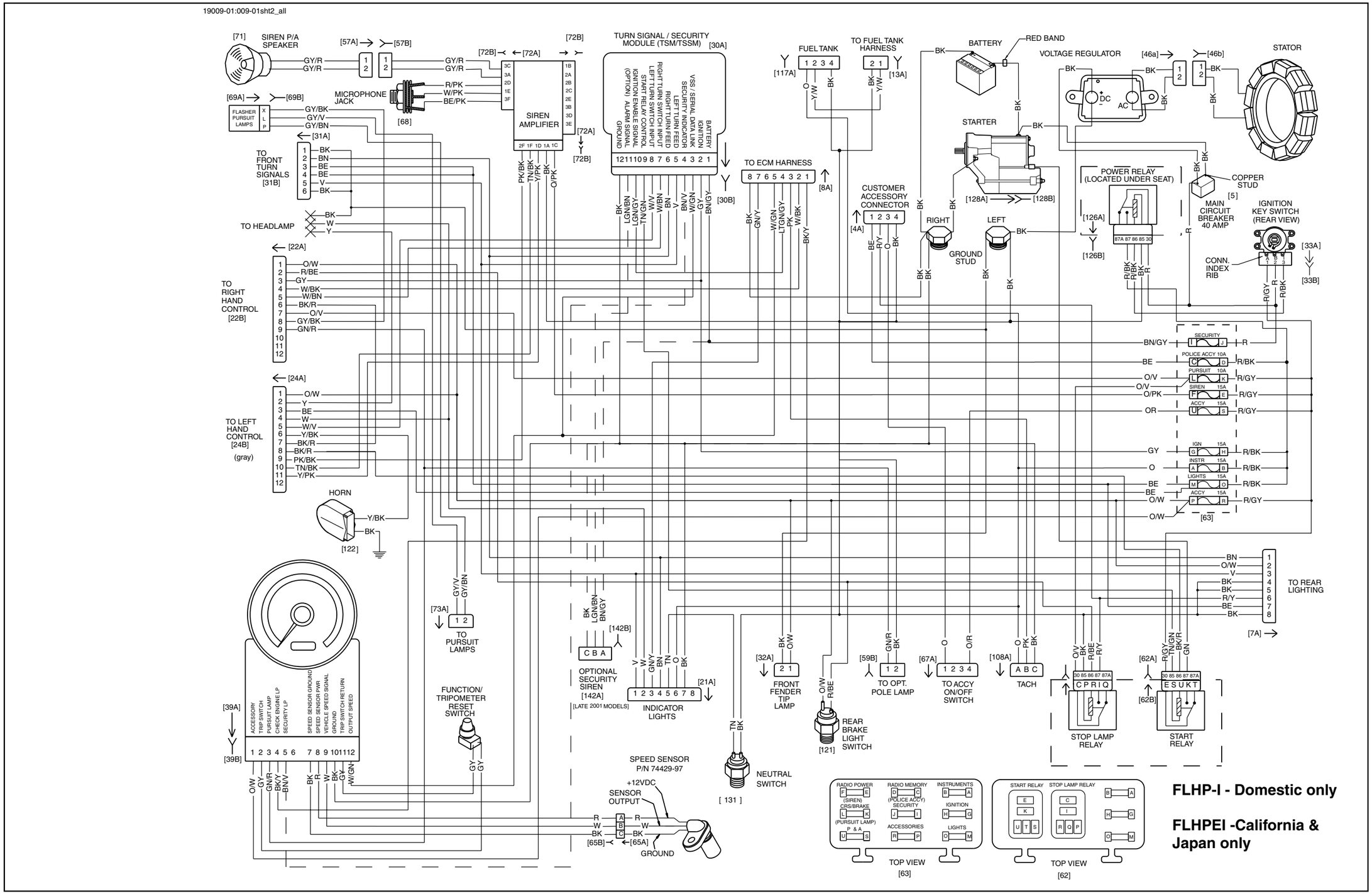



**Figure A-27. 2001 All FLHPI/FLHPEI Models (See Above for Destination) Wiring Diagram, Main Harness**

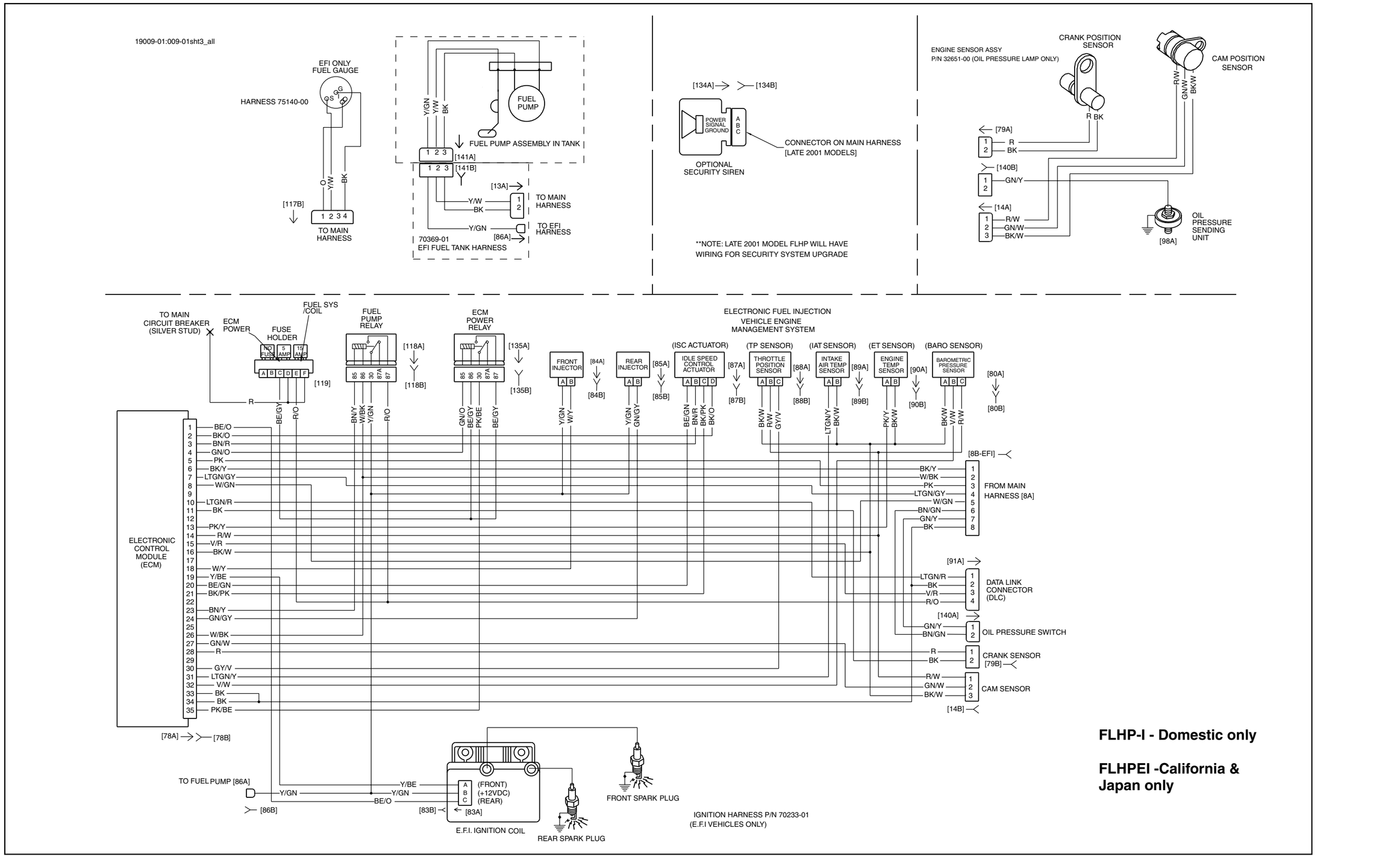
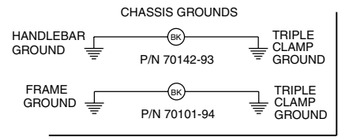
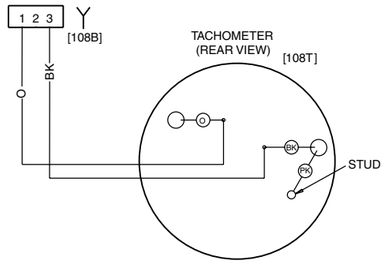
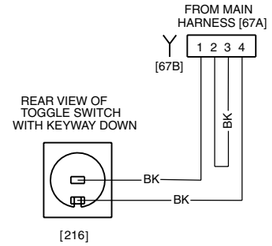
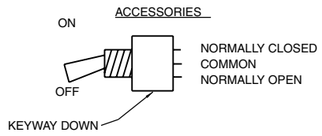


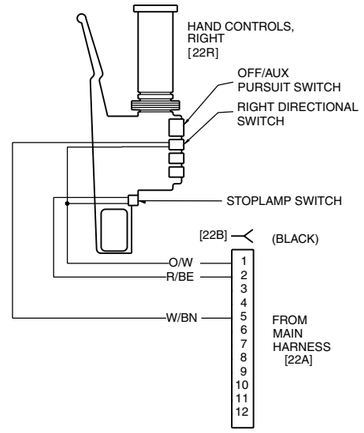

**Figure A-28. 2001 All FLHPI/FLHPEI Models (See Above for Destination) Wiring Diagram, Main Harness**

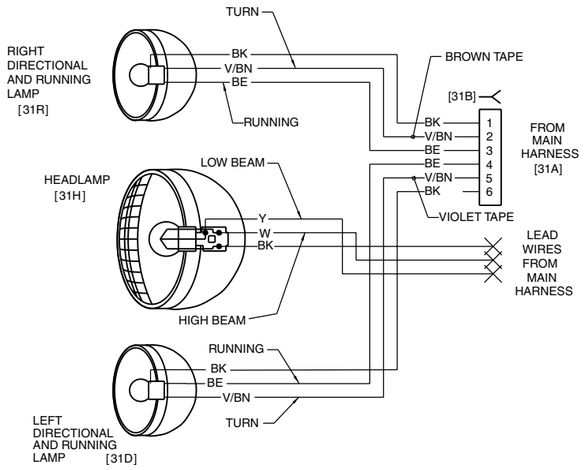


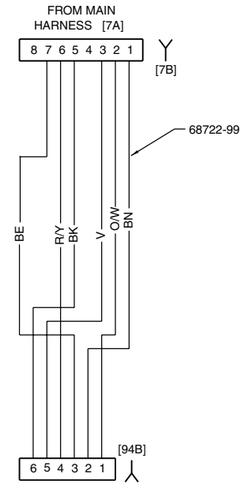



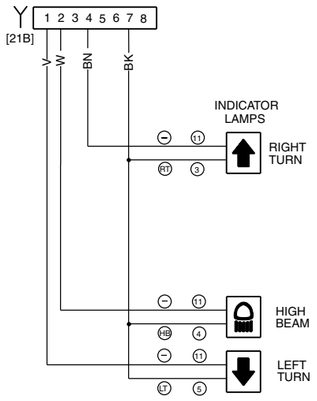



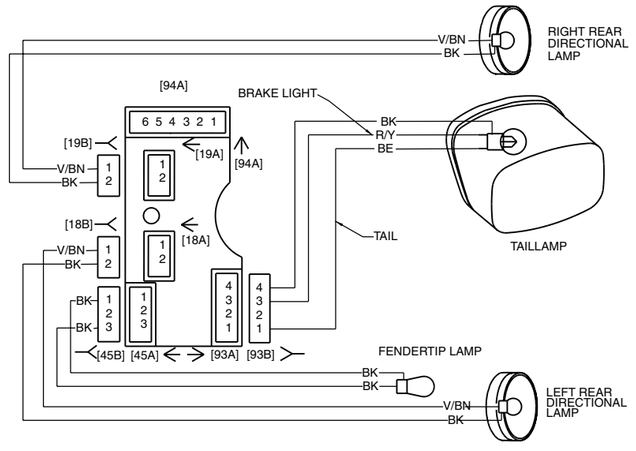




**FLHP-I - Domestic only**

**FLHPEI -California & Japan only**

**Figure A-29. 2001 All FLHPI/FLHPEI Models (See Above for Destination) Wiring Diagram, Ignition Harness**

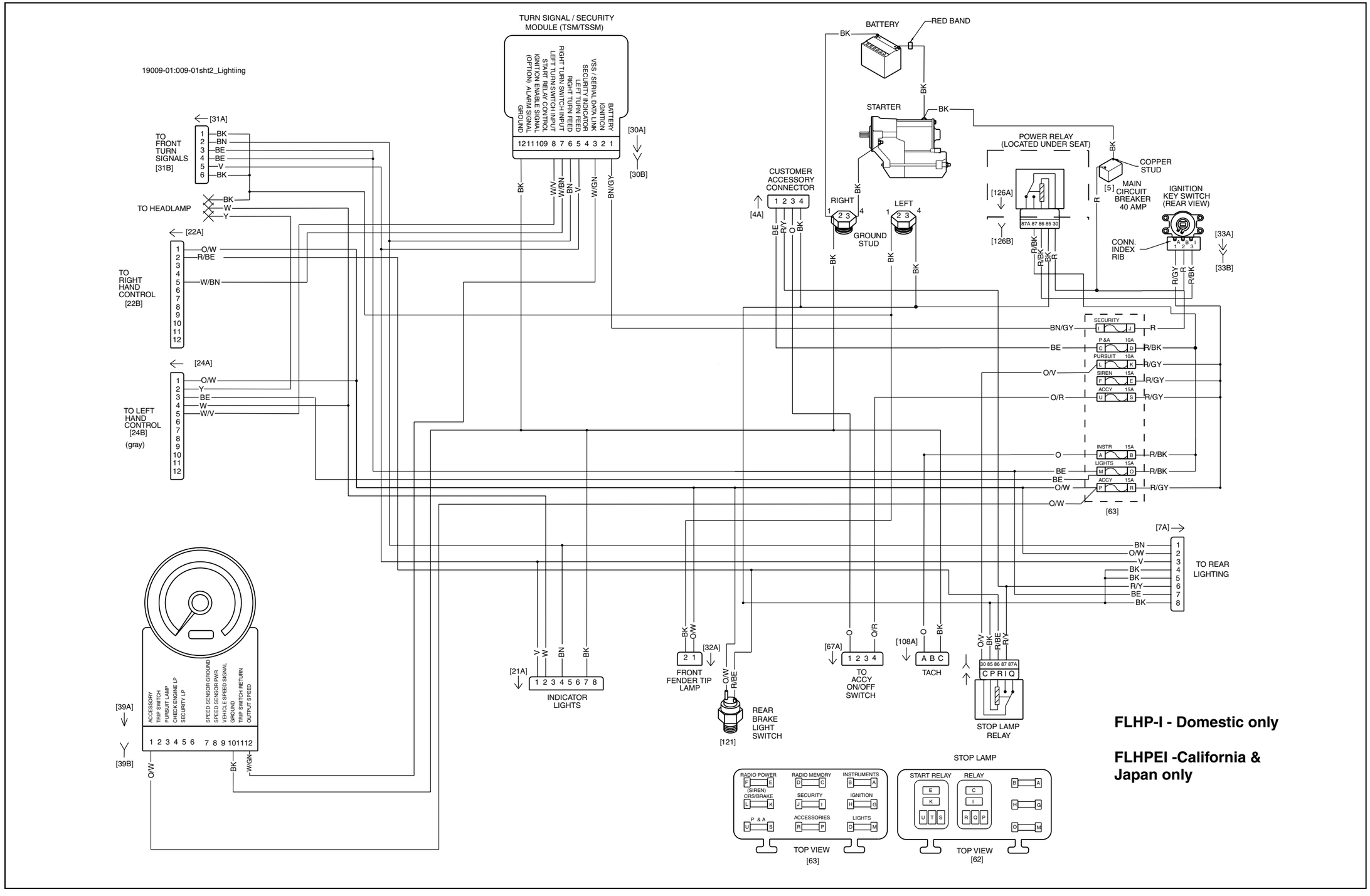



**Figure A-30. 2001 All FLHPI/FLHPEI Models (See Above for Destination) Wiring Diagram, Lights Circuit (Sheet 1 of 2)**

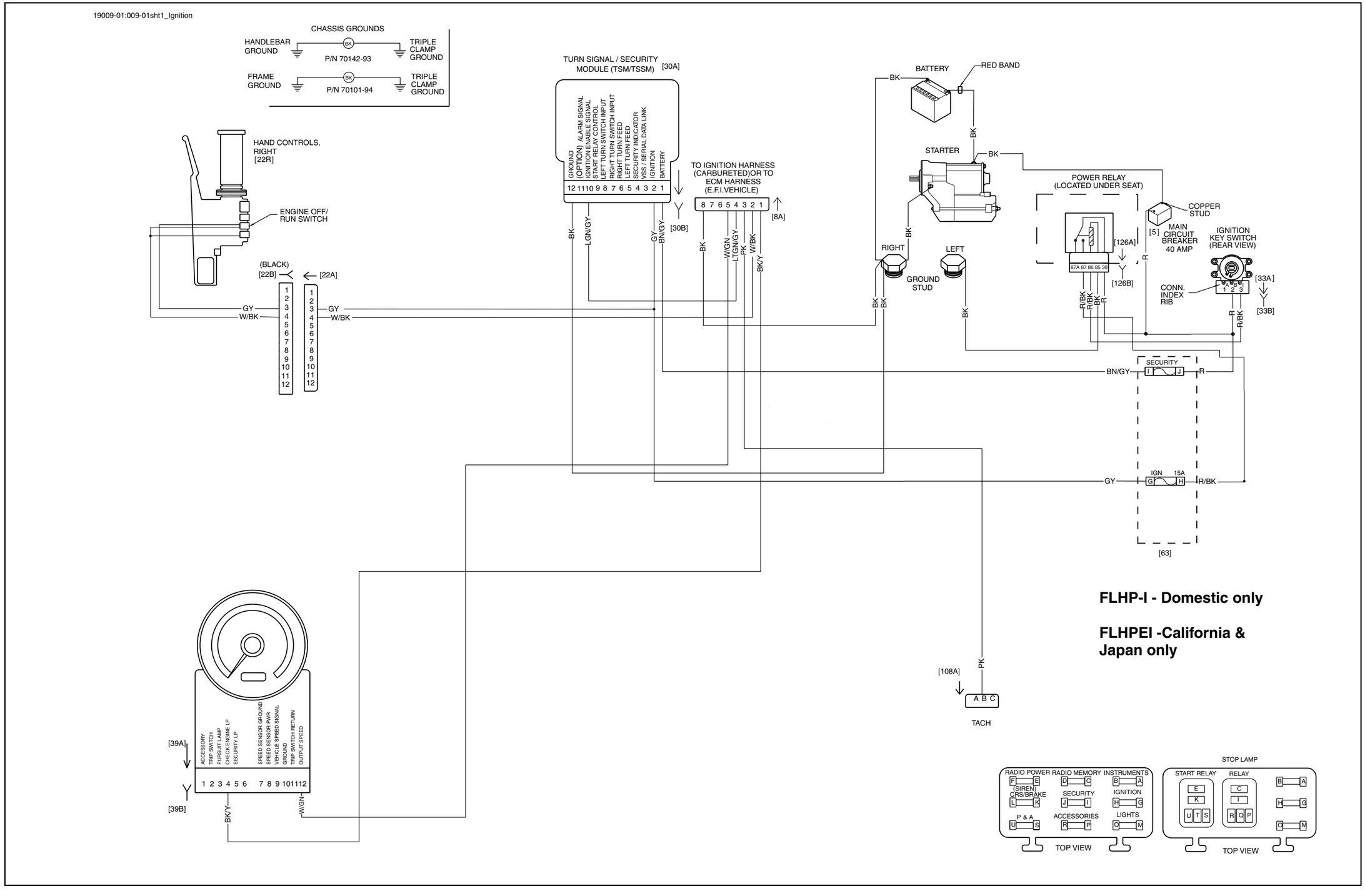



**Figure A-31. 2001 All FLHPI/FLHPEI Models (See Above for Destination) Wiring Diagram, Lights Circuit (Sheet 2 of 2)**

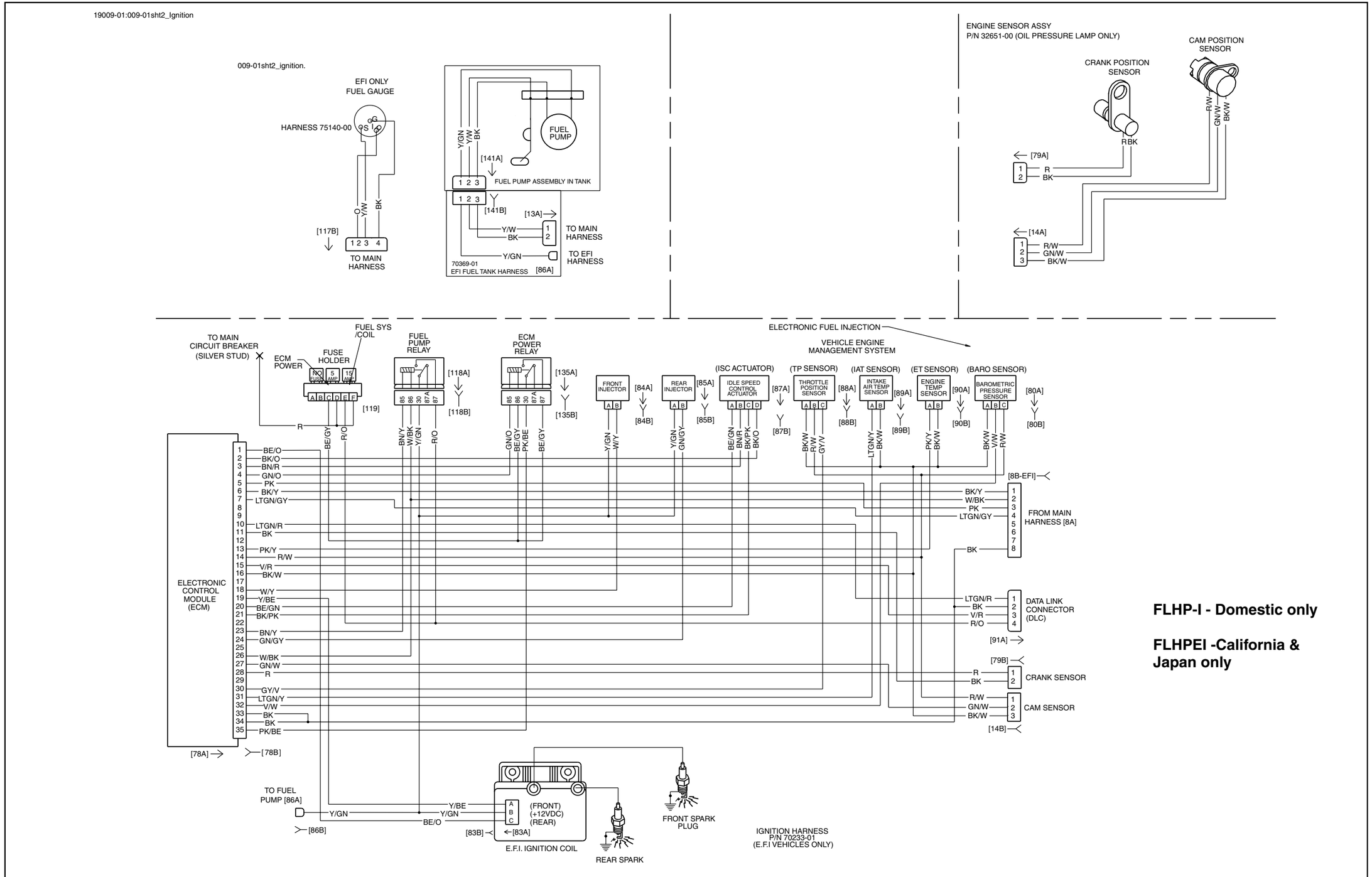
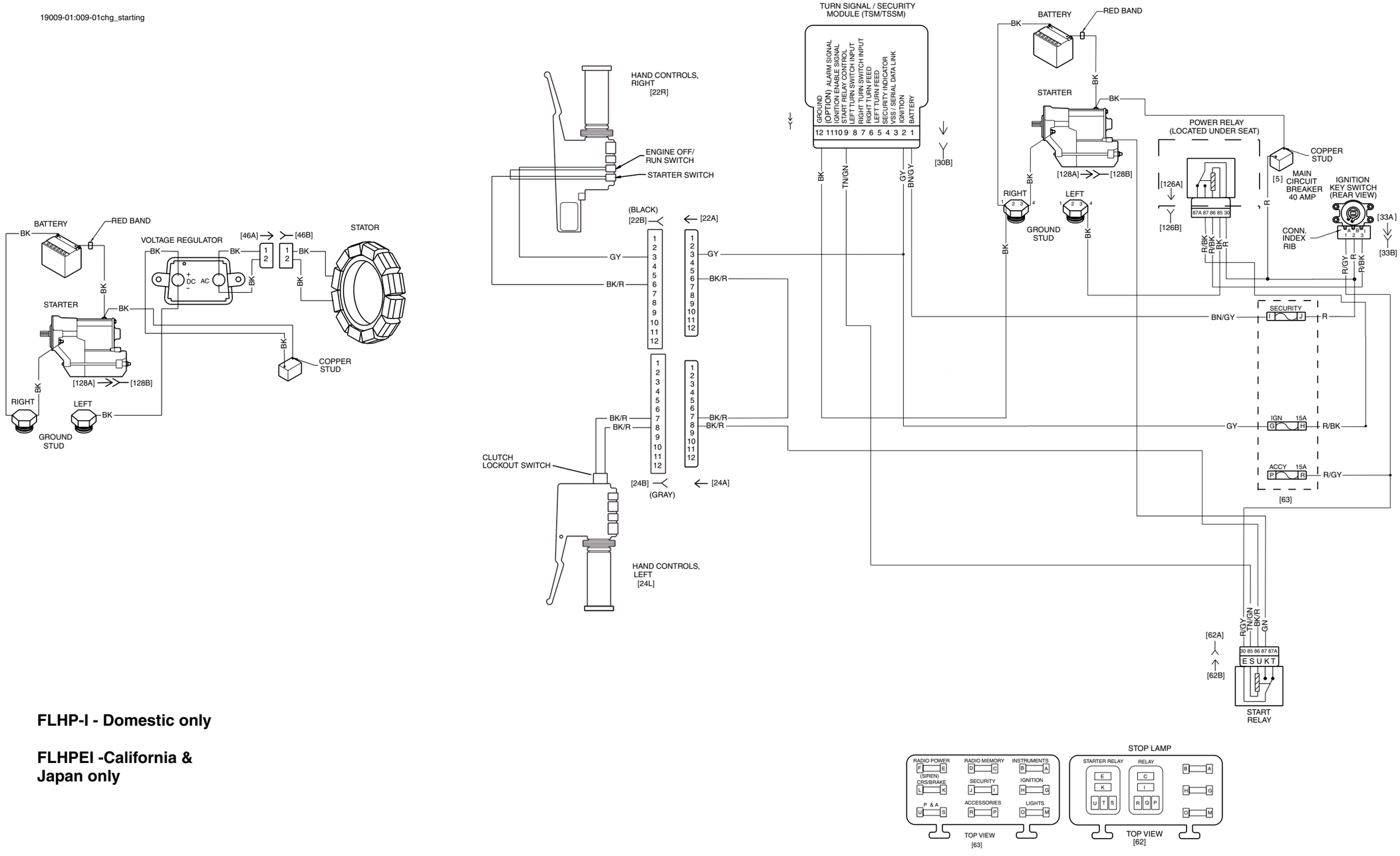



**Figure A-32. 2001 All FLHPI/FLHPEI Models (See Above for Destination) Wiring Diagram, Ignition Circuit (Sheet 1 of 2)**

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**FLHP-I - Domestic only**

**FLHPEI -California & Japan only**

**Figure A-33. 2001 All FLHPI/FLHPEI Models (See Above for Destination) Wiring Diagram, Ignition Circuit (Sheet 2 of 2)**

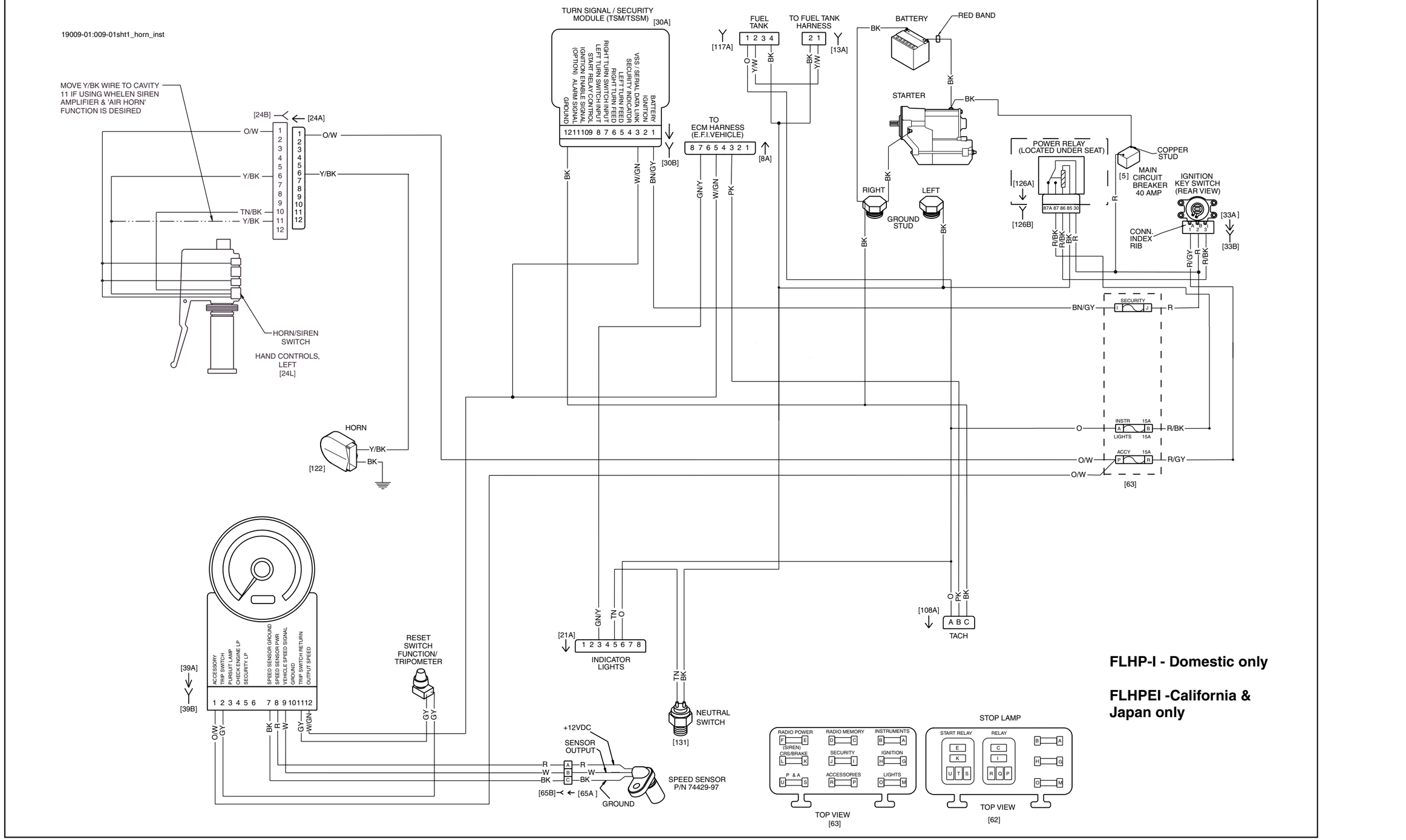



**Figure A-34. 2001 All FLHPI/FLHPEI Models (See Above for Destination)Wiring Diagram, Horn and Instruments Circuit (Sheet 1 of 2)**

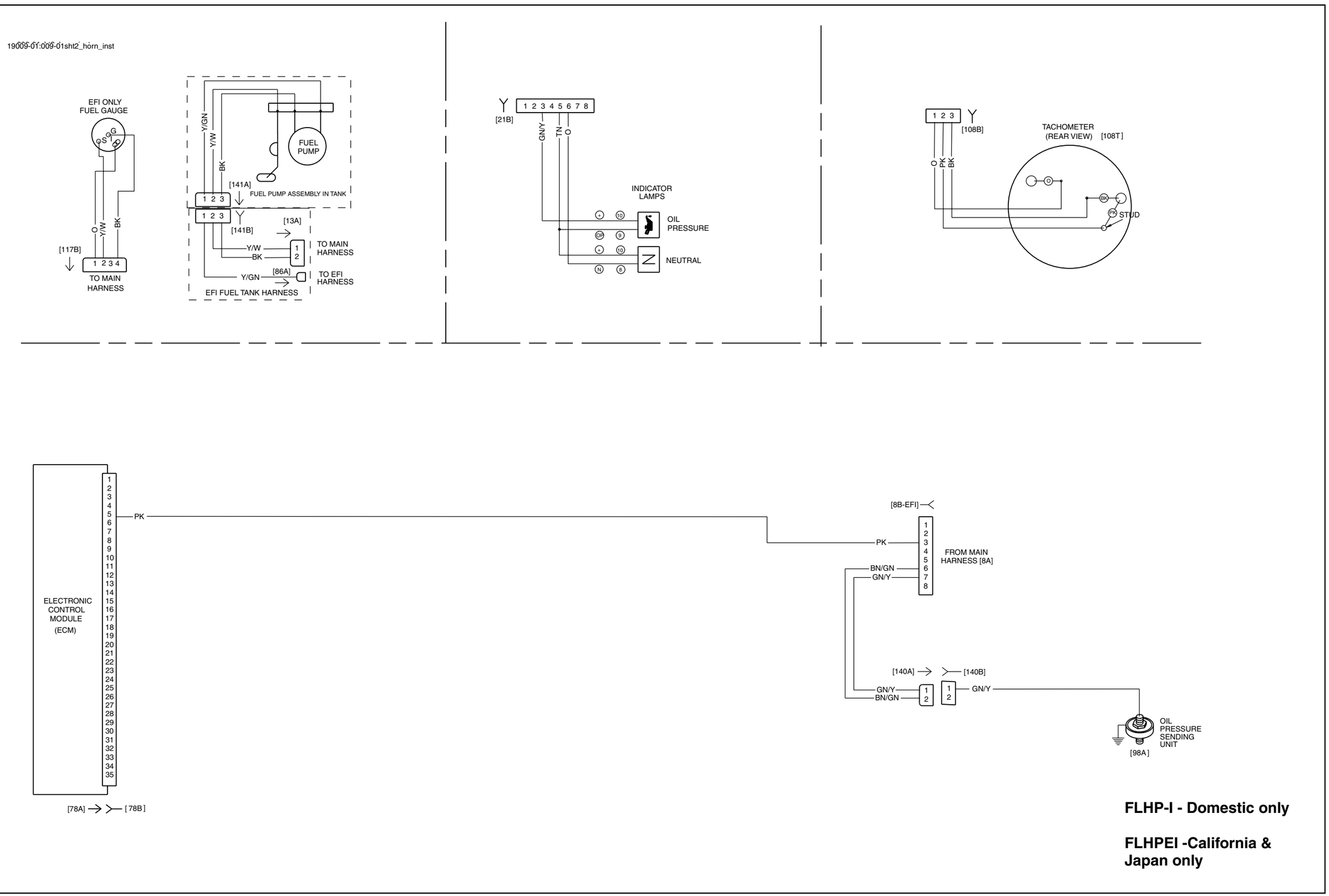



**Figure A-35. 2001 All FLHPI/FLHPEI Models (See Above for Destination) Wiring Diagram, Horn and Instruments Circuit (Sheet 2 of 2)**

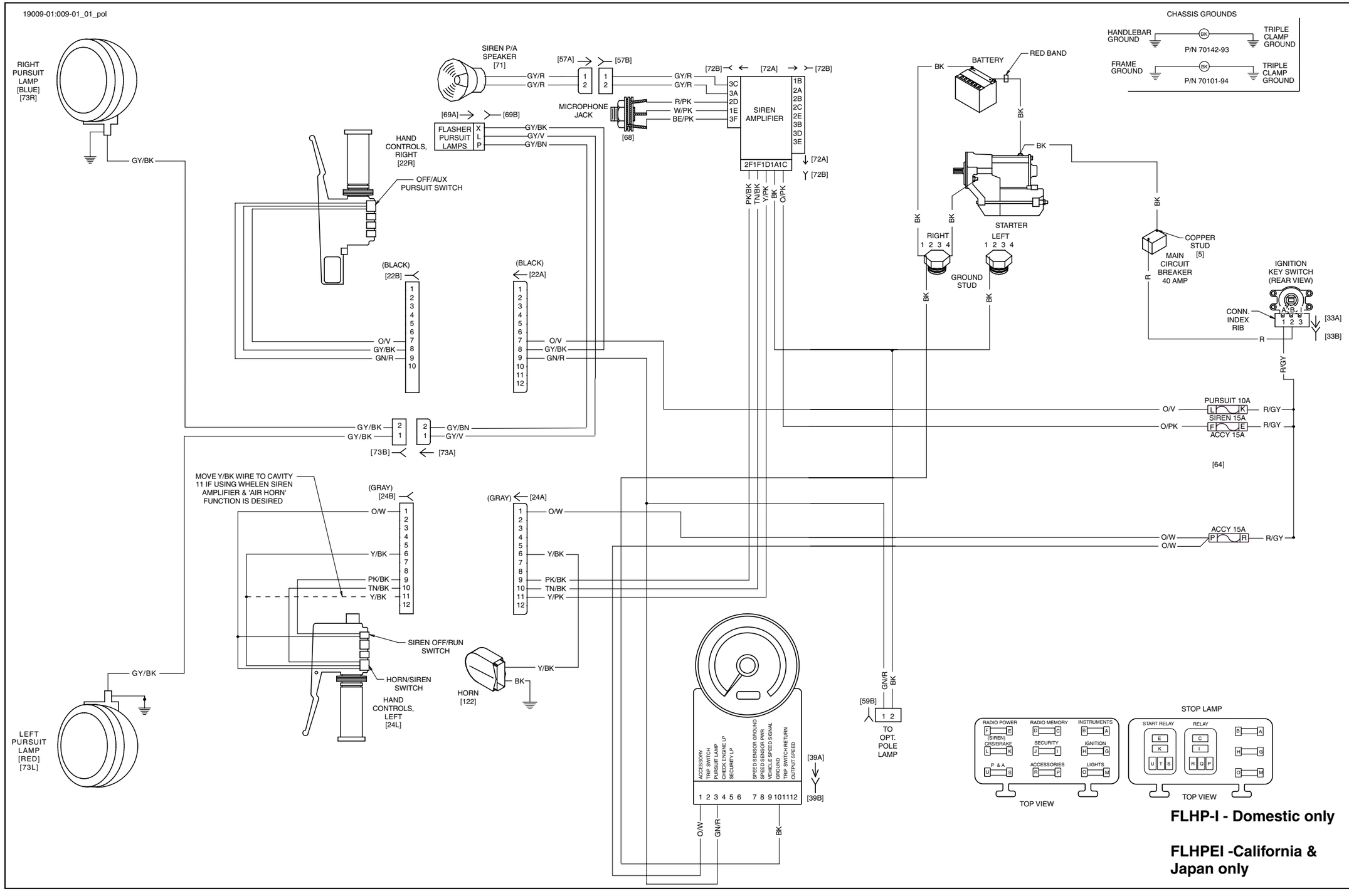



**Figure A-36. 2001 All FLHPI/FLHPEI Models (See Above for Destination) Wiring Diagram, Police Circuit**

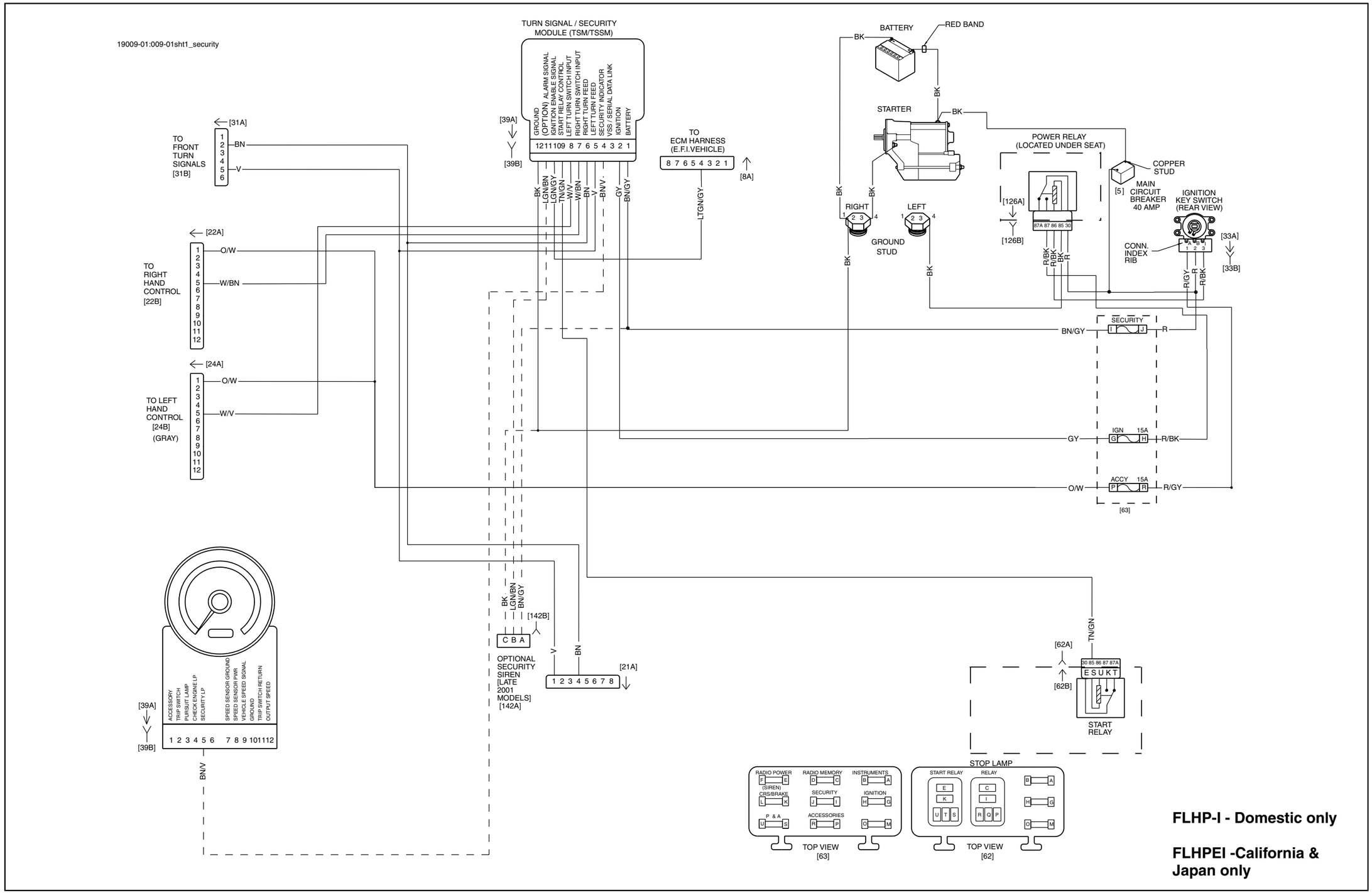



**Figure A-37. 2001 All FLHPI/FLHPEI Models (See Above for Destination) Wiring Diagram, Security Circuit (Sheet 1 of 2)**

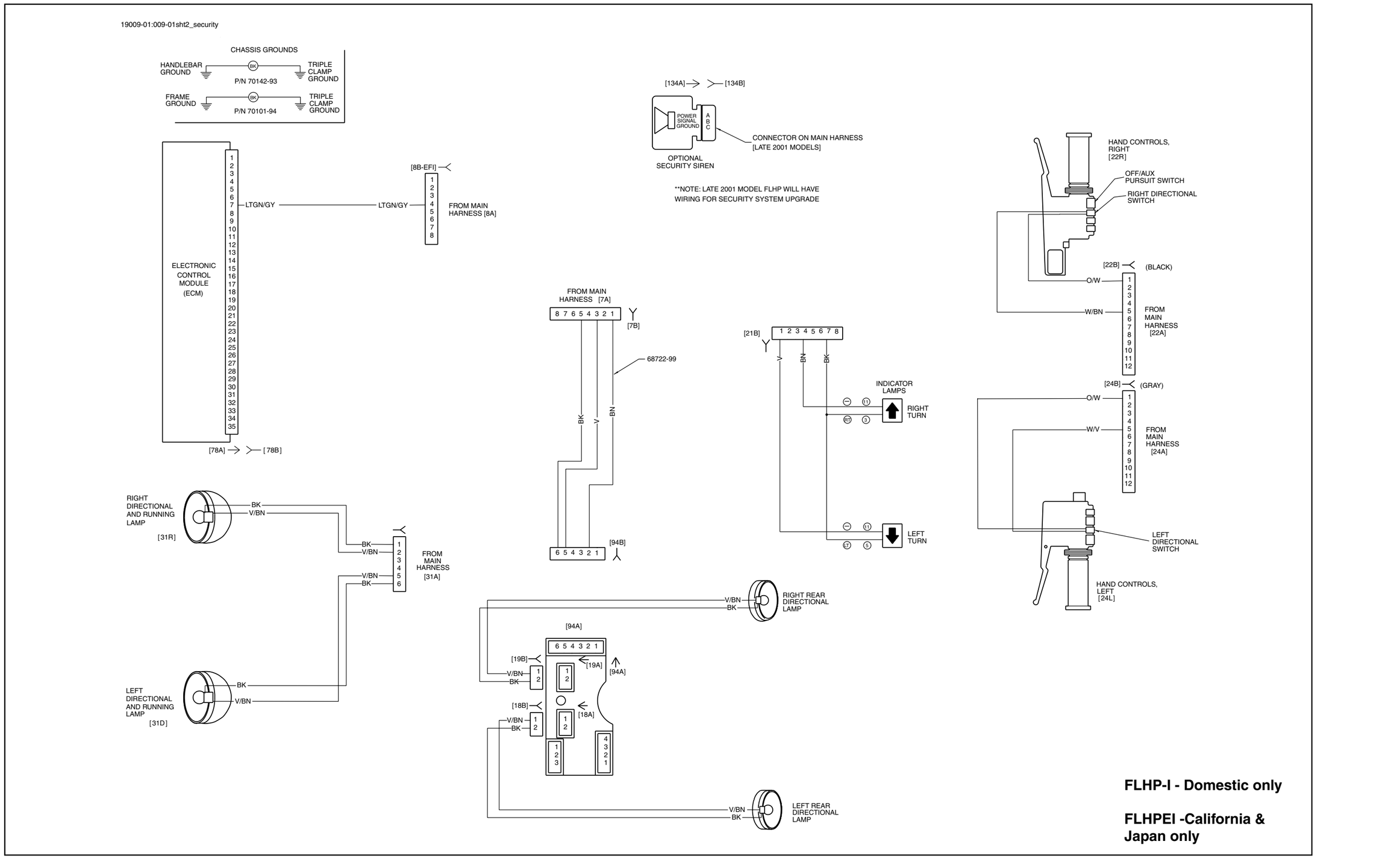



**Figure A-38. 2001 All FLHPI/FLHPEI Models (See Above for Destination) Wiring Diagram, Security Circuit (Sheet 2 of 2)**