2003 FLT MODELS

SERVICE MANUAL

Part Number 99483-03A

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ELECTRICAL DIAGNOSTICS

Part Number 99497-03

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MAINTENANCE 1

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TROUBLESHOOTING 1.1

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. TSM/TSSM BAS 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, CKP and/or TSM/TSSM).
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 spline 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 and/or CKP Sensor.
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).

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 and/or CKP Sensor.
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/vehicle 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. Oil pump misaligned or in poor condition.
6. 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. Oil pump misaligned or in poor condition.
6. Piston rings badly worn or broken.
7. Valve guides or seals worn.
8. 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 or clean out plug 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 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- friction material 0.04 inch (1.02 mm) thick or less.
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. Improper vehicle alignment.
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 improperly adjusted.
15. Worn engine stabilizer links.
16. Damaged rear engine isolation mounts.
17. Swingarm 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.

Always verify cleanliness of blind holes before assembly. Tightening screws with dirt, water or oil in the holes can cause castings to crack or break.

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 (unless instructed otherwise). 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

- Never use a punch or chisel with a chipped or mushroomed end; dress mushroomed chisels and punches with a file.
- Hold a chisel or a punch with a tool holder if possible.
- When using a chisel on a small piece, clamp the piece firmly in a vise, and chip toward the stationary jaw.
- Wear approved eye protection when using these tools.
- 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 Touring models. 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, turn to page 14 for the start of more detailed service procedures. For your added convenience, the adjacent chart lists the part numbers of required lubricants.

Lubricant		Part Number
Engine Oil		See Table 1-1.
Hydraulic Fork Oil, Type "E"		99884-80 (16 oz.)
D.O.T. 5 Hydraulic Brake Fluid		99902-77 (12 oz.)
Semi-Synthetic Transmission Lubricant	Quart	99892-84
	Case of Quarts	98853-96
	Gallon	99891-84
	Case of Gallons	98852-96
Primary Chaincase Lubricant	Quart	99887-84
	Gallon	99886-84
Clutch and Throttle Cable Lubricant		Super Oil 94968-85TV
Steering Head Bearing Lubricant		Special Purpose Grease 99857-97 (cartridge)
Electrical Contact Grease		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	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
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 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 adjuster screw* 1/2-1 turn *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 99892-84 (qt), 99891-84 (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.
Wheel Spokes		I		I		I		I		I		I		I		I		I		I		I	*Spoke nipple torque* 40-50 **in-lbs** (4.5-5.6 Nm)

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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
Steering Head Bearing Swing-By		X				X				X				X				X				X	See Section 2.15.
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 2.15.
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* 0.04 in. (1.02 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	*On ground without rider* 5/16-3/8 in. (7.9-9.5 mm) in bottom strand with 10 lb. (4.5 kg) upward force
Rear Shock Absorbers		I		I		I		I		I		I		I		I		I		I		I	See Section 2.17.
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* 36-60 **in-lbs** (4-7 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.
Fuel Tank Filter										I								I					*Hex fitting torque* 15-20 ft-lbs (20-27 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
Enrichener Control	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	See Section 4.3.
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)
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* 12-18 ft-lbs (16-24 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
Critical Fastener Torque		T				T				T				T				T				T	Verify tightness. See Table 1-6.
Front Fork Oil										R								R					*Fork oil (Type E)* Part No. 99884-80 (16 oz)
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 (1,600 km) service interval, and at every 5000 mile (8,000 km) 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.

NOTE

Use OIL FILTER WRENCH (HD-44067) if HD-42311 is not available.

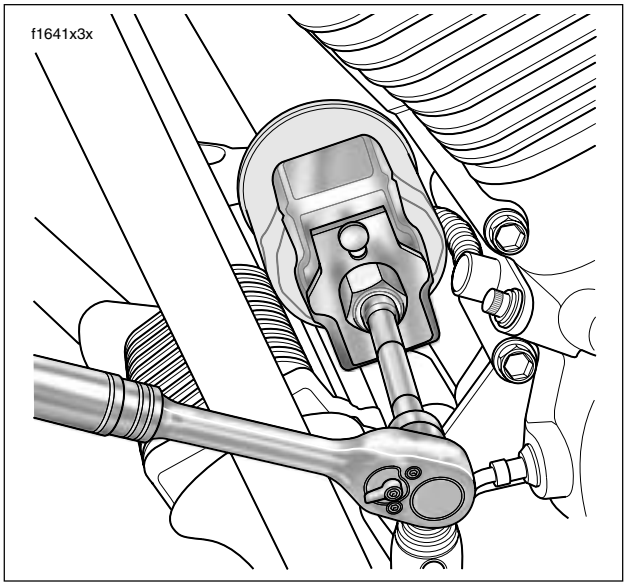


Figure 1-1. Remove Engine Oil Filter

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 for oil filter installation.

NOTE

Use of the 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

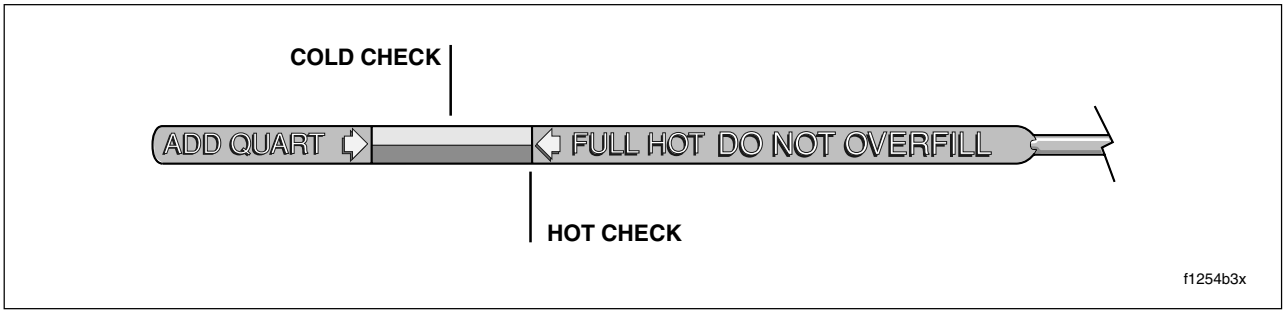


Figure 1-2. Engine Oil Dipstick

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 (1,600 km) service interval, and at every 5000 mile (8,000 km) service interval thereafter, inspect the primary chain tension and adjust if necessary.

Proceed as follows:

1. Remove seat. See Section 2.22 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

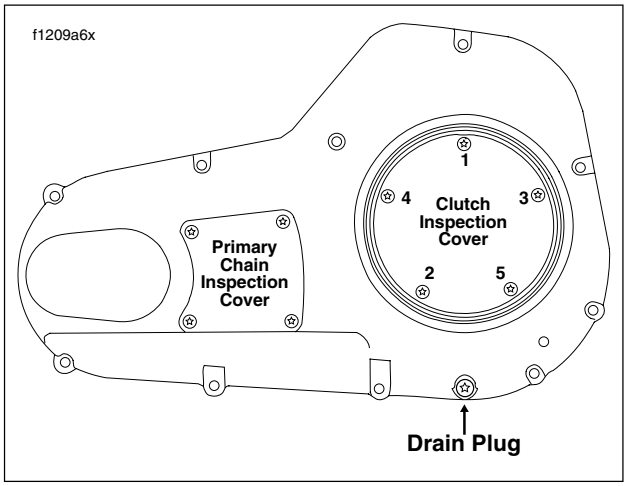


Figure 1-3. Primary Chaincase Cover

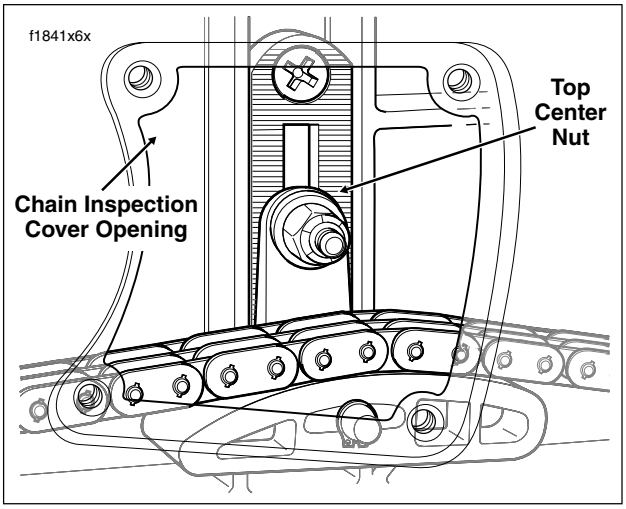


Figure 1-4. Primary Chaincase Cover

5. Measure the free play to be sure that it falls within the range specified for a hot or cold engine. See Table 1-2.
6. If the chain is too tight or too loose, then adjust 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. Replace the primary chain if it is worn to the point where it cannot be properly adjusted.

CAUTION

Always keep the primary chain properly adjusted. Allowing the chain to run too tight or too loose will result in excessive chain and sprocket wear.

   c. Tighten the top center nut of the chain tensioner assembly to 21-29 ft-lbs (29-39 Nm).
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 84-108 **in-lbs** (10-12 Nm) in a crosswise pattern.

PRIMARY CHAIN LUBRICANT

At the 1000 mile (1,600 km) service interval, and at every 5000 mile (8,000 km) service interval thereafter, replace the primary chain lubricant as follows:

1. Using a T27 TORX drive head, remove five screws (with captive washers) to free clutch inspection cover from primary chaincase cover.
2. 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.
3. Clean drain plug. Apply Loctite Pipe Sealant with Teflon 565 to threads and install back into primary chaincase cover. Using a dial caliper, tighten plug until 0.160-0.180 inch (4.06-4.57 mm) above the surface of the casting.

NOTE

If drain plug has accumulated a lot of debris, inspect the condition of chaincase components.

4. Pour 32 ounces (946 ml) of Harley-Davidson PRIMARY CHAINCASE LUBRICANT through the clutch inspection cover opening, Part No. 99887-84 (quart) or Part No. 99886-84 (gallon). See Figure 1-5.

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 quad ring from groove in primary chaincase cover. Wipe all lubricant from the quad ring and inspect for cuts, tears or signs of deterioration. Replace as necessary.

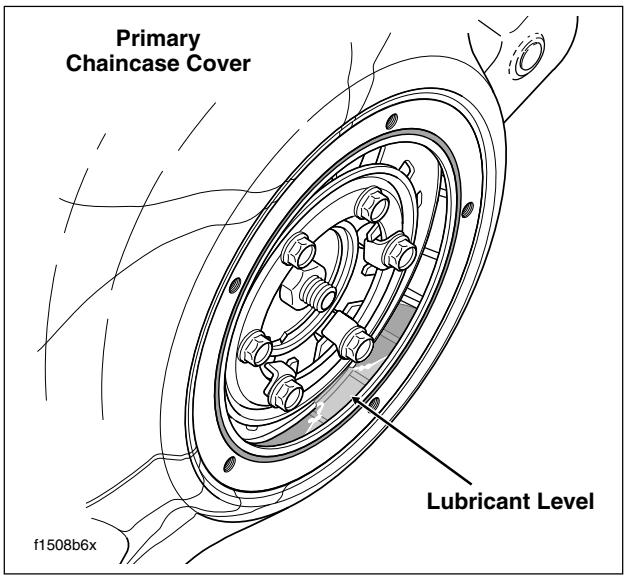


Figure 1-5. Fill Primary Chaincase With Lubricant

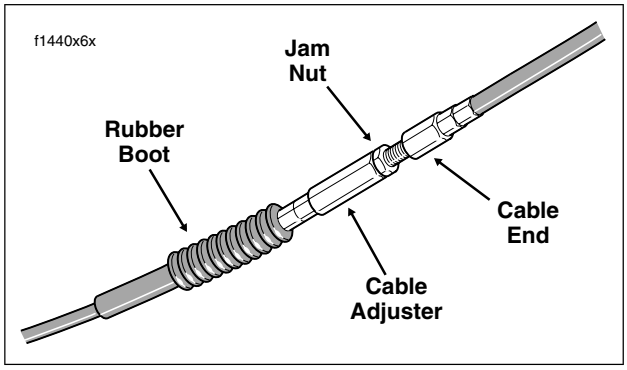


Figure 1-6. Clutch Cable Adjuster Mechanism

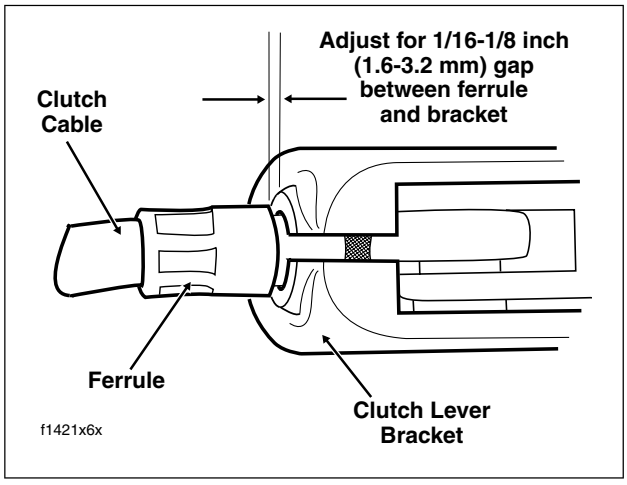


Figure 1-7. Adjust Clutch Free Play

6. Swab all lubricant from the quad ring groove. Install quad ring in primary chaincase cover with the nubs contacting the ring groove walls.

NOTE

If lubricant is not thoroughly removed from both the quad ring and groove, compression of the 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 84-108 **in-lbs** (10-12 Nm) in the pattern shown in Figure 1-3.

⚠WARNING

When 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 (1,600 km) service interval, and at every 5000 mile (8,000 km) 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.
4. See Figure 1-8. Loosen locknut on clutch adjuster screw. To take up all free play in push rods, turn screw inward (clockwise) until lightly seated.

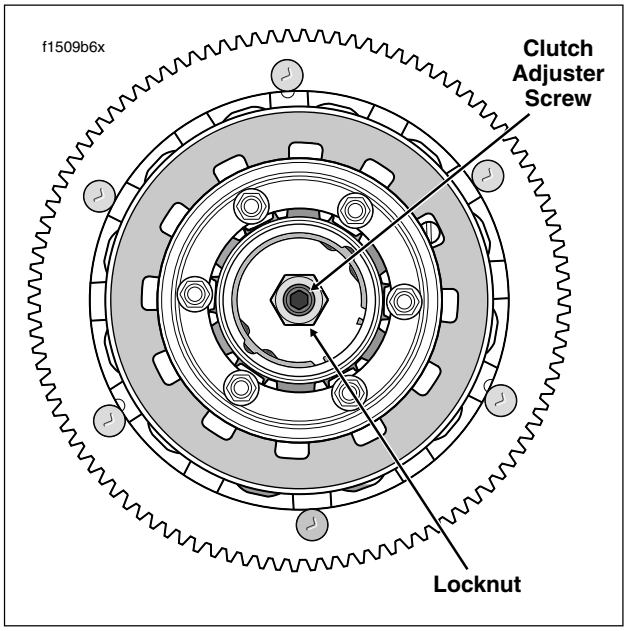


Figure 1-8. Clutch Assembly

5. Back out adjuster screw 1/2 to 1 turn. While holding adjuster screw with an allen wrench, tighten locknut to 72-120 **in-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 quad ring from groove in primary chaincase cover. Wipe all lubricant from the quad ring and inspect for cuts, tears or signs of deterioration. Replace as necessary.
10. Swab all lubricant from the quad ring groove. Install quad ring in primary chaincase cover with the nubs contacting the ring groove walls.
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 84-108 **in-lbs** (10-12 Nm) in the pattern shown in Figure 1-3.

TRANSMISSION LUBRICANT

At the 1000 mile (1,600 km) service interval, and at every 5000 mile (8,000 km) service interval thereafter, replace the transmission lubricant as follows:

1. Remove the filler plug from the clutch release cover on the right side of the transmission case. See Figure 1-9. Check the O-ring for tears, cuts or general deterioration. Replace as necessary. See Figure 1-10.
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 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.

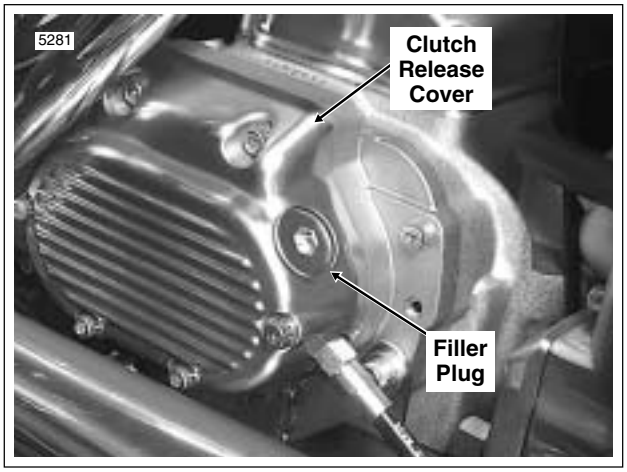


Figure 1-9. Transmission Case (Right Side)

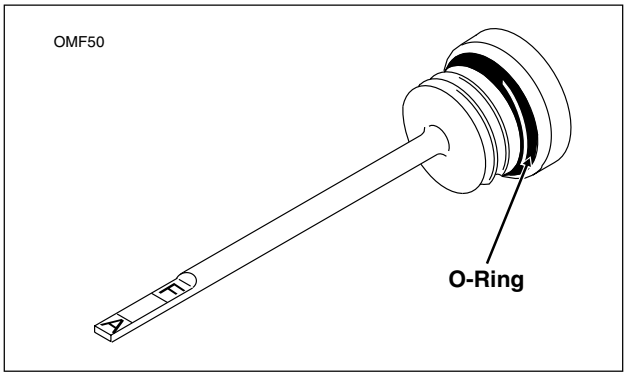


Figure 1-10. Transmission Lubricant Filler Plug/Dipstick

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 SEMI-SYNTHETIC TRANSMISSION LUBRICANT: Part No.'s 99892-84 (quart), 98853-96 (case of quarts), 99891-84 (gallon), or 98852-96 (case of 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

Inspect the tires at every scheduled service interval.

1. Inspect for wear as follows:
   a. Locate the arrows on the tire sidewalls. The arrows point to location of the tread wear indicator bars. See upper frame of Figure 1-11.

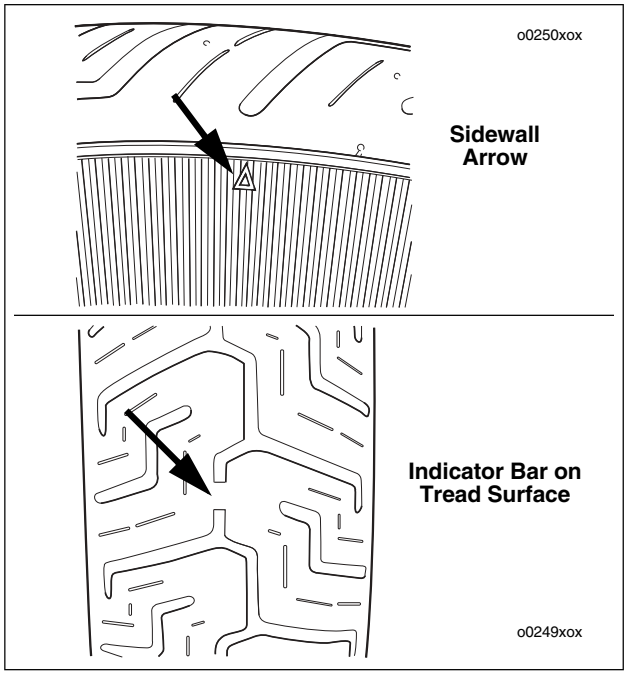


Figure 1-11. Tread Wear Indicator Bars

b. Immediately replace tires if any tread wear indicator bar is on the tire tread surface, indicating that 1/32 inch (0.8 mm) or less of tire tread pattern remains. See lower frame of Figure 1-11.

NOTE

Harley-Davidson recommends that the tires be replaced ***BEFORE*** *the tread wear indicator bars are on the tire tread surface.*

2. Inspect for damage. Replace tires if:
   - Cords or fabric become visible through cracked sidewalls, snags or deep cuts.
   - Bump, bulge or split line is observed.
   - Puncture, deep cut or other damage is present that is not repairable.
3. 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 (8,000 km) 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 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.

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 1-12.

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

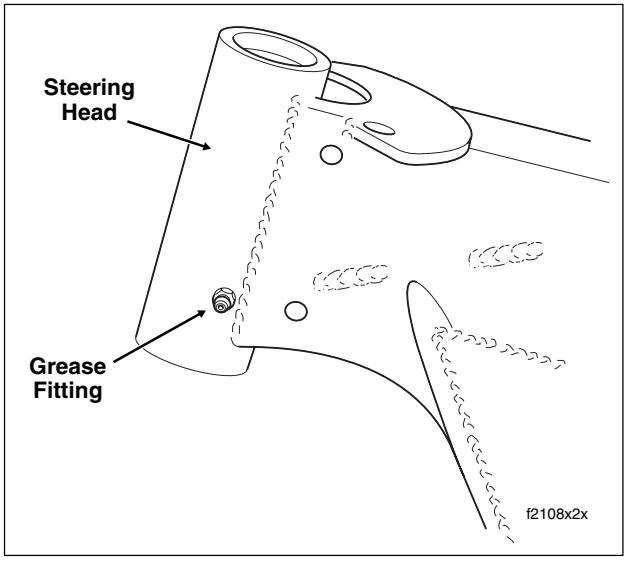


Figure 1-12. Steering Head Bearing Grease Fitting

BRAKE FLUID

At the 1000 mile (1,600 km) service interval, and at every 5000 mile (8,000 km) 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:

1. Remove left side saddlebag. See Section 2.23 SADDLEBAG, REMOVAL.
2. Check deflection at the tightest spot in the belt with the transmission in neutral and the motorcycle cold. 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. See Figure 1-13. Belt deflection should be within the range specified in Table 1-4.

Table 1-4. Belt Deflection on the Ground

Orientation	Inches	Millimeters
On Ground Without Rider	5/16 - 3/8	7.9 - 9.5
On Ground With Rider 11.5 inches (292 mm) Between Shock Eyelets	1/4 - 5/16	6.4 - 7.9

If belt deflection is within specification, install left side saddlebag. If adjustment is necessary, proceed to step 3.

3. Remove right side saddlebag. See Section 2.23 SADDLEBAG, REMOVAL.
4. Remove right side muffler as follows:
   a. Open worm drive clamps to remove heat shield from rear header pipe in front of muffler.
   b. Using a bungee cord, tie the muffler to the lower saddlebag support rail.

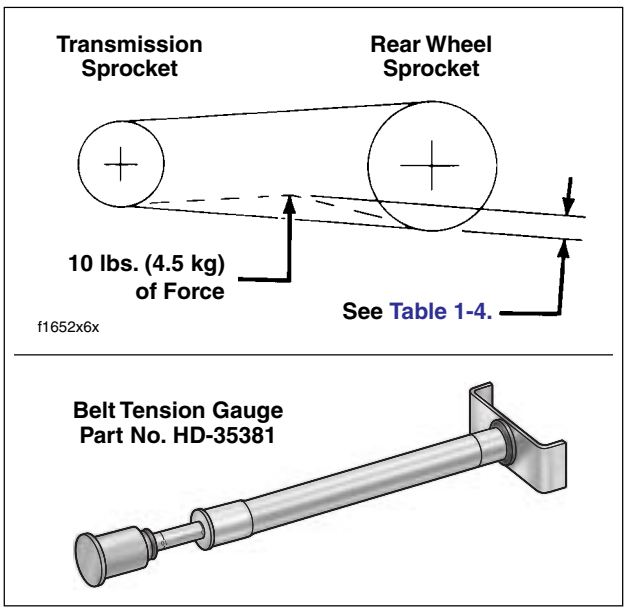


Figure 1-13. Check and Adjust Belt Deflection

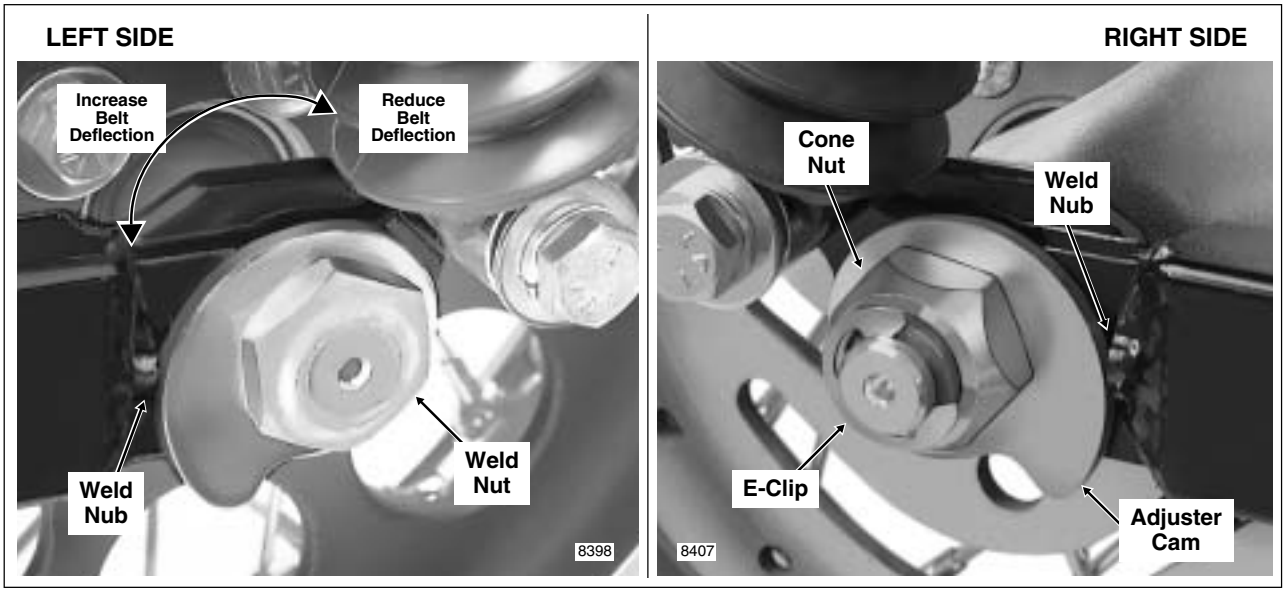


Figure 1-14. Move Rear Wheel Forward Until Adjuster Cams Just Contact Weld Nubs

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.

5. Standing on right side of vehicle, remove E-clip from groove at end of axle. Loosen cone nut, and then snug to 15-20 ft-lbs (20-27 Nm). See Figure 1-14.

6. If belt is too tight, move to step 7 to increase belt deflection. If belt is too loose, reduce belt deflection as described below:

   a. Rotate weld nut on left side of axle in a clockwise direction.

   b. Check belt deflection. Apply 10 lbs. (4.5 kg) of force at the midpoint of the bottom belt strand. Belt deflection should be within the range specified in Table 1-4.

   c. If belt is still too loose, repeat steps 6(a) through 6(b). If belt is now too tight, move to step 7.

7. If belt is too tight, increase belt deflection as follows:

   a. Using a hydraulic center stand, raise motorcycle so that the rear wheel is off the ground.

   b. Rotate weld nut on left side of axle in a counterclockwise direction.

   c. Push wheel forward slightly so that adjuster cam just contacts weld nub on both sides of rear swingarm. See Figure 1-14.

   d. Lower hydraulic center stand so that the motorcycle is on the ground.

   e. Check belt deflection. Apply 10 lbs. (4.5 kg) of force at the midpoint of the bottom belt strand. Belt deflection should be within the range specified in Table 1-4.

   f. If belt is still too tight, repeat steps 7(a) through 7(e). If belt is now too loose, move to step 6.

8. **Holding** weld nut on left side of axle, tighten cone nut on right side to 95-105 ft-lbs (128.8-142.4 Nm).

NOTE

If the axle moves during tightening of the cone nut, then the the belt deflection procedure must be restarted.

9. Recheck belt deflection to verify that it is still within specification.

   If the belt deflection is not within specification, loosen cone nut and then snug to 15-20 ft-lbs (20-27 Nm) before returning to step 6.

10. With the flat side out, install **new** E-clip in groove on right side of axle.

11. 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.

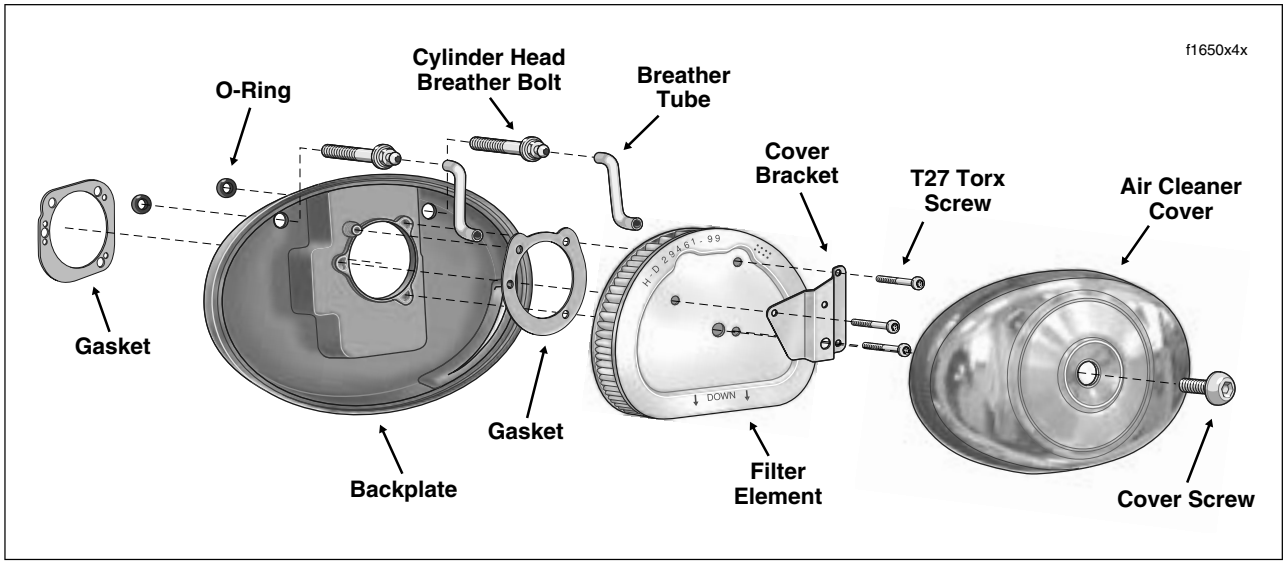


Figure 1-15. Air Cleaner Assembly

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.

12. Install saddlebags. See Section 2.23 SADDLEBAG, INSTALLATION.

REAR SHOCK ABSORBERS

At the 1000 mile (1,600 km) service interval, and at every 5000 mile (8,000 km) service interval thereafter, inspect the rear shock absorbers for signs of leakage or damage, and replace if necessary.

AIR CLEANER

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 1-15.
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 carbureted California models, pull clean air inlet tube (to charcoal canister) from hole on inboard side of 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. Aligning flat edge of gasket with molded tab, install **new** gasket on inboard side of backplate. On California models, install gasket by aligning small holes with plastic pins.
18. On California models, push clean air inlet tube (to charcoal canister) into hole on inboard side of backplate.
19. 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).
20. Slide **new** gasket over sleeve on inboard side of filter element. Be sure holes in gasket are aligned with those in filter.
21. Insert breather tubes about 1/4 inch (6.4 mm) into holes on inboard side of filter element.
22. 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.

23. Place filter element onto backplate with the flat side down, so that hole on inboard side of element fits over molded boss in backplate.
24. 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.
25. Verify that rubber seal is properly seated around perimeter of air cleaner cover. Replace seal if cut, torn or shows signs of deterioration.
26. 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 36-60 **in-lbs** (4.1-6.8 Nm).

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.

FUEL TANK FILTER (CARBURETED)

At every 20,000 mile (32,000 km) 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.

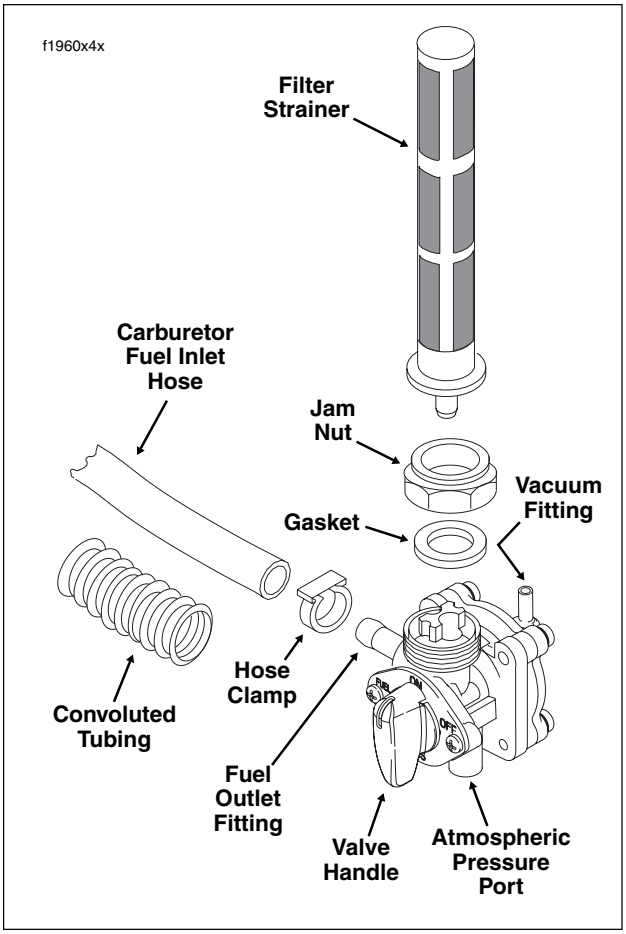


Figure 1-16. Vacuum Operated Fuel Valve

2. Using a side cutters, cut clamp and remove hose from fuel outlet fitting at the front of the fuel valve. See Figure 1-16. Drain free end of hose into a suitable container.
3. Remove elbow of intake manifold vacuum tube from fitting on inboard side 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-23738A) 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, remove the Mity-Vac® Hand Pump from the vacuum fitting.
9. Holding fuel tank adapter, turn the hex jam nut in a clockwise direction to remove the fuel valve assembly.
10. Remove the fuel filter strainer from the valve head. Clean or replace.
11. Remove the hex jam nut from the fuel valve.
12. Remove the gasket from the valve head. Discard the gasket.
13. Install a **new** gasket on the valve head.
14. Install the fuel filter strainer fitting the internal tube into the larger hole in the valve head.
15. Apply Loctite Pipe Sealant with Teflon 565 to threads of fuel valve and fuel tank adapter.
16. With the hex side down, turn the jam nut two full turns in a counterclockwise direction to thread onto fuel tank adapter.
17. Insert fuel filter strainer into fuel tank. Holding the hex jam nut to prevent rotation, turn the fuel valve two full turns in a clockwise direction to thread onto hex jam nut.

⚠WARNING

Do not thread fuel valve onto hex jam nut more than two turns or nut 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.

18. Holding the fuel valve to prevent rotation, turn the hex jam nut in a counterclockwise direction until snug. Tighten the hex jam nut to 15-20 ft-lbs (20.3-27.1 Nm).

CAUTION

Do not allow dirt or fluids to get into the vacuum tube that connects the fuel valve to the intake manifold. Contaminants can block the vacuum signal which could cause the fuel valve to malfunction.

19. Connect elbow of intake manifold vacuum tube to fitting on inboard side of the fuel valve.
20. Slide **new** clamp onto free end of carburetor fuel inlet hose. Install hose onto fuel outlet fitting at front of fuel valve. Crimp clamp using HOSE CLAMP PLIERS (HD-97087-65B).
21. Turn the handle of the fuel valve to OFF and fill the fuel tank. Carefully inspect for leaks at fitting.
22. Turn the valve handle to ON and start engine. No priming or special procedures are required to start fuel flow. Carefully inspect for leaks at fitting.
23. Stop engine and return the valve to the OFF position.

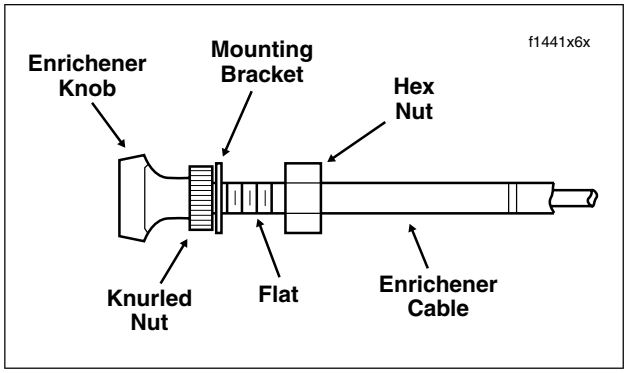


Figure 1-17. Enrichener Control

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 1-17. 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.

THROTTLE CABLES

At the 1000 mile (1,600 km) service interval, and at every 5000 mile (8,000 km) 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 (4.0 mm) 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.

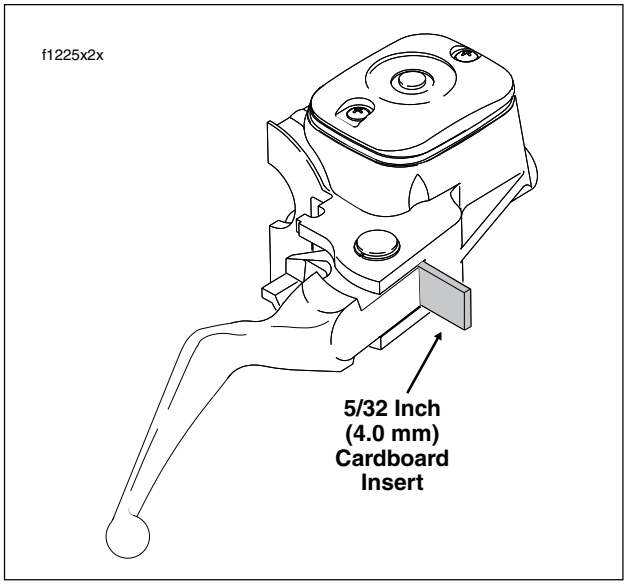


Figure 1-18. Install Cardboard Insert

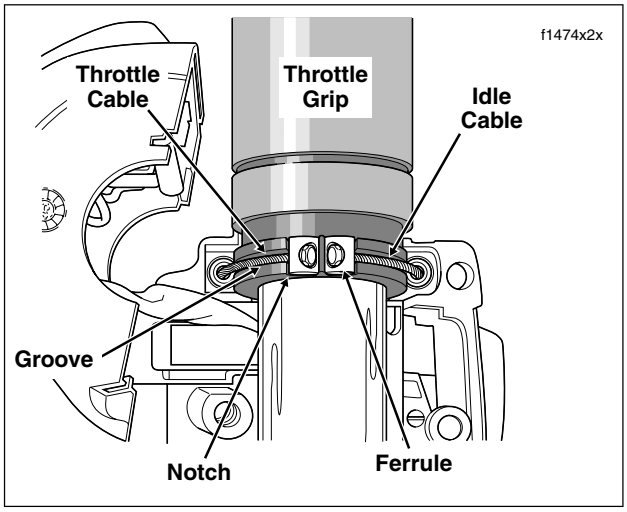


Figure 1-19. Remove Throttle/Idle Cables

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 1-18.
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 1-19.

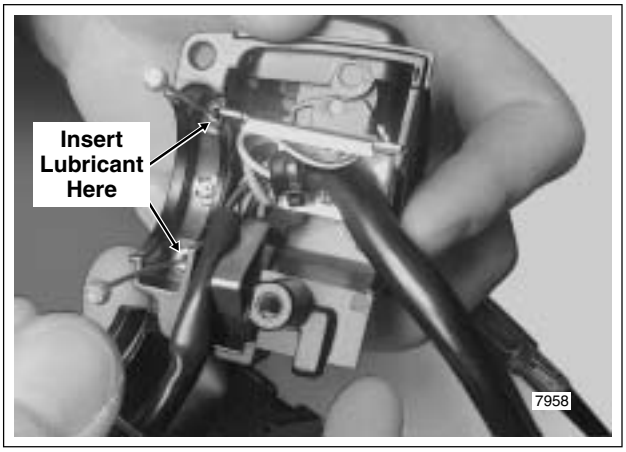


Figure 1-20. Lubricate Throttle/Idle Cables

NOTE

On non cruise equipped models, remove the friction shoe from the end of the tension adjuster screw. 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 throttle control grip from the end of the handlebar.
6. 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.

7. 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 1-20.
8. Repeat the procedure squirting a quantity of lubricant between the idle cable and cable housing.

NOTE

On non cruise equipped models, install the friction shoe with the concave side up so that the pin hole is over the point of the adjuster screw. 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.

9. Apply a light coating of graphite to the handlebar.
10. 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).
11. 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 1-19.
12. 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.
13. Start the upper and lower switch housing screws, but do not tighten.
14. 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.
15. 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.
16. 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.

17. Remove the cardboard insert between the brake lever and lever bracket.
18. Turn the Ignition/Light Key Switch to IGNITION and apply brake lever to test operation of brake lamp.

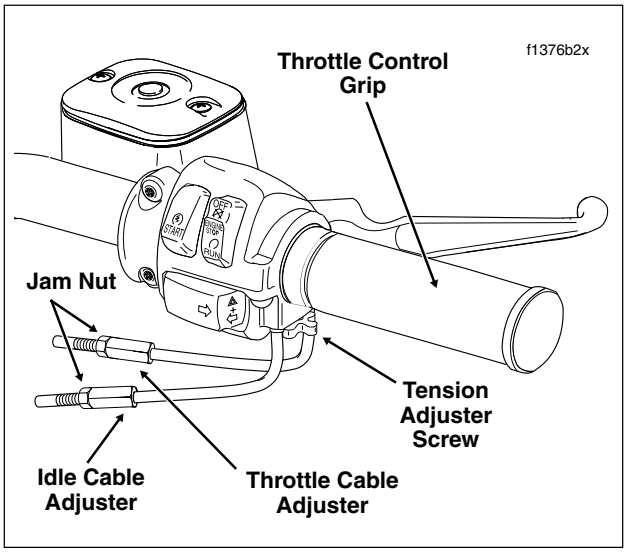


Figure 1-21. Throttle Cable Assembly - Throttle Side (FLHR)

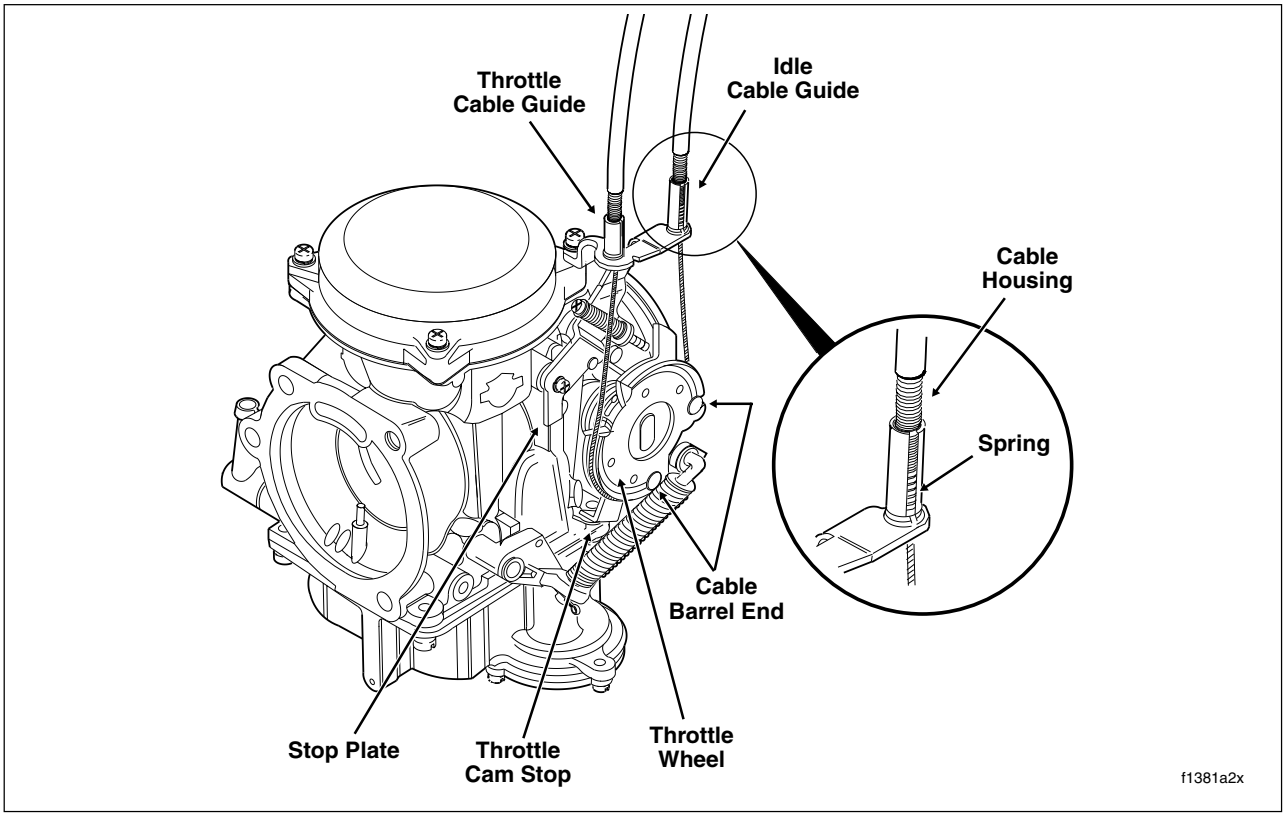


Figure 1-22. Throttle Cable Assembly - Carburetor Side

Adjustment

NOTE

For throttle and idle cable adjustment on cruise equipped models, see Section 8.28 CRUISE CONTROL (FLHRC, FLTR, FLHTCU).

1. Slide rubber boot off throttle cable adjuster. See Figure 1-21. 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 1-22. 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.

SPARK PLUGS

Inspect the spark plugs at every 5000 mile (8,000 km) service interval. Replace the spark plugs at every 10,000 mile (16,000 km) 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.

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)

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.

   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.

   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.

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 12-18 ft-lbs (16-24 Nm).

ELECTRICAL COMPONENTS

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

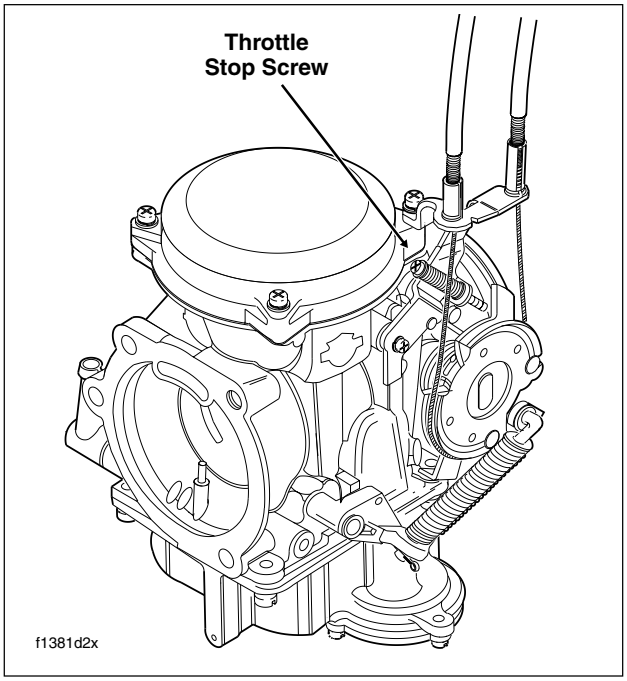


Figure 1-23. Idle Speed Adjustment

ENGINE IDLE SPEED

At the 1000 mile (1,600 km) service interval, and at every 5000 mile (8,000 km) service interval thereafter, inspect the engine idle speed as follows:

NOTES

- *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 1-23. 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.

CRITICAL FASTENERS

At the 1000 mile (1,600 km) service interval, and at every 10,000 mile (16,000 km) service interval thereafter, inspect the tightness of all critical fasteners. Replace fastener if damaged or missing.

Table 1-6. Critical Fastener Torque

Fastener	ft/in-lbs	Nm
Axle		
Front axle nut	50-55 ft-lbs	68-75 Nm
Rear axle cone nut	95-105 ft-lbs	129-142 Nm
Brakes		
Banjo Bolts	17-22 ft-lbs	23-30 Nm
Front Brake Disc Mounting Screws	16-24 ft-lbs	22-33 Nm
Front Brake Caliper Mounting Bolts	28-38 ft-lbs	38-52 Nm
Brake Caliper Pad Pins	180-200 **in-lbs**	20-23 Nm
Rear Brake Disc Mounting Screws	30-45 ft-lbs	41-61 Nm
Rear Master Cylinder Mounting Nut	30-40 ft-lbs	41-54 Nm
Reservoir Cover Screws	6-8 **in-lbs**	0.7-0.9 Nm
Front Forks		
Axle Holder Nuts	132-180 **in-lbs**	14.9-20.3 Nm
Hand Controls		
Clutch Lever/Handlebar Clamp	60-80 **in-lbs**	6.8-9.0 Nm
Master Cylinder/Handlebar Clamp Screws	60-80 **in-lbs**	6.8-9.0 Nm
Upper/Lower Switch Housing Screws	35-45 **in-lbs**	4-5 Nm
Handlebars		
Lower Clamp (Riser) Bolts	30-40 ft-lbs	40.7-54.2 Nm
Pivot Shaft		
Locknuts	40-45 ft-lbs	54-61 Nm
Swingarm Bracket Bolts	34-42 ft-lbs	46-57 Nm

Continued...

Table 1-6. Critical Fastener Torque (Cont'd)

Fastener	ft/in-lbs	Nm
Engine		
Engine Mounting Bracket to Cylinder Head Bolts	25-30 ft-lbs	34-41 Nm
Top Stabilizer Link to Top Engine Mounting Bracket Bolt	18-22 ft-lbs	24-30 Nm
Top Stabilizer Link to Frame Weldment Bolt	18-22 ft-lbs	24-30 Nm
Front Stabilizer Link to Frame Weldment Bolt	18-22 ft-lbs	24-30 Nm
Front Stabilizer Link to Front Engine Mounting Bracket Bolt	18-22 ft-lbs	24-30 Nm
Center Front Engine Mounting Bracket to Rubber Mount Bolt	35-45 ft-lbs	48-61 Nm
Front Engine Mount to Frame Crossmember Bolts	33-38 ft-lbs	45-52 Nm
Engine to Front Engine Mounting Bracket Bolts	33-38 ft-lbs	45-52 Nm
Engine to Transmission Bolts	30-35 ft-lbs	41-48 Nm

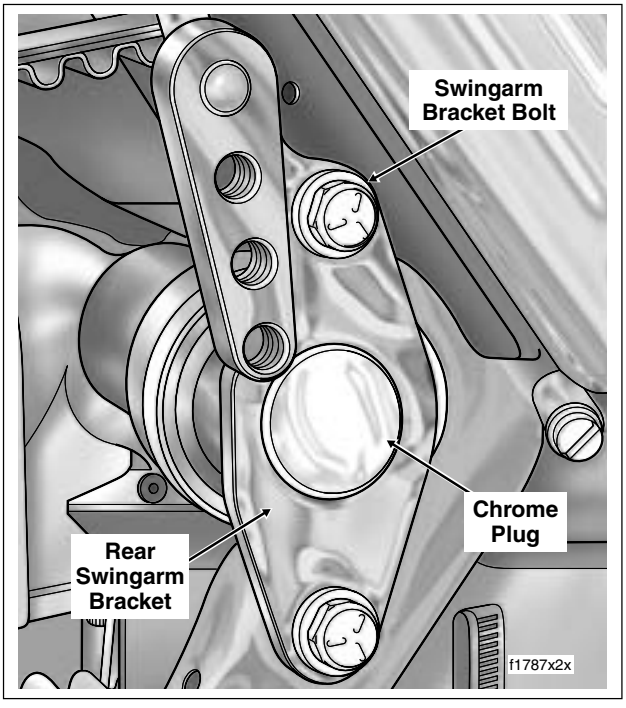


Figure 1-24. Remove Chrome Plugs and Check Pivot Shaft Locknut Torque

REAR SWING ARM PIVOT SHAFT

1. Remove the decorative chrome plugs from the rear swingarm brackets (left and right side of vehicle). See Figure 1-24.

2. Holding right side nut on the pivot shaft, tighten left side locknut to 40-45 ft-lbs (54-61 Nm). Then hold left side nut and tighten right side locknut using the same torque value.
3. Snap the chrome plugs back into the rear swingarm brackets.
4. Tighten four rear swingarm bracket bolts to 34-42 ft-lbs (46-57 Nm).

ENGINE MOUNTS

NOTE

Raise fuel tank to access top engine stabilizer bolts and jam nuts. For carbureted models, see Section 4.7 FUEL TANK (CARBURETED), PARTIAL REMOVAL, FLHT/C, FLTR, or FLHR. For fuel injected models, see Section 9.4 FUEL TANK (FUEL INJECTED), PARTIAL REMOVAL, FLHT/C/U/I, FLTRI, or FLHR/C/I.

Top

- On left side of vehicle, tighten top engine mounting bracket bolts to front and rear cylinder heads to 25-30 ft-lbs (34-41 Nm). See A of Figure 1-25.
- Top stabilizer link - tighten eyelet bolt to top engine mounting bracket to 18-22 ft-lbs (24-30 Nm). See B of Figure 1-25.
- Moving to right side of vehicle, tighten eyelet bolt to frame weldment to 18-22 ft-lbs (24-30 Nm). See C of Figure 1-25.
- Verify tightness of jam nuts on top stabilizer link.

Bottom

- Front stabilizer link - on left side of vehicle, tighten eyelet bolt to frame weldment to 18-22 ft-lbs (24-30 Nm). See D of Figure 1-25.
- Moving to right side of vehicle, tighten eyelet bolt to block on front engine mounting bracket to 18-22 ft-lbs (24-30 Nm). See E of Figure 1-25.
- Verify tightness of jam nuts on front stabilizer link.
- Tighten center front engine mounting bracket to rubber mount bolt to 35-45 ft-lbs (48-61 Nm). See F of Figure 1-25.
- Tighten the two front engine mount to frame crossmember bolts to 33-38 ft-lbs (45-52 Nm). See G of Figure 1-25.
- Tighten two engine to front engine mounting bracket bolts to 33-38 ft-lbs (45-52 Nm). See H of Figure 1-25.
- Tighten four engine to transmission bolts to 30-35 ft-lbs (41-48 Nm).

NOTE

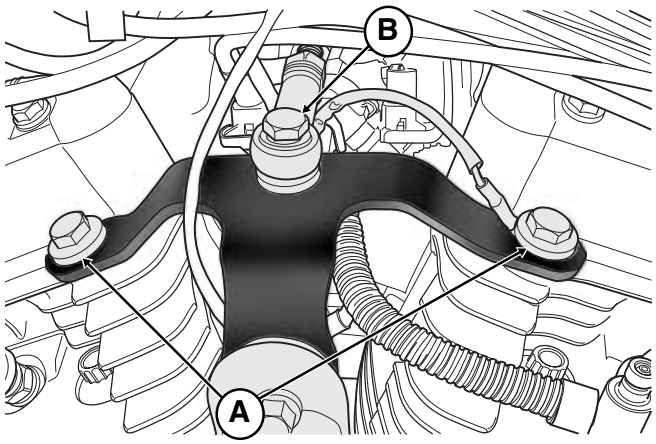
Install fuel tank. For carbureted models, see Section 4.7 FUEL TANK (CARBURETED), INSTALLATION (AFTER PARTIAL REMOVAL), FLHT/C, FLTR, or FLHR. For fuel injected models, see Section 9.4 FUEL TANK (FUEL INJECTED), INSTALLATION (AFTER PARTIAL REMOVAL), FLHT/C/U/I, FLTRI, or FLHR/C/I.

FRONT FORK OIL

At every 20,000 mile (32,000 km) service interval, replace the front fork oil. For detailed instructions, see Section 2.14 FRONT FORKS.

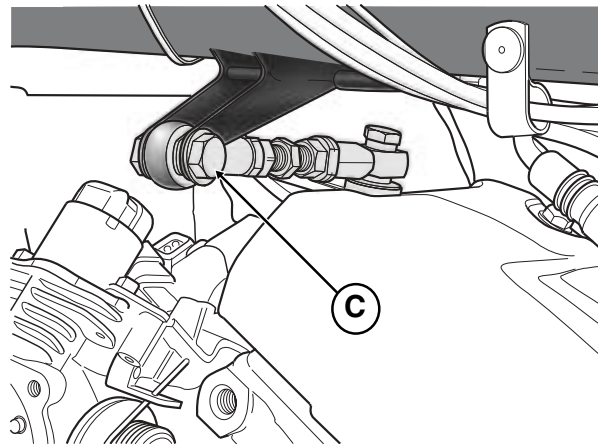
ROAD TEST

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



LEFT SIDE

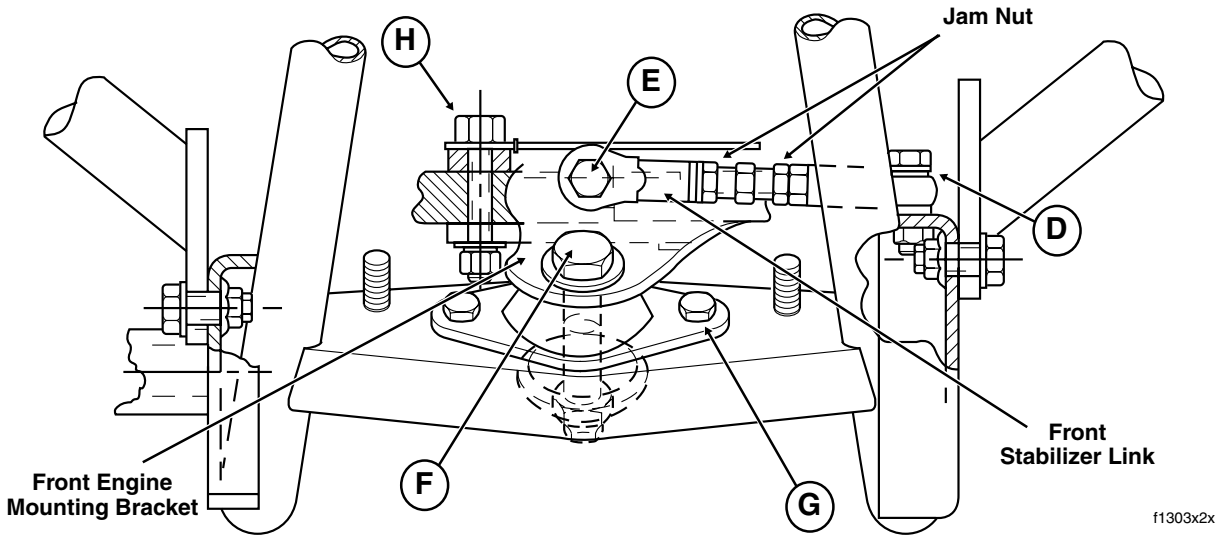
f2112x2x



RIGHT SIDE

f2111x2x

Top Stabilizer Link and Engine Mounting Bracket



Front Stabilizer Link and Engine Mounting Bracket

Top

- **A** Top Engine Mounting Bracket to Cylinder Heads
- **B** Eyelet to Top Engine Mounting Bracket
- **C** Eyelet to Frame Weldment

Bottom

- **D** Eyelet to Frame Weldment
- **E** Eyelet to Front Engine Mounting Bracket
- **F** Front Engine Mounting Bracket to Rubber Mount
- **G** Front Engine Mount to Frame Crossmember
- **H** Engine to Front Engine Mounting Bracket

Figure 1-25. Engine Mounting Bracket Bolts

NOTES

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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) Total* Reserve	5 0.9		5 0.9		5 0.9	
Oil Tank (quarts) with filter	4		4		4	
Transmission (Ounces, approximate)	20-24		20-24		20-24	
Primary Chaincase (Ounces, approximate)	32		32		32	
Front Fork (Ounces)	Left	Right	Left	Right	Left	Right
	10.0	11.1	11.1	11.1	10.0	11.1

* Includes Reserve on Carbureted Models

CAPACITIES (METRIC)

	FLHT/C/U		FLHR/C		FLTR	
Fuel Tank (liters) Total* Reserve	18.9 3.4		18.9 3.4		18.9 3.4	
Oil Tank (liters) with filter	3.78		3.78		3.78	
Transmission (Milliliters)	591-710		591-710		591-710	
Primary Chaincase (Milliliters)	946		946		946	
Front Fork (Milliliters)	Left	Right	Left	Right	Left	Right
	295	328	328	328	295	328

* 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 axle holder nuts	132-180 **in-lbs**	14.9-20.3 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 axle cone nut	95-105 ft-lbs	129-142 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	70-100 **in-lbs**	7.9-11.3 Nm
Handlebar clamp to master cylinder housing TORX screws	60-80 **in-lbs**	6.8-9.0 Nm
Brake caliper bleeder valve	80-100 **in-lbs**	9.0-11.3 Nm
Rear brake pedal shaft locknut	15-20 ft-lbs	20-27 Nm
Brake pedal/master cylinder assembly to mounting bracket hex nut	30-40 ft-lbs	41-54 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	35-40 **in-lbs**	4.0-4.5 Nm
Fairing lower to engine guard clamp TORX screw	30-35 **in-lbs**	3.4-4.0 Nm
Fairing lower cap screws	10-15 **in-lbs**	1.1-1.7 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**	20-23 Nm
Brake caliper bridge bolts	28-38 ft-lbs	38-52 Nm

Continued ...

TORQUE VALUES (CONT.'D)

Item	ft/in-lbs	Nm
Fork oil drain plugs	72-96 **in-lbs**	8-11 Nm
Fork pinch bolts	30-35 ft-lbs	41-48 Nm
Fork stem nut	60-80 ft-lbs	81-109 Nm
Fork tube plug	22-58 ft-lbs	30-79 Nm
Fork cap bolt	50-60 ft-lbs	68-81 Nm
Damper rod/cartridge 6mm screw	132-216 **in-lbs**	14.9-24.4 Nm
Damper rod locknut (cartridge type fork)	13-20 ft-lbs	18-27 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 switch housing TORX screws	35-45 **in-lbs**	4-5 Nm
Handlebar clamp to clutch lever bracket screws	60-80 **in-lbs**	6.8-9.0 Nm
Clutch release cover socket head screws	120-144 **in-lbs**	13.6-16.3 Nm
Clutch cable fitting	36-60 **in-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
Inner fairing screws	20-30 **in-lbs**	2.3-3.4 Nm
Outer fairing screws (below windshield)	25-30 **in-lbs**	2.8-3.4 Nm
Fairing cap TORX screws	25-30 **in-lbs**	2.8-3.4 Nm
Speedometer/tachometer bracket socket screws	10-20 **in-lbs**	1.1-2.3 Nm
2 inch diameter gauge nuts	10-20 **in-lbs**	1.1-2.3 Nm
Passing lamp bracket fork side TORX bolts	15-20 ft-lbs	20-27 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
		Continued ...

Item		ft/in-lbs	Nm
Short fairing screws (FLTR)		6-12 **in-lbs**	0.7-1.4 Nm
Long fairing screws (FLTR)		10-15 **in-lbs**	1.1-1.7 Nm
Instrument bezel TORX screws (FLTR)		25-35 **in-lbs**	2.8-4.0 Nm
Instrument nacelle to fork side TORX bolts (FLTR)		15-20 ft-lbs	20-27 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)		96-144 **in-lbs**	10.9-16.3 Nm
Headlamp nacelle handle-bar clamp shroud Phillips screw		10-20 **in-lbs**	1.1-2.3 Nm
Headlamp nacelle trim strip flange nut		15-20 **in-lbs**	1.7-2.3 Nm
Passing lamp bracket fork side stud acorn nuts		72-108 **in-lbs**	8.1-12.2 Nm
Front fender mounting bolts		16-20 ft-lbs	22-27 Nm
Rear fender TORX bolts		15-20 ft-lbs	20-27 Nm
Jiffy stand leg stop flange nut		43-53 ft-lbs	58-72 Nm
Intake flange adapter screws		96-144 **in-lbs**	10.9-16.3 Nm
Exhaust flange adapter screws		60-80 **in-lbs**	6.8-9.0 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
Transmission clamp bolt		60-96 **in-lbs**	6.8-10.8 Nm
Passenger footboard socket screws		15-18 ft-lbs	20-24 Nm
Air valve mount hex nut		40-50 **in-lbs**	4.5-5.6 Nm
Handlebar upper clamp screws		12-16 ft-lbs	16.3-21.7 Nm
Handlebar lower clamp bolts (risers)		30-40 ft-lbs	40.7-54.2 Nm
Ignition switch nut	DOM	50-70 **in-lbs**	5.7-7.9 Nm
	HDI	125-150 **in-lbs**	14.1-16.9 Nm
Speaker box to Tour-Pak bolts		25-35 **in-lbs**	2.8-4.0 Nm
Throttle cable J-clamp screw to wellnut (FLHR/C)		9-18 **in-lbs**	1.0-2.0 Nm

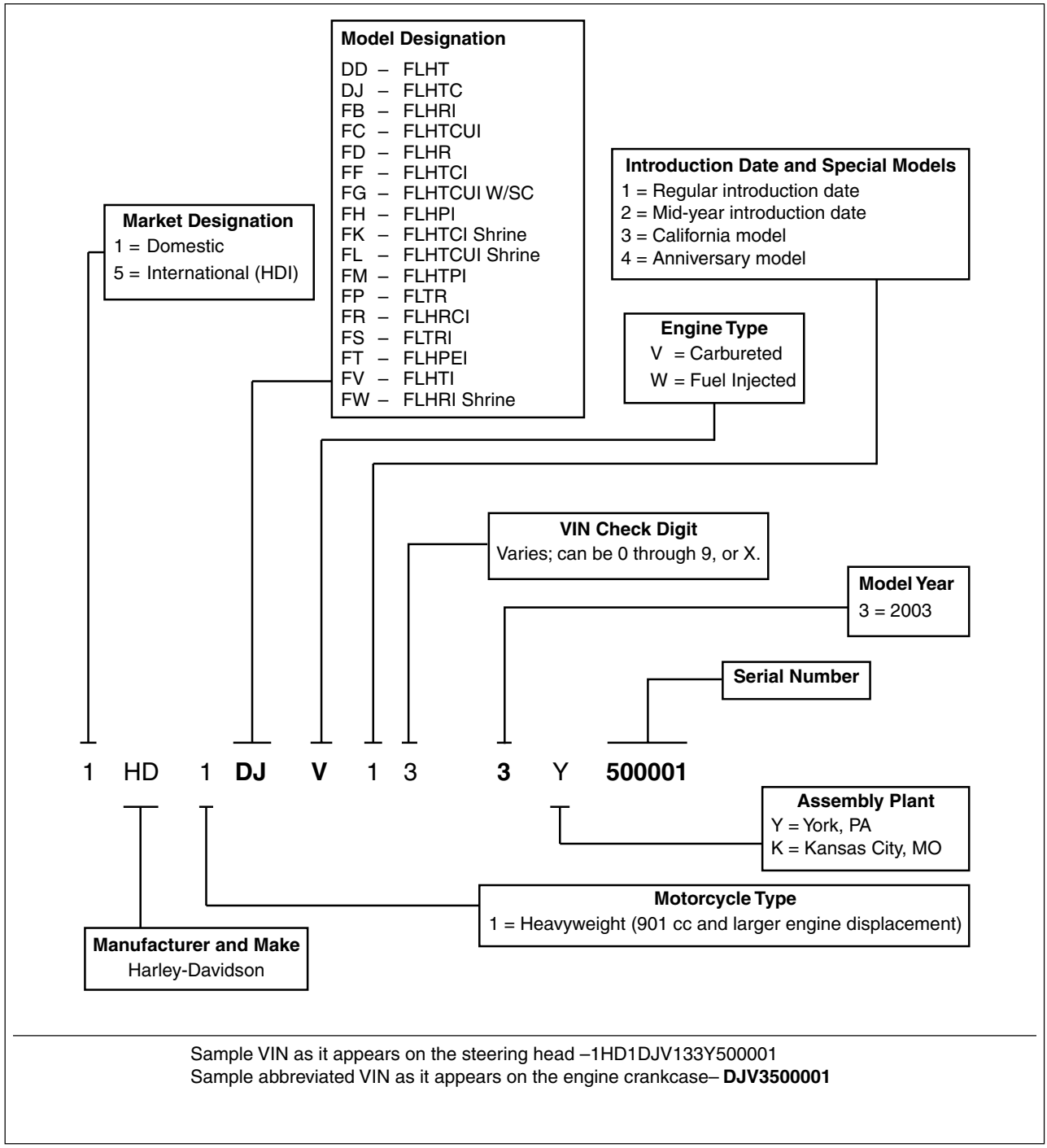
NOTES

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 –1HD1DJV133Y500001
Sample abbreviated VIN as it appears on the engine crankcase– **DJV3500001**

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, see Section 1.1 TROUBLESHOOTING, HANDLING, 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.

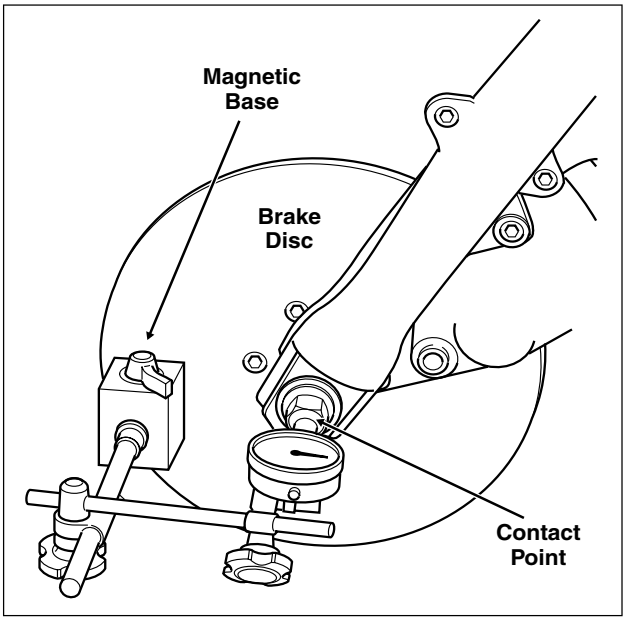


Figure 2-1. Check Front Wheel End Play

   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 axle holder 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.

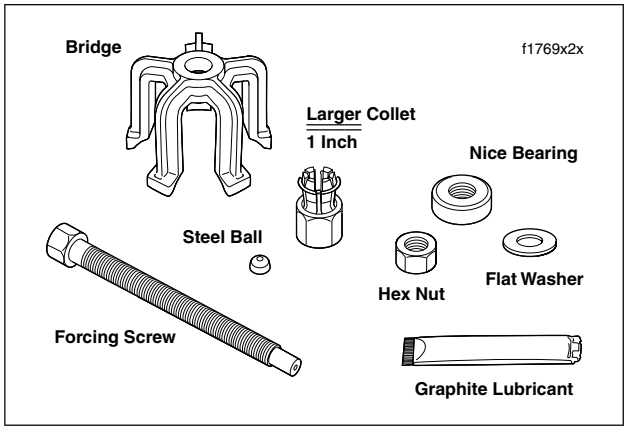


Figure 2-2. Front Wheel Bearing Remover Tools (Part No. HD-44060)

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.

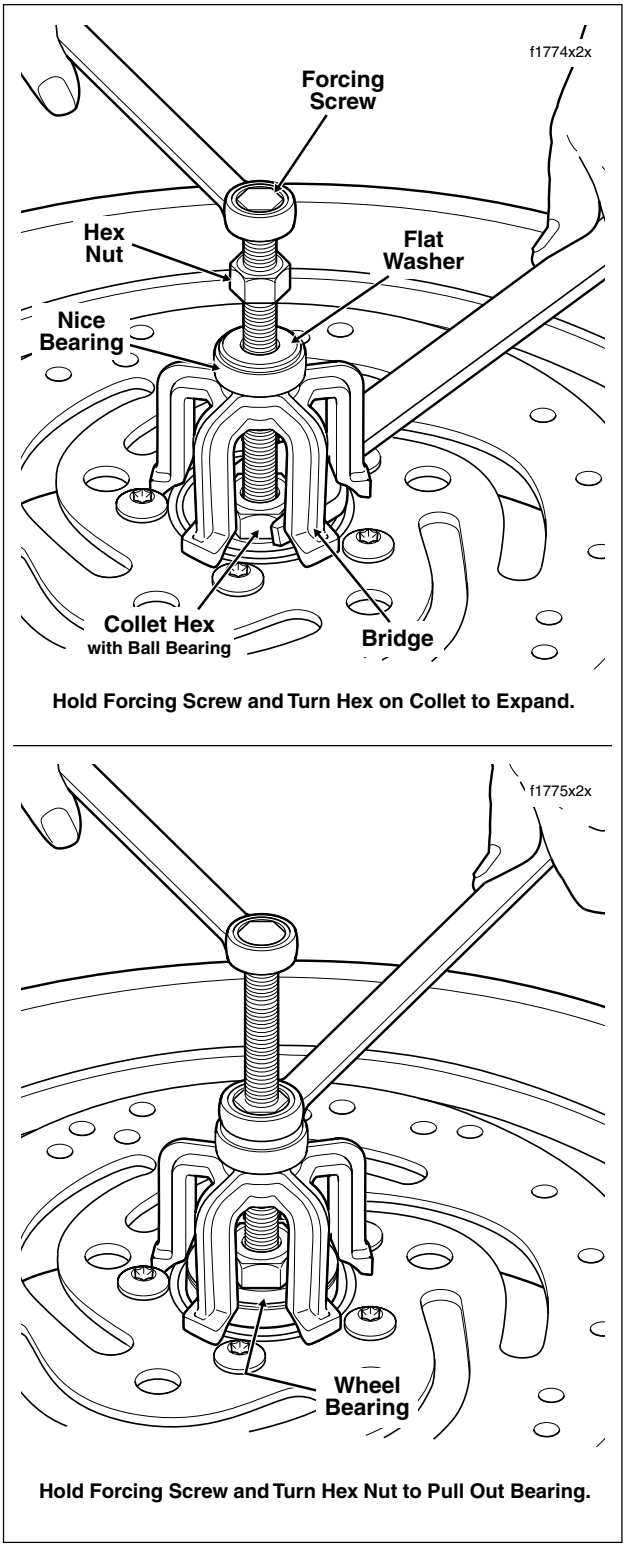


Figure 2-3. Remove Sealed Wheel Bearings

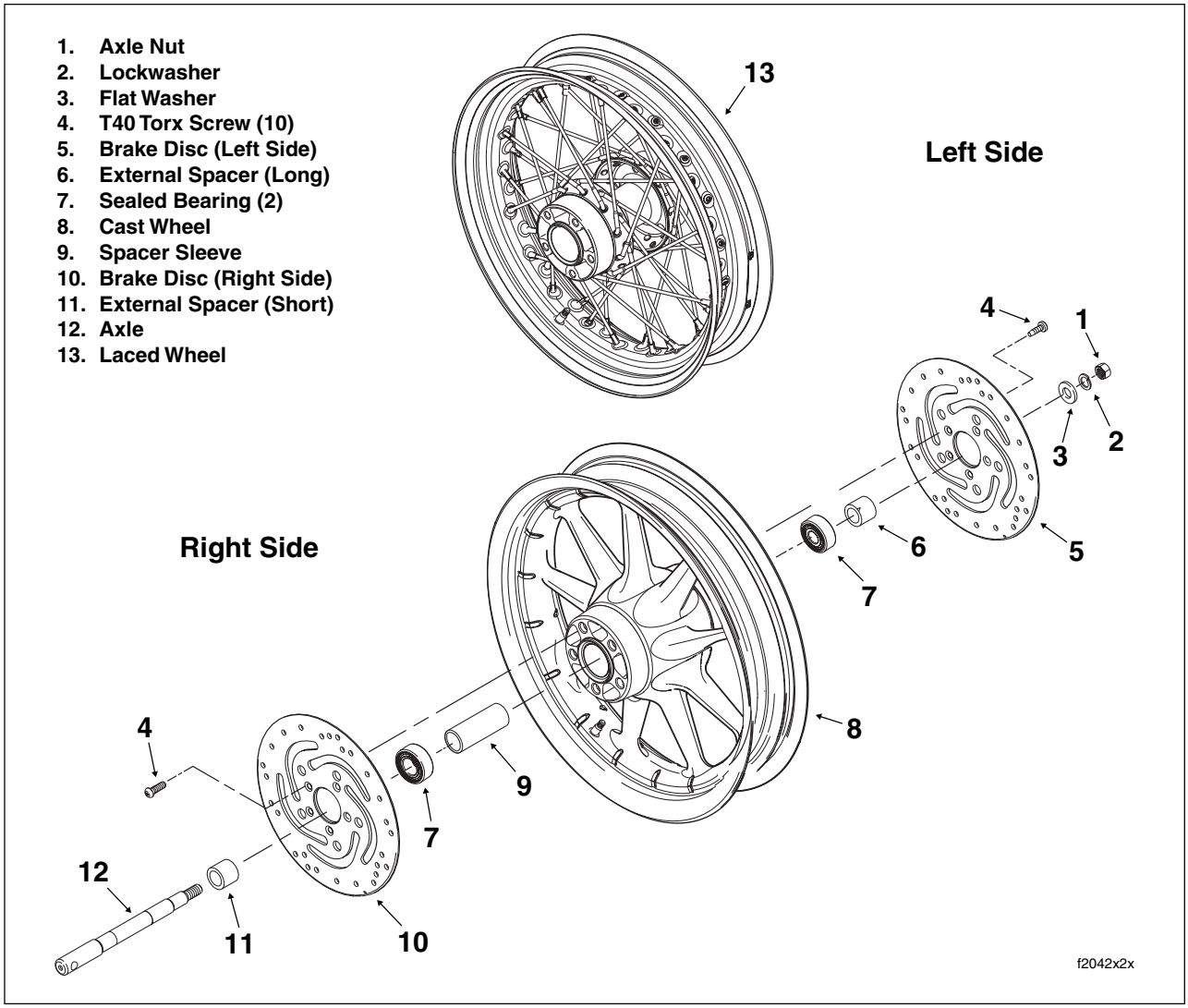


Figure 2-4. Front Wheel (Exploded View)

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.

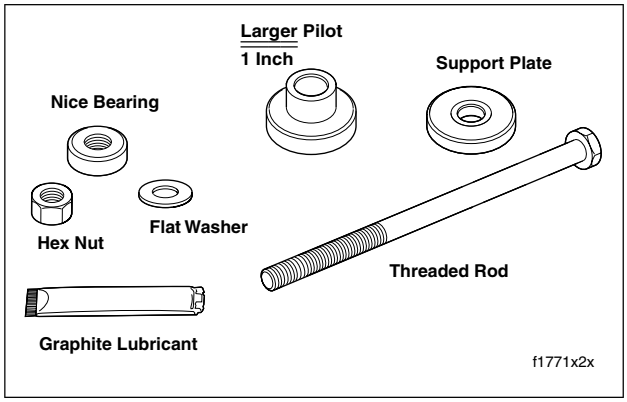


Figure 2-5. Front Wheel Bearing Installer Tools (Part No. HD-44060)

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 rim strip on wheel rim, if applicable. Install tube and tire, if applicable. Verify that wheel is balanced.

INSTALLATION

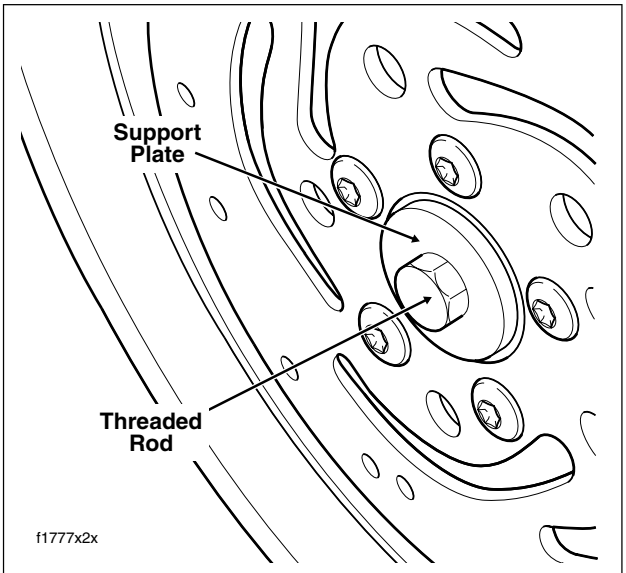
1. Place wheel into position between forks with the valve stem on the right side of the vehicle.

2. Coat the axle with ANTI-SIEZE LUBRICANT.

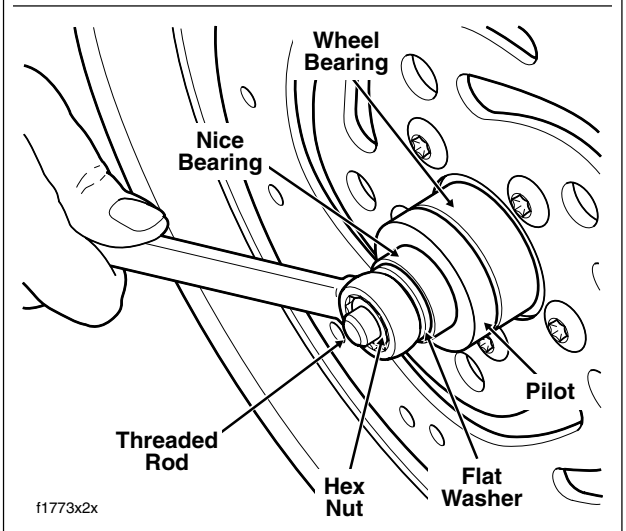
3. Supporting wheel, insert threaded end of axle through right fork leg. Push axle through fork, **short** external spacer and wheel hub until it begins to emerge from left side.

4. With the three notches on the bearing side, push axle through **long** external spacer and left fork leg until axle shoulder contacts external spacer on right fork side.

5. Install flat washer, lockwasher and axle nut.



Slide Threaded Rod (with Support Plate) Through Hub.



Hold Threaded Rod and Turn Hex Nut to Push In Bearing.

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 axle holder nuts to 132-180 **in-lbs** (14.9-20.3 Nm).

9. Remove drill bit from axle hole.

10. Install brake caliper as follows:

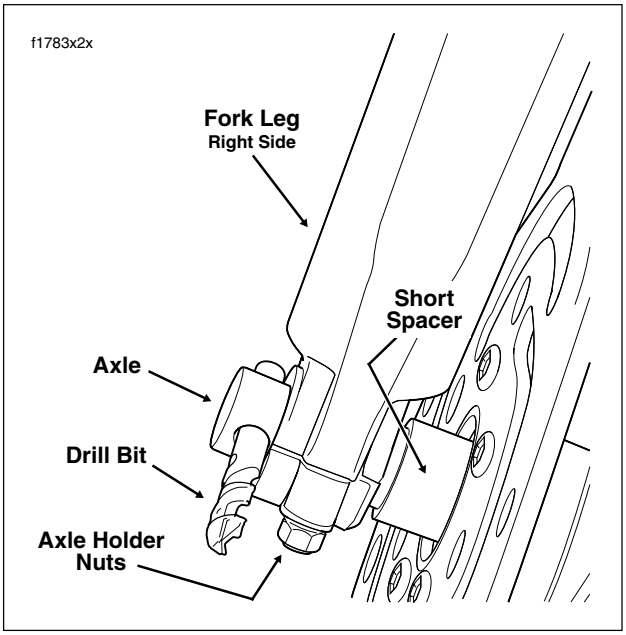


Figure 2-7. Align Front Wheel

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, see Section 1.1 TROUBLESHOOTING, HANDLING, 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 2.23 SADDLEBAG, REMOVAL.
2. Remove both mufflers as follows:

Left Side

   a. Open worm drive clamps to remove heat shield from crossover pipe.
   b. Using a bungee cord, tie the muffler to the lower saddlebag support rail.
   c. Loosen TORCA clamp between crossover 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.

Right Side

   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.

3. Standing on right side of vehicle, remove E-clip from groove at end of axle.
4. Remove cone nut and adjuster cam from axle.
5. Using a soft mallet, gently tap end of axle towards left side to loosen. Catching external spacers on right and left side of hub, pull axle free of wheel and rear swingarm.
6. 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.
7. Remove caliper from anchor weldment on rear swingarm, and carefully hang over lower saddlebag support rail.
8. Move wheel forward and slip belt off sprocket.
9. 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. Remove five bolts (with flat washers) securing belt sprocket to hub.
   b. Obtain the WHEEL BEARING REMOVER/INSTALLER (HD-44060). Pick out the wheel bearing remover tools for the rear wheel. See Figure 2-8.

NOTE

The smaller 3/4 inch collet (and pilot) is only used to replace the rear wheel bearings on 2000/2001 Touring models.

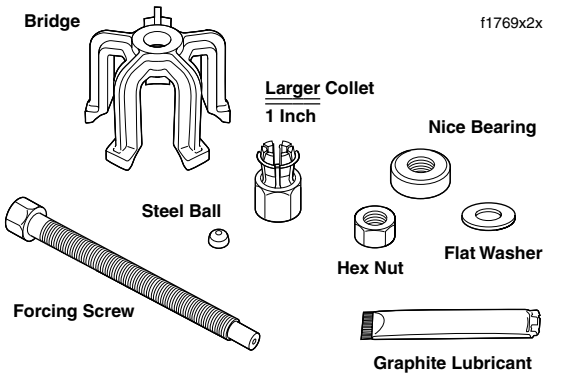


Figure 2-8. Rear Wheel Bearing Remover Tools (Part No. HD-44060)

c. To prolong service life and ensure smooth operation, sparingly apply graphite lubricant to threads of forcing screw.

d. Install nut, flat washer and Nice bearing on forcing screw. Insert end of forcing screw through hole in bridge.

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

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

g. 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.

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

i. Remove spacer sleeve from wheel hub.

j. 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 tire, if necessary. Remove tube from the rim, if applicable. See Section 2.7 TIRES AND TUBES.

4. If it is necessary to remove the hub from a laced wheel, loosen all spoke nipples and remove the rim and spokes.

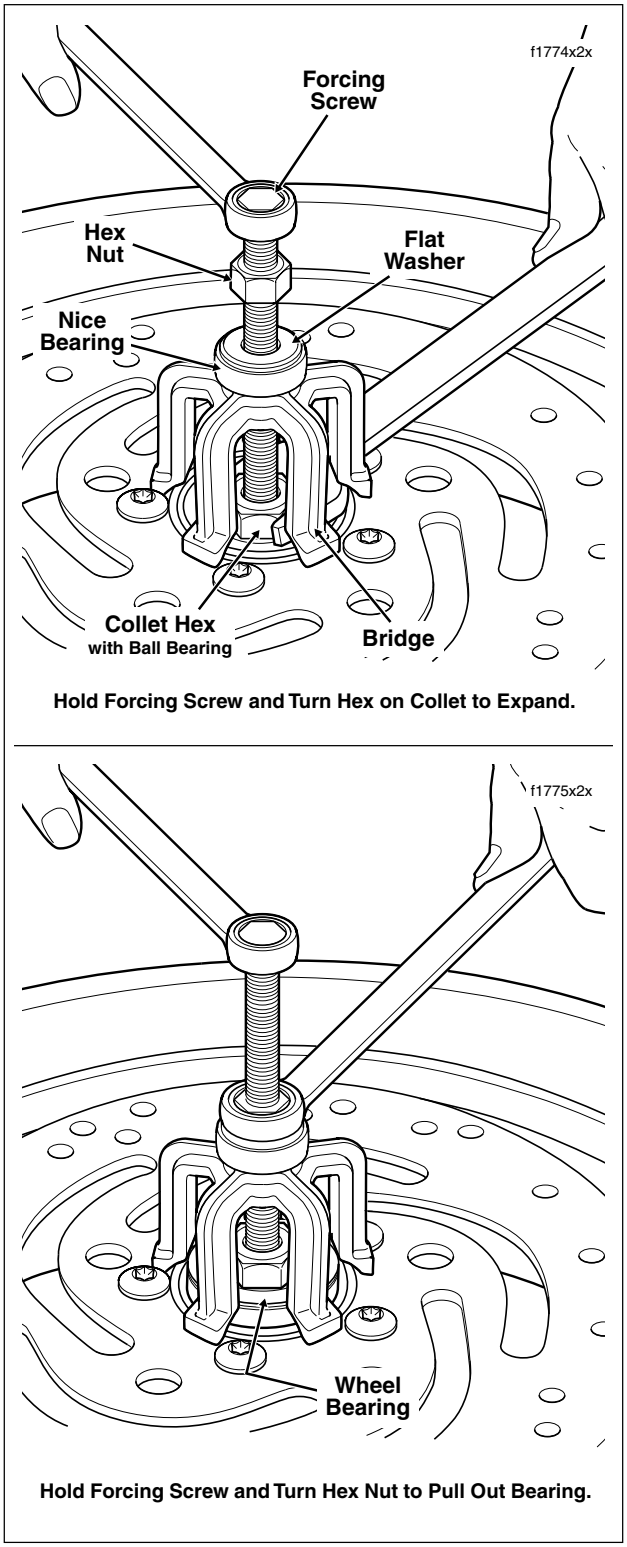


Figure 2-9. Remove Sealed Wheel Bearings

CLEANING AND INSPECTION

1. Thoroughly clean all parts in solvent.

2. Inspect all parts for damage or excessive wear.

3. Always replace bearings as a complete set.

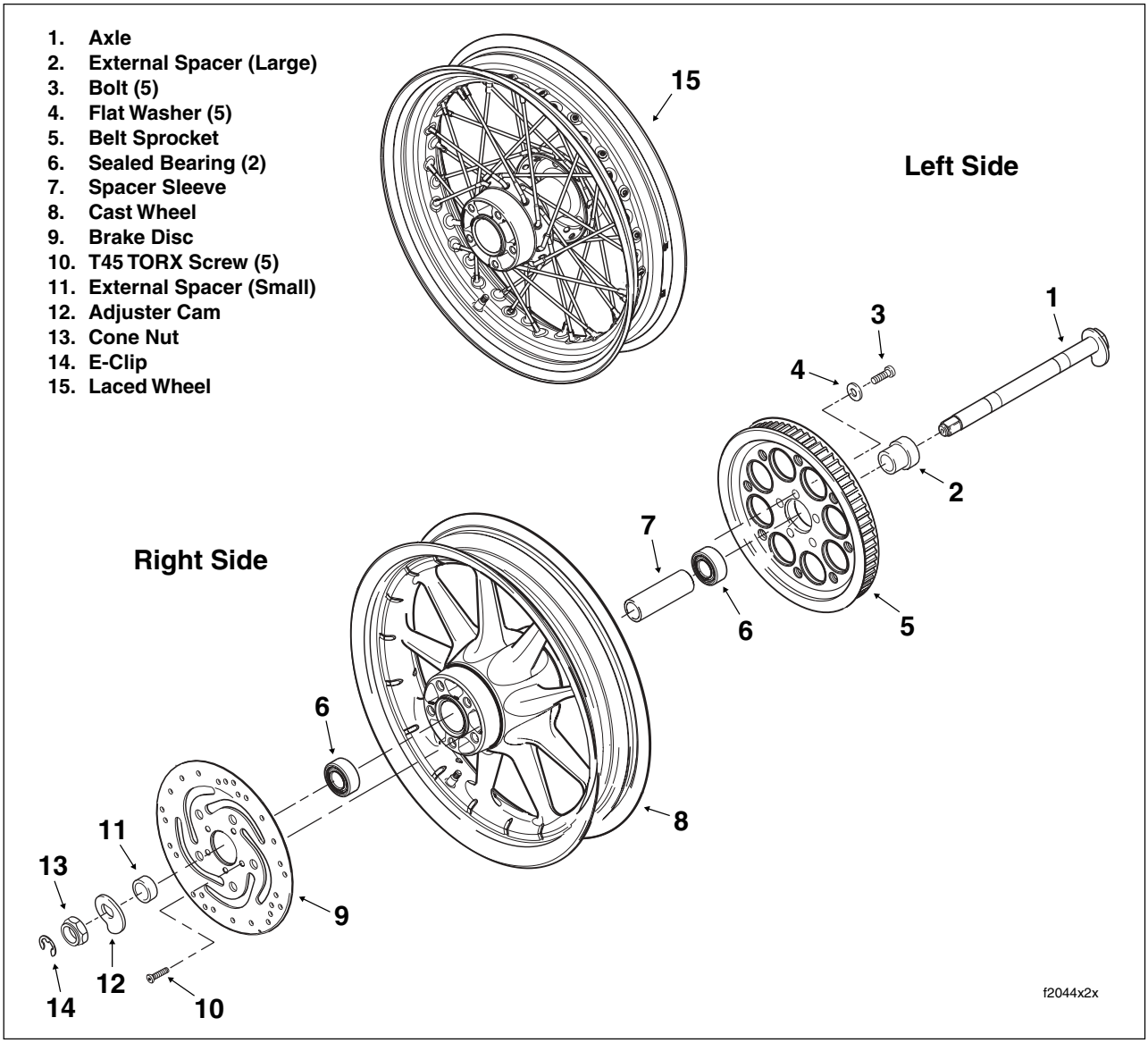


Figure 2-10. Rear Wheel (Exploded View)

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.
2. Verify that wheel is true. See Section 2.4 CHECKING RIM RUNOUT or Section 2.6 TRUING LACED WHEEL, whichever applies.

⚠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.

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

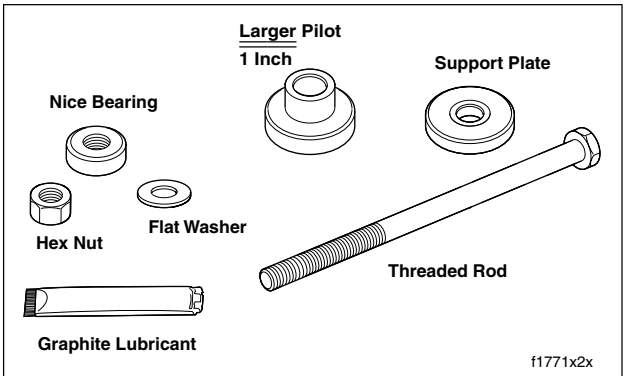


Figure 2-11. Rear Wheel Bearing Installer Tools (Part No. HD-44060)

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 **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 2-12. 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. Install rim strip on wheel rim, if applicable. Install tube and tire, if applicable. Verify that wheel is balanced.

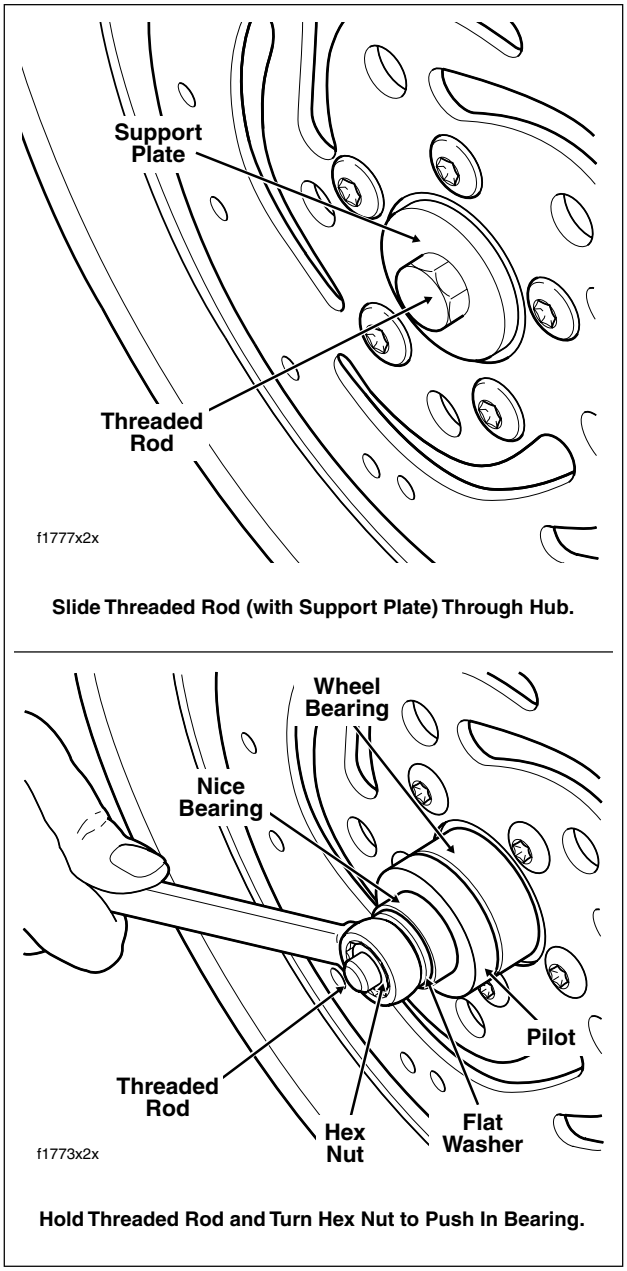


Figure 2-12. Install Sealed Wheel Bearings

6. Apply two drops of Loctite High Strength Threadlocker 271 (red) to threads of five belt sprocket bolts. Always use **new** bolts after three use cycles. Install bolts with flat washers to secure sprocket to hub. Alternately tighten bolts to 55-65 ft-lbs (75-88 Nm).

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 (127 mm) in diameter. Sharp bending can weaken the belt and cause premature failure.

2. Seat caliper on anchor weldment of rear swingarm. Position wheel in swingarm, so that brake disc is centered between brake pads.
3. Coat the axle with ANTI-SIEZE LUBRICANT.
4. With the larger OD on the outboard side, hold external spacer between rear swingarm and belt sprocket. Slide axle through left side of rear swingarm, external spacer, and belt sprocket into wheel hub.
5. When axle emerges from hub on brake disc side of wheel, push axle through **short** external spacer, caliper bracket and right side of rear swingarm.
6. Rotate axle so that the flat on the threaded end is topside. With the thumb down and the cam forward, install adjuster cam on end of axle.
7. Apply a thin film of ANTI-SIEZE LUBRICANT to the inboard side of the cone nut avoiding contact with threads. Install cone nut on axle, but finger tighten only.
8. Verify that adjuster cam just contacts weld nub on both sides of rear swingarm. If necessary, push wheel forward slightly to achieve the desired result. Snug the cone nut to 15-20 ft-lbs (20-27 Nm). See Figure 2-13.
9. Lower hydraulic center stand so that the motorcycle is on the ground.
10. Rotate weld nut on left side of axle in a clockwise direction.
11. Check deflection at the tightest spot in the belt. 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 as follows:

Table 2-1. Belt Deflection on the Ground

Orientation	Inches	Millimeters
On Ground Without Rider	5/16 - 3/8	7.9 - 9.5
On Ground With Rider 11.5 inches (292 mm) Between Shock Eyelets	1/4 - 5/16	6.4 - 7.9

12. If belt is too tight, move to step 13 to increase belt deflection. If belt is too loose, reduce belt deflection as described below:
    a. Rotate weld nut on left side of axle in a clockwise direction.
    b. Check belt deflection. Apply 10 lbs. (4.5 kg) of force at the midpoint of the bottom belt strand. Belt deflection should be within the range specified in Table 2-1.
    c. If belt is still too loose, repeat steps 12(a) through 12(b). If belt is now too tight, move to step 13.
13. If belt is too tight, increase belt deflection as follows:
    a. Raise motorcycle so that the rear wheel is off the ground.
    b. Rotate weld nut on left side of axle in a counterclockwise direction.
    c. Push wheel forward slightly so that adjuster cam just contacts weld nub on both sides of rear swingarm. See Figure 2-13.

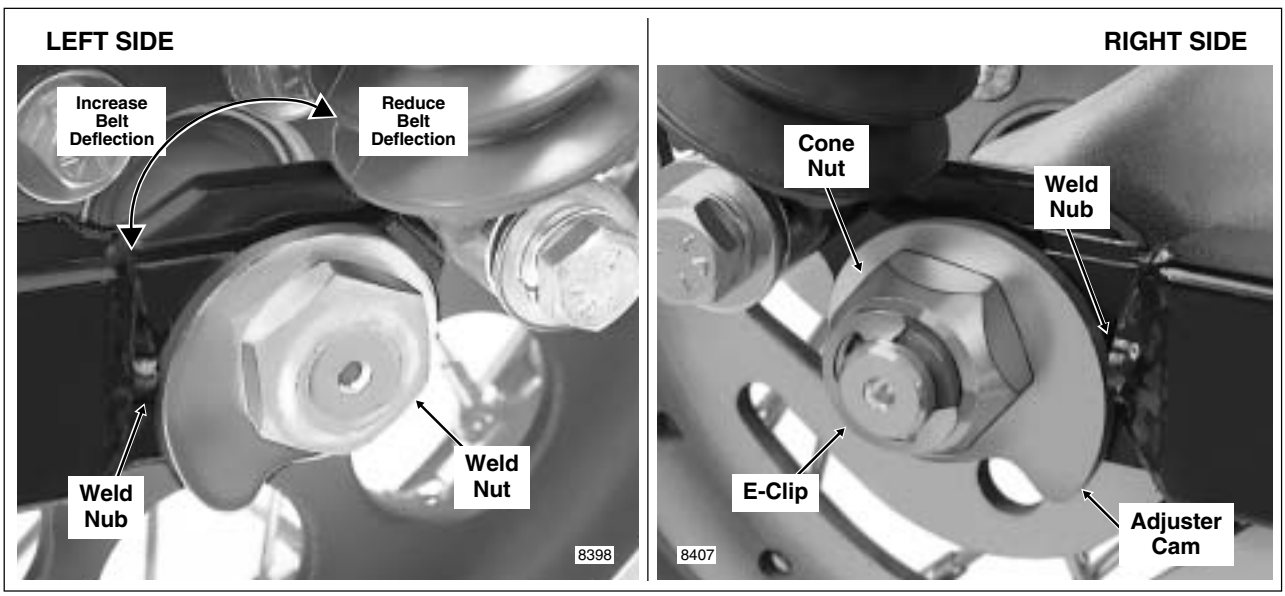


Figure 2-13. Move Rear Wheel Forward Until Adjuster Cams Just Contact Weld Nubs

d. Lower hydraulic center stand so that the motorcycle is on the ground.

e. Check belt deflection. Apply 10 lbs. (4.5 kg) of force at the midpoint of the bottom belt strand. Belt deflection should be within the range specified in Table 2-1.

f. If belt is still too tight, repeat steps 13(a) through 13(e). If belt is now too loose, move to step 12.

14. **Holding** weld nut on left side of axle, tighten cone nut on right side to 95-105 ft-lbs (128.8-142.4 Nm).

NOTE

If the axle moves during tightening of the cone nut, then the the belt deflection procedure must be restarted.

15. Recheck belt deflection to verify that it is still within specification.

    If the belt deflection is not within specification, loosen cone nut and then snug to 15-20 ft-lbs (20-27 Nm) before returning to step 12.

16. With the flat side out, install **new** E-clip in groove on right side of axle.

17. Install both mufflers 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.

Left Side

a. Slide **new** TORCA clamp onto free end of crossover pipe.

b. Using a bungee cord, tie muffler to lower saddlebag support rail. Install muffler on crossover pipe. Place TORCA clamp into position between crossover 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 crossover 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.

Right Side

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.

⚠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.

18. Depress rear brake pedal several times to set brake pads to proper operating position within caliper.

19. Install saddlebags. See Section 2.23 SADDLEBAG, INSTALLATION.

CHECKING RIM RUNOUT 2.4

INSPECTION

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

1. Install truing arbor in wheel hub and place wheel in WHEEL TRUING STAND, Part No. HD-99500-80.
2. See Figure 2-14. To check rim lateral runout, place a gauge rod or dial indicator near the rim bead. If lateral runout exceeds 0.040 inch (1.02 mm), replace the wheel if cast. Retrue the wheel if laced.
3. See Figure 2-15. Check the rim radial runout as shown. If radial runout exceeds 0.030 inch (0.76 mm), replace the wheel if cast. Retrue the wheel if laced.

NOTE

Rim lateral and radial runout is adjustable on laced wheels. See Section 2.6 TRUING LACED WHEEL.

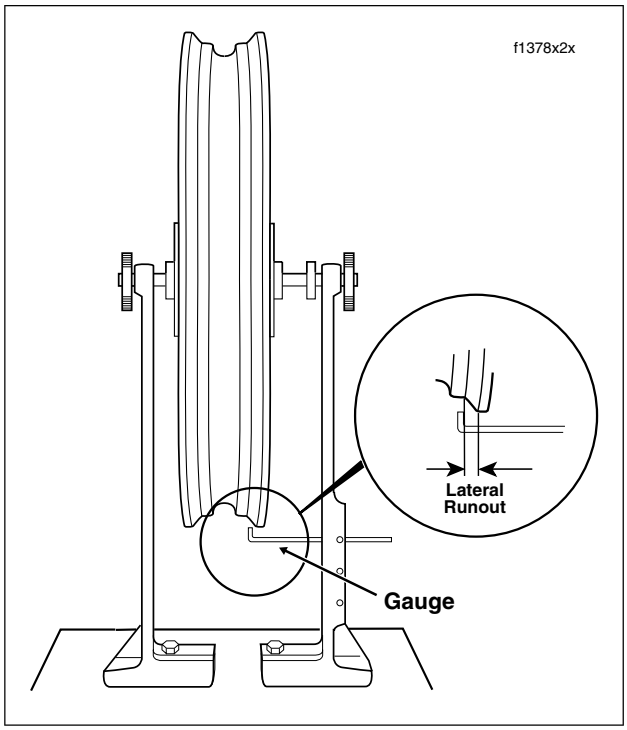


Figure 2-14. Checking Rim Lateral Runout

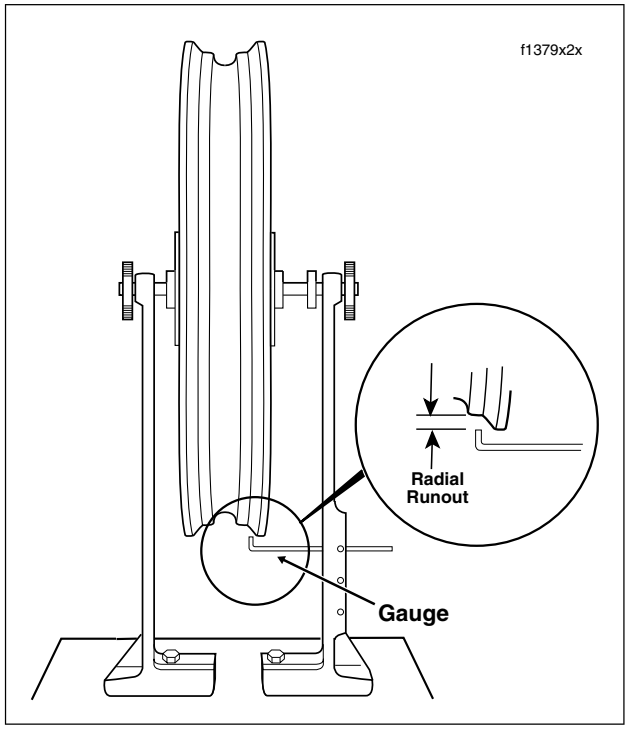


Figure 2-15. Checking Rim Radial Runout

4. If working with a laced wheel, proceed to Section 2.6 TRUING LACED WHEEL to check the wheel offset dimension.

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 2-16. 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 the shape 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 2-16.

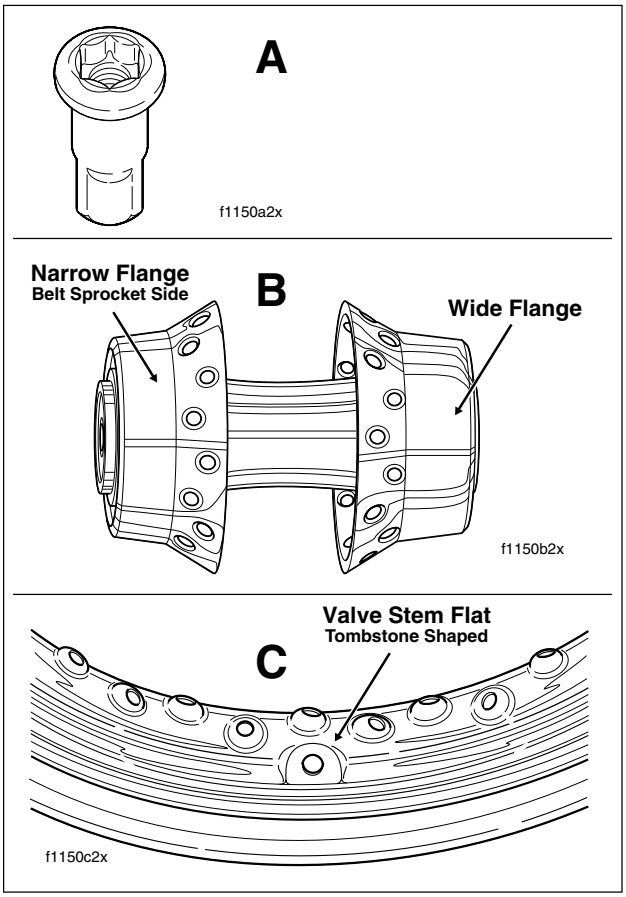


Figure 2-16. Parts Identification

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 is up. Insert a spoke in each hole of the lower row as shown below. Angle the spokes in a clockwise direction .

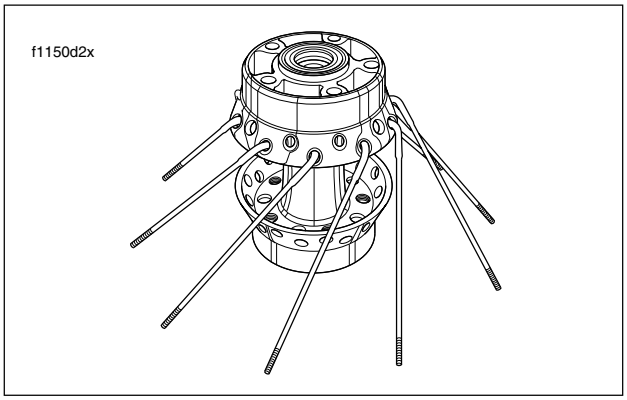


Figure 2-17.

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.

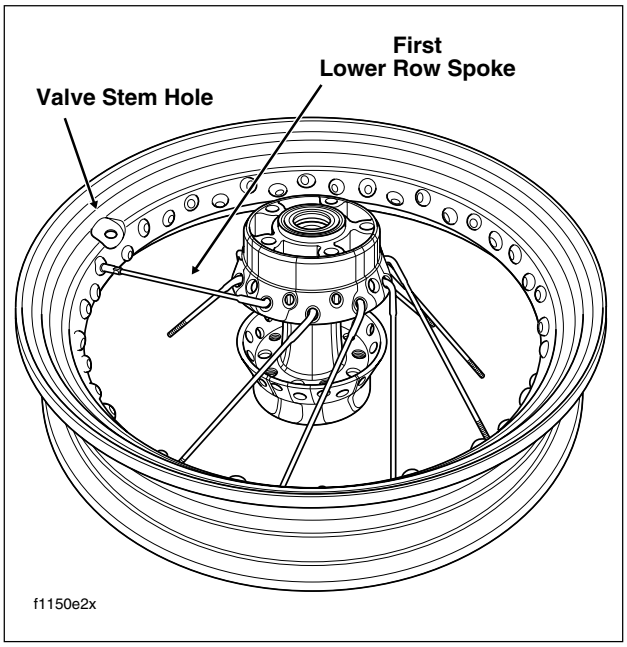


Figure 2-18.

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

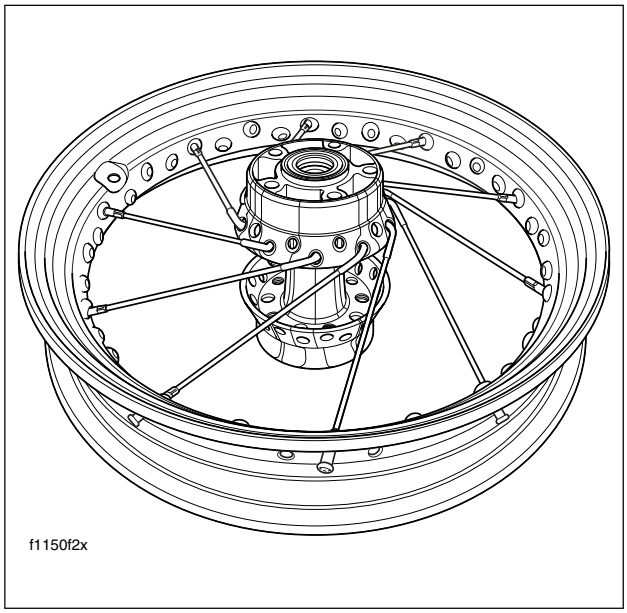


Figure 2-19.

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.

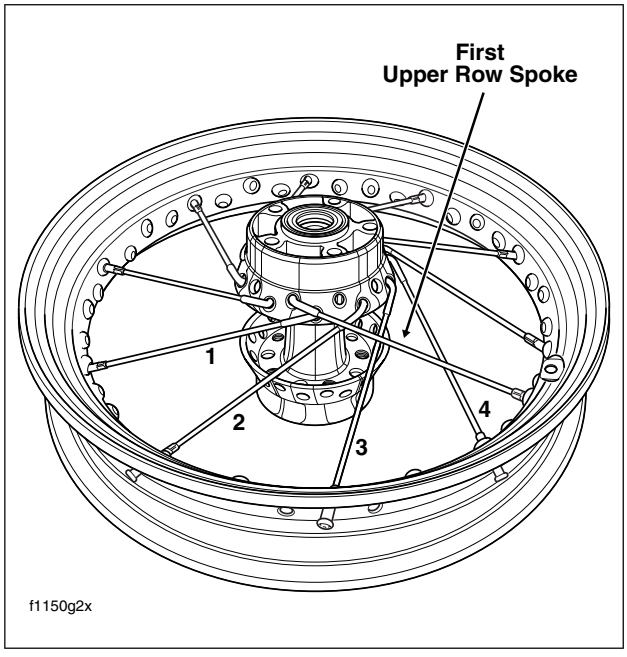


Figure 2-20.

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

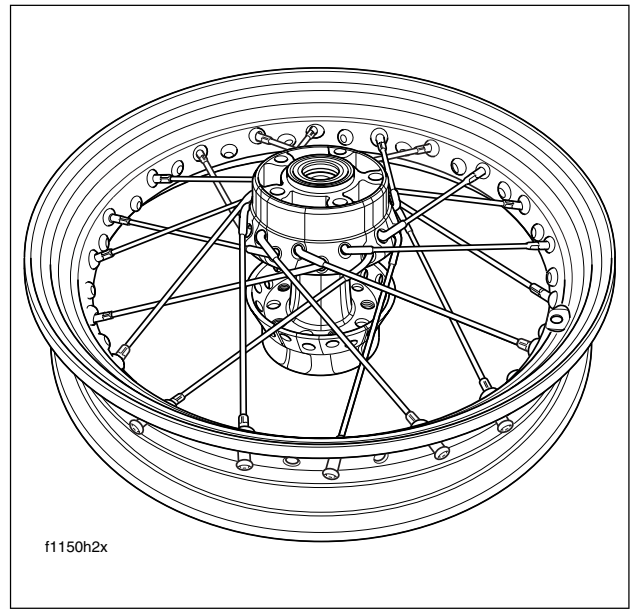


Figure 2-21.

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.

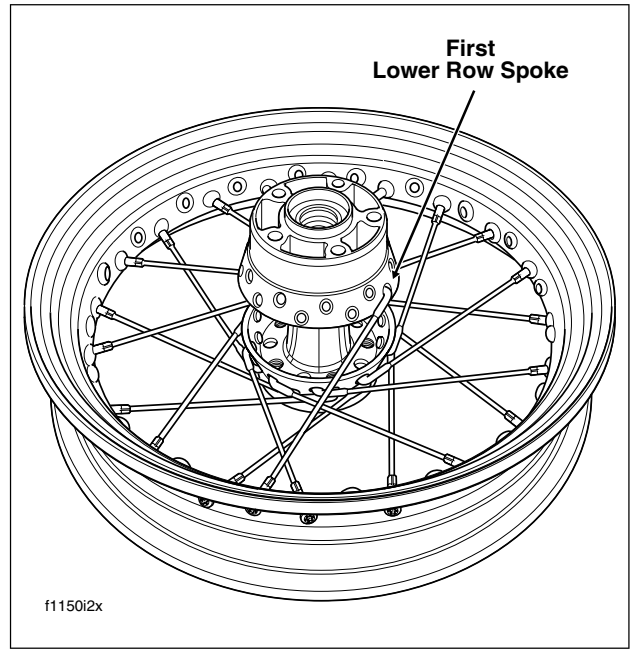


Figure 2-22.

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

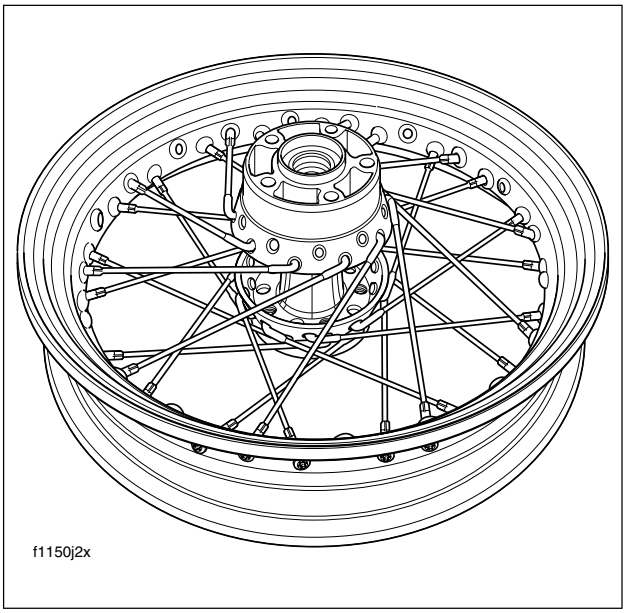


Figure 2-23.

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

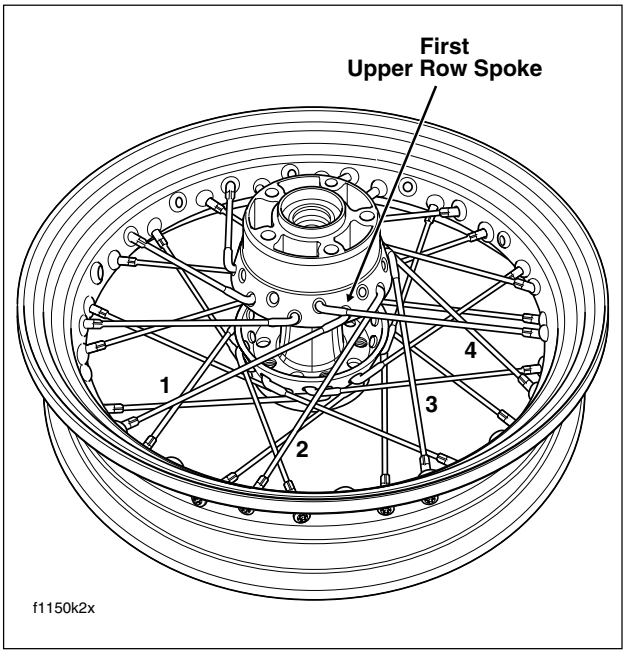


Figure 2-24.

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

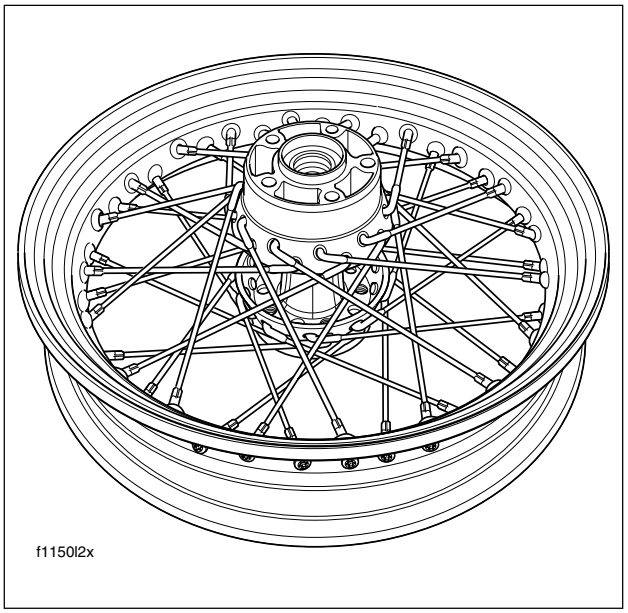


Figure 2-25.

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 (8,000 km) 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

PROCEDURE

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 2-27. Install truing arbor in wheel hub and place wheel in WHEEL TRUING STAND, Part No. HD-99500-80. 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 2-26. 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 right side and tighten the two spokes attached to the hub left side. Turn all four spokes an equal number of turns until offset dimension is correct.

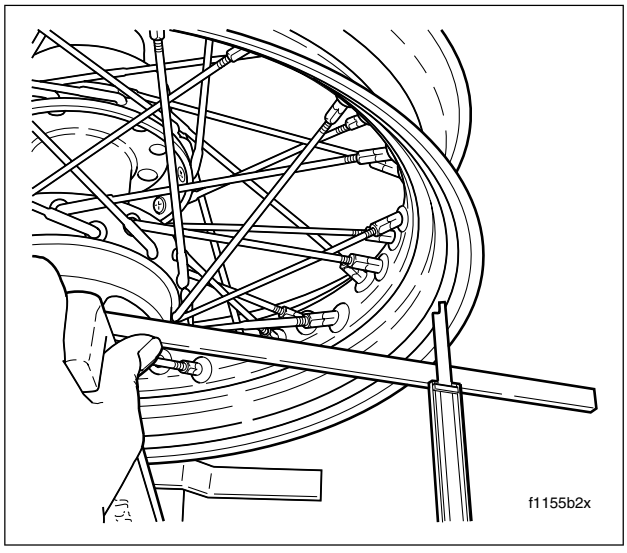


Figure 2-26. Checking Laced Hub Offset Dimension

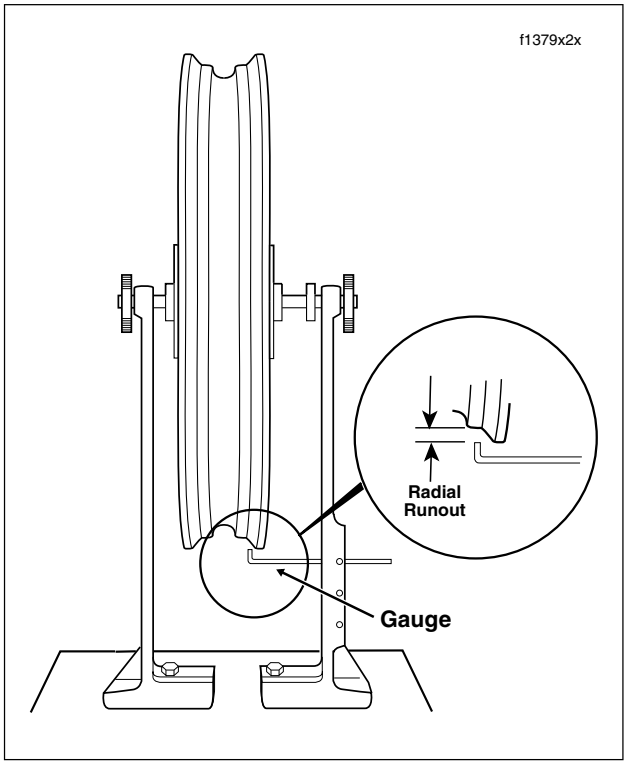


Figure 2-27. Truing Rim Radially

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 2-27. 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 inch (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.

10. Check the rim lateral and radial runout as described under Section 2.4 CHECKING RIM RUNOUT.

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.

TIRES AND TUBES 2.7

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, which indicates that 1/32 inch (0.79 mm) tread pattern depth remains. Worn/unworn tire combinations and worn tires used in wet conditions can ad-versely 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 2-28. Starting Bead Off Rim

2. Loosen both tire beads from rim flange. See Figure 2-28. 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.

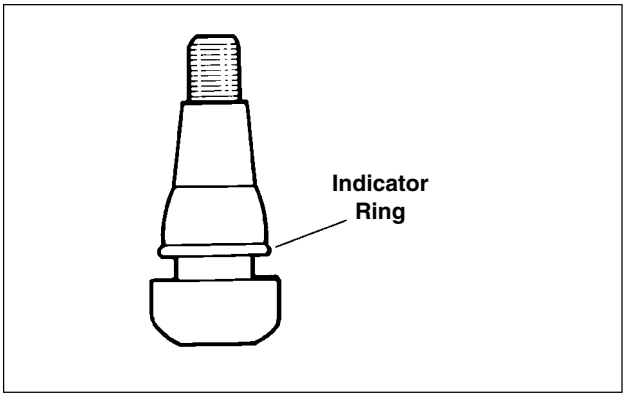


Figure 2-29. Snap-in Tubeless Tire Valves

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 2-29. 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 2-30. Starting Bead on Rim



Figure 2-31. 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 2-30. 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 2-31. 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 TIRE DATA at the beginning of this section. 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 2-32.
2. Tire tread runout should be no more than 0.090 inch (2.28 mm) If tire tread runout exceeds this specification, remove tire from rim and check rim runout to see if rim is at fault. (See Section 2.4 CHECKING 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 inch (0.79 mm), tire is at fault and should be replaced. If rim runout exceeds this specification, correct by replacing cast wheel or truing laced wheel.

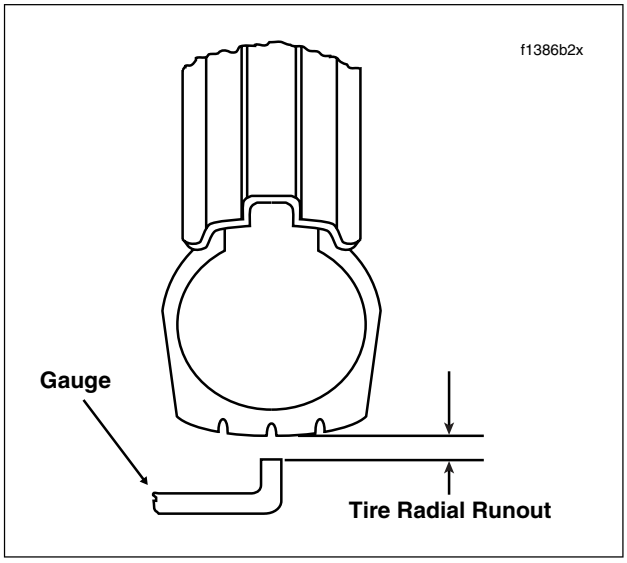


Figure 2-32. Checking Tire Radial Runout

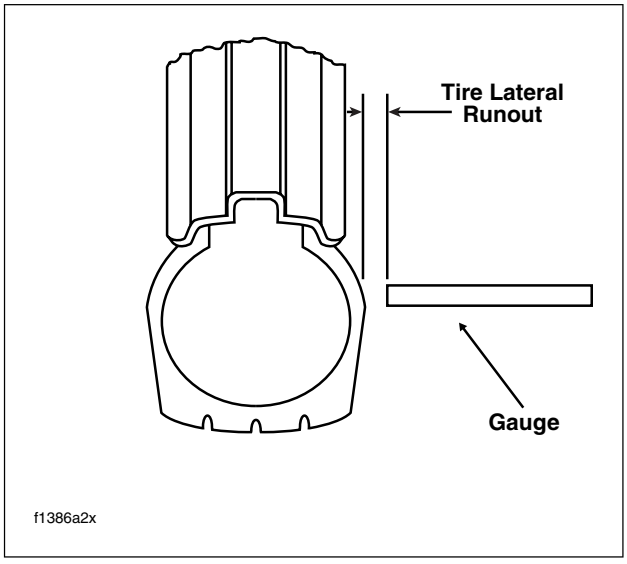


Figure 2-33. Checking Tire Lateral Runout

Checking Tire Lateral Runout

1. Check runout by turning wheel on axle, measuring tread runout. See Figure 2-33.
2. Tire tread runout should be no more than 0.080 inch (2.03 mm). If tire tread runout exceeds this specification, remove tire from rim and check rim bead runout to see if rim is at fault (see Section 2.4 CHECKING 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 inch (0.79 mm), tire is at fault and should be replaced. If rim bead runout exceeds this specification, 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 three 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-99500-80, 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.

VEHICLE ALIGNMENT 2.8

⚠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.

METHOD A

NOTE

Use this procedure to realign the powertrain to the frame whenever major disassembly or engine replacement occurs. For acceptable results, a careful inspection should be performed (wheel and tire runout, laced wheel offset, rubber mount condition, etc.) to ensure that it is conducted with serviceable components. See INSPECTION for more information.

1. Place the motorcycle on a hydraulic center stand or place blocking under the frame to support the vehicle and lift the rear wheel off the ground. Be sure the motorcycle is positioned as level as possible.
2. Remove socket screw with lockwasher to remove left passenger footboard from rear swingarm bracket. Tighten both rear swingarm bracket bolts to 34-42 ft-lbs (46-57 Nm). Repeat step on right side of motorcycle.
3. Remove the decorative chrome plug from both rear swingarm brackets. While holding the left side pivot shaft locknut, tighten the right side locknut to 40-45 ft-lbs (54-61 Nm). Then hold the right side pivot shaft locknut and tighten the left side locknut to 40-45 ft-lbs (54-61 Nm).
4. Verify that belt deflection is within specification and that adjuster cams are tight against rear swingarm weld nubs. **Holding** weld nut on left side of axle, tighten cone nut on right side to 95-105 ft-lbs (128.8-142.4 Nm).
5. Remove seat. See Section 2.22 SEAT, REMOVAL.
6. Partially remove fuel tank to gain access to top engine mounting bracket and stabilizer link. See Section 4.7 FUEL TANK (CARBURETED), PARTIAL REMOVAL, FLHT/C, FLTR, or FLHR. For fuel injected models, see Section 9.4 FUEL TANK (FUEL INJECTED), PARTIAL REMOVAL, FLHT/C/U/I, FLTRI, or FLHR/C/I.
7. Top Engine Mount:
   a. On left side of motorcycle, tighten the two top engine mounting bracket to front and rear cylinder head bolts to 25-30 ft-lbs (34-41 Nm). See A of Figure 2-36.
   b. Moving to right side of motorcycle, tighten the top stabilizer link eyelet to frame weldment bolt to 18-22 ft-lbs (24-30 Nm). See C of Figure 2-36.

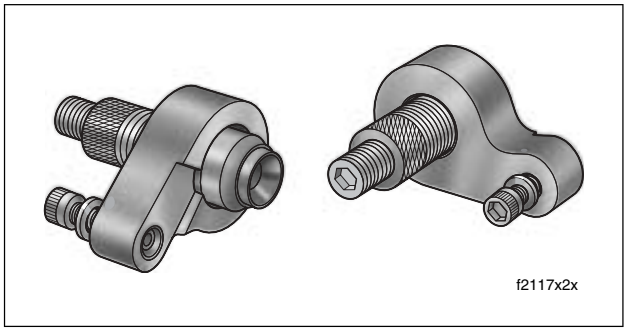


Figure 2-34. Vehicle Alignment Tool (Part No. HD-46247)

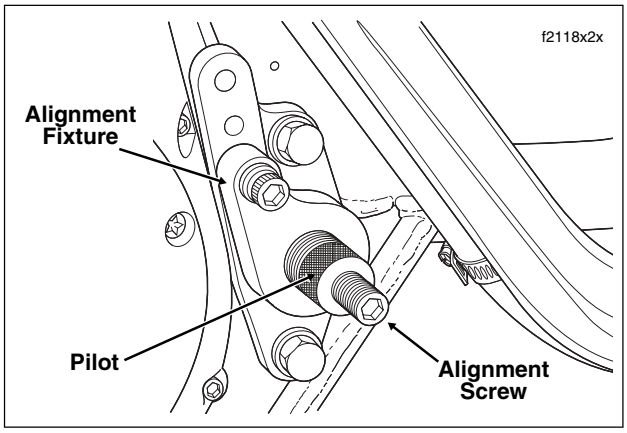
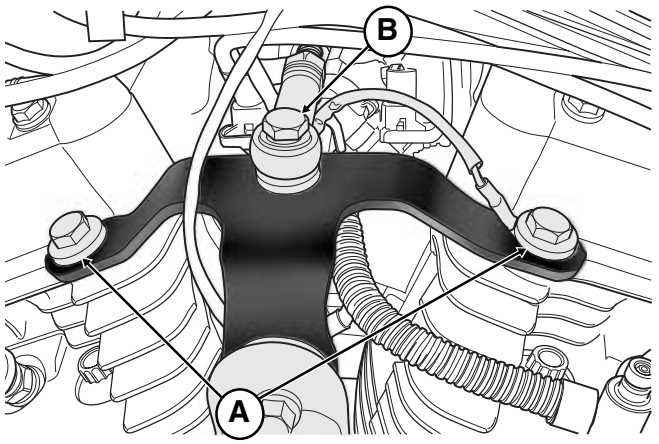


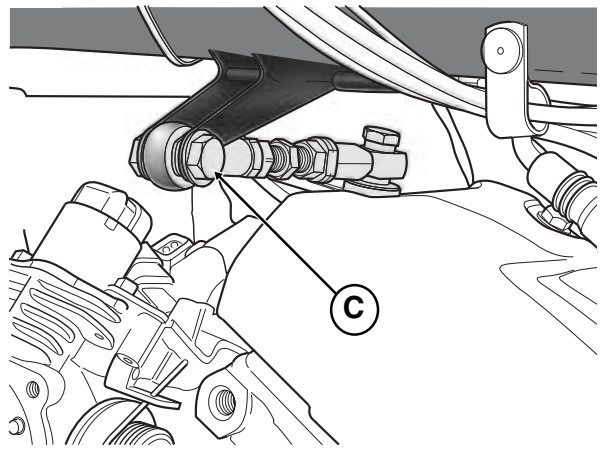
Figure 2-35. Install Vehicle Alignment Tool (Left Side)

   c. Loosen both top stabilizer link jam nuts.
   d. Remove the top stabilizer link eyelet to top engine mounting bracket bolt. See B of Figure 2-36.
8. Front Engine Mount:
   a. Remove flange locknuts from studs on lower frame crossmember. Remove voltage regulator from studs and allow to hang by cables at front of motorcycle.
   b. Tighten two engine to front engine mounting bracket bolts to 33-38 ft-lbs (45-52 Nm). See H of Figure 2-36.
   c. Tighten front stabilizer link eyelet bolt to block on front engine mounting bracket to 18-22 ft-lbs (24-30 Nm). See E of Figure 2-36.
   d. Loosen both front stabilizer link jam nuts.
   e. Remove front stabilizer link eyelet to frame weldment bolt. See D of Figure 2-36.
   f. Remove the center front engine mounting bracket to rubber mount bolt (with washers and nut). See F of Figure 2-36.



LEFT SIDE

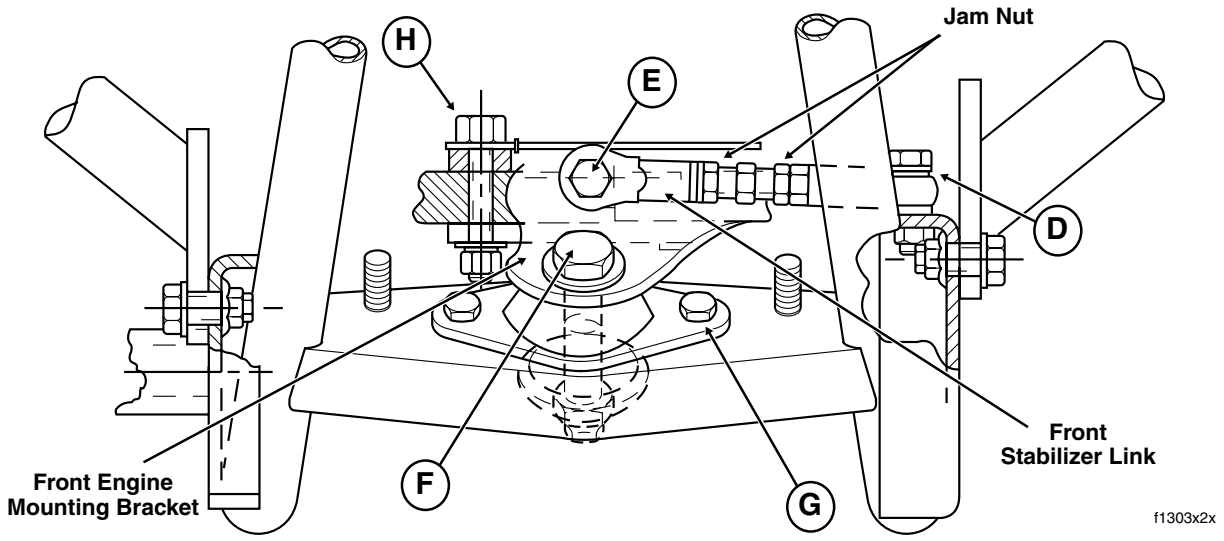
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RIGHT SIDE

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Top Stabilizer Link and Engine Mounting Bracket



Front Stabilizer Link and Engine Mounting Bracket

Top

- **A** Top Engine Mounting Bracket to Cylinder Heads
- **B** Eyelet to Top Engine Mounting Bracket
- **C** Eyelet to Frame Weldment

Bottom

- **D** Eyelet to Frame Weldment
- **E** Eyelet to Front Engine Mounting Bracket
- **F** Front Engine Mounting Bracket to Rubber Mount
- **G** Front Engine Mount to Frame Crossmember
- **H** Engine to Front Engine Mounting Bracket

Figure 2-36. Engine Mounting Bracket Bolts

9. Obtain Vehicle Alignment Tool (HD-46247). See Figure 2-34. Proceed as follows:
   a. Back off alignment screws so that no contact is made with pivot shaft during initial installation.

b. Position alignment fixture so that pilot begins to engage hole in rear swingarm bracket and then start 5/16 allen head screw (with flat washer) into lower hole of passenger footboard mount. Leave fixture loosely installed. Repeat step on other side of motorcycle.

NOTE

Alignment fixtures are stamped L(eft) and R(ight) for easy identification. When installing alignment fixture on right side of motorcycle, first remove hex screw to free brake hose P-clamp from rear swingarm bracket. Relief in right side fixture accommodates hex screw boss.

c. Holding alignment fixture tight against rear swingarm bracket, use knurling to rotate pilot until it bottoms in rear swingarm bracket. Without disturbing setting of pilot, tighten allen head screw to passenger footboard mount to 18-22 ft-lbs (24-30 Nm). Repeat step on other side of motorcycle.

d. Hand turn alignment screw until it bottoms against end of pivot shaft. Repeat step on other side of motorcycle.

e. Tighten alignment screw to 60-80 **in-lbs** (6.8-9.0 Nm). Repeat step on other side of motorcycle. See Figure 2-35.

10. Adjust each stabilizer link as follows:
    a. Using the center hex to maintain equal thread engagement at both eyelets, adjust stabilizer links so that bolts removed under steps 7(d) and 8(e) thread in without any stress or engine movement. See B and D of Figure 2-36.
    b. Alternately tighten bolts to 18-22 ft-lbs (24-30 Nm).
    c. Holding the stabilizer link adjuster and mounting eyelets to prevent movement or binding, tighten jam nuts on top and front stabilizer links.

11. Verify that front rubber mount is centered under the front mounting plate bolt hole and has not been bound by the plate dragging across the isolator.
    a. If the front rubber mount is centered and free of binding, proceed as follows:
    - Tighten the two front engine mount to frame crossmember bolts to 33-38 ft-lbs (45-52 Nm). See G of Figure 2-36.
    - Install center front engine mounting bracket to rubber mount bolt (with washers and nut) and tighten to 35-45 ft-lbs (48-61 Nm). See F of Figure 2-36.

    b. If centering or relaxation of the mount is required, proceed as follows:
    - Loosen the two front engine mount to frame crossmember bolts. See G of Figure 2-36.
    - Push on the rubber mount to center it with the thru bolt hole in the mounting plate. It may be necessary to bounce or wiggle the engine to unload any binding of the rubber mount on the mounting plate.
    - After the mount is centered, tighten the two front engine mount to frame crossmember bolts to 33-38 ft-lbs (45-52 Nm). See G of Figure 2-36.
    - Install center front engine mounting bracket to rubber mount bolt (with washers and nut) and tighten to 35-45 ft-lbs (48-61 Nm). See F of Figure 2-36.

12. Slide voltage regulator over studs on lower frame crossmember at front of vehicle. Install flange locknuts on studs and tighten to 70-100 **in-lbs** (7.9-11.3 Nm).
13. Remove vehicle alignment tool from rear swingarm brackets.
14. Snap the chrome plugs back into the rear swingarm brackets.
15. Install socket screw with lockwasher to fasten passenger footboard to rear swingarm bracket. Tighten screw to 15-18 ft-lbs (20-24 Nm). Repeat step on other side of motorcycle.
16. Install fuel tank. For carbureted models, see Section 4.7 FUEL TANK (CARBURETED), INSTALLATION (AFTER PARTIAL REMOVAL), FLHT/C, FLTR, or FLHR. For fuel injected models, see Section 9.4 FUEL TANK (FUEL INJECTED), INSTALLATION (AFTER PARTIAL REMOVAL), FLHT/C/U/I, FLTRI, or FLHR/C/I.
17. Verify **minimum clearance** between the powertrain and the following frame mounted components:
    a. Top Engine/Horn Mounting Bracket to Fuel Tank: 0.328 inch (8.3 mm).
    b. Rocker Covers to Fuel Tank: 0.375 inch (9.5 mm).
    c. Carburetor Top Cover to Fuel Tank: 0.375 inch (9.5 mm).
    d. Rear Spark Plug Boot to Fuel Valve: 0.250 inch (6.4 mm).
    e. Top Stabilizer Link to Induction Module: 0.375 inch (9.5 mm).
    f. Front Stabilizer Link to Voltage Regulator: 0.375 inch (9.5 mm).
    g. Inner Primary Chaincase to Lower Frame Tube: 0.187 inch (4.8 mm).
    h. Exhaust Crossover Pipe to Primary Housing: 0.125 inch (3.2 mm).
    i. Tire to Rear Fender: 0.280 inch (7.1 mm).
    j. Perform the procedure under Method B to troubleshoot clearance problems and to identify offending component(s).
18. Install seat. See Section 2.22 SEAT, INSTALLATION.
19. Test ride the motorcycle.

NOTE

Vehicle leads that require more than 2-lbs pull to correct need further diagnosis. Perform the procedure under Method B in this section.

METHOD B

NOTE

Use this procedure to determine the cause of vehicle misalignment and to locate clearance problems, or as an alternative to use of the Vehicle Alignment Tool (HD-46247) described under Method A. For acceptable results, a careful inspection should be performed (wheel and tire runout, laced wheel offset, rubber mount condition, etc.) to ensure that it is conducted with serviceable components. See INSPECTION for more information.

1. Place the motorcycle on a hydraulic center stand or place blocking under the frame to support the vehicle and lift the rear wheel off the ground. Be sure the motorcycle is positioned as level as possible.
2. Remove socket screw with lockwasher to remove left passenger footboard from rear swingarm bracket. Tighten both rear swingarm bracket bolts to 34-42 ft-lbs (46-57 Nm). Repeat step on right side of motorcycle.
3. Remove the decorative chrome plug from both rear swingarm brackets. While holding the left side pivot shaft locknut, tighten the right side locknut to 40-45 ft-lbs (54-61 Nm). Then hold the right side pivot shaft locknut and tighten the left side locknut to 40-45 ft-lbs (54-61 Nm).
4. Verify that belt deflection is within specification and that adjuster cams are tight against rear swingarm weld nubs. **Holding** weld nut on left side of axle, tighten cone nut on right side to 95-105 ft-lbs (128.8-142.4 Nm).
5. Remove seat. See Section 2.22 SEAT, REMOVAL.
6. Partially remove fuel tank to gain access to top engine mounting bracket and stabilizer link. See Section 4.7 FUEL TANK (CARBURETED), PARTIAL REMOVAL, FLHT/C, FLTR, or FLHR. For fuel injected models, see Section 9.4 FUEL TANK (FUEL INJECTED), PARTIAL REMOVAL, FLHT/C/U/I, FLTRI, or FLHR/C/I.
7. Top Engine Mount:
   a. On left side of motorcycle, tighten the two top engine mounting bracket to front and rear cylinder head bolts to 25-30 ft-lbs (34-41 Nm). See A of Figure 2-36.
   b. Moving to right side of motorcycle, tighten the top stabilizer link eyelet to frame weldment bolt to 18-22 ft-lbs (24-30 Nm). See C of Figure 2-36.
   c. Loosen both top stabilizer link jam nuts.
   d. Remove the top stabilizer link eyelet to top engine mounting bracket bolt. See B of Figure 2-36.
8. Front Engine Mount:
   a. Remove flange locknuts from studs on lower frame crossmember. Remove voltage regulator from studs and allow to hang by cables at front of motorcycle.
   b. Tighten two engine to front engine mounting bracket bolts to 33-38 ft-lbs (45-52 Nm). See H of Figure 2-36.
   c. Tighten front stabilizer link eyelet to frame weldment bolt to 18-22 ft-lbs (24-30 Nm). See D of Figure 2-36.
   d. Tighten front stabilizer link eyelet bolt to block on front engine mounting bracket to 18-22 ft-lbs (24-30 Nm). See E of Figure 2-36.
   e. Remove the center front engine mounting bracket to rubber mount bolt (with washers and nut). See F of Figure 2-36.
9. To verify alignment, install alignment bars or other suitable device on both the left and right side of motorcycle. Proceed as follows:

NOTE

If the front tire is wider than the rear, then the alignment bars must either be shimmed out equally at the points of contact on the rear tire, notched at the front to clear the front tire, or attached to the front tire with all measurements performed at the rear. For explanatory purposes, the following procedure assumes the alignment bars are secured to the rear tire.

   a. Place a set of straightedges on both the left and right sides of the motorcycle alongside the front and rear tires.
   b. Verify that both alignment bars firmly contact the rear wheel at two points. Use clamp or bungee cords to hold the bars in place. Tension should be equal to avoid spreading or pinching the bars.
   c. Verify that the bars are straight by matching the width measurements at both ends.
   d. Straighten the front end and verify that the measurements from the front wheel to the bar on one side of the motorcycle are equal at two points, both fore and aft.
   e. Measure the front wheel to the bar on the other side of the motorcycle, both fore and aft, and compare the results to the measurements obtained under step 9(d). Measurements from left to right should be equal +/- 0.030 inch (0.76 mm).
   f. Loosen jam nuts, and using the center hex, adjust the front stabilizer link as required to obtain equal measurements at all four points (+/- 0.030 inch or 0.76 mm). See Figure 2-37.

NOTE

After each adjustment, unload any binding of the front rubber mount and verify that the alignment bars and front wheel are still correctly positioned.

   g. Holding the front stabilizer link adjuster and mounting eyelets to prevent movement or binding, tighten both jam nuts.
   h. Verify that the front rubber mount is centered under the thru bolt hole in the mounting plate.

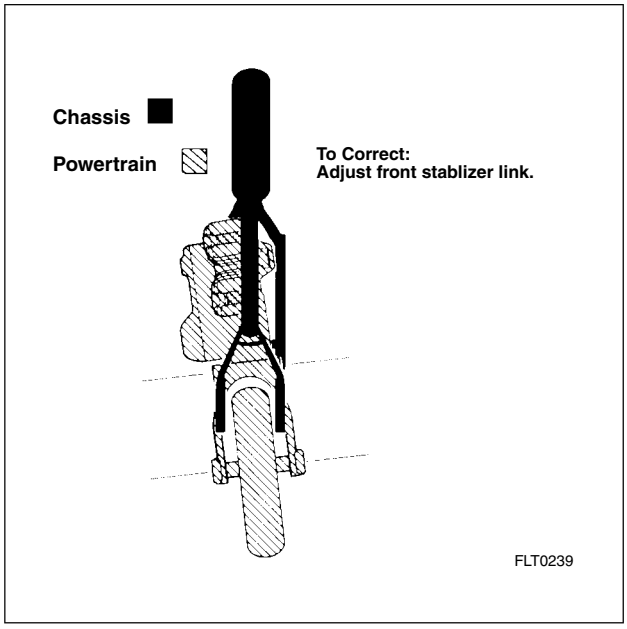


Figure 2-37. Horizontally Misaligned

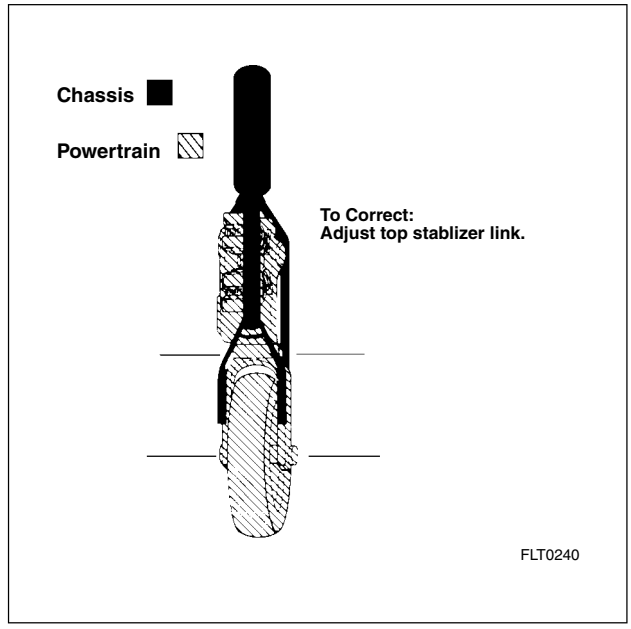


Figure 2-38. Vertically Misaligned

i. If the front rubber mount is centered and free of binding, proceed as follows:

- Tighten the two front engine mount to frame crossmember bolts to 33-38 ft-lbs (45-52 Nm). See G of Figure 2-36.
- Install center front engine mounting bracket to rubber mount bolt (with washers and nut) and tighten to 35-45 ft-lbs (48-61 Nm). See F of Figure 2-36.

j. If centering or relaxation of the mount is required, proceed as follows:

- Loosen the two front engine mount to frame crossmember bolts. See G of Figure 2-36.
- Push on the rubber mount to center it with the thru bolt hole in the mounting plate. It may be necessary to bounce or wiggle the engine to unload any binding of the rubber mount on the mounting plate.
- After the mount is centered, tighten the two front engine mount to frame crossmember bolts to 33-38 ft-lbs (45-52 Nm). See G of Figure 2-36.
- Install center front engine mounting bracket to rubber mount bolt (with washers and nut) and tighten to 35-45 ft-lbs (48-61 Nm). See F of Figure 2-36.

10. Slide voltage regulator over studs on lower frame crossmember at front of vehicle. Install flange locknuts on studs and tighten to 70-100 **in-lbs** (7.9-11.3 Nm).
11. Adjust the top stabilizer link as follows:

a. Using the center hex to maintain equal thread engagement at both eyelets, adjust stabilizer link so that bolt removed under step 7(d) threads in without any stress or engine movement.

b. Tighten the stabilizer link eyelet to top engine mounting bracket bolt to 18-22 ft-lbs (24-30 Nm). See B of Figure 2-36.

c. Holding the top stabilizer link adjuster and mounting eyelets to prevent movement or binding, tighten both jam nuts.

12. Lower motorcycle to floor and remove hydraulic center stand or blocking.
13. After verifying that the motorcycle is level, check vertical alignment placing an inclinometer on both front and rear brake rotors. Front and rear lean angles should be equal +/- 1/2 degree. See Figure 2-38. If vertical alignment exceeds specification, proceed as follows:

a. Loosen the top stabilizer link eyelet to top engine mounting bracket bolt. See B of Figure 2-36. Verify that bolt is unloaded and threads freely in and out of the mounting bracket hole. If necessary, loosen jam nuts and adjust stabilizer link to a achieve a free state. Tighten bolt to 18-22 ft-lbs (24-30 Nm) and then tighten jam nuts before rechecking vertical alignment.

b. Look for components that are worn, damaged or out of specification. See INSPECTION on the next page.

14. Remove the alignment bars from both the left and right side of the motorcycle.
15. Snap the chrome plugs back into the rear swingarm brackets.
16. Install socket screw with lockwasher to fasten passenger footboard to rear swingarm bracket. Tighten screw to 15-18 ft-lbs (20-24 Nm). Repeat step on other side of motorcycle.
17. Install fuel tank. For carbureted models, see Section 4.7 FUEL TANK (CARBURETED), INSTALLATION (AFTER PARTIAL REMOVAL), FLHT/C, FLTR, or FLHR. For fuel injected models, see Section 9.4 FUEL TANK (FUEL INJECTED), INSTALLATION (AFTER PARTIAL REMOVAL), FLHT/C/U/I, FLTRI, or FLHR/C/I.
18. Verify **minimum clearance** between the powertrain and the following frame mounted components:
    a. Top Engine/Horn Mounting Bracket to Fuel Tank: 0.328 inch (8.3 mm).
    b. Rocker Covers to Fuel Tank: 0.375 inch (9.5 mm).
    c. Carburetor Top Cover to Fuel Tank: 0.375 inch (9.5 mm).
    d. Rear Spark Plug Boot to Fuel Valve: 0.250 inch (6.4 mm).
    e. Top Stabilizer Link to Induction Module: 0.375 inch (9.5 mm).
    f. Front Stabilizer Link to Voltage Regulator: 0.375 inch (9.5 mm).
    g. Inner Primary Chaincase to Lower Frame Tube: 0.187 inch (4.8 mm).
    h. Exhaust Crossover Pipe to Primary Housing: 0.125 inch (3.2 mm).
    i. Tire to Rear Fender: 0.280 inch (7.1 mm).
19. Install seat. See Section 2.22 SEAT, INSTALLATION.
20. Test ride the motorcycle.

NOTE

Vehicle leads that require more than 2-lbs pull to correct need further diagnosis. See INSPECTION on this page.

INSPECTION

Perform inspection every 10000 miles (16000 km) or when sag in the powertrain or abnormal handling characteristics/ vibrations are experienced.

Front Rubber Mount

1. Verify condition and torque of the mounting hardware. Visually inspect for wear, damage or improper installation. Replace hardware as necessary.
2. Examine carefully at the bottom of the motorcycle paying special attention to the area between the large flat metal washer and the bracket on the frame. There should be a gap between the mounting plate and the cushion portion of the rubber mount.
3. Replace the rubber mount if there are any signs of cracking or shearing.

Rear Swingarm Mounts

1. Verify condition and torque of the mounting hardware. Visually inspect for wear, damage or improper installation. Replace hardware as necessary.
2. Examine rubber mount to be sure there is no twisting or binding at the parting line.

Engine Stabilizer Links

1. Verify condition and torque of the mounting hardware. Visually inspect for wear, damage or improper installation. Replace hardware as necessary.
2. Using flats machined into the stabilizer eyelet, gently rock the link and check for separation of the molded-in sleeve. Replace as necessary.

   Wear in the link also can be measured with a dial indicator by hand compressing and then releasing the link. Replace any link that exceeds 0.025 inch (0.64 mm) of play or wear.

FRONT BRAKE MASTER CYLINDER 2.9

GENERAL

Master cylinders designed for dual disc (two caliper) operation have an 11/16 inch bore, while those that are designed for single disc (one caliper) operation have a 9/16 inch bore. The bore size is stamped on the master cylinder assembly inboard of the handlebar clamp bracket. See Figure 2-39.

⚠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. Remove banjo bolt and two steel/rubber washers to disconnect fitting of hydraulic brake line from master cylinder housing. Hold paper cup or other suitable container under banjo bolt bore to allow reservoir to drain. Discard steel/rubber washers.

CAUTION

Do not remove the master cylinder assembly without first placing the 5/32 inch (4.0 mm) 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.

2. Place the cardboard insert between the brake lever and lever bracket. See Figure 2-40.

3. 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 2-41.

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

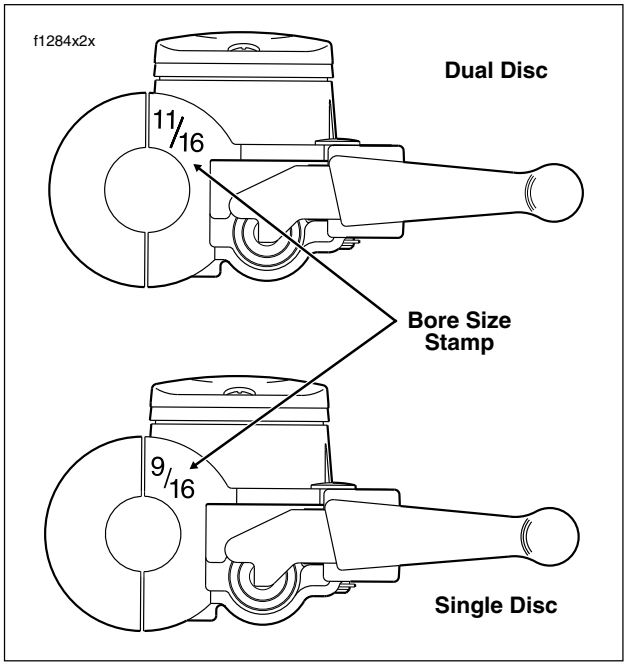


Figure 2-39. Verify Correct Bore Size Before Use

⚠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. Remove retaining ring from pivot pin groove at bottom of master cylinder bracket. Discard retaining ring.

6. Remove pivot pin and brake hand lever from master cylinder assembly.

7. Carefully remove wiper with pick or similar tool.

8. Remove piston cap.

9. Remove piston with O-ring and primary cup.

10. Remove spring.

CAUTION

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

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



Figure 2-40. Install Cardboard Insert Before Removing Master Cylinder Assembly

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.
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

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 2-41.
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.

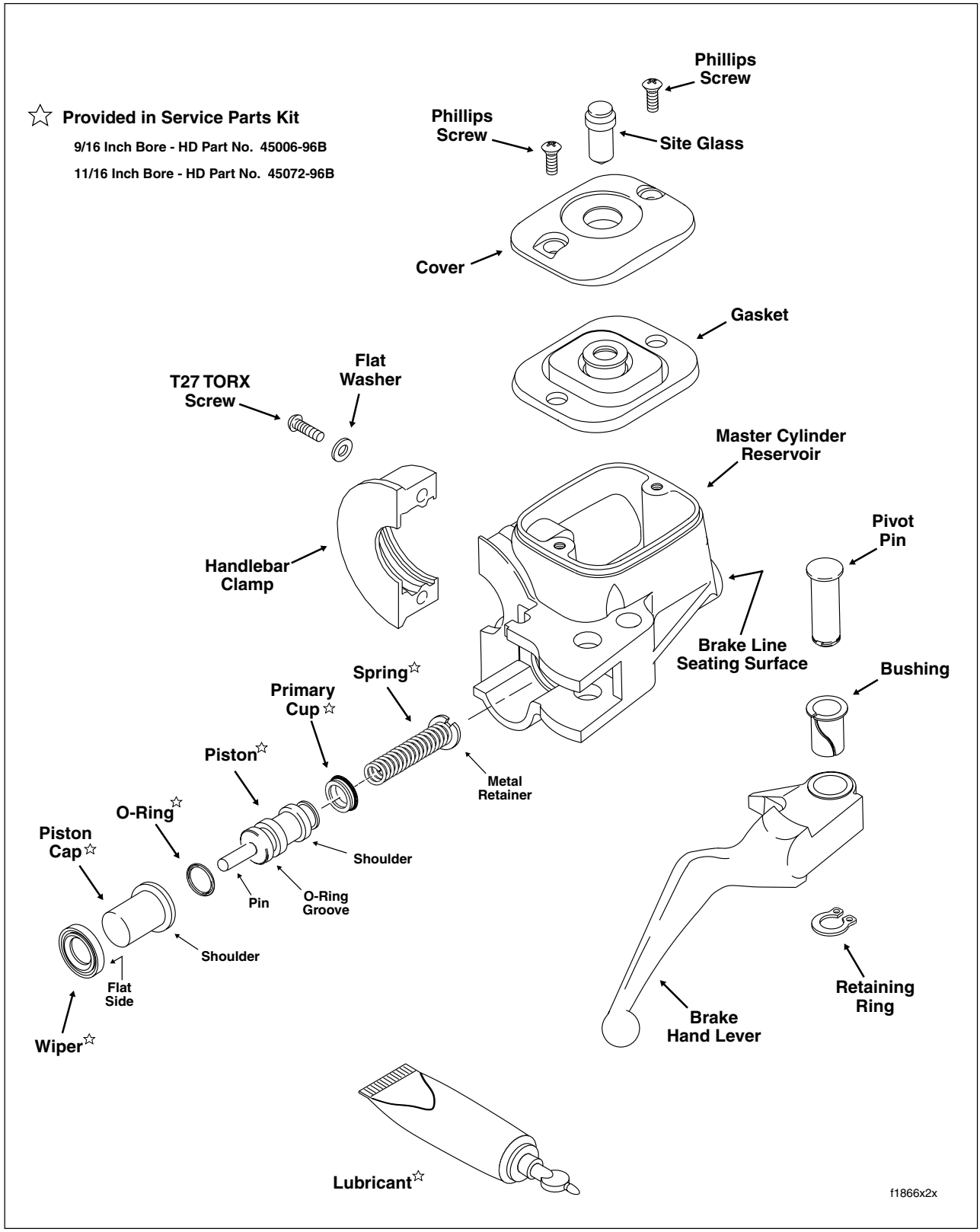


Figure 2-41. Front Brake Master Cylinder Assembly

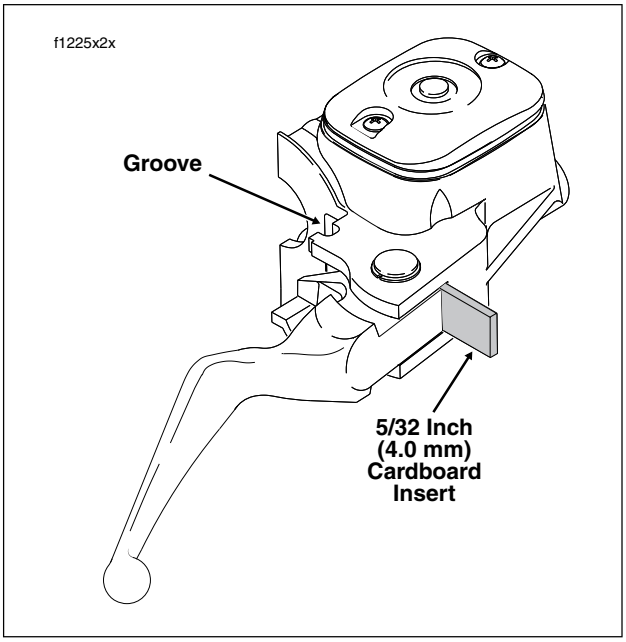


Figure 2-42. Install Cardboard Insert Before Installing Master Cylinder Assembly

⚠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 2-42. Do not install the master cylinder assembly without first placing the 5/32 inch (4.0 mm) 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 2-43.
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 60-80 **in-lbs** (6.8-9.0 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 banjo bolt through washers and fitting. Thread bolt into master cylinder housing and tighten to 17-22 ft-lbs (23-30 Nm).
16. Remove the master cylinder reservoir 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.

17. 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.

18. 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.
19. Remove cap from bleeder valve 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.

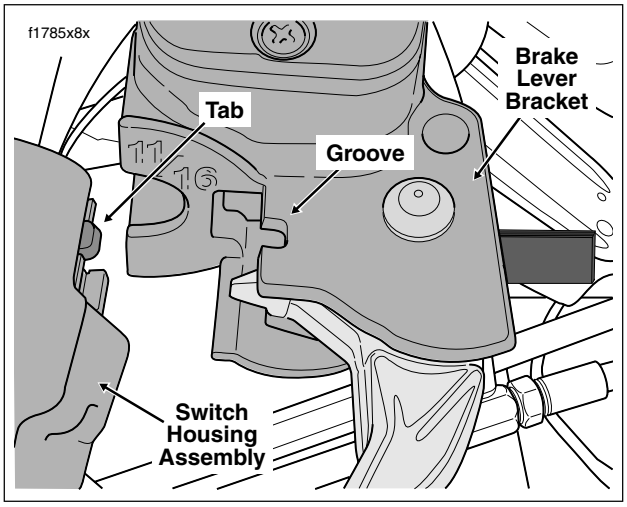


Figure 2-43. Fit Brake Lever/Master Cylinder to Right Handlebar Switch Housings

20. Depress and hold the brake hand lever to build up hydraulic pressure.

21. 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.

22. Add brake fluid to the master cylinder reservoir until the fluid level is about 1/8 inch (3.2 mm) from the top.

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 valve cap.

25. 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).

26. 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.

27. 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

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. 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.
6. Remove right side saddlebag. See Section 2.23 SADDLEBAG, REMOVAL.
7. Gently pull side cover from frame downtube (no tools required).
8. Remove bleeder valve 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.

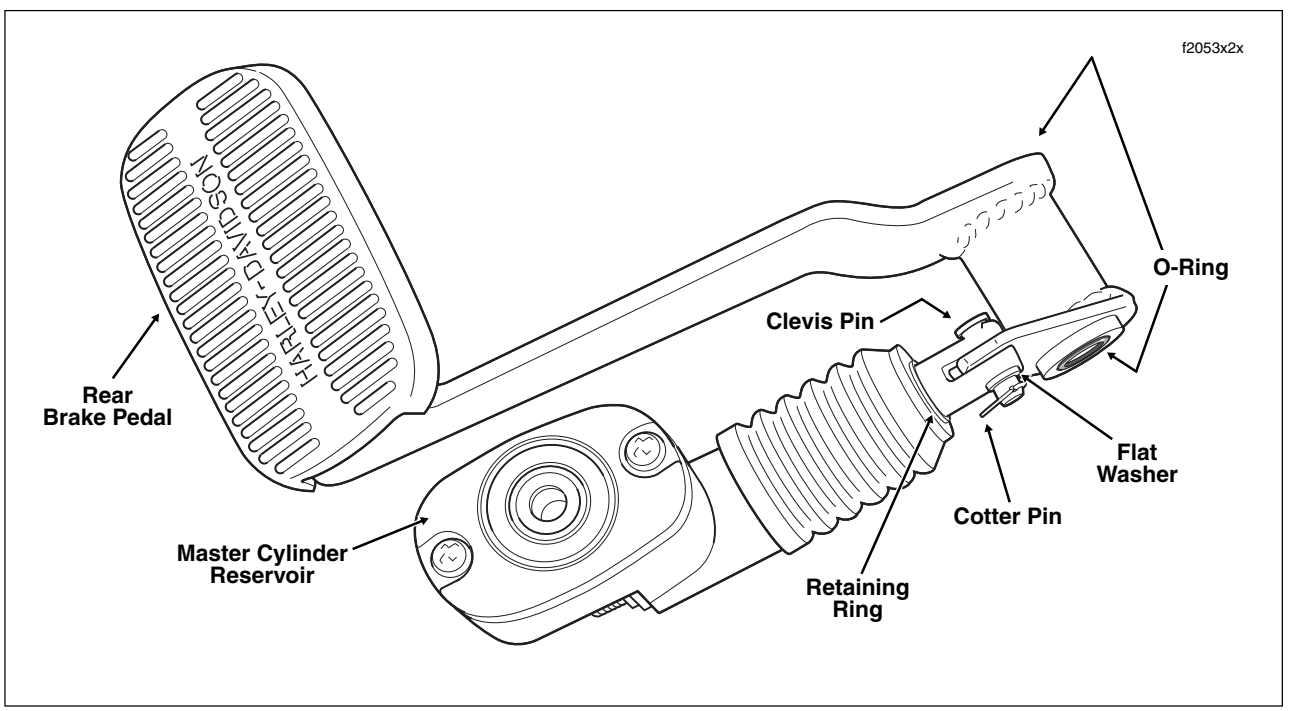


Figure 2-44. Rear Brake Pedal/Master Cylinder Assembly

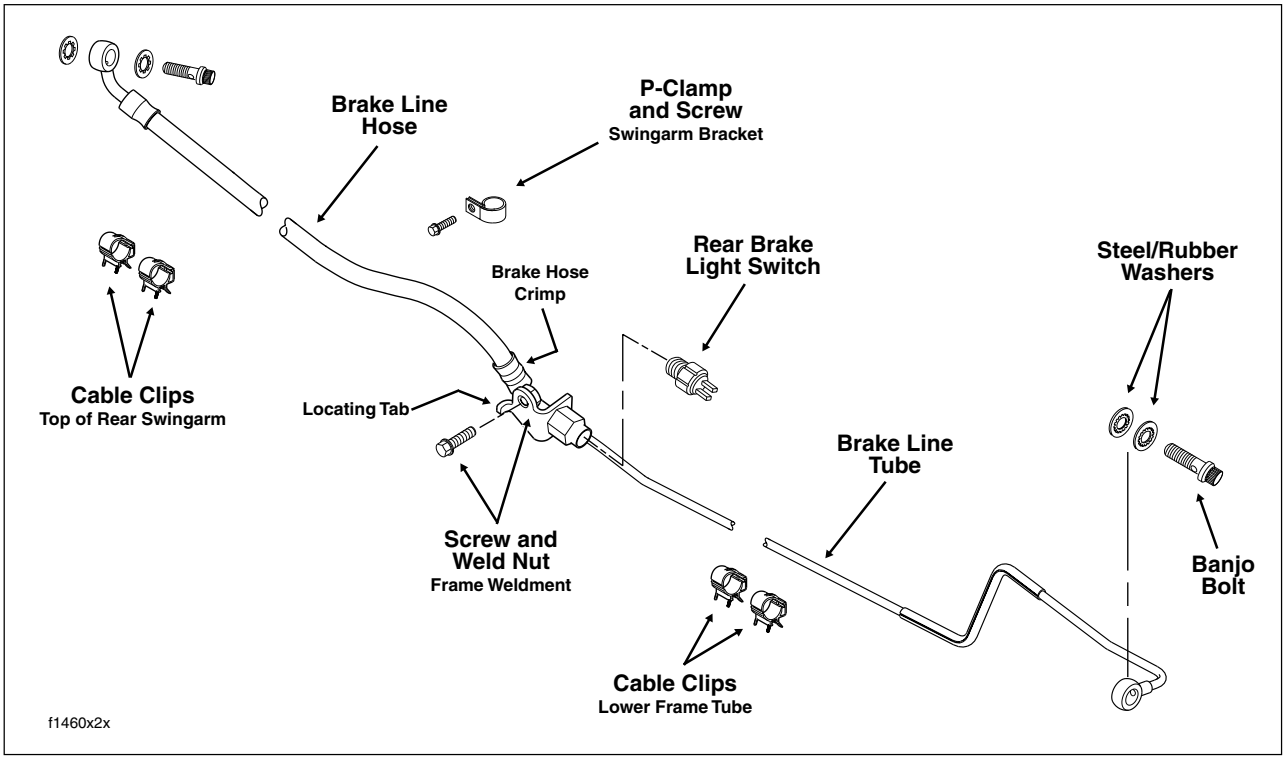


Figure 2-45. Rear Brake Line Assembly

5. Remove locknut with flat washer to free brake pedal/master cylinder assembly from pedal shaft. Remove assembly from vehicle. Remove and discard O-ring on each side of brake pedal shaft bore. See Figure 2-44.
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 assembly in vise, tap in clevis pin using a brass drift. Install flat washer and cotter pin on clevis pin. See Figure 2-44.
3. Install **new** O-ring on each side of brake pedal shaft bore.
4. Apply a light coat of *Wheel Bearing Grease (Part No. 99855-89)* to the brake pedal shaft and bore. Install brake pedal/master cylinder assembly on the pedal shaft fitting collar on cartridge body into square-shaped hole in mounting bracket. Install flat washer and **new** locknut on pedal shaft and tighten to 15-20 ft-lbs (20-27 Nm).
5. Apply Loctite Medium Strength Threadlocker 243 (blue) to threads of hex nut. Install hex nut on threaded end of cartridge body and tighten to 30-40 ft-lbs (41-54 Nm).
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, 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 2-45.

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 swingarm 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 swingarm 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 swingarm 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 swingarm bracket, feed brake line hose rearward following top of rear swingarm.
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 swingarm 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 swingarm 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 2-46.
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

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 (6.35 mm) from frame downtube. Verify that fairing lower is square, and then alternately tighten locknuts to 35-40 **in-lbs** (4.0-4.5 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 30-35 **in-lbs** (3.4-4.0 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. 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. Install length of clear plastic tubing over caliper bleeder valve, if removed. Place free end of tube in a suitable container.
9. 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.

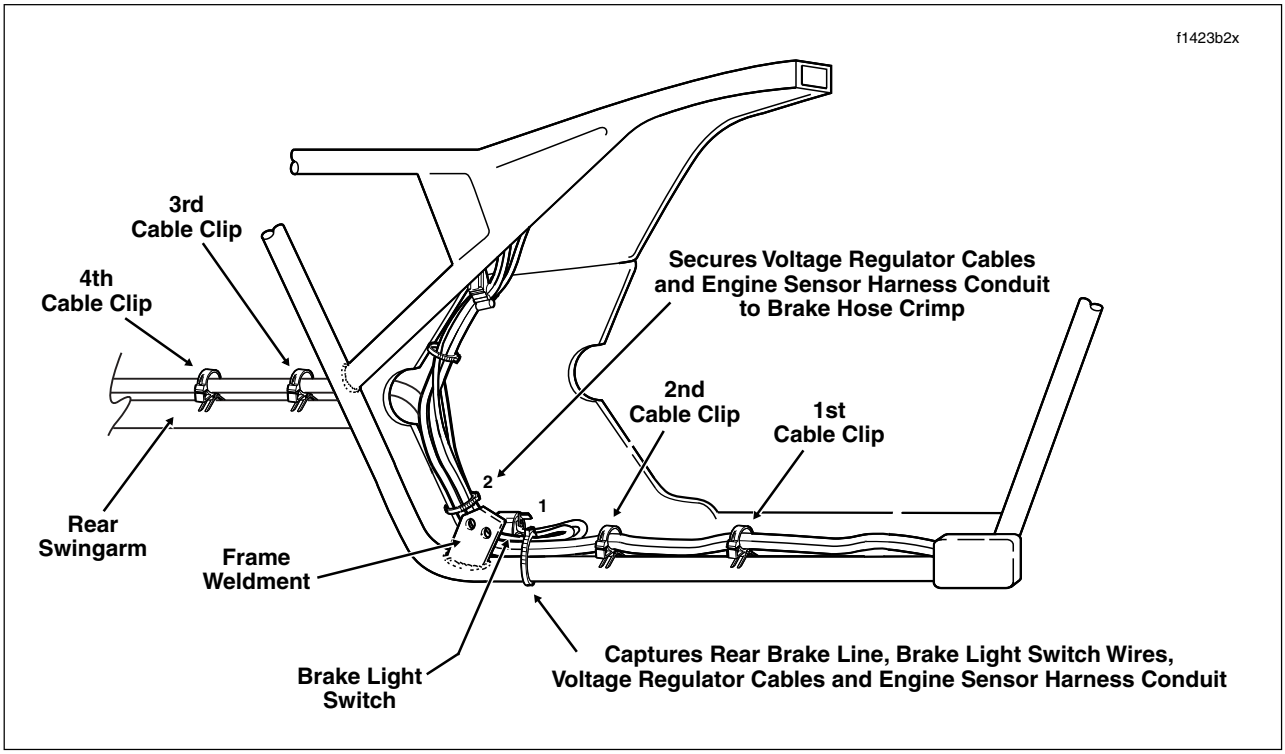


Figure 2-46. Rear Brake Line Routing (Right Side View)

10. 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

Verify proper operation of the master cylinder relief port. 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.

11. 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.
12. Add brake fluid to the master cylinder reservoir until the fluid level is 1/8 inch (3.2 mm) from the top.
13. Depress and hold the rear brake pedal to build up hydraulic pressure.
14. 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.
15. Repeat steps 12-14 until all air bubbles are purged.
16. Final tighten the bleeder valve to 80-100 **in-lbs** (9.0-11.3 Nm). Install the bleeder cap.
17. Add brake fluid to the master cylinder reservoir until the fluid level is about 1/8 inch (3.2 mm) from the top.
18. 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).
19. 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.

20. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required).
21. Install right side saddlebag. See Section 2.23 SADDLEBAG, INSTALLATION.
22. Test ride the motorcycle. If the brake feels spongy, repeat the bleeding procedure.

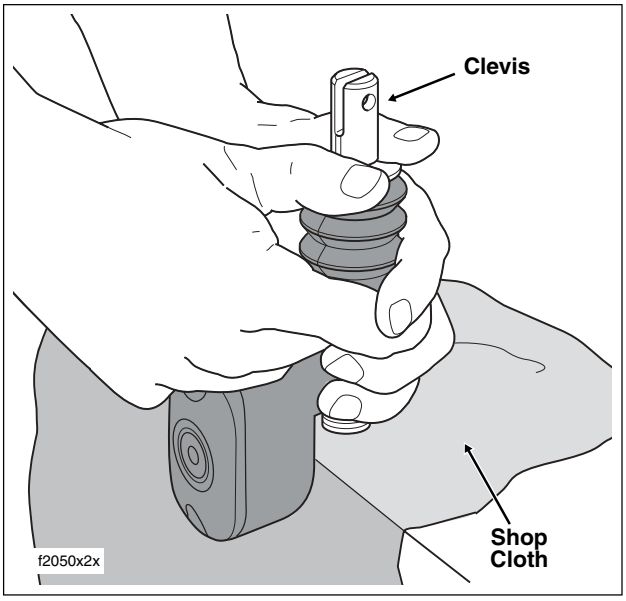


Figure 2-47. Compress Spring and Remove Retaining Ring

NOTE

A sight glass enables the rider to visually check the brake fluid level without removing the master cylinder cover. The sight glass is dark when the reservoir is full, but as the fluid level drops, the glass lightens to alert the rider of this condition.

MASTER CYLINDER

DISASSEMBLY

NOTE

If installing the Master Cylinder Reservoir Kit (Part No. 42454-99), see steps 1-7 below. If installing the Push Rod Kit (Part No. 41957-97A) or the assembled cartridge body from the Master Cylinder Repair Kit (Part No. 42382-87C), see steps 1-9.

1. See BRAKE PEDAL/MASTER CYLINDER ASSEMBLY, REMOVAL, in this section.
2. Thoroughly clean exterior of master cylinder assembly with denatured alcohol.
3. 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.

⚠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. Push down on large flat washer to compress spring. While holding the spring in a compressed state, remove retaining ring from groove in clevis and then carefully release spring. See Figure 2-47. Discard retaining ring.

NOTE

The push rod, clevis and spacer washer are a one-piece assembly.

5. Remove the large flat washer, dust boot and spring from the cartridge body. Remove spring and spring retainer from dust boot.
6. Push on threaded end of cartridge body to remove from reservoir adapter. Use hand pressure only. Exercise caution to keep cartridge body free of dirt and grease. See Figure 2-48.
7. Carefully remove two O-rings from cartridge body. Exercise caution to avoid scratching O-ring grooves.
8. Remove small retaining ring from groove in cartridge body bore. Piston assembly is spring loaded so be sure to hold parts together as retaining ring is removed.
9. Remove push rod with captured spacer washer from cartridge body. Remove small retaining ring from push rod, if attached. Discard retaining ring.

NOTE

Do not disassemble the cartridge body. The cartridge body components are not sold separately. If piston seal leakage is evident, replace the entire cartridge body assembly.

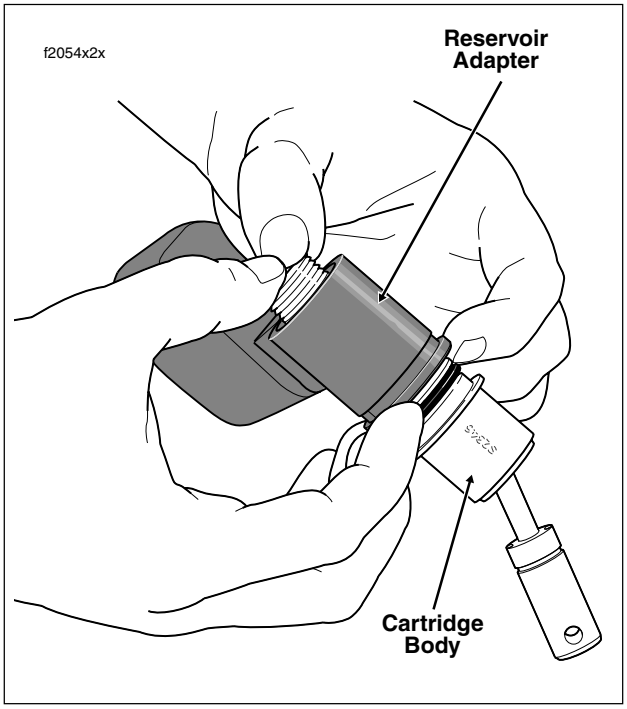


Figure 2-48. Remove Cartridge From Reservoir Adapter

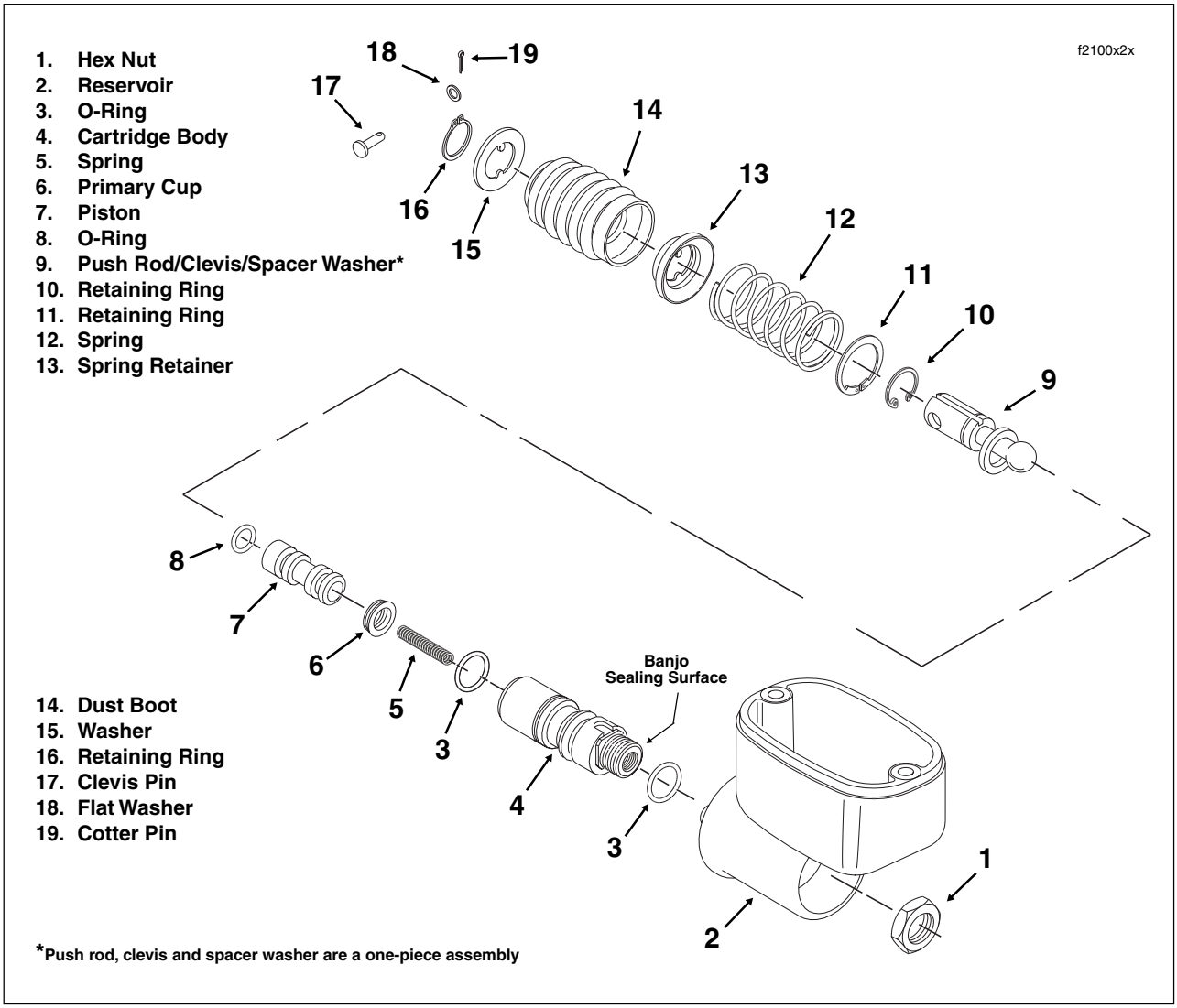


Figure 2-49. Rear Brake Master Cylinder Assembly (Exploded View)

CLEANING AND INSPECTION

⚠WARNING

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. Replace if threads are damaged.
5. Inspect the spring for distortion, cracks or broken coils. Replace as necessary.
6. Inspect O-ring grooves on the cartridge body for dirt. Carefully clean 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

NOTE

If installing assembled cartridge body from Master Cylinder Repair Kit (Part No. 42382-87C), begin at step 2 below. If installing the Push Rod Kit (Part No. 41957-97A), begin at step 3. If installing the Master Cylinder Reservoir Kit (Part No. 42454-99), start at step 7.

1. To install piston in cartridge body, proceed as follows:

   a. Install small spring into cartridge body making sure that spring is seated in counterbore.

   b. Lightly lubricate primary cup and O-ring on piston with D.O.T. 5 SILICONE HYDRAULIC BRAKE FLUID.

   c. Install piston over spring.

2. Install **new** large retaining ring in groove on push rod side of cartridge body.

3. Position **new** retaining ring on push rod between spacer washer and clevis, or on clevis inboard of the retaining ring groove.

NOTE

The push rod, clevis and spacer washer are a one-piece assembly.

4. Stand cartridge body upright on banjo sealing surface. Lay down a clean shop cloth to protect the sealing surface from damage. See Figure 2-50.

⚠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. Insert ball end of push rod into piston cup. Pushing down on push rod to compress spring, fit captured spacer washer into cartridge body. Further compressing spring as necessary, install retaining ring positioned in step 4 in groove of cartridge body bore.

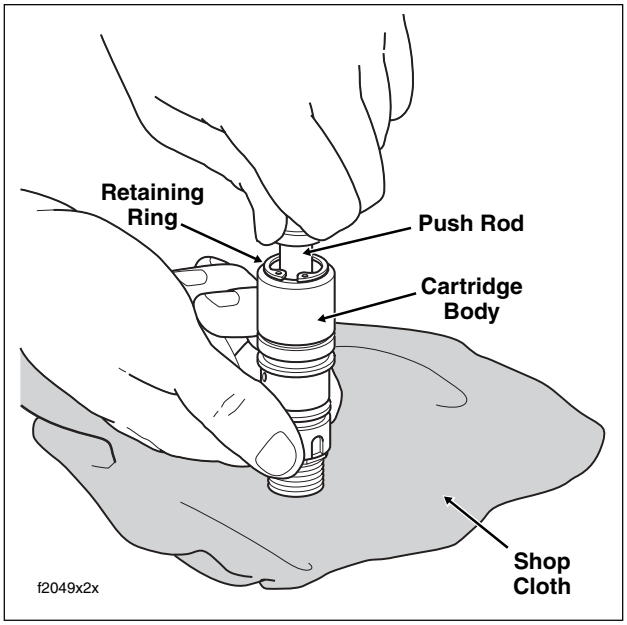


Figure 2-50. Compress Spring and Install Retaining Ring

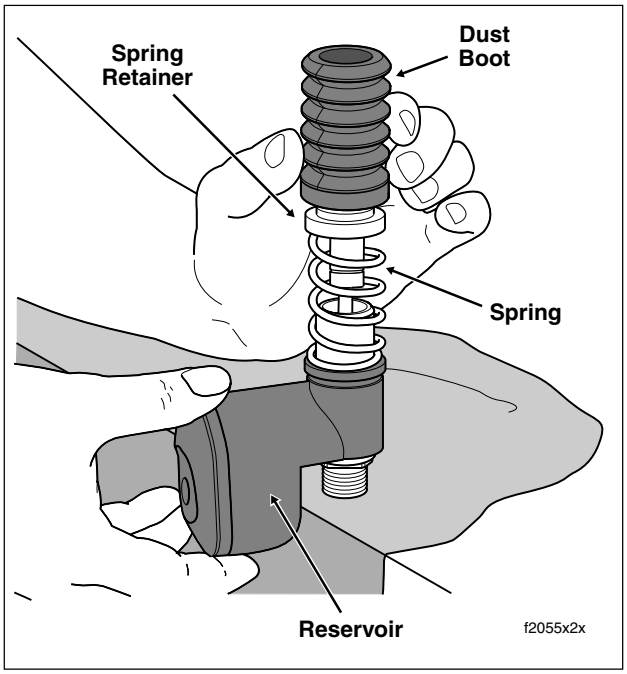


Figure 2-51. Install Spring, Spring Retainer and Dust Boot

6. Verify that retaining ring is completely seated in groove and that push rod rotates freely.

7. Lubricate **new** O-rings with D.O.T. 5 SILICONE HYDRAULIC BRAKE FLUID and carefully install in grooves on outside of cartridge body.

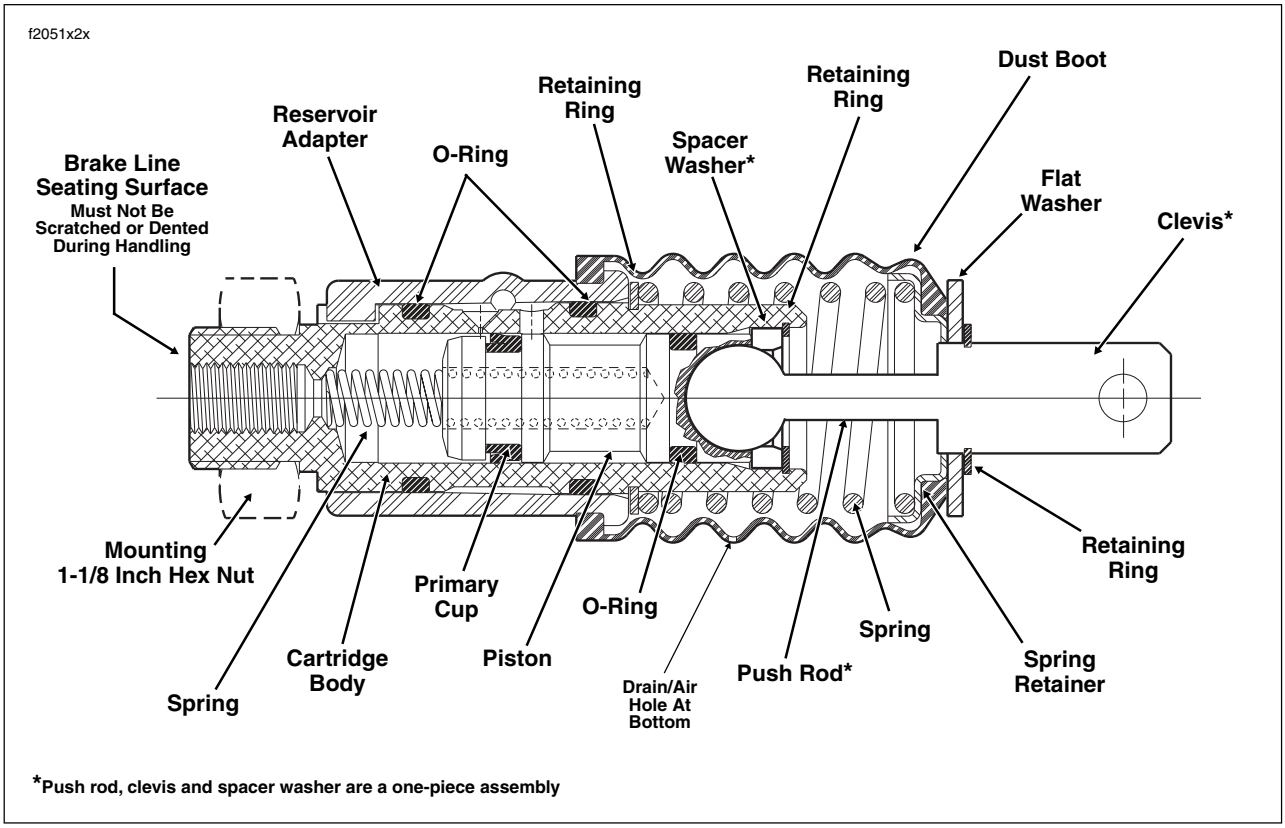


Figure 2-52. Rear Brake Master Cylinder Assembly (Cross Sectional View)

8. Wipe bore of reservoir adapter with D.O.T. 5 SILICONE HYDRAULIC BRAKE FLUID.
9. 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 reservoir adapter contacts large retaining ring.
10. 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.
11. Install spring over push rod and cartridge body until it contacts side of large retaining ring. See Figure 2-51.
12. Place concave side of spring retainer over end of spring fitting inside tabs in slot of clevis.
13. Slide dust boot over spring and spring retainer.
14. Place large flat washer on top of dust boot fitting inside tabs in slot of clevis.
15. Push down on large flat washer to compress spring. While holding spring in a compressed state, install **new** retaining ring in groove of clevis.
16. Pull down dust boot as necessary to seat over lip on reservoir adapter.
17. Rotate boot so that drain/air hole is at the bottom.
18. 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 2-53.
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.

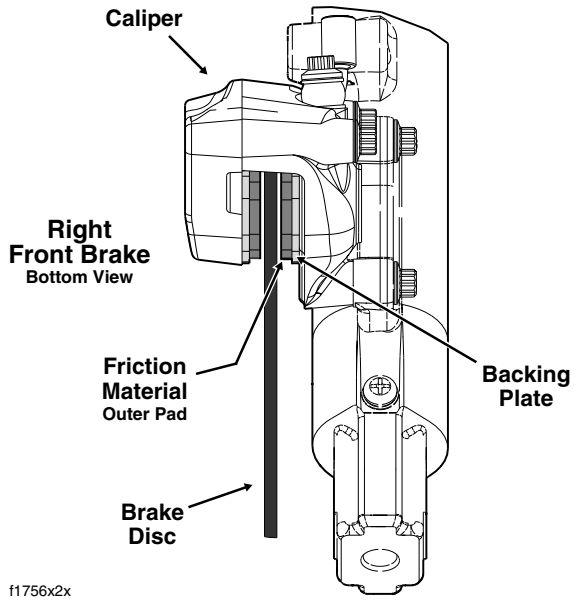
⚠WARNING

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 2-53. Measure Brake Pad Wear

FRONT BRAKE PAD REPLACEMENT

PAD REMOVAL

1. Loosen two pad pins, but do not remove. See Figure 2-54.
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.

NOTE

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.

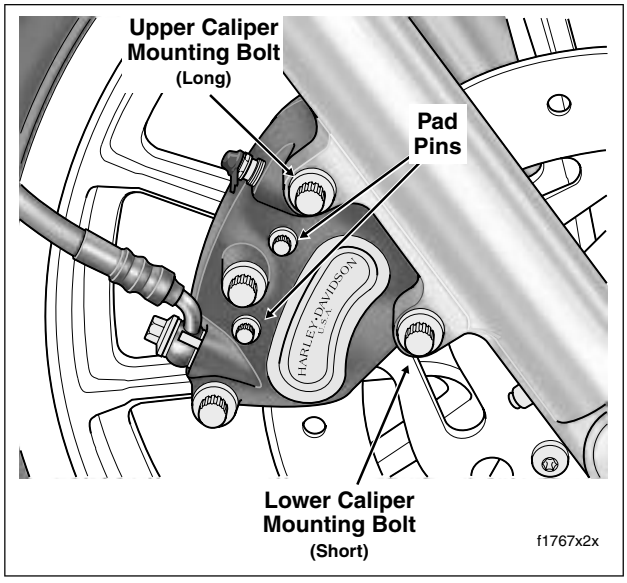


Figure 2-54. Loosen Pad Pins and Remove Caliper Mounting Bolts (Right Side View)

5. With the pistons retracted, remove two pad pins and both inner and outer brake pads. Inspect pad pins. See CLEANING AND INSPECTION, step 4.

NOTE

Replacing one pad at a time keeps the anti-rattle spring in place. Remove both pads to remove or replace the spring.

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. 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 2-55.

   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.

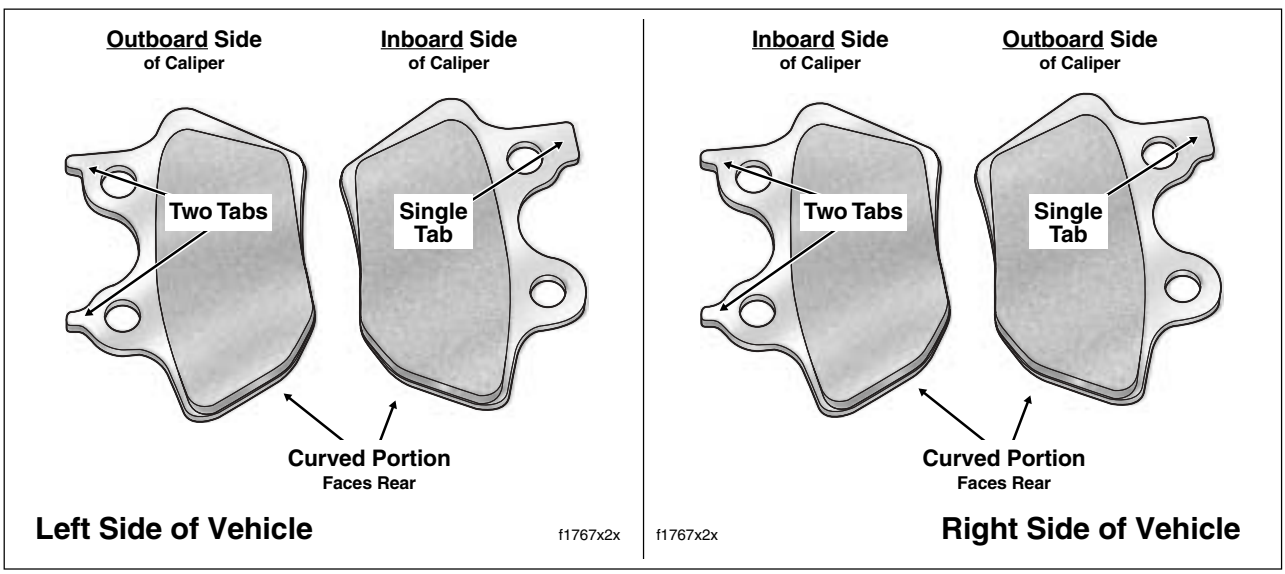


Figure 2-55. Front Brake Pad Locations

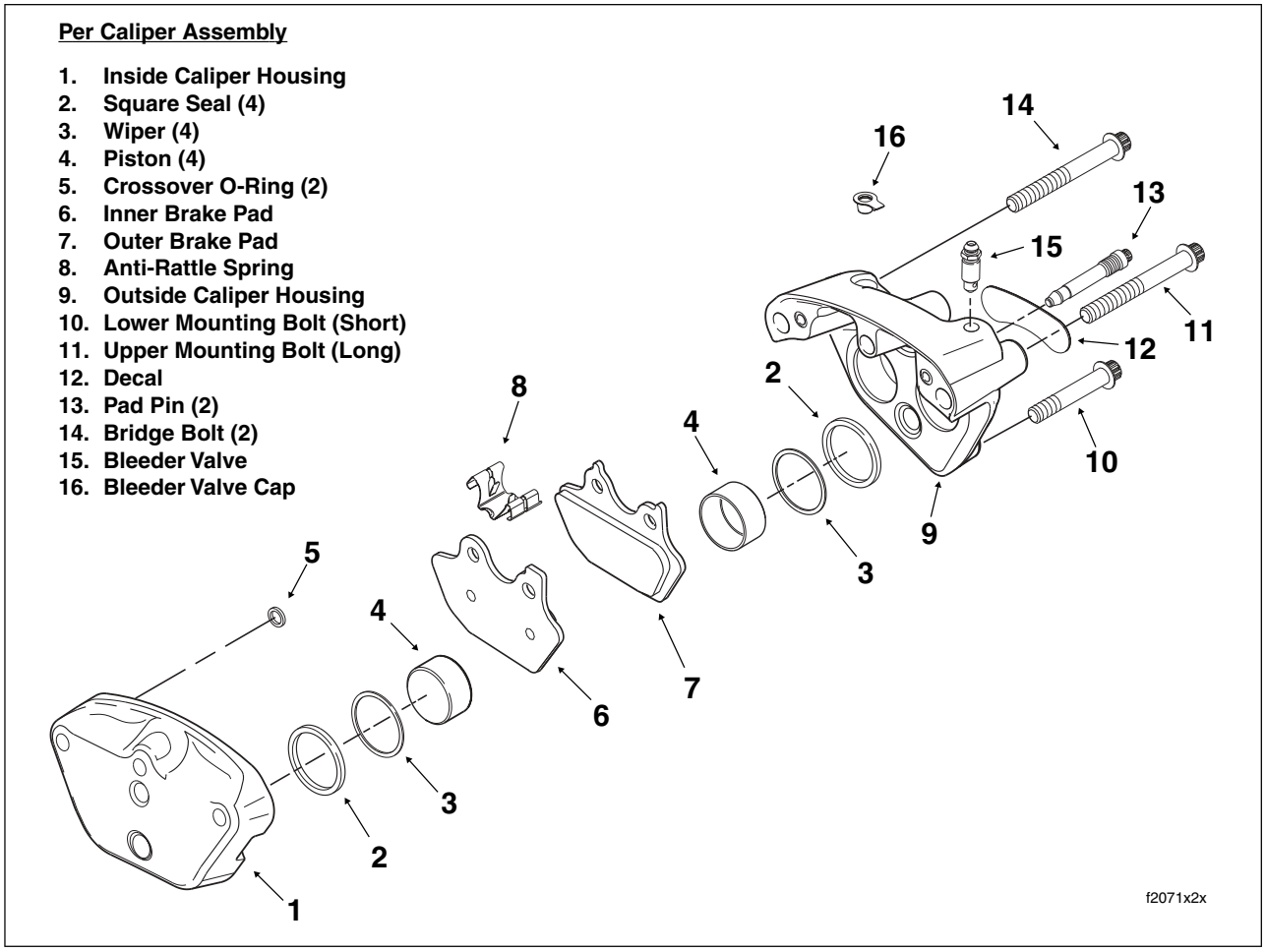


Figure 2-56. Front Brake Caliper Assembly (Left Side)

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 could 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).

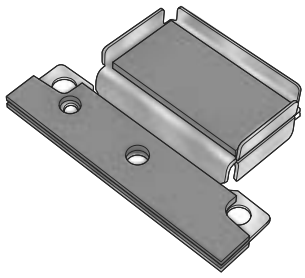
CALIPER REMOVAL

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.

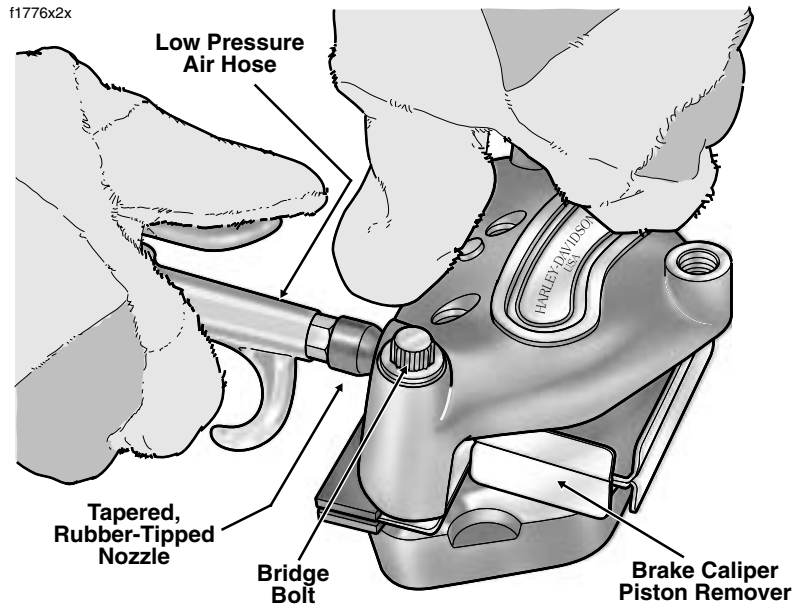


Figure 2-57. Direct Compressed Air Into Banjo Bolt Hole to Force Pistons From Bores

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 DISASSEMBLY

1. See Figure 2-54. 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.

⚠WARNING

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

5. Remove four pistons as follows:
   a. Obtain BRAKE CALIPER PISTON REMOVER (Part No. HD-43293A). See inset of Figure 2-57.
   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 2-57.
   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 2-58.

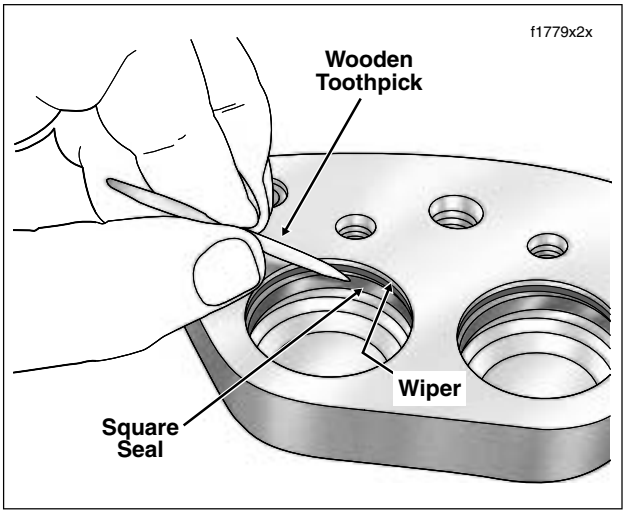


Figure 2-58. Remove Wipers and Square Seals From Piston Bores

CLEANING AND INSPECTION

⚠WARNING

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 at the beginning of this section.
4. Inspect pad pins for wear and grooving. Replace both pins if wear of either pin exceeds 0.015 inch (0.38 mm).

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. Spring is not directional. See Figure 2-59.
   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 2-55.

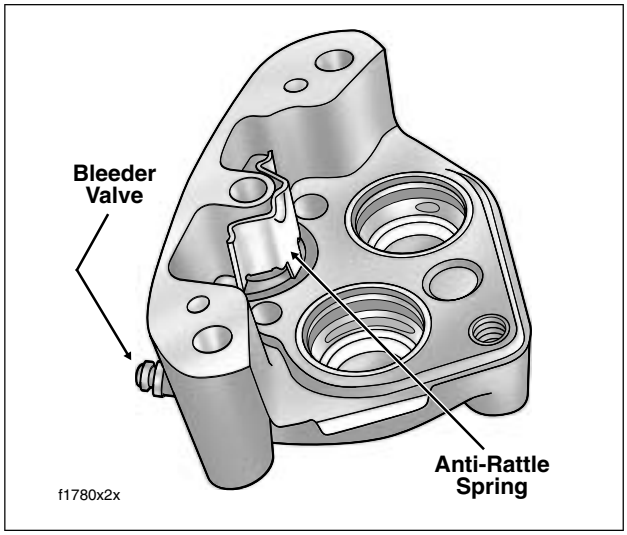


Figure 2-59. Install Anti-Rattle Spring

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 2-59. (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

Verify proper operation of the master cylinder relief port. 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. 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 2-60.
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.

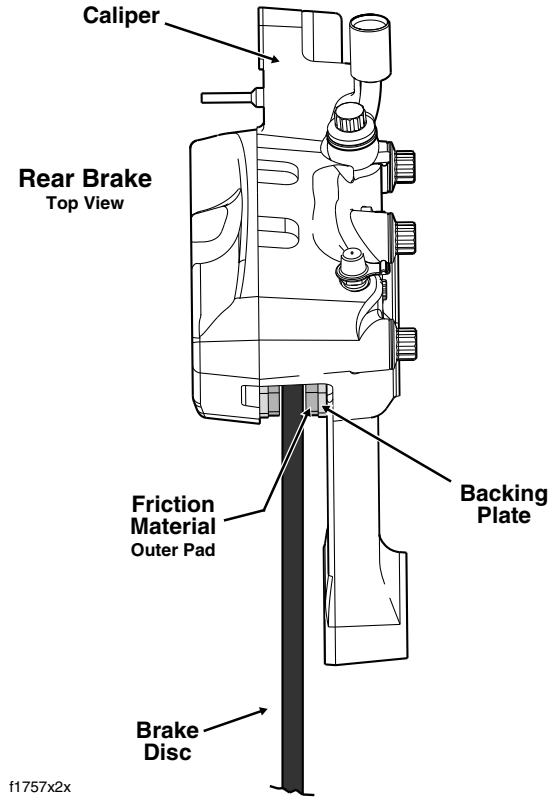
⚠WARNING

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 2-60. Measure Brake Pad Wear

REAR BRAKE PAD REPLACEMENT

PAD REMOVAL/INSTALLATION

1. Remove right side saddlebag. See Section 2.23 SADDLEBAG, REMOVAL.
2. Loosen both pad pins, but do not remove. See Figure 2-61.
3. Remove two Phillips screws to release cover from rear master cylinder reservoir.

NOTE

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.

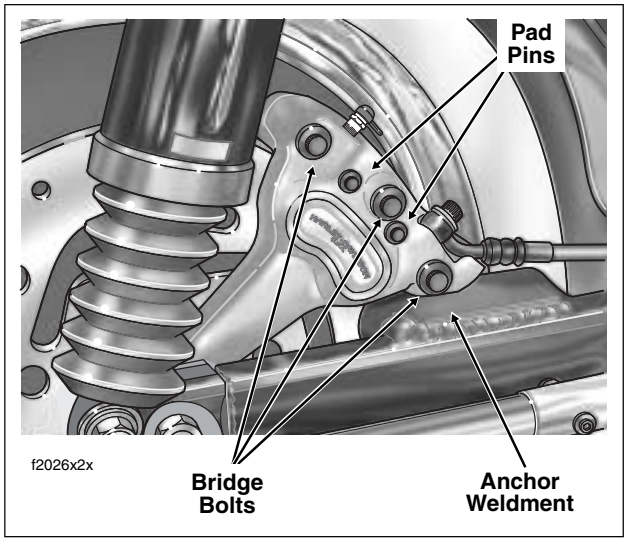


Figure 2-61. Loosen Both Pad Pins

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.

NOTE

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.
6. Install **new** inside brake pad using the same orientation. Curved portion of pad must face rear of motorcycle.
7. Install pad pins, but do not fully tighten.
8. Pump rear brake pedal to move inside pistons out until they contact inside brake pad.
9. 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.
10. 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.
11. 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.

NOTE

Replacing one pad at a time keeps the anti-rattle spring in place. Remove both pads to remove or replace the spring.

12. Inspect pad pins. See CLEANING AND INSPECTION, step 4.
13. 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.

14. Pump rear brake pedal to move pistons out until they contact both brake pads. Verify piston location against pads.
15. 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).
16. Install right side saddlebag. See Section 2.23 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.

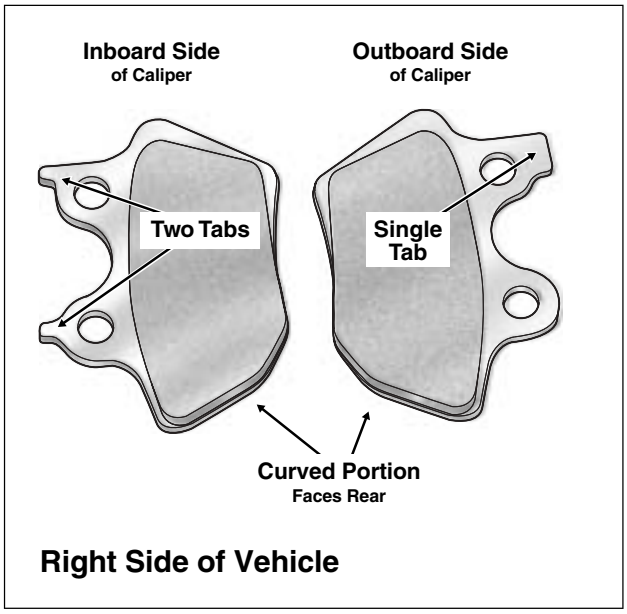


Figure 2-62. Rear Brake Pad Locations

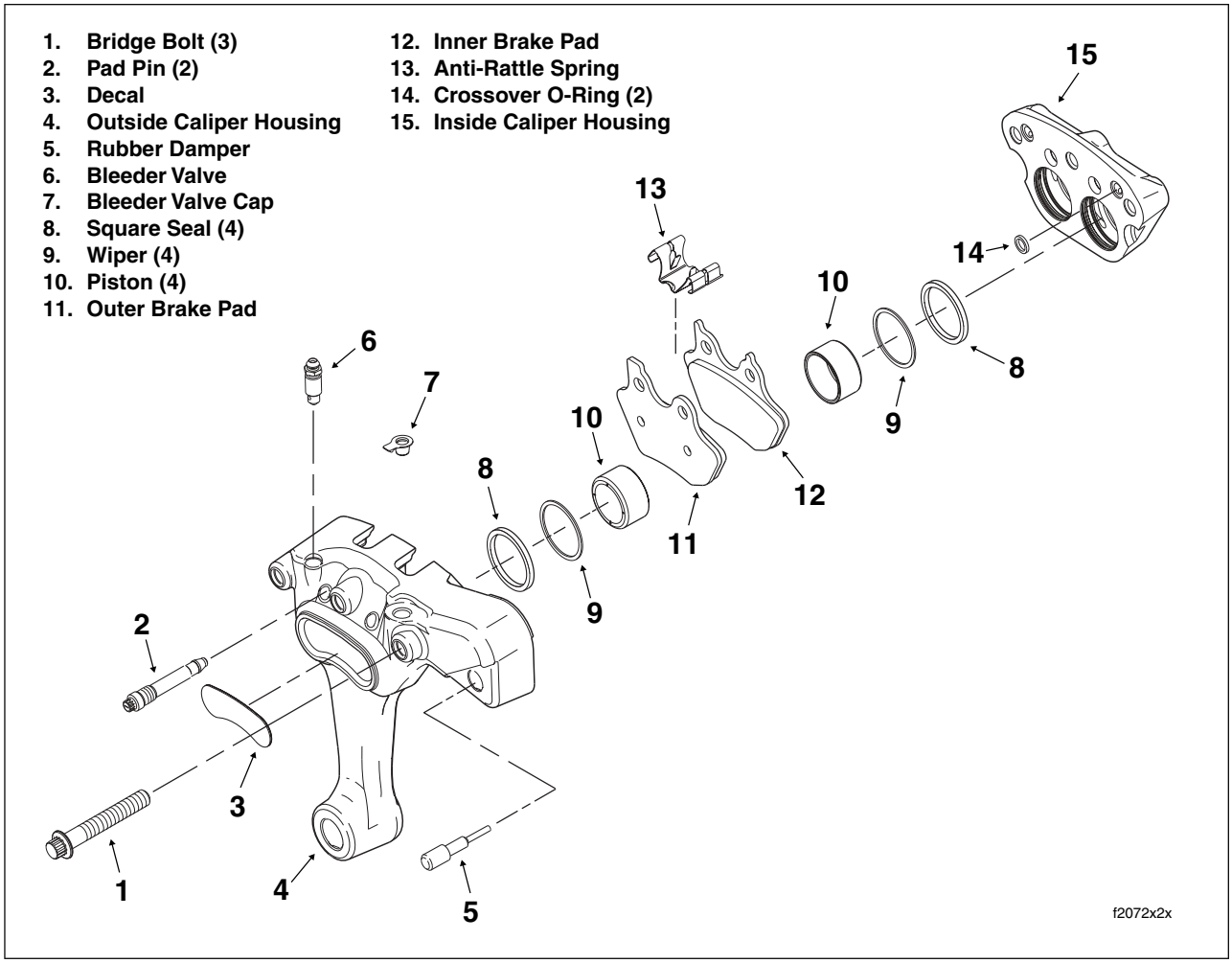


Figure 2-63. Rear Brake Caliper Assembly (Right Side)

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).

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 2.23 SADDLEBAG, REMOVAL.

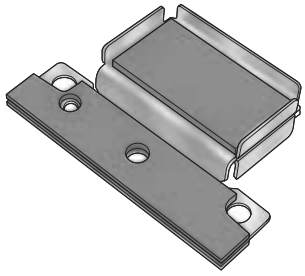
CAUTION

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 rear wheel. See Section 2.3 REAR WHEEL, REMOVAL, steps 2-6.
5. Remove caliper from anchor weldment on rear swingarm.

CALIPER DISASSEMBLY

1. See Figure 2-61. Remove two pad pins. Remove brake pads from caliper housings.
2. Remove three bridge bolts and separate inside and outside caliper housings.



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.

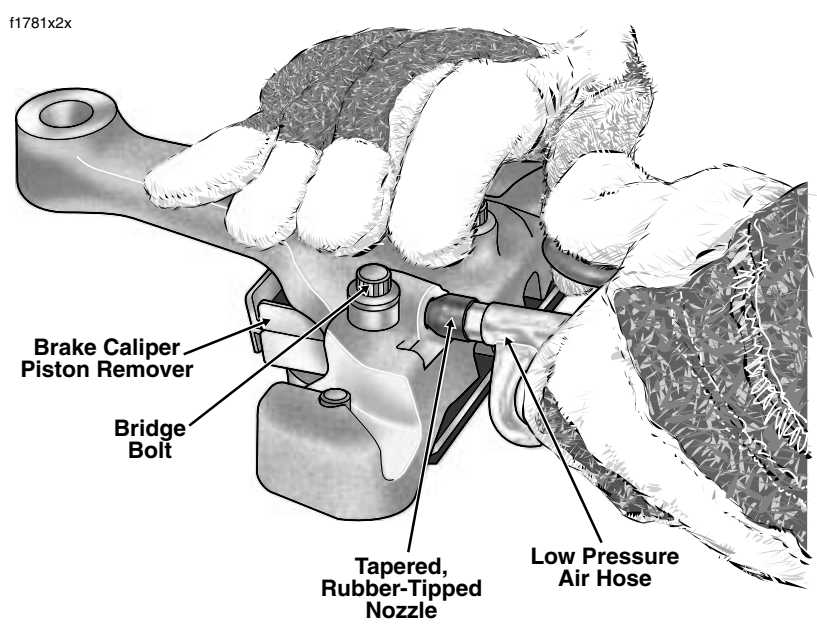


Figure 2-64. Direct Compressed Air Into Banjo Bolt Hole to Force Pistons From Bores

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.

⚠WARNING

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

6. Remove four pistons as follows:
   a. Obtain BRAKE CALIPER PISTON REMOVER (Part No. HD-43293A). See inset of Figure 2-64.
   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 2-64.
   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 2-65.

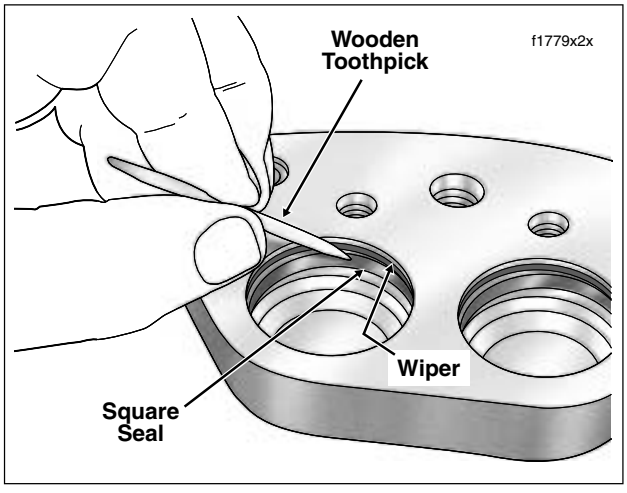


Figure 2-65. Remove Wipers and Square Seals From Piston Bores

CLEANING AND INSPECTION

⚠WARNING

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 at the beginning of this section.
4. Inspect pad pins for wear and grooving. Replace both pins if wear of either pin exceeds 0.015 inch (0.38 mm).

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. Spring is not directional. See Figure 2-66.
   c. Mate inside and outside caliper housings and loosely install two bridge bolts.
   d. Tighten bridge bolts to 28-38 ft-lbs (37.9-51.5 Nm).
   e. If rubber damper was removed, lubricate anchor of **new** damper with isopropyl alcohol or glass cleaner and install by pulling rubber bead through hole in outside caliper housing, as shown in Figure 2-66.
   f. Verify that anti-rattle spring is still seated.

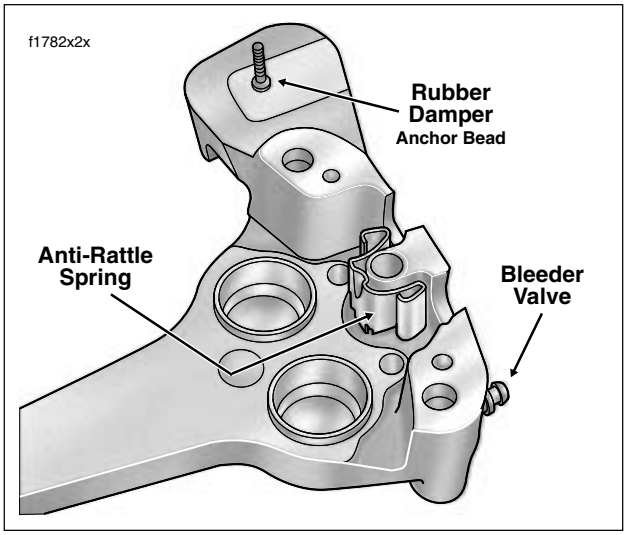


Figure 2-66. Install Anti-Rattle Spring

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 2-62.

   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 2-66. (3) Pads are pushed tight against anti-rattle spring.

CALIPER INSTALLATION

1. Install rear wheel. See Section 2.3 REAR WHEEL, INSTALLATION, steps 1-9.

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 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

Verify proper operation of the master cylinder relief port. 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.

4. 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.

5. 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.
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. Install saddlebags. See Section 2.23 SADDLEBAG, INSTALLATION.
8. 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.

9. 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 2-67. 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.

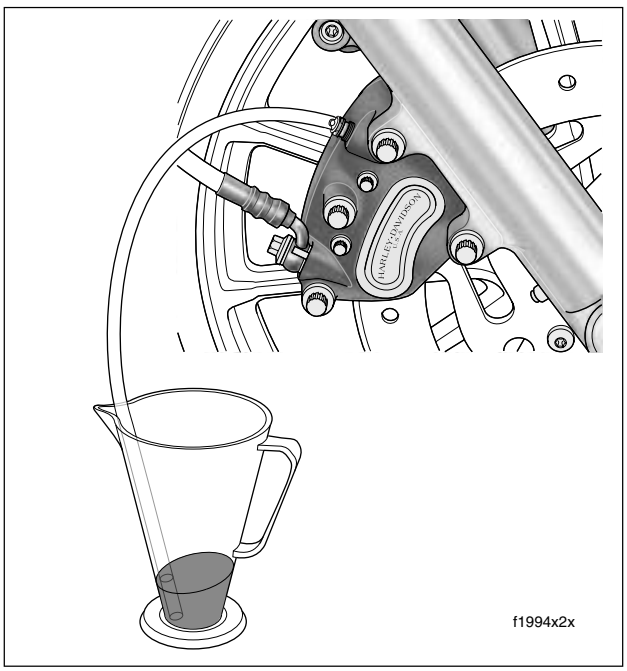


Figure 2-67. Bleeding Hydraulic System

CHANGING FORK OIL

Change the front fork oil at every 20,000 mile (32,000 km) service interval. Proceed as follows:

Table 2-2. Fork Oil Requirements

FORK	MODEL	TYPE	AMOUNT			
			OZ.	ML	IN.	MM
Left	All models **except** Road King	Cartridge	10.0	295	4.21	107
			See Warning Below			
	Road King	Conventional	11.1	328	5.24	133
Right	All models					

⚠WARNING

Fork oil level in cartridge type forks is carefully measured from top of tube after pumping damper rod. Any deviation from instructions can result in incorrect amount of fork oil. Incorrect amount of fork oil can adversely affect handling and lead to loss of vehicle control, which could result in death or serious injury.

NOTE

All touring models with the exception of Road King have the cartridge type fork on the left side and the conventional type fork on the right. Road King uses the conventional type fork on both sides. To change the fork oil on a cartridge type fork, partial disassembly of the fork is required.

FLHT/C/U, FLTR

1. Remove left fork. See REMOVAL, steps 1-9.
2. Partially disassemble left fork. See DISASSEMBLY, LEFT FORK, steps 1-13.
3. Position fork assembly upside down over drain pan. Allow sufficient time for fork to thoroughly drain (about 10-15 minutes).
4. Assemble left fork. See ASSEMBLY, LEFT FORK, steps 13-28.
5. Drain and fill right fork. Removal and disassembly of the fork is not required. See FLHR/C below, steps 3-7.

NOTE

If removing and inverting right fork is the preferred method of draining, see REMOVAL, steps 4-9.

6. Install fork(s) and assemble motorcycle. See INSTALLATION in this section.

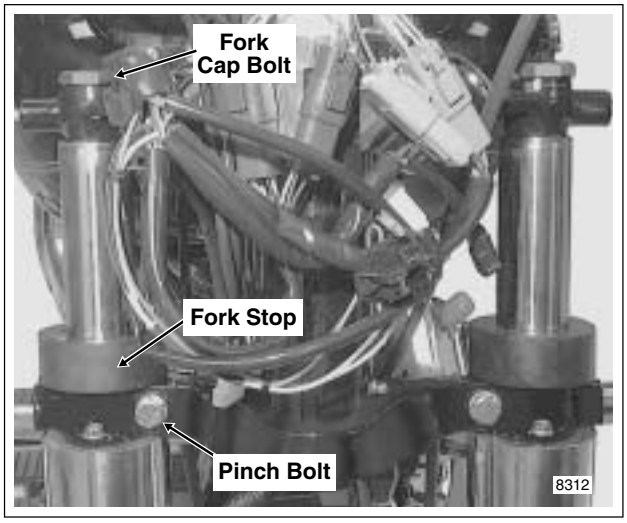


Figure 2-68. Remove Fork Cap Bolt (FLHR/C Shown)

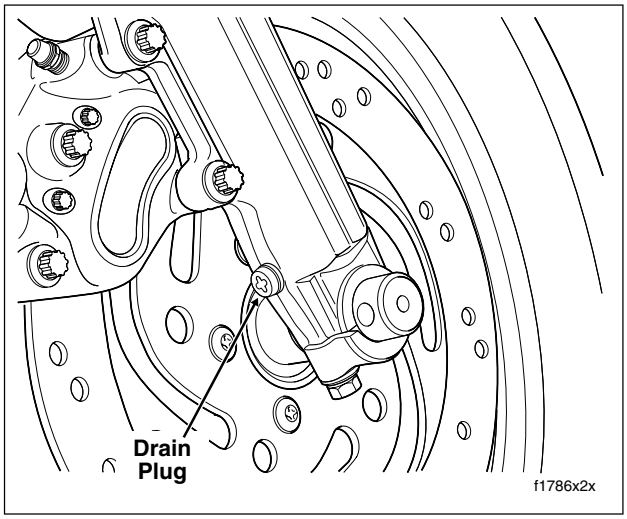


Figure 2-69. Remove Fork Oil Drain Plug (Right Side Shown)

FLHR/C

1. Remove headlamp nacelle. See Section 2.29 WINDSHIELD/HEADLAMP NACELLE (FLHR/C), 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.
3. Remove fork cap bolt from fork tube plug at top of fork tube. See Figure 2-68.
4. Remove the drain plug from the bottom of the fork slider. See Figure 2-69.

5. When fork oil is fully drained, install drain plug and tighten to 72-96 **in-lbs** (8-11 Nm).
6. Using a funnel, pour 11.1 ounces (328 ml) of Harley-Davidson Type E Fork Oil into the fork tube.
7. Install fork cap bolt and tighten to 50-60 ft-lbs (68-81 Nm).
8. Repeat steps 3-7 on other fork.
9. Install instrument nacelle. See Section 2.28 UPPER FAIRING/WINDSHIELD (FLTR), INSTRUMENT NACELLE, INSTALLATION.

NOTE

*If fork is leaking or fails visual inspection, completely disassemble following the instructions under REMOVAL and DISASSEMBLY. Use the occasion to thoroughly examine all parts and install a **new** fork oil seal.*

REMOVAL

1. Place suitable blocking under frame to raise front wheel several inches off the floor. For best results, use an hydraulic center stand on a level surface.
2. Remove the front wheel and fender. See Section 2.30 FRONT FENDER, REMOVAL.
3. **FLHT/C/U:**
   a. Remove fairing cap. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), FAIRING CAP, REMOVAL.
   b. Move to front of motorcycle. Loosen two upper outer fairing screws. Remove two lower outer fairing screws.
   c. Remove two screws from lower fork bracket to release passing lamp bracket, chrome skirt and inner fairing. Remove chrome skirt.

   FLTR:
   a. Remove instrument nacelle. See Section 2.28 UPPER FAIRING/WINDSHIELD (FLTR), INSTRUMENT NACELLE, REMOVAL.

   FLHR/C:
   a. Remove headlamp nacelle. See Section 2.29 WINDSHIELD/HEADLAMP NACELLE (FLHR/C), NACELLE REMOVAL.
4. Standing at front of vehicle, loosen pinch bolt (with lockwasher) on left side of lower fork bracket, but do not remove. See Figure 2-68.
5. Loosen fork cap bolt from fork tube plug at top of fork tube, but do not remove.
6. Spray glass cleaner on fork tube above the rubber fork stop. After lubricating surfaces, move fork stop up fork tube until it contacts bottom of upper fork bracket.
7. Holding fork slider to prevent fork from dropping, remove fork cap bolt from fork tube plug. Slide fork tube down and out of upper fork bracket, fork stop, lower fork bracket, and slider cover.

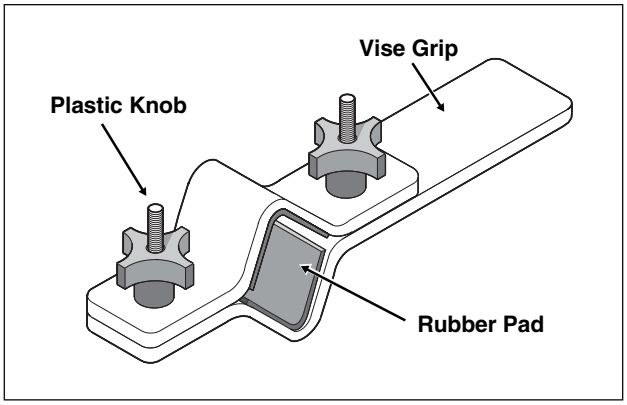


Figure 2-70. Fork Tube Holder (HD-41177)

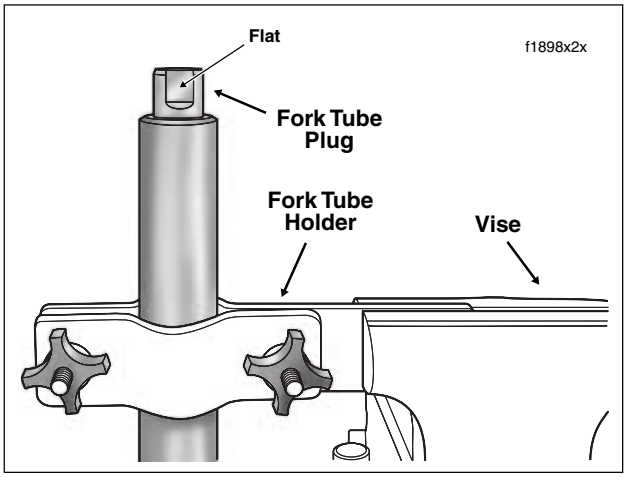


Figure 2-71. Install Fork Tube Into Fork Holder

8. Thread fork cap bolt back into fork tube plug to prevent loss of fork oil while handling.
9. Move front fork to bench area. Place suitable drain pan on floor beneath vise.
10. Repeat steps 4-9 to remove right fork.

DISASSEMBLY

LEFT FORK

Cartridge Type - All Models Except Road King

NOTE

Since Road King uses the conventional type fork on both sides, see DISASSEMBLY, RIGHT FORK, for Road King instructions.

1. Remove the fork assembly. See REMOVAL in this section.

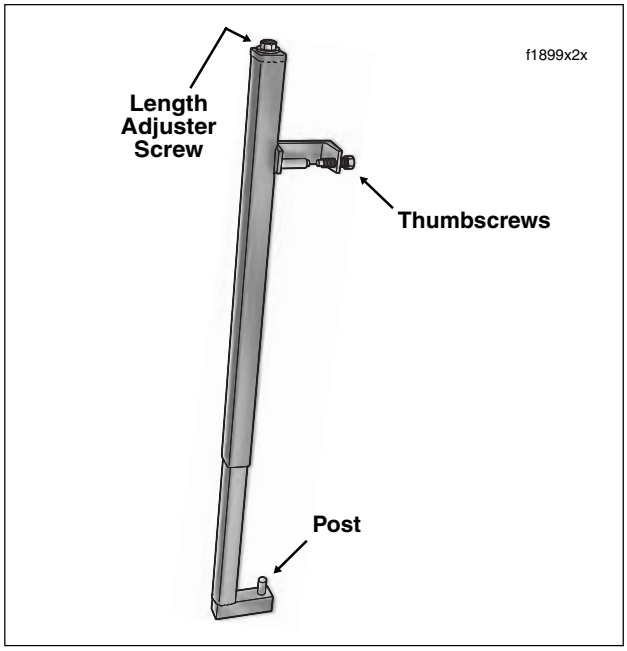


Figure 2-72. Fork Spring Compressing Tool

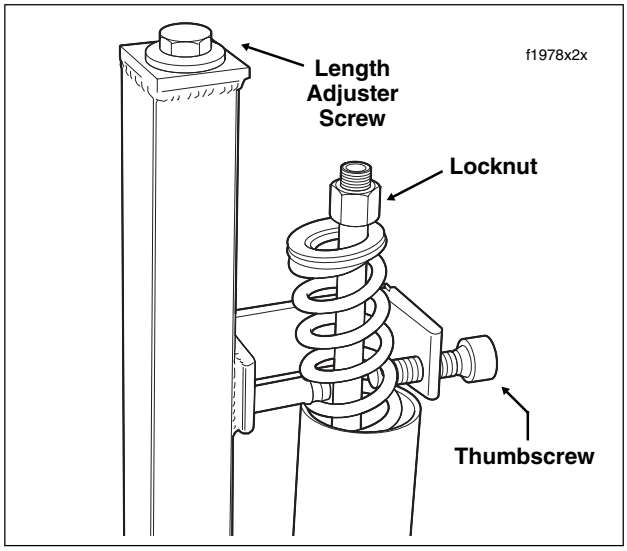


Figure 2-73. Compress Fork Spring

CAUTION

Exercise caution to avoid scratching or nicking fork tube. Damaging tube can result in fork oil leaks after assembly.

2. Obtain the FORK TUBE HOLDER (HD-41177). See Figure 2-70. Proceed as follows:
   a. Clamp end of tool in vise in a horizontal position with plastic knobs facing toward you.
   b. With the fork cap bolt topside, clamp fork tube between rubber pads on inboard side of tool. Tighten knobs until fork tube is securely held.
3. Remove fork cap bolt from fork tube plug. Remove and discard quad ring seal.
4. Using flat, unthread fork tube plug from fork tube. See Figure 2-71.
5. Pull up on fork slider to compress fork assembly, which causes the damper rod to protrude from the top of the fork tube.
6. Holding locknut, remove fork tube plug from threaded end of damper rod. Remove O-ring from fork tube plug. Discard O-ring.
7. Remove fork assembly from fork tube holder. Turning fork upside down, drain fork oil into drain pan.
8. Remove fork tube holder from vise.
9. Obtain fork spring compressing tool (commercially available) similar to that shown in Figure 2-72. Install as follows:
   a. Clamp tool in vise in a vertical position with length adjuster screw topside.
   b. Pull up on fork slider to compress fork assembly,
   c. Keeping fork compressed, place post at bottom end of tool into hole at bottom of fork slider, while centering groove at end of each thumbscrew on fourth spring coil. See Figure 2-73.

NOTE

Fork spring compressing tool may need some adjustment to reach from bottom of fork slider to fourth spring coil. Turn screw at top end of tool in a counterclockwise direction to lengthen, a clockwise direction to shorten.

CAUTION

Use only hand tools to turn screw on fork spring compressing tool. Do not use an air impact wrench or tool damage can occur.

   d. When tool is properly positioned as described under step 9(c), turn screw at top end of tool in a clockwise direction to compress spring. See Figure 2-73.
10. Remove locknut from end of damper rod. Remove spring seat and flat washer.
11. Turn screw at top end of fork spring compressing tool in a counterclockwise direction to release tension on fork spring. Remove fork assembly from tool and remove tool from vise.
12. Remove fork spring from fork tube.

13. Obtain damper rod extension tool (commercially available) similar to that shown in Figure 2-74. Thread extension tool onto end of damper rod. Turn fork assembly upside down over drain pan and slowly pump damper rod at least twenty times until rod moves freely. See Figure 2-75.

NOTE

If just changing the fork oil, continue procedure at ASSEMBLY, LEFT FORK, step 13. If overhauling the fork assembly, continue with step below.

14. Remove extension tool from damper rod. Install fork spring back into fork tube.
15. Place a shop rag on the floor, and turning fork assembly upside down, press end of spring against rag. While compressing spring to prevent rotation of damper cartridge, remove 6mm screw from end of fork slider. Use an air impact wrench for best results. Discard 6mm screw and copper crush washer.
16. Remove spring and damper cartridge from fork tube.

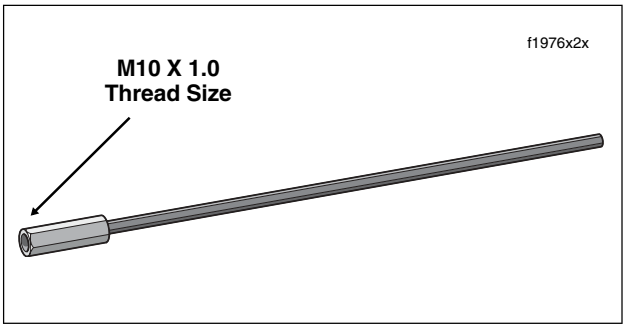


Figure 2-74. Damper Rod Extension Tool

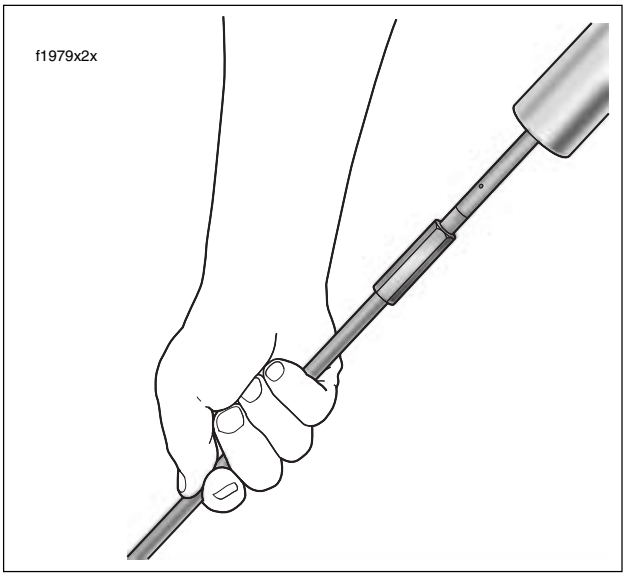


Figure 2-75. Pump Damper Rod Extension Tool

CAUTION

Do not expand or stretch retaining clip to remove from fork tube or clip may become bent or distorted.

17. Using pick tool, remove retaining clip between fork slider and fork tube.
18. Remove fork tube from fork slider.

NOTE

To overcome any resistance, use the fork tube as a slide hammer, that is, first push fork tube into fork slider and then pull it outward with a moderate amount of force. Repeat this sequence until fork tube separates from fork slider.

19. Slide fork oil seal, slider spacer and slider bushing off end of fork tube. Discard fork oil seal and slider bushing.
20. Gently pry at split line to expand fork leg bushing, and then remove from groove at end of fork tube. Discard fork leg bushing.
21. Remove lower stop from fork slider, or end of damper cartridge if still installed.

RIGHT FORK

Conventional Type - All Models

1. Remove the fork assembly. See REMOVAL in this section.
2. Remove nuts, lockwashers, flat washers and axle holder from studs at end of fork slider.

CAUTION

Exercise caution to avoid scratching or nicking fork tube. Damaging tube can result in fork oil leaks after assembly.

3. Obtain the FORK TUBE HOLDER (HD-41177). See Figure 2-70. Proceed as follows:
   a. Clamp end of tool in vise in a horizontal position with plastic knobs facing toward you.
   b. With the fork cap bolt topside, clamp fork tube between rubber pads on inboard side of tool. Tighten knobs until fork tube is securely held. See Figure 2-71.
4. Remove fork cap bolt from fork tube plug. Remove and discard O-ring.
5. Using flat, slowly unthread fork tube plug from fork tube. Be aware that fork tube plug is under spring pressure, so have a firm grasp on plug as the last thread is turned. Remove and discard O-ring from fork tube plug.
6. Remove fork spring from fork tube.
7. Remove fork assembly from fork tube holder.

8. Turning fork upside down, drain fork oil into drain pan. For best results, slowly pump fork tube and slider at least ten times.
9. Install fork spring back into fork tube.
10. Place a shop rag on the floor, and turning fork assembly upside down, press end of spring against rag. While compressing spring to prevent rotation of damper tube, remove 6mm screw from end of fork slider. Use an air impact wrench for best results. Discard 6mm screw and copper crush washer.
11. Remove fork spring and damper tube from fork tube.
12. Remove wear ring and rebound spring from damper tube.

CAUTION

Do not expand or stretch retaining clip to remove from fork tube or clip may become bent or distorted.

13. Using pick tool, remove retaining clip between fork slider and fork tube.
14. Remove fork tube from fork slider.

NOTE

To overcome any resistance, use the fork tube as a slide hammer, that is, first push fork tube into fork slider and then pull it outward with a moderate amount of force. Repeat this sequence until fork tube separates from fork slider.

15. Slide fork oil seal, slider spacer and slider bushing off end of fork tube. Discard fork oil seal and slider bushing.
16. Gently pry at split line to expand fork leg bushing, and then remove from groove at end of fork tube. Discard fork leg bushing.
17. Remove the lower stop from the fork slider.

CLEANING AND INSPECTION

1. Thoroughly clean and inspect all parts. Replace any parts that are bent, broken or obviously damaged.
2. Inspect fork cap bolt quad ring seal and fork tube plug O-ring for cuts, tears or signs of deterioration. Replace if necessary.
3. Replace the retaining clip if bent or distorted.
4. Check the slider and fork leg bushings for scratches or excessive wear. Always replace bushings in a set if either bearing is damaged or worn.
5. Check the fork tube and slider for scoring, scratches and excessive or abnormal wear. Replace parts as necessary. Set the fork tube on V-blocks and measure the runout using a dial indicator gauge. Replace fork if runout exceeds 0.008 inch (0.2 mm). See Figure 2-76.

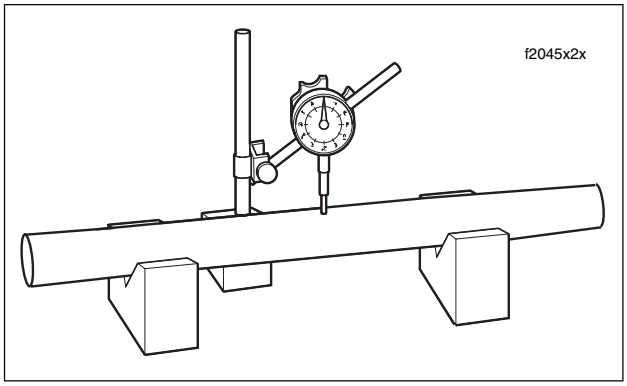


Figure 2-76. Measure Fork Tube Runout

6. Inspect upper fork springs for damage or distortion. Verify that free length is a minimum of 15 inches (381.0 mm) on cartridge type forks, 18.5 inches (469.9 mm) on the conventional type. Replace rebound spring on the conventional type fork if the free length is less than 15/16 inch (23.8 mm) or whenever the upper fork spring requires replacement.

ASSEMBLY

LEFT FORK

Cartridge Type - All Models Except Road King

NOTE

Since Road King uses the conventional type fork on both sides, see ASSEMBLY, RIGHT FORK, for Road King instructions.

CAUTION

Exercise caution to avoid scratching or nicking fork tube. Damaging tubes can result in fork oil leaks after assembly.

1. Coat fork leg bushing ID with clean fork oil. Expand fork leg bushing at split line only so far as required to slip over end and into groove of fork tube.
2. Slide damper cartridge into fork tube, so that cartridge end drops through hole at bottom of fork tube. Install lower stop at end of damper cartridge.
3. Install fork slider in fork tube holder. Slide fork tube into fork slider.
4. Coat slider bushing ID with clean fork oil. Slide slider bushing down fork tube.
5. Slide slider spacer down fork tube until it contacts slider bushing.

6. Obtain the FORK OIL SEAL INSTALLER (HD-34634). See Figure 2-77. Proceed as follows:
   a. Slide the fork oil seal installer down the fork tube, and using the tool like a slide hammer, drive slider bushing into counterbore of fork slider. Remove tool.

NOTE

Place masking tape over edge of fork tube to avoid damaging lip of fork oil seal during installation.

   b. Coat **new** fork oil seal ID with clean fork oil. With the lip garter spring side facing down (toward the fork slider), slide seal down fork tube until it contacts slider spacer. Remove masking tape from edge of fork tube.
   c. Slide the fork oil seal installer down the fork tube until it contacts the fork oil seal.
   d. Using the tool like a slide hammer, drive fork oil seal down fork tube until retaining clip groove is visible in fork slider ID. See Figure 2-78. Remove tool.

CAUTION

Do not expand or stretch retaining clip to install on fork tube or clip may become bent or distorted.



Figure 2-77. Fork Oil Seal Installer (HD-34634)

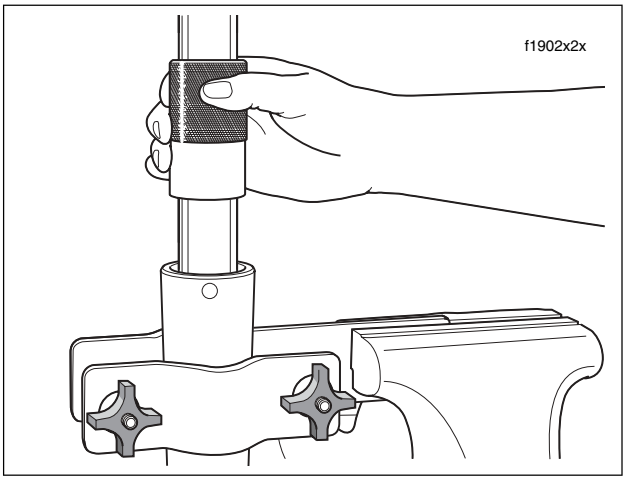


Figure 2-78. Install Fork Oil Seal

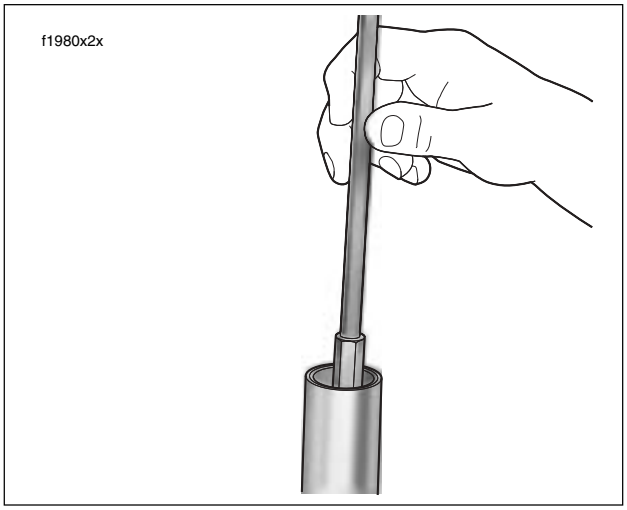


Figure 2-79. Pump Damper Rod Extension Tool

   e. Slide the retaining clip down the fork tube until it contacts the fork oil seal. Install retaining clip in the fork slider groove.
7. Install fork spring into fork tube.
8. Remove fork assembly from fork tube holder.
9. Place a shop rag on the floor, and turning fork assembly upside down, press end of spring against rag.
10. Install **new** 6mm screw with copper crush washer. Slide screw through hole at bottom of fork slider and start into end of damper cartridge.
11. While compressing spring to prevent rotation of damper cartridge, tighten 6mm screw to 132-216 **in-lbs** (14.9-24.4 Nm).
12. Remove fork spring from fork tube.
13. With the fork tube topside, clamp fork slider (not the fork tube) into fork tube holder.

NOTE

Install the drain plug at the bottom of the fork slider, if removed. Tighten the plug to 72-96 ***in-lbs*** *(8-11 Nm).*

14. Fill the fork tube as follows:
   a. Obtain damper rod extension tool similar to that shown in Figure 2-74. Thread extension tool onto end of damper rod.
   b. Pour 5 ounces (147.9 ml) of Harley-Davidson Type E Fork Oil into the fork tube.
   c. Grasping extension tool, slowy pump the damper rod until resistance is felt, and then pump five more times. See Figure 2-79.
   d. Place the damper rod in the fully bottomed position.
   e. Pour 6 more ounces (177.5 ml) of fork oil into the fork tube.
   f. Remove extension tool from end of damper rod.

15. Adjust the fork oil level, so that it is 4.21 inches (107 mm) from the top of the fork tube with the fork compressed. Proceed as follows:
    a. Obtain the FRONT FORK OIL LEVEL GAUGE (HD-59000A). See Figure 2-80.
    b. Loosen thumbscrew on metal ring and move it up or down the rod until the bottom of the ring is 4.21 inches (107 mm) from the bottom of the rod. Tighten thumbscrew.
    c. Push the handle on the cylinder all the way in.
    d. Insert rod into top of fork tube until metal ring rests flat on top of fork tube. See Figure 2-81.
    e. Pull out handle to suck fork oil from fork tube. Observe fork oil through transparent tube as it is drawn into cylinder. If no oil is drawn through transparent tube, add enough oil so that tool usage sets fork oil level.
    f. Remove rod from fork tube. Push handle into cylinder to eject excess fork oil into suitable container.
    g. If necessary, repeat steps 15(d) thru 15(f). Level is correct when no fork oil is observed being drawn through transparent tube.

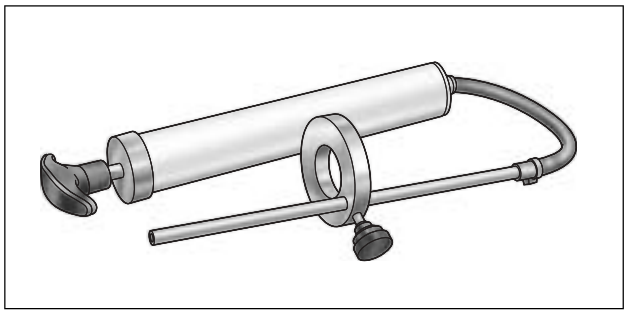


Figure 2-80. Front Fork Oil Level Gauge (HD-59000A)

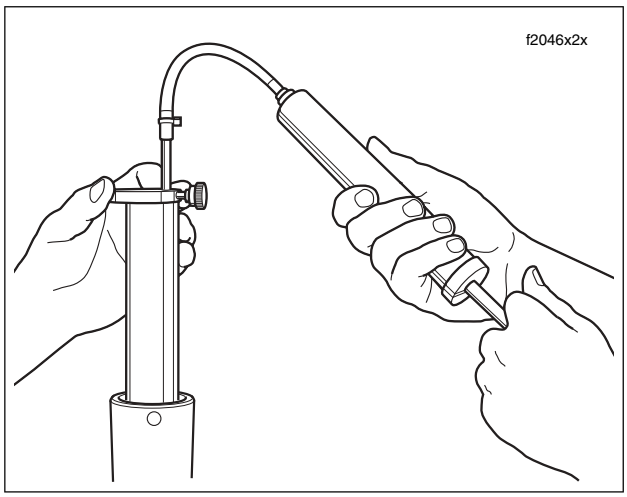


Figure 2-81. Remove Excess Fork Oil

⚠WARNING

Be sure fork oil level is correct. The incorrect amount of fork oil can adversely affect handling and may lead to loss of vehicle control, which could result in death or serious injury.

16. With the closer spaced coils at the bottom, slide fork spring into fork tube.
17. Pull up on fork slider to compress fork assembly, which causes the damper rod and spring to protrude from the top of the fork tube.
18. Obtain damper rod extension tool similar to that shown in Figure 2-74. Thread extension tool onto end of damper rod.
19. Obtain fork spring compressing tool similar to that shown in Figure 2-72. Install as follows:
    a. Clamp tool in vise in a vertical position with length adjuster screw topside.
    b. Keeping fork compressed, place post at bottom end of tool into hole at bottom of fork slider, while centering groove at end of each thumbscrew on fourth spring coil. See Figure 2-73.

NOTE

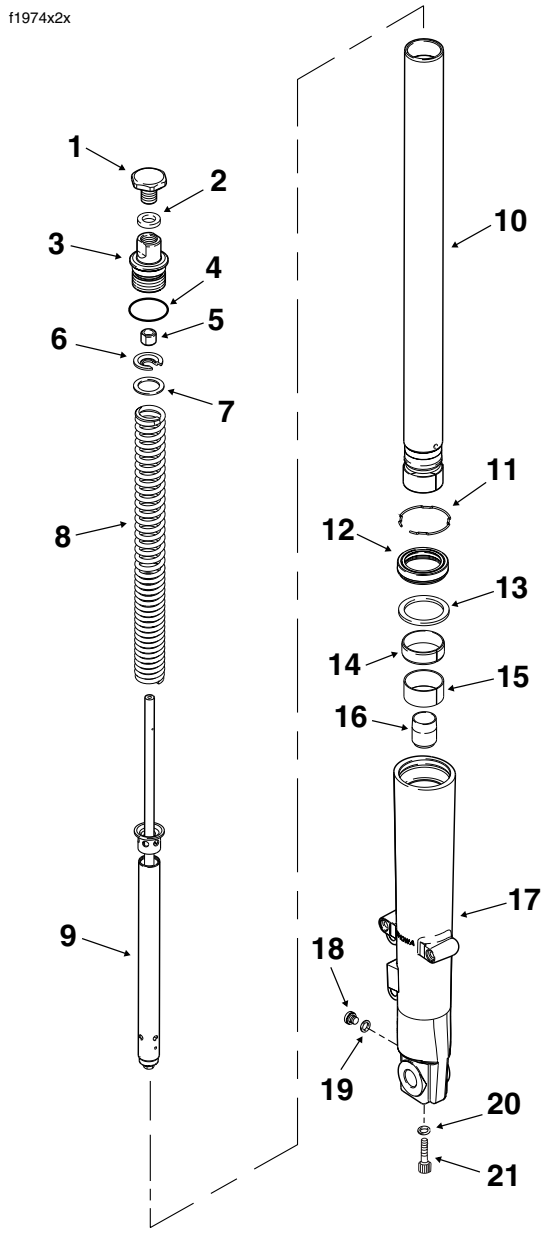
Fork spring compressing tool may need some adjustment to reach from bottom of fork slider to fourth spring coil. Turn screw at top end of tool in a counterclockwise direction to lengthen, a clockwise direction to shorten.

CAUTION

Use only hand tools to turn screw on fork spring compressing tool. Do not use an air impact wrench or tool damage can occur.

    c. When tool is properly positioned as described under step 19(b), turn screw at top end of tool in a clockwise direction to compress spring. See Figure 2-73.

20. After a number of turns, pull up on extension tool to raise damper rod. If threaded portion of rod cannot be pulled completely out of spring, compress spring further.
21. Repeat step 20 until threaded portion of rod can be pulled completely out of spring. Remove extension tool, but do not let go of damper rod.
22. Place flat washer rounded side up on top of spring. Place spring seat concave side up on top of flat washer. Thread locknut onto damper rod until it contacts shoulder.
23. Install **new** O-ring onto fork tube plug. Thread fork tube plug onto threaded end of rod until it bottoms. Now turn locknut in a counterclockwise direction until it makes firm contact with the fork tube plug. Tighten locknut to 13-20 ft-lbs (18-27 Nm).



1. Fork cap bolt
2. Quad ring seal
3. Fork tube plug
4. O-Ring
5. Locknut
6. Spring seat
7. Flat washer
8. Spring
9. Damper cartridge
10. Fork tube
11. Retaining clip
12. Lip seal
13. Slider spacer
14. Slider bushing
15. Fork leg bushing
16. Lower stop
17. Fork slider
18. Plug
19. Flat Washer
20. Copper washer
21. Screw (6mm)

Figure 2-82. Left Side Fork - Cartridge Type (All Models Except Road King)

24. Turn screw at top end of fork spring compressing tool in a counterclockwise direction to release tension on fork spring. Remove fork assembly from tool and remove tool from vise.
25. Install fork tube holder in vise. Clamp fork tube into fork tube holder.
26. Tighten fork tube plug to 22-58 ft-lbs (30-79 Nm).
27. Install **new** O-ring onto fork cap bolt. Thread fork cap bolt into fork tube plug to prevent loss of fork oil while handling.
28. Remove fork assembly from fork tube holder.

RIGHT FORK

Conventional Type - All Models

CAUTION

Exercise caution to avoid scratching or nicking fork tube. Damaging tubes can result in fork oil leaks after assembly.

1. Coat fork leg bushing ID with clean fork oil. Expand fork leg bushing at split line only so far as required to slip over end and into groove of fork tube.
2. Install **new** wear ring in groove at top of damper tube. Install rebound spring on opposite end.
3. With the wear ring topside, slide damper tube into fork tube, so that tube end drops through hole at bottom of fork tube. Install lower stop at end of damper tube.
4. Install fork slider in fork tube holder. Slide fork tube into fork slider.
5. Coat slider bushing ID with clean fork oil. Slide slider bushing down fork tube.
6. Slide slider spacer down fork tube until it contacts slider bushing.
7. Obtain the FORK OIL SEAL INSTALLER (HD-34634). See Figure 2-77. Proceed as follows:
   a. Slide the fork oil seal installer down the fork tube, and using the tool like a slide hammer, drive slider bushing into counterbore of fork slider. Remove tool.

NOTE

Place masking tape over edge of fork tube to avoid damaging lip of fork oil seal during installation.

   b. Coat **new** fork oil seal ID with clean fork oil. With the lip garter spring side facing down (toward the fork slider), slide seal down fork tube until it contacts slider spacer. Remove masking tape from edge of fork tube.

c. Slide the fork oil seal installer down the fork tube until it contacts the fork oil seal.

d. Using the tool like a slide hammer, drive fork oil seal down fork tube until retaining clip groove is visible in fork slider ID. See Figure 2-78. Remove tool.

CAUTION

Do not expand or stretch retaining clip to install on fork tube or clip may become bent or distorted.

e. Slide the retaining clip down the fork tube until it contacts the fork oil seal. Install retaining clip in the fork slider groove.

8. Install fork spring into fork tube.
9. Remove fork assembly from fork tube holder.
10. Place a shop rag on the floor, and turning fork assembly upside down, press end of spring against rag.
11. Install **new** 6mm screw with copper crush washer. Slide screw through hole at bottom of fork slider and start into end of damper tube.
12. While compressing spring to prevent rotation of damper tube, tighten 6mm screw to 132-216 **in-lbs** (14.9-24.4 Nm).
13. Remove fork spring from fork tube.
14. With the fork tube topside, clamp fork slider (not the fork tube) into fork tube holder.

NOTE

Install the drain plug at the bottom of the fork slider, if removed. Tighten the plug to 72-96 ***in-lbs*** *(8-11 Nm).*

15. Pour 11.1 ounces (328 ml) of Harley-Davidson Type E Fork Oil into the fork tube.
16. Adjust the fork oil level, so that it is 5.24 inches (133 mm) from the top of the fork tube with the fork compressed. Proceed as follows:

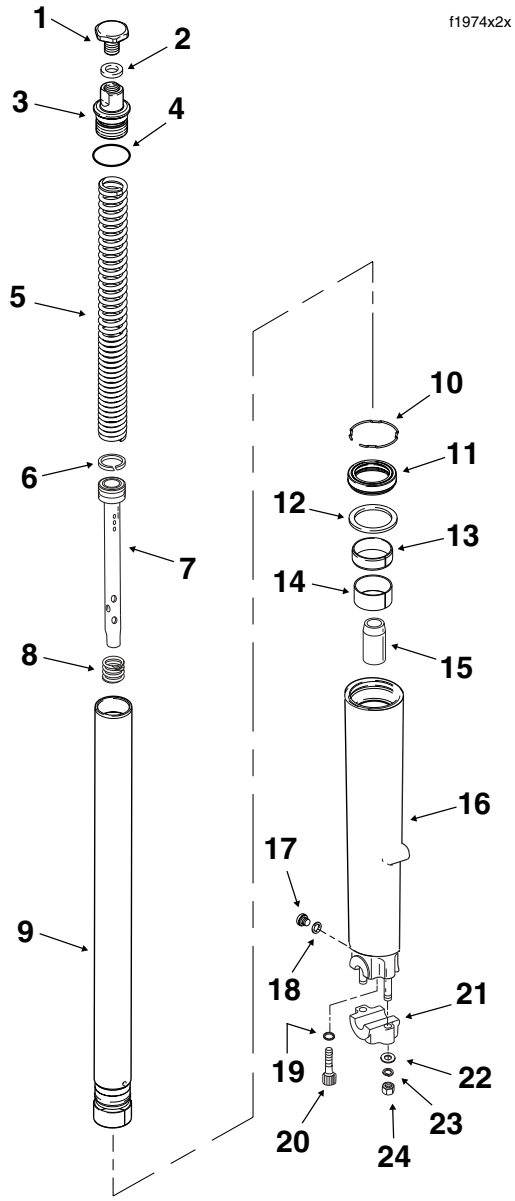
a. Obtain the FRONT FORK OIL LEVEL GAUGE (HD-59000A). See Figure 2-80.

b. Loosen thumbscrew on metal ring and move it up or down the rod until the bottom of the ring is 5.24 inches (133 mm) from the bottom of the rod. Tighten thumbscrew.

c. Push the handle on the cylinder all the way in.

d. Insert rod into top of fork tube until metal ring rests flat on top of fork tube. See Figure 2-81.

e. Pull out handle to suck fork oil from fork tube. Observe fork oil through transparent tube as it is drawn into cylinder. If no oil is drawn through transparent tube, add enough oil so that tool usage sets fork oil level.



1.	Fork cap bolt	13.	Slider bushing
2.	Quad ring seal	14.	Fork leg bushing
3.	Fork tube plug	15.	Lower stop
4.	O-Ring	16.	Fork slider
5.	Spring	17.	Plug
6.	Wear ring	18.	Flat Washer
7.	Damper tube	19.	Copper washer
8.	Rebound spring	20.	Screw (6mm)
9.	Fork tube	21.	Axle holder
10.	Retaining clip	22.	Flat washer (2)
11.	Lip seal	23.	Lockwasher (2)
12.	Slider spacer	24.	Nut (2)

Figure 2-83. Right Side Fork - Conventional Type (All Models)

f. Remove rod from fork tube. Push handle into cylinder to eject excess fork oil into suitable container.

g. If necessary, repeat steps 16(d) thru 16(f). Level is correct when no fork oil is observed being drawn through transparent tube.

⚠WARNING

Be sure fork oil level is correct. The incorrect amount of fork oil can adversely affect handling and may lead to loss of vehicle control, which could result in death or serious injury.

17. With the closer spaced coils at the bottom, slide fork spring into fork tube.
18. Install **new** O-ring onto fork tube plug. Compressing fork spring with end of fork tube plug, thread fork tube plug into fork tube. Tighten fork tube plug to 22-58 ft-lbs (30-79 Nm).
19. Install **new** quad ring seal onto fork cap bolt. Thread fork cap bolt into fork tube plug to prevent loss of fork oil while handling.
20. Loosely install axle holder, flat washers, lockwashers and nuts on studs at end of fork slider.

INSTALLATION

1. Remove fork cap bolt.
2. Standing at front of vehicle, slide fork tube up and into slider cover, lower fork bracket, fork stop, and upper fork bracket. Install fork cap bolt.
3. Move rubber fork stop down fork tube until it contacts top of lower fork bracket. Lubricate surfaces with glass cleaner, if necessary.
4. Install pinch bolt (with lockwasher) on left side of lower fork bracket. See Figure 2-68. Tighten pinch bolt to 30-35 ft-lbs (41-48 Nm).
5. Tighten fork cap bolt to 50-60 ft-lbs (68-81 Nm).
6. Repeat steps 1-5 on other fork, if removed.
7. Install the front fender and wheel. See Section 2.30 FRONT FENDER, INSTALLATION.
8. **FLHT/C/U:**

   a. Slide chrome skirt into position between passing lamp bracket and inner fairing. To avoid possible wire damage, be sure that trim strip is installed on top edge of skirt. Install two screws to secure passing lamp bracket, chrome skirt and inner fairing to lower fork bracket.

   b. Move to front of motorcycle. Install two lower outer fairing screws. Tighten two upper outer fairing screws.

   c. Install fairing cap. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), FAIRING CAP, INSTALLATION

   FLTR:

   a. Install instrument nacelle. See Section 2.28 UPPER FAIRING/WINDSHIELD (FLTR), INSTRUMENT NACELLE, INSTALLATION.

   FLHR/C:

   a. Install headlamp nacelle. See Section 2.29 WINDSHIELD/HEADLAMP NACELLE (FLHR/C), NACELLE 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 2-84.

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.

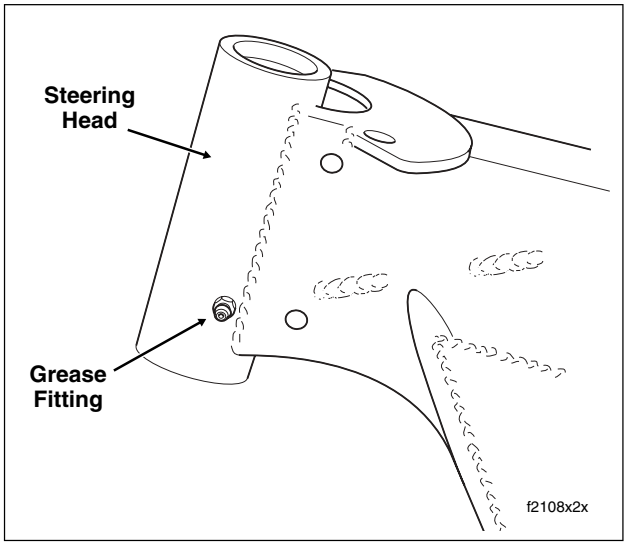


Figure 2-84. Steering Head Bearing Grease Fitting

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 2-85.
4. To correct a swing pattern that is too short or too long, see ADJUSTMENT below.

ADJUSTMENT

1. 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.
2. 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 2-68.
3. Bend tab on lock plate away from flat of fork stem nut. Loosen the fork stem nut. See Figure 2-86.
4. Fashion a bearing adjuster tool using a drill rod 16 inches long. See lower frame of Figure 2-87.

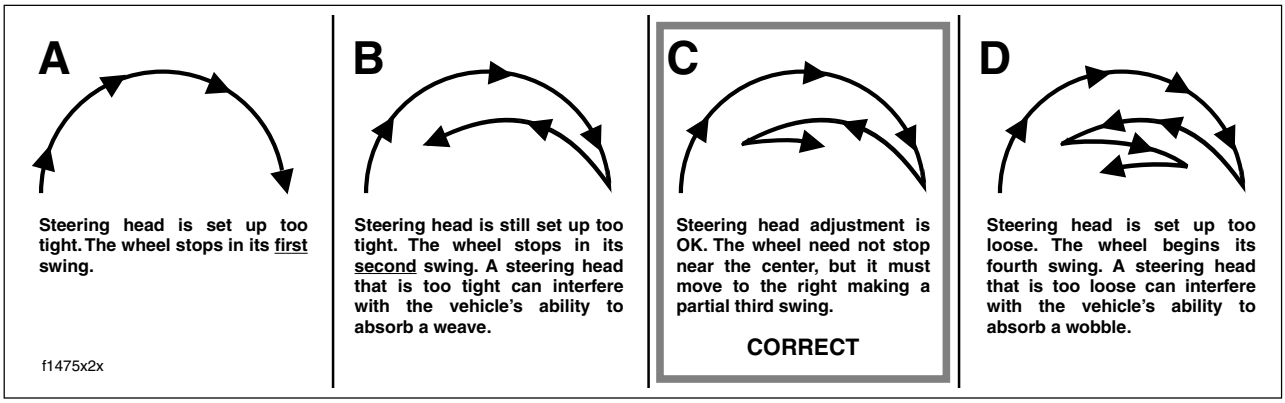


Figure 2-85. Check Steering Head Bearing Swing-By

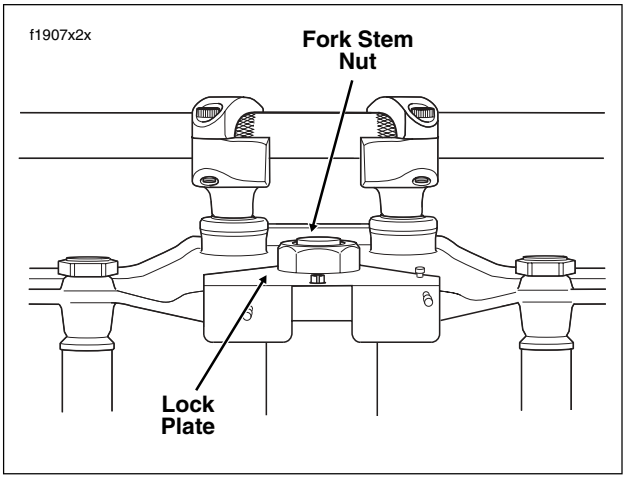


Figure 2-86. Fork Stem Nut

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 60-80 ft-lbs (81-109 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 30-35 ft-lbs (41-48 Nm) and properly position the rubber fork stops.
8. Verify that the fork stem nut is tightened to 60-80 ft-lbs (81-109 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.

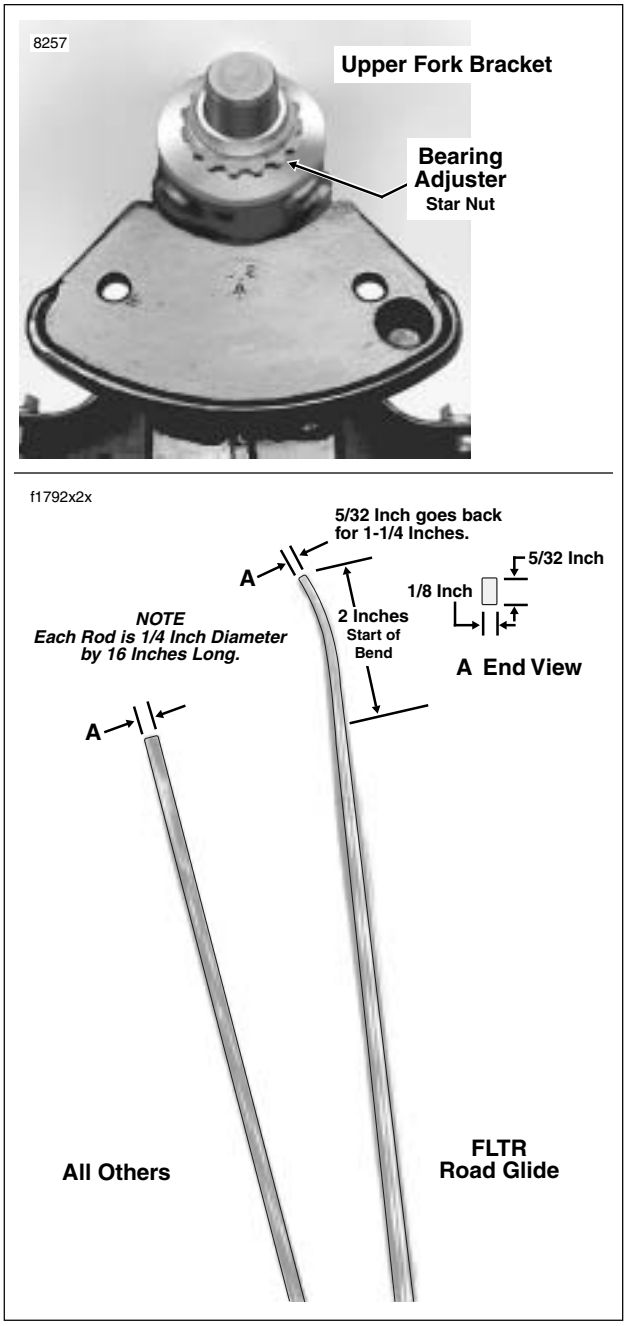


Figure 2-87. Fashion Steering Head Bearing Adjustment Tool From Drill Rod

2. Remove the front wheel and fork sides. 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 2-87. Remove dust shield and bearing from top of steering head.

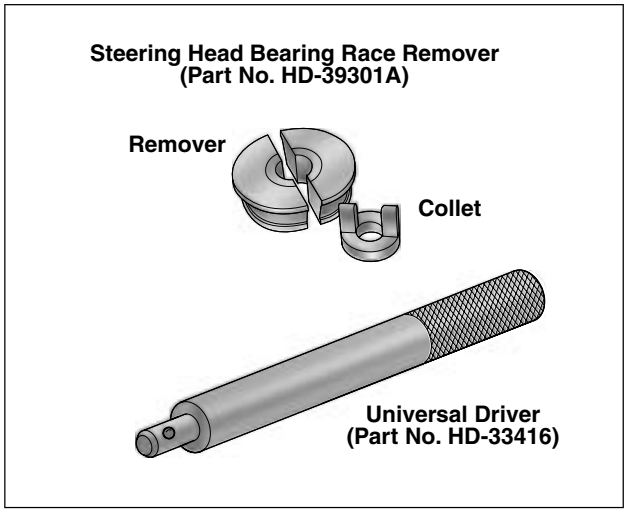


Figure 2-88. Steering Head Bearing Race Removal Tools

INSPECTION

1. Check the bearing races in the steering head. If pitted or grooved, replace both the bearings and races.
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 2-88.

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 2-89.
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 upside down while heating the inner race. Race will expand and fall free.

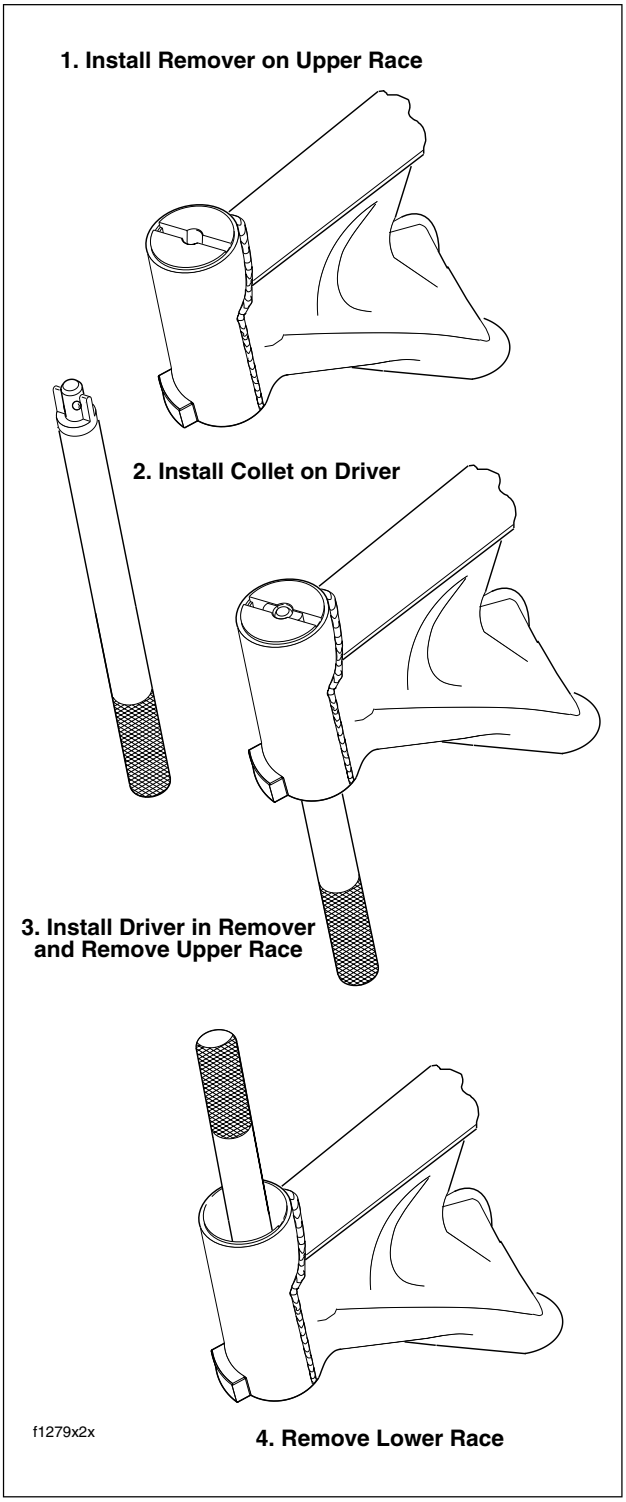


Figure 2-89. Remove Upper and Lower Steering Head Bearing Races

ASSEMBLY

1. Pack **new** bearings with Harley-Davidson SPECIAL PURPOSE GREASE, Part No. 99857-97.
2. Install dust shield on fork stem. Use a sleeve that will contact only the inner race of the new bearing, then press the bearing into place on fork stem.
3. Install new bearing races in steering head using STEERING HEAD BEARING RACE INSTALLATION TOOL, Part No. HD-39302.

INSTALLATION

1. 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

Be sure fork stem nut adjustment is correct. An improperly adjusted 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 60-80 ft-lbs (81-109 Nm). Bend the lockplate tab against the nut flat. See Figure 2-86.
3. Install fork sides, 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 rear suspension. Air pressure may be varied to suit load conditions, riding style and 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.

Table 2-3. Rear Air Suspension Pressures

Shock Loading	Recommended Pressures	
	PSI 0-35	kPa 0-241
Solo rider up to 150 lbs. (68 kg), hereafter referred to as “Average”	0	0
Solo rider 150-200 lbs. (68-91 kg)	0-10	0-69
Solo rider 200-250 lbs. (91-113 kg)	5-15	35-103
Average rider with passenger up to 150 lbs. (68 kg)	10-15	69-103
Average rider with passenger up to 200 lbs. (91 kg)	20-25	138-172
Maximum GVWR (see Section 2.1 Specifications)	20-35	138-241

⚠WARNING

Use this table as a starting point in determining suitable rear air suspension pressures. Do not exceed maximum GVWR when loading vehicle and do not pressurize system in excess of 35 psi (241 kPa). Excessive load weight and/or air suspension pressure can adversely affect handling and lead to loss of vehicle control, which could result in death or serious injury.

CAUTION

Improper inflation of rear air suspension components also can result in a reduction of available suspension travel, reduced rider comfort and possible damage to shock absorbers.

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.

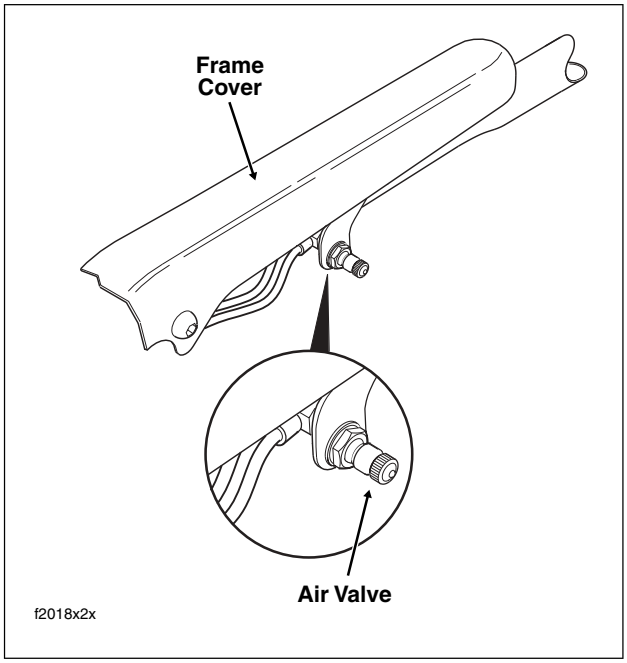


Figure 2-90. Rear Air Suspension Air Valve (Under Protective Cap)

CAUTION

Use a no-loss air gauge to check air pressure. Check pressure in 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.

⚠WARNING

Exercise caution when bleeding air from the air valve. 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.

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 left side of the vehicle. See Figure 2-90. Always adjust pressures with the vehicle on the jiffy stand.

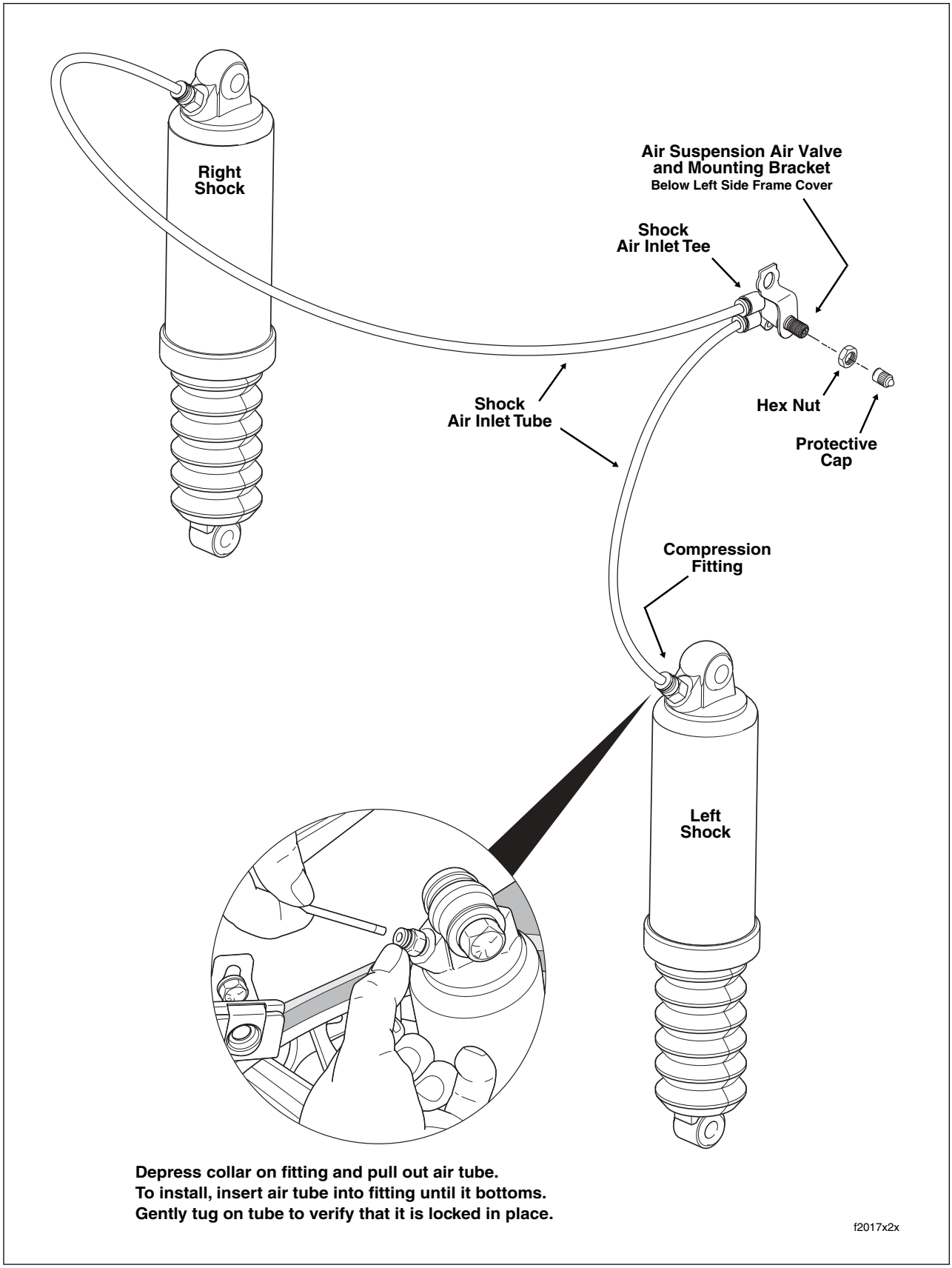


Figure 2-91. Rear Air Suspension System

REMOVAL/INSTALLATION

Remove and replace components as necessary. Check for air leaks as follows:

1. Remove left side saddlebag. See Section 2.23 SADDLEBAG, REMOVAL.
2. Remove protective cap from air valve. Install the no-loss air gauge and set to correct pressure. See Table 2-3. Remove the gauge and wait overnight.
3. Recheck air pressure. If no leakage is observed, move to step 8. If a loss of 5-10 psi (34.5-68.9 kPa) is noted, then proceed to step 4.
4. Pressurize rear air suspension system and check for leaks as described below.

Compression Fitting:

5. Spray or brush a light film of soapy water on the compression fitting at the top of each shock absorber. If no leakage is observed, move to step 6. If leakage is noted, proceed as follows:
   a. Depress pin in valve to bleed air from shocks. To purge lines of any oil, add 3-5 psi (20.7-34.5 kPa) before releasing air.
   b. Remove air tube from compression fitting. 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.
   c. Pressurize rear air suspension system and check for leaks. If leakage continues, proceed to step 5(d).
   d. Remove air tube from compression fitting. Remove compression fitting from shock absorber.
   e. Apply PIPE SEALANT WITH TEFLON to the threads of a **new** compression fitting and install in shock absorber.
   f. Install air tube in compression fitting.
   g. Pressurize rear air suspension system and check for leaks. If no leakage is observed, move to step 8. If leakage continues, proceed to step 6.

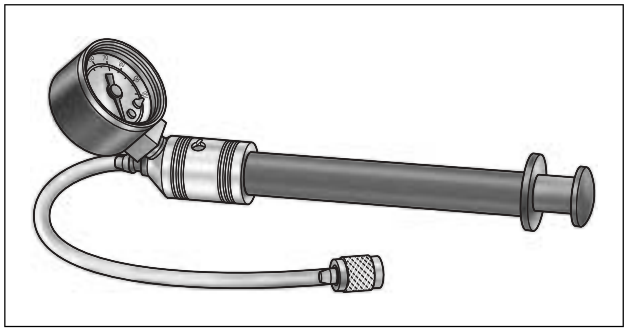


Figure 2-92. Air Suspension Pump and Gauge (Part No. HD-34633)

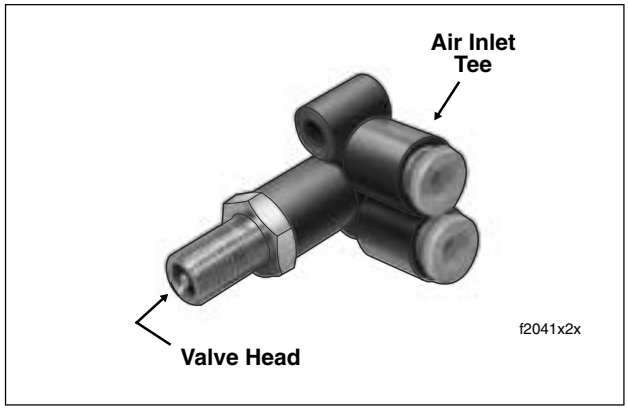


Figure 2-93. Air Valve Assembly

Air Valve Assembly:

6. Spray or brush a light film of soapy water into the valve head and where the air tubes exit the air inlet tee. If leakage is not observed at either location, move to step 7. If leakage is noted, proceed as follows:
   a. If leakage is at the air inlet tee, proceed to step 6(b). If leakage is at the valve head, proceed to step 6(e).
   b. Depress pin in valve to bleed air from shocks. To purge lines of any oil, add 3-5 psi (20.7-34.5 kPa) before releasing air.
   c. Remove air tubes from air inlet tee. 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.
   d. Pressurize rear air suspension system and check for leaks. If no leakage is observed, move to step 8. If leakage continues, proceed to step 6(e).
   e. Using a valve core tool, verify that valve core is properly tightened. If leakage continues, proceed to step 6(f).
   f. Depress pin in valve to bleed air from shocks. To purge lines of any oil, add 3-5 psi (20.7-34.5 kPa) before releasing air.
   g. Remove hex nut from valve head. See Figure 2-91.
   h. Push on valve head to free air valve assembly from mounting bracket. See Figure 2-93.
   i. Remove air tubes from air inlet tee.
   j. Insert air tubes into air inlet tee of **new** air valve assembly.
   k. From inboard side, insert valve head through hole in mounting bracket. Install hex nut on valve head (flat side facing inboard). Tighten nut to 40-50 **in-lbs** (4.5-5.6 Nm).
   l. Pressurize rear air suspension system and check for leaks.

m. If no leakage is observed, move to step 8. If leakage continues, reinstall old air valve assembly and proceed to step 7.

Air Tubes:

7. Inspect air tubes for kinks, cuts, holes, chafing or other damage that may result in air leaks. If tube replacement is necessary, proceed as follows:
   a. Remove seat. See Section 2.22 SEAT, REMOVAL.
   b. Depress pin in valve to bleed air from shocks. To purge lines of any oil, add 3-5 psi (20.7-34.5 kPa) before releasing air.
   c. Remove air tubes from air inlet tee. Remove opposite end of tubes from compression fittings. See Figure 2-91.
   d. Cut bulk tube to proper length.
   e. Insert **new** tubes into air inlet tee. Install opposite end of tubes into compression fittings.
   f. Pressurize rear air suspension system.
   g. Install seat. See Section 2.22 SEAT, INSTALLATION.
8. Install protective cap on air valve.
9. Install left side saddlebag. See Section 2.23 SADDLEBAG, INSTALLATION.

REAR SHOCK ABSORBERS 2.17

ADJUSTMENT

For the correct air pressure, see Section 2.16 REAR AIR SUSPENSION.

REMOVAL

NOTE

If replacing both shock absorbers, remove and install one shock at a time. Remove and install the second shock only after the first shock is installed, but before the air suspension system is pressurized.

1. Place the motorcycle on a hydraulic center stand with the rear wheel raised off the ground.
2. Remove saddlebags. See Section 2.23 SADDLEBAG, REMOVAL.

⚠WARNING

Exercise caution when bleeding air from the air valve. 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.

3. Remove protective cap from air valve. Using a no-loss AIR SUSPENSION PUMP AND GAUGE (Part No. HD-34633), add 3-5 psi (20.7-34.5 kPa) to purge lines of any oil.
4. Depress pin in valve to bleed air from shocks.
5. Depress collar on compression fitting to release air tube. See upper frame of Figure 2-94.
6. Remove the upper shock mounting bolt with lockwasher and flat washer. See lower frame of Figure 2-94.
7. Remove the lower shock mounting bolt with lockwasher and flat washer. Remove the shock absorber assembly from the vehicle.

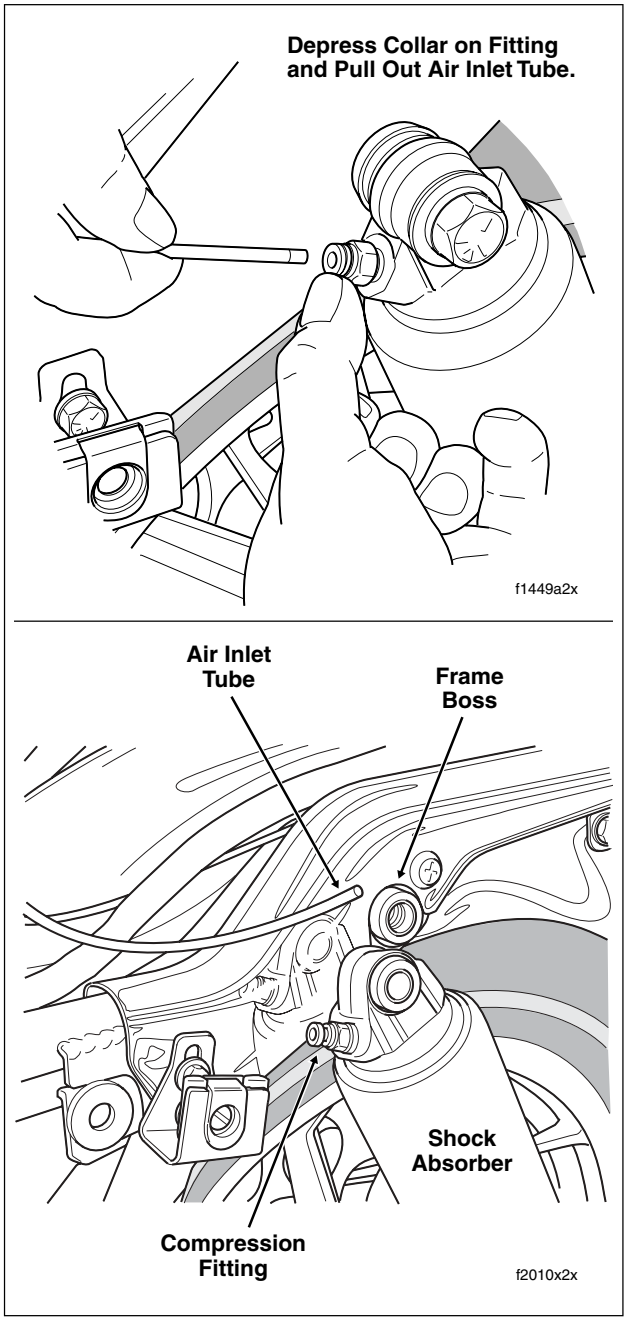


Figure 2-94. Remove Air Inlet Tube and Upper Shock Mounting Bolt (Left Side View)

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 parts that are worn or damaged.

ASSEMBLY

NOTE

If the compression fittings were removed, apply PIPE SEALANT WITH TEFLON to the threads before assembly.

INSTALLATION

1. Install lockwasher and flat washer on the lower shock mounting bolt. Insert bolt through the shock bottom bushing.
2. Apply two or three drops of Loctite Medium Strength Threadlocker 243 (blue) to threads.
3. Start bolt into rear swingarm mount. Tighten bolt to 35-40 ft-lbs (47-54 Nm).
4. Install lockwasher and flat washer on the upper shock mounting bolt. Insert bolt through the shock upper bushing
5. Apply two or three drops of Loctite Medium Strength Threadlocker 243 (blue) to threads.
6. Start bolt into frame boss. Tighten bolt to 33-35 ft-lbs (45-48 Nm).
7. Insert air tube into compression fitting until it bottoms. Gently tug on tube to verify that it is locked in place.

NOTE

If replacing both shock absorbers, remove and install the other shock at this time.

8. Pressurize rear air suspension system and check for leaks. For the correct air pressure, see Section 2.16 REAR AIR SUSPENSION.
9. Install saddlebags. See Section 2.23 SADDLEBAG, INSTALLATION.

REAR SWINGARM 2.18

REMOVAL

1. Remove saddlebags. See Section 2.23 SADDLEBAG, REMOVAL.
2. Remove socket screw with lockwasher to remove passenger footboard from rear swingarm bracket. Repeat step on opposite side of vehicle.
3. Remove both mufflers as follows:

Left Side

a. Open worm drive clamps to remove heat shield from crossover pipe in front of muffler.

b. Using a bungee cord, tie the muffler to the lower saddlebag support rail.

c. Loosen TORCA clamp between crossover 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.

Right Side

a. Open worm drive clamps to remove heat shield from rear header pipe in front of muffler.

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.

4. Place the motorcycle on a hydraulic center stand. Slide a block of wood beneath the oil pan to support the weight of the transmission once the pivot shaft is removed.
5. Standing on right side of vehicle, remove E-clip from groove at end of axle.
6. Remove cone nut and adjuster cam from axle.
7. Using a soft mallet, gently tap end of axle towards left side to loosen. Catching external spacers on right and left side of hub, pull axle free of wheel and rear swingarm.
8. 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.

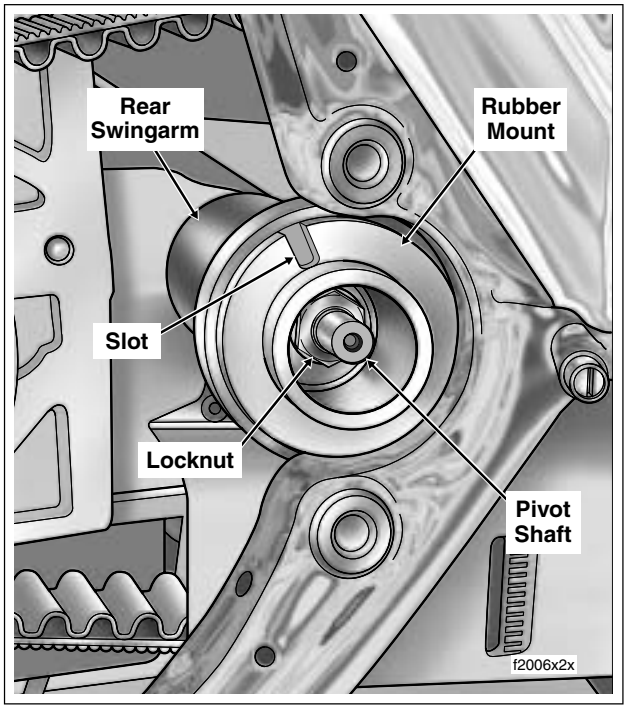


Figure 2-95. Remove Rear Swingarm Bracket (Left Side View)

9. Remove caliper from anchor weldment on rear swingarm, and carefully hang over lower saddlebag support rail.
10. Roll wheel forward and slip belt off sprocket. Move wheel out from beneath rear fender.
11. Remove belt guard from bottom of left side swingarm. First remove two rear screws, and then loosen front screw. Push belt guard toward the front of the vehicle until screw engages large end of slot, and then remove.
12. Remove lower shock mounting bolt (with lockwasher and flat washer) to release shock absorber from rear swingarm mount. Repeat step on opposite side of vehicle.
13. Remove two bolts (with lockwashers) to free rear swingarm bracket from left side of vehicle frame. See Figure 2-95.
14. Moving to right side of vehicle, leave rear swingarm bracket installed, but remove decorative chrome plug.
15. Open two cable clips on T-studs at top of right side swingarm. Free rear brake line hose 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.

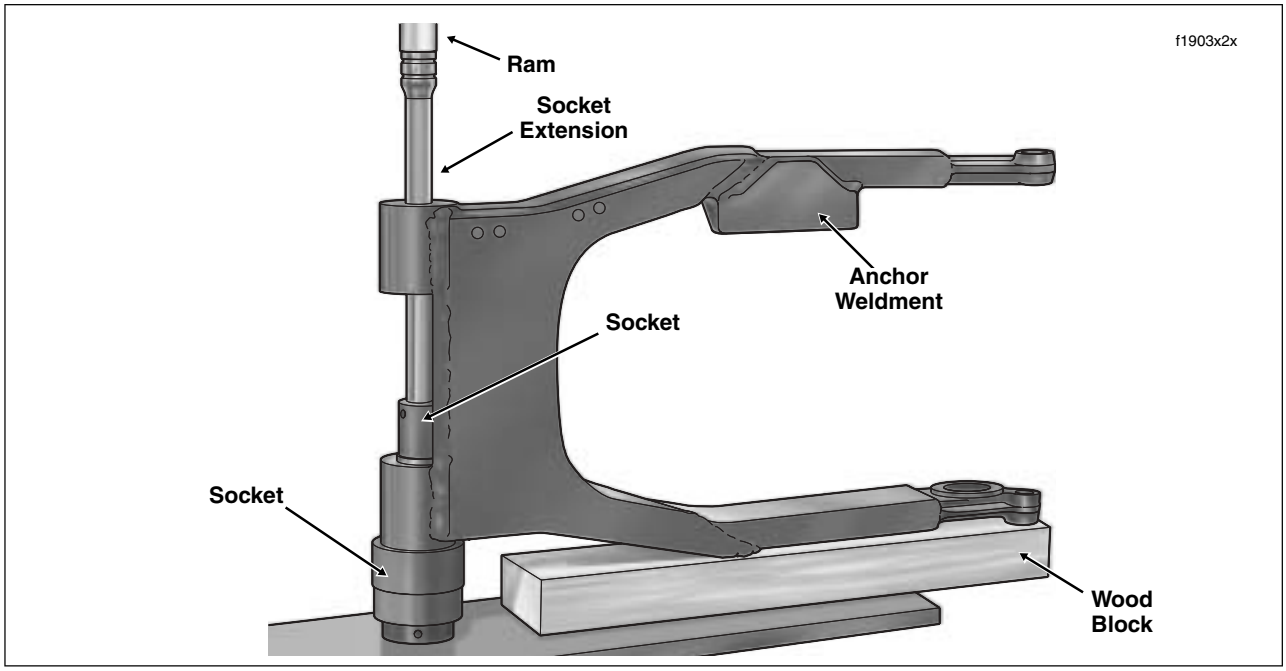


Figure 2-96. Press Out Drive Side Bearing

16. Holding left side nut within rubber mount, remove right side locknut from end of pivot shaft. Remove cup washer.
17. Using a suitable drift, tap pivot shaft toward left side of vehicle.
18. Moving to left side, pull pivot shaft assembly (pivot shaft, locknut, cup washer, rubber mount and outer spacer) out of transmission mount and left side swingarm. See Figure 2-100.
19. Standing at rear of vehicle, work rear swingarm free of transmission mount and rear swingarm brackets.
20. Remove outer spacer from right side swingarm tube.
21. Remove rubber mount from behind right side swingarm bracket.

DISASSEMBLY/ASSEMBLY

Bearing Removal

1. Move rear swingarm to an hydraulic press.
2. Place swingarm on its side, so that the brake side is on top. The brake side is easily recognized by the anchor weldment for mounting of the brake caliper.
3. Support the swingarm with a block of wood and a large socket as shown in Figure 2-96. Verify that assembly is square and the bearing bore is completely vertical.

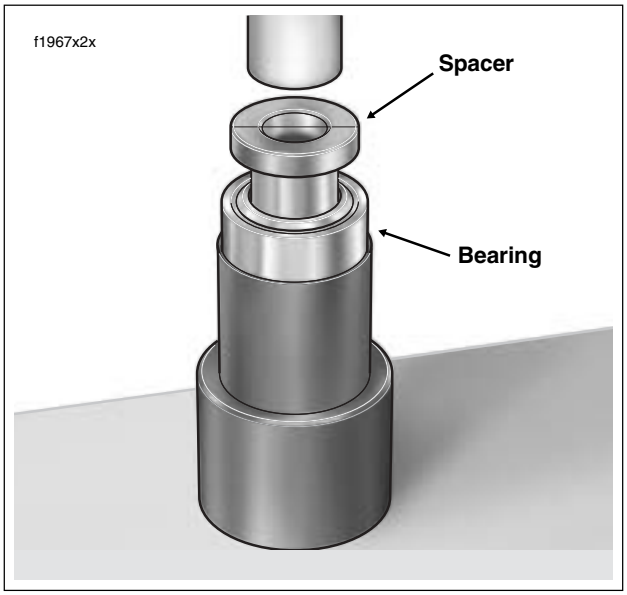


Figure 2-97. Press Spacer Into Bearing

4. Slide driver handle (or long socket extension) through the brake side swingarm tube and bearing until it contacts driver (or large socket) placed on inboard side of drive side bearing.
5. Center driver handle (or long socket extension) under ram and press drive side bearing from rear swingarm.
6. Remove tools from rear swingarm. Turn swingarm over and repeat steps 3-5 to press out brake side bearing.

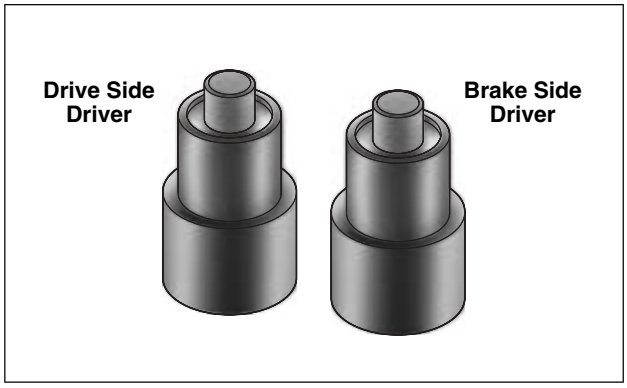


Figure 2-98. Rear Swingarm Bearing Installer (HD-45327)

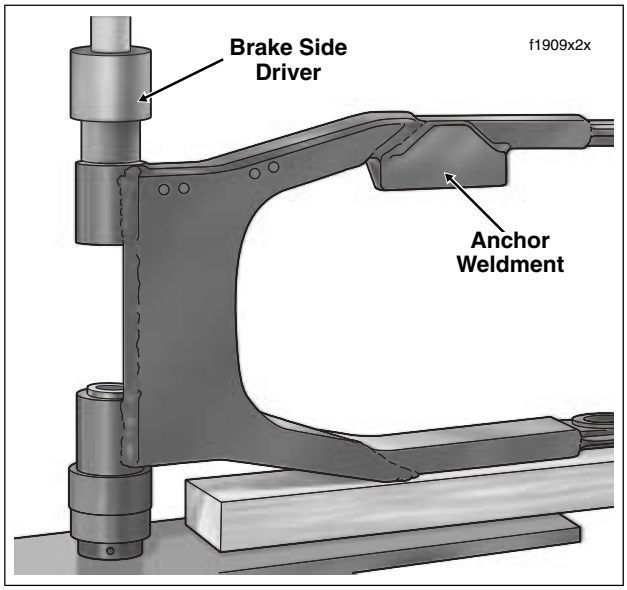


Figure 2-99. Press In Brake Side Bearing

Bearing Installation

1. Obtain **new** rear swingarm bearings. Bearings and spacers must be assembled before installation. Proceed as follows:
   a. Obtain REAR SWINGARM BEARING INSTALLER (HD-45327). See Figure 2-98.
   b. With the nose topside, center one of the drivers under ram of hydraulic press.
   c. Place bearing over nose of driver. With the collar topside, place spacer over nose and into bearing. See Figure 2-97.
   d. Apply pressure to spacer until it bottoms in bearing.
   e. Repeat step to assemble second swingarm bearing.
2. Install assembled bearings into rear swingarm. Proceed as follows:
   a. Place swingarm on its side, so that the brake side is on top. The brake side is easily recognized by the anchor weldment for mounting of the brake caliper.
   b. With the spacer inboard, insert bearing into outboard side of brake side swingarm tube.
   c. Insert driver stamped “Brake Side” into swingarm tube until it contacts installed bearing. Center driver under ram and press on brake side bearing until shoulder on tool makes contact with casting of swingarm. See Figure 2-99.
   d. Remove tool and turn rear swingarm over. With the spacer inboard, insert bearing into outboard side of drive side swingarm tube.
   e. Insert driver stamped “Drive Side” into swingarm tube until it contacts installed bearing. Center driver under ram and press on drive side bearing until it bottoms. Shoulder on tool will **not** make contact with casting of swingarm.
   f. Remove tool from swingarm. Remove swingarm from hydraulic press.

Pivot Shaft Disassembly

1. Partially install locknut on right side of pivot shaft. Install second locknut on right side until it contacts the first. Holding first locknut to prevent rotation of shaft, remove left side locknut. See Figure 2-100.
2. Remove cup washer, rubber mount and outer spacer.
3. Remove right side locknuts from pivot shaft.

Pivot Shaft Assembly

1. With larger OD outboard, slide outer spacer onto left side of pivot shaft until counterbore contacts shoulder on shaft.
2. Install rubber mount with the flat side inboard toward outer spacer.
3. Install cup washer with the concave side facing in toward the rubber mount.

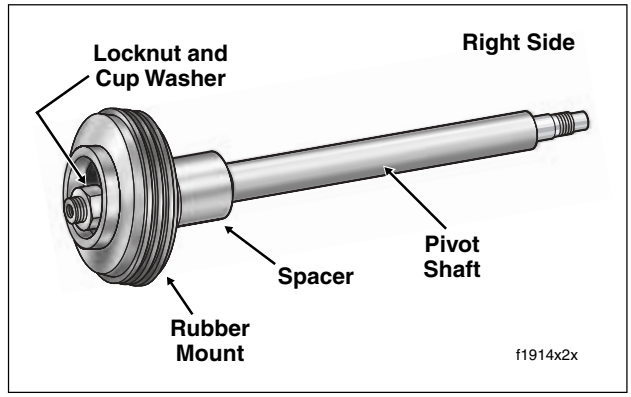


Figure 2-100. Pivot Shaft Assembly

4. Apply two drops of Loctite Medium Strength Threadlocker 243 (blue) to threads of left side locknut, and then start on shaft.
5. Partially install locknut on right side of pivot shaft. Install second locknut on right side until it contacts the first. Holding second locknut to prevent rotation of shaft, tighten left side locknut to 40-45 ft-lbs (54-61 Nm).
6. Remove right side locknuts from pivot shaft.

INSTALLATION

1. With the slot on the outboard side between the twelve and one o'clock positions, install rubber mount behind rear swingarm bracket on right side of vehicle. Be sure that index tab cast on inboard side of bracket fully engages slot in rubber mount.
2. Place outer spacer into right side swingarm tube.
3. With the belt on the inboard side of the left side swingarm, work the rear swingarm into position between the transmission mount and the rear swingarm brackets. Use a rubber mallet and carefully tap swingarm into position, if necessary.
4. The pivot shaft secures the rear swingarm and transmission to the vehicle frame. See Figure 2-100. Install the pivot shaft as follows:
   a. Coat pivot shaft with Loctite ANTI-SEIZE LUBRICANT.
   b. From left side of vehicle, slide pivot shaft assembly (pivot shaft, locknut, cup washer, rubber mount and outer spacer) through left side swingarm and transmission mount. After exiting right side swingarm, guide end of pivot shaft through holes in rubber mount and right side swingarm bracket.
   c. With the concave side inboard, slide cup washer onto end of pivot shaft.
   d. Install locknut on pivot shaft. Holding left side nut on pivot shaft, tighten locknut to 40-45 ft-lbs (54-61 Nm). Now hold right side nut and tighten left side locknut using the same torque value.
   e. Carefully raise swingarm up and down slightly to verify movement (and that assembly is not in a bind).
   f. Install decorative chrome plug in right side rear swingarm bracket.
   g. Moving to left side of vehicle, rotate the rubber mount so that the slot is between the eleven and twelve o'clock positions. Install left side swingarm bracket fitting index tab into rubber mount slot. See Figure 2-95.
   h. Install two bolts (with lockwashers) to secure left side swingarm bracket to vehicle frame. Tighten bolts to 34-42 ft-lbs (46-57 Nm).
5. Install lockwasher and flat washer on the lower shock mounting bolt. Insert bolt through the shock bottom bushing. Apply two or three drops of Loctite Medium Strength Threadlocker 243 (blue) to threads. Start bolt into rear swingarm mount. Tighten bolt to 35-40 ft-lbs (47-54 Nm). Repeat step on opposite side of vehicle.
6. Install belt guard at bottom of left side swingarm. Push belt guard toward the rear of the vehicle until front screw engages small end of slot. Install two rear screws, and then tighten front screw.
7. Capture rear brake line hose in two cable clips at top of right side swingarm. Snap cable clips closed.
8. 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 (127 mm) in diameter. Sharp bending can weaken the belt and cause premature failure.

9. Seat caliper on anchor weldment of rear swingarm. Position wheel in swingarm, so that brake disc is centered between brake pads.
10. Coat the axle with ANTI-SIEZE LUBRICANT.
11. With the larger OD on the outboard side, hold external spacer between rear swingarm and belt sprocket. Slide axle through left side of rear swingarm, external spacer, and belt sprocket into wheel hub.
12. When axle emerges from hub on brake disc side of wheel, push axle through **short** external spacer, caliper bracket and right side of rear swingarm.
13. Rotate axle so that the flat on the threaded end is topside. With the thumb down and the cam forward, install adjuster cam on end of axle.
14. Apply a thin film of ANTI-SIEZE LUBRICANT to the inboard side of the cone nut avoiding contact with threads. Install cone nut on axle, but finger tighten only.
15. Verify that adjuster cam just contacts weld nub on both sides of rear swingarm. If necessary, push wheel forward slightly to achieve the desired result. Snug the cone nut to 15-20 ft-lbs (20-27 Nm). See Figure 2-101.
16. Lower hydraulic center stand so that the motorcycle is on the ground.
17. Rotate weld nut on left side of axle in a clockwise direction.
18. Check deflection at the tightest spot in the belt. 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 as follows:

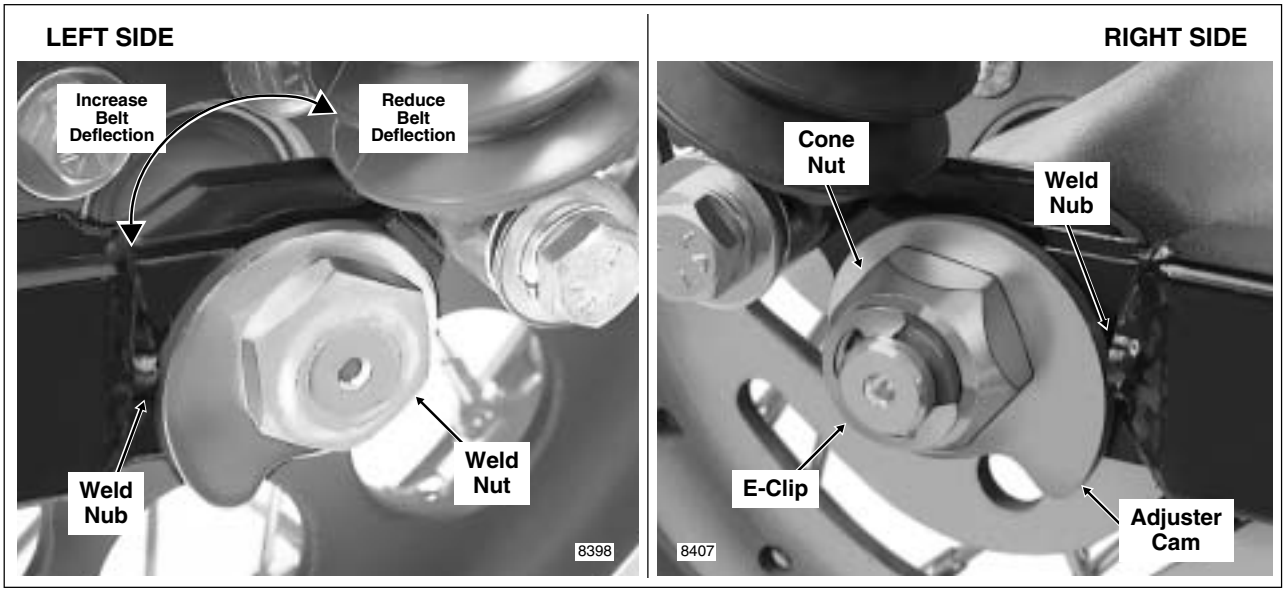


Figure 2-101. Move Rear Wheel Forward Until Adjuster Cams Just Contact Weld Nubs

Table 2-4. Belt Deflection on the Ground

Orientation	Inches	Millimeters
On Ground Without Rider	5/16 - 3/8	7.9 - 9.5
On Ground With Rider 11.5 inches (292 mm) Between Shock Eyelets	1/4 - 5/16	6.4 - 7.9

19. If belt is too tight, move to step 20 to increase belt deflection. If belt is too loose, reduce belt deflection as described below:
    a. Rotate weld nut on left side of axle in a clockwise direction.
    b. Check belt deflection. Apply 10 lbs. (4.5 kg) of force at the midpoint of the bottom belt strand. Belt deflection should be within the range specified in Table 2-4.
    c. If belt is still too loose, repeat steps 19(a) through 19(b). If belt is now too tight, move to step 20.

20. If belt is too tight, increase belt deflection as follows:
    a. Raise motorcycle so that the rear wheel is off the ground.
    b. Rotate weld nut on left side of axle in a counterclockwise direction.
    c. Push wheel forward slightly so that adjuster cam just contacts weld nub on both sides of rear swingarm. See Figure 2-101.
    d. Lower hydraulic center stand so that the motorcycle is on the ground.
    e. Check belt deflection. Apply 10 lbs. (4.5 kg) of force at the midpoint of the bottom belt strand. Belt deflection should be within the range specified in Table 2-4.
    f. If belt is still too tight, repeat steps 20(a) through 20(e). If belt is now too loose, move to step 19.

21. **Holding** weld nut on left side of axle, tighten cone nut on right side to 95-105 ft-lbs (128.8-142.4 Nm).

NOTE

If the axle moves during tightening of the cone nut, then the the belt deflection procedure must be restarted.

22. Recheck belt deflection to verify that it is still within specification.

    If the belt deflection is not within specification, loosen cone nut and then snug to 15-20 ft-lbs (20-27 Nm) before returning to step 19.

23. With the flat side out, install **new** E-clip in groove on right side of axle.

24. Depress rear brake pedal several times to set brake pads to proper operating position within caliper.

⚠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.

25. Install both mufflers 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.

Left Side

a. Slide **new** TORCA clamp onto free end of crossover pipe.

b. Using a bungee cord, tie muffler to lower saddlebag support rail. Install muffler on crossover pipe. Place TORCA clamp into position between crossover 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 crossover 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.

Right Side

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.

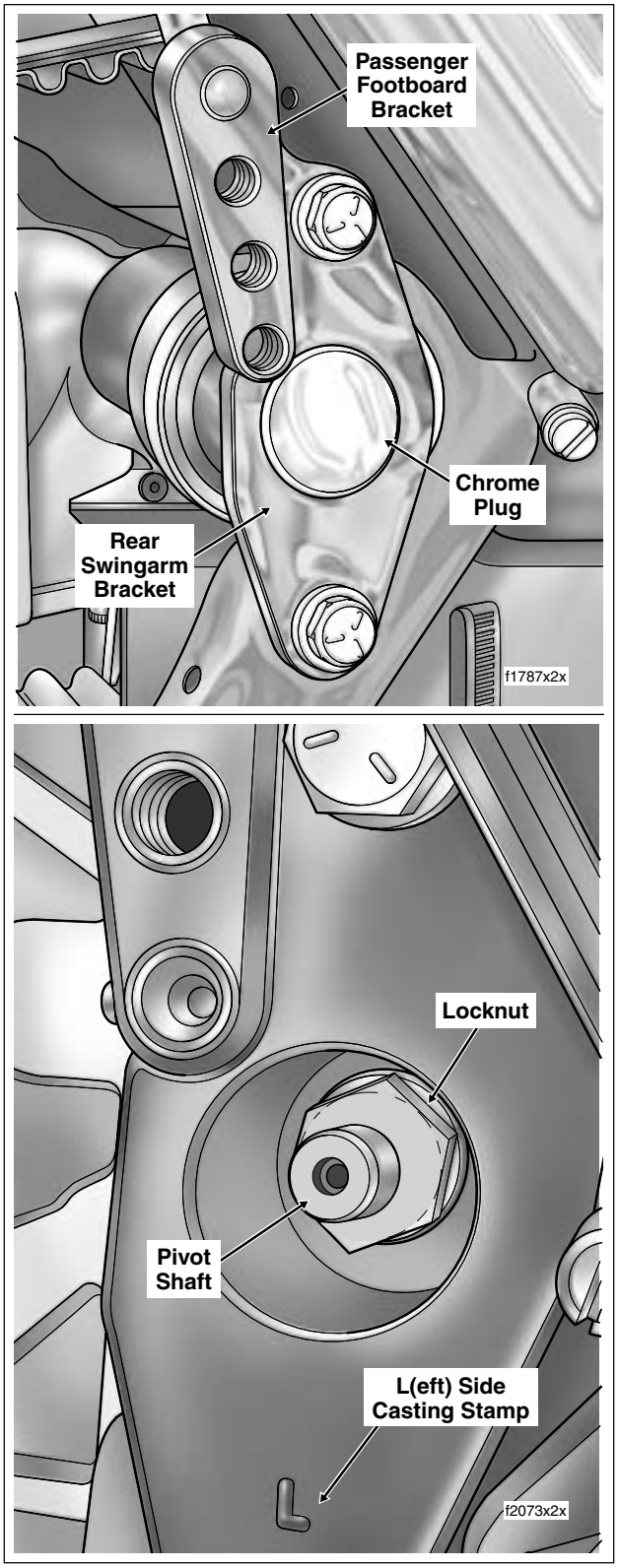


Figure 2-102. Remove Chrome Plugs and Check Pivot Shaft Locknut Torque (Left Side View)

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.

26. Install socket screw with lockwasher to fasten passenger footboard to rear swingarm bracket. Tighten screw to 15-18 ft-lbs (20-24 Nm). Repeat step on opposite side of vehicle.

27. Install saddlebags. See Section 2.23 SADDLEBAG, INSTALLATION.

NOTE

Remove the decorative chrome plugs in the rear swingarm brackets and check the torque on the pivot shaft locknuts every 10,000 miles (16,000 km). See Figure 2-102. Holding right side nut on the pivot shaft, tighten left side locknut to 40-45 ft-lbs (54-61 Nm). Then hold left side nut and tighten right side locknut using the same torque value.

NOTES

THROTTLE CABLES (NON-CRUISE) 2.19

ADJUSTMENT

NOTE

For throttle and idle cable adjustment or replacement on cruise equipped models, see Section 8.28 CRUISE CONTROL (FLHRC, FLTR, FLHTCU).

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 2-103. 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 counter-clockwise until the throttle cam stop just touches the stop plate. See Figure 2-104. Release the throttle control grip and then tighten the jam nut against the throttle cable adjuster. 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 cable guide (as seen through slot). 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.

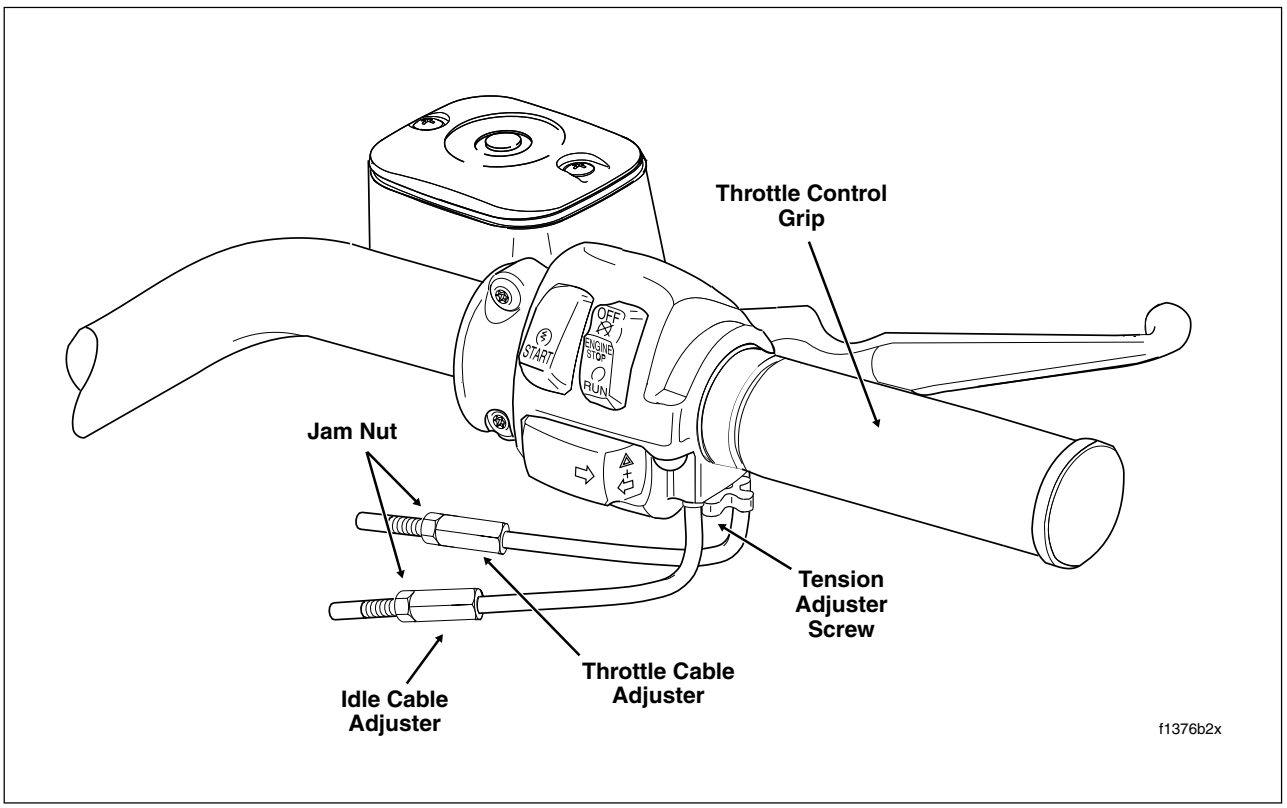


Figure 2-103. Throttle Cable Assembly - Throttle Side (FLHR)

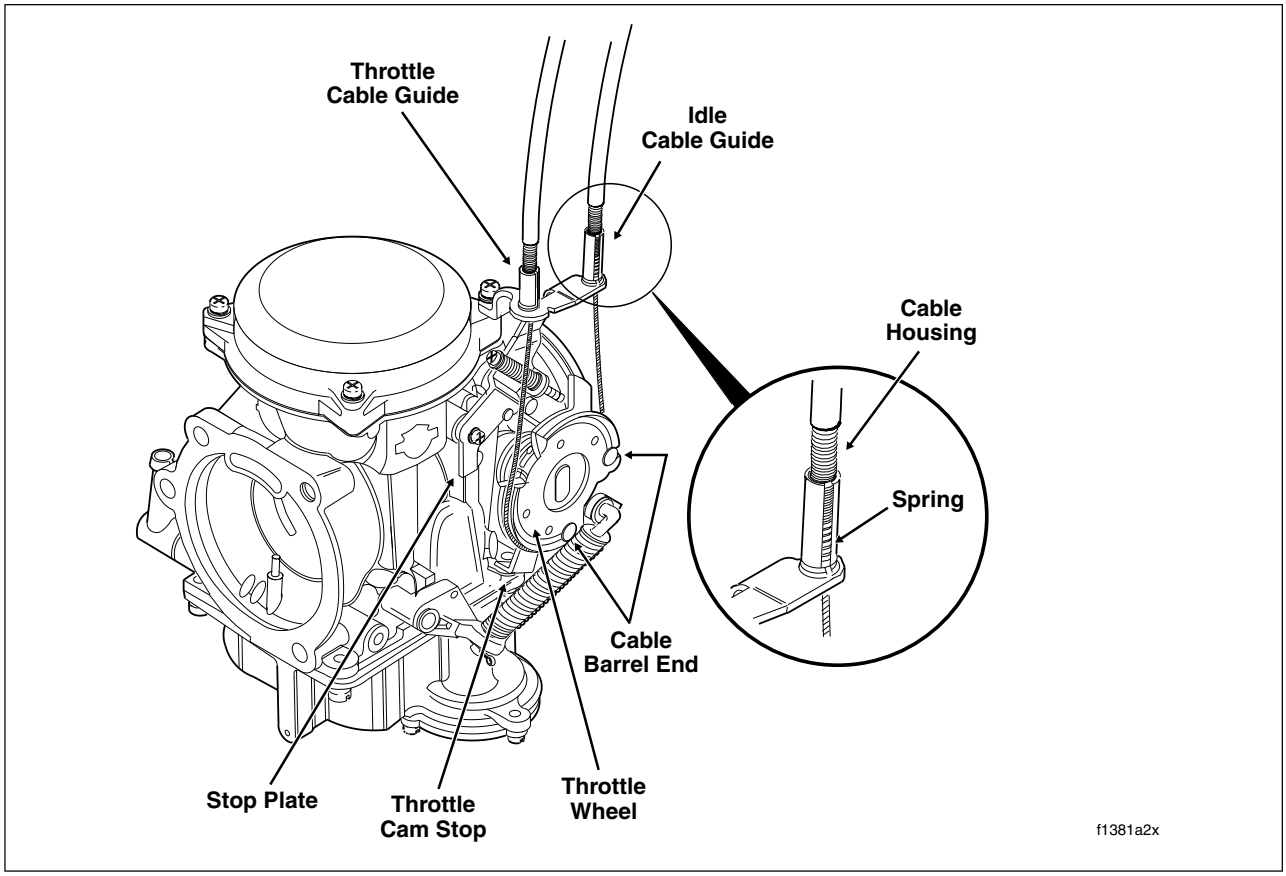


Figure 2-104. Throttle Cable Assembly - Carburetor Side

REMOVAL

THROTTLE SIDE

CAUTION

Do not remove the switch housing assembly without first placing the 5/32 inch (4.0 mm) 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 2-105.
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.

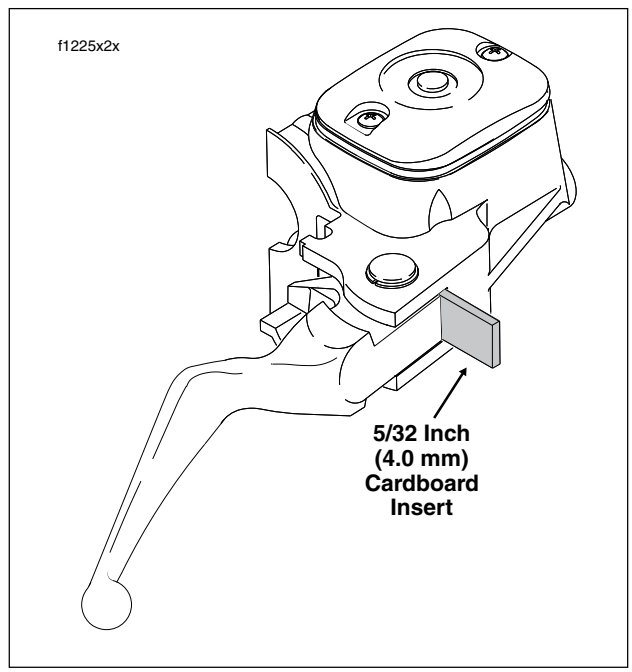


Figure 2-105. Install Cardboard Insert

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 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. See Section 4.5 AIR CLEANER, REMOVAL.
2. Raise fuel tank to access cables in area of frame backbone. For carbureted models, see Section 4.7 FUEL TANK (CARBURETED), PARTIAL REMOVAL, FLHT/C, FLTR, or FLHR. For fuel injected models, see Section 9.4 FUEL TANK (FUEL INJECTED), PARTIAL REMOVAL, FLHT/C/U/I, FLTRI, or FLHR/C/S/I.
3. **Carbureted:** Using a needle nose pliers, carefully pull idle cable barrel from upper inboard hole in throttle wheel. Pull throttle cable barrel from remaining hole. Release idle and throttle cables from guides in throttle cable bracket. See Figure 2-104.

   Induction Module: Using a needle nose pliers, carefully pull idle cable barrel from upper hole in throttle wheel. Pull throttle cable barrel from lower hole. Using slots, release idle and throttle cables from guides in throttle cable bracket. See Figure 2-108.
4. Cut and discard 14 inch cable strap capturing frame backbone, wire bundles, and idle and throttle cables.
5. Free cables from J-clamp riveted to right side of frame backbone.
6. If present, remove screw (with flat washer) to release J-clamp from wellnut in right side of steering head. Remove J-clamp from cables.

CLEANING AND INSPECTION

1. Clean all parts in a non-flammable cleaning solvent and blow dry with compressed air.

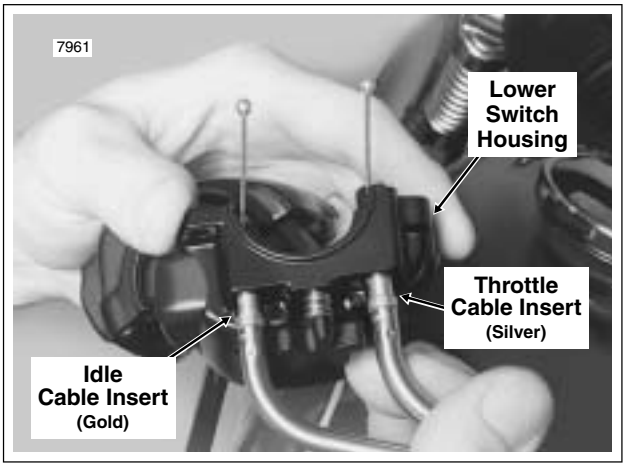


Figure 2-106. Install Throttle/Idle Cables in Lower Switch Housing

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 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 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 cables into the lower switch housing until they snap in place. See Figure 2-106. Proceed as follows:

   Note the different diameter inserts crimped into the end of the throttle and idle 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.

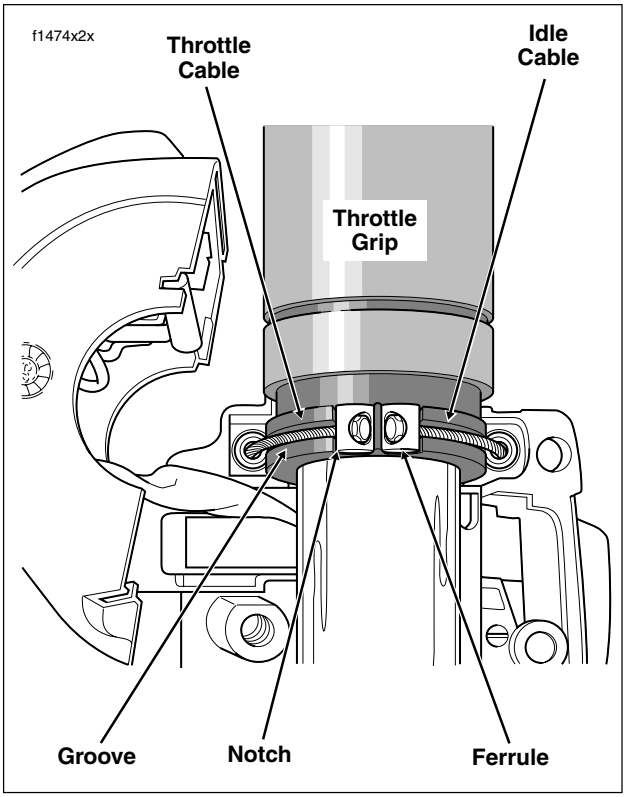


Figure 2-107. Install Throttle/Idle Cables on Throttle Control Grip

3. 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.

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 2-107.

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 toward the rear 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 toward the rear along the right side of the steering head. Capture cables in J-clamp and then start screw (with flat washer) to fasten J-clamp to wellnut in right side of steering head. Tighten screw to 9-18 **in-lbs** (1.0-2.0 Nm).

2. Route the throttle and idle cables rearward along the right side of the frame backbone. After passing through J-clamp riveted to frame backbone, route cables downward to carburetor/induction module.

3. **Carbureted:** Install sleeve on throttle cable housing into shorter cable guide in throttle cable bracket. Drawing throttle cable downward, fit barrel end into lower outboard hole in throttle wheel. Install sleeve and spring on idle cable housing into longer cable guide inserting barrel end into upper inboard hole in throttle wheel. See Figure 2-104.

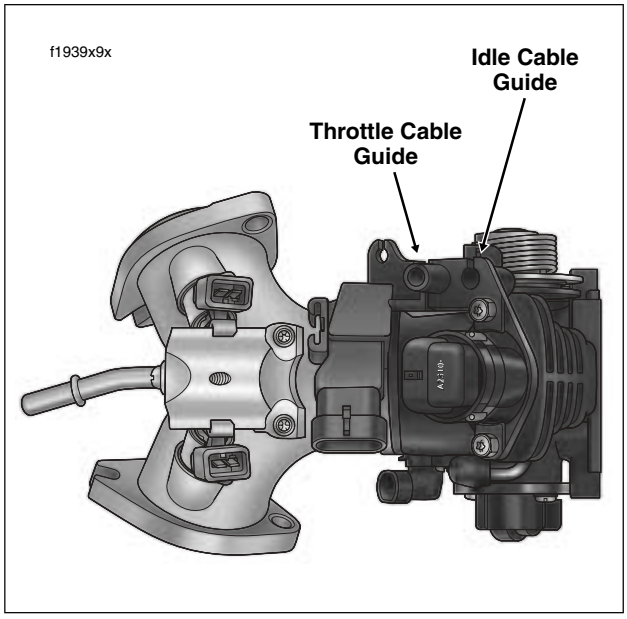


Figure 2-108. Throttle Cable Assembly - Induction Module Side

Induction Module: Install sleeve on throttle cable housing into shorter cable guide at top of throttle cable bracket. Drawing throttle cable downward, fit barrel end into lower hole in throttle wheel. Install sleeve and spring on idle cable housing into longer cable guide at bottom of throttle cable bracket inserting barrel end into upper hole in throttle wheel. See Figure 2-108.

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.

5. At front of top engine stabilizer bracket, install **new** 14 inch cable strap capturing frame backbone, wire bundles, and idle and throttle cables. Tighten cable strap, but leave loose enough so that one finger can be inserted between strap and frame backbone. **Do not overtighten.** Cut any excess cable strap material.

6. Install fuel tank. For carbureted models, see Section 4.7 FUEL TANK (CARBURETED), INSTALLATION (AFTER PARTIAL REMOVAL), FLHT/C, FLTR, or FLHR. For fuel injected models, see Section 9.4 FUEL TANK (FUEL INJECTED), INSTALLATION (AFTER PARTIAL REMOVAL), FLHT/C/U/I, FLTRI, or FLHR/C/S/I.

7. Install the air cleaner assembly. See Section 4.5 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 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 2-109.
4. Repeat the procedure squirting a quantity of lubricant between the idle 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.

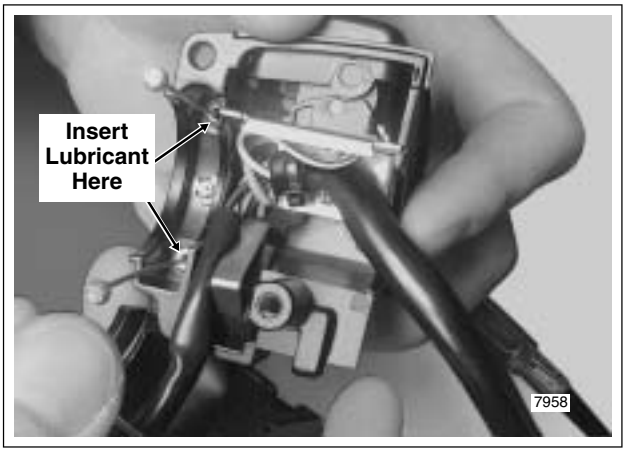


Figure 2-109. Right Handlebar Lower Switch Housing

CLUTCH CABLE 2.20

ADJUSTMENT

See Section 6.3 CLUTCH, ADJUSTMENT.

REMOVAL

1. Remove seat. See Section 2.22 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 right side exhaust system. See Section 3.7 REMOVING ENGINE FROM CHASSIS, steps 3-9.
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 2-110.
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 2-111.
7. Remove six socket head screws and washers to free clutch release cover from transmission case. Remove and discard gasket. See Figure 2-112.

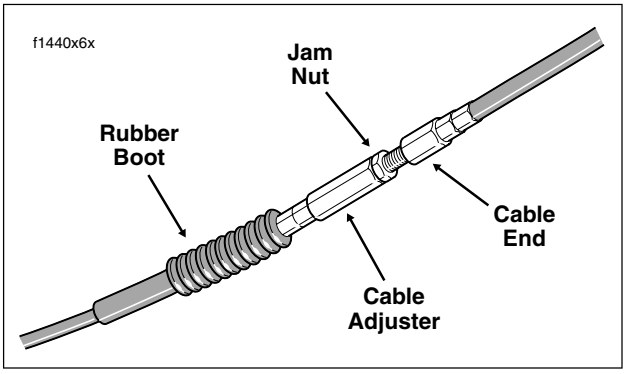


Figure 2-110. Clutch Cable Adjuster Mechanism

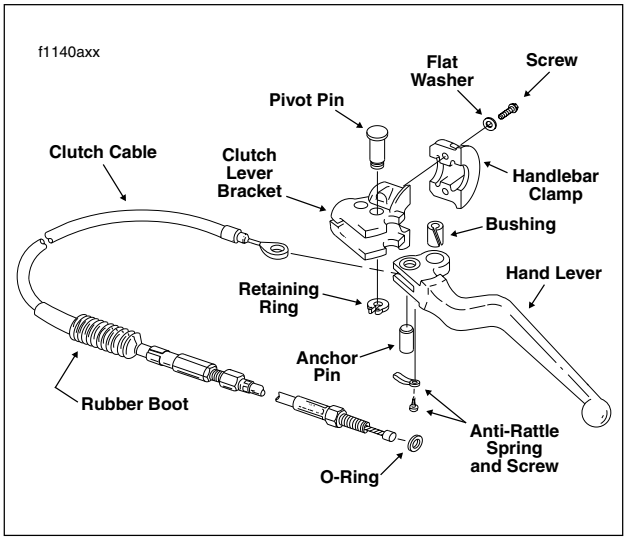


Figure 2-111. Clutch Hand Lever Assembly

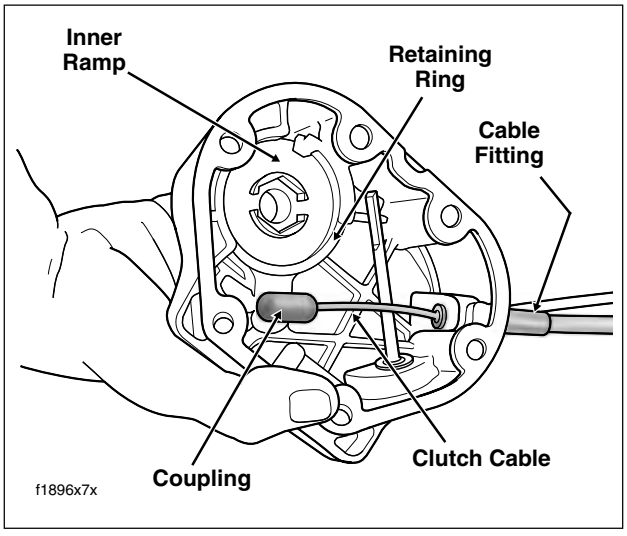


Figure 2-112. Clutch Release Cover Assembly

⚠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 2-111. Starting with the top screw, tighten screws to 60-80 ***in-lbs*** *(6.8-9.0 Nm).*

1. See Figure 2-111. 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 between engine guard and front of left frame downtube. Continue downward progression while crossing to right side of vehicle running cable between outboard side of voltage regulator and inboard side of right frame downtube. Threading cable strap through hole in cross brace, secure clutch cable to downtube as shown in Figure 2-113. 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.

   FLTR: Capture clutch cable in P-clamp secured by upper left instrument nacelle bolt. On left side of steering head, run cable downward between engine guard and front of left frame downtube. Continue downward progression while crossing to right side of vehicle running cable between outboard side of voltage regulator and inboard side of right frame downtube. Threading cable strap through hole in cross brace, secure clutch cable to downtube as shown in Figure 2-113. 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 P-clamp secured by upper left passing lamp bracket nut. See Figure 2-114. On left side of steering head, run cable downward between engine guard and front of left frame downtube.

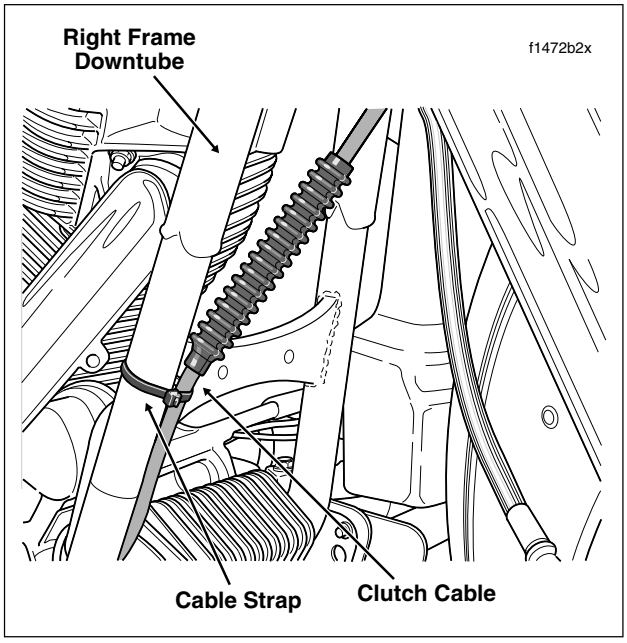


Figure 2-113. Clutch Cable Routing (Right Side View)

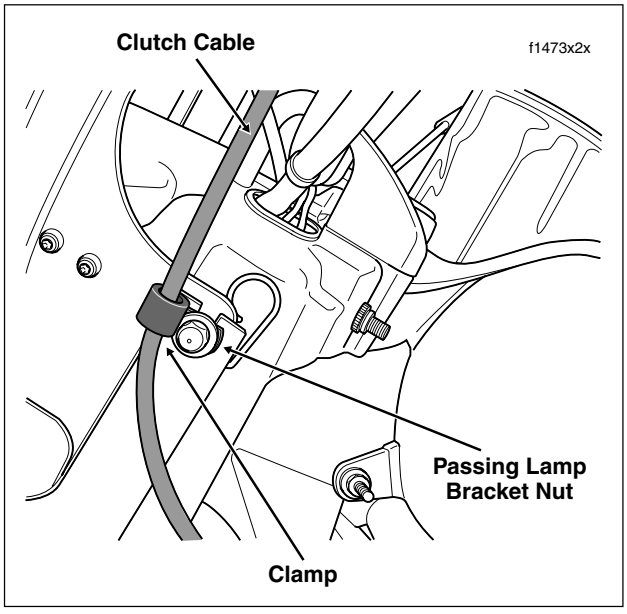


Figure 2-114. Clutch Cable Routing - FLHR/C (Left Side View)

Continue downward progression while crossing to right side of vehicle running cable between outboard side of voltage regulator and inboard side of right frame downtube. Threading cable strap through hole in cross brace, secure clutch cable to downtube as shown in Figure 2-113. 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.

5. Inspect cable fitting O-ring and replace if damaged or deformed. Install clutch cable fitting into clutch release cover. See Figure 2-112. 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 120-144 **in-lbs** (13.6-16.3 Nm).
13. Tighten clutch cable fitting to 36-60 **in-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 2-115. Check the O-ring for tears, cuts or general deterioration. Replace as necessary. See Figure 2-116.

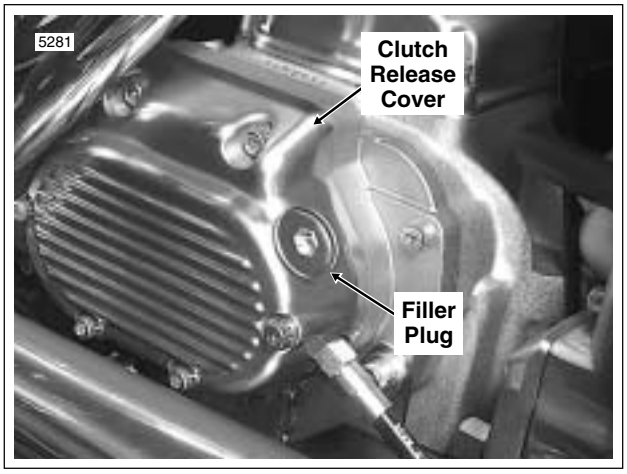


Figure 2-115. Transmission Case (Right Side)

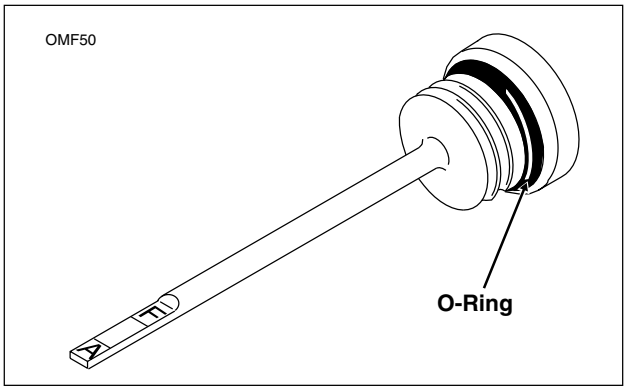


Figure 2-116. Transmission Lubricant Filler Plug/Dipstick

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).
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 system. See Section 3.8 INSTALLING ENGINE IN CHASSIS, steps 49-55.
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 2.22 SEAT, INSTALLATION.

HANDLEBAR ADJUSTMENT

1. Remove seat. See Section 2.22 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. **FLHR:** Remove the handlebar clamp shroud. See Section 2.29 WINDSHIELD/HEADLAMP NACELLE (FLHR/C), NACELLE REMOVAL, steps 1-11.

   FLTR: Remove the instrument bezel. See Section 2.28 UPPER FAIRING/WINDSHIELD (FLTR), BEZEL, REMOVAL.

   FLHT/C/U: Remove the fairing cap. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), FAIRING CAP, REMOVAL.
4. Loosen rear screws on the upper handlebar clamps. On FLTR models, loosen the front screws instead.
5. Position handlebars for rider posture and comfort.
6. To be sure that the handlebars are centered, verify that the knurled area on the outboard side of the left side handlebar clamp is equal to that on the right side.
7. Snug upper handlebar clamp screws.

⚠WARNING

Improperly aligned handlebars can contact the fuel tank when turned to the left or right fork stops. Contact with the fuel tank while riding can cause loss of vehicle control resulting in death or serious injury.

8. Slowly turn handlebars to the full right fork stop and then the full left fork stop to be sure there is no contact with the fuel tank. If contact occurs and handlebars are properly aligned, raise handlebars as necessary until the proper clearance is obtained.
9. Tighten the upper handlebar clamp screws to 12-16 ft-lbs (16.3-21.7 Nm).
10. **FLHR:** Install the handlebar clamp shroud. See Section 2.29 WINDSHIELD/HEADLAMP NACELLE (FLHR/C), NACELLE INSTALLATION, steps 2-11.

    FLTR: Install the instrument bezel. See Section 2.28 UPPER FAIRING/WINDSHIELD (FLTR), BEZEL, INSTALLATION.

    FLHT/C/U: Install the fairing cap. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), FAIRING CAP, INSTALLATION.
11. If necessary, adjust left and right handlebar switch controls as follows:
    a. Using a T27 TORX drive head, loosen the two screws securing the handlebar clamp to the clutch lever bracket (left) or master cylinder housing (right).
    b. Position switch controls for rider posture and comfort.
    c. Beginning with the top screw, tighten the screws to 60-80 **in-lbs** (6.8-9.0 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. Install seat. See Section 2.22 SEAT, INSTALLATION.

HANDLEBAR REMOVAL

1. Remove seat. See Section 2.22 SEAT, REMOVAL.

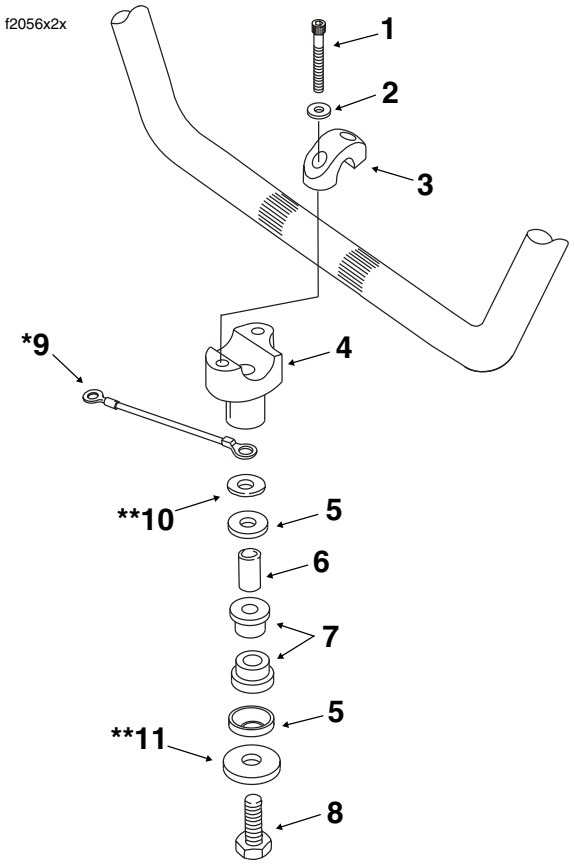
⚠WARNING

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. Place blanket or protective cover over front of fuel tank to protect against scratches or other damage.
4. **FLHR:** Remove the handlebar clamp shroud. See Section 2.29 WINDSHIELD/HEADLAMP NACELLE (FLHR/C), NACELLE REMOVAL, steps 1-11.

   FLTR: Remove the instrument nacelle. See Section 2.28 UPPER FAIRING/WINDSHIELD (FLTR), INSTRUMENT NACELLE, REMOVAL.

   FLHT/C/U: Remove the fairing cap. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), FAIRING CAP, REMOVAL. Remove the radio (or storage box). See Section 8.29 PREMIUM SOUND SYSTEM (FLHTC/U, FLTR), RADIO (FLHTC/U), REMOVAL, steps 3-7.



1. Screw
2. Flat washer
3. Upper clamp
4. Lower clamp
5. Cup washer
6. Spacer
7. Rubber bushing
8. Bolt

*LEFT CLAMP ONLY

9. Ground cable

**RIGHT CLAMP ONLY

10. Flat washer
11. Large flat washer

Figure 2-117. Handlebar Clamp Assemblies

5. Remove the left and right handlebar switch controls. See Section 8.20 HANDLEBAR SWITCHES, REMOVAL.
6. Remove upper handlebar clamp screws (with flat washers). Remove upper handlebar clamps and handlebar.

HANDLEBAR INSTALLATION

1. Place **new** handlebars on lower handlebar clamps. Install upper handlebar clamps and loosely install clamp screws (with flat washers).
2. To be sure that the handlebars are centered, verify that the knurled area on the outboard side of the left side handlebar clamp is equal to that on the right side.
3. Snug upper handlebar clamp screws.

⚠WARNING

Improperly aligned handlebars can contact the fuel tank when turned to the left or right fork stops. Contact with the fuel tank while riding can cause loss of vehicle control resulting in death or serious injury.

4. Slowly turn handlebars to the full right fork stop and then the full left fork stop to be sure there is no contact with the fuel tank. If contact occurs and handlebars are properly aligned, raise handlebars as necessary until the proper clearance is obtained.
5. Tighten upper handlebar clamp screws as follows:
   a. Tighten front screws until upper and lower handlebar clamps make contact.
   b. Tighten rear screws to 12-16 ft-lbs (16.3-21.7 Nm).
   c. Tighten front screws to 12-16 ft-lbs (16.3-21.7 Nm).

NOTE

A slight gap will exist between the upper and lower clamps at the rear of the handlebars after tightening.

6. Install the left hand grip. See LEFT HAND GRIP, INSTALLATION, in this section.
7. Install the left and right handlebar switch controls. See Section 8.20 HANDLEBAR SWITCHES, INSTALLATION.
8. **FLHR:** Install the handlebar clamp shroud. See Section 2.29 WINDSHIELD/HEADLAMP NACELLE (FLHR/C), NACELLE INSTALLATION, steps 2-11.

   FLTR: Install the instrument nacelle. See Section 2.28 UPPER FAIRING/WINDSHIELD (FLTR), INSTRUMENT NACELLE, INSTALLATION.

   FLHT/C/U: Install the fairing cap. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), FAIRING CAP, INSTALLATION. Install the radio (or storage box). See Section 8.29 PREMIUM SOUND SYSTEM (FLHTC/U, FLTR), RADIO (FLHTC/U), INSTALLATION, steps 1-6.
9. 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).
10. Install seat. See Section 2.22 SEAT, INSTALLATION.
11. Turn the ignition/light key switch to IGNITION and test each handlebar switch for proper operation.
12. Apply front brake hand lever to test operation of brake lamp.

13. Adjust idle and throttle control cables as follows:

    Non-Cruise: See Section 2.19 THROTTLE CABLES (NON-CRUISE), ADJUSTMENT.

    Cruise Equipped: See Section 8.28 CRUISE CONTROL (FLHRC, FLTR, FLHTCU), CABLE ADJUSTMENT.

LEFT HAND GRIP

REMOVAL

1. Remove the left handlebar switch controls. See Section 8.20 HANDLEBAR SWITCHES, REMOVAL.
2. Use a sharp blade to carefully cut rubber and then peel off handlebar.
3. Thoroughly clean handlebar to remove all residual adhesive.

INSTALLATION

⚠WARNING

HARLEY-DAVIDSON ADHESIVE contains METHYL ETHYL KETONE, a chemical known to the State of California to cause cancer or other reproductive harm.

⚠WARNING

Use HARLEY-DAVIDSON ADHESIVE in well ventilated areas only. Vapors are flammable and can be harmful to breath. Avoid contact with eyes, mucous membranes, or prolonged contact with skin. Keep out of reach of children.

1. Obtain a **new** left hand grip and HARLEY-DAVIDSON ADHESIVE (Part No. 99839-95). Apply a coat of the adhesive to the inside surface of the grip one inch (25.4 mm) from the open end. Apply a coat to the end of the handlebar.
2. Immediately push grip completely onto end of handlebar using a twisting motion. Do not hesitate when installing grip or adhesive may dry before installation is complete.

NOTE

If the left hand grip is patterned, align it with the pattern on the right grip with the throttle in the fully closed position.

3. Let 6-8 hours elapse (at 70° F.) to allow adhesive to fully cure.
4. Install the left handlebar switch controls. See Section 8.20 HANDLEBAR SWITCHES, INSTALLATION.

RUBBER MOUNTS

NOTE

For complete disassembly of the handlebar clamp assemblies and/or to replace the rubber mounts, proceed as follows.

REMOVAL

General

1. Turn fork to left fork stop and loosen right side bolt at bottom of upper fork bracket. Turn fork to right fork stop and loosen left side bolt at bottom of upper fork bracket.
2. Remove handlebars. See HANDLEBAR REMOVAL in this section.

Right Side

3. Holding lower handlebar clamp to prevent rotation, turn bolt at bottom of upper fork bracket until free.
4. Remove lower handlebar clamp, flat washer and cup washer at top of upper fork bracket. See Figure 2-118.
5. Pull bushing from fork bracket bore and discard. See Figure 2-119.

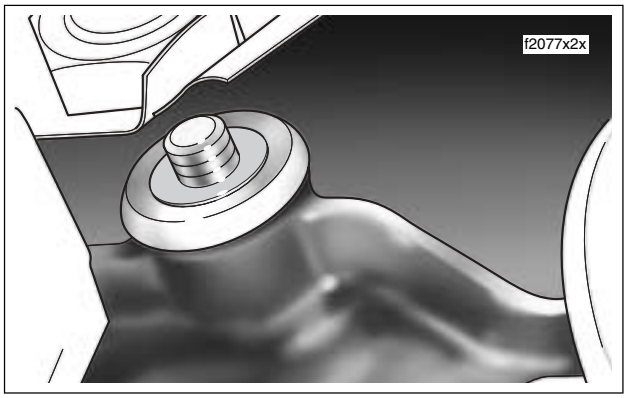


Figure 2-118. Remove Flat Washer and Upper Cup Washer (Right Side)

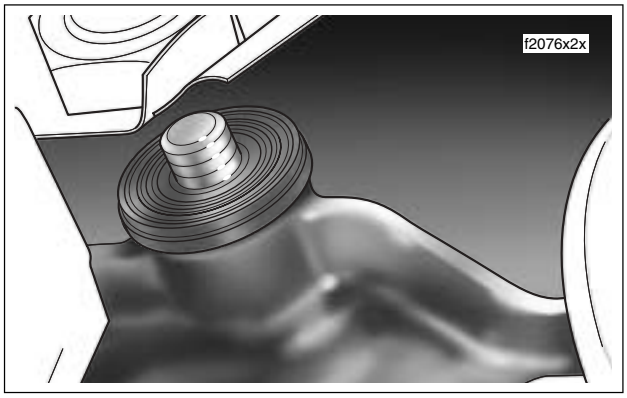


Figure 2-119. Remove Upper Bushing (Right Side)

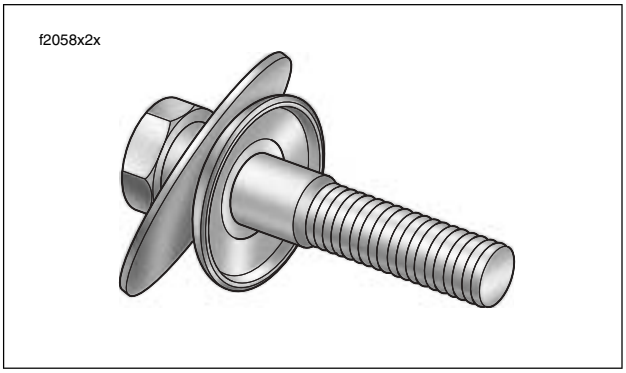


Figure 2-120. Remove Bolt, Large Washer and Lower Cup Washer (Right Side)

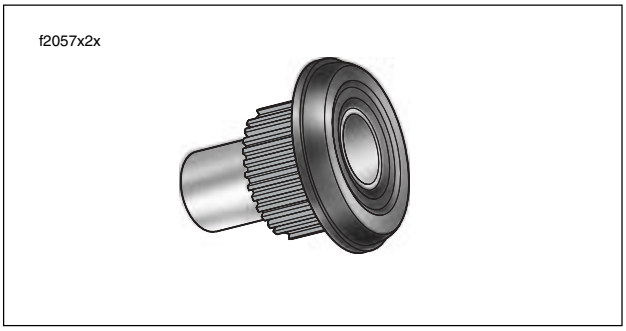


Figure 2-121. Remove Spacer From Lower Bushing

6. Moving to bottom of upper fork bracket, remove bolt, large flat washer and cup washer. See Figure 2-120.
7. Pull bushing and spacer from fork bracket bore. Remove spacer from bushing. See Figure 2-121. Discard bushing.

Left Side

8. Holding lower handlebar clamp to prevent rotation, turn bolt at bottom of upper fork bracket until free.
9. Remove lower handlebar clamp, ground wire ring terminal and cup washer at top of upper fork bracket.
10. Pull bushing from fork bracket bore and discard. See Figure 2-119.
11. Moving to bottom of upper fork bracket, remove bolt and cup washer.
12. Pull bushing and spacer from fork bracket bore. Remove spacer from bushing. See Figure 2-121. Discard bushing.

INSTALLATION

Right Side

1. Insert spacer into **new** bushing until flush with outboard side of collar. See Figure 2-121.
2. Insert bushing into bore at bottom of upper fork bracket fitting collar of bushing over lip of boss.
3. Install large flat washer and cup washer on bolt. See Figure 2-120. Insert bolt into bushing fitting concave side of cup washer over collar of bushing.
4. Moving to top of upper fork bracket, insert bushing into bore fitting collar of bushing over lip of boss. See Figure 2-119.
5. Install cup washer over threaded end of bolt fitting concave side over collar of bushing. Install flat washer. See Figure 2-118.
6. Apply two or three drops of Loctite Medium Strength Threadlocker 243 (blue) to threads of bolt and start lower handlebar clamp. Holding clamp to prevent rotation, turn bolt at bottom of upper fork bracket until snug.

Left Side

7. Insert spacer into **new** bushing until flush with outboard side of collar. See Figure 2-121.
8. Insert bushing into bore at bottom of upper fork bracket fitting collar of bushing over lip of boss.
9. Install cup washer on bolt. Insert bolt into bushing fitting concave side of cup washer over collar of bushing.
10. Moving to top of upper fork bracket, insert bushing into bore fitting collar of bushing over lip of boss. See Figure 2-119.
11. Install cup washer over threaded end of bolt fitting concave side over collar of bushing. Install ground wire ring terminal.
12. Apply two or three drops of Loctite Medium Strength Threadlocker 243 (blue) to threads of bolt and start lower handlebar clamp. Holding clamp to prevent rotation, turn bolt at bottom of upper fork bracket until snug.

General

13. Install handlebars and upper handlebar clamps. See HANDLEBAR INSTALLATION in this section, steps 1-5.
14. Turn fork to left fork stop and tighten right side bolt at bottom of upper fork bracket to 30-40 ft-lbs (40.7-54.2 Nm). Turn fork to right fork stop and tighten left side bolt to the same torque value.
15. Complete assembly of motorcycle. See HANDLEBAR INSTALLATION in this section, steps 7-13.

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 2-122.
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 2-122.
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.

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 access the seat mounting bracket screw. If the Tour-Pak is in the forward position, remove Tour-Pak and install in rearward position. See Section 2.24 TOUR-PAK for more information.

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 2-122.

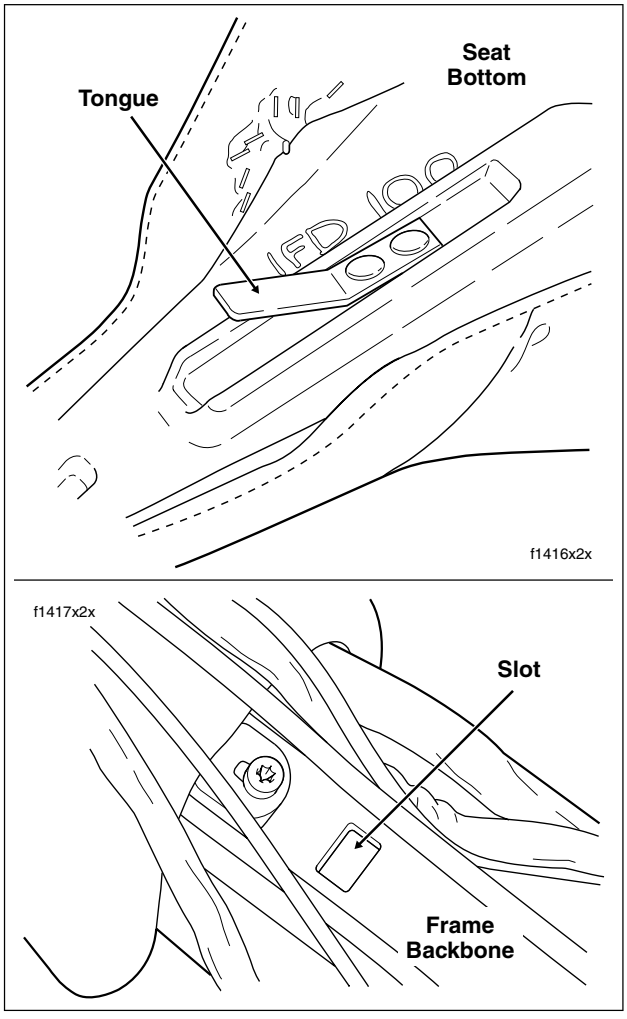


Figure 2-122. Seat Mounting

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 (76.2 mm), use other hand to firmly push front of seat downward and rearward until tongue engages slot in frame backbone. See Figure 2-122.

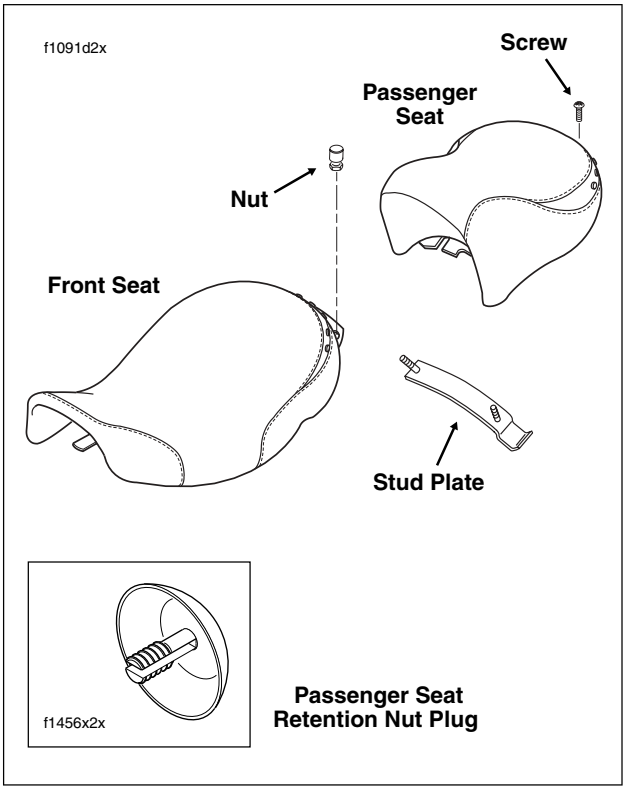


Figure 2-123. Seat Assembly - FLHR

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 2-123. 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 inset of Figure 2-123. 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 2-122.

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 2-122. 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.

FLHRC

REMOVAL

1. Remove right side saddlebag. See Section 2.23 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 2-124.
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 2-122.
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 2-122.
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 2-124.
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 2.23 SADDLEBAG, INSTALLATION.
7. Using an open end/box wrench, tighten saddlebag front mounting bracket bolt.

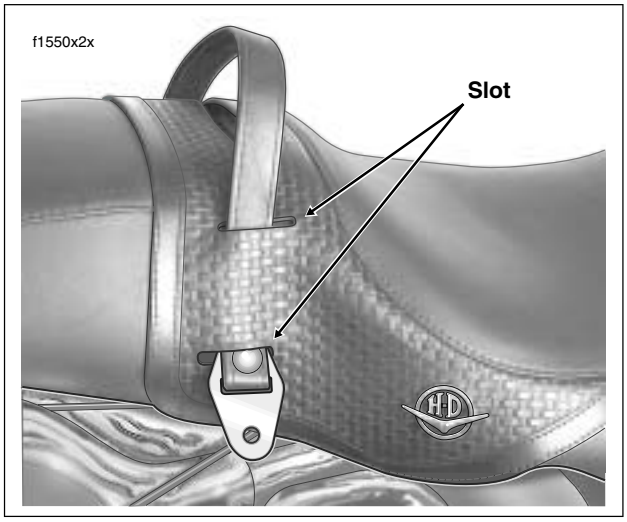


Figure 2-124. Route Passenger Seat Strap Through Slots in Seat - FLHRC

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 2.23 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 2-122.
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 2-122.
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 2.23 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 2-125. 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.

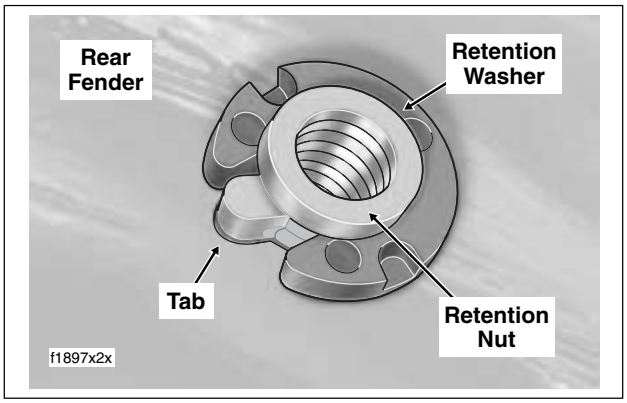


Figure 2-125. Seat Retention Nut and Washer

OPENING

NOTE

Maximum recommended load for each saddlebag is 15 lbs.

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 2-126.
3. With top of lid tilted toward motorcycle, carefully lift inboard side of lid upward disengaging front and rear anchor tabs from anchor brackets.
4. Pivot lid on latch hinge to open. A nylon check strap suspends the lid in the open position. See lower frame of Figure 2-126.

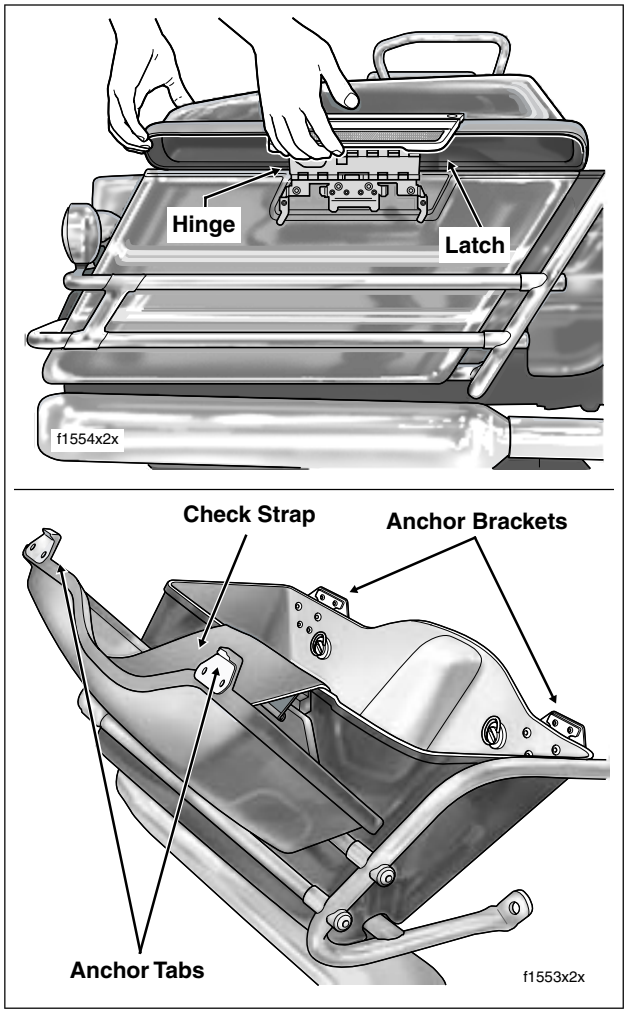


Figure 2-126. Open Saddlebag (FLHT/C/U, FLTR, FLHR)

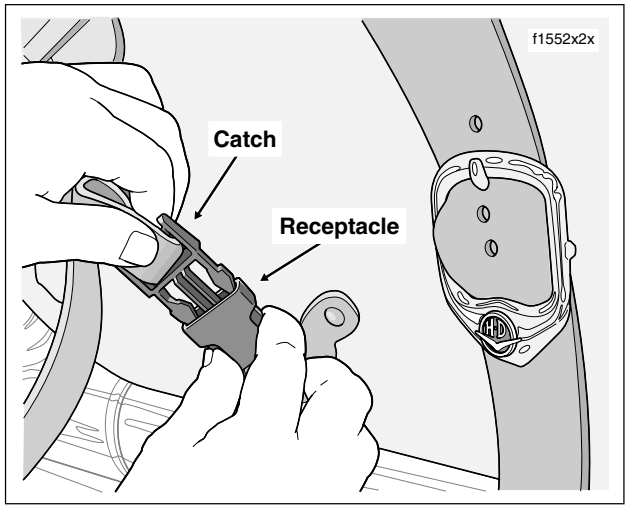


Figure 2-127. Release Catch to Open Saddlebag (FLHRC)

NOTE

On FLHRC models, simply raise the decorative buckle and press tabs on both sides of catch to release from receptacle. See Figure 2-127. 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 2-128.

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.

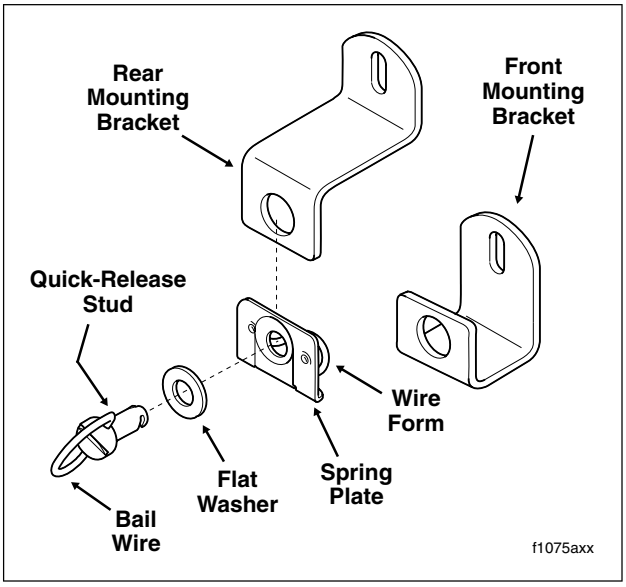


Figure 2-128. Saddlebag Quick-Release Fasteners

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 2-129. Retighten bolts after seating saddlebag on support rail.

LATCH SPRING REPLACEMENT

REMOVAL

1. Lay clean pad or blanket on work bench to protect painted surfaces of saddlebag.
2. Remove saddlebag from motorcycle leaving lid open. See REMOVAL in this section.
3. Lay saddlebag flat on pad with the inboard side facing up and the lid closest to you.

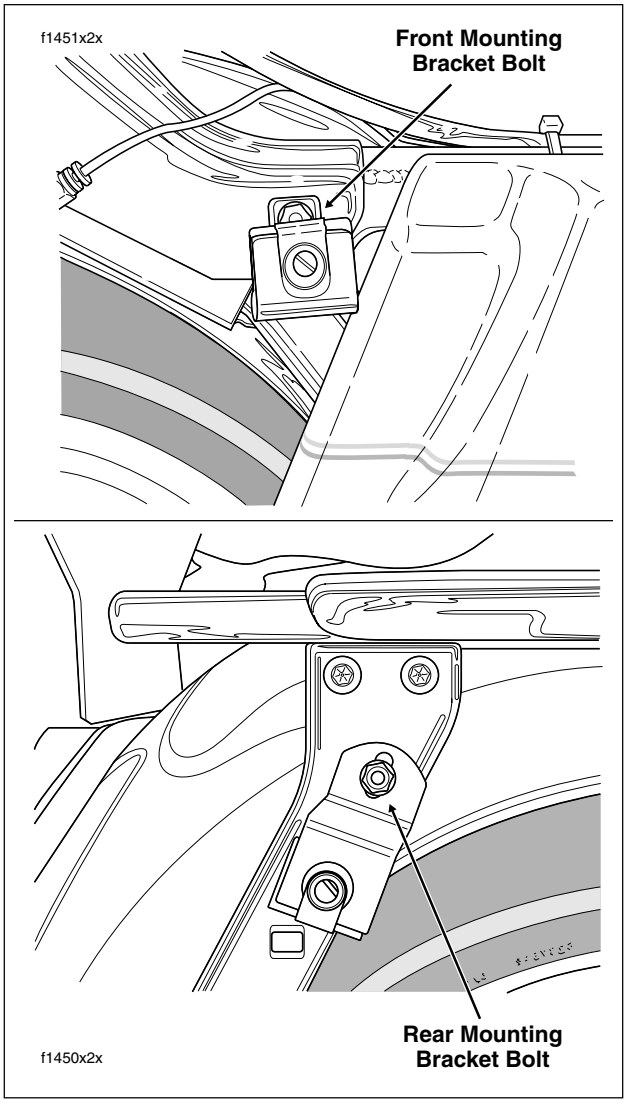


Figure 2-129. Saddlebag Mounting Bracket Bolts (Right Side View)

4. Remove two T20 TORX screws to release check strap from lid.
5. Remove two T15 TORX screws to release check strap from saddlebag.
6. Remove two remaining T15 TORX screws to remove latch from saddlebag. Move saddlebag back and out of the way.

CAUTION

This procedure assumes that the latch is NOT removed from the saddlebag lid. If there is doubt as to whether the procedure can be accomplished without scratching painted surfaces of the lid, then remove the five remaining T15 TORX screws to completely remove latch.

7. Position lid right side up with latch closest to you.

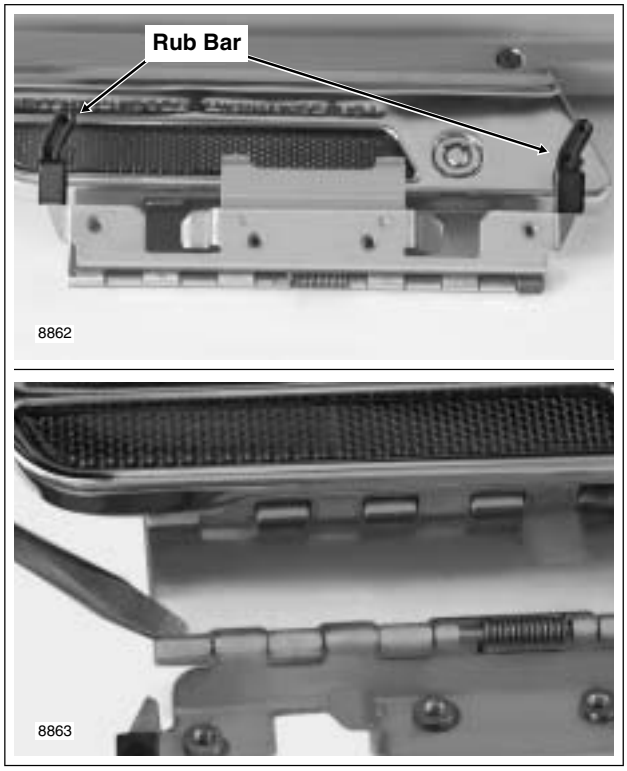


Figure 2-130. Lid Right Side Up With Latch on Near Side

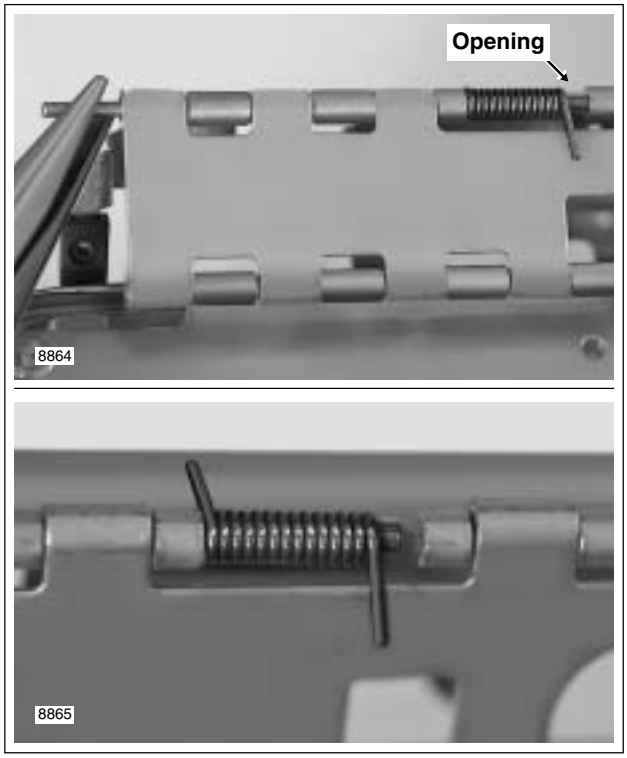


Figure 2-131. Lid Up Side Down With Latch on Far Side

8. Raise latch slightly and rotate hinge on inboard side so that it is topside with the two plastic rub bars pointed upward. See upper frame of Figure 2-130.
9. Rotate rub bar section of hinge to expose hinge pin and spring. Using a flat tip screwdriver, carefully bend crimped end link outward. See lower frame of Figure 2-130.

NOTE

The end link on opposite side of hinge has a weld spot that prevents pin removal.

10. Reposition lid so that it is upside down with the latch farthest from you. Rotate hinge so that plastic rub bars are positioned beneath latch and spring is topside.
11. Using a needle nose pliers, grasp pin through opening just outboard of the spring and push toward the crimped link side. Work pin in this manner until end can be seen exiting crimped link. See upper frame of Figure 2-131. If necessary, pry crimped link outward a little more to achieve the desired result.
12. Grasping end with needle nose pliers, slowly pull pin from links until spring can be slid off opposite end. Only pull pin as far as necessary to remove spring. See lower frame of Figure 2-131.

INSTALLATION

1. Slide **new** spring onto end of pin. Orient spring as shown in lower frame of Figure 2-131.
2. Slide pin back through links. Using tapered end of needle nose pliers, push end of pin into crimped link.
3. Reposition lid so that it is right side up with latch closest to you. As before, raise latch slightly and rotate hinge on inboard side so that it is topside with plastic rub bars pointing upward. Now rotate rub bar section of hinge to expose hinge pin and spring. See Figure 2-130.
4. Holding lid down with elbow, if necessary, use a pliers to bend crimped link back into its original position, so that pin is captured and will not back out of hinge.
5. Reposition lid so that it is upside down with the latch farthest from you. Move saddlebag forward for reinstallation of lid. Align four holes in saddlebag with those in latch.
6. Install two inboard T15 TORX screws to fasten latch to saddlebag. Alternately tighten screws to 20-25 **in-lbs** (2.3-2.8 Nm).
7. Align holes in check strap with those in lid and saddlebag. Orient check strap so that logo is topside with the bottom of the bar and shield on the lid side.
8. Install two T15 TORX screws to fasten check strap and latch to saddlebag. Alternately tighten screws to 20-25 **in-lbs** (2.3-2.8 Nm).
9. Install two T20 TORX screws to fasten check strap to lid. Alternately tighten screws to 18-20 **in-lbs** (2.0-2.3 Nm).
10. Close saddlebag and install on motorcycle. See INSTALLATION in this section.

FLHTC

NOTE

For instructions covering riveted components, such as hinges and catches, refer to the Instruction Sheet included with the RIVET TOOL, HD-39787.

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 2-132.
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 2-133.
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 2-134.

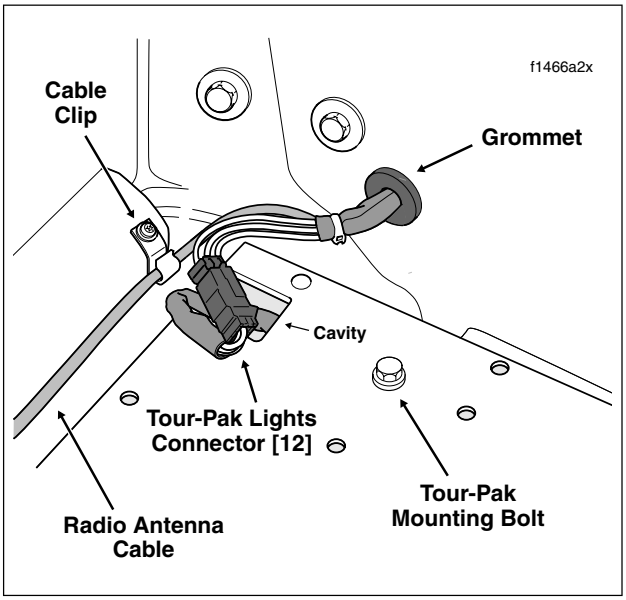


Figure 2-132. Disconnect Tour-Pak Lights Connector

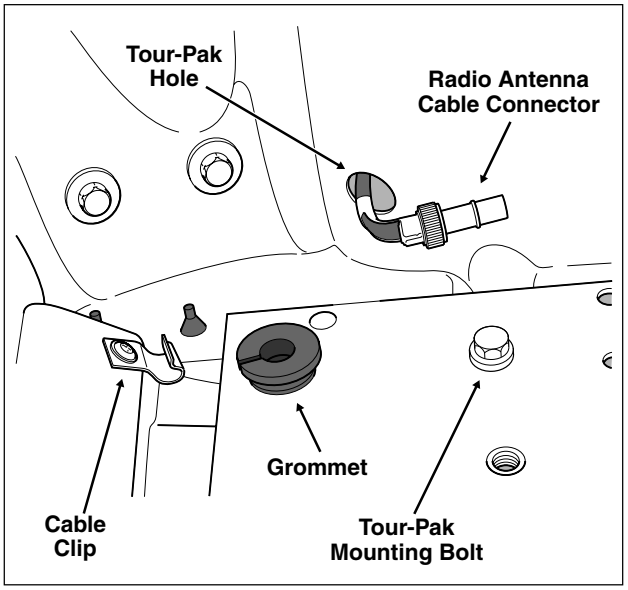


Figure 2-133. Feed Main Harness Thru Tour-Pak Hole

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 2-134.

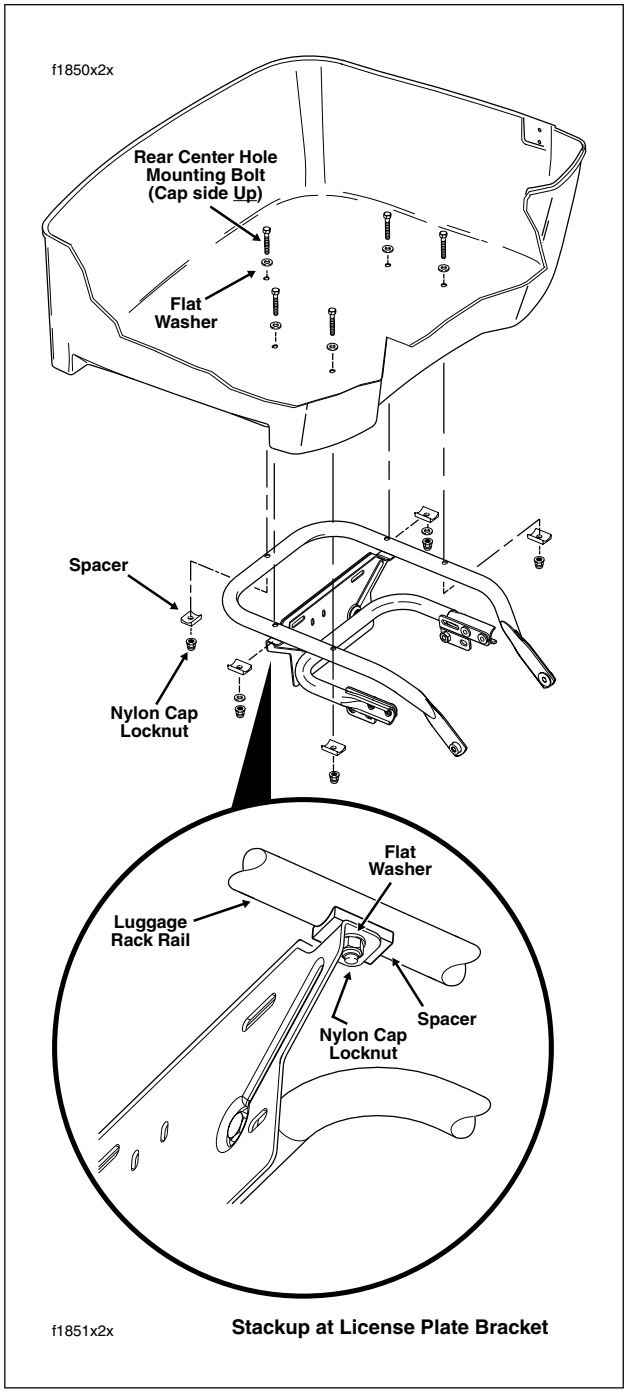


Figure 2-134. Install Tour-Pak Mounting Bolts

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 2-132.

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 2-132.

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 2-133.

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 2-135.

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.

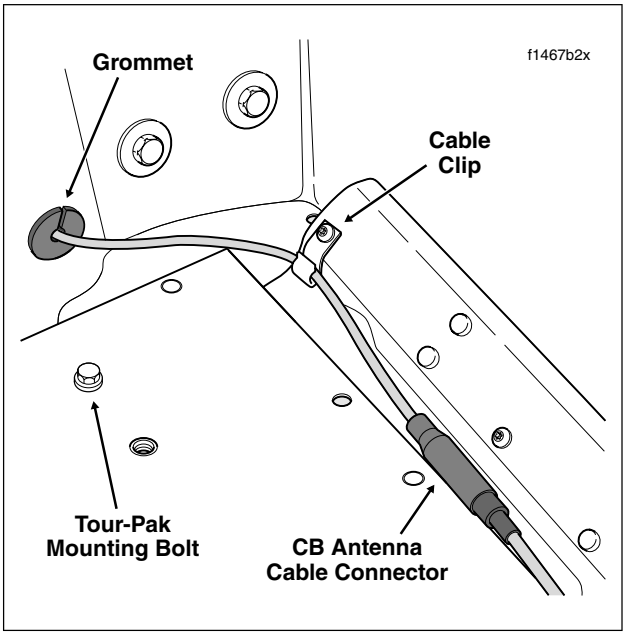


Figure 2-135. Disconnect CB Antenna Cable Connector

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 2-134.

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 2-134.
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 2-135.
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 2-132.
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.

TOUR-PAK LIGHTS/BACKREST/SPEAKER BOX 2.25

GENERAL

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.

SIDE MARKER LIGHTS FLHTC/U

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 2-136. 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 2-136.
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 2.24 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.

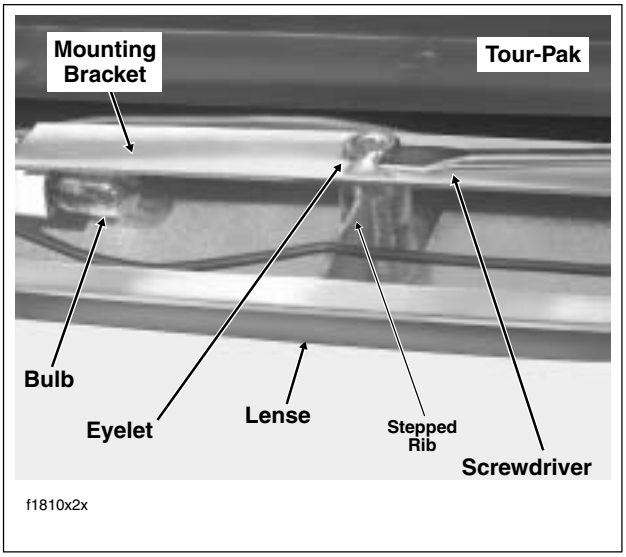


Figure 2-136. Remove Eyelets to Release Mounting Bracket From Lense

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 2-137.
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 2-136.

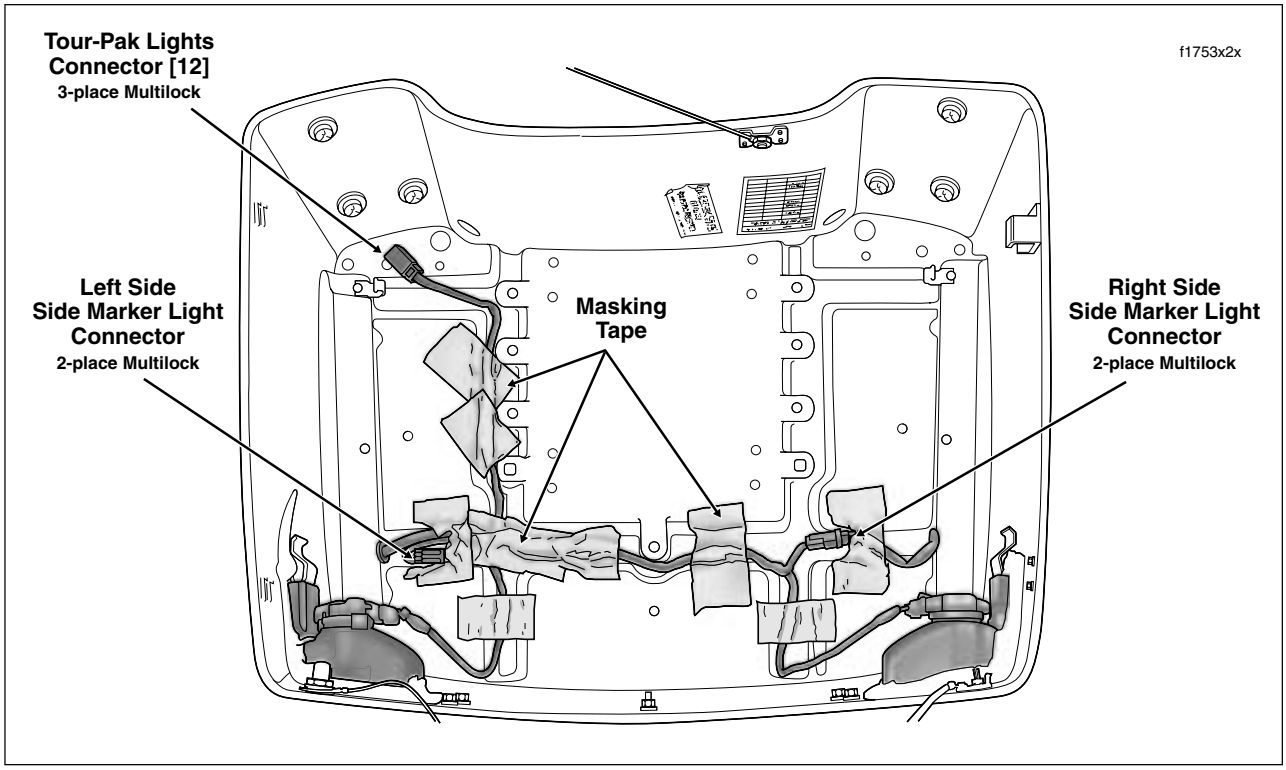


Figure 2-137. Side Marker Light Connectors and Conduit

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 2-137.
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 2.24 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.

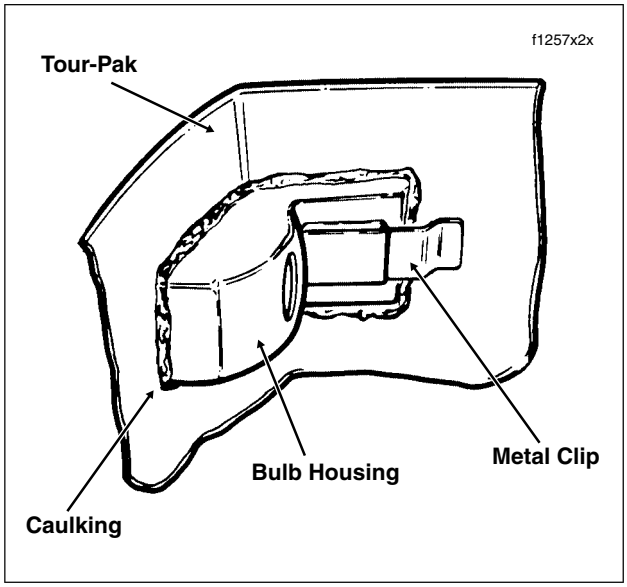


Figure 2-138. Wrap-Around Light Assembly

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 2-138.

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 2-138.
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 connector. 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 6 of the 2003 ELECTRICAL DIAGNOSTIC MANUAL (Part No. 99497-03). 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 2-139.
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.

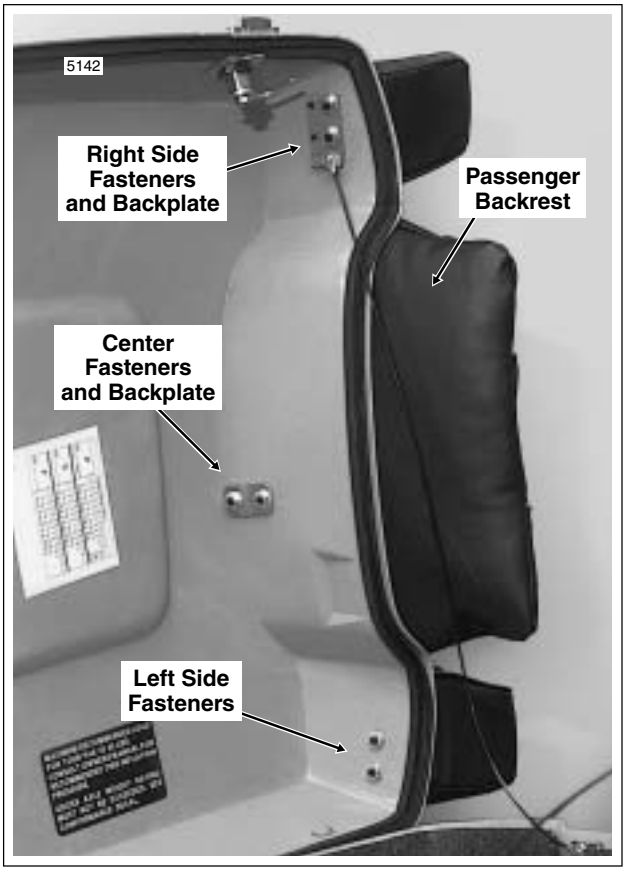


Figure 2-139. Tour-Pak Cover (Underside)

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. Alternately tighten bolts to 25-35 **in-lbs** (2.8-4.0 Nm).
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.

LOWER FAIRING

REMOVAL

1. Remove two screws from fairing lower cap. See Figure 2-140.
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.
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. 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.
4. Adjust the fairing lower so that ear at top inboard side is approximately 1/4 inch (6.4 mm) from frame downtube. Verify that fairing lower is square, and then alternately tighten locknuts to 35-40 **in-lbs** (4.0-4.5 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 30-35 **in-lbs** (3.4-4.0 Nm).
6. Install two screws to secure fairing lower cap to fairing lower. Tighten screws to 10-15 **in-lbs** (1.1-1.7 Nm).
7. Repeat steps 1-6 on other side of vehicle.

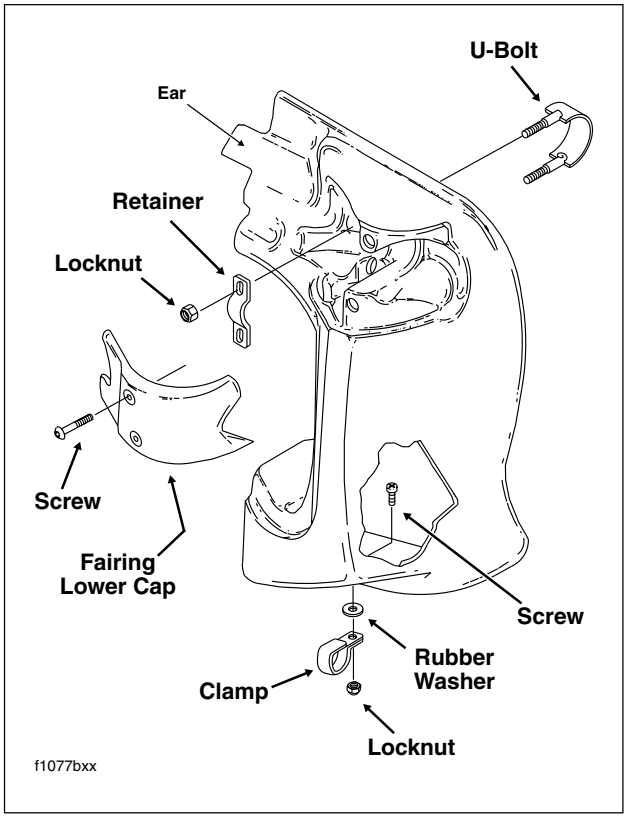


Figure 2-140. Fairing Lower (Right Side) - FLHTCU

ENGINE GUARD

REMOVAL

1. Remove fairing lowers, if present. See LOWER FAIRING, REMOVAL, in this section. Remove fairing lower clamps from engine guard.
2. Remove T40 TORX screws (with flanged locknuts) to release ends of engine guard from frame weldments.
3. Remove hex socket screw (with flat washer) to release tab at top of engine guard from slot at base of steering head.

INSTALLATION

1. Insert tab at top of engine guard into slot at base of steering head. Start hex socket screw (with flat washer) to hang engine guard.
2. Position ends of engine guard outboard of frame weldments on each side of motorcycle. Install T40 TORX screws positioning flanged locknuts on inboard side of frame weldments.
3. Alternately tighten three screws to 15-20 ft-lbs (20.3-27.1 Nm).
4. Install fairing lowers, if present, but first install fairing lower clamps on each side of engine guard. See LOWER FAIRING, INSTALLATION, in this section.

OUTER FAIRING/WINDSHIELD

REMOVAL

1. Remove seat. See Section 2.22 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 windshield. See Figure 2-141.
   b. Moving to the inner fairing side, 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 left side of the fairing cap. Turn the handlebar to the left and remove the fairing screw below the right side of the fairing cap.
   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.

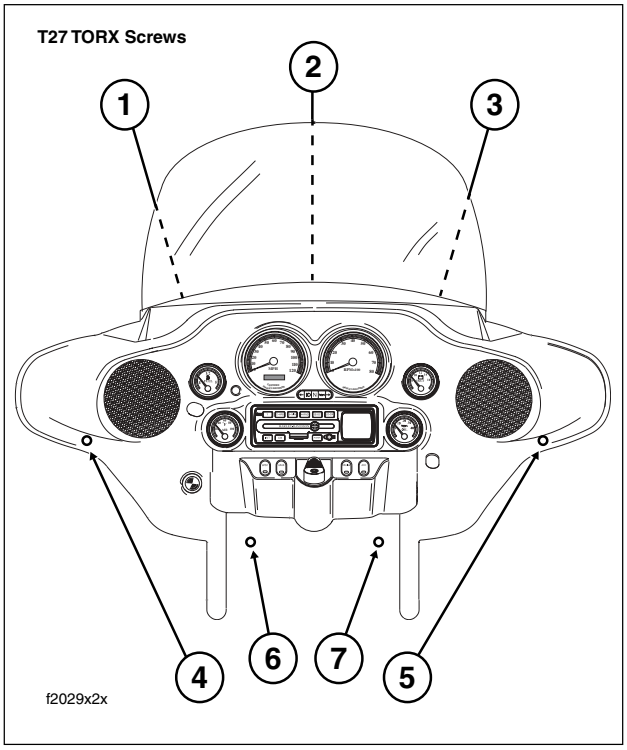


Figure 2-141. Outer Fairing TORX Screw Locations

   b. Using a T27 TORX drive head, start the three outer fairing screws (with flat washers) just below the windshield.
   c. Moving to the inner fairing side, 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 start the outer fairing screw reaching in below the right side of the fairing cap. Turn the handlebar to the right and start the fairing screw below the left side of the fairing cap.
   e. Alternately tighten the four fairing screws on the inner fairing side to 20-30 **in-lbs** (2.3-3.4 Nm).
   f. Moving to the front of the vehicle, tighten the outer fairing screws below the windshield to 25-30 **in-lbs** (2.8-3.4 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 2.22 SEAT, INSTALLATION.

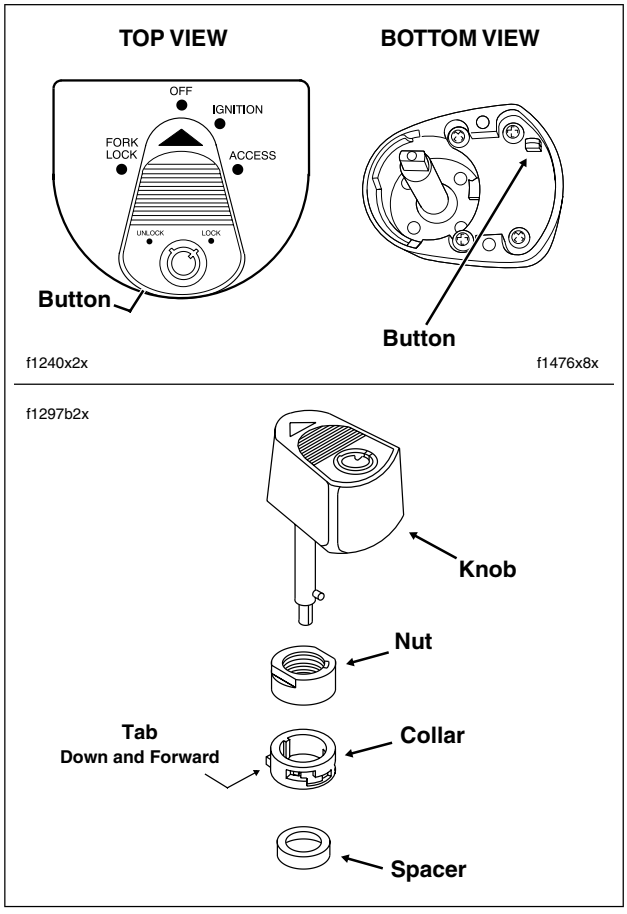


Figure 2-142. Ignition Switch Knob (Domestic)

FAIRING CAP

REMOVAL

1. Partially disassemble domestic ignition switch as follows:

NOTE

For partial disassembly of HDI ignition switch, see Section 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHT/C/U, FLTR (INTERNATIONAL), REMOVAL, steps 1-4.

   a. See upper frame of Figure 2-142. To remove the ignition switch knob, insert the Ignition Switch key and turn to the UNLOCK position. Leaving the key installed, rotate the knob to ACCESS. Depressing the release button at bottom (left side) with a small screwdriver, push key down and turn an additional 60 degrees in a counter-clockwise direction. Lift and remove knob.

   b. 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 2-142.

   c. Gently remove the switch position plate by pulling tabs from slots in fairing cap.

2. 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.

3. With the forks turned fully to the left, disconnect the Fairing cap 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.

4. Remove the fairing cap from the motorcycle. See Figure 2-143.

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 2-143.

2. Connect the Fairing cap 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.

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. Assemble domestic ignition switch as follows:

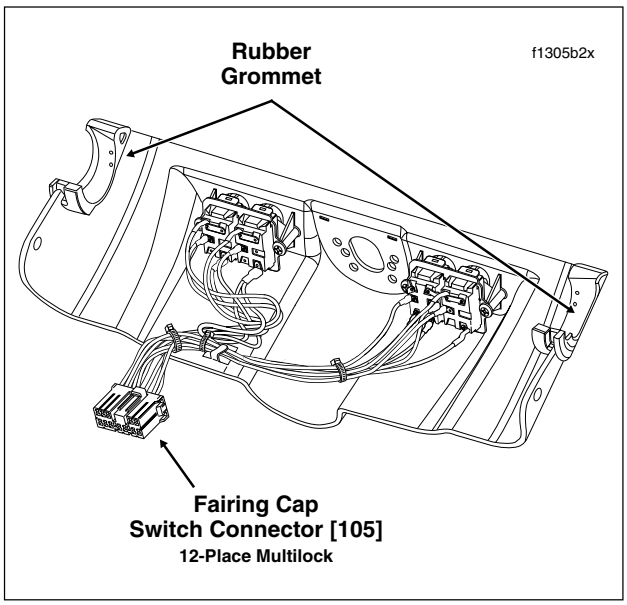


Figure 2-143. Fairing Cap Assembly (FLHT/C/U)

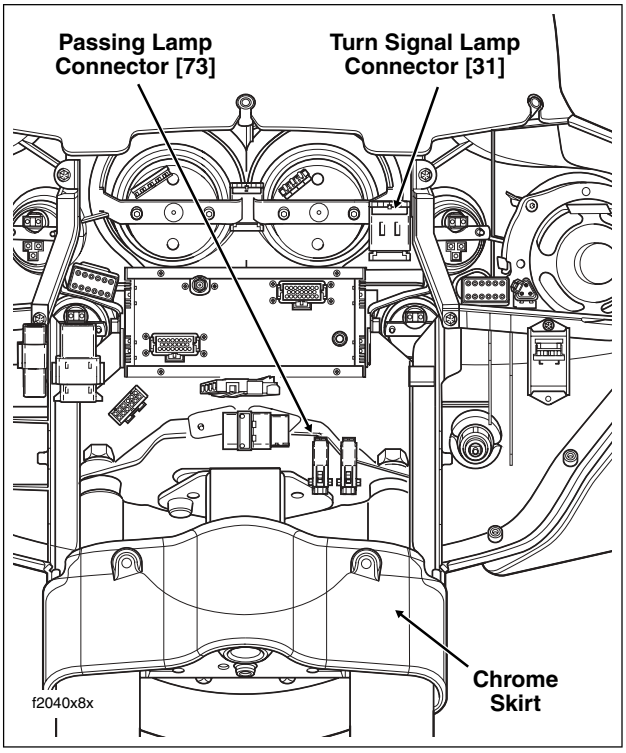


Figure 2-144. Inner Fairing (Front View)

NOTE

For assembly of HDI ignition switch, see Section 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHT/C/U, FLTR (INTERNATIONAL), INSTALLATION, steps 5-10.

a. Install switch position 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.

b. 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 to 50-70 **in-lbs** (5.7-7.9 Nm).

c. 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.

6. Using a T27 TORX drive head, tighten two fairing cap screws to 25-30 **in-lbs** (2.8-3.4 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 2-144.
4. Using a T40 TORX drive head, remove four bolts to release passing lamp bracket from fork sides. 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.



Figure 2-145. Install Cardboard Insert

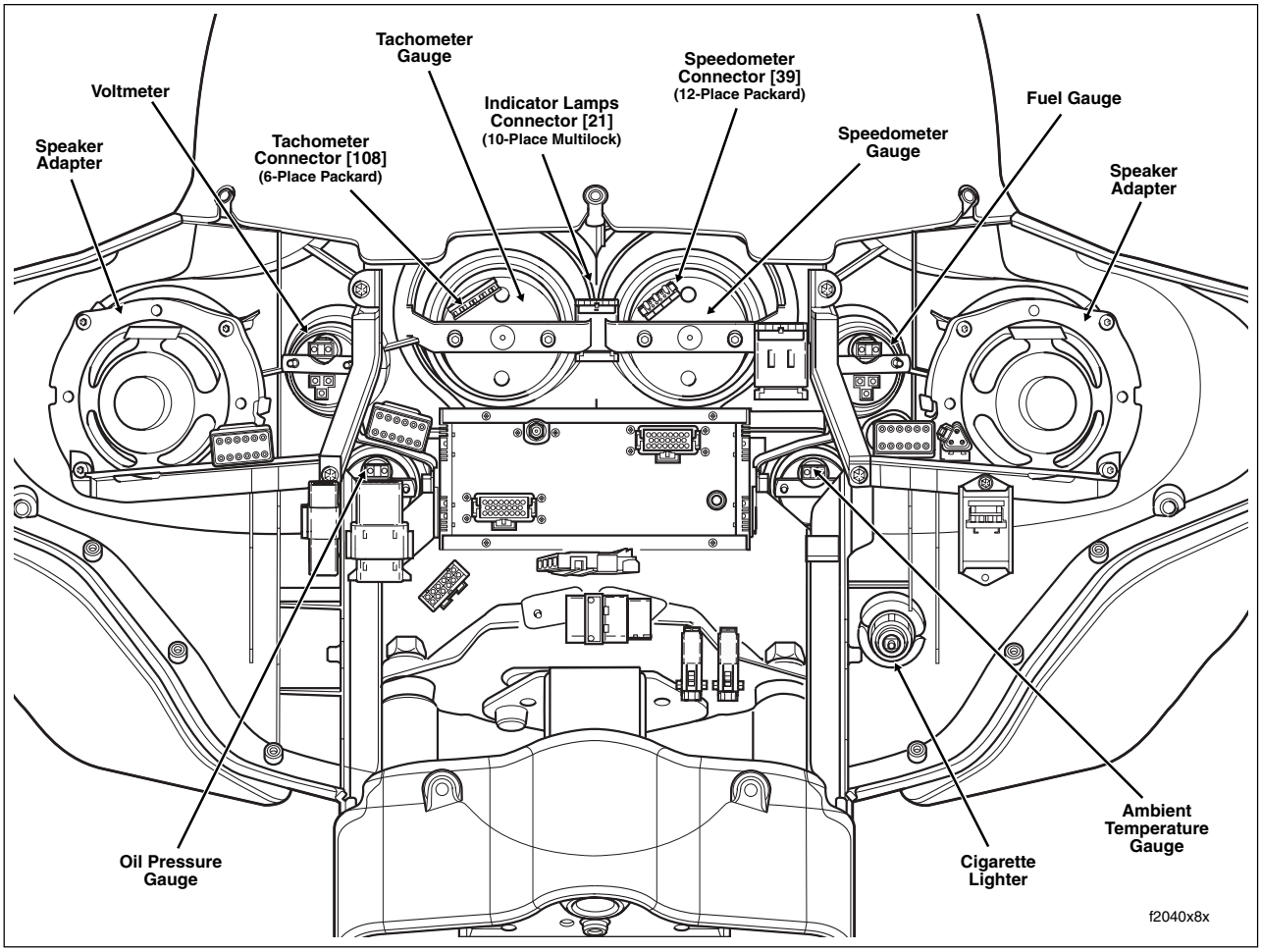


Figure 2-146. Inner Fairing Connections (FLHTC/U)

11. Feed clutch cable through inner fairing grommet to front of vehicle.
12. Remove the grommet from the inner fairing.

CAUTION

Do not remove the switch housing assembly without first placing the 5/32 inch (4.0 mm) 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 2-145.
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.

NOTE

On non cruise equipped models, remove the friction shoe from the end of the tension adjuster screw. 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.

17. Remove the throttle control grip from the end of the handlebar.
18. 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.

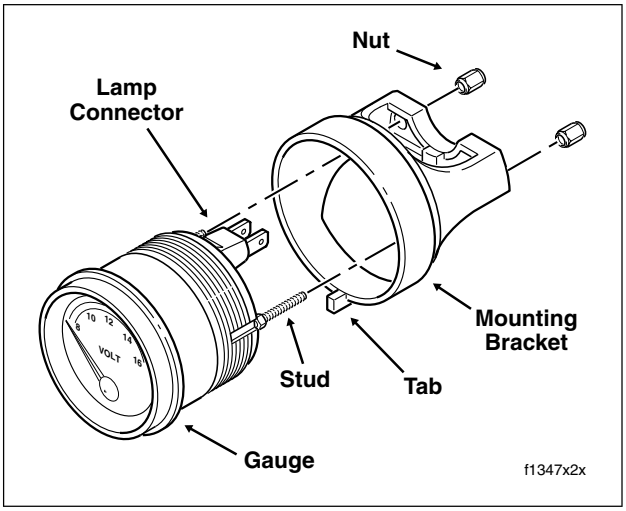


Figure 2-147. Voltmeter Gauge Assembly

19. Remove the throttle and idle control cables from the switch housing and feed through inner fairing grommet to front of vehicle.
20. Remove the grommet from the inner fairing.
21. See Figure 2-146. Moving back to the front of the vehicle, disconnect the socket terminals from the spade contacts on the:
    - Cigarette lighter
    - Speakers (both sides)
22. Using a T25 TORX drive head, remove the three screws to release the speaker adapter from the inner fairing (both sides).
23. Remove cigarette lighter from socket. Holding socket, unscrew outer shell. Remove socket and outer shell from the fairing.
24. Pull the interconnect wire harness connectors from the:
    - Voltmeter
    - Fuel Gauge
25. Cut cable strap to release indicator lamps connector between speedometer and tachometer brackets.
26. 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.

27. Remove allen head socket screws to free mounting brackets from back of tachometer and speedometer gauges. Remove gauges from inner fairing.
28. Remove hex nuts from studs at back of voltmeter and fuel gauges. Remove mounting brackets. See Figure 2-147. Remove gauges from inner fairing.
29. Release four paddles to free indicator bulb housing from lense assembly. See Figure 2-148. Remove lense assembly from inner fairing.
30. 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.
31. On Classic and Ultra models, pull the interconnect wire harness connectors from the:
    - Oil Pressure Gauge
    - Ambient Air Temperature Gauge
32. Remove hex nuts from studs at back of ambient air temperature and oil pressure gauges. Remove mounting brackets. Remove gauges from inner fairing.
33. Remove four socket head screws to free inner fairing from fairing brackets. See Figure 2-149.
34. Raise inner fairing further (along with fairing brackets) and then tilt inner fairing toward rear of vehicle to work free of radio nose seal.
35. Raise and remove inner fairing leaving fairing brackets, radio and interconnect harness on the vehicle.

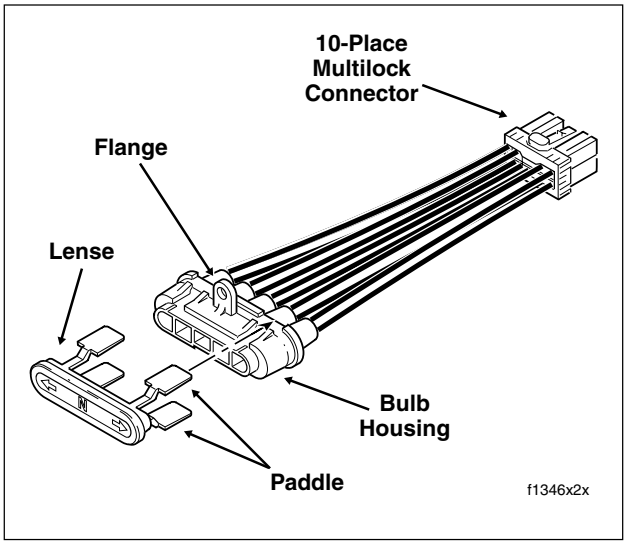


Figure 2-148. Indicator Lense/Bulb Assembly

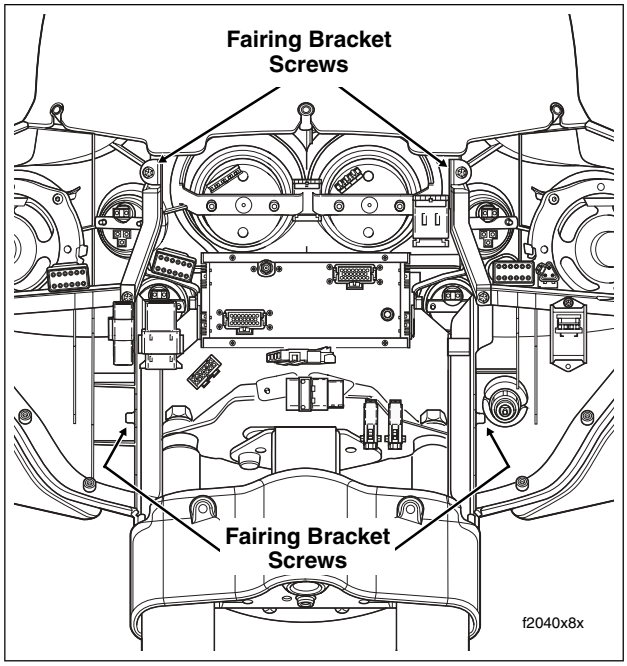


Figure 2-149. Remove Fairing Bracket Screws

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 2-149.
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 2-148.
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 10-20 **in-lbs** (1.1-2.3 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 2-147. Loosely install hex nuts on studs. Verify that gauge is properly aligned and then tighten nuts to 10-20 **in-lbs** (1.1-2.3 Nm). 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) - different size spade contacts prevent improper assembly.
    - 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).

NOTE

On non cruise equipped models, install the friction shoe with the concave side up so that the pin hole is over the point of the adjuster screw. 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.

15. Push the throttle and idle control cables into the lower switch housing until they snap in place. Proceed as follows:

    a. Note the different diameter inserts crimped into the end of the throttle and idle control cable housings.

    b. Push the larger diameter insert (silver) on the throttle cable housing into the larger hole in front of the tension adjuster screw, if provided.

    c. 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.

16. 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).

17. 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 2-150.

18. Position the upper switch housing over the handlebar and lower switch housing.

19. 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.

20. Start the upper and lower switch housing screws, but do not tighten.

CAUTION

See Figure 2-145. Do not remove the 5/32 inch (4.0 mm) 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.

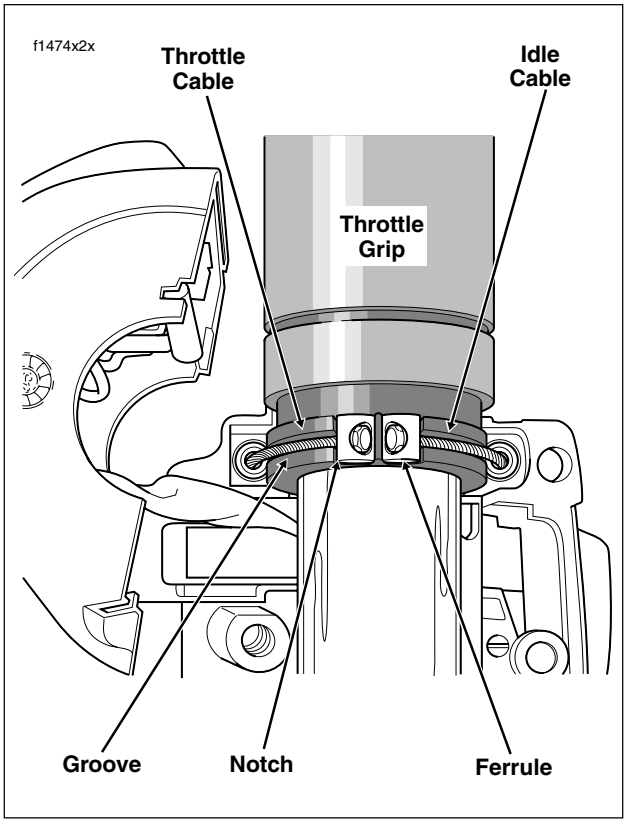


Figure 2-150. Install Throttle/Idle Control Cables on Throttle Control Grip

21. 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.

22. 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.

23. 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.

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

25. Feed clutch cable through inner fairing grommet (left side).

26. Insert cable eyelet into groove of clutch hand lever aligning eyelet with hole without bushing. Insert anchor pin through lever and eyelet.
27. Insert lever into groove of clutch lever bracket fitting sleeve at end of cable housing into bore on inboard side of bracket.
28. 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.

29. Install retaining ring in pivot pin groove.
30. Adjust the clutch. See Section 6.3 CLUTCH, ADJUSTMENT.
31. Install the fairing cap. See FAIRING CAP, INSTALLATION, in this section.
32. Install chrome skirt aligning holes with dowels in lower fork bracket. Using a T40 TORX drive head, start two lower passing lamp bracket bolts into fork sides.
33. Slide lower slots of passing lamp bracket onto lower TORX bolts. Start two upper TORX bolts into fork sides. Alternately tighten four bolts to 15-20 ft-lbs (20-27 Nm).
34. 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.
35. Slide odometer reset switch through hole in inner fairing. Install rubber boot to secure.
36. 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 2-151. 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.

2. Moving to front of vehicle, push wellnuts into holes in outer fairing. See Figure 2-152.

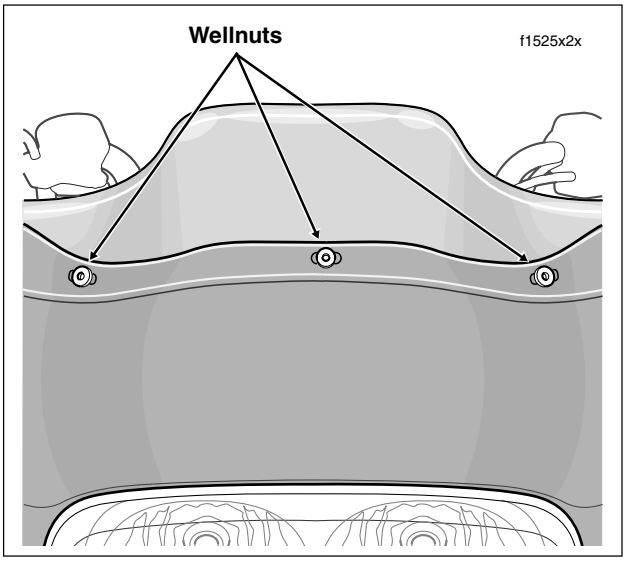


Figure 2-151. Remove Wellnuts From Outer Fairing

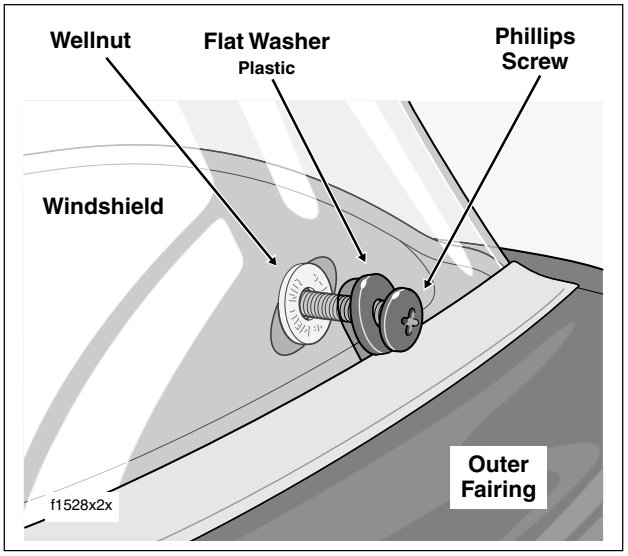


Figure 2-152. Install Windshield (Decal Removed for Illustration Purposes)

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

Windshield may be left 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 2-153.
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.
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 2-154.

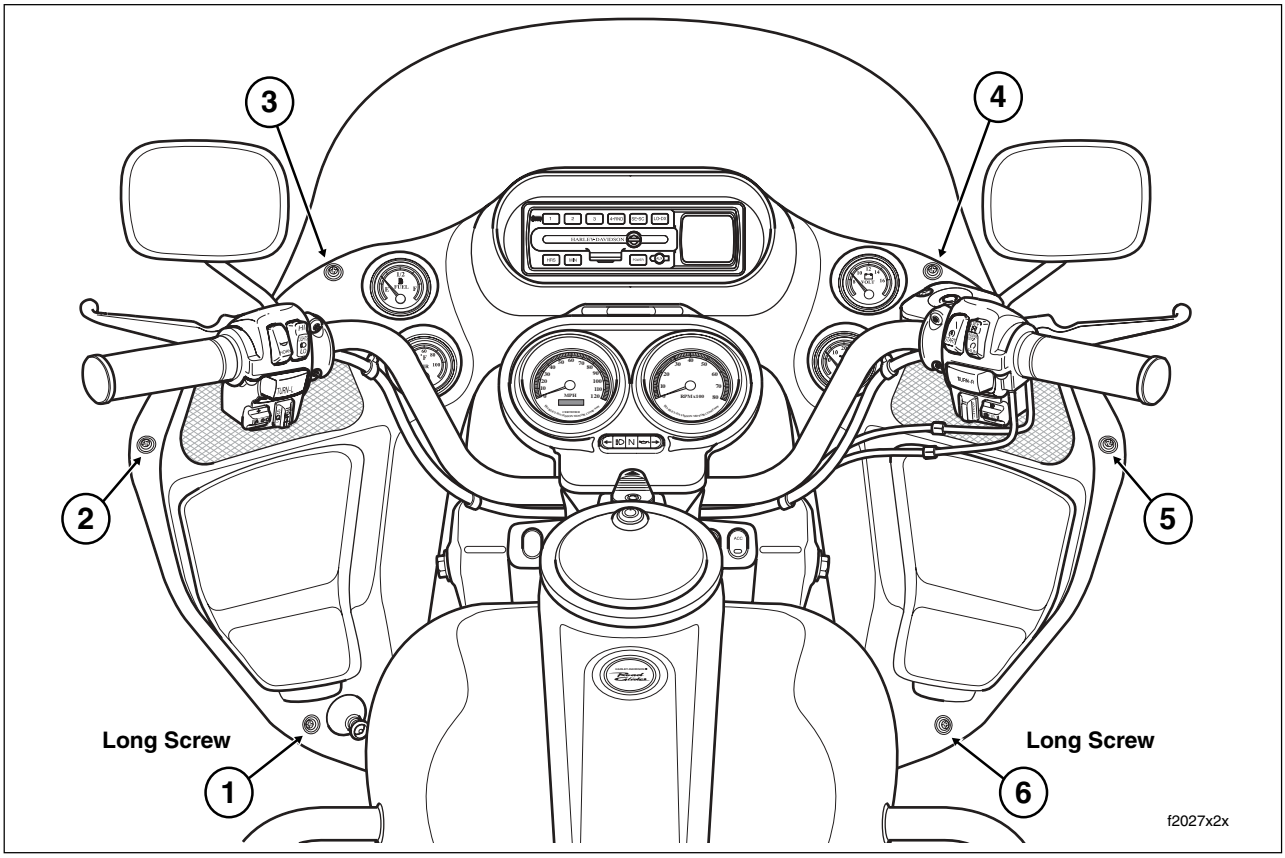


Figure 2-153. Remove Six Outer Fairing Screws

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 prevent scratches or other damage. Rest outer fairing on pad and connect headlamp harness connector.
2. To avoid chafing wires of interconnect harness, verify that trim strips are installed inboard of hooks on radio bracket.

CAUTION

If windshield is attached during outer fairing installation, exercise caution to avoid scratching or damaging inner fairing with windshield screws and wellnuts.

3. Place outer fairing against inner fairing. Two slots in outer fairing must engage hooks on radio bracket. Move harness conduit and wiring as necessary to ensure full engagement between outer and inner fairings.

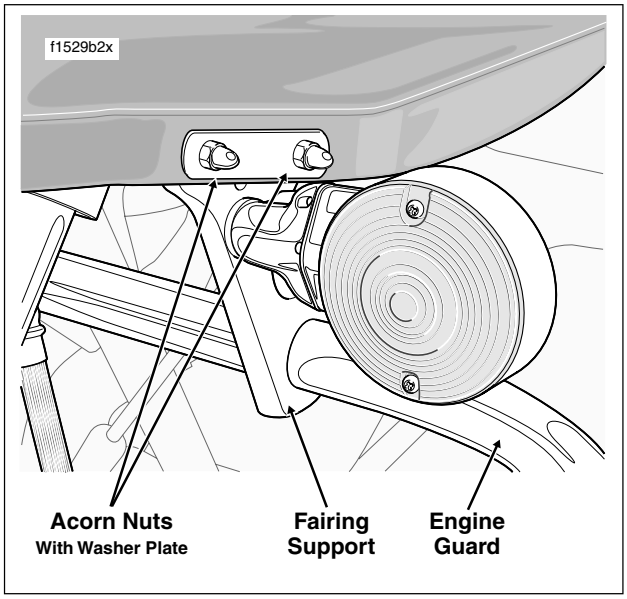


Figure 2-154. Remove Acorn Nuts to Release Stud Plate (Left Side View)

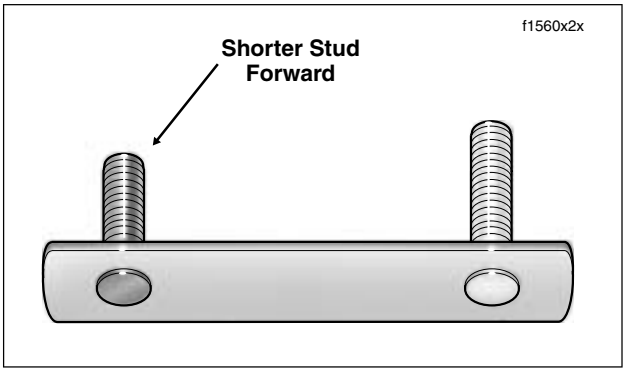


Figure 2-155. Stud Plate

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 2-155.
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 2-154.
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 10-15 **in-lbs** (1.1-1.7 Nm).

BEZEL

REMOVAL

1. Using a T25 TORX drive head, remove screw on left and right side of instrument bezel. See Figure 2-156.
2. Use thumbs to push tab at rear of bezel from slot in front of 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 2-157. 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 2-157. Looking into the instrument nacelle, connect the following connector to jumper harness.

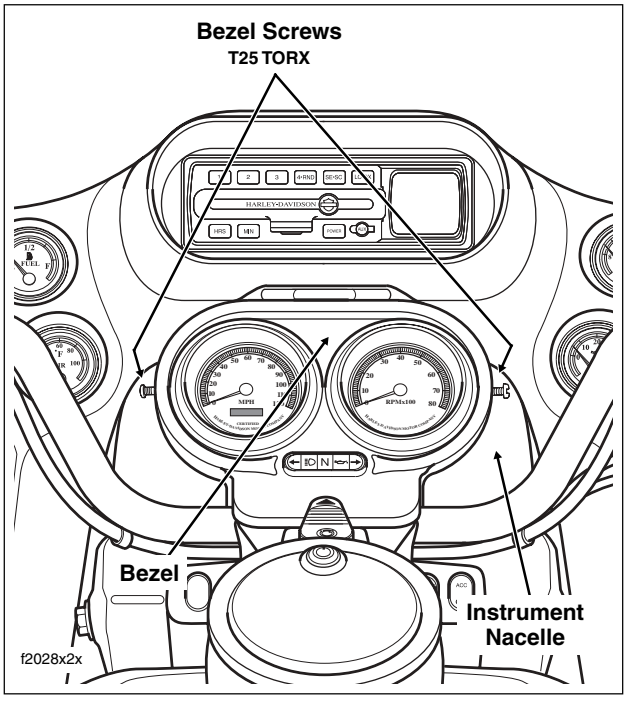


Figure 2-156. Remove Instrument Bezel Screws

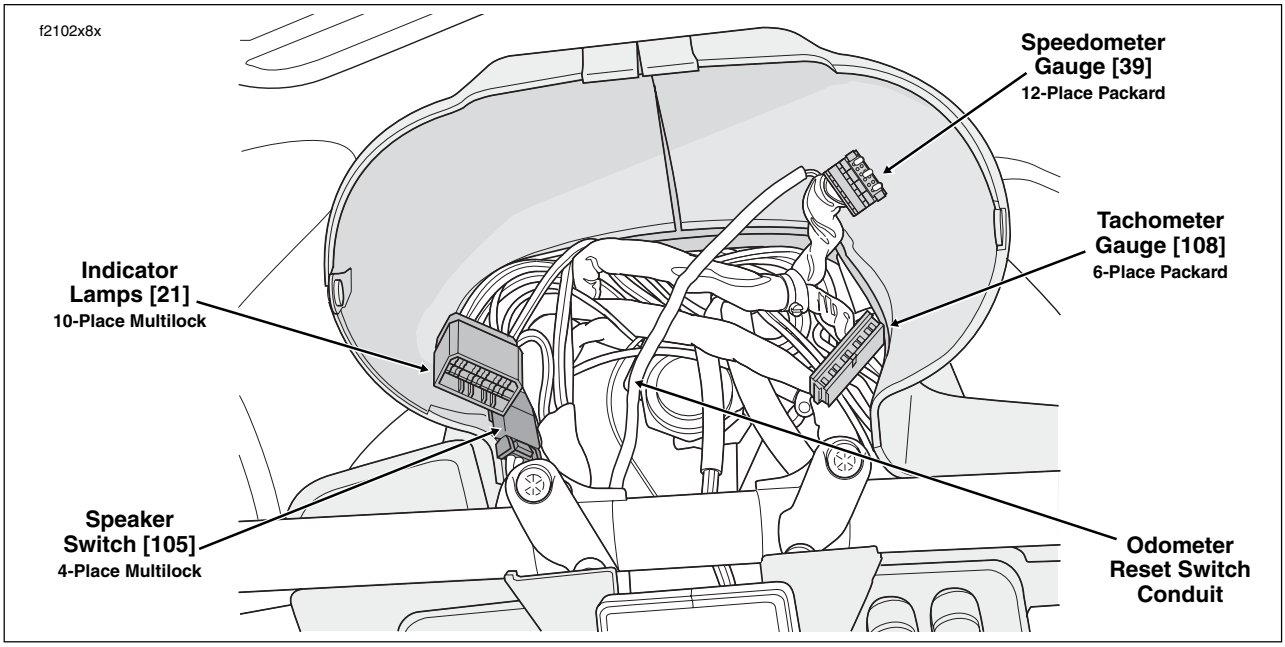


Figure 2-157. Instrument Nacelle (Bezel Removed)

- 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 in front of 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 25-35 **in-lbs** (2.8-4.0 Nm). See Figure 2-156.

INSTRUMENT NACELLE

REMOVAL

1. Remove bezel. See BEZEL, REMOVAL, in this section.
2. Partially disassemble domestic ignition switch as follows:

NOTE

For partial disassembly of HDI ignition switch, see Section 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHT/C/U, FLTR (INTERNATIONAL), REMOVAL, steps 1-4.

   a. To remove the ignition switch knob, insert the Ignition Switch key and turn to the UNLOCK position. Leaving the key installed, rotate the knob to ACCESS. Depressing the release button at bottom (left side) with a small screwdriver, push key down and turn an additional 60 degrees in a counterclockwise direction. Lift and remove knob. See upper frame of Figure 2-158.

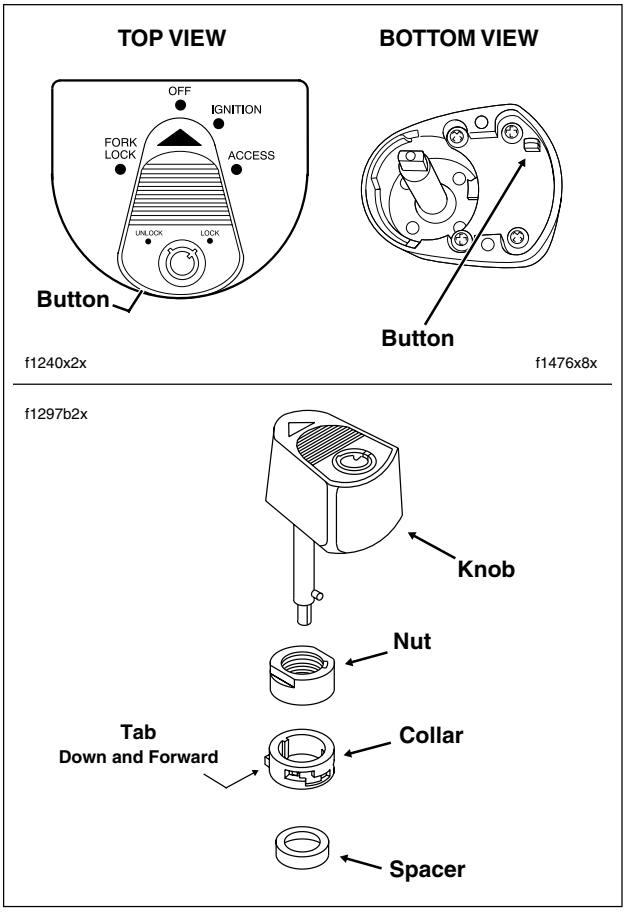


Figure 2-158. Ignition Switch Knob (Domestic)

b. 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 2-158.

c. Remove the switch position plate from threaded post of ignition switch housing.

3. See Figure 2-157. 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.
4. Using a T40 TORX drive head, remove two bolts (with flat washers) to release left side of instrument nacelle from fork side.
5. While carefully removing left side instrument nacelle from vehicle, unthread rubber boot and pull odometer reset switch from hole. See Figure 2-160.
6. Remove the outer fairing. See OUTER FAIRING, REMOVAL, in this section.
7. 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.
8. See Figure 2-159. Disconnect jumper harness from interconnect harness as follows:
   - Indicator Lamps connector [21], 10-place Multilock.
   - Instrument nacelle switch connector [105], 12-place Multilock.
9. Pull throttle cable clip from hole on right side of instrument nacelle.
10. Using a T40 TORX drive head, remove two bolts (with flat washers) to release right side of instrument nacelle from fork side.
11. 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 2-160.

INSTALLATION

1. While installing right side of instrument nacelle, feed free end of jumper harness through tunnel of fairing bracket to front of inner fairing (beneath radio).

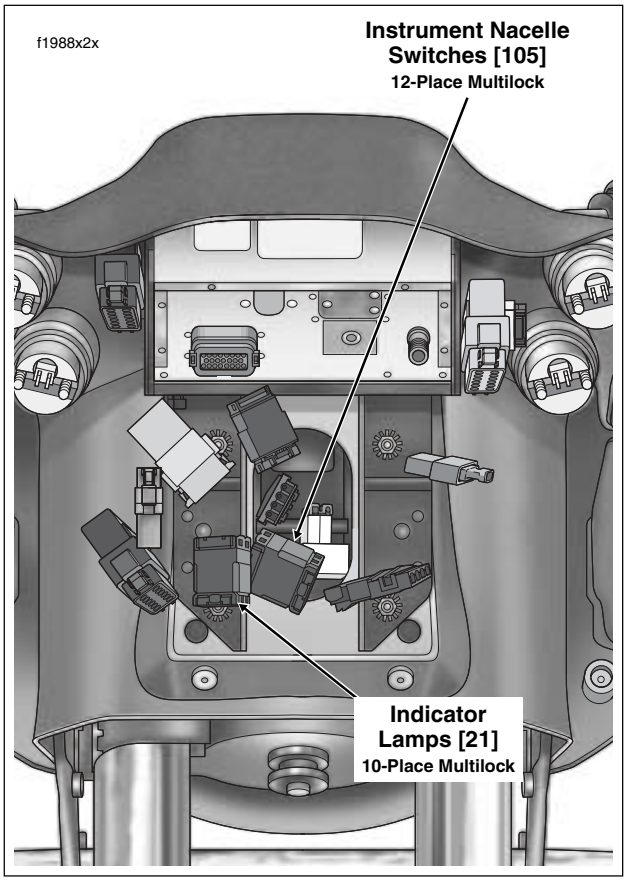
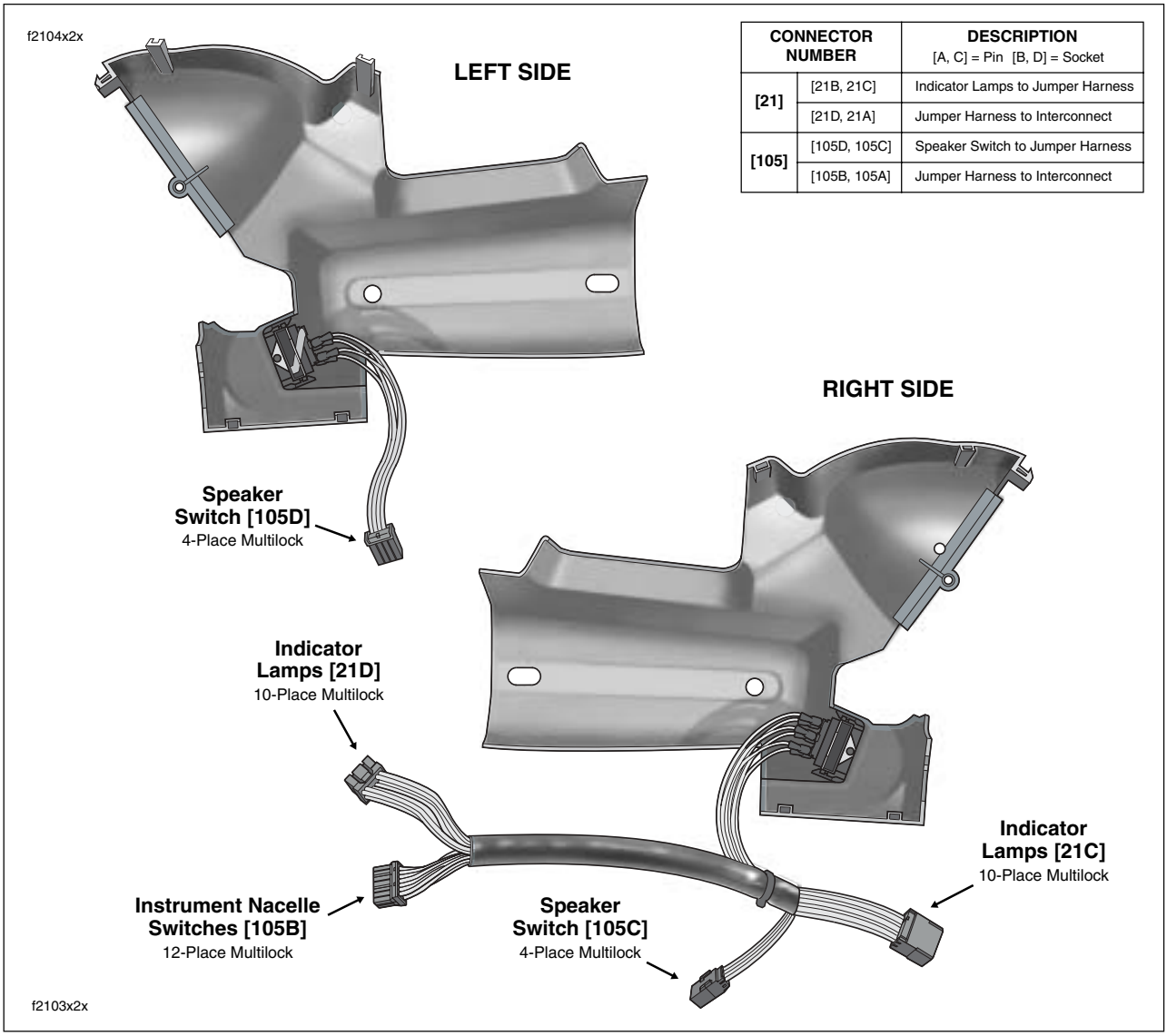


Figure 2-159. Interconnect Harness Connectors



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 2-160. Instrument Nacelle Halves

2. See Figure 2-159. 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.
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. While carefully placing left side of instrument nacelle on vehicle, slide odometer reset switch through hole and install rubber boot to secure.
6. Verify that left and right sides of nacelle are properly mated. Four pins on left side of nacelle must fully engage holes on right.
7. 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. Tighten bolts to 15-20 ft-lbs (20-27 Nm).
8. Using a T40 TORX drive head, install two bolts (with flat washers) to fasten right side instrument nacelle to fork side. Tighten bolts to 15-20 ft-lbs (20-27 Nm).

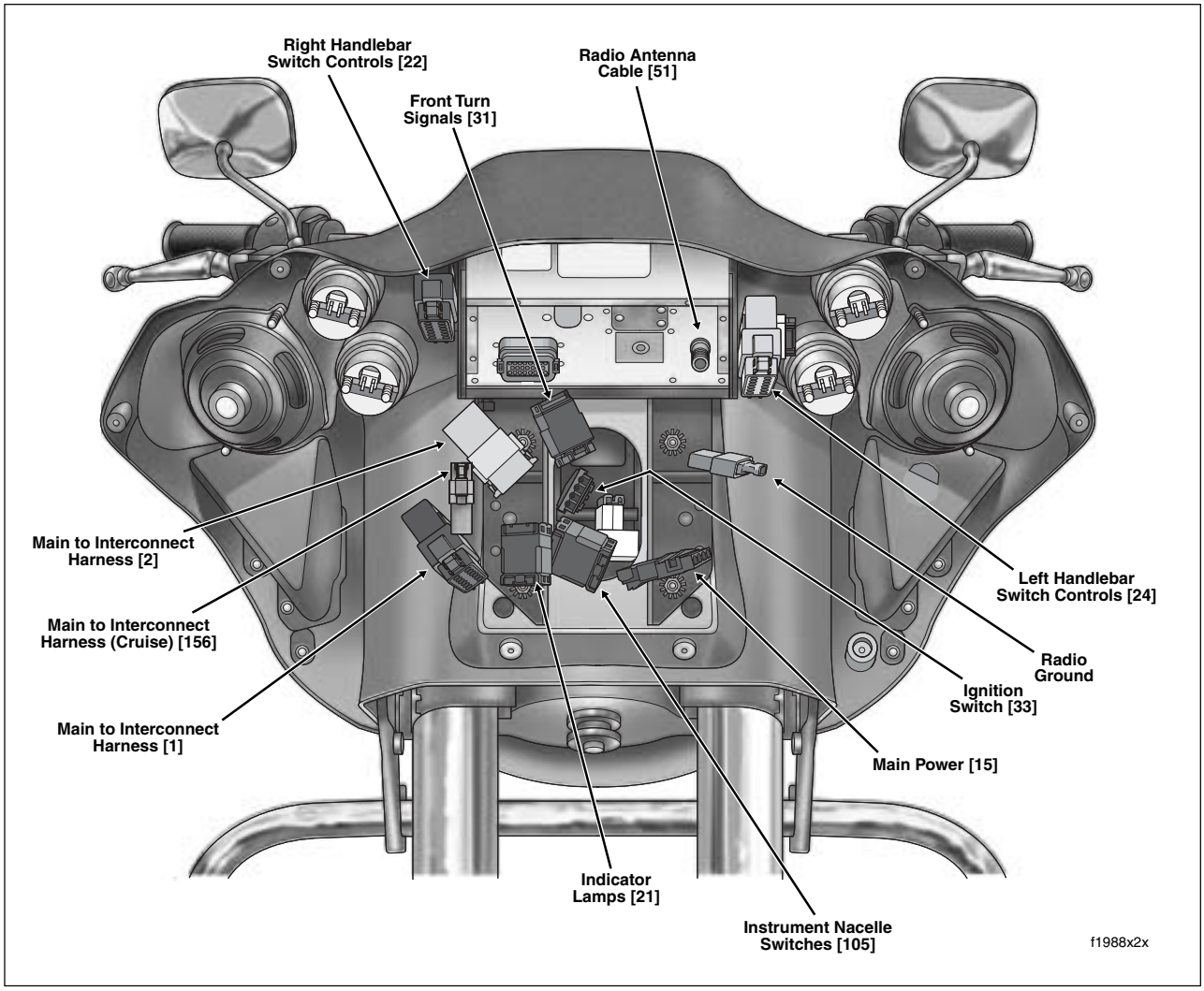


Figure 2-161. Inner Fairing Connections (FLTR)

9. Assemble domestic ignition switch as follows:

NOTE

For assembly of HDI ignition switch, see Section 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHT/C/U, FLTR (INTERNATIONAL), INSTALLATION, steps 5-10.

   a. Install the switch position plate over threaded post of ignition switch housing. Tabs on plate fit in holes at top of instrument nacelle.

   b. 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 to 50-70 **in-lbs** (5.7-7.9 Nm). See lower frame of Figure 2-158.

   c. 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. 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 2-157.

11. Capture throttle cables in cable clip. Insert cable clip into hole in right side of instrument nacelle.

12. Install bezel. See BEZEL, INSTALLATION, in this section.

INNER FAIRING

REMOVAL

1. Remove odometer reset switch from left side of instrument nacelle. See INSTRUMENT NACELLE, REMOVAL, in this section, steps 1-5.
2. Remove the outer fairing. See OUTER FAIRING, REMOVAL, in this section.
3. 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.
4. Draw free end of main harness (branch terminating in odometer reset switch and speedometer and tachometer connectors) from instrument nacelle through tunnel of fairing bracket to front of inner fairing.
5. See Figure 2-159. Disconnect jumper harness from interconnect harness as follows:
   - Indicator Lamps connector [21], 10-place Multilock.
   - Instrument nacelle switch connector [105], 12-place Multilock.
6. See Figure 2-161. 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 to interconnect harness (cruise) connector [156], 4-place Deutsch (gray); below radio (right side).
   - Main power connector [15], 4-place Packard (black); below radio.
   - Radio antenna cable connector [51]; back of radio (left side).
7. See Figure 2-161. Disconnect ignition switch from main harness as follows:
   - Ignition switch connector [33], 4-place Packard (black); inside fairing bracket tunnel (left side).
8. See Figure 2-161. 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.

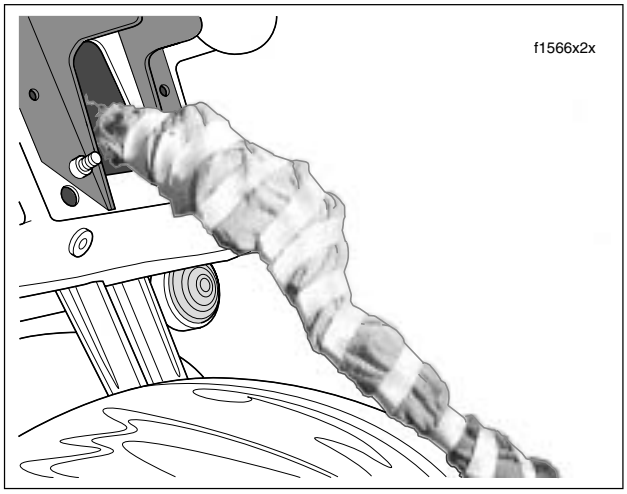


Figure 2-162. Wrap Harness Bundle in Shop Towels

9. Release turn signal conduit from flexible clips on both sides of inner fairing and draw wires downward to free conduit from slots at bottom.
10. Cut cable straps as necessary to release jumper harness, main harness, and handlebar switch control conduit from interconnect harness.
11. Place protective material on top of front fender to protect paint from scratches or other damage.
12. Draw the jumper harness, main harness, and handlebar switch control conduit as far forward as possible, resting the connectors of the longer harnesses on the front fender.
13. Tightly wrap clean shop towels around the harness bundle (capturing all connectors) and secure with masking tape. See Figure 2-162.
14. Remove four locknuts to release radio bracket (and inner fairing) from studs of fairing bracket. See Figure 2-163.
15. Lift inner fairing (with attached radio bracket) from fairing bracket studs and move to bench area.
16. To remove fairing bracket, proceed as follows:
    a. Remove shop towels and masking tape from around the harness bundle. Separate jumper harness and main 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 through opening on right side of fairing bracket.
    d. Remove locknuts and bolts to release fairing bracket from holes at rear of steering head.

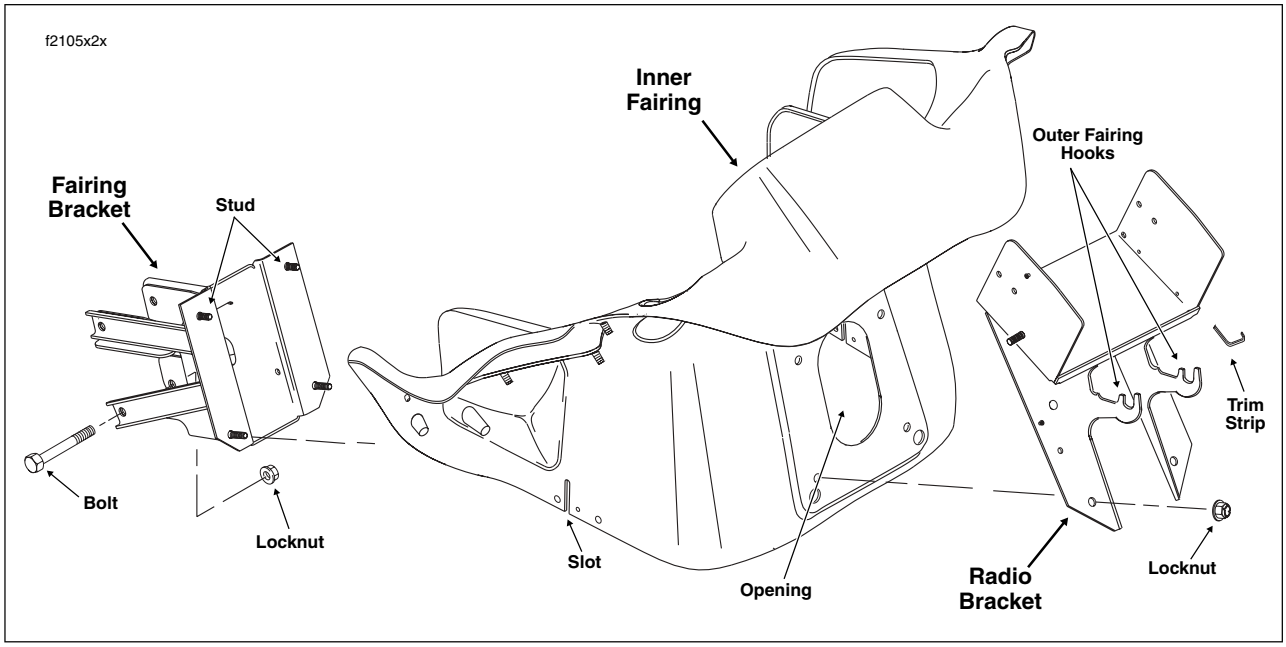


Figure 2-163. Inner Fairing Assembly

INSTALLATION

1. If fairing bracket is installed, move to step 2. To install fairing bracket, proceed as follows:

   a. Route main harness and radio ground wire through opening on right side of fairing bracket. See Figure 2-164.

   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 2-164.

   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 2-162.

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 2-163. Verify that sides of inner fairing are positioned outboard of both fairing supports (on engine guards).

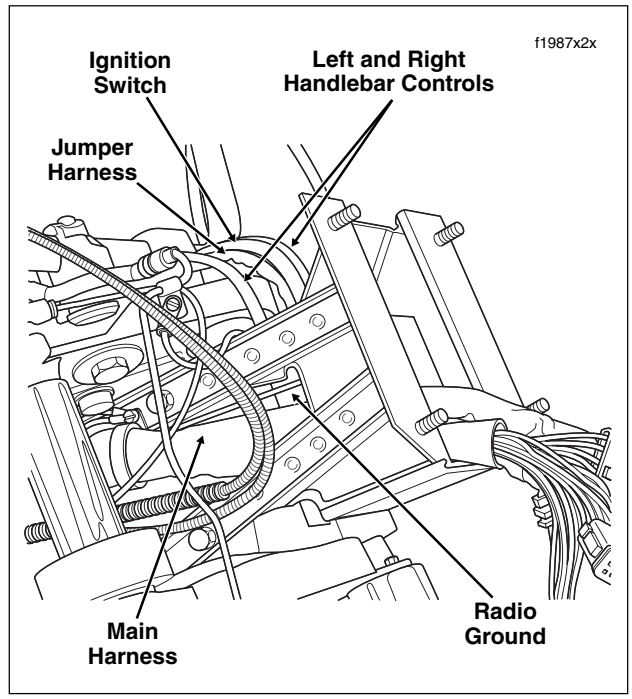


Figure 2-164. Route Harnesses Thru Fairing Bracket

4. Install four locknuts to secure radio bracket and inner fairing to fairing bracket studs. Tighten locknuts to 96-144 **in-lbs** (10.9-16.3 Nm).

5. Draw the harness bundle as far forward as possible, resting the end of the bundle on the front fender. See Figure 2-162.
6. Remove shop towels and masking tape from around the harness bundle. Separate jumper harness, main 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.
8. See Figure 2-161. 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 2-161. 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 to interconnect harness (cruise) connector [156], 4-place Deutsch (gray); below radio (right side).
   - Main power connector [15], 4-place Packard (black); below radio.
   - Radio antenna cable connector [51]; back of radio (left side).
10. See Figure 2-161. Connect ignition switch to main harness as follows:
    - Ignition switch connector [33], 4-place Packard (black); inside fairing bracket tunnel (left side).
11. See Figure 2-161. Connect jumper harness to interconnect harness as follows:
    - Indicator Lamps connector [21], 10-place Multilock.
    - Instrument nacelle switch connector [105], 12-place Multilock.
12. Feed free end of main harness (branch terminating in odometer reset switch and speedometer and tachometer connectors) from front of inner fairing through tunnel of fairing bracket to instrument nacelle.
13. 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.

CAUTION

To avoid chafing wires of interconnect harness and possible damage to slots of outer fairing during installation, verify that trim strips are installed on hooks of radio bracket.

14. Install the outer fairing. See OUTER FAIRING, INSTALLATION, in this section.
15. Install odometer reset switch and left side of instrument nacelle. See INSTRUMENT NACELLE, INSTALLATION, in this section, steps 5-7 and 9-10.
16. 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.
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 damaged or missing. Insert tail of rubber bumper into hole, and moving to front of inner fairing, pull anchor through hole.*

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.
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) 2.29

WINDSHIELD REMOVAL

1. See Figure 2-165. 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 2-165.
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 eight Phillips screws to free the headlamp housing from the headlamp nacelle.

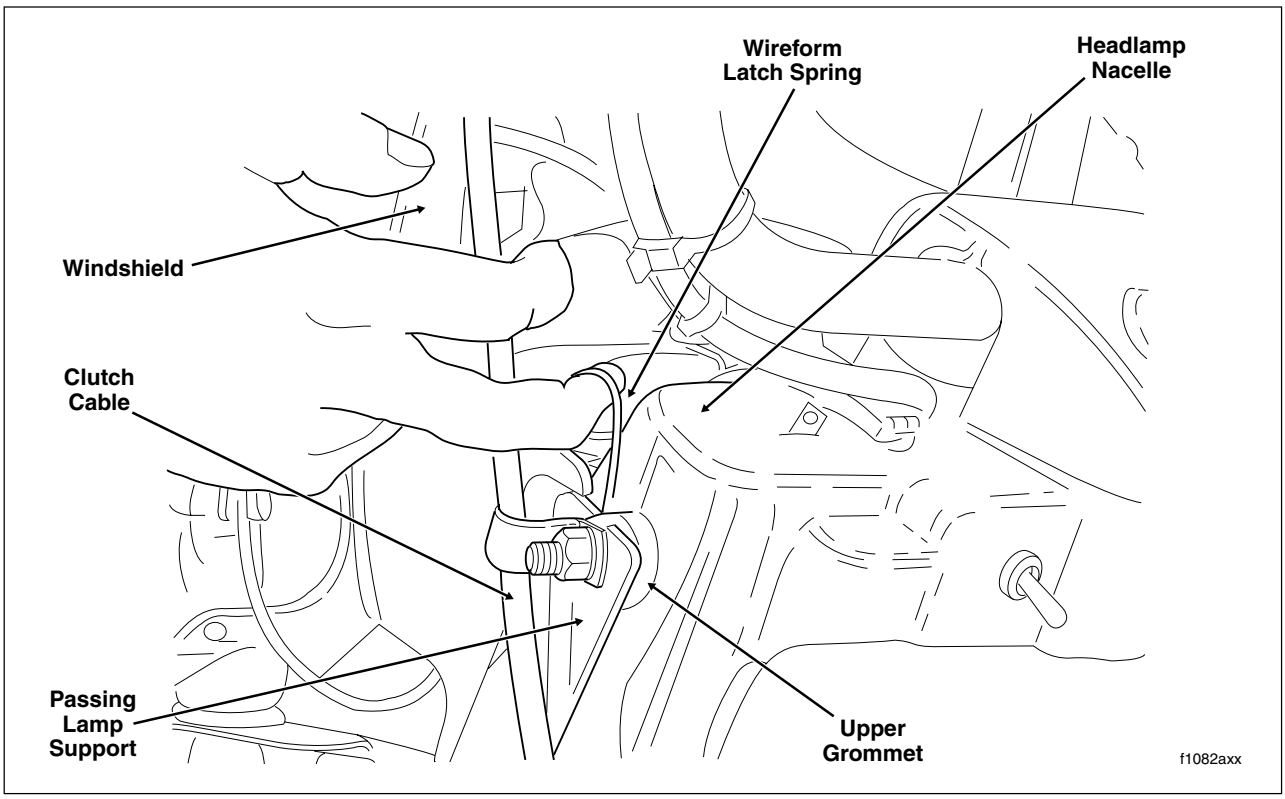


Figure 2-165. Windshield (Left Side View)

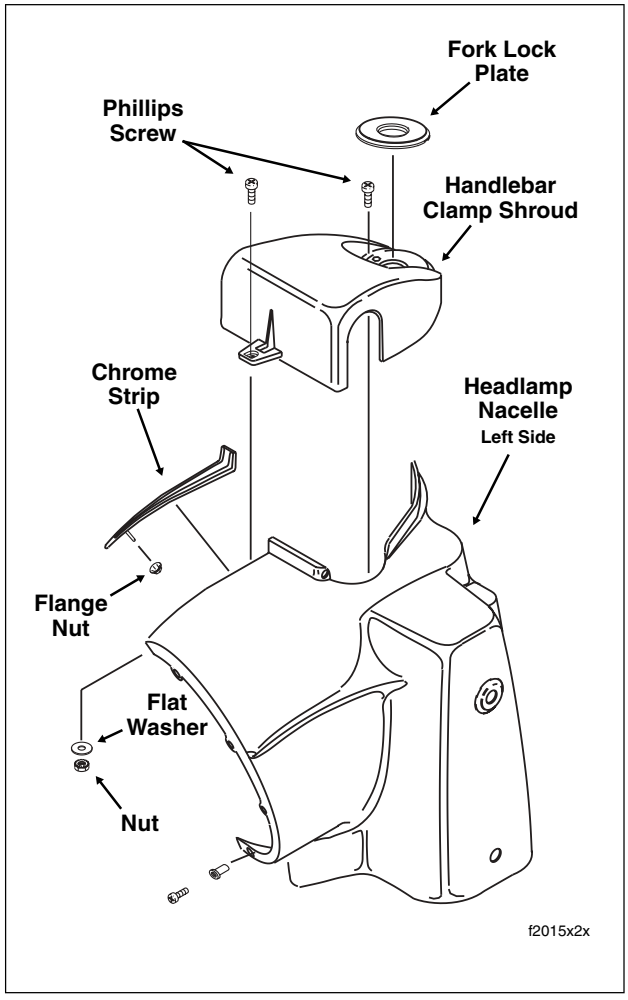


Figure 2-166. Headlamp Nacelle Assembly

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 flange nut to release the chrome strip at the top of the nacelle. See Figure 2-166.
6. Carefully pry off the fork lock plate at the rear of the handlebar clamp shroud. Remove two Phillips screws beneath the lock plate.
7. Loosen the Phillips screw from tab at the front of the handlebar clamp shroud (but do not remove).
8. Remove the two acorn nuts from the left side fork studs. Remove acorn nuts from the right side fork studs.
9. 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.
10. Remove the grommets (and clutch cable clamp) from the left and right side fork studs.
11. Raise the handlebar clamp shroud slightly, and while separating the halves of the headlamp nacelle, remove the shroud from the vehicle. See Figure 2-167.
12. 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 2-167. With the halves of the nacelle mated, tighten the Phillips screw to 10-20 **in-lbs** (1.1-2.3 Nm).
3. Install two Phillips screws to secure the handlebar clamp shroud to the fork lock mechanism. Install the fork lock plate.
4. Inserting the weld stud on the chrome strip into the hole at the top of the headlamp nacelle, reach inside the nacelle to install flange nut. Tighten flange nut to 15-20 **in-lbs** (1.7-2.3 Nm).
5. Install the grommets on the left and right side fork studs.
6. 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.

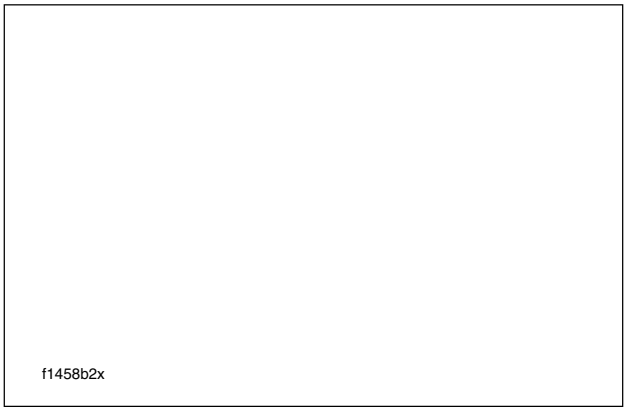


Figure 2-167. Handlebar Clamp Shroud

7. Install the acorn nuts on the fork studs and tighten to 72-108 **in-lbs** (8.1-12.2 Nm). Be sure to capture the clutch cable clamp on the upper left stud before installing the acorn nut.
8. Install the wire connector at the back of headlamp bulb.
9. Align holes in headlamp housing with those in headlamp nacelle (headlamp door bracket at bottom). Install the eight Phillips screws.
10. 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.
11. Install the windshield. See WINDSHIELD INSTALLATION in this section.

FRONT FENDER 2.30

REMOVAL

1. **FLHT/C/U:** Reaching in below the fairing cap on the left side of the steering head, locate the front fender tip lamp connector (black 2-place Multilock). See Figure 2-168. Remove the outer fairing only if necessary. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL.

   FLHR: Remove the Phillips screw at the bottom of the headlamp door (chrome ring). Remove the headlamp door. Remove the eight 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 2-169.

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 to fender area.

4. Carefully cut cable strap to release front fender tip lamp wires 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. Using thru hole, cable strap caliper to rail of engine guard. 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 axle holder 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.

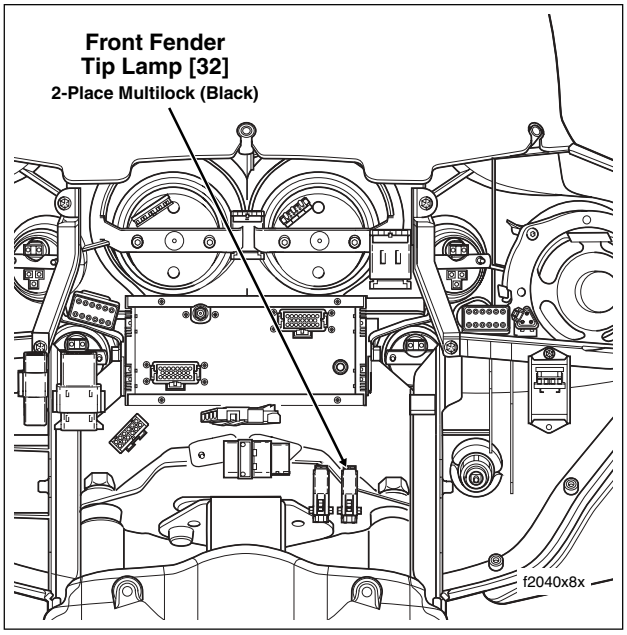


Figure 2-168. Inner Fairing (FLHT/C/U)

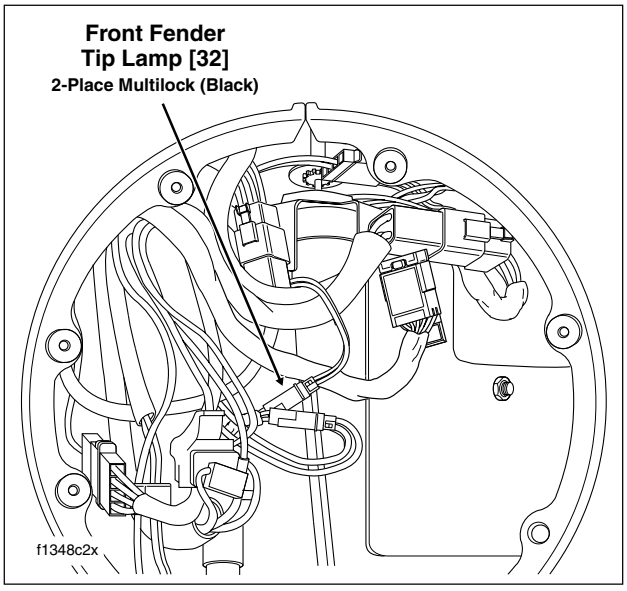


Figure 2-169. Headlamp Nacelle (FLHR)

INSTALLATION

1. Align mounting holes in fender and lockplates with those in fork tubes. Install four fender mounting bolts and tighten to 16-20 ft-lbs (22-27 Nm). Bend tabs on lockplates against flats of fender mounting bolts.

2. Route socket housing of front fender tip lamp connector upward behind chrome skirt (FLHT/C/U) or through bottom of headlamp nacelle (FLHR) to area of top fork bracket. Mate pin and socket halves.

NOTE

To connect front fender tip lamp with the outer fairing installed (FLHT/C/U models), reach in below the fairing cap on the left side of the steering head.

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 leg. Push axle through fork, **short** external spacer and wheel hub until it begins to emerge from left side.
6. With the three notches on the bearing side, push axle through **long** external spacer and left fork leg until axle shoulder contacts external spacer on right fork side.
7. Install flat washer, lockwasher and axle nut.
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 axle holder nuts to 132-180 **in-lbs** (14.9-20.3 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 wires to brake line hose. Cut any excess cable strap material.
14. **FLHT/C/U:** Install the outer fairing, if removed. See Section 2.27 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 eight 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 2.22 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 2-170.
5. Gently pull side cover from frame downtube (no tools required). Repeat step on opposite side of vehicle.
6. Remove four screws (two on FLHR/C and FLTR) to release license plate bracket from luggage rack.
7. Standing on left side of vehicle, use a T40 TORX drive head to release front of rear fender from battery box. See Figure 2-171.
8. 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 2-172.

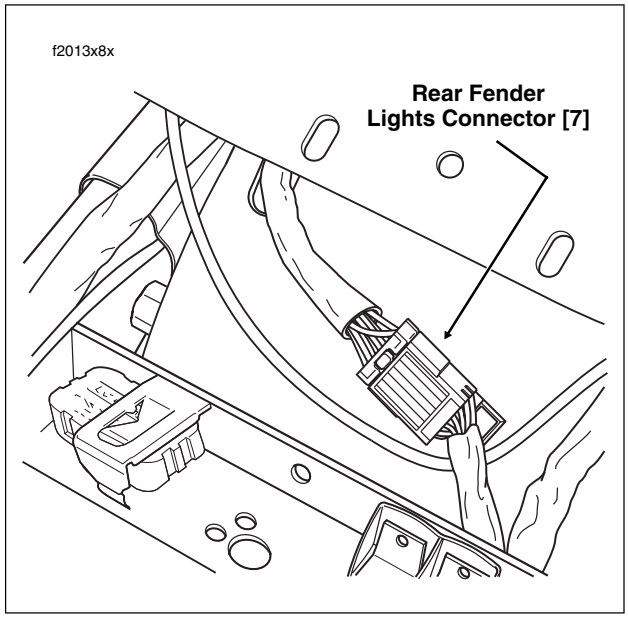


Figure 2-170. Rear Fender (Top View)

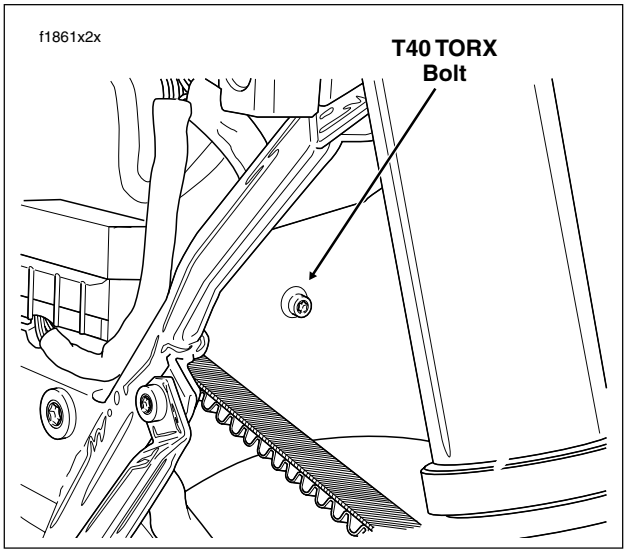


Figure 2-171. Rear Fender Front Mounting Bolt (Left Side View)

9. Reaching under bumper, remove nut (with flat washer) to free bumper bracket from weld stud on fender. Remove bumper from vehicle.
10. 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 2-173.
11. Using a T40 TORX drive head, remove upper rear bolt from saddlebag support bracket. Repeat step on opposite side of vehicle. See Figure 2-174.

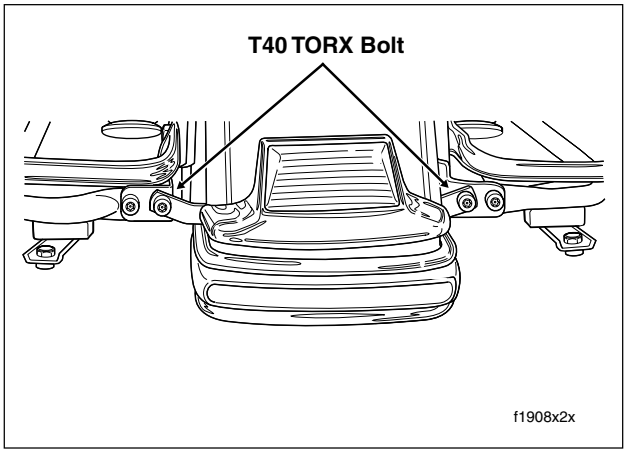


Figure 2-172. Release Bumper From Saddlebag Rail

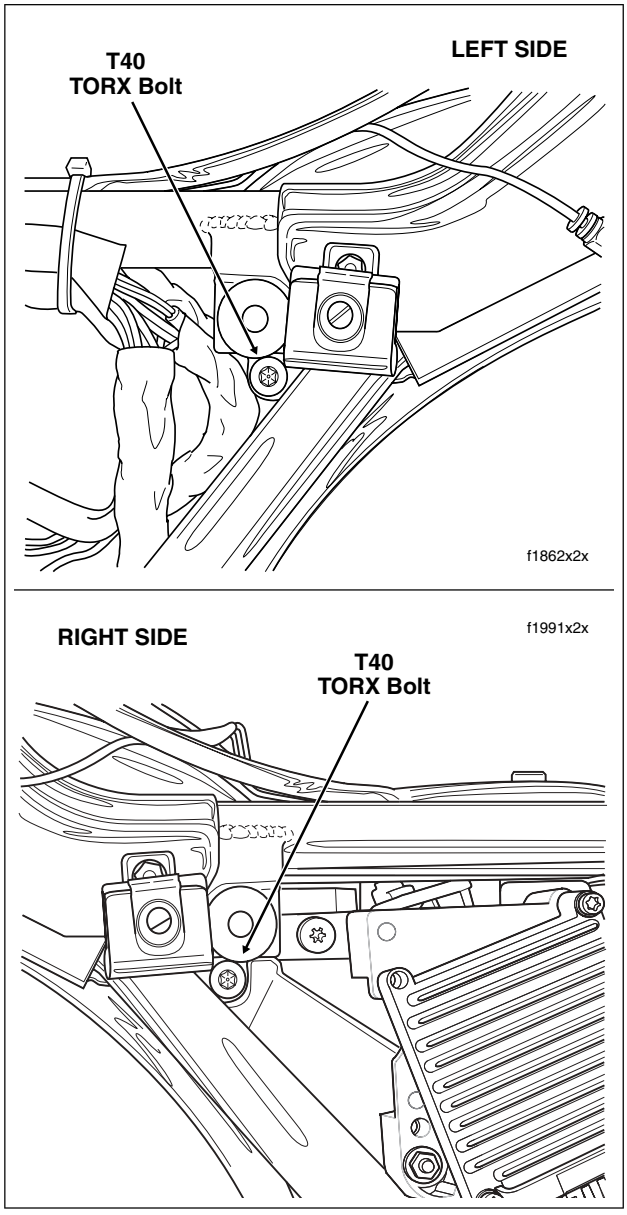


Figure 2-173. Rear Fender Side Mounting Bolts

12. 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.
13. Exercising caution to avoid scratching fender paint on luggage rack or other bracketry, carefully roll the fender out. See Figure 2-175. If necessary, have one person spread the saddlebag support brackets while the fender is rolled out.

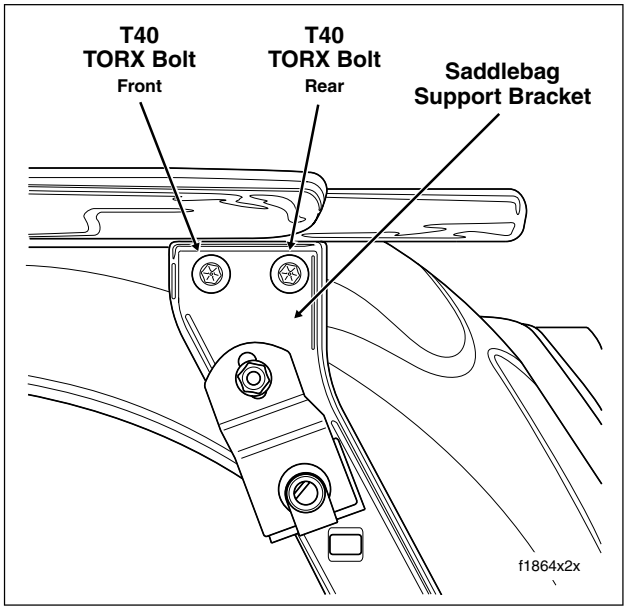


Figure 2-174. Saddlebag Support Bracket Bolts (Left Side View)

INSTALLATION

1. Exercising caution to avoid scratching fender paint on luggage rack or other bracketry, carefully roll the fender in. See Figure 2-175. 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 2-174.
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 2-171.
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 2-173.
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 2-172.

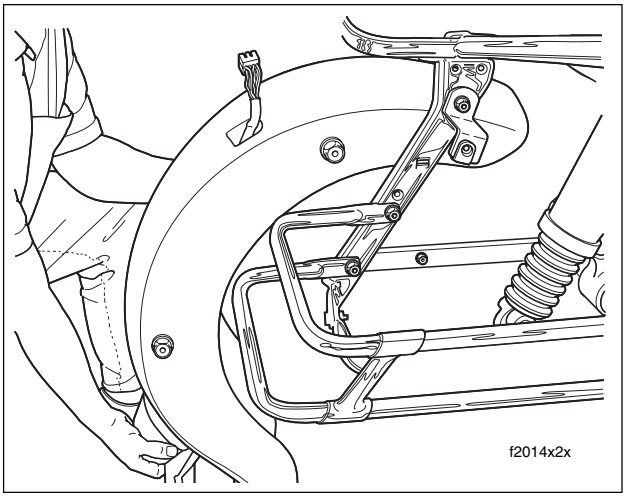


Figure 2-175. Carefully Roll Out Rear Fender

8. Alternately tighten all rear fender T40 TORX bolts to 15-20 ft-lbs (20-27 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 2-170.
11. 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.
12. Install rear wheel. See Section 2.3 REAR WHEEL, INSTALLATION.
13. Install seat. See Section 2.22 SEAT, INSTALLATION.

JIFFY STAND 2.32

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.

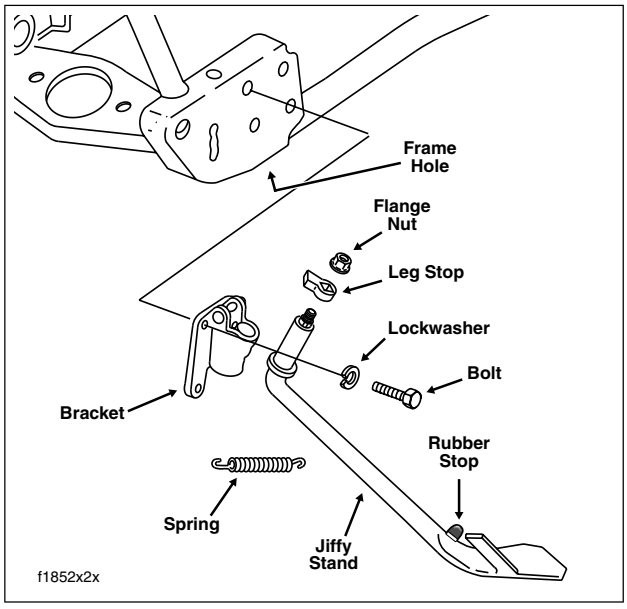


Figure 2-176. Jiffy Stand Assembly

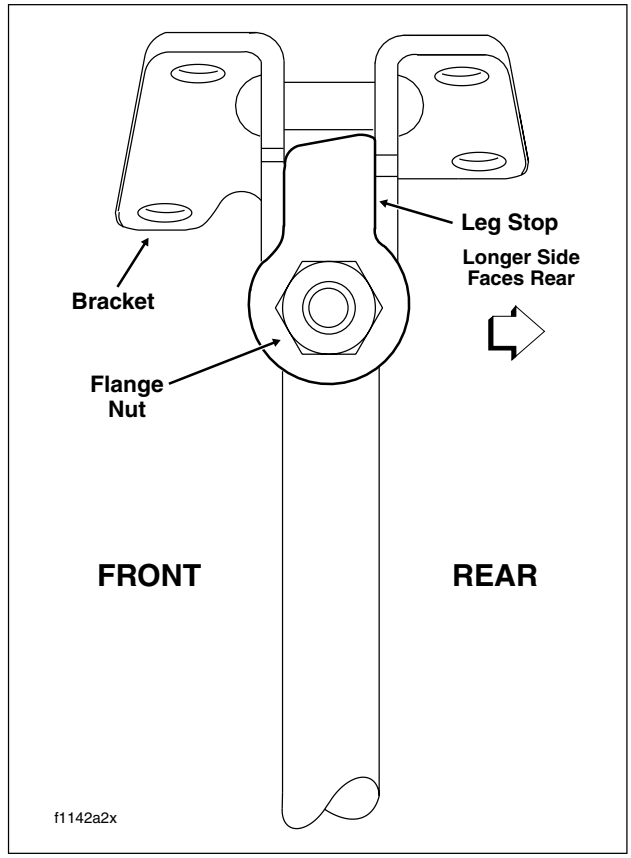


Figure 2-177. Leg Stop Orientation (Full Forward Position)

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 2-176. 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 Loctite Aerosol Anti-Seize Lubricant. 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 2-177.

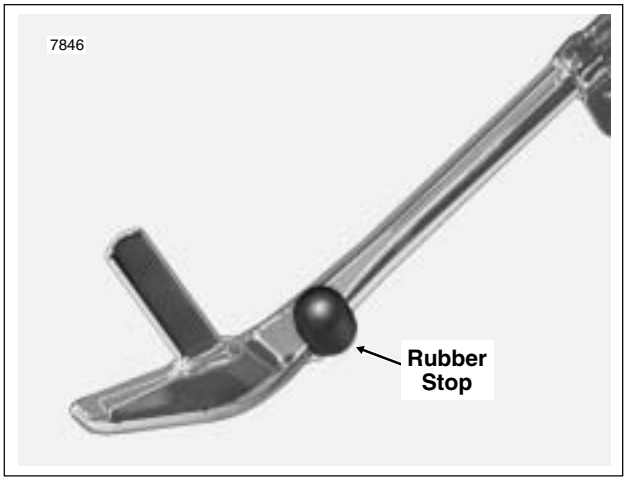


Figure 2-178. Jiffy Stand

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 2-178.

REMOVAL

1. Remove saddlebags. See Section 2.23 SADDLEBAG, REMOVAL.
2. See Figure 2-180. 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 2-179. 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 muffler

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 and pull bracket tab and stud from slots in TORCA clamp and 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 door, 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 bottom nut to 60-80 **in-lbs** (6.8-9.0 Nm). Final tighten the top nut to 60-80 **in-lbs** (6.8-9.0 Nm).
    b. Tighten the bottom nut of the rear cylinder head exhaust flange to 9-18 **in-lbs** (1-2 Nm). Tighten the top nut to 60-80 **in-lbs** (6.8-9.0 Nm). Final tighten the bottom nut to 60-80 **in-lbs** (6.8-9.0 Nm).
    c. Tighten the transmission clamp bolt to 60-96 **in-lbs** (6.8-10.8 Nm).
    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.

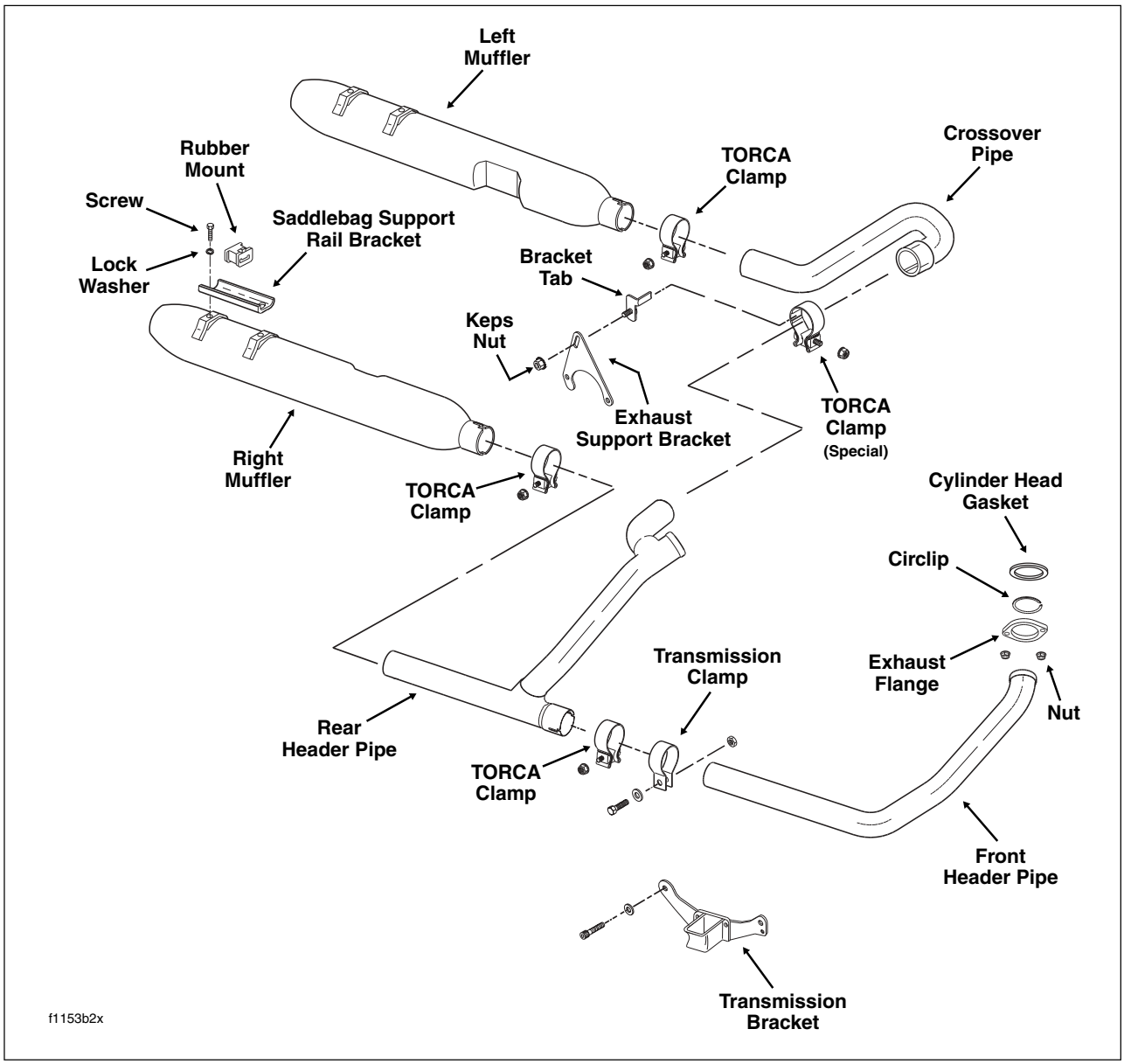


Figure 2-179. Exhaust System (without Heat Shields)

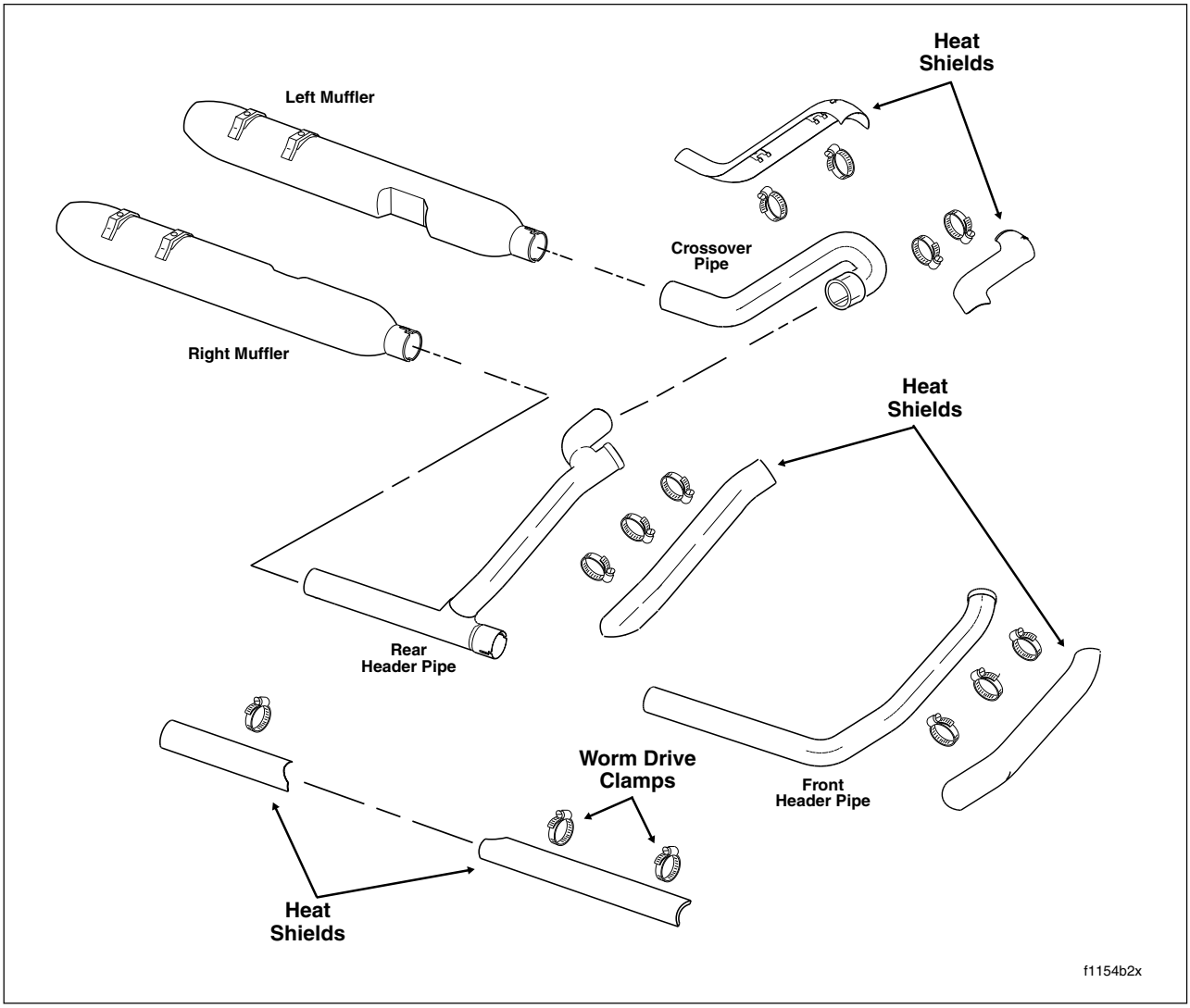


Figure 2-180. Heat Shields

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 2-180. 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 2.23 SADDLEBAG, INSTALLATION.

NOTES

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SPECIFICATIONS 3.1

MANUFACTURING TOLERANCES

General	
Number of cylinders	2
Type	4-cycle, 45˚V[2], air-cooled
Torque	86 ft-lbs (108.8 Nm) @ 3500 rpm, chrome duals 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°-30°
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	12-18 ft-lbs (16-24 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° F (110° 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:		
Early Piston	0.0006-0.0017	0.015-0.043
Late Piston	0.0014-0.0025	0.036-0.064
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)	0.0002-0.0005	0.005- 0.013

MANUFACTURING TOLERANCES (CONT.)

Connecting Rod	IN.	MM
Piston pin fit (loose)	0.0007-0.0012	0.018-0.030
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	0.000-0.254
Runout (shaft at flywheel)	0.000-0.002	0.000-0.051
End play	0.003-0.010	0.076-0.254

Crankshaft/Sprocket Shaft Bearings	IN.	MM
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)	0.0038-0.0054	0.097-0.137
Bearing inner race on crankshaft (tight)	0.0004-0.0014	0.010-0.036

TORQUE VALUES

Item	ft/in-lbs	NM
Breather assembly bolts	90-120 **in-lbs**	10-14 Nm
Cam cover screws	125-155 **in-lbs**	14-18 Nm
Cam cover plate screws	20-30 **in-lbs**	2.3-3.4 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**	10.2-13.6 Nm
Piston jet screws	25-35 **in-lbs**	2.8-4.0 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	84-108 **in-lbs**	9-12 Nm
Oil filter	1/2-3/4 turn after gasket contact	
Oil filter mount	12-16 ft-lbs	16-22 Nm
Crankcase oil fittings/plugs	120-168 **in-lbs**	13.6-18.9 Nm
Oil hose cover screws	84-108 **in-lbs**	10-12 Nm
Oil pressure sending unit	96-120 **in-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	120-168 **in-lbs**	13.6-18.9 Nm
Spark plugs	12-18 ft-lbs	16-24 Nm
Stator screws	55-75 **in-lbs**	6.2-8.5 Nm
Upper engine mounting bracket: To cylinder heads To top stabilizer link	 25-30 ft-lbs 18-22 ft-lbs	 34-41 Nm 24-30 Nm
Engine sensor harness clip screws to crankcase	25-35 **in-lbs**	2.8-4.0 Nm
Engine temperature sensor	120-180 **in-lbs**	13.6-20.3 Nm
Intake flange adapter screws	96-144 **in-lbs**	10.9-16.3 Nm
Exhaust flange adapter screws	60-80 **in-lbs**	6.8-9.0 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	0.254
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 0.051
Head warpage	More than 0.006	More than 0.152

Cylinder	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Taper	0.002	0.051
Out of round	0.002	0.051
Warpage of gasket or O-ring surfaces: top	0.006	0.152
Warpage of gasket or O-ring surfaces: base	0.004	0.102

Cylinder Bore	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Standard	3.752	95.301
0.005 in. oversize	3.757	95.428
0.010 in. oversize	3.762	95.555

Piston		REPLACE IF WEAR EXCEEDS	
		IN.	MM
Fit in cylinder (loose)		0.003	0.076
Piston pin fit (loose)		0.0008	0.020
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)	0.002	0.051
Side play between flywheels	0.020	0.508
Fit on crankpin (loose)	0.002	0.051

Flywheel	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Runout (flywheels at rim)	0.015	0.381
Runout (shaft at flywheel)	0.003	0.076
End play	0.010	0.254

Crankshaft/Sprocket Shaft Bearings	IN.	MM
Bearing fit in crankcase (loose)	0.0015	0.038
Shaft runout	0.003	0.076
Bearing fit in crankcase (tight)	0.0038	0.097
Bearing inner race on shaft (tight)	0.0004	0.010

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.

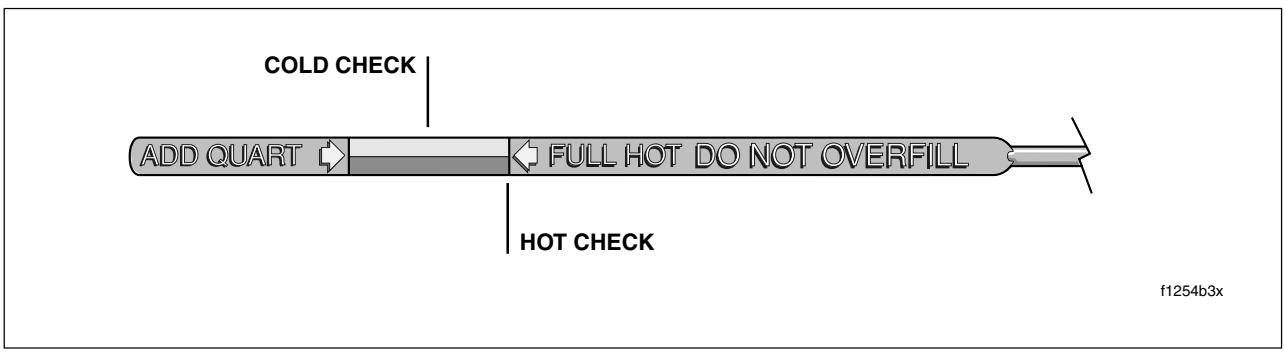


Figure 3-1. Engine Oil Dipstick

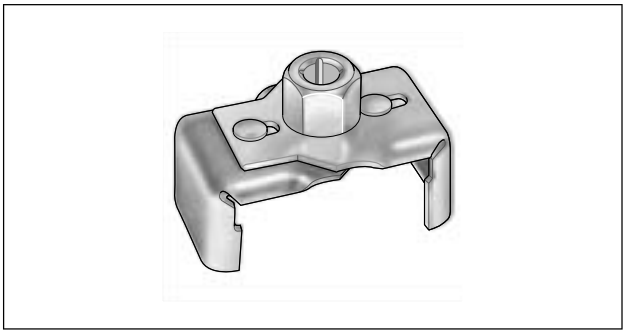


Figure 3-2. Oil Filter Wrench (Part No. HD-42311)

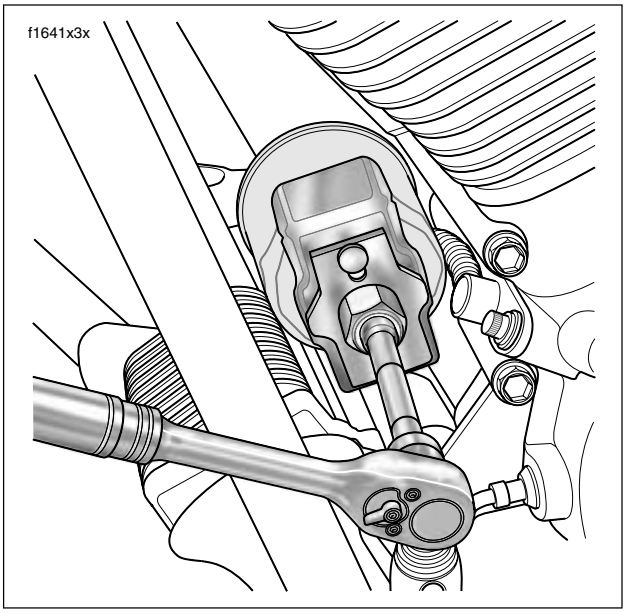


Figure 3-3. Remove Engine Oil Filter

CHANGING ENGINE OIL AND FILTER

NOTE

Change engine oil and filter after first 1000 miles (1600 km) of service and then seasonally or at 5000 mile (8000 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.

NOTE

Use OIL FILTER WRENCH (HD-44067) if HD-42311 is not available.

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 for oil filter installation.

NOTE

Use of the 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.

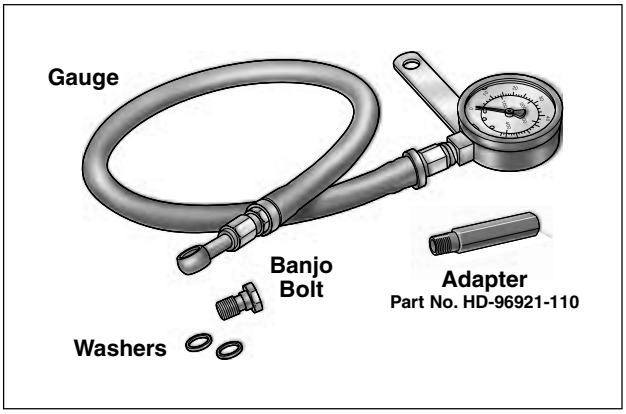


Figure 3-4. Oil Pressure Gauge (Part No. HD-96921-52B)

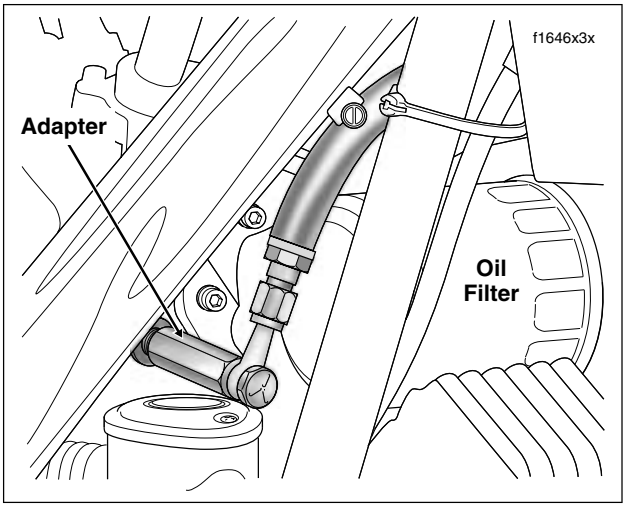


Figure 3-5. Install Adapter and Oil Pressure Gauge

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 96-120 **in-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.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.

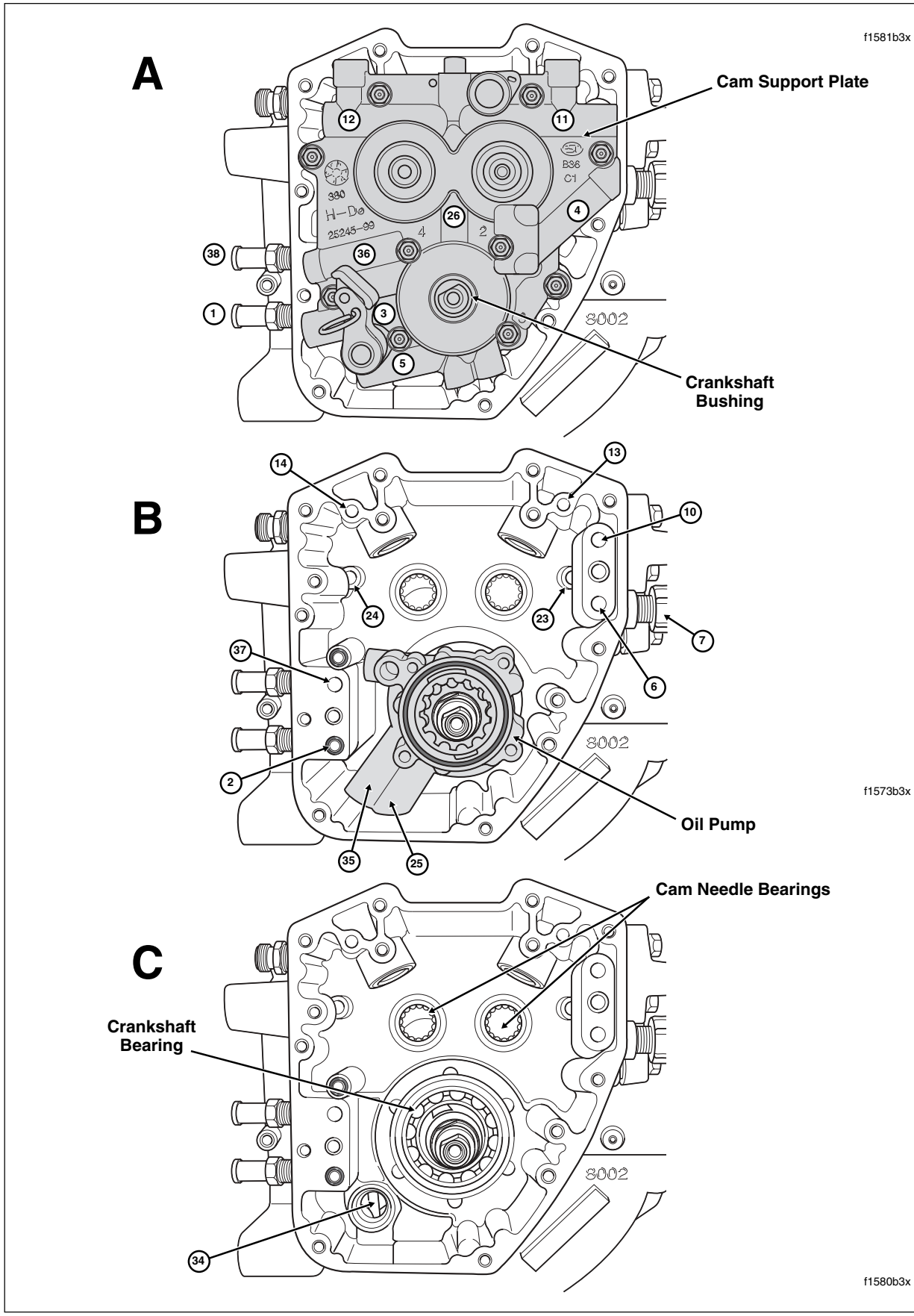


Figure 3-6. Engine Oil Flow - Cam Support Plate/Right Crankcase Half

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 bearing and the camshaft needle bearings in the right crankcase half. This same action serves to lubricate the sprocket shaft bearing in the left crankcase half (M28).

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 filler spout. 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.

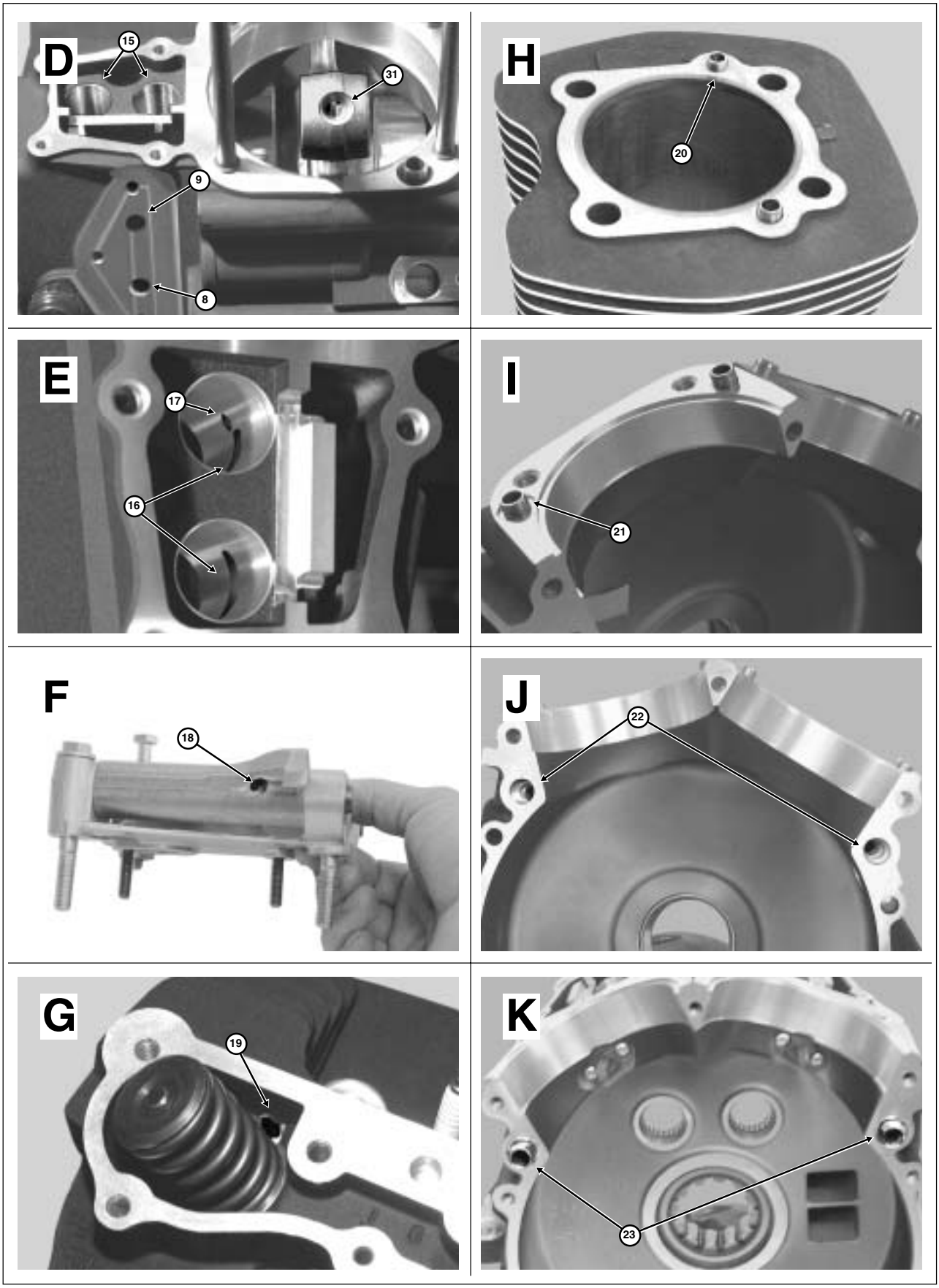


Figure 3-7. Engine Oil Flow - Top End

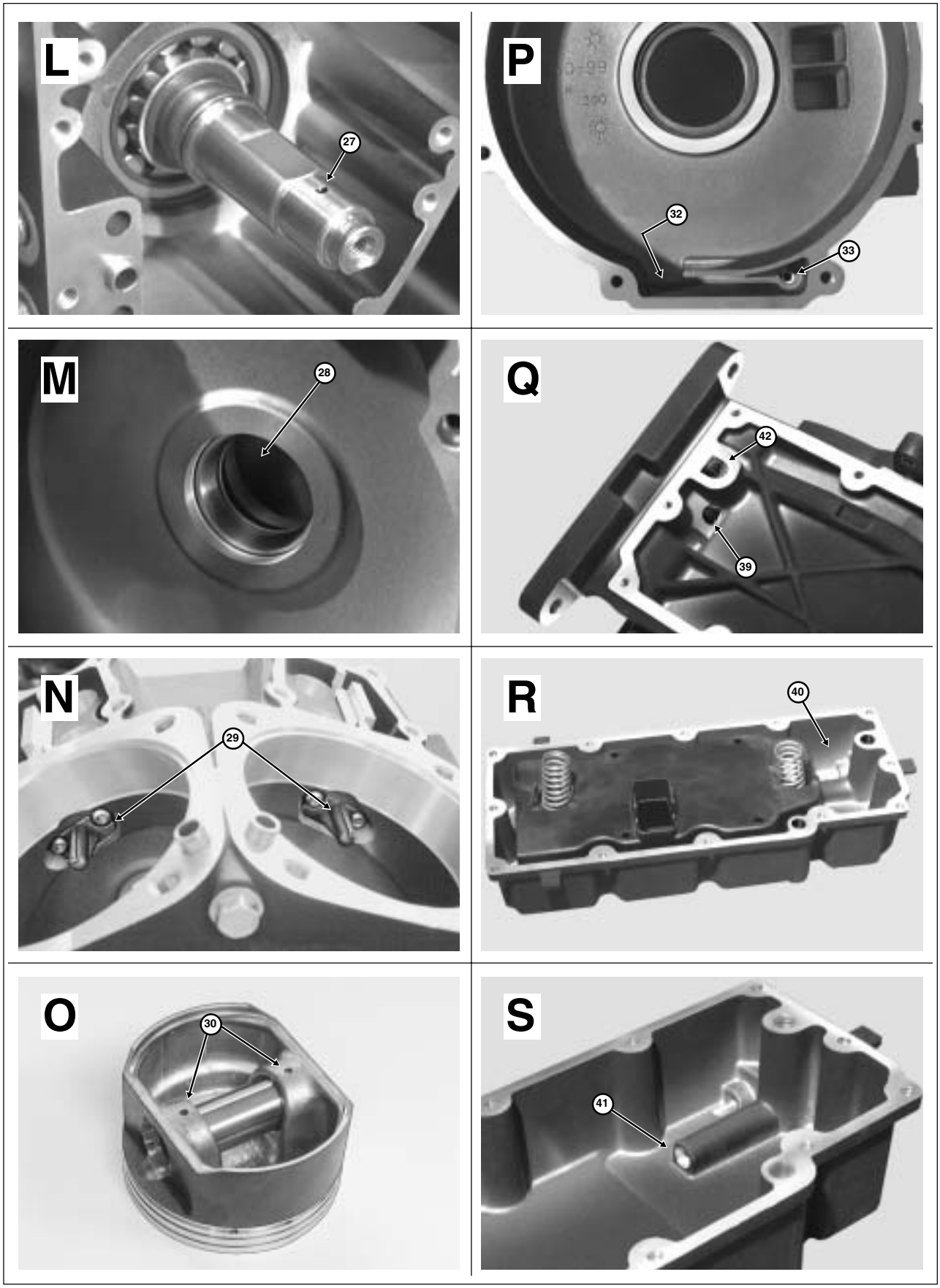


Figure 3-8. Engine Oil Flow - Bottom End

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.

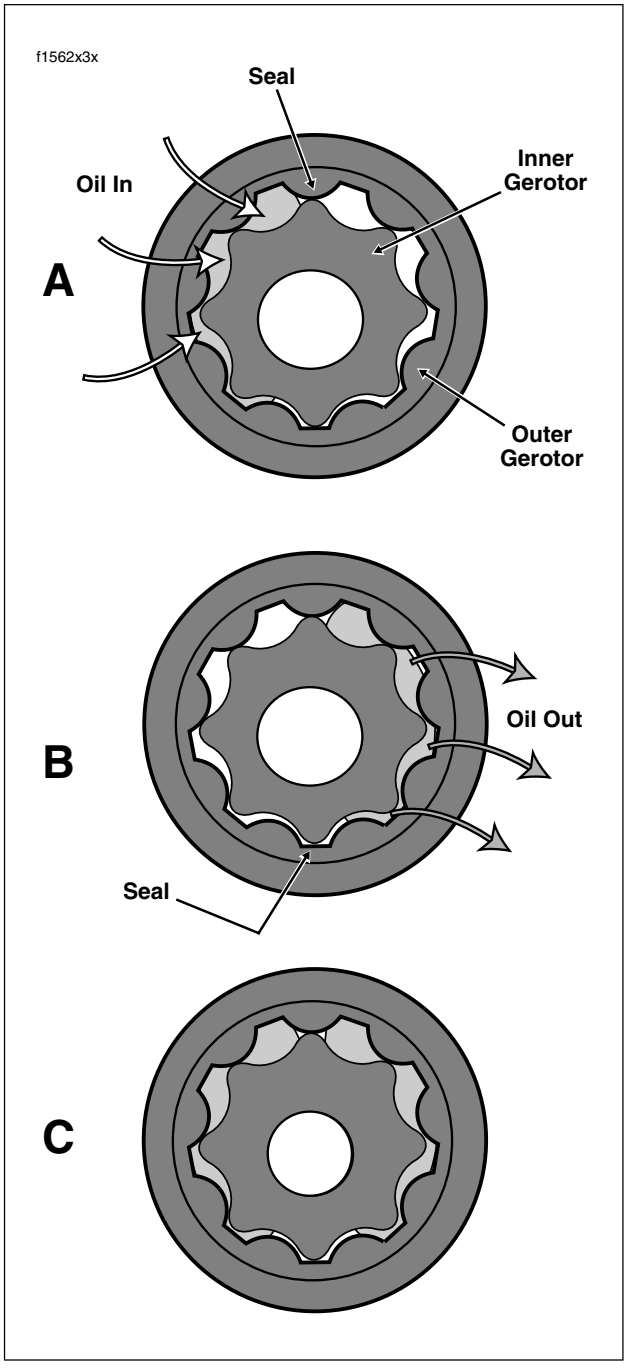


Figure 3-9. Gerotor Operation

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 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 3.9 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 3.11 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 3.9 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.

After the motorcycle has been stripped and the engine removed, follow all of the steps under Section 3.9 TOP END OVERHAUL, DISASSEMBLY. When finished, continue with disassembly of the bottom half by performing those steps listed under Section 3.10 BOTTOM END OVERHAUL, DISASSEMBLY.

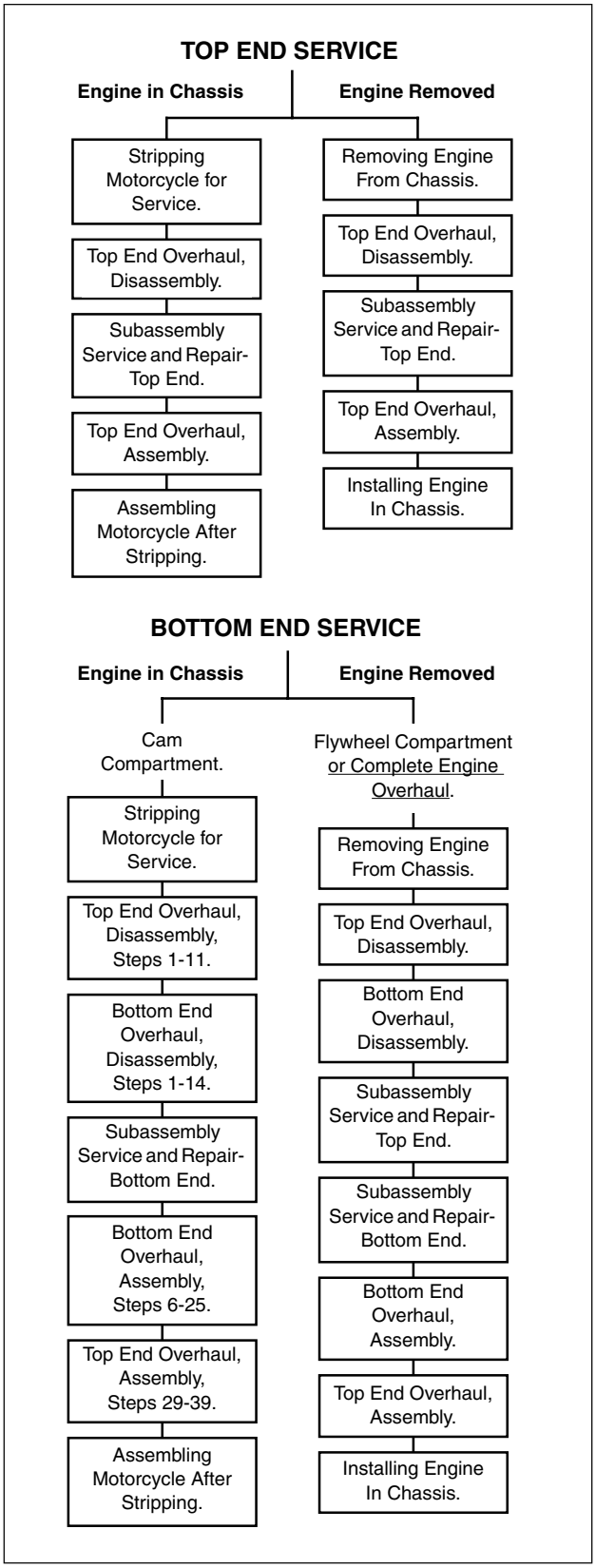


Figure 3-10. Top/Bottom End Service

As with the top end disassembly instructions, references are made to Section 3.11 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 3.10 BOTTOM END OVERHAUL, ASSEMBLY, and then proceed to Section 3.9 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 3.11 SUBASSEMBLY SERVICE AND REPAIR for all service instructions.

For example, if just installing new cams, then refer to Section 3.11 SUBASSEMBLY SERVICE AND REPAIR, CAM SUPPORT PLATE.

The steps under Section 3.9 TOP END OVERHAUL and Section 3.10 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.

PROCEDURE

NOTE

If performing top end service (or both cam compartment and top end), follow steps 1-21. If servicing cam compartment components only, perform steps 1-12.

1. Drain and remove fuel tank. Proceed as follows:

   Carbureted: See Section 4.7 FUEL TANK (CARBURETED), COMPLETE REMOVAL, FLHT/C, FLTR, or FLHR.

   Fuel Injected: See Section 9.4 FUEL TANK (FUEL INJECTED), COMPLETE REMOVAL, FLHT/C/U/I, FLTRI, or FLHR/C/I.

2. Remove left side saddlebag. See Section 2.23 SADDLEBAG, REMOVAL.

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. See Section 4.5 AIR CLEANER, REMOVAL.

7. 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.

8. 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 and stud 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 door).

   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.

9. Moving to left side of vehicle, pull boots on spark plug cables to release from spark plug and ignition coil towers. Release cables from three cable clips at bottom of frame backbone.

10. Remove spark plugs.

11. Pull external latch outward and use rocking motion to remove electrical connector from left side of ignition coil.

12. Pull sides of ignition coil bracket outward to remove from bosses of front fuel tank mount.

13. Remove connections to carburetor or induction module. Proceed as follows:

Carbureted:

a. Standing on left side of vehicle, remove electrical connector from manifold absolute pressure (MAP) sensor at top of intake manifold.

b. 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.

Fuel Injected:

a. Standing on right side of vehicle, remove idle air control and manifold absolute pressure sensor connectors. Pull external latch(es) outward and use rocking motion to separate pin and socket halves.

b. Depress wire form to remove electrical connectors from front and rear fuel injectors.

c. Remove throttle position sensor and intake air temperature sensor 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 remove connector. Cut cable strap to release conduit from 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.

14. Remove idle and throttle control cables as follows:

    Carbureted: Using a needle nose pliers, carefully pull idle cable barrel from upper inboard hole in throttle wheel. Pull throttle cable barrel from remaining hole. Release idle and throttle cables from guides in throttle cable bracket.

    Fuel Injected: Using a needle nose pliers, carefully pull idle cable barrel from upper hole in throttle wheel. Pull throttle cable barrel from lower hole. Using slots, release idle and throttle cables from guides in throttle cable bracket.

15. Free idle and throttle control cables from J-clamp fastened to right side of frame backbone. Move cables up and out of the way.

16. If equipped with cruise control, remove E-clip from sleeve at end of cruise cable housing. Using slot, remove cable housing from cable guide in throttle cable bracket. 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.

17. Remove intake manifold/carburetor or induction module. Proceed as follows:

    a. Remove right side 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. Moving to opposite side of vehicle, just loosen left side allen head socket screws from flange adapters. Slots in flanges make removal of left side screws unnecessary.

    c. Remove intake manifold/carburetor or induction module from right side of vehicle.

18. Standing on left side of vehicle, remove two hex head bolts (with flat washers) to release top engine mounting bracket from cylinder heads.

19. Leaving ground wire ring terminal in place, detach socket terminal of yellow lead from spade contact at back of horn. Release wire conduit from J-clamp.

20. Moving to right side of vehicle, turn hex head bolt to release stabilizer link from frame weldment.

21. Remove horn, top engine mounting bracket and stabilizer link as an assembly.

ASSEMBLING MOTORCYCLE AFTER STRIPPING 3.6

PROCEDURE

NOTE

If top end service was performed (or both cam compartment and top end), follow steps 1-19. If only cam compartment components were serviced, perform steps 8-18.

1. Install intake manifold/carburetor or induction module. Proceed as follows:
   a. With the counterbore facing outward, slide cylinder head flange adapters onto outlet ports of intake manifold/induction module. The flange adapters are not interchangeable. 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/induction module toward installed position so that open-ended slots on flange adapters begin to engage allen head socket screws loosely installed 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 the air cleaner backplate or INDUCTION SYSTEM ALIGNMENT BRACKET (P&A Part No. 40054-01) to properly locate carburetor/induction module. Proceed as follows:

      Backplate: Install two breather bolts to fasten backplate to front and rear cylinder heads. Install three T27 TORX screws to secure backplate to face of carburetor/induction module.

      Alignment bracket: Fitting pins on inboard side into holes in face of carburetor/induction module, install two breather bolts to fasten bracket to front and rear cylinder heads.

   f. Tighten allen head socket screw in fixed holes of flange adapters until snug. Moving to left side of engine, tighten screws in slotted holes to 96-144 **in-lbs** (10.9-16.3 Nm).
   g. Remove breather bolts and T27 TORX screws to remove backplate, if installed.
   h. Tighten allen head socket screws in fixed holes of flange adapters to 96-144 **in-lbs** (10.9-16.3 Nm).
   i. Remove breather bolts to remove alignment bracket, if installed.
2. Install horn, top engine mounting bracket and stabilizer link as an assembly. Proceed as follows:
   a. Moving to right side of vehicle, turn hex head bolt to secure stabilizer link to frame weldment. Tighten bolt to 18-22 ft-lbs (24-30 Nm).
   b. Attach socket terminal of yellow lead to spade contact at back of horn. Capture wire conduit in J-clamp.
   c. Standing on left side of vehicle, install two hex head bolts (with flat washers) to secure top engine mounting bracket to front and rear cylinder heads. Alternately tighten bolts to 25-30 ft-lbs (34-41 Nm).
3. If equipped with cruise control, slide groove in cruise cable end fitting over cap of wheel pin. Push on end fitting until it snaps in place. Using slot, slip cruise cable housing into cable guide in throttle cable bracket. Install **new** E-clip on sleeve at end of cruise cable housing.
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 sleeve on throttle cable housing into shorter cable guide in throttle cable bracket. Drawing throttle cable downward, fit barrel end into lower outboard hole in throttle wheel. Install sleeve and spring on idle cable housing into longer cable guide inserting barrel end into upper inboard hole in throttle wheel.

   Induction Module: Install sleeve on throttle cable housing into shorter cable guide at top of throttle cable bracket. Drawing throttle cable downward, fit barrel end into lower hole in throttle wheel. Install sleeve and spring on idle cable housing into longer cable guide at bottom of throttle cable bracket inserting barrel end into upper hole in throttle wheel.
6. Adjust 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.
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. Slide threaded portion of enrichener cable into slot of mounting bracket. Flat on threads must face rear of vehicle for script on enrichener 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).

Fuel Injected:

a. Install electrical connectors on fuel injectors.

b. Install manifold absolute pressure sensor and idle air control connectors.

c. Install intake air temperature sensor and throttle position sensor connectors.

d. Moving to left side of vehicle, install connector to engine temperature sensor at back of front cylinder. Pull boot over sensor to keep out dirt and debris. Install **new** cable strap to secure connector conduit to horn bracket.

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 bottom nut to 60-80 **in-lbs** (6.8-9.0 Nm). Final tighten the top nut to 60-80 **in-lbs** (6.8-9.0 Nm).
- Tighten the bottom nut of the rear cylinder head exhaust flange to 9-18 **in-lbs** (1-2 Nm). Tighten the top nut to 60-80 **in-lbs** (6.8-9.0 Nm). Final tighten the bottom nut to 60-80 **in-lbs** (6.8-9.0 Nm).
- Tighten the transmission clamp bolt to 60-96 **in-lbs** (6.8-10.8 Nm).
- 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 door).
- 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. Install the backplate and air cleaner. See Section 4.5 AIR CLEANER, INSTALLATION.

11. 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.
12. Align barbed studs in right side cover with grommets in frame downtubes and push firmly into place (no tools required).
13. Install right side saddlebag. See Section 2.23 SADDLEBAG, INSTALLATION.
14. Repeat steps 11-13 to install side cover, saddlebag and fairing lower on left side of vehicle.
15. Install spark plugs in front and rear cylinder heads. Install the plugs finger tight and then tighten to 12-18 ft-lbs (16-24 Nm).
16. Install ignition coil and spark plug cables as follows:
    a. With the coil towers facing rear of vehicle, hold ignition coil and bracket at bottom of frame backbone. Pull sides of bracket outward and install on bosses of front fuel tank mount. See Figure 3-11.
    b. Install electrical connector on left side of ignition coil.
    c. Install spark plug cable to front cylinder onto left side coil tower. Verify that spark plug cable is captured in double-sided cable clip at bottom left side of frame backbone. Install **new** cable clip on T-stud if damaged or missing.
    d. Install spark plug cable to rear cylinder onto right side coil tower. Verify that spark plug cable is captured in two single-sided cable clips at bottom left side of frame backbone. Install **new** cable clips on T-studs if damaged or missing.
17. Install the fuel tank. Proceed as follows:

    Carbureted: See Section 4.7 FUEL TANK (CARBURETED), INSTALLATION (AFTER COMPLETE REMOVAL), FLHT/C, FLTR, or FLHR.

    Fuel Injected: See Section 9.4 FUEL TANK (FUEL INJECTED), INSTALLATION (AFTER COMPLETE REMOVAL), FLHT/C/U/I, FLTRI, or FLHR/C/I.
18. 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 30-35 **in-lbs** (3.4-4.0 Nm). Repeat step on opposite side of vehicle.
19. Adjust idle and throttle control cables as follows:

    Non-Cruise: See Section 2.19 THROTTLE CABLES (NON-CRUISE), ADJUSTMENT.

    Cruise Equipped: See Section 8.28 CRUISE CONTROL (FLHRC, FLTR, FLHTCU), CABLE ADJUSTMENT.

REMOVING ENGINE FROM CHASSIS 3.7

PROCEDURE

1. Drain and remove fuel tank. Proceed as follows:

   Carbureted: See Section 4.7 FUEL TANK (CARBURETED), COMPLETE REMOVAL, FLHT/C, FLTR, or FLHR.

   Fuel Injected: See Section 9.4 FUEL TANK (FUEL INJECTED), COMPLETE REMOVAL, FLHT/C/U/I, FLTRI, 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 2.23 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. See Section 4.5 AIR CLEANER, REMOVAL.
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 and stud 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 door).
   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. 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. 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.

Fuel Injected:

   a. Standing on right side of vehicle, remove idle air control and manifold absolute pressure sensor connectors. Pull external latch(es) outward and use rocking motion to separate pin and socket halves.
   b. Depress wire form to remove electrical connectors from front and rear fuel injectors.



Figure 3-11. Remove Ignition Coil Bracket From Vehicle

c. Remove throttle position sensor and intake air temperature sensor 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 remove connector. Cut cable strap to release conduit from 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.

11. Remove idle and throttle control cables as follows:

    Carbureted: Using a needle nose pliers, carefully pull idle cable barrel from upper inboard hole in throttle wheel. Pull throttle cable barrel from remaining hole. Release idle and throttle cables from guides in throttle cable bracket.

    Fuel Injected: Using a needle nose pliers, carefully pull idle cable barrel from upper hole in throttle wheel. Pull throttle cable barrel from lower hole. Using slots, release idle and throttle cables from guides in throttle cable bracket.

12. Free idle and throttle control cables from J-clamp fastened to right side of frame backbone. Move cables up and out of the way.

13. If equipped with cruise control, remove E-clip from sleeve at end of cruise cable housing. Using slot, remove cable housing from cable guide in throttle cable bracket. 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.

14. Moving to left side of vehicle, pull boots on spark plug cables to release from spark plug and ignition coil towers. Release cables from three cable clips at bottom of frame backbone.

15. Remove spark plugs.

16. Pull external latch outward and use rocking motion to remove electrical connector from left side of ignition coil.

17. Pull sides of ignition coil bracket outward to remove from bosses of front fuel tank mount. See Figure 3-11.

18. Moving to right side of vehicle, remove two allen head socket screws to release oil hose cover.

19. Using a side cutters, cut and remove clamps on engine side of oil hoses. Pull hoses from crankcase fittings.

20. 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.

21. Moving to front left side of vehicle, locate stator/voltage regulator connector fixed to bracket at bottom of voltage regulator. Slide connector toward left side to release groove on connector from ridge on bracket. Raise the external latch and use a rocking motion to separate pin and socket halves of connector. See Figure 3-12.

22. Remove locknut from left side leg of voltage regulator. Loosen right side locknut. Raise voltage regulator as necessary to free left side leg from stud on lower frame crossmember. Remove P-clip from stud. Remove P-clip from cable conduit.

23. Draw connector and cable conduit to rear of engine stabilizer link and then up to area in front of primary chaincase.

24. Depress tangs inside socket housing and back out sockets through wire end of connector. Proceed as follows:

    a. Looking into the socket housing, take note of the cavity on each side of the terminal.

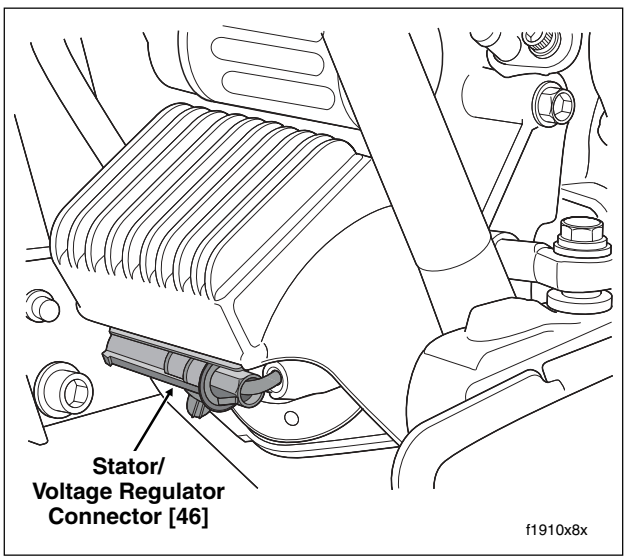


Figure 3-12. Stator/Voltage Regulator Connector (Left Side View)

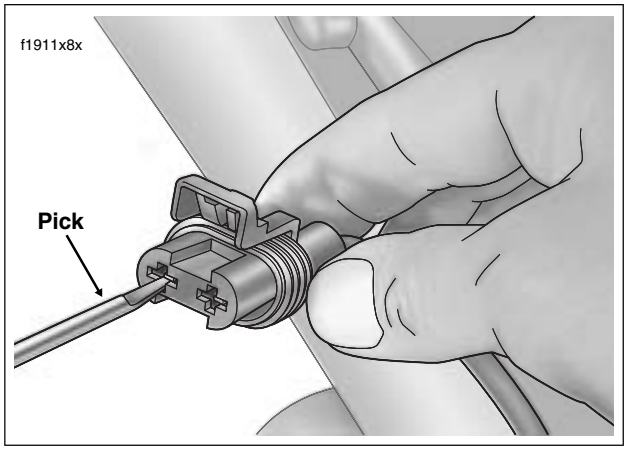


Figure 3-13. Remove Socket Terminals From Stator/Voltage Regulator Connector

b. Gently insert pick (Snap-On TT600-3) into the cavity about 1/4 inch (6.4 mm) or until it stops, and pivot the side of the pick toward the terminal body. Repeat step on other cavity. See Figure 3-13.

c. Gently tug on cable to pull terminal from chamber. If terminal is still locked, one or both tangs are not fully depressed. Repeat steps 24(b) and 24(c) as necessary.

d. Repeat procedure to release second terminal.

25. Remove conduit from cables. For best results, feed one cable and socket terminal through conduit at a time.
26. Coil cable lengths so that they are out of the way and will not be pinched or cut during engine removal.
27. Remove voltage regulator from studs and allow to hang by cables at front of vehicle.
28. Partially remove the engine sensor harness 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 harness conduit and clip.

    e. Remove T20 TORX screw from threaded hole at rear of crankcase (under cam cover) to release harness conduit and clip.

    f. Coil engine sensor harness conduit and allow to hang below lower frame tube at front of vehicle. If harness is not moved out of the way, it may be damaged during engine removal.

29. 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.
30. Standing on left side of vehicle, remove two hex head bolts (with flat washers) to release top engine mounting bracket from cylinder heads.
31. Leaving ground wire ring terminal in place, detach socket terminal of yellow lead from spade contact at back of horn. Release wire conduit from J-clamp.
32. Moving to right side of vehicle, turn hex head bolt to release stabilizer link from frame weldment.
33. Remove horn, top engine mounting bracket and stabilizer link as an assembly.
34. Remove four bolts (with flat washers) to free rear of crankcase from transmission housing. Loosen and remove bolts in a crosswise pattern.
35. Remove two bolts (with flat washers) to free front of crankcase from front engine mounting bracket.
36. Wrap rear master cylinder reservoir with foam padding or bubble pack.
37. 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.
38. 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.

39. 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.
40. Using the TWIN CAM 88 CRADLE (HD-42310-2), install engine in BENCH STAND (HD-42310) or ROLLING STAND (HD-43646A). See Figure 3-14.
41. Remove intake manifold/carburetor or induction module. Proceed as follows:

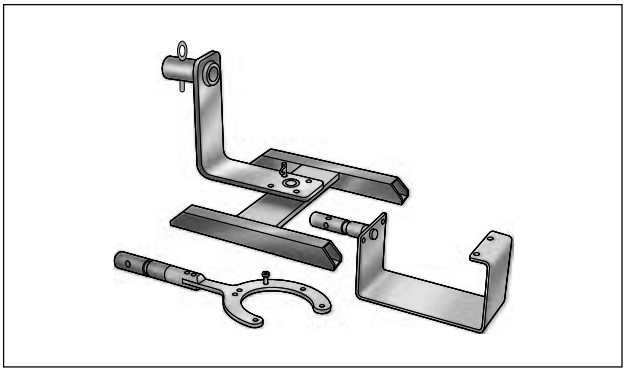


Figure 3-14. Engine/Transmission Bench Stand (Part No. HD-42310)

a. Remove right side 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. Moving to opposite side of vehicle, just loosen left side allen head socket screws from flange adapters. Slots in flanges make removal of left side screws unnecessary.

c. Remove intake manifold/carburetor or induction module from right side of vehicle.

42. Remove the rotor as follows:

⚠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 REMOVER/ 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 - 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.

43. Remove stator as follows:

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 3-15. Tilt awl slightly squirting isopropyl 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.

44. 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.

NOTE

Use OIL FILTER WRENCH (HD-44067) if HD-42311 is not available.

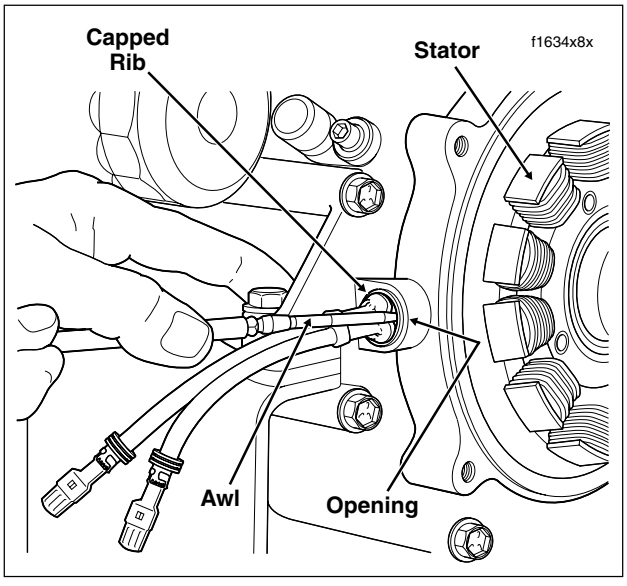


Figure 3-15. Remove Grommet From Crankcase

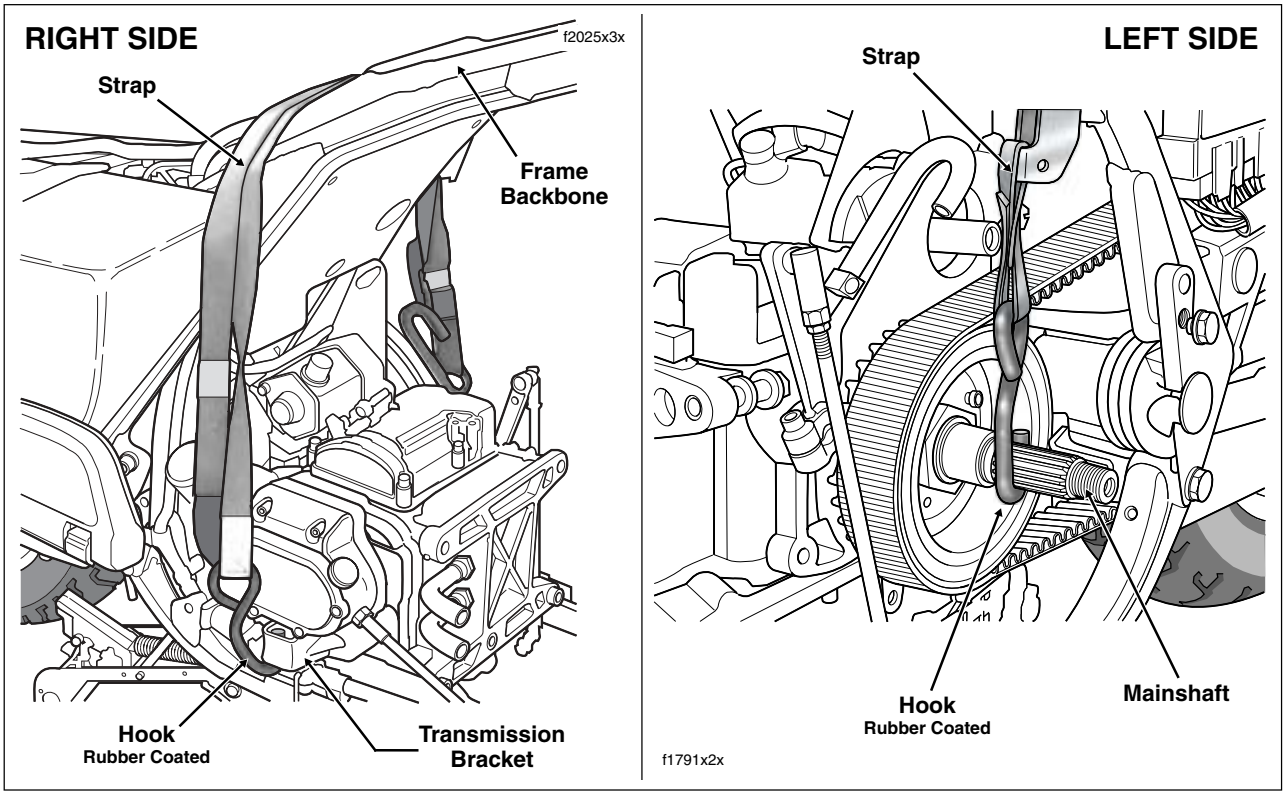


Figure 3-16. Secure Transmission Using Transmission Bracket and Mainshaft

45. 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.

    c. Remove two O-rings from inboard side of filter mount. Discard O-rings.

NOTES

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.*

46. 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 3-16.

    b. Lower and remove jack under oil pan.

    c. Locate oil drain plug at front of the oil pan. See Figure 3-17. Remove the plug and allow oil to drain completely.

    d. Locate transmission drain plug on right side of the oil pan. See Figure 3-17. 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 3-17.

    f. Remove gasket from oil pan and discard.

PROCEDURE

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 84-108 **in-lbs** (9-12 Nm) following the pattern shown in Figure 3-17.
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.'s 99892-84 (quart), 98853-96 (case of quarts), 99891-84 (gallon), or 98852-96 (case of gallons).

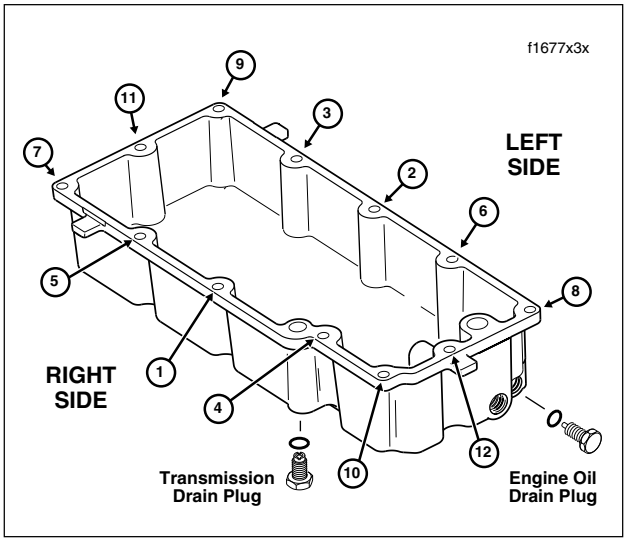


Figure 3-17. Oil Pan Torque Sequence

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).
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 12-18 ft-lbs (16-24 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 Loctite Medium Strength Threadlocker 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 Loctite Medium Strength Threadlocker 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 12-16 ft-lbs (16-22 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 for oil filter installation.

NOTE

Use of the 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 isopropyl 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 55-75 **in-lbs** (6.2-8.5 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, 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 REMOVER/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:

a. With the counterbore facing outward, slide cylinder head flange adapters onto outlet ports of intake manifold/induction module. The flange adapters are not interchangeable. 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.

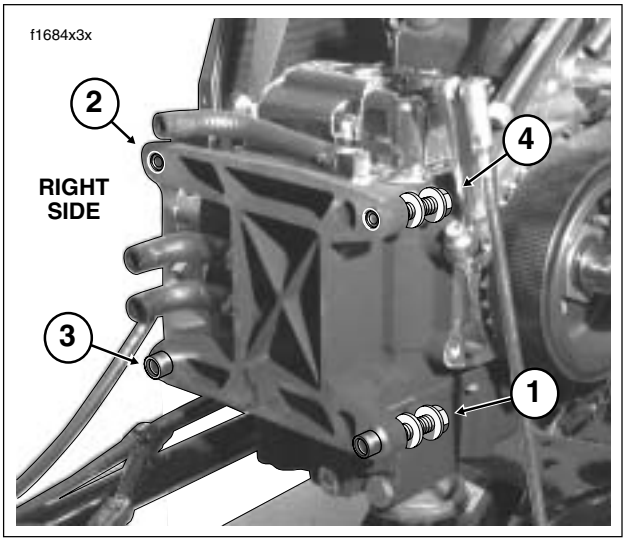


Figure 3-18. Transmission Housing to Crankcase Torque Sequence

c. Standing on right side of engine, slide intake manifold/induction module toward installed position so that open-ended slots on flange adapters begin to engage allen head socket screws loosely installed 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 the air cleaner backplate or INDUCTION SYSTEM ALIGNMENT BRACKET (P&A Part No. 40054-01) to properly locate carburetor/induction module. Proceed as follows:

Backplate: Install two breather bolts to fasten backplate to front and rear cylinder heads. Install three T27 TORX screws to secure backplate to face of carburetor/induction module.

Alignment bracket: Fitting pins on inboard side into holes in face of carburetor/induction module, install two breather bolts to fasten bracket to front and rear cylinder heads.

f. Tighten allen head socket screw in fixed holes of flange adapters until snug. Moving to left side of engine, tighten screws in slotted holes to 96-144 **in-lbs** (10.9-16.3 Nm).

g. Remove breather bolts and T27 TORX screws to remove backplate, if installed.

h. Tighten allen head socket screws in fixed holes of flange adapters to 96-144 **in-lbs** (10.9-16.3 Nm).

i. Remove breather bolts to remove alignment bracket, if installed.

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-43646A) 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 3-18.

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).

    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, turn hex head bolt to secure stabilizer link to frame weldment. Tighten bolt to 18-22 ft-lbs (24-30 Nm).

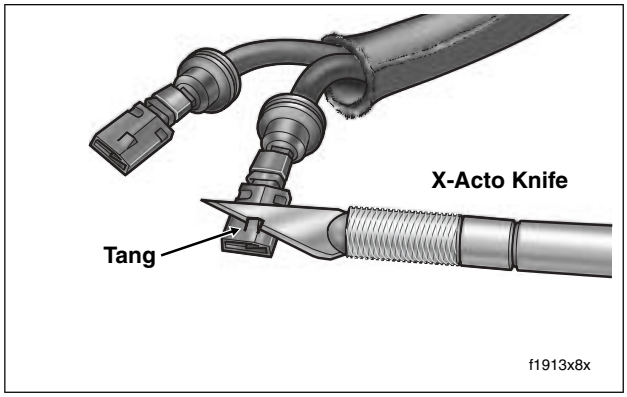


Figure 3-19. Bend Tangs Outward on Socket Terminals of Stator/Voltage Regulator Connector

b. Attach socket terminal of yellow lead to spade contact at back of horn. Capture wire conduit in J-clamp.

c. Standing on left side of vehicle, install two hex head bolts (with flat washers) to secure top engine mounting bracket to front and rear cylinder heads. Alternately tighten bolts to 25-30 ft-lbs (34-41 Nm).

29. Lower and remove jack under oil pan.

30. At front of vehicle, slide voltage regulator over studs on lower frame crossmember.

31. Install conduit onto stator cables. For best results, feed one cable and socket terminal through conduit at a time.

32. Install sockets into stator/voltage regulator connector as follows:

    a. Using a fingernail or a thin flat blade, like that on an X-Acto knife, carefully bend the tangs outward away from each terminal body. See Figure 3-19.

    b. Feed each socket into wire end of stator/voltage regulator connector until it “clicks” in place.

    c. Verify that sockets will not back out of chambers. A slight tug on each cable will confirm that it is locked.

33. Feed connector and cable conduit down under engine stabilizer link and forward to area of voltage regulator.

34. Install P-clip on cable conduit approximately five inches (127 mm) from where cables exit left side of voltage regulator. Install P-clip on stud on lower frame crossmember. Properly oriented, P-clip is positioned at rear of stud with the open side down.

35. Raise voltage regulator as necessary to install left side leg onto stud. Install locknut and tighten to 70-100 **in-lbs** (7.9-11.3 Nm). Tighten right side locknut using same torque value.

36. Mate pin and socket housings of stator/voltage regulator connector.

37. At bottom of voltage regulator, slide connector toward right side of vehicle until groove on connector fully engages ridge on bracket. See Figure 3-12.

38. Complete installation of the engine sensor harness as follows:

    a. Uncoil engine sensor harness conduit. 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 25-35 **in-lbs** (2.8-4.0 Nm).

    f. Capturing conduit in cable clip, start T20 TORX screw into threaded hole at rear of crankcase (under cam cover). Tighten screw to 25-35 **in-lbs** (2.8-4.0 Nm).

39. 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).

40. Slide **new** clamps onto free ends of oil hoses. Install hoses onto crankcase fittings. Crimp clamps.

41. 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 84-108 **in-lbs** (10-12 Nm).

42. Install ignition coil and spark plug cables as follows:

    a. With the coil towers facing rear of vehicle, hold ignition coil and bracket at bottom of frame backbone. Pull sides of bracket outward and install on bosses of front fuel tank mount. See Figure 3-11.

    b. Install electrical connector on left side of ignition coil.

    c. Install spark plug cable to front cylinder onto left side coil tower. Verify that spark plug cable is captured in double-sided cable clip at bottom left side of frame backbone. Install **new** cable clip on T-stud if damaged or missing.

    d. Install spark plug cable to rear cylinder onto right side coil tower. Verify that spark plug cable is captured in two single-sided cable clips at bottom left side of frame backbone. Install **new** cable clips on T-studs if damaged or missing.

43. If equipped with cruise control, slide groove in cruise cable end fitting over cap of wheel pin. Push on end fitting until it snaps in place. Using slot, slip cruise cable housing into cable guide in throttle cable bracket. Install **new** E-clip on sleeve at end of cruise cable housing.

44. Route idle and throttle control cables through J-clamp fastened to right side of frame backbone.
45. Install idle and throttle control cables as follows:

    Carbureted: Install sleeve on throttle cable housing into shorter cable guide in throttle cable bracket. Drawing throttle cable downward, fit barrel end into lower outboard hole in throttle wheel. Install sleeve and spring on idle cable housing into longer cable guide inserting barrel end into upper inboard hole in throttle wheel.

    Induction Module: Install sleeve on throttle cable housing into shorter cable guide at top of throttle cable bracket. Drawing throttle cable downward, fit barrel end into lower hole in throttle wheel. Install sleeve and spring on idle cable housing into longer cable guide at bottom of throttle cable bracket inserting barrel end into upper hole in throttle wheel.

46. 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.
47. 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. Slide threaded portion of enrichener cable into slot of mounting bracket. Flat on threads must face rear of vehicle for script on enrichener 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).

Fuel Injected:

a. Install electrical connectors on fuel injectors.

b. Install manifold absolute pressure sensor and idle air control connectors.

c. Install intake air temperature sensor and throttle position sensor connectors.

d. Moving to left side of vehicle, install connector to engine temperature sensor at back of front cylinder. Pull boot over sensor to keep out dirt and debris. Install **new** cable strap to secure connector conduit to horn bracket.

48. Install the primary chaincase. See Section 6.5 PRIMARY CHAINCASE, INSTALLATION, steps 1-29.
49. 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 bottom nut to 60-80 **in-lbs** (6.8-9.0 Nm). Final tighten the top nut to 60-80 **in-lbs** (6.8-9.0 Nm).
- Tighten the bottom nut of the rear cylinder head exhaust flange to 9-18 **in-lbs** (1-2 Nm). Tighten the top nut to 60-80 **in-lbs** (6.8-9.0 Nm). Final tighten the bottom nut to 60-80 **in-lbs** (6.8-9.0 Nm).
- Tighten the transmission clamp bolt to 60-96 **in-lbs** (6.8-10.8 Nm).
- 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.

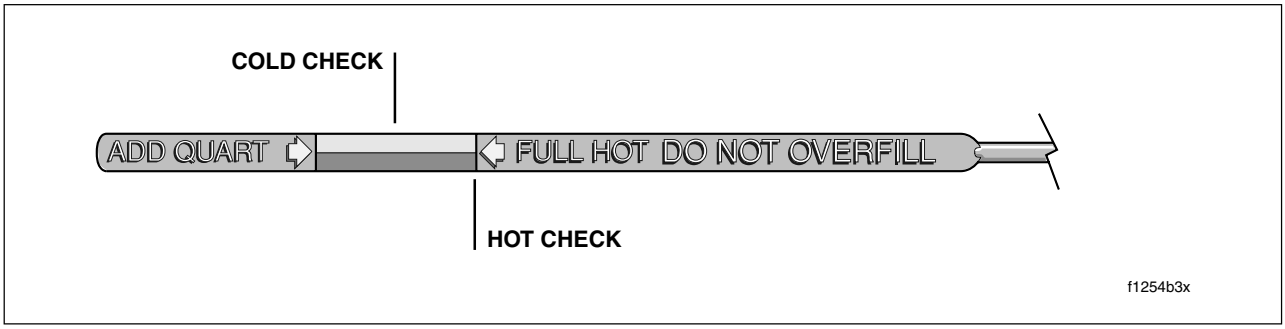


Figure 3-20. Engine Oil Dipstick

- 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 door).
- 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).

50. 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. Alternately tighten screws to 30-35 ft-lbs (41-48 Nm).
51. Install the backplate and air cleaner. See Section 4.5 AIR CLEANER, INSTALLATION.
52. 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.
53. Align barbed studs in right side cover with grommets in frame downtubes and push firmly into place (no tools required).
54. Install right side saddlebag. See Section 2.23 SADDLEBAG, INSTALLATION.
55. Repeat steps 52-54 to install side cover, saddlebag and fairing lower on left side of vehicle.
56. Install the fuel tank. Proceed as follows:

    Carbureted: See Section 4.7 FUEL TANK (CARBURETED), INSTALLATION (AFTER COMPLETE REMOVAL), FLHT/C, FLTR, or FLHR.

    Fuel Injected: See Section 9.4 FUEL TANK (FUEL INJECTED), INSTALLATION (AFTER COMPLETE REMOVAL), FLHT/C/U/I, FLTRI, or FLHR/C/I.
57. 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 30-35 **in-lbs** (3.4-4.0 Nm). Repeat step on opposite side of vehicle.
58. Adjust idle and throttle control cables as follows:

    Non-Cruise: See Section 2.19 THROTTLE CABLES (NON-CRUISE), ADJUSTMENT.

    Cruise Equipped: See Section 8.28 CRUISE CONTROL (FLHRC, FLTR, FLHTCU), CABLE ADJUSTMENT.

    NOTE

    *If oil pan was **not** drained, move to step 60.*
59. 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

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.

60. 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 3-20. 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.
61. 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 3-20. Do not overfill.
62. Start engine and carefully check for oil leaks around drain plug and oil filter.

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 3-21. 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 3-23. Remove the rocker cover bolts.

NOTE

It is assumed that each step performed on one cylinder is automatically repeated on the other.

3. Remove the rocker cover and gasket. Discard the gasket.

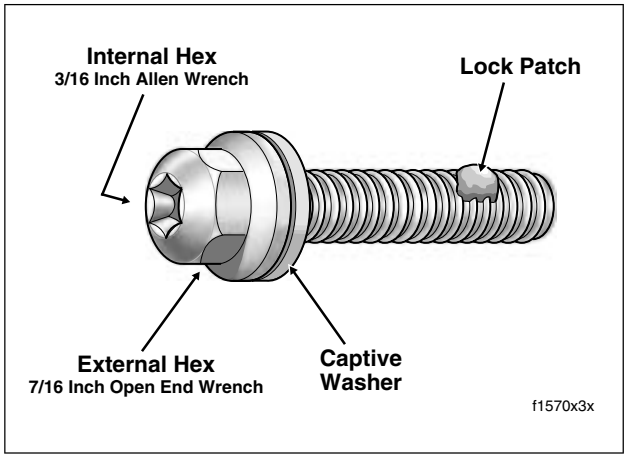


Figure 3-21. Rocker Cover Bolt (1-1/4 Inch)

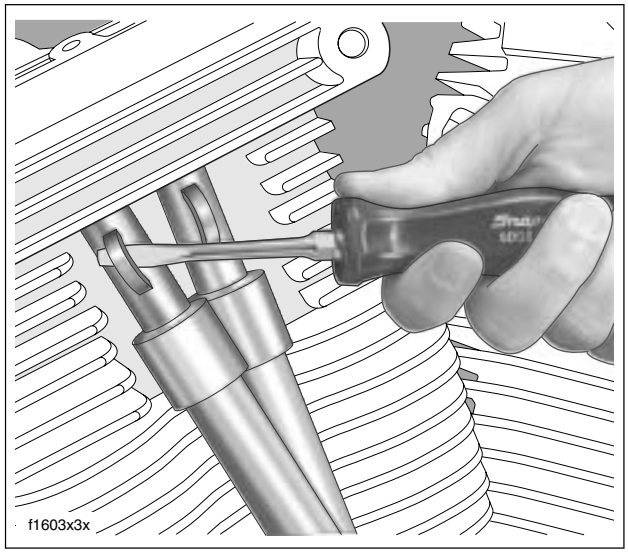


Figure 3-22. Remove Spring Cap Retainer

4. 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 3-22. Repeat step on second push rod cover.
5. Collapse upper and lower push rod covers.
6. 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 - With vehicle on center stand, place the transmission in 5th gear and rotate rear wheel in a clockwise direction (as viewed from right side) until the base circle is found. See step 6(d) to find the base circle.

b. With primary cover removed - 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 6(d) to find the base circle.

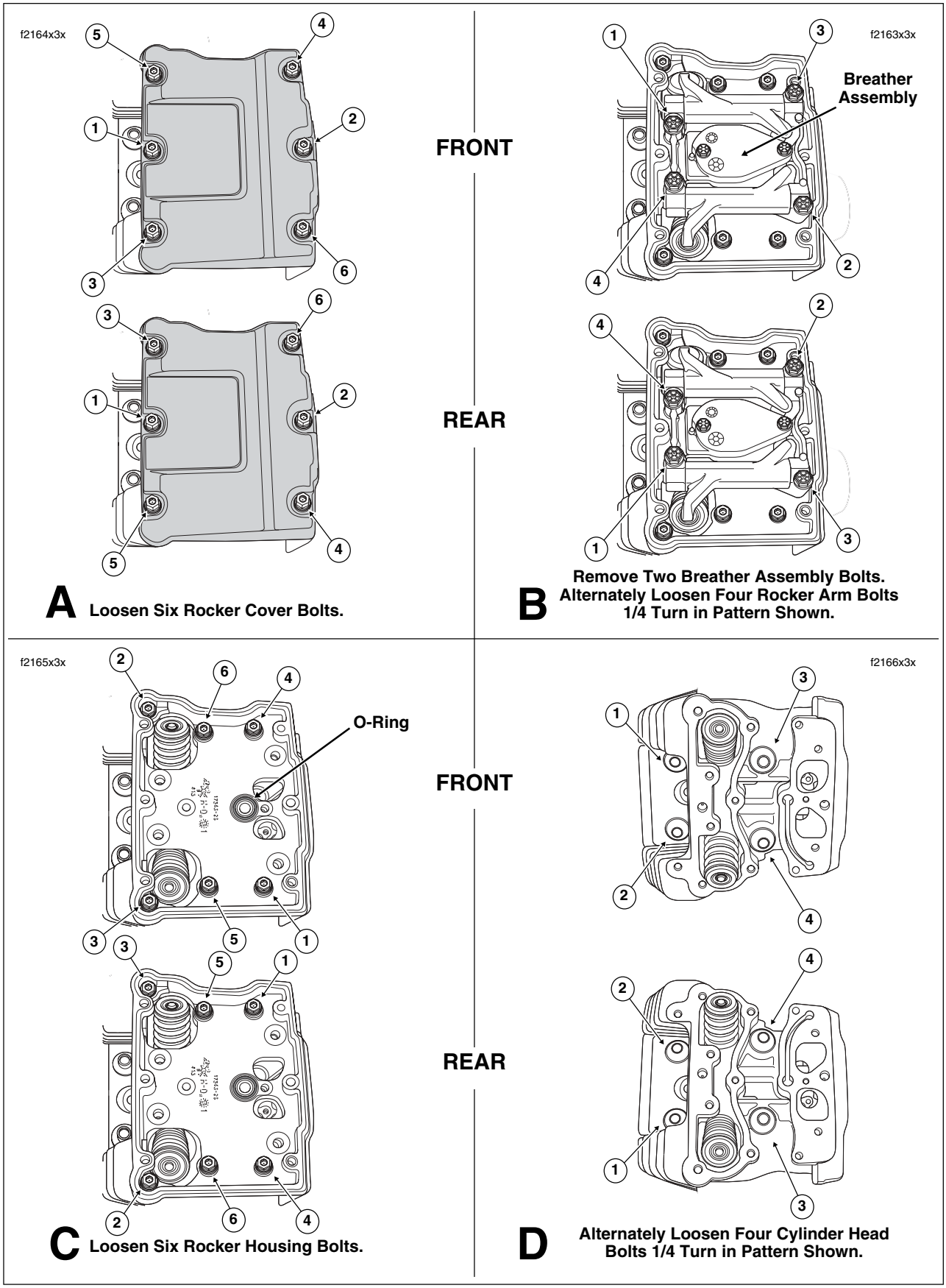


Figure 3-23. Top End Disassembly

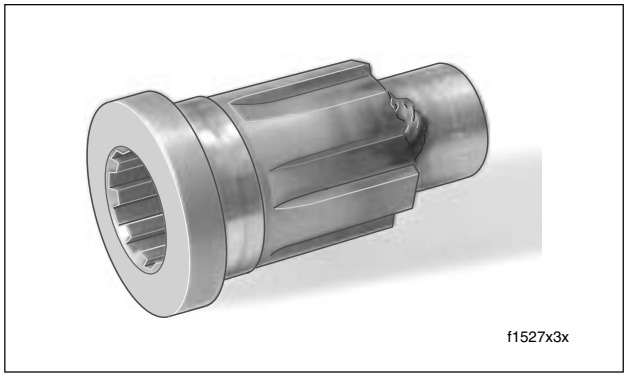


Figure 3-24. Sprocket Shaft Engine Rotation Tool

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 outboard side of extension. See Figure 3-24. Install tool on sprocket shaft and rotate in a counterclockwise direction until the base circle is found. See step 6(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 (and should turn freely).

7. Remove two bolts to release breather assembly from the rocker arm support plate. See B of Figure 3-23. See Section 3.11 SUBASSEMBLY SERVICE AND REPAIR, BREATHER ASSEMBLY.

8. Alternately loosen each of the four rocker arm support plate bolts just 1/4 turn following the pattern shown in B of Figure 3-23. 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 3.11 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 3.11 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. Alternately loosen the six rocker housing bolts following the pattern shown in C of Figure 3-23. 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. Alternately loosen each of the four cylinder head bolts just 1/4 turn following the pattern shown in D of Figure 3-23. Continue turning the bolts in these increments until loose. Remove the cylinder head bolts.

NOTE

Save the cylinder head gasket if not damaged. The gasket is needed to install the CYLINDER TORQUE PLATES (HD-42324A) when measuring, boring or honing of the cylinder is required.

19. Remove cylinder head and head gasket. See Section 3.11 SUBASSEMBLY SERVICE AND REPAIR, CYLINDER HEAD.

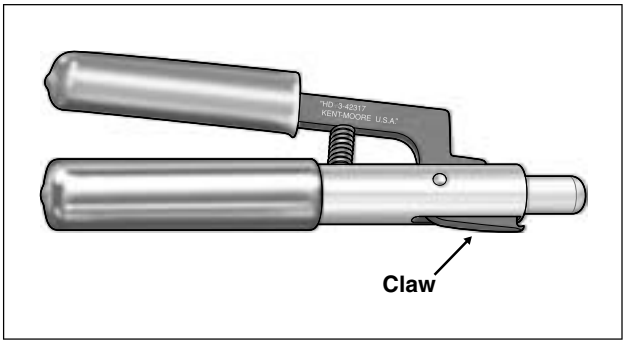


Figure 3-25. Piston Pin Circlip Remover/Installer (Part No. HD-42317A)

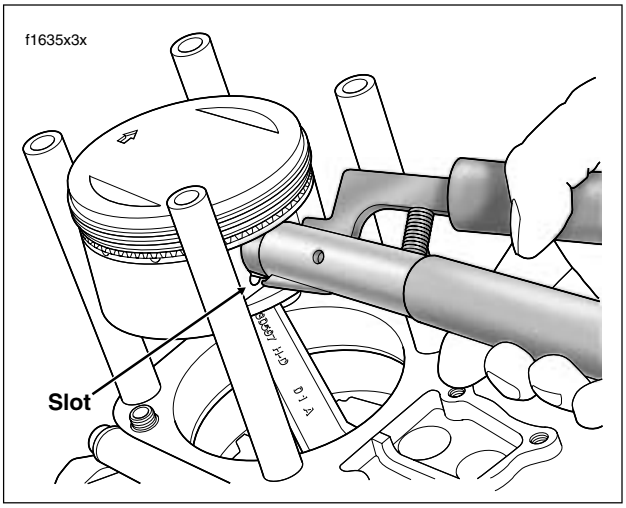


Figure 3-26. Remove Piston Pin Circlip

20. 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.

21. 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.

22. 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.

23. Remove O-ring seal from the bottom of the cylinder liner. Discard O-ring seal. See Section 3.11 SUBASSEMBLY SERVICE AND REPAIR, CYLINDER.

24. 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.

25. Verify that clean shop towels are properly positioned over the crankcase bore to prevent the piston pin circlip from falling into the crankcase.

26. Remove the piston pin circlip as follows:

    a. Insert the PISTON PIN CIRCLIP REMOVER/INSTALLER (HD-42317A) into the piston pin bore until claw on tool is positioned in slot of piston (directly under circlip). See Figure 3-26.

    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 both piston pin circlips during piston removal. Leave the second circlip in the pin bore.

27. Remove the piston pin. If piston pin is difficult to remove, use PISTON PIN REMOVER (HD-42320A). See Figure 3-27. 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 3-28.

28. 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.

29. Turn the piston over and mark the pin boss with the letters “F(ront)” or “R(ear)” to identify location. See Section 3.11 SUBASSEMBLY SERVICE AND REPAIR, PISTON and UPPER CONNECTING ROD.

30. If performing a top end overhaul only, see Section 3.11 SUBASSEMBLY SERVICE AND REPAIR, TOP END, before proceeding to Section 3.9 TOP END OVERHAUL, ASSEMBLY, which follows. If performing a complete engine overhaul, see Section 3.10 BOTTOM END OVERHAUL, DISASSEMBLY.

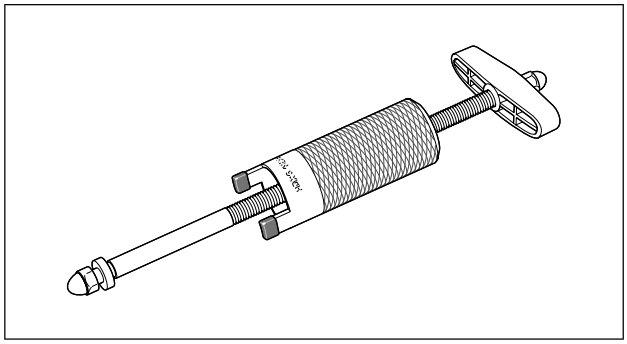


Figure 3-27. Piston Pin Remover (Part No. HD-42320A)

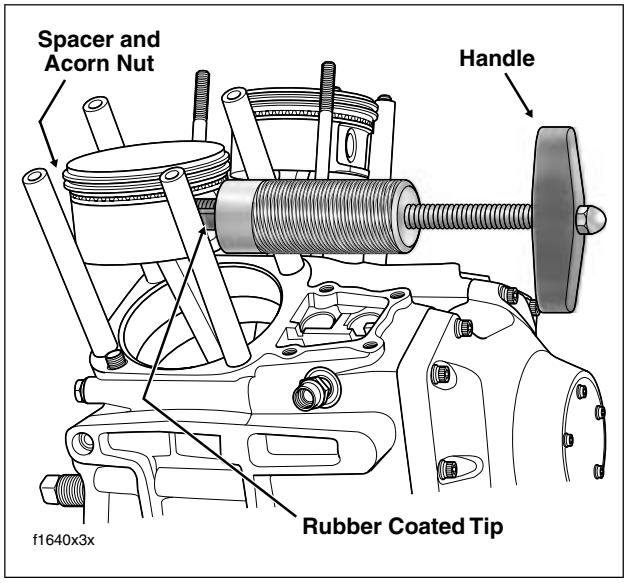


Figure 3-28. Remove Piston Pin

ASSEMBLY

NOTE

It is assumed that each step performed on one cylinder is automatically repeated on the other.

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-42317A). 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 3-29.
   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.

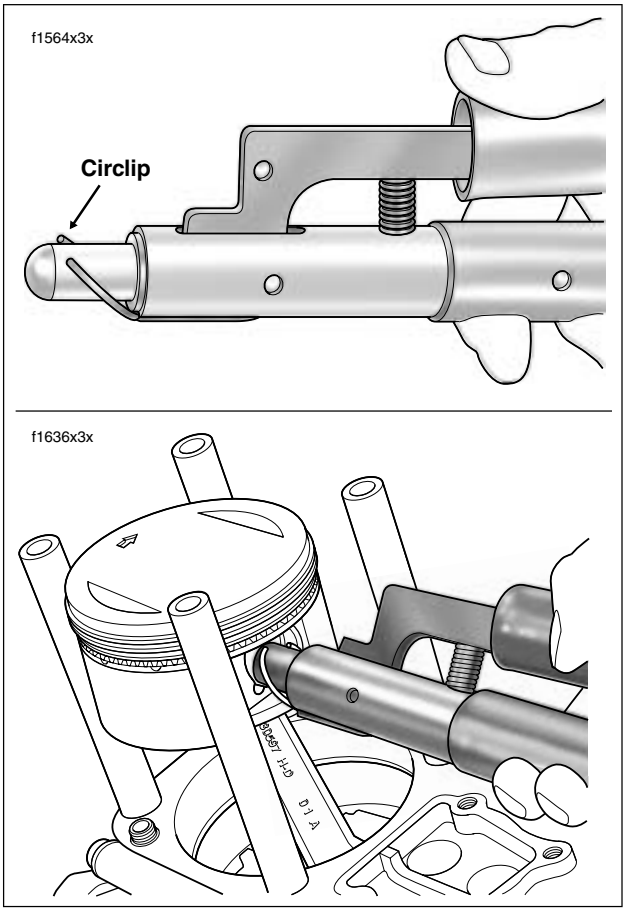


Figure 3-29. Install Piston Pin Circlip

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 properly staggered. If necessary, see Section 3.11 SUBASSEMBLY SERVICE AND REPAIR, PISTON.

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 31 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 3-31.

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.

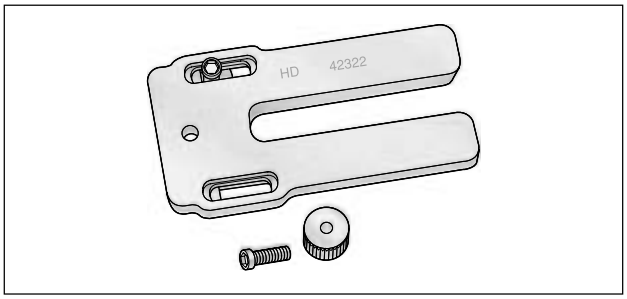


Figure 3-30. Piston Support Plate (Part No. HD-42322)

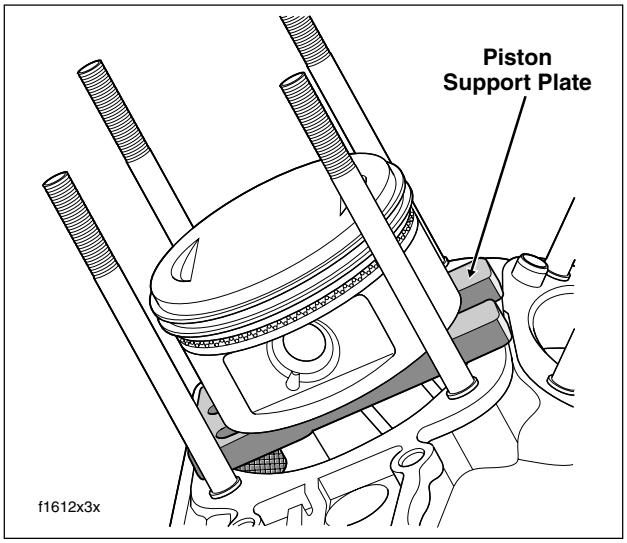


Figure 3-31. Install Piston Support Plate

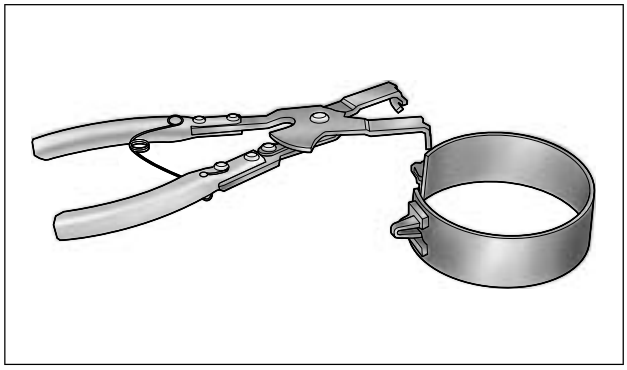


Figure 3-32. Piston Ring Compressor (Part No. HD-96333-51C)

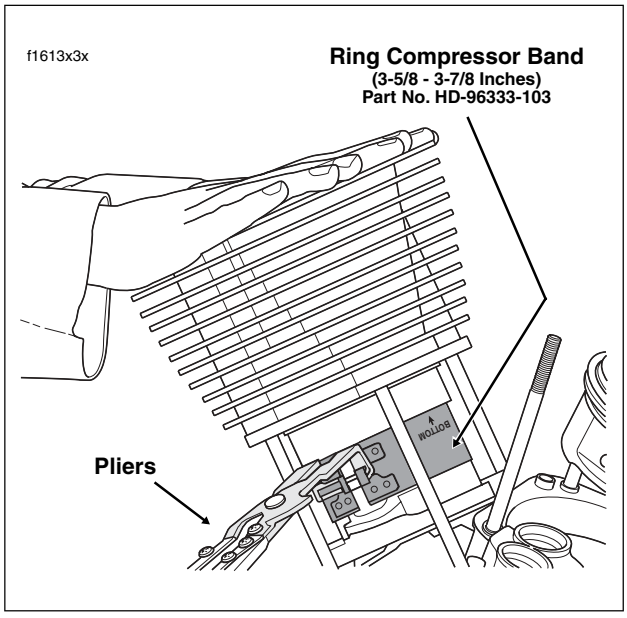


Figure 3-33. Install Cylinder

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 3-33.

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 3-34.

15. With the part number topside, place the head gasket over the two ring dowels in the upper flange of the cylinder.

16. 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 cylinder ring dowels. To avoid damage to machined surfaces or 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.

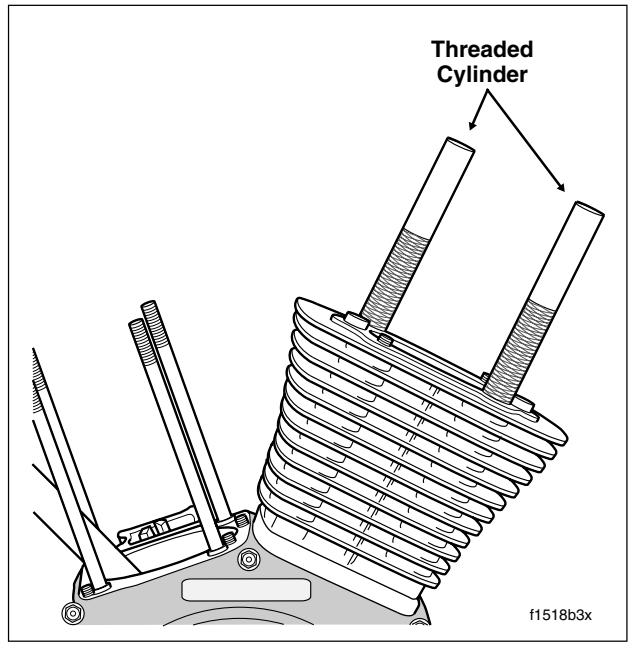


Figure 3-34. Install Threaded Cylinders to Studs (Part No. HD-95952-1)

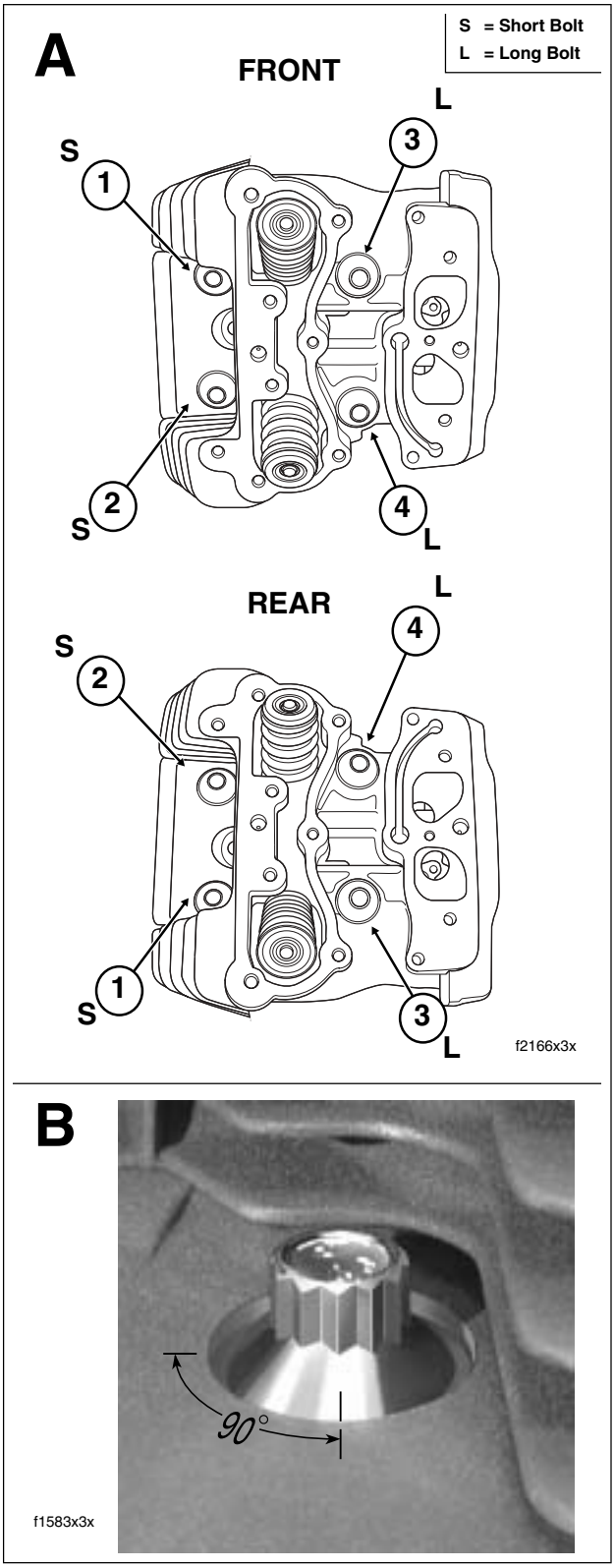


Figure 3-35. Cylinder Head Torque Sequence and Bolt Size

17. Lightly coat the threads and bottom face of the cylinder head bolts in clean H-D 20W50 engine oil. Wipe off any excess oil.
18. 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.
19. 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 84-108 **in-lbs** (9.5-12.2 Nm) in the sequence shown in A of Figure 3-35.

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. Using the marks as a guide, turn each bolt 1/4 turn or 90 degrees. See B of Figure 3-35. Be sure to tighten the cylinder head bolts in the sequence shown in A of Figure 3-35.

NOTE

For best results, obtain Snap-on® Torque Angle Gauge TA360.

20. 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.

21. Verify that the rocker housing gasket is installed correctly by noting that the breather channel is concealed. See Figure 3-36.
22. With the indent facing forward, place the rocker housing into position aligning the holes in the housing with those in the gasket.
23. 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 120-168 **in-lbs** (13.6-18.9 Nm) in the pattern shown in Figure 3-37.

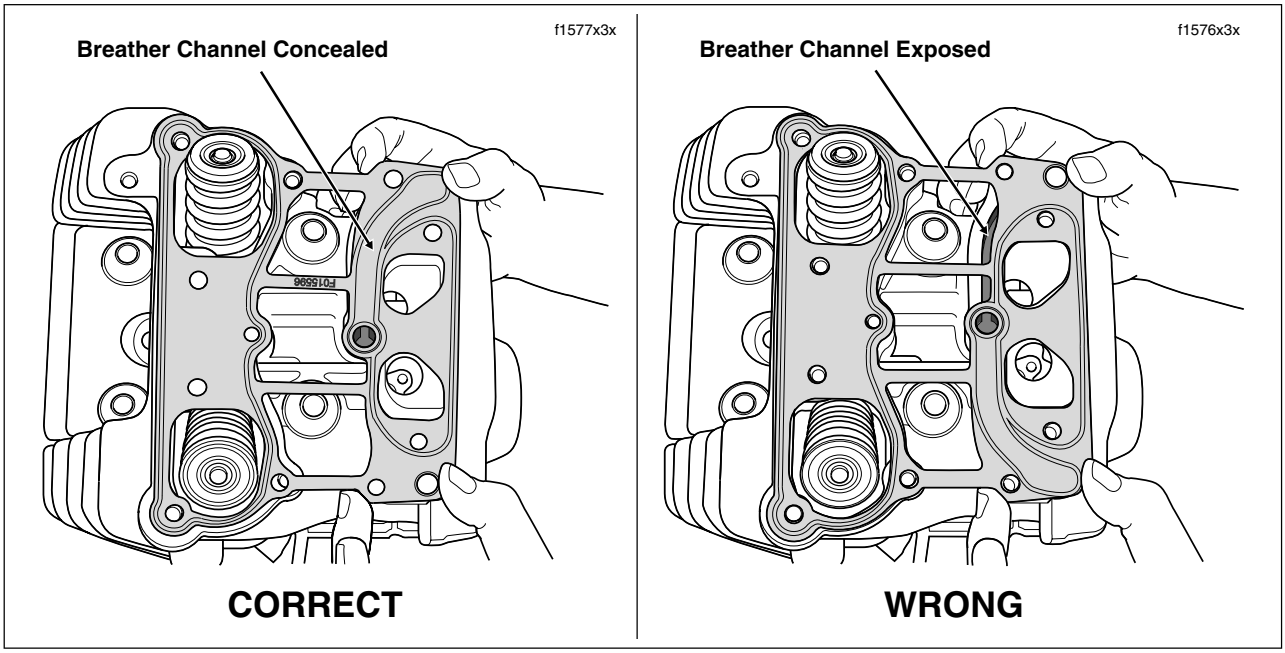


Figure 3-36. Install Rocker Housing Gasket (Rear Cylinder Shown)

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 new O-rings keeping them packaged until use to avoid confusion.

24. 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 3-37.
25. 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.

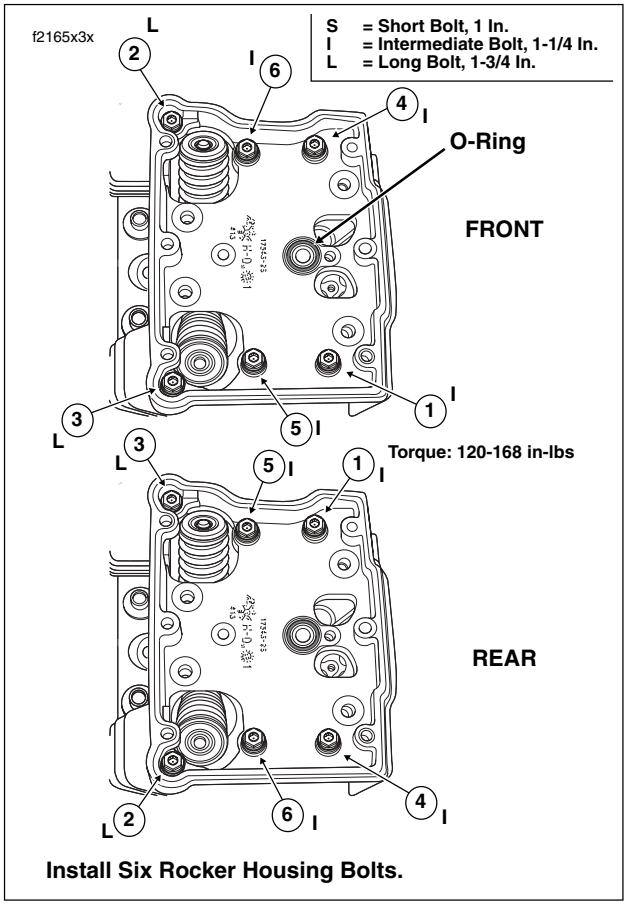


Figure 3-37. Rocker Housing Torque Sequence and Bolt Size

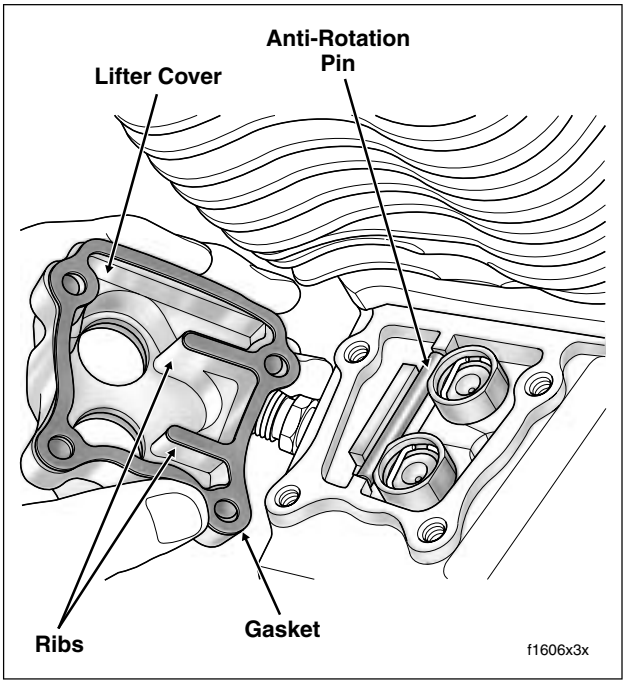


Figure 3-38. Install Lifters and Lock Position With Anti-Rotation Pin

26. Place anti-rotation pin on the machined flat between the blocks cast into the crankcase. See Figure 3-38.
27. 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.

28. 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 3-38. Tighten the lifter cover screws to 90-120 **in-lbs** (10.2-13.6 Nm) in a crosswise pattern.
29. 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.

30. 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.
31. 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 - With vehicle on center stand, place the transmission in 5th gear and rotate rear wheel in a clockwise direction (as viewed from right side) until the base circle is found. See step 31(d) to find the base circle.

b. With primary cover removed - 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 31(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 outboard side of extension. See Figure 3-24. Install tool on sprocket shaft and rotate in a counterclockwise direction until the base circle is found. See step 31(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

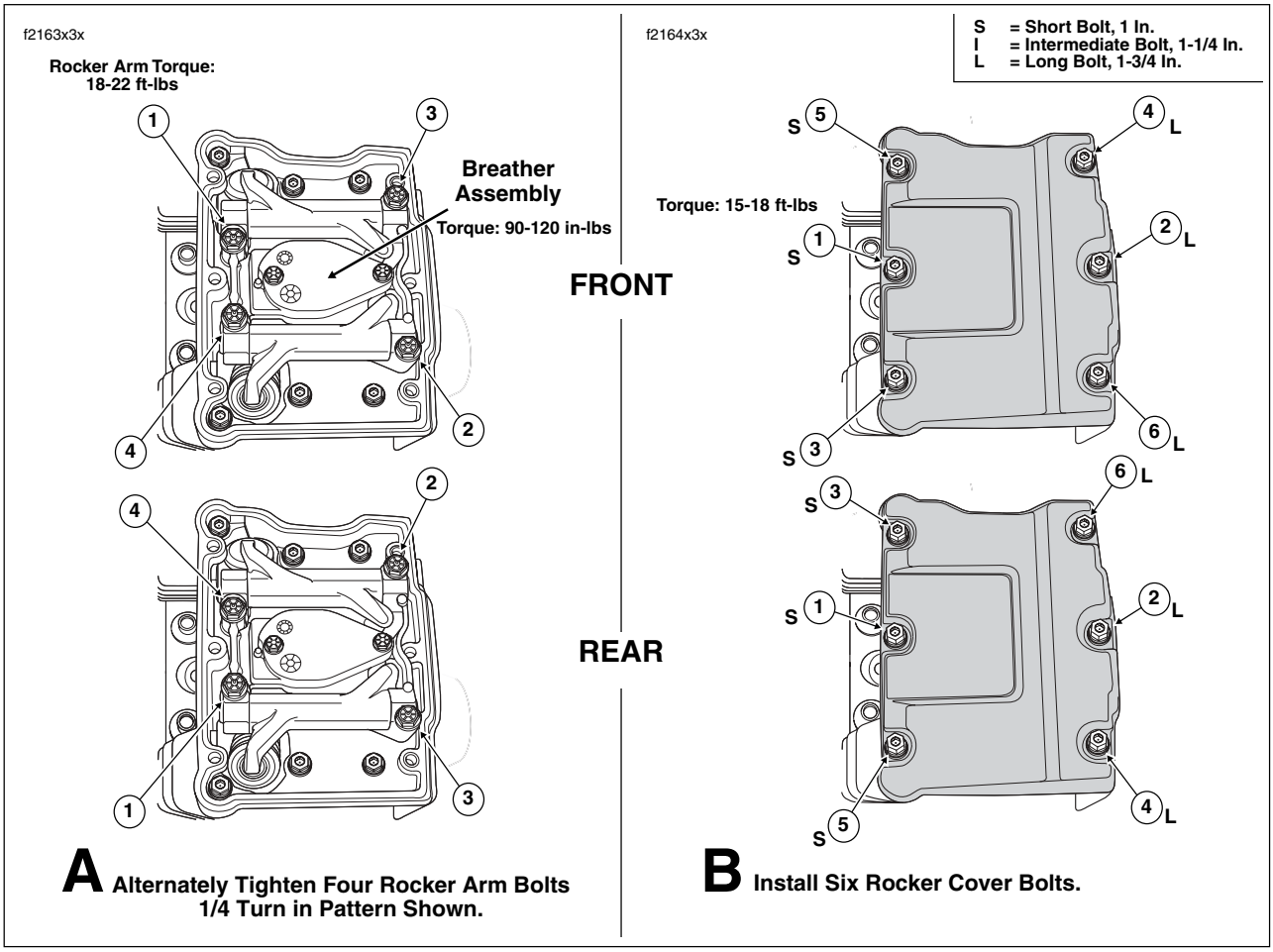


Figure 3-39. Rocker Arm/Rocker Cover Torque Sequence and Bolt Size

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.

32. Place the rocker arm support plate assembly into the rocker housing. Start the four rocker arm support plate bolts into the cylinder head.

33. Place breather assembly at top of rocker arm support plate. Apply a small dab of Loctite Medium Strength Threadlocker 243 (blue) to threads of two breather assembly bolts. Start bolts into cylinder head.

34. Alternately tighten each of the four rocker arm support plate bolts just 1/4 turn following the pattern shown in A of Figure 3-39. 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).

35. Alternately tighten the two breather assembly bolts to 90-120 **in-lbs** (10.2-13.6 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.

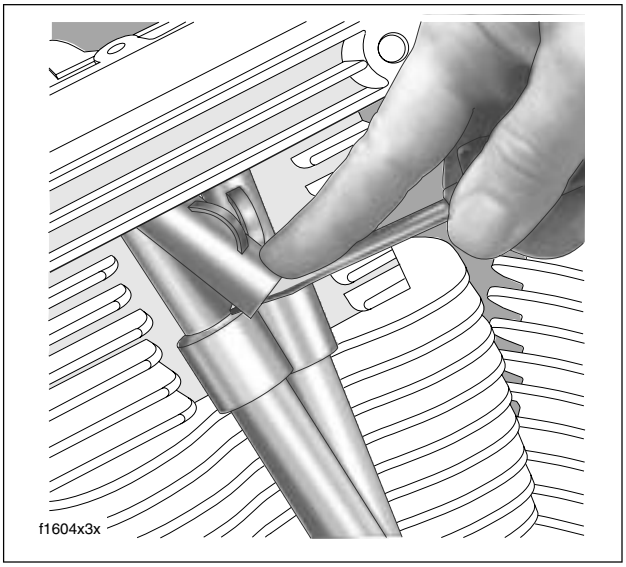


Figure 3-40. Install Spring Cap Retainer

36. 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.

37. 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 3-40.

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.

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 3-39.

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 3.9 TOP END OVERHAUL, DISASSEMBLY. If only servicing cam compartment components, see steps 1-11. If performing a complete engine overhaul, reference steps 1-29.

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.
3. Using a colored marker, mark the crank sprocket and 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 3-41.
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.

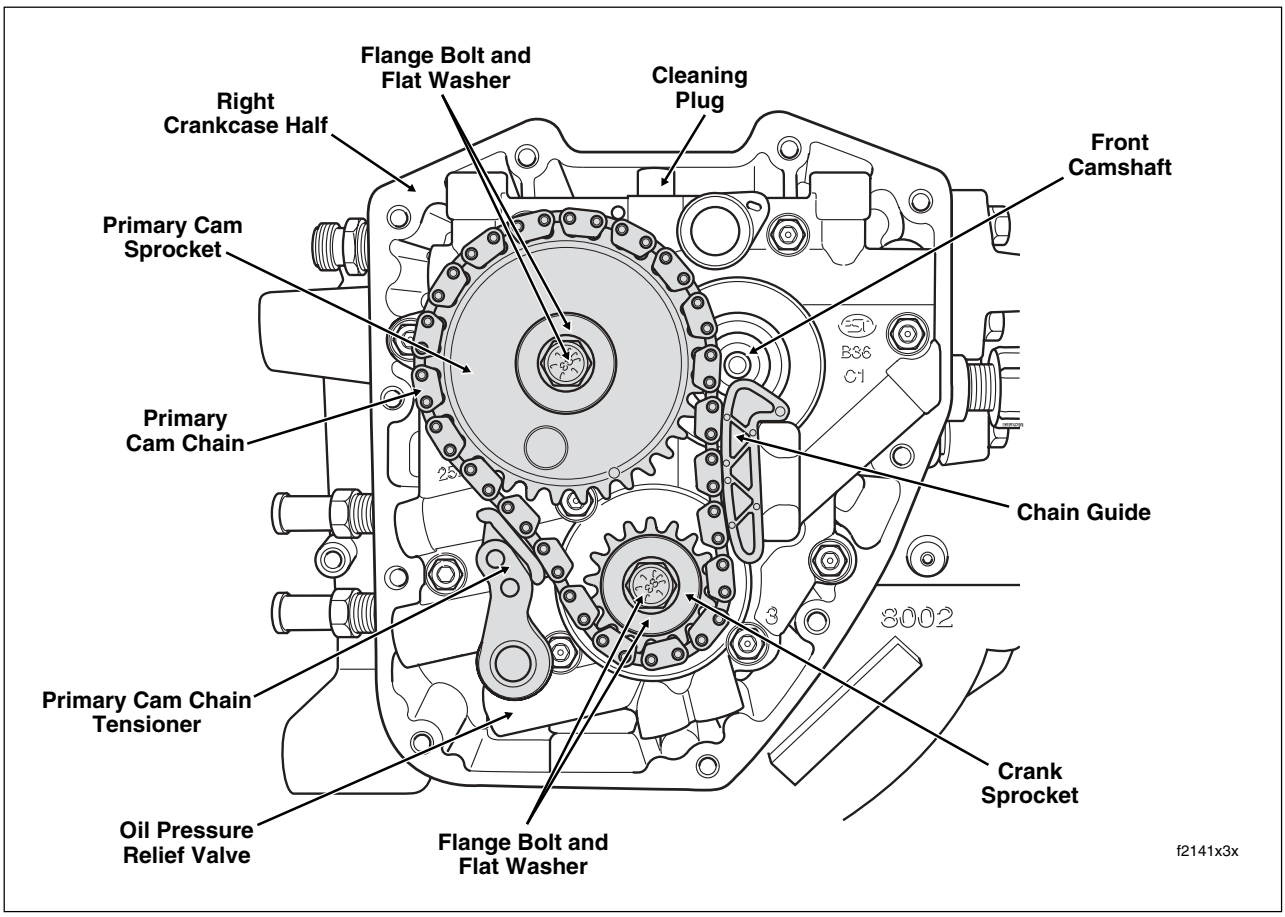


Figure 3-41. Cam Support Plate Assembly

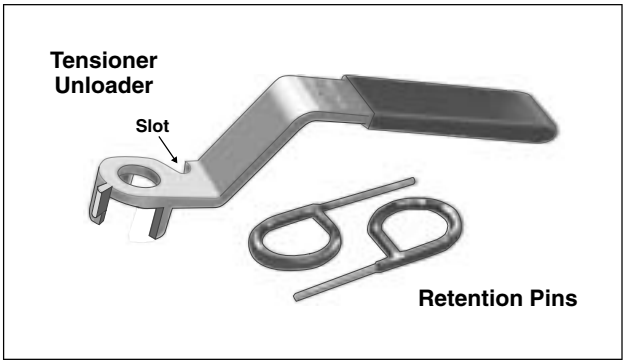


Figure 3-42. Cam Chain Tensioner Unloader with Retention Pins (Part No. HD-42313)

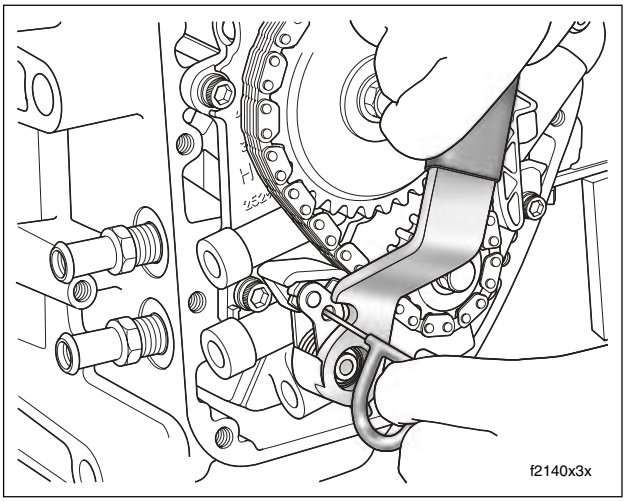


Figure 3-43. Retract Primary Cam Chain Tensioner

⚠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 3-43.
   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. Release the cam support plate from the oil pump flange. Alternately loosen and then remove the four allen head socket screws following the pattern shown in B of Figure 3-51.
12. Release the cam support plate from the crankcase flange. Alternately loosen and then remove the six allen head socket screws following the pattern shown in A of Figure 3-51.
13. Two ring dowels in crankcase flange locate cam support plate (lower rear, upper front). See Figure 3-44. 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 3.11 SUBASSEMBLY SERVICE AND REPAIR, CAM SUPPORT PLATE.

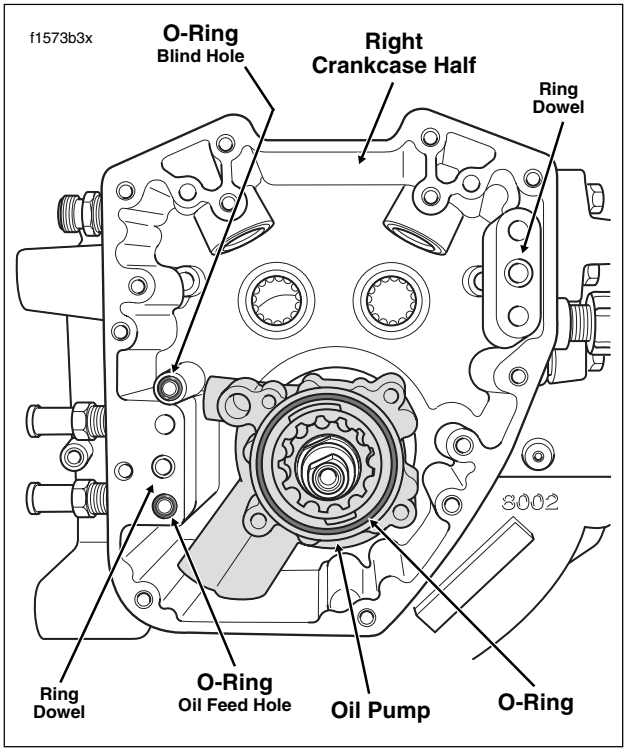


Figure 3-44. Oil Pump Assembly

⚠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.

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 3-44.
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 3.11 SUBASSEMBLY SERVICE AND REPAIR, OIL PUMP.

⚠WARNING

Be sure that stator mount flange (sprocket shaft side) is NOT facing up when the case halves are separated or the flywheel assembly will drop to the floor. Dropping the flywheel assembly may result in parts damage and minor or moderate injury.

16. Rotate crankcase in the engine stand so that the cam cover flange is facing upward. Remove the nine crankcase bolts in the left case half. Follow the sequence shown in Figure 3-47.

⚠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. Using pry points, 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 3.11 SUBASSEMBLY SERVICE AND REPAIR, CRANKCASE.

ASSEMBLY

1. If removed, install left crankcase half in engine stand so that the split line face is vertical.
2. To prevent damage to the sprocket shaft bearing, slide CRANKSHAFT GUIDE (HD-42326A) over end of sprocket shaft. Install flywheel assembly into left case half. Remove tool.

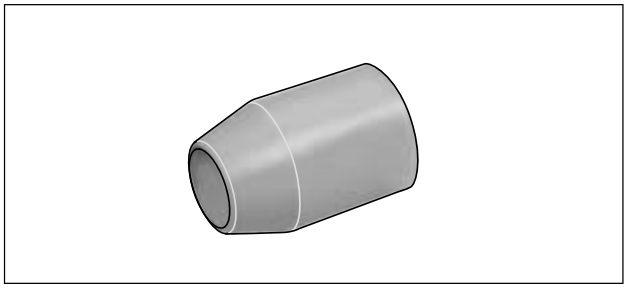


Figure 3-45. Crankshaft Guide (Part No. HD-42326A)

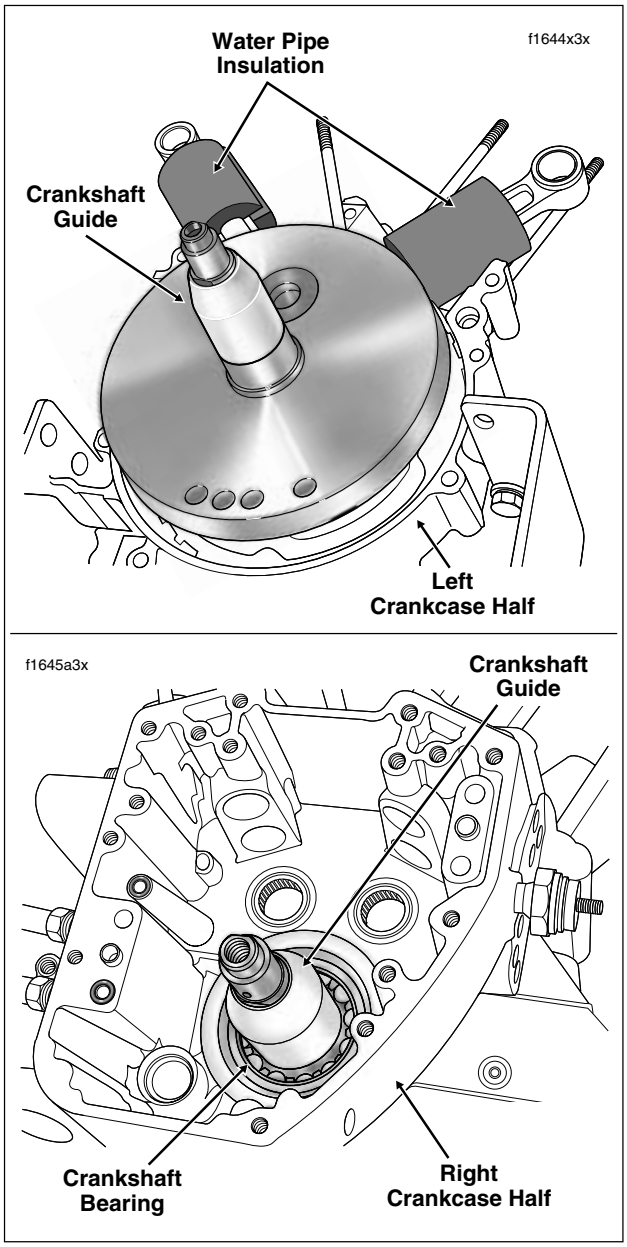


Figure 3-46. Install Crankshaft Guide to Protect Crankshaft Bearing

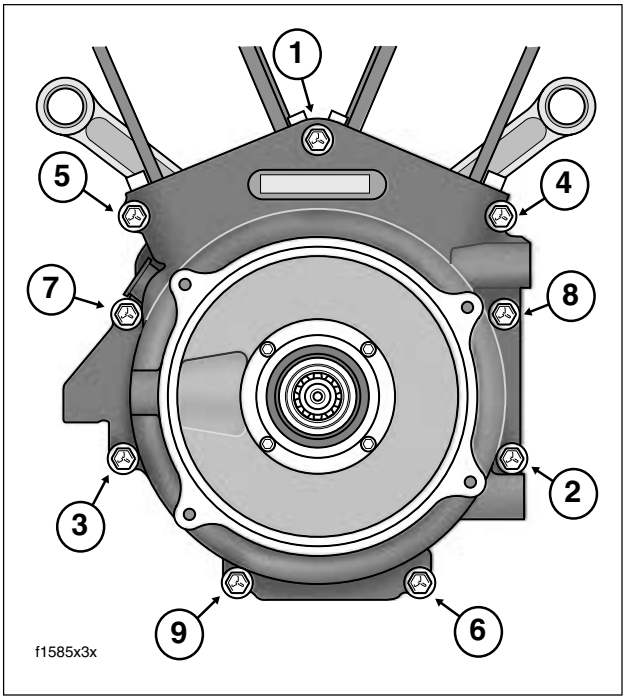


Figure 3-47. Crankcase Torque Sequence (Left Side View)

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.

3. Install **new** O-rings over two ring dowels in split line face of right case half.
4. Apply a small bead of sealant approximately 0.056 inch (1.4 mm) wide to the split line face. For best results, use High-Performance Sealant (gray), Part No. HD-99650-02.
5. To prevent damage to the crankshaft bearing, place CRANKSHAFT GUIDE (HD-42326A) over end of crankshaft. Mate case halves sliding bearing in right crankcase half over end of crankshaft. Remove tool. See Figure 3-46.
6. 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 3-47.
   c. Following the same sequence, tighten each bolt to 15-19 ft-lbs (20.3-25.8 Nm).
7. Rotate crankcase in the engine stand so that the stator mount flange (sprocket shaft side) is facing upward. Install service thrust washer on sprocket shaft with the ink stamp facing outside (and the chamfer inboard). If using OE part without markings, orient as required to preserve existing wear pattern.
8. 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 3-48.

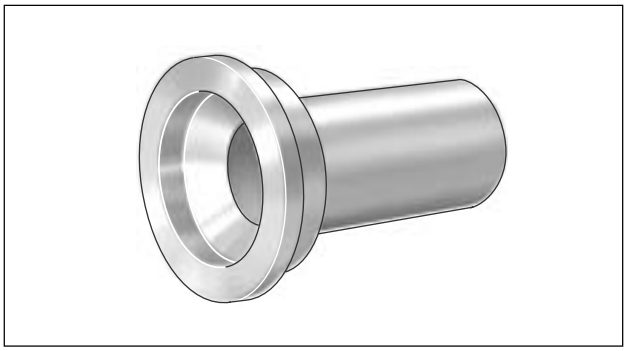


Figure 3-48. Sprocket Shaft Oil Seal Installer (Part No. HD-39361A)

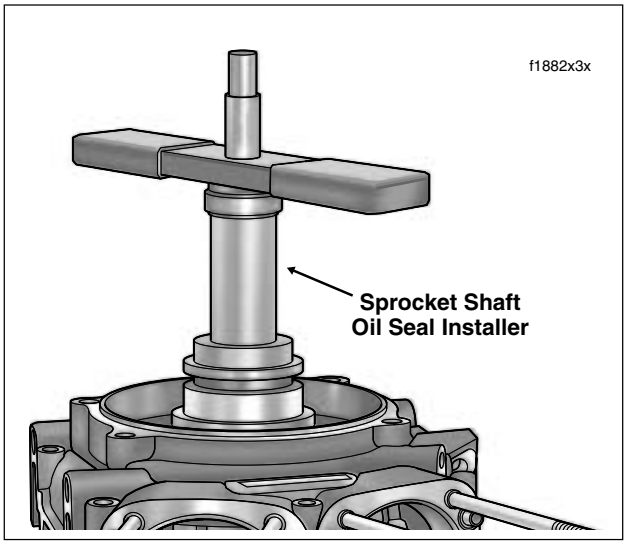


Figure 3-49. Install Oil Seal In Bore

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 3-49.

h. Remove handle, flat washer, Nice bearing, seal installer and pilot from sprocket shaft.

9. Slide sprocket shaft spacer over end of sprocket shaft. Push spacer into oil seal until seated against bearing race.

10. Rotate crankcase in the engine stand so that the cam cover flange is facing upward.

11. 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).

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.

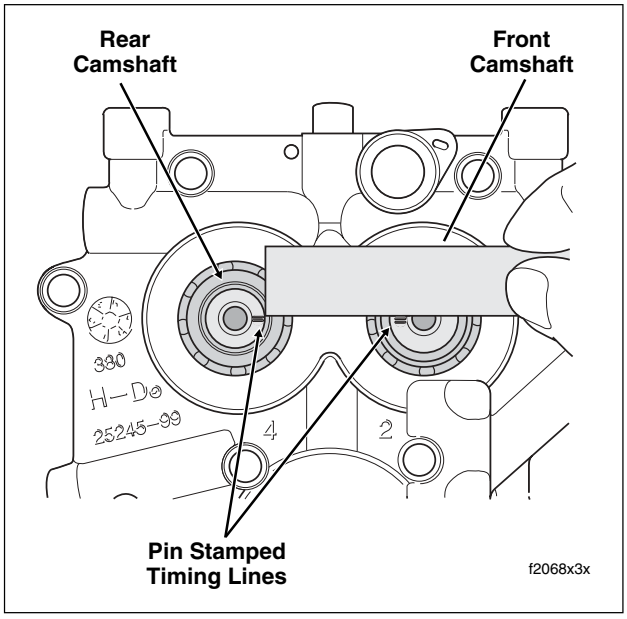


Figure 3-50. Verify Alignment of Timing Lines on Front and Rear Camshafts

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 3-44. Apply a very thin film of clean H-D 20W50 engine oil to O-ring before installation.

12. 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.

13. 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.

14. Lubricate cam needle bearings with clean H-D 20W50 engine oil.

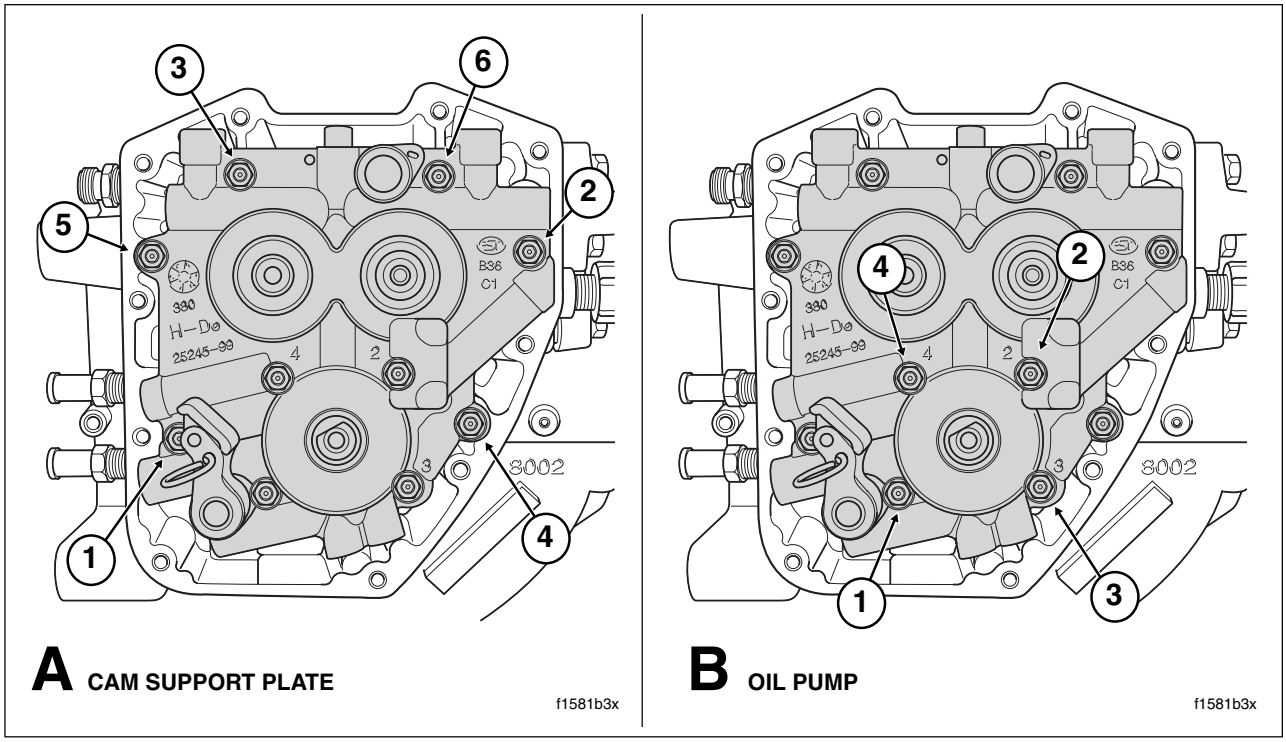


Figure 3-51. Cam Support Plate/Oil Pump Torque Sequence

15. Using a straightedge, verify that the pin stamped timing lines on the ends of the front and rear camshafts are in alignment (although they may be somewhat difficult to see). See Figure 3-50. If necessary, rotate camshafts in order to make this observation.
16. 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.
17. 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 3-51.
18. Secure the cam support plate to the oil pump flange as follows:
    a. Start two allen head socket screws (1/4 x 1 inch) into holes 3 and 4. See B of Figure 3-51.
    b. Obtain two ALIGNMENT TOOLS used to install lifter guides on Evolution engines (HD-33443). Loosely install alignment tools in holes 1 and 2.
    c. While rotating the engine, alternately snug and then tighten the alignment tools to 40-45 **in-lbs** (4.5-5.1 Nm).

NOTE

For methods of engine rotation, see Section 3.9 TOP END OVERHAUL, DISASSEMBLY, step 7.

    d. Alternately snug and then tighten the screws in holes 3 and 4 to 40-45 **in-lbs** (4.5-5.1 Nm).
    e. Remove the alignment tool from hole 1. Install the allen head socket screw and tighten to 40-45 **in-lbs** (4.5-5.1 Nm).
    f. Repeat step 18(e) to replace alignment tool in hole 2 with allen head socket screw.
    g. Final tighten all four screws to 90-120 **in-lbs** (10.2-13.6 Nm). Use the pattern shown in B of Figure 3-51. Numbers cast adjacent to the bolt holes also indicate the oil pump torque sequence.

NOTE

If only realigning the oil pump, first loosen all screws following the pattern shown in B of Figure 3-51. Remove screws from holes 1 and 2 and then follow the alignment procedure starting at step 18(b).

19. Pull retention pin from hole in cam support plate to release secondary cam chain tensioner.
20. Squeeze tabs and install chain guide between blocks cast into cam support plate.
21. Install primary cam sprocket spacer onto rear camshaft.
22. If using the original cam support plate, camshafts, primary cam sprocket, crank sprocket and flywheel assembly, then move to step 23. 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 22(e).

c. To prevent rotation, position the CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL (HD-42314) between the crank and primary cam sprockets. See Figure 3-53. 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.

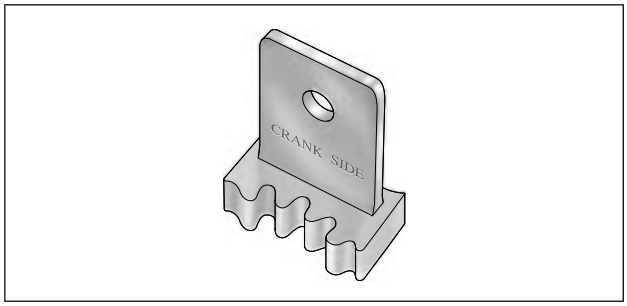


Figure 3-52. Crankshaft/Camshaft Sprocket Locking Tool (Part No. HD-42314)

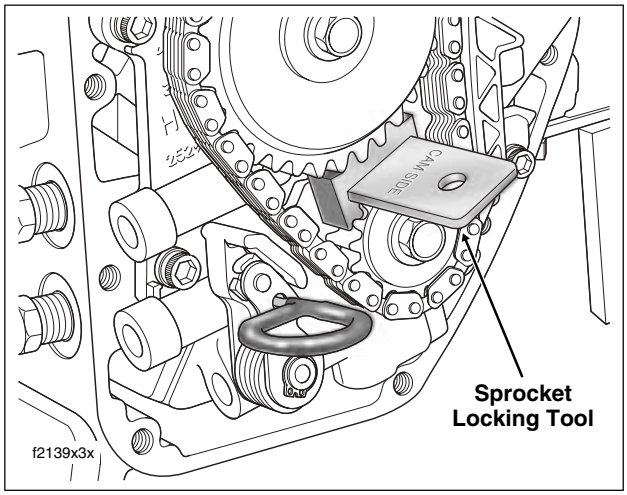


Figure 3-53. Lock Crank and Primary Cam Sprockets Before Tightening Flange Bolts

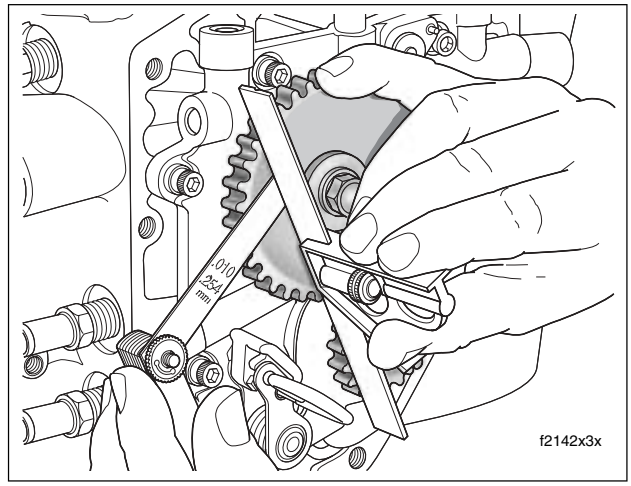


Figure 3-54. Check Alignment of Crank and Primary Cam Sprocket Faces

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 3-54. If the feeler gauge does not fit at either location, then proceed to step 22(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 21 to repeat the check with the new spacer installed.

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
0.337	25725-00

f. Remove both crank and primary cam sprockets. Discard smaller diameter flat washer obtained from bulk inventory.

23. Install the primary cam chain and sprocket assembly as follows:

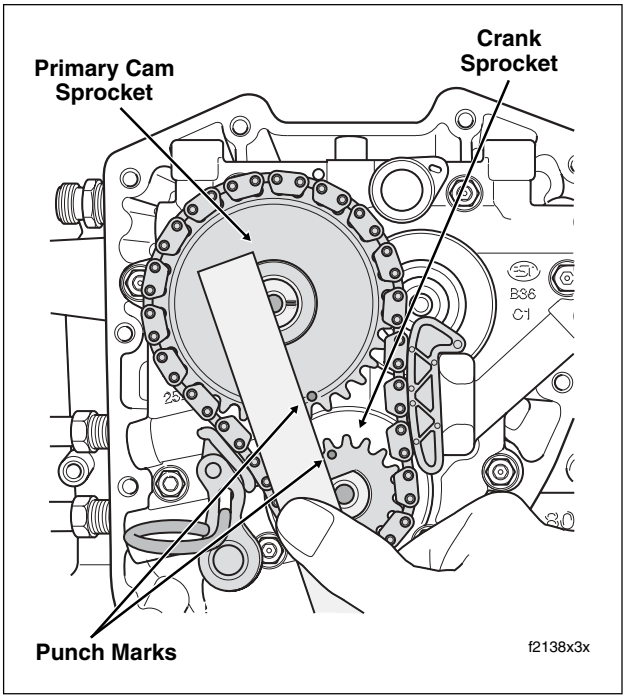


Figure 3-55. Verify Alignment of Crank and Primary Cam Sprocket Punch Marks

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 and crank sprocket is facing away from 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.

24. 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 3-55.

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.*

25. 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 3-53. 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).

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.

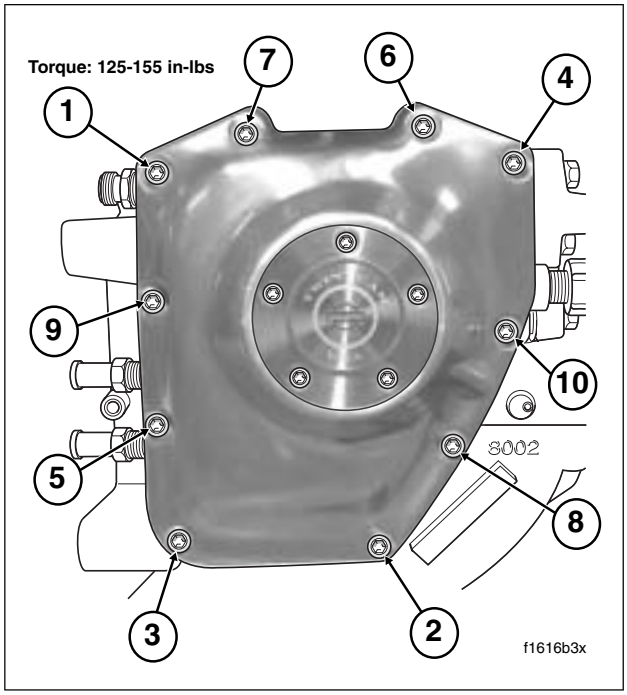


Figure 3-56. Cam Cover Torque Sequence

26. 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.

27. Apply clean H-D 20W50 engine oil to crank and primary cam sprockets.

CAUTION

Before cam cover installation, verify cleanliness of blind holes in the crankcase flange. Tightening screws with dirt, water or oil in the holes can cause the casting to crack or break. Damage to the casting requires replacement of the right crankcase half.

28. Align holes in **new** cam cover gasket with those in the crankcase flange.

29. Install the cam cover using ten allen head socket screws (1/4 x 1-1/4 inches). Alternately tighten screws to 125-155 **in-lbs** (14.1-17.5 Nm) following the pattern shown in Figure 3-56.

30. If performing a complete engine overhaul, see Section 3.9 TOP END OVERHAUL, ASSEMBLY, steps 1-39. If only cam compartment components were serviced, just see steps 28-37.

Legend:

1. Bolt
2. Bolt
3. Rocker Cover
4. Rocker Cover Gasket
5. Breather Bolt
6. Breather Baffle Assembly
7. Filter Element
8. Rocker Arm Bolt
9. Rocker Arm Support Plate
10. Rocker Arm Bushing
11. Rocker Arm
12. Rocker Arm Shaft
13. Rocker Arm
14. Breather Baffle O-Ring
15. Rocker Housing Bolt
16. Rocker Housing Bolt
17. Rocker Housing
18. Rocker Housing Gasket
19. O-Ring
20. Upper Push Rod Cover
21. Spring Cap Retainer
22. Spring Cap
23. Spring
24. Flat Washer
25. O-Ring
26. Lower Push Rod Cover
27. O-Ring
28. Lifter Cover Screw
29. Lifter Cover
30. Anti-Rotation Pin
31. Lifter Cover Gasket
32. Hydraulic Lifter
33. Push Rod

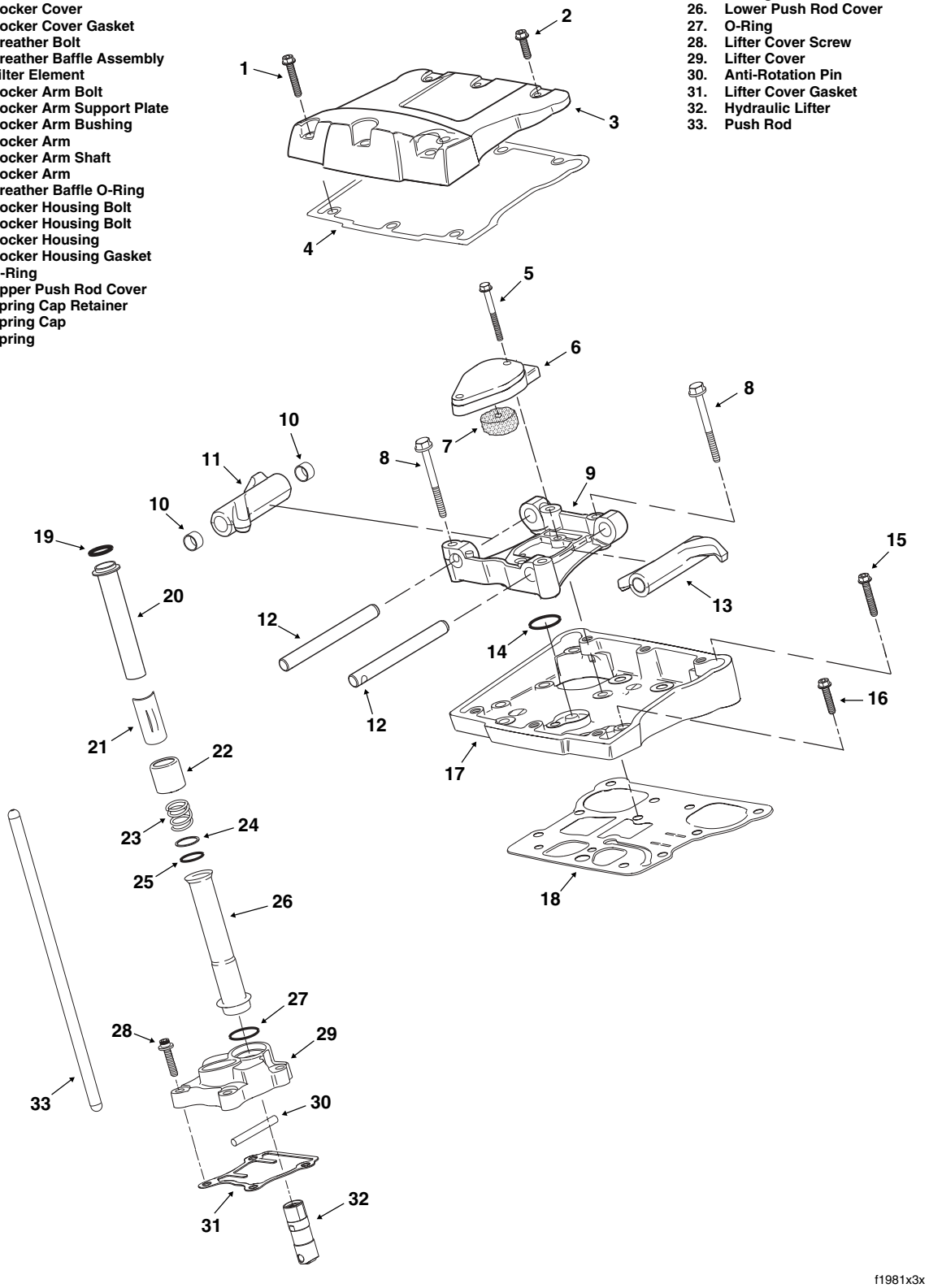


Figure 3-57. Rocker Arm/Breather/Lifter Assemblies (Exploded View)

TOP END

BREATHER ASSEMBLY

Removal

1. See Section 3.9 TOP END OVERHAUL, DISASSEMBLY, steps 1-8.

Disassembly

1. Remove two bolts from breather assembly and remove breather assembly from rocker arm support plate. See Figure 3-58.
2. Remove and discard filter element from bore on underside of breather assembly.

Cleaning and Inspection

1. Wipe breather assembly with a clean dry shop cloth. Replace breather assembly if damage or debris is present.

CAUTION

Do NOT attempt to wash breather assembly in cleaning solutions or solvents. Do NOT attempt to blow debris from breather assembly with compressed air. Breather assembly can be damaged and may cause improper engine operation if reused.

Assembly

1. Press **new** filter element into bore on underside of breather assembly. Hole in filter element accommodates umbrella valve stem.

Installation

1. See Section 3.9 TOP END OVERHAUL, ASSEMBLY, steps 31-39.

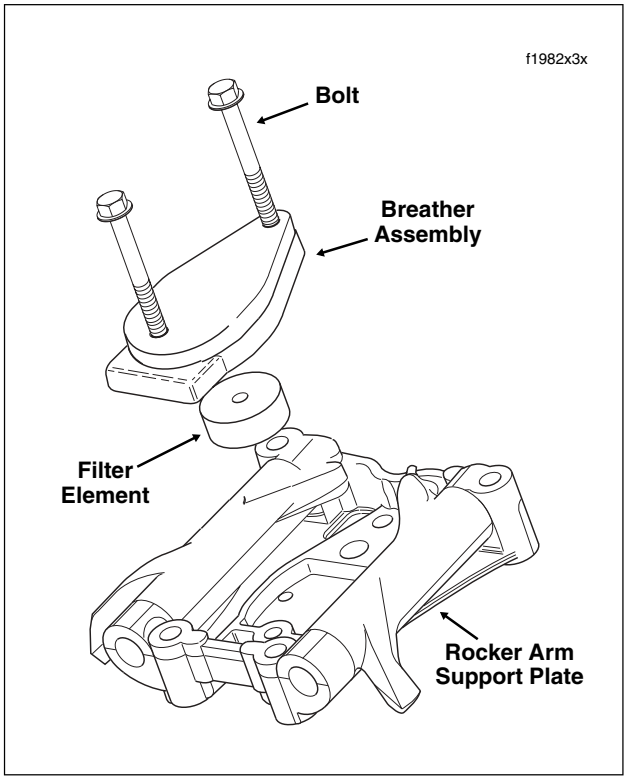


Figure 3-58. Breather Assembly

ROCKER ARM ASSEMBLY

Removal

1. See Section 3.9 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.

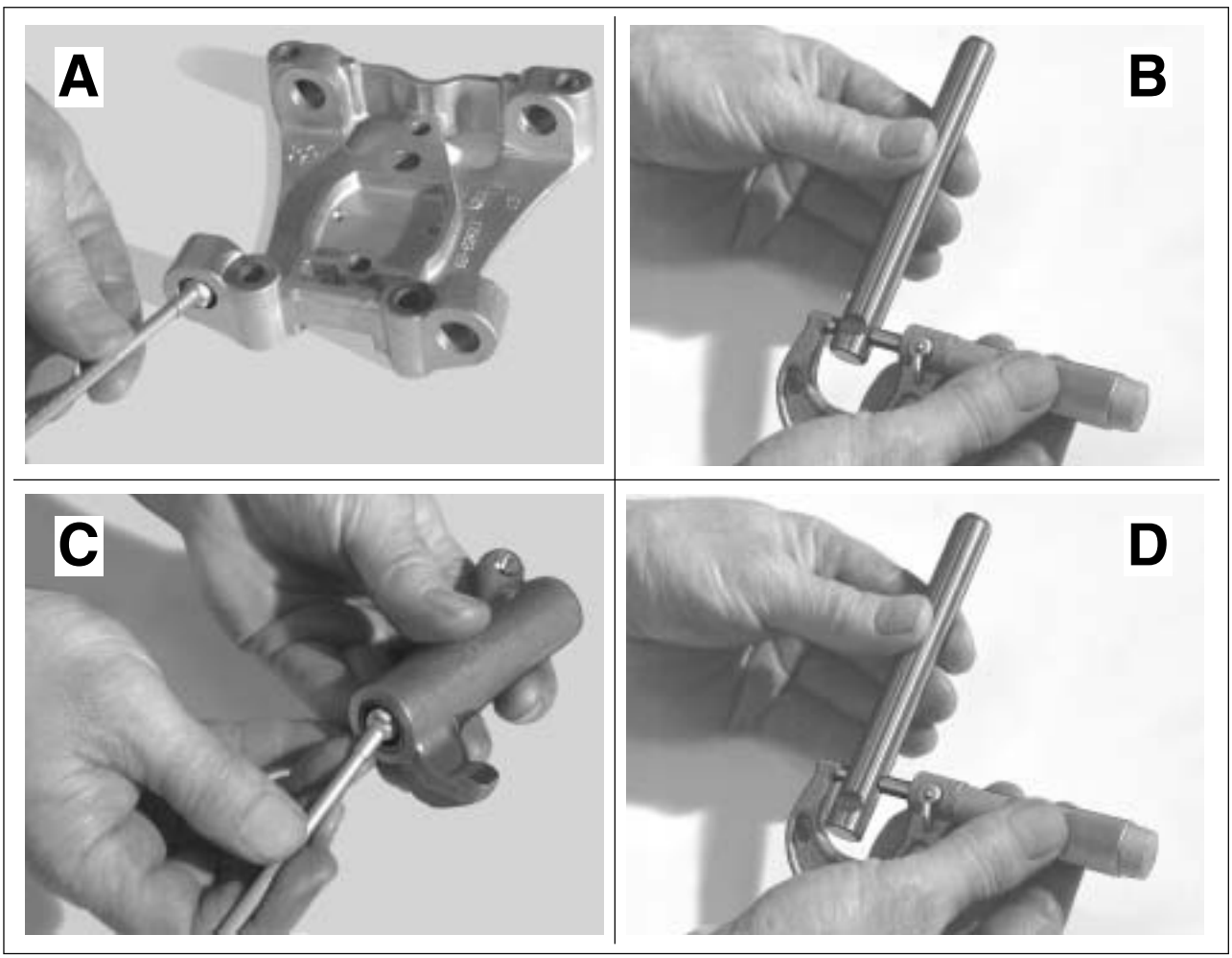


Figure 3-59. Measure Rocker Arm Assembly for Wear

5. Measure the inside diameter of the rocker arm support plate bore. See A of Figure 3-59. Measure the outside diameter of the rocker arm shaft where it fits in the bore. See B of Figure 3-59. 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 3-59. Measure the outside diameter of the rocker arm shaft where it rides in the bushing. See D of Figure 3-59. 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:

NOTE

Remove, install and ream one bushing at a time.

   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 3-60.

   b. Using a suitable driver, press **new** bushing into side of rocker arm until flush with casting. See center frame of Figure 3-60. Be sure to orient bushing so that split line faces top of rocker arm.

CAUTION

Never back reamer out of rocker arm or new bushing will be damaged.

   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 old bushing in rocker arm. Note that old bushing on drive side of reamer serves as pilot. See lower frame of Figure 3-60. Rotate reamer until new bushing on far side is reamed, and then continuing in the same direction, draw drive side of reamer from new bushing.

   d. Repeat steps 7(a) thru 7(c) to remove, install and ream second bushing.

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.

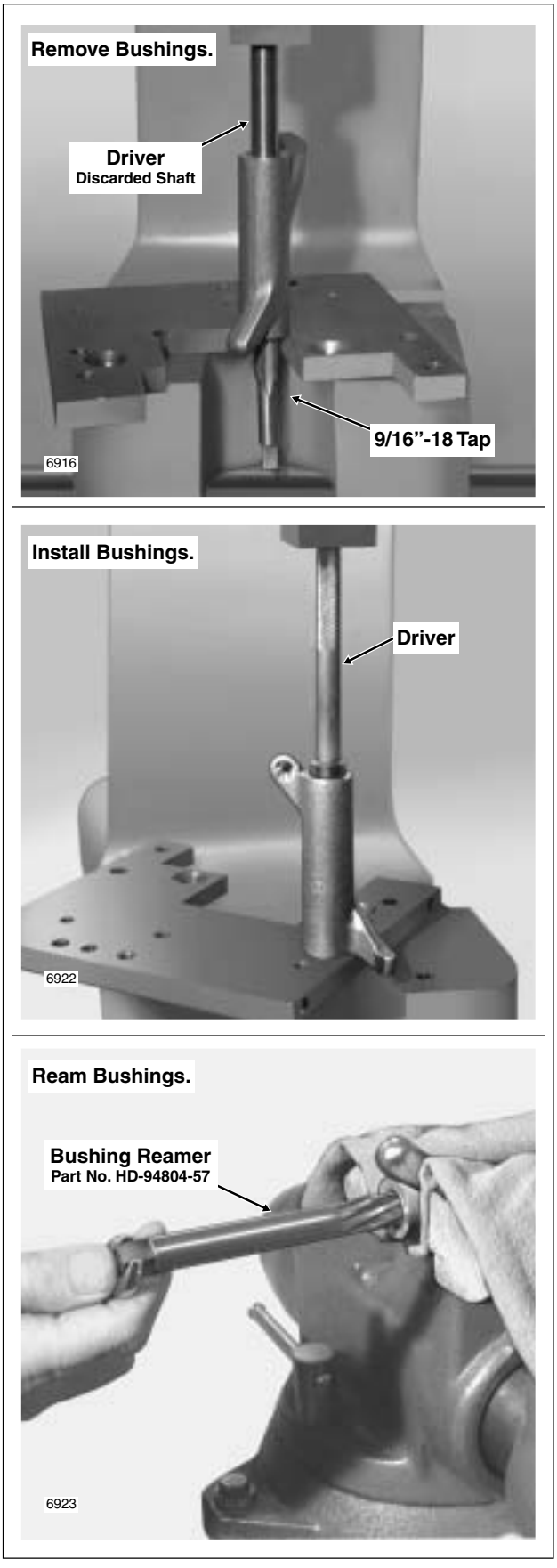


Figure 3-60. Replace Rocker Arm Bushings

3. To check for proper end play, insert a feeler gauge between the rocker arm and support plate. See Figure 3-61. 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 3.9 TOP END OVERHAUL, ASSEMBLY, steps 31-39.



Figure 3-61. Check End Play

PUSH RODS/LIFTERS/COVERS

Removal

1. See Section 3.9 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:

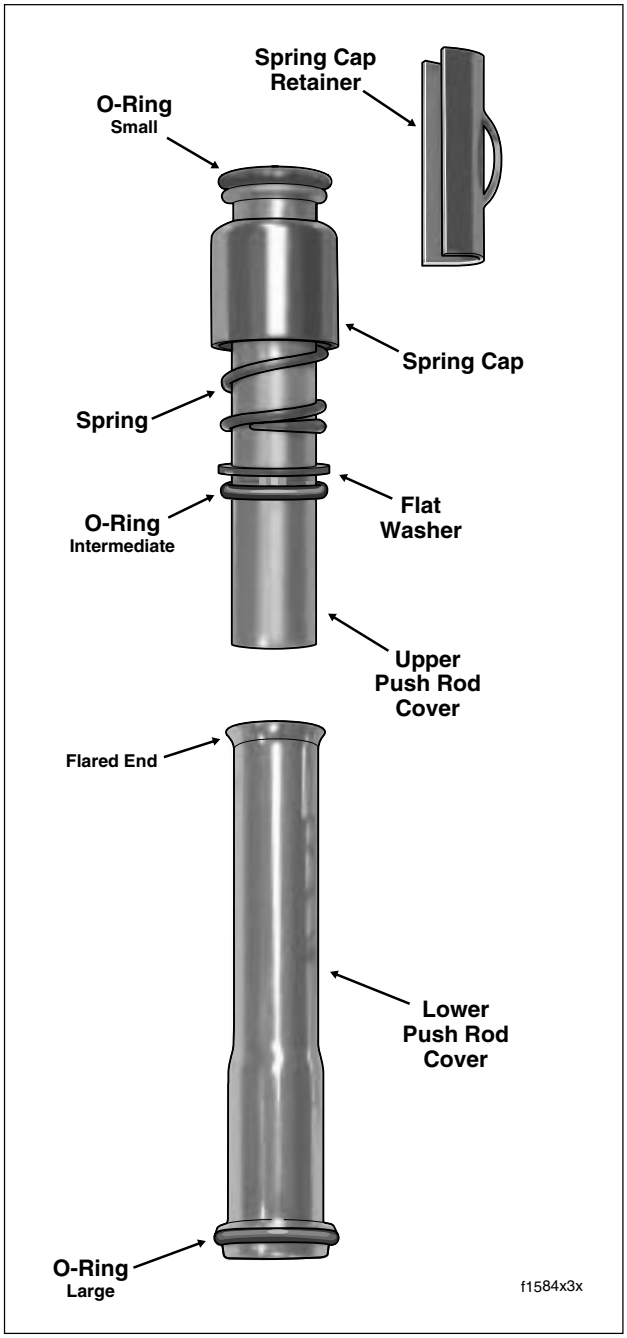


Figure 3-62. Push Rod Cover Assembly

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 3.9 TOP END OVERHAUL, ASSEMBLY, steps 25-39.

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. Ring Dowel
16. O-Ring Seal
17. Cylinder Stud
18. Piston
19. Piston Pin
20. Circlip
21. Top Compression Ring
22. Second Compression Ring
23. Oil Rail
24. Oil Rail Spacer

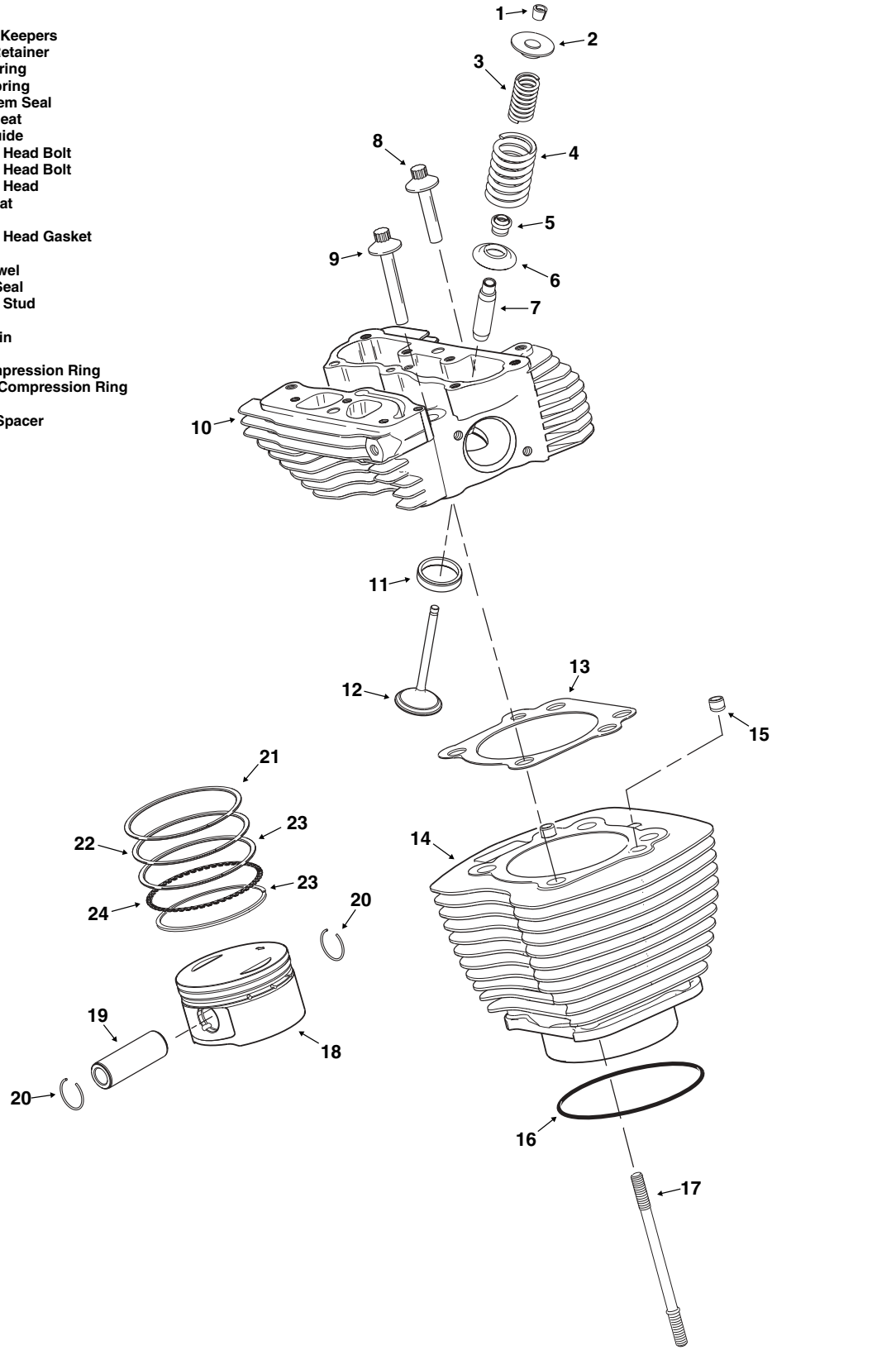


Figure 3-63. Cylinder Head/Cylinder/Piston Assemblies (Exploded View)

CYLINDER HEAD

Removal

1. See Section 3.9 TOP END OVERHAUL, DISASSEMBLY, steps 1-11 and 15-19.

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.

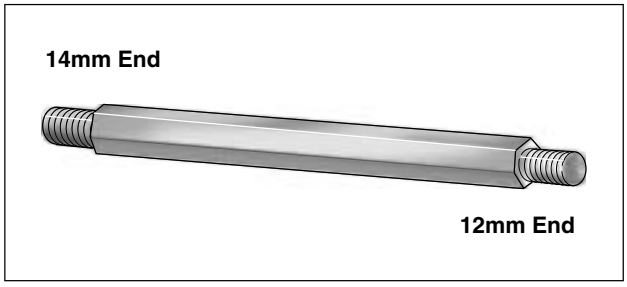


Figure 3-64. Cylinder Head Holding Fixture (Part No. HD-39786)

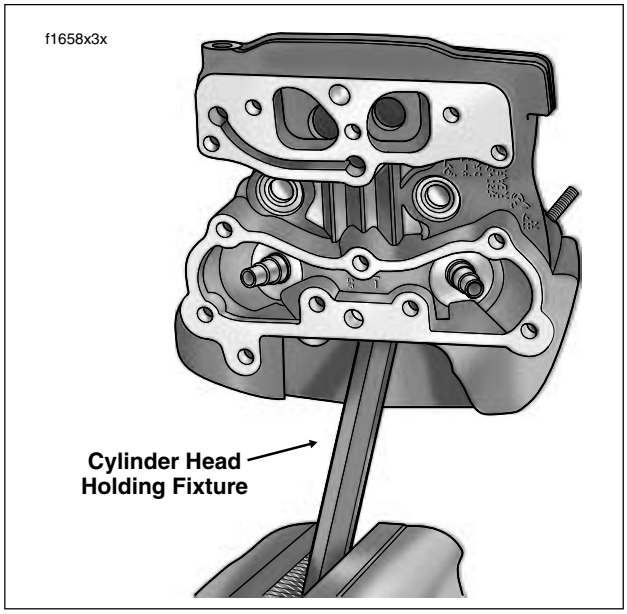


Figure 3-65. Install Cylinder Head Holding Fixture in Vise

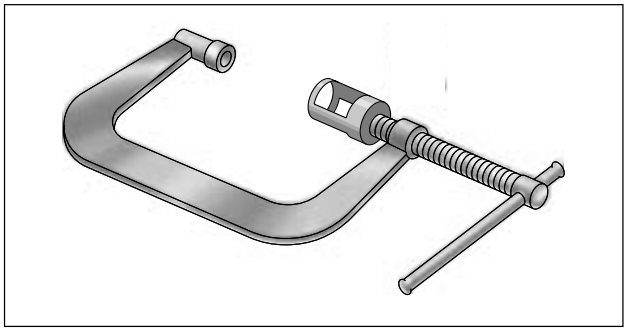


Figure 3-66. Valve Spring Compressor (Part No. HD-34736B)

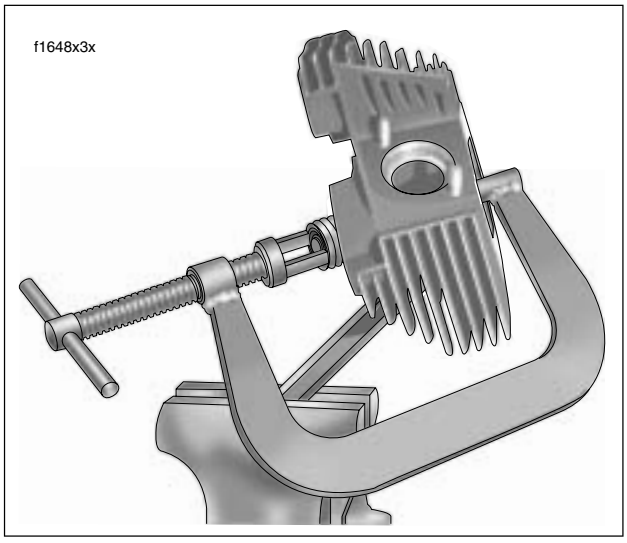


Figure 3-67. Compress Valve Springs

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 3-65.
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 3-67.
   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 (0.13 mm) or greater.

NOTE

For good results, use one of the CYLINDER TORQUE PLATES (HD-42324A) in lieu of the straightedge. Lay the upper plate flat on the machined surface of the head. As a preliminary check, see if the plate rocks from side to side. A head on which the plate rocks is immediately suspect. Insert a feeler gauge between the plate and head at various locations to see if warpage exceeds above specification.

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)

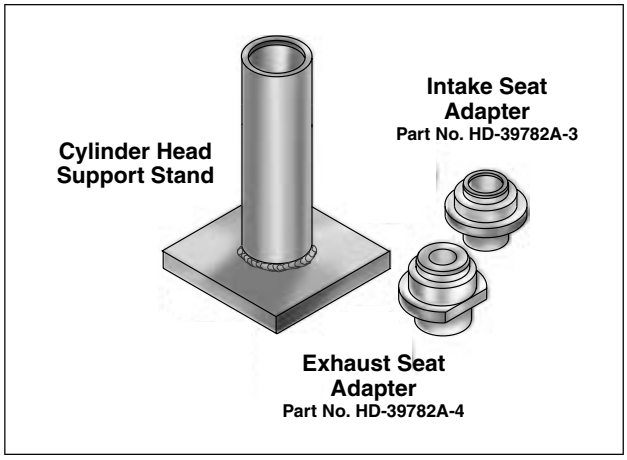


Figure 3-68. Cylinder Head Support Stand (Part No. HD-39782A)

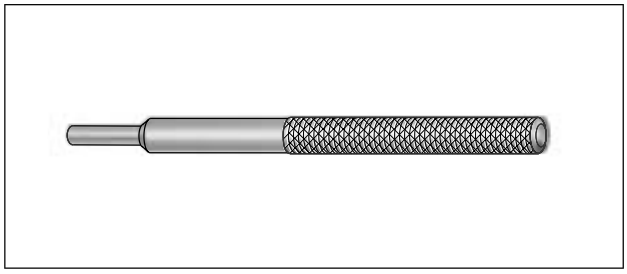


Figure 3-69. Valve Guide Driver (Part No. HD-34740)

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.
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-39782A) and proceed as follows:
   a. Insert sleeve of intake or exhaust seat adapter into tube at top of support stand. See Figure 3-68.
   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.

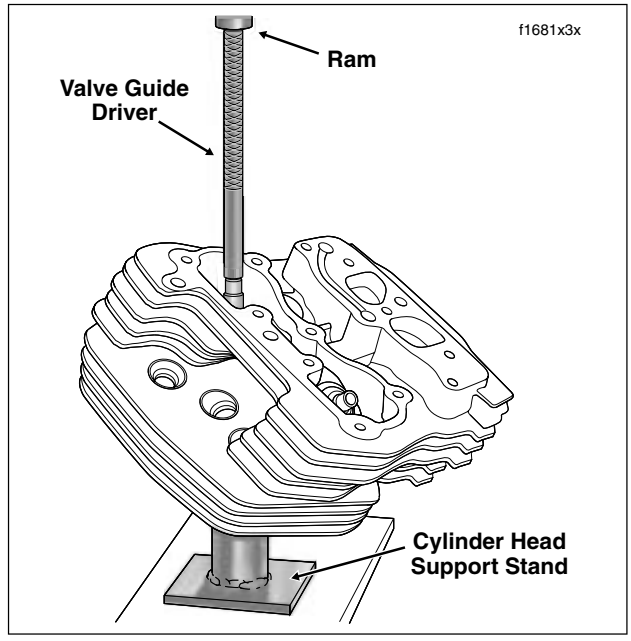


Figure 3-70. Remove Valve Guide

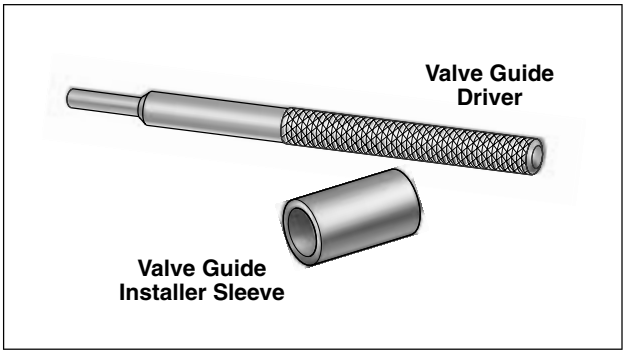


Figure 3-71. Valve Guide Driver (Part No. HD-34740) and Valve Guide Installer Sleeve (Part No. HD-34731)

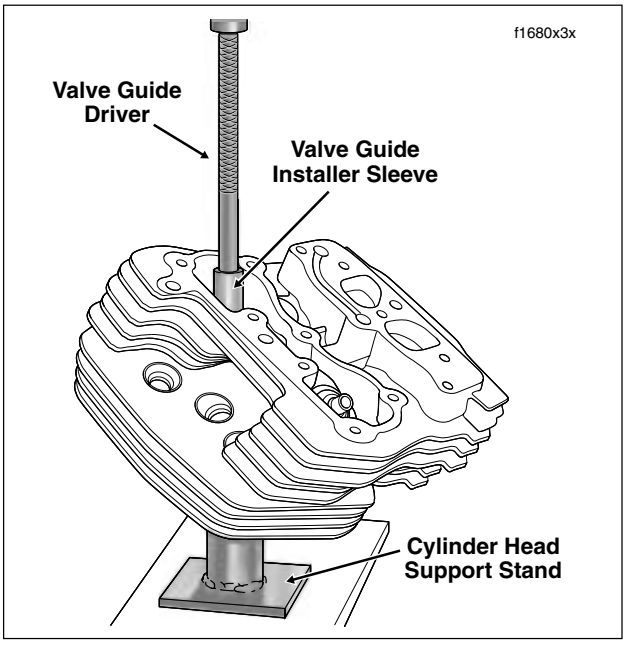


Figure 3-72. Install Valve Guide

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.

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 3-70.

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 (0.051-0.084 mm) larger than the bore.

   If clearance is not within specification, then select one of the following oversize guides - 0.001 inch (0.025 mm), 0.002 inch (0.05 mm) or 0.003 inch (0.08 mm).

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-39782A), 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 3-72.

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:

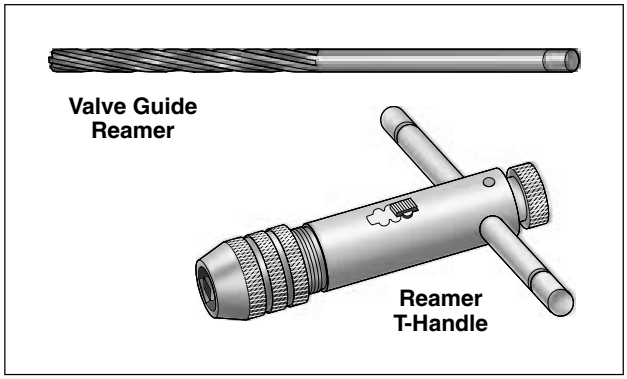


Figure 3-73. Valve Guide Reamer (Part No. HD-39932) and Reamer T-Handle (Part No. HD-39847)

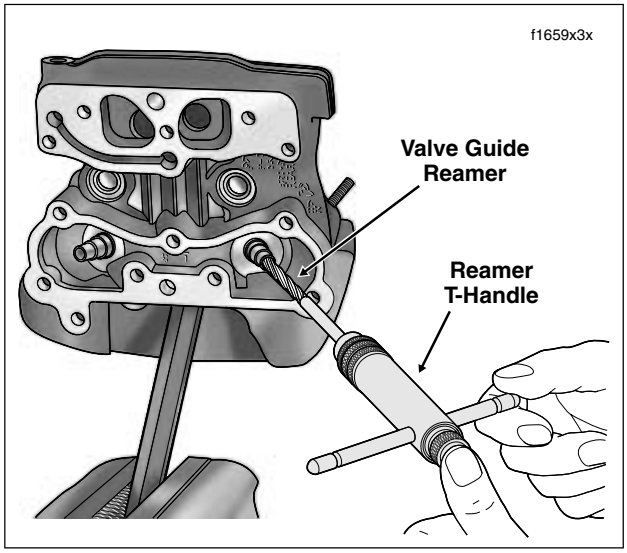


Figure 3-74. Ream Valve Guide Bore

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 - 0.0025 mm) of finished size.

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 3-74. 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 3-76. 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 3-78.

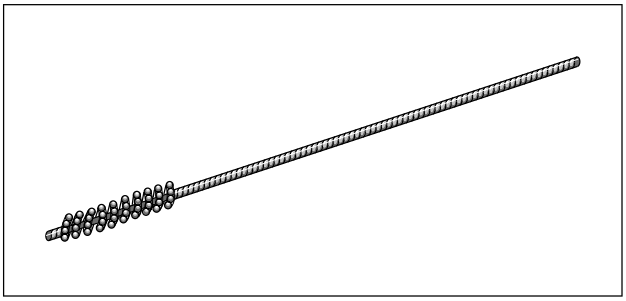


Figure 3-75. Valve Guide Hone (Part No. HD-34723)

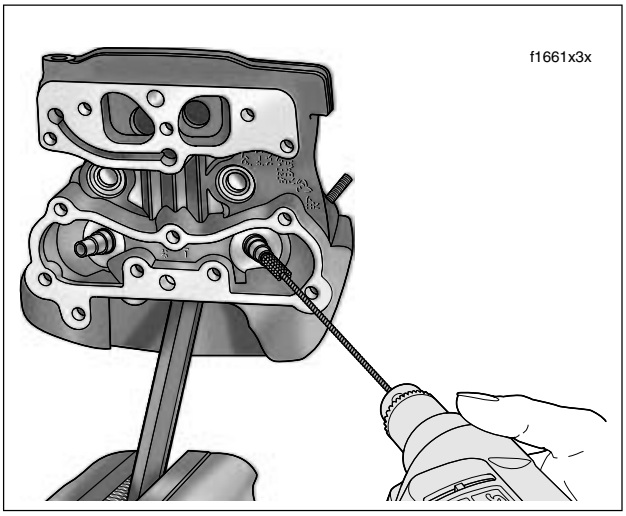


Figure 3-76. Hone Valve Guide Bore

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.

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.

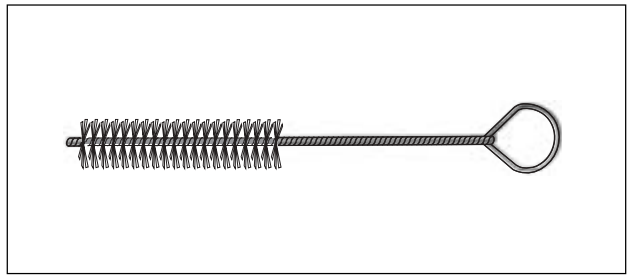


Figure 3-77. Valve Guide Brush (Part No. HD-34751)

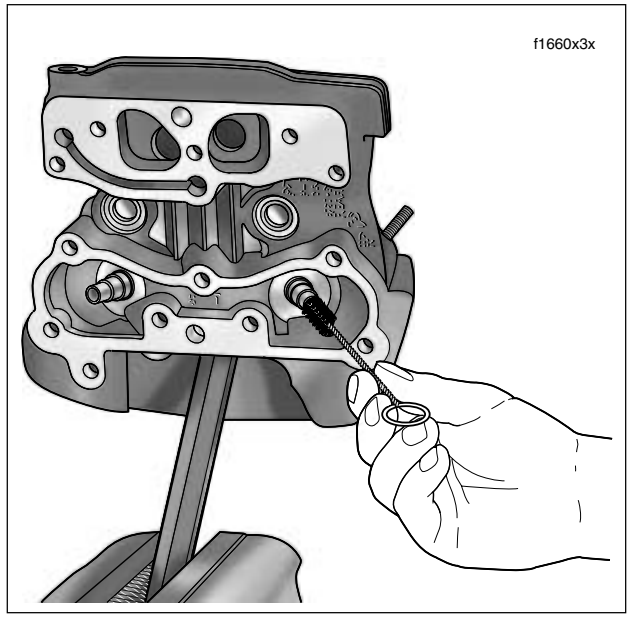


Figure 3-78. Scrub Valve Guide Bore

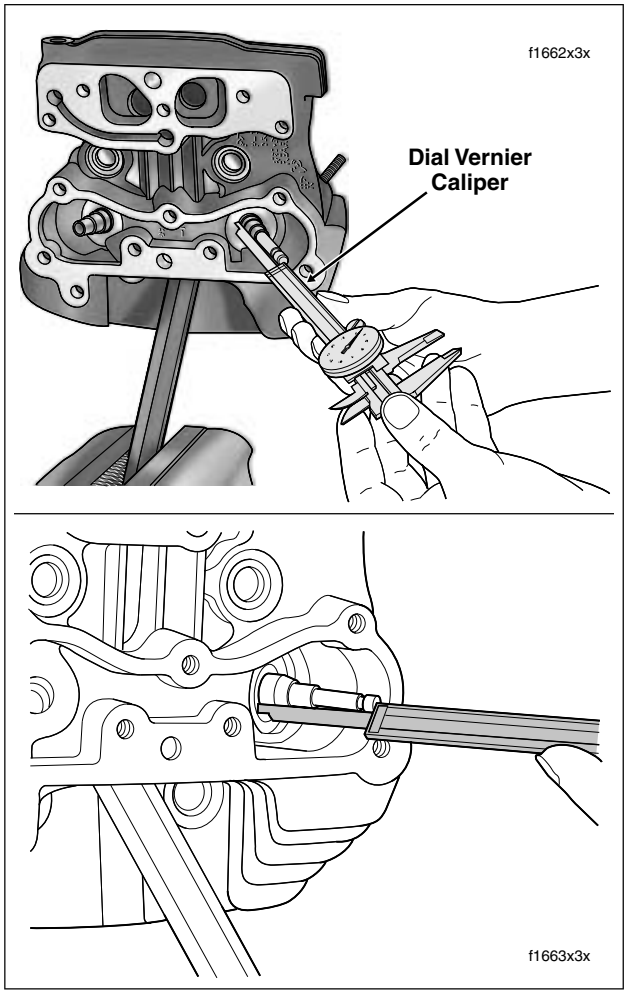


Figure 3-79. Measure Valve Stem Protrusion

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.

   Obtain a **new** valve if grinding leaves the margin less than 0.0313 inch (0.795 mm). 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°.

NOTE

Do not remove any more metal than is necessary to clean up the seat (that is, to provide a uniform finish and remove pitting).

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 3-79.

   Seat wear and valve refacing causes the valve stem protrusion to change. If valve stem protrusion exceeds 2.034 inches (51.66 mm), but is less than 2.064 inches (52.43 mm), obtain the short service replacement valve. Service replacement valves are 0.030 inch (0.76 mm) shorter than the standard valve.

   If protrusion exceeds 2.064 inches (52.43 mm), 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. Apply magic marker or similar product to valve seat and allow to thoroughly dry.

8. Insert the valve stem into the valve guide. Push on bottom of valve until it contacts the valve seat.

9. Obtain the VALVE LAPPING TOOL (HD-96550-36A) and proceed as follows:

   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 3-81.

10. Remove the valve from the cylinder head and carefully inspect the mating surfaces under a good light.

    Inspection of the valve seat should show an unbroken contact area of uniform width. If the seat is not concentric with the valve guide, then the cutter 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 cutter blade or cutter pilot have not have been properly cleaned.

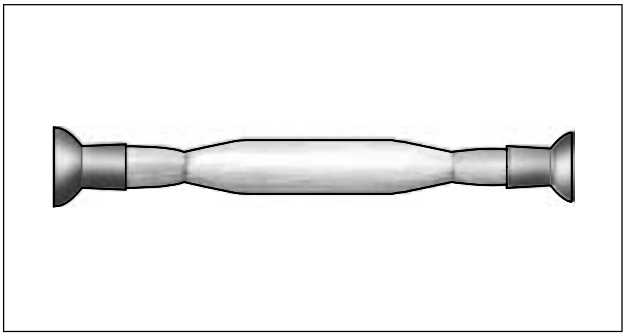


Figure 3-80. Valve Lapping Tool (Part No. HD-96550-36A)

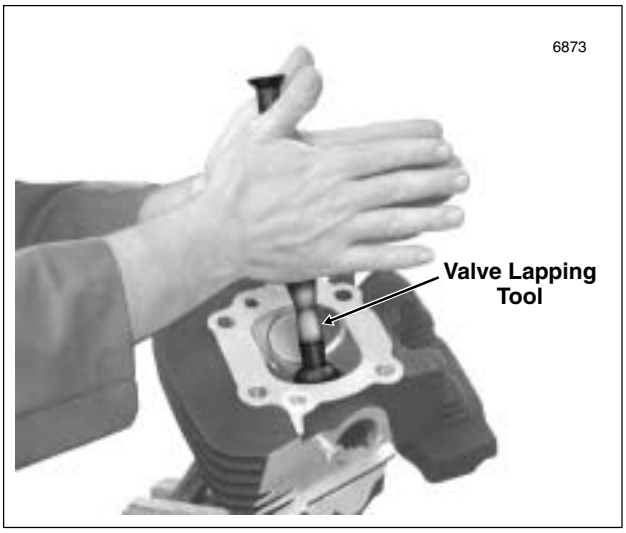


Figure 3-81. Oscillate Tool to Create Contact Area

NOTE

If the results are not acceptable, then recut the valve seat or replace the valve guide.

11. Inspect the contact pattern on the valve seat to be sure area is 0.040-0.062 inch (1.02-1.57 mm) wide and contacts the valve two-thirds of the way towards the outer edge of the valve face. See Figure 3-82. If necessary, modify the seat pattern as follows:
    a. Use the 31° angle cutter to lower the valve seat surface and reduce its width.
    b. Use the 60° angle cutter to raise the valve seat surface and reduce its width.
    c. Use the 46° angle cutter to widen the valve seat surface.
12. Using a magic marker, mark three equally spaced vertical lines across the valve face and then insert the valve back into the cylinder head.
13. 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.

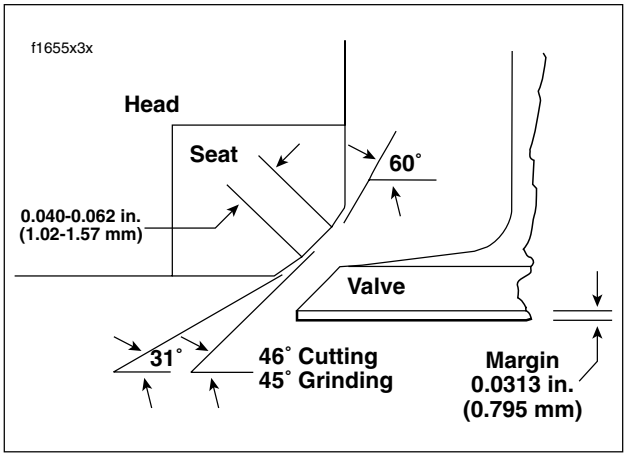


Figure 3-82. Valve Seat Angles

14. Remove the valve and perform a final inspection of the contact pattern. If necessary, return to step 11.
15. 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.
16. Release the cylinder head holding fixture from the vise and then remove the tool from the spark plug hole.
17. 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.
18. Clean valves, cylinder head and valve seats in solvent. Follow up with a thorough wash in hot soapy water. Blow dry with compressed air.

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.

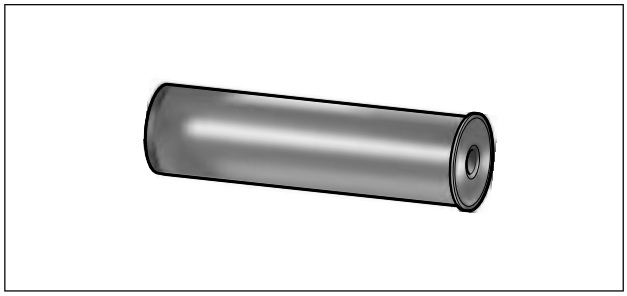


Figure 3-83. Valve Stem Seal Installer (Part No. HD-34643A)

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 isopropyl alcohol or other suitable degreaser, thoroughly clean external surface of valve guide until completely free of grease and oil.

CAUTION

Do not apply Loctite 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.

10. Obtain tube of Loctite RC/620 (green) High Temperature Retaining Compound. Carefully apply Loctite 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.

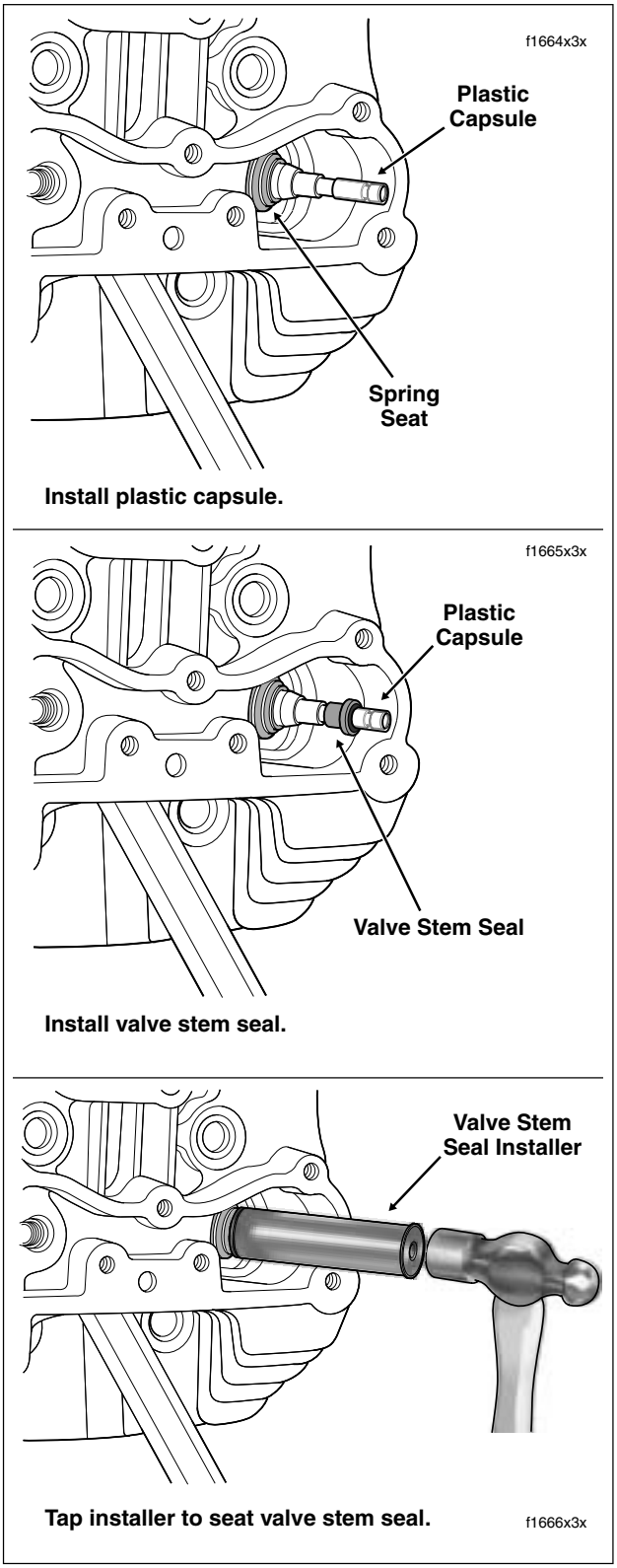


Figure 3-84. Install Valve Stem Seal

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 3-84.
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 3-84. 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 3-84. 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 3-85.

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.

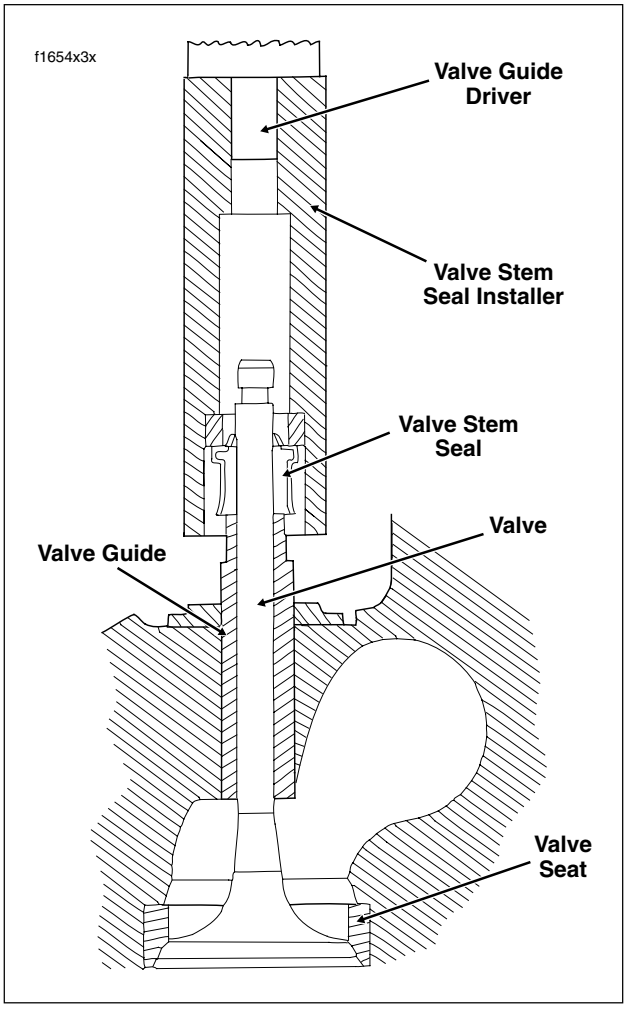


Figure 3-85. Using Arbor Press to Install Valve Stem Seal

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 3.9 TOP END OVERHAUL, ASSEMBLY, steps 14-24 and 29-39.

CYLINDER

Removal

1. See Section 3.9 TOP END OVERHAUL, DISASSEMBLY, steps 1-11 and 15-24.

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 the CYLINDER TORQUE PLATES (HD-42324A), check the machined surfaces for flatness. Proceed as follows:
   a. Lay gasket side of the upper plate (without vise grip) flat against the head gasket surface.
   b. As a preliminary check, see if the plate rocks from side to side. A cylinder on which the plate rocks is immediately suspect.
   c. Insert a feeler gauge between the plate and cylinder at various locations.
   d. The head gasket surface must be flat within 0.006 inch (0.15 mm).
   e. Now turn the cylinder upside down and lay the seal side of the lower plate (with vise grip) flat against the O-ring seal surface. Repeat steps 6(b) and 6(c).
   f. The O-ring seal surface must be flat within 0.008 inch (0.20 mm).
   g. 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.

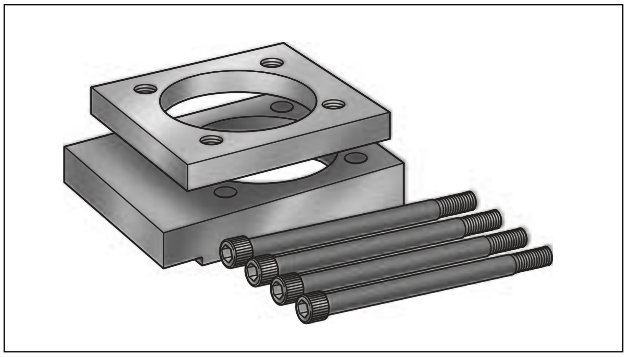


Figure 3-86. Cylinder Torque Plates (Part No. HD-42324A)

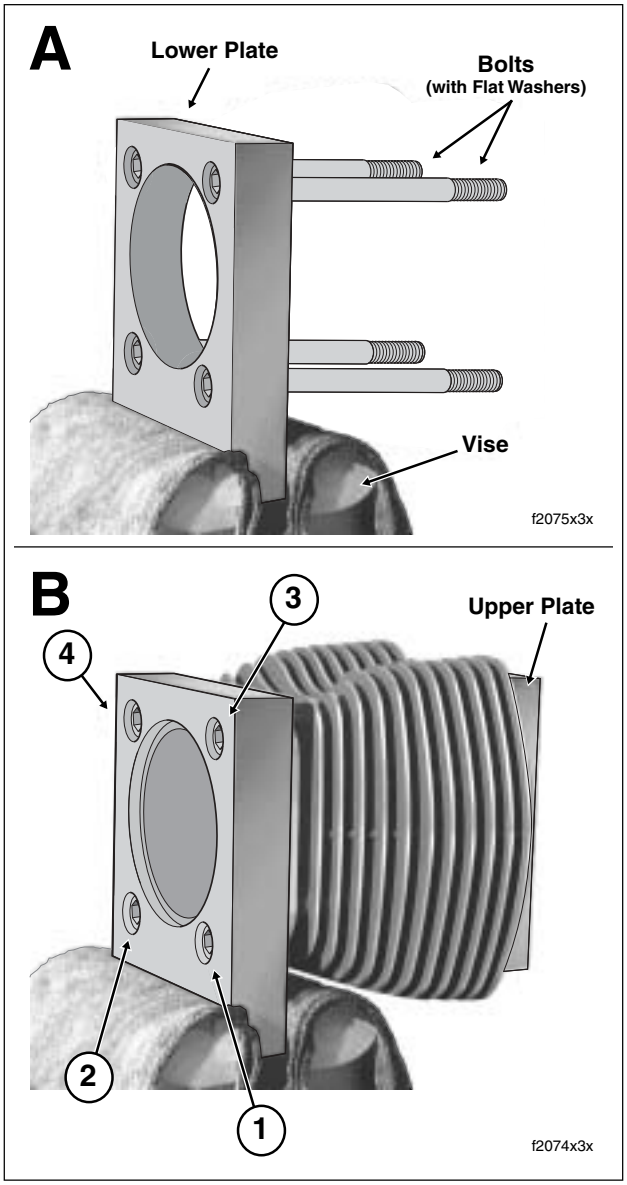


Figure 3-87. Install Cylinder to Torque Plates

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-42324A). Install the torque plates as follows:

   a. Remove O-ring seal from cylinder sleeve, if installed.

   b. Place used head gasket over two ring dowels at top of cylinder.

   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.

   d. Slide four bolts (with flat washers) all the way through holes of lower plate until washers contact outboard side. See A of Figure 3-87.

   e. Slide cylinder down bolts with the indent in the cooling fins facing upward.

   f. With the 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 84-108 **in-lbs** (9.5-12.2 Nm) in the sequence shown in B of Figure 3-87.

   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. 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 3-87.

NOTE

For best results, obtain Snap-on® Torque Angle Gauge TA360.

   j. For purposes of inspection, remove the assembly from the vise and place on bench top.

2. See Figure 3-88. 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.

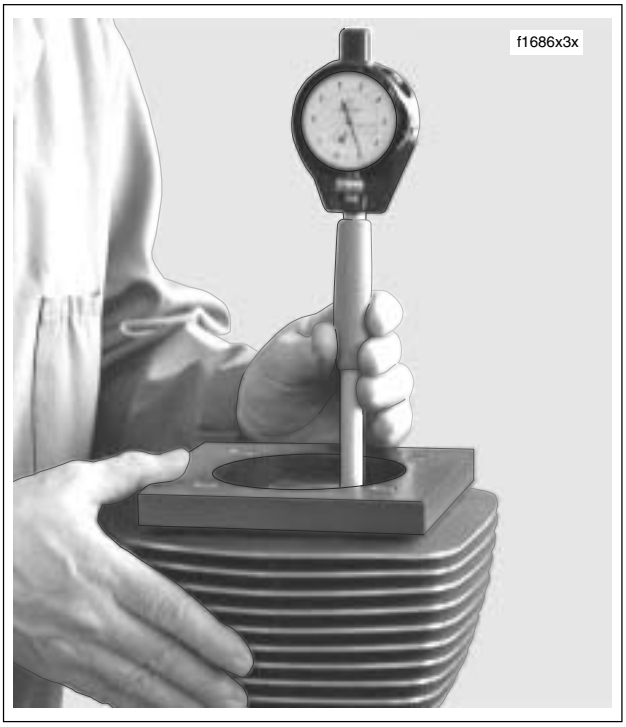


Figure 3-88. Measure for Out-of-Round and Taper

   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 the next page.

   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	3.7500 - 3.7505 in. (95.250 - 95.263 mm)
0.005 In. (0.13 mm) **Oversize**	3.7550 - 3.7555 in. (95.377 - 95.390 mm)
0.010 In. (0.25 mm) **Oversize**	3.7600 - 3.7605 in. (95.504 - 95.517 mm)
Example: A 0.005 in. (0.13 mm) oversize piston will have the proper running clearance with a cylinder bore size of 3.7550 - 3.7555 in. (95.377 - 95.390 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 3.9 TOP END OVERHAUL, ASSEMBLY, steps 8-24 and 29-39.

PISTON

Removal

1. See Section 3.9 TOP END OVERHAUL, DISASSEMBLY, steps 1-11 and 15-29.

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 0.0008 in. (0.020 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 3-89.



Figure 3-89. Measure Piston Ring Side Clearance



Figure 3-90. Measure Early Style 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 running clearance on fully coated early style pistons 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 pin bore). Start below the bottom ring land and move micrometer towards bottom of skirt. Micrometer will be loose, then tight (about 1/2 inch from bottom), and then loose again. See lower frame of Figure 3-90.

b. Measure the piston skirt at the tightest spot and then transfer that measurement to the dial bore gauge.

NOTE

On late style pistons, the measurement is taken on the bare aluminum to avoid measuring errors. An oval-shaped opening is present on each side of the piston for proper placement of the micrometer. See upper frame of Figure 3-91. Since the oval openings are too small for a standard flat anvil micrometer, which would result in measuring errors, use a 3-4 inch blade or ball anvil style micrometer, or a 4-5 inch micrometer with spherical ball anvil adapters. See lower frame of Figure 3-91.

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 0.0002 inch (0.005 mm), both piston and cylinder must be at room temperatures.

d. Replace piston and/or cylinder if running clearance exceeds 0.003 in. (0.076 mm).

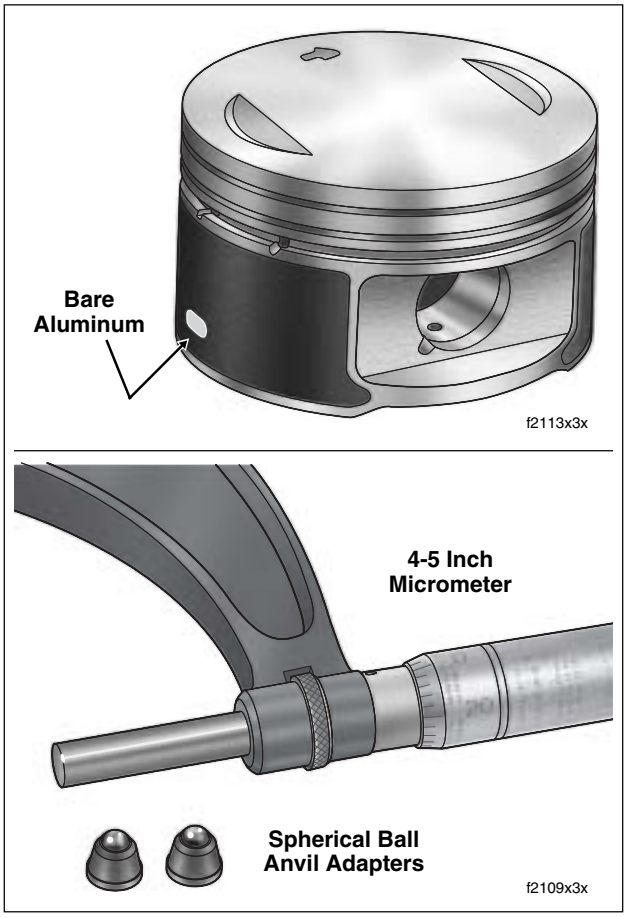


Figure 3-91. Measure Late Style Piston for Running Clearance



Figure 3-92. Measure Ring End Gap

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.

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.

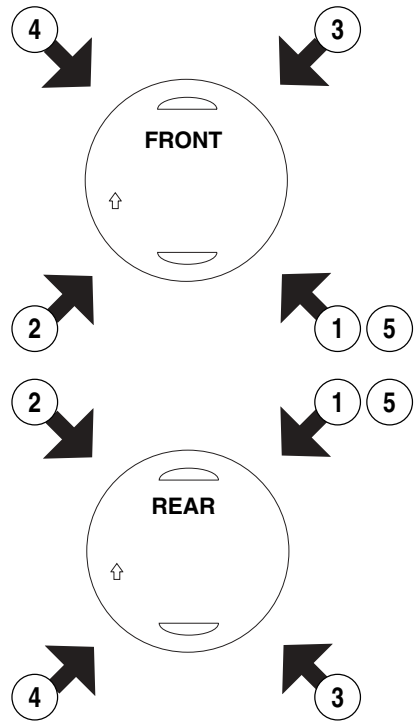
CAUTION

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 3-92. 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)



1. **Expander spring**
2. **Bottom oil rail**
3. **Top oil rail**
4. **Second compression ring**
5. **Top compression ring**

Figure 3-93. Piston Ring Gap Alignment

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. Using the proper piston ring expander (Snap-On PRS8), carefully install the second compression ring making sure that the dot (punch mark) near the ring gap faces the piston crown. Rotate the ring so the gap is 90 degrees from the gap in the top oil rail.

d. Carefully install the top compression ring using the proper piston ring expander (Snap-On PRS8). Rotate the ring so the gap is 180 degrees from the gap in the second compression ring.

e. Rotate the three piston rings using the palms of both hands. The rings must rotate freely without sticking.

f. Verify that the ring gaps are still properly staggered. See Figure 3-93.

Installation

1. See Section 3.9 TOP END OVERHAUL, ASSEMBLY, steps 1-23 and 28-37.

NOTES

UPPER CONNECTING ROD

Removal

1. See Section 3.9 TOP END OVERHAUL, DISASSEMBLY, steps 1-11 and 15-29.

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 3-95. 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.

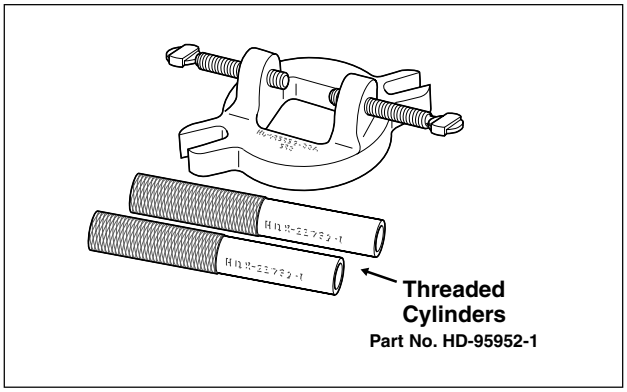


Figure 3-94. Connecting Rod Clamping Tool (Part No. HD-95952-33B)

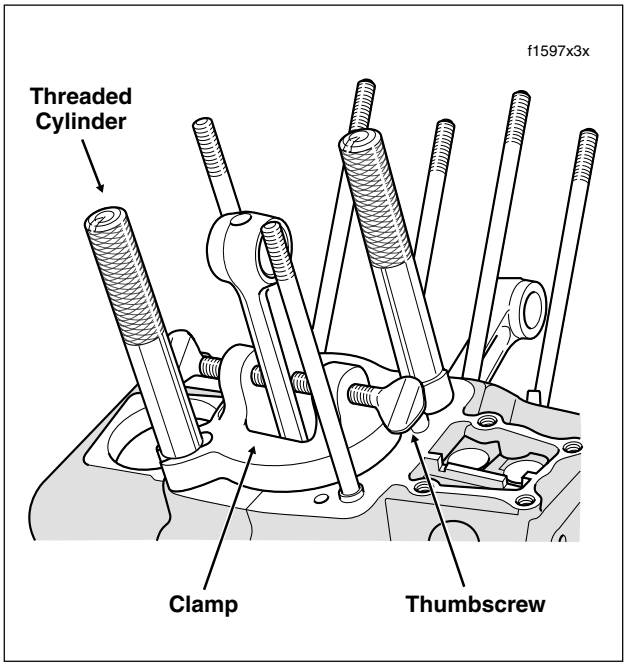


Figure 3-95. Install Connecting Rod Clamping Tool

   f. Thread the hex cylinder onto rod until assembly is snug. See upper frame of Figure 3-97.
   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:

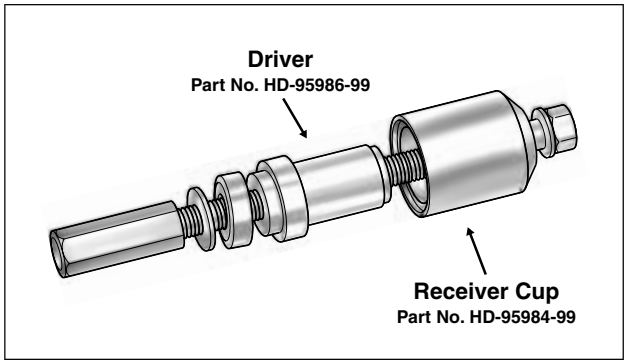


Figure 3-96. Connecting Rod Bushing Remover/Installer (Part No. HD-95970-32D)

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 3-97.

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 3-97.

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 3-99.

   c. Placing thumb on drive socket, apply slight pressure on reamer while rotating handle/drive socket in a clockwise direction.

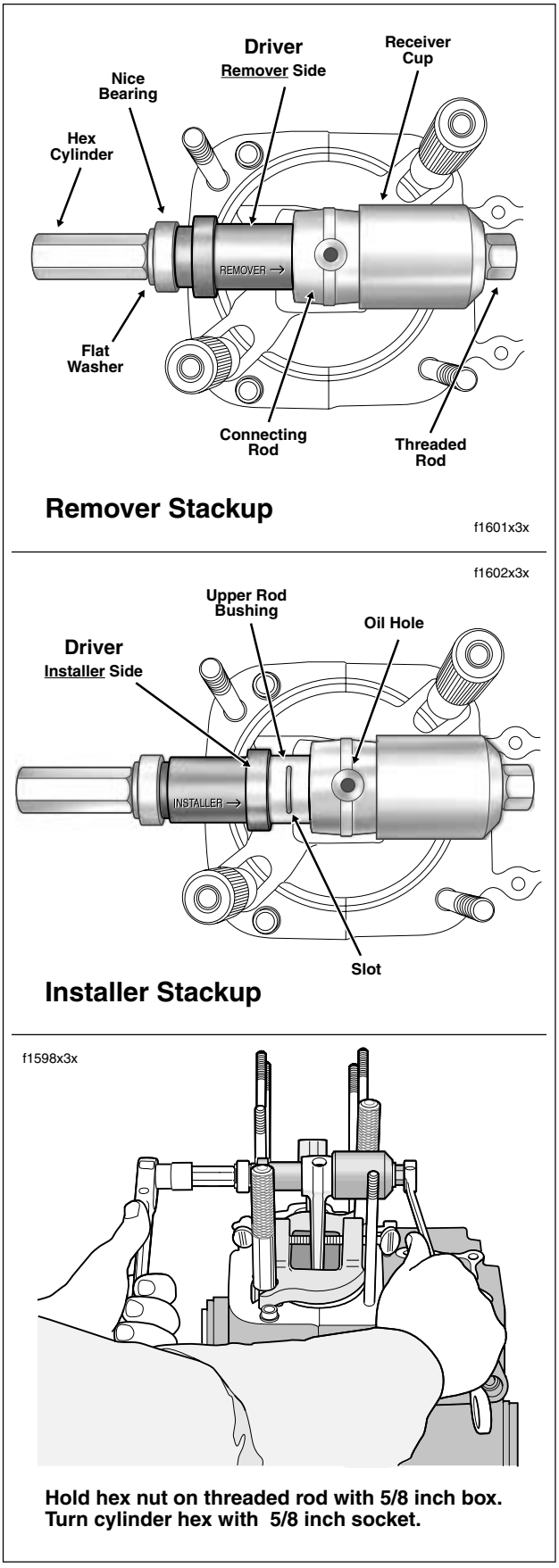


Figure 3-97. Remove/Install Connecting Rod Bushing

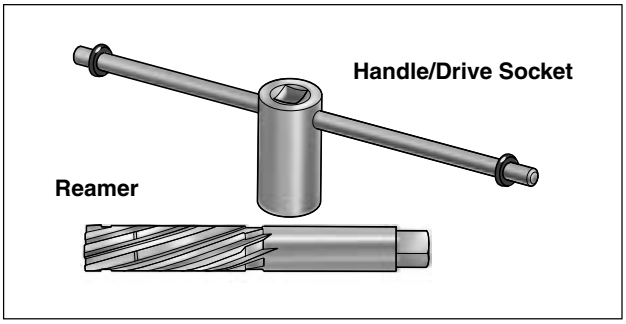


Figure 3-98. Connecting Rod Bushing Reamer (Part No. HD-42318) and Handle/Drive Socket (Part No. HD-43645)

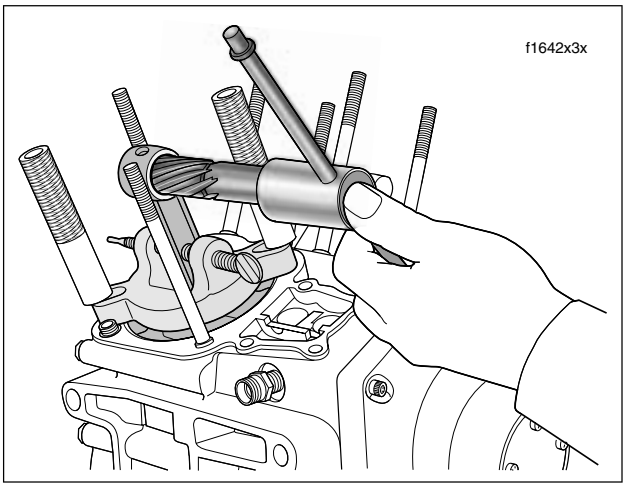


Figure 3-99. Ream Connecting Rod Bushing

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 3-101. Work for a crosshatch pattern of approximately 60˚.

CAUTION

Abrasive particles can damage machined surfaces and plug oil passageways possibly resulting in engine failure.

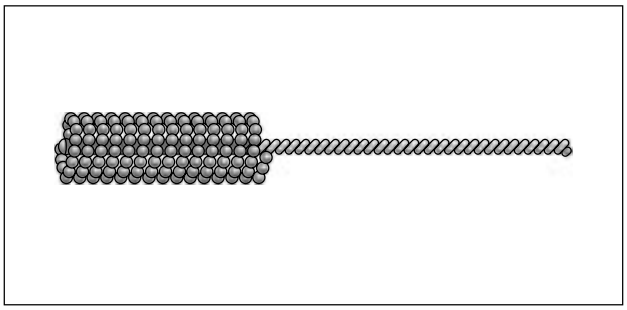


Figure 3-100. Connecting Rod Bushing Hone (Part No. HD-42569)

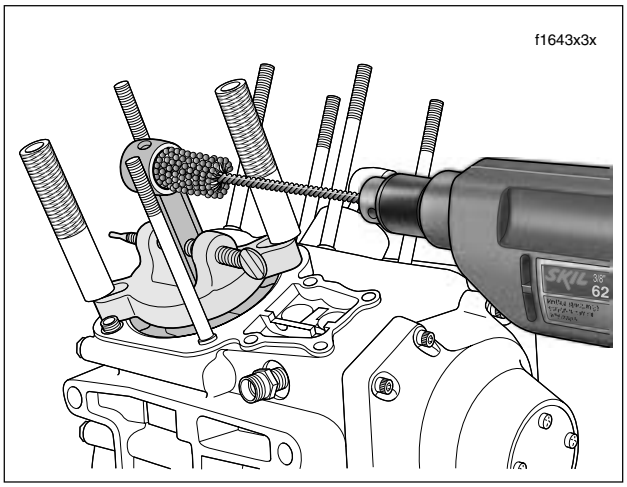


Figure 3-101. Hone Connecting Rod Bushing

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 3.9 TOP END OVERHAUL, ASSEMBLY, steps 1-24 and 29-39.

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 Piston
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

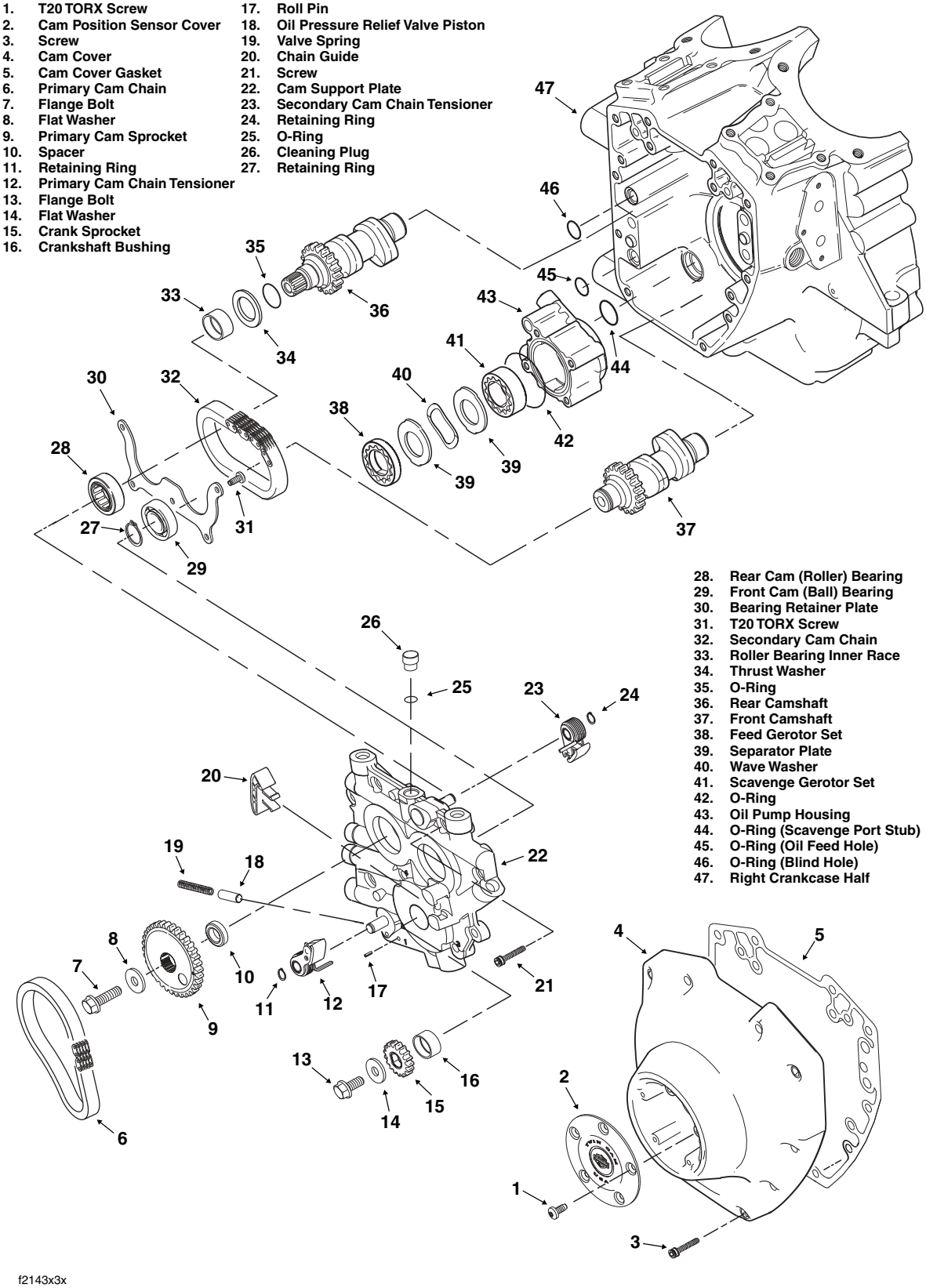


Figure 3-102. Cam Support Plate/Oil Pump Assemblies (Exploded View)

BOTTOM END

CAM SUPPORT PLATE

Removal

1. See Section 3.9 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 3-103.
   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 3-103.
3. See Section 3.10 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 3-105.
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.

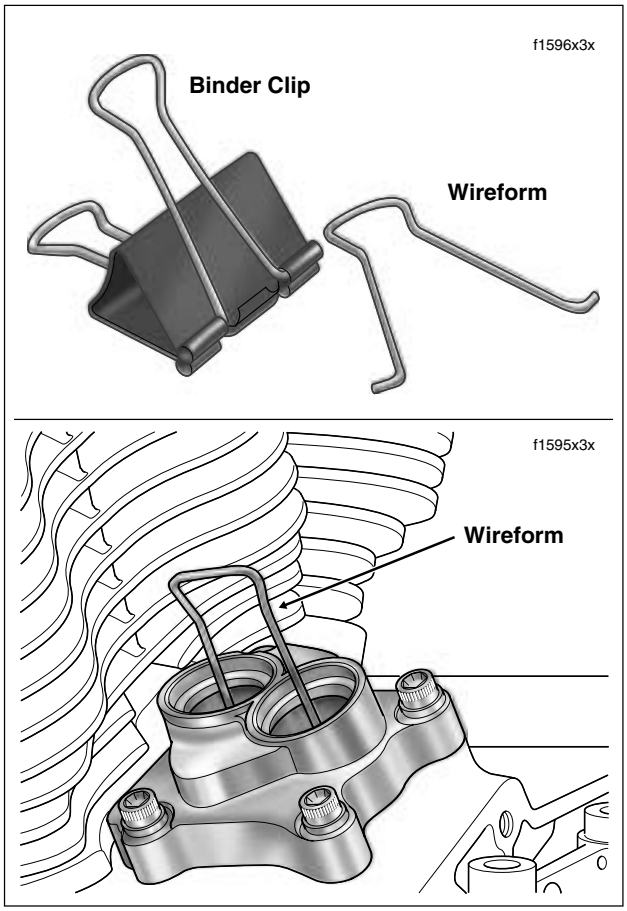


Figure 3-103. Fashion Tool to Hold Hydraulic Lifters

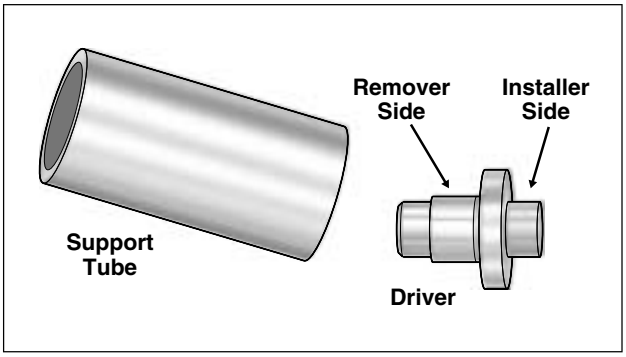


Figure 3-104. Crankshaft Bushing Remover/Installer (Part No. HD-42315)

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 3-105.
7. Press on driver until collar of tool makes firm contact with cam support plate.
8. Ream the crankshaft bushing following the directions below.

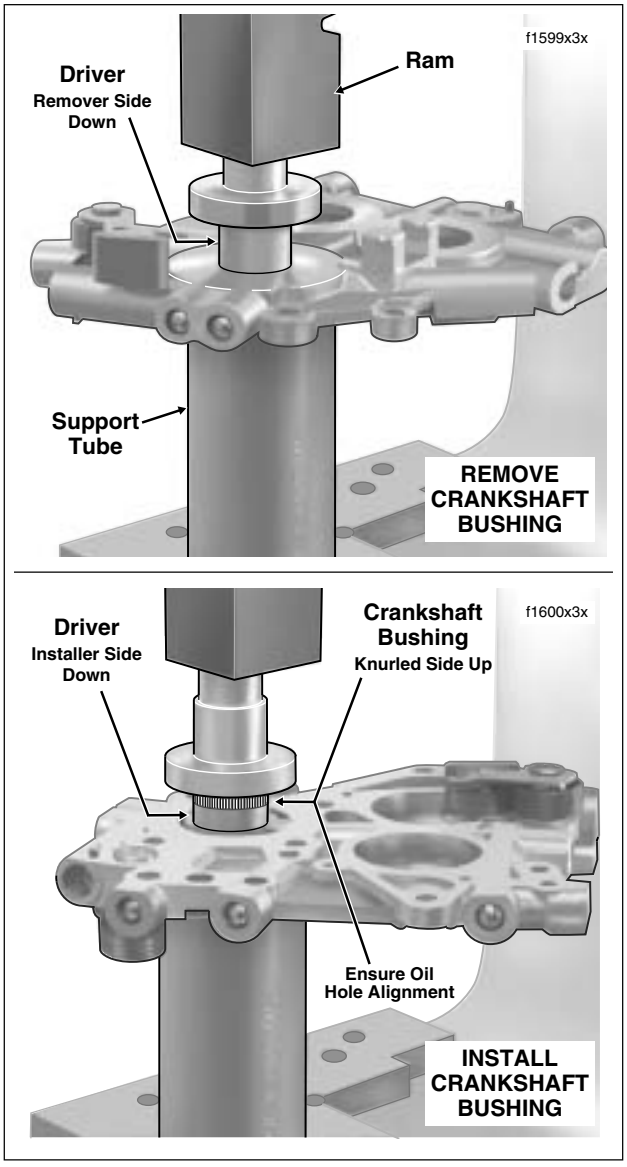


Figure 3-105. Remove/Install Crankshaft Bushing in Cam Support Plate

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:
   a. From flywheel compartment side, carefully insert tapered end of reamer pilot into crankshaft bearing until it stops. See left frame of Figure 3-107.
   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 3-107.
   d. Placing thumb on drive socket, apply slight pressure on reamer while rotating handle/drive socket in a clockwise direction.

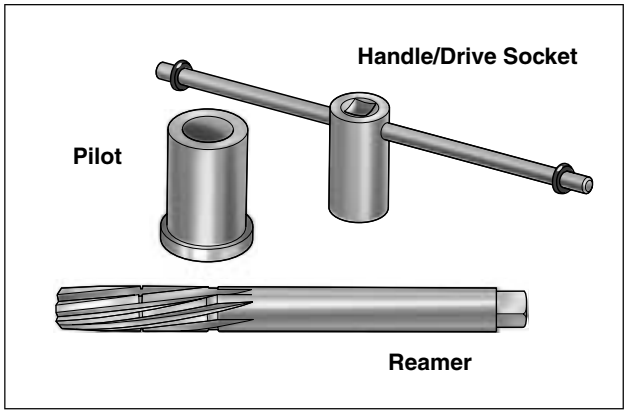


Figure 3-106. Crankshaft Bushing Reamer (Part No. HD-42316) and Handle/Drive Socket (Part No. HD-43645)

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 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.

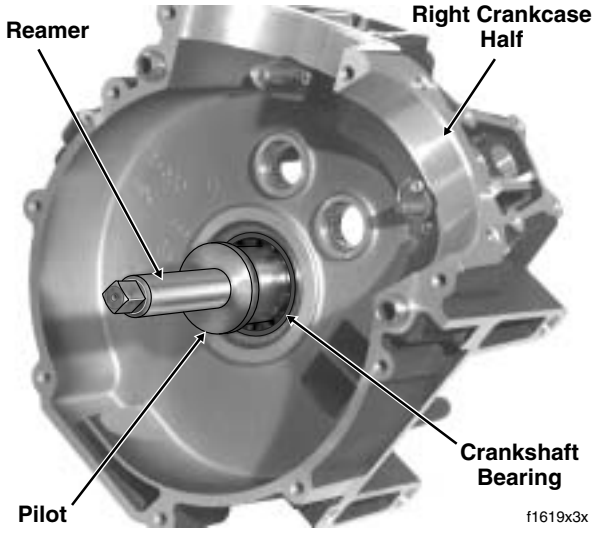
5. Using a small screwdriver, carefully pry cleaning plug from top of cam support plate. Thoroughly flush right crankcase half and cam support plate in cleaning solvent to remove any metal shavings or debris. Blow dry with compressed air. Install cleaning plug in cam support plate replacing O-ring if 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 3-108. 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.

Install pilot and reamer from flywheel side of case.



Install handle/drive socket on reamer.

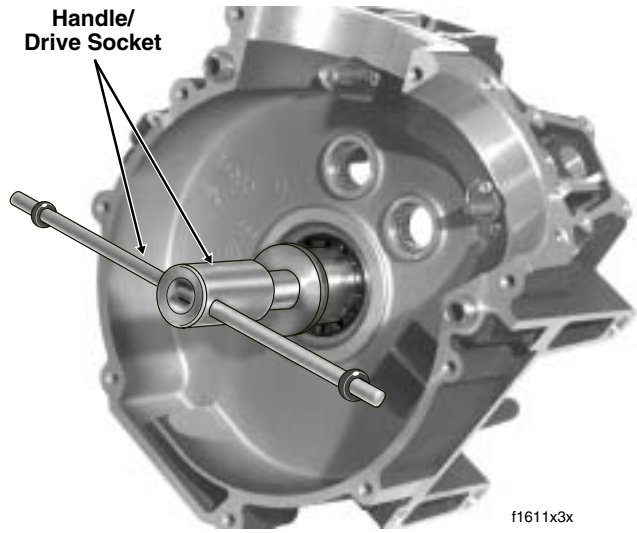


Figure 3-107. Ream Crankshaft Bushing

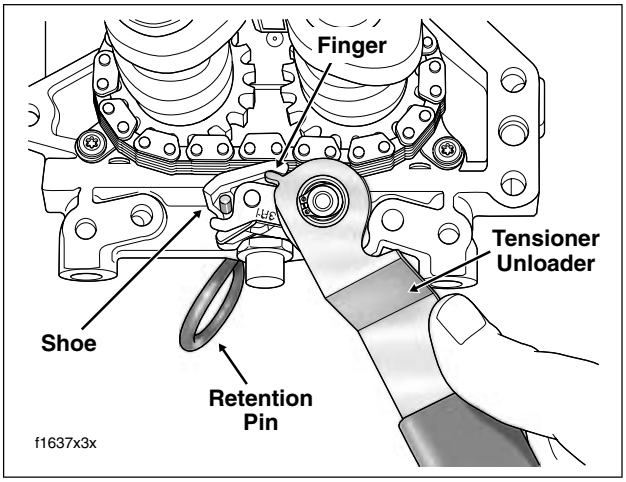


Figure 3-108. Retract Secondary Cam Chain Tensioner

⚠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 3-109.

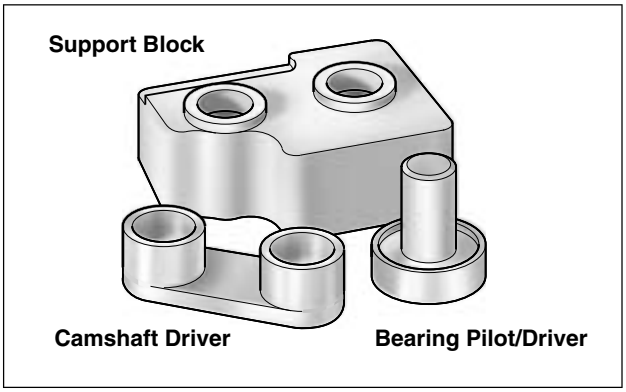
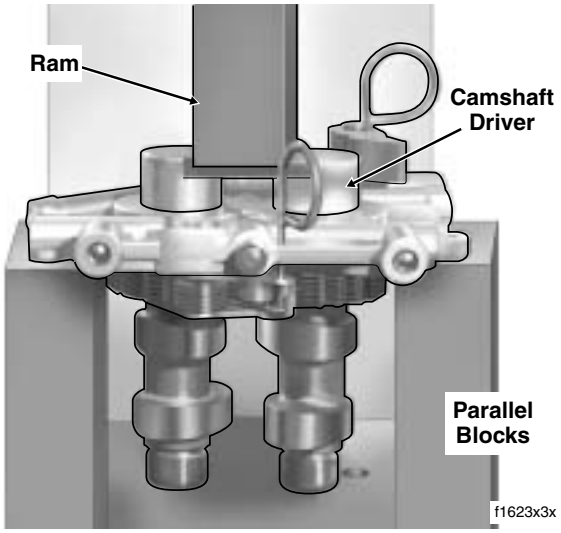


Figure 3-109. Camshaft/Camshaft Bearing Remover/Installer (Part No. HD-43644)

Press out camshafts (with bearings).



Remove bearing from front camshaft.

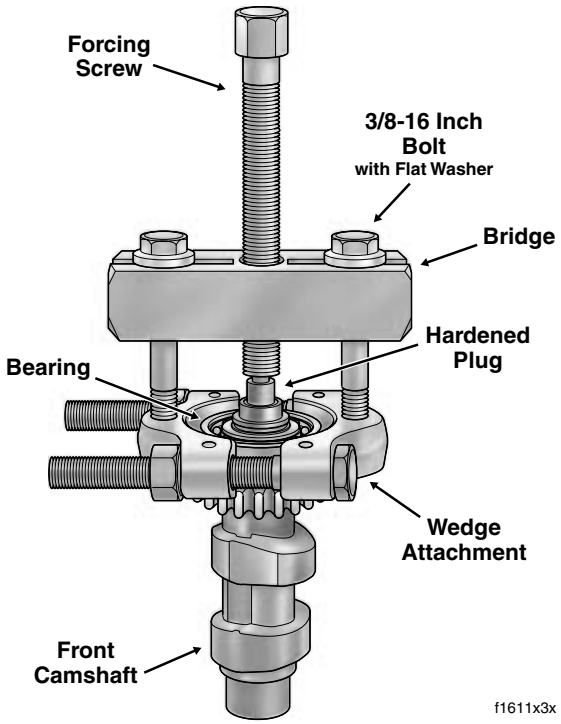


Figure 3-110. Remove Camshafts/Front Cam Bearing

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.

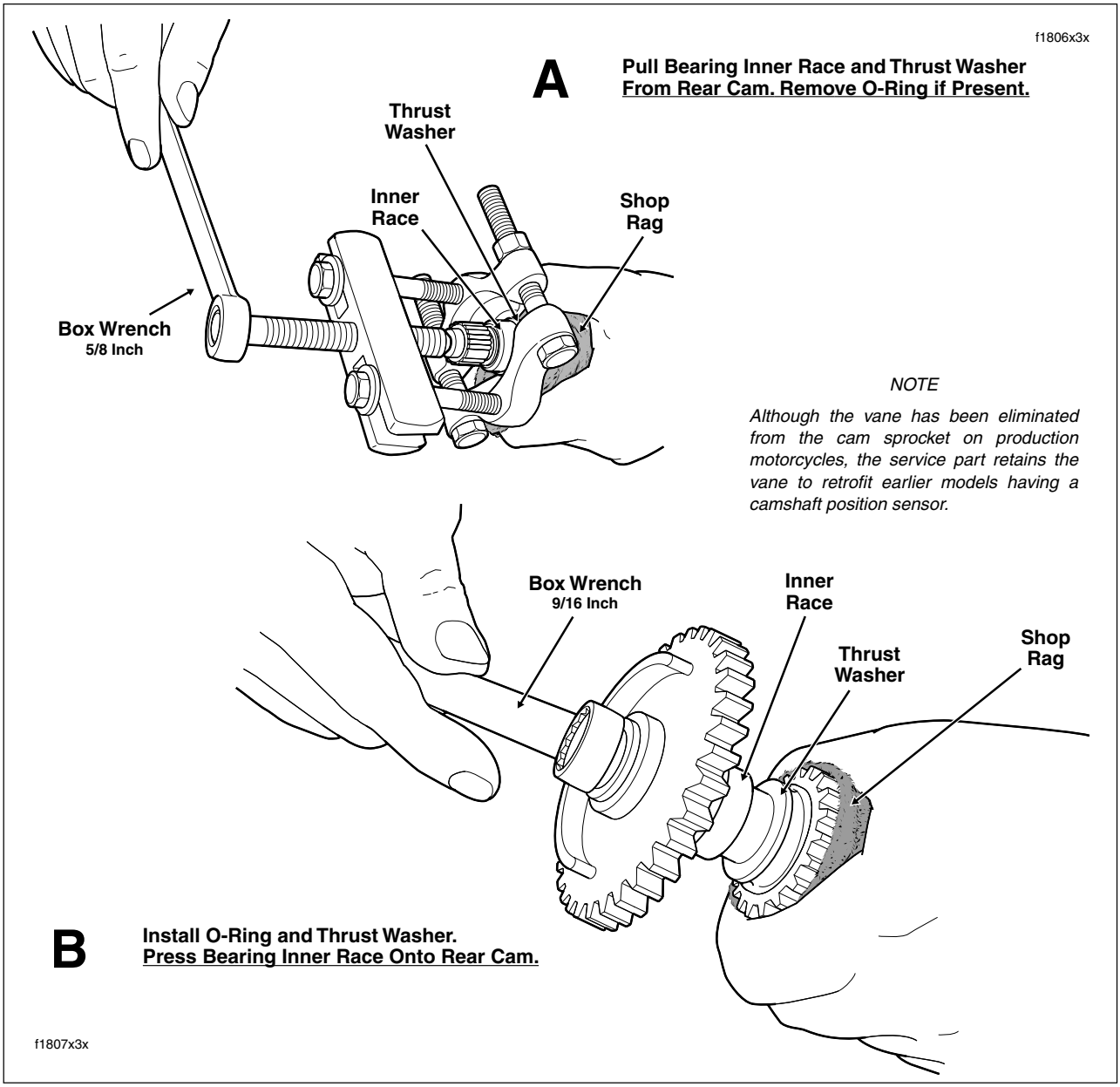


Figure 3-111. Remove/Install Bearing Inner Race (With O-Ring and Thrust Washer) Onto Rear Camshaft

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 3-110.
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 3-110. 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 3-111. 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 3-112.

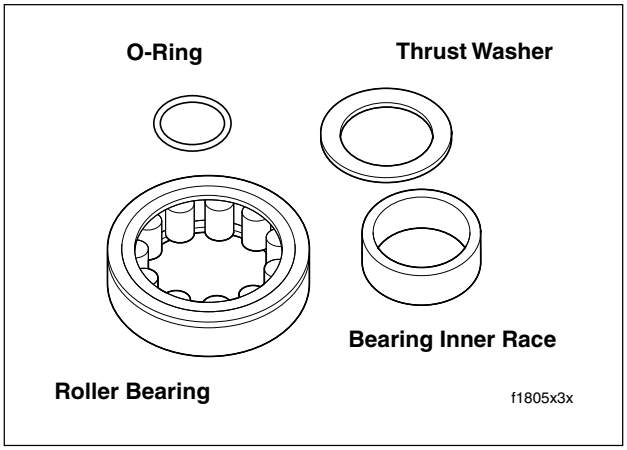


Figure 3-112. Rear Cam Roller Bearing Kit (P/N 8983)

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 3-111.

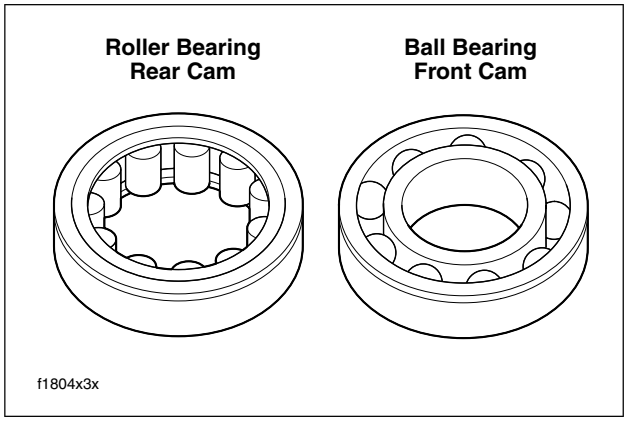


Figure 3-113. Cam Bearings

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 not interchangeable. The rear bearing is the roller type, while the front is the ball bearing kind. See Figure 3-113.

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 3-115. 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 243 (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 pin stamped timing lines on teeth of secondary cam sprockets (outboard faces). See Figure 3-114. Using a colored marker, carefully mark the timing line 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 outboard 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.

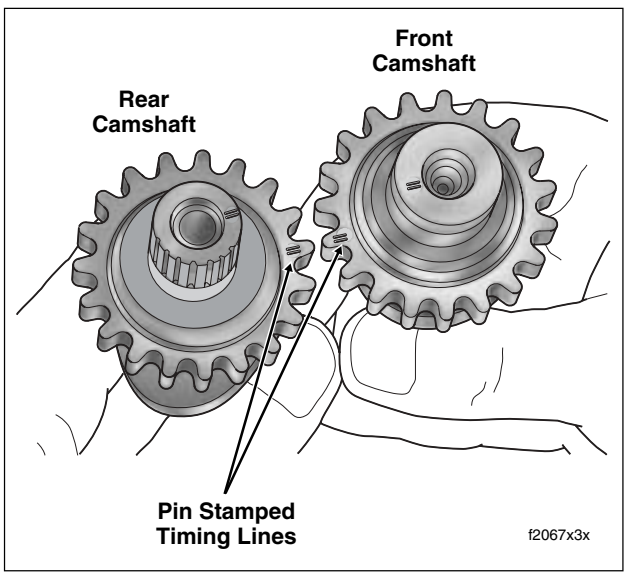


Figure 3-114. Align Timing Lines on Teeth of Camshaft Sprockets

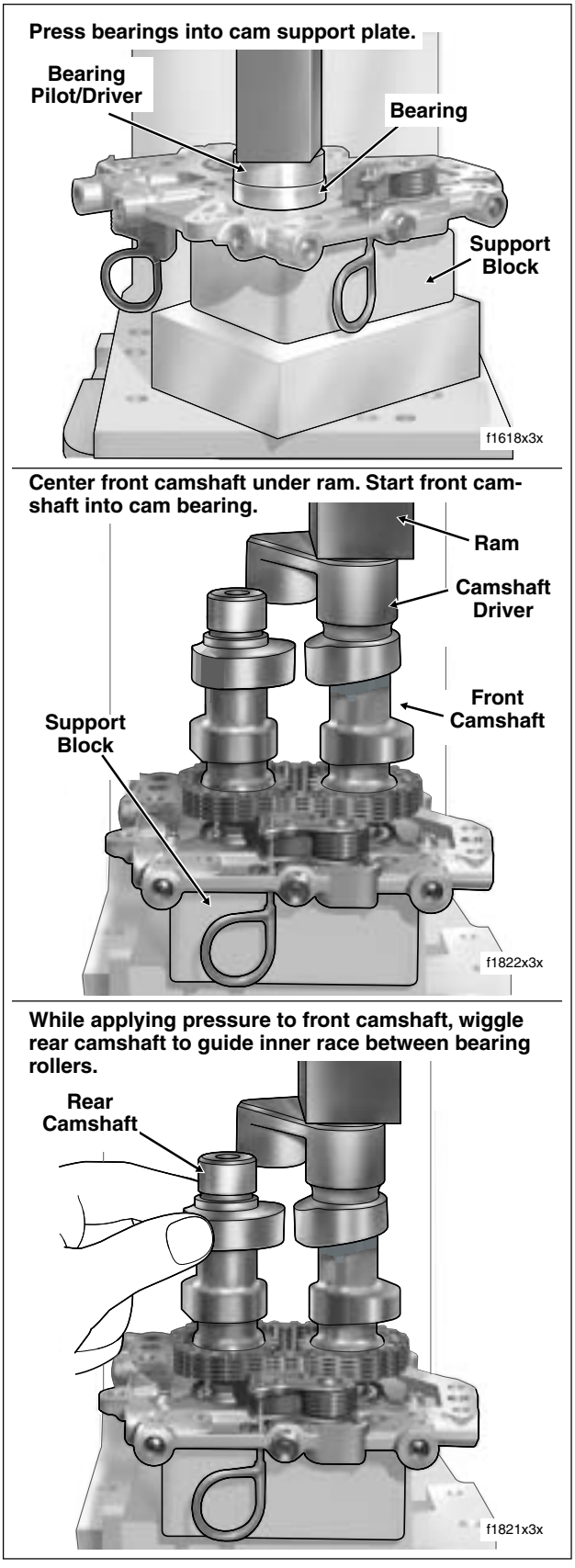


Figure 3-115. Install Cam Bearings/Camshafts

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 3-115.

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 3-115.

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 pin stamped timing lines 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 timing lines (although they may be somewhat difficult to see). Using a straightedge, verify that these timing lines are in alignment. See Figure 3-116. If they are not, then the camshafts must be removed and reinstalled (with a new bearing set).

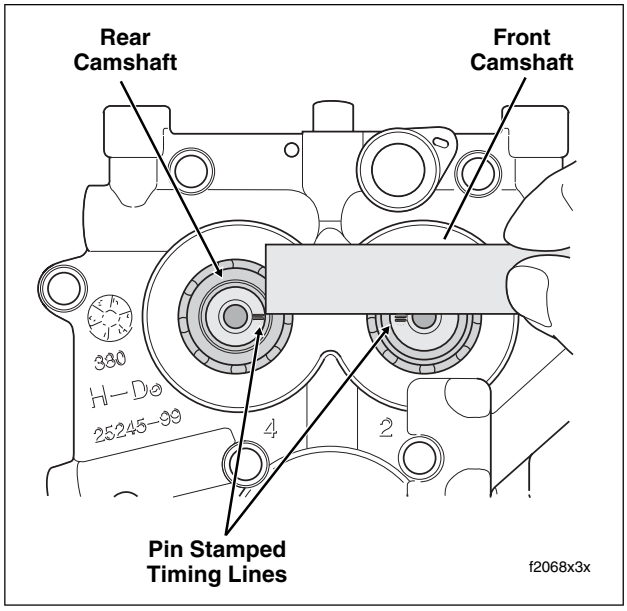


Figure 3-116. Verify Alignment of Timing Lines on Ends of Camshafts

⚠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. With the sharp edge out, 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.

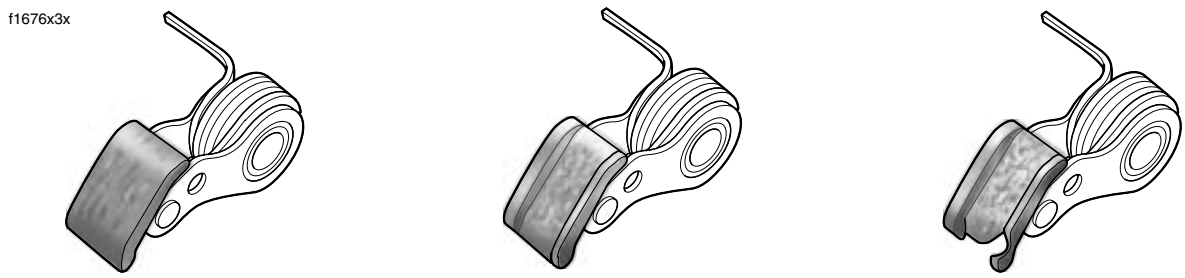
⚠WARNING

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.

Installation

1. Slide cam chain tensioner assembly onto post inserting spring pin into hole in cam support plate.



Acceptable Wear

Continue use of the tensioner shoe assembly if worn to a depth that is less than half the thickness of the shoe material.

Unacceptable Wear

Replace the tensioner shoe assembly if worn to a depth that is equal to or greater than half the thickness of the shoe material.

Unacceptable Wear

Replace the tensioner shoe assembly if there is any evidence of melting, burning or cracking.

Figure 3-117. Cam Chain Tensioner Shoe Wear

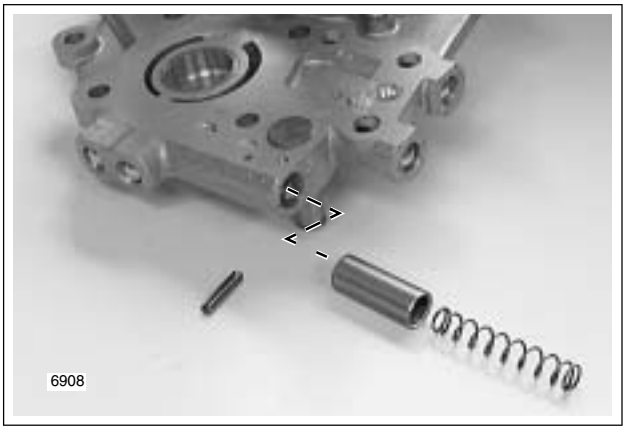


Figure 3-118. Oil Pressure Relief Valve Assembly

⚠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.

2. With the sharp edge out, 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. Before removal, see CLEANING AND INSPECTION in this section.
2. Remove primary cam chain tensioner assembly. See CAM CHAIN TENSIONERS, REMOVAL.
3. 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.
4. Using a 1/8 inch punch with a small hammer, carefully tap roll pin from pin hole in cam support plate. Discard roll pin.
5. Remove spring and piston from bypass port.

Installation

1. Secure the cam support plate in a vise. Install a pair of brass jaw inserts to avoid damage to the casting.
2. Lubricate piston with clean H-D 20W50 engine oil. Slide piston into bypass port with the open side facing outward.
3. Slide spring into bypass port until seated in open side of piston.
4. Start **new** roll pin into hole in cam support plate. Compress spring 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 primary cam chain tensioner assembly. See CAM CHAIN TENSIONERS, INSTALLATION, in this section.

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 3-119.
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.

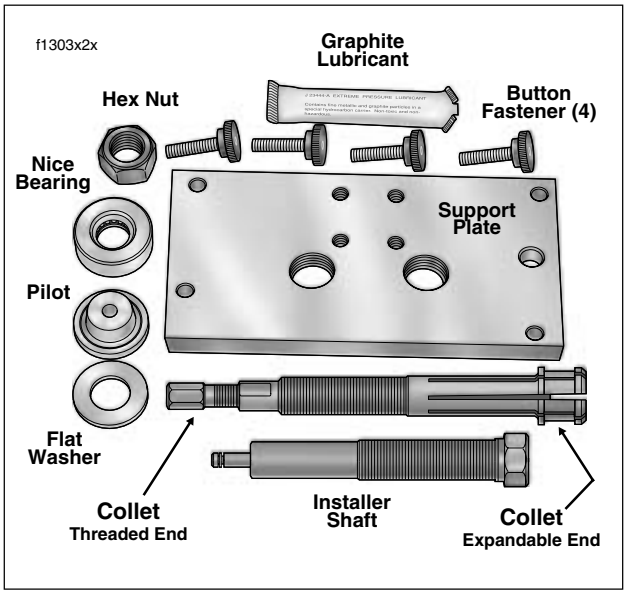


Figure 3-119. Camshaft Needle Bearing Remover/Installer (HD-42325)

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 3-120.
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 3-120. 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 3-120.
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.
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 3-121.
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 3-121.
9. Turn end of installer shaft in a counterclockwise direction until pilot is free of needle bearing bore.

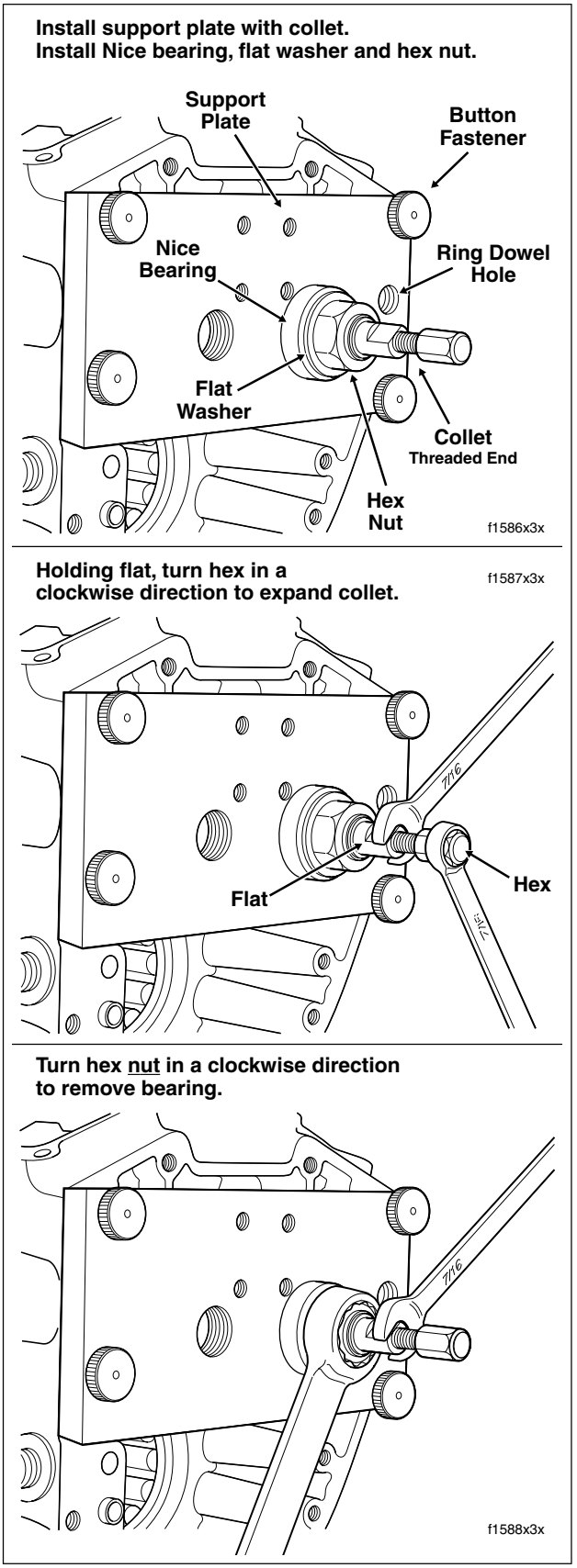
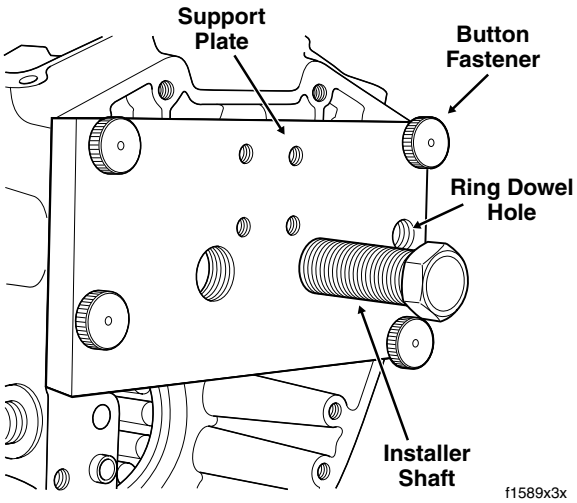


Figure 3-120. Remove Cam Needle Bearing

Install support plate with installer shaft (and pilot).



Turn hex on installer shaft in a clockwise direction to install bearing.

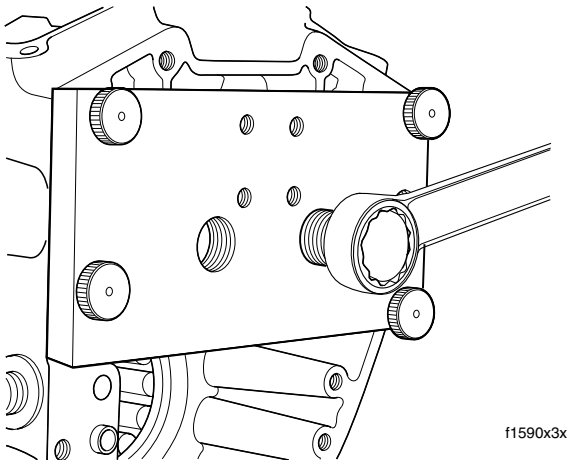


Figure 3-121. Install Cam Needle Bearing

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. Inspect oil pressure relief valve as follows:

NOTE

If diagnosing low oil pressure, start with step 1(a). If diagnosing high oil pressure, then begin with step 1(b).

a. Insert straight stiff wire into unplugged hole outboard of roll pin until it bottoms. Mark wire and measure distance from edge of cam support plate to inboard side of piston. With piston fully seated in the bore, depth should be approximately 2.25 inches (57.15 mm). If it is not, continue with step 1(b).

b. Remove oil pressure relief valve. See OIL PRESSURE RELIEF VALVE, REMOVAL, in this section.

c. Inspect spring for stretching, kinking or distortion.

d. Inspect piston and bore for burrs, scoring or other damage. Look for steel particles or aluminum chips. Replace cam support plate and piston if any of these conditions are found.

e. Install piston in bore and measure running clearance. If running clearance exceeds 0.003 inch (0.076 mm), install new piston and remeasure. Replace cam support plate if running clearance still exceeds specification.

2. Clean cam support plate as follows:

a. Using a small screwdriver, carefully pry cleaning plug from cam support plate. See Figure 3-122.

b. Thoroughly flush cam support plate with a non-volatile cleaning solution or solvent and then blow dry with low pressure compressed air.

c. Reinstall cleaning plug replacing O-ring if damaged or deteriorated.

d. 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 3.10 BOTTOM END OVERHAUL, ASSEMBLY, steps 12-29.
2. Remove wireforms to release hydraulic lifters.
3. See Section 3.9 TOP END OVERHAUL, ASSEMBLY, steps 29-39.



Figure 3-122. Remove Cleaning Plug

OIL PUMP

Removal

1. See Section 3.9 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 3-103.
   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 3-103.
3. See Section 3.10 BOTTOM END OVERHAUL, DISASSEMBLY, steps 1-15.

Cleaning and Inspection

1. Clean all parts in a non-volatile cleaning solution or solvent.

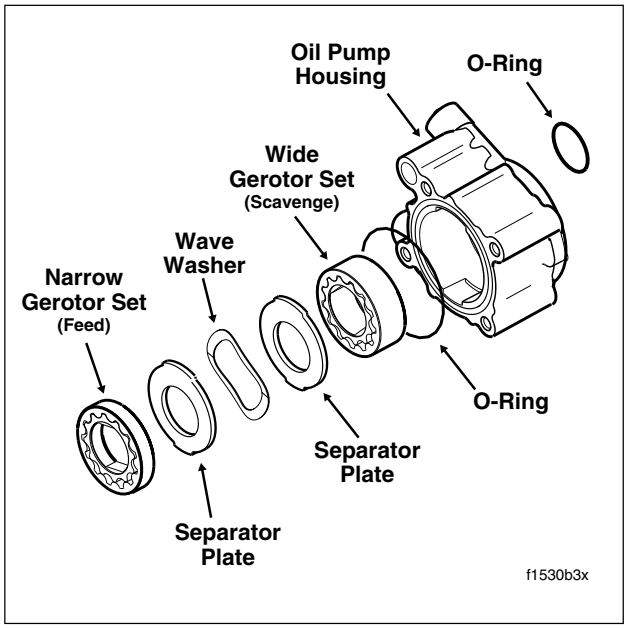


Figure 3-123. Oil Pump Assembly

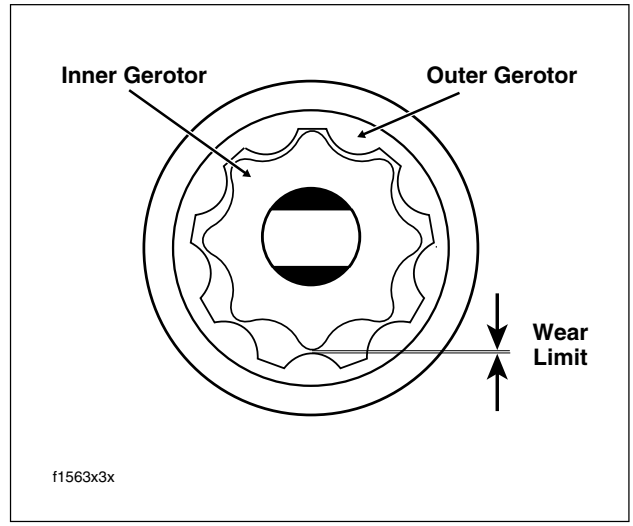


Figure 3-124. Measure Gerotor Sets for Wear

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 gerotors and between lobes on inner gerotor.
6. Mesh pieces of one gerotor set together as shown in Figure 3-124. 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 gerotor set if clearance exceeds specification. Inspect second gerotor set in the same manner.
7. Measure thickness of inner gerotor of one set with a micrometer. Measure the outer gerotor of the same set. Replace the gerotor set if the difference exceeds 0.001 inch (0.025 mm). Inspect second gerotor set in the same manner.
8. Assemble the oil pump. Verify that feed gerotors stand proud of the oil pump surface 0.080-0.090 inch (2.03-2.29 mm). If measurement is less than 0.080 inch (2.03 mm), remove feed gerotor set and reassemble using **new** wave washer. Repeat measurement and replace oil pump body if still not within specification.

Installation

1. See Section 3.10 BOTTOM END OVERHAUL, ASSEMBLY, steps 11-29.
2. Remove wireforms to release hydraulic lifters.
3. See Section 3.9 TOP END OVERHAUL, ASSEMBLY, steps 29-39.

Legend:

f2070x3x

1. Crankshaft Bearing
2. Ring Dowel
3. Cam Needle Bearing
4. Oil Inlet Fitting
5. Oil Outlet Fitting
6. Crankcase Breather Fitting
7. Right Crankcase Half
8. O-Ring
9. Piston Jet
10. T20 TORX Screw
11. Lock Ring
12. Sprocket Shaft Bearing
13. O-Ring
14. Ring Dowel
15. Plug
16. O-Ring
17. Oil Filter Mount
18. Oil Filter Adapter
19. Flat Washer
20. Bolt
21. Lockplate
22. Oil Filter
23. Crankcase Bolt
24. Ring Dowel
25. O-Ring
26. Left Crankcase Half
27. Thrust Washer
28. Oil Seal
29. Sprocket Shaft Spacer

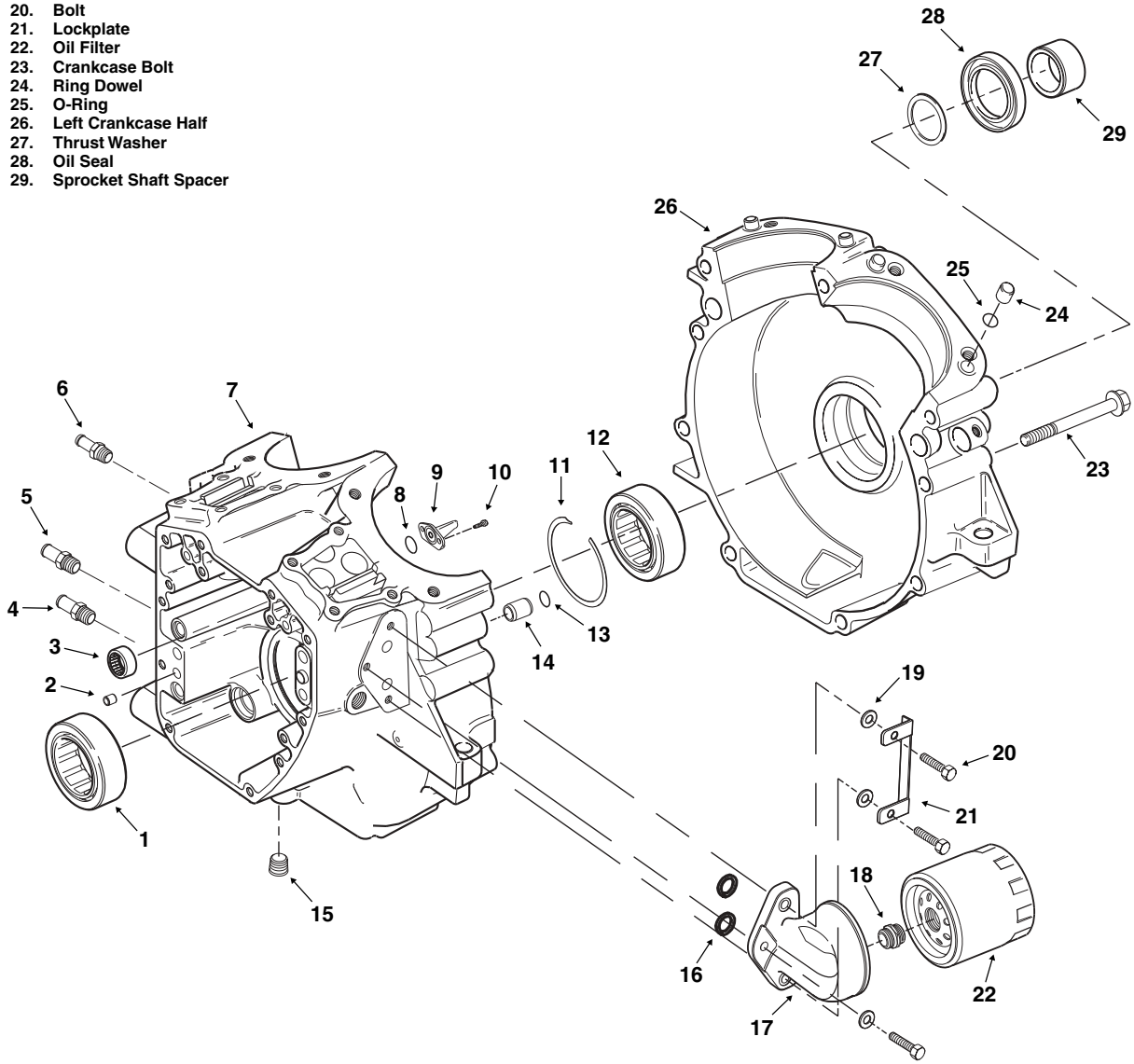


Figure 3-125. Crankcase Assembly (Exploded View)

CRANKCASE

Removal

1. See Section 3.9 TOP END OVERHAUL, DISASSEMBLY, steps 1-29.
2. See Section 3.10 BOTTOM END OVERHAUL, DISASSEMBLY, steps 1-18.

Disassembly/Assembly

RIGHT CRANKCASE HALF

Crankshaft 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. See Figure 3-126. Obtain CRANKSHAFT/SPROCKET SHAFT BEARING REMOVER/INSTALLER PILOT/DRIVER (B-45655) and CRANKSHAFT/SPROCKET SHAFT BEARING REMOVER/INSTALLER SUPPORT TUBE (HD-42720-5).
2. Place support tube on hydraulic press table with the “A” end up. The ends of the support tube are stamped “A” and “B” to ensure proper orientation.
3. With the outboard side of the right crankcase half facing upward, position crankshaft bearing bore over support tube.

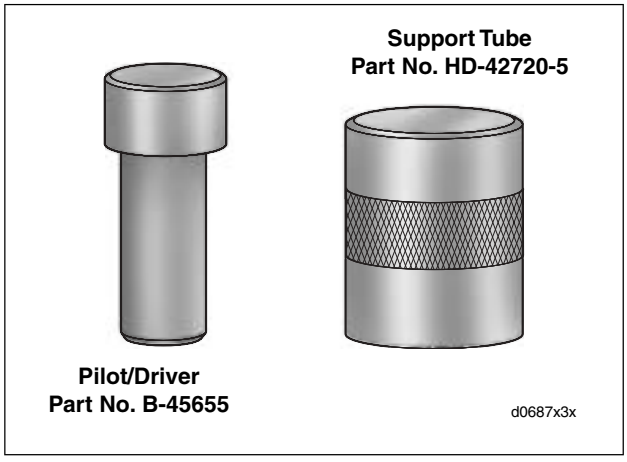


Figure 3-126. Crankshaft/Sprocket Shaft Bearing Pilot/Driver and Support Tube

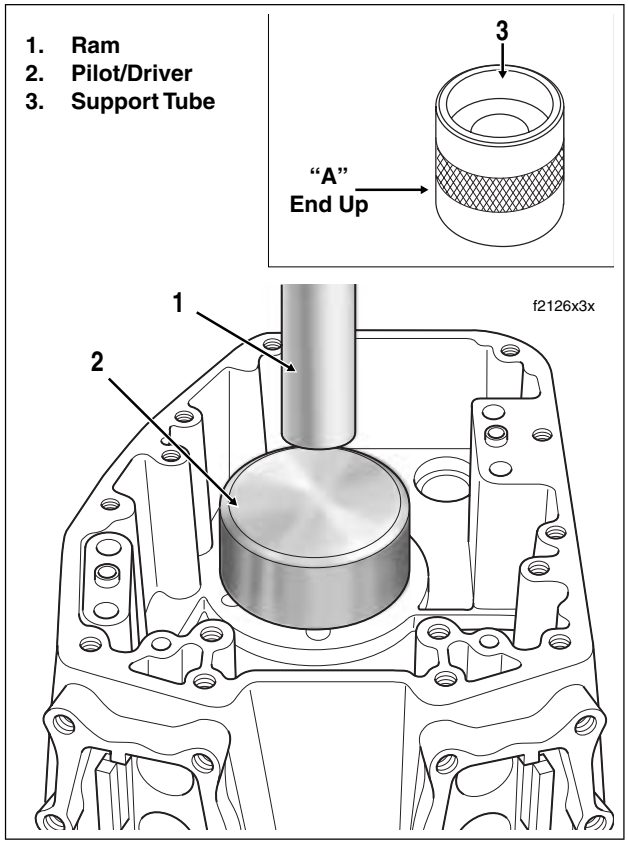


Figure 3-127. Remove Crankshaft Bearing

4. Slide pilot/driver through bearing into support tube.
5. Center pilot/driver under ram of press. Apply pressure to pilot/driver until bearing is free. See Figure 3-127.
6. Remove right crankcase half, pilot/driver and bearing from support tube. Discard bearing.

Installation

1. See Figure 3-126. Obtain CRANKSHAFT/SPROCKET SHAFT BEARING REMOVER/INSTALLER PILOT/DRIVER (B-45655) and CRANKSHAFT/SPROCKET SHAFT BEARING REMOVER/INSTALLER SUPPORT TUBE (HD-42720-5).
2. Turn support tube over so that the “B” end is up. The ends of the support tube are stamped “A” and “B” to ensure proper orientation.
3. With the outboard side of the right crankcase half facing upward, position crankshaft bearing bore over support tube.
4. Obtain **new** crankshaft bearing and apply a thin film of clean engine oil to O.D.

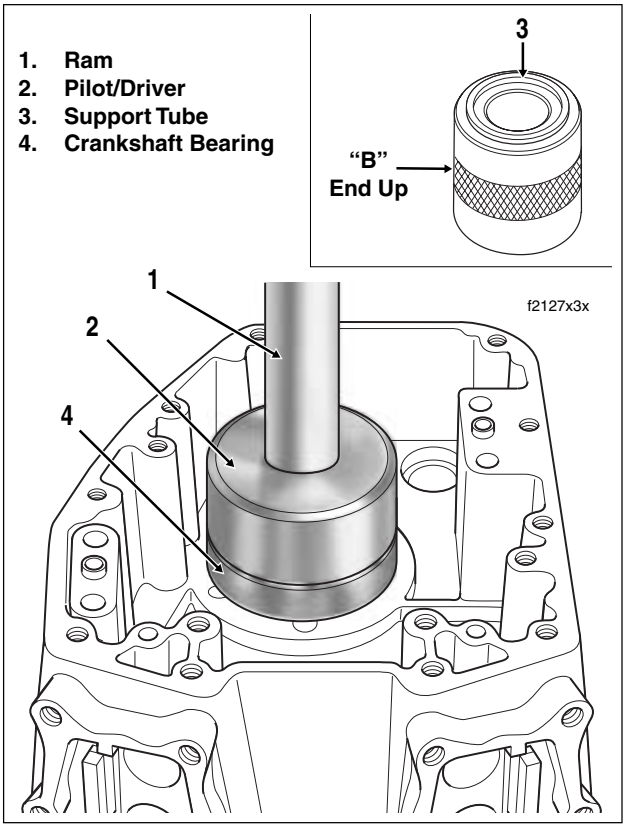


Figure 3-128. Install Crankshaft Bearing

5. Start crankshaft bearing into bore with the lettered side up. Lubricate leading edge of bearing before placement.
6. Slide pilot/driver through bearing into support tube.
7. Center pilot/driver under ram of press. Apply pressure to pilot/driver until resistance is felt and bearing bottoms in support tube. See Figure 3-128.
8. Remove pilot/driver and right crankcase half from support tube.

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.

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 screws to 25-35 **in-lbs** (2.8-4.0 Nm).

LEFT CRANKCASE HALF

Sprocket Shaft 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.

⚠WARNING

Do NOT rotate left crankcase half in the engine stand so the stator mount flange (sprocket shaft side) is facing up or the flywheel assembly will drop to the floor. Dropping the flywheel assembly may result in parts damage and minor or moderate injury.

1. Holding flywheel assembly so that it does not drop out of left crankcase half, rotate cradle so that engine is upright and crankshaft and sprocket shaft are horizontal.
2. Carefully slide flywheel assembly out of left crankcase half.
3. Remove left crankcase half from engine stand and move to bench area. Remove thrust washer from outboard side of crankcase by pulling it past the oil seal. Set thrust washer aside for inspection or reuse.
4. Using a suitable drift, tap oil seal from bearing bore. Discard oil seal.

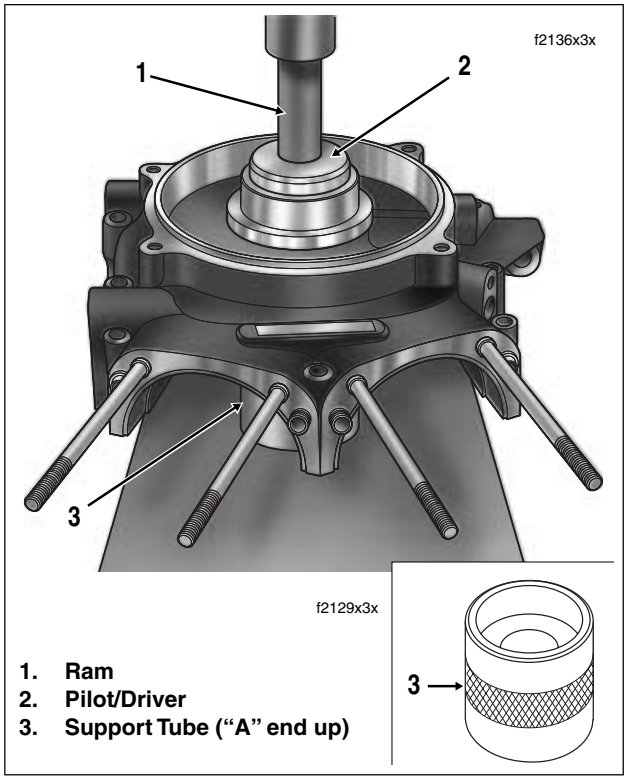


Figure 3-129. Remove Sprocket Shaft Bearing

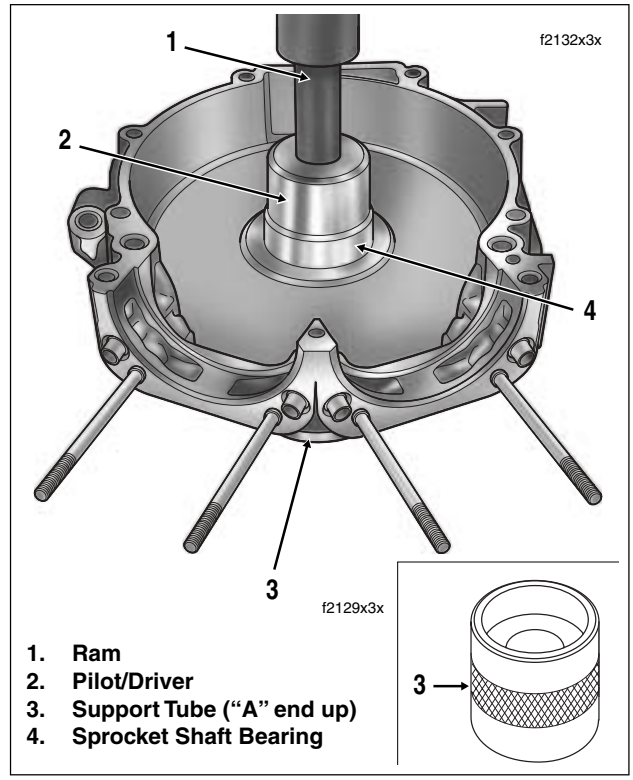


Figure 3-130. Install Sprocket Shaft Bearing

5. See Figure 3-126. Obtain CRANKSHAFT/SPROCKET SHAFT BEARING REMOVER/INSTALLER SUPPORT TUBE (HD-42720-5) and CRANKSHAFT/SPROCKET SHAFT BEARING REMOVER/INSTALLER PILOT/DRIVER (B-45655).
6. Place left crankcase half on work bench with inboard side of facing upward.
7. Using the tip of a flat blade screwdriver, carefully lift end of lock ring out of groove in bearing bore. Working the screwdriver around the edge, lift the lock ring up and out of the groove. Be careful not to damage the lip of the groove during removal.
8. Place support tube on hydraulic press table with the “A” end up. The ends of the support tube are stamped “A” and “B” to ensure proper orientation.
9. With the outboard side of the left crankcase half facing upward, position sprocket shaft bearing bore over support tube. See Figure 3-129.
10. Slide pilot/driver through bearing into support tube.
11. Center pilot/driver under ram of press. Apply pressure to pilot/driver until bearing is free.
12. Remove left crankcase half, pilot/driver and bearing from support tube. Discard bearing.

Installation

⚠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. See Figure 3-126. Obtain CRANKSHAFT/SPROCKET SHAFT BEARING REMOVER/INSTALLER SUPPORT TUBE (HD-42720-5) and CRANKSHAFT/SPROCKET SHAFT BEARING REMOVER/INSTALLER PILOT/DRIVER (B-45655).
2. Place support tube on hydraulic press table with the “A” end up. The ends of the support tube are stamped “A” and “B” to ensure proper orientation.
3. With inboard side of the left crankcase half facing upward, position sprocket shaft bearing bore over support tube.
4. See Figure 3-130. Obtain **new** sprocket shaft bearing and apply a thin film of clean engine oil to O.D.
5. Start sprocket shaft bearing into bearing bore with the lettered side down. Lubricate leading edge of bearing before placement.

6. Slide pilot/driver through bearing into support tube.
7. Center pilot/driver under ram of press. Apply pressure to pilot/driver until bearing lightly bottoms in the bore.
8. Remove left crankcase half and pilot/driver from support tube.
9. Place left crankcase half on work bench with inboard side of facing upward.
10. Obtain **new** lock ring and work into groove in bearing bore. Be careful not to damage the lip of the groove during installation. Verify that lock ring is fully seated in the groove.

NOTE

If lock ring will not fit into groove, bearing bore may not have been properly cleaned and/or bearing may not be fully seated in the bore.

Sprocket Shaft Bearing Inner Race

Removal

1. If reusing flywheel, remove bearing inner race and thrust washer as follows:
   a. Obtain FLYWHEEL SUPPORT FIXTURE (HD-44358). See Figure 3-131. 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 thrust washer and turn hex nuts an equal number of turns to draw halves of wedge together.

CAUTION

Install wedge attachment only so far as necessary to ensure positive contact with thrust washer. Installing tool with more contact than absolutely necessary will result in damage to flywheel.

   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).

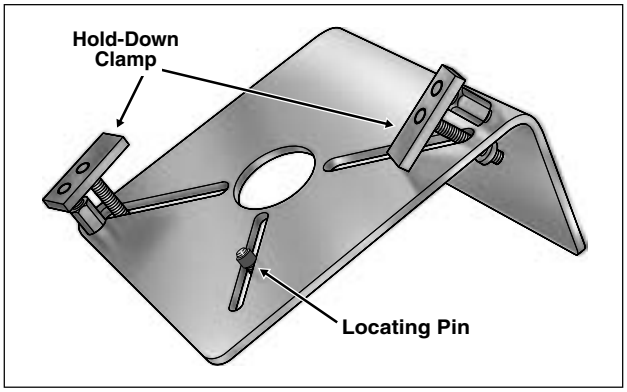
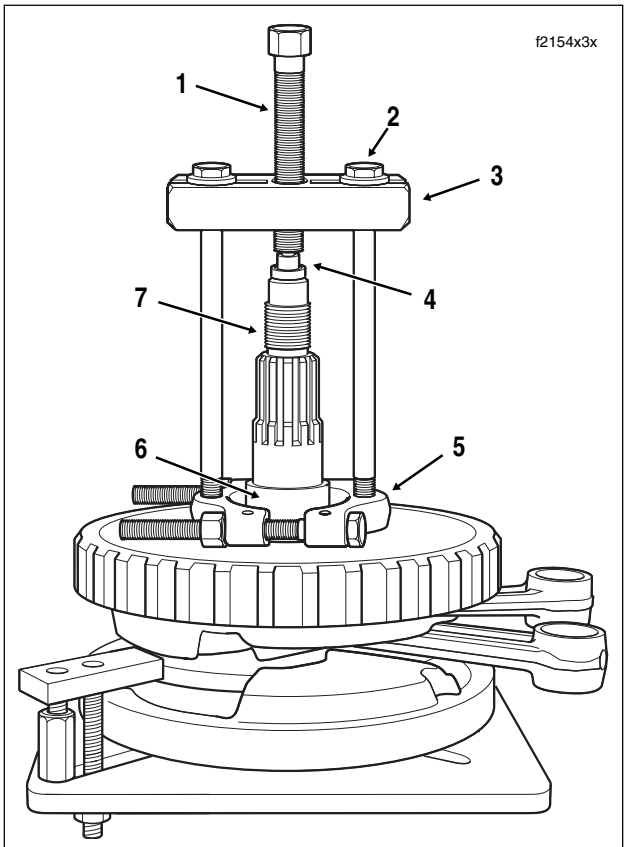


Figure 3-131. Flywheel Fixture (Part No. HD-44358)



1. Forcing Screw
2. 3/8-16 Inch Bolt with Flat Washer
3. Bridge
4. Hardened Plug
5. Wedge Attachment
6. Bearing Inner Race
7. Sprocket Shaft

Figure 3-132. Remove Inner Race From Sprocket Shaft

   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.

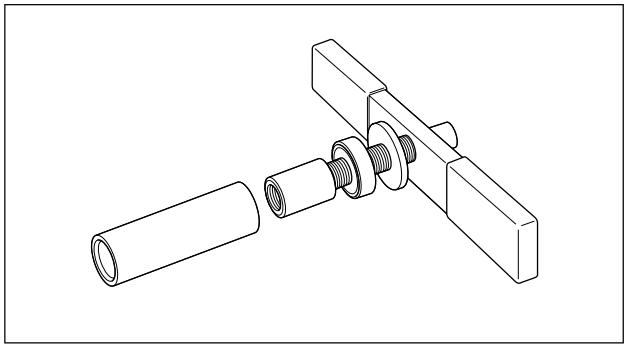


Figure 3-133. Sprocket Shaft Timken Bearing Cone Installer (Part No. HD-97225-55B)

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. Using the Robinair Heat Gun (HD-25070), uniformly heat the bearing inner race for about 30 seconds using a circular motion.

NOTE

To faciliate removal without heat, apply a light penetrating oil to shaft and leading edge of bearing inner race.

⚠WARNING

Never use both heat and penetrating oil. Use only one or the other. Excessive heat can cause the penetrating oil to ignite resulting in flames or fire. Inadequate safety precautions can result in death or serious injury.

j. Turn forcing screw until thrust washer and bearing inner race move approximately 1/8 inch (3.2 mm).

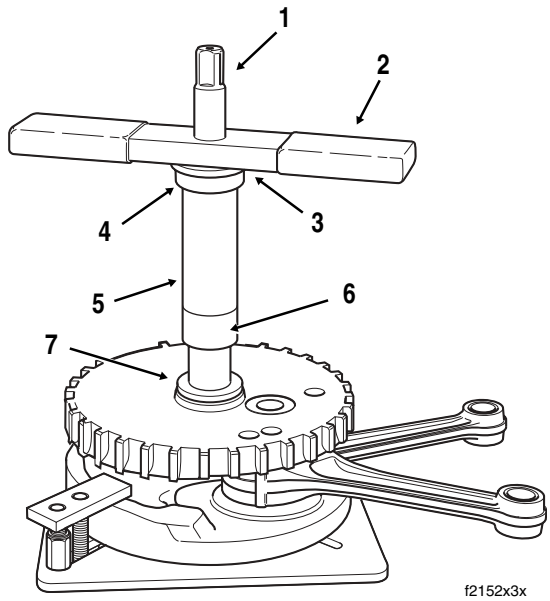
k. Turn hex nuts an equal number of turns to separate halves of WEDGE ATTACHMENT.

l. After bottoming thrust washer on shaft, reposition WEDGE ATTACHMENT (HD-95637-46A) on inboard side of bearing inner race. Turn hex nuts an equal number of turns to draw halves of wedge together.

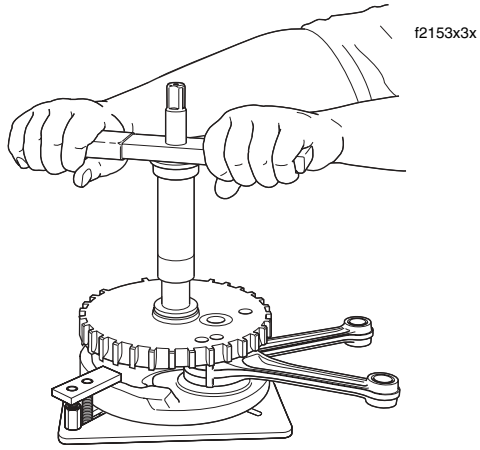
CAUTION

Install wedge attachment only so far as necessary to ensure positive contact with bearing inner race. Installing tool with more contact than absolutely necessary will result in damage to flywheel.

1. Install Thrust Washer and Bearing Inner Race On Sprocket Shaft. Assemble Tool.



2. Press Bearing Inner Race Onto Sprocket Shaft.



1. **Pilot Shaft**
2. **Handle**
3. **Flat Washer**
4. **Nice Bearing**
5. **Sleeve**
6. **Inner Race**
7. **Thrust Washer**

Figure 3-134. Press Inner Race Onto Sprocket Shaft

m. Verify that the tool assembly is square, so that the bearing inner race is not cocked during removal. See Figure 3-132.

n. Using the Robinair Heat Gun (HD-25070), uniformly heat the bearing inner race for about 30 seconds using a circular motion.

NOTE

To faciliate removal without heat, apply a light penetrating oil to shaft and leading edge of bearing inner race.

o. Turn forcing screw until bearing inner race is pulled free of sprocket shaft.
p. Remove thrust washer from sprocket shaft.

2. Discard thrust washer and bearing inner race.

Installation

1. Place **new** thrust washer over sprocket shaft with the ink stamp facing outside (and the chamfer on the ID inboard).
2. Place **new** bearing inner race on bench top. Using the Robinair Heat Gun (HD-25070), uniformly heat bearing inner race for about 60 seconds using a circular motion.
3. Wearing suitable gloves to protect hands from burns, place heated bearing inner race over sprocket shaft.

NOTE

To faciliate installation without heat, apply a light penetrating oil to shaft and leading edge of bearing inner race.

⚠WARNING

Never use both heat and penetrating oil. Use only one or the other. Excessive heat can cause the penetrating oil to ignite resulting in flames or fire. Inadequate safety precautions can result in death or serious injury.

4. Obtain the SPROCKET SHAFT TIMKEN BEARING CONE INSTALLER (HD-97225-55B). See Figure 3-133. 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 inner race.
   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 3-134.
5. Rotate handle of tool in a clockwise direction until bearing inner race bottoms against thrust washer. See lower frame of Figure 3-134.
6. Remove handle, flat washer, Nice bearing, sleeve and pilot from sprocket shaft.

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 from cylinder deck.

Installation

1. Hand start stud in cylinder deck with the collar side down.
2. Install steel ball bearing into unused cylinder head bolt. Position head bolt on end of stud.
3. Using an air gun, tighten stud until collar almost contacts cylinder deck.
4. Leaving cylinder head bolt installed, hand 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 120-168 **in-lbs** (13.6-18.9 Nm).
3. Install pipe plug. Tighten pipe plug to 120-168 **in-lbs** (13.6-18.9 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.

Installation

1. See Section 3.10 BOTTOM END OVERHAUL, ASSEMBLY, steps 1-29.
2. See Section 3.9 TOP END OVERHAUL, ASSEMBLY, steps 1-39.

FLYWHEEL/CONNECTING ROD ASSEMBLY

Removal

1. See Section 3.9 TOP END OVERHAUL, DISASSEMBLY, steps 1-29.
2. See Section 3.10 BOTTOM END OVERHAUL, DISASSEMBLY, steps 1-18.
3. See Section 3.11 SUBASSEMBLY SERVICE AND REPAIR, CRANKCASE, LEFT CRANKCASE HALF, SPROCKET SHAFT 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 from induction hardening and is considered a normal condition.

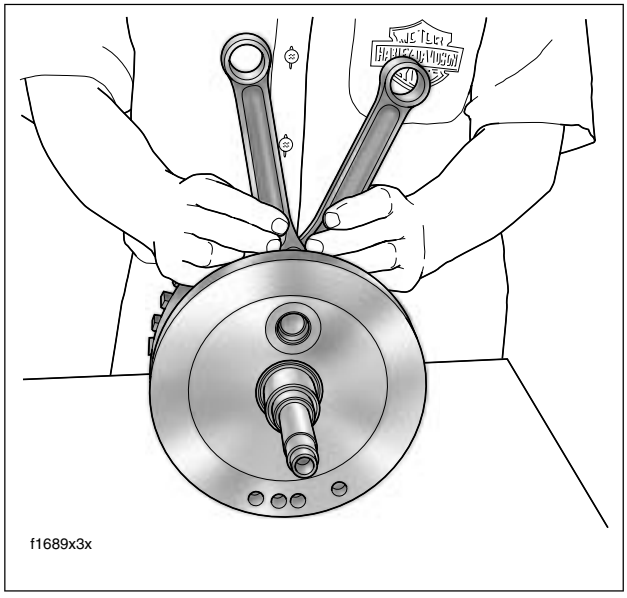


Figure 3-89. Check Connecting Rod Bearing Clearance

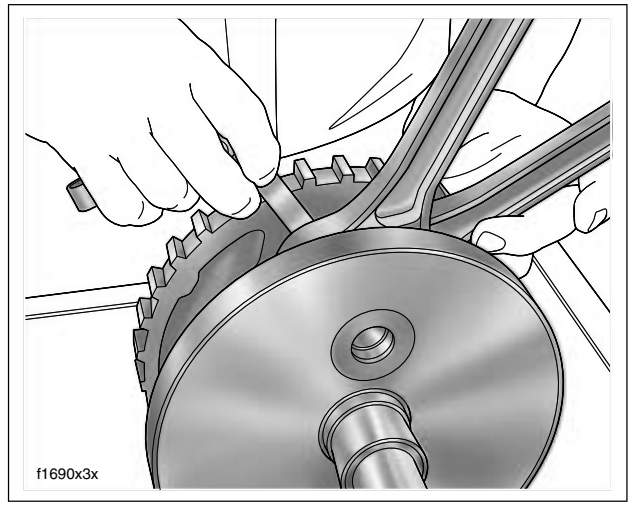


Figure 3-90. Check Connecting Rod Side Play

- The crankshaft/sprocket shaft bearing inner races are brinelled, burnt, scored, blued or damaged.

2. Orient the assembly as shown in Figure 3-89. 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 3-90. Replace the assembly if rod side play exceeds 0.020 inch (0.51 mm).

NOTE

If the flywheel, connecting rods or right side bearing inner race need to be replaced, then replace the entire flywheel assembly.

Installation

1. See Section 3.11 SUBASSEMBLY SERVICE AND REPAIR, CRANKCASE, LEFT CRANKCASE HALF, SPROCKET SHAFT BEARING, INSTALLATION.
2. See Section 3.10 BOTTOM END OVERHAUL, ASSEMBLY, steps 1-29.
3. See Section 3.9 TOP END OVERHAUL, ASSEMBLY, steps 1-39.

NOTES

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SPECIFICATIONS 4.1

CVH CARBURETOR JET SIZES

Model	Main Fuel Jet No.	Slow Fuel Jet No.
49 state	190	45
HDI	195	45
California	190	45

FUEL TANK CAPACITY

Capacity	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	120-144 **in-lbs**	13.6-16.3 Nm
Air cleaner cover bracket screws	20-40 **in-lbs**	2.3-4.5 Nm
Air cleaner cover screw	36-60 **in-lbs**	4.1-6.8 Nm
Fuel valve hex jam nut	15-20 ft-lbs	20-27 Nm
Fuel tank adapter	18-21 ft-lbs	24-29 Nm
Fuel tank rear mounting bolt	15-20 ft-lbs	20-27 Nm
Fuel tank front mounting bolts	15-20 ft-lbs	20-27 Nm
Battery hold-down clamp bolt	15-20 ft-lbs	20-27 Nm
Console mounting bolt acorn nut	50-90 **in-lbs**	5.7-10.2 Nm

FUEL SYSTEM TROUBLESHOOTING (CARBURETED) 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. Improper fuel level in float bowl.	4. Adjust float tab for correct fuel level.
5. Damaged or leaking float assembly.	5. Replace float assembly.
6. Particle contamination in fuel inlet fitting cavity.	6. Clean and clear cavity and fuel supply tract.
7. Worn or dirty inlet valve or seat.	7. Clean or replace valve and clean seat.

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. High speed riding style.	1. Modify riding habits.
2. Excessive use of enrichener system.	2. Limit system use.
3. Fuel level too high.	3. Adjust float level.
4. Restricted fuel tank vent system.	4. Correct restricted hose. Replace vapor valve.
5. Dirty air cleaner element.	5. Clean or replace as required.
6. Excessive accelerator pump output.	6. Check and clean accelerator pump bypass orifice.
7. Plugged or restricted bowl vent.	7. Clean and clear passages.
8. Vacuum piston assembly malfunction.	8. See Vacuum Piston Troubleshooting.
9. Loose jets.	9. Tighten jets.
10. Worn or damaged needle or needle jet.	10. Replace needle or needle jet.
11. Plugged air jets or passages.	11. Clean and clear passages.
12. Enrichener valve not seated or leaking.	12. Adjust, clean or replace.
13. Idle speed improperly adjusted.	13. Adjust operating idle speed.

POOR ACCELERATION

Check for:	Remedy:
1. Throttle cables misadjusted.	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. Inlet system air leak.	1. Correct as required.
2. Restricted fuel tank vent system.	2. Correct restricted hose. Replace vapor valve.
3. Dirty or damaged air cleaner element.	3. Clean or replace.
4. Accelerator pump inoperative.	4. Repair as required.
5. Plugged bowl vent or overflow.	5. Clean and clear passages.
6. Vacuum piston assembly malfunction.	6. See Vacuum Piston Troubleshooting.
7. Loose or plugged fuel and air jets or passages.	7. Clean, clear and correct as required.
8. Worn or damaged needle or needle jet.	8. Replace assembly.
9. Restricted fuel supply tract.	9. Correct and clear restriction.
10. Enrichener valve not seated or leaking.	10. Adjust, clean or replace.
11. Idle speed improperly adjusted.	11. Adjust operating idle speed.

POOR HIGH SPEED PERFORMANCE	
Check for:	**Remedy:**
1. Inlet system air leak.	1. Clean or replace.
2. Restricted fuel tank vent system.	2. Correct restricted hose. Replace vapor valve.
3. Dirty or damaged air cleaner element.	3. Clean or replace.
4. Accelerator pump inoperative.	4. Repair as required.
5. Plugged bowl, vent or overflow.	5. Clean and clear passages.
6. Vacuum piston assembly malfunction.	6. See Vacuum Piston Troubleshooting.
7. Restricted fuel supply tract.	7. Correct and clean restriction.
8. Loose or plugged main jets or passages.	8. Tighten, clean, clear as required.
9. Improper fuel level.	9. Adjust float level.
10. Worn or damaged needle or needle jet.	10. Replace assembly.
11. Enrichener valve not seated or leaking.	11. Adjust, clean or replace.

VACUUM PISTON ASSEMBLY TROUBLESHOOTING

PISTON DOES NOT RAISE PROPERLY

Check for:	Remedy:
1. Diaphragm cap loose, damaged or leaking.	1. Tighten or replace cap.
2. Diaphragm pinched at lip groove.	2. Reposition diaphragm lip.
3. Piston atmosphere vent blocked.	3. Clear vent.
4. Piston vacuum passage plugged.	4. Clean and clear passage.
5. Torn diaphragm.	5. Replace piston diaphragm assembly.
6. Piston binding.	6. Clean piston slides and body or replace piston.
7. Spring binding.	7. Correct or replace spring.
8. Enrichener valve open, not seated or leaking.	8. Adjust, clean or replace.

PISTON DOES NOT CLOSE PROPERLY

Check for:	Remedy:
1. Piston diaphragm ring dirty or damaged.	1. Clean or replace piston.
2. Piston binding.	2. Clean piston slides and body or replace piston.
3. Spring damaged.	3. Replace spring.

ENRICHENER (CARBURETED) 4.3

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.

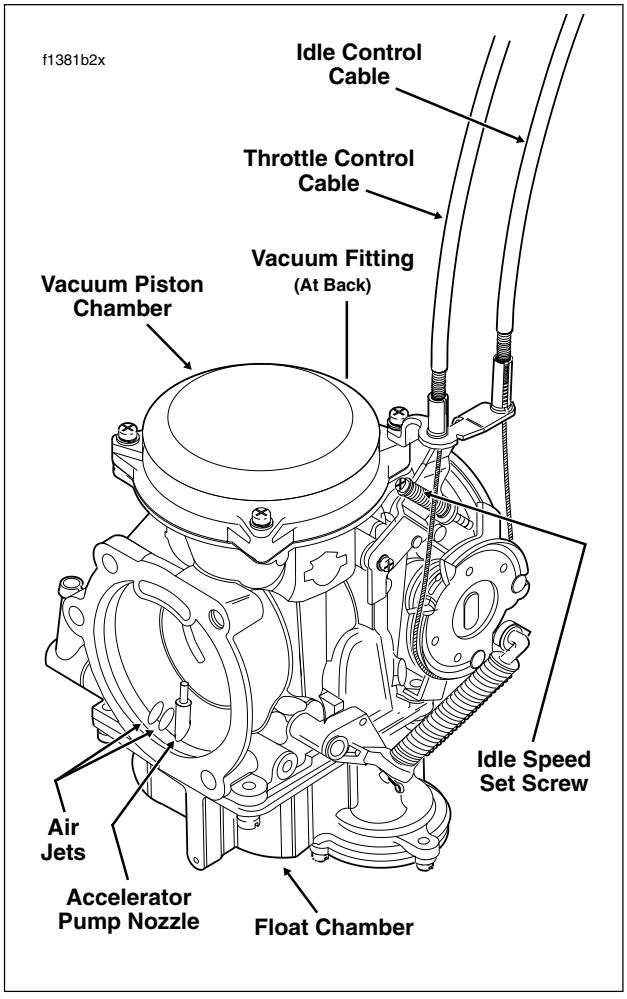


Figure 4-1. CVH Carburetor

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 recommendations 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 (3.2 km) with enrichener knob in full out position. See Figure 4-2.
2. Push the enrichener knob in to the 1/2 way position. Ride an additional 2 minutes or 2 miles (3.2 km).
3. 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 (0.8 km) with enrichener knob in full out position. See Figure 4-2.
2. Push the enrichener knob in to the 1/2 way position. Ride an additional 1 minute or 1/2 mile (0.8 km).
3. Push the enrichener knob fully in.

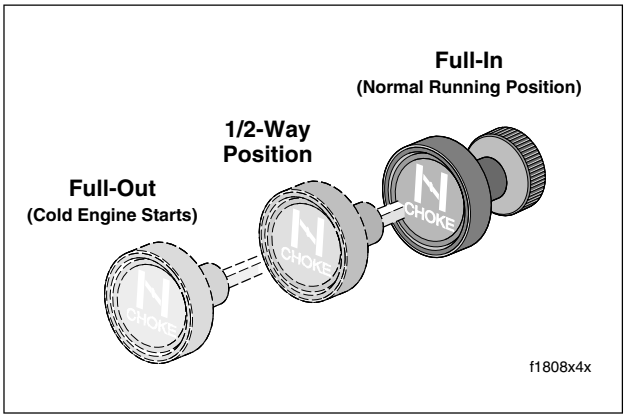


Figure 4-2. Set the Enrichener Knob

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.

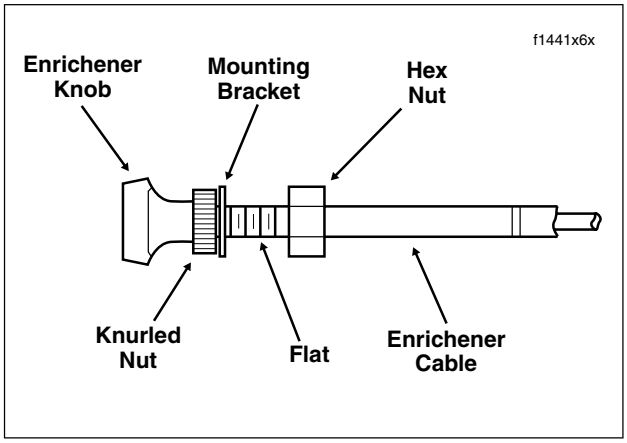


Figure 4-3. Enrichener Control

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.

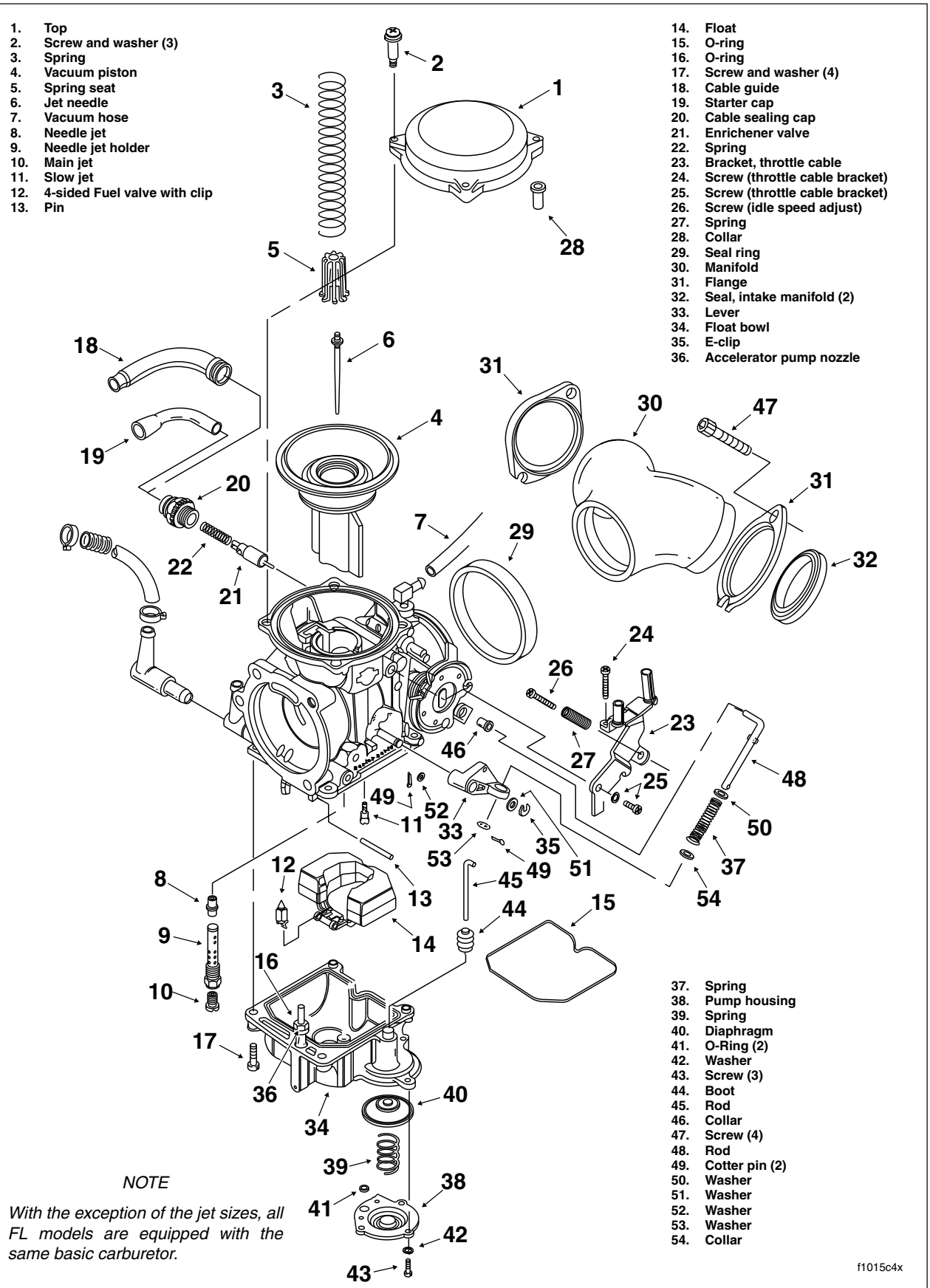


Figure 4-4. Carburetor

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 2.22 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.

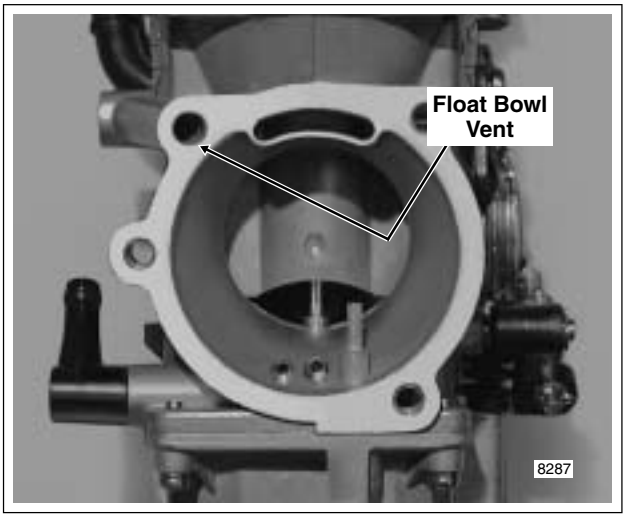


Figure 4-5. Drain Carburetor Float Bowl

8. If cruise control equipped, remove E-clip to release cruise cable housing from cable guide in throttle cable bracket. Push plastic end fitting on cruise cable to outboard side to release from wheel pin.
9. Using a needle nose pliers, carefully pull idle cable barrel from upper inboard hole in throttle wheel. Pull throttle cable barrel from remaining hole. Release idle and throttle cables from guides in throttle cable bracket.
10. Pull vacuum hose elbow from fitting on inboard side of carburetor.
11. Carefully remove carburetor while drawing enrichener cable to right side of vehicle.
12. Keeping carburetor upright, move assembly to bench area. Tilting carburetor, carefully pour gasoline in float bowl into a suitable container. Gasoline will exit float bowl vent shown in Figure 4-5.

INSTALLATION

1. Place carburetor into approximate position on right side of vehicle while feeding enrichener cable over to left side.
2. Push vacuum hose elbow onto fitting on inboard side of carburetor.
3. Install sleeve on throttle cable housing into shorter cable guide in throttle cable bracket. Drawing throttle cable downward, fit barrel end into lower outboard hole in throttle wheel. Install sleeve and spring on idle cable housing into longer cable guide inserting barrel end into upper inboard hole in throttle wheel.



Figure 4-6. Remove Enrichener Cable

4. 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.
5. If cruise control equipped, slide groove in plastic end fitting over cap of wheel pin. Push on end fitting until it snaps in place. Slip cruise cable housing into cable guide in throttle cable bracket. Install **new** E-clip on sleeve at end of cruise cable housing.

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 brass fitting at side of carburetor. Making sure clamp is positioned inboard of lip on fitting, 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 enrichener 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-CRUISE), 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 2.22 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 (CARBURETED), ADJUSTMENTS.

DISASSEMBLY

Vacuum Piston Chamber

1. Placing a 14mm open end wrench on hex, loosen plastic fitting at enrichener bore of carburetor housing. See Figure 4-6. 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.
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 4-7.

Float Chamber

1. Turn carburetor upside down and remove four Phillips screws at bottom to remove float bowl from carburetor body.

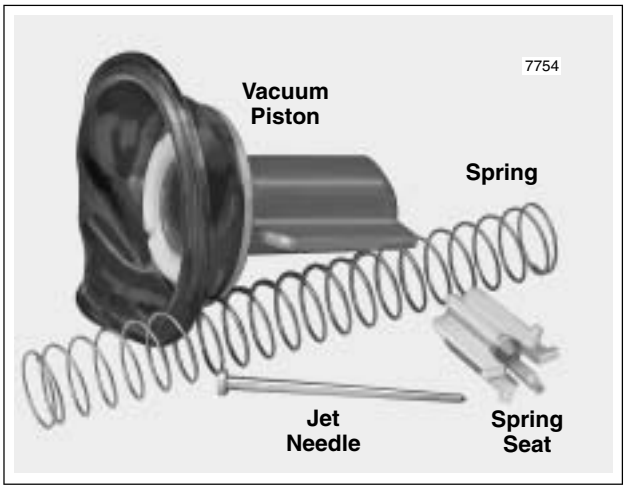


Figure 4-7. Vacuum Piston Chamber Components

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 4-8.
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 4-9.
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 4-11.
5. Using a 5/16 inch wrench, turn hex on needle jet holder to unthread from main jet bore.
6. Turn carburetor right side up to drop out needle jet, which is loose in main jet bore. See B of Figure 4-9.
7. Insert thin bladed flat tip screwdriver into slow jet bore. See Figure 4-11. Using slot at top of slow jet, unthread to remove. See C of Figure 4-9.
8. Disassemble accelerator pump from float bowl. See Figure 4-10. Proceed as follows:

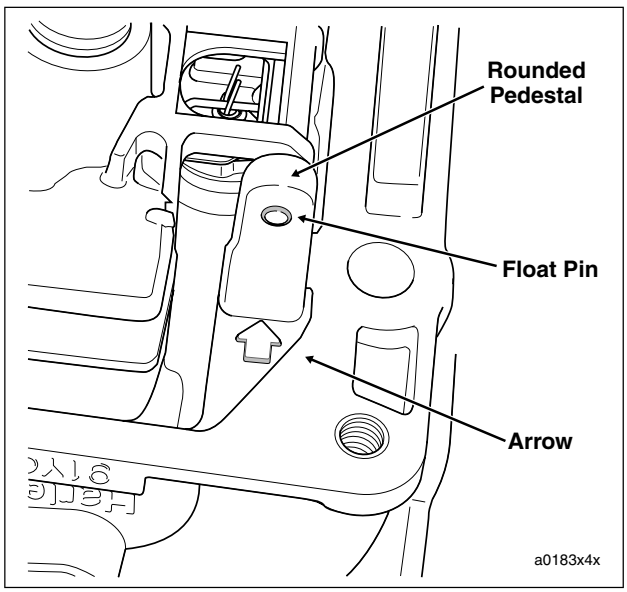


Figure 4-8. Remove Float Pin in Direction of Arrow

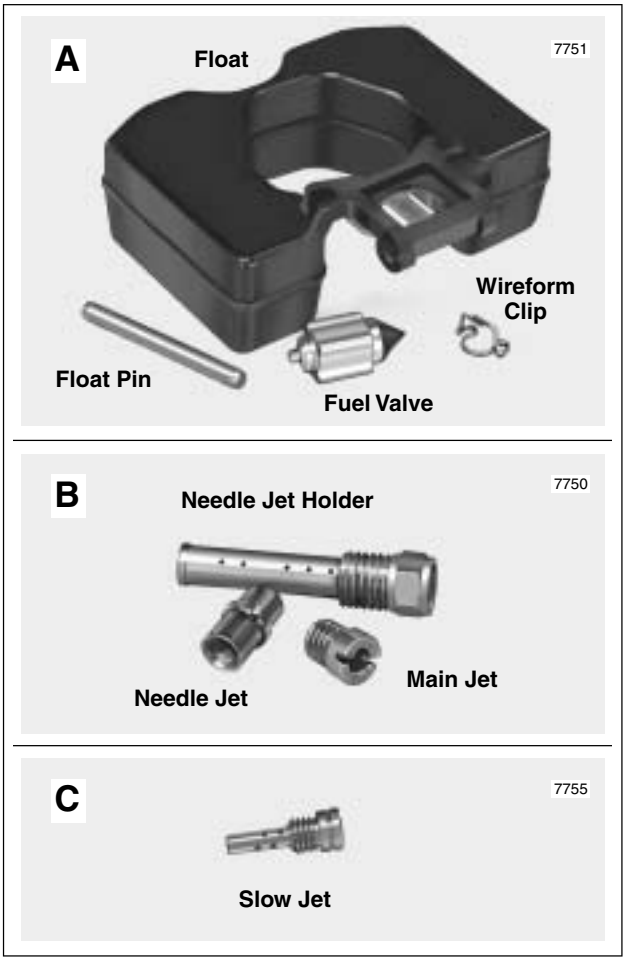


Figure 4-9. Float Chamber Components

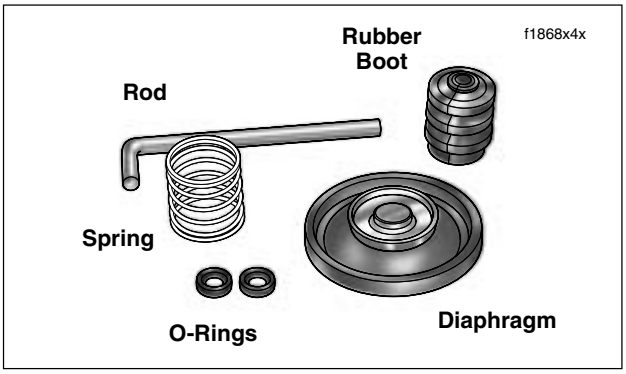


Figure 4-10. Accelerator Pump Components

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.

Slow Speed Circuit

a. Spray carburetor cleaner into air inlet hole of slow speed circuit. See A of Figure 4-12. While spraying, verify that solution exits slow jet bore at bottom of carburetor housing. See B of Figure 4-12. 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.

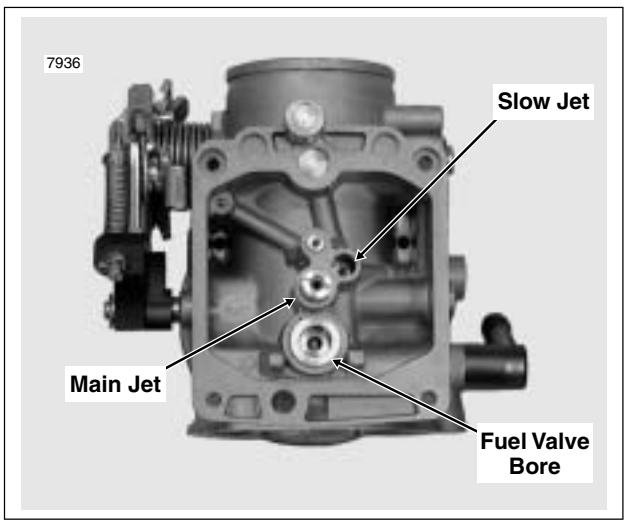


Figure 4-11. Carburetor Housing

Main Circuit

a. Plugging main jet hole in carburetor throat, spray carburetor cleaner into air inlet hole of main circuit. See A of Figure 4-12. While spraying, verify that solution exits main jet bore at bottom of carburetor housing. See B of Figure 4-12.

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 4-12. While spraying, verify that solution exits two holes in float bowl chamber at bottom of carburetor housing. See B of Figure 4-12.

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.

Vacuum Piston Chamber Components

1. Thoroughly clean all loose parts (except diaphragm) with carburetor cleaner. See Figure 4-7. 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.

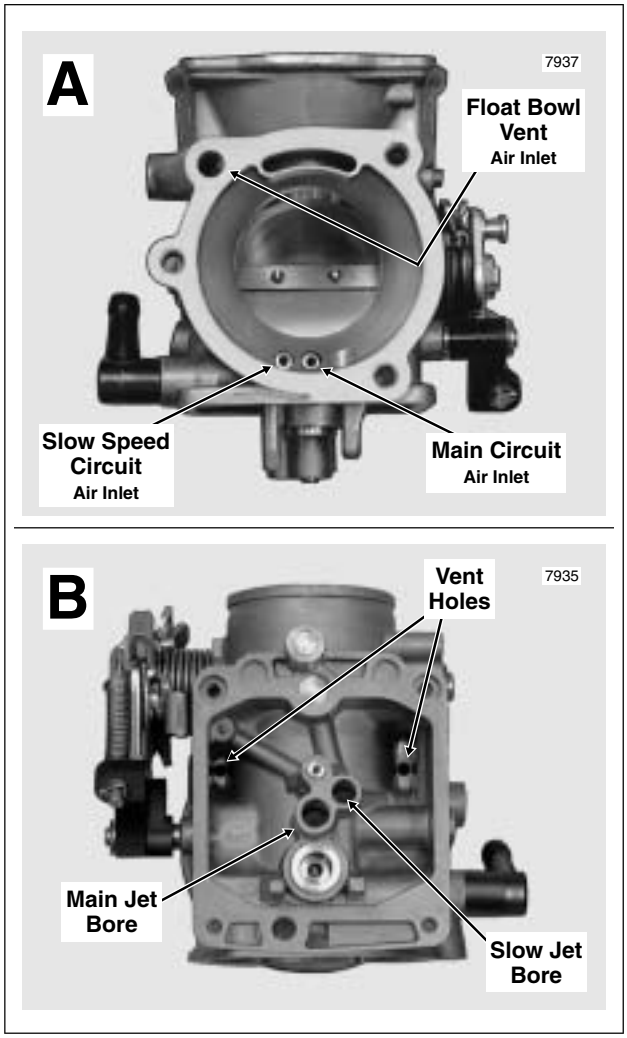


Figure 4-12. Clean Air/Fuel Passages

Float Chamber Components

1. Thorougly clean all loose parts with carburetor cleaner. See Figure 4-9. 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

Vacuum Piston Chamber

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 4-6.

Float Chamber

1. Place needle jet into main jet bore. See Figure 4-11. 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 4-11. 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 4-11.

CAUTION

Tapping the float pin in from the rounded pedestal side will result in damage that requires carburetor replacement.

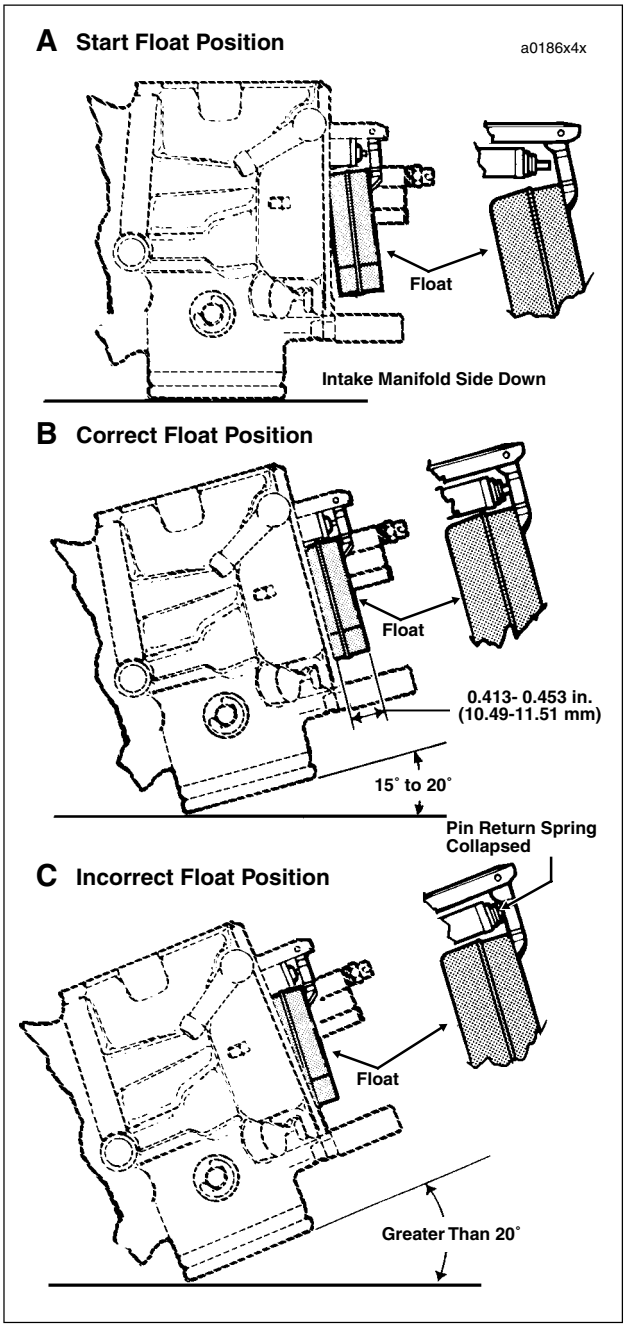


Figure 4-13. Float Check and Adjustment

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 4-13.

b. Tilt the carburetor 15° to 20° in a counter-clockwise direction until float comes to rest. See B of Figure 4-13.

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.

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

GENERAL

The air cleaner prevents foreign material from entering the engine, trapping airborne dust and dirt in the filter element. Service the air cleaner filter element every 5000 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 4-14.
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 carbureted California models, pull clean air inlet tube (to charcoal canister) from hole on inboard side of 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.

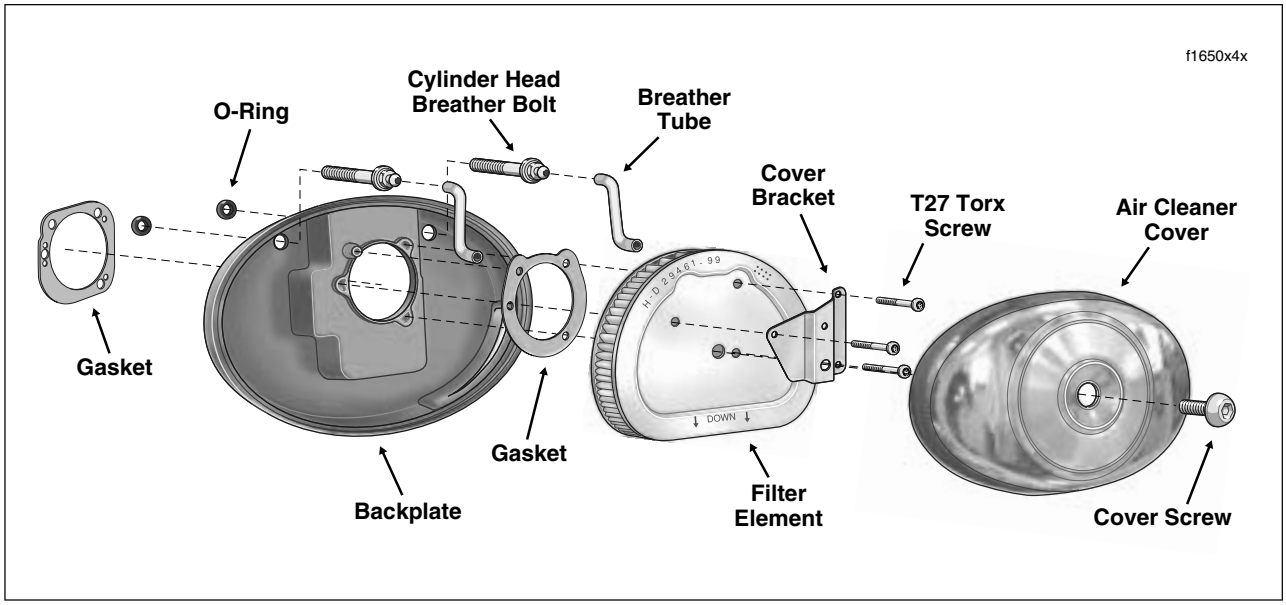


Figure 4-14. Air Cleaner Assembly

⚠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.

4. 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.
5. 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.
6. Inspect the breather tubes for cuts, tears, holes or signs of deterioration. Replace as necessary. Direct compressed air through 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. Aligning flat edge of gasket with molded tab, install **new** gasket on inboard side of backplate. On California models, install gasket by aligning small holes with plastic pins.
3. On California models, push clean air inlet tube (to charcoal canister) into hole on inboard side of backplate.
4. 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 120-144 **in-lbs** (13.6-16.3 Nm).
5. Slide **new** gasket over sleeve on inboard side of filter element. Be sure holes in gasket are aligned with those in filter.
6. Insert breather tubes about 1/4 inch (6.4 mm) into holes on inboard side of filter element.
7. 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.

8. Place filter element onto backplate with the flat side down, so that hole on inboard side of element fits over molded boss in backplate.
9. 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).
10. Verify that rubber seal is properly seated around perimeter of air cleaner cover. Replace seal if cut, torn or shows signs of deterioration.
11. 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 and tighten to 36-60 **in-lbs** (4.1-6.8 Nm).

VACUUM OPERATED FUEL VALVE (CARBURETED) 4.6

GENERAL

A fuel 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.

To access the main fuel supply, turn the valve handle **down** to the fully vertical position, so that the indicator points up to ON. To access the reserve supply, turn the handle **up** to the fully vertical position, so that the indicator points down to RES(ERVE). Move the handle to the horizontal position to shut the gasoline supply to the carburetor OFF. Always turn the valve to the OFF position to refuel, or whenever 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.

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.

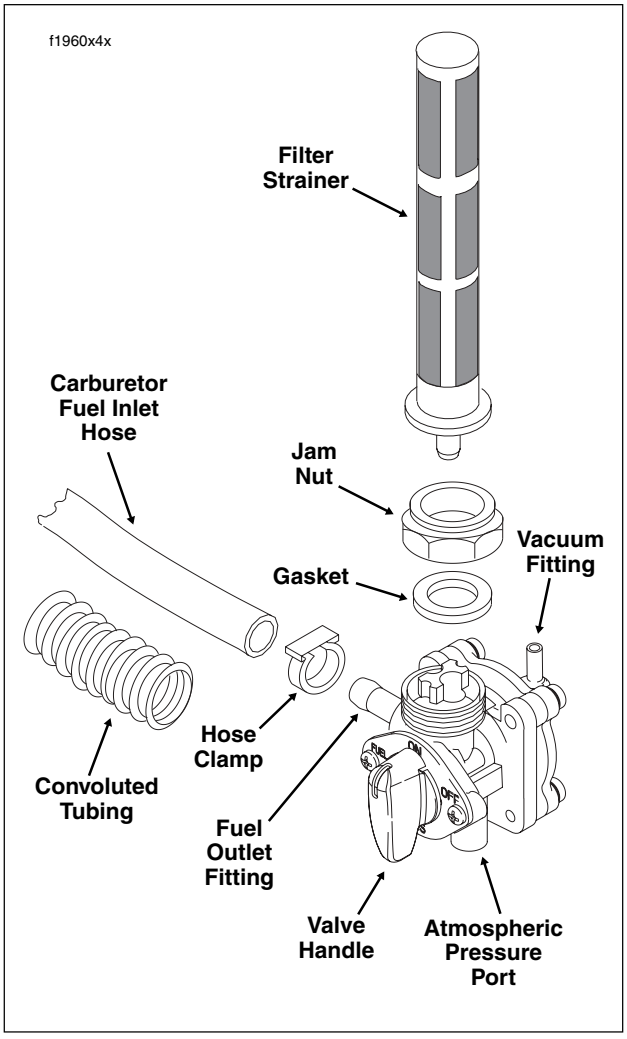


Figure 4-15. Vacuum Operated Fuel Valve

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 hose from fuel outlet fitting at the front of the fuel valve. See Figure 4-15. Drain free end of hose into a suitable container.

3. Remove elbow of intake manifold vacuum tube from fitting on inboard side 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-23738A) 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, remove the Mity-Vac® Hand Pump from the vacuum fitting.
9. Holding fuel tank adapter, turn the hex jam nut in a clockwise direction to remove the fuel valve assembly.
10. Remove the fuel filter strainer from the valve head.
11. Remove the hex jam nut from the fuel valve.
12. Remove the gasket from the valve head. Discard the gasket.

CLEANING AND INSPECTION

1. Clean or replace the fuel filter strainer.
2. Flush the tank. See Section 4.7 FUEL TANK (CARBURETED), CLEANING AND INSPECTION.

INSTALLATION

1. Install a **new** gasket on the valve head.
2. Install the fuel filter strainer fitting the internal tube into the larger hole in the valve head.
3. Apply Loctite Pipe Sealant with Teflon 565 to threads of fuel valve and fuel tank adapter.
4. With the hex side down, turn the jam nut two full turns in a counterclockwise direction to thread onto fuel tank adapter.
5. Insert fuel filter strainer into fuel tank. Holding the hex jam nut to prevent rotation, turn the fuel valve two full turns in a clockwise direction to thread onto hex jam nut.

⚠WARNING

Do not thread fuel valve onto hex jam nut more than two turns or nut 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 fuel valve assembly.
	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 fuel valve assembly.
	2.2 Plugged vacuum fitting.	2.2.2 Clean as necessary.
	2.3 Broken or missing internal spring.	2.3.1 Replace fuel valve assembly.
3. Valve leaks gasoline at atmospheric pressure port.	3.1 Leaking diaphragm.	3.1.1 Replace fuel valve assembly.
	3.2 Loose diaphragm housing screws.	3.2.1 Tighten screws.

6. Holding the fuel valve to prevent rotation, turn the hex jam nut in a counterclockwise direction until snug. Tighten the hex jam nut to 15-20 ft-lbs (20.3-27.1 Nm).

CAUTION

Do not allow dirt or fluids to get into the vacuum tube that connects the fuel valve to the intake manifold. Contaminants can block the vacuum signal which could cause the fuel valve to malfunction.

7. Connect elbow of intake manifold vacuum tube to fitting on inboard side of the fuel valve.
8. Slide **new** clamp onto free end of carburetor fuel inlet hose. Install hose onto fuel outlet fitting at front of fuel valve. Crimp clamp using HOSE CLAMP PLIERS (HD-97087-65B).
9. Turn the handle of the fuel valve to OFF and fill the fuel tank. Carefully inspect for leaks at fitting.
10. Turn the valve handle to ON and start engine. No priming or special procedures are required to start fuel flow. Carefully inspect for leaks at fitting.
11. Stop engine and return the valve to the OFF position.

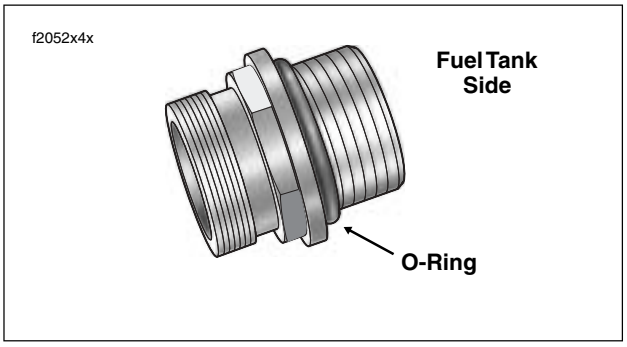


Figure 4-16. Fuel Tank Adapter

FUEL TANK ADAPTER

If leakage or damage is observed at the fuel tank adapter, replace O-ring and/or adapter as follows:

1. Remove fuel valve assembly. See REMOVAL in this section.
2. Slide a 7/8 inch socket over hex on adapter, and looking down at top of fuel tank, rotate in a clockwise direction to remove. See Figure 4-16.
3. Remove O-ring from adapter. Discard O-ring.
4. Apply a very thin film of clean H-D 20W50 engine oil to **new** O-ring. Install O-ring into groove of adapter.
5. Hand thread adapter into fuel tank bore. Looking down at top of fuel tank, rotate adapter in a counterclockwise direction until snug.
6. Slide a 7/8 inch socket over hex and tighten to 18-21 ft-lbs (24.4-28.5 Nm).
7. Install fuel valve assembly. See INSTALLATION in this section.

COMPLETE REMOVAL

NOTE

For fuel injected models, see Section 9.4 FUEL TANK (FUEL INJECTED) for removal and installation instructions.

FLHT/C, FLTR

1. Remove seat. See Section 2.22 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 (CARBURETED), 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 side of frame backbone.
5. Disconnect 3-place Multilock connector in front of battery to release fuel level sender from main harness. See Figure 4-17.
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 clip nut on fuel tank weldment.
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. Gently pry fuel vapor vent tube from fitting on filler neck of fuel tank. Exercise caution to avoid pulling fitting from filler neck.
10. 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.

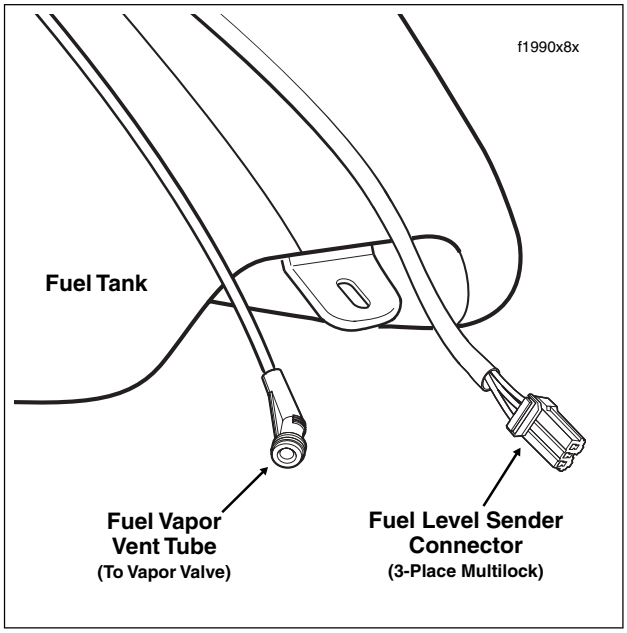


Figure 4-17. Fuel Level Sender Connector

⚠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.

FLHR

1. Remove seat. See Section 2.22 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 (CARBURETED), DRAINING FUEL TANK, steps 1-8.
4. Carefully cut anchored cable strap securing main harness bundle, instrument console conduit, and fuel vapor vent tube to left side of frame backbone.
5. Remove acorn nut and Phillips screw (with large flat washer) from instrument console.

CAUTION

When removing instrument console, exercise caution to avoid damaging speedometer unit. Wrap console in a clean, dry shop towel to prevent damage.

6. Remove console and secure to top of rear fender using bungee cords.
7. Remove console mounting bolt from slot at top of canopy.
8. Pull fuel vapor vent tube from fitting.
9. Bend back flexible clamp and then depress button on socket side of 3-place Mini-Deutsch connector to disconnect fuel level sender from main harness.
10. 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.
11. 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 dis-pose of rags in a suitable manner. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

12. Using a side cutters, cut clamp from one end of crossover hose beneath fuel tank. Drain free end of hose into a suitable container.
13. Remove fuel tank from vehicle.

CLEANING AND INSPECTION

1. Inspect the fuel tank for leaks and other damage. Replace damaged tanks that cannot be successfully repaired.
2. If sludge, rust or varnish deposits are evident, clean fuel tank as follows:

⚠WARNING

Even with the fuel tank completely drained, a small amount of gasoline may leak from the bore when the fuel 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.

a. Remove the fuel valve assembly and plug fuel tank opening. See Section 4.6 VACUUM OPERATED FUEL VALVE (CARBURETED), REMOVAL.

b. Remove canopy as follows:

FLHT/C, FLTR: See Section 8.27 FUEL LEVEL SENDER (CARBURETED), FLHT/C, FLTR CANOPY, REMOVAL, steps 11-13.

FLHR: See Section 8.27 FUEL LEVEL SENDER (CARBURETED), FLHR CANOPY, REMOVAL, steps 10-12.

⚠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.

c. Fill the tank with commercial cleaning solvent or a soap and water solution. Shake the tank to agitate the cleaning agent.

⚠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.

d. If necessary, non-ferrous metallic balls or pellets may be added to the tank to help loosen deposits.

e. Thoroughly flush the fuel tank after cleaning. Allow tank to air dry.

f. Install fuel valve assembly. See Section 4.6 VACUUM OPERATED FUEL VALVE (CARBURETED), INSTALLATION.

g. Install canopy as follows:

FLHT/C, FLTR: See Section 8.27 FUEL LEVEL SENDER (CARBURETED), FLHT/C, FLTR CANOPY, INSTALLATION, steps 1-3.

FLHR: See Section 8.27 FUEL LEVEL SENDER (CARBURETED), FLHR CANOPY, INSTALLATION, steps 1-3.

3. Inspect crossover hose for cuts, cracks, nicks or other damage. Be sure aging has not caused the hose to become hard and brittle. If replacing from bulk storage, use SAE R9 or equivalent fuel hose only. Remove old hose and cut new hose to same length using HOSE CUTTER (HD-41185).

INSTALLATION (AFTER COMPLETE REMOVAL)

FLHT/C, FLTR

CAUTION

Exercise caution to avoid pinching wire harness between 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. Crimp clamp using HOSE CLAMP PLIERS (HD-97087-65B).
3. Slide **new** clamp onto free end of carburetor fuel inlet hose. Install hose onto fuel outlet fitting at side of fuel valve. Crimp clamp.
4. Install the intake manifold vacuum hose onto the vacuum fitting at the back of the fuel valve.
5. Start fuel tank front mounting bolts (with flat washers) into left and right side of frame.
6. Install bolt (with flat washer) to secure rear of fuel tank to frame backbone. Tighten bolt to 15-20 ft-lbs (20-27 Nm).
7. Tighten fuel tank front mounting bolts to 15-20 ft-lbs (20-27 Nm).
8. Connect fuel vapor vent tube to fitting on filler neck of fuel tank.
9. Remove filler cap. Position console on canopy. Route cables from beneath console as shown in Figure 4-18. Be sure that hoses and wires are not pinched by the console during installation. Reinstall filler cap.

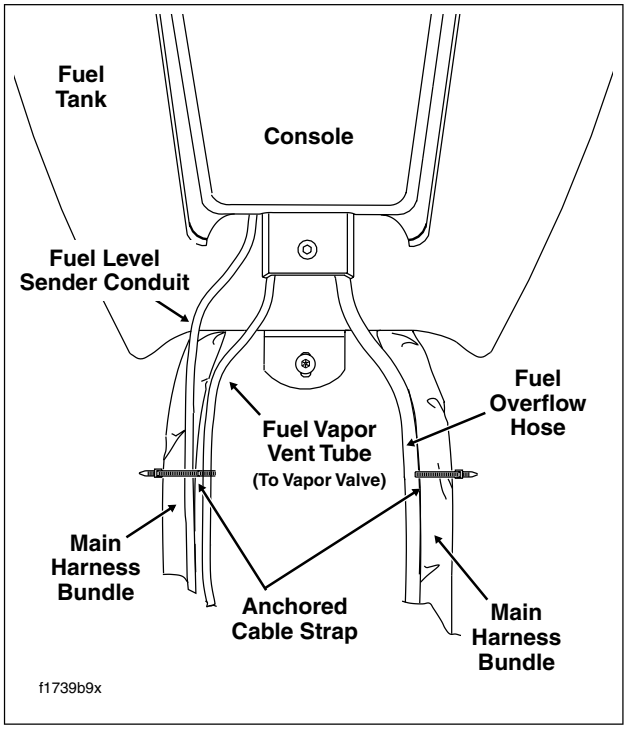


Figure 4-18. Console Cable/Hose Routing -FLHT/C, FLTR (Top View)

10. Install Allen head screw to fasten rear flange of console to clip nut on fuel tank weldment. Tighten screw to 25-30 **in-lbs** (2.8-3.4 Nm).
11. Open fuel door on console. Install two Allen head screws to secure front of console to clip nuts on canopy bracket. Alternately tighten screws to 25-30 **in-lbs** (2.8-3.4 Nm).
12. Connect the fuel level sender to the main harness. Locate the 3-place Multilock connector in front of battery and mate pin and socket halves. See Figure 4-17.
13. Snap anchor of **new** cable strap into hole on left side of frame backbone. Tighten cable strap capturing main harness bundles, fuel level sender conduit, and fuel vapor vent 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 4-18.

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 2.22 SEAT, INSTALLATION.
16. Turn the handle of the fuel valve to OFF and fill the fuel tank. Carefully inspect for leaks. Turn the valve handle to ON and start engine. Repeat inspection.
17. Stop engine and return the valve to the OFF position.

FLHR

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. Crimp clamp using HOSE CLAMP PLIERS (HD-97087-65B).
3. Slide **new** clamp onto free end of carburetor fuel inlet hose. Install hose onto fuel outlet fitting at side of fuel valve. Crimp clamp.
4. Install the intake manifold vacuum hose onto the vacuum fitting at the back of the fuel valve.
5. Start fuel tank front mounting bolts (with flat washers) into left and right side of frame.
6. Install bolt (with flat washer) to secure rear of fuel tank to frame backbone. Tighten bolt to 15-20 ft-lbs (20-27 Nm).
7. Tighten fuel tank front mounting bolts to 15-20 ft-lbs (20-27 Nm).
8. 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.
9. Connect fuel vapor vent tube to fitting at top of canopy.
10. Mate pin and socket halves of 3-place Mini-Deutsch connector to connect fuel level sender to main harness. Bend flexible clamp to capture conduit at top of 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 to 50-90 **in-lbs** (5.7-10.2 Nm). Install Phillips screw (with large flat washer) and tighten to 36-60 **in-lbs** (4.1-6.8 Nm).
13. Snap anchor of **new** cable strap into hole on left side of frame backbone. Tighten cable strap capturing main harness bundle, instrument console conduit, and fuel vapor vent 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 4-18.

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 2.22 SEAT, INSTALLATION.
16. Turn the handle of the fuel valve to OFF and fill the fuel tank. Carefully inspect for leaks. Turn the valve handle to ON and start engine. Repeat inspection.
17. Stop engine and return the valve to the OFF position.

PARTIAL REMOVAL

NOTE

For fuel injected models, see Section 9.4 FUEL TANK (FUEL INJECTED) for removal and installation instructions.

FLHT/C, FLTR

1. Remove seat. See Section 2.22 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 side of frame backbone.
4. Disconnect 3-place Multilock connector in front of battery to release fuel level sender from main harness. See Figure 4-17.
5. 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.
6. Remove Allen head screw to detach flange at rear of console from clip nut on fuel tank weldment.
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. Gently pry fuel vapor vent tube from fitting on filler neck of fuel tank. Exercise caution to avoid pulling fitting from filler neck.
9. 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. 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.

FLHR

1. Remove seat. See Section 2.22 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 bundle, instrument console conduit, and fuel vapor vent tube to left side of frame backbone.
4. Remove acorn nut and Phillips screw (with large flat washer) from instrument console.

CAUTION

When removing instrument console, exercise caution to avoid damaging speedometer unit. Wrap console in a clean, dry shop towel to prevent damage.

5. Remove console and secure to top of rear fender using bungee cords.
6. Remove console mounting bolt from slot at top of canopy.
7. Pull fuel vapor vent tube from fitting.
8. Bend back flexible clamp and then depress button on socket side of 3-place Mini-Deutsch connector to disconnect fuel level sender from main harness.
9. 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.
10. 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.
11. Raise the 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 and rest on frame backbone.
12. 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)

FLHT/C, FLTR

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. 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. 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 15-20 ft-lbs (20-27 Nm).
4. Tighten fuel tank front mounting bolts to 15-20 ft-lbs (20-27 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 4-18. 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 clip nut on fuel tank weldment. Tighten screw to 25-30 **in-lbs** (2.8-3.4 Nm).
8. Open fuel door on console. Install two Allen head screws to secure front of console to clip nuts on canopy bracket. Alternately tighten screws to 25-30 **in-lbs** (2.8-3.4 Nm).
9. Connect the fuel level sender to the main harness. Locate the 3-place Multilock connector in front of battery and mate pin and socket halves. See Figure 4-17.
10. Snap anchor of **new** cable strap into hole on left side of frame backbone. Tighten cable strap capturing main harness bundles, fuel level sender conduit, and fuel vapor vent 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 4-18.

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 2.22 SEAT, INSTALLATION.

FLHR

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. 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. 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 15-20 ft-lbs (20-27 Nm).

4. Tighten fuel tank front mounting bolts to 15-20 ft-lbs (20-27 Nm).

5. 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.

6. Connect fuel vapor vent tube to fitting at top of canopy.

7. Mate pin and socket halves of 3-place Mini-Deutsch connector to connect fuel level sender to main harness. Bend flexible clamp to capture conduit 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 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 to 50-90 **in-lbs** (5.7-10.2 Nm). Install Phillips screw (with large flat washer) and tighten to 36-60 **in-lbs** (4.1-6.8 Nm).

10. Snap anchor of **new** cable strap into hole on left side of frame backbone. Tighten cable strap capturing main harness bundle, instrument console conduit, and fuel vapor vent 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 4-18.

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 2.22 SEAT, INSTALLATION.

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 4-19.

The EVAP system functions as follows:

- The fuel vapor vent tube connected to a fitting on the filler neck (top of 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) draws the fuel vapors stored in the charcoal canister through the purge tube to the carburetor (or induction module) where they are burned as part of the normal combustion process.
- On carbureted models, 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.

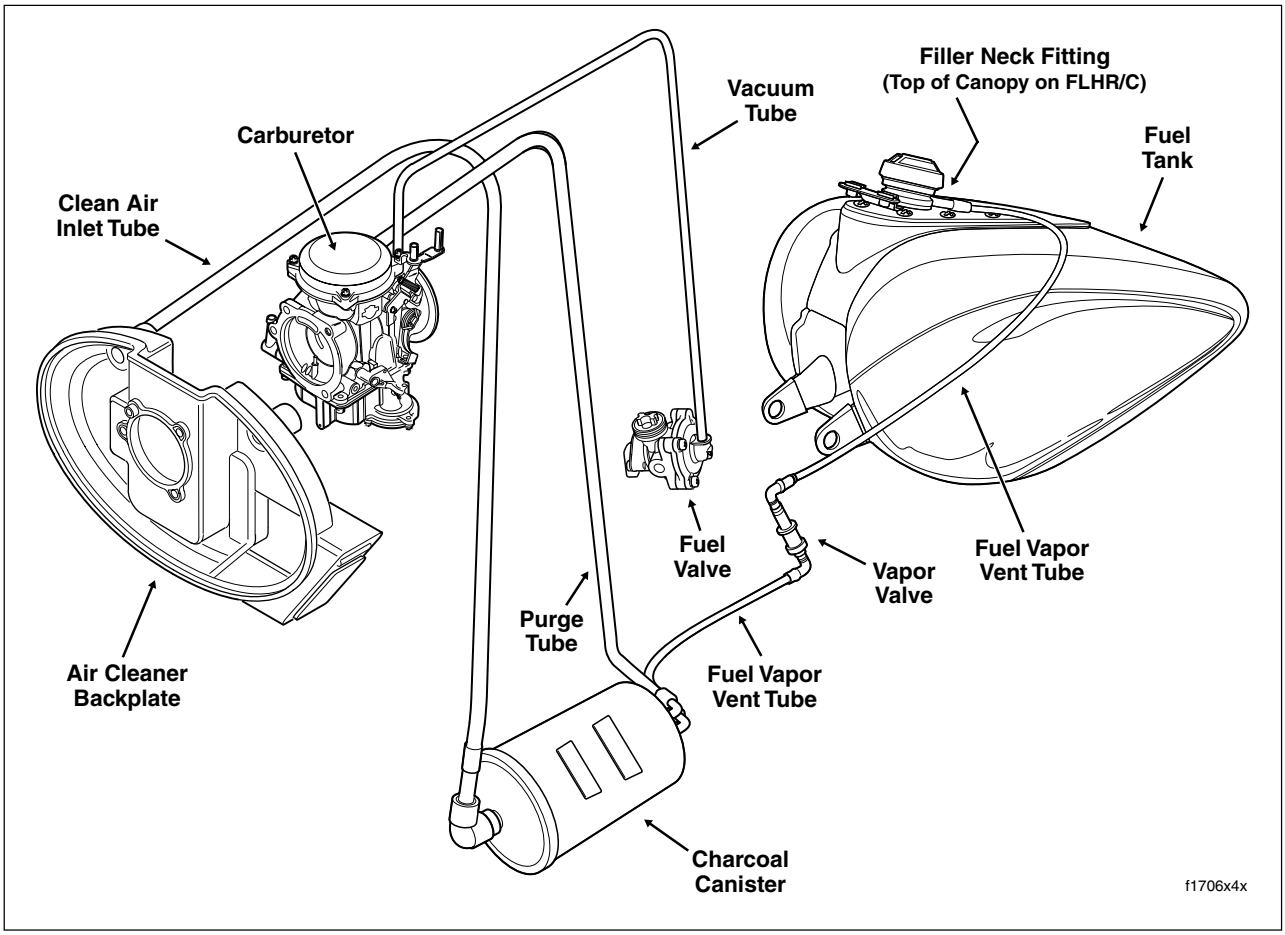


Figure 4-19. California Evaporative Emissions Control System (Carbureted Models)

⚠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 2.22 SEAT, REMOVAL.
2. Remove left side saddlebag. See Section 2.23 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 4-20.
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.

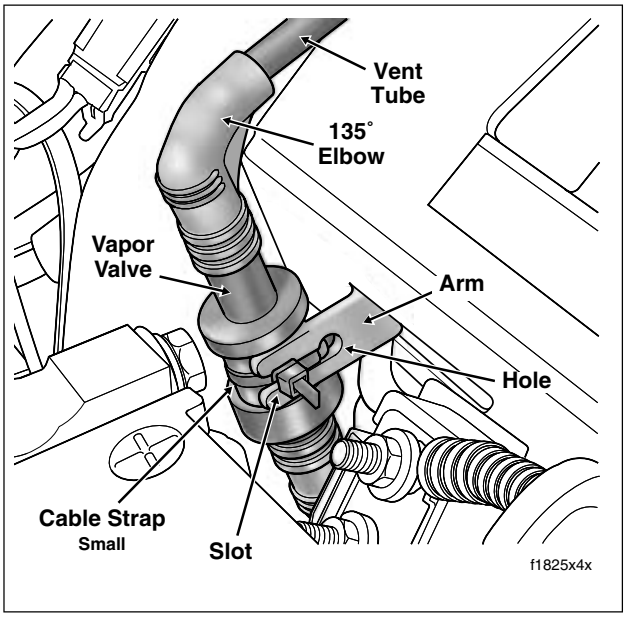


Figure 4-20. Vapor Valve Mounting Bracket

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 4-20.
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 4-22.

   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 2.23 SADDLEBAG, INSTALLATION.
8. Install seat. See Section 2.22 SEAT, INSTALLATION.

CHARCOAL CANISTER

REMOVAL

1. Remove rear fender. See Section 2.31 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. See inset of Figure 4-21.
6. Reaching in between battery box and right side frame member, pull clean air inlet tube (to air cleaner backplate on carbureted models) from fitting on right side of charcoal canister. On fuel injected models, pull 90˚ elbow connector from fitting.
7. Moving to rear left side of vehicle, 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 4-21. Reaching in between battery box and frame member, pull tubes from canister.
8. With the handle of a rubber mallet, rap canister 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) to lock position of canister. See inset of Figure 4-21.
2. Attach tubes to fittings on left side of canister. Install the purge tube to the carburetor (or induction module) onto the top fitting stamped “CARB.” Install the fuel vapor vent tube from the fuel tank (via the vapor valve) to the bottom fitting stamped “TANK.”

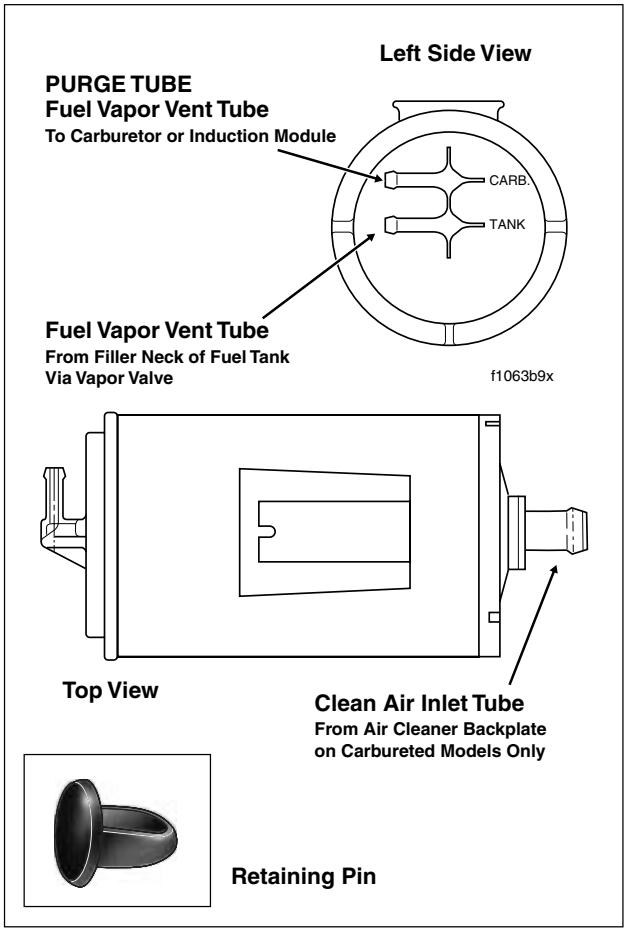


Figure 4-21. Charcoal Canister

3. Moving to rear right side of vehicle, attach clean air inlet tube (to air cleaner backplate on carbureted models) to fitting on right side of canister. On fuel injected models, install 90˚ elbow connector with the free end pointing down.

NOTE

The clean air inlet tube is absent on fuel injected models.

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).

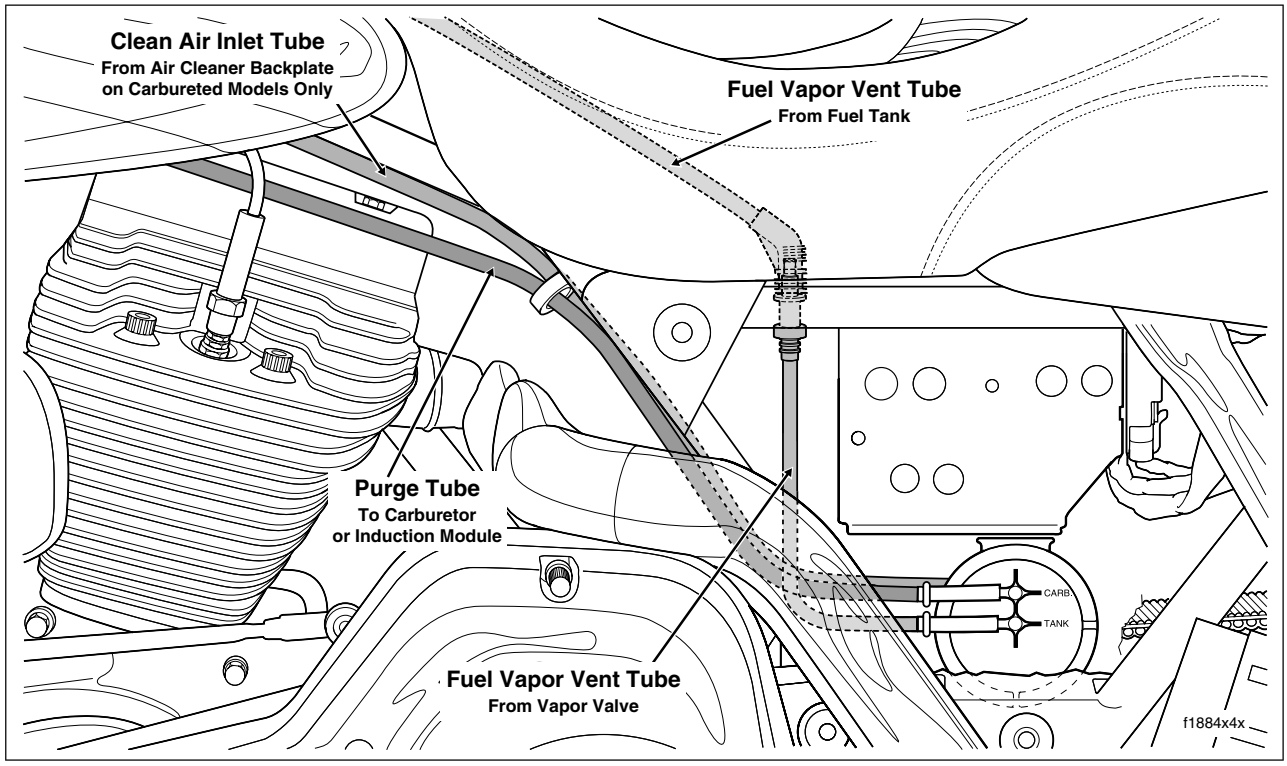


Figure 4-22. Charcoal Canister Tube/Hose Routing (Left Side View)

7. Rotate 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).
8. Install rear fender. See Section 2.31 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 (or induction module). See Figure 4-22.

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 (top of 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).

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NOTE

See the 2003 ELECTRICAL DIAGNOSTIC MANUAL (Part No. 99497-03) for all SYSTEM DIAGNOSIS and ELECTRICAL TROUBLESHOOTING information.

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	84-108 **in-lbs**	9.5-12.2 Nm
Starter jackshaft bolt	84-108 **in-lbs**	9.5-12.2 Nm
Solenoid terminal nut	70-90 **in-lbs**	7.9-10.2 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.

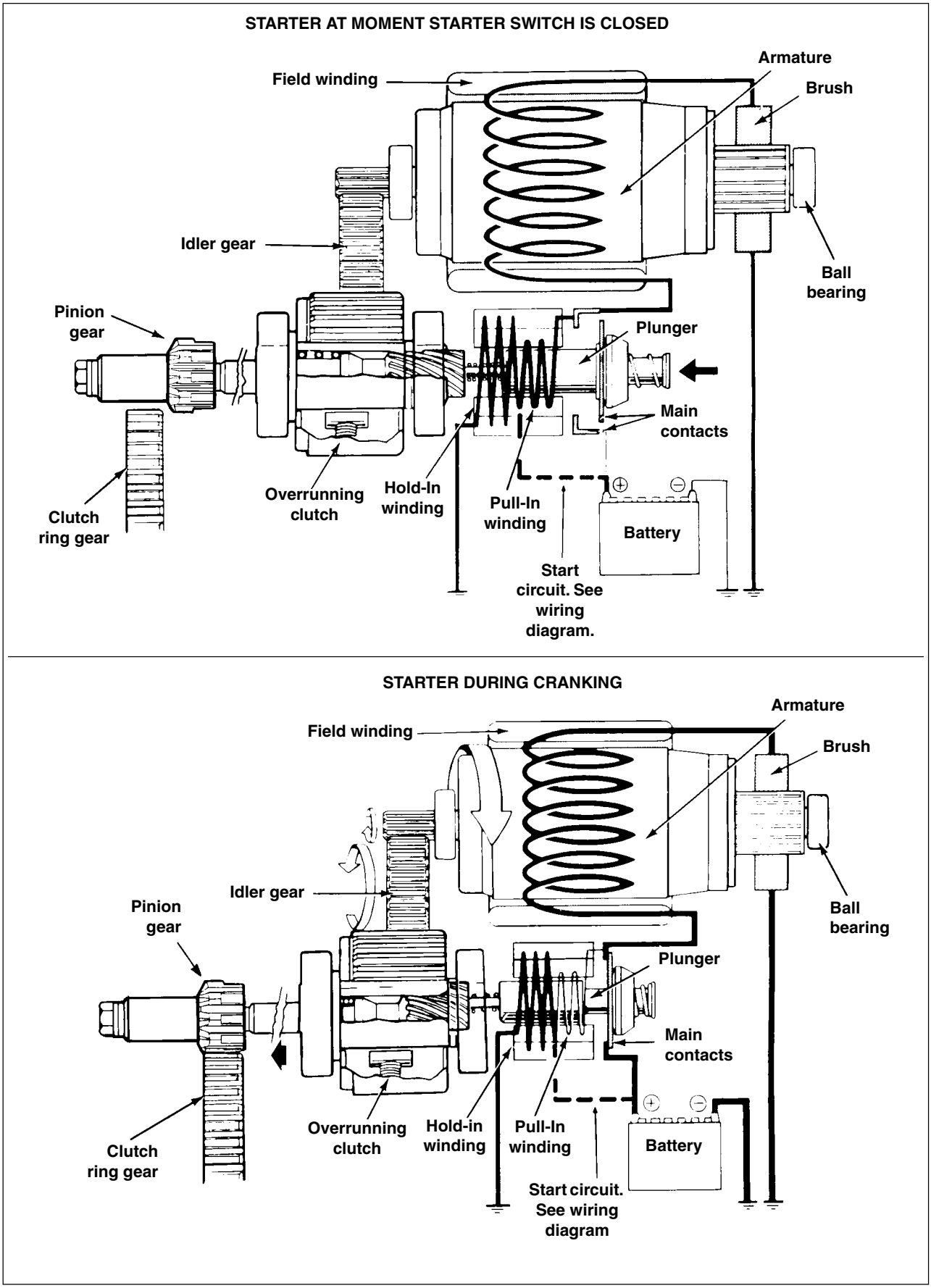


Figure 5-1. Starter Operation

STARTER RELAY 5.3

REMOVAL

FLHR/C

1. Remove left side saddlebag. See Section 2.23 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 rear fuse block. See upper frame of Figure 5-2.

FLTR, FLHT/C/U

1. Remove seat. See Section 2.22 SEAT, REMOVAL.
2. Locate the starter relay installed in cavity of frame crossmember at rear of battery box. See lower frame of Figure 5-2.
3. Place a finger on the rubber molding to hold it in position, and using a needle nose pliers, carefully pull on tab to release starter relay. Since the position of the relays may be reversed, starter relay can be positively identified by heavy gauge Green wire.
4. Remove harness connector from bottom of relay.

INSTALLATION

FLHR/C

1. Install **new** relay in rear 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 2.23 SADDLEBAG, INSTALLATION.

FLTR, FLHT/C/U

1. Install harness connector at bottom of **new** relay.

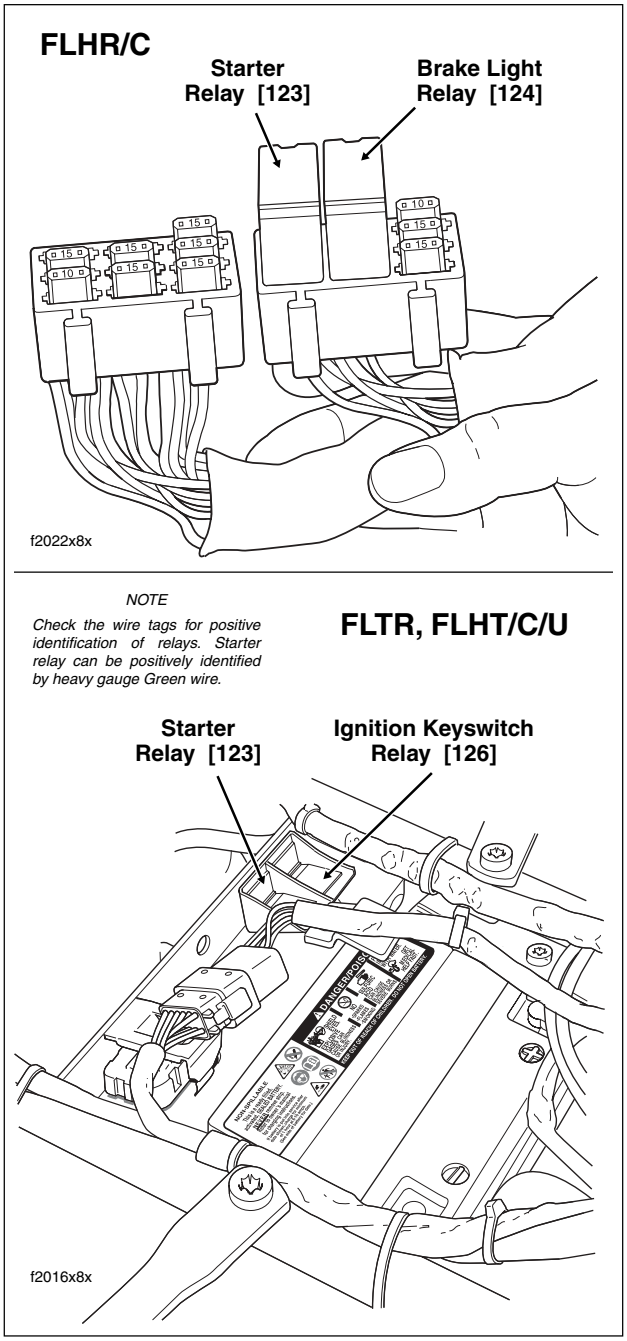


Figure 5-2. Locate Starter Relay

2. Place a finger on the molding to hold it in position and push on relay until seated in cavity of frame crossmember.
3. Install seat. See Section 2.22 SEAT, INSTALLATION.

STARTER 5.4

REMOVAL

1. Remove seat. See Section 2.22 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 chassis ground cable ring terminal. Remove Keps nut from stud of bracket tab and remove exhaust support bracket.
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 decorative chrome cover 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

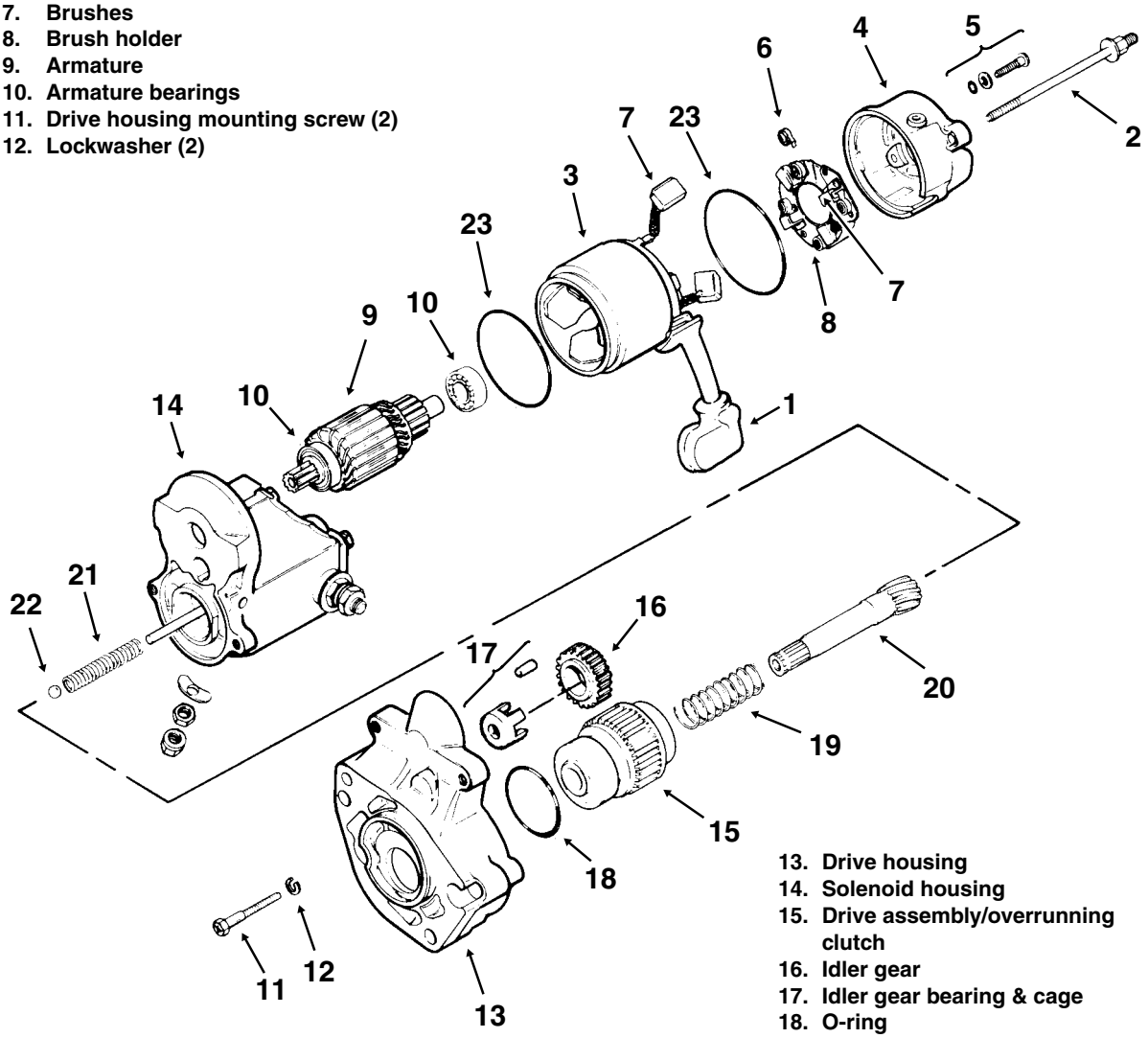
1. Inspect the retaining ring within the output shaft coupling for damage or distortion. Replace as necessary. With the counterbore on the outboard side, install the coupling on the starter motor output shaft, if removed.
2. From right side of vehicle, place starter in its installed position. Install slot of exhaust support bracket onto stud of bracket tab aligning other holes with those in starter flange. Start Keps nut on stud.
3. Engaging hole in exhaust support bracket, install starter front mounting screw with lockwasher. Slide chassis ground cable ring terminal onto rear mounting screw (with lockwasher) and install in the same manner.
4. Alternately tighten starter front and rear mounting screws to 13-20 ft-lbs (18-27 Nm). Tighten Keps nut on stud of bracket tab.
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 84-108 **in-lbs** (9-12 Nm).
7. Snap solenoid connector to terminal at top of starter housing.

NOTE

If removed, install allen screw to fasten decorative chrome cover to starter.

8. Slide lockplate and **new** 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 84-108 **in-lbs** (9.5-12.2 Nm). 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.

1. Field wire
2. Thru-bolt (2)
3. Field coil
4. End cap
5. End cap screw (2)
6. Brush spring (4)
7. Brushes
8. Brush holder
9. Armature
10. Armature bearings
11. Drive housing mounting screw (2)
12. Lockwasher (2)



13. Drive housing
14. Solenoid housing
15. Drive assembly/overrunning clutch
16. Idler gear
17. Idler gear bearing & cage
18. O-ring
19. Spring
20. Shaft
21. Return spring
22. Ball
23. O-ring (2)

Figure 5-3. Starter

14. Start engine and carefully check for leaks around oil filler spout.
15. Install seat. See Section 2.22 SEAT, INSTALLATION.

DISASSEMBLY, TESTING AND REPAIR

1. See Figures 5-3 and 5-4. Disconnect field wire (1).

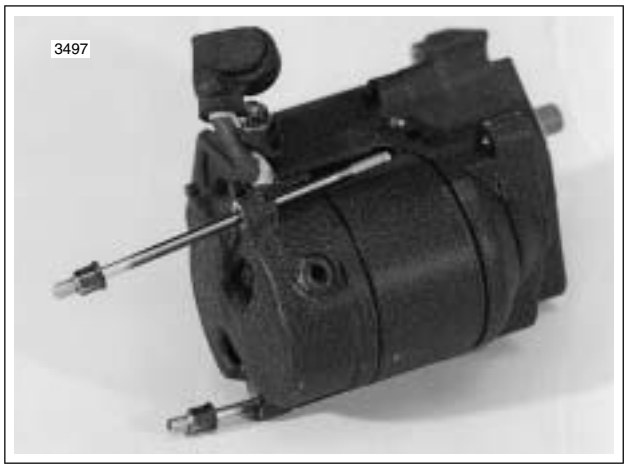


Figure 5-4. Remove Thru-Bolts

2. See Figures 5-3 and 5-5. Remove thru-bolts (2). Remove field coil (3) and end 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 Cap Screws and O-Rings

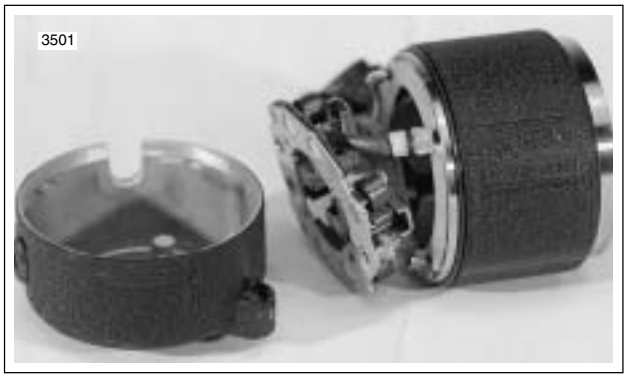


Figure 5-7. Remove End Cap

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

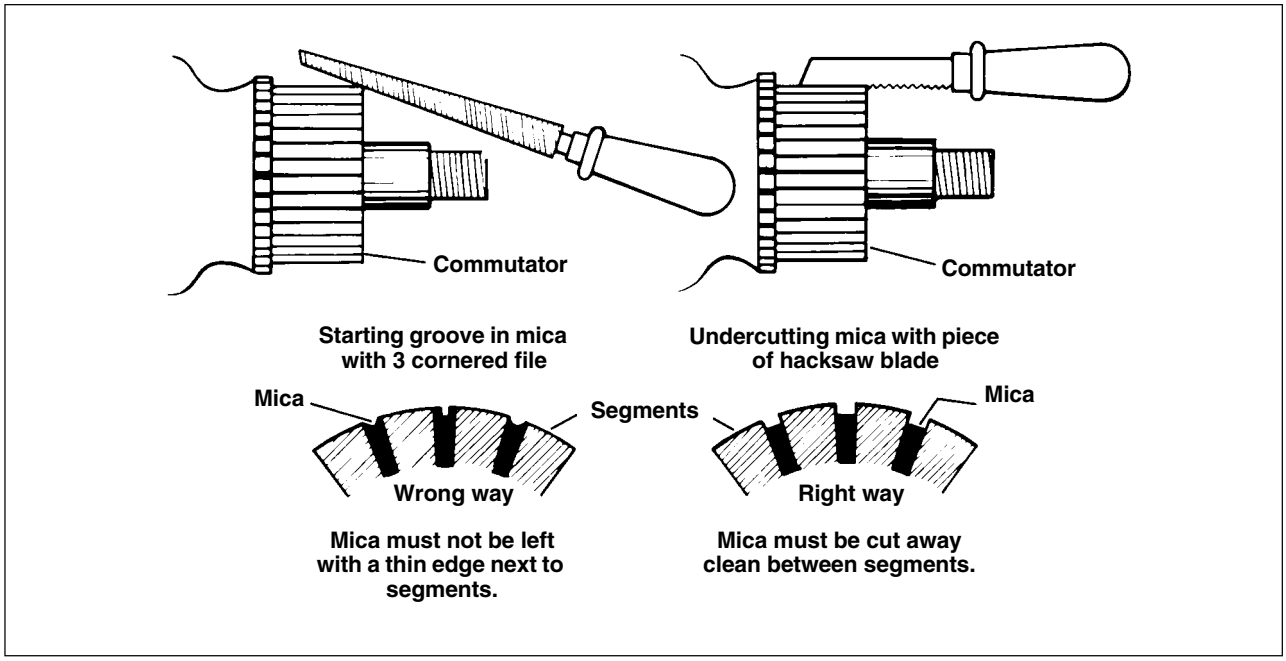


Figure 5-9. Undercutting the Mica Separators

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.

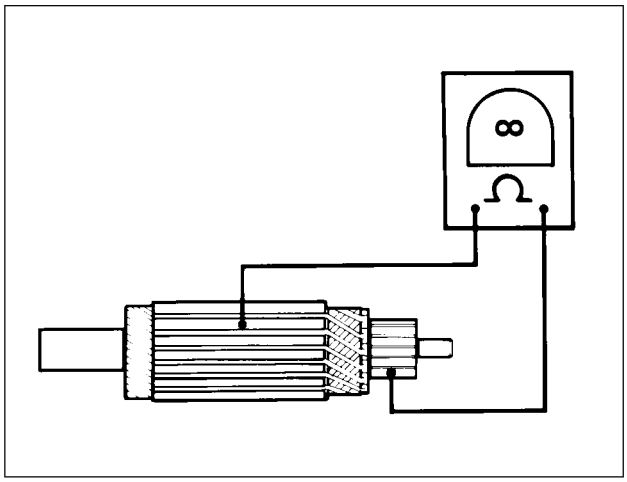


Figure 5-11. Grounded Armature Test

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.

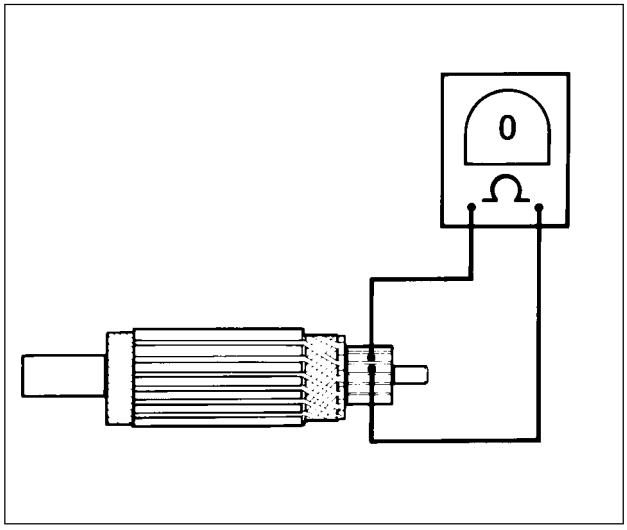


Figure 5-12. Armature Open Test

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.

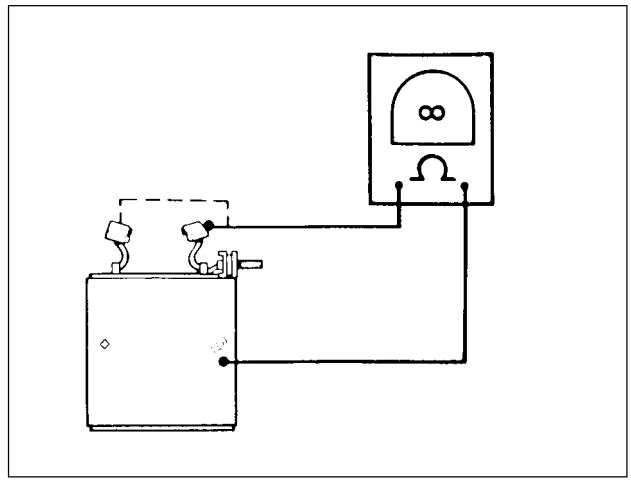


Figure 5-13. Grounded Field Test

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.

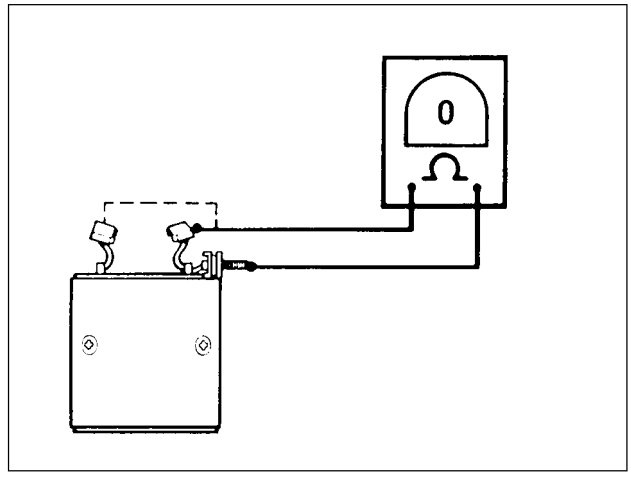


Figure 5-14. Open Field Test

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.

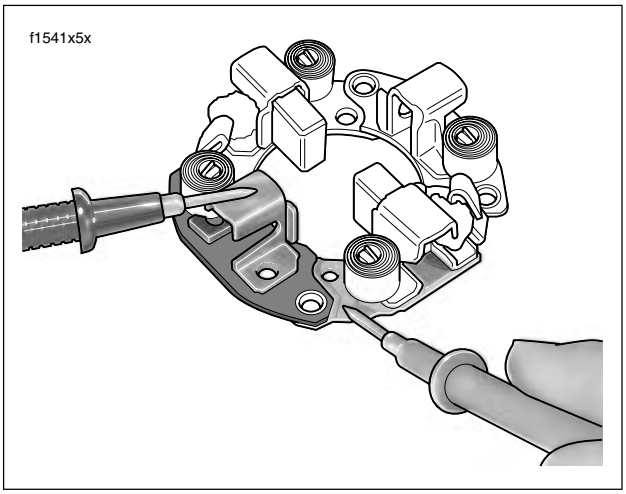


Figure 5-15. Brush Holder Insulation Test

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.

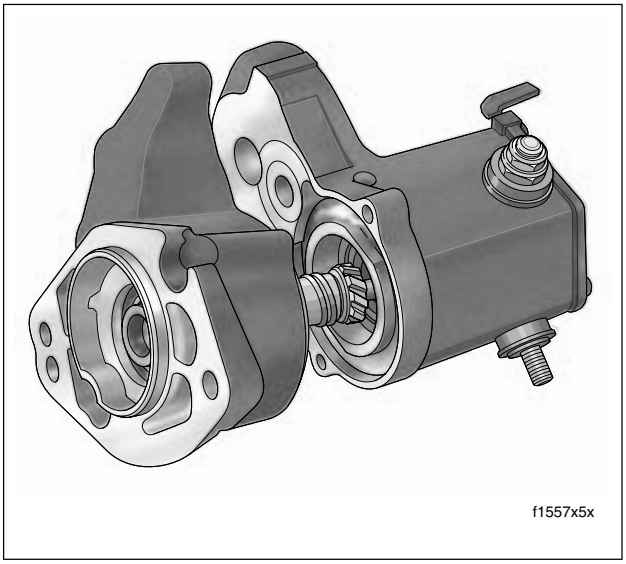


Figure 5-16. Remove Drive Housing

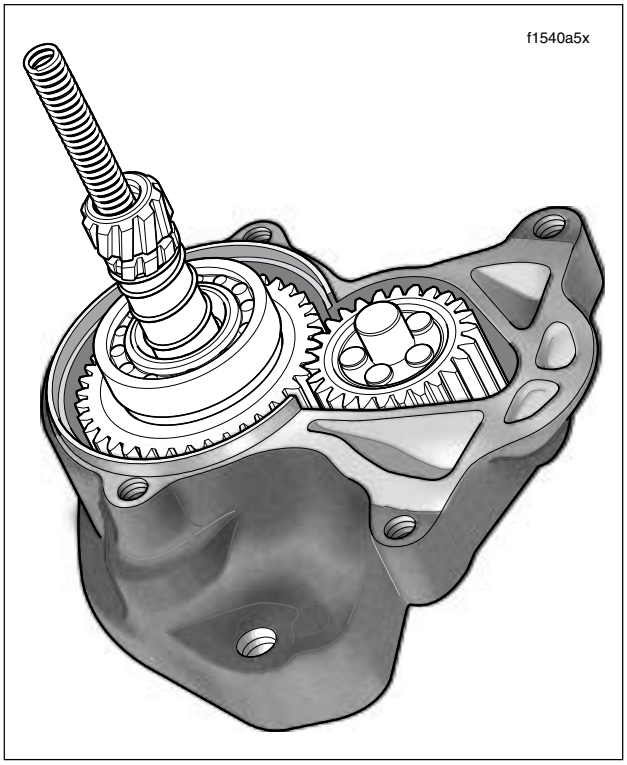


Figure 5-17. Drive Housing Assembly



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 cap (4) with screws (5).
8. Install thru-bolts (2).
9. Connect field wire (1) to solenoid terminal. Tighten solenoid terminal nut to 70-90 **in-lbs** (7.9-10.2 Nm).

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.

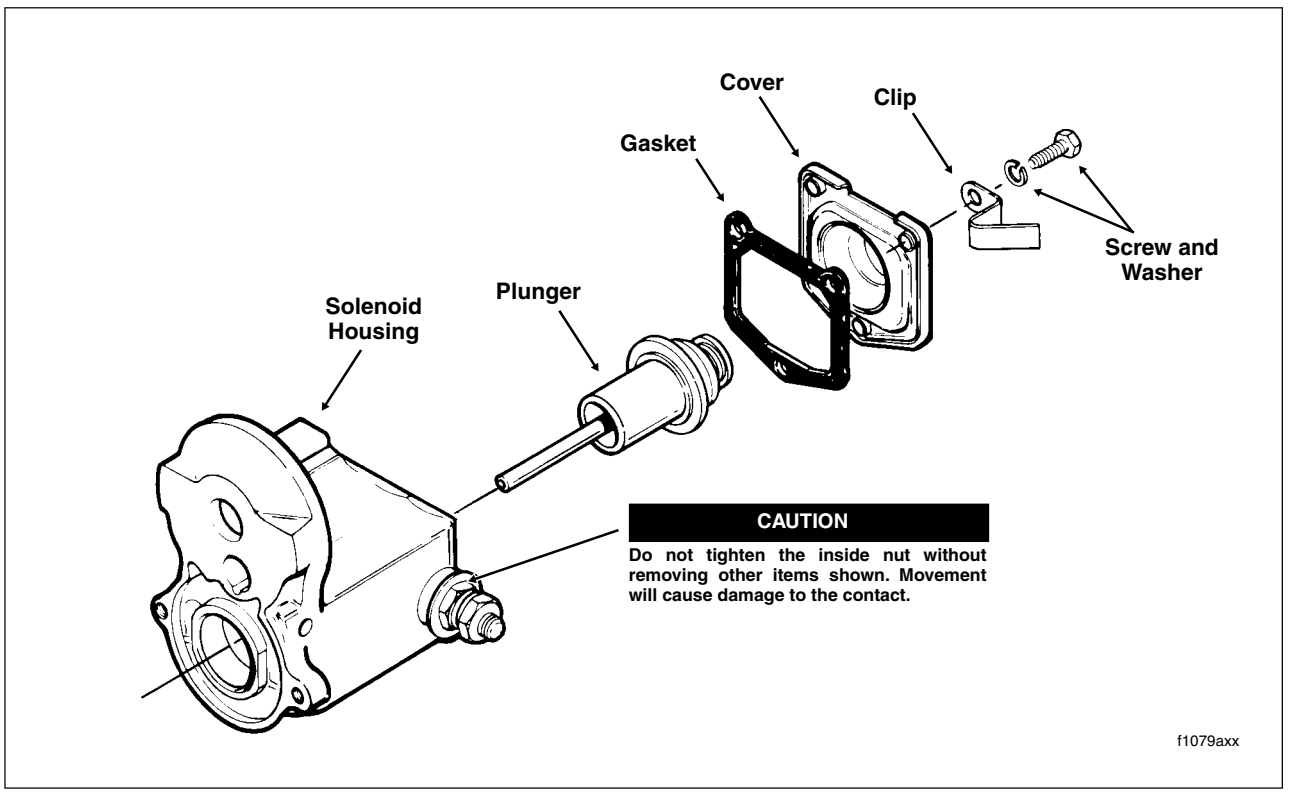


Figure 5-19. Starter Solenoid

STARTER JACKSHAFT 5.6

REMOVAL/DISASSEMBLY

1. Remove seat. See Section 2.22 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.

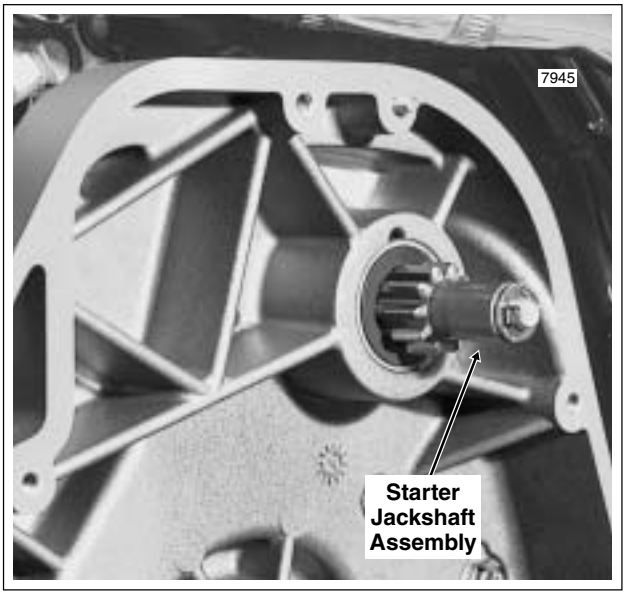


Figure 5-20. Primary Chaincase

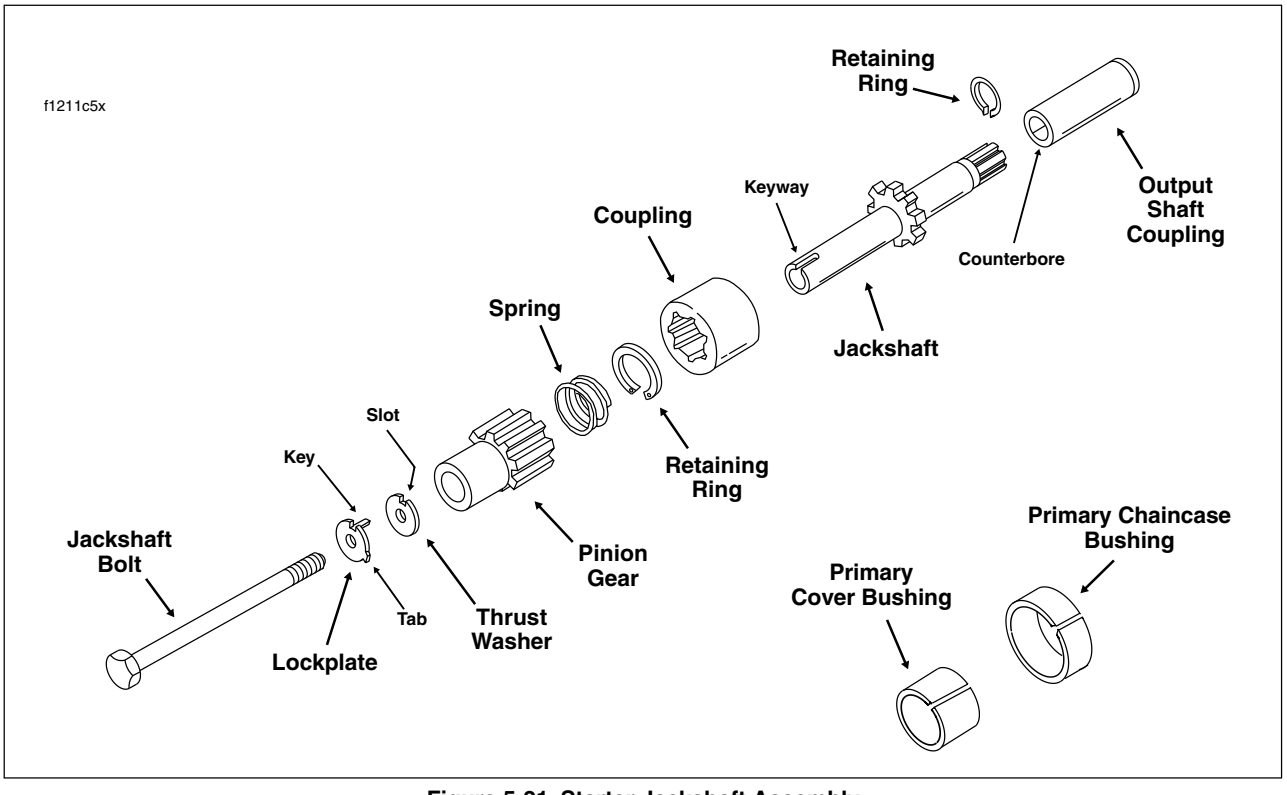


Figure 5-21. Starter Jackshaft Assembly

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 chassis ground cable ring terminal. Remove Keps nut from stud of bracket tab and remove exhaust support bracket.
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 decorative chrome cover 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. From right side of vehicle, place starter in its installed position. Install slot of exhaust support bracket onto stud of bracket tab aligning other holes with those in starter flange. Start Keps nut on stud.
3. Engaging hole in exhaust support bracket, install starter front mounting screw with lockwasher. Slide chassis ground cable ring terminal onto rear mounting screw (with lockwasher) and install in the same manner.
4. Alternately tighten starter front and rear mounting screws to 13-20 ft-lbs (18-27 Nm). Tighten Keps nut on stud of bracket tab.
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.

NOTE

If removed, install allen screw to fasten decorative chrome cover to starter.

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 **new** 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 84-108 **in-lbs** (9-12 Nm). 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 2.22 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	All Models
1	10.11
2	6.96
3	4.95
4	3.86
5	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 Lubricant

Amount	**Ounces**	**Milliliters**
	32	946
Part Number	**Quart**	**Gallon**
	99887-84	99886-84

Rear Belt Adjustment

Deflection	Inches	Millimeters
On Ground Without Rider	5/16 - 3/8 at 10 lbs force	7.9 - 9.5 at 4.5 kg force
On Ground With Rider*	1/4 - 5/16 at 10 lbs force	6.4 - 7.9 at 4.5 kg force

*11.5 Inches Between Shock Eyelets

SPROCKETS

Number of Teeth	
Sprocket	**All Models**
Engine	25
Clutch	36
Transmission	32
Rear wheel	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 Nm
Tensioner shoe adjuster plate screws	12-14 ft-lbs	16-19 Nm
Primary chain inspection cover screws	84-108 **in-lbs**	10-12 Nm
Clutch adjuster screw locknut	72-120 **in-lbs**	8-14 Nm
Clutch inspection cover screws	84-108 **in-lbs**	10-12 Nm
Clutch diaphragm spring retainer to clutch hub bolts	90-110 **in-lbs**	10-12 Nm
Rear axle cone nut	95-105 ft-lbs	129-142 Nm
Rear swingarm pivot shaft locknut	40-45 ft-lbs	54-61 Nm
Rear swingarm bracket bolts	34-42 ft-lbs	46-57 Nm

Continued ...

TORQUE VALUES (CONT.'D)

Item		ft/in-lbs	Nm
Shock bottom mounting bolt		35-40 ft-lbs	47-54 Nm
Exhaust pipe TORCA clamps		45-60 ft-lbs	61-81 Nm
Heat shield worm drive clamp screws		20-40 **in-lbs**	2.3-4.5 Nm
Transmission mainshaft sprocket nut		60 ft-lbs, then 35° to 45°	81 Nm, then 35° to 45°
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 Nm
Starter jackshaft bolt		84-108 **in-lbs**	9-12 Nm
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		84-108 **in-lbs**	9-12 Nm
Passenger footboard socket screws		15-18 ft-lbs	20-24 Nm
Shifter lever socket screws	1/4"	90-110 **in-lbs**	10.2-12.4 Nm
	5/16"	18-22 ft-lbs	24-30 Nm

PRIMARY CHAIN ADJUSTMENT

Check the primary chain tension after the first 1000 miles (1,600 km) and then every 5000 miles (8,000 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 adjust 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.

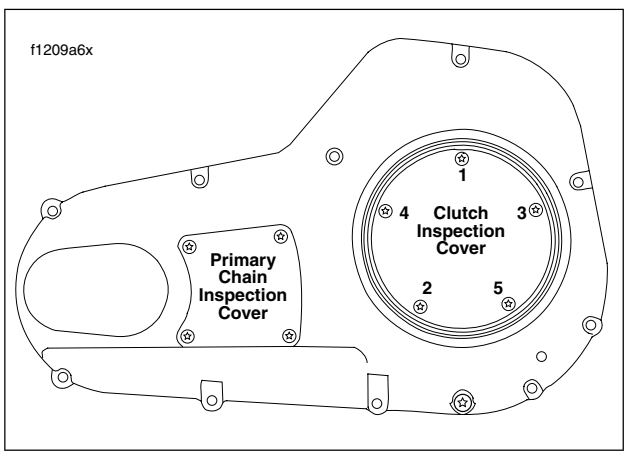


Figure 6-1. Primary Chaincase Cover

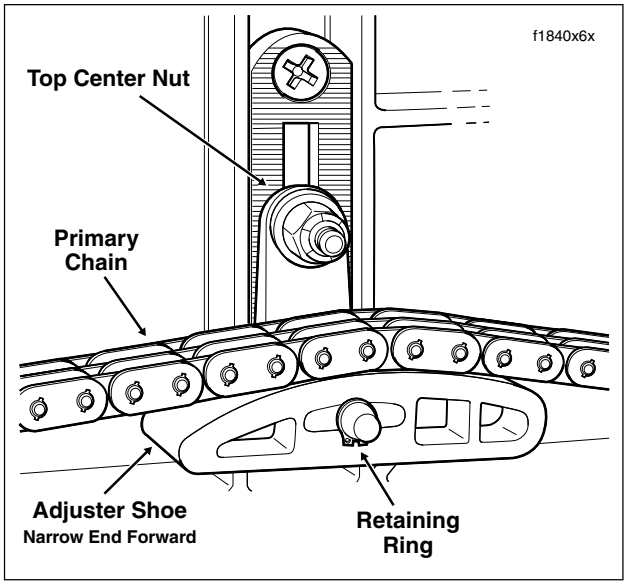


Figure 6-2. Chain Tensioner Assembly

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

CAUTION

Always keep the primary chain properly adjusted. Allowing the chain to run too tight or too loose will result in excessive chain and sprocket wear.

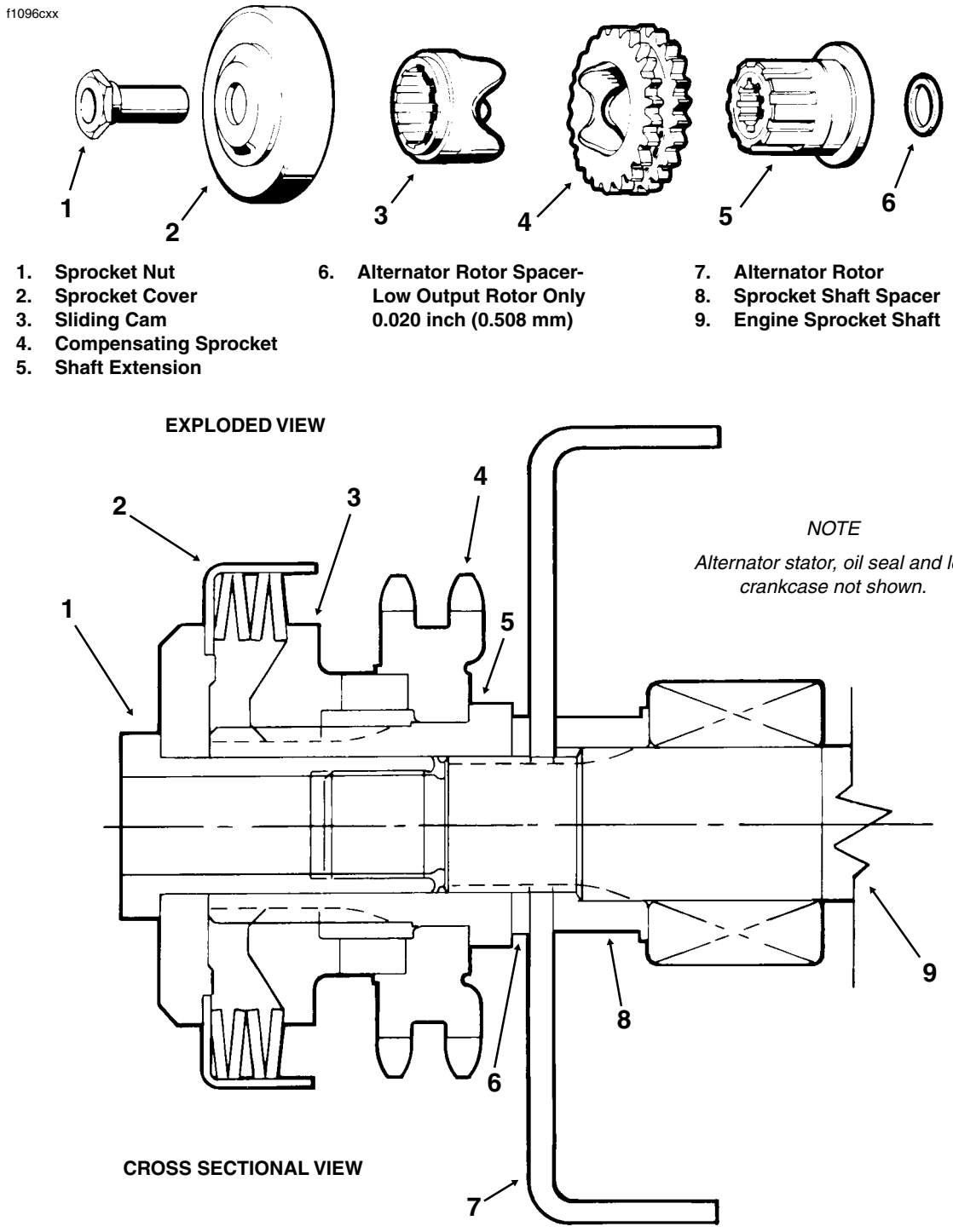
   c. Tighten the top center nut of the chain tensioner assembly to 21-29 ft-lbs (29-39 Nm).

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 84-108 **in-lbs** (10-12 Nm) 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.



1. Sprocket Nut
2. Sprocket Cover
3. Sliding Cam
4. Compensating Sprocket
5. Shaft Extension
6. Alternator Rotor Spacer-Low Output Rotor Only 0.020 inch (0.508 mm)
7. Alternator Rotor
8. Sprocket Shaft Spacer
9. Engine Sprocket Shaft

Figure 6-3. Engine 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 Nm).
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.

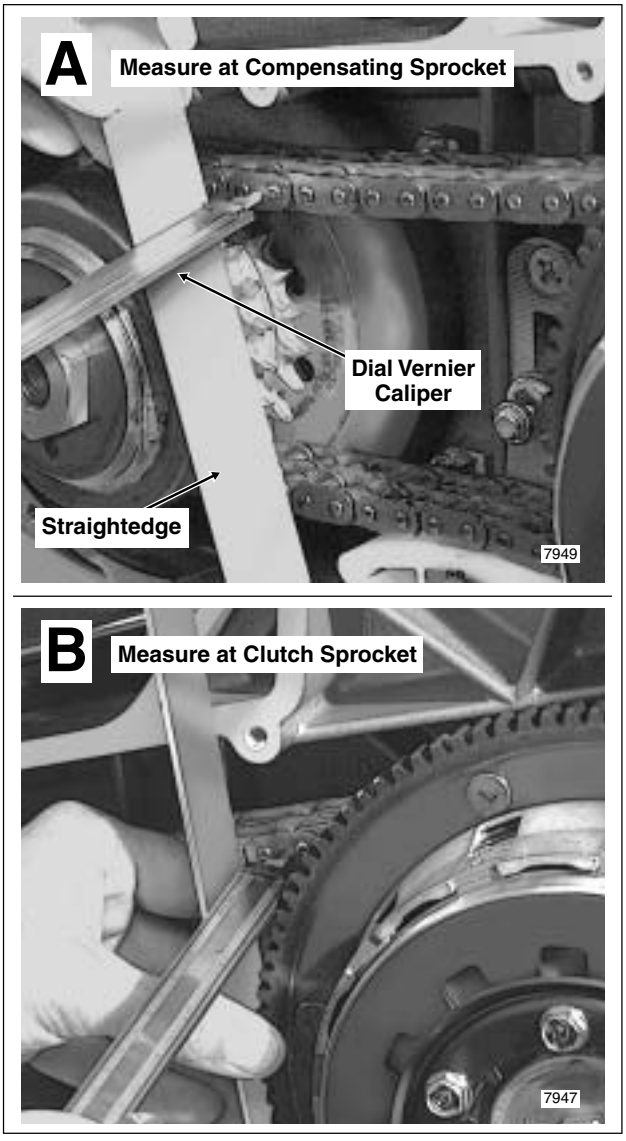


Figure 6-4. Check Sprocket Alignment

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 (1,600 km) and then every 5000 miles (8,000 km) thereafter.

NOTE

Perform adjustment procedure whenever clutch components are replaced. Repeat adjustment after first 500 miles (800 km) of use.

1. Stand vehicle upright and level.

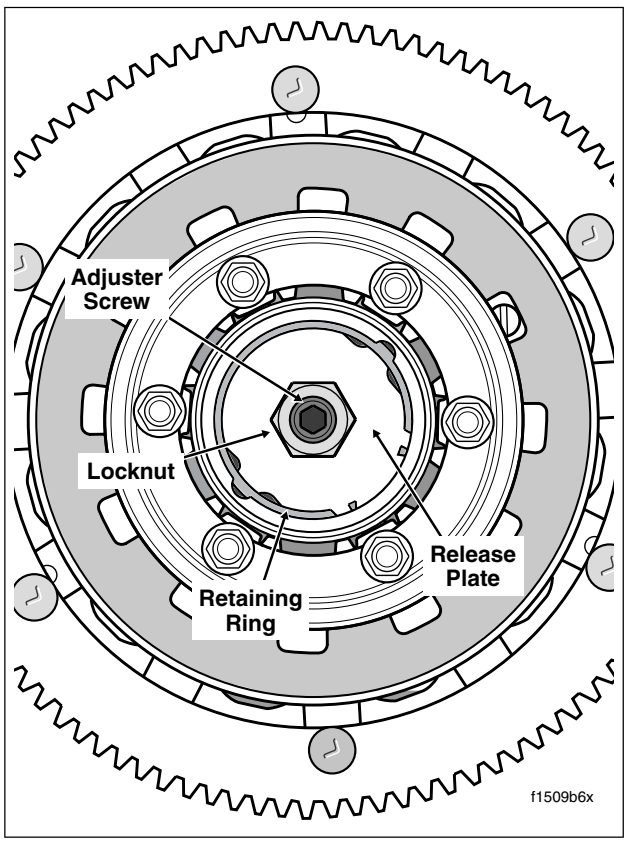


Figure 6-5. Clutch Adjustment

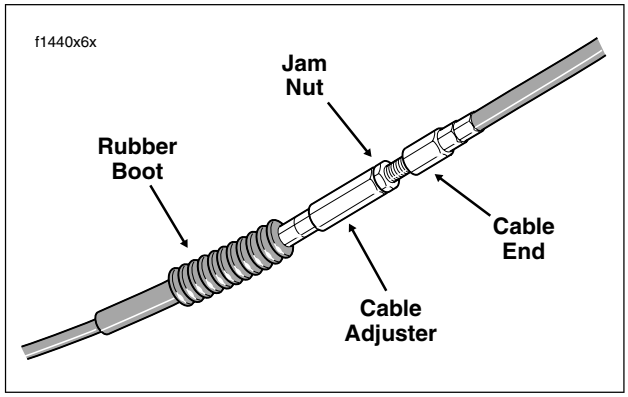


Figure 6-6. Clutch Cable Adjuster Mechanism

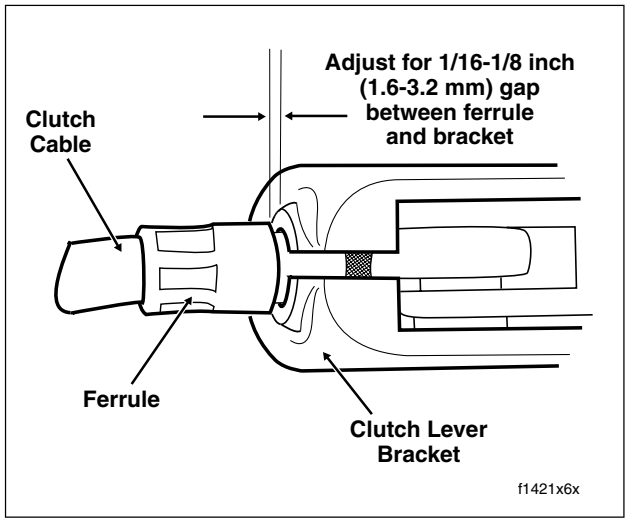


Figure 6-7. Adjust Clutch Free Play

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 72-120 **in-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 quad ring from groove in primary chaincase cover. Wipe all lubricant from the quad ring and inspect for cuts, tears or signs of deterioration. Replace as necessary.
10. Swab all lubricant from the quad ring groove. Install quad ring in primary chaincase cover with the nubs contacting the ring groove walls.

NOTE

If lubricant is not thoroughly removed from both the quad ring and groove, compression of the 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 84-108 **in-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.

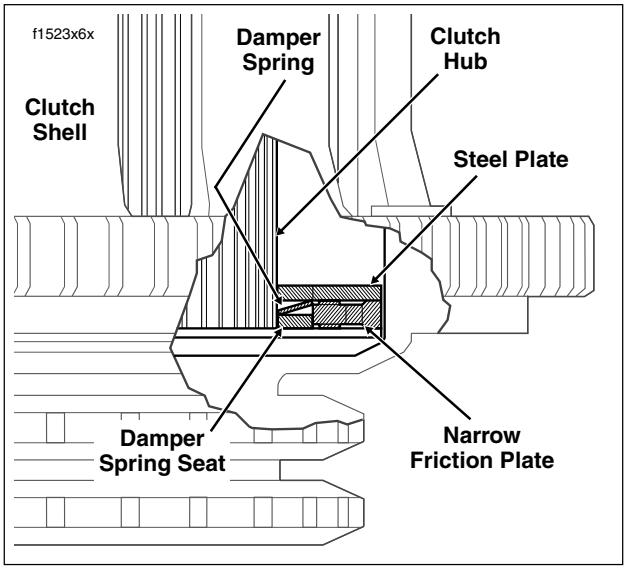


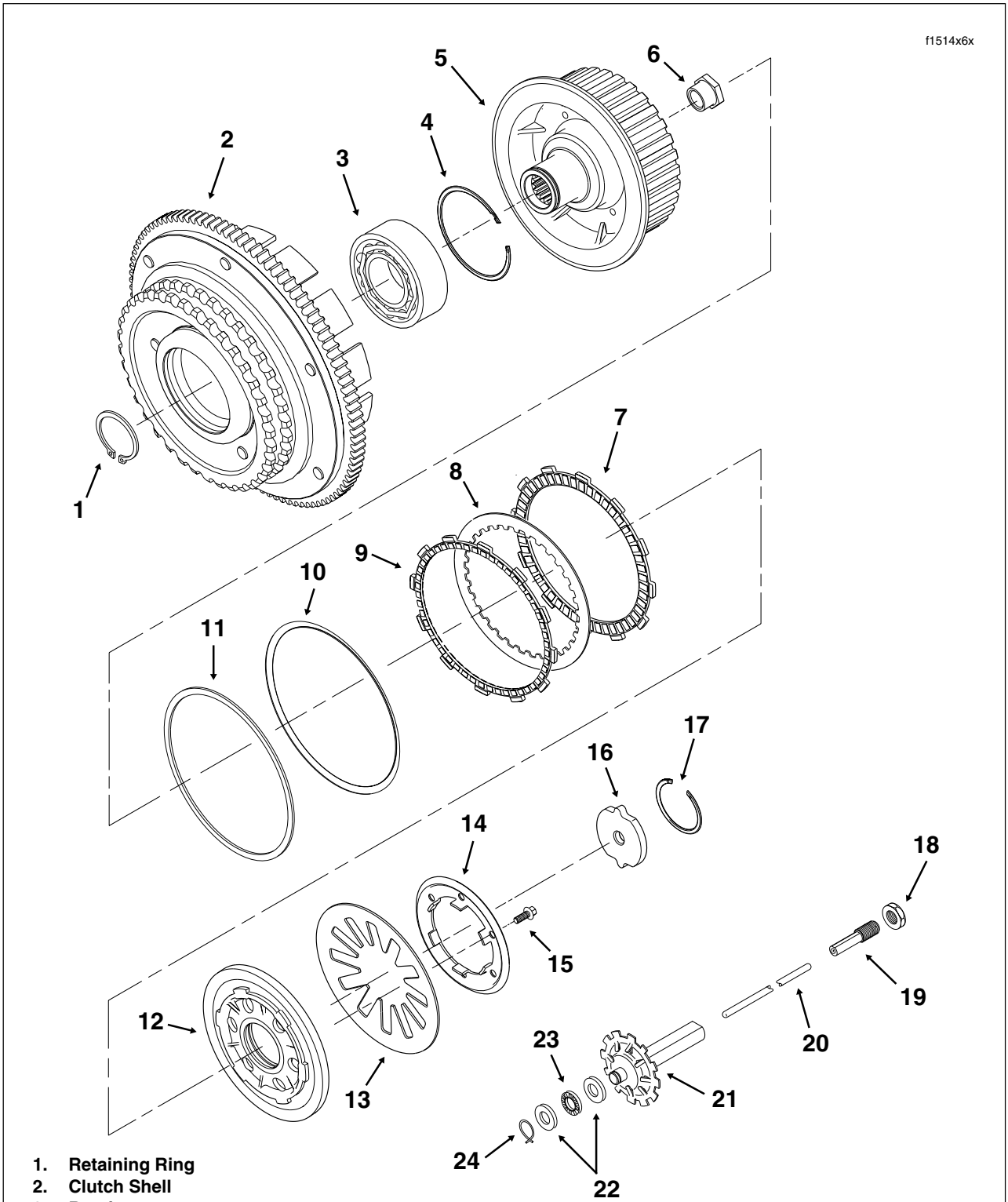
Figure 6-8. Clutch Pack Stack-Up (Cut-Away View)

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. Submerge and soak all friction and steel plates in PRIMARY CHAINCASE LUBRICANT for at least five minutes.
2. Install the narrow friction plate on the clutch hub engaging tabs on plate with slots in clutch shell.
3. Install damper spring seat on clutch hub so that it seats inboard of narrow friction plate.
4. Install damper spring on clutch hub with the concave side up (facing opposite damper spring seat). See Figure 6-8.
5. 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.
6. Install pressure plate on clutch hub aligning holes in plate with threaded bosses on hub.
7. Seat diaphragm spring in recess of pressure plate with the concave side down.
8. Align holes in diaphragm spring retainer with threaded bosses on clutch hub. Tabs on spring retainer contact flats on inboard side of bosses.
9. Install six bolts to secure diaphragm spring retainer to clutch hub. Alternately tighten bolts to 90-110 **in-lbs** (10.2-12.4 Nm).
10. 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

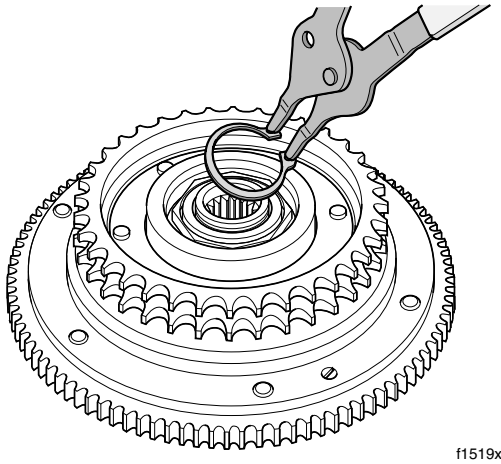
1. Wash all parts in cleaning solvent, except for friction plates and bearing, if removed. Blow dry with compressed air.
2. Check **friction plates** as follows:
   - Wipe all lubricant from the friction plates. Measure the thickness of each plate with a dial caliper or micrometer. If the thickness of 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.

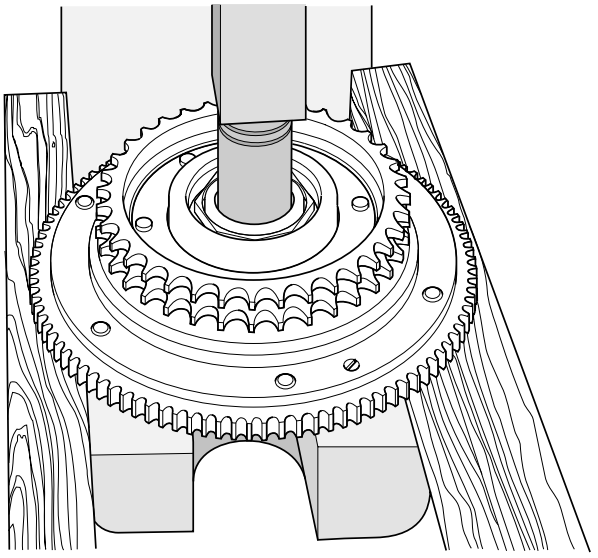
3. Check **steel plates** as follows:
   - Discard any plate that is grooved or bluish in color. Blue plates are likely warped or distorted.
   - Check each plate for distortion. Lay the plate on a precision flat surface. Insert a feeler gauge between the plate and the flat surface in several places. 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

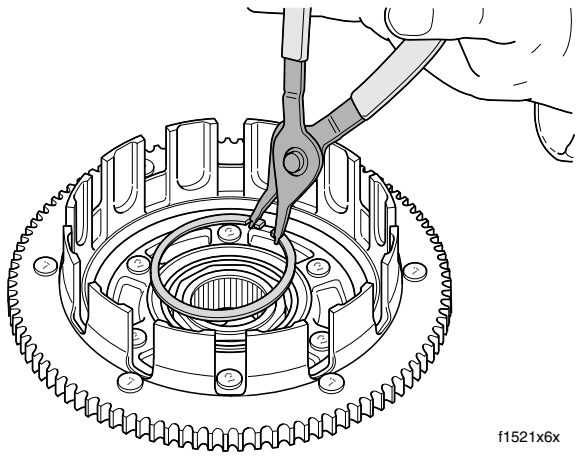
CLUTCH PACK AND BEARING

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

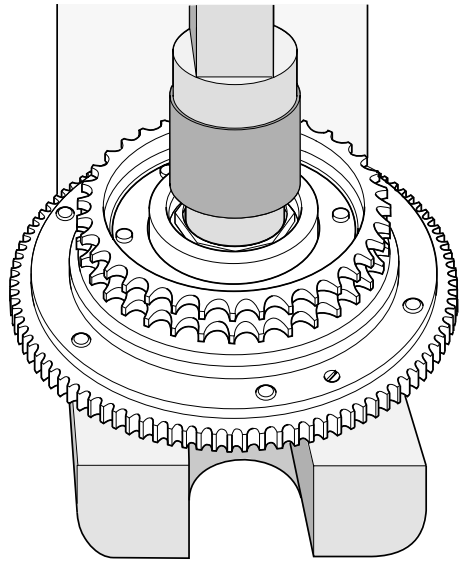
To avoid possible bearing damage, do not disassemble the clutch shell and hub assembly unless the bearing, hub or shell require replacement. Replace the bearing if disassembled.

Remove retaining ring from clutch shell.



f1521x6x

Press bearing from clutch shell.



f1520x6x

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. Submerge and soak all friction and steel plates in PRIMARY CHAINCASE LUBRICANT for at least five 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.

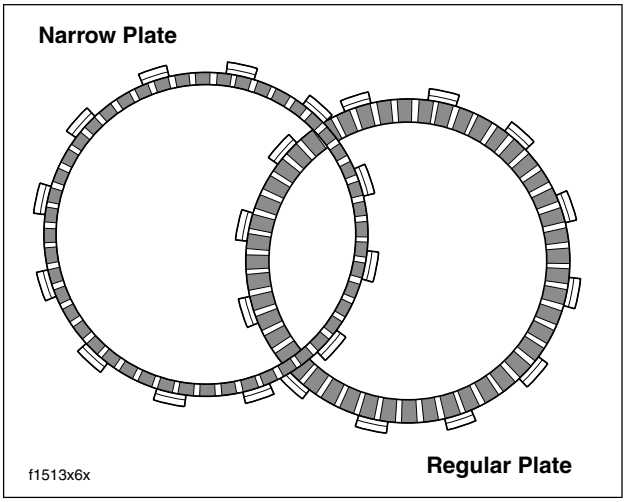


Figure 6-12. Friction Plates

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

1. Remove left side saddlebag. See Section 2.23 SADDLEBAG, REMOVAL.
2. Check deflection at the tightest spot in the belt with the transmission in neutral and the motorcycle cold. 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. See Figure 6-13. Belt deflection should be within the range specified in Table 6-3.

Table 6-3. Belt Deflection on the Ground

Orientation	Inches	Millimeters
On Ground Without Rider	5/16 - 3/8	7.9 - 9.5
On Ground With Rider 11.5 inches (292 mm) Between Shock Eyelets	1/4 - 5/16	6.4 - 7.9

If belt deflection is within specification, install left side saddlebag. If adjustment is necessary, proceed to step 3.

3. Remove right side saddlebag. See Section 2.23 SADDLEBAG, REMOVAL.
4. Remove right side muffler as follows:
   a. Open worm drive clamps to remove heat shield from rear header pipe in front of muffler.
   b. Using a bungee cord, tie the muffler to the lower saddlebag support rail.

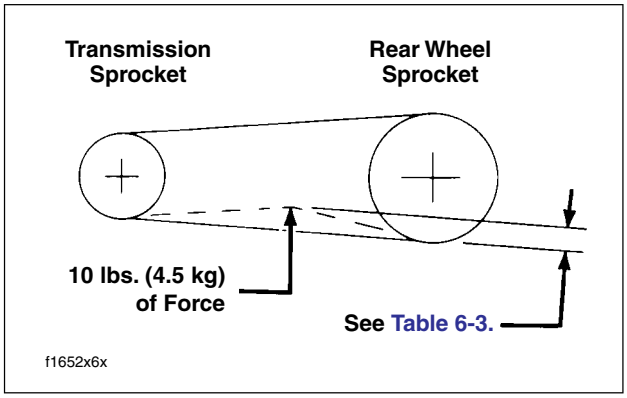


Figure 6-13. Check and Adjust Belt Deflection

   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.
5. Standing on right side of vehicle, remove E-clip from groove at end of axle. Loosen cone nut, and then snug to 15-20 ft-lbs (20-27 Nm). See Figure 6-14.
6. If belt is too tight, move to step 7 to increase belt deflection. If belt is too loose, reduce belt deflection as described below:

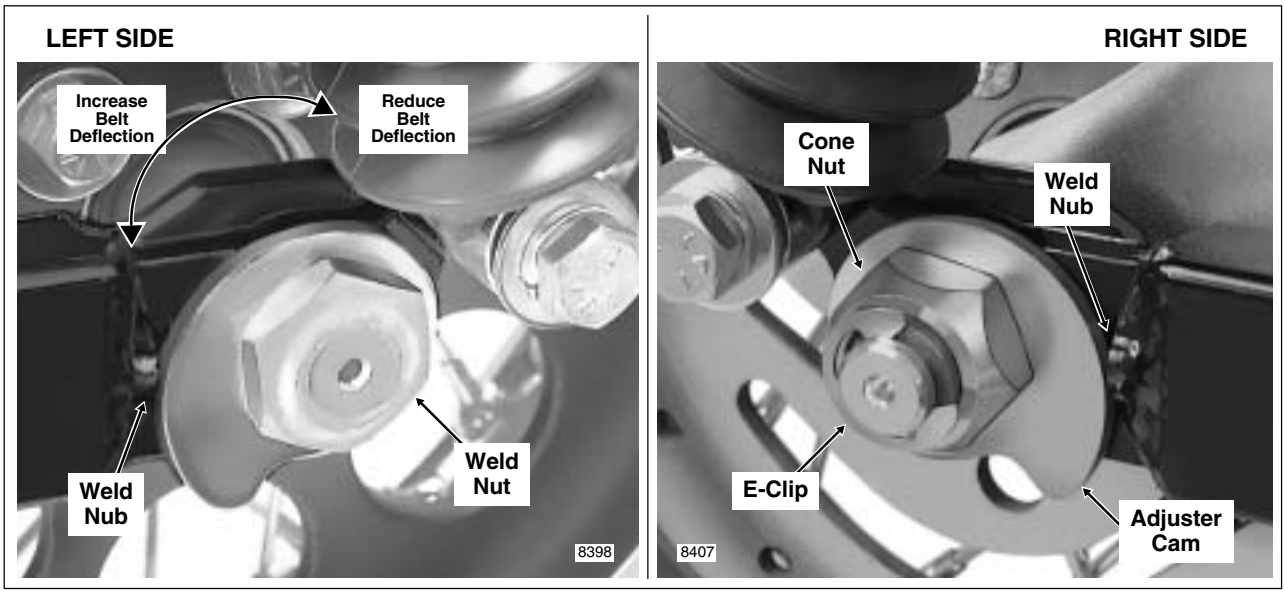


Figure 6-14. Move Rear Wheel Forward Until Adjuster Cams Just Contact Weld Nubs

a. Rotate weld nut on left side of axle in a clockwise direction.

b. Check belt deflection. Apply 10 lbs. (4.5 kg) of force at the midpoint of the bottom belt strand. Belt deflection should be within the range specified in Table 6-3.

c. If belt is still too loose, repeat steps 6(a) through 6(b). If belt is now too tight, move to step 7.

7. If belt is too tight, increase belt deflection as follows:

a. Using a hydraulic center stand, raise motorcycle so that the rear wheel is off the ground.

b. Rotate weld nut on left side of axle in a counterclockwise direction.

c. Push wheel forward slightly so that adjuster cam just contacts weld nub on both sides of rear swingarm. See Figure 6-14.

d. Lower hydraulic center stand so that the motorcycle is on the ground.

e. Check belt deflection. Apply 10 lbs. (4.5 kg) of force at the midpoint of the bottom belt strand. Belt deflection should be within the range specified in Table 6-3.

f. If belt is still too tight, repeat steps 7(a) through 7(e). If belt is now too loose, move to step 6.

8. **Holding** weld nut on left side of axle, tighten cone nut on right side to 95-105 ft-lbs (128.8-142.4 Nm).

NOTE

If the axle moves during tightening of the cone nut, then the the belt deflection procedure must be restarted.

9. Recheck belt deflection to verify that it is still within specification.

   If the belt deflection is not within specification, loosen cone nut and then snug to 15-20 ft-lbs (20-27 Nm) before returning to step 6.

10. With the flat side out, install **new** E-clip in groove on right side of axle.

11. 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.

12. Install saddlebags. See Section 2.23 SADDLEBAG, INSTALLATION.

CLEANING AND INSPECTION

1. Use a spray solution of soap and water to clean belt. Avoid immersion. Wipe the belt down or blow dry. Although the belt's urethane compound is resistant to most solvents, these should only be used on a limited basis, and then must always be followed by a soap and water wash.

2. 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.

3. 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.

4. 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.

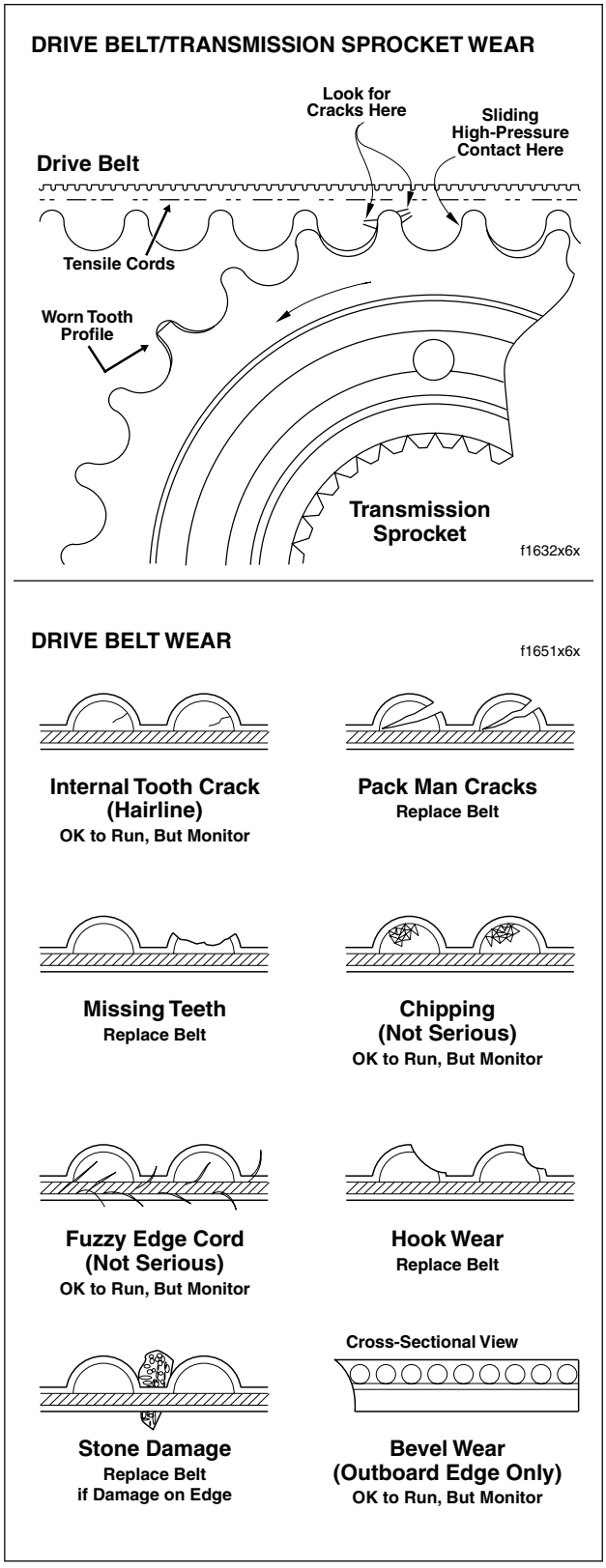


Figure 6-15. Drive Belt/Transmission Sprocket Wear

5. 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.

6. For common types of belt wear and damage, see lower frame of Figure 6-15.

REPLACEMENT

Removal

1. Remove rear wheel and rear swingarm. See Section 2.18 REAR SWINGARM, REMOVAL.
2. Remove the primary chaincase assembly. See Section 6.5 PRIMARY CHAINCASE, REMOVAL.
3. Remove the old belt from the transmission sprocket.

Installation

CAUTION

Handle the drive belt with care. Never bend belt forward into a loop smaller than five inches (127 mm) diameter. Never bend belt into a reverse loop smaller than ten inches (254 mm) diameter. Over bending will weaken belt and result in premature failure. Always install belt in the same direction of rotation as when it was removed. For other handling tips, see Figure 6-16.

1. Install the **new** belt on the transmission sprocket.
2. Install the primary chaincase assembly. See Section 6.5 PRIMARY CHAINCASE, INSTALLATION.
3. Install rear swingarm and rear wheel. Adjust belt deflection. See Section 2.18 REAR SWINGARM, INSTALLATION.

TRANSMISSION SPROCKET

Removal

1. Remove rear wheel. See Section 2.3 REAR WHEEL, REMOVAL.
2. Remove the primary chaincase assembly. See Section 6.5 PRIMARY CHAINCASE, REMOVAL.

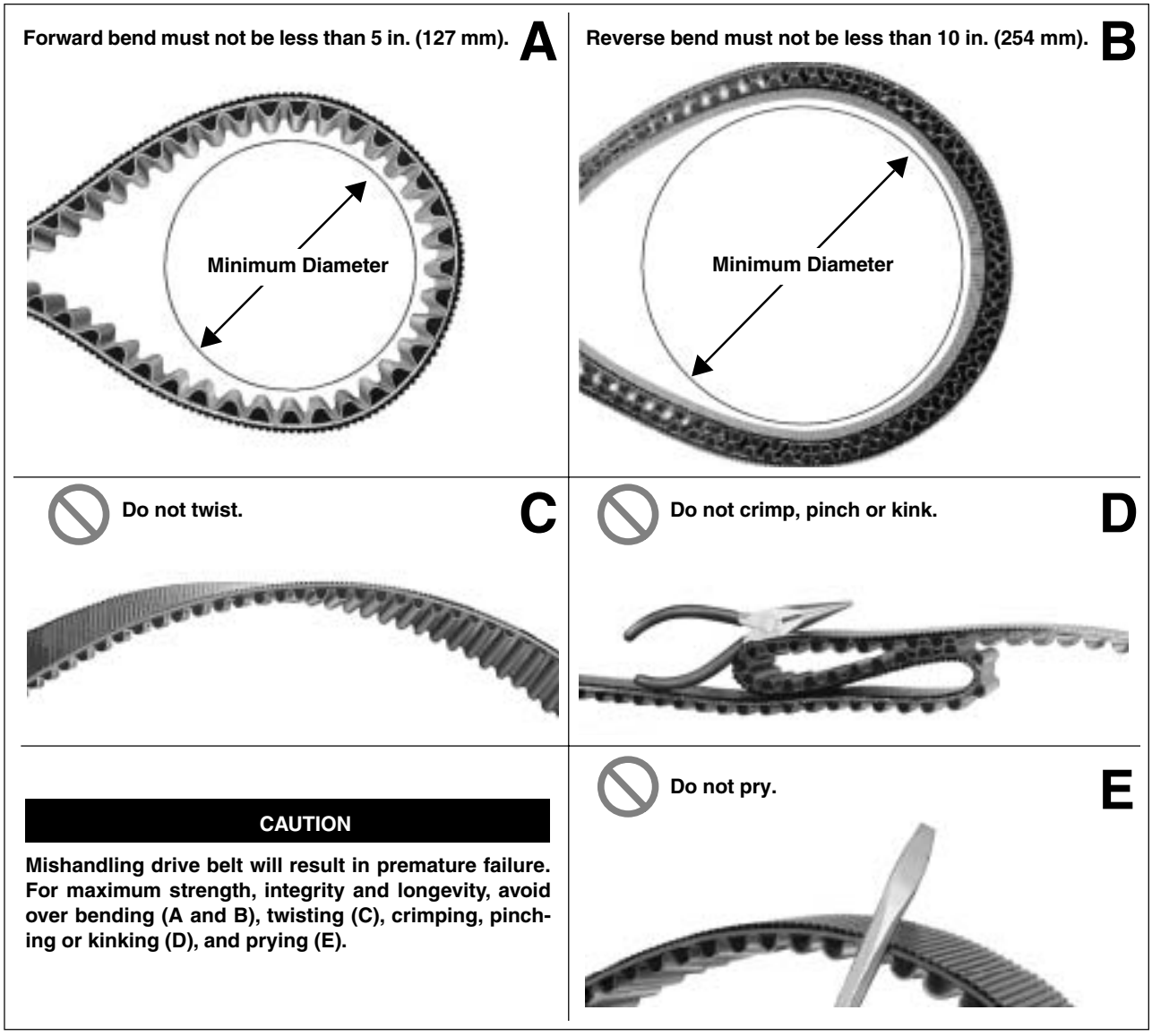


Figure 6-16. Proper Drive Belt Handling

3. See Figure 6-17. 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.

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.

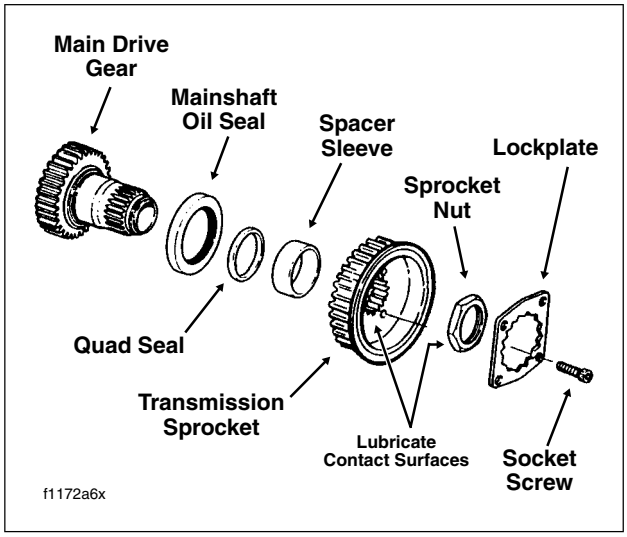


Figure 6-17. Transmission Sprocket Components

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 High Strength Threadlocker 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). See Figure 6-18.

   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.

4. Install pilot of MAINSHAFT LOCKNUT WRENCH (Part No. HD-94660-37B) on threaded end of mainshaft. See Figure 6-20. Slide sleeve of locknut wrench over pilot and onto sprocket nut. Tighten sprocket nut to 60 ft-lbs (81 Nm). As the nut is tightened the handle of the sprocket locking tool rises to contact the pivot shaft, thereby preventing sprocket/mainshaft rotation. See Figure 6-21.

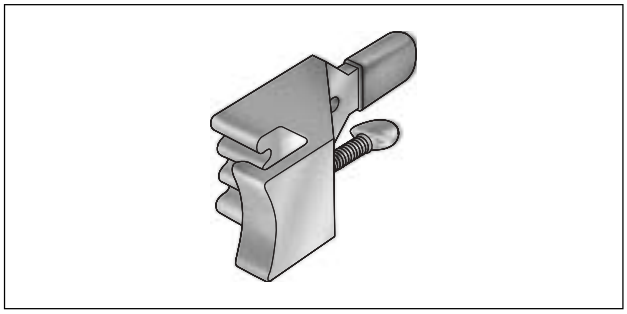


Figure 6-18. Final Drive Sprocket Locking Tool (Part No. HD-41184)

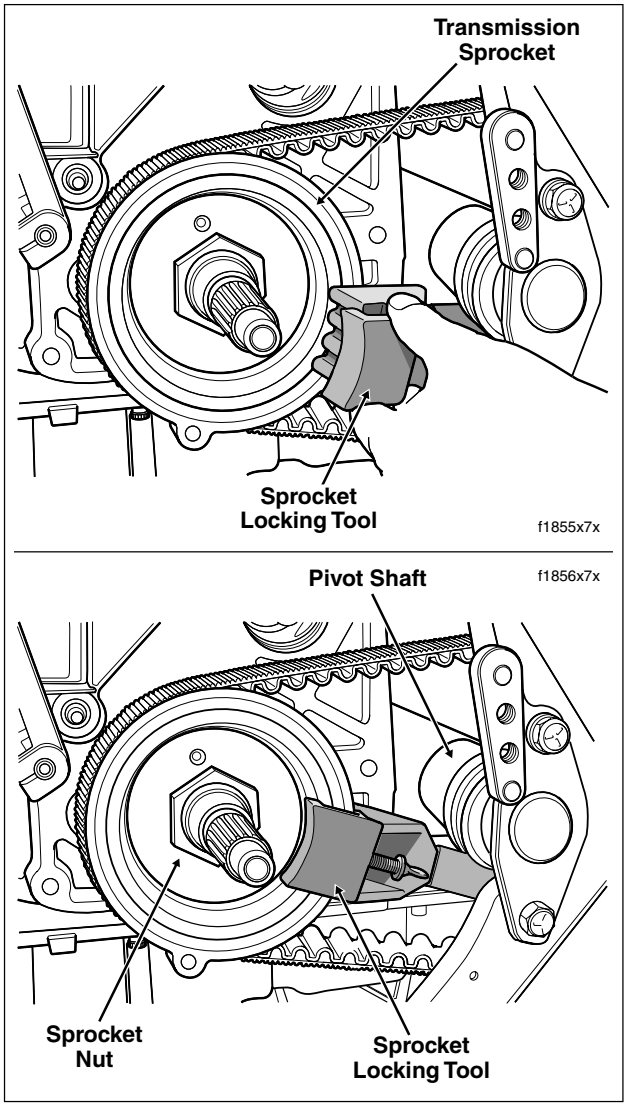


Figure 6-19. Install Final Drive Sprocket Locking Tool

5. Scribe a straight line on the transmission sprocket nut continuing the line over onto the transmission sprocket as shown in Figure 6-22. Tighten the transmission sprocket nut an additional 35° to 40°.

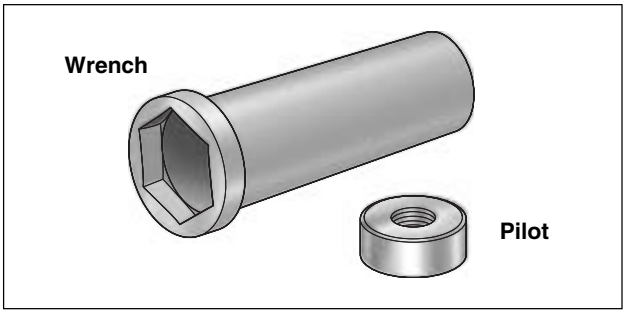


Figure 6-20. Mainshaft Locknut Wrench/Pilot (Part No. HD-94660-37B)

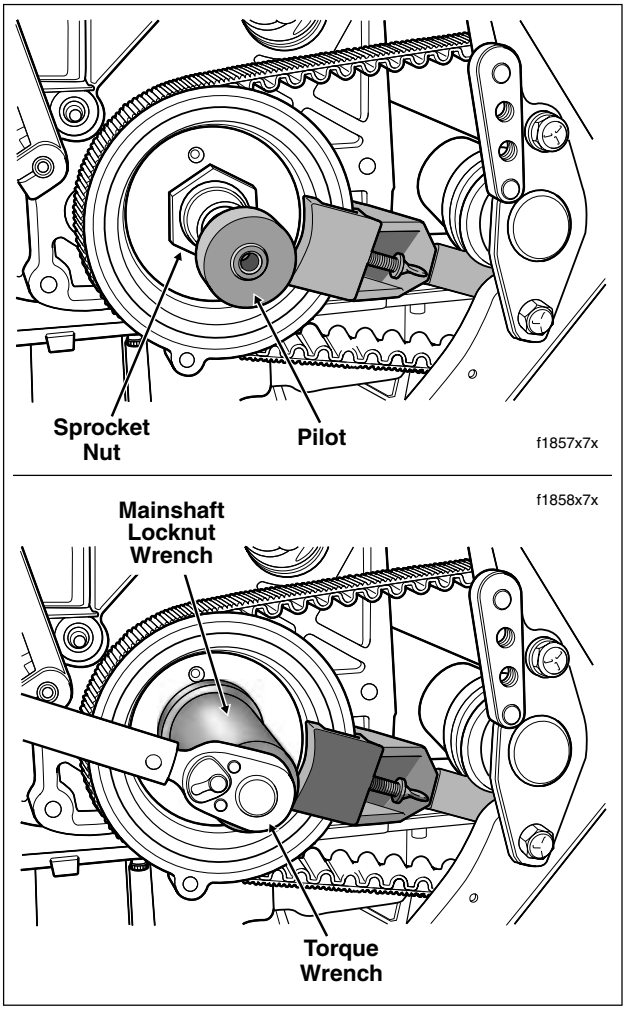


Figure 6-21. Install Mainshaft Locknut Pilot/Wrench and Torque Sprocket Nut

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 6-22.

CAUTION

Maximum allowable tightening of sprocket nut is 45° of counterclockwise rotation after a torque of 60 ft-lbs (81 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).

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. Install primary chaincase assembly. See Section 6.5 PRIMARY CHAINCASE, INSTALLATION.

10. Install rear wheel and adjust belt deflection. See Section 2.3 REAR WHEEL, 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.

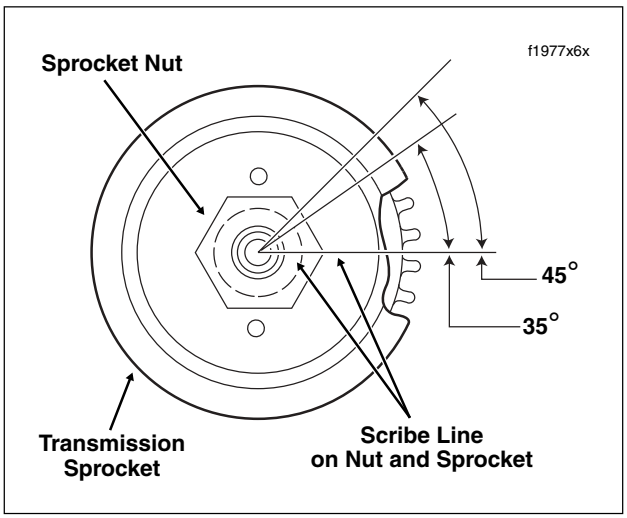


Figure 6-22. Tighten/Secure Sprocket Nut

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 High Strength 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. Install rear wheel and adjust belt deflection. 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 (1,600 km) and every 5000 miles (8,000 km) thereafter.

1. Using a T27 TORX drive head, remove five screws (with captive washers) to free clutch inspection cover from primary chaincase cover.
2. Using a T40 TORX drive head, remove magnetic drain plug at bottom of primary chaincase cover. Drain lubricant into suitable container. See Figure 6-23.
3. Clean drain plug. Apply Loctite Pipe Sealant with Teflon 565 to threads and install back into primary chaincase cover. Using a dial caliper, tighten plug until 0.160-0.180 inch (4.06-4.57 mm) above the surface of the casting.
4. Pour 32 ounces (946 ml) of Harley-Davidson PRIMARY CHAINCASE LUBRICANT through the clutch inspection cover opening, Part No. 99887-84 (quart) or Part No. 99886-84 (gallon). See Figure 6-24.

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.

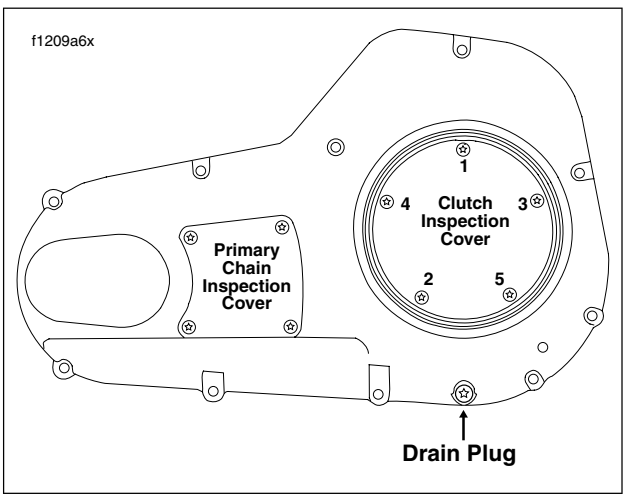


Figure 6-23. Primary Chaincase Cover

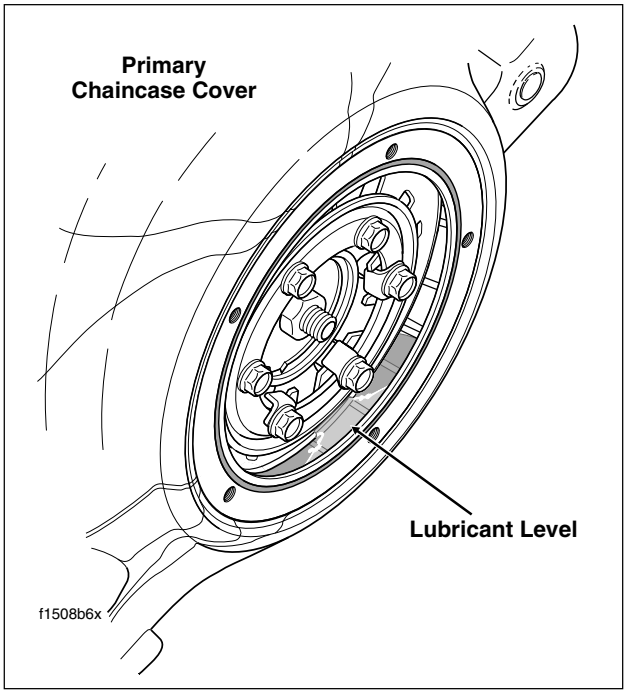


Figure 6-24. Fill Primary Chaincase With Lubricant

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

NOTE

If lubricant is not thoroughly removed from both the quad ring and groove, compression of the 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 84-108 **in-lbs** (10-12 Nm) in the pattern shown in Figure 6-23.

REMOVAL

1. Remove seat. See Section 2.22 SEAT, REMOVAL.

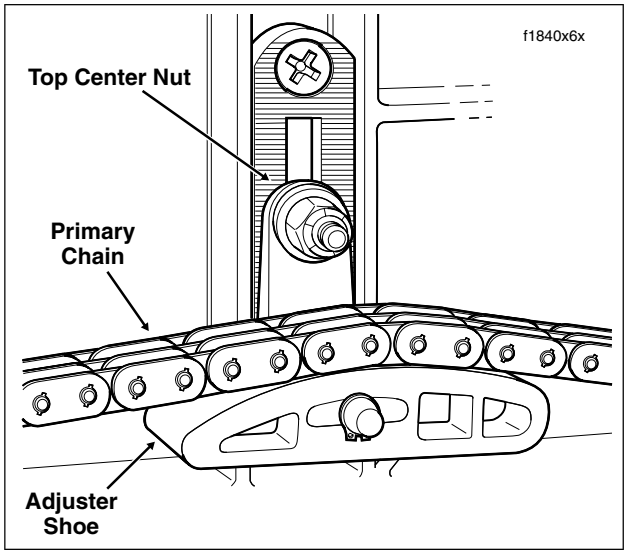


Figure 6-25. Chain Tensioner Assembly

⚠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.

NOTE

If drain plug has accumulated a lot of debris, inspect the condition of chaincase components.

4. Remove socket screw with lockwasher to remove passenger footboard from rear swingarm bracket.
5. Remove socket screw (with lockwasher and flat washer) to release front footboard forward bracket from frame weldment. For best results, approach from opposite side using a 3/8 inch ball allen with extension. 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).
6. Remove locknut, lockwasher and flat washer to free shifter rod from front inboard shifter lever.
7. Remove socket head screws and pull both toe and heel shifter levers from shifter shaft. Remove rubber spacer. If preferable, remove socket head screw to release front inboard shifter lever instead, and then pull shifter shaft/lever assembly from primary chaincase bore. When pulling any lever from splined shaft, always mark splines on both shaft and lever to assist in assembly.
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 6-25. 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 6-26.
11. Obtain the PRIMARY DRIVE LOCKING TOOL (HD-41214). See Figure 6-27.

    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 6-28.

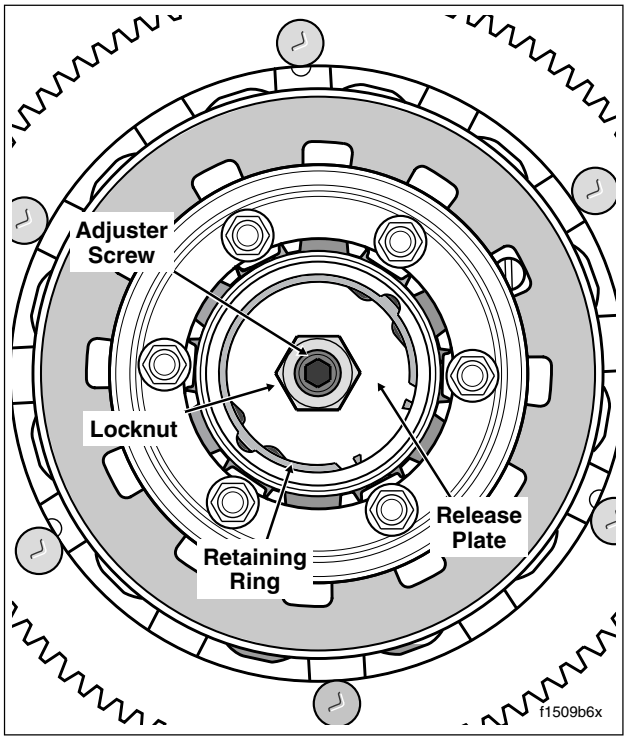


Figure 6-26. Clutch Hub Release Plate Assembly

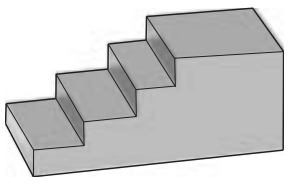
NOTE

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 heat 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.

⚠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 6-30.



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 6-27. Primary Drive Locking Tool (Part No. HD-41214)

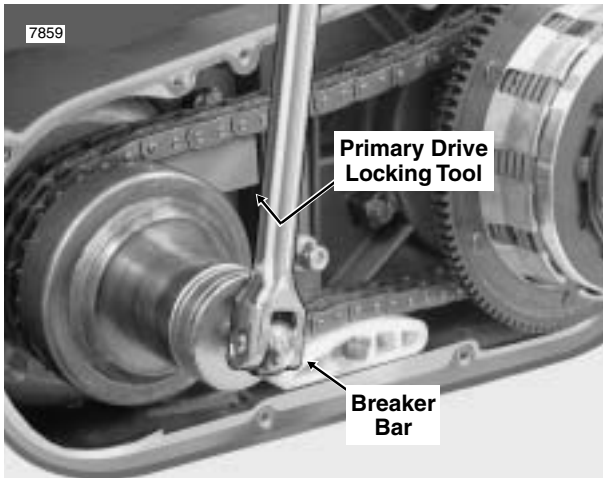


Figure 6-28. Place Primary Drive Locking Tool and Loosen Compensating Sprocket Nut

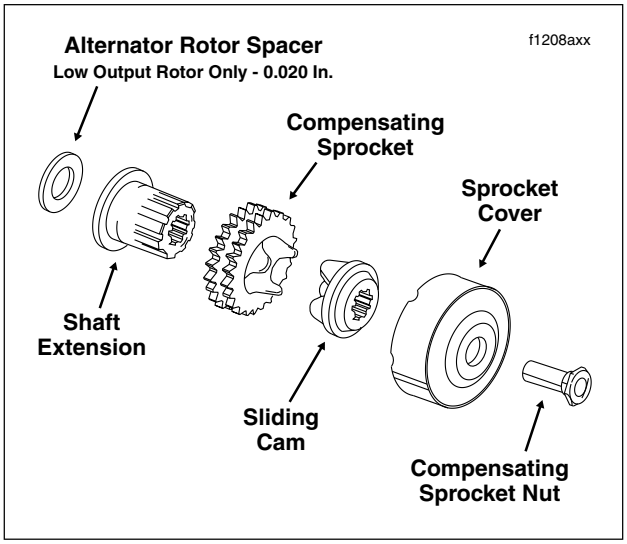


Figure 6-29. Engine Compensating Sprocket Assembly

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 6-29.
15. Remove clutch, primary chain, compensating sprocket and shaft extension as a single assembly. See Figure 6-31.
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.

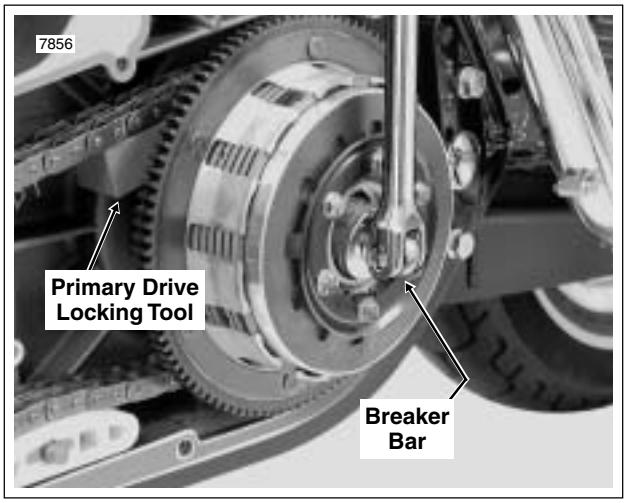


Figure 6-30. Place Primary Drive Locking Tool and Loosen Clutch Hub Mainshaft Nut

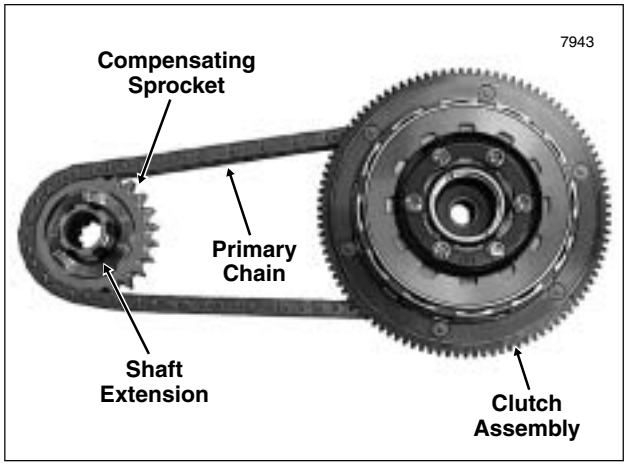


Figure 6-31. Remove Clutch Assembly, Primary Chain, Compensating Sprocket and Shaft Extension

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 chassis ground cable ring terminal.
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 transmission 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.

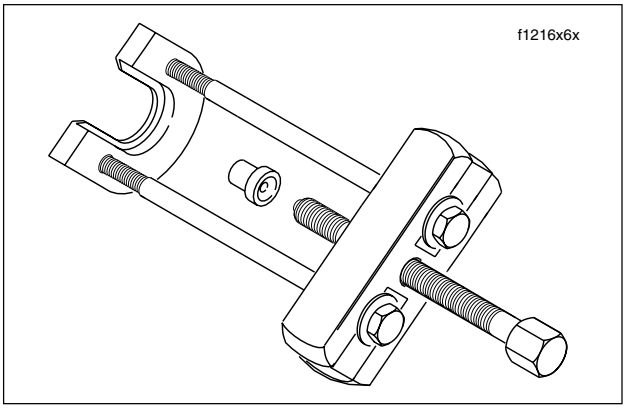


Figure 6-32. Mainshaft Bearing Inner Race Remover (Part No. HD-34902B)

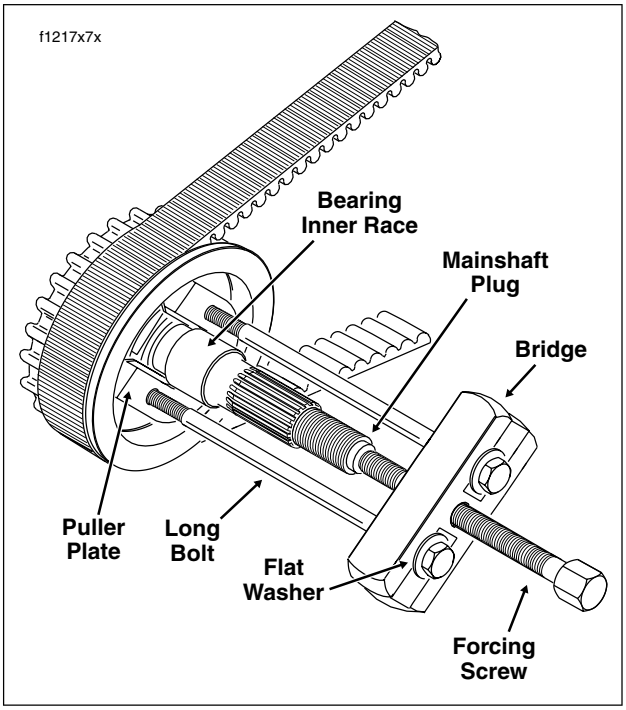


Figure 6-33. Pull Mainshaft Bearing Inner Race

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 transmission 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.
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 6-32 and Figure 6-34.

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 6-33.
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 6-35. Chamfered edge first, slide the bearing inner race onto the transmission mainshaft.
2. Thread extension shaft onto end of mainshaft.

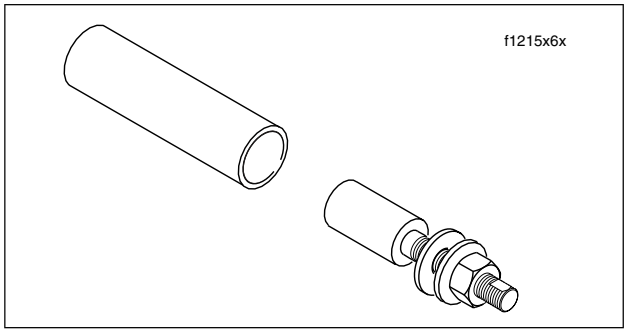


Figure 6-34. Mainshaft Bearing Inner Race Installer (Part No. HD-34902B)

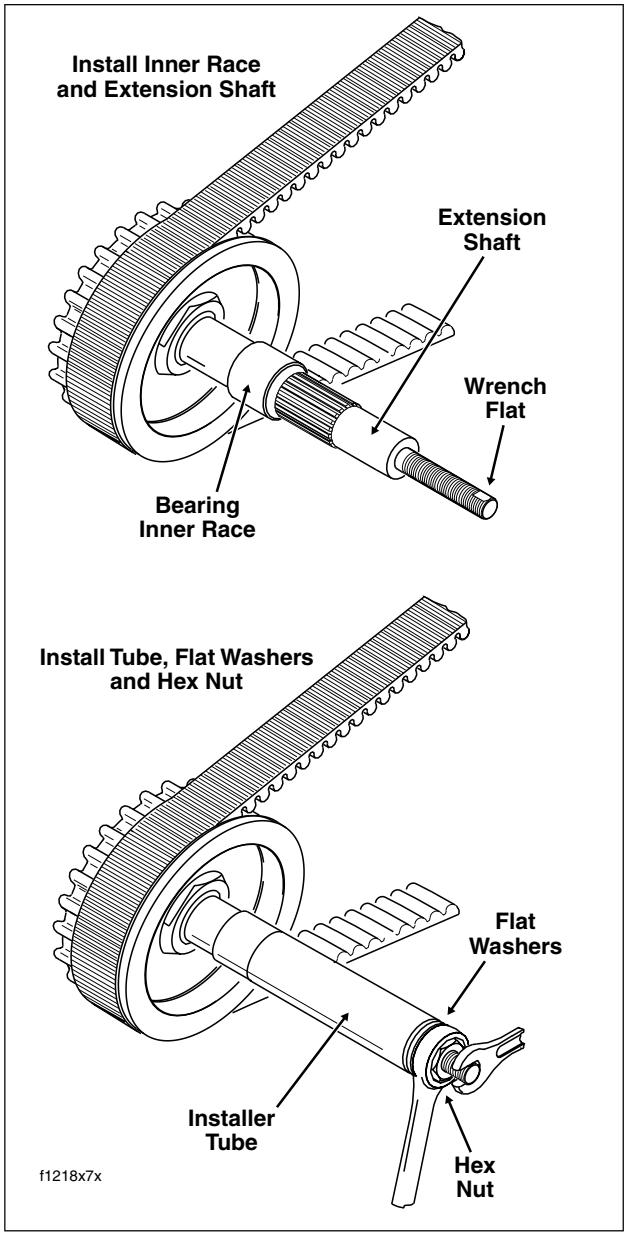


Figure 6-35. Press Bearing Inner Race onto Mainshaft

NOTE

Extension shaft has left handed threads, so turn counter-clockwise to install.

3. See Figure 6-35. 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.

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 6-36. 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.

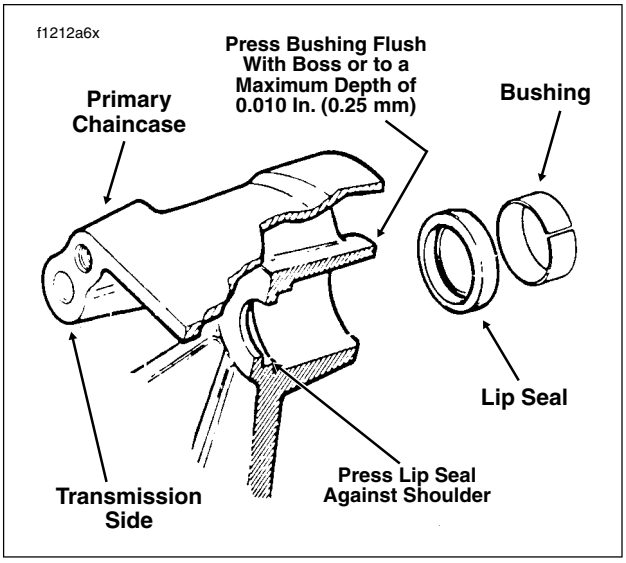


Figure 6-36. Install Jackshaft Seal and Bushing in Primary Chaincase

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.

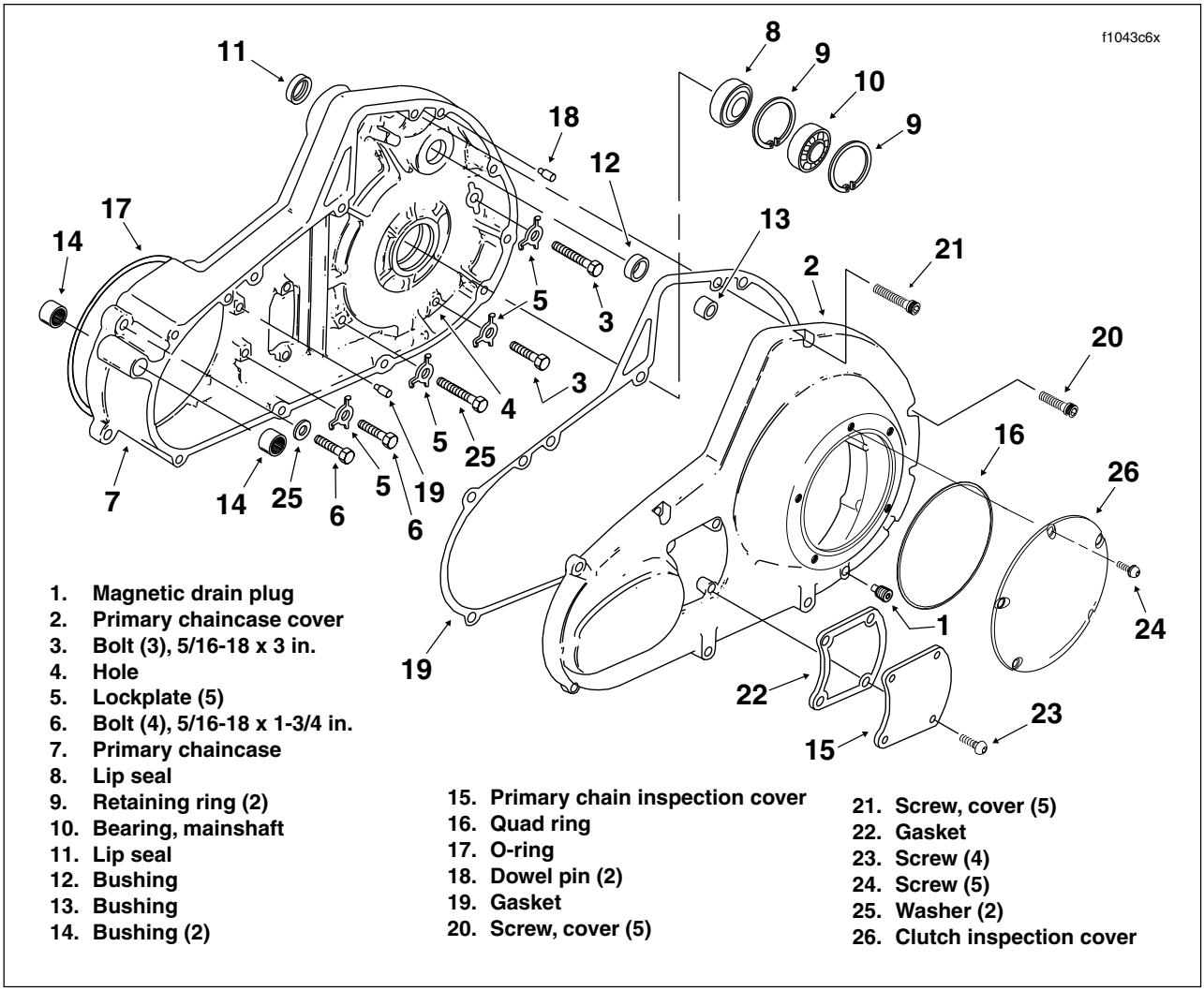
SHIFTER BRACKET BUSHINGS

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. Quad 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 6-37. 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 RTV silicone sealer to the following areas:
   - Around the two rear primary chaincase to crankcase bolt holes. See B in left frame of Figure 6-38.
   - Around the three primary chaincase to transmission bolt holes. See right frame of Figure 6-38.

   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 6-38. Start two forward bolts (1-3/4 inches with flat washers) to fasten outside edge of primary chaincase to front of crankcase.

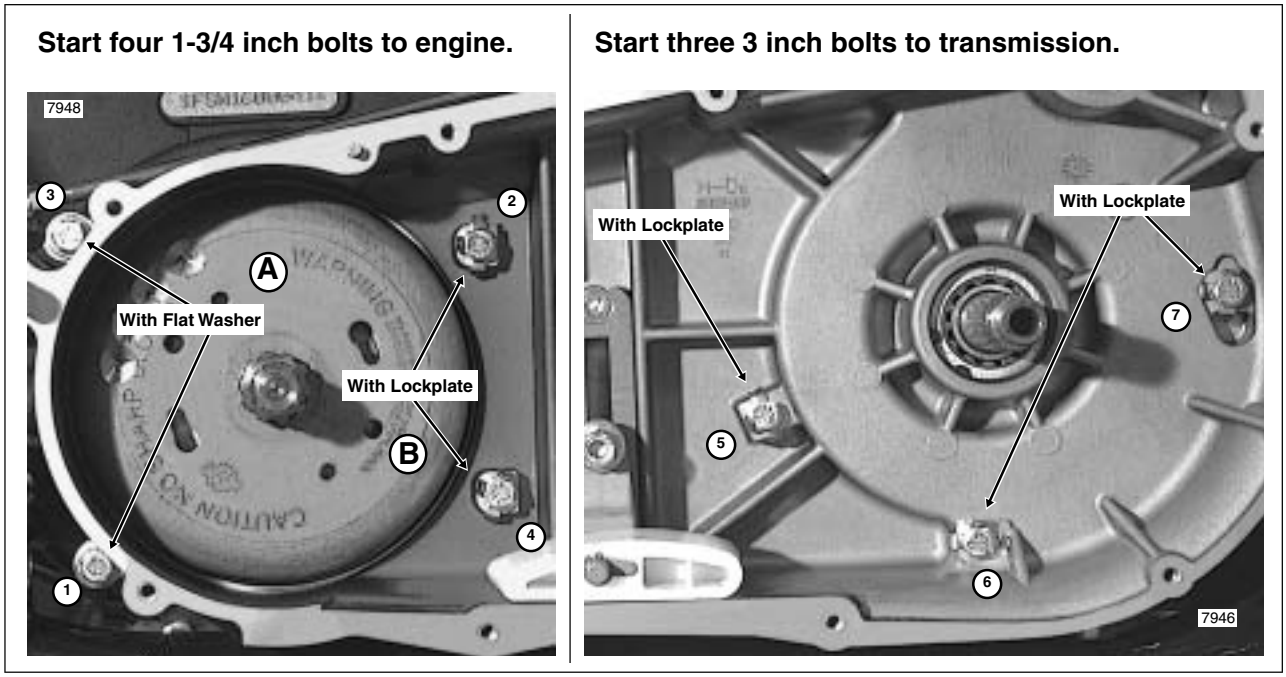


Figure 6-38. Primary Chaincase Screw Size and Torque Sequence

See B in left frame of Figure 6-38. 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 6-38. 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 6-38.

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 cable ring terminal). Alternately tighten front and rear starter mounting screws to 13-20 ft-lbs (18-27 Nm).

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 84-108 **in-lbs** (9-12 Nm). Bend tab on lockplate against flat of bolt head to secure.

8. Install alternator rotor spacer on engine sprocket shaft, if present. See Figure 6-29.

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 6-31. 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 6-29.

11. Apply two drops of Loctite High Strength Threadlocker 262 (red) to the threads of the engine compensating sprocket nut. Install nut and hand tighten in a clockwise direction.

12. Apply two drops of Loctite High Strength Threadlocker 262 (red) 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.

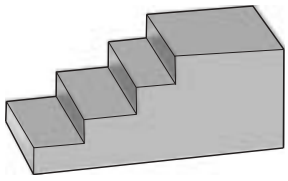
13. Obtain the PRIMARY DRIVE LOCKING TOOL (HD-41214). See Figure 6-39.

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 6-40.

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 6-41.
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 6-39. Primary Drive Locking Tool (Part No. HD-41214)

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.
21. Start ten allen head socket screws (five long, five short) with flat washers to install primary chaincase cover. Tighten screws to 84-108 **in-lbs** (9-12 Nm) in the numerical sequence shown in Figure 6-42.
22. Apply Loctite Pipe Sealant with Teflon 565 to threads and install magnetic drain plug back into primary chaincase cover. Using a dial caliper, tighten plug until 0.160-0.180 inch (4.06-4.57 mm) above the surface of the casting.
23. Using a T27 TORX drive head, remove five screws (with captive washers) to free clutch inspection cover from primary chaincase cover, if installed.

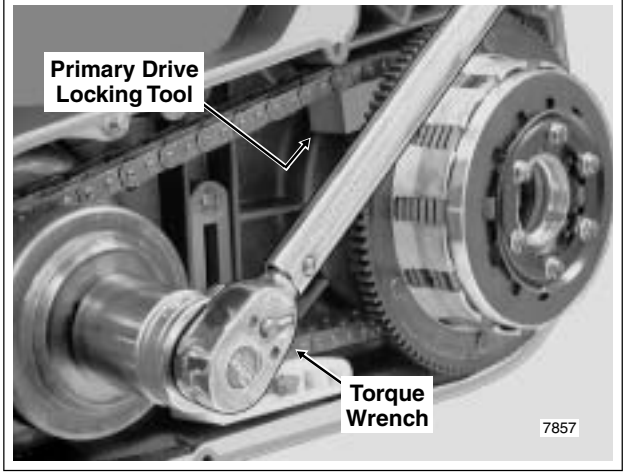


Figure 6-40. Place Primary Drive Locking Tool and Torque Compensating Sprocket Nut

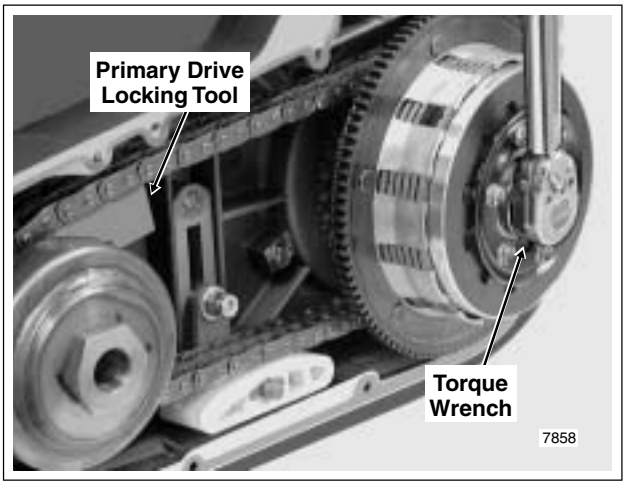


Figure 6-41. Place Primary Drive Locking Tool and Torque Clutch Hub Mainshaft Nut

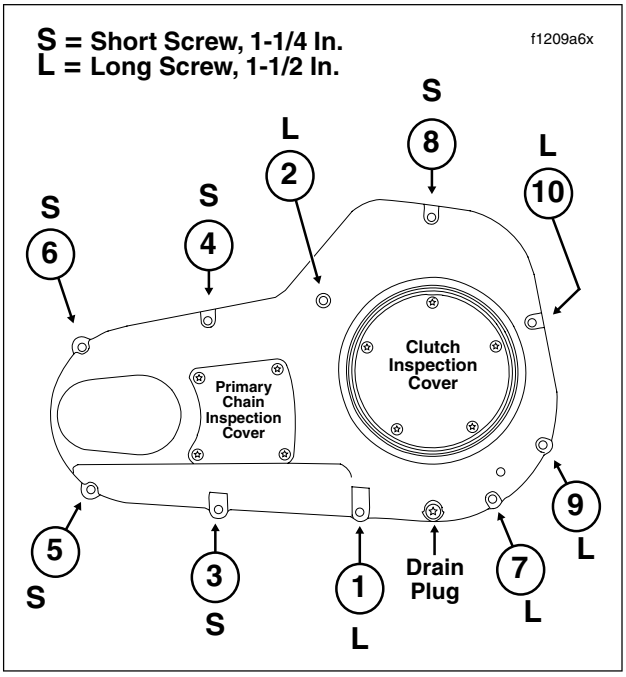


Figure 6-42. Primary Chaincase Cover Torque Sequence and Screw Size

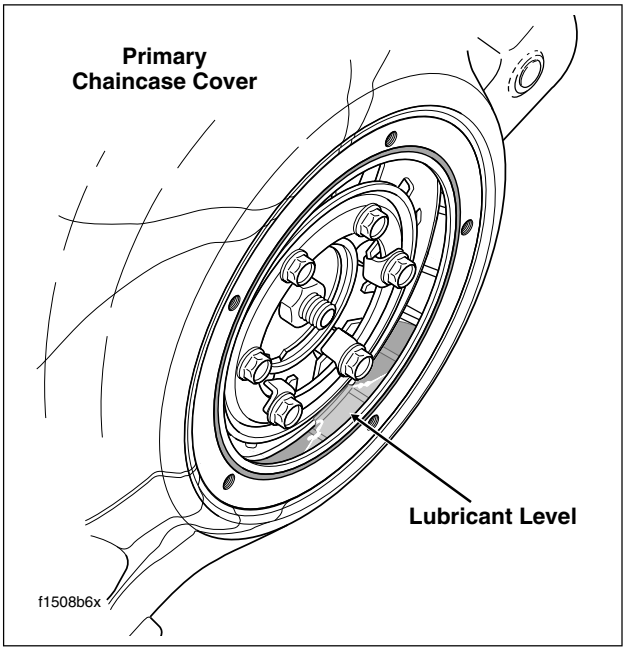


Figure 6-43. Fill Primary Chaincase With Lubricant

24. Pour 32 ounces (946 ml) of Harley-Davidson PRIMARY CHAINCASE LUBRICANT through the clutch inspection cover opening, Part No. 99887-84 (quart) or Part No. 99886-84 (gallon). See Figure 6-43.

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 quad ring from groove in primary chaincase cover. Wipe all lubricant from the quad ring and inspect for cuts, tears or signs of deterioration. Replace as necessary.

26. Swab all lubricant from the quad ring groove. Install quad ring in primary chaincase cover with the nubs contacting the ring groove walls.

NOTE

If lubricant is not thoroughly removed from both the quad ring and groove, compression of the 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.

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 84-108 **in-lbs** (10-12 Nm) in the pattern shown in Figure 6-44.

28. If installing toe and heel shifter levers, perform steps 28(a) thru 28(d). If just installing front inboard shifter lever, perform steps 28(c) and 28(d).

    a. Install rubber spacer onto end of shifter shaft.

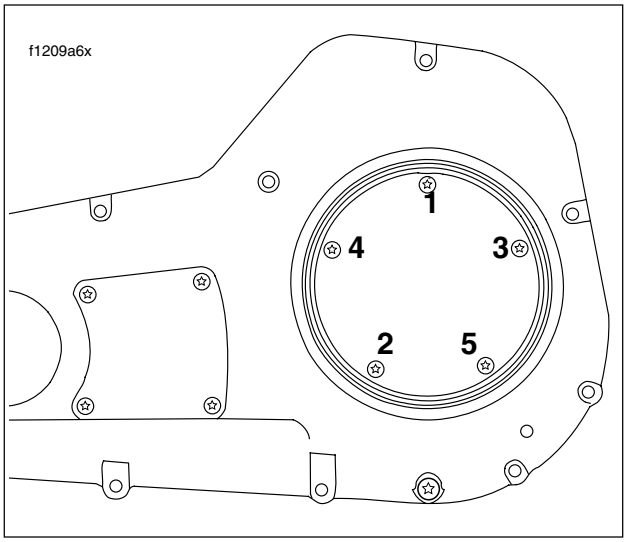


Figure 6-44. Clutch Inspection Cover Torque Sequence

b. Set the shifter levers down, so that the Harley-Davidson script on the rubber peg 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).

c. Install lever(s) onto splined shaft taking note to align marks placed on splines during disassembly.

d. Install socket head screw(s) to fasten lever(s) to shaft. Tighten 1/4 inch screws to 90-110 **in-lbs** (10.2-12.4 Nm) or 5/16 inch screws to 18-22 ft-lbs (24-30 Nm).

29. Install flat washer, lockwasher and locknut to fasten shifter rod to front inboard shifter lever.

30. Install socket screw with lockwasher to fasten passenger footboard to rear swingarm bracket. Tighten screw to 15-18 ft-lbs (20-24 Nm). Repeat step on opposite side of vehicle.

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 2.22 SEAT, INSTALLATION.

NOTES

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TRANSMISSION 7

SPECIFICATIONS 7.1

TRANSMISSION DATA

TRANSMISSION		DATA
Type		5-speed forward - constant mesh
Semi-synthetic transmission lubricant	Quart	Part No. 99892-84
	Case of Quarts	Part No. 98853-96
	Gallon	Part No. 99891-84
	Case of Gallons	Part No. 98852-96
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

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.

NOTE

Since a sidecar equipped motorcycle is fixed in an upright position, the actual full engine oil level is about 1/2 inch (12.7 mm) above the FULL mark on the dipstick.

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
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

SERVICE WEAR LIMITS (CONT.'D)

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	80-120 **in-lbs**	9.0-13.6 Nm
Detent arm pivot screw to right support block	84-108 **in-lbs**	9.5-12.2 Nm
Shifter cam support block screws	84-108 **in-lbs**	9-12 Nm
Transmission top cover socket head screws	84-108 **in-lbs**	9-12 Nm
Neutral switch	120-180 **in-lbs**	13.6-20.3 Nm
Clutch release cover socket head screws	120-144 **in-lbs**	13.6-16.3 Nm
Clutch cable fitting	36-60 **in-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 5/16 inch screws 1/4 inch screws	 13-16 ft-lbs 84-108 **in-lbs**	 18-22 Nm 9-12 Nm
Mainshaft/countershaft locknuts	45-55 ft-lbs	61-75 Nm
Transmission mainshaft sprocket nut	60 ft-lbs, then 35° to 45°	81 Nm, then 35° to 45°
Transmission sprocket nut lockplate screws	90-110 **in-lbs**	10.2-12.4 Nm
Oil pan bolts	84-108 **in-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	84-108 **in-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.

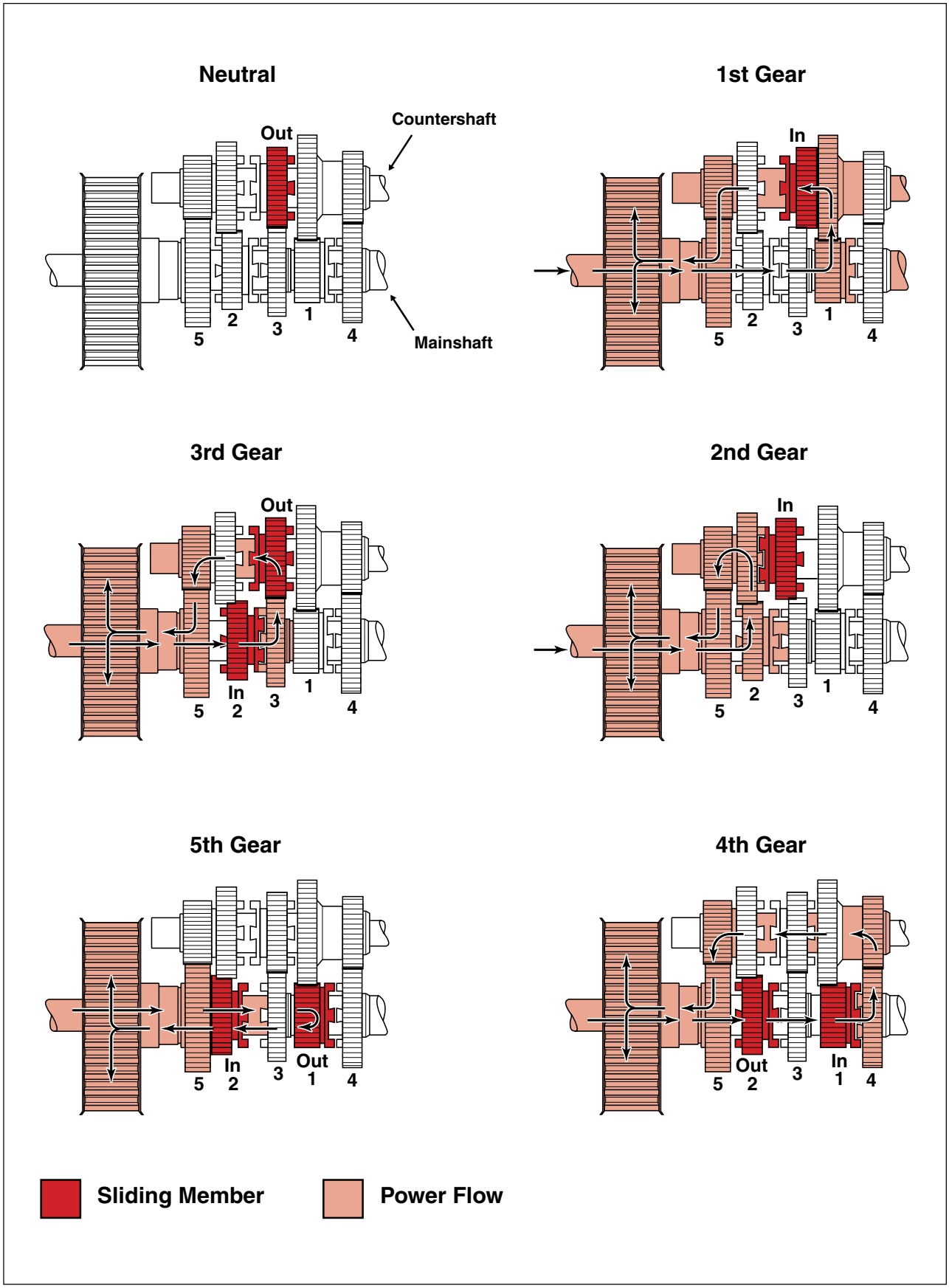


Figure 7-1. Transmission Power Flow Schematic

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.

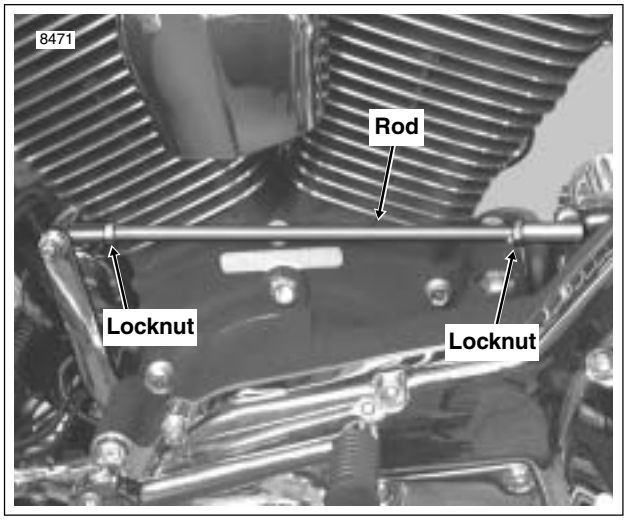


Figure 7-2. Shifter Linkage Adjustment

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 80-120 **in-lbs** (9.0-13.6 Nm).

SHIFTER CAM ASSEMBLY/SHIFTER FORKS 7.4

DISASSEMBLY

1. Remove seat. See Section 2.22 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 system in two sections. See Section 3.7 REMOVING ENGINE FROM CHASSIS, steps 3-9.
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 transmission 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:

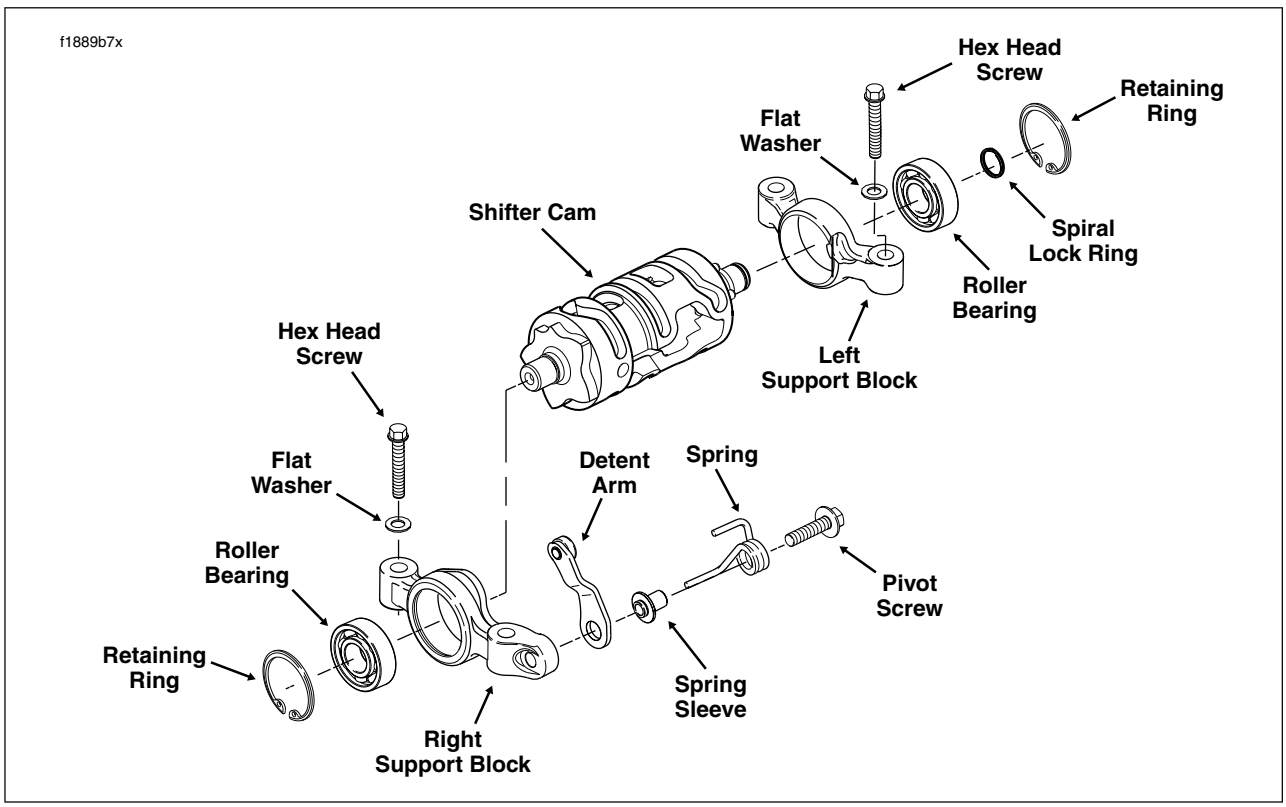


Figure 7-3. Shifter Cam Assembly

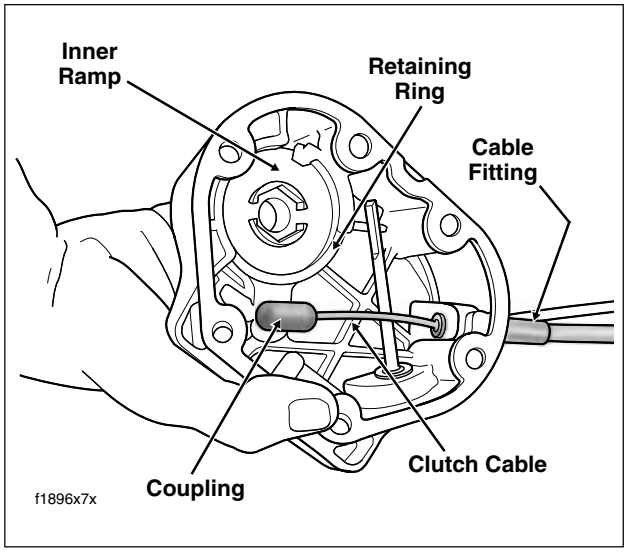


Figure 7-4. Clutch Release Cover Assembly

⚠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 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.

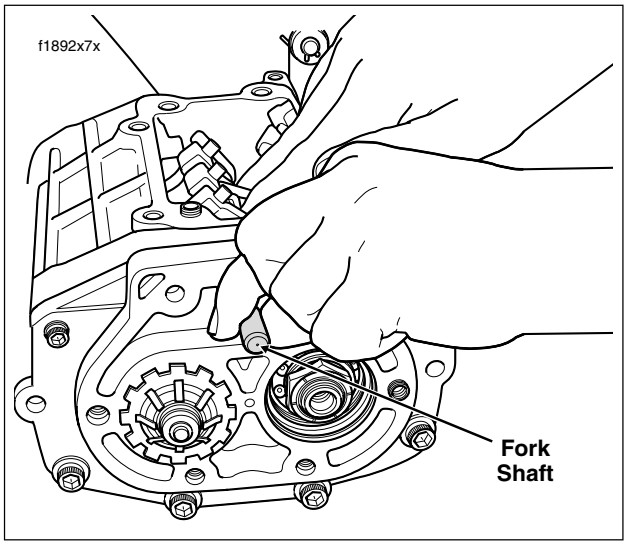


Figure 7-5. Remove Fork Shaft/Shifter Forks (Right Side View)

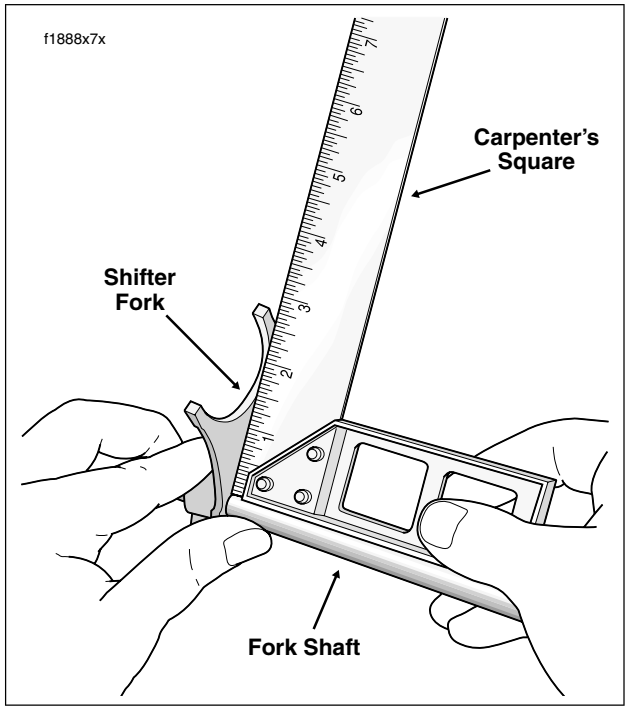


Figure 7-6. Check Shifter Forks for Squareness

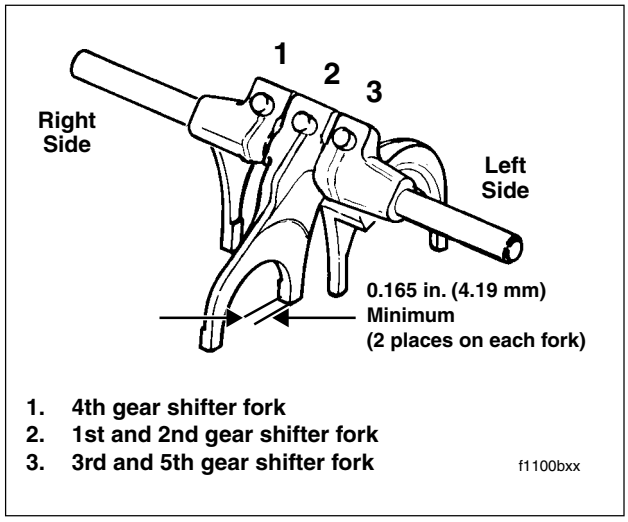


Figure 7-7. Shifter Fork Identification

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.

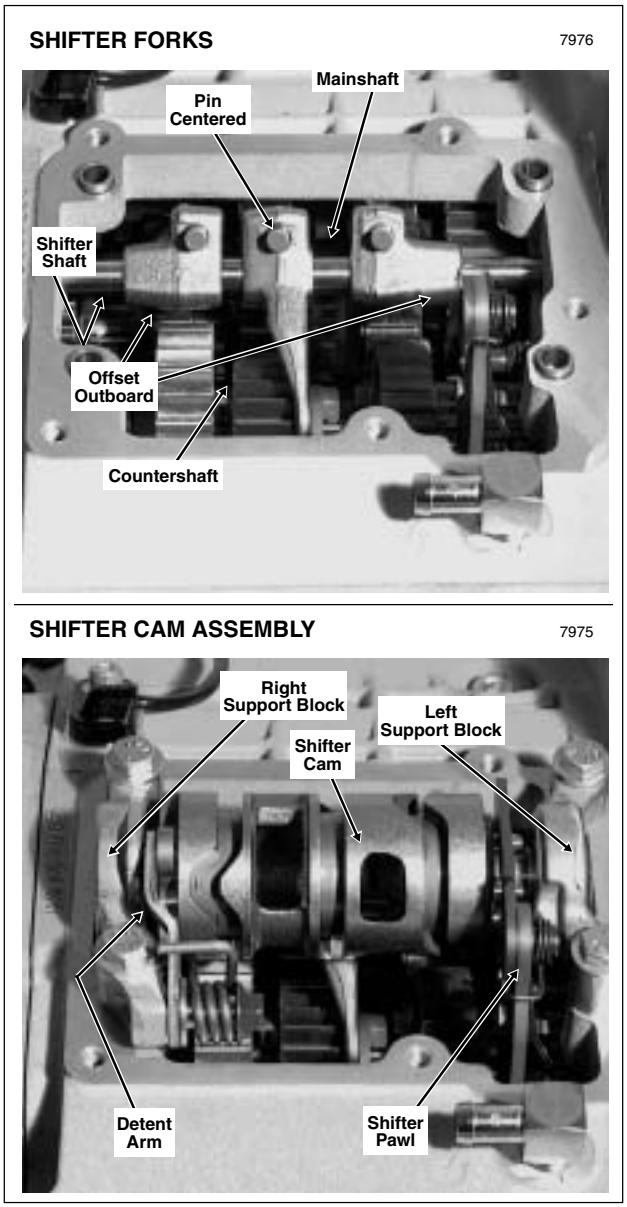


Figure 7-8. Install Shifter Forks/Shifter Cam

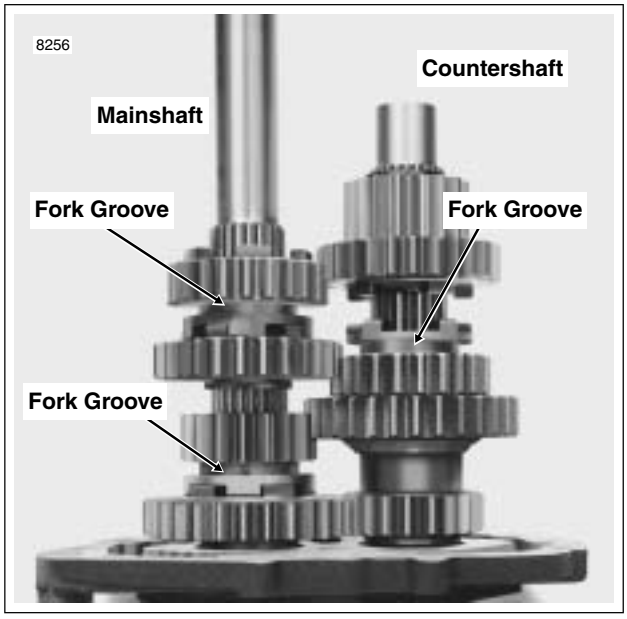


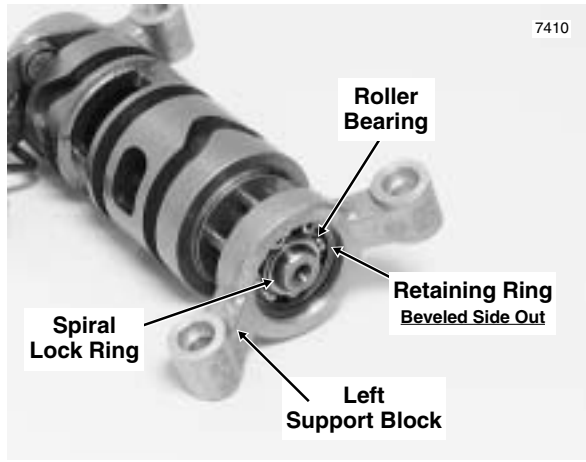
Figure 7-9. Shifter Fork Groove Locations

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.

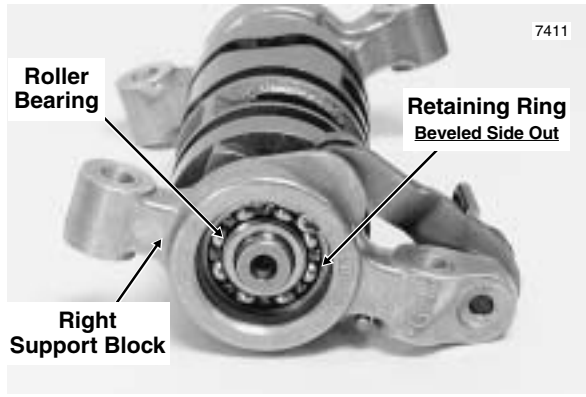
⚠WARNING

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.



Left Side



Right Side

Figure 7-10. Shifter Cam Assembly

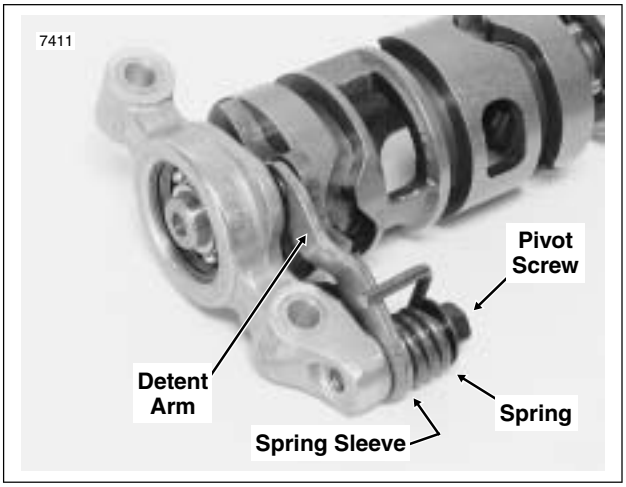


Figure 7-11. Shifter Cam Assembly

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. See Figure 7-12. 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 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 84-108 **in-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 84-108 **in-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 120-180 **in-lbs** (13.6-20.3 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 120-144 **in-lbs** (13.6-16.3 Nm) in the sequence shown in Figure 7-13.
16. Tighten clutch cable fitting to 36-60 **in-lbs** (4-7 Nm).

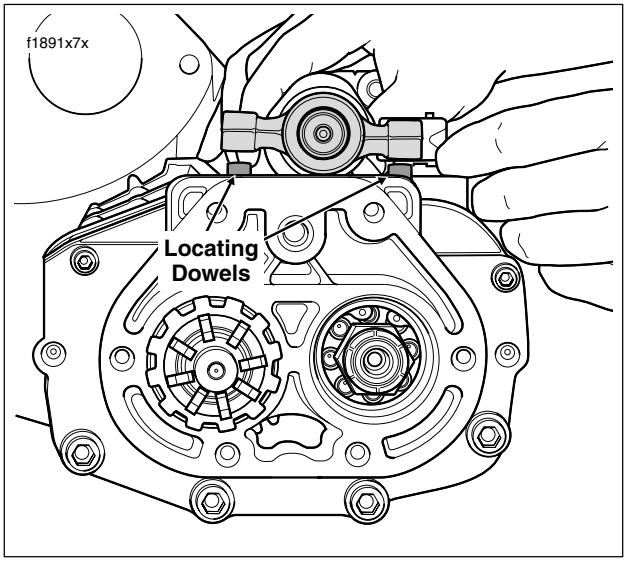


Figure 7-12. Place Support Blocks on Locating Dowels

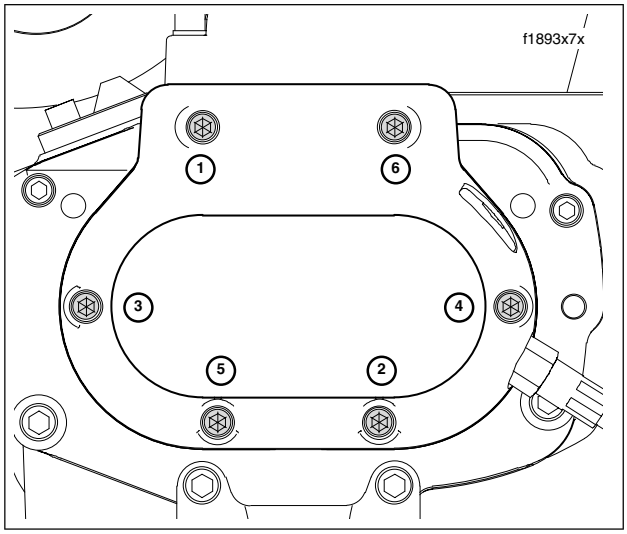


Figure 7-13. Clutch Release Cover Torque Sequence

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 SEMI-SYNTHETIC TRANSMISSION LUBRICANT: Part No.'s 99892-84 (quart), 98853-96 (case of quarts), 99891-84 (gallon), or 98852-96 (case of 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 system. See Section 3.8 INSTALLING ENGINE IN CHASSIS, steps 49-55.

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 2.22 SEAT, INSTALLATION.

CLUTCH RELEASE COVER 7.5

REMOVAL/DISASSEMBLY

1. Remove seat. See Section 2.22 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 system in two sections. See Section 3.7 REMOVING ENGINE FROM CHASSIS, steps 3-9.
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. Remove six socket head screws to free clutch release cover from transmission side door. Depress clutch lever to break the cover seal, and then remove and discard gasket.
6. 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.

⚠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.

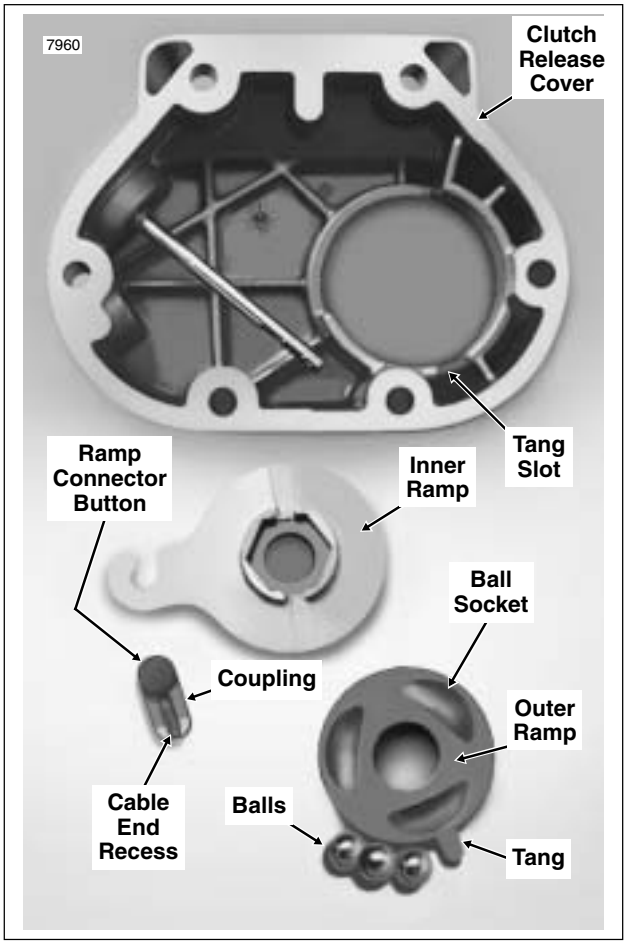


Figure 7-14. Clutch Release Cover Assembly

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.

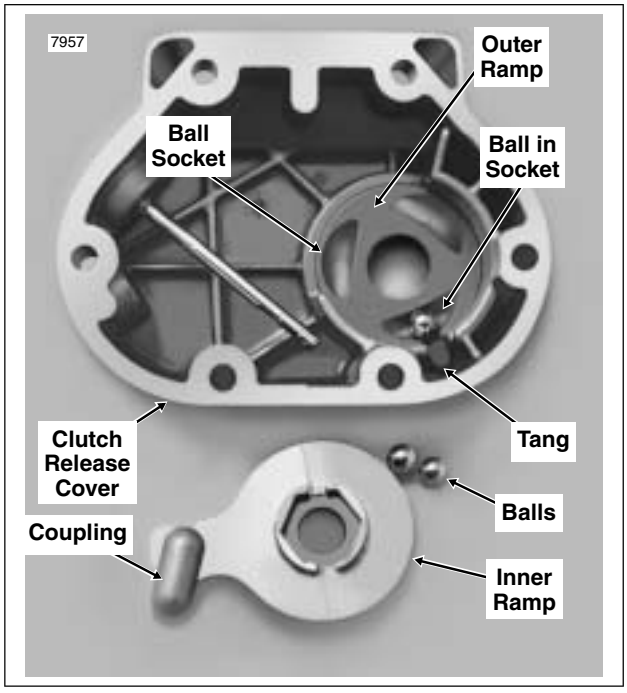


Figure 7-15. Install Outer Ramp and Balls

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 120-144 **in-lbs** (13.6-16.3 Nm) in the sequence shown in Figure 7-13.
9. Tighten clutch cable fitting to 36-60 **in-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. Check the O-ring for tears, cuts or general deterioration. Replace as necessary. See Figure 7-17.
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 SEMI-SYNTHETIC TRANSMISSION LUBRICANT: Part No.'s 99892-84 (quart), 98853-96 (case of quarts), 99891-84 (gallon), or 98852-96 (case of 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).

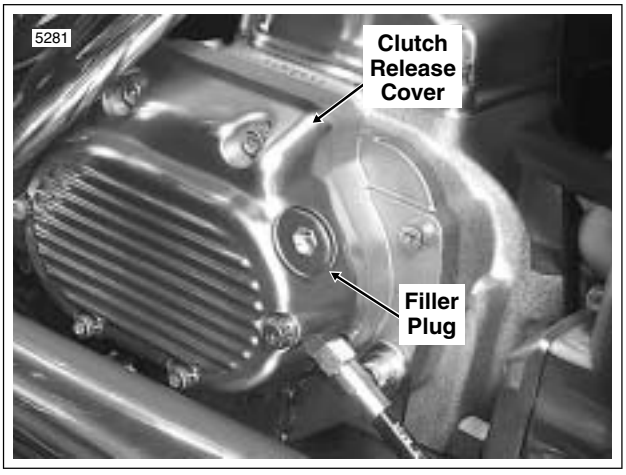


Figure 7-16. Transmission Case (Right Side)

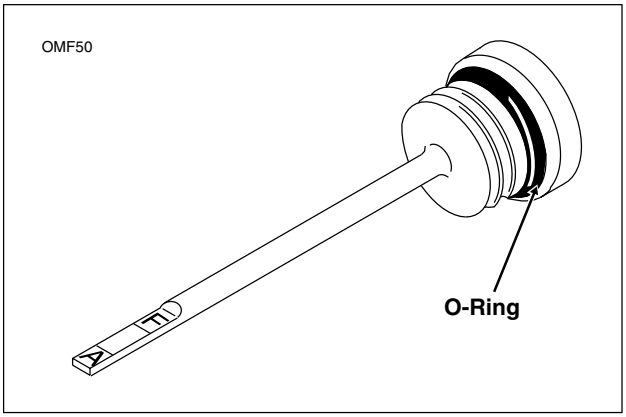


Figure 7-17. Transmission Lubricant Filler Plug/Dipstick

14. Adjust the clutch cable. See Section 6.3 CLUTCH, ADJUSTMENT.
15. Install the exhaust system. See Section 3.8 INSTALLING ENGINE IN CHASSIS, steps 49-55.
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 2.22 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 exhaust system in two sections. See Section 3.7 REMOVING ENGINE FROM CHASSIS, steps 3-9.
2. Remove the shifter cam and shifter fork assemblies. See Section 7.4 SHIFTER CAM ASSEMBLY/SHIFTER FORKS, DISASSEMBLY.
3. 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.
4. Remove oil filler spout and starter. See Section 5.4 STARTER, REMOVAL, steps 6-12.
5. Remove the bearing inner race from the transmission mainshaft. See Section 6.5 PRIMARY CHAINCASE, MAINSHAFT BEARING INNER RACE, REMOVAL.
6. Remove the oil slinger assembly (with two-piece push rod and clutch release bearing components).
7. 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 counterclockwise.
8. 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.
9. 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.

10. To remove the main drive gear, refer to Section 7.7 MAIN DRIVE GEAR, REMOVAL, steps 6-11.

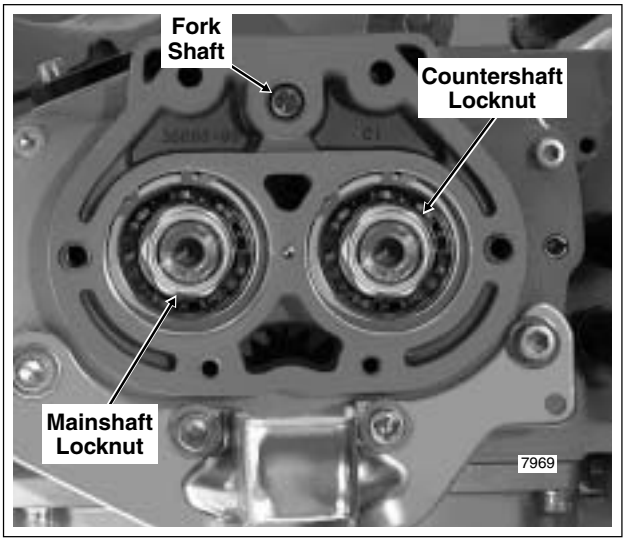


Figure 7-18. Remove Mainshaft/Countershaft Locknuts

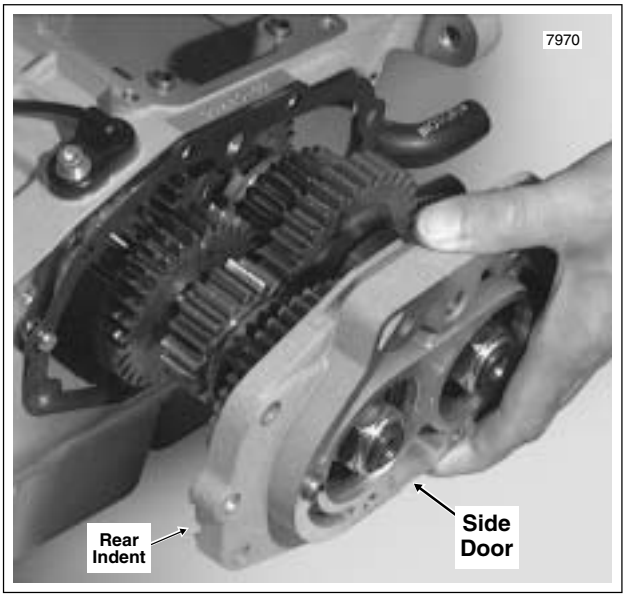


Figure 7-19. Remove Transmission Side Door

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.

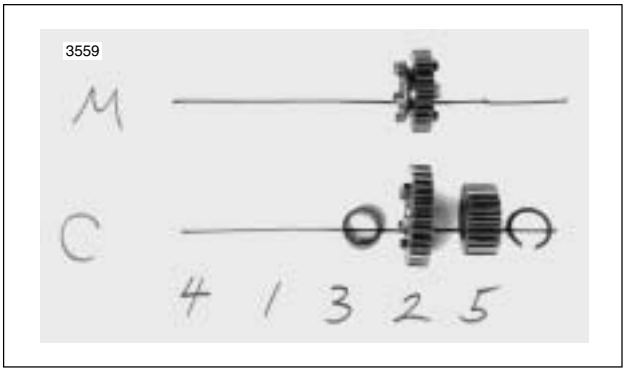


Figure 7-20. Note Gear Location During Disassembly

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

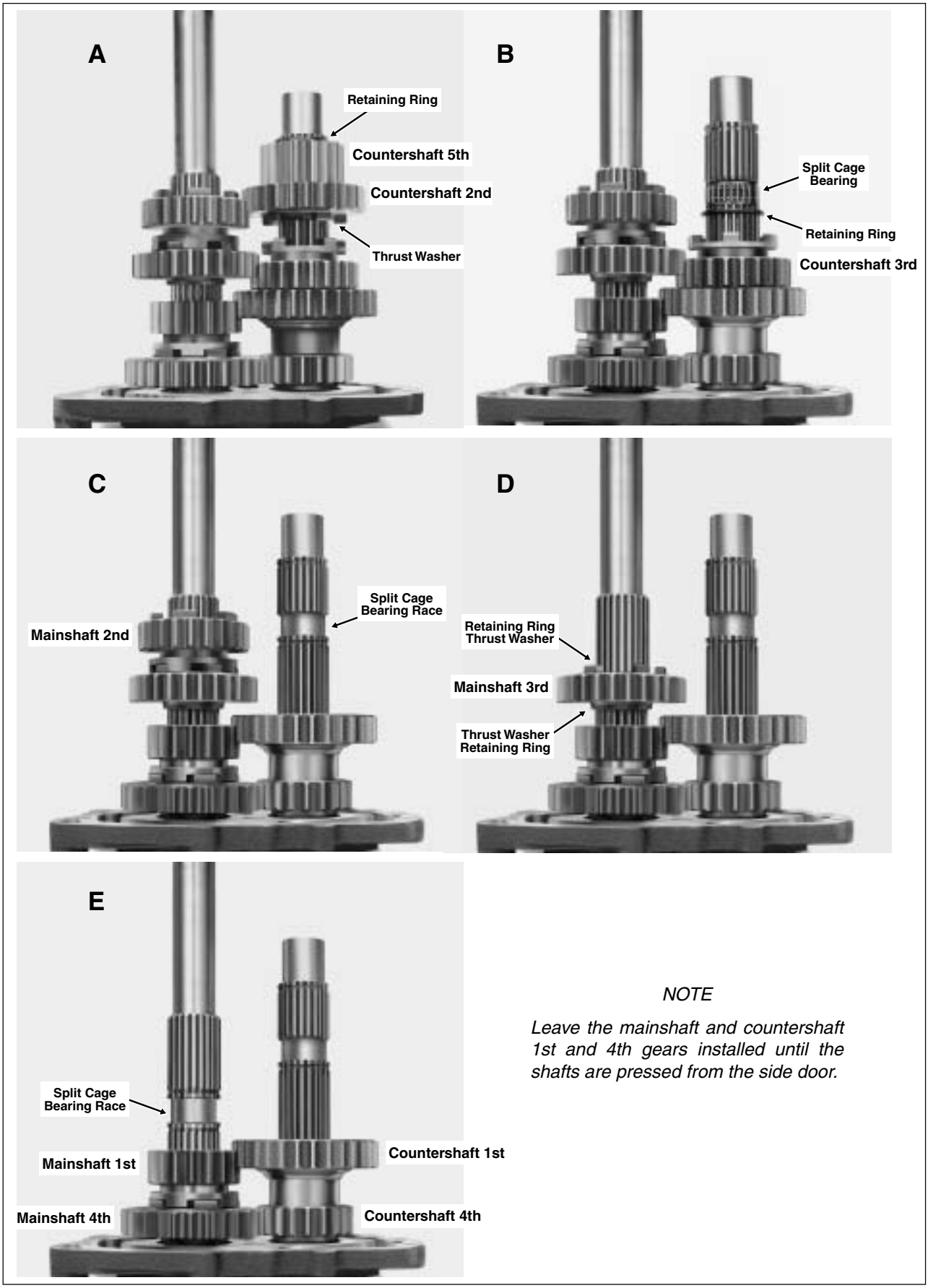
To avoid side door damage, use a flat plate for support when pressing in new bearings.

   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.

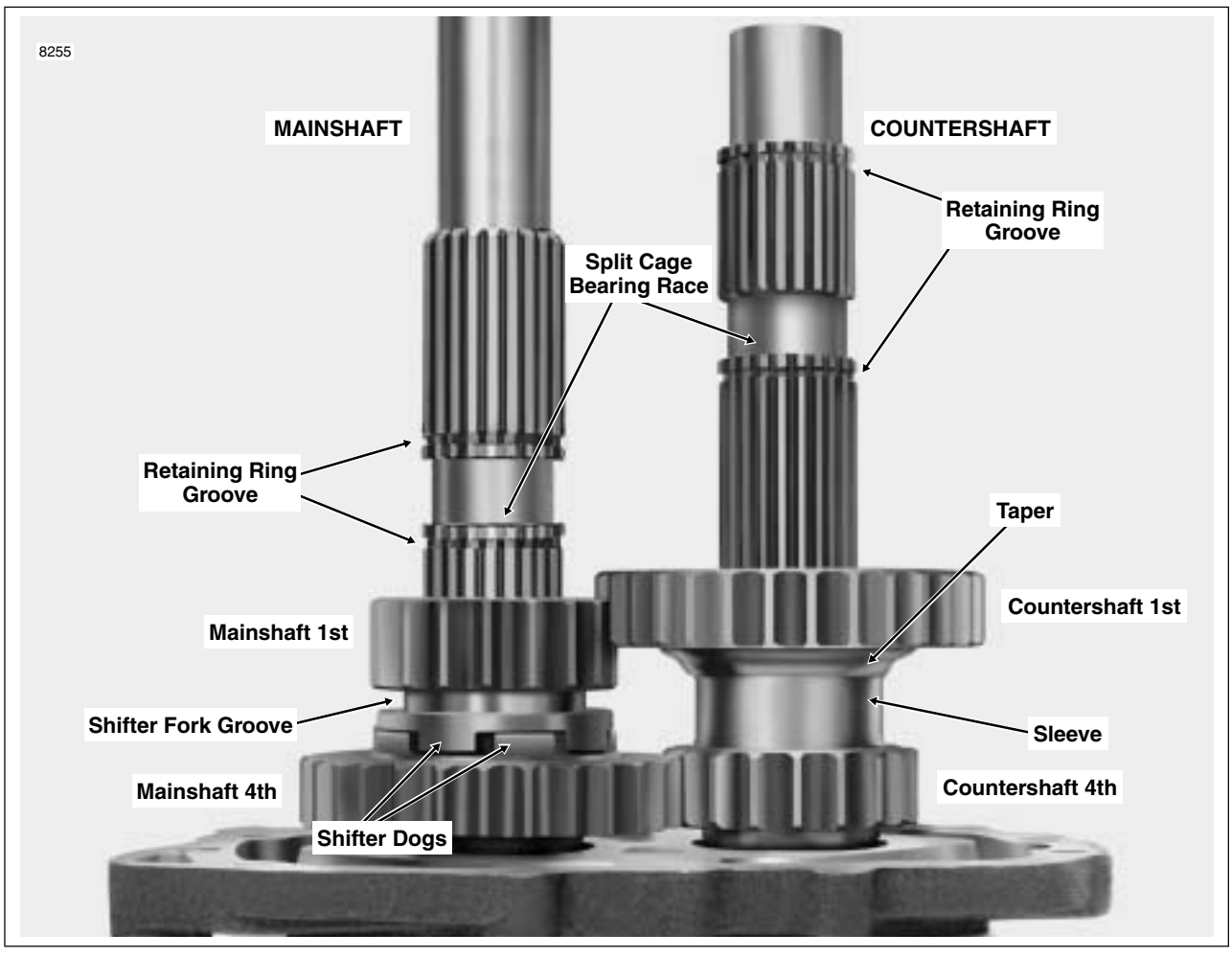


Figure 7-22. Install Mainshaft and Countershaft 1st and 4th Gears

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.

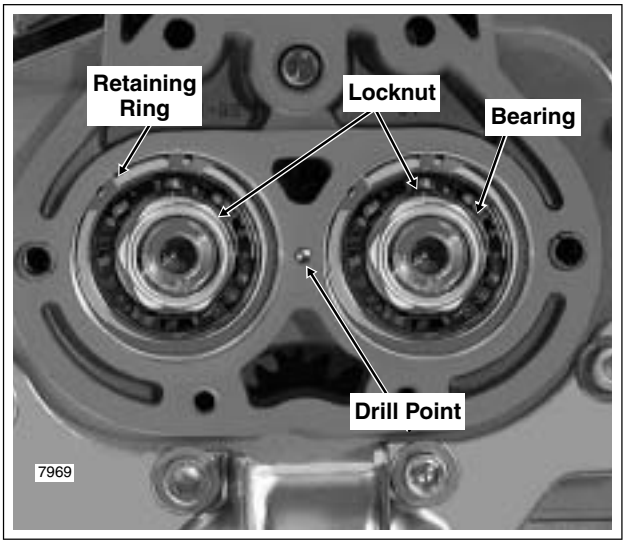


Figure 7-23. Side Door Bearings

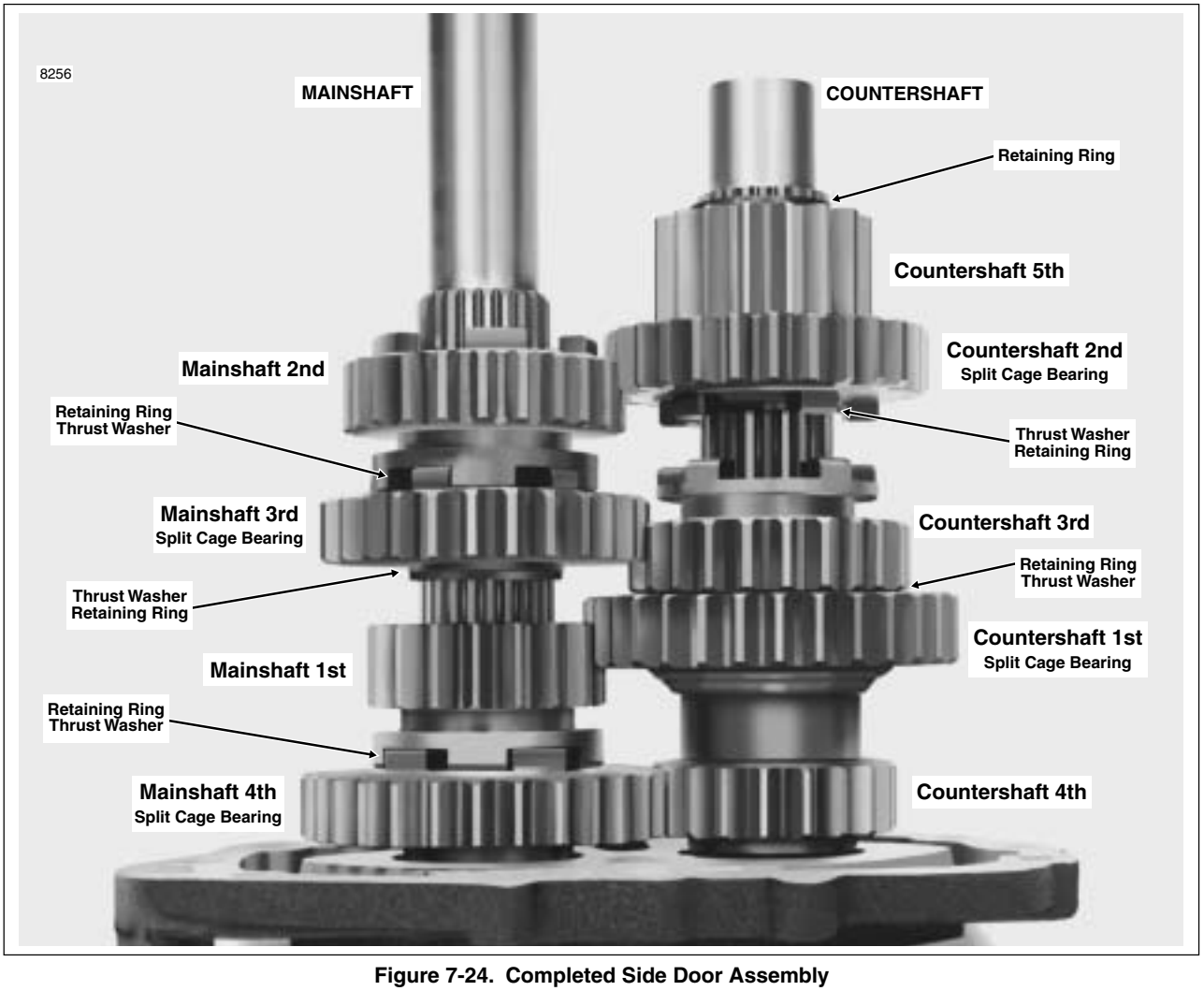


Figure 7-24. Completed Side Door Assembly

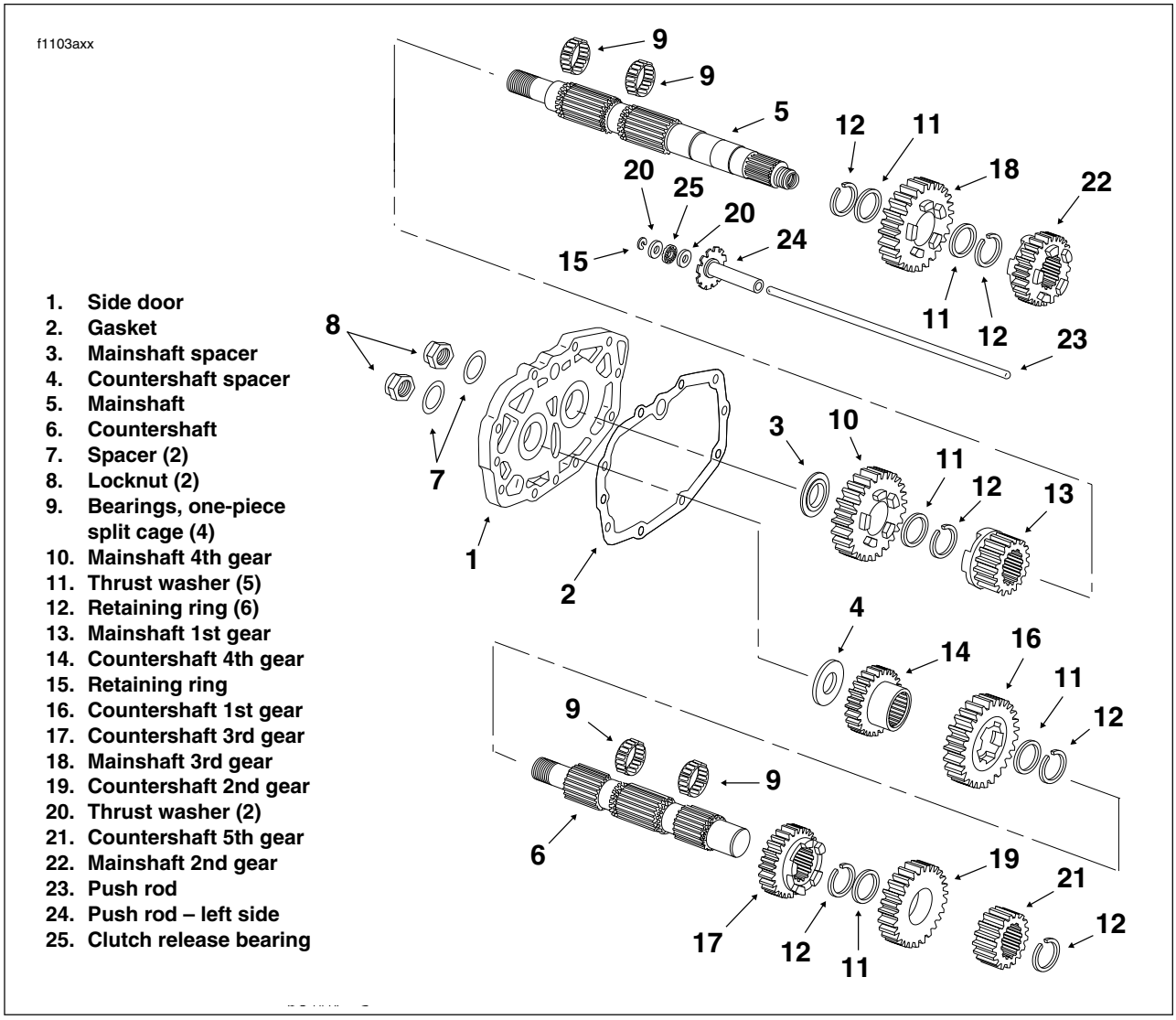


Figure 7-25. Side Door, Mainshaft and Countershaft Assembly (Exploded View)

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.

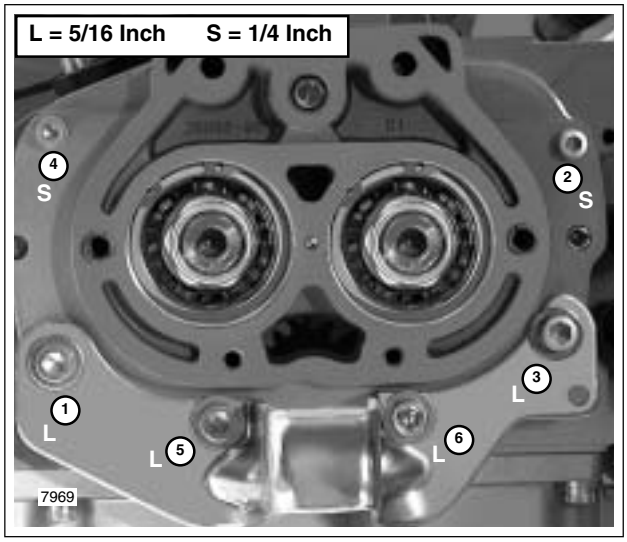


Figure 7-26. Side Door Screw Size and Torque Sequence

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 84-108 **in-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.
11. Install the exhaust system. See Section 3.8 INSTALLING ENGINE IN CHASSIS, steps 49-55.

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 exhaust system in two sections. See Section 3.7 REMOVING ENGINE FROM CHASSIS, steps 3-9.
2. Remove the shifter cam and shifter fork assemblies. See Section 7.4 SHIFTER CAM ASSEMBLY/SHIFTER FORKS, DISASSEMBLY.
3. 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.
4. Remove oil filler spout and starter. See Section 5.4 STARTER, REMOVAL, steps 6-12.
5. Remove the bearing inner race from the transmission mainshaft. See Section 6.5 PRIMARY CHAINCASE, MAINSHAFT BEARING INNER RACE, REMOVAL.
6. 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.

7. 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.

8. Moving to rear wheel, remove E-clip and loosen hex nut on right side of axle. Moving to left side, turn adjuster cam in a counterclockwise direction until belt tension is relieved. Remove the belt from the transmission sprocket.
9. Remove the transmission sprocket, spacer sleeve, mainshaft oil seal and quad seal.

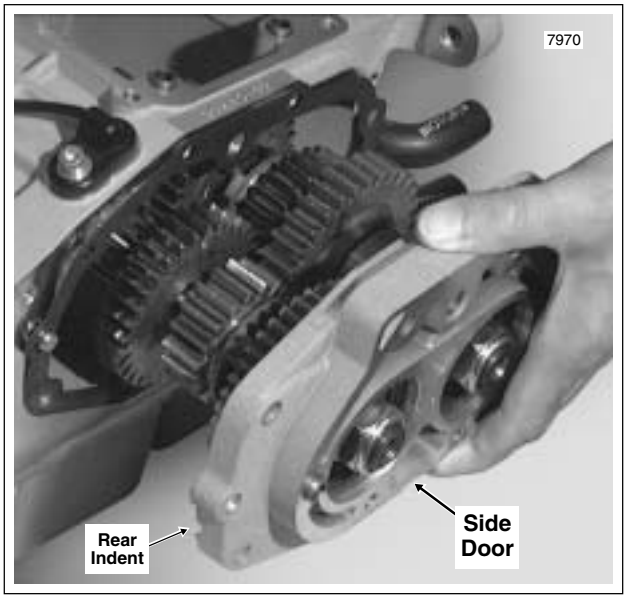


Figure 7-27. Remove Transmission Side Door

⚠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.

10. Remove the retaining ring from the roller bearing bore.
11. Pull the main drive gear using HD-35316B, MAIN DRIVE GEAR REMOVER AND INSTALLER. See instructions provided with the tool.
12. 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.

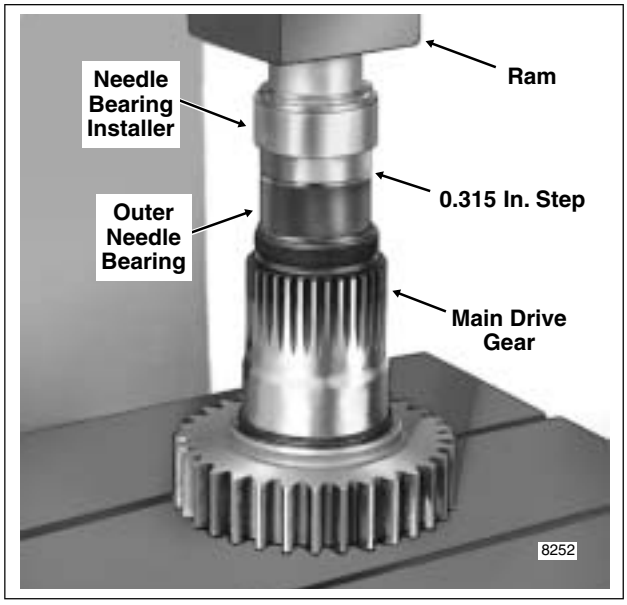


Figure 7-28. Press Clutch Side Needle Bearing into Main Drive Gear

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. Install outer (clutch side) needle bearing using an arbor press and the 0.315 inch step end of tool HD-37842A as shown in Figure 7-28. The tool will bottom on the gear when the correct depth is obtained.
3. Turn over tool and press on oil seal using the 0.080 inch step (garter spring side toward main drive gear). See Figure 7-29.

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.

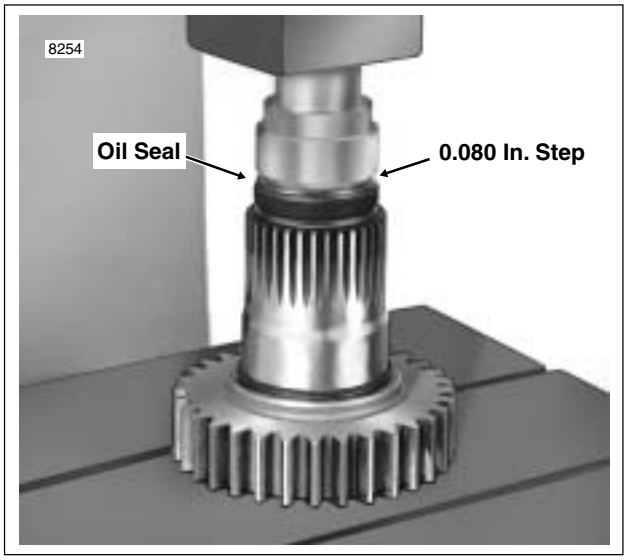


Figure 7-29. Press Oil Seal on Main Drive Gear

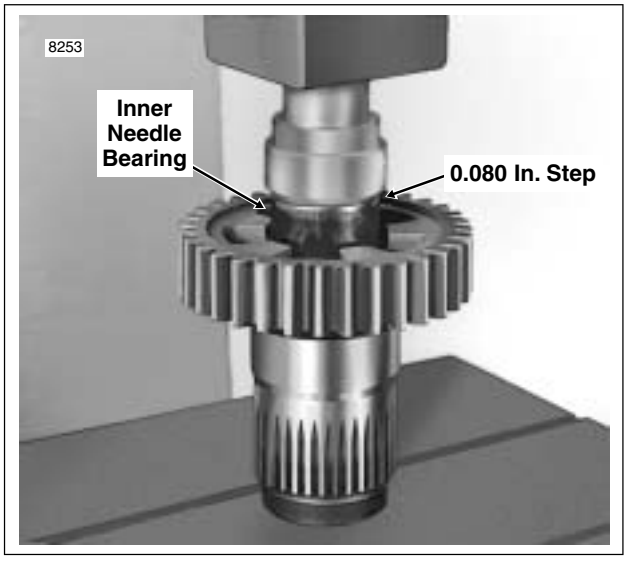


Figure 7-30. Press Transmission Side Needle Bearing into Main Drive Gear

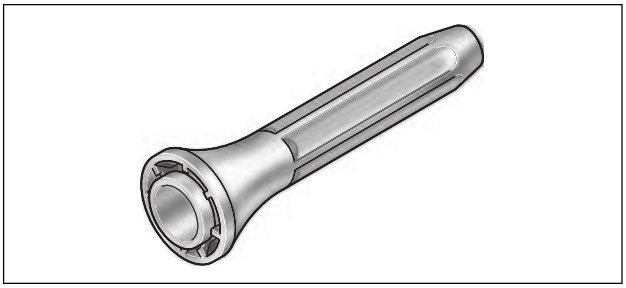


Figure 7-31. Main Drive Gear Large Oil Seal Installer (Part No. HD-41496)

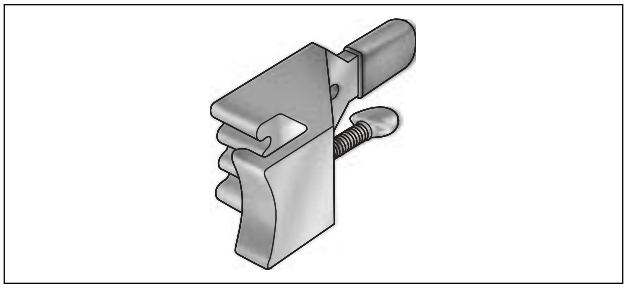


Figure 7-33. Final Drive Sprocket Locking Tool (Part No. HD-41184)

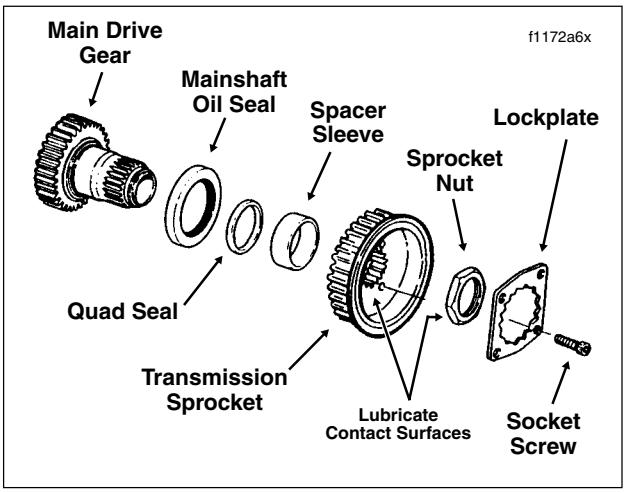


Figure 7-32. Install Transmission Sprocket Components

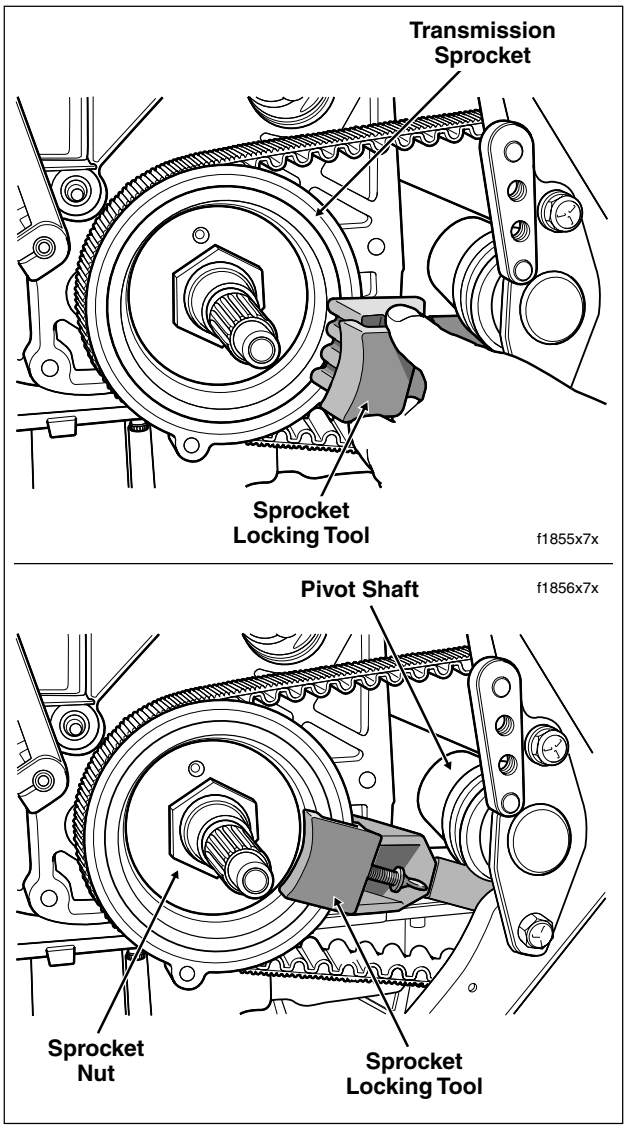


Figure 7-34. Install Final Drive Sprocket Locking Tool

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-35316B). 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 84-108 **in-lbs** (9-12 Nm).
3. 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). See Figure 7-31. 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. See Figure 7-32.
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. See Figure 7-33. 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 7-34.

8. Install pilot of MAINSHAFT LOCKNUT WRENCH (Part No. HD-94660-37B) on threaded end of mainshaft. See Figure 7-35. Slide sleeve of locknut wrench over pilot and onto sprocket nut. Tighten sprocket nut to 60 ft-lbs (81 Nm). As the nut is tightened the handle of the sprocket locking tool rises to contact the pivot shaft, thereby preventing sprocket/mainshaft rotation. See Figure 7-36.

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 35° 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.

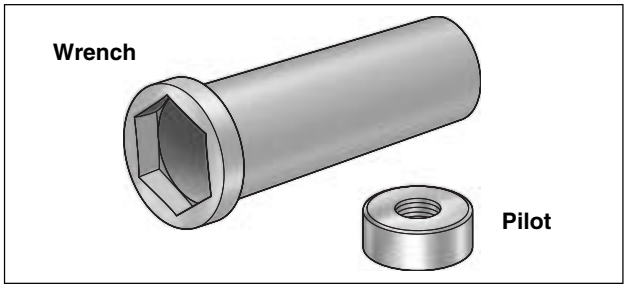


Figure 7-35. Mainshaft Locknut Wrench/Pilot (Part No. HD-94660-37B)

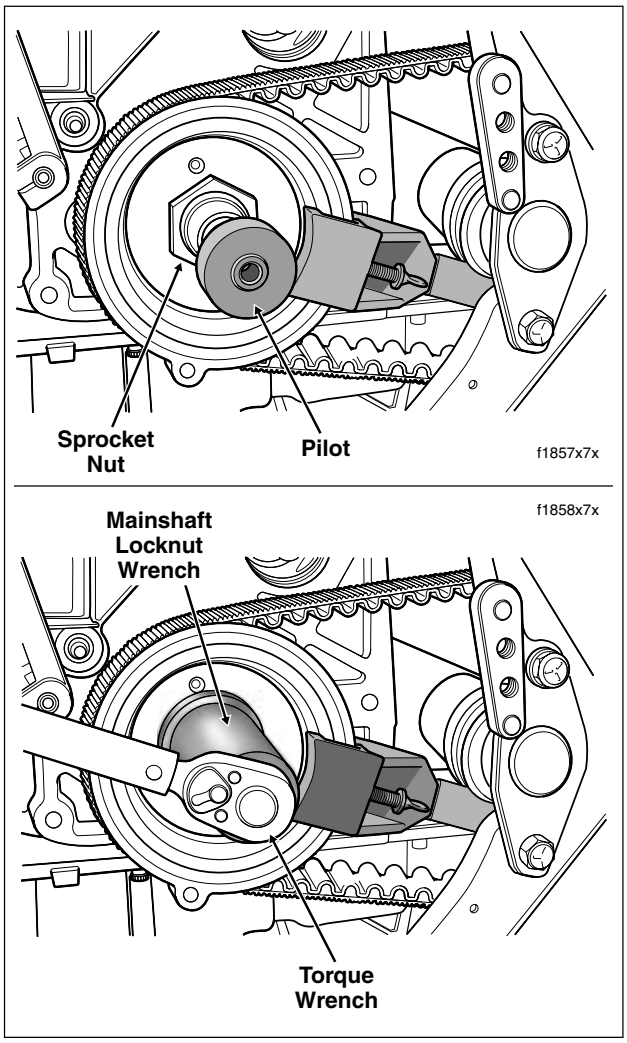


Figure 7-36. Install Mainshaft Locknut Pilot/Wrench and Torque Sprocket Nut

CAUTION

Maximum allowable tightening of sprocket nut is 45° of counterclockwise rotation after a torque of 60 ft-lbs (81 Nm). Do not loosen sprocket nut when attempting to align holes.

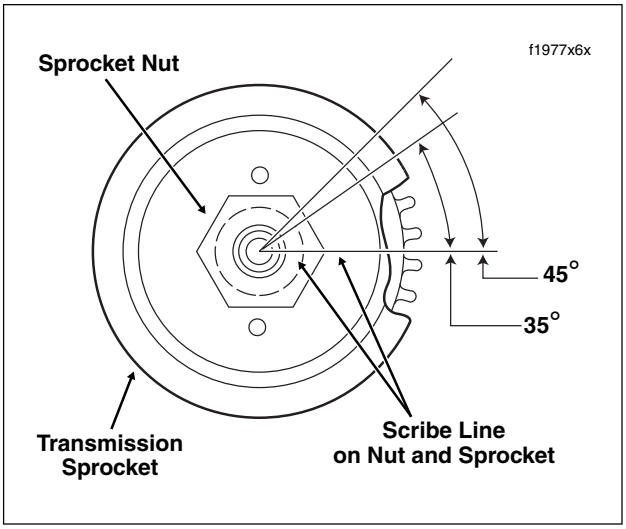


Figure 7-37. Tighten/Secure Sprocket Nut

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 and complete installation of rear wheel. See Section 6.4 SECONDARY DRIVE BELT AND SPROCKETS, ADJUSTMENT, steps 6-10.

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.

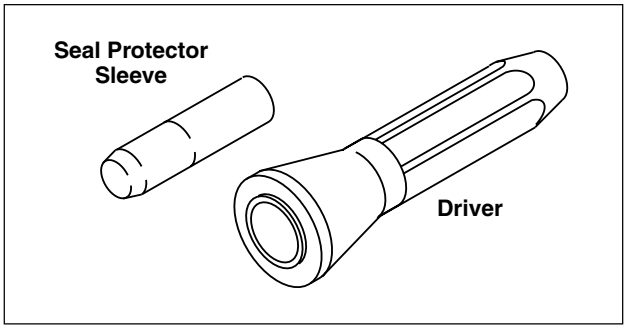


Figure 7-38. Main Drive Gear Seal Installer (Part No. HD-41405)

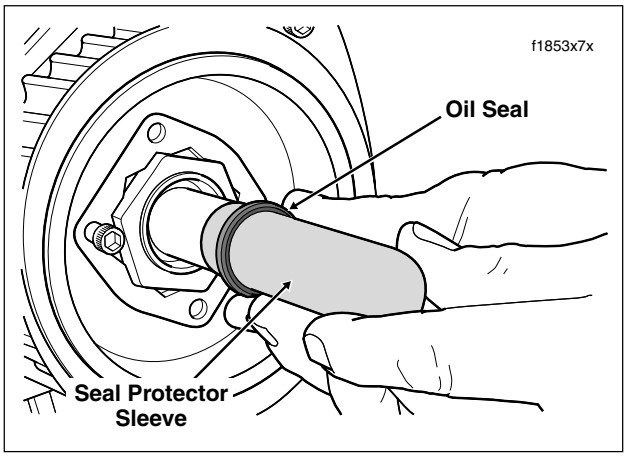


Figure 7-39. Slide Protector Sleeve/Oil Seal on Mainshaft

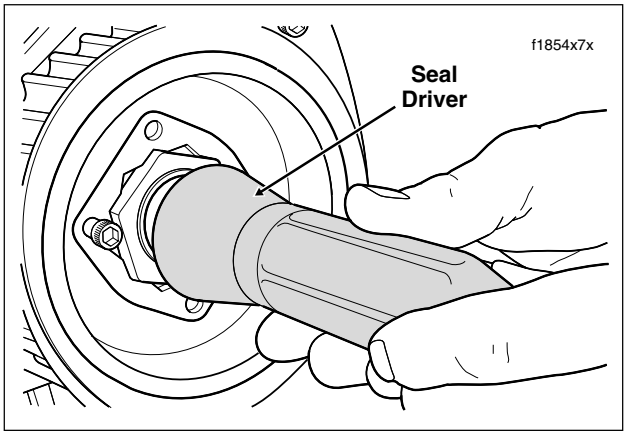


Figure 7-40. Install Oil Seal Using Driver

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.
19. Install the exhaust system. See Section 3.8 INSTALLING ENGINE IN CHASSIS, steps 49-55.

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

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.

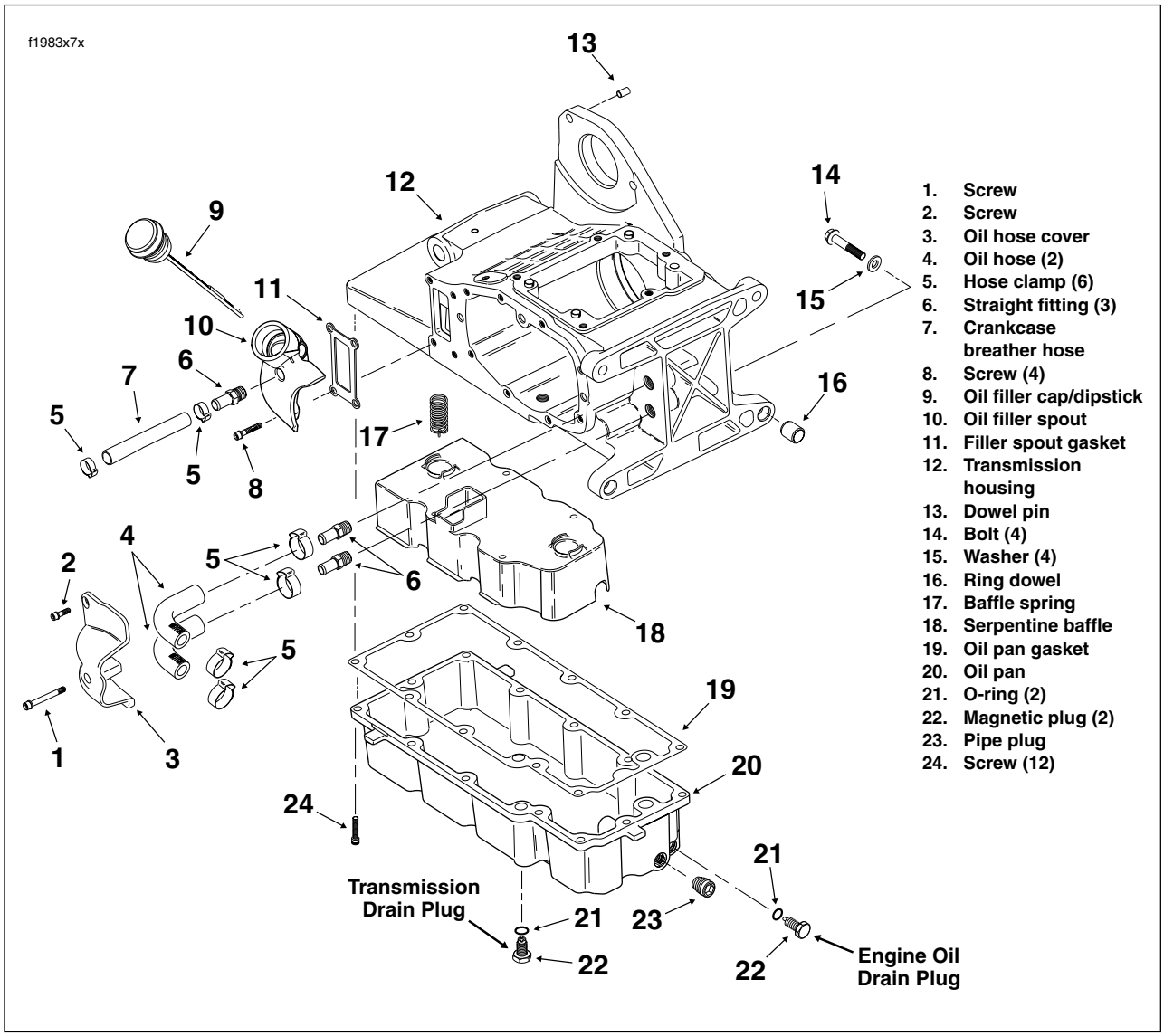


Figure 7-41. Transmission Case and Oil Pan

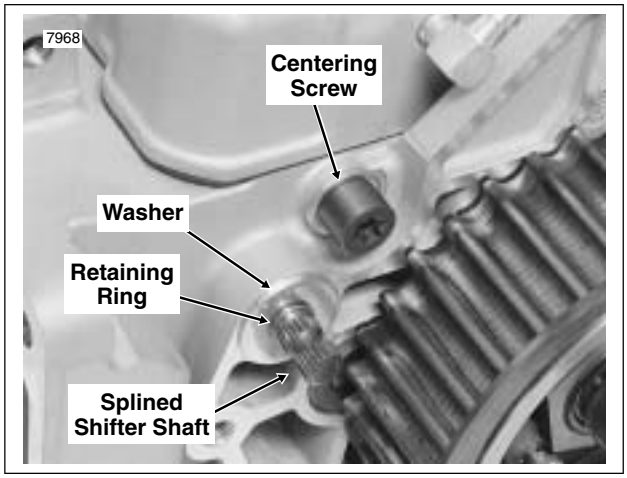


Figure 7-42. Shifter Pawl Centering Screw

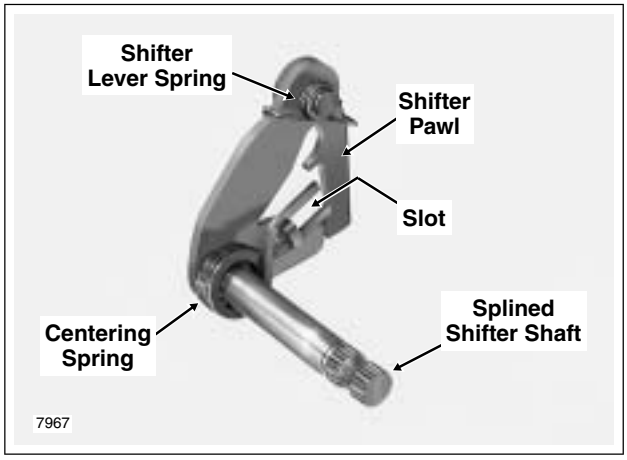


Figure 7-43. Shifter Pawl Assembly

3. Remove rear wheel and rear swingarm. See Section 2.18 REAR SWINGARM, REMOVAL.

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 oil filler spout.
9. 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.

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.

10. 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 oil pan from the transmission case. 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 7-44. Remove both the engine oil and transmission lubricant drain plugs from the oil pan. Drain the fluids into suitable containers.

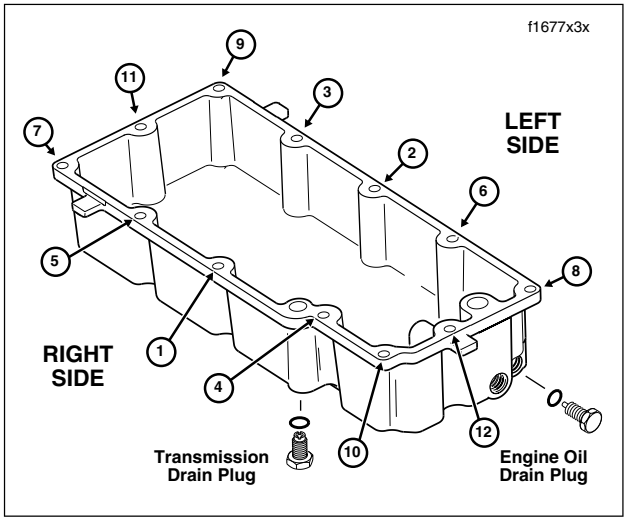


Figure 7-44. Oil Pan Torque Sequence

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.

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 lever assembly if pawl 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.
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 84-108 **in-lbs** (9-12 Nm) following the numerical sequence shown in Figure 7-44.
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.
   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. Repeating the pattern again, final tighten the four 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. Crimp clamps using the Hose Clamp Pliers (HD-41137).

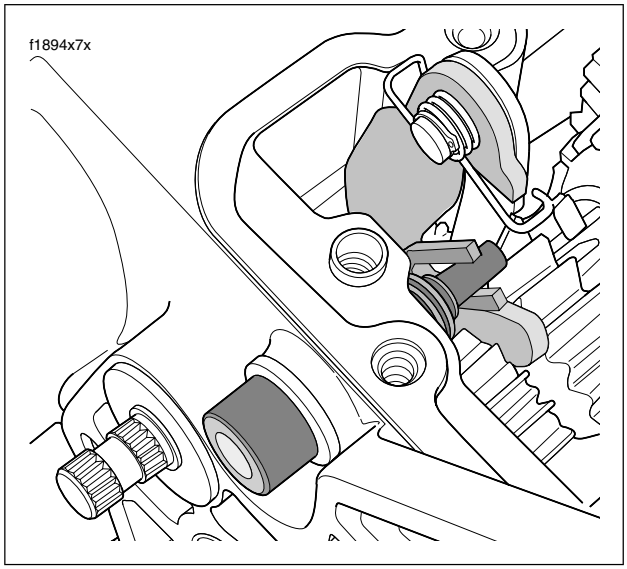


Figure 7-45. Shifter Pawl Assembly

4. Slide **new** clamp onto free end of crankcase breather hose. Install hose onto fitting of oil filler spout. 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 84-108 **in-lbs** (10-12 Nm).

6. 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 7-45.

7. 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.

8. Install the mainshaft and countershaft assemblies. See Section 7.6 MAINSHAFT/COUNTERSHAFT, INSTALLATION.

9. Install belt on transmission sprocket.

10. Install the primary chaincase and starter jackshaft assembly. Install clutch assembly, primary chain, and compensating sprocket components. Install the primary chaincase cover. See Section 6.5 PRIMARY CHAINCASE, INSTALLATION.

11. Install rear swingarm and rear wheel. Adjust belt tension. See Section 2.18 REAR SWINGARM, INSTALLATION.

12. Install engine oil drain plug and tighten to 14-21 ft-lbs (19-28 Nm).

13. Add engine oil. See Section 3.3 GENERAL INFORMATION, CHANGING ENGINE OIL AND FILTER, steps 9-12.

NOTES

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ELECTRICAL 8

NOTE

See the 2003 ELECTRICAL DIAGNOSTIC MANUAL (Part No. 99497-03) for all SYSTEM DIAGNOSIS and ELECTRICAL TROUBLESHOOTING information.

SPECIFICATIONS 8.1

IGNITION TIMING

ALL FL Models	
RANGE	TDC - 50˚ BTDC
START	TDC

ALTERNATOR SYSTEM

Output Voltage @ 3600 rpm14.3-14.7

FLHR, FLHRI, FLHRCI, FLHT, FLHTC, FLTR

Amperes 38 amp

FLHTI, FLHTCI, FLHTCUI, FLTRI

Amperes 45 amp

BATTERY

Voltage 12V

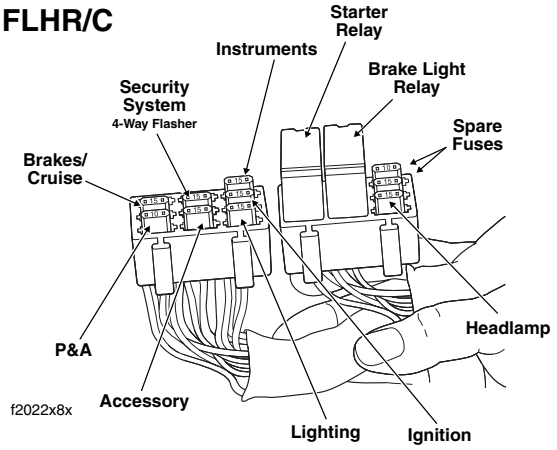
Amperes – 28 AH @ 20 Hour Rate

FUSES

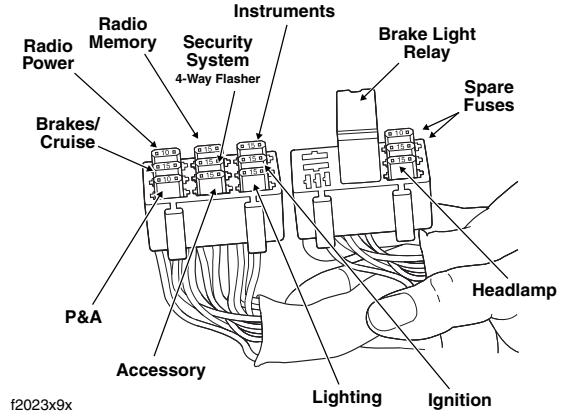
Circuit	Rating (Amperes)	Color	Terminal Type
Main	40	-	Threaded Posts
System Fuses			
Radio Power	10	Red	Blade
Brakes/Cruise	15	Blue	Blade
P & A	10	Red	Blade
Radio Memory	15	Blue	Blade
Security System (Hazard 4-Way Flasher)	15	Blue	Blade
Accessory	15	Blue	Blade
Instruments	15	Blue	Blade
Ignition	15	Blue	Blade
Lighting	15	Blue	Blade
Headlamp	15	Blue	Blade
EFI Fuses			
Fuel Pump	15	Blue	Blade
ECM Power	15	Blue	Blade

Fuse Blocks (Under Left Side Cover)

FLHR/C



FLTR, FLHT/C/U



EFI Fuse Block (Under Right Side Cover)

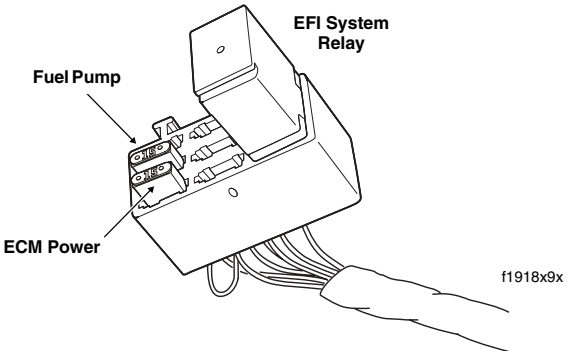


Figure 8-1. Fuse Locations

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.

TORQUE VALUES

Item		ft/in-lbs	Nm
Ignition module socket head screws		50-60 **in-lbs**	5.7-6.8 Nm
MAP sensor TORX screw		25-35 **in-lbs**	2.8-4.0 Nm
Ignition coil bracket socket screws		84-144 **in-lbs**	9.5-16.3 Nm
Spark plug		12-18 ft-lbs	16-24 Nm
Stator to crankcase TORX screws		55-75 **in-lbs**	6.2-8.5 Nm
Battery cable bolt		60-96 **in-lbs**	6.8-10.9 Nm
Voltage regulator locknuts		70-100 **in-lbs**	7.9-11.3 Nm
Main 40 amp circuit breaker Keps nuts		20-35 **in-lbs**	2.3-4.0 Nm
Battery hold-down clamp TORX bolt		15-20 ft-lbs	20-27 Nm
Headlamp door screw		9-18 **in-lbs**	1.0-2.0 Nm
Passing lamp bracket fork side TORX bolts		15-20 ft-lbs	20-27 Nm
Passing lamp bracket fork side stud acorn nuts		72-108 **in-lbs**	8.1-12.2 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		20-25 **in-lbs**	2.3-2.8 Nm
Front fender tip lamp nuts		20-25 **in-lbs**	2.3 - 2.8 Nm
Front fender trim strip tee bolt nuts		10-15 **in-lbs**	1.1-1.7 Nm
Ignition switch to upper fork bracket		36-60 **in-lbs**	4.1-6.8 Nm
Fairing cap TORX screws		25-30 **in-lbs**	2.8-3.4 Nm
Ignition switch button head screws		18-23 **in-lbs**	2.0-2.6 Nm
Ignition switch nut	DOM	50-70 **in-lbs**	5.7-7.9 Nm
	HDI	125-150 **in-lbs**	14.1-16.9 Nm

Continued ...

Item	ft/in-lbs	Nm
Fork lock to upper fork bracket (FLHR/C)	36-60 **in-lbs**	4.1-6.8 Nm
Ignition switch screws (FLHR/C)	20-30 **in-lbs**	2.3-3.4 Nm
Instrument bezel TORX screws	25-35 **in-lbs**	2.8-4.0 Nm
Handlebar clamp to master cylinder housing screws	60-80 **in-lbs**	6.8-9.0 Nm
Lower and upper handlebar 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	120-180 **in-lbs**	13.6-20.3 Nm
Horn stud flange nut (10mm)	80-100 **in-lbs**	9.0-11.3 Nm
Horn bracket acorn nut to rubber mount stud	80-100 **in-lbs**	9.0-11.3 Nm
2 inch diameter gauge nuts	10-20 **in-lbs**	1.1-2.3 Nm
Tachometer bracket socket screws	10-20 **in-lbs**	1.1-2.3 Nm
Speedometer speed sensor screw	84-108 **in-lbs**	9-12 Nm
Speedometer bracket socket screws	10-20 **in-lbs**	1.1-2.3 Nm
Console mounting bolt acorn nut (FLHR/C)	50-90 **in-lbs**	5.7-10.2 Nm
Console pod Phillips screws	6-11 **in-lbs**	0.7-1.2 Nm
Fuel tank canopy TORX screws	18-24 **in-lbs**	2.0-2.7 Nm
Cruise module locknuts	60-96 **in-lbs**	6.8-10.9 Nm
Radio to support bracket socket screws	35-45 **in-lbs**	4.0-5.1 Nm
Upper fairing speaker lower TORX screw	22-28 **in-lbs**	2.5-3.2 Nm
Upper fairing speaker upper TORX screws	35-50 **in-lbs**	4.0-5.7 Nm
Throttle cable J-clamp screw to wellnut (FLHR/C)	9-18 **in-lbs**	1.0-2.0 Nm

BULB CHART 8.2

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	68329-03
FLTR	2	4.58/5	55/60	68329-03
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	Early/Late***		Early/Late***
Tail Lamp		0.59/0.59	7/6	68168-89A/68167-88
Stop Lamp		2.25/2.10	27/24	
Tail Lamp (HDI)		0.42/0.59	5/6	68169-90A/68167-88
Stop Lamp(HDI)		1.75/2.10	21/24	
License Plate (HDI)	1	0.37	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 Marker Lamps *	4	0.3	3.7	53439-79
Tail/Brake Lamps (Ultra)	2	0.59	7	68168-89A
FENDER TIP LAMPS *	2	0.3	3.7	53439-79
INSTRUMENT PANEL LAMPS				
FLHT/C/U, FLTR				
High Beam	1	0.15	2.1	68024-94
Oil Pressure	1	0.15	2.1	68024-94
Neutral	1	0.15	2.1	68024-94
Turn Signal	2	0.15	2.1	68024-94
GAUGE LAMPS				
FLHT/C/U, FLTR				
Speedometer **				
Tachometer **				
Voltmeter	1	0.24	3.4	67445-00
Oil Pressure Gauge	1	0.24	3.4	67445-00
Air Temperature Gauge	1	0.24	3.4	67445-00
Fuel Gauge	1	0.24	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.

*** Early 2003 bulbs are bayonet mount type, while late 2003 bulbs are wedge mount.

NOTES

IGNITION MODULE 8.3

REMOVAL

1. Remove right side saddlebag. See Section 2.23 SADDLEBAG, REMOVAL.
2. Gently pull side cover from frame downtubes (no tools required).
3. 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.
4. Remove two socket screws to detach ignition module from electrical bracket.

INSTALLATION

1. Align holes in ignition module with those in electrical bracket. Install two socket screws and tighten to 50-60 **in-lbs** (5.7-6.8 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. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required).

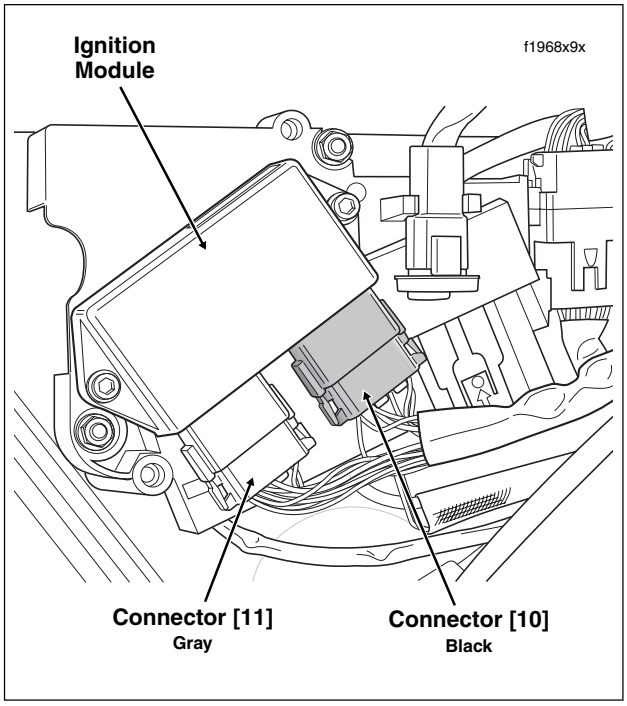


Figure 8-2. Ignition Module (Under Right Side Cover)

4. Install right side saddlebag. See Section 2.23 SADDLEBAG, INSTALLATION.

MANIFOLD ABSOLUTE PRESSURE SENSOR

Removal

1. Partially remove fuel tank. See Section 4.7 FUEL TANK (CARBURETED), 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.

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,

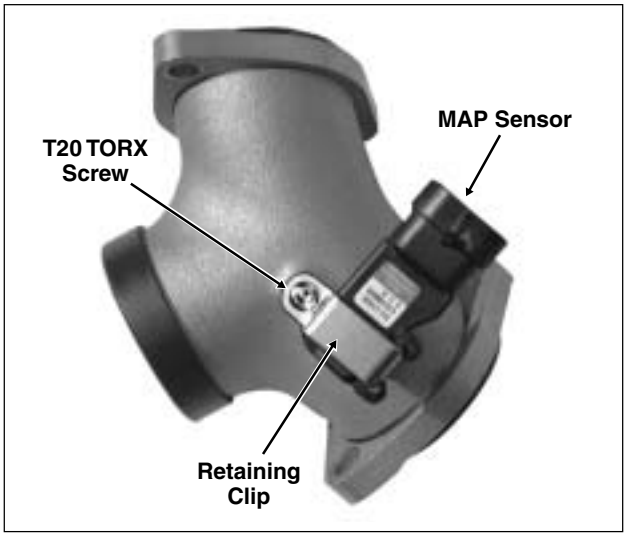


Figure 8-3. Intake Manifold

3. Install T20 TORX screw and tighten to 25-35 **in-lbs** (2.8-4.0 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 (CARBURETED), INSTALLATION (AFTER PARTIAL REMOVAL), FLHT/C, FLTR, or FLHR.

CRANKSHAFT POSITION SENSOR

See Section 9.3 SENSORS, CRANKSHAFT POSITION SENSOR.

IGNITION COIL 8.5

REMOVAL

1. Partially remove fuel tank. For carbureted models, see Section 4.7 FUEL TANK (CARBURETED), PARTIAL REMOVAL, FLHT/C, FLTR, or FLHR. For fuel injected models, see Section 9.4 FUEL TANK (FUEL INJECTED), PARTIAL REMOVAL, FLHT/C/U/I, FLTRI, or FLHR/C/I.
2. Unplug spark plug cables from ignition coil towers.
3. Pull external latch outward and use rocking motion to remove electrical connector from left side of ignition coil.
4. Pull sides of ignition coil bracket outward to remove from bosses of front fuel tank mount. See Figure 8-4.
5. Remove two socket screws to free ignition coil from bracket.

INSTALLATION

1. Align holes in **new** ignition coil with holes in bracket. Properly positioned, connector pin housing should be positioned at cut in bracket. Install two socket screws and tighten to 84-144 **in-lbs** (9.5-16.3 Nm). See Figure 8-5.
2. With the coil towers facing rear of vehicle, hold ignition coil and bracket at bottom of frame backbone. Pull sides of bracket outward and install on bosses of front fuel tank mount. See Figure 8-4.
3. Install electrical connector on left side of ignition coil. Align latch on socket housing with locking tab on pin housing and push connector halves together until latch clicks.
4. Install spark plug cable to front cylinder onto left side coil tower. Verify that spark plug cable is captured in double-sided cable clip at bottom left side of frame backbone. Install **new** cable clip on T-stud if damaged or missing. See Figure 8-7.
5. Install spark plug cable to rear cylinder onto right side coil tower. Verify that spark plug cable is captured in two single-sided cable clips at bottom left side of frame backbone. Install **new** cable clips on T-studs if damaged or missing. See Figure 8-7.
6. Install fuel tank. For carbureted models, see Section 4.7 FUEL TANK (CARBURETED), INSTALLATION (AFTER PARTIAL REMOVAL), FLHT/C, FLTR, or FLHR. For fuel injected models, see Section 9.4 FUEL TANK (FUEL INJECTED), INSTALLATION (AFTER PARTIAL REMOVAL), FLHT/C/U/I, FLTRI, or FLHR/C/I.



Figure 8-4. Remove Ignition Coil Bracket From Vehicle

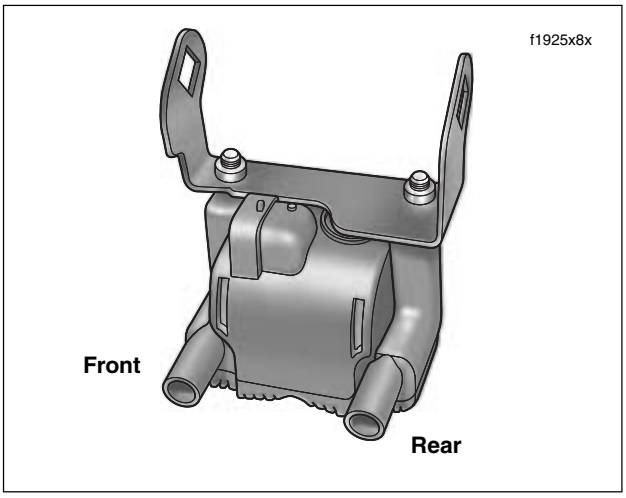


Figure 8-5. Install Bracket to Ignition Coil

SPARK PLUGS/SPARK PLUG CABLES 8.6

SPARK PLUGS

Inspect spark plugs at 5000 miles (8,000 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 8-6. 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 8-6. 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 12-18 ft-lbs (16-24 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 (508 mm)	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 spark plugs.
2. Install spark plug cable to front cylinder onto left side coil tower. Verify that spark plug cable is captured in double-sided cable clip at bottom left side of frame backbone. Install **new** cable clip on T-stud if damaged or missing. See Figure 8-7.
3. Install spark plug cable to rear cylinder onto right side coil tower. Verify that spark plug cable is captured in two single-sided cable clips at bottom left side of frame backbone. Install **new** cable clips on T-studs if damaged or missing. See Figure 8-7.



Figure 8-7. Spark Plug Cable Clips (Left Side View)

REMOVAL

1. Remove seat. See Section 2.22 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 REMOVER/INSTALLER and SHAFT PROTECTOR SLEEVE (HD-41771) must be used to prevent parts damage and possible hand injury during removal and installation.

5. 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 8-8.

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.

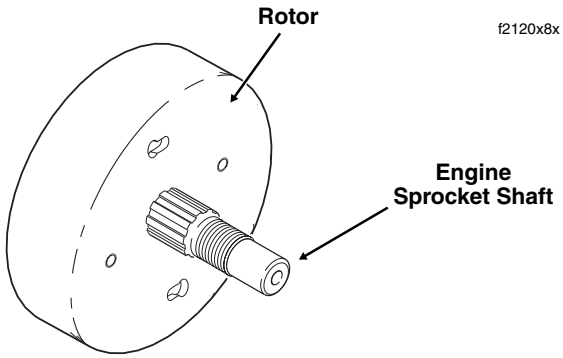
Low Output Rotor - 38 Amp

CAUTION

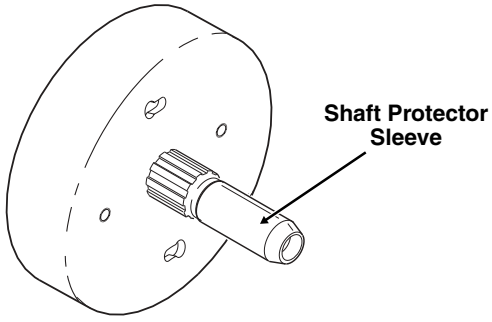
Do not strike or drop rotor. Damage to magnet adhesive may result in rotor failure.

a. Fabricate wire hooks or use the ends of two allen wrenches to carefully pull rotor at holes in rotor face.

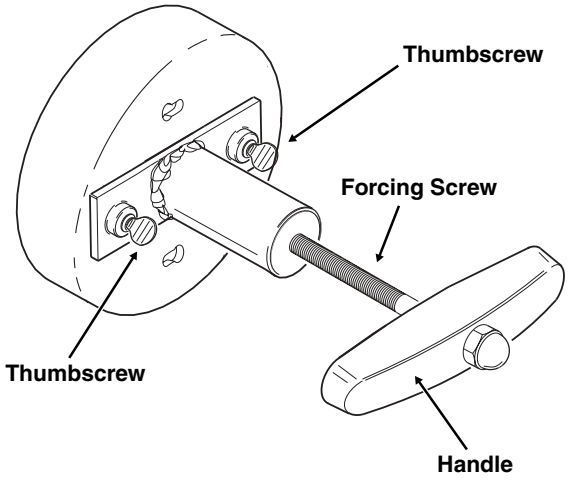
b. Pull rotor from stator. Magnets in rotor cause some resistance during removal.



1. Clean Sprocket Shaft Threads.



2. Install Shaft Protector Sleeve.



3. Install Rotor Remover/Installer. Rotate Handle in a Clockwise Direction.

Figure 8-8. Remove Rotor from Engine Sprocket Shaft

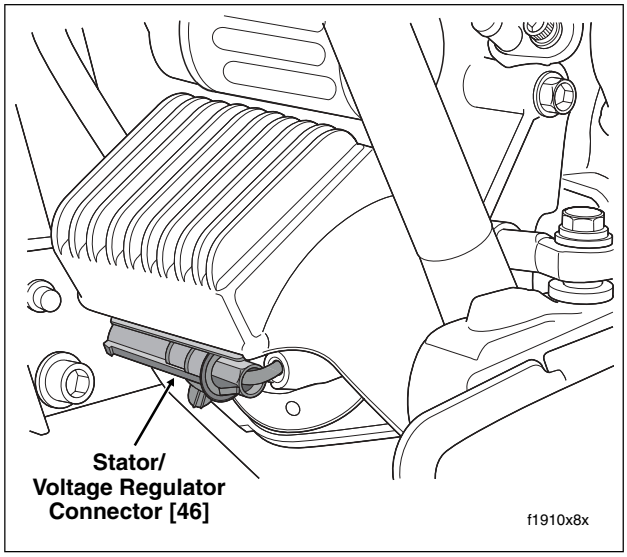


Figure 8-9. Stator/Voltage Regulator Connector (Left Side View)

6. Moving to front left side of vehicle, locate stator/voltage regulator connector fixed to bracket at bottom of voltage regulator. Slide connector toward left side to release groove on connector from ridge on bracket.
7. Raise the external latch and use a rocking motion to separate pin and socket halves of connector.
8. Remove locknut from left side leg of voltage regulator. Loosen right side locknut. Raise voltage regulator as necessary to free left side leg from stud on lower frame crossmember.
9. Remove P-clip from stud. Remove P-clip from cable conduit.
10. Draw connector and cable conduit to rear of engine stabilizer link and then up to area in front of primary chaincase.
11. Depress tangs inside socket housing and back out sockets through wire end of connector. Proceed as follows:
    a. Looking into the socket housing, take note of the cavity on each side of the terminal. See upper frame of Figure 8-10.
    b. Gently insert pick (Snap-On TT600-3) into the cavity about 1/4 inch (6.4 mm) or until it stops, and pivot the side of the pick toward the terminal body. Repeat step on other cavity. See lower frame of Figure 8-10.
    c. Gently tug on cable to pull terminal from chamber. If terminal is still locked, one or both tangs are not fully depressed. Repeat steps 11(b) and 11(c) as necessary.
    d. Repeat procedure to release second terminal.
12. Remove conduit from cables. For best results, feed one cable and socket terminal through conduit at a time.
13. Using a T27 TORX drive head, remove four screws to free stator from crankcase. Discard screws.
14. Using point of awl, carefully lift capped rib on grommet away from crankcase and then insert into bore between grommet and casting. See Figure 8-11. Tilt awl slightly squirting isopropyl alcohol or glass cleaner into opening. Repeat this step at one or two other locations around grommet.
15. 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.
16. Draw stator cables and socket terminals through crankcase bore. For best results, feed one cable and socket terminal through at a time.

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.

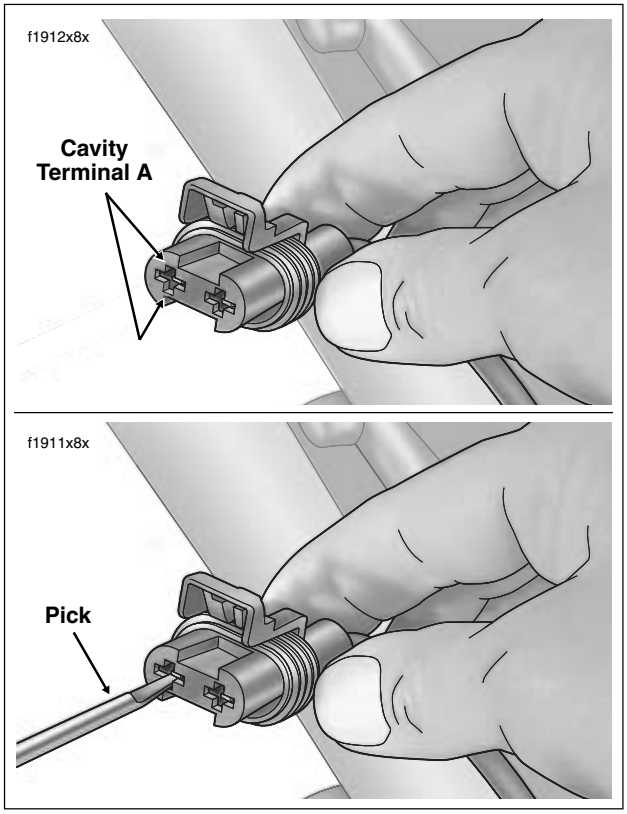


Figure 8-10. Remove Socket Terminals

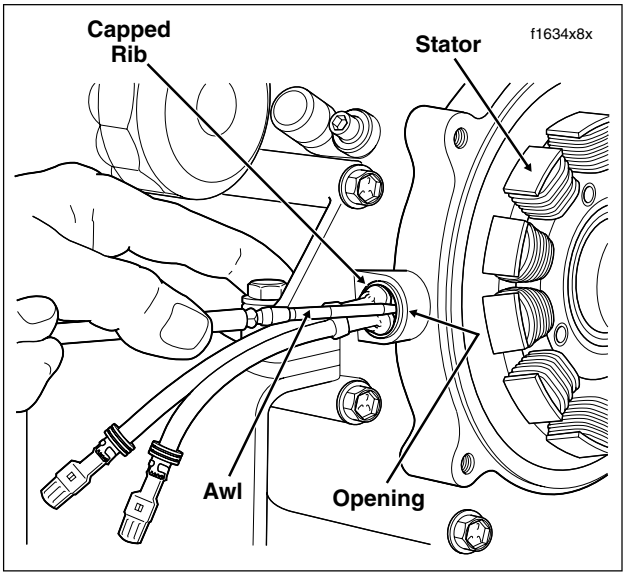


Figure 8-11. Remove Grommet From Crankcase

INSTALLATION

1. From inside crankcase, feed socket terminals and stator cables through hole in crankcase. For best results, feed one cable and socket terminal through at a time.
2. Thorougly lubricate grommet with isopropyl 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.

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 55-75 **in-lbs** (6.2-8.5 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 8-8.

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 8-13. Install the 0.020 inch (0.508 mm) thick alternator rotor spacer and the shaft extension on the engine sprocket shaft.

7. Install conduit onto stator cables. For best results, feed one cable and socket terminal through conduit at a time.
8. Install sockets into stator/voltage regulator connector as follows:

a. Using a fingernail or a thin flat blade, like that on an X-Acto knife, carefully bend the tangs outward away from each terminal body. See Figure 8-12.

b. Feed each socket into wire end of stator/voltage regulator connector until it “clicks” in place.

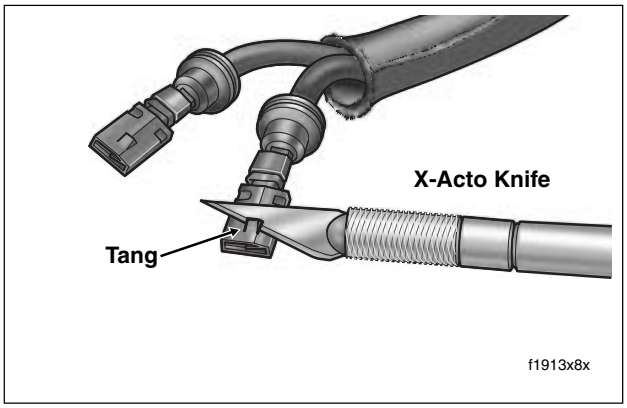


Figure 8-12. Bend Tangs Outward

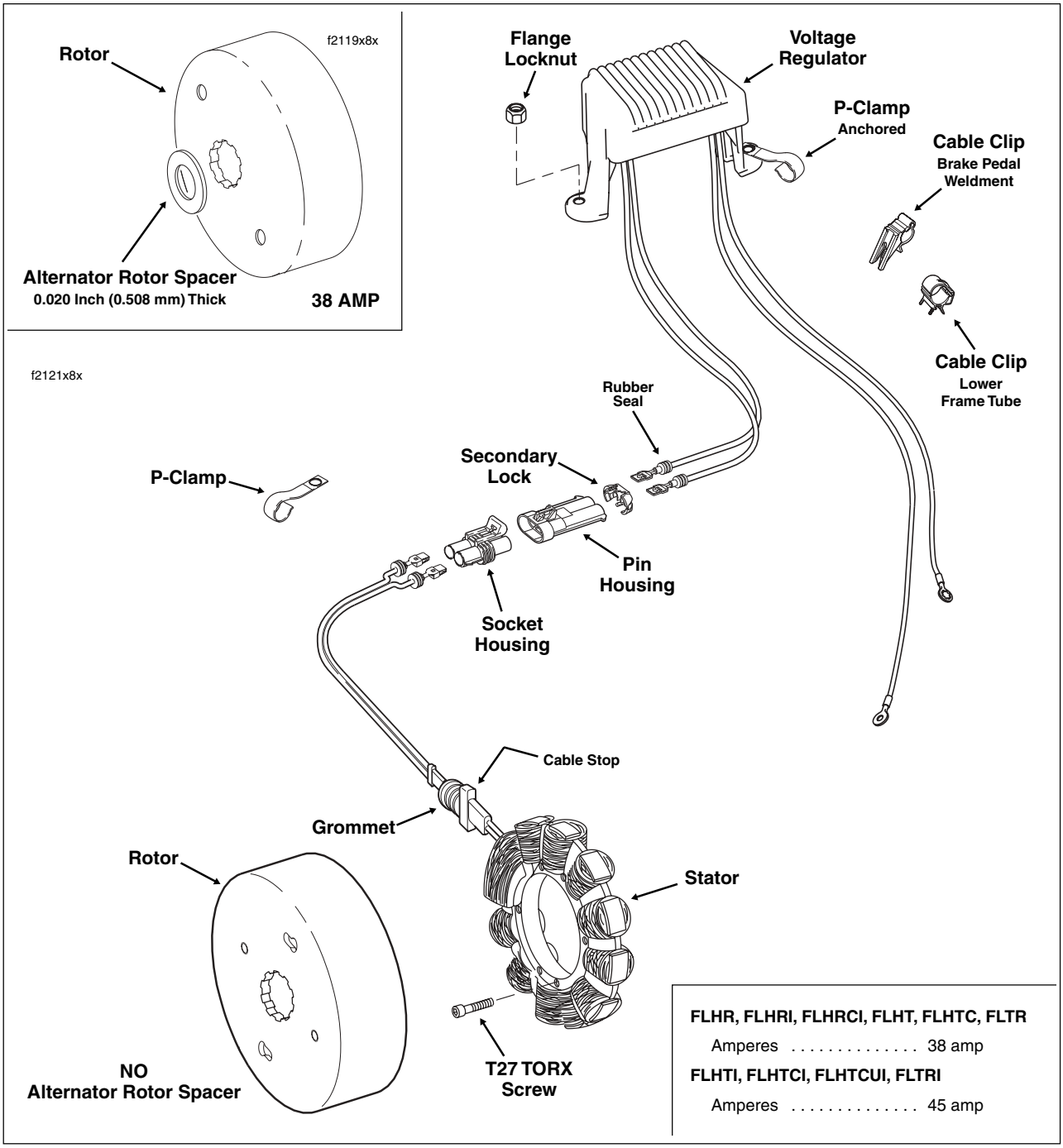


Figure 8-13. Stator/Voltage Regulator Assemblies - 45 AMP

c. Verify that sockets will not back out of chambers. A slight tug on each cable will confirm that it is locked.

9. Feed connector and cable conduit down under engine stabilizer link and forward to area of voltage regulator.

10. Install P-clip on cable conduit approximately five inches (127 mm) from where cables exit left side of voltage regulator. Install P-clip on stud on lower frame crossmember. Properly oriented, P-clip is positioned at rear of stud with the open side down.

CAUTION

Damage to cables can result in electrical problems. Be sure there is enough clearance with castings to prevent powertrain movement from chafing cables.

11. Raise voltage regulator as necessary to install left side leg onto stud. Install locknut and tighten to 70-100 **in-lbs** (7.9-11.3 Nm).
12. Tighten right side locknut to 70-100 **in-lbs** (7.9-11.3 Nm).
13. Mate pin and socket housings of stator/voltage regulator connector. Push halves together until the latch “clicks.”
14. At bottom of voltage regulator, slide connector toward right side of vehicle until groove on connector fully engages ridge on bracket.
15. 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.
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 2.22 SEAT, INSTALLATION.

VOLTAGE REGULATOR 8.8

REMOVAL

1. Remove seat. See Section 2.22 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 nut from left side ground post in front of battery box. Remove internal tooth ring terminal (with black shrink tube). See Figure 8-14.
6. Remove Keps nut from silver post of 40 amp circuit breaker. Remove ring terminal (with yellow shrink tube).
7. Standing on right side of vehicle, release cable conduit from clip at front of battery box.

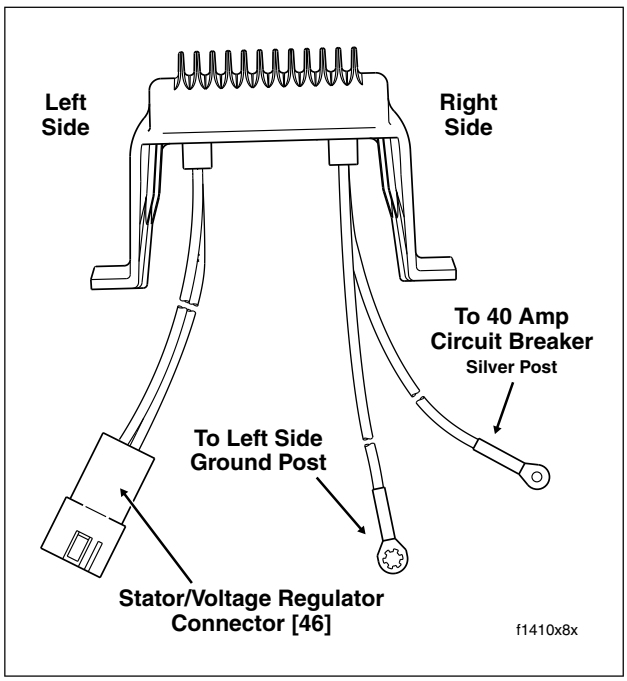


Figure 8-14. Voltage Regulator

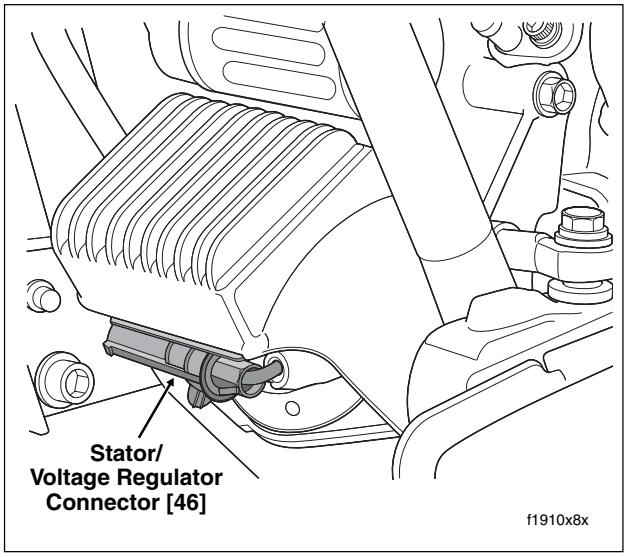


Figure 8-15. Stator/Voltage Regulator Connector (Left Side View)

8. Cut three cable straps at locations shown in illustration at bottom of Figure 8-16.
9. Open two cable clips on T-studs at top of lower frame tube. Free voltage regulator cable conduit 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. Free voltage regulator cable conduit from cable clip on T-stud inboard of rear brake pedal weldment.
11. Moving to front left side of vehicle, locate stator/voltage regulator connector fixed to bracket at bottom of voltage regulator. Slide connector toward left side to release groove on connector from ridge on bracket. See Figure 8-15.
12. Raise the external latch and use a rocking motion to separate pin and socket halves of connector.
13. Remove locknuts from studs on lower frame crossmember. Remove voltage regulator from studs.
14. Remove cable conduit from P-clips. Remove P-clip from left side stud. Note that right side P-clip is anchored to leg of voltage regulator.

INSTALLATION

1. With the open side down, install P-clip on cable conduit approximately five inches (127 mm) from where cables exit left side of voltage regulator. Repeat step to install anchored P-clip on cables exiting right side of voltage regulator. See illustration at top of Figure 8-16.

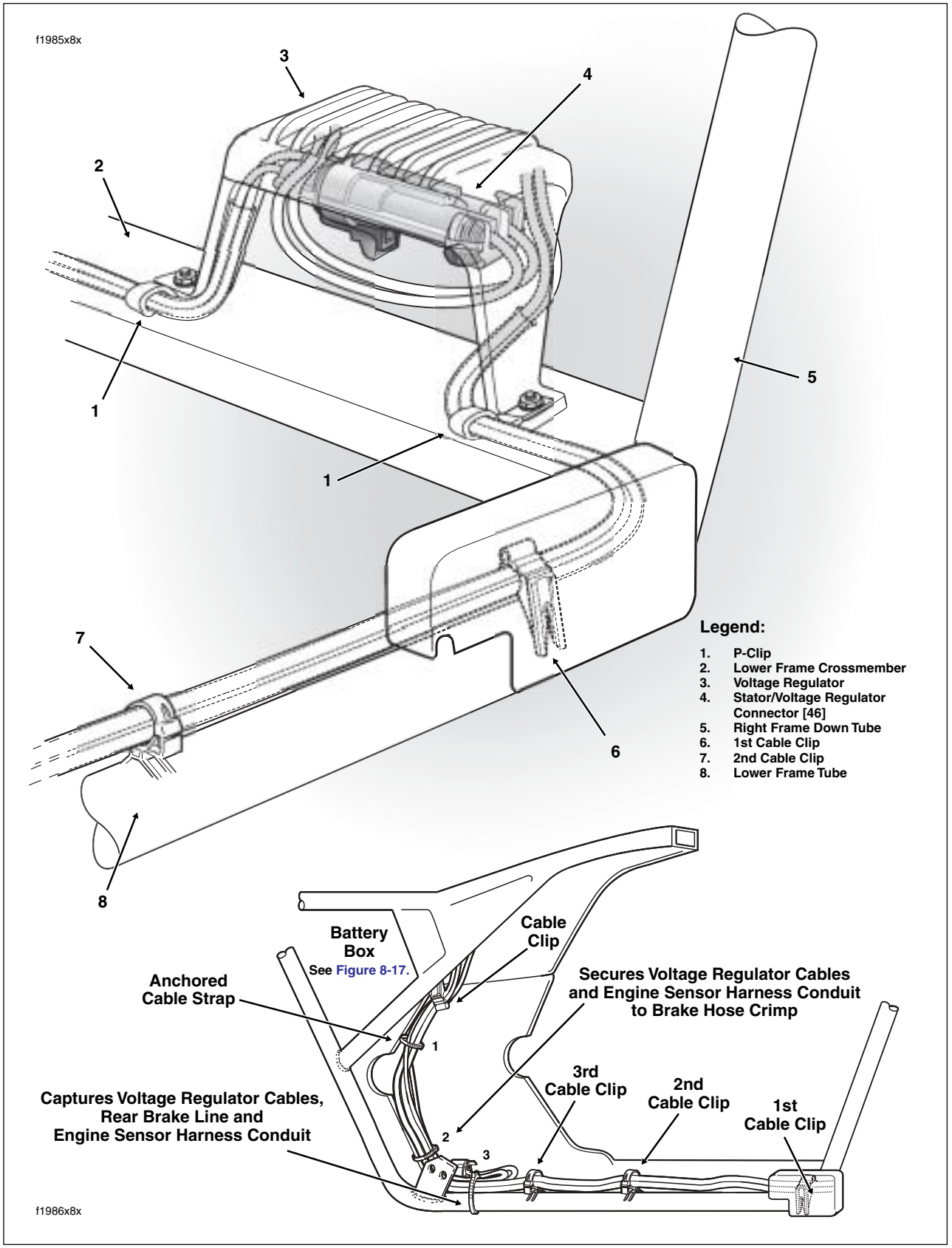


Figure 8-16. Voltage Regulator Cable Routing (Right Side View)

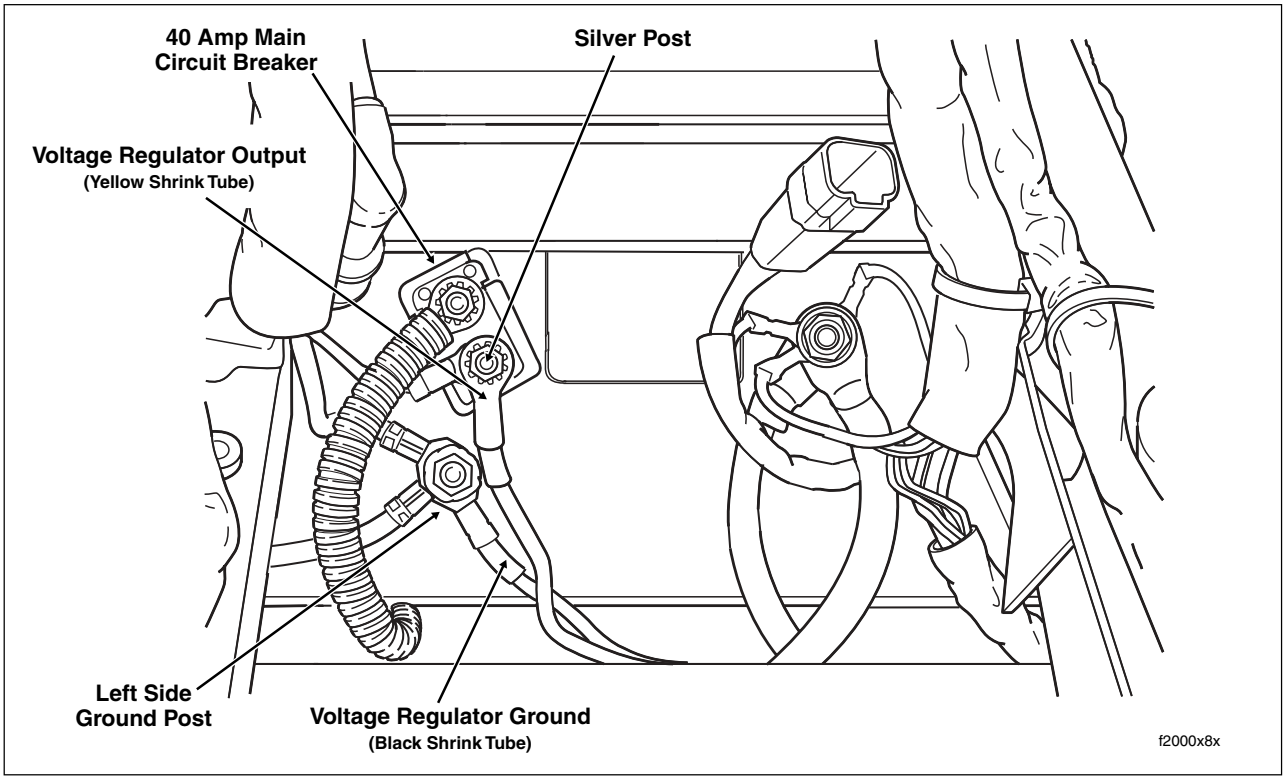


Figure 8-17. Electrical Connections - Upper Frame Cross Member (Under Seat)

2. Slide P-clip over left side stud on lower frame cross-member. Slide voltage regulator over studs. Properly oriented, P-clips are positioned at rear of studs with the open sides down.
3. Install locknuts on studs and tighten to 70-100 **in-lbs** (7.9-11.3 Nm).
4. Mate pin and socket housings of stator/voltage regulator connector. Push halves together until the latch "clicks."
5. At bottom of voltage regulator, slide connector toward right side of vehicle until groove on connector fully engages ridge on bracket. See Figure 8-15.
6. Route cables through cable clip on T-stud on inboard side of rear brake pedal weldment. Run cables toward rear of vehicle passing through two cable clips on T-studs at top of lower frame tube. Snap each clip closed after capturing cables. See illustration at bottom of Figure 8-16.

NOTE

The two rear 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) onto silver post of main 40 amp circuit breaker. Install nuts and tighten to 20-35 **in-lbs** (2.3-4.0 Nm). See Figure 8-17.
9. Install three **new** cable straps at locations shown in illustration at bottom of Figure 8-16. 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.

⚠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 2.22 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 8-18. 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. See Figure 8-19.

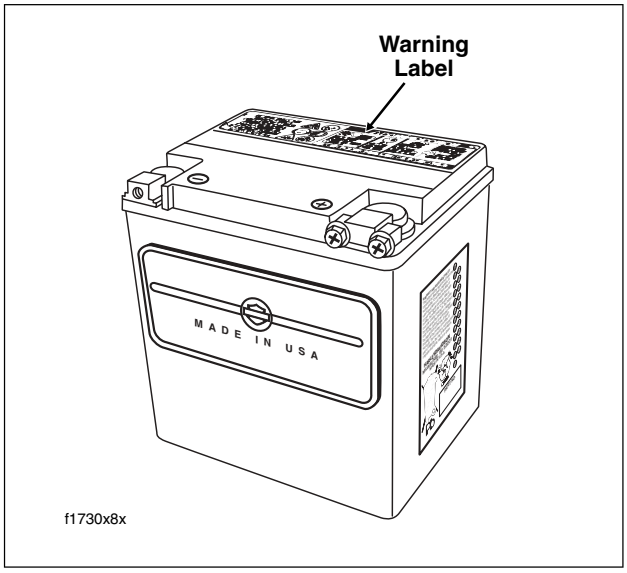


Figure 8-18. Maintenance-Free Battery

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 8-19. 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 2.22 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 instructions for the charger being used. In addition to the manufacturer's instructions, follow these general safety precautions:

- **Always wear proper eye, face and hand protection.**
- **Always charge batteries in a well-ventilated area.**
- **Turn the charger "OFF" before connecting the leads to the battery to avoid dangerous sparks.**
- **Never try to charge a visibly damaged or frozen battery.**
- **Connect the charger leads to the battery; red positive (+) lead to the positive (+) 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 on this page.

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 8-20.

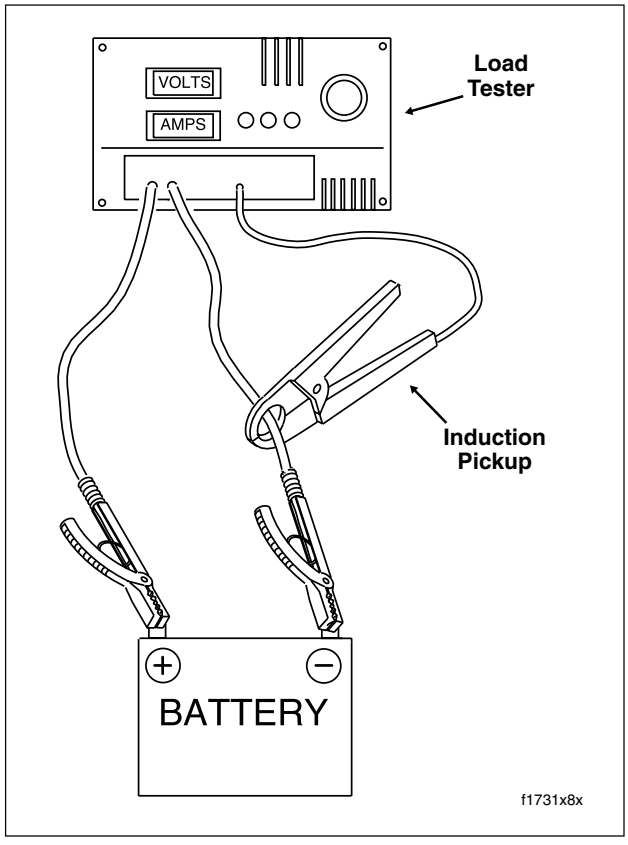


Figure 8-20. Load Test Battery

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. Cables should be positioned as shown in Figure 8-21.

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 2.22 SEAT, INSTALLATION.

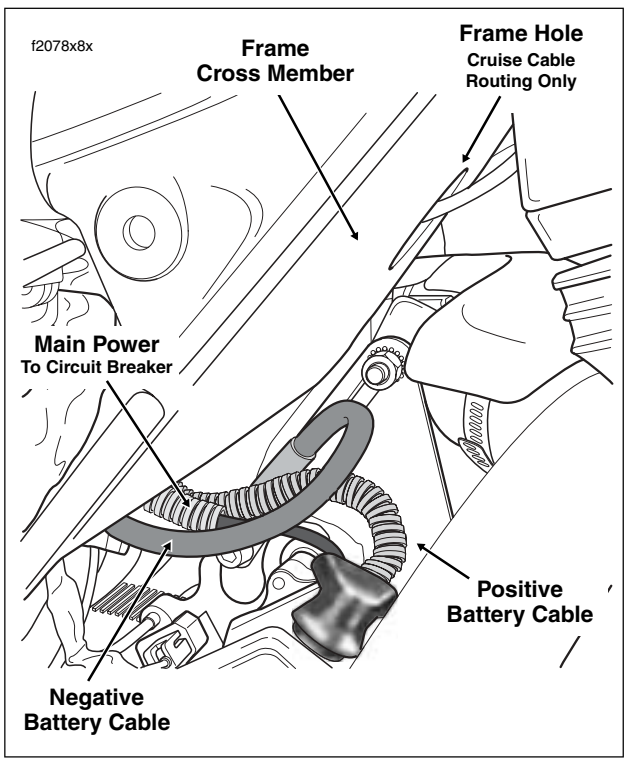


Figure 8-21. Battery Cable Routing (Right Side View)

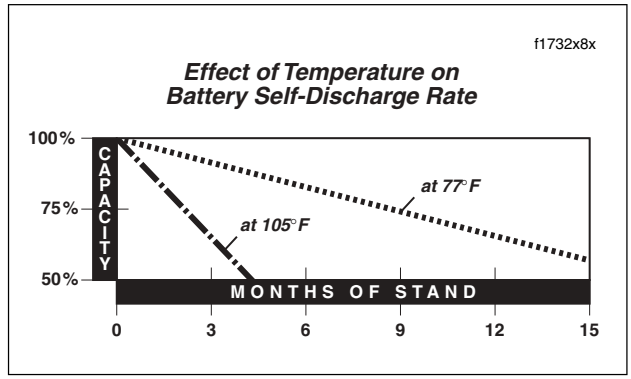


Figure 8-22. Battery Self-Discharge Rate

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 cause a 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 8-22.

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 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 eight 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 eight 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 Phillips screw at the bottom of the headlamp door and tighten to 9-18 **in-lbs** (1.0-2.0 Nm).

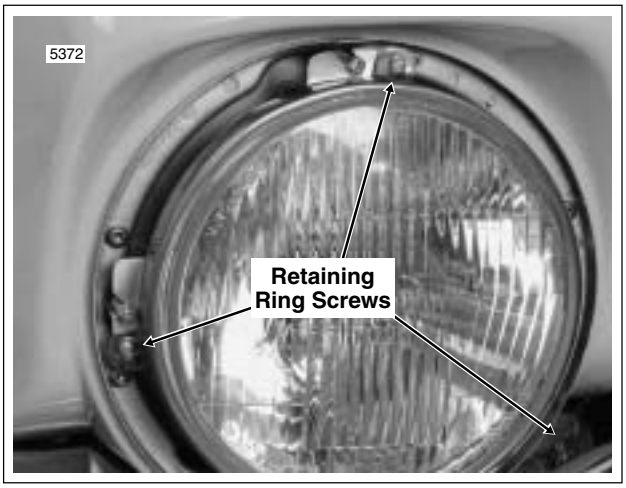


Figure 8-23. Remove Retaining Ring Screws (FLHT/C/U Model Shown)

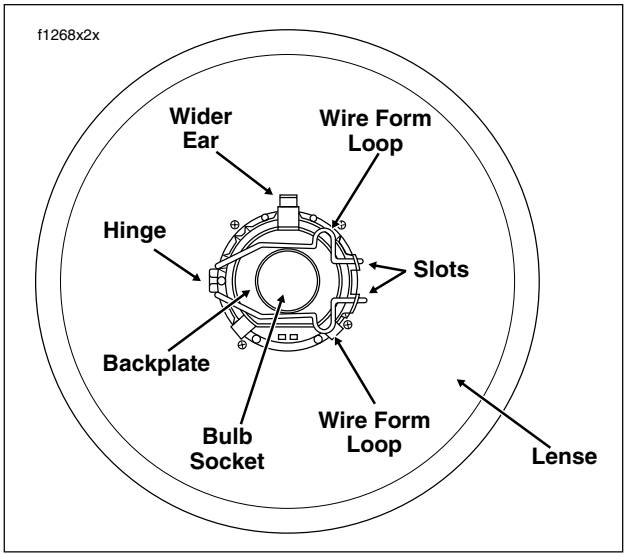


Figure 8-24. Headlamp Lense/Bulb Assembly (Rear View)

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 8-23. 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 8-24. 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.

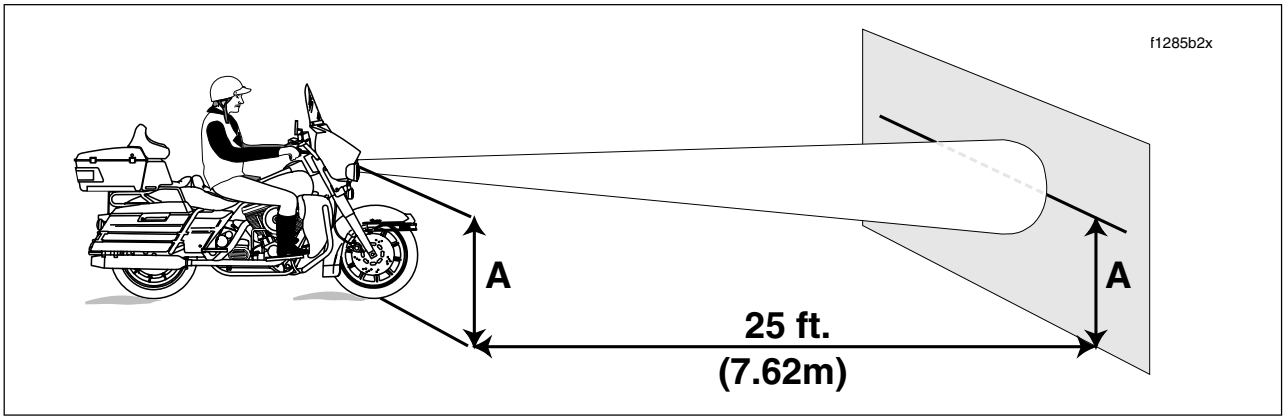


Figure 8-25. Check Headlamp Alignment

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 Phillips screw at the bottom of the headlamp door and tighten to 9-18 **in-lbs** (1.0-2.0 Nm).

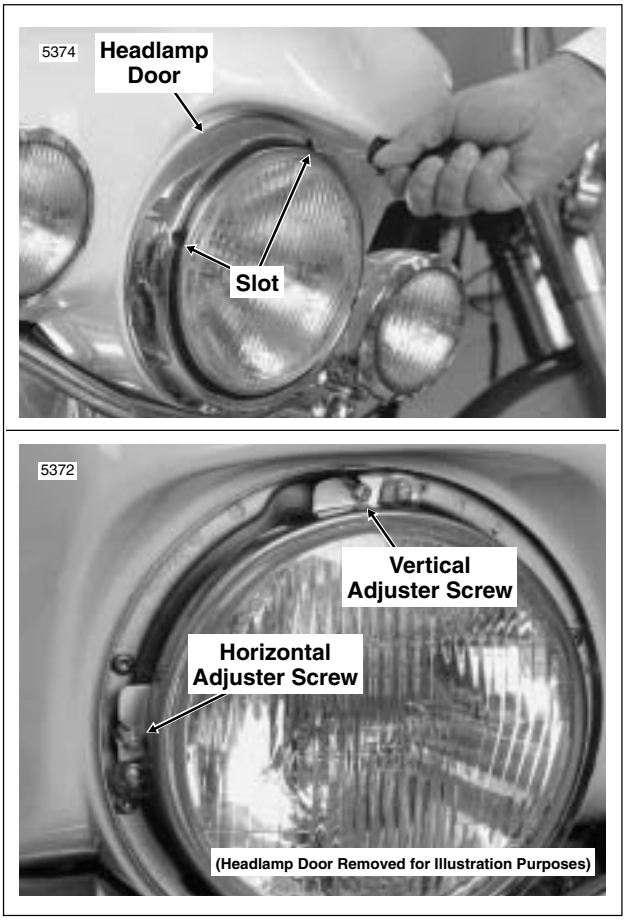


Figure 8-26. Adjust Headlamp Alignment (FLHT/C/U Model Shown)

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 8-25. 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 8-26.

HEADLAMP ASSEMBLY

REMOVAL

1. Remove the outer fairing. See Section 2.28 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 8-27.

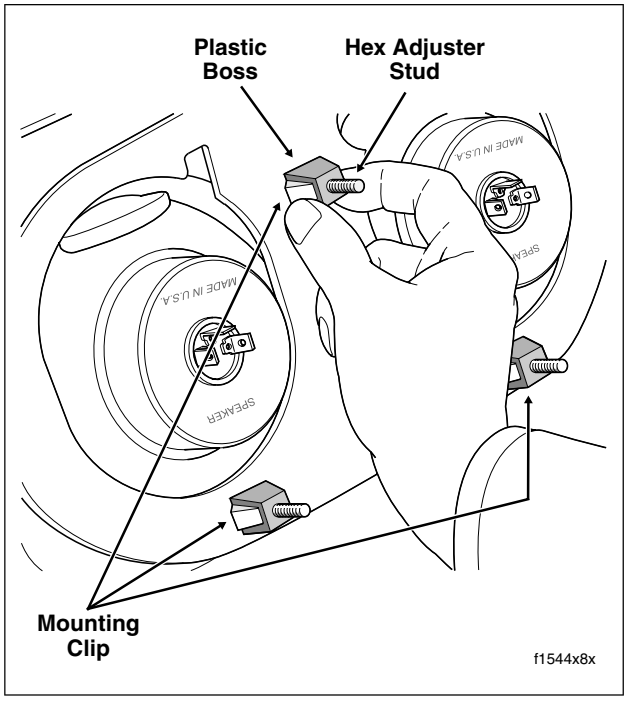


Figure 8-27. Depress Mounting Clips

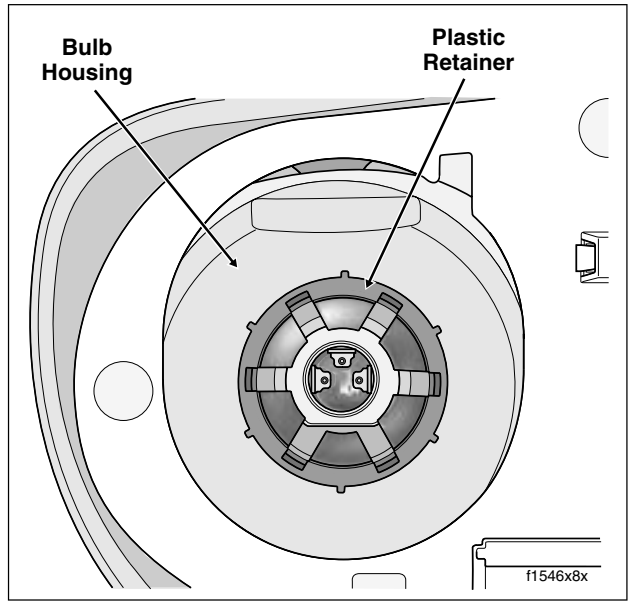


Figure 8-28. Remove Retainer to Release Bulb

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 2.28 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 2.28 UPPER FAIRING/WINDSHIELD (FLTR), OUTER FAIRING, REMOVAL.
2. Move outer fairing assembly to bench area.

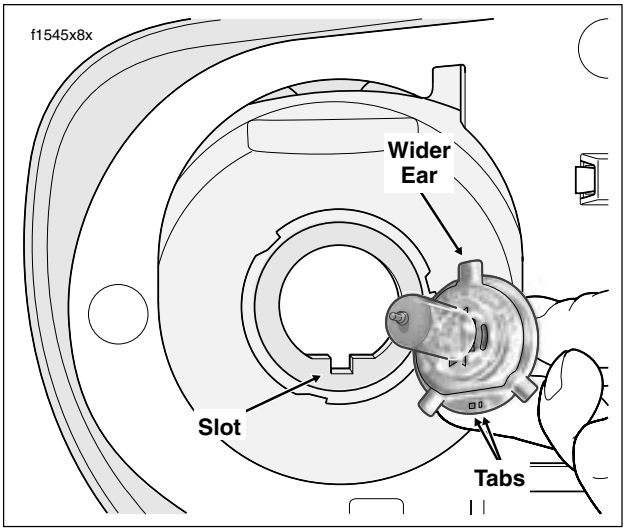


Figure 8-29. Install New Bulb in Bulb Housing

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 8-28.

⚠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 8-29.
2. Place plastic retainer over bulb housing flange and rotate in a clockwise direction until tight. See Figure 8-28.
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 2.28 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.

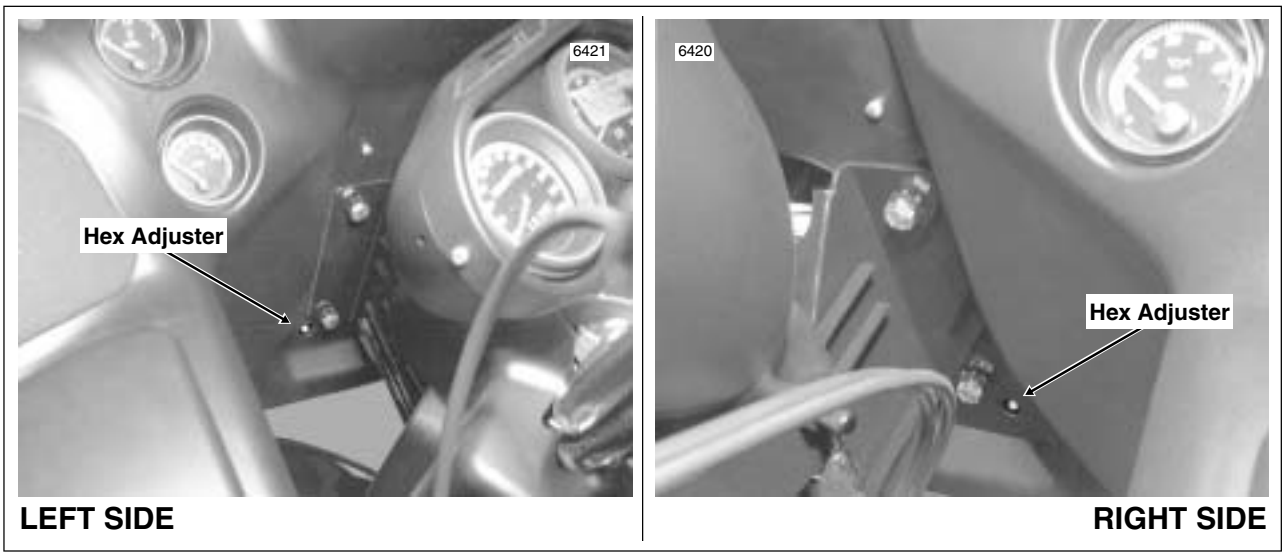


Figure 8-30. Headlamp Adjustment (FLTR)

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 8-25. 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 8-30. 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

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 8-31. 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).

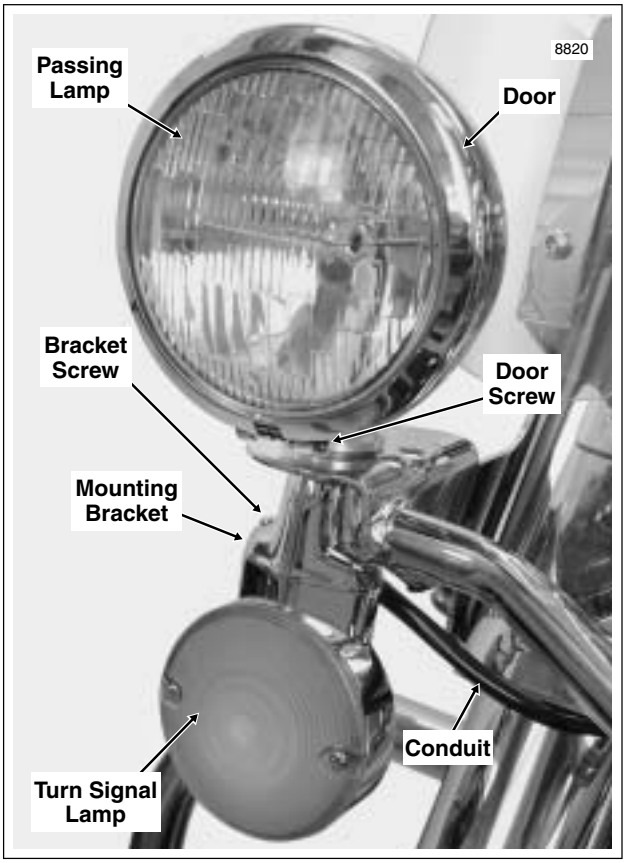


Figure 8-31. Passing Lamp and Turn Signal

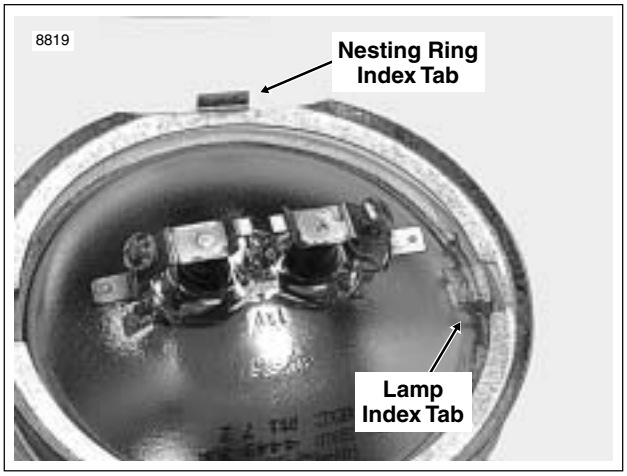


Figure 8-32. Install Nesting Ring at Back of Passing Lamp Bulb

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. Loosen passing lamp door screw as required to pull lamp door from lip of lamp housing. See Figure 8-31.
2. Pull socket terminals from spade contacts at back of lamp.
3. Remove nesting ring and discard lamp.

INSTALLATION

1. Place nesting ring at back of **new** lamp with the concave side up. See Figure 8-32.
2. Install black wire socket terminal onto spade contact next to lamp index tab. Install socket terminal of gray/black wire onto remaining spade contact.
3. Install lamp fitting nesting ring over edge of lamp housing. Rotate nesting ring so that nesting ring index tab is aligned with slot at bottom of lamp housing.

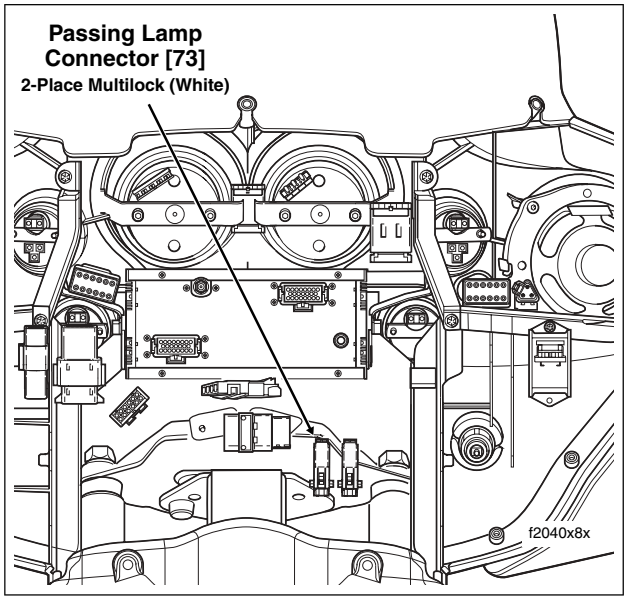


Figure 8-33. Inner Fairing (FLHT/C/U)

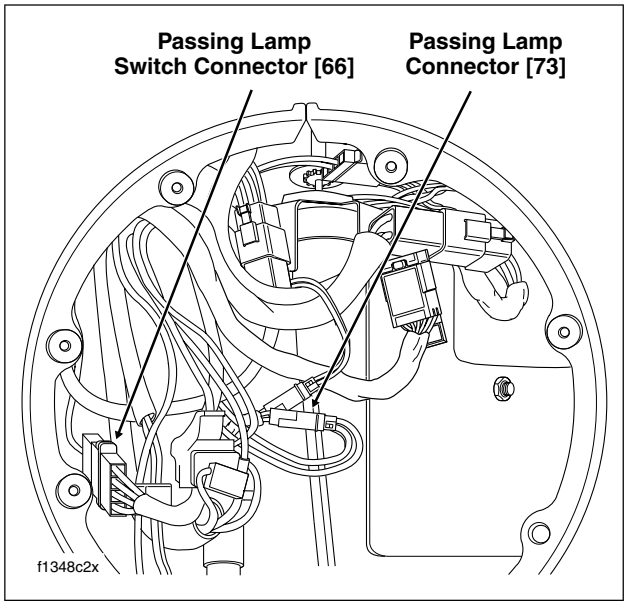


Figure 8-34. Headlamp Nacelle (FLHR/C)

4. Holding nesting ring in place, rotate lamp so that lamp index tab is aligned with slot on left side of nesting ring.

5. Verify that two adhesive foam strips are present on inboard side of lamp door. Install **new** foam strips if deteriorated or missing.

6. Install lamp door over lip of lamp housing. Rotate lamp door so that screw is centered at bottom, and then tighten door screw until snug.

PASSING LAMP BRACKET

REMOVAL

1. **FLHT/C/U:** Remove the outer fairing. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL. Locate passing lamp connector (2-place Multilock) next to top fork bracket. See Figure 8-33.

   FLHR/C: Remove the Phillips screw at the bottom of the headlamp door (chrome ring). Remove the headlamp door. Remove the eight 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 8-34.

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.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 8-31. 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 8-35. Repeat step with remaining socket terminal.

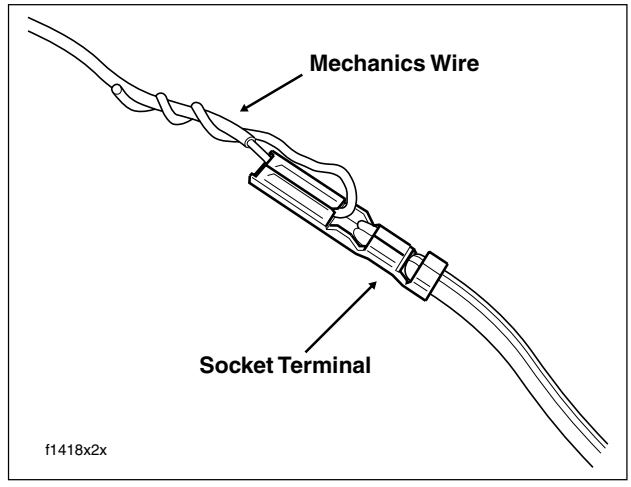


Figure 8-35. Fix Mechanics Wire to Socket Terminals

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 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 15-20 ft-lbs (20-27 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.
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.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 2.27 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 eight 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 (4.8 mm) of insulation off **new** lamp wire and crimp on **new** socket terminal.

NOTE

For instructions on crimping wire terminals, see APPENDIX 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 8-36.
2. Depress button at bottom of 4-place Multilock socket to release tail lamp assembly from pin housing. See right side of Figure 8-36.

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 8-36.
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 8-36.
2. Depress button at bottom of 4-place Multilock socket to release tail lamp assembly from pin housing. See right side of Figure 8-36.
3. Depress buttons to remove four remaining Multilock sockets from pin housing. See Figure 8-37.

   All remaining release buttons are at the top, with the exception of the rear fender lights harness socket, where

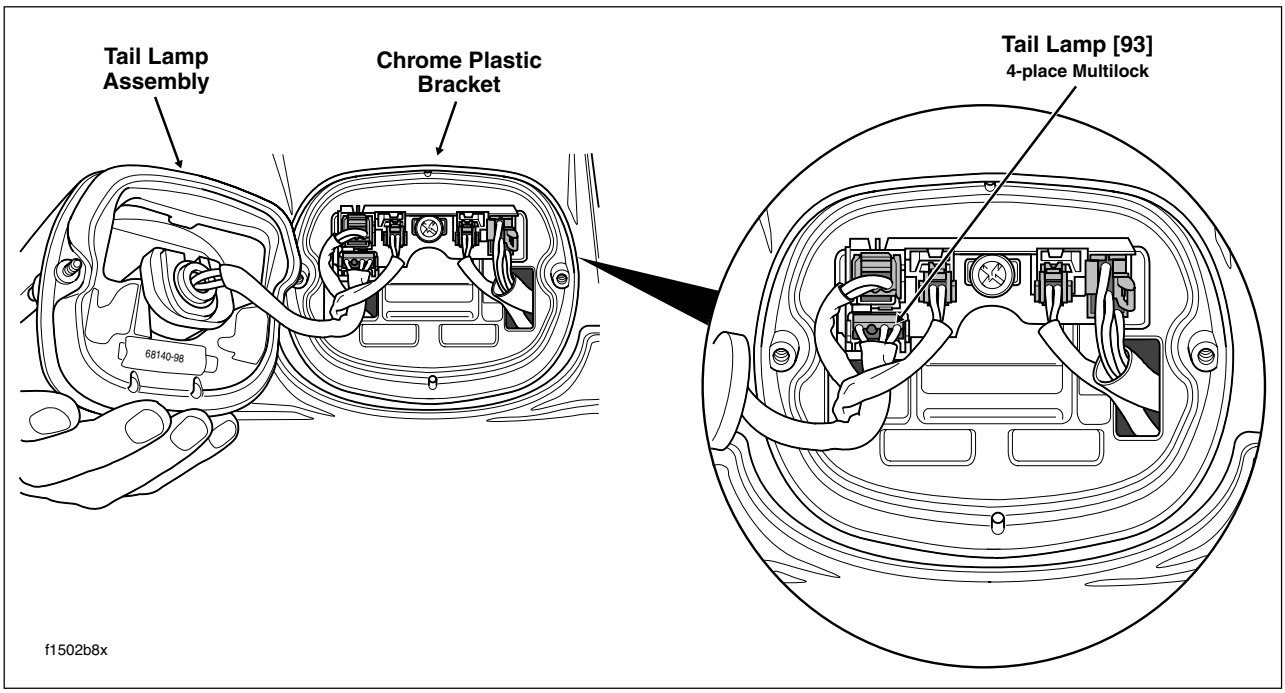


Figure 8-36. Remove Tail Lamp and Depress Button to Release Socket

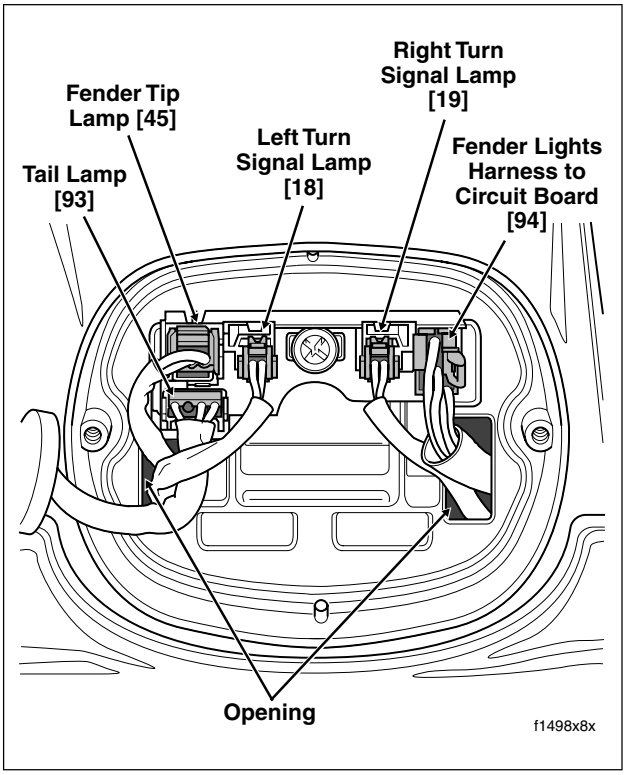


Figure 8-37. Rear Fender Lights Assembly

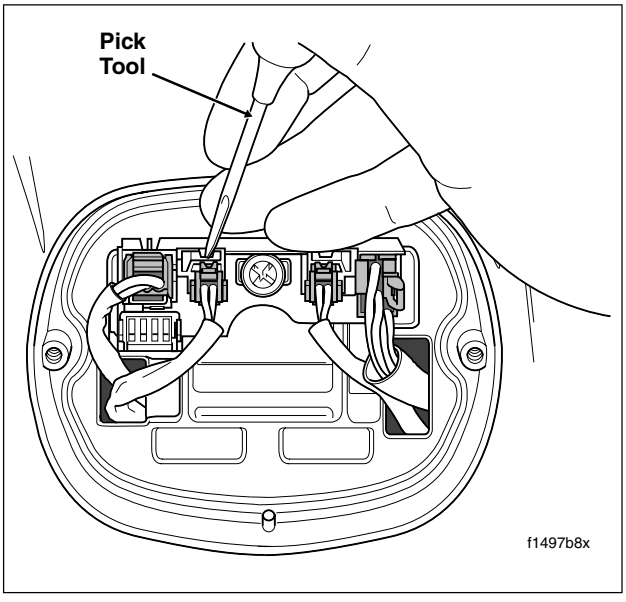


Figure 8-38. Release Left Turn Signal Lamp Socket

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 8-38.

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 8-37. For best results, free the smaller sockets first.

INSTALLATION

1. Feed Multilock sockets through openings to outboard side of chrome plastic bracket. See Figure 8-37. 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 8-39.
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).

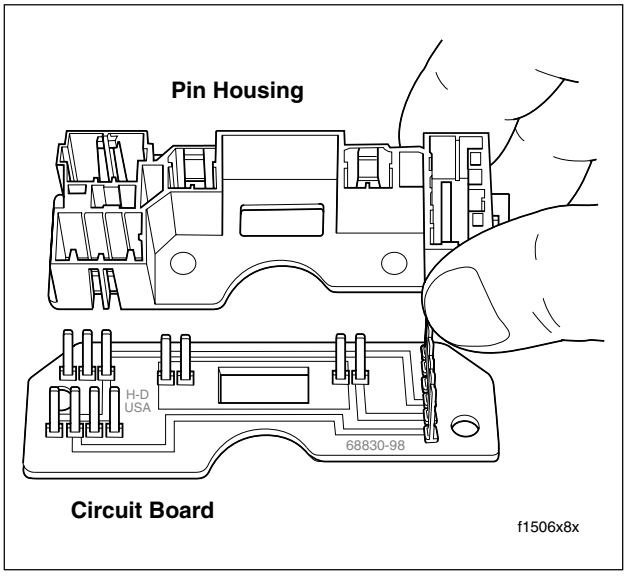


Figure 8-39. Place Pin Housing Over Circuit Board

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 8-37.
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 8-42.

INSTALLATION

1. Mate pin and socket halves of 2-place Multilock connector to attach front fender tip lamp assembly to jumper harness. See Figure 8-42.
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:** Reaching in below the fairing cap on the left side of the steering head, locate the front fender tip lamp connector (black 2-place Multilock). See Figure 8-40. Remove the outer fairing only if necessary. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL.

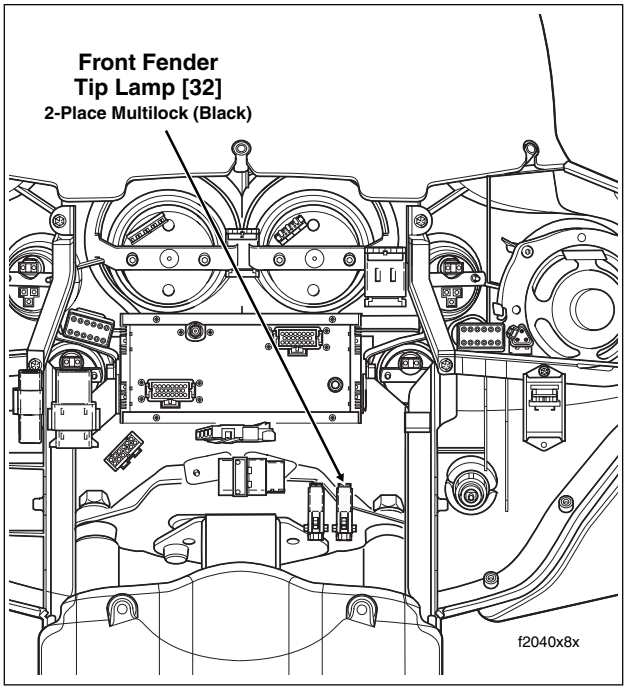


Figure 8-40. Inner Fairing (FLHT/C/U)

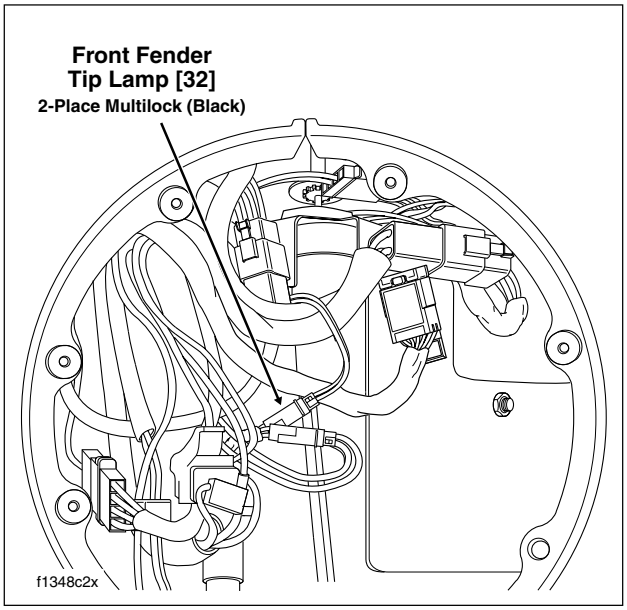


Figure 8-41. Headlamp Nacelle (FLHR)

FLHR: Remove the Phillips screw at the bottom of the headlamp door (chrome ring). Remove the headlamp door. Remove the eight 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 8-41.

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 to fender area.
4. Carefully cut cable strap to release front fender tip lamp wires from brake line hose.
5. Remove terminals from socket housing.

NOTE

For instructions on properly removing wire terminals, see APPENDIX 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 8-43.
9. Pull wires and Multilock socket terminals through grommet to inboard side of fender. See Figure 8-44. Reaching under left side of fender, release wires from one weld clip and four metal adhesive clips.
10. Feed wires and Multilock socket terminals through oblong hole to outboard side of fender.

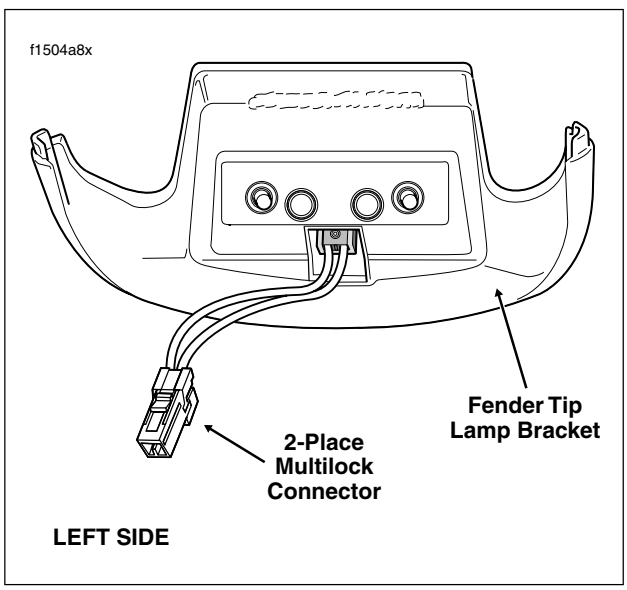


Figure 8-42. Fender Tip Lamp Assembly

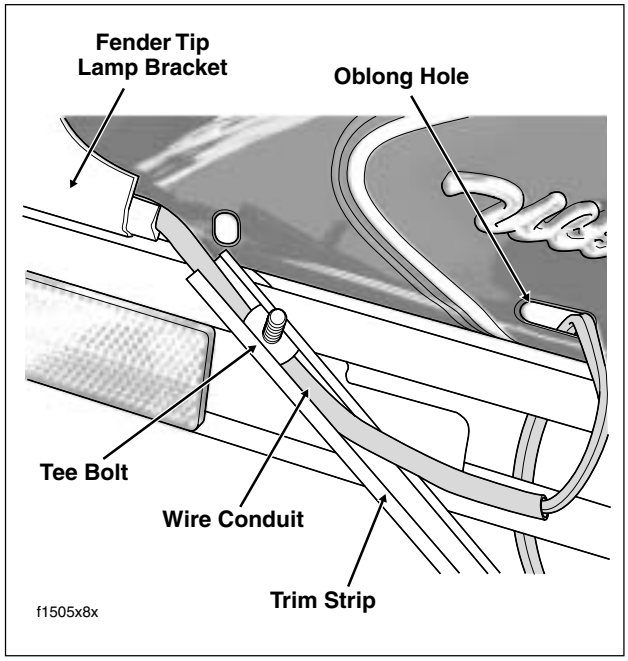


Figure 8-43. Install Conduit in Trim Strip

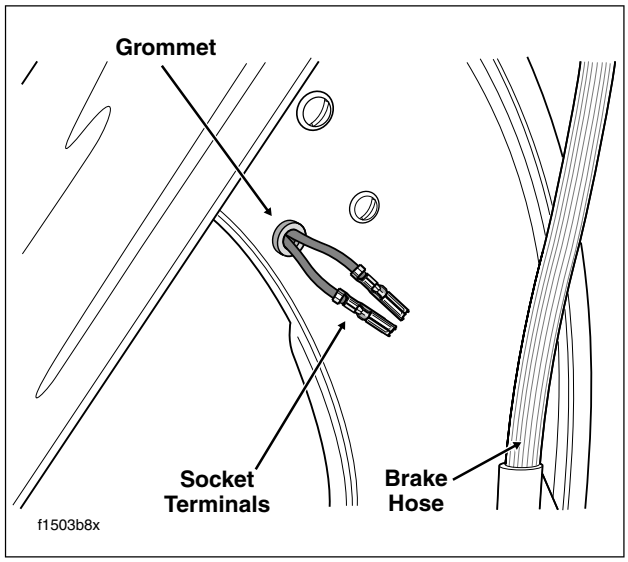


Figure 8-44. Pull Fender Tip Lamp Wires and Terminals Through Fender Grommet

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 8-42.

INSTALLATION

1. See Figure 8-45. Carefully inspect the condition and security of the four metal adhesive clips in the left side fender well. Replace the clips if broken, loose or missing. Proceed as follows:
   a. Remove remnants of old clip, as well as all residual adhesive.
   b. Using a soapy Scotch Brite® pad, thoroughly clean fender well in area of clip.
   c. Rinse with clear water and dry with a clean white cloth. Repeat step until clean cloth shows no evidence of dirt.
   d. Swab area with isopropyl alcohol.
   e. Obtain **new** metal adhesive clip (Part No. 10187).
   f. Remove paper backing to expose adhesive and firmly press clip into place.
2. Mate pin and socket halves of 2-place Multilock connector to attach front fender tip lamp assembly to jumper harness. See Figure 8-42.
3. 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.

4. Slide Phillips screws through bracket and fender holes and install Keps nuts. Holding nuts at inboard side of fender, tighten screws to 20-25 **in-lbs** (2.3-2.8 Nm).
5. Place gasket into position on fender tip lamp bracket, if present.
6. 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.
7. Route wire conduit inside trim strip and slide front tee bolt over conduit. See Figure 8-43. Verify that second tee bolt is in position at rear of trim strip.
8. Feed Multilock socket terminals and wires through oblong hole to inboard side of fender.
9. While removing slack from wires 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. Alternately tighten nuts to 10-15 **in-lbs** (1.1-1.7 Nm).
10. Pull Multilock socket terminals and wires through grommet to outboard side of fender. See Figure 8-44.

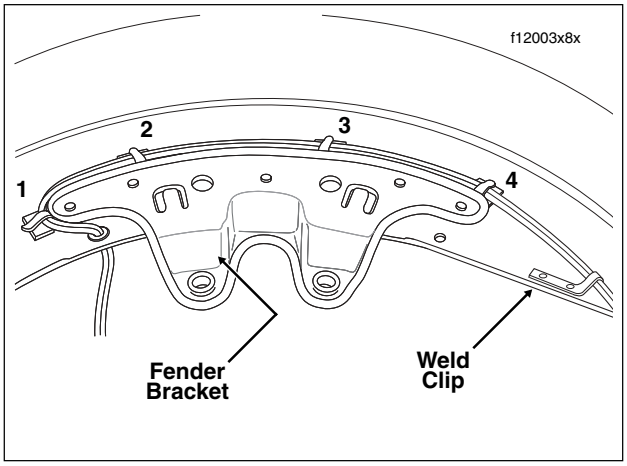


Figure 8-45. Four Metal Adhesive Clips (Left Side Front Fender Well)

11. Install terminals into socket housing.

NOTE

For instructions on properly installing wire terminals, see APPENDIX B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, INSTALLING SOCKET/PIN TERMINALS.

12. Reaching under left side of fender, route wires of the jumper harness through one weld clip and four metal adhesive clips. See Figure 8-45.

⚠WARNING

If any portion of the jumper harness crosses over the riveted fender bracket, contact with the tire can cause chafing or other damage. Damage to the wiring can lead to loss of lighting while riding, which could result in death or serious injury.

13. Verify that no portion of the jumper harness crosses over the riveted fender bracket.

⚠WARNING

If the height of any metal clip is above the riveted fender bracket, contact with the tire can cause damage that results in premature tire failure, which could result in death or serious injury.

14. Using finger pressure, bend arm of each clip down over wires so that no portion of the clip is above the height of the fender bracket.
15. Route socket housing of front fender tip lamp connector upward behind chrome skirt (FLHT/C/U) or through bottom of headlamp nacelle (FLHR) to area of top fork bracket. Mate pin and socket halves.

NOTE

To connect front fender tip lamp with the outer fairing installed (FLHT/C/U models), reach in below the fairing cap on the left side of the steering head.

16. Install the front wheel. See Section 2.2 FRONT WHEEL, INSTALLATION.
17. Install **new** cable strap to secure front fender tip lamp wires to brake line hose. Cut any excess cable strap material.
18. **FLHT/C/U:** Install the outer fairing, if removed. See Section 2.27 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 eight Phillips screws. Install the headlamp door (chrome ring) and door screw.
19. 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.

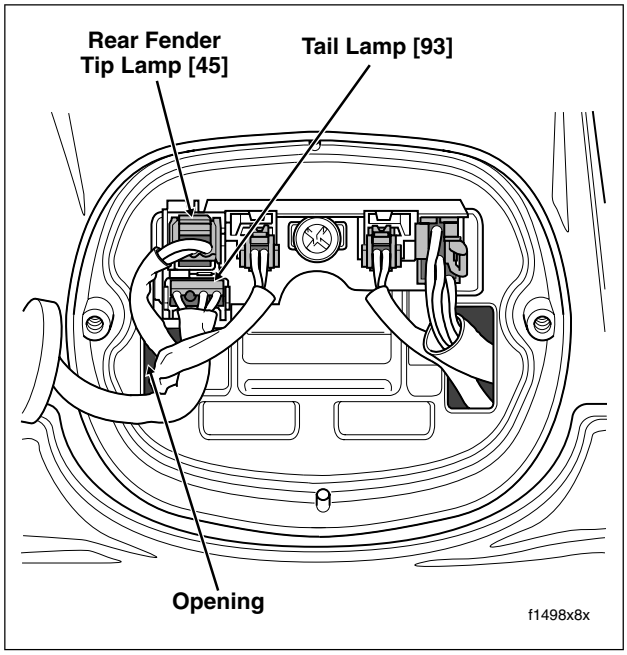


Figure 8-46. Depress Button to Release Socket From Pin Housing

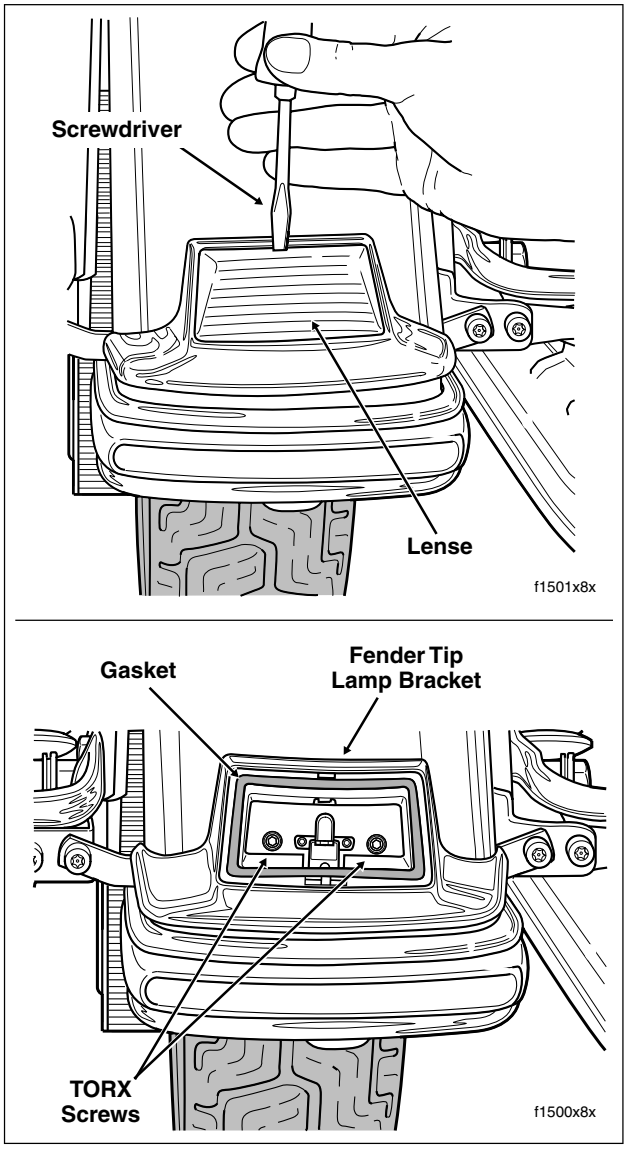


Figure 8-47. Remove Rear Fender Tip Lamp Lense and Bracket

2. Depress button at bottom of 4-place Multilock socket to release tail lamp assembly from pin housing. See Figure 8-46.
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.
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 8-47.

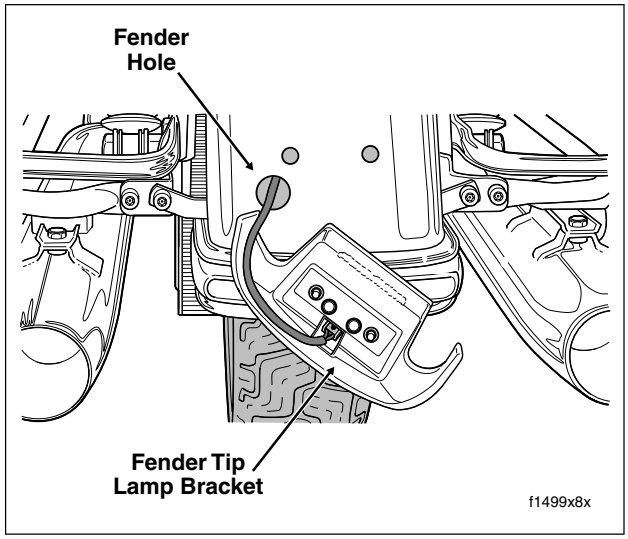


Figure 8-48. Feed Fender Tip Lamp Socket and Conduit Through Fender Hole

6. Remove gasket from fender tip lamp bracket, if present. See lower frame of Figure 8-47.
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 8-48.
9. Remove terminals from socket housing.

NOTE

For instructions on properly removing wire terminals, see APPENDIX 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.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.2 AMP MULTILOCK ELECTRICAL CONNECTORS, INSTALLING SOCKET/PIN TERMINALS.

4. Feed 3-place Multilock socket and conduit through bottom fender hole. See Figure 8-48.
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 8-47.
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.
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 8-46.
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 20-25 **in-lbs** (2.3-2.8 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/or the turn signal module.

FLHT/C/U, FLHR/C

The front turn signals are mounted to the passing lamp bracket 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 8-49. Remove the two Phillips screws to release the amber lense. While pushing in the bulb, rotate 1/4 turn in a counter-clockwise direction.

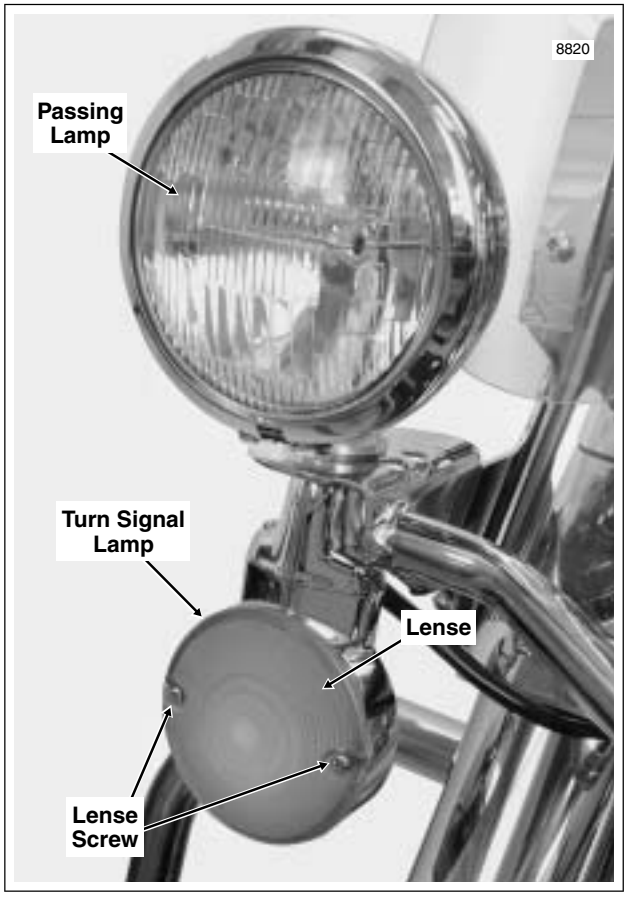


Figure 8-49. Front Turn Signal Lamp

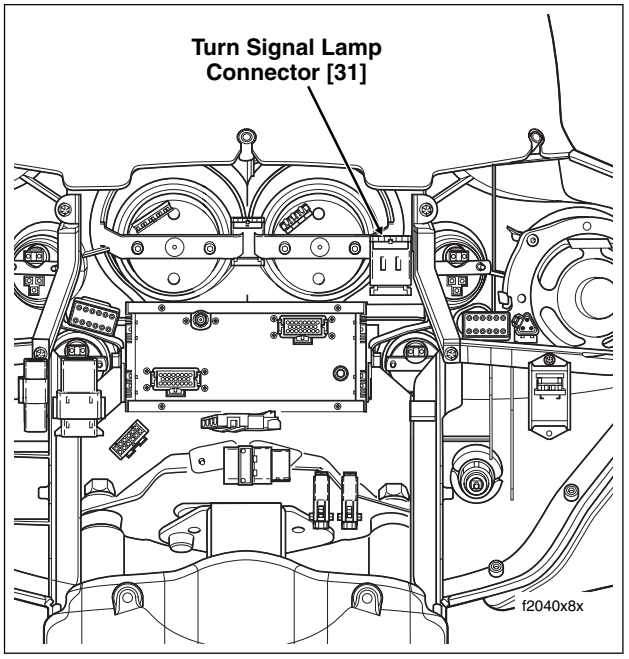


Figure 8-50. Inner Fairing (FLHT/C/U)

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 2.27 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 8-50.

   FLHR/C: Remove the Phillips screw at the bottom of the headlamp door (chrome ring). Remove the headlamp door. Remove the eight 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 8-51.

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.

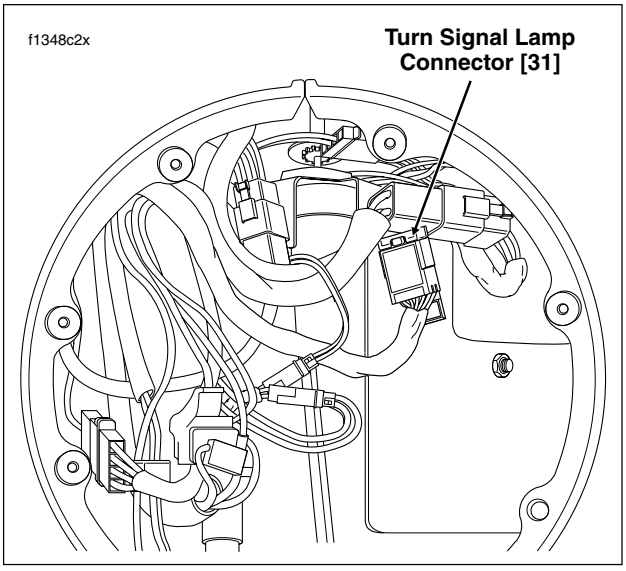


Figure 8-51. Headlamp Nacelle (FLHR/C)

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.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 8-52. 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 (4.8 mm) of insulation off **new** lamp wires and crimp on **new** socket terminals.

NOTE

For instructions on crimping wire terminals, see APPENDIX 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.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.

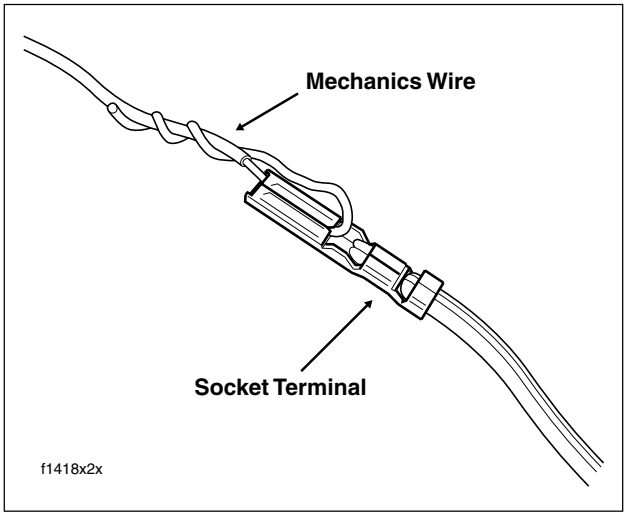


Figure 8-52. Fix Mechanics Wire to Socket Terminals

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 2.27 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 eight 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 8-53.

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 8-54.

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 8-54.

6. Remove saddlebag on same side of vehicle. See Section 2.23 SADDLEBAG, REMOVAL.

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.2 AMP MULTILOCK ELECTRICAL CONNECTORS, REMOVING SOCKET/PIN TERMINALS.

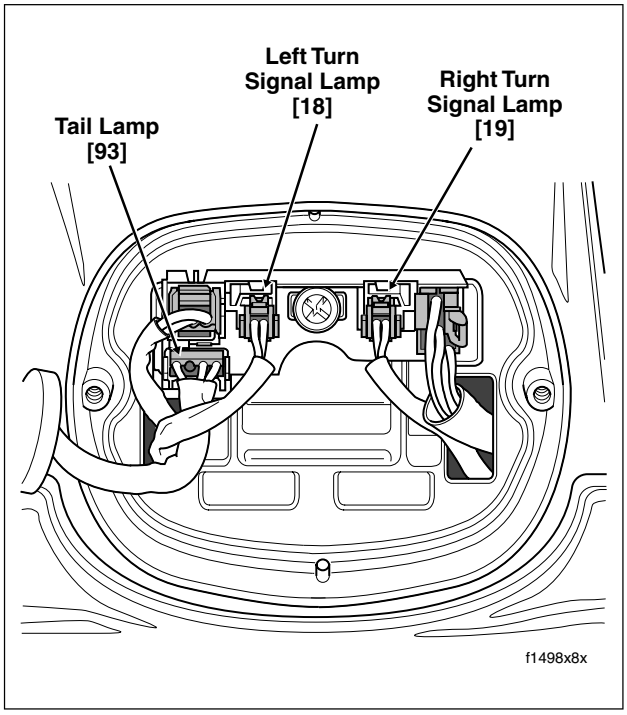


Figure 8-53. Release Tail Lamp Socket

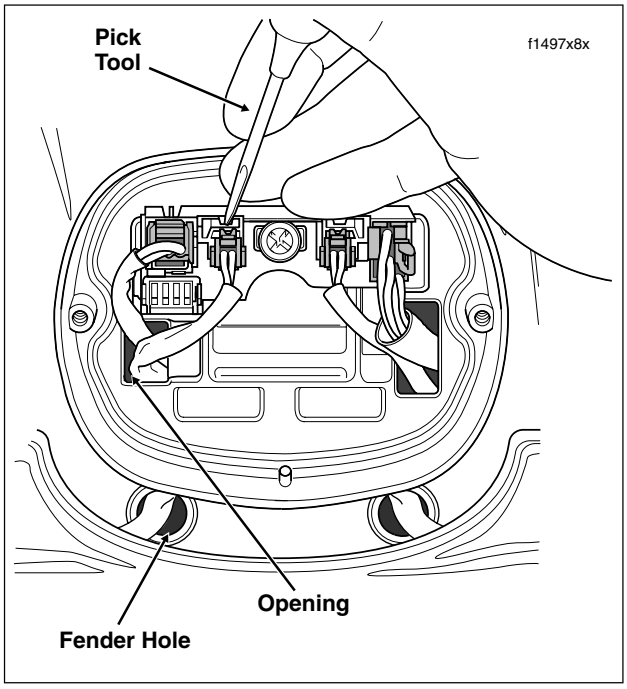


Figure 8-54. Release Left Turn Signal Lamp Socket

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.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.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 8-54.

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 8-53.

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. Install saddlebag on vehicle. See Section 2.23 SADDLEBAG, INSTALLATION.

TURN SIGNAL/SECURITY MODULE 8.16

REMOVAL

NOTE

The turn signal/security module also houses the bank angle sensor.

IMPORTANT NOTE

If equipped with the optional "Harley-Davidson Factory Security System," verify that the security status lamp in speedometer face is not flashing before proceeding (security system disarmed).

1. Remove seat. See Section 2.22 SEAT, REMOVAL.
2. Locate the turn signal/security module installed in cavity of frame crossmember at rear of battery box. See Figure 8-55.
3. Depress tab at front of spring clip and lift to release legs from holes in crossmember.
4. Remove turn signal/security module from cavity and disconnect 12-place Deutsch connector [30].

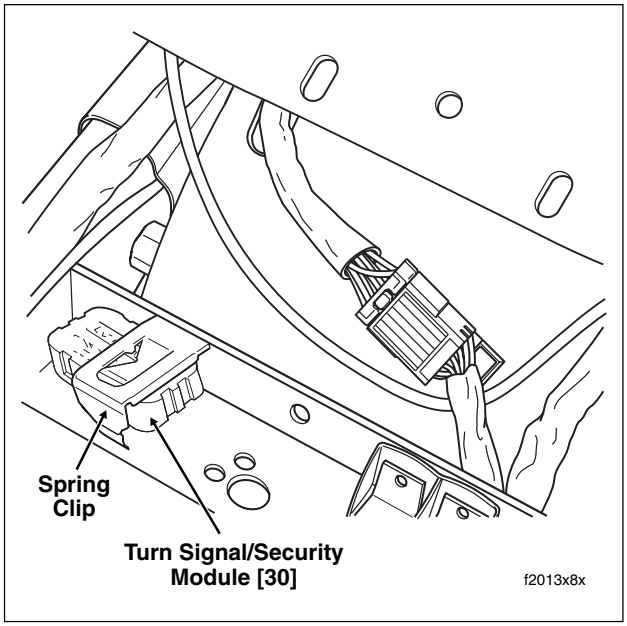


Figure 8-55. Turn Signal/Security Module

INSTALLATION

1. Connect 12-place Deutsch connector [30] to **new** turn signal/security module and install into cavity of frame crossmember at rear of battery box.
2. Insert legs of spring clip into holes in crossmember and push down until tab at front snaps in place.
3. Install seat. See Section 2.22 SEAT, INSTALLATION.
4. Test all turn signal functions. Test all security system functions, if so equipped.

NOTES

⚠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, FLTR (DOMESTIC)

REMOVAL

1. Remove the outer fairing. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL.
2. To remove the ignition switch knob, insert the Ignition Switch key and turn to the UNLOCK position. Leaving the key installed, rotate the knob to ACCESS. Depressing the release button at bottom (left side) with a small screwdriver, push key down and turn an additional 60 degrees in a counter-clockwise direction. Lift and remove knob. See Figure 8-56.

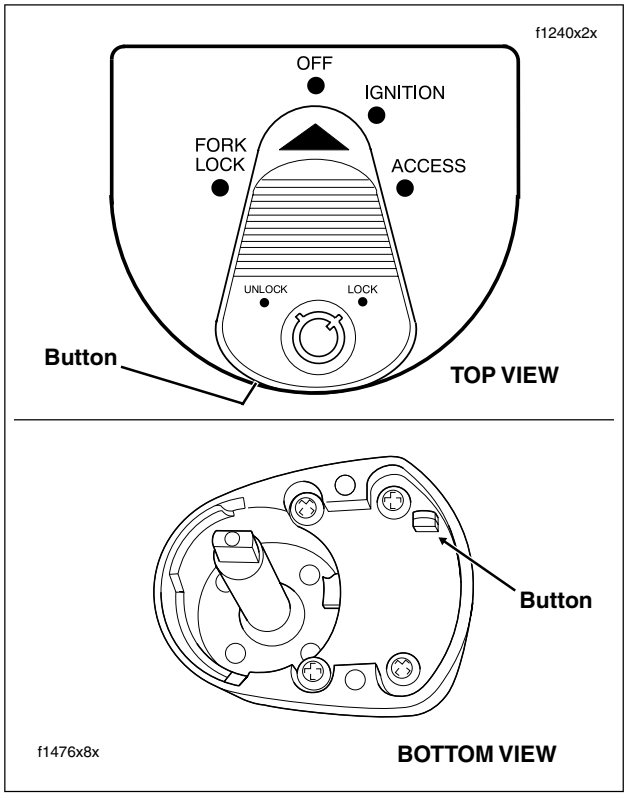


Figure 8-56. Ignition Switch Knob Release Button

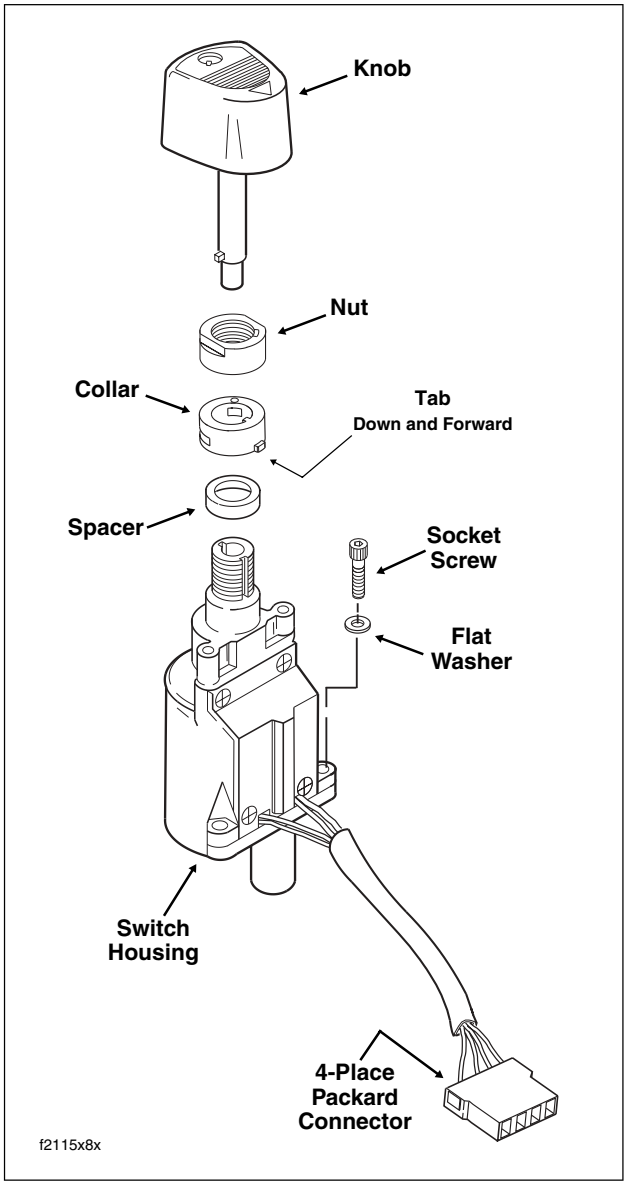


Figure 8-57. Ignition Switch Assembly (Domestic)

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 8-57.
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 switch position 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 cap 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 8-58.
8. Locate the Ignition switch connector [33], 4-place Packard, attached to barbed anchor at bottom of radio. Slide connector off anchor and separate pin and socket halves. See Figure 8-59.
9. Remove the socket screws (with flat washers) and lift the switch housing from the upper fork bracket 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 upper fork bracket. Install screws (with flat washers) and tighten to 36-60 **in-lbs** (4.1-6.8 Nm).
2. Route the Ignition switch connector [33], 4-place Packard, to front of inner fairing. Mate pin and socket halves of connector and slide onto barbed anchor at bottom of radio. See Figure 8-59.
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 cap 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.

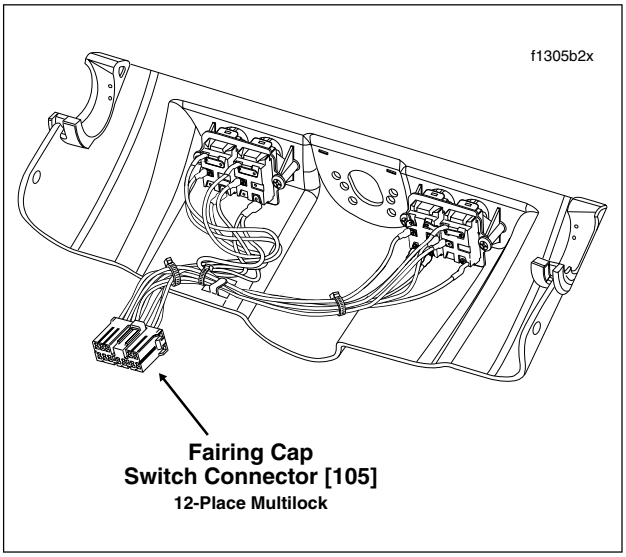


Figure 8-58. Fairing Cap Assembly (FLHT/C/U)

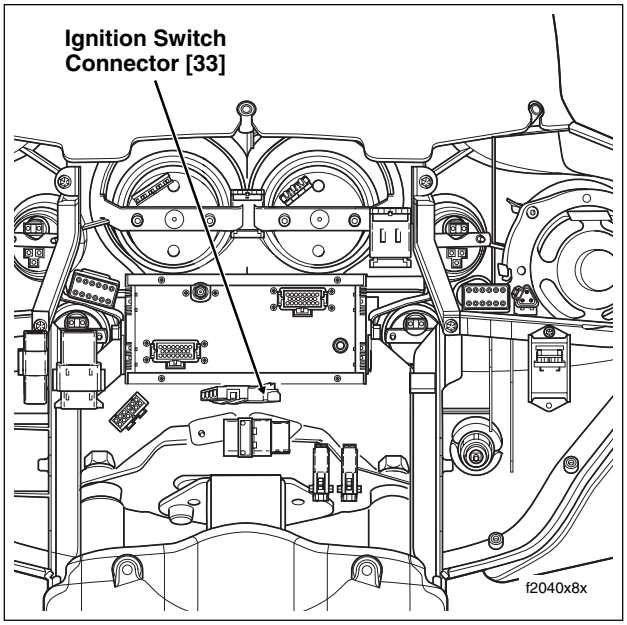


Figure 8-59. Ignition Switch Connector Location (FLHT/C/U)

6. Install switch position 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 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 to 50-70 **in-lbs** (5.7-7.9 Nm).
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 25-30 **in-lbs** (2.8-3.4 Nm).
11. Verify operation of both the ignition switch and fork lock assemblies.
12. Install the outer fairing. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.

FLHT/C/U, FLTR (INTERNATIONAL)

REMOVAL

1. Remove the ignition switch knob as follows:

   a. Insert the ignition switch key and turn to the UNLOCK position. Leave the key installed in the ignition switch knob.

   b. Turn the front forks to the left fork stop and rotate the knob to FORK LOCK.

   c. Depressing the release button at bottom (left side) with a small screwdriver, push key down and turn 60 degrees in a counter-clockwise direction. See Figure 8-60.

   d. Lift and remove knob. Be aware that spring will drop out of bore at underside of knob when removed.

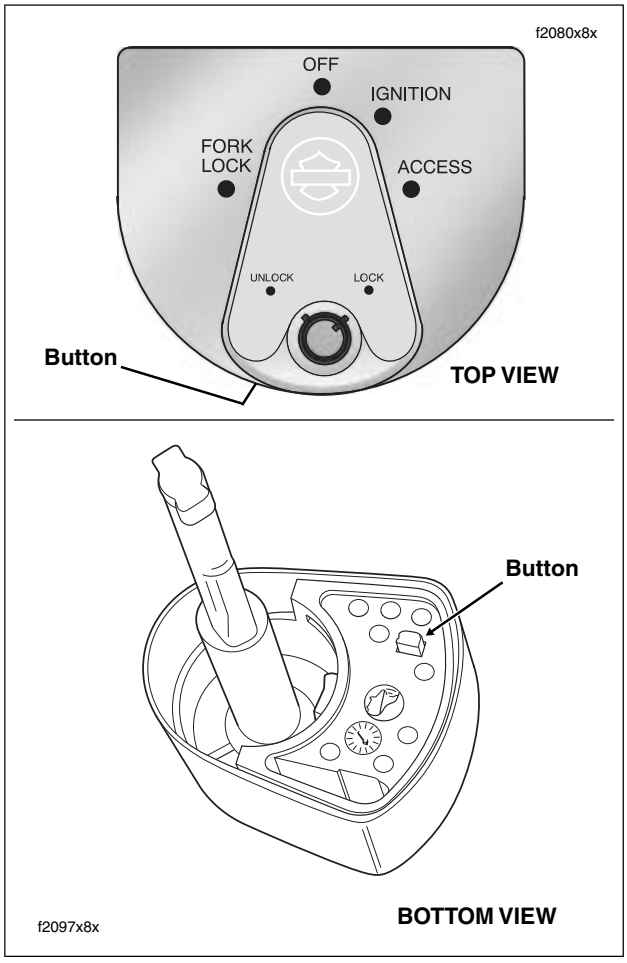


Figure 8-60. Ignition Switch Knob Release Button

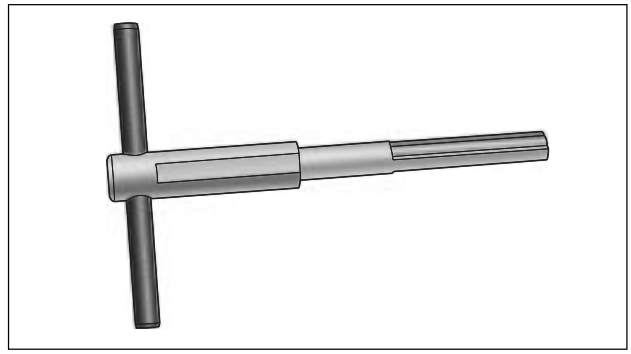


Figure 8-61. Ignition Switch Alignment Tool (Part No. HD-45962)

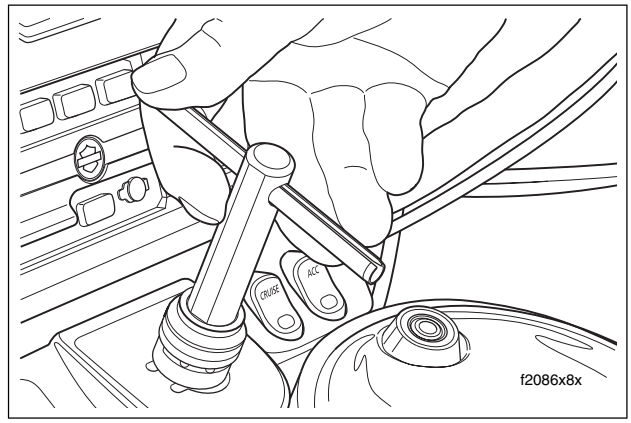


Figure 8-62. Bottom Alignment Tool in Threaded Post and Rotate to Desired Position

NOTE

After removal of the knob, the IGNITION SWITCH ALIGNMENT TOOL (HD-45962) may be used to move the switch to other positions as required. Insert tool until bottom of handle contacts top of threaded post, and then rotate handle in a clockwise direction to the selected position. See Figure 8-62.

2. Turn the front forks to the right fork stop, and using a 7/8 inch open end wrench on flats, remove nut from threaded post of ignition switch housing.

3. Pull collar and spacer from threaded post.

4. Remove the switch position plate by pulling tabs from slots in fairing cap (FLHT/C/U) or instrument nacelle (FLTR).

5. **FLTR:** Remove the instrument nacelle. See Section 2.28 UPPER FAIRING/WINDSHIELD (FLTR), INSTRUMENT NACELLE, REMOVAL.

   FLHT/C/U: Remove the fairing cap. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), FAIRING CAP, REMOVAL.

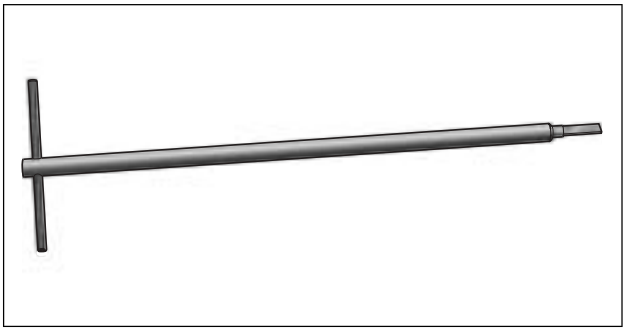


Figure 8-63. Ignition Switch Connector Remover (Part No. HD-45961)

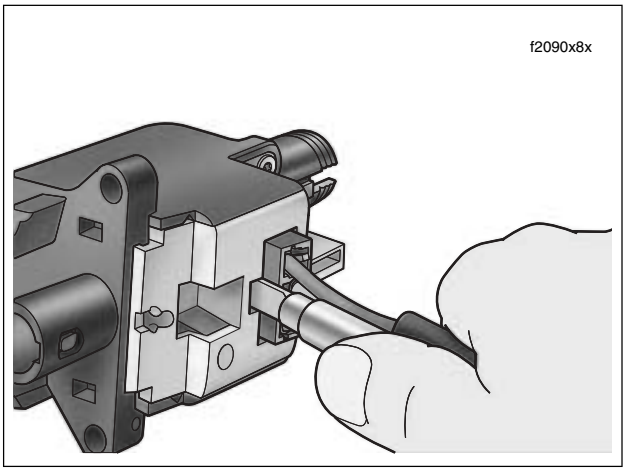


Figure 8-64. Pull Jumper Harness Conduit and Tool to Release Socket Housing

⚠WARNING

Always wear proper eye protection when drilling. Flying debris may result in eye injury.

6. Remove the two break-away screws at the base of the ignition switch housing. Proceed as follows:

   a. Use a center punch to make a pilot hole at the top of each break-away screw.

   b. Install a 1/8 inch left handed bit in drill and set the drill to Reverse. Positioning the bit in the pilot hole, spin out the break-away screws.

NOTE

If the above method fails, use a 3/16 inch bit with long shank to carefully drill off heads of break-away screws. Use a pliers to unthread the shafts from the upper fork bracket.

7. Remove ignition switch housing from upper fork bracket bore.

8. Disconnect the ignition switch jumper harness connector [33], 3-place Packard, at front of ignition switch housing. Proceed as follows:

   a. Obtain the IGNITION SWITCH CONNECTOR REMOVER (HD-45961). See Figure 8-63.

   b. Gently insert end of tool into slot in ignition switch housing until it stops.

   c. Grasping jumper harness conduit and tool, pull both at the same time to release socket housing from ignition switch housing. See Figure 8-64.

NOTE

For instructions on properly removing, installing and crimping jumper harness terminals, see APPENDIX B.3 PACKARD ELECTRICAL CONNECTORS, PUSH-TO-SEAT TERMINALS.

INSTALLATION

1. Install Ignition switch jumper harness connector [33], 3-place Packard, at front of **new** ignition switch housing.
2. Slide base of ignition switch housing into bore of upper fork bracket.

CAUTION

Verify that the threads in the upper fork bracket 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.

CAUTION

Exercise care to avoid losing heads of break-away 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. **FLTR:** Install the instrument nacelle. See Section 2.28 UPPER FAIRING/WINDSHIELD (FLTR), INSTRUMENT NACELLE, INSTALLATION.

   FLHT/C/U: Install the fairing cap. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), FAIRING CAP, INSTALLATION.

5. Install switch position plate fitting tabs in slots of fairing cap (FLHT/C/U) or instrument nacelle (FLTR). Plate snaps in place when properly installed. Exercise care to avoid breaking tabs. Replace plate if tabs are broken.
6. Install spacer over threaded post of ignition switch housing until it contacts switch position plate. Orient spacer so that the widest side is forward and the inside tabs fit in slots of post. See Figure 8-65.

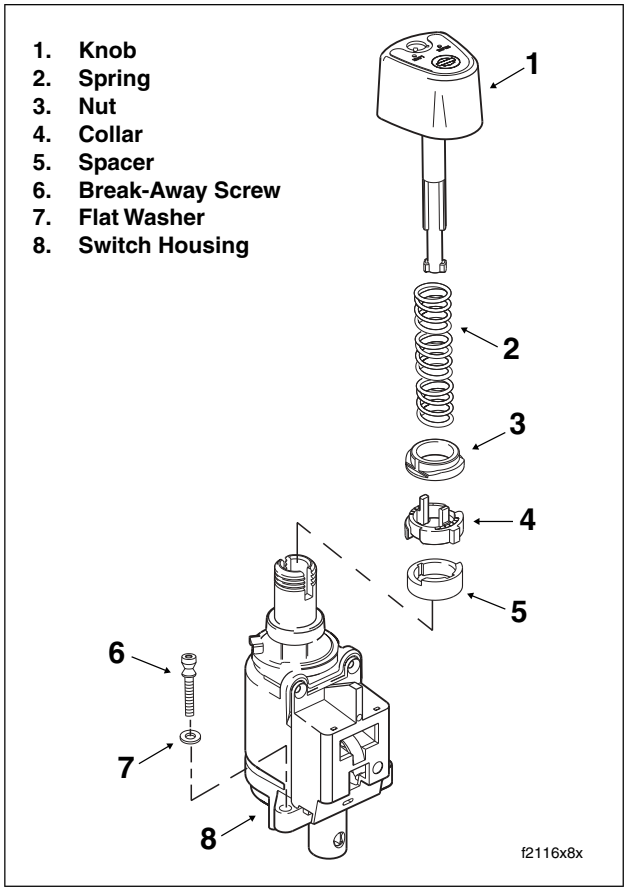


Figure 8-65. Ignition Switch Assembly (International)

7. Slide collar over threaded post until it contacts spacer. Orient collar so that the outside tab is forward and the inside tabs fit in slots of post.
8. Thread nut onto post with the lipped side down and the smaller OD topside. Turn the front forks to the right fork stop, and using a 7/8 inch Open End Crow Foot on flats, tighten nut to 125-150 **in-lbs** (14.1-16.9 Nm).
9. Install spring into bore at underside of knob.
10. With the knob pointing toward the FORK LOCK position, insert shaft into threaded post. Holding the knob down, turn key clockwise to UNLOCK. An audible “click” should be heard when knob and switch are properly engaged. Release knob and then rotate through all four switch positions to verify proper operation.

    If knob will not install properly, move to step 11.
11. Proceed as follows:

    a. Verify that button at bottom of knob is depressed and key is turned 60 degrees beyond the UNLOCK position. See Figure 8-60.

    b. Repeat step 10.

    c. If knob does not install properly, move to step 12.
12. Knob was removed in ACCESS or switch may have been moved out of the FORK LOCK position. Proceed as follows:

    a. Insert alignment tool until bottom of handle contacts top of threaded post, and holding front forks at the left fork stop, rotate handle of tool in a counter-clockwise direction until fork locks. See Figure 8-62.

    b. Remove tool and repeat step 10.

    c. If knob does not install properly, move to step 13.
13. Detent and switch position lugs are misaligned. This can occur when the alignment tool (or ignition switch knob) is rotated before it is properly bottomed in the ignition switch housing. Proceed as follows:

    a. Reinstall knob inserting shaft into threaded post and gently rotate knob until it drops into the partially installed position. Take note of the position of the knob, that is, whether it is pointing toward the rear, or to ACCESS, IGNITION or OFF.

    b. Remove knob and insert alignment tool so that the bottom of the handle is approximately 1/2-3/4 inch (12.7-19.1 mm) from the top of the threaded post, and then hold. See Figure 8-66.

    c. Rotate alignment tool in a counter-clockwise direction the number of positions needed to get to FORK LOCK. For example, if the knob dropped into the partially installed position at IGNITION in step 13(a), rotate the alignment tool two positions in a counter-clockwise direction. Or if the knob was pointing toward the rear when it dropped, rotate the alignment tool four positions in a counter-clockwise direction or one position in a clockwise direction. Repeat step 10.

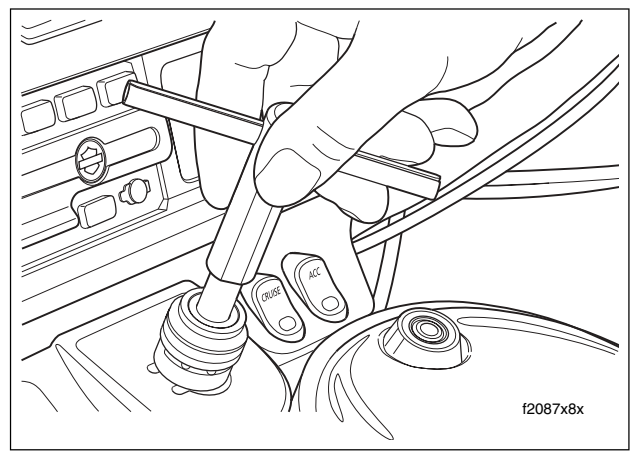


Figure 8-66. Rotate Alignment Tool Without Bottoming

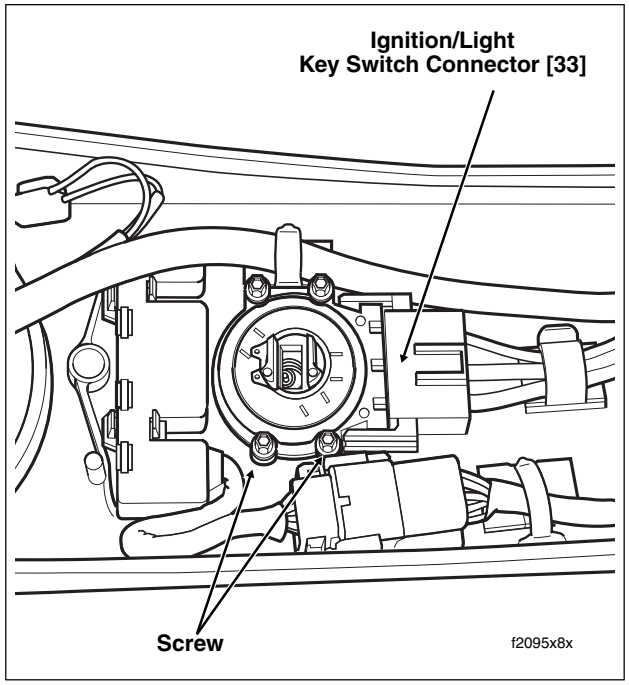


Figure 8-67. Instrument Console (FLHR/C)

FLHR/C

IGNITION/LIGHT KEY SWITCH

Removal

1. Remove seat. See Section 2.22 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 large 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. Pull external latches outward to disconnect Ignition/Light Key Switch connector [33], 3-place Packard. See Figure 8-67.
6. Remove four screws to release switch from console.

Installation

1. Align holes in **new** switch with those in console. See Figure 8-67.
2. Start four screws and alternately tighten to 20-30 **in-lbs** (2.3-3.4 Nm) in a crosswise pattern.
3. Connect Ignition/Light Key Switch connector [33], 3-place Packard.
4. 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.
5. Install acorn nut on mounting bolt and tighten to 50-90 **in-lbs** (5.7-10.2 Nm). Install Phillips screw (with large flat washer) and tighten to 36-60 **in-lbs** (4.1-6.8 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. Install seat. See Section 2.22 SEAT, INSTALLATION.

FORK LOCK

Removal

1. Remove the handlebar clamp shroud. See Section 2.29 WINDSHIELD/HEADLAMP NACELLE (FLHR/C), NACELLE REMOVAL, steps 1-11.
2. Start acorn nuts on both the left and right side fork studs to keep halves of headlamp nacelle on motorcycle.
3. Remove two allen head socket screws (with flat washers) and pull fork lock assembly from upper fork bracket bore. See Figure 8-68.

NOTE

On HDI models, use a center punch to make a pilot hole at the top of each break-away screw. Install a 1/8 inch left handed bit in drill and set the drill to reverse. Positioning the bit in the pilot hole, spin out the break-away screws.

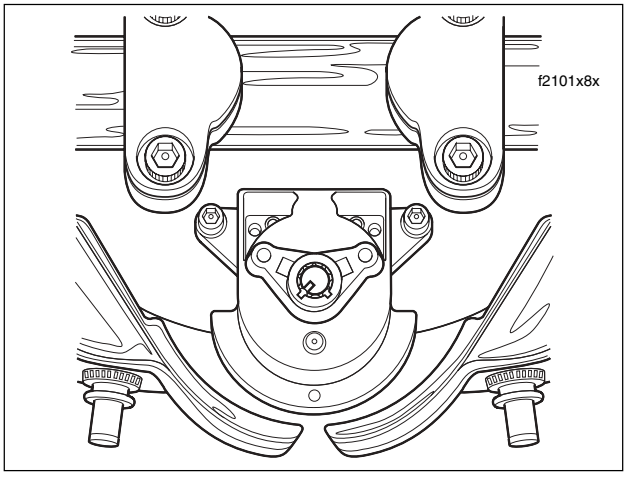


Figure 8-68. Fork Lock (FLHR/C)

Installation

1. Install **new** fork lock assembly into bore of upper fork bracket. See Figure 8-68.
2. Install two allen head socket screws (with flat washers) and alternately tighten to 36-60 **in-lbs** (4.1-6.8 Nm).

NOTE

*On HDI models, install **new** break-away screws and turn in a clockwise direction until heads snap off. Verify that threads in upper fork bracket are clean and in good condition or heads may break off before fork lock assembly is properly tightened. Avoid losing heads of screws in vehicle as vibration may cause captured heads to scratch finished surfaces, chafe wires or cause other damage.*

3. Install the handlebar clamp shroud. See Section 2.29 WINDSHIELD/HEADLAMP NACELLE (FLHR/C), NACELLE INSTALLATION, steps 2-11.

FAIRING CAP SWITCHES (FLHTC/U) 8.18

REMOVAL

1. Partially disassemble domestic ignition switch as follows:

NOTE

For partial disassembly of HDI ignition switch, see Section 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHT/C/U, FLTR (INTERNATIONAL), REMOVAL, steps 1-4.

   a. See Figure 8-69. To remove the ignition switch knob, insert the Ignition Switch key and turn to the UNLOCK position. Leaving the key installed, rotate the knob to ACCESS. Depressing the release button at bottom (left side) with a small screwdriver, push key down and turn an additional 60 degrees in a counter-clockwise direction. Lift and remove knob.

   b. Using a 7/8 inch wrench on flats, loosen switch nut and remove from threaded post of ignition switch housing. Remove collar and spacer.

   c. Gently remove the switch position plate by pulling tabs from slots in fairing cap. If necessary, raise the fairing cap slightly to facilitate removal.

2. 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.

3. With the forks turned fully to the left, disconnect the Fairing cap 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.

4. Remove the fairing cap from the motorcycle. See Figure 8-70.

5. 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.

6. Using a T25 TORX drive head, remove two screws to release switch bracket.

7. Gently pry two latches on bracket outward to release tabs on switch. Remove switch from bracket. See Figure 8-71.

8. If replacing Cruise or Speaker Switch, cut Black/Green wire lead halfway between Cruise and Speaker Switch terminals.

9. Follow the wires of the faulty switch to the socket housing, or reference Figure 8-72 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.

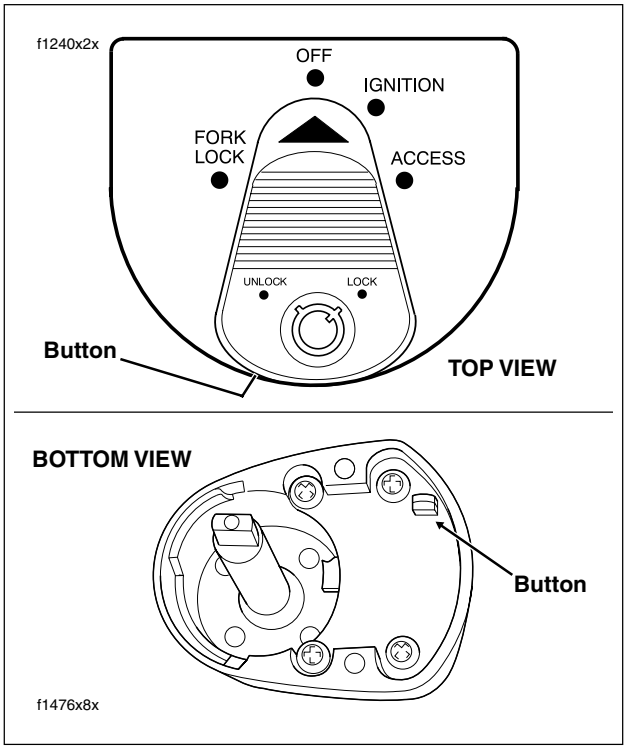


Figure 8-69. Ignition Switch Knob Release Button

10. Remove the appropriate terminals from the socket housing.

NOTE

For instructions on properly removing wire terminals, see APPENDIX B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, REMOVING SOCKET/PIN TERMINALS.

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.2 AMP MULTILOCK ELECTRICAL CONNECTORS, INSTALLING SOCKET/PIN TERMINALS.

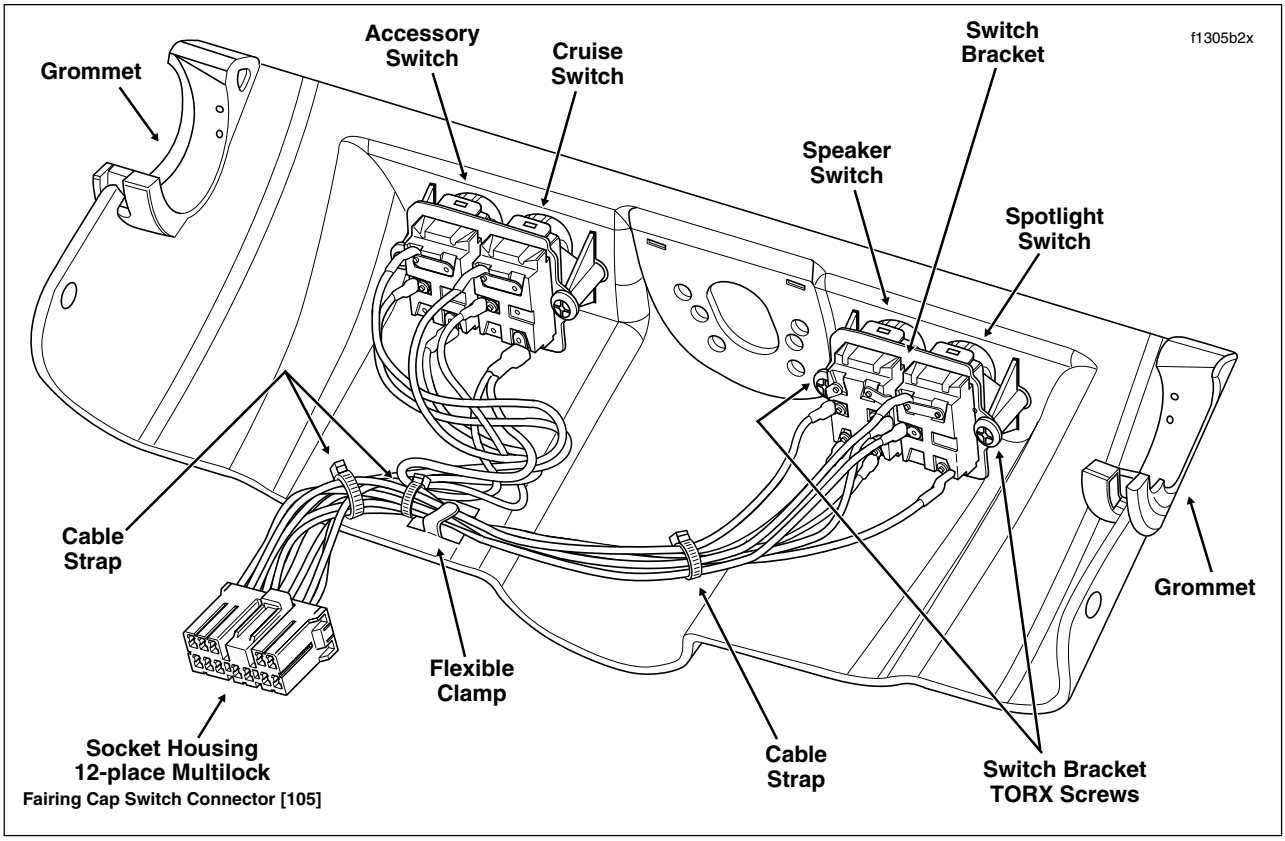


Figure 8-70. Fairing Cap (Inboard Side) - Ultra Model Shown

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.4 SEALED BUTT SPLICE CONNECTORS.

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 8-70.
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 cap 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. Verify that grommets in fairing cap fully capture handlebar along with throttle and clutch cables.
9. Start two fairing cap screws (with flat washers). Using a T27 TORX drive head, alternately tighten screws to 25-30 **in-lbs** (2.8-3.4 Nm).

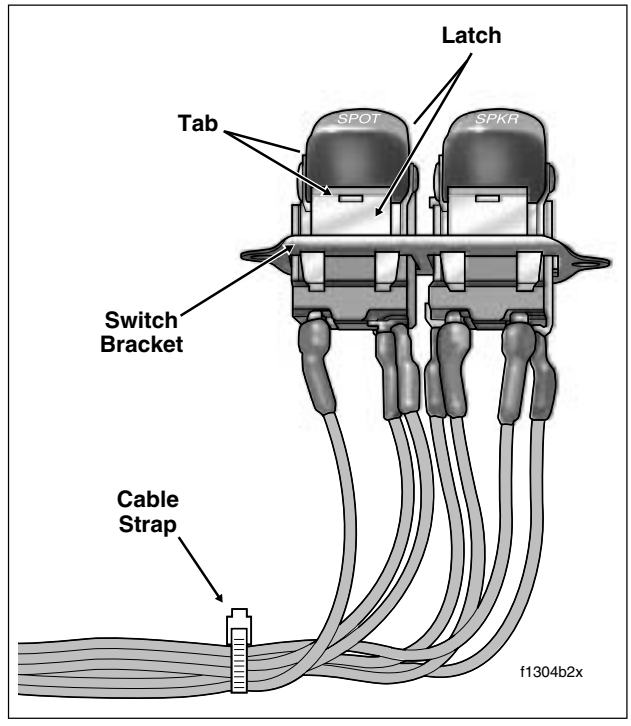
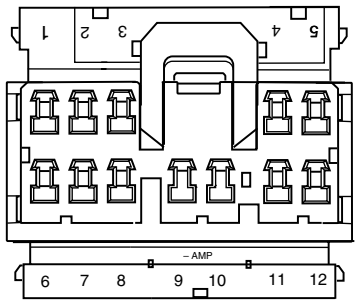


Figure 8-71. Bend Latches Outward to Release Tabs



Secondary Locks Open

f1287b2x

Figure 8-72. 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

10. Assemble domestic ignition switch as follows:

NOTE

For assembly of HDI ignition switch, see Section 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHT/C/U, FLTR (INTERNATIONAL), INSTALLATION, steps 5-10.

a. Install switch position 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.

b. Slide spacer over threaded post of ignition switch housing until it contacts switch position plate.

c. Slide collar over post with the tab side down (and forward).

d. Install nut, and using a 7/8 inch wrench on flats, tighten to 50-70 **in-lbs** (5.7-7.9 Nm).

e. 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.

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 in front of 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 8-73. 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. Partially disassemble domestic ignition switch as follows:

   NOTE

   For partial disassembly of HDI ignition switch, see Section 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHT/C/U, FLTR (INTERNATIONAL), REMOVAL, steps 1-4.

   a. To remove the ignition switch knob, insert the Ignition Switch key and turn to the UNLOCK position. Leaving the key installed, rotate the knob to ACCESS. Depressing the release button at bottom (left side) with a small screwdriver, push key down and turn an additional 60 degrees in a counterclockwise direction. Lift and remove knob. See upper frame of Figure 8-74.

   b. 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 8-74.

   c. Remove the switch position plate from threaded post of ignition switch housing.
7. Follow instructions based on location of defective switch.

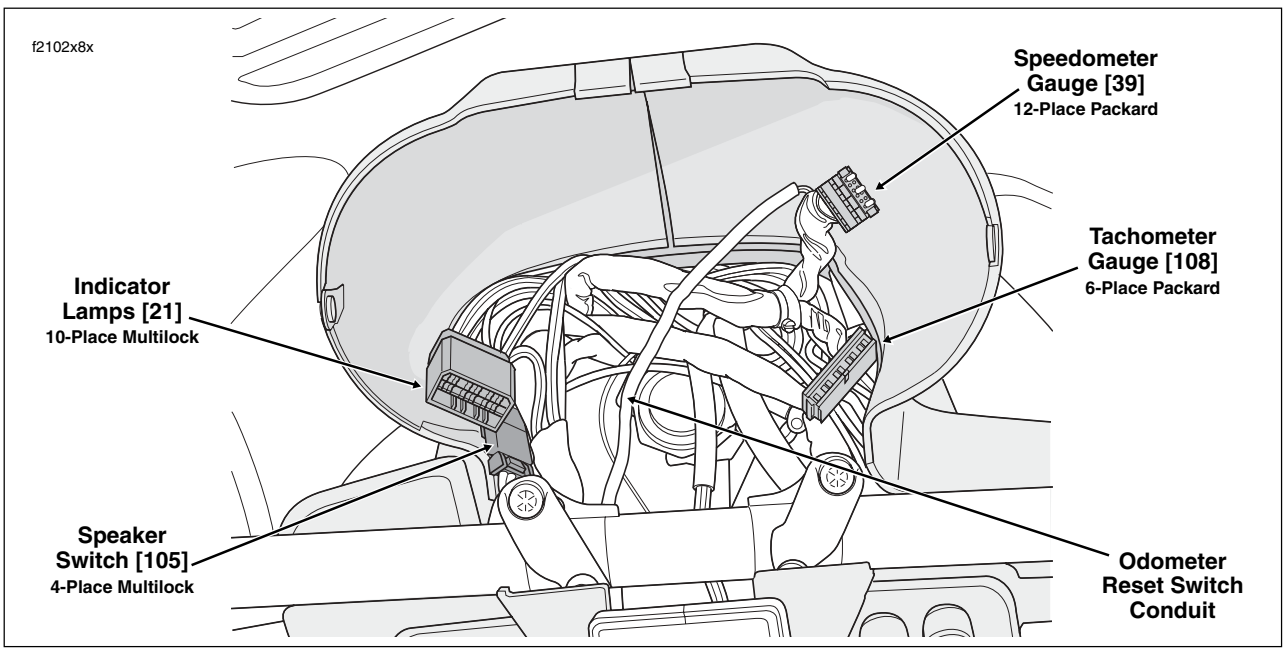


Figure 8-73. Instrument Nacelle (Bezel Removed)

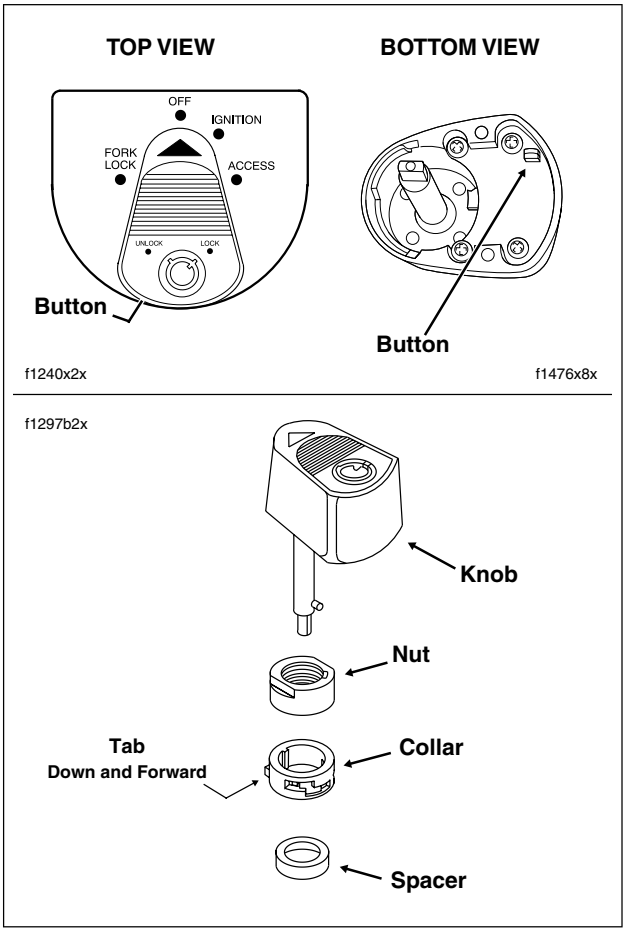


Figure 8-74. Ignition Switch Knob (Domestic)

LEFT SIDE SWITCH

a. See Figure 8-73. 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.

c. While removing left side instrument nacelle, unthread rubber boot and pull odometer reset switch from hole. Move left side of nacelle to bench area leaving right side on vehicle. See Figure 8-79.

d. Gently bend back molded retainer to release switch bracket assembly from instrument nacelle.

e. Carefully pry two latches on bracket outward to release tabs on switch. Remove switch from bracket. See Figure 8-76.

RIGHT SIDE SWITCH

a. Pull throttle cable clip from hole on right side of instrument nacelle.

b. Remove the outer fairing. See Section 2.28 UPPER FAIRING/WINDSHIELD (FLTR), OUTER FAIRING, REMOVAL.

c. 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.

d. See Figure 8-75. Disconnect jumper harness from interconnect harness as follows:

- Indicator Lamps connector [21], 10-place Multilock.
- Instrument nacelle switch connector [105], 12-place Multilock.

e. Using a T40 TORX drive head, remove two bolts (with flat washers) to release right side of instrument nacelle from fork side.

f. 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 8-79.

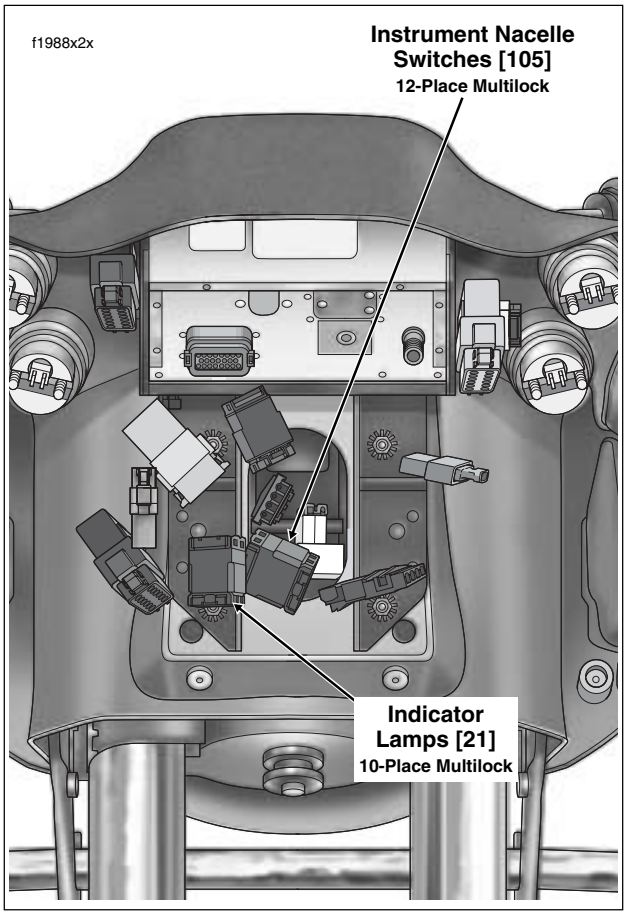


Figure 8-75. Interconnect Harness Connectors

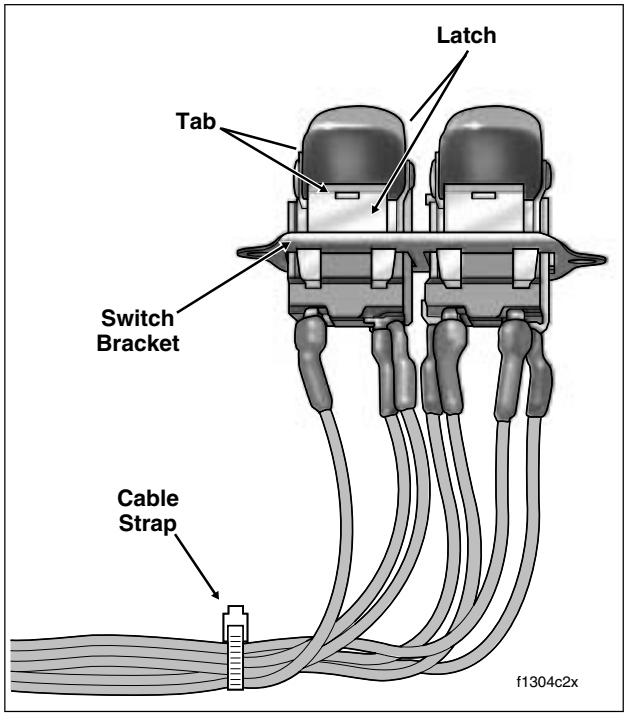


Figure 8-76. Bend Latches Outward to Release Tabs

g. Carefully pry back molded retainer to release switch bracket assembly from instrument nacelle.

h. Carefully pry two latches on bracket outward to release tabs on switch. Remove switch from bracket. See Figure 8-76.

i. Cut cable strap to separate Cruise and Accessory switch wires, if present. Cut cable strap on inboard side of jumper harness conduit.

j. Follow the wires of the faulty switch to the socket housing, or reference Figure 8-77 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.

k. Remove the appropriate terminals from the socket housing.

NOTE

For instructions on properly removing wire terminals, see APPENDIX B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, REMOVING SOCKET/PIN TERMINALS.

l. 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 8-78. 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.

m. Carefully pull wires to draw socket terminals through conduit. For best results, pull one wire at a time.

n. 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. While carefully placing left side of instrument nacelle on vehicle, slide odometer reset switch through hole and install rubber boot to secure.

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].

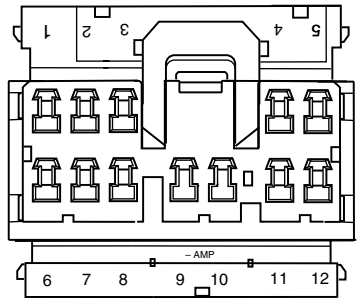


Figure 8-77. Numbers Stamped on Secondary Locks (Socket Housing Shown)

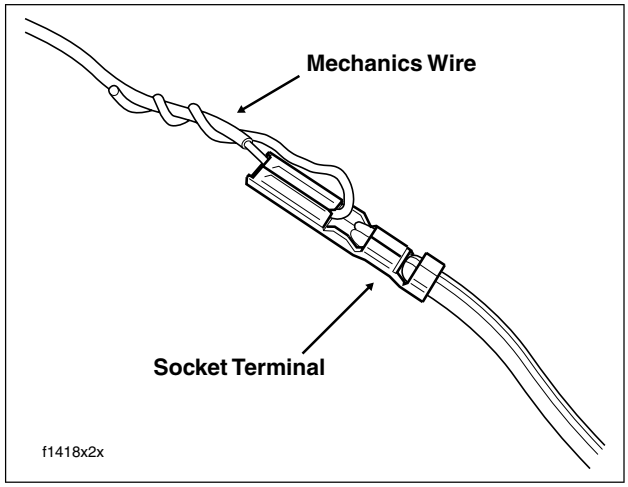


Figure 8-78. Fix Mechanics Wire to Socket Terminals

d. 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.

e. Mate pin and socket halves of Speaker Switch connector [105], 4-place Multilock. See Figure 8-73.

f. 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 8-76.

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.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 8-76.

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 8-75. 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 2.28 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. Capture throttle cables in cable clip. Insert cable clip into hole in upper right side of instrument nacelle.

2. Assemble domestic ignition switch as follows:

NOTE

For assembly of HDI ignition switch, see Section 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHT/C/U, FLTR (INTERNATIONAL), INSTALLATION, steps 5-10.

a. Install the switch position plate over threaded post of ignition switch housing. Tabs on plate fit in holes at top of instrument nacelle.

b. 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 to 50-70 **in-lbs** (5.7-7.9 Nm). See lower frame of Figure 8-74.

c. 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.

3. See Figure 8-73. 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.

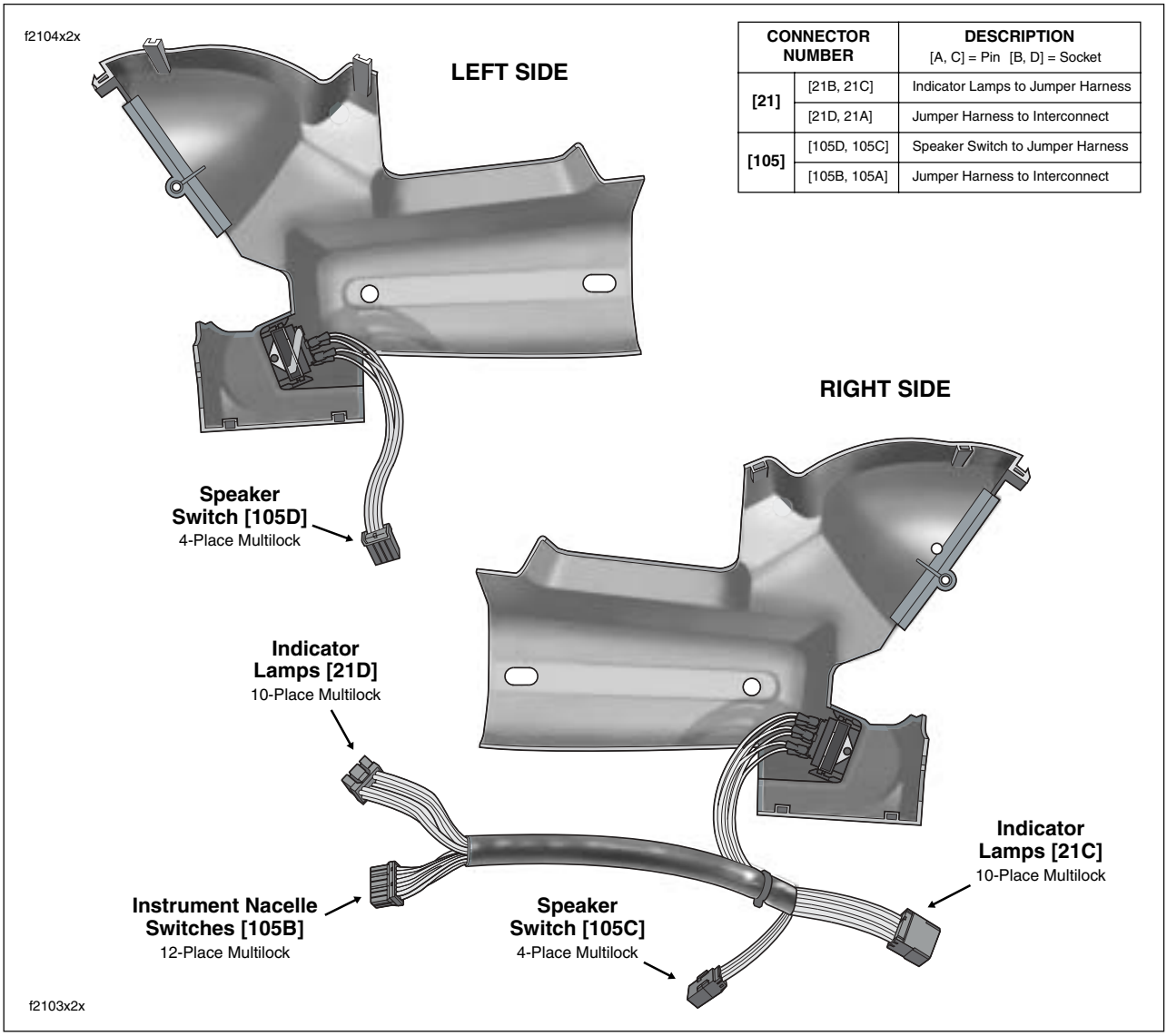
4. Connect instruments to main harness.

- 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.



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 8-79. Instrument Nacelle Halves

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.

5. Verify that left and right sides of instrument nacelle are properly mated. Pins on left side of nacelle must fully engage holes on right.

6. Insert tab at rear of bezel into slot of instrument nacelle (just in front of 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.*

7. Using a T25 TORX drive head, install screw on each side of bezel. Tighten screws to 25-35 **in-lbs** (2.8-4.0 Nm).

HANDLEBAR SWITCHES 8.20

GENERAL

The basic switch configuration is the “Road King.” The Road King switches have no specialized functions. Other switches, referred to as the Road King Classic, Classic and Ultra, have additional functions, such as cruise control, sound system controls, 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		FLHRI	
Road King Classic			
FLHRCI			
Classic			
FLHT	FLHTI	FLHTC	FLHTCI
Ultra			
FLTR	FLTRI	FLHTCUI	
NOTE: See Figures 8-88 thru 8-91 for illustrations.			

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 four different switch configurations for Touring models (Road King, Road King Classic, 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 (4.0 mm) 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 8-80.
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 cruise equipped 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.
8. Cut two cable straps to release wire harness conduit from handlebar.



Figure 8-80. 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. Cut two cable straps to release wire harness conduit from handlebar.
4. Remove hand grip from handlebar, if damaged. See Section 2.21 HANDLEBARS, LEFT HAND GRIP, REMOVAL.

INSTALLATION

NOTE

While there are four different switch configurations for Touring models (Road King, Road King Classic, 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 cruise equipped 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:

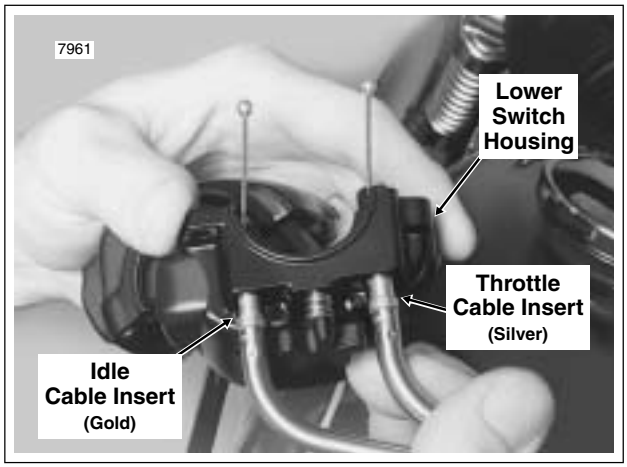


Figure 8-81. Install Throttle/Idle Control Cables in Lower Switch Housing

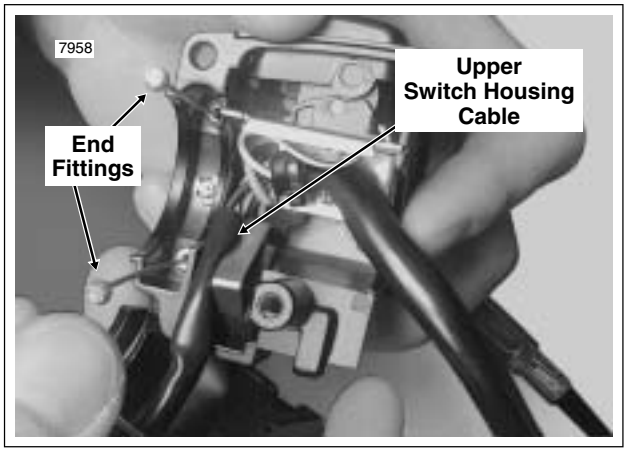


Figure 8-82. Route Cable to Upper Switch Housing

Note the different diameter inserts crimped into the end of the throttle and idle control cable housings. See Figure 8-81.

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 8-82.
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 8-83.
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.

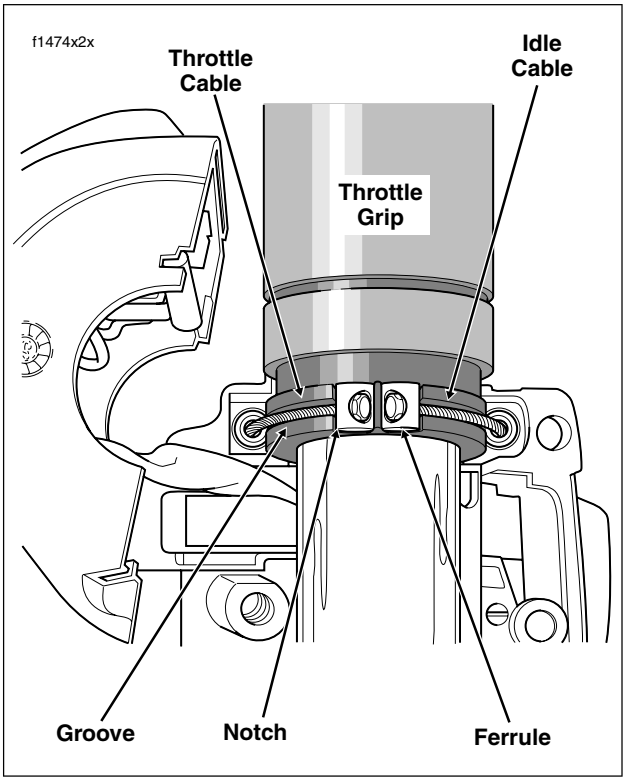


Figure 8-83. Install Throttle/Idle Control Cables on Throttle Control Grip

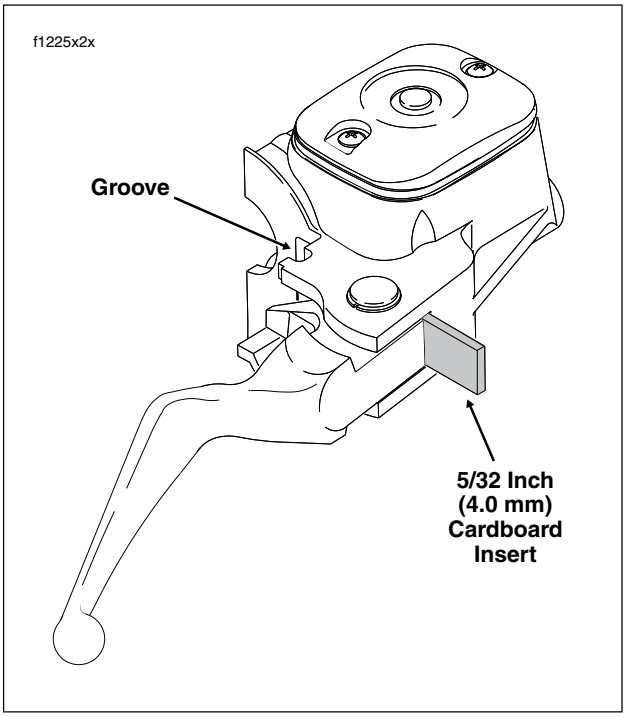


Figure 8-84. Leave Cardboard Insert in Place

CAUTION

See Figure 8-84. Do not remove the 5/32 inch (4.0 mm) 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 8-85.
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 8-88.
13. Secure wire harness conduit to handlebar using two **new** cable straps. Position first cable strap approximately 4-5 inches (102-127 mm) from handlebar clamp. Cut any excess cable strap material.
14. Test the switches for proper operation.

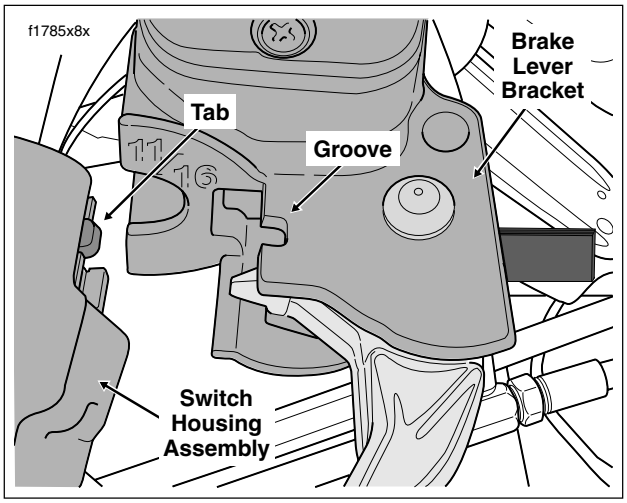


Figure 8-85. Fit Brake Lever/Master Cylinder to Right Handlebar Switch Housings

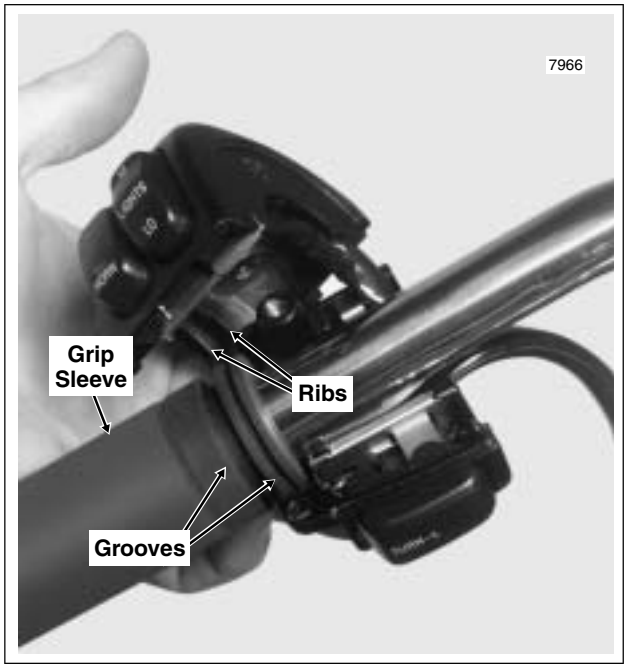


Figure 8-86. Install Left Handlebar Switch Housings

LEFT HANDLEBAR CONTROLS

1. Install **new** hand grip, if removed,. See Section 2.21 HANDLEBARS, LEFT HAND GRIP, INSTALLATION.

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 8-86.

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 8-87.

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.

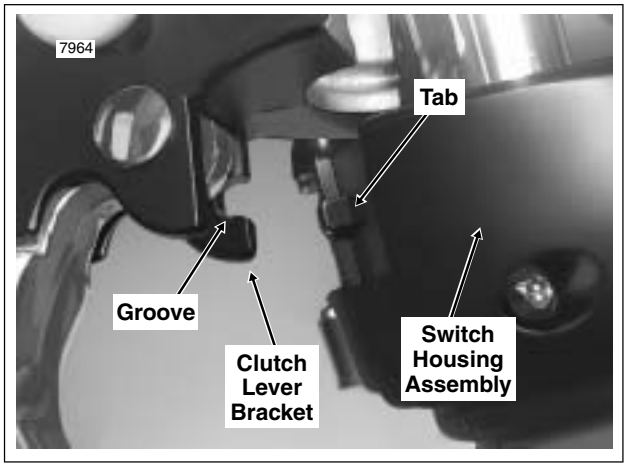


Figure 8-87. Fit Clutch Lever Bracket to Left Handlebar Switch Housings

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 8-88.

8. Secure wire harness conduit to handlebar using two **new** cable straps. Position first cable strap approximately 4-5 inches (102-127 mm) from handlebar clamp. Cut any excess cable strap material.

9. Test the switches for proper operation.

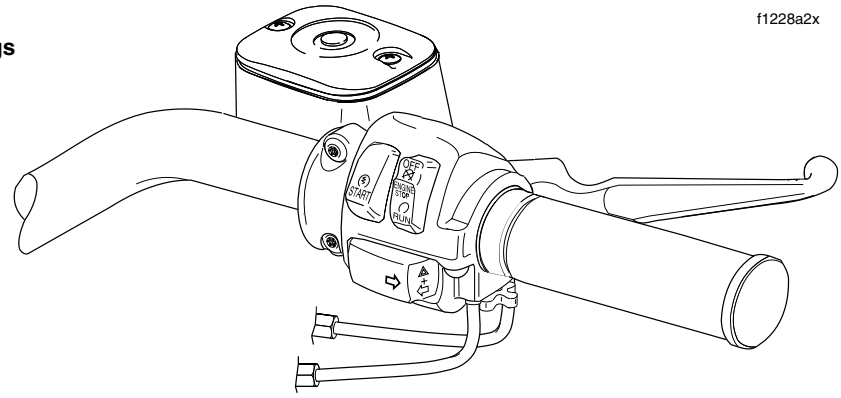
Right Handlebar Switch Housings

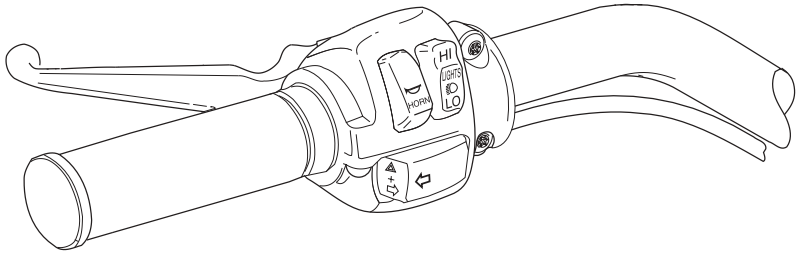
Upper Switch Housing:

- Engine Start Switch
- Engine Stop Switch: Off/Run

Lower Switch Housing:

- Turn-Right Signal Switch
- Front Stoplight Switch





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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

Figure 8-88. Road King Handlebar Switch Assemblies

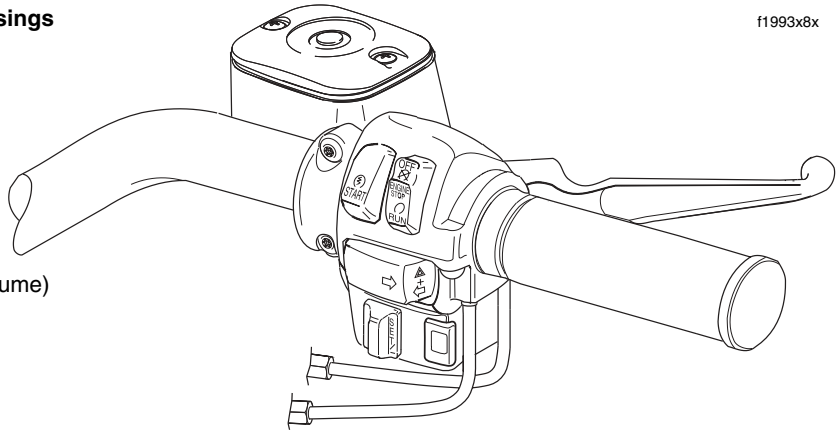
Right Handlebar Switch Housings

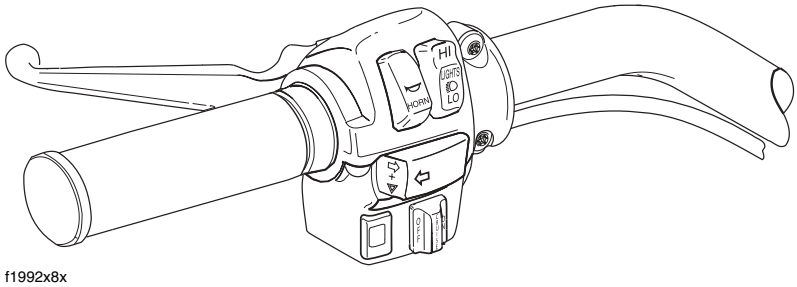
Upper Switch Housing:

- Engine Start Switch
- Engine Stop Switch: Off/Run

Lower Switch Housing:

- Turn-Right Signal Switch
- Front Stoplight Switch
- Cruise Control Switch: Set/Res(ume)
- Cruise Engaged Lamp (Green)





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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
- Cruise Control Switch: On/Off
- Cruise On Lamp (Red)

Figure 8-89. Road King Classic Handlebar Switch Assemblies

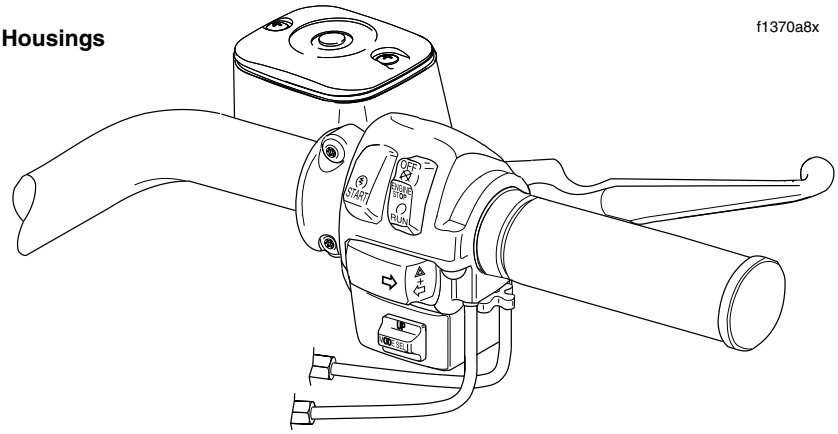
Right Handlebar Switch Housings

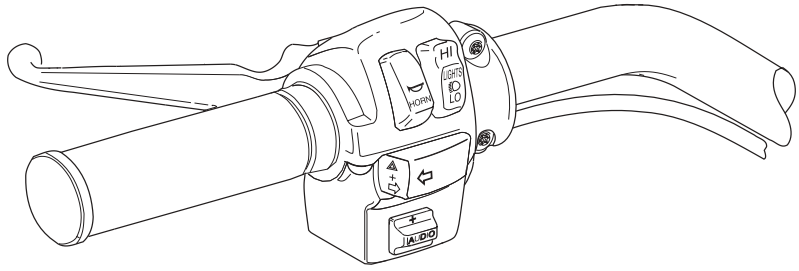
Upper Switch Housing:

- Engine Start Switch
- Engine Stop Switch: Off/Run

Lower Switch Housing:

- Turn-Right Signal Switch
- Front Stoplight Switch
- Mode Select Switch: UP/DN





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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 8-90. Classic Handlebar Switch Assemblies

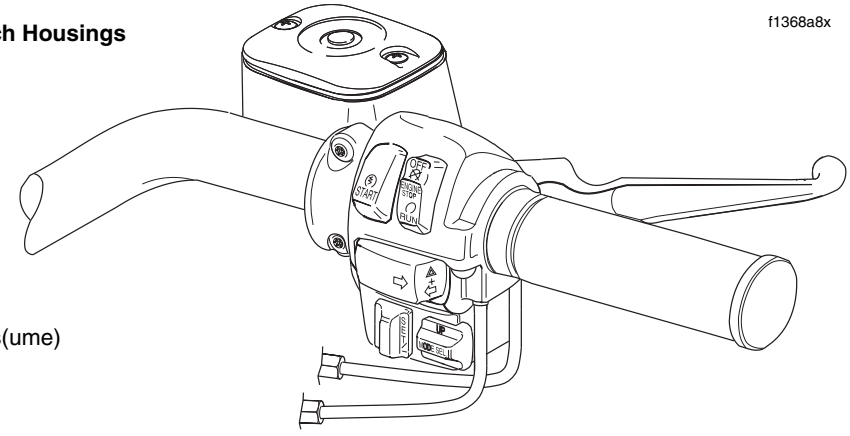
Right Handlebar Switch Housings

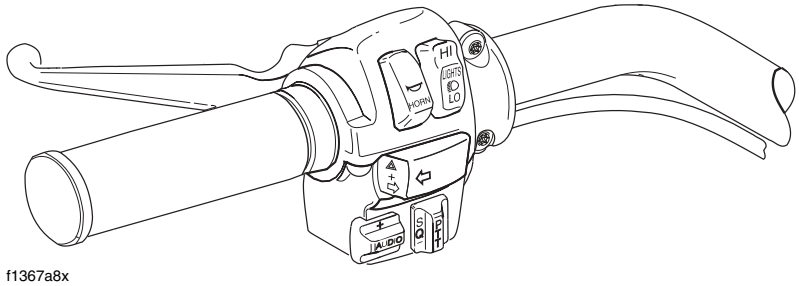
Upper Switch Housing:

- 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)





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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: +/-
- Squelch Control and Driver P(ush) T(o) T(ransmit) Switch: SQ-/PTT/SQ+

Figure 8-91. 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 (4.0 mm) 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 cruise equipped 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.

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, on this page.]

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 8-92.
2. Move cable conduit from beneath wing of bracket. Cut wires 1/4 inch (6.4 mm) 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 (12.7 mm) 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 8-93. Route wires downstream of splices beneath wing on Engine Stop Switch side of bracket as seen in Figure 8-92.
7. Install a **new** 7 inch cable strap beneath wing on Engine Start Switch side of bracket and capture wire splices.

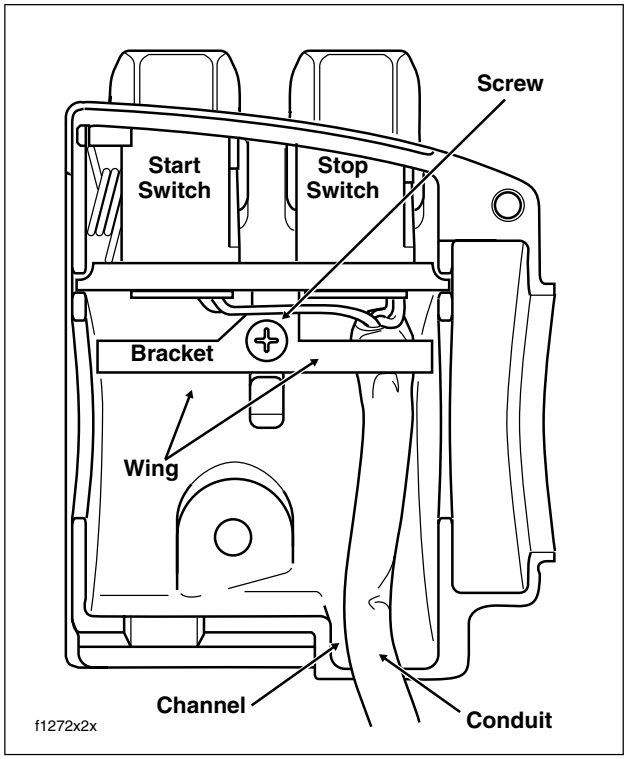


Figure 8-92. Upper Right Handlebar Switch Housing (Without Splices)

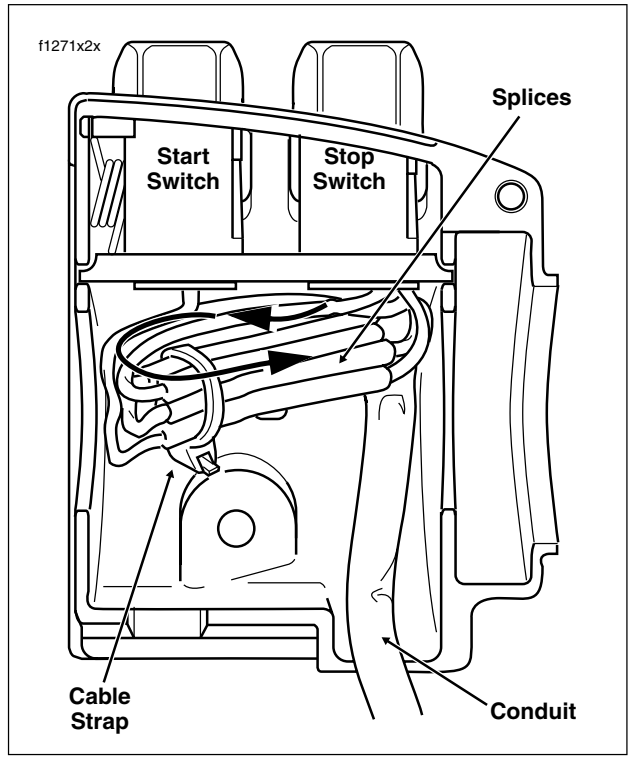


Figure 8-93. Upper Right Handlebar Switch Housing (With Splices)

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 8-92.
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 8-94. 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 (6.4 mm) 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 (12.7 mm) 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 8-95. Route wires downstream of splices beneath wing on High/Low Beam Switch side of bracket as seen in Figure 8-94.
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.

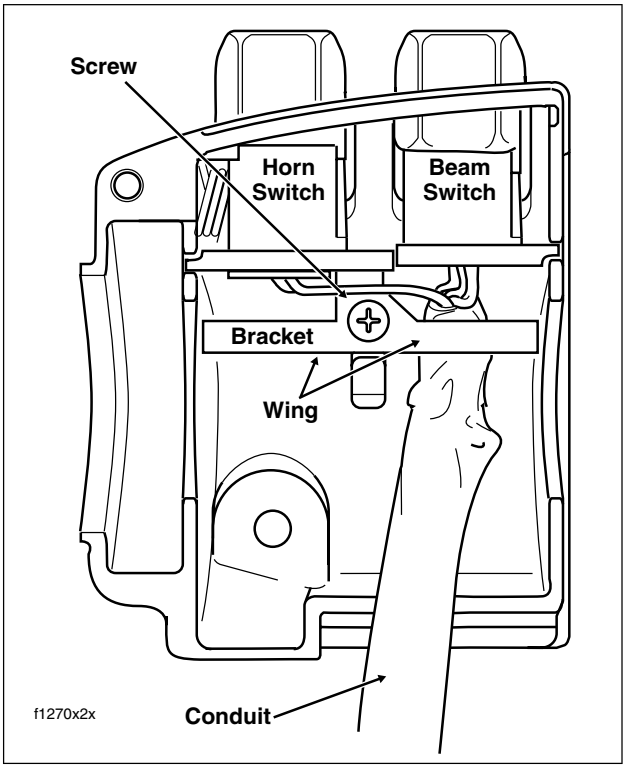


Figure 8-94. Upper Left Handlebar Switch Housing (Without Splices)

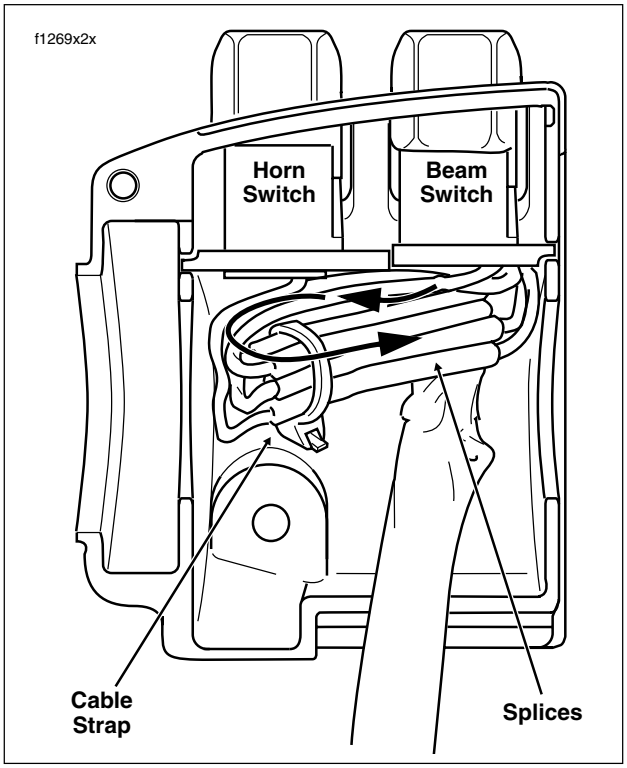


Figure 8-95. Upper Left Handlebar Switch Housing (With Splices)

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 8-94.
10. Securely tighten cable strap to draw splices to bracket. Remove any excess cable strap material. See Figure 8-95.
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, if present.
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 (38.1 mm) 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 RIGHT SIDE HANDLEBAR, 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 (25.4 mm) 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.
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 8-96.
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 RIGHT SIDE HANDLEBAR, FINAL INSTRUCTIONS on the next page.

- **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 8-97.

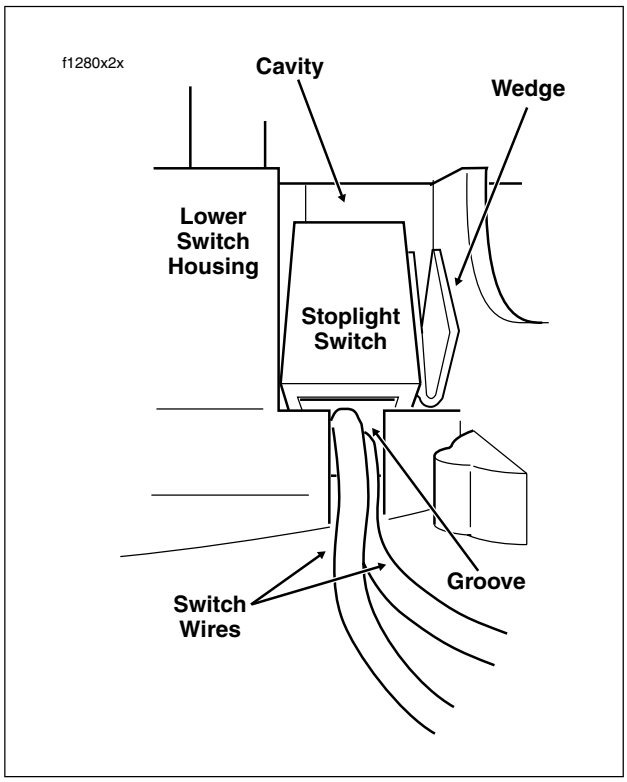


Figure 8-96. Install Stoplight Switch

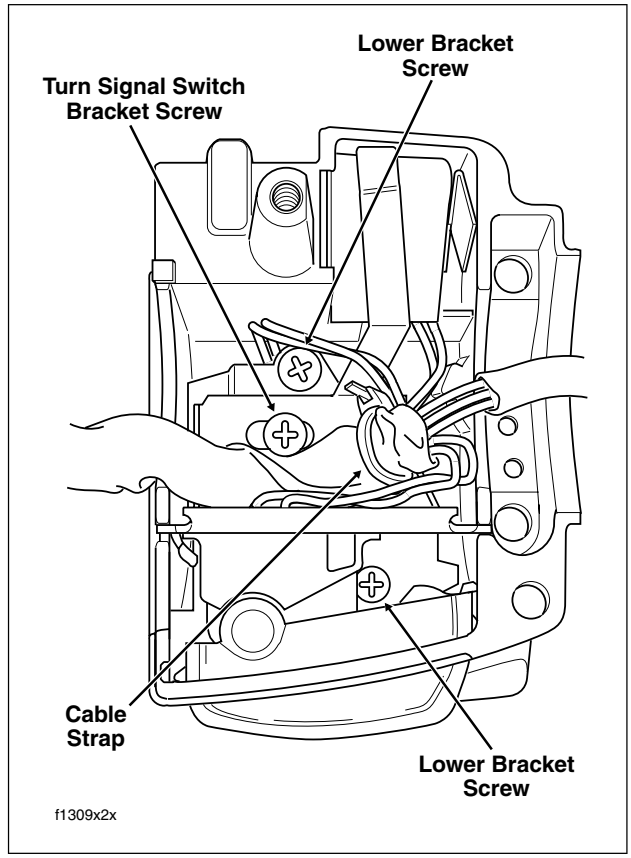


Figure 8-97. Lower Right Handlebar Switch Housing (Without Splices) - Classic/Ultra Models

3. Cut wires 1-1/4 inches (31.8 mm) 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.
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 RIGHT SIDE HANDLEBAR, FINAL INSTRUCTIONS on the next page.

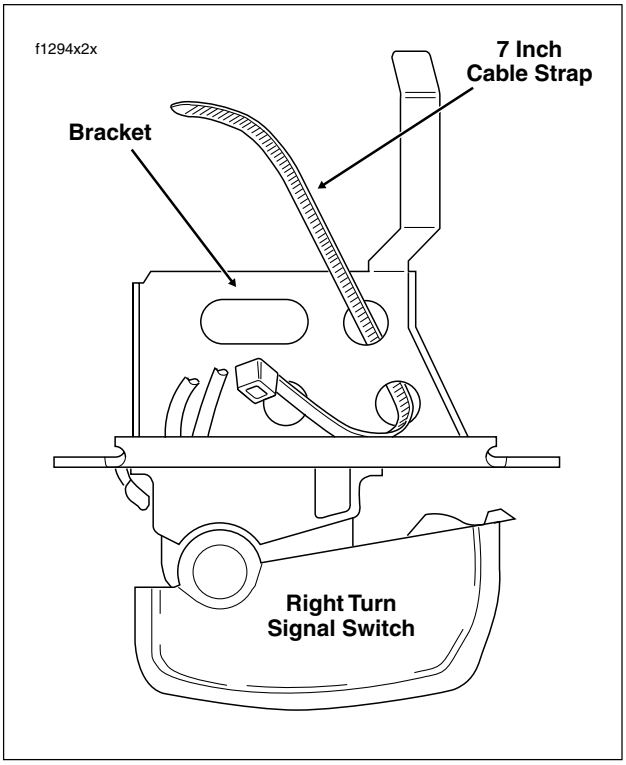


Figure 8-98. Insert Cable Strap in Switch Bracket

- **Cruise Engaged Lamp (Road King Classic Models)**

1. Remove two lower bracket screws. Pull bracket from switch housing. Pull lamp upper housing from lamp lower housing, but leave lamp lower housing in place. Remove lamp from lamp upper housing.
2. Cut wires 1-1/2 inches (38.1 mm) from old lamp. Discard lamp assembly.

NOTE

Cut replacement Cruise Engaged Lamp wires to 2 inches and strip 1/2 inch of insulation.

3. See GENERAL REPAIR PROCEDURES in this section.
4. Verify that lamp lower housing is situated between blocks cast in lower switch housing and that the concave side is up. Position lamp between arms at bottom of lamp upper housing so that lip of lense engages groove in housing. Press upper and lower halves of lamp housing together until arms on upper housing engage notches in lower housing.
5. Keeping splices above the bracket, install the lower bracket (weld nut side down), so that the lower step is positioned over the Cruise Set/Resume Switch (horizontally oriented with the blue/black wire towards the master cylinder). Slots in the upper step engage two tabs on lamp upper housing.
6. Install shorter screw to secure front side of lower bracket to threaded boss. Install longer rear screw. Use thru hole in upper step of bracket to engage threaded hole in casting.
7. See RIGHT SIDE HANDLEBAR, FINAL INSTRUCTIONS on this page.

- **Cruise Set/Resume Switch (Road King Classic and Ultra Models)**

1. Pull keycap from switch shaft.
2. Remove two lower bracket screws. Pull bracket and switch from switch housing.
3. Cut wires 1-1/2 inches (38.1 mm) from old switch. Discard switch assembly.

NOTE

Replacement Cruise Set/Resume 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.
6. Keeping splices above the bracket, install the lower bracket (weld nut side down), so that the lower step is positioned over the switch. Slots in the upper step engage two tabs on the Cruise On Lamp upper housing (Road King Classic), or the body of the Mode Select Switch (Ultra models).

NOTE

The Mode Select Switch is vertically oriented with the gray/white wire topside.

7. Install shorter screw to secure front side of lower bracket to threaded boss. Install longer rear screw. Use thru hole in upper step of bracket to engage threaded hole in casting.
8. Note lettering for proper orientation and gently push keycap onto switch shaft.
9. See RIGHT SIDE HANDLEBAR, FINAL INSTRUCTIONS on this page.

RIGHT SIDE HANDLEBAR

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 8-98.

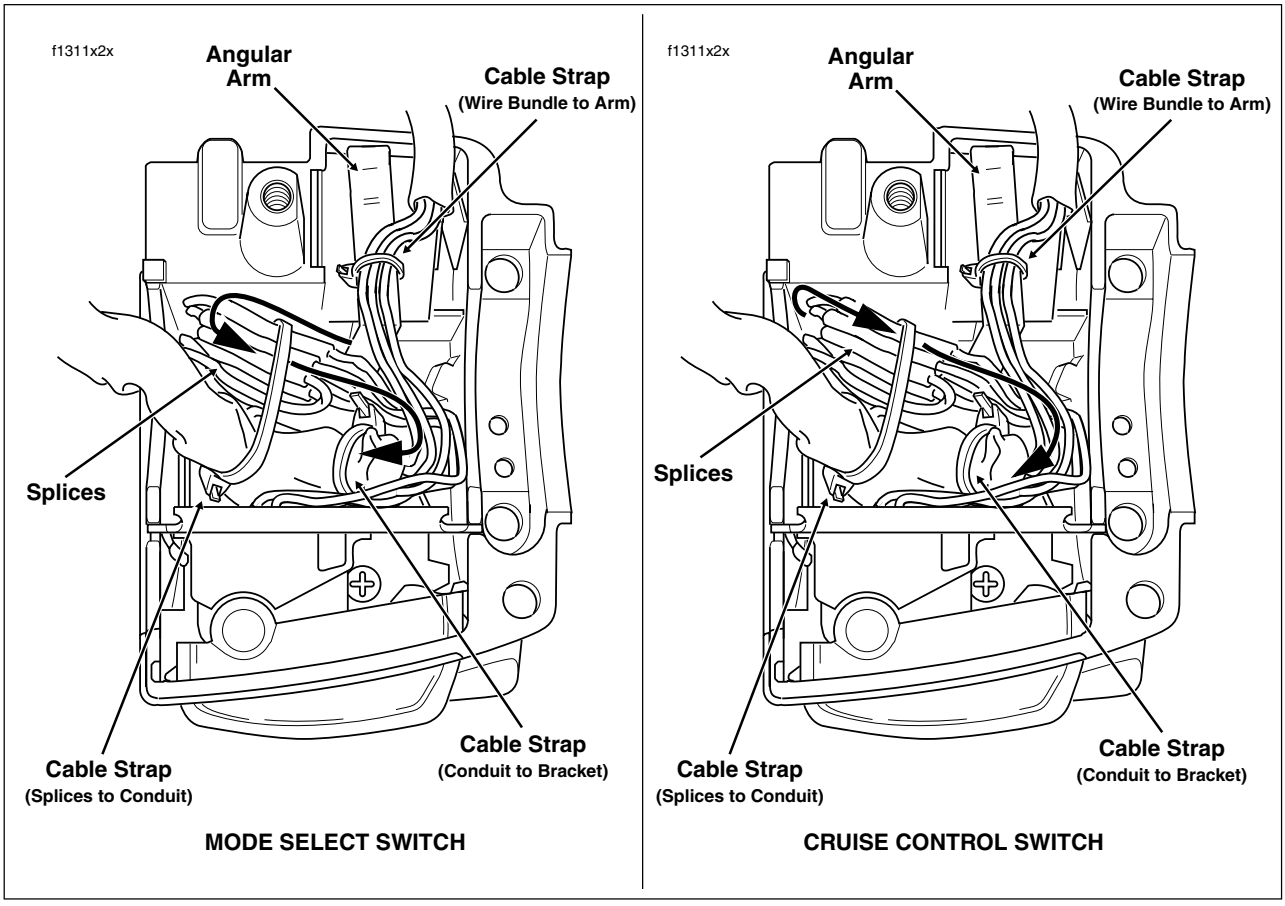


Figure 8-99. Lower Right Handlebar Switch Housing (With Splices) - Classic/Ultra Models

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 lower bracket weld nut (threaded boss on Road King Standard 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 8-99.
5. Capturing conduit about 1/4 inch (6.4 mm) 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.

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, if present.

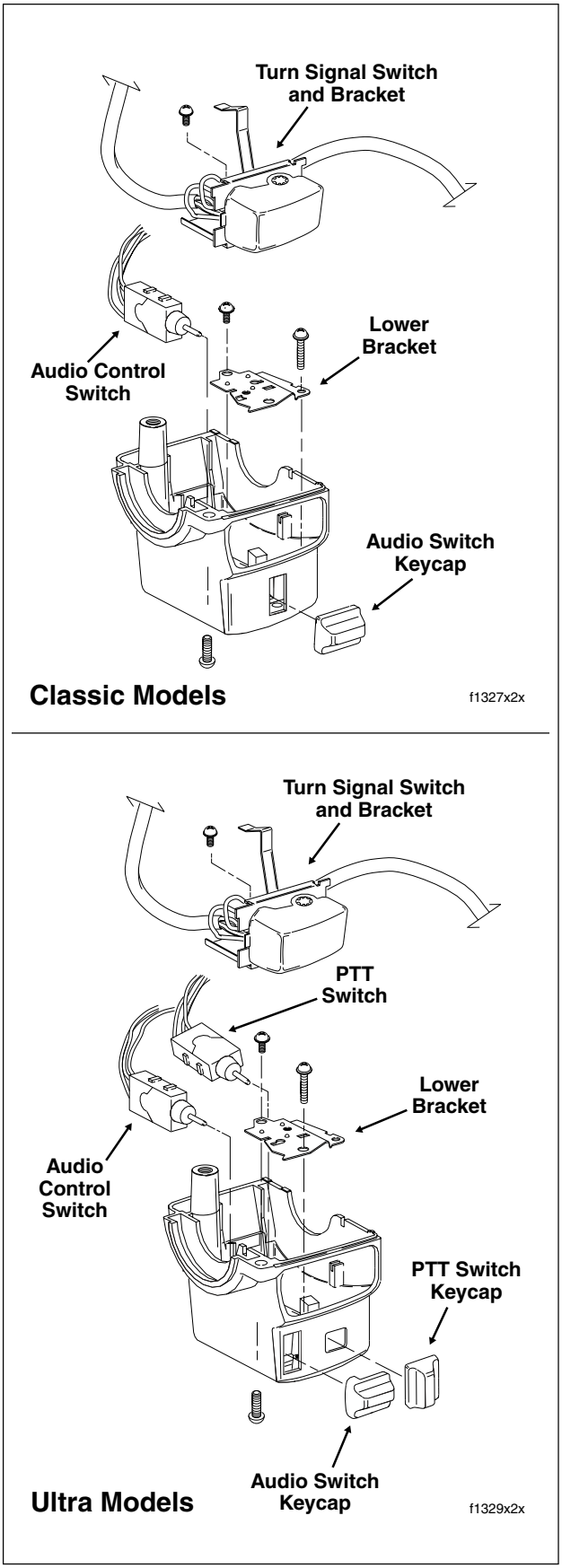


Figure 8-100. Lower Left Handlebar Switch Assemblies (Exploded View)

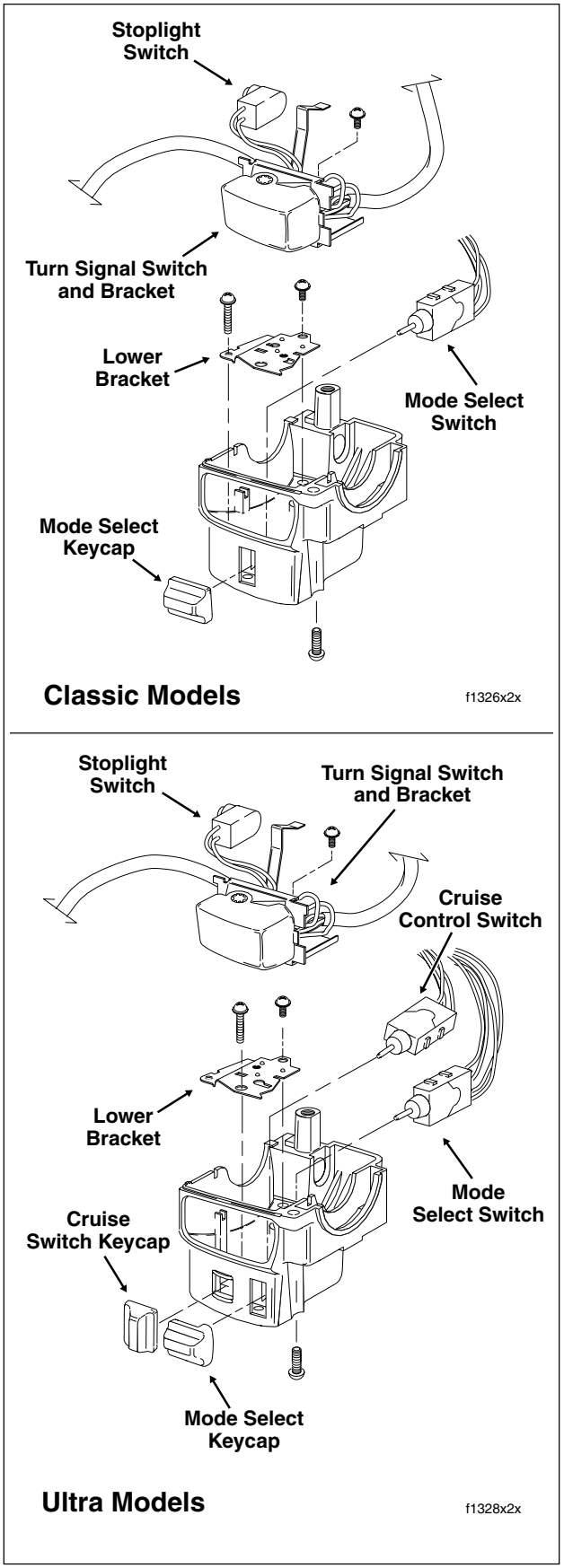


Figure 8-101. Lower Right Handlebar Switch Assemblies (Exploded View)

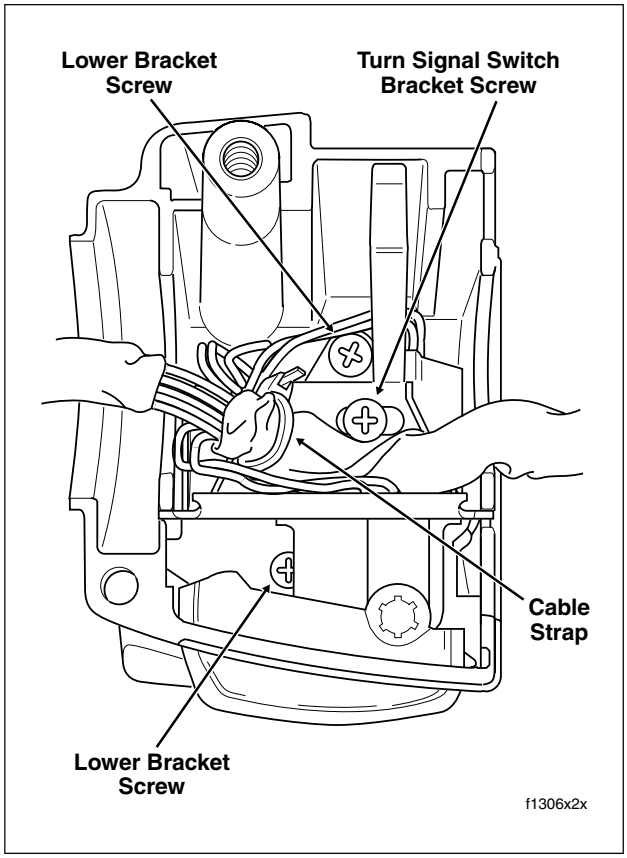


Figure 8-102. Lower Left Handlebar Switch Housing (Without Splices) - Classic/Ultra Models

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 (38.1 mm) 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 LEFT SIDE HANDLEBAR, 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 8-102. Pull bracket and switch from switch housing.
3. Cut wires 1-1/4 inches (31.8 mm) 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 LEFT SIDE HANDLEBAR, FINAL INSTRUCTIONS on the next page.

- **Cruise On Lamp (Road King Classic Models)**

1. Remove two lower bracket screws. Pull bracket from switch housing. Pull lamp upper housing from lamp lower housing, but leave lamp lower housing in place. Remove lamp from lamp upper housing.
2. Cut wires 1-1/2 inches (38.1 mm) from old lamp. Discard lamp assembly.

NOTE

Cut replacement Cruise On Lamp wires to 2 inches and strip 1/2 inch of insulation.

3. See GENERAL REPAIR PROCEDURES in this section.
4. Verify that lamp lower housing is situated between blocks cast in lower switch housing and that the concave side is up. Position lamp between arms at bottom of lamp upper housing so that lip of lense engages groove in housing. Press upper and lower halves of lamp housing together until arms on upper housing engage notches in lower housing.
5. Keeping splices above the bracket, install the lower bracket (weld nut side down), so that the lower step is positioned over the Cruise On/Off Switch (horizontally oriented with orange/white wire towards clutch lever bracket). Slots in the upper step engage two tabs on lamp upper housing.

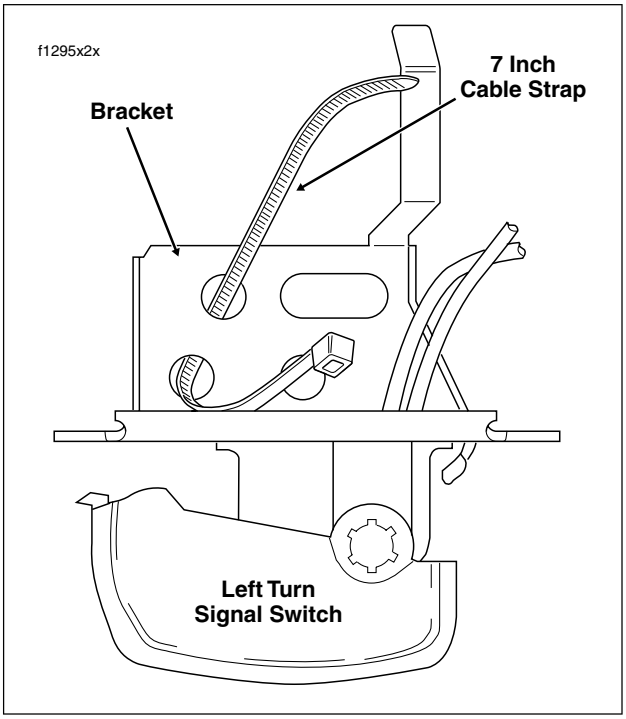


Figure 8-103. Insert Cable Strap in Switch Bracket

6. Install shorter screw to secure front side of lower bracket to threaded boss. Install longer rear screw. Use thru hole in upper step of bracket to engage threaded hole in casting.
7. See LEFT SIDE HANDLEBAR, FINAL INSTRUCTIONS on this page.

- **CB Push-To-Transmit Switch (Ultra Models)**

1. Pull keycap from switch shaft.
2. Remove two lower bracket screws. See Figure 8-102. Pull bracket and switch from switch housing.
3. Cut wires 1-1/2 inches (38.1 mm) 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.
5. Fit new switch into cavity so that it sits in a horizontal position (brown/black wire towards clutch lever 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 (horizontally oriented). Slots in the upper step engage two tabs on body of Audio 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 keycap onto switch shaft.
9. See LEFT SIDE HANDLEBAR, FINAL INSTRUCTIONS on this page.

- **Cruise On/Off Switch (Road King Classic Models)**

1. Pull keycap from switch shaft.
2. Remove two lower bracket screws. Pull bracket and switch from switch housing.
3. Cut wires 1-1/2 inches (38.1 mm) from old switch. Discard switch assembly.

NOTE

Cut replacement Cruise On/Off Switch wires to 2 inches and strip 1/2 inch of insulation.

4. See GENERAL REPAIR PROCEDURES in this section.
5. Fit new switch into cavity so that it sits in a horizontal position (orange/white wire towards clutch lever 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 switch. Slots in the upper step engage two tabs on the Cruise On Lamp upper housing.
7. Install shorter screw to secure front side of lower bracket to threaded boss. Install longer rear screw. Use thru hole in upper step of bracket to engage threaded hole in casting.
8. Note lettering for proper orientation and gently push keycap onto switch shaft.
9. See LEFT SIDE HANDLEBAR, FINAL INSTRUCTIONS below.

LEFT SIDE HANDLEBAR

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 8-103.

NOTE

Be sure that all splices are positioned above the turn signal switch bracket.

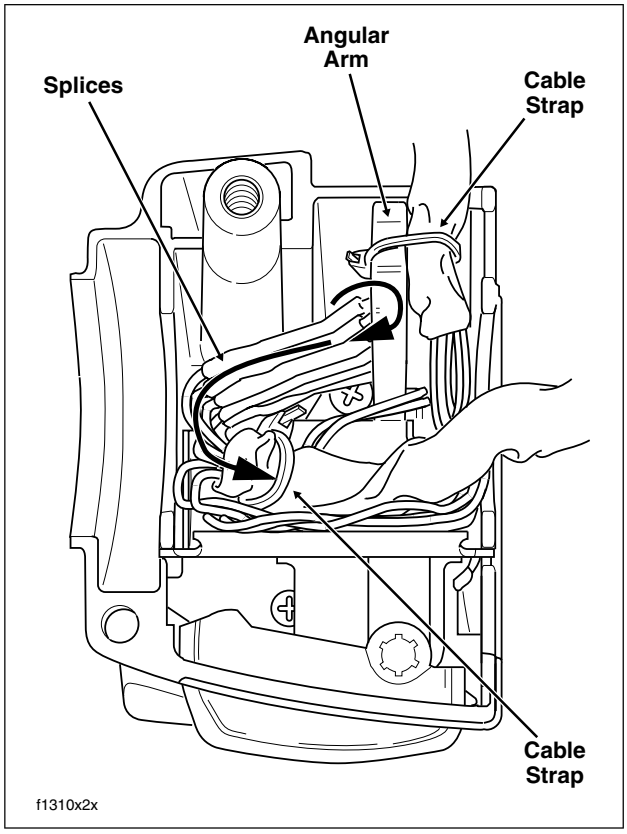


Figure 8-104. Lower Left Handlebar Switch Housing (With Splices) - Classic/Ultra Models

2. Place the turn signal switch assembly into the housing aligning the oblong hole in the bracket with the lower bracket weld nut (threaded boss on Road King Standard 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 8-104.
5. Capturing conduit about 1/4 inch (6.4 mm) 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 8-104. Secure bundle to arm using **new** cable strap. Cut any excess cable strap material.
8. See LEFT SIDE HANDLEBAR SWITCHES, ASSEMBLY, which follows.

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 (25.4 mm) segments. Slide tubing over each wire of new switch assembly.

NOTE

If absent from kit, obtain heat shrink tubing (Part No. 72266-94) and two 7 inch cable straps (Part No. 10181).

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 8-105. 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 8-105.
   c. Tightly coil the remaining two-thirds of the left hand wire around the right with the results shown in C of Figure 8-105.
   d. Solder the spliced connections.

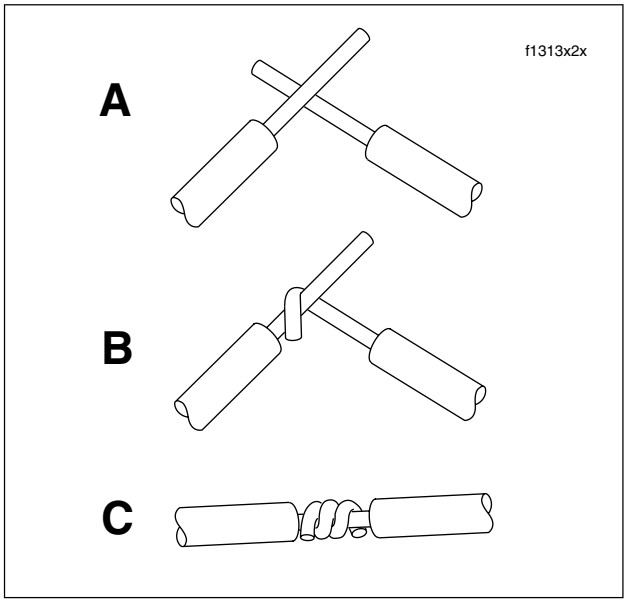


Figure 8-105. Splice Switch Wires

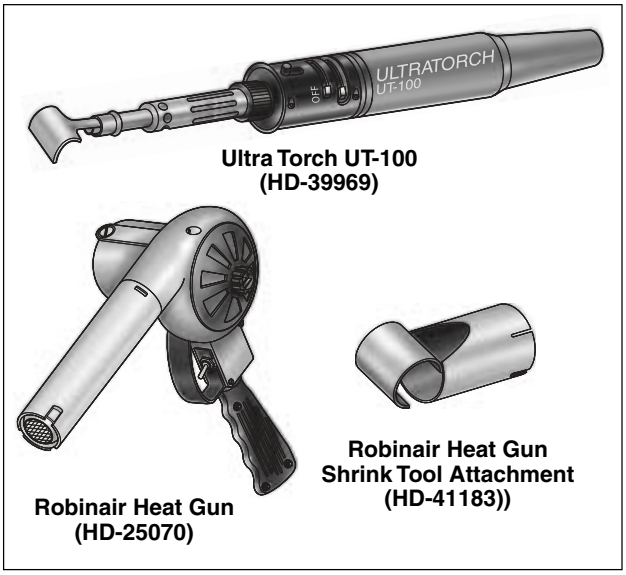


Figure 8-106. Radiant Heating Devices

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 8-106. 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.

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 cruise equipped 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/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.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.

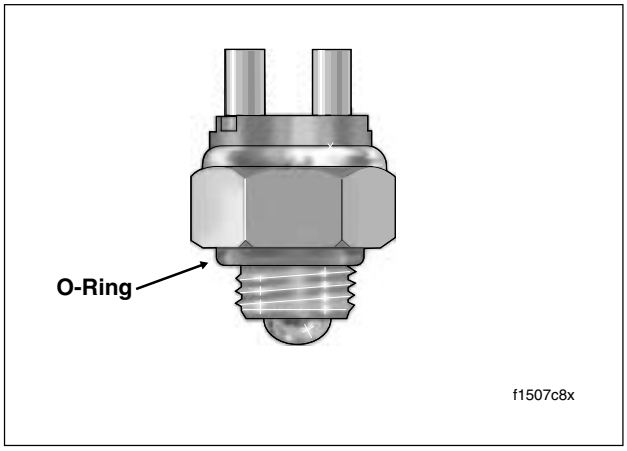


Figure 8-107. Neutral Switch Assembly

3. Using 7/8 inch box and open end wrench, install neutral switch with O-ring in the transmission top cover. Tighten to 120-180 **in-lbs** (13.6-20.3 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 80-100 **in-lbs** (9.0-11.3 Nm).

CIGARETTE LIGHTER (FLHTCU, FLTR) 8.24

GENERAL

FLHTCU 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 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL. On FLTR models, see Section 2.28 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 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION. On FLTR models, see Section 2.28 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 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL.

   FLTR: See Section 2.28 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 8-108.
3. Loosely install hex nuts on studs. Verify that gauge is properly aligned and then tighten nuts to 10-20 **in-lbs** (1.1-2.3 Nm).
4. Install interconnect wire harness connectors (gauge and lamp).
5. Install outer fairing. Proceed as follows:

   FLHT/C/U: See Section 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.

   FLTR: Section 2.28 UPPER FAIRING/WINDSHIELD (FLTR), OUTER FAIRING, INSTALLATION.

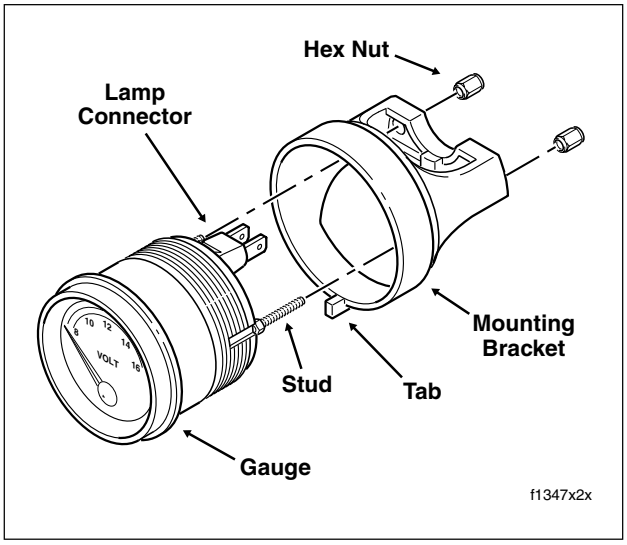


Figure 8-108. Voltmeter Gauge Assembly

GAUGES- 4 INCH DIAMETER

TACHOMETER

REMOVAL

1. Proceed as follows:

   FLHT/C/U: Remove the outer fairing. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL.

   FLTR: Remove instrument bezel. See Section 2.28 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 10-20 **in-lbs** (1.1-2.3 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 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.

   FLTR: Install instrument bezel. See Section 2.28 UPPER FAIRING/WINDSHIELD (FLTR), BEZEL, INSTALLATION, steps 1-2.

SPEEDOMETER SPEED SENSOR

REMOVAL

1. Remove seat. See Section 2.22 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 8-109. 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 8-109. 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 84-108 **in-lbs** (9-12 Nm).
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.

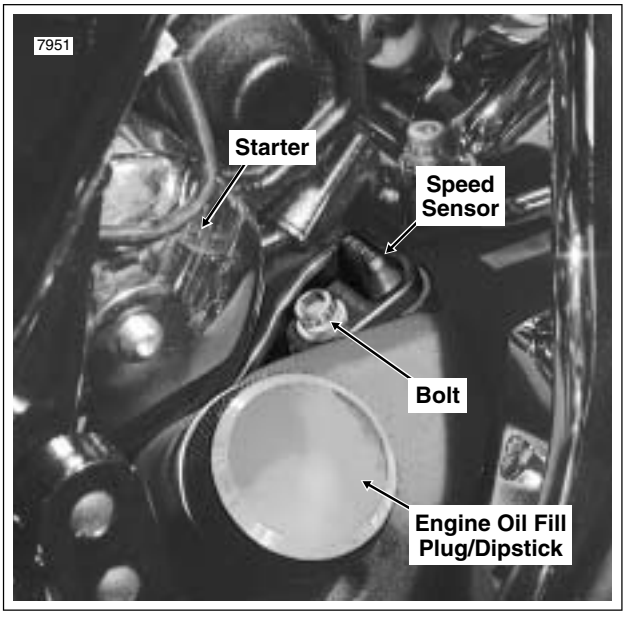


Figure 8-109. Speedometer Speed Sensor Location

SPEEDOMETER

REMOVAL

1. Proceed as follows:

   FLHT/C/U: Remove the outer fairing. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL.

   FLTR: Remove instrument bezel. See Section 2.28 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 10-20 **in-lbs** (1.1-2.3 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 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.

   FLTR: Install instrument bezel. See Section 2.28 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 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL.

   FLTR: Remove instrument bezel. See Section 2.28 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 8-110. 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.

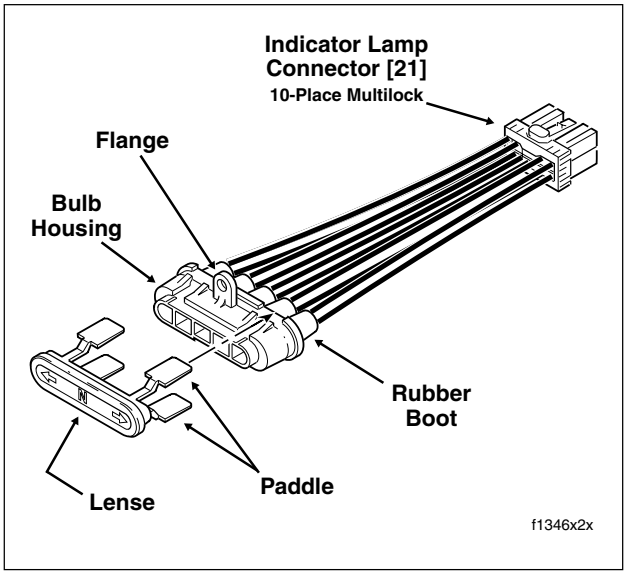


Figure 8-110. Indicator Lamp Assembly

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 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.

   FLTR: Install instrument bezel. See Section 2.28 UPPER FAIRING/WINDSHIELD (FLTR), BEZEL, INSTALLATION, steps 1-2.

FUEL GAUGE

REMOVAL

1. Remove seat. See Section 2.22 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, gently pull on convoluted tubing 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.2 AMP MULTILOCK ELECTRICAL CONNECTORS, REMOVING SOCKET/PIN TERMINALS.

6. Remove convoluted tubing from wires.
7. 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.
8. To remove fuel gauge from vehicle, feed wires 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.

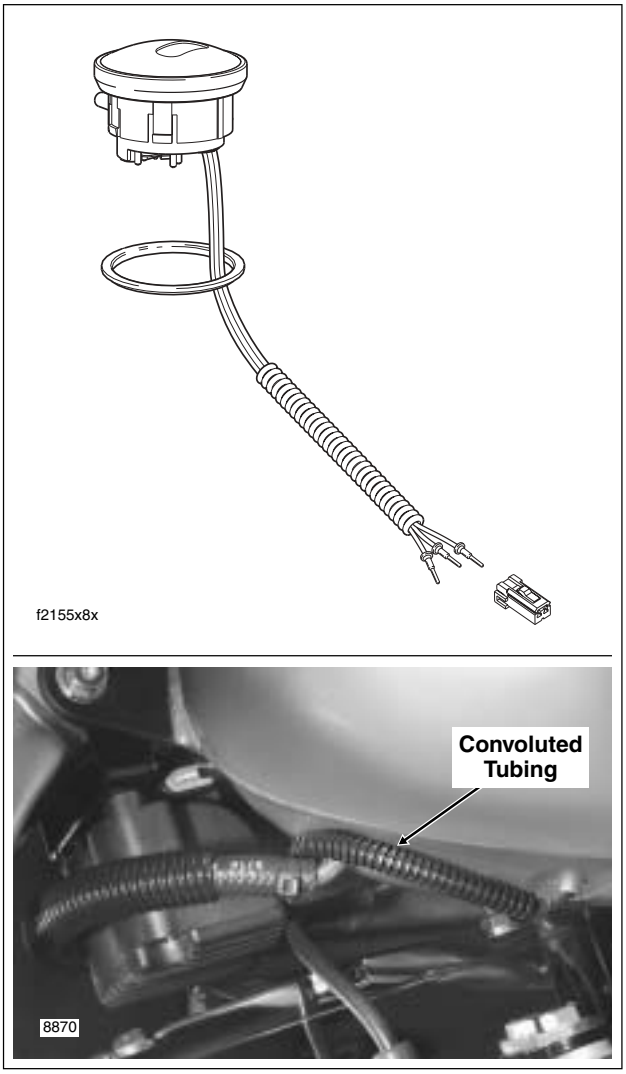


Figure 8-111. Fuel Gauge (FLHR/C)

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.2 AMP MULTILOCK ELECTRICAL CONNECTORS, CRIMPING INSTRUCTIONS.

3. While carefully lowering cap, feed wires 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.
4. Install convoluted tubing on wires.
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.2 AMP MULTILOCK ELECTRICAL CONNECTORS, INSTALLING SOCKET/PIN TERMINALS.

6. Route pin housing and convoluted tubing forward and then inboard between crossover hose fitting and bottom of fuel tank. See lower frame of Figure 8-111.
7. Mate pin and socket halves of 4-place Multilock connector. Feed connector into tunnel of fuel tank.
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 2.22 SEAT, INSTALLATION.

SPEEDOMETER SPEED SENSOR

REMOVAL

1. Remove seat. See Section 2.22 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 8-112. 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 8-112. 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 84-108 **in-lbs** (9-12 Nm).

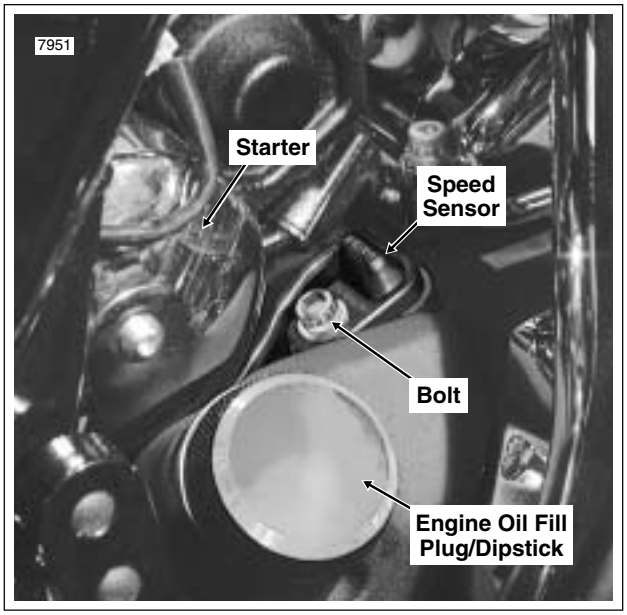


Figure 8-112. Speedometer Speed Sensor Location

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 2.22 SEAT, INSTALLATION.

SPEEDOMETER

REMOVAL

1. Remove seat. See Section 2.22 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.

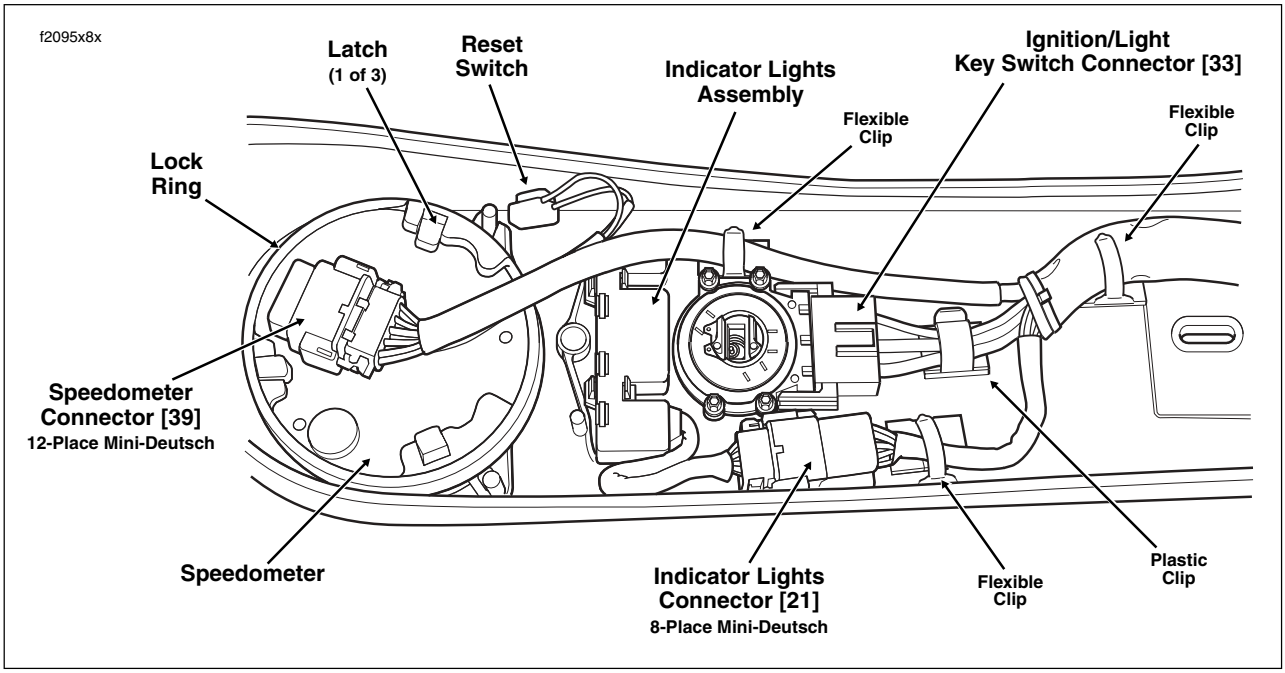


Figure 8-113. Instrument Console Assembly (FLHR/C)

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 8-113. Gently pry the three latches upward to release the lock ring from the back of the speedometer.
8. Turn the console over and remove the speedometer from the top side.
9. Remove gasket from console speedometer bore.

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 8-113.
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 50-90 **in-lbs** (5.7-10.2 Nm). Install Phillips screw (with large flat washer) and tighten to 36-60 **in-lbs** (4.1-6.8 Nm).
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 2.22 SEAT, INSTALLATION.

INDICATOR LIGHTS

NOTE

All FLHR/C models are 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 2.22 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 large 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. 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 8-114.
   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.”

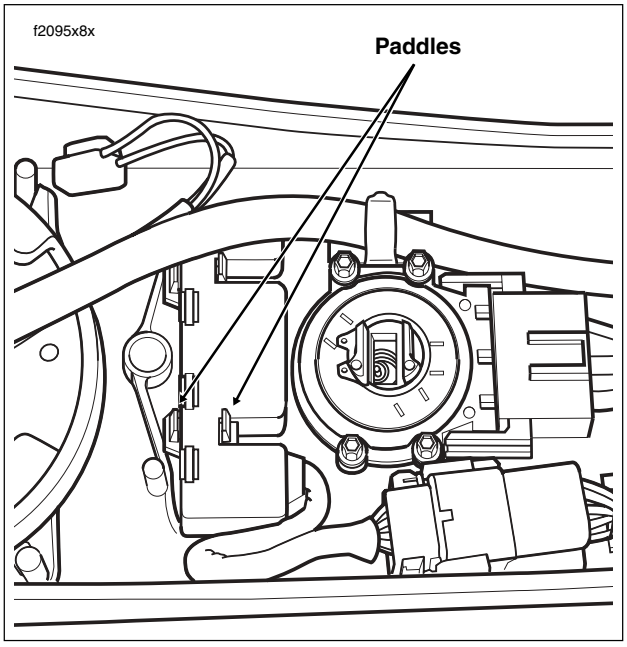


Figure 8-114. Release Paddles to Free Indicator Lights Assembly (FLHR/C)

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 50-90 **in-lbs** (5.7-10.2 Nm). Install Phillips screw (with large flat washer) and tighten to 36-60 **in-lbs** (4.1-6.8 Nm).
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 2.22 SEAT, INSTALLATION.

IGNITION SWITCH

NOTE

See Section 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHR/C.

FLHT/C, FLTR CANOPY

NOTE

For replacement of the fuel level sender on fuel injected models, see Section 9.4 FUEL TANK (FUEL INJECTED), FUEL LEVEL SENDER.

REMOVAL

1. Drain the fuel tank. See Section 4.6 VACUUM OPERATED FUEL VALVE (CARBURETED), DRAINING FUEL TANK, steps 1-8.
2. Remove seat. See Section 2.22 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.

3. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
4. Carefully cut anchored cable strap securing main harness bundle, fuel level sender conduit, and fuel vapor vent tube to left side of frame backbone.
5. 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.
6. Remove Allen head screw to detach flange at rear of console from clip nut on fuel tank weldment.
7. Lay a clean shop towel on forward part of rear fender.
8. Remove filler cap from neck of fuel tank. Remove console and lay upside down on shop towel. Reinstall filler cap.
9. Gently pry fuel vapor vent tube from fitting on filler neck of fuel tank. Exercise caution to avoid pulling fitting from filler neck.
10. Depress button on 3-place Mini-Deutsch connector to release fuel tank harness from top of canopy.
11. Using a T20 TORX bit, remove ten screws around the outer edge of the canopy. Discard screws.
12. Remove canopy with attached fuel level sender from fuel tank. Tilt canopy toward the right until it is at a 45˚ angle to top of fuel tank and then carefully pull assembly from left side lobe of fuel tank.
13. Remove and discard canopy gasket. Verify that sealing devices from screws are not lodged in canopy holes. Remove and discard devices if present.
14. Replace fuel level sender. See FUEL LEVEL SENDER in this section.

INSTALLATION

1. Obtain **new** canopy gasket. With the locator bump on the gasket OD toward the front, position gasket at bottom of canopy. Start four nubs on gasket into holes in canopy. Moving to top of canopy, alternately grasp each nub and pull through hole.

CAUTION

Exercise care to avoid bending float rod of fuel level sender during installation. A bent float rod will result in erroneous gauge readings.

2. Holding assembly so that canopy is at a 45˚ angle to top of fuel tank, insert assembly into left side lobe of fuel tank.

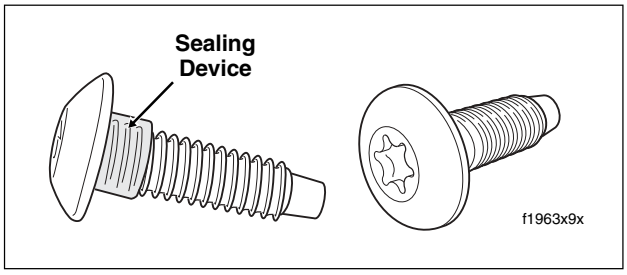


Figure 8-115. Canopy Sealing Screws

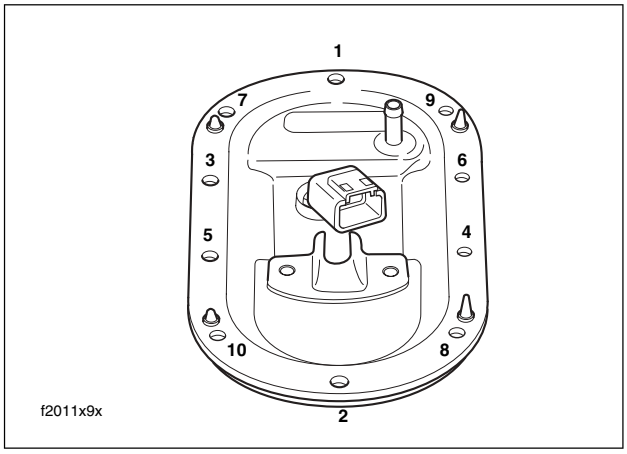


Figure 8-116. Canopy Torque Sequence (FLHR)

⚠WARNING

Always use new screws when installing the canopy. 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.

NOTE

Check canopy screws for proper sealing devices. Screws must have a bonded seal on underside of head. Replace screws if seal is missing or damaged. See Figure 8-115.

3. While pushing down on the canopy, align holes in canopy with those in fuel tank. Hand start ten **new** T20 TORX screws in perimeter of canopy. Tighten screws to 18-24 **in-lbs** (2.0-2.7 Nm) using the pattern shown in Figure 8-116.
4. Connect fuel vapor vent tube to fitting on filler neck of fuel tank.
5. Mate pin and socket halves of 3-place Mini-Deutsch connector to install fuel tank harness at top of canopy.
6. Remove filler cap. Position console on canopy. Route cables from beneath console as shown in Figure 8-117. 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 clip nut on fuel tank weldment. Tighten screw to 25-30 **in-lbs** (2.8-3.4 Nm).
8. Open fuel door on console. Install two Allen head screws to secure front of console to clip nuts on canopy bracket. Alternately tighten screws to 25-30 **in-lbs** (2.8-3.4 Nm).
9. Snap anchor of **new** cable strap into hole on left side of frame backbone. Tighten cable strap capturing main harness bundles, fuel level sender conduit, and fuel vapor vent tube. See Figure 8-117. Cut 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 2.22 SEAT, INSTALLATION.
12. Turn the handle of the fuel valve to OFF and fill the fuel tank. Carefully inspect for leaks. Turn the valve handle to ON and start engine. Repeat inspection.
13. Stop engine and return the valve to the OFF position.

FLHR CANOPY

NOTE

For replacement of the fuel level sender on fuel injected models, see Section 9.4 FUEL TANK (FUEL INJECTED), FUEL LEVEL SENDER.

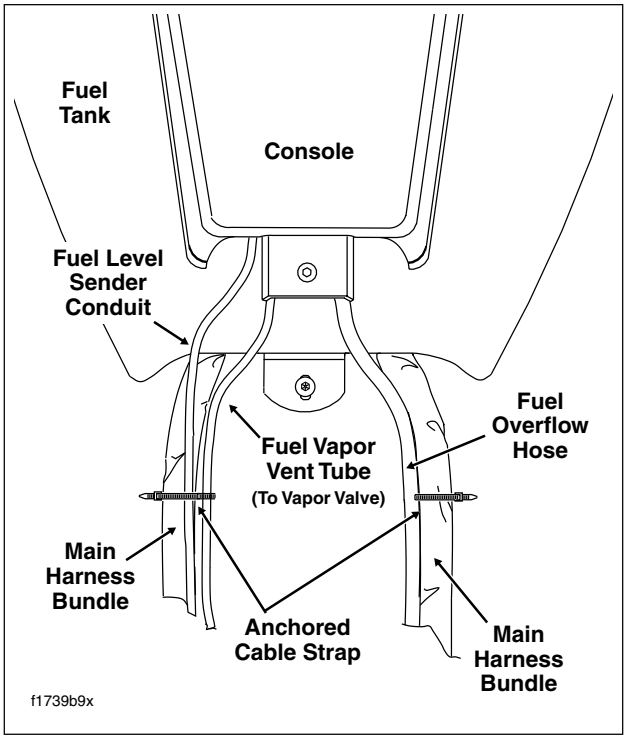


Figure 8-117. Console Cable/Hose Routing - FLHT/C, FLTR (Top View)

REMOVAL

1. Drain the fuel tank. See Section 4.6 VACUUM OPERATED FUEL VALVE (CARBURETED), DRAINING FUEL TANK, steps 1-8.
2. Remove seat. See Section 2.22 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.

3. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
4. Carefully cut anchored cable strap securing main harness bundle, instrument console conduit, and fuel vapor vent tube to left side of frame backbone.
5. Remove acorn nut and Phillips screw (with large flat washer) from instrument console.

CAUTION

When removing instrument console, exercise caution to avoid damaging speedometer unit. Wrap console in a clean, dry shop towel to prevent damage.

6. Remove console and secure to top of rear fender using bungee cords.
7. Remove console mounting bolt from slot at top of canopy.
8. Pull fuel vapor vent tube from fitting.
9. Bend back flexible clamp and then depress button on socket side of 3-place Mini-Deutsch connector to disconnect fuel level sender from main harness.
10. Using a T20 TORX bit, remove ten screws around the outer edge of the canopy. Discard screws.
11. Remove canopy with attached fuel level sender from fuel tank. Tilt canopy toward the right until it is at a 45˚ angle to top of fuel tank and then carefully pull assembly from left side lobe of fuel tank.
12. Remove and discard canopy gasket. Verify that sealing devices from screws are not lodged in canopy holes. Remove and discard devices if present.
13. Replace fuel level sender. See FUEL LEVEL SENDER on this page.

INSTALLATION

1. Obtain **new** canopy gasket. With the locator bump on the gasket OD toward the front, position gasket at bottom of canopy. Start four nubs on gasket into holes in canopy. Moving to top of canopy, alternately grasp each nub and pull through hole.

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. Holding assembly so that canopy is at a 45˚ angle to top of fuel tank, insert assembly into left side lobe of fuel tank keeping the float rod positioned to the right of the fuel gauge drain tube.

⚠WARNING

Always use new screws when installing the canopy. 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.

NOTE

Check canopy screws for proper sealing devices. Screws must have a bonded seal on underside of head. Replace screws if seal is missing or damaged. See Figure 8-115.

3. While pushing down on the canopy, align holes in canopy with those in fuel tank. Hand start ten **new** T20 TORX screws in perimeter of canopy. Tighten screws to 18-24 **in-lbs** (2.0-2.7 Nm) using the pattern shown in Figure 8-116.
4. Connect fuel vapor vent tube to fitting at top of canopy.
5. Mate pin and socket halves of 3-place Mini-Deutsch connector to connect fuel level sender to main harness. Bend flexible clamp to capture conduit at top of canopy.
6. Slide head of console mounting bolt into slot. Align hole in console with mounting bolt and place into position over canopy.
7. Install acorn nut on mounting bolt and tighten to 50-90 **in-lbs** (5.7-10.2 Nm). Install Phillips screw (with large flat washer) and tighten to 36-60 **in-lbs** (4.1-6.8 Nm).
8. Snap anchor of **new** cable strap into hole on left side of frame backbone. Tighten cable strap capturing main harness bundle, instrument console conduit, and fuel vapor vent tube. Cut any excess cable strap material.
9. 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).
10. Install seat. See Section 2.22 SEAT, INSTALLATION.
11. Turn the handle of the fuel valve to OFF and fill the fuel tank. Carefully inspect for leaks. Turn the valve handle to ON and start engine. Repeat inspection.
12. Stop engine and return the valve to the OFF position.

FUEL LEVEL SENDER

REMOVAL

CAUTION

Do not replace the special teflon coated fuel level sender wiring with ordinary bulk wire. Ordinary insulation materials may deteriorate when in contact with gasoline.

NOTE

Damaged fuel level sender wiring requires replacement of the fuel level sender unit.

1. See FLHT/C, FLTR CANOPY, REMOVAL, or FLHR CANOPY, REMOVAL, in this section.
2. Cut cable strap to release wiring from support arm.
3. Unwind spiral tubing from fuel level sender wiring.
4. At bottom of canopy, remove socket terminal from spade contact on connector clip.

⚠CAUTION

Always wear proper eye protection when drilling. Flying debris may result in eye injury.

CAUTION

Exercise care to avoid bending support arm during removal of the fuel level sender. Support area around rivet head when drilling or tapping. A bent support arm will result in erroneous gauge readings.

5. Drill off head of fuel level sender rivet using a 1/4 inch drill bit. Exercise caution to avoid enlarging hole in support arm when drilling. Use a punch to tap rivet shaft through hole in support arm if necessary. Blow away all metal shavings and debris using compressed air.
6. Remove 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 8-118. With tabs released, gently tug on wires to release wire block from connector body.
   c. Pull the wire socket terminals out of the wire block. See lower frame of Figure 8-118. Cut off the socket terminals and back the wires 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. Position **new** fuel level sender on inboard side of support arm fitting finger at end of support arm into bottom hole in fuel level sender flange.
2. Align top hole in fuel level sender flange with hole in support arm and install **new** rivet. Insert rivet through the support arm first, so that deformed end is on the fuel level sender side.
3. Insert socket terminals into wire block. Take note of the table below for wire locations.

Table 8-14. Fuel Tank Harness Connector [141], 3-Place Mini-Deutsch

Chamber	Wire Color	Function
1	-	-
2	Yellow	Sender Output
3	Black	Ground

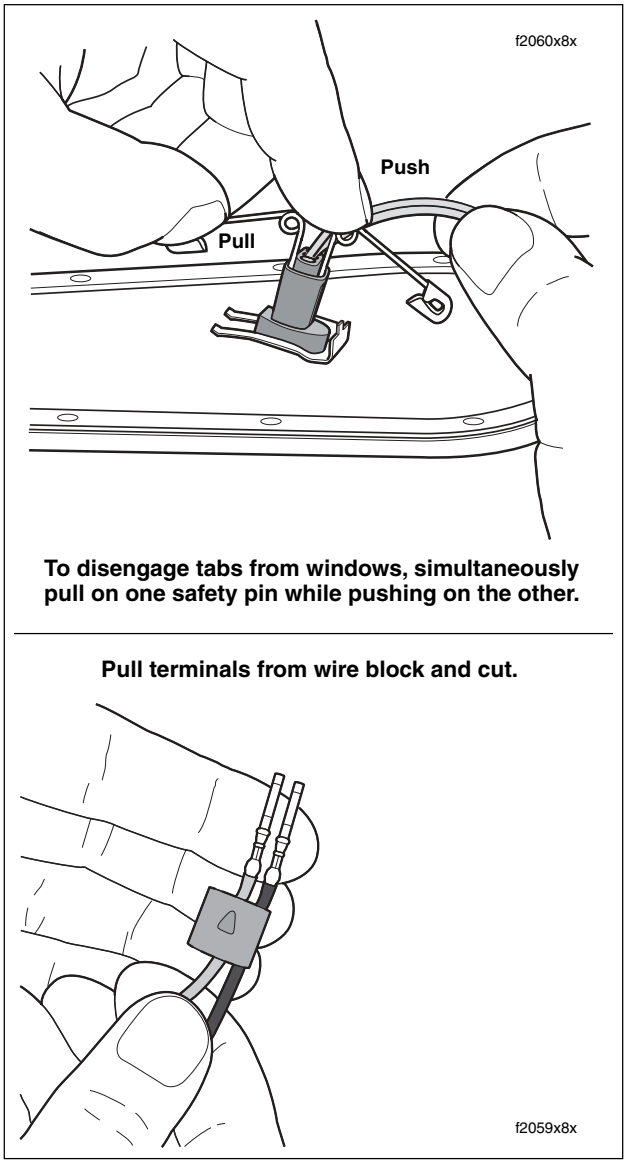


Figure 8-118. Remove Wire Block and Cut Terminals

NOTE

A series of dots are molded 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.)

4. Gently tug on wires to verify that they will not back out of wire block.
5. Install socket terminal onto spade contact on connector clip.
6. Wind spiral tubing around fuel level sender wiring.

7. Insert **new** cable strap into hole in support arm. Tighten cable strap capturing fuel level sender wiring. Cut any excess cable strap material.
8. See FLHT/C, FLTR CANOPY, INSTALLATION, or FLHR CANOPY, INSTALLATION, in this section.

CANOPY CONNECTOR/O-RING

REMOVAL

1. See FLHT/C, FLTR CANOPY, REMOVAL, or FLHR CANOPY, REMOVAL, in this section.
2. At bottom of canopy, remove socket terminal from spade contact on connector clip.
3. Remove wire block from connector body as described under FUEL LEVEL SENDER, REMOVAL, steps 6(a)-6(b), on the previous page.
4. Slide connector clip from slots on connector body. Remove connector body from canopy.
5. Remove O-ring from groove on connector body.

INSTALLATION

1. Apply a very thin film of clean H-D 20W50 engine oil to **new** 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. Install socket terminal onto spade contact on connector clip.
5. See FLHT/C, FLTR CANOPY, INSTALLATION, or FLHR CANOPY, INSTALLATION, in this section.

NOTES

CRUISE CONTROL (FLHRC, FLTR, FLHTCU) 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 Cruise ON/OFF Switch to the ON position. See Figure 8-119. The switch is located on the fairing cap of FLHTCU models, the instrument nacelle of FLTR models, and the left handlebar lower switch housing on FLHRC models. A red lamp in or next to the switch illuminates to indicate that the system is activated.
2. Both the switch and the lamp are located in the left handlebar lower switch housing on FLHRC models.

   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.
3. 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 8-120.

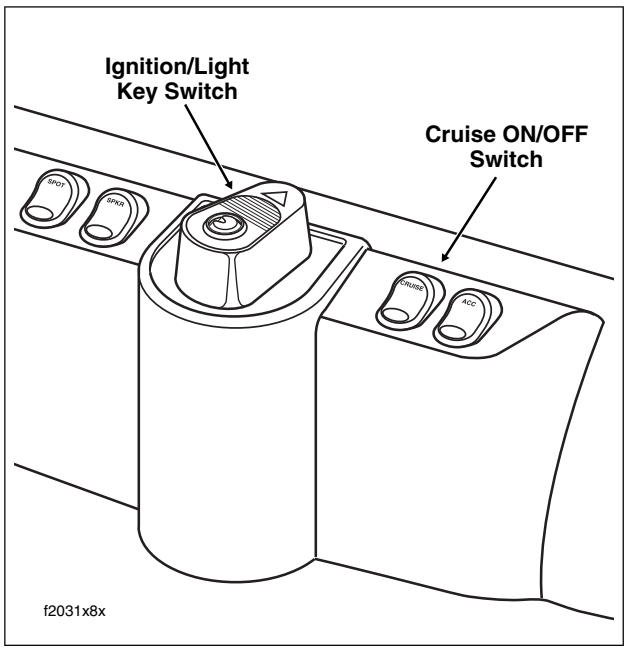


Figure 8-119. Fairing Cap (FLHTCU)

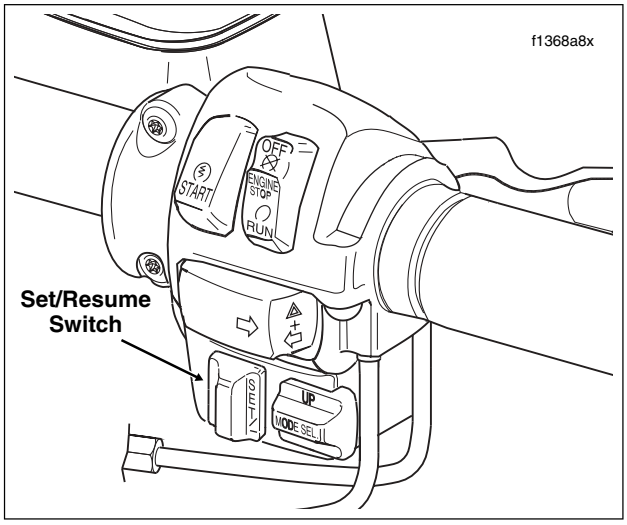


Figure 8-120. Right Handlebar Switch Assembly (FLTR, FLHTCU)

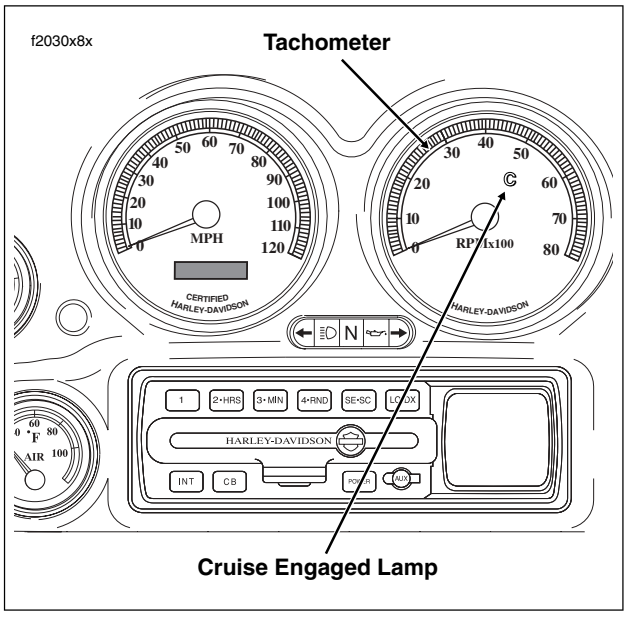


Figure 8-121. Instrument Panel (FLHTCU)

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 illuminates to indicate that the cruising speed is locked in. The lamp is on the right handlebar lower switch housing on FLHRC models, and appears as a capital letter “C” on the tachometer gauge of FLTR and FLHTCU models. See Figure 8-121.

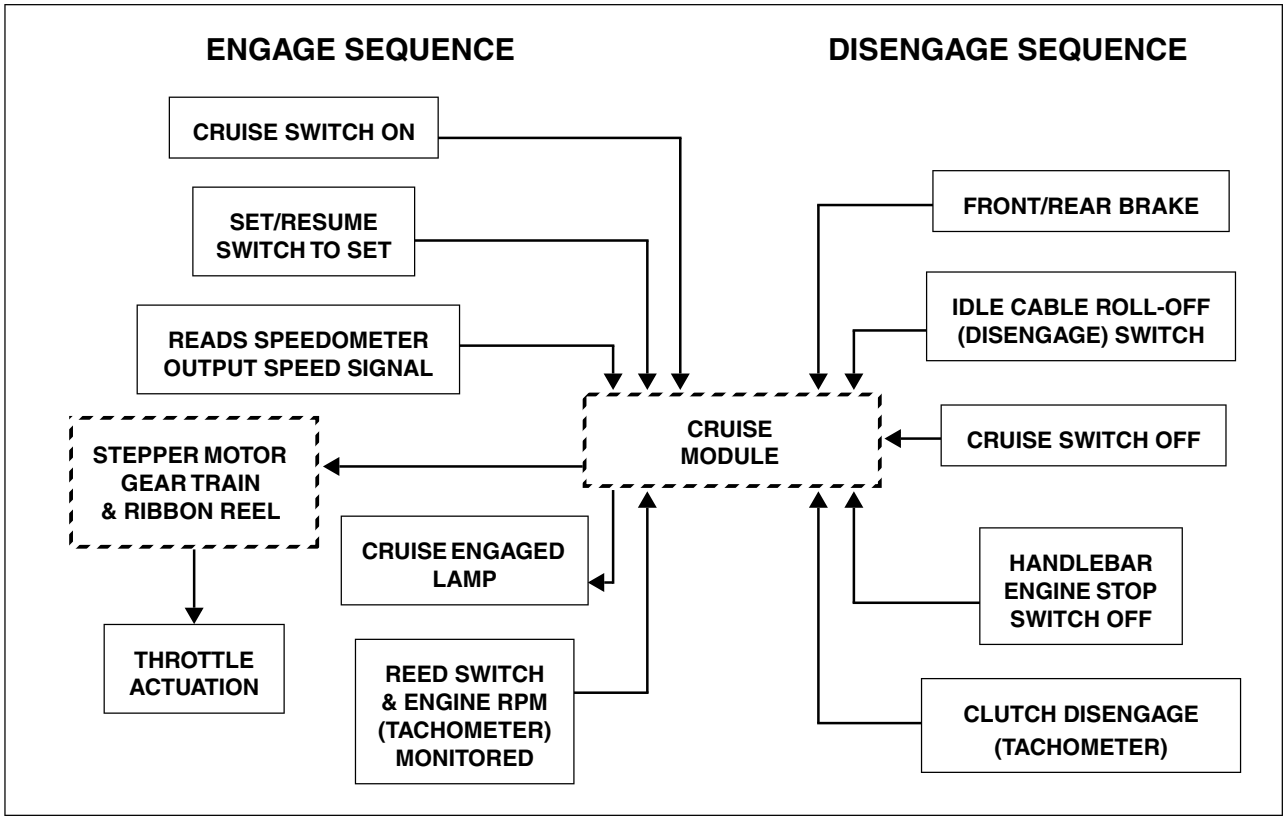


Figure 8-122. Cruise System Diagram

4. 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.
5. 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. Cruise ON/OFF Switch placed in the OFF position. The switch is located on the fairing cap of FLHTCU models, the instrument nacelle of FLTR models, and the left handlebar lower switch housing on FLHRC models. A red lamp in or next to the switch is extinguished to indicate that the system is deactivated.
   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/induction module.

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 idle stop, adjust (loosen) pull-open cable just enough so that contact is made 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. Remove left side saddlebag. See Section 2.23 SADDLEBAG, REMOVAL.
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. Install left side saddlebag. See Section 2.23 SADDLEBAG, INSTALLATION.

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 31 mm). 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 and throttle and idle cables are correctly adjusted and operational.

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.

THROTTLE/IDLE CABLES

NOTE

While the same throttle cable is used on all Touring models, the idle cable of “cruise” models is provided with a cruise roll-off (disengage) switch.

REMOVAL

1. See Section 2.19 THROTTLE CABLES (NON-CRUISE), REMOVAL, THROTTLE SIDE.
2. Remove the air cleaner and backplate. See Section 4.5 AIR CLEANER, REMOVAL.
3. Raise fuel tank to access cables in area of frame backbone. For carbureted models, see Section 4.7 FUEL TANK (CARBURETED), PARTIAL REMOVAL, FLHT/C, FLTR, or FLHR. For fuel injected models, see Section 9.4 FUEL TANK (FUEL INJECTED), PARTIAL REMOVAL, FLHT/C/U/I, FLTRI, or FLHR/C/I.

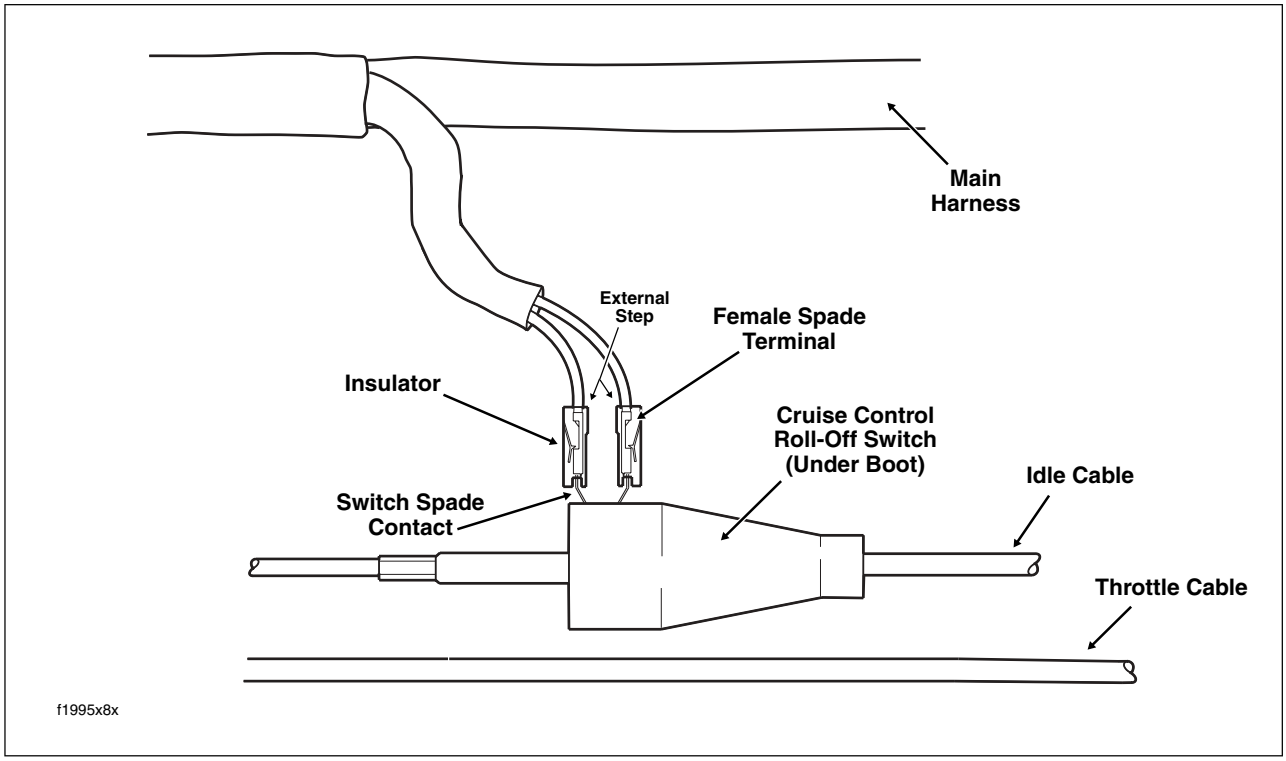


Figure 8-123. Throttle/Idle Cable Configuration (Right Side View)

4. Locate the cruise control roll-off switch plumbed into the idle cable on the right side of the vehicle. See Figure 8-123. 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 a needle nose pliers, carefully pull idle cable barrel from upper inboard hole in throttle wheel. Pull throttle cable barrel from remaining hole. Release idle and throttle cables from guides in throttle cable bracket.

   Induction Module: Using a needle nose pliers, carefully pull idle cable barrel from upper hole in throttle wheel. Pull throttle cable barrel from lower hole. Using slots, release idle and throttle cables from guides in throttle cable bracket.
7. Cut and discard 14 inch cable strap capturing frame backbone, wire bundles, and idle and throttle cables.
8. Free cables from J-clamp riveted to right side of frame backbone.
9. If present, remove screw (with flat washer) to release J-clamp from wellnut in right side of steering head. Remove J-clamp from cables.

INSTALLATION

1. See Section 2.19 THROTTLE CABLES (NON-CRUISE), INSTALLATION, THROTTLE SIDE.
2. Route the throttle and idle cables as follows:

   FLHTCU: Route the cables downward following the brake line to the inner fairing. Pass the cables through the inner fairing grommet and then loop them toward the rear along the right side of the steering head.

   FLHRC: 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 toward the rear along the right side of the steering head. Capture cables in J-clamp and then start screw (with flat washer) to fasten J-clamp to wellnut in right side of steering head. Tighten screw to 9-18 **in-lbs** (1.0-2.0 Nm).
3. Route the throttle and idle cables rearward along the right side of the frame backbone. After passing through J-clamp riveted to frame backbone, route cables downward to 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 up to the point where they enter the wire harness conduit. Now route the leads straight down.
6. Orient the idle cable so that the spade contacts are at the top.

7. 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 8-123.

8. Fit the rubber boot over the cruise control roll-off switch. An oval cut in the boot accommodates the switch spade terminal connections.

9. Position the throttle cable below the idle cable.

10. **Carbureted:** Install sleeve on throttle cable housing into shorter cable guide in throttle cable bracket. Drawing throttle cable downward, fit barrel end into lower outboard hole in throttle wheel. Install sleeve and spring on idle cable housing into longer cable guide inserting barrel end into upper inboard hole in throttle wheel.

    Induction Module: Install sleeve on throttle cable housing into shorter cable guide at top of throttle cable bracket. Drawing throttle cable downward, fit barrel end into lower hole in throttle wheel. Install sleeve and spring on idle cable housing into longer cable guide at bottom of throttle cable bracket inserting barrel end into upper hole in throttle wheel.

11. 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.

12. At front of top engine stabilizer bracket, install **new** 14 inch cable strap capturing frame backbone, wire bundles, and idle and throttle cables. Tighten cable strap, but leave loose enough so that one finger can be inserted between strap and frame backbone. **Do not overtighten.** Cut any excess cable strap material.

13. Install fuel tank. For carbureted models, see Section 4.7 FUEL TANK (CARBURETED), INSTALLATION (AFTER PARTIAL REMOVAL), FLHT/C, FLTR, or FLHR. For fuel injected models, see Section 9.4 FUEL TANK (FUEL INJECTED), INSTALLATION (AFTER PARTIAL REMOVAL), FLHT/C/U/I, FLTRI, or FLHR/C/I.

14. Install backplate and air cleaner assembly. See Section 4.5 AIR CLEANER, INSTALLATION.

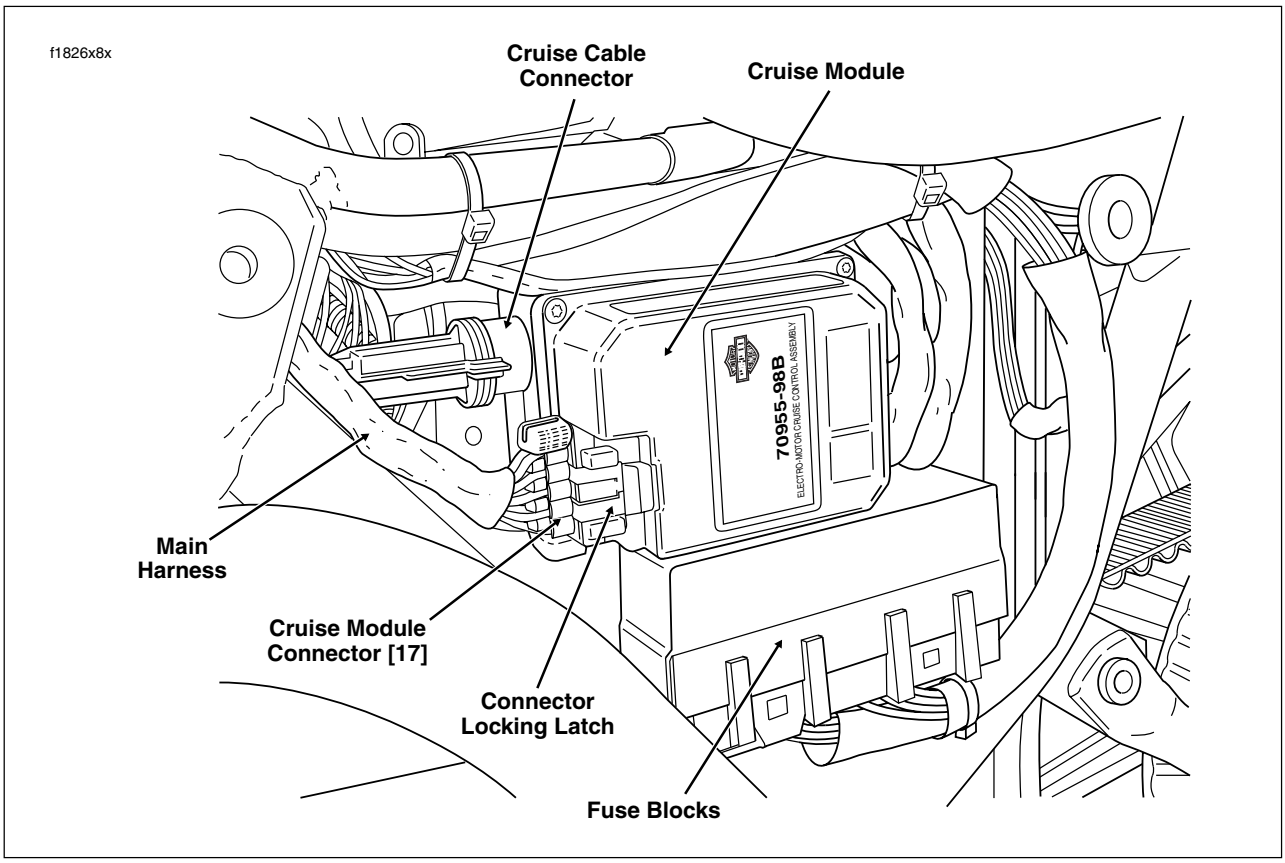


Figure 8-124. Cruise Control Module (Under Left Side Cover)

15. Adjust the throttle and idle cables. Be sure to use the cable adjustment procedure for Ultra models. See CABLE ADJUSTMENT, in this section.

CRUISE CABLE

REMOVAL

1. Remove the air cleaner and backplate. See Section 4.5 AIR CLEANER, REMOVAL.
2. Remove E-clip from sleeve at end of cruise cable housing. Discard E-clip. Using slot, remove cruise cable housing from cable guide in throttle cable bracket.
3. Push the plastic end fitting on the cruise cable to the outboard side to release from wheel pin. See Figure 8-125.
4. Remove left side saddlebag. See Section 2.23 SADDLEBAG, REMOVAL.
5. Gently pull side cover from frame downtubes (no tools required).
6. Rotate cruise cable connector in a counterclockwise direction to detach from cruise module. See Figure 8-124.
7. Pull the cable out of the connector and remove the cable end bead from the ribbon end eyelet. See Figure 8-126.
8. Pull anchored cable clip from hole in frame crossmember. See Figure 8-127.
9. Carefully pull cruise cable from beneath fuel tank drawing it out through hole in frame crossmember.

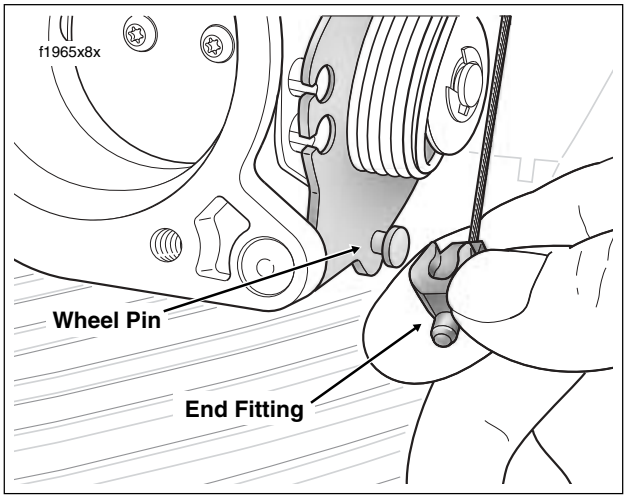


Figure 8-125. Remove End Fitting From Wheel Pin

INSTALLATION

1. Draw the cruise cable forward along the left side of the frame backbone, and then route the cable toward the right side of the vehicle in front of the top engine stabilizer bracket.
2. Slide groove in cruise cable end fitting over cap of wheel pin. Push on end fitting until it snaps in place. See Figure 8-125.
3. Using slot, slip cruise cable housing into cable guide in throttle cable bracket. At bottom of bracket, install **new** E-clip on sleeve at end of cruise cable housing.

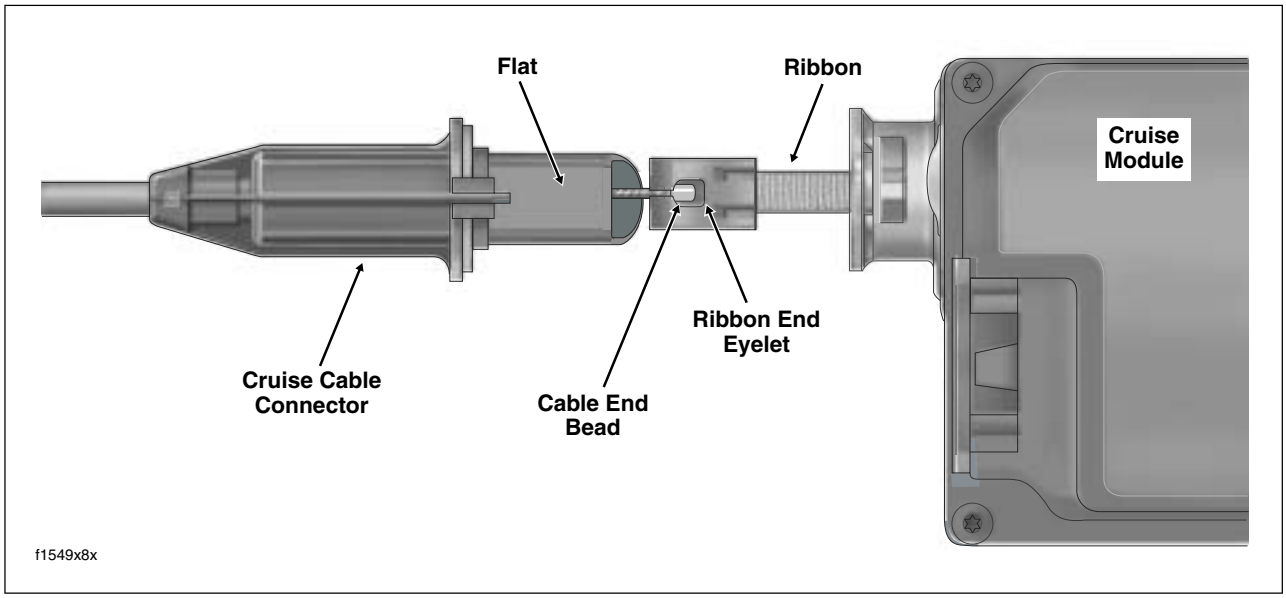


Figure 8-126. Remove Cable End Bead From Ribbon End Eyelet

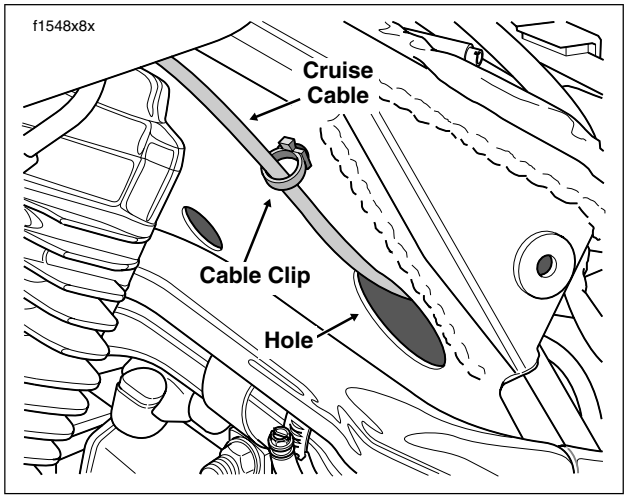


Figure 8-127. Cruise Cable Routing (Left Side)

4. Feed cruise cable and connector through hole in frame crossmember. See Figure 8-127.

CAUTION

Be sure that the ribbon is not twisted. A twisted ribbon may adversely affect performance or even prevent cruise operation.

5. 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 8-126.
6. Verify that bead, eyelet and ribbon are lined up correctly. If necessary, remove plastic end fitting from wheel pin and gently pull on end fitting to remove cable slack. Reinstall end fitting, if removed.
7. 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.
8. Capture cruise cable in cable clip and anchor in hole of frame crossmember. See Figure 8-127.
9. Adjust the throttle and idle cables. See CABLE ADJUSTMENT, in this section.
10. Install backplate and air cleaner assembly. See Section 4.5 AIR CLEANER, INSTALLATION.
11. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required).
12. Install left side saddlebag. See Section 2.23 SADDLEBAG, INSTALLATION.
13. Perform the CABLE LASH INITIALIZATION routine described in this section.

CRUISE CONTROL MODULE

REMOVAL

1. Remove the air cleaner and backplate. See Section 4.5 AIR CLEANER, REMOVAL.
2. Push the plastic end fitting on the cruise cable to the outboard side to release from wheel pin. See Figure 8-125.
3. Remove seat. See Section 2.22 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.

4. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
5. Unthread bolt and remove battery positive cable (red) from battery positive (+) terminal.
6. Using a T40 TORX drive head, loosen bolt to move lip of hold-down clamp off edge of battery. Remove battery from battery box.
7. Lift the locking latch and remove the cruise module connector [17]. See Figure 8-124.
8. Rotate cruise cable connector in a counterclockwise direction to detach from cruise module.
9. From inside battery box, remove the two front and one rear locknut from studs. Exercising caution to avoid losing grommets, carefully pull cruise module from battery box.

INSTALLATION

1. Install grommets onto studs of **new** cruise module.

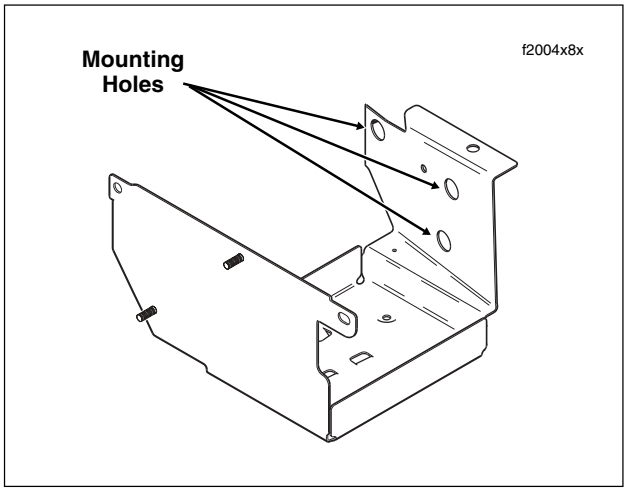


Figure 8-128. Battery Box (Right Side View)

2. Place the cruise module into position on left side of battery box. See Figure 8-128.
3. Install locknuts on front and rear studs. Tighten locknuts to 60-96 **in-lbs** (6.8-10.9 Nm).

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 8-126.
5. Verify that bead, eyelet and ribbon are lined up correctly. If necessary, remove plastic end fitting from wheel pin and 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. Install the cruise module connector [17] until locking latch engages. See Figure 8-124.
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 2.22 SEAT, INSTALLATION.
12. Slide groove in cruise cable end fitting over cap of wheel pin. Push on end fitting until it snaps in place. See Figure 8-125.
13. Install backplate and air cleaner assembly. See Section 4.5 AIR CLEANER, INSTALLATION.
14. Perform the CABLE LASH INITIALIZATION routine described in this section.

AUDIO HARNESS

For instructions on replacement of the audio harness, see Section 8.30 WIRING HARNESSES AND CABLES (FLHT/C/U), AUDIO HARNESS.

CRUISE CONTROL SWITCHES

FAIRING CAP

See Figure 8-129. For instructions on replacement of the CRUISE ON/OFF SWITCH, see Section 8.18 FAIRING CAP SWITCHES (FLHTC/U), Section 8.19 INSTRUMENT NACELLE SWITCHES (FLTR), or Section 8.20 HANDLEBAR SWITCHES (FLHRCI).

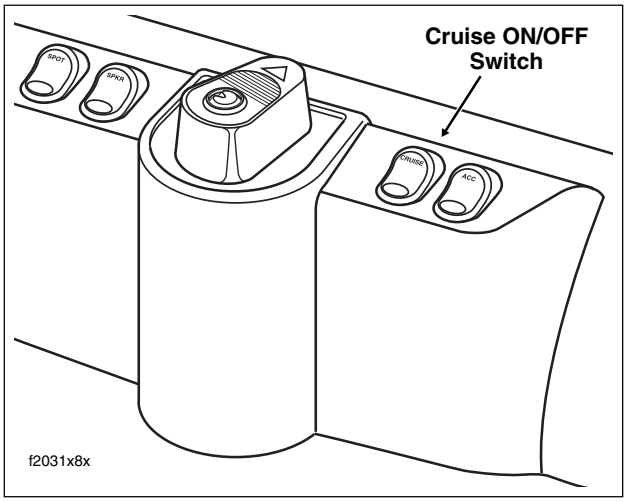


Figure 8-129. Fairing Cap (FLHTCU)

HANDLEBAR

See Figure 8-130. For instructions on replacement of the handlebar mounted CRUISE SET/RESUME switch, see Section 8.20 HANDLEBAR SWITCHES, SWITCH REPAIR/REPLACEMENT.

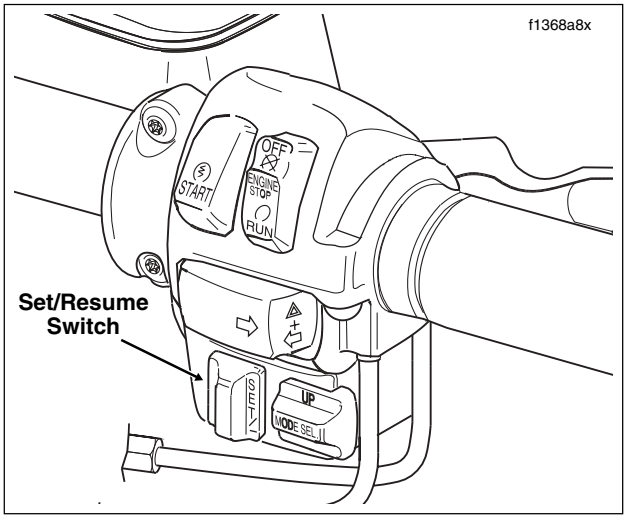


Figure 8-130. Right Handlebar Switch Assembly (FLTR, FLHTCU)

RADIO (FLHTC/U)

REMOVAL

1. Remove seat. See Section 2.22 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 2.27 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 8-131.

4. See Figure 8-132. 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.*

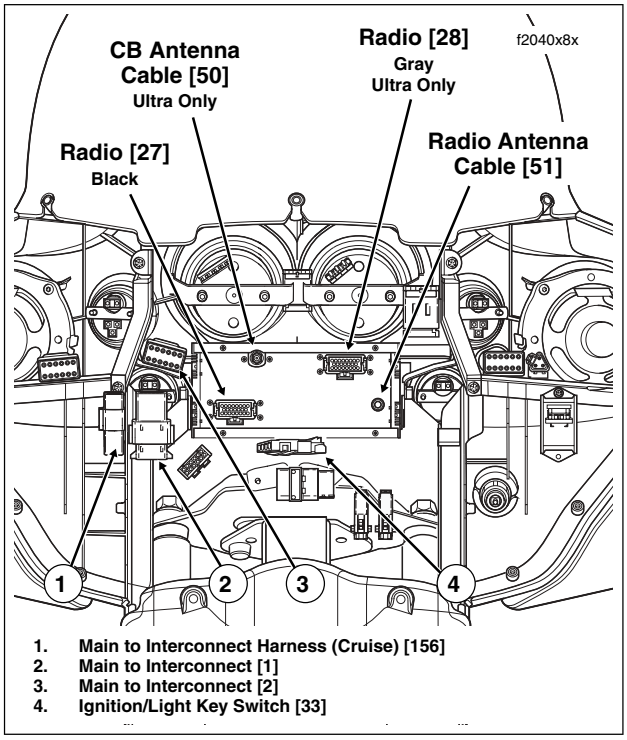


Figure 8-132. Radio Connections - FLHTCU

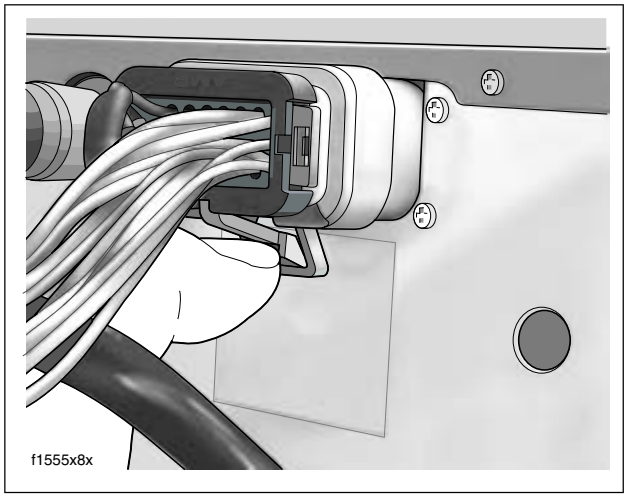


Figure 8-131. Pull Down Latch to Free Radio Connector

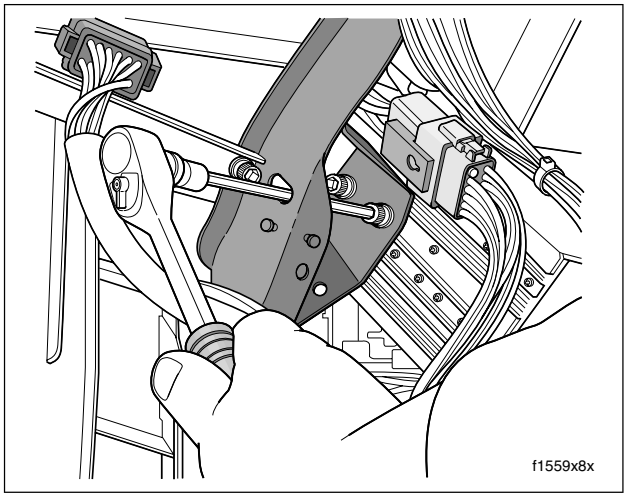


Figure 8-133. Release Carrier from Fairing Brackets

5. To better access radio bracket screws, move the following connectors from their fixed locations:
   a. Main to interconnect harness (cruise) connector [156], 4-place Deutsch (gray); T-stud on outboard side of right fairing bracket. *Ultra models.*
   b. Main to interconnect harness connector [1], 12-place Deutsch (black); T-stud at front of right fairing bracket. *Classic and Ultra models.*
   c. Main to interconnect harness connector [2], 12-place Deutsch (gray); T-stud to right radio support bracket. *Classic and Ultra models.*
6. Remove Ignition/light key switch connector [33], 4-place Packard, from barbed anchor at bottom of radio.
7. 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 8-133.
8. Pull radio forward to remove. If radio nose seal gets caught on radio support brackets, rock up and down until free.

INSTALLATION

1. Position radio between radio support brackets and push into approximate position. If radio nose seal gets caught on radio support brackets, rock up and down 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 35-45 **in-lbs** (4.0-5.1 Nm).
4. Install Ignition/light key switch connector [33], 4-place Packard, onto barbed anchor at bottom of radio.
5. See Figure 8-132. 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.*
6. Return the following connectors to their fixed locations:
   a. Main to interconnect harness (cruise) connector [156], 4-place Deutsch (gray); T-stud on outboard side of right fairing bracket. *Ultra models.*
   b. Main to interconnect harness connector [1], 12-place Deutsch (black); T-stud at front of right fairing bracket. *Classic and Ultra models.*
   c. Main to interconnect harness connector [2], 12-place Deutsch (gray); T-stud to right radio support bracket. *Classic and Ultra models.*
7. Install outer fairing. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.

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.

8. 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).
9. Install seat. See Section 2.22 SEAT, INSTALLATION.

FRONT FAIRING SPEAKERS

REMOVAL

1. Remove the outer fairing. See Section 2.27 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. Carefully pull speaker from adapter.

INSTALLATION

1. With the speaker spade contacts at the top of the adapter, the top being the side with the widest edge, snap speaker into adapter using finger pressure.
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. With the widest edge of adapter at the top, align holes in speaker adapter assembly with those in inner fairing.
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).

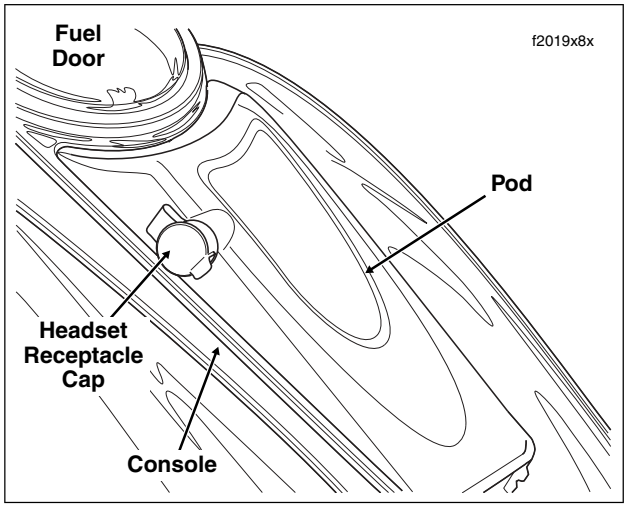


Figure 8-134. Console Pod Assembly

6. Install the socket terminals onto the speaker spade contacts. Different size spade contacts prevent improper assembly.
7. Install the outer fairing. See Section 2.27 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 2.22 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 2.23 SADDLEBAG, REMOVAL.
4. Gently pull side cover from frame downtubes (no tools required).
5. Carefully cut anchored cable strap securing main harness, audio harness, console pod conduit, fuel level sender/fuel pump conduit, and fuel vapor vent tube to left side of frame backbone. Cut cable strap securing console pod conduit and audio harness to left frame tube at 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 clip nut on fuel tank weldment.
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.
10. Release Console Pod Connector [53], 12-place Mini-Deutsch, from attachment clip anchored in hole of frame crossmember (at rear of battery box). See Figure 8-135. Depress external latches and use a rocking motion to separate pin and socket halves.
11. Remove three Phillips screws to release pod from console.

INSTALLATION

1. Feed pin housing and conduit through top of console seating pod in recess. Install three Phillips screws screws to secure pod to console. Alternately tighten screws to 6-11 **in-lbs** (0.7-1.2 Nm). Capture conduit in flexible clamp at bottom of console.

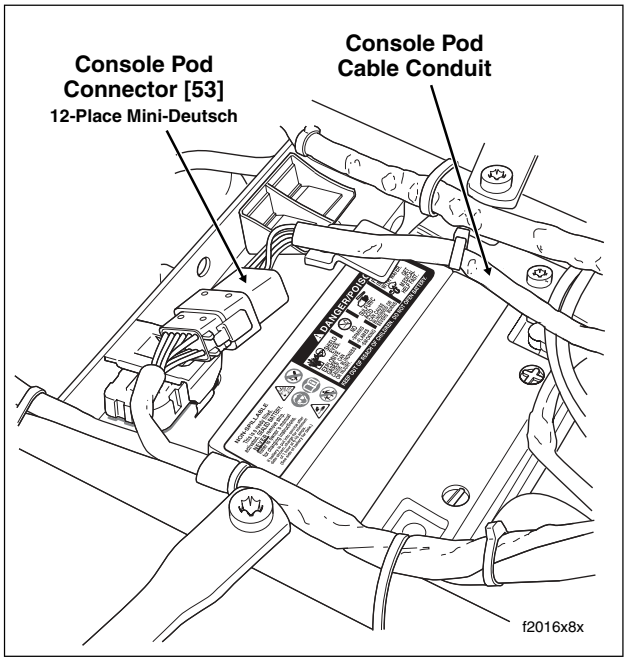


Figure 8-135. Disconnect Console Pod Connector

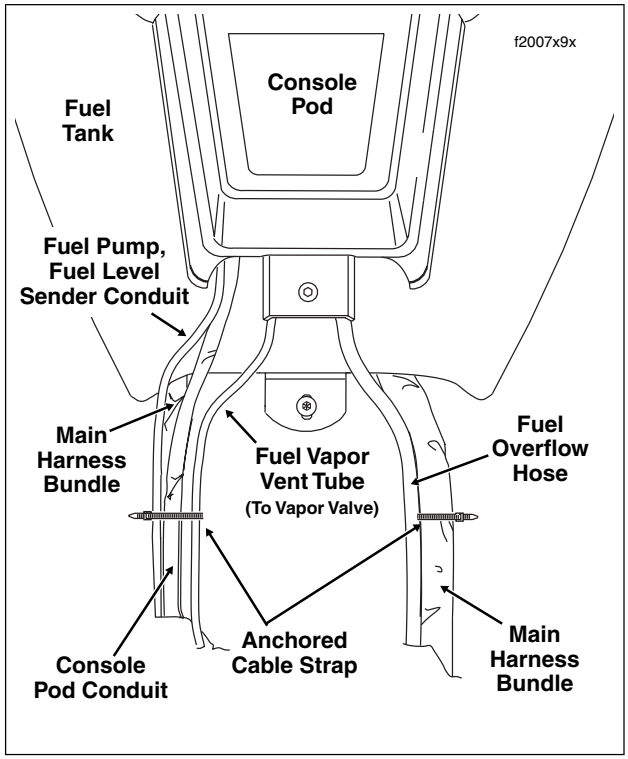


Figure 8-136. Console Pod Cable/Hose Routing (Top View)

⚠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 8-136. 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 clip nut on fuel tank weldment. Tighten screw to 25-30 **in-lbs** (2.8-3.4 Nm).
4. Open fuel door on console. Install two Allen head screws to secure front of console to clip nuts on canopy bracket. Alternately tighten screws to 25-30 **in-lbs** (2.8-3.4 Nm).
5. Snap anchor of **new** cable strap into hole on left side of frame backbone. Tighten cable strap capturing main harness, audio harness, console pod conduit, fuel level sender/fuel pump conduit, and fuel vapor vent tube. See Figure 8-136. Install **new** cable strap to secure console pod conduit and audio harness to left frame tube at front of saddlebag rail. Cut any excess cable strap material.
6. Mate pin and socket halves of Console Pod Connector [53], 12-place Mini-Deutsch. Install connector onto attachment clip anchored in hole of frame crossmember (at rear of battery box).
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 2.22 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 2.23 SADDLEBAG, INSTALLATION.

FRONT HEADSET RECEPTACLE

REMOVAL

1. Remove console pod. See CONSOLE POD ASSEMBLY, REMOVAL, in this section.
2. 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.1 DEUTSCH ELECTRICAL CONNECTORS, REMOVING/INSTALLING PINS.

3. Raise headset receptacle cap. Place pin punch in either notch of lock ring and rotate in a counterclockwise direction until loose. See Figure 8-137.
4. Remove lock ring and cap from headset receptacle.
5. Remove headset receptacle from pod.

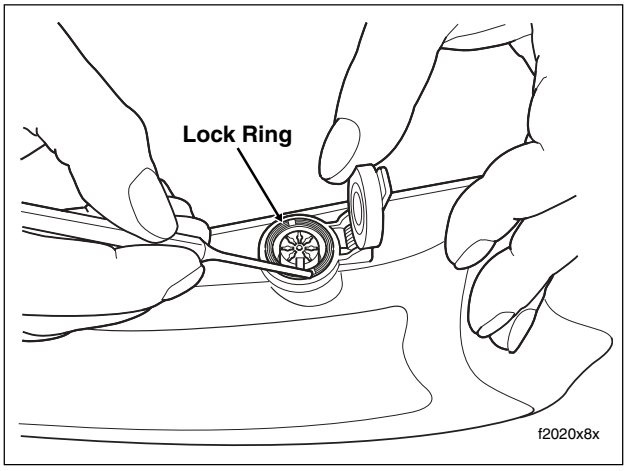


Figure 8-137. Remove Lock Ring from Receptacle Using Pin Punch

INSTALLATION

1. From inside pod, insert threaded end of headset receptacle through side hole.
2. Place receptacle cap over end of headset receptacle so that it seats in recess of pod.
3. Open cap, and with the notches on the outboard side, thread lock ring onto headset receptacle.
4. Place pin punch in either notch of lock ring and rotate in a clockwise direction until tight.
5. 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.1 DEUTSCH ELECTRICAL CONNECTORS, REMOVING/INSTALLING PINS.

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), AUDIO HARNESS.

REAR PASSENGER SWITCHES

REMOVAL

NOTE

Right and left side replacement passenger switch assemblies are interchangeable.

1. Remove seat. See Section 2.22 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.

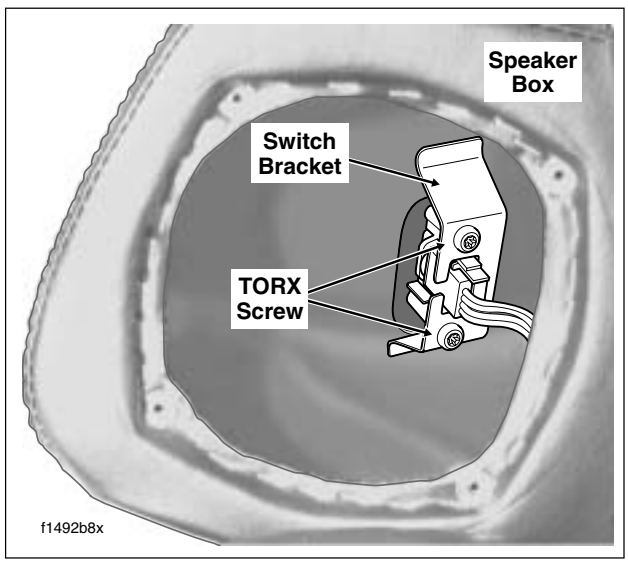


Figure 8-138. Remove Passenger Switch Assembly (Right Side Speaker Box Shown)

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 8-138.
10. Pull switch housing assembly, wire harness conduit, speaker terminals and Mini-Deutsch socket from speaker box using switch housing hole on outboard side.
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.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].

NOTE

For instructions on properly installing wire terminals, see APPENDIX 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 8-139.
4. Note lettering for proper orientation and gently push keycap onto switch shaft. When orienting keycap, remember that bottom of assembly is determined by location of switch housing rib.

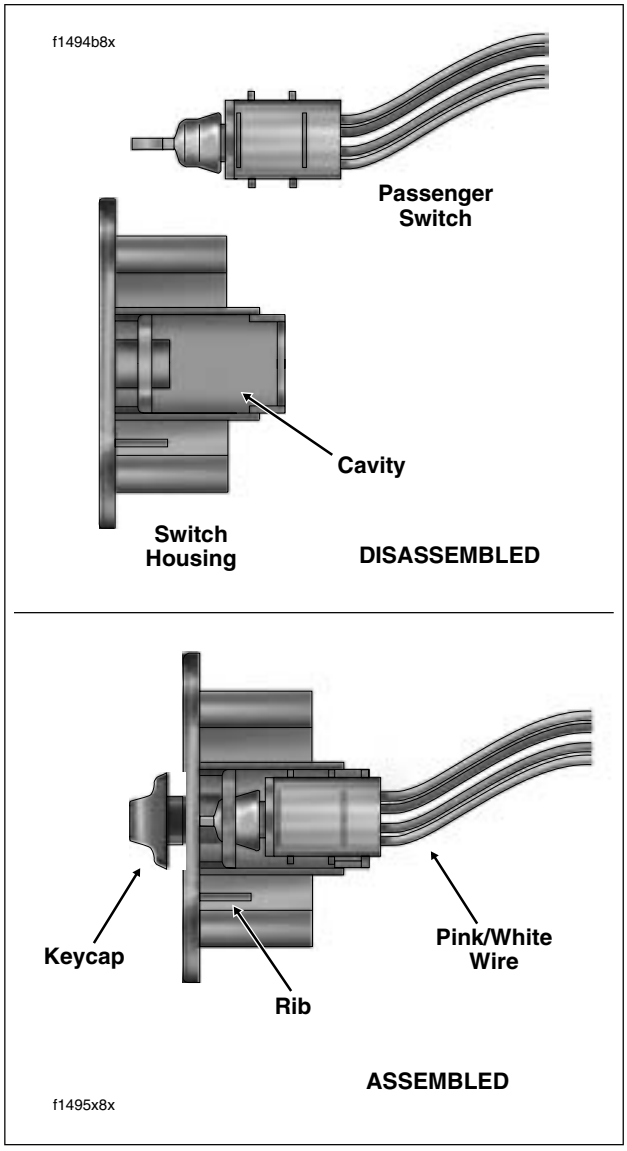


Figure 8-139. Install Switch in Housing

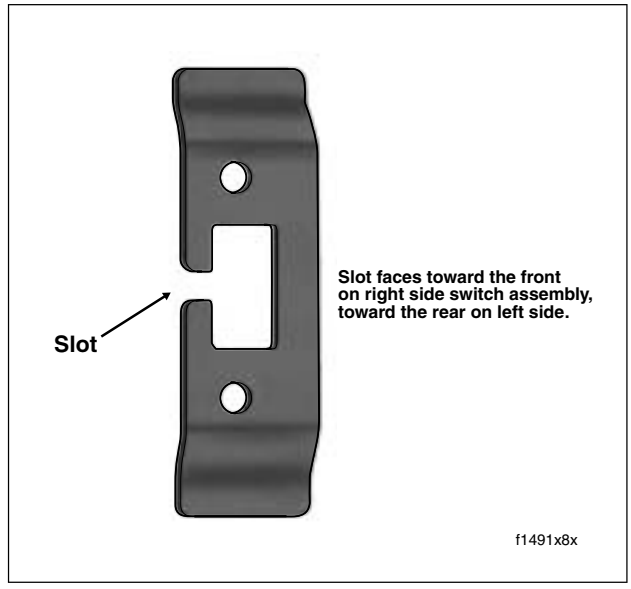


Figure 8-140. Properly Orient Switch Bracket

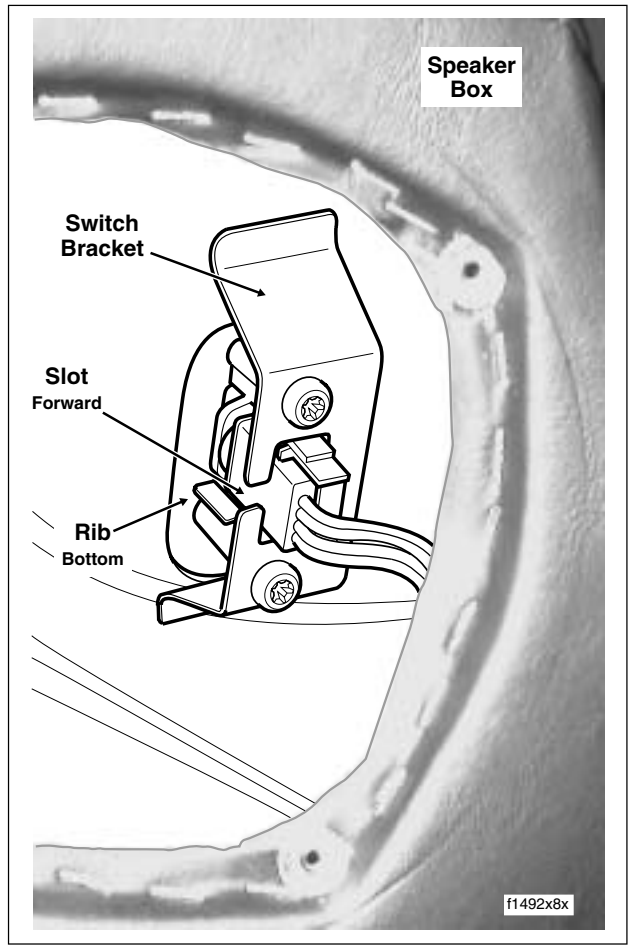


Figure 8-141. Install Passenger Switch Assembly (Right Side Speaker Box Shown)

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. See Figure 8-141.

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. See Figure 8-140. Switch also must be square in cavity of switch housing or bracket will not fit.

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 2.22 SEAT, INSTALLATION.

REAR SPEAKERS

REMOVAL

1. Remove seat. See Section 2.22 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 from speaker grille. Remove speaker grille from speaker box.
5. Remove speaker from speaker box. Carefully pull two socket terminals from speaker spade contacts.

INSTALLATION

1. Install two socket terminals onto speaker spade contacts. Different size spade contacts prevent improper assembly.
2. With spade contacts at bottom, install speaker in speaker box.
3. Align holes in speaker with those in speaker box. Align holes in grille with those in speaker.
4. Install four screws. Aternately tighten screws using a T10 TORX drive head.
5. Close Tour-Pak 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 2.22 SEAT, INSTALLATION.
8. Test speaker for proper operation.

FUSE BLOCKS

REMOVAL

1. Remove seat. See Section 2.22 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 2.23 SADDLEBAG, REMOVAL.
4. Gently pull side cover from frame downtubes (no tools required).

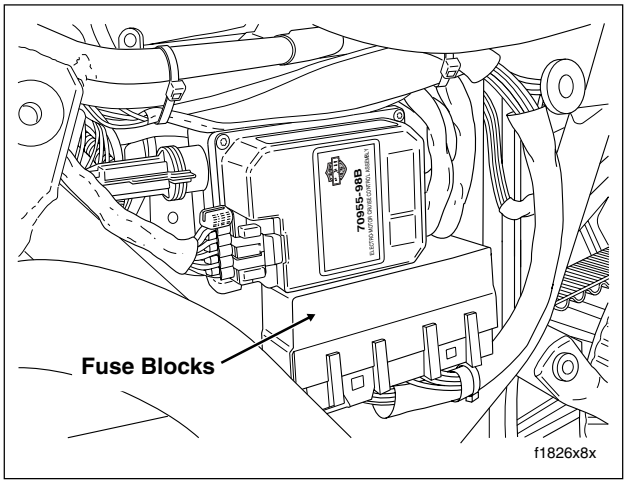


Figure 8-142. Left Side Cover Removed - FLHTCUI

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 8-142.

6. Remove the fuses from the block. See Figure 8-143.

7. Look into the top of the fuse block. Since two tangs anchor each terminal in the fuse block, take note of the cavity 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. Tug on wire to pull terminal from wire end of chamber.

NOTE

For best results, obtain Snap-on® GA500A to depress both tangs simultaneously. Insert smallest pair of pins until body of tool almost contacts top of fuse block. Leaving the tool in place, pull on wire to remove. Terminal will not just slip out of fuse block, so to overcome any resistance, give a good tug on the wire using a moderate amount of force. See Figure 8-144.

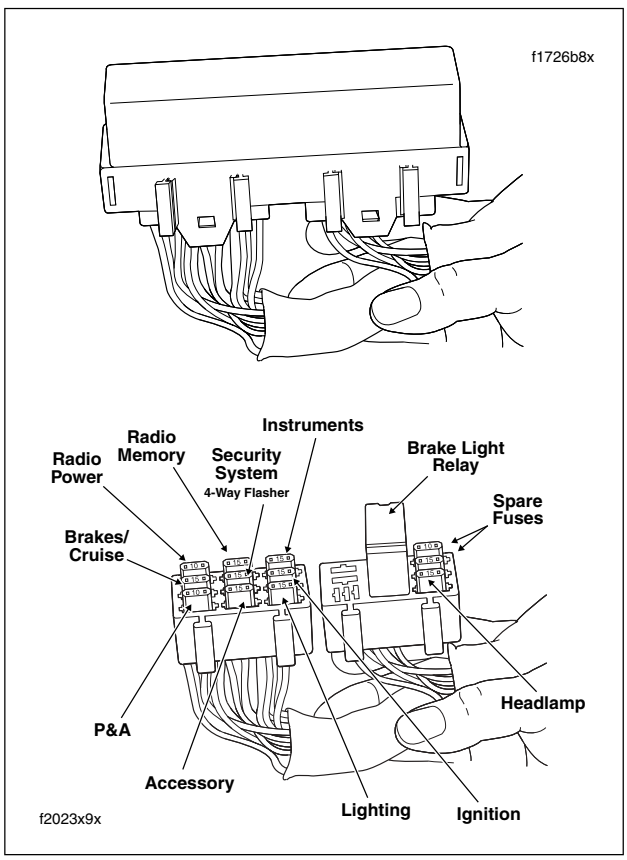


Figure 8-143. Fuse Blocks (FLTR, FLHT/C/U)

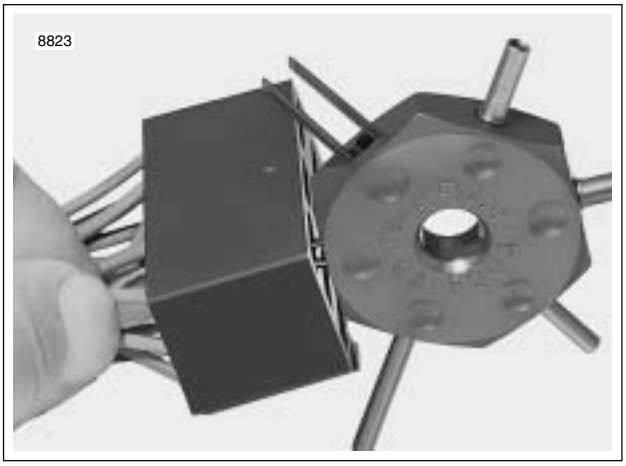


Figure 8-144. Remove Terminal From Fuse Block

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. See Section B.7 WIRING DIAGRAMS, MAIN HARNESS, for wire locations.

4. Install fuses in fuse block. See Figure 8-143.

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 2.22 SEAT, INSTALLATION.

8. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required).

9. Install left side saddlebag. See Section 2.23 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. Follow the SWR Adjustment procedure in Section 6 of the 2003 ELECTRICAL DIAGNOSTIC MANUAL (Part No. 99497-03). Remove SWR meter, plug in antenna connector and tighten antenna connector stud.

AUDIO HARNESS

For removal and installation instructions, see Section 8.30 WIRING HARNESSES AND CABLES (FLHT/C/U), AUDIO 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 (CARBURETED), COMPLETE REMOVAL, FLHT/C, FLTR. For fuel injected models, see Section 9.4 FUEL TANK (FUEL INJECTED), COMPLETE REMOVAL, FLHT/C/U/I, FLTRI.
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. Remove left side saddlebag. See Section 2.23 SADDLEBAG, REMOVAL.
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.

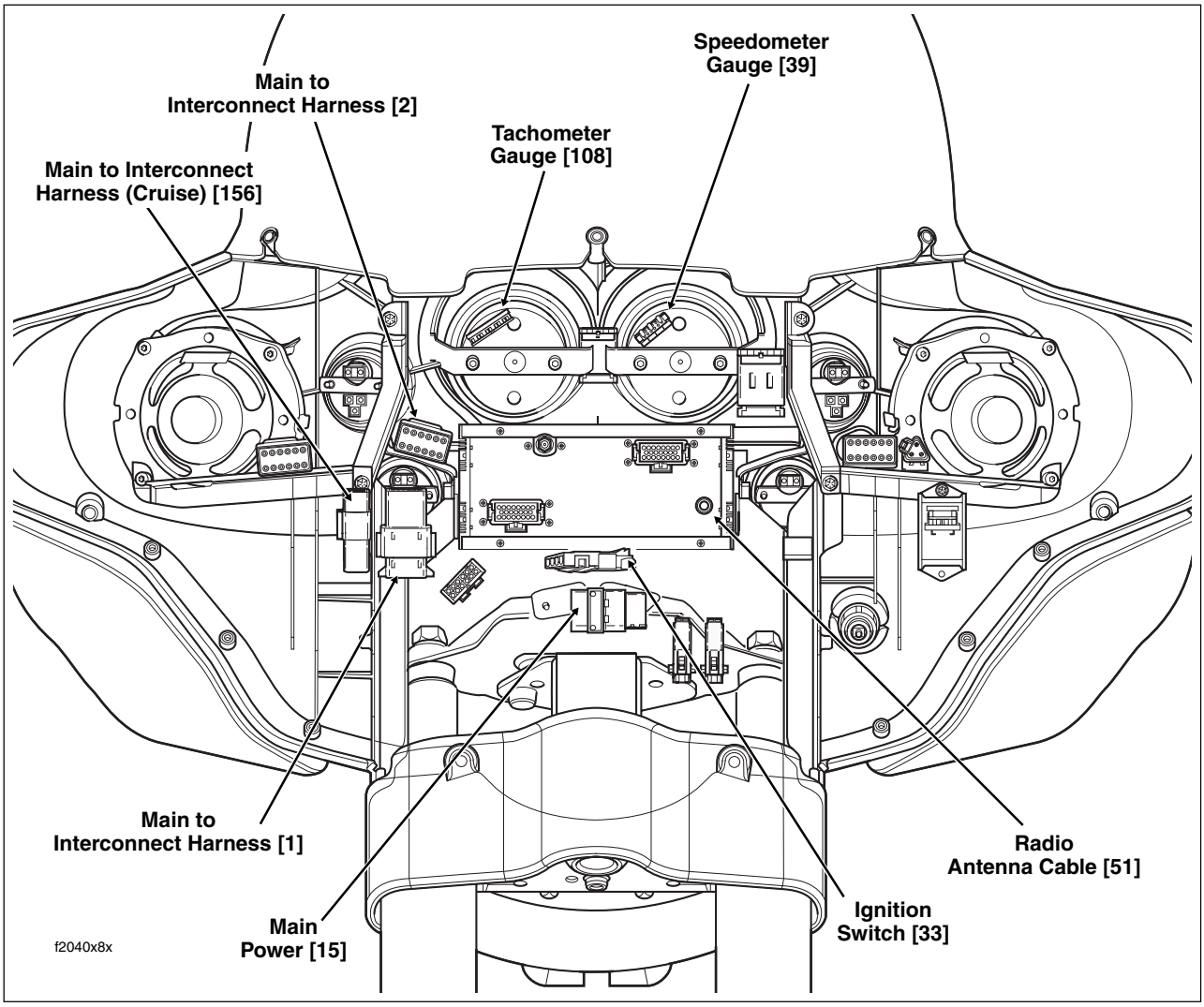


Figure 8-145. Inner Fairing - Main Harness Connectors (FLHTC/U)

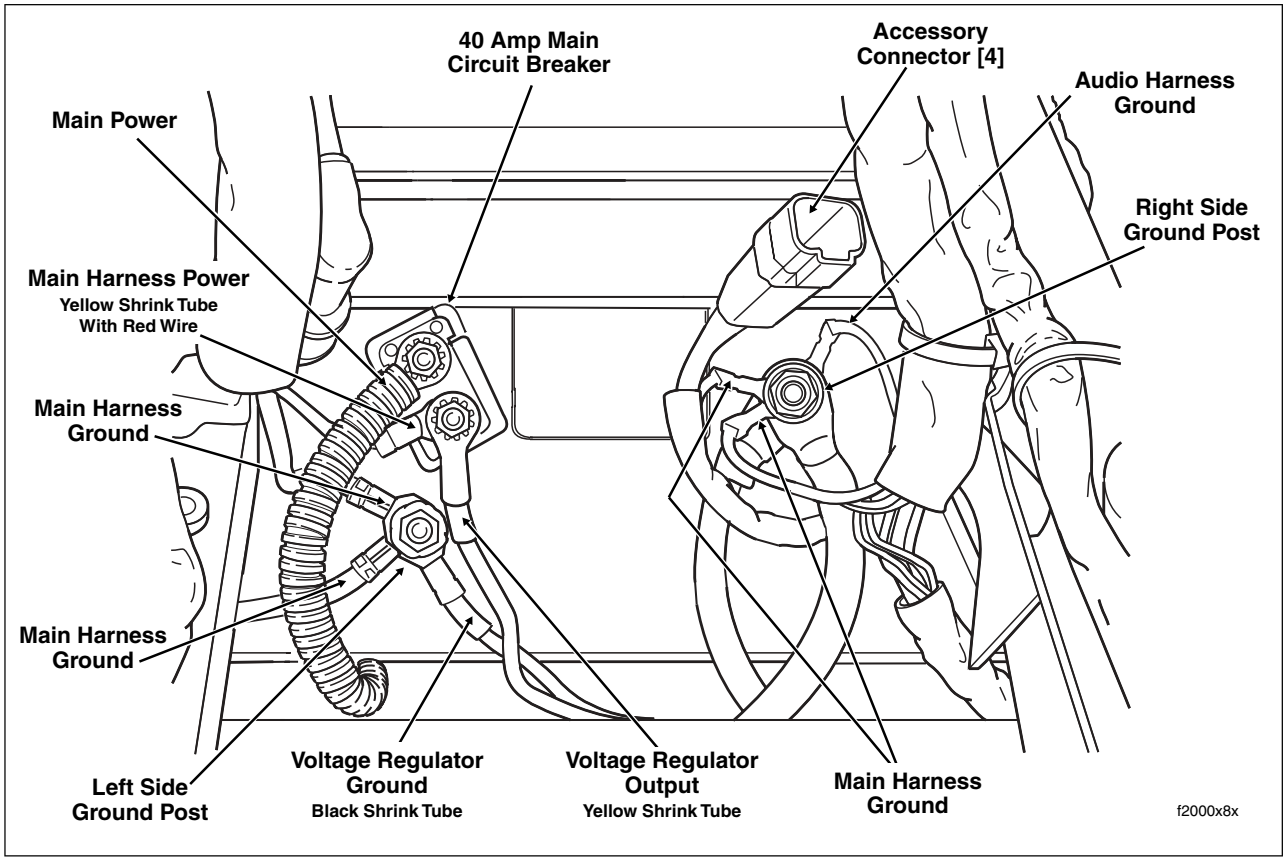


Figure 8-146. Electrical Connections - Upper Frame Crossmember (Under Seat)

7. Remove the outer fairing and windshield. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL.
8. At rear left side of inner fairing, unthread rubber boot to free odometer reset switch. Pull switch from hole in inner fairing.
9. See Figure 8-145. Standing at front of motorcycle, remove the following wire harness connectors from their retaining devices and disconnect pin and socket halves:
   a. Main to interconnect harness (cruise) connector [156], 4-place Deutsch (gray); T-stud on outboard side of right fairing bracket.
   b. Main to interconnect harness connector [1], 12-place Deutsch (black); T-stud on front of right fairing bracket.
   c. Main to interconnect harness connector [2], 12-place Deutsch (gray); T-stud on top of right radio support bracket.
   d. Ignition switch connector [33], 4-place Packard (black); front of top fork bracket (below radio).
   e. Main power connector [15], 4-place Packard (black); anchored to front of top fork bracket (below radio).
   f. Radio antenna cable connector [51]; back of radio (left side).
   g. Speedometer connector [39], 12-place Packard; inner fairing (back of speedometer).
   h. Tachometer connector [108], 6-place Packard; inner fairing (back of tachometer).
10. Remove screw, ground wire ring terminal and P-clamp to release main harness bundles from top fork bracket.
11. Remove screw, ground wire ring terminal and P-clamp to release main harness bundles from right side of steering head.
12. Locate the cruise control roll-off switch plumbed into the idle cable on right side of steering head. Push rubber boot on switch forward and remove socket terminals from spade contacts.
13. Moving rearward, carefully cut cable straps securing main harness bundles to frame backbone, and right and left frame tubes. See Figure 8-152.
14. Carefully cut cable straps to release main harness from both audio harness (FLHTCU only) and EFI harness (if fuel injected).

15. Carefully pull main harness conduit and connectors rearward under right side of fairing cap allowing it to hang over front right engine guard.
16. Moving to left side of motorcycle, remove acorn nut to release horn bracket from rubber mount stud. Pull socket terminal from spade contact on horn. Loosen screw to release wire conduit from J-clamp.
17. Remove nut from left side ground post on upper frame crossmember in front of battery box. Remove voltage regulator wire (with black shrink tube) and two other internal tooth ring terminals (main harness grounds).
18. Remove Keps nut from silver post of main 40 amp circuit breaker at same location. Disconnect voltage regulator and main harness power wires (ring terminals with yellow shrink tube). See Figure 8-146.

    Remove Keps nut from copper post of main 40 amp circuit breaker. Disconnect main power lead (ring terminal with convoluted tubing).

    Bend tab on mounting clip away from circuit breaker and remove.
19. Disconnect the rear fender lights connector [7], 8-place Multilock, anchored at front of rear fender. Depress the button on the socket terminal side and pull apart the pin and socket halves. See Figure 8-147.
20. Release ignition keyswitch and starter relays by pulling anchors on rubber molding from holes in frame weldment at rear of battery box. Remove molding from relays. Remove relays from connectors. Push connectors down into cavity below frame weldment.
21. Locate the turn signal/security module inside hole of frame weldment on opposite side. Depress tab at front of spring clip and lift to release legs from holes in weldment. Remove module and disconnect 8-place Deutsch connector [30]. Push connector down into cavity below frame weldment.

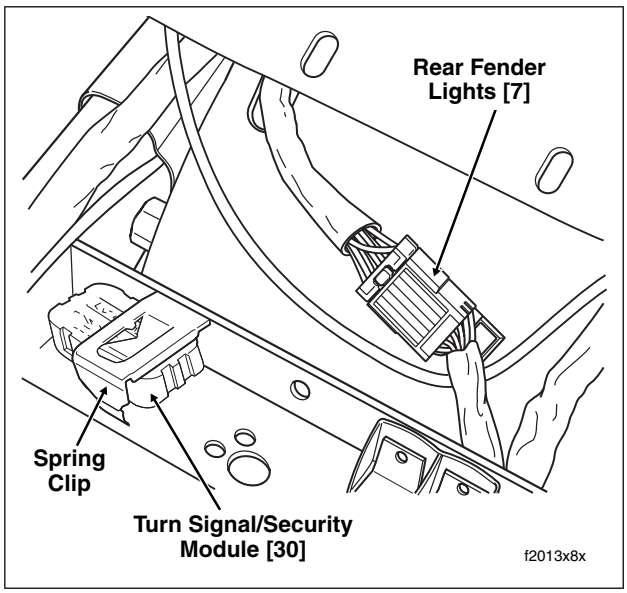


Figure 8-147. Rear Fender (Under Seat)

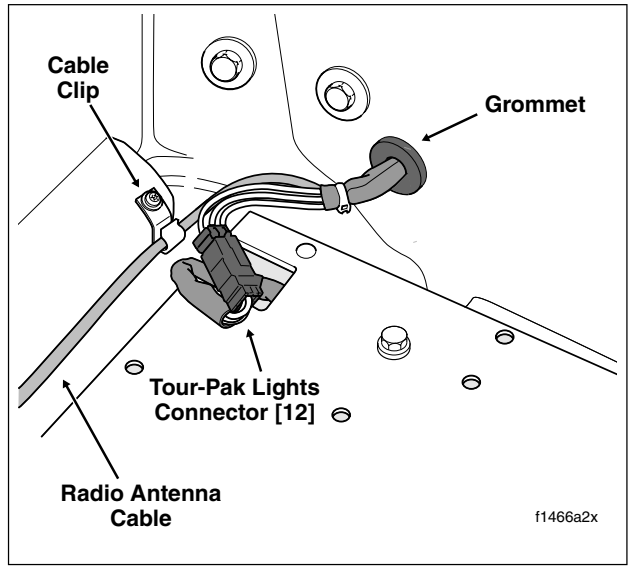


Figure 8-148. Disconnect Tour-Pak Lights Connector

22. Lift the locking latch and remove cruise module connector [17]. Rotate cruise cable connector in a counterclockwise direction to detach from cruise module. From inside battery box, remove the two front and one rear locknut from studs. Exercising caution to avoid losing grommets, carefully pull cruise module from battery box.
23. Pull fuse blocks from tabs on mounting panel. Tabs on panel fit into slots on each side of fuse block cover. Release harness conduit clip from weldment between frame downtubes. Remove fuse block cover.
24. Draw rear fender lights, ignition keyswitch and starter relays, and turn signal/security module conduit and connectors through opening between rear of battery box and front of rear fender and allow to hang on left side of motorcycle.
25. Open Tour-Pak. Open map pocket and remove acorn nuts. Remove map pocket and molded liner from Tour-Pak.
26. Depress external latch and remove bulb socket from left side of Tour-pak.
27. 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.
28. Depress button and separate pin and socket halves of Tour-pak lights connector [12], 3-place Multilock, inside Tour-pak. See Figure 8-148.
29. Pull grommet into Tour-pak and remove from main harness conduit.
30. Pull Tour-pak lights and radio antenna cable connectors through hole at front of Tour-Pak. Cut cable strap to release conduit from luggage rack rail.

31. Draw Tour-pak lights and radio antenna cable connectors forward and then down through opening between rear of frame weldment and front of rear fender and allow to hang on left side of motorcycle. Remove flange nuts to release passenger hand rail, if necessary.

32. Feed sections of main harness hanging on left side of motorcycle through opening between rear of frame crossmember and front of battery box. Pulling branches out of battery box, allow conduit and connectors to hang on right side of motorcycle. Remove vapor valve to facilitate removal, if necessary.

33. Moving to right side of motorcycle, remove accessory connector [4], 3-place Deutsch (gray), from anchor on frame crossmember in front of battery box. See Figure 8-146.

34. Locate speedometer speed sensor connector [65], 3-place Deutsch (black) at same location, and depress external latch to separate pin and socket halves.

35. Remove terminal nut from right side ground post in front of battery box. Remove three internal tooth ring terminals (main and audio harness grounds).

36. Moving down to lower frame tube, pull two socket terminals from spade contacts on rear brake light switch.

37. Depress external latch and pull solenoid connector from top of starter housing.

38. Gently pull terminals from neutral switch.

39. Cut anchored cable strap to release starter solenoid, neutral switch and rear brake light switch conduit from frame downtube. Cut two cable straps to release rear brake light switch conduit from lower frame tube.

40. Carefully pull rear brake light switch, starter solenoid, and neutral switch connectors up into battery box through opening between bottom of frame crossmember and top of battery tray. Draw conduit and connectors out of battery box and allow to hang on right side of frame backbone.

41. Pull main harness to EFI harness connector [8] from slot in electrical bracket. Depress external latches and use a rocking motion to separate pin and socket halves. See Figure 8-149.

42. Remove two flange nuts to release electrical bracket from studs on side of battery box. Release siren connector and conduit from inboard side of electrical bracket.

43. Pull main harness to EFI harness and siren connectors and conduit into battery box through opening between rear of frame crossmember and top of battery box. Pull branches out of battery box and allow to hang on right side of frame backbone.

44. Remove main harness from motorcycle.

INSTALLATION

1. Position main harness as follows:
   a. Lay main harness on frame backbone, so that end terminating in radio connector, odometer reset switch, etc. is hanging over front right engine guard.
   b. Adjust harness so that left and right side branches split from main branch at location of anchor at center of frame backbone.

   Left Side

   a. Locate left side branch terminating in rear fender lights, relays, turn signal/security module, cruise module, fuse blocks, Tour-pak lights and radio antenna cable connectors. Feed connectors and conduit into battery box pulling branches out through opening between rear of frame crossmember and front of battery box. Continue drawing conduit through opening until ring terminals exiting harness are adjacent to left side ground post on frame crossmember.
   b. At left side of motorcycle, feed rear fender lights, Tour-pak lights and radio antenna cable connectors and conduit up through opening between rear of frame weldment and front of rear fender drawing longer conduit rearward along inboard side of upper frame tube. Feed relay and turn signal/security module connectors through same opening into cavity beneath frame weldment.

   Right Side

   a. Place remaining connectors and conduit into battery box. Feed rear brake light switch, starter solenoid and neutral switch connectors and conduit down through opening between bottom of frame crossmember and top of battery tray to area of starter. Feed main harness to EFI harness and siren connectors and conduit to right side of motorcycle through opening between rear of frame crossmember and front top of battery box.

2. Moving to left side of motorcycle, thread **new** cable strap through anchor on center of frame backbone loosely capturing main harness.
3. Install socket terminal onto horn spade contact. Capture conduit in J-clamp. Slide horn bracket onto rubber mount stud and install acorn nut.
4. Install voltage regulator wire (with black shrink tube) and two other internal tooth ring terminals (main harness grounds) onto left side ground post on upper frame crossmember. Install terminal nut.
5. Snap main 40 amp circuit breaker into mounting clip at same location. Install voltage regulator and main harness power wires (ring terminals with yellow shrink tube) onto silver post. Install Keps nut and tighten to 20-35 **in-lbs** (2.3-4.0 Nm). See Figure 8-146.

   Place main power lead (ring terminal with convoluted tubing) onto copper post. Install Keps nut and tighten to 20-35 **in-lbs** (2.3-4.0 Nm).

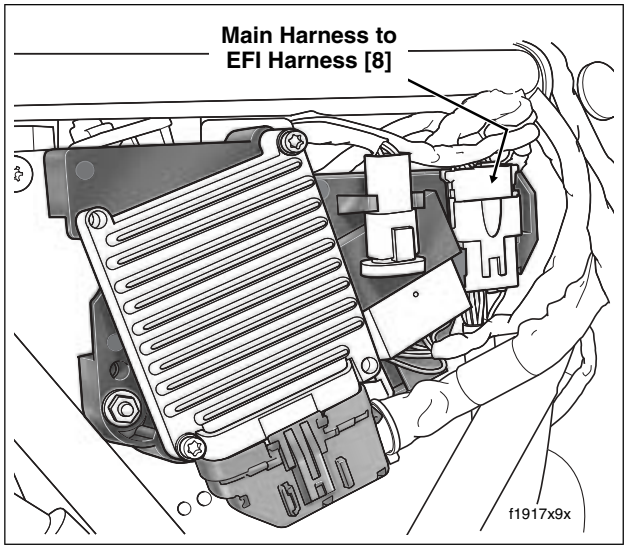


Figure 8-149. Electrical Bracket Assembly (Under Right Side Cover)

6. Mate pin and socket halves of rear fender lights connector [7], 8-place Multilock, anchored at the front of the rear fender. See Figure 8-147.
7. From bottom of frame weldment at rear of battery box, feed relay connectors up through rectangular shaped hole. Install relays in connectors. Fit rubber molding onto relays and install anchors on molding into holes in weldment.
8. Feed 8-place Deutsch connector [30] up through hole on opposite side of weldment and connect turn signal/security module. Install module in hole. Insert legs of spring clip into holes in weldment and push down until tab at front snaps in place. See Figure 8-147.
9. Install grommets onto studs at rear of cruise module. Place the module into position on left side of battery box. Install locknuts on front and rear mounting studs and tighten to 60-96 **in-lbs** (6.8-10.9 Nm). Rotate cruise cable connector in a clockwise direction to attach to cruise module. Install cruise module connector [17] and engage locking latch.
10. Install cover on fuse blocks. Slide fuse blocks into position on mounting panel. Tabs on panel fit into slots on each side of fuse block cover. Hook harness conduit clip onto weldment between frame downtubes.
11. Feed Tour-pak lights and radio antenna cable connectors and conduit through hole at front of Tour-pak. Capture cable and 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 8-148.
13. Rotate knurled ring in a clockwise direction to mate pin and socket halves of radio antenna cable connector [51]. Capture cable in two clips at bottom of Tour-Pak.
14. Install bulb socket on left side of Tour-pak.
15. Loosely install **new** cable strap to secure main harness conduit to luggage rack rail.
16. Moving to right side of motorcycle, install accessory connector [4], 3-place Deutsch (gray), on anchor of frame crossmember in front of battery box.
17. Connect the speedometer speed sensor connector [65], 3-place Deutsch (black), at same location.

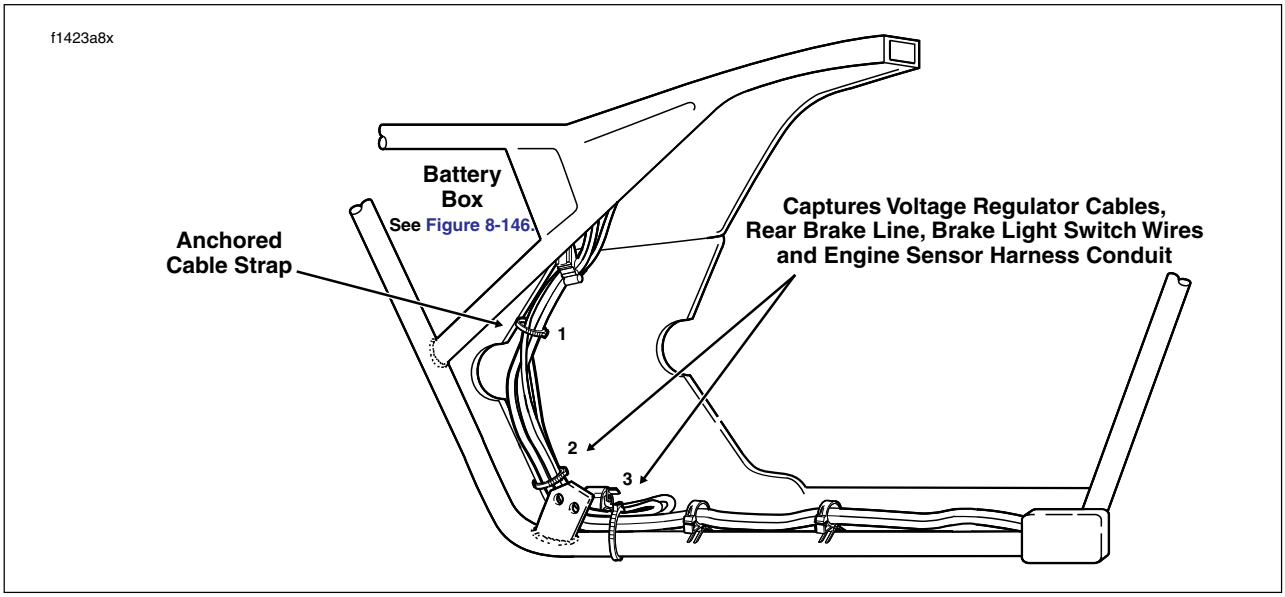


Figure 8-150. Frame Cable Straps (Right Side View)

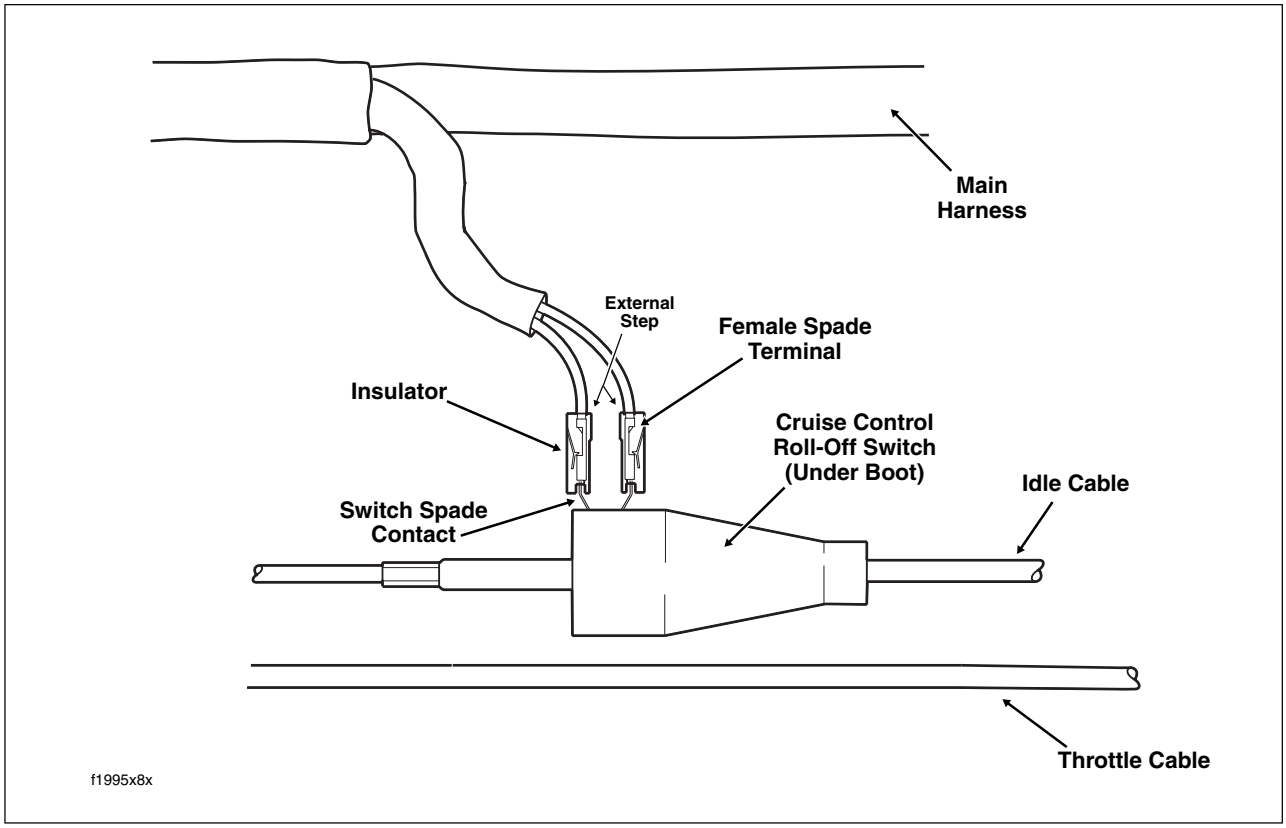


Figure 8-151. Throttle/Idle Cable Configuration (Right Side View)

18. Install three internal two tooth ring terminals onto right side ground post (main and audio harness grounds). Install terminal nut.
19. Routing lead under chrome starter cover, install terminals on posts of neutral switch.
20. Snap solenoid connector to terminal at top of starter housing.
21. Install two socket terminals onto spade contacts of rear brake light switch.
22. Install three **new** cable straps at locations shown in Figure 8-150. Hole in frame at rear location requires anchored type cable strap. Cut excess cable strap material.
23. Remove electrical bracket from studs at side of battery box. Route siren connector and conduit on inboard side of bracket and reinstall on studs. Install flange nuts on studs and tighten to 36-48 **in-lbs** (4.1-5.4 Nm).
24. Mate pin and socket halves of main harness to EFI harness connector [8]. Install connector into slot of electrical bracket. See Figure 8-149.
25. Install molded liner in Tour-Pak. Install map pocket and secure using acorn nuts. Close Tour-Pak
26. Moving to front right engine guard, carefully feed main harness conduit and connectors forrward under right side of fairing cap to front of inner fairing. See Figure 8-145. Standing at front of motorcycle, mate pin and socket halves of the following wire harness connectors and fix positions using retaining devices, if present:
    a. Main to interconnect harness (cruise) connector [156], 4-place Deutsch (gray); T-stud on outboard side of right fairing bracket.
    b. Main to interconnect harness connector [1], 12-place Deutsch (black); T-stud on front of right fairing bracket.
    c. Main to interconnect harness connector [2], 12-place Deutsch (gray); T-stud on top of right radio support bracket.
    d. Ignition switch connector [33], 4-place Packard (black); front of top fork bracket (below radio).
    e. Main power connector [15], 4-place Packard (black); anchored to front of top fork bracket (below radio).
    f. Radio antenna cable connector [51]; back of radio (left side).
    g. Speedometer connector [39], 12-place Packard; inner fairing (back of speedometer).

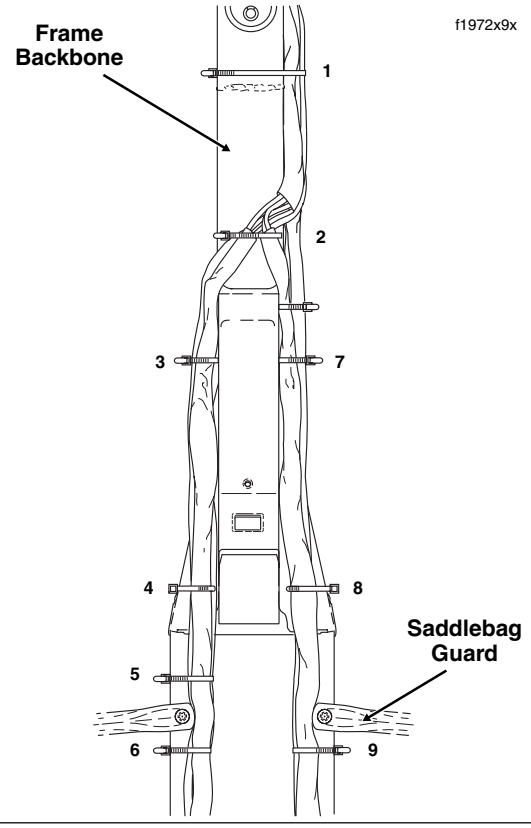
h. Tachometer connector [108], 6-place Packard; inner fairing (back of tachometer).

27. Slide odometer reset switch through hole in inner fairing. Install rubber boot to secure.
28. Capture main harness bundles in P-clamp. Install ring terminal of ground wire on screw and fasten P-clamp to top fork bracket.
29. On right side of vehicle, capture main harness bundles in second P-clamp. Install ring terminal of ground wire on screw and fasten P-clamp to right side of steering head.
30. Install cruise roll-off switch as follows:
    a. Separate the cruise roll-off switch wires up to the point where they enter the wire harness conduit. Now route the leads straight down.
    b. Orient the idle cable so that the spade contacts are at the top.
    c. 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 8-151.
    d. Fit the rubber boot over the cruise control roll-off switch. An oval cut in the boot accommodates the switch spade terminal connections.
31. At front of top engine stabilizer bracket, install **new** 14 inch cable strap capturing frame backbone, main harness bundles, and idle and throttle cables. Tighten cable strap, but leave loose enough so that one finger can be inserted between strap and frame backbone. **Do not overtighten.** Cut any excess cable strap material.
32. Install remaining cables straps as shown in Figure 8-152.
33. Install the windshield and outer fairing. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.
34. 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.

35. 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).
36. 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).
37. Align barbed studs in left side cover with grommets in frame downtubes and push firmly into place (no tools required).



1	Captures frame backbone, main harness, audio harness (FLHTCU only), and throttle cables.
2-3	Captures main harness and audio harness (FLHTCU only). Anchored.
4	Captures main harness, audio harness (FLHTCU only), and console pod/instrument console conduit. Anchored.
5-6	Captures frame tube, main harness, audio harness (FLHTCU only), and console pod/instrument console conduit.
7-8	Captures main harness, audio harness (FLHTCU only), and EFI harness (if fuel injected). Anchored.
9	Captures frame tube, main harness, and audio harness (FLHTCU only).

Figure 8-152. Install Cable Straps

38. Install left side saddlebag. See Section 2.23 SADDLEBAG, INSTALLATION.
39. Repeat steps 44-45 to install right side saddlebag and side cover.
40. Install fuel tank. For carbureted models, see Section 4.7 FUEL TANK (CARBURETED), INSTALLATION (AFTER COMPLETE REMOVAL), FLHT/C, FLTR. For fuel injected models, see Section 9.4 FUEL TANK (FUEL INJECTED), INSTALLATION (AFTER COMPLETE REMOVAL), FLHT/C/U/I, FLTRI.

INTERCONNECT HARNESS

REMOVAL

1. Remove the seat. See Section 2.22 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 2.27 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 8-153. 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. Audio to interconnect harness connector [6], 3-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 (cruise) connector [156], 4-place Deutsch (gray); T-stud on outboard side of right fairing bracket.
   m. Main to interconnect harness connector [1], 12-place Deutsch (black); T-stud on front of right fairing bracket.
   n. Right handlebar switch controls connector [22], 12-place Deutsch (black); T-stud on top of right fairing support brace.
   o. Fairing cap switch connector [105], 12-place Multilock (black); right side of radio next to top fork bracket (floating).
5. See Figure 8-154. 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:

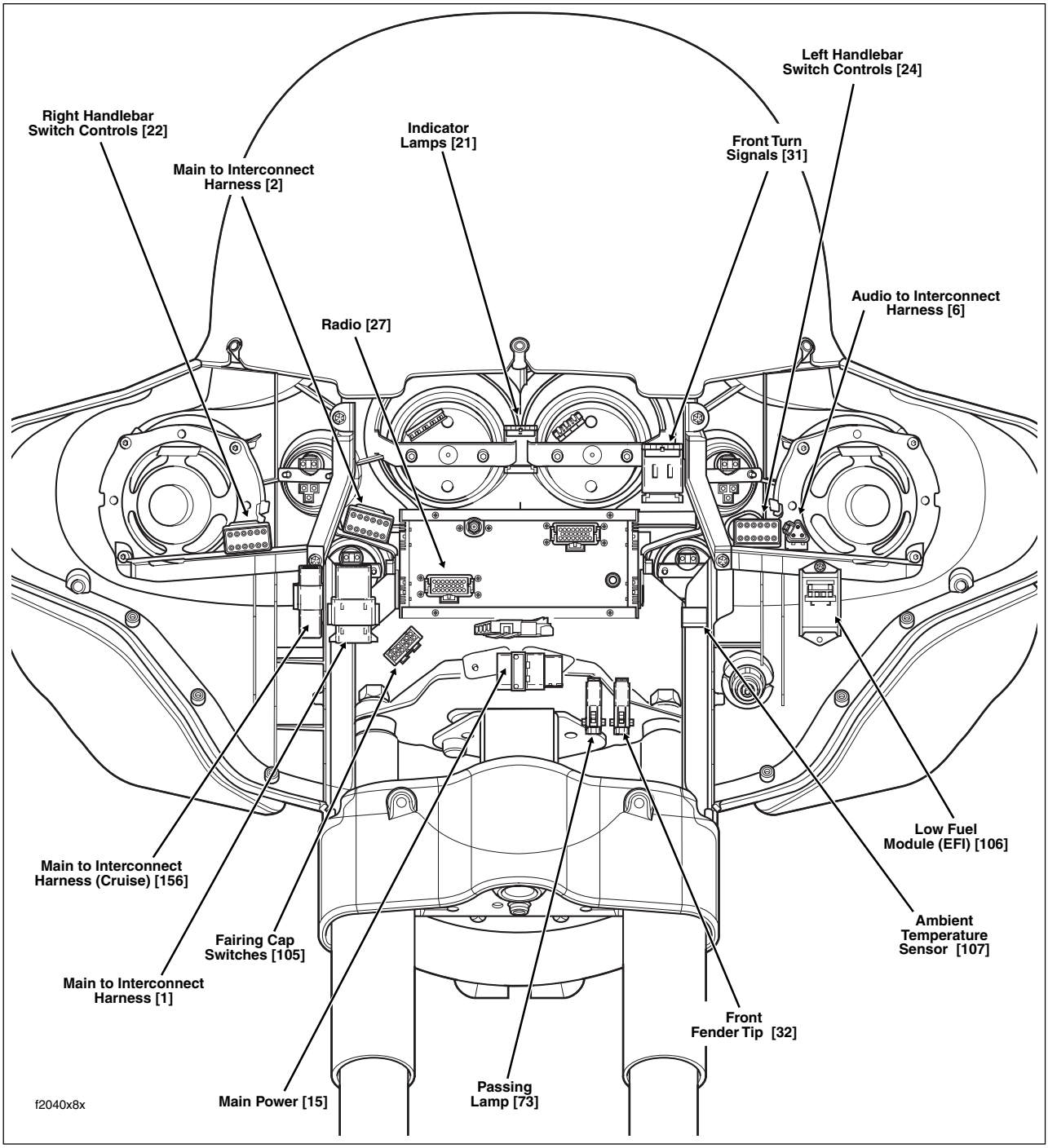


Figure 8-153. Inner Fairing - Interconnect Harness Connectors (FLHTC/U)

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.*

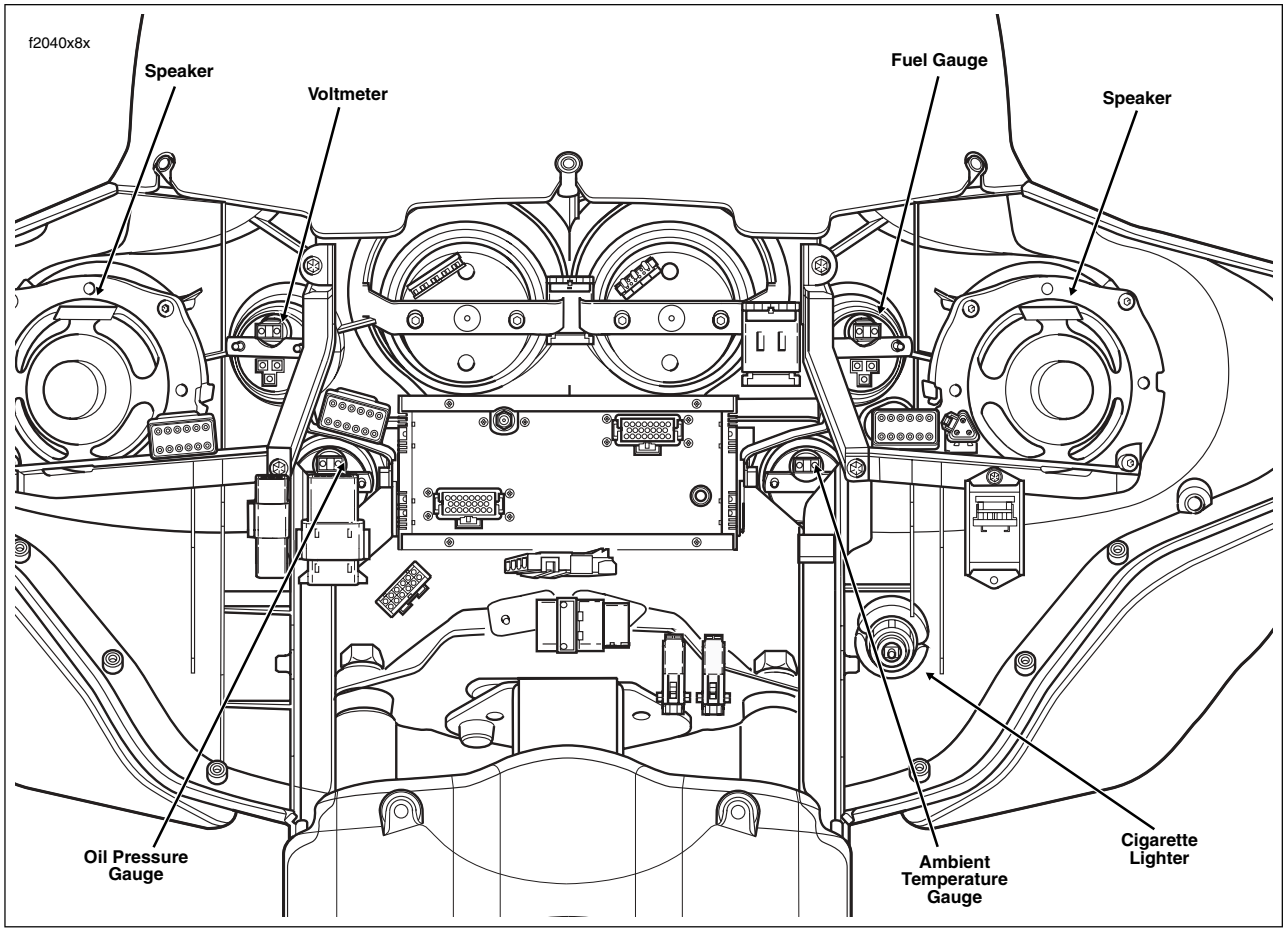


Figure 8-154. Inner Fairing - Interconnect Harness Connectors (FLHTC/U)

e. Low fuel module connector [106]; 6-place Multilock (black); front of left fairing support brace. *Classic and Ultra models only.*

f. Audio to interconnect harness connector [6], 3-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 (cruise) connector [156], 4-place Deutsch (gray); T-stud on outboard side of right fairing bracket.

m. Main to interconnect harness connector [1], 12-place Deutsch (black); T-stud on front of right fairing bracket.

n. Right handlebar switch controls connector [22], 12-place Deutsch (black); T-stud on top of right fairing support brace.

o. 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 2.27 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 2.22 SEAT, INSTALLATION.

AUDIO HARNESS

REMOVAL

1. Remove fuel tank to access cables in area of frame backbone. For carbureted models, see Section 4.7 FUEL TANK (CARBURETED), COMPLETE REMOVAL, FLHT/C, FLTR. For fuel injected models, see Section 9.4 FUEL TANK (FUEL INJECTED), COMPLETE REMOVAL, FLHT/C/U/I, FLTRI.
2. Remove right side saddlebag. See Section 2.23 SADDLEBAG, REMOVAL.
3. Gently pull side cover from frame downtubes (no tools required).
4. Repeat steps 2 and 3 on left side of vehicle.
5. Remove the outer fairing and windshield. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, REMOVAL.
6. See Figure 8-155. Disconnect pin and socket halves of the following connectors:
   a. CB antenna cable connector [50], back of radio (right side).
   b. Audio to interconnect harness connector [6], 3-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).

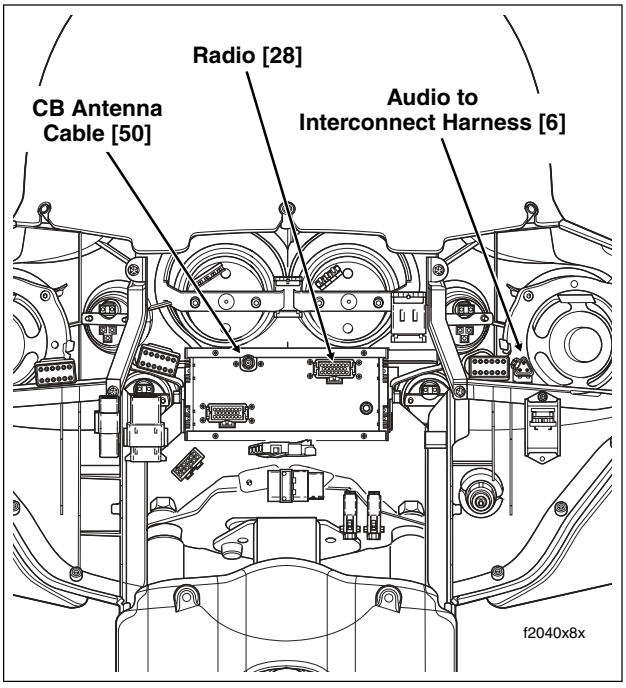


Figure 8-155. Audio Harness Connectors

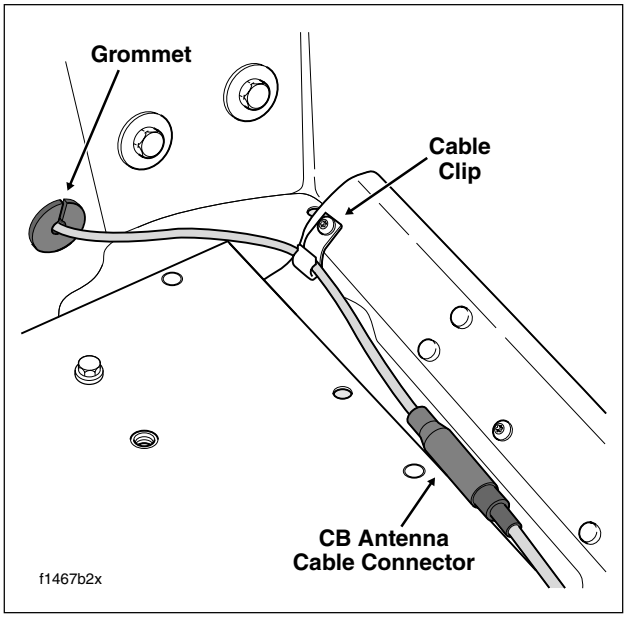


Figure 8-156. Disconnect CB Antenna Cable Connector

7. Remove screw, ground wire ring terminal and P-clamp to release main and audio harness bundles from top fork bracket.
8. Remove screw, ground wire ring terminal and P-clamp to release main and audio harness bundles from right side of steering head.
9. Carefully cut cable straps securing main harness to frame backbone, left and right frame tubes, and luggage rack rails. See Figure 8-158. Carefully cut cable straps securing audio harness to main harness. Remove audio harness from vehicle.
10. Carefully cut cable straps to release main harness from both audio harness (FLHTCU only) and EFI harness (if fuel injected).
11. Carefully pull audio harness conduit and connectors rearward under right side of fairing cap allowing it to hang over front right engine guard.
12. Locate right side ground post on frame crossmember in front of battery box. Remove terminal nut and ring terminal.
13. Release console pod connector [53], 12-place Mini-Deutsch, from attachment clip anchored in hole at rear of battery box. See Figure 8-157. Depress external latches and use a rocking motion to separate pin and socket halves.
14. 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.

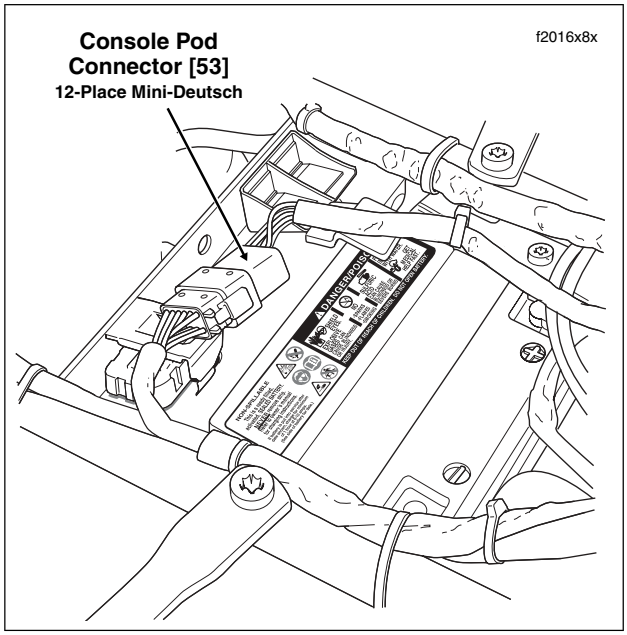


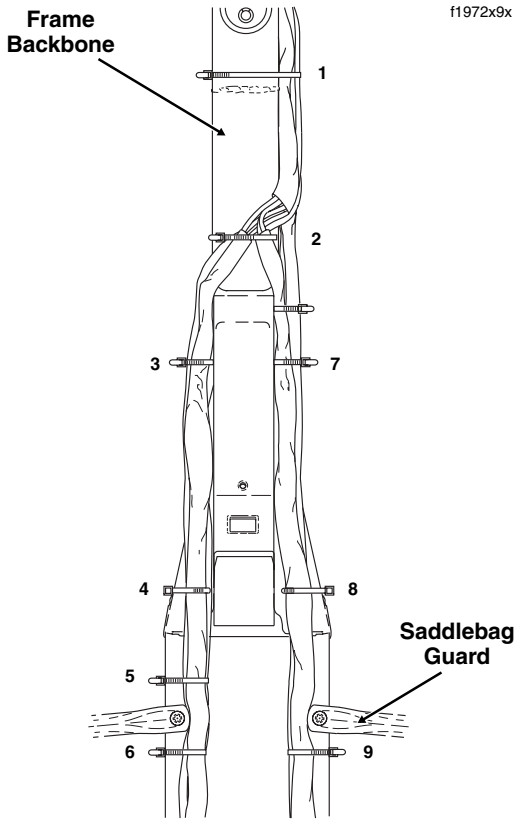
Figure 8-157. Disconnect Console Pod Connector

15. Open Tour-Pak. Open map pocket and remove acorn nuts. Remove map pocket and molded liner from Tour-Pak.
16. Separate pin and socket halves of CB antenna cable connector [50]. Release cable from clip at bottom of Tour-Pak. See Figure 8-156.
17. Pull right side grommet into Tour-Pak and remove from CB antenna cable. Feed CB antenna cable through hole at front of Tour-Pak.
18. Moving to opposite side of vehicle, 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.
19. Release rear headset receptacle from bracket at bottom of left side speaker box. Release spring from hole in receptacle wire jacket.
20. Remove audio harness from vehicle.

INSTALLATION

1. Place **new** audio harness on vehicle following original routing. Note that the audio harness follows the main harness as it is routed to the rear left and right side of the vehicle.

   Specifically, from the clamp on the top fork bracket, the audio 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 8-155. 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. Audio harness connector [6], 3-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 audio 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 audio 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. Locate right side ground post on frame crossmember in front of battery box. Install ring terminal and terminal nut.
7. 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 8-157.
8. 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.
9. 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.
10. Mate pin and socket halves of CB antenna cable connector. Capture antenna cable in clip at bottom of Tour-Pak. See Figure 8-156.
11. Moving to opposite side of vehicle, 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.
12. Attach spring to rear headset receptacle using hole in wire jacket. Capture headset receptacle in bracket at bottom of left side speaker box.



1	Captures frame backbone, main harness, audio harness (FLHTCU only), and throttle cables.
2-3	Captures main harness and audio harness (FLHTCU only). Anchored.
4	Captures main harness, audio harness (FLHTCU only), and console pod/instrument console conduit. Anchored.
5-6	Captures frame tube, main harness, audio harness (FLHTCU only), and console pod/instrument console conduit.
7-8	Captures main harness, audio harness (FLHTCU only), and EFI harness (if fuel injected). Anchored.
9	Captures frame tube, main harness, and audio harness (FLHTCU only).

Figure 8-158. Install Cable Straps

13. At front of top engine stabilizer bracket, install **new** 14 inch cable strap capturing frame backbone, main and audio harness bundles, and idle and throttle cables. Tighten cable strap, but leave loose enough so that one finger can be inserted between strap and frame backbone. **Do not overtighten.** Cut any excess cable strap material.

14. Install remaining cables straps as shown in Figure 8-158.

15. Install the outer fairing and windshield. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.

16. Align barbed studs in right side cover with grommets in frame downtubes and push firmly into place (no tools required).

17. Install right side saddlebag. See Section 2.23 SADDLEBAG, INSTALLATION.

18. Repeat steps 15 and 16 on left side of vehicle.

19. Install fuel tank. For carbureted models, see Section 4.7 FUEL TANK (CARBURETED), INSTALLATION (AFTER COMPLETE REMOVAL), FLHT/C, FLTR. For fuel injected models, see Section 9.4 FUEL TANK (FUEL INJECTED), INSTALLATION (AFTER COMPLETE REMOVAL), FLHT/C/U/I, FLTRI.

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 (CARBURETED), COMPLETE REMOVAL, FLHT/C, FLTR. For fuel injected models, see Section 9.4 FUEL TANK (FUEL INJECTED), COMPLETE REMOVAL, FLHT/C/U/I, FLTRI.
2. Remove left side saddlebag. See Section 2.23 SADDLEBAG, REMOVAL.
3. Gently pull side cover from frame downtubes (no tools required).
4. Remove the outer fairing and windshield. See Section 2.27 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 8-159. Carefully cut cable where it exits branch of main harness conduit.
6. Remove screw, ground wire ring terminal and P-clamp to release wire bundles from top fork bracket.
7. Remove screw, ground wire ring terminal and P-clamp to release wire bundles from right side of steering head.
8. Carefully cut cable straps securing main harness to frame backbone, left frame tube and luggage rack rail. See Figure 8-162.
9. Open Tour-Pak. Open map pocket and remove acorn nuts. Remove map pocket and molded liner from Tour-Pak.

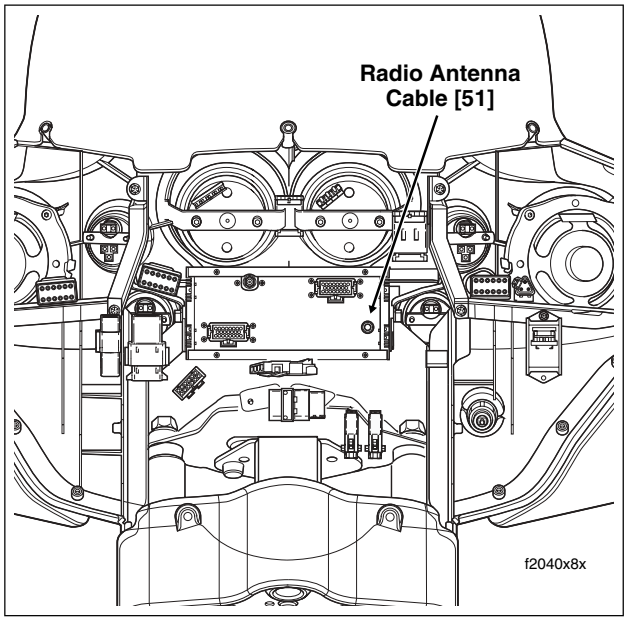


Figure 8-159. Radio Antenna Cable Connector (Inner Fairing)

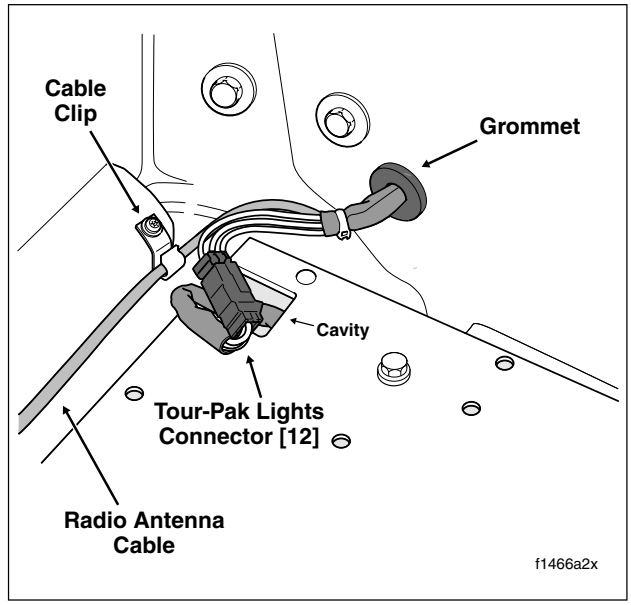


Figure 8-160. Disconnect Tour-Pak Lights Connector

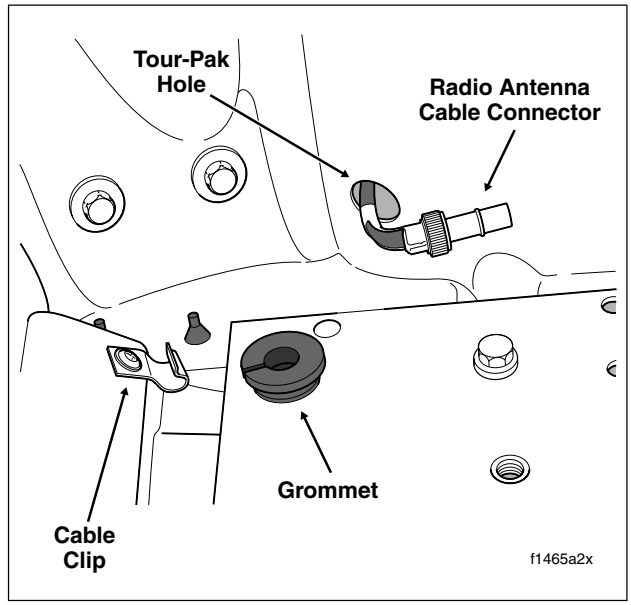


Figure 8-161. Feed Main Harness Thru Tour-Pak Hole

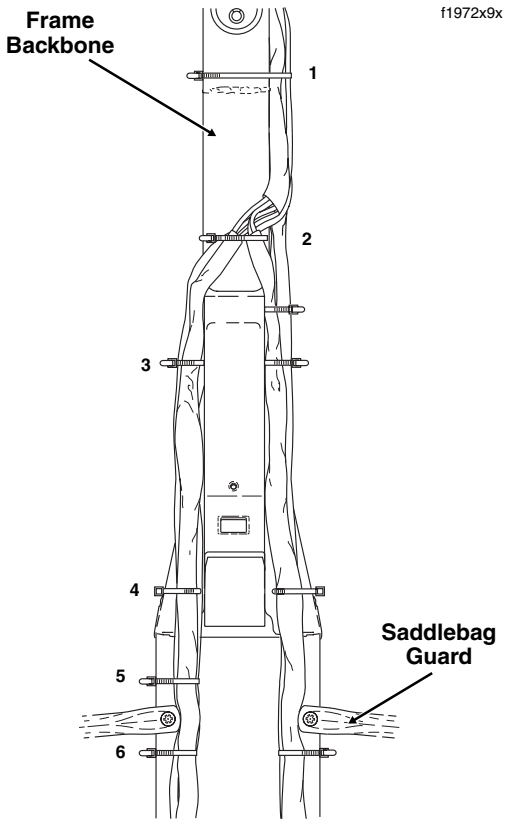
10. Depress external latch and remove bulb socket from left side of Tour-Pak.
11. Rotate knurled ring in a counterclockwise direction to separate pin and socket halves of radio antenna cable connector. Release cable from two clips at bottom of Tour-Pak.
12. Depress button and separate pin and socket halves of Tour-Pak lights connector [12], 3-place Multilock, inside Tour-Pak. See Figure 8-160.

13. Pull grommet into Tour-Pak and remove from main harness conduit.
14. Pull Tour-pak lights and radio antenna cable connectors through hole at front of Tour-Pak. See Figure 8-161.
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 P-clamp on the top fork bracket, the radio antenna cable is routed under the fairing cap where it passes through a second P-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 down the luggage rack rail where it passes through the hole at the front of the Tour-Pak.
2. Feed Tour-pak lights and radio antenna cable connectors and conduit through hole at front of Tour-Pak. Capture 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 8-160.
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. See Figure 8-159.
8. Capture radio antenna cable and wire bundles in P-clamp. Install ring terminal of ground wire on screw and fasten P-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 P-clamp to right side of steering head.
10. At front of top engine stabilizer bracket, install **new** 14 inch cable strap capturing frame backbone, main harness bundles, and idle and throttle cables. Tighten cable strap, but leave loose enough so that one finger can be inserted between strap and frame backbone. **Do not overtighten.** Cut any excess cable strap material.
11. Install remaining cables straps as shown in Figure 8-162.



1	**Captures frame backbone, main harness, audio harness (FLHTCU only), and throttle cables.**
2-3	**Captures main harness and audio harness (FLHTCU only). Anchored.**
4	**Captures main harness, audio harness (FLHTCU only), and console pod/instrument console conduit. Anchored.**
5-6	**Captures frame tube, main harness, audio harness (FLHTCU only), and console pod/instrument console conduit.**

Figure 8-162. Install Cable Straps

12. Install the outer fairing and windshield. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.
13. Align barbed studs in left side cover with grommets in frame downtubes and push firmly into place (no tools required).
14. Install left side saddlebag. See Section 2.23 SADDLEBAG, INSTALLATION.
15. Install fuel tank. For carbureted models, see Section 4.7 FUEL TANK (CARBURETED), INSTALLATION (AFTER COMPLETE REMOVAL), FLHT/C, FLTR. For fuel injected models, see Section 9.4 FUEL TANK (FUEL INJECTED), INSTALLATION (AFTER COMPLETE REMOVAL), FLHT/C/U/I, FLTRI.

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 (CARBURETED), COMPLETE REMOVAL, FLHT/C, FLTR. For fuel injected models, see Section 9.4 FUEL TANK (FUEL INJECTED), COMPLETE REMOVAL, FLHT/C/U/I, FLTRI.
2. Remove right side saddlebag. See Section 2.23 SADDLEBAG, REMOVAL.
3. Gently pull side cover from frame downtubes (no tools required).
4. Remove the outer fairing and windshield. See Section 2.27 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 8-163. 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.
7. Remove screw, ground wire ring terminal and P-clamp to release wire bundles from right side of steering head.

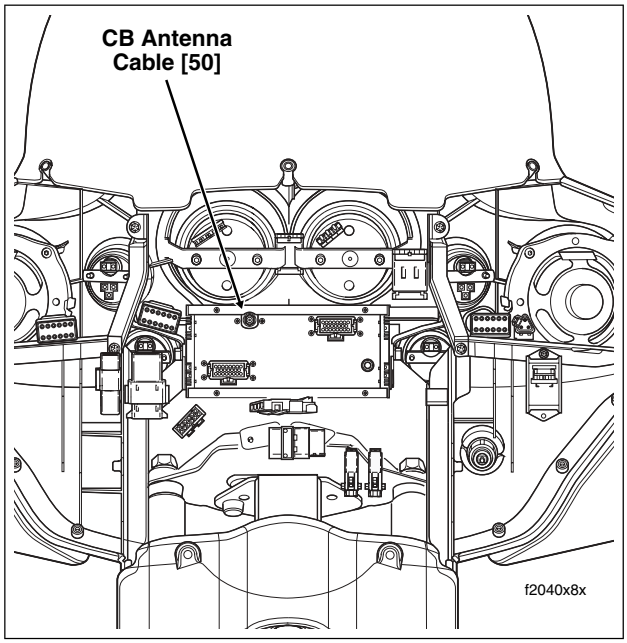


Figure 8-163. CB Antenna Cable Connector (Inner Fairing)

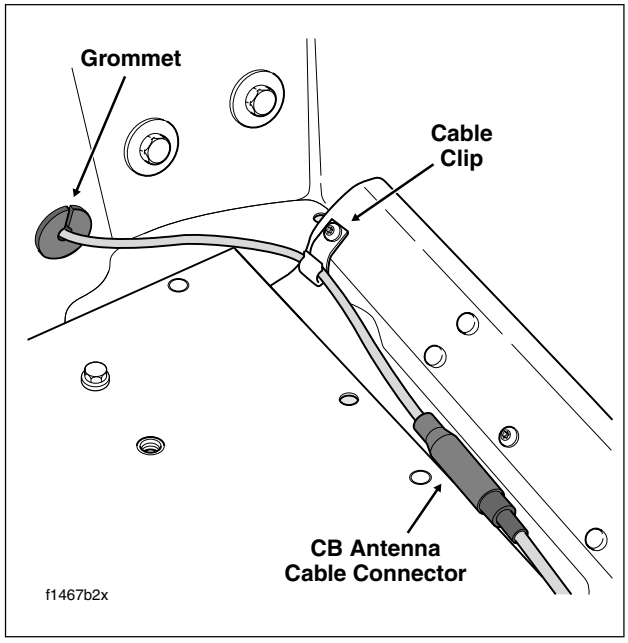


Figure 8-164. CB Antenna Cable Connector (Tour-Pak)

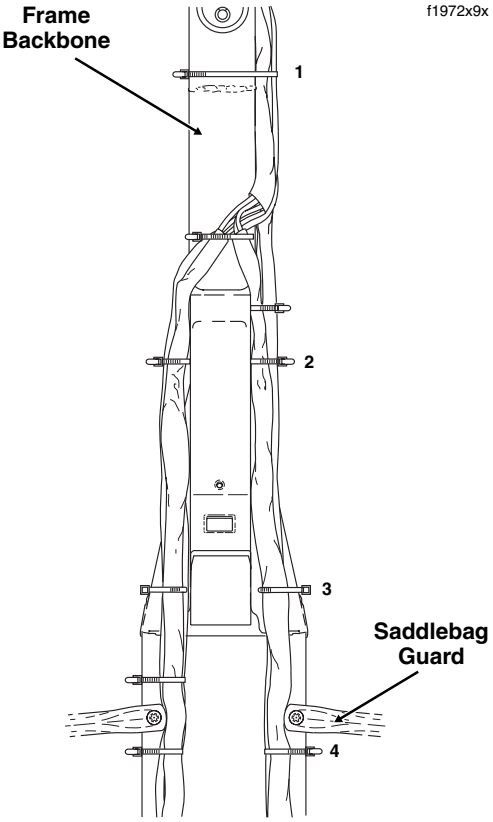
8. Carefully cut cable straps securing main harness to frame backbone, right frame tube and luggage rack rail. See Figure 8-165. Carefully cut cable straps securing audio harness to main harness.
9. Open Tour-Pak. Open map pocket and remove acorn nuts. Remove map pocket and molded liner from Tour-Pak.
10. Separate pin and socket halves of CB Antenna cable connector [50]. Release cable from clip at bottom of Tour-Pak. See Figure 8-164.
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 branch of audio harness conduit.

INSTALLATION

1. Place **new** CB antenna cable on vehicle following original routing. Note that the cable follows that portion of the main (and audio) harness routed to the rear right side of the vehicle.

   Specifically, from the P-clamp on the top fork bracket, the CB antenna cable is routed under the fairing cap where it passes through a second P-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 down 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 8-164. Install **new** cable strap to secure cable to luggage rack rail.
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. See Figure 8-163.
6. Capture CB antenna cable and wire bundles in P-clamp. Install ring terminal of ground wire on screw and fasten P-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 P-clamp to right side of steering head.
8. At front of top engine stabilizer bracket, install **new** 14 inch cable strap capturing frame backbone, main and audio harness bundles, and idle and throttle cables. Tighten cable strap, but leave loose enough so that one finger can be inserted between strap and frame backbone. **Do not overtighten.** Cut any excess cable strap material.
9. Install remaining cables straps as shown in Figure 8-165.
10. Install the outer fairing and windshield. See Section 2.27 UPPER FAIRING/WINDSHIELD (FLHT/C/U), OUTER FAIRING/WINDSHIELD, INSTALLATION.
11. Align barbed studs in right side cover with grommets in frame downtubes and push firmly into place (no tools required).
12. Install right side saddlebag. See Section 2.23 SADDLEBAG, INSTALLATION.
13. Install fuel tank. For carbureted models, see Section 4.7 FUEL TANK (CARBURETED), INSTALLATION (AFTER COMPLETE REMOVAL), FLHT/C, FLTR. For fuel injected models, see Section 9.4 FUEL TANK (FUEL INJECTED), INSTALLATION (AFTER COMPLETE REMOVAL), FLHT/C/U/I, FLTRI.



1	**Captures frame backbone, main harness, audio harness (FLHTCU only), and throttle cables.**
2-3	**Captures main harness, audio harness (FLHTCU only), and EFI harness (if fuel injected). Anchored.**
4	**Captures frame tube, main harness, and audio harness (FLHTCU only).**

Figure 8-165. Install Cable Straps

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NOTE

See the 2003 ELECTRICAL DIAGNOSTIC MANUAL (Part No. 99497-03) for all SYSTEM DIAGNOSIS and ELECTRICAL TROUBLESHOOTING information.

FUEL INJECTION 9

SPECIFICATIONS 9.1

EFI FUSES

Fuel Pump	15	Blue	Blade
ECM Power	15	Blue	Blade

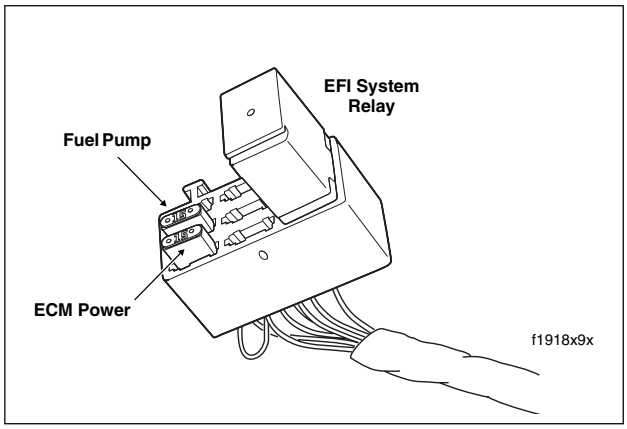


Figure 9-1. EFI Fuses (Under Right Side Cover)

TORQUE VALUES

Item	ft/in-lbs	Nm
Battery hold-down clamp TORX bolt	15-20 ft-lbs	20-27 Nm
Battery cable bolt	60-96 **in-lbs**	6.8-10.9 Nm
ECM socket screws	50-60 **in-lbs**	5.7-6.8 Nm
Electrical bracket flange nuts	36-48 **in-lbs**	4.1-5.4 Nm
Crank position sensor screw	90-120 **in-lbs**	10.2-13.6 Nm
Engine sensor harness clip screws to crankcase	25-35 **in-lbs**	2.8-4.0 Nm
Engine temperature sensor	120-180 **in-lbs**	13.6-20.3 Nm
Fuel tank rear mounting bolt	15-20 ft-lbs	20-27 Nm
Fuel tank front mounting bolts	15-20 ft-lbs	20-27 Nm
Fuel tank canopy TORX screws	18-24 **in-lbs**	2.0-2.7 Nm
Fuel level sender TORX screw	25-35 **in-lbs**	2.8-4.0 Nm
Fuel supply line quick-connect fitting	22-26 ft-lbs	29.8-35.3 Nm
Fairing lower U-bolt retainer locknuts	35-40 **in-lbs**	4.0-4.5 Nm
Fairing lower cap screws	10-15 **in-lbs**	1.1-1.7 Nm
Intake manifold to throttle body TORX screws	27-33 **in-lbs**	3.1-3.7 Nm
Intake flange adapter screws	96-144 **in-lbs**	10.9-16.3 Nm
Exhaust flange adapter screws	60-80 **in-lbs**	6.8-9.0 Nm
Fuel rail TORX screws	18 **in-lbs**	2.0 Nm
Fuel supply tube clamp TORX screw	18 **in-lbs**	2.0 Nm
Intake air temperature sensor TORX screws	12 **in-lbs**	1.4 Nm
Throttle position sensor TORX screws	18 **in-lbs**	2.0 Nm
Throttle cable bracket side TORX screw	18 **in-lbs**	2.0 Nm
Idle air control flange screws	25 **in-lbs**	2.8 Nm
Main 40 amp circuit breaker Keps nuts	20-35 **in-lbs**	2.3-4.0 Nm
Console mounting bolt acorn nut	50-90 **in-lbs**	5.7-10.2 Nm

NOTES

ELECTRICAL BRACKET ASSEMBLY 9.2

GENERAL

See Figure 9-2. The electrical bracket assembly is mounted beneath the side cover on the right side of the vehicle. The electrical bracket assembly carries the following components:

- Data Link Connector
- Main Harness to EFI Harness Connector
- ECM Power Fuse/Fuel Pump Fuse
- EFI System Relay
- Crankshaft Position Sensor Connector
- Oil Pressure Sending Unit Connector
- Electronic Control Module (ECM)
- Optional Siren Connector

DATA LINK CONNECTOR

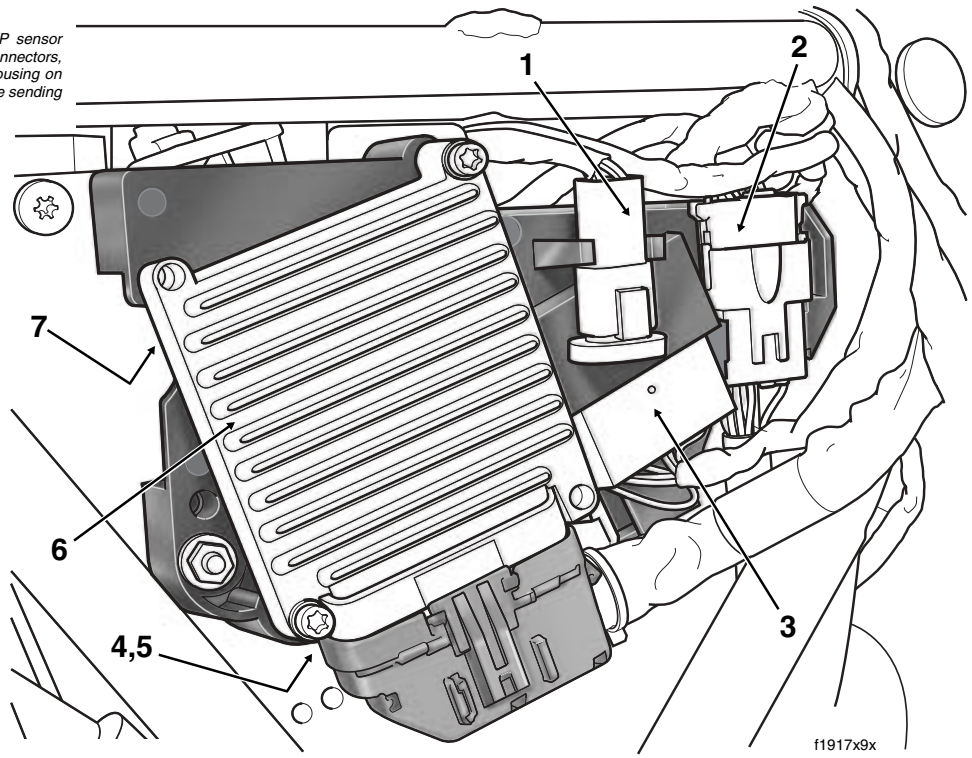
SETTING ENGINE IDLE SPEED

Idle speed can only be set using the SCANALYZER (Part No. HD-41325) or DIGITAL TECHNICIAN (Part No. HD-44750). Use of the throttle stop screw will not permanently change idle speed.

1. Turn the ignition/light key switch to OFF.
2. Remove right side saddlebag. See Section 2.23 SADDLEBAG, REMOVAL.
3. Gently pull side cover from frame downtubes (no tools required).
4. Note the data link connector attached to the electrical bracket. See Figure 9-2. Gently pull on connector to disengage from arms on bracket.

NOTE

For positive identification of CKP sensor and oil pressure sending unit connectors, note that CKP sensor has pin housing on engine sensor harness side, while sending unit has socket housing.



1. **Data Link Connector [91]**
2. **Main Harness to EFI Harness Connector [8]**
3. **Fuse Block (ECM Power Fuse, Fuel Pump Fuse, EFI System Relay)**
4. **Crankshaft Position Sensor Connector [79] (Under Bracket)**
5. **Oil Pressure Sending Unit Connector [140] (Under Bracket)**
6. **Electronic Control Module (ECM)**
7. **P&A Siren Connector [142] (Under Bracket)**

Figure 9-2. Electrical Bracket Assembly

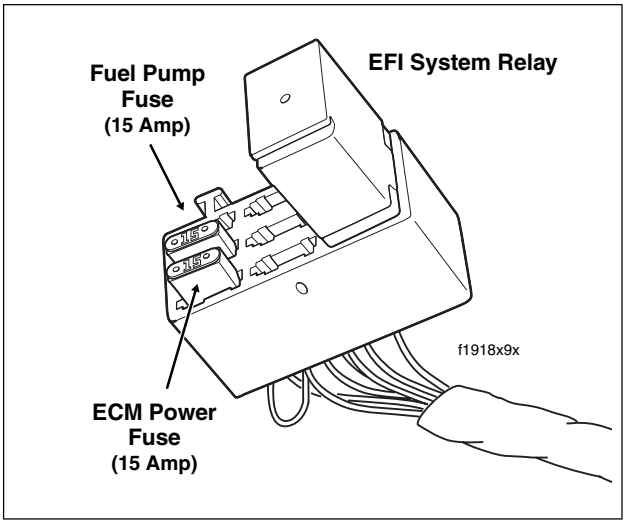


Figure 9-3. EFI Fuse Block

5. Remove rubber protective plug from data link connector. Plug connector into Scanalyzer.
6. Turn ignition/light key switch to ON. Set engine stop switch to RUN, but do not start engine.
7. Insert the diagnostic application cartridge into the Scanalyzer. During the next few seconds, the Scanalyzer sequences through a series of screens that reflect a power-on self test, the system copyright, and then an attempt at communications with the ECM. Once communications is established, the diagnostic menu appears.
8. Start the engine and bring to operating temperature.
9. Scroll down and press number “7” to select **Calibrations**.
10. Press number “1” to select **Idle Adjust**.

NOTE

Although the idle speed can be adjusted from 800 to 1250 RPM. The Harley-Davidson specification for idle speed on Touring models is 1000 ± 50 RPM.

11. Press **Exit/Mode.**
12. Turn engine off.
13. Remove Scanalyzer from data link connector.
14. Install protective plug in data link connector.
15. With the plug side down and in contact with tab, position connector between arms on electrical bracket.
16. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required).
17. Install right side saddlebag. See Section 2.23 SADDLEBAG, INSTALLATION.

EFI SYSTEM RELAY

REMOVAL

1. Remove right side saddlebag. See Section 2.23 SADDLEBAG, REMOVAL.
2. Gently pull side cover from frame downtubes (no tools required).
3. Locate painted white dot on inboard side of fuse block. Pressing on dot, gently tug on conduit to release tabs on fuse block from slots in bracket.
4. Pull relay from slots in fuse block. See Figure 9-3.

INSTALLATION

1. Install relay in slots of fuse block. See Figure 9-3.
2. Engage tabs on fuse block with slots in bracket. Slide fuse block up into cavity. Gently tug on conduit to verify that fuse block is locked in place.
3. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required).
4. Install right side saddlebag. See Section 2.23 SADDLEBAG, INSTALLATION.

EFI FUSES

REMOVAL

1. Remove right side saddlebag. See Section 2.23 SADDLEBAG, REMOVAL.
2. Gently pull side cover from frame downtubes (no tools required).
3. Locate painted white dot on inboard side of fuse block. Pressing on dot, gently tug on conduit to release tabs on fuse block from slots in bracket.
4. Pull fuses from slots in fuse block and inspect for damage. Replace fuse if the element is burned or broken. Automotive type ATO fuses are used. See Figure 9-3.

NOTE

One extra 10 amp and 15 amp fuse are located in the system fuse block under the left side cover. See Section 8.29 PREMIUM SOUND SYSTEM (FLHTC/U, FLTR), FUSE BLOCKS, for more information.

INSTALLATION

1. Insert fuse in the appropriate slot. See Figure 9-3.
2. Engage tabs on fuse block with slots in bracket. Slide fuse block up into cavity. Gently tug on conduit to verify that fuse block is locked in place.

3. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required).
4. Install right side saddlebag. See Section 2.23 SADDLEBAG, INSTALLATION.

ELECTRONIC CONTROL MODULE

REMOVAL

1. Remove right side saddlebag. See Section 2.23 SADDLEBAG, REMOVAL.
2. Gently pull side cover from frame downtubes (no tools required).
3. Depress external latch and use rocking motion to remove 36-place Packard connector from ECM.
4. Remove two socket screws to detach ECM from electrical bracket.

INSTALLATION

1. Align holes in ECM with those in electrical bracket. Install two socket screws and tighten to 50-60 **in-lbs** (5.7-6.8 Nm).
2. Install 36-place Packard connector onto ECM. Push connector halves together until latch clicks.
3. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required).
4. Install right side saddlebag. See Section 2.23 SADDLEBAG, INSTALLATION.

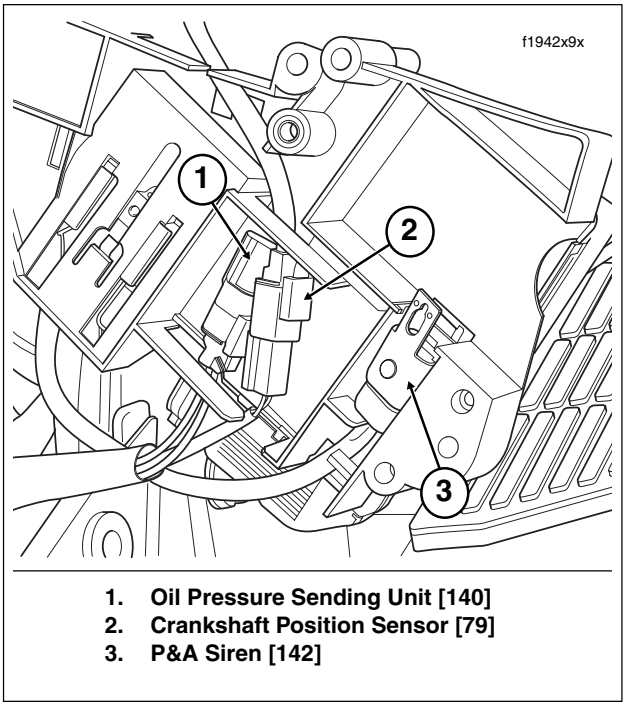
SIREN CONNECTOR

REMOVAL

1. Remove right side saddlebag. See Section 2.23 SADDLEBAG, REMOVAL.
2. Gently pull side cover from frame downtubes (no tools required).
3. Remove two flange nuts to release electrical bracket from studs on side of battery box.

INSTALLATION

1. Route siren, oil pressure sending unit, and crankshaft position sensor connectors and conduit on inboard side of electrical bracket as shown in Figure 9-4.
2. Slide electrical bracket onto studs at side of battery box. Be sure that conduit is properly routed on inboard side of electrical bracket or wires may be pinched during installation.



1. **Oil Pressure Sending Unit [140]**
2. **Crankshaft Position Sensor [79]**
3. **P&A Siren [142]**

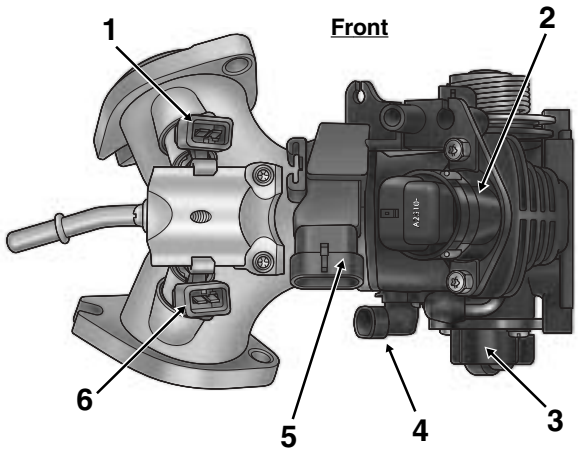
Figure 9-4. Electrical Bracket (Inboard Side)

3. Install flange nuts on studs and tighten to 36-48 **in-lbs** (4.1-5.4 Nm).
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 2.23 SADDLEBAG, INSTALLATION.

EFI WIRE HARNESS

REMOVAL

1. Remove fuel tank. See Section 9.4 FUEL TANK (FUEL INJECTED), COMPLETE REMOVAL, FLHT/C/U/I, FLTRI, or FLHR/C/I.
2. Remove air cleaner and backplate. See Section 4.5 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. Remove right side saddlebag. See Section 2.23 SADDLEBAG, REMOVAL.



1. **Fuel Injector (Front)** f1939x9x
2. **Idle Air Control**
3. **Throttle Position Sensor**
4. **Intake Air Temperature Sensor**
5. **Manifold Absolute Pressure Sensor**
6. **Fuel Injector (Rear)**

Figure 9-5. Induction Module Assembly (Top View)

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. Carefully cut cable straps to free EFI wire harness from right side of frame backbone and main wire harness bundle. See Figure 9-7.
8. Standing on right side of vehicle, remove idle air control and manifold absolute pressure sensor connectors. Pull external latch(es) outward and use rocking motion to separate pin and socket halves. See Figure 9-5.
9. Depress wire form to remove electrical connectors from front and rear fuel injectors.
10. Remove throttle position sensor and intake air temperature sensor connectors.
11. Moving to left side of vehicle, remove electrical connector from left side of ignition coil.
12. 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.
13. Returning to right side of vehicle, depress external latch and remove 36-place Packard connector from ECM.
14. Note the data link connector (pin side of 4-place Deutsch) attached to the electrical bracket. See Figure 9-2. Gently pull on connector to disengage from arms on bracket.
15. Locate painted white dot on inboard side of fuse block. Pressing on dot, gently tug on conduit to release tabs on fuse block from slots in bracket.
16. Pull main harness to EFI harness connector from slot in electrical bracket. Depress external latches and use a rocking motion to separate pin and socket halves.
17. Remove two flange nuts to release electrical bracket from studs on side of battery box.
18. On inboard side of electrical bracket, disconnect oil pressure sensing unit and crankshaft position sensor connectors. Depress button on socket terminal side and pull apart pin and socket halves. See Figure 9-4.

CAUTION

Damage to wires can result in electrical problems. Be sure that rubber boot is present on threaded end of battery box TORX screw. Replace rubber boot if absent or damaged.

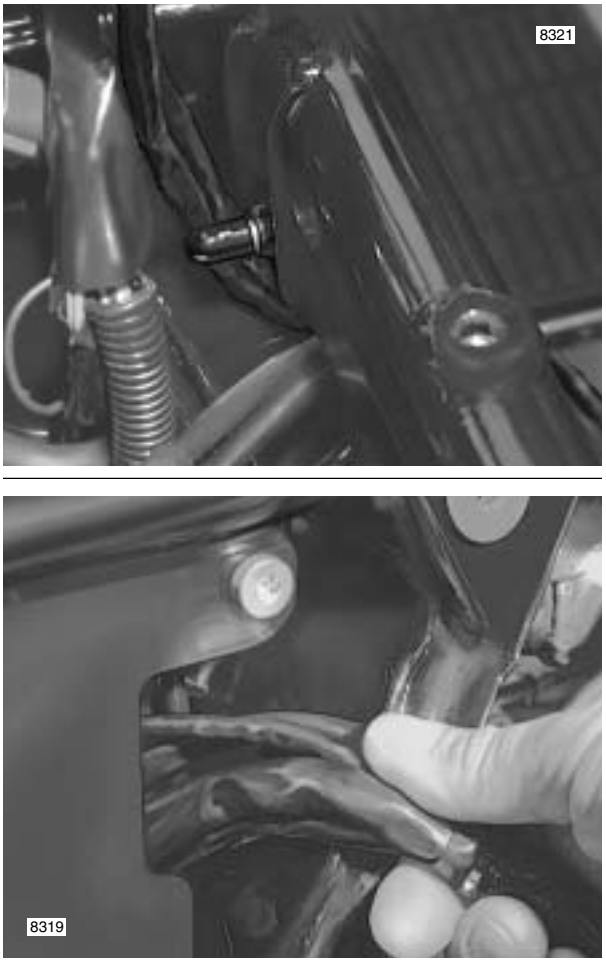


Figure 9-6. Remove EFI Harness From Vehicle

19. Note that harness conduit runs forward of the front battery box TORX screw. See upper frame of Figure 9-6. Pull conduit to the rear of the screw, and then draw sensor connectors and conduit down right side of frame backbone into battery box.

20. Pull connectors and conduit out through opening at side of battery box to remove harness from vehicle. See lower frame of Figure 9-6.

INSTALLATION

CAUTION

Damage to wires can result in electrical problems. Be sure that rubber boot is present on threaded end of battery box TORX screw. Replace rubber boot if absent or damaged.

1. Standing on right side of vehicle, carefully feed sensor connectors and conduit through opening into battery box. See lower frame of Figure 9-6. Pull up on harness and tuck conduit into space in front of the battery box TORX screw. See upper frame of Figure 9-6.

2. Draw sensor connectors and conduit up along right side of frame backbone just below the main wire harness bundle.

3. Loosely install **new** cable straps to secure EFI wire harness to right side of frame backbone and main wire harness bundle. See Figure 9-7.

4. Install electrical connectors on fuel injectors. See Figure 9-5.

5. Install manifold absolute pressure sensor and idle air control connectors.

6. Install intake air temperature sensor and throttle position sensor connectors.

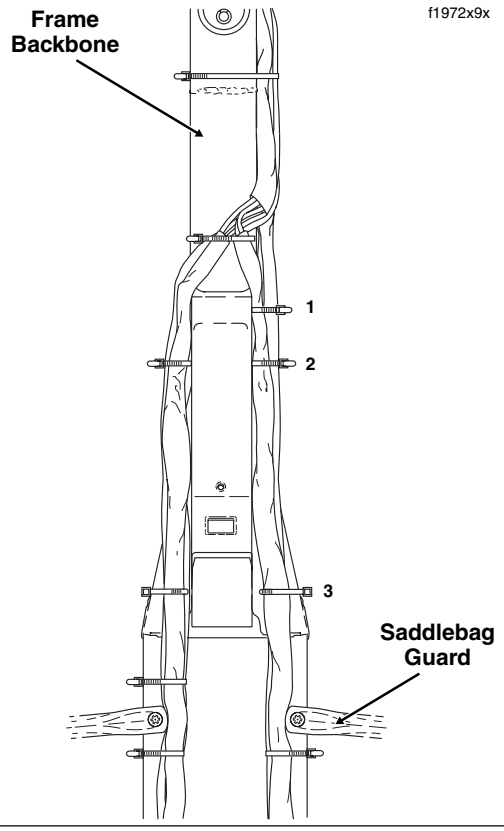
7. Feed ignition coil and engine temperature sensor connectors to left side of vehicle, routing the first in front of the top engine stabilizer link, the latter to the rear.

8. Install electrical connector onto left side of ignition coil.

9. Install connector to engine temperature sensor at back of front cylinder. Pull boot over sensor to keep out dirt and debris. Install **new** cable strap to secure connector conduit to horn bracket.

10. Mate pin and socket halves of oil pressure sending unit and crankshaft position sensor connectors. To prevent improper mating, crankshaft position sensor has pin housing on engine sensor harness side, while the oil pressure sending unit has a socket housing.

11. Route siren, oil pressure sending unit, and crankshaft position sensor connectors and conduit on inboard side of electrical bracket as shown in Figure 9-4.



1	**Captures main harness, audio harness (FLHTCU only), and EFI harness.**
2 3	**Captures main harness, audio harness (FLHTCU only), and EFI harness. Anchored.**

Figure 9-7. Install Cable Straps

12. Slide electrical bracket onto studs at side of battery box. Be sure that conduit is properly routed on inboard side of electrical bracket or wires may be pinched during installation. Install flange nuts and tighten to 36-48 **in-lbs** (4.1-5.4 Nm).

13. Mate pin and socket housings of main harness to EFI harness connector. Install connector into slot of electrical bracket. See Figure 9-2.

14. Engage tabs on fuse block with slots in electrical bracket. Slide fuse block up into cavity. Gently tug on conduit to verify that fuse block is locked in place.

15. Install 36-place Packard connector onto ECM. Push connector halves together until latch clicks.

16. Verify that protective plug is installed in data link connector. With the plug side down and in contact with tab, position connector between arms on electrical bracket.

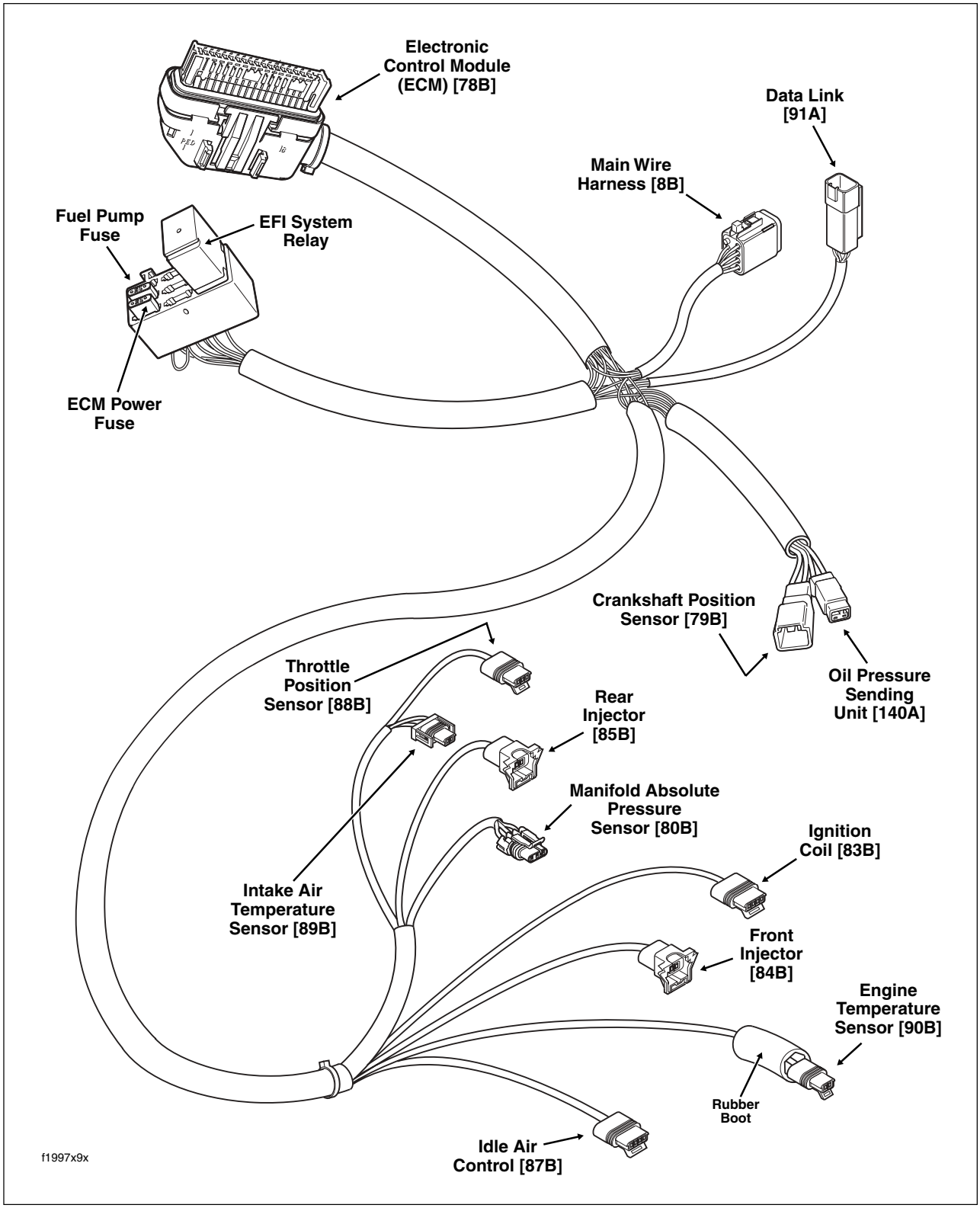


Figure 9-8. EFI Wire Harness Connectors

17. Tighten three cable straps securing EFI wire harness to right side of frame backbone and main wire harness bundle. Cut any excess cable strap material.

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.

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. See Section 9.4 FUEL TANK (FUEL INJECTED), INSTALLATION (AFTER COMPLETE REMOVAL), FLHT/C/U/I, FLTRI, or FLHR/C/I

21. Install backplate and air cleaner. See Section 4.5 AIR CLEANER, INSTALLATION.

22. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required).

23. Install right side saddlebag. See Section 2.23 SADDLEBAG, INSTALLATION.

24. Start vehicle and verify proper operation without setting trouble codes.

GENERAL

Six sensors inform the ECM of the environmental and engine operating factors influencing fuel and spark requirements. The sensors are as follows:

- Intake Air Temperature Sensor
- Throttle Position Sensor
- Manifold Absolute Pressure Sensor
- Bank Angle Sensor (Internal to TSM/TSSM)
- Crankshaft Position Sensor
- Engine Temperature Sensor

INTAKE AIR TEMPERATURE SENSOR

See Section 9.5 INDUCTION MODULE ASSEMBLY, INTAKE AIR TEMPERATURE SENSOR.

THROTTLE POSITION SENSOR

See Section 9.5 INDUCTION MODULE ASSEMBLY, THROTTLE POSITION SENSOR.

MANIFOLD ABSOLUTE PRESSURE SENSOR

See Section 9.5 INDUCTION MODULE ASSEMBLY, MANIFOLD ABSOLUTE PRESSURE SENSOR.

BANK ANGLE SENSOR

See Section 8.16 TURN SIGNAL/SECURITY MODULE.

CRANKSHAFT POSITION SENSOR

REMOVAL

1. Remove seat. See Section 2.22 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 right side saddlebag. See Section 2.23 SADDLEBAG, REMOVAL.
4. Gently pull side cover from frame downtubes (no tools required).
5. Depress external latch and use rocking motion to remove 36-place Packard connector from ECM.

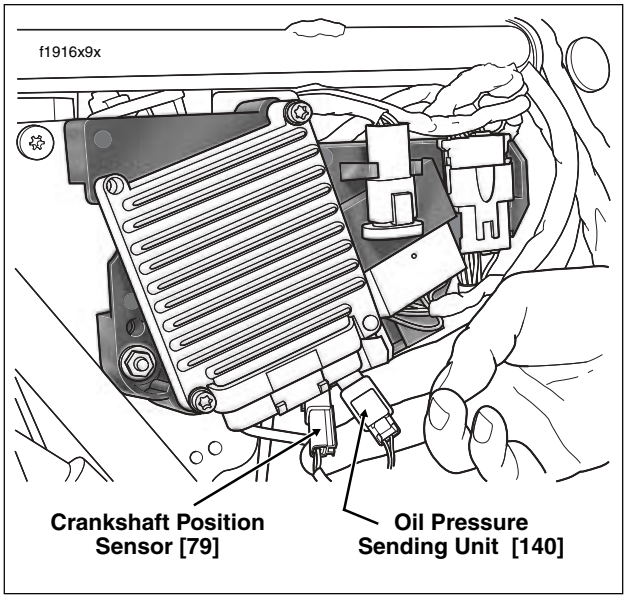


Figure 9-9. Pull Connectors From Cavity

CAUTION

Plastic tab protects connectors from dirt and moisture. Do not pull plastic tab any further than necessary to free connectors from cavity. Pulling tab too far will cause the tab to crack or break.

6. Locate plastic tab on molding. Pull tab down slightly and gently tug on wires to pull oil pressure sending unit and crankshaft position sensor connectors out of cavity. See Figure 9-9.
7. Depress button on socket terminal side and pull apart pin and socket halves of both connectors.
8. Feed engine sensor harness conduit and connectors forward through opening between frame downtube and bottom front corner of battery box.
9. Cut anchored cable strap to release conduit from frame downtube (inboard of rear swingarm bracket). Cut cable strap to release conduit from brake hose crimp.
10. 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 rear swingarm bracket.
11. 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.

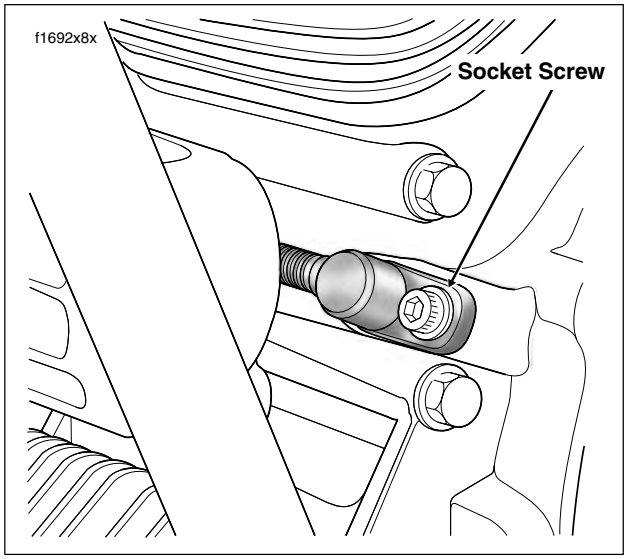


Figure 9-10. Remove Sensor Mount Socket Screw

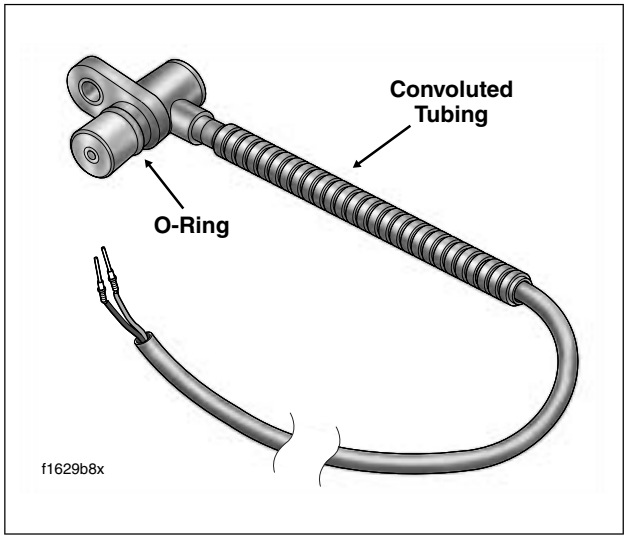


Figure 9-11. Crankshaft Position Sensor

12. Remove T20 TORX screw from threaded hole at front of crankcase to release cable clip and conduit. Remove T20 TORX screw from threaded hole at rear of crankcase (under cam cover). Remove cable clips from conduit.

13. 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.

14. 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.

15. Remove terminals from pin housing of 2-place Mini-Deutsch connector.

NOTE

For instructions on properly removing wire terminals, see APPENDIX B.1 DEUTSCH ELECTRICAL CONNECTORS, REMOVING/INSTALLING PINS.

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.

17. Attach mechanics wire to pin side of crankshaft position sensor cable. Carefully pull cable to draw pin terminals and mechanics wire through conduit. When pin terminals exit conduit, remove mechanics wire from cable.

18. 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 9-10.

19. Carefully pull sensor to draw cable and pin terminals under oil filter mount to left side of crankcase. See Figure 9-11.

20. Remove convoluted tubing from crankshaft position sensor cable.

INSTALLATION

1. Install convoluted tubing onto crankshaft position sensor cable. See Figure 9-11.

2. Standing on left side of vehicle, route crankshaft position sensor cable under oil filter mount to right side of crankcase.

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.

4. 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 9-10.

5. 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 mechanics wire to draw pin terminals and cable back through conduit. Remove mechanics wire from cable.

6. Install terminals into pin housing of 2-place Mini-Deutsch connector. See the table which follows for pin locations and wire colors.

Table 9-1. Crankshaft Position Sensor [79]

Wire Color	Chamber Number
Red	1
Black	2

NOTE

For instructions on properly installing wire terminals, see APPENDIX B.1 DEUTSCH ELECTRICAL CONNECTORS, REMOVING/INSTALLING PINS.

7. Draw conduit and connectors downward between rear brake master cylinder reservoir and frame downtube to inboard side of lower frame tube.
8. Attach wire socket (Packard connector on Ultra models) to oil pressure sending unit.
9. 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. Attach cable clip and install T20 TORX screw into threaded hole at rear of crankcase (under cam cover). Alternately tighten screws to 25-35 **in-lbs** (2.8-4.0 Nm).
10. Route engine sensor harness connectors and conduit rearward along top of lower frame tube to inboard side of rear brake light switch.
11. 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).
12. Install **new** anchored cable strap to secure engine sensor harness conduit (and voltage regulator cables) to frame downtube (inboard of rear swingarm bracket). Install **new** cable strap to secure conduit (and voltage regulator cables) to brake hose crimp. Cut any excess cable strap material.
13. Install screw to secure rear brake line clamp to rear swingarm bracket, if removed.
14. 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.

15. Mate pin and socket halves of oil pressure sending unit and crankshaft position sensor connectors. See Figure 9-9. 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.

CAUTION

Plastic tab protects connectors from dirt and moisture. Do not pull plastic tab any further than necessary to insert connectors into cavity. Pulling tab too far will cause the tab to crack or break.

16. Locate plastic tab on molding. Pull down tab slightly and gently insert both connectors into cavity.
17. Install 36-place Packard connector onto ECM. Push connector halves together until latch clicks.
18. Align barbed studs in side cover with grommets in frame downtubes and push firmly into place (no tools required).
19. Install right side saddlebag. See Section 2.23 SADDLEBAG, INSTALLATION.
20. 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).
21. Install seat. See Section 2.22 SEAT, INSTALLATION.

ENGINE TEMPERATURE SENSOR

REMOVAL

1. Remove seat. See Section 2.22 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 9-12. 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.

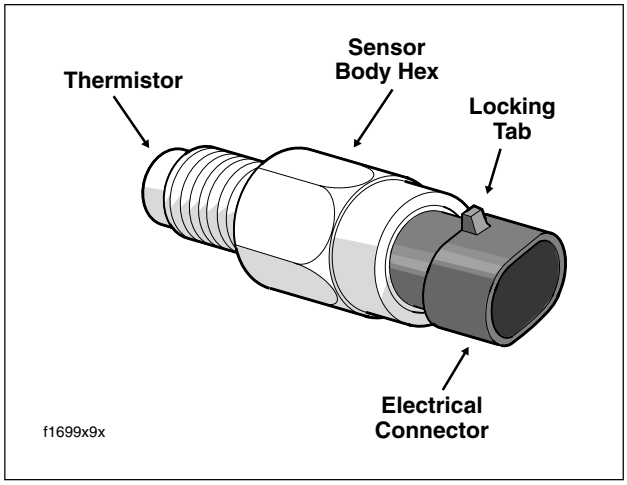


Figure 9-12. Engine Temperature Sensor

2. Slide 3/4 inch deepwell socket over sensor hex and tighten to 120-180 **in-lbs** (13.6-20.3 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 2.22 SEAT, INSTALLATION.

FUEL TANK (FUEL INJECTED) 9.4

GENERAL

See Figure 9-13. The fuel pump, fuel filter canister, fuel pressure regulator, 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 Pump
- Fuel Pressure Regulator
- Fuel Filter Canister
- Fuel Level Sender
- Low Fuel Level Warning Lamp
- Fuel Supply Check Valve

COMPLETE REMOVAL

FLHT/C/U/I, FLTRI

⚠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.

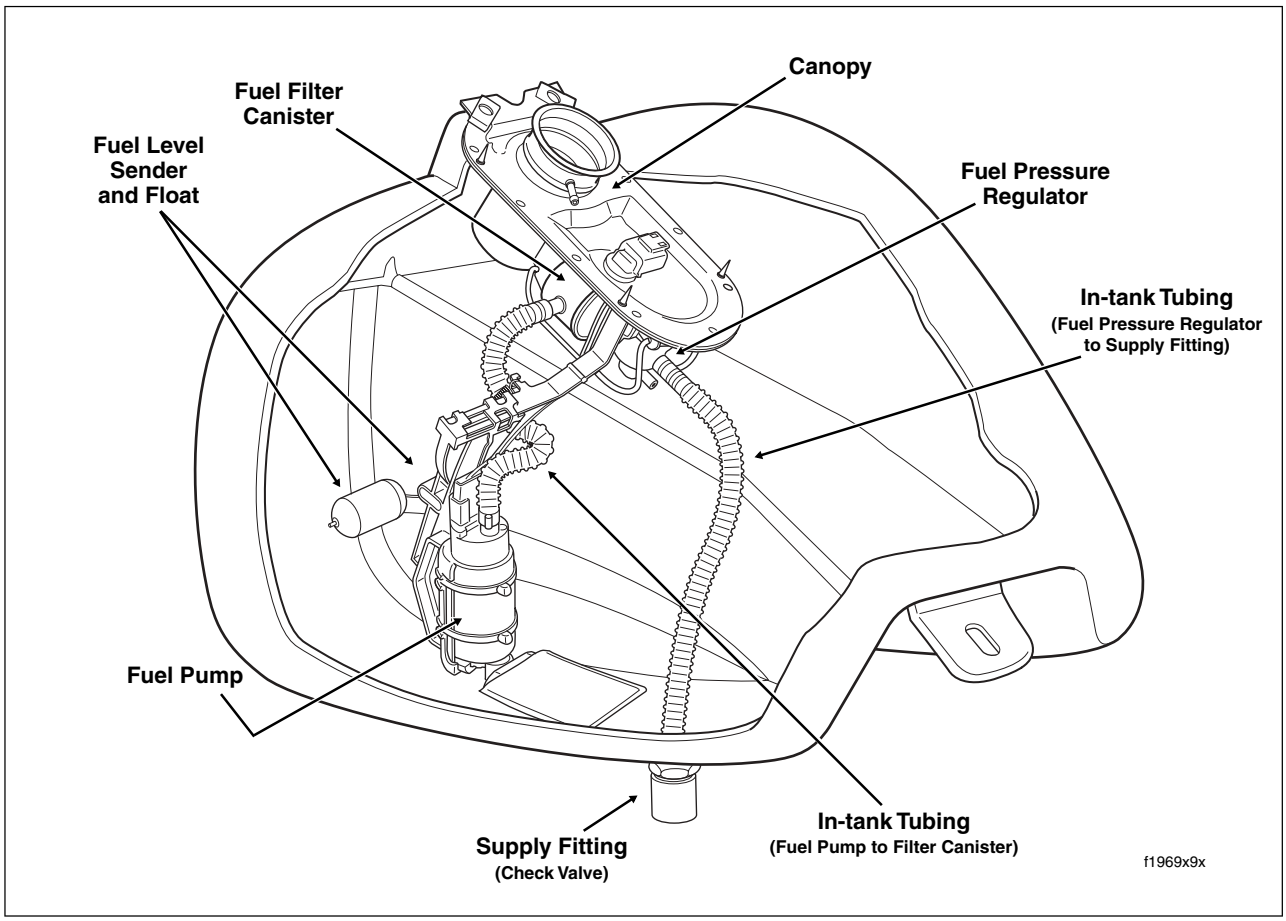


Figure 9-13. Fuel Tank Assembly (FLHT/C/U/I, FLTRI)

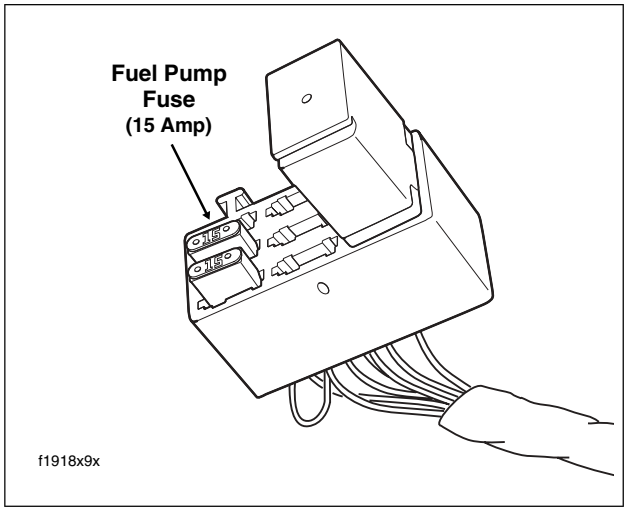


Figure 9-14. EFI Fuse Block

⚠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 with a 5/16 inch (7.9 mm) 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 2.22 SEAT, REMOVAL.

⚠WARNING

The gasoline in the fuel supply line downstream of the fuel pump is under high pressure (58 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 line of high pressure gas. Proceed as follows:

   a. Remove the 15 amp fuel pump fuse. See Figure 9-14. If necessary, see Section 9.2 ELECTRICAL BRACKET ASSEMBLY, EFI FUSES, REMOVAL.

   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 level sender/fuel pump conduit, and fuel vapor vent tube to left side of frame backbone.

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 clip nut on fuel tank weldment.

8. Lay a clean shop towel on forward part of rear fender.

9. Remove filler cap from neck of fuel tank. Remove console and lay upside down on shop towel. Reinstall filler cap.

10. At top of canopy, depress button on socket side of 3-place Mini-Deutsch connector to release fuel tank harness.

11. Gently pry fuel vapor vent tube from fitting on filler neck of fuel tank. Exercise caution to avoid pulling fitting from filler neck.

⚠WARNING

A small amount of gasoline may drain from the fuel supply line 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.

⚠WARNING

Exercise caution to avoid twisting the fuel supply line fitting, as any cracks in the plastic construction of the line can result in gas leaks. Gas leakage can cause fire or explosion which could result in death or serious injury.

12. Locate quick-connect fitting on left side of fuel tank. Pull up on chrome sleeve and pull down on fuel supply line fitting to disconnect. See Figure 9-15.

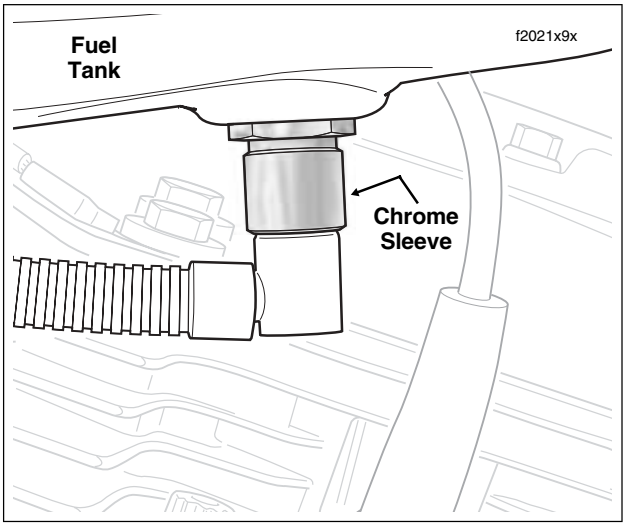


Figure 9-15. Fuel Supply Line Fitting

13. 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.

NOTE

The fuel tank mounting bolts have both an internal TORX recess and an external hex, which allows them to be removed with either a T40 TORX bit or a 1/2 inch open end/box wrench. Use of the external hex allows the front mounting bolts to be removed without having to loosen or remove the fairing lowers, if installed.

14. Remove fuel tank from vehicle.

FLHR/C/I

1. See Section 9.4 FUEL TANK (FUEL INJECTED), COMPLETE REMOVAL, FLHT/C/U/I, FLTRI, steps 1-4.
2. Carefully cut anchored cable strap securing main harness bundle, instrument console conduit, and fuel vapor vent tube to left side of frame backbone.
3. Remove acorn nut and Phillips screw (with large flat washer) from instrument console.

CAUTION

When removing instrument console, exercise caution to avoid damaging speedometer unit. Wrap console in a clean, dry shop towel to prevent damage.

4. Remove console and secure to top of rear fender using bungee cords.
5. Remove console mounting bolt from slot at top of canopy.
6. Pull fuel vapor vent tube from fitting at top of canopy.
7. Bend back flexible clamp and then depress button on socket side of 3-place Mini-Deutsch connector to release main harness from canopy.
8. 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 line 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.

⚠WARNING

Exercise caution to avoid twisting the fuel supply line fitting, as any cracks in the plastic construction of the line can result in gas leaks. Gas leakage can cause fire or explosion which could result in death or serious injury.

9. Locate quick-connect fitting on left side of fuel tank. Pull up on chrome sleeve and pull down on fuel supply line fitting to disconnect. See Figure 9-15.
10. 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.
11. Remove fuel tank from vehicle.

INSTALLATION (AFTER COMPLETE REMOVAL)

FLHT/C/U/I, FLTRI

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. 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 15-20 ft-lbs (20-27 Nm).

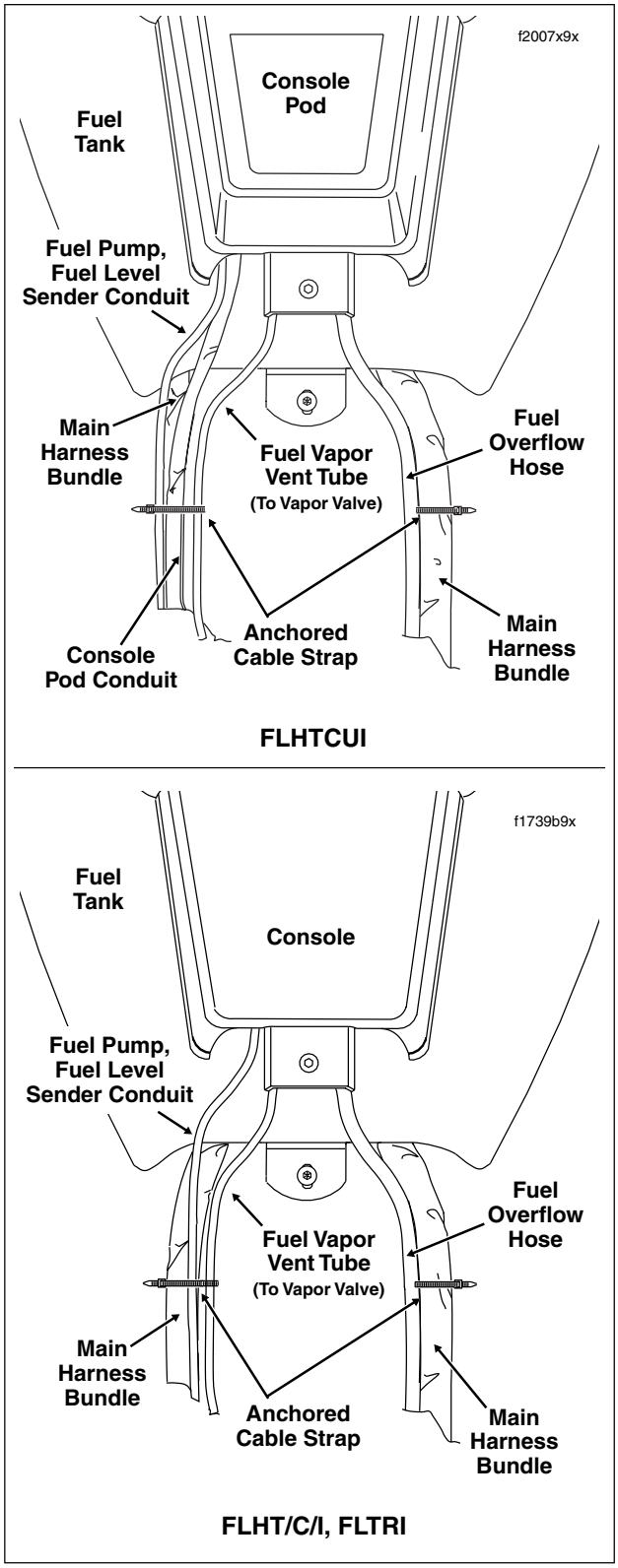


Figure 9-16. Console Pod Cable/Hose Routing (Top View)

5. Tighten fuel tank front mounting bolts to 15-20 ft-lbs (20-27 Nm).

⚠WARNING

Exercise caution to avoid twisting the fuel supply line fitting, as any cracks in the plastic construction of the line can result in gas leaks. Gas leakage can cause fire or explosion which could result in death or serious injury.

6. Locate quick-connect fitting on left side of fuel tank. Pull up on chrome sleeve and insert neck of fuel supply line fitting. While pushing up on bottom of fitting, pull down on chrome sleeve until it “clicks” into the locked position.

⚠WARNING

To avoid an uncontrolled discharge or spray of gasoline, always be sure the quick-connect fitting is properly mated. A slight tug on the fuel supply line fitting will verify this condition. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

7. Connect fuel vapor vent tube to nipple 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 on canopy. Route cables from beneath console as shown in Figure 9-16. Be sure that hoses and wires are not pinched by the console during installation. Reinstall filler cap.
10. Install Allen head screw to fasten rear flange of console to clip nut on fuel tank weldment. Tighten screw to 25-30 **in-lbs** (2.8-3.4 Nm).
11. Open fuel door on console. Install two Allen head screws to secure front of console to clip nuts on canopy bracket. Alternately tighten screws to 25-30 **in-lbs** (2.8-3.4 Nm).
12. Snap anchor of **new** cable strap into hole on left side of frame backbone. Tighten cable strap capturing main harness bundles, console pod conduit (Ultra models only), fuel level sender/fuel pump conduit, and fuel vapor vent tube. See Figure 9-16. 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.

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. Install the 15 amp fuel pump fuse. See Figure 9-14. If necessary, see Section 9.2 ELECTRICAL BRACKET ASSEMBLY, EFI FUSES, INSTALLATION.
15. Install seat. See Section 2.22 SEAT, INSTALLATION.

FLHR/C/I

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. 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 15-20 ft-lbs (20-27 Nm).
5. Tighten fuel tank front mounting bolts to 15-20 ft-lbs (20-27 Nm).

⚠WARNING

Exercise caution to avoid twisting the fuel supply line fitting, as any cracks in the plastic construction of the line can result in gas leaks. Gas leakage can cause fire or explosion which could result in death or serious injury.

6. Locate quick-connect fitting on left side of fuel tank. Pull up on chrome sleeve and insert neck of fuel supply line fitting. While pushing up on bottom of fitting, pull down on chrome sleeve until it “clicks” into the locked position.

⚠WARNING

To avoid an uncontrolled discharge or spray of gasoline, always be sure the quick-connect fitting is properly mated. A slight tug on the fuel supply line fitting will verify this condition. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

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 connect main harness at top of canopy. Bend flexible clamp to capture conduit.
9. Slide head of console mounting bolt into slot at top of canopy. Align hole in console with mounting bolt and place into position over canopy.
10. Install acorn nut on mounting bolt and tighten to 50-90 **in-lbs** (5.7-10.2 Nm). Install Phillips screw (with large flat washer) and tighten to 36-60 **in-lbs** (4.1-6.8 Nm).
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 backbone. Tighten cable strap capturing main harness bundle, instrument console conduit, and fuel vapor vent tube. Cut any excess cable strap material. See Figure 9-16.
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. Install the 15 amp fuel pump fuse. See Figure 9-14. If necessary, see Section 9.2 ELECTRICAL BRACKET ASSEMBLY, EFI FUSES, INSTALLATION.
15. Install seat. See Section 2.22 SEAT, INSTALLATION.

PARTIAL REMOVAL

FLHT/C/U/I, FLTRI

⚠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 2.22 SEAT, REMOVAL.

⚠WARNING

The gasoline in the fuel supply line downstream of the fuel pump is under high pressure (58 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 line of high pressure gas. Proceed as follows:
   a. Remove the 15 amp fuel pump fuse. See Figure 9-14. If necessary, see Section 9.2 ELECTRICAL BRACKET ASSEMBLY, EFI FUSES, REMOVAL.
   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 level sender/fuel pump conduit, and fuel vapor vent tube to left side of frame backbone.
5. 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.

6. Remove Allen head screw to detach flange at rear of console from clip nut on fuel tank weldment.
7. Lay a clean shop towel on forward part of rear fender.
8. Remove filler cap from neck of fuel tank. Remove console and lay upside down on shop towel. Reinstall filler cap.
9. At top of canopy, depress button on socket side of 3-place Mini-Deutsch connector to release fuel tank harness.
10. Gently pry fuel vapor vent tube from fitting on filler neck of fuel tank. Exercise caution to avoid pulling fitting from filler neck.

⚠WARNING

A small amount of gasoline may drain from the fuel supply line 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.

⚠WARNING

Exercise caution to avoid twisting the fuel supply line fitting, as any cracks in the plastic construction of the line can result in gas leaks. Gas leakage can cause fire or explosion which could result in death or serious injury.

11. Locate quick-connect fitting on left side of fuel tank. Pull up on chrome sleeve and pull down on fuel supply line fitting to disconnect. See Figure 9-15.
12. 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.

NOTE

The fuel tank mounting bolts have both an internal TORX recess and an external hex, which allows them to be removed with either a T40 TORX bit or a 1/2 inch open end/box wrench. Use of the external hex allows the front mounting bolts to be removed without having to loosen or remove the fairing lowers, if installed.

13. Raise the 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 and rest on frame backbone.
14. 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.

FLHR/C/I

1. See Section 9.4 FUEL TANK (FUEL INJECTED), PARTIAL REMOVAL, FLHT/C/U/I, FLTRI, steps 1-3.
2. Carefully cut anchored cable strap securing main harness bundle, instrument console conduit, and fuel vapor vent tube to left side of frame backbone.
3. Remove acorn nut and Phillips screw (with large flat washer) from instrument console.

CAUTION

When removing instrument console, exercise caution to avoid damaging speedometer unit. Wrap console in a clean, dry shop towel to prevent damage.

4. Remove console and secure to top of rear fender using bungee cords.
5. Remove console mounting bolt from slot at top of canopy.
6. Pull fuel vapor vent tube from fitting at top of canopy.
7. Bend back flexible clamp and then depress button on socket side of 3-place Mini-Deutsch connector to release main harness from canopy.
8. 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 line 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.

⚠WARNING

Exercise caution to avoid twisting the fuel supply line fitting, as any cracks in the plastic construction of the line can result in gas leaks. Gas leakage can cause fire or explosion which could result in death or serious injury.

9. Locate quick-connect fitting on left side of fuel tank. Pull up on chrome sleeve and pull down on fuel supply line fitting to disconnect. See Figure 9-15.
10. 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.
11. Raise the 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 and rest on frame backbone.

12. 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)

FLHT/C/U/I, FLTRI

1. Remove wooden blocks and move fuel tank toward its installed position. While positioning fuel tank, move crossover hose in front of ignition coil. Work fuel tank into position aligning front flange holes with those in frame.
2. 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 15-20 ft-lbs (20-27 Nm).
4. Tighten fuel tank front mounting bolts to 15-20 ft-lbs (20-27 Nm).

⚠WARNING

Exercise caution to avoid twisting the fuel supply line fitting, as any cracks in the plastic construction of the line can result in gas leaks. Gas leakage can cause fire or explosion which could result in death or serious injury.

5. Locate quick-connect fitting on left side of fuel tank. Pull up on chrome sleeve and insert neck of fuel supply line fitting. While pushing up on bottom of fitting, pull down on chrome sleeve until it “clicks” into the locked position.

⚠WARNING

To avoid an uncontrolled discharge or spray of gasoline, always be sure the quick-connect fitting is properly mated. A slight tug on the fuel supply line fitting will verify this condition. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

6. Connect fuel vapor vent tube to fitting on filler neck of fuel tank.
7. Mate pin and socket halves of 3-place Mini-Deutsch connector to install fuel tank harness at top of canopy.
8. Remove filler cap. Position console on canopy. Route cables from beneath console as shown in Figure 9-16. Be sure that hoses and wires are not pinched by the console during installation. Reinstall filler cap.
9. Install Allen head screw to fasten rear flange of console to clip nut on fuel tank weldment. Tighten screw to 25-30 **in-lbs** (2.8-3.4 Nm).
10. Open fuel door on console. Install two Allen head screws to secure front of console to clip nuts on canopy bracket. Alternately tighten screws to 25-30 **in-lbs** (2.8-3.4 Nm).
11. Snap anchor of **new** cable strap into hole on left side of frame backbone. Tighten cable strap capturing main harness bundles, console pod conduit (Ultra models only), fuel level sender/fuel pump conduit, and fuel vapor vent tube. Cut any excess cable strap material. See Figure 9-16.

NOTE

Route fuel overflow hose inboard of wire bundles on right side of frame, but do not capture in cable straps.

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. Install the 15 amp fuel pump fuse. See Figure 9-14. If necessary, see Section 9.2 ELECTRICAL BRACKET ASSEMBLY, EFI FUSES, INSTALLATION.
14. Install seat. See Section 2.22 SEAT, INSTALLATION.

FLHR/C/I

1. Remove wooden blocks and move fuel tank toward its installed position. While positioning fuel tank, move crossover hose in front of ignition coil. Work fuel tank into position aligning front flange holes with those in frame.
2. 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 15-20 ft-lbs (20-27 Nm).
4. Tighten fuel tank front mounting bolts to 15-20 ft-lbs (20-27 Nm).

⚠WARNING

Exercise caution to avoid twisting the fuel supply line fitting, as any cracks in the plastic construction of the line can result in gas leaks. Gas leakage can cause fire or explosion which could result in death or serious injury.

5. Locate quick-connect fitting on left side of fuel tank. Pull up on chrome sleeve and insert neck of fuel supply line fitting. While pushing up on bottom of fitting, pull down on chrome sleeve until it “clicks” into the locked position.

⚠WARNING

To avoid an uncontrolled discharge or spray of gasoline, always be sure the quick-connect fitting is properly mated. A slight tug on the fuel supply line fitting will verify this condition. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

6. Connect fuel vapor vent tube to fitting at top of canopy.
7. Mate pin and socket halves of 3-place Mini-Deutsch connector to connect main harness at top of canopy. Bend flexible clamp to capture conduit.

8. Slide head of console mounting bolt into slot at top of canopy. Align hole in console with mounting bolt and place into position over canopy.
9. Install acorn nut on mounting bolt and tighten to 50-90 **in-lbs** (5.7-10.2 Nm). Install Phillips screw (with large flat washer) and tighten to 36-60 **in-lbs** (4.1-6.8 Nm).
10. 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.
11. Snap anchor of **new** cable strap into hole on left side of frame backbone. Tighten cable strap capturing main harness bundle, instrument console conduit, and fuel vapor vent tube. Cut any excess cable strap material. See Figure 9-16.
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. Install the 15 amp fuel pump fuse. See Figure 9-14. If necessary, see Section 9.2 ELECTRICAL BRACKET ASSEMBLY, EFI FUSES, INSTALLATION.
14. Install seat. See Section 2.22 SEAT, INSTALLATION.

CONSOLE POD/CANOPY

FLHT/C/U/I, FLTRI

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 with a 5/16 inch (7.9 mm) 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 2.22 SEAT, REMOVAL.

⚠WARNING

The gasoline in the fuel supply line downstream of the fuel pump is under high pressure (58 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 line of high pressure gas. Proceed as follows:
   a. Remove the 15 amp fuel pump fuse. See Figure 9-14. If necessary, see Section 9.2 ELECTRICAL BRACKET ASSEMBLY, EFI FUSES, REMOVAL.
   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 bundle, console pod conduit (Ultra models only), fuel level sender/fuel pump conduit, and fuel vapor vent tube to left side of frame backbone.
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 clip nut on fuel tank weldment.
8. Lay a clean shop towel on forward part of rear fender.
9. Remove filler cap from neck of fuel tank. Remove console and lay upside down on shop towel. Reinstall filler cap.
10. At top of canopy, depress button on 3-place Mini-Deutsch connector to release fuel tank harness.
11. Gently pry fuel vapor vent tube from fitting on filler neck of fuel tank. Exercise caution to avoid pulling fitting from filler neck.
12. Using a T20 TORX bit, remove ten screws around the outer edge of the canopy. Discard screws.
13. Raise canopy slightly to access top fitting (inlet port) at back of fuel pressure regulator. Using a side cutters, cut hose clamp and remove convoluted tube. Exercise caution to avoid cutting or damaging tube or dropping pieces of cut clamp into fuel tank. See Figure 9-17.

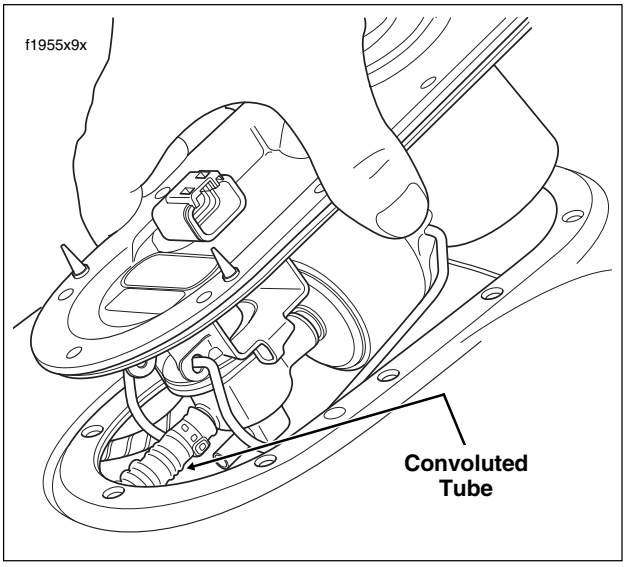


Figure 9-17. Raise Canopy and Remove Tube (FLHT/C/U/I, FLTRI)

14. Remove canopy from fuel tank (with attached fuel pressure regulator, fuel filter canister, fuel pump and fuel level sender).

    A spring-loaded hinge on the fuel pump bracket facilitates removal of the assembly. For best results, press down on top of fuel pump with index finger or end of screwdriver, and after raising canopy slightly, rotate on hinge in a counterclockwise direction. When canopy is at

    a 45˚ angle to top of fuel tank, carefully pull assembly from left side lobe of fuel tank. See Figure 9-19.

15. Remove and discard canopy gasket. Verify that sealing devices from screws are not lodged in canopy holes. Remove and discard devices if present.

INSTALLATION

1. Obtain **new** canopy gasket. With the locator bump on the gasket OD toward the front, position gasket at bottom of canopy. Start four nubs on gasket into holes in canopy. Moving to top of canopy, alternately grasp each nub and pull through hole.

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. While holding fuel pump stationary, raise canopy slightly and rotate on hinge 90˚ in a counterclockwise direction.

3. Holding assembly so that canopy is at a 45˚ angle to top of fuel tank, insert assembly into left side lobe of fuel tank. The spring-loaded hinge on the fuel pump bracket automatically returns assembly to its installed position inside 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. Raise canopy slightly and slide **new** hose clamp onto free end of convoluted tube. Install tube onto top fitting (inlet port) at back of fuel pressure regulator. Crimp clamp. See Figure 9-17.

⚠WARNING

Always use new screws when installing the canopy. 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.

NOTE

Check canopy screws for proper sealing devices. Screws must have a bonded seal on underside of head. Replace screws if seal is missing or damaged. See Figure 9-18.

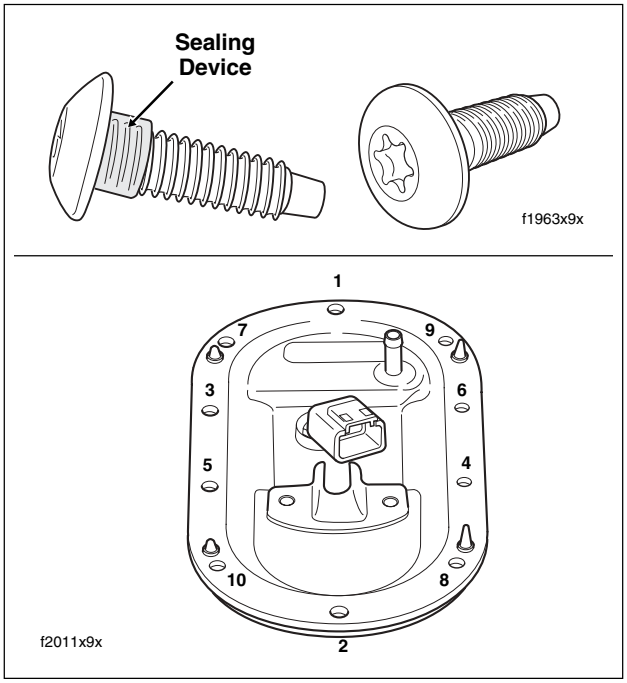


Figure 9-18. Canopy Sealing Screws and Torque Sequence

5. While pushing down on the canopy, align holes in canopy with those in fuel tank. Hand start ten **new** T20 TORX screws in perimeter of canopy. Tighten screws to 18-24 **in-lbs** (2.0-2.7 Nm) using the pattern shown in Figure 9-18.
6. Connect fuel vapor vent tube to fitting on filler neck of fuel tank.
7. Mate pin and socket halves of 3-place Mini-Deutsch connector to install fuel tank harness at top of canopy.
8. Remove filler cap. Position console on canopy. Route cables from beneath console as shown in Figure 9-16. Be sure that hoses and wires are not pinched by the console during installation. Reinstall filler cap.
9. Install Allen head screw to fasten rear flange of console to clip nut on fuel tank weldment. Tighten screw to 25-30 **in-lbs** (2.8-3.4 Nm).
10. Open fuel door on console. Install two Allen head screws to secure front of console to clip nuts on canopy bracket. Alternately tighten screws to 25-30 **in-lbs** (2.8-3.4 Nm).
11. Snap anchor of **new** cable strap into hole on left side of frame backbone. Tighten cable strap capturing main harness bundles, console pod conduit (Ultra models only), fuel level sender/fuel pump conduit, and fuel vapor vent tube. See Figure 9-16. Cut excess cable strap material.
12. 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.
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. Install the 15 amp fuel pump fuse. See Figure 9-14. If necessary, see Section 9.2 ELECTRICAL BRACKET ASSEMBLY, EFI FUSES, INSTALLATION.
15. Install seat. See Section 2.22 SEAT, INSTALLATION.

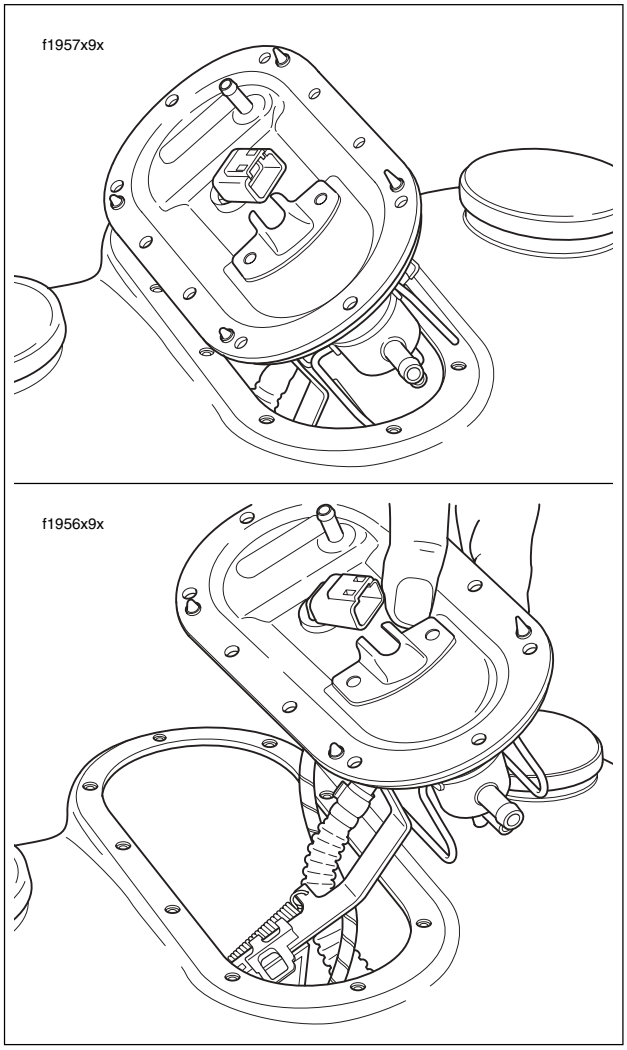


Figure 9-19. Remove Canopy From Vehicle (FLHR/C/I)

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 with a 5/16 inch (7.9 mm) 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 2.22 SEAT, REMOVAL.

⚠WARNING

The gasoline in the fuel supply line downstream of the fuel pump is under high pressure (58 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 line of high pressure gas. Proceed as follows:
   a. Remove the 15 amp fuel pump fuse. See Figure 9-14. If necessary, see Section 9.2 ELECTRICAL BRACKET ASSEMBLY, EFI FUSES, REMOVAL.
   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 bundle, instrument console conduit, and fuel vapor vent tube to left side of frame backbone.
6. Remove acorn nut and Phillips screw (with large flat washer) from instrument console.

CAUTION

When removing instrument console, exercise caution to avoid damaging speedometer unit. Wrap console in a clean, dry shop towel to prevent damage.

7. Remove console and secure to top of rear fender using bungee cords.
8. Remove console mounting bolt from slot at top of canopy.
9. Pull fuel vapor vent tube from fitting at top of canopy.
10. Bend back flexible clamp and then depress button on socket side of 3-place Mini-Deutsch connector to release main harness from canopy.
11. Using a T20 TORX bit, remove ten screws around the outer edge of the canopy. Discard screws.
12. Raise canopy slightly to access top fitting (inlet port) at back of fuel pressure regulator. Using a side cutters, cut hose clamp and remove convoluted tube. Exercise caution to avoid cutting or damaging tube or dropping pieces of cut clamp into fuel tank. See Figure 9-17.
13. Remove canopy from fuel tank (with attached fuel pressure regulator, fuel filter canister, fuel pump and fuel level sender).

    A spring-loaded hinge on the fuel pump bracket facilitates removal of the assembly. For best results, press down on top of fuel pump with index finger or end of screwdriver, and after raising canopy slightly, rotate on hinge in a counterclockwise direction. When canopy is at a 45˚ angle to top of fuel tank, carefully pull assembly from left side lobe of fuel tank. See Figure 9-19.
14. Remove and discard canopy gasket. Verify that sealing devices from screws are not lodged in canopy holes. Remove and discard devices if present.

INSTALLATION

1. Obtain **new** canopy gasket. With the locator bump on the gasket OD toward the front, position gasket at bottom of canopy. Start four nubs on gasket into holes in canopy. Moving to top of canopy, alternately grasp each nub and pull through hole.

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. While holding fuel pump stationary, raise canopy slightly and rotate on hinge 90˚ in a counterclockwise direction.
3. Holding assembly so that canopy is at a 45˚ angle to top of fuel tank, insert assembly into left side lobe of fuel tank keeping the float rod positioned to the right of the fuel gauge drain tube. The spring-loaded hinge on the fuel pump bracket automatically returns assembly to its installed position inside 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. Raise canopy slightly and slide **new** hose clamp onto free end of convoluted tube. Install tube onto top fitting (inlet port) at back of fuel pressure regulator. Crimp clamp. See Figure 9-17.

⚠WARNING

Always use new screws when installing the canopy. 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.

NOTE

Check canopy screws for proper sealing devices. Screws must have a bonded seal on underside of head. Replace screws if seal is missing or damaged. See Figure 9-18.

5. While pushing down on the canopy, align holes in canopy with those in fuel tank. Hand start ten **new** T20 TORX screws in perimeter of canopy. Tighten screws to 18-24 **in-lbs** (2.0-2.7 Nm) using the pattern shown in Figure 9-18.
6. Connect fuel vapor vent tube to fitting at top of canopy.
7. Mate pin and socket halves of 3-place Mini-Deutsch connector to connect main harness at top of canopy. Bend flexible clamp to capture conduit.
8. Slide head of console mounting bolt into slot. Align hole in console with mounting bolt and place into position over canopy.
9. Install acorn nut on mounting bolt and tighten to 50-90 **in-lbs** (5.7-10.2 Nm). Install Phillips screw (with large flat washer) and tighten to 36-60 **in-lbs** (4.1-6.8 Nm).
10. Snap anchor of **new** cable strap into hole on left side of frame backbone. Tighten cable strap capturing main harness bundle, instrument console conduit, and fuel vapor vent tube. Cut any excess cable strap material.
11. 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.
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. Install the 15 amp fuel pump fuse. See Figure 9-14. If necessary, see Section 9.2 ELECTRICAL BRACKET ASSEMBLY, EFI FUSES, INSTALLATION.
14. Install seat. See Section 2.22 SEAT, INSTALLATION.

FUEL FILTER CANISTER

Replace the fuel filter canister every 25,000 miles (40,000 km) . Proceed as follows:

REMOVAL

1. See CONSOLE POD/CANOPY, FLHT/C/U/I, FLTRI, REMOVAL, or INSTRUMENT CONSOLE/CANOPY, FLHR/C/I, REMOVAL.
2. Release fuel filter canister as follows:
   a. Pull wireform to release from slots on fuel filter canister bracket. See A of Figure 9-20.
   b. Use hinge to swing wireform out of the way. Move canister bracket forward to disengage tab from slot on canopy weldment. See B of Figure 9-20.
   c. Pull fitting on canister from fuel pressure regulator assembly. See C of Figure 9-20.

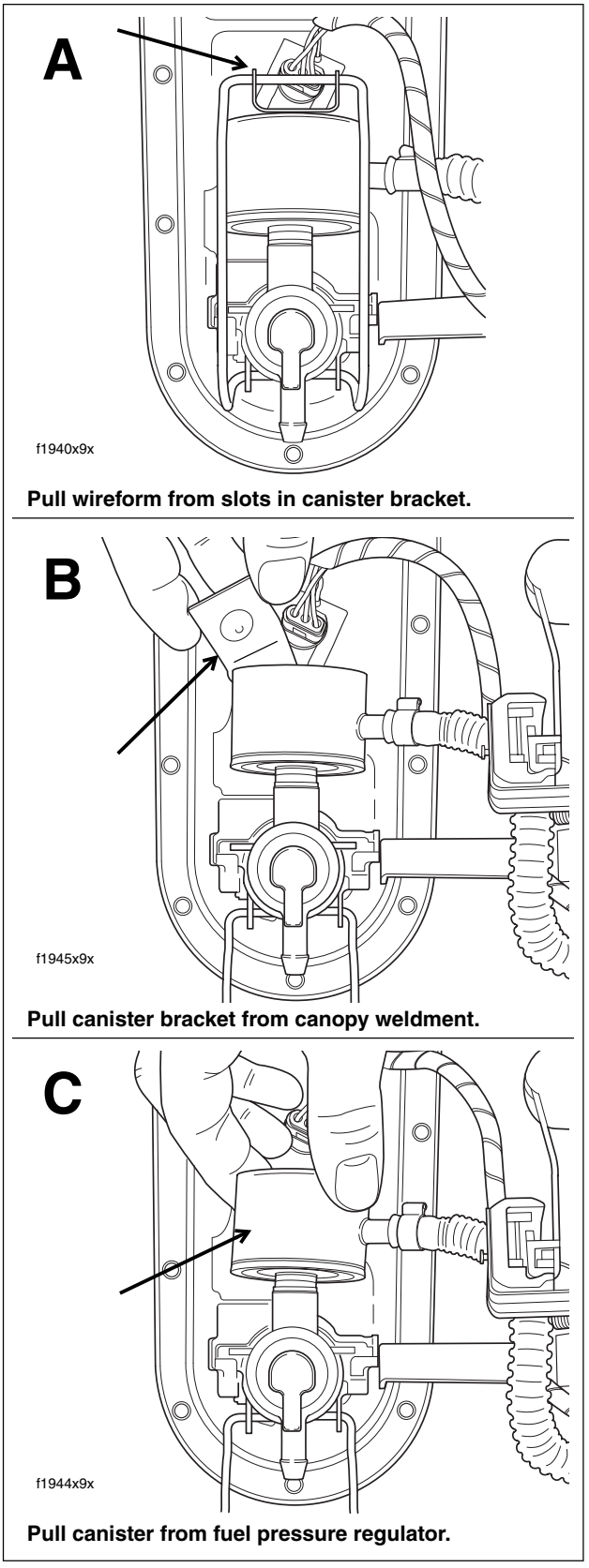


Figure 9-20. Remove Fuel Filter Canister (FLHR/C/I)

3. Using a side cutters, cut hose clamp and remove convoluted tube from inlet port at side of fuel filter canister. Exercise caution to avoid cutting or damaging tube. 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. Slide **new** hose clamp onto free end of convoluted tube (from fuel pump). Install tube onto inlet port at side of fuel filter canister. If necessary, use a little isopropyl alcohol or glass cleaner to aid installation. Crimp clamp.
3. Install fuel filter canister as follows:
   a. Install **new** O-ring onto fitting of fuel filter canister. Insert fitting into fuel pressure regulator assembly, so that inlet port is on fuel pump side. See C of Figure 9-20.
   b. Slide tab on canister bracket into slot of canopy weldment until bump on bracket engages depression at side of canister. See B of Figure 9-20.
   c. Use hinge to rotate wireform over canister bracket. Press on wireform until it fully engages slots on canister bracket. See A of Figure 9-20.

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. See CONSOLE POD/CANOPY, FLHT/C/U/I, FLTRI, INSTALLATION, or INSTRUMENT CONSOLE/CANOPY, FLHR/C/I, INSTALLATION.

FUEL PRESSURE REGULATOR

REMOVAL

1. See CONSOLE POD/CANOPY, FLHT/C/U/I, FLTRI, REMOVAL, or INSTRUMENT CONSOLE/CANOPY, FLHR/C/I, REMOVAL.
2. See FUEL FILTER CANISTER, REMOVAL, step 2.

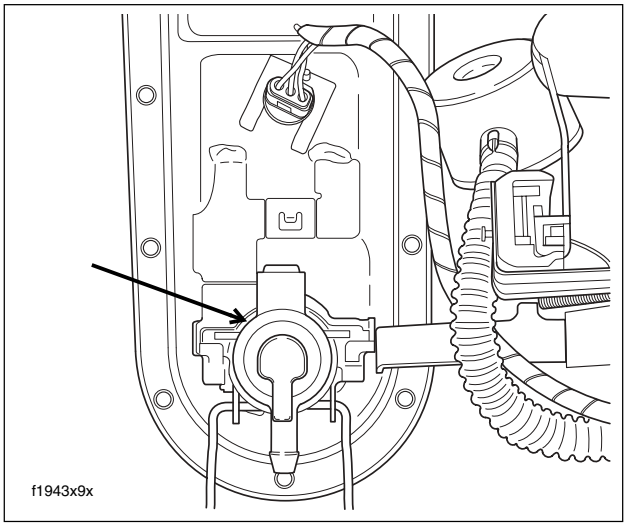


Figure 9-21. Remove Fuel Pressure Regulator (FLHR/C/I)

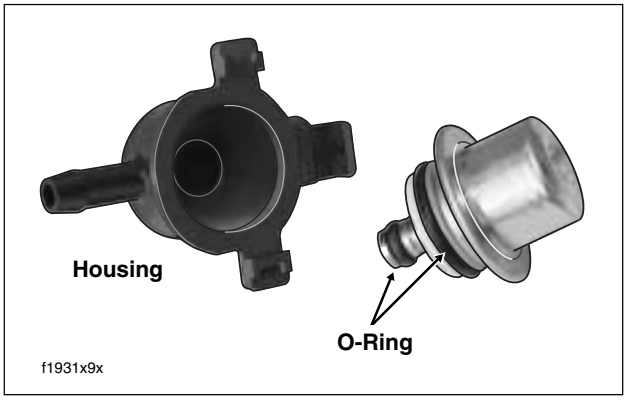


Figure 9-22. Fuel Pressure Regulator Assembly

3. Slide fuel pressure regulator assembly forward to free arms from catches on canopy weldment. See Figure 9-21.
4. Remove fuel pressure regulator from housing. To overcome the resistance of two O-rings, insert blade of small screwdriver into gap between regulator and housing and gently pry regulator out. See Figure 9-22.
5. Inspect O-rings for cuts, tears or general deterioration. Replace the O-rings if they have taken a definite set.

INSTALLATION

1. Apply a thin coat of clean engine oil to **new** O-rings. Install O-rings in grooves of fuel pressure regulator. See Figure 9-22.
2. Install fuel pressure regulator into housing.
3. Fit fuel pressure regulator assembly into canopy weldment engaging arms in catches. See Figure 9-21.

4. See FUEL FILTER CANISTER, INSTALLATION, step 3.
5. See CONSOLE POD/CANOPY, FLHT/C/U/I, FLTRI, INSTALLATION, or INSTRUMENT CONSOLE/CANOPY, FLHR/C/I, INSTALLATION.

FUEL PUMP

REMOVAL

1. See CONSOLE POD/CANOPY, FLHT/C/U/I, FLTRI, REMOVAL, or INSTRUMENT CONSOLE/CANOPY, FLHR/C/I, REMOVAL.
2. Depress external latch and remove electrical connector at top of fuel pump.
3. 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).
4. Remove T15 TORX screw and pull fuel level sender from post on fuel pump bracket.
5. Release end of return spring from hook on fuel pump bracket.

CAUTION

Be absolutely certain fuel pump is faulty before removing hinge from support arm. Hinge is damaged during removal and requires replacement of the fuel pump and bracket assembly.

6. Insert flat tip screwdriver at location shown in Figure 9-23. Carefully crack plastic webbing at top of hinge and remove from support arm. Discard fuel pump and bracket assembly.
7. Inspect the condition of the fuel pump wiring. If the wiring needs to be replaced, see FUEL PUMP/FUEL LEVEL SENDER WIRING on this page.

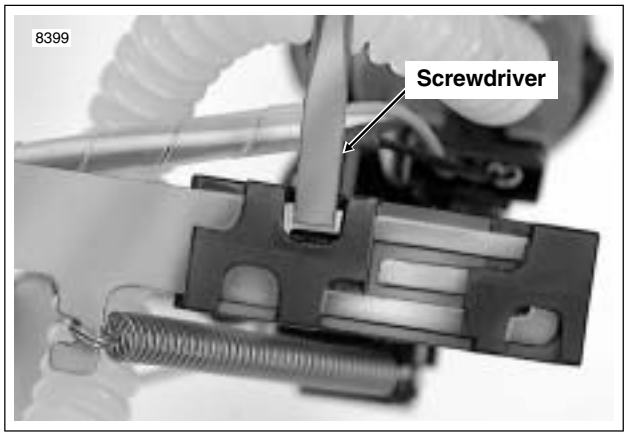


Figure 9-23. Crack Hinge to Remove From Support Arm

INSTALLATION

1. Obtain **new** fuel pump and bracket assembly. Install **new** hinge at top of fuel pump bracket, so that opening of support arm slot is on the fuel level sender mount side.
2. Slide end of support arm into slot at top of hinge. Pull on hinge to verify that it is locked by pin on support arm. Install free end of return spring onto hook on fuel pump bracket.

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 (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.
4. 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.
5. Align two holes in fuel level sender with threaded hole and post on fuel pump bracket. Install T15 TORX screw in upper hole and tighten to 25-35 **in-lbs** (2.8-4.0 Nm).
6. See CONSOLE POD/CANOPY, FLHT/C/U/I, FLTRI, INSTALLATION, or INSTRUMENT CONSOLE/CANOPY, FLHR/C/I, INSTALLATION.

FUEL PUMP/FUEL LEVEL SENDER WIRING

CAUTION

Do not replace the special teflon coated fuel pump/fuel level sender wiring with ordinary bulk wire. Ordinary insulation materials may deteriorate when in contact with gasoline.

NOTE

Damaged fuel pump and/or fuel level sender wiring requires replacement of the fuel level sender unit. See FUEL LEVEL SENDER on this page.

FUEL LEVEL SENDER

REMOVAL

1. See CONSOLE POD/CANOPY, FLHT/C/U/I, FLTRI, REMOVAL, or INSTRUMENT CONSOLE/CANOPY, FLHR/C/I, REMOVAL.

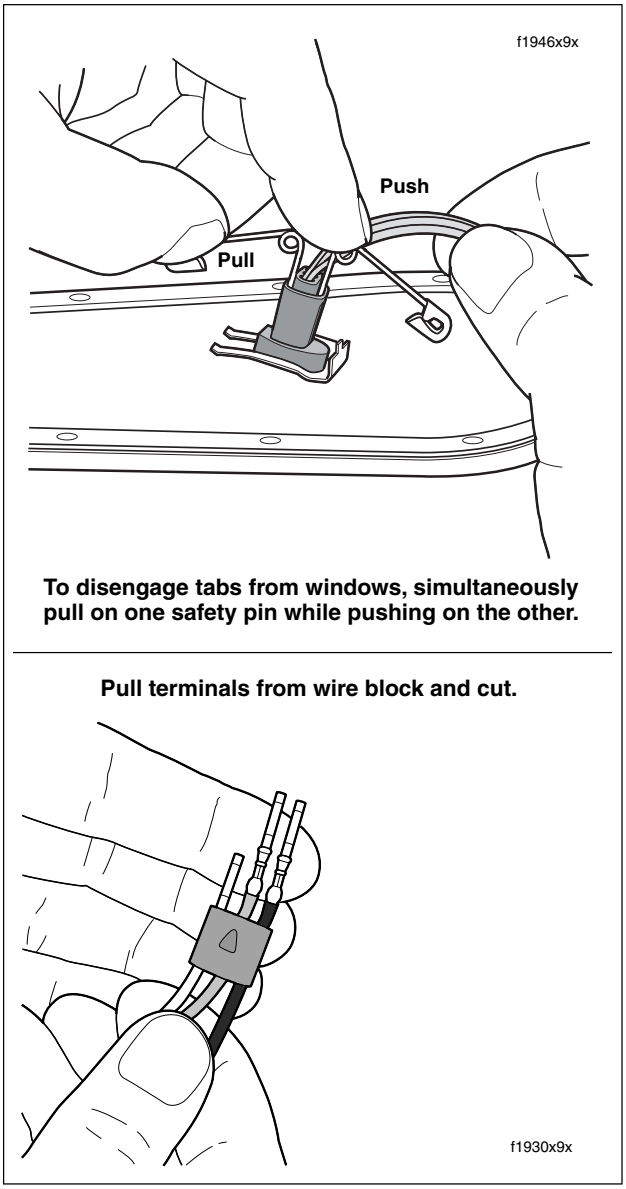


Figure 9-24. Remove Wire Block and Cut Terminals

2. If present, cut cable strap to release wiring at bottom of support arm.
3. Unwind spiral tubing from fuel pump and fuel level sender wiring.
4. Depress external latch and remove electrical connector at top of fuel pump.
5. At bottom of canopy, remove socket terminal from spade contact on connector clip.
6. Remove T15 TORX screw and pull fuel level sender from post on fuel pump bracket.
7. Remove socket terminals from 3-place Mini-Deutsch connector on canopy. Proceed as follows:

NOTE

For additional clearance, pull wireform to release from slots on fuel filter canister bracket, and then use hinge to swing wireform out of the way. Move canister bracket forward to disengage tab from slot on canopy weldment. Remove socket terminal from spade contact on connector clip.

   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 9-24. With tabs released, gently tug on wires to release wire block from connector body.
   c. Pull the wire socket terminals out of the wire block. See lower frame of Figure 9-24. Cut off the socket terminals and back the wires 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 terminals of **new** wiring into wire block. Take note of the table below for wire locations.

Table 9-2. Fuel Tank Harness Connector [141], 3-Place Mini-Deutsch

Chamber	Wire Color	Function
1	Orange	Pump Power
2	Yellow	Sender Output
3	Black	Ground

NOTE

A series of dots are molded 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. Install socket terminal onto spade contact on connector clip.
4. Align two holes in fuel level sender with threaded hole and post on fuel pump bracket. Install T15 TORX screw in upper hole and tighten to 25-35 **in-lbs** (2.8-4.0 Nm).

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. Wind spiral tubing around fuel pump (and fuel level sender) wiring.
7. Install **new** cable strap capturing wiring at bottom of support arm. Cut any excess cable strap material.
8. See CONSOLE POD/CANOPY, FLHT/C/U/I, FLTRI, INSTALLATION, or INSTRUMENT CONSOLE/CANOPY, FLHR/C/I, INSTALLATION.

CANOPY CONNECTOR/O-RING

REMOVAL

1. See CONSOLE POD/CANOPY, FLHT/C/U/I, FLTRI, REMOVAL, or INSTRUMENT CONSOLE/CANOPY, FLHR/C/I, REMOVAL.
2. At bottom of canopy, remove socket terminal from spade contact on connector clip.
3. Remove wire block from connector body as described under FUEL LEVEL SENDER, REMOVAL, steps 7(a)-7(b), on the previous page.
4. Slide connector clip from slots on connector body. Remove connector body from canopy.
5. 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. Install socket terminal onto spade contact on connector clip.
5. See CONSOLE POD/CANOPY, FLHT/C/U/I, FLTRI, INSTALLATION, or INSTRUMENT CONSOLE/CANOPY, FLHR/C/I, INSTALLATION.

FUEL SUPPLY CHECK VALVE/TUBE

NOTE

The in-tank check valve is housed in the quick-connect fitting. The check valve prevents the fuel tank from draining when the external supply line is disconnected.

REMOVAL

1. See CONSOLE POD/CANOPY, FLHT/C/U/I, FLTRI, REMOVAL, steps 1-13, or INSTRUMENT CONSOLE/CANOPY, FLHR/C/I, REMOVAL, steps 1-12.

⚠WARNING

A small amount of gasoline may drain from the fuel supply line 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.

⚠WARNING

Exercise caution to avoid twisting the fuel supply line fitting, as any cracks in the plastic construction of the line can result in gas leaks. Gas leakage can cause fire or explosion which could result in death or serious injury.

2. Locate quick-connect fitting on left side of fuel tank. Pull up on chrome sleeve and pull down on fuel supply line fitting to disconnect. See Figure 9-15.

⚠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. Slide a 7/8 inch deepwell socket over chrome sleeve engaging hex on quick-connect fitting. See Figure 9-25. 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 and into groove of **new** quick-connect fitting. See Figure 9-25.
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.

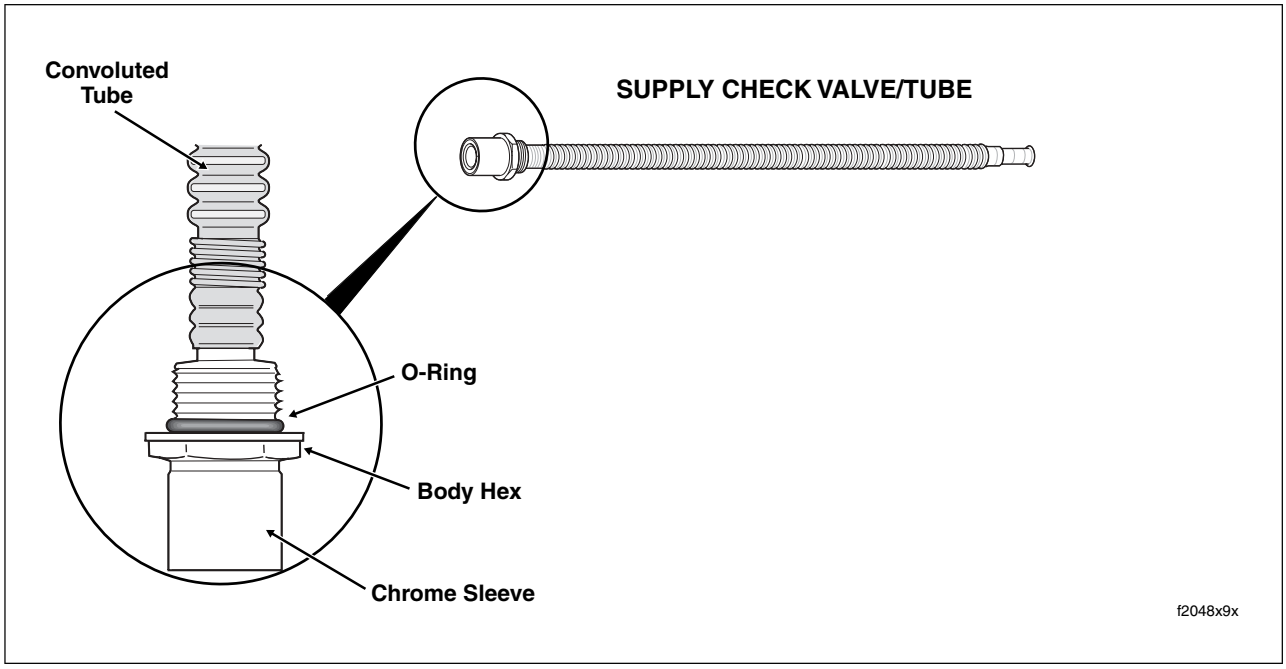


Figure 9-25. Supply Check Valve (Quick-Connect Fitting)

3. Slide a 7/8 inch deepwell socket over chrome sleeve engaging hex on quick-connect fitting. Tighten fitting to 22-26 ft-lbs (29.8-35.3 Nm).

⚠WARNING

Exercise caution to avoid twisting the fuel supply line fitting, as any cracks in the plastic construction of the line can result in gas leaks. Gas leakage can cause fire or explosion which could result in death or serious injury.

4. Pull up on chrome sleeve of quick-connect fitting and insert neck of fuel supply line fitting. While pushing up on bottom of fitting, pull down on chrome sleeve until it "clicks" into the locked position.

⚠WARNING

To avoid an uncontrolled discharge or spray of gasoline, always be sure the quick-connect fitting is properly mated. A slight tug on the fuel supply line fitting will verify this condition. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

5. See CONSOLE POD/CANOPY, FLHT/C/U/I, FLTRI, INSTALLATION, steps 4-15, or INSTRUMENT CONSOLE/CANOPY, FLHR/C/I, INSTALLATION, steps 4-14.

INDUCTION MODULE ASSEMBLY 9.5

GENERAL

See Figure 9-26. The Induction Module Assembly consists of the following components:

- Induction Module
- Fuel Supply Line
- Fuel Rail/Fuel Supply Tube
- Fuel Injectors
- Intake Air Temperature Sensor
- Throttle Position Sensor
- Manifold Absolute Pressure Sensor
- Idle Air Control

INDUCTION MODULE

REMOVAL

1. Partially remove fuel tank. See Section 9.4 FUEL TANK (FUEL INJECTED), PARTIAL REMOVAL, either FLHT/C/U/I, FLTRI or FLHR/C/I.
2. Remove air cleaner and backplate. See Section 4.5 AIR CLEANER, REMOVAL.
3. Pull purge tube from fitting at top of induction module (California models only). See Figure 9-26.
4. Using a needle nose pliers, carefully pull idle cable barrel from upper hole in throttle wheel. Pull throttle cable barrel from lower hole. Using slots, release idle and throttle cables from guides in throttle cable bracket.
5. On cruise control equipped models, remove E-clip from sleeve at end of cruise cable housing. Using slot, remove cable housing from cable guide in throttle cable bracket. Push the plastic end fitting on the cruise cable to the outboard side to release from wheel pin. See Figure 9-27.
6. Remove idle air control and manifold absolute pressure sensor connectors. Pull external latch(es) outward and use rocking motion to separate pin and socket halves.
7. Depress wire form to remove electrical connectors from front and rear fuel injectors.
8. Remove throttle position sensor and intake air temperature sensor connectors.

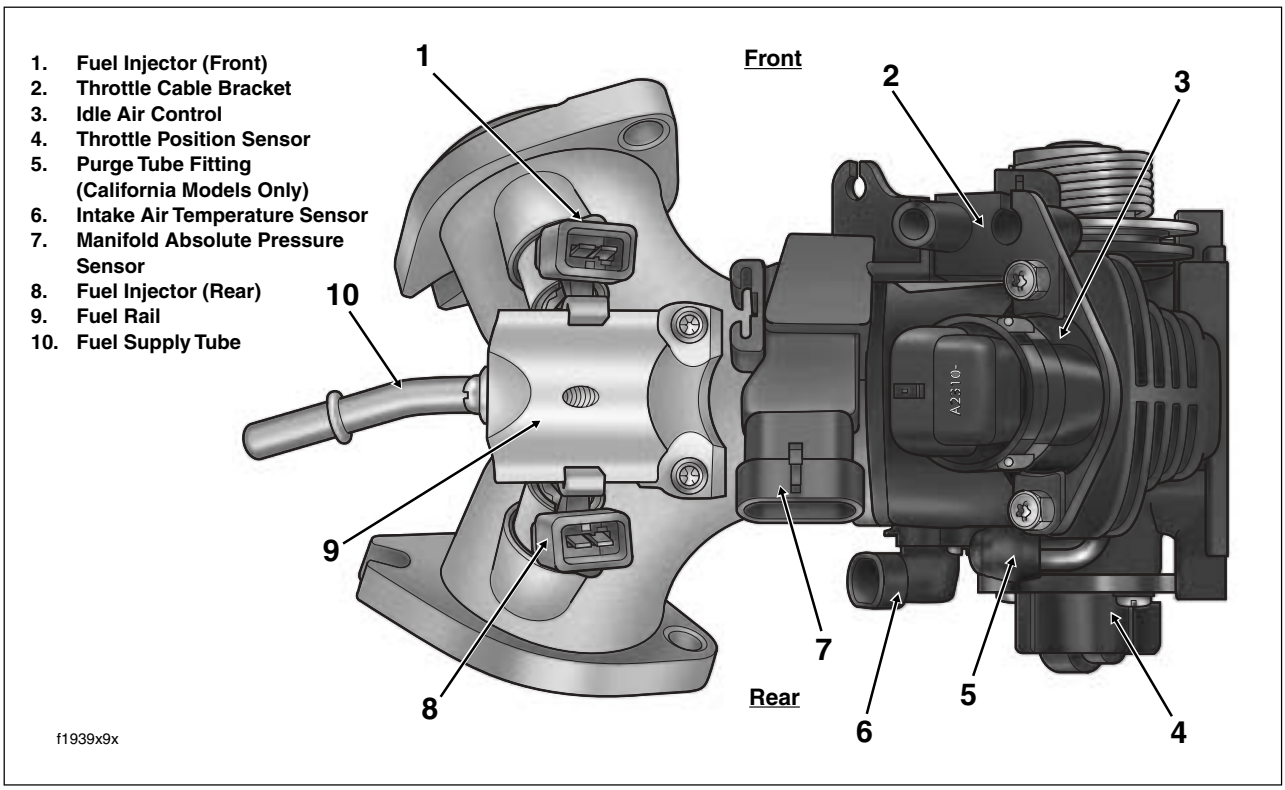


Figure 9-26. Induction Module Assembly

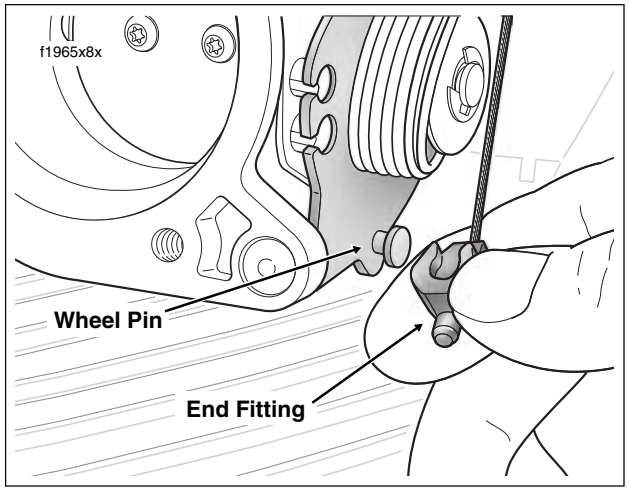


Figure 9-27. Remove End Fitting From Wheel Pin

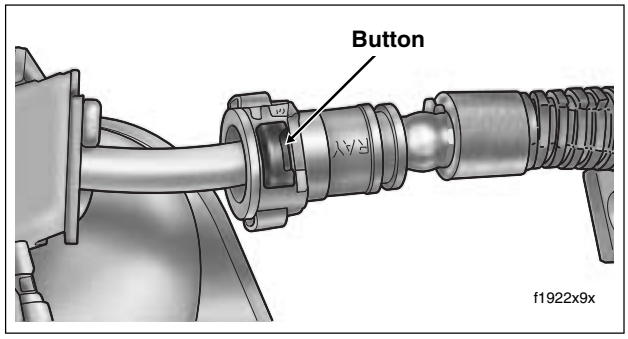


Figure 9-28. Remove Fuel Supply Line From Supply Tube

9. Remove right side 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.
10. Moving to opposite side of vehicle, just loosen left side allen head socket screws from flange adapters. Slots in flanges make removal of left side screws unnecessary. To better access bolts, loosen acorn nut and swing horn assembly out of the way.
11. Slide induction module out from right side of vehicle. Use caution around horn bracket to prevent damage to fuel line.

⚠WARNING

A small amount of gasoline will drain from the fuel supply line when disconnected from the supply tube. 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.

12. Depress button on inboard side of fuel supply line and remove from supply tube. See Figure 9-28.
13. Remove seals from flange adapters. Discard seals. Remove flange adapters from outlet ports of induction module.
14. If it should become necessary to split the induction module, that is, separate the throttle body from the intake manifold, proceed as follows:
    a. Remove top and bottom T20 TORX screws to separate intake manifold and throttle body flanges.
    b. Remove O-ring from counterbore of throttle body flange. Discard O-ring.

INSTALLATION

1. If induction module was split, assemble the intake manifold and throttle body as follows:
    a. Apply a thin coat of clean engine oil to **new** O-ring. Install O-ring in counterbore of throttle body flange. Mate intake manifold and throttle body flanges.
    b. Apply Loctite Wicking Threadlocker 290 (green) to threads of two T20 TORX screws. Install screws and alternately tighten to 27-33 **in-lbs** (3.1-3.7 Nm). Allow approximately 3-6 hours to elapse for compound to cure.
2. Slide fuel supply line onto tube at top of induction module. A slight tug will verify that the line is locked in place.
3. Orientate the induction module as shown in Figure 9-26. With the counterbore facing outward, slide cylinder head flange adapters onto outlet ports of induction module. The flange adapters are not interchangeable. Look next to the slotted bolt hole for a stamp that indicates F(ront) and R(ear) cylinder.
4. Place a **new** seal in each flange adapter with the beveled side in against the counterbore.
5. Standing on right side of engine, slide induction module toward installed position so that open-ended slots on flange adapters begin to engage allen head socket screws loosely installed on left side. Use caution around horn bracket to prevent damage to fuel line.
6. Install sleeve on throttle cable housing into shorter cable guide at top of throttle cable bracket. Drawing throttle cable downward, fit barrel end into lower hole in throttle wheel. Install sleeve and spring on idle cable housing into longer cable guide at bottom of throttle cable bracket inserting barrel end into upper hole in throttle wheel.
7. On cruise control equipped models, slide groove in cruise cable end fitting over cap of wheel pin. Push on end fitting until it snaps in place. Using slot, slip cruise cable housing into cable guide in throttle cable bracket. Install **new** E-clip on sleeve at end of cruise cable housing.
8. 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.

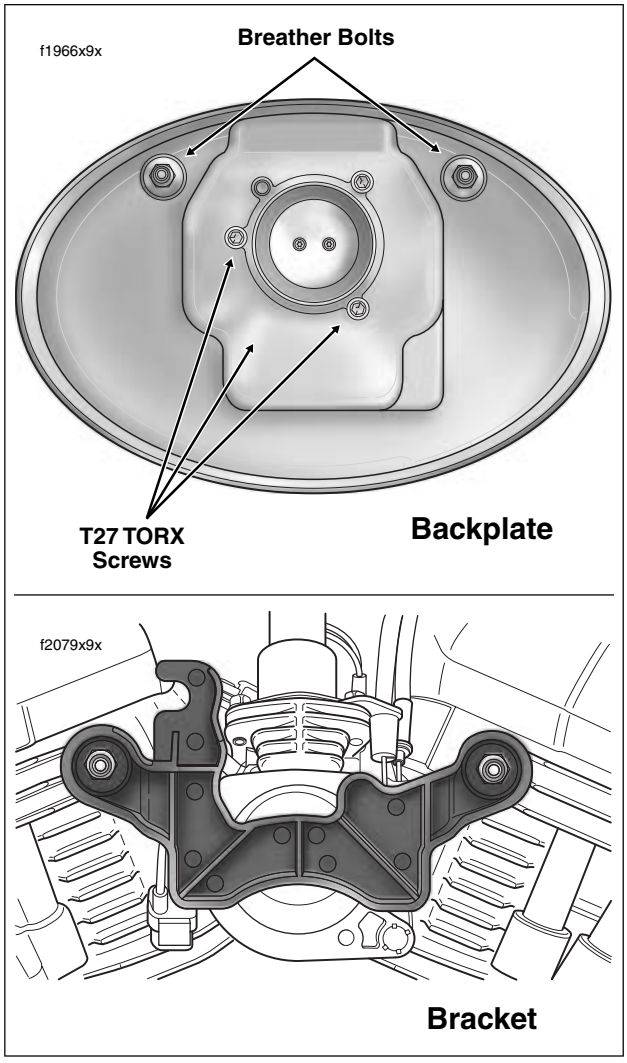


Figure 9-29. Install Backplate or Bracket

9. Use the air cleaner backplate or INDUCTION SYSTEM ALIGNMENT BRACKET (P&A Part No. 40054-01) to properly locate induction module. Proceed as follows:
   a. **Backplate**: Install two breather bolts to fasten backplate to front and rear cylinder heads. Install three T27 TORX screws to secure backplate to face of induction module. See upper frame of Figure 9-29.
   b. **Alignment bracket**: Fitting pins on inboard side into holes in face of induction module, install two breather bolts to fasten bracket to front and rear cylinder heads. See lower frame of Figure 9-29.
10. Tighten allen head socket screw in fixed holes of flange adapters until snug. Moving to left side of engine, tighten screws in slotted holes to 96-144 **in-lbs** (10.9-16.3 Nm). If moved, swing horn assembly back into position and tighten acorn nut.
11. Remove breather bolts and T27 TORX screws to remove backplate, if installed.
12. Tighten allen head socket screws in fixed holes of flange adapters to 96-144 **in-lbs** (10.9-16.3 Nm).
13. Remove breather bolts to remove alignment bracket, if installed.
14. Install electrical connectors on fuel injectors.
15. Install manifold absolute pressure sensor and idle air control connectors.
16. Install intake air temperature sensor and throttle position sensor connectors.
17. Connect purge tube to fitting at top of induction module (California models only). See Figure 9-26.
18. Install fuel tank. See Section 9.4 FUEL TANK (FUEL INJECTED), INSTALLATION (AFTER PARTIAL REMOVAL), FLHT/C/U/I, FLTRI, or FLHR/C/I.
19. Install backplate and air cleaner. See Section 4.5 AIR CLEANER, INSTALLATION.
20. Check throttle and idle control cable adjustment. Check cruise cable adjustment.

FUEL SUPPLY LINE

⚠WARNING

The gasoline in the fuel supply line downstream of the fuel pump is under high pressure (58 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 9.4 FUEL TANK (FUEL INJECTED), PARTIAL REMOVAL, FLHT/C/U/I, FLTRI, or FLHR/C/I.

⚠WARNING

A small amount of gasoline will drain from the fuel supply line 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 valve in the fuel tank fitting impedes any further fuel seepage once external fuel line has drained.

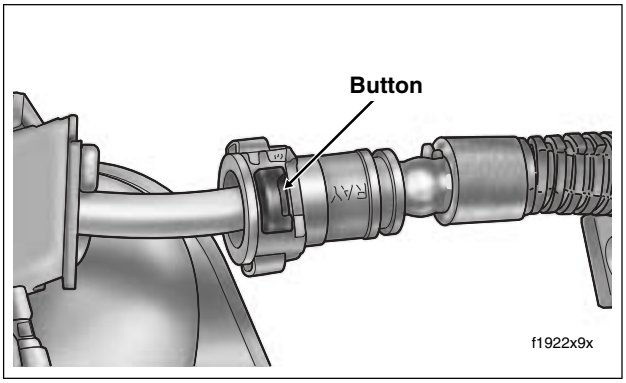


Figure 9-30. Remove Fuel Supply Line From Supply Tube

2. Pull up on chrome sleeve of quick-connect fitting on left side of fuel tank and pull down on fuel supply line to disconnect. See Figure 9-27.
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.

⚠WARNING

A small amount of gasoline will drain from the fuel supply line when disconnected from the supply tube at the top of 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.

5. Depress button on inboard side of fuel supply line and remove from supply tube. See Figure 9-30.

INSTALLATION

1. Slide fuel supply line onto tube at top of induction module. A slight tug will verify that the line is locked in place. See Figure 9-30.
2. Pull up on chrome sleeve of quick-connect 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.
3. Install fuel tank. See Section 9.4 FUEL TANK (FUEL INJECTED), INSTALLATION (AFTER PARTIAL REMOVAL), FLHT/C/U/I, FLTRI, or FLHR/C/I.

FUEL RAIL/FUEL SUPPLY TUBE

REMOVAL

1. See INDUCTION MODULE, REMOVAL, in this section.
2. Depress button on inboard side of fuel supply line and remove from fuel supply tube. See Figure 9-30.
3. Using a T20 TORX drive head, remove screw to release fuel supply tube clamp. See Figure 9-31.
4. Gently pull fuel supply tube from fuel rail. Remove sealing washer from end of fuel supply tube. Remove O-ring from fuel rail bore. Discard sealing washer and O-ring.

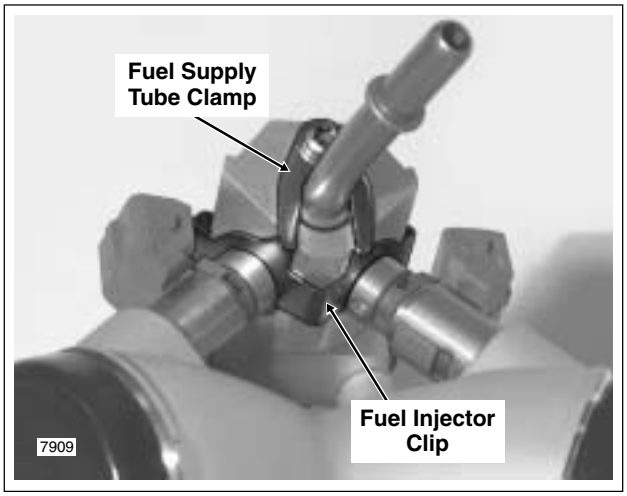


Figure 9-31. Remove Fuel Supply Tube Clamp and Fuel Injector Clip

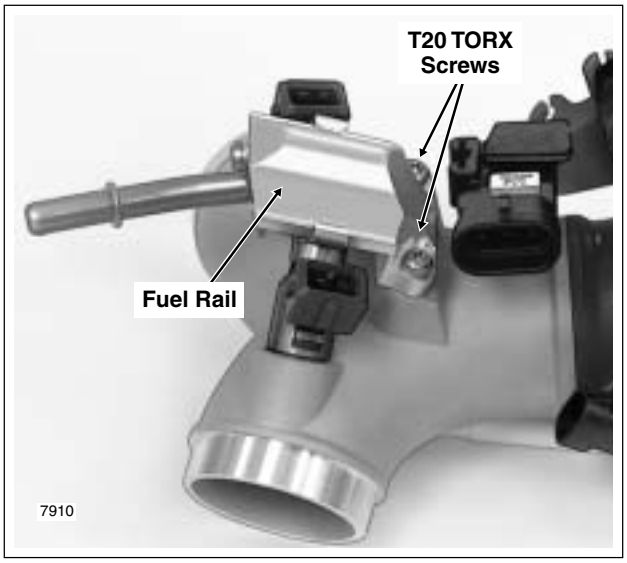


Figure 9-32. Remove Fuel Rail

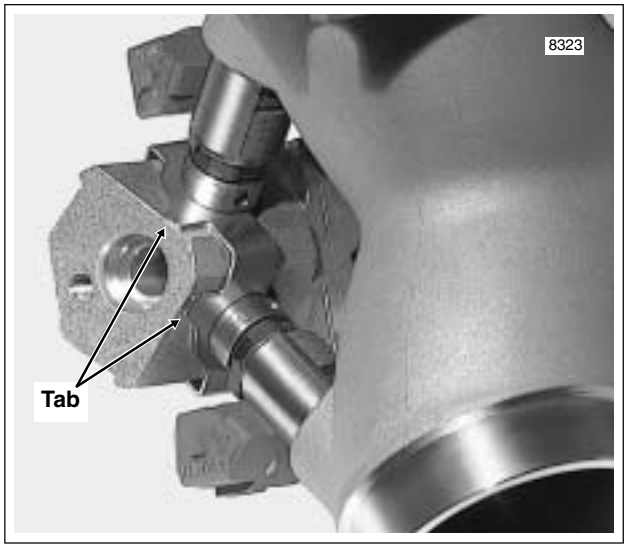


Figure 9-33. Install Fuel Injector Clip

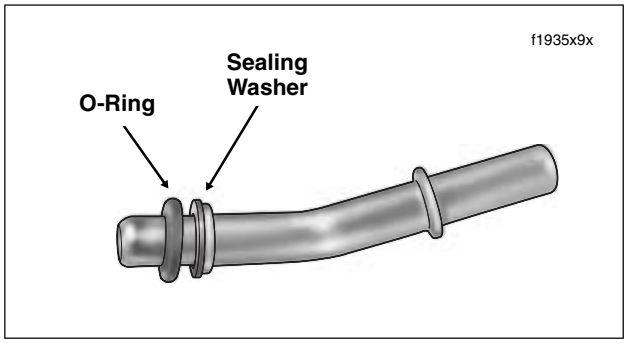


Figure 9-34. Install Fuel Supply Tube

5. Slide fuel injector clip toward left side of induction module (intake manifold side) to release from fuel rail.
6. Using a T20 TORX drive head, remove two screws to release fuel rail from induction module. See Figure 9-32.
7. Pull fuel rail with attached fuel injectors from induction module. To overcome the resistance of the bottom O-ring on both fuel injectors, gently rock assembly back and forth while pulling.
8. Pull fuel injectors from fuel rail. To overcome the resistance of the top O-ring, gently rock each fuel injector while pulling.
9. Remove O-rings from fuel injectors. Discard O-rings. See Figure 9-35.

INSTALLATION

1. Apply a thin coat of clean engine oil to **new** injector O-rings. Install O-rings on fuel injectors. See Figure 9-35.
2. With the electrical connector topside, push fuel injectors into induction module bores. Rotate fuel injectors, so that the electrical connectors are on the outboard side.
3. Push fuel rail over fuel injectors until fuel rail flange contacts boss on induction module.
4. Slide fuel injector clip onto fuel rail until clip fully engages groove in each fuel injector. Full engagement occurs when the tabs on both sides of the clip are flush with the left side edge of the fuel rail. See Figure 9-33.
5. Using a T20 TORX drive head, install two screws to fasten fuel rail to induction module. Alternately tighten screws to 18 **in-lbs** (2.0 Nm). See Figure 9-32.
6. Note the collar on each end of the fuel supply tube. Slide a **new** sealing washer down the shorter neck until it contacts the collar. Slide a **new** o-ring down the tube until it contacts the sealing washer. See Figure 9-34. Push tube into fuel rail bore until collar is flush with casting.
7. Align hole in fuel supply tube clamp with hole in fuel rail. Using a T20 TORX drive head, install screw and tighten to 18 **in-lbs** (2.0 Nm). See Figure 9-31. Rotate fuel supply tube so that it angles downward.
8. See INDUCTION MODULE, INSTALLATION, in this section.

FUEL INJECTORS

REMOVAL

1. See INDUCTION MODULE, REMOVAL, in this section.
2. Depress button on inboard side of fuel supply line and remove from fuel supply tube. See Figure 9-30.
3. Using a T20 TORX drive head, remove screw to release fuel supply tube clamp. See Figure 9-31.
4. Slide fuel injector clip toward left side of induction module (intake manifold side) to release from fuel rail.
5. Using a T20 TORX drive head, remove two screws to release fuel rail from induction module. See Figure 9-32.

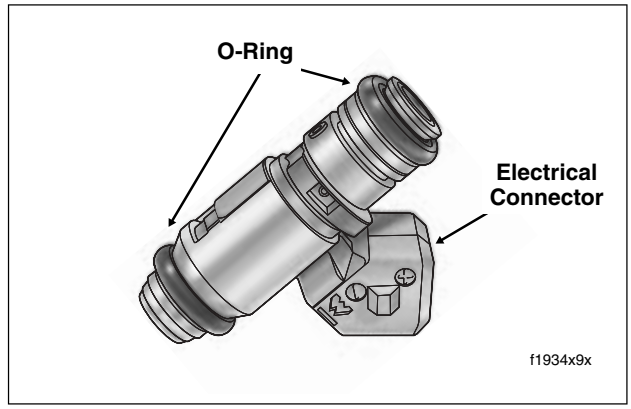


Figure 9-35. Fuel Injector

6. Pull fuel rail with attached fuel injectors from induction module. To overcome the resistance of the bottom O-ring on both fuel injectors, gently rock assembly back and forth while pulling.
7. Pull fuel injectors from fuel rail. To overcome the resistance of the top O-ring, gently rock each fuel injector while pulling.
8. Remove O-rings from fuel injectors. Discard O-rings. See Figure 9-35.

INSTALLATION

1. Apply a thin coat of clean engine oil to **new** injector O-rings. Install O-rings on fuel injectors. See Figure 9-35.
2. With the electrical connector topside, push fuel injectors into induction module bores. Rotate fuel injectors, so that the electrical connectors are on the outboard side.
3. Push fuel rail over fuel injectors until fuel rail flange contacts boss on induction module.
4. Slide fuel injector clip onto onto fuel rail until clip fully engages groove in each fuel injector. Full engagement occurs when the tabs on both sides of the clip are flush with the left side edge of the fuel rail.
5. Using a T20 TORX drive head, install two screws to fasten fuel rail to induction module. Alternately tighten screws to 18 **in-lbs** (2.0 Nm). See Figure 9-32.
6. Align hole in fuel supply tube clamp with hole in fuel rail. Using a T20 TORX drive head, install screw and tighten to 18 **in-lbs** (2.0 Nm). See Figure 9-31. Rotate fuel supply tube so that it angles downward.
7. See INDUCTION MODULE, INSTALLATION, in this section.

INTAKE AIR TEMPERATURE SENSOR

REMOVAL

1. Remove seat. See Section 2.22 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 and backplate. See Section 4.5 AIR CLEANER, REMOVAL.
4. Disconnect the intake air temperature sensor connector. See Figure 9-36. Pull external latches outward and use a rocking motion to separate pin and socket halves.

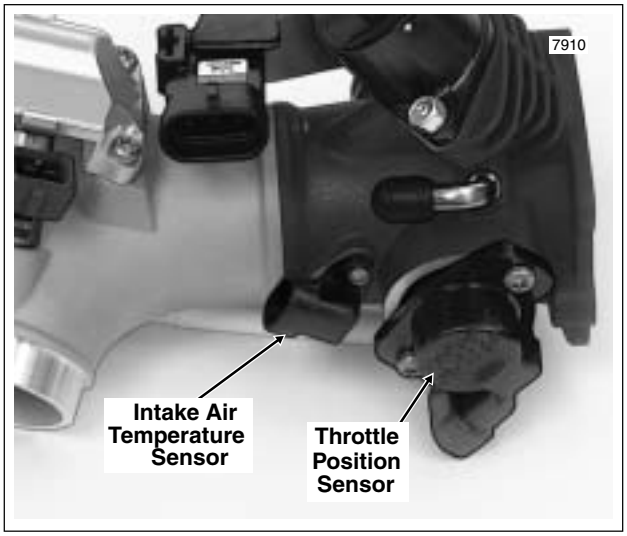


Figure 9-36. Induction Module (Rear View)

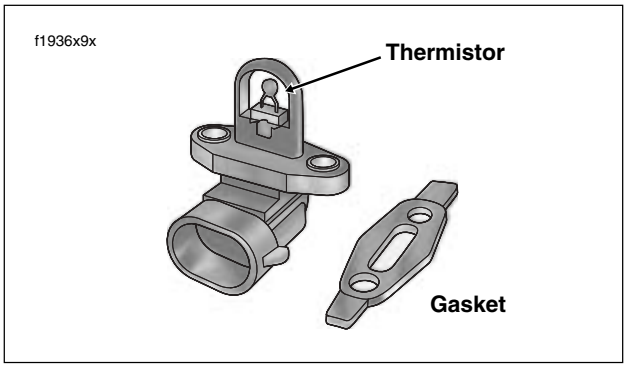


Figure 9-37. Intake Air Temperature Sensor

5. Using a T10 TORX drive head, remove two screws to release intake air temperature sensor from induction module. See Figure 9-36.
6. Remove and discard gasket.

INSTALLATION

1. Place **new** gasket on flange of intake air temperature sensor.
2. Insert sensor into induction module with electrical connector facing toward the left side of the vehicle. See Figure 9-36.
3. Using a T10 TORX drive head, install two screws to secure intake air temperature sensor to induction module. Alternately tighten screws to 12 **in-lbs** (1.4 Nm). See Figure 9-36.
4. Install the intake air temperature sensor connector.
5. Install backplate and air cleaner. See Section 4.5 AIR CLEANER, INSTALLATION.

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 2.22 SEAT, INSTALLATION.

THROTTLE POSITION SENSOR

REMOVAL

1. Remove seat. See Section 2.22 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 and backplate. See Section 4.5 AIR CLEANER, REMOVAL.
4. Disconnect the throttle position sensor connector. See Figure 9-36. Pull external latch outward and use a rocking motion to separate pin and socket halves.
5. Using a T20 TORX drive head, remove two screws to release sensor from induction module. See Figure 9-36.

INSTALLATION

1. With electrical connector facing down, fit pocket of throttle position sensor over throttle shaft.
2. Align holes in flange of throttle position sensor with holes in induction module. It may be necessary to turn the sensor slightly to align holes.
3. Using a T20 TORX drive head, install two screws to secure throttle position sensor to induction module. Alternately tighten screws to 18 **in-lbs** (2.0 Nm). See Figure 9-36.
4. 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.
5. Install the throttle position sensor connector.
6. Install backplate and air cleaner. See Section 4.5 AIR CLEANER, INSTALLATION.
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 2.22 SEAT, INSTALLATION.

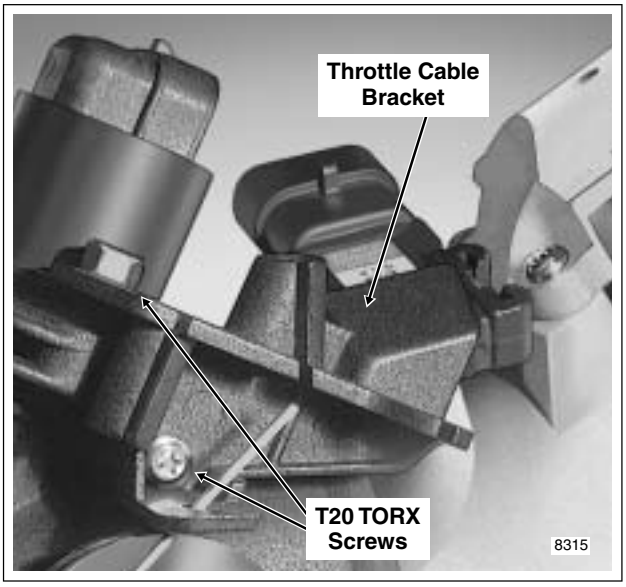


Figure 9-38. Remove Screws to Release Bracket

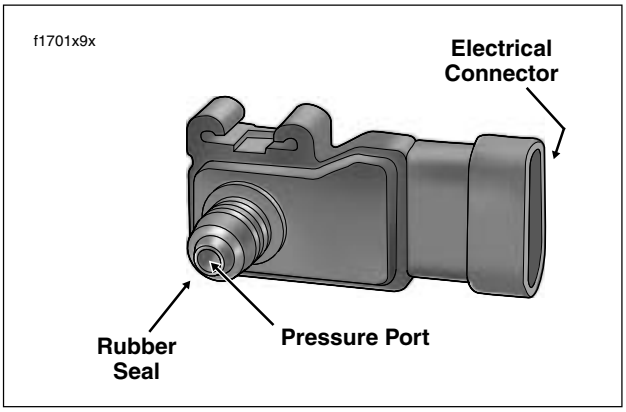


Figure 9-39. Manifold Absolute Pressure Sensor

MANIFOLD ABSOLUTE PRESSURE SENSOR

REMOVAL

⚠WARNING

The screw securing the throttle cable bracket and idle air control flange to the induction module has a loctite patch that may make it very difficult to remove. Since a heat gun may be needed to break down the loctite, remove induction module from vehicle, so that heat is not applied close to fuel tank. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

1. See INDUCTION MODULE, REMOVAL, in this section.

CAUTION

The idle air control screw has a loctite patch that may make it very difficult to remove. If necessary, use a heat gun to break down the loctite. Apply heat evenly around screw head in a circular motion. Do not direct heat at idle air control and other components or damage can occur.

2. Using a T20 TORX drive head, remove two screws to release throttle cable bracket from induction module. See Figure 9-38. Discard flange screw of idle air control.
3. Pull pressure port (enveloped in rubber seal) from hole in induction module.
4. If replacing sensor, remove and save rubber seal if condition is good. Replace the seal if cut, torn or shows signs of deterioration.

INSTALLATION

1. Install rubber seal on pressure port, if removed.
2. With the electrical connector facing toward the rear of the induction module (side opposite throttle cable bracket), insert pressure port into hole in induction module. See Figure 9-39.
3. Align hole in throttle cable bracket with hole at side of induction module. Start screw into induction module. See Figure 9-38.
4. Align hole at top of throttle cable bracket with thru hole in flange of idle air control. Start **new** screw with loctite patch into induction module.
5. Using a T20 TORX drive head, tighten screw at side of throttle cable bracket to 18 **in-lbs** (2.0 Nm).
6. Tighten flange screw of idle air control to 25 **in-lbs** (2.8 Nm).
7. Move free end of throttle return spring into slot in throttle cable bracket.
8. See INDUCTION MODULE, INSTALLATION, in this section.

IDLE AIR CONTROL

REMOVAL

⚠WARNING

The screws securing the idle air control flange to the induction module have a loctite patch that may make them very difficult to remove. Since a heat gun may be needed to break down the loctite, remove induction module from vehicle, so that heat is not applied close to fuel tank. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

1. See INDUCTION MODULE, REMOVAL, in this section.

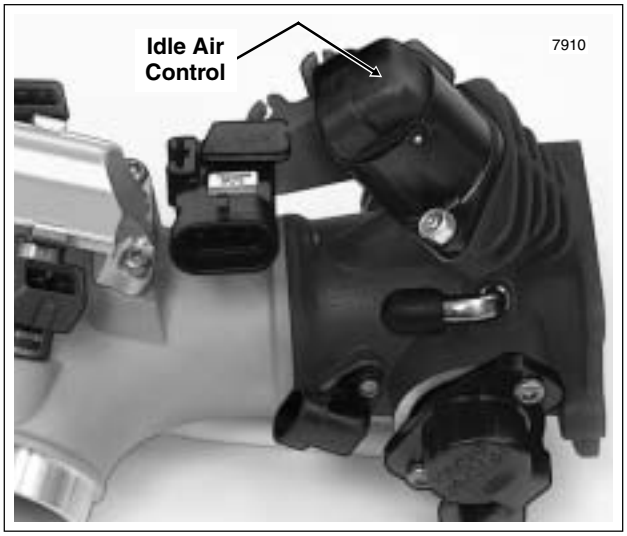


Figure 9-40. Induction Module (Rear View)

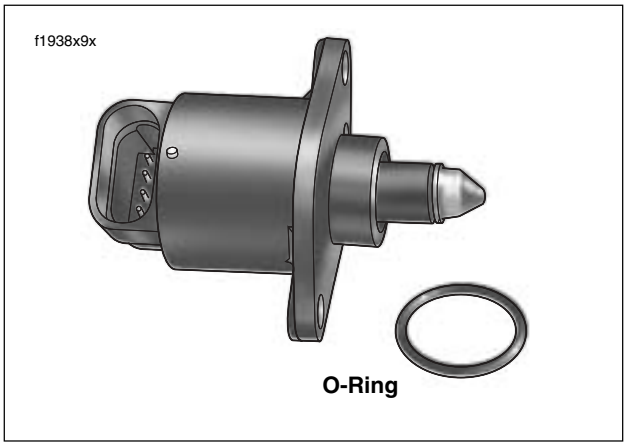


Figure 9-41. Idle Air Control

CAUTION

The idle air control screws have a loctite patch that may make them very difficult to remove. If necessary, use a heat gun to break down the loctite. Apply heat evenly around screw head in a circular motion. Do not direct heat at idle air control and other components or damage can occur.

2. Using a T20 TORX drive head, remove two screws to release throttle cable bracket from induction module. See Figure 9-38. Discard flange screw of idle air control.
3. Remove remaining screw to release flange of idle air control from top of induction module. Discard screw.
4. Pull idle air control from bore of induction module.
5. Remove O-ring from body of idle air control. Discard O-ring. See Figure 9-41.

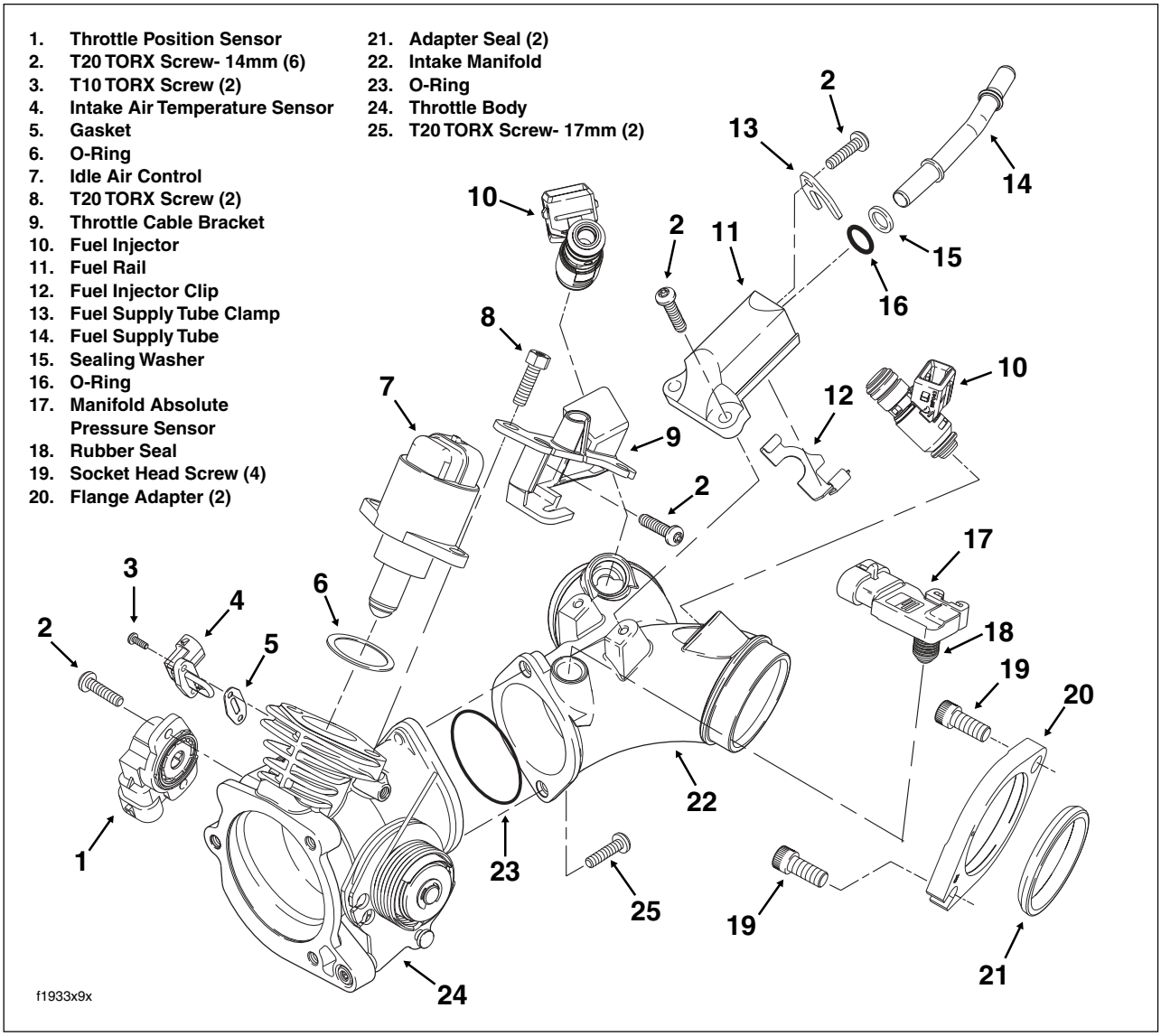


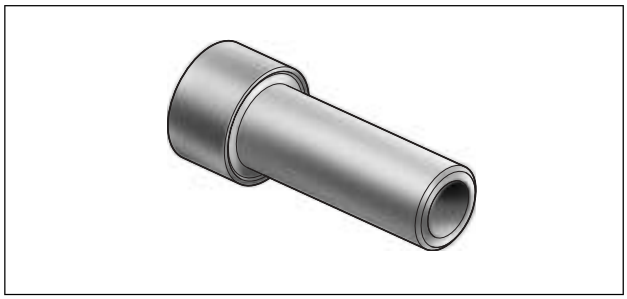
Figure 9-42. Induction Module Assembly

INSTALLATION

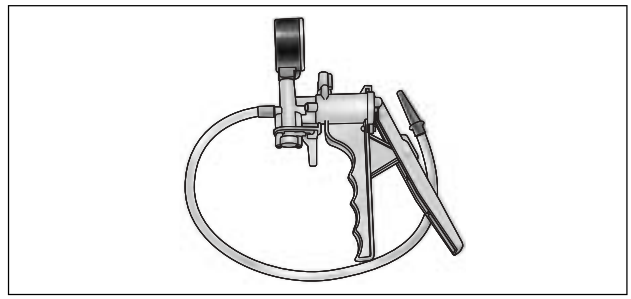
1. Apply a thin coat of clean engine oil to **new** O-ring. Install O-ring on counterbore of induction module flange.
2. With the electrical connector facing the left side of the induction module (intake manifold side), install idle air control into bore.
3. Align hole in throttle cable bracket with hole at side of induction module. Start screw into induction module. See Figure 9-38.
4. Align hole at top of throttle cable bracket with thru hole in flange of idle air control. Start **new** screw with loctite patch into induction module.
5. Install remaining screw into flange of idle air control. Again, use **new** screw with loctite patch.
6. Using a T20 TORX drive head, tighten screw at side of throttle cable bracket to 18 **in-lbs** (2.0 Nm).
7. Alternately tighten flange screws of idle air control to 25 **in-lbs** (2.8 Nm).
8. Move free end of throttle return spring into slot in throttle cable bracket.
9. See INDUCTION MODULE, INSTALLATION, in this section.

NOTES

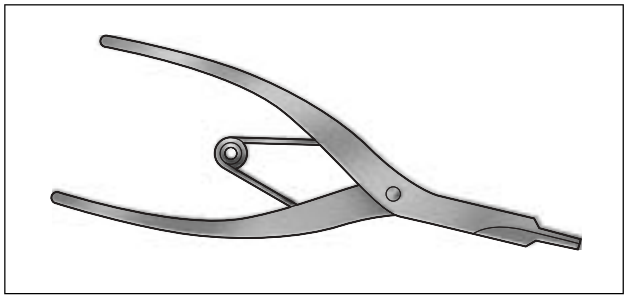
TOOLS A.1



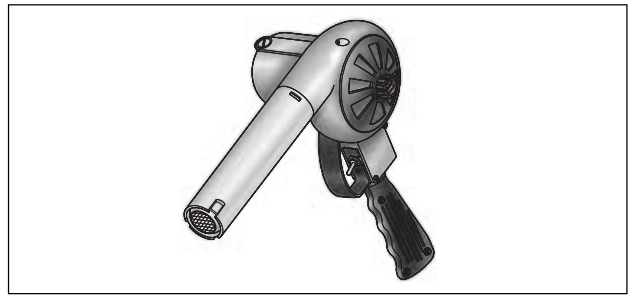
Part No. B-45655 Crankshaft/Sprocket Shaft Bearing Remover/Installer Pilot/Driver
Use with HD-42720-5.



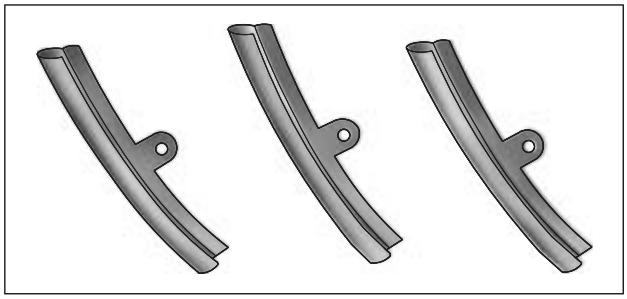
Part No. HD-23738A Mity-Vac Vacuum Pump



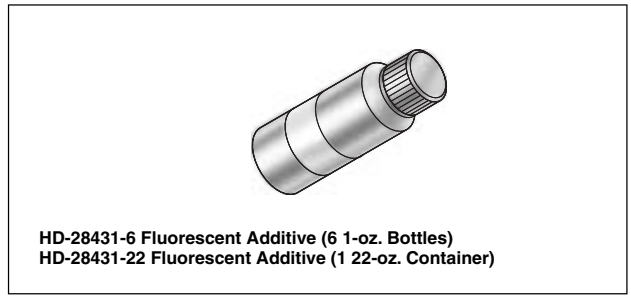
Part No. J-5586A Transmission Shaft Retaining Ring Pliers



Part No. HD-25070 Robinair Heat Gun
Use with HD-41183.

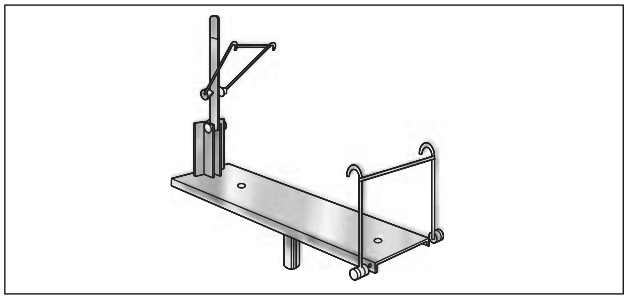


Part No. HD-01289 Rim Protectors

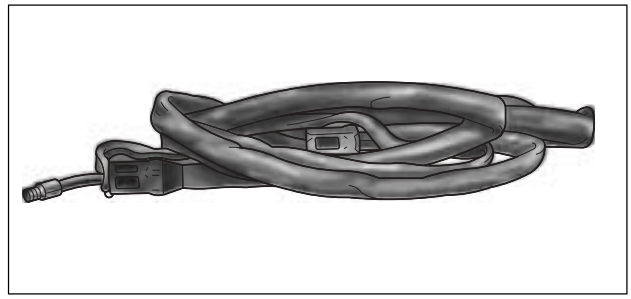


HD-28431-6 Fluorescent Additive (6 1-oz. Bottles)
HD-28431-22 Fluorescent Additive (1 22-oz. Container)

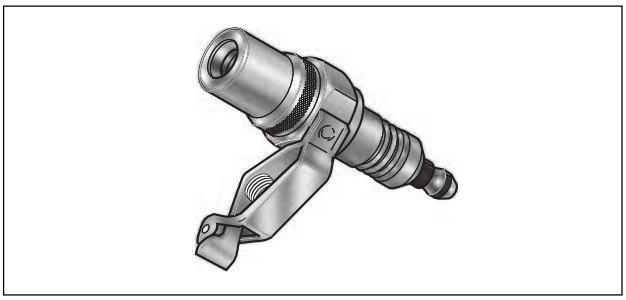
Part No. HD-28431B Fluorescent Additive (24 1-oz. Bottles). Use with HD-35457.



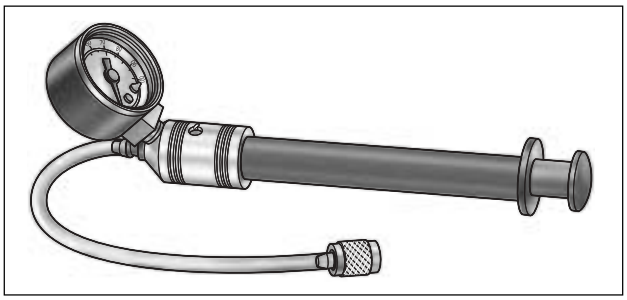
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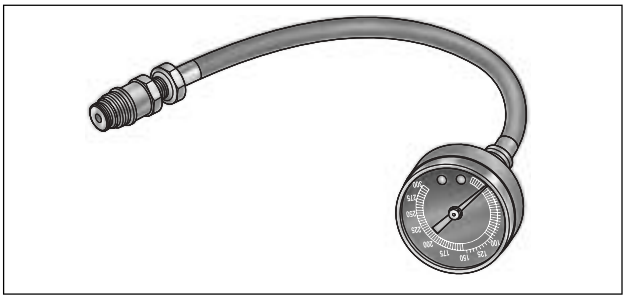
Part No. HD-28700 Tire Bead Expander



Part No. HD-26792 Spark Tester



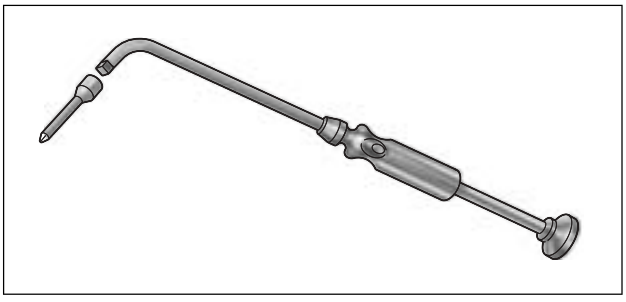
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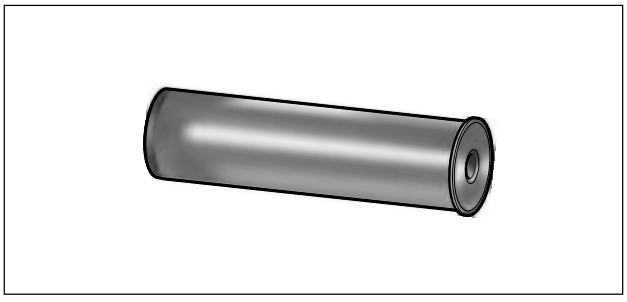
Part No. HD-33223-1 Cylinder Compression Gauge



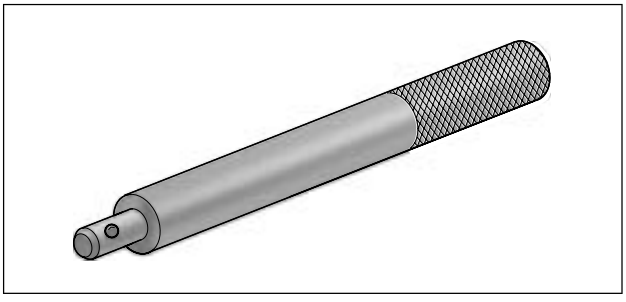
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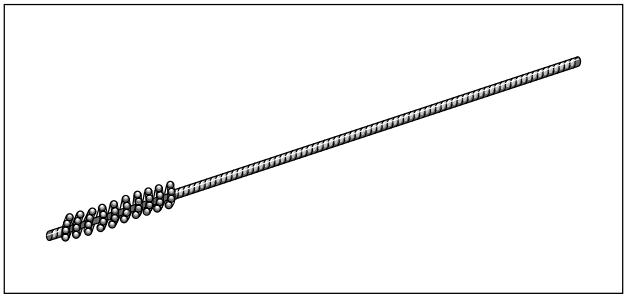
Part No. HD-33413A Carburetor Idle Adjuster



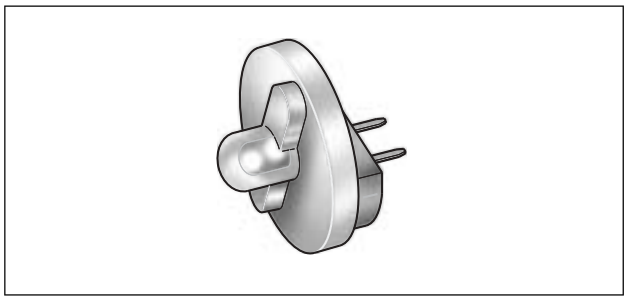
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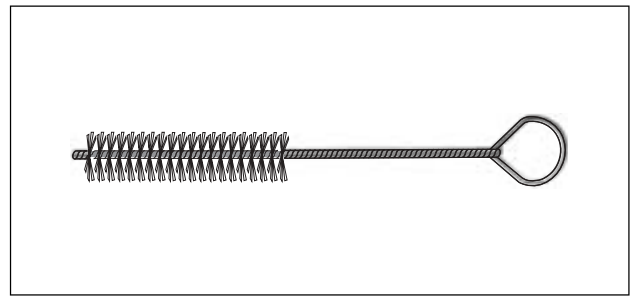
Part No. HD-33416 Universal Driver Handle
(12 Inch Length)



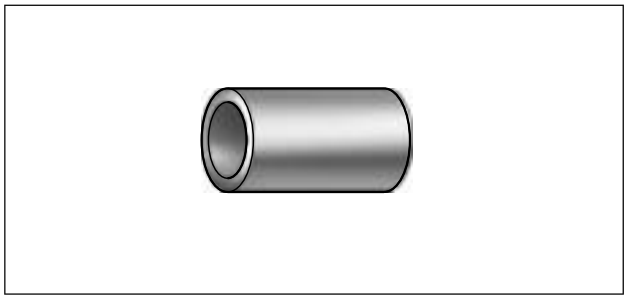
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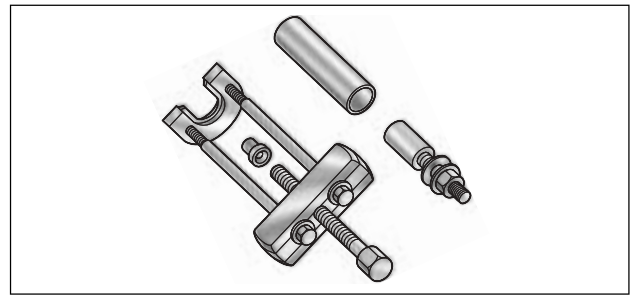
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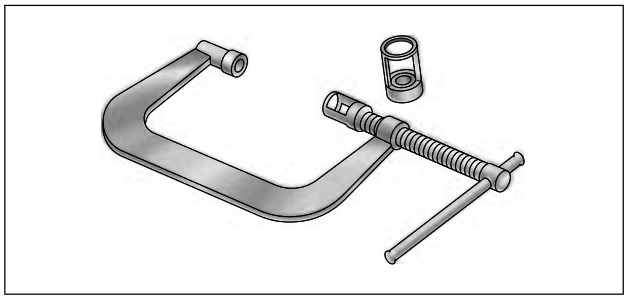
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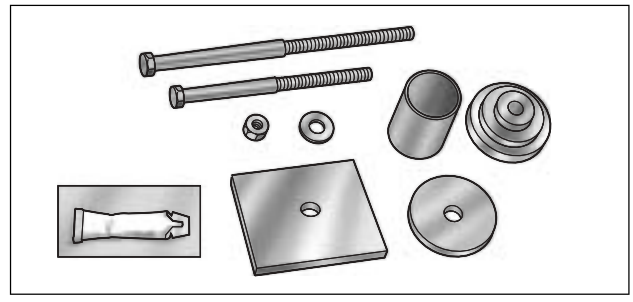
Part No. HD-34731 Valve Guide Installer Sleeve



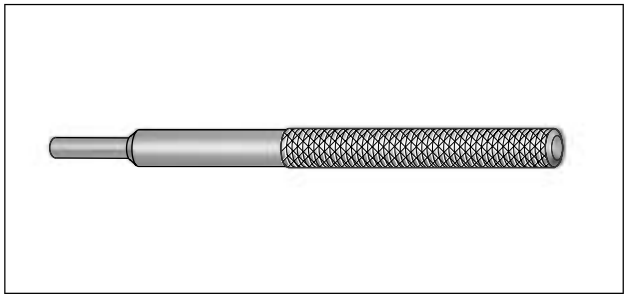
Part No. HD-34902B Mainshaft Bearing Inner Race Remover and Installer



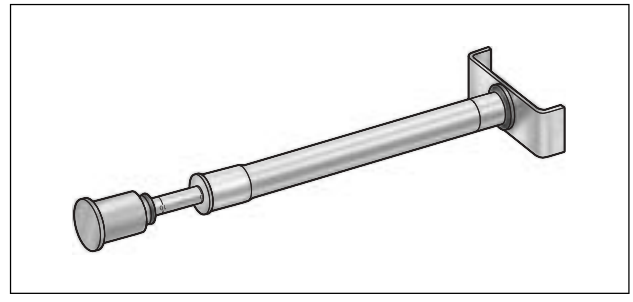
Part No. HD-34736B Valve Spring Compressor



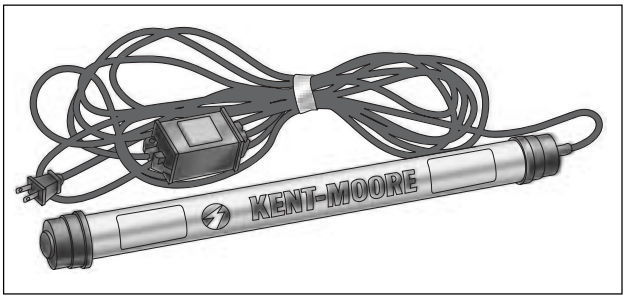
Part No. HD-35316B Main Drive Gear Remover/Installer and Main Drive Gear Bearing Installer



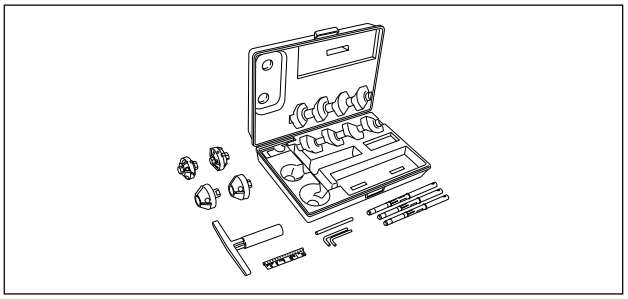
Part No. HD-34740 Valve Guide Driver
Use with HD-34643A and HD-34731.



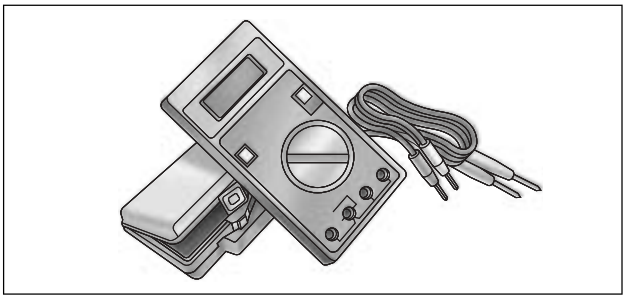
Part No. HD-35381 Belt Tension Gauge



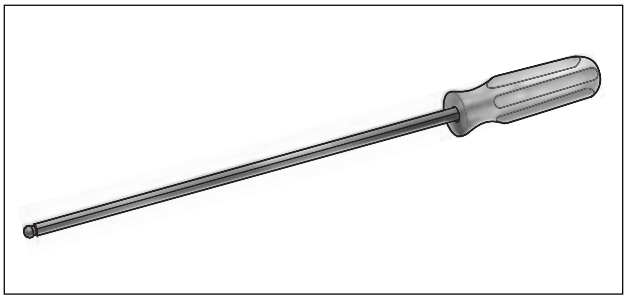
Part No. HD-35457 Black Light Leak Detector



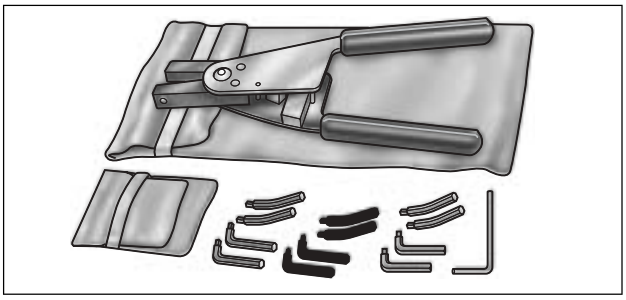
Part No. HD-35758B Neway Valve Seat Cutter Set



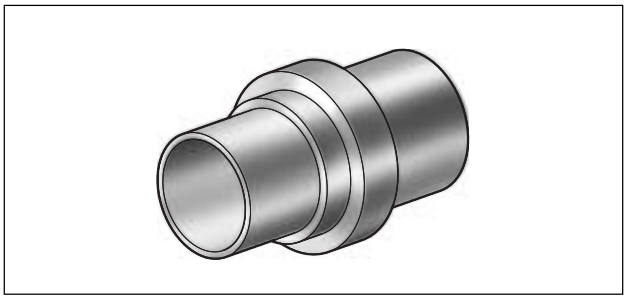
Part No. HD-35500B Digital Multi-Meter



Part No. HD-35801 Intake Manifold Screw Wrench



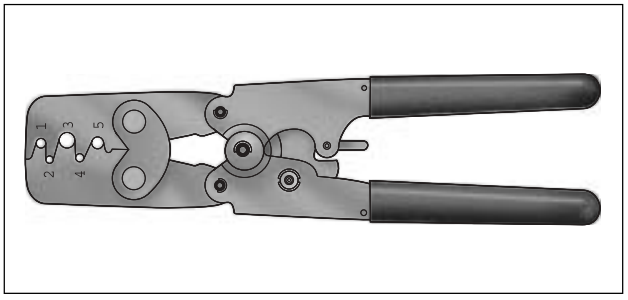
Part No. HD-35518 Internal/External Retaining Ring Pliers



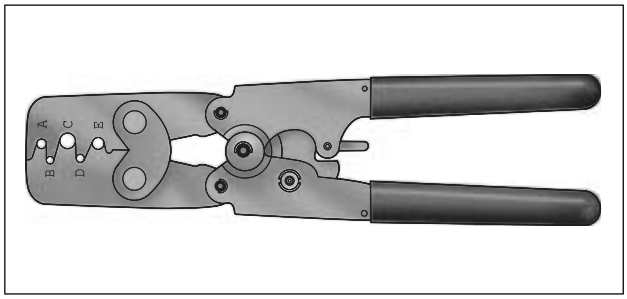
Part No. HD-37842A Inner/Outer Main Drive Gear Needle Bearing and Seal Installer



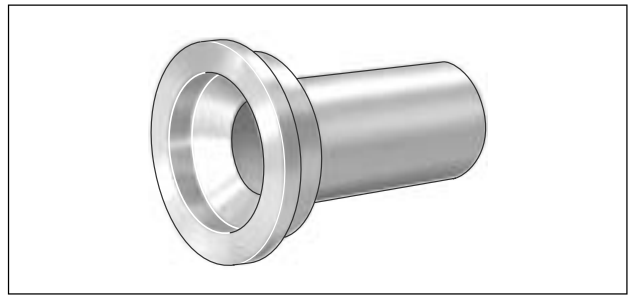
Part No. HD-35667A Cylinder Leakdown Tester



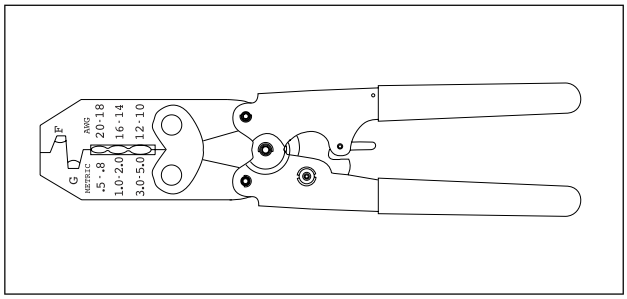
Part No. HD-38125-6 Packard Terminal Crimp Tool (Sealed)



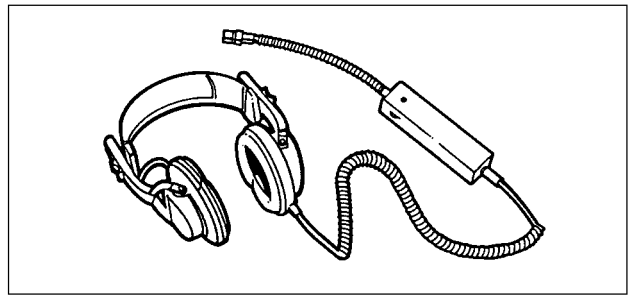
Part No. HD-38125-7 Packard Terminal Crimp Tool (Nonsealed)



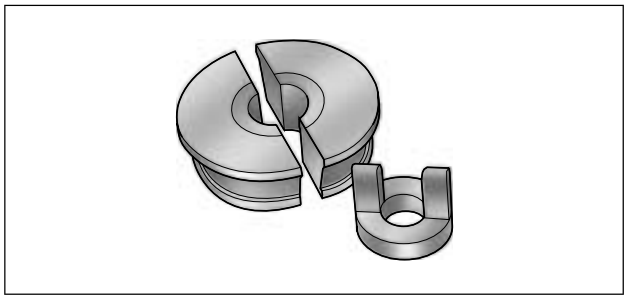
Part No. HD-39361A Sprocket Shaft Oil Seal Installer



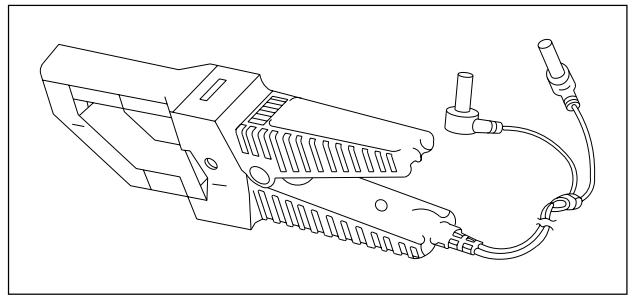
Part No. HD-38125-8 Packard Terminal Crimp Tool



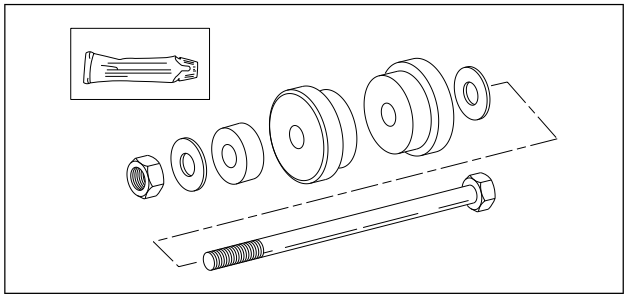
Part No. HD-39565 Engine Sound Probe



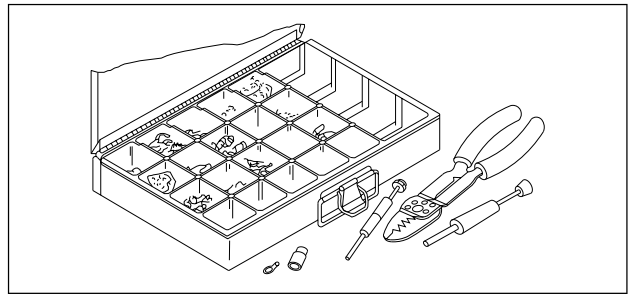
Part No. HD-39301A Steering Head Bearing Race Remover. Use with HD-33416.



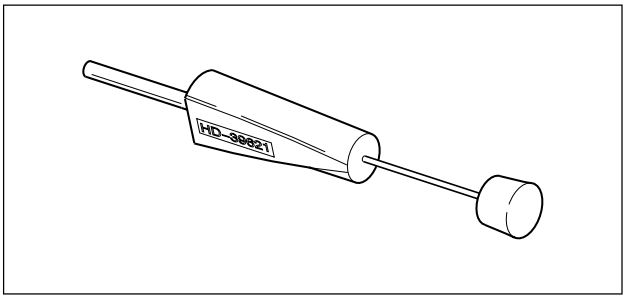
Part No. HD-39617 Inductive Amp Probe. Use with HD-35500B.



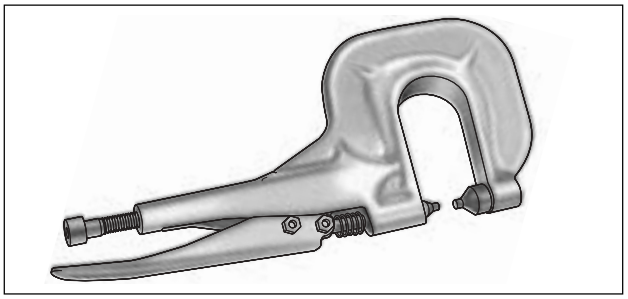
Part No. HD-39302 Steering Head Bearing Race Installer



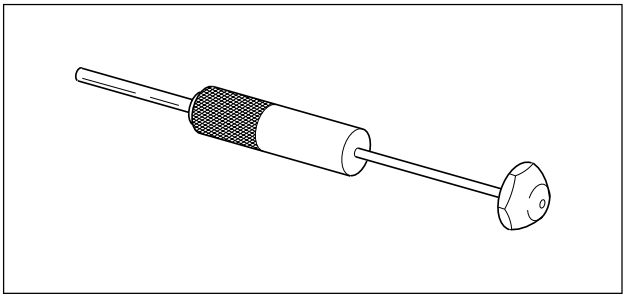
Part No. HD-39621 Electrical Terminal Repair Kit



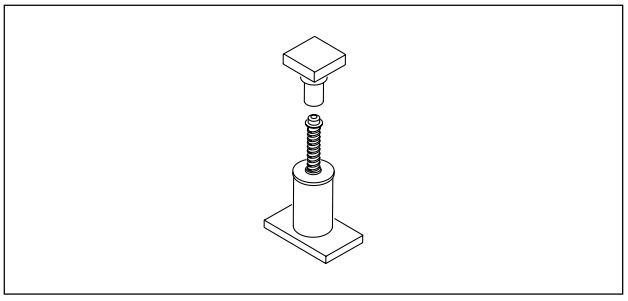
Part No. HD-39621-27 Socket Terminal Remover (AMP Connectors)



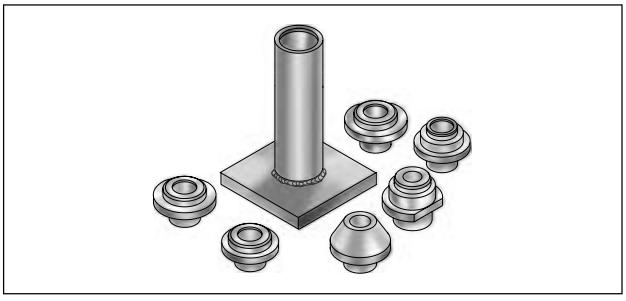
Part No. HD-39787 Rivet Tool



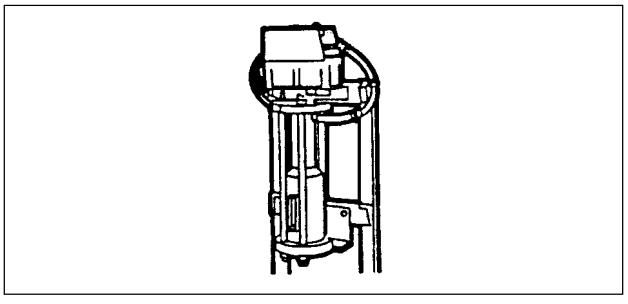
Part No. HD-39621-28 Pin Terminal Remover (AMP Connectors)



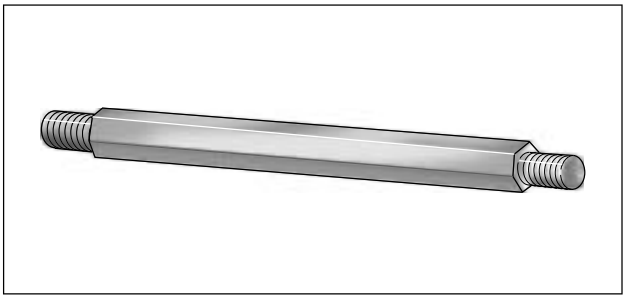
Part No. HD-39800 Oil Filter Crusher (Small)



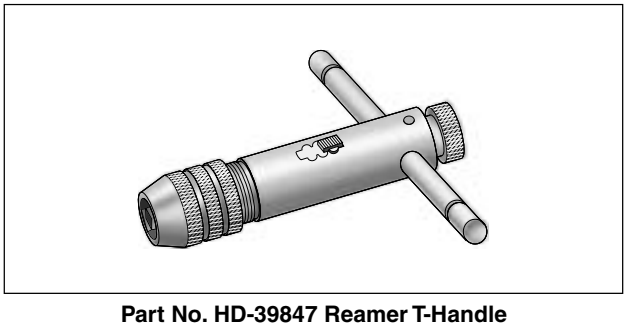
Part No. HD-39782A Cylinder Head Support Stand



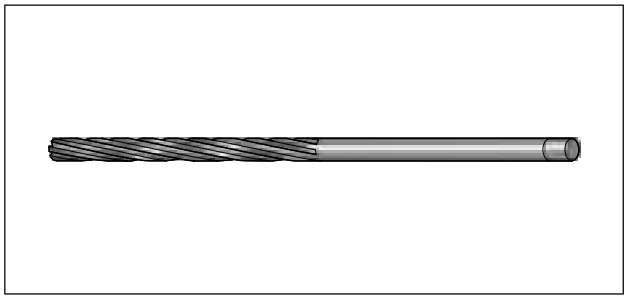
Part No. HD-39823 Oil Filter Crusher (Large)



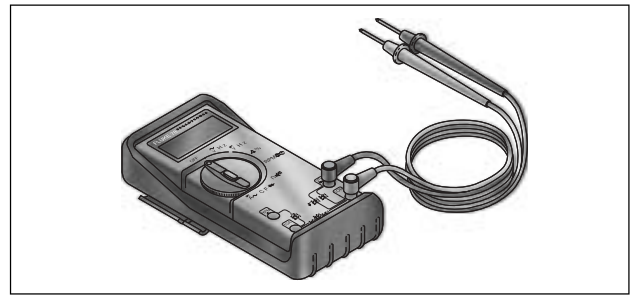
Part No. HD-39786 Cylinder Head Holding Fixture



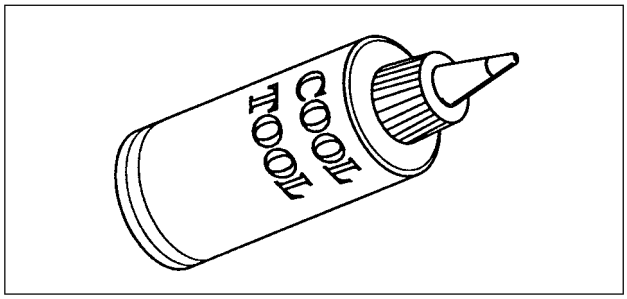
Part No. HD-39847 Reamer T-Handle



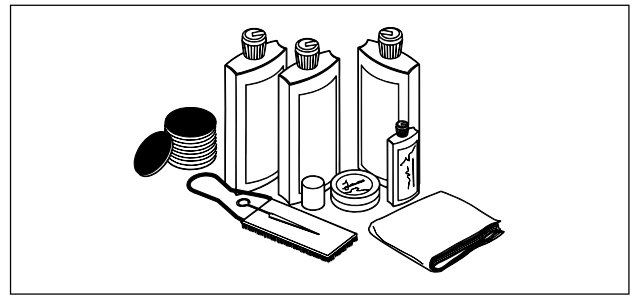
Part No. HD-39932 (Steel) or HD-39932-CAR (Carbide)
Valve Guide Reamer



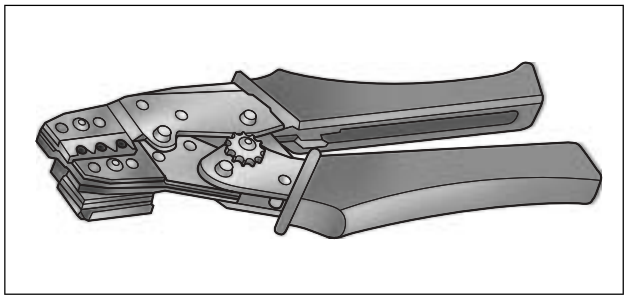
Part No. HD-39978 Fluke 78 Multimeter (DVOM)
Use with HD-41198 and HD-44608.



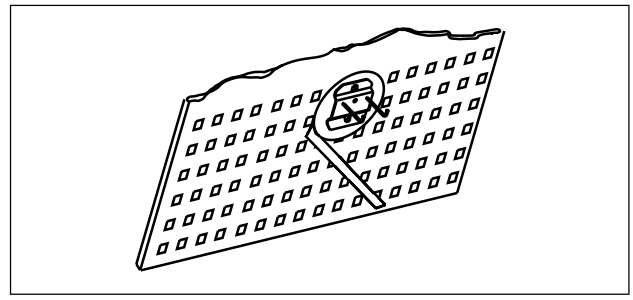
Part No. HD-39964 Reamer Lubricant (Cool Tool)



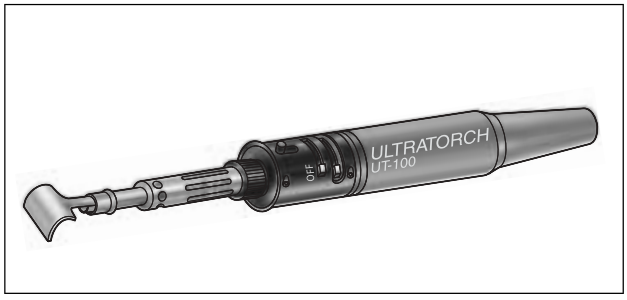
Part No. HD-39994 Paint Repair Kit



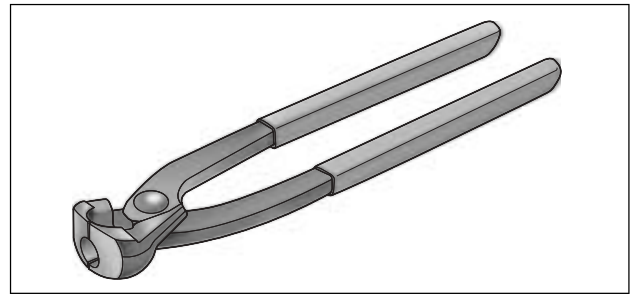
Part No. HD-39965 Deutsch Terminal Crimp Tool



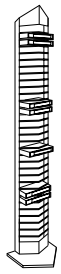
Part No. HD-41025A Tool Organizational System



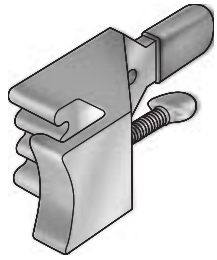
Part No. HD-39969 Ultra Torch UT-100



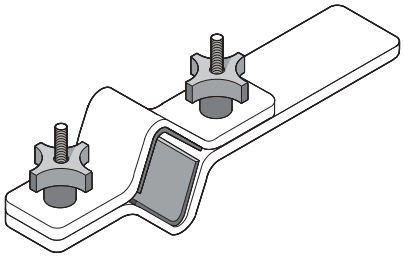
Part No. HD-41137 Two-Way Hose Clamp Pliers



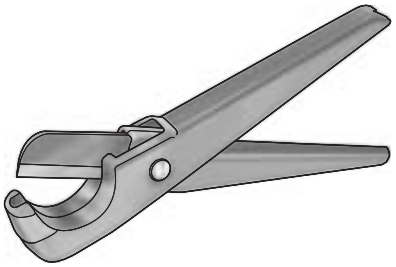
Part No. HD-41155 VHS Tape Storage Tower



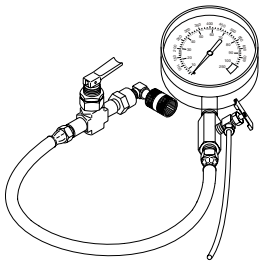
Part No. HD-41184 Final Drive Sprocket Locking Tool



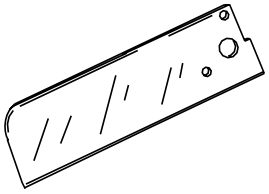
Part No. HD-41177 Fork Tube Holder



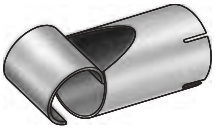
Part No. HD-41185 Hose Cutter



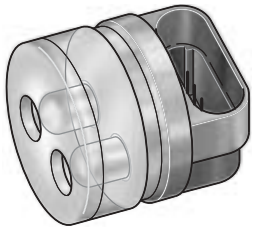
Part No. HD-41182 Fuel Pressure Gauge



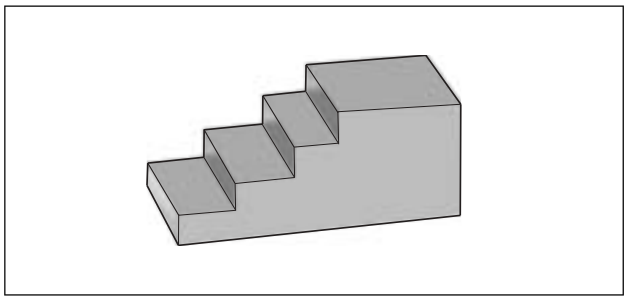
Part No. HD-41185-1 Hose Cutter Blade



Part No. HD-41183 Robinair Heat Gun Shrink Tool Attachment. Use with HD-25070.



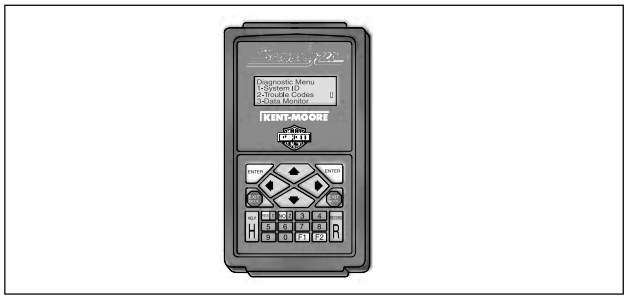
Part No. HD-41199-3 Idle Speed Control Actuator Test Lamp



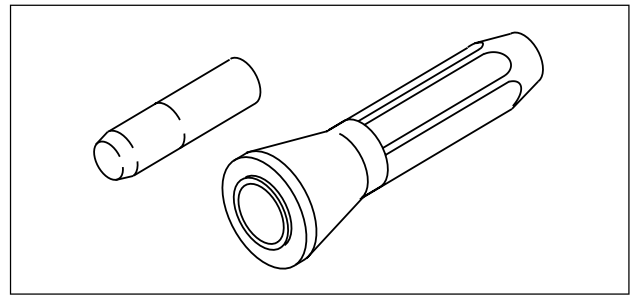
Part No. HD-41214 Primary Drive Locking Tool



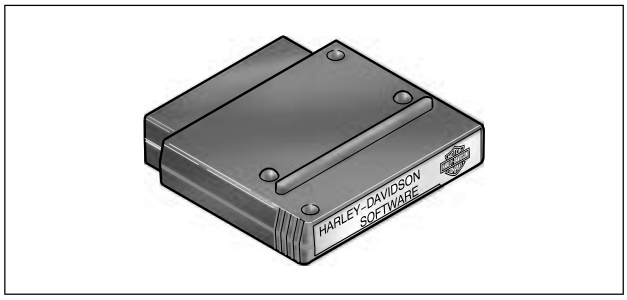
Part No. HD-41404 EFI Harness Connector Test Kit



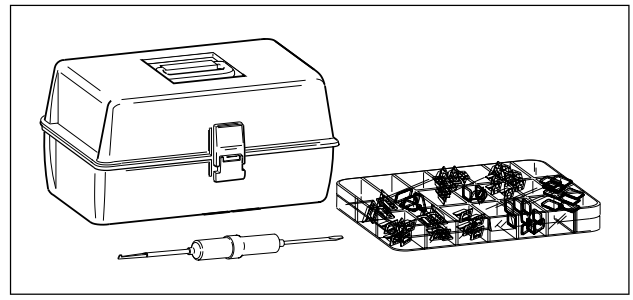
Part No. HD-41325D Scanalyzer



Part No. HD-41405 Main Drive Gear Seal Installer



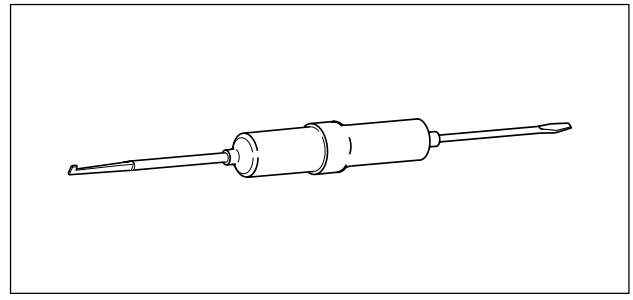
Part No. HD-41325-95C Scanalyzer Diagnostic Application Cartridge



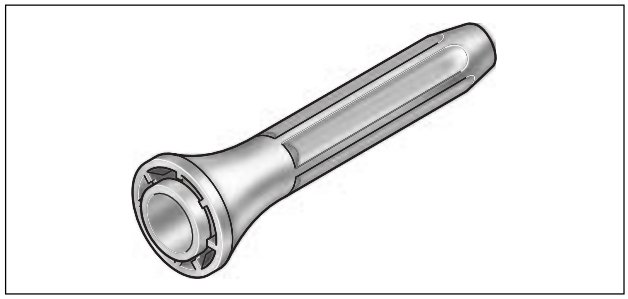
Part No. HD-41475 Deutsch Connector Service Kit Includes HD-41475-100.



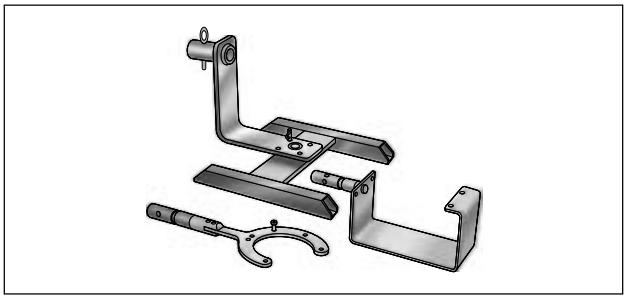
Part No. HD-41354 Speedometer Tester



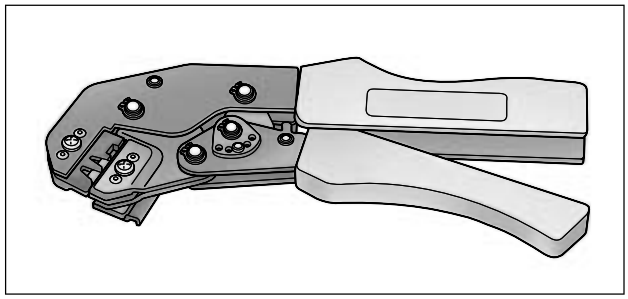
Part No. HD-41475-100 Deutsch Connector Pick Tool



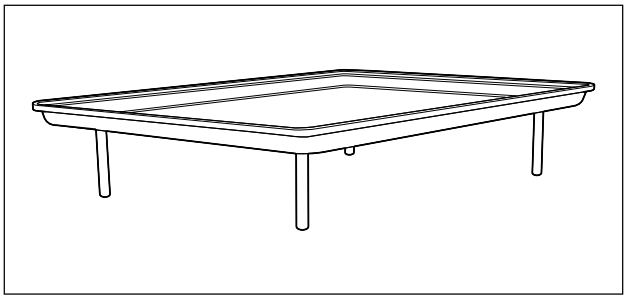
Part No. HD-41496 Main Drive Gear Large Seal Installer



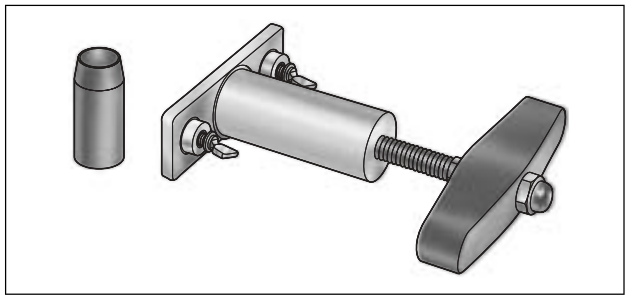
Part No. HD-42310 Engine/Transmission Bench Stand



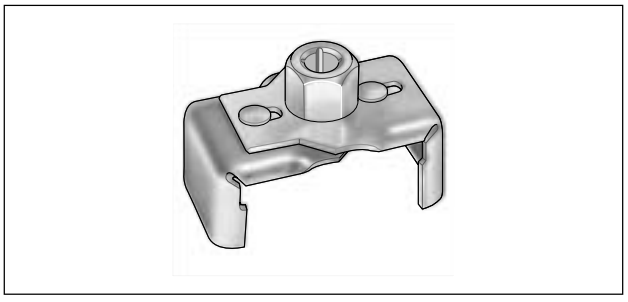
Part No. HD-41609 Amp Multilock Terminal Crimp Tool



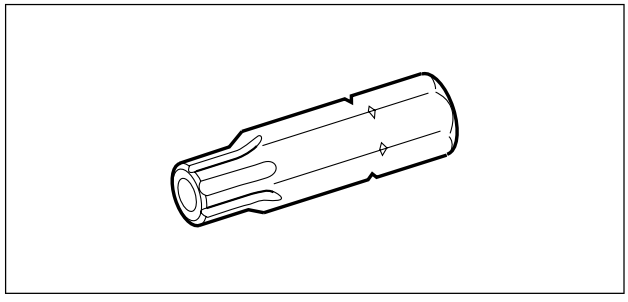
Part No. HD-42310-150 Drip Pan
Use with HD-42310.



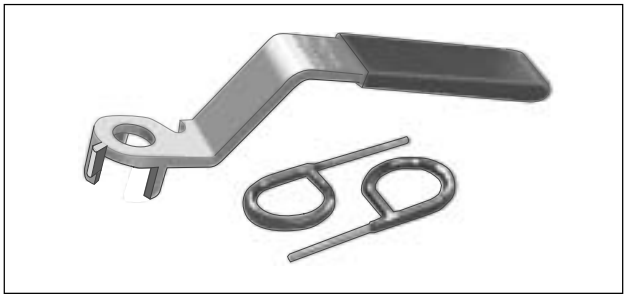
Part No. HD-41771 Rotor Remover/Installer



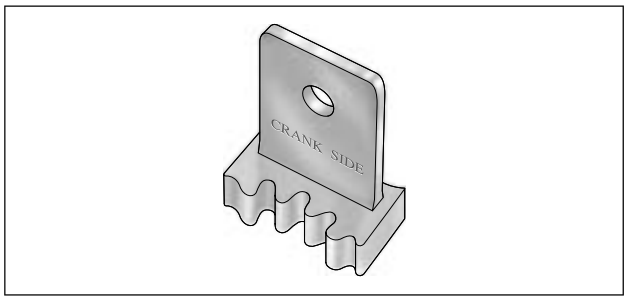
Part No. HD-42311 Oil Filter Wrench



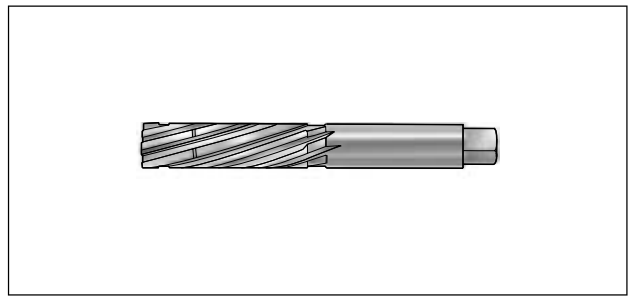
Part No. HD-42135 T-30 I.P. Torx Plus
Spoke Nipple Driver



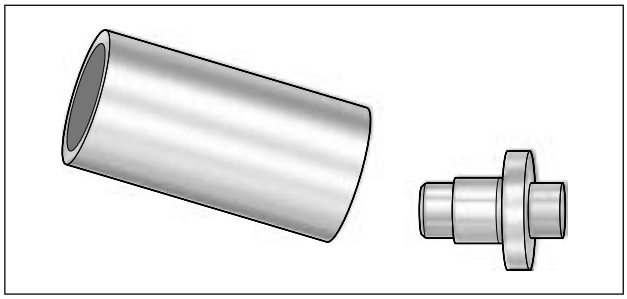
Part No. HD-42313 Cam Chain Tensioner Unloader
With Retention Pins



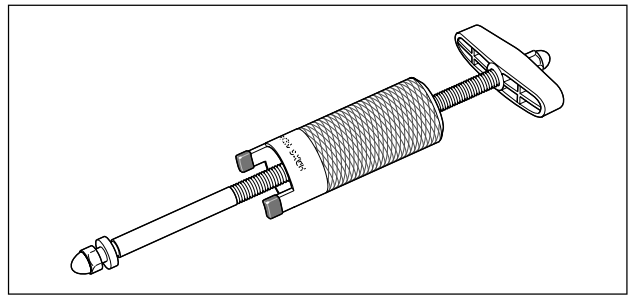
Part No. HD-42314 Crankshaft/Camshaft Sprocket Locking Tool



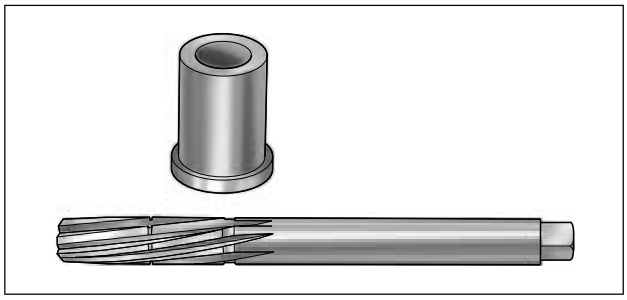
Part No. HD-42318 Connecting Rod Bushing Reamer



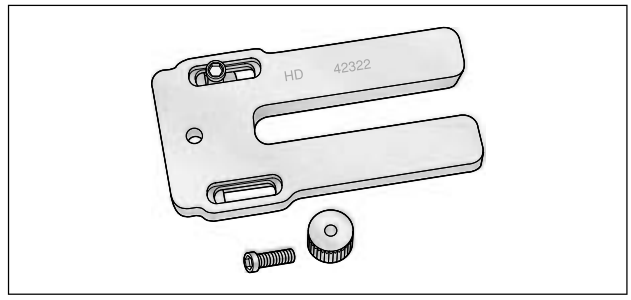
Part No. HD-42315 Crankshaft Bushing Remover/Installer



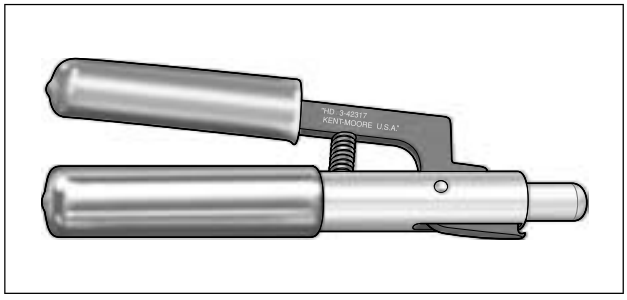
Part No. HD-42320A Piston Pin Remover



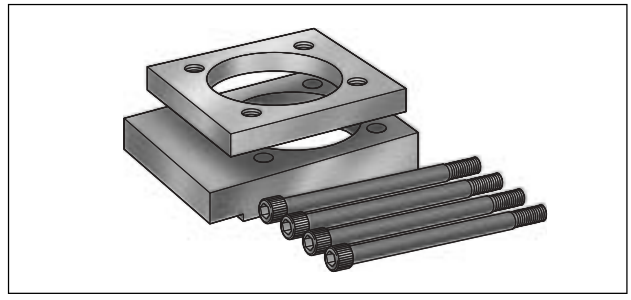
Part No. HD-42316 Crankshaft Bushing Reamer



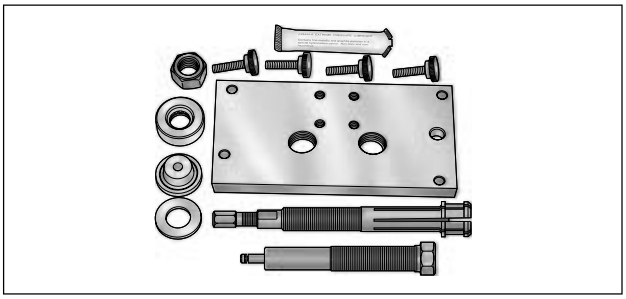
Part No. HD-42322 Piston Support Plate



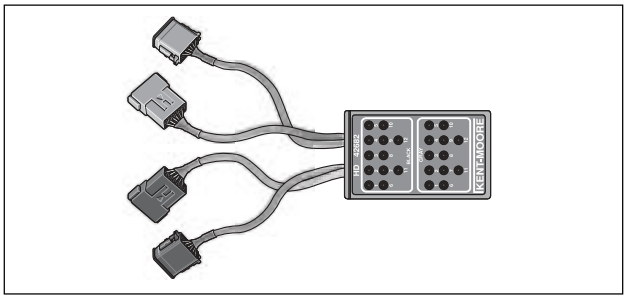
Part No. HD-42317A Piston Pin Circlip Remover/Installer



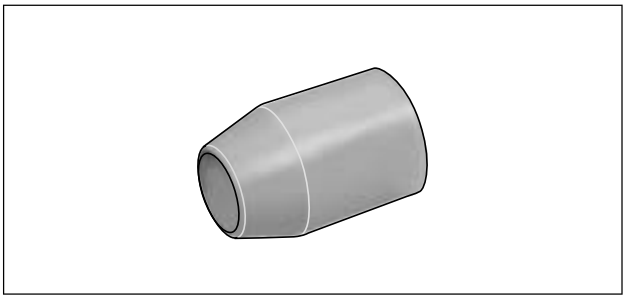
Part No. HD-42324A Cylinder Torque Plates



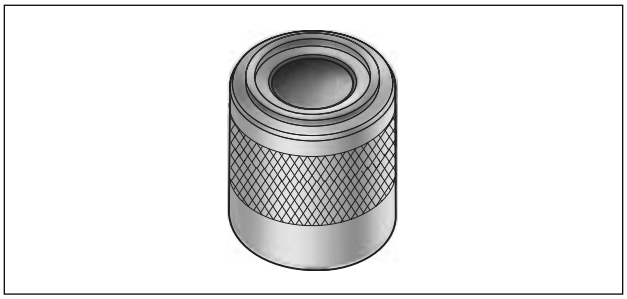
Part No. HD-42325 Camshaft Needle Bearing Remover/Installer



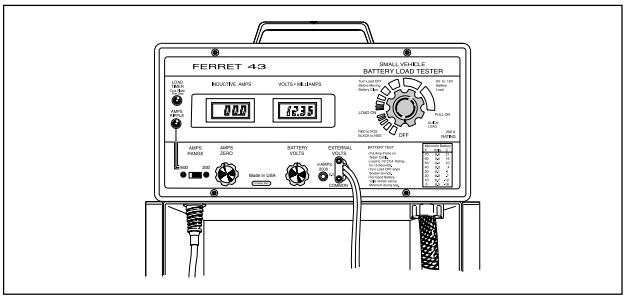
Part No. HD-42682 Breakout Box (Carbureted) Use with HD-39978.



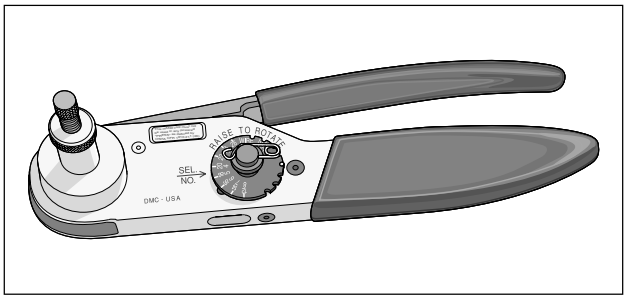
Part No. HD-42326A Crankshaft Guide



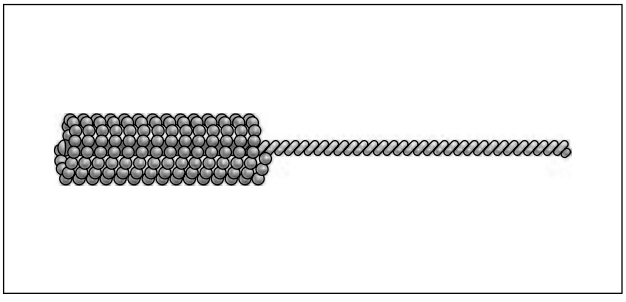
Part No. HD-42720-5 Crankshaft/Sprocket Shaft Bearing Remover/Installer Support Tube Use with B-45655.



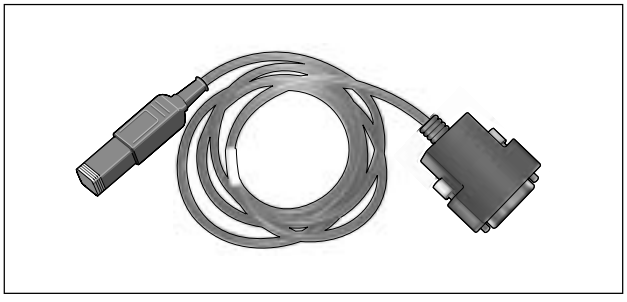
Part No. HD-42376 Battery/Charging System Load Tester



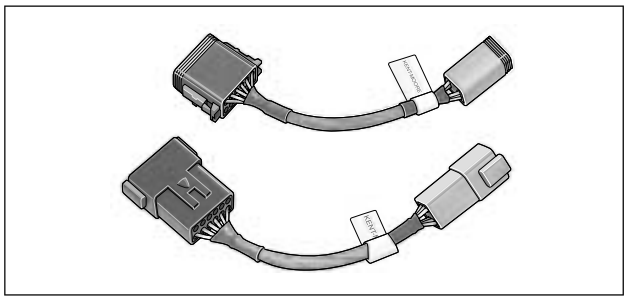
Part No. HD-42879 Deutsch Solid Barrel Contact Crimp Tool



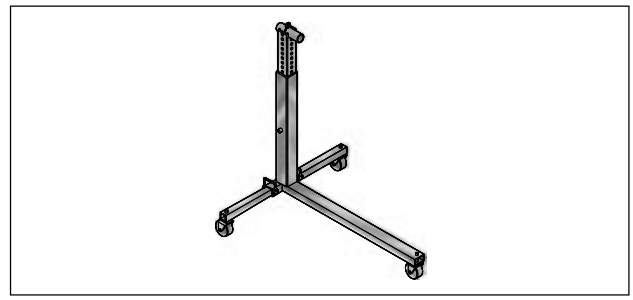
Part No. HD-42569 Connecting Rod Bushing Hone



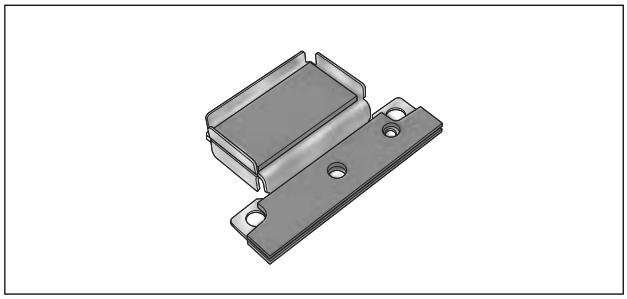
Part No. HD-42921B Scanalyzer Cable



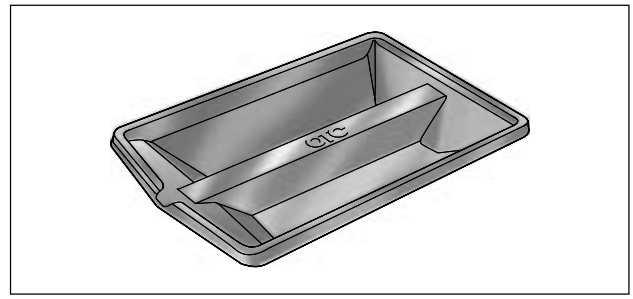
Part No. HD-42962 Breakout Box Adapters



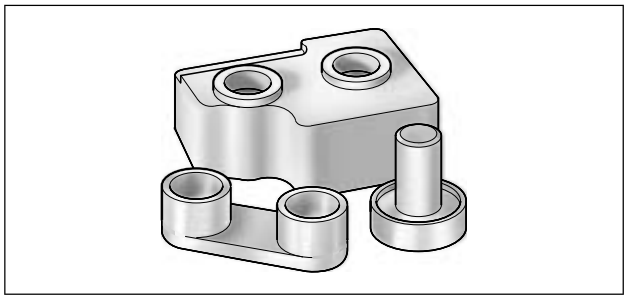
Part No. HD-43646A Engine Rolling Stand



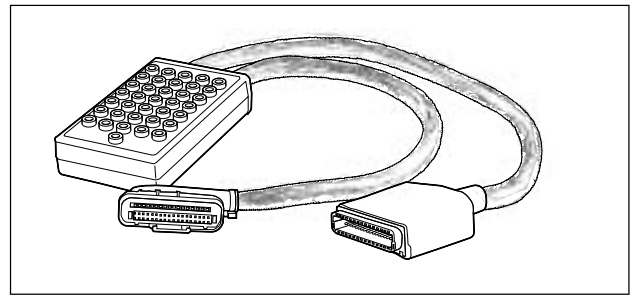
Part No. HD-43293A Brake Caliper Piston Remover



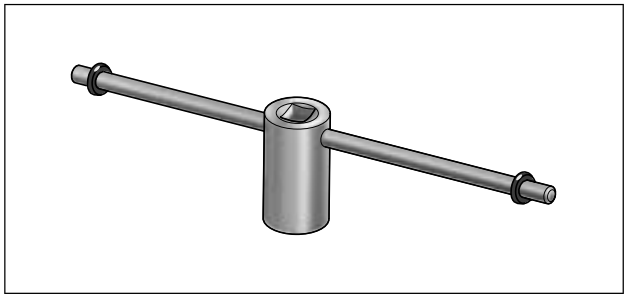
Part No. HD-43646-10 Drip Pan
Use with HD-43646A.



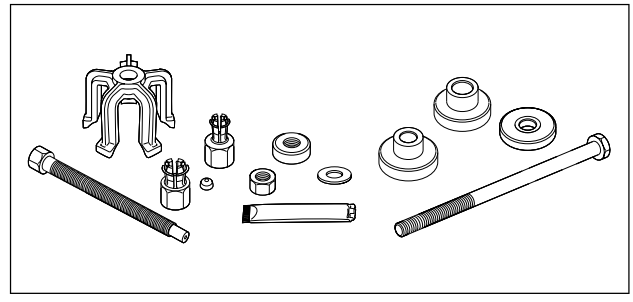
Part No. HD-43644 Camshaft/Camshaft Bearing Remover/Installer



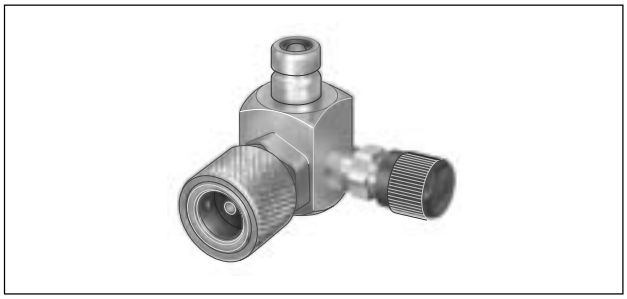
Part No. HD-43876 Breakout Box (EFI)
Use with HD-39978.



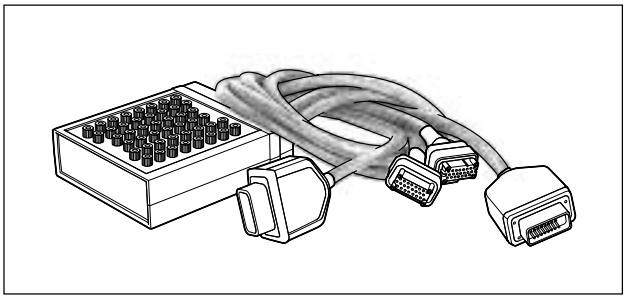
Part No. HD-43645 Reamer Handle/Drive Socket



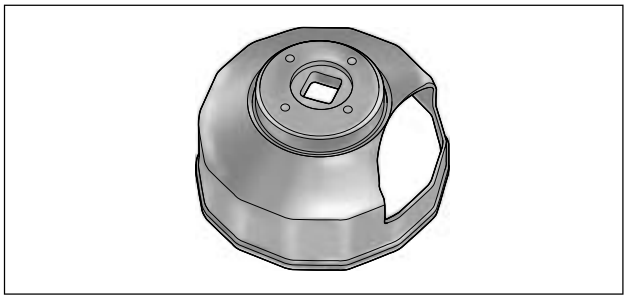
Part No. HD-44060 Wheel Bearing Remover/Installer



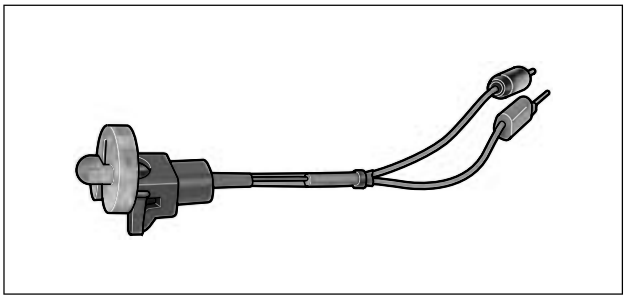
Part No. HD-44061 Fuel Pressure Gauge Adapter



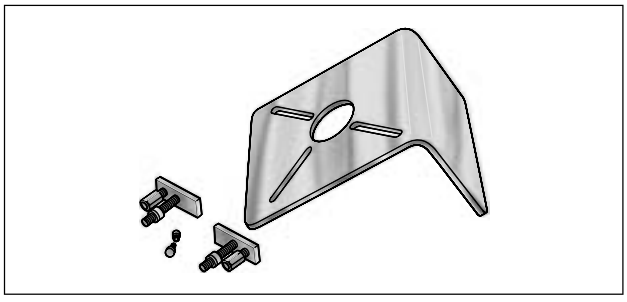
Part No. HD-44608 Radio Breakout Box
Use with HD-39978.



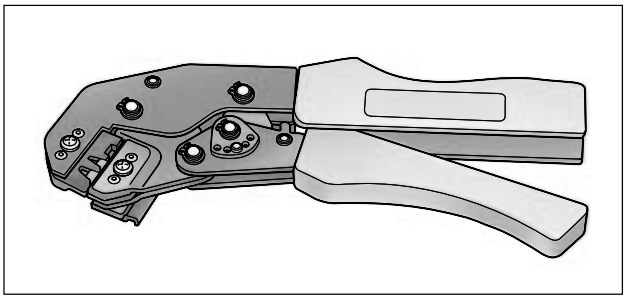
Part No. HD-44067 Oil Filter Wrench



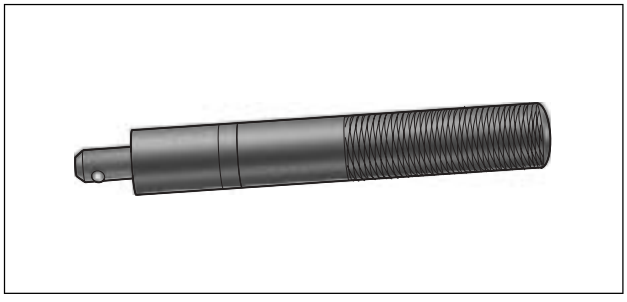
Part No. HD-44687 Ignition Coil Circuit Test Adapter



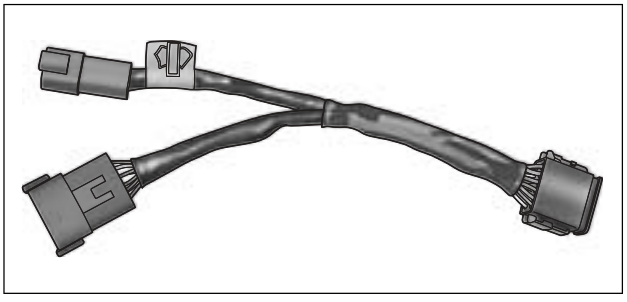
Part No. HD-44358 Flywheel Support Fixture



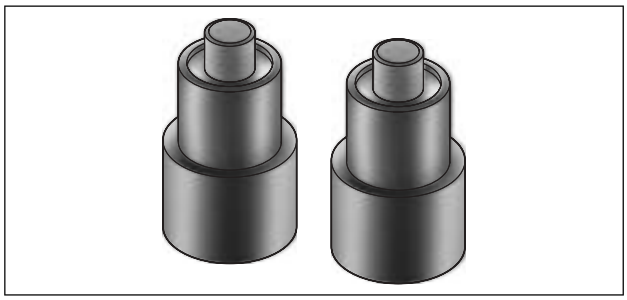
Part No. HD-44695 Mini Amp Multilock
Electrical Terminal Crimp Tool



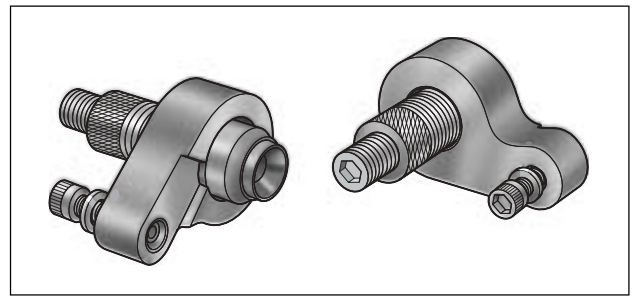
Part No. HD-44567 Universal Driver Handle
(7 Inch Length)



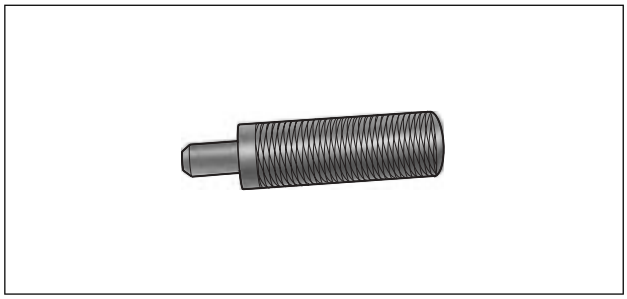
Part No. HD-44720 TSSM Diagnostic Interface Harness



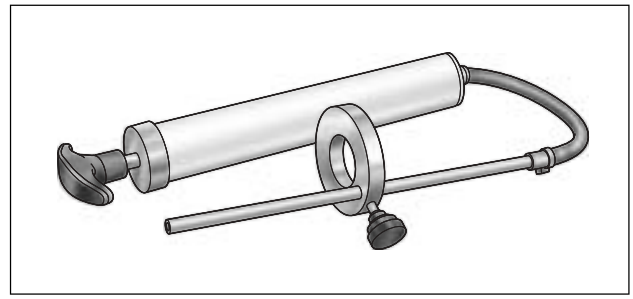
Part No. HD-45327 Rear Swingarm Bearing Installer



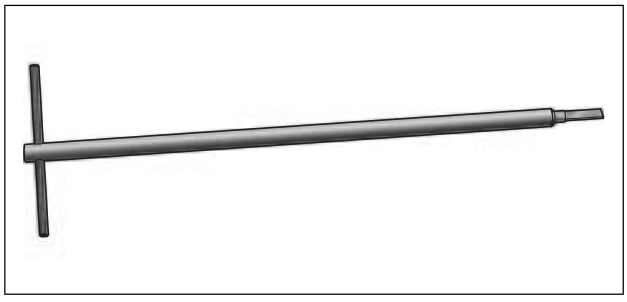
Part No. HD-46247 Vehicle Alignment Tool



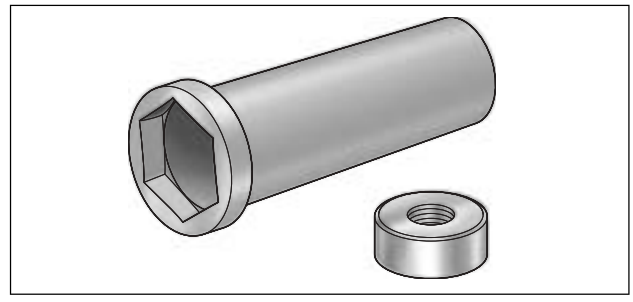
Part No. HD-45907 Universal Driver Handle
(4 Inch Length)



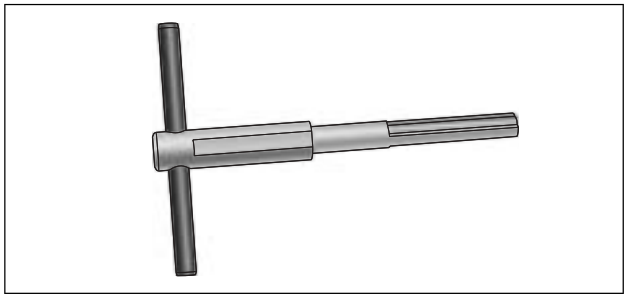
Part No. HD-59000A Fork Oil Level Gauge



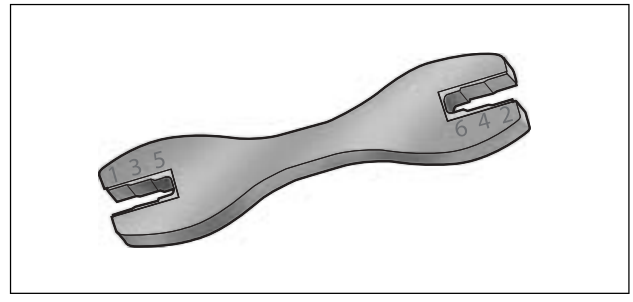
Part No. HD-45961 HDI Ignition Switch
Connector Remover



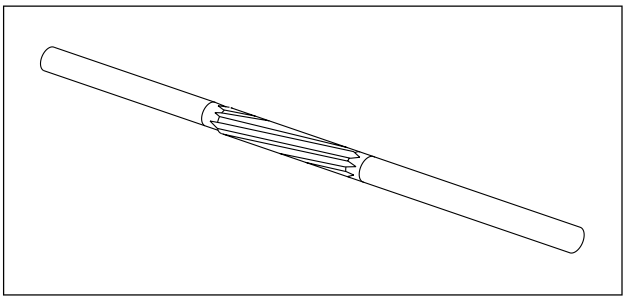
Part No. HD-94660-37B Mainshaft Locknut Wrench



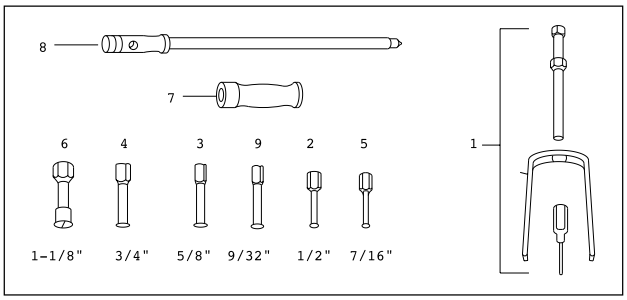
Part No. HD-45962 HDI Ignition Switch
Alignment Tool



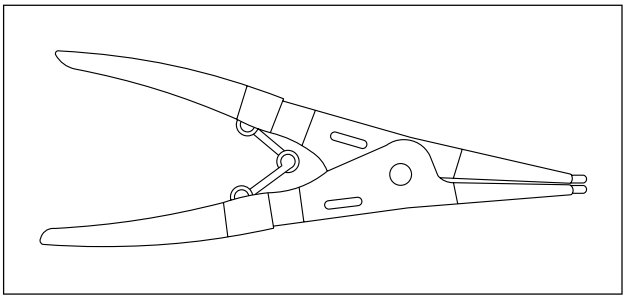
Part No. HD-94681-80 Spoke Nipple Wrench



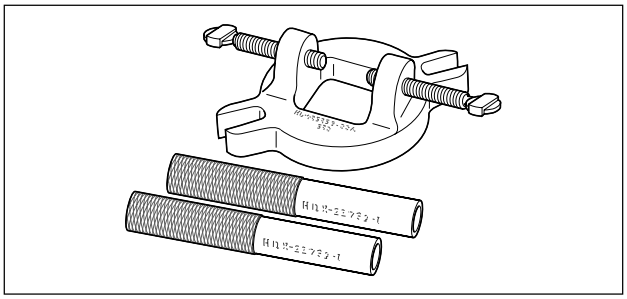
Part No. HD-94804-57 Rocker Arm Bushing Reamer



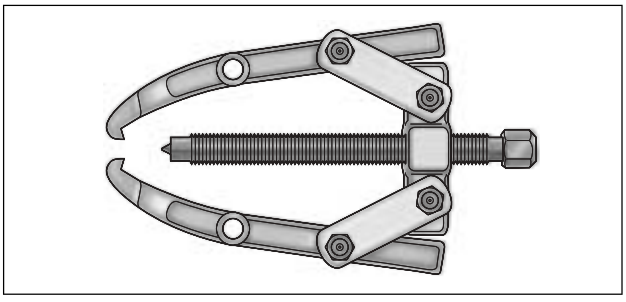
Part No. HD-95760-69A Bushing/Bearing Puller. Items 5 (HD-95768-69), 6 (HD-95769-69), 7 (HD-95770-69) and 8 (HD-95771-69) are optional.



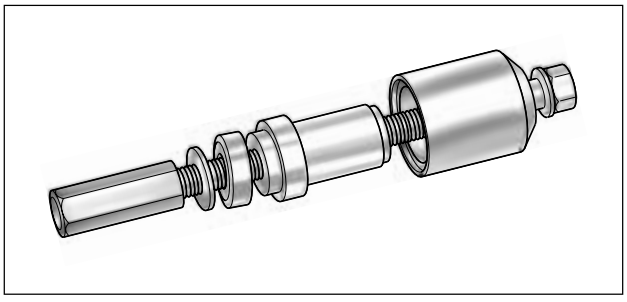
Part No. HD-95017-61 Large External Retaining Ring Pliers



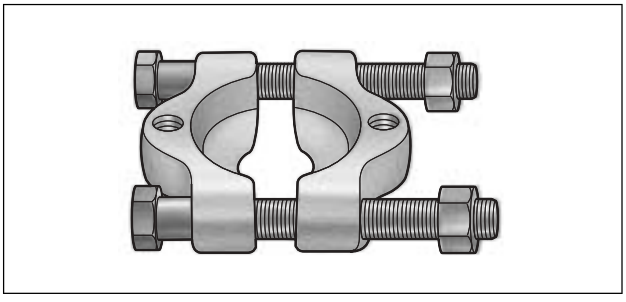
Part No. HD-95952-33B Connecting Rod Clamping Tool



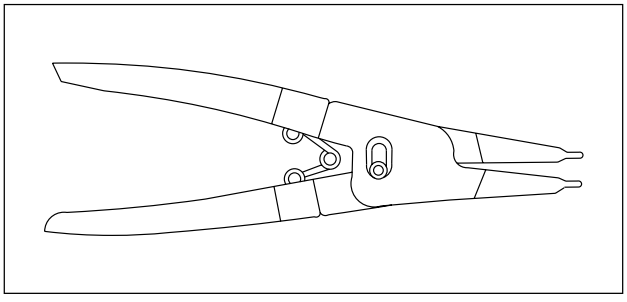
Part No. HD-95635-46 All Purpose Claw Puller



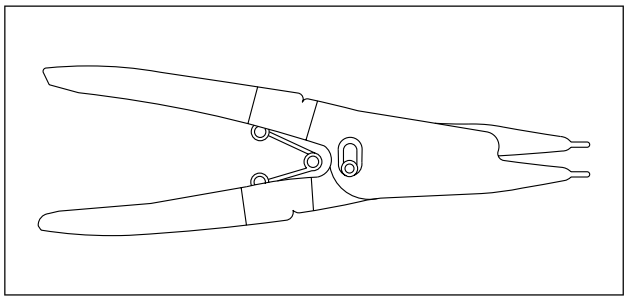
Part No. HD-95970-32D Upper Connecting Rod Bushing Remover/Installer



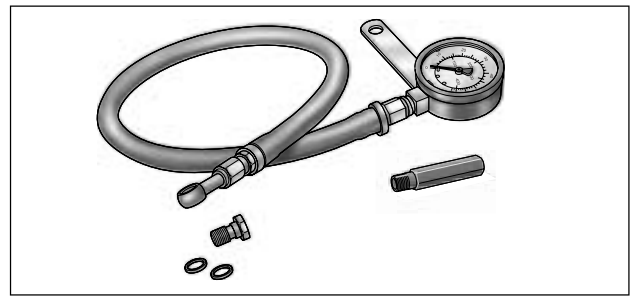
Part No. HD-95637-46A Wedge Attachment for Claw Puller. Use with HD-95635-46.



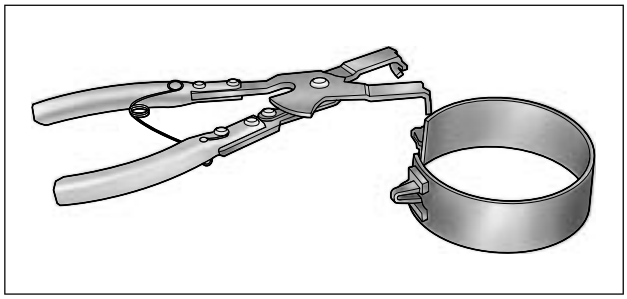
Part No. HD-96215-49 Small Internal Retaining Ring Pliers



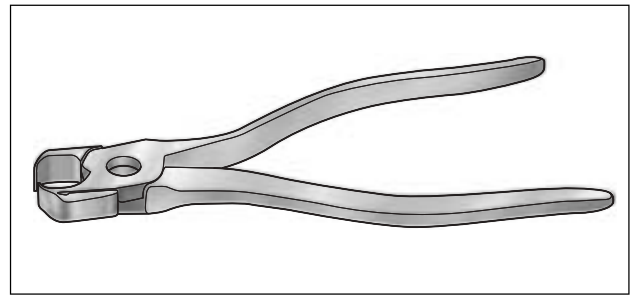
Part No. HD-96216-49 Large Internal Retaining Ring Pliers



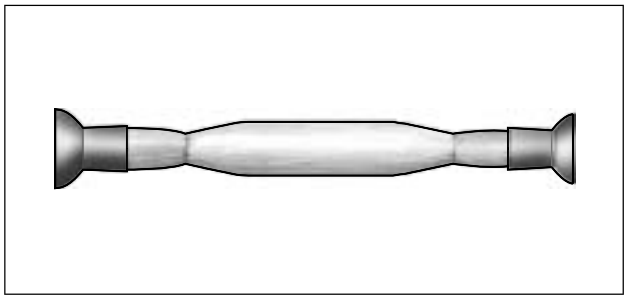
Part No. HD-96921-52B Oil Pressure Gauge



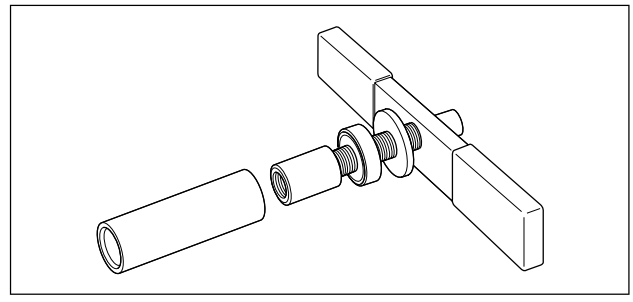
Part No. HD-96333-51C Piston Ring Compressor



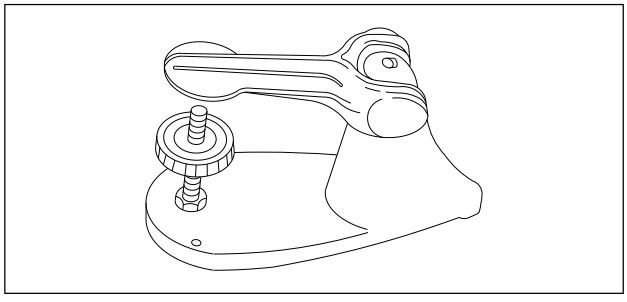
Part No. HD-97087-65B Hose Clamp Pliers



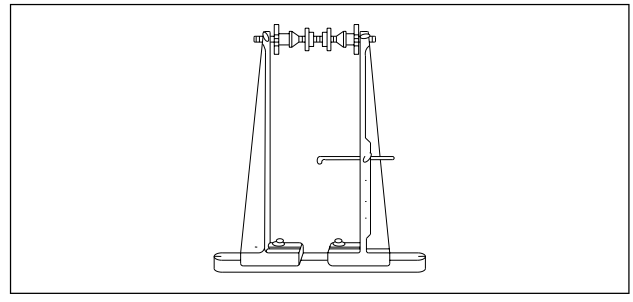
Part No. HD-96550-36A Valve Lapping Tool



Part No. HD-97225-55B Sprocket Shaft (Timken) Bearing Cone Installer Use with HD-39361A.



Part No. HD-96796-47 Valve Spring Tester



Part No. HD-99500-80 Wheel Truing Stand

NOTES

DEUTSCH ELECTRICAL CONNECTORS B.1

GENERAL

All Touring models use Deutsch Electrical Connectors. The Deutsch connector features a superior seal to protect electrical contacts from dirt and moisture in harsh environments. The connector also provides better pin retention than many other connectors.

To become familiar with the Deutsch connector, read the parts description below while referencing the 12-place connector illustrated in Figure B-3.

Socket housing: alignment tabs and/or external latch, secondary locking wedge, internal seal, wire seal, seal pin.

NOTE

Seal pins or plugs are installed in the wire seals of unused pin and socket locations. If removed, seal pins must be replaced to maintain the integrity of the environmental seal.

Pin housing: alignment grooves and/or external latch cover, attachment clip, secondary locking wedge, wire seal, seal pin.

REMOVING/DISASSEMBLING

Attachment clips are attached to the pin housings of most connectors. The clips are then attached to T-studs on the motorcycle frame. T-studs give positive location to electrical connectors and wire harnesses. Consistent location reduces electrical problems and improves serviceability.

1. Push the connector to disengage small end of slot on attachment clip fromT-stud. Lift connector off T-stud.

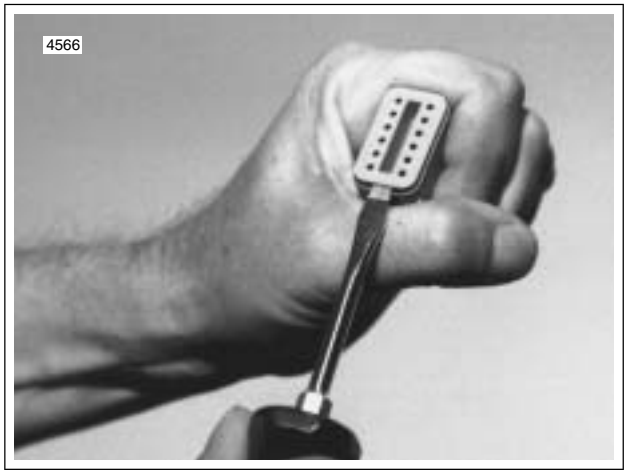


Figure B-1. Remove Secondary Locking Wedge

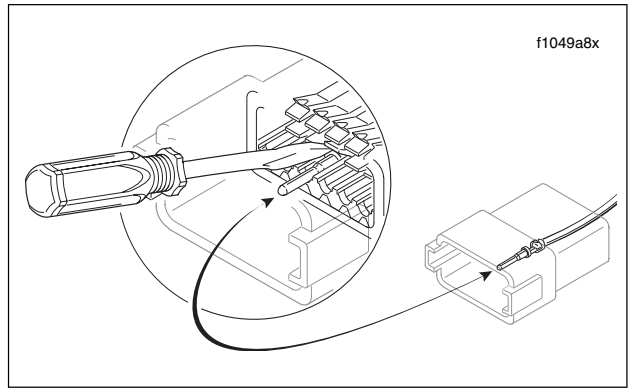


Figure B-2. Depress Terminal Latches/Back Out Pins

2. Depress the external latch(es) on the socket housing side and use a rocking motion to separate the pin and socket halves. Two-, three-, four- and six-place Deutsch connectors have one external latch, while eight- and twelve-place connectors have two, both of which must be pressed simultaneously to separate the connector halves.

NOTE

With few exceptions, the socket housing can always be found on the accessory side, while the pin side of the connector is plumbed to the wiring harness.

REMOVING/INSTALLING SOCKETS

1. See Figure B-1. Remove the secondary locking wedge. Insert the blade of a small screwdriver between the socket housing and locking wedge inline with the groove (inline with the pin holes if the groove is absent). Turn the screwdriver 90 degrees to pop the wedge up.
2. Gently depress terminal latches inside socket housing and back out sockets through holes in rear wire seal. See Figure B-2.

NOTE

If new terminals must be installed, see CRIMPING INSTRUCTIONS in this section.

3. Fit rear wire seal into back of socket housing, if removed. Grasp socket approximately 1 inch (25.4 mm) behind the contact barrel. Gently push sockets through holes in wire seal into their respective chambers. Feed socket into chamber until it “clicks” in place. Verify that socket will not back out of chamber; a slight tug on the wire will confirm that it is properly locked in place.

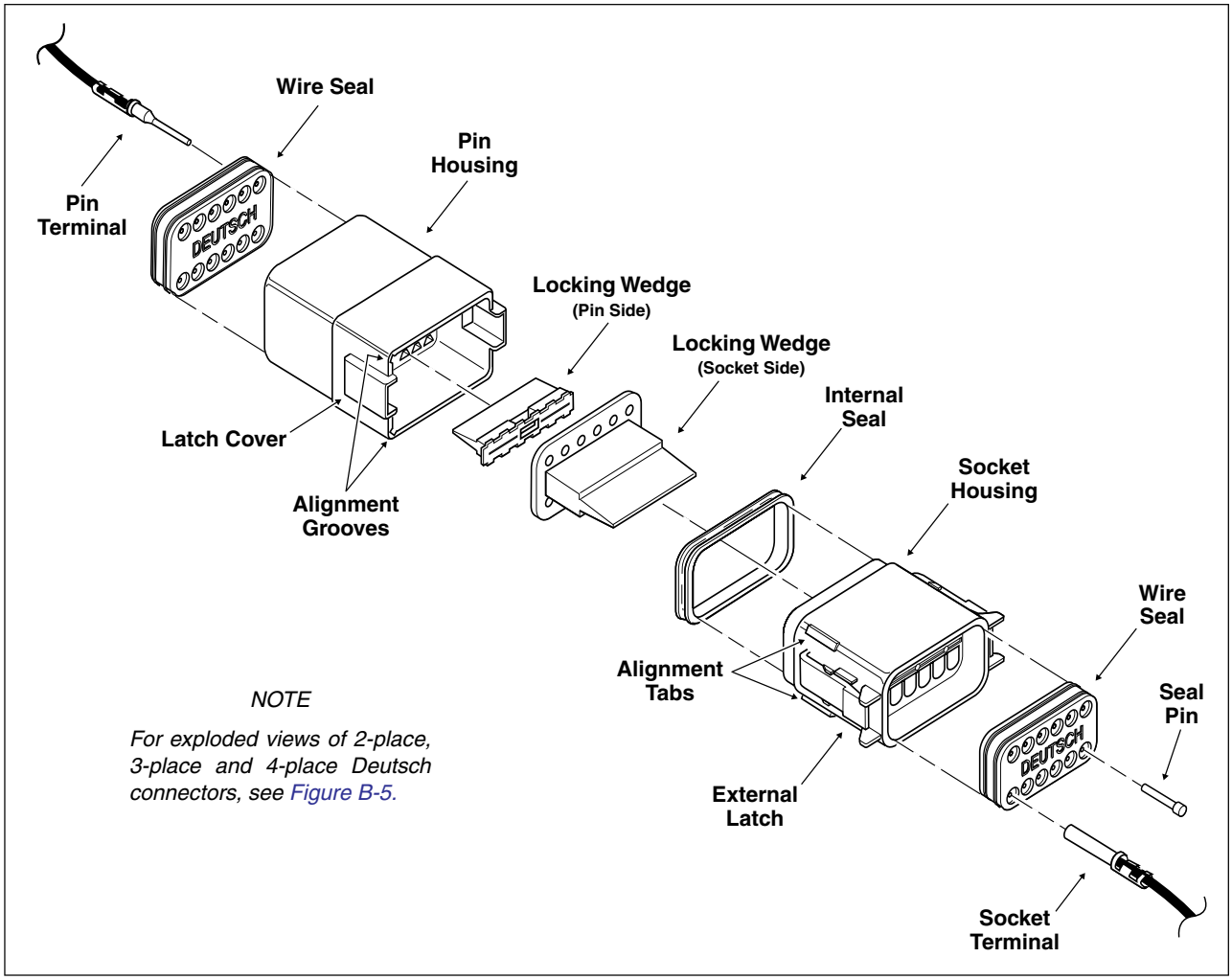


Figure B-3. 12-Place Deutsch Connector (Exploded View)

4. Install internal seal on lip of socket housing, if removed. Insert tapered end of secondary locking wedge into socket housing and press down until it snaps in place. The wedge fits into the center groove within the socket housing and holds the terminal latches tightly closed.

NOTE

While rectangular wedges do not require a special orientation, the conical secondary locking wedge of the 3-place connector must be installed with the arrow pointing toward the external latch. See Figure B-4.

NOTE

If the secondary locking wedge does not slide into the installed position easily, verify that all terminals are fully installed in the socket housing. The lock indicates when terminals are not properly installed by not entering its fully installed position.

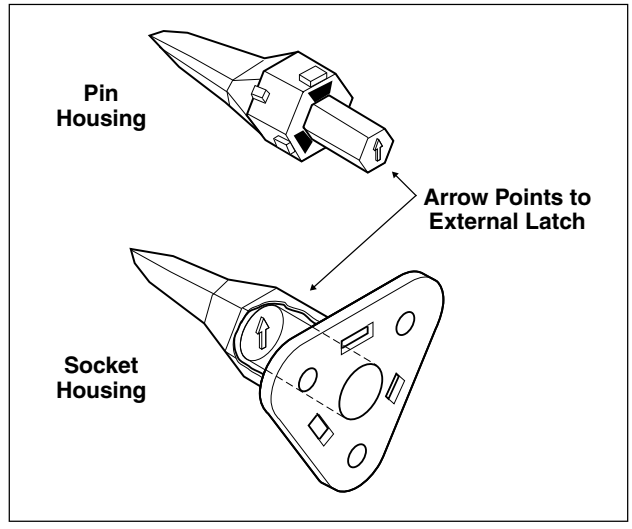


Figure B-4. 3-Place Locking Wedge Orientation

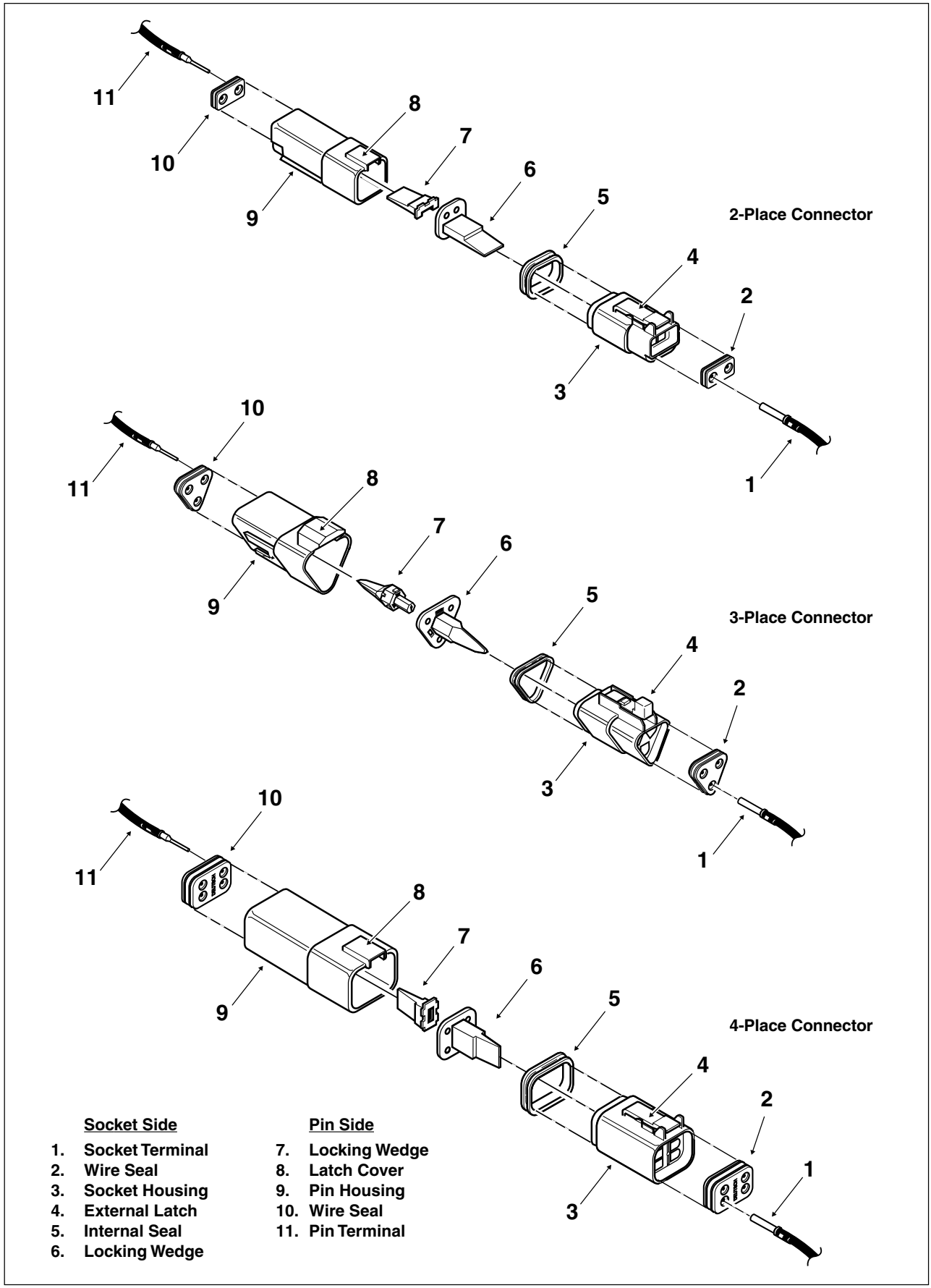


Figure B-5. 2-Place, 3-Place and 4-Place Deutsch Connectors

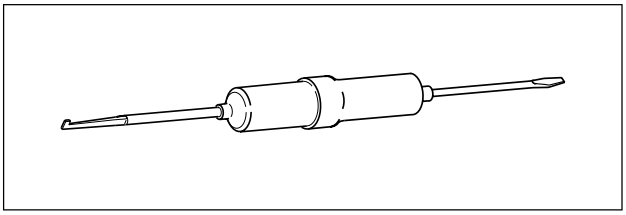


Figure B-6. Deutsch Connector Pick Tool (Part No. HD-41475-100)

REMOVING/INSTALLING PINS

1. Remove the secondary locking wedge. Use the hooked end of a stiff piece of mechanics wire, a needle nose pliers or a suitable pick tool (HD-41475-100). See Figure B-6.
2. Gently depress terminal latches inside pin housing and back out pins through holes in wire seal.

NOTE

If new terminals must be installed, see CRIMPING INSTRUCTIONS on this page.

3. Fit wire seal into back of pin housing. Grasp crimped pin approximately 1 inch (25.4 mm) behind the contact barrel. Gently push pins through holes in wire seal into their respective numbered locations. Feed pin into chamber until it "clicks" in place. Verify that pin will not back out of chamber; a slight tug on the wire will confirm that it is properly locked in place.
4. Insert tapered end of secondary locking wedge into pin housing and press down until it snaps in place. The wedge fits in the center groove within the pin housing and holds the terminal latches tightly closed.

NOTE

While rectangular wedges do not require a special orientation, the conical secondary locking wedge of the 3-place connector must be installed with the arrow pointing toward the external latch. See Figure B-4.

NOTE

If the secondary locking wedge does not slide into the installed position easily, verify that all terminals are fully installed in the pin housing. The lock indicates when terminals are not properly installed by not entering its fully installed position.

ASSEMBLING/INSTALLING

1. Insert socket housing into pin housing until it snaps in place. Two-, three-, four- and six-place Deutsch connectors have one external latch on the socket half of the connector. To fit the halves of the connector together, the latch on the socket side must be aligned with the latch cover on the pin side.

   For those connectors with two external latches (8-place and 12-place), a different system is used to prevent improper assembly. Align the tabs on the socket housing with the grooves on the pin housing. Push the connector halves together until the latches "click." If latches do not click (latch), press on one side of the connector until that latch engages, then press on the opposite side to engage the other latch.

NOTES

- *Deutsch connectors are colored coded for location purposes. Those connectors associated with **left** side accessories, such as the front and rear **left** turn signals, are **gray**. All other connectors, including those associated with right side accessories, are black.*
- *If it should become necessary to replace a plug or receptacle, please note that the 8-place and 12-place gray and black connectors are not interchangeable. Since location of the alignment tabs differ between the black and gray connectors, plugs or receptacles must be replaced by those of the same color. If replacing both the socket and pin halves, then the black may be substituted for the gray, and vice versa. The socket and pin halves of all other connectors are interchangeable, that is, the black may be mated with the gray, since the alignment tabs are absent and the orientation of the external latch is the same.*

2. Fit the attachment clip to the pin housing, if removed. Place large end of slot on attachment clip over T-stud on frame. Push assembly forward to engage small end of slot.

CRIMPING INSTRUCTIONS

Use the Deutsch Terminal Crimp Tool (HD-39965) to install standard size terminals with crimp tails, as described under STANDARD TERMINALS below. To install the mini-Deutsch terminals with crimp tails, see MINI TERMINALS, which follows. To install those terminals without crimp tails, both standard and mini-Deutsch, use the Deutsch Solid Barrel Contact Crimp Tool (HD-42879) as described under SOLID BARREL CONTACTS.

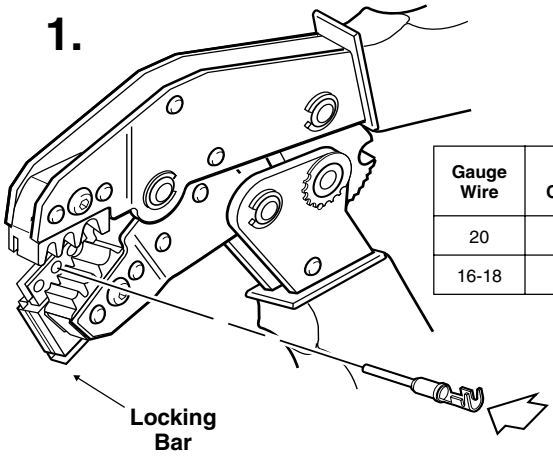
NOTE

A Deutsch Connector Service Kit (HD-41475) contains a selection of wire seals, internal seals, seal plugs, secondary locking wedges, attachment clips and socket/pin terminals. Also included is a compartmented storage box, carrying case and pick tool (HD-41475-100) used for the removal of all types of locking wedges.

STANDARD TERMINALS

1. Obtain the DEUTSCH TERMINAL CRIMP TOOL (HD-39965).

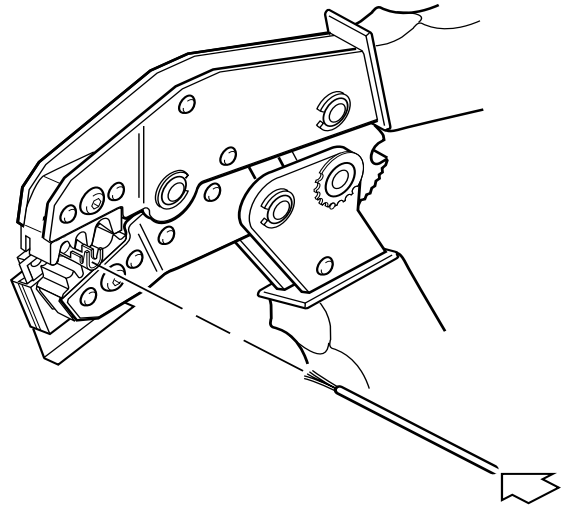
1.



Gauge Wire	Nest of Crimp Tool
20	Front
16-18	Middle

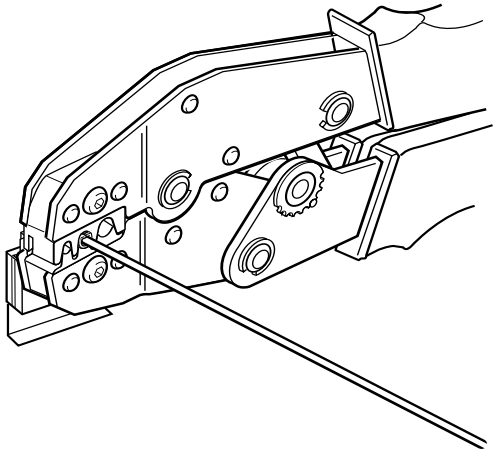
1. Insert contact through hole of locking bar so that barrel rests on nest of crimp tool.

2.



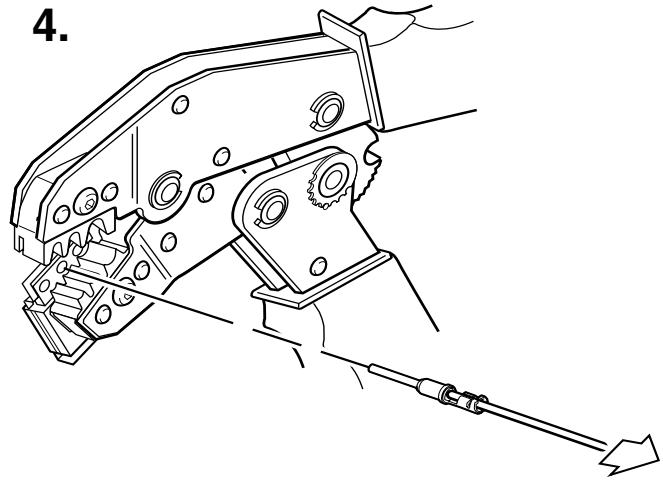
2. Insert stripped lead until it contacts locking bar.

3.



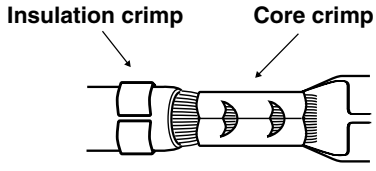
3. Close and squeeze crimp tool.

4.



4. Raise locking bar and remove contact.

5.



5. Inspect quality of core and insulation crimps.

Figure B-7. Deutsch Crimping Procedure

2. Squeeze the handles to cycle the crimp tool to the fully open position. See Figure B-7.
3. Raise the locking bar by pushing up on bottom flange. With the crimp tails facing upward, insert contact (socket/pin) through hole of locking bar, so that the rounded side of the contact barrel rests on the nest (concave split level area) of the crimp tool. Use the middle hole in the locking bar for 16-18 gauge wire, the front hole for 20 gauge wire.
4. Release locking bar to lock position of contact. If the crimp tails are slightly out of vertical alignment, the crimp tool automatically rotates the contact so that the tails face straight upward. When correctly positioned, the locking bar fits snugly in the space between the contact band and the core crimp tails.
5. Strip lead removing 5/32 inch (4.0 mm) of insulation. Insert wires between crimp tails until ends make contact with locking bar. Verify that wire is positioned so that short pair of crimp tails squeeze bare wire strands, while long pair folds over insulation material.
6. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete. Raise up locking bar and remove contact.
7. Inspect the quality of the core and insulation crimps. Distortion should be minimal.

MINI TERMINALS

1. Obtain the PACKARD TERMINAL CRIMP TOOL (HD-38125-7).
2. Strip wire lead removing 5/32 inch (4.0 mm) of insulation.
3. Compress handles until ratchet automatically opens.

NOTE

Always perform core crimp before insulation crimp.

4. Position the core crimp on nest E of the crimping tool. Be sure the core crimp tails are facing the forming jaws.
5. Gently apply pressure to handles of tool until crimpers just secure the core crimp tails.
6. Insert stripped wire between crimp tails. Verify that wire is positioned so that short pair of crimp tails squeeze bare wire strands, while long pair is positioned over the insulation material.
7. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.
8. Position the insulation crimp on nest C of the crimping tool. Be sure the insulation crimp tails are facing the forming jaws.
9. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.
10. Inspect the quality of the core and insulation crimps. Distortion should be minimal.

SOLID BARREL CONTACTS

For Size 20, 16 and 12 Contacts
Wire Range 26-12 AWG

1. Obtain the DEUTSCH SOLID BARREL CONTACT CRIMP TOOL (HD-42879).
2. Squeeze the handles to cycle the crimp tool to the fully open position.
3. Remove locking pin from selector knob. See Figure B-8.
4. Raise selector knob and rotate until selected wire size stamped on wheel is aligned with “SEL. NO.” arrow. See upper frame of Figure B-9.
5. Loosen knurled locknut and turn adjusting screw clockwise (in) until it stops.
6. Turn tool over and drop contact into indentor cover hole with the wire end out.
7. Turn adjusting screw counterclockwise (out) until contact is flush with bottom of depression in indentor cover. Tighten knurled locknut.
8. Slowly squeeze handles of crimp tool until contact is centered between indentor points. See middle frame of Figure B-9.
9. Strip wire lead removing 1/4 inch (6.4 mm) of insulation.
10. Insert bare wire strands into contact barrel. See lower frame of Figure B-9.

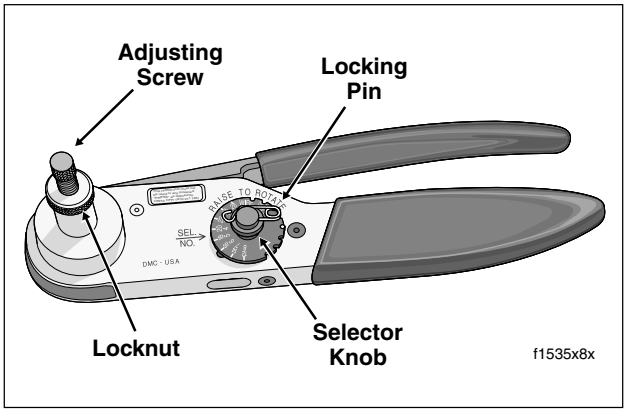
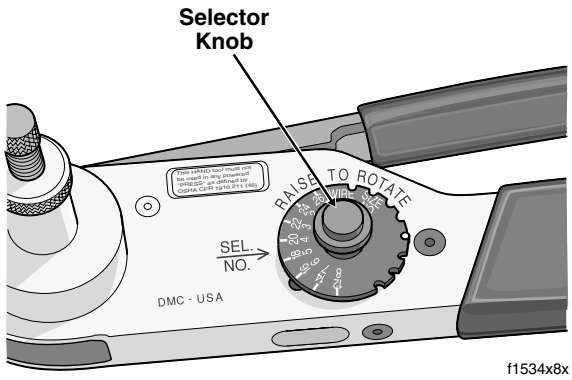
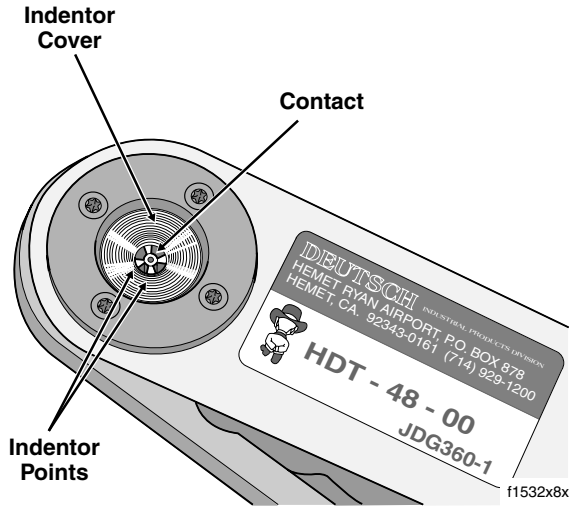


Figure B-8. Deutsch Solid Barrel Contact Crimp Tool (Part No. HD-42879)

Rotate selector knob to align wire size on wheel with arrow stamped in tool.



Turn adjusting screw as described in text. When contact is flush with bottom of depression in indentor cover, squeeze handles to center contact between indentor points.



Insert bare wire strands into contact barrel. Squeeze handle of crimp tool until tightly closed.

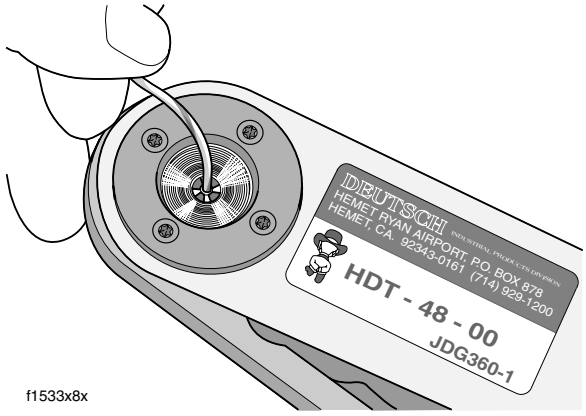


Figure B-9. Deutsch Solid Barrel Contact Crimping Procedure

11. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.
12. Remove crimped contact from indentor.
13. Inspect the quality of the crimp. Verify that all wire strands are in crimp barrel.

NOTE

Tool must be readjusted when changing contact size/type.

14. Install pin to lock position of selector knob.

NOTES

AMP MULTILOCK ELECTRICAL CONNECTORS B.2

REMOVING SOCKET/PIN TERMINALS

1. Remove connector from the retaining device, either attachment or rosebud clip.
2. Depress the button on the socket terminal side of the connector (plug) and pull apart the pin and socket halves. See Figure B-10.
3. Bend back the latch slightly and free one side of secondary lock, then repeat the step to release the other side. Rotate the secondary lock outward on hinge to access terminals in chambers of connector housing.
4. Looking in the terminal side of the connector (opposite the secondary lock), take note of the cavity next to each terminal.
5. See Figure B-11. With the flat edge against the terminal, insert the pick (Snap-On TT600-3) into the cavity until it stops. Pivot the end of the pick away from the terminal and gently tug on wire to pull terminal from chamber. Do not tug on the wire until the tang is released or the terminal will be difficult to remove. A “click” is heard if the tang is engaged but then inadvertently released. Repeat the step without releasing the tang.

NOTE

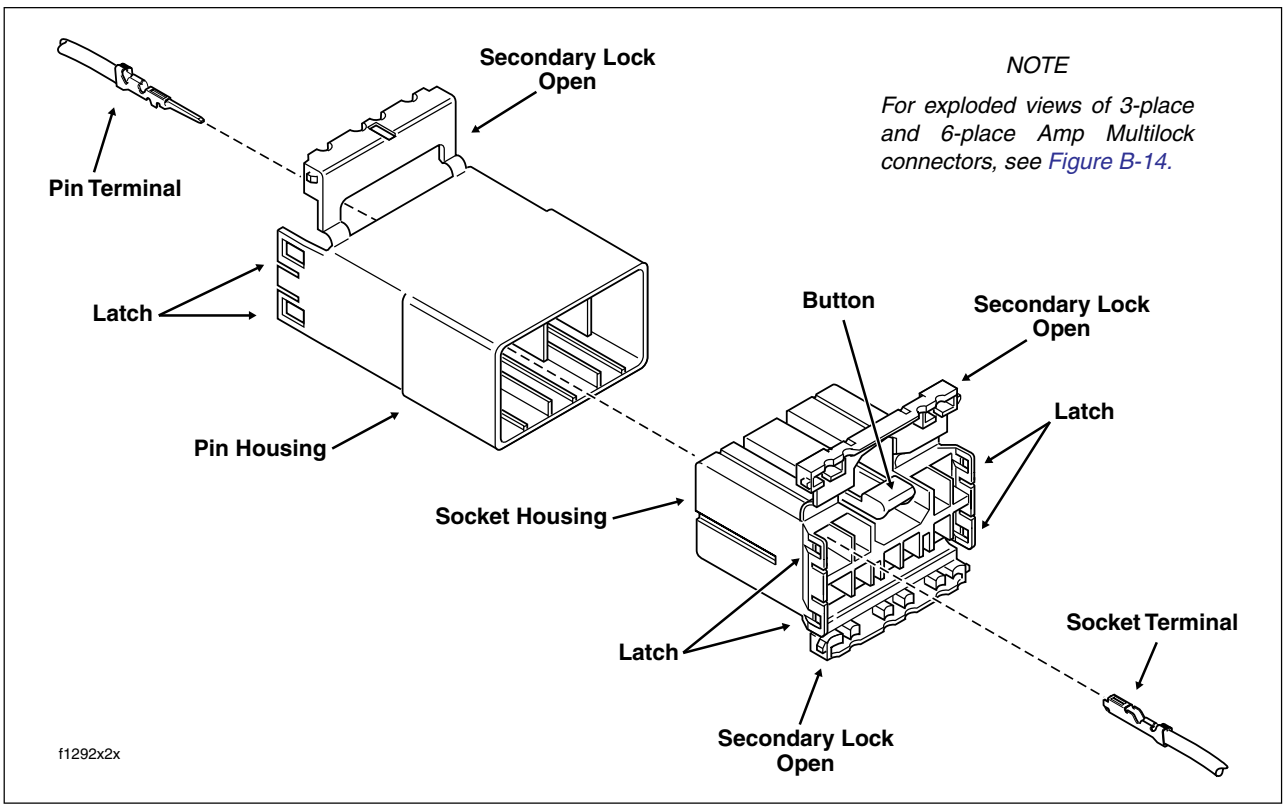
An Electrical Terminal Crimp Tool (Part No. HD-41609) is used to install Amp Multilock pin and socket terminals on wires. If new terminals must be installed, see CRIMPING INSTRUCTIONS in this section.

INSTALLING SOCKET/PIN TERMINALS

NOTE

For wire location purposes, numbers are stamped into the secondary locks of both the socket and pin housings. See Figure B-13.

1. From the secondary lock side of the connector, insert the terminal into its respective numbered chamber until it snaps in place. For proper fit, the slot in the terminal must face the tang in the chamber.



NOTE

For exploded views of 3-place and 6-place Amp Multilock connectors, see Figure B-14.

Figure B-10. 10-Place Amp Multilock Connector (Exploded View)

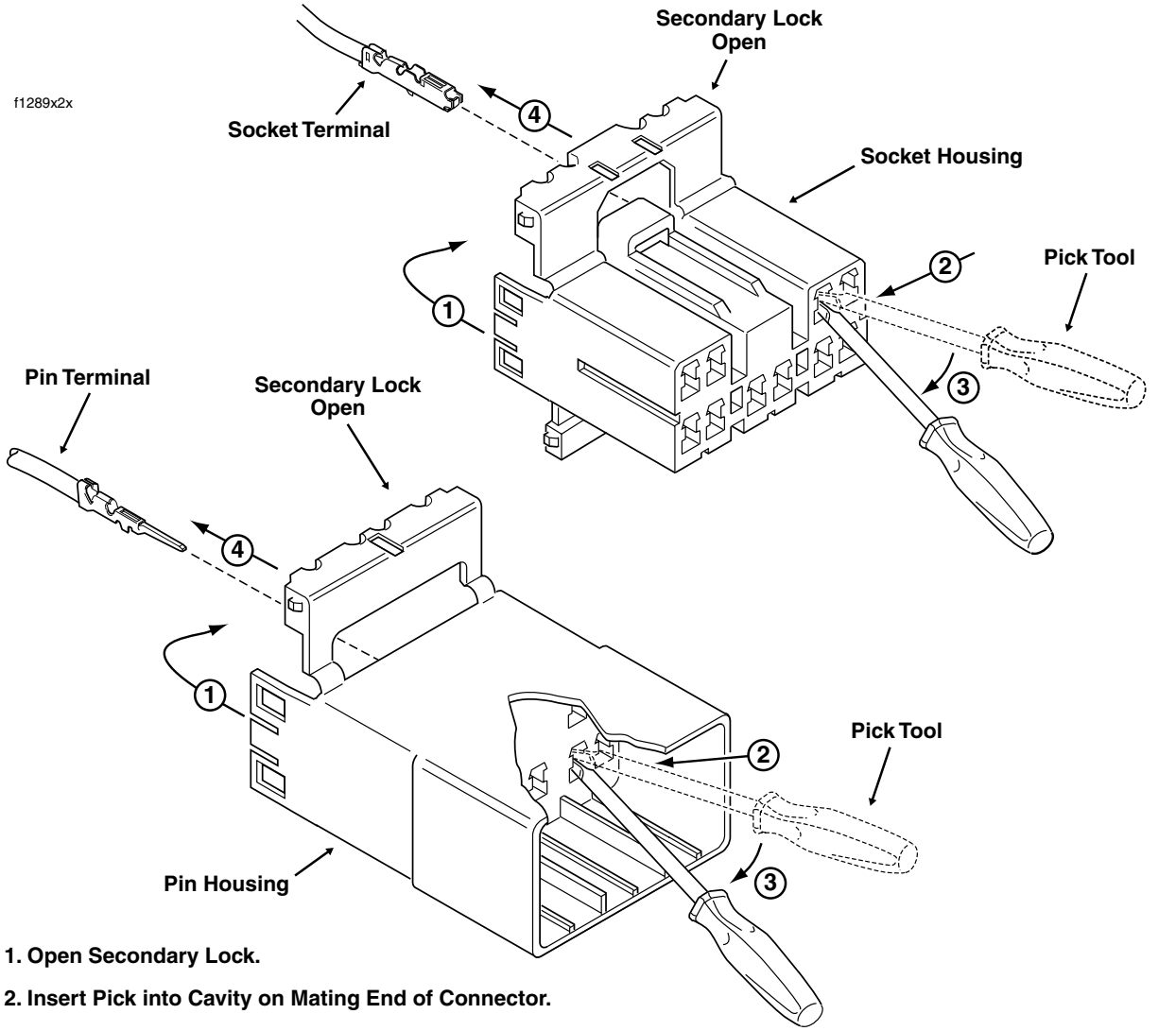


Figure B-11. Release Tang and Back Out Terminals

NOTE

The tang in the chamber engages the slot to lock the terminal in position. On the pin side of the connector, tangs are positioned at the bottom of each chamber, so the slot in the pin terminal (on the side opposite the crimp tails) must face downward. On the socket side, tangs are at the top of each chamber, so the socket terminal slot (on the same side as the crimp tails) must face upward. Up and down can be determined by the position of the release button (used to separate the pin and socket halves), the button always being the top of the connector. See Figure B-12.

2. Gently tug on wire end to verify that the terminal is locked in place and will not back out of chamber.

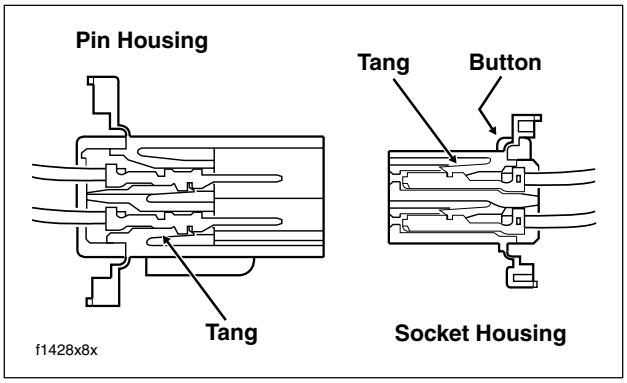


Figure B-12. Tang Location (Cross Sectional View)

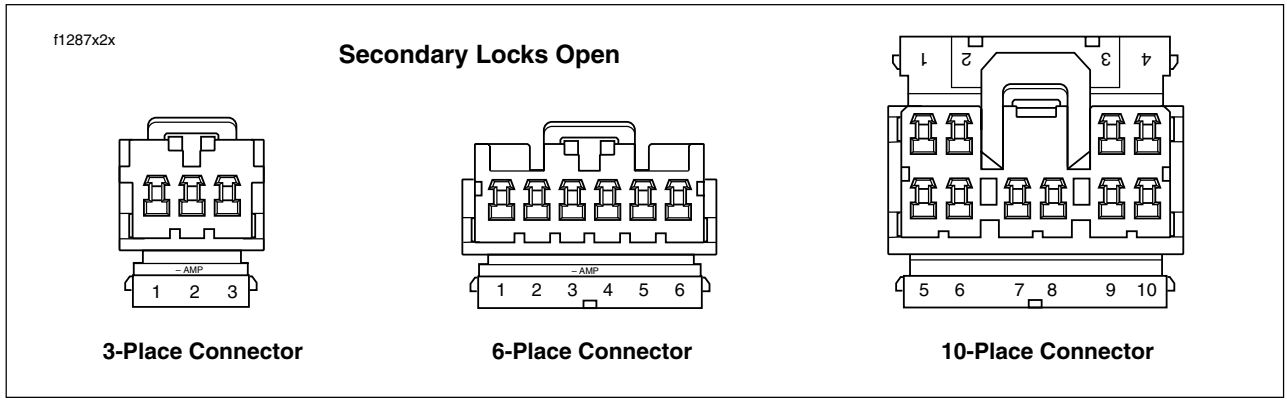


Figure B-13. Numbers Stamped on Secondary Locks for Wire Color Locations (Socket Housings Shown)

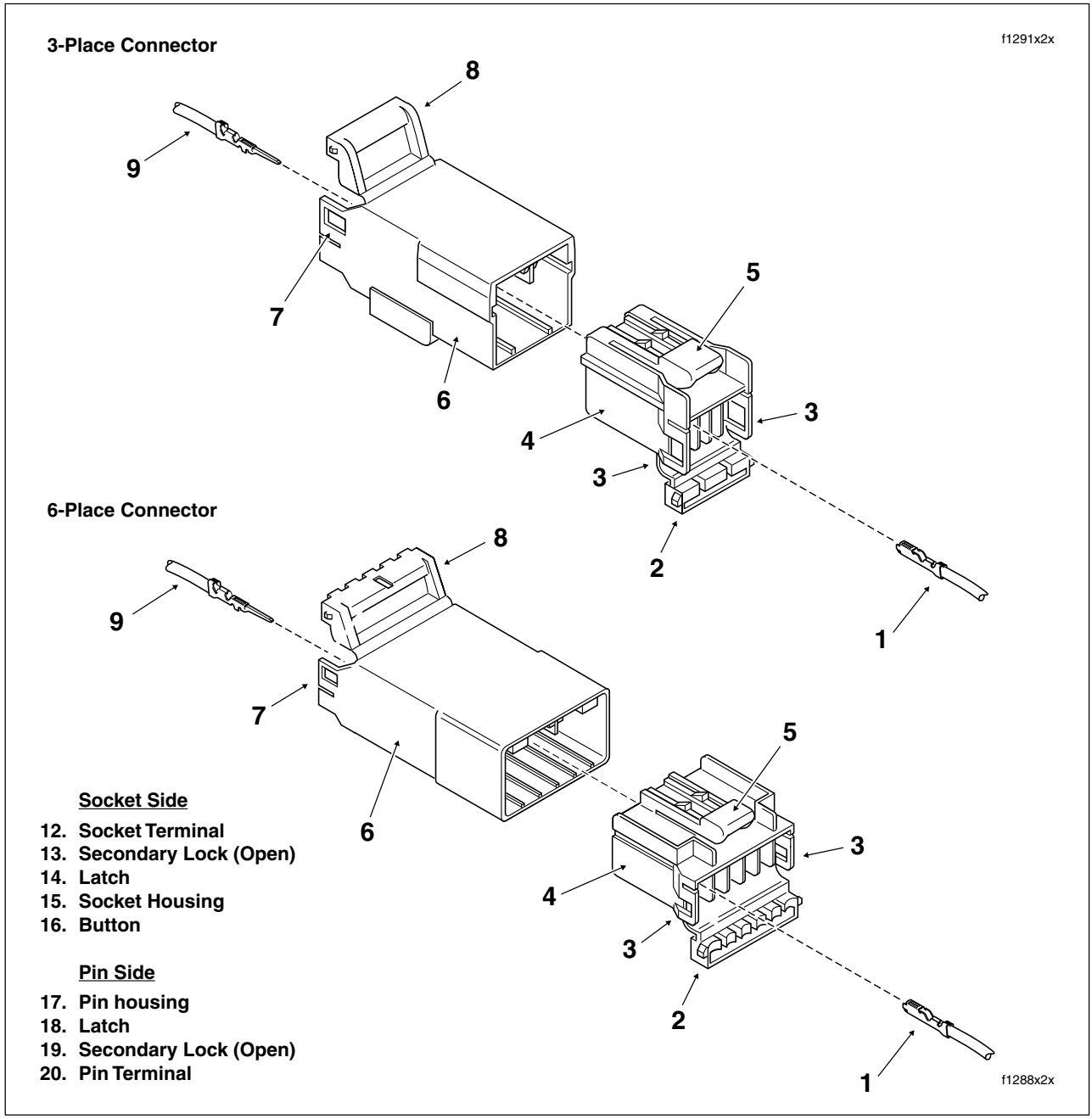
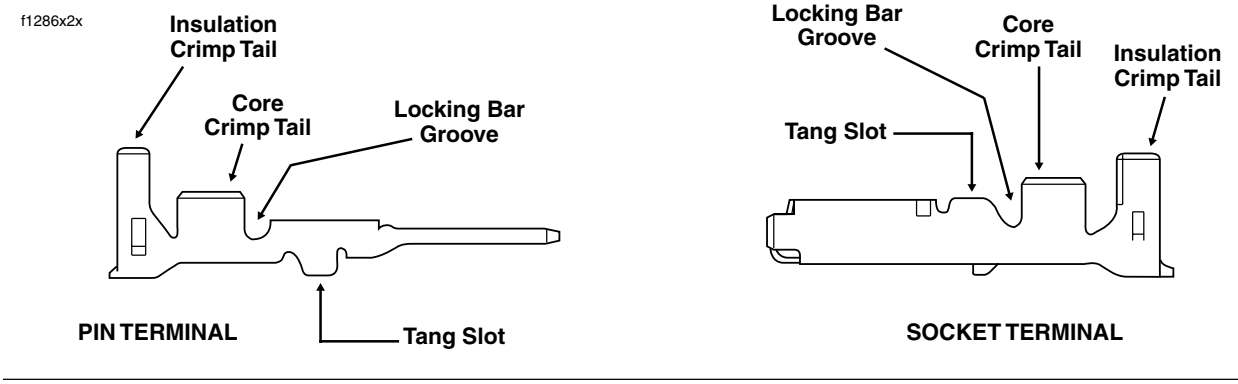
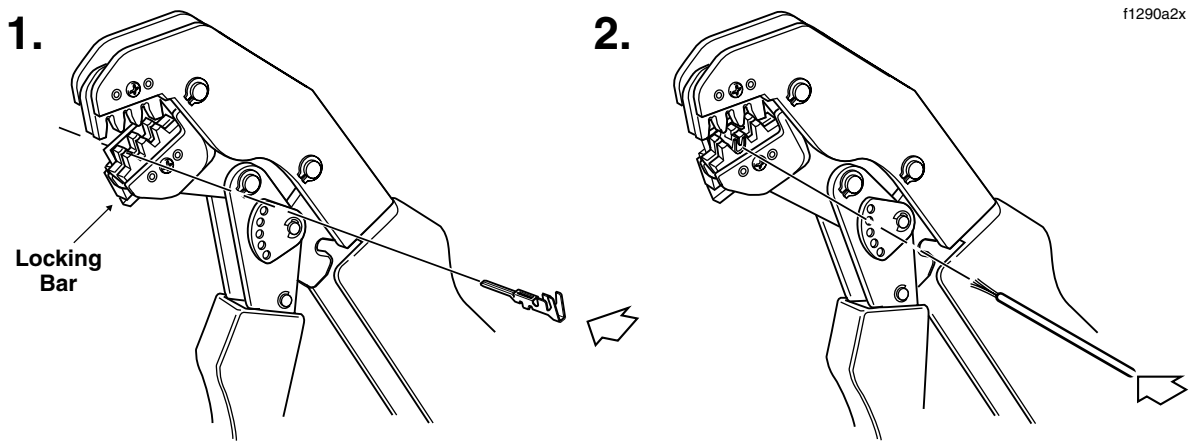


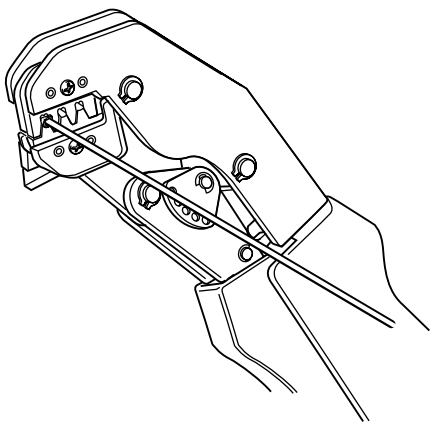
Figure B-14. 3-Place and 6-Place Amp Multilock Connectors



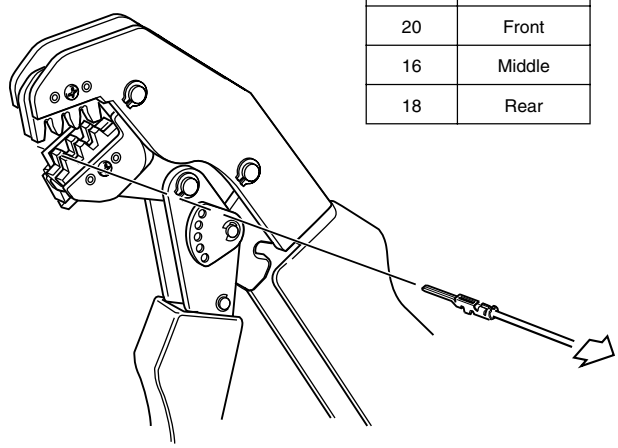


1. Raise locking bar and seat contact on nest of crimp tool. Release locking bar.

2. Insert stripped lead until it contacts locking bar.



3. Close and squeeze crimp tool.



Gauge Wire	Nest of Crimp Tool
20	Front
16	Middle
18	Rear

4. Raise locking bar and remove contact.

Figure B-15. Amp Multilock Crimping Procedure

3. Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.
4. Insert the socket housing (plug) into the pin housing (receptacle) until it snaps in place.
5. Install connector on retaining device, either attachment or rosebud clip.

CRIMPING INSTRUCTIONS

1. Squeeze the handles to cycle the crimp tool (Part No. HD-41609) to the fully open position.
2. Raise locking bar by pushing up on bottom flange. With the crimp tails facing upward, insert contact (socket/pin) through locking bar, so that the closed side of the contact rests on the nest (concave split level area) of the crimp tool). Use the front nest for 20 gauge wire, the middle for 16 gauge and the rear for 18 gauge. See Figure B-15.
3. Release locking bar to lock position of contact. When correctly positioned, the locking bar fits snugly in the space at the front of the core crimp tails.
4. Strip lead removing 5/32 inch (4.0 mm) of insulation. Insert wires between crimp tails until ends make contact with locking bar. Verify that wire is positioned so that short pair of crimp tails squeeze bare wire strands, while long pair folds over insulation material.
5. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete. Raise up locking bar and remove contact.
6. Inspect the quality of the core and insulation crimps. Distortion should be minimal.

PACKARD ELECTRICAL CONNECTORS B.3

GENERAL

From a servicing standpoint, there are two basic types of Packard electrical connectors, those with pull-to-seat terminals and those with push-to-seat terminals.

Look into the mating end of the connector. If it appears that the terminal can be extracted from this side, then it is probably the pull-to-seat type.

At least one Packard pull-to-seat terminal can be easily recognized by the presence of a locking ear. The ear engages a slot in the connector housing and prevents the terminal from being removed from the wire end side of the connector. The ear also acts as a strain relief in the event that the wires are pulled and further inhibits movement of the terminal inside the chamber. For an example of this type of connector, note the IAT Sensor connector [89B].

PULL-TO-SEAT TERMINALS

Unlike most connectors, where the terminals are pulled out the wire end of the connector, to remove the terminals from the pull-to-seat connectors, the terminal is pushed out the mating end of the connector. Once a new terminal is crimped onto the end of the wire, the wire is pulled to draw the terminal back inside the chamber of the connector housing.

The Packard pull-to-seat terminal connectors found on Touring models are listed below.

- MAP Sensor [80B]
- Ignition Coil [83B]
- Fuel Injector [84B and 85B]
- IAC Actuator [87B]
- TP Sensor [88B]
- IAT Sensor [89B]
- ET Sensor [90B]

Two types of Packard pull-to-seat electrical connectors are used. One type has an external latch to lock the pin and socket halves together, while the other makes use of a wireform. See Figure B-16. The manner in which the terminals are picked differs between these two types of connectors, as further described below.

Removing Pull-to-seat Terminals External Latch Type

1. Remove the connector from the retaining device, if present.
2. Bend back the external latch(es) slightly and separate the pin and socket halves of the connector.

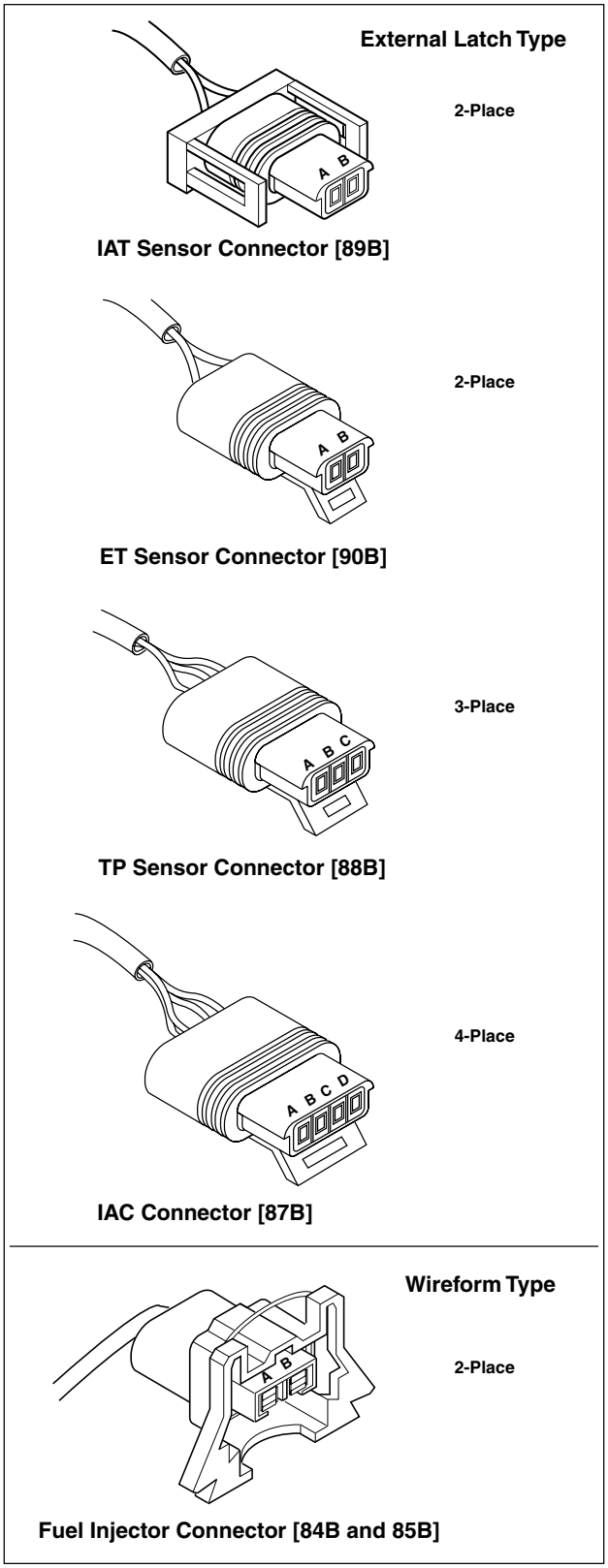


Figure B-16. Packard Pull-to-Seat Terminal Connectors (Socket Sides)

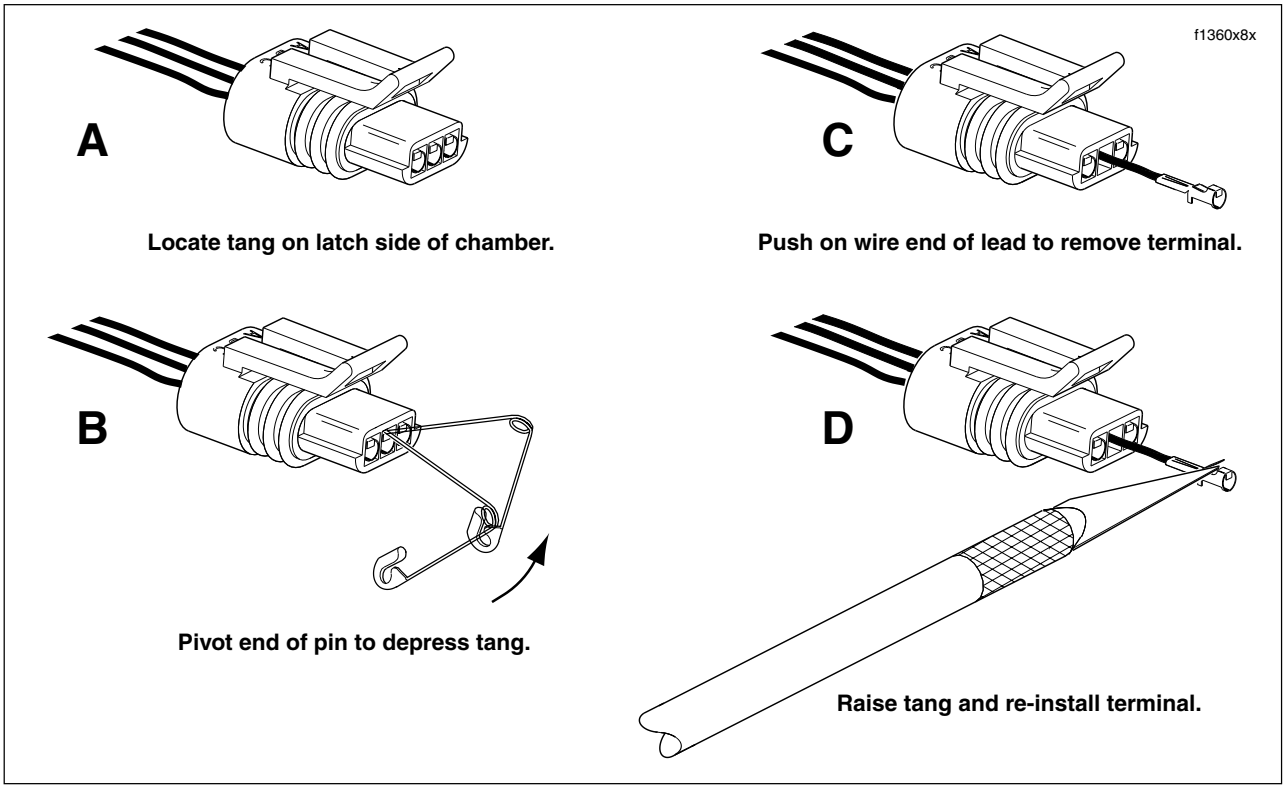


Figure B-17. Depress Tang and Extract Terminal From Mating End of Connector

3. To free a pull-to-seat terminal from the connector housing, first look into the mating end of the connector to find the locking tang. See A in Figure B-17. The tangs are always positioned in the middle of the chamber and are on the same side as the external latch. On those connectors with locking ears, the tang is on the side opposite the ear.
4. At a slight angle, gently insert the point of a one inch safety pin down the middle of the chamber about 1/8 inch (3.2 mm), and pivot the end of the pin toward the terminal body. When a click is heard, remove the pin and repeat the procedure. See B in Figure B-17. The click is the sound of the tang returning to the locked position as it slips from the point of the pin. Pick at the tang in this manner until the clicking stops and the pin seems to slide in at a slightly greater depth than it had previously. This is an indication that the tang has been depressed.

NOTE

On those terminals that have been extracted on a previous occasion, no clicking sound may be heard when the pin is pivoted to depress the tang, but proceed as if the clicking is audible and then push on the wire end of the lead to check if the terminal is free.

NOTE

When picking multiple terminals, the end of the pin may become malleable. For best results, continue the procedure with a new safety pin.

5. Remove the pin and push on the wire end of the lead to extract the terminal from the mating end of the connector. See C in Figure B-17. If necessary, pull back the conduit and remove the wire seal at the back of the connector to introduce some slack in the wires.

NOTE

A series of Packard Electrical Terminal Crimp Tools are available to install Packard pin and socket terminals on wires. If new terminals must be installed, see CRIMPING INSTRUCTIONS in this section.

Installing Pull-to-seat Terminals External Latch Type

NOTE

For wire location purposes, alpha characters are stamped into the socket housings.

1. Using a thin flat blade, like that on an X-Acto knife, carefully bend the tang outward away from the terminal body. See D in Figure B-17.
2. Gently pull on the lead at the wire end of the connector to draw the terminal back into the chamber. A click is heard when the terminal is properly seated.

3. Push on the lead to verify that the terminal is locked in place.

4. Push the pin and socket halves of the connector together until the latches “click.”

Removing Pull-to-Seat Socket Terminals Wireform Type

1. Depress the wireform and use a rocking motion to detach the electrical connector.

2. Pry rubber seal from wire end of connector and move seal down wires toward conduit.

3. Hold the connector so that the wireform is facing down, and looking into the wire end of the connector, insert the point of a safety pin between the top of the terminal and the inside chamber wall.

4. Push safety pin completely into chamber while watching terminal on mating end of connector. When terminal is observed moving forward slightly, then tang is depressed. See A in Figure B-18. Remove safety pin.

NOTE

Repeat steps 3 and 4 as necessary until the desired result is achieved.

5. Push on wire end of the lead to extract the terminal from the mating end of the connector. See B in Figure B-18.

Installing Pull-to-Seat Socket Terminals Wireform Type

NOTE

For wire color locations, see Section B.7 WIRING DIAGRAMS and then refer to the bottom frame of Figure B-16.

1. Using a thin flat blade, like that on an X-Acto knife, carefully bend the tang outward away from the terminal body. See C in Figure B-18.

2. Gently pull on the lead at the wire end of the connector to draw the terminal back into the chamber. Be sure that the tang faces opposite the wireform as it enters the chamber. A “click” is heard when the terminal is properly seated. See D in Figure B-18.

3. Push on lead to verify that terminal is locked in place.

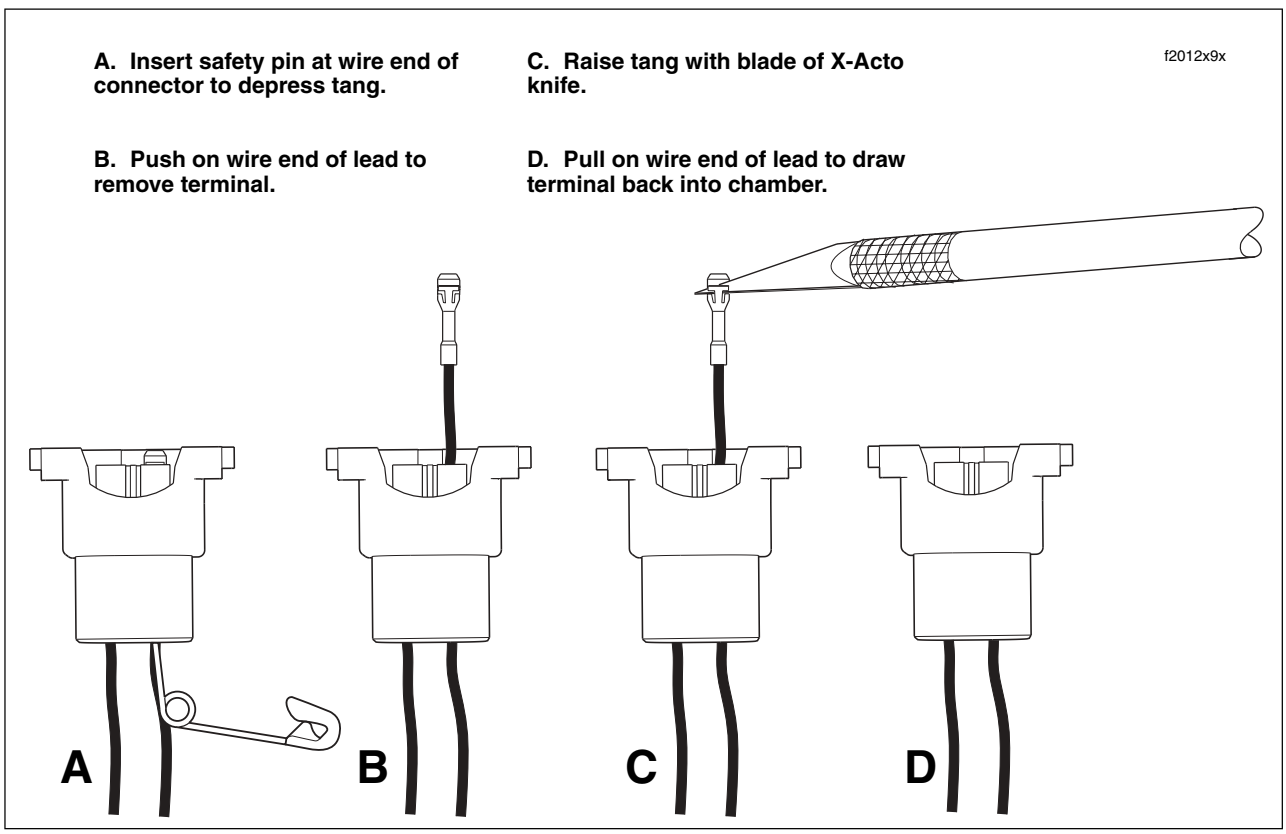


Figure B-18. Extract/Install Socket Terminal at Mating End of Connector

4. Fit rubber wire seal back into wire end of connector.
5. Push the pin and socket halves of the connector together until the latch “clicks.” The groove in the socket housing must be aligned with the tab in the pin housing.

PUSH-TO-SEAT TERMINALS

The Packard push-to-seat terminals can be found as follows:

- Ignition Light/Key Switch [33]
- Main Power [3]
- HDI Ignition Light/Key Switch Jumper Harness [33D]
- Fuse Blocks

Ignition Switch and Main Power

Removing Terminals

1. Remove connector from barbed anchor or other retaining device, if present.
2. Bend back the external latch slightly and separate pin and socket halves of the connector.
3. Bend back the latch slightly and free one side of the secondary lock. Repeat the step to unlatch the other side.
4. Rotate the secondary lock outward on hinge to view the terminals in the chambers of the connector housing. The locking tang is on the side opposite the crimp tails and engages a rib in the chamber wall to lock the terminal in place.
5. Moving to the mating end of the connector, take note of the small opening on the chamber wall side of each terminal.
6. Insert pick (Snap-on® TT600-3) into opening until it stops. Pivot the end of the pick toward the terminal to depress the locking tang.
7. Remove the pick and gently tug on the wire to pull the terminal from the wire end of the connector. Repeat steps if the terminal is still locked in place.
8. If necessary, crimp new terminals on wires. See CRIMPING INSTRUCTIONS in this section.

Installing Terminals

NOTE

For wire location purposes, alpha characters are molded into the secondary locks of each connector housing.

1. Using a thin flat blade, like that on an X-Acto knife, carefully bend the tang outward away from the terminal body.
2. With the tang facing the chamber wall, push the lead into the chamber at the wire end of the connector. A click is heard when the terminal is properly seated.
3. Gently tug on the wire end to verify that the terminal is locked in place and will not back out of the chamber.
4. Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.
5. Push the pin and socket halves of the connector together until the latches “click.”
6. Install connector on barbed anchor or other retaining device, if present.

HDI Ignition Switch Jumper Harness

Removing Terminals

1. Obtain terminal pick (Snap-on® GA500A) like that shown Figure B-19.
2. Insert smallest pair of pins into chamber on mating end of socket housing to depress tangs on each side of terminal simultaneously.
3. Gently pull on wire to remove terminal from wire end of socket housing.
4. If necessary, crimp new terminals on wires. See CRIMPING INSTRUCTIONS in this section.

Installing Terminals

1. Using a thin flat blade, like that on an X-Acto knife, carefully bend tang on each side of terminal outward away from terminal body.
2. With the open side of the terminal facing rib on wire end of socket housing, insert terminal into chamber until it locks in place.

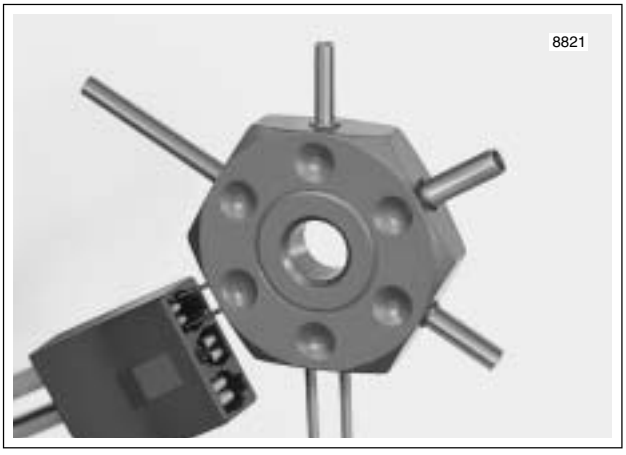


Figure B-19. Depress Tangs and Remove Terminal

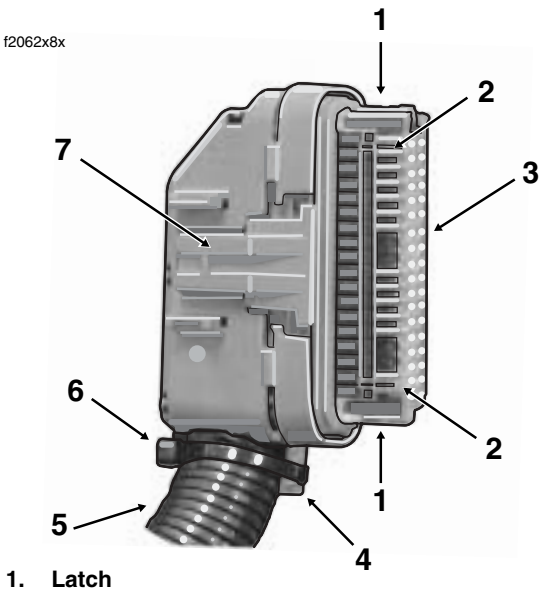
Fuse Blocks

See Section 8.29 PREMIUM SOUND SYSTEM (FLHTC/U, FLTR), FUSE BLOCKS.

PACKARD ECM CONNECTOR

Disassembly

1. Gently depress latch on each side of the clear plastic secondary lock and remove. For best results, release one side at a time, See Figure B-20.
2. Carefully cut cable strap to free strain relief collar from conduit.
3. Using a thin blade, gently pry at seam at back of socket housing to release three plastic pins from slots in housing. Separate and spread halves of socket housing. See Figure B-21.
4. Push on selected wire to free terminal from chamber. See Figure B-22.
5. If necessary, crimp new terminals on wires. See CRIMPING INSTRUCTIONS on the next page.



1. **Latch**
2. **Rib**
3. **Secondary Lock**
4. **Strain Relief Collar**
5. **Conduit**
6. **Cable Strap**
7. **External Latch**

Figure B-20. Remove Secondary Lock

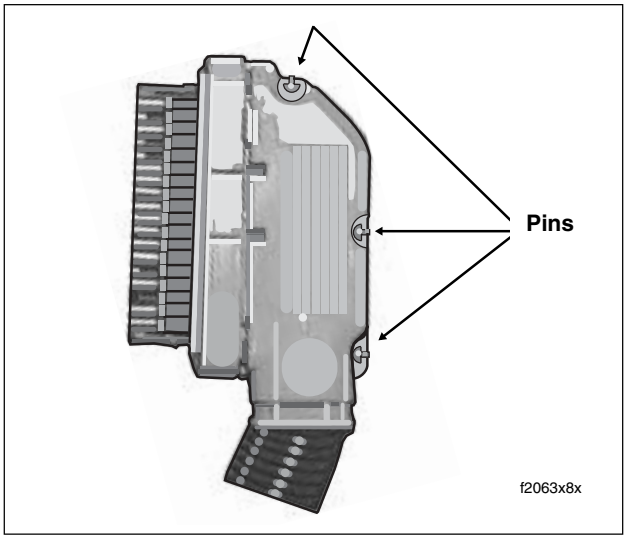


Figure B-21. Separate Halves of Socket Housing

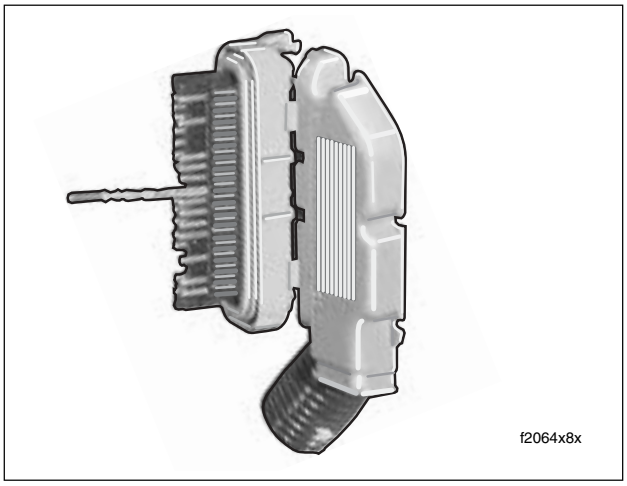


Figure B-22. Push Wire to Extract Terminal

Assembly

1. From inside socket housing, gently pull on wire to draw terminal into chamber. See Figure B-22.
2. Exercising caution to avoid pinching wires, press halves of socket housing together until three plastic pins fully engage slots in housing. See Figure B-21.
3. Install **new** cable strap in groove of strain relief collar capturing cable conduit. See Figure B-20.
4. With the two ribs on the secondary lock on the same side as the external latch, install over terminals until latches lock in place.

CRIMPING INSTRUCTIONS

1. Strip wire lead removing 5/32 inch (4.0 mm) of insulation.
2. Compress handles until ratchet automatically opens.

NOTE
Always perform core crimp before insulation/seal crimp.

3. See Figure B-23. Determine the correct dye or nest for the core crimp.
4. Position the core crimp on the appropriate nest. Be sure the core crimp tails are facing the forming jaws.
5. Gently apply pressure to handles of tool until crimpers just secure the core crimp tails.
6. Insert stripped wire between crimp tails. Verify that wire is positioned so that short pair of crimp tails squeeze bare wire strands, while long pair is positioned over the insulation or seal material.
7. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.
8. See Figure B-23. Determine the correct dye or nest for the insulation/seal crimp.
9. Position the insulation/seal crimp on the appropriate nest. Be sure the insulation/seal crimp tails are facing the forming jaws.

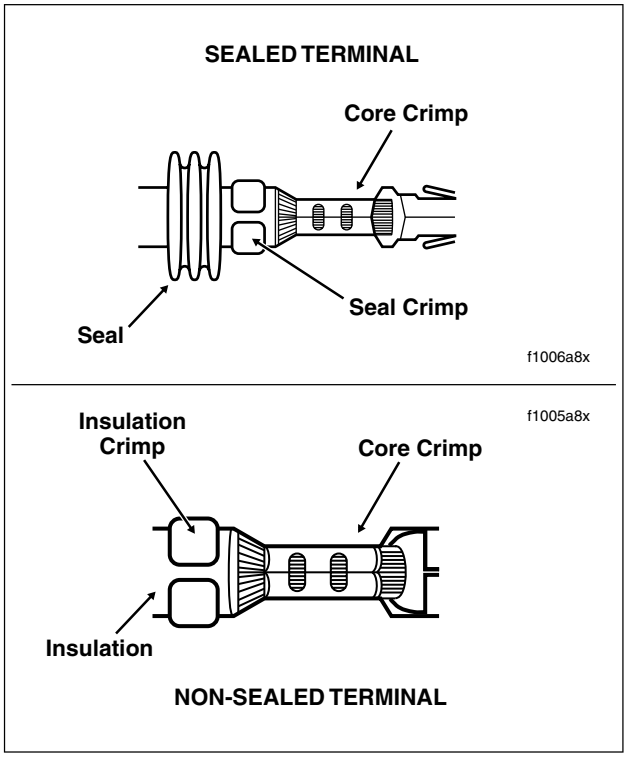


Figure B-24. Inspect Core and Insulation/Seal Crimps

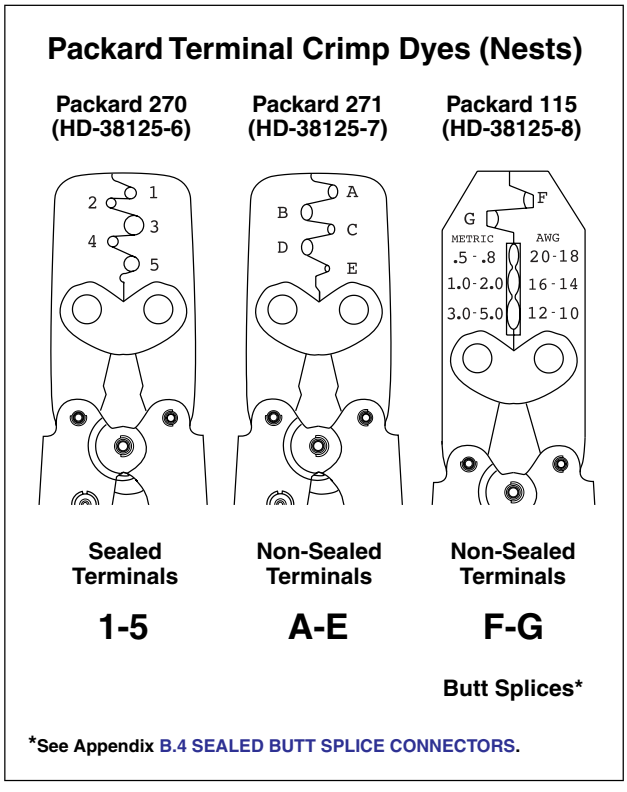


Figure B-23. Packard Terminal Crimp Tools

10. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.
11. Inspect the quality of the core and insulation/seal crimps. Distortion should be minimal. See Figure B-24.

SEALED BUTT SPLICE CONNECTORS B.4

PROCEDURE

Butt splicing may be a necessary procedure for the replacement of some components. Proceed as follows:

1. Strip 3/8 inch (9.5 mm) of insulation off the ends of the wires.
2. Compress the handles of the Packard Crimp Tool (HD-38125-8) until the ratchet automatically opens.
3. Since the size of the connectors vary with the gauge of the wire, reference the following table to ensure properly sealed splices are used.

Gauge Wire	Connector Color	Part Number
18-20	Red	P/N 70585-93
14-16	Blue	P/N 70586-93
10-12	Yellow	P/N 70587-93

4. Determine the correct dye or nest for the crimping operation. Match the color or gauge wire marked on the butt splice connector with the corresponding crimp cavity on the crimp tool. See Figure B-25.
5. Gently apply pressure to the handles until the crimper lightly secures one side of the metal insert inside the butt splice connector. The connector must be crimped in two stages, one side and then the other.
6. See Figure B-26. Feed the wire into the butt splice connector until the stripped end contacts the wire stop inside the metal insert.
7. Squeeze the handles of the crimp tool until tightly closed. The tool automatically opens when the crimping se-quence is complete.
8. Repeat steps 5, 6 and 7 on the other side of the butt splice connector.

NOTE

If adjacent wires are being spliced, stagger the splices so that the butt splice connectors are spaced at different positions along the length of the wires.

9. Using the UltraTorch UT-100 (HD-39969), Robinair Heat Gun (HD-25070) with heatshrink attachment (HD-41183) or other suitable radiant heating device, heat the crimped splice to encapsulate the butt splice connection. Apply heat from the center of the crimp out to each end until the meltable sealant exudes out both ends of the connector. See Figure B-26.

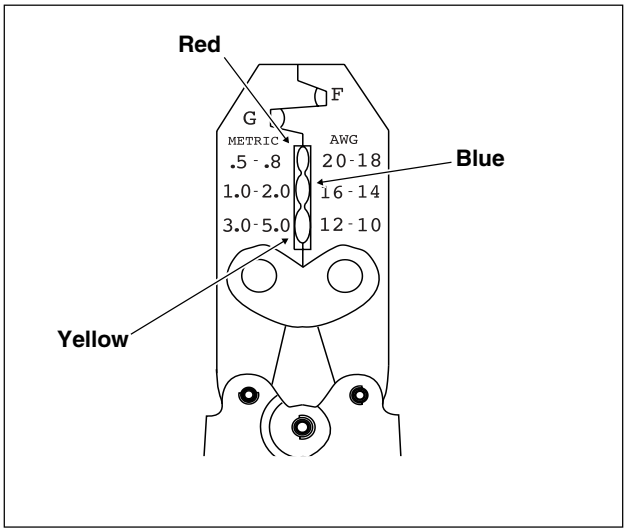


Figure B-25. Packard Crimp Tool (HD-38125-8)

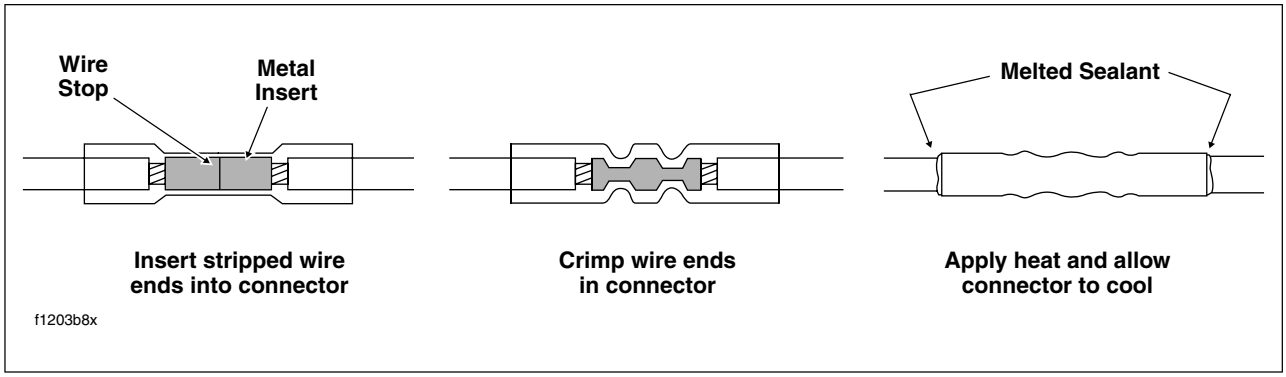


Figure B-26. Installing Sealed Butt Splice Connectors

⚠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.

NOTE

It is acceptable for the splice to rest against the heat shrink tool attachment.

10. Heat the center of the splice until the crimp indentations disappear and the tubing assumes a smooth cylindrical appearance.

AMP ELECTRICAL CONNECTORS B.5

1-PLACE CONNECTOR

The 1-place Amp MATE-N-LOK connector can be found on some Touring models.

SOCKET TERMINAL

Removal

1. Bend back the ears on the pin housing slightly and separate the pin and socket halves of the connector.
2. Grasp the lead on the wire end of the socket housing and push the terminal forward toward the mating end of the connector until it stops. This will disengage the locking tang from the groove in the connector.
3. Fit the barrel of the Amp Socket Terminal Remover (HD-39621-27) over the socket, and while rotating the tool slightly, push until it bottoms in the housing. Allow the plunger to "back out" of the handle. See Figure B-27.

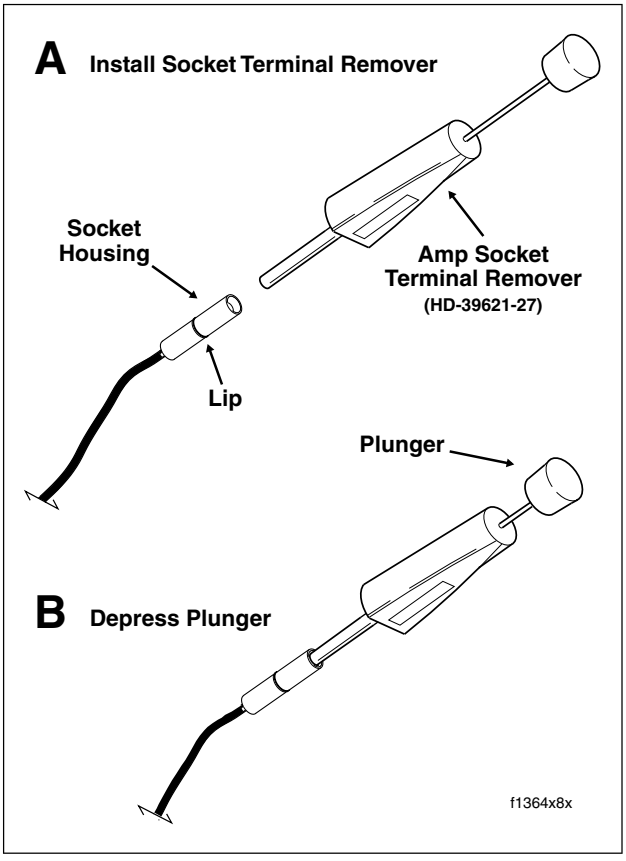


Figure B-27. Remove Terminal from Amp Socket Housing

4. Holding the socket housing while keeping the tool firmly bottomed, depress the plunger. The terminal pops out the wire end of the connector.

NOTE

If the terminal is not released from the socket housing, then the terminal was not pushed forward far enough before placement of the tool or the tool was not bottomed in the connector housing.

Installation

1. Note the lip at the middle of the socket housing. One side of the lip is flat while the other side is tapered. Insert the wire terminal into the socket housing on the flat lip side.
2. Push the lead into the socket housing until it stops. A click is heard when the terminal is properly seated.
3. Gently tug on the lead to verify that the terminal is locked in place.
4. Push the pin and socket halves of the connector together until the latches "click."

PIN TERMINAL

Removal

1. Bend back the ears on the pin housing slightly and separate the pin and socket halves of the connector.
2. Grasp the lead on the wire end of the pin housing and push the terminal forward toward the mating end of the connector until it stops. This will disengage the locking tang from the groove in the connector.
3. Fit the barrel of the Amp Pin Terminal Remover (HD-39621-28) over the pin, and while rotating the tool slightly, push until it bottoms in the housing. Allow the plunger to "back out" of the handle. See Figure B-28.
4. Holding the pin housing while keeping the tool firmly bottomed, depress the plunger. The terminal pops out the wire end of the connector.

NOTE

If the terminal is not released from the pin housing, then the terminal was not pushed forward far enough before placement of the tool or the tool was not bottomed in the connector housing.

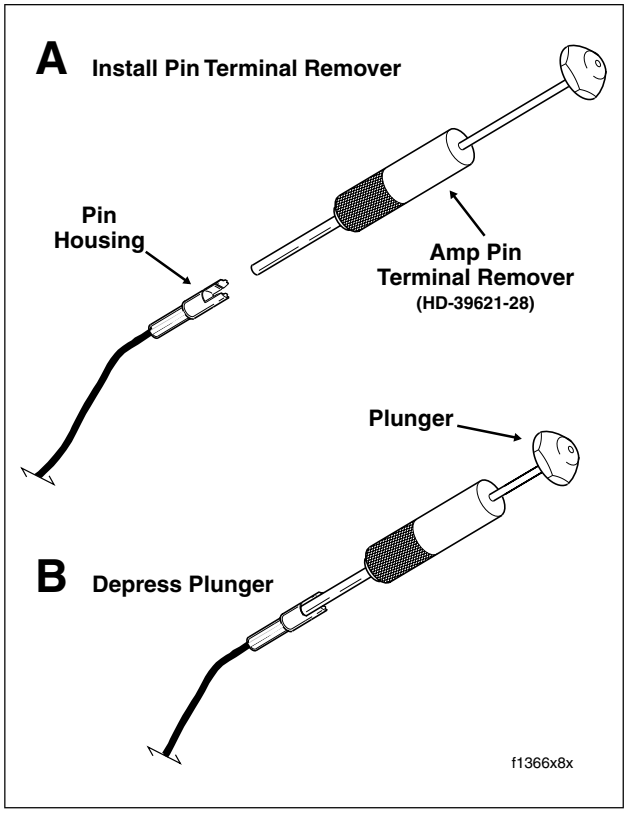


Figure B-28. Remove Terminal from Amp Pin Housing

Installation

1. Push the lead into the pin housing until it stops. A click is heard when the terminal is properly seated.
2. Gently tug on the lead to verify that the terminal is locked in place.
3. Push the pin and socket halves of the connector together until the latches “click.”

ELECTRICAL CONNECTOR LOCATIONS B.6

FLHT/C/U WIRE HARNESS CONNECTORS

No.	Description	Type	Location	Fig.
[1]	Main to Interconnect Harness	12 - Place Deutsch (Black)	Inner Fairing - Right Fairing Bracket	29
[2]	Main to Interconnect Harness	12 - Place Deutsch (Gray)	Inner Fairing - Right Radio Support Bracket	29
[4]	Accessory	4 - Place Deutsch	Upper Frame Cross Member (Under Seat)	34
[5]	Main Circuit Breaker	Ring Terminals	Upper Frame Cross Member (Under Seat)	34
[6]	Audio to Interconnect Harness	3 - Place Deutsch (Black)	Inner Fairing - Left Fairing Support Brace	29
[7]	Rear Fender Lights Harness	8 - Place Multilock	Top of Rear Fender (Under Seat)	37
[8]	Ignition Harness (Main to EFI Harness on EFI models)	12 - Place Deutsch (Gray)	Under Right Side Cover	33
[10]	Ignition Module ****	12 - Place Deutsch (Black)	Under Right Side Cover	36
[11]	Ignition Module ****	12 - Place Deutsch (Gray)	Under Right Side Cover	36
[12]	Tour-Pak Lights	3 - Place Multilock	Inside Tour-Pak	30
[13]	Fuel Level Sender (and Fuel Pump on EFI models)	3 - Place Multilock	Behind Fuel Tank (Under Seat)	40
[15]	Main Power	4 - Place Packard	Inner Fairing - Front of Top Fork Bracket (Below Radio)	29
[17]	Cruise Control Module **	10 - Place Packard	Under Left Side Cover	31
[18]	Left Rear Turn Signal	2 - Place Multilock	Circuit Board Under Tail Lamp Assembly	38
[19]	Right Rear Turn Signal	2 - Place Multilock	Circuit Board Under Tail Lamp Assembly	38
[21]	Indicator Lamps	10 - Place Multilock	Inner Fairing (Between Speedometer and Tachometer Brackets)	29
[22]	Interconnect to Right Handlebar Switch Controls	12 - Place Deutsch (Black)	Inner Fairing - Right Fairing Support Brace	29
[24]	Interconnect to Left Handlebar Switch Controls	12 - Place Deutsch (Gray)	Inner Fairing - Left Fairing Support Brace	29
[27]	Radio *	23 - Place Amp (Black)	Inner Fairing - Back of Radio (Right Side)	29
[28]	Radio **	23 - Place Amp (Gray)	Inner Fairing - Back of Radio (Left Side)	29
[30]	Turn Signal/Security Module	12 - Place Deutsch	Cavity in Crossmember at Rear of Battery Box (Under Seat)	35
[31]	Front Turn Signals	6 - Place Multilock	Inner Fairing - Inboard of Left Fairing Bracket	29
[32]	Front Fender Tip Lamp (DOM)	2 - Place Multilock (Black)	Inner Fairing - Next to Top Fork Bracket	29
[33]	Ignition/Light Key Switch	4 - Place Packard	Inner Fairing - Below Radio	29
[38]	Headlamp	Headlamp Connector	Inner Fairing	-
[39]	Speedometer	12 - Place Packard	Inner Fairing (Back of Speedometer)	29
[41]	Rear Right Speaker/Passenger Controls **	6 - Place Mini-Deutsch	Inside Rear Right Speaker Box	-
[42]	Rear Left Speaker/Passenger Controls **	6 - Place Mini-Deutsch	Inside Rear Left Speaker Box	-
[45]	Rear Fender Tip Lamp (DOM)	3 - Place Multilock	Circuit Board Under Tail Lamp Assembly	38
[46]	Stator/Voltage Regulator	2 - Place Packard	Bottom of Voltage Regulator	39
[50]	CB Antenna Cable **	-	Inner Fairing - Back of Radio (Right Side)	29,30
[51]	Radio Antenna Cable *	-	Inner Fairing - Back of Radio (Left Side)	29
[53]	Console Pod **	12 - Place Mini-Deutsch	Rear of Battery Box (Under Seat)	35
[62]	Rear Fuse Block	Fuse Terminals	Under Left Side Cover	31,32
[64]	Front Fuse Block	Fuse Terminals	Under Left Side Cover	31,32
[65]	Speedometer Sensor	3 - Place Deutsch	Upper Frame Cross Member (Under Seat)	-
[73]	Passing Lamps	2 - Place Multilock (White)	Inner Fairing - Next to Top Fork Bracket	29
[75]	Cruise Roll-Off Switch	Spade Contacts	Right Side of Steering Head	-
[76]	Passenger Headset	7 - Place DIN	Below Rear Left Speaker Box	-
[78]	Electronic Control Module (ECM) ***	36 - Place Packard	Under Right Side Cover	33
[79]	Crankshaft Position (CKP) Sensor	2 - Place Mini-Deutsch	Under Right Side Cover (Behind Electrical Bracket)	33
[80]	Manifold Absolute Pressure (MAP) Sensor	3 - Place Packard	Top of Intake Manifold/Induction Module	-
[83]	Ignition Coil	4 - Place Packard	Below Fuel Tank (Left Side)	-
[84]	Front Injector ***	2 - Place Packard	Below Fuel Tank (Left Side)	-
[85]	Rear Injector ***	2 - Place Packard	Below Fuel Tank (Left Side)	-
[87]	Idle Air Control (IAC) ***	4 - Place Packard	Below Fuel Tank (Right Side)	-

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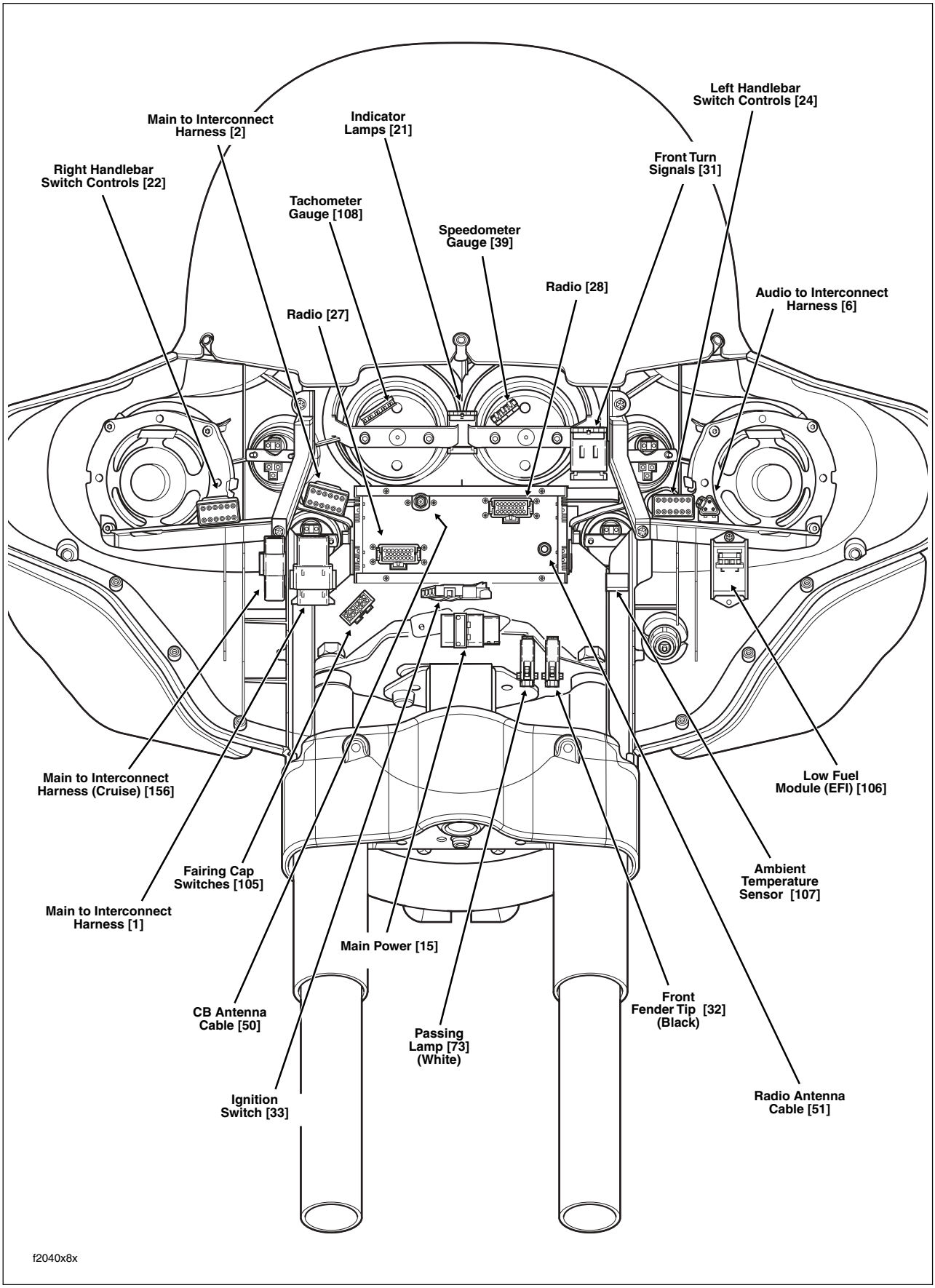


Figure B-29. Inner Fairing Connectors (FLHT/C/U)

FLHT/C/U WIRE HARNESS CONNECTORS (Continued)

No.	Description	Type	Location	Fig.
[88]	Throttle Position Sensor (TP Sensor) ***	3 - Place Packard	Below Fuel Tank (Right Side)	-
[89]	Intake Air Temperature Sensor (IAT Sensor) ***	2 - Place Packard	Below Fuel Tank (Right Side)	-
[90]	Engine Temperature Sensor (ET Sensor) ***	2 - Place Packard	Back of Front Cylinder (Left Side)	-
[91]	Data Link	4 - Place Deutsch	Under Right Side Cover	33
[93]	Tail Lamp	4 - Place Multilock	Circuit Board Under Tail Lamp Assembly	38
[94]	Rear Fender Lights Harness to Circuit Board	6 - Place Multilock	Circuit Board Under Tail Lamp Assembly	38
[105]	Fairing Cap Switches	12 - Place Multilock	Inner Fairing - Beneath Radio (Right Side)	29
[106]	Low Fuel Module ***	6 - Place Multilock	Inner Fairing - Left Fairing Support Brace	29
[107]	Ambient Air Temperature Sensor *	3 - Place Multilock	Inner Fairing - Left Fairing Bracket	29
[108]	Tachometer	6 - Place Packard	Inner Fairing (Back of Tachometer)	29
[110]	Voltmeter Lamp	Spade Connector	Inner Fairing	-
[111]	Voltmeter	Spade Connector	Inner Fairing	-
[112]	Oil Pressure Gauge Lamp	Spade Connector	Inner Fairing	-
[113]	Oil Pressure Gauge	Spade Connector	Inner Fairing	-
[114]	Air Temperature Gauge Lamp	Spade Connector	Inner Fairing	-
[115]	Air Temperature Gauge	Spade Connector	Inner Fairing	-
[116]	Fuel Gauge Lamp	Spade Connector	Inner Fairing	-
[117]	Fuel Gauge	Spade Connector	Inner Fairing	-
[119]	EFI Fuses ***	Fuse Terminals	Fuse Block (Under Right Side Cover)	33
[120]	Oil Pressure Sending Unit	4 - Place Packard	Front Right Crankcase	-
[121]	Rear Brake Light Switch	Spade Terminals	Beneath Transmission (Right Side)	-
[122]	Horn	Spade Terminals	Between Cylinders (Left Side)	-
[123]	Starter Relay	Relay Connector	Rear of Battery Box (Under Seat) - Left Side	35
[124]	Brake Light Relay	Relay Connector	Rear Fuse Block (Under Left Side Cover)	32
[126]	Ignition Keyswitch Relay	Relay Connector	Rear of Battery Box (Under Seat) - Left Side	35
[128]	Starter Solenoid	Spade Terminals	Top of Starter	-
[129]	Harness Grounds	Ring Terminals	Upper Frame Cross Member (Under Seat)	34
[131]	Neutral Switch	Post Terminals	Transmission Top Cover	-
[132]	Cigarette Lighter *	Spade Terminals	Inner Fairing	-
[135]	EFI System Relay ***	Relay Connector	Fuse Block (Under Right Side Cover)	33
[140]	Oil Pressure Sending Unit	2 - Place Mini-Deutsch	Under Right Side Cover (Behind Electrical Bracket)	33
[141]	Fuel Tank Harness	3 - Place Mini-Deutsch	Top of Canopy (Under Console)	-
[142]	Siren (Optional)	3 - Place Packard	Under Right Side Cover (Behind Electrical Bracket)	33
[156]	Main to Interconnect Harness (Cruise)	4 - Place Deutsch	Inner Fairing - Right Fairing Bracket	29

* Classic and Ultra ** Ultra Only *** Fuel Injected Models **** Carbureted Models

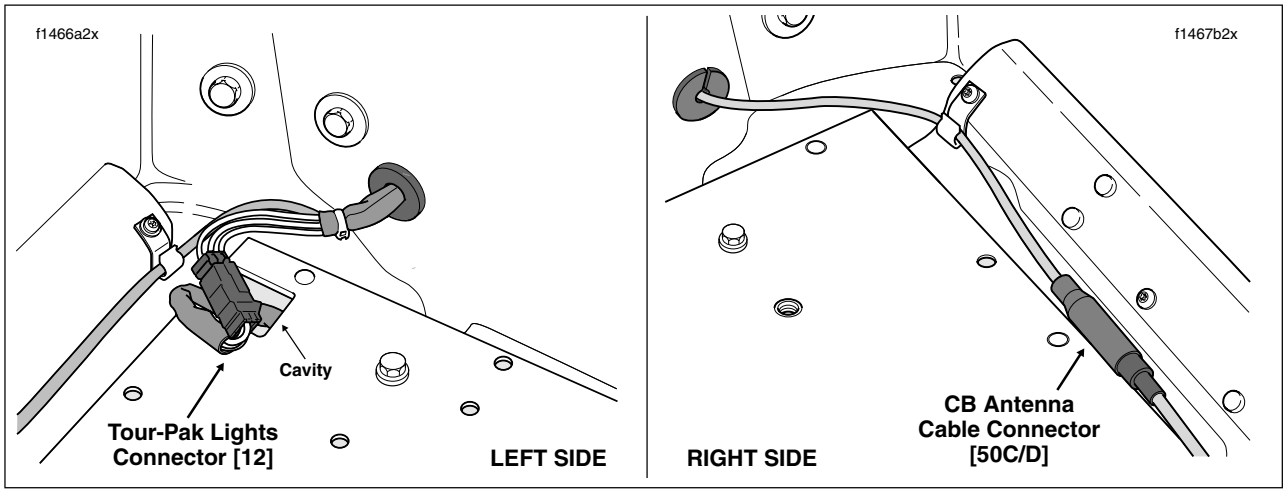


Figure B-30. Tour-Pak Connectors

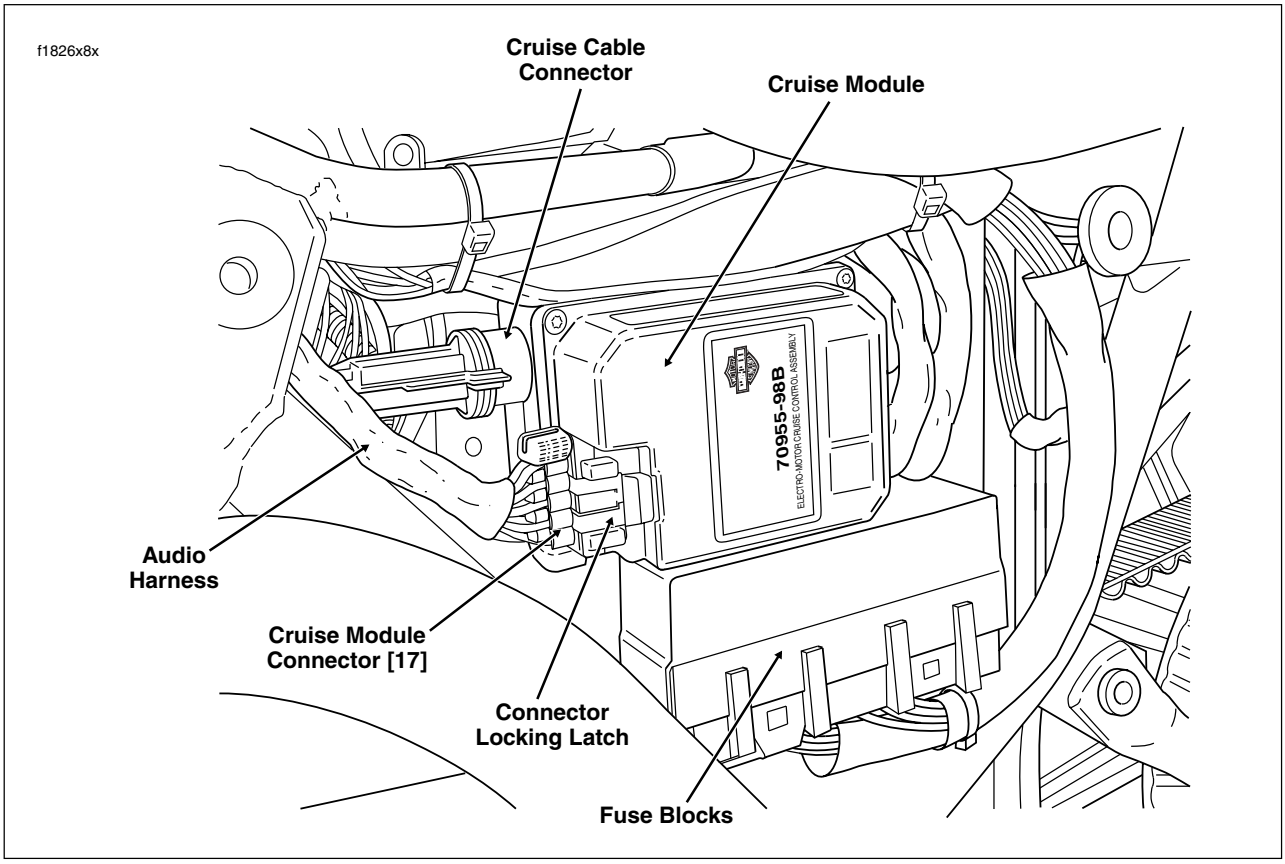


Figure B-31. Cruise Control Module (Under Left Side Cover)

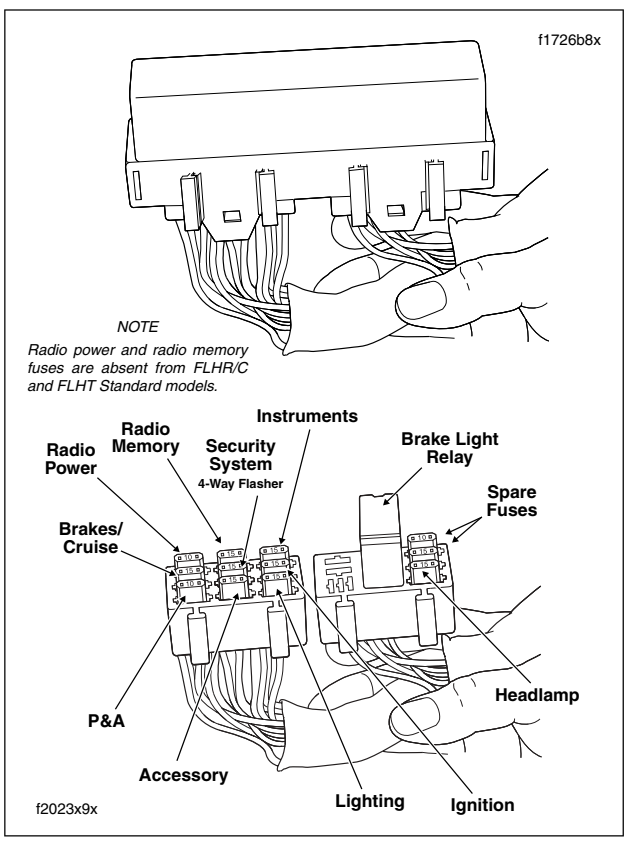


Figure B-32. Fuse Blocks - FLTR, FLHTC/U (Under Left Side Cover)

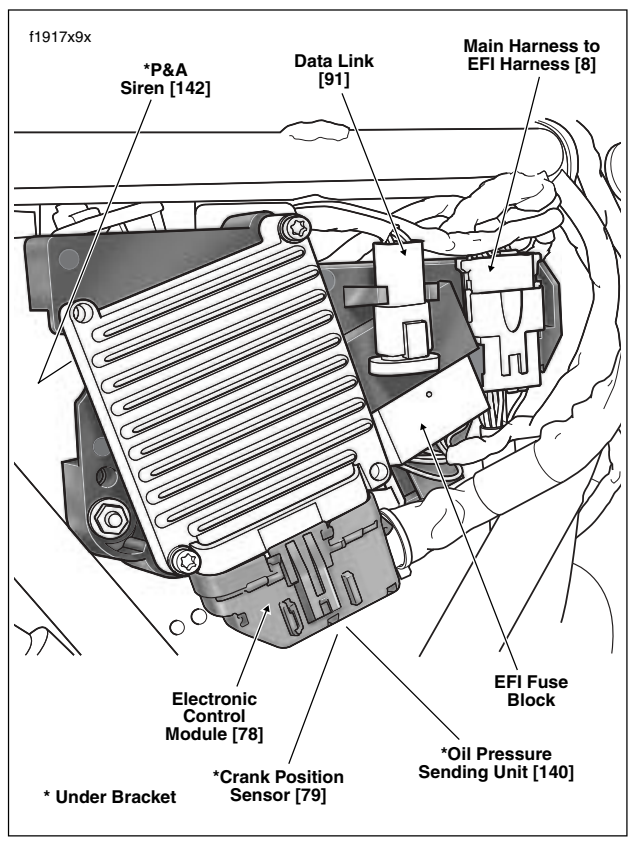


Figure B-33. Electrical Bracket - Fuel Injected Models (Under Right Side Cover)

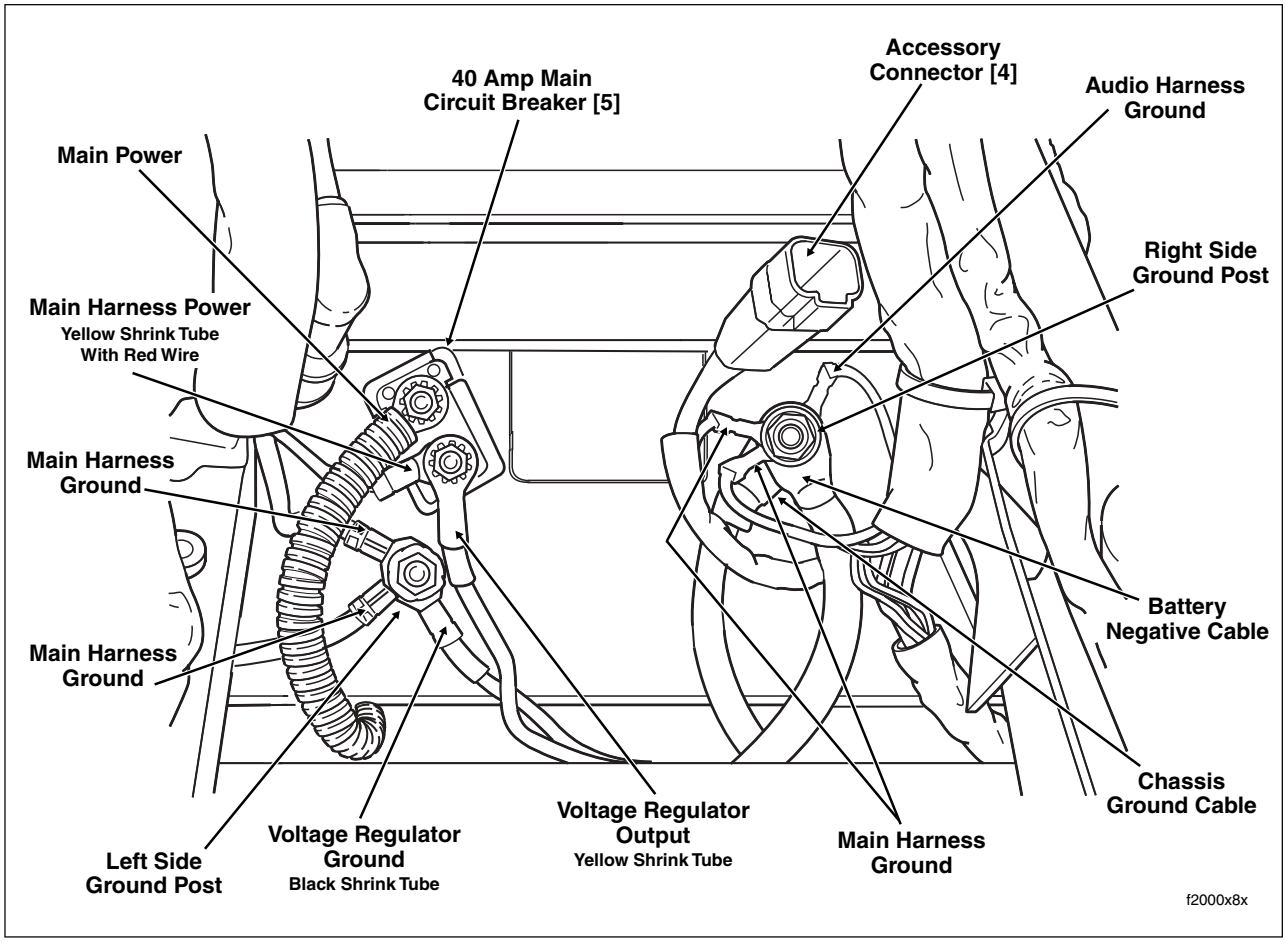


Figure B-34. Electrical Connections - Upper Frame Cross Member (Under Seat)

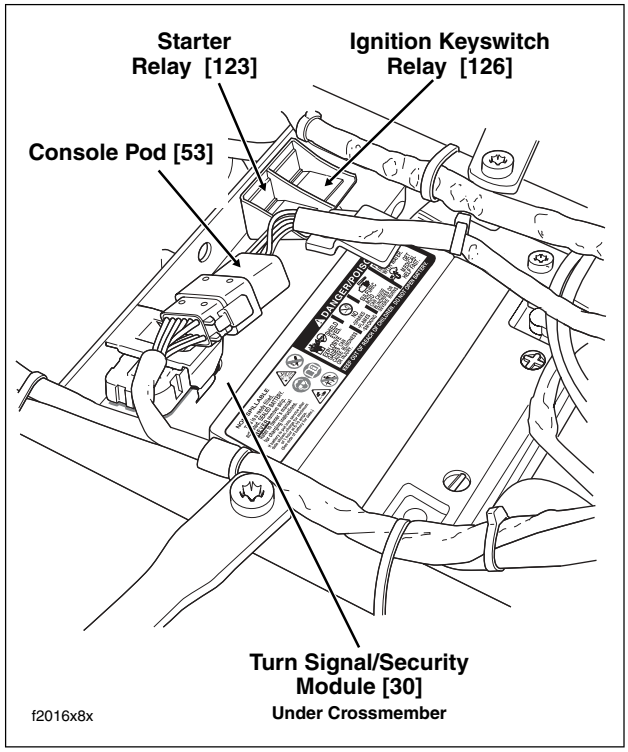


Figure B-35. Electrical Connectors/Relays (Under Seat)

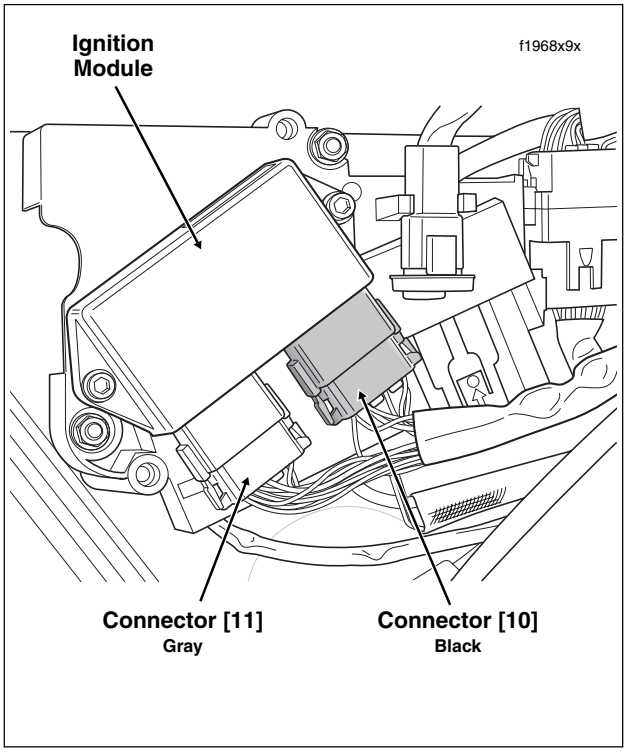


Figure B-36. Ignition Module - Carbureted Models (Under Right Side Cover)

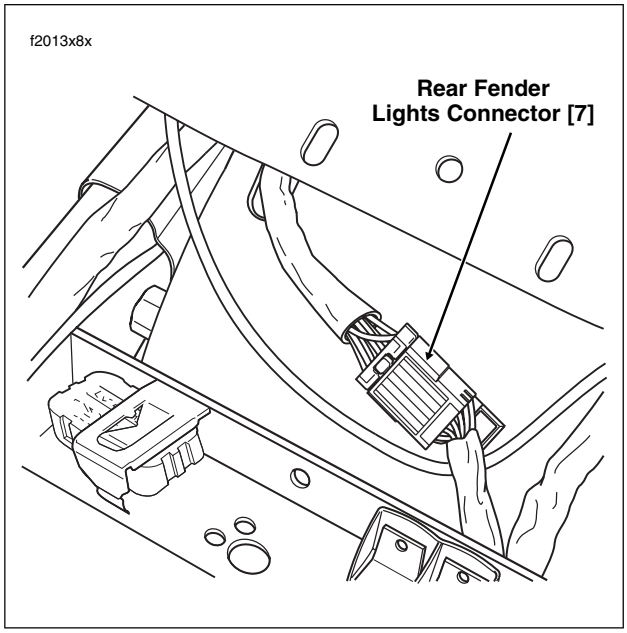


Figure B-37. Rear Fender (Under Seat)

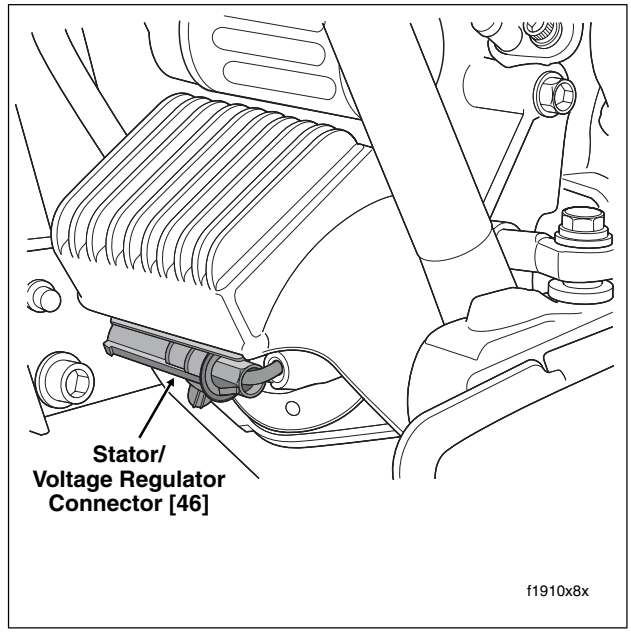


Figure B-39. Stator/Voltage Regulator Connector

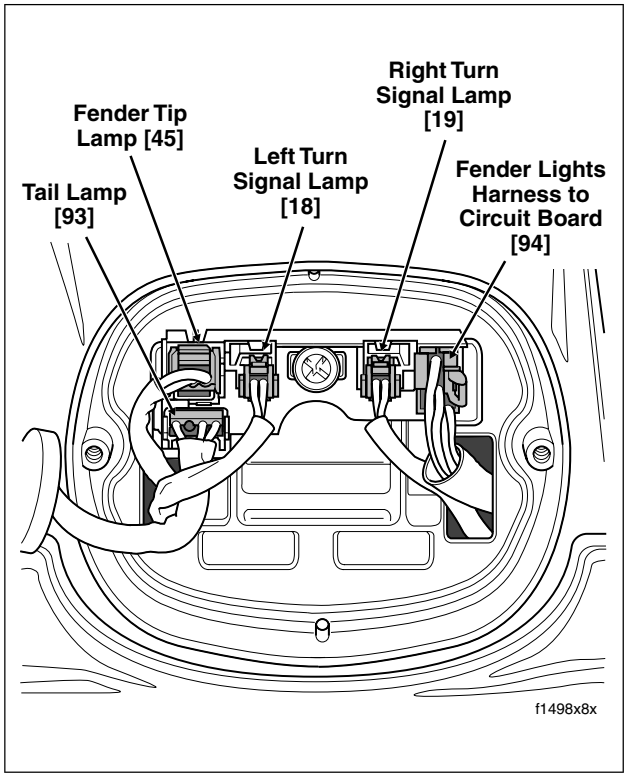


Figure B-38. Rear Fender Lights Assembly

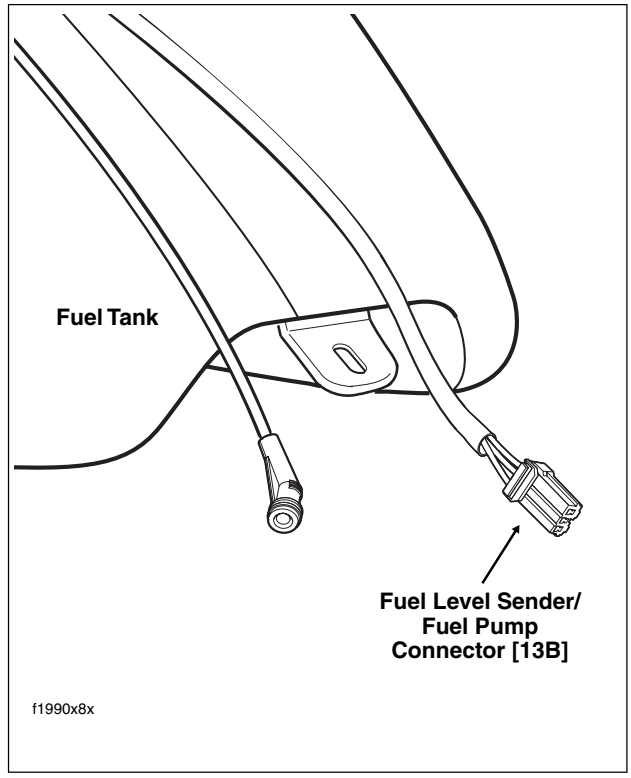


Figure B-40. Rear of Fuel Tank (Under Seat)
FLHT/C/U, FLTR

FLHR/C WIRE HARNESS CONNECTORS

No.	Description	Type	Location	Fig.
[4]	Accessory	4 - Place Deutsch	Upper Frame Cross Member (Under Seat)	34
[5]	Main Circuit Breaker	Ring Terminals	Upper Frame Cross Member (Under Seat)	34
[7]	Rear Fender Lights Harness	8 - Place Multilock	Top of Rear Fender (Under Seat)	37
[8]	Ignition Harness (Main to EFI Harness on EFI models)	12 - Place Deutsch (Gray)	Under Right Side Cover	33
[10]	Ignition Module ****	12 - Place Deutsch (Black)	Under Right Side Cover	36
[11]	Ignition Module ****	12 - Place Deutsch (Gray)	Under Right Side Cover	36
[13]	Fuel Level Sender (and Fuel Pump on EFI models)	3 - Place Multilock	Behind Fuel Tank (Under Seat)	40
[18]	Left Rear Turn Signal	2 - Place Multilock	Circuit Board Under Tail Lamp Assembly	38
[19]	Right Rear Turn Signal	2 - Place Multilock	Circuit Board Under Tail Lamp Assembly	38
[21]	Indicator Lamps	8 - Place Mini-Deutsch	Under Console	42
[22]	Right Handlebar Controls	6 - Place Deutsch	Inside Headlamp Nacelle	41
[24]	Left Handlebar Controls	6 - Place Deutsch	Inside Headlamp Nacelle	41
[30]	Turn Signal/Security Module	12 - Place Deutsch	Cavity at Rear of Battery Box (Under Seat)	35
[31]	Front Turn Signals	6 - Place Multilock	Inside Headlamp Nacelle	41
[32]	Front Fender Tip Lamp (DOM)	2 - Place Multilock (Black)	Inside Headlamp Nacelle	41
[33]	Ignition/Light Key Switch	3 - Place Packard	Under Console	42
[38]	Headlamp	Headlamp Connector	Inside Headlamp Nacelle	-
[39]	Speedometer	12 - Place Mini-Deutsch	Back of Speedometer (Under Console)	42
[45]	Rear Fender Tip Lamp (DOM)	3 - Place Multilock	Circuit Board Under Tail Lamp Assembly	38
[46]	Stator/Voltage Regulator	2 - Place Packard	Bottom of Voltage Regulator	39
[62]	Rear Fuse Block	Fuse Terminals	Under Left Side Cover	31,32
[64]	Front Fuse Block	Fuse Terminals	Under Left Side Cover	31,32
[65]	Speedometer Sensor	3 - Place Deutsch	Upper Frame Cross Member (Under Seat)	-
[66]	Passing Lamp Switch	4 - Place Amp	Inside Headlamp Nacelle	41
[67]	Accessory Switch	4 - Place Amp	Inside Headlamp Nacelle	41

Continued ...

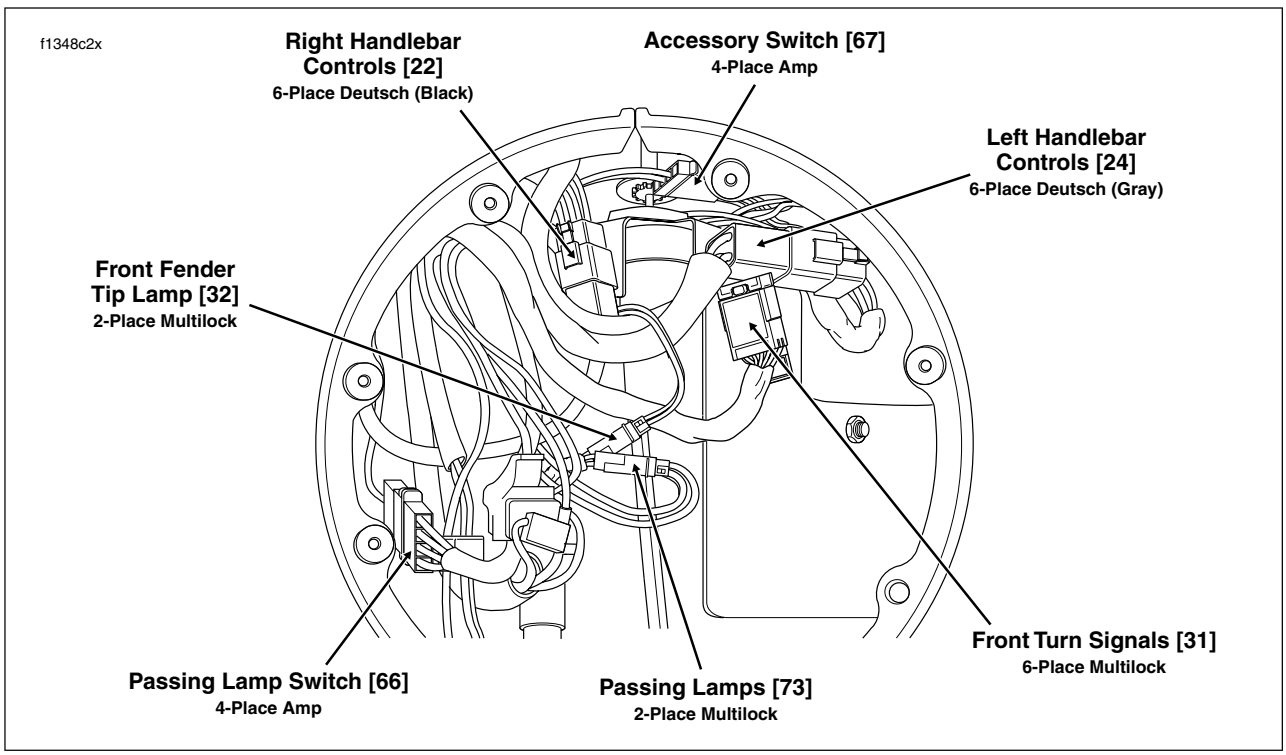


Figure B-41. Headlamp Nacelle Connectors (FLHR)

FLHR/C WIRE HARNESS CONNECTORS (Continued)

No.	Description	Type	Location	Fig.
[73]	Passing Lamps	2 - Place Multilock (White)	Inside Headlamp Nacelle	41
[75]	Cruise Roll-Off Switch **	Spade Contacts	Right Side of Steering Head	-
[78]	Electronic Control Module (ECM) ***	36 - Place Packard	Under Right Side Cover	33
[79]	Crankshaft Position (CKP) Sensor	2 - Place Mini-Deutsch	Under Right Side Cover (Behind Electrical Bracket)	33
[80]	Manifold Absolute Pressure (MAP) Sensor	3 - Place Packard	Top of Intake Manifold/Induction Module	-
[83]	Ignition Coil	4 - Place Packard	Below Fuel Tank (Left Side)	-
[84]	Front Injector ***	2 - Place Packard	Below Fuel Tank (Left Side)	-
[85]	Rear Injector ***	2 - Place Packard	Below Fuel Tank (Left Side)	-
[87]	Idle Air Control (IAC) ***	4 - Place Packard	Below Fuel Tank (Right Side)	-
[88]	Throttle Position Sensor (TP Sensor) ***	3 - Place Packard	Below Fuel Tank (Right Side)	-
[89]	Intake Air Temperature Sensor (IAT Sensor) ***	2 - Place Packard	Below Fuel Tank (Right Side)	-
[90]	Engine Temperature Sensor (ET Sensor) ***	2 - Place Packard	Back of Front Cylinder (Left Side)	-
[91]	Data Link	4 - Place Deutsch	Under Right Side Cover	33
[93]	Tail Lamp	4 - Place Multilock	Circuit Board Under Tail Lamp Assembly	38
[94]	Rear Fender Lights Harness to Circuit Board	6 - Place Multilock	Circuit Board Under Tail Lamp Assembly	38
[98]	Oil Pressure Sending Unit	Post Terminal	Front Right Crankcase	-
[108]	Optional Tachometer	1 - Place Amp	Inside Headlamp Nacelle	-
[117]	Fuel Gauge	4 - Place Multilock	Below Fuel Tank (Left Side)	-
[119]	EFI Fuses ***	Fuse Terminals	Fuse Block (Under Right Side Cover)	33
[121]	Rear Brake Light Switch	Spade Terminals	Beneath Transmission	-
[122]	Horn	Spade Terminals	Between Cylinders (Left Side)	-
[123]	Starter Relay	Relay Connector	Rear Fuse Block (Under Left Side Cover)	-
[124]	Brake Light Relay	Relay Connector	Rear Fuse Block (Under Left Side Cover)	32
[126]	Ignition Keyswitch Relay	Relay Connector	Rear of Battery Box (Under Seat) - Left Side	35
[128]	Starter Solenoid	Spade Terminals	Top of Starter	-
[129]	Harness Grounds	Ring Terminals	Upper Frame Cross Member (Under Seat)	34
[131]	Neutral Switch	Post Terminals	Top of Transmission	-
[135]	EFI System Relay ***	Relay Connector	Fuse Block (Under Right Side Cover)	33
[140]	Oil Pressure Sending Unit	2 - Place Mini-Deutsch	Under Right Side Cover (Behind Electrical Bracket)	33
[141]	Fuel Tank Harness	3 - Place Mini-Deutsch	Top of Canopy (Under Console)	-
[142]	Siren (Optional)	3 - Place Packard	Under Right Side Cover (Behind Electrical Bracket)	33
[158]	Left Handlebar Controls (Cruise Switches) **	4 - Place Deutsch (Gray)	Inside Headlamp Nacelle	-
[159]	Right Handlebar Controls (Cruise Switches) **	4 - Place Deutsch (Black)	Inside Headlamp Nacelle	-

** FLHRCI Only *** Fuel Injected Models **** Carbureted Models

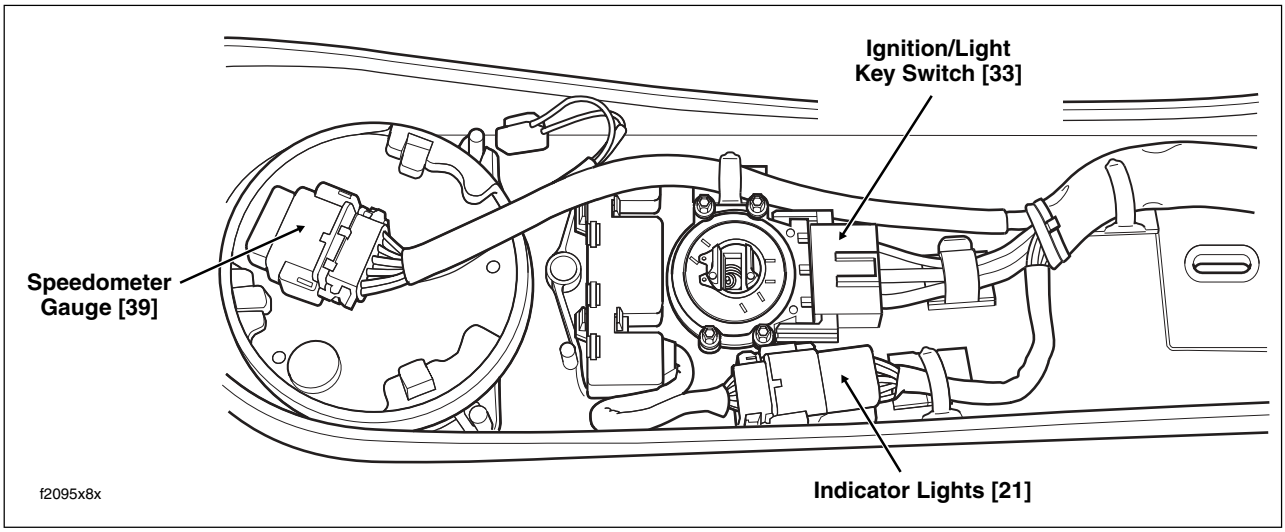


Figure B-42. Instrument Console Connectors (FLHR/C)

FLTR WIRE HARNESS CONNECTORS

No.	Description	Type	Location	Fig.
[1]	Main to Interconnect Harness	12 - Place Deutsch (Black)	Inner Fairing - Below Radio (Right Side)	44
[2]	Main to Interconnect Harness	12 - Place Deutsch (Gray)	Inner Fairing - Front of Radio Bracket (Right Side)	44
[4]	Accessory	4 - Place Deutsch	Upper Frame Cross Member (Under Seat)	34
[5]	Main Circuit Breaker	Ring Terminals	Upper Frame Cross Member (Under Seat)	34
[7]	Rear Fender Lights Harness	8 - Place Multilock	Top of Rear Fender (Under Seat)	37
[8]	Ignition Harness (Main to EFI Harness on EFI models)	12 - Place Deutsch (Gray)	Under Right Side Cover	33
[10]	Ignition Module ****	12 - Place Deutsch (Black)	Under Right Side Cover	36
[11]	Ignition Module ****	12 - Place Deutsch (Gray)	Under Right Side Cover	36
[13]	Fuel Level Sender (and Fuel Pump on EFI models)	3 - Place Multilock	Behind Fuel Tank (Under Seat)	40
[15]	Main Power	4 - Place Packard	Inner Fairing - Below Radio	44
[17]	Cruise Control Module	10 - Place Packard	Under Left Side Cover	31
[18]	Left Rear Turn Signal	2 - Place Multilock	Circuit Board Under Tail Lamp Assembly	38
[19]	Right Rear Turn Signal	2 - Place Multilock	Circuit Board Under Tail Lamp Assembly	38
[21]	Indicator Lamps			
	[21B, 21C] Indicator Lamps to Jumper Harness	10 - Place Multilock	Inside Instrument Nacelle (Under Bezel)	43
	[21D, 21A] Jumper Harness to Interconnect	10 - Place Multilock	Inner Fairing - Below Radio	44
[22]	Interconnect to Right Handlebar Switch Controls	12 - Place Deutsch (Black)	Inner Fairing - Right Side of Radio Bracket	44
[24]	Interconnect to Left Handlebar Switch Controls	12 - Place Deutsch (Gray)	Inner Fairing - Left Side of Radio Bracket	44
[27]	Radio	23 - Place Amp (Black)	Inner Fairing - Back of Radio (Right Side)	44
[30]	Turn Signal/Security Module	12 - Place Deutsch (Gray)	Cavity at Rear of Battery Box (Under Seat)	35
[31]	Front Turn Signals	6 - Place Multilock	Inner Fairing - Below Radio	44
[33]	Ignition/Light Key Switch	4 - Place Packard	Inner Fairing - Inside Fairing Bracket Tunnel (Right Side)	44
[38]	Headlamp	Headlamp Connector	Inner Fairing	-
[39]	Speedometer	12 - Place Packard	Inside Instrument Nacelle (Back of Speedometer)	43
[45]	Rear Fender Tip Lamp (DOM)	3 - Place Multilock	Circuit Board Under Tail Lamp Assembly	38

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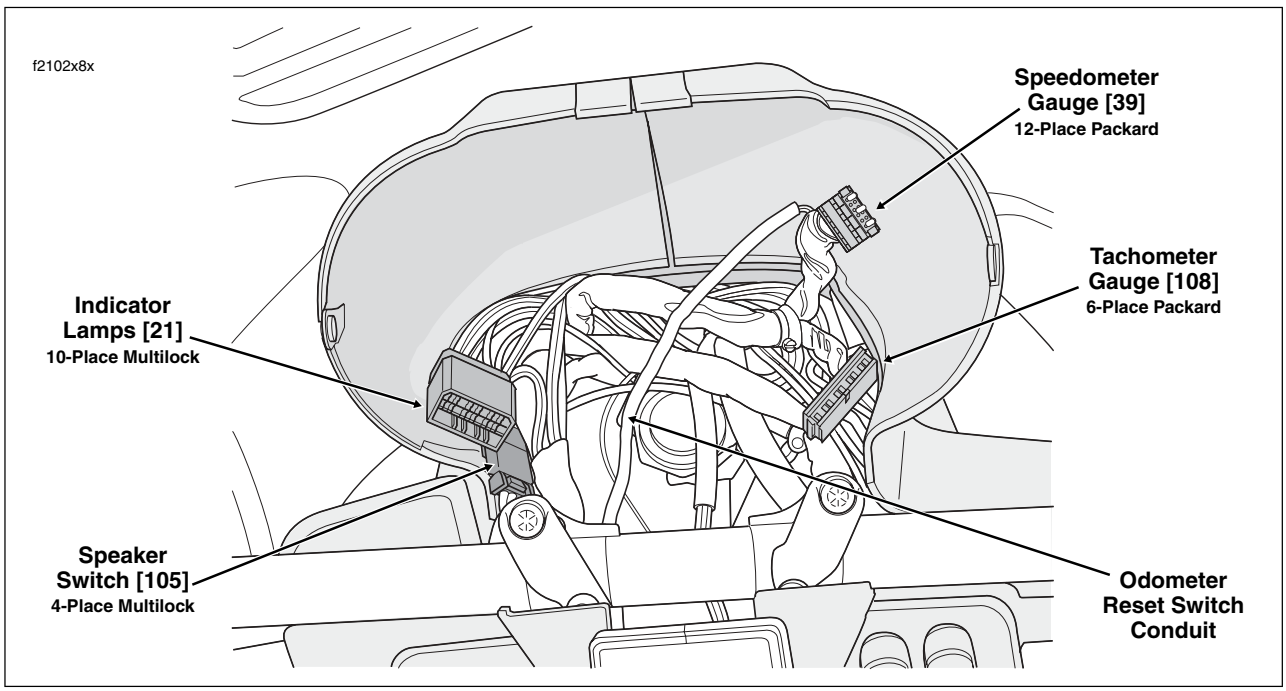


Figure B-43. Instrument Nacelle Connectors (FLTR)

FLTR WIRE HARNESS CONNECTORS (Continued)

No.	Description	Type	Location	Fig.
[46]	Stator/Voltage Regulator	2 - Place Packard	Bottom of Voltage Regulator	39
[51]	Radio Antenna Cable	-	Inner Fairing - Back of Radio (Left Side)	44
[62]	Rear Fuse Block	Fuse Terminals	Under Left Side Cover	31,32
[64]	Front Fuse Block	Fuse Terminals	Under Left Side Cover	31,32
[65]	Speedometer Sensor	3 - Place Deutsch	Upper Frame Cross Member (Under Seat)	-
[75]	Cruise Roll-Off Switch	Spade Contacts	Right Side of Steering Head	-
[78]	Electronic Control Module (ECM) ***	36 - Place Packard	Under Right Side Cover	33
[79]	Crankshaft Position (CKP) Sensor	2 - Place Mini-Deutsch	Under Right Side Cover (Behind Electrical Bracket)	33
[80]	Manifold Absolute Pressure (MAP) Sensor	3 - Place Packard	Top of Intake Manifold/Induction Module	-
[83]	Ignition Coil	4 - Place Packard	Below Fuel Tank (Left Side)	-
[84]	Front Injector ***	2 - Place Packard	Below Fuel Tank (Left Side)	-

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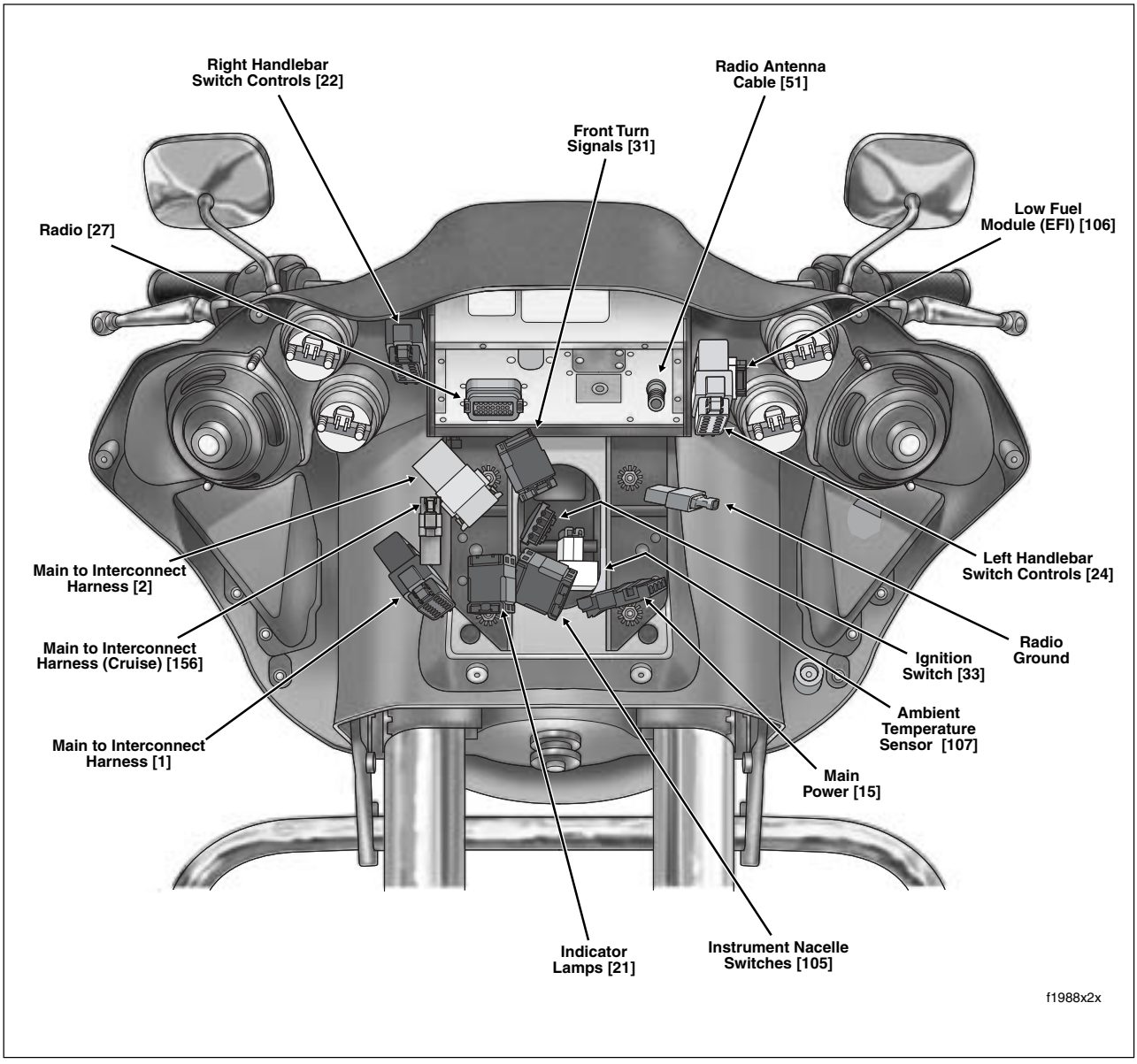


Figure B-44. Inner Fairing Connectors (FLTR)

FLTR WIRE HARNESS CONNECTORS (Continued)

No.	Description	Type	Location	Fig.
[85]	Rear Injector ***	2 - Place Packard	Below Fuel Tank (Left Side)	-
[87]	Idle Air Control (IAC) ***	4 - Place Packard	Below Fuel Tank (Right Side)	-
[88]	Throttle Position Sensor (TP Sensor) ***	3 - Place Packard	Below Fuel Tank (Right Side)	-
[89]	Intake Air Temperature Sensor (IAT Sensor) ***	2 - Place Packard	Below Fuel Tank (Right Side)	-
[90]	Engine Temperature Sensor (ET Sensor) ***	2 - Place Packard	Back of Front Cylinder (Left Side)	-
[91]	Data Link	4 - Place Deutsch	Under Right Side Cover	33
[93]	Tail Lamp	4 - Place Multilock	Circuit Board Under Tail Lamp Assembly	38
[94]	Rear Fender Lights Harness to Circuit Board	6 - Place Multilock	Circuit Board Under Tail Lamp Assembly	38
[105]	Instrument Nacelle Switches			
	[105D, 105C] Speaker Switch to Jumper Harness	4 - Place Multilock	Inside Instrument Nacelle (Under Bezel)	43
	[105B, 105A] Jumper Harness to Interconnect	12 - Place Multilock	Inner Fairing - Below Radio	44
[106]	Low Fuel Module ***	6 - Place Multilock	Inner Fairing - Left Side of Radio Bracket	44
[107]	Ambient Air Temperature Sensor	3 - Place Multilock	Inner Fairing - Inside Fairing Bracket Tunnel (Left Side)	44
[108]	Tachometer	6 - Place Packard	Inside Instrument Nacelle (Back of Tachometer)	43
[110]	Voltmeter Lamp	Spade Connector	Inner Fairing	-
[111]	Voltmeter	Spade Connector	Inner Fairing	-
[112]	Oil Pressure Gauge Lamp	Spade Connector	Inner Fairing	-
[113]	Oil Pressure Gauge	Spade Connector	Inner Fairing	-
[114]	Air Temperature Gauge Lamp	Spade Connector	Inner Fairing	-
[115]	Air Temperature Gauge	Spade Connector	Inner Fairing	-
[116]	Fuel Gauge Lamp	Spade Connector	Inner Fairing	-
[117]	Fuel Gauge	Spade Connector	Inner Fairing	-
[119]	EFI Fuses ***	Fuse Terminals	Fuse Block (Under Right Side Cover)	33
[120]	Oil Pressure Sending Unit	4 - Place Packard	Front Right Crankcase	-
[121]	Rear Brake Light Switch	Spade Terminals	Beneath Transmission (Right Side)	-
[122]	Horn	Spade Terminals	Between Cylinders (Left Side)	-
[123]	Starter Relay	Relay Connector	Rear of Battery Box (Under Seat) - Left Side	35
[124]	Brake Light Relay	Relay Connector	Rear Fuse Block (Under Left Side Cover)	32
[126]	Ignition Keyswitch Relay	Relay Connector	Rear of Battery Box (Under Seat) - Left Side	35
[128]	Starter Solenoid	Spade Terminals	Top of Starter	-
[129]	Harness Grounds	Ring Terminals	Upper Frame Cross Member (Under Seat)	34
[131]	Neutral Switch	Post Terminals	Transmission Top Cover	-
[132]	Cigarette Lighter	Spade Terminals	Inner Fairing	-
[135]	EFI System Relay ***	Relay Connector	Fuse Block (Under Right Side Cover)	33
[140]	Oil Pressure Sending Unit	2 - Place Mini-Deutsch	Under Right Side Cover (Behind Electrical Bracket)	33
[141]	Fuel Tank Harness	3 - Place Mini-Deutsch	Top of Canopy (Under Console)	-
[142]	Siren (Optional)	3 - Place Packard	Under Right Side Cover (Behind Electrical Bracket)	33

*** Fuel Injected Models **** Carbureted Models

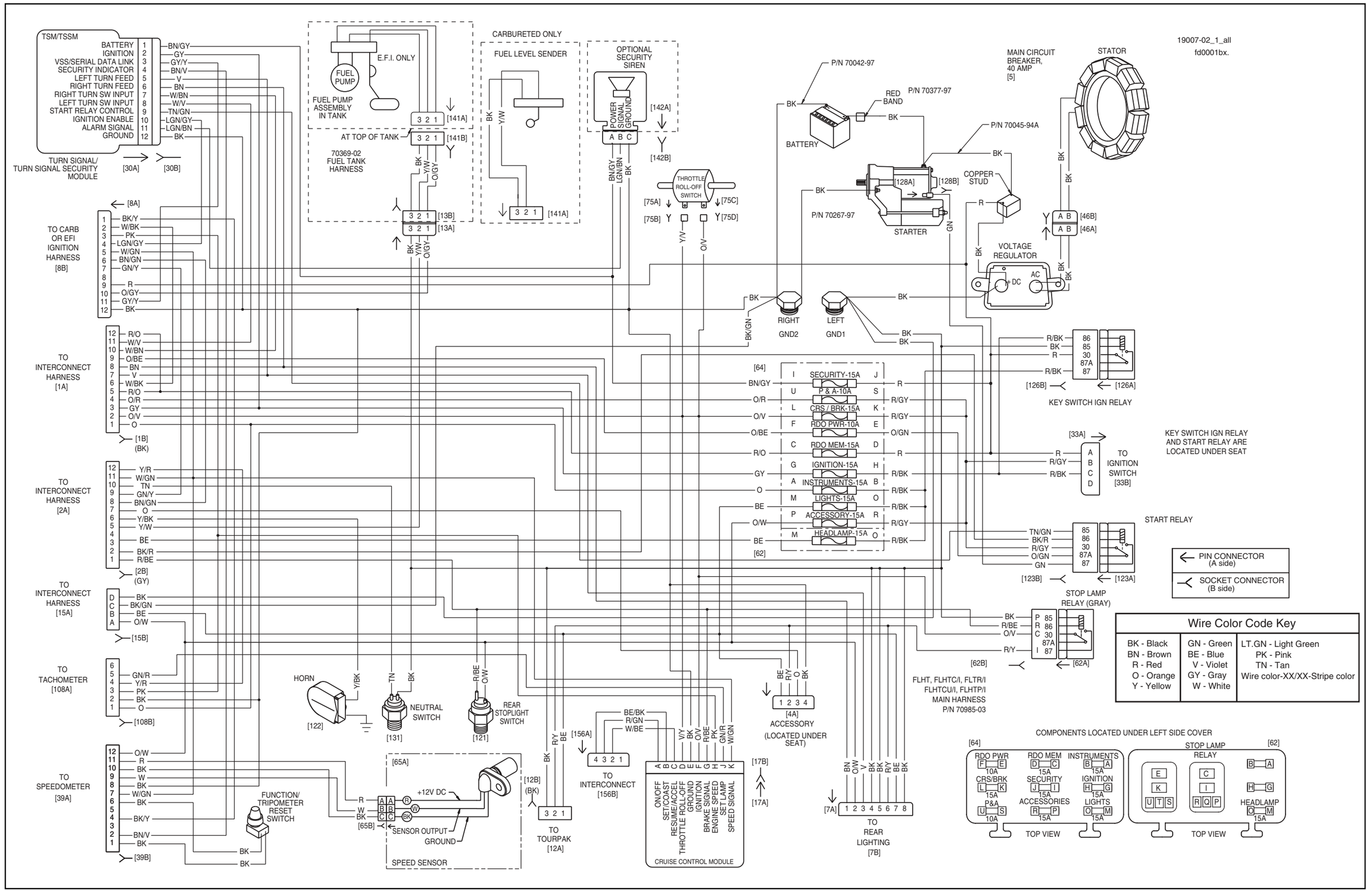
WIRING DIAGRAMS B.7

SUBJECT	PAGE NO.
FLHT, FLHTC, FLHTCU	
Main Harness	B-37
Interconnect Harness	B-38
Ignition Harness	B-39
Engine Sensor Harness	B-39
Engine Management Circuitry	B-39
Ignition Switch	B-40
Tail Lamp, Passing Lamps, Directional Lamps and Tour-Pak Lights	B-40
Starting and Charging	B-41
Handlebar Controls, Speedometer, Tachometer and Indicator Lamps	B-42
Dash Panel Switches	B-42
Radio, CB/Intercom and Rear Speakers	B-43
FLTR	
Main Harness	B-37
Interconnect Harness	B-38
Ignition Harness	B-39
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Engine Management Circuitry	B-39
Ignition Switch	B-40
Tail Lamp and Directional Lamps	B-40
Starting and Charging	B-41
Handlebar Controls, Speedometer, Tachometer and Indicator Lamps	B-42
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FLHR, FLHRC	
Main Harness	B-44
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Engine Sensor Harness	B-45
Engine Management Circuitry	B-45
Starting and Charging	B-46
Handlebar Controls, Speedometer, Indicator Lamps, Tail Lamp, Passing Lamps and Directional Lamps	B-47
TLE Sidecar, TLE Ultra Sidecar	
Chassis	B-48
Audio Harness	B-48

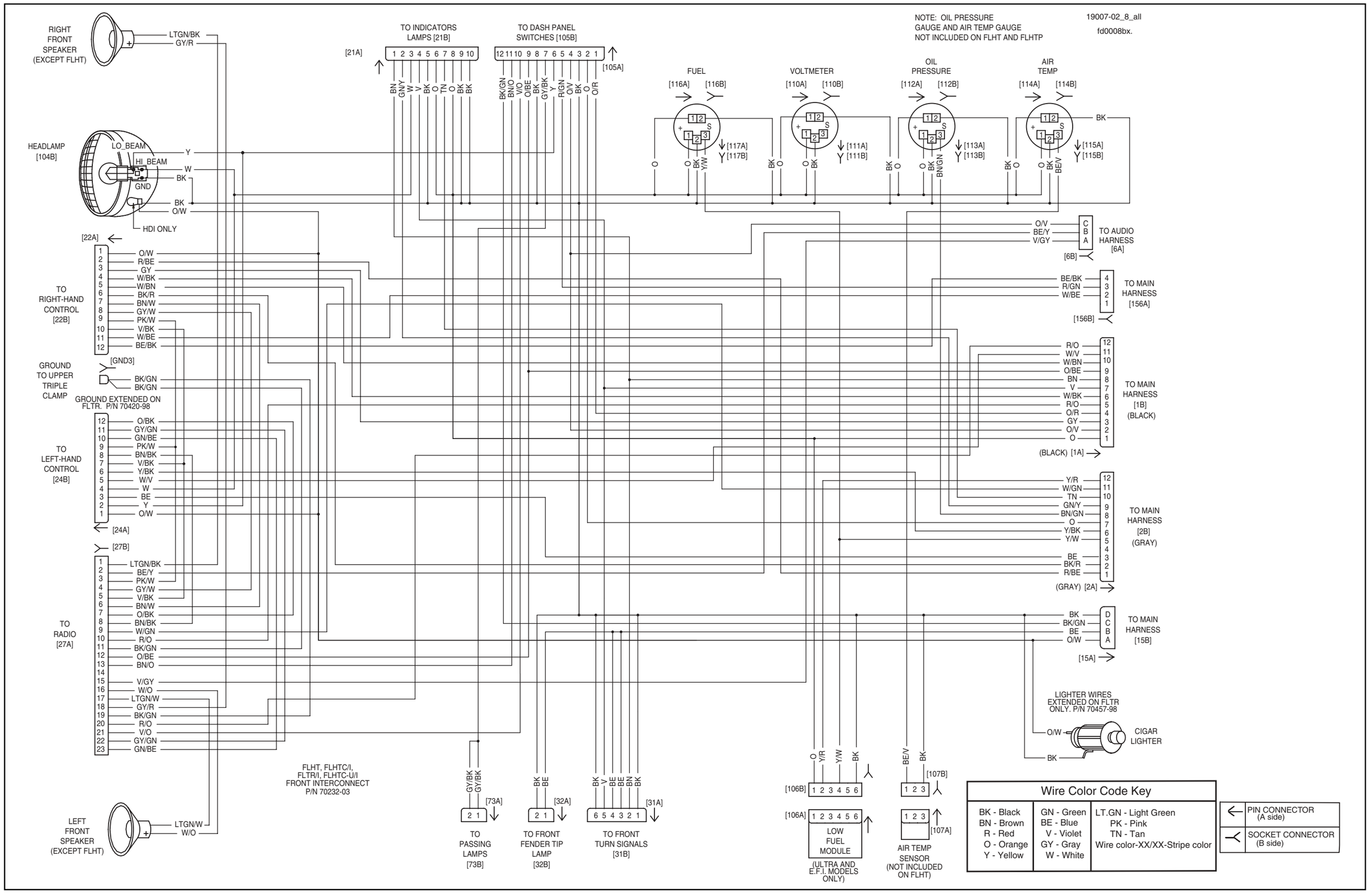
NOTE

Harness Part No.'s may be included on some wiring diagrams. Use these numbers for reference only. ALWAYS REFER TO THE PARTS CATALOG WHEN ORDERING WIRING HARNESSES.

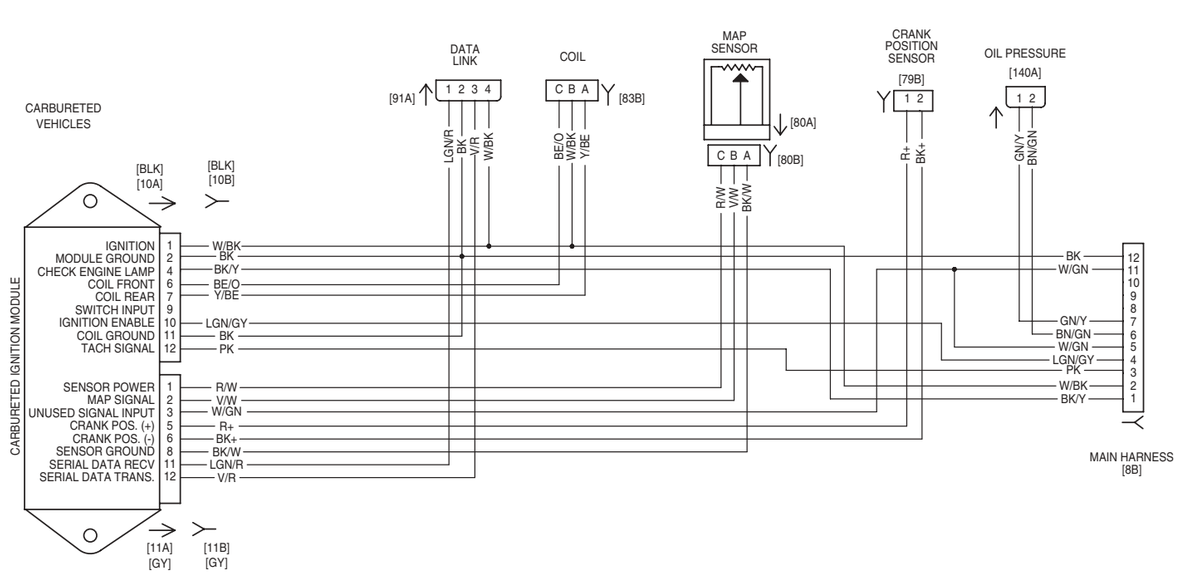
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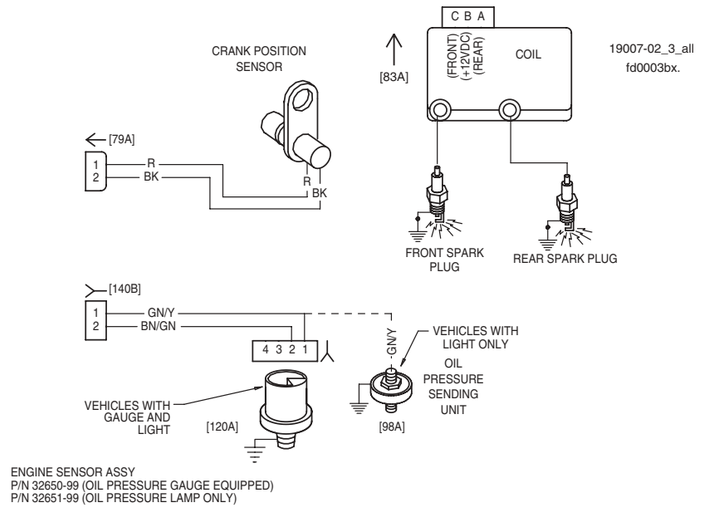


2003 FLHT, FLHTC, FLHTCU and FLTR, DOMESTIC and INTERNATIONAL Models, Main Harness

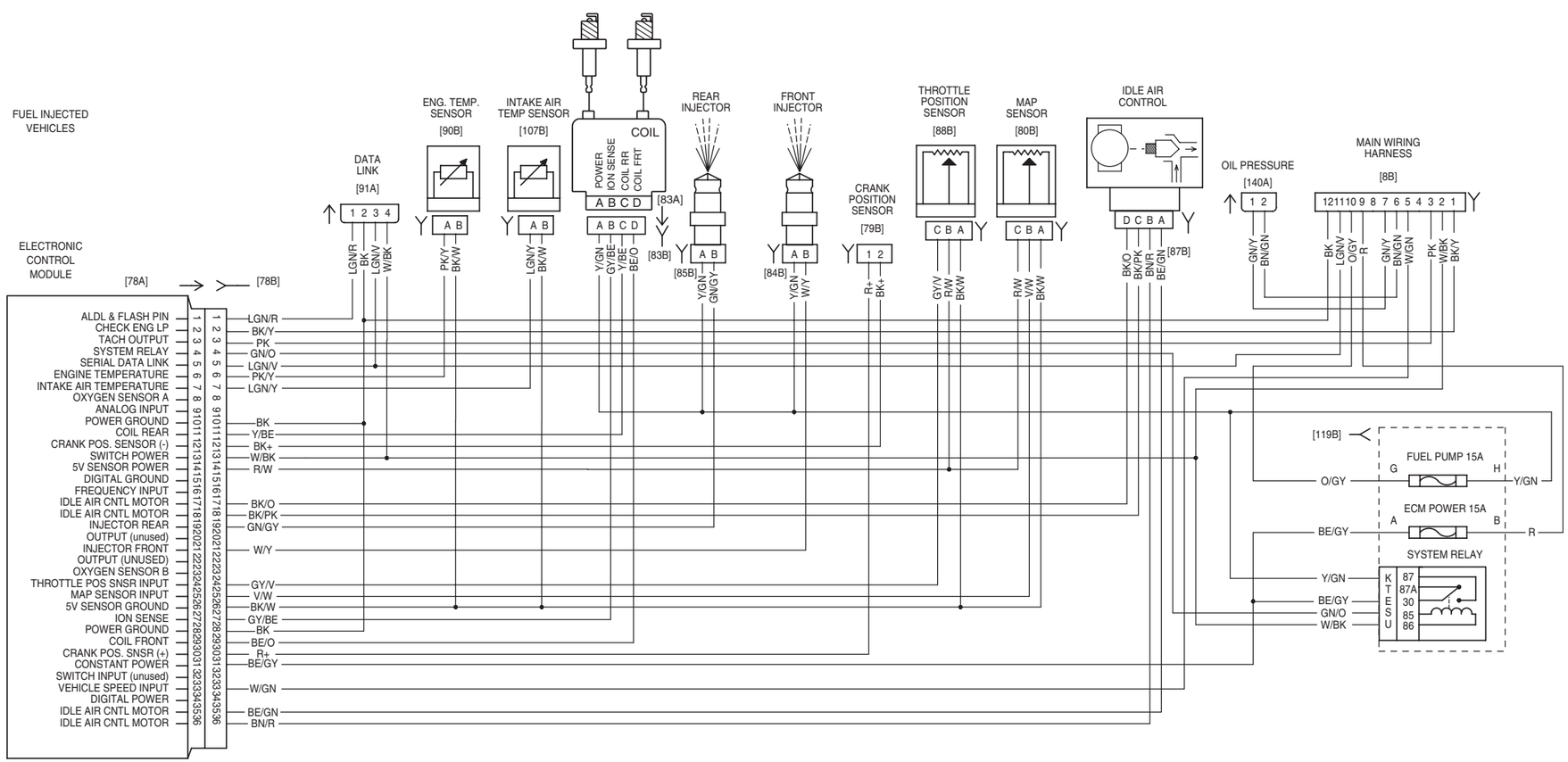


2003 FLHT, FLHTC, FLHTCU and FLTR, DOMESTIC and INTERNATIONAL Models, Interconnect Harness

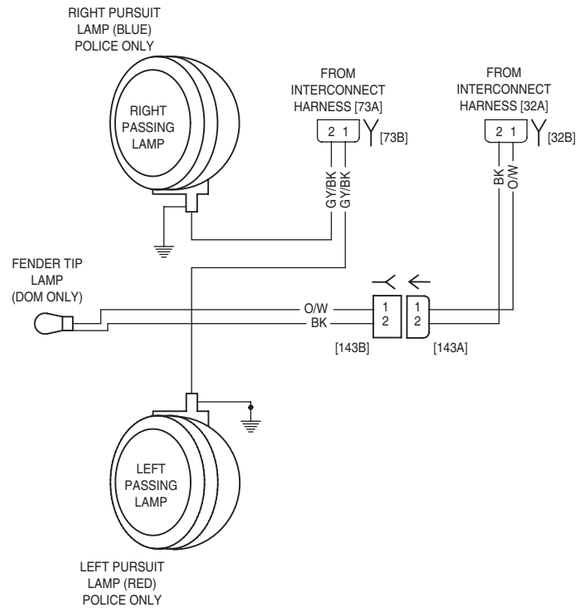


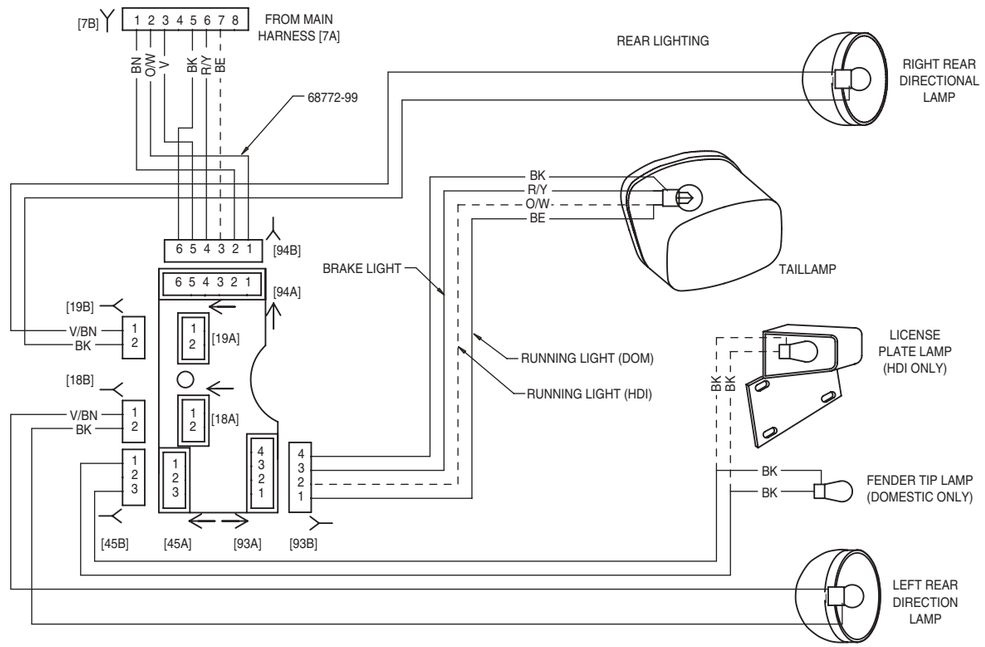


ENGINE SENSOR ASSY
P/N 32650-99 (OIL PRESSURE GAUGE EQUIPPED)
P/N 32651-99 (OIL PRESSURE LAMP ONLY)

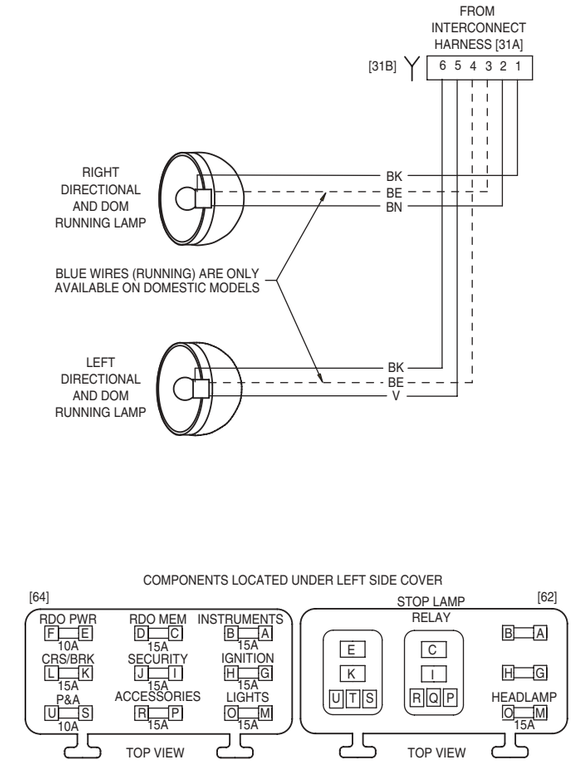


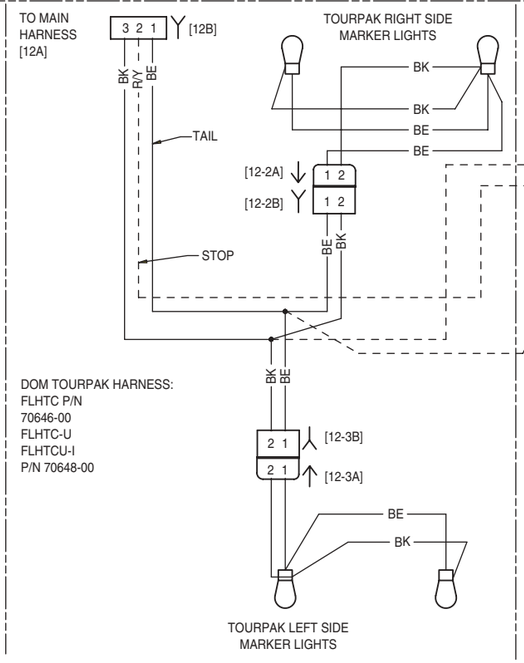
2003 FLHT, FLHTC, FLHTCU and FLTR, DOMESTIC and INTERNATIONAL Models, Ignition Harness, Engine Sensor Harness and Engine Management Circuitry





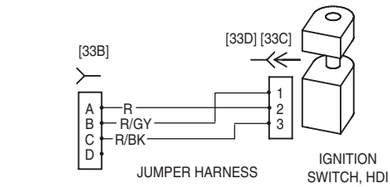
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19007-02_2_all



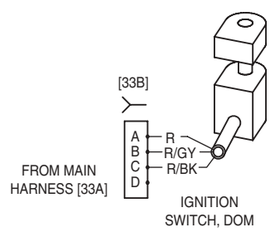


HDI FLHTC AND FLHTCU MODELS DO NOT HAVE TOURPAK LIGHTING

TOURPAK NOT INCLUDED ON FLHT OR FLHTP-FRG



IGNITION SWITCH LEGEND (HDI)			
SWITCH POSITION	"X" INDICATES CONTINUITY BETWEEN LEAD WIRES IN POSITION INDICATED		
	RED	RED/ GRAY	RED/ BLACK
LOCK	X		
OFF	X		
IGN	X	X	X
ACC	X	X	



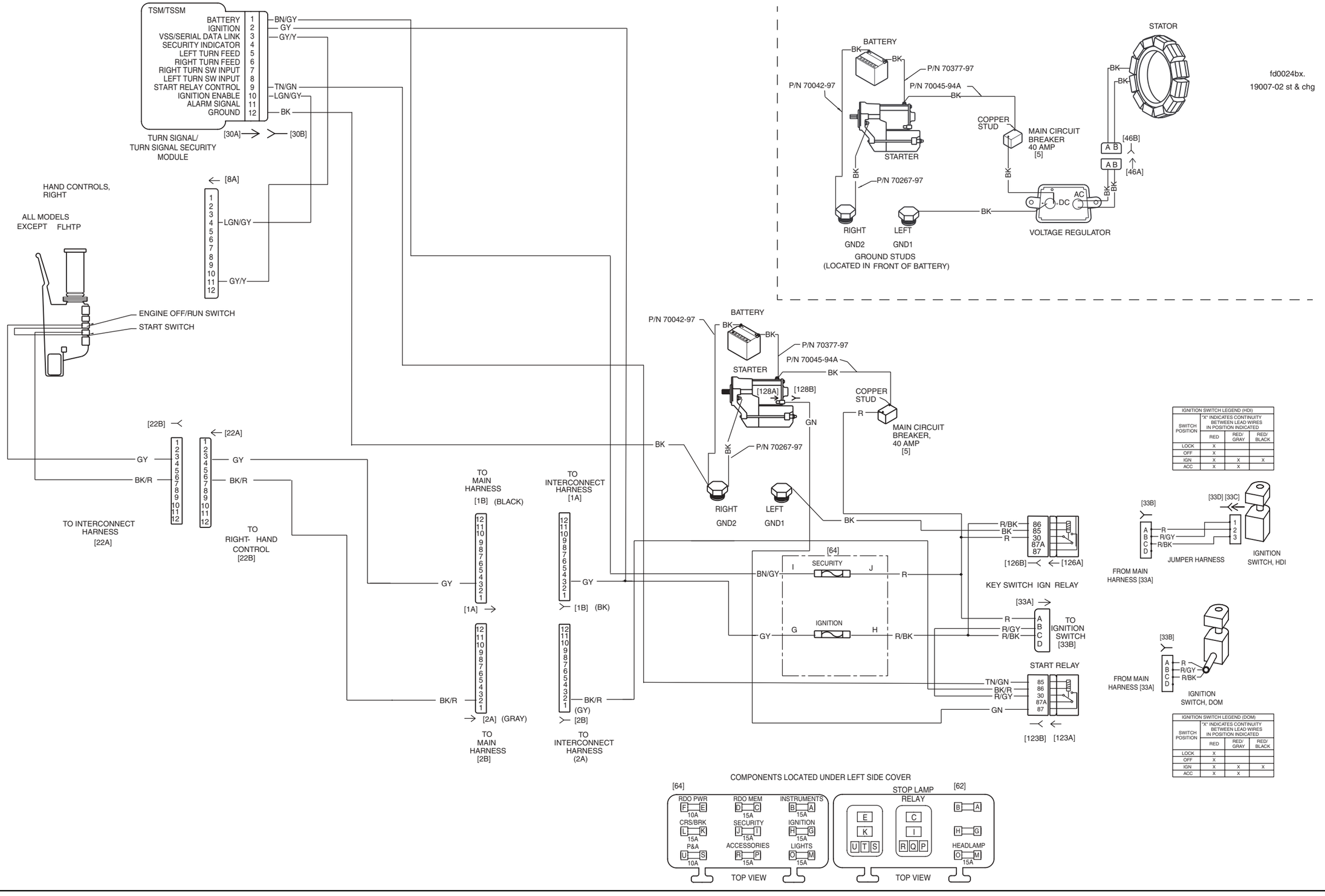
IGNITION SWITCH LEGEND (DOM)			
SWITCH POSITION	"X" INDICATES CONTINUITY BETWEEN LEAD WIRES IN POSITION INDICATED		
	RED	RED/ GRAY	RED/ BLACK
LOCK	X		
OFF	X		
IGN	X	X	X
ACC	X	X	

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

← PIN CONNECTOR (A side)

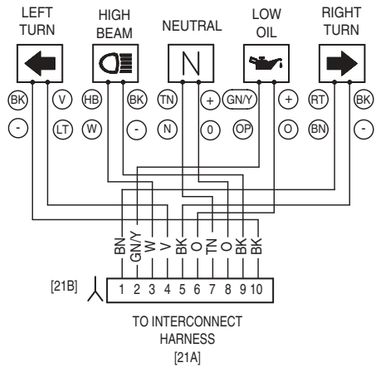
≻ SOCKET CONNECTOR (B side)

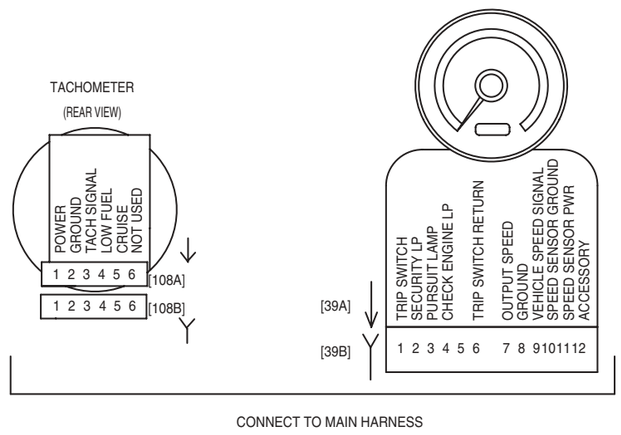
2003 FLHT, FLHTC, FLHTCU and FLTR, DOMESTIC and INTERNATIONAL Models, Ignition Switch, Tail Lamp, Passing Lamps, Directional Lamps, Fender Tip Lamps and Tour-Pak Lights

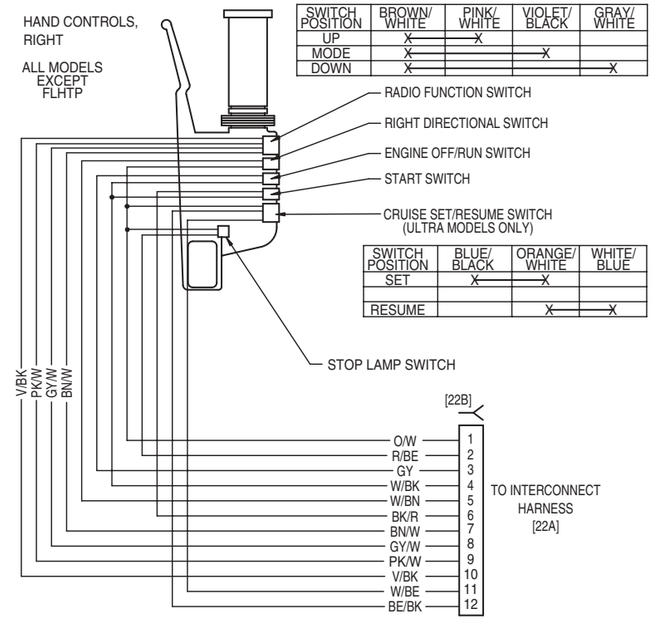

TSM/TSSM
BATTERY 1
IGNITION 2
VSS/SERIAL DATA LINK 3
SECURITY INDICATOR 4
LEFT TURN FEED 5
RIGHT TURN FEED 6
RIGHT TURN SW INPUT 7
LEFT TURN SW INPUT 8
START RELAY CONTROL 9
IGNITION ENABLE 10
ALARM SIGNAL 11
GROUND 12
BN/GY
GY
GY/Y
TN/GN
LGN/GY
BK
[30A]
[30B]
TURN SIGNAL/
TURN SIGNAL SECURITY
MODULE
[8A]
HAND CONTROLS,
RIGHT
ALL MODELS
EXCEPT FLHTP
LGN/GY
GY/Y
ENGINE OFF/RUN SWITCH
START SWITCH
[22B]
[22A]
GY
BK/R
TO INTERCONNECT
HARNESS
[22A]
TO
RIGHT- HAND
CONTROL
[22B]
TO
MAIN
HARNESS
[1B] (BLACK)
TO
INTERCONNECT
HARNESS
[1A]
GY
[1A]
[1B] (BK)
BK/R
[2A] (GRAY)
[2B]
(GY)
TO
MAIN
HARNESS
[2B]
TO
INTERCONNECT
HARNESS
(2A)
BK
BATTERY
P/N 70042-97
P/N 70377-97
P/N 70045-94A
STARTER
[128A]
[128B]
COPPER
STUD
MAIN CIRCUIT
BREAKER,
40 AMP
[5]
GN
R
P/N 70267-97
RIGHT
GND2
LEFT
GND1
[64]
SECURITY
BN/GY
I
J
R
IGNITION
G
H
R/BK
KEY SWITCH IGN RELAY
R/BK
BK
R
[126B]
[126A]
[33A]
TO
IGNITION
SWITCH
[33B]
START RELAY
TN/GN
BK/R
R/GY
GN
[123B]
[123A]
STATOR
BATTERY
P/N 70042-97
P/N 70377-97
P/N 70045-94A
STARTER
COPPER
STUD
MAIN CIRCUIT
BREAKER
40 AMP
[5]
P/N 70267-97
[46B]
[46A]
RIGHT
GND2
LEFT
GND1
GROUND STUDS
(LOCATED IN FRONT OF BATTERY)
VOLTAGE REGULATOR
AC
DC
fd0024bx.
19007-02 st & chg
IGNITION SWITCH LEGEND (HDI)
SWITCH POSITION
"X" INDICATES CONTINUITY BETWEEN LEAD WIRES IN POSITION INDICATED
RED
RED/ GRAY
RED/ BLACK
LOCK X
OFF X
IGN X X X
ACC X X
[33B]
[33D] [33C]
JUMPER HARNESS
IGNITION
SWITCH, HDI
FROM MAIN
HARNESS [33A]
IGNITION SWITCH LEGEND (DOM)
SWITCH POSITION
"X" INDICATES CONTINUITY BETWEEN LEAD WIRES IN POSITION INDICATED
RED
RED/ GRAY
RED/ BLACK
LOCK X
OFF X
IGN X X X
ACC X X
IGNITION
SWITCH, DOM
COMPONENTS LOCATED UNDER LEFT SIDE COVER
[64]
RDO PWR F E 10A
RDO MEM D C 15A
INSTRUMENTS B A 15A
CRS/BRK L K 15A
SECURITY J I 15A
IGNITION H G 15A
P&A U S 10A
ACCESSORIES R P 15A
LIGHTS O M 15A
TOP VIEW
STOP LAMP
RELAY
E K U T S
C I R Q P
[62]
B A
H G
HEADLAMP O M 15A
TOP VIEW

fd0004bx.

19007-02_4_all



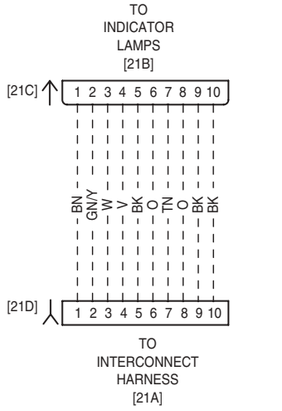


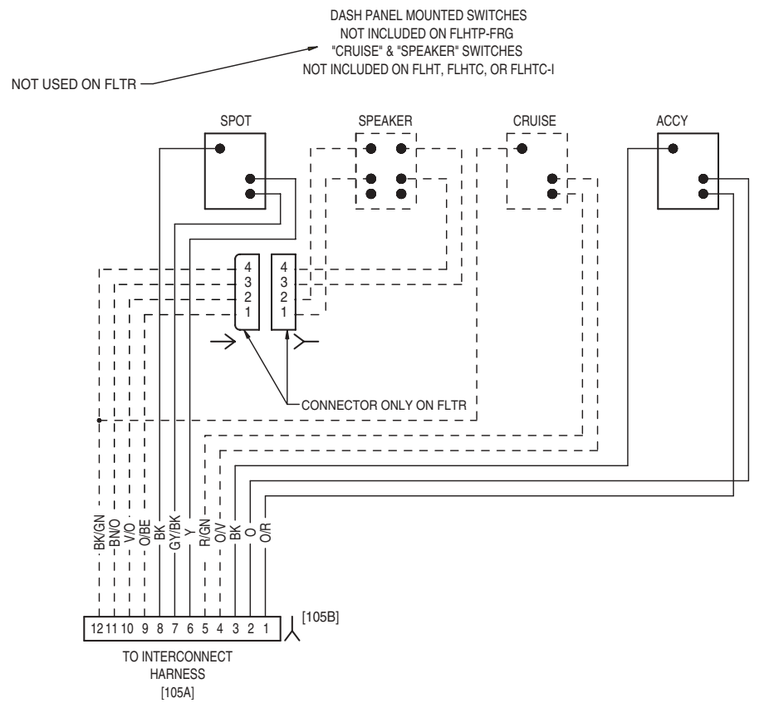


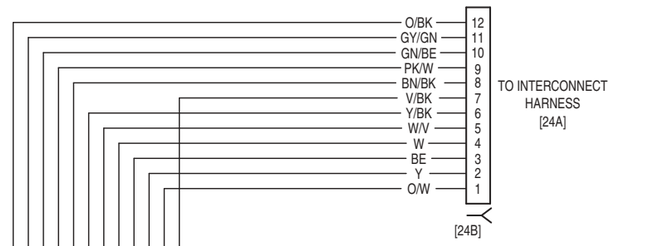
SWITCH POSITION	BROWN/ WHITE	PINK/ WHITE	VIOLET/ BLACK	GRAY/ WHITE
UP	X	X		
MODE	X		X	
DOWN	X			X

SWITCH POSITION	BLUE/ BLACK	ORANGE/ WHITE	WHITE/ BLUE
SET	X	X	
RESUME		X	X

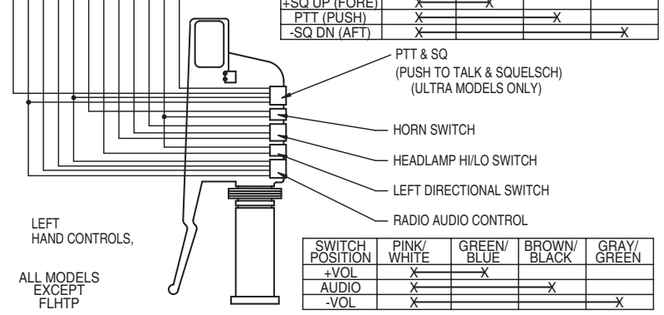
THIS JUMPER USED ON FLTR ONLY
P/N 71625-98







SWITCH POSITION	VIOLET/ BLACK	GRAY/ GREEN	ORANGE/ BLACK	BROWN/ BLACK
+SQ UP (FORE)	X	X		
PTT (PUSH)	X		X	
-SQ DN (AFT)	X			X



SWITCH POSITION	PINK/ WHITE	GREEN/ BLUE	BROWN/ BLACK	GRAY/ GREEN
+VOL	X	X		
AUDIO	X		X	
-VOL	X			X

fd0007bx.

AM/FM
ANTENNA MAST
FLHTC/U
MODELS ONLY

TO RADIO
ANTENNA
CONNECTOR
[51B]
(FLHTC/U
MODELS
ONLY)

P/N 70084-96

ANTENNA CABLE PART OF
MAIN HARNESS AND
PRESENT ON ALL MODELS

BK

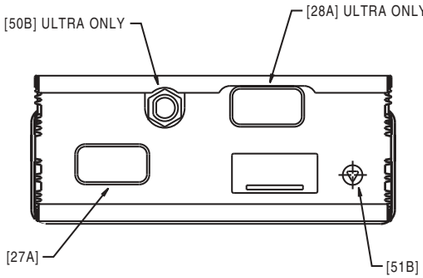
[29A]

[29B]

[51A]

[50B] ULTRA ONLY

[28A] ULTRA ONLY



[27A]

[51B]

TO RIGHT
GROUND STUD
UNDER SEAT

BK

C.B. MAST ASSY
P/N 76250-98

LOADING COIL ASSY
P/N 76318-98

C.B. ANTENNA
INSIDE TOUR PACK

[50C]

[50D]

C.B. ANTENNA
BACK OF
ULTRA RADIO

[50A]

P/N 70160-02
AUDIO HARNESS

[28B]

1	Y/R
2	Y/BK
3	W/BN
4	LTGN/BN
5	BN/W
6	GY/W
7	DRAIN
8	BK
9	Y/W
10	BN
11	GN
12	O/BK
13	PK/W
14	V/BK
15	DRAIN
16	GY/Y
17	GY/O
18	GY/BK
19	W/V
20	W/R
21	R
22	R
23	BK

TO
ULTRA
RADIO

[41A]

1	PK/W
2	GY/W
3	V/BK
4	O/BK
5	GN
6	LTGN/BN

[41B]

1	PK/W
2	GY/W
3	V/BK
4	O/BK
5	
6	

+VOL
PTT
-VOL

LTGN/BN
GN

RIGHT REAR
SPEAKER &
CONTROLS

[76B]

1	R
2	GY/BK
3	GY/Y
4	BK
5	GY/O
6	
7	DRAIN
TAB	

PASSENGER
HEADSET

CAV	CIR
1	R
2	GY/BK & DRAIN
3	GY/Y
4	BK
5	GY/O
6	---
7	---
TAB	DRAIN

TO AUDIO
HARNESS
[6B]

C	O/V
B	BE/Y
A	V/GY

[6A]

O/V
W/R
W/V
V/GY
BK
BE/Y
Y/BK
Y/W
Y/R
BK
R
DRAIN

[53B] 1 2 3 4 5 6 7 8 9 101112

[53A] 1 2 3 4 5 6 7 8 9 101112

BE/Y
Y/BK
Y/W
Y/R
BK
R
DRAIN

[42A]

1	PK/W
2	GY/W
3	V/BK
4	BN/W
5	BN
6	W/BN

[42B]

1	PK/W
2	GY/W
3	V/BK
4	O/BK
5	
6	

BN
W/BN

LEFT REAR
SPEAKER &
CONTROLS

UP
MODE
DOWN

DRIVER
HEADSET

CAV	CIR
1	R
2	Y/BK & DRAIN
3	Y/R
4	BK
5	Y/W
6	DRAIN
7	BE/Y
TAB	DRAIN

LEFT & RIGHT REAR PASSENGER CONTROLS

COLOR / POSITION	ORANGE/ BLACK	PINK/ WHITE	VIOLET/ BLACK	GRAY/ WHITE
UP/+VOL	●	●		
MODE/PTT	●		●	
DOWN/-VOL	●			●

RADIO PINOUTS

RT FRONT HEADSET(+)	1
FRT HEADSET COMMON	2
LFT RR SPEAKER ()	3
RT RR SPEAKER()	4
C4 (RR CNTL MATRIX)	5
R1 (RR CNTL MATRIX)	6
RR MIC SHIELD	7
RR MIC COMMON	8
LFT FRT HEADSET	9
LFT RR SPEAKER (+)	10
RT RR SPEAKER (+)	11
C3 (RR CNTL MATRIX)	12
R0 (RR CNTL MATRIX)	13
R2 (RR CNTL MATRIX)	14
FRT MIC SHIELD	15
RT RR HEADSET (+)	16
LFT RR HEADSET (+)	17
RR HEADSET COMMON	18
N/C	19
N/C	20
RR MIC	21
FRT MIC	22
FRT MIC COMMON	23

BASE
RADIO
CONNECTOR
[27A]

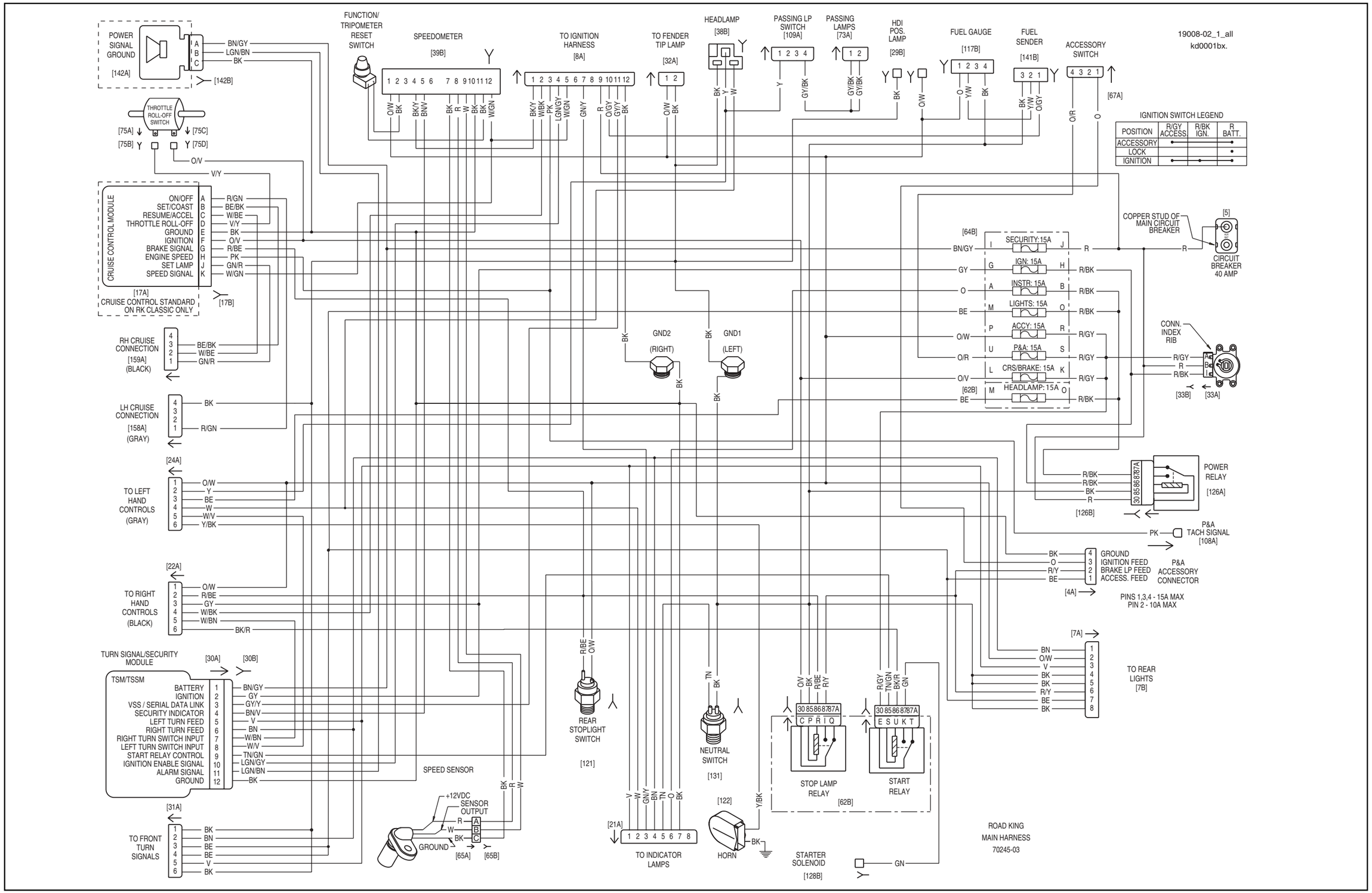
1	RT FRT SPEAKER (+)
2	PUSH TO TALK (MIC)
3	R0 (HANDLEBAR MATRIX)
4	R1 (HANDLEBAR MATRIX)
5	R2 (HANDLEBAR MATRIX)
6	C4 (HANDLEBAR MATRIX)
7	C3 (HANDLEBAR MATRIX)
8	C2 (HANDLEBAR MATRIX)
9	VEHICLE SPEED SIGNAL
10	BATTERY
11	GROUND
12	IGNITION
13	HEADSET SPEAKERS B
14	N/C
15	N/C
16	LFT FRT SPEAKER (+)
17	LFT FRT SPEAKER ( )
18	RT FRT SPEAKER (+)
19	GROUND
20	BATTERY
21	HEADSET SPEAKERS A
22	C1 (HANDLEBAR MATRIX)
23	C0 (HANDLEBAR MATRIX)

ULTRA
RADIO
CONNECTOR
[28A]

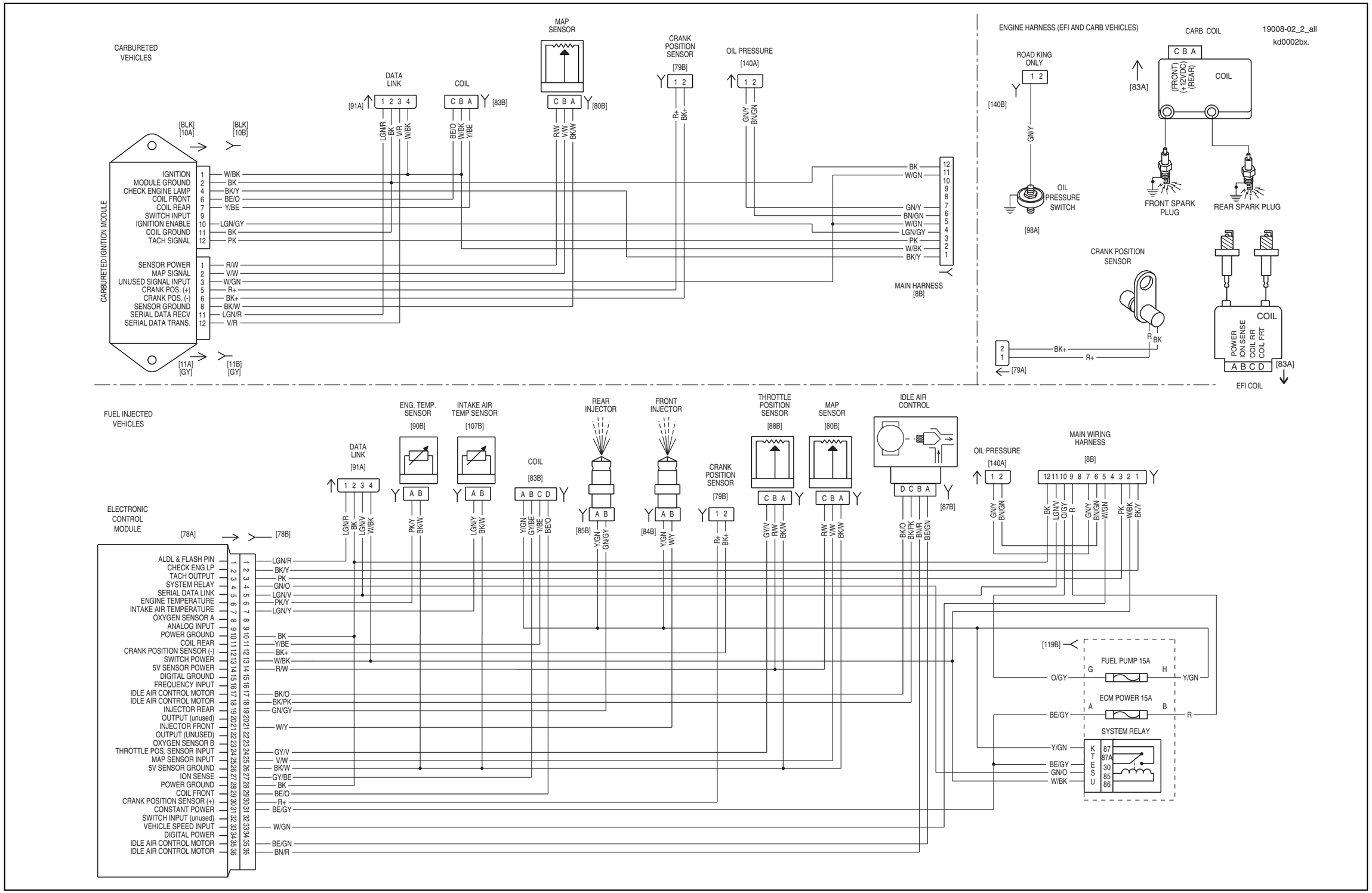
RR CONTROL MATRIX		
	C3	C4
R0	RR VOL UP	UP TUNE / FF
R1	RR VOL DWN	DWN TUNE / REWIND
R2	PUSH TO TALK	BAND

HANDLEBAR MATRIX					
	C0	C1	C2	C3	C4
R0	VOL UP	VOL DWN	MENU		UP TUNE / FF
R1					DWN TUNE / REWIND
R2		SQUELCH UP	SQUELCH DWN	PUSH TO TALK	BAND

2003 FLHTC, FLHTCU and FLTR, DOMESTIC and INTERNATIONAL Models,
Radio, CB/Intercom and Rear Speakers



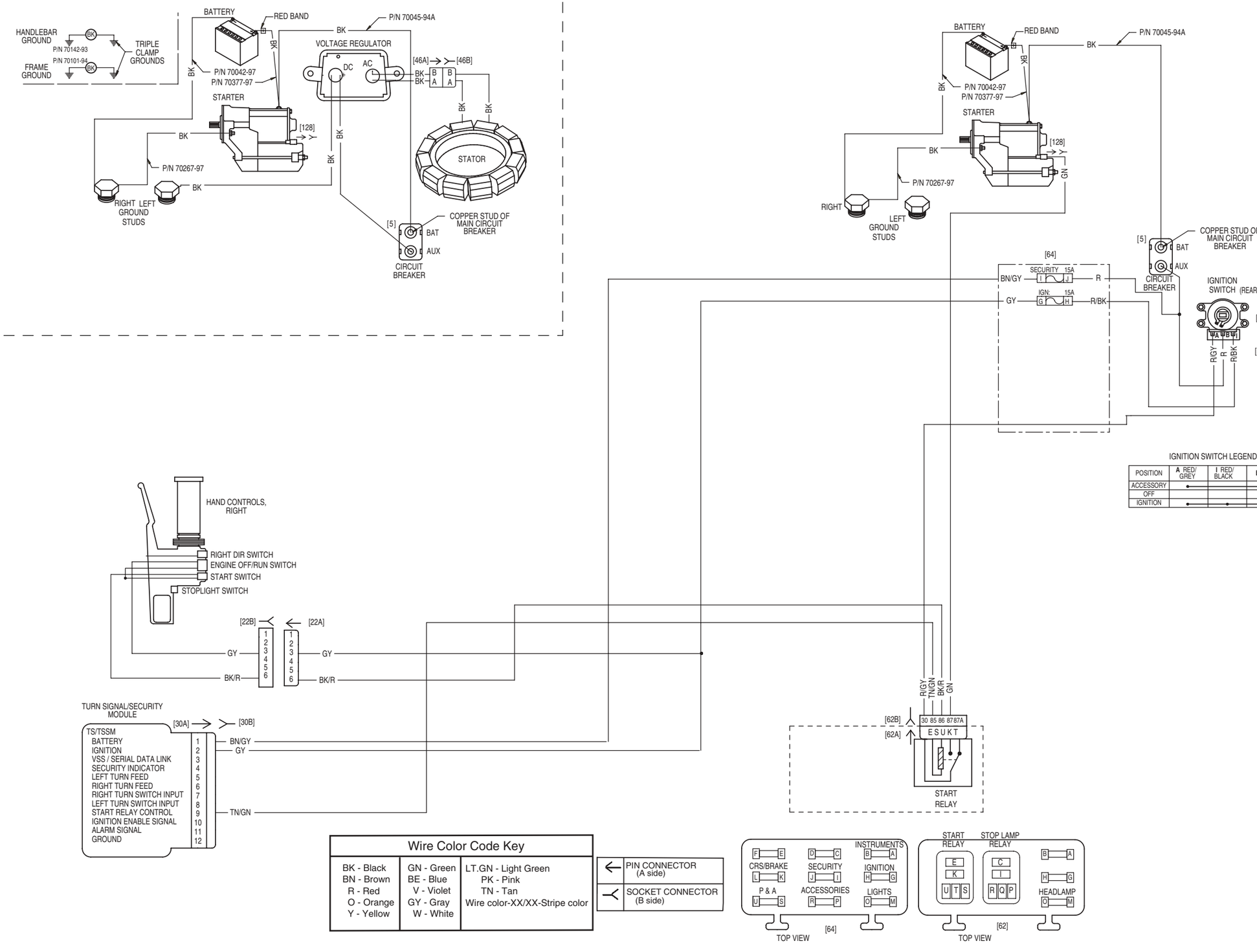
2003 FLHR and FLHRC, DOMESTIC and INTERNATIONAL Models,
Main Harness



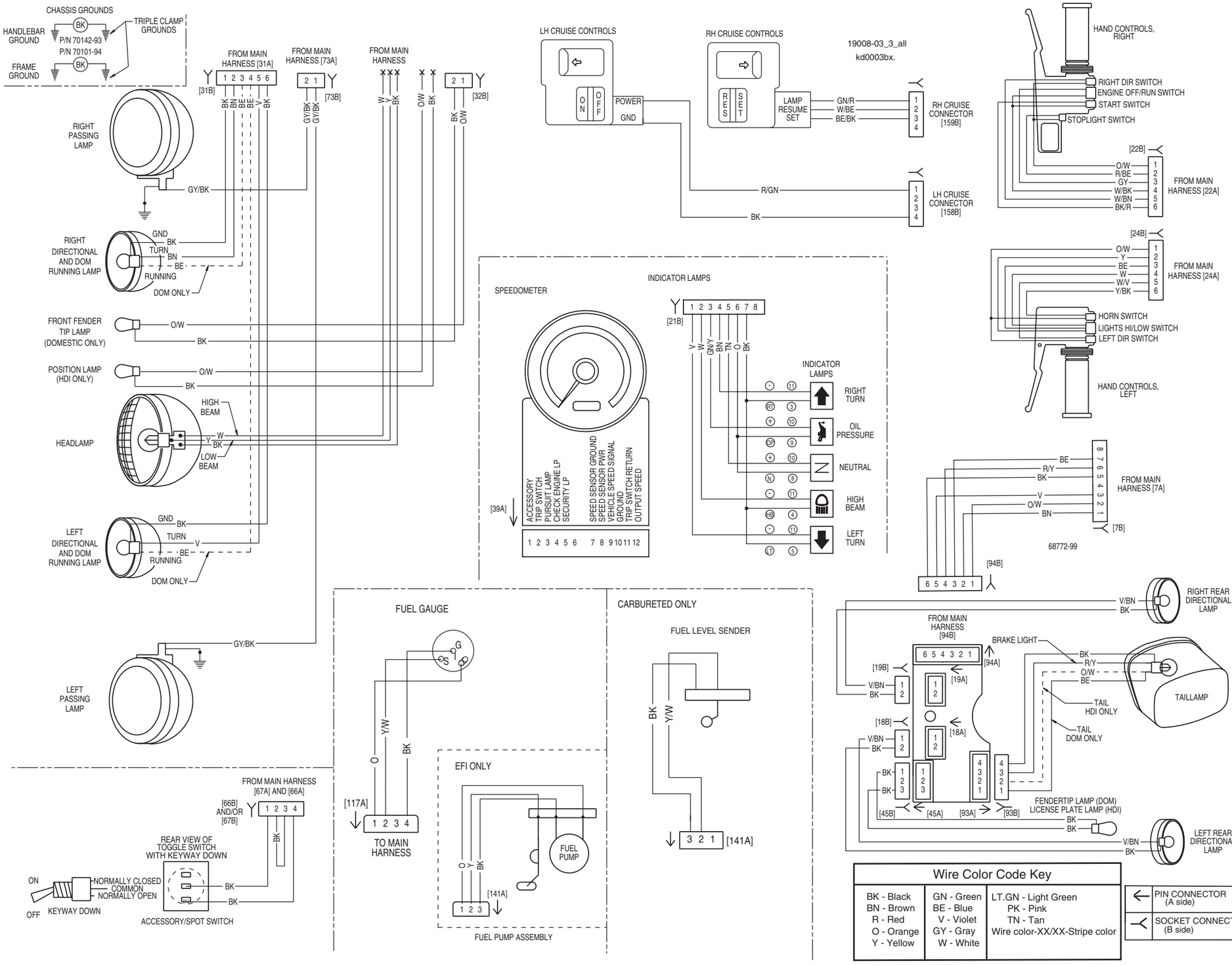
2003 FLHR and FLHRC, DOMESTIC and INTERNATIONAL Models,
Ignition Harness, Engine Sensor Harness and Engine Management Circuitry

kd0009bx.

19008-02_chg+starting.



2003 FLHR and FLHRC, DOMESTIC and INTERNATIONAL Models, Starting and Charging

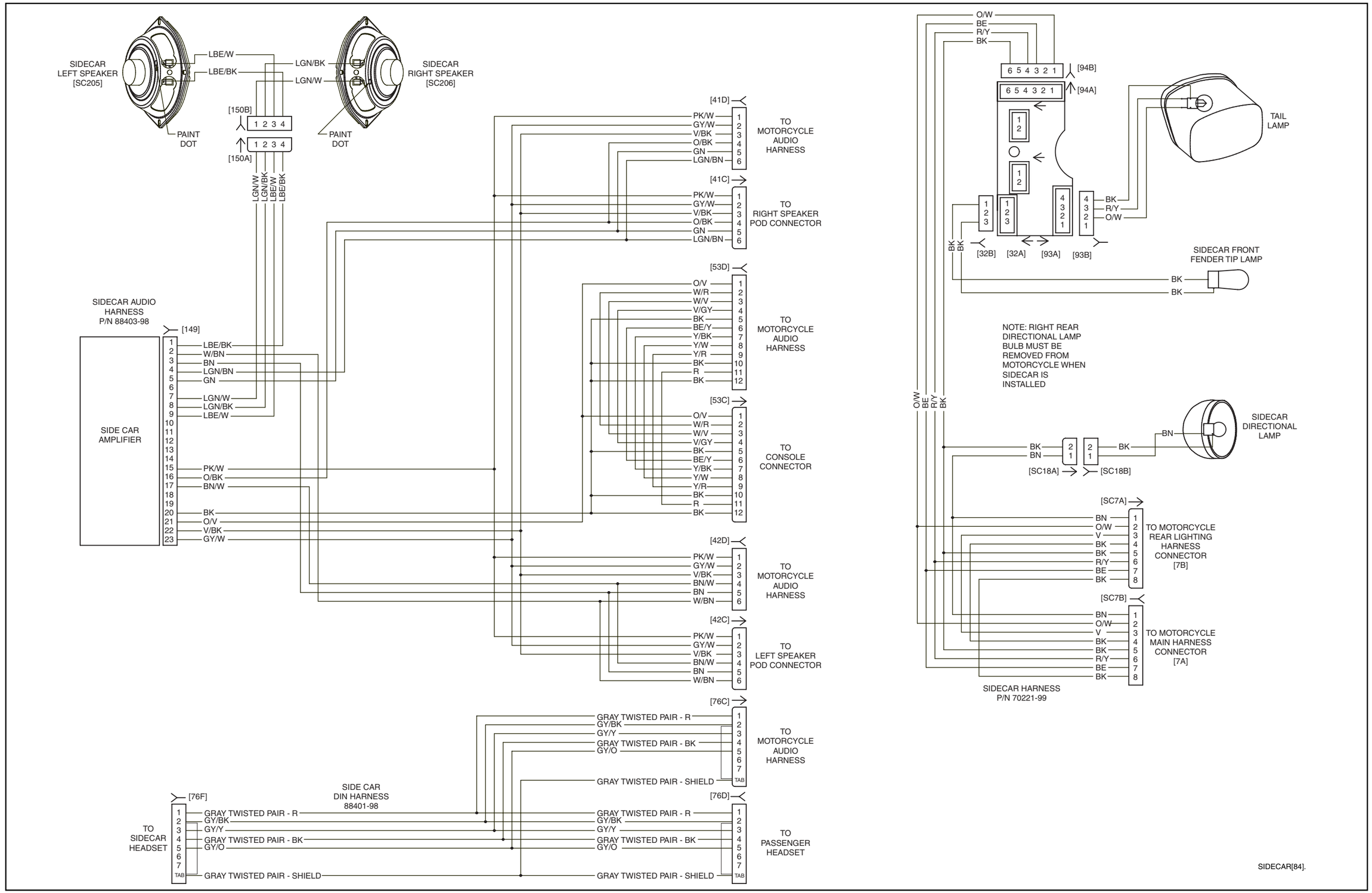


Wire Color Code Key		
BK - Black	GN - Green	LT.GN - Light Green
BN - Brown	BE - Blue	PK - Pink
R - Red	V - Violet	TN - Tan
O - Orange	GY - Gray	Wire color-XX/XX-Stripe color
Y - Yellow	W - White	

← PIN CONNECTOR (A side)

SOCKET CONNECTOR (B side)

2003 FLHR and FLHRC, DOMESTIC and INTERNATIONAL Models,
Handlebar Controls, Speedometer, Indicator Lamps, Tail Lamp, Passing Lamps, Directional Lamps and Fender Tip Lamps


SIDECAR LEFT SPEAKER [SC205]
LBE/W
LBE/BK
PAINT DOT
LGN/BK
LGN/W
SIDECAR RIGHT SPEAKER [SC206]
PAINT DOT
[150B]
[150A]
LGN/W
LGN/BK
LBE/W
LBE/BK
SIDECAR AUDIO HARNESS P/N 88403-98
[149]
SIDE CAR AMPLIFIER
LBE/BK
W/BN
BN
LGN/BN
GN
LGN/W
LGN/BK
LBE/W
PK/W
O/BK
BN/W
BK
O/V
V/BK
GY/W
[41D]
PK/W
GY/W
V/BK
O/BK
GN
LGN/BN
TO MOTORCYCLE AUDIO HARNESS
[41C]
PK/W
GY/W
V/BK
O/BK
GN
LGN/BN
TO RIGHT SPEAKER POD CONNECTOR
[53D]
O/V
W/R
W/V
V/GY
BK
BE/Y
Y/BK
Y/W
Y/R
BK
R
BK
TO MOTORCYCLE AUDIO HARNESS
[53C]
O/V
W/R
W/V
V/GY
BK
BE/Y
Y/BK
Y/W
Y/R
BK
R
BK
TO CONSOLE CONNECTOR
[42D]
PK/W
GY/W
V/BK
BN/W
BN
W/BN
TO MOTORCYCLE AUDIO HARNESS
[42C]
PK/W
GY/W
V/BK
BN/W
BN
W/BN
TO LEFT SPEAKER POD CONNECTOR
[76C]
GRAY TWISTED PAIR - R
GY/BK
GY/Y
GRAY TWISTED PAIR - BK
GY/O
GRAY TWISTED PAIR - SHIELD
TAB
TO MOTORCYCLE AUDIO HARNESS
SIDE CAR DIN HARNESS 88401-98
[76F]
TO SIDECAR HEADSET
GRAY TWISTED PAIR - R
GY/BK
GY/Y
GRAY TWISTED PAIR - BK
GY/O
GRAY TWISTED PAIR - SHIELD
TAB
[76D]
GRAY TWISTED PAIR - R
GY/BK
GY/Y
GRAY TWISTED PAIR - BK
GY/O
GRAY TWISTED PAIR - SHIELD
TAB
TO PASSENGER HEADSET
O/W
BE
R/Y
BK
[94B]
[94A]
TAIL LAMP
BK
R/Y
O/W
[32B]
[32A]
[93A]
[93B]
SIDECAR FRONT FENDER TIP LAMP
BK
BK
NOTE: RIGHT REAR DIRECTIONAL LAMP BULB MUST BE REMOVED FROM MOTORCYCLE WHEN SIDECAR IS INSTALLED
SIDECAR DIRECTIONAL LAMP
BN
BK
BN
[SC18A]
[SC18B]
[SC7A]
BN
O/W
V
BK
BK
R/Y
BE
BK
TO MOTORCYCLE REAR LIGHTING HARNESS CONNECTOR [7B]
[SC7B]
BN
O/W
V
BK
BK
R/Y
BE
BK
TO MOTORCYCLE MAIN HARNESS CONNECTOR [7A]
SIDECAR HARNESS P/N 70221-99
SIDECAR[84].

METRIC CONVERSIONS C.1

Table C-1. Metric Conversions

MILLIMETERS to INCHES (mm x 0.03937 = inches)								INCHES to MILLIMETERS (inches x 25.40 = mm)							
mm	in.	mm	in.	mm	in.	mm	in.	in.	mm	in.	mm	in.	mm	in.	mm
.1	.0039	25	.9842	58	2.283	91	3.582	.001	.025	.6	15.240	1 15/16	49.21	3 5/16	84.14
.2	.0078	26	1.024	59	2.323	92	3.622	.002	.051	5/8	15.875	2	50.80	3 3/8	85.72
.3	.0118	27	1.063	60	2.362	93	3.661	.003	.076	11/16	17.462	2 1/16	52.39	3.4	86.36
.4	.0157	28	1.102	61	2.401	94	3.701	.004	.102	.7	17.780	2.1	53.34	3 7/16	87.31
.5	.0197	29	1.142	62	2.441	95	3.740	.005	.127	3/4	19.050	2 1/8	53.97	3 1/2	88.90
.6	.0236	30	1.181	63	2.480	96	3.779	.006	.152	.8	20.320	2 3/16	55.56	3 9/16	90.49
.7	.0275	31	1.220	64	2.519	97	3.819	.007	.178	13/16	20.638	2.2	55.88	3.6	91.44
.8	.0315	32	1.260	65	2.559	98	3.858	.008	.203	7/8	22.225	2 1/4	57.15	3 5/8	92.07
.9	.0354	33	1.299	66	2.598	99	3.897	.009	.229	.9	22.860	2.3	58.42	3 11/16	93.66
1	.0394	34	1.338	67	2.638	100	3.937	.010	.254	15/16	23.812	2 5/16	58.74	3.7	93.98
2	.0787	35	1.378	68	2.677	101	3.976	1/64	.397	1	25.40	2 3/8	60.32	3 3/4	95.25
3	.1181	36	1.417	69	2.716	102	4.016	.020	.508	1 1/16	26.99	2.4	60.96	3.8	96.52
4	.1575	37	1.456	70	2.756	103	4.055	.030	.762	1.1	27.94	2 7/16	61.91	3 13/16	96.84
5	.1968	38	1.496	71	2.795	104	4.094	1/32	.794	1 1/8	28.57	2 1/2	63.50	3 7/8	98.42
6	.2362	39	1.535	72	2.834	105	4.134	.040	1.016	1 3/16	30.16	2 9/16	65.09	3.9	99.06
7	.2756	40	1.575	73	2.874	106	4.173	.050	1.270	1.2	30.48	2.6	66.04	3 15/16	100.01
8	.3149	41	1.614	74	2.913	107	4.212	.060	1.524	1 1/4	31.75	2 5/8	66.67	4	101.6
9	.3543	42	1.653	75	2.953	108	4.252	1/16	1.588	1.3	33.02	2 11/16	68.26	4 1/16	102.19
10	.3937	43	1.693	76	2.992	109	4.291	.070	1.778	1 5/16	33.34	2.7	68.58	4.1	104.14
11	.4331	44	1.732	77	3.031	110	4.331	.080	2.032	1 3/8	34.92	2 3/4	69.85	4 1/8	104.77
12	.4724	45	1.772	78	3.071	111	4.370	.090	2.286	1.4	35.56	2.8	71.12	4 3/16	106.36
13	.5118	46	1.811	79	3.110	112	4.409	.1	2.540	1 7/16	36.51	2 13/16	71.44	4.2	106.68
14	.5512	47	1.850	80	3.149	113	4.449	1/8	3.175	1 1/2	38.10	2 7/8	73.02	4 1/4	107.95
15	.5905	48	1.890	81	3.189	114	4.488	3/16	4.762	1 9/16	39.69	2.9	73.66	4.3	109.22
16	.6299	49	1.929	82	3.228	115	4.527	.2	5.080	1.6	40.64	2 15/16	74.61	4 5/16	109.54
17	.6693	50	1.968	83	3.268	116	4.567	1/4	6.350	1 5/8	41.27	3	76.20	4 3/8	111.12
18	.7086	51	2.008	84	3.307	117	4.606	.3	7.620	1 11/16	42.86	3 1/16	77.79	4.4	111.76
19	.7480	52	2.047	85	3.346	118	4.645	5/16	7.938	1.7	43.18	3.1	78.74	4 7/16	112.71
20	.7874	53	2.086	86	3.386	119	4.685	3/8	9.525	1 3/4	44.45	3 1/8	79.37	4 1/2	114.30
21	.8268	54	2.126	87	3.425	120	4.724	.4	10.160	1.8	45.72	3 3/16	80.96	4 9/16	115.89
22	.8661	55	2.165	88	3.464	121	4.764	7/16	11.112	1 13/16	46.04	3.2	81.28	4.6	116.84
23	.9055	56	2.205	89	3.504	122	4.803	1/2	12.700	1 7/8	47.62	3 1/4	82.55	4 5/8	117.47
24	.9449	57	2.244	90	3.543	123	4.842	9/16	14.288	1.9	48.26	3.3	83.82	4 11/16	119.06

FASTENER TORQUE VALUES C.2

GENERAL

Torque specifications for specific components are listed in each section at the point of use. When converting to Newton-meters, use the formulas given at the bottom of the page. For all other steel fasteners, use the values listed in one of the two tables. In the English table, torque figures are listed in ft-lbs, except those marked with an asterisk (*), which are listed in **in-lbs**. In the metric table, all figures are listed in Newton-meters.

WARNING

The fasteners used on Harley-Davidson motorcycles have specific strength, finish and type requirements to perform properly in the assembly and operating environment. Use only genuine Harley-Davidson replacement fasteners tightened to the proper torque. Substitution can cause fastener failure, which could result in death or serious injury.

Table C-2. English Torque Values

FASTENER	TYPE	MINIMUM TENSILE STRENGTH	MATERIAL	BODY SIZE OR OUTSIDE DIAMETER																
				# (number)							in. (inches)									
				2	3	4	5	6	8	10	1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4	7/8	1
	SAE 2 STEEL	74,000 PSI	LOW CARBON								6	12	20	32	47	69	96	155	206	310
	SAE 5 STEEL	120,000 PSI	MEDIUM CARBON HEAT TREAT						14*	22*	10	19	33	54	78	114	154	257	382	587
	SAE 7 STEEL	133,000 PSI	MEDIUM CARBON ALLOY								13	25	44	71	110	154	215	360	570	840
	SAE 8 STEEL	150,000 PSI	MEDIUM CARBON ALLOY								14	29	47	78	119	169	230	380	600	900
	SAE 8 STEEL	150,000 PSI	MEDIUM CARBON ALLOY								14	29	47	78	119	169	230	380	600	900
	SOCKET SET SCREW	212,000 PSI	HIGH CARBON QUENCHED TEMPERED					9*	16*	30*	70*	140*	18	29	43	63	100	146		
	STUDS			Use SAE 2, 5 and 8 values when grade is known, with nut of sufficient strength.																

*These marked torque values are listed in **in-lbs.**

Table C-3. Metric Torque Values

FASTENER	TYPE	MINIMUM TENSILE STRENGTH	MATERIAL	BODY SIZE OR OUTSIDE DIAMETER																
				# (number)							mm (millimeters)									
				2	3	4	5	6	8	10	6.4	7.9	9.5	11.1	12.7	14.3	15.9	19.1	22.2	25.4
	SAE 2 STEEL	5,202 kg/cm^2	LOW CARBON								8.3	16.6	27.7	44.3	65.0	95.4	132.8	214.4	283.5	428.7
	SAE 5 STEEL	8,436 kg/cm^2	MEDIUM CARBON HEAT TREAT						1.6	2.5	13.8	26.3	45.6	74.7	107.9	157.7	213.0	355.4	528.3	811.8
	SAE 7 STEEL	9,350 kg/cm^2	MEDIUM CARBON ALLOY								18.0	34.6	60.8	98.2	152.1	213.0	297.3	497.9	788.3	1161.7
	SAE 8 STEEL	10,545 kg/cm^2	MEDIUM CARBON ALLOY								19.4	40.1	65.0	107.9	164.6	233.7	318.1	525.5	829.8	1220.0
	SAE 8 STEEL	10,545 kg/cm^2	MEDIUM CARBON ALLOY								19.4	40.1	65.0	107.9	164.6	233.7	318.1	525.5	829.8	1220.0
	SOCKET SET SCREW	14,904 kg/cm^2	HIGH CARBON QUENCHED TEMPERED					1.0	1.8	3.4	8.1	16.1	24.9	40.1	59.5	87.1	138.3	201.9		
	STUDS			Use SAE 2, 5 and 8 values when grade is known, with nut of sufficient strength.																

foot-pounds (ft-lbs) x 1.356 = Newton-meters (Nm)

inch-pounds (**in-lbs**) x 0.113 = Newton-meters (Nm)

FLUID CONVERSIONS C.3

UNITED STATES SYSTEM

Unless otherwise specified, **all fluid volume measurements in this Service Manual are expressed in United States (U.S.) units-of-measure.** See below:

- 1 pint (U.S.) = 16 fluid ounces (U.S.)
- 1 quart (U.S.) = 2 pints (U.S.) = 32 fl. oz. (U.S.)
- 1 gallon (U.S.) = 4 quarts (U.S.) = 128 fl. oz. (U.S.)

METRIC SYSTEM

Fluid volume measurements in this Service Manual include the metric system equivalents. In the metric system, 1 liter (L) = 1,000 milliliters (mL). Should you need to convert from U.S. units-of-measure to metric units-of-measure (or vice versa), refer to the following:

- fluid ounces (U.S.) x 29.574 = milliliters
- pints (U.S.) x 0.473 = liters
- quarts (U.S.) x 0.946 = liters
- gallons (U.S.) x 3.785 = liters
- milliliters x 0.0338 = fluid ounces (U.S.)
- liters x 2.114 = pints (U.S.)
- liters x 1.057 = quarts (U.S.)
- liters x 0.264 = gallons (U.S.)

BRITISH IMPERIAL SYSTEM

Fluid volume measurements in this Service Manual do not include the British Imperial (Imp.) system equivalents. The following conversions exist in the British Imperial system:

- 1 pint (Imp.) = 20 fluid ounces (Imp.)
- 1 quart (Imp.) = 2 pints (Imp.)
- 1 gallon (Imp.) = 4 quarts (Imp.)

Although the same unit-of-measure terminology as the U.S. system is used in the British Imperial (Imp.) system, the actual volume of each British Imperial unit-of-measure differs from its U.S. counterpart. The U.S. fluid ounce is larger than the British Imperial fluid ounce. However, the U.S. pint, quart, and gallon are smaller than the British Imperial pint, quart, and gallon, respectively. Should you need to convert from U.S. units to British Imperial units (or vice versa), refer to the following:

- fluid ounces (U.S.) x 1.042 = fluid ounces (Imp.)
- pints (U.S.) x 0.833 = pints (Imp.)
- quarts (U.S.) x 0.833 = quarts (Imp.)
- gallons (U.S.) x 0.833 = gallons (Imp.)
- fluid ounces (Imp.) x 0.960 = fluid ounces (U.S.)
- pints (Imp.) x 1.201 = pints (U.S.)
- quarts (Imp.) x 1.201 = quarts (U.S.)
- gallons (Imp.) x 1.201 = gallons (U.S.)

NOTES

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STARTER TROUBLESHOOTING 1.1

Table 1-1. Starter Does Not Run or Runs At Very Low Speeds

SOURCE OF PROBLEM	PROBABLE CAUSE	SOLUTION
Battery	Voltage drop due to discharged battery.	Charge battery.
	Short-circuited or open between electrodes.	Replace battery.
	Poor contact condition of battery terminal(s).	Clean and retighten.
Wiring	Poor or no connection at either battery positive or negative cable, at either end.	Repair or replace cable(s).
	Cracked or corroded battery cable ends.	Clean, tighten or replace cable(s) as needed.
	Open wire(s) or poor connection at handlebar switch or starter relay, especially relay ground wire.	Tighten connections or repair or replace wire(s).
Handlebar start switch	Poor switch contacts or open switch.	Replace switch.
Starter relay	Open coil winding.	Replace relay.
	Poor or no continuity at relay points.	Replace relay.
	TSM/TSSM has disabled starter relay.	Check for open on wire to TSM/TSSM. Correct lack of ground.
Solenoid	Poor contact condition caused by burnt contact.	Polish contact surface or replace solenoid assembly.
	Pull-in winding open or short-circuited.	Repair or replace solenoid assembly.
	Hold-in winding open or short-circuited.	Repair or replace solenoid assembly.
Starting motor	Brushes worn below specification.	Check brush spring tension. Replace field frame and holder.
	Commutator burnt.	Re-face or replace.
	Commutator high mica.	Correct by undercutting.
	Field winding grounded.	Replace.
	Armature winding grounded or short-circuited.	Replace.
	Reduction gears damaged.	Replace.
	Insufficient brush spring tension.	Replace.
	Disconnected lead wire between solenoid and field windings.	Repair or replace lead wire.
	Ball bearing sticks.	Replace bearing.

Table 1-2. Pinion Does Not Engage With Ring Gear While Starter is Cranked or Engine Cannot Be Cranked

SOURCE OF PROBLEM	PROBABLE CAUSE	SOLUTION
Battery	Voltage drop due to discharged battery.	Charge battery.
	Short-circuited or open between electrodes.	Replace battery.
	Poor contact condition of battery terminal(s).	Clean and retighten.
Overrunning clutch.	Overrunning clutch malfunction (rollers or compression spring).	Replace overrunning clutch.
	Pinion teeth worn out.	Replace pinion.
	Pinion does not run in overrunning direction.	Replace overrunning clutch.
	Poor sliding condition of spline teeth.	Remove foreign materials, dirt or replace overrunning clutch or pinion shaft.
	Reduction gears damaged.	Replace overrunning clutch and idler gear.
Jackshaft assembly	Improper jackshaft parts assembly.	Disassemble and assemble parts properly.
Gear teeth on clutch shell	Excessively worn teeth.	Replace clutch shell.

Table 1-3. Starter Does Not Stop Running

SOURCE OF PROBLEM	PROBABLE CAUSE	SOLUTION
Starting switch or starter relay.	Unopened contacts.	Replace starting switch or starter relay.
	Poor return caused by sticky switch or relay contacts.	Replace starting switch or starter relay.
Gear teeth on clutch shell	Excessively worn teeth.	Replace clutch shell.
Solenoid.	Return spring worn.	Replace spring.
	Coil layer shorted.	Replace solenoid.
	Contact plate melted and stuck.	Replace solenoid.

STARTING SYSTEM DIAGNOSIS 1.2

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the starter system flow charts.

1. See Section 1.4 DIAGNOSTICS/TROUBLESHOOTING, VOLTAGE DROPS.
2. Remove starter motor. Connect jumper wires as described under Section 1.6 TESTING ASSEMBLED STARTER, FREE RUNNING CURRENT DRAW TEST.
3. Remove TSSM and use HARNESS CONNECTOR TEST KIT (Part No. HD-41404) to short Pin 9 on connector [30] to ground. If starter motor cranks, replace TSSM.
4. See Section 1.5 STARTER SYSTEM TESTING, STARTER CURRENT DRAW TEST.
5. See Section 1.6 TESTING ASSEMBLED STARTER, FREE RUNNING CURRENT DRAW TEST.

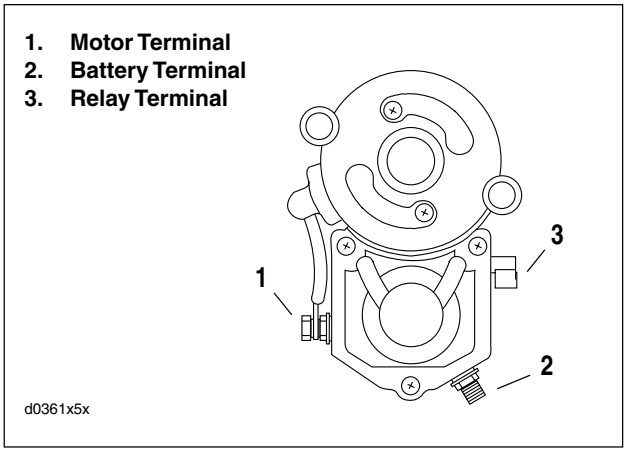
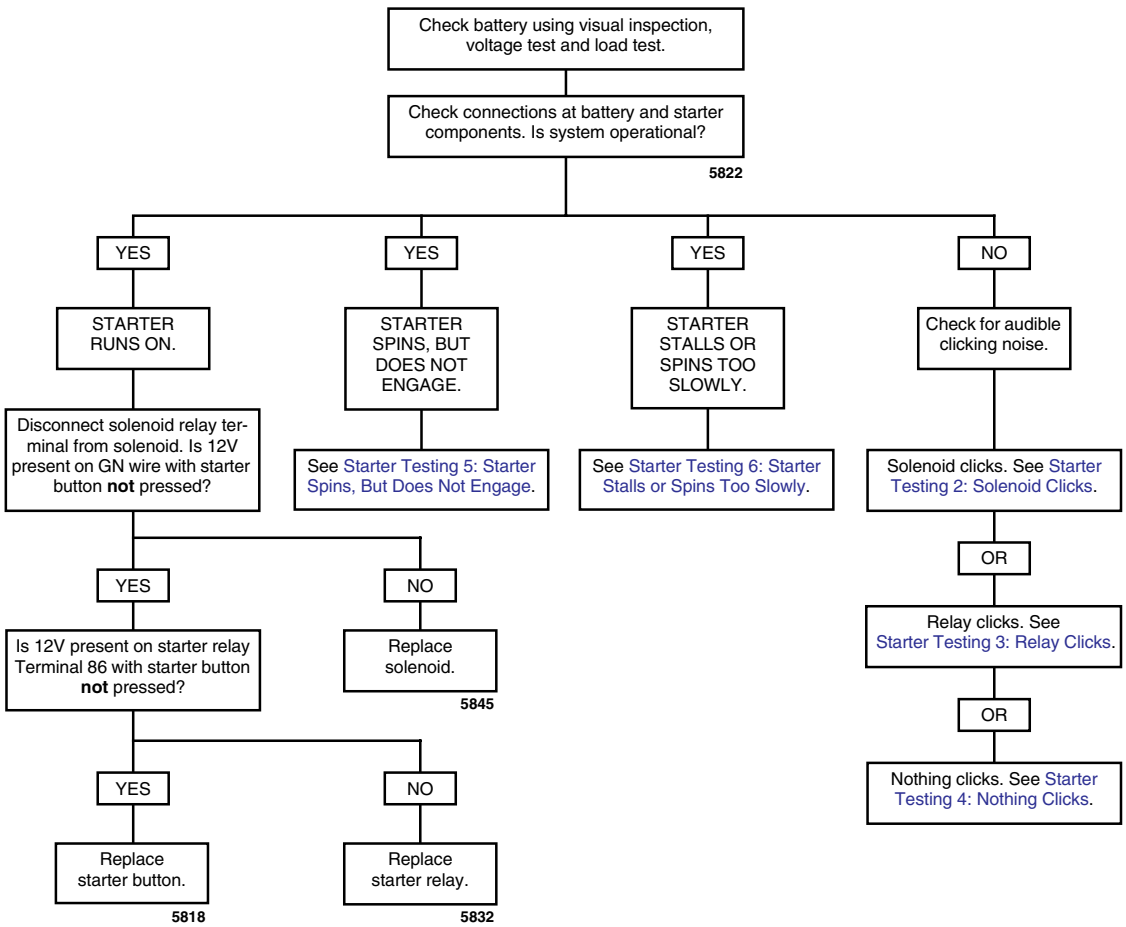
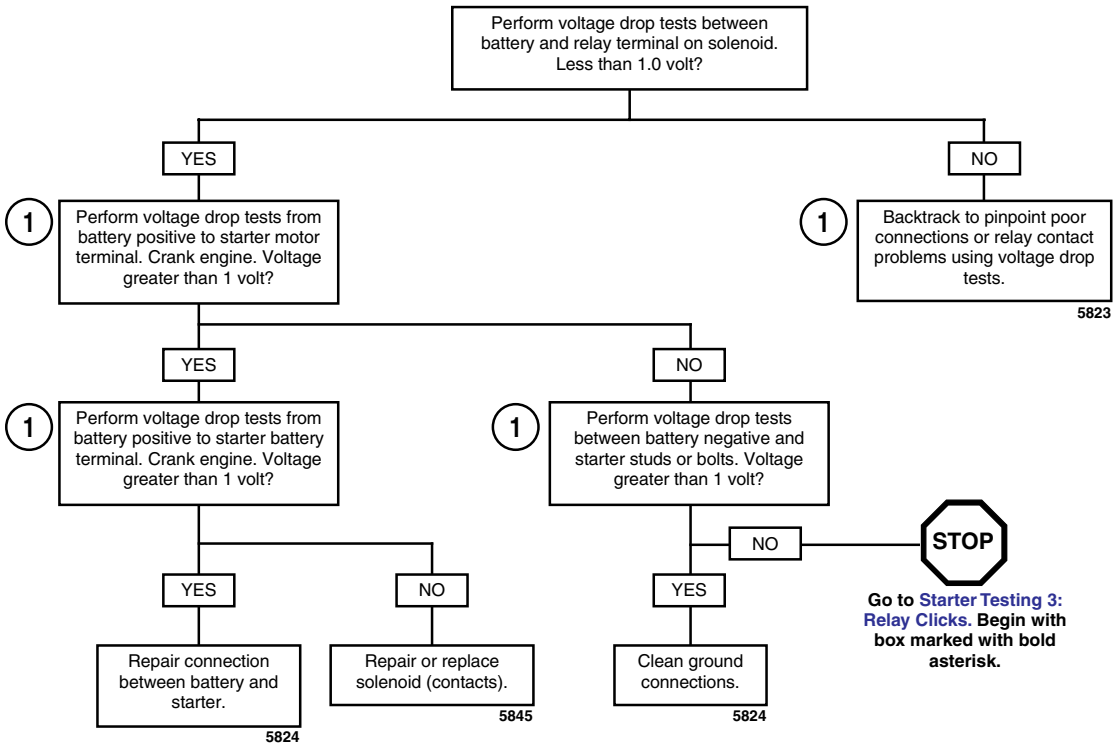


Figure 1-1. Starter Terminals

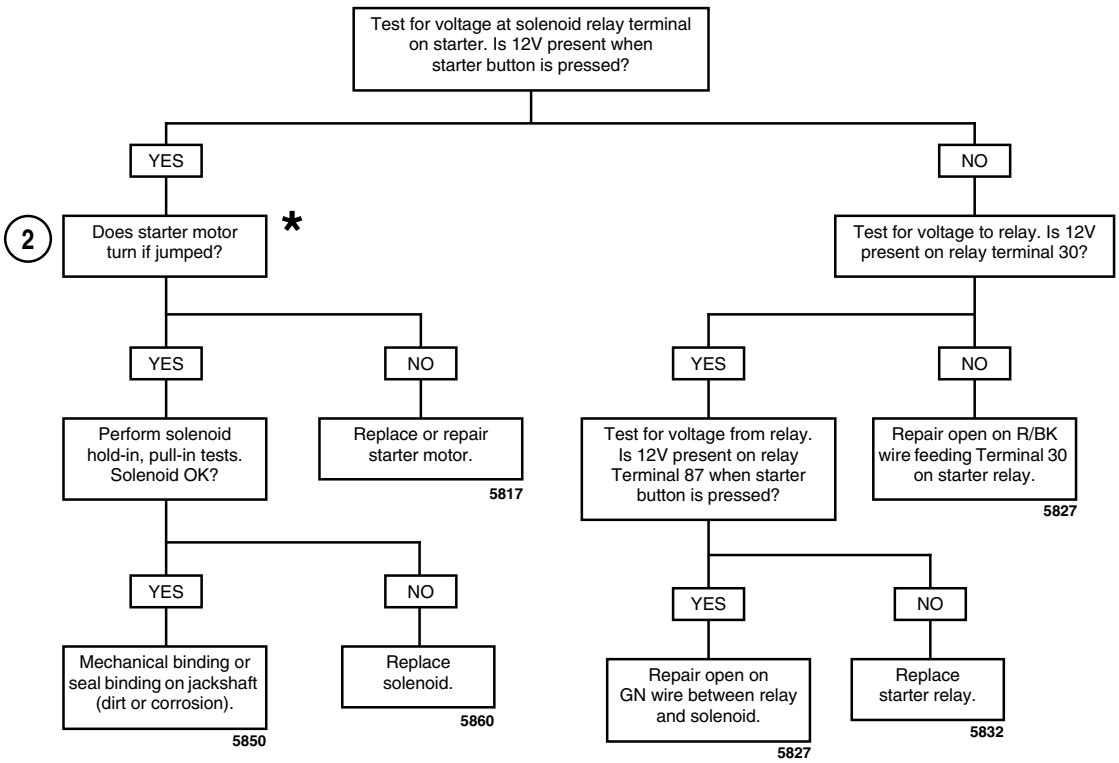
Starter Testing 1



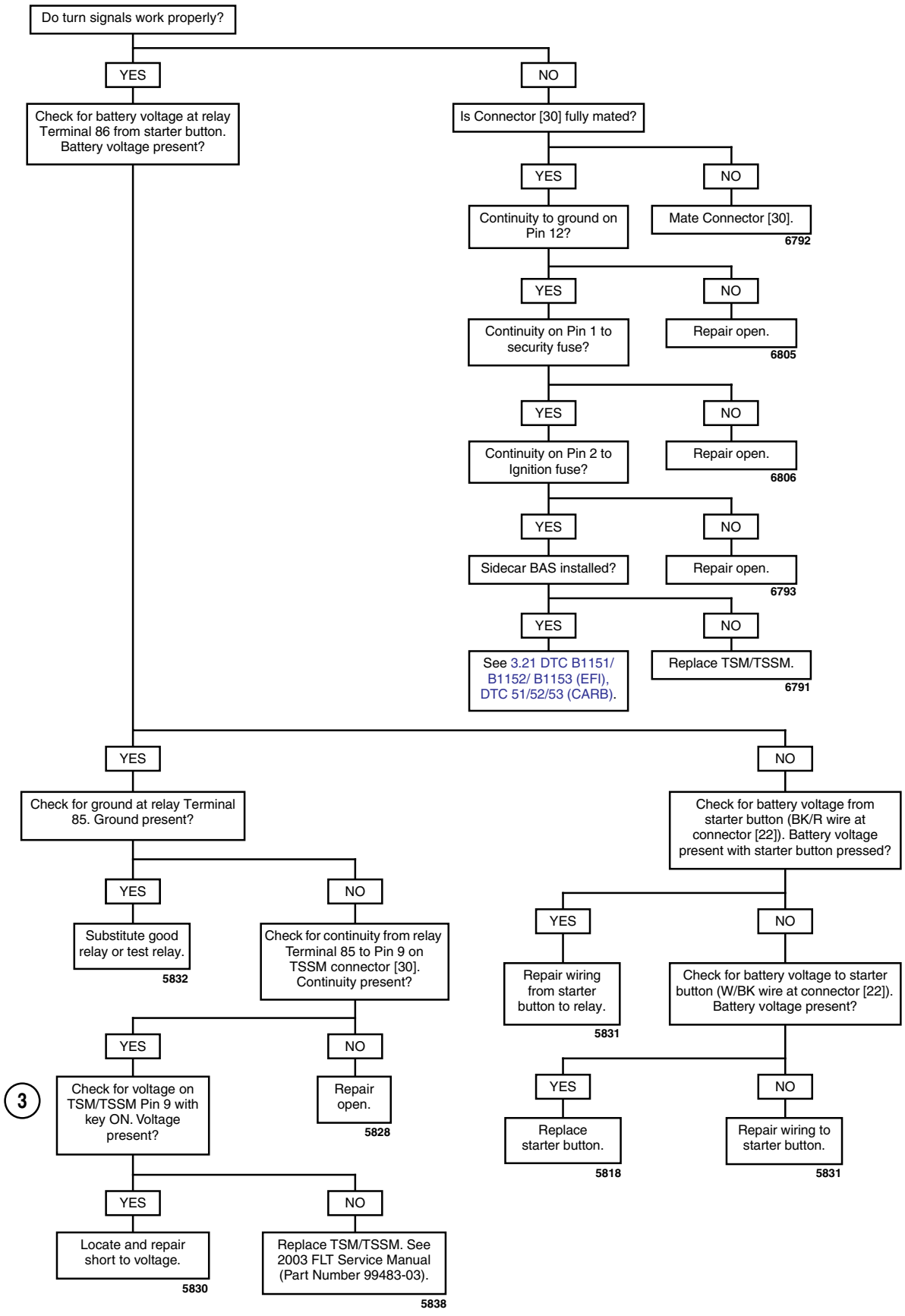
Starter Testing 2: Solenoid Clicks



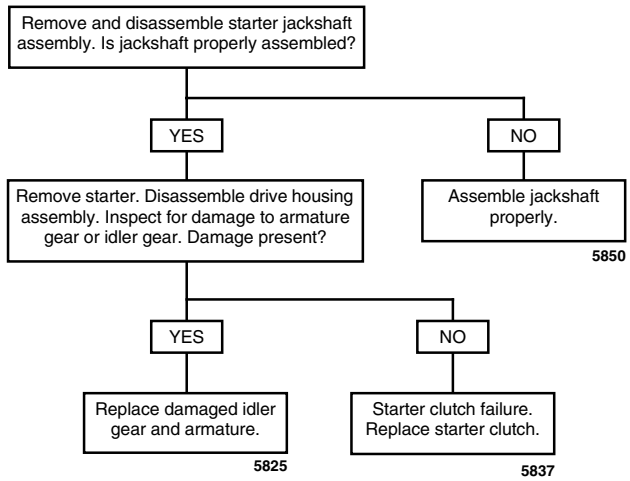
Starter Testing 3: Relay Clicks



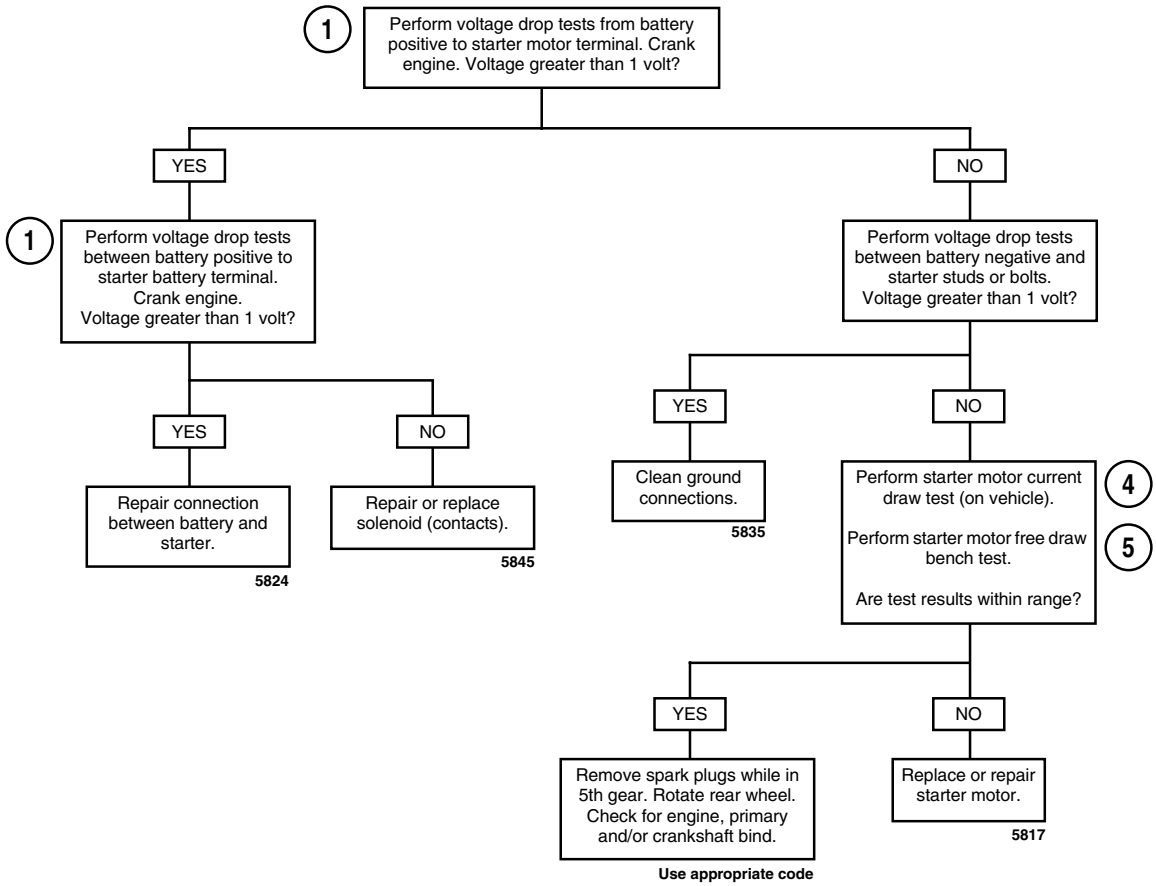
Starter Testing 4: Nothing Clicks



Starter Testing 5: Starter Spins, But Does Not Engage



Starter Testing 6: Starter Stalls or Spins Too Slowly



STARTER ACTIVATION CIRCUITS 1.3

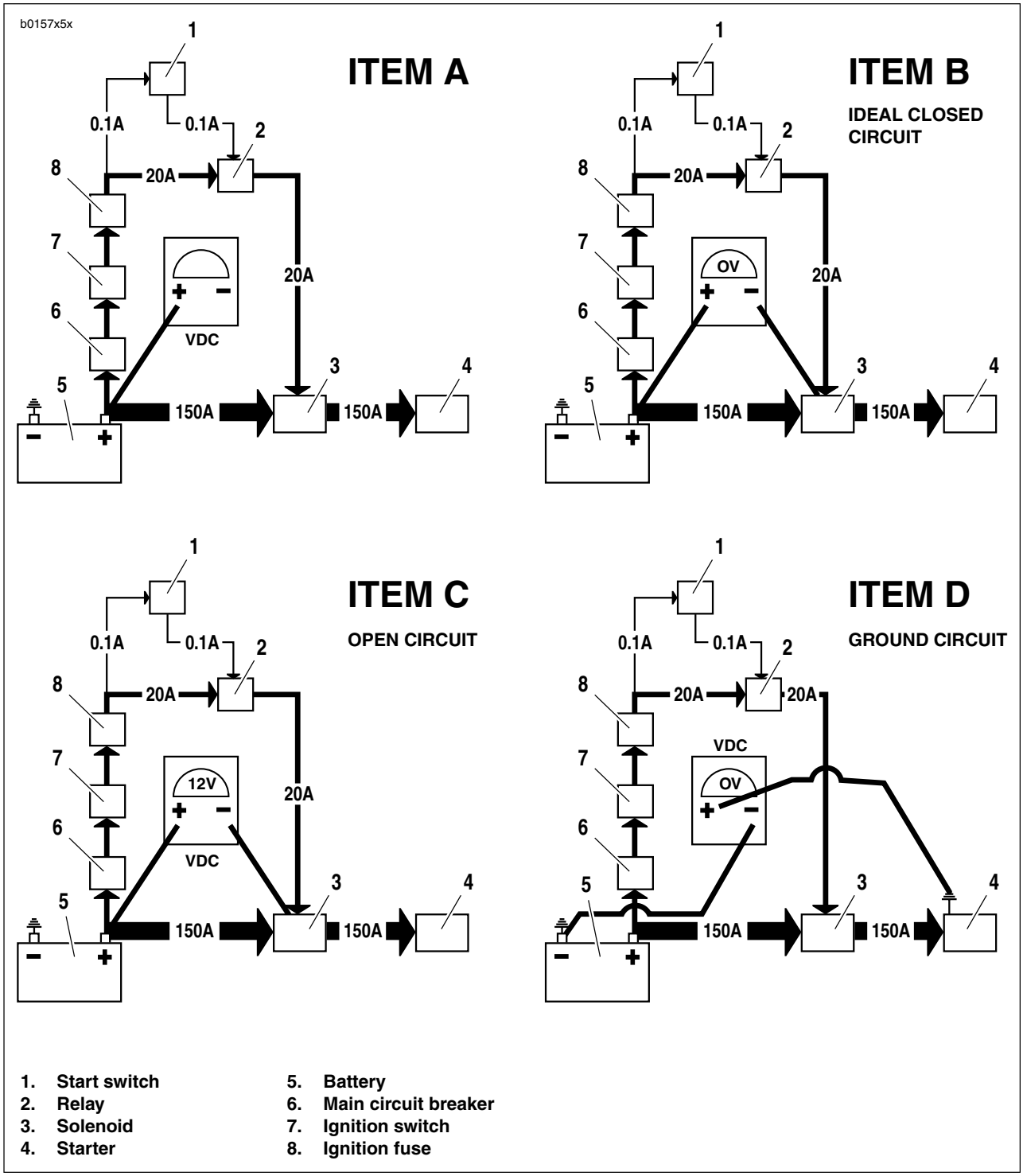


Figure 1-2. Typical Circuity. Refer to wiring diagrams for more information.

GENERAL

The troubleshooting tables beginning on page 1-1 contain detailed procedures to solve and correct problems. Follow the 1.2 STARTING SYSTEM DIAGNOSIS diagram to diagnose starting system problems. The VOLTAGE DROPS procedure below will help you to locate poor connections or components with excessive voltage drops.

VOLTAGE DROPS

Check the integrity of all wiring, switches, circuit breakers and connectors between the source and destination.

The voltage drop test measures the difference in potential or the actual voltage dropped between the source and destination.

1. See ITEM A in Figure 1-2. Attach your red meter lead to the most positive part of the circuit, which in this case would be the positive post of the battery.
2. See ITEM B in Figure 1-2. Attach the black meter lead to the final destination or component in the circuit (solenoid terminal from relay).
3. Activate the starter and observe the meter reading. The meter will read the voltage dropped or the difference in potential between the source and destination.
4. An ideal circuit's voltage drop would be 0 volts or no voltage dropped, meaning no difference in potential.
5. See ITEM C in Figure 1-2. An open circuit should read 12 volts, displaying all the voltage dropped, and the entire difference in potential displayed on the meter.

NOTE

Open circuits on the ground side will read zero.

6. Typically, a good circuit will drop less than 1 volt.
7. If the voltage drop is greater, back track through the connections until the source of the potential difference is found. The benefit of doing it this way is speed.
   a. Your readings aren't as sensitive to real battery voltage.
   b. Your readings show the actual voltage dropped, not just the presence of voltage.
   c. This tests the system as it is actually being used. It is more accurate and will display hard to find poor connections.
   d. This approach can be used on lighting circuits, ignition circuits, etc. Start from most positive and go to most negative (the destination or component).
8. See ITEM D in Figure 1-2. The negative or ground circuit can be checked as well.
   a. Place the negative lead on the most negative part of the circuit (or the negative battery post). Remember, there is nothing more negative than the negative post of the battery.
   b. Place the positive lead to the ground you wish to check.
   c. Activate the circuit. This will allow you to read the potential difference or voltage dropped on the negative or ground circuit. This is very effective for identifying poor grounds due to powdered paint. Even the slightest connection may cause an ohmmeter to give a good reading. However, when sufficient current is passed through, the resistance caused by the powdered paint will cause a voltage drop, or potential difference in the ground circuit.

STARTER SYSTEM TESTING 1.5

GENERAL

Before removing the starter, perform one of the Starter Relay Tests which follow. If the relay is known to be good, perform the STARTER CURRENT DRAW TEST in this section.

STARTER RELAY TEST 1

1. Remove relay. For FLHR/C models, see upper frame of Figure 1-3. For all other models, see upper frame of Figure 1-4.

2. Substitute a **new** relay known to be good and verify operation. For convenience, use the brake light relay as a temporary substitute on FLHR/C models, or use the ignition keyswitch relay as a temporary substitute on FLTR and FLHT/C/U models.

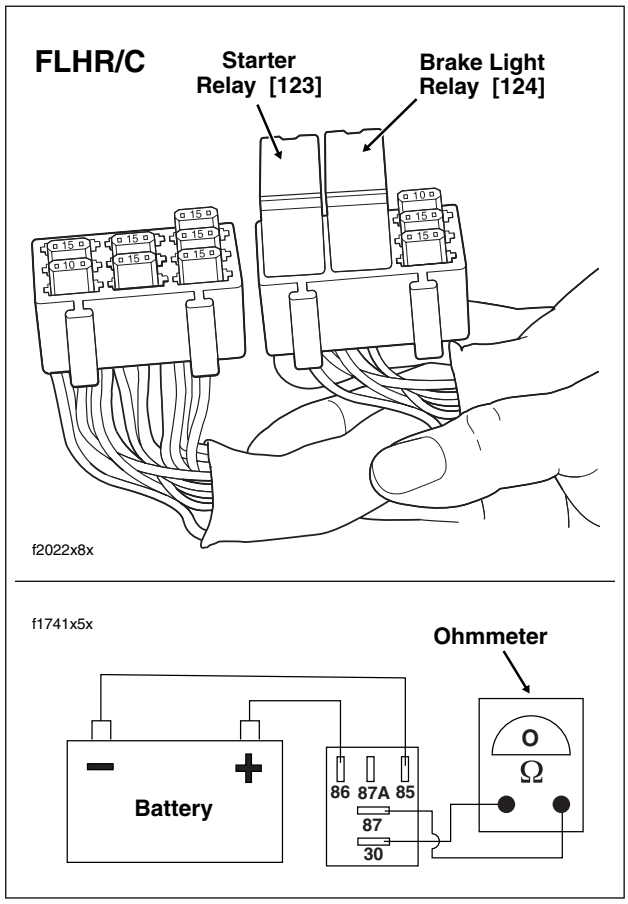


Figure 1-3. Locate Relay Under Left Side Cover

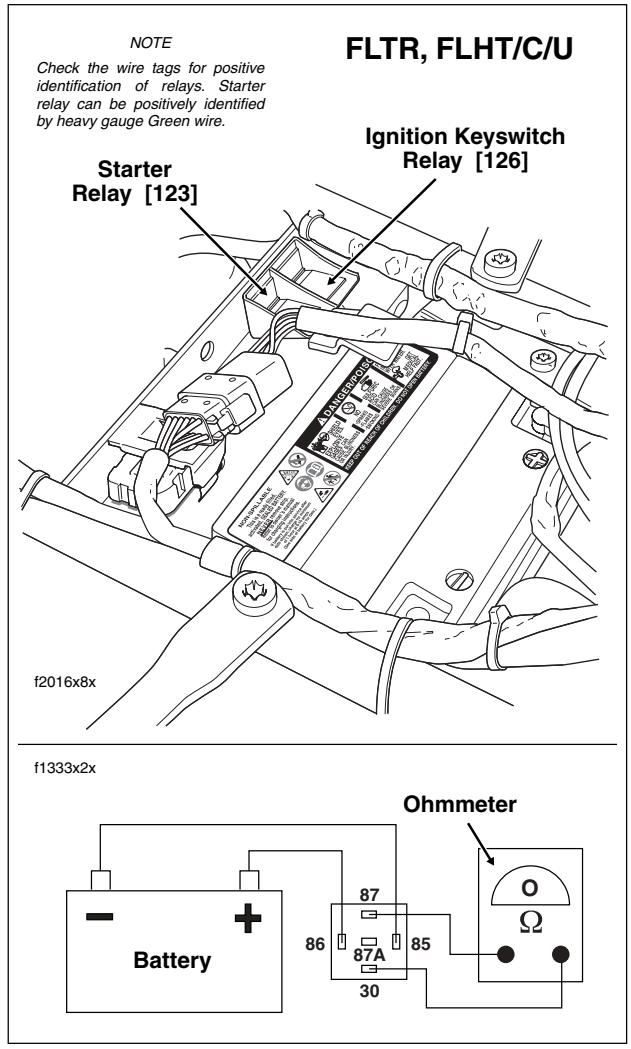


Figure 1-4. Locate Relay Under Seat

STARTER RELAY TEST 2

The starter relay can be tested using the vehicle's 12 volt battery and a continuity tester or ohmmeter (HD-35500B). Proceed as follows:

1. Remove relay. For FLHR/C models, see upper frame of Figure 1-3. For all other models, see upper frame of Figure 1-4.

2. To energize the relay, connect the battery leads to terminals 86 and 85. For FLHR/C models, see lower frame of Figure 1-3. For all other models, see lower frame of Figure 1-4.

3. Check for continuity between terminals 30 and 87.

4. If the tester lamp illuminates or there is a zero ohm reading on the ohmmeter, then continuity is present and the relay is good. Replace the relay if continuity is not present.

CAUTION

Relay terminal "85" must be connected to the negative battery terminal to avoid damaging the diode connected across the relay winding.

STARTER CURRENT DRAW TEST

Check the starter current draw with an inductive amp probe (HD-39617) or induction ammeter. Before proceeding, be sure that the battery is fully charged and that the engine temperature is stable and at room temperature.

1. Verify that the transmission is in neutral.
2. Disconnect the spark plug wires from the spark plug terminals.
3. Clamp induction ammeter over the positive battery cable. See Figure 1-5.
4. With the ignition ON, turn the engine over by pressing start switch while taking a reading on the ammeter. Disregard initial high current reading which is normal during time the engine is first turned over.

   Typical starter current draw will range between 160 and 180 amperes.

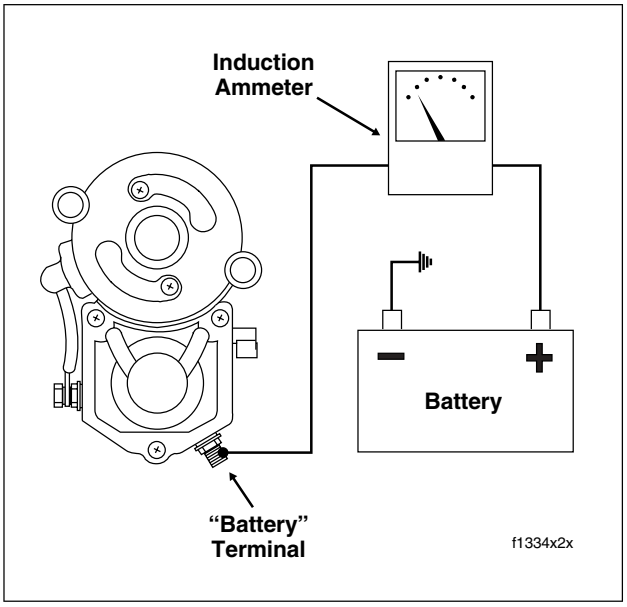


Figure 1-5. Starter Current Draw Test

5. If the starter current draw exceeds 200 amperes, the problem may be in the starter or starter drive.
6. Remove the starter for testing, if necessary. See the 2003 FLT Service Manual (Part Number 99483-03), STARTER, REMOVAL.
7. See Section 1.6 TESTING ASSEMBLED STARTER, FREE RUNNING CURRENT DRAW TEST.

TESTING ASSEMBLED STARTER 1.6

STARTER SOLENOID

⚠WARNING

Wear eye protection during this series of tests. These tests may produce flying sparks which could result in death or serious injury.

NOTE

Do not disassemble solenoid. Before testing, disconnect field wire from motor terminal as shown in Figure 1-6.

CAUTION

Each test should be performed for only 3-5 seconds to prevent damage to solenoid.

NOTE

The solenoid Pull-in, Hold-in, and Return tests must be performed together in one continuous operation. Conduct all three tests one after the other in the sequence listed.

SOLENOID PULL-IN TEST

1. See Figure 1-6. Using a 12 volt battery, connect three separate test leads as follows:
   a. Solenoid housing to negative battery post.
   b. Solenoid motor terminal to negative battery post.
   c. Solenoid relay terminal to positive battery post.
2. Observe starter shaft.
   a. If starter shaft extends strongly, solenoid is working properly.
   b. If starter shaft does not extend strongly, replace the solenoid.

SOLENOID HOLD-IN TEST

1. See Figure 1-7. With test leads still connected in the manner specified in the previous SOLENOID PULL-IN TEST, disconnect solenoid motor terminal/battery negative test lead (B) at negative battery post only; reconnect loose end of this test lead to positive battery post instead.

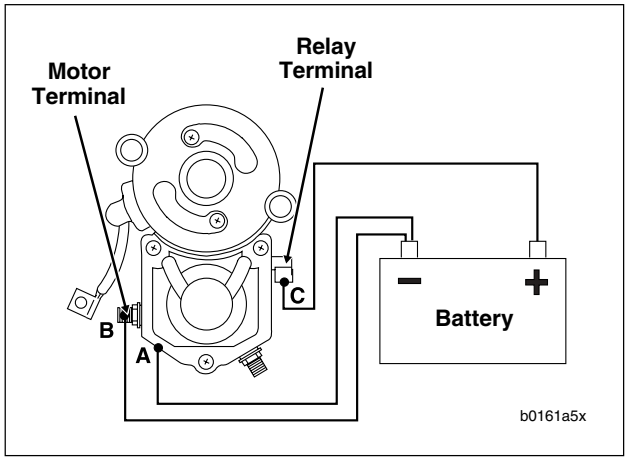


Figure 1-6. Test 1: Pull-In Test

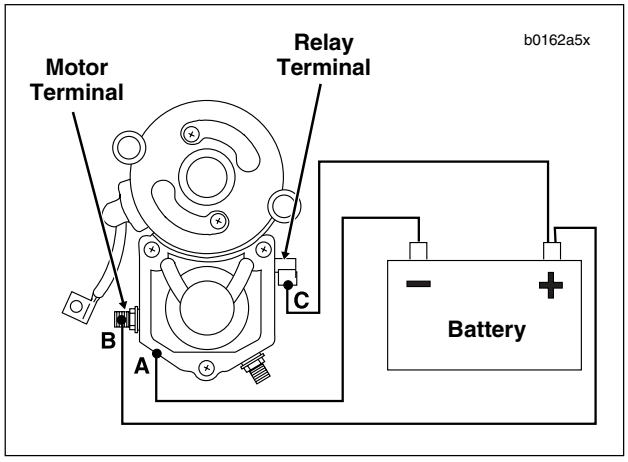


Figure 1-7. Test 2: Hold-In Test

2. Observe starter shaft.
   a. If starter shaft remains extended, solenoid is working properly.
   b. If starter shaft retracts, replace the solenoid.
   c. If starter shaft does not retract, replace the solenoid.

SOLENOID RETURN TEST

1. See Figure 1-8. With test leads still connected in the manner specified at the end of the previous SOLENOID HOLD-IN TEST, disconnect solenoid relay terminal/positive battery post test lead (C) at either end.
2. Observe starter pinion.
   a. If starter shaft retracts, solenoid is working properly.
   b. If starter shaft does not retract, replace the solenoid.

FREE RUNNING CURRENT DRAW TEST

1. Place starter in vise, using a clean shop towel to prevent scratches or other damage.
2. Connect a heavy jumper cable (6 gauge minimum) to starter mounting flange as shown in Figure 1-9.
3. Connect other end to the negative (-) terminal of a fully charged battery.
4. Connect a heavy jumper cable (6 gauge minimum) to the positive (+) terminal of the battery.
5. Attach an inductive ammeter to positive cable and connect the other end of the positive cable to the “Battery” terminal of the starter solenoid.
6. Use a smaller jumper cable (14 gauge) and connect to the positive (+) terminal of the battery.
7. Connect other end of small jumper cable to the solenoid “Relay” terminal.
8. Check ammeter reading. Ammeter should show 90 amps maximum. If reading is higher, disassemble starter for inspection.

NOTE

If starter current draw on vehicle was over 200 amps and the starter FREE RUNNING CURRENT DRAW TEST was within specification, there may be a problem with engine, primary drive or starter jackshaft.

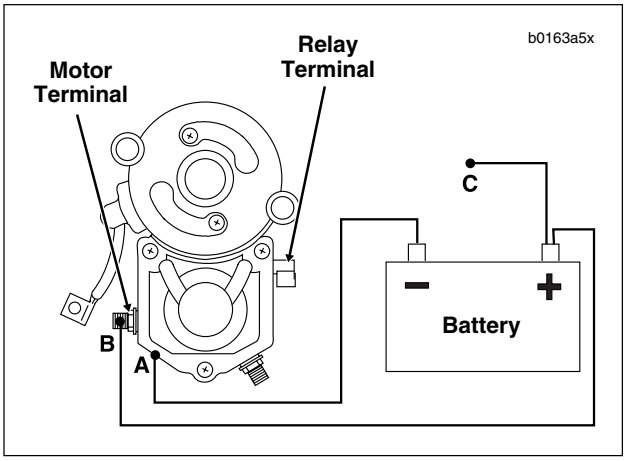
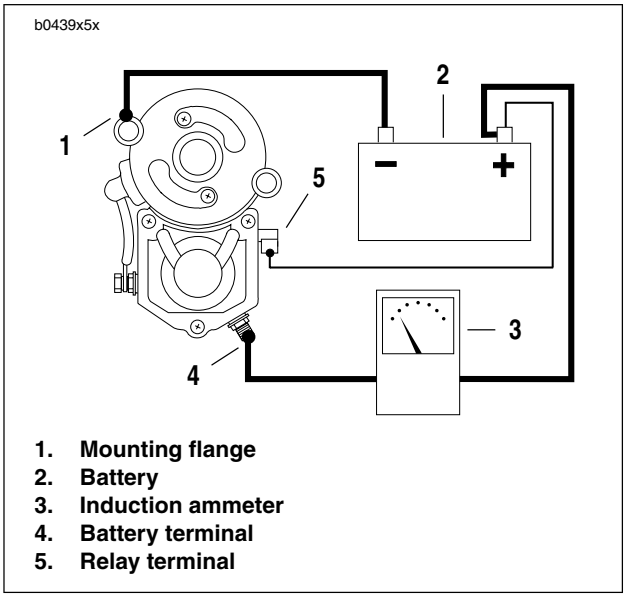


Figure 1-8. Test 3: Return Test



1. **Mounting flange**
2. **Battery**
3. **Induction ammeter**
4. **Battery terminal**
5. **Relay terminal**

Figure 1-9. Free Running Current Draw Test

CHARGING SYSTEM 1.7

GENERAL

The charging system consists of the alternator and voltage regulator. Charging system circuits are shown in Figure 1-10.

Alternator

The alternator consists of two main components: the rotor which is mounted on the engine sprocket shaft, and the stator which is bolted to the engine crankcase.

Voltage Regulator

A series regulator with a circuit that combines the functions of rectifying and regulating.

TROUBLESHOOTING

When the charging system fails to charge or does not charge at a satisfactory rate, it is recommended that the following checks be made.

Battery

Check for a weak or dead battery. Battery must be fully charged in order to perform any electrical tests.

Wiring

See charging system circuit in Figure 1-10. Check for corroded or loose connections.

Voltage Regulator Inspection

The regulator must have a clean, tight ground connection for proper operation. Check by using an ohmmeter with one lead on the battery ground cable and the other on the regulator ground terminal (on left side ground post in front of battery).

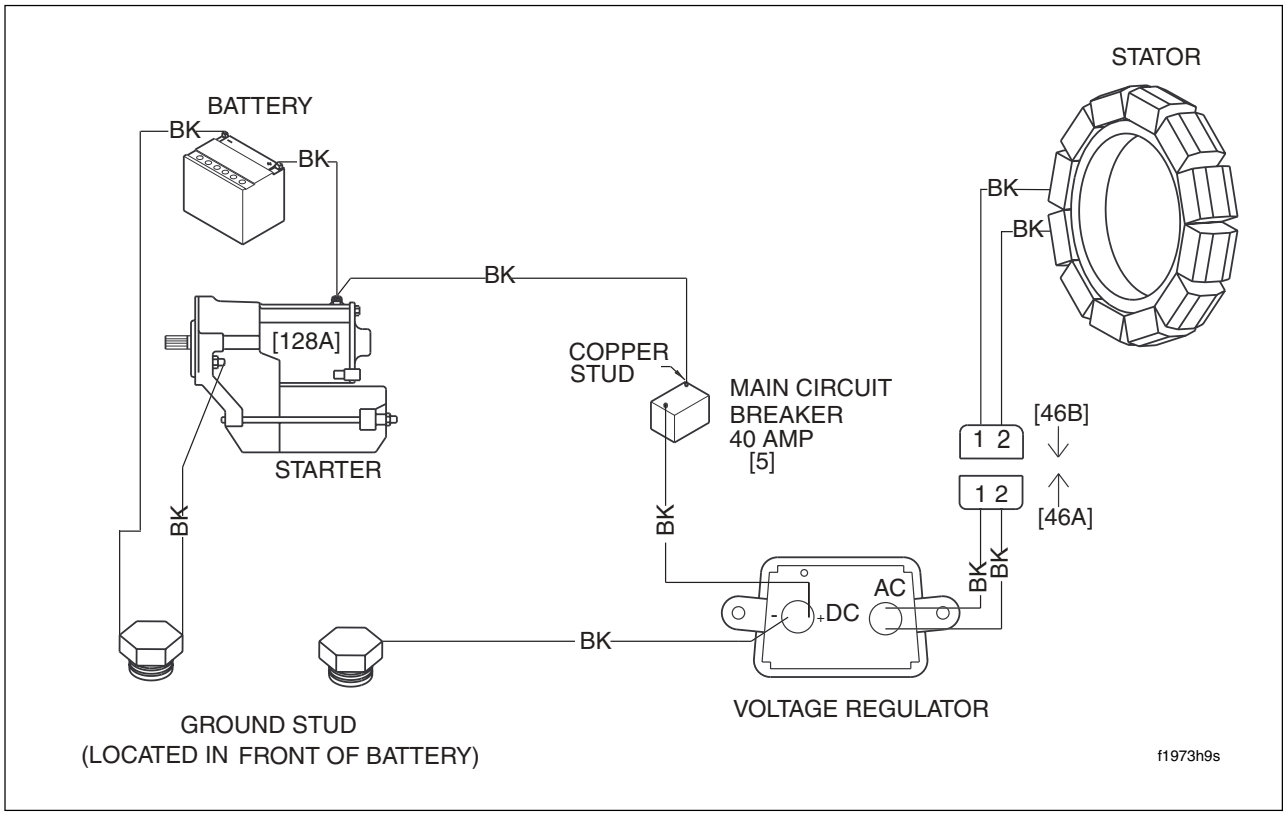
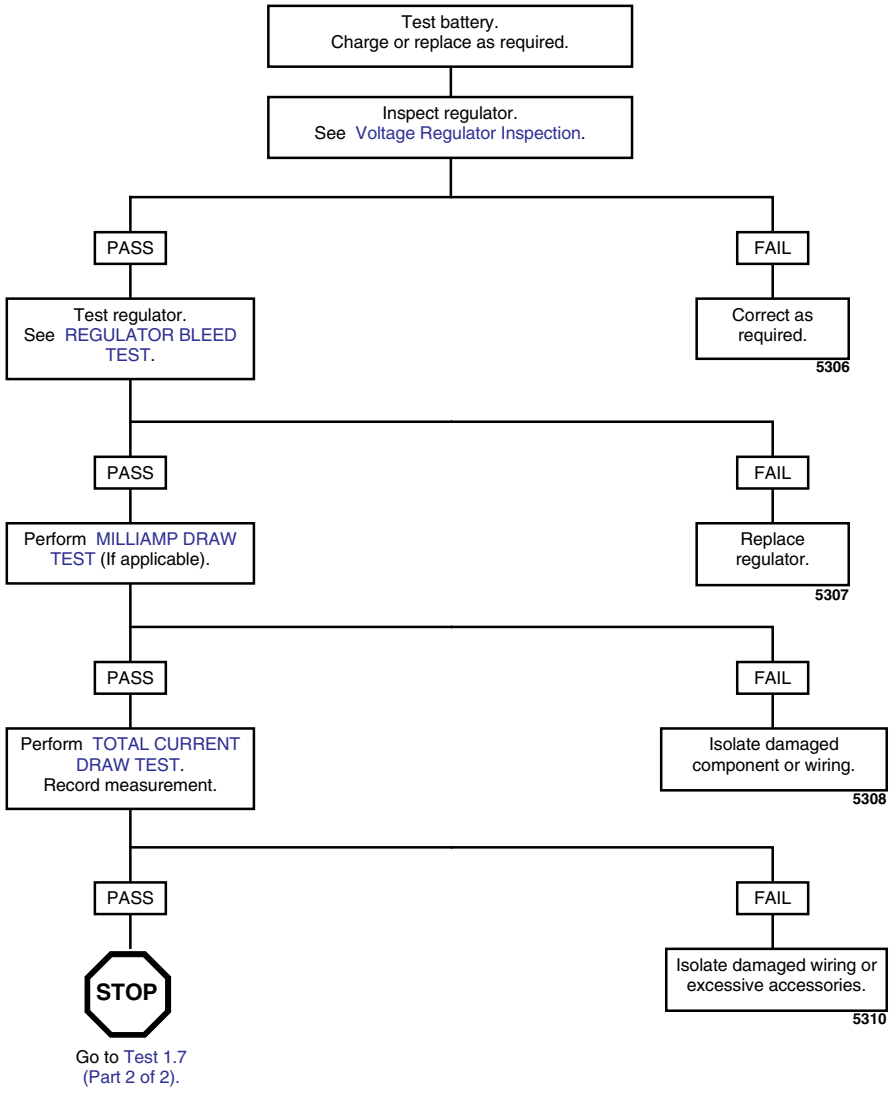


Figure 1-10. Charging System Circuit (Typical)

Test 1.7 (Part 1 of 2)

SYMPTOM: BATTERY BECOMES DISCHARGED

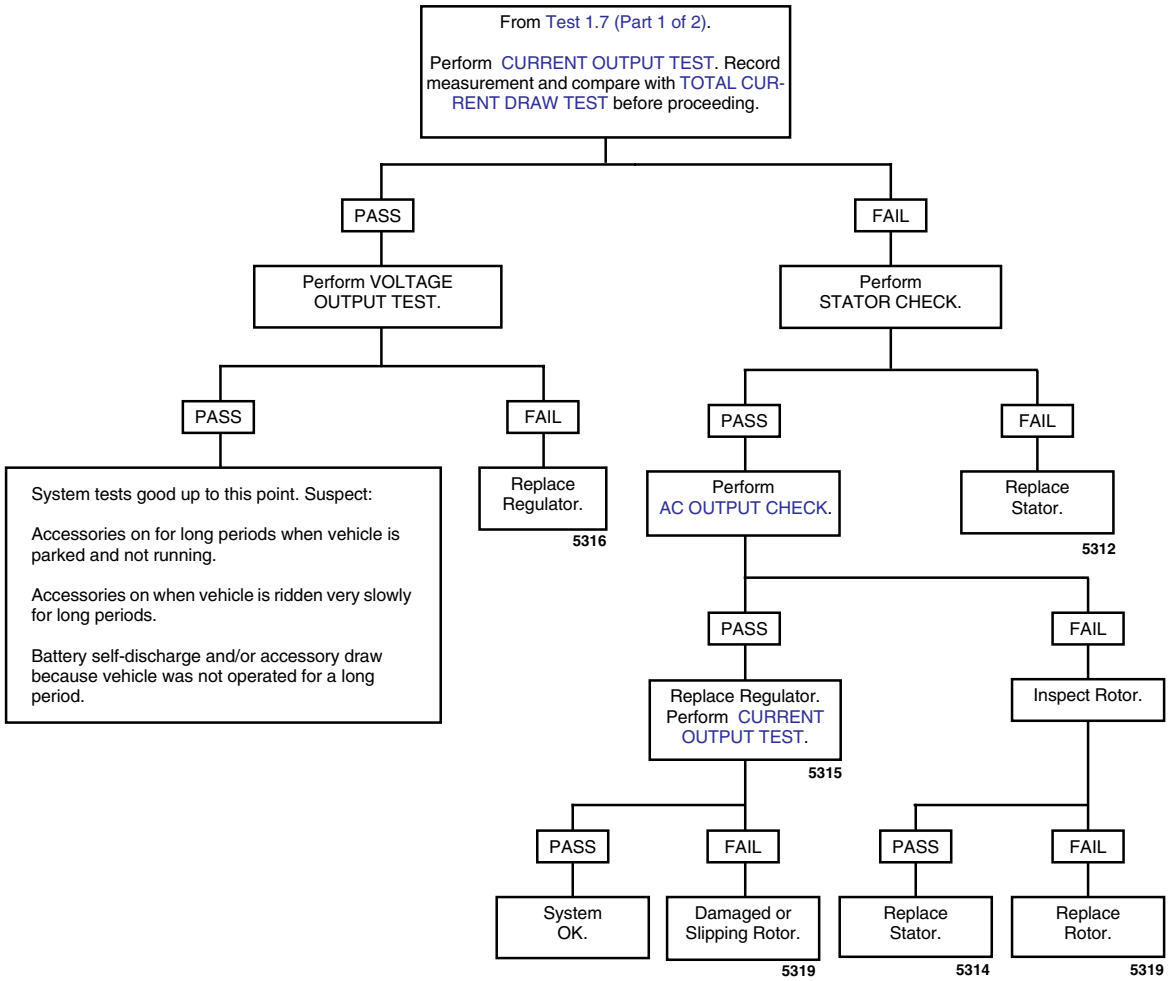


NOTE

Whenever a charging system component fails a test and is replaced, retest the system to be sure the problem has been corrected.

Test 1.7 (Part 2 of 2)

SYMPTOM: BATTERY BECOMES DISCHARGED



NOTE

Whenever a charging system component fails a test and is replaced, retest the system to be sure the problem has been corrected.

TESTING

REGULATOR BLEED TEST

Be sure regulator is connected to battery. Unplug stator connector. Use a trouble light and touch one probe to a known good ground and the other to the regulator pins, one at a time. If light glows, replace regulator.

MILLIAMP DRAW TEST

NOTES

- *Be sure accessories are not wired so they stay on at all times. Check for this by connecting ammeter between negative battery terminal and battery.*
- *TSM/TSSM will continue to draw 16-25 mA for 30 seconds after ignition is turned OFF. Any disruption and reconnection of battery power, such as disconnecting the battery to place a meter in series, will cause TSM/TSSM to draw 16-25 mA for 30 seconds.*

See Figure 1-11. Connect ammeter between negative battery terminal and battery. With this arrangement, you will also pick up any regulator drain.

The limits for these drains are listed in Table 1-4.

- Any accessories must be considered and checked for excessive drain.
- This condition could drain battery completely if vehicle is parked for a long time.

NOTES

- *A battery with surface discharge condition could cause a static drain. Correct by cleaning battery case.*
- *Any reading that exceeds the "Maximum Meter Reading" values below indicates excessive current draw. Check for bad radio, voltage regulator or a short in the interconnecting wiring. Alarms and customer accessories are also prime suspects. Isolate problem by disconnecting suspect components and observe change in meter reading.*

Table 1-4. Maximum Meter Reading

COMPONENT	MAXIMUM METER READING (Milliamperes)
TSM (No Security)*	0.5
TSSM (Disarmed)*	0.5
TSSM (Armed)*	3.0
ECM	1
Voltage Regulator	2
Radio	4

TOTAL CURRENT DRAW TEST

If the battery runs down during use, the current draw of the motorcycle components and accessories may exceed the output of the charging system. To check for this condition, place load tester induction pickup or current probe pickup over battery negative cable as shown in Figure 1-12. Disconnect regulator from stator. Start engine and run at 3000 rpm.

With ignition and all continuously running lights and accessories turned on (headlamp on high beam), read the total current draw. Compare this reading to the reading obtained in CURRENT OUTPUT TEST. The current output should exceed current draw by 3.5 amps, minimum. If not, there may be too many accessories for the charging system to handle. Reconnect regulator when test is complete.

NOTE

Rider's habits may require output test at lower RPM.

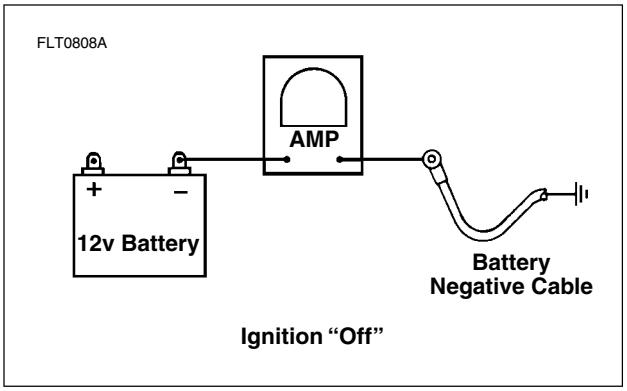


Figure 1-11. Milliamp Draw Test

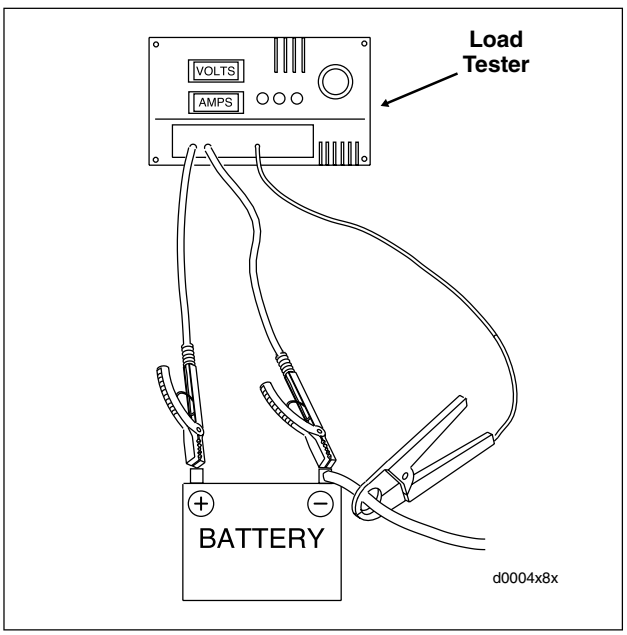


Figure 1-12. Check Current Draw (Ignition Switch On)

CURRENT OUTPUT TEST

1. Connect load tester negative and positive leads to battery terminals and place load tester induction pickup over positive regulator cable as shown in Figure 1-13.
2. Run the engine at 3000 rpm and increase the load as required to obtain a constant 13.0 volts.
3. The current output should be as follows. Make note of the measurement.

   FLHR, FLHR-I, FLHRC-I, FLHT, FLHTC, FLTR

   38 amp (Low Output) ..... 34-40 amperes

   FLHT-I, FLHTC-I, FLHTCU-I, FLTR-I

   45 amp (High Output) ..... 41-48 amperes

VOLTAGE OUTPUT TEST

See Figure 1-13. After removing the load, read the load tester voltage meter. Voltage to the battery must be less than 15 volts. If voltage is higher, regulator is not functioning properly or connections are loose or dirty.

CAUTION

Do not leave any load switch turned on for more than 20 seconds or overheating and tester damage are possible.

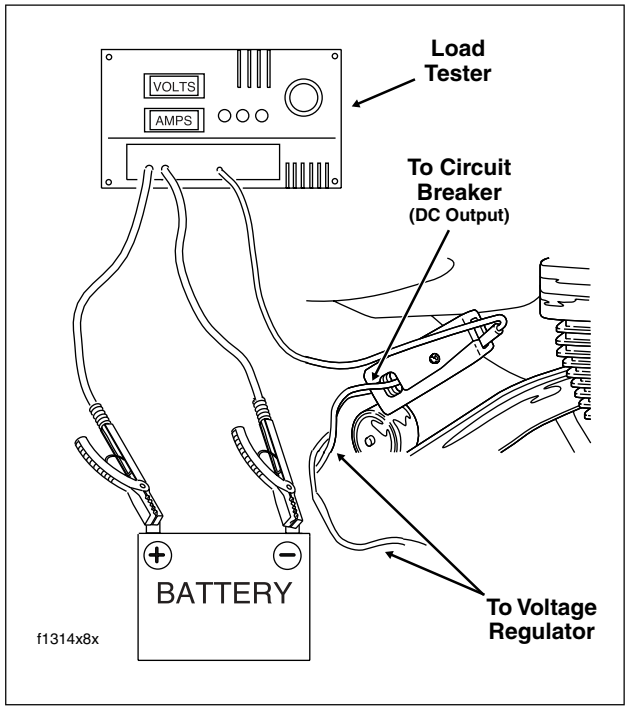


Figure 1-13. Current and Voltage Output Test

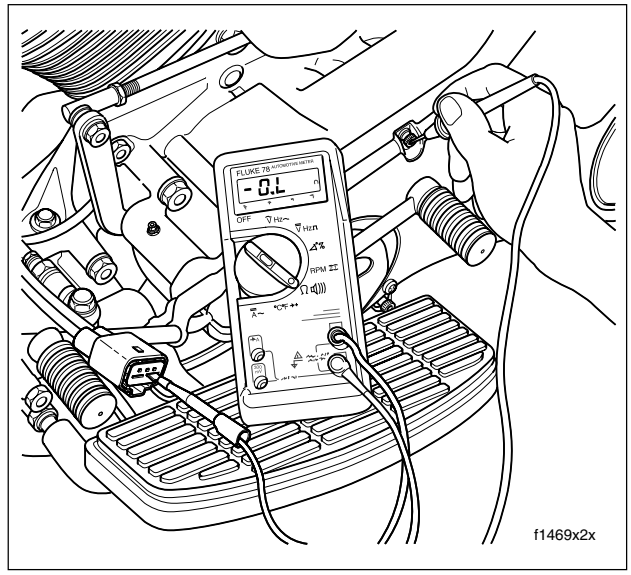


Figure 1-14. Test for Grounded Stator

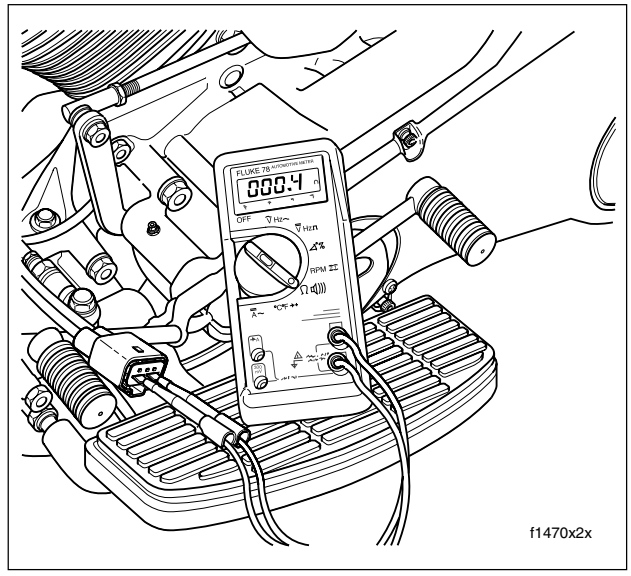


Figure 1-15. Check for Stator Resistance

STATOR CHECK

1. To check for a grounded stator, turn off ignition and disconnect the regulator from the stator.
2. See Figure 1-14. Connect an ohmmeter on the RX1 scale between primary cover bolt and either stator socket. Use Harness Connector Test Kit (HD-41404), red pin probes and patch cords. There should be no continuity (∞ ohms) across either test point. Any other reading indicates a grounded stator which must be replaced.
3. See Figure 1-15. Check the resistance using an ohmmeter set on the RX1 scale. Resistance should be less than 0.5 ohms across the stator socket. If it is not, then the stator is damaged and must be replaced.

AC OUTPUT CHECK

1. See Figure 1-16. To test AC output, disconnect the regulator and connect an AC voltmeter across both stator sockets. Run the engine at 2000 RPM. The AC output should be as follows.

   FLHR, FLHR-I, FLHRC-I, FLHT, FLHTC, FLTR

   38 amp (Low Output) ..... 16-20 VAC per 1000 RPM

   FLHT-I, FLHTC-I, FLHTCU-I, FLTR-I

   45 amp (High Output) ..... 19-26 VAC per 1000 RPM

2. If the output is below specifications, charging problem could be a faulty rotor or stator. Replace the rotor or stator.
3. Check the output again as described under CHARGING SYSTEM OUTPUT TEST given earlier.

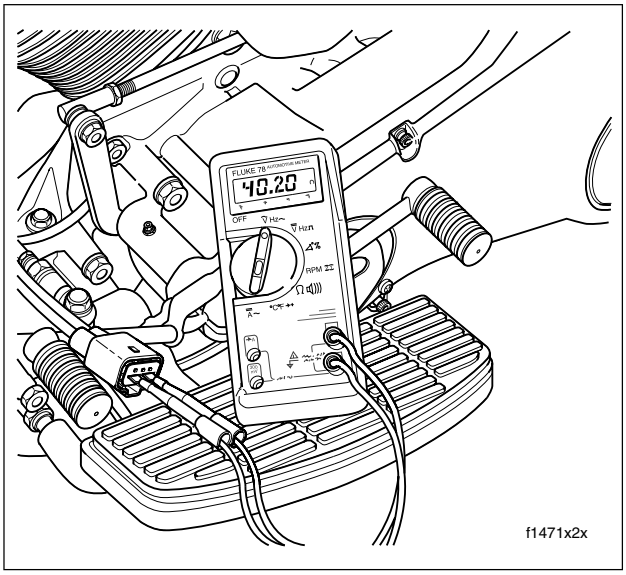


Figure 1-16. Check AC Output

BATTERY LOAD TEST 1.8

VOLTMETER TEST

See Table 1-5. 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.

Table 1-5. Voltmeter Test

Voltage (OCV)	State of Charge
12.8	100%
12.6	75%
12.3	50%
12.0	25%
11.8	0%

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:

1. Remove seat.

⚠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.

CAUTION

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

5. Always fully charge the battery before testing or test readings will be incorrect. Load testing a discharged battery can also result in permanent battery damage.
6. After charging, allow battery to stand for at least one hour before testing.

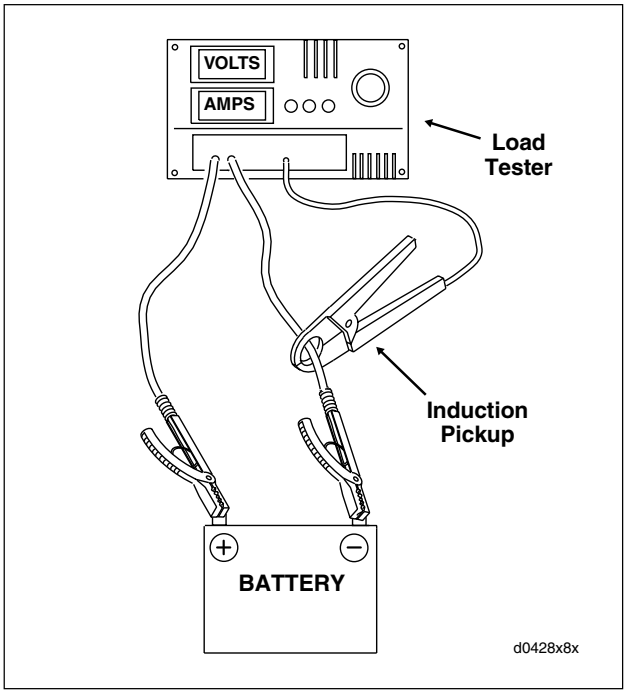


Figure 1-17. Load Test Battery

⚠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.

7. Connect tester leads to battery posts and place induction pickup over negative (black) cable. See Figure 1-17.

CAUTION

To avoid load tester and/or battery damage, do not leave the load tester switch turned ON for more than 20 seconds.

8. 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 1-6. 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.

9. 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.

10. 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).
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. Apply a light coat of petroleum jelly or corrosion retardant material to both battery terminals.
13. 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).
14. Install seat.

INSTRUMENTS 2

Table Of Contents

SUBJECT	PAGE NO.
2.1 Gauges and Instruments	2-1
2.2 Speedometer	2-5
2.3 Speedometer Performance Check	2-11

GAUGES AND INSTRUMENTS 2.1

GENERAL

Use the troubleshooting tables on the following pages to diagnose and locate problems with malfunctioning or inoperative instruments and gauges. For wire connections at rear of gauges, see Figure 2-1. Refer to the applicable wiring diagram at the back of this book for further assistance.

DIAGNOSTICS

Fuel Level Gauge

When the Ignition/Light Key Switch is turned to IGNITION, the fuel gauge is connected to + 12 vdc. Current flows through the gauge and variable resistor in the fuel level sender to ground. The sender unit float controls the amount of resistance in the variable resistor.

Fuel Level Sender Test

1. See the following chart and “ground” the applicable test point.
2. Turn the Ignition/Light Key Switch to IGNITION. If gauge indicated FULL, gauge is functioning correctly. Proceed to step 3. If gauge did not indicate FULL, proceed to step 4.

GAUGE LOCATION	TEST POINT & LOCATION
Instrument panel	Yellow/White wire at sender unit connector under seat.

3. With the Multi-Meter, Part No. HD-35500A, set on the RXI scale, measure the resistance of the sender unit. Place one probe on the center terminal and the other probe on a good ground.
4. The meter must indicate approximately 7-95 ohms on FLHT/C/U and FLTR models, 27-260 ohms on FLHR/C models.
   a. If the fuel tank is full, the reading should be approximately 7-14 ohms on FLHT/C/U and FLTR models, 27-40 ohms on FLHR/C models.
   b. An empty tank should have a 74-95 ohm resistance on FLHT/C/U and FLTR models, 240-260 ohm resistance on FLHR/C models.

NOTE

If a very high resistance or infinity is indicated on the meter, the sender may be “open” or not grounded. Verify that the sender and fuel tank are grounded by placing one probe of Multi-Meter on sender flange and the other probe on crankcase. Meter must indicate one ohm or less. Replace sender if one ohm or less was present. If a higher resistance is present, refer to applicable wiring diagram at rear of this manual and check sender ground circuit.

5. If gauge did not indicate FULL, use Multi-Meter (Part No. HD-35500A) to verify that 2-7 vdc is present at sender. If 2-7 vdc is not present, check for broken or disconnected wire or an open winding in fuel gauge. Replace gauge if winding is open.

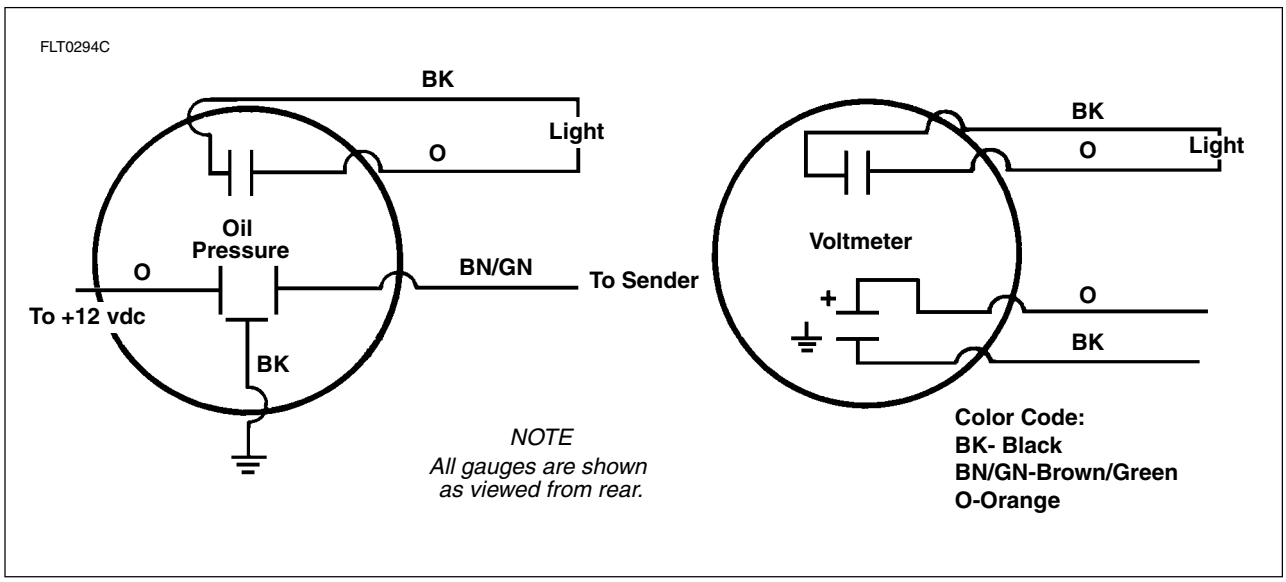


Figure 2-1. Connections for Gauges

Fuel Gauge: FLHR/C

Problem: Gauge Faulty

Perform resistance checks to determine if fuel gauge is faulty. Disconnect the gauge, remove the bulb and check for resistance as follows:
441 +/- 20 ohms between the “S” and “G” studs
102 +/- 5 ohms between the “S” and “I” studs

Low Fuel Level Lamp: FLHTCU, FLTR

Problem: Fuel low level lamp does not illuminate when fuel level is low.

Cause	Solution
Lack of power.	Check for power (12 vdc or battery voltage) between pins 1 (positive) and 6 (negative). All checks are made at Low fuel module connector [106].
No ground.	Check for continuity to ground on pin 6.
Lamp defective or wiring broken.	Ground pin 2. If lamp illuminates, then LED is functional and wiring is OK.
Defective module, insufficient voltage to module.	LED should illuminate when voltage at pin 4 exceeds 3.7 vdc.

Low Fuel Level Lamp: FLHR/C

Problem: Gauge Faulty

Perform all checks at the gauge. Allow up to 30 seconds for the delay feature (both FLHR/C and FLHTCU). Orange is 12 volts DC. Pink is the sender. Black is ground. Pink to Black readings are listed below.		
	Key On	**Key Off** (Sender Disconnected)
Full	3 Volts	35 Ohms
1/4	6.4 Volts	153 Ohms (Low Light On)
Empty	7.3 Volts	215 Ohms

Oil Pressure Gauge and Indicator Light

Problem: Low oil pressure light remains on with engine running above idle and/or oil pressure gauge does not work.

Cause	Solution
No oil pressure due to lack of oil or faulty oil pump.	**CAUTION** **Running engine when OIL pressure light remains on and gauge indicates low pressure will result in engine damage.** 1. Check oil level. Add oil if low. 2. Restart engine and verify that oil pressure light goes off and gauge indicates pressure. If problem still exists, refer to OIL PUMP in the 2003 Touring Models Service Manual (Part Number 99483-03).
Contacts in pressure sending unit not opening to shut off light. Variable resistor in sender is shorted to ground.	1. Locate the oil pressure sending unit on the front right side of the crankcase. 2. Verify that the electrical connector is properly connected to the sending unit. 3. If the oil pressure gauge indicates pressure but the low oil pressure light remains on, proceed as follows: a. Remove electrical connector from oil pressure sending unit. Place one ohmmeter probe on indicator lamp terminal (closest to latch), place the other probe on the crankcase. Meter must read zero ohms. b. Start the engine and run at a fast idle. The ohmmeter must read infinity. c. Replace the sending unit if the above meter readings are **not** obtained. 4. If the low oil pressure light functions correctly, but the pressure gauge does not, then proceed as follows: a. Remove electrical connector from oil pressure sending unit. Turn the Ignition/ Light Key Switch to IGNITION. The gauge must read zero. b. Ground BN/GN wire terminal to crankcase. The gauge must read full scale 70 PSI. c. Replace the sending unit if the above gauge readings are obtained. If the gauge readings are **not** obtained, then replace the pressure gauge.
No power to gauge.	See Voltmeter.

Ambient Air Temperature Gauge

Problem: Gauge inoperative.

Cause	Solution
Sensor not grounded or open between sensor and gauge.	Test for continuity between pin 1 and ground and pin 3 and gauge. Repair if open.
Broken or disconnected power or ground wire to gauge.	Check for 12 vdc between pins 1 and 3 at connector [115A]. Replace gauge if voltage is present. Use voltage drop tests and continuity checks to isolate if voltage is not present.
Malfunction in gauge or sensor.	Measure resistance between pins 1 and 3 at 65˚ to 85˚ F. Resistance should be 43-31 ohms. Replace sensor if out of range, replace gauge if within range.

Voltmeter

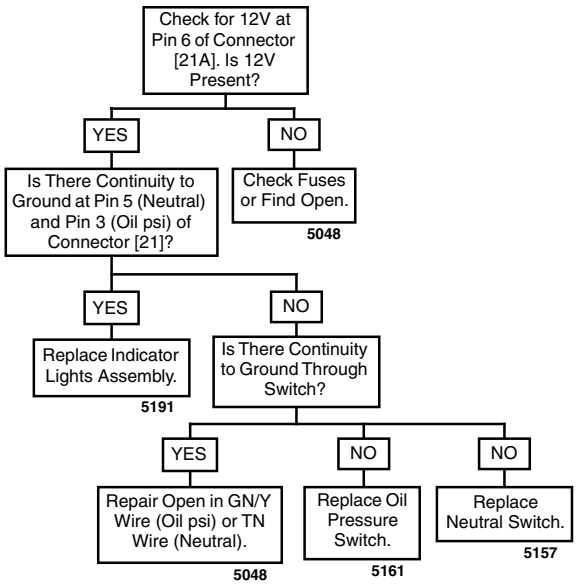
Problem: Meter inoperative.

Cause	Solution
Broken or disconnected leads to meter or open meter winding.	1. With Ignition/Light Key Switch turned to IGNITION, verify that 12 vdc is present at "±" terminal on voltmeter. With switch turned to OFF, check ground terminal for continuity to ground. 2. Replace the voltmeter if 12 vdc is present and ground terminal is grounded. 3. If 12 vdc is not present, trace wiring until disconnected or broken wire is found and repair as necessary. If ground terminal is not grounded, refer to wiring diagram and repeat procedure given for 12 vdc lead.

Indicator Lights: FLHR/C

Problem: Light(s) inoperative.

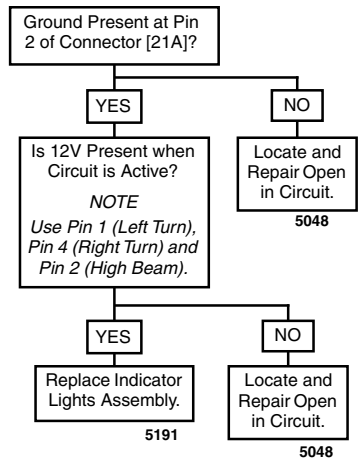
① Oil Pressure or Neutral Indicator Will Not Function



NOTE

Oil Pressure Indicator	Ground through switch
Neutral Indicator	Ground through switch
High Beam Indicator	12V when active
R/L Turn Indicator	12V when active

② High Beam or R/L Turn Signal Indicator Will Not Function



Indicator Lights Connector [21]		
Terminal	**Wire Color**	**Indicator**
1	Violet	Left Turn
2	White	High Beam
3	Green/Yellow	Oil Pressure
4	Brown	Right Turn
5	Tan	Neutral
6	Orange	Neutral/Oil Pressure
7	Black	Right/Left Turn/High Beam
8	Not Used	Not Used

SPEEDOMETER 2.2

GENERAL

NOTE

The performance (proper operation and sweeping action) of the speedometer can be evaluated using the Speedometer Tester (HD-41354). Before replacing the speedometer, see Section 2.3 SPEEDOMETER PERFORMANCE CHECK.

The electronic speedometer consists of a speed sensor, reset switch and speedometer unit.

The Hall-Effect speed sensor circuitry is triggered by the teeth of the transmission mainshaft 4th gear. The sensor output is a series of pulses that are interpreted by the speedometer circuitry to control the position of the speedometer needle and the odometer's liquid crystal display (LCD). The odometer mileage is permanently stored and is not lost when electrical power is turned off or disconnected.

NOTE

Circuitry in the speedometer also conditions the sensor input to provide an input to the turn signal canceler.

By momentarily pressing the reset switch, the user is able to toggle between the odometer and trip odometer displays. To zero the trip odometer, depress and hold the reset switch while the odometer display is visible. The trip odometer mileage will then appear for approximately 2-3 seconds, after which time the recorded figure is zeroed.

The odometer can display seven numbers to indicate a maximum of 999999.9 miles. The trip odometer can display five numbers for a maximum of 9999.9 miles.

Reset Switch

See Figure 2-2. Besides toggling between the odometer and trip odometer displays, the reset switch is also used to identify the speedometer pulses per unit and to enter the diagnostic mode. In the diagnostic mode, the user can display the fault codes stored in memory. The fault codes assist the user in troubleshooting speedometer problems.

Diagnostic Mode

To enter the diagnostic mode, hold the reset switch in and turn the Ignition/Light Key Switch from OFF to IGNITION. The normal power-up sequence occurs before the diagnostic mode is entered. Any diagnostic codes set during this power-up sequence also will be stored.

IMPORTANT NOTE

Holding the reset switch in for more than 5 seconds while in the diagnostic mode will clear all set diagnostic codes from memory.

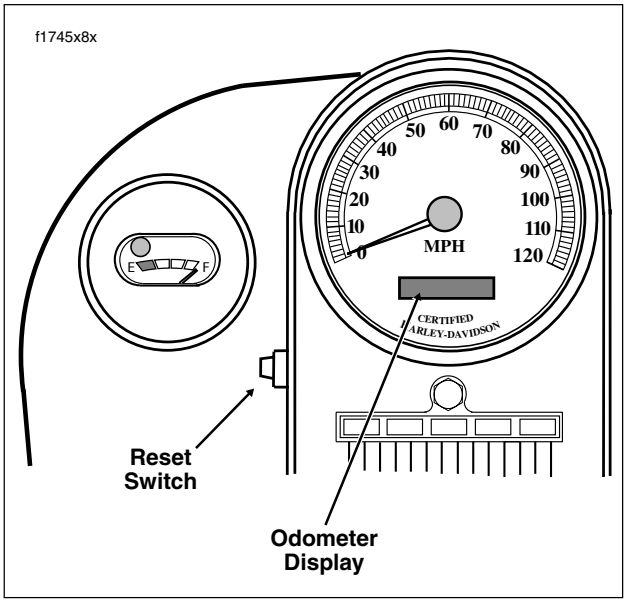


Figure 2-2. Reset Switch (FLHR/C)

Once in the diagnostic mode, the first diagnostic code appears in the odometer display. When the reset switch is pressed again the next code is displayed. Press the switch until all ten codes have been viewed. If the reset switch is held in for more than 5 seconds, all fault codes are cleared (erased) from memory.

There are a total of ten possible fault codes, three of which are currently unused. See Table 2-1.

Table 2-1. Speedometer Diagnostic Codes

CODE	MEANING	WIRE COLOR
d01	Speed sensor power output shorted low	Red
d02	Speed sensor power output shorted high or open	Red
d03	Not used	-
d04	Not used	-
d05	Speed sensor return shorted high	White
d06	Speed sensor return shorted low	White
d07	Not used	-
d08	Speedometer power overvoltage	Orange/White
d09	Speed output shorted high	White/Green
d10	Speed output shorted low or open	White/Green
5 digit number	Speedometer pulses per unit	-

When in the diagnostic mode, all diagnostic codes are displayed in numerical sequence, from d01 to d10. As a code appears (d02 for example), it will either be displayed as “d02SEt” (code set) or “d02CLr” (code clear). A code clear condition means that the fault condition does not exist (or that it has been erased).

Write down the fault codes on a piece of paper. Note that the fault codes indicate the start point for troubleshooting speedometer problems using the flow charts which follow. If multiple fault codes are set, begin with the lowest code.

To troubleshoot fault code d01, d02, d05, d06 or d08, proceed to the appropriate box marked by an asterisk in Speedometer Test 2B in this section. For codes d09 or d10, see the box marked by an asterisk in Section 3.16 TURN SIGNAL ERRORS, Turn Signal Error 1B (EFI) or Turn Signal Error 2C (Carbureted).

NOTE

If fault codes are not used to troubleshoot speedometer problems, then start at the beginning of the appropriate flow chart and disregard the asterisks (but not the instruction boxes) when your progression through the chart brings you to these locations.

After all the diagnostic codes are displayed, the speedometer’s pulses per unit setting is displayed. This number will vary depending on speedometer part number.

To exit the diagnostic mode, turn the Ignition/Light Key Switch from IGNITION to OFF and then back to IGNITION without depressing the reset switch. The diagnostic mode will also be exited if a speed signal greater than 5 MPH is detected.

NOTE

*With one exception, onboard diagnostics cannot be performed if system voltage is less than 9 VDC or greater than 16 VDC. The exception is Code **d08** which is set when system voltage exceeds 16VDC.*

DIAGNOSTICS

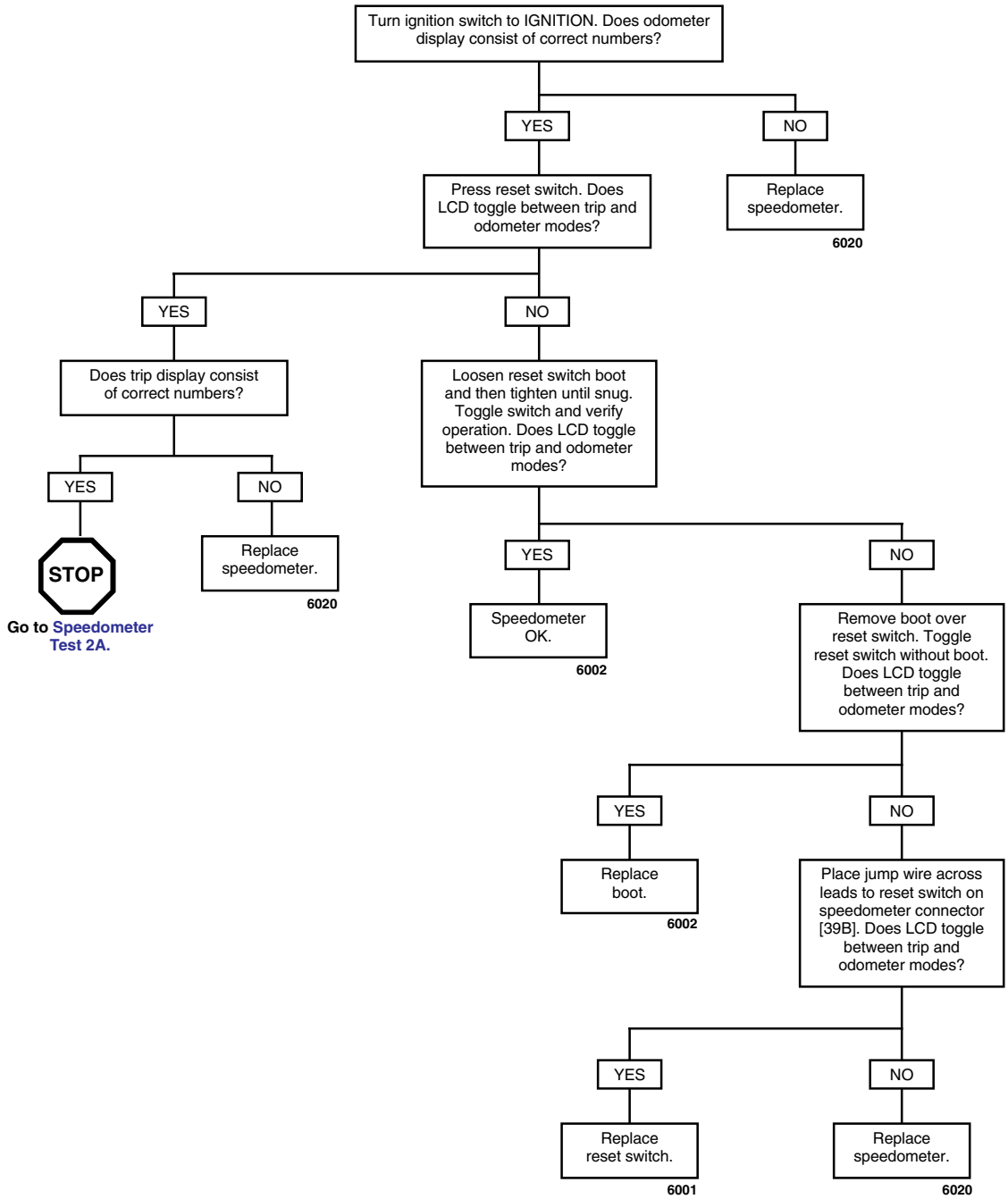
Diagnostic Notes

The reference numbers below correlate with circled numbers on the speedometer diagnostic flow charts.

1. To enable diagnostic mode: depress odometer reset switch and turn ignition/key switch to ON.
2. To clear codes: turn ignition switch from OFF to ON while holding reset switch in. Press and release the reset switch to cycle through the codes. Set codes will display as Code d0xSet; holding the reset switch in will result in Code d0xClr being displayed. This indicates the code has been cleared.
3. To return speedometer to normal operating state: cycle ignition/key switch.
4. Remove seat.
5. Test results may be inaccurate if tester battery is low.
6. See Section 2.3 SPEEDOMETER PERFORMANCE CHECK.
7. Sensor can also be tested with SPEEDOMETER TESTER (Part No. HD-41354) and test harness. See Section 2.3 SPEEDOMETER PERFORMANCE CHECK.
8. Remove sensor and check for accumulation of debris. Clean sensor and repeat test if debris is found. Replace sensor if debris is not present. See SPEEDOMETER SPEED SENSOR, REMOVAL/INSTALLATION, in the 2003 Touring Models Service Manual (Part Number 99483-03).
9. Sweep tool has frequency jumps in full scale sweeps. Perform sweep in 3 stages as described in speedometer tester manual.
10. Disconnecting speed sensor or installing speedometer tester will cause code d02 to set.

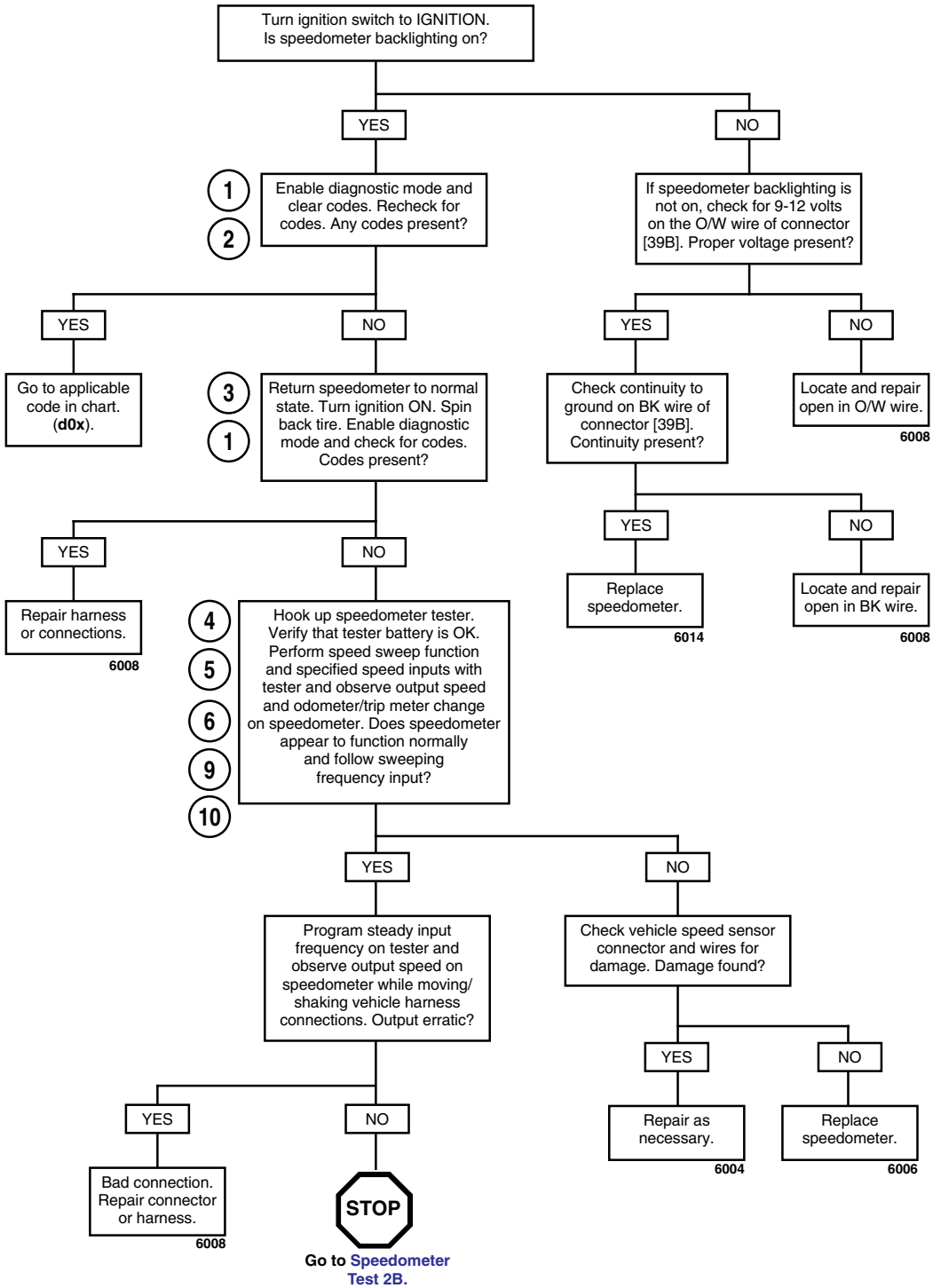
Speedometer Test 1

ODOMETER, TRIP ODOMETER AND RESET SWITCH



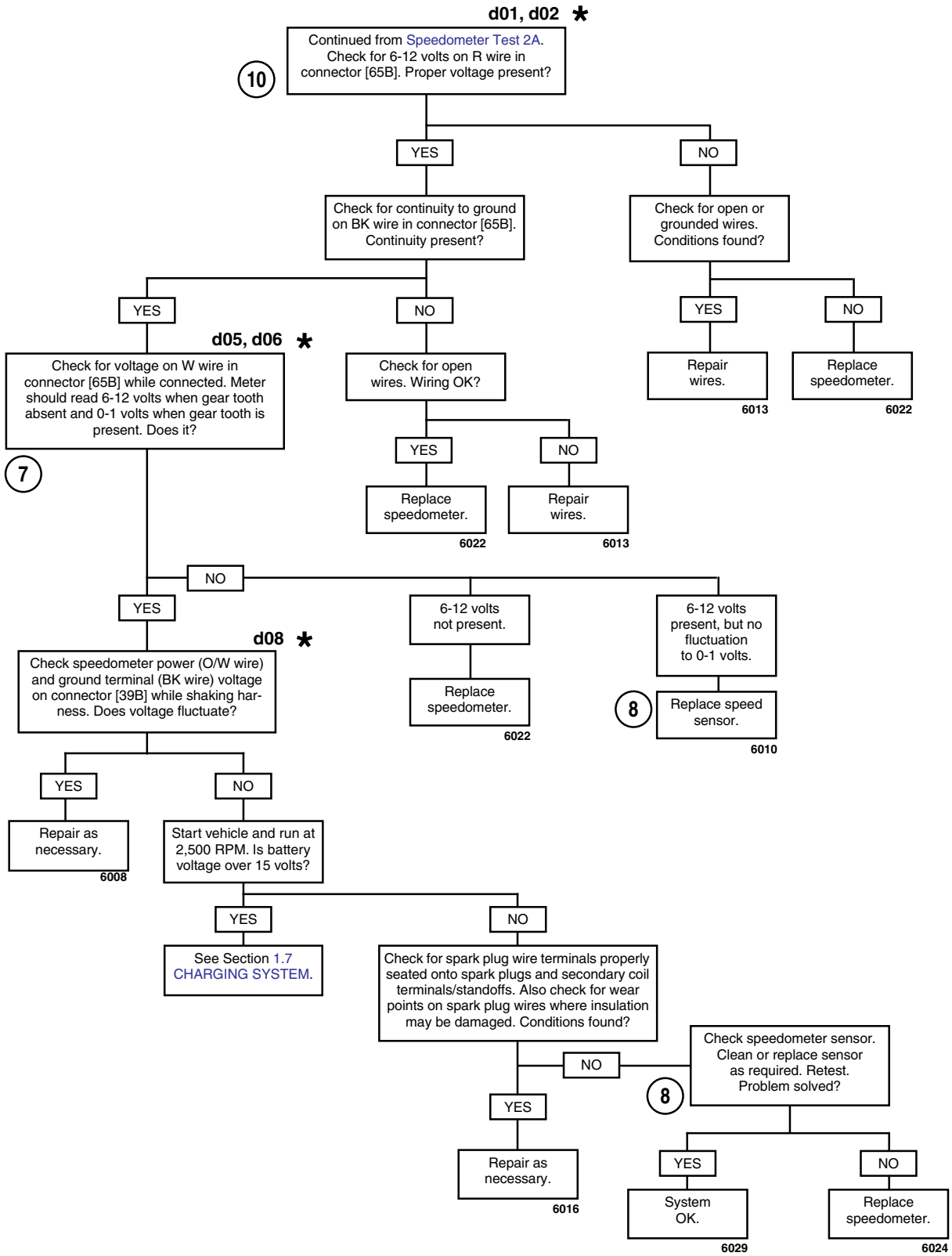
Speedometer Test 2A

SPEEDOMETER INOPERATIVE, READS HIGH/LOW, NEEDLE STICKS, INTERMITTENT/ERRATIC, OUTPUT SPEED SIGNAL INOPERATIVE



Speedometer Test 2B

SPEEDOMETER INOPERATIVE, READS HIGH/LOW, NEEDLE STICKS, INTERMITTENT/ERRATIC, OUTPUT SPEED SIGNAL INOPERATIVE



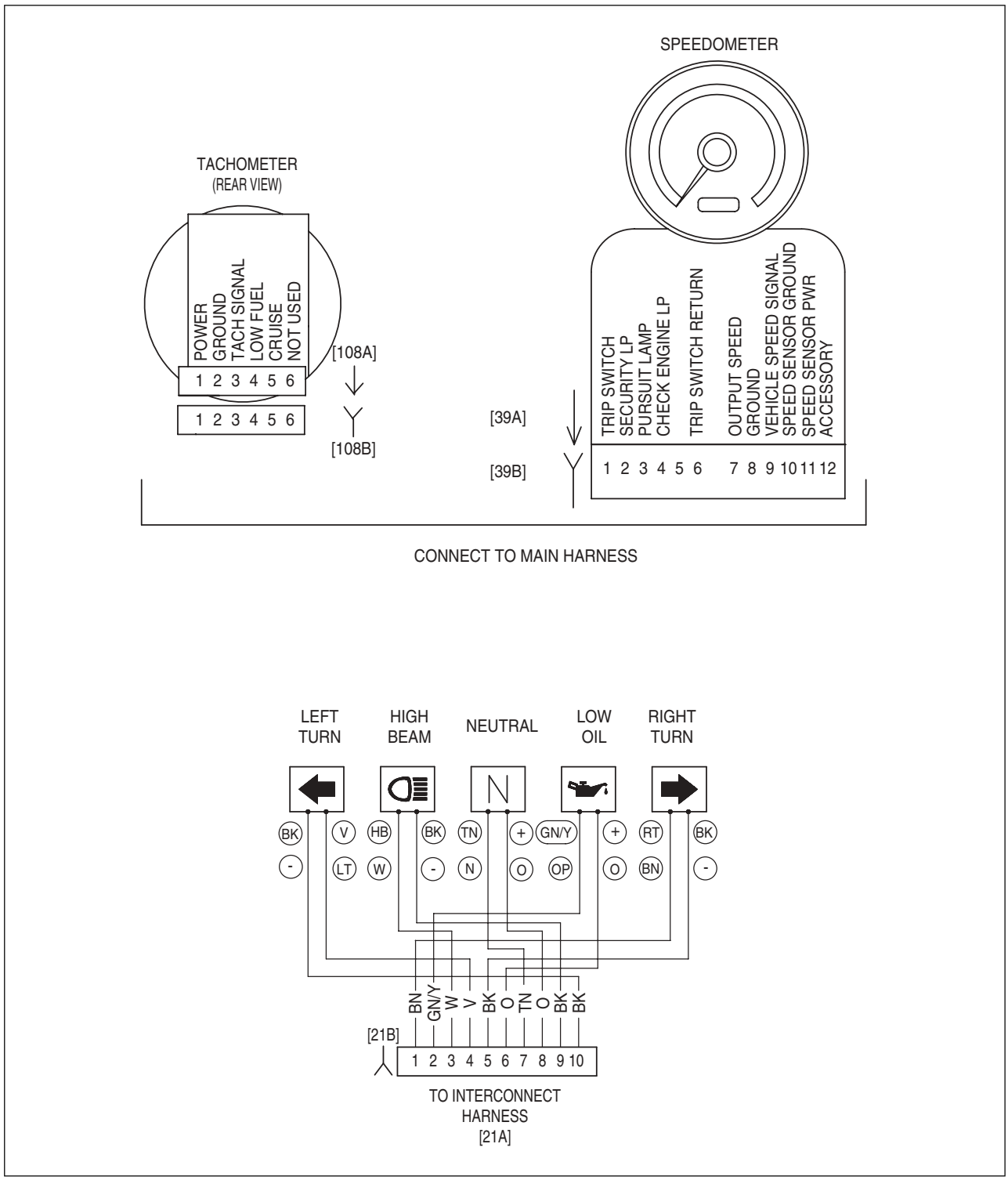


Figure 2-3. Electronic Speedometer Connectors (Typical)

SPEEDOMETER PERFORMANCE CHECK 2.3

GENERAL

The performance (proper operation and sweeping action) of the speedometer can be evaluated with the Speedometer Tester, HD-41354. For the purpose of checking the speedometer operation, the tester generates a signal that simulates the input normally received from the speedometer sensor.

NOTES

- *Use the following procedures in conjunction with the manual supplied with the speedometer tester.*
- *Test results may be inaccurate if tester battery is low.*

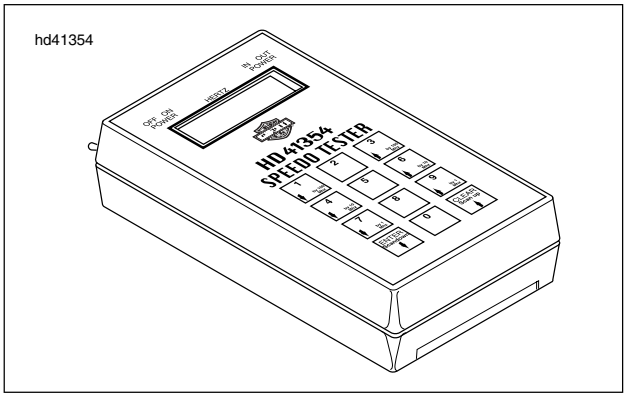


Figure 2-4. Speedometer Tester (HD-41354)

TESTING

NOTE

See Figure 2-4. The speedometer tester does not verify the calibration of a speedometer nor will it verify the speedometer's function to support legal proceedings. It's purpose is to verify speedometer function when performing service diagnosis or repair, and to assist in determining if speedometer replacement is necessary.

Frequency Input Test

1. Disconnect the speedometer sensor connector [65] located under the seat (3-place Deutsch). Mate the Speedometer Tester and speedometer sensor [65B] connectors. See Figure 2-5.
2. Place the Speedometer Tester Power Signal Switch in the "OUT" position. Place the Power Switch in the "ON" position. Turn the Ignition/Light Key Switch to IGNITION.
3. When the Speedometer Tester displays "P_ _ _1", press "1" on the keypad followed by the "ENTER" button. A series of three dashes is displayed on the tester LCD.
4. Refering to the table below, enter a selected frequency and press the "ENTER" button again.

Table 2-2. Frequency Test

MODEL	Tester Frequency (in Hz) Corresponding to:			
	20 MPH (30 KPH)	40 MPH (60 KPH)	60 MPH (100 KPH)	80 MPH (130 KPH)
Domestic (mile)	464	925	1381	1833
Great Britain (mile/kilo)				
HDI (kilo)	433	863	1431	1851

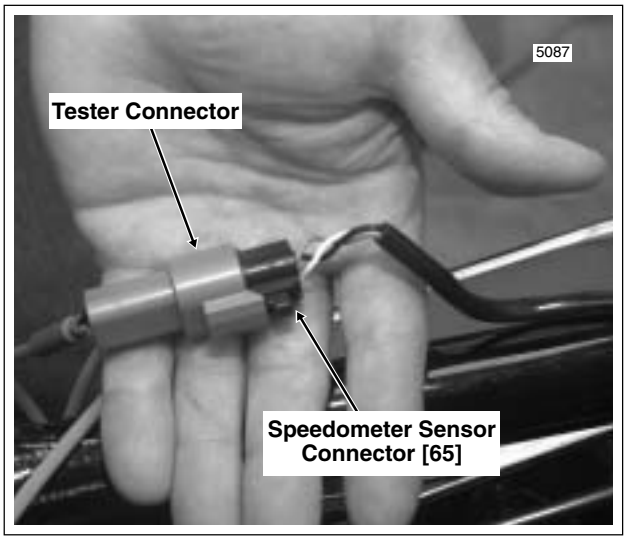


Figure 2-5. Mate Sensor and Tester Connectors

NOTE

If the entered frequency is 0 or more than 19,999, then the message "FAIL" will appear on the LCD display and the unit will return to the frequency select prompt.

5. Look at the needle of the speedometer gauge to verify that it corresponds to the speed printed at the top of the frequency column.
6. To change the frequency, press the "CLEAR" button on the keypad to cancel the operation, enter a new frequency and then press the "ENTER" button to begin.

NOTE

Speedometers are calibrated to be 0 to plus 4 mph (6.4 kph) fast. Certified speedometers (FLHP and FLHR/C models only) are calibrated to be plus or minus 2 mph (3.2 kph).

Needle Sweep Test

The sweep function of the Speedometer Tester moves the needle on the speedometer gauge through its full operating range. Observe the movement of the needle and take note of any hesitancy or sticking. Proceed as follows:

NOTE

If the Speedometer Tester was just used to perform the Operation Test, turn the Power Switch OFF and then ON to reset the device.

1. With the tester connected as described in Frequency Input Test, place the Speedometer Tester Power Switch in the “ON” position. Place the Power Signal Switch in the “OUT” position.
2. Turn the Ignition/Light Key Switch to IGNITION.
3. When the Speedometer Tester displays “P_ _ _1”, press “0” on the keypad followed by the “ENTER” button. The tester will scan for two seconds and then put out 1 Hz.
4. Press one of three keys to select a test range.
   a. Press 2 to select LO range (1-20 Hz).
   b. Press 5 to select CEN range (21-999 Hz).
   c. Press 8 to select HI range (1000-20,000 Hz).
5. Next, use the corresponding arrow keys to accelerate through the selected range. For example, keys 1 and 3 move through the LO range. As you move through the speed range, check for smooth needle movement. Replace any speedometer that sweeps erratically up or down.

Table 2-3. Needle Sweep Test

THESE BUTTONS DECREASE BY		THESE BUTTONS INCREASE BY	
1	100	**3**	100
4	10	**6**	10
7	1	**9**	1

Speedometer Sensor Test

If the speedometer is inoperative, but the backlighting and odometer work, then the speedometer sensor may be faulty.

To test the speedometer sensor as described below, a test harness is required.

1. Fabricate the test harness by splicing together two Deutsch 3-place socket housings (72113-94BK) and one Deutsch 3-place pin housing (72103-94BK). See Figure 2-6. Use six inch lengths of 18 gage wire each 6.0 inches (15 cm) long.

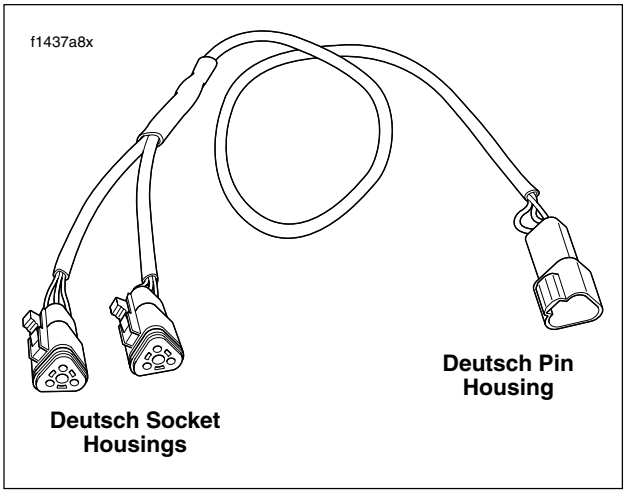


Figure 2-6. Test Harness

6. Install the test harness between the speedometer sensor connectors [65A & 65B].
7. Test for voltage to the sensor by checking for 8-12 VDC on Red wire in connector [65B]. Next, check for continuity to ground on the Black wire in connector [65B].

NOTE

The following test will only work if voltage and proper ground are present at the speedometer sensor.

8. To diagnose the speedometer sensor proceed as follows:
   a. Turn the Power Switch to “ON” and place the Signal Switch in the “IN” position.
   b. Plug the Speedometer Tester into the test harness and turn the Ignition/Light Key Switch to IGNITION.
   c. Press ENTER on the tester keypad.
   d. Rotate the motorcycle’s rear wheel greater than 3 mph. The numbers on the speedometer tester readout should change with changes in wheel speed. If the readout does not change, then the speedometer sensor is suspect.
   e. Install a known, good speedometer sensor and test again for proper operation.

Tachometer Testing

Use the SCANALYZER (Part No. HD-41325) to test the tachometer.

TSM/TSSM 3

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TSM/TSSM OVERVIEW 3.1

GENERAL

See Figure 3-1. The turn signal module (TSM) has two major functions:

- Control turn signals.
- Serve as bank angle sensor.

The optional, factory-installed, security system (turn signal security module or TSSM) provides the same functionality as the TSM, but also includes:

- Security and immobilization functions.

See Section 3.2 TSM/TSSM FEATURES for complete details.

TROUBLESHOOTING

Problems fall into at least one of four categories:

- Turn signal malfunction.
- Bank angle (engine disable).
- Security lamp problem (TSSM only).
- Security system malfunction (TSSM only).

To resolve TSM/TSSM problems, five basic steps are involved. In order of occurrence, they are:

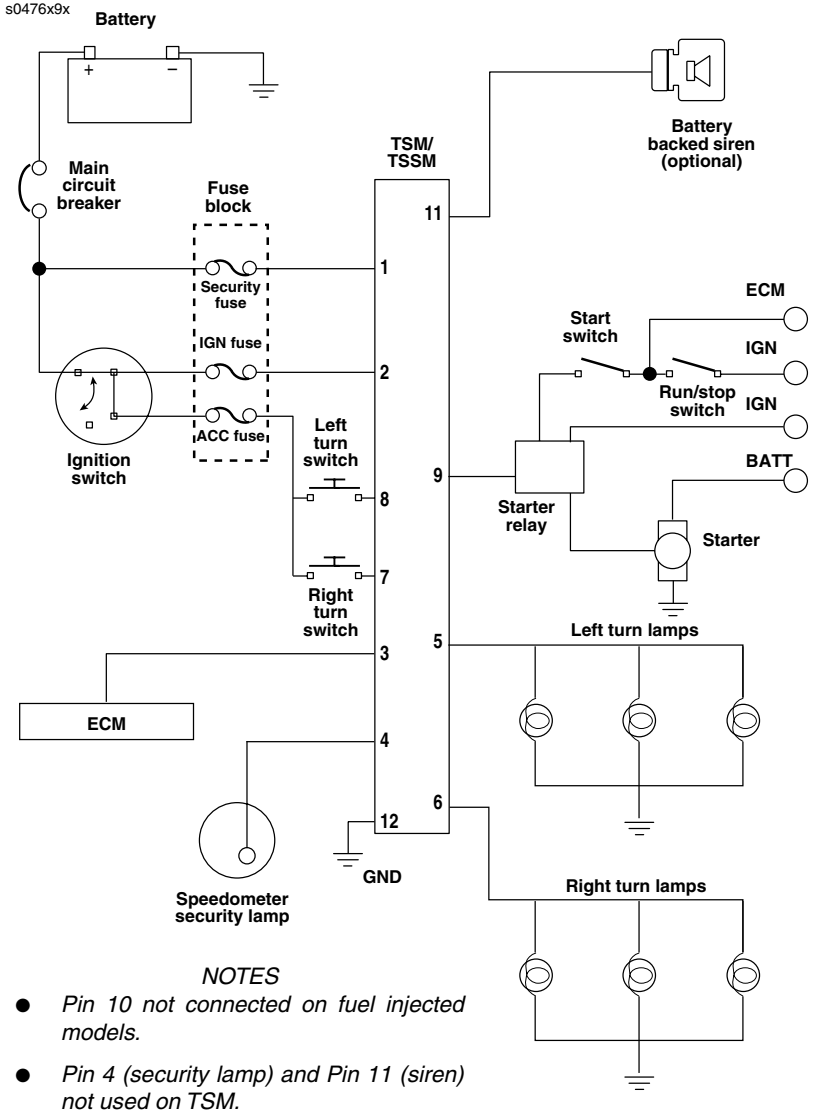
1. Check for trouble codes by observing the turn signals. See Section 3.8 CHECKING FOR TROUBLE CODES: TSM/TSSM.
2. Retrieve trouble codes using SCANALYZER (Part No. HD-41325) or TSM/TSSM diagnostics. See Section 3.11 SCANALYZER: EFI ONLY or Section 3.8 CHECKING FOR TROUBLE CODES: TSM/TSSM.
3. Diagnose system problems. This involves using special tools and the diagnostic flow charts in this section.
4. Correct problems through the replacement and/or repair of the affected components.
5. After repairs are performed, the work must be validated. This involves clearing the trouble codes and confirming proper vehicle operation as indicated by the behavior of the turn signals.



Figure 3-1. TSM/TSSM



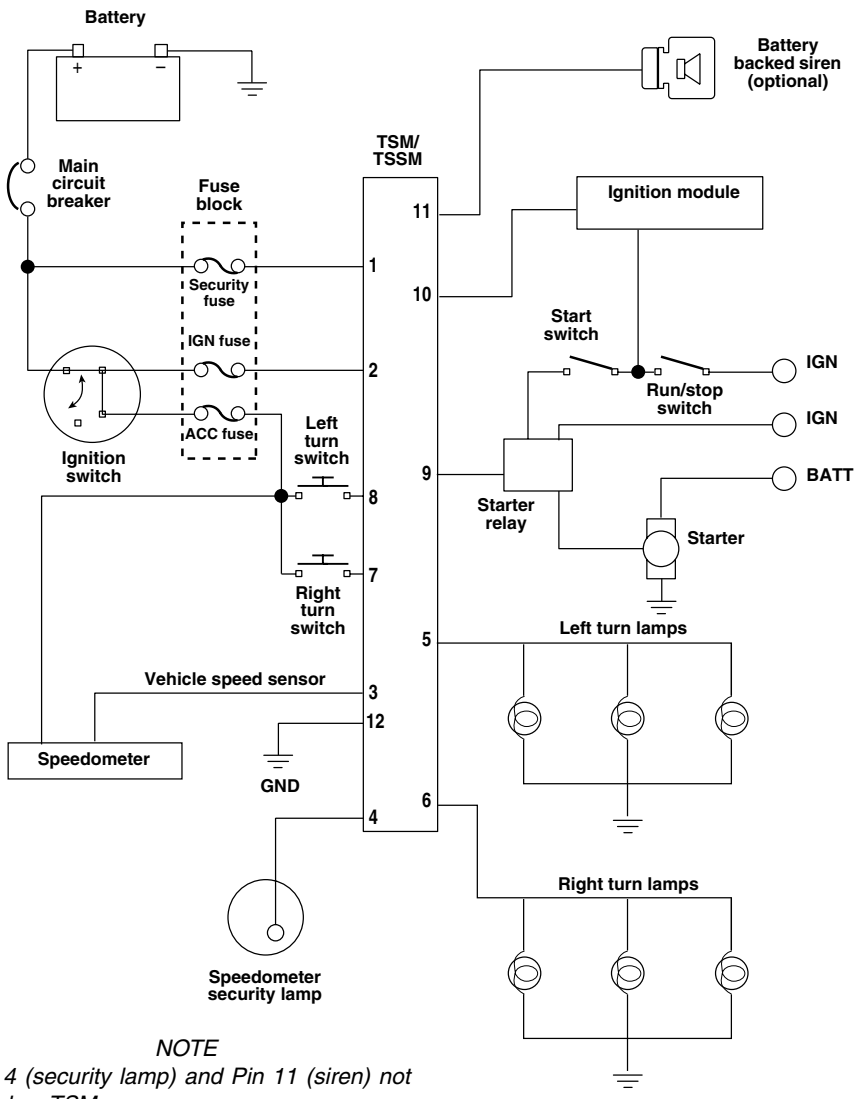
Figure 3-2. Key Fob



NOTES

- *Pin 10 not connected on fuel injected models.*
- *Pin 4 (security lamp) and Pin 11 (siren) not used on TSM.*

Fuel Injected Models



NOTE

Pin 4 (security lamp) and Pin 11 (siren) not used on TSM.

Carbureted Models

Figure 3-3. Simplified TSM/TSSM Wiring: See Diagrams For Wire Colors

TSM/TSSM FEATURES 3.2

GENERAL

The TSM/TSSM provides the following capabilities. Note that some hardware options and software settings are dependent upon vehicle market specifications.

TURN SIGNAL FUNCTIONS

TSM/TSSM Features

See Section 3.4 TSM/TSSM TURN SIGNAL FUNCTIONS for complete details.

- **Manual turn signal control:** Manual activation/deactivation of left and right turn signal flashing sequences.
- **Automatic turn signal cancellation:** Automatic cancellation of left and right turn signal flashing sequences based on either vehicle speed, vehicle acceleration or turn completion.
- **Emergency flashers:** Four-way left and right turn signal flashing capability.
- **Turn signal lamp diagnostics:** Self-diagnostics for short circuit and open lamp conditions on both left and right turn signal systems.

BANK ANGLE FUNCTIONS

TSM/TSSM Features

See Section 3.5 TSM/TSSM BANK ANGLE FUNCTION for complete details.

- **Emergency engine shutdown:** Monitors vehicle lean and will provide engine shutdown when lean exceeds 45° from vertical for more than one second.
- **Emergency outputs disable:** Monitors vehicle lean and will disable turn signal lamps and starter motor when lean exceeds 45° from vertical for more than one second.

SECURITY ALARM AND IMMOBILIZATION FUNCTIONS

TSSM Only Feature

The following information applies only to vehicles with the security option (TSSM). See Section 3.6 SECURITY SYSTEM (TSSM) FUNCTIONS for more information.



Figure 3-4. Key Fob

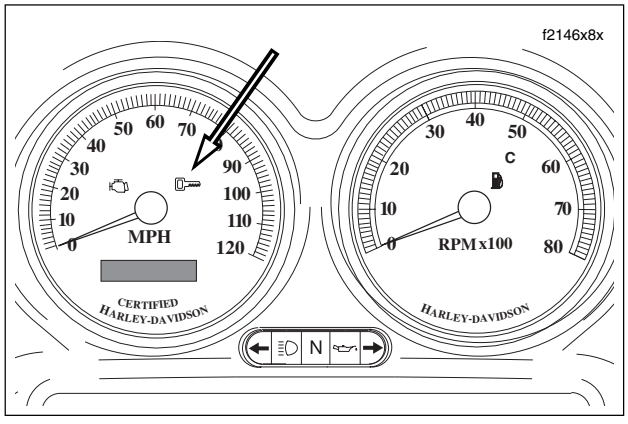


Figure 3-5. TSSM Lamp

- **Remote arming/disarming:** See Figure 3-4. Owners may enable and disable security alarm and immobilization functions with a remote, personally carried transmitter. This transmitter is referred to as a **key fob** within this document.
- **Security status lamp:** See Figure 3-5. A lamp within the speedometer face tells the rider if the system is armed or disarmed.
- **Personal code disarming:** If a key fob is not available, the TSSM allows the rider to disable the security alarm and immobilization functions if the rider knows the previously entered personal code.
- **Security command confirmation:** When the system is armed or disarmed, the system provides visual feedback to the rider by flashing the turn signals and sounding the optional siren.

- **Auto-arming:** Automatically enables the security alarm and immobilization functions when the ignition switch is turned OFF.

NOTE

Default auto-arming behavior depends upon vehicle market. All HDI vehicles have auto-arming by default. Motorcycles sold in other markets have auto-arming disabled, but it may be activated. See Section 3.3 TSM/TSSM VEHICLE DELIVERY.

- **Transport mode:** It is possible to arm the security system without enabling the motion detector for one ignition cycle. This allows the vehicle to be moved in an immobilized state.
- **Starter/ignition disable:** Should the security alarm and immobilization functions be triggered by a vehicle security condition, the starter and ignition system will be disabled.
- **Security system alarm:** See Figure 3-6. The system will alternately flash the left and right turn signals and sound an optional siren if a vehicle security condition is detected while the system is armed.

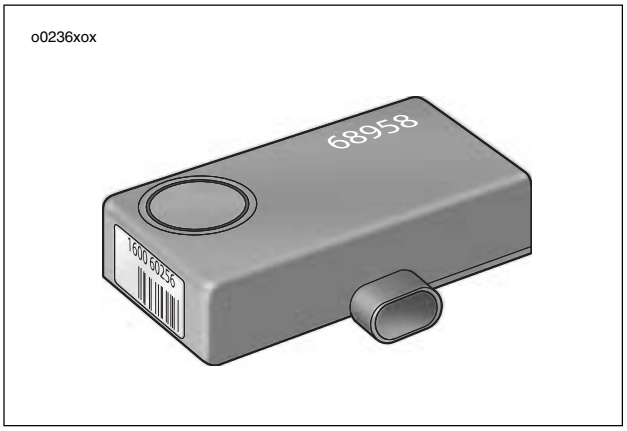


Figure 3-6. Siren

TSM/TSSM VEHICLE DELIVERY 3.3

GENERAL

Setting up a vehicle TSM/TSSM depends on two factors:

- Does the vehicle have a sidecar attached?
- Does the vehicle have a turn signal module (TSM) or the optional security system (TSSM) installed?

All motorcycles ship with the TSM/TSSM set for use **without** a sidecar installed. If a motorcycle is equipped with a TSM, no further configuration is required. However, if a motorcycle has a sidecar or an optional security system (TSSM) installed, perform the following steps as necessary.

1. Verify TSM/TSSM is correctly configured for sidecar or solo use. See SIDECAR CONFIGURATION on this page.
2. Configure TSSM motorcycles by assigning **both** key fobs to the vehicle.
3. Configure TSSM motorcycles by entering a personal code picked by the owner. The personal code allows the owner to operate the system if the key fob is lost or inoperable. Record this code in the owner's manual and instruct the customer to carry a copy.

IMPORTANT NOTE

Do not forget to enter a personal code for TSSM vehicles. If a code is not assigned and the key fob is lost or damaged while the vehicle is armed, the TSSM must be replaced.

Changes to TSM/TSSM settings are made by a series of programming operations involving the ignition switch, left/right turn signal switches, key fob (security systems only) and/or the appropriate diagnostic tool.

At certain steps in the programming sequence, the motorcycle may provide confirmation of settings by flashing the turn signals, turn signal indicators, and/or security lamp.

All programming operations are listed in table format. Follow the numbered steps to configure the system. If a confirmation response is listed, wait for the confirmation before continuing to the next step. Additional information is found in the NOTES column.

USING SCANALYZER ON EFI MODELS

The SCANALYZER CARTRIDGE (Part No. HD-41325-95C) has TSM/TSSM configuration capability on fuel injected models.

SIDECAR CONFIGURATION

⚠WARNING

ONLY FLT model motorcycles are suitable for sidecar use. Use of any other model could result in death or serious injury.

⚠WARNING

If the vehicle is being operated with a sidecar, the setting MUST be switched from solo vehicle operation to sidecar operation or the TSM/TSSM will not function properly.

If a sidecar is installed, install Sidecar BAS Kit (Part No. 88115-03) and reconfigure the TSM/TSSM using Digital Technician on fuel injected models and the TSSM Diagnostic Interface Harness (HD-44720) on carbureted models.

If the sidecar is permanently removed, the TSM/TSSM **must** be reconfigured back to the solo setting using the appropriate diagnostic tool. To verify whether the TSM/TSSM is configured for solo or sidecar usage, see Table 3-1.

POWER DISRUPTION/CONFIGURING WITHOUT DIAGNOSTIC TOOL

The TSM/TSSM will not enter configuration mode on the first attempt after battery voltage has been removed from Pin 1. This will occur after any of the following situations:

- Battery disconnect or power drain.
- Security fuse removal.
- Connecting Breakout Box to TSM/TSSM connector.

Therefore, after all battery reconnects, the configuration sequence must be modified as follows.

1. Set run switch to **OFF**, cycle ignition switch **ON**-OFF-**ON**-OFF-**ON** and press left turn signal switch **twice**.
2. Repeat step listed above.
3. Continue with configuration sequence listed.

KEY FOB ASSIGNMENT

The key fob on TSSM motorcycles must be set so it will operate the alarm system on the vehicle. This assignment **must** be completed with no pauses between steps greater than 10 seconds. Turn the ignition OFF after all key fobs have been assigned. The programming mode will also exit after 60 seconds has elapsed without detecting any fob signup messages or turn signal switch activity.

Two key fobs may be assigned to the TSSM. The first successful attempt to program a fob will disable all previously assigned fobs. If a second fob is to be programmed, it must be done in the same programming sequence as the initial fob.

To assign a key fob to a motorcycle, see Table 3-2.

PERSONAL CODE ENTRY

First Time Code Entry: TSSM Only

IMPORTANT NOTE

Do not forget to enter a personal code for TSSM vehicles. If a code is not assigned and the key fob is lost or damaged while the vehicle is armed, the TSSM must be replaced.

The TSSM personal code consists of five digits. Each digit can be any number from 1-9. The personal code **must** be used to disarm the security system in case the key fob becomes unavailable.

To set a personal code on a motorcycle with no code previously installed, see Table 3-3. The procedure listed uses 3-1-3-1-3 as the desired personal code.

NOTE

For better security, do not use 3-1-3-1-3 as a personal code. It is shown as an example only.

Decide what five digit code the owner would like to use. The code will be programmed using the turn signal switches and key fob. Keep a record of the code in a secure place such as your wallet or the owner's manual.

- When programming the personal code, the security lamp flashes to provide feedback when entering each digit.
- The number of security lamp flashes corresponds to the number currently selected for a given digit. Therefore, the lamp may flash 1-9 times depending on the number entered.
- Press the left turn switch one time to increment each digit of the code.
- Quickly press the key fob button twice to advance to the next digit of the code.

NOTE

The programming mode is exited when the Ignition/Light Key Switch is turned to OFF or if no turn signal switch/key fob button activity occurs for 60 seconds. No data is saved for partial configuration attempts.

Modifying Existing Codes: TSSM Only

If a code was previously entered, the lamp will flash the equivalent digit. Each additional press of the left turn switch will increment the digit.

- To advance from 5 to 6, press and release the left turn switch 1 time.
- To advance from 8 to 2, press and release the left turn switch 3 times (9-1-2).

NOTE

Can also be accomplished with Digital Technician in 2003.

Table 3-1. Verifying Whether TSM/TSSM is Configured for Solo/Sidecar* Use

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set **RUN/OFF** switch to **OFF**		Verify that security lamp is not blinking (vehicle is disarmed)
2	Turn **IGN** switch **ON**-OFF-**ON**-OFF-**ON**		
3	Press **left** turn switch **2 times** and release	1-3 flashes turn signals & indicators depending on vehicle configuration (See Section 3.3 TSM/TSSM VEHICLE DELIVERY regarding battery disconnects.)	1 flash-Worldwide TSM, no security 2 flashes-North American/ Domestic configuration TSSM 3 flashes-European/HDI configuration TSSM
4	Press **right** turn switch **1 time** and release	1 flash turn signals & indicators	
5	Press **right** turn switch **1 time** and release	2 flashes turn signals & indicators	
6	Press **left** turn switch **1 time** and release	1-2 flashes turn signals & indicators depending on vehicle configuration	1 flash-Solo 2 flashes-Sidecar
7	Turn **IGN** switch OFF		

* Only Touring models can be configured for sidecar usage. If a sidecar is installed, install Sidecar BAS Kit (Part No. 88115-03) and reconfigure the TSM/TSSM using Digital Technician on fuel injected models and the TSSM Diagnostic Interface Harness (HD-44720) on carbureted models.

Table 3-2. TSSM Key Fob Assignment

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set **RUN/OFF** switch to **OFF**		Verify that security lamp is not blinking (vehicle is disarmed) This assignment procedure **must** be completed with no pauses between steps greater than 10 seconds
2	Turn **IGN** switch **ON**-OFF-**ON**-OFF-**ON**		
3	Press **left** turn switch **2 times** and release	1-3 flashes turn signals & indicators depending on vehicle configuration (See Section 3.3 TSM/TSSM VEHICLE DELIVERY regarding battery disconnects.)	1 flash-Worldwide TSM, no security 2 flashes-North American/ Domestic configuration TSSM 3 flashes-European/HDI configuration TSSM
4	Press **right** turn switch **1 time** and release	1 flash turn signals & indicators	
5	Press **left** turn switch **1 time** and release	2 flashes turn signals & indicators	
6	Press and hold **key fob** button until confirmation is received	2 flashes turn signals & indicators	This may take 10-25 seconds
7	If you have two key fobs, press and hold button on second **key fob** until confirmation is received	2 flashes turn signals & indicators	optional step
8	Turn **IGN** switch OFF		

Table 3-3. Programming A TSSM Personal Code (Example: 3-1-3-1-3) With No Code Previously Installed

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set **RUN/OFF** switch to **OFF**		Verify that security lamp is not blinking (vehicle is disarmed)
2	Turn **IGN** switch **ON**-OFF-**ON**-OFF-**ON**		
3	Press **left** turn switch **2 times** and release	1-3 flashes turn signals & indicators depending on vehicle configuration (See Section under 3.3 TSM/TSSM VEHICLE DELIVERY regarding battery disconnects)	1 flash-Worldwide TSM, no security 2 flashes-North American/ Domestic configuration TSSM 3 flashes-European/HDI configuration TSSM
4	Quickly press **key fob** button **2 times** and release	1 flash turn signals & indicators	Vehicle is in personal code entry mode
5	Press **left** turn switch **1 time** and release	None if no code entered 1 - 9 flashes if code previously entered	A lack of confirmation flashes indicates no digit is entered
6	Press and release **left** turn switch to advance through the digits In this example, you will press and release three times	security lamp flashes to indicate each digit selected In this example, the lamp will flash 3 times	You've selected 3 as a number for the first digit
7	Quickly press **key fob** button **2 times** and release	2 flashes turn signals & indicators	You've confirmed 3 as a number for the first digit and have advanced to entering the second digit
8	Press **left** turn switch **1 time** and release	none	A lack of confirmation flashes indicates no digit is entered
9	Press and release **left** turn switch to advance through the digits In this example, you will perform this step one time	security lamp flashes to indicate each digit selected In this example, the lamp will flash 1 time	You've selected 1 as a number for the second digit
10	Quickly press **key fob** button **2 times** and release	3 flashes turn signals & indicators	You've confirmed 1 as a number for the second digit and have advanced to entering the third digit
11	Press **left** turn switch **1 time** and release	none	A lack of confirmation flashes indicates no digit is entered
12	Press and release **left** turn switch to advance through the digits In this example, you will repeat this step three times	security lamp flashes to indicate each digit selected In this example, the lamp will flash 3 times	You've selected 3 as a number for the third digit
13	Quickly press **key fob** button **2 times** and release	4 flashes turn signals & indicators	You've confirmed 3 as a number for the third digit and have advanced to entering the fourth digit
14	Press **left** turn switch **1 time** and release	none	A lack of confirmation flashes indicates no digit is entered

Table 3-3. Programming A TSSM Personal Code (Example: 3-1-3-1-3) With No Code Previously Installed

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
15	Press and release **left** turn switch to advance through the digits In this example, you will perform this step one time	security lamp flashes to indicate each digit selected In this example, the lamp will flash 1 time	You've selected 1 as a number for the fourth digit
16	Quickly press **key fob** button **2 times** and release	5 flashes turn signals & indicators	You've confirmed 1 as a number for the fourth digit and have advanced to entering the fifth digit
17	Press **left** turn switch **1 time** and release	none	A lack of confirmation flashes indicates no digit is entered
18	Press and release **left** turn switch to advance through the digits In this example, you will repeat this step three times	security lamp flashes to indicate each digit selected In this example, the lamp will flash 3 times	You've selected 3 as a number for the fifth digit
19	Quickly press **key fob** button **2 times** and release	1 flash turn signals & indicators	You've confirmed 3 as a number for the fifth digit and have gone back to the first digit
20	Turn **IGN** switch OFF		
21	Write down code in owner's manual		
22	Arm the security system and attempt to disarm using personal code entry. See Table 3-9.		

TSM/TSSM TURN SIGNAL FUNCTIONS 3.4

GENERAL

The TSM/TSSM's turn signal feature has several modes:

- Automatic cancellation.
- Manual cancellation.
- Four-way flashing.
- Diagnostics mode.

Turn signals cannot be activated or deactivated when the Ignition/Light Key Switch is in the ACC position. The turn signals can only be activated or deactivated with the switch in the IGNITION position.

CAUTION

If the vehicle is being operated with a sidecar, the setting MUST be switched from solo vehicle operation to sidecar operation or the TSM/TSSM will not function properly.

If a sidecar is installed, install Sidecar BAS Kit (Part No. 88115-03) and reconfigure the TSM/TSSM using Digital Technician on fuel injected models and the TSSM Diagnostic Interface Harness (HD-44720) on carbureted models.

AUTOMATIC CANCELLATION

Press the left or right turn switch to activate automatic turn signal cancellation. There is no need to hold the turn switch in when approaching the turn. The TSM/TSSM will not cancel the signal before the turn is actually completed.

- When the directional switch is released, the system starts a 20 count. As long as the vehicle is traveling above 7 MPH the directional will always cancel after 20 flashes if the system does not recognize any other input.
- If the vehicle speed drops to 7 MPH or less, including stopped, the directionals will continue to flash. Counting will resume when vehicle speed reaches 8 MPH and will automatically cancel when the count total equals 20 as stated above.
- The turn signals will cancel within two seconds upon turn completion if the turn is greater than 45 degrees. A sensor inside the TSM/TSSM cancels the signal after the vehicle has been returned to an upright position.

NOTE

The bank angle cancellation function has a calibration feature. Ride the motorcycle for 1/4 mile (0.4 KM) at steady speeds (upright) to calibrate the system.

MANUAL CANCELLATION

If you want to stop the turn signals from flashing, briefly depress the turn signal switch a second time.

If you are signalling to turn in one direction and you depress the switch for the opposite turn signal, the first signal is cancelled and the opposite side begins flashing.

FOUR-WAY FLASHING

Use the following method to activate the four-way flashers.

1. With Ignition/Light Key Switch turned to IGNITION and security system disarmed (models with security only), press the left and right turn signal switches at the same time.
2. Turn the ignition switch OFF and arm the security system if present and desired. The four-way flashers will continue for two hours.
3. To cancel four-way flashing, disarm the security system if necessary, turn the ignition switch ON and press the left and right turn signal switches at the same time.

NOTE

Auto-arming (always active on HDI bikes, user selectable on other vehicles) requires that the four-way flashers be activated within 30 seconds of key OFF or after the vehicle has been disarmed.

This system allows a stranded vehicle to be left in the four-way flashing mode and secured until help is found.

If the security system is disarmed while the four-way flashers are active, the lights will flash as follows:

1. TSSM stops four-way flashing mode. Motorcycle sits for 1 second with turn signals off.
2. TSSM performs disarming confirmation (1 flash).
3. Motorcycle sits for 1 second with turn signals off.
4. Motorcycle restarts four-way flashing mode.

DIAGNOSTICS MODE

The TSM/TSSM measures the current when the turn signals are used. If there is a burned out light bulb on one side, the remaining light and the corresponding turn signal indicator flash at double the normal rate starting with the fifth flash.

Other diagnostic conditions monitored include:

- Short circuit in the turn signal wiring.
- Open circuit in the turn signal wiring.

- Stuck turn signal switch.

NOTES

- *A stuck turn signal switch will disable the automatic turn signal cancellation feature.*
- *If a stuck switch is detected, you must hold the left and right turn signal switches in for more than one second to activate the four-way flashers.*

See Section 3.8 CHECKING FOR TROUBLE CODES: TSM/TSSM for more information.

TSM/TSSM BANK ANGLE FUNCTION 3.5

GENERAL

The turn signals, starter motor, ignition controller (ECM/EFI), fuel pump (EFI models) and coil will be disabled in the event the vehicle tilts more than 45 degrees from vertical for longer than one second.

CAUTION

If the vehicle is being operated with a sidecar, the setting MUST be switched from solo vehicle operation to sidecar operation or the TSM/TSSM will not function properly.

If a sidecar is installed, install Sidecar BAS Kit (Part No. 88115-03) and reconfigure the TSM/TSSM using Digital Technician on fuel injected models and the TSSM Diagnostic Interface Harness (HD-44720) on carbureted models.

OPERATION

The engine will shut off automatically if the vehicle tilts more than 45 degrees from vertical for longer than one second. The engine will automatically shut off even if the tilt occurs at a very slow speed.

To restart the motorcycle after shutdown has occurred:

1. Return the motorcycle to an upright position.
2. Cycle the ignition switch OFF-**ON** before restarting the vehicle.

SECURITY SYSTEM (TSSM) FUNCTIONS 3.6

GENERAL

Security System Operation

The TSSM provides security and immobilization functions not found on the TSM. The TSSM will disable the starter and ignition system. Additional functions include the ability to alternately flash the left and right turn signals and sound a siren (if purchased as an option) if a theft attempt is detected.

Conditions that activate the security system when system is armed include:

- **Detecting small vehicle movement:** Turn signals flash 3 times and optional siren chirps once and then turns off. If the vehicle is not returned to its original position the warning will reactivate after 4 seconds. This cycle may repeat a maximum of 255 times.
- **Detecting large vehicle movement:** System activates for 30 seconds and turn off. If the vehicle is not returned to its original position the alarm will reactivate after 10 seconds. This cycle may repeat a maximum of 10 times.
- **Detecting tampering of the security lamp circuit:** System activates for 30 seconds. This cycle repeats once for each tampering incident.
- **Detecting that a battery or ground disconnect has occurred while armed.** Siren, if installed, activates its self-alarm mode. Turn signals will not flash.

See Section 3.7 ARMING/DISARMING SECURITY SYSTEM (TSSM) for more information.

NOTE

Always disarm the TSSM before removing or disconnecting the battery to prevent the siren (if installed) from activating. If the TSSM is in auto-arming mode, you must disarm the system using two clicks of the key fob and disconnect the battery or remove the TSSM fuse before the 30 second arming period expires.

Security System Options

The following customization options are only available on the TSSM unit: alarm sensitivity, auto-arming feature and storage mode.

Default settings for the TSSM include:

- Solo vehicle configuration (sidecar not installed).
- Medium motion sensitivity on alarm sensitivity.
- Auto-arming standard on HDI vehicles and disabled on domestic motorcycles.
- Storage mode set to 60 days.

Differences By Market Specifications

The HDI version of the TSSM differs from the domestic as follows:

- The HDI version always auto-arms itself within 30 seconds after the ignition switch is turned to OFF.

ALARM SENSITIVITY

Sensitivity

The TSSM has four sensitivity settings: extremely low, low, medium or high. The selection controls the sensitivity of the security system with respect to motion detection.

To set alarm sensitivity, see Table 3-4.

Transport Mode

It is possible to arm the security system without enabling the motion detector for one ignition cycle. This allows the vehicle to be picked up and moved in an armed state. In this mode, any attempt to hot-wire the vehicle will trigger the security system.

- To enter the transport mode, see Table 3-5.
- To exit from transport mode and return the system to normal operation/functions, disarm the system using either the key fob or personal code.

NOTE

Transport mode is especially useful when working on HDI vehicles. If it is not used, then the alarm will activate under many typical service activities.

AUTO-ARMING FUNCTION

Auto-arming causes the system to automatically arm itself (no key fob needed) within 30 seconds after the ignition switch is turned OFF. During this period, the security lamp stays on solid to indicate auto-arming is starting up.

The vehicle may be moved during these 30 seconds without triggering the alarm. However, any motion after that period will trigger the security alarm. Upon expiration of the auto-arming period, the turn signals flash twice, the security lamp begins to flash and the siren (if installed) chirps twice.

The TSSM allows remote arming via the key fob at anytime. However, if the system is remotely disarmed (with the key fob) but the Ignition/Light Key Switch is not turned to IGNITION within 30 seconds, the system will rearm itself when auto-arming is enabled.

The auto-arming setting depends upon vehicle market specifications.

- Motorcycles sold in North America have auto-arming **disabled** by default. However, the feature may be enabled if the customer desires.
- Vehicles sold elsewhere have auto-arming **enabled** and this setting cannot be changed.

When auto-arming is disabled, the key fob must be used to arm the security system.

To set the auto-arming function, if it is available on your vehicle, see Table 3-6.

STORAGE MODE

The TSSM has a special mode for long term storage. This mode prevents the security system from draining the battery after a period of days (30, 60, 90 or infinite) without any Ignition/Light Key Switch activity.

- If the TSSM is set to infinite, the system will not go into storage mode.
- Vehicles will enter storage mode whether the security system is armed or disarmed.
- If set to infinite or 90 days, the customer must use a trickle charger to keep the battery from discharging.

In storage mode, all alarm functions are suspended and the receiver is shut down and will not respond to the key fob. The vehicle is immobilized because the starter motor and ignition module/ECM controllers are disabled. When the storage mode is entered, the security lamp stops flashing to conserve power.

To wake up the TSSM from storage mode, the ignition switch must be turned to IGNITION. This will trigger the alarm if the system was previously armed. You must use the key fob or personal code to disarm the system and stop the alarm.

To set the storage mode preferences, see Table 3-7.

Table 3-4. TSSM Alarm Sensitivity

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set **RUN/OFF** switch to **OFF**		Verify that security lamp is not blinking (vehicle is disarmed)
2	Turn **IGN** switch **ON**-OFF-**ON**-OFF-**ON**		
3	Press **left** turn switch **2 times** and release	2 or 3 flashes turn signals & indicators depending on vehicle configuration (See Section 3.3 TSM/TSSM VEHICLE DELIVERY regarding battery disconnects.)	2 flashes-North American/ Domestic configuration TSSM 3 flashes-European/HDI configuration TSSM
4	Press and hold **key fob** button until confirmation is received	1 flash turn signals & indicators	
5	Press **left** turn switch **1 time** and release	turn signals & indicators flash to indicate option selected	1 flash-extremely low 2 flashes-low sensitivity 3 flashes-medium sensitivity 4 flashes-high sensitivity
6	Press and release **left** turn switch to advance through options	turn signals & indicators flash to indicate option selected	1 flash-extremely low 2 flashes-low sensitivity 3 flashes-medium sensitivity 4 flashes-high sensitivity
7	Turn **IGN** switch OFF		

Table 3-5. TSSM Transport Mode

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set **RUN/OFF** switch to **OFF**		Verify that security lamp is not blinking (vehicle is disarmed)
2	Turn **IGN** switch **ON**		
3	Press and hold **key fob** button until confirmation is received	3 flashes turn signals & indicators	
4	Turn **IGN** switch OFF		
5	Press and hold **key fob** button until confirmation is received	3 flashes turn signals & indicators	The vehicle can be moved without tripping the alarm

Table 3-6. Selecting TSSM Auto-arming Function (Not Available on HDI Vehicles)

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set **RUN/OFF** switch to **OFF**		Verify that security lamp is not blinking (vehicle is disarmed)
2	Turn **IGN** switch **ON**-OFF-**ON**-OFF-**ON**		
3	Press **left** turn switch **2 times** and release	2 or 3 flashes turn signals & indicators depending on vehicle configuration (See Section 3.3 TSM/TSSM VEHICLE DELIVERY regarding battery disconnects.)	2 flashes-North American/ Domestic configuration TSSM 3 flashes-European/HDI configuration TSSM
4	Press and hold **key fob** button until confirmation is received	1 flash turn signals & indicators	
5	Press and hold **key fob** button until confirmation is received	2 flashes turn signals & indicators	
6	Press **left** turn switch **1 time** and release	turn signals & indicators flash to indicate option selected	1 flash- auto-arming disabled 2 flashes- auto-arming enabled
7	Press and release **left** turn switch to advance through options	turn signals & indicators flash to indicate option selected	
8	Turn **IGN** switch OFF		

Table 3-7. TSSM Storage Mode Preferences

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set **RUN/OFF** switch to **OFF**		Verify that security lamp is not blinking (vehicle is dis-armed)
2	Turn **IGN** switch **ON**-OFF-**ON**-OFF-**ON**		
3	Press **left** turn switch **2 times** and release	2 or 3 flashes turn signals & indicators depending on vehicle configuration (See Section 3.3 TSM/TSSM VEHICLE DELIVERY regarding battery disconnects.)	2 flashes-North American/ Domestic configuration TSSM 3 flashes-European/HDI configuration TSSM
4	Press and hold **key fob** button until confirmation is received	1 flash turn signals & indicators	
5	Release and then hold **key fob** button until confirmation is received	2 flashes turn signals & indicators	
6	Release and then hold **key fob** button until confirmation is received	3 flashes turn signals & indicators	
7	Press **left** turn switch **1 time** and release	turn signals & indicators flash to indicate option selected	1 flash-30 days 2 flashes-60 days 3 flashes-90 days 4 flashes-Infinite
8	Press **left** turn switch to advance through options	turn signals & indicators flash to indicate option selected	1 flash-30 days 2 flashes-60 days 3 flashes-90 days 4 flashes-Infinite
9	Turn **IGN** switch OFF		

ARMING/DISARMING SECURITY SYSTEM (TSSM) 3.7

GENERAL

There are two methods to arm the security system:

- Using the key fob.
- Using auto-arming. See Section 3.6 SECURITY SYSTEM (TSSM) FUNCTIONS.

NOTE

The vehicle cannot be armed with the engine running or the ignition ON.

There are two ways to disarm the system:

- Using the key fob. This method works in all situations **except** before turning ignition switch to IGNITION when TSSM storage mode is activated.
- Using the personal code.

SECURITY LAMP

See Table 3-8. The security lamp within the speedometer provides feedback to the rider confirming armed or disarmed status.

Table 3-8. Security Lamp Status

LAMP	MODE
Does not flash	No security system (TSM), security system not armed or storage mode active
Flashes every second	10 minute timeout after failed personal code entry attempt or a battery reconnect has occurred while armed
Flashes every 2 seconds	Security system armed
Flashes 3 times a second	Personal code entry mode
Stays on solid with ignition switch OFF	Auto-arming is starting up. You have 30 seconds before system is armed.
Stays on solid with ignition switch at IGNITION	If solid for more than 4 seconds after switch is turned to IGNITION, a current trouble code is present

USING KEY FOB

General

The TSSM's reception range for the key fob signal depends on a specific receiver pattern.

NOTE

Environmental and geographic conditions may affect signal range.

Arming the System

1. Hold key fob horizontal at waist level.
2. Point key fob at the front of the vehicle.
3. Hold down the key fob button until the system responds with two turn signal flashes.

Disarming the System

1. Hold key fob horizontal at waist level.
2. Point key fob at the front of the vehicle.
3. Quickly press the key fob button twice. The system will respond with one turn signal flash.

NOTE

*Disarming function may require practice. The key fob button **must** be pressed twice within 1.5 seconds to send the disarm command. The action is very similar to double-clicking a computer mouse. Light quick taps work best; very hard or very slow taps are less likely to work.*

Troubleshooting

If the key fob button has been pressed numerous times while away from the vehicle, the fob may fall out of synchronization with the TSSM. If this happens, the TSSM might fail to recognize the key fob's commands.

To solve this problem, press and hold the key fob button for 10-15 seconds until the security system responds with two turn signal flashes. After confirmation, you may resume normal fob operation.

USING THE PERSONAL CODE

General

The personal code consists of five digits entered using the left and right turn signal switches. Each digit can be any number from 1-9. The personal code is intended to be used to disarm the vehicle in case the key fob becomes unavailable or inoperable.

See Section 3.3 TSM/TSSM VEHICLE DELIVERY to set a personal code.

Disarming the System

See Table 3-9. If you make an error while disarming the TSSM using the personal code, the alarm will activate for 30 seconds after the last digit is entered. After a failed attempt, the security lamp will flash once every second for 10 minutes. **During this time, the vehicle will not accept any attempt to enter a personal code.**

Table 3-9. Entering A Personal Code To Disarm TSSM (Example: 3-1-3-1-3)

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set **RUN/OFF** switch to **OFF**		
2	Turn **IGN** switch to **ACC**		
3	Hold **both** turn switches in until confirmation	security lamp blinks at fast rate	System is ready for personal code entry
4	Enter first digit of code (3) by pressing **left** turn switch **3 times**		
5	Press **right** turn switch **1 time**		Serves as “enter” key for first digit
6	Enter second digit of code (1) by pressing **left** turn switch **1 time**		
7	Press **right** turn switch **1 time**		Serves as “enter” key for second digit
8	Enter third digit of code (3) by pressing **left** turn switch **3 times**		
9	Press **right** turn switch **1 time**		Serves as “enter” key for third digit
10	Enter fourth digit of code (1) by pressing **left** turn switch **1 time**		
11	Press **right** turn switch **1 time**		Serves as “enter” key for fourth digit
12	Enter fifth digit of code (3) by pressing **left** turn switch **3 times**		
13	Press **right** turn switch **1 time**	security lamp stops blinking	System is disarmed. You may use the vehicle or program another key fob

CHECKING FOR TROUBLE CODES: TSM/TSSM 3.8

GENERAL

The TSM/TSSM allows three levels of diagnostics:

- The most sophisticated mode employs a computer based diagnostic package called the DIGITAL TECHNICIAN (Part No. HD-44750).
- The second mode, which only works on fuel injected motorcycles, employs a portable diagnostic tool called a Scanalyzer. This device plugs into the motorcycle wiring harness and facilitates the diagnosis of system problems through a direct interface with the TSM/TSSM. See Section 3.11 SCANALYZER: EFI ONLY.

NOTE

The TSSM Diagnostic Interface Harness (HD-44720) is now available for carbureted models.

- The third mode is to observe the behavior of the turn signals. If the turn signals flash six fast four-way flashes shortly after the Ignition/Light Key Switch is turned to IGNITION, then an error code is logged. See TURN SIGNAL DIAGNOSTICS which follow.

CODE TYPES

There are two types of trouble codes: current and historic. If a trouble code is stored, it can be read using either a Scanalyzer or TSM/TSSM diagnostics.

NOTE

You must use the Scanalyzer to differentiate between current and historic codes. If a Scanalyzer is available, see Section 3.12 INITIAL DIAGNOSTIC CHECK: TSM/TSSM.

Current

Current trouble codes are those which are present during the current ignition cycle. See the appropriate flow charts for solutions.

Historic

If a particular problem happens to resolve itself, the active status problem is dropped and it becomes a historic code rather than a current code. For example, intermittent output shorts can become typical historic codes.

Historic codes are stored for 50 ignition cycles after any code was last set as current to assist in the diagnosis of intermittent faults. On the 50th cycle, the code will clear itself.

It is important to note that historic codes will exist whenever the system indicates the existence of a current fault.

TURN SIGNAL DIAGNOSTICS

To determine which error code (either current and/or historic) is logged without using a Scanalyzer:

1. Activate TSM/TSSM diagnostic mode using instructions in Table 3-10.
2. Observe the turn signals. All codes are flashed in numeric order.
   a. The flashes will pause for 4 seconds.
   b. Watch for four-way flashers to cycle a number of times equal to the first digit of the first DTC.
   c. The flashes will pause for 1.5 seconds.
   d. Watch for four-way flashers to cycle a number of times equal to the second digit of the first DTC.
   e. If multiple codes are present, the system will restart with Step A.
3. To determine the meaning of a code, see Section 3.12 INITIAL DIAGNOSTIC CHECK: TSM/TSSM and Table 3-12.

NOTES

- *When DTC B1141 (EFI), DTC 41 (CARB) is set as current, this feature will not be available.*
- *If the turn signals flash six four-way flashes shortly after the Ignition/Light Key Switch is turned to IGNITION, it indicates an error code has been logged sometime in the last 3 ignition cycles.*
- *On vehicles with a TSSM, the security lamp will also light for 8 seconds after the bulb check if historic codes are present. The security lamp will stay on if current codes are set. If a historic code is present, the security lamp will light for 50 ignition cycles or until the code is cleared manually.*

Table 3-10. Invoking TSM/TSSM Code Diagnostics

NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Set **RUN/OFF** switch to **OFF**		
2	Turn **IGN** switch **ON**-OFF-**ON**-OFF-**ON**		
3	Press **left** turn switch **2 times** and release	1-3 flashes turn signals & indicators depending on vehicle configuration (See Section 3.3 TSM/TSSM VEHICLE DELIVERY regarding battery disconnects.)	1 flash-Worldwide TSM, no security 2 flashes-North American/ Domestic configuration TSSM 3 flashes-European/HDI configuration TSSM
4	Press **right** turn switch **1 time** and release	1 flash turn signals & indicators	
5	Press **right** turn switch **1 time** and release	2 flashes turn signals & indicators	
6	Press **right** turn switch **1 time** and release	3 flashes turn signals & indicators	
7	Press **left** turn switch **1 time** and release	turn signals & indicators flash to indicate trouble codes	See Table 3-12.
8	To clear codes, press and hold **left** turn switch for 4-5 seconds until confirmation is received	2 flashes turn signals & indicators	
9	Turn **IGN** switch OFF		

SECURITY LAMP

To diagnose system problems, start by observing the behavior of the security lamp.

NOTES

- *See Figure 3-7. "Key ON" means that the Ignition/Light Key Switch is turned to IGNITION and the Engine Stop/Run Switch is set to RUN (although the engine is **not** running).*
- *If the security lamp is not illuminated at Key ON or if it fails to turn OFF after the initial four second period, then a problem exists in the lamp circuit. See Section 3.13 NO SECURITY LAMP AT KEY ON or Section 3.14 SECURITY LAMP ON CONTINUOUSLY for more information.*

1. See Figure 3-8. When the Ignition/Light Key Switch is turned to IGNITION, the security lamp will illuminate for approximately four seconds and then turn off.
2. See Figure 3-9. After the lamp turns off after being illuminated for the first four second period, one of three situations may occur.
   a. The lamp remains off. This indicates there are no current fault conditions or stored historic trouble codes currently detected by the TSSM.
   b. The lamp stays off for only four seconds and then comes back on for an eight second period. This indicates a historic code is stored, but no current trouble code exists.
   c. If the lamp remains on beyond the eight second period, then a current trouble code exists.
3. See CODE TYPES under Section 3.8 CHECKING FOR TROUBLE CODES: TSM/TSSM for a complete description of trouble code formats.

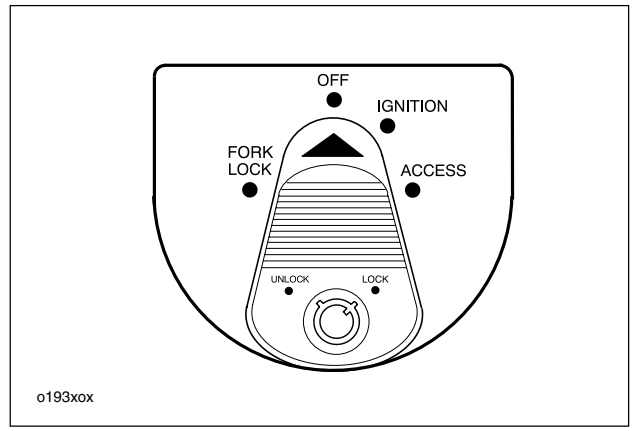


Figure 3-7. Ignition Switch: All But FLHR/C/I

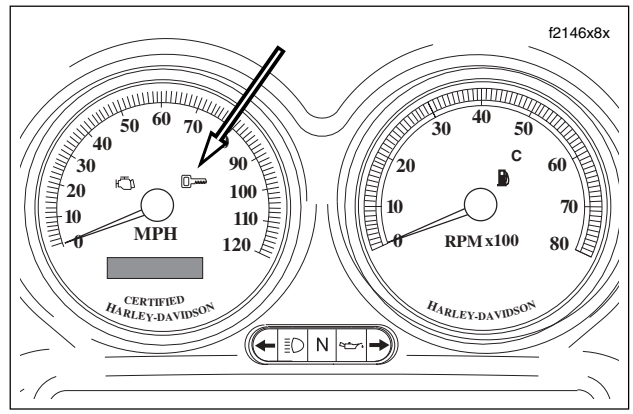


Figure 3-8. Security Lamp

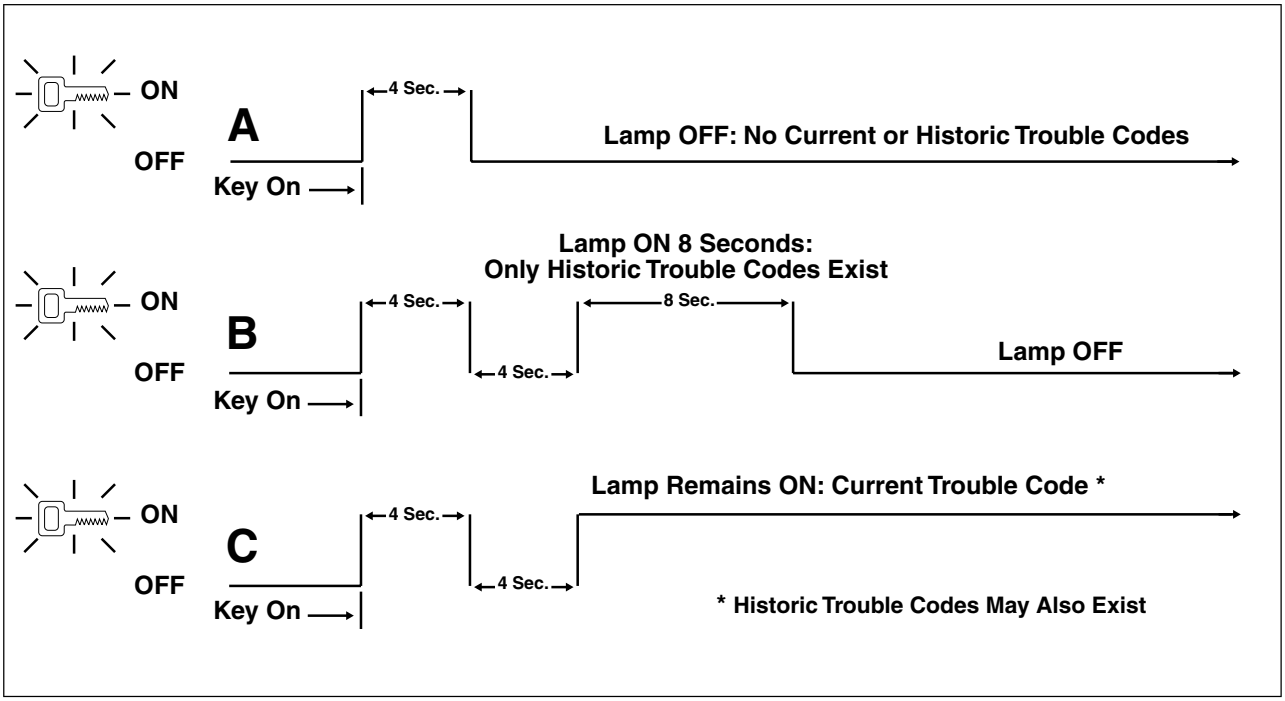


Figure 3-9. Security Lamp Operation

BREAKOUT BOX: TSM/TSSM 3.10

GENERAL

The BREAKOUT BOX (HD-42682) splices into the main harness. Used in conjunction with a DVOM, it allows circuit diagnosis of wiring harness and connections without having to probe with sharp objects.

INSTALLATION

1. Remove seat. Remove spring clip and lift TSM/TSSM from cavity in frame crossmember. See 2003 FLT Service Manual (Part Number 99483-03).
2. See Figure 3-10. Depress latches on socket housing to remove wire harness from TSM/TSSM connector.
3. See Figure 3-11. Attach Breakout Box as follows:
   a. Mate gray socket housing on Breakout Box with TSM/TSSM connector [30A].
   b. Mate gray pin housing on Breakout Box with wire harness connector [30B].

REMOVAL

1. Remove Breakout Box as follows:
   a. Remove gray socket housing on Breakout Box from TSM/TSSM connector [30A].
   b. Remove gray pin housing on Breakout Box from wire harness connector [30B].
2. Mate socket housing on wire harness with TSM/TSSM connector.
3. Position TSM/TSSM into cavity in frame crossmember and install spring clip. Install seat.

NOTE

Vehicle will not start with TSM/TSSM disconnected or incorrectly mounted.

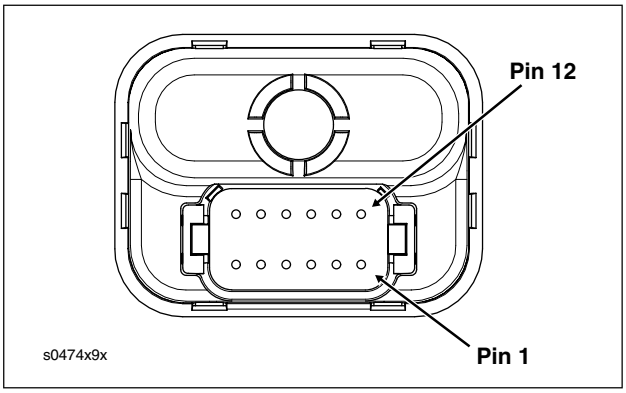


Figure 3-10. TSM/TSSM Connector

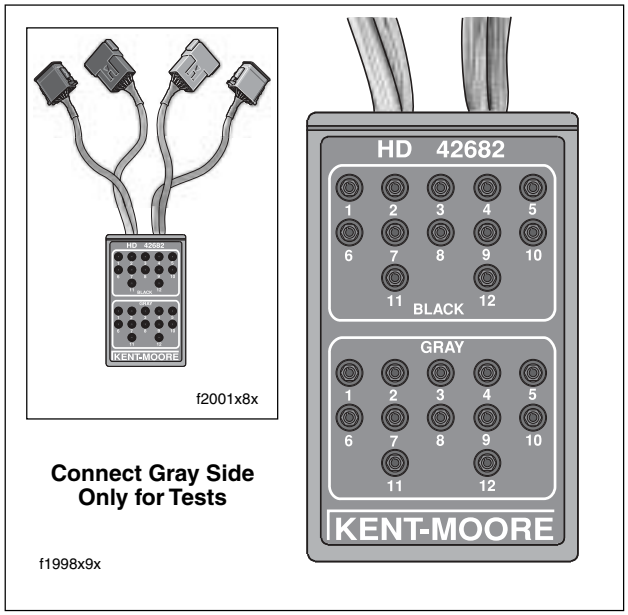


Figure 3-11. Breakout Box (Part No. HD-42682)

Table 3-11. TSM/TSSM Connector [30B]

PIN	FUNCTION
1	Battery
2	Ignition
3	Vehicle speed sensor
4	Security indicator
5	Left turn feed
6	Right turn feed
7	Right turn switch input
8	Left turn switch input
9	Start relay control
10	Ignition enable signal
11	Alarm signal
12	Ground

SCANALYZER DIAGNOSTICS

General

The Scanalyzer can only be used to diagnose TSM/TSSM problems on fuel injected motorcycles.

Data Link Connector

See Figure 3-12. Using the Scanalyzer requires access to the data link connector. See the instructions below.

Scanalyzer Cartridge

See Figure 3-13. Through a special programmable application cartridge, the Scanalyzer offers data displays and menu selections that allow for quick and easy retrieval of data. The device enables the user to perform a variety of diagnostic tests while monitoring inputs and outputs.

Sample Scanalyzer menu selections are shown in Figure 3-14.

INSTALLATION

PART NO.	SPECIALTY TOOL
HD-41325	Scanalyzer
HD-41325-95C	Scanalyzer cartridge
HD-42921A	Cable

The behavior of the turn signal lamps (Section 3.8 CHECKING FOR TROUBLE CODES: TSM/TSSM) may indicate the presence of trouble codes.

1. Turn Ignition/Light Key Switch to OFF.
2. Remove right saddlebag and side cover to access data link connector.
3. See Figure 3-12. Remove rubber protective plug from data link connector. Plug Scanalyzer into connector.
4. Turn Ignition/Light Key Switch to IGNITION. Set Engine Stop/Run Switch to RUN, but do not start engine.
5. See Figure 3-13. Insert the diagnostic application cartridge into the Scanalyzer. During the next few seconds, the Scanalyzer sequences through a series of screens that reflect a power-on self test, the system copyright, and then an attempt at communications with the ECM and turn signal module (TSM) or turn signal security module (TSSM). Once communications is established with both modules, the diagnostic menu appears. See Figure 3-14.
6. Continue with the instructions listed under USAGE which follows.

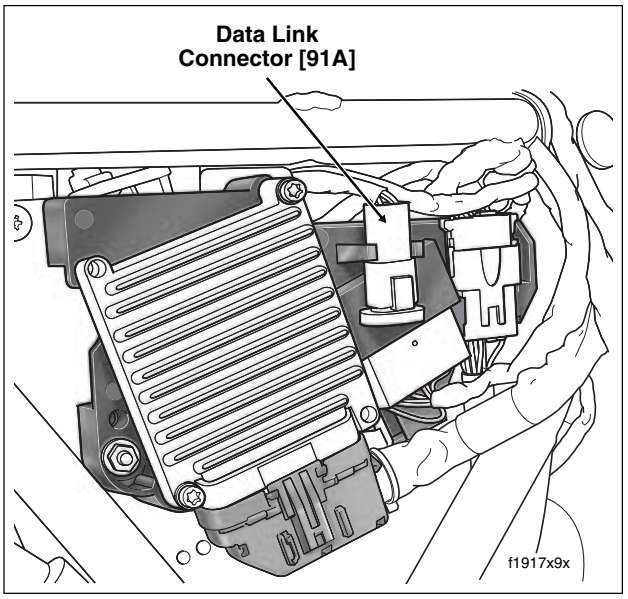


Figure 3-12. Right Side Cover Removed

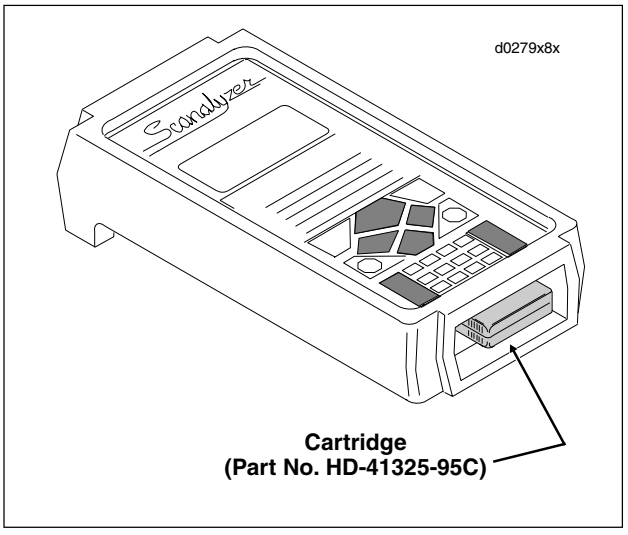


Figure 3-13. Scanalyzer (Part No. HD-41325)

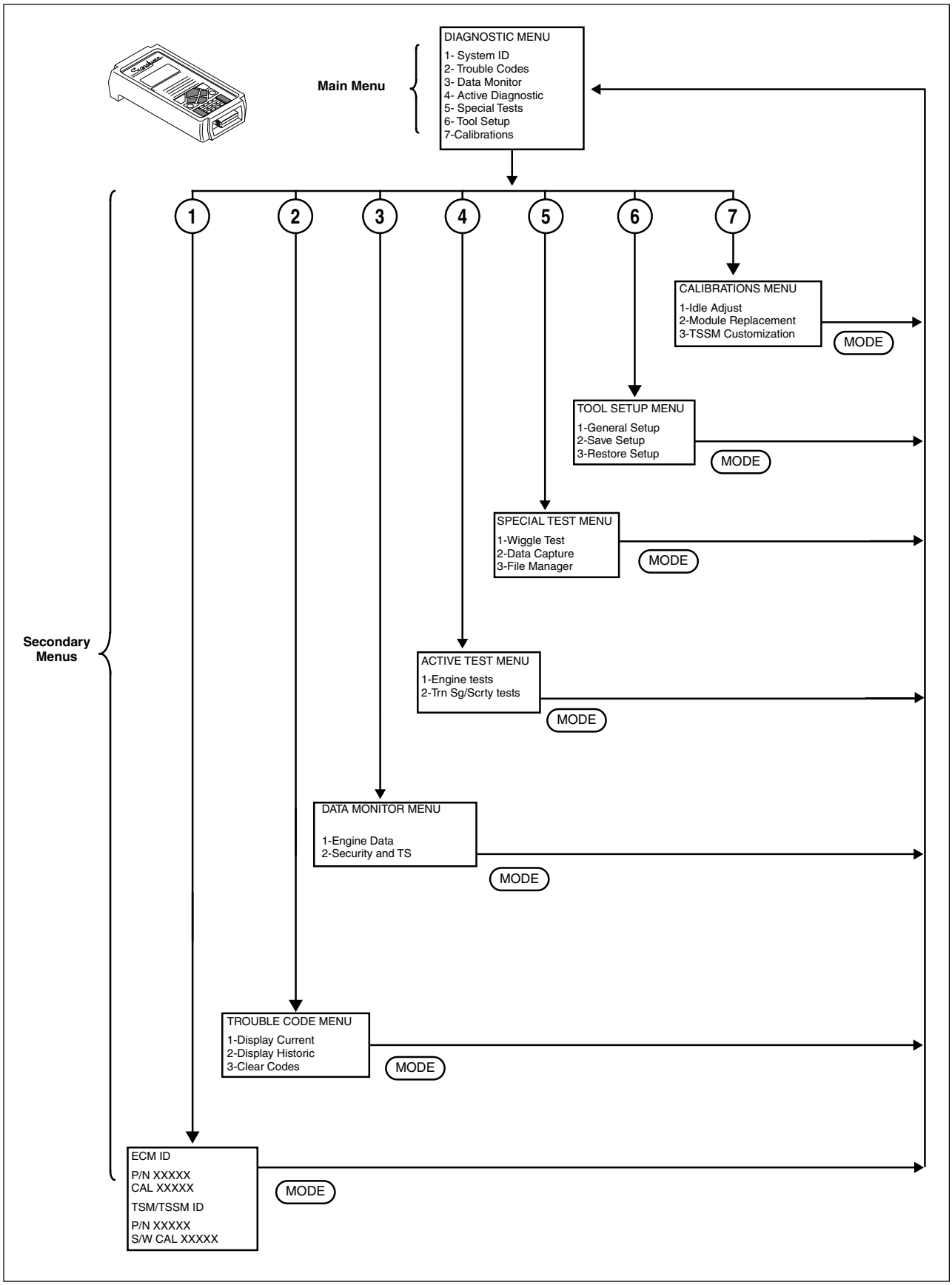


Figure 3-14. Scanalyzer Menus

USAGE

See Figure 3-14. The diagnostic menu is the primary system menu (main menu) through which all other secondary menus and displays are accessed. Since the screen may not be large enough to display all line items at any given time, use the up and down arrow keys to scroll through the list.

Checking Codes

1. See Figure 3-15. From the diagnostic menu, press number “2” to access the trouble codes menu. At this point, the unit allows the operator to:
   a. Press number “1” to display current trouble codes.
   b. Press number “2” to display historic trouble codes.
   c. Press number “3” to clear trouble codes. See Clearing Codes below.
2. When examining trouble codes, write down all codes on a piece of paper. If a current trouble code exists, place it at the top of the list.
   a. If trouble codes are present, see Table 3-12. Follow the applicable flow charts for each code.
   b. If trouble codes are NOT present, but starting or driveability problems are evident, see symptoms charts under Section 3.12 INITIAL DIAGNOSTIC CHECK: TSM/TSSM.
   c. After reading current/historic trouble codes, simply press the mode key to return to the trouble codes menu.
3. Press the mode key again to return to the diagnostic menu. In this manner, regardless of where the operator is in the program, the mode key need only be pressed once or twice to return to the main menu.
4. After correcting system problems, clear trouble codes using the trouble codes menu of the scanalyzer.

Clearing Codes

The Scanalyzer allows the operator to clear trouble codes from memory as well as differentiate between current and historic codes.

NOTE

For more detailed instructions, refer to the literature provided with the Scanalyzer.

REMOVAL

1. Turn Ignition/Light Key Switch to OFF. Set Engine Stop/Run Switch to the STOP position.
2. Unplug Scanalyzer from data link connector. Install protective plug.

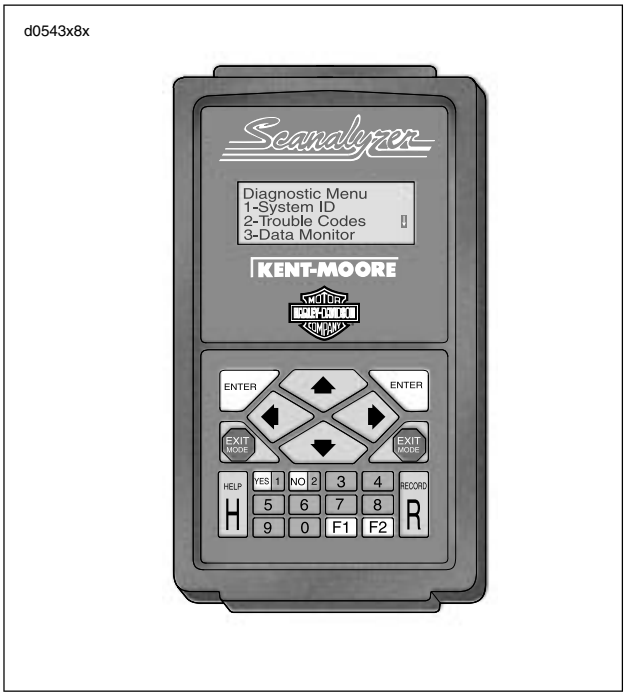


Figure 3-15. Scanalyzer Diagnostic Menu

3. Install right side cover and saddlebag.
4. Road test vehicle and observe security lamp. Confirm proper operation without the reoccurrence of trouble codes. See Section 3.8 CHECKING FOR TROUBLE CODES: TSM/TSSM.

INITIAL DIAGNOSTIC CHECK: TSM/TSSM 3.12

GENERAL

To locate faulty circuits or other system problems, follow the diagnostic flow charts in this section. For a systematic approach, always begin with INITIAL DIAGNOSTICS which follows. Read the general information and then work your way through the flow chart box by box.

Diagnostic Notes

If a numbered circle appears adjacent to a flow chart box, then more information is offered in the diagnostic notes. Many diagnostic notes contain supplemental information, descriptions of various diagnostic tools or references to other parts of the manual where information on the location and removal of components may be obtained.

Scanalyzer Icon

The Scanalyzer icon appears at those points in the flow chart where the Scanalyzer may be used. If a number is printed next to the icon, then refer to the Scanalyzer notes, which are similar to the diagnostic notes, but are restricted to information on the use of the Scanalyzer. All Scanalyzer notes may be found at the end of the respective flow chart.

Circuit Diagram/Wire Harness Connector Table

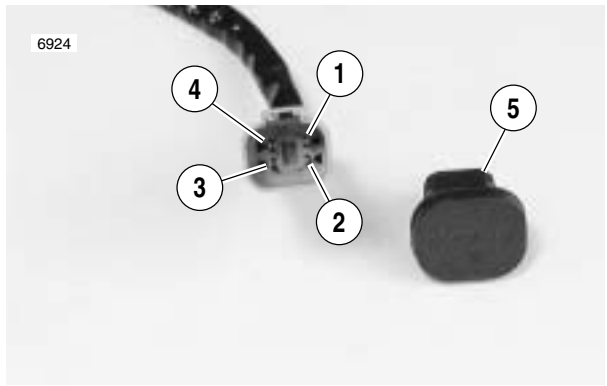
When working through a flow chart, refer to the illustrations, the associated circuit diagram and the wire harness connector table as necessary. The wire harness connector table for each circuit diagram identifies the connector number, description, type and general location.

In order to perform most diagnostic routines, a Breakout Box and a DVOM are required. See Section 3.10 BREAKOUT BOX: TSM/TSSM.

To perform the circuit checks with any degree of efficiency, a familiarity with the various wire connectors is also necessary. See the appendix or electrical section of your service manual.

Job/Time Code Values

Dealership technicians filing warranty claims should use the job/time code values printed in **bold text** underneath the appropriate repair.



1. **Terminal 1: flash pin (Lt GN/R)**
2. **Terminal 2: ground (BK)**
3. **Terminal 3: serial data (Lt GN/V)**
4. **Terminal 4: power (GY)**
5. **Protective cap**

Figure 3-16. Data Link Connector

INITIAL DIAGNOSTICS

Diagnostic Tips

- If the Scanalyzer is not working properly, check operation on another vehicle.

NOTE

The Scanalyzer can only be used to diagnose TSM/TSSM problems on fuel injected motorcycles.

- If proper Scanalyzer function is verified, check serial data connector [91A] for 12 volts (Terminal 4) and proper ground (Terminal 2).
- If Scanalyzer reads “No Response” with the Ignition/Light Key Switch turned to IGNITION (Engine Stop/Run Switch at RUN with the engine off), check serial data for an open or short to ground between data connector Terminal 3 and ECM or TSSM.
- Check for an open diagnostic test terminal between data connector Terminal 3 and TSM/TSSM. With Ignition/Light Key Switch turned to IGNITION, transmit serial data connector should have 0.6-0.8 volts within a typical range of 0-7.0 volts.

Table 3-12. TSM/TSSM Diagnostic Trouble Codes (DTC) and Fault Conditions

DTC	TURN SIGNAL LAMP CODE	FAULT CONDITION	SOLUTION
N/A	N/A	No security lamp at key ON	3.13 NO SECURITY LAMP AT KEY ON
N/A	N/A	Security lamp on continuously	3.14 SECURITY LAMP ON CONTINUOUSLY
N/A	N/A	Fob signal to TSSM weak or fails	3.15 KEY FOB SIGNAL TO TSSM WEAK OR FAILS
B0563	11	Battery voltage high	3.17 DTC B0563 (EFI), DTC 11 (CARB)
B1121	21	Left turn output fault	3.16 TURN SIGNAL ERRORS
B1122	22	Right turn output fault	3.16 TURN SIGNAL ERRORS
N/A	25	Ignition enable output high	3.18 DTC 25 (CARB ONLY)
B1131	31	Alarm output low	3.19 DTC B1131/ B1132 (EFI), DTC 31/32 (CARB)
B1132	32	Alarm output high	3.19 DTC B1131/ B1132 (EFI), DTC 31/32 (CARB)
B1134	34	Starter output high	3.20 DTC B1134 (EFI), DTC 34 (CARB)
B1135	35	Accelerometer fault	3.22 DTC B1135 (EFI), DTC 35 (CARB)
B1141	41	Ignition switch open/low	3.16 TURN SIGNAL ERRORS
B1151	51	Sidecar BAS low	3.21 DTC B1151/ B1152/ B1153 (EFI), DTC 51/52/53 (CARB)
B1152	52	Sidecar BAS high	3.21 DTC B1151/ B1152/ B1153 (EFI), DTC 51/52/53 (CARB)
B1153	53	Sidecar BAS out of range	3.21 DTC B1151/ B1152/ B1153 (EFI), DTC 51/52/53 (CARB)
U1016	14	Loss of all ECM serial data (state of health)	3.23 DTC U1016 (EFI), DTC 14/24/33/43 (CARB)
U1016	24	Loss of vehicle speed	3.23 DTC U1016 (EFI), DTC 14/24/33/43 (CARB)
U1016	33	Loss of vehicle inhibit motion	3.23 DTC U1016 (EFI), DTC 14/24/33/43 (CARB)
U1016	43	Loss of powertrain security status	3.23 DTC U1016 (EFI), DTC 14/24/33/43 (CARB)
U1300	13	Serial data low	5.14 STARTS, THEN STALLS
U1301	23	Serial data high	5.14 STARTS, THEN STALLS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the diagnostic check flow charts.

1. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), black socket probes and patch cord.
2. Connect BREAKOUT BOX (Part No. HD-43876) to ECM. See Section 5.7 BREAKOUT BOX: EFI.

Multiple Trouble Codes

The following notes apply to Table 3-12.

- Serial data codes (DTC U1300 and U1301) may be accompanied by other codes. **Always** correct the serial data codes before resolving the other codes.
- DTCs that have a current fault status take priority over historic status codes.
- Codes listed in **BOLD** apply to fuel injected models only.

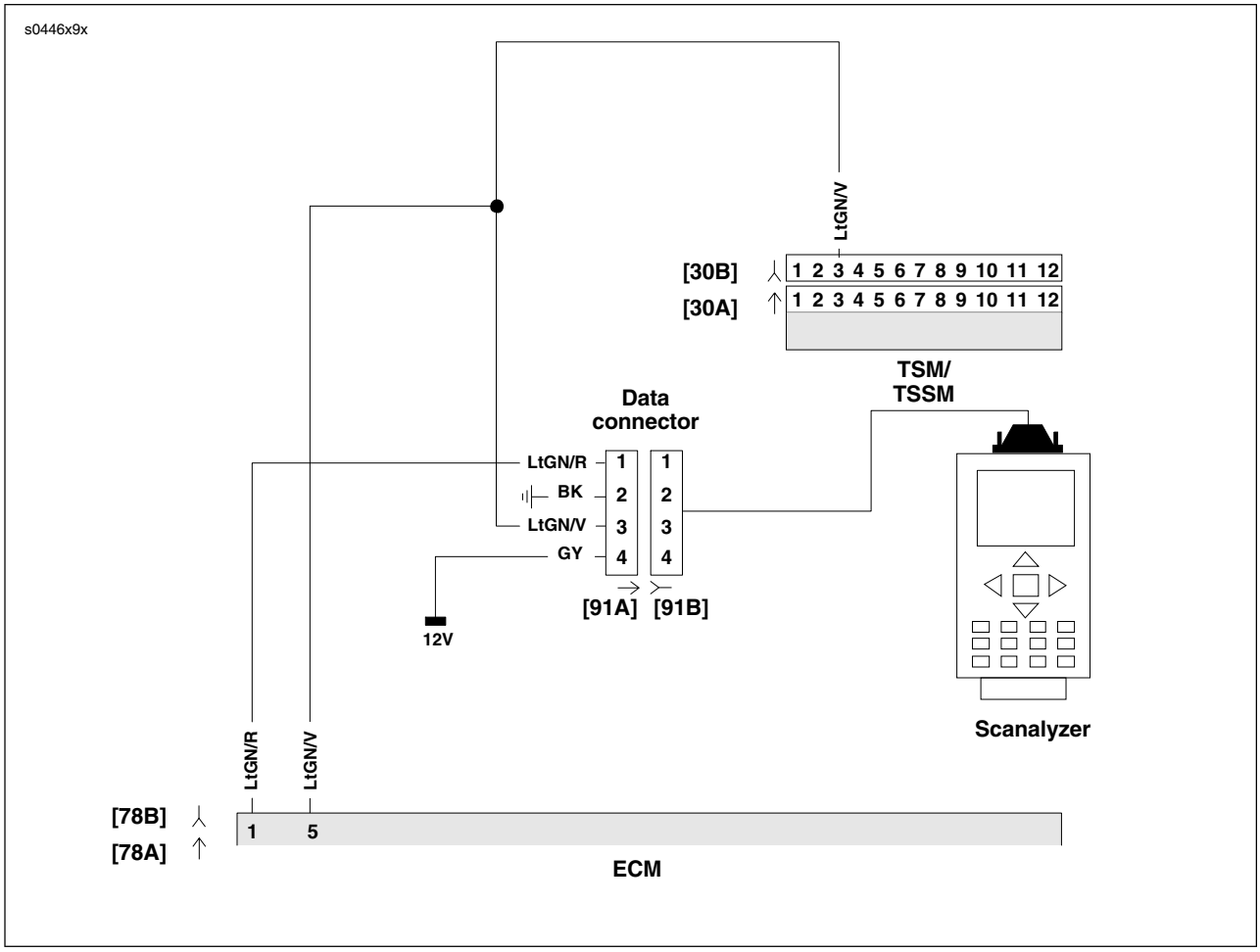
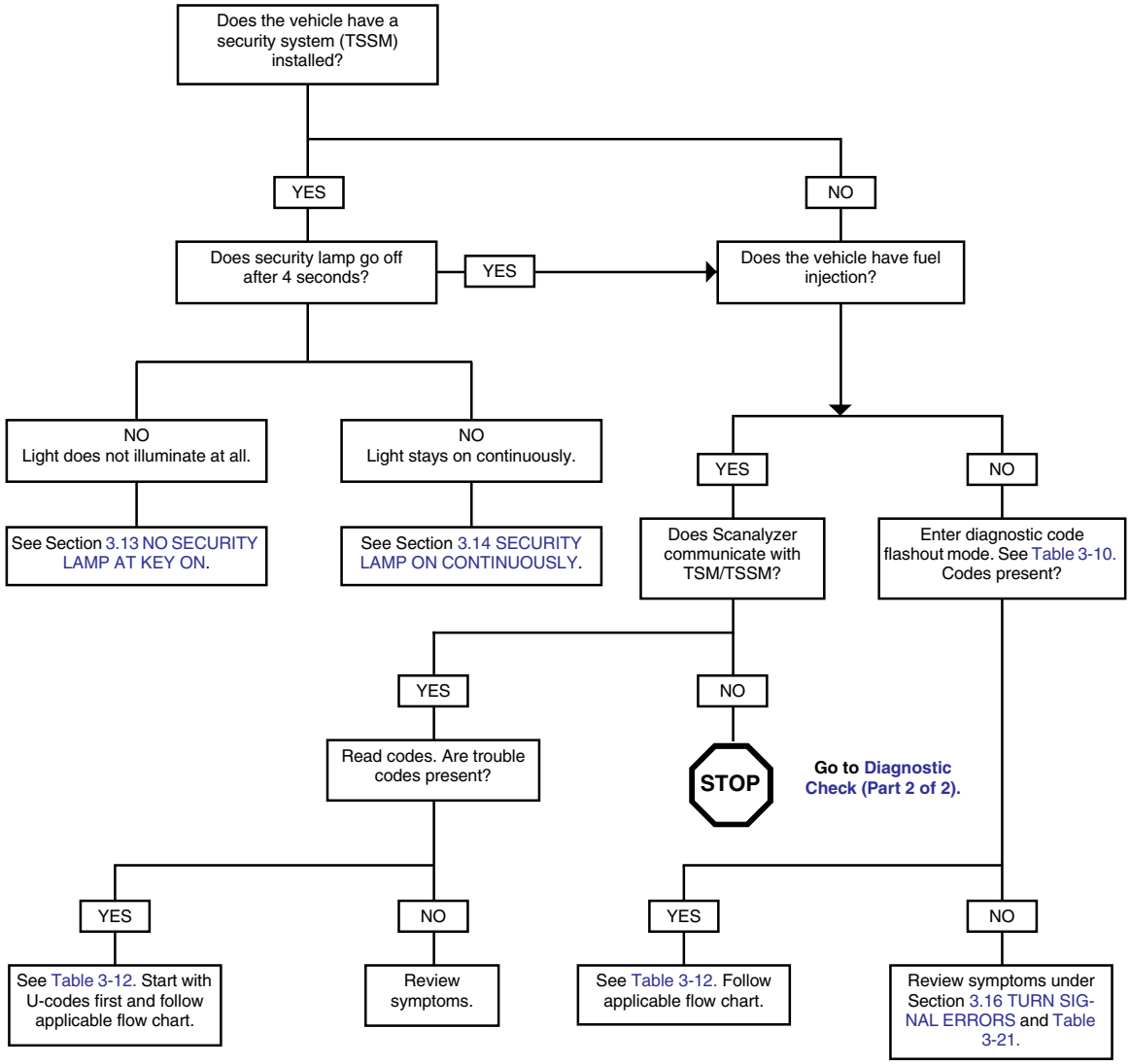


Figure 3-17. Diagnostic Check: EFI Models

Table 3-13. Wire Harness Connectors in Figure 3-17.

NO.	DESCRIPTION	TYPE	LOCATION
[30]	TSM/TSSM	12-Place Deutsch	Cavity in Crossmember at Rear of Battery Box (Under Seat)
[78]	ECM	36-Place Packard	Under Right Side Cover
[91A]	Data Link	4-Place Deutsch	Under Right Side Cover

Diagnostic Check (Part 1 of 2)



IMPORTANT NOTE

For the first three ignition cycles after a fault has occurred, the turn signals flash six fast four-way flashes shortly after key ON.

Diagnostic Check (Part 2 of 2)

Continued from Diagnostic Check (Part 1 of 2).

(1)
(2)

Test the four data connector terminals for continuity.

DATA TERMINAL		TERMINAL	
Pin	Wire Color	Pin	Connector
1	Lt. GN/R	1	[78B]
2	BK	28	[78B]
3	Lt. GN/V	5	[78B]
4	GY	GY terminal on left side of ignition fuse	

Continuity present in all four circumstances?

- YES → Check Scanalyzer on another vehicle. Scanalyzer OK?
  - YES → Disconnect ECM at [78]. Does Scanalyzer display TSM/TSSM data.
    - YES → Replace ECM. Reprogram and learn password. **7125**
    - NO → (2) Remove TSM/TSSM connector [30]. Check for continuity to ground at data connector [91A] Terminal 3. Continuity to ground?
      - YES → Locate and repair short to ground. **7115**
      - NO → Check for voltage at pin 3 of data connector [91A]. Voltage present?
        - YES → Locate and repair short to voltage. **7115**
        - NO → Replace TSM/TSSM. Reprogram and learn password. **7126**
  - NO → Scanalyzer malfunction.
- NO → Inspect terminals for damage or repair opens as necessary. **7120**

Clear codes and confirm proper operation with no check engine lamp.

NOTES

NO SECURITY LAMP AT KEY ON 3.13

GENERAL

No TSSM Power

See Figure 3-18. When the Ignition/Light Key Switch is turned to IGNITION, the security lamp should illuminate for 4 seconds. Following the initial period of illumination, the lamp should go off for 4 seconds. It may then come back on for an 8 second period (historic code) or remain on (current code).

Ground is supplied to the lamp bulb. Battery voltage is supplied by the TSSM through the BN/V wire. A lack of power to the TSSM will cause the security lamp to be inoperative and will also create a no start situation.

Table 3-15. Models Affected

VEHICLE	EFI	CARBURETOR
SECURITY	Yes	Yes
NO SECURITY	No	No

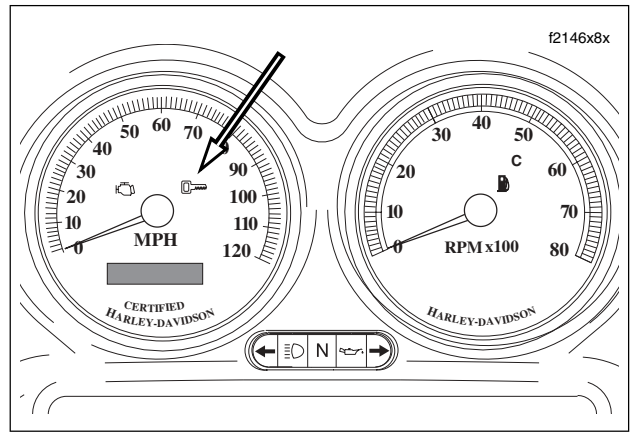


Figure 3-18. Security Lamp

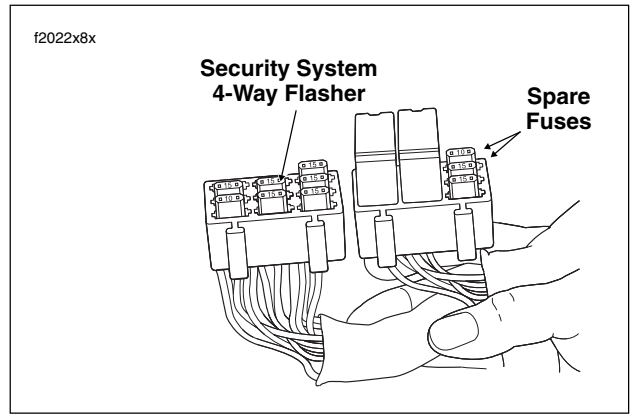


Figure 3-19. Left Side Cover Removed

DIAGNOSTICS

Diagnostic Tips

- Check for open in BN/V wire.
- Check for blown security fuse. See Figure 3-19.

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 3.13 flow charts.

1. Connect BREAKOUT BOX (Part No. HD-42682) between wire harness and TSSM. See Section 3.10 BREAKOUT BOX: TSM/TSSM.
2. Connector [39B] is at the back of the speedometer. Leave connector halves mated to test. Insert probe into wire end of connector [39B] until contact is made with backside of terminal. If necessary, use a fine paper clip to avoid damage.
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), purple pin probe and patch cord between breakout Breakout Box and ground. Align blade with slot in terminal of Breakout Box.
4. Security lamp failure requires speedometer replacement. See SPEEDOMETER, REMOVAL/INSTALLATION, in the 2003 Touring Models Service Manual (Part Number 99483-03).

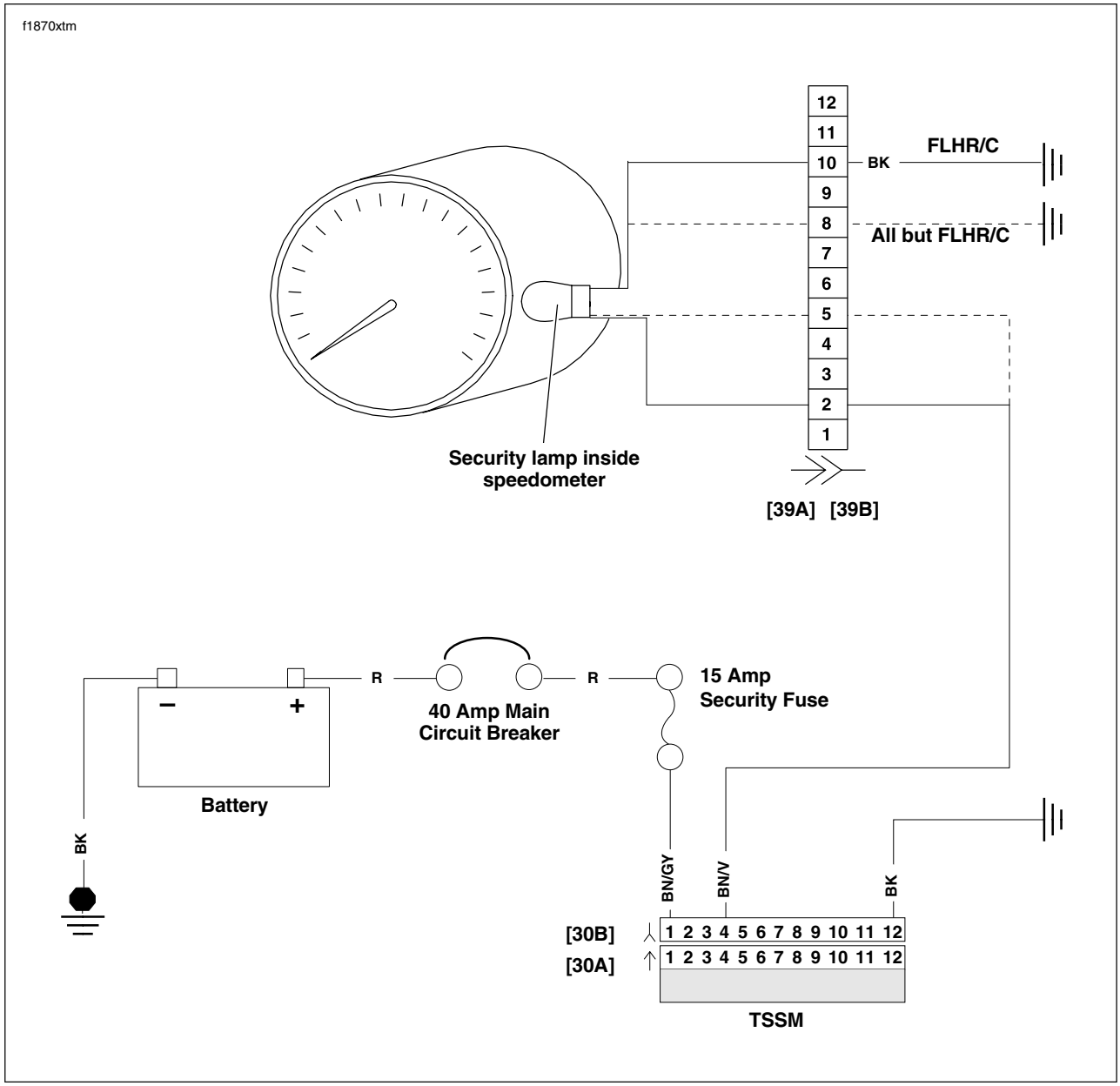


Figure 3-20. Security Lamp Circuit

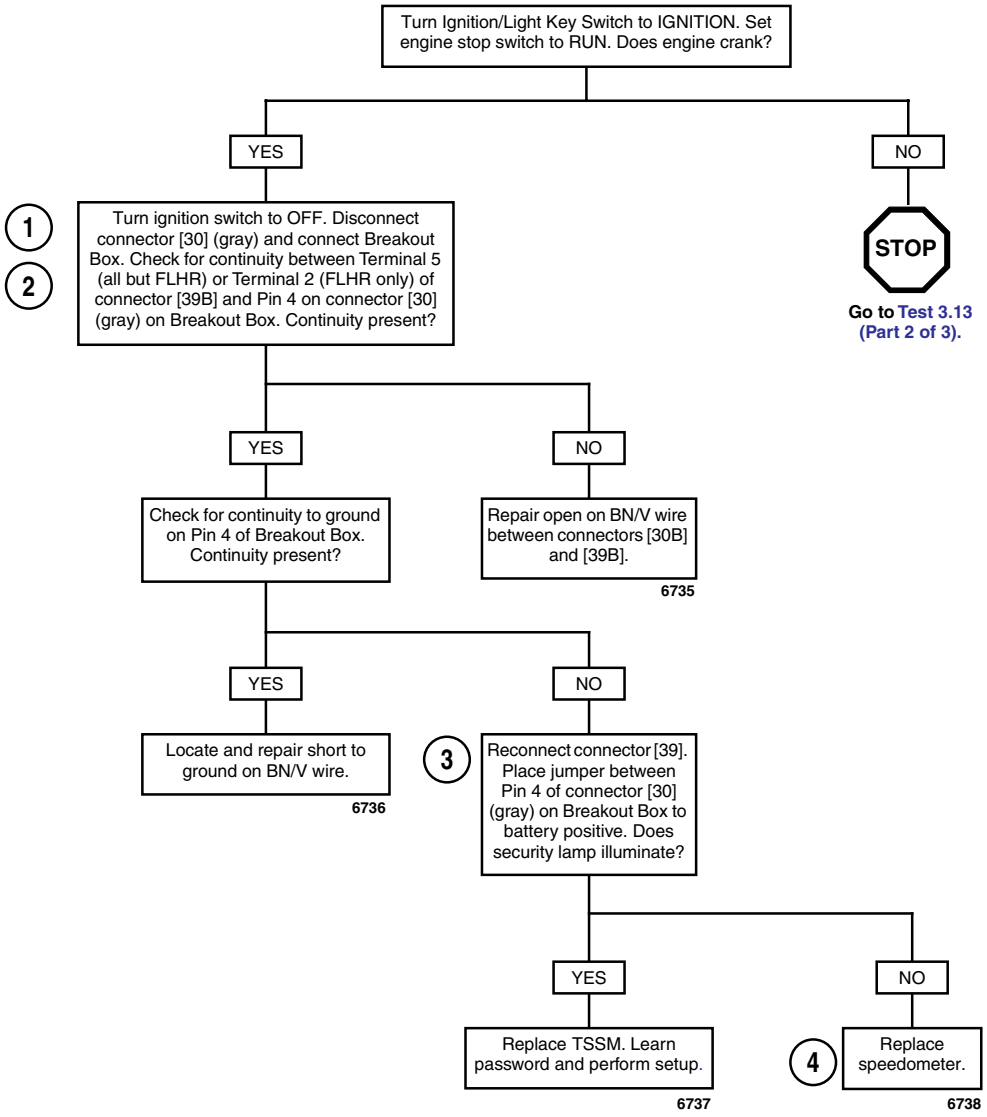
Table 3-16. Wire Harness Connectors in Figure 3-20.

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[30]	TSSM	All	12-Place Deutsch	Cavity in Crossmember at Rear of Battery Box (Under Seat)
[39]	Speedometer	FLHT/C/U	12-Place Packard	Inner Fairing (Back of Speedometer)
		FLTR	12-Place Packard	Under Bezel (Back of Speedometer)
		FLHR/C	12-Place Mini-Deutsch	Under Console (Back of Speedometer)

Test 3.13 (Part 1 of 3)

NO SECURITY LAMP A KEY ON

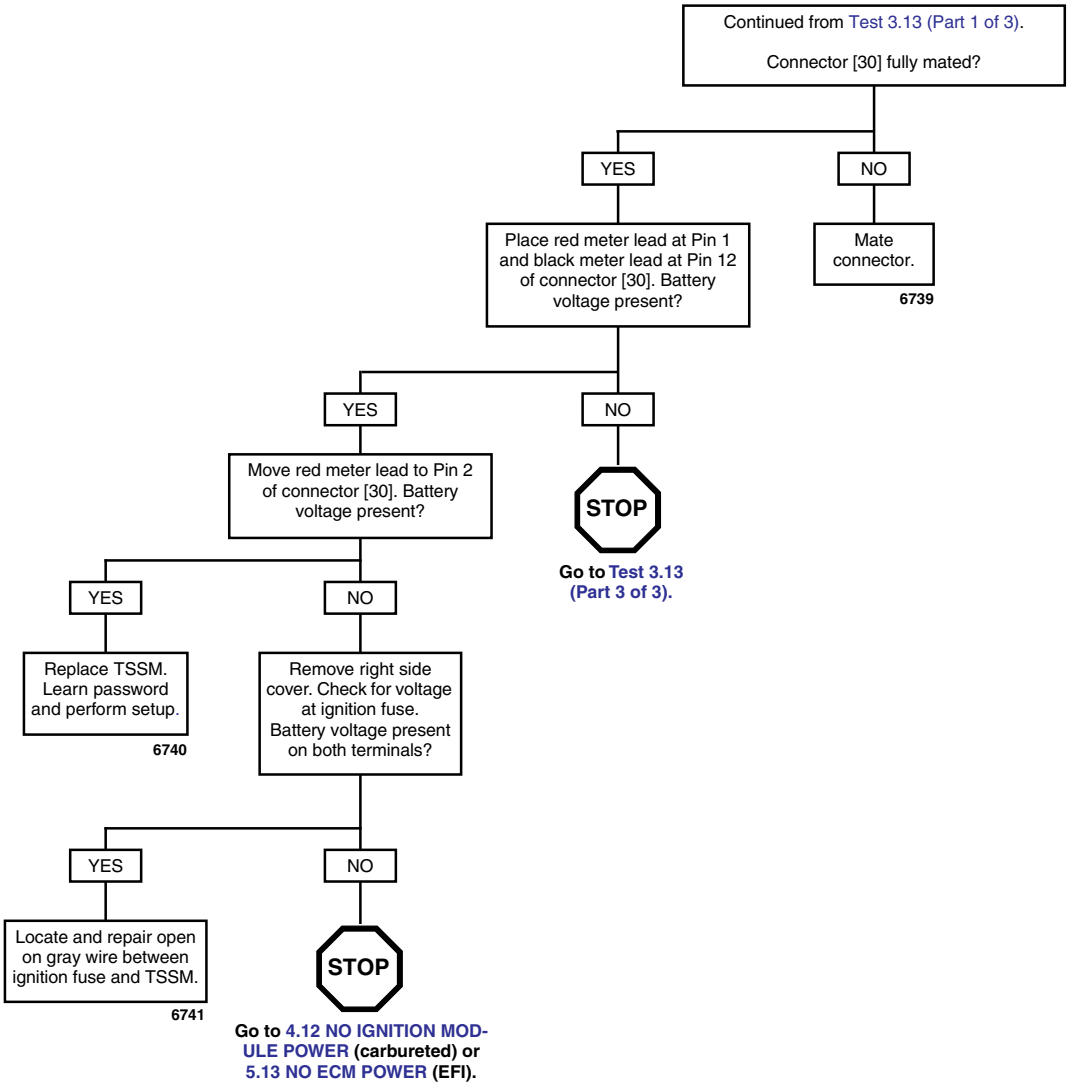
Security equipped vehicles only.



Clear codes and confirm proper operation with no security lamp.

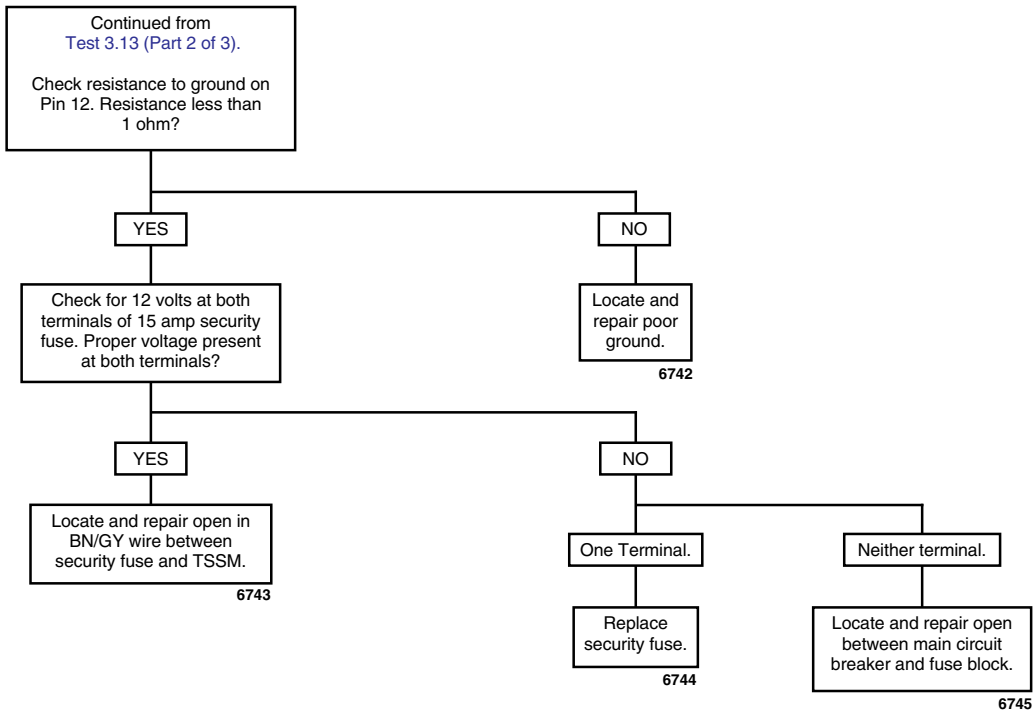
Test 3.13 (Part 2 of 3)

NO SECURITY LAMP A KEY ON



Test 3.13 (Part 3 of 3)

NO SECURITY LAMP A KEY ON



Clear codes and confirm proper operation with no security lamp.

SECURITY LAMP ON CONTINUOUSLY 3.14

GENERAL

See Figure 3-21. When the Ignition/Light Key Switch is turned to IGNITION, the security lamp should illuminate for 4 seconds. Following the initial period of illumination, the lamp should go off for 4 seconds. It may then come back on for an 8 second period (historic code) or remain on (current code).

Table 3-17. Models Affected

VEHICLE	EFI	CARBURETOR
SECURITY	Yes	Yes
NO SECURITY	No	No

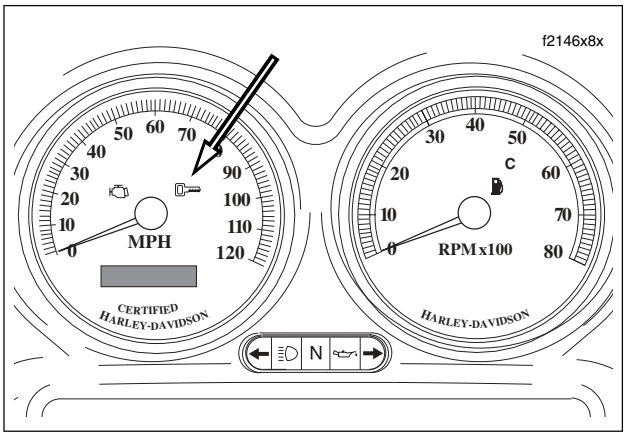


Figure 3-21. Security Lamp

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 3.14 flow chart.

1. Connector [39B] is on the back of the speedometer. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), black pin probe and patch cord.

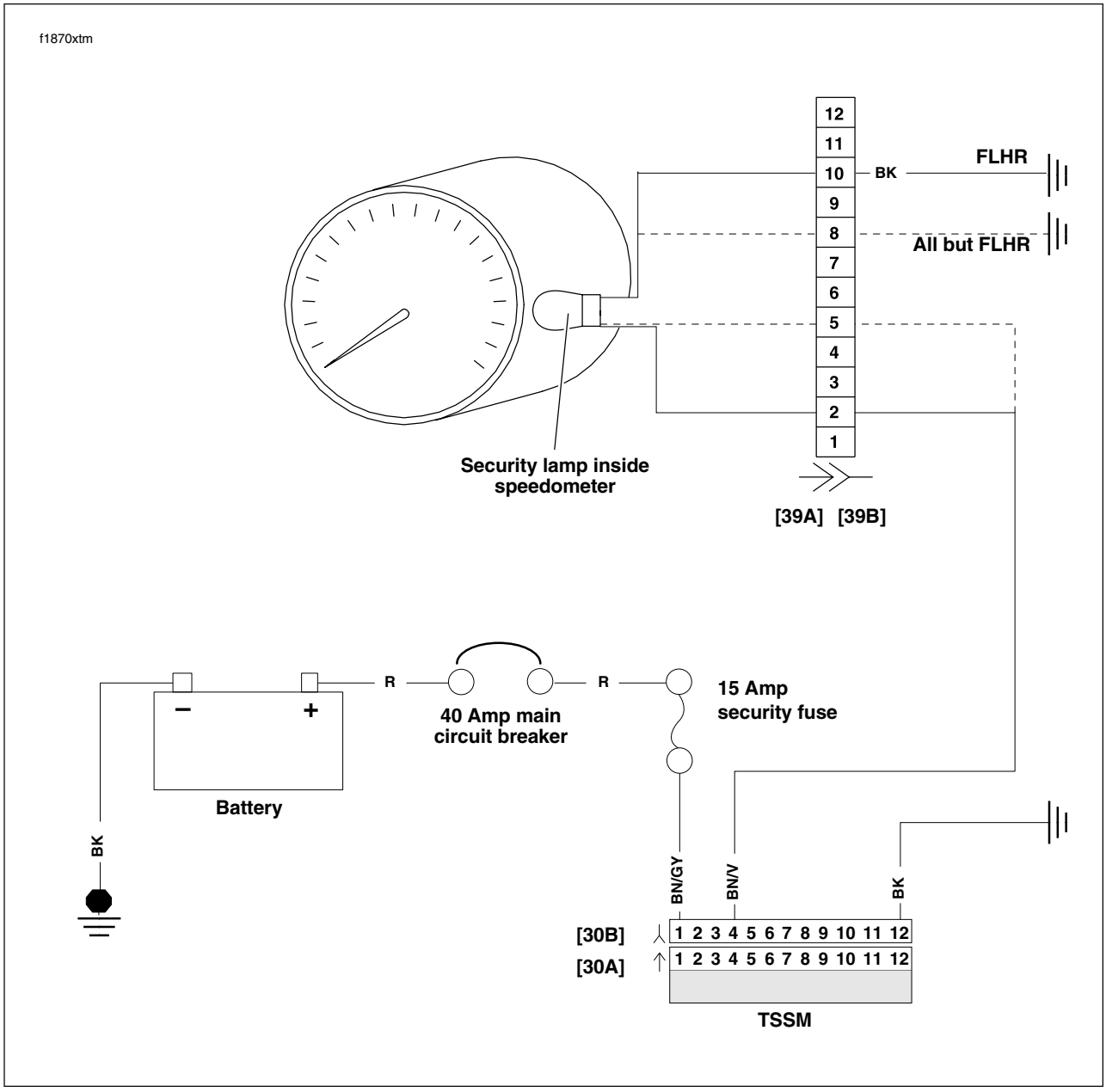


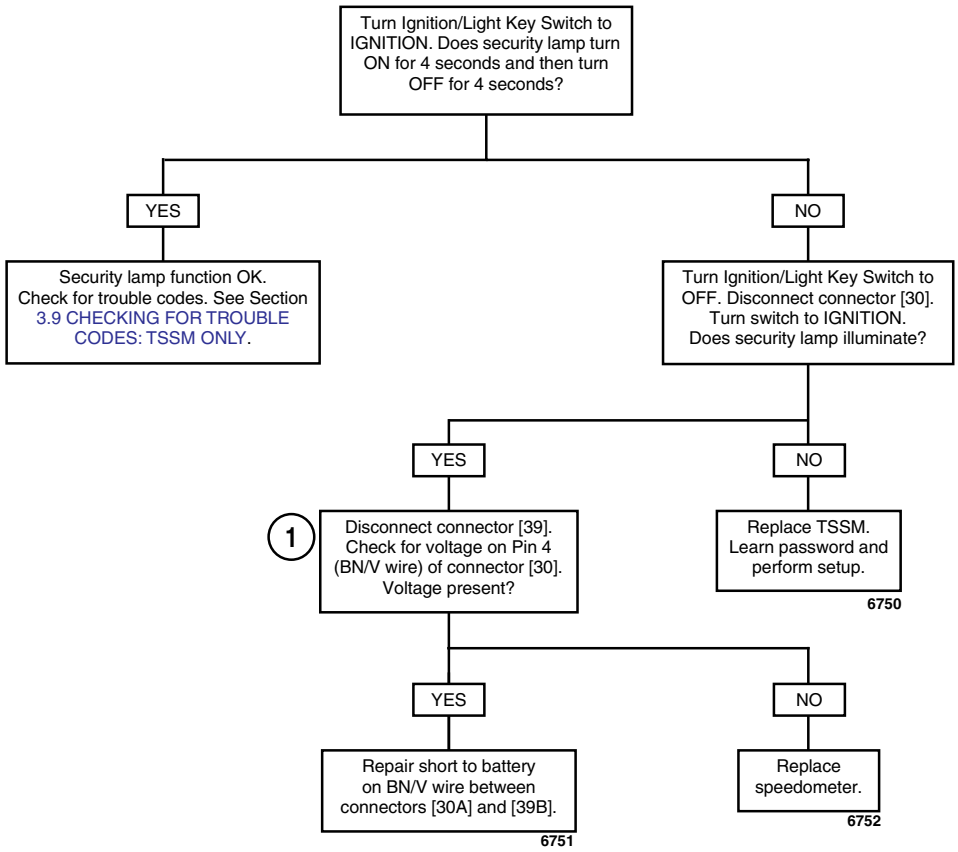
Figure 3-22. Security Lamp Circuit

Table 3-18. Wire Harness Connectors in Figure 3-22.

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[30]	TSSM	All	12-Place Deutsch	Cavity in Crossmember at Rear of Battery Box (Under Seat)
[39]	Speedometer	FLHT/C/U	12-Place Packard	Inner Fairing (Back of Speedometer)
		FLTR	12-Place Packard	Under Bezel (Back of Speedometer)
		FLHR/C	12-Place Mini-Deutsch	Under Console (Back of Speedometer)

Test 3.14

SECURITY LAMP ON CONTINUOUSLY



Clear codes and confirm proper operation with no security lamp.

KEY FOB SIGNAL TO TSSM WEAK OR FAILS 3.15

GENERAL

NOTE

*Disarming function may require practice. The key fob button **must** be pressed twice within 1.5 seconds to send the disarm command. The action is very similar to double-clicking a computer mouse. Light quick taps work best; very hard or very slow taps are less likely to work.*

See Figure 3-23. The key fob sends a RF signal to activate all remote TSSM functions. The left front turn signal switch wire serves as the vehicle's antenna. If the TSSM does not respond (no confirmation at arming/disarming system) or responds weakly (limited range, won't consistently arm/disarm or synchronize), follow the Test 3.15 flow chart.

Table 3-19. Models Affected

VEHICLE	EFI	CARBURETOR
SECURITY	Yes	Yes
NO SECURITY	No	No

DIAGNOSTICS

Diagnostic Tips

- Verify key fob battery is installed positive side down.
- Verify key fob battery voltage is approximately 3 volts.
- Interference from physical surroundings may affect RF transmission. Place fob next to left handgrip and disarm with two clicks or move motorcycle to a new location and retest.
- Check for damage to antenna wire. Does left turn signal work?

NOTE

See Section 3.7 ARMING/DISARMING SECURITY SYSTEM (TSSM). Use only the proper key fob for your market and TSSM package.

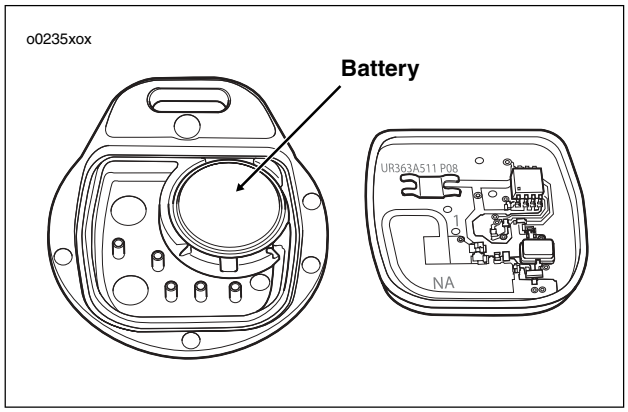


Figure 3-23. Open Key Fob

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 3.15 flow chart.

1. After a battery disconnect, the TSSM will not enter the configuration mode on the first attempt. All attempts to assign a fob or enter the configuration mode will require at least two attempts.

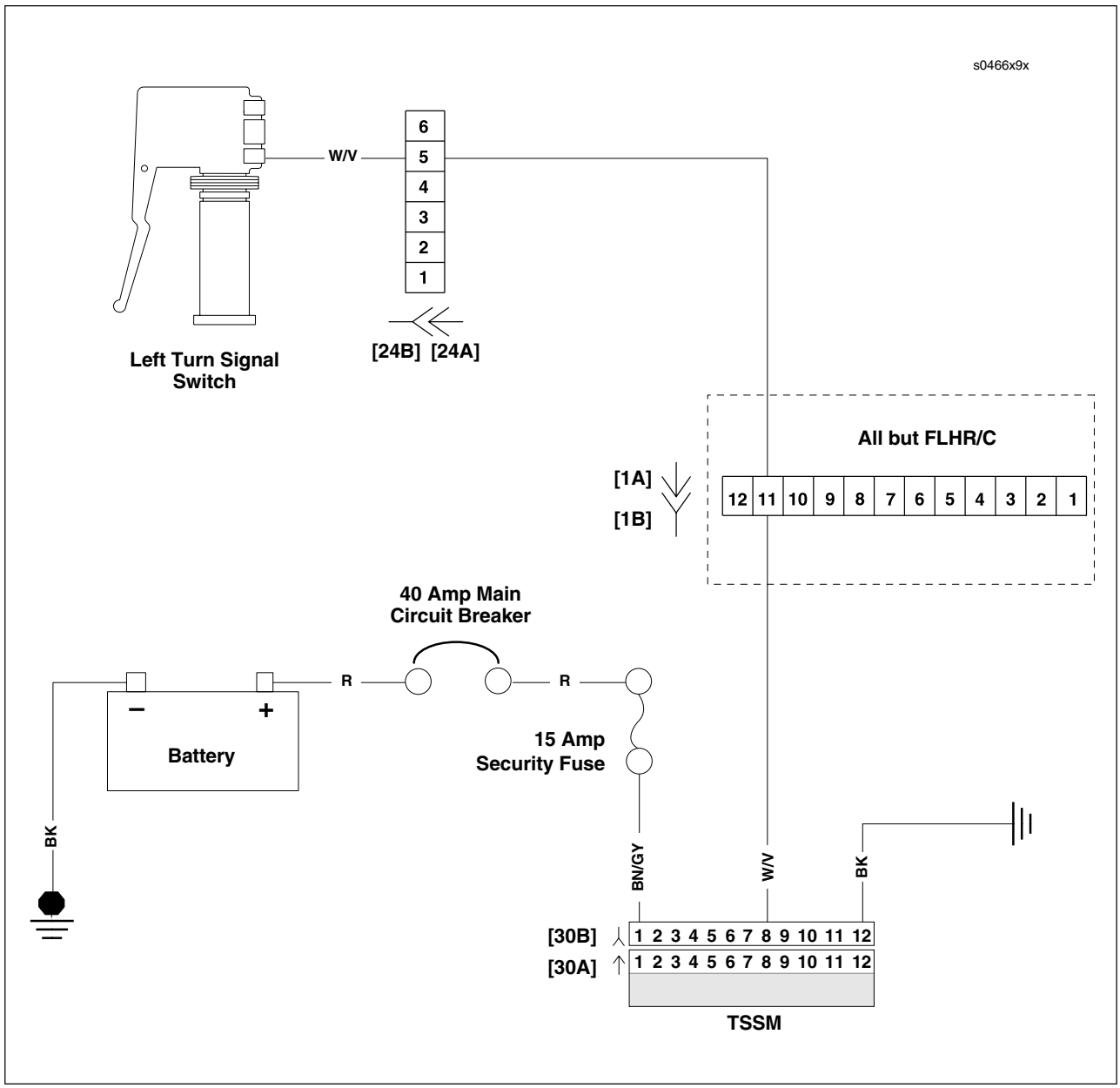


Figure 3-24. Starter/TSSM Circuit

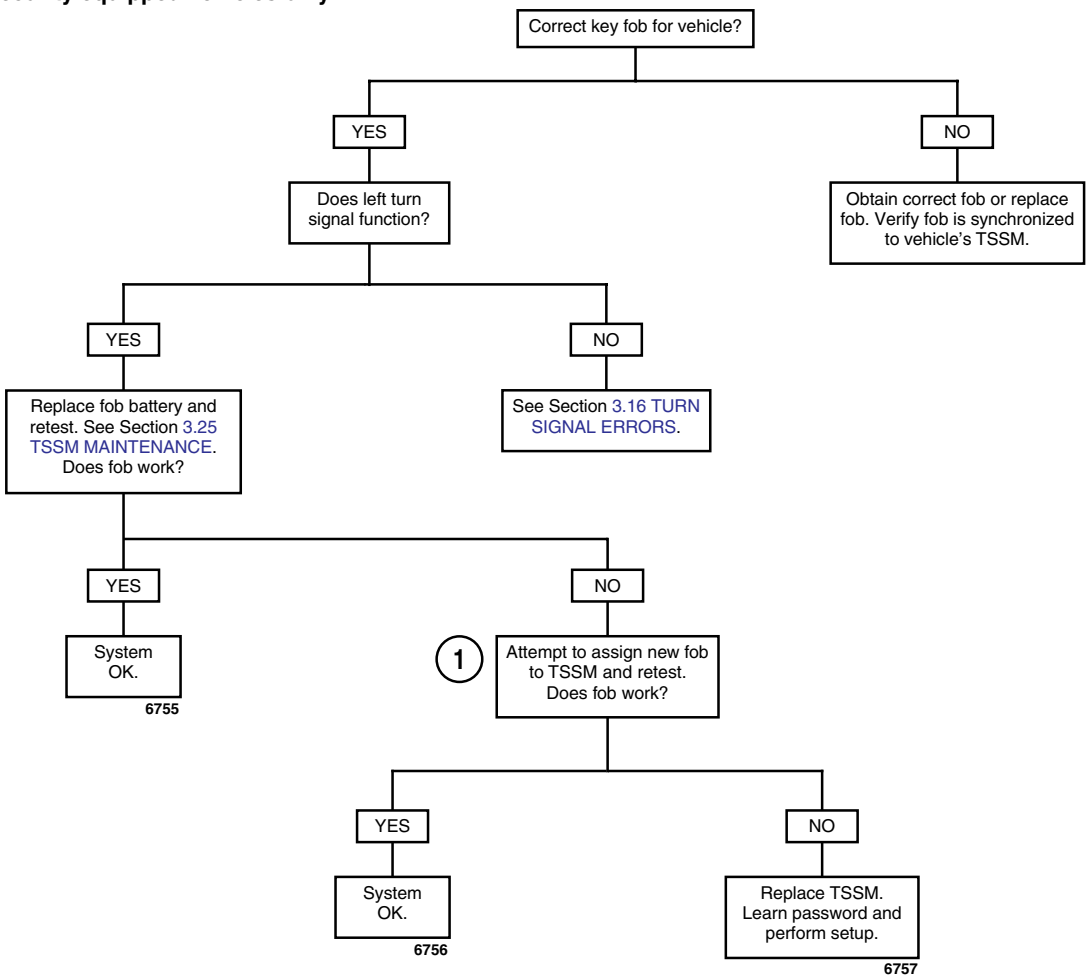
Table 3-20. Wire Harness Connectors in Figure 3-24.

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to Interconnect Harness	FLHT/C/U	12-Place Deutsch	Inner Fairing - Right Fairing Bracket
		FLTR	12-Place Deutsch	Inner Fairing - Below Radio (Right Side)
[24]	Left Handlebar Switch Controls	FLHT/C/U	12-Place Deutsch	Inner Fairing - Left Fairing Support Brace
		FLTR	12-Place Deutsch	Inner Fairing - Left Side of Radio Bracket
		FLHR/C	6-place Deutsch	Inside Headlamp Nacelle
[30]	TSSM	All	12-Place Deutsch	Cavity in Crossmember at Rear of Battery Box (Under Seat)

Test 3.15

FOB SIGNAL TO TSSM WEAK OR FAILS

Security equipped vehicles only.



TURN SIGNAL ERRORS 3.16

GENERAL

The turn signals will automatically cancel either based on the speed/acceleration of the vehicle or based upon turn completion. See Section 3.4 TSM/TSSM TURN SIGNAL FUNCTIONS.

For turn signal diagnostics, see Table 3-21.

DIAGNOSTICS

Diagnostic Tips

- On vehicles with a security system, DTC B1121 and B1122 will illuminate the security lamp.
- On vehicles with a security system, DTC B1141 will **not** illuminate the security lamp.
- When the TSM/TSSM is in four-way flasher mode, a fault on either the left or right turn lamp output will not cause either DTC B1121 and DTC B1122 to be set as current. If fault occurs on both left and right outputs, then both DTC B1121 and DTC B1122 will be set as current.



Figure 3-25. TSM/TSSM

- When the TSM/TSSM detects an over current (or short to ground) condition, it will turn off the turn lamp outputs. The outputs will be automatically reactivated once the fault is removed.

Table 3-21. Turn Signal Errors

SYMPTOM	MODEL	START WITH FLOW CHART	DTC
Turn signals will not cancel or cancel erratically	EFI	Turn Signal Error 1A	N/A
Turn signals will not cancel or cancel erratically	Carbureted	Turn Signal Error 2A	N/A
Turn signals will not flash, 4-way flashers inoperable	All	Turn Signal Error 3A	B1121, B1122, B1141 (EFI) 21, 22, 41 (CARB)
Left or right turn signals flash at double the normal rate while all bulbs are working	All	Turn Signal Error 3A	N/A

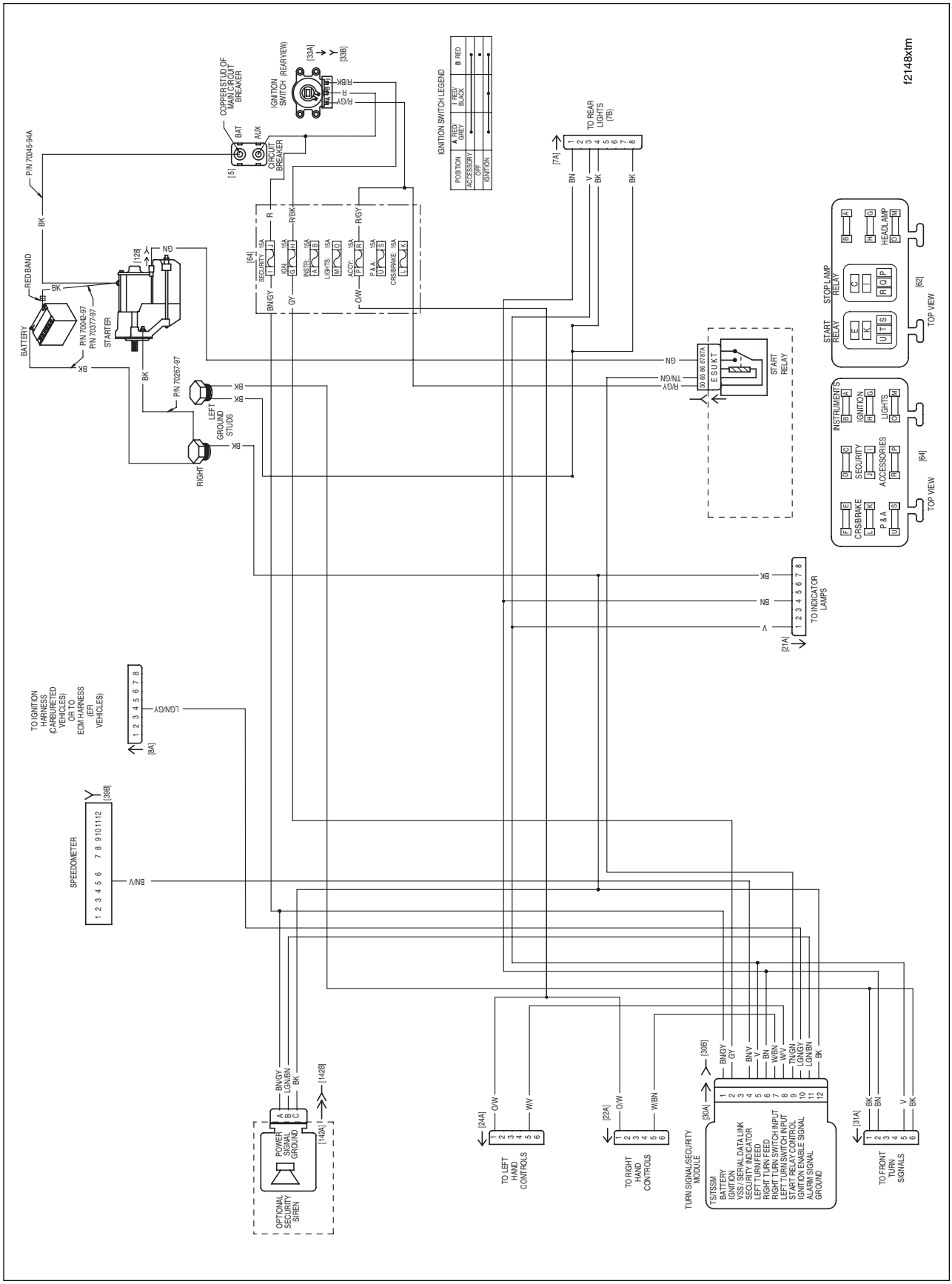


Figure 3-26. Turn Signal Circuit: FLHR/C/I

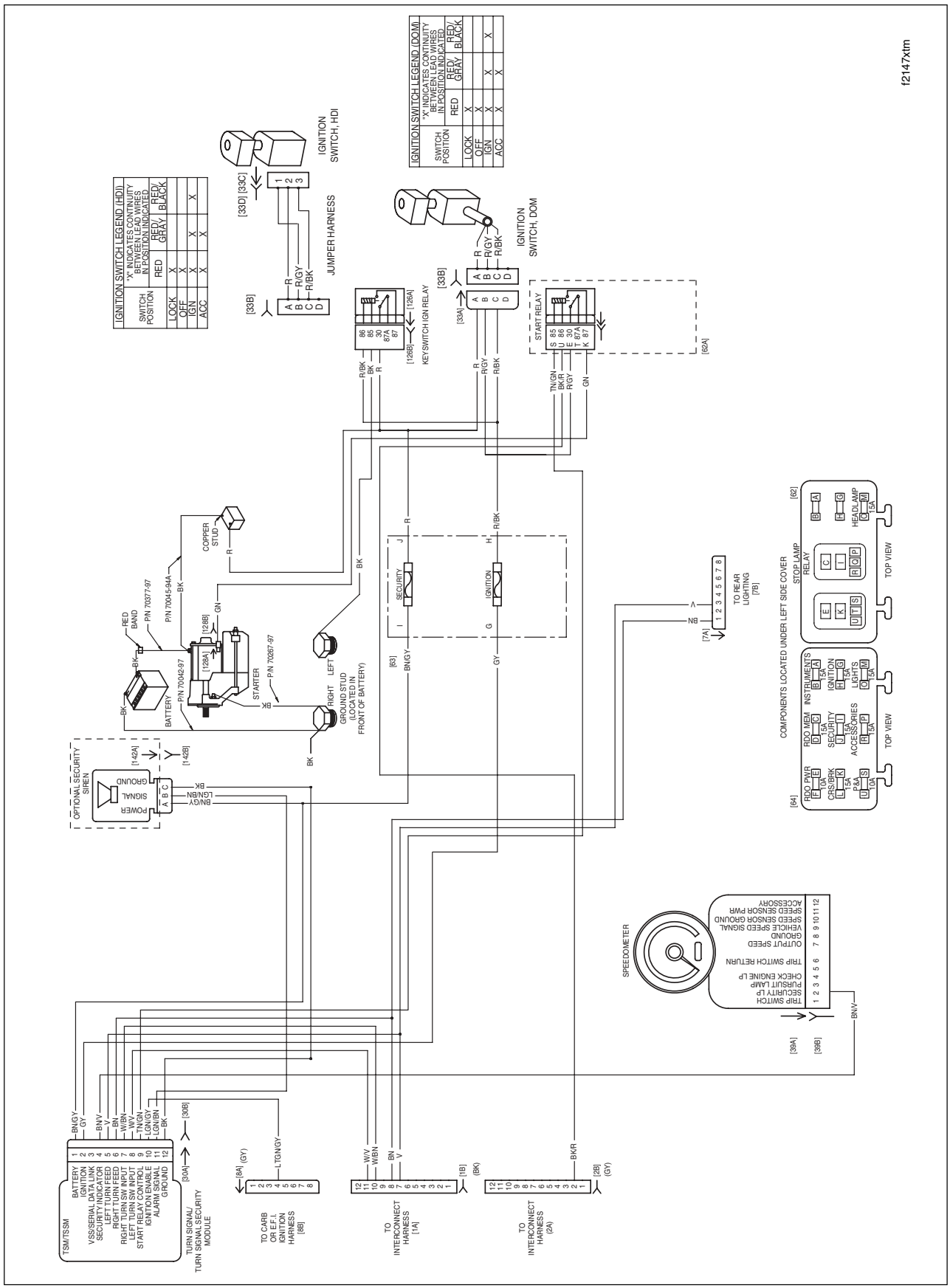


Figure 3-27. Turn Signal Circuit: FLHT/C/U, FLTR

Diagnostic Notes: All Turn Signal Flow Charts

The reference numbers below correlate with the circled numbers on the turn signal flow charts.

1. The turn signals will automatically cancel either based on the speed/acceleration of the vehicle or based upon turn completion. See Section 3.4 TSM/TSSM TURN SIGNAL FUNCTIONS.
2. See Figure 3-28. Use SPEEDOMETER TESTER (Part No. HD-41354) to input a signal which duplicates 3 MPH. Enter 70 into tester and watch for voltage drop on W/GN wire. If tester is not available, elevate rear wheel and spin briskly while looking for voltage drop on W/GN wire.
3. Use SPEEDOMETER TESTER (Part No. HD-41354) to input a signal which duplicates 20 MPH. Enter 431 into tester. If turn signals are working correctly, they will flash 20 times and then cancel.
4. Connect BREAKOUT BOX to ECM.
5. Use the following steps to enable diagnostic mode.
   a. See Figure 3-29. Depress odometer reset switch and turn Ignition/Light Key Switch to IGNITION.
   b. To clear codes, turn ignition switch from OFF to IGNITION while holding reset switch in.
   c. Press and release the reset switch to cycle through the codes. Set codes will display as Code d0xSet; holding the reset switch in will result in Code d0xClr being displayed. This indicates the code has been cleared.
   d. To return speedometer to normal operating state, cycle ignition key.
6. Connect BREAKOUT BOX (Part No. HD-42682) to TSM/TSSM. See Section 3.10 BREAKOUT BOX: TSM/TSSM.
7. Check for corrosion at rear fender lights harness connector [7], front turn signal connector [31] and TSSM connector [30].

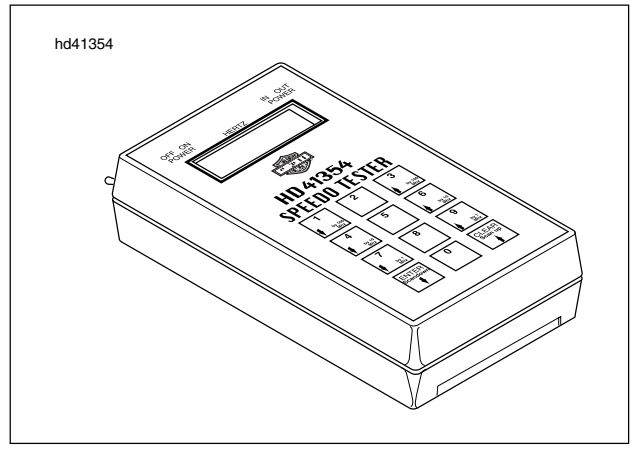


Figure 3-28. Speedometer Tester

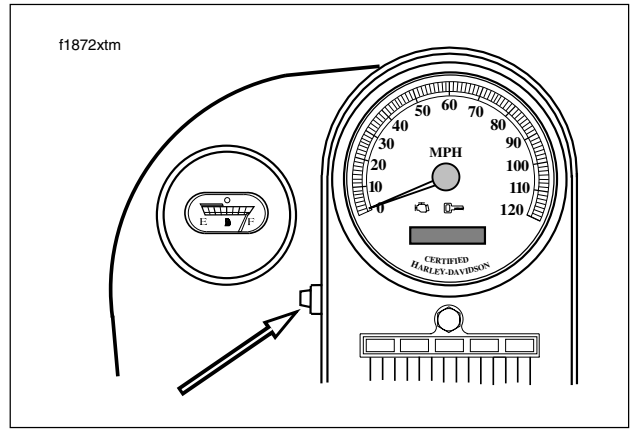
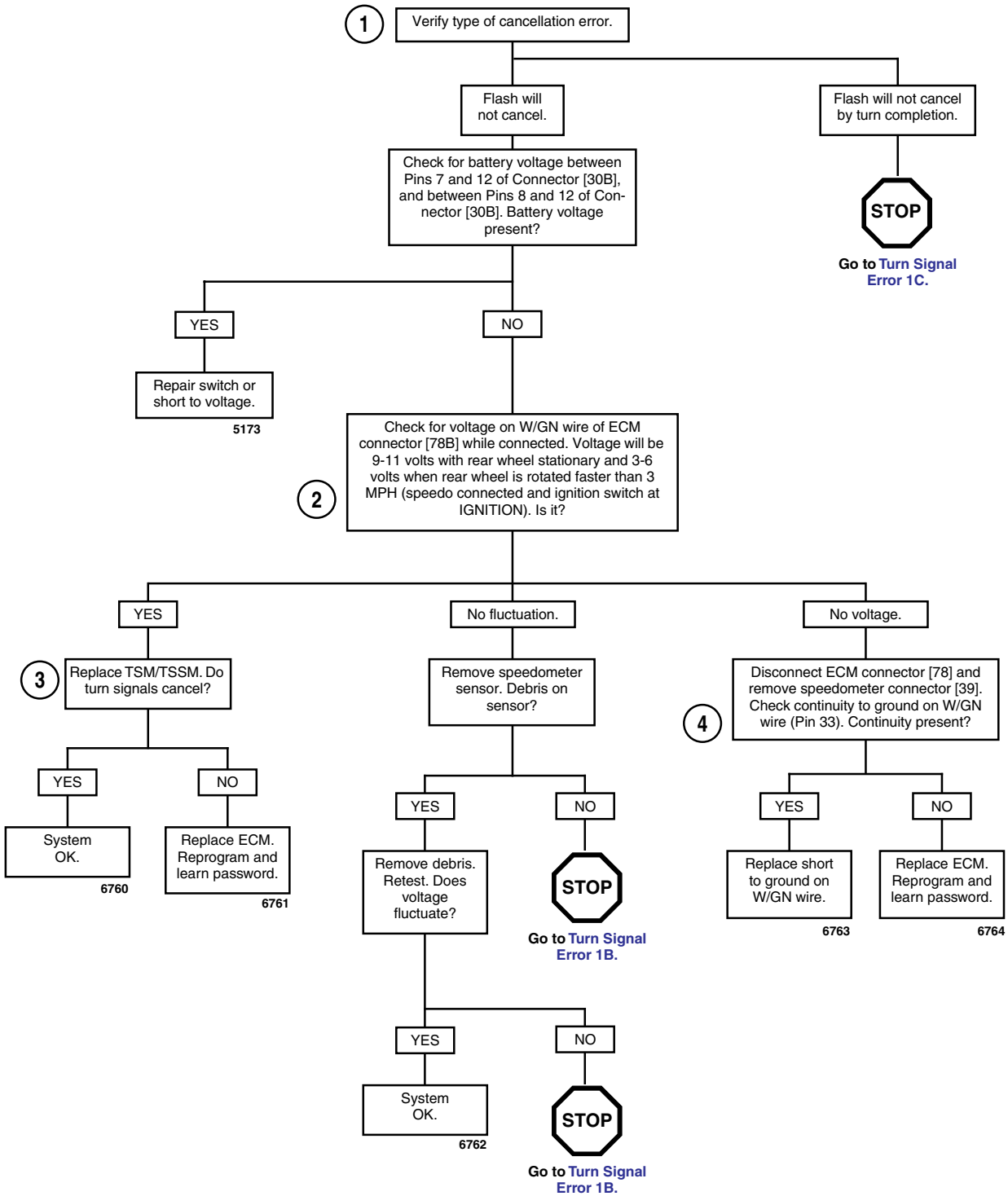


Figure 3-29. Odometer Reset Switch (FLHR/C)

Turn Signal Error 1A

WILL NOT CANCEL OR CANCEL ERRATICALLY (EFI MODELS ONLY)



Turn Signal Error 1B

WILL NOT CANCEL OR CANCEL ERRATICALLY (EFI MODELS ONLY)

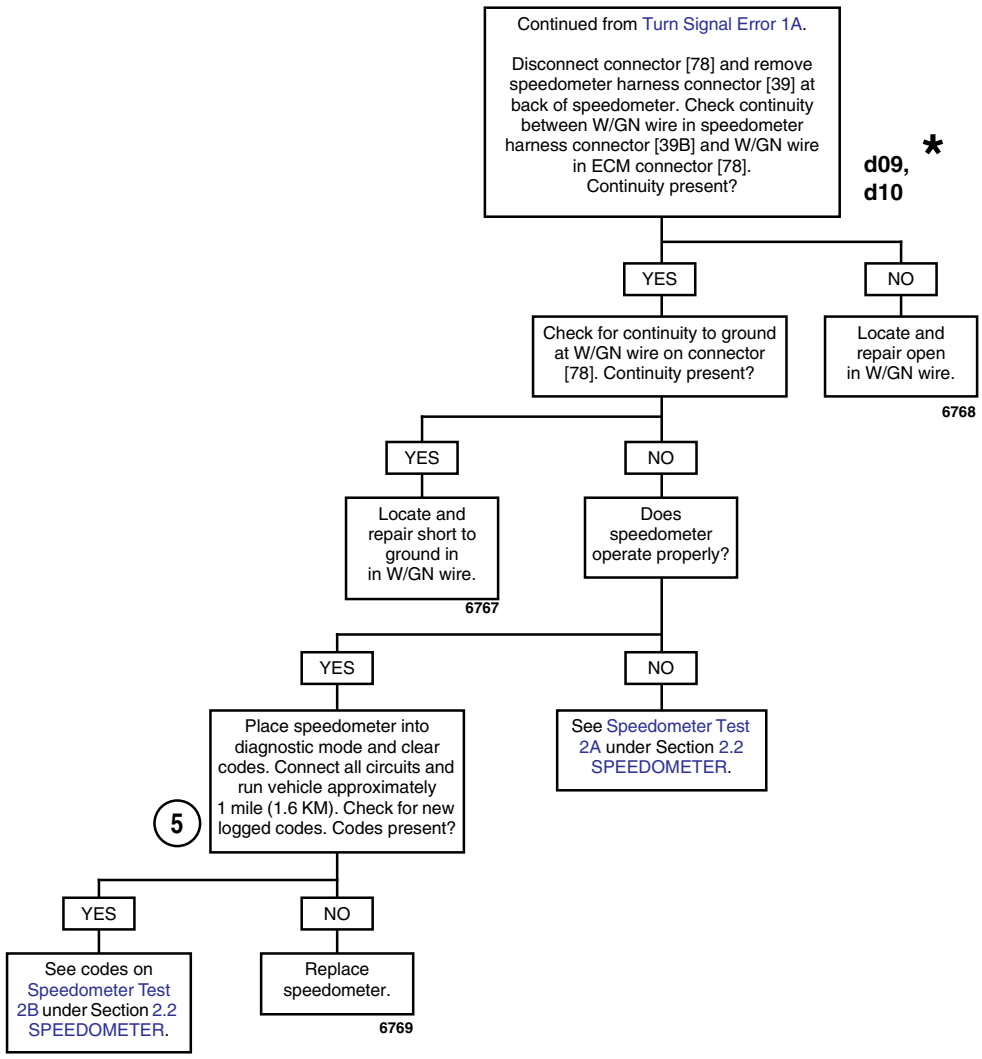
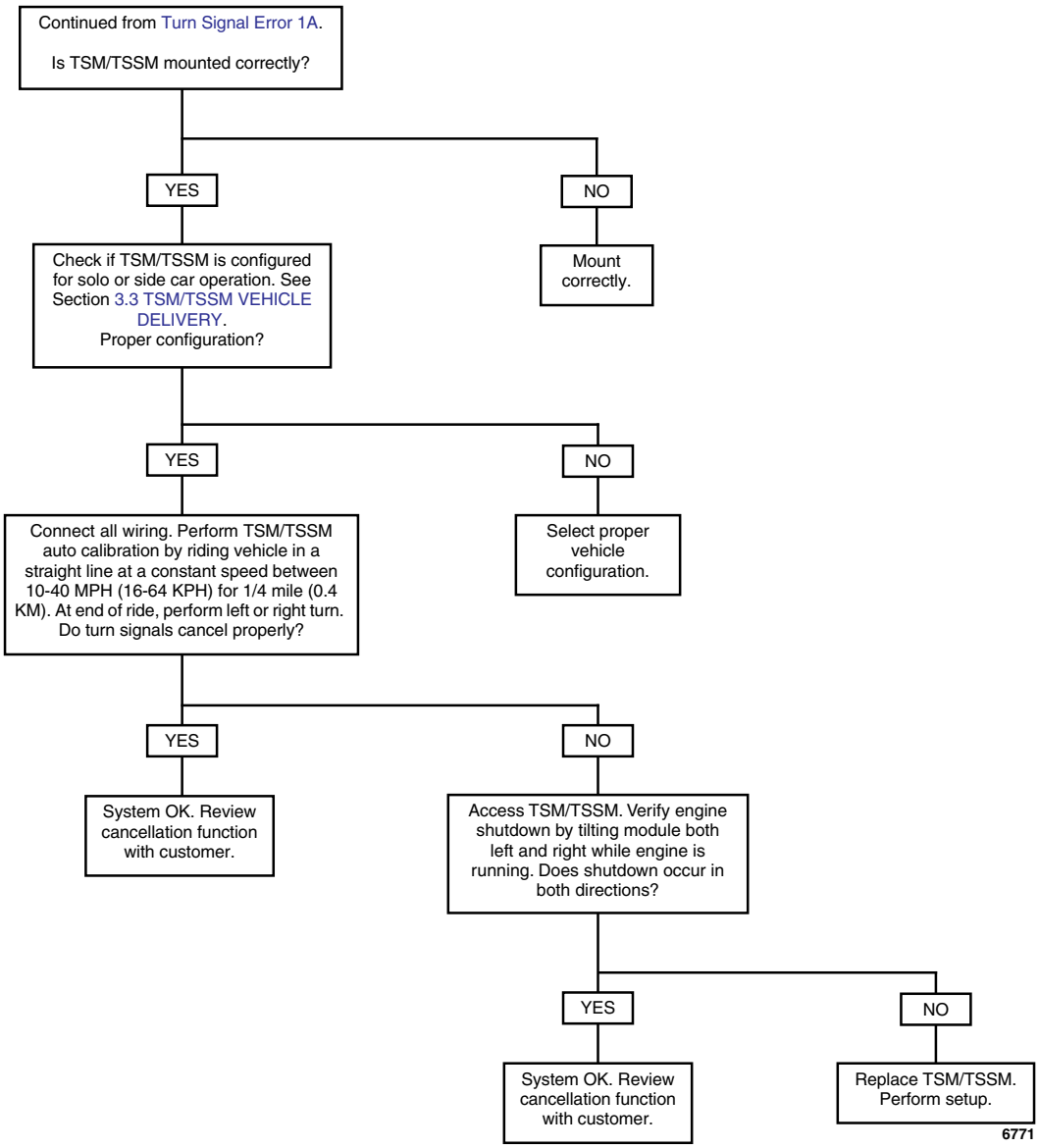


Table 3-22. Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[10]	Ignition Module	12-Place Deutsch (Black)	Under Right Side Cover
[11]	Ignition Module	12-Place Deutsch (Gray)	Under Right Side Cover
[18]	Left Rear Turn Signal	2-Place Multilock	Circuit Board Under Tail Lamp Assembly
[19]	Right Rear Turn Signal	2-Place Multilock	Circuit Board Under Tail Lamp Assembly
[22]	Right Handlebar Switch Controls	12-Place Deutsch (Black)	Inner Fairing- Right Fairing Support Brace
[24]	Left Handlebar Switch Controls	12-Place Deutsch (Gray)	Inner Fairing- Left Fairing Support Brace
[30]	TSM/TSSM	12-Place Deutsch	Cavity in Crossmember at Rear of Battery Box (Under Seat)
[31]	Front Turn Signals	6-Place Multilock	Inner Fairing- Inboard of Left Fairing Bracket

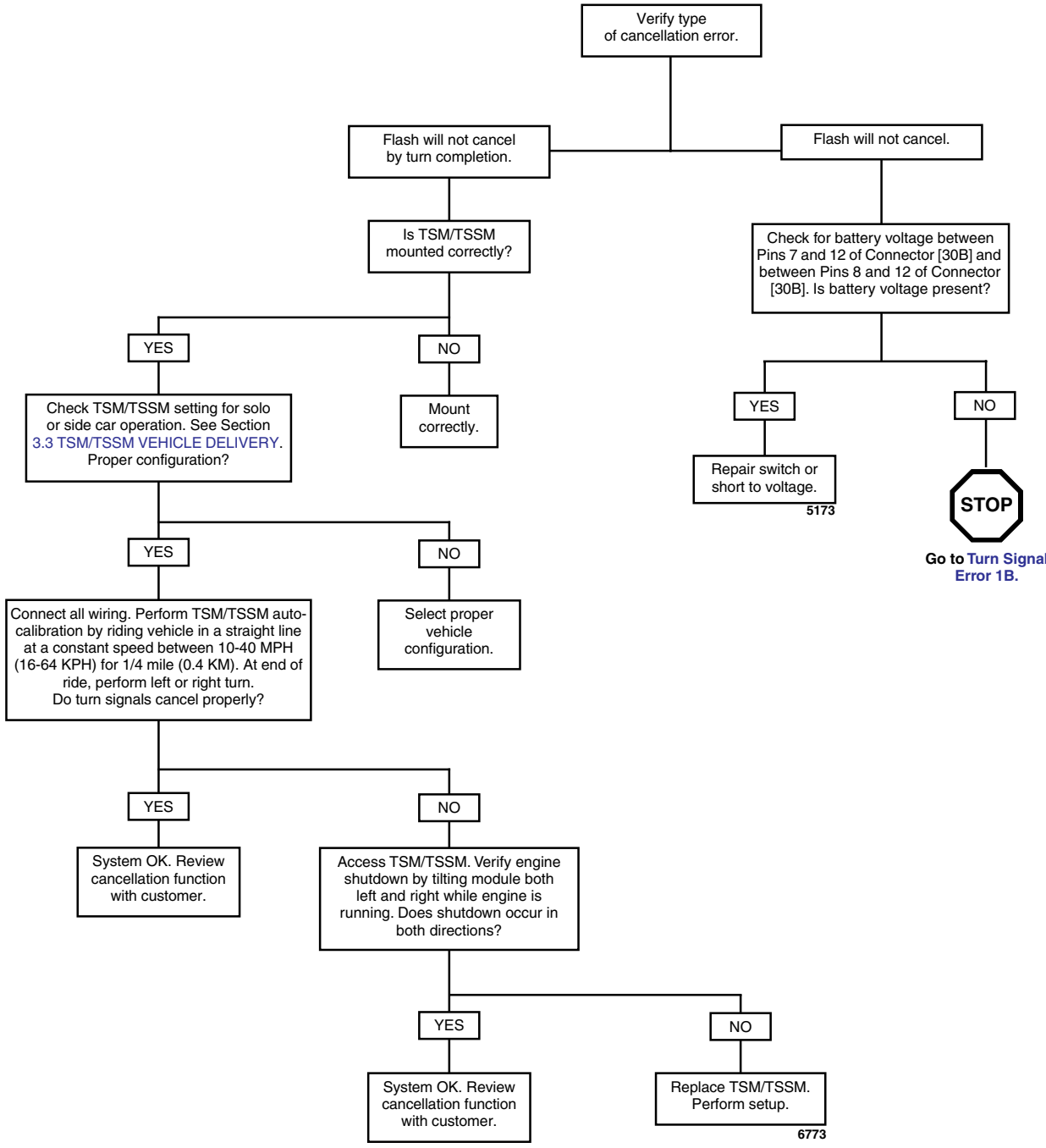
Turn Signal Error 1C

WILL NOT CANCEL OR CANCEL ERRATICALLY (EFI MODELS ONLY)



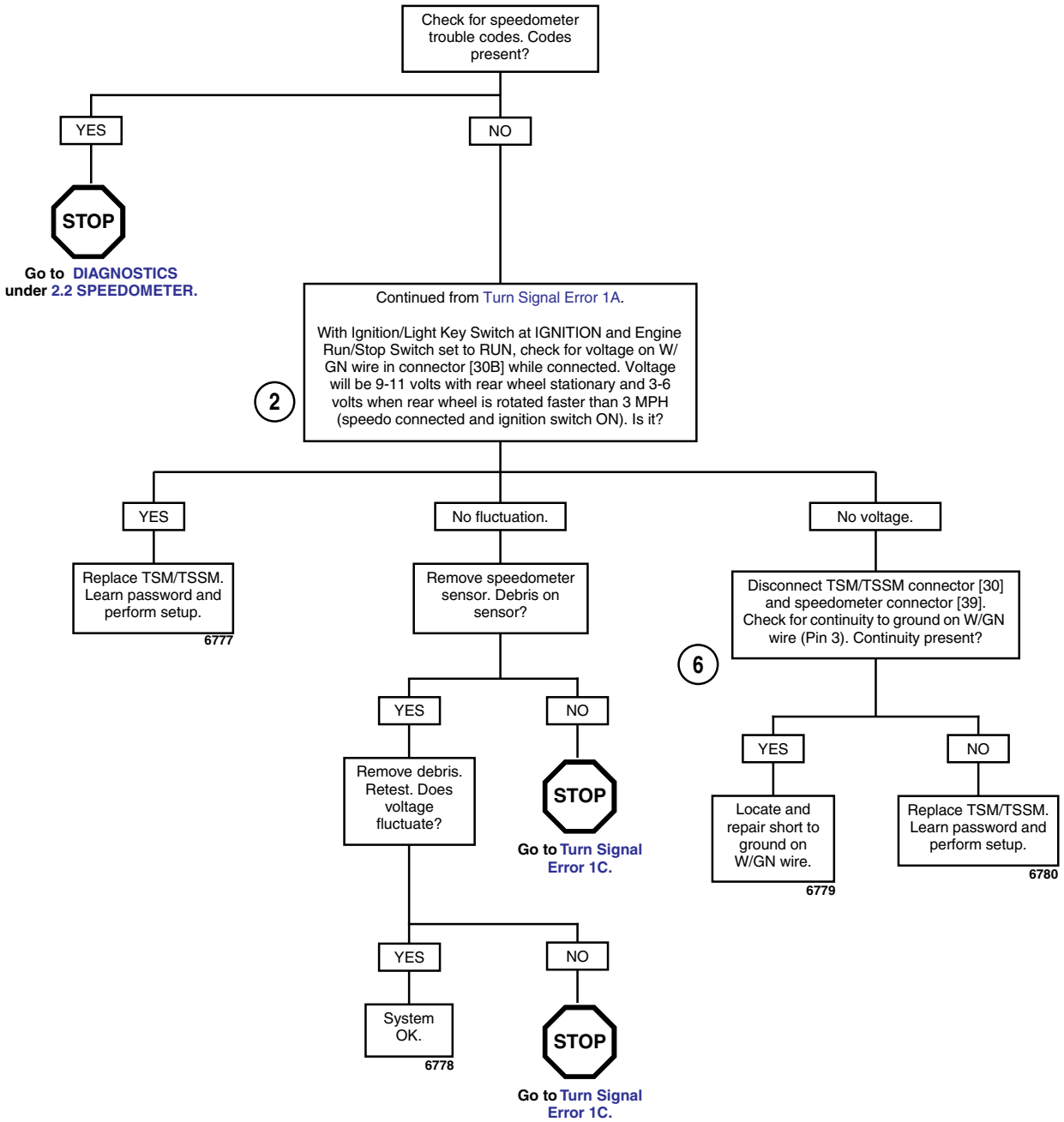
Turn Signal Error 2A

WILL NOT CANCEL OR CANCEL ERRATICALLY (CARBURETED MODELS ONLY)



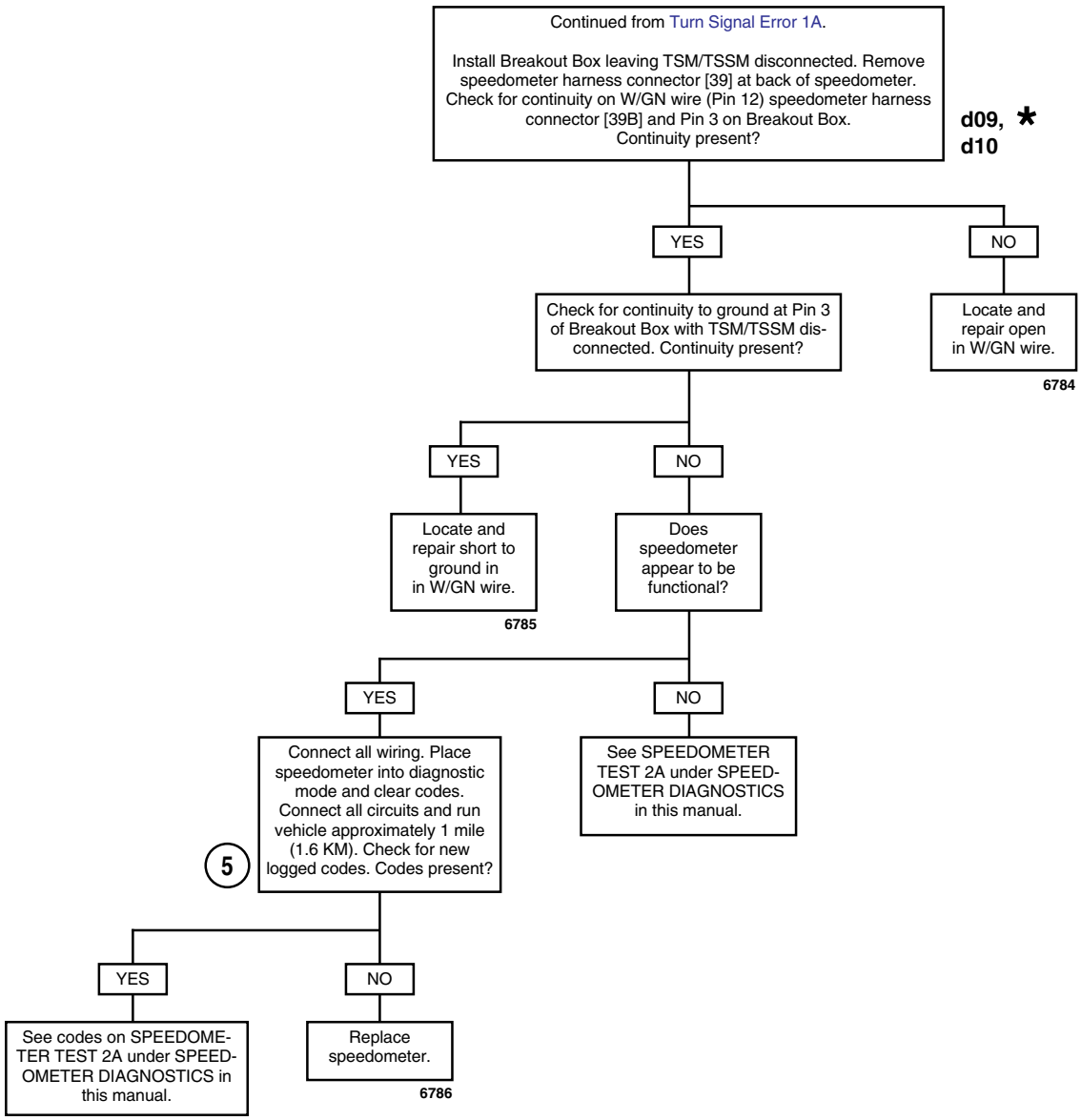
Turn Signal Error 2B

WILL NOT CANCEL OR CANCEL ERRATICALLY (CARBURETED MODELS ONLY)



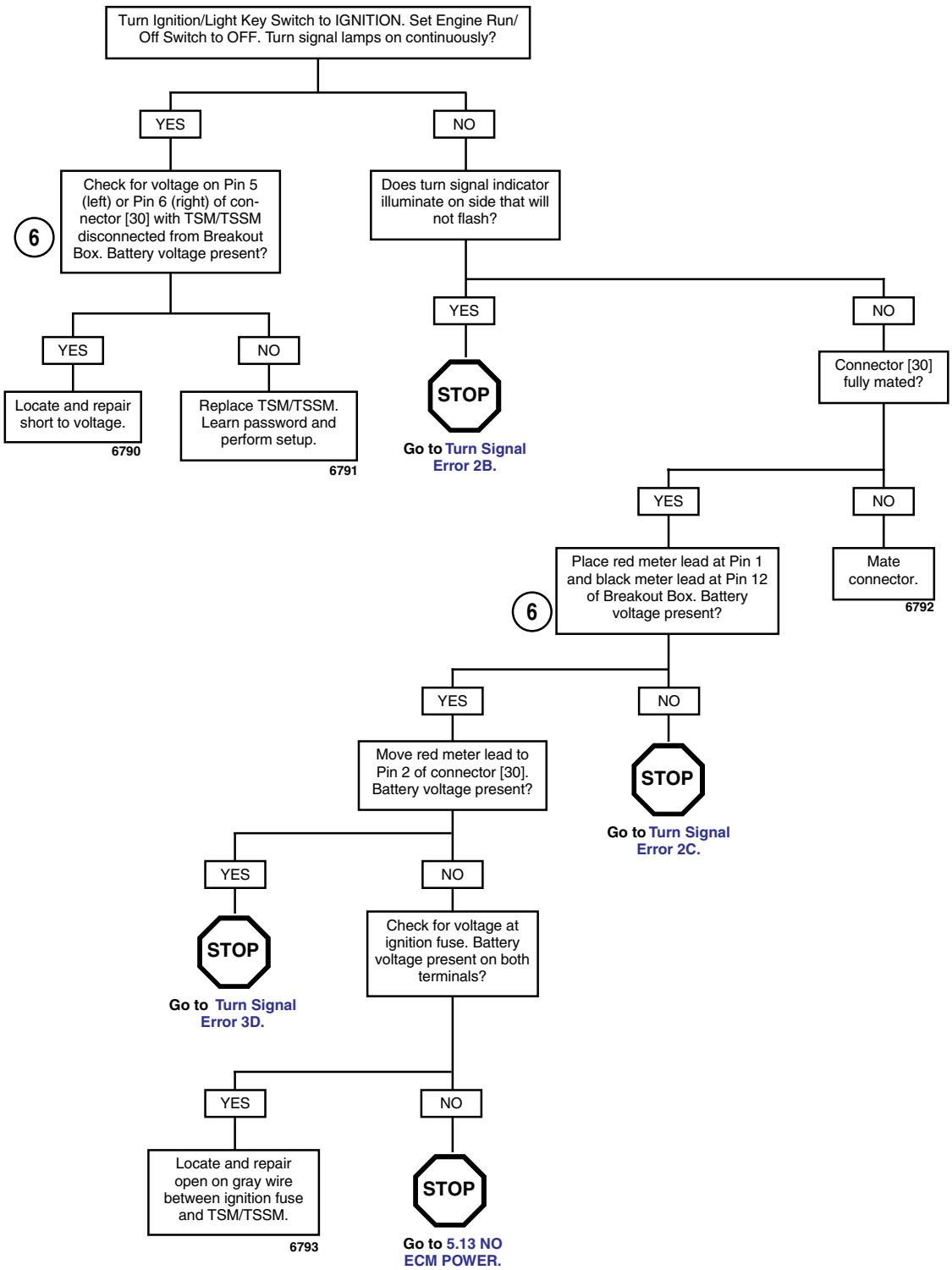
Turn Signal Error 2C

WILL NOT CANCEL OR CANCEL ERRATICALLY (CARBURETED MODELS ONLY)



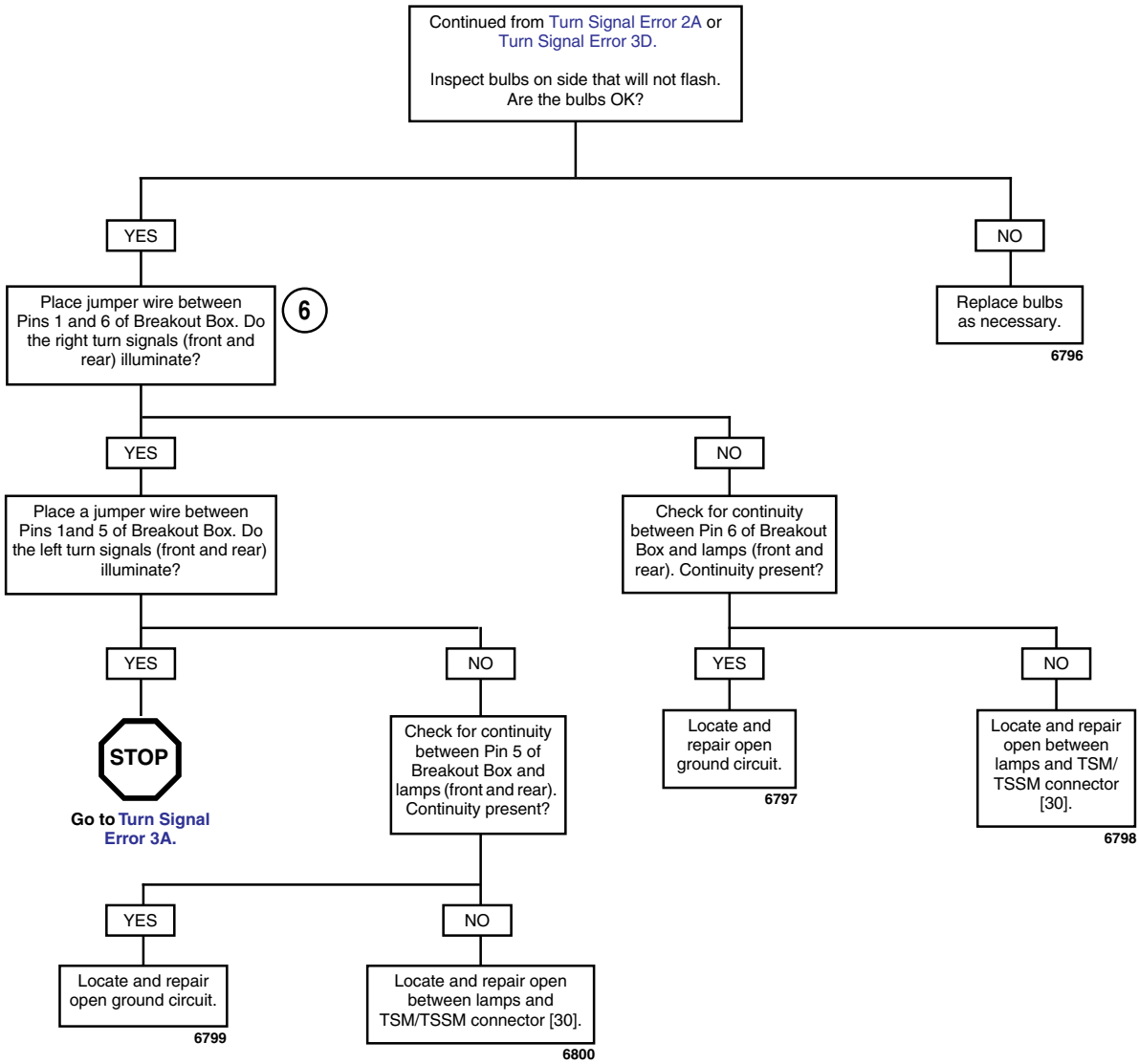
Turn Signal Error 3A

WILL NOT FLASH, 4-WAY FLASHERS INOPERABLE (ALL MODELS): DTC B1121, B1122, B1141 (EFI) DTC 21, 22, 41 (CARB)



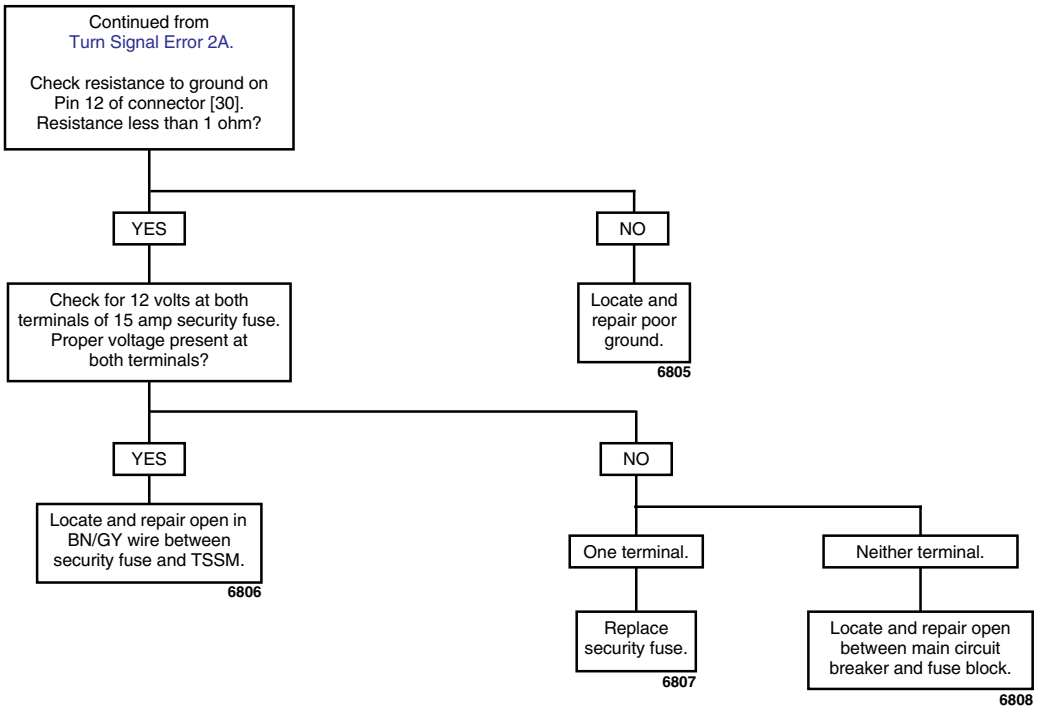
Turn Signal Error 3B

WILL NOT FLASH, 4-WAY FLASHERS INOPERABLE (ALL MODELS): DTC B1121, B1122, B1141 (EFI) DTC 21, 22, 41 (CARB)



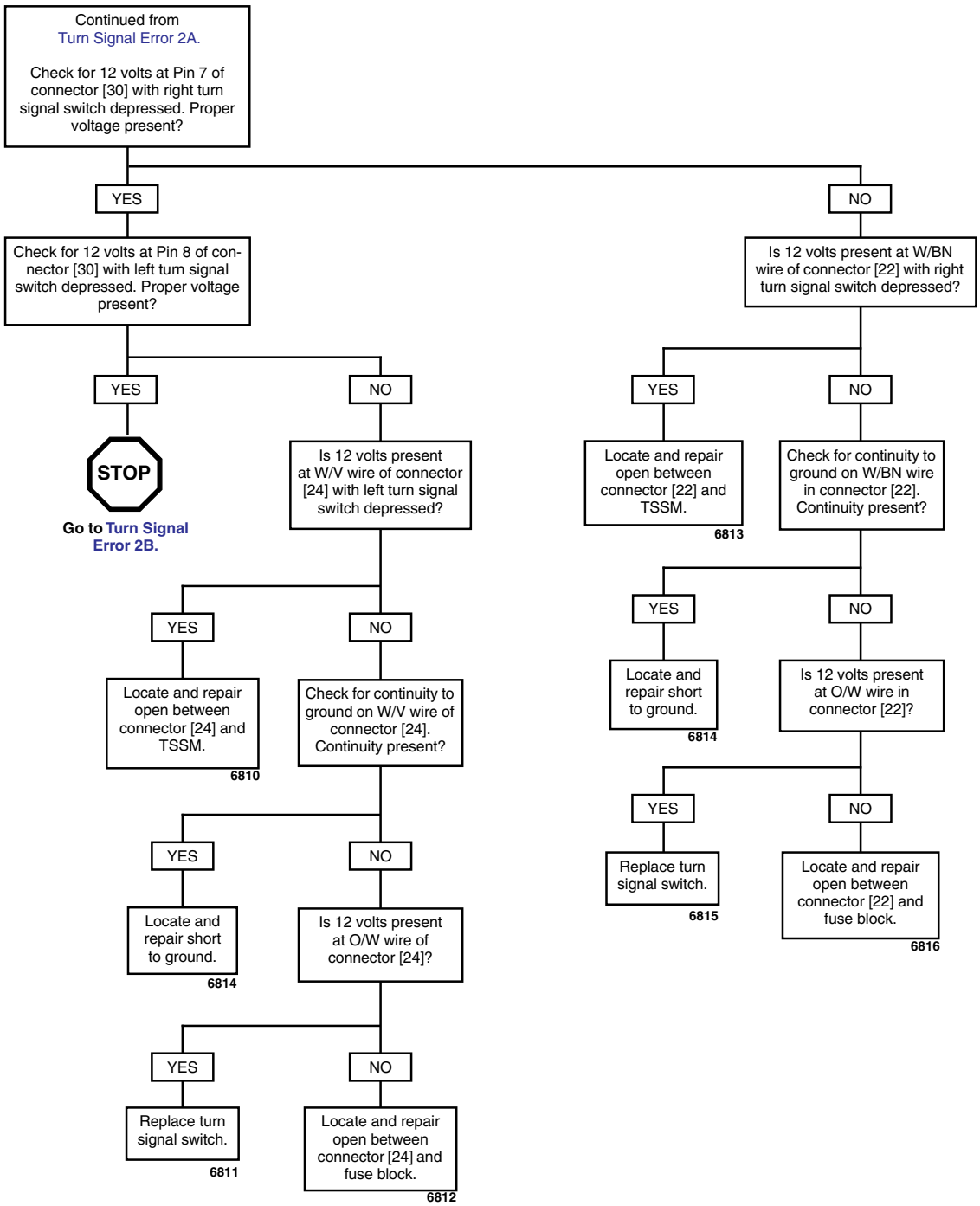
Turn Signal Error 3C

WILL NOT FLASH, 4-WAY FLASHERS INOPERABLE (ALL MODELS): DTC B1121, B1122, B1141 (EFI) DTC 21, 22, 41 (CARB)



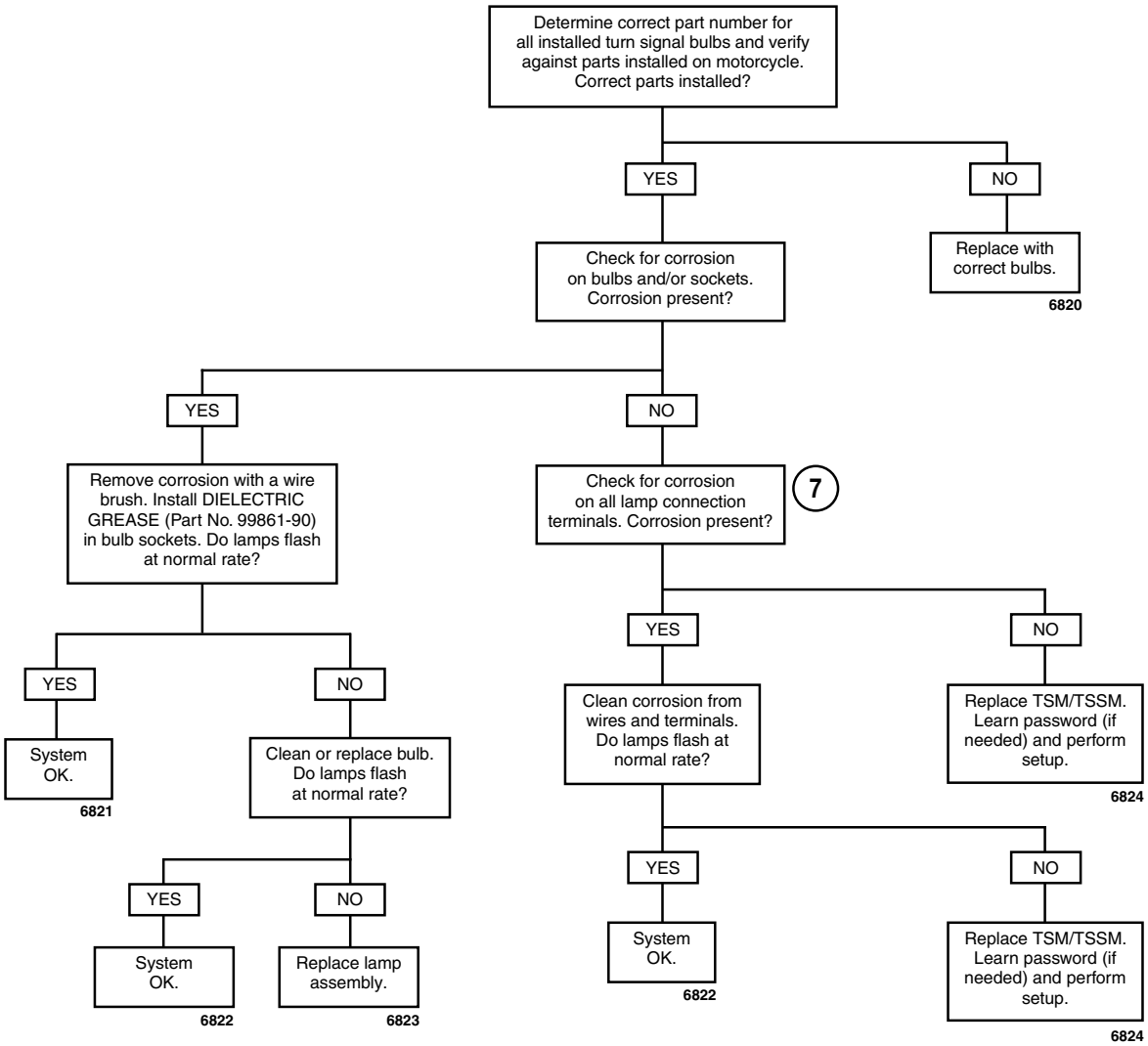
Turn Signal Error 3D

WILL NOT FLASH, 4-WAY FLASHERS INOPERABLE (ALL MODELS): DTC B1121, B1122, B1141 (EFI) DTC 21, 22, 41 (CARB)



Turn Signal Error 4A

FLASH AT DOUBLE NORMAL RATE, ALL BULBS WORKING (ALL MODELS)



DTC B0563 (EFI), DTC 11 (CARB) 3.17

GENERAL

Battery Voltage High

The TSM/TSSM continually checks the battery voltage during IGN/OFF and IGN/RUN power modes. If the voltage exceeds 16.0 volts for more than 5.0±0.5 seconds, the TSM/TSSM sets DTC B0563 (EFI), DTC 11 (CARB).

Table 3-23. Models Affected

VEHICLE	EFI	CARBURETOR
SECURITY	Yes	Yes
NO SECURITY	Yes	Yes

DIAGNOSTICS

Diagnostic Tips

- This DTC may set when the vehicle is placed on a a battery charger, on fast charge, for a long period of time.
- The TSSM does not illuminate the security lamp when this code is set as current.

Diagnostic Notes

See charging system tests in Section 1 to correct. Problem may be faulty voltage regulator.

DTC 25 (CARB ONLY) 3.18

GENERAL

Ignition Enable Output High

During vehicle operation, the TSM/TSSM checks the ignition enable output (Pin 10) for a short to battery condition. This test occurs when the Ignition/Light Key Switch is turned to IGNITION and the Engine Run/Off Switch is set to RUN.

Table 3-24. Models Affected

VEHICLE	EFI	CARBURETOR
SECURITY	No	Yes
NO SECURITY	No	Yes

DIAGNOSTICS

Diagnostic Tips

The TSSM does not illuminate the security lamp when this code is set as current.

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 3.18 flow chart.

1. Attach BREAKOUT BOX (Part No. HD-42682). See Section 3.10 BREAKOUT BOX: TSM/TSSM.

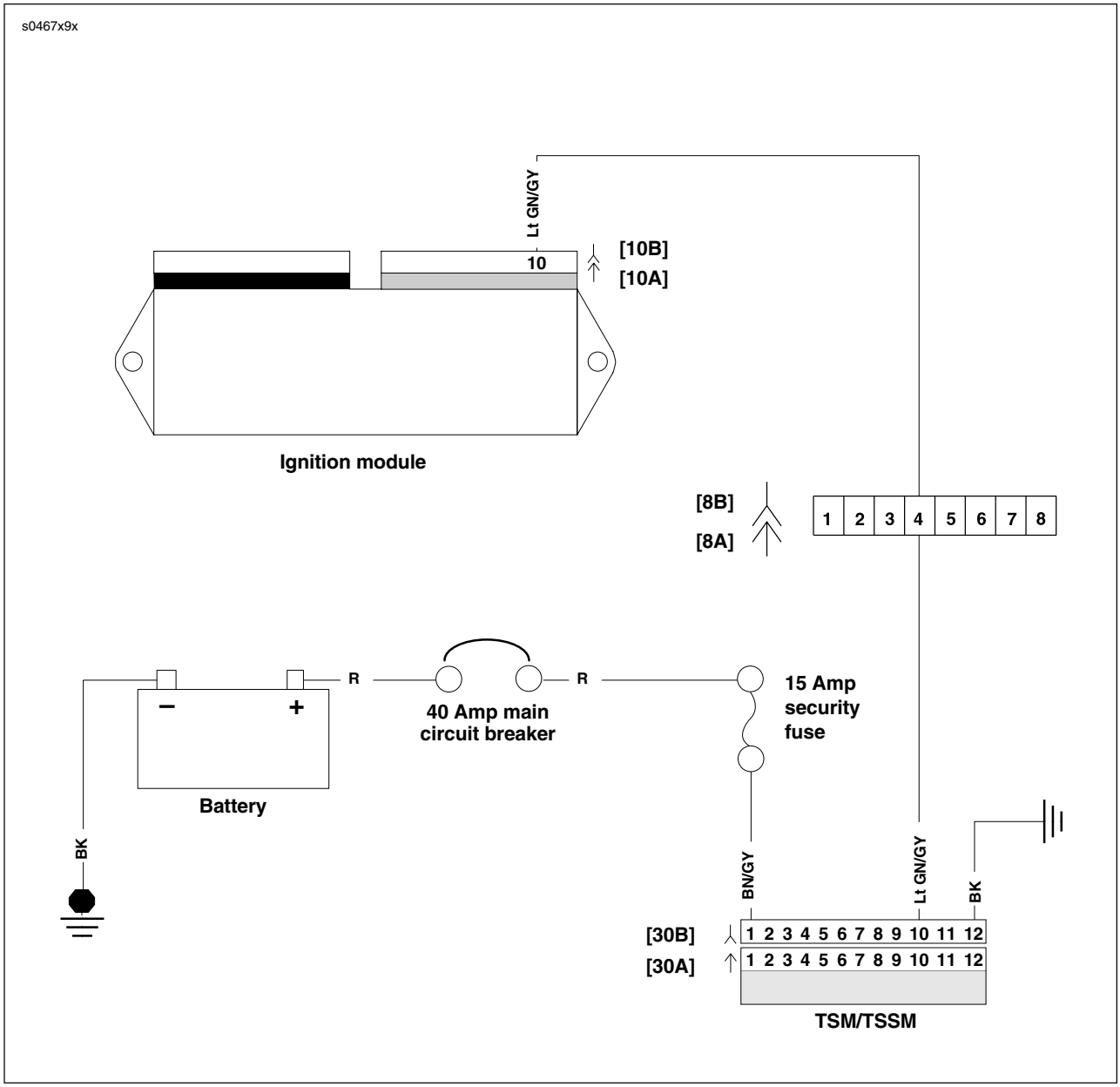


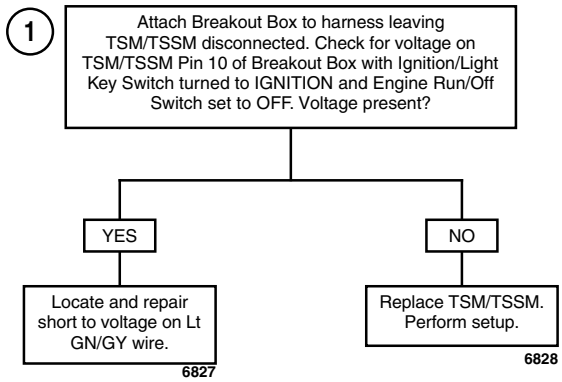
Figure 3-30. Ignition Circuit: Carbureted Models

Table 3-25. Wire Harness Connectors in Figure 3-30.

NO.	DESCRIPTION	TYPE	LOCATION
[8]	Ignition (Main to EFI Harness)	12-Place Deutsch (Gray)	Under Right Side Cover
[10]	Ignition Module	12-Place Deutsch (Black)	Under Right Side Cover
[30]	TSM/TSSM	12-Place Deutsch	Cavity in Crossmember at Rear of Battery Box (Under Seat)

Test 3.18

IGNITION ENABLE OUTPUT HIGH: DTC 25 (CARB ONLY)



GENERAL

Alarm Output Low (DTC B1131/DTC 31) or Alarm Output High (DTC B1132/DTC 32)

See Figure 3-31. An alarm cycle is activated when the TSSM is connected, the siren has been armed by the TSSM and a security event occurs. See Section 3.6 SECURITY SYSTEM (TSSM) FUNCTIONS. Under normal armed operation, the siren input (Pin B) is driven low by the TSSM to trigger the audible alarm. When the siren input is driven high by the TSSM the audible alarm stops.

Table 3-26. Models Affected

VEHICLE	EFI	CARBURETOR
SECURITY	Yes	Yes
NO SECURITY	No	No

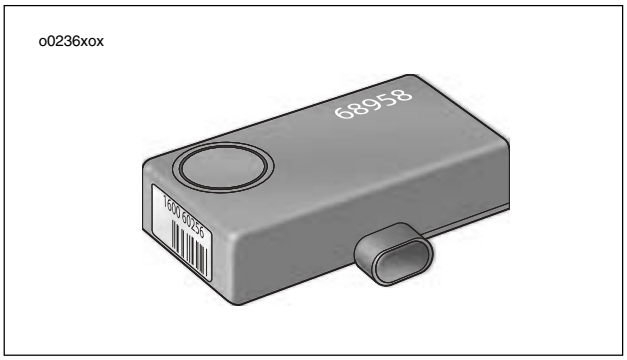


Figure 3-31. Siren

DIAGNOSTICS

Diagnostic Tips

- If the siren is armed and the internal siren battery is dead, shorted, disconnected, or has been charging for a period longer than 24 hours, the siren will respond with three chirps on arming instead of two.
- The internal siren battery may not charge if the vehicle's battery is less than 12.5 volts.
- If the siren does not chirp, two or three times, on a valid arming command from the TSSM, the siren is either not connected, not working, or the siren wiring was opened or shorted while the siren was disarmed.
- If the siren enters the self-driven mode where it is powered from the siren internal nine-volt battery, the turn-signal lamps will not alternately flash. If the TSSM activates the siren, the turn-signal lamps will flash. If the siren has been armed and a security event occurs, and the siren is in self-driven mode, the siren will alarm for 20 to 30 seconds and then turn off for 5 to 10 seconds. This alarm cycle will be repeated ten times if the siren is in the self-driven mode.
- If the siren does not stop alarming after it has been armed, then either the TSSM output or siren input may be shorted to ground, or the siren vehicle battery connection is open or shorted to ground, or the siren vehicle ground connection is open, or a security event has occurred. See Section 3.6 SECURITY SYSTEM (TSSM) FUNCTIONS for a description of alarm functions.

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 3.19 flow chart.

1. Use BREAKOUT BOX (Part No. HD-42682) and HARNESS CONNECTOR TEST KIT (Part No. HD-41404), gray pin probe and patch cord. See Section 3.10 BREAKOUT BOX: TSM/TSSM.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), gray socket probe and patch cord.
3. Having the correct multimeter ohm scale is important for this test. Some meters may read infinity for high ohm values. If this is the case, check your ohm scale and retest.

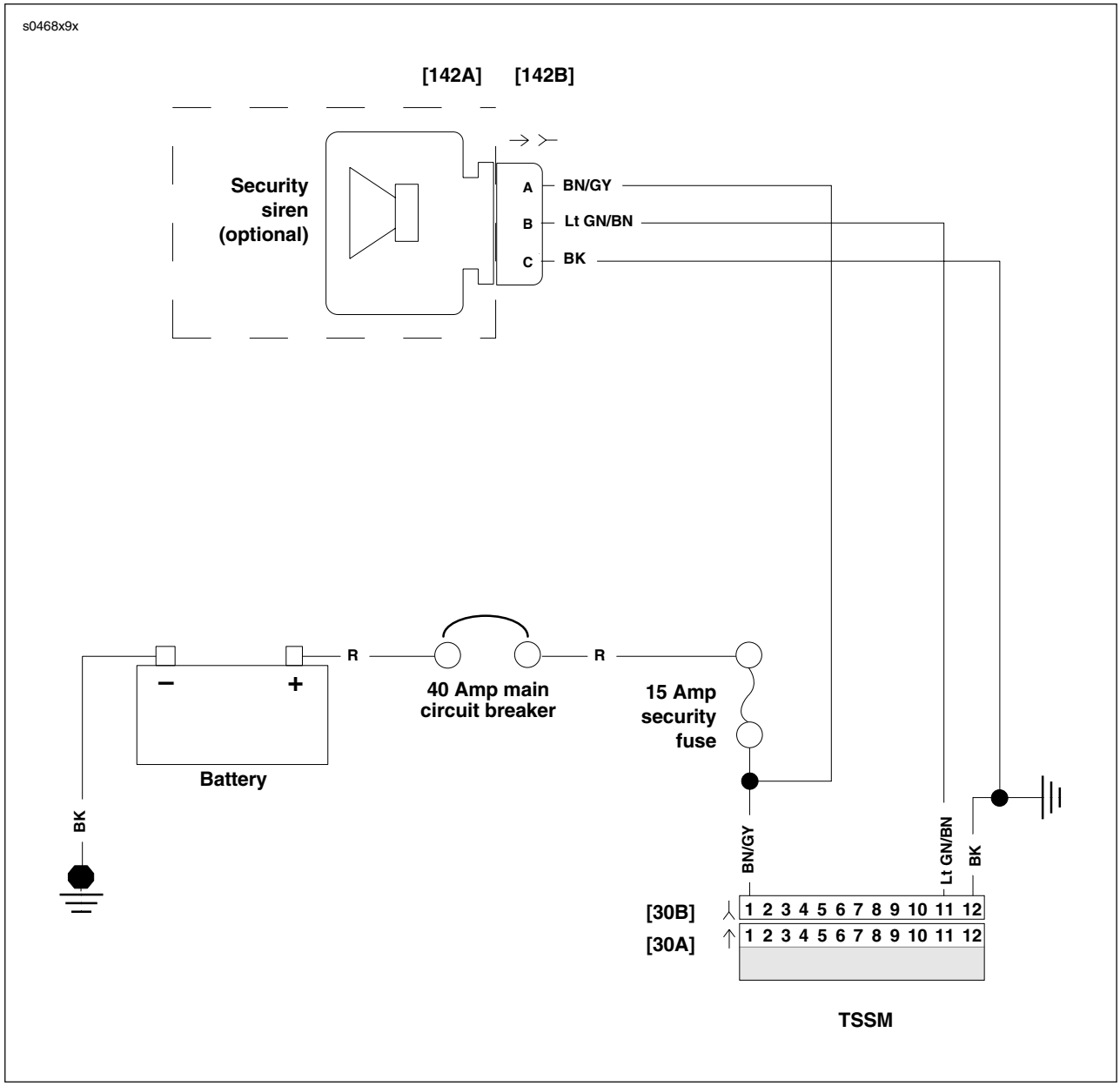


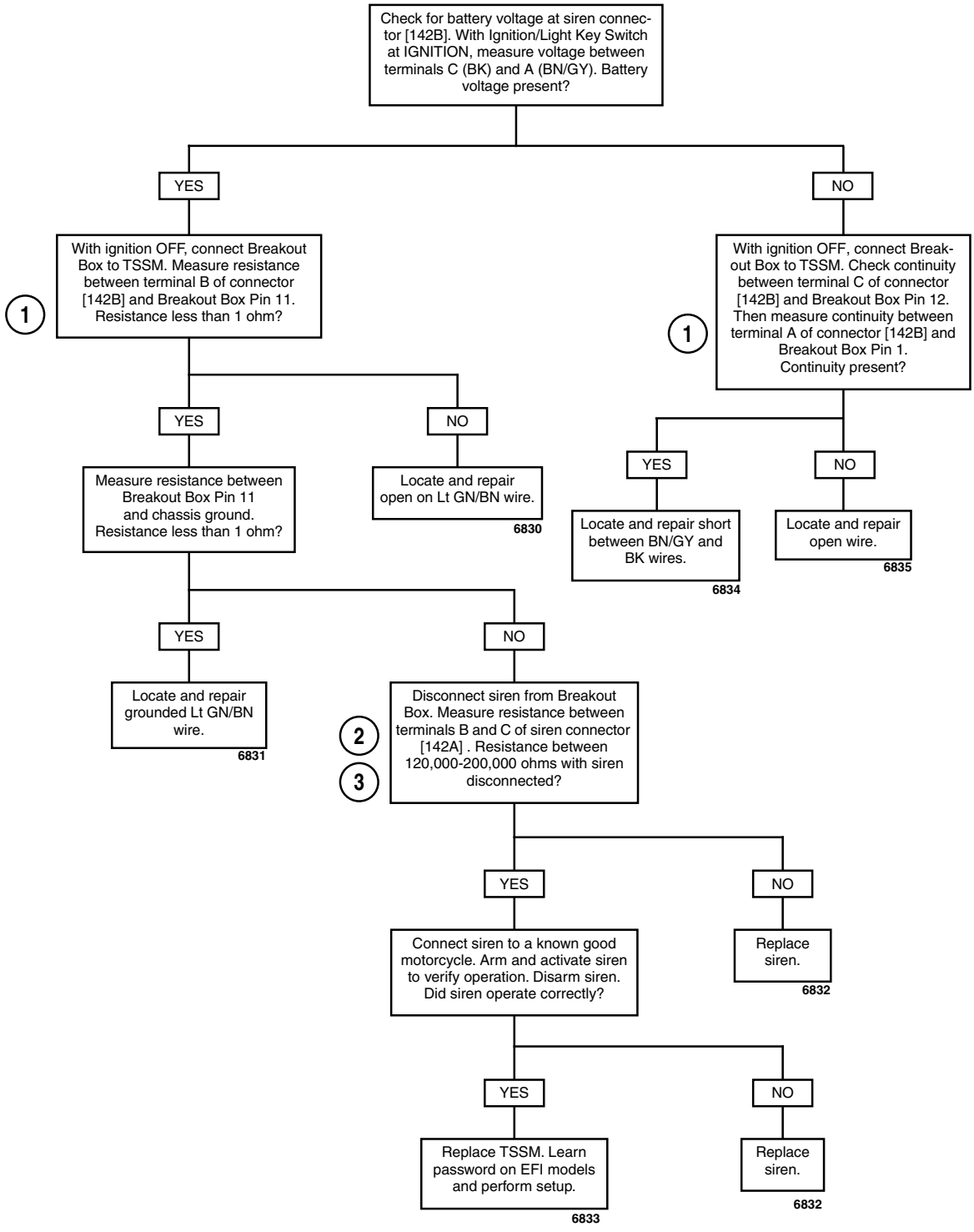
Figure 3-32. Siren Circuit

Table 3-27. Wire Harness Connectors in Figure 3-32.

NO.	DESCRIPTION	TYPE	LOCATION
[30]	TSM/TSSM	12-Place Deutsch	Cavity in Crossmember at Rear of Battery Box (Under Seat)
[142]	Siren	3-Place Packard	Under Right Side Cover (Behind Electrical Bracket)

Test 3.19

ALARM OUTPUT: DTC B1131, B1132 (EFI)
DTC 31, 32 (CARB)



Clear codes and confirm proper operation with no security lamp.

DTC B1134 (EFI), DTC 34 (CARB) 3.20

GENERAL

Starter Output High

With the TSM/TSSM disarmed and ignition ON, the starter relay is grounded. Battery voltage is applied to the starter relay and coil which are grounded through the TSM/TSSM. This code is set when that ground is not established through the TSM/TSSM.

Table 3-28. Models Affected

VEHICLE	EFI	CARBURETOR
SECURITY	Yes	Yes
NO SECURITY	Yes	Yes

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 3.20 flow charts.

1. Connect BREAKOUT BOX (Part No. HD-42682) to wire harness leaving TSM/TSSM disconnected. See Section 3.10 BREAKOUT BOX: TSM/TSSM.

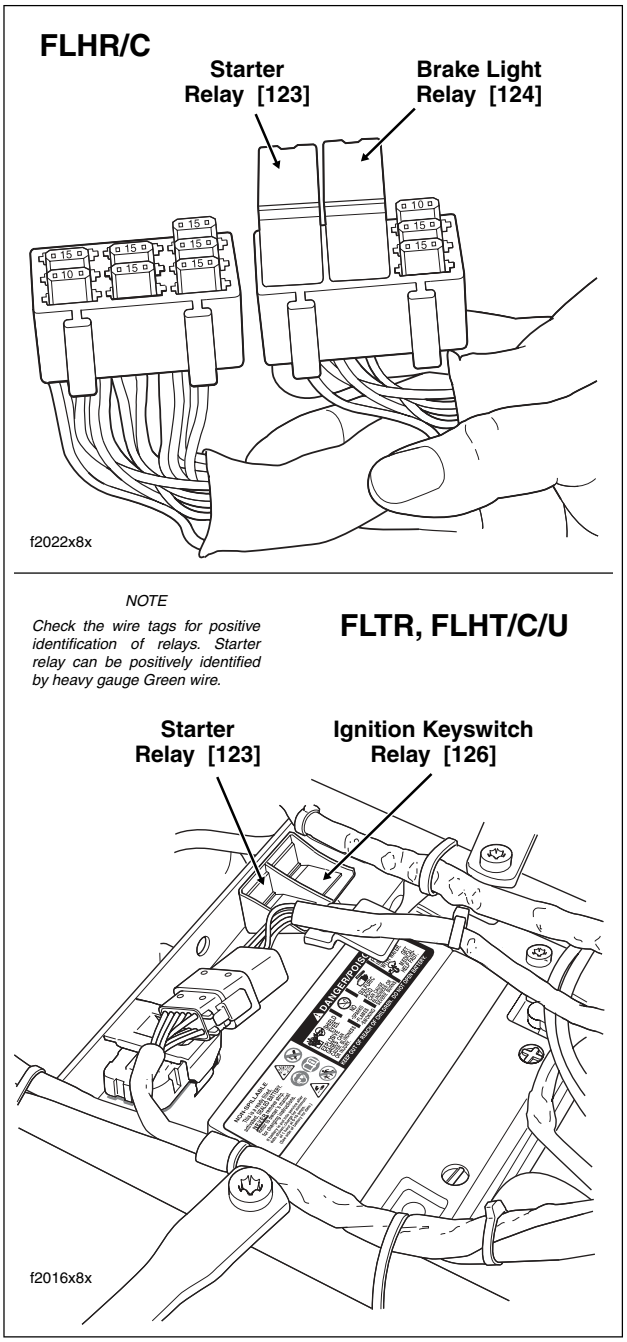


Figure 3-33. Locate Starter Relay

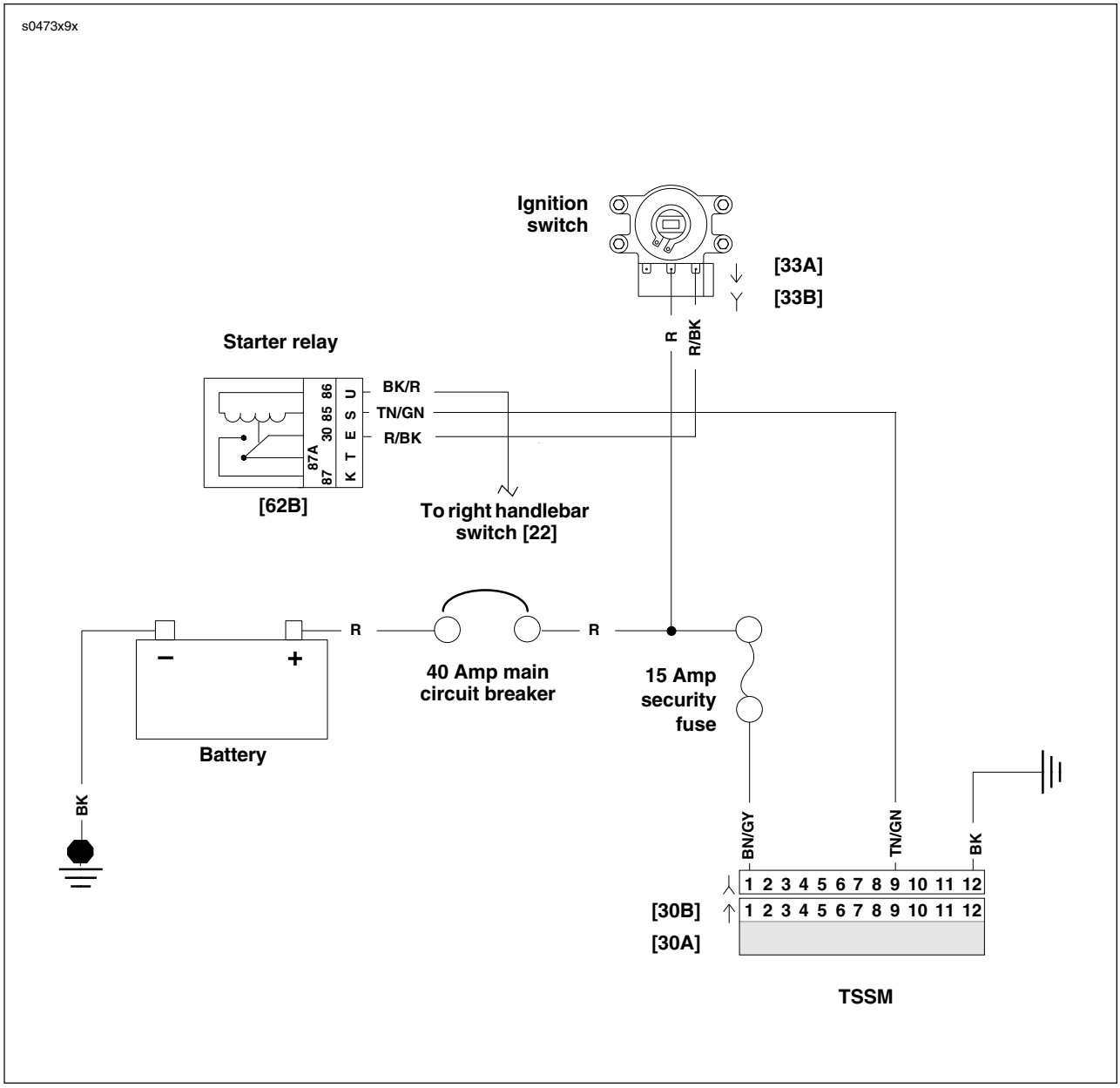


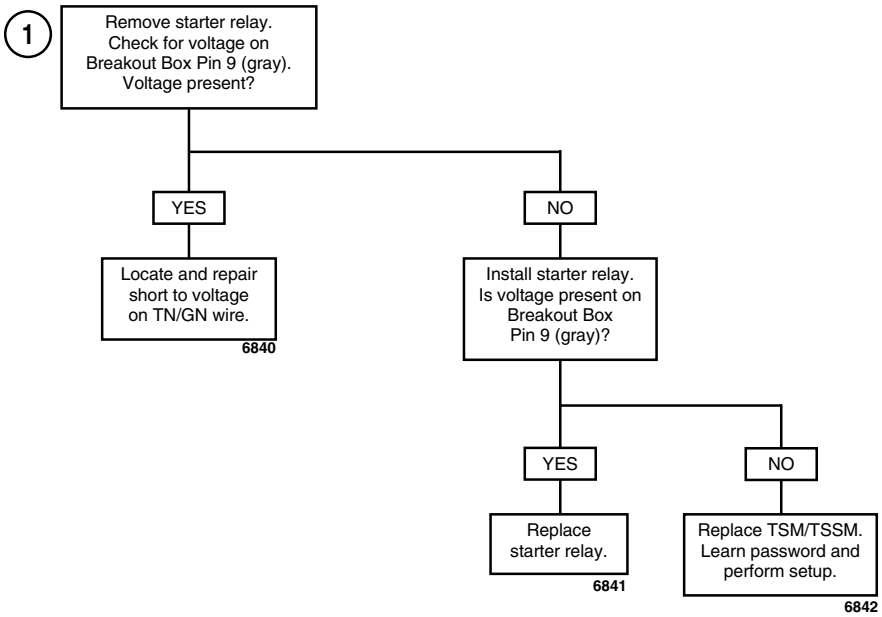
Figure 3-34. Starter/TSSM Circuit: FLHR Shown

Table 3-29. Wire Harness Connectors in Figure 3-34.

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[30]	TSSM	All	12-Place Deutsch	Cavity in Crossmember at Rear of Battery Box (Under Seat)
[62]	Starter Relay	FLHR/C	Fuse Block	Rear Fuse Block (Under Left Side Cover)
		FLTR, FLHT/C/U	Relay Connector	Rear of Battery Box - Left Side (Under Seat)

Test 3.20

STARTER OUTPUT HIGH: DTC B1134 (EFI)
DTC 34 (CARB)



Clear codes and confirm proper operation with no security lamp.

DTC B1151/ B1152/ B1153 (EFI), DTC 51/52/53 (CARB) 3.21

GENERAL

Sidecar BAS Low (DTC B1151/DTC 51), High (DTC B1152/DTC 52) or Out of Range (DTC B1153/DTC 53)

These codes are set when a TSM/TSSM is configured for sidecar use and a fault is detected with the sidecar BAS.

Table 3-30. Models Affected

VEHICLE	EFI	CARBURETOR
SECURITY	Yes	Yes
NO SECURITY	Yes	Yes

DIAGNOSTICS

Diagnostic Tips

- The smart siren cannot be disarmed when the ignition switch is on and a bank angle sensor is installed. If the ignition switch triggers the security alarm, then the switch must be turned off to disarm the siren.
- Use Digital Technician with the TSSM Diagnostic Interface Harness (HD-44720) to ensure sidecar learn. See Figure 3-35.
- Ensure that no other circuits are tied to Pin 11 of the TSSM.
- If a sidecar is installed without the bank angle sensor kit then the TSM/TSSM will continue to operate in Solo mode on a sidecar bike.
- If the bank angle sensor is removed without disabling sidecar learning then the TSSM will set a DTC until sidecar learning is disabled using Digital Technician or the bank angle sensor is reinstalled.
- The software is designed to prevent the TSM/TSSM from switching to sidecar mode unless the entire system is operating properly (no codes set).
- The bank angle sensor cannot be detected when the security function is in the alarm mode (that is, lights flashing, siren sounding).

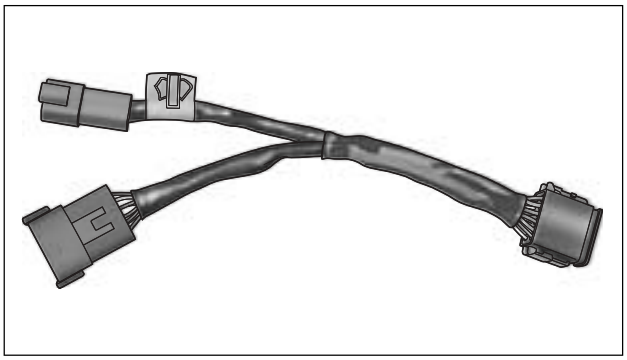


Figure 3-35. TSSM Diagnostic Interface Harness (Part No. HD-44720)

- A sidecar tip-over event cannot be detected when the security function is in the alarm mode (that is, lights flashing, siren sounding).
- A short to ground fault cannot be detected when the security function is in the alarm mode (that is, lights flashing, siren sounding).
- A short to battery fault cannot be detected **unless** the security function is in the alarm mode (that is, lights flashing, siren sounding).
- An out of range fault cannot be detected when the security function is in the alarm mode (that is, lights flashing, siren sounding).

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 3.19 flow chart.

1. Use BREAKOUT BOX (Part No. HD-42682) and HARNESS CONNECTOR TEST KIT (Part No. HD-41404), gray pin probe and patch cord. See Section 3.10 BREAKOUT BOX: TSM/TSSM.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), gray pin probe and patch cord.

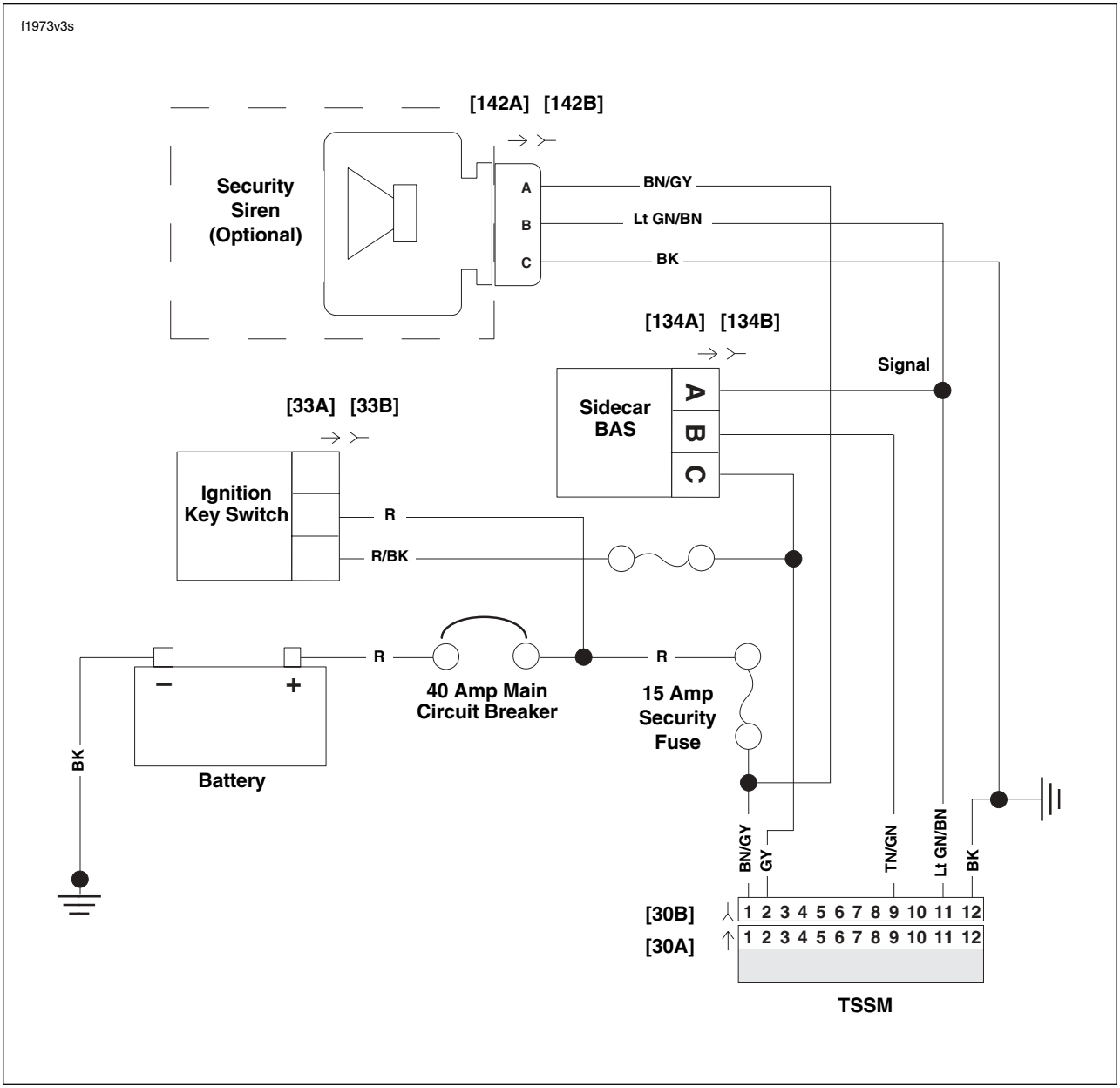


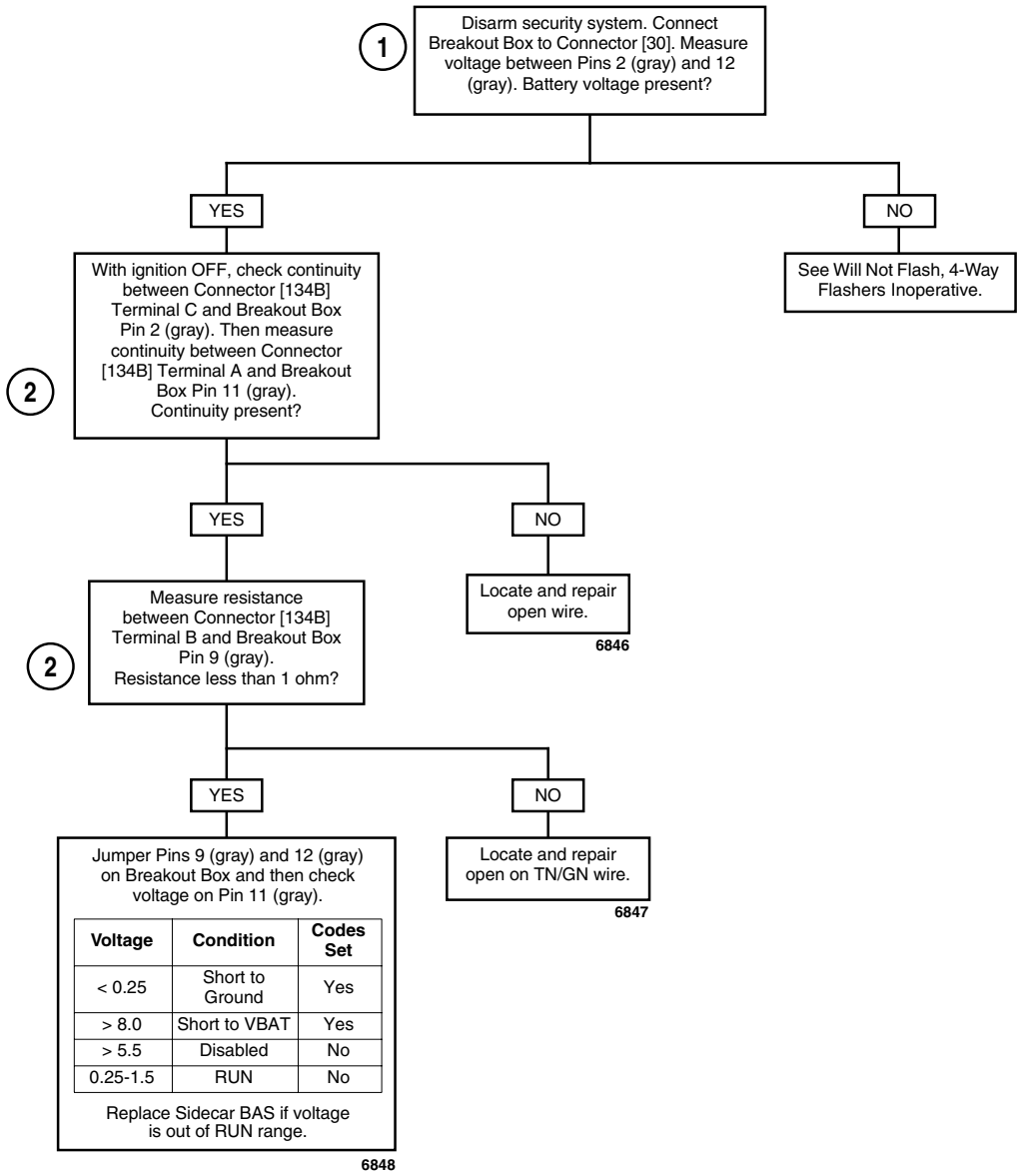
Figure 3-36. Siren Circuit

Table 3-31. Wire Harness Connectors in Figure 3-36.

NO.	DESCRIPTION	TYPE	LOCATION
[30]	TSM/TSSM	12-Place Deutsch	Cavity in Crossmember at Rear of Battery Box (Under Seat)
[142]	Siren	3-Place Packard	Under Right Side Cover (Behind Electrical Bracket)
[134]	Sidecar BAS	3-Place Packard	Under Seat

Test 3.21

SIDECAR BAS: DTC B1151, B1152, B1153 (EFI)
DTC 51, 52, 53 (CARB)



Clear codes and confirm proper operation with no security lamp.

NOTES

DTC B1135 (EFI), DTC 35 (CARB) 3.22

GENERAL

Accelerometer Fault

This DTC indicates a failure which requires replacement of the TSM/TSSM (Job Time Code 6845).

NOTE

When DTC B1135 (EFI), DTC 35 (CARB) is set as current, the tip-over engine shutdown, TSSM tamper alarm and bank angle sensors are disabled. The security lamp will also illuminate on vehicles with security systems.

Table 3-32. Models Affected

VEHICLE	EFI	CARBURETOR
SECURITY	Yes	Yes
NO SECURITY	Yes	Yes

DTC U1016 (EFI), DTC 14/24/33/43 (CARB) 3.23

GENERAL

Loss of ECM Serial Data

On fuel injected motorcycles the data link connector provides a means for the ECM and TSM/TSSM to communicate their current status. When all operating parameters are within specification, a state of health message is sent between the components. A DTC U1016 (EFI) indicates that the ECM is not capable of sending this state of health message.

Table 3-33. Code Description

DTC	LAMP CODE	DESCRIPTION
U1016	14	Loss of all ECM serial data (state of health)
	24	Loss of vehicle speed
	33	Loss of vehicle inhibit motion
	43	Loss of powertrain security status

NOTE

Turn signal lamp code 23 also reflects DTC U1300/U1301. If either of these turn signal lamp codes appear, refer to Section 5.14 STARTS, THEN STALLS for diagnostics.

Table 3-34. Models Affected

VEHICLE	EFI	CARBURETOR
SECURITY	Yes	No
NO SECURITY	Yes	No

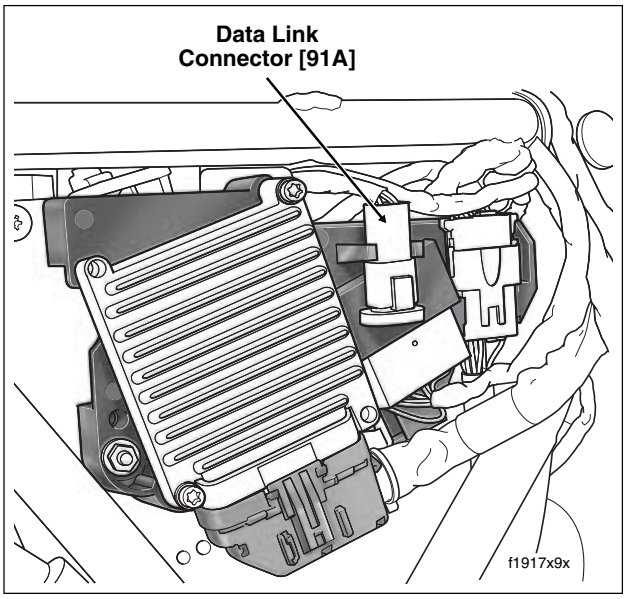


Figure 3-37. Right Side Cover Removed

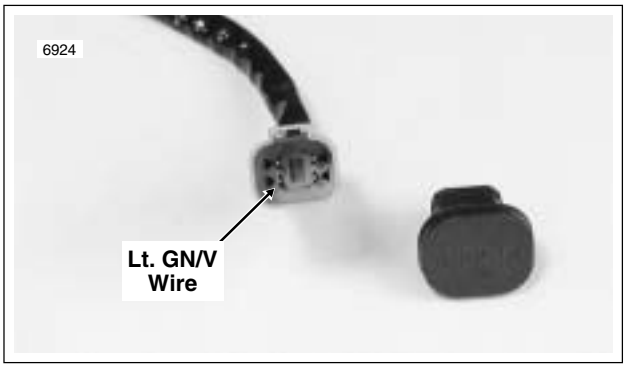


Figure 3-38. Data Link Connector [91A]

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 3.23 flow chart.

1. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness and ECM. See Section 5.7 BREAKOUT BOX: EFI.
2. Connect BREAKOUT BOX (Part No. HD-42682) between wire harness and TSM/TSSM. See Section 3.10 BREAKOUT BOX: TSM/TSSM.

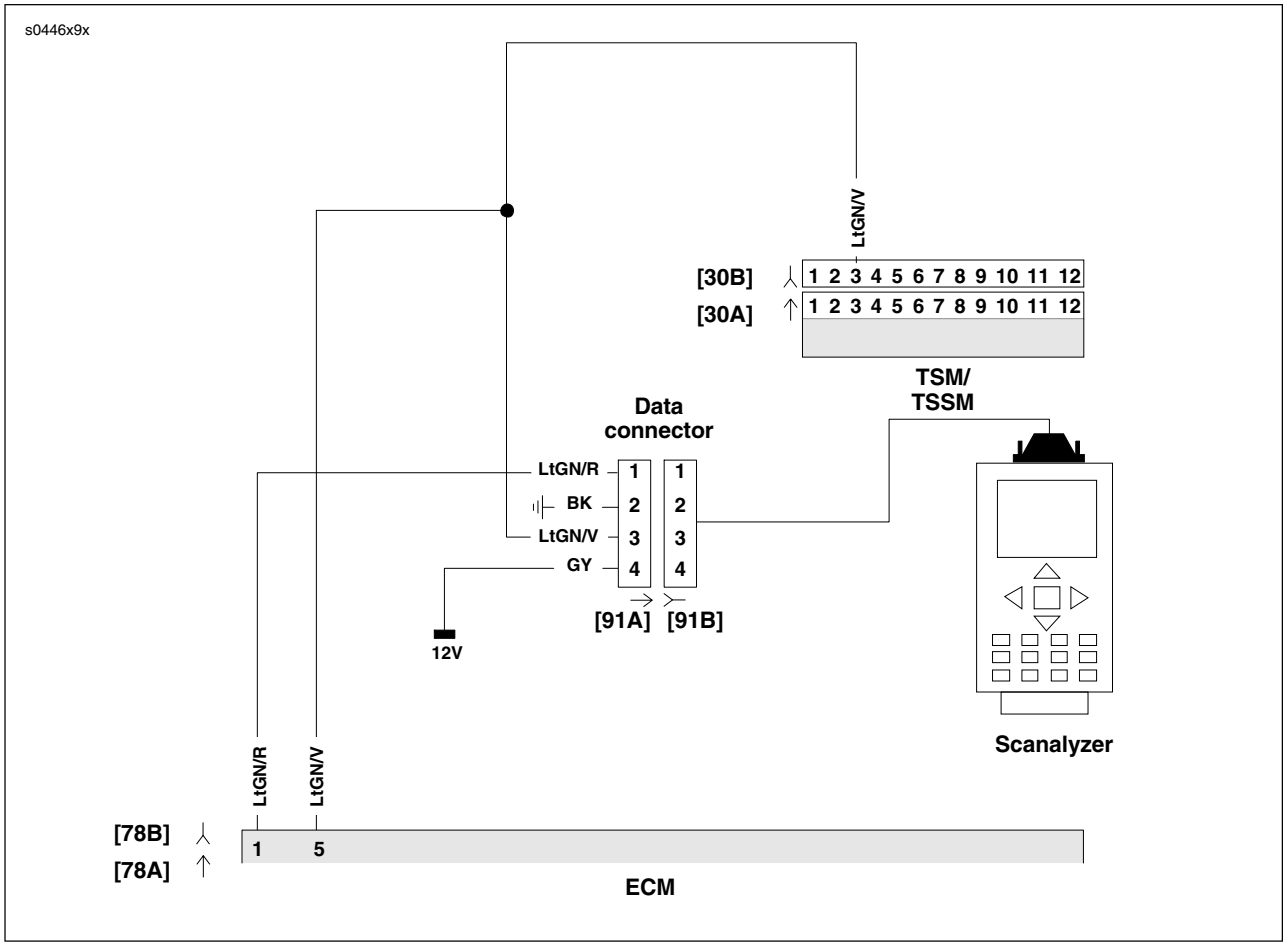


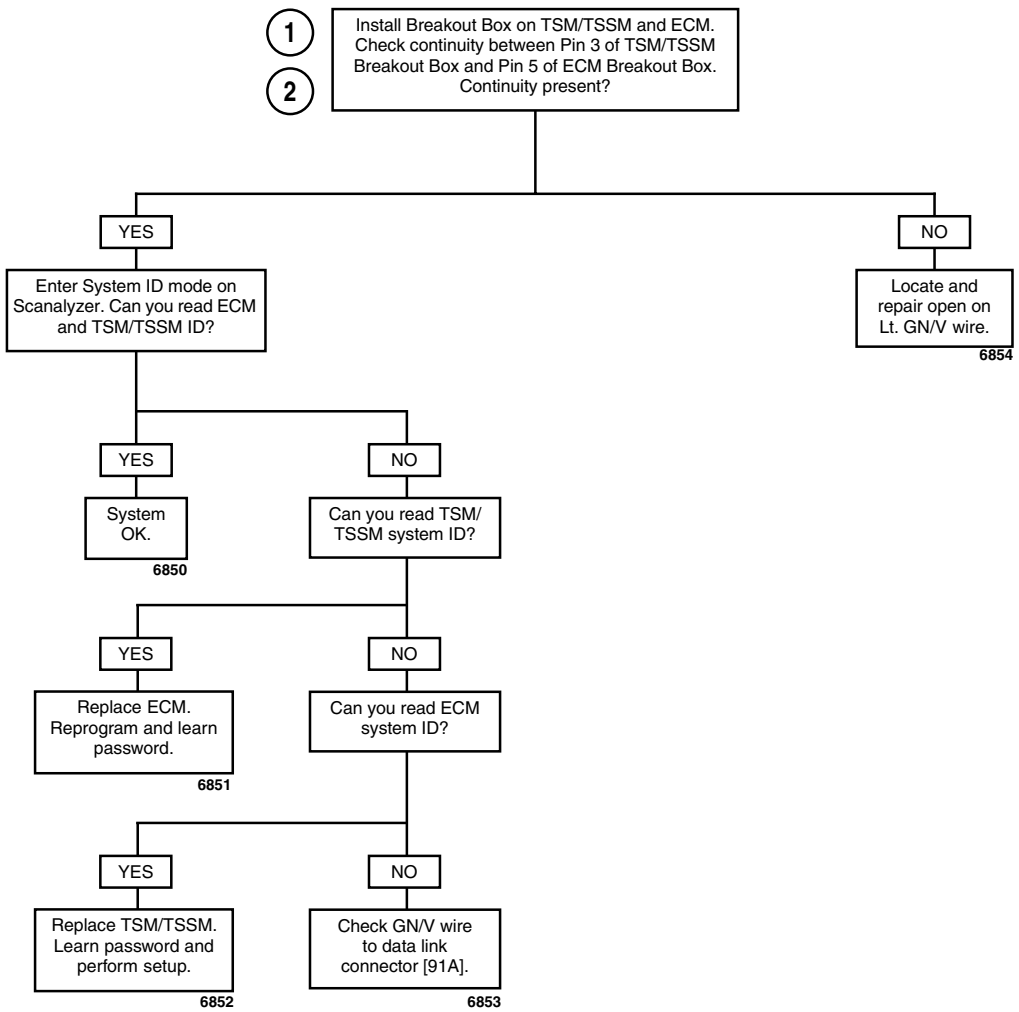
Figure 3-39. ECM and TSM/TSSM Circuit

Table 3-35. Wire Harness Connectors in Figure 3-39.

NO.	DESCRIPTION	TYPE	LOCATION
[30]	TSSM	12-Place Deutsch	Cavity in Crossmember at Rear of Battery Box (Under Seat)
[78]	ECM	36-Place Packard	Under Right Side Cover
[91]	Data Link	4-Place Deutsch	Under Right Side Cover

Test 3.23

LOSS OF ECM SERIAL DATA: DTC U1016 (EFI)
DTC 14, 24, 33, 43 (CARB)



Clear codes and confirm proper operation with no security lamp.

REMOVAL/INSTALLATION

Replace the TSM/TSSM following the instructions in the 2003 Touring Models Service Manual (Part Number 99483-03). Next, proceed as follows:

- Check if a password learning process is necessary. For more information, see Table 3-36.
- Always perform all appropriate instructions under Section 3.3 TSM/TSSM VEHICLE DELIVERY after TSM/TSSM replacement or removal.

IMPORTANT NOTE

Do not forget to enter a personal code for TSSM vehicles. If a code is not assigned and the key fob is lost or damaged while the vehicle is armed, the TSSM must be replaced.

Table 3-36. Password Learning Needed?

PART REPLACED	EFI	CARBURETOR
TSM (no security)	No	No
TSSM (security)	Yes	No
Ignition module	N/A	No
ECM	Yes	N/A

PASSWORD LEARNING

Using Scanalyzer

See Table 3-37. Use the information in this table and a SCANALYZER (Part No. HD-41325) with CARTRIDGE (Part No. HD-41325-95C) and CABLE (Part No. HD-42921A) to mate the TSM/TSSM and ECM after replacement. When finished, continue with all instructions under Section 3.3 TSM/TSSM VEHICLE DELIVERY.

Without Scanalyzer

If a Scanalyzer is not available, see Table 3-38. When finished, continue with all instructions under Section 3.3 TSM/TSSM VEHICLE DELIVERY.

Table 3-37. Setting TSM/TSSM and ECM Password Using Scanalyzer

NO.	ACTION	CONFIRMATION	NOTES
1	Install **new** TSM/TSSM or ECM. If vehicle has fuel injection, continue with step 2. If vehicle does not have fuel injection, perform all steps under Section 3.3 TSM/TSSM VEHICLE DELIVERY.		
2	Set **RUN/OFF** switch to **RUN**		Verify that security lamp is not blinking (vehicle is disarmed)
3	Turn **IGN** switch **ON**		TSSM enables starter relay
4	Press **starter** button **1 time**	vehicle starts and stalls	No stored password for new part causes bad password DTC, fuel flow is stopped
5	Leave ignition ON and wait 10 seconds	security lamp illuminates	ECM enters password learning mode. If IGN switch is cycled or Scanalyzer disconnected, learning mode exits
6	Connect Scanalyzer to connector [91A] and set password within 10 minutes. See instructions with Scanalyzer cartridge.	Scanalyzer indicates password learn process complete, security lamp turns off when password is learned	After 10 minute period, ECM and TSSM have exchanged three consecutive matching passwords
7	Turn **IGN** switch OFF for 15 seconds		Allow 15 seconds before turning IGN switch back ON
8	Password learning is complete. Perform all steps under Section 3.3 TSM/TSSM VEHICLE DELIVERY.		

Table 3-38. Setting TSM/TSSM and ECM Password Without Scanalyzer

NO.	ACTION	CONFIRMATION	NOTES
1	Install **new** TSM/TSSM or ECM. If vehicle has fuel injection, remove lighting fuse to reduce battery discharge and then continue with step 2. If vehicle does not have fuel injection, perform all steps under Section 3.3 TSM/TSSM VEHICLE DELIVERY.		
2	Set **RUN/OFF** switch to **RUN**		Verify that security lamp is not blinking (vehicle is disarmed)
3	Turn **IGN** switch **ON**		TSSM enables starter relay
4	Press **starter** button **1 time**	vehicle starts and stalls	No stored password for new part causes bad password DTC, fuel flow is stopped
5	Wait 10 seconds	security lamp illuminates	ECM enters password learning mode. If IGN switch is cycled, learning mode exits
6	After 10 minutes, ECM completes auto learn mode	security lamp turns off	
7	Quickly turn **IGN** switch OFF-**ON**		ECM must not be allowed to shutdown
8	Repeat steps 5-7 two more times		
7	Turn **IGN** switch OFF and install lighting fuse		Allow 15 seconds before turning IGN switch back ON
8	Password learning is complete. Perform all steps under Section 3.3 TSM/TSSM VEHICLE DELIVERY.		

GENERAL

The TSSM system uses batteries in the key fob and siren. These are the only parts requiring periodic maintenance.

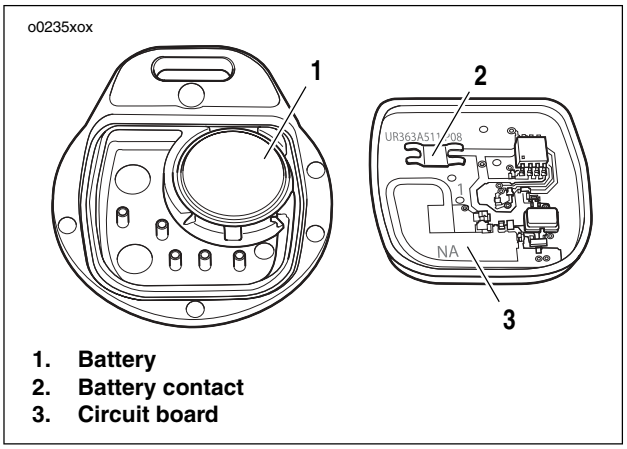
KEY FOB

Schedule

Replace the key fob battery every 2 years.

Battery Replacement

1. Open the key fob as follows:
   a. Place a thin blade between the 2 halves of the case.
   b. Slowly twist the blade.
2. See Figure 3-40. Replace battery as follows:
   a. Remove the original battery.
   b. Install a **new** battery with the positive (+) side down. Use a Panasonic® 2032 or equivalent.
3. See Figure 3-41. Align case and circuit board as shown. Snap case halves together.
4. While standing next to the motorcycle, press and hold the key fob button for 10-15 seconds until the security system responds with two turn signal flashes/siren chirps.



1. **Battery**
2. **Battery contact**
3. **Circuit board**

Figure 3-40. Open Key Fob Case

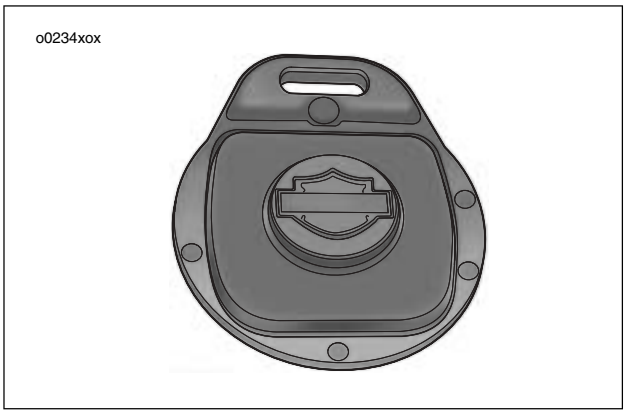


Figure 3-41. Key Fob Assembly

SIREN (IF INSTALLED)

Schedule

The siren's internal 9 volt battery is rechargeable and does not need to be replaced on a regular basis. Battery life under normal conditions is approximately three to six years.

NOTE

The siren battery may not charge if the motorcycle battery is less than 12.5 volts.

Battery Replacement

1. Disarm system and remove siren.
2. Remove battery cover as follows:
   a. Place the siren on a flat table with the potted side up. See Figure 3-42.
   b. Position a knife blade at a 45 degree angle to the long side of the siren case. Insert the knife blade between the siren case and battery cover at one of the outboard corners of the battery cover. Keep the blade slightly higher towards the battery cover as this helps keep the blade away from the battery seal.
   c. Slowly twist the blade to pop off the battery cover.

NOTE

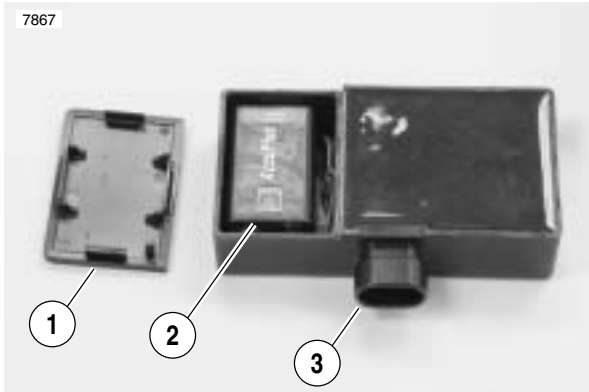
*Battery terminals and battery clip are covered with a special grease to protect against corrosion. Do not wipe away special grease. Apply all existing grease to terminals of **new** battery.*

3. See Figure 3-42. Remove old battery from battery clip. Install **new** 9 volt nickel metal hydride battery (Part No. 68959-00).

NOTE

Only a nickel metal hydride nine-volt battery should be used in the siren.

4. See Figure 3-42. Install battery cover as follows.
   a. Carefully replace rubber seal.



1. Cover
2. Battery
3. Siren Connector [142A]

Figure 3-42. Siren Battery Compartment

   b. With rounded corners on cover on the outboard side, align battery cover with case. Snap cover into position.
5. Install siren and check operation. If working properly, siren will respond with two chirps after receiving the arm command.

NOTES

ENGINE MANAGEMENT (CARB) 4

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SPECIFICATIONS 4.1

Table 4-1. Spark Specifications

IGNITION	DATA
Ignition timing range	TDC - 50° BTDC
Spark plug size	12 mm
Spark plug gap	0.038-0.043 in
	0.97-1.09 mm
Spark plug type	Harley-Davidson No. 6R12 (no substitute)
Ignition coil primary resistance at room temperature	0.3-0.5 ohms
Ignition coil secondary resistance at room temperature	2750-3250 ohms

Table 4-2. Circuit Breaker/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
Lighting	15	Blue	Blade
Headlamp	15	Blue	Blade

NOTE

See Figure 4-1. The fuse labeled Security provides basic turn signal functionality on vehicles without a factory-installed security system. Do not remove this fuse or use it as a replacement fuse for other systems.

Table 4-3. Charging Specifications

ITEM	DATA
Battery	28 amp hour/300 CCA
Alternator AC voltage output	
FLHR, FLHR-I, FLHRC-I, FLHT, FLHTC, FLTR (38 Amp)	16-20 VAC per 1000 RPM
FLHT-I, FLTR-I, FLHTC-I, FLHTCU-I (45 Amp)	19-26 VAC per 1000 RPM
Alternator stator coil resistance	0.1-0.3 ohms
Regulator voltage output @ 3000 RPM	14.4-14.6 volts
Regulator amperes @ 3000 RPM	
FLHR, FLHR-I, FLHRC-I, FLHT, FLHTC, FLTR (38 Amp)	34-40 Amps
FLHT-I, FLTR-I, FLHTC-I, FLHTCU-I (45 Amp)	41-48 Amps

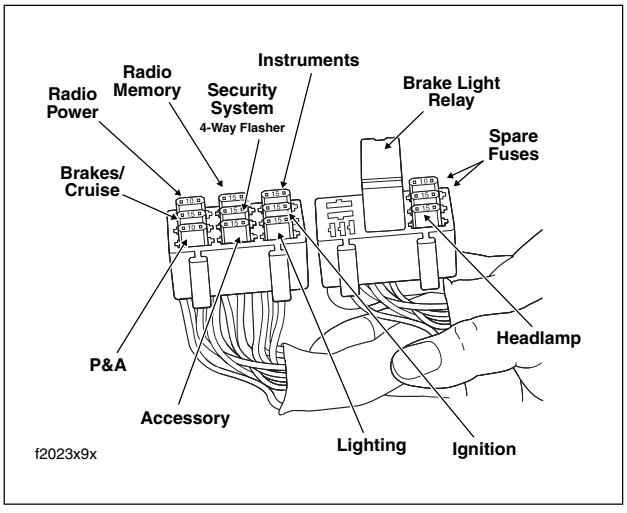


Figure 4-1. Fuse Locations (FLTR, FLHT/C)

SYSTEM PROBLEMS

All system problems fall into at least one of three general categories.

No Start

The engine cranks over freely, but will not start. This does not include situations where the engine will not crank, such as a bad starter, dead battery, etc., and assumes that all obvious checks are made- there is sufficient fuel in the tank, etc.

Poor Performance

The engine starts but there are performance problems, such as poor fuel economy, rough idle, engine misfire, engine hesitation, severe spark knock, etc.

Check Engine Lamp

The lamp indicates the existance of a fault condition. There may also be starting or performance problems. See Figure 4-2.

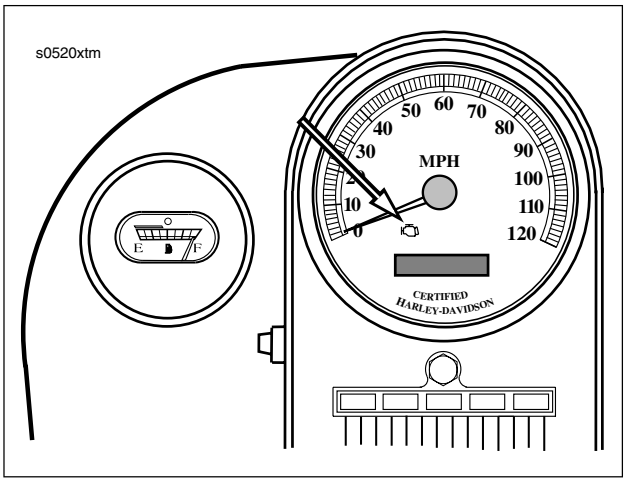


Figure 4-2. Check Engine Lamp (FLHR)

RESOLVING PROBLEMS

To resolve system problems, five basic steps are involved. In order of occurrence, they are:

1. Check for trouble codes through observation of the check engine lamp. See Section 4.3 CHECKING FOR TROUBLE CODES.
2. Retrieve trouble codes with the SCANALYZER (Part No. HD-41325) or the check engine lamp diagnostics. See Section 4.4 SCANALYZER: CARB, Section 4.5 CHECK ENGINE LAMP DIAGNOSTICS: CARB and Figure 4-3.
3. Diagnose problems relating to current trouble codes using the diagnostic flow charts, Scanalyzer and other special tools.
4. Correct problems through replacement and/or repair of faulty components.
5. Validate repairs. Clear trouble codes and confirm proper vehicle operation without recurrence of the fault condition, as indicated by the behavior of the check engine lamp.



Figure 4-3. Scanalyzer

CHECK ENGINE LAMP

To diagnose system problems, start by observing the behavior of the Check Engine Lamp. See Figure 4-5.

1. At Key On, the Check Engine Lamp will illuminate for approximately four seconds and then turn off.

NOTES

- *References to "Key ON" or "Ignition Switch ON" in this document means that the Ignition/Light Key Switch is turned to IGNITION and the handlebar Engine Stop/Run Switch is in the RUN position (although the engine is **not** running). See Figure 4-4.*
- *If the Check Engine Lamp is not illuminated at Key ON or if it fails to go OFF after the initial four second ON period, then a problem exists in the lamp circuit. See Section 4.9 NO CHECK ENGINE LAMP AT KEY ON or Section 4.10 CHECK ENGINE LAMP ON CONTINUOUSLY.*

2. When the lamp turns off after being illuminated for the first four second period, it will:
   a. Remain off if there are no fault conditions or trouble codes currently detected by the ignition module. See A of Figure 4-5.
   b. Come back on for an 8 second period if only historic codes exist. See B of Figure 4-5.
   c. Come back on, and remain on, if a current trouble code exists. See C of Figure 4-5.

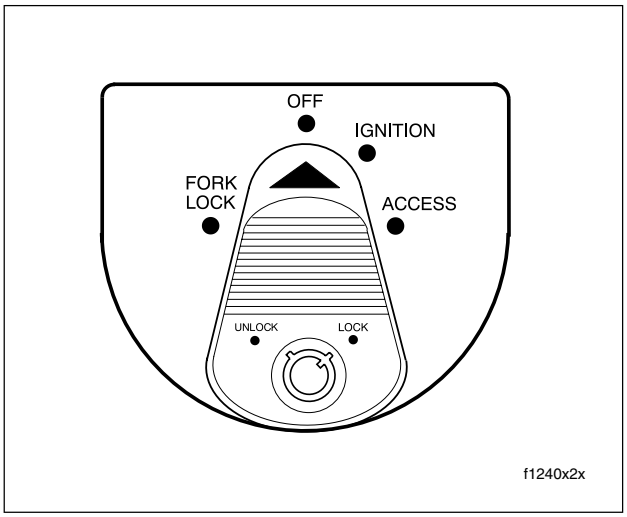


Figure 4-4. Ignition Switch (FLTR, FLHT/C/U)

3. See CODE TYPES which follows for a complete description of trouble code formats.

NOTE

Trouble codes relating to the ignition coil can only be fully diagnosed during actuation. For example, a problem with an ignition coil will be considered a current fault even after the problem is corrected, since the ignition module will not know of its resolution until after the coil is exercised by a vehicle start sequence. In this manner, there may sometimes be a false indication of a current trouble code.

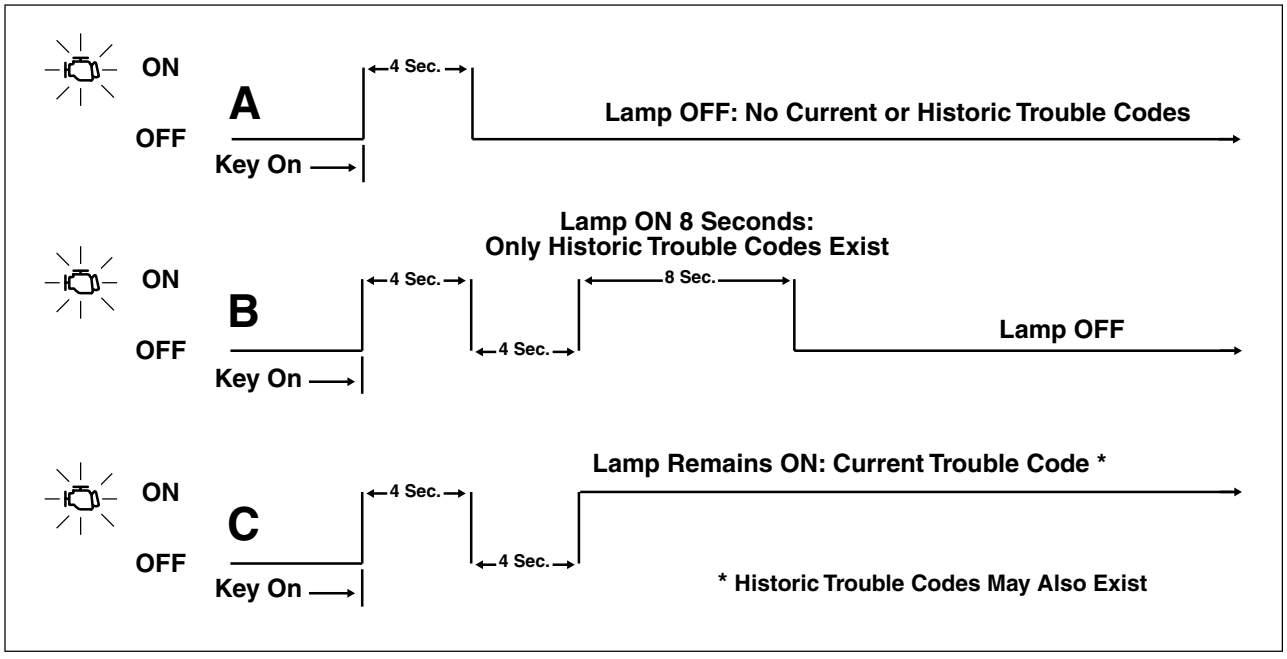


Figure 4-5. Check Engine Lamp Operation

CODE TYPES

There are three types of diagnostic trouble codes (DTCs), current, historic and functional.

Current

Current trouble codes are those which presently disrupt motorcycle operation. When current trouble codes are stored, they can be read using either the Scanalyzer or the Check Engine Lamp Diagnostics. A current trouble code resides in the memory of the ignition module until the problem is corrected, at which point it becomes a “historic,” rather than a “current” fault.

Historic

If a particular problem happens to resolve itself, the active or current status is dropped and it also becomes a historic code. Historic trouble codes are stored for a length of time to assist in the diagnosis of intermittent faults. While historic trouble codes are stored, they can be read using the Scanalyzer only. The Check Engine Lamp will **not** indicate the existence of historic trouble codes.

A historic trouble code resides in the memory of the ignition module until the code is cleared by use of the Scanalyzer or a total of 50 trips has elapsed. A “trip” consists of a start and run cycle, the run cycle lasting at least 30 seconds. After the 50 trip retention period, the trouble code is automatically erased from memory (that is, assuming no subsequent faults of the same type are detected in that period).

It is important to note that historic trouble codes may also be present whenever the system indicates the existence of a current code. See MULTIPLE TROUBLE CODES for more information.

Functional

A functional trouble code indicates an internal problem that requires replacement of the ignition module (trouble codes 52 through 55).

RETRIEVING TROUBLE CODES

The system provides three levels of diagnostics.

- The most sophisticated level uses a computer based diagnostic package called the DIGITAL TECHNICIAN (Part No. HD-44750).
- At the second level, a portable Scan Tool called a “Scanalyzer” (HD-41325) plugs into the Data Link Connector and facilitates the diagnosis of system problems through a direct interface with the ignition module. Using a special programmable application cartridge, the Scanalyzer offers data displays and menu selections that allow for quick and easy retrieval of data and enables the user to perform a variety of diagnostic tests while monitoring inputs and outputs. See Section 4.4 SCANALYZER: CARB.
- At the third level, the Check Engine Lamp is observed by the user after being placed in the diagnostic mode. The lamp blinks a code which correlates to a particular problem area. See Section 4.5 CHECK ENGINE LAMP DIAGNOSTICS: CARB.

MULTIPLE TROUBLE CODES

While it is possible for more than one fault to occur and set more than one trouble code, there are several conditions which may result in **one** fault setting multiple trouble codes:

- If one of the primary side coil lines becomes grounded it will also ground the Bank Angle Sensor resulting in multiple trouble codes being set (DTC 24 and/or 25 and 44).

Always start with the trouble code having the lowest numerical value. In the case of multiple trouble codes, the second code should be resolved when the first code is corrected. For a priority ranking, see list of fault conditions in Table 4-8.

SCANALYZER DIAGNOSTICS

Scanalyzer Cartridge

See Figure 4-7. Through a special programmable application cartridge, the Scanalyzer offers data displays and menu selections that allow for quick and easy retrieval of data. The device enables the user to perform a variety of diagnostic tests while monitoring inputs and outputs. For Scanalyzer menu selections see Figure 4-8.

INSTALLATION

PART NO.	SPECIALTY TOOL
HD-41325	Scanalyzer
HD-41325-95C	Scanalyzer Cartridge
HD-42921A	Cable

The behavior of the check engine lamp as described under Section 4.3 CHECKING FOR TROUBLE CODES indicates the existence of a trouble code. Proceed as follows:

1. Turn the Ignition/Light Key Switch to OFF.
2. Remove right saddlebag and side cover to access data link connector. See Figure 4-6.
3. Remove rubber protective plug from data link connector. Plug the Scanalyzer into the data link connector.
4. Turn the Ignition/Light Key Switch to IGNITION. Turn the handlebar mounted Engine Stop/Run Switch to RUN (but do not start the engine).
5. Insert the diagnostic application cartridge into the Scanalyzer. During the next few seconds, the Scanalyzer sequences through a series of screens that reflect a power-on self test, the system copyright, and then an attempt at communications with the ignition module. Once communications is established, the Diagnostic Menu appears. See Figure 4-8.
6. Continue with the instructions under USAGE which follows.

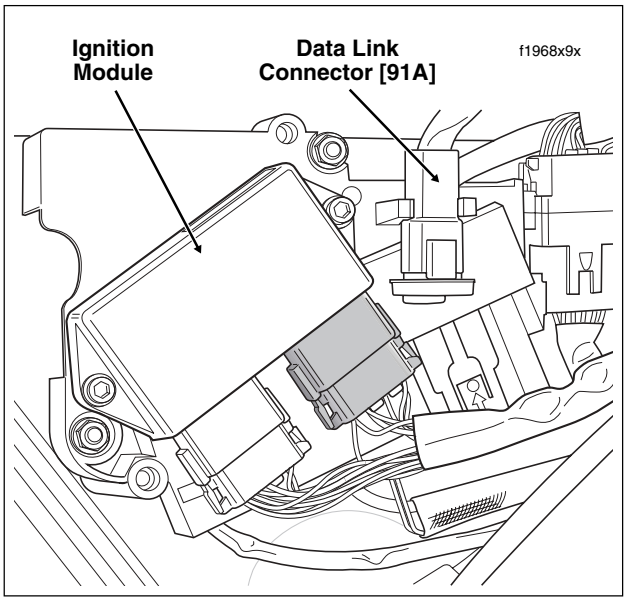


Figure 4-6. Right Side Cover Removed

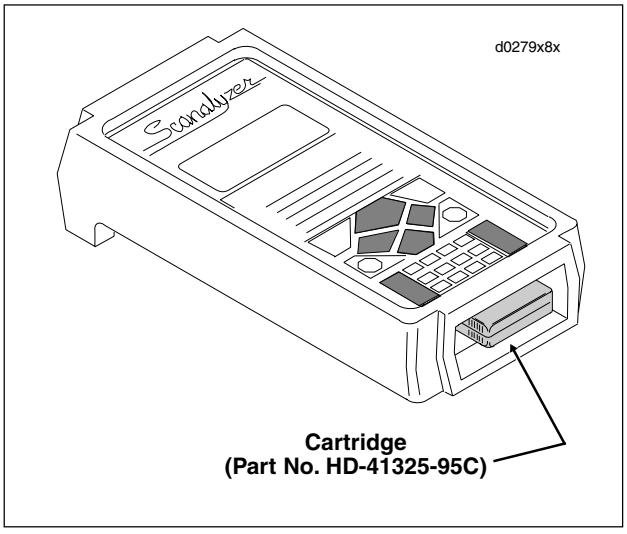


Figure 4-7. Scanalyzer (Part No. HD-41325)

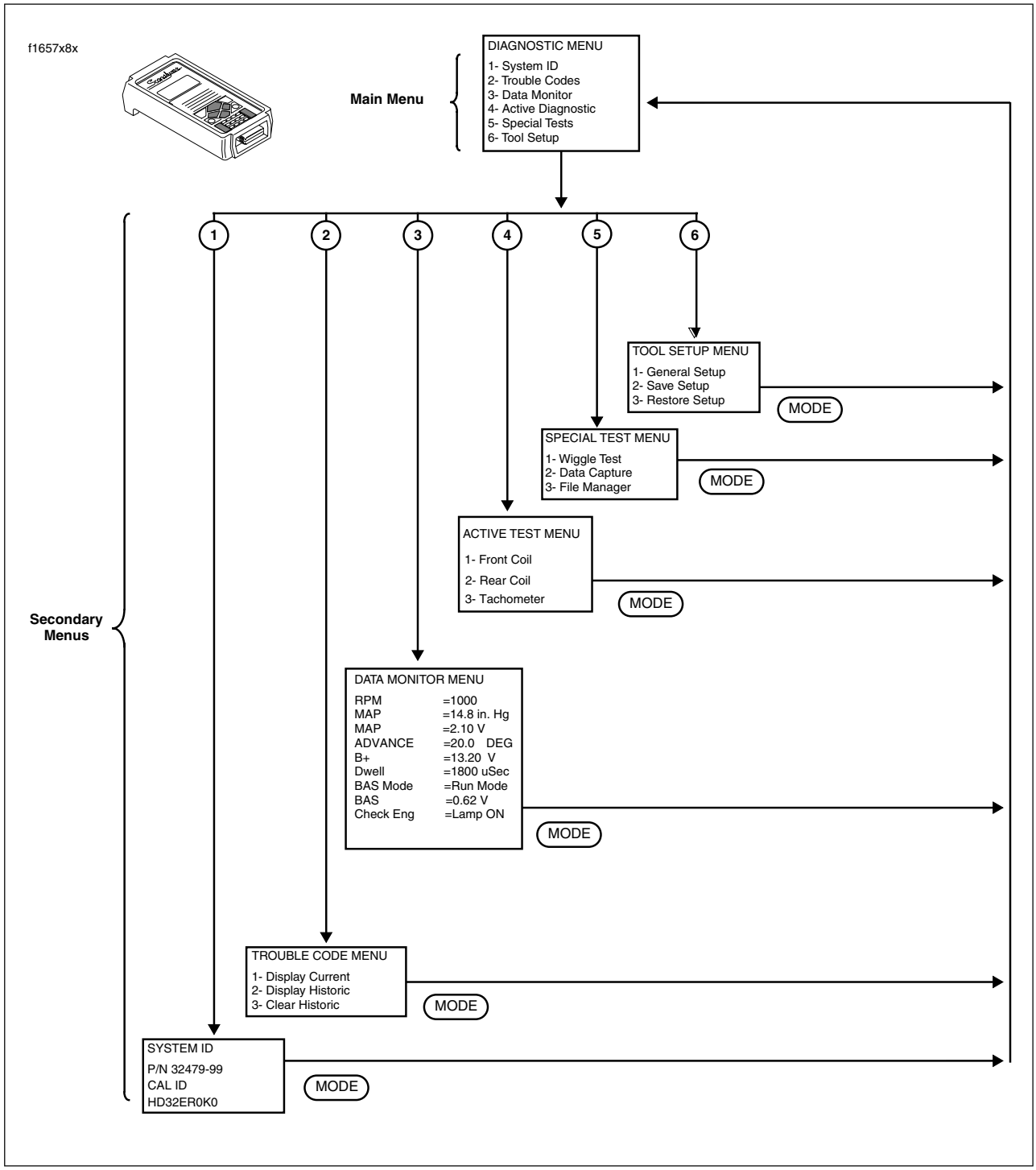


Figure 4-8. Scanalyzer Menus

USAGE

See Figure 4-8. The Diagnostic Menu, which consists of six items, is the primary system menu (main menu) through which all other secondary menus and displays are accessed. Since the screen may not be large enough to display all line items at any given time, use the up and down arrow keys to scroll through the list.

Checking/Clearing Trouble Codes

1. See Figure 4-9. From the diagnostic menu, press the number “2” to access the Trouble Codes Menu.
2. At this point, the operator may:
   a. Press number “1” to display current trouble codes.
   b. Press number “2” to display historic trouble codes.
   c. Press number “3” to clear trouble codes. Note that the Scanalyzer is the only method by which the operator can display and manually clear historic trouble codes.
3. After reading trouble codes, simply press the Mode key to return to the Trouble Codes Menu. Press the Mode key again to return to the Diagnostic Menu. In this manner, regardless of where the operator is in the program, the Mode key need only be pressed once or twice to return to the Main Menu.

NOTE

For more detailed instructions, refer to the literature provided with the Scanalyzer.

4. Write down all trouble codes on a piece of paper. If a current trouble code exists, place it at the top of the list.
   a. If current trouble codes are present, see Table 4-8. to identify the source of the fault condition and then see the applicable flow chart.
   b. If only historic trouble codes are present, then a fault condition does not currently exist. If you wish, look for an intermittent in the appropriate circuit.
   c. If trouble codes are NOT present, but starting or driveability problems are evident, see symptoms charts under Section 4.8 INITIAL DIAGNOSTIC CHECK.
5. After correcting system problems, clear trouble codes using the Trouble Codes Menu of the Scanalyzer.

NOTE

Trouble codes cannot be cleared while the engine is running. Turn the engine off, but leave the Ignition/Light Key Switch in the IGNITION position and return the handlebar Engine Stop/Run Switch to RUN.

d0543x8x

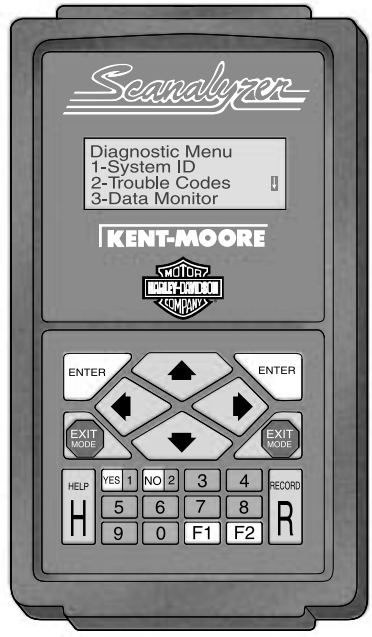


Figure 4-9. Scanalyzer Diagnostic Menu

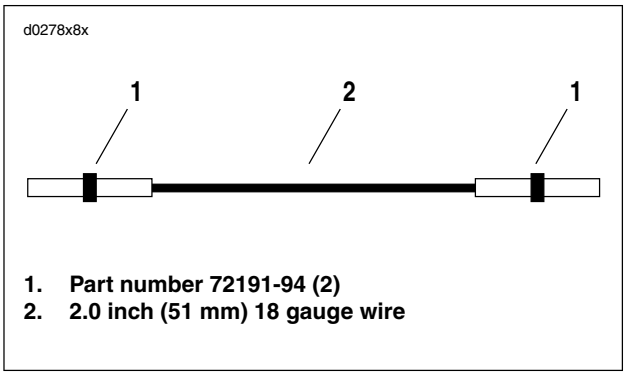
REMOVAL

1. Turn the Ignition/Light Key Switch to OFF. Set the Engine Stop/Run Switch to STOP.
2. Unplug the Scanalyzer from the Data Link Connector. Install protective plug.
3. Install right side cover and saddlebag.
4. Road test the vehicle and observe the check engine lamp to confirm proper operation without the reoccurrence of trouble codes. See Section 4.3 CHECKING FOR TROUBLE CODES.

ACTIVATION

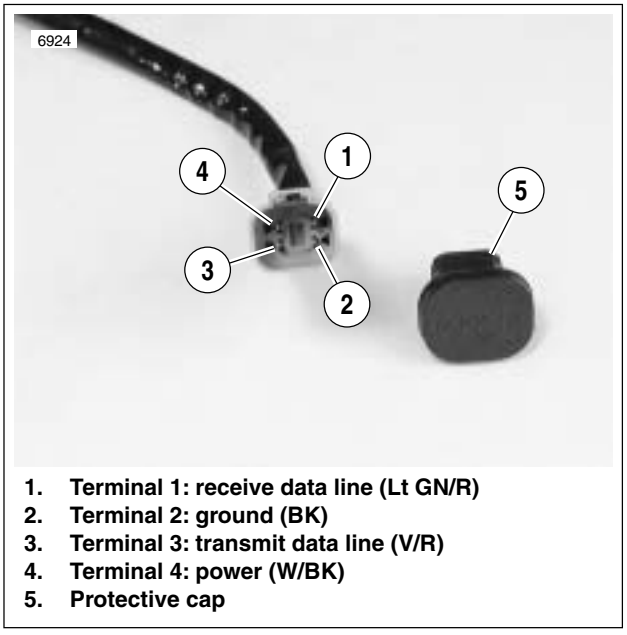
Use of check engine lamp diagnostics assumes that the SCANALYZER (Part No. HD-41325) is not available.

1. Access the data link connector [91] under the right side cover.
2. Activate the diagnostic feature of the check engine lamp as follows:
   a. See Figure 4-10. Create diagnostic test wire from parts shown.
   b. See Figure 4-11. Install diagnostic test wire across Terminal 1 and Terminal 2 on the data link connector [91A].
   c. Turn the Ignition/Light Key Switch to IGNITION and wait approximately eight seconds for the check engine lamp to start flashing.
3. See Figure 4-12. All trouble codes are sent out as a series of flashes. To retrieve the first digit of the trouble code simply observe the number of times the lamp flashes.
   a. The transmission of a trouble code is always preceded by six rapid flashes (about 3 per second).
   b. This “intermission” is followed by a 2 second pause in which the lamp is off.
   c. The lamp will then flash one or more times to indicate the first digit of the trouble code. The length of time the lamp is illuminated and the length of time in which it is off are each about 1 second in duration.
4. The second digit follows:
   a. Following transmission of the first digit, there is another 2 second pause in which the lamp is off.
   b. The lamp will then flash one or more times to indicate the second digit of the trouble code. Count the number of times the lamp flashes to retrieve the second digit.
5. If more than one trouble code is sent:
   a. Following transmission of the second digit of the first code, there is a third 2 second pause in which the lamp is off.
   b. After the pause comes the intermission, which is followed by transmission of the next recorded trouble code.
   c. All subsequent codes are sent in the same manner, each separated from the next by the intermission.
6. Once all codes have been sent, the data string is repeated. When you have recorded the same trouble code twice, it is an indication that the transmission has been restarted and that all trouble codes have been retrieved.



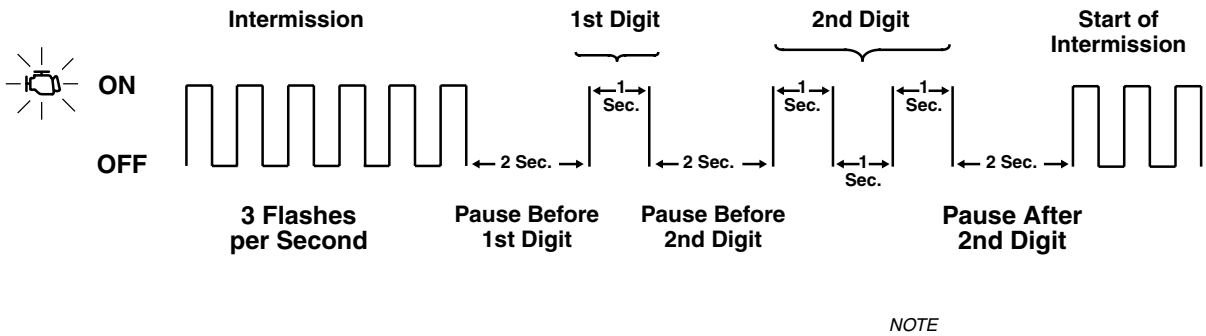
1. Part number 72191-94 (2)
2. 2.0 inch (51 mm) 18 gauge wire

Figure 4-10. Diagnostic Test Wire



1. Terminal 1: receive data line (Lt GN/R)
2. Terminal 2: ground (BK)
3. Terminal 3: transmit data line (V/R)
4. Terminal 4: power (W/BK)
5. Protective cap

Figure 4-11. Installing Diagnostic Test Wire



NOTE

Looking at the above transmission, we can see that the trouble code is 12. Now reference Table 4-8. The source of the fault condition is identified as the Manifold Absolute Pressure (MAP) Sensor.

Figure 4-12. Check Engine Lamp Diagnostics

NOTE

If the lamp flashes at a rate faster than normal, then you are observing the "Intermission" only, which means that no trouble codes are present.

7. When examining trouble codes, write down all codes on a piece of paper. If a current trouble code exists, place it at the top of the list.
   a. If trouble codes are present, see Table 4-8. Follow the applicable flow charts for each code.
   b. If trouble codes are NOT present, but starting or driveability problems are evident, see symptoms charts under Section 4.8 INITIAL DIAGNOSTIC CHECK.
8. Turn the Ignition/Light Key Switch to OFF.
9. Remove diagnostic test wire from connector. Install protective plug in data link connector.
10. Install right side cover and saddlebag.

IMPORTANT NOTE

If diagnostic test wire is installed across Pins 1 and 2 on connector [91A] in lieu of a Scanalyzer, the ignition module is placed in a diagnostic test mode and the engine will start. The test wire must be removed from the data link connector and the ignition switch turned OFF or the check engine lamp will continue to flash codes.

BREAKOUT BOX: CARB 4.6

GENERAL

See Figure 4-13. The BREAKOUT BOX (Part No. HD-42682), used in conjunction with a DVOM, allows circuit diagnosis without having to probe connectors with sharp objects.

INSTALLATION

1. Remove the right saddlebag and side cover.
2. Remove connector [10] and connector [11] to release ignition harness from ignition module. See Figure 4-14.
3. Install Breakout Box connectors to ignition module and ignition harness connectors of the same color.

REMOVAL

1. Separate connectors to remove Breakout Box between ignition module and ignition harness.
2. To connect ignition harness, install connector [10] and connector [11] to ignition module connectors of the same color. See Figure 4-14.
3. Install the right side cover and saddlebag.

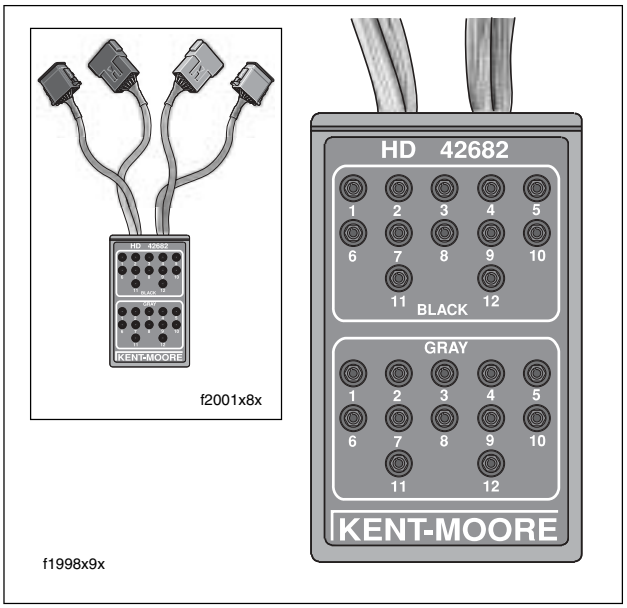


Figure 4-13. Breakout Box (Part No. HD-42682)

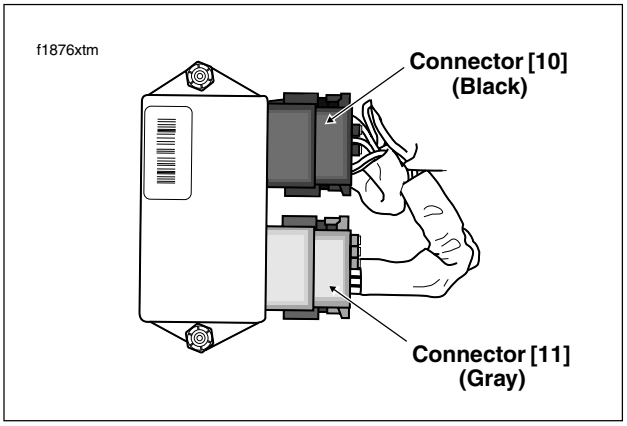


Figure 4-14. Ignition Module

WIGGLE TEST 4.7

GENERAL

The wiggle test indicates the presence of intermittents in a wiring harness. Depending upon the availability of diagnostic tools, either version of this test may be used.

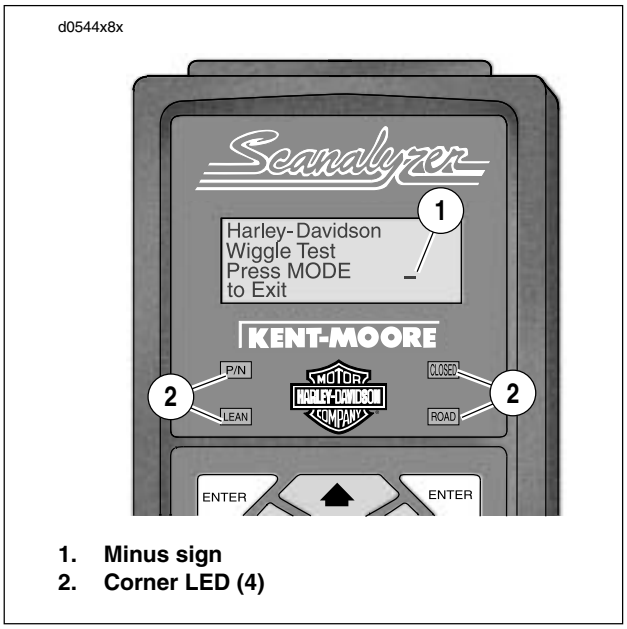
PROCEDURE

Using Scanalyzer (Part No. HD-41325)

1. Connect Scanalyzer to vehicle. See Section 4.4 SCANALYZER: CARB.
2. Start motorcycle and allow to idle.
3. Enter wiggle test mode.
   a. Press “5” from the Diagnostic Menu to enter the Special Tests menu.
   b. Press “1” from the Special Tests menu to enter the Wiggle Test.
4. Shake or wiggle harness to detect intermittents. If intermittents are present the Scanalyzer will beep, light the four corner LED’s and display a minus sign when a current trouble code is detected. See Figure 4-15.

NOTE

If a current trouble code is present when the wiggle test is entered, the Scanalyzer will respond as described immediately upon entering the wiggle test mode. With key ON and engine off, clear trouble codes and then perform wiggle test with vehicle running.



1. **Minus sign**
2. **Corner LED (4)**

Figure 4-15. Wiggle Test Indicators

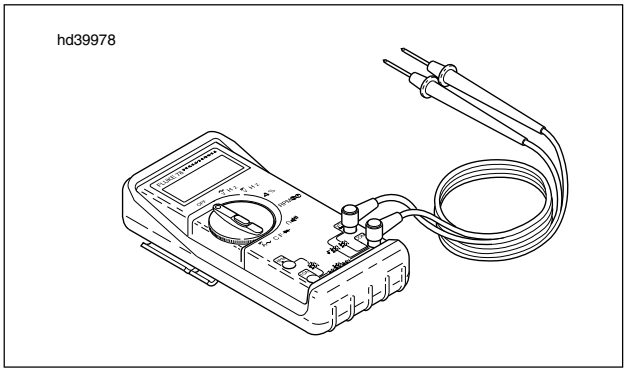


Figure 4-16. Fluke 78 Multimeter (DVOM) (Part No. HD-39978)

Using DVOM (Part No. HD-39978)

1. See Figure 4-16. Connect DVOM to wiring harness between the suspect connections. When diagnosing ignition module connections, a BREAKOUT BOX (Part No. HD-42682) may be used to simplify the procedure. See Section 4.6 BREAKOUT BOX: CARB.
2. Set DVOM to read voltage changes.
3. Start motorcycle and allow to idle.
4. Shake or wiggle harness to detect intermittents. If intermittents are present, radical voltage changes will register on the DVOM.

INITIAL DIAGNOSTIC CHECK 4.8

GENERAL

To locate faulty circuits or other system problems, follow the diagnostic flow charts in this chapter. Read the general information and then work your way through the flow chart box by box. For a systematic approach, always begin with INITIAL DIAGNOSTICS below.

Diagnostic Notes

If a numbered circle appears adjacent to a box of the flow chart, then more information is offered in the Diagnostic Notes. Many diagnostic notes contain supplemental information, descriptions of various diagnostic tools or references to other parts of the manual.

Scanalyzer Icon

The Scanalyzer icon appears at those points in the flow chart where the Scanalyzer may be used.

Circuit Diagram/Connector Location Table

When working through a flow chart, refer to the illustrations, the associated Circuit Diagram and the Wire Harness Connector Table as necessary. The wire harness connector table opposite each flow chart identifies the connector number, description, type and general location.

In order to perform most diagnostic routines, a Breakout Box and a DVOM are required. See Section 4.6 BREAKOUT BOX: CARB. To perform the circuit checks with any degree of efficiency, a familiarity with the various wire connectors is also necessary.

Job/Time Code Values

When filing warranty claims, dealer technicians should use the numeric job/time codes printed below the appropriate box of the flow chart.

INITIAL DIAGNOSTICS

General

The diagnostic check is an organized approach to identifying a system problem. If no problems are found after completion of the diagnostic check, a comparison of Scanalyzer parameters may be used to help locate intermittents and out-of-specification sensors. See Table 4-4.

Diagnostic Tips

- If the Scanalyzer is not working properly, check operation on another vehicle.
- If proper Scanalyzer function is verified, check data link connector [91A] for 12 volts (Terminal 4) and proper ground (Terminal 2). See Figure 4-17.
- See Figure 4-11. If Scanalyzer reads “No Response” with the ignition switch turned to IGNITION (engine stop switch at RUN with the engine off), check serial receive data wire for an open or short to ground between data link Terminal 1 and ignition module.
- Check for an open diagnostic test terminal between data link Terminal 3 and ignition module. With ignition switch turned to IGNITION, transmit data line and receive data line should have 5 volts.

IMPORTANT NOTE

If diagnostic test wire is installed across Pins 1 and 2 on connector [91A] in lieu of a Scanalyzer, the ignition module is placed in a diagnostic test mode and the engine will start. The test wire must be removed from the data link connector and the ignition switch turned OFF or the check engine lamp will continue to flash codes.

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the diagnostic check flow charts. See page 4-15.

1. Compare engine behavior to symptoms tables.
   a. Starts hard. See Table 4-5.
   b. Hesitates, stumbles, surges, misfires and/or sluggish performance. See Table 4-6.
   c. Engine exhaust emits black smoke or fouls plugs. See Table 4-7.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), black socket probes and patch cord.
3. Connect BREAKOUT BOX (Part No. HD-42682) to ignition module. See Section 4.6 BREAKOUT BOX: CARB.

Table 4-4. Typical Scan Values

ITEM	MIN. VALUE	MAX. VALUE	HOT IDLE
MAP sensor	0.1 V (high vacuum)	4.96 V (atmospheric pressure)	1.5-3.0 V
Spark advance while running	0°	50°	10-15°
RPM	0	5600	1000
Bank angle sensor	Run mode 0.45-1.1 V	Disable 1.8-3.2 V	Run mode 0.45-1.1 V
Dwell	960 uSec	8100 uSec	1600-2400 uSec

Table 4-5. Engine Starts Hard

SYMPTOM	SOLUTION
Battery discharged	See charging system troubleshooting in this section.
Spark plugs	Section 4.13 MISFIRE.
Spark plug wires	Section 4.13 MISFIRE
Ignition coil	Section 4.13 MISFIRE.
Valve sticking	See Section 3 in 2003 FLT Service Manual (Part Number 99483-03).
Water or dirt in fuel system	Drain and refill with fresh fuel.

Table 4-6. Engine Performance Problems

SYMPTOM	SOLUTION
Manifold leak	Spray water around induction module seals with engine idling. If RPM changes, change seals.
MAP sensor plugged or not operating properly	Section 4.14 DTC 12.
Water or dirt in fuel system	Drain and refill with fresh fuel.
Spark plugs	Section 4.13 MISFIRE.
EVAP hose disconnected from induction module (CA)	Connect.
Throttle plates not opening fully	See throttle cable adjustment in 2003 FLT Service Manual (Part Number 99483-03),

Table 4-7. Engine Exhaust Emits Black Smoke or Fouls Plugs

SYMPTOM	SOLUTION
Clogged air filter	See Section 1 in 2003 FLT Service Manual (Part Number 99483-03).
MAP sensor plugged or not operating properly	Section 4.14 DTC 12.

Table 4-8. Diagnostic Trouble Codes (DTC) and Fault Conditions

DTC	FAULT CONDITION	RELEVANT SECTION
12	Map Sensor	4.14 DTC 12
16	Battery Voltage	4.15 DTC 16
24	Front Ignition Coil	4.16 DTC 24, 25
25	Rear Ignition Coil	4.16 DTC 24, 25
35	Tachometer	4.17 DTC 35
41	Crank Sensor	4.18 DTC 41
44	Bank Angle Sensor (Within TSM/TSSM) Detects Possible Theft Attempt	4.19 DTC 44
52	RAM Failure	4.20 DTC 52, 53, 54, 55
53	ROM Failure	4.20 DTC 52, 53, 54, 55
54	EEPROM Failure	4.20 DTC 52, 53, 54, 55
55	Ignition Module Failure	4.20 DTC 52, 53, 54, 55

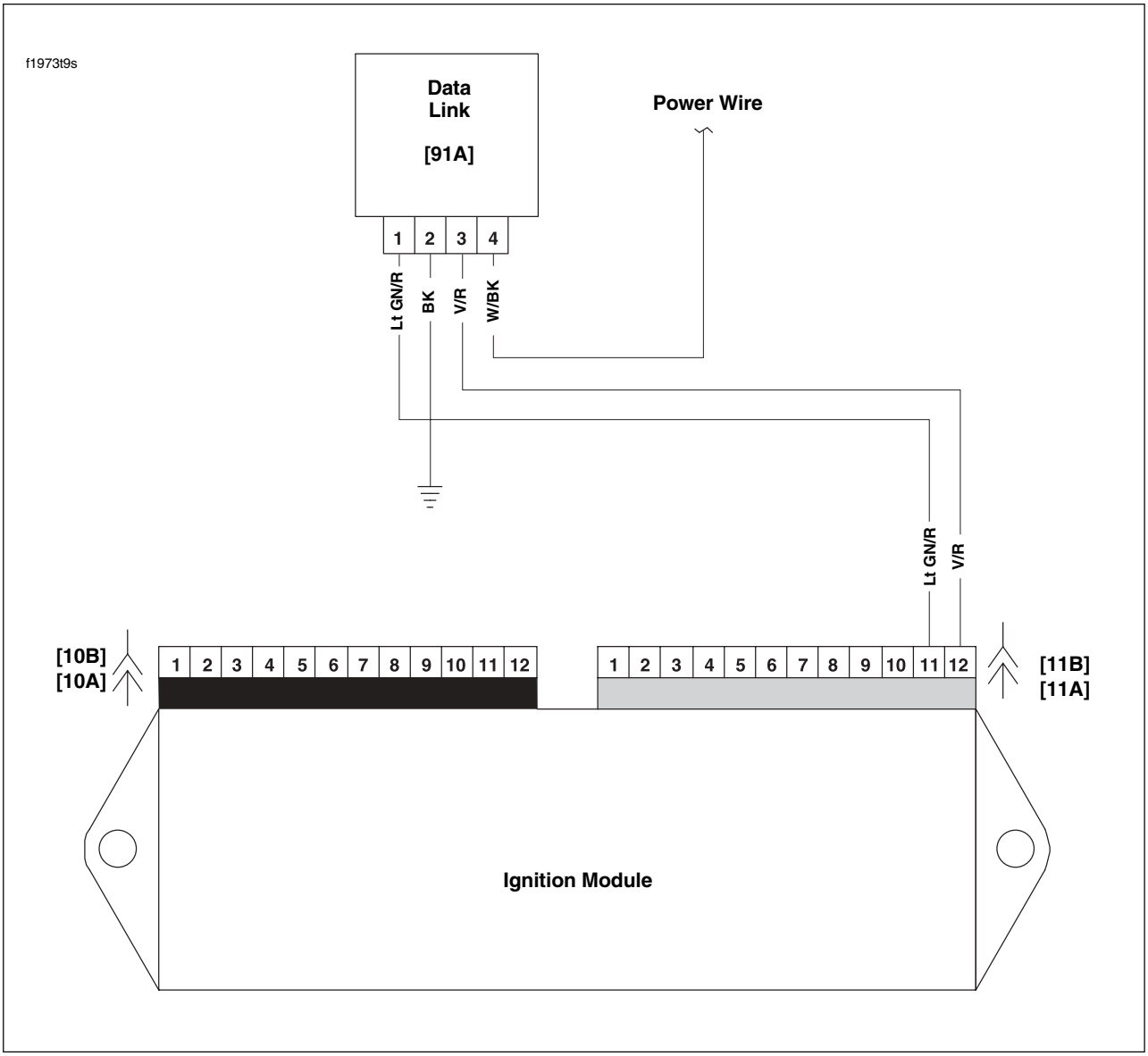
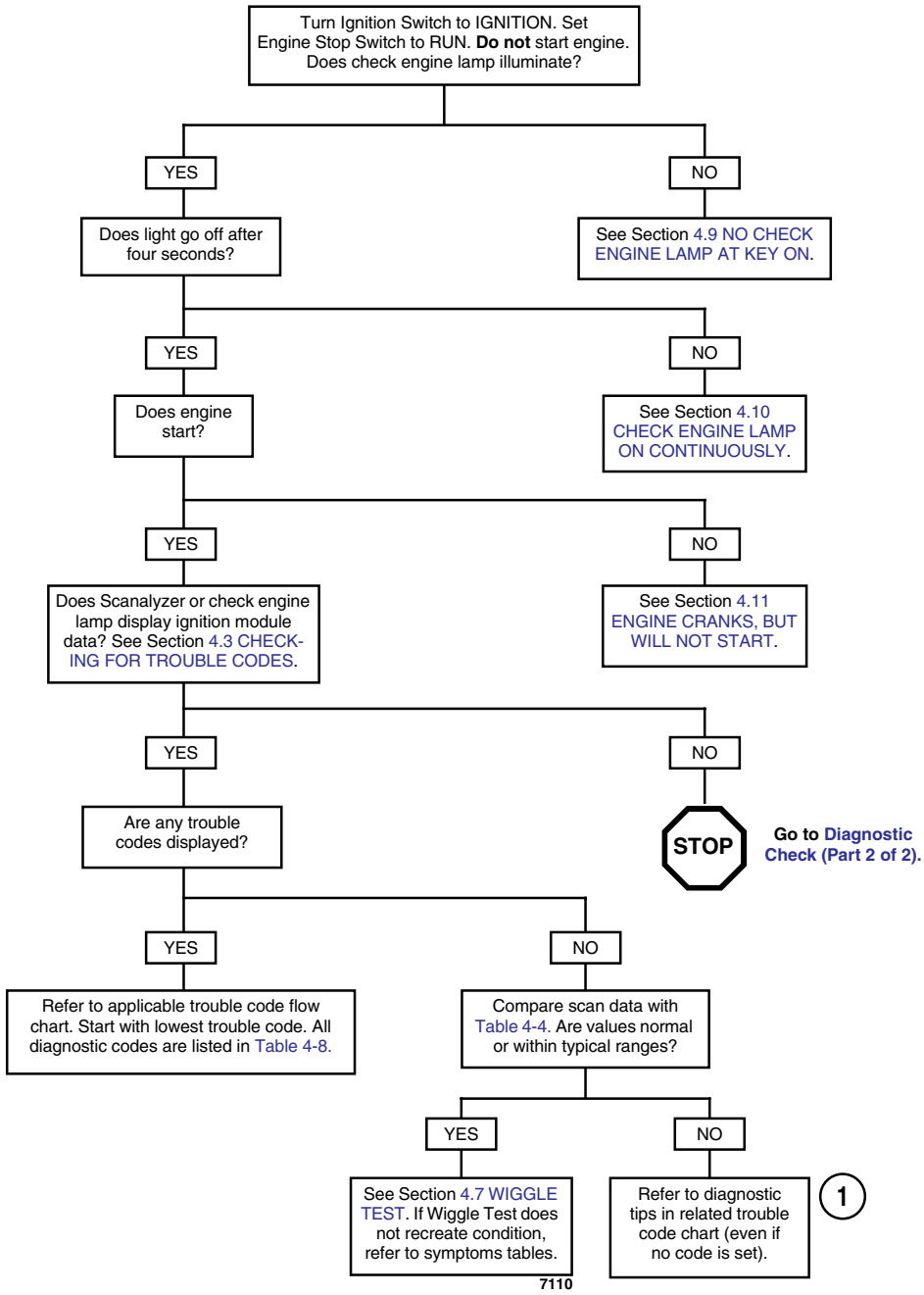


Figure 4-17. Diagnostic Check

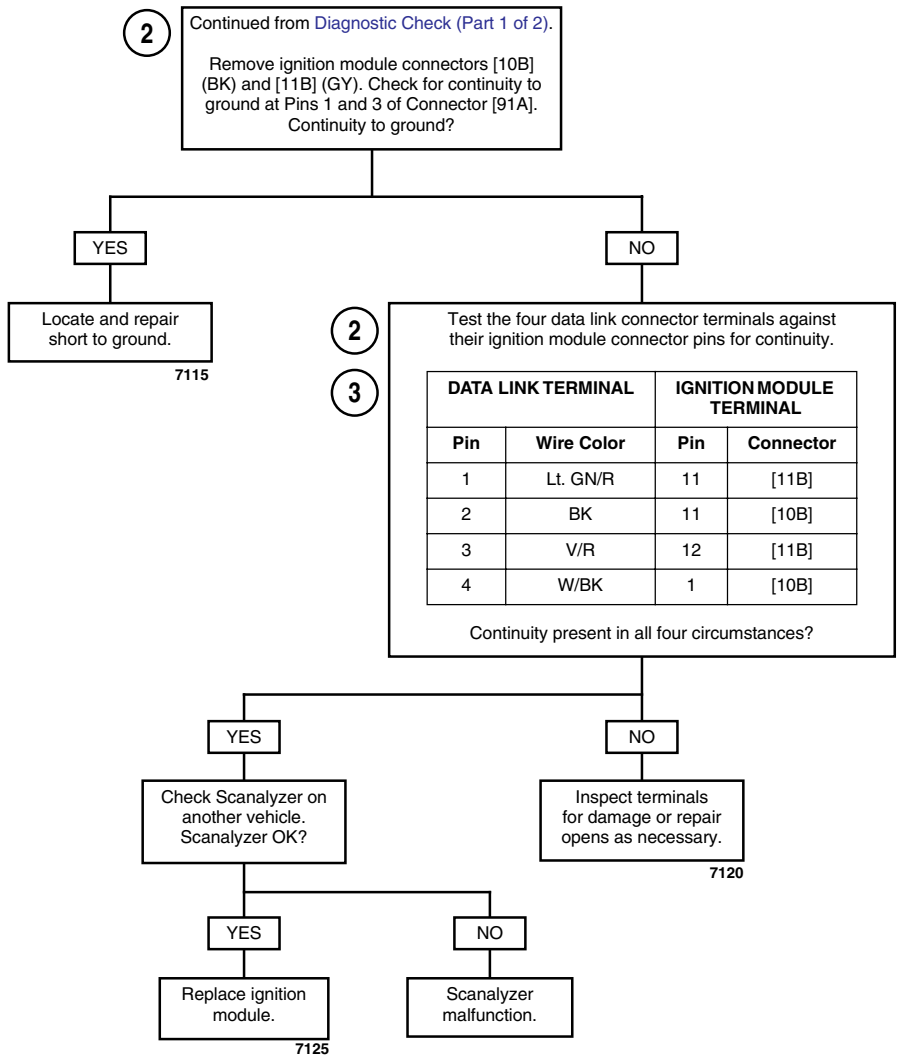
Table 4-9. Wire Harness Connectors in Figure 4-17.

NO.	DESCRIPTION	TYPE	LOCATION
[10]	Ignition Module (Black)	12-Place Deutsch	Under Right Side Cover
[11]	Ignition Module (Gray)	12-Place Deutsch	Under Right Side Cover
[91]	Data Link	4-Place Deutsch	Under Right Side Cover

Diagnostic Check (Part 1 of 2)



Diagnostic Check (Part 2 of 2)



NO CHECK ENGINE LAMP AT KEY ON 4.9

GENERAL

If the Ignition/Light Key Switch is turned to IGNITION and the Engine Stop/Run Switch is set to RUN (with the engine off), the check engine lamp should illuminate for four seconds. See Figure 4-18.

Battery voltage is supplied to the lamp bulb. The lamp bulb is grounded by the ignition module through the BK/Y wire. A lack of power to the ignition module will cause the check engine lamp to be inoperative and also create a no start situation.

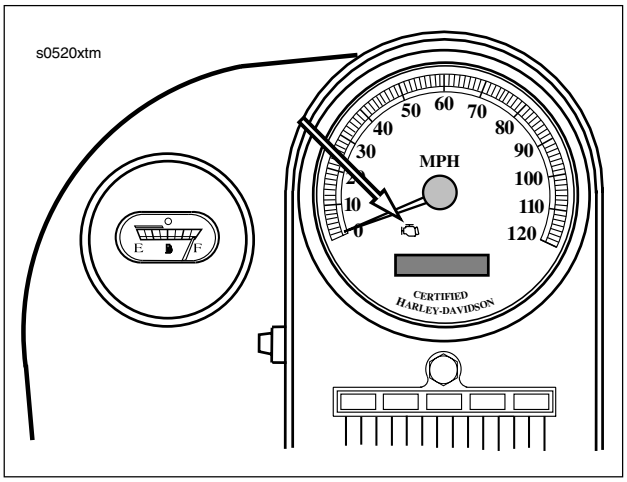


Figure 4-18. Check Engine Lamp (FLHR)

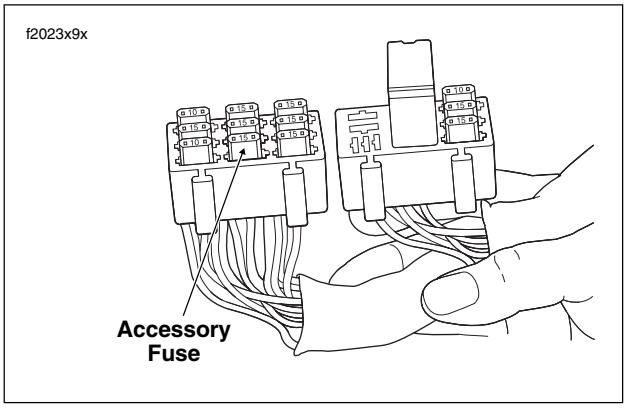


Figure 4-19. Left Side Cover Removed (FLTR, FLHT/C)

DIAGNOSTICS

Diagnostic Tips

Check for the following conditions:

- Check for open in BK/Y wire.
- Check for blown accessory fuse. See Figure 4-19.

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 4.9 flow chart.

1. Connect BREAKOUT BOX (Part No. HD-42682). See Section 4.6 BREAKOUT BOX: CARB.
2. Remove instrument console on FLHR models, outer fairing on FLHT/C, or instrument bezel on FLTR. See the 2003 FLT Service Manual (Part Number 99483-03).
3. Leaving speedometer connector [39] connected, insert probe into wire end of connector [39B] until contact is made with backside of terminal. If necessary, use a fine paper clip to avoid damage.
4. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), purple pin probe and patch cord between Breakout Box and ground. Align blade with slot in terminal of Breakout Box.
5. LED failure requires speedometer replacement.
6. Assumes speedometer is functioning. If speedometer is not functioning, see Section 2.2 SPEEDOMETER.
7. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), black pin or socket probe and patch cord.
8. Check continuity.
   a. If continuity is present, most likely short to voltage;
   b. If no continuity present, then open.

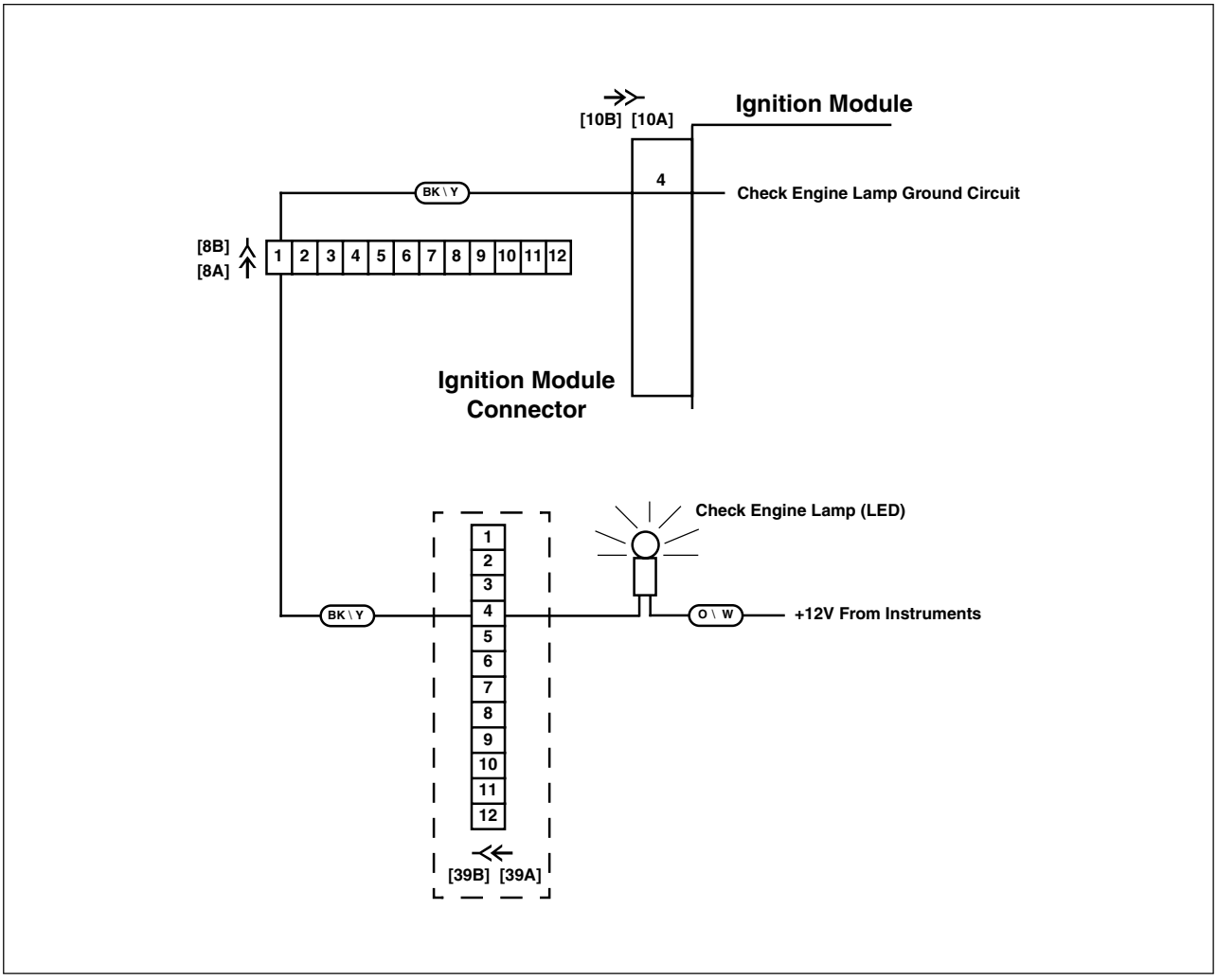


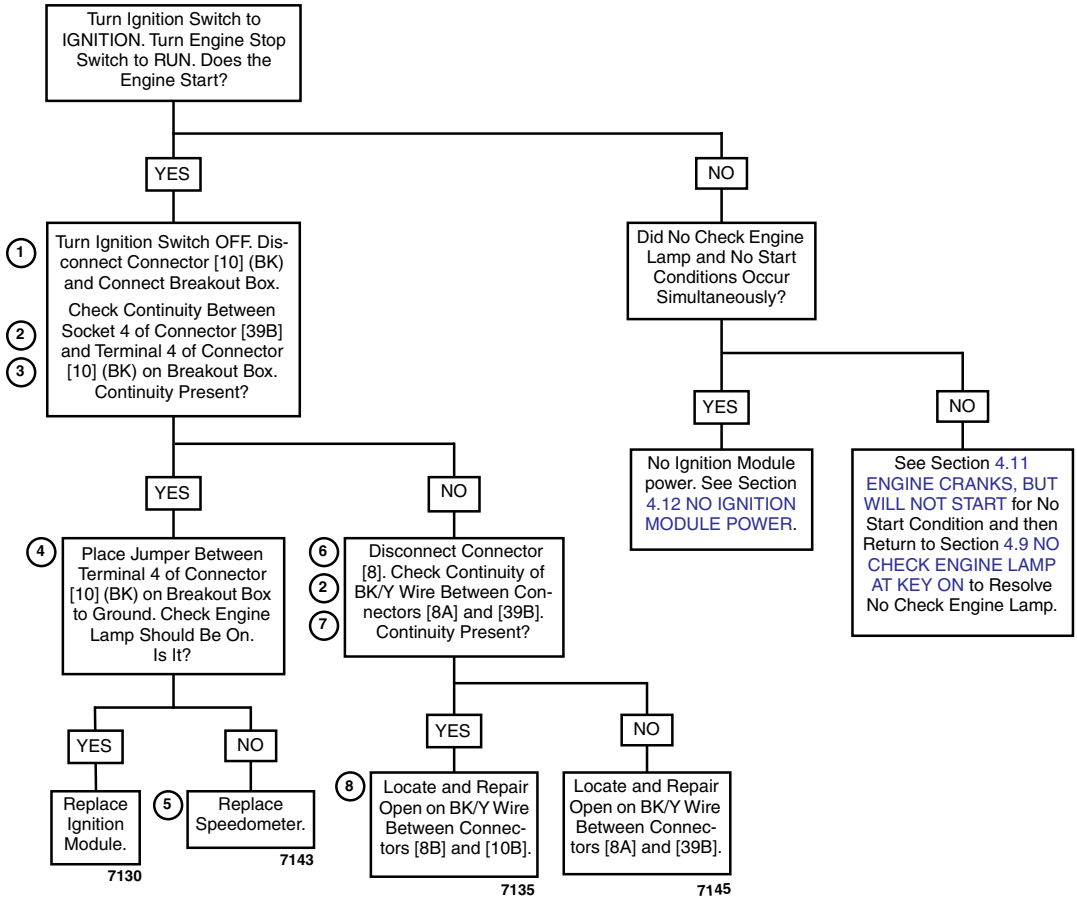
Figure 4-20. Check Engine Lamp Circuit

Table 4-10. Wire Harness Connectors in Figure 4-20.

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[8]	Ignition Harness	All	12-Place Deutsch	Under Right Side Cover
[10]	Ignition Module	All	12-Place Deutsch (Black)	Under Right Side Cover
[39]	Speedometer	FLHT/C	12-Place Packard	Inner Fairing (Back of Speedometer)
		FLTR	12-Place Packard	Under Bezel (Back of Speedometer)
		FLHR/C	12-Place Mini-Deutsch	Under Console (Back of Speedometer)

Test 4.9

NO CHECK ENGINE LAMP AT KEY ON



CHECK ENGINE LAMP ON CONTINUOUSLY 4.10

GENERAL

If the Ignition/Light Key Switch is turned to IGNITION and the Engine Stop/Run Switch is set to RUN (with the engine off), the check engine lamp should illuminate for four seconds. See Figure 4-21.

Following the initial period of illumination, the lamp should go off for four seconds. It may then come back on for an eight second period or remain on continuously.

Battery voltage is supplied to the lamp bulb. The lamp bulb is grounded by the ignition module through the BK/Y wire. A steady light may indicate a short to ground on the black wire.

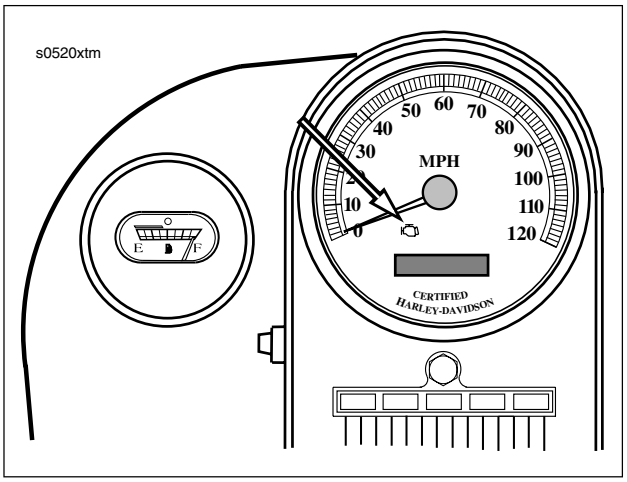


Figure 4-21. Check Engine Lamp (FLHR)

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 4.10 flow chart.

1. If the lamp goes OFF when ignition module connector is unplugged, BK/Y wire is shorted to ground.
2. Check for trouble codes. See RETRIEVING TROUBLE CODES under Section 4.3 CHECKING FOR TROUBLE CODES.
3. Remove instrument console on FLHR models, outer fairing on FLHT/C, or instrument bezel on FLTR. See the 2003 FLT Service Manual (Part Number 99483-03).
4. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), black pin probe and patch cord.

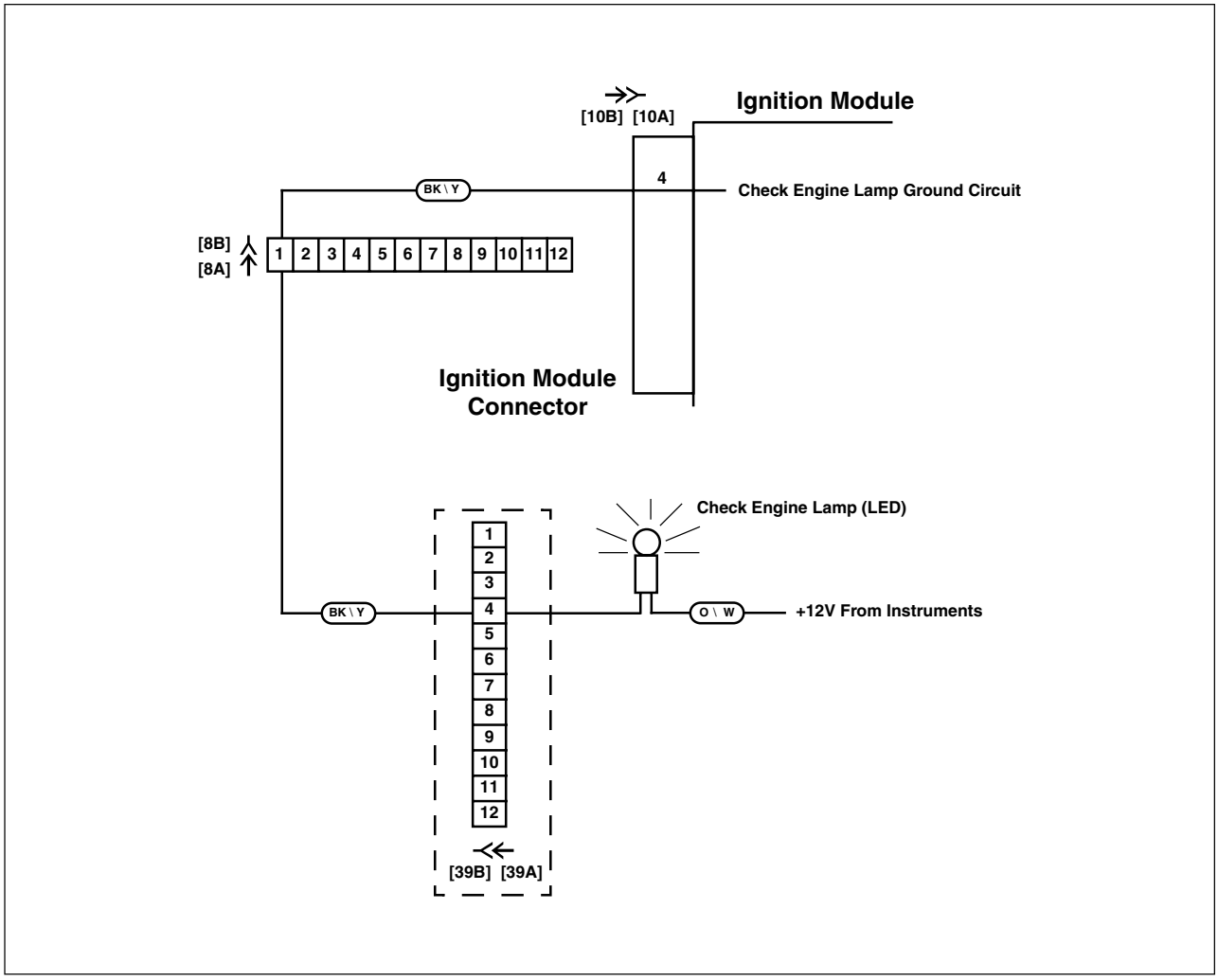


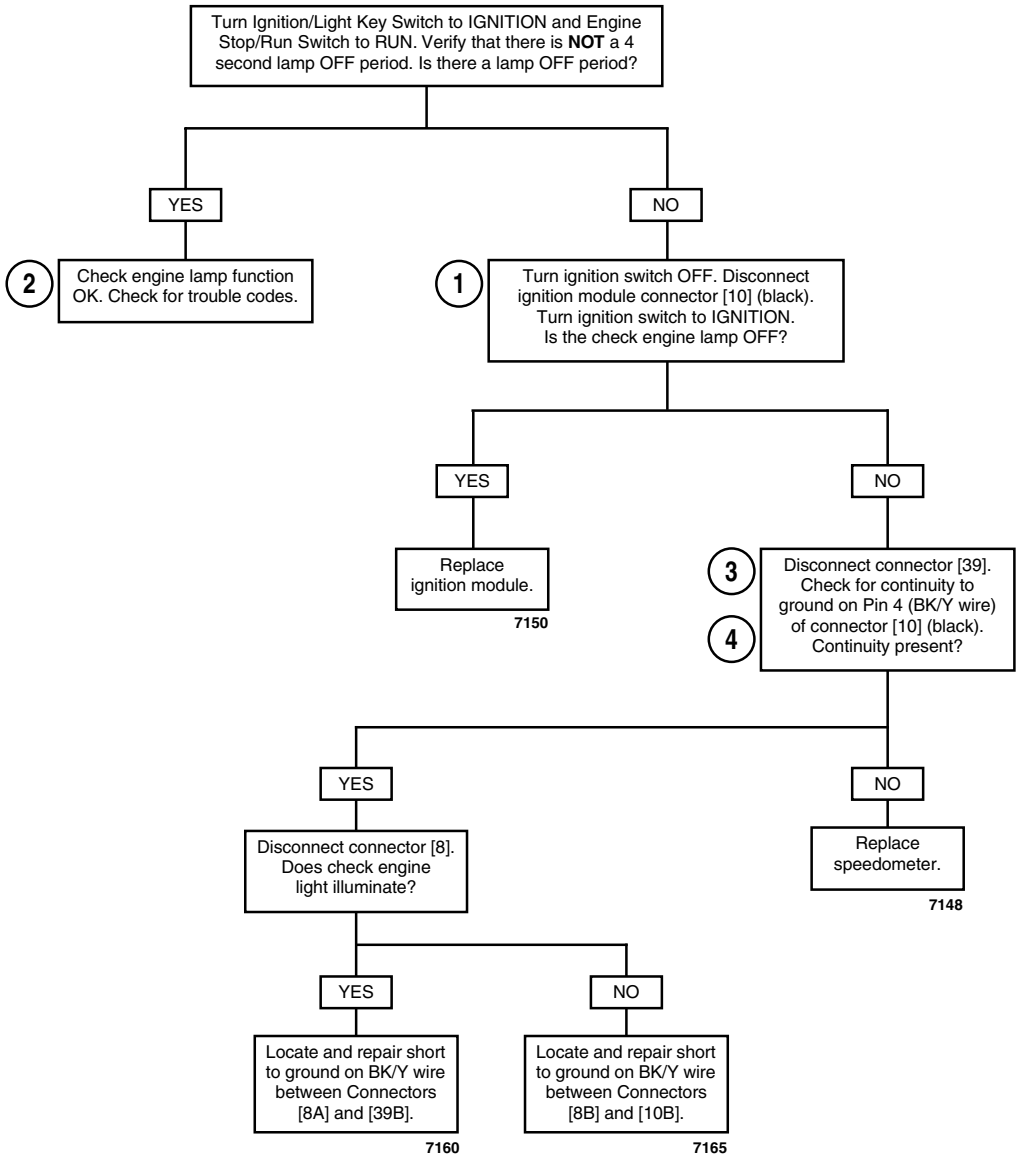
Figure 4-22. Check Engine Lamp Circuit

Table 4-11. Wire Harness Connectors in Figure 4-22.

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[8]	Ignition Harness	All	12-Place Deutsch	Under Right Side Cover
[10]	Ignition Module	All	12-Place Deutsch (Black)	Under Right Side Cover
[39]	Speedometer	FLHT/C	12-Place Packard	Inner Fairing (Back of Speedometer)
		FLTR	12-Place Packard	Under Bezel (Back of Speedometer)
		FLHR/C	12-Place Mini-Deutsch	Under Console (Back of Speedometer)

Test 4.10

CHECK ENGINE LAMP ON CONTINUOUSLY



ENGINE CRANKS, BUT WILL NOT START 4.11

GENERAL

If starter will not crank engine, the problem is not ignition related. Refer to Starting/Charging in Section 1 of this manual.

Engine can be started with diagnostic test wire installed or if the receive data line is grounded. The ignition switch must be turned OFF after test wire is removed or check engine lamp will continue to flash stored codes.

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 4.11 flow charts.

1. Check for trouble codes. See RETRIEVING TROUBLE CODES under Section 4.3 CHECKING FOR TROUBLE CODES.
2. Check the condition of the battery. Perform a voltage test and recharge if below 12.60V. Check battery connections and perform load test. Replace the battery if necessary.
3. Remove spark plug cable from spark plug.
   a. Visually check condition of plug.
   b. Attach cable to SPARK TESTER (Part No. HD-26792). Clip tester to cylinder head bolt. See Figure 4-23.
   c. While cranking engine, look for spark. Repeat procedure on other spark plug cables.

NOTE

Engine will not spark with both spark plugs removed. When checking for spark, use SPARK TESTER with both spark plugs installed.

4. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404) gray pin probes and patch cords.
5. Gently use test lamp as shown in Figure 4-24. Inserting the test lamp forcefully into the connector will damage the terminal and require its replacement.
6. Connect BREAKOUT BOX (Part No. HD-42682). See Section 4.6 BREAKOUT BOX: CARB.

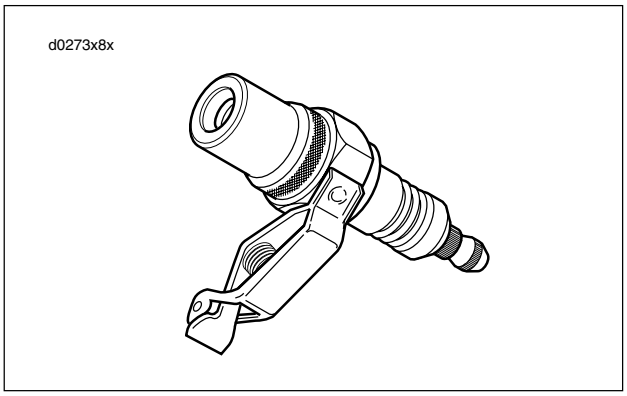


Figure 4-23. Spark Tester

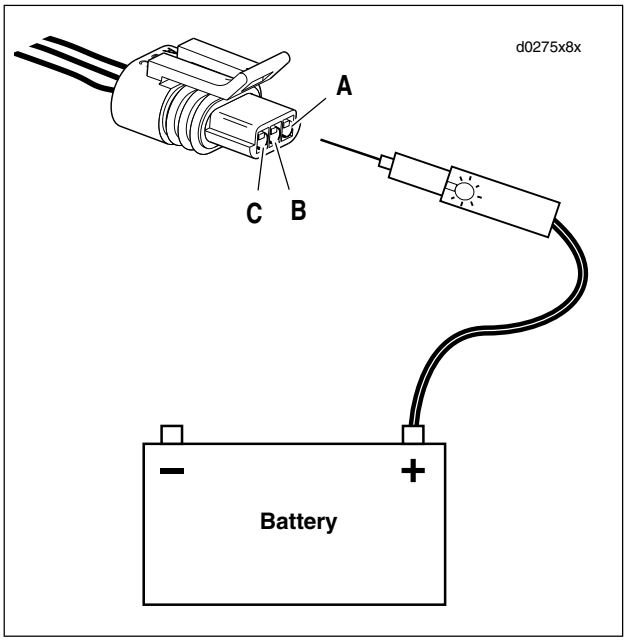


Figure 4-24. Ignition Coil Test

7. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), gray pin probe and patch cord.
8. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), brown socket probe and patch cord.

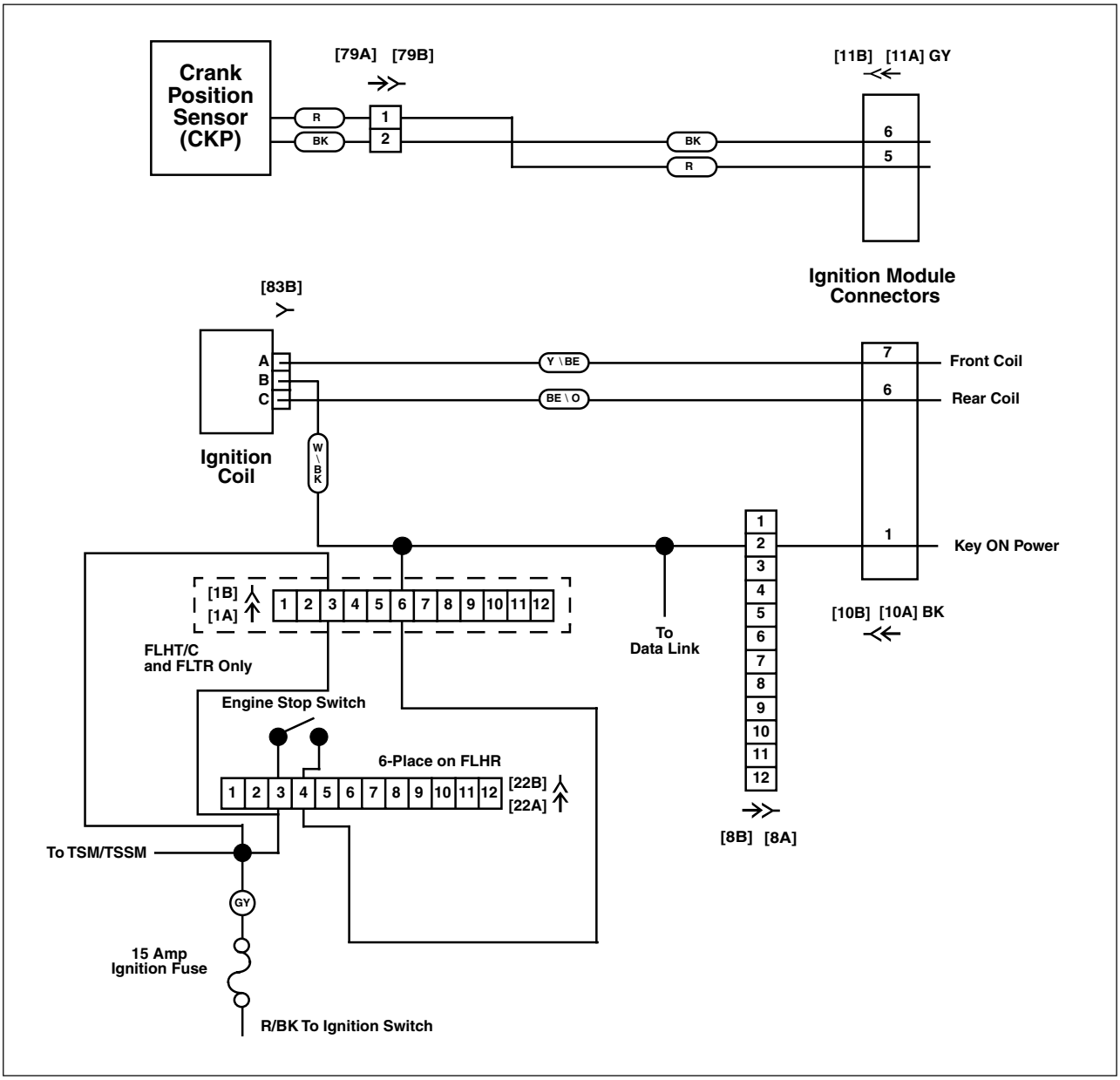


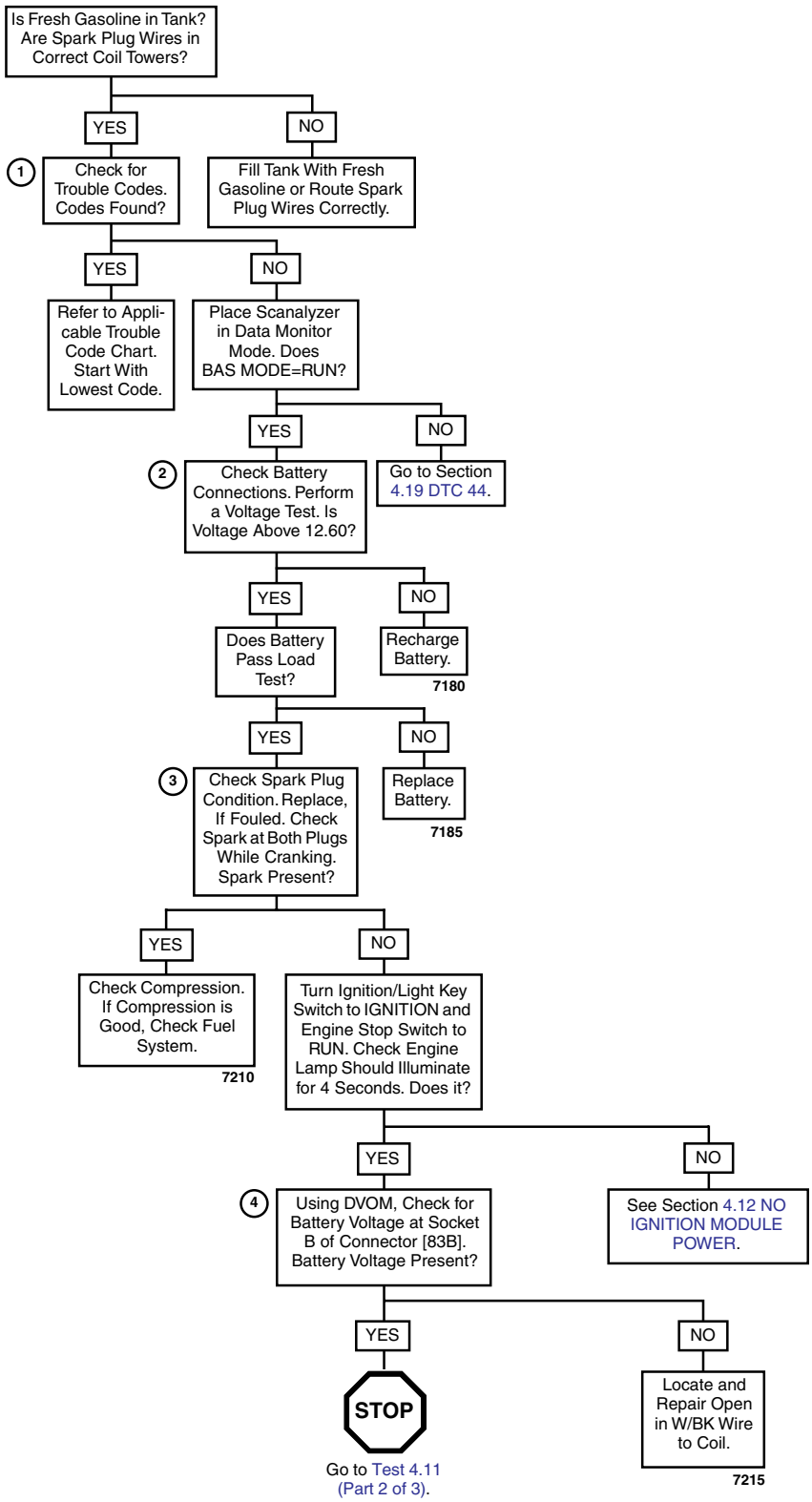
Figure 4-25. Ignition Circuit Diagram

Table 4-12. Wire Harness Connectors in Figure 4-25.

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to Interconnect Harness	FLHT/C	12-Place Deutsch	Inner Fairing- Right Fairing Bracket
		FLTR	12-Place Deutsch	Inner Fairing- Below Radio (Right Side)
[8]	Ignition Harness	All	12-Place Deutsch	Under Right Side Cover
[10]	Ignition Module	All	12-Place Deutsch (Black)	Under Right Side Cover
[11]	Ignition module	All	12-Place Deutsch (Gray)	Under Right Side Cover
[79]	CKP Sensor	All	2-Place Mini-Deutsch	Under Right Side Cover (Behind Electrical Bracket)
[83]	Ignition Coil	All	3-Place Packard	Below Fuel Tank (Left Side)

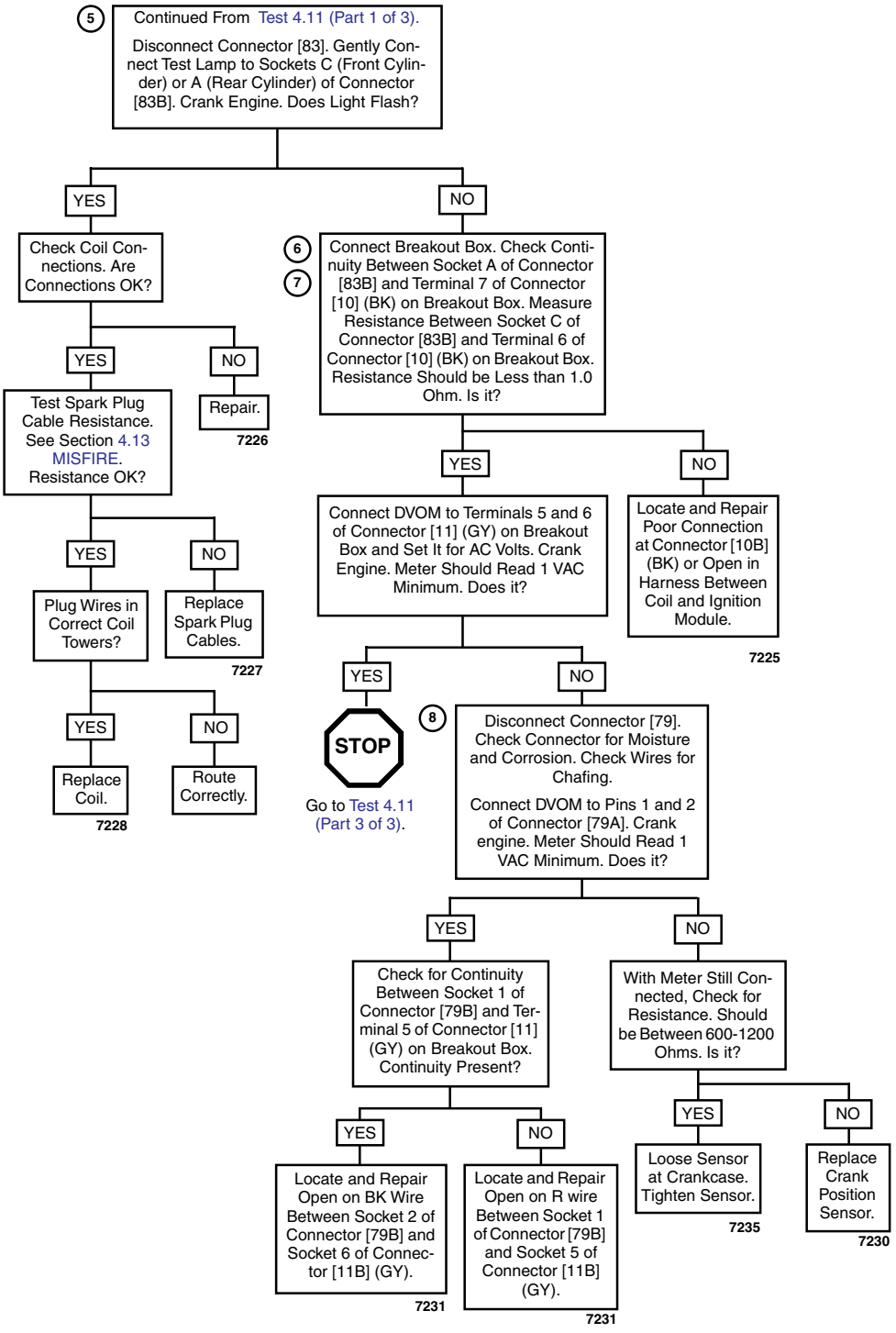
Test 4.11 (Part 1 of 3)

ENGINE CRANKS, BUT WILL NOT START



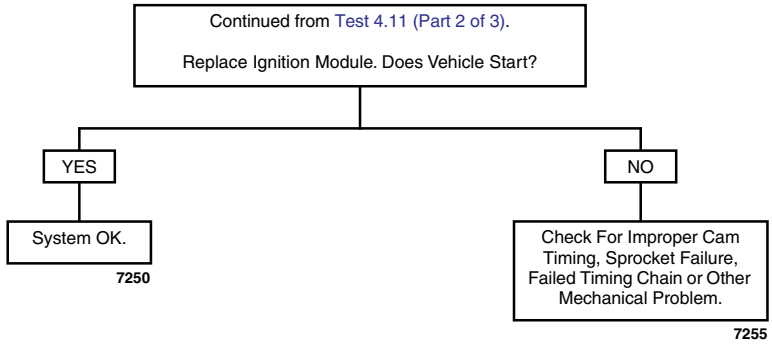
Test 4.11 (Part 2 of 3)

ENGINE CRANKS, BUT WILL NOT START



Test 4.11 (Part 3 of 3)

ENGINE CRANKS, BUT WILL NOT START



NO IGNITION MODULE POWER 4.12

GENERAL

No Spark/No Check Engine Lamp At Key ON

The ignition module turns on when power is applied to Pin 1 of Connector [10], black. The ignition module goes through an initialization sequence every time power is removed and re-applied to Pin 1. The only visible part of this sequence is the check engine lamp. Upon starting, the check engine lamp will illuminate for 4 seconds and then (if parameters are normal) go out.

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 4.12 flow chart.

1. See Section 4.1 SPECIFICATIONS.
2. Connect BREAKOUT BOX (Part No. HD-42682). See Section 4.6 BREAKOUT BOX: CARB.
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-4104), black pin probe and patch cord.
4. Remove headlamp assembly on FLHR models or outer fairing on FLHT/C and FLTR. See the 2003 FLT Service Manual (Part Number 99483-03).

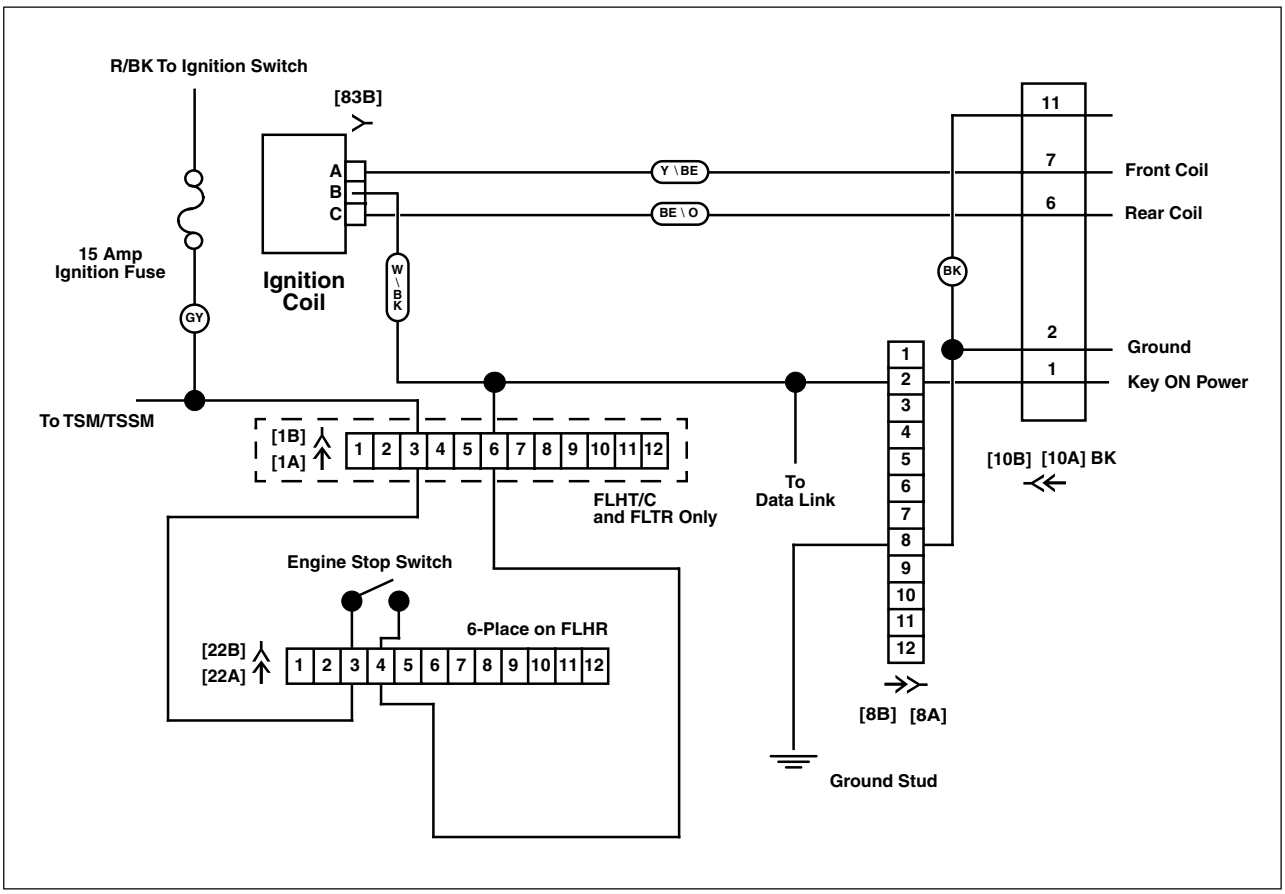


Figure 4-26. Ignition Coil Circuit Diagram

Test 4.12
NO IGNITION MODULE POWER

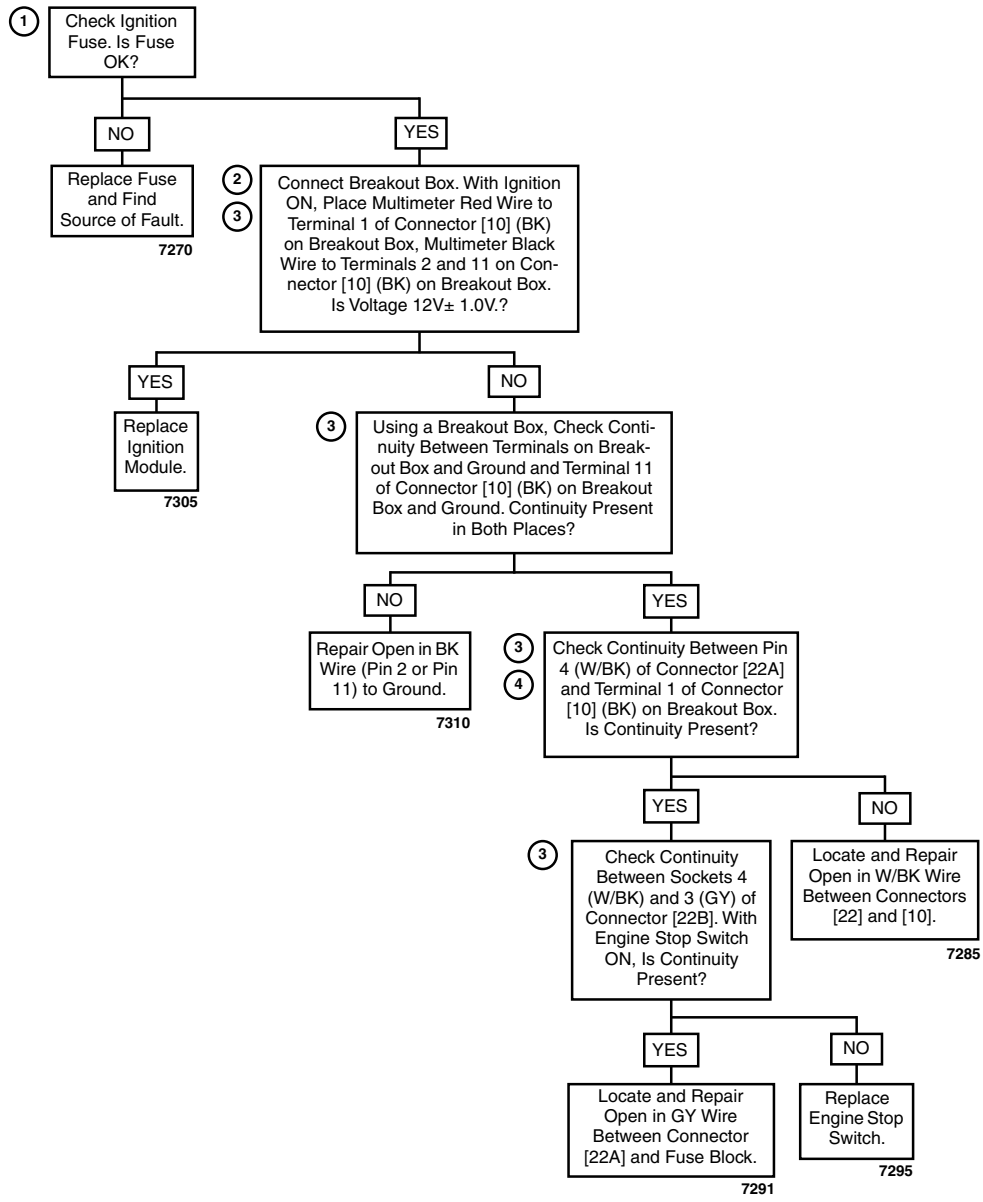


Table 4-13. Wire Harness Connectors in Figure 4-26.

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to Interconnect Harness	FLHT/C	12-Place Deutsch	Inner Fairing- Right Fairing Bracket
		FLTR	12-Place Deutsch	Inner Fairing- Below Radio (Right Side)
[8]	Ignition Harness	All	12-Place Deutsch	Under Right Side Cover
[10]	Ignition Module	All	12-Place Deutsch (Black)	Under Right Side Cover
[22]	Interconnect to Right Handlebar Switch Controls	FLHT/C	12-Place Deutsch	Inner Fairing- Right Fairing Support Brace
		FLTR	12-Place Deutsch	Inner Fairing - Right Side of Radio Bracket
		FLHR	6-Place Deutsch	Inside Headlamp Nacelle

GENERAL

Misfire at Idle or Under Load

- Battery condition and connections may also cause misfires.
- Fuel system problems may also cause misfires. See Table 4-6.

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 4.13 flow chart.

⚠WARNING

Any open spark around gasoline or other combustibles may result in fire or explosion. Thoroughly wipe up any spilt fuel and dispose of rags in a suitable manner. Inadequate safety precautions could result in death or serious injury.

1. See Figure 4-27. Use the SPARK TESTER (Part No. HD-26792) to verify adequate secondary voltage (25,000 volts) at the spark plug.
   a. Turn Ignition/Light Key Switch to IGNITION.
   b. Remove spark plug cable from spark plug. Visually check plug condition.
   c. Attach cable to SPARK TESTER. Clip tester to cylinder head bolt.
   d. While cranking engine, watch for spark to jump tester gap on leads.

IMPORTANT NOTE

Engine will not spark with both spark plugs removed. When checking for spark, use SPARK TESTER with both spark plugs installed.

   e. Reinstall and repeat procedure on other spark plug cable.
2. Perform spark plug cable resistance test.
   a. Remove spark plug cable from spark plug and ignition coil. For best results, use a needle nose pliers for removal/installation on coil. Gently grasp cable as close to terminals as possible.
   b. Using an ohmmeter, touch probes to terminals on each end plug wire.

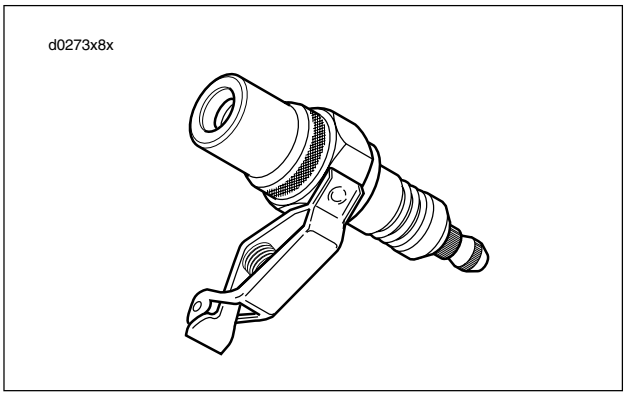


Figure 4-27. Spark Tester

   c. Compare resistance values to Table 4-14. Replace cables not meeting specifications. Reinstall and repeat procedure on other spark plug cable.

Table 4-14. Spark Plug Cables

LOCATION	LENGTH	RESISTANCE
Front/Rear	20 inch	5,000-11,666

3. If carbon tracking is evident, replace ignition coil and inspect spark plug wires. Wires must be clean and tight. Excessive wire resistance or faulty connections can cause coil damage.
4. This test can also be performed by substituting a known good coil for one causing the no spark condition. The coil does not require full installation to be functional. Verify faulty coil by performing resistance test.
5. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), gray pin probe and patch cord to the coil connector [83B].
6. Inspect for corrosion at battery terminals, main circuit breaker, ignition fuse terminals GY and R/BK, right handlebar switch controls connector [22], and ignition coil connector [83].

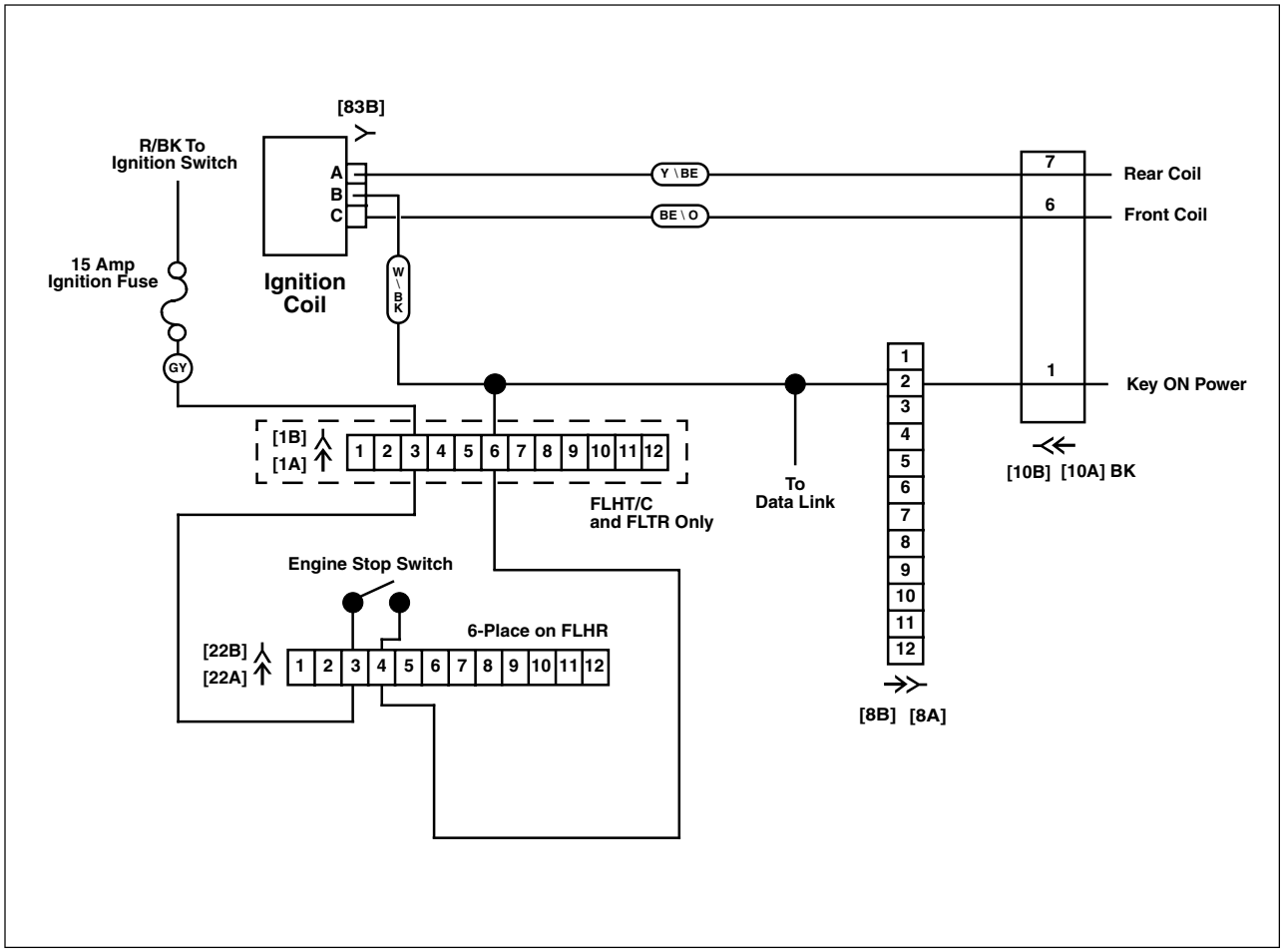


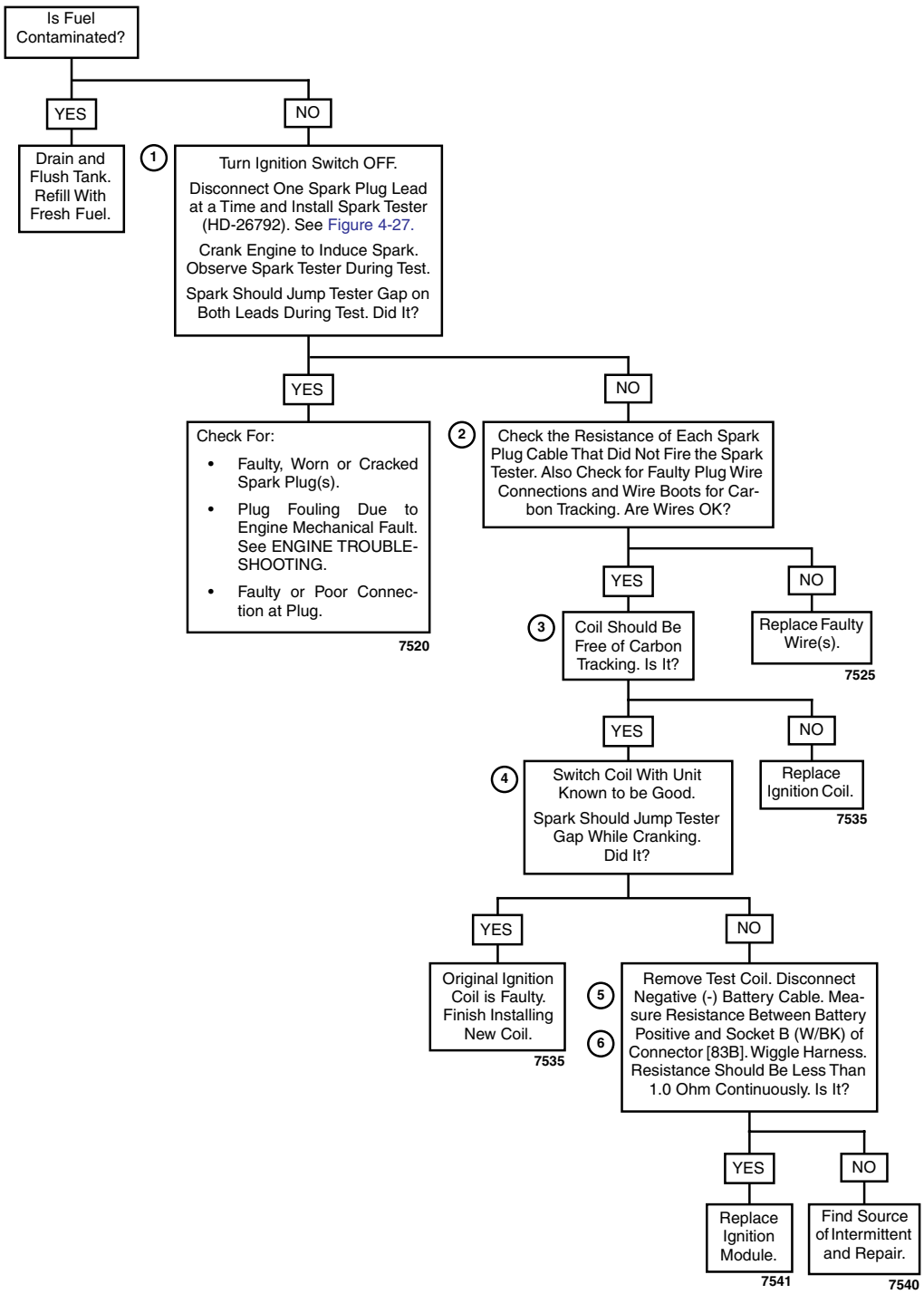
Figure 4-28. Ignition Coil Circuit Diagram

Table 4-15. Wire Harness Connectors in Figure 4-28.

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[10]	Ignition Module	All	12-Place Deutsch (Black)	Under Right Side Cover
[22]	Interconnect to Right Handlebar Switch Controls	FLHT/C	12-Place Deutsch	Inner Fairing- Right Fairing Support Brace
		FLTR	12-Place Deutsch	Inner Fairing - Right Side of Radio Bracket
		FLHR	6-Place Deutsch	Inside Headlamp Nacelle
[83]	Ignition Coil	All	3-Place Packard	Below Fuel Tank (Left Side)

Test 4.13

MISFIRE AT IDLE OR UNDER LOAD



GENERAL

MAP Sensor

See Figure 4-29. The manifold absolute pressure (MAP) sensor is supplied 5 volts from the ignition module and sends a signal back to the ignition module. This signal varies in accordance with engine vacuum and atmospheric barometric pressure. Changes in barometric pressure are influenced by weather and altitude.

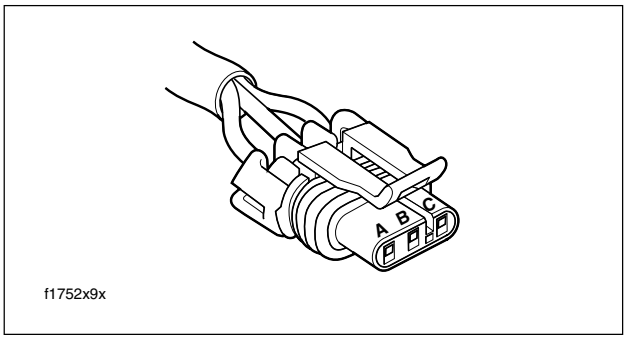


Figure 4-29. MAP Sensor Connector

DIAGNOSTICS

Diagnostic Tips

- DTC 12 will set if the MAP sensor signal is out of range or fluctuates faster than normal operation.
- With the MAP sensor disconnected, the ignition module and Scanalyzer should recognize a low voltage. If low voltage is observed, the ignition module and harness are not at fault.

NOTE

Engine must be running for Scanalyzer to work properly.

- Gently place a jumper wire across MAP Sensor connector [80B] Terminals B and C using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), gray male probes and patch cord. With the jumper in place, the ignition module and Scanalyzer should recognize a high voltage.
- MAP sensor output check. Using the VACUUM PUMP (Part No. HD-23738A), apply a vacuum to the pressure port of the MAP sensor. The signal voltage should lower as the vacuum is applied.
- Historic codes may be set if rider operates motorcycle with **extreme** high RPM downshifting.

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 4.14 flow charts.

1. Connect BREAKOUT BOX (Part No. HD-42682) between wire harness and ignition module. See Section 4.6 BREAKOUT BOX: CARB.
2. See Section 4.7 WIGGLE TEST to check for intermittents.
3. See MANIFOLD ABSOLUTE PRESSURE SENSOR, REMOVAL/INSTALLATION, in the 2003 Touring Models Service Manual (Part Number 99483-03).
4. See IGNITION MODULE, REMOVAL/INSTALLATION, in the 2003 Touring Models Service Manual (Part Number 99483-03).
5. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), gray pin probes and patch cords.

Scanalyzer Notes

The Scanalyzer icon appears at those points in the flow chart where the Scanalyzer can be used.

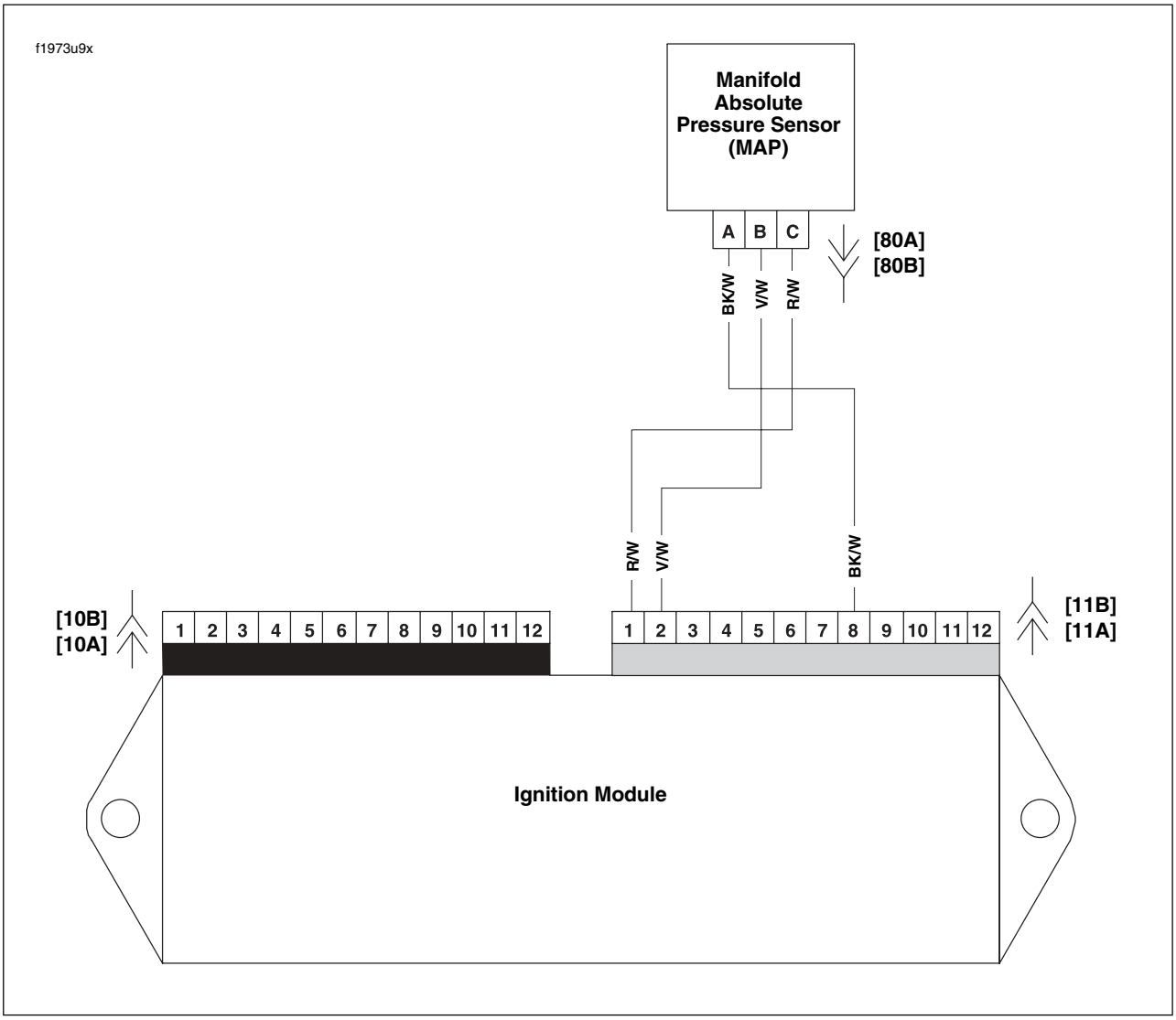


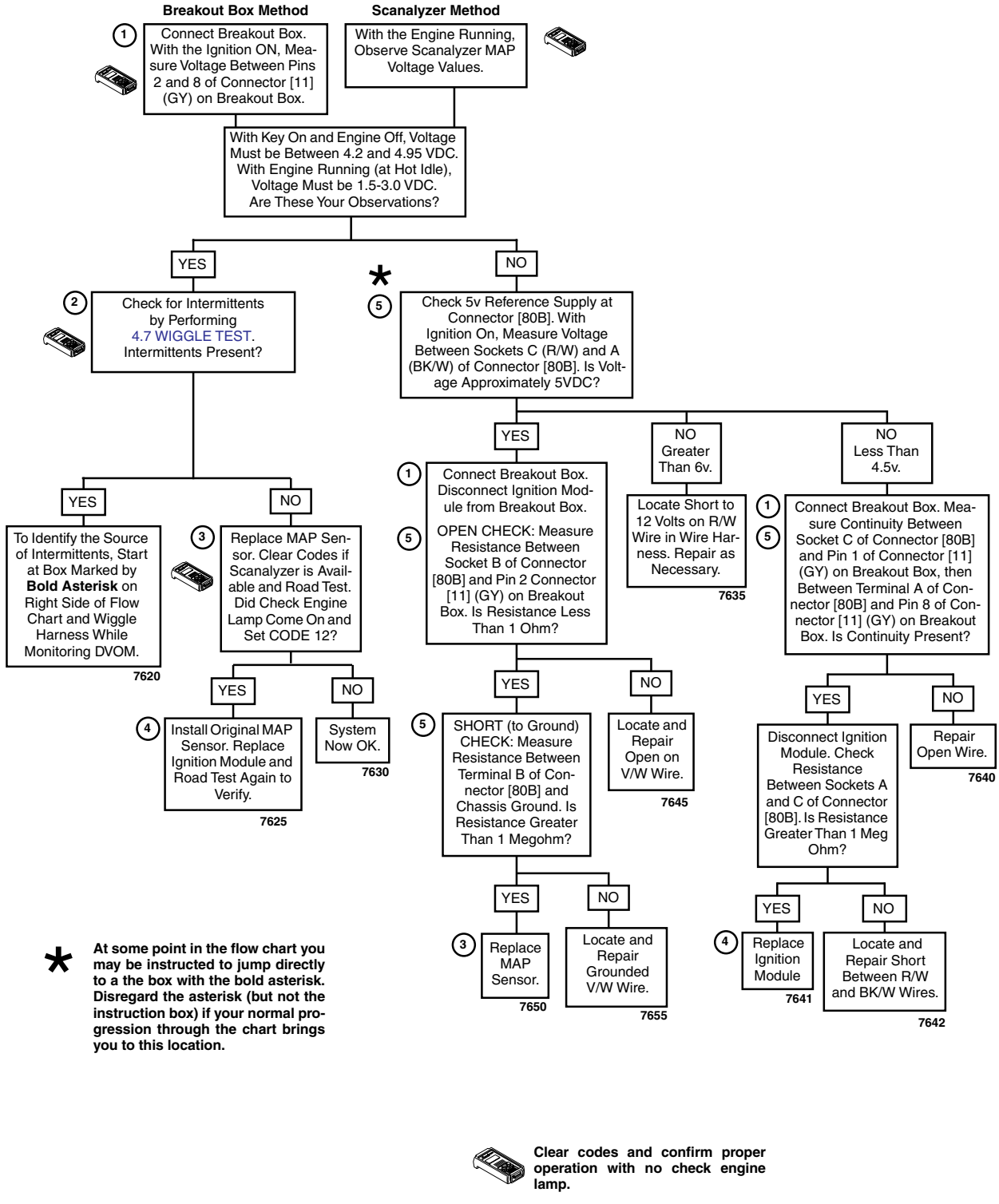
Figure 4-30. MAP Sensor Circuit Diagram

Table 4-16. Wire Harness Connectors in Figure 4-30.

NO.	DESCRIPTION	TYPE	LOCATION
[10]	Ignition Module	12-Place Deutsch (Black)	Under Right Side Cover
[11]	Ignition Module	12-Place Deutsch (Gray)	Under Right Side Cover
[80]	MAP Sensor	3-Place Packard	Top of Intake Manifold

Test 4.14

MAP SENSOR: DTC 12



* **At some point in the flow chart you may be instructed to jump directly to a the box with the bold asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.**

Clear codes and confirm proper operation with no check engine lamp.

GENERAL

Battery Voltage

A DTC 16 is set if the ignition module sees battery positive voltage less than 8 or greater than 16 volts.

- Low voltage generally indicates a loose wire, corroded connections and/or a charging system problem.
- A high voltage condition may be caused by a faulty voltage regulator.

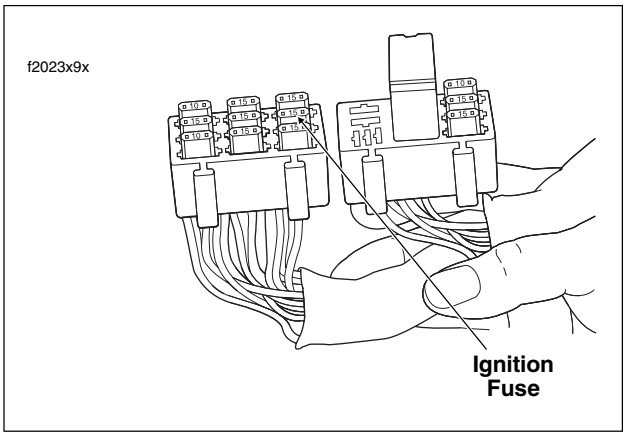


Figure 4-31. Left Side Cover Removed (FLTR, FLHT/C)

DIAGNOSTICS

Scanalyzer Notes

The Scanalyzer icon appears at those points in the flow chart where the Scanalyzer can be used.

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 4.15 flow charts.

1. Was battery allowed to discharge? Was battery drawn down by a starting problem?
   a. **Yes.** Charge battery.
   b. **No.** See charging system troubleshooting.
2. Connect BREAKOUT BOX (Part No. HD-42682) between wire harness and ignition module. See Section 4.6 BREAKOUT BOX: CARB.
3. The ignition module is monitoring voltage at ignition module connector [10] (black) Pin 1.
4. This checks for voltage drops in the ignition module circuit.
   a. Place (+) probe to battery positive terminal.
   b. Place (-) probe to Pin 1 of ignition module connector [10] (BK) (W/BK wire) on Breakout Box.

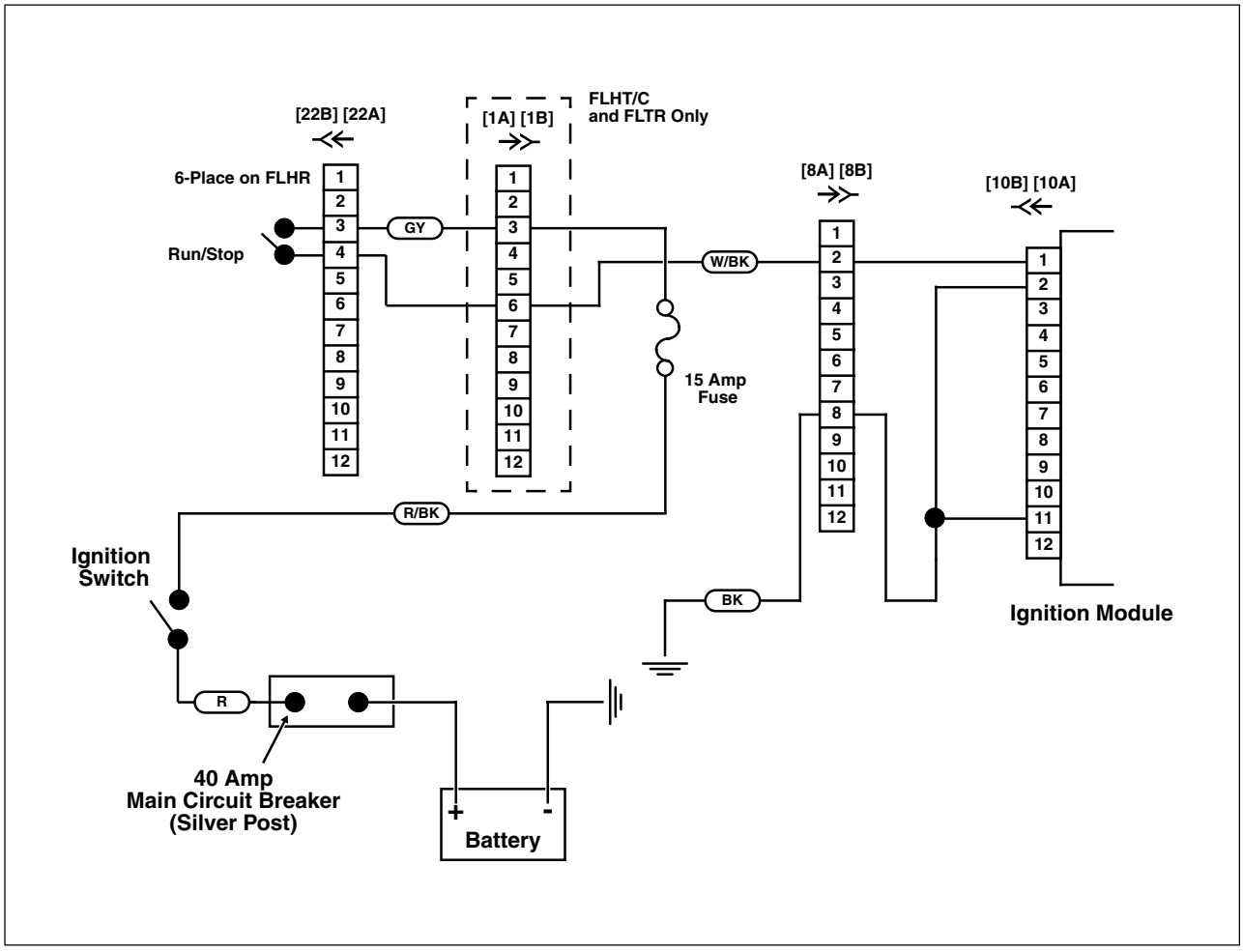


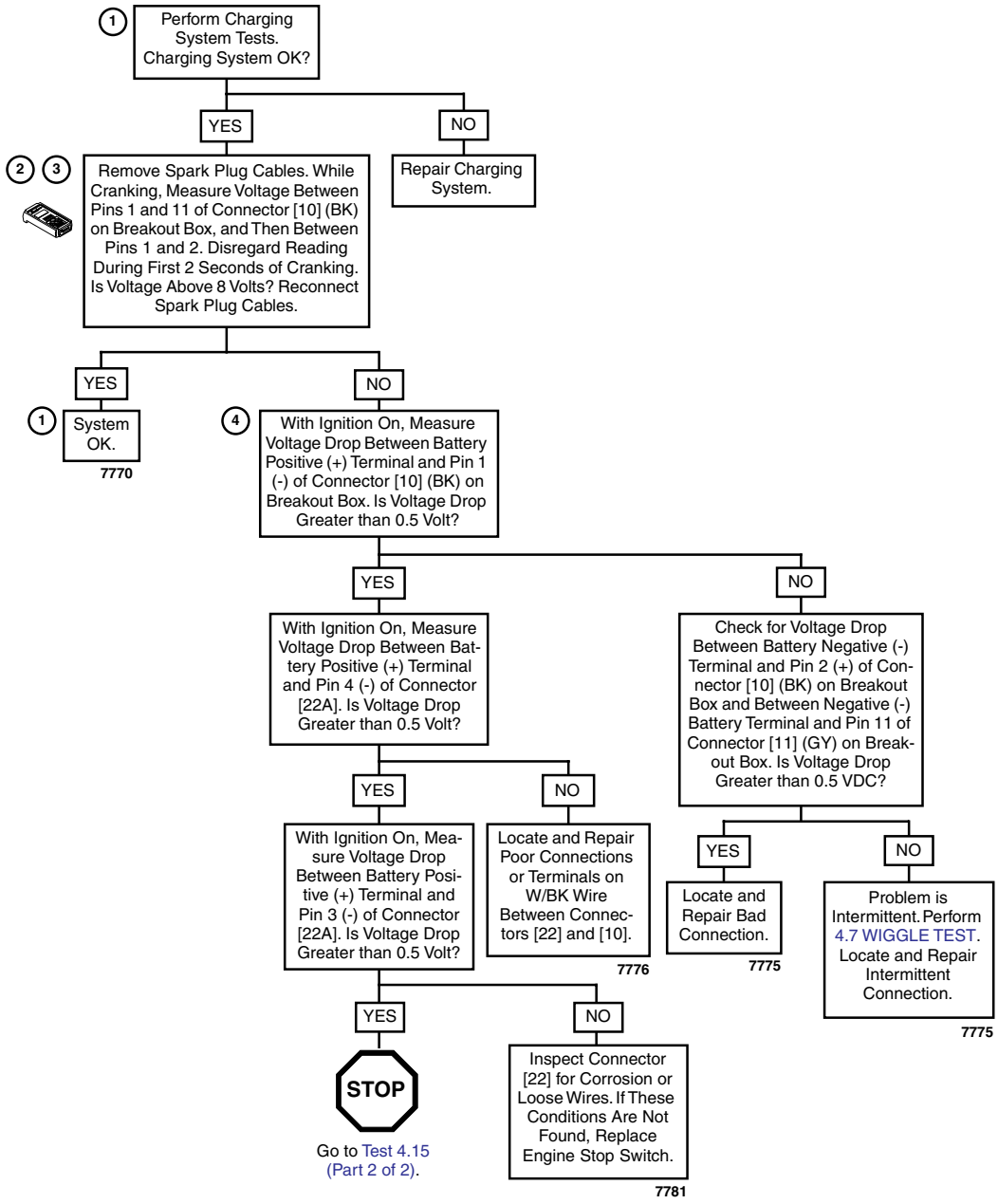
Figure 4-32. Battery Voltage Circuit Diagram

Table 4-17. Wire Harness Connectors in Figure 4-32.

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to Interconnect Harness	FLHT/C	12-Place Deutsch	Inner Fairing- Right Fairing Bracket
		FLTR	12-Place Deutsch	Inner Fairing- Below Radio (Right Side)
[8]	Ignition Harness	All	12-Place Deutsch	Under Right Side Cover
[10]	Ignition Module	All	12-Place Deutsch (Black)	Under Right Side Cover
[22]	Interconnect to Right Handlebar Switch Controls	FLHT/C	12-Place Deutsch	Inner Fairing- Right Fairing Support Brace
		FLTR	12-Place Deutsch	Inner Fairing - Right Side of Radio Bracket
		FLHR	6-Place Deutsch	Inside Headlamp Nacelle

Test 4.15 (Part 1 of 2)

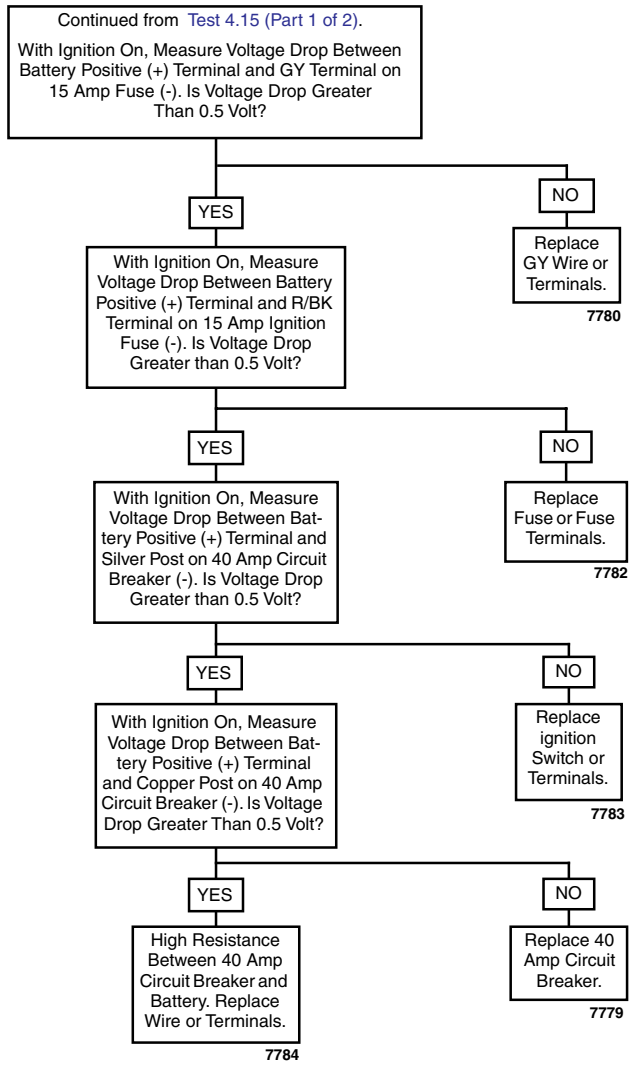
BATTERY VOLTAGE: DTC 16



Clear codes and confirm proper operation with no check engine lamp.

Test 4.15 (Part 2 of 2)

BATTERY VOLTAGE: DTC 16



Clear codes and confirm proper operation with no check engine lamp.

GENERAL

Front Ignition Coil (DTC 24) and Rear Ignition Coil (DTC 25)

A DTC 24 or 25 will set if the ignition coil voltage is out of range. This could occur if there is an open coil or loss of power to the coil. If both codes are set, it is likely a coil power failure or a coil failure.

The coil receives power from the engine run/stop switch. The ignition module is responsible for turning on the coils by providing the ground to activate the coils, which in turn powers the coils.

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 4.16 flow chart.

1. Gently use test lamp as shown in Figure 4-33. Inserting the test lamp forcefully into the connector will damage the terminal and require its replacement.
2. See IGNITION COIL, REMOVAL/INSTALLATION, in the 2003 Touring Models Service Manual (Part Number 99483-03).
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), gray pin probes and patch cord.
4. Connect BREAKOUT BOX (Part No. HD-42682) between wire harness and ignition module. See Section 4.6 BREAKOUT BOX: CARB.
5. See Section 4.21 IGNITION COIL.
6. See IGNITION MODULE, REMOVAL/INSTALLATION, in the 2003 Touring Models Service Manual (Part Number 99483-03).

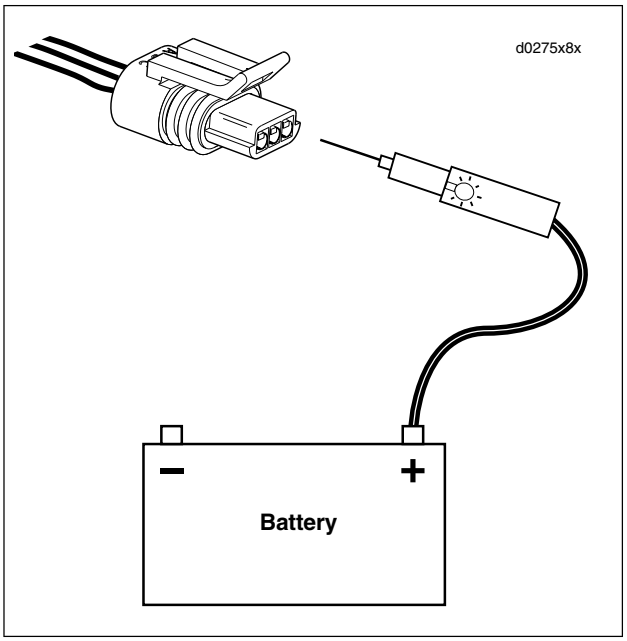


Figure 4-33. Ignition Coil Test

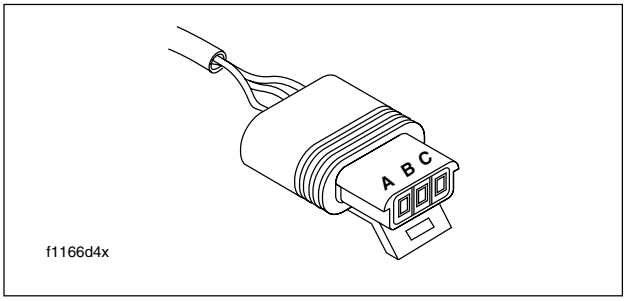


Figure 4-34. Ignition Coil Connector [83B]

Scanalyzer Notes

The Scanalyzer icon appears at those points in the flow chart where the Scanalyzer can be used.

NOTE

With the engine OFF, the Scanalyzer (Active Diagnostic Test Mode) can be used to energize either the front or rear coil once each second for a total of five seconds.

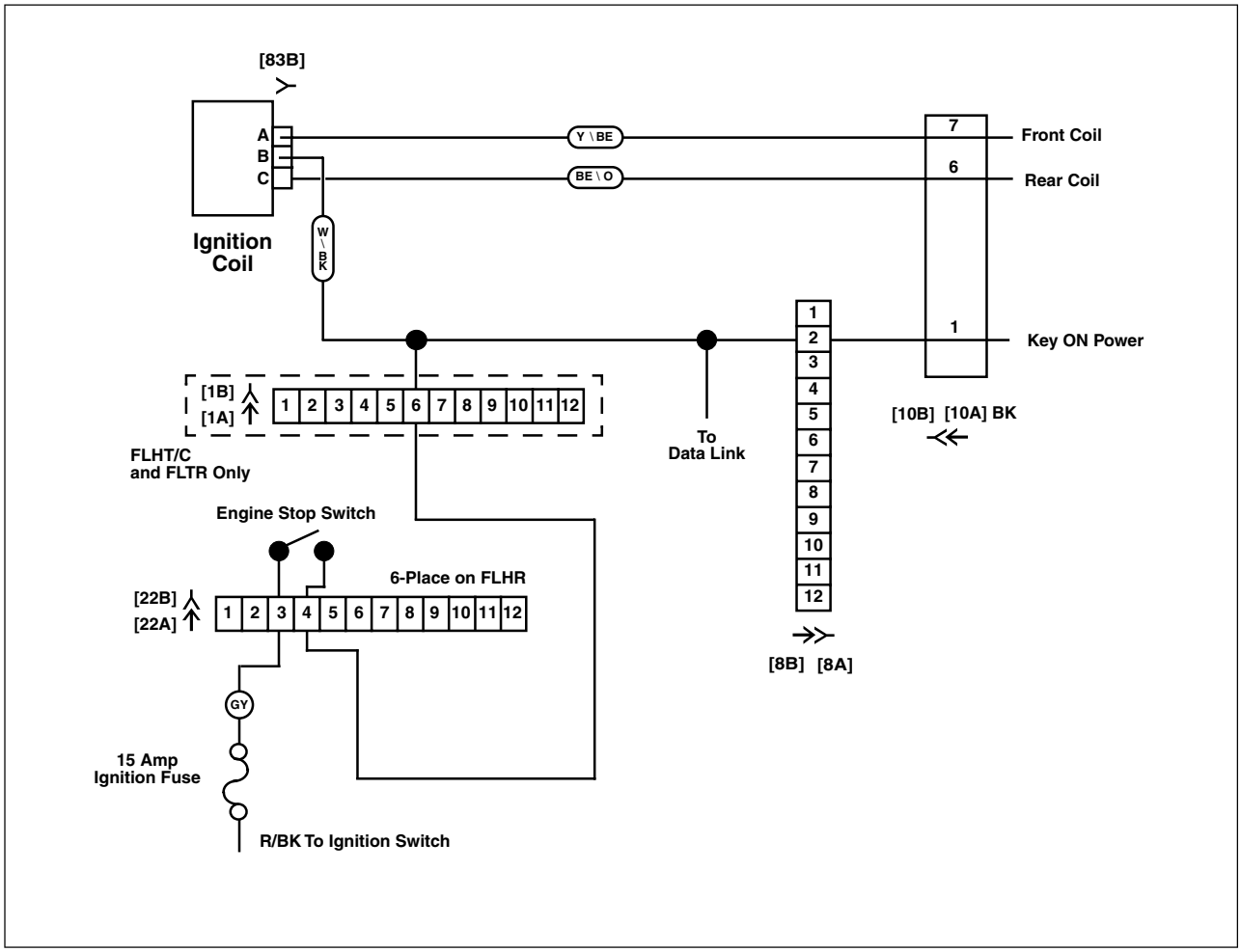


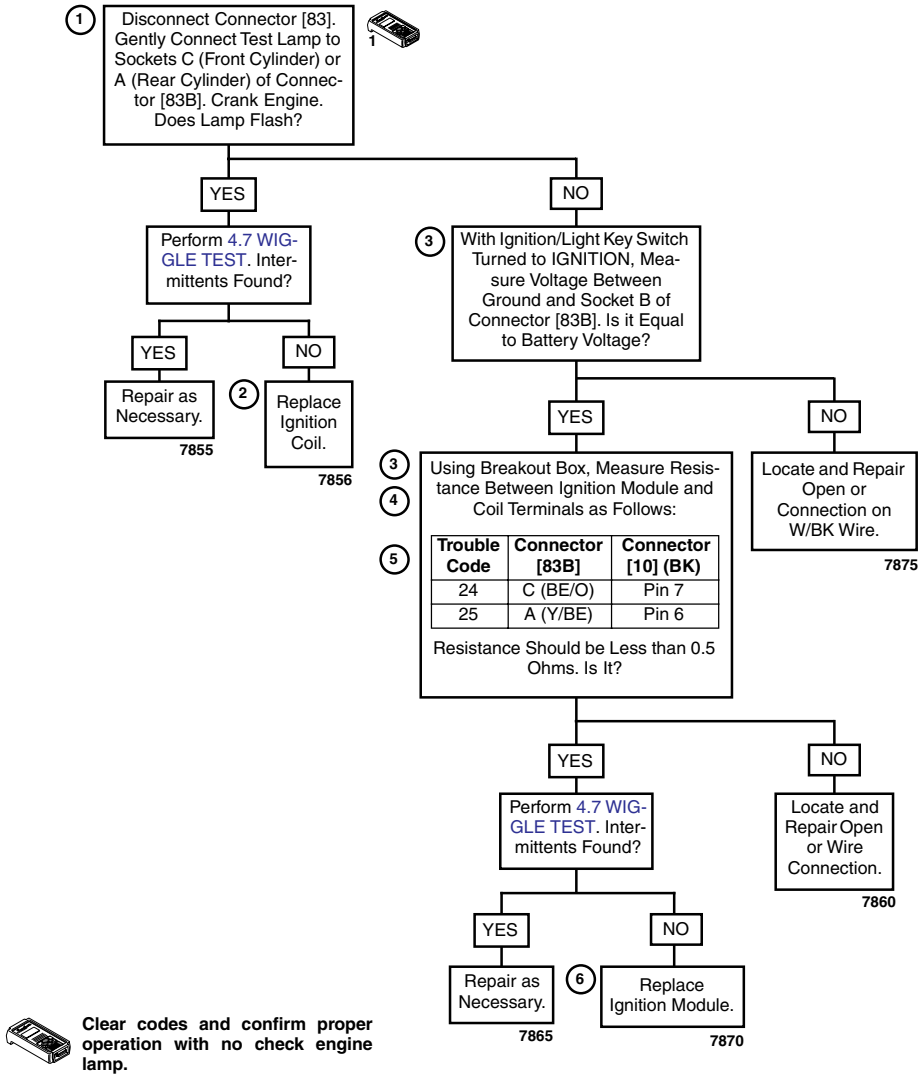
Figure 4-35. Ignition Coil Circuit Diagram

Table 4-18. Wire Harness Connectors in Figure 4-35.

NO.	DESCRIPTION	TYPE	LOCATION
[10]	Ignition Module	12-Place Deutsch (Black)	Under Right Side Cover
[83]	Ignition Coil	3-Place Packard	Below Fuel Tank (Left Side)

Test 4.16

IGNITION COIL: DTC 24, 25



GENERAL

Tachometer: All Except FLHR

A DTC 35 will set if the PK wire is shorted to power or ground.

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 4.17 flow chart.

1. Connect BREAKOUT BOX (Part No. HD-42682). See Section 4.6 BREAKOUT BOX: CARB.
2. See the 2003 Touring Models Service Manual (Part Number 99483-03).

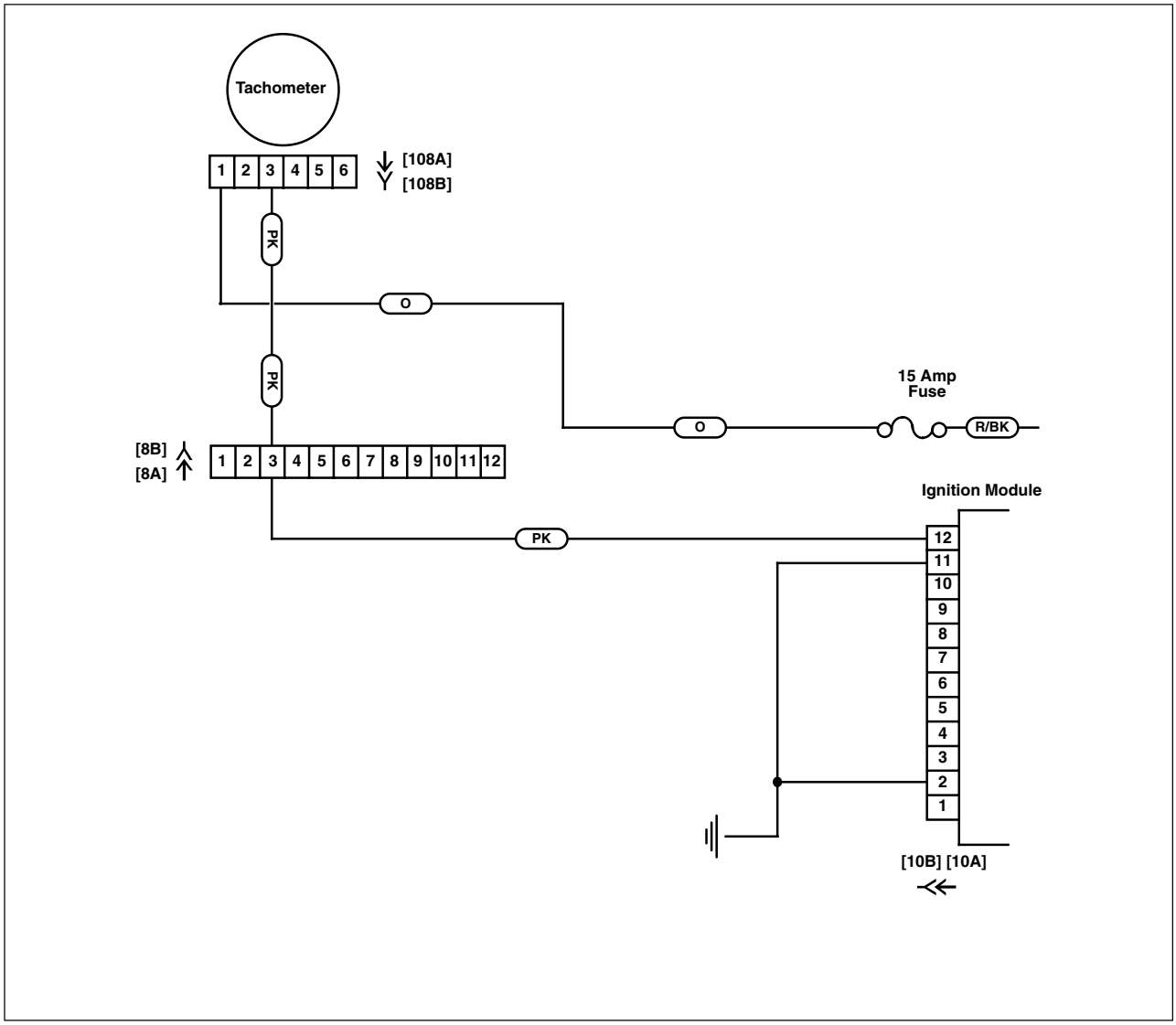


Figure 4-36. Tachometer Circuit Diagram

Test 4.17

TACHOMETER: DTC 35

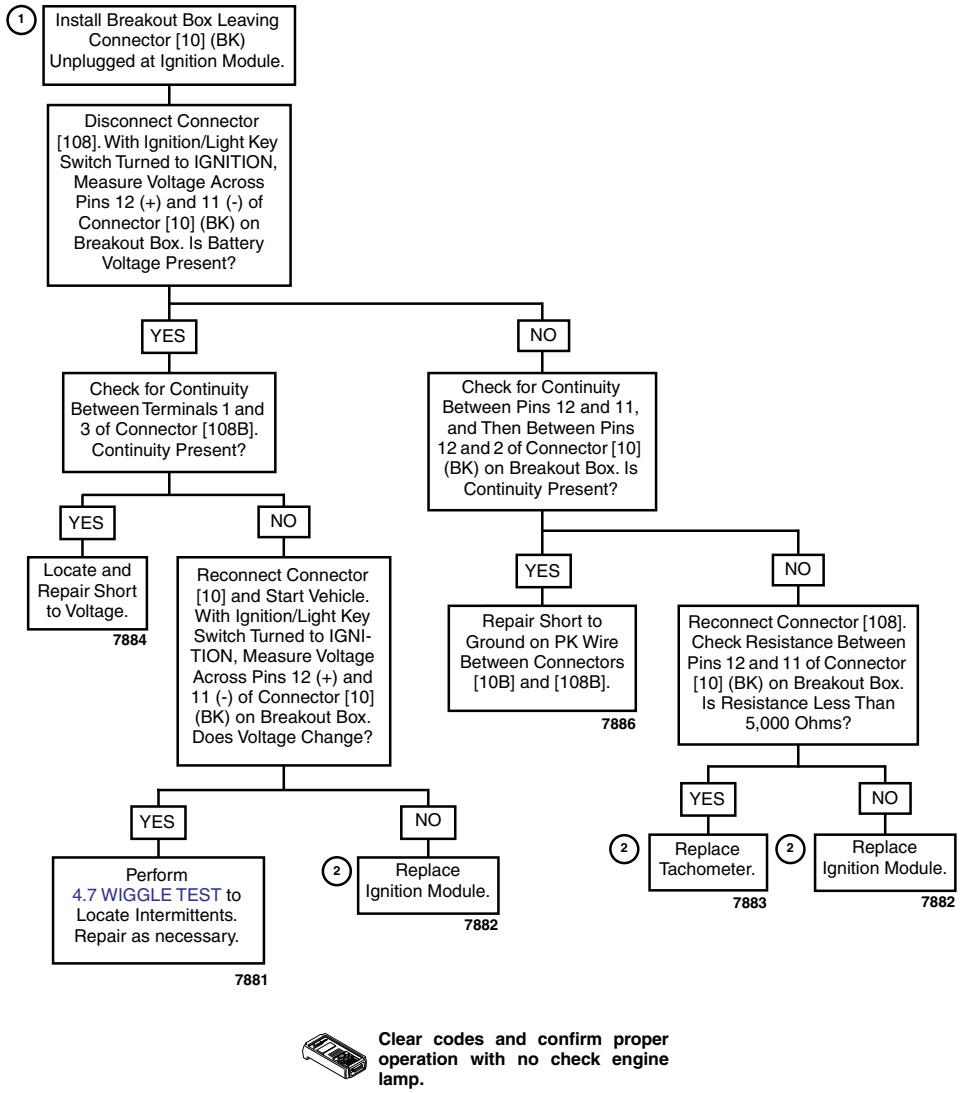


Table 4-19. Wire Harness Connectors in Figure 4-36.

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[8]	Ignition Harness	All	12-Place Deutsch	Under Right Side Cover
[10]	Ignition Module	All	12-Place Deutsch (Black)	Under Right Side Cover
[108]	Tachometer	FLHT/C	6-Place Packard	Inner Fairing (Back of Tachometer)
		FLTR	6-Place Packard	Under Bezel (Back of Tachometer)

GENERAL

Crank Position Sensor

See Figure 4-37. A DTC 41 will set if the crankshaft position sensor (CKP) signal is weak or absent.

If the crank position sensor becomes grounded, it may set DTC 41 and 44. Always troubleshoot the trouble code with the lowest number first. In the case of multiple trouble codes, the second code should be resolved when the first code is corrected.

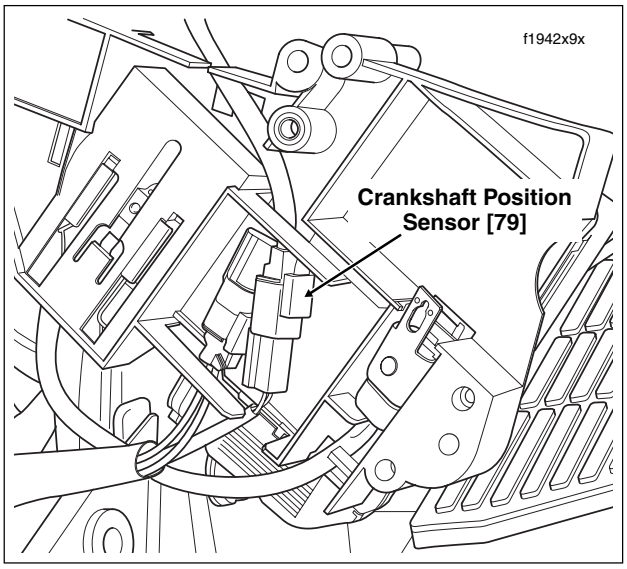


Figure 4-37. Electrical Bracket (Inboard Side)

DIAGNOSTICS

Diagnostic Notes

1. Connect BREAKOUT BOX (Part No. HD-42682) to ignition harness only, leaving ignition module disconnected. See Section 4.6 BREAKOUT BOX: CARB.
2. One megohm is very high resistance. Some meters will read infinity, OL, etc.
3. See the 2003 Touring Models Service Manual (Part Number 99483-03).
4. Use HARNESS CONNECTOR TEST KIT (Part No. D-41404), brown socket probes and patch cords.
5. For testing purposes, install sensor without running wiring along normal path. Disconnect and route wiring properly if system is now OK.

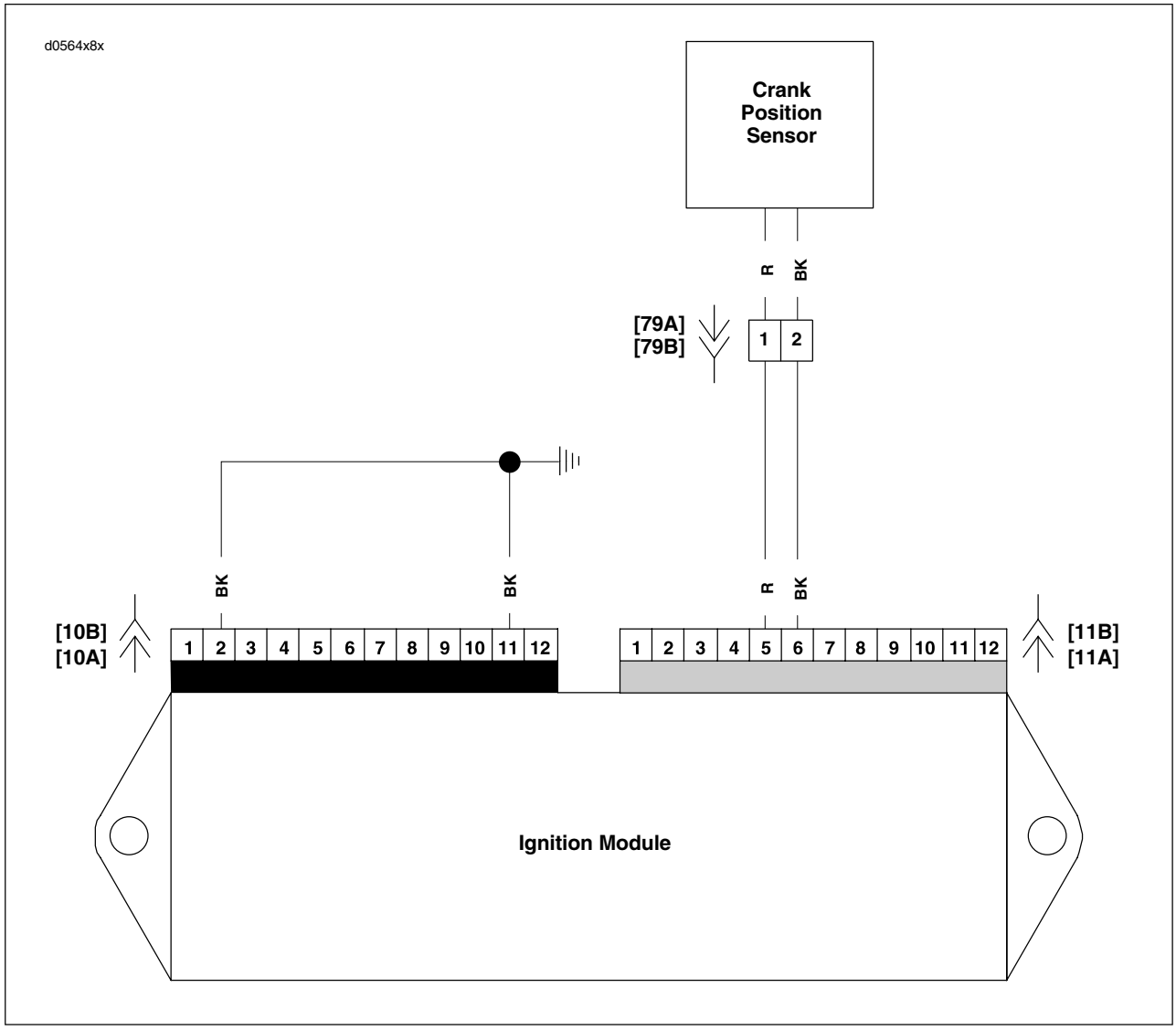


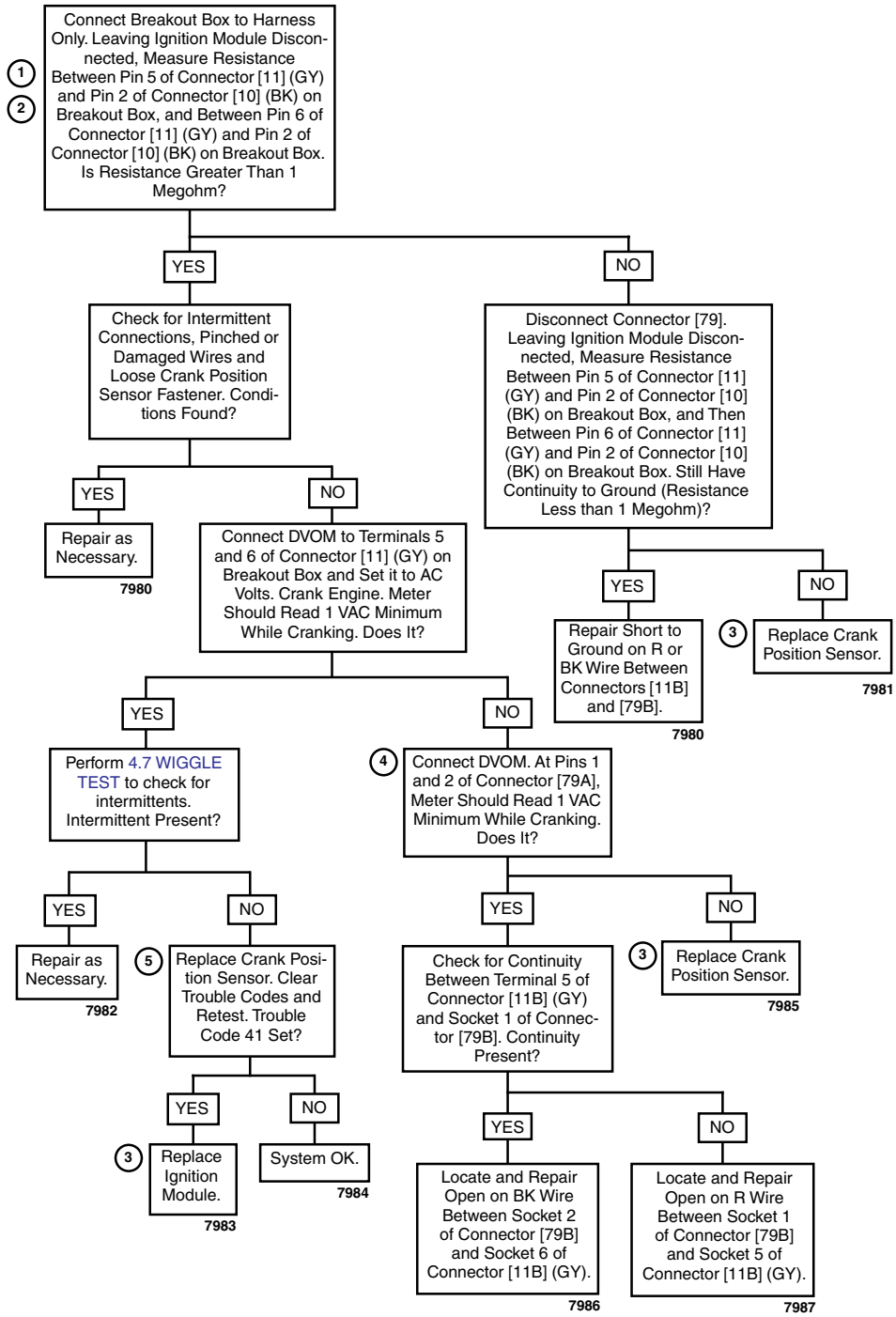
Figure 4-38. Ignition Circuit Diagram

Table 4-20. Wire Harness Connectors in Figure 4-38.

NO.	DESCRIPTION	TYPE	LOCATION
[10]	Ignition Module	12-Place Deutsch (Black)	Under Right Side Cover
[11]	Ignition Module	12-Place Deutsch (Gray)	Under Right Side Cover
[79]	CKP Sensor	2-Place Mini-Deutsch	Under Right Side Cover (Behind Electrical Bracket)

Test 4.18

CRANK POSITION SENSOR: DTC 41



Clear codes and confirm proper operation with no check engine lamp.

GENERAL

TSM/TSSM

DTC 44 occurs when the TSM/TSSM detects a fault in the Lt GN/GY wire. If the fault occurs with the ignition OFF, this DTC represents a possible theft attempt.

If this code occurs, the engine may stop running. The engine may still be started and ridden to a dealership for repair.

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 4.19 flow chart.

1. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), black pin probes and patch cord.
2. Connect BREAKOUT BOX (Part No. HD-42682). See Section 4.6 BREAKOUT BOX: CARB.

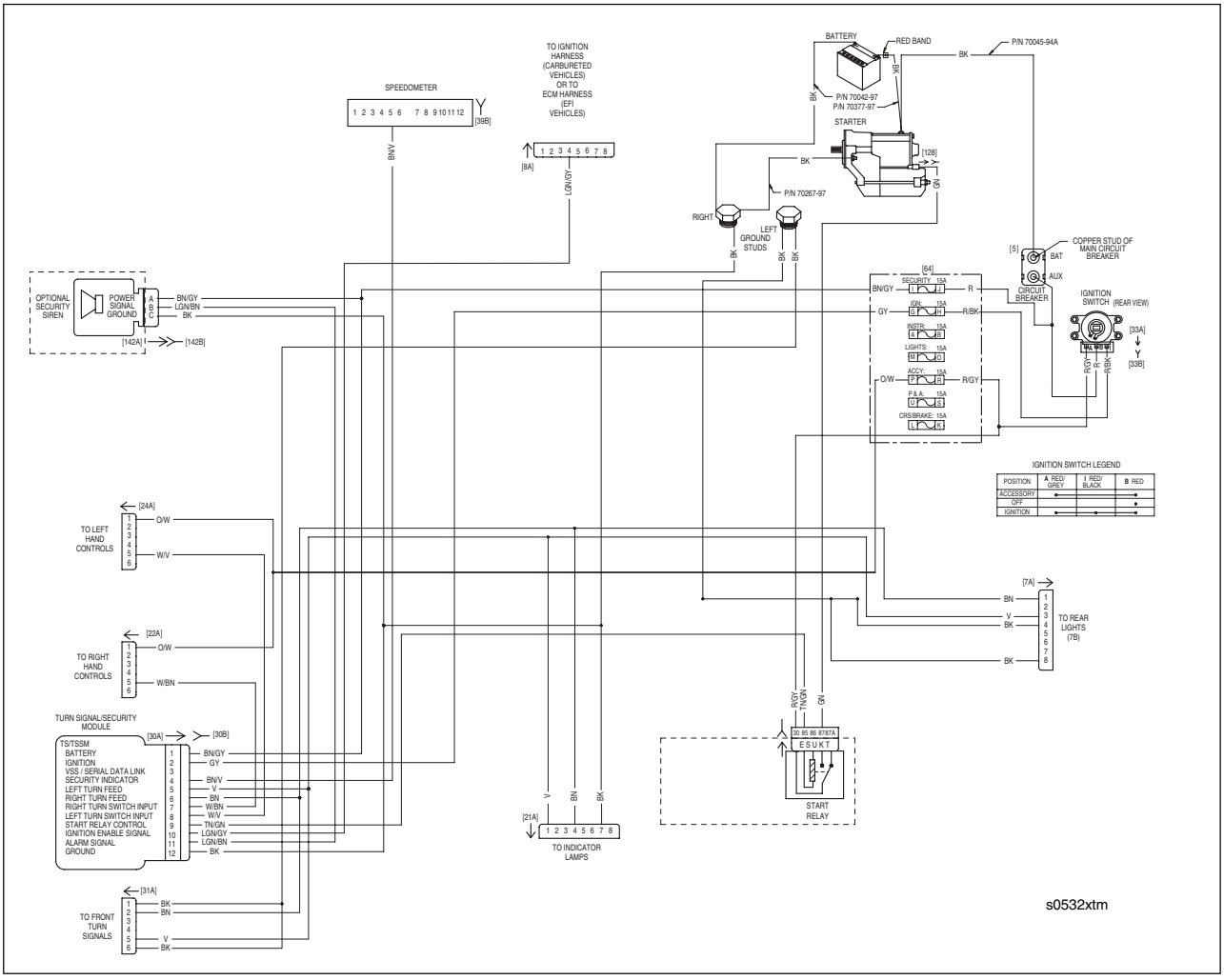


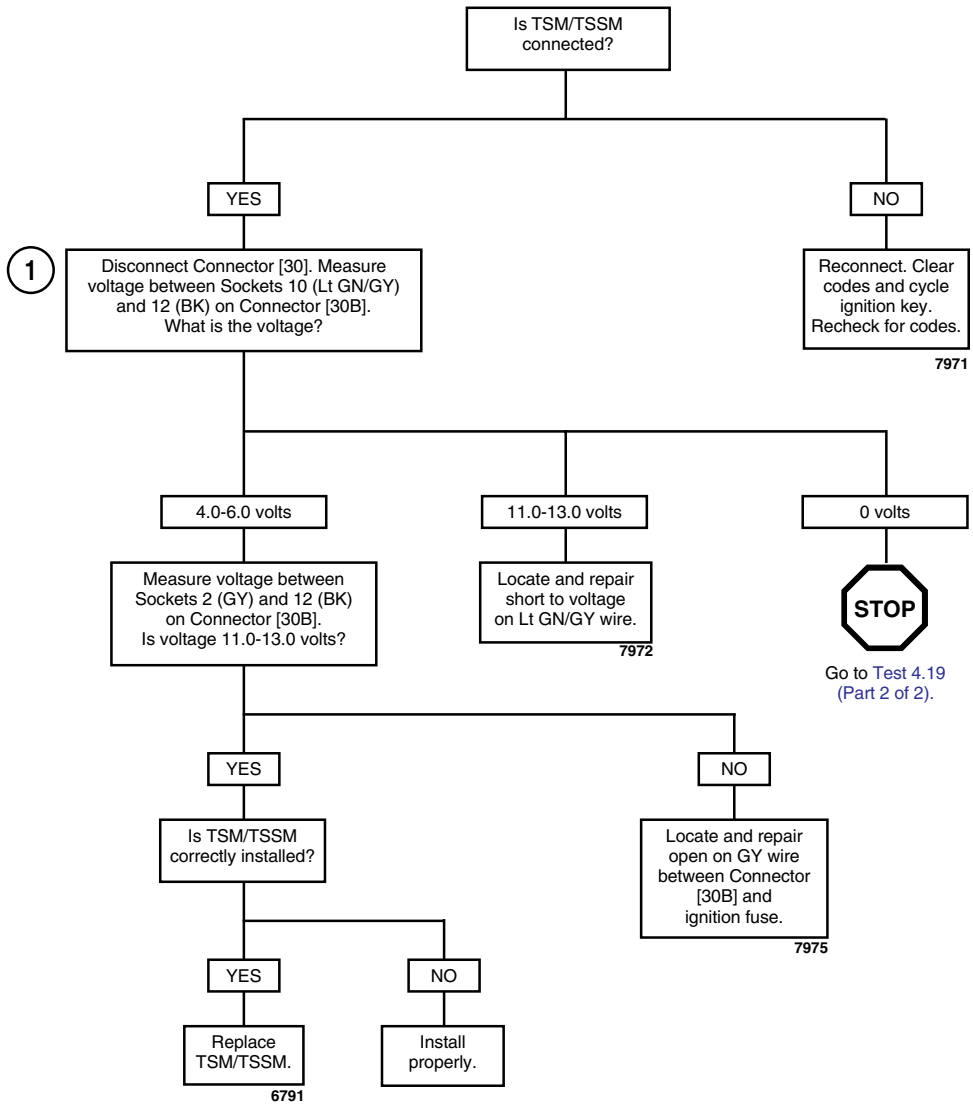
Figure 4-39. Bank Angle Sensor Circuit (Typical)

Table 4-21. Wire Harness Connectors in Figure 4-39.

NO.	DESCRIPTION	TYPE	LOCATION
[10]	Ignition Module	12-Place Deutsch (Black)	Under Right Side Cover
[30]	TSM/TSSM	12-Place Deutsch	Rear of Battery Box (Under Seat)

Test 4.19 (Part 1 of 2)

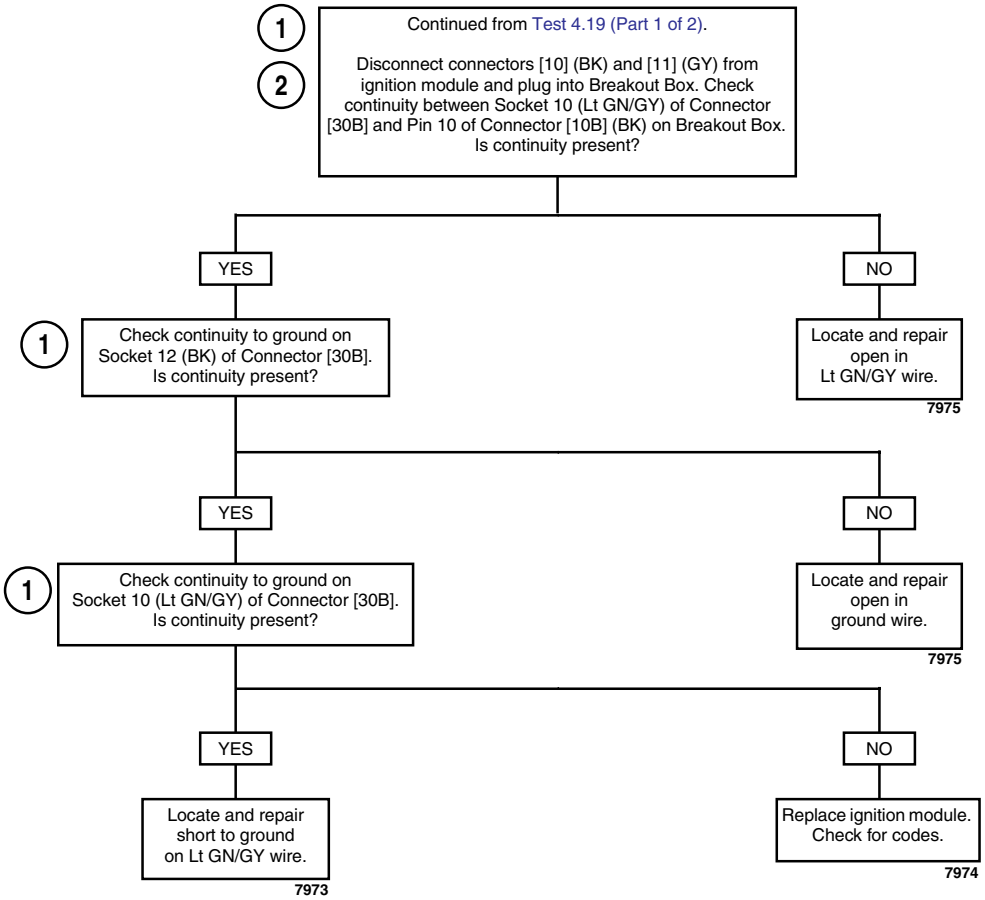
TSM/TSSM: DTC 44



Clear codes and confirm proper operation with no check engine lamp.

Test 4.19 (Part 2 of 2)

TSM/TSSM: DTC 44



Clear codes and confirm proper operation with no check engine lamp.

DTC 52, 53, 54, 55 4.20

GENERAL

Ignition Module Failure

All of the following codes indicate an internal failure that requires replacement of the ignition module. See IGNITION MODULE, REMOVAL/INSTALLATION, in the 2003 Touring Models Service Manual (Part Number 99483-03).

- DTC 52 - RAM failure
- DTC 53 - ROM failure
- DTC 54 - EE PROM failure
- DTC 55 - Module microprocessor malfunction.

NOTE

*Dealership technicians filing warranty claims should use job/time code **7913** for all DTC 52, 53, 54 and 55 ignition module replacements.*

TROUBLESHOOTING

Follow the troubleshooting procedures listed under Section 4.8 INITIAL DIAGNOSTIC CHECK (Carbureted) or Section 5.9 INITIAL DIAGNOSTIC CHECK: EFI if the engine will not start, is difficult to start or runs roughly. Also check condition of spark plug cables. Insulation on cables may be cracked or damaged allowing high tension current to short to metal parts. This problem is most noticeable when cables are wet.

If poor starting/running condition persists, check resistance of ignition coil primary and secondary windings using an ohmmeter.

NOTE

The ignition coil cannot be repaired. Replace the unit if it fails.

Ignition Coil Primary Circuit Test

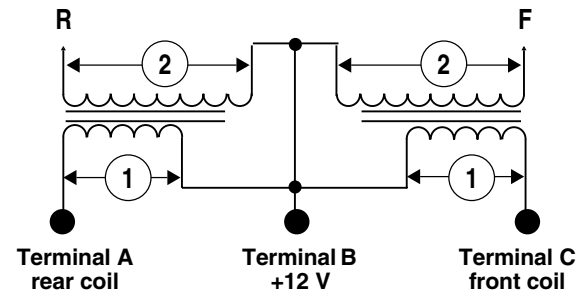
1. Remove ignition coil.
2. Set ohmmeter scale to RX1.
   a. Place multimeter wires on primary coil windings A to B, B to C. See Figure 4-40.
3. Check for primary coil winding resistance.
   a. Normal resistance range is 0.5-0.7 ohms.
   b. See TEST RESULTS below if resistance is not within normal operating range.

Ignition Coil Secondary Circuit Test

1. Remove ignition coil.
2. Set ohmmeter scale to RX1K.
3. Place multimeter wires on secondary coil windings B to R, B to F. See Figure 4-40.
4. Check for secondary coil winding resistance.
   a. Normal resistance range is 5.5-7.5K ohms.
   b. See TEST RESULTS below if resistance is not within normal operating range.

Test Results

1. A low resistance value indicates a short in the coil winding. Replace coil.
2. A high resistance value might indicate that there is some corrosion/oxidation of the coil terminals. Clean the terminals and repeat resistance test. If resistance is still high after cleaning terminals, replace coil.
3. An infinite ohms (∞ or no continuity) resistance value indicates an open circuit (a break in the coil winding). Replace coil.



1. Primary resistance should be 0.5-0.7 ohms.
2. Secondary resistance should be 5.5-7.5K ohms.

Figure 4-40. Ignition Coil Testing

Ignition Coil Substitution

If a coil tester is not available, use the following test.

1. Substitute a **new** ignition coil by attaching it to any convenient point near the old coil. Transfer terminal wires to **new** coil.
2. Attach **new** spark plug cables to coil and plugs.
3. Test system. If ignition trouble is eliminated by the temporary installation of a **new** coil, carefully inspect old coil and cables for damage. The insulation on the cables may be cracked or otherwise damaged allowing high tension current to short to metal parts. This is most noticeable in wet weather or after the motorcycle has been washed.

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5.33 DTC U1064	5-120

SPECIFICATIONS 5.1

Table 5-1. Spark Specifications

IGNITION	DATA
Idle speed	1000 ± 50 RPM
Spark plug size	12 mm
Spark plug gap	0.038-0.043 in
	0.97-1.09 mm
Spark plug type	Harley-Davidson No. 6R12 (no substitute)
Ignition coil primary resistance at room temperature	0.3-0.5 ohms
Ignition coil secondary resistance at room temperature	2750-3250 ohms

Table 5-2. Circuit Breaker/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
Lighting	15	Blue	Blade
Headlamp	15	Blue	Blade
EFI Fuses			
Fuel Pump	15	Blue	Blade
ECM Power	15	Blue	Blade

NOTE

The fuse labeled Security provides basic turn signal functionality on vehicles without a factory-installed security system. Do not remove this fuse or use it as a replacement fuse for other systems.

Table 5-3. Charging Specifications

ITEM	DATA
Battery	28 amp hour/300 CCA
Alternator AC voltage output	
FLHR, FLHR-I, FLHRC-I, FLHT, FLHTC, FLTR (38 Amp)	16-20 VAC per 1000 RPM
FLHT-I, FLTR-I, FLHTC-I, FLHTCU-I (45 Amp)	19-26 VAC per 1000 RPM
Alternator stator coil resistance	0.1-0.3 ohms
Regulator voltage output @ 3000 RPM	14.4-14.6 volts
Regulator amperes @ 3000 RPM	
FLHR, FLHR-I, FLHRC-I, FLHT, FLHTC, FLTR (38 Amp)	34-40 Amps
FLHT-I, FLTR-I, FLHTC-I, FLHTCU-I (45 Amp)	41-48 Amps

NOTES

GENERAL

The engine management system consists of the following components:

- Electronic control module (ECM).
- Crank position sensor (CKP).
- Manifold absolute pressure sensor (MAP).
- Intake air temperature sensor (IAT).
- Engine temperature sensor (ET).
- Idle air control (IAC).
- Throttle position sensor (TP).
- Vehicle speed sensor (VSS).
- Turn signal module (TSM) or optional, factory-installed turn signal security module (TSSM). This includes an integrated bank angle sensor (BAS).
- Ignition coil.

The ECM is mounted under the right side cover. It computes the spark advance for proper ignition timing based on sensor inputs (from CKP, MAP and TP sensor) and regulates the low-voltage circuits between battery and ignition coil. The Scanalyzer can access the data received by and stored in the ECM.

The ECM contains all of the solid state components used in the ignition system. The dwell time for the ignition coil is also calculated in the microprocessor and is dependent upon battery voltage. The programmed dwell is an added feature to give adequate spark at all speeds. (The ECM has added protection against transient voltages, continuous reverse voltage protection, and damage due to jump starts.) The ECM is fully enclosed to protect it from vibration, dust, water or oil. This unit is a non-repairable item. If it fails, it must be replaced.

The crank position sensor (CKP) is located in the front left side of the crankcase. The CKP generates an AC signal which is sent to the ECM where it is used to reference engine position (TDC) and speed. It functions by taking readings off the 30 teeth on the left side flywheel (two teeth are missing to establish a reference point).

The MAP sensor is located at the top of the induction module. The MAP sensor monitors the intake manifold pressure (vacuum) and sends the information to the ECM where the module adjusts the spark and fuel timing advance curve for optimum performance.

The bank angle sensor is within the turn signal/turn signal security module. If the vehicle lean angle exceeds 45 degrees, the ignition system is shut off. Once the sensor is tripped, the motorcycle must be uprighted, turned off and then on again before the engine can be restarted. This is communicated across the data link.

Front and rear coils fire each spark plug independently (one cylinder at a time - no wasted spark). The coil also has an extra terminal to monitor current on the coil secondary circuit. This is used for knock detection and combustion diagnostics.

The ignition system gives a spark near top dead center for starting. At RPM and loads above this, the system gives a spark advance that varies between 0° and 50°.

The IAT, ET and TP sensors are used to provide information to the ECM to fine tune spark and fuel delivery. The VSS is used as an input for idle speed control.

TROUBLESHOOTING

See the diagnostic charts that follow for troubleshooting information.

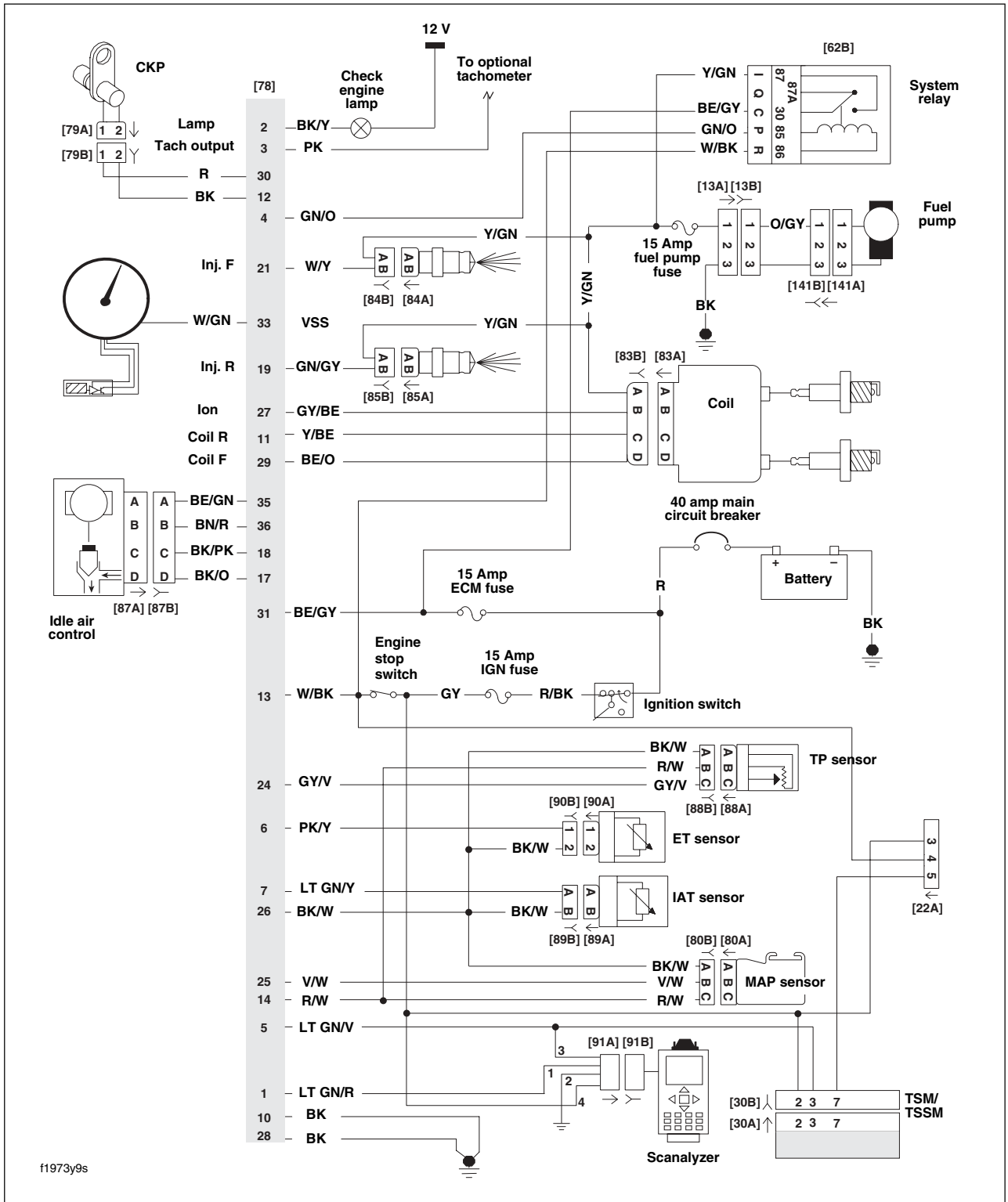


Figure 5-1. EFI System Circuit

EFI DIAGNOSTIC INTRODUCTION 5.3

SYSTEM PROBLEMS

All system problems fall into at least one of three general categories.

No Start

The engine cranks over freely, but will not start. This does not include situations where the engine will not crank, such as a bad starter, dead battery, etc., and assumes that all obvious checks are made- there is sufficient fuel in the tank, etc.

Poor Performance

The engine starts but there are performance problems, such as poor fuel economy, rough idle, engine misfire, engine hesitation, severe spark knock, etc.

Check Engine Lamp

The lamp indicates the existance of a fault condition. There may also be starting or performance problems. See Figure 5-2.

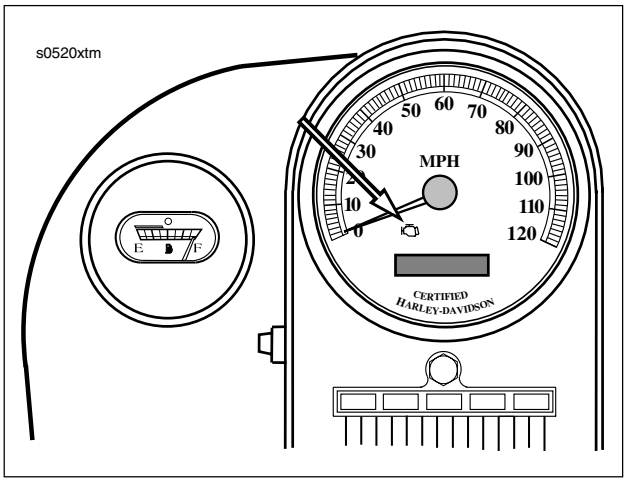


Figure 5-2. Check Engine Lamp

RESOLVING PROBLEMS

To resolve system problems, five basic steps are involved. In order of occurrence, they are:

1. Check for trouble codes through observation of the check engine lamp. See Section 5.4 CHECKING FOR TROUBLE CODES: EFI.
2. Retrieve trouble codes with the SCANALYZER (Part No. HD-41325) or the check engine lamp diagnostics. See Section 5.5 SCANALYZER: EFI, Section 5.6 CHECK ENGINE LAMP DIAGNOSTICS: EFI and Figure 5-3.
3. Diagnose problems relating to current trouble codes using the diagnostic flow charts, Scanalyzer and other special tools.
4. Correct problems through replacement and/or repair of faulty components.
5. Validate repairs. Clear trouble codes and confirm proper vehicle operation without recurrence of the fault condition, as indicated by the behavior of the check engine lamp.

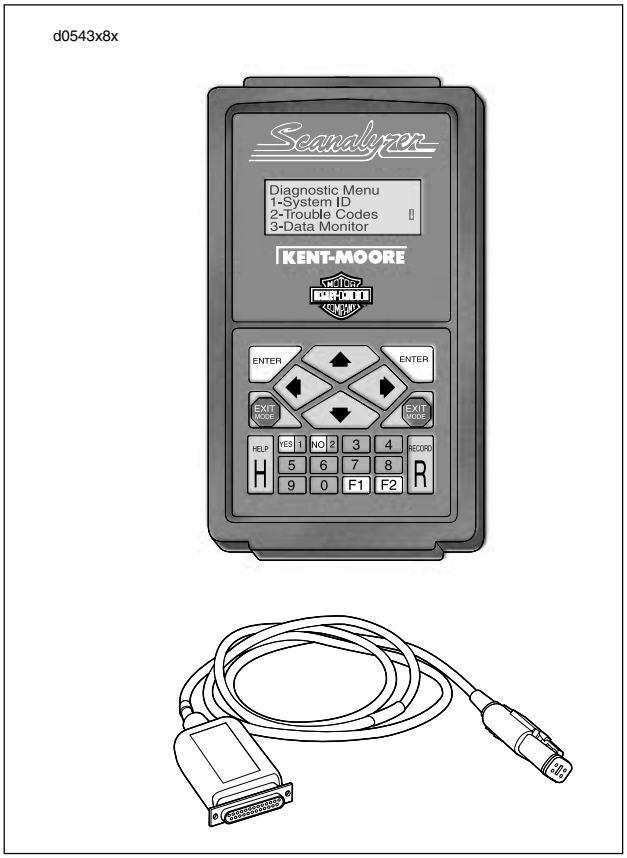


Figure 5-3. Scanalyzer and Cable

CHECK ENGINE LAMP

To diagnose system problems, start by observing the behavior of the Check Engine Lamp. See Figure 5-5.

1. At Key On, the Check Engine Lamp will illuminate for approximately four seconds and then turn off.

NOTES

- *References to "Key ON" or "Ignition Switch ON" in this document means that the Ignition/Light Key Switch is turned to IGNITION and the handlebar Engine Stop/Run Switch is in the RUN position (although the engine is **not** running). See Figure 5-4.*
- *If the Check Engine Lamp is not illuminated at Key ON or if it fails to go OFF after the initial four second ON period, then a problem exists in the lamp circuit. See Section 5.10 NO CHECK ENGINE LAMP AT KEY ON or Section 5.11 CHECK ENGINE LAMP ON CONTINUOUSLY.*

2. When the lamp turns off after being illuminated for the first four second period, it will:
   a. Remain off if there are no fault conditions or trouble codes currently detected by the ECM. See A in Figure 5-5.
   b. Come back on for an 8 second period if only historic codes exist. See B in Figure 5-5.
   c. Come back on, and remain on, if a current trouble code exists. See C in Figure 5-5.

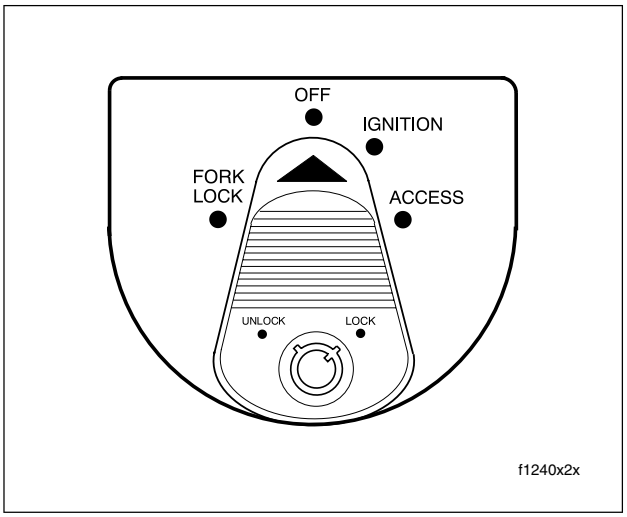


Figure 5-4. Ignition Switch (FLTR, FLHT/C/U)

3. See CODE TYPES which follows for a complete description of trouble code formats.

NOTE

Trouble codes relating to the fuel injectors or the ignition coil can only be fully diagnosed during actuation. For example, a problem with an ignition coil will be considered a current fault even after the problem is corrected, since the ECM will not know of its resolution until after the coil is exercised by a vehicle start sequence. In this manner, there may sometimes be a false indication of a current trouble code.

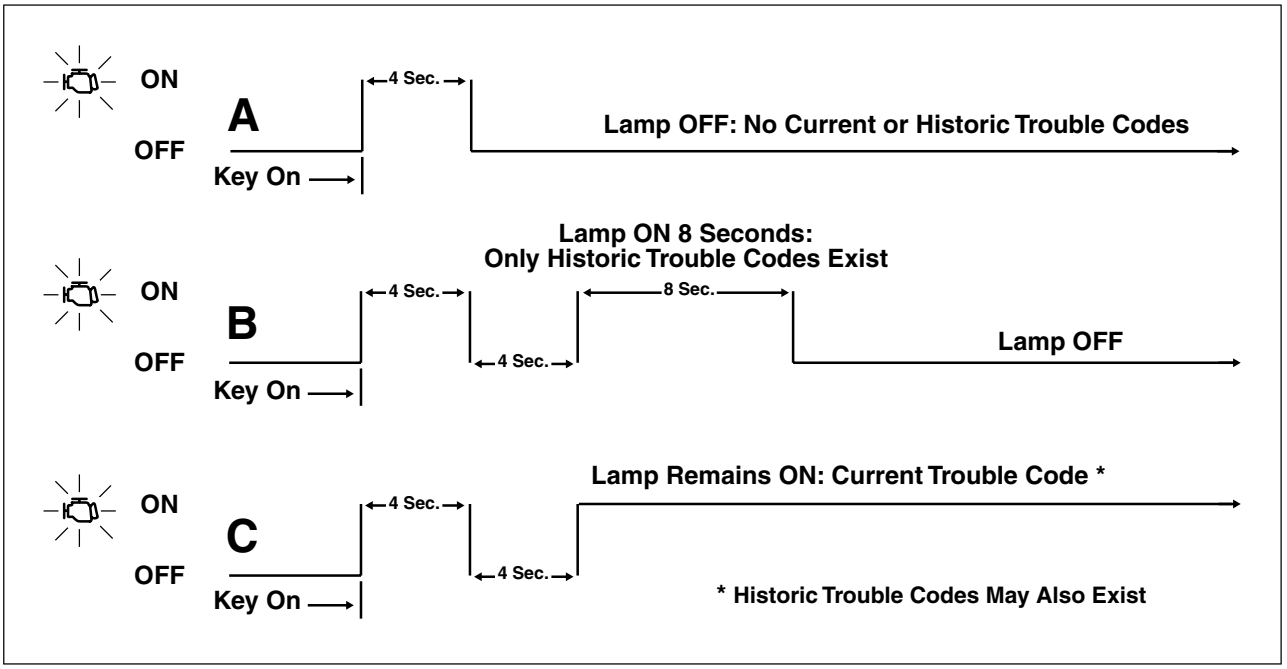


Figure 5-5. Check Engine Lamp Operation

CODE TYPES

There are two types of diagnostic trouble codes (DTCs), current and historic.

Current

Current trouble codes are those which presently disrupt motorcycle operation. When current trouble codes are stored, they can be read using either the Scanalyzer or the Check Engine Lamp Diagnostics. A current trouble code resides in the memory of the ECM until cleared by use of the Scanalyzer or corrected, at which point it becomes a “historic,” rather than a “current” fault.

Historic

If a particular problem happens to resolve itself, the active or current status is dropped and it also becomes a historic code. Historic trouble codes are stored for a length of time to assist in the diagnosis of intermittent faults. While historic trouble codes are stored, they can be read using the Scanalyzer only. The Check Engine Lamp will **not** indicate the existence of historic trouble codes.

A historic trouble code resides in the memory of the ECM until the code is cleared by use of the Scanalyzer or a total of 50 trips has elapsed. A “trip” consists of a start and run cycle, the run cycle lasting at least 30 seconds. After the 50 trip retention period, the trouble code is automatically erased from memory (that is, assuming no subsequent faults of the same type are detected in that period).

It is important to note that historic codes may also be present whenever the system indicates the existence of a current code. See MULTIPLE TROUBLE CODES for more information.

RETRIEVING TROUBLE CODES

The system provides three levels of diagnostics.

- The most sophisticated mode uses a computer based diagnostic package called the DIGITAL TECHNICIAN (Part No. HD-44750).
- At the second level, a portable Scan Tool called a “Scanalyzer” (HD-41325) plugs into the Data Link Connector and facilitates the diagnosis of system problems through a direct interface with the ECM. Using a special programmable application cartridge, the Scanalyzer offers data displays and menu selections that allow for quick and easy retrieval of data and enables the user to perform a variety of diagnostic tests while monitoring inputs and outputs. See Section 5.5 SCANALYZER: EFI.
- At the third level, the Check Engine Lamp is observed by the user after being placed in the diagnostic mode. The lamp blinks a code which correlates to a particular problem area. See Section 5.6 CHECK ENGINE LAMP DIAGNOSTICS: EFI.

MULTIPLE TROUBLE CODES

While it is possible for more than one fault to occur and set more than one trouble code, there are several conditions which may result in **one** fault setting multiple trouble codes:

- The MAP and TP sensors are connected to the same reference line (+5V Vref). If the reference line goes to ground or open, multiple codes will be set (DTC P0107 and P0122).
- Serial data codes (DTC U1300 and U1301) may be accompanied by other codes. **Always** correct the serial data codes before resolving the other codes.

In the case of multiple trouble codes, the second code should be resolved when the first code is corrected. For a priority ranking, see list of fault conditions in Table 5-8.

SCANALYZER DIAGNOSTICS

Scanalyzer Cartridge

See Figure 5-7. Through a special programmable application cartridge, the Scanalyzer offers data displays and menu selections that allow for quick and easy retrieval of data. The device enables the user to perform a variety of diagnostic tests while monitoring inputs and outputs. For Scanalyzer menu selections see Figure 5-8.

INSTALLATION

PART NO.	SPECIALTY TOOL
HD-41325	Scanalyzer
HD-41325-95C	Scanalyzer cartridge
HD-42921A	Cable

The behavior of the check engine lamp as described under Section 5.4 CHECKING FOR TROUBLE CODES: EFI indicates the existence of a trouble code. Proceed as follows:

1. Turn the Ignition/Light Key Switch to OFF.
2. Remove right saddlebag and side cover. See Figure 5-6.
3. Remove rubber protective plug from data link connector. Plug the Scanalyzer into the data link connector.
4. Turn the Ignition/Light Key Switch to IGNITION. Turn the handlebar mounted Engine Stop/Run Switch to RUN (but do not start the engine).
5. Insert the diagnostic application cartridge into the Scanalyzer. During the next few seconds, the Scanalyzer sequences through a series of screens that reflect a power-on self test, the system copyright, and then an attempt at communications with the ECM and TSM/TSSM. Once communications is established, the Diagnostic Menu appears. See Figure 5-8.
6. Continue with the instructions under USAGE which follows.

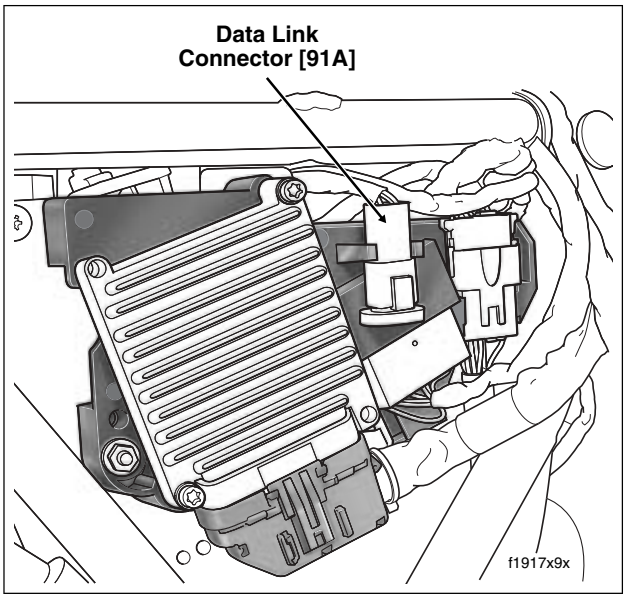


Figure 5-6. Right Side Cover Removed

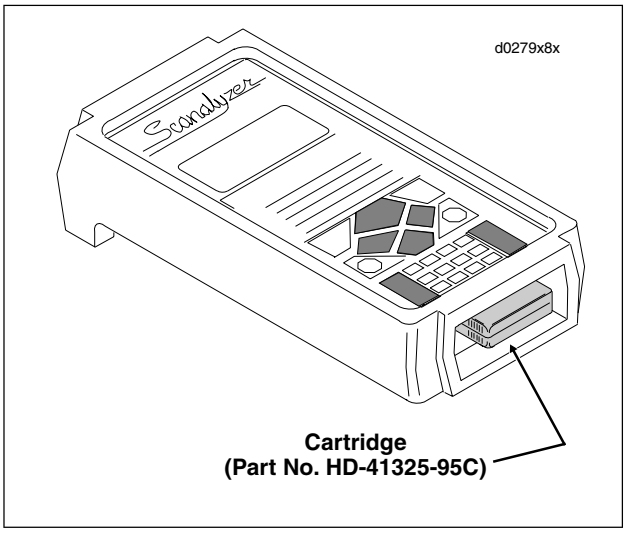


Figure 5-7. Scanalyzer (Part No. HD-41325)

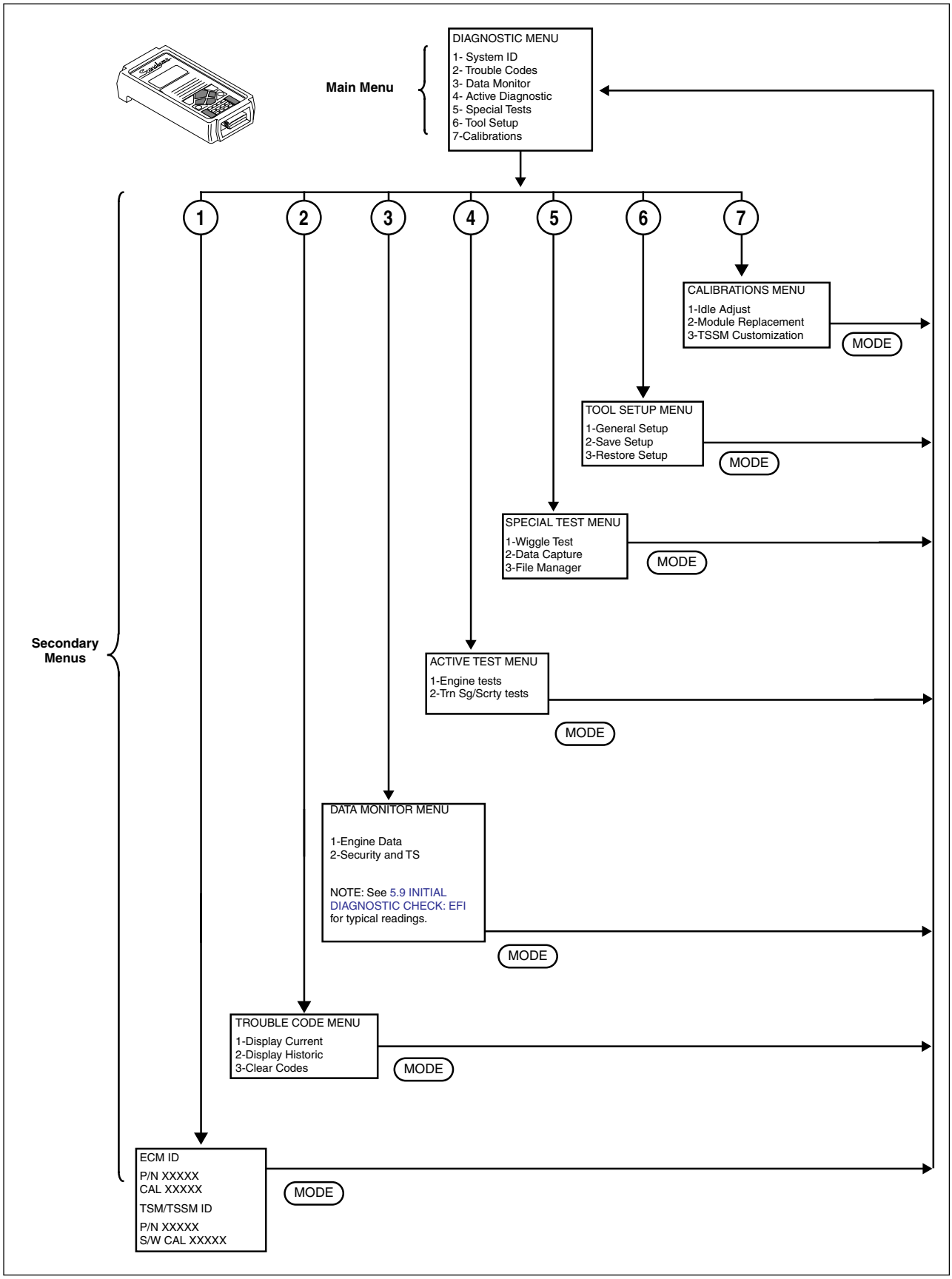


Figure 5-8. Scanalyzer Menus

USAGE

See Figure 5-8. The Diagnostic Menu, which consists of seven items, is the primary system menu (main menu) through which all other secondary menus and displays are accessed. Since the screen may not be large enough to display all line items at any given time, use the up and down arrow keys to scroll through the list.

Checking/Clearing Trouble Codes

1. See Figure 5-9. From the diagnostic menu, press the number “2” to access the Trouble Codes Menu.
2. At this point, the operator may:
   a. Press number “1” to display current trouble codes.
   b. Press number “2” to display historic trouble codes.
   c. Press number “3” to clear trouble codes. Note that the Scanalyzer is the only method by which the operator can display and manually clear historic trouble codes.
3. After reading trouble codes, simply press the Mode key to return to the Trouble Codes Menu. Press the Mode key again to return to the Diagnostic Menu. In this manner, regardless of where the operator is in the program, the Mode key need only be pressed once or twice to return to the Main Menu.

NOTE

For more detailed instructions, refer to the literature provided with the Scanalyzer.

4. Write down all trouble codes on a piece of paper. If a current trouble code exists, place it at the top of the list.
   a. If current trouble codes are present, see Table 5-8. to identify the source of the fault condition and then see the applicable flow chart.
   b. If only historic trouble codes are present, then a fault condition does not currently exist. If you wish, look for an intermittent in the appropriate circuit.
   c. If trouble codes are NOT present, but starting or driveability problems are evident, see symptoms charts under Section 5.9 INITIAL DIAGNOSTIC CHECK: EFI.
5. After correcting system problems, clear trouble codes using the Trouble Codes Menu of the Scanalyzer.

NOTE

Trouble codes cannot be cleared while the engine is running. Turn the engine off, but leave the Ignition/Light Key Switch in the IGNITION position and return the handlebar Engine Stop/Run Switch to RUN.



Figure 5-9. Scanalyzer Diagnostic Menu

REMOVAL

1. Turn the Ignition/Light Key Switch to OFF. Set the Engine Stop/Run Switch to STOP.
2. Unplug the Scanalyzer from the Data Link Connector. Install protective plug.
3. Install right side cover and saddlebag.
4. Road test the vehicle and observe the check engine lamp to confirm proper operation without the reoccurrence of trouble codes. See Section 5.4 CHECKING FOR TROUBLE CODES: EFI.

CHECK ENGINE LAMP DIAGNOSTICS: EFI 5.6

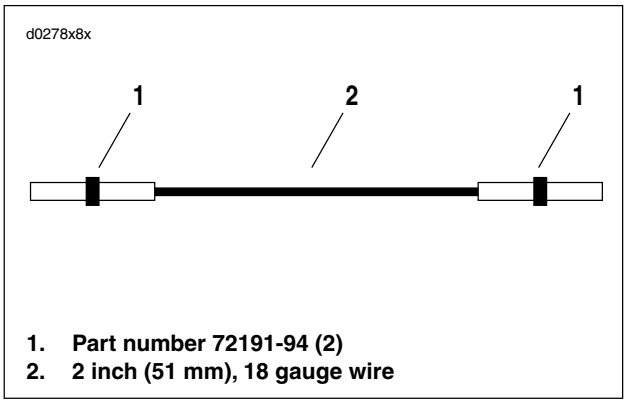
GENERAL

If the check engine lamp shows no current or historic codes at key ON, then no codes will be flashed when the diagnostic test wire is installed.

ACTIVATION

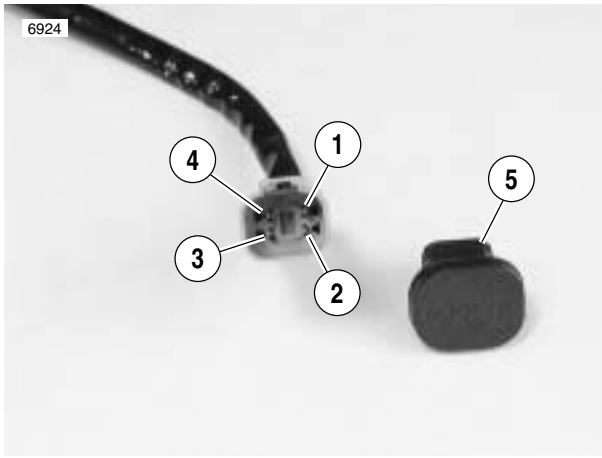
Use of check engine lamp diagnostics assumes that the SCANALYZER (Part No. HD-41325) is not available.

1. Remove right side saddlebag and side cover. Remove protective plug from data link connector [91A].
2. To activate the diagnostic feature, proceed as follows:
   a. Create diagnostic test wire from parts shown in Figure 5-10.
   b. See Figure 5-11. Install diagnostic test wire across Terminals 1 and 2 on the data link connector [91A].
   c. Turn Ignition/Light Key Switch to IGNITION and wait approximately 10 seconds (4 seconds lamp ON, 6 seconds lamp OFF) for check engine lamp to start flashing. See Figure 5-12.
3. All trouble codes are sent out as a series of flashes. To retrieve the first digit of the trouble code simply observe the number of times the lamp flashes.
   a. The lamp will then flash one or more times to indicate the first digit of the trouble code. The length of time the lamp is illuminated and the length of time in which it is off are each about 0.5 second in duration.
4. The second digit follows:
   a. Following the transmission of the first digit, there is a 1.2 second pause in which the lamp is off.
   b. The lamp will then flash one or more times to indicate the second digit of the trouble code. Count the number of times the lamp flashes to retrieve the second digit.
5. If more than one trouble code is sent:
   a. Following transmission of the second digit of the first code, there is a 3 second pause in which the lamp is off.



1. Part number 72191-94 (2)
2. 2 inch (51 mm), 18 gauge wire

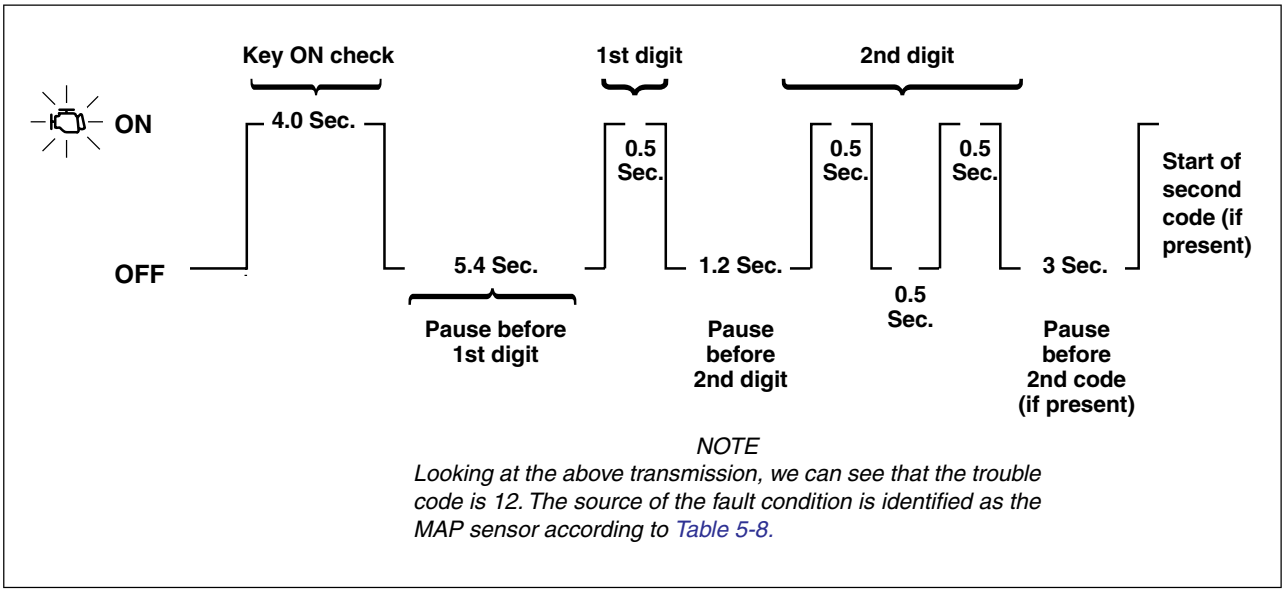
Figure 5-10. Diagnostic Test Wire



1. Terminal 1: flash pin (Lt GN/R)
2. Terminal 2: ground (BK)
3. Terminal 3: serial data (Lt GN/V)
4. Terminal 4: power (GY)
5. Protective cap

Figure 5-11. Installing Diagnostic Test Wire

   b. Once all codes have been sent, the data string is repeated. When you have recorded the same trouble code twice, it is an indication that the transmission has been restarted and that all trouble codes have been retrieved.



NOTE

Looking at the above transmission, we can see that the trouble code is 12. The source of the fault condition is identified as the MAP sensor according to Table 5-8.

Figure 5-12. Check Engine Lamp Diagnostics

6. When examining trouble codes, write down all codes on a piece of paper. If a current trouble code exists, place it at the top of the list.
   a. If trouble codes are present, see Table 5-8. Follow the applicable flow charts for each code.
   b. If trouble codes are NOT present, but starting or driveability problems are evident, see symptoms charts under Section 5.9 INITIAL DIAGNOSTIC CHECK: EFI.
7. Turn the Ignition/Light Key Switch to OFF.
8. Remove diagnostic test wire from connector. Install protective plug in data link connector [91A].
9. Install right side cover and saddlebag.

IMPORTANT NOTE

If diagnostic test wire is installed across Pins 1 and 2 on connector [91A] in lieu of a Scanalyzer, the ECM is placed in a diagnostic test mode and the engine will start. The test wire must be removed from the data connector and the ignition switch turned OFF or the check engine lamp will continue to flash codes.

BREAKOUT BOX: EFI 5.7

GENERAL

The BREAKOUT BOX (Part No. HD-43876), used in conjunction with a DVOM, allows circuit diagnosis without having to probe connectors with sharp objects.

INSTALLATION

1. Remove the right saddlebag and side cover.
2. Depress latch and remove connector [78B] to release EFI harness from ECM. See Figure 5-13.
3. Install connectors on Breakout Box to ECM and EFI harness connectors.

REMOVAL

1. Separate connectors to remove Breakout Box between ECM and EFI harness.
2. Install connector [78B] to connect EFI harness to ECM.
3. Install right side cover and saddlebag.

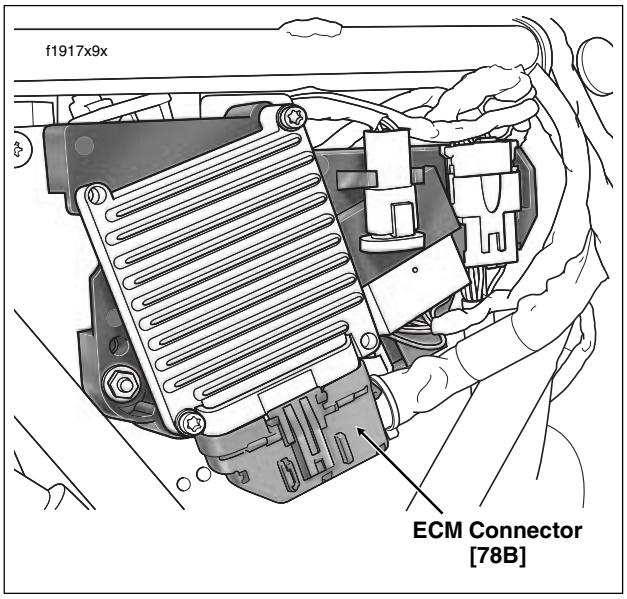


Figure 5-13. Right Side Cover Removed

WIGGLE TEST 5.8

GENERAL

The wiggle test indicates the presence of intermittents in a wiring harness. Depending upon the availability of diagnostic tools, either version of this test may be used.

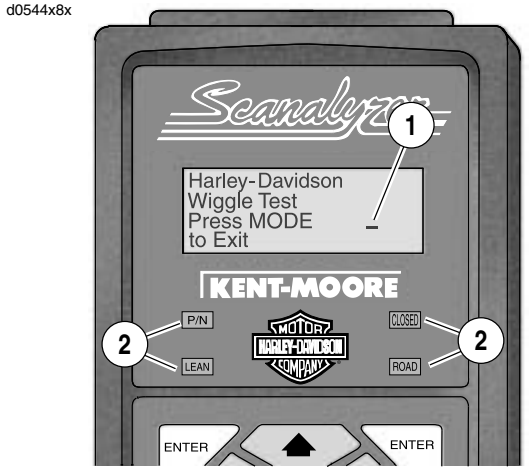
PROCEDURE

Using Scanalyzer (HD-41325)

1. Connect Scanalyzer to vehicle. See Section 5.5 SCANALYZER: EFI.
2. Start motorcycle engine and run at idle.
3. Enter wiggle test mode.
   a. Press “5” from the DIAGNOSTIC MENU to enter the SPECIAL TESTS menu.
   b. Press “1” from the SPECIAL TESTS menu to enter the WIGGLE TEST.
4. Shake or wiggle harness to detect intermittents. If intermittents are present the Scanalyzer will beep, light the four corner LEDs and display a minus sign when a current trouble code is detected. See Figure 5-14.

NOTE

If a current trouble code is present when the wiggle test is entered, the Scanalyzer will respond as described immediately upon entering the wiggle test mode. With key ON and engine off, clear trouble codes and then perform wiggle test with vehicle running.



1. **Minus sign**
2. **Corner LED (4)**

Figure 5-14. Wiggle Test Indicators

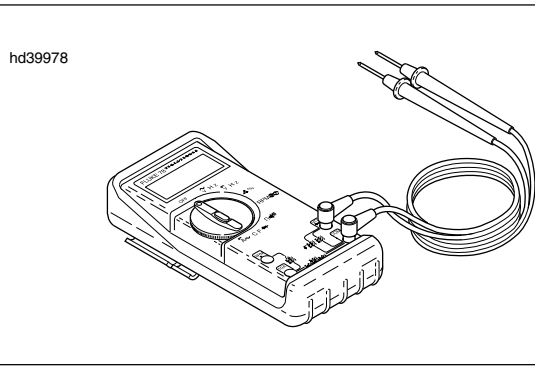


Figure 5-15. Fluke 78 Multimeter (DVOM) (Part No. HD-39978)

Using DVOM (HD-39978)

1. See Figure 5-15. Connect DVOM to wiring harness between the suspect connections. When diagnosing ECM connections, use a BREAKOUT BOX (Part No. HD-43876) to simplify the procedure. See Section 5.7 BREAKOUT BOX: EFI.
2. Set DVOM to read voltage changes.
3. Start motorcycle engine and run at idle.
4. Shake or wiggle harness to detect intermittents. If intermittents are present, radical voltage changes will register on the DVOM.

INITIAL DIAGNOSTIC CHECK: EFI 5.9

GENERAL

To locate faulty circuits or other system problems, follow the diagnostic flow charts in this chapter. Read the general information and then work your way through the flow chart box by box. For a systematic approach, always begin with INITIAL DIAGNOSTICS below.

Diagnostic Notes

If a numbered circle appears adjacent to a box of the flow chart, then more information is offered in the Diagnostic Notes. Many diagnostic notes contain supplemental information, descriptions of various diagnostic tools or references to other parts of the manual.

Scanalyzer Icon

The Scanalyzer icon appears at those points in the flow chart where the Scanalyzer may be used.

Circuit Diagram/Connector Location Table

When working through a flow chart, refer to the illustrations, the associated Circuit Diagram and the Wire Harness Connector Table as necessary. The wire harness connector table opposite each flow chart identifies the connector number, description, type and general location.

In order to perform most diagnostic routines, a Breakout Box and a DVOM are required. See Section 5.7 BREAKOUT BOX: EFI. To perform the circuit checks with any degree of efficiency, a familiarity with the various wire connectors is also necessary.

Job/Time Code Values

When filing warranty claims, dealer technicians should use the numeric job/time codes printed below the appropriate box of the flow chart.

INITIAL DIAGNOSTICS

General

The diagnostic check is an organized approach to identifying a system problem. If no problems are found after completion of the diagnostic check, a comparison of Scanalyzer parameters may be used to help locate intermittents and out-of-specification sensors. See Table 5-4.

Diagnostic Tips

- If the Scanalyzer is not working properly, check operation on another vehicle. If OK, check data link connector [91A] for 12 volts (terminal 4) and proper ground (terminal 2). See Figure 5-16.
- If the Scanalyzer reads “No Response” with the Ignition/Light Key Switch turned to IGNITION (Engine Stop/Run Switch at RUN with the engine off), check for an open or short to ground between terminal 3 of data link connector [91A] and the ECM (or TSM/TSSM). See Figure 5-11.
- Check for an open diagnostic test terminal between data Terminal 3 and ECM. With Ignition/Light Key Switch turned to IGNITION, transmit data should typically be 0.6-0.8 volts. The range of acceptable operation is 0-7.0 volts. Scanalyzer should communicate when proper voltage is present.

IMPORTANT NOTE

If diagnostic test wire is installed across Pins 1 and 2 on connector [91A] in lieu of Scanalyzer, the ECM is placed in a diagnostic test mode and the engine will start. The test wire must be removed from the data link connector and the ignition switch turned to OFF or the check engine lamp will continue to flash codes.

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the diagnostic check flow charts.

1. Compare engine behavior to symptoms tables.
   a. Starts hard. See Table 5-5.
   b. Hesitates, stumbles, surges, misfires and/or sluggish performance. See Table 5-6.
   c. Engine exhaust emits black smoke or fouls plugs. See Table 5-7.
2. Use HARNESS CONNECTOR TEST KIT (HD-41404), black socket probe and patch cord.
3. Connect BREAKOUT BOX (HD-43876) to ECM. See Section 5.7 BREAKOUT BOX: EFI.

Other Codes

All EFI diagnostic codes are listed in Table 5-8. See Section 3.12 INITIAL DIAGNOSTIC CHECK: TSM/TSSM for any codes related to the turn signal module (TSM) or turn signal/security module (TSSM).

Table 5-4. Typical Scan Values for Engine Data

ITEM	MIN. VALUE	MAX. VALUE	HOT IDLE
MAP sensor	10 kPa	104 kPa	10.3-13.3 in. Hg 35-45 kPa
	0 volts	5.1 volts	
TP sensor	0	100	0%
	0.2 volts	4.5 volts	0.2-1.0 volts
IAC pintle	0	155	20-50 steps
RPM	800	5600	1000
ET sensor	3° F (-16° C)	464° F (240° C)	230-300° F (110-150° C)
	0.0 volts	5.0 volts	0.5-1.5 volts
IAT sensor	3° F (-16° C)	248° F (120° C)	104-140° F (40-60° C)
	0.0 volts	5.0 volts	2.0-3.5 volts
INJ PW front	0	50 mS	2-4 mSec
INJ PW rear	0	50 mS	2-4 mSec
Advance front	0	50°	10-15°
Advance rear	0	50°	10-15°
VSS	0	120	0 MPH
Battery voltage	10	15	13.4 volts
ENG RUN	off	Run	Run
Idle RPM	800	1250	1000

NOTE

Hot idle specifications are with stock exhaust, the engine operating at 1000 RPM and an engine temperature of approximately 260° F (127° C). Idle settings may be changed with the idle set procedure. See DATA LINK CONNECTOR, SETTING ENGINE IDLE SPEED, in the 2003 Touring Models Service Manual (Part Number 99483-03).

Table 5-5. Engine Starts Hard

CAUSE	SOLUTION
Battery discharged	See charging system troubleshooting in this section.
Spark plugs	5.19 MISFIRE AT IDLE OR UNDER LOAD.
Spark plug wires	5.19 MISFIRE AT IDLE OR UNDER LOAD.
Ignition coil	5.19 MISFIRE AT IDLE OR UNDER LOAD.
Valve sticking	See Section 3 of the 2003 Touring Models Service Manual (Part Number 99483-03).
Water or dirt in fuel system	Drain and refill with fresh fuel.
Loss of battery power to ECM Pin 31*	See Section 5.13.

* Will not clear codes (although it appears to).

Table 5-6. Engine Performance Problems

CAUSE	SOLUTION
Manifold leak	With a cold engine, spray water around induction module seals. Start and idle engine. If bubbles appear, change seals. A low IAC count may also indicate an air leak.
MAP sensor plugged or not operating properly	5.21 DTC P0107, P0108.
Water or dirt in fuel system	Drain and refill with fresh fuel.
Spark plugs	5.19 MISFIRE AT IDLE OR UNDER LOAD.
Throttle plate not opening fully	See THROTTLE CABLES, ADJUSTMENT, in the 2003 Touring Models Service Manual (Part Number 99483-03).
Low fuel pressure	5.17 FUEL PRESSURE TEST.

Table 5-7. Engine Exhaust Emits Black Smoke or Fouls Plugs

CAUSE	SOLUTION
Clogged air filter	See AIR CLEANER in the 2003 Touring Models Service Manual (Part Number 99483-03).
MAP sensor plugged or not operating properly	5.21 DTC P0107, P0108.

Table 5-8. EFI Diagnostic Trouble Codes (DTC) and Fault Conditions

RANKING	DTC	STATUS	CHECK ENGINE LAMP CODE	FAULT CONDITION	SOLUTION
1	P0605	Current	53	ECM flash error	5.29 DTC P0603, P0605
2	P0605	Historic	53	ECM flash error	5.29 DTC P0603, P0605
3	P0603	Current	54	ECM EEPROM error	5.29 DTC P0603, P0605
4	P0603	Historic	54	ECM EEPROM error	5.29 DTC P0603, P0605
5	U1300	Current	63	ECM serial data low	5.14 STARTS, THEN STALLS
6	U1301	Current	63	ECM serial data open/high	5.14 STARTS, THEN STALLS
7	U1300	Current	63	TSSM serial data low	5.14 STARTS, THEN STALLS
8	U1301	Current	63	TSSM serial data open/high	5.14 STARTS, THEN STALLS
9	U1064	Current	61	Loss of TSM/TSSM serial data	5.33 DTC U1016, U1064, U1255
10	U1016	Current	14	Loss of all ECM serial data (state of health)	3.23 DTC U1016 (EFI), DTC 14/24/33/43 (CARB)
			24	Loss of vehicle speed	3.23 DTC U1016 (EFI), DTC 14/24/33/43 (CARB)
			33	Loss of vehicle inhibit motion	3.23 DTC U1016 (EFI), DTC 14/24/33/43 (CARB)
			43	Loss of powertrain security status	3.23 DTC U1016 (EFI), DTC 14/24/33/43 (CARB)
11	P1003	Current	33	System relay contacts open	5.16 SYSTEM RELAY CHECK
12	P1002	Current	33	System relay coil high/shorted	5.16 SYSTEM RELAY CHECK
13	P1001	Current	33	System relay coil open/low	5.16 SYSTEM RELAY CHECK
14	P1004	Current	33	System relay contacts closed	5.16 SYSTEM RELAY CHECK
15	P1009	Current	99	Incorrect password	5.30 DTC P1009, P1010
16	P1010	Current	99	Missing password	5.30 DTC P1009, P1010
17	P0373	Current	41	CKP sensor intermittent	5.26 DTC P0373, P0374
18	P0374	Current	41	CKP sensor synch error	5.26 DTC P0373, P0374
19	P0122	Current	11	TP sensor open/low	5.24 DTC P0122, P0123
20	P0123	Current	11	TP sensor high	5.24 DTC P0122, P0123
21	P0107	Current	12	MAP sensor open/low	5.21 DTC P0107, P0108
22	P0108	Current	12	MAP sensor high	5.21 DTC P0107, P0108
23	P0117	Current	14	ET sensor voltage low	5.23 DTC P0117, P0118
24	P0118	Current	14	ET sensor open/high	5.23 DTC P0117, P0118
25	P0112	Current	15	IAT sensor voltage low	5.22 DTC P0112, P0113
26	P0113	Current	15	IAT sensor open/high	5.22 DTC P0112, P0113
27	P1351	Current	24	Front ignition coil open/low	5.31 DTC P1351, P1352, P1354, P1355
28	P1354	Current	25	Rear ignition coil open/low	5.31 DTC P1351, P1352, P1354, P1355
29	P1352	Current	24	Front ignition coil high/shorted	5.31 DTC P1351, P1352, P1354, P1355
30	P1355	Current	25	Rear ignition coil high/shorted	5.31 DTC P1351, P1352, P1354, P1355
31	P1357	Current	24	Front cylinder combustion intermittent	5.20 COMBUSTION ABSENT/INTERMITTENT
32	P1358	Current	25	Rear cylinder combustion intermittent	5.20 COMBUSTION ABSENT/INTERMITTENT
33	P0261	Current	23	Front injector open/low	5.25 DTC P0261, P0262, P0263, P0264
34	P0263	Current	32	Rear injector open/low	5.25 DTC P0261, P0262, P0263, P0264
35	P0262	Current	23	Front injector high	5.25 DTC P0261, P0262, P0263, P0264
36	P0264	Current	32	Rear injector high	5.25 DTC P0261, P0262, P0263, P0264
37	P0562	Current	16	Battery voltage low	5.28 DTC P0562, P0563
38	P0563	Current	16	Battery voltage high	5.28 DTC P0562, P0563
39	P0501	Current	43	VSS sensor low	5.27 DTC P0501, P0502
40	P0502	Current	43	VSS sensor high	5.27 DTC P0501, P0502

Table 5-8. EFI Diagnostic Trouble Codes (DTC) and Fault Conditions

RANKING	DTC	STATUS	CHECK ENGINE LAMP CODE	FAULT CONDITION	SOLUTION
41	P1651	Current	N/A	Check engine light open/low	5.10 NO CHECK ENGINE LAMP AT KEY ON or 5.11 CHECK ENGINE LAMP ON CONTINUOUSLY
42	P1652	Current	N/A	Check engine light high	5.10 NO CHECK ENGINE LAMP AT KEY ON
43	P1653	Current	35	Tachometer low	5.32 DTC P1653, P1654
44	P1654	Current	35	Tachometer high	5.32 DTC P1653, P1654
45	P1356	Current	25	Rear cylinder no combustion	5.20 COMBUSTION ABSENT/INTERMITTENT
46	P1353	Current	24	Front cylinder no combustion	5.20 COMBUSTION ABSENT/INTERMITTENT
47	P0505	Current	34	Loss of idle speed control	5.18 IDLE AIR CONTROL
48	B1135	Current	35	Accelerometer fault	3.22 DTC B1135 (EFI), DTC 35 (CARB)
49	B1134	Current	34	Starter output high	3.20 DTC B1134 (EFI), DTC 34 (CARB)
50	B1125	Current	25	Ignition enable output high	3.18 DTC 25 (CARB ONLY)
51	B1121	Current	21	Left turn output fault	3.16 TURN SIGNAL ERRORS
52	B1122	Current	22	Right turn output fault	3.16 TURN SIGNAL ERRORS
53	B0563	Current	11	Battery voltage high	3.17 DTC B0563 (EFI), DTC 11 (CARB)
54	B1131	Current	31	Alarm output low	3.19 DTC B1131/ B1132 (EFI), DTC 31/32 (CARB)
55	B1132	Current	32	Alarm output high	3.19 DTC B1131/ B1132 (EFI), DTC 31/32 (CARB)
56	B1141	Current	41	Ignition switch open/low	3.16 TURN SIGNAL ERRORS
57	U1300	Historic	63	ECM serial data low	5.14 STARTS, THEN STALLS
58	U1301	Historic	63	ECM serial data open/high	5.14 STARTS, THEN STALLS
59	U1300	Historic	63	TSSM serial data low	5.14 STARTS, THEN STALLS
60	U1301	Historic	63	TSSM serial data open/high	5.14 STARTS, THEN STALLS
61	U1064	Historic	61	Loss of TSM/TSSM serial data	5.33 DTC U1016, U1064, U1255
62	U1016	Historic	14	Loss of all ECM serial data (state of health)	3.23 DTC U1016 (EFI), DTC 14/24/33/43 (CARB)
63	P1003	Historic	33	System relay contacts open	5.16 SYSTEM RELAY CHECK
64	P1002	Historic	33	System relay coil high/shorted	5.16 SYSTEM RELAY CHECK
65	P1001	Historic	33	System relay coil open/low	5.16 SYSTEM RELAY CHECK
66	P1004	Historic	33	System relay contacts closed	5.16 SYSTEM RELAY CHECK
67	P1009	Historic	99	Incorrect password	5.30 DTC P1009, P1010
68	P1010	Historic	99	Missing password	5.30 DTC P1009, P1010
69	P0373	Historic	41	CKP sensor intermittent	5.26 DTC P0373, P0374
70	P0374	Historic	41	CKP sensor synch error	5.26 DTC P0373, P0374
71	P0122	Historic	11	TP sensor open/low	5.24 DTC P0122, P0123
72	P0123	Historic	11	TP sensor high	5.24 DTC P0122, P0123
73	P0107	Historic	12	MAP sensor open/low	5.21 DTC P0107, P0108
74	P0108	Historic	12	MAP sensor high	5.21 DTC P0107, P0108
75	P0117	Historic	14	ET sensor voltage low	5.23 DTC P0117, P0118
76	P0118	Historic	14	ET sensor open/high	5.23 DTC P0117, P0118
77	P0112	Historic	15	IAT sensor voltage low	5.22 DTC P0112, P0113
78	P0113	Historic	15	IAT sensor open/high	5.22 DTC P0112, P0113
79	P1351	Historic	24	Front ignition coil open/low	5.31 DTC P1351, P1352, P1354, P1355
80	P1354	Historic	25	Rear ignition coil open/low	5.31 DTC P1351, P1352, P1354, P1355
81	P1352	Historic	24	Front ignition coil high/shorted	5.31 DTC P1351, P1352, P1354, P1355
82	P1355	Historic	25	Rear ignition coil high/shorted	5.31 DTC P1351, P1352, P1354, P1355
83	P1357	Historic	24	Front cylinder combustion intermittent	5.20 COMBUSTION ABSENT/INTERMITTENT
84	P1358	Historic	25	Rear cylinder combustion intermittent	5.20 COMBUSTION ABSENT/INTERMITTENT
85	P0261	Historic	23	Front injector open/low	5.25 DTC P0261, P0262, P0263, P0264
86	P0263	Historic	32	Rear injector open/low	5.25 DTC P0261, P0262, P0263, P0264
87	P0262	Historic	23	Front injector high	5.25 DTC P0261, P0262, P0263, P0264

Table 5-8. EFI Diagnostic Trouble Codes (DTC) and Fault Conditions

RANKING	DTC	STATUS	CHECK ENGINE LAMP CODE	FAULT CONDITION	SOLUTION
88	P0264	Historic	32	Rear injector high	5.25 DTC P0261, P0262, P0263, P0264
89	P0562	Historic	16	Battery voltage low	5.28 DTC P0562, P0563
90	P0563	Historic	16	Battery voltage high	5.28 DTC P0562, P0563
91	P0501	Historic	43	VSS sensor low	5.27 DTC P0501, P0502
92	P0502	Historic	43	VSS sensor high	5.27 DTC P0501, P0502
93	P1651	Historic	N/A	Check engine light open/low	5.10 NO CHECK ENGINE LAMP AT KEY ON or 5.11 CHECK ENGINE LAMP ON CONTINUOUSLY
94	P1652	Historic	N/A	Check engine light high	5.10 NO CHECK ENGINE LAMP AT KEY ON
95	P1653	Historic	35	Tachometer low	5.32 DTC P1653, P1654
96	P1654	Historic	35	Tachometer high	5.32 DTC P1653, P1654
97	P1356	Historic	25	Rear cylinder no combustion	5.20 COMBUSTION ABSENT/INTERMITTENT
98	P1353	Historic	24	Front cylinder no combustion	5.20 COMBUSTION ABSENT/INTERMITTENT
99	P0505	Historic	34	Loss of idle speed control	5.18 IDLE AIR CONTROL
100	B1135	Historic	35	Accelerometer fault	3.22 DTC B1135 (EFI), DTC 35 (CARB)
101	B1134	Historic	34	Starter output high	3.20 DTC B1134 (EFI), DTC 34 (CARB)
102	B1125	Historic	25	Ignition enable output high	3.18 DTC 25 (CARB ONLY)
103	B1121	Historic	21	Left turn output fault	3.16 TURN SIGNAL ERRORS
104	B1122	Historic	22	Right turn output fault	3.16 TURN SIGNAL ERRORS
105	B0563	Historic	11	Battery voltage high	3.17 DTC B0563 (EFI), DTC 11 (CARB)
106	B1131	Historic	31	Alarm output low	3.19 DTC B1131/ B1132 (EFI), DTC 31/32 (CARB)
107	B1132	Historic	32	Alarm output high	3.19 DTC B1131/ B1132 (EFI), DTC 31/32 (CARB)
108	B1141	Historic	41	Ignition switch open/low	3.16 TURN SIGNAL ERRORS

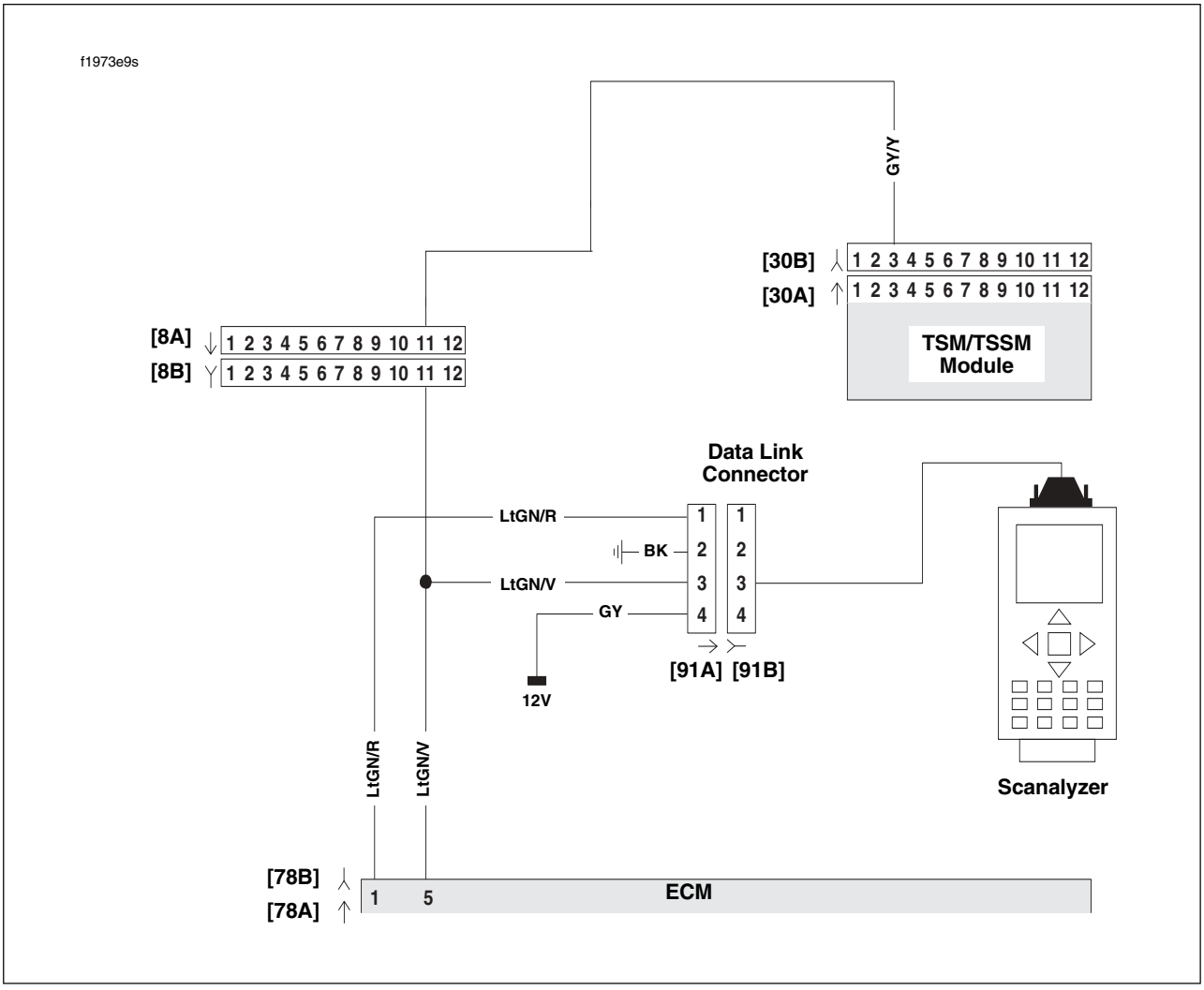
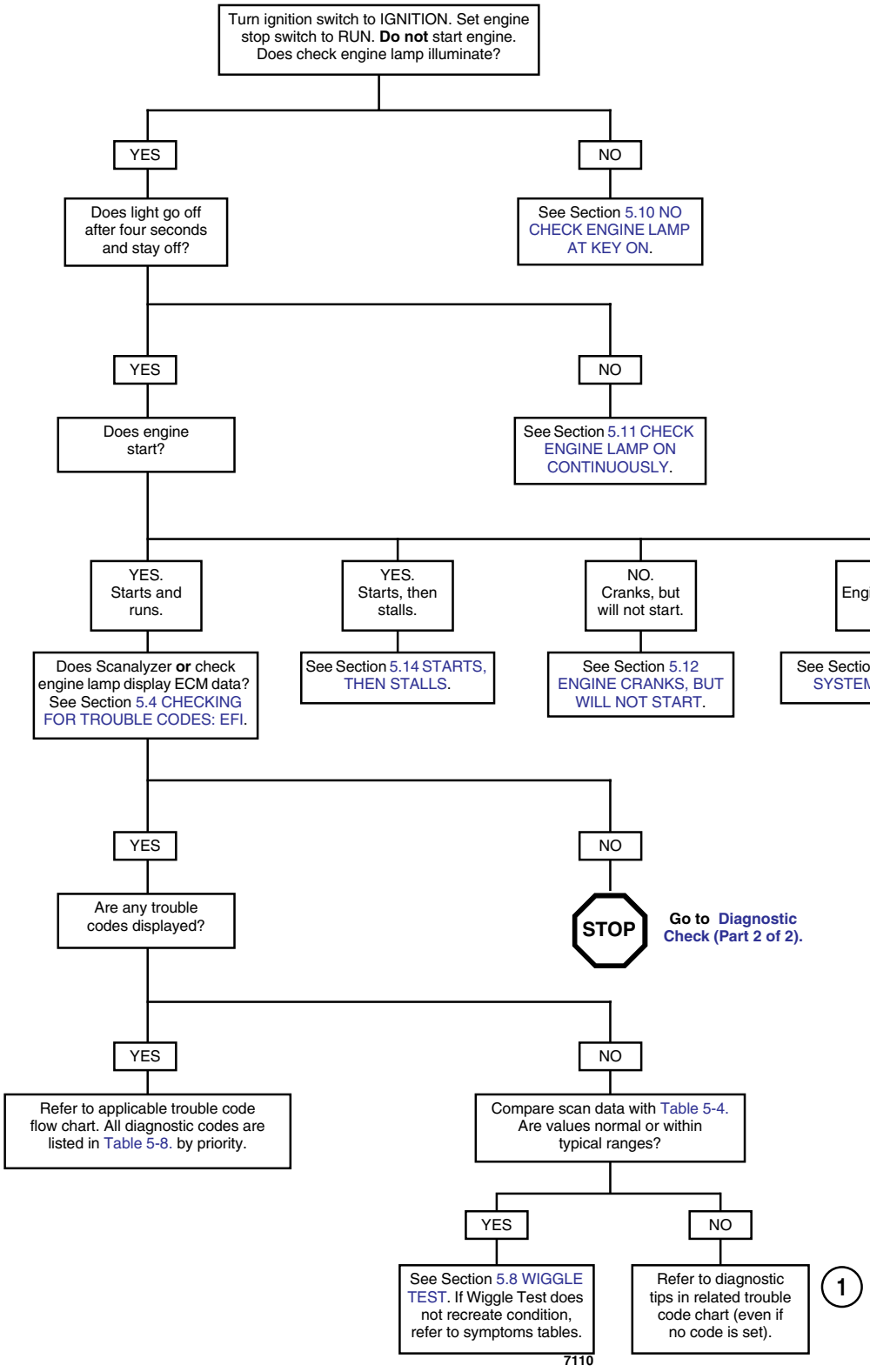


Figure 5-16. Diagnostic Check

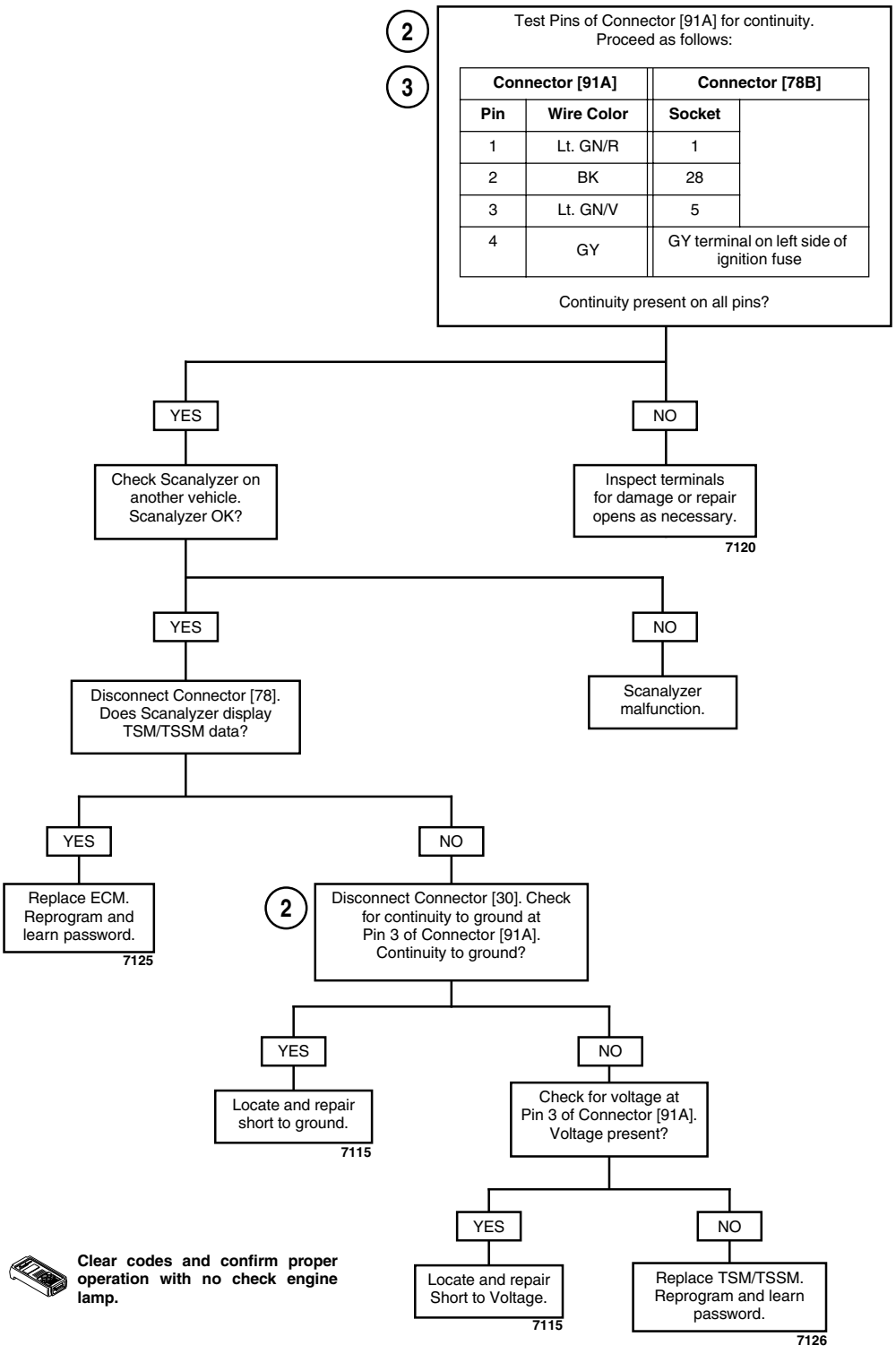
Table 5-9. Wire Harness Connectors in Figure 5-16.

NO.	DESCRIPTION	TYPE	LOCATION
[8]	Ignition (Main to EFI Harness)	12-Place Deutsch (Gray)	Under Right Side Cover
[30]	TSM/TSSM	12-Place Deutsch	Cavity in Crossmember at Rear of Battery Box (Under Seat)
[78]	ECM	36-Place Packard	Under Right Side Cover
[91]	Data Link	4-Place Deutsch	Under Right Side Cover

Diagnostic Check (Part 1 of 2)



Diagnostic Check (Part 2 of 2)



NO CHECK ENGINE LAMP AT KEY ON 5.10

GENERAL

Diagnostic Trouble Codes P1652, P1651

If the ignition switch is turned to IGNITION and the engine stop switch is set to RUN with the engine off, the check engine lamp should illuminate for four seconds. See Figure 5-17.

Battery voltage is supplied to the lamp bulb. The lamp bulb is grounded by the ECM through the BK/Y wire. A lack of power to the ECM will cause the check engine lamp to be inoperative and also create a no start situation.

Table 5-10. Code Description

DTC	LAMP CODE	DESCRIPTION
P1651	N/A	Check engine light open/low
P1652	N/A	Check engine light high

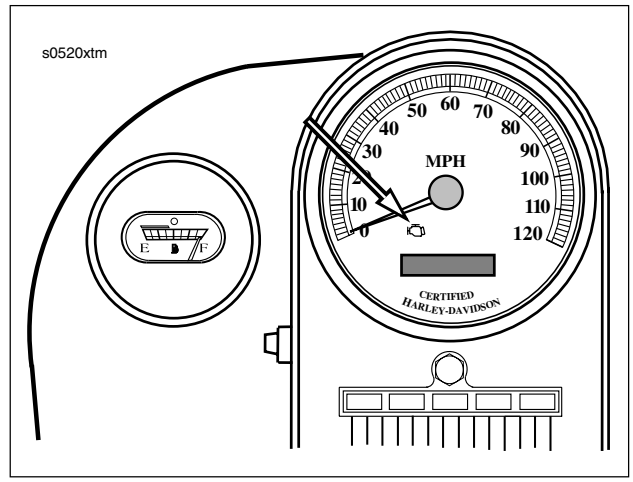


Figure 5-17. Check Engine Lamp

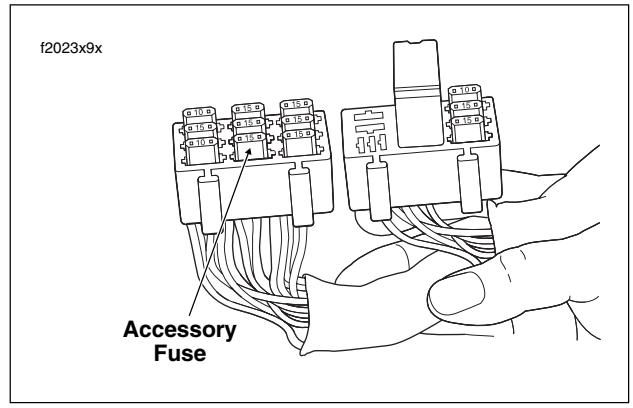


Figure 5-18. Left Side Cover Removed (FLTR, FLHT/C)

DIAGNOSTICS

Diagnostic Tips

Check for the following conditions:

- Check for open in BK/Y wire.
- See Figure 5-18. Check accessory fuse.

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 5.10 flow chart.

1. Connect BREAKOUT BOX (Part No. HD-43876). See Section 5.7 BREAKOUT BOX: EFI.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), purple pin probe and patch cord between Breakout Box and ground. Align blade with slot on Breakout Box terminal.
3. Assumes speedometer is functioning. If speedometer is not functioning, see Section 2.3 SPEEDOMETER PERFORMANCE CHECK.
4. LED failure requires speedometer replacement.

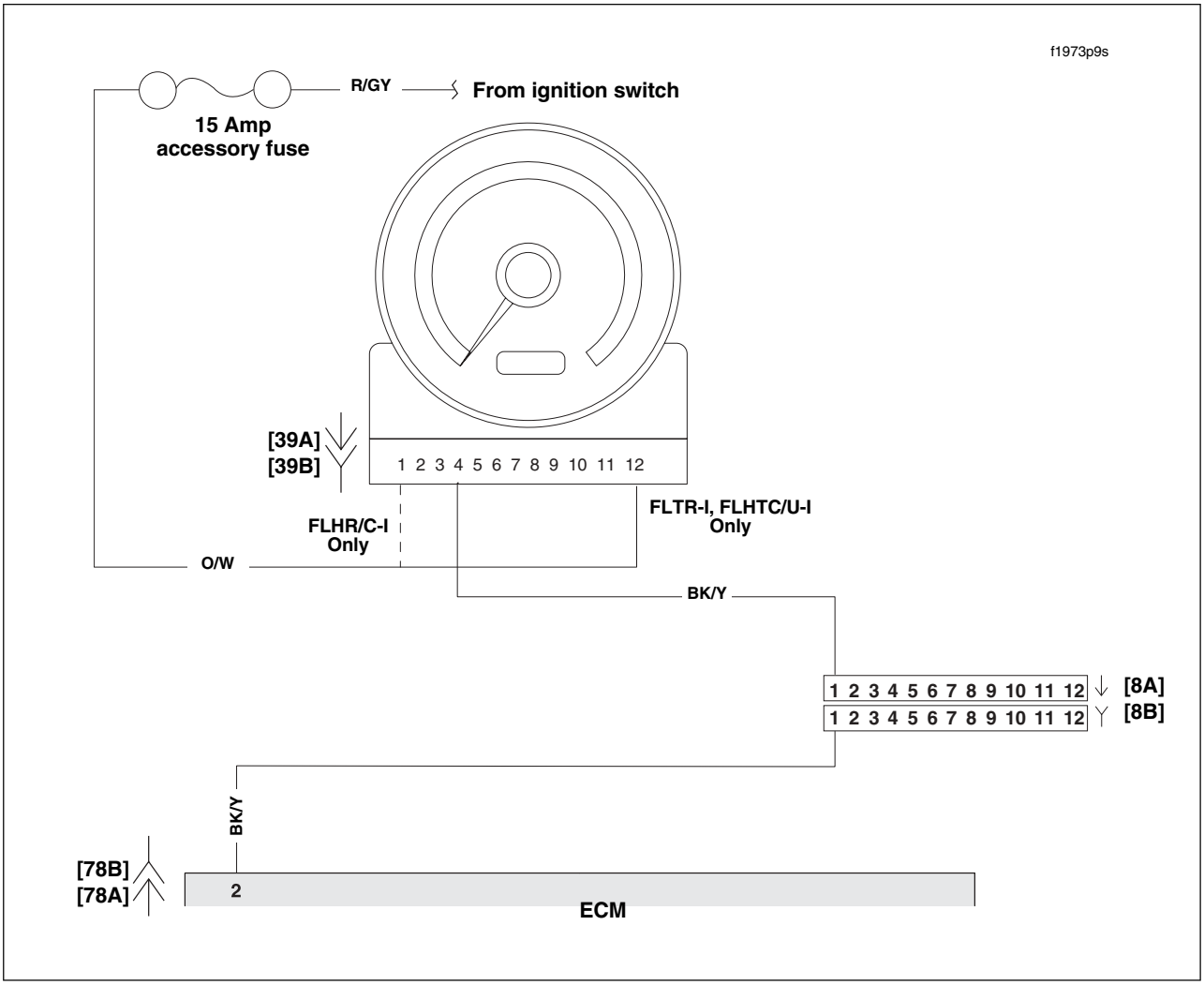


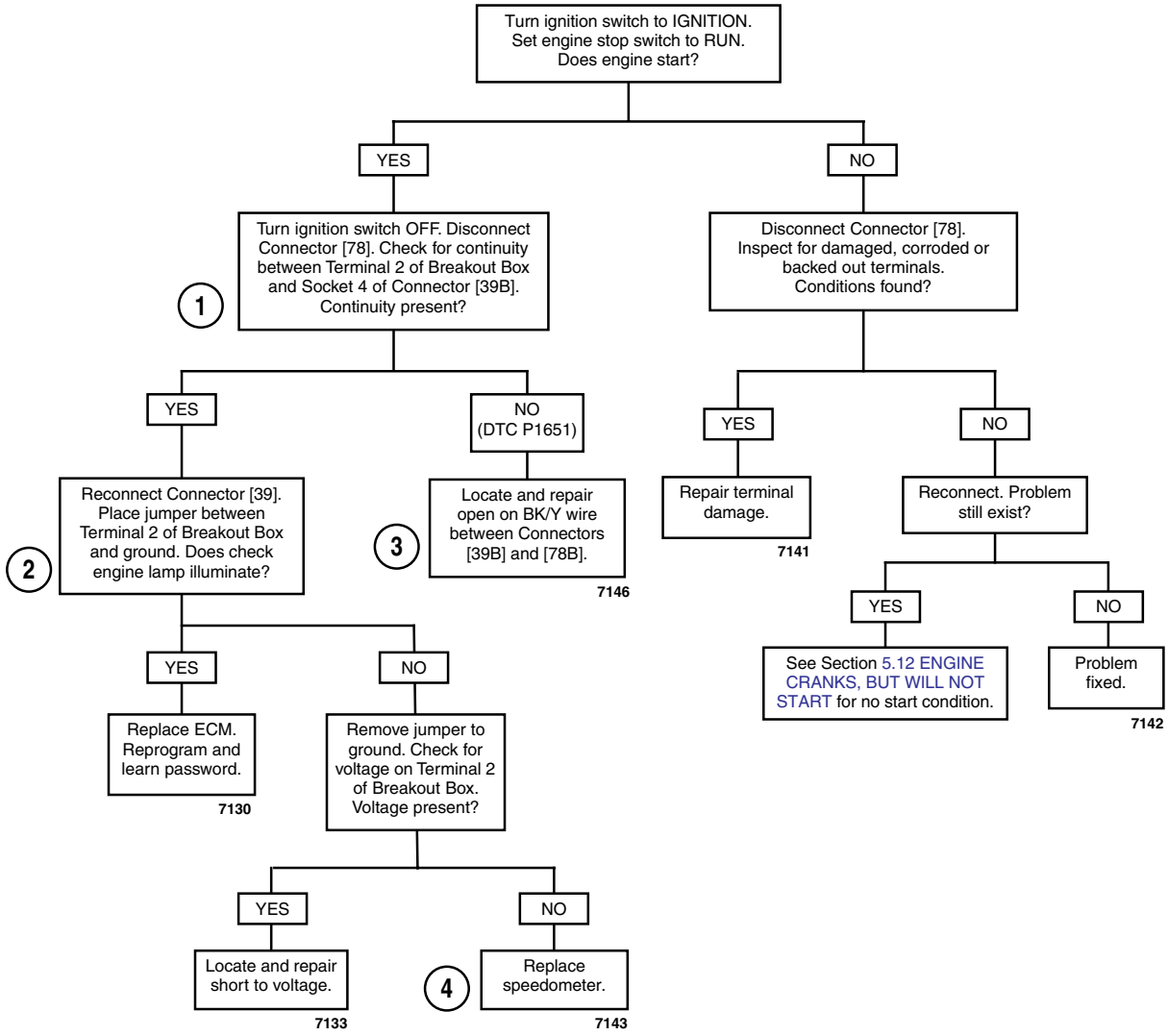
Figure 5-19. Check Engine Lamp Circuit

Table 5-11. Wire Harness Connectors in Figure 5-19.

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[8]	Ignition (Main to EFI Harness)	All	12-Place Deutsch (Gray)	Under Right Side Cover
[39]	Speedometer	FLHR/C-I	12-Place Mini-Deutsch	Under Console (Back of Speedometer)
		FLTR-I	12-Place Packard	Inside Instrument Nacelle (Back of Speedometer)
		FLHTC/U-I	12-Place Packard	Inner Fairing (Back of Speedometer)
[78]	ECM	All	36-Place Packard	Under Right Side Cover

Test 5.10

NO CHECK ENGINE LAMP AT KEY ON: DTC P1652, P1651



Clear codes and confirm proper operation with no check engine lamp.

CHECK ENGINE LAMP ON CONTINUOUSLY 5.11

GENERAL

Diagnostic Trouble Code P1651

If the ignition switch is turned to IGNITION and the engine stop switch is set to RUN with the engine off, the check engine lamp should illuminate for four seconds. See Figure 5-20.

Following the initial period of illumination, the lamp should go off for four seconds. It may then come back on for an eight second period (for a stored code) or remain on continuously.

Battery voltage is supplied to the lamp bulb. The lamp bulb is grounded by the ECM through the BK/Y wire. A steady light may indicate a short to ground on the black wire.

Table 5-12. Code Description

DTC	LAMP CODE	DESCRIPTION
P1651	N/A	Check engine light open/low

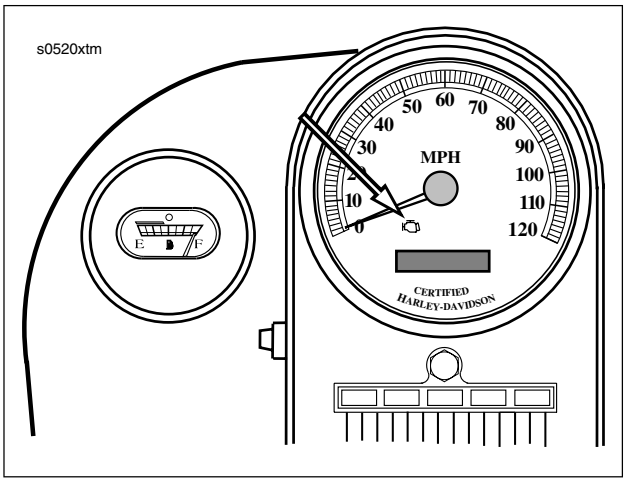


Figure 5-20. Check Engine Lamp (FLHRC-I)

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 5.11 flow chart.

1. Check for trouble codes. See RETRIEVING TROUBLE CODES under Section 5.4 CHECKING FOR TROUBLE CODES: EFI.
2. If the lamp stays on when ECM connector is unplugged, BK/Y wire is shorted to ground.
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), black pin probe and patch cord.

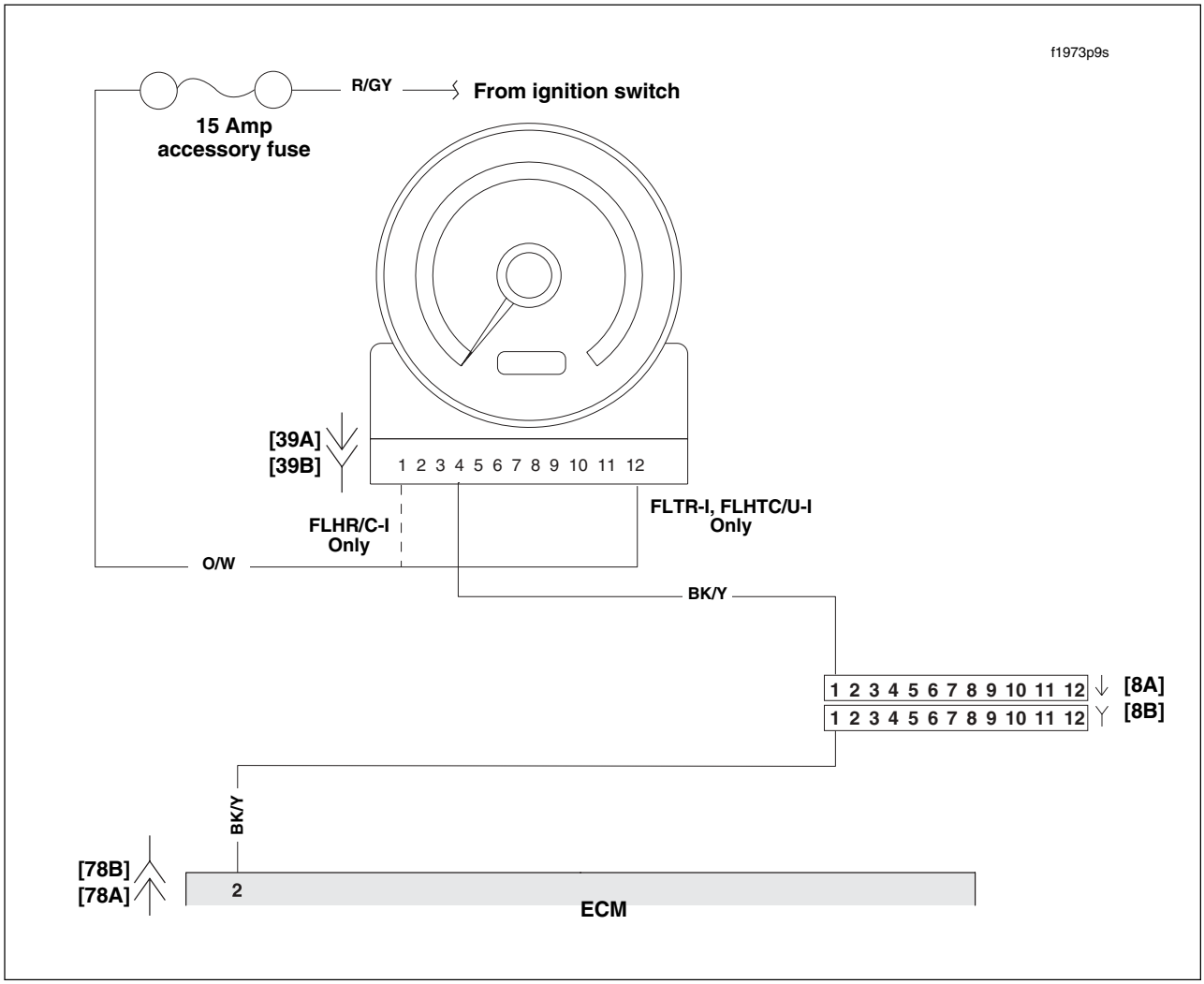


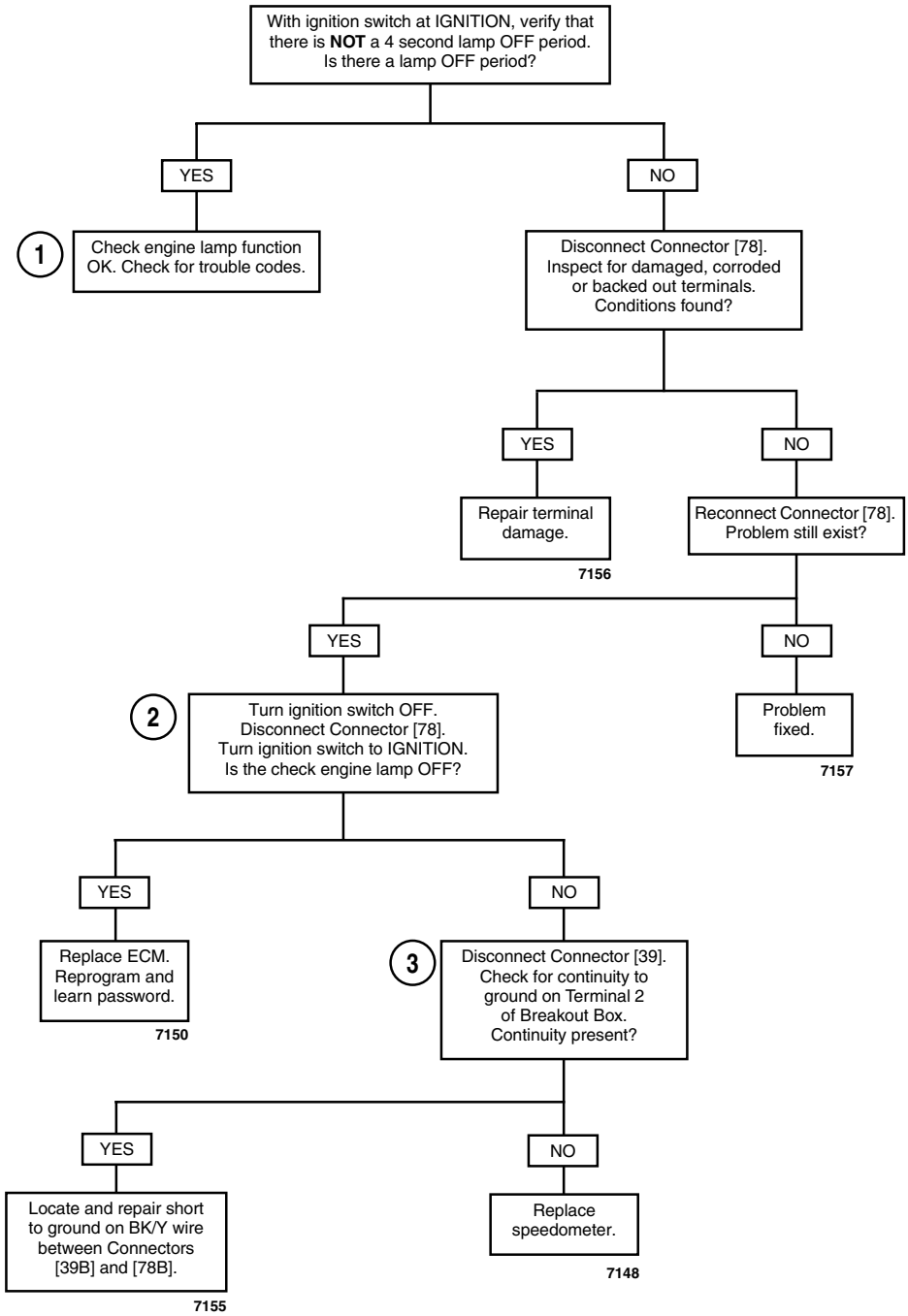
Figure 5-21. Check Engine Lamp Circuit

Table 5-13. Wire Harness Connectors in Figure 5-21.

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[8]	Ignition (Main to EFI Harness)	All	12-Place Deutsch (Gray)	Under Right Side Cover
[39]	Speedometer	FLHR/C-I	12-Place Mini-Deutsch	Under Console (Back of Speedometer)
		FLTR-I	12-Place Packard	Inside Instrument Nacelle (Back of Speedometer)
		FLHTC/U-I	12-Place Packard	Inner Fairing (Back of Speedometer)
[78]	ECM	All	36-Place Packard	Under Right Side Cover

Test 5.11

CHECK ENGINE LAMP ON CONTINUOUSLY: DTC P1651



Clear codes and confirm proper operation with no check engine lamp.

ENGINE CRANKS, BUT WILL NOT START 5.12

GENERAL

If the starter will not crank the engine, the problem is not EFI related. Refer to SECTION 1: STARTING & CHARGING or SECTION 3: TSM & TSSM.

Engine can be started with diagnostic test wire installed. Ignition switch must be turned to OFF after test wire is removed or check engine lamp will continue to flash stored codes.

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 5.12 flow charts.

1. Check for trouble codes. See RETRIEVING TROUBLE CODES under Section 5.4 CHECKING FOR TROUBLE CODES: EFI. If Scanalyzer does not communicate and check engine lamp comes back on after 4 second pause, see Section 5.14 STARTS, THEN STALLS.
2. Check the condition of the battery. Perform a voltage test and recharge if below 12.60V. Check battery connections and perform load test. Replace the battery if necessary.
3. Remove spark plug cable from spark plug.
   a. Visually check condition of plug.
   b. Attach cable to SPARK TESTER (Part No. HD-26792). Clip tester to cylinder head bolt. See Figure 5-22.
   c. While cranking engine, look for spark. Repeat procedure on other spark plug cables.

IMPORTANT NOTE

Engine will not spark with both spark plugs removed. When checking for spark, use SPARK TESTER with both spark plugs installed.

4. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404) gray pin probes and patch cords.
5. Typically, when IAC is not functioning, the engine will not start unless throttle is opened and the engine will stall when throttle is closed.
6. See Figure 5-23. Plug IGNITION COIL CIRCUIT TEST ADAPTER (Part No. HD-44687) and FUEL INJECTOR TEST LAMP (Part No. HD-34730-2C) into Breakout Box Terminals 13 and 11. Crank engine. If lamp flashes, no problem is found. Repeat for Breakout Box Terminals 13 and 29.

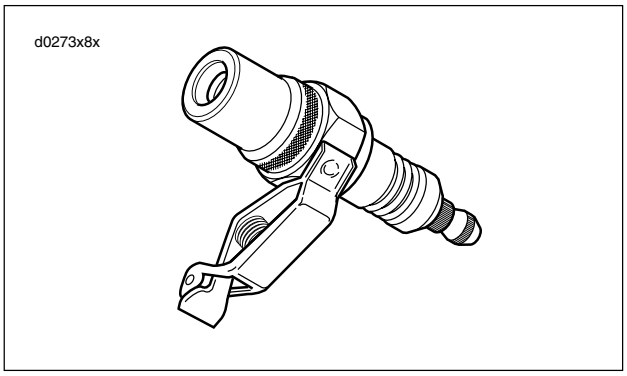


Figure 5-22. Spark Tester (HD-26792)



Figure 5-23. Ignition Coil Circuit Test

7. Connect BREAKOUT BOX (Part No. HD-43876). See Section 5.7 BREAKOUT BOX: EFI.
8. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), gray pin probe and patch cord.
9. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), brown socket probe and patch cord.

Diagnostic Tip

Check TPS value with Scanalyzer. If TPS sensor is greater than 90%, then system is in “clear flood” mode and engine will not start. While spark will be present, fuel is shut off (injectors disabled). Problem can be mechanical, such as throttle/throttle cables stuck.

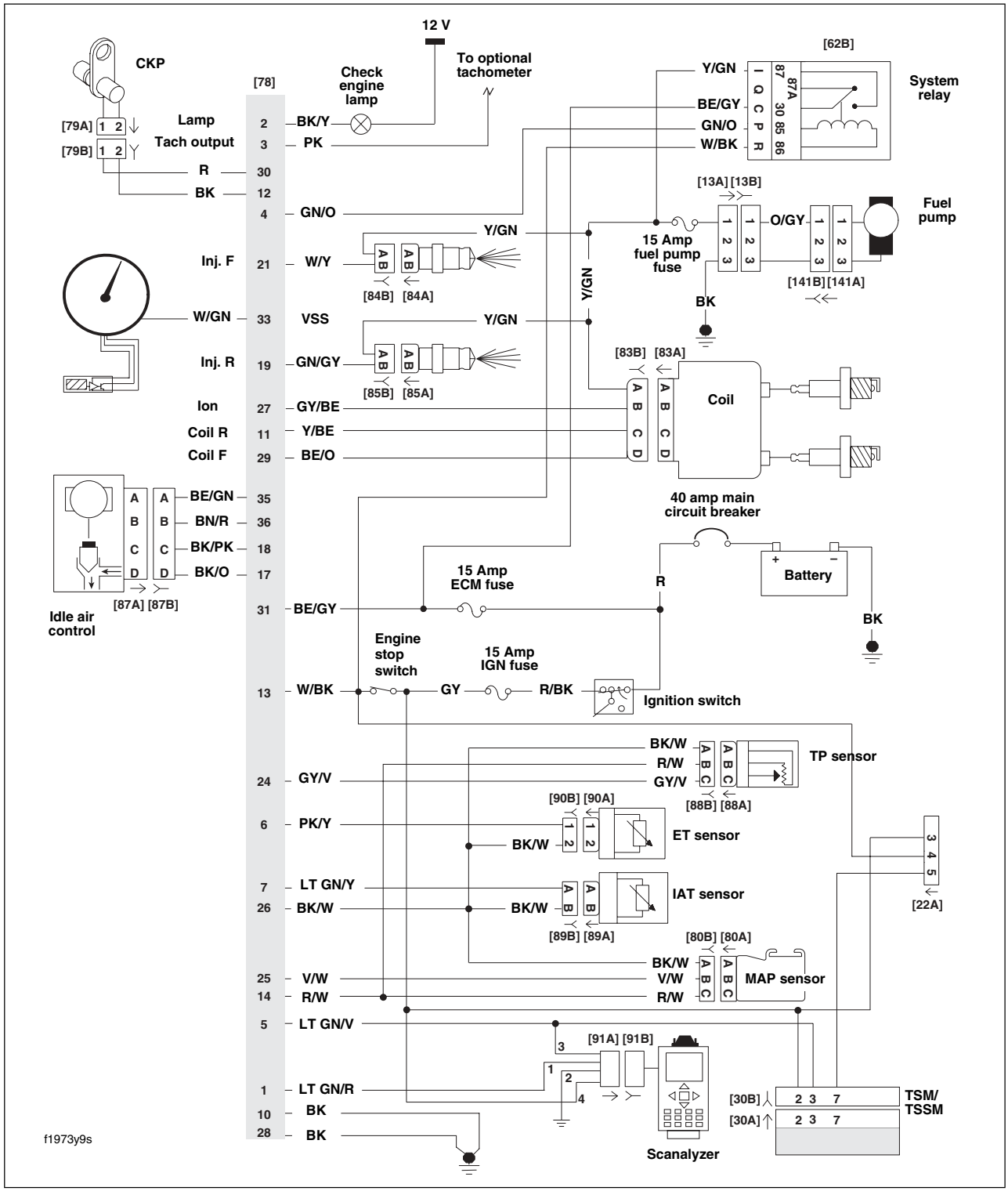


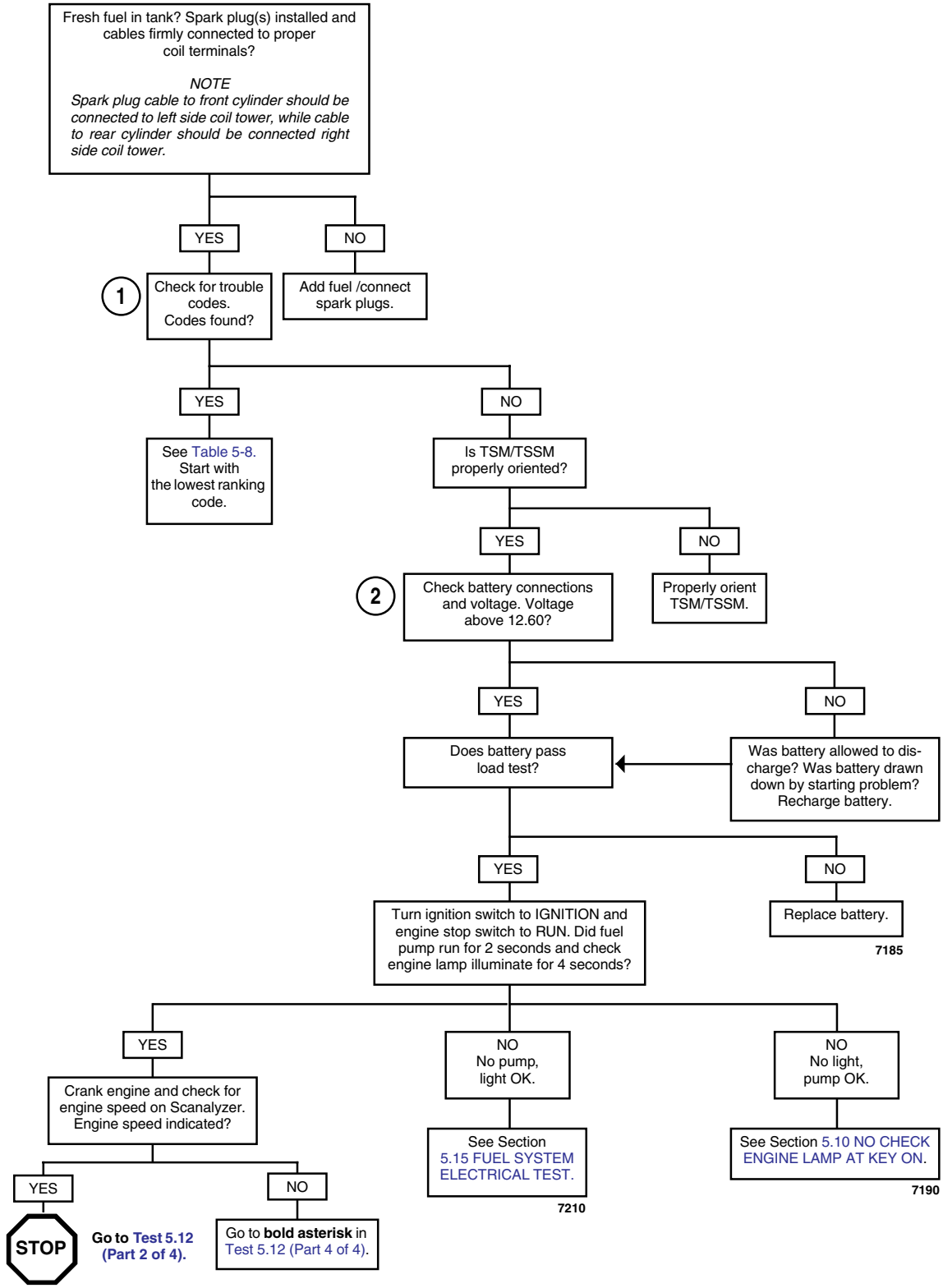
Figure 5-24. EFI Circuit Diagram

Table 5-14. Wire Harness Connectors in Figure 5-24.

NO.	DESCRIPTION	TYPE	LOCATION
[22]	Right Handlebar Switches	6-Place Deutsch	Inside Headlamp Nacelle
[78]	ECM	36-Place Packard	Under Right Side Cover
[79]	CKP Sensor	2-Place Mini-Deutsch	Under Right Side Cover
[83]	Ignition Coil	4-Place Packard	Below Fuel Tank (Left Side)

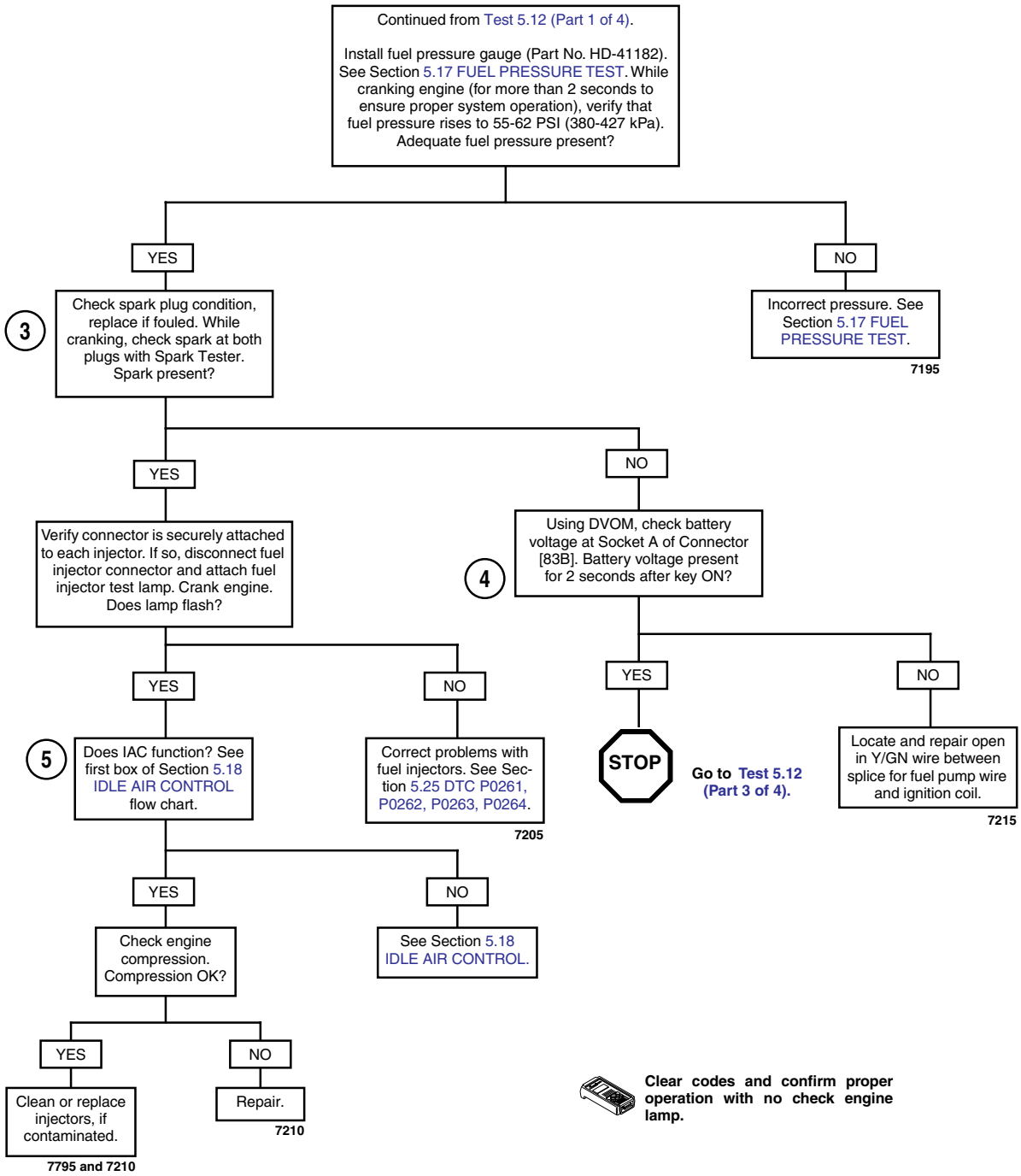
Test 5.12 (Part 1 of 4)

ENGINE CRANKS, BUT WILL NOT START



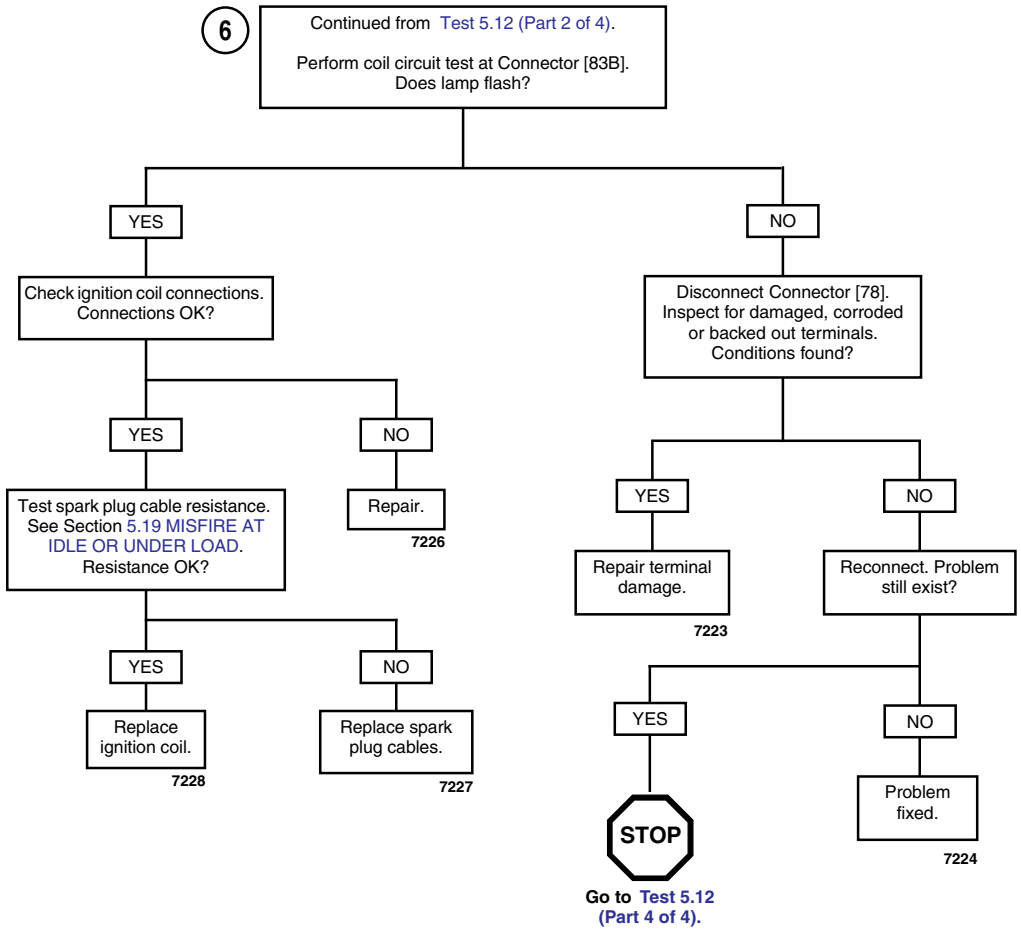
Test 5.12 (Part 2 of 4)

ENGINE CRANKS, BUT WILL NOT START



Test 5.12 (Part 3 of 4)

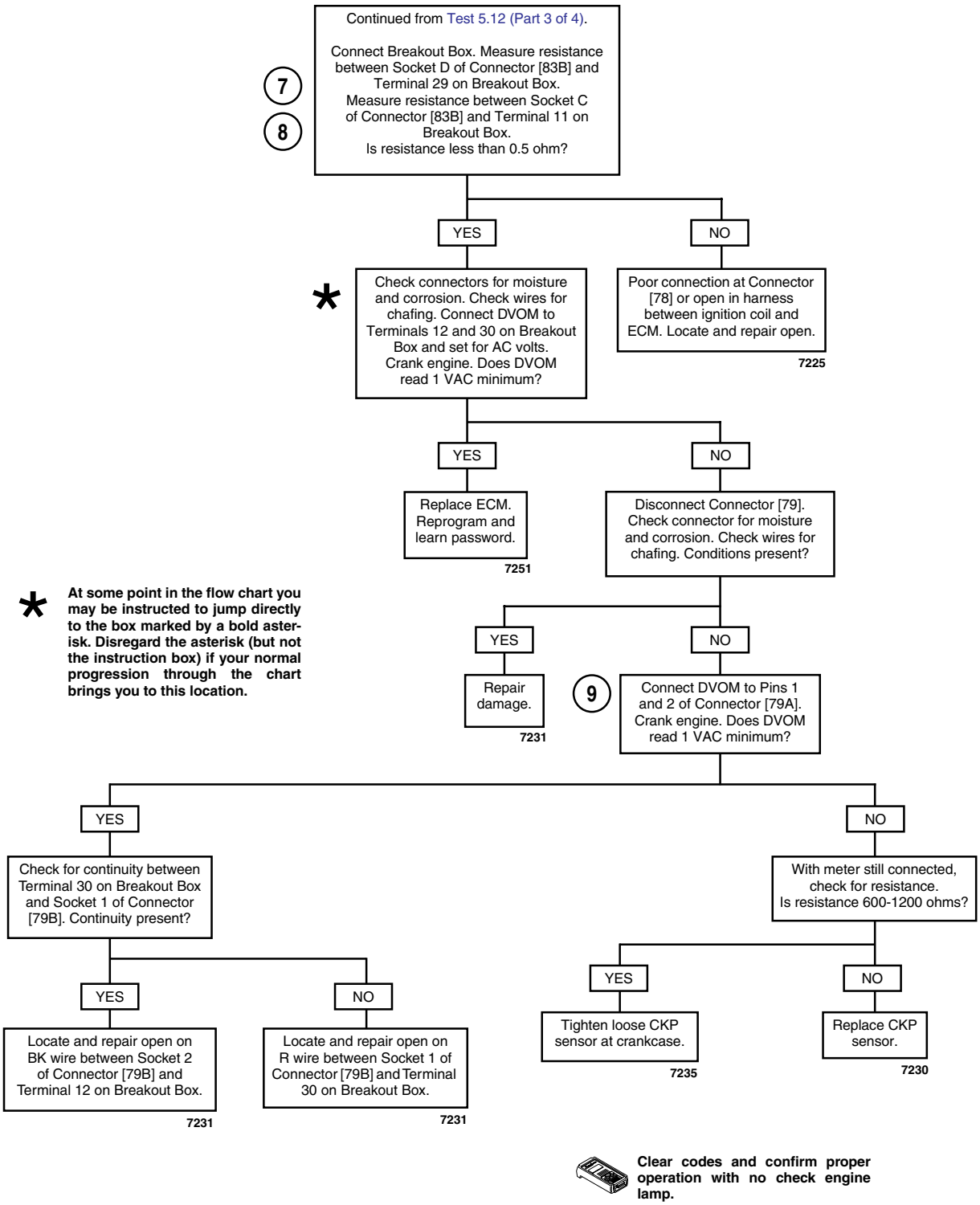
ENGINE CRANKS, BUT WILL NOT START



Clear codes and confirm proper operation with no check engine lamp.

Test 5.12 (Part 4 of 4)

ENGINE CRANKS, BUT WILL NOT START



* **At some point in the flow chart you may be instructed to jump directly to the box marked by a bold asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.**

NO ECM POWER 5.13

GENERAL

No Spark/No Check Engine Lamp at Key ON

Constant power is supplied to the ECM through Pin 31. The ECM turns on when power is applied to Pin 13 of connector [78]. The ECM goes through an initialization sequence every time power is removed and re-applied to Pin 13. The only visible part of this sequence is the check engine lamp. Upon starting, the check engine lamp will illuminate for 4 seconds and then go out (if conditions are normal).

NOTE

The key ON sequence also activates the idle air control motor. If power from Pin 31 is disrupted (blown fuse, etc.), always cycle the ignition switch to IGNITION for 10 seconds and then OFF for 10 seconds to reset the motor to the default position.

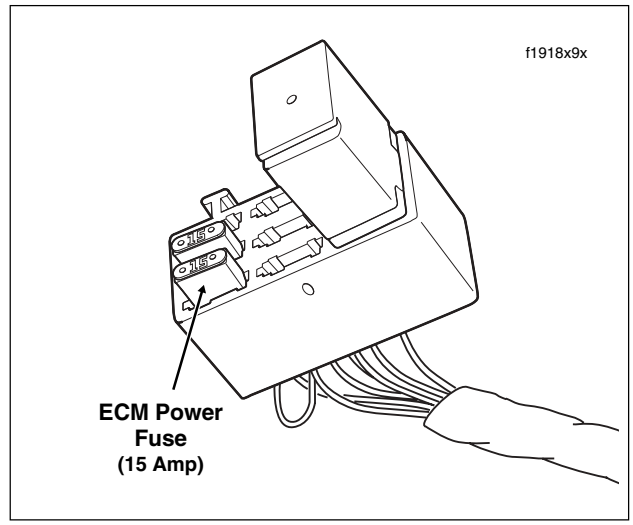


Figure 5-25. EFI Fuse Block

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 5.13 flow charts.

1. Connect BREAKOUT BOX (Part No. HD-43876). See Section 5.7 BREAKOUT BOX: EFI.
2. Connect BREAKOUT BOX (Part No. HD-42682) to Connector [22]. FLHR/C-I models will also need HD-42962 adapters.

Diagnostic Tip

If there is a loss of ECM power, the engine will seem to operate properly, but system will not be able to flash codes and ISC will not set properly (eventually leading to idle speed problems). Furthermore, system will not clear Scanalyzer codes even though it will indicate that it did.

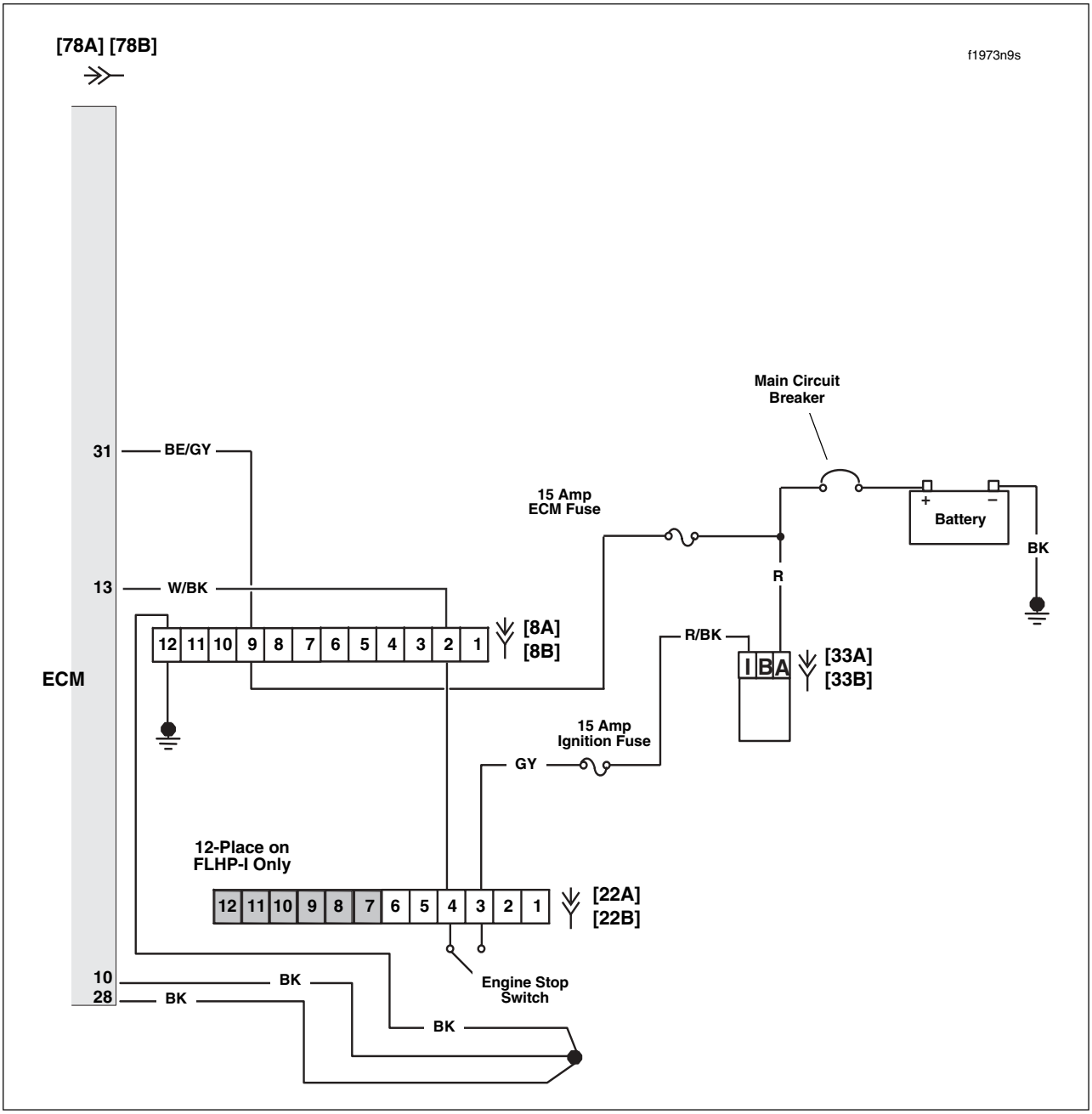


Figure 5-26. ECM Power Circuit Diagram (FLHR/C-I, FLHP-I)

Table 5-15. Wire Harness Connectors in Figure 5-26.

NO.	DESCRIPTION	TYPE	LOCATION
GND 1	ECM Ground	Ring Terminal	Under Seat
[8]	Ignition (Main to EFI Harness)	8-Place Deutsch (Gray)	Under Right Side Cover
[22]	Right Handlebar Switches	12-Place Deutsch (Black)	Inside Headlamp Nacelle
[33]	Ignition/Light Key Switch	3-Place Packard	Under Console
[78]	ECM	36-Place Packard	Under Right Side Cover

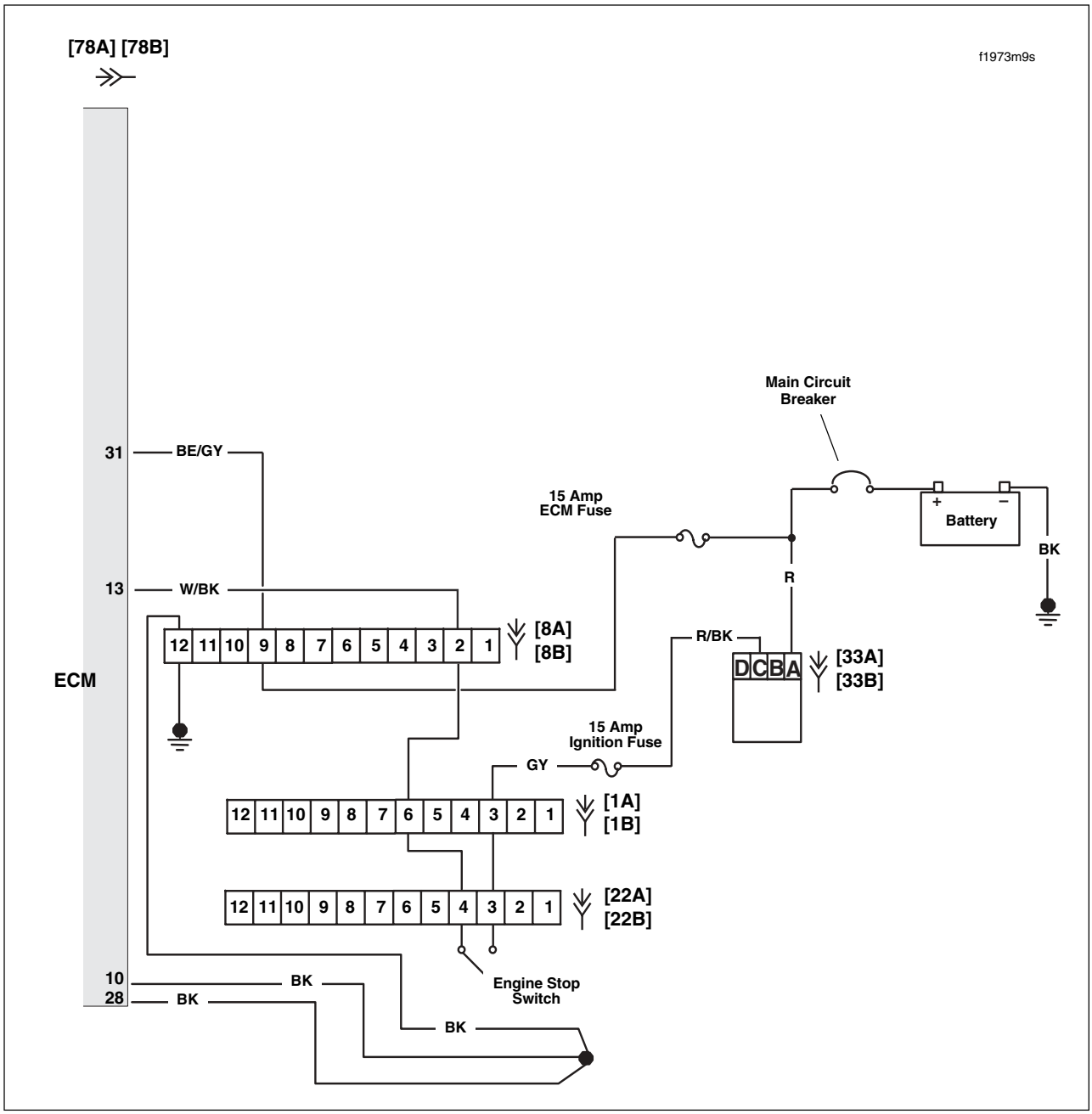


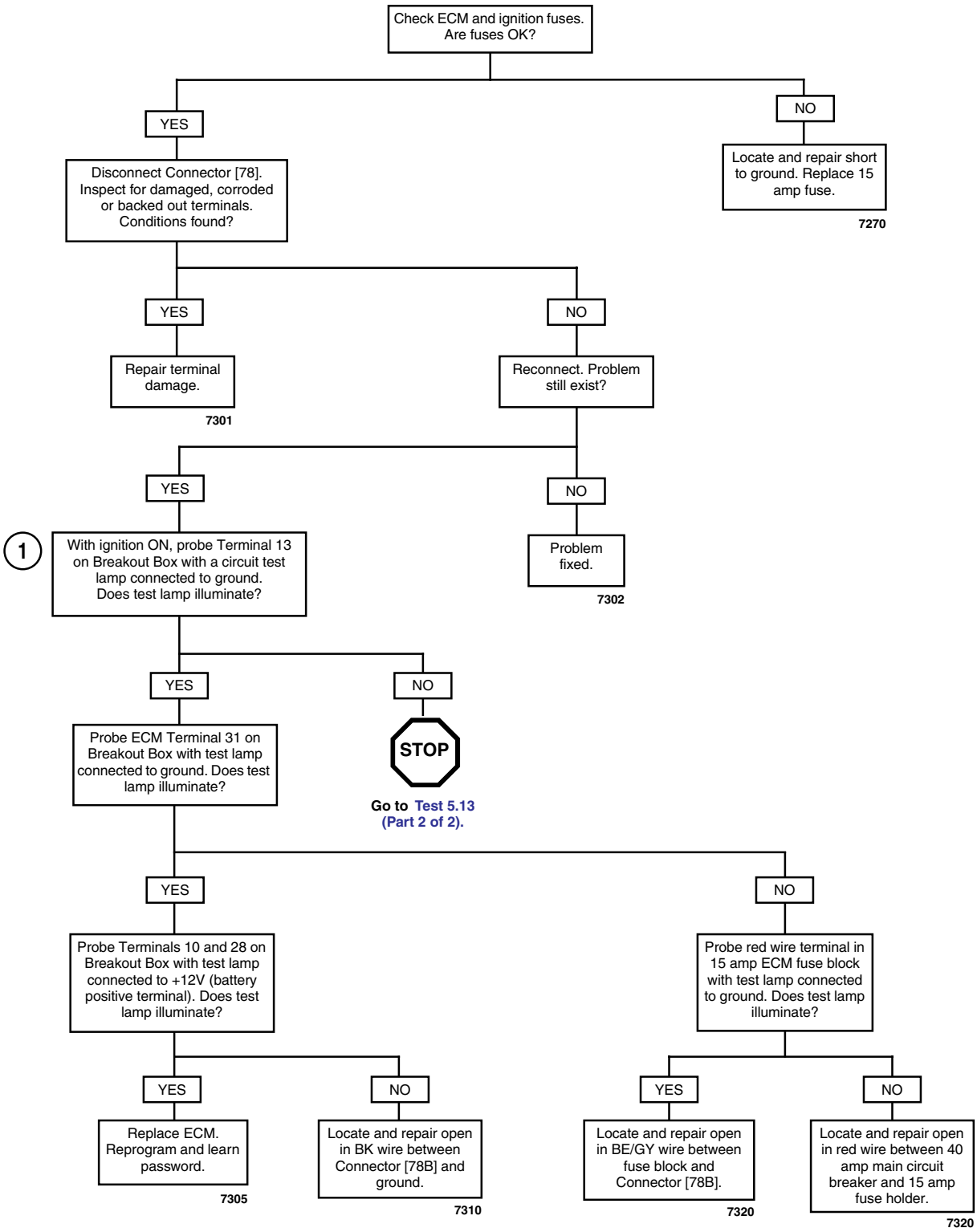
Figure 5-27. ECM Power Circuit Diagram (FLTR-I, FLHTC/U-I)

Table 5-16. Wire Harness Connectors in Figure 5-27.

NO.	DESCRIPTION	TYPE	LOCATION
GND 1	ECM Ground	Ring Terminal	Under Seat
[1]	Main to Interconnect Harness	12-Place Deutsch (Black)	Inner Fairing (Right Fairing Bracket)
[8]	Ignition (Main to EFI Harness)	8-Place Deutsch (Gray)	Under Right Side Cover
[22]	Right Handlebar Switches	12-Place Deutsch (Black)	Inner Fairing (Right Fairing Support Brace)
[33]	Ignition/Light Key Switch	4-Place Packard	Inner Fairing (Front of Top Fork Bracket -Below Radio)
[78]	ECM	36-Place Packard	Under Right Side Cover

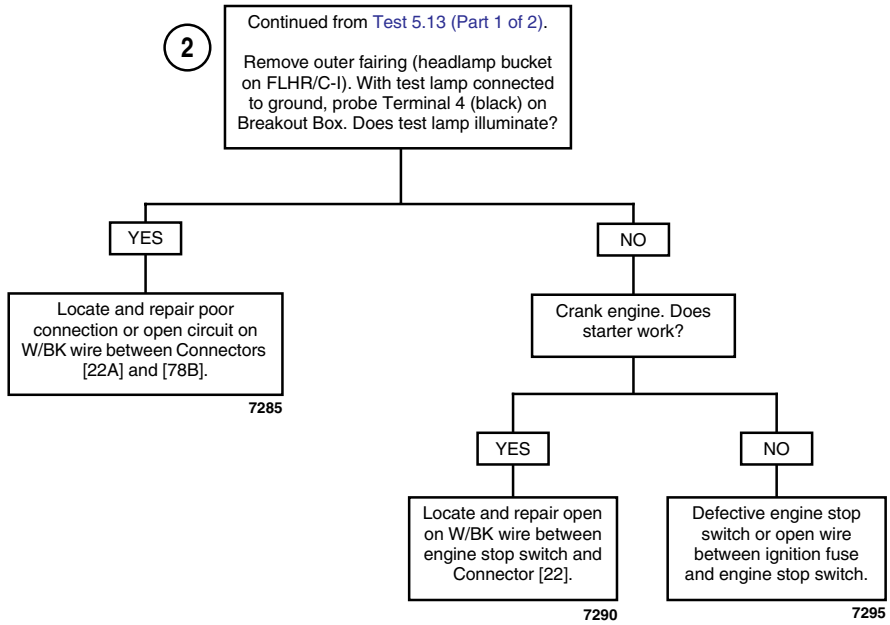
Test 5.13 (Part 1 of 2)

NO ECM POWER



Test 5.13 (Part 2 of 2)

NO ECM POWER



Clear codes and confirm proper operation with no check engine lamp.

GENERAL

Diagnostic Trouble Codes U1300, U1301: Serial Data Failure

The typical serial data voltage range is 0 volts (inactive) to 7 volts (active). Due to the short pulse, voltages will be much lower on a DVOM. In analog mode, a DVOM reading serial data will show continuous voltage when active, typically 0.6-0.8 volts. The range for acceptable operations is 0-7.0 volts.

Table 5-17. Code Description

DTC	LAMP CODE	DESCRIPTION
U1300	63	Serial data low
U1301	63	Serial data open/high

NOTE

Turn signal lamp code 23 also reflects DTC U1301.

DIAGNOSTICS

Diagnostic Tips

- If serial data is shorted, these codes will automatically trip the check engine light.
- Along with the codes listed in Table 5-16 above, you may also get trouble codes P1009 and P1010.

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 5.14 flow charts.

1. Connect BREAKOUT BOX (Part No. HD-43876). See Section 5.7 BREAKOUT BOX: EFI.
2. Historic code U1300 would have been set. Clear historic codes.
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), black socket probes and patch cord.

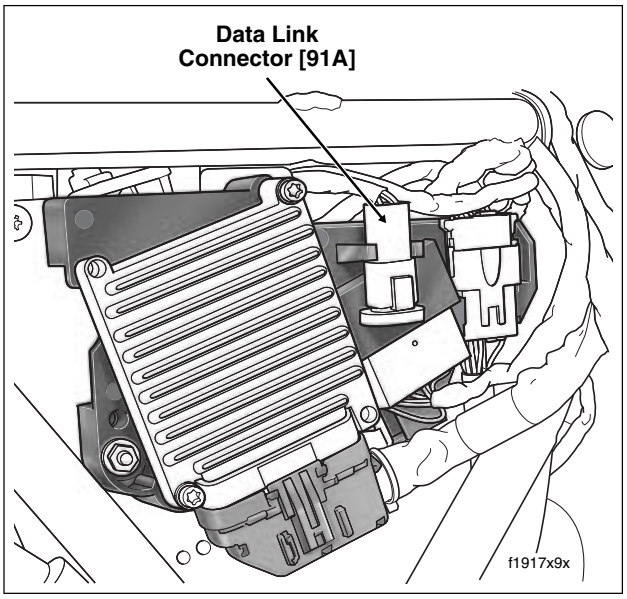


Figure 5-28. Right Side Cover Removed



Figure 5-29. TSM/TSSM Module

4. Check for trouble codes. See RETRIEVING TROUBLE CODES under Section 5.4 CHECKING FOR TROUBLE CODES: EFI. If Scanalyzer does not communicate and check engine lamp comes back on after 4 second pause, see Section 5.14 STARTS, THEN STALLS.

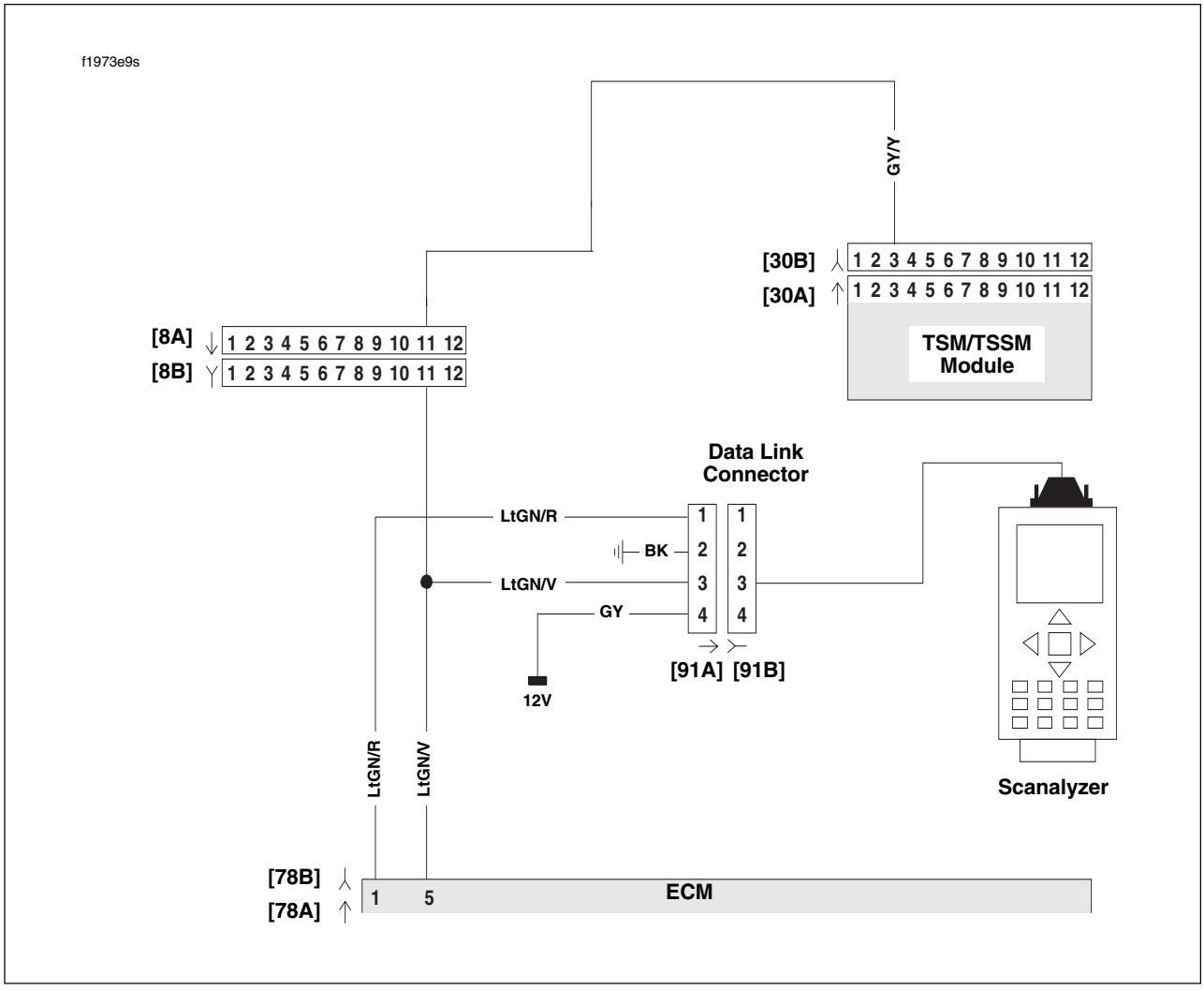


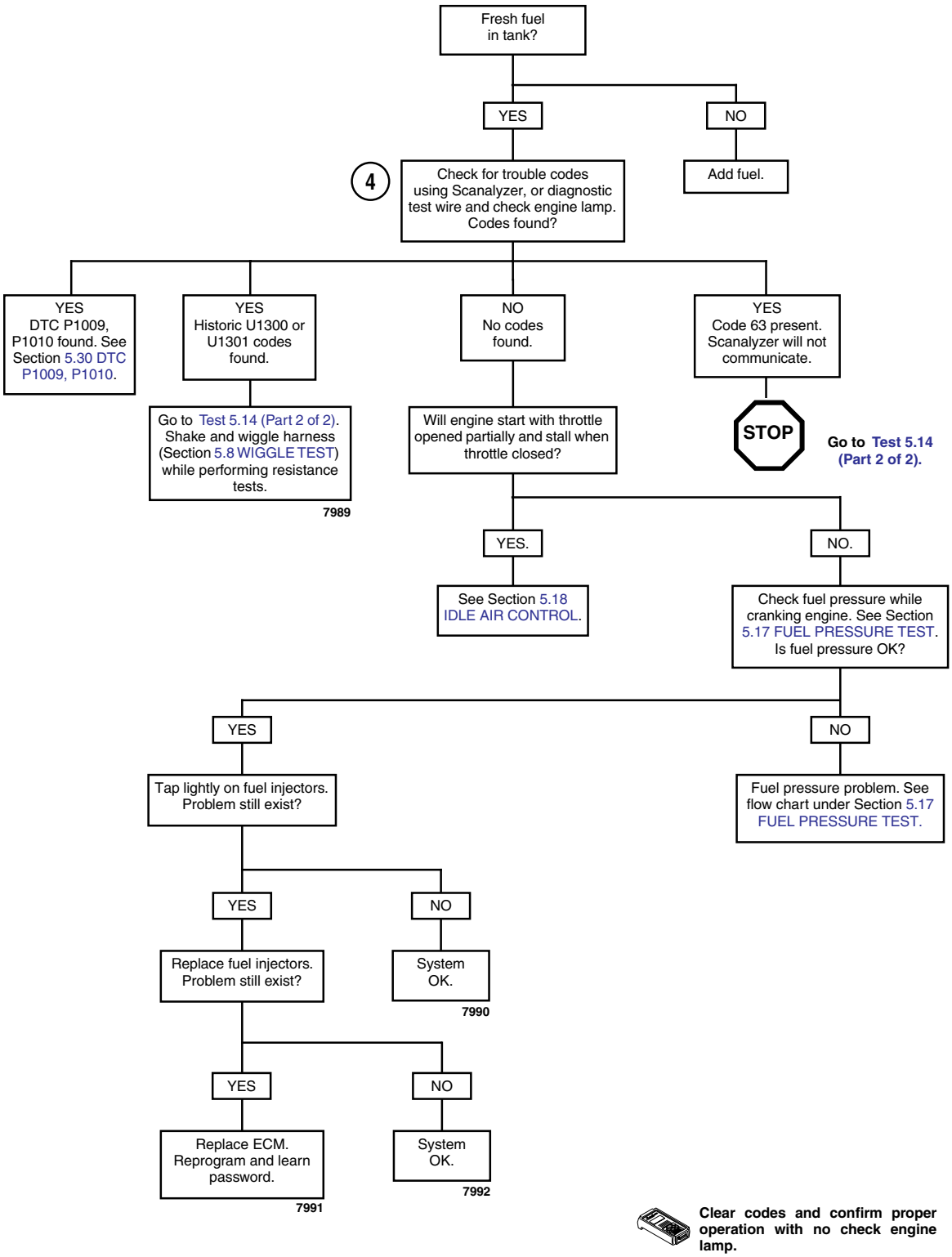
Figure 5-30. ECM and TSM/TSSM Circuit

Table 5-18. Wire Harness Connectors in Figure 5-30.

NO.	DESCRIPTION	TYPE	LOCATION
[8]	Ignition (Main to EFI Harness)	12-Place Deutsch (Gray)	Under Right Side Cover
[30]	TSM/TSSM	12-Place Deutsch	Cavity in Crossmember at Rear of Battery Box (Under Seat)
[78]	ECM	36-Place Packard	Under Right Side Cover
[91]	Data Link	4-Place Deutsch	Under Right Side Cover

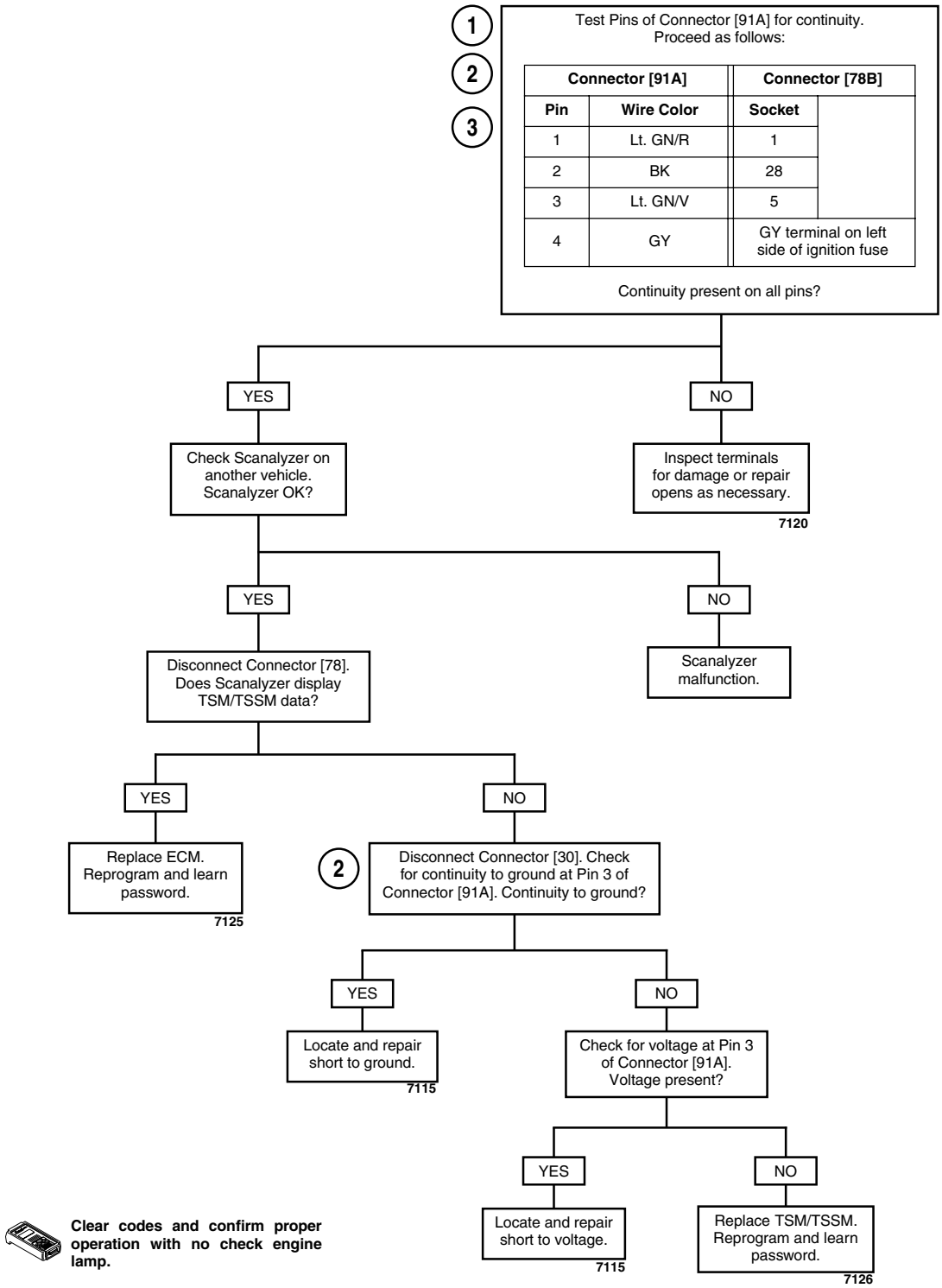
Test 5.14 (Part 1 of 2)

STARTS, THEN STALLS: DTC U1300, U1301



Test 5.14 (Part 2 of 2)

STARTS, THEN STALLS: DTC U1300, U1301



Clear codes and confirm proper operation with no check engine lamp.

FUEL SYSTEM ELECTRICAL TEST 5.15

GENERAL

With ignition switch turned to IGNITION and the engine stop switch at RUN, the ECM will energize the system relay to complete the circuit to the in-tank fuel pump. It will remain on as long as the engine is cranking or running, and the ECM is receiving ignition reference pulses from the CKP. If there are no reference pulses, the ECM will de-energize the system relay within 2 seconds after ignition is ON or engine has stalled, or immediately after the ignition is shut OFF.

The fuel pump delivers fuel to the injectors. The pressure regulator is where the system pressure is controlled. Excess fuel flow is bypassed into the fuel tank through the pressure regulator. When the engine is stopped, the pump can be turned on by applying battery voltage and ground to the fuel pump connector [141A]. The fuel pump connector is located on the canopy at the top of the fuel tank. Improper fuel system pressure may contribute to one or all of the following symptoms.

- Engine cranks, but won't run.
- Engine cuts out (may feel like ignition problems).
- Hesitation, loss of power and poor fuel economy.

NOTE

After turning ignition OFF, you must wait 10 seconds before turning the ignition back ON to get the fuel pump to reprime. This time out period is necessary for the ECM and IAC to reset.

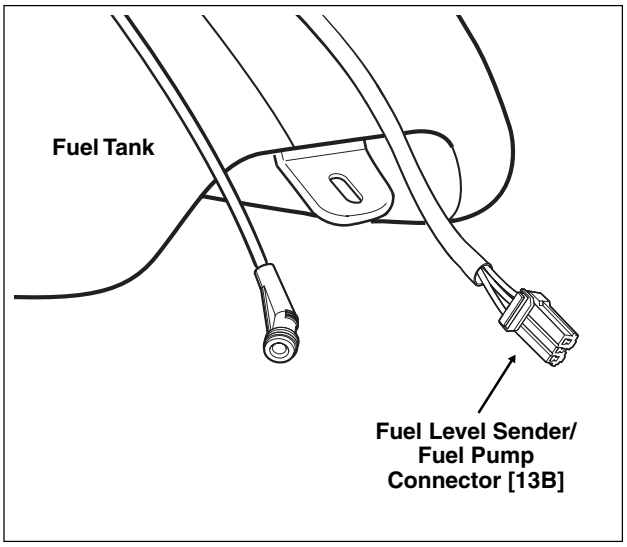


Figure 5-31. Fuel Pump Connector

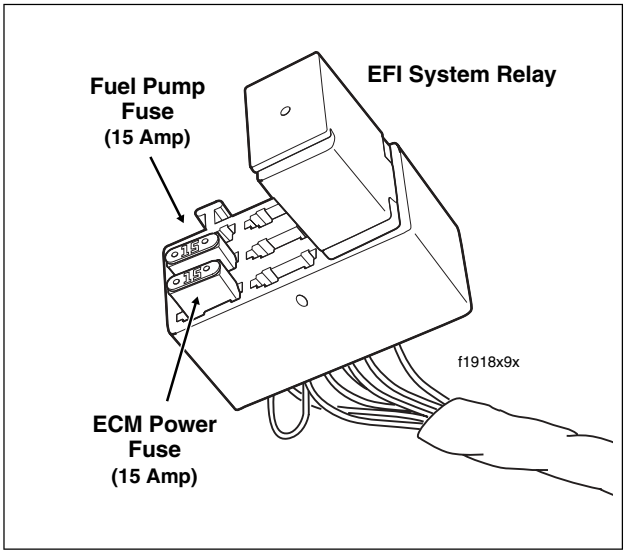


Figure 5-32. EFI Fuse Block

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 5.15 flow charts.

1. Turns on fuel pump if wiring is OK. If pump runs, problem is in basic fuel delivery.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), brown pin probe and patch cord.
3. See EFI SYSTEM RELAY in the 2003 Touring Models Service Manual (Part Number 99483-03). This test checks for a short to ground in the system relay harness circuit.
4. See either FUEL INJECTORS or IGNITION COIL in the 2003 Touring Models Service Manual (Part Number 99483-03).
5. See Figure 5-32. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), purple pin probe and patch cord.
6. Connect BREAKOUT BOX (Part No. HD-43876). See Section 5.7 BREAKOUT BOX: EFI.

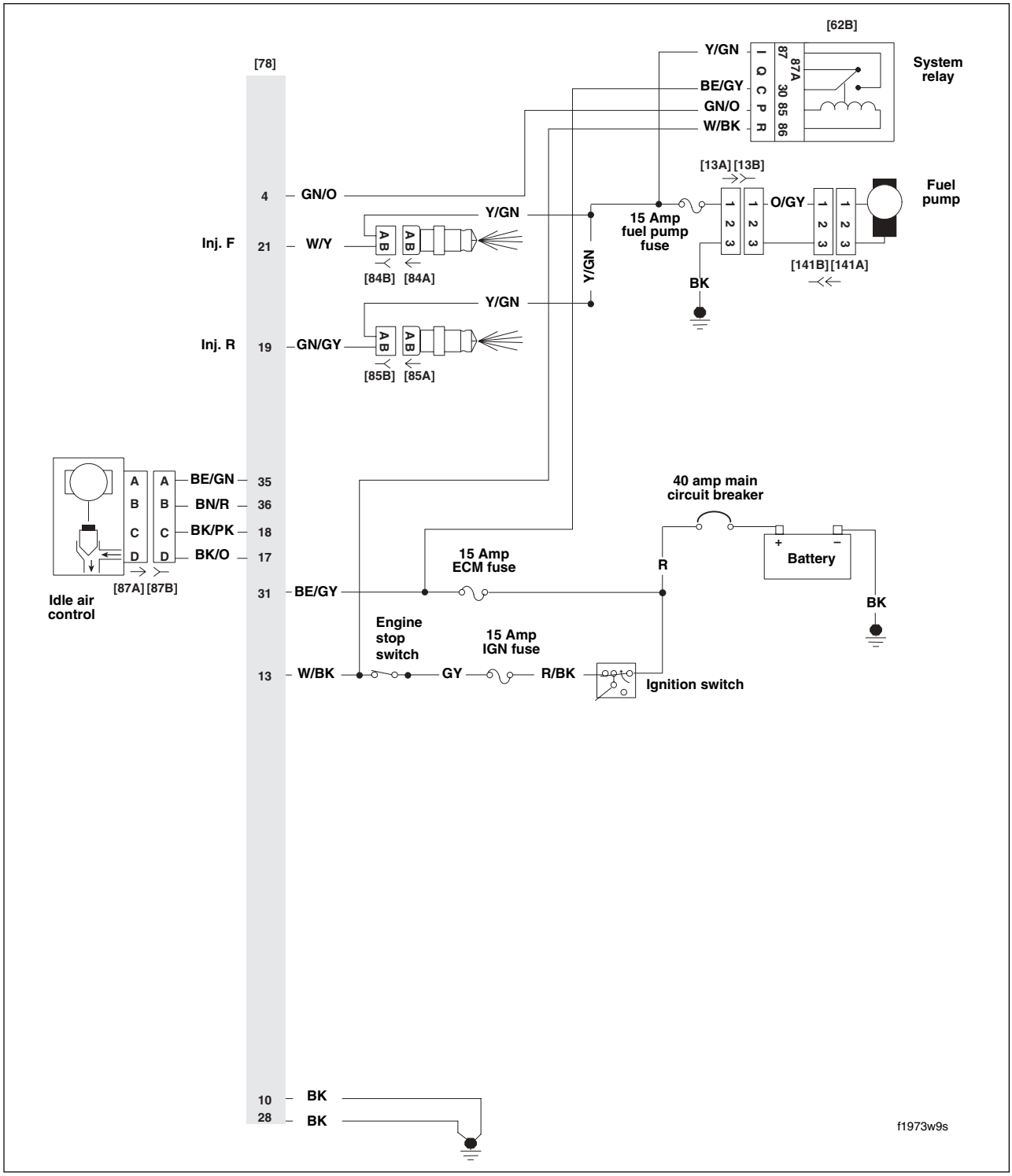


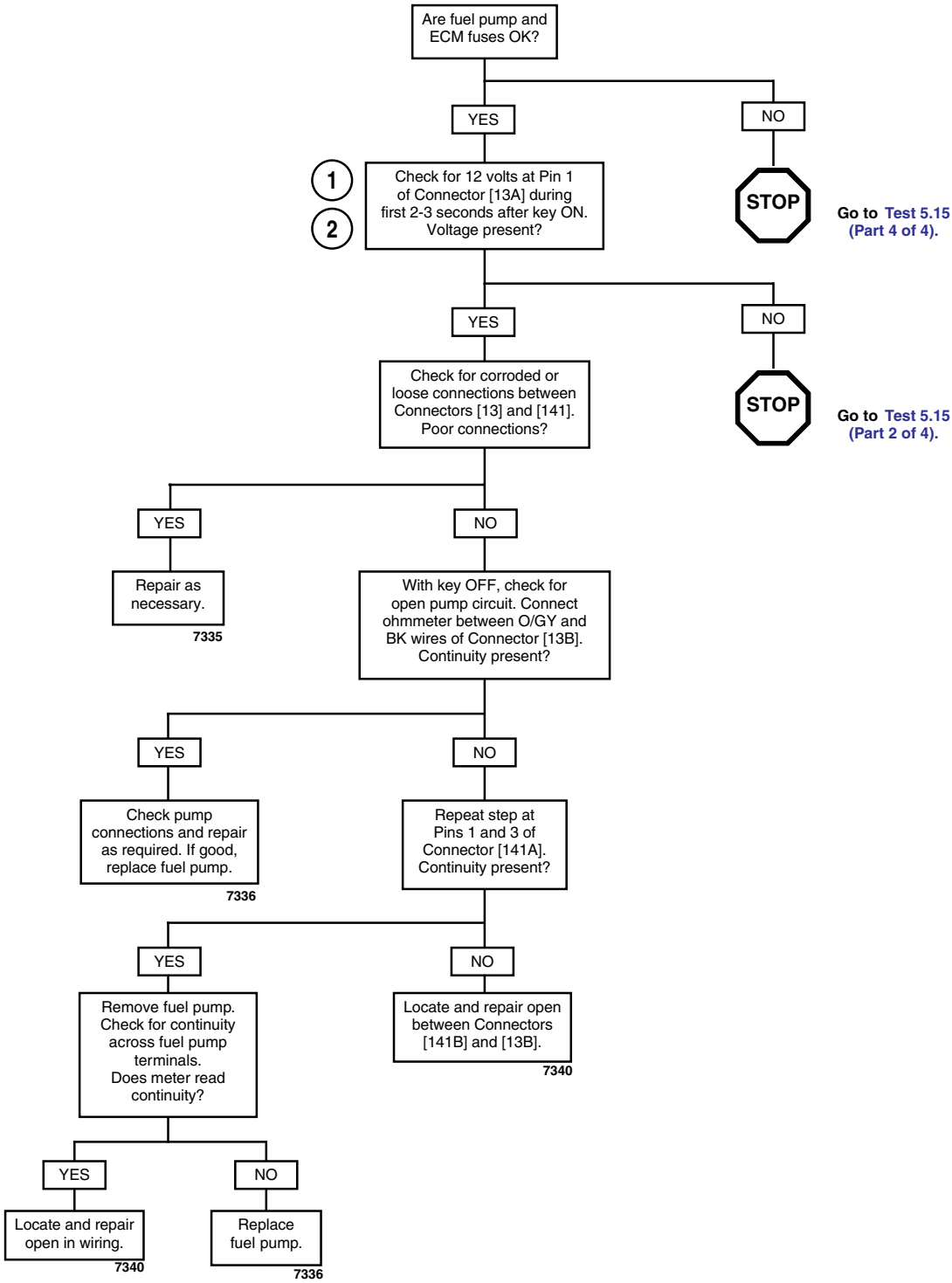
Figure 5-33. Fuel Pump Circuit

Table 5-19. Wire Harness Connectors in Figure 5-33.

NO.	DESCRIPTION	TYPE	LOCATION
[13]	Fuel Level Sender/Fuel Pump	3-Place Multilock	Behind Fuel Tank (Under Seat)
[78]	ECM	36-Place Packard	Under Right Side Cover
[141]	Fuel Pump	3-Place Mini-Deutsch	Top of Canopy (Under Console)

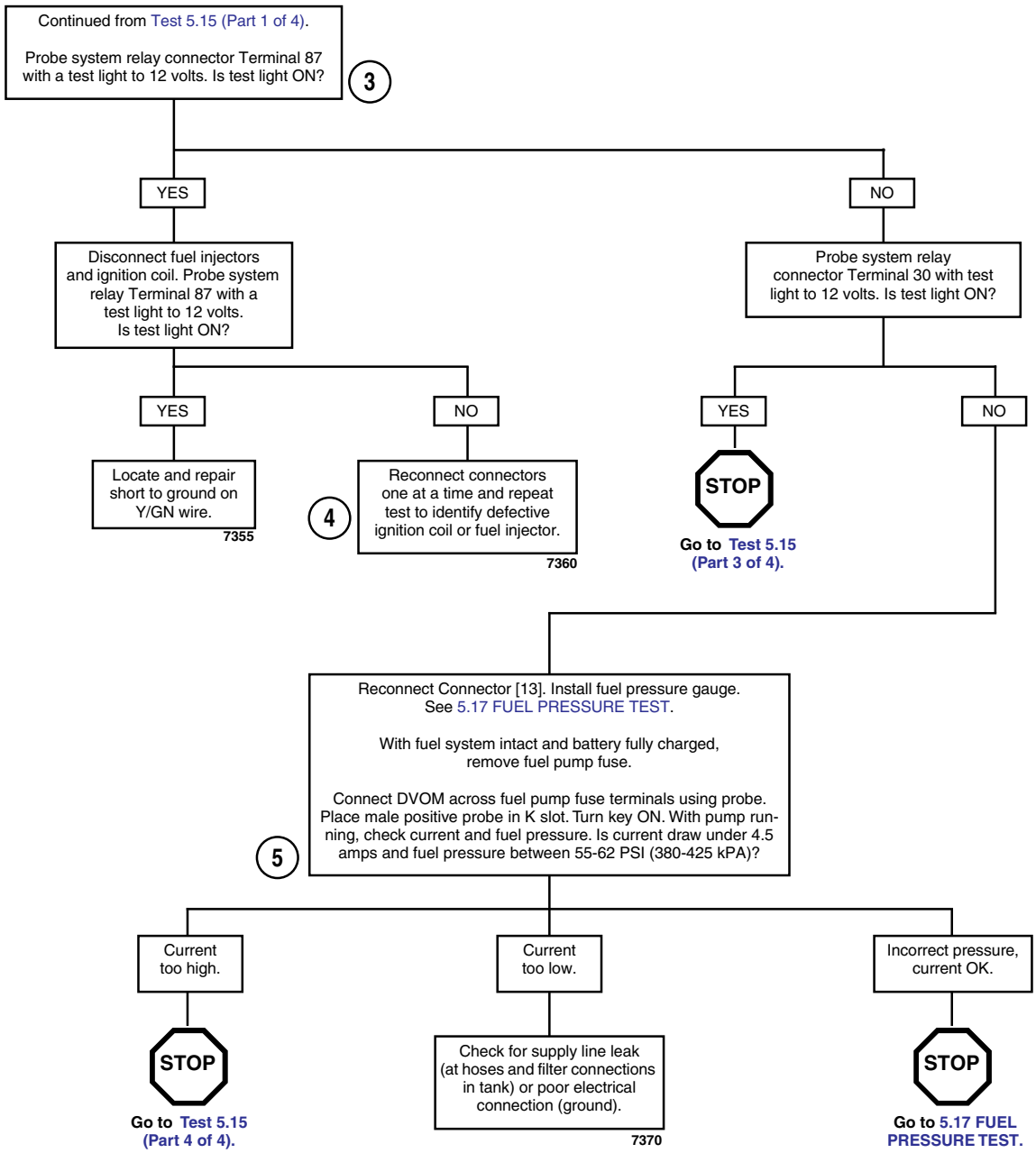
Test 5.15 (Part 1 of 4)

FUEL SYSTEM ELECTRICAL TEST



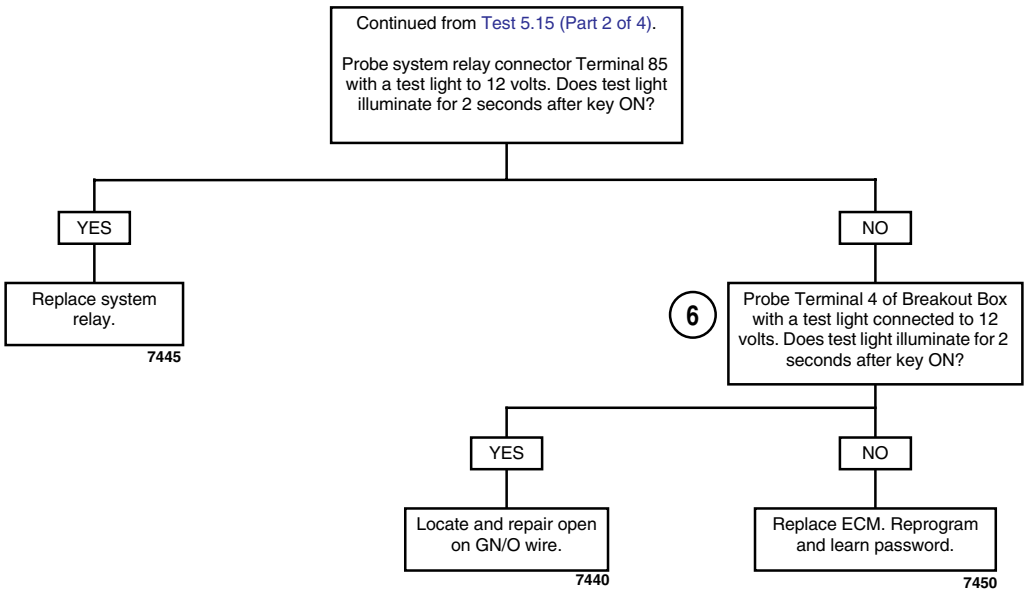
Test 5.15 (Part 2 of 4)

FUEL SYSTEM ELECTRICAL TEST



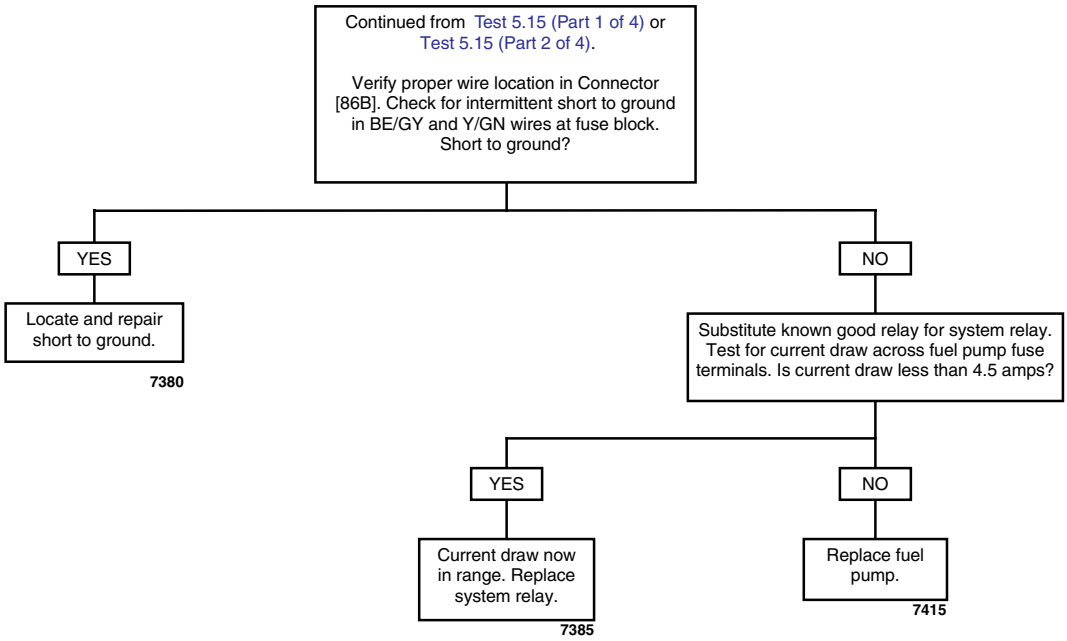
Test 5.15 (Part 3 of 4)

FUEL SYSTEM ELECTRICAL TEST



Test 5.15 (Part 4 of 4)

FUEL SYSTEM ELECTRICAL TEST



SYSTEM RELAY CHECK 5.16

GENERAL

System Relay

See Figure 5-34. With ignition switch turned to IGNITION and the engine stop/run switch at RUN, the ECM energizes the system relay to complete the circuit to the in-tank fuel pump, ignition coil and fuel injectors. They will remain powered as long as the engine is cranking or running, and the ECM is receiving ignition reference pulses from the CKP. If there are no reference pulses, the ECM will de-energize the system relay within 2 seconds after ignition is ON or engine has stalled, or immediately after the ignition is shut OFF.

Table 5-20. Code Description

DTC	LAMP CODE	DESCRIPTION
P1001	33	System relay coil open/low
P1002	33	System relay coil high/shorted
P1003	33	System relay contacts open
P1004	33	System relay contacts closed

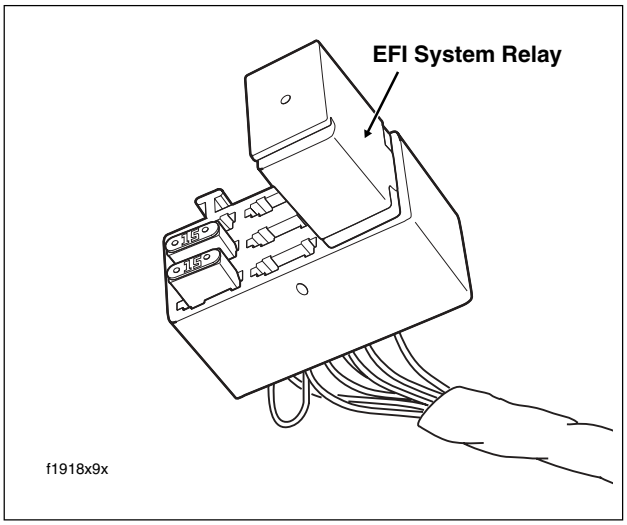


Figure 5-34. EFI Fuse Block

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 5.16 flow charts.

1. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), gray pin probe and patch cord.
2. Connect BREAKOUT BOX (Part No. HD-43876) to ECM. See Section 5.7 BREAKOUT BOX: EFI.

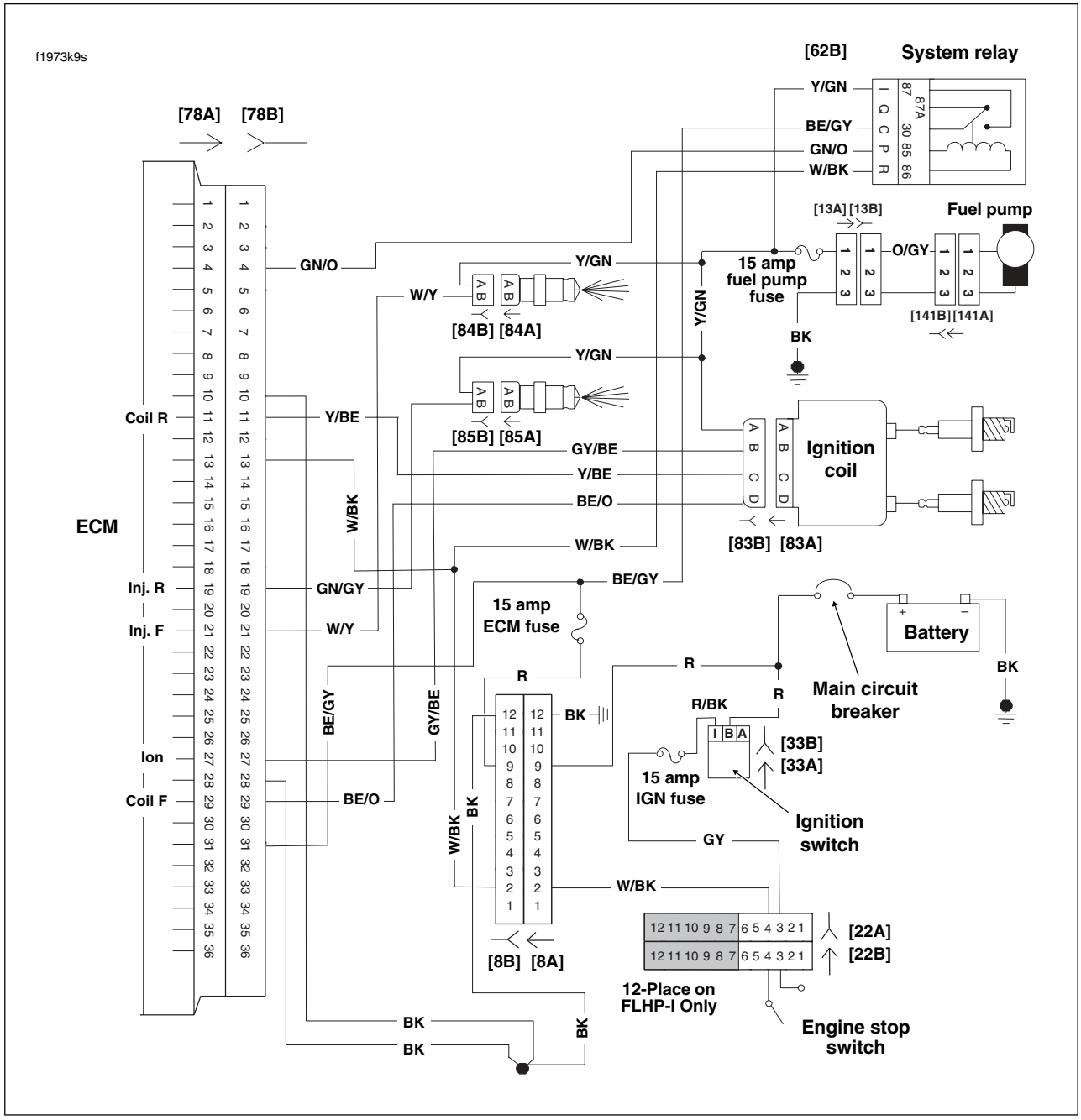


Figure 5-35. System Relay Circuit (FLHR/C-I, FLHP-I)

Table 5-21. Wire Harness Connectors in Figure 5-35.

NO.	DESCRIPTION	TYPE	LOCATION
[8]	Ignition (Main to EFI Harness)	12-Place Deutsch (Gray)	Under Right Side Cover
[22]	Right Handlebar Switches	12-Place Deutsch (Black)	Inside Headlamp Nacelle
[33]	Ignition/Light Key Switch	3-Place Packard	Under Left Side Cover
[78]	ECM	36-Place Packard	Under Right Side Cover
[83]	Ignition Coil	4-Place Packard	Below Fuel Tank (Left Side)
[84]	Front Injector	2-Place Packard	Below Fuel Tank (Left Side)
[85]	Rear Injector	2-Place Packard	Below Fuel Tank (Left Side)

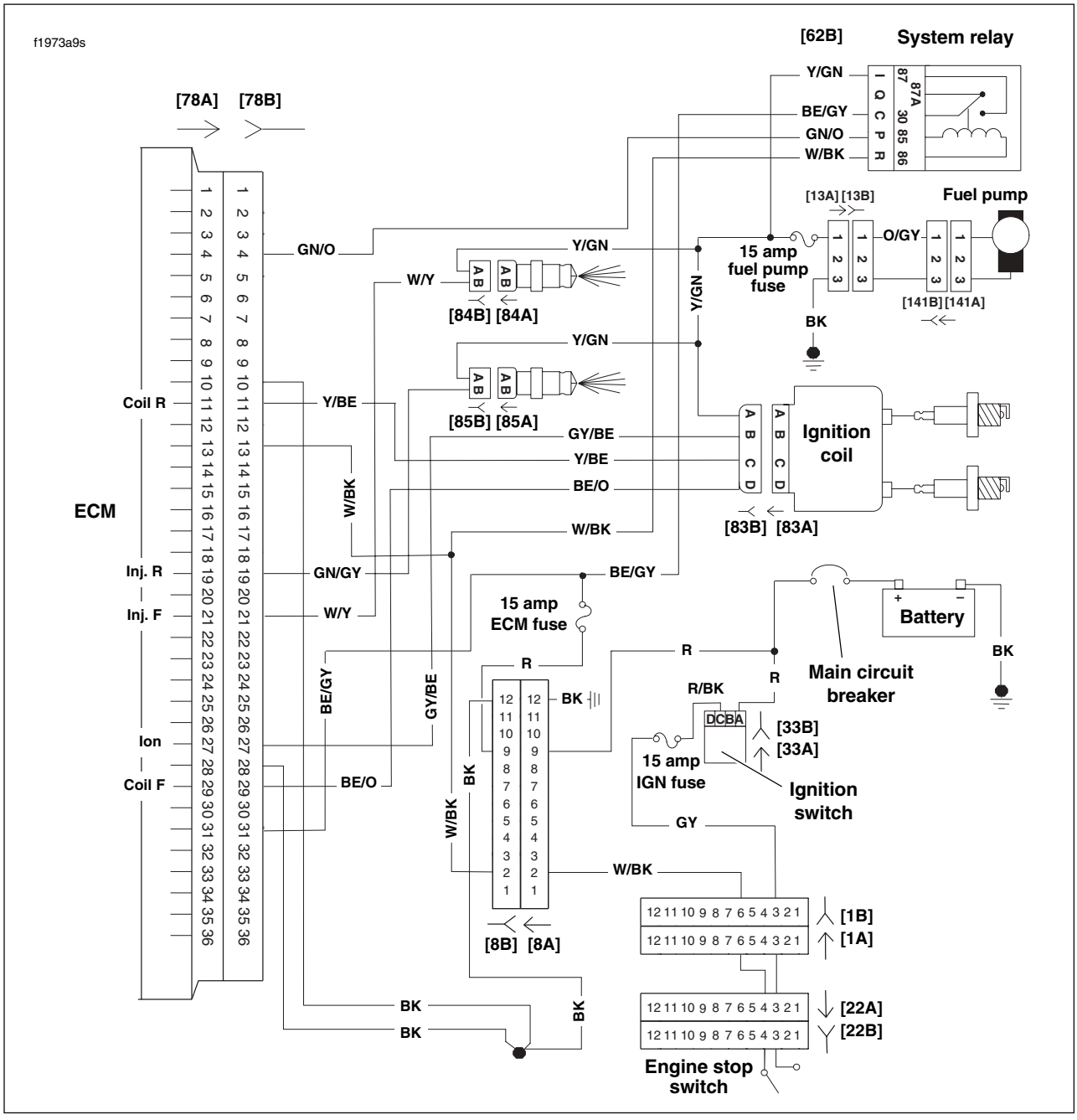


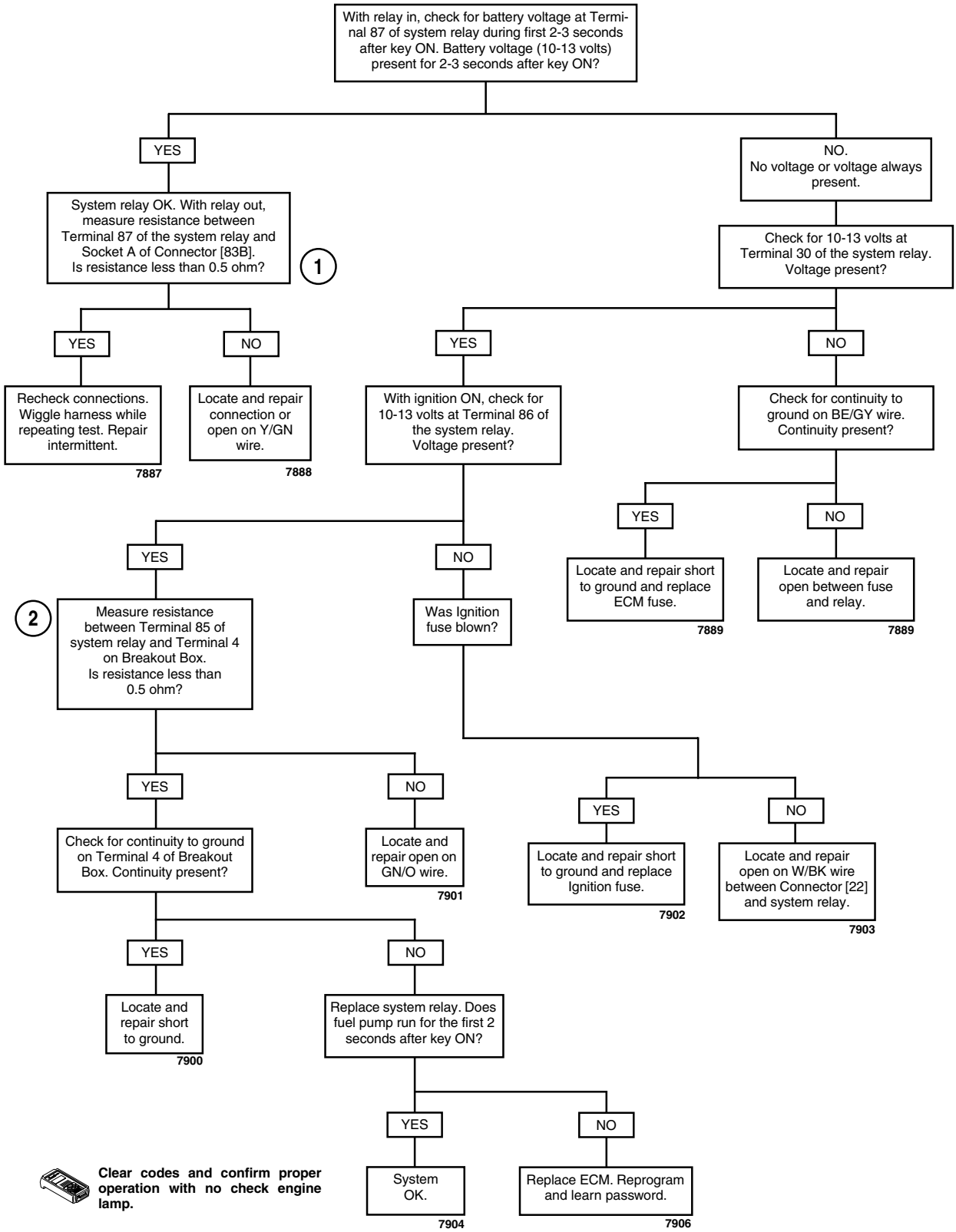
Figure 5-36. System Relay Circuit (FLTR-I, FLHTC/U-I)

Table 5-22. Wire Harness Connectors in Figure 5-36.

NO.	DESCRIPTION	TYPE	LOCATION
[1]	Main to Interconnect Harness	12-Place Deutsch (Black)	Inner Fairing (Right Fairing Bracket)
[8]	Ignition (Main to EFI Harness)	8-Place Deutsch (Gray)	Under Right Side Cover
[22]	Right Handlebar Switches	12-Place Deutsch (Black)	Inner Fairing (Right Fairing Support Brace)
[33]	Ignition/Light Key Switch	4-Place Packard	Inner Fairing (Top Fork Bracket)
[78]	ECM	36-Place Packard	Under Right Side Cover
[83]	Ignition Coil	4-Place Packard	Below Fuel Tank (Left Side)
[84]	Front Injector	2-Place Packard	Below Fuel Tank (Left Side)
[85]	Rear Injector	2-Place Packard	Below Fuel Tank (Left Side)

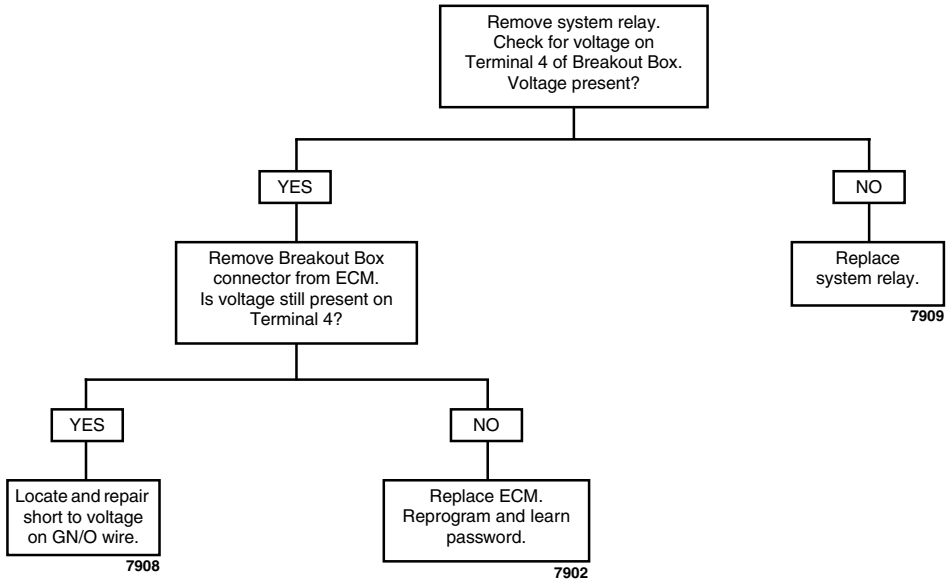
Test 5.16 (Part 1 of 3)

SYSTEM RELAY: DTC P1001, P1003



Test 5.16 (Part 2 of 3)

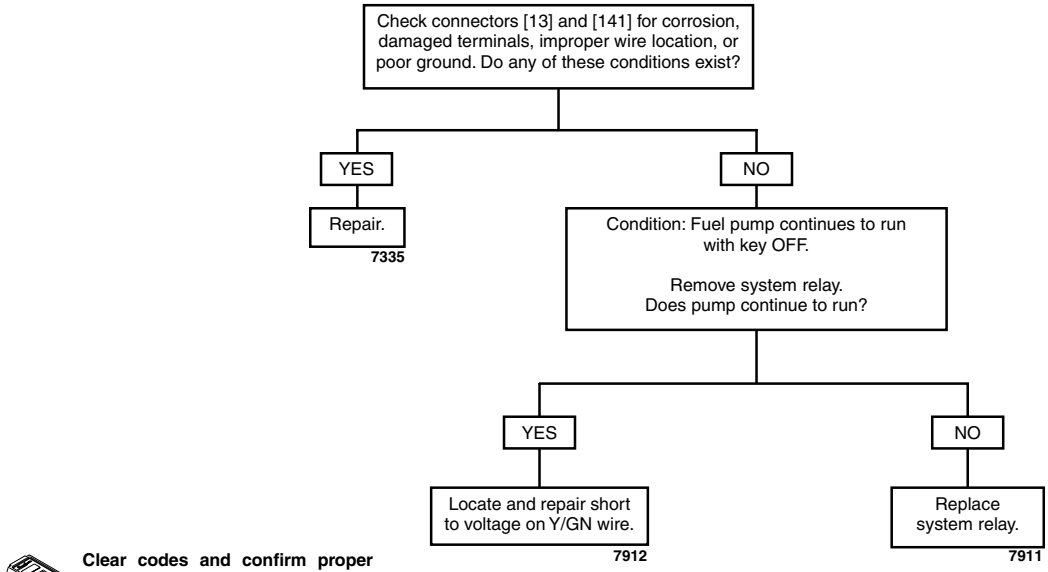
SYSTEM RELAY: DTC P1002



Clear codes and confirm proper operation with no check engine lamp.

Test 5.16 (Part 3 of 3)

SYSTEM RELAY: DTC P1004



Clear codes and confirm proper operation with no check engine lamp.

FUEL PRESSURE TEST 5.17

GENERAL

The fuel pump delivers fuel to the fuel line, to a cavity in the induction module that supplies the fuel injectors and to the pressure regulator, where the system pressure is controlled. Excess fuel pressure is bypassed to the fuel tank through the pressure regulator.

See Figure 5-37. The fuel pump fuse is located in the fuse block under the right side cover. The fuel pump can be turned on with the Scanalyzer or by applying battery voltage to the fuel pump fuse.

Improper fuel system pressure may contribute to one of the following conditions:

- Cranks, but won't run.
- Cuts out (may feel like ignition problem).
- Hesitation, loss of power or poor fuel economy.

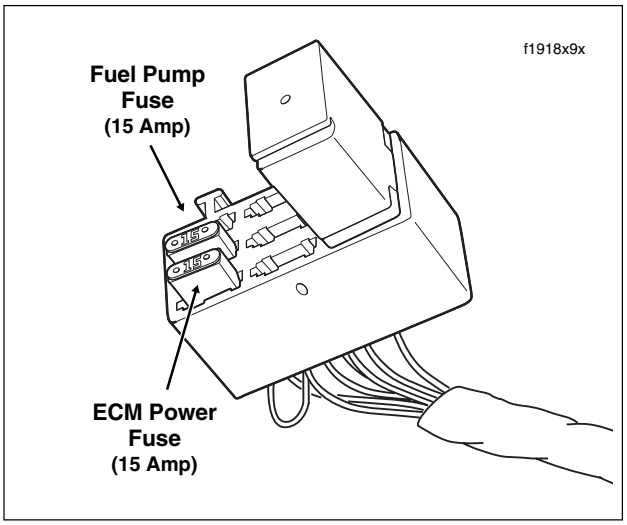


Figure 5-37. EFI Fuse Block

TESTING

The fuel pressure gauge (0-100 PSI) allows for fuel injector and fuel system pressure diagnosis. Special adapters allow the gauge to be attached to the external fuel supply line.

PART NO.	SPECIALTY TOOL
HD-41182	Fuel pressure gauge
HD-44061	Fuel pressure gauge adapters (2)

1. Remove right side saddlebag and side cover.

⚠WARNING

The gasoline in the fuel supply line downstream of the fuel pump is under high pressure (58 psi). To avoid an uncontrolled discharge or spray of gasoline, always purge the system of high pressure gas before removing the fuel supply line from the fuel tank. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

2. Purge the fuel supply line of high pressure gas.
   a. See Figure 5-37. Pull the fuel pump fuse from the EFI fuse block.
   b. Start the engine and allow the vehicle to run.
   c. When the engine stalls, operate the starter for 3 seconds to remove any remaining fuel from the fuel lines.

⚠WARNING

A small amount of gasoline may drain from the quick-connect fitting when the fuel supply line is removed. Thoroughly wipe up any spilt 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.

3. Locate quick-connect fitting on left side of fuel tank. Pull up on chrome sleeve, and then pull down on fuel supply line to disconnect.

CAUTION

The next step requires two fuel pressure gauge adapters. Failure to use two adapters will cause the fuel line to twist. This may result in a broken fuel line or fuel line fitting.

4. Attach fuel line to gauge assembly.
   a. See Figure 5-38. Install a second adapter in series with the first.
   b. See Figure 5-39. Pull up on chrome sleeve of quick-connect fitting and insert neck of FUEL PRESSURE GAUGE ADAPTER (Part No. HD-44061) into fuel supply line.
   c. While pushing up on bottom of adapter, pull down on chrome sleeve until it "clicks" into the locked position. Tug on adapter to be sure that it will not come free.

d. See Figure 5-40. In the same manner, install neck of second fuel supply line fitting into quick-connect fitting on fuel tank. Tug on fuel supply line to be sure that it will not come free.

⚠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 pressure gauge adapter and fuel supply line will verify this condition. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

5. Verify that the fuel valve and air bleed petcock on the FUEL PRESSURE GAUGE (Part No. HD-41182) are closed.
6. See Figure 5-38. Remove protective cap from free end of fuel pressure gauge adapter. Connect fuel pressure gauge to Schroeder valve.
7. See Figure 5-37. Install fuel pump fuse.
8. Start and idle engine to pressurize the fuel system. Open the fuel valve to allow the flow of fuel down the hose of the pressure gauge.
9. Position the clear air bleed tube in a suitable container and open and close the air bleed petcock to purge the gauge and hose of air. Repeat this step several times until only solid fuel (without bubbles) flows from the air bleed tube. Close the petcock.
10. Open and close throttle to change engine speed. Note the reading of the pressure gauge. Fuel pressure should remain steady at 55-62 psi (380-425 kPa).
11. Turn the engine off. Position the air bleed tube in a suitable container. Open the air bleed petcock to relieve the fuel system pressure and purge the pressure gauge of gasoline.

⚠WARNING

A small amount of gasoline may drain from the adapter when the gauge is removed. Thoroughly wipe up any spilt 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.

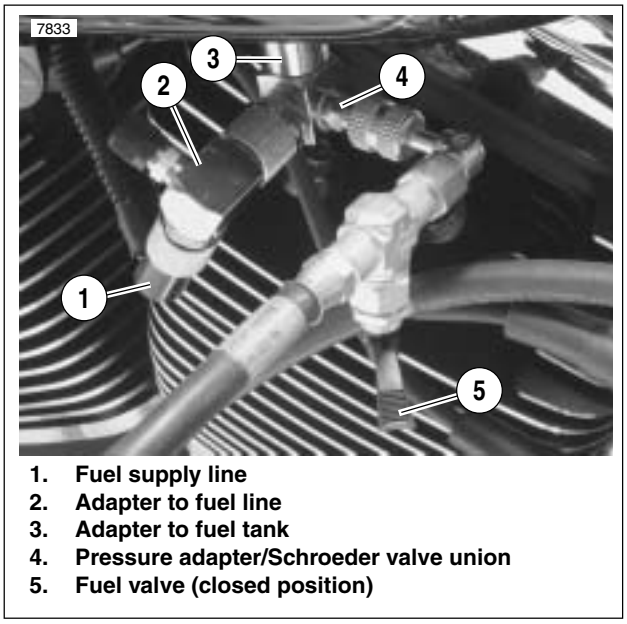
12. Remove fuel pressure gauge from the adapter. Install protective cap over Schroeder valve.

⚠WARNING

A small amount of gasoline may drain from the fuel supply line and adapter when these items are removed. Thoroughly wipe up any spilt 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.



Figure 5-38. Fuel Pressure Gauge Adapters



1. **Fuel supply line**
2. **Adapter to fuel line**
3. **Adapter to fuel tank**
4. **Pressure adapter/Schroeder valve union**
5. **Fuel valve (closed position)**

Figure 5-39. Fuel Line

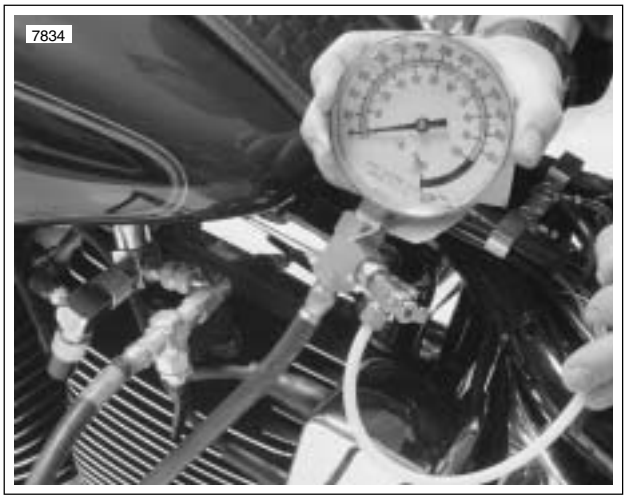


Figure 5-40. Fuel Pressure Gauge Installed (Typical)

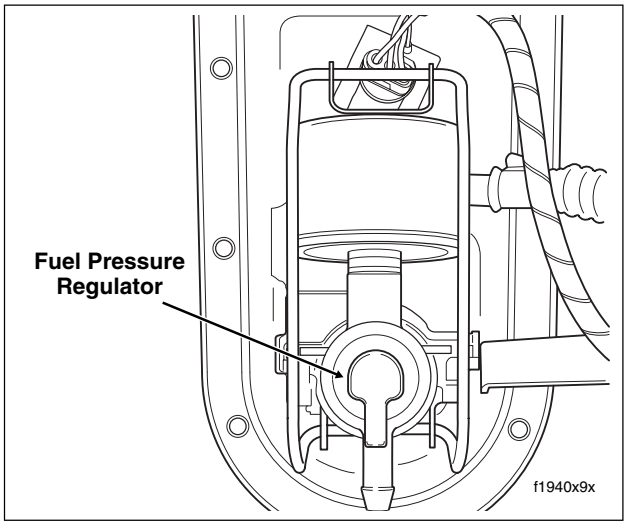


Figure 5-41. Underside of Canopy

13. Pull up on sleeve of quick-connect fitting and remove fuel supply line from fuel pressure gauge adapter. Release adapter from fuel tank in the same manner.

⚠WARNING

To avoid an uncontrolled discharge or spray of gasoline, always be sure the quick-connect fitting is properly mated. A slight tug on the fuel supply line will verify this condition. Gasoline is extremely flammable and highly explosive. Inadequate safety precautions could result in death or serious injury.

14. Pull up on chrome sleeve of quick-connect fitting 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.

15. Install right side cover and saddlebag.

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 5.17 flow chart.

1. See FUEL PRESSURE REGULATOR, REMOVAL/INSTALLATION, in the 2003 Touring Models Service Manual (Part Number 99483-03).
2. If fuel system has pressure, but it is less than specification, check for the following conditions.
   a. The amount of fuel to the injectors is within limits, but pressure is too low. Also, hard starting cold and overall poor performance condition may exist.
   b. Restricted fuel flow causing pressure drop. However, if pressure drop occurs only when driving, engine may surge and lose power as pressure begins to drop rapidly.
3. This condition may be identified when the fuel level is low and the fuel pump is turned on for the first 2 seconds after key ON. A metallic ringing sound can be heard as the high pressure fuel is sprayed against the inside wall of the fuel tank.

Scanalyzer Notes

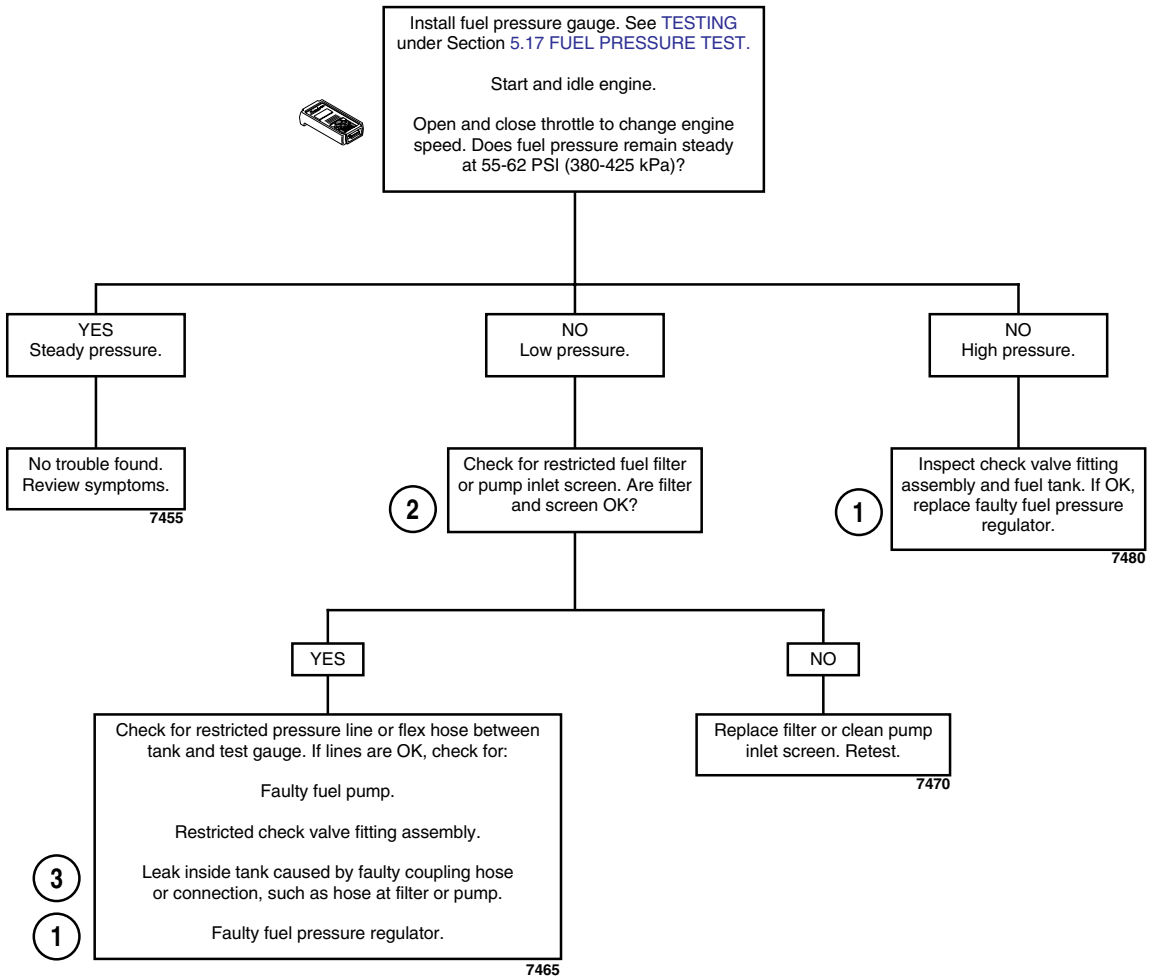
The Scanalyzer icon appears at those points in the flow chart where the Scanalyzer can be used.

NOTE

With the engine OFF, the Scanalyzer (Active Diagnostic Test Mode) can be used to turn the fuel pump on for periods up to 30 seconds.

Test 5.17

FUEL PRESSURE TEST



IDLE AIR CONTROL 5.18

GENERAL

IAC Operation

The ECM controls engine idle speed by moving the idle air control (IAC) to open or close a passage around the throttle plate. It does this by sending voltage pulses to the proper motor winding of the IAC. This causes the pintle to move in or out of the IAC a given distance for each pulse received.

- To increase idle speed, the ECM retracts the pintle, allowing more air to flow through the throttle body.
- To decrease idle speed, the ECM extends the pintle, allowing less air to flow through the throttle body.

The IAC position can be measured in steps. Use the Data Monitor Display (Section 5.5 SCANALYZER: EFI) to check this measurement.

- A high number of steps represents a fully retracted pintle and open passage around throttle plate. This correlates with an increase in the amount of air flowing through the throttle body.
- Zero steps represents a fully extended pintle. A zero reading indicates that the pintle has been fully extended and has consequently closed the passage around throttle plate, which is an abnormal condition.

Each time the ignition is turned off, the ECM resets the IAC by sending enough pulses to extend the pintle and effectively close the throttle body. The fully extended value is the ECM reference point. A given number of counts are then calculated by the ECM for use in setting the proper idle speed and IAC position.

NOTE

Warm idle speed is controlled by the ECM and can be adjusted with a Scanalyzer. See DATA LINK CONNECTOR, SETTING ENGINE IDLE SPEED, in the 2003 Touring Models Service Manual (Part Number 99483-03).

Diagnostic Trouble Code P0505: Loss of Idle Speed Control

Loss of idle speed control will result if the idle RPM is ±200 from preset idle speed and IAC motor is at zero or maximum for greater than 5 seconds. This code may occur with others for a multiple code situation. Resolve the other codes first to correct.

Table 5-23. Code Description

DTC	LAMP CODE	DESCRIPTION
P0505	34	Loss of idle speed control

DIAGNOSTICS

Diagnostic Tips

Engine idle speed can be adversely affected by the following:

- A loss of idle speed control does not necessarily imply the IAC actuator or wiring has failed. It can be caused by a number of conditions such as an intake air leak, improperly adjusted throttle stop or a misfiring cylinder.
- Leaking injectors will cause fuel imbalance and poor idle quality due to different air/fuel ratios in each cylinder. To check for leaky injectors, first remove the air cleaner. With the throttle wide open, turn key ON for 2 seconds and then OFF for 2 seconds five consecutive times. Replace the fuel injector if there is any evidence of raw fuel in the bores. See FUEL INJECTORS, REMOVAL/INSTALLATION, in the 2003 Touring Models Service Manual (Part Number 99483-03).
- Vacuum leaks. To check for vacuum leaks, spray water around the Induction Module seals while idling the engine. If RPM changes, replace seals. A leak can also be indicated by a low IAC count on the Scanalyzer Data Monitor.
- Contaminated fuel.
- Excessive oil in the crankcase (oil sumping).
- TPS reading greater than 1% (possible throttle cable misadjustment) or battery voltage reading of less than 9 volts or a vehicle speed sensor (VSS) greater than 0 will disable idle speed control.
- Loss of battery power to ECM pin 31.

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 5.18 flow charts.

1. When the engine is stopped, the IAC pintle extends and then retracts to a fixed “Park” position for increased airflow and idle speed during the next engine start sequence. This key OFF reset procedure takes 10 seconds to perform.

2. Test lamp behavior may follow two patterns. The color of the lights is not relevant to IAC operation.

   a. **Normal behavior:** At key ON, test lights will alternately flash and then remain steady on to confirm ECM signals. At key OFF lights alternately flash and go out after 10 second reset procedure.

   b. **Problem indicated:** One or more lights fail to illuminate during key ON/key OFF cycle.

NOTE

There is a remote possibility that one of the circuits is shorted to voltage which would have been indicated by a steady light. Disconnect ECM and turn the ignition ON. Probe terminals to check for this condition.

3. Connect BREAKOUT BOX (Part No. HD-43876) to EFI wire harness only, leaving ECM disconnected. See Section 5.7 BREAKOUT BOX: EFI.

4. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), gray pin probe and patch cord.

5. Repair faulty ECM connection or replace ECM.

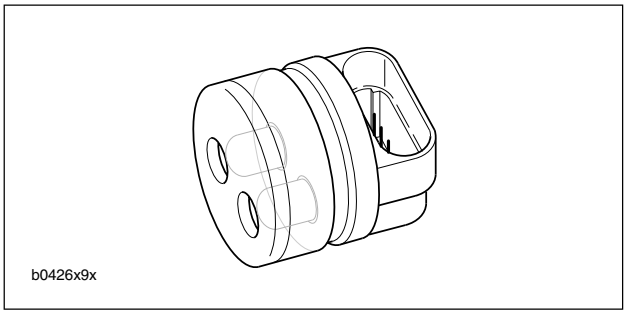


Figure 5-42. IAC Test Lamp (Part No. HD-41199-3)

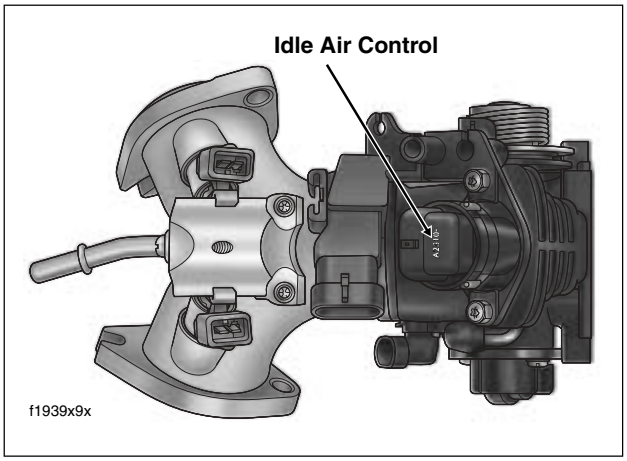


Figure 5-43. Induction Module (Top View)

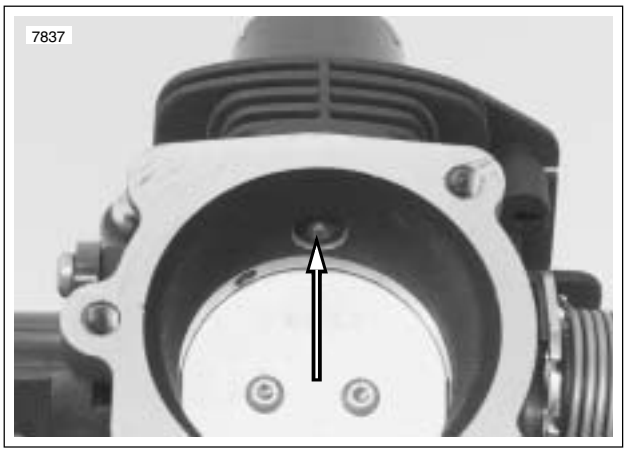


Figure 5-44. IAC Pintle

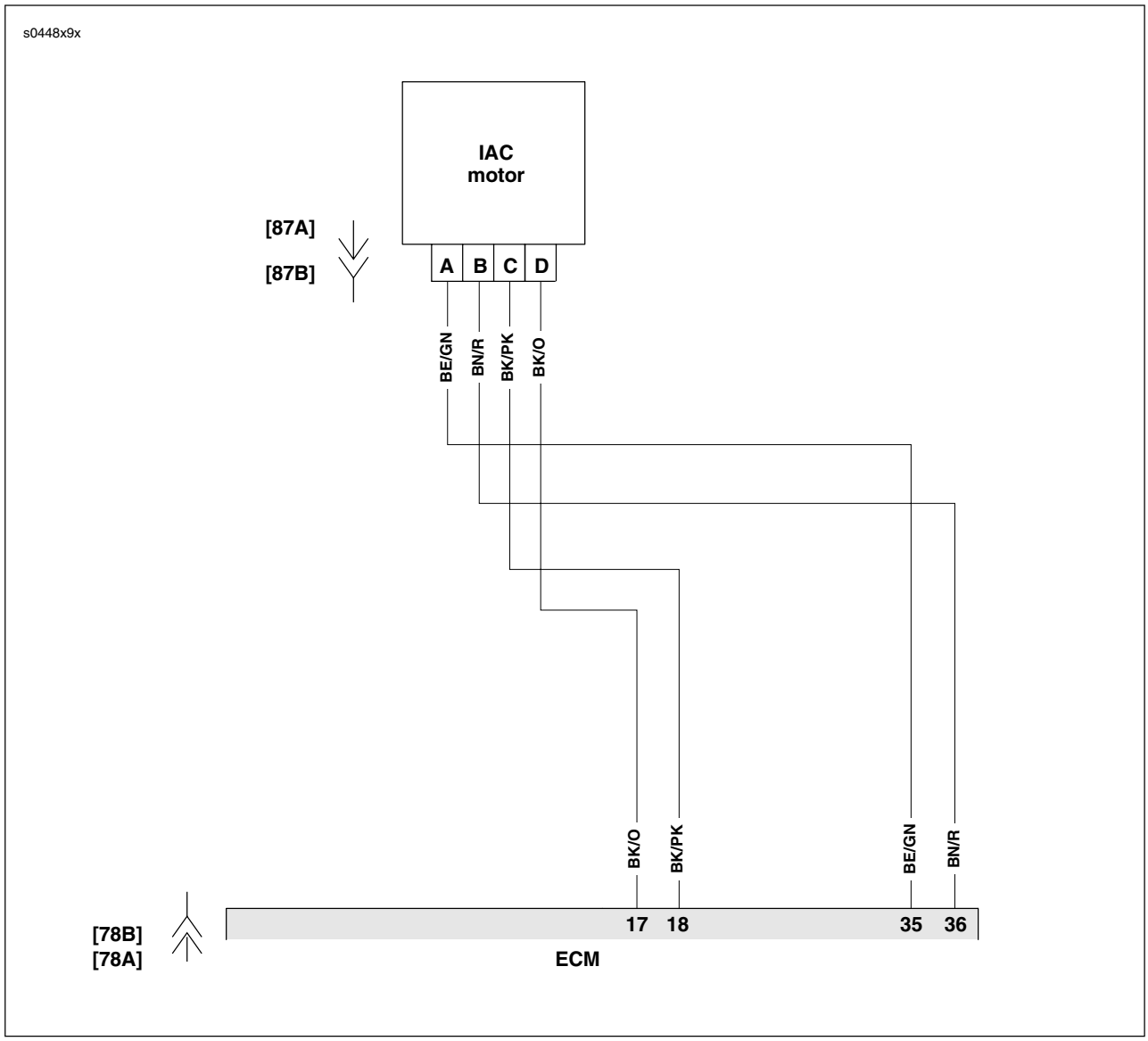


Figure 5-45. IAC Circuit

Table 5-24. Wire Harness Connectors in Figure 5-45.

NO.	DESCRIPTION	TYPE	LOCATION
[78]	ECM	36-Place Packard	Under Right Side Cover
[87]	IAC	4-Place Packard	Below Fuel Tank (Right Side)

Test 5.18 (Part 1 of 2)

IDLE AIR CONTROL: DTC P0505

View Data Monitor display on Scanalyzer. Is TP sensor reading greater than 0%?

YES

Lubricate and adjust throttle cables.

NO

Remove air cleaner cover and element.

Monitor IAC pintle for 10 seconds after turning ignition OFF. Does pintle extend and then retract during 10 second key OFF reset procedure?

1

YES

Check intake manifold for leaks by spraying water on manifold with engine running. If RPM changes, then leaks are present. Leaks found?

YES

Repair intake leak.

7486

NO

Check fuel pressure. See Section 5.17 FUEL PRESSURE TEST.

7487

NO

Disconnect IAC and connect test lamp. See Figure 5-42.

Turn ignition switch to IGNITION for 2 seconds, and then OFF for 10 seconds.

Check test lamp during key ON/OFF cycle.

2

Problem indicated.

Remove test lamp.

Connect Breakout Box to Connector [78B] leaving ECM disconnected. Check Terminal 31 for 12 volts. Battery voltage present?

YES

Using DVOM, measure resistance between IAC connector [87B] and Breakout Box.

IAC	WIRE COLOR	ECM
A	BE/GN	to 35
B	BN/R	to 36
C	BK/PK	to 18
D	BK/O	to 17

3

4

Does each wire measure 0.5 ohms or less?

YES

4

Turn ignition ON. With ECM still disconnected, check voltage on all four sockets of Connector [87B]. Is voltage present?

YES

Locate and repair short to voltage.

7505

NO

STOP

Go to Test 5.18 (Part 2 of 2).

NO

Repair poor connection at Connectors [87B] or [78B], or repair open wire in harness.

7495

Normal behavior.

Repair faulty IAC connection or IAC assembly.

7490

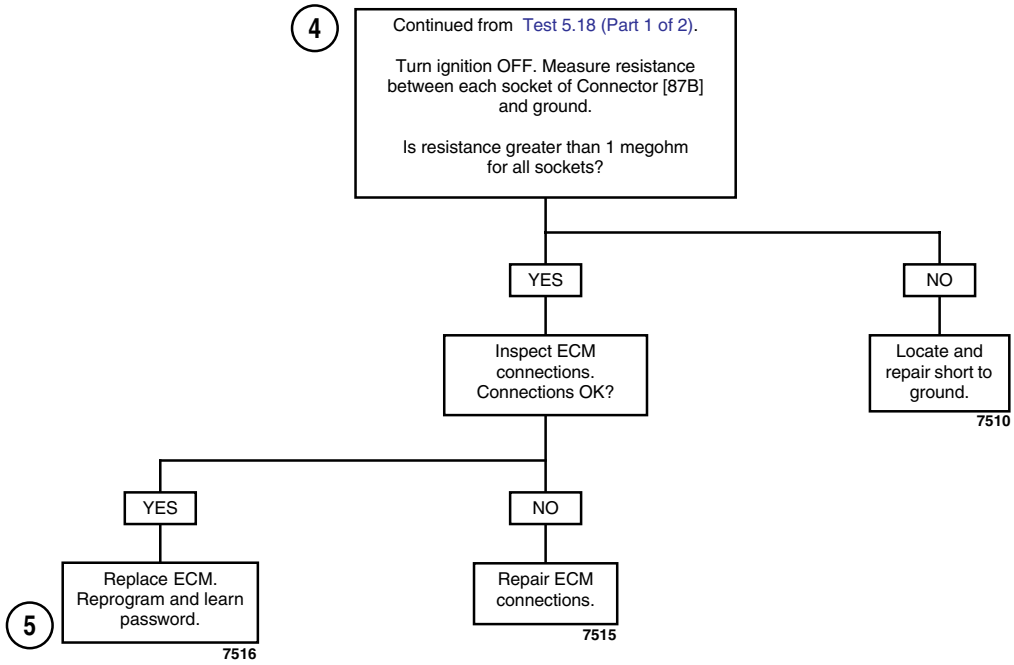
NO

Go to Test 5.13. No ECM Power.

Clear codes and confirm proper operation with no check engine lamp.

Test 5.18 (Part 2 of 2)

IDLE AIR CONTROL: DTC P0505





Clear codes and confirm proper operation with no check engine lamp.

MISFIRE AT IDLE OR UNDER LOAD 5.19

GENERAL

Misfire at Idle or Under Load

- Battery condition and connections may also cause misfires. See BATTERY in the 2003 Touring Models Service Manual (Part Number 99483-03).
- Fuel system problems may also cause misfires. Consult Section 5.17 FUEL PRESSURE TEST and then see symptom tables under Section 5.9 INITIAL DIAGNOSTIC CHECK: EFI.
- Mechanical problems with the engine may cause misfires. See Section 3 of the 2003 Touring Models Service Manual (Part Number 99483-03).
- Vehicle modification, such as changing intake and/or exhaust components, may cause a misfire condition to occur.

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 5.19 flow charts.

⚠WARNING

Any open spark around gasoline or other combustibles may result in fire or explosion. Thoroughly wipe up any spilt fuel 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.

1. A SPARK TESTER (Part No. HD-26792) must be used to verify adequate secondary voltage (25,000 volts) at the spark plug. See Figure 5-46.

IMPORTANT NOTE

Engine will not spark with both spark plugs removed. When checking for spark, use SPARK TESTER with both spark plugs installed.

   a. Turn ignition/light key switch to OFF.
   b. Remove spark plug cable from spark plug. Visually check plug condition.
   c. Attach cable to SPARK TESTER. Clip tester to cylinder head bolt.
   d. While cranking engine, watch for spark to jump tester gap on leads.
   e. Reinstall and repeat procedure on other spark plug cable.

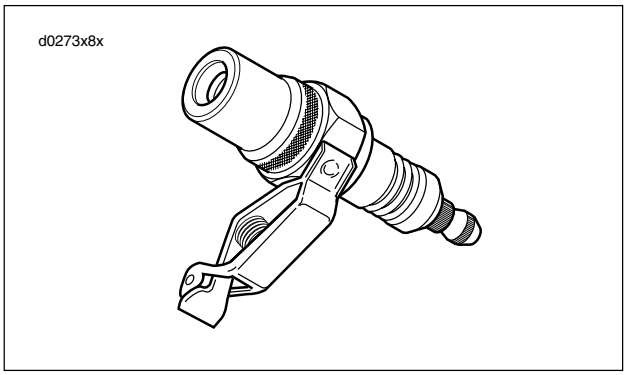


Figure 5-46. Spark Tester (HD-26792)

2. Perform spark plug cable resistance test.
   a. Remove spark plug cable from spark plug and ignition coil. For best results, use a needle nose pliers for removal/installation on coil. Gently grasp cable as close to terminals as possible.
   b. Using an ohmmeter, touch probes to terminals on each end plug wire.
   c. Compare resistance values to Table 5-25. Replace cables not meeting specifications. Reinstall and repeat procedure on other spark plug cable.

Table 5-25. Spark Plug Cables

SPECIFICATION	REAR	FRONT
Length in.	7.25	19.0 in
Length mm	184	483
Resistance-ohms	1500-4500	4500-12000

3. If carbon tracking is evident on outside of coil towers, replace ignition coil and inspect spark plug wires. Wires must be clean and tight. Excessive wire resistance or faulty connections can cause coil damage.
4. This test can also be performed by substituting a known good coil for one causing the no spark condition. The coil does not require full installation to be functional. Verify faulty coil by performing resistance test. See IGNITION COIL in the 2003 Touring Models Service Manual (Part Number 99483-03).
5. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), red pin probe and patch cord to relay and gray pin probe and patch cord to the coil connector [83B].

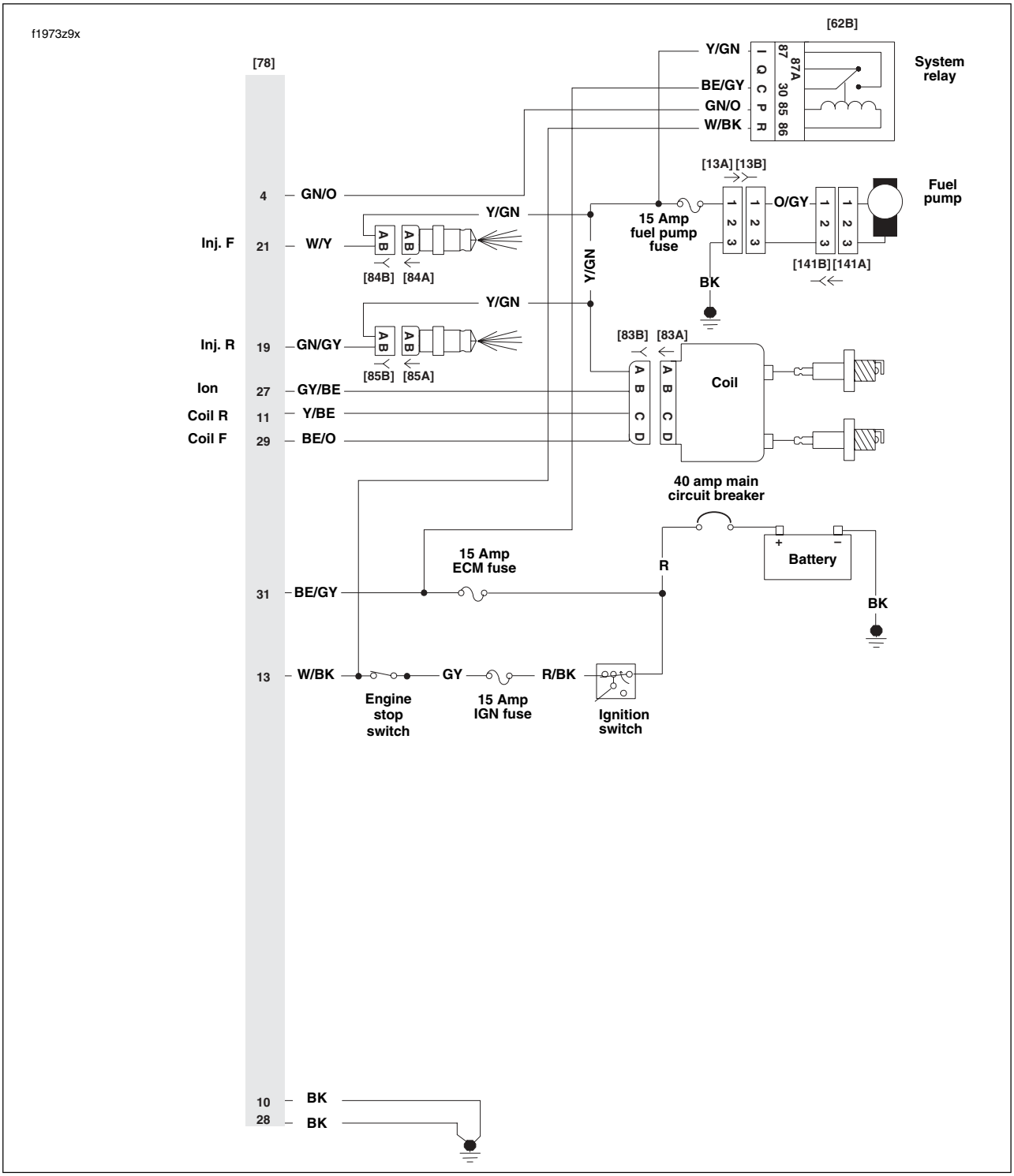


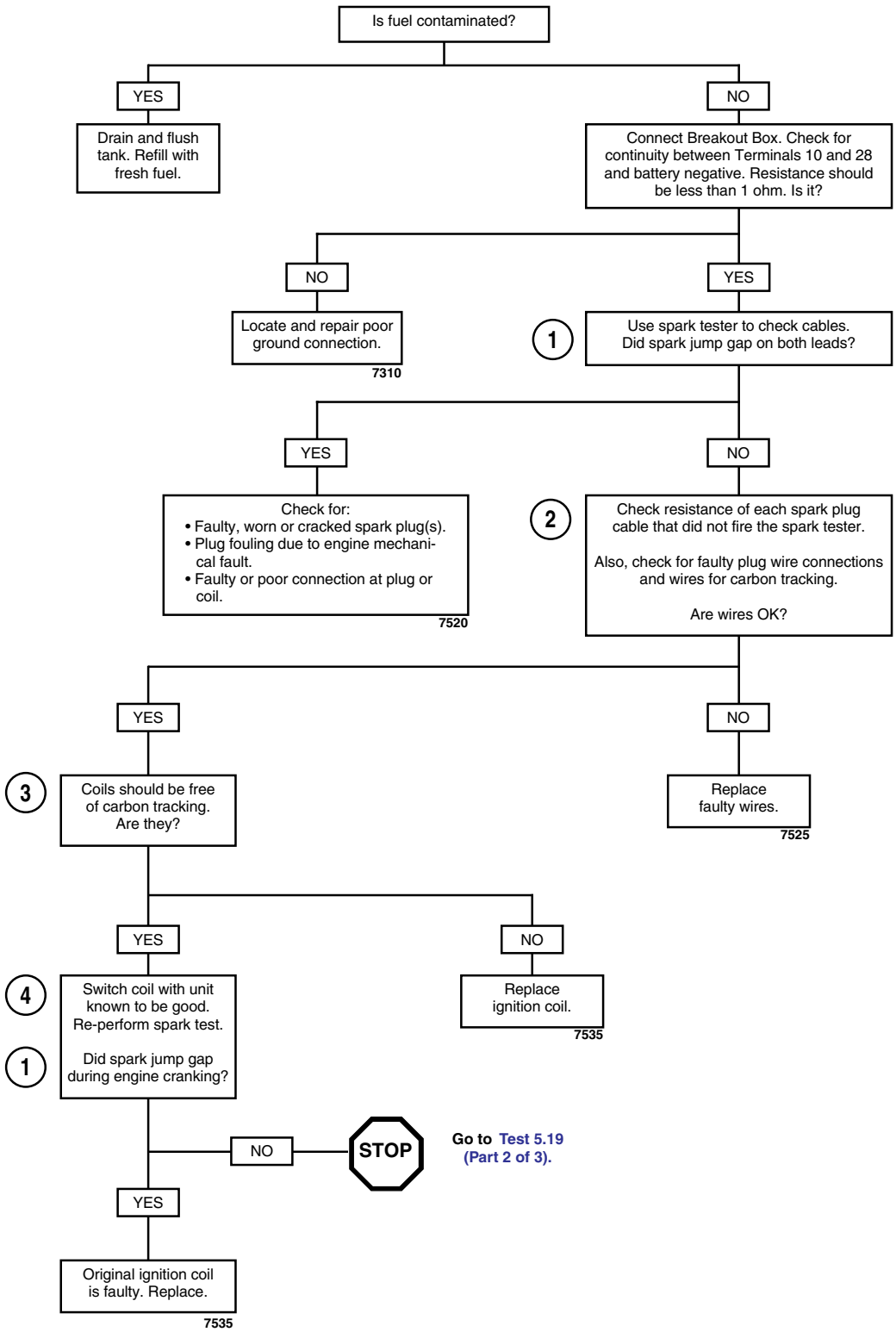
Figure 5-47. Ignition Coil Circuit Diagram

Table 5-26. Wire Harness Connectors in Figure 5-47.

NO.	DESCRIPTION	TYPE	LOCATION
[78]	ECM	36-Place Packard	Under Right Side Cover
[83]	Ignition Coil	4-Place Packard	Below Fuel Tank (Left Side)

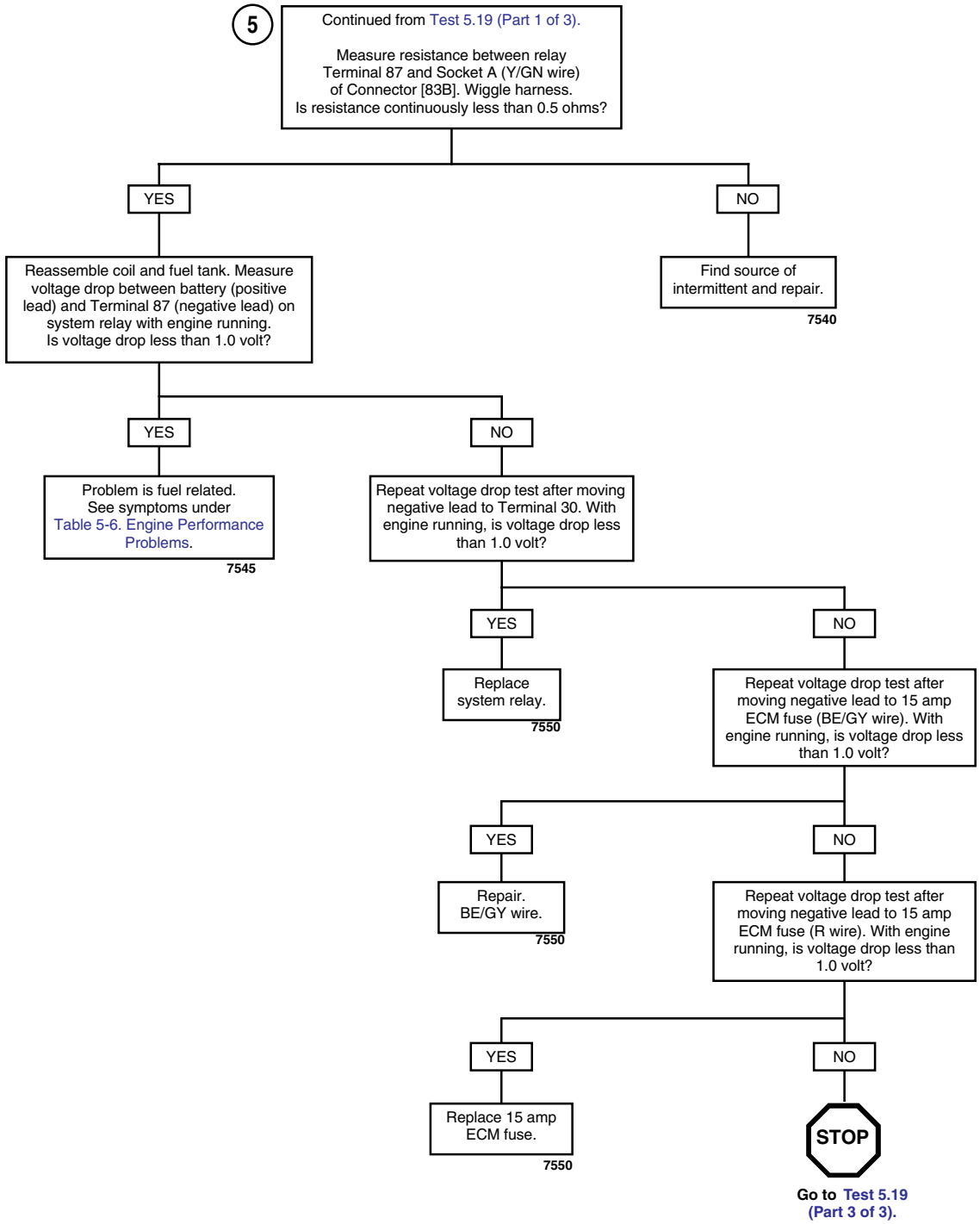
Test 5.19 (Part 1 of 3)

MISFIRE AT IDLE OR UNDER LOAD



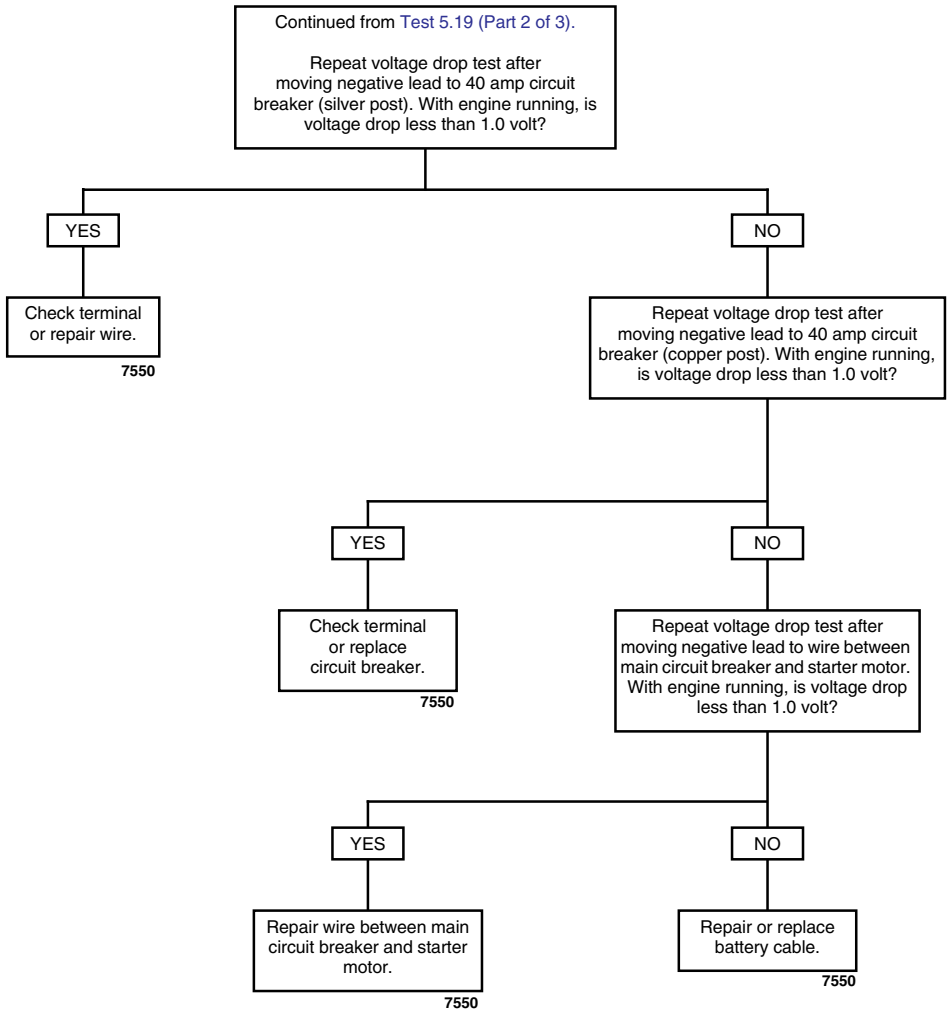
Test 5.19 (Part 2 of 3)

MISFIRE AT IDLE OR UNDER LOAD



Test 5.19 (Part 3 of 3)

MISFIRE AT IDLE OR UNDER LOAD



COMBUSTION ABSENT/INTERMITTENT 5.20

GENERAL

Diagnostic Trouble Codes P1353, P1356, P1357, P1358: No Combustion

See Figure 5-48. A feedback voltage signal in the secondary ignition circuit detects the presence of combustion each time a cylinder fires on ECM Pin 27. For diagnostic purposes, this signal is only analyzed under load above 2000 rpm where it may be easily measured. Failure to detect combustion at high speed and load means one of following conditions exist.

- Cylinder is truly misfiring.
- There is a lack of continuity in the ignition coil secondary circuit.

Table 5-27. Code Description

DTC	LAMP CODE	DESCRIPTION
P1353	24	Front cylinder no combustion
P1356	25	Rear cylinder no combustion
P1357	24	Intermittent secondary front
P1358	25	Intermittent secondary rear

DIAGNOSTICS

Diagnostic Notes

The reference number below correlates with the circled numbers on the Test 5.20 flow charts.

1. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness and ECM. See Section 5.7 BREAKOUT BOX: EFI.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), gray pin probes and patch cords.
3. Perform spark plug cable resistance test.
   a. Remove spark plug cable from spark plug and ignition coil. For best results, use a needle nose pliers for removal/installation on coil. Gently grasp cable as close to terminals as possible.

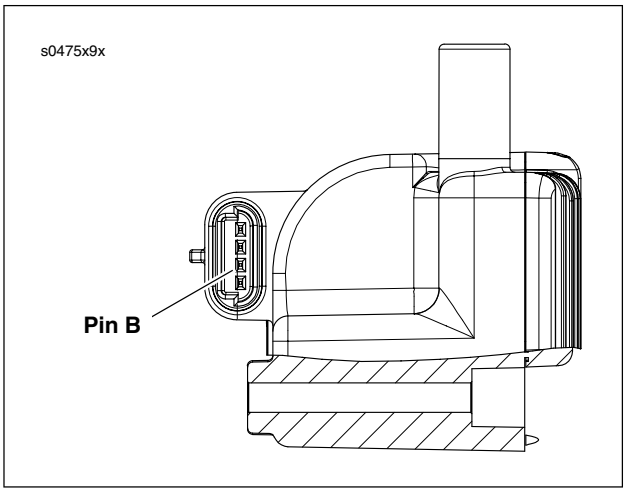


Figure 5-48. Ignition Coil

   b. Using an ohmmeter, touch probes to terminals on each end plug wire.
   c. Compare resistance values to Table 5-25. Replace cables not meeting specifications. Reinstall and repeat procedure on other spark plug cable.

Table 5-28. Spark Plug Cables

SPECIFICATION	REAR	FRONT
Length in.	19.0-19.25	7.25-7.50
Length mm	482.6-489.0	184.2-190.5
Resistance-ohms	4750-11,230	1812-4375

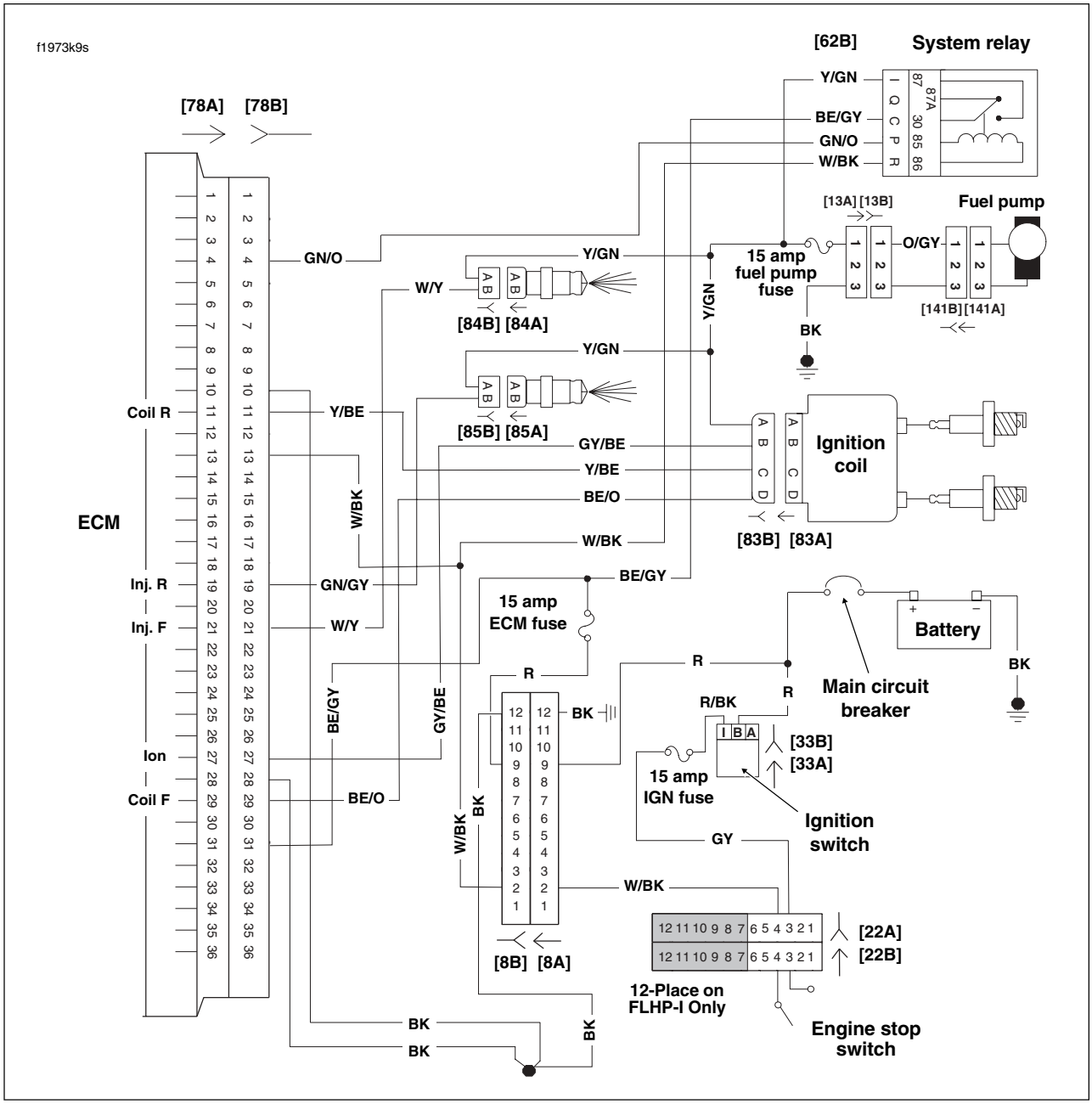


Figure 5-49. Battery Voltage Circuit Diagram (FLHR/C-I, FLHP-I)

Table 5-29. Wire Harness Connectors in Figure 5-49.

NO.	DESCRIPTION	TYPE	LOCATION
[8]	Ignition (Main to EFI Harness)	8-Place Deutsch (Gray)	Under Right Side Cover
[22]	Right handlebar Switches	12-Place Deutsch (Black)	Inside Headlamp Nacelle
[33]	Ignition/Light Key Switch	3-Place Packard	Under Left Side Cover
[78]	ECM	36-Place Packard	Under Right Side Cover
[83]	Ignition Coil	4-Place Packard	Below Fuel Tank (Left Side)
[84]	Front Injector	2-Place Packard	Below Fuel Tank (Left Side)
[85]	Rear Injector	2-Place Packard	Below Fuel Tank (Left Side)

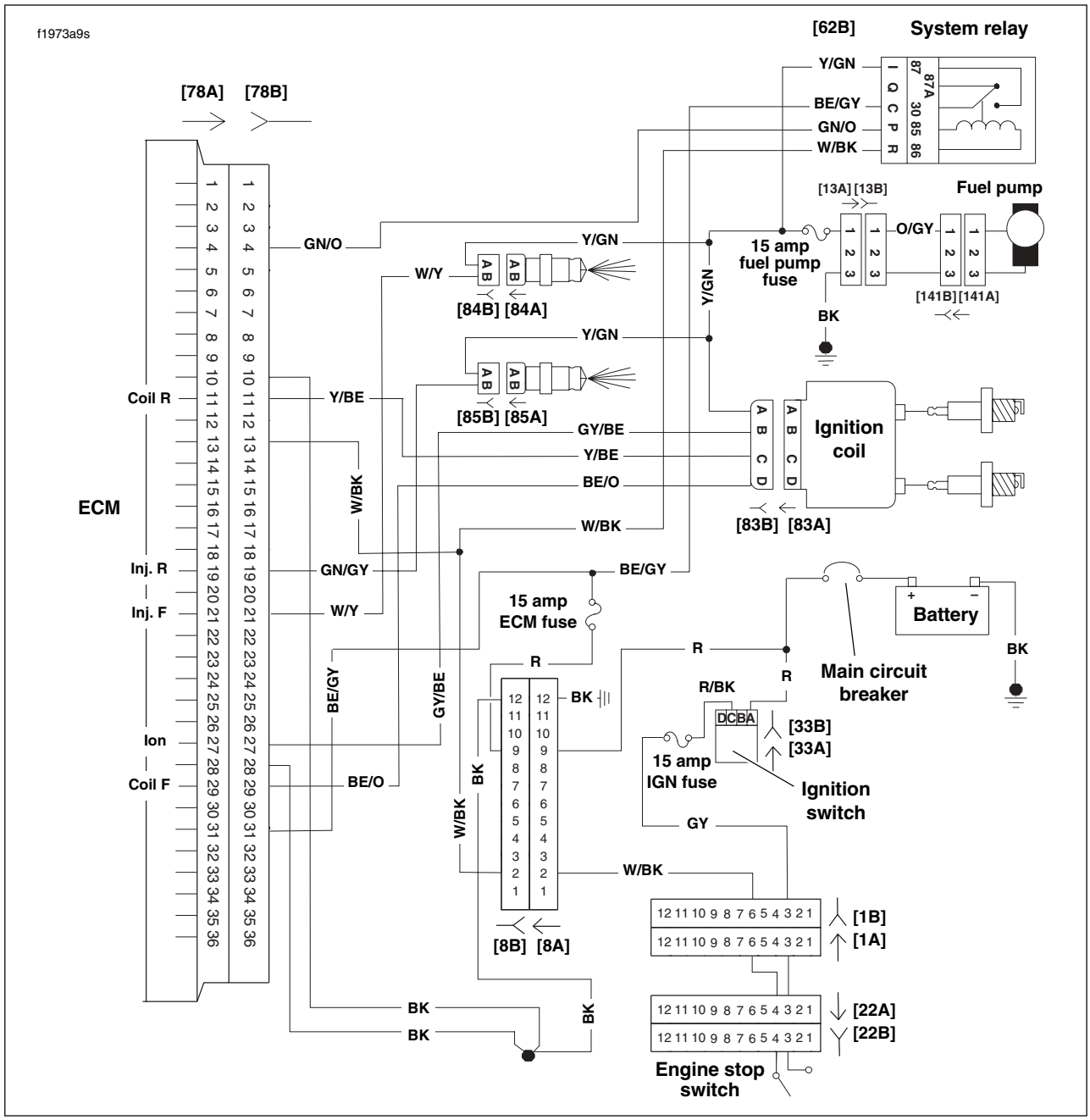


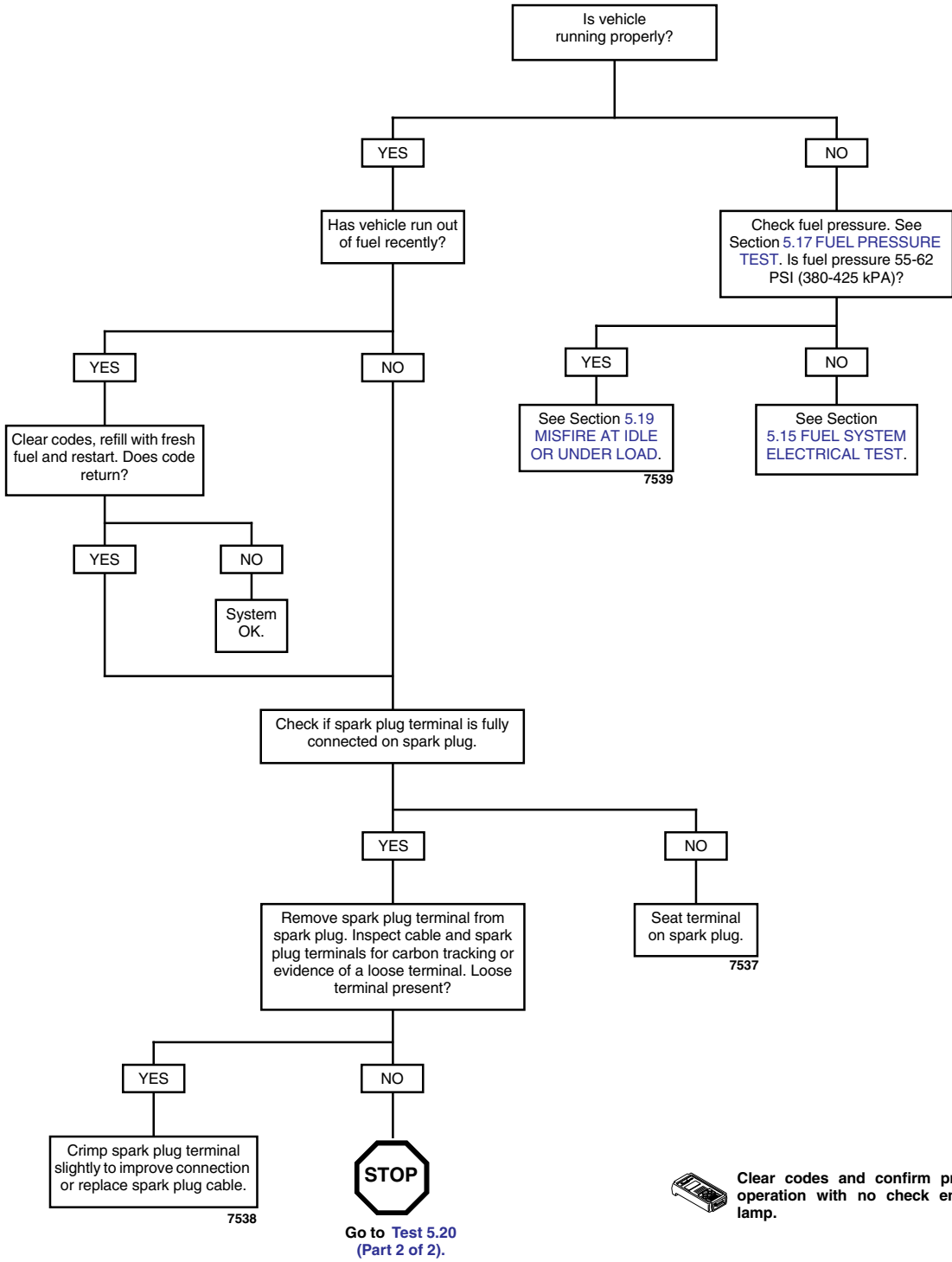
Figure 5-50. Battery Voltage Circuit Diagram (FLTR-I, FLHTC/U-I)

Table 5-30. Wire Harness Connectors in Figure 5-50.

NO.	DESCRIPTION	TYPE	LOCATION
[1]	Main to Interconnect Harness	12-Place Deutsch (Black)	Inner Fairing (Right Fairing Bracket)
[8]	Ignition (Main to EFI Harness)	8-Place Deutsch (Gray)	Under Right Side Cover
[22]	Right Handlebar Switches	12-Place Deutsch (Black)	Inner Fairing (Right Fairing Support Brace)
[33]	Ignition/Light Key Switch	4-Place Packard	Inner Fairing (Top Fork Bracket)
[78]	ECM	36-Place Packard	Under Right Side Cover
[83]	Ignition Coil	4-Place Packard	Below Fuel Tank (Left Side)
[84]	Front Injector	2-Place Packard	Below Fuel Tank (Left Side)
[85]	Rear Injector	2-Place Packard	Below Fuel Tank (Left Side)

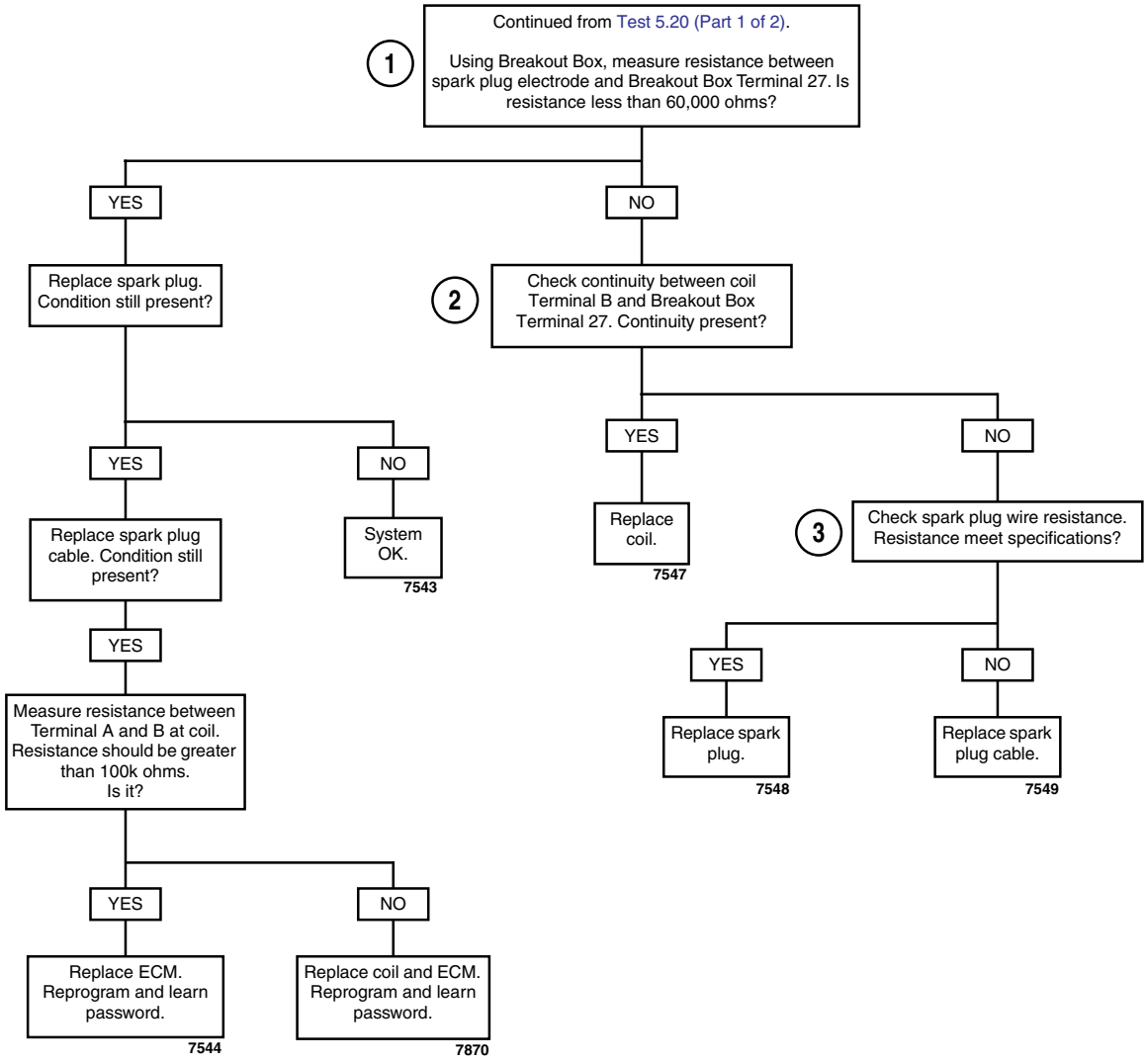
Test 5.20 (Part 1 of 2)

COMBUSTION ABSENT: DTC P1353, P1356, P1357, P1358



Test 5.20 (Part 2 of 2)

COMBUSTION ABSENT: DTC P1353, P1356, P1357, P1358



Clear codes and confirm proper operation with no check engine lamp.

DTC P0107, P0108 5.21

GENERAL

MAP Sensor

See Figure 5-51. The manifold absolute pressure sensor (MAP sensor) is supplied 5 volts from the ECM (Pin 14) and sends a signal back to the ECM (Pin 25). This signal varies in accordance with engine vacuum and atmospheric barometric pressure. Changes in barometric pressure are influenced by weather and altitude.

Table 5-31. Code Description

DTC	LAMP CODE	DESCRIPTION
P0107	12	MAP sensor open/low
P0108	12	MAP sensor high

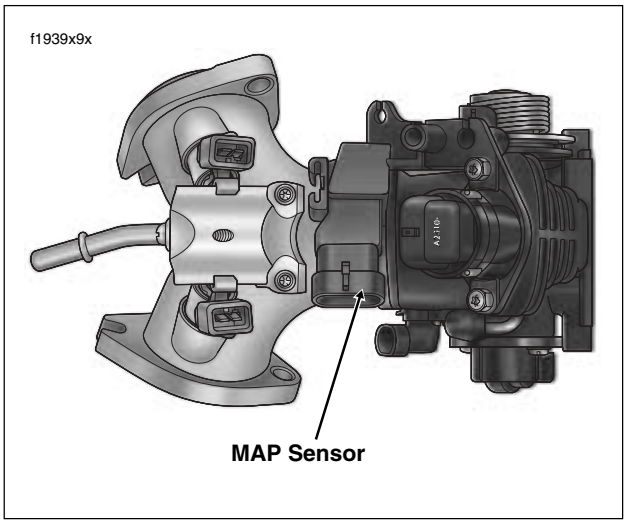


Figure 5-51. Induction Module (Top View)

DIAGNOSTICS

Diagnostic Tips

- These codes will set if the MAP sensor signal is out of range. Code P0108 can only be detected with the engine running.
- With the MAP sensor disconnected, the ECM and Scanalyzer should recognize a low voltage. If low voltage is observed, the ECM and harness are not at fault unless there is a short to ground.
- Gently place a jumper wire across MAP sensor connector [80B] Terminals B and C using HARNESS CONNECTOR TEST KIT (Part No. HD-41404), gray male probes and patch cord. With the jumper in place, the ECM and Scanalyzer should recognize a high voltage.
- MAP sensor output check. Using the VACUUM PUMP (Part No. HD-23738), apply a vacuum to the pressure port of the MAP sensor. The signal voltage should lower as the vacuum is applied.
- The MAP and TP sensors are connected to the same reference line (+5V Vref). If the reference line goes to ground or open, multiple codes will be set (DTC P0107, P0108, P0122, P0123).

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 5.21 flow charts.

1. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness and ECM. See Section 5.7 BREAKOUT BOX: EFI.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), gray pin probes and patch cords.

Scanalyzer Notes

The Scanalyzer icon appears at those points in the flow chart where the Scanalyzer can be used.

1. Press F1 key on Scanalyzer to view volts.

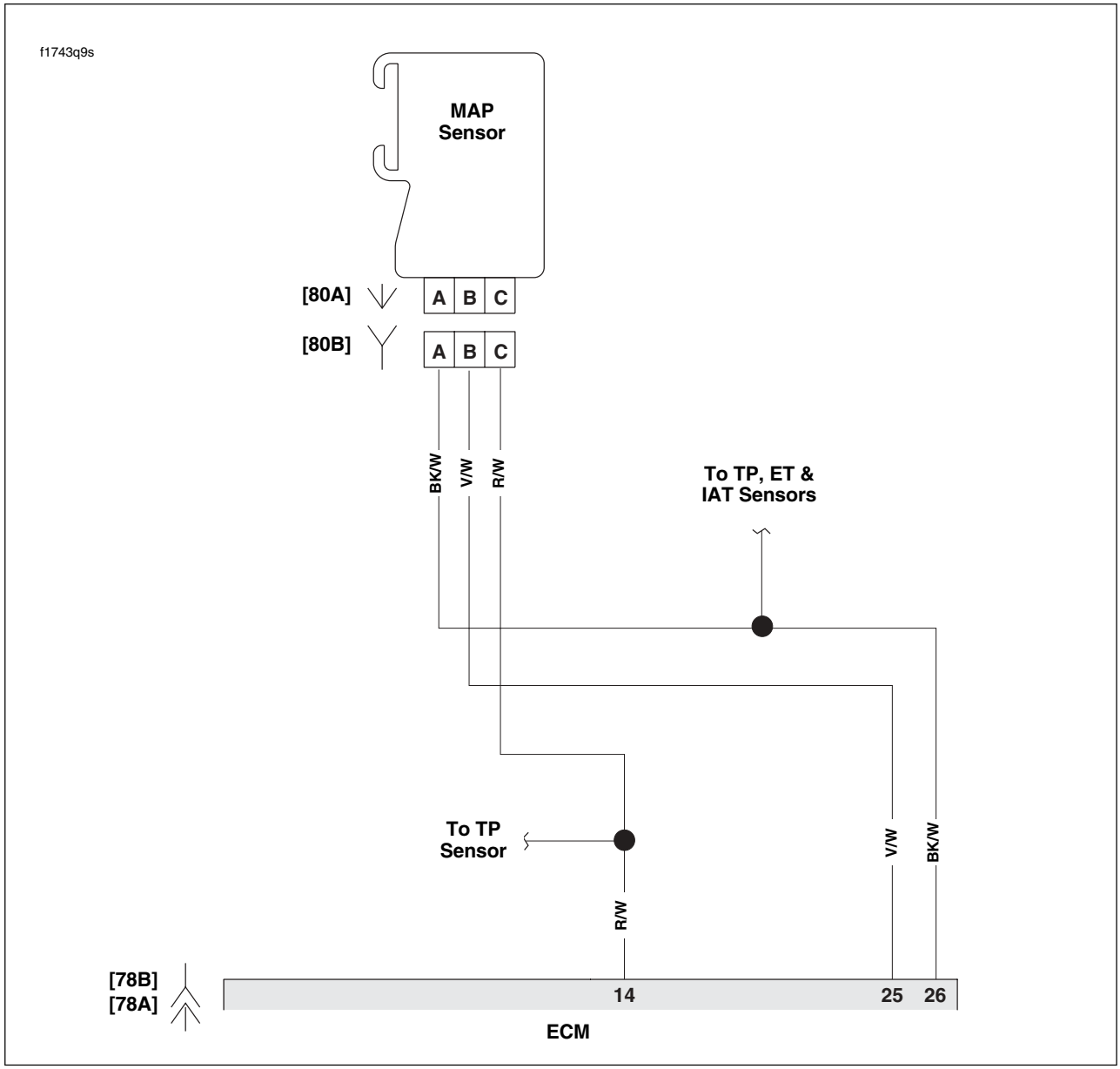


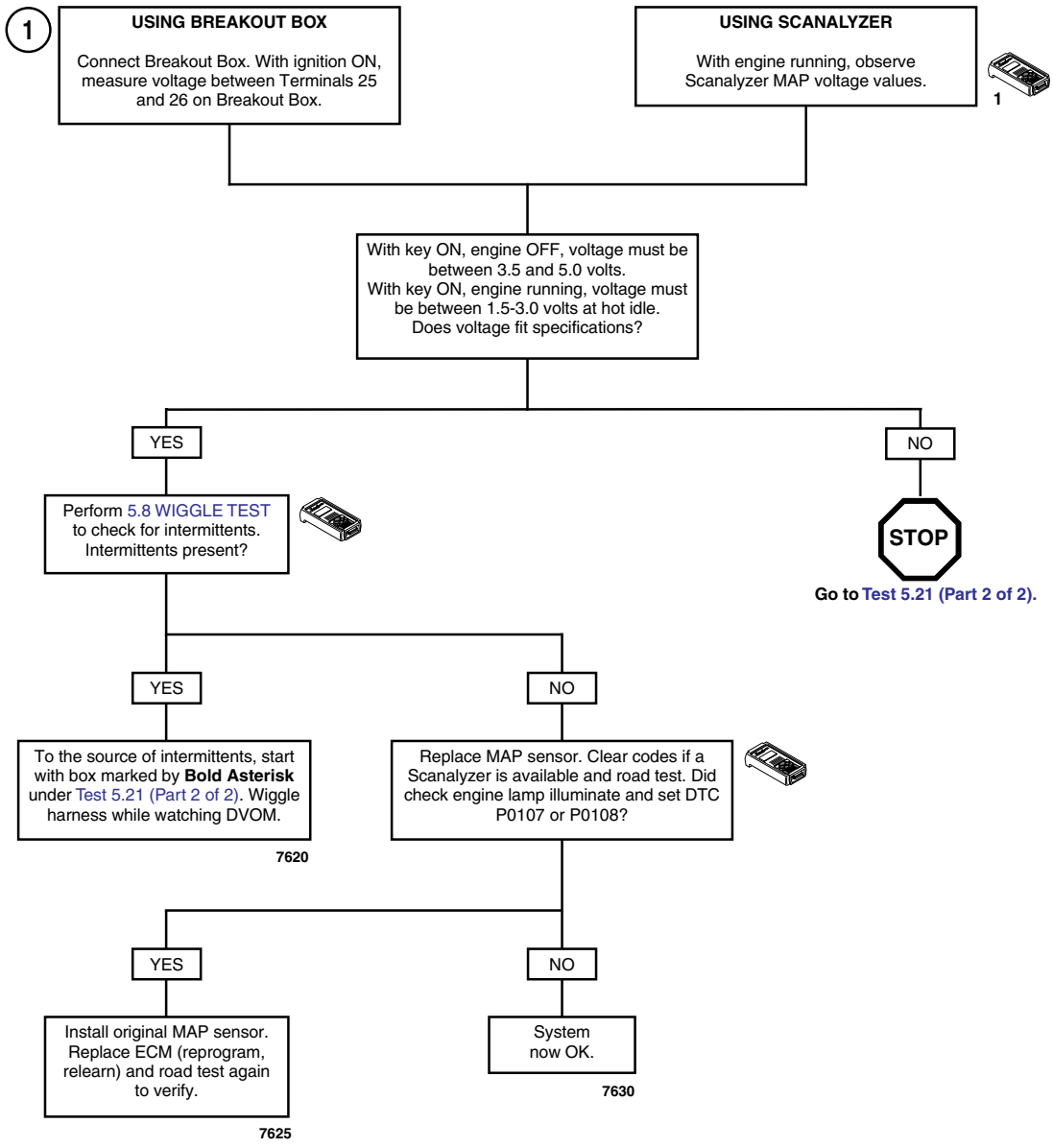
Figure 5-52. MAP Sensor Circuit

Table 5-32. Wire Harness Connectors in Figure 5-52.

NO.	DESCRIPTION	TYPE	LOCATION
[78]	ECM	36-Place Packard	Under Right Side Cover
[80]	MAP Sensor	3-Place Packard	Top of Induction Module

Test 5.21 (Part 1 of 2)

MAP SENSOR: DTC P0107, P0108

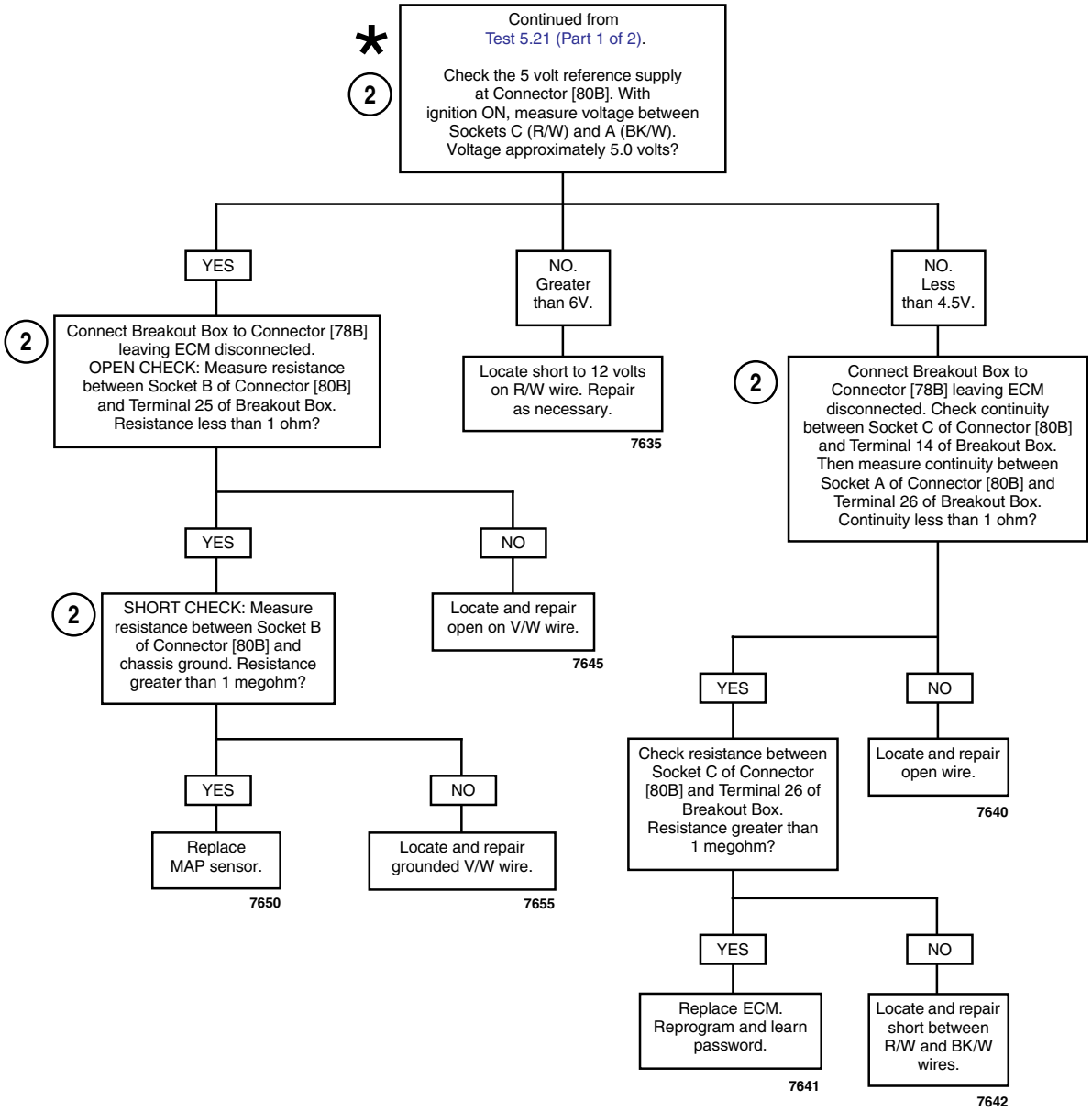


* **At some point in the flow chart you may be instructed to jump directly to the box marked by a bold asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.**

Clear codes and confirm proper operation with no check engine lamp.

Test 5.21 (Part 2 of 2)

MAP SENSOR: DTC P0107, P0108



At some point in the flow chart you may be instructed to jump directly to the box marked by a bold asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.

Clear codes and confirm proper operation with no check engine lamp.

DTC P0112, P0113 5.22

GENERAL

IAT Sensor

The ECM supplies and monitors a voltage signal (Pin 7) to one side of the intake air temperature sensor (IAT sensor). The other side of the IAT sensor is connected to a common sensor ground, which is also connected to the ECM (Pin 26).

The IAT sensor is a thermistor device, meaning that at a specific temperature, it will have a specific resistance across its terminals. As this resistance varies, so does the voltage on Pin 7.

- At high temperatures, the resistance of the sensor is very low, which effectively lowers the signal voltage on Pin 7.
- At low temperatures, the resistance is very high, allowing the voltage to rise close to 5 volts.

The ECM monitors this voltage to compensate for various operating conditions.

Table 5-33. Code Description

DTC	LAMP CODE	DESCRIPTION
P0112	15	IAT sensor voltage low
P0113	15	IAT sensor open/high

Table 5-34. IAT Sensor Table

TEMP °C	RESISTANCE	VOLTAGE	TEMP °F
-40	100950	4.9	-40
-30	53100	4.8	-22
-20	29121	4.7	-4
-10	16599	4.5	14
0	9750	4.2	32
10	5970	3.8	50
20	3747	3.3	68
25	3000	3.0	77
30	2417	2.7	86
40	1598	2.2	104
50	1080	1.8	122
60	746	1.4	140
70	526	1.0	158

DIAGNOSTICS

Diagnostic Tips

The Scanalyzer displays intake air temperature in degrees, or by pressing the F1 key, in volts. An intermittent may be caused by a poor connection, rubbed through wire insulation or a wire broken inside the insulation. Check the following conditions:

- **Poor connection:** Inspect ECM and harness connector [78] for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harness.
- **See Section 5.8 WIGGLE TEST to locate intermittents:** If connections and harness are OK, use the Scanalyzer to check the intake air temperature reading while moving related connectors and wiring harness. If failure is induced, the intake air temperature display will change.
- **Shifted sensor:** See Table 5-34. Use table to test the intake air temperature sensor at various temperature levels in order to evaluate the possibility of a shifted (out-of-calibration) sensor which can result in driveability problems.

NOTE

All voltage and resistance values are approximate (±20%). Measure IAT sensor resistance between ECM Terminal 7 and system ground (ECM Terminal 26).

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 5.22 flow charts.

1. Connect BREAKOUT BOX (Part No. HD-43876) to EFI wire harness **only** (leave ECM disconnected). See Section 5.7 BREAKOUT BOX: EFI.
2. If the engine has not been operated for 1 hour, the measured resistance should be very close to the measured resistance across the ET sensor which is Pins 6 and 26 on the Breakout Box. Scanalyzer values (using Data Monitor Mode) will be approximately the same if code is historic. Current code will read default value.
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), gray pin probes and patch cords.
4. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), gray socket probes and patch cords.
5. See INTAKE AIR TEMPERATURE SENSOR, REMOVAL/INSTALLATION, in the 2003 Touring Models Service Manual (Part Number 99483-03).

Scanalyzer Notes

The Scanalyzer icon appears at those points in the flow chart where the Scanalyzer can be used.

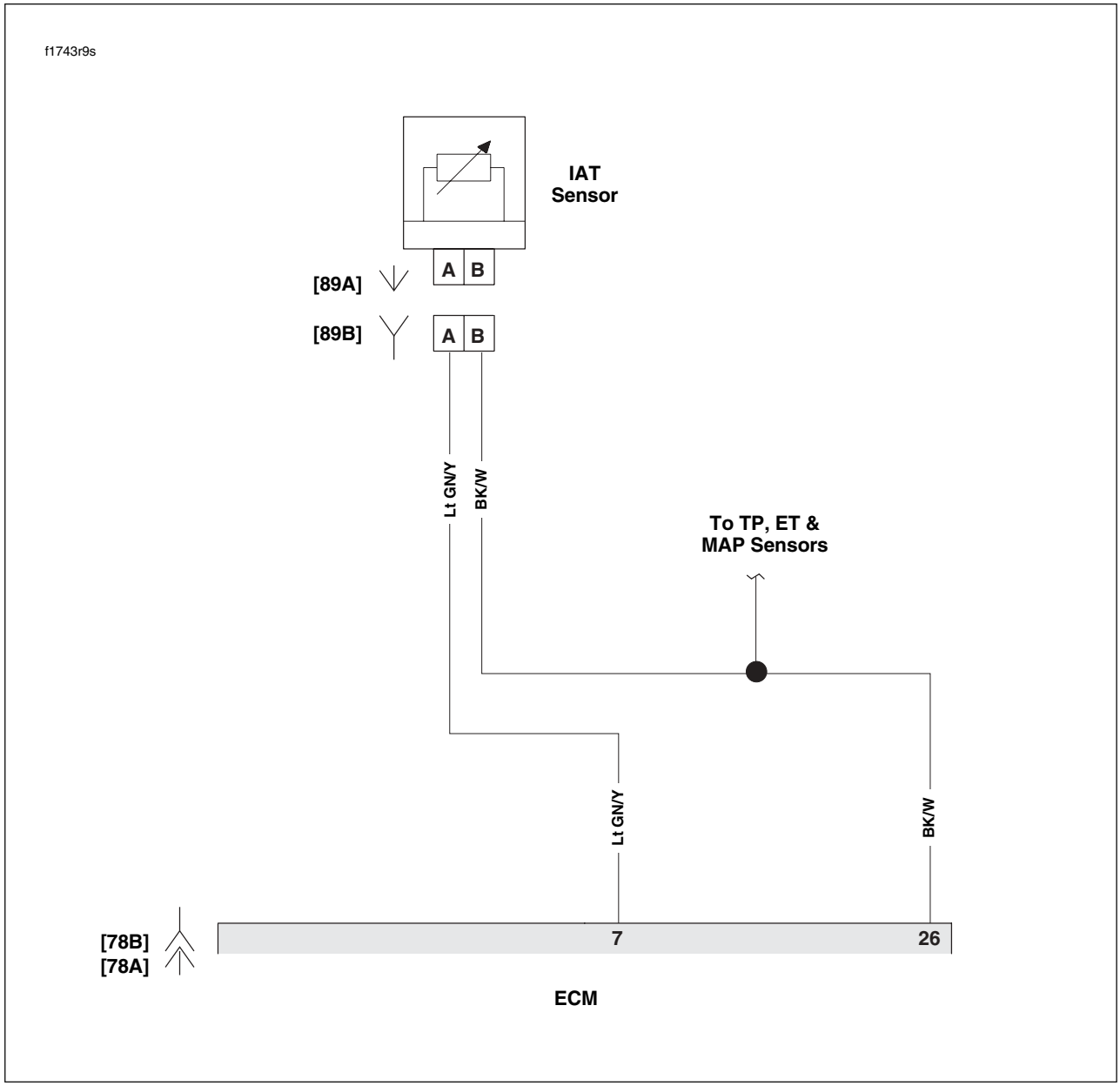


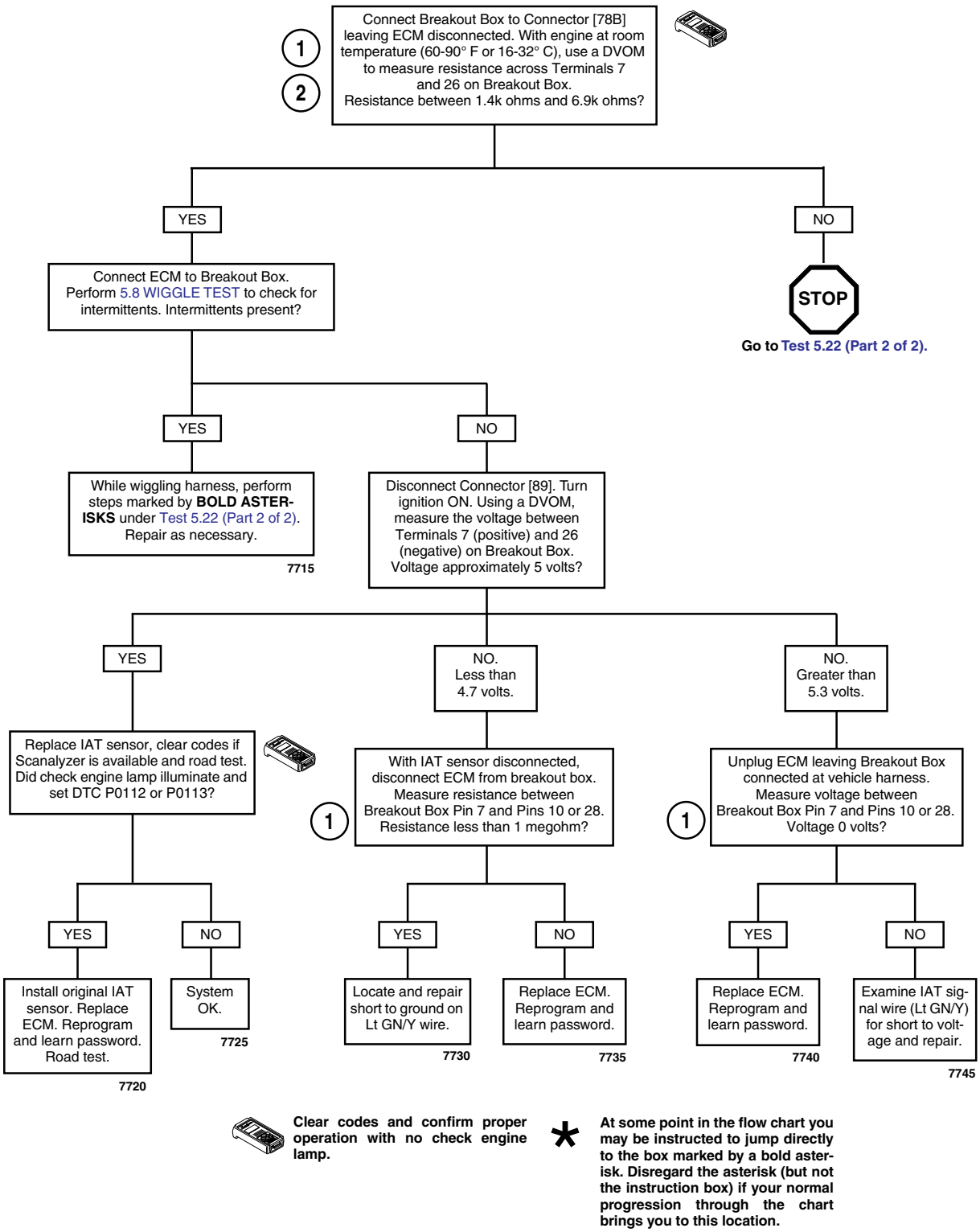
Figure 5-53. IAT Sensor Circuit

Table 5-35. Wire Harness Connectors in Figure 5-53.

NO.	DESCRIPTION	TYPE	LOCATION
[78]	ECM	36-Place Packard	Under Right Side Cover
[89]	IAT Sensor	2-Place Packard	Below Fuel Tank (Right Side)

Test 5.22 (Part 1 of 2)

IAT SENSOR: DTC P0112, P0113

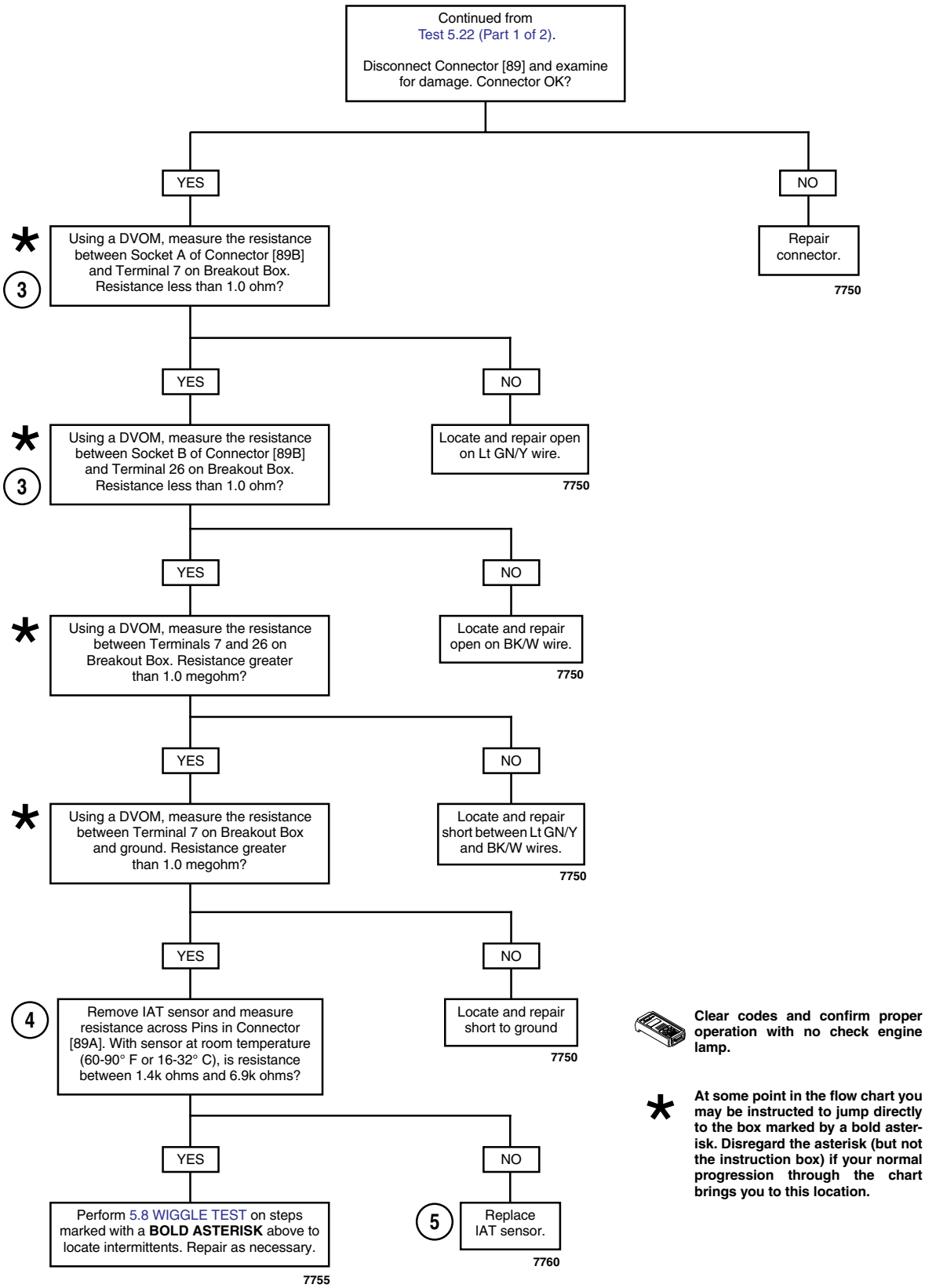


Clear codes and confirm proper operation with no check engine lamp.

*** At some point in the flow chart you may be instructed to jump directly to the box marked by a bold asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.**

Test 5.22 (Part 2 of 2)

IAT SENSOR: DTC P0112, P0113



Clear codes and confirm proper operation with no check engine lamp.

*** At some point in the flow chart you may be instructed to jump directly to the box marked by a bold asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.**

DTC P0117, P0118 5.23

GENERAL

ET Sensor

The ECM supplies and monitors a voltage signal (Pin 6) to one side of the engine temperature sensor (ET sensor). The other side of the ET sensor is connected to a common sensor ground, which is also connected to the ECM (Pin 26).

The ET sensor is a thermistor device, which means that at a specific temperature it will have a specific resistance across its terminals. As this resistance varies, so does the voltage on Pin 6.

- At high temperatures, the resistance of the sensor is very low, which effectively lowers the signal voltage on Pin 6.
- At low temperatures, the resistance is very high, allowing the voltage to rise close to 5 volts.

The ECM monitors this voltage to compensate for various operating conditions. The ECM also uses the sensor input as a reference for determining IAC pintle position.

Table 5-36. Code Description

DTC	LAMP CODE	DESCRIPTION
P0117	14	ET sensor voltage low
P0118	14	ET sensor open/high

Table 5-37. ET Sensor Table

TEMP °C	RESISTANCE	VOLTAGE	TEMP °F
-10	16599	4.5	14
0	9750	4.1	32
10	5970	3.8	50
20	3747	3.3	68
25	3000	3.0	77
30	2417	2.7	86
40	1598	2.2	104
50	1080	1.8	122
60	746	1.4	140
70	526	1.0	158
80	377	0.8	176
90	275	0.6	194
100	204	0.5	212
110	153	0.4	230

DIAGNOSTICS

Diagnostic Tips

The Scanalyzer displays engine temperature in degrees, or by pressing the F1 key, in volts. After the engine is started, the temperature should rise steadily.

An intermittent may be caused by a poor connection, rubbed through wire insulation or a wire broken inside the insulation.

Check the following conditions:

- **Poor connection:** Inspect ECM and harness connector [78] for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harness.
- **See Section 5.8 WIGGLE TEST to locate intermittents:** If connections and harness are OK, use the Scanalyzer to check the intake air temperature reading while moving related connectors and wiring harness. If failure is induced, the intake air temperature display will change.
- **Shifted sensor:** See Table 5-37. Use table to test the engine temperature sensor at various temperature levels in order to evaluate the possibility of a shifted (out-of-calibration) sensor which can result in driveability problems.

NOTE

All voltage and resistance values are approximate (±20%). Measure ET sensor resistance between ECM Terminal 6 and system ground (ECM Terminal 26).

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 5.23 flow charts.

1. Connect BREAKOUT BOX (Part No. HD-43876) to EFI wire harness **only** (leave ECM disconnected). See Section 5.7 BREAKOUT BOX: EFI.
2. If engine has not been operated for 1 hour, the measured resistance should be very close to the measured resistance across the IAT sensor which is Pins 7 and 26 on the Breakout Box. Scanalyzer values (using Data Monitor Mode) will be approximately the same if code is historic. Current code will read default value.
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), gray pin probes and patch cords.
4. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), gray socket probes and patch cords.
5. See ENGINE TEMPERATURE SENSOR, REMOVAL/INSTALLATION, in the 2003 Touring Models Service Manual (Part Number 99483-03).

Scanalyzer Notes

The Scanalyzer icon appears at those points in the flow chart where the Scanalyzer can be used.

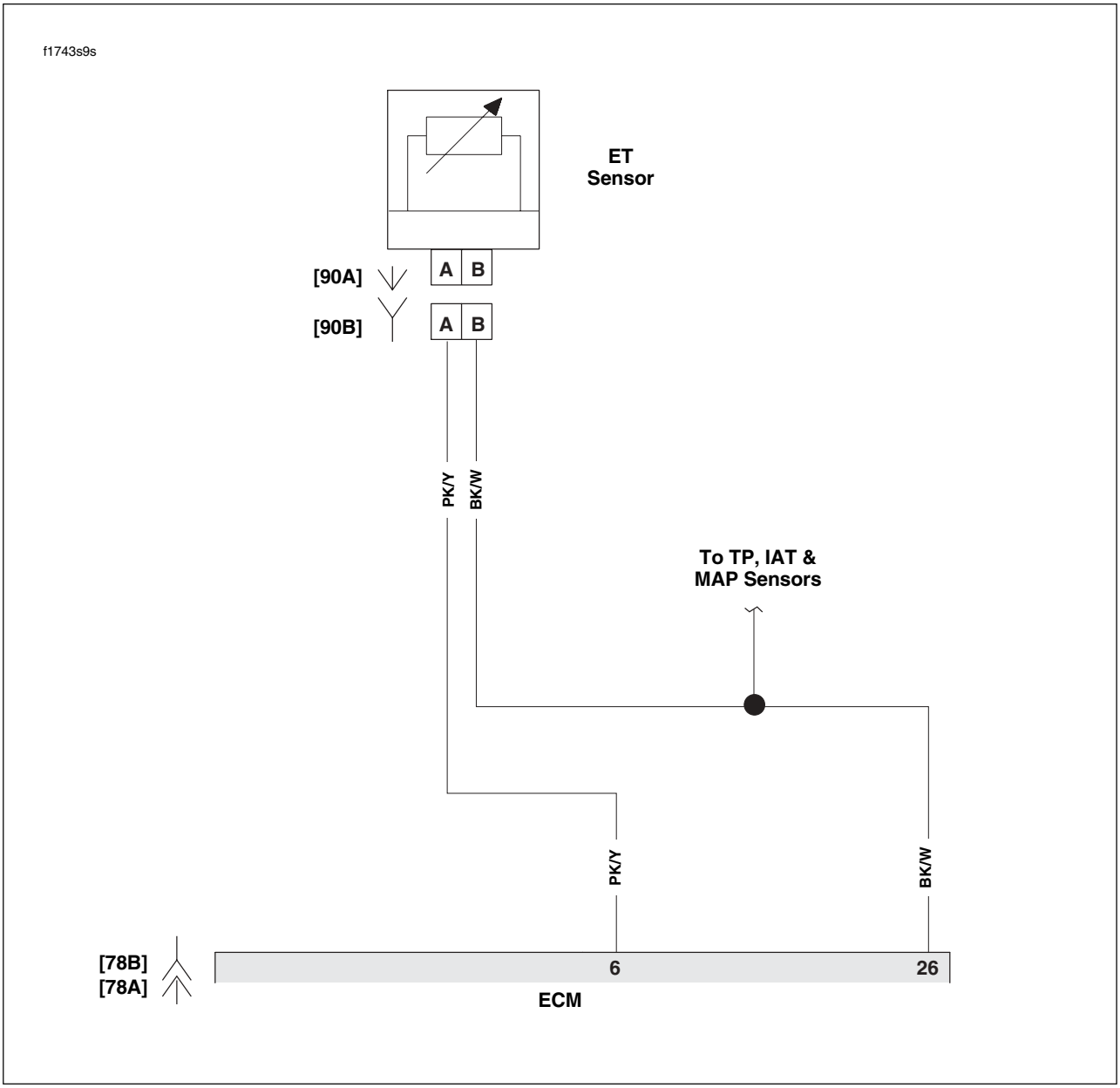


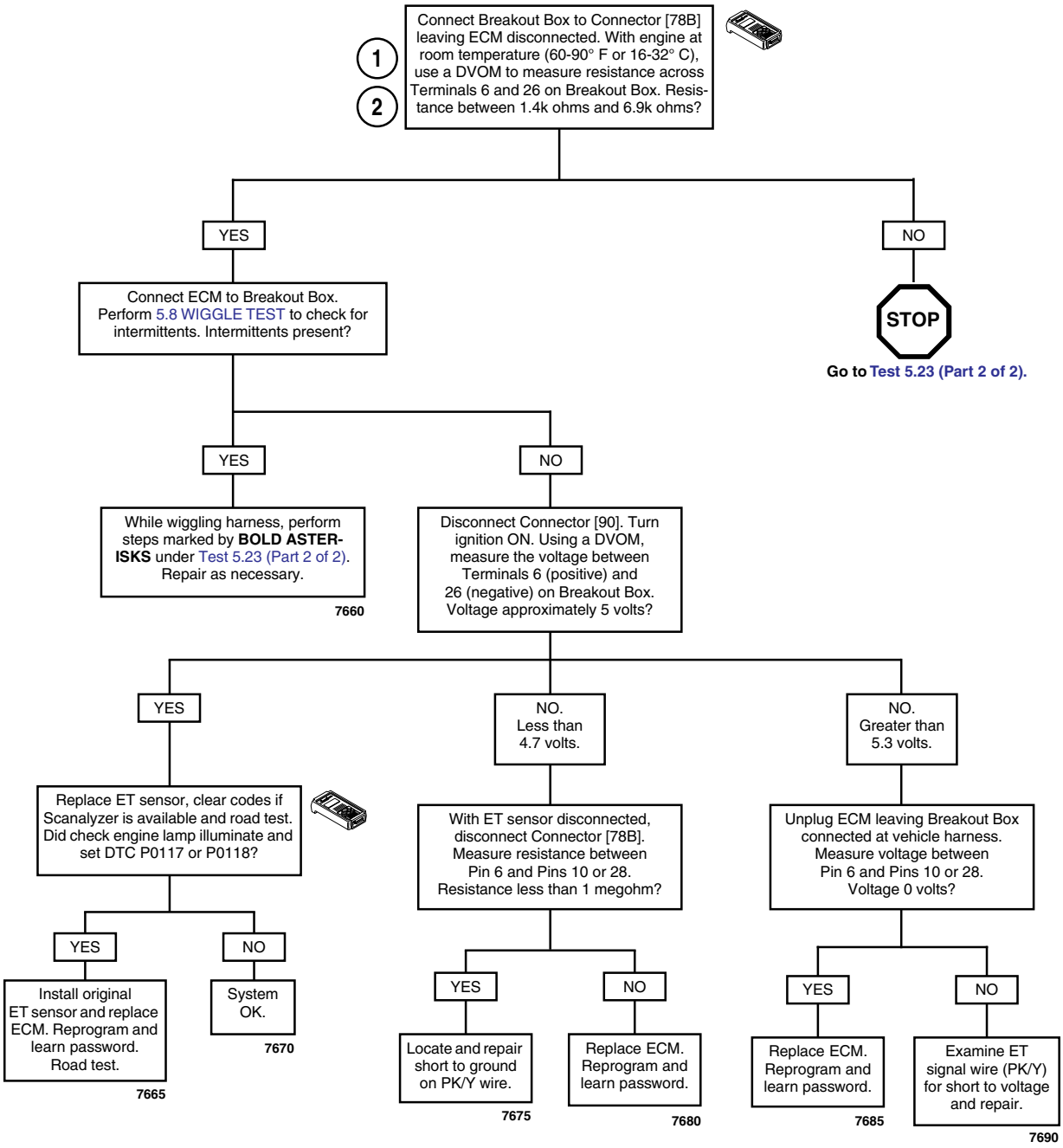
Figure 5-54. ET Sensor Circuit

Table 5-38. Wire Harness Connectors in Figure 5-54.

NO.	DESCRIPTION	TYPE	LOCATION
[78]	ECM	36-Place Packard	Under Right Side Cover
[90]	ET Sensor	2-Place Packard	Back of Front Cylinder (Left Side)

Test 5.23 (Part 1 of 2)

ET SENSOR: DTC P0117, P0118

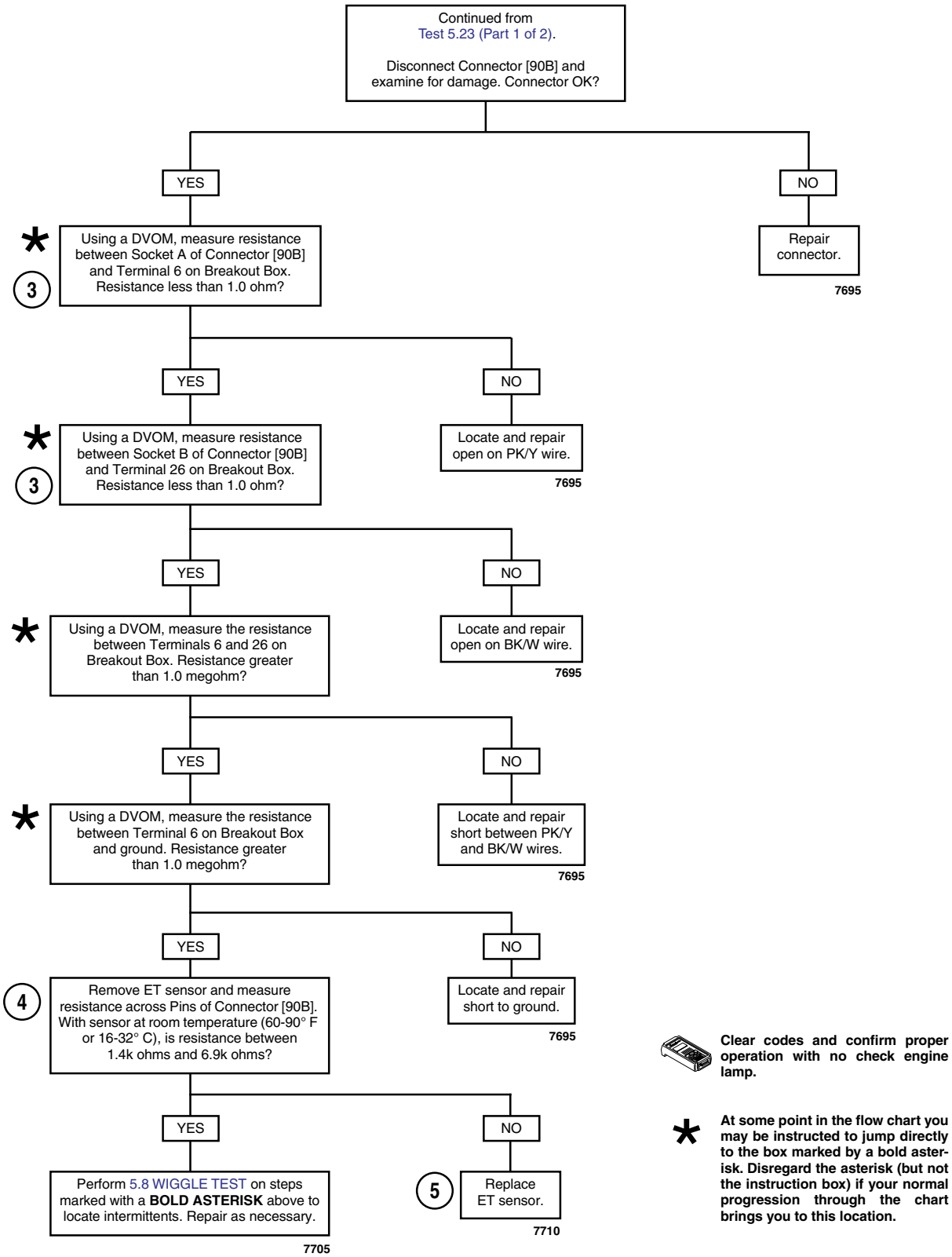


Clear codes and confirm proper operation with no check engine lamp.

*** At some point in the flow chart you may be instructed to jump directly to the box marked by a bold asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.**

Test 5.23 (Part 2 of 2)

ET SENSOR: DTC P0117, P0118



Clear codes and confirm proper operation with no check engine lamp.

* **At some point in the flow chart you may be instructed to jump directly to the box marked by a bold asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.**

DTC P0122, P0123 5.24

GENERAL

TP Sensor

The ECM supplies a 5 volt signal (Pin 14) to the throttle position sensor (TP sensor). The TP sensor sends a signal back to the ECM (Pin 24). The returned signal varies in voltage according to throttle position.

- At idle (closed throttle), the signal is typically in the range of 0.20-0.60 volts.
- At wide open throttle, the signal is normally 4.6-4.9 volts.

A code P0122 or P0123 will set if the TP sensor voltage signal does not fall within the acceptable range.

- If TPS sensor is greater than 90%, then the system is in “clear flood” mode and engine will not start. While spark will be present, fuel is shut off (injectors disabled). Problem can be mechanical, such as throttle/throttle cables stuck.

Table 5-39. Code Description

DTC	LAMP CODE	DESCRIPTION
P0122	11	TP sensor open/low
P0123	11	TP sensor high

DIAGNOSTICS

Diagnostic Tips

The Scanalyzer or DVOM reads throttle position in volts, or by pressing the F1 key, as a percentage of throttle opening. Voltage should increase at a steady rate as the throttle is moved from idle to wide open. A short to ground or open on the GY/V or R/W wires also will result in a DTC P0122. A short to ground or open on the R/W wire (+5v REF) sets multiple codes as described below.

NOTE

The MAP and TP sensors are both connected to the same reference line (+5v Vref). If the line goes to ground or open, multiple trouble codes will be set, that is, diagnostic trouble codes P0107, P0108 and P0122 or P0123. Start with the trouble code having the lowest ranking value.

Check for the following conditions:

- **Poor Connection:** Inspect ECM and harness connector [78B] for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harness.
- **Perform 5.8 WIGGLE TEST to locate intermittents:** If connections and harness check out OK, monitor TP sensor voltage using a Scanalyzer or DVOM while moving related connectors and wiring harness. If the failure is induced, the TP sensor display will also change in data monitor mode.
- **TP sensor scaling:** Observe the TP sensor voltage display while opening the throttle with engine stopped and ignition key ON. Display should vary from closed throttle TP sensor voltage (when throttle is closed) to greater than 4.5 volts (when throttle is held wide open). As the throttle is **slowly** moved, the voltage should change gradually without spikes or low voltages being observed.

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 5.24 flow charts.

1. Connect a BREAKOUT BOX (Part No. HD-43876) between EFI wire harness and ECM before measuring voltage. See Section 5.7 BREAKOUT BOX: EFI.
   a. If using a DVOM to measure voltage, take reading across Pin 24 (positive lead) and Pin 26 (negative lead) on Breakout Box.
   b. If using Scanalyzer to measure voltage, consult Data Monitor Mode. See Section 5.5 SCANALYZER: EFI for more information.
2. See THROTTLE POSITION SENSOR, REMOVAL/INSTALLATION, in the 2003 Touring Models Service Manual (Part Number 99483-03).
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), gray pin probes and patch cords.

Scanalyzer Notes

The Scanalyzer icon appears at those points in the flow chart where the Scanalyzer can be used.

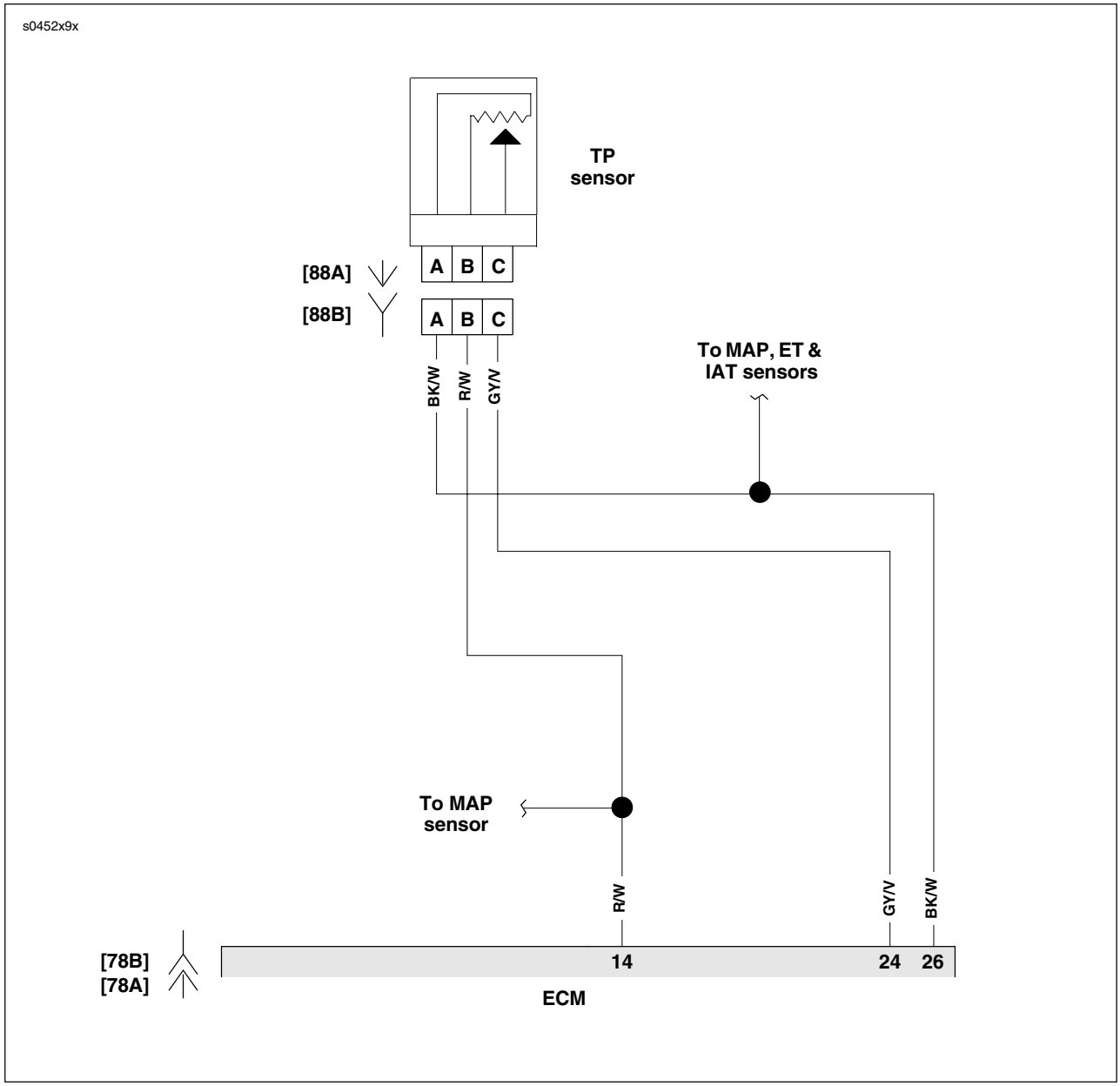


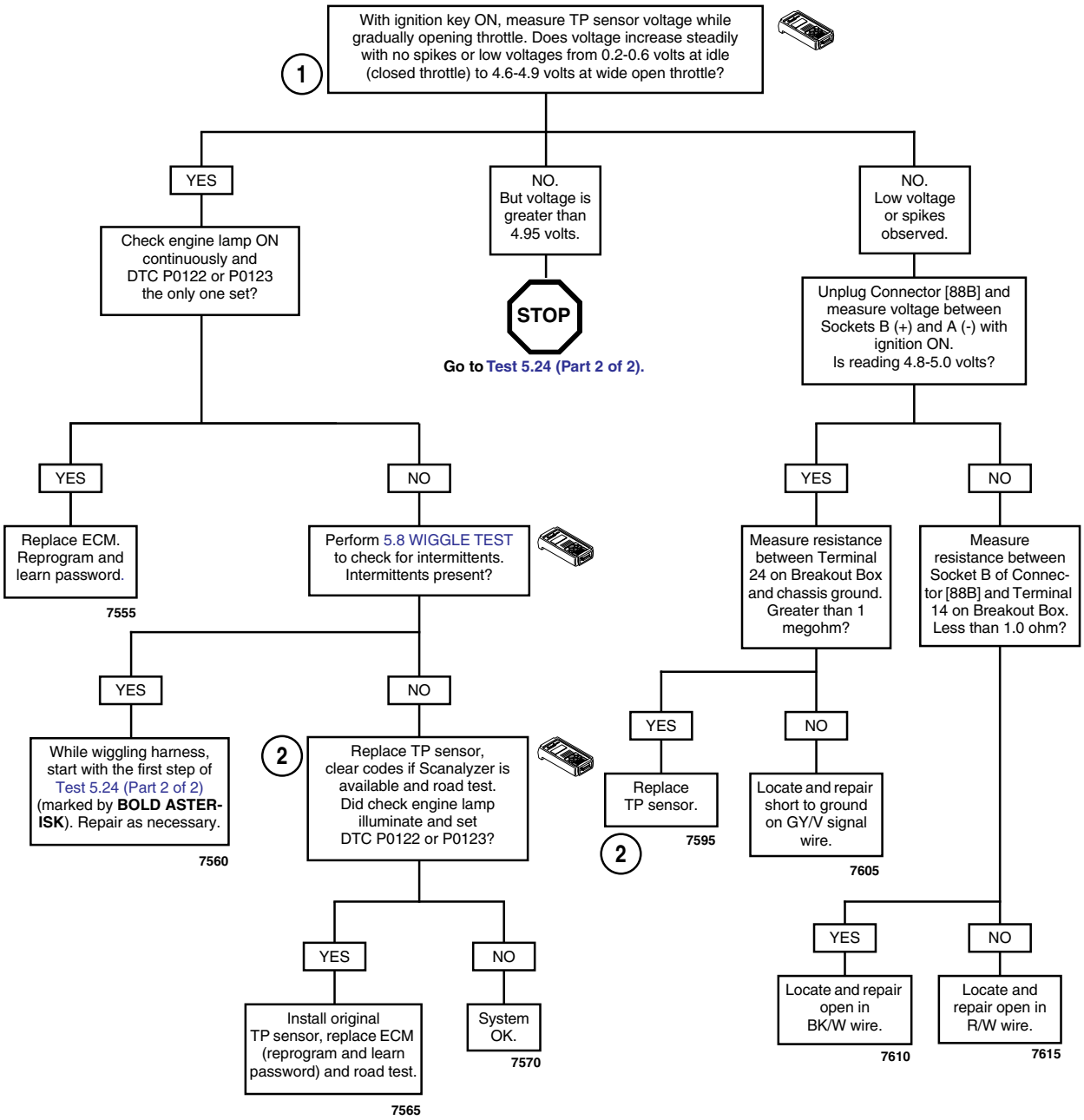
Figure 5-55. TP Sensor Circuit

Table 5-40. Wire Harness Connectors in Figure 5-55.

NO.	DESCRIPTION	TYPE	LOCATION
[78]	ECM	36-Place Packard	Under Right Side Cover
[88]	TP Sensor	3-Place Packard	Below Fuel Tank (Right Side)

Test 5.24 (Part 1 of 2)

TP SENSOR: DTC P0122, P0123

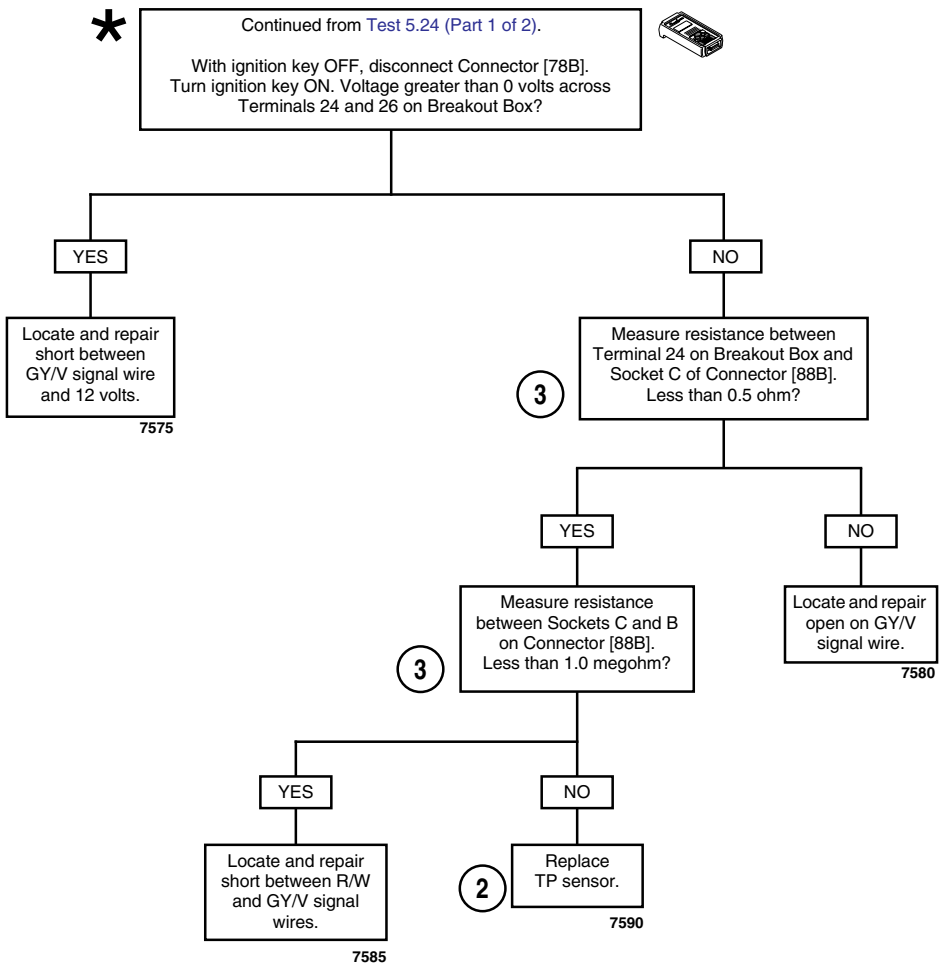


Clear codes and confirm proper operation with no check engine lamp.

*** At some point in the flow chart you may be instructed to jump directly to the box marked by a bold asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.**

Test 5.24 (Part 2 of 2)

TP SENSOR: DTC P0122, P0123



Clear codes and confirm proper operation with no check engine lamp.

At some point in the flow chart you may be instructed to jump directly to the box marked by a bold asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.

GENERAL

Fuel Injectors

The fuel injectors are solenoids that allow pressurized fuel into the intake tract. The injectors are timed to the engine cycle and triggered sequentially. The power for the injectors comes from the system relay. The system relay also provides power for the fuel pump and the ignition coil. The ECM provides the path to ground to trigger the injectors.

NOTE

ECM power fuse and EFI system relay failures or wiring harness problems will cause 12 volt power to be lost to both injectors, ignition coils and fuel pump.

Table 5-41. Code Description

DTC	LAMP CODE	DESCRIPTION
P0261	23	Front injector open/low
P0262	23	Front injector high
P0263	32	Rear injector open/low
P0264	32	Rear injector high

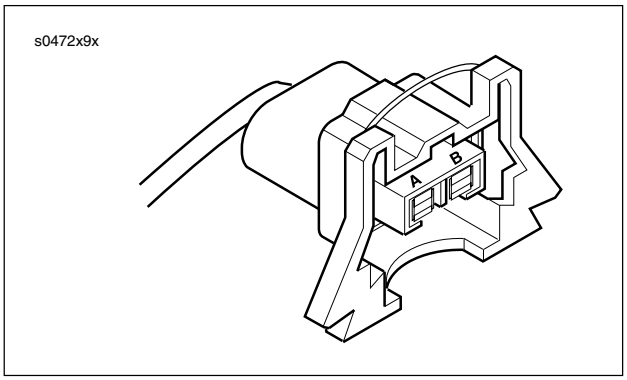


Figure 5-56. Fuel Injector Connector

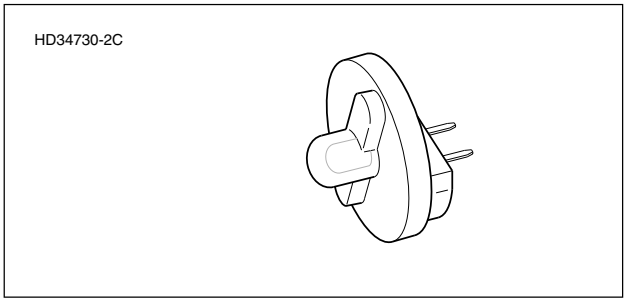


Figure 5-57. Fuel Injector Test Lamp (Part No. HD-34730-2C)

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 5.25 flow charts.

1. See FUEL INJECTORS, REMOVAL/INSTALLATION, in the 2003 Touring Models Service Manual (Part Number 99483-03).
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), purple pin probe and patch cord.
3. Connect a BREAKOUT BOX (Part No. HD-43876) between EFI wire harness and ECM. See Section 5.7 BREAKOUT BOX: EFI.
4. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), gray socket probe and patch cord.

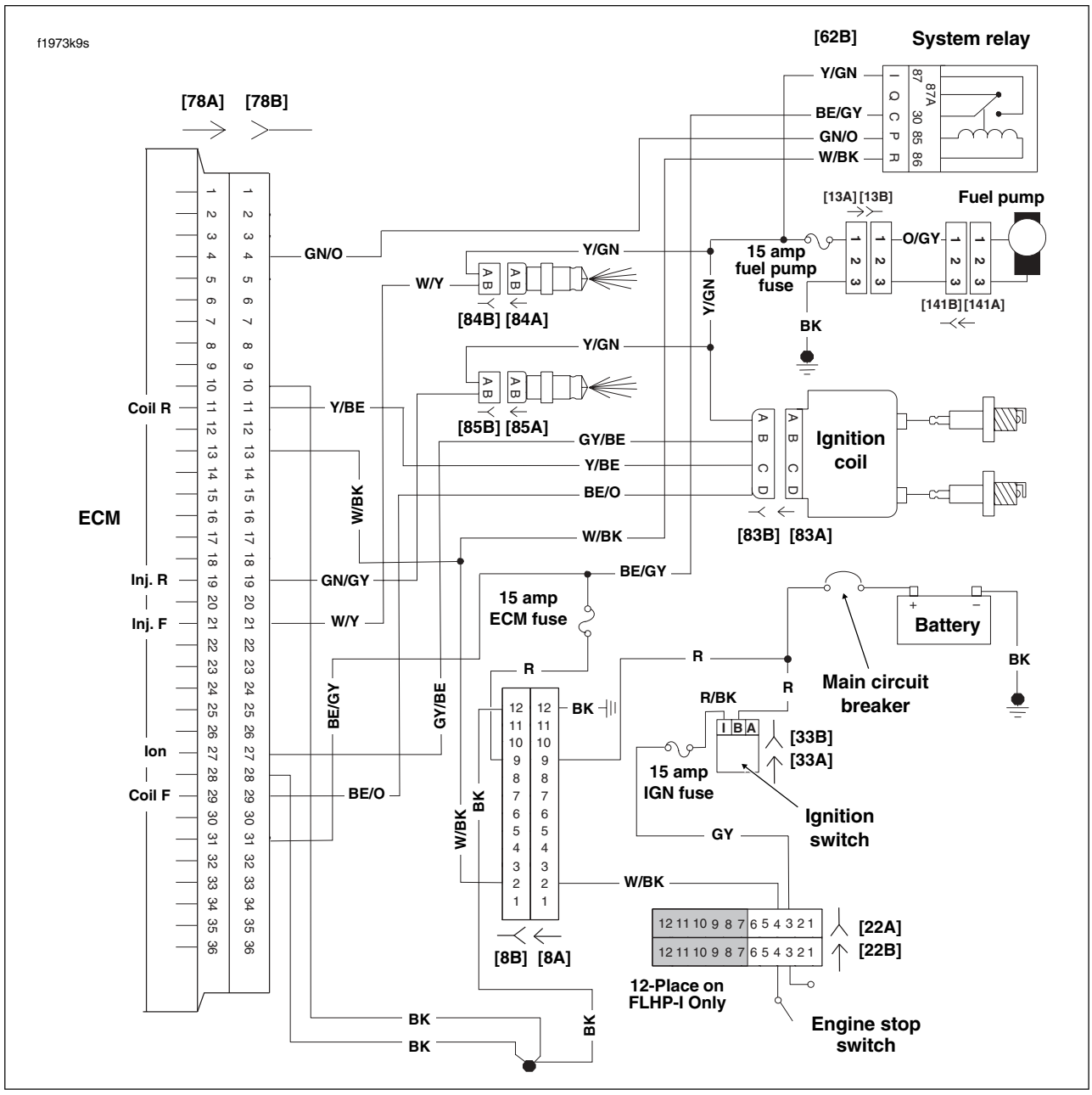


Figure 5-58. Battery Voltage Circuit Diagram (FLHR/C-I, FLHP-I)

Table 5-42. Wire Harness Connectors in Figure 5-58.

NO.	DESCRIPTION	TYPE	LOCATION
[8]	Ignition (Main to EFI Harness)	12-Place Deutsch (Gray)	Under Right Side Cover
[22]	Right Handlebar Switches	12-Place Deutsch (Black)	Inside Headlamp Nacelle
[33]	Ignition/Light Key Switch	3-Place Packard	Under Left Side Cover
[78]	ECM	36-Place Packard	Under Right Side Cover
[83]	Ignition Coil	4-Place Packard	Below Fuel Tank (Left Side)
[84]	Front Injector	2-Place Packard	Below Fuel Tank (Left Side)
[85]	Rear Injector	2-Place Packard	Below Fuel Tank (Left Side)

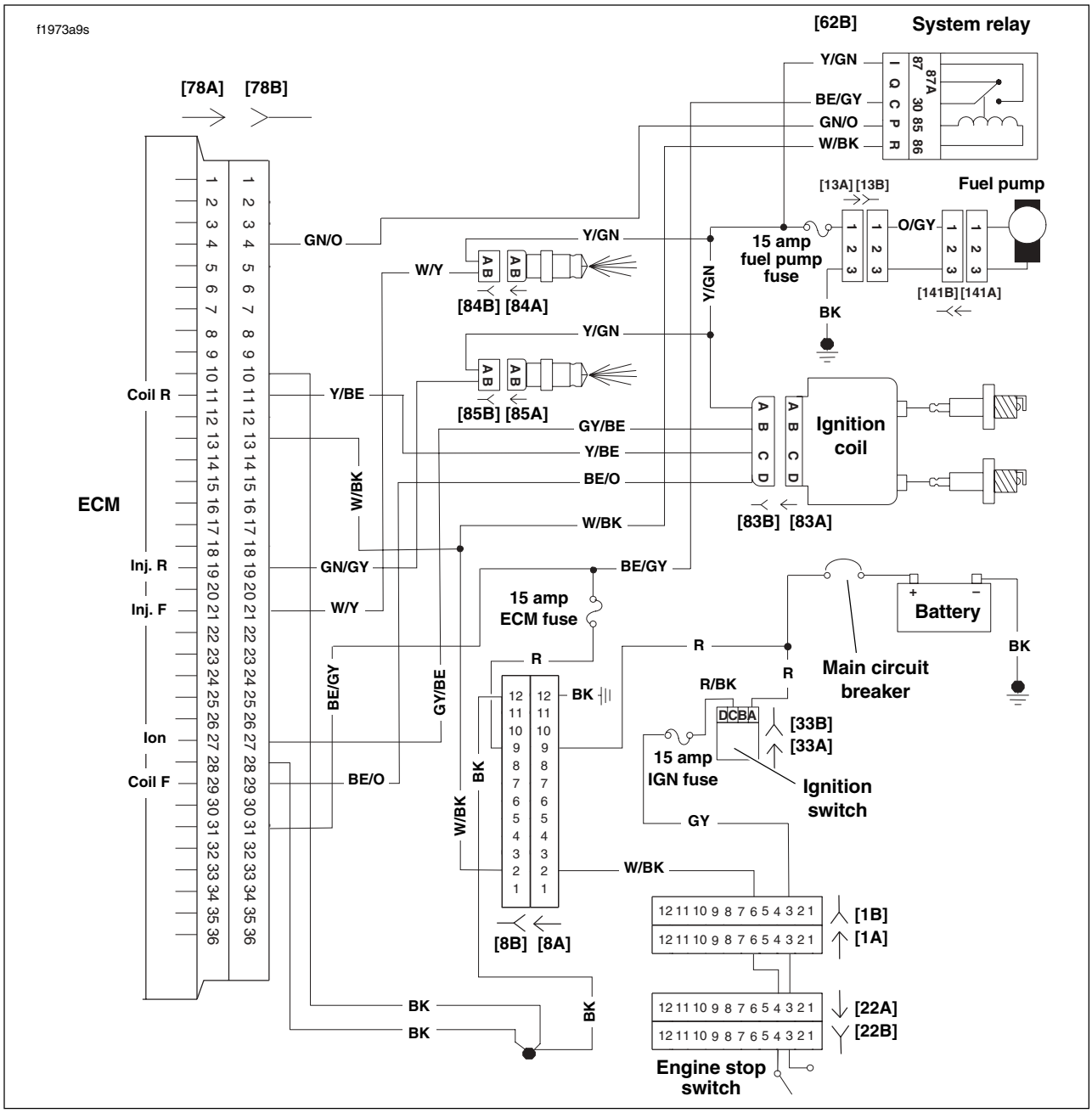


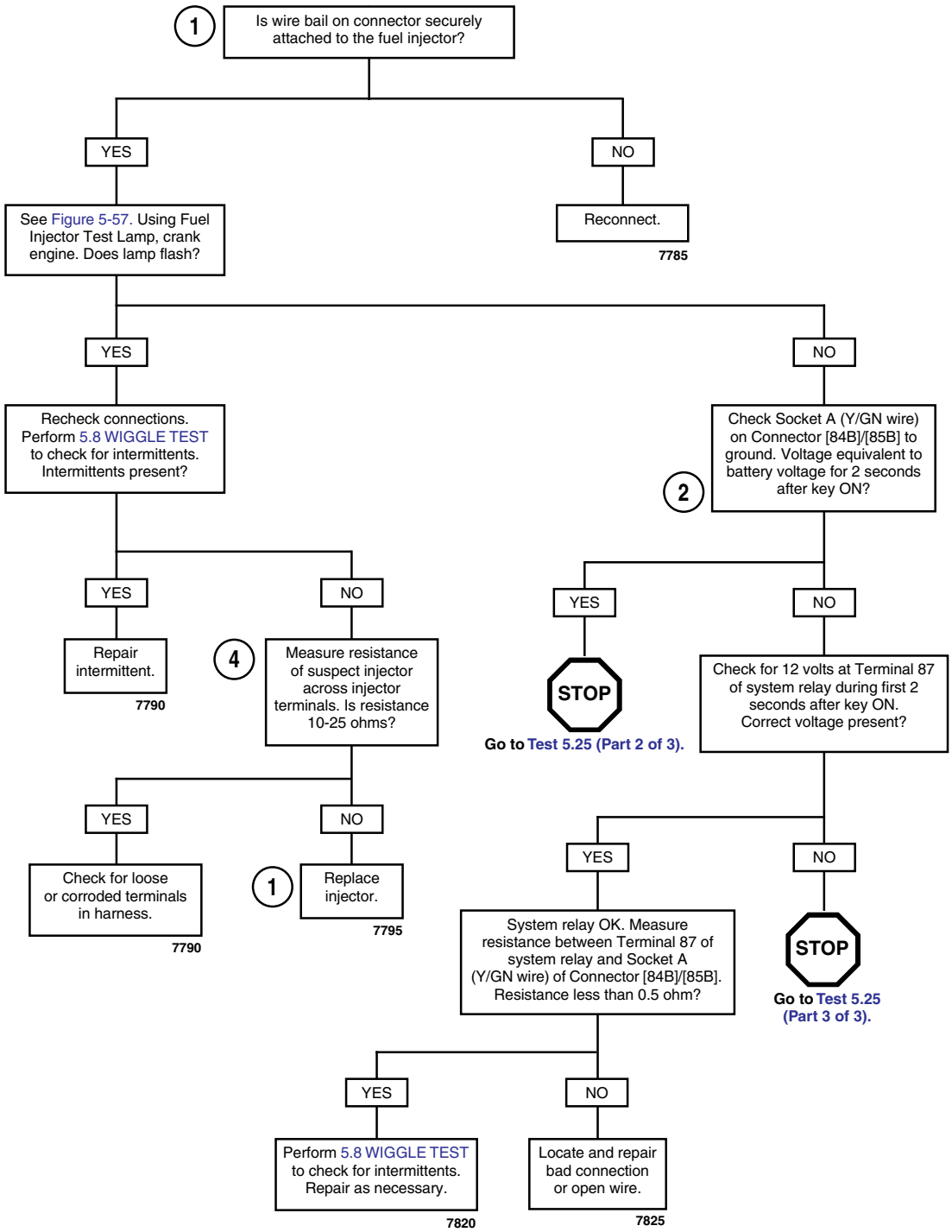
Figure 5-59. Battery Voltage Circuit Diagram (FLTR-I, FLHTC/U-I)

Table 5-43. Wire Harness Connectors in Figure 5-59.

NO.	DESCRIPTION	TYPE	LOCATION
[1]	Main to Interconnect Harness	12-Place Deutsch (Black)	Inner Fairing (Right Fairing Bracket)
[8]	Main to EFI Harness	12-Place Deutsch (Gray)	Under Right Side Cover
[22]	Right Handlebar Switches	12-Place Deutsch (Black)	Inner Fairing (Right Fairing Support Brace)
[33]	Ignition/Light Key Switch	4-Place Packard	Inner Fairing (Top Fork Bracket)
[78]	ECM	36-Place Packard	Under Right Side Cover
[83]	Ignition Coil	4-Place Packard	Below Fuel Tank (Left Side)
[84]	Front Injector	2-Place Packard	Below Fuel Tank (Left Side)
[85]	Rear Injector	2-Place Packard	Below Fuel Tank (Left Side)

Test 5.25 (Part 1 of 3)

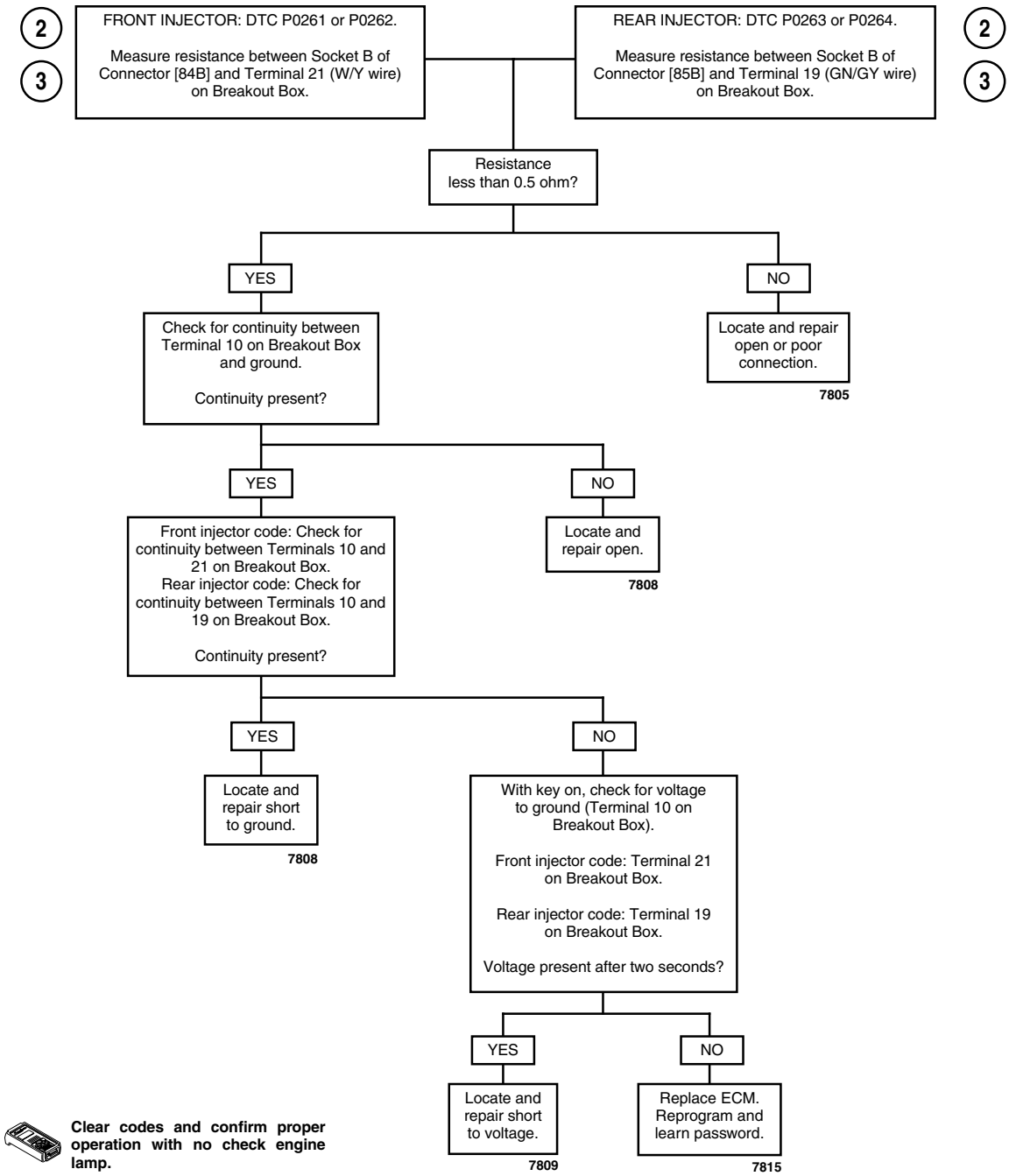
FUEL INJECTORS: DTC P0261, P0262, P0263, P0264



Clear codes and confirm proper operation with no check engine lamp.

Test 5.25 (Part 2 of 3)

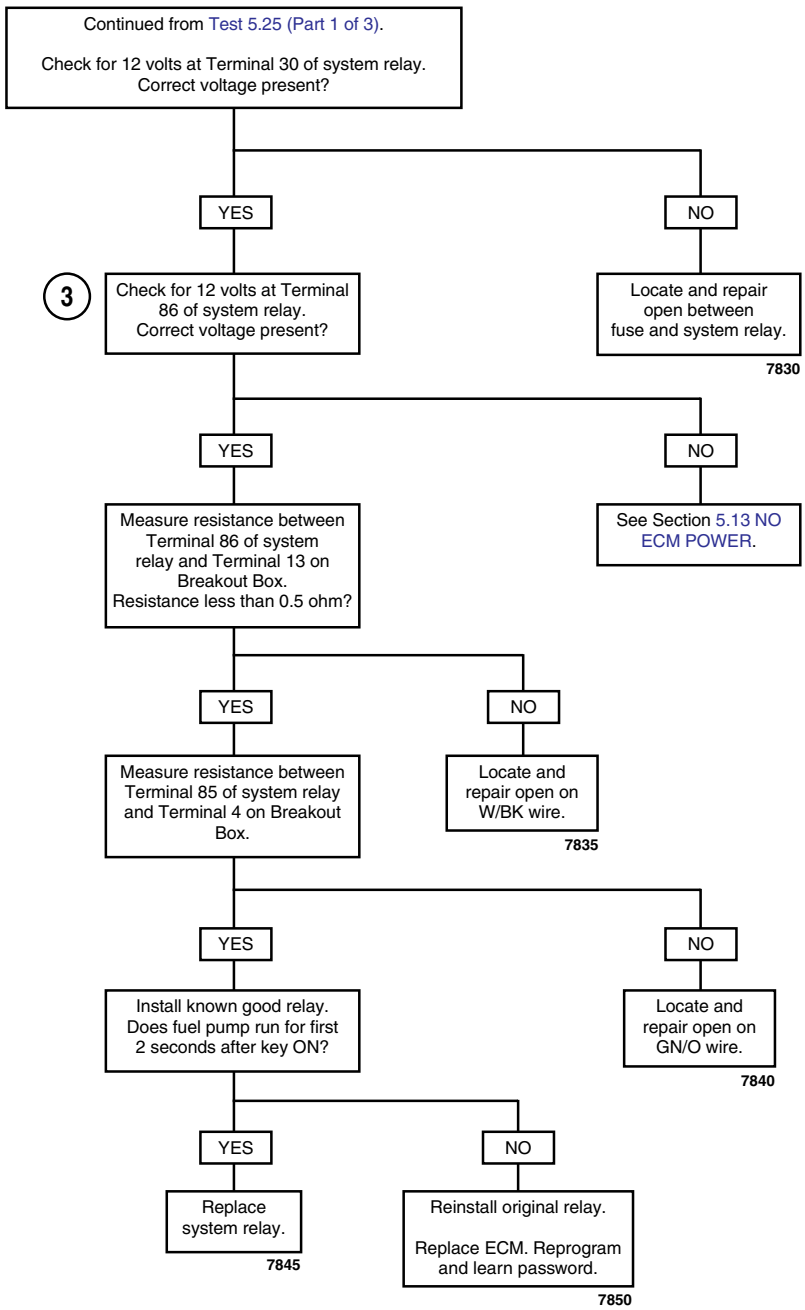
FUEL INJECTORS: DTC P0261, P0262, P0263, P0264



Clear codes and confirm proper operation with no check engine lamp.

Test 5.25 (Part 3 of 3)

FUEL INJECTORS: DTC P0261, P0262, P0263, P0264



Clear codes and confirm proper operation with no check engine lamp.

DTC P0373, P0374 5.26

GENERAL

CKP Sensor

If the crank position sensor (CKP sensor) signal is weak or absent, diagnostic trouble codes P0373 or P0374 will be set.

NOTE

If signal is not detected or cannot synchronize (DTC P0374), engine will not start.

Table 5-44. Code Description

DTC	LAMP CODE	DESCRIPTION
P0373	41	CKP sensor intermittent
P0374	41	CKP sensor synch error

DIAGNOSTICS

Diagnostic Tips

- Engine must be cranked for more than five seconds without CKP signal to set code.
- With a fully charged battery and vehicle at room temperature, the Scanalyzer should display RPM in Data Monitor Mode while cranking. (A low voltage during cranking may cause the Scanalyzer to reset). If RPM is present, problem is intermittent.

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 5.26 flow chart.

1. Connect BREAKOUT BOX (Part No. HD-43876) to ECM wire harness **only** (leave ECM disconnected). See Section 5.7 BREAKOUT BOX: EFI.
2. One megohm is very high resistance. Some meters will read ∞, OL, etc.
3. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), brown socket probes and patch cords.
4. For testing purposes, install sensor without running wiring along normal path. Disconnect and route wiring properly if system is now OK.

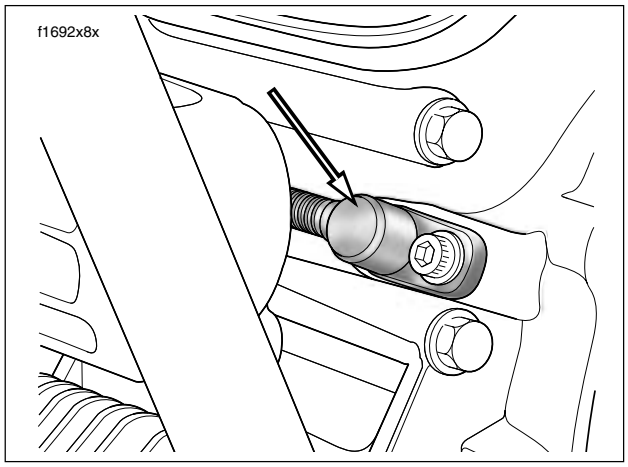


Figure 5-60. CKP Sensor

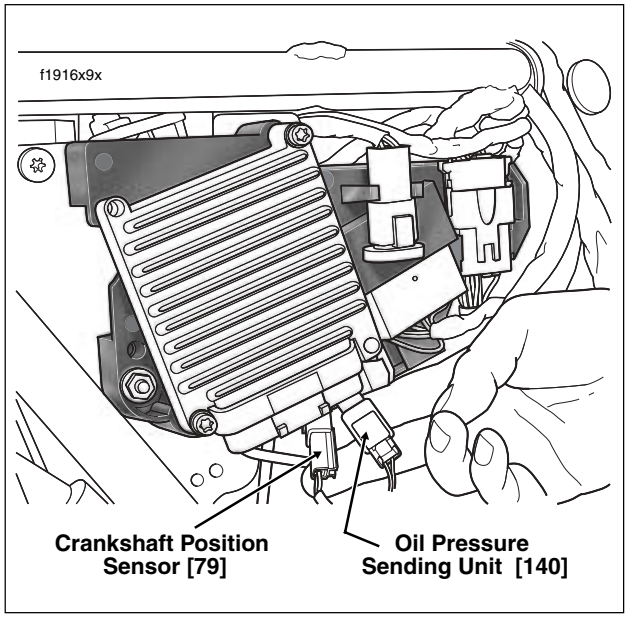


Figure 5-61. CKP Sensor Connector Location

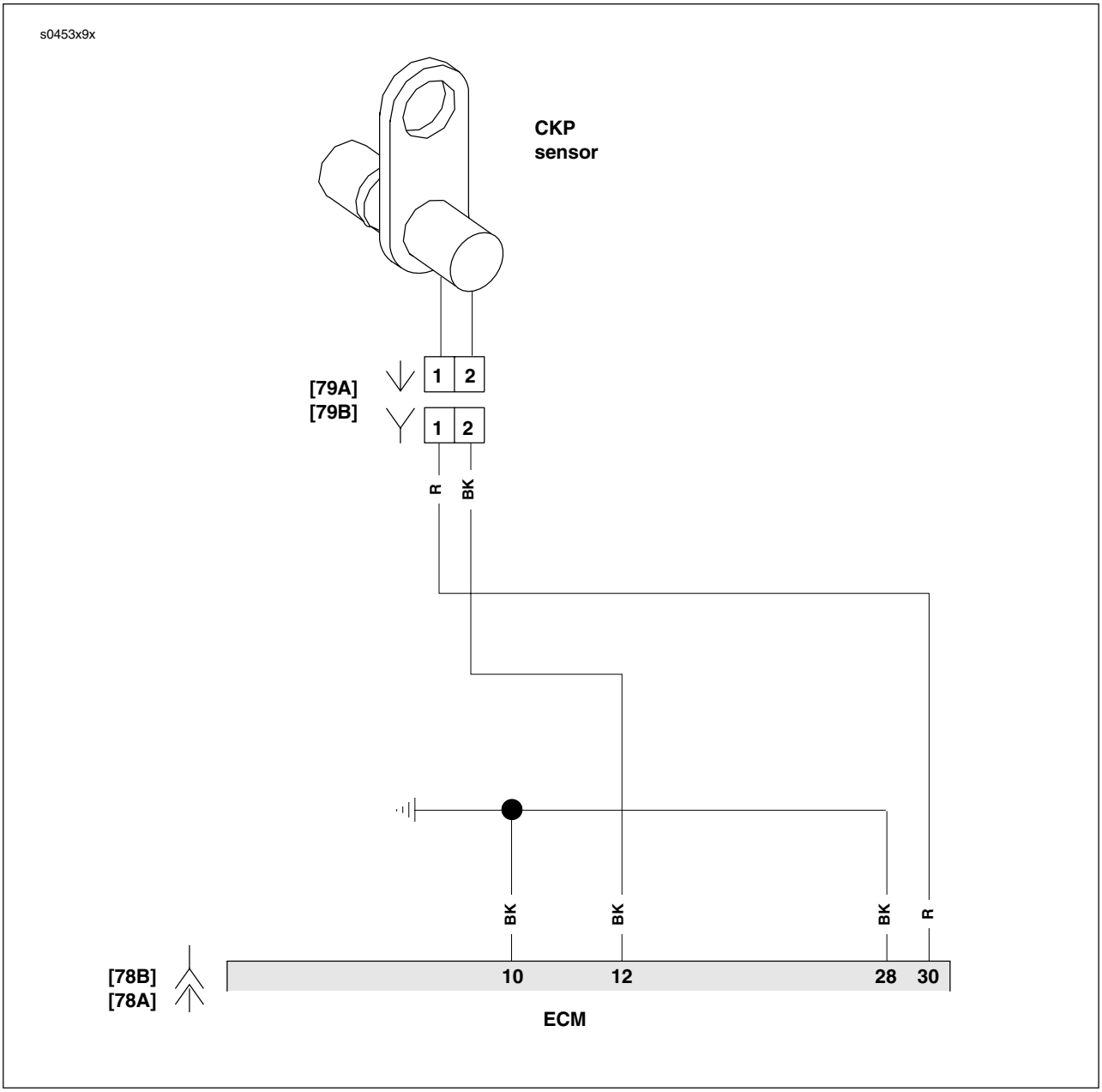


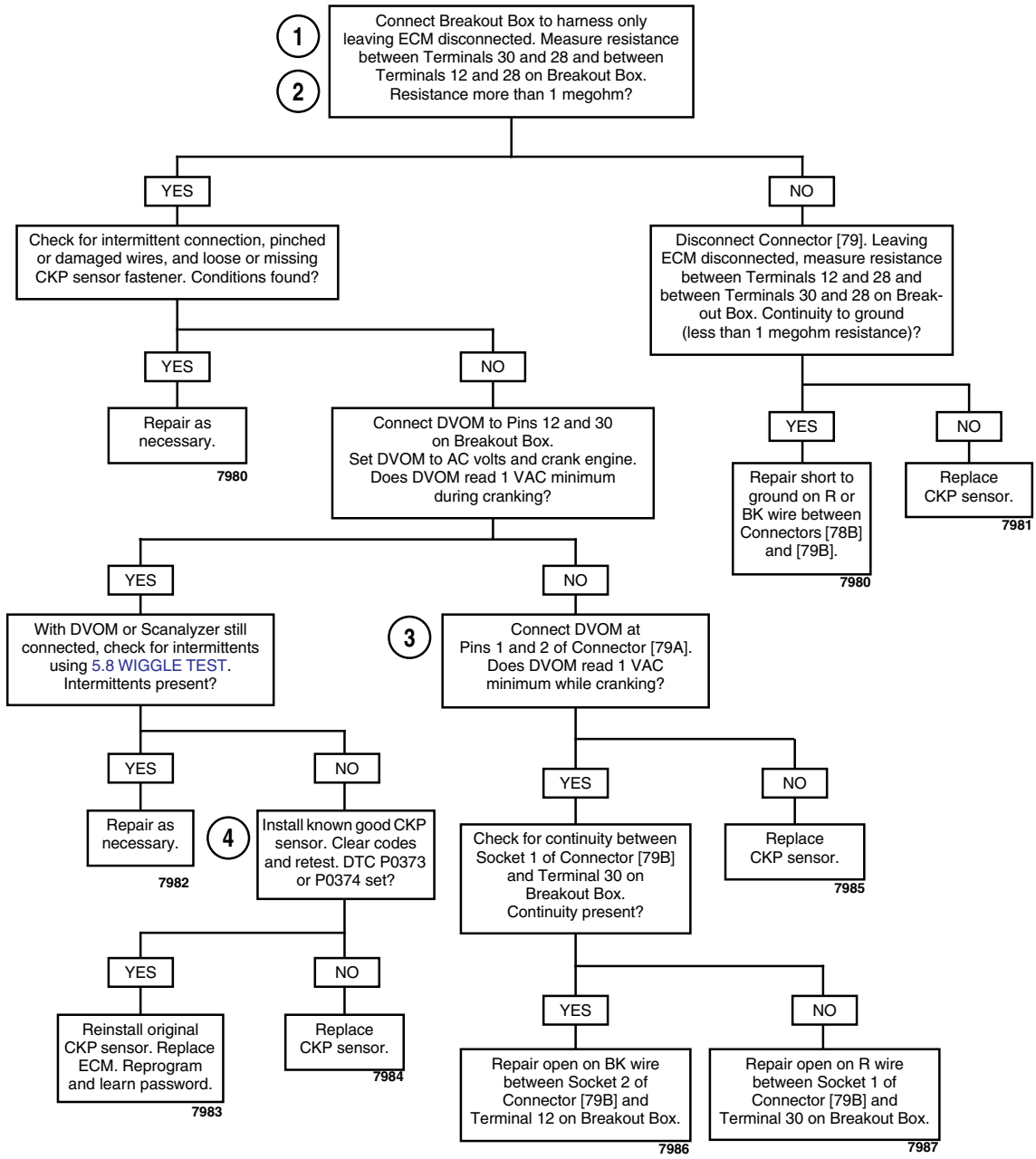
Figure 5-62. CKP Circuit

Table 5-45. Wire Harness Connectors in Figure 5-62.

NO.	DESCRIPTION	TYPE	LOCATION
[78]	ECM	36-Place Packard	Under Right Side Cover
[79]	CKP Sensor	2-Place Mini-Deutsch	Under Right Side Cover

Test 5.26

CKP SENSOR: DTC P0373, P0374



Clear codes and confirm proper operation with no check engine lamp.

GENERAL

Vehicle Speed Sensor

See Figure 5-63. The vehicle speed sensor is powered and monitored by the speedometer. The speedometer sends a vehicle speed signal (9000 pulses/mile) to the ECM. The ECM processes the vehicle speed signal and transmits this signal to the TSM/TSSM through the serial data line.

NOTE

When the vehicle speed signal is greater than 0, the idle speed control is inhibited.

Table 5-46. Code Description

DTC	LAMP CODE	DESCRIPTION
P0501	43	VSS sensor low
P0502	43	VSS sensor high

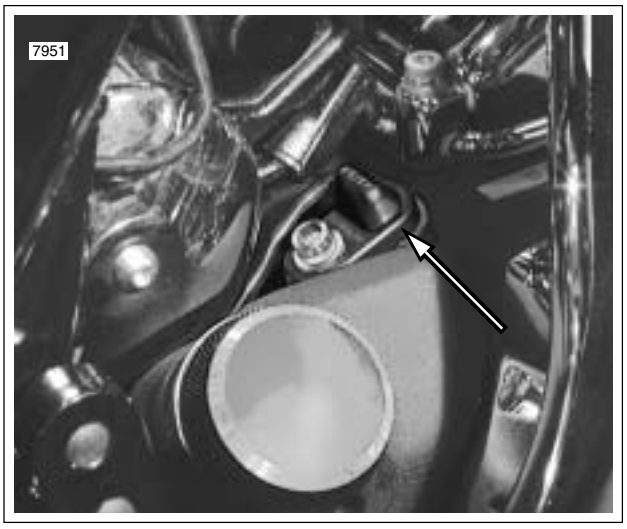


Figure 5-63. Speedometer Speed Sensor

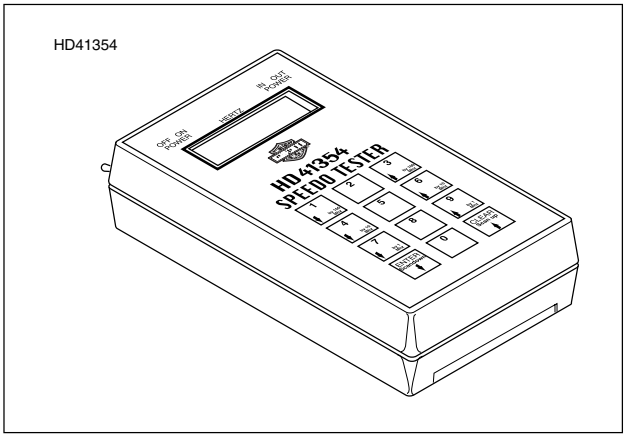


Figure 5-64. Speedometer Tester

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 5.27 flow charts.

1. The speedometer has a built-in diagnostic mode.
   a. To enter diagnostic mode, depress odometer reset switch and turn ignition switch to IGN.
   b. To clear codes, depress odometer reset switch and hold for ten seconds.
   c. To return speedometer to normal operating mode, cycle ignition switch.
2. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness and ECM. See Section 5.7 BREAKOUT BOX: EFI.
3. See Figure 5-64. Check system using SPEEDOMETER TESTER (Part No. HD-41354). Enter the number **70** to simulate 3 MPH. If tester is not available, elevate the rear wheel and spin briskly while looking for a voltage drop.
4. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), black pin probe and patch cord.

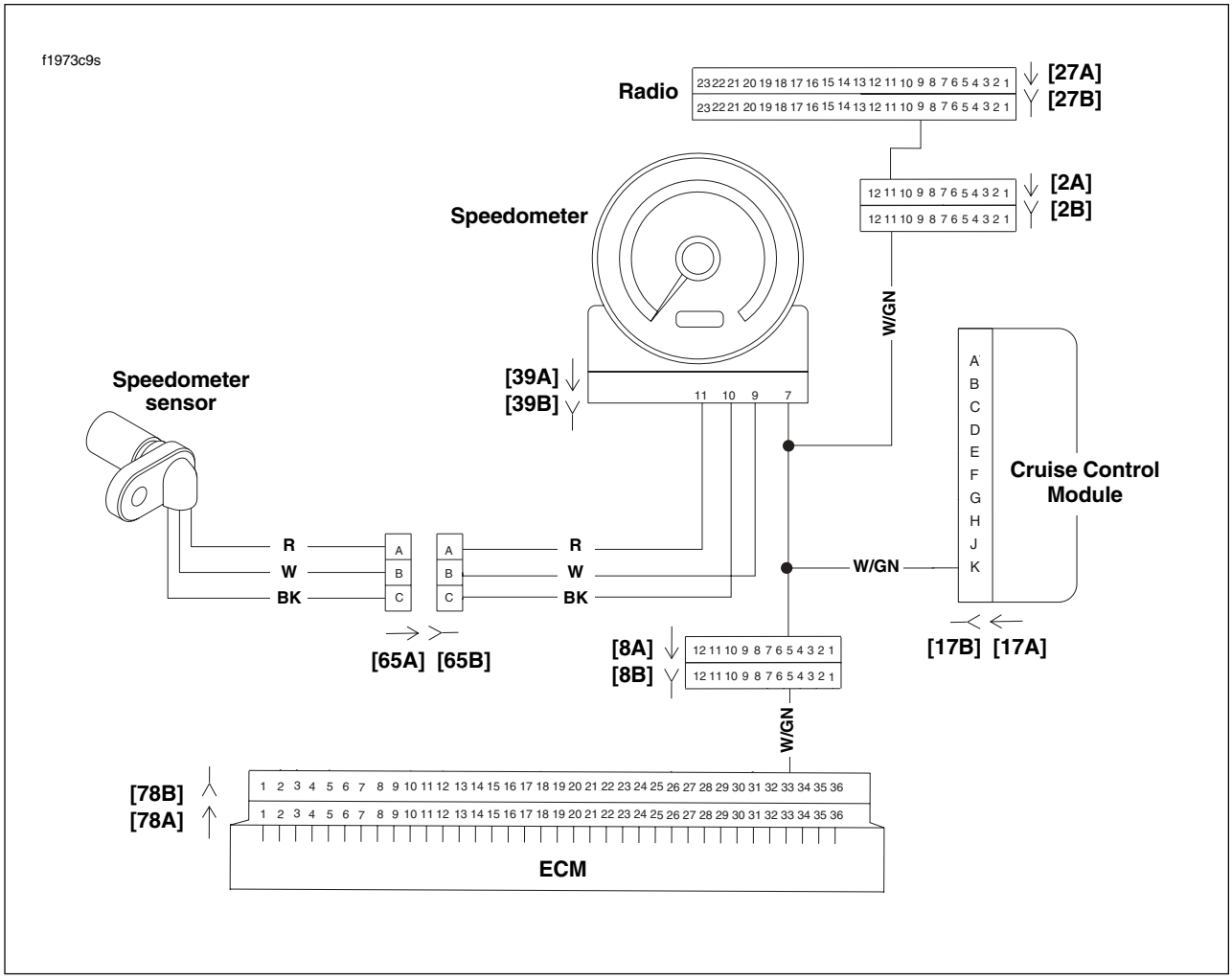


Figure 5-65. Vehicle Speed Sensor Circuit (FLTR-I, FLHTC/U-I)

Table 5-47. Wire Harness Connectors in Figure 5-65.

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[2]	Main to Interconnect Harness	All	12-Place Deutsch (Gray)	Inner Fairing (Right Radio Support Bracket)
[8]	Ignition (Main to EFI Harness)	All	12-Place Deutsch (Gray)	Under Right Side Cover
[17]	Cruise Control Module	All	10-Place Packard	Under Left Side Cover
[27]	Radio	All	23-Place Amp (Black)	Inner Fairing -Back of Radio (Right Side)
[39]	Speedometer	FLTR-I	12-Place Packard	Under Instrument Bezel (Back of Speedometer)
		FLHTC/U-I	12-Place Packard	Inner Fairing (Back of Speedometer)
[65]	Speedometer Speed Sensor	All	3-Place Deutsch	Upper Frame Crossmember (Under Seat)
[78]	ECM	All	36-Place Packard	Under Right Side Cover

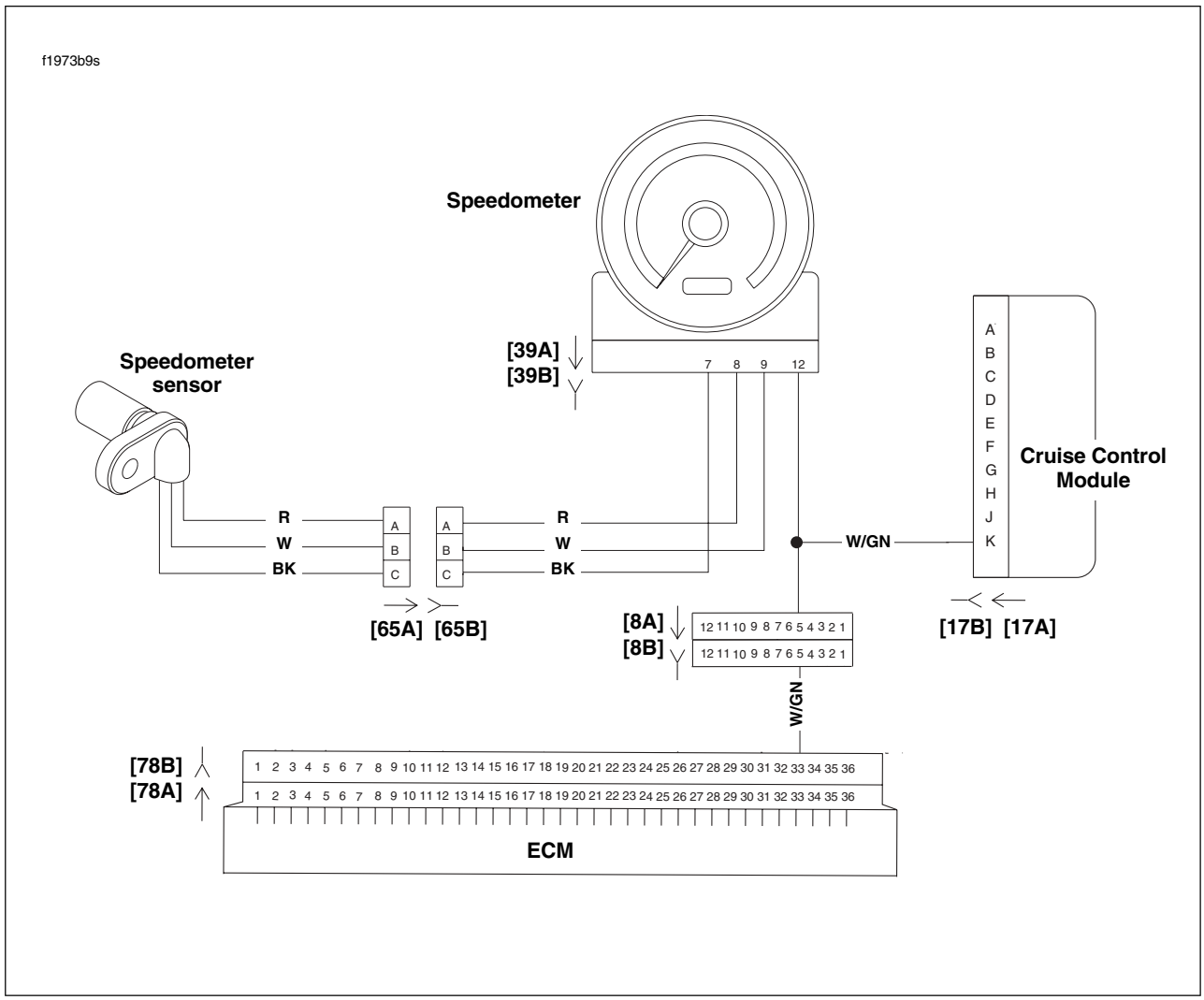


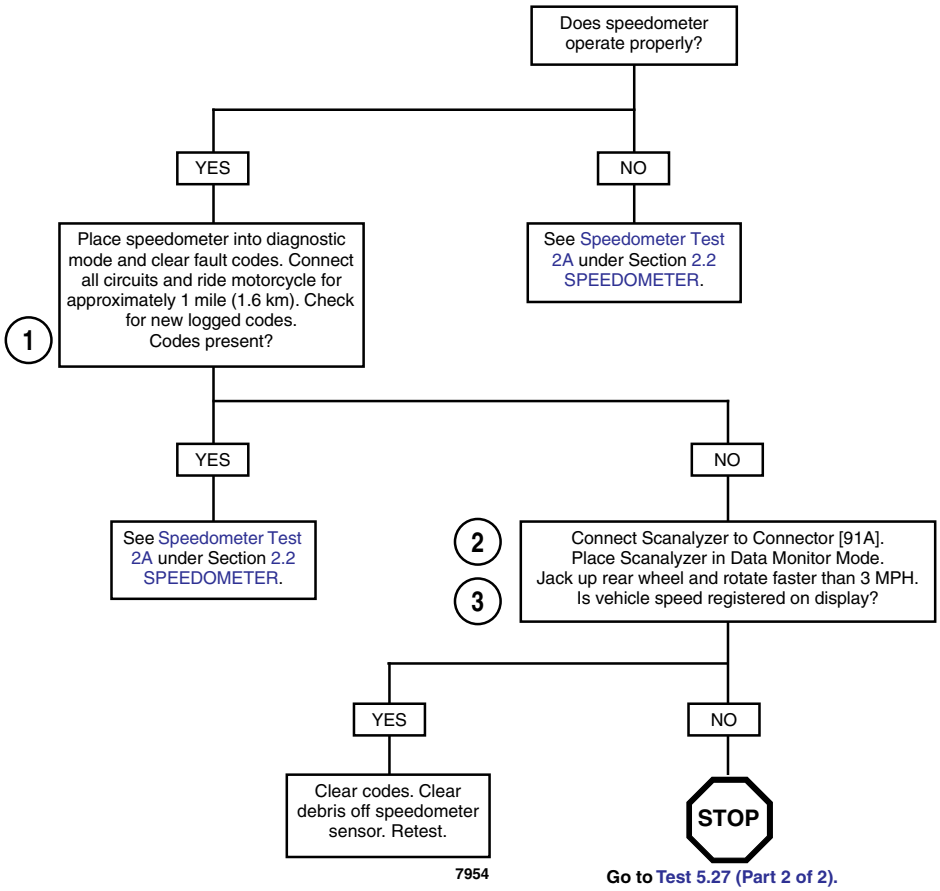
Figure 5-66. Vehicle Speed Sensor Circuit (FLHR/C-I)

Table 5-48. Wire Harness Connectors in Figure 5-66.

NO.	DESCRIPTION	TYPE	LOCATION
[8]	Ignition (Main to EFI Harness)	12-Place Deutsch (Gray)	Under Right Side Cover
[17]	Cruise Control Module	10-Place Packard	Under Left Side Cover
[39]	Speedometer	12-Place Mini-Deutsch	Back of Speedometer (Under Console)
[65]	Speedometer Speed Sensor	3-Place Deutsch	Upper Frame Crossmember (Under Seat)
[78]	ECM	36-Place Packard	Under Right Side Cover

Test 5.27 (Part 1 of 2)

VEHICLE SPEED SENSOR: DTC P0501, P0502

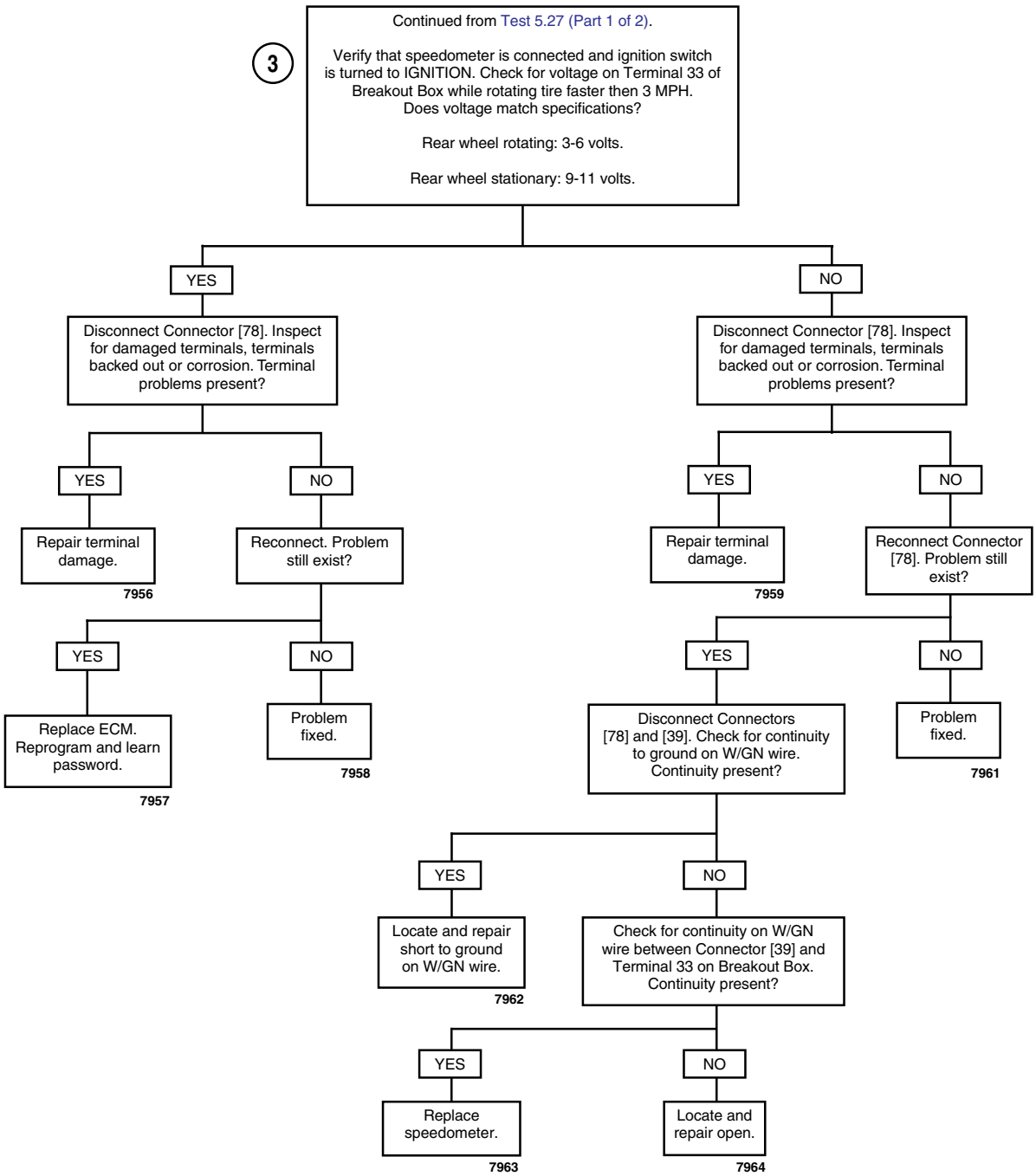


Clear codes and confirm proper operation with no check engine lamp.

*** At some point in the flow chart you may be instructed to jump directly to the box marked by a bold asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.**

Test 5.27 (Part 2 of 2)

VEHICLE SPEED SENSOR: DTC P0501, P0502



Clear codes and confirm proper operation with no check engine lamp.

*** At some point in the flow chart you may be instructed to jump directly to the box marked by a bold asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.**

DTC P0562, P0563 5.28

GENERAL

Battery Voltage

Battery voltage is constantly monitored by the ECM (Pin 13). If the battery voltage fails to meet normal operating parameters, a code is set.

- Code P0562 is displayed when battery positive voltage is less than 11.0 volts at 2000 RPM for longer than 5 seconds.
- Code P0563 is displayed when battery positive voltage is greater than 16.0 volts for more than 4 seconds.

NOTES

- *Warm idle speed will be automatically increased if battery voltage is low at idle.*
- *TSSM problems may also set a code P0562 or P0563.*

Table 5-49. Code Description

DTC	LAMP CODE	DESCRIPTION
P0562	16	Battery voltage low
P0563	16	Battery voltage high

DIAGNOSTICS

Diagnostic Tips

- Low voltage generally indicates a loose wire, corroded battery connections and/or a charging system problem.
- A high voltage condition may be caused by a shorted stator (check when hot) or faulty voltage regulator.

Scanalyzer Notes

The Scanalyzer icon appears at those points in the flow chart where the Scanalyzer can be used.

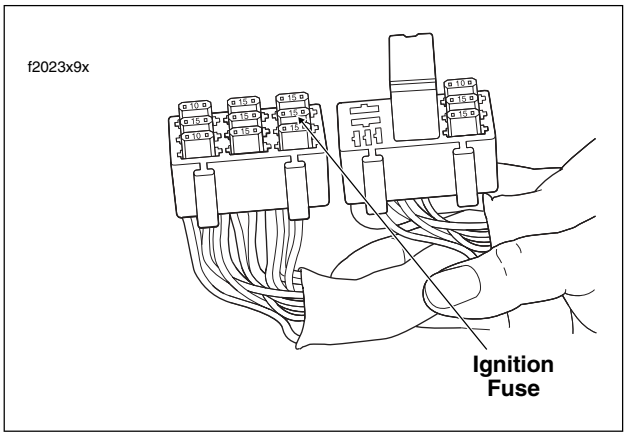


Figure 5-67. Left Side Cover Removed (FLTR, FLHT/C)

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 5.28 flow charts.

1. Was battery allowed to discharge? Was battery drawn down by a starting problem?
   a. **Yes.** Charge battery.
   b. **No.** See charging system troubleshooting.
2. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness and ECM. See Section 5.7 BREAKOUT BOX: EFI.
3. Use Scanalyzer Data Monitor Mode to check RPM on vehicles without tachometers.
4. This checks for voltage drops in the ignition module circuit.
   a. Place (+) probe to battery positive terminal.
   b. Place (-) probe to W/BK terminal on Breakout Box.
5. Problem is most likely the ground connection at the frame.
6. Connect BREAKOUT BOX (Part No. HD-42682) to Connector [22]. FLHR/C-I models will also need HD-42962 adapters.

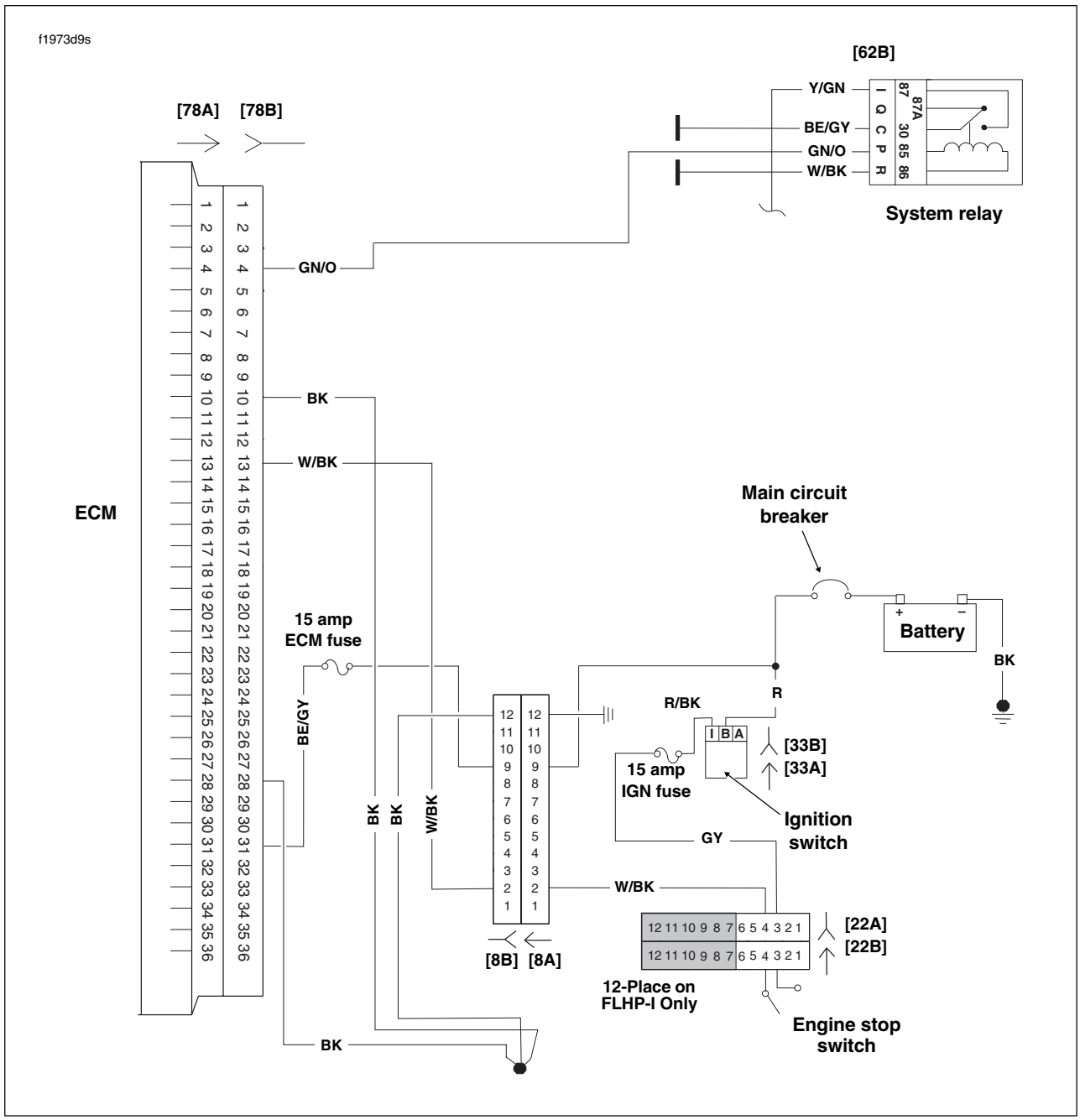


Figure 5-68. Battery Voltage Circuit Diagram (FLHR/C-I, FLHP-I)

Table 5-50. Wire Harness Connectors in Figure 5-68.

NO.	DESCRIPTION	TYPE	LOCATION
[8]	Ignition (Main to EFI Harness)	8-Place Deutsch (Gray)	Under Right Side Cover
[22]	Right Handlebar Switches	12-Place Deutsch (Black)	Inside Headlamp Nacelle
[33]	Ignition/Light Key Switch	3-Place Packard	Under Left Side Cover
[78]	ECM	36-Place Packard	Under Right Side Cover

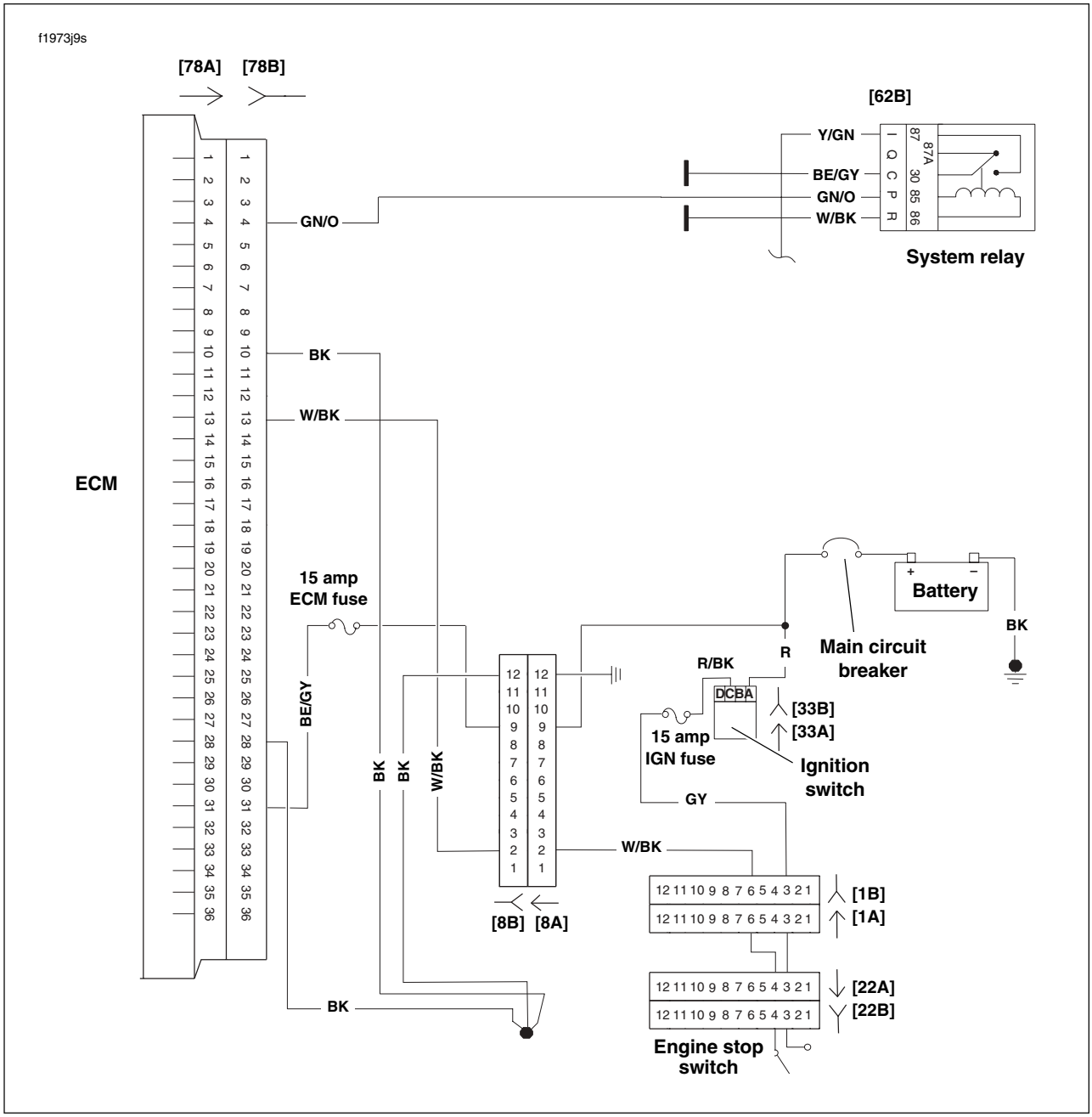


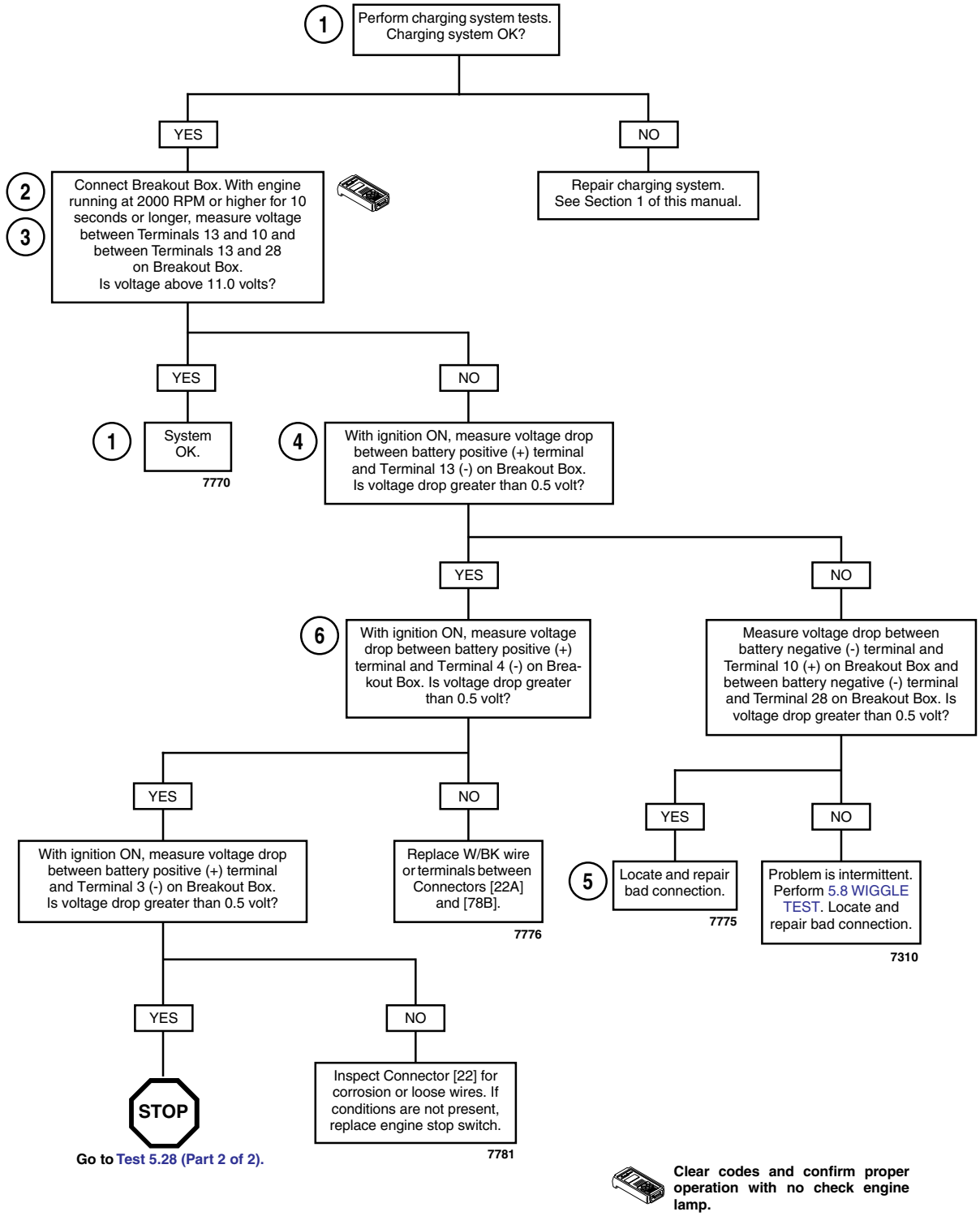
Figure 5-69. Battery Voltage Circuit Diagram (FLTR-I, FLHTC/U-I)

Table 5-51. Wire Harness Connectors in Figure 5-69.

NO.	DESCRIPTION	TYPE	LOCATION
[1]	Main to Interconnect Harness	12-Place Deutsch (Black)	Inner Fairing (Right Fairing Bracket)
[8]	Ignition (Main to EFI Harness)	8-Place Deutsch (Gray)	Under Right Side Cover
[22]	Right Handlebar Switches	12-Place Deutsch (Black)	Inner Fairing (Right Fairing Support Brace)
[33]	Ignition/Light Key Switch	4-Place Packard	Inner Fairing (Top Fork Bracket)
[78]	ECM	36-Place Packard	Under Right Side Cover

Test 5.28 (Part 1 of 2)

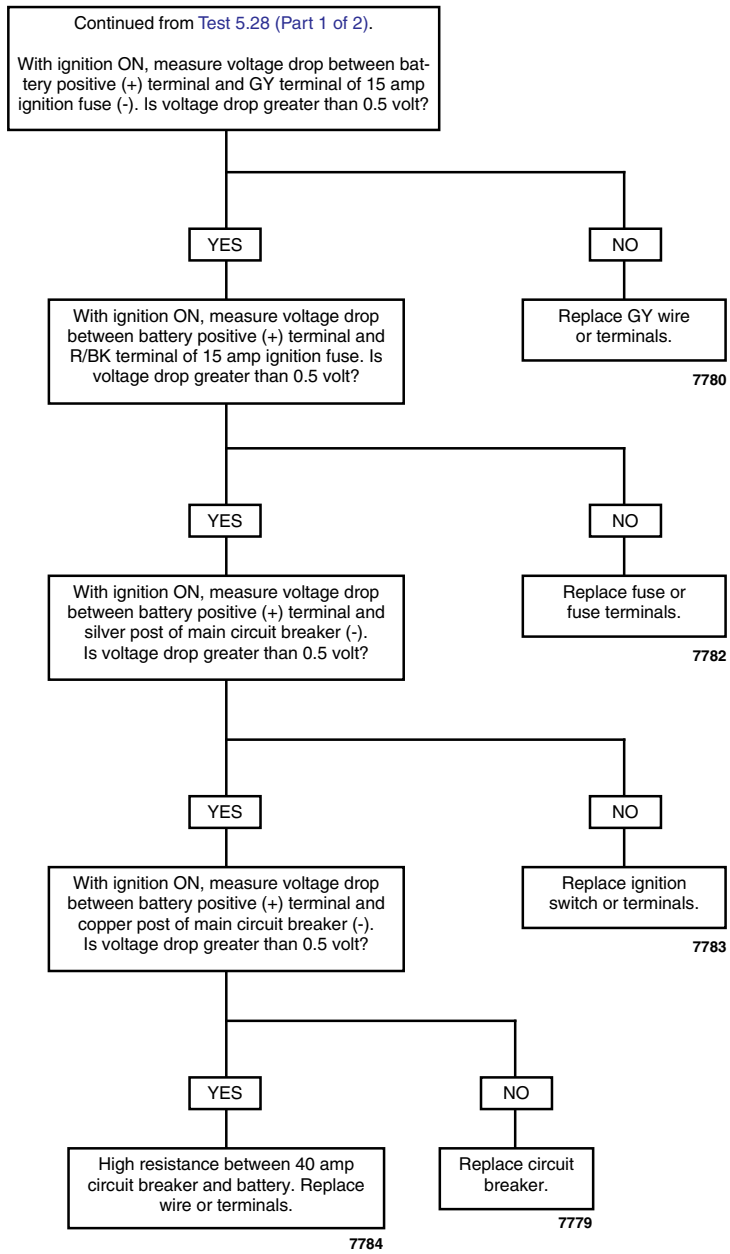
BATTERY VOLTAGE: DTC P0562, P0563



Go to Test 5.28 (Part 2 of 2).

Test 5.28 (Part 2 of 2)

BATTERY VOLTAGE: DTC P0562, P0563



Clear codes and confirm proper operation with no check engine lamp.

DTC P0603, P0605 5.29

GENERAL

ECM Failure

See Table 5-52. The codes indicate a failure that requires replacement of the ECM (Job Time Code 7913). See ELECTRONIC CONTROL MODULE, REMOVAL/INSTALLATION, in the 2003 Touring Models Service Manual (Part Number 99483-03).

Table 5-52. Code Description

DTC	LAMP CODE	DESCRIPTION
P0603	54	ECM EEPROM error
P0605	53	ECM flash error

DIAGNOSTICS

DTC P0603 Test

1. Power down the vehicle.
2. Clear codes using Scanalyzer.
3. Replace ECM if codes reappear.

DTC P0605 Test

1. Power down the vehicle.
2. Clear codes using Scanalyzer.
3. Attempt to reprogram ECM using correct calibration.
4. Restart vehicle. If code reappears, replace ECM.
5. Perform password learn and code clearing.

DTC P1009, P1010 5.30

GENERAL

Password Problem

The ECM and TSM/TSSM exchange passwords during operation. An incorrect password or missing password will set a diagnostic code.

NOTE

If the TSM/TSSM is not connected to the wiring harness, the vehicle will not start.

Table 5-53. Code Description

DTC	LAMP CODE	DESCRIPTION
P1009	99	Incorrect password
P1010	99	Missing password

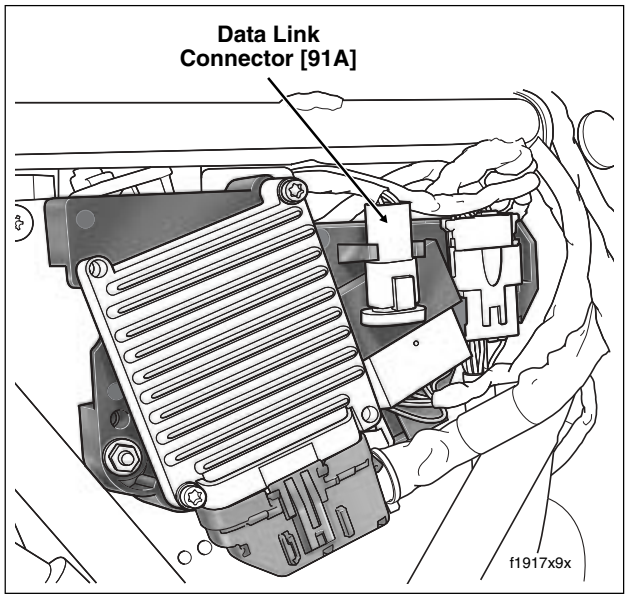


Figure 5-70. Right Side Cover Removed

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 5.30 flow charts.

1. DTC P1009 may be set if a recent ECM or TSM/TSSM replacement did not follow the correct password assignment procedure. See Section 3.24 TSM/TSSM for details.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), black socket probes and patch cord.
3. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness and ECM. See Section 5.7 BREAKOUT BOX: EFI.
4. See TURN SIGNAL/SECURITY MODULE, REMOVAL/INSTALLATION, in the 2003 Touring Models Service Manual (Part Number 99483-03). If necessary, be sure to reference the Electrical Diagnostic Manual for the password learn routine (Scanalyzer menu refers to this function as “module replacement”).



Figure 5-71. TSM/TSSM Module

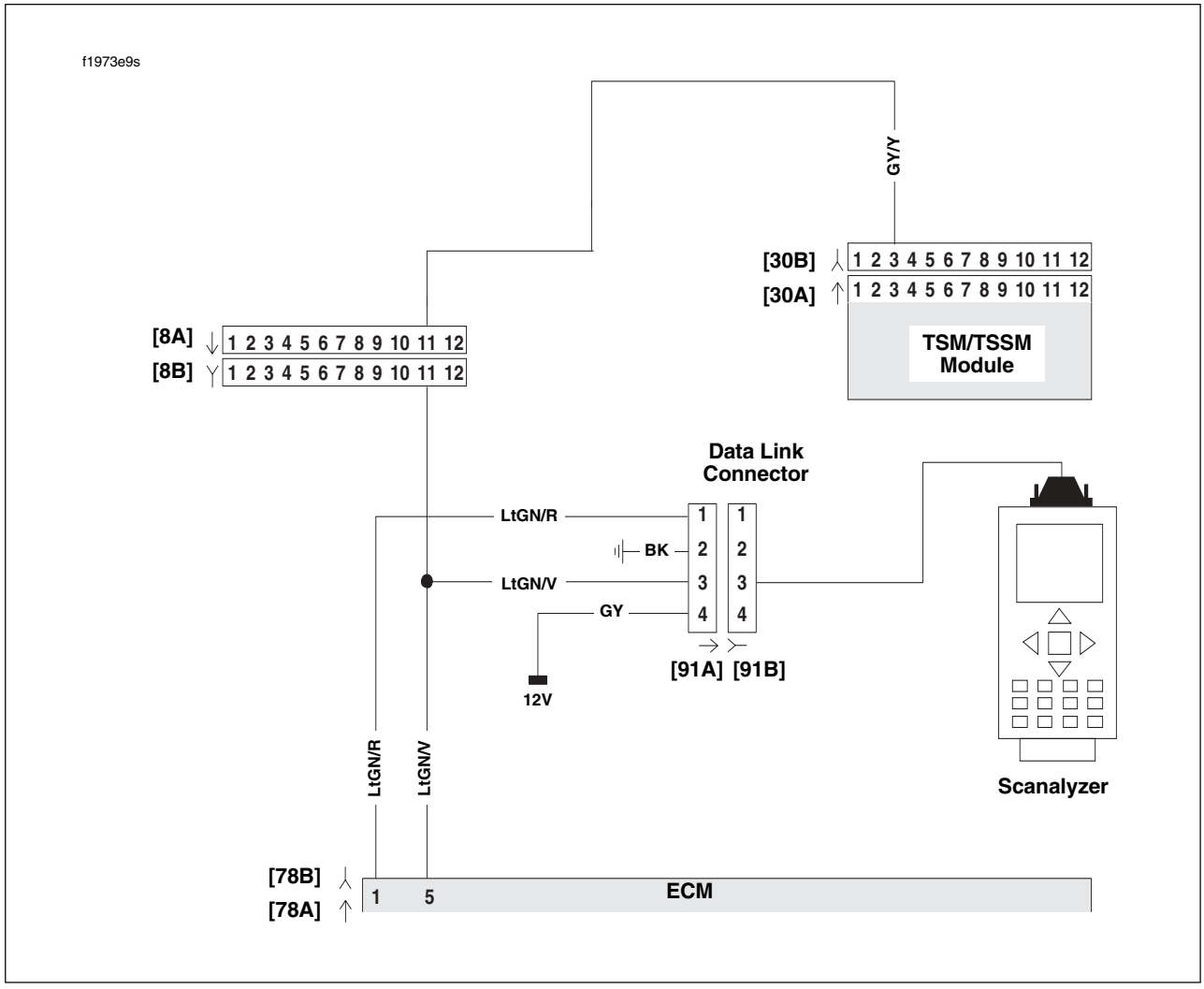


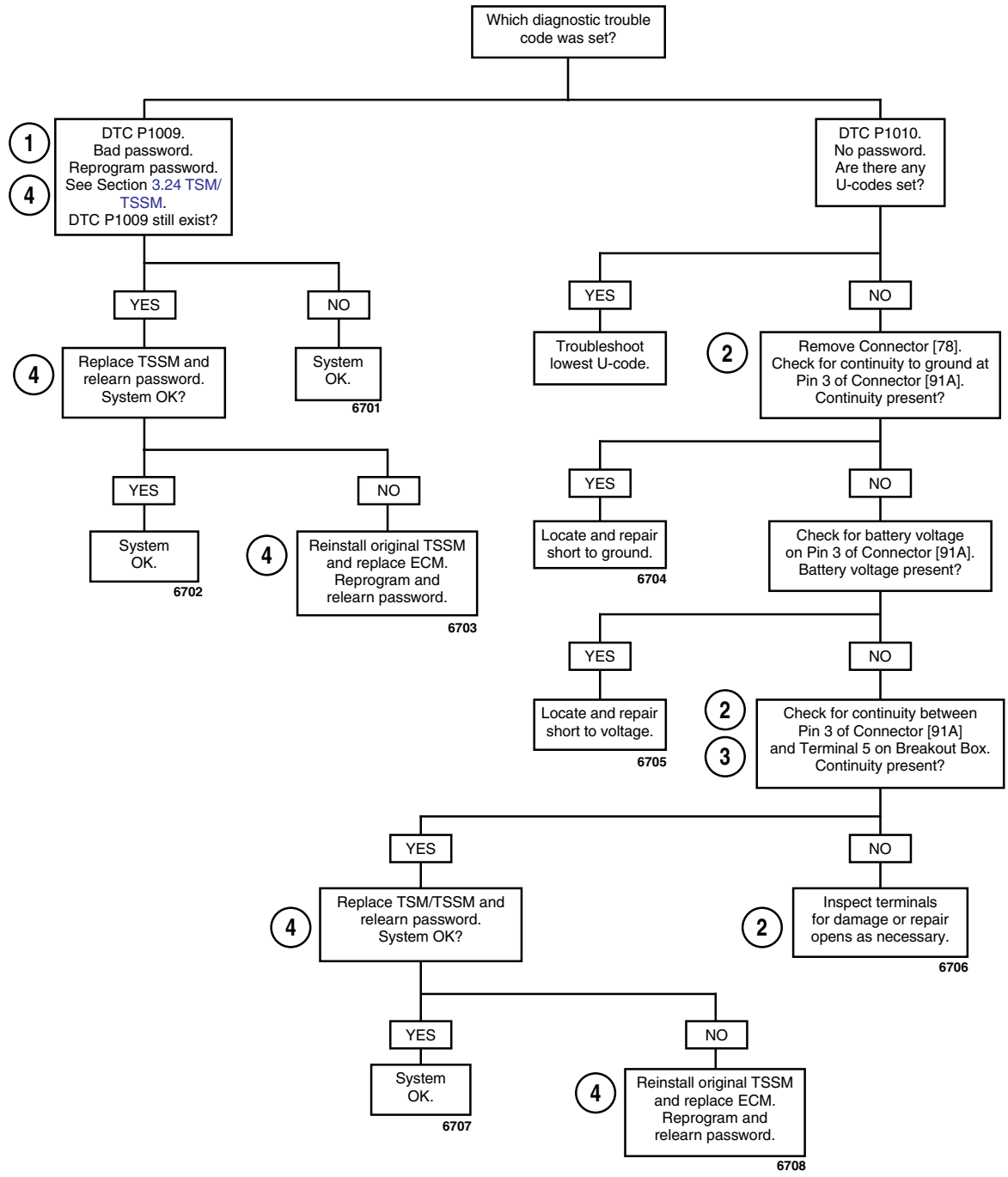
Figure 5-72. ECM and TSM/TSSM Circuit

Table 5-54. Wire Harness Connectors in Figure 5-72.

NO.	DESCRIPTION	TYPE	LOCATION
[8]	Ignition (Main to EFI Harness)	12-Place Deutsch (Gray)	Under Right Side Cover
[30]	TSM/TSSM	12-Place Deutsch	Cavity in Crossmember at Rear of Battery Box (Under Seat)
[78]	ECM	36-Place Packard	Under Right Side Cover
[91]	Data Link	4-Place Deutsch	Under Right Side Cover

Test 5.30

PASSWORD PROBLEM: DTC P1009, P1010



DTC P1351, P1352, P1354, P1355 5.31

GENERAL

Ignition Coil

Ignition coil codes will set if the ignition coil primary voltage is out of range. This could occur if there is an open coil or loss of power to the coil. If front and rear codes are set simultaneously, it is likely a coil power failure or a coil failure.

The coil receives power from the system relay at the same time that the fuel pump and injectors are activated. The system relay is active for the first 2 seconds after the ignition switch is turned ON and then shuts off until RPM is detected from the CKP sensor, at which time it is reactivated. The ECM is responsible for turning on the system relay by providing the ground to activate the relay, which in turn powers the coil.

Table 5-55. Code Description

DTC	LAMP CODE	DESCRIPTION
P1351	24	Front ignition coil open/low
P1352	24	Front ignition coil high/shorted
P1354	25	Rear ignition coil open/low
P1355	25	Rear ignition coil high/shorted

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 5.31 flow charts.

1. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), gray pin probes and patch cord.
2. See Figure 5-73. Plug IGNITION COIL CIRCUIT TEST ADAPTER (Part No. HD-44687) and FUEL INJECTOR TEST LAMP (Part No. HD-34730-2C) into Breakout Box. Note that cranking the engine with test lamp in place of the ignition coil can sometimes cause a DTC P1351, P1352, P1354 or P1355. This condition is normal and does not by itself indicate a malfunction. Clear codes afterward.



Figure 5-73. Ignition Coil Circuit Test

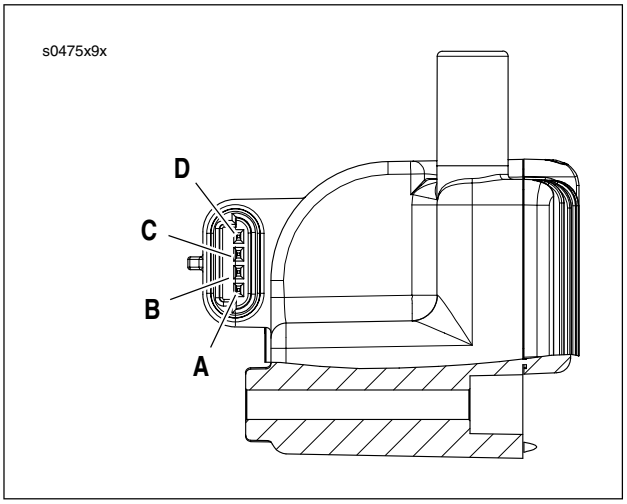


Figure 5-74. Ignition Coil Connector Terminals

3. Connect BREAKOUT BOX (Part No. HD-43876) between EFI wire harness and ECM. See Section 5.7 BREAKOUT BOX: EFI.
4. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), gray socket probes and patch cord.

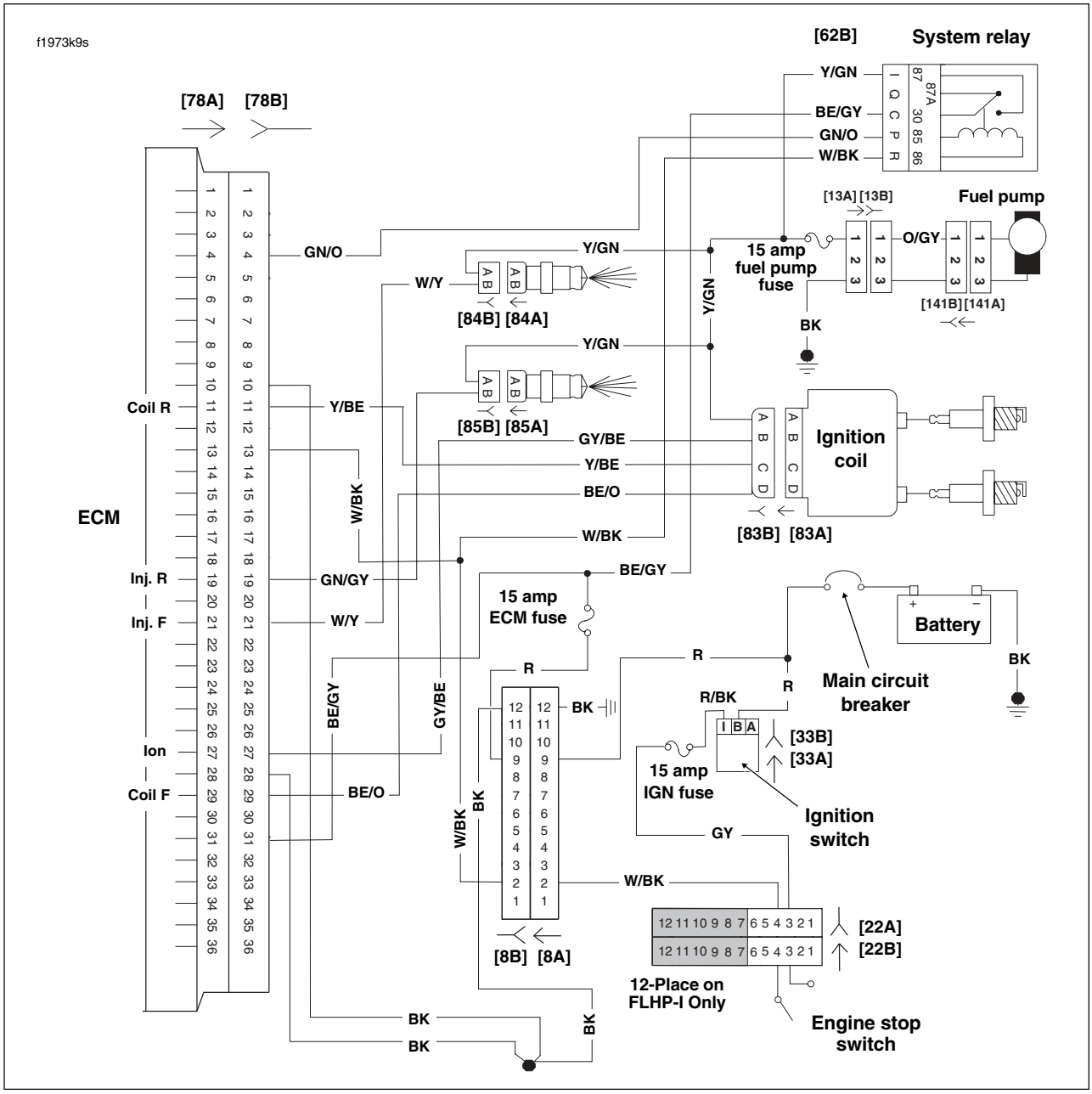


Figure 5-75. Battery Voltage Circuit Diagram (FLHR/C-I, FLHP-I)

Table 5-56. Wire Harness Connectors in Figure 5-75.

NO.	DESCRIPTION	TYPE	LOCATION
[8]	Ignition (Main to EFI Harness)	8-Place Deutsch (Gray)	Under Right Side Cover
[22]	Right Handlebar Switches	12-Place Deutsch (Black)	Inside Headlamp Nacelle
[33]	Ignition/Light Key Switch	3-Place Packard	Under Left Side Cover
[78]	ECM	36-Place Packard	Under Right Side Cover
[83]	Ignition Coil	4-Place Packard	Below Fuel Tank (Left Side)
[84]	Front Injector	2-Place Packard	Below Fuel Tank (Left Side)
[85]	Rear Injector	2-Place Packard	Below Fuel Tank (Left Side)

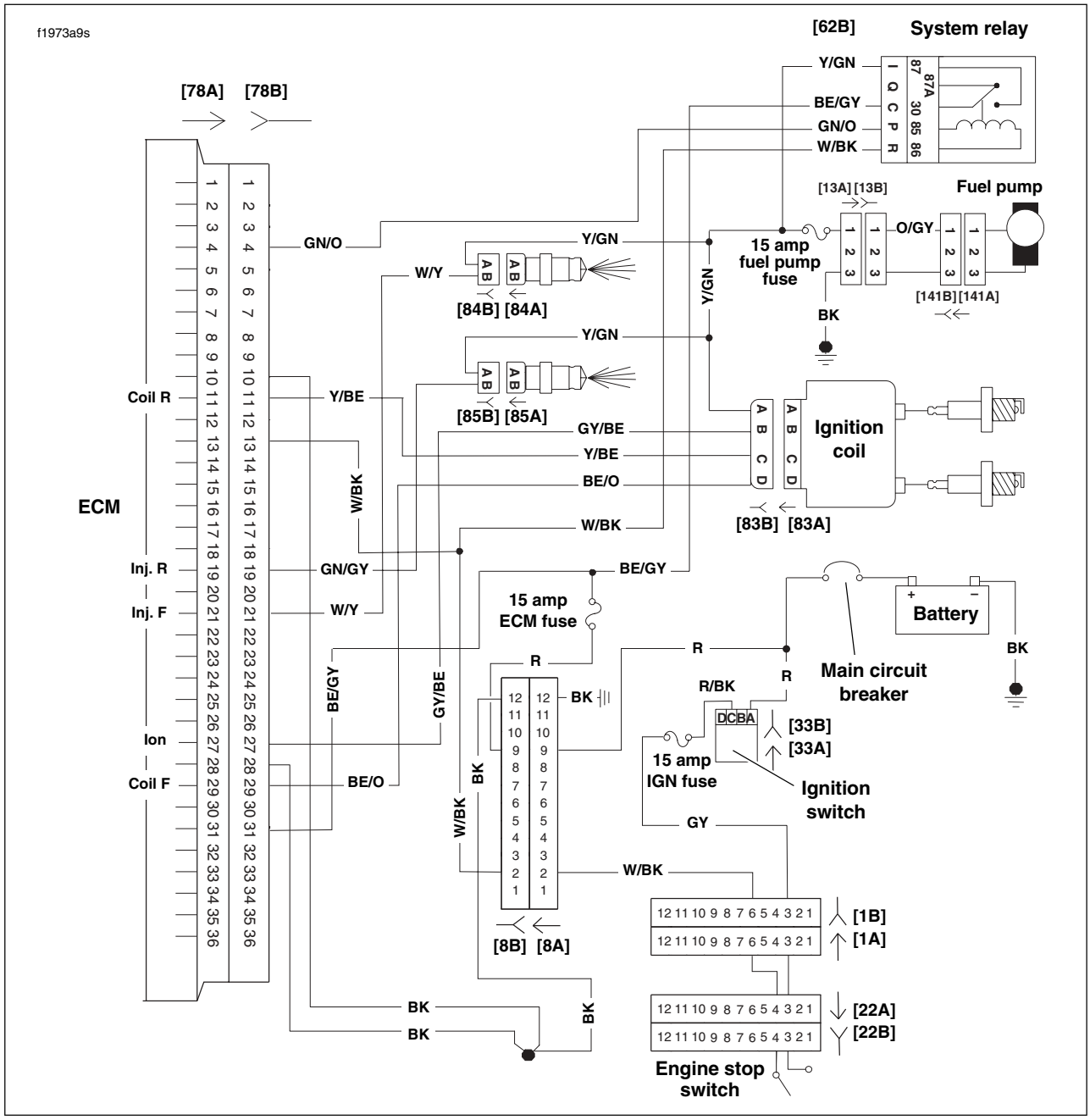


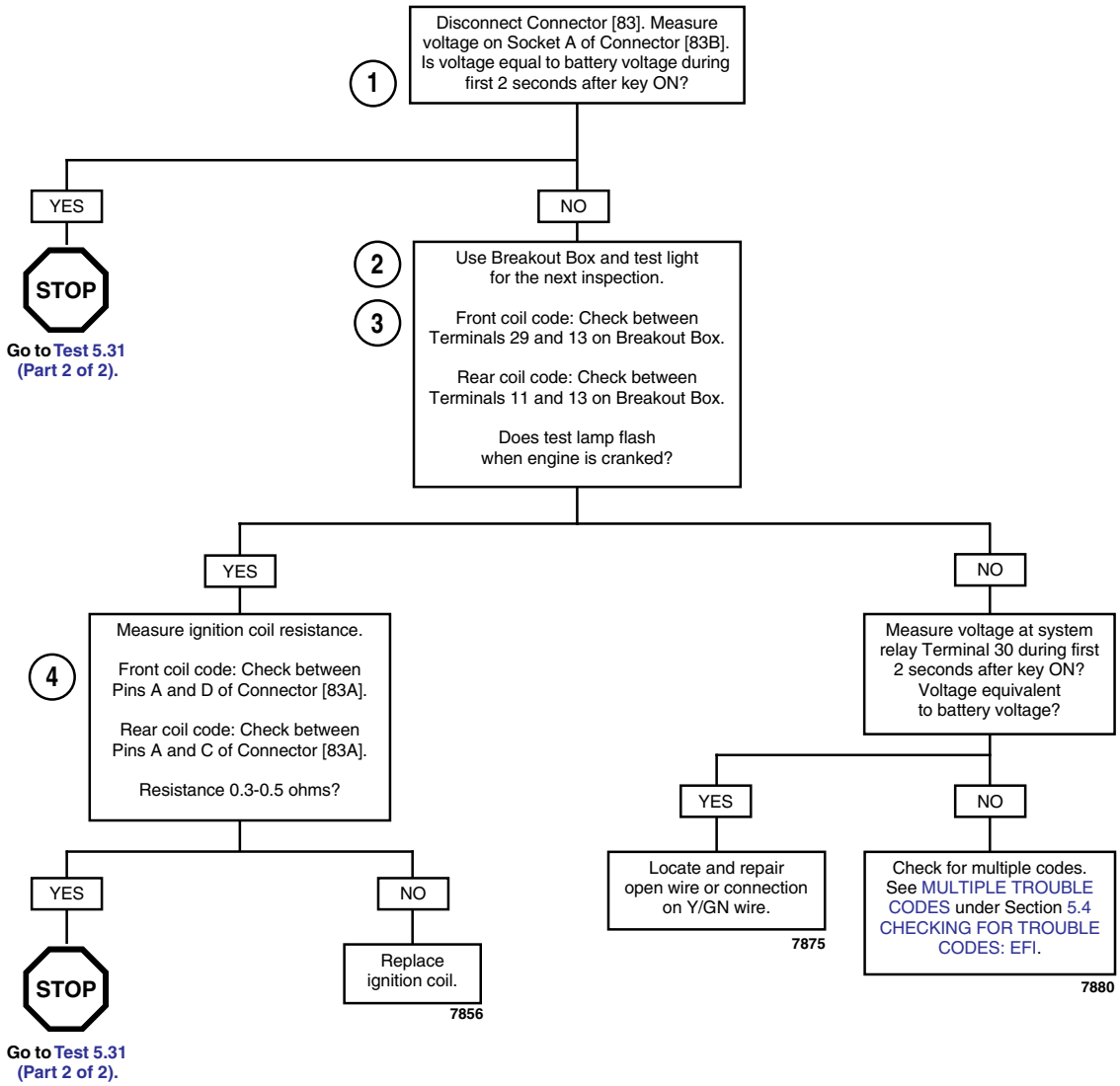
Figure 5-76. Battery Voltage Circuit Diagram (FLTR-I, FLHTC/U-I)

Table 5-57. Wire Harness Connectors in Figure 5-76.

NO.	DESCRIPTION	TYPE	LOCATION
[1]	Main to Interconnect Harness	12-Place Deutsch (Black)	Inner Fairing (Right Fairing Bracket)
[8]	Ignition (Main to EFI Harness)	8-Place Deutsch (Gray)	Under Right Side Cover
[22]	Right Handlebar Switches	12-Place Deutsch (Black)	Inner Fairing (Right Fairing Support Brace)
[33]	Ignition/Light Key Switch	4-Place Packard	Inner Fairing (Top Fork Bracket)
[78]	ECM	36-Place Packard	Under Right Side Cover
[83]	Ignition Coil	4-Place Packard	Below Fuel Tank (Left Side)
[84]	Front Injector	2-Place Packard	Below Fuel Tank (Left Side)
[85]	Rear Injector	2-Place Packard	Below Fuel Tank (Left Side)

Test 5.31 (Part 1 of 2)

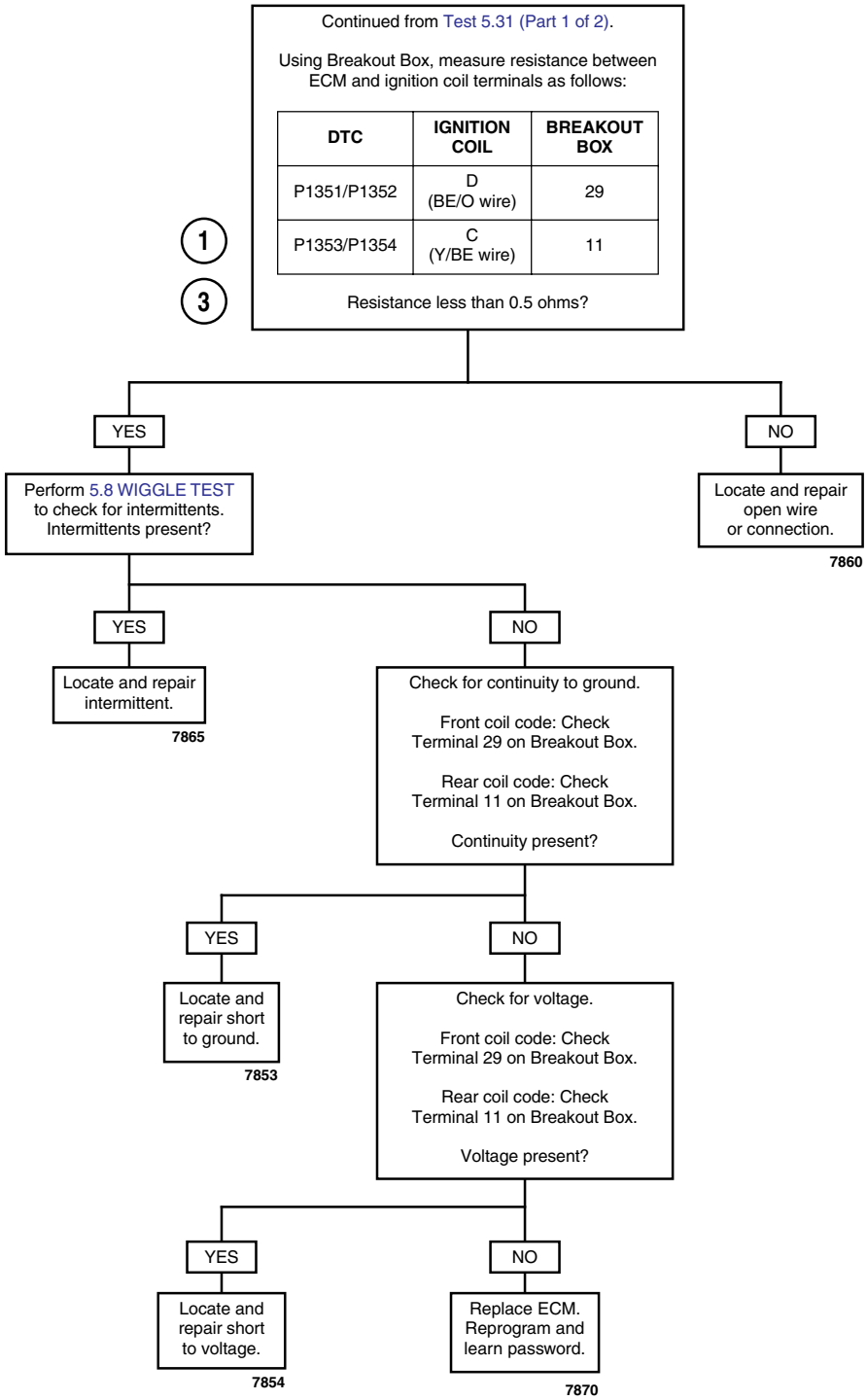
IGNITION COIL: DTC P1351, P1352, P1354, P1355



Clear codes and confirm proper operation with no check engine lamp.

Test 5.31 (Part 2 of 2)

IGNITION COIL: DTC P1351, P1352, P1354, P1355



Clear codes and confirm proper operation with no check engine lamp.

DTC P1653, P1654 5.32

GENERAL

Tachometer

Tachometers may be OE installed or as a customer purchased accessory item. Any damage to the tachometer's PK wire could set a code even without an installed tachometer.

NOTE

The system cannot diagnose an open wire. It can only detect a short high or low.

Table 5-58. Code Description

DTC	LAMP CODE	DESCRIPTION
P1653	35	Tachometer low
P1654	35	Tachometer high

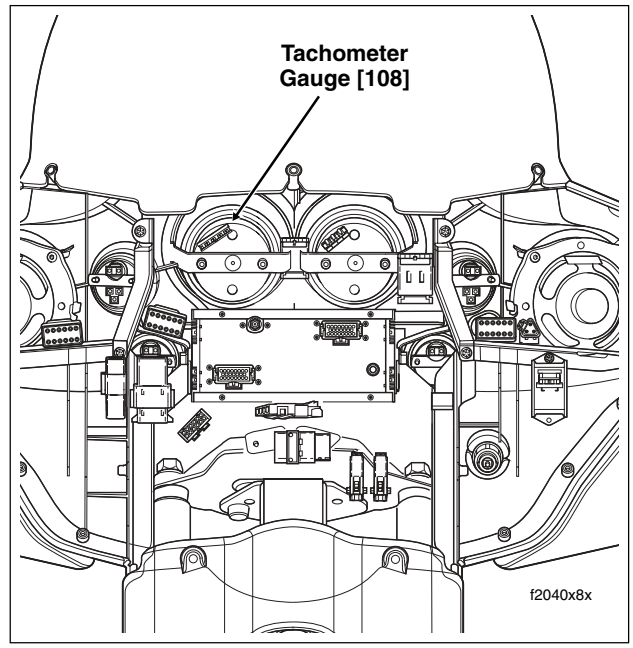


Figure 5-77. Outer Fairing Removed

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 5.32 flow charts.

1. Consult the instruction sheet which accompanied the tachometer kit.

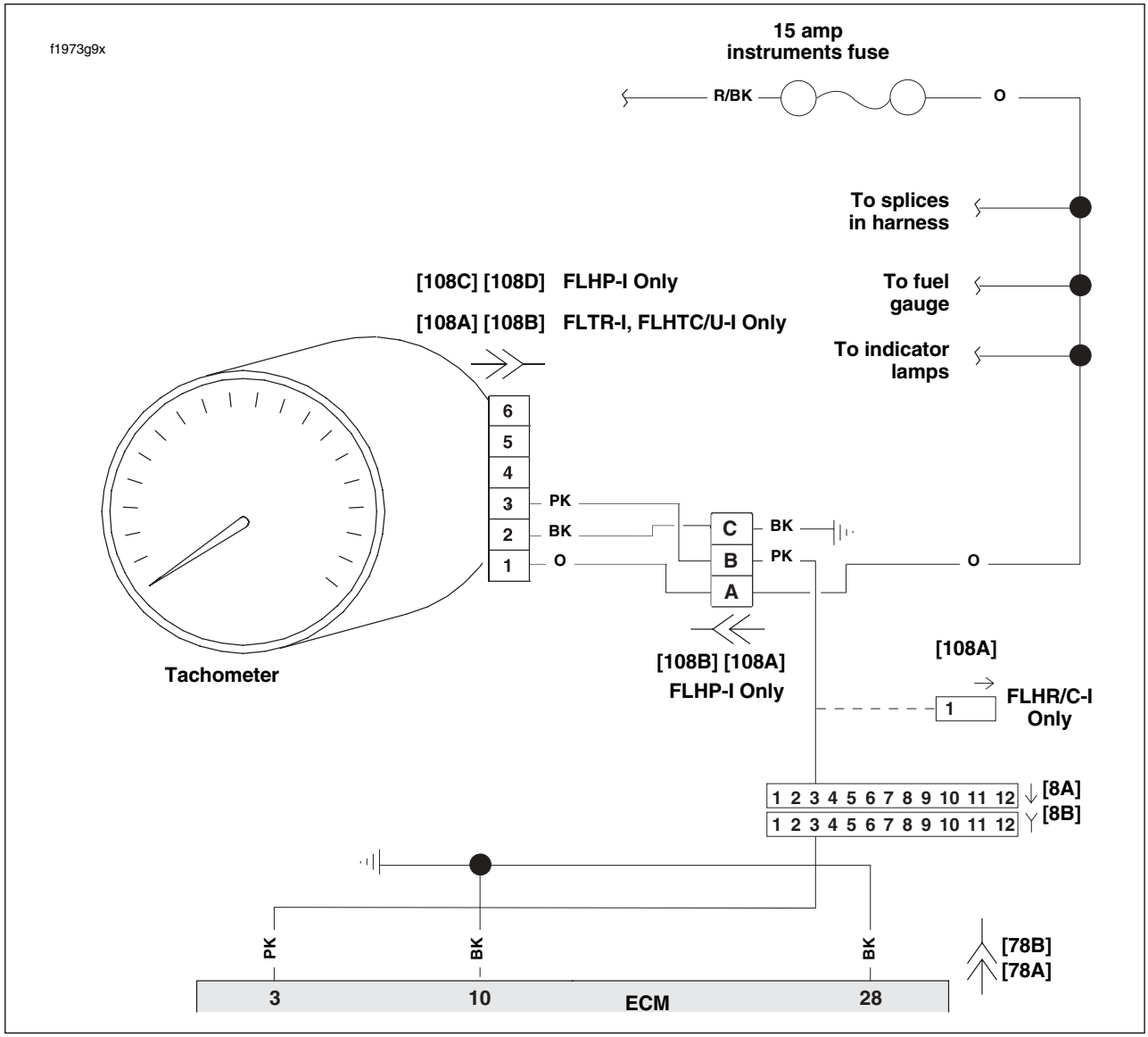


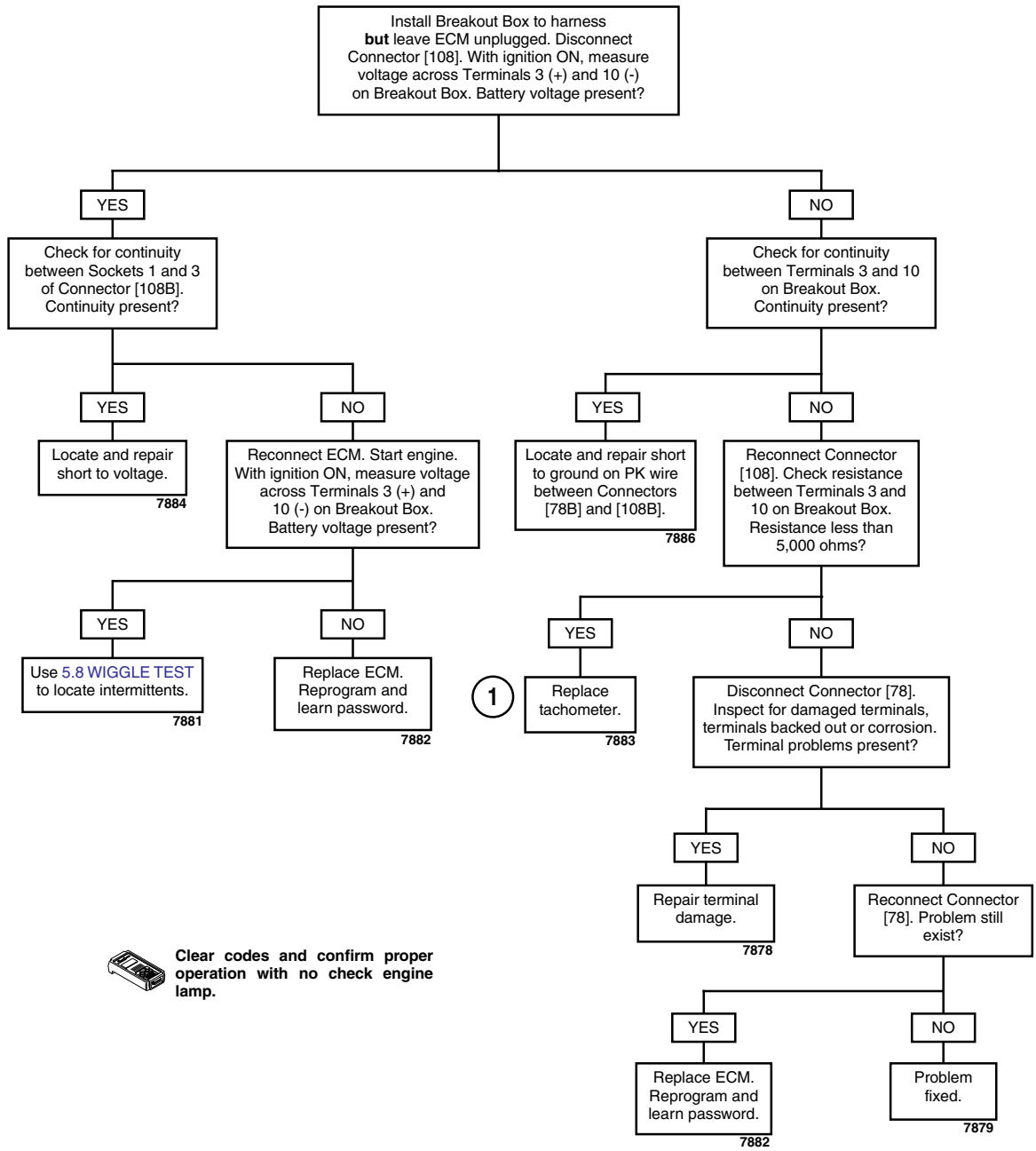
Figure 5-78. Tachometer Circuit

Table 5-59. Wire Harness Connectors in Figure 5-78.

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[8]	Ignition (Main to EFI Harness)	All	12-Place Deutsch (Gray)	Under Right Side Cover
[78]	ECM	All	36-Place Packard	Under Right Side Cover
[108]	Tachometer	FLHR/C-I	1-Place Amp	Inside Headlamp Nacelle
		FLTR-I	6-Place Packard	Inside Instrument Nacelle (Back of Tachometer)
		FLHTC/U-I	6-Place Packard	Inner Fairing (Back of Tachometer)

Test 5.32

TACHOMETER: DTC P1653, P1654



GENERAL

Loss of TSM/TSSM or ECM Serial Data

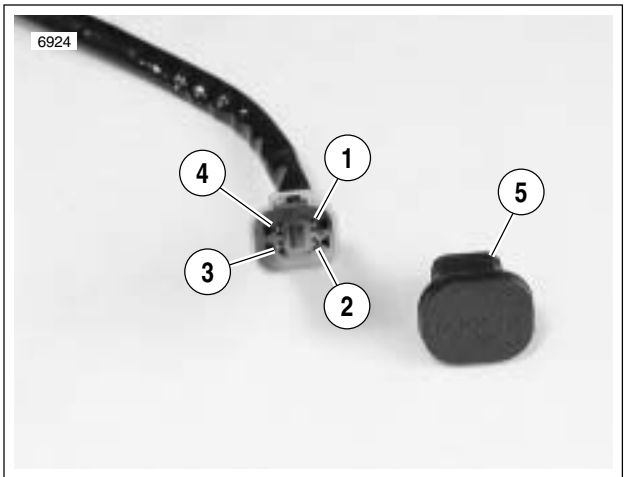
On fuel injected motorcycles the serial data connector provides a means for the ECM and TSM/TSSM to communicate their current status. When all operating parameters on the serial data link are within specifications, a state of health message is sent between the components. While a DTC U1016 indicates that the ECM is not receiving this state of health message, a DTC U1064 indicates that the TSM/TSSM is not receiving.

Table 5-60. Code Description

DTC	LAMP CODE	DESCRIPTION
U1064	61	Loss of TSM/TSSM serial data



Figure 5-79. TSM/TSSM Module



1. **Terminal 1: flash pin (Lt GN/R)**
2. **Terminal 2: ground (BK)**
3. **Terminal 3: serial data (Lt GN/V)**
4. **Terminal 4: power (GY)**
5. **Protective cap**

Figure 5-80. Data Link Connector

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Test 5.33 flow chart.

1. Connect BREAKOUT BOX (Part No. HD-43876) between wire harness and ECM. See Section 5.7 BREAKOUT BOX: EFI.
2. Connect BREAKOUT BOX (Part No. HD-42682) between wire harness and TSM/TSSM. See Section 3.10 BREAKOUT BOX: TSM/TSSM.

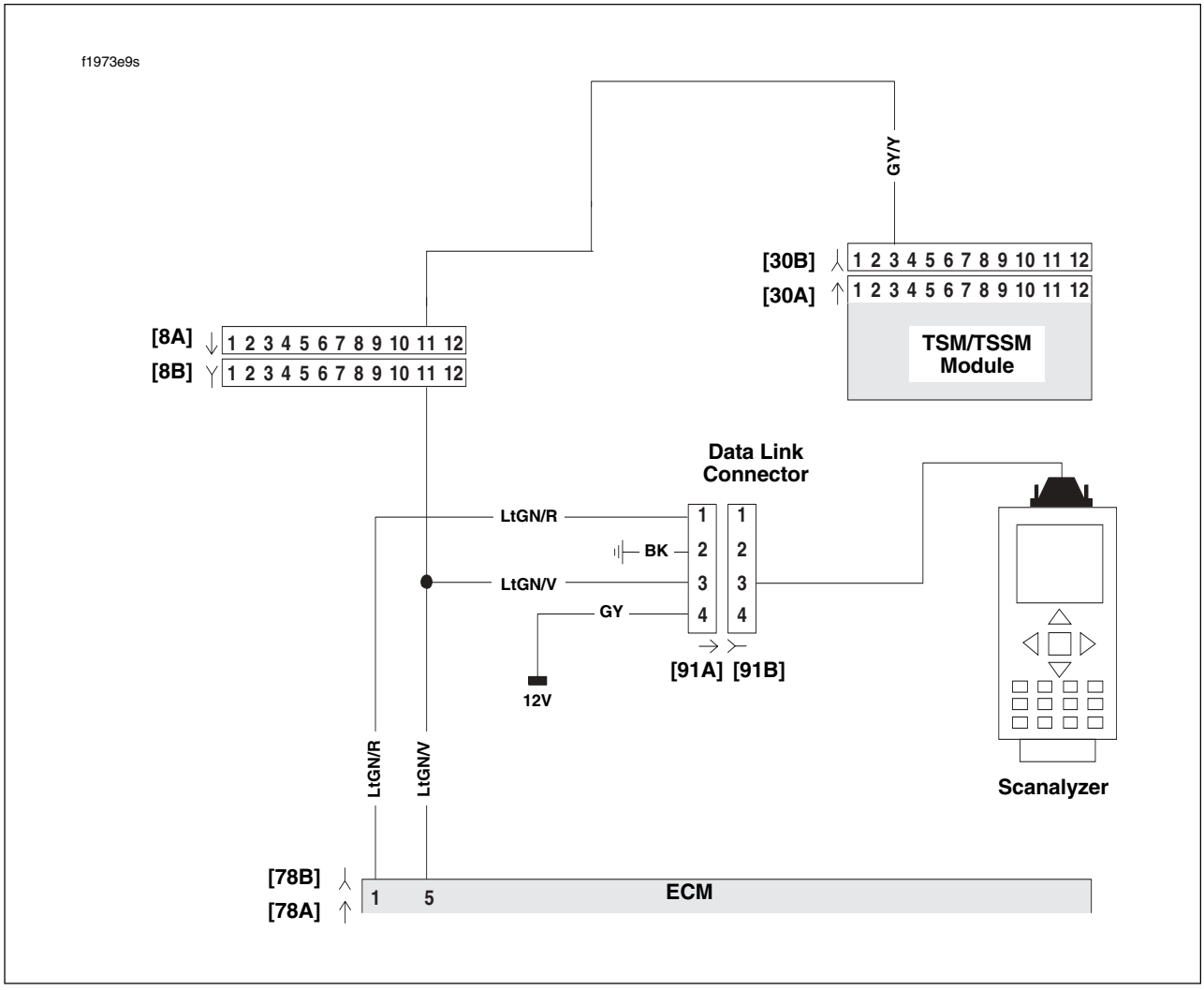


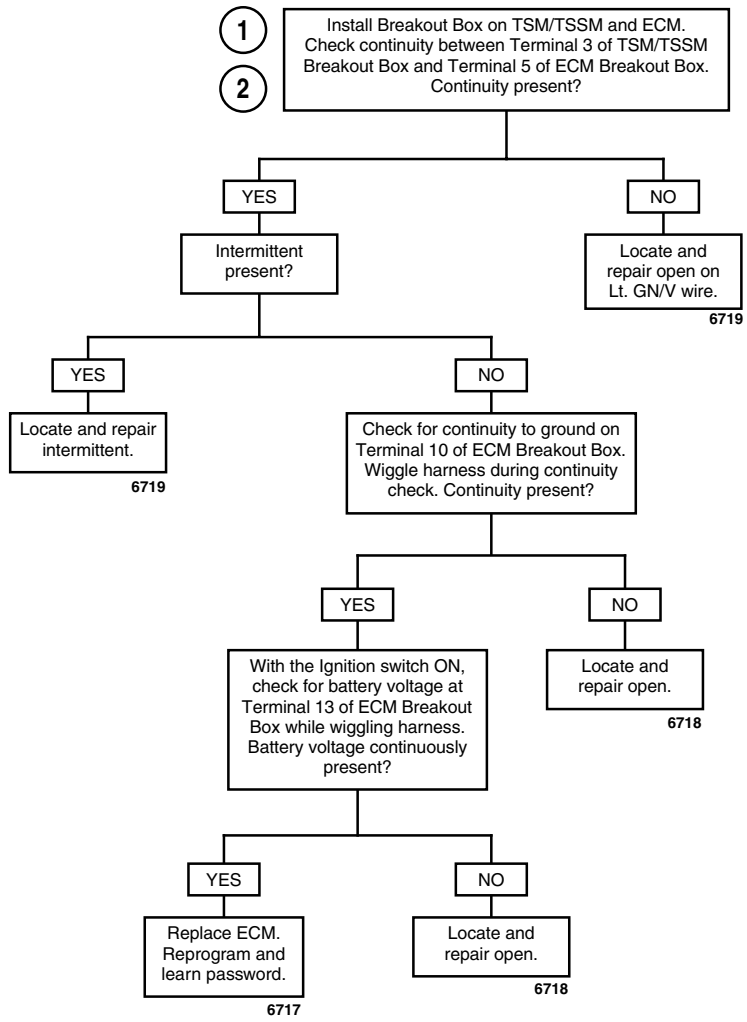
Figure 5-81. ECM and TSM/TSSM Circuit

Table 5-61. Wire Harness Connectors in Figure 5-81.

NO.	DESCRIPTION	TYPE	LOCATION
[8]	Ignition (Main to EFI Harness)	12-Place Deutsch (Gray)	Under Right Side Cover
[30]	TSM/TSSM	12-Place Deutsch	Cavity in Crossmember at Rear of Battery Box (Under Seat)
[78]	ECM	36-Place Packard	Under Right Side Cover
[91]	Data Link	4-Place Deutsch	Under Right Side Cover

Test 5.33 (Part 1 of 2)

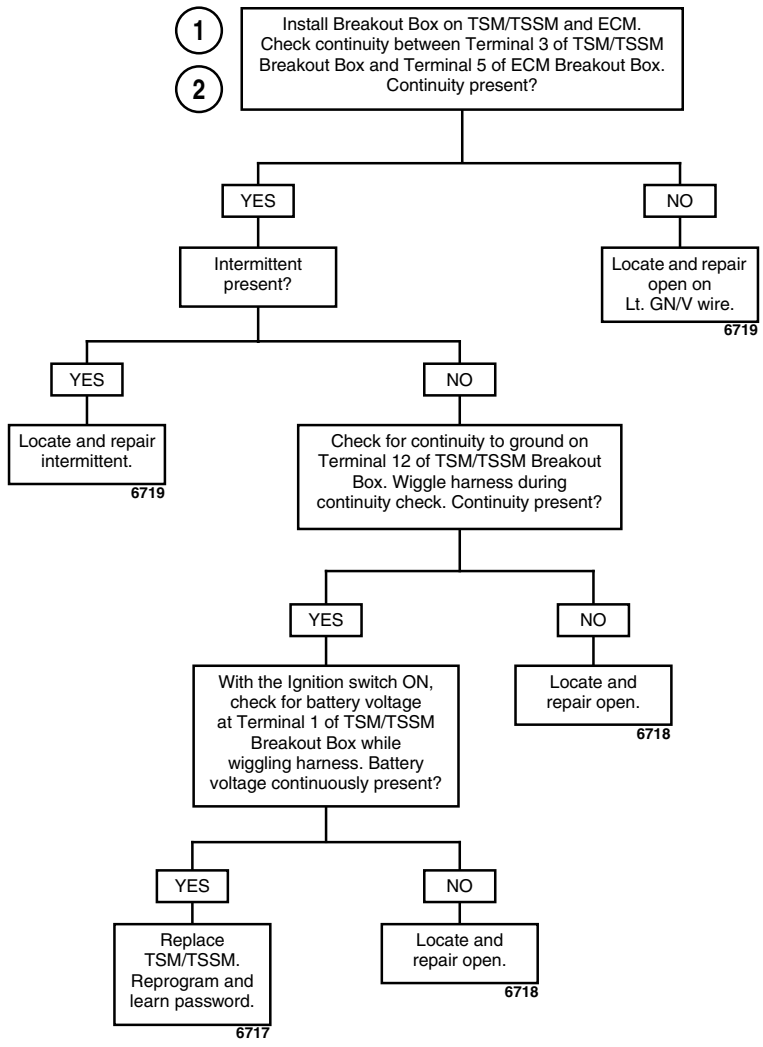
LOSS OF ECM SERIAL DATA: DTC U1016



Clear codes and confirm proper operation with no security lamp.

Test 5.33 (Part 2 of 2)

LOSS OF TSM/TSSM SERIAL DATA: DTC U1064
DTC U1255



Clear codes and confirm proper operation with no security lamp.

NOTES

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6.3 Breakout Box 6-5
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PREMIUM SOUND 6

DIAGNOSTIC INTRODUCTION 6.1

GENERAL

The radio diagnostics for the Premium Sound System is **symptom based**.

Simply locate the apparent problem from the list of 15 symptoms listed in Table 6-1. Take note of the section number and turn to the flow chart that addresses the problem.

NOTE

If the problem is not listed or is intermittent, locate the most relative symptom and inspect connectors for moisture or corrosion. Also look for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harness.

At the beginning of the section, follow the SETUP instructions and then review the FUNCTIONALITY description to determine whether the system is operating as intended. If it appears that the system is not working correctly, validate the problem by performing the flow chart under SOFTWARE DIAGNOSIS. (See Section 6.2 DIAGNOSTIC MODE OVERVIEW to gain a general understanding of how the on-board diagnostics work.)

If the Diagnostic Mode indicates that a malfunction exists, refer to the flow chart under HARDWARE DIAGNOSIS for correction of the problem.

Work your way through each flow chart box by box. If a numbered circle appears adjacent to a box, then more information is offered in the **Diagnostic Notes**. Many Diagnostic Notes contain supplemental information, helpful tips or references to other parts of the manual.

When working through a flow chart, refer to the illustrations, and the **Wire Harness Connector** table as necessary. The wire harness connector table identifies the connector number, description, type and general location.

After correction of the problem, refer back to SETUP and FUNCTIONALITY to verify proper operation.

Table 6-1. Symptom Table

SYMPTOM	SOLUTION
Audio Control Inoperative	6.4 RADIO SYMPTOM 1
Mode Control Inoperative	6.5 RADIO SYMPTOM 2
No Sound in One or More Speakers (External)	6.6 RADIO SYMPTOM 3
Automatic Volume Control (AVC) Inoperative	6.7 RADIO SYMPTOM 4
Poor Stereo Reception	6.8 RADIO SYMPTOM 5
No Power	6.9 RADIO SYMPTOM 6
CD Will Not Eject	6.10 RADIO SYMPTOM 7
No Sound in One or More Headsets/Microphone Inoperative	6.11 RADIO SYMPTOM 8
Rear Headset Volume/PTT Inoperative	6.12 RADIO SYMPTOM 9
Intercom Inoperative	6.13 RADIO SYMPTOM 10
CB Receiver Inoperative	6.14 RADIO SYMPTOM 11
CB Transmitter Inoperative (With CB Antenna Test and SWR Adjustment)	6.15 RADIO SYMPTOM 12
PTT/Squelch Control Inoperative	6.16 RADIO SYMPTOM 13
Handheld Microphone PTT Inoperative	6.17 RADIO SYMPTOM 14
No CB Audio in Headset in Center Position	6.18 RADIO SYMPTOM 15

Not Applicable to Classic/Road Glide Models

GENERAL

Push any two of four Preset buttons on the front panel of the radio. See Figure 6-1. With the buttons depressed, turn the Ignition/Light Key Switch to IGNITION. Diagnostic Group 1, the first of five diagnostic screens, appears on the LCD display, as indicated by the “d1” in the lower portion. Figure 6-2.

The upper portion of the display shows a line of input bits which correlate to a particular set of switch functions. Whether the display shows a “0,” a “1” or is able to toggle between “0” and “1” indicates whether or not the switch is working.

Push the LO/DX button on the front panel to sequence from Diagnostic Group 1 to Diagnostic Group 2. Figure 6-3. Press the button again to advance to Diagnostic Group 3. After all modes have been accessed, the final push of the LO/DX button will cause the system to revert back to normal radio operation. The Diagnostic Mode can also be exited at any time by simply turning the Ignition/Light Key Switch to OFF.

NOTE

Diagnostic Groups 3, 4 and 5 are for factory use only, while the last display, which follows Diagnostic Group 5, allows the user to adjust the rate of volume change for the Automatic Volume Control (AVC). See Automatic Volume Control (AVC) Adjustment under Section 6.7 RADIO SYMPTOM 4 for additional information.

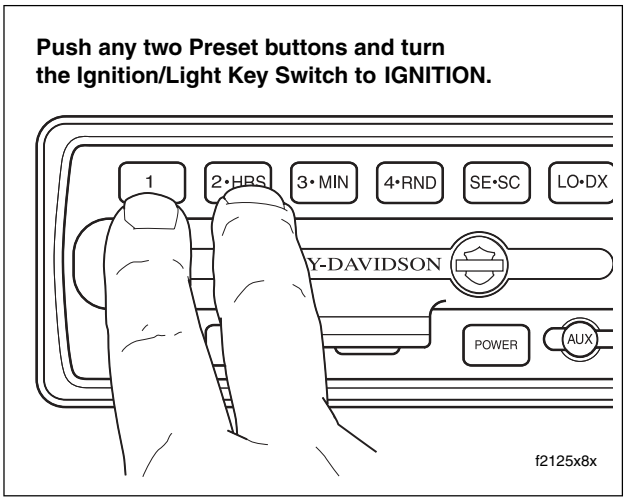


Figure 6-1. Access Radio Diagnostic Mode

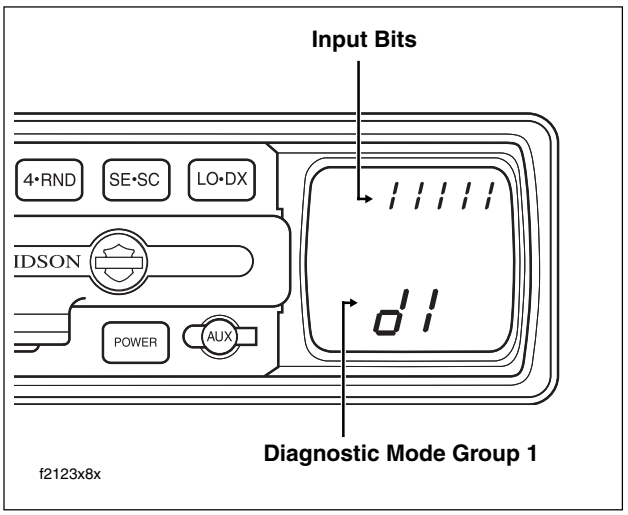


Figure 6-2. Front Panel LCD Display

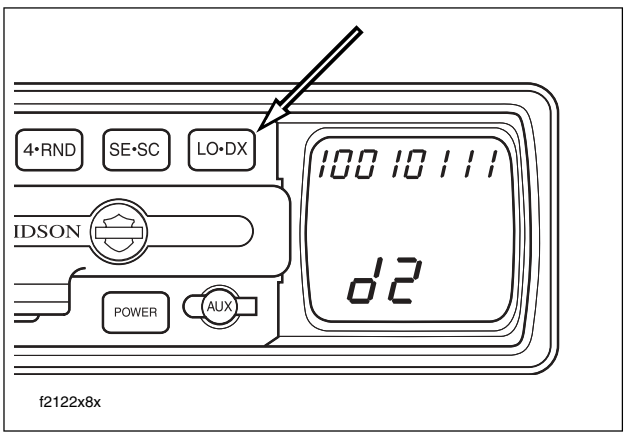


Figure 6-3. LO/DX Button

DIAGNOSTIC MODE GROUP 1

GENERAL

When the Diagnostic Mode is first accessed, a line of five input bits appears in the upper portion of the front panel LCD display. See Figure 6-2.

SAMPLE DIAGNOSTIC

For explanatory purposes, assume that the REAR VOLUME UP control is inoperative. Referencing the matrix at the top of Figure 6-4, note that this switch function is found at the intersection of the C3 and R0 lines. The matrix indicates that the problem either involves the O/BK or the PK/W wires.

Operate the switch while observing the input bit. The input bit to watch correlates with the position of the switch in the matrix. Therefore, the REAR VOLUME UP control is the second bit from the left hand side. If the input bit toggles between “1” and “0” at a one second rate while the switch is depressed, then the switch is functioning normally. However, if the switch is locked on “1” or “0” and fails to toggle, then a problem exists.

Now assume that the input bit of the REAR VOLUME UP control is locked on “1.” Review the text below the matrix in Figure 6-4. From this information, we see that when the input bit is locked on “1,” then either the O/BK or the PK/W wires are shorted to +12 volts.

To further pinpoint the problem, exercise the MODE UP or FAST FORWARD functions, or any other switch function on the R0 line, which also utilize the PK/W wire. If the input bit toggles, then one can conclude that the PK/W wire is alright and the problem involves the O/BK lead. Now operate the REAR VOLUME DOWN switch to verify the conclusion. As seen from the matrix, this switch function also utilizes the O/BK wire. If the input bit is still locked on “1” then the O/BK wire is confirmed as the source of the problem. Operation of the PTT and PRESET 4 buttons (the remaining switch functions on the C3 line) would serve to confirm the same conclusion.

On the other hand, if all other switch functions on the C3 line toggle between “1” and “0” at a one second rate, indicating that the switch is functioning normally, then an open exists on the R0 line. Conversely, if all other switch functions on the R0 line toggle between “1” and “0” at a one second rate, then an open exists on the C3 line.

Therefore, a continuous “0” is a short to ground, while a continuous “1” is a short to +12 volts, but ONLY if all other switch functions on that respective Cx or Rx line are also locked on “0” or “1,” respectively. If all other switch functions on the Cx and Rx lines toggle between “1” and “0,” then an open is indicated.

Not Applicable to Classic/Road Glide Models

	C4 (BN/W)	C3 (O/BK)	C2 (BN/BK)	C1 (GY/GN)	CO (GN/BE)
RO (PK/W)	MODE UP FF	REAR VOLUME UP	AUDIO IN	AUDIO -	AUDIO +
R1 (GY/W)	MODE DN RW	REAR VOLUME DOWN	EJECT	LO/DX	RADIO POWER
R2 (V/BK)	MODE IN	PTT	SQUELCH DOWN	SQUELCH UP	SEEK SCAN
R3 (INT)	NOT USED	PRESET 4	PRESET 3	PRESET 2	PRESET 1

Cx = C0 thru C4. Rx = R0 thru R3.

- If Cx and Rx are normal, input bit on LCD display toggles between “1” and “0” at a one second rate while button is depressed.
- If Cx is shorted to ground, input bit on LCD display appears as “0” whether switch is open or closed. See Figure A below.
- If Cx is shorted to +12 volts, input bit on LCD display appears as “1” whether switch is open or closed. See Figure B below.
- If Rx is shorted to ground, input bit on LCD display appears as “1” when switch is open and “0” when switch is closed (depressed), but does not toggle at a one second rate as occurs when switch is normal. See Figure C below.
- If Rx is shorted to +12 volts, input bit on LCD display appears as “1” whether switch is open or closed. See Figure D below.
- If all other switch functions on the Cx and Rx lines toggle between “1” and “0,” then an open is indicated. See Figure E and Figure F below.

A.

	0			
	0			
	0			
	0			

C3 is shorted to ground.

B.

	1			
	1			
	1			
	1			

C3 is shorted to +12 volts.

C.

[1/0]	[1/0]	[1/0]	[1/0]	[1/0]

R0 is shorted to ground.

D.

1	1	1	1	1

R0 is shorted to +12 volts.

E.

(1/0)	1	(1/0)	(1/0)	(1/0)

C3 is open.

F.

	1			
	(1/0)			
	(1/0)			
	(1/0)			

R0 is open.

[1/0] = Displays “1” when open, “0” when button is depressed.

(1/0) = Toggles between “1” and “0” while button is depressed.

Figure 6-4. Diagnostic Mode Group 1 Matrix

DIAGNOSTIC MODE GROUP 2

GENERAL

When the radio Diagnostic Mode is first accessed, Diagnostic Group 1 appears on the LCD display, as indicated by the “d1” in the lower portion. Push the LO/DX button on the front panel to sequence to Diagnostic Group 2. See Figure 6-5.

The upper portion of the Diagnostic Group 2 display shows a line of eight input bits each of which correlates to a particular switch function. The characters “d2” appear in the lower portion.

SAMPLE DIAGNOSTIC

Operate the switch while observing the input bit. The input bit to watch correlates with the position of the switch in the line.

For example, the INTERCOM OFF/ON SWITCH is the fifth input bit from the left hand side. If the input bit toggles between “1” and “0” as the console mounted rocker switch is turned ON and then OFF, respectively, then the switch is functioning normally. However, if the switch is locked on “1” or “0,” then a problem exists.

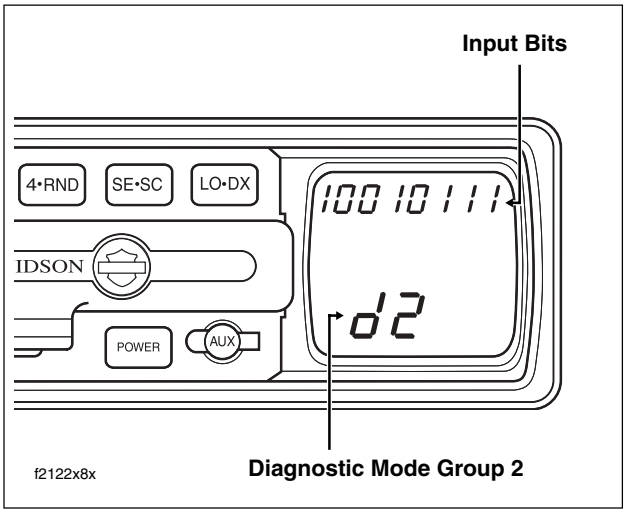


Figure 6-5. Front Panel LCD Display

Unlike the Diagnostic Group 1 input bits, whether the problem is a short to ground, a short to +12 volts or an open is not so readily apparent. See Figure 6-6 for further explanation of the Diagnostic Group 2 input bits and then refer to the appropriate flow chart under SOFTWARE DIAGNOSIS.

Not Applicable to Classic/Road Glide Models

0=PTT	0 or 1	1=Break		1=ON	1=ON	10=Headset 11=Speaker 01=Center	
HAND-HELD MIC. PTT	AVC VEHICLE SPEED SIGNAL	VOX BREAK	CB SQUELCH BREAK	INTERCOM OFF/ON SWITCH	CB OFF/ON SWITCH	SPEAKER SWITCH “B”	SPEAKER SWITCH “A”
7 (BE/Y)	6 (W/GN)	5 Internal	4 Internal	3 Internal	2 Internal	1 (BN/O)	0 (V/O)

Diagnostic Mode 2, which displays the logic states of various signals, functions as follows (left to right):

- Handheld Microphone PTT: input bit on LCD appears as “1” when PTT button is **not** depressed, “0” when button is depressed. (This should not be confused with the handlebar mounted PTT Switch.)
- AVC Vehicle Speed Signal: Input bit normally toggles between “1” and “0” as the rear wheel is rotated greater than 3 mph. The rate at which it toggles is proportional to the speed of the wheel.
- * VOX Break: When the microphone signal is strong enough to exceed threshold (set in Intercom Set Up Mode), input bit on LCD appears as “1.” When VOX is not broken, display appears as “0.”
- * CB Squelch Break: When CB receives signal strong enough to exceed threshold (set by squelch level setting), input bit on LCD appears as “1.” When CB Squelch is not broken, display appears as “0.”
- Intercom OFF/ON: When switch is ON, input bit on LCD display appears as “1.” When switch is OFF, display appears as “0.”
- CB OFF/ON: When switch is ON, input bit on LCD appears as “1.” When switch is OFF, display appears as “0.”
- Speaker Switch A, Speaker Switch B: When fairing cap rocker switch is in the HEADSET position, input bits on LCD display appears as “10.” Display is “11” in the SPEAKER position and “01” in the Center position.

* CB or Intercom must be turned on and VOX or Squelch settings must be established before entering diagnostic mode.

Figure 6-6. Diagnostic Mode Group 2

BREAKOUT BOX 6.3

GENERAL

The RADIO BREAKOUT BOX (Part No. HD-44608), used in conjunction with a DVOM, allows circuit diagnosis without having to probe connectors with sharp objects. See Figure 6-7.

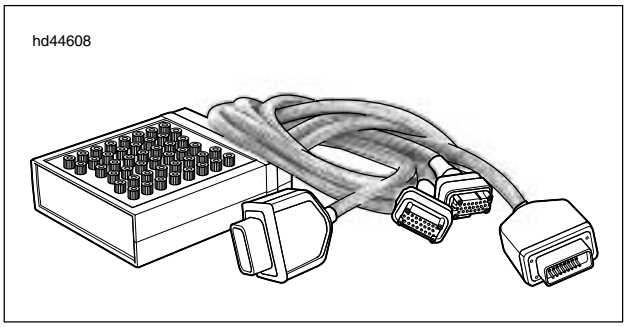


Figure 6-7. Radio Breakout Box (HD-44608)

INSTALLATION

1. Remove the outer fairing. See 2003 Touring Service Manual (Part Number 99483-03).
2. Remove black connector [27] from back of radio to release interconnect harness. See Figure 6-8.
3. Remove gray connector [28] from back of radio to release audio harness (Ultra models only).
4. Install black connectors on Breakout Box to black radio and interconnect harness connectors.
5. Install gray connectors on Breakout Box to gray radio and audio harness connectors.

REMOVAL

1. Remove Breakout Box between radio and wiring harness connectors.
2. Install black connector [27] at back of radio to connect interconnect harness. See Figure 6-8.
3. Install gray connector [28] at back of radio to connect audio harness (Ultra models only).
4. Install the outer fairing. See 2003 Touring Service Manual (Part Number 99483-03).

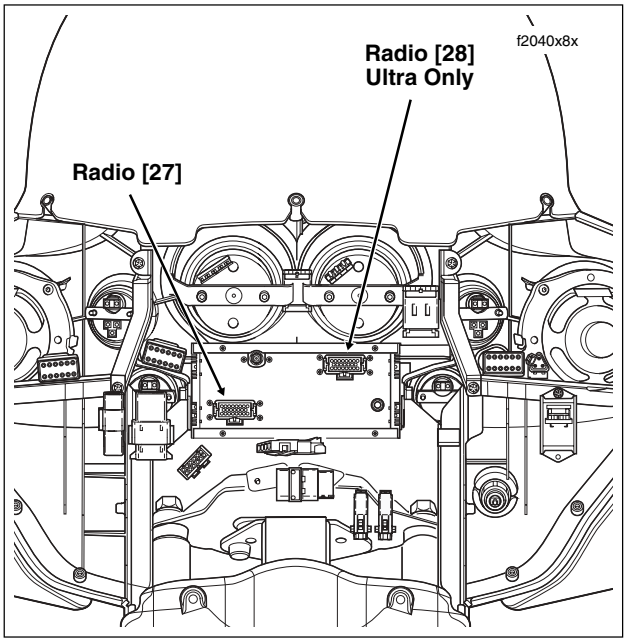


Figure 6-8. Radio Connections - FLHTCU

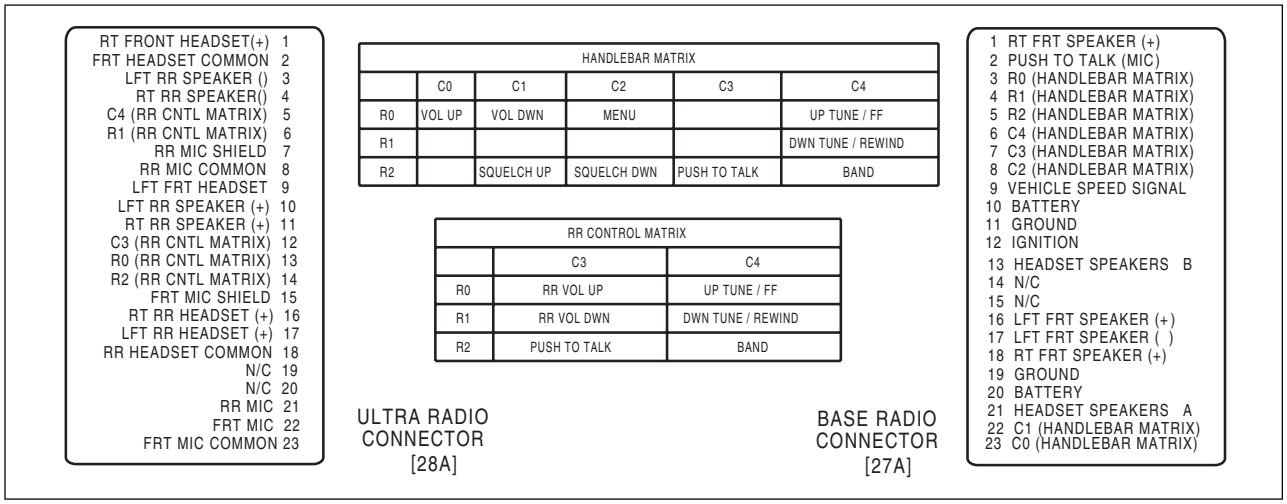


Figure 6-9. Radio Pinouts

RADIO SYMPTOM 1 6.4

GENERAL

Problem

Audio control inoperative.

Setup

- Press the POWER button to turn the radio ON.
- Press and hold the CB button to turn the Citizen Band radio OFF. Press and hold the INT button to turn the Intercom OFF.
- Set fairing mounted Headset/Speaker Switch to SPEAKER.

Functionality

Locate the Audio Control Switch on the left handlebar. Push the switch in to sequence to Bass, Treble, Fader and then back to Volume. The front panel LCD display indicates the function selected.

Momentarily push the switch upward (+) to raise the volume, downward (-) to lower the volume. The front panel LCD annunciates volume level through a horizontal bar graph display and stereo audio should be present in all four speakers (front speakers on non-Ultra). The display reverts to the time of day approximately two seconds after the switch is released.

Are these your observations?

- **Yes -** System is OK. See Section 6.6 RADIO SYMPTOM 3.
- **No -** See Test 6.4 (Part 1 of 2).

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers in the Test 6.4 flow charts.

1. This also may be an open. First go to SHORT TO VOLTAGE in Test 6.4 (Part 2 of 2).

Not Applicable to Classic/Road Glide Models

	C4 (BN/W)	C3 (O/BK)	C2 (BN/BK)	C1 (GY/GN)	CO (GN/BE)
RO (PK/W)	MODE UP FF	REAR VOLUME UP	AUDIO IN	AUDIO -	AUDIO +
R1 (GY/W)	MODE DN RW	REAR VOLUME DOWN	EJECT	LO/DX	RADIO POWER
R2 (V/BK)	MODE IN	PTT	SQUELCH DOWN	SQUELCH UP	SEEK SCAN
R3 (INT)	NOT USED	PRESET 4	PRESET 3	PRESET 2	PRESET 1

Figure 6-10. Diagnostic Mode Group 1 Switch Matrix

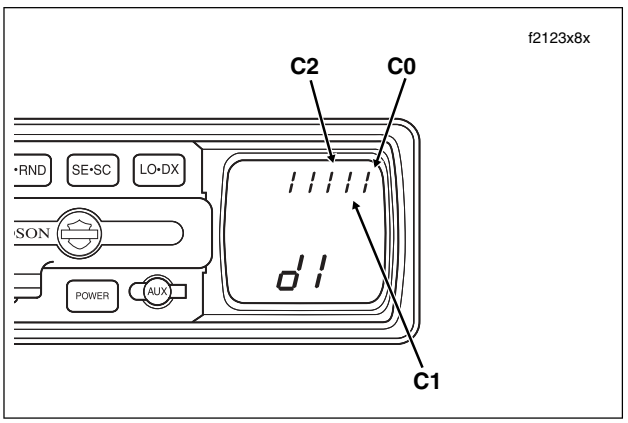


Figure 6-11. Audio Control Switch Input Bits

2. Install BREAKOUT BOX (Part No. HD-44608). See Section 6.3 BREAKOUT BOX, INSTALLATION.
3. Revalidate failure. Reconnect all connectors. If problem still exists, replace radio. If problem is gone, look for intermittents.
4. Use HARNESS CONNECTOR KIT (Part No. HD-41404), black pin probes and patch cord.

Test 6.4 (Part 1 of 2)

AUDIO CONTROL INOPERATIVE: SOFTWARE DIAGNOSIS

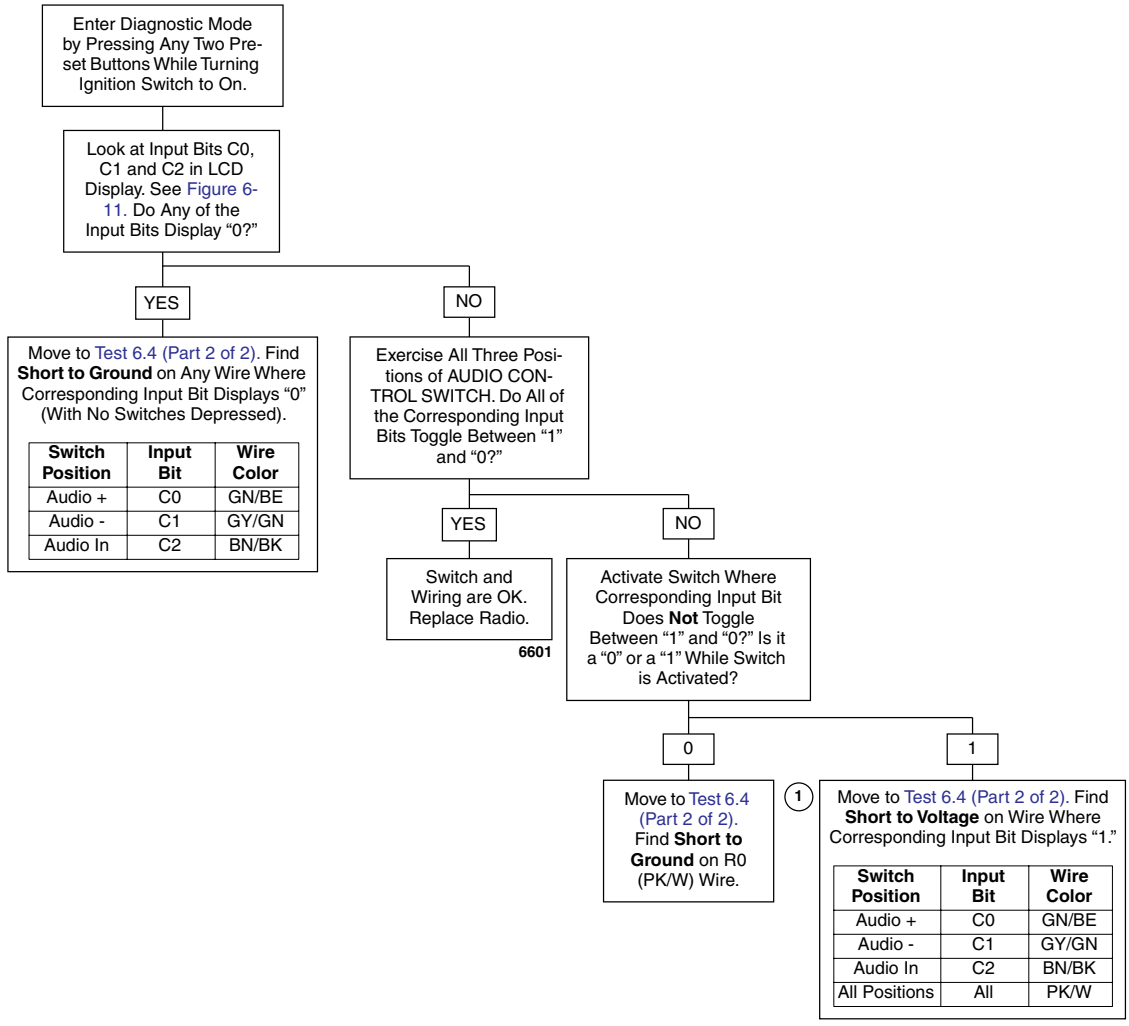
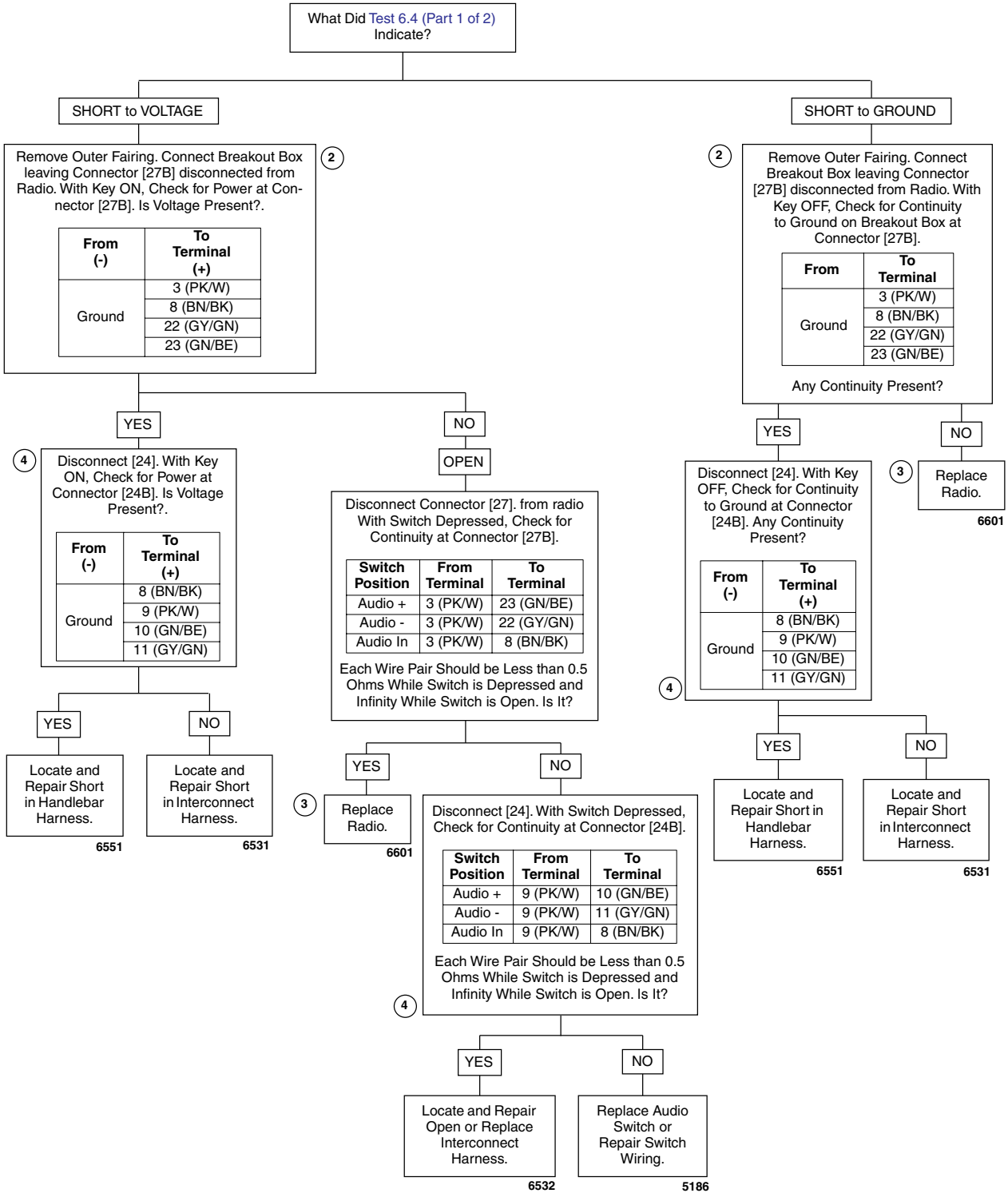


Table 6-2. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[24]	Interconnect Harness to Left Handlebar Switch Controls	FLHTC/U	12-Place Deutsch (Gray)	Inner Fairing- Left Fairing Support Brace
		FLTR	12-Place Deutsch (Gray)	Inner Fairing- Left Side of Radio Bracket
[27]	Radio	All	23-Place Amp (Black)	Inner Fairing- Back of Radio (Right Side)

Test 6.4 (Part 2 of 2)

AUDIO CONTROL INOPERATIVE: HARDWARE DIAGNOSIS



After correction of problem, refer to SETUP and FUNCTIONALITY to verify proper operation.

RADIO SYMPTOM 2 6.5

GENERAL

Problem

Mode control inoperative.

Setup

- Press the POWER button to turn the radio ON.
- Press and hold the CB button to turn the Citizen Band radio OFF. Press and hold the INT button to turn the Intercom OFF.

Functionality

Locate the Mode Select Switch on the right handlebar. Momentarily push the switch in to sequence between the AM, FM and WB bands. The LCD display indicates the band selected.

Momentarily push the Mode Select Switch in an upward direction (UP) to cause the receiver to increment one step on the frequency scale. Similarly, push the Mode Select Switch in a downward direction (DN) to cause the receiver to decrement one step on the frequency scale.

NOTE

In Intercom Setup Mode (Ultra models only), the UP and DN functions adjust the VOX sensitivity level. Press UP to increase microphone sensitivity, press DN to decrease sensitivity. In CB Setup Mode, UP and DN allow for channel selection.

Are these your observations?

- **Yes -** System is OK. See Owner's Manual.
- **No -** See Test 6.5 (Part 1 of 4).

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers in the Test 6.5 flow charts.

1. To eliminate Rear Mode Control Switch from diagnosis, disconnect Connector [28]. If problem is eliminated, see REAR MODE CONTROL INOPERATIVE. If problem remains, continue with present flow chart.
2. Install BREAKOUT BOX (Part No. HD-44608). See Section 6.3 BREAKOUT BOX, INSTALLATION.

Not Applicable to Classic/Road Glide Models

	C4 (BN/W)	C3 (O/BK)	C2 (BN/BK)	C1 (GY/GN)	CO (GN/BE)
RO (PK/W)	MODE UP FF	REAR VOLUME UP	AUDIO IN	AUDIO -	AUDIO +
R1 (GY/W)	MODE DN RW	REAR VOLUME DOWN	EJECT	LO/DX	RADIO POWER
R2 (V/BK)	MODE IN	PTT	SQUELCH DOWN	SQUELCH UP	SEEK SCAN
R3 (INT)	NOT USED	PRESET 4	PRESET 3	PRESET 2	PRESET 1

Figure 6-12. Diagnostic Mode Group 1 Switch Matrix

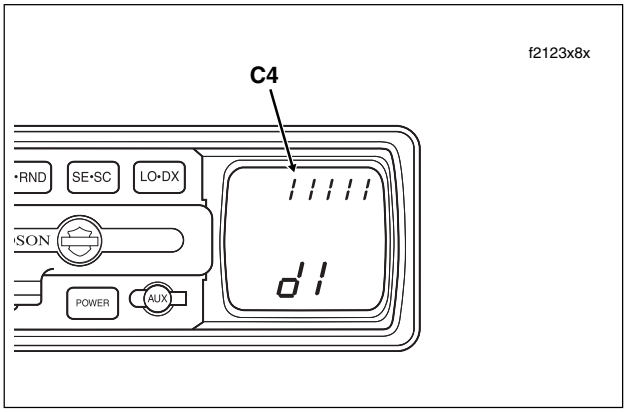
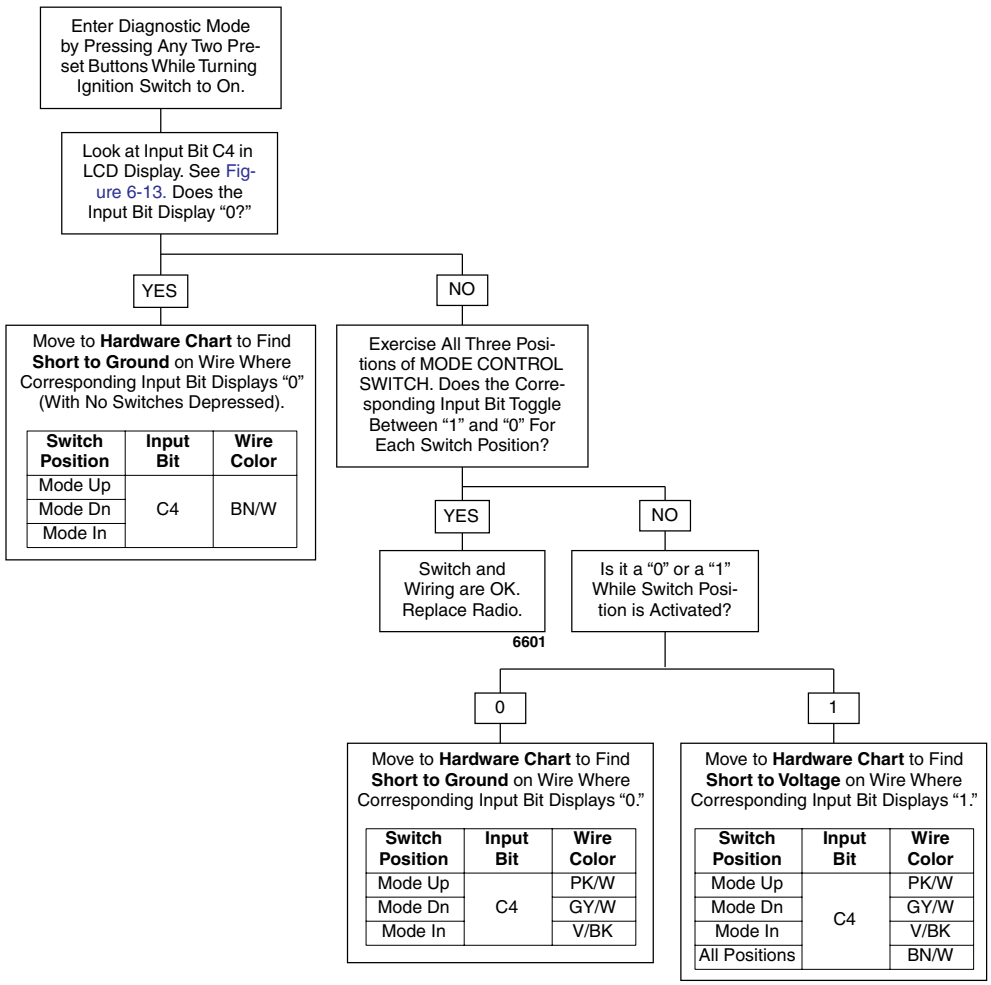


Figure 6-13. Mode Control Switch Input Bit

3. Revalidate failure. Reconnect all connectors. If problem still exists, replace radio. If problem is gone, look for intermittents.
4. Mode Control switch is integral part of sidecar amplifier. Replace sidecar amplifier if switch fails.
5. Use HARNESS CONNECTOR KIT (Part No. HD-41404), black pin probes and patch cord.
6. Use HARNESS CONNECTOR KIT (Part No. HD-41404), black socket probes and patch cord.

Test 6.5 (Part 1 of 4)

MODE CONTROL INOPERATIVE: SOFTWARE DIAGNOSIS



HARDWARE CHART	CONTINUE WITH
Front Mode Control	Test 6.5 (Part 2 of 4)
Rear Mode Control	Test 6.5 (Part 3 of 4)
Sidecar Mode Control	Test 6.5 (Part 4 of 4)

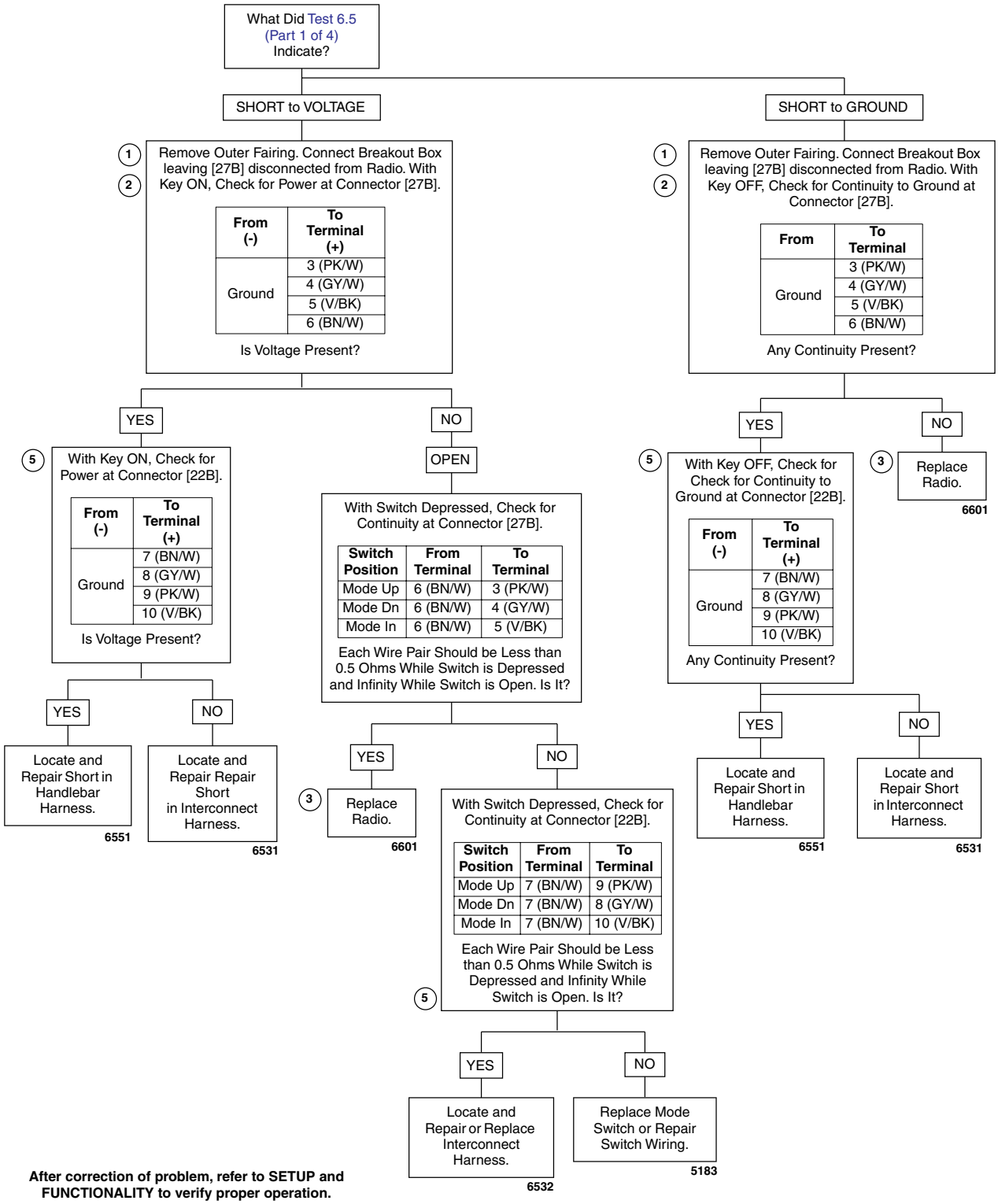
After correction of problem, refer to SETUP and FUNCTIONALITY to verify proper operation.

Table 6-3. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[22]	Interconnect Harness to Right Handlebar Switch Controls	FLHTC/U	12-Place Deutsch (Black)	Inner Fairing- Right Fairing Support Brace
		FLTR	12-Place Deutsch (Black)	Inner Fairing- Right Side of Radio Bracket
[27]	Radio	All	23-Place Amp (Black)	Inner Fairing- Back of Radio (Right Side)
[28]	Radio	All	23-Place Amp (Gray)	Inner Fairing- Back of Radio (Left Side)
[42]	Rear Left Speaker/Passenger Controls	FLHTCU	6-Place Mini-Deutsch (Black)	Inside Rear Left Speaker Box

Test 6.5 (Part 2 of 4)

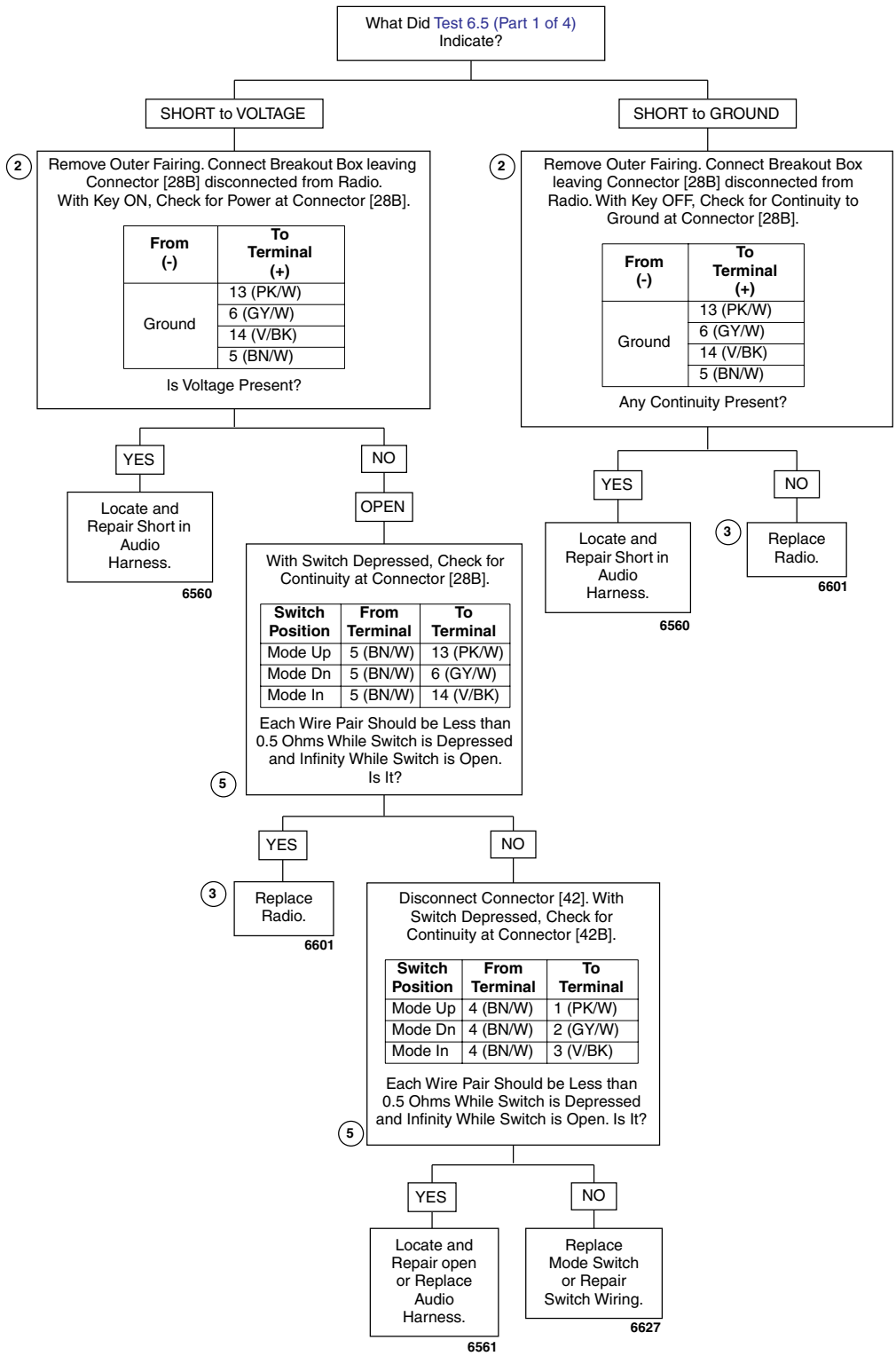
FRONT MODE CONTROL INOPERATIVE: HARDWARE DIAGNOSIS



After correction of problem, refer to SETUP and FUNCTIONALITY to verify proper operation.

Test 6.5 (Part 3 of 4)

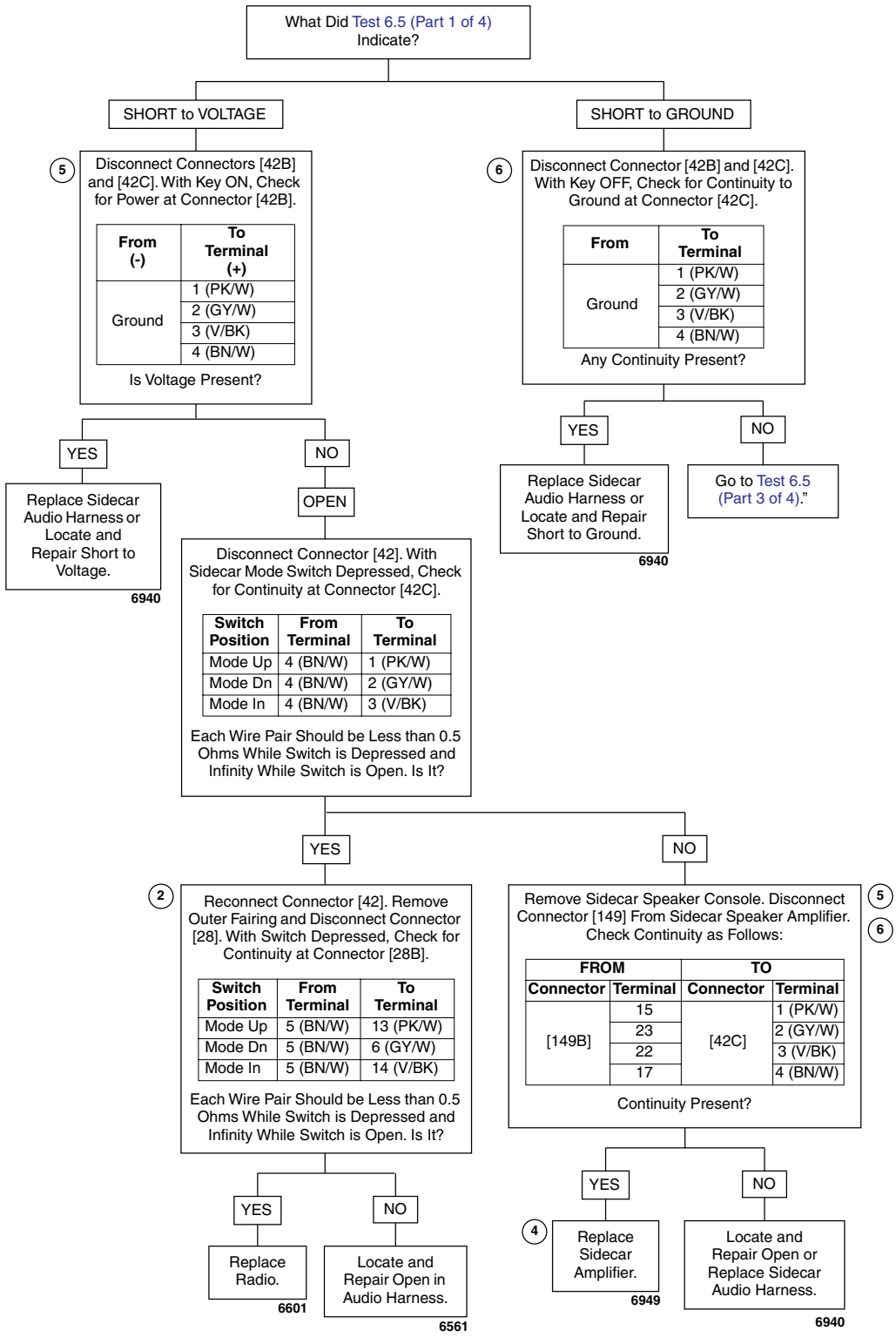
REAR MODE CONTROL INOPERATIVE: HARDWARE DIAGNOSIS



After correction of problem, refer to SETUP and FUNCTIONALITY to verify proper operation.

Test 6.5 (Part 4 of 4)

SIDECAR MODE CONTROL INOPERATIVE: HARDWARE DIAGNOSIS



After correction of problem, refer to SETUP and FUNCTIONALITY to verify proper operation.

RADIO SYMPTOM 3 6.6

GENERAL

Problem

No sound in one or more speakers (external).

Setup

- Press the POWER button to turn the radio ON.
- Press and hold the CB button to turn the Citizen Band radio OFF. Press and hold the INT button to turn the Intercom OFF.
- Set fairing mounted Headset/Speaker Switch to SPEAKER (red lamp illuminated).
- Set radio frequency to known strong station.
- Set Volume and Fader to Middle position on horizontal bar graph display.
- If performing sidecar diagnosis, rotate sidecar volume control clockwise to middle or full volume position.

Functionality

Sound should be audible in all speakers. Is it?

- **Yes -** System is OK.
- **No -** See Test 6.6 (Part 1 of 3).

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers in the Test 6.6 flow charts.

1. For input bit location see illustration inside flow chart.
2. If both motorcycle speakers and sidecar speakers are inoperative, first go to Test 6.6 (Part 2 of 3).
3. Perform following:
   a. **Impedance Check:** With ohmmeter set on R x 1, measure impedance or resistance of the speaker voice coil. Place probes of ohmmeter on the speaker terminals and observe the reading. Reading must be 6-10 ohms. Replace the speaker if any other reading is observed.
   b. **Cone Inspection:** Inspect the speaker cone for damage. Replace the speaker if torn or warped. Check for binding voice coil. Remove speaker and place four fingers evenly across the face of the speaker cone. Very gently press inward evenly on the cone. The cone must move smoothly without binding. Release finger pressure. Cone must move outward smoothly. Replace the speaker if the cone does not move without binding.
4. Assumes Speaker Switch B input bit displays “0.”
5. Revalidate failure. Reconnect all connectors. If problem still exists, replace radio. If problem is gone, look for intermittents.
6. Use HARNESS CONNECTOR KIT (Part No. HD-41404), black pin probes and patch cord.
7. Use HARNESS CONNECTOR KIT (Part No. HD-41404), black socket probes and patch cord.

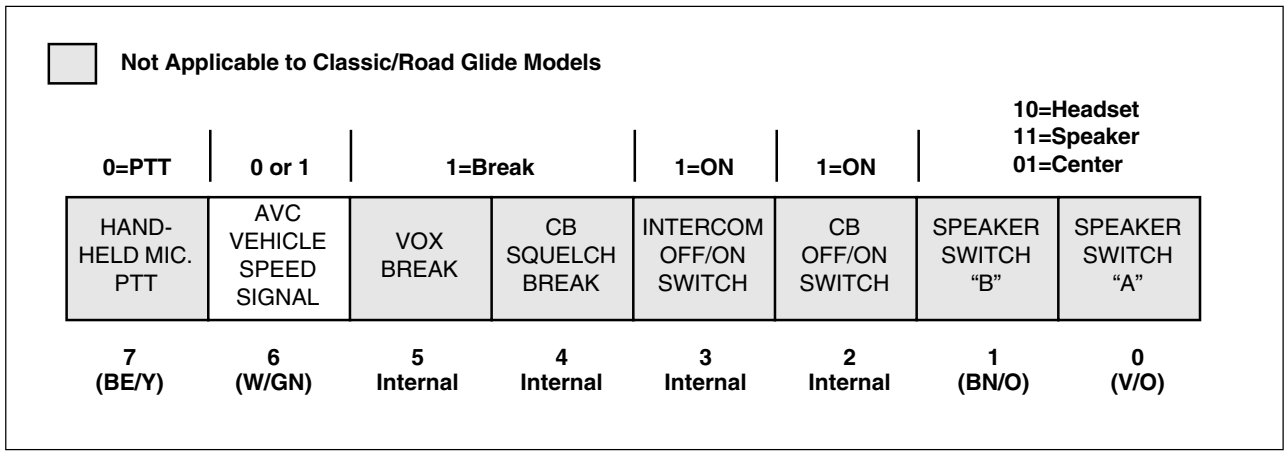
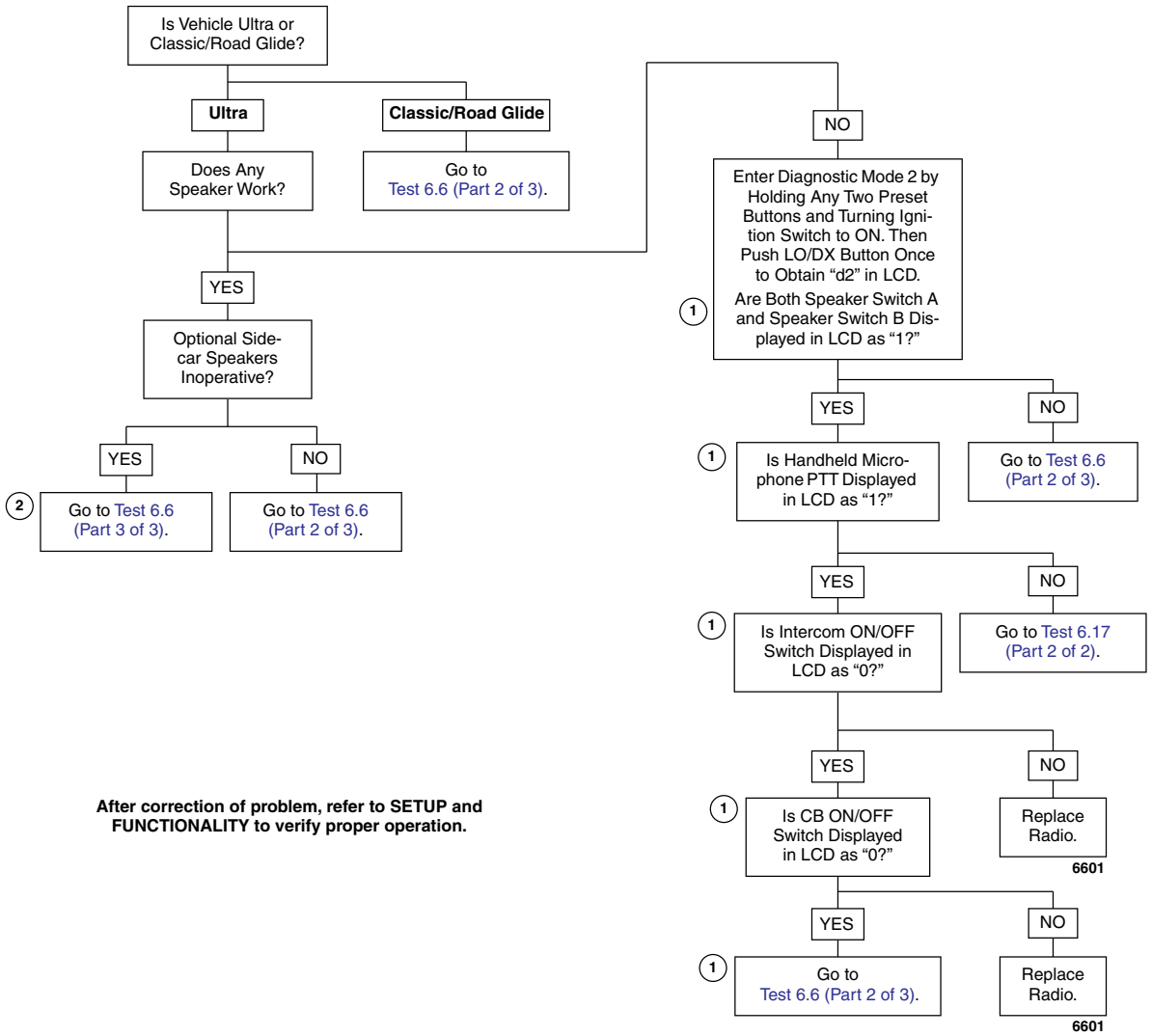


Figure 6-14. Diagnostic Mode Group 2 Matrix

Test 6.6 (Part 1 of 3)

NO SOUND IN ONE OR MORE SPEAKERS/SIDECAR SPEAKERS: SOFTWARE DIAGNOSIS



After correction of problem, refer to SETUP and FUNCTIONALITY to verify proper operation.

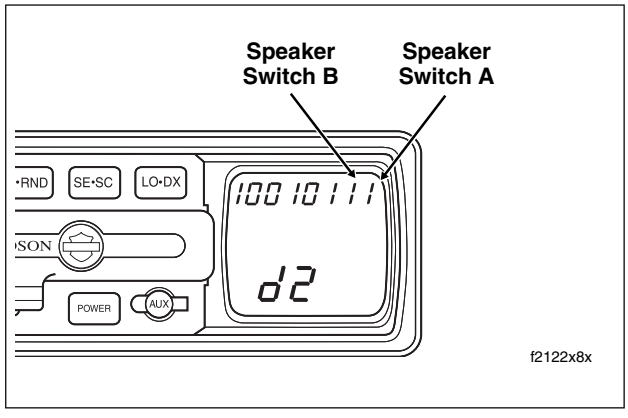
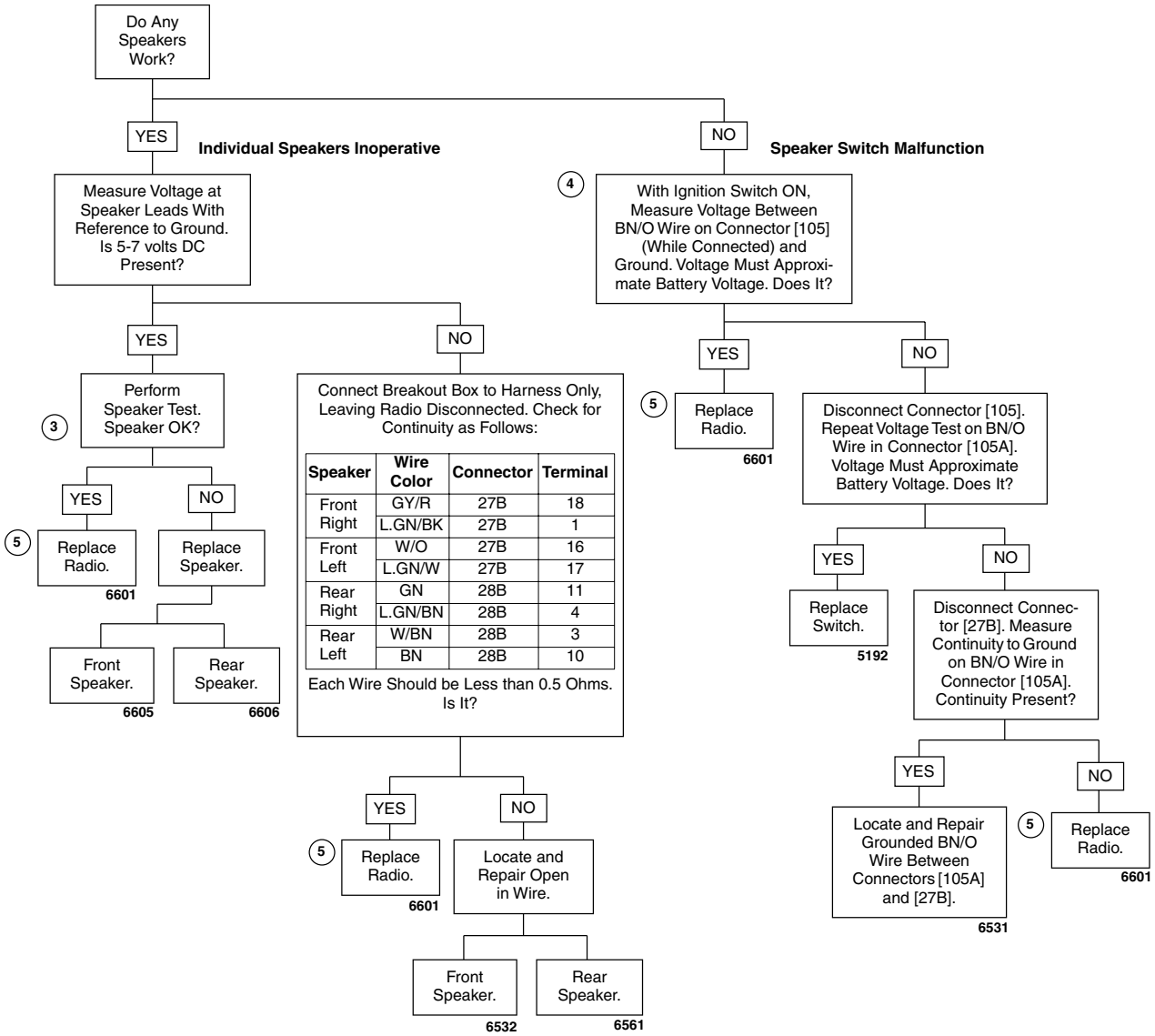


Figure 6-15. Speaker Switch B and Speaker Switch A Input Bits

Test 6.6 (Part 2 of 3)

NO SOUND IN ONE OR MORE SPEAKERS: HARDWARE DIAGNOSIS



Speaker	Wire Color	Connector	Terminal
Front Right	GY/R	27B	18
	L.GN/BK	27B	1
Front Left	W/O	27B	16
	L.GN/W	27B	17
Rear Right	GN	28B	11
	L.GN/BN	28B	4
Rear Left	W/BN	28B	3
	BN	28B	10

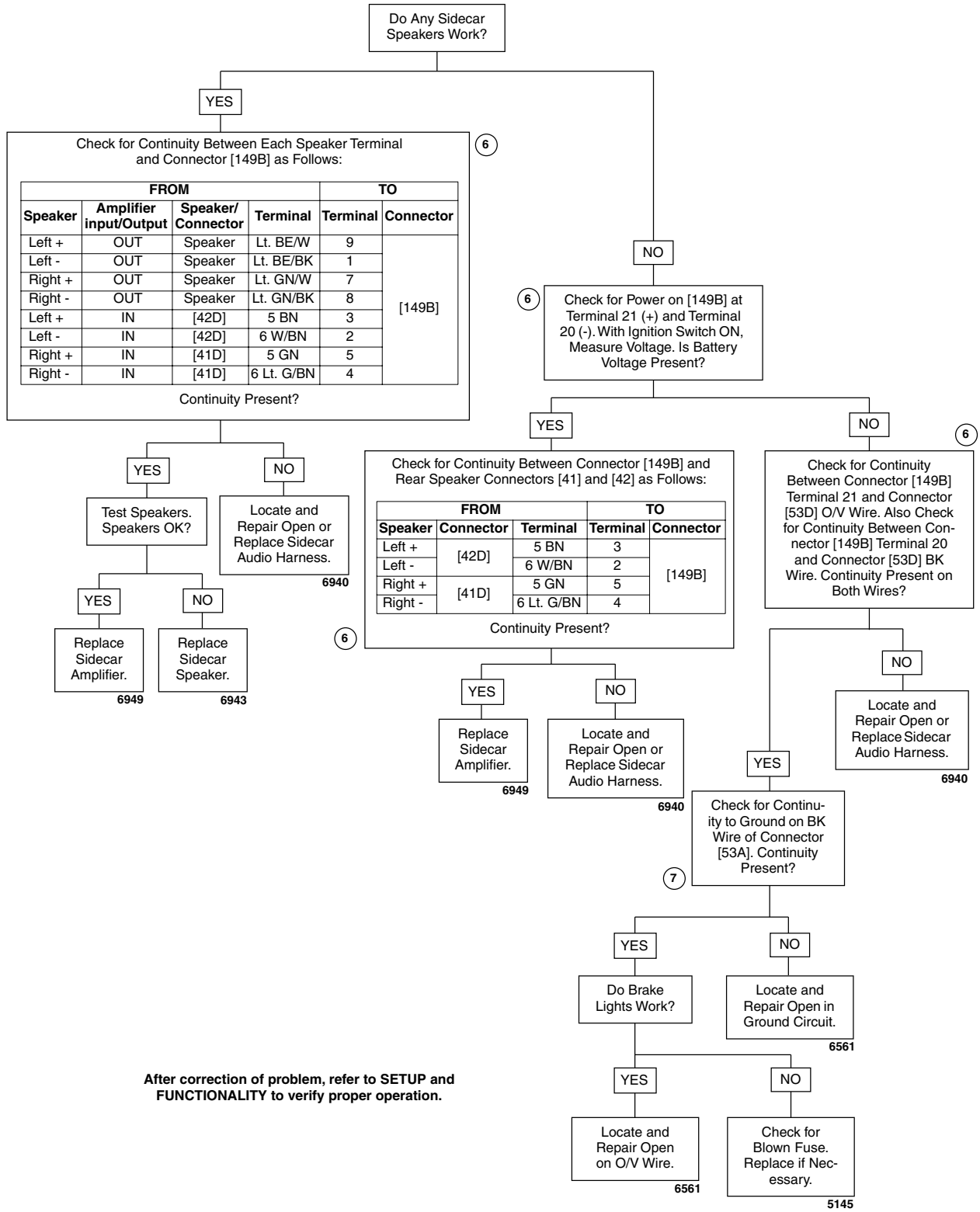
After correction of problem, refer to SETUP and FUNCTIONALITY to verify proper operation.

Table 6-4. FLHTC/U Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[27]	Radio	23-Place Amp (Black)	Inner Fairing- Back of Radio (Right Side)
[105]	Fairing Cap Switches	12-Place Multilock	Inner Fairing- Beneath Radio (Right Side)

Test 6.6 (Part 3 of 3)

NO SOUND IN ONE OR MORE SIDECAR SPEAKERS: HARDWARE DIAGNOSIS



After correction of problem, refer to SETUP and FUNCTIONALITY to verify proper operation.

GENERAL

Problem

Automatic volume control (AVC) inoperative.

Setup

- Press the POWER button to turn the radio ON.
- Press and hold the CB button to turn the Citizen Band radio OFF. Press and hold the INT button to turn the Intercom OFF.
- Set fairing mounted Headset/Speaker Switch to SPEAKER (red lamp illuminated).
- Set radio frequency to known strong station.
- Set Volume and Fader to Middle position on horizontal bar graph display.

Functionality

To compensate for higher background noise, volume should increase with increasing motorcycle speed (most evident above 40 MPH). Does it?

- **Yes -** System is OK.
- **No -** See Test 6.7 (Part 1 of 2).

NOTE

Since AVC function is not as obtrusive as that seen in previous model years, providing a very smooth transition from no AVC effect up to full AVC effect, it may be most easily observed in the headsets (Ultra models only). To ramp the AVC up or down, that is, to change the rate of volume increase, see Automatic Volume Control (AVC) Adjustment below.

DIAGNOSTICS

Automatic Volume Control (AVC) Adjustment

Active in CB, INTERCOM and music, Automatic Volume Control (AVC) automatically adjusts volume level to compensate for ambient noise associated with motorcycle speed. Since wind and road noise is less of a factor with headset speakers, headset and external speakers are provided with separate AVC schedules.

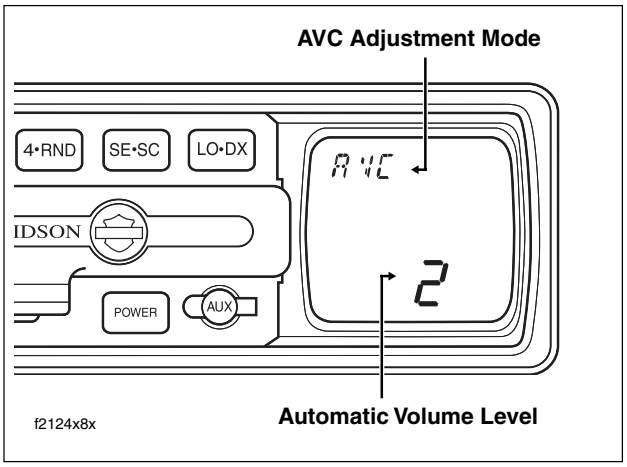


Figure 6-16. Adjust Automatic Volume Control

If the AVC does not adequately compensate for ambient noise (or if it overcompensates), adjust as follows:

1. Push any two Preset buttons on the front panel of the radio. With the buttons depressed, turn the Ignition/Light Key Switch to IGNITION. Diagnostic Group 1, the first of five diagnostic screens, appears on the LCD display, as indicated by the “d1” in the lower portion.
2. Continue pushing the LO/DX button on the front panel of the radio to sequence to the AVC adjustment screen. The letters “AVC” are displayed in the upper portion of the LCD display, while the automatic volume level number appears in the lower portion. See Figure 6-16.
3. To ramp the AVC up, press the Mode Select Switch on the right handlebar in an upward direction (UP). To ramp the AVC down, press the switch in a downward direction (DN). Although the factory presets the volume level at number “2,” it is adjustable from “0” (AVC least aggressive) to “4” (AVC most aggressive). Any adjustment affects the AVC schedules of both headset and external speakers.
4. After making the desired change, continue pushing the LO/DX button until the system reverts back to normal radio operation. The Diagnostic Mode also can be exited by simply turning the Ignition/Light Key Switch to OFF.

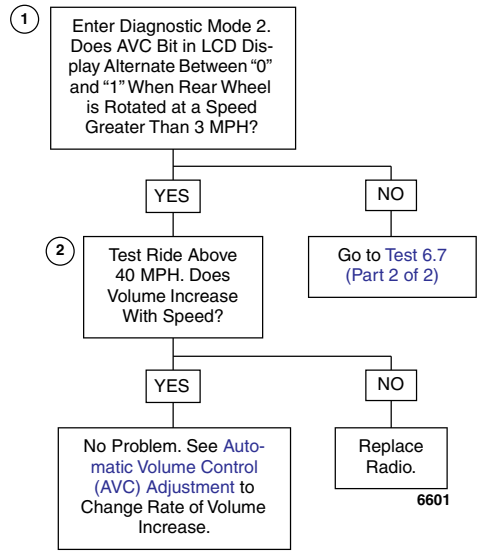
Diagnostic Notes

The reference numbers below correlate with the circled numbers in the Test 6.7 flow charts.

1. The circuit that recognizes the reed switch signal is the same one that controls the AVC. If the bit alternates between “0” and “1,” then the AVC is functioning as designed.
2. Connect Speedometer Tester (HD-41354) to speedometer sensor connector [65] located under the seat (3-place Deutsch). Enter a speed greater than 40 MPH, and observe speedometer needle and radio volume. Volume should begin to increase around 40 MPH and further increase as indicated speed rises above 40 MPH.
3. See Test 6.7 (Part 1 of 2).
4. Install BREAKOUT BOX (Part No. HD-44608). See Section 6.3 BREAKOUT BOX, INSTALLATION.
5. Connect Speedometer Tester (HD-41354) to speedometer sensor connector [65] located under the seat (3-place Deutsch). For a signal that duplicates 3 MPH, enter the number “70” on the keypad and watch for a voltage drop on the W/GN wire. If the tester is not available, elevate the rear wheel and spin briskly while looking for voltage drop.
6. To enable Diagnostic Mode, depress odometer reset switch and turn Ignition/Light Key Switch to IGNITION. To clear codes, depress and hold reset switch for ten seconds. To return speedometer to normal operating mode, cycle Ignition/light Key Switch.
7. Leaving Speedometer Connector [39] connected, insert probe into wire end of connector [39B] until contact is made with backside of terminal. If necessary, use a fine paper clip to avoid damage.

Test 6.7 (Part 1 of 2)

AUTOMATIC VOLUME CONTROL (AVC) INOPERATIVE: SOFTWARE DIAGNOSIS



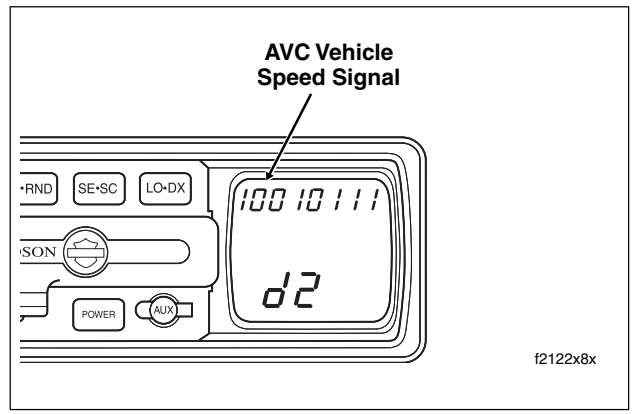
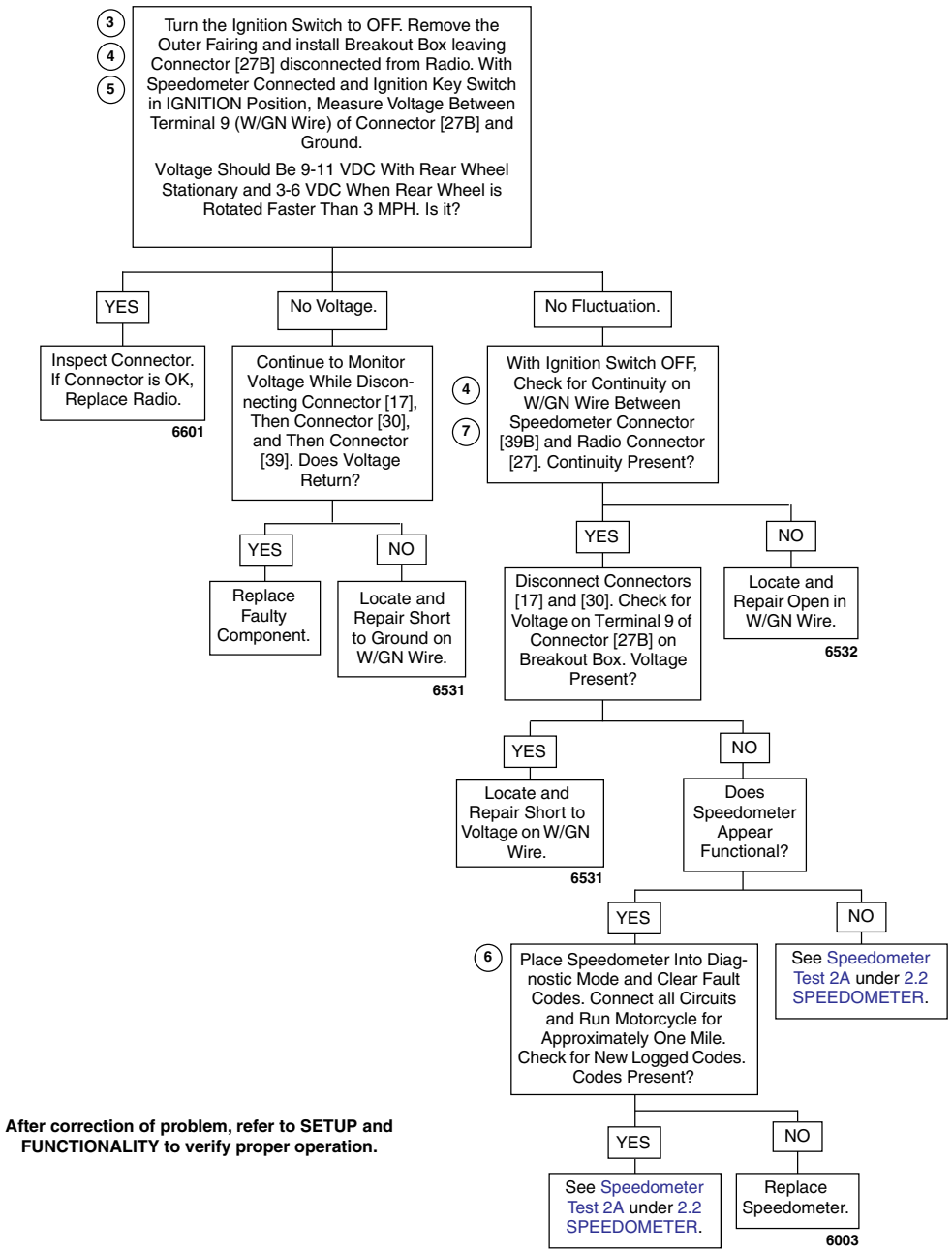


Figure 6-17. LCD Input Bit Display

Test 6.7 (Part 2 of 2)

AUTOMATIC VOLUME CONTROL (AVC) INOPERATIVE: HARDWARE DIAGNOSIS



After correction of problem, refer to SETUP and FUNCTIONALITY to verify proper operation.

Table 6-5. FLHTC/U Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[17]	Cruise Control Module	10-Place Packard	Under Left Side Cover
[27]	Radio	23-Place Amp (Black)	Inner Fairing- Back of Radio (Right Side)
[30]	Turn Signal/Security Module	12-Place Deutsch	Cavity in Crossmember at Rear of Battery Box (Under Seat)
[39]	Speedometer	12-Place Packard	Inner Fairing- Back of Speedometer

RADIO SYMPTOM 5 6.8

GENERAL

Problem

Poor stereo reception.

Setup

- Press the POWER button to turn the radio ON.
- Select AM mode.
- Set LO/DX Switch to LO(CAL).
- Select SEEK function and use MODE CONTROL SWITCH to select station with strong signal.

Functionality

Radio should lock onto strong station. Does it?

- **Yes -** System is OK.
- **No -** See Radio Antenna Test below. If antenna passes test, continue with the Test 6.8 flow chart.

DIAGNOSTICS

Radio Antenna Test

A faulty antenna can cause poor reception. Check it in three steps after cleaning the mast.

1. See Figure 6-18. Set your ohmmeter to the X 1 scale and connect the leads as shown. If the reading is more than 1 ohm, replace the antenna or cable. If less than 1 ohm, proceed to Step 2.
2. Using the same scale, connect the leads as shown. If the reading is greater than 1 ohm, replace the antenna or cable. If less than 1 ohm, proceed to Step 3.
3. Set the meter to the X 1,000 scale and connect the leads as shown. If the reading is not infinite, replace the antenna or cable. If replacement parts are necessary, retest after installation of new parts.

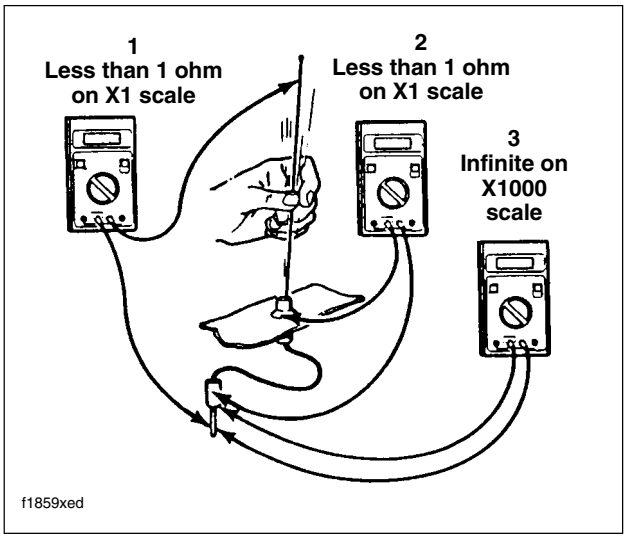
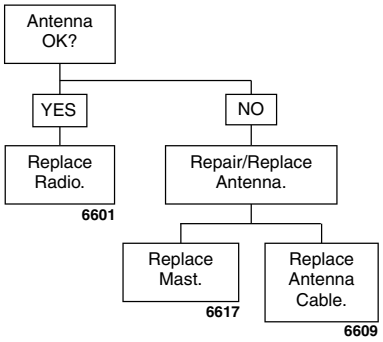


Figure 6-18. Antenna Test Hookup

Test 6.8

POOR STEREO RECEPTION



RADIO SYMPTOM 6 6.9

GENERAL

Problem

No power.

Setup

- Turn the Ignition/Light Key Switch to IGNITION.

Functionality

The radio LCD should illuminate. The LCD should display the time or an operational mode (radio, CD, etc.), depending on the last state of the POWER button on the radio front panel. The radio should toggle between the time display and an operational mode when the POWER button is repeatedly pushed. Does it?

- **Yes -** System is OK.
- **No -** See Test 6.9 (Part 1 of 2).

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers in the Test 6.9 flow charts.

1. See Test 6.9 (Part 1 of 2).
2. Perform tests to ensure that battery is fully charged.

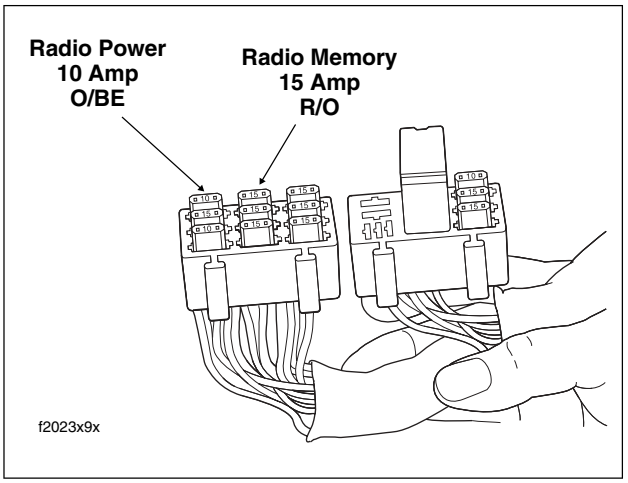
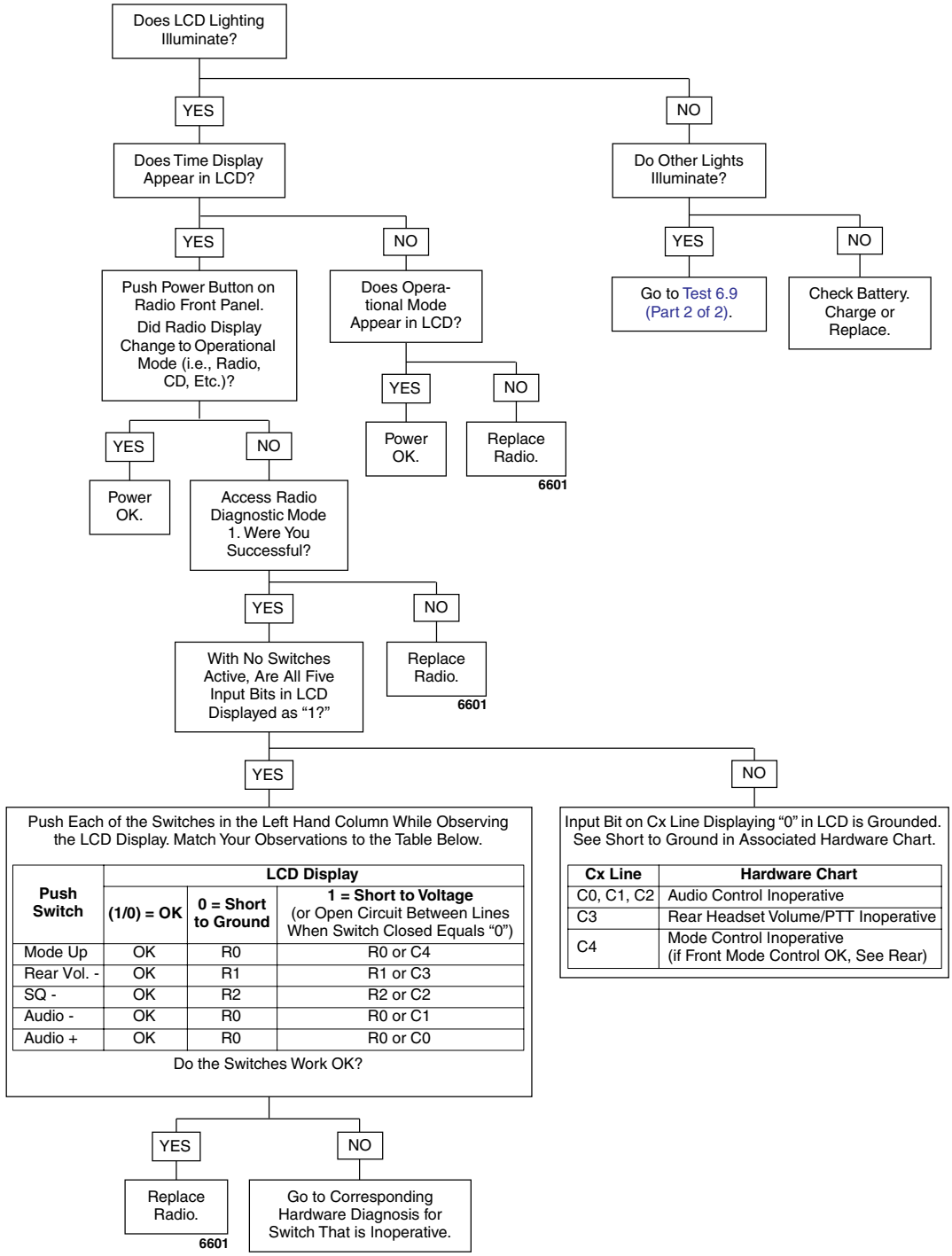


Figure 6-19. Fuse Blocks (Under Left Side Cover)

3. Install BREAKOUT BOX (Part No. HD-44608). See Section 6.3 BREAKOUT BOX, INSTALLATION.
4. Revalidate failure. Reconnect all connectors. If problem still exists, replace radio. If problem is gone, look for intermittents.
5. Use HARNESS CONNECTOR KIT (Part No. HD-41404), black pin probes and patch cord.

Test 6.9 (Part 1 of 2)

NO POWER: SOFTWARE DIAGNOSIS



After correction of problem, refer to SETUP and FUNCTIONALITY to verify proper operation.

Test 6.9 (Part 2 of 2)

NO POWER: HARDWARE DIAGNOSIS

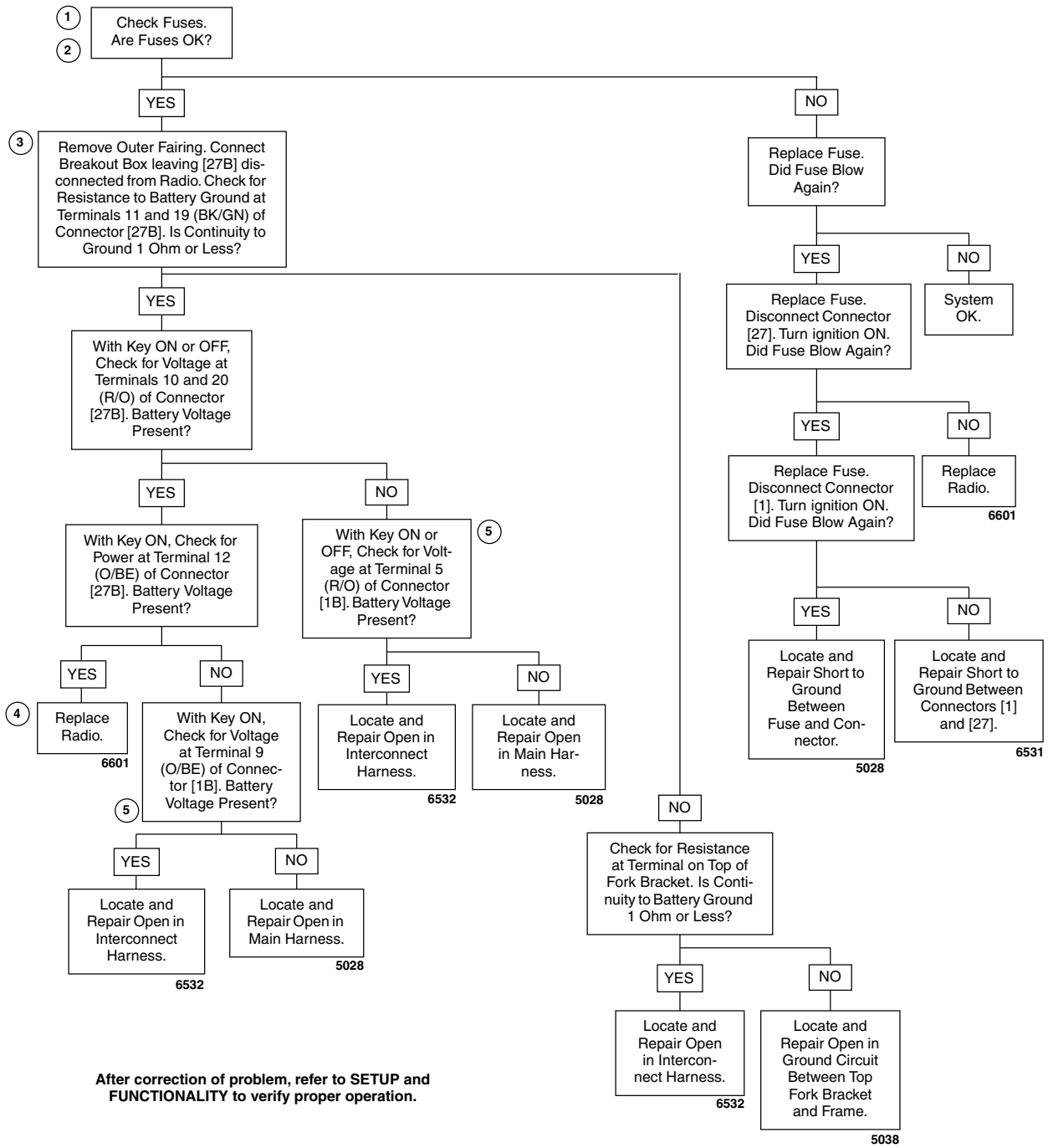


Table 6-6. Wire Harness Connectors

NO.	DESCRIPTION	MODEL	TYPE	LOCATION
[1]	Main to Interconnect Harness	FLHTC/U	12-Place Deutsch	Inner Fairing- Right Fairing Bracket
		FLTR	12-Place Deutsch	Inner Fairing- Below Radio (Right Side)
[27]	Radio	All	23-Place Amp (Black)	Inner Fairing- Back of Radio (Right Side)

RADIO SYMPTOM 7 6.10

GENERAL

Problem

CD will not eject.

Setup

- Press the POWER button to turn the radio ON.

Functionality

CD should eject when EJECT button is pushed while radio is in either CD or radio mode. Does it?

- Yes - System is OK.
- **No -** See Test 6.10 (Part 1 of 2).

DIAGNOSTICS

Diagnostic Notes

The reference number below correlates with the circled numbers in the Test 6.10 flow charts.

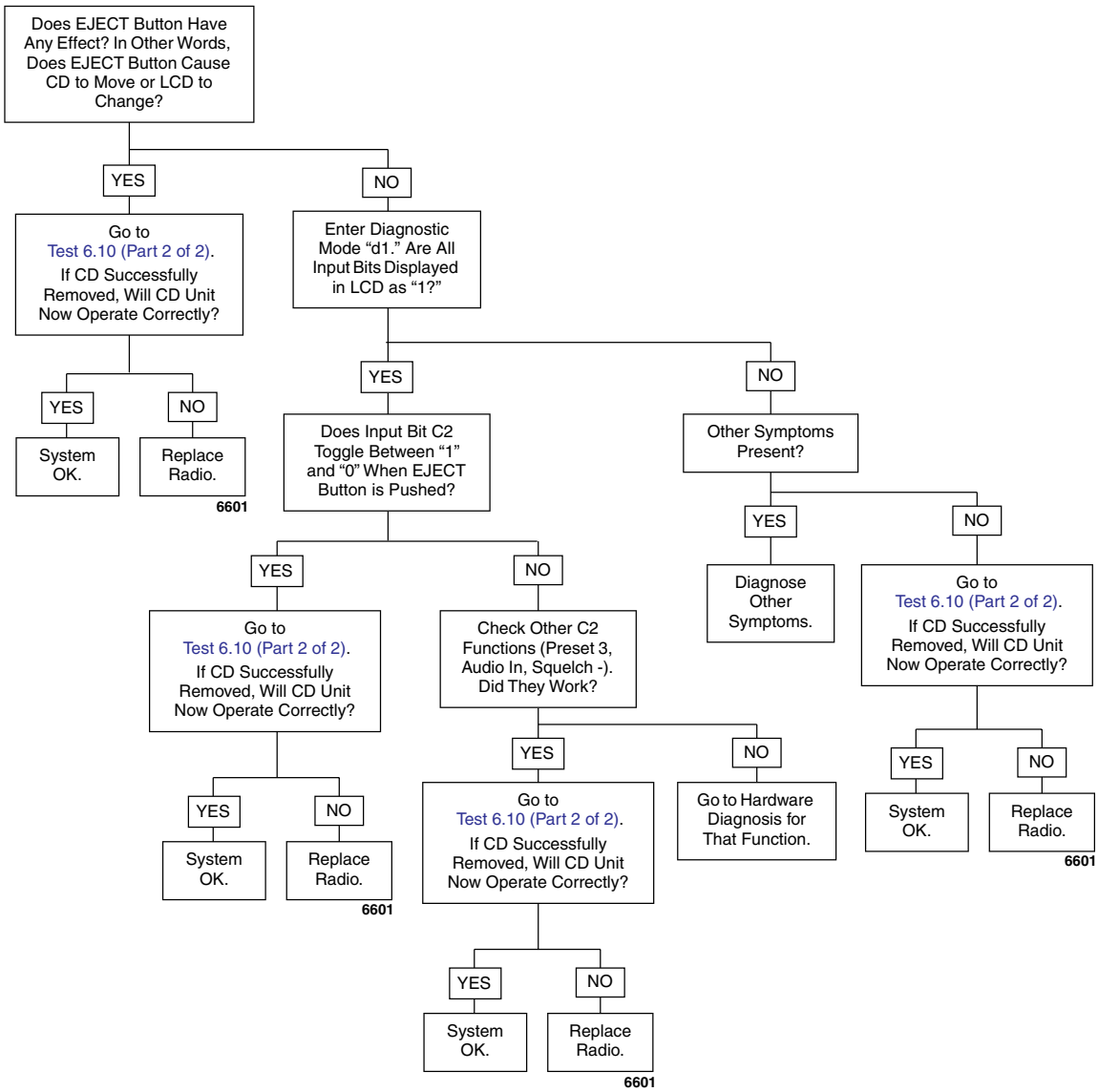
CAUTION

Do not force mechanism or radio damage will occur.

1. If ejection does not work, contact your Radio Sound representative.

Test 6.10 (Part 1 of 2)

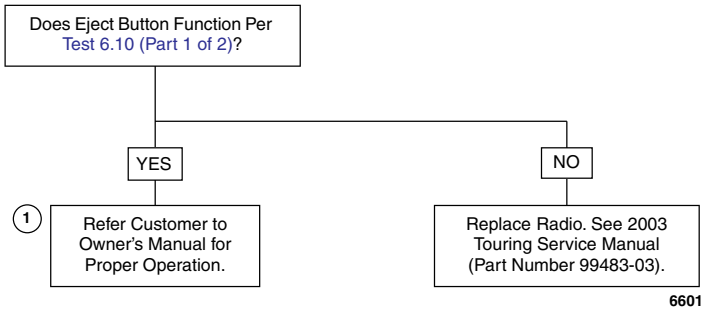
CD WILL NOT EJECT: SOFTWARE DIAGNOSIS



After correction of problem, refer to SETUP and FUNCTIONALITY to verify proper operation.

Test 6.10 (Part 2 of 2)

CD WILL NOT EJECT: HARDWARE DIAGNOSIS



After correction of problem, refer to SETUP and FUNCTIONALITY to verify proper operation.

RADIO SYMPTOM 8 6.11

GENERAL

Problem

No sound in one or more headsets/microphone inoperative.

Setup

- Press the POWER button to turn the radio ON.
- Set fairing mounted Headset/Speaker Switch to HEADSET.
- Press and hold the CB button to turn the Citizen Band radio OFF. Press and hold the INT button to turn the Intercom OFF.
- Set Front and Rear Volume Control to Middle position on horizontal bar graph display.
- Set radio frequency to known strong station.

Functionality

Sound should be audible in all headsets. Is it?

- **Yes -** System is OK.
- **No -** See Test 6.11 (Part 1 of 2).

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers in the Test 6.11 flow charts.

1. Install BREAKOUT BOX (Part No. HD-44608). See Section 6.3 BREAKOUT BOX, INSTALLATION.
2. BE/Y Wire for Handheld PTT is also part of front Interconnect Harness.

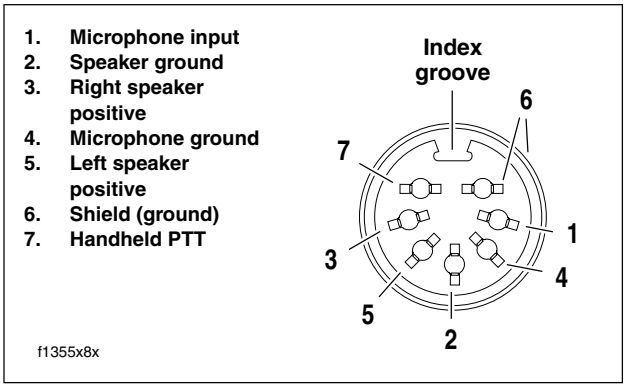


Figure 6-20. 7-place DIN Connector: Socket Side

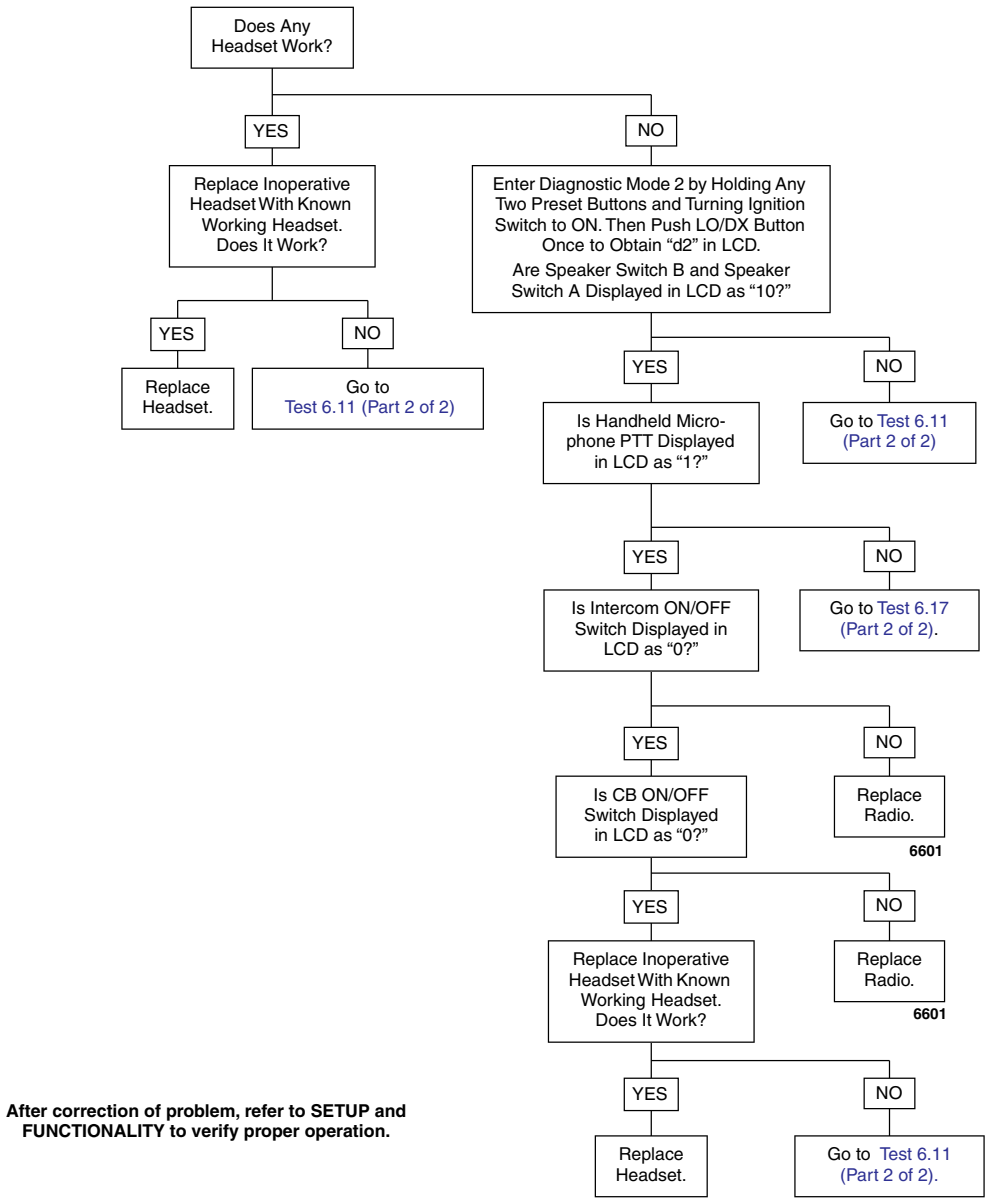
Not Applicable to Classic/Road Glide Models

0=PTT	0 or 1	1=Break		1=ON	1=ON	10=Headset 11=Speaker 01=Center	
HAND-HELD MIC. PTT	AVC VEHICLE SPEED SIGNAL	VOX BREAK	CB SQUELCH BREAK	INTERCOM OFF/ON SWITCH	CB OFF/ON SWITCH	SPEAKER SWITCH “B”	SPEAKER SWITCH “A”
7 (BE/Y)	6 (W/GN)	5 Internal	4 Internal	3 Internal	2 Internal	1 (BN/O)	0 (V/O)

Figure 6-21. Diagnostic Mode Group 2

Test 6.11 (Part 1 of 2)

NO SOUND IN ONE OR MORE HEADSETS/MICROPHONE INOPERATIVE: SOFTWARE DIAGNOSIS



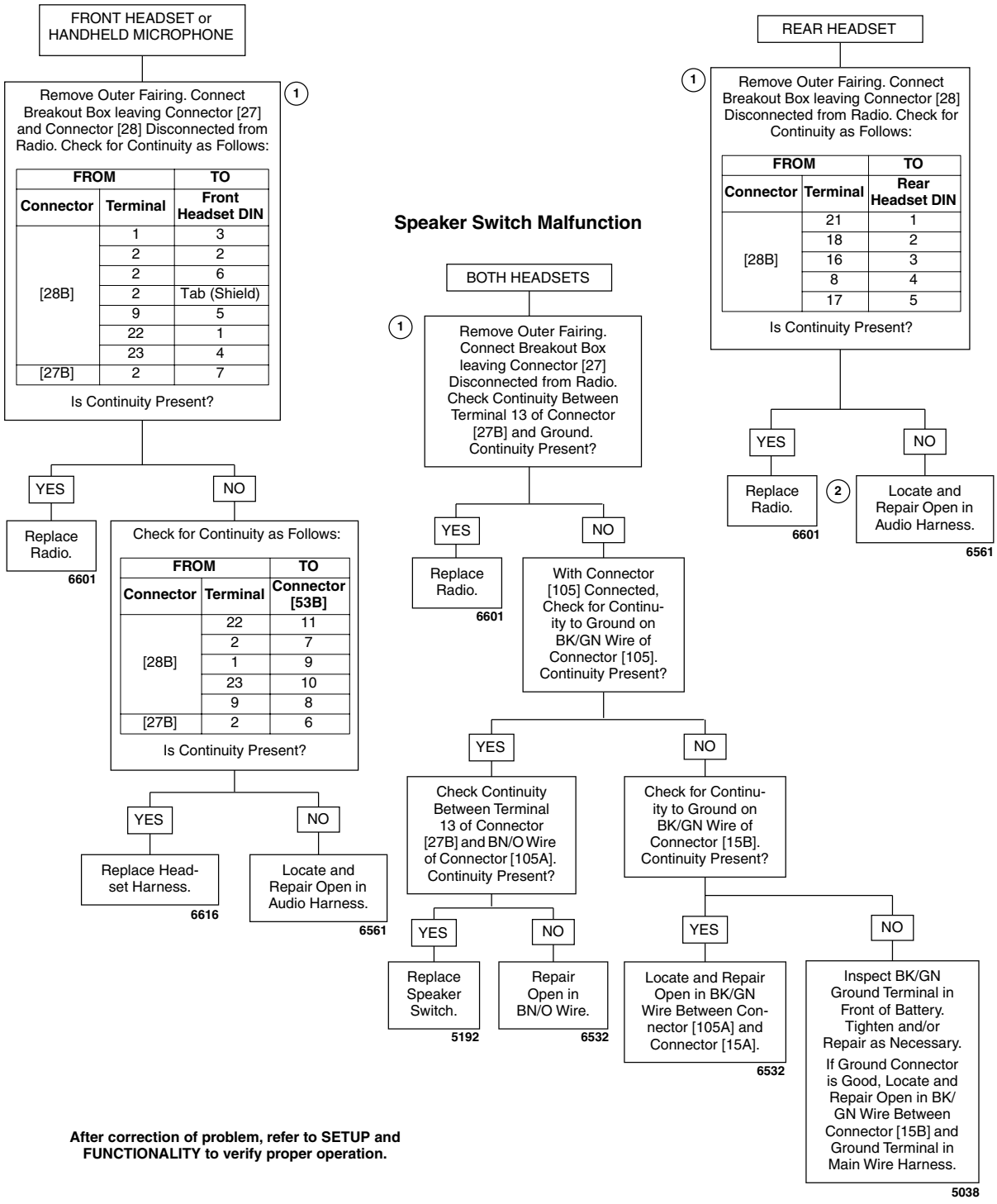
After correction of problem, refer to SETUP and FUNCTIONALITY to verify proper operation.

Table 6-7. FLHTCU Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[15]	Main Power	4-Place Packard	Inner Fairing- Top Fork Bracket
[27]	Radio	23-Place Amp (Black)	Inner Fairing- Back of Radio (Right Side)
[28]	Radio	23-Place Amp (Gray)	Inner Fairing- Back of Radio (Left Side)
[105]	Fairing Cap Switches	12-Place Multilock	Inner Fairing- Beneath Radio (Right Side)

Test 6.11 (Part 2 of 2)

NO SOUND IN ONE OR MORE HEADSETS/MICROPHONE INOPERATIVE: HARDWARE DIAGNOSIS



After correction of problem, refer to SETUP and FUNCTIONALITY to verify proper operation.

RADIO SYMPTOM 9 6.12

GENERAL

Problem

Rear headset volume/PTT inoperative.

Setup

- Press the POWER button to turn the radio ON.
- Set fairing mounted Headset/Speaker Switch to HEADSET.
- Press and hold the CB button to turn the Citizen Band radio OFF. Press and hold the INT button to turn the Intercom OFF.
- Set radio frequency to known strong station.

Functionality

Adjust the volume with the Audio Control Switch on the rear right speaker box. Stereo audio should be present in the headset. Push the switch upward (+) to raise the volume, downward (-) to lower the volume. The front panel LCD annunciates rear volume level through a horizontal bar graph display. The display reverts to the time of day approximately two seconds after the switch is released. Pressing PTT while CB is OFF activates Intercom microphone. Pressing PTT while CB is ON activates CB transmitter.

Are these your observations?

- **Yes -** System is OK.
- **No -** See Test 6.12 (Part 1 of 3).

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers in the Test 6.12 flow charts.

1. Install BREAKOUT BOX (Part No. HD-44608). See Section 6.3 BREAKOUT BOX, INSTALLATION.

Not Applicable to Classic/Road Glide Models

	C4 (BN/W)	C3 (O/BK)	C2 (BN/BK)	C1 (GY/GN)	CO (GN/BE)
RO (PK/W)	MODE UP FF	REAR VOLUME UP	AUDIO IN	AUDIO -	AUDIO +
R1 (GY/W)	MODE DN RW	REAR VOLUME DOWN	EJECT	LO/DX	RADIO POWER
R2 (V/BK)	MODE IN	PTT	SQUELCH DOWN	SQUELCH UP	SEEK SCAN
R3 (INT)	NOT USED	PRESET 4	PRESET 3	PRESET 2	PRESET 1

Cx = C0 thru C4. Rx = R0 thru R3.

Figure 6-22. Diagnostic Mode Group 1 Switch Matrix

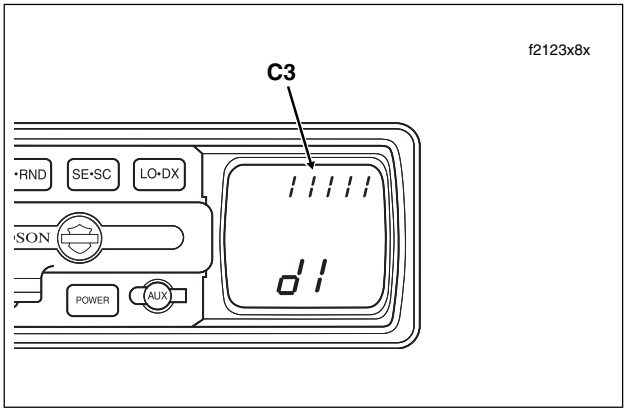
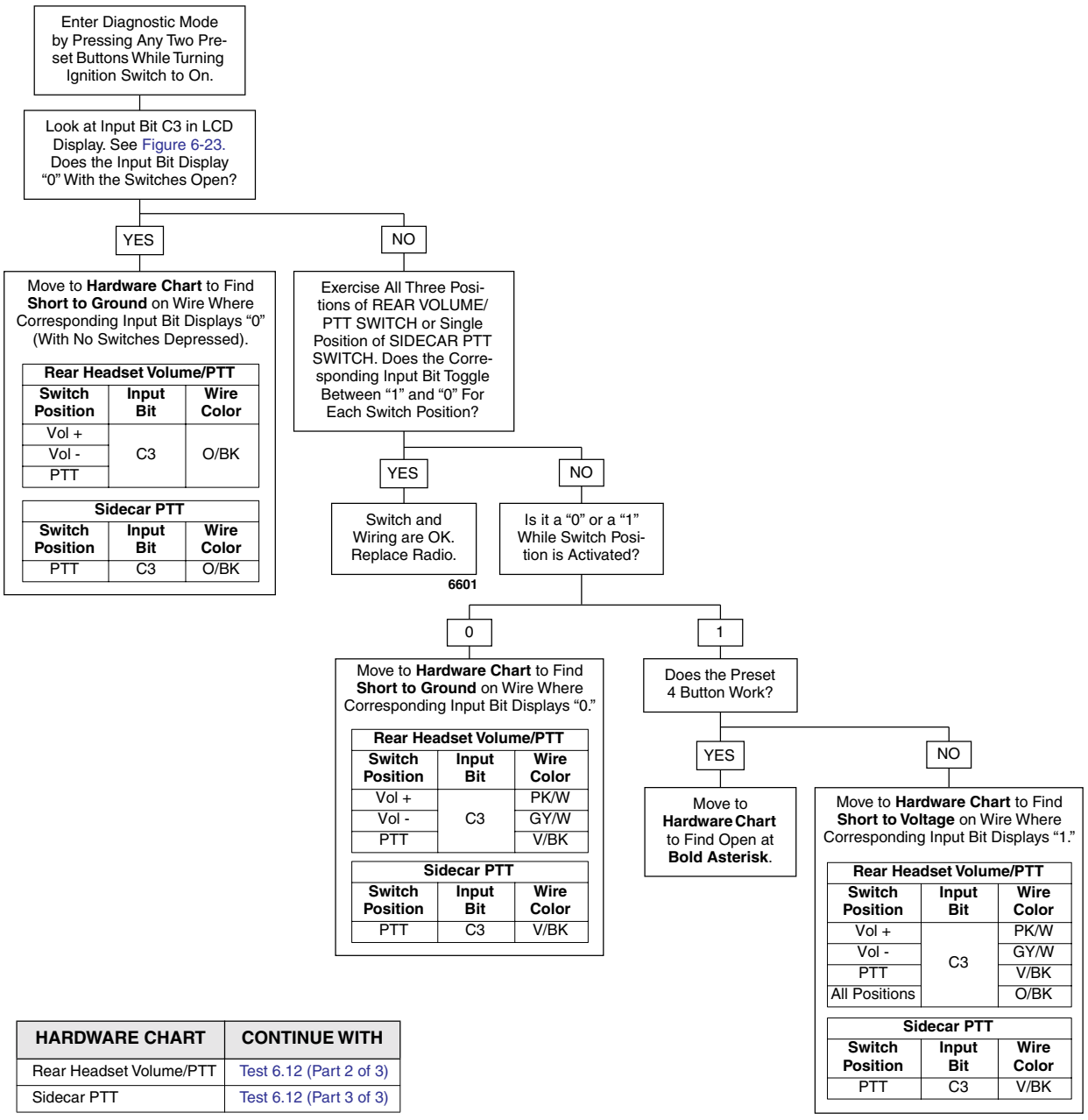


Figure 6-23. Rear Headset Volume/PTT Switch Input Bit

2. Revalidate failure. Reconnect all connectors. If problem still exists, replace radio. If problem is gone, look for intermittents.
3. Use HARNESS CONNECTOR KIT (Part No. HD-41404), black pin probes and patch cord.
4. Use HARNESS CONNECTOR KIT (Part No. HD-41404), black socket probes and patch cord.

Test 6.12 (Part 1 of 3)

REAR HEADSET VOLUME/PTT INOPERATIVE OR SIDECAR PTT INOPERATIVE: SOFTWARE DIAGNOSIS



HARDWARE CHART	CONTINUE WITH
Rear Headset Volume/PTT	Test 6.12 (Part 2 of 3)
Sidecar PTT	Test 6.12 (Part 3 of 3)

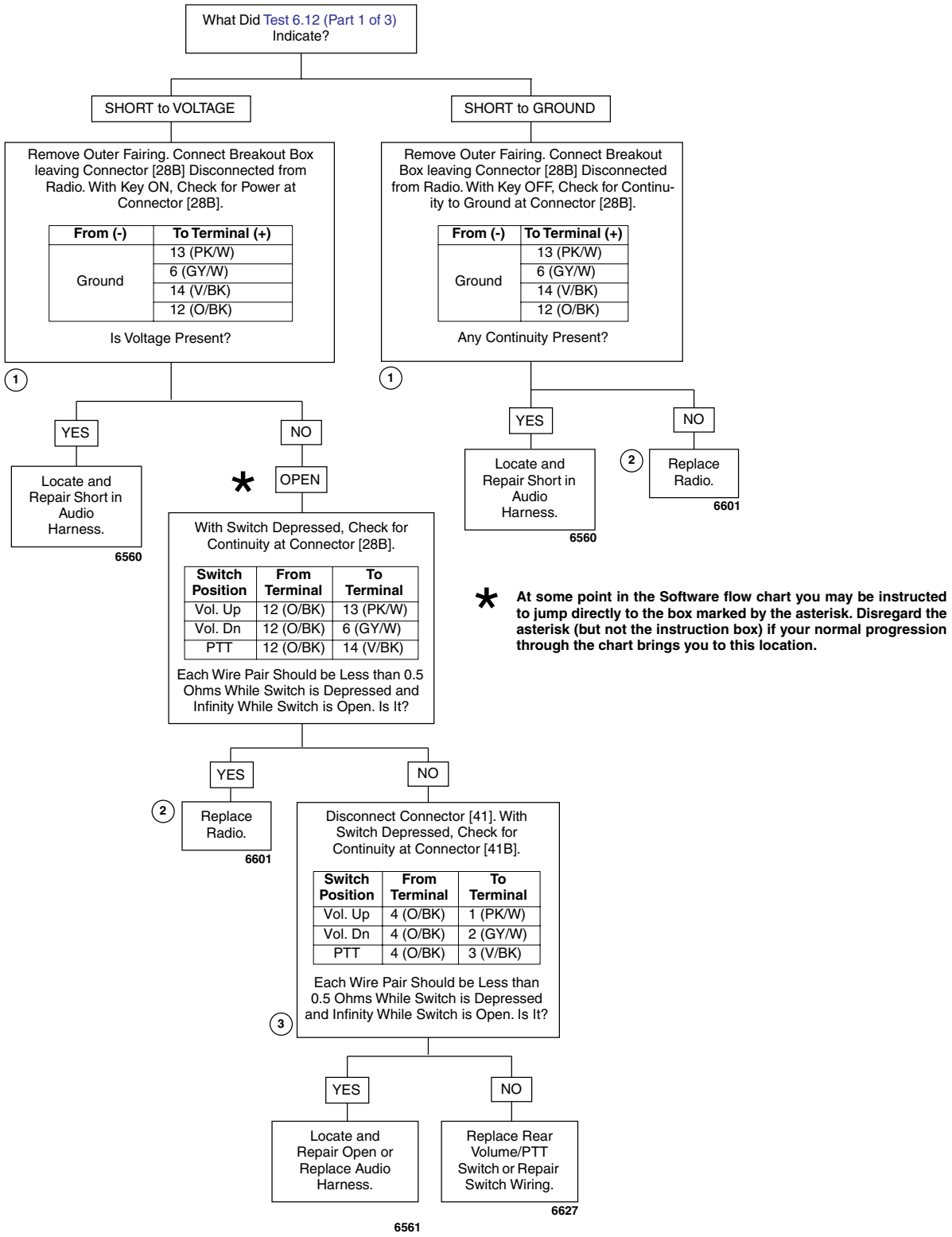
After correction of problem, refer to SETUP and FUNCTIONALITY to verify proper operation.

Table 6-8. FLHTCU Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[28]	Radio	23-Place Amp (Gray)	Inner Fairing- Back of Radio (Left Side)
[41]	Rear Right Speaker/Passenger Controls	6-Place Mini-Deutsch (Black)	Inside Rear Right Speaker Box

Test 6.12 (Part 2 of 3)

REAR HEADSET VOLUME/PTT INOPERATIVE: HARDWARE DIAGNOSIS

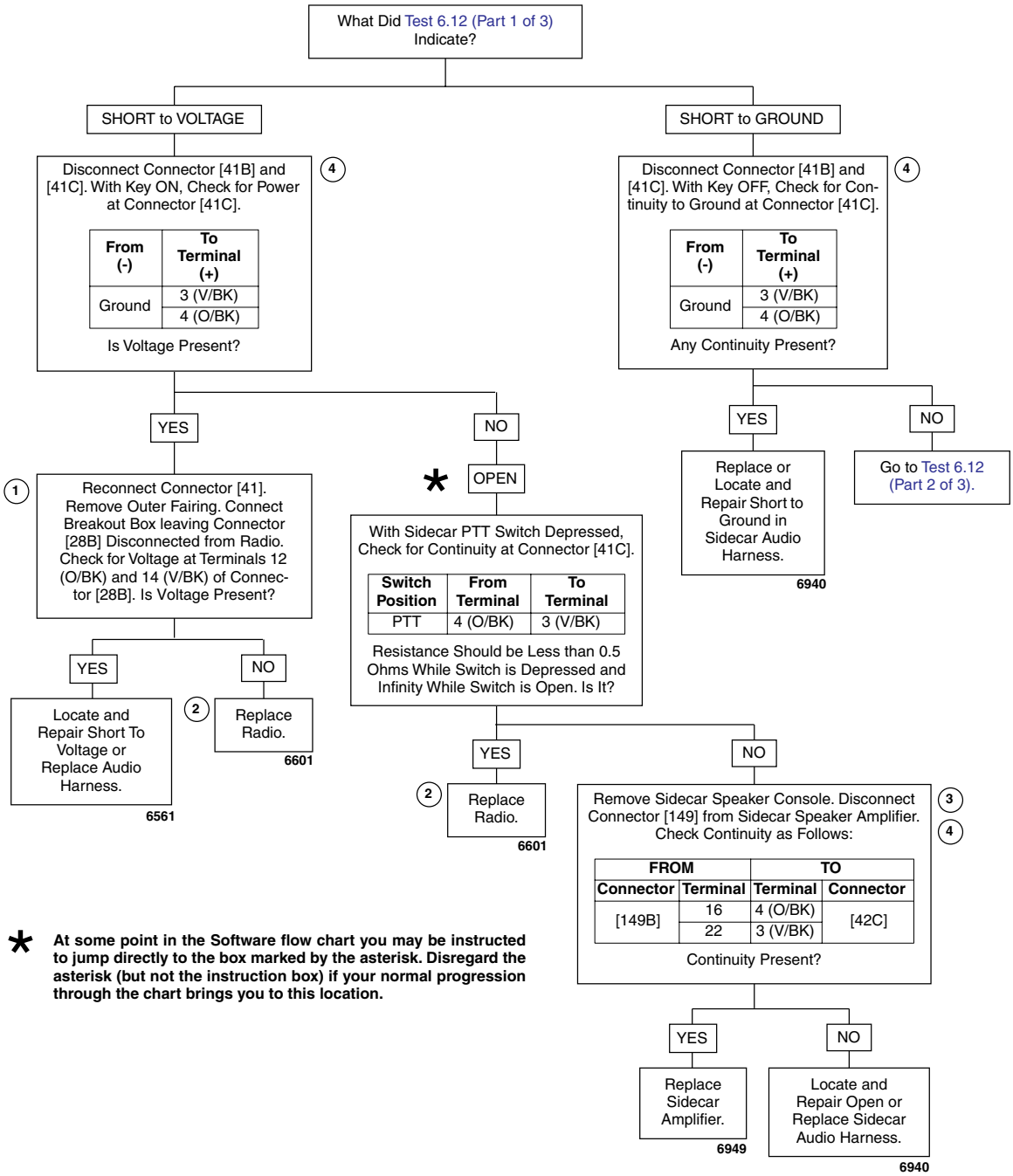


*** At some point in the Software flow chart you may be instructed to jump directly to the box marked by the asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.**

After correction of problem, refer to SETUP and FUNCTIONALITY to verify proper operation.

Test 6.12 (Part 3 of 3)

SIDECAR PTT INOPERATIVE: HARDWARE DIAGNOSIS



*** At some point in the Software flow chart you may be instructed to jump directly to the box marked by the asterisk. Disregard the asterisk (but not the instruction box) if your normal progression through the chart brings you to this location.**

After correction of problem, refer to SETUP and FUNCTIONALITY to verify proper operation.

NOTES

RADIO SYMPTOM 10 6.13

GENERAL

Problem

Intercom inoperative.

Setup

- Press the POWER button to turn the radio ON.
- Set fairing mounted Headset/Speaker Switch to HEADSET.
- Press and hold the CB button to turn the Citizen Band radio OFF.
- Press and hold the INT button to turn the Intercom ON (Setup Mode).
- Use Mode Select Switch to adjust VOX sensitivity to a value greater than “10.”
- Set Front and Rear Volume Control to Middle position on horizontal bar graph display.

Functionality

Speak into Intercom. Voice should be heard in all headsets. Is it?

- **Yes -** System is OK.
- **No -** See Test 6.13.

DIAGNOSTICS

See Test 6.13 on the next page.

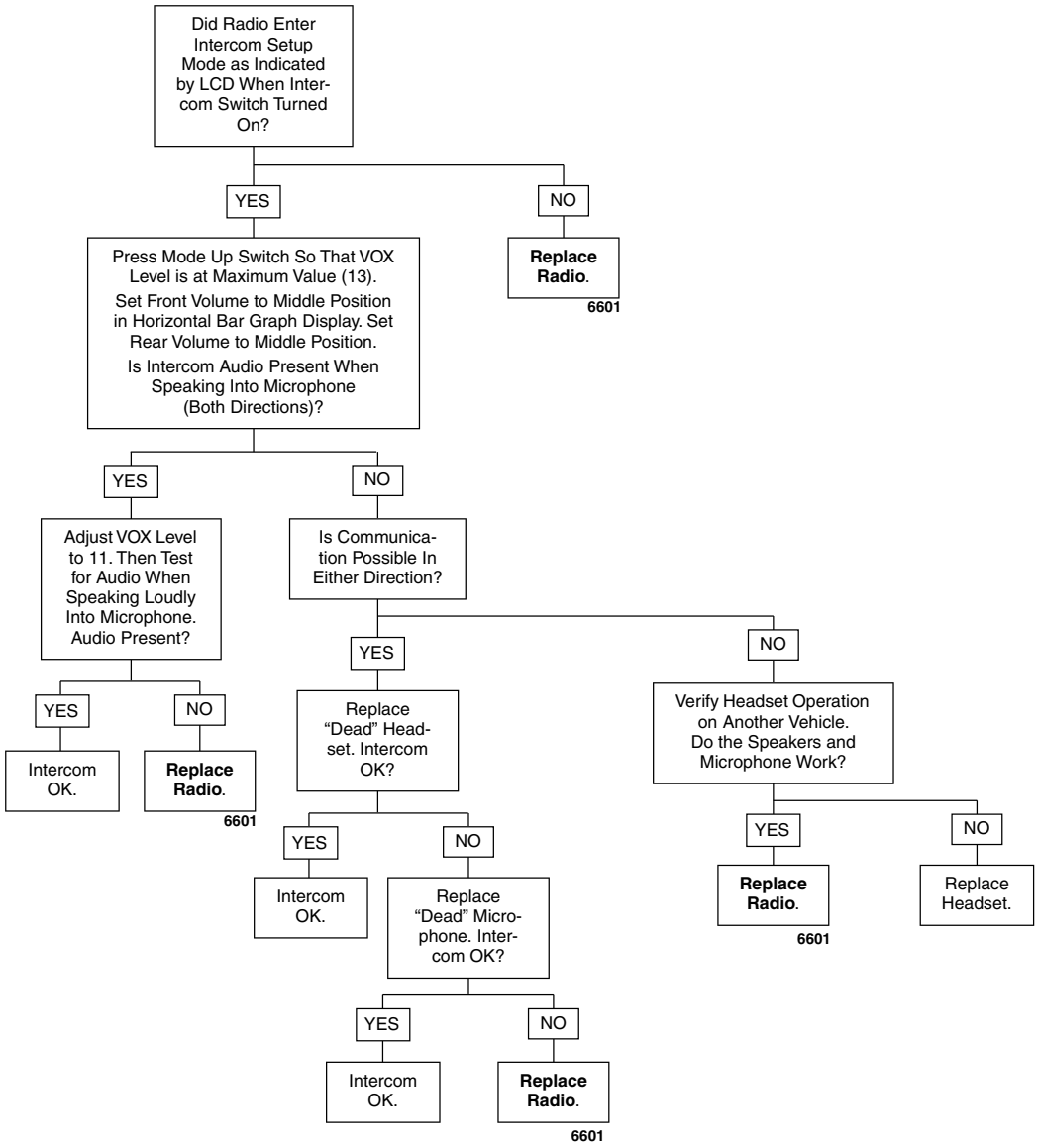
Not Applicable to Classic/Road Glide Models

0=PTT	0 or 1	1=Break		1=ON	1=ON	10=Headset 11=Speaker 01=Center	
HAND-HELD MIC. PTT	AVC VEHICLE SPEED SIGNAL	VOX BREAK	CB SQUELCH BREAK	INTERCOM OFF/ON SWITCH	CB OFF/ON SWITCH	SPEAKER SWITCH “B”	SPEAKER SWITCH “A”
7 (BE/Y)	6 (W/GN)	5 Internal	4 Internal	3 Internal	2 Internal	1 (BN/O)	0 (V/O)

Figure 6-24. Diagnostic Mode Group 2 Matrix

Test 6.13

INTERCOM INOPERATIVE: SOFTWARE DIAGNOSIS



After correction of problem, refer to SETUP and FUNCTIONALITY to verify proper operation.

RADIO SYMPTOM 11 6.14

GENERAL

Problem

CB receiver inoperative.

Setup

- Press the POWER button to turn the radio ON.
- Press and hold the INT button to turn the Intercom OFF.
- Set fairing mounted Headset/Speaker Switch to SPEAKER.
- Set Volume Control to Middle position on horizontal bar graph display.
- Press and hold the CB button to turn the Citizen Band radio ON.

Functionality

See Test 6.14.

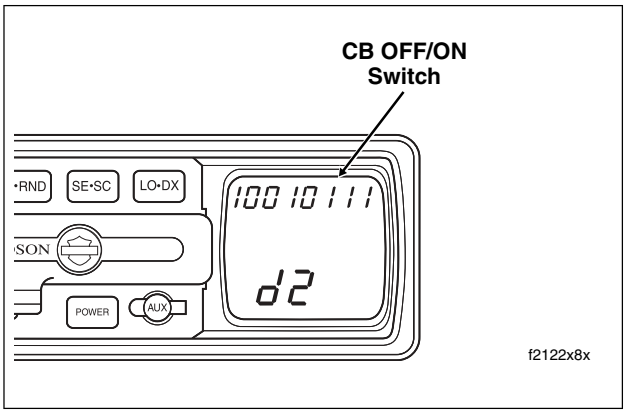


Figure 6-25. LCD Input Bit Display

DIAGNOSTICS

Diagnostic Notes

The reference number below correlates with the circled number in the Test 6.14 flow chart.

1. See Section 6.15 RADIO SYMPTOM 12.

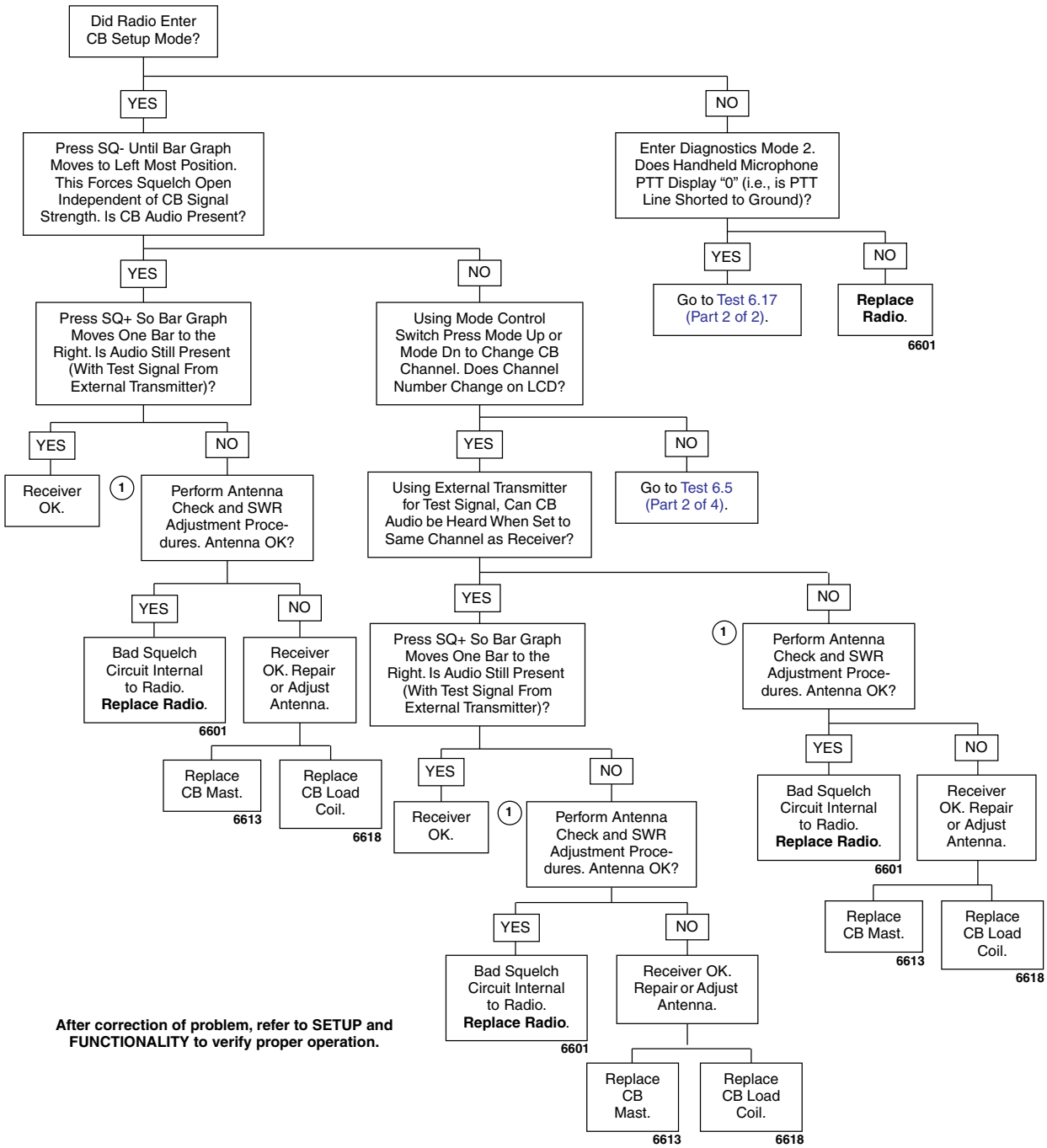
Not Applicable to Classic/Road Glide Models

0=PTT	0 or 1	1=Break		1=ON	1=ON	10=Headset 11=Speaker 01=Center	
HAND-HELD MIC. PTT	AVC VEHICLE SPEED SIGNAL	VOX BREAK	CB SQUELCH BREAK	INTERCOM OFF/ON SWITCH	CB OFF/ON SWITCH	SPEAKER SWITCH “B”	SPEAKER SWITCH “A”
7 (BE/Y)	**6 (W/GN)**	**5 Internal**	**4 Internal**	**3 Internal**	**2 Internal**	**1 (BN/O)**	**0 (V/O)**

Figure 6-26. Diagnostic Mode Group 2

Test 6.14

CB RECEIVER INOPERATIVE: SOFTWARE DIAGNOSIS



NOTES

RADIO SYMPTOM 12 6.15

GENERAL

Problem

CB transmitter inoperative.

Setup

- Press the POWER button to turn the radio ON.
- Press and hold the INT button to turn the Intercom OFF.
- Set fairing mounted Headset/Speaker Switch to SPEAKER.
- Set Volume Control to Middle position on horizontal bar graph display.
- Press and hold the CB button to turn the Citizen Band radio ON.

Functionality

Depressing any PTT switch will change the radio display to reflect CB mode and cause the transmitter to transmit. To verify transmission, use another CB receiver tuned to the same channel. In CB Setup mode, the squelch display will disappear when PTT is depressed. Are these your observations?

- **Yes -** System is OK.
- **No -** See Test 6.15 (Part 1 of 2).

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers in the Test 6.15 flow charts.

1. Remove outer fairing. Disconnect antenna connector from CB and replace it with a dummy load, that is, the lamp included with tool HD-39448.

NOTE

The lamp acts as a load that allows the CB to be operated and provides a means of checking relative power output and modulation.

2. To use the load, screw the dummy load onto the antenna jack of the CB. Depress the PTT switch. If the CB is transmitting a carrier wave, the lamp should illuminate. Speaking into the microphone should cause the lamp to flicker. It should get brighter and dimmer depending on how loud your voice is. A change in lamp brilliance means the CB is modulating.

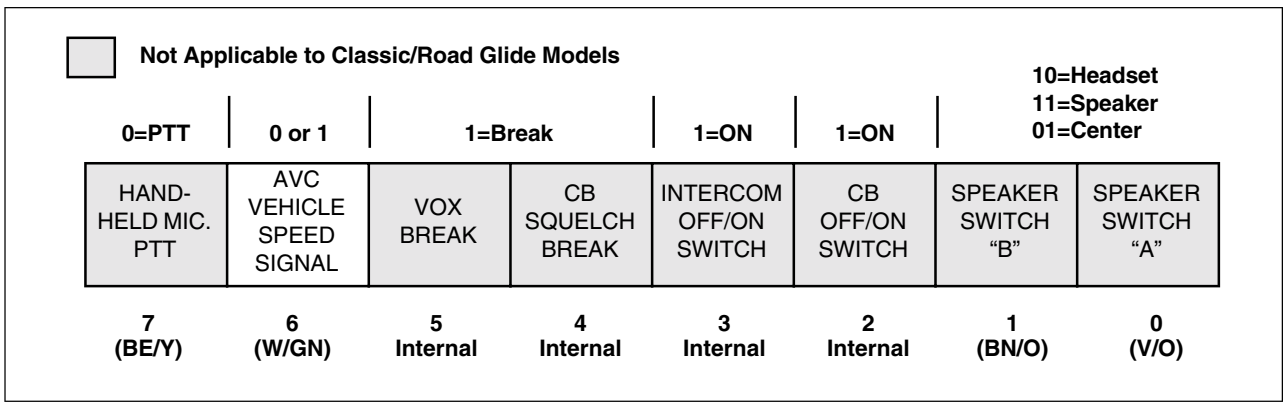
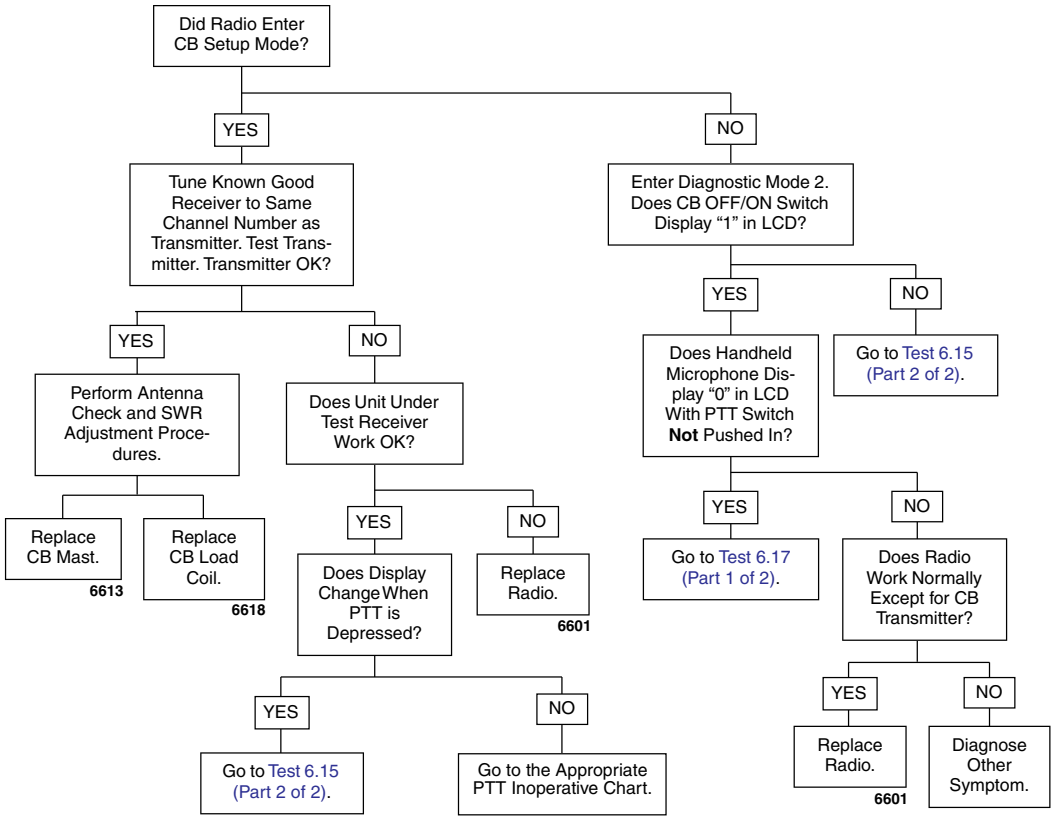


Figure 6-27. Diagnostic Mode Group 2

Test 6.15 (Part 1 of 2)

CB TRANSMITTER INOPERATIVE: SOFTWARE DIAGNOSIS

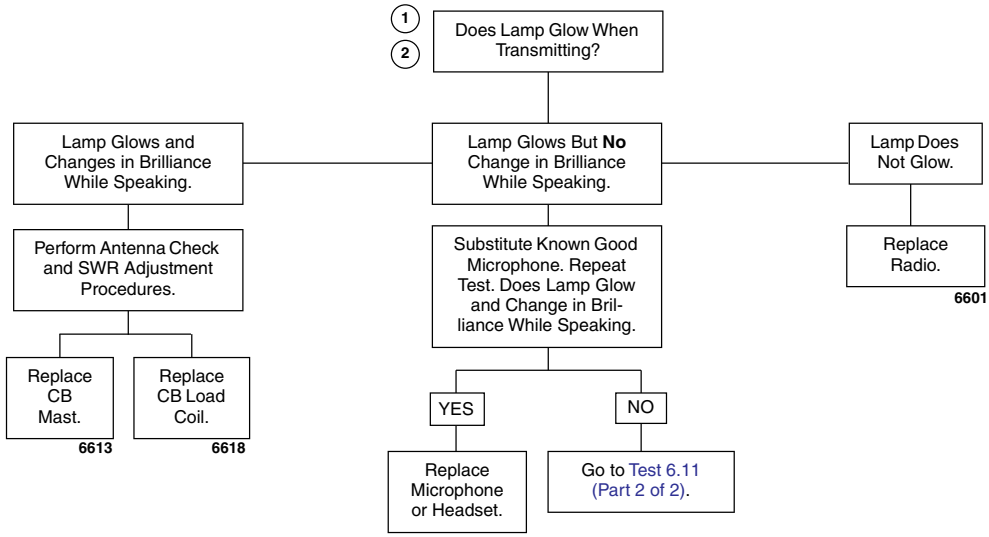


PTT INOPERATIVE CHART	CONTINUE WITH
Rear Headset Volume PTT	6.12 RADIO SYMPTOM 9
Sidecar PTT	6.12 RADIO SYMPTOM 9
PTT/Squelch	6.16 RADIO SYMPTOM 13
Handheld Microphone/PTT	6.17 RADIO SYMPTOM 14

After correction of problem, refer to SETUP and FUNCTIONALITY to verify proper operation.

Test 6.15 (Part 2 of 2)

CB TRANSMITTER INOPERATIVE: HARDWARE DIAGNOSIS



After correction of problem, refer to SETUP and FUNCTIONALITY to verify proper operation.

CB Antenna Test

A faulty CB antenna can cause poor reception and transmitting range. Check the antenna system as follows:

1. Remove outer fairing. Remove antenna cable from back of radio. Using clip-on test leads, connect one lead of ohmmeter to center pin in antenna lead and other lead to antenna mast. Meter must read 1 ohm or less. Wiggle or flex mast while observing meter. If resistance is more than 1 ohm or varies when mast is wiggled, replace mast. Inspect connections at base of loading coil and at mounting bracket.

NOTE

It is normal to observe a reading of less than one ohm between the center conductor and ground due to the configuration of the loading coil.

2. Check SWR adjustment.
3. To replace the CB antenna, see the 2003 Touring Service Manual (Part Number 99483-03).

SWR Adjustment

CAUTION

Do not press PTT switches with antenna and SWR meter disconnected. Transceiver damage could result.

Standing wave ratio (SWR) is a technical term for the procedure that checks how well the CB transmitter and antenna are matched. The SWR should be 2:1 or below on channel 20. A SWR of 1:1 is optimum.

To check SWR, a SWR meter or bridge is required. Your Harley-Davidson dealer will either have a SWR meter or direct you to a CB repair shop for a SWR check. Since the operating procedures for SWR meters vary, be sure you carefully follow the operating instructions for the SWR meter being used.

1. Locate motorcycle outdoors or in a building with a ceiling of 11 ft. (3.4 m) minimum above floor. Also, there must be 8 ft. (2.4 m) of radial clearance around motorcycle. Adjusting the SWR in an area with a lower ceiling and/or less radial clearance may result in an inaccurate adjustment.

2. Remove the outer fairing. Remove the antenna cable and connect the SWR meter to the radio. Connect the antenna cable to the SWR meter. The SWR meter is connected in series with the antenna cable so the antenna will be connected to the SWR meter.
3. Check that the antenna loading coil bracket in Tour-Pak is tight and that antenna cable is tightly connected to loading coil.
4. Check that antenna mast is threaded securely on to base and set screw is tight.
5. Before measuring the SWR, the SWR meter must be calibrated. Follow the instructions for the meter being used. The following procedure is the general calibration most meter instructions specify.

CAUTION

Do not touch the antenna or meter during calibration or SWR measurement. Move CAL knob and then move your hand away from meter while calibrating.

6. With ignition and CB switches ON, the SWR meter set on “FWD”, Channel 20 selected, press either PTT switches. Hold the PTT switch and rotate the calibration (CAL) control until the meter needle aligns with the “CAL” mark.
7. Release the PTT switch and move the FWD/REF switch to “REF” (reflected).

CAUTION

Do not touch the antenna or meter during calibration or SWR measurement. Move CAL knob and then move your hand away from meter while calibrating. Do not press PTT switches with antenna and SWR meter disconnected. Transceiver damage could result.

8. Press and hold either PTT switch. The meter reading is the SWR.
9. If SWR is more than 3:1, remove antenna cable from transceiver under Tour-Pak. Using clip-on test leads, connect one lead of ohmmeter to center pin in antenna lead and other lead to antenna mast. Meter must read 1 ohm or less. Wiggle or flex mast while observing meter. If resistance is more than 1 ohm or varies when mast is wiggled, replace mast. Inspect connections at base of loading coil and at mounting bracket. If the SWR is less than 3:1, loosen antenna set screw and change mast length.

NOTE

It is normal to observe a reading of less than one ohm between the center conductor and ground due to the configuration of the loading coil.

10. Repeat Step 8. If SWR became higher, adjust antenna mast in opposite direction. Continue adjusting antenna until the minimum SWR is achieved. If you cannot obtain an SWR of 2:1 or less by adjusting the antenna length, make the mast shorter to improve the SWR. Remove mast and use grinder to shorten mast (grind in small increments).
11. After SWR is adjusted on channel 20, check SWR on channels 1 and 40. Adjust the mast length to obtain a balance between channels 1 and 40.

NOTE

Check the SWR if a luggage rack is installed on the Tour-Pak cover. Be sure that the Tour-Pak cover is closed when the check is performed. Accessories mounted on the Tour Pak may affect the SWR reading and broadcast range, so the luggage rack should be mounted as far forward as possible. The Ultra Tour-Pak chrome accent rail also can adversely affect SWR.

RADIO SYMPTOM 13 6.16

GENERAL

Problem

PTT/Squelch control inoperative.

Setup

- Press the POWER button to turn the radio ON.
- Press and hold the INT button to turn the Intercom OFF.
- Press and hold the CB button to turn the Citizen Band radio ON.
- Set fairing mounted Headset/Speaker Switch to SPEAKER.

Functionality

Depressing any PTT switch will change the radio display to reflect CB mode and cause the transmitter to transmit. Pressing the Squelch Control in either direction will cause the horizontal bar graph display to change. Are these your observations?

- **Yes -** System is OK.
- **No -** See Test 6.16 (Part 1 of 2).

DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers in the Test 6.16 flow charts.

1. This also may be an open. First go to SHORT TO VOLTAGE in Test 6.16 (Part 2 of 2).
2. Install BREAKOUT BOX (Part No. HD-44608). See Section 6.3 BREAKOUT BOX, INSTALLATION.

Not Applicable to Classic/Road Glide Models

	C4 (BN/W)	C3 (O/BK)	C2 (BN/BK)	C1 (GY/GN)	CO (GN/BE)
RO (PK/W)	MODE UP FF	REAR VOLUME UP	AUDIO IN	AUDIO -	AUDIO +
R1 (GY/W)	MODE DN RW	REAR VOLUME DOWN	EJECT	LO/DX	RADIO POWER
R2 (V/BK)	MODE IN	PTT	SQUELCH DOWN	SQUELCH UP	SEEK SCAN
R3 (INT)	NOT USED	PRESET 4	PRESET 3	PRESET 2	PRESET 1

Figure 6-28. Diagnostic Mode Group 1 Switch Matrix

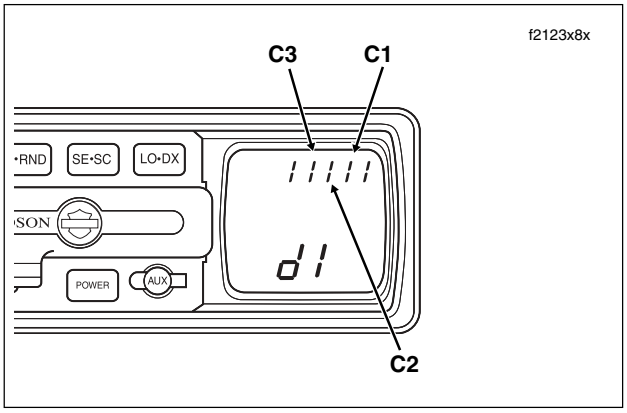
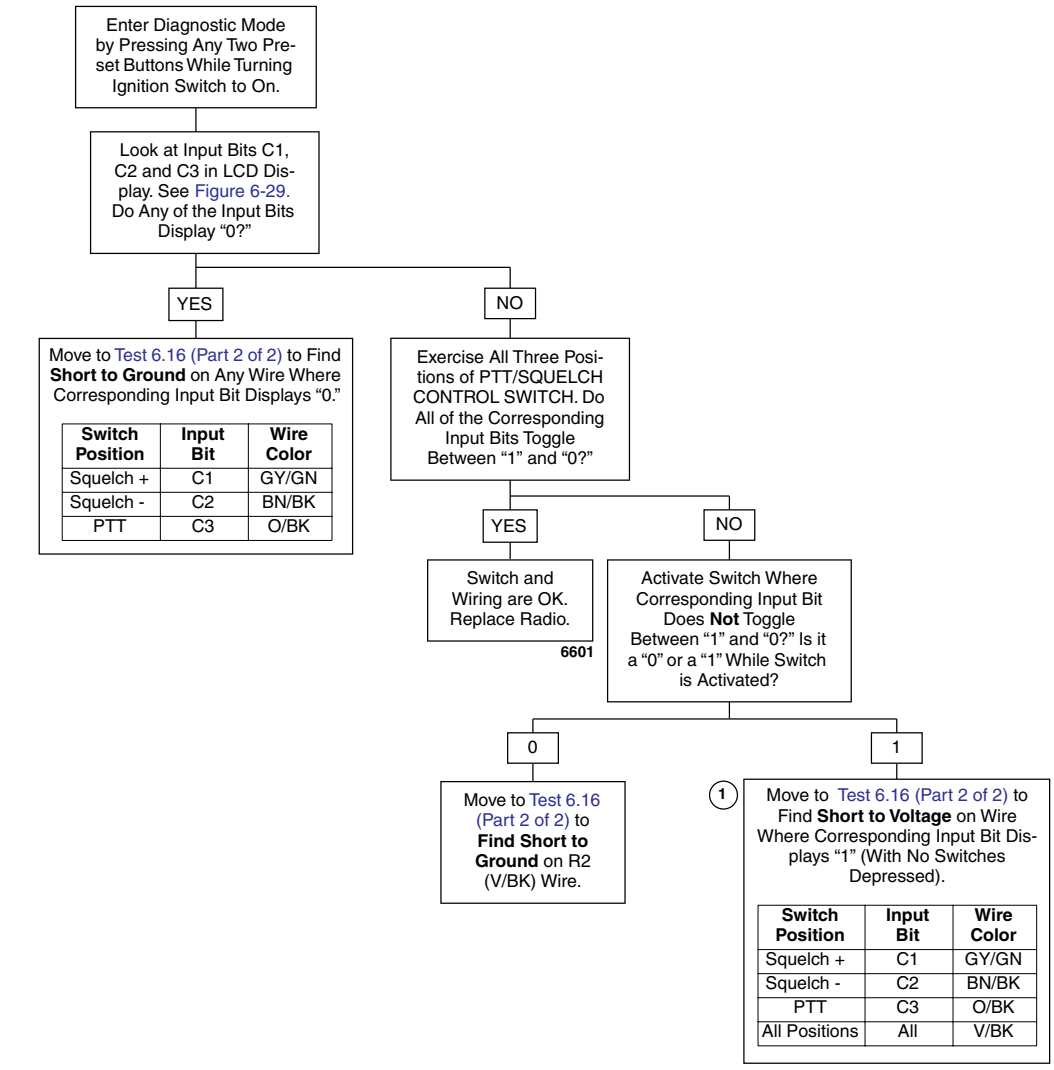


Figure 6-29. PTT/Squelch Control Switch Input Bits

3. Revalidate failure. Reconnect all connectors. If problem still exists, replace radio. If problem is gone, look for intermittents.
4. Use HARNESS CONNECTOR KIT (Part No. HD-41404), black pin probes and patch cord.

Test 6.16 (Part 1 of 2)

PTT/SQUELCH CONTROL INOPERATIVE: SOFTWARE DIAGNOSIS



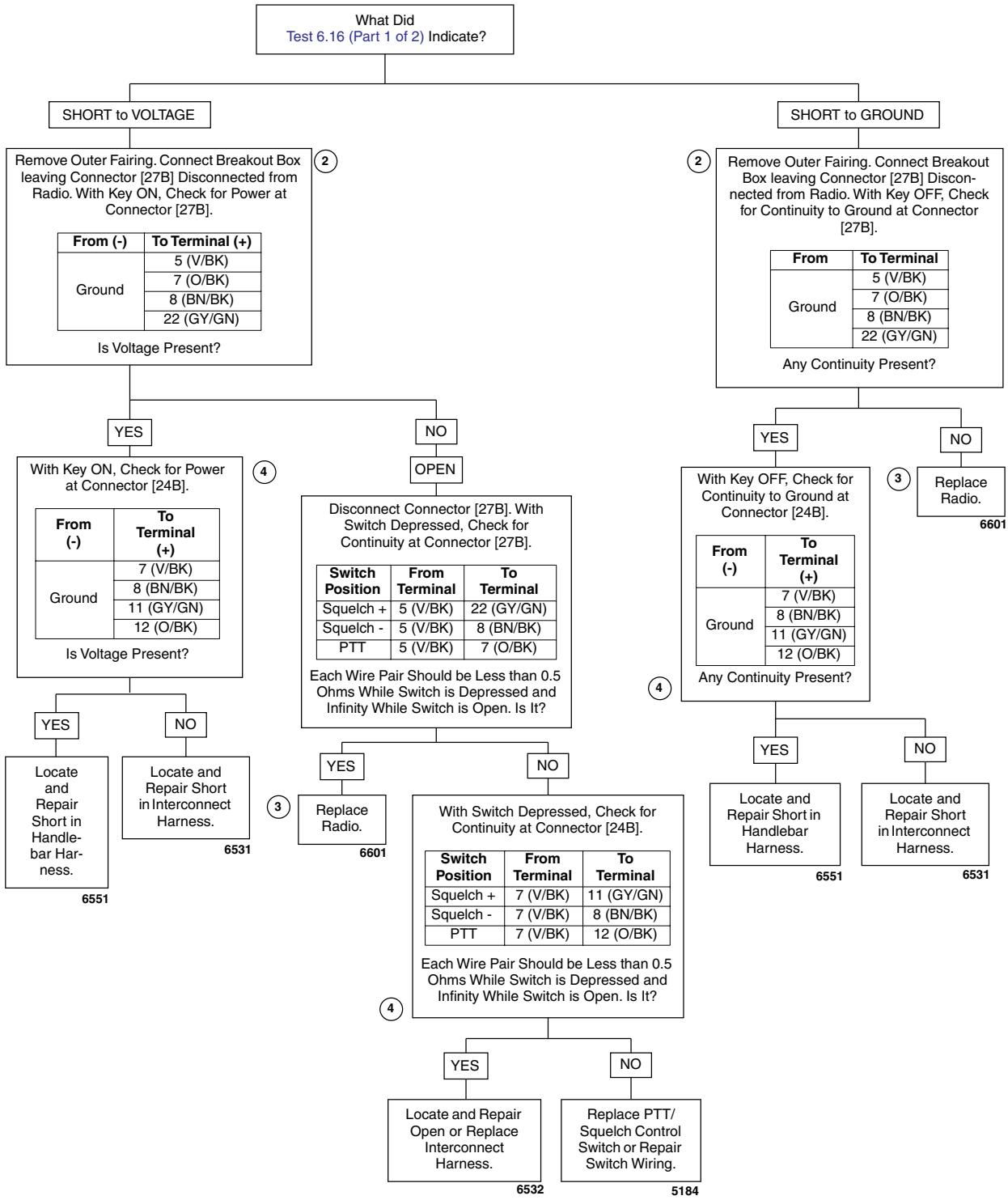
After correction of problem, refer to SETUP and FUNCTIONALITY to verify proper operation.

Table 6-9. FLHTCU Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[24]	Interconnect Harness to Left Handlebar Switch Controls	12-Place Deutsch (Gray)	Inner Fairing- Left Fairing Support Brace
[27]	Radio	23-Place Amp (Black)	Inner Fairing- Back of Radio (Right Side)

Test 6.16 (Part 2 of 2)

PTT/SQUELCH CONTROL INOPERATIVE: HARDWARE DIAGNOSIS



After correction of problem, refer to SETUP and FUNCTIONALITY to verify proper operation.

RADIO SYMPTOM 14 6.17

GENERAL

Problem

Handheld microphone PTT inoperative.

Setup

- Press the POWER button to turn the radio ON.
- Press and hold the INT button to turn the Intercom OFF.
- Press and hold the CB button to turn the Citizen Band radio ON.
- Set fairing mounted Headset/Speaker Switch to SPEAKER.

Functionality

Depressing handheld PTT switch will change the radio display to reflect CB mode and cause the transmitter to transmit. In CB Setup mode, the squelch display will disappear when PTT is depressed. Are these your observations?

- **Yes -** System is OK.
- **No -** See Test 6.17 (Part 1 of 2).

DIAGNOSTICS

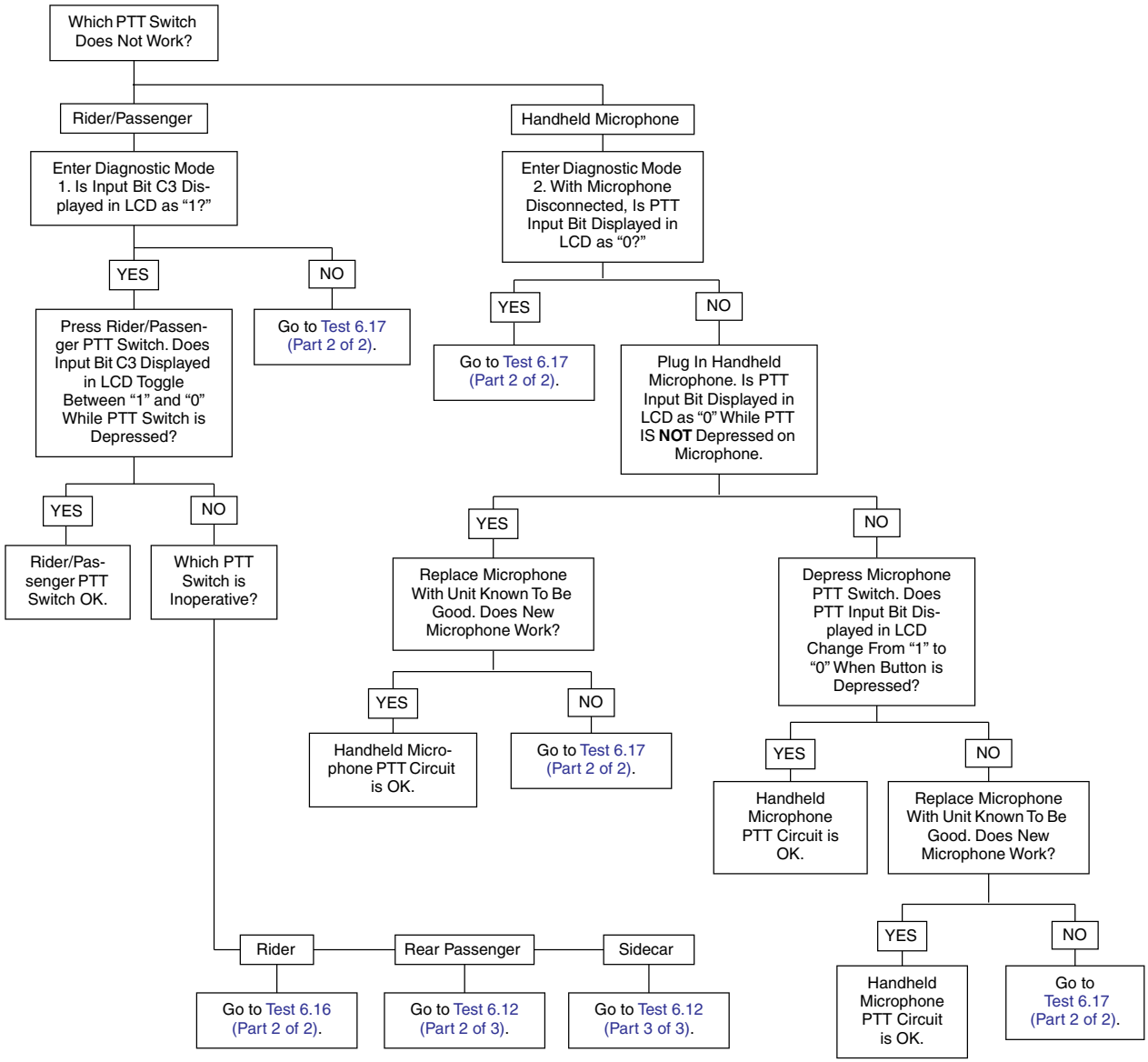
Diagnostic Notes

The reference numbers below correlate with the circled numbers in the Test 6.17 flow charts.

1. Install BREAKOUT BOX (Part No. HD-44608). See Section 6.3 BREAKOUT BOX, INSTALLATION.
2. Use HARNESS CONNECTOR TEST KIT (Part No. HD-41404), black pin probes and patch cords.
3. Use HARNESS CONNECTOR KIT (Part No. HD-41404), black socket probes and patch cord.

Test 6.17 (Part 1 of 2)

HANDHELD MICROPHONE PTT INOPERATIVE: SOFTWARE DIAGNOSIS



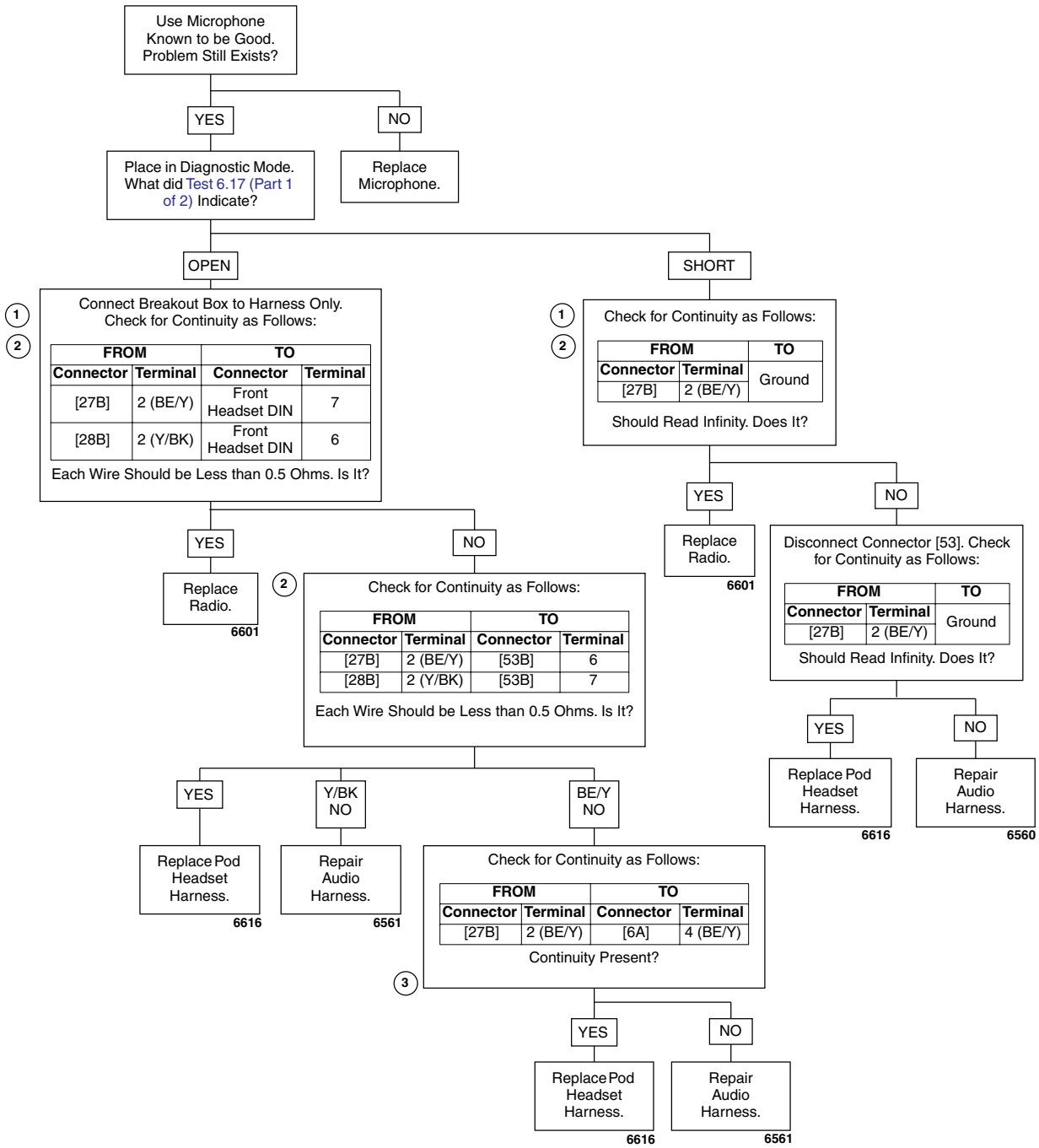
After correction of problem, refer to SETUP and FUNCTIONALITY to verify proper operation.

Table 6-10. FLHTCU Wire Harness Connectors

NO.	DESCRIPTION	TYPE	LOCATION
[27]	Radio	23-Place Amp (Black)	Inner Fairing- Back of Radio (Right Side)
[28]	Radio	23-Place Amp (Gray)	Inner Fairing- Back of Radio (Left Side)
[53]	Console Pod	12-Place Mini-Deutsch (Black)	Rear of Battery Box (Under Seat)

Test 6.17 (Part 2 of 2)

HANDHELD MICROPHONE PTT INOPERATIVE: HARDWARE DIAGNOSIS



After correction of problem, refer to SETUP and FUNCTIONALITY to verify proper operation.

RADIO SYMPTOM 15 6.18

GENERAL

Problem

No CB audio in headset in center position.

Setup

- Press the POWER button to turn the radio ON.
- Press and hold the INT button to turn the Intercom OFF.
- Press and hold the CB button to turn the Citizen Band radio ON.
- Set fairing mounted Headset/Speaker Switch to CENTER position.
- Set Volume Control to Middle position on horizontal bar graph display.
- Set Squelch Control to receive incoming CB signals.

Functionality

CB audio should be heard in headset and stereo audio should be heard in fairing speakers. Is it?

- Yes - System is OK.
- No - See Test 6.18.

DIAGNOSTICS

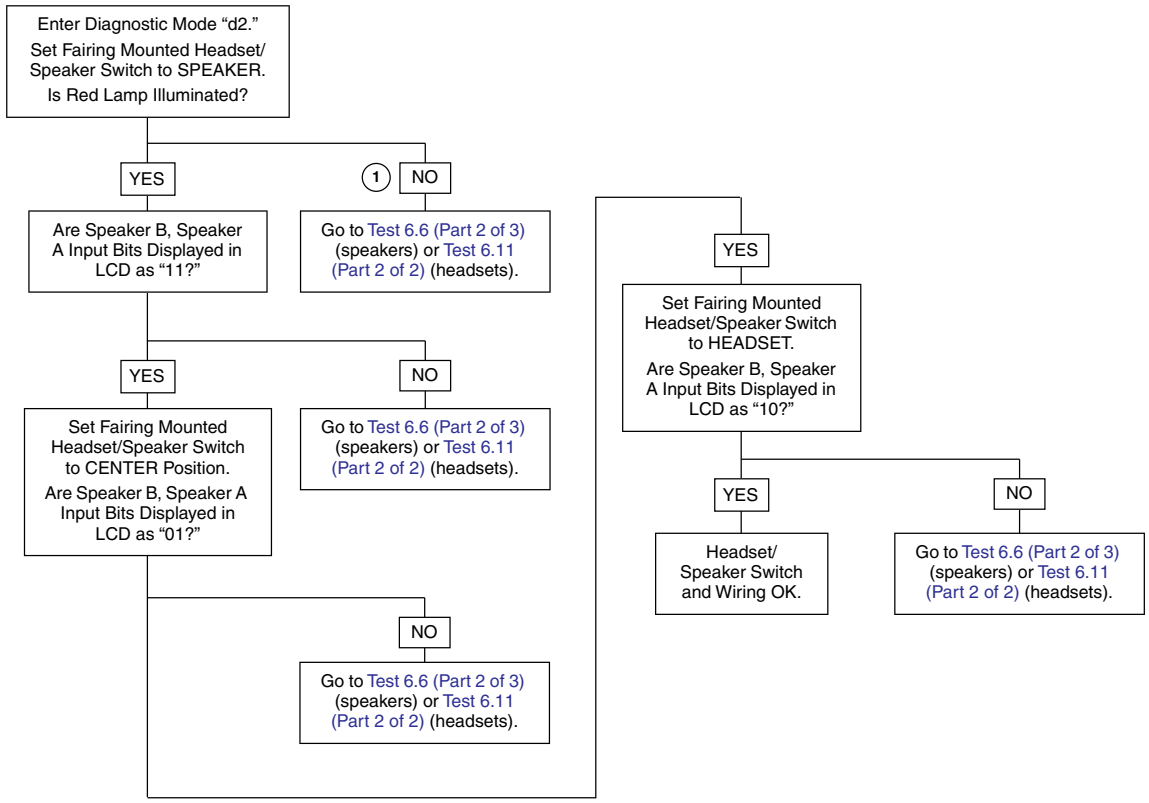
Diagnostic Notes

The reference number below correlates with the circled number in the Test 6.18 flow chart.

1. If the lamp is missing or the filament is broken, Speaker B, Speaker A input bits are displayed in LCD as “11” with the Headset/Speaker Switch in the center position. In other words, the system functions as though the switch is in the SPEAKER position.

Test 6.18

NO CB AUDIO IN HEADSET IN CENTER POSITION: SOFTWARE DIAGNOSIS



NOTES

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SUBJECT **PAGE NO.**

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7.3 Cruise Dropout Diagnostics 7-6
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CRUISE CONTROL 7

CRUISE CONTROL 7.1

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.

OPERATION

To engage and disengage the cruise control system, proceed as follows:

1. While riding in fourth or fifth gear, turn the Cruise ON/OFF Switch to the ON position. See Figure 7-1. The switch is located on the fairing cap of FLHTCU models, the instrument nacelle of FLTR models, and the left handlebar lower switch housing on FLHRC models. A red lamp in or next to the switch illuminates to indicate that the system is activated.
2. Both the switch and the lamp are located in the left handlebar lower switch housing on FLHRC models.

   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.
3. 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 7-2.

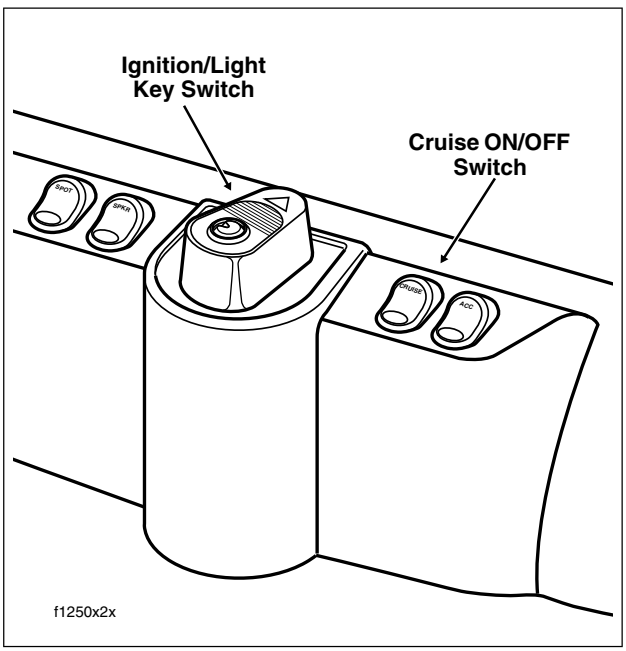


Figure 7-1. Fairing Cap (FLHTCU)

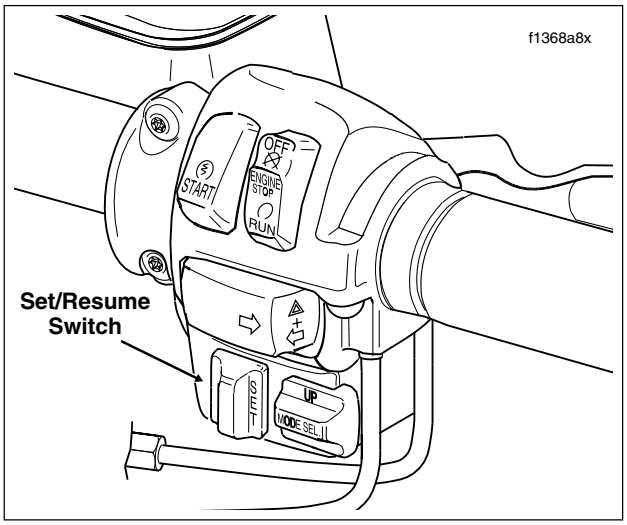


Figure 7-2. Right Handlebar Switch Assembly (FLTR, FLHTCU)

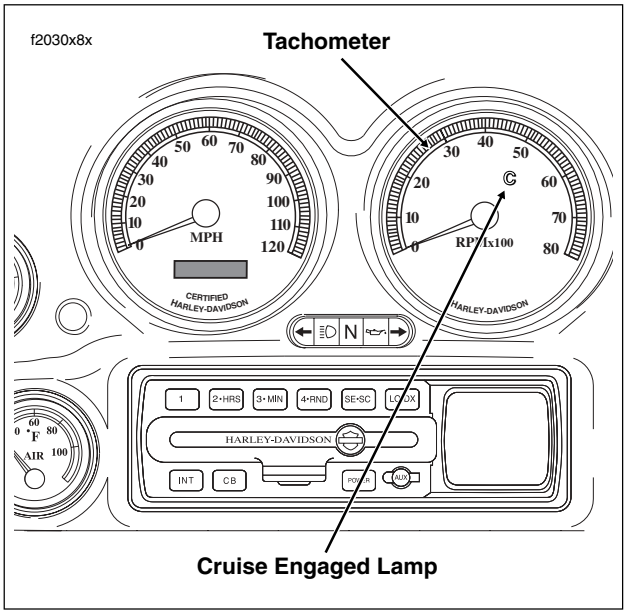


Figure 7-3. Instrument Panel (FLHTCU)

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 illuminates to indicate that the cruising speed is locked in. The lamp is on the right handlebar lower switch housing on FLHRC models, and appears as a capital letter “C” on the tachometer gauge of FLTR and FLHTCU models. See Figure 7-3.

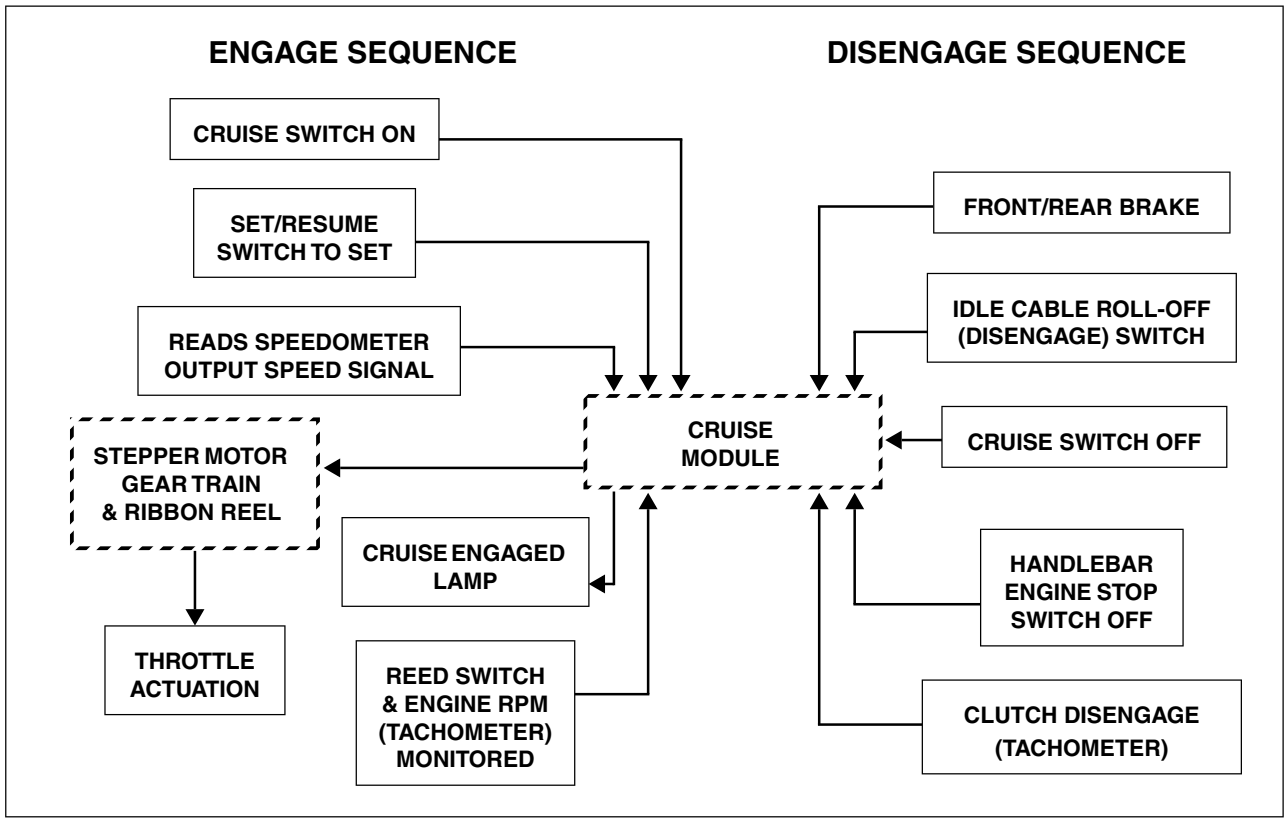


Figure 7-4. Cruise System Diagram

4. 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.
5. 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. Cruise ON/OFF Switch placed in the OFF position. The switch is located on the fairing cap of FLHTCU models, the instrument nacelle of FLTR models, and the left handlebar lower switch housing on FLHRC models. A red lamp in or next to the switch is extinguished to indicate that the system is deactivated.
   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.

TROUBLESHOOTING

The cruise module circuitry provides on-board diagnostics to help isolate any problems that might occur with the cruise system.

If the cruise is inoperative or fails to set, begin troubleshooting with 7.2 CRUISE INOPERATIVE DIAGNOSTICS. If the cruise seems to disengage or drop out for no apparent reason, then see 7.3 CRUISE DROPOUT DIAGNOSTICS.

In the diagnostic mode, the green Cruise Engaged Lamp is employed as a test indicator. The lamp is on the right handlebar lower switch housing on FLHRC models, and appears as a capital letter “C” on the tachometer gauge of FLTR and FLHTCU models. See Figure 7-3.

CRUISE INOPERATIVE DIAGNOSTICS 7.2

GENERAL

Perform the following diagnostic procedures in the order presented. If the test sequence is not followed precisely, the diagnostic mode may not be exited at conclusion of the diagnostic routine and the test indicator (Cruise Engaged Lamp) may continue to flash while the engine is running.

INOPERATIVE DIAGNOSTICS

See Table 7-2. All diagnostic steps are listed in table format. Follow the numbered steps to test the system. Compare the system behavior to CORRECT FUNCTION or INCORRECT FUNCTION columns and advance to the next step listed.

Diagnostic Notes

The diagnostic notes below provides supplementary information for Table 7-2.

1. If the cruise engaged lamp does not illuminate at all, check for one or more of the following conditions:
   a. SET/RESUME switch faulty or not wired correctly.
   b. Broken or pinched wire to SET switch or cruise module.
   c. Cruise engaged lamp burned out or miswired. Lamp is turned on by module supplied ground.
   d. Main 10-place connector not plugged into cruise module.
   e. Faulty cruise main switch and associated wiring.
   f. No module ground at Terminal E of 10-place module connector.
   g. Brake light on constantly.
   h. Throttle cables too tight.
   i. Bad cruise control fuse.
2. Repeat Steps 1 and 2. If the cruise engaged lamp still does not illuminate, see 7.4 CRUISE CHART A: INITIAL DIAGNOSTICS. For cruise module connector wire color locations and functions, see Table 7-1. Repair any problems and recheck by repeating Steps 1 and 2.

Table 7-1. Cruise Module Connector [17A]

TERMINAL	WIRE COLOR	FUNCTION AND CONNECTION
A	Red/Green	ON/OFF switch enable
B	Blue/Black	SET input from SET/RESUME switch
C	White/Blue	RESUME input from SET/RESUME switch
D	Violet/Yellow	Idle cable disengage switch (12 vdc from 15 amp fuse)
E	Black	Cruise module ground
F	Orange/Violet	12 vdc power from 15 amp fuse
G	Red/Blue	Disengage from brake relay (12 vdc)
H	Pink	Tachometer input
J	Green/Red	12 vdc from “CRUISE” indicator in instrument panel (module provides ground)
K	White/Green	Vehicle speed signal input

Table 7-2. Cruise Inoperative Diagnostics

NO.	ACTION	CORRECT FUNCTION	INCORRECT FUNCTION
1	Turn the Ignition/Light Key Switch to OFF. Connect Speedometer Tester (HD-41354).		
2	Enter the diagnostic mode: With the fairing cap Cruise ON/OFF Switch at ON, and the handlebar mounted Cruise SET/RESUME Switch **held** at SET, turn the Ignition/Light Key Switch to IGNITION.	The cruise engaged lamp will illuminate and remain on as long as the Cruise SET/RESUME switch is held in the SET position. **Continue with Step 3.**	If the cruise engaged lamp remains illuminated after the switch is released, then either the switch or related wiring is shorted. See Diagnostic Note 1 for possible causes. **Continue with steps listed under Diagnostic Note 2.**
3	Push the handlebar mounted Cruise SET/RESUME Switch to RES(UME) and hold in this position.	The cruise engaged lamp will illuminate and remain on as long as the SET/RESUME Switch is held in the RES(UME) position. **Continue with Step 4.**	If the cruise engaged lamp does not illuminate at all, check for one or more of the following conditions: ● RES(UME) switch not wired correctly. ● Broken or pinched wire to RES(UME) switch or cruise module. Continue with 7.5 CRUISE CHART B: RESUME SWITCH.
4	Next, turn the throttle grip tightly closed to check the throttle grip switch.	The cruise engaged lamp will illuminate when the switch is closed, and then be extinguished when the throttle grip returns to its free position. **Continue with Step 5.**	If the cruise engaged lamp does not illuminate at all, check for one or more of the following conditions: ● Throttle grip switch not wired correctly. ● Broken or pinched wire to throttle grip switch or cruise module. ● Throttle grip switch not working correctly. Continue with 7.11 CRUISE CHART G: THROTTLE SWITCH.
5	Apply the brake hand lever.	The cruise engaged lamp will illuminate and remain on until the brake lever is released. **Continue with Step 6.**	If the cruise engaged lamp does not illuminate at all, check for one or more of the following conditions: ● Front brake switch not wired correctly. ● Broken or pinched wire to front brake switch or cruise module. ● Front brake switch not working properly. See 7.9 CRUISE CHART F-1: BRAKE LIGHTS ON (constant brake light input) or 7.10 CRUISE CHART F-2: BRAKE LIGHTS OFF (no front and/or rear brake lights).
6	Press and hold the brake foot pedal for at least 5 seconds.	The cruise engaged lamp will illuminate. After depressing and holding the brake foot pedal for 5 seconds, the lamp will be extinguished. Release the brake pedal and the cruise module will momentarily pull the throttle open slightly and then release. **Continue with Step 7.**	The cruise engaged lamp will not illuminate if any of the following conditions exist: ● Rear brake switch not wired correctly. ● Broken or pinched wire to rear brake switch or cruise control module. ● Rear brake switch not working properly. The throttle will not open if the following conditions exist: ● Cables not adjusted properly. ● Faulty cruise control module. See 7.9 CRUISE CHART F-1: BRAKE LIGHTS ON (constant brake light input) or 7.10 CRUISE CHART F-2: BRAKE LIGHTS OFF (no front and/or rear brake lights).

Table 7-2. Cruise Inoperative Diagnostics

NO.	ACTION	CORRECT FUNCTION	INCORRECT FUNCTION
7	Turn on Speedometer Tester (HD-41354), turn POWER IN/OUT Switch to OUT. To send the speed signal, press 1 on the keypad, followed by ENTER, and then press 200 followed by ENTER.	The cruise engaged lamp will flash on and off indicating that the vehicle speed signal is wired properly and working correctly. **Continue with Step 8.**	The cruise engaged lamp will not illuminate if any of the following conditions exist: ● Vehicle speed signal not wired correctly. ● Broken or pinched wire to speedometer. ● Speedometer not working properly. ● Vehicle speed signal wiring disconnected. See 7.12 CRUISE CHART H: SPEEDOMETER INPUT.
8	Turn Speedometer Tester (HD-41354), the fairing cap Cruise ON/OFF Switch, and the Ignition/Light Key Switch to OFF. Disconnect spark plug wires.	**Continue with Step 9.**	
9	Press SET/RESUME Switch to RES(UME), and hold.	**Continue with Step 10.**	
10	While holding SET/RESUME Switch at RES(UME), turn Ignition/Light Key Switch to ON and crank engine. (If weak battery or poor connections result in low system voltage, Diagnostic Mode may be aborted.)	The cruise engaged lamp flashes with RPM input. **Continue with Step 11.**	The cruise engaged lamp does not flash with RPM input. See 7.13 CRUISE CHART I: TACHOMETER INPUT.
11	While continuing to hold SET/RESUME Switch at RES(UME), turn fairing cap Cruise ON/OFF Switch to ON. Release SET/RESUME Switch.	Cruise engaged lamp blinks twice. NOTE: Lamp may go on for three seconds if RPM signal was above cranking speed. **DIAGNOSTIC ROUTINE EXITED**	
12	To restart or repeat the diagnostic sequence, return to Step 1.		

CRUISE DROPOUT DIAGNOSTICS 7.3

GENERAL

To check for diagnostic codes, see DROPOUT DIAGNOSTICS below. If other problems are experienced, such as harsh cruise engagement or speed loss, see Table 7-4.

DROPOUT DIAGNOSTICS

The last eight diagnostic codes for cruise disengagement are stored in memory.

1. To enter the diagnostic mode, turn the engine off and proceed as follows:
   a. Turn the fairing cap Cruise ON/OFF switch to OFF. The light in the rocker switch is extinguished to indicate this condition to the operator.
   b. Push the Cruise SET/RESUME Switch on the right handlebar to SET and hold.
   c. Turn the Ignition/Light Key Switch to IGNITION, but do not start the engine.
   d. Release the Cruise SET/RESUME Switch from the SET position while observing the behavior of the green Cruise Engaged Lamp (capital letter “C”) on the tachometer gauge.
2. The system transmits the most recent cruise dropout code. Each dropout code consists of 3 digits and is sent out as a series of flashes.
3. The lamp will begin by flashing one or more times to indicate the first digit of the dropout code. The length of time the lamp is illuminated and the length of time in which it is off are each about 1/4 second in duration. Simply count the number of times the lamp flashes in order to retrieve the first digit of the dropout code.
4. Following transmission of the first digit, there is a one second pause in which the lamp is off. The lamp will then flash one or more times to indicate the second digit of the dropout code. Count the number of times the lamp flashes to retrieve the second digit. See Figure 7-5.
5. Following transmission of the second digit, there is a another one second pause in which the lamp is off. The lamp will then flash one or more times to indicate the third digit of the dropout code. Again, count the number of times the lamp flashes to retrieve the third digit.
6. Write down the dropout code on a piece of paper. To identify the reason for cruise disengagement see Table 7-3. The last column of the table suggests the appropriate corrective action.
7. To verify the dropout code, toggle the Cruise SET/RESUME Switch to RESUME. The transmission of the most recent dropout code is repeated. To continue with the next code, simply toggle the Cruise Switch to SET. All subsequent codes are sent in the same manner as the first, after which the operator may repeat the code or move on to the next in the series.
8. After the eighth (or oldest) dropout code is flashed, the Cruise Engaged Lamp remains illuminated to indicate that the end of the dropout code buffer has been reached.
9. To start the sequence at the beginning, that is, with transmission of the most recent dropout code, momentarily push the Cruise SET/RESUME Switch to SET.

CAUTION

While in the diagnostics mode, holding the Cruise Switch at RESUME for a period of 10 seconds or more will clear or erase the dropout code buffer.

10. To exit the diagnostic mode, turn the Ignition/Light Key Switch to OFF.

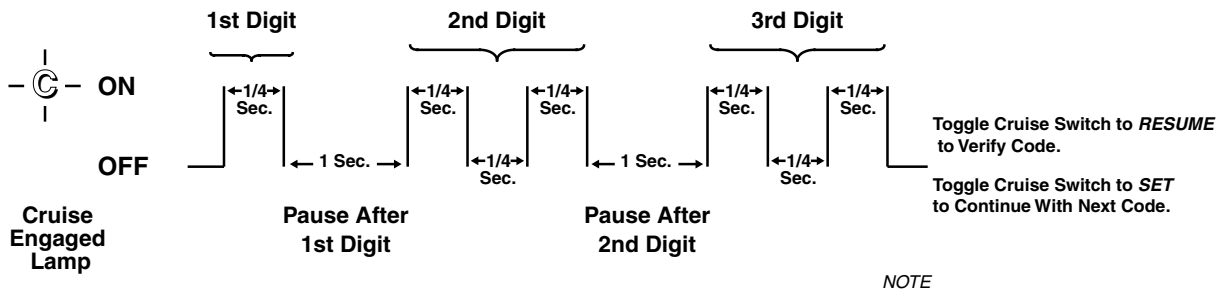


Figure 7-5. Cruise Engaged Lamp Dropout Code Timing Diagram

Table 7-3. Cruise Dropout Code Key

CODE	CONDITION	ACTION
		NOTE *While performing instructions under applicable flow chart, wiggle connectors and wires to identify intermittents.*
111	Initial State or Cleared Memory (No Codes Recorded)	-
112	Throttle Roll Off	7.11 CRUISE CHART G: THROTTLE SWITCH
113	Fairing Cap Cruise Switch Turned OFF	7.8 CRUISE CHART E: CRUISE ENABLE
121	Short in Wiring Between Set/Resume	7.4 CRUISE CHART A: INITIAL DIAGNOSTICS or 7.5 CRUISE CHART B: RESUME SWITCH
122	Application of Front or Rear Brakes *NOTE* *May require inspection of brake levers or front brake light switch mounting.*	7.9 CRUISE CHART F-1: BRAKE LIGHTS ON
211	Coast (S/C Button Engaged) Interval Longer than 6 Seconds	7.4 CRUISE CHART A: INITIAL DIAGNOSTICS
212	Speed Drops Below 30 MPH While in Coast (S/C Button Engaged)	7.4 CRUISE CHART A: INITIAL DIAGNOSTICS or 7.12 CRUISE CHART H: SPEEDOMETER INPUT
213	Speed Drops Below 26 MPH or Exceeds 90 MPH	7.12 CRUISE CHART H: SPEEDOMETER INPUT
221	Speed Drops 15 MPH Below Set Speed (Such as When Climbing a Steep Hill)	7.12 CRUISE CHART H: SPEEDOMETER INPUT
222	Speed Decreases Greater than 20 MPH per Second	7.12 CRUISE CHART H: SPEEDOMETER INPUT
223	Vehicle Speed Sensor Input	7.12 CRUISE CHART H: SPEEDOMETER INPUT
231	Over 5000 RPM	7.13 CRUISE CHART I: TACHOMETER INPUT
232	Loss of Tachometer Signal	7.13 CRUISE CHART I: TACHOMETER INPUT
242	High Rate of Change of RPM Detected (Such as When Clutch is Pulled In or Contact is Made With Ice Patch or Slippery Surface)	7.13 CRUISE CHART I: TACHOMETER INPUT
311	Internal Failure	Replace cruise module. See the 2003 Touring Models Service Manual (Part Number 99483-03).
312		
313		
321		
323		
331		
332		
333		
341	Low Voltage	7.7 CRUISE CHART D: CRUISE POWER
342	Internal Failure	Replace cruise module. See the 2003 Touring Models Service Manual (Part Number 99483-03).
343		
351		
352		
353		
361		
362		
363		
371		
423		
432		
777		

Table 7-4. Other Malfunctions

CONDITION	SYMPTOM	CHECK FOR
Harsh engagement	Cruise control opens throttle abruptly or harshly	Check for a cruise cable that is too tight. See CABLE LASH INITIALIZATION in the 2003 Touring Models Service Manual (Part Number 99483-03).
Speed variation	Loses speed	● Cruise cable too loose. See CABLE LASH INITIALIZATION in the 2003 Touring Models Service Manual (Part Number 99483-03). ● Set switch held too long.
	Gains speed	● Cruise cable too tight. See CABLE LASH INITIALIZATION in the 2003 Touring Models Service Manual (Part Number 99483-03).
	Speed surges	● Intermittent vehicle speed signal. ● Intermittent speedometer. ● Defective cruise module. See CRUISE MODULE, REMOVAL/INSTALLATION, in the 2003 Touring Models Service Manual (Part Number 99483-03). *NOTE* *Check for surging with cruise control turned OFF. If surging is still present, a lean fuel mixture may be the cause.*

CRUISE CHART A: INITIAL DIAGNOSTICS 7.4

DIAGNOSTICS

Test 7.4 (Part 1 of 2)

Remove Left Saddlebag and Sidecover. Is 10-place Connector [17B] Plugged Into Cruise Module? See Figure 7-6.

YES

Unplug Connector [17B].

SET SWITCH

Check Continuity Between the O/V Terminal (F) and BE/BK Terminal (B) of Connector [17B]. **Resistance Must Be ∞ Ohms.** Pressing SET/RESUME Switch to SET Should Produce a Reading of Less Than 0.5 Ohms. Are These Your Observations?

YES

STOP

Go to Test 7.4 (Part 2 of 2)

NO

Plug In Connector [17B].

NO

FLHRC-I

Remove the Headlamp Assembly. Disconnect 6-Place Connector [22] and 4-Place Connector [159]. Measure Resistance Between O/W Wire on Connector [22B] and BE/BK Wire on Connector [159B]. **Resistance Must Be ∞ Ohms.** Pressing SET/RESUME Switch to SET Should Produce a Reading of Less Than 0.5 Ohms. Are These Your Observations?

YES

Locate and Repair Open on BE/BK Wire in Main Harness.

5028

NO

Right Handlebar Switch Wiring Pinched or Damaged?

YES

Repair Wiring.

6552

NO

Replace Cruise SET/RESUME Switch.

5182

FLH TCU-I, FLTR/I

Remove the Outer Fairing. Locate the 12-Place Connector [22] for Right Handlebar Switch Controls. See Figure 7-8 or Figure 7-8. Measure Between the O/W and BE/BK Terminals at Connector [22B]. **Resistance Must Be ∞ Ohms.** Pressing SET/RESUME Switch to SET Should Produce a Reading of Less Than 0.5 Ohms. Are These Your Observations?

YES

Check Continuity on O/V and BE/BK Wires Between Connectors [17B] and [156A]. See Figure 7-7 and Figure 7-9. Continuity Present?

YES

Repair Interconnect Harness.

6532

NO

Repair Main Harness.

5028

NO

Right Handlebar Switch Wiring Pinched or Damaged?

YES

Repair Wiring.

6552

NO

Replace Cruise SET/RESUME Switch.

5182

After correction of problem, restart 7.2 CRUISE INOPERATIVE DIAGNOSTICS to verify proper performance.

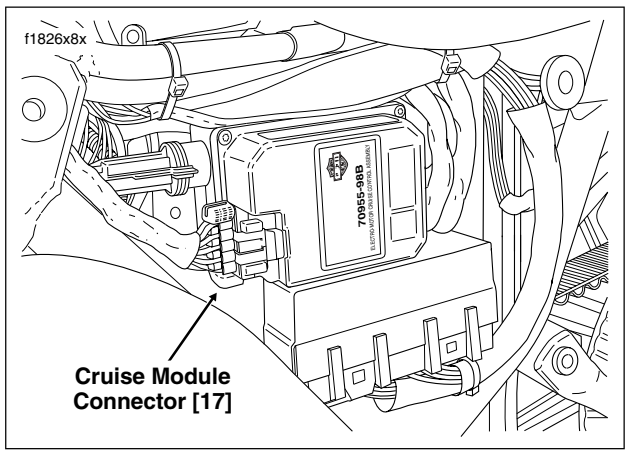


Figure 7-6. Left Side Cover Removed

Test 7.4 (Part 2 of 2)

INITIAL DIAGNOSTICS

Continued from Test 7.4 (Part 1 of 2).

Connect a Jumper From the GN/R Terminal (J) to Ground. The Cruise Engaged Lamp Should Illuminate When the Ignition/Light Key Switch is Positioned to IGNITION. Does It?

- YES: Place the Positive Probe on the O/V Terminal (F) and the Negative Probe on the BK Terminal (E). With the Ignition/Light Key Switch Positioned to IGNITION, the Meter Should Read Battery Voltage. Does It?
  - YES: Place the Positive Probe on the R/GN Terminal (A) and the Negative Probe on the BK Terminal (E). With the Ignition/Light Key Switch Positioned to IGNITION and the Fairing Cap Cruise ON/OFF Switch Positioned to ON, the Meter Should Read Battery Voltage. Does It?
    - YES: Place the Positive Probe on the R/BE Terminal (G) and the Negative Probe on the BK Terminal (E). Meter Should Read Between 11-13 Volts **Only** When the Brake is Applied and the Ignition/Light Key Switch is Positioned to IGNITION. Does It?
      - YES: Check Continuity Between the V/Y Terminal (D) and the O/V Terminal (F) With the Ignition/Light Key Switch Positioned to OFF. The Meter Should Read Infinity When the Throttle Switch is in the Relaxed Position, and Continuity When the Throttle Grip is Rolled Forward. Does It?
        - YES: Reconnect All Connectors. Restart 7.2 CRUISE INOPERATIVE DIAGNOSTICS if Cruise Engaged Lamp has Never Illuminated. If the Lamp Will Not Illuminate When the First Test is Performed Now, Replace the Cruise Module.
        - NO: See 7.11 CRUISE CHART G:THROTTLE SWITCH.
      - NO: See 7.9 CRUISE CHART F-1: BRAKE LIGHTS ON or 7.10 CRUISE CHART F-2: BRAKE LIGHTS OFF.
    - NO: See 7.8 CRUISE CHART E: CRUISE ENABLE.
  - NO: See 7.7 CRUISE CHART D: CRUISE POWER.
- NO: See 7.6 CRUISE CHART C: CRUISE ENGAGED LAMP.

6635

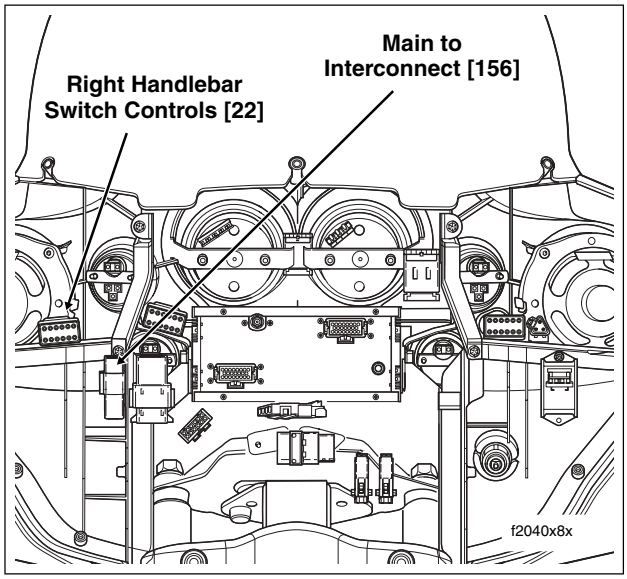


Figure 7-7. Outer Fairing Removed (FLHTC/U)

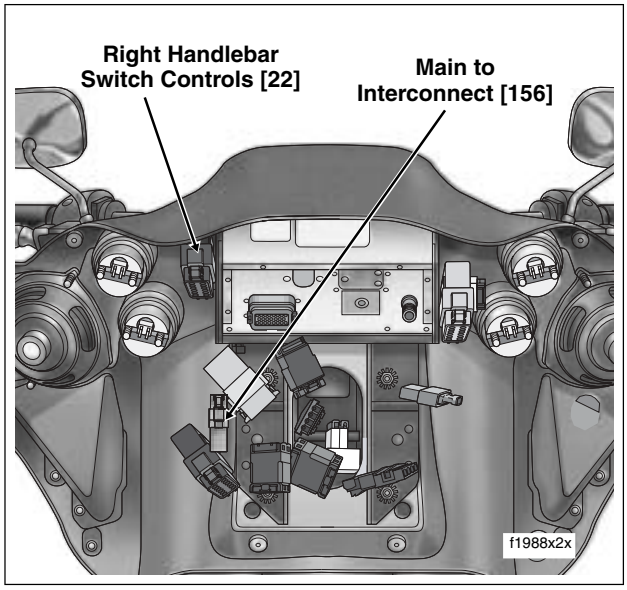
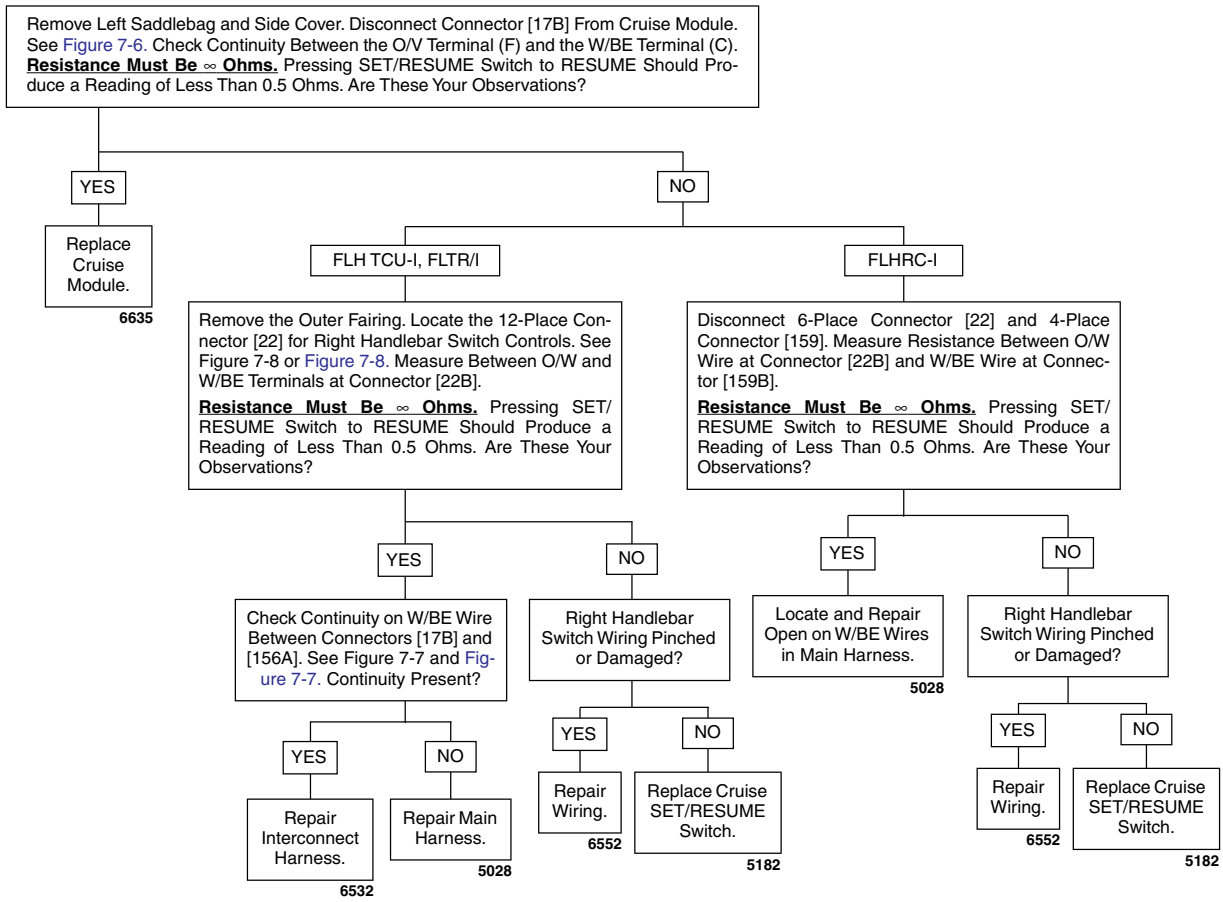


Figure 7-8. Outer Fairing Removed (FLTR)

CRUISE CHART B: RESUME SWITCH 7.5

DIAGNOSTICS

Test 7.5

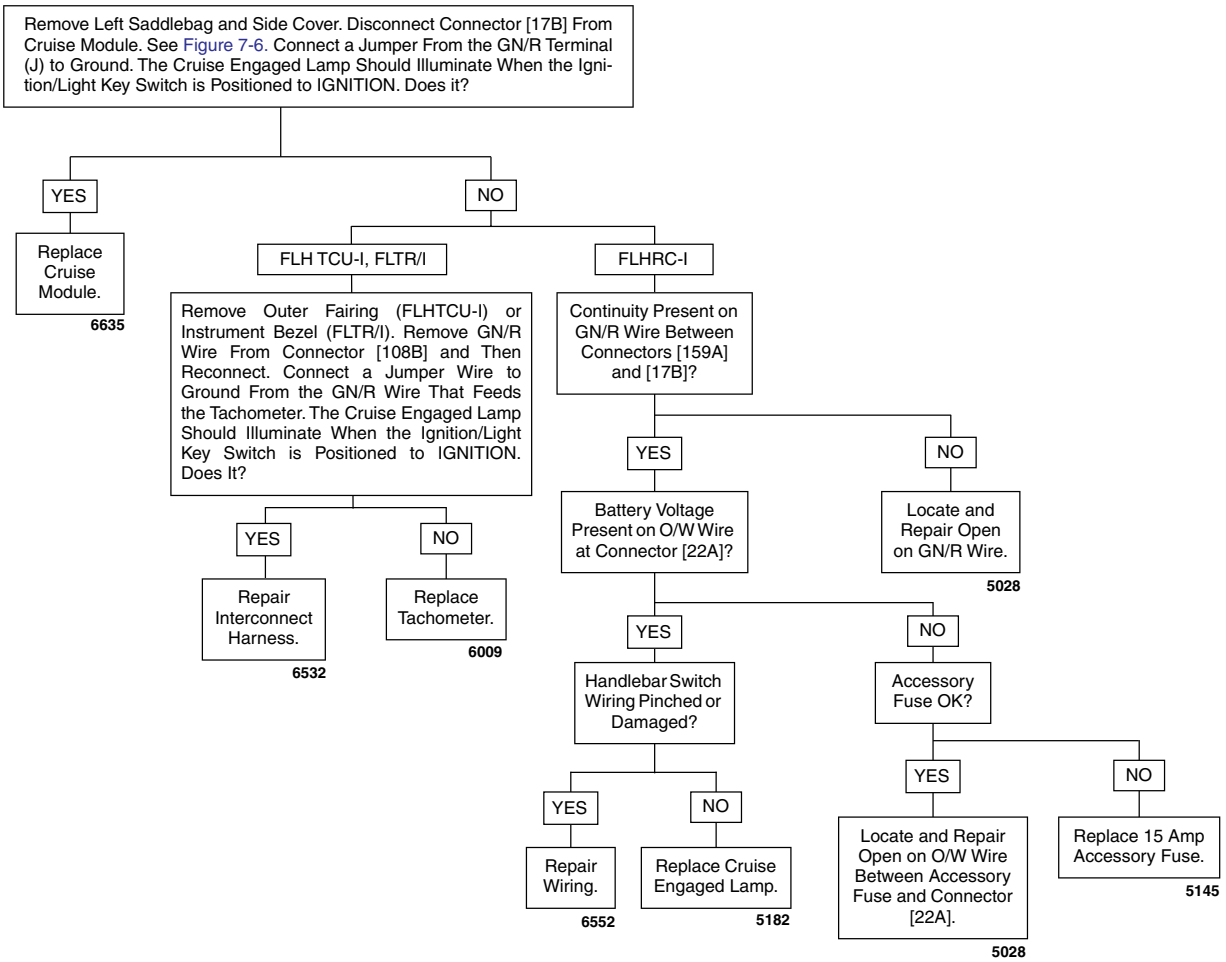


After correction of problem, restart 7.2 CRUISE INOPERATIVE DIAGNOSTICS to verify proper performance.

CRUISE CHART C: CRUISE ENGAGED LAMP 7.6

DIAGNOSTICS

Test 7.6

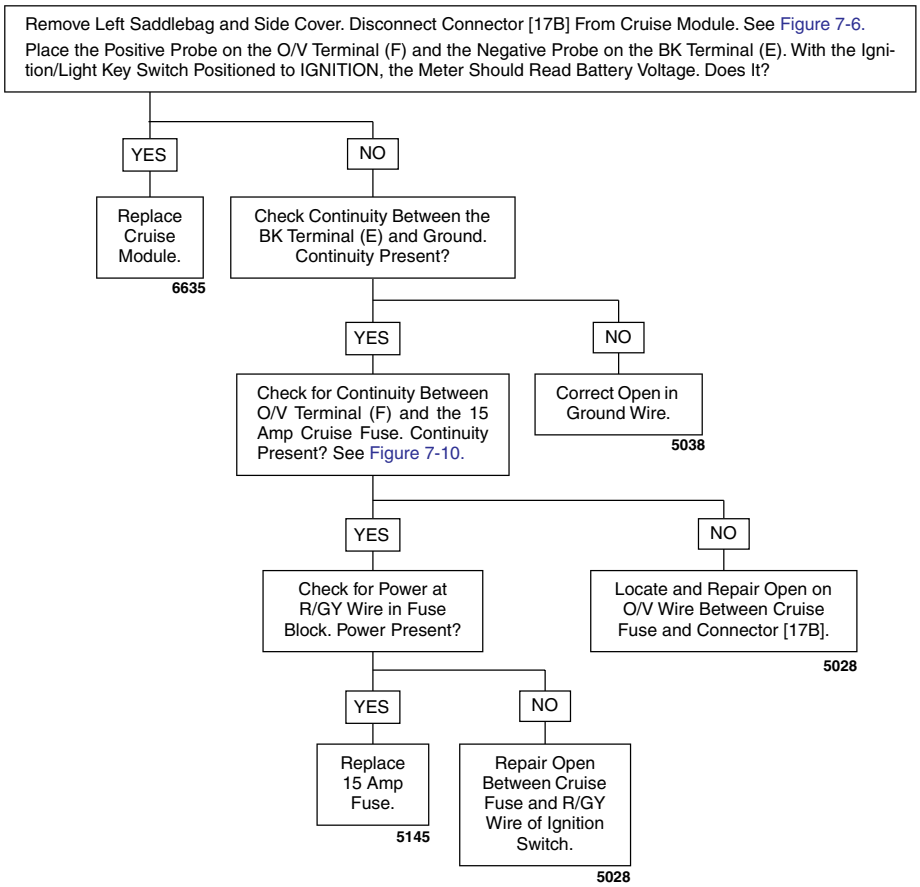


After correction of problem, restart 7.2 CRUISE INOPERATIVE DIAGNOSTICS to verify proper performance.

CRUISE CHART D: CRUISE POWER 7.7

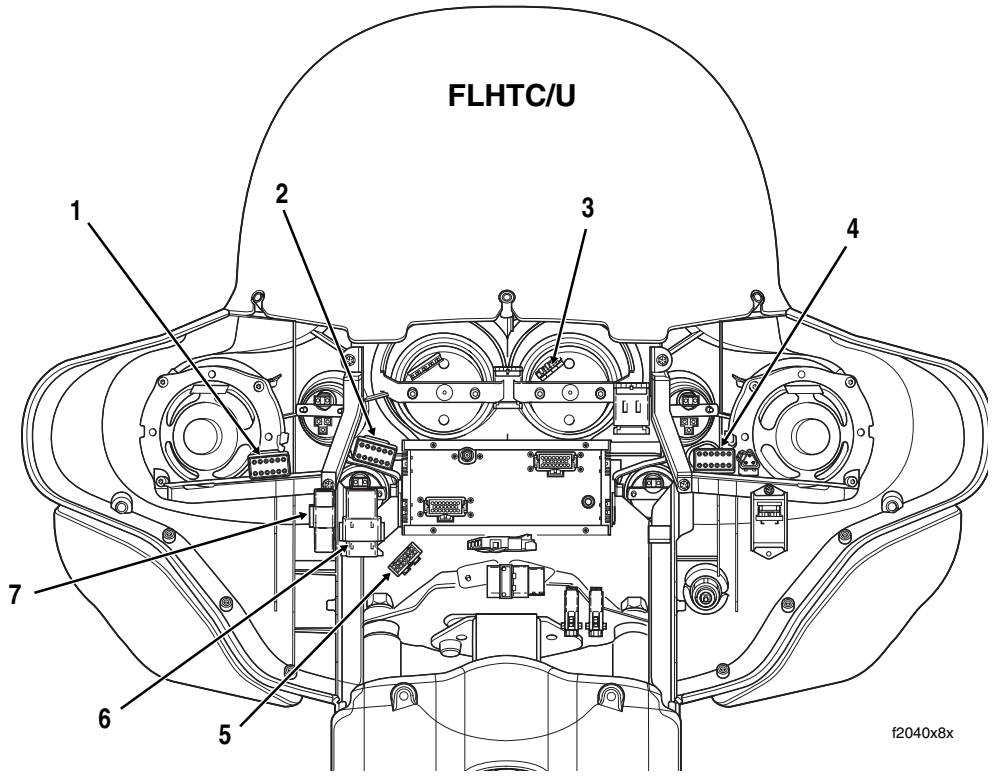
DIAGNOSTICS

Test 7.7



After correction of problem, restart 7.2 CRUISE INOPERATIVE DIAGNOSTICS to verify proper performance.

1. Right Handlebar Switch Controls [22]
2. Main to Interconnect Harness [2]
3. Speedometer Gauge [39]
4. Left Handlebar Switch Controls [24]
5. Fairing Cap (FLHTCU) or Instrument Nacelle (FLTR) Switches [105]
6. Main to Interconnect Harness [1]
7. Main to Interconnect Harness (Cruise) [156]



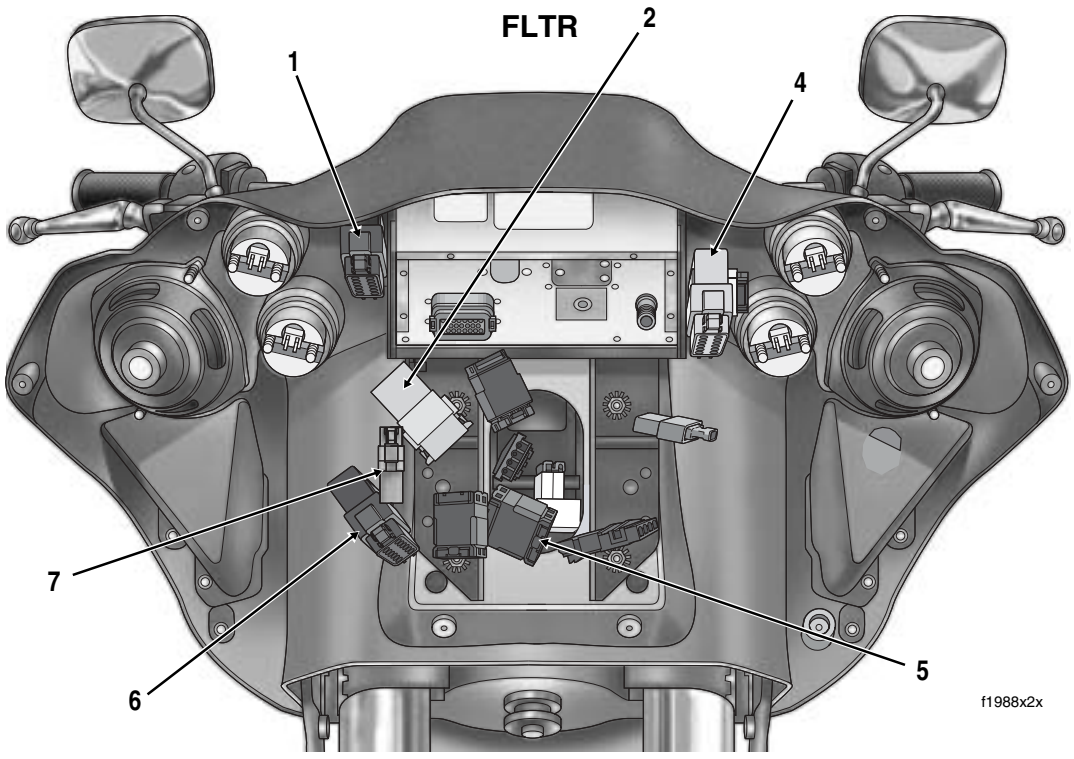
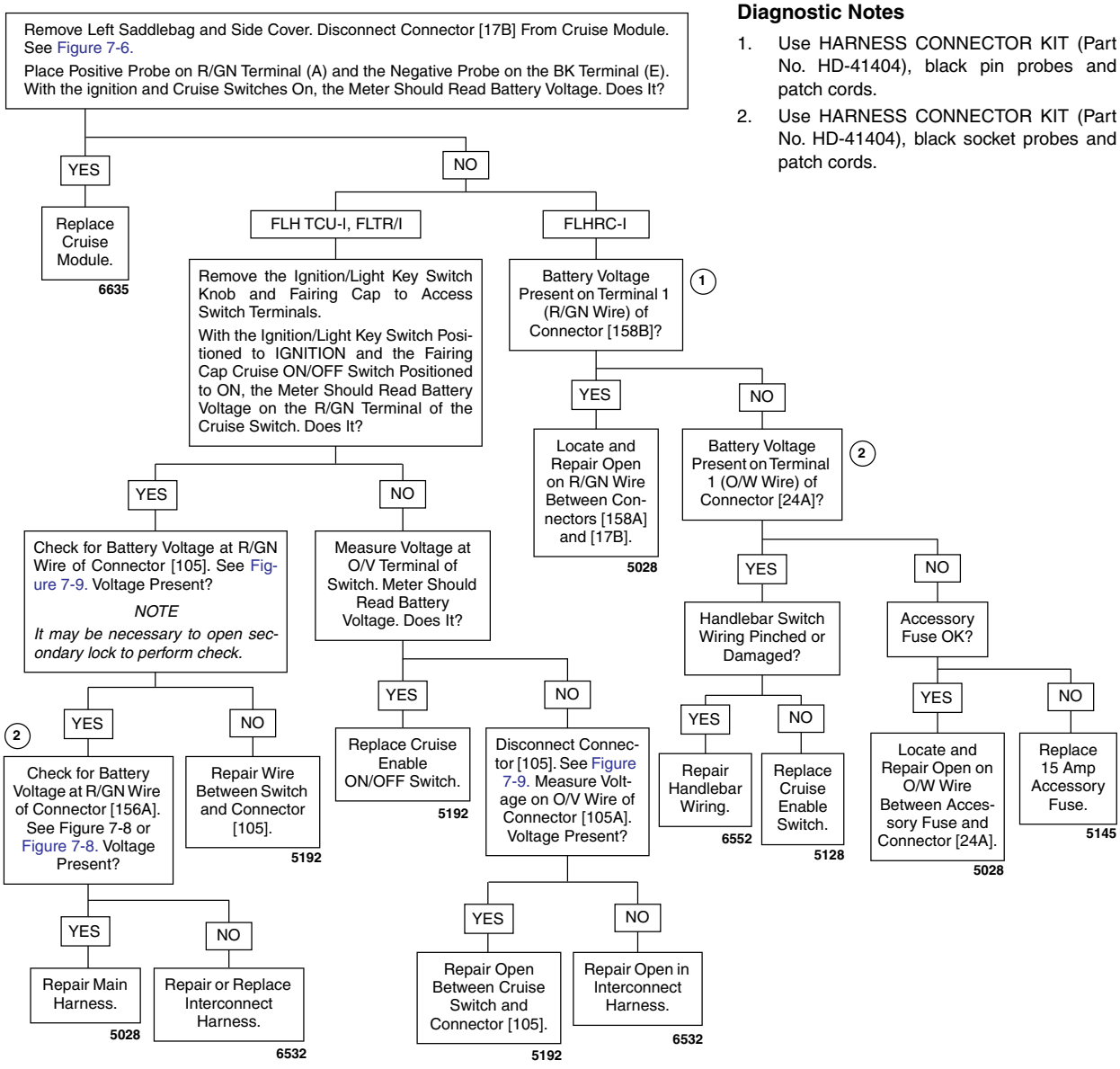


Figure 7-9. Outer Fairing Removed

CRUISE CHART E: CRUISE ENABLE 7.8

DIAGNOSTICS

Test 7.8



Diagnostic Notes

1. Use HARNESS CONNECTOR KIT (Part No. HD-41404), black pin probes and patch cords.
2. Use HARNESS CONNECTOR KIT (Part No. HD-41404), black socket probes and patch cords.

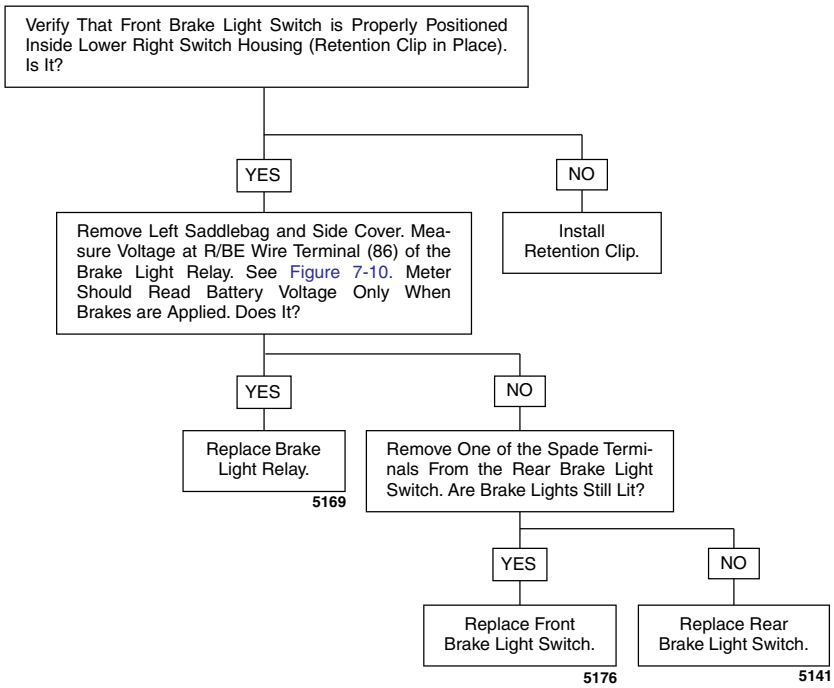
After correction of problem, restart 7.2 CRUISE INOPERATIVE DIAGNOSTICS to verify proper performance.

CRUISE CHART F-1: BRAKE LIGHTS ON 7.9

DIAGNOSTICS

Test 7.9

CONSTANT BRAKE LIGHT INPUT



After correction of problem, restart 7.2 CRUISE INOPERATIVE DIAGNOSTICS to verify proper performance.

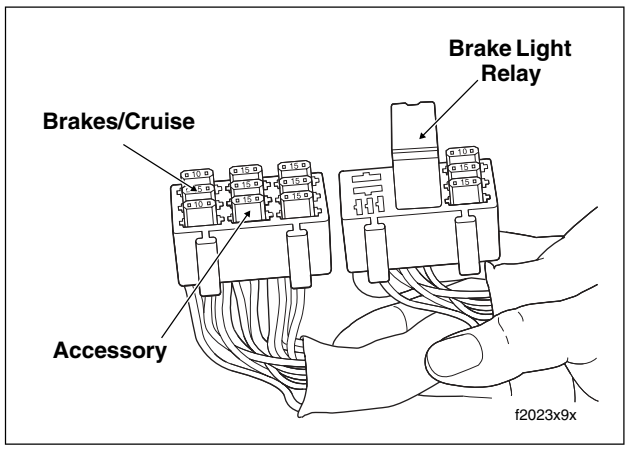


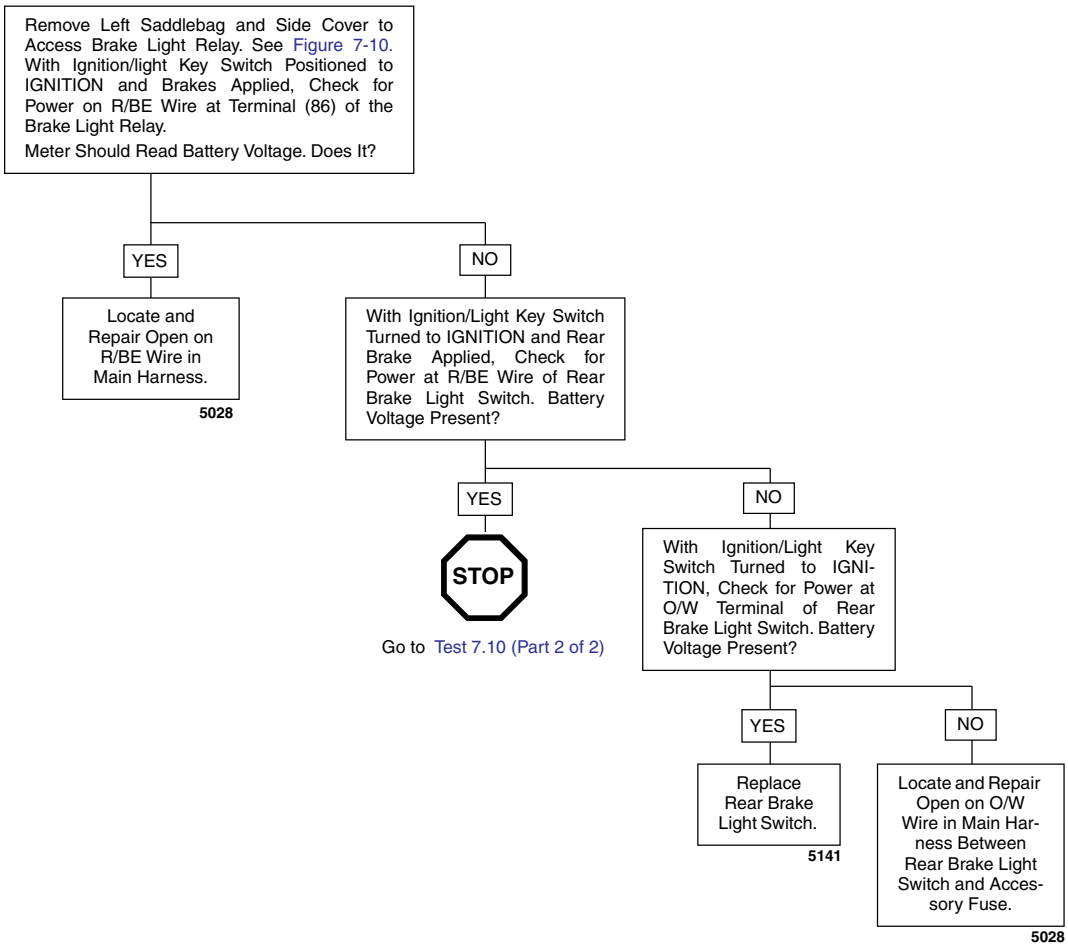
Figure 7-10. Fuse Blocks (FLHTCU-I)

CRUISE CHART F-2: BRAKE LIGHTS OFF 7.10

DIAGNOSTICS

Test 7.10 (Part 1 of 2)

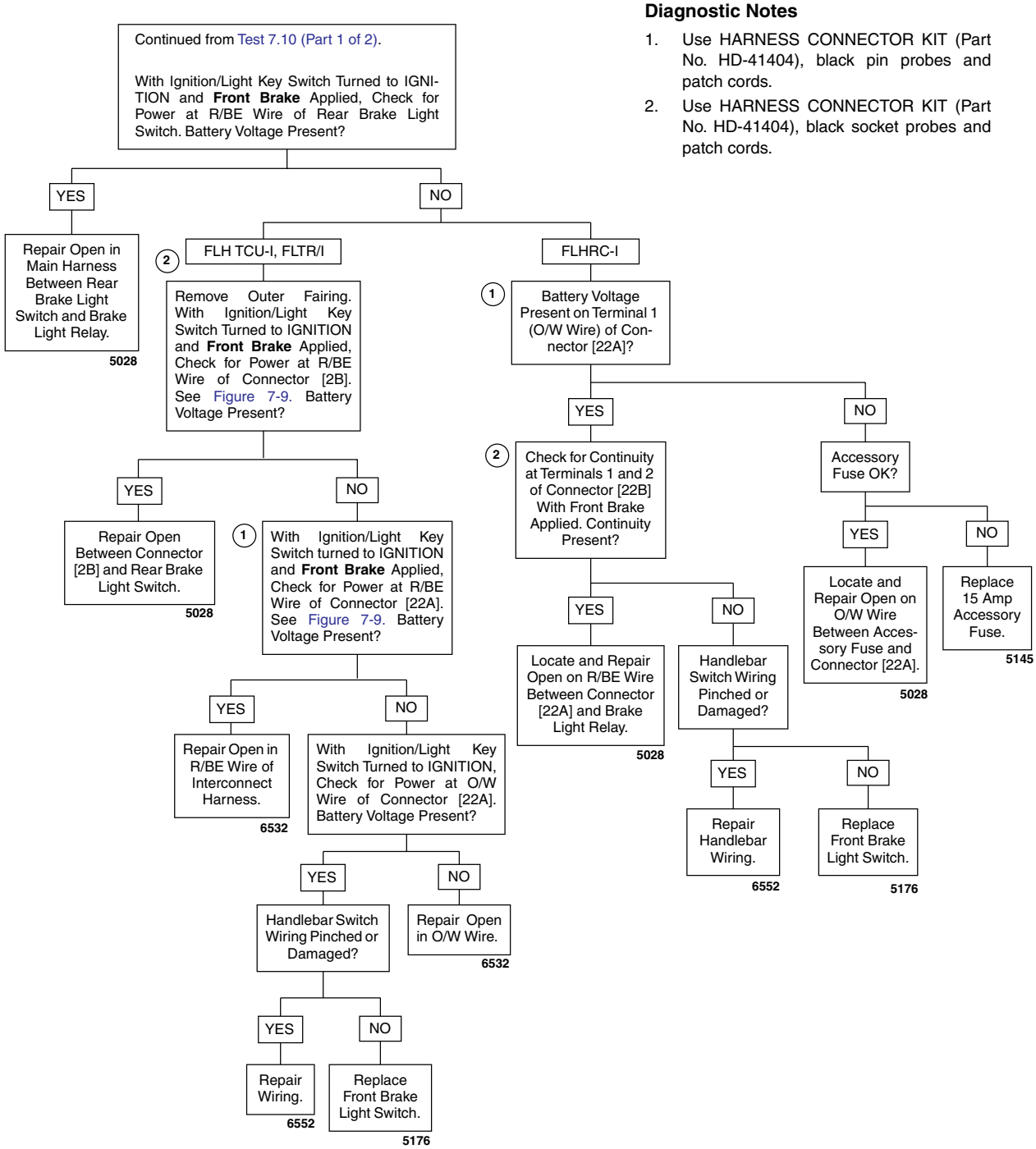
NO FRONT AND/OR REAR BRAKE LIGHTS



After correction of problem, restart 7.2 CRUISE INOPERATIVE DIAGNOSTICS to verify proper performance.

Test 7.10 (Part 2 of 2)

NO FRONT AND/OR REAR BRAKE LIGHTS



Diagnostic Notes

1. Use HARNESS CONNECTOR KIT (Part No. HD-41404), black pin probes and patch cords.
2. Use HARNESS CONNECTOR KIT (Part No. HD-41404), black socket probes and patch cords.

After correction of problem, restart 7.2 CRUISE INOPERATIVE DIAGNOSTICS to verify proper performance.

CRUISE CHART G: THROTTLE SWITCH 7.11

DIAGNOSTICS

Test 7.11

THROTTLE SWITCH

Remove Left Saddlebag and Side Cover. Disconnect Connector [17B] From Cruise Module. See Figure 7-11.

With the Ignition/Light Key Switch Positioned to OFF, Check Continuity Between the V/Y Terminal (D) and the O/V Terminal (F). The Meter Should Read Infinity When the Throttle Switch is in the Relaxed Position and Continuity When the Throttle Grip is Rolled Forward. Are These Your Observations?

YES

Restart 7.2 CRUISE INOPERATIVE DIAGNOSTICS to Verify That Problem is Corrected. If the Cruise Engaged Lamp Will Not Illuminate When This Step is Performed Now, Replace The Cruise Module.

6635

NO

Adjust the Idle Throttle Cable and Retest for Continuity. Continuity Present?

YES

System OK.

NO

Check for Continuity Directly at Throttle Switch. Continuity Should Only be Present When the Throttle is Rolled Forward Under Pressure. Is It?

YES

Battery Voltage Present on O/V Throttle Switch Terminal [75D]?

YES

Locate and Repair Open on Y/V Wire in Main Harness.

5028

NO

Locate and Repair Open on O/V Throttle Switch Wires in Main Harness.

5028

NO

Replace Idle Throttle Cable.

2241

After correction of problem, restart 7.2 CRUISE INOPERATIVE DIAGNOSTICS to verify proper performance.

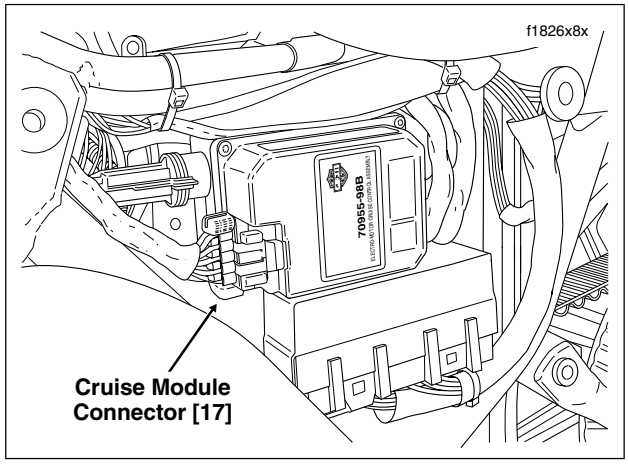


Figure 7-11. Left Side Cover Removed

CRUISE CHART H: SPEEDOMETER INPUT 7.12

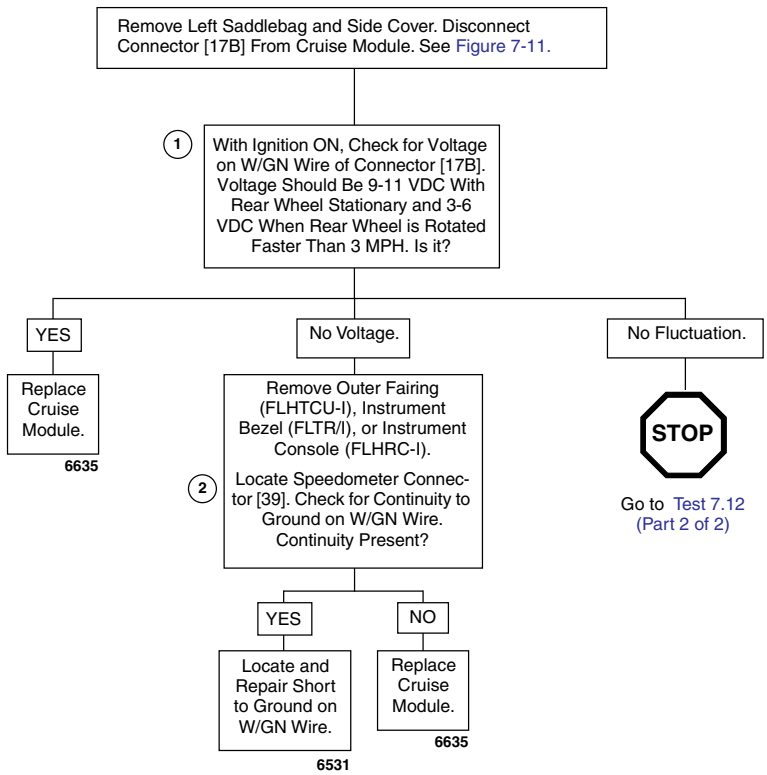
DIAGNOSTICS

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Speedometer Input flow charts.

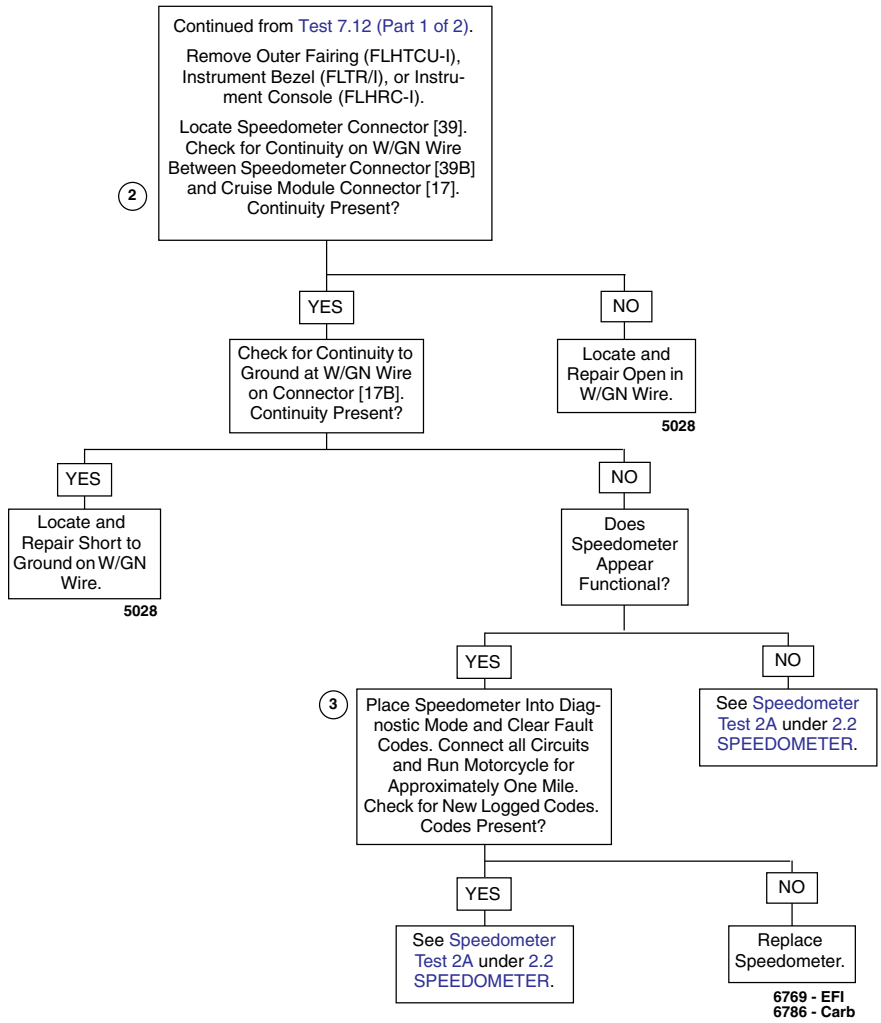
1. Obtain the Speedometer Tester (Part No. HD-41354). For a signal that duplicates 3 MPH, enter the number “70” on the keypad and watch for a voltage drop on the W/GN wire. If the tester is not available, elevate the rear wheel and spin briskly while looking for voltage drop.
2. Leaving speedometer connector [39] connected, insert probe into wire end of connector [39B] until contact is made with backside of terminal. If necessary, use a fine paper clip to avoid damage.
3. To enable Diagnostic Mode, depress odometer reset switch and turn Ignition/Light Key Switch to IGNITION. To clear codes, depress and hold reset switch for ten seconds. To return speedometer to normal operating mode, cycle Ignition/light Key Switch.

Test 7.12 (Part 1 of 2)



After correction of problem, restart 7.2 CRUISE INOPERATIVE DIAGNOSTICS to verify proper performance.

Test 7.12 (Part 2 of 2)



After correction of problem, restart 7.2 CRUISE INOPERATIVE DIAGNOSTICS to verify proper performance.

CRUISE CHART I: TACHOMETER INPUT 7.13

DIAGNOSTICS

Test 7.13

Remove Left Saddlebag and Side Cover. Disconnect Connector [17B] From Cruise Module. See Figure 7-11.

Place the Positive Probe on the PK Terminal (H) and the Negative Probe on the BK Terminal (E). The Meter Should Read Battery Voltage. If Voltage is Not Present, Momentarily Press the Starter Button Until Voltage is Present. The Meter Should Read a Voltage Fluctuation During Cranking. Are These Your Observations?

- YES → Replace Cruise Module. (6635)
- NO → Remove Right Saddlebag and Side Cover. Disconnect Gray 12-Place Ignition/EFI Harness Connector [8]. See Figure 7-12. Check for Continuity Between the PK Terminal (H) and the PK Wire in Connector [8A]. Continuity Present?
  - YES → Locate and Repair Open in PK Wire of Ignition/EFI Harness. (6532)
  - NO → Locate and Repair Open in Main Harness. (5028)

After correction of problem, restart 7.2 CRUISE INOPERATIVE DIAGNOSTICS to verify proper performance.

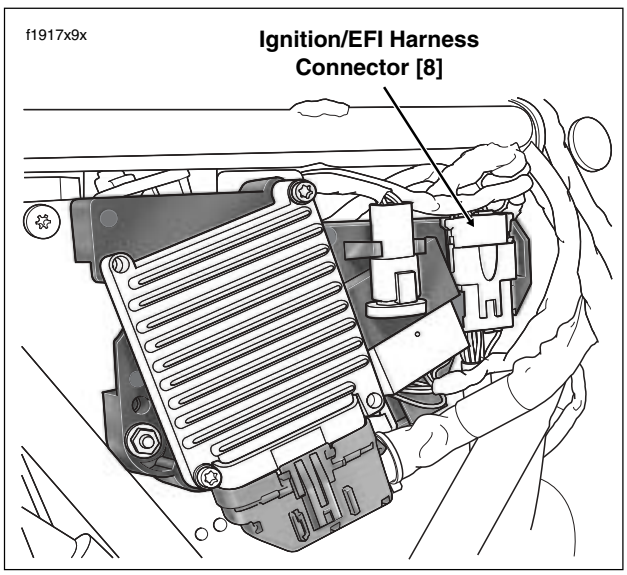


Figure 7-12. Right Side Cover Removed

Table Of Contents

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8.1 Electrical Connector Locations 8-1
8.2 Wiring Diagrams 8-13

WIRING 8

ELECTRICAL CONNECTOR LOCATIONS 8.1

FLHT/C/U WIRE HARNESS CONNECTORS

No.	Description	Type	Location	Fig.
[1]	Main to Interconnect Harness	12 - Place Deutsch (Black)	Inner Fairing - Right Fairing Bracket	1
[2]	Main to Interconnect Harness	12 - Place Deutsch (Gray)	Inner Fairing - Right Radio Support Bracket	1
[4]	Accessory	4 - Place Deutsch	Upper Frame Cross Member (Under Seat)	6
[5]	Main Circuit Breaker	Ring Terminals	Upper Frame Cross Member (Under Seat)	6
[6]	Audio to Interconnect Harness	3 - Place Deutsch (Black)	Inner Fairing - Left Fairing Support Brace	1
[7]	Rear Fender Lights Harness	8 - Place Multilock	Top of Rear Fender (Under Seat)	9
[8]	Ignition Harness (Main to EFI Harness on EFI models)	12 - Place Deutsch (Gray)	Under Right Side Cover	5
[10]	Ignition Module ****	12 - Place Deutsch (Black)	Under Right Side Cover	8
[11]	Ignition Module ****	12 - Place Deutsch (Gray)	Under Right Side Cover	8
[12]	Tour-Pak Lights	3 - Place Multilock	Inside Tour-Pak	2
[13]	Fuel Level Sender (and Fuel Pump on EFI models)	3 - Place Multilock	Behind Fuel Tank (Under Seat)	12
[15]	Main Power	4 - Place Packard	Inner Fairing - Front of Top Fork Bracket (Below Radio)	1
[17]	Cruise Control Module **	10 - Place Packard	Under Left Side Cover	3
[18]	Left Rear Turn Signal	2 - Place Multilock	Circuit Board Under Tail Lamp Assembly	10
[19]	Right Rear Turn Signal	2 - Place Multilock	Circuit Board Under Tail Lamp Assembly	10
[21]	Indicator Lamps	10 - Place Multilock	Inner Fairing (Between Speedometer and Tachometer Brackets)	1
[22]	Interconnect to Right Handlebar Switch Controls	12 - Place Deutsch (Black)	Inner Fairing - Right Fairing Support Brace	1
[24]	Interconnect to Left Handlebar Switch Controls	12 - Place Deutsch (Gray)	Inner Fairing - Left Fairing Support Brace	1
[27]	Radio *	23 - Place Amp (Black)	Inner Fairing - Back of Radio (Right Side)	1
[28]	Radio **	23 - Place Amp (Gray)	Inner Fairing - Back of Radio (Left Side)	1
[30]	Turn Signal/Security Module	12 - Place Deutsch	Cavity in Crossmember at Rear of Battery Box (Under Seat)	7
[31]	Front Turn Signals	6 - Place Multilock	Inner Fairing - Inboard of Left Fairing Bracket	1
[32]	Front Fender Tip Lamp (DOM)	2 - Place Multilock (Black)	Inner Fairing - Next to Top Fork Bracket	1
[33]	Ignition/Light Key Switch	4 - Place Packard	Inner Fairing - Below Radio	1
[38]	Headlamp	Headlamp Connector	Inner Fairing	-
[39]	Speedometer	12 - Place Packard	Inner Fairing (Back of Speedometer)	1
[41]	Rear Right Speaker/Passenger Controls **	6 - Place Mini-Deutsch	Inside Rear Right Speaker Box	-
[42]	Rear Left Speaker/Passenger Controls **	6 - Place Mini-Deutsch	Inside Rear Left Speaker Box	-
[45]	Rear Fender Tip Lamp (DOM)	3 - Place Multilock	Circuit Board Under Tail Lamp Assembly	10
[46]	Stator/Voltage Regulator	2 - Place Packard	Bottom of Voltage Regulator	11
[50]	CB Antenna Cable **	-	Inner Fairing - Back of Radio (Right Side)	1,2
[51]	Radio Antenna Cable *	-	Inner Fairing - Back of Radio (Left Side)	1
[53]	Console Pod **	12 - Place Mini-Deutsch	Rear of Battery Box (Under Seat)	7
[62]	Rear Fuse Block	Fuse Terminals	Under Left Side Cover	3,4
[64]	Front Fuse Block	Fuse Terminals	Under Left Side Cover	3,4
[65]	Speedometer Sensor	3 - Place Deutsch	Upper Frame Cross Member (Under Seat)	-
[73]	Passing Lamps	2 - Place Multilock (White)	Inner Fairing - Next to Top Fork Bracket	1
[75]	Cruise Roll-Off Switch	Spade Contacts	Right Side of Steering Head	-
[76]	Passenger Headset	7 - Place DIN	Below Rear Left Speaker Box	-
[78]	Electronic Control Module (ECM) ***	36 - Place Packard	Under Right Side Cover	5
[79]	Crankshaft Position (CKP) Sensor	2 - Place Mini-Deutsch	Under Right Side Cover (Behind Electrical Bracket)	5
[80]	Manifold Absolute Pressure (MAP) Sensor	3 - Place Packard	Top of Intake Manifold/Induction Module	-
[83]	Ignition Coil	4 - Place Packard	Below Fuel Tank (Left Side)	-
[84]	Front Injector ***	2 - Place Packard	Below Fuel Tank (Left Side)	-
[85]	Rear Injector ***	2 - Place Packard	Below Fuel Tank (Left Side)	-
[87]	Idle Air Control (IAC) ***	4 - Place Packard	Below Fuel Tank (Right Side)	-

Continued ...

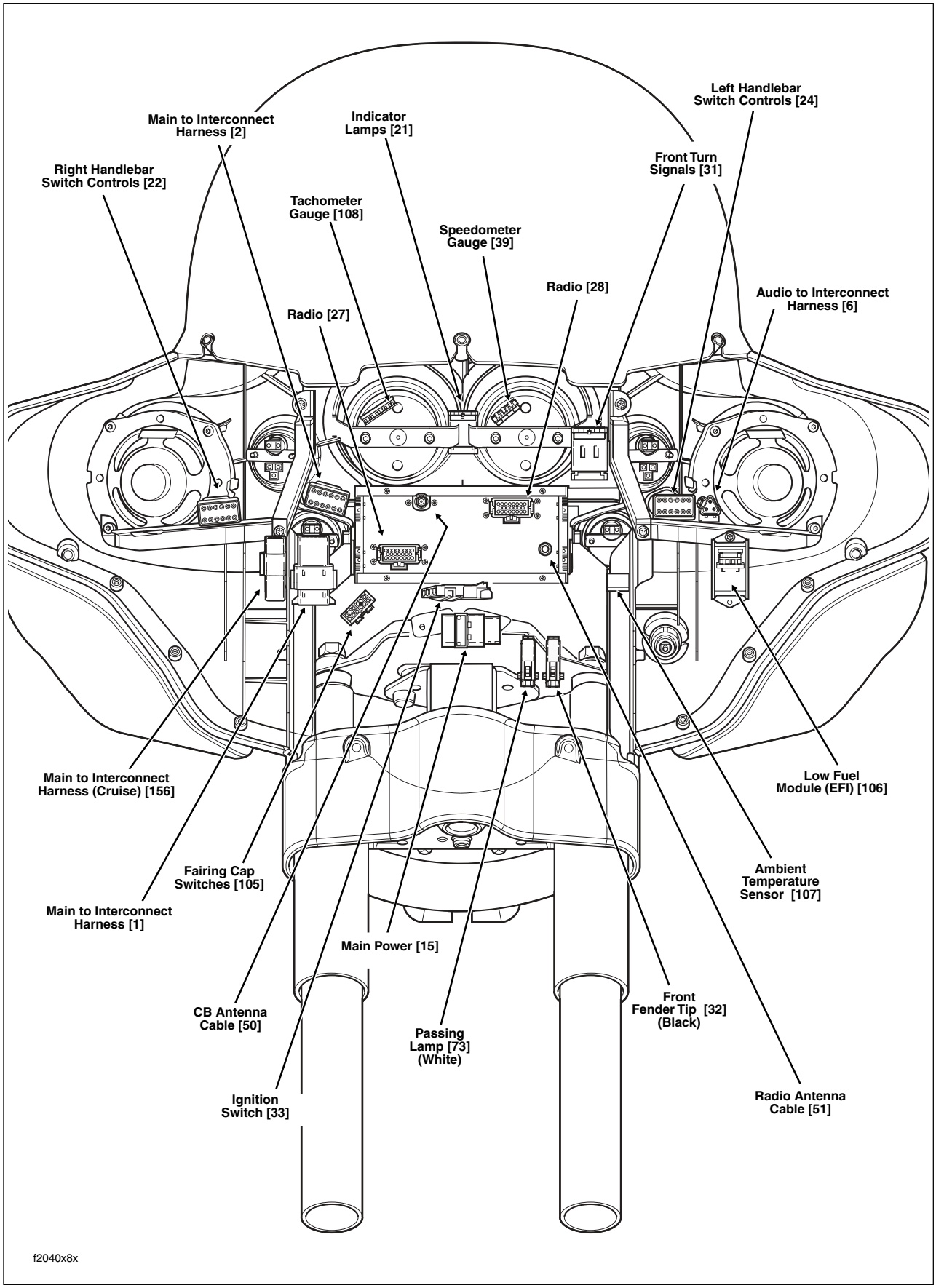


Figure 8-1. Inner Fairing Connectors (FLHT/C/U)

FLHT/C/U WIRE HARNESS CONNECTORS (Continued)

No.	Description	Type	Location	Fig.
[88]	Throttle Position Sensor (TP Sensor) ***	3 - Place Packard	Below Fuel Tank (Right Side)	-
[89]	Intake Air Temperature Sensor (IAT Sensor) ***	2 - Place Packard	Below Fuel Tank (Right Side)	-
[90]	Engine Temperature Sensor (ET Sensor) ***	2 - Place Packard	Back of Front Cylinder (Left Side)	-
[91]	Data Link	4 - Place Deutsch	Under Right Side Cover	5
[93]	Tail Lamp	4 - Place Multilock	Circuit Board Under Tail Lamp Assembly	10
[94]	Rear Fender Lights Harness to Circuit Board	6 - Place Multilock	Circuit Board Under Tail Lamp Assembly	10
[105]	Fairing Cap Switches	12 - Place Multilock	Inner Fairing - Beneath Radio (Right Side)	1
[106]	Low Fuel Module ***	6 - Place Multilock	Inner Fairing - Left Fairing Support Brace	1
[107]	Ambient Air Temperature Sensor *	3 - Place Multilock	Inner Fairing - Left Fairing Bracket	1
[108]	Tachometer	6 - Place Packard	Inner Fairing (Back of Tachometer)	1
[110]	Voltmeter Lamp	Spade Connector	Inner Fairing	-
[111]	Voltmeter	Spade Connector	Inner Fairing	-
[112]	Oil Pressure Gauge Lamp	Spade Connector	Inner Fairing	-
[113]	Oil Pressure Gauge	Spade Connector	Inner Fairing	-
[114]	Air Temperature Gauge Lamp	Spade Connector	Inner Fairing	-
[115]	Air Temperature Gauge	Spade Connector	Inner Fairing	-
[116]	Fuel Gauge Lamp	Spade Connector	Inner Fairing	-
[117]	Fuel Gauge	Spade Connector	Inner Fairing	-
[119]	EFI Fuses ***	Fuse Terminals	Fuse Block (Under Right Side Cover)	5
[120]	Oil Pressure Sending Unit	4 - Place Packard	Front Right Crankcase	-
[121]	Rear Brake Light Switch	Spade Terminals	Beneath Transmission (Right Side)	-
[122]	Horn	Spade Terminals	Between Cylinders (Left Side)	-
[123]	Starter Relay	Relay Connector	Rear of Battery Box (Under Seat) - Left Side	7
[124]	Brake Light Relay	Relay Connector	Rear Fuse Block (Under Left Side Cover)	4
[126]	Ignition Keyswitch Relay	Relay Connector	Rear of Battery Box (Under Seat) - Left Side	7
[128]	Starter Solenoid	Spade Terminals	Top of Starter	-
[129]	Harness Grounds	Ring Terminals	Upper Frame Cross Member (Under Seat)	6
[131]	Neutral Switch	Post Terminals	Transmission Top Cover	-
[132]	Cigarette Lighter *	Spade Terminals	Inner Fairing	-
[135]	EFI System Relay ***	Relay Connector	Fuse Block (Under Right Side Cover)	5
[140]	Oil Pressure Sending Unit	2 - Place Mini-Deutsch	Under Right Side Cover (Behind Electrical Bracket)	5
[141]	Fuel Tank Harness ***	3 - Place Mini-Deutsch	Top of Canopy (Under Console)	-
[142]	Siren (Optional)	3 - Place Packard	Under Right Side Cover (Behind Electrical Bracket)	5
[156]	Main to Interconnect Harness (Cruise)	4 - Place Deutsch	Inner Fairing - Right Fairing Bracket	1

* Classic and Ultra ** Ultra Only *** Fuel Injected Models **** Carbureted Models

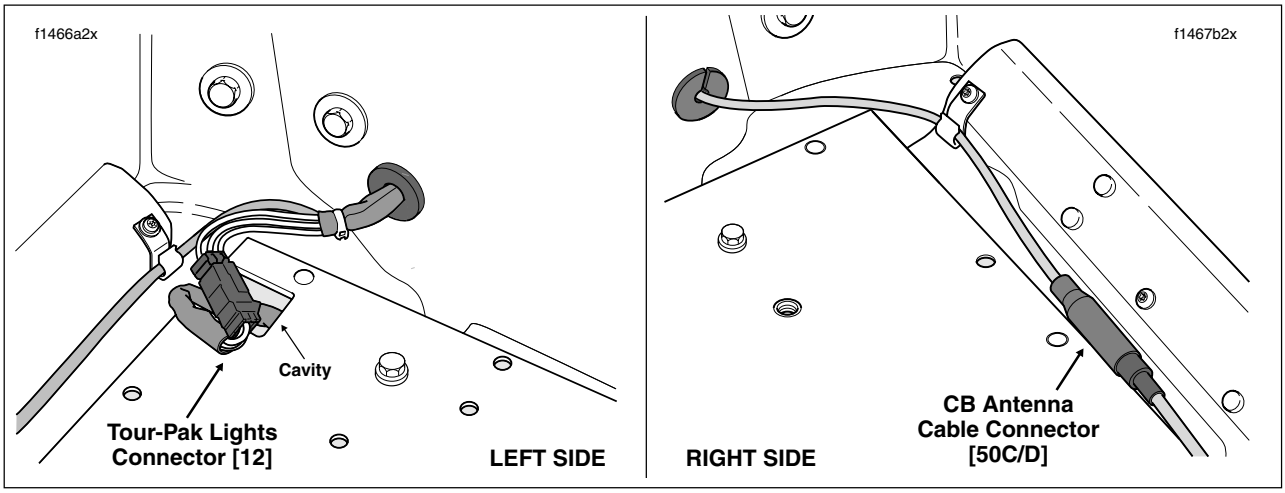


Figure 8-2. Tour-Pak Connectors

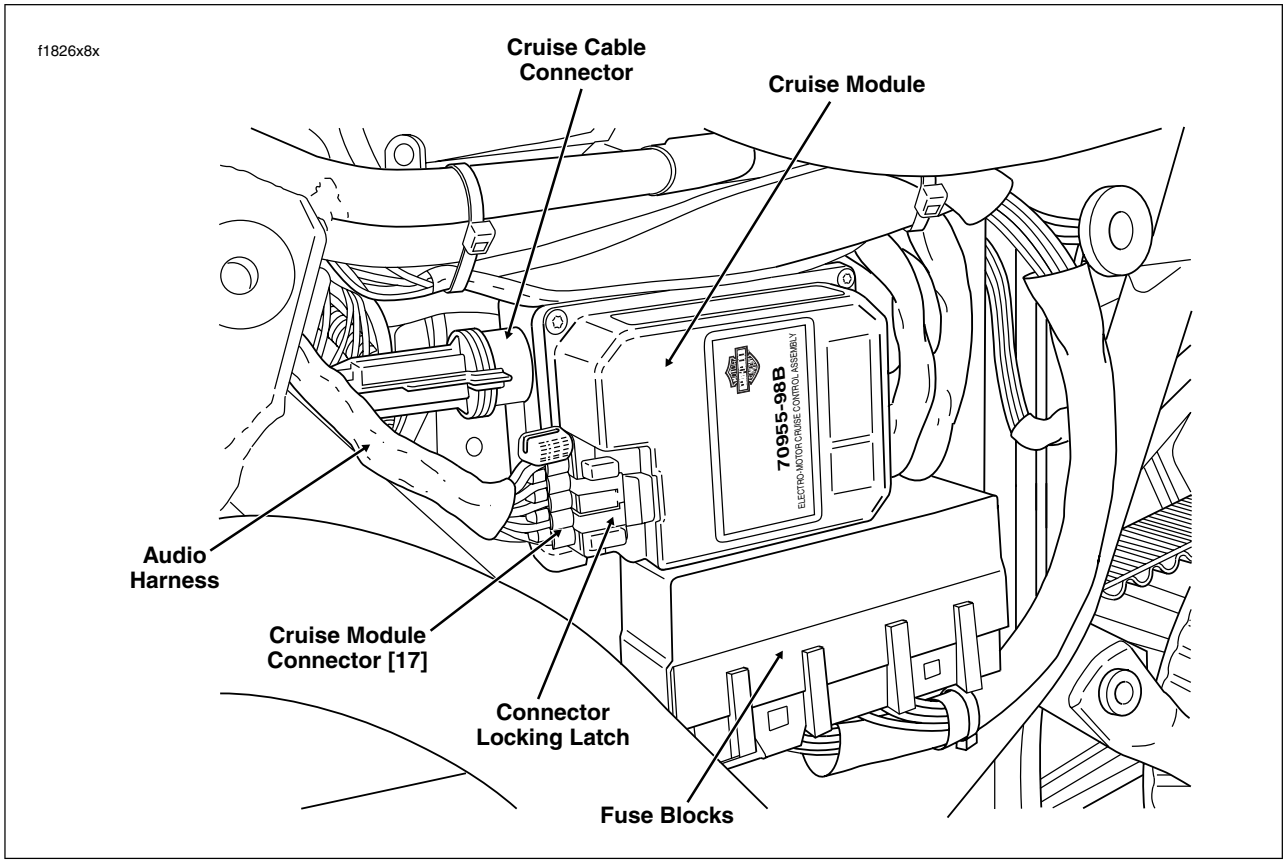


Figure 8-3. Cruise Control Module (Under Left Side Cover)

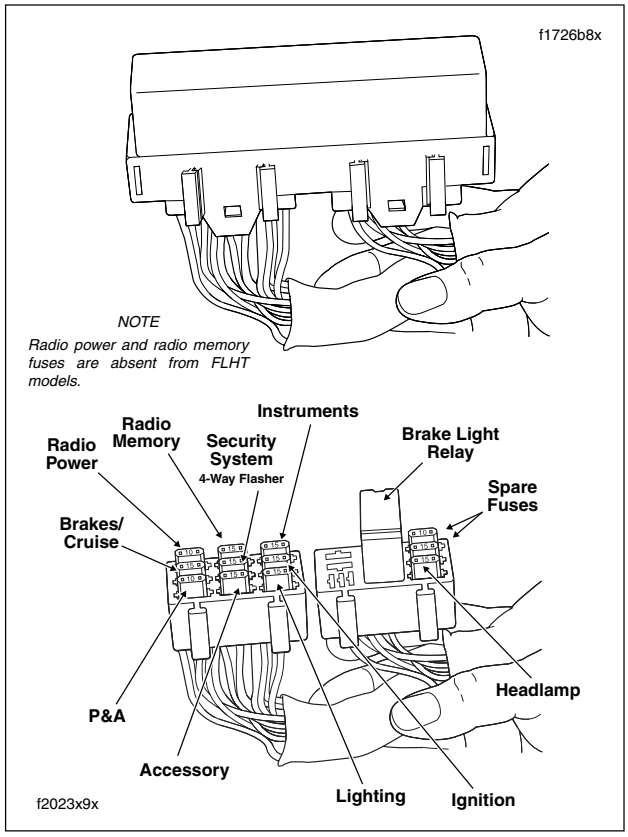


Figure 8-4. Fuse Blocks - FLTR, FLHT/C/U (Under Left Side Cover)

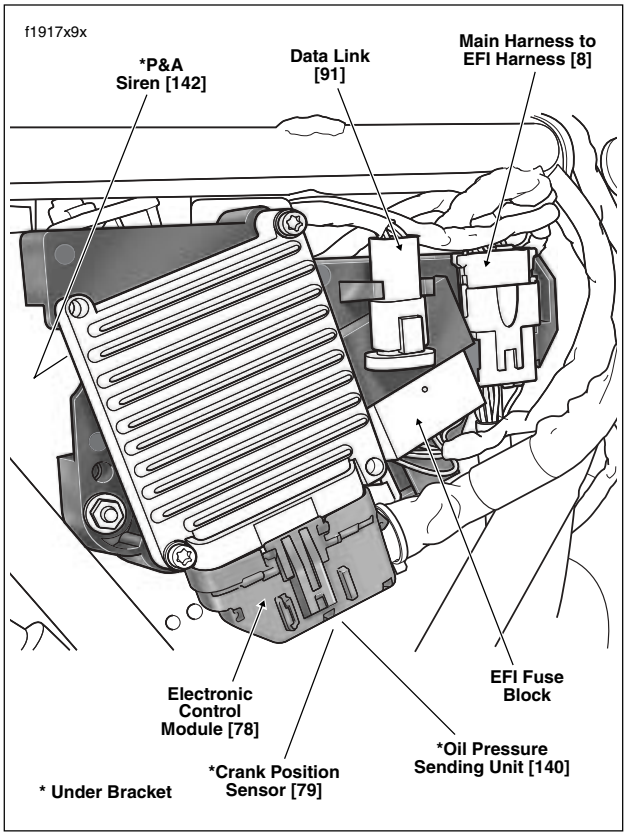


Figure 8-5. Electrical Bracket - Fuel Injected Models (Under Right Side Cover)

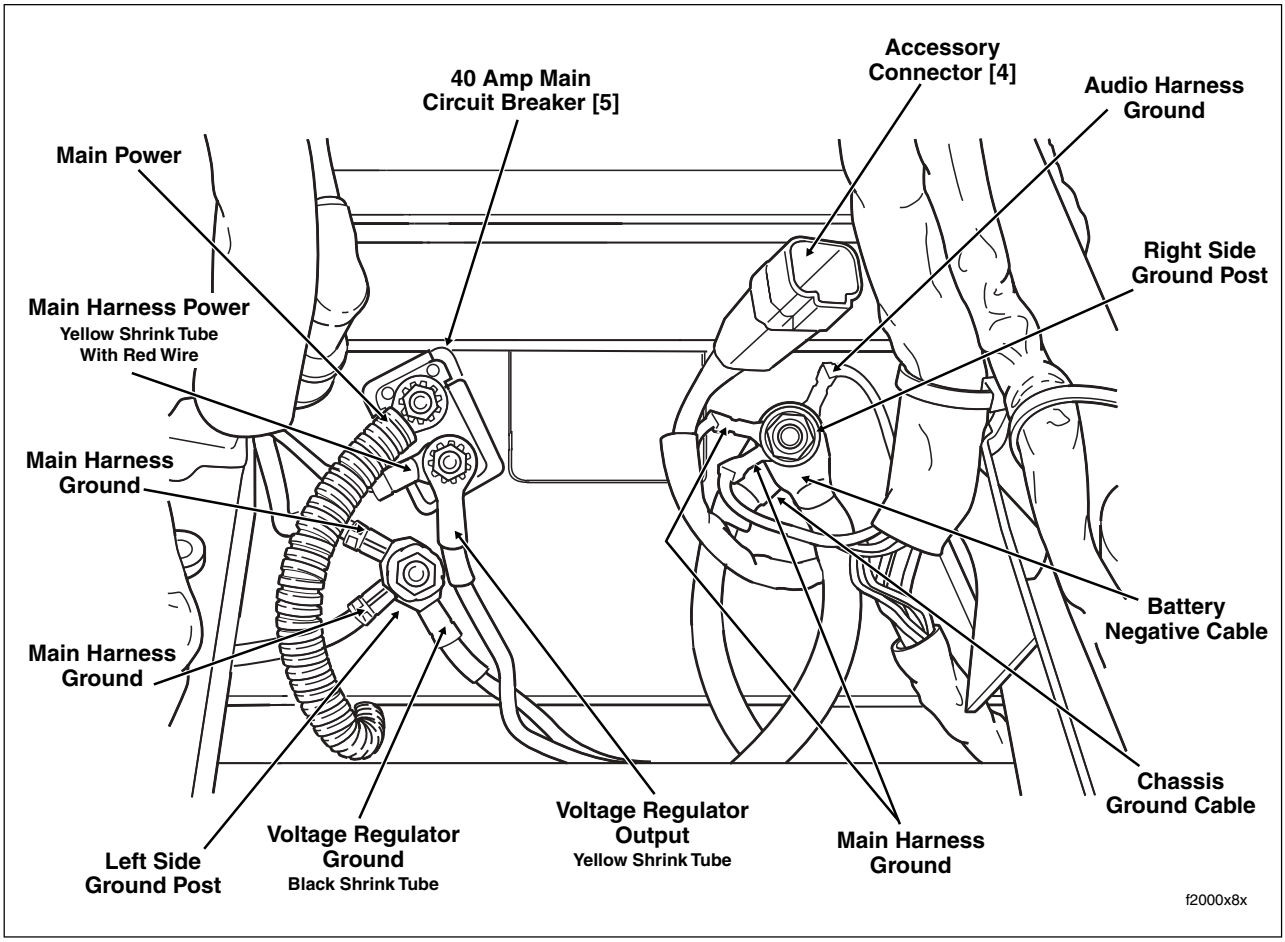


Figure 8-6. Electrical Connections - Upper Frame Cross Member (Under Seat)

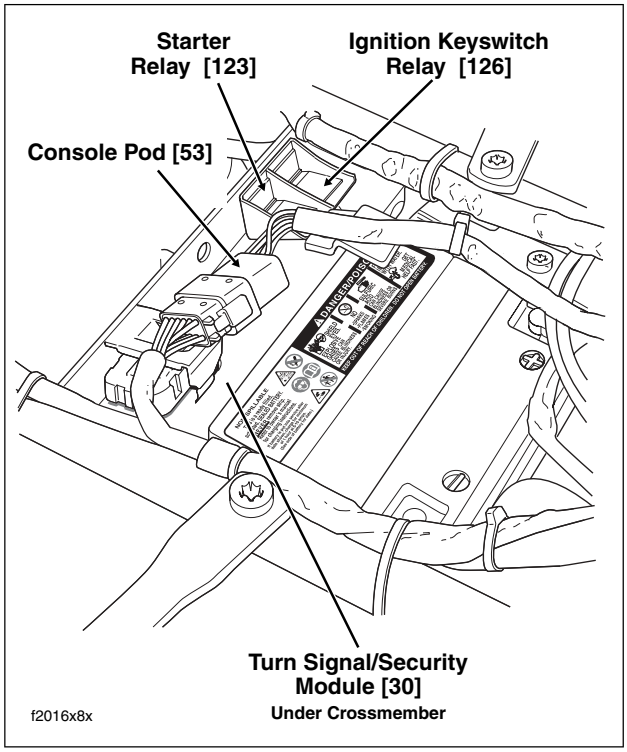


Figure 8-7. Electrical Connectors/Relays (Under Seat)

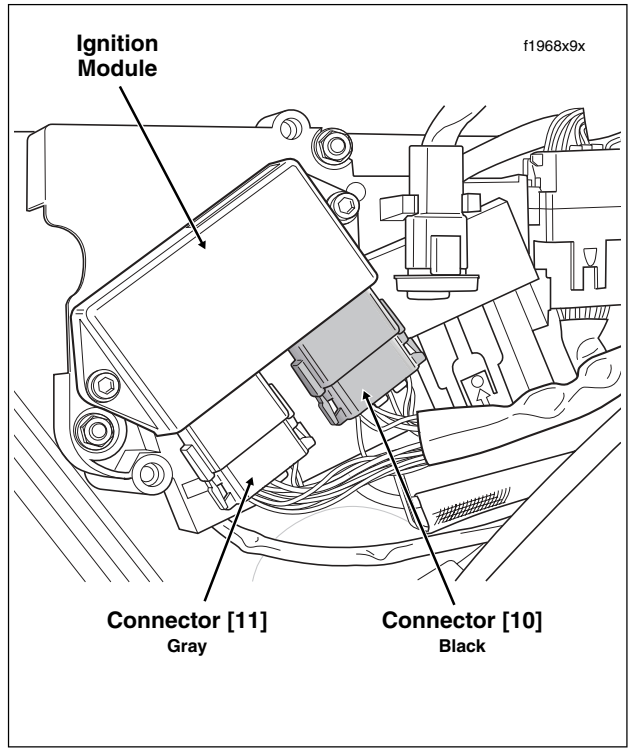


Figure 8-8. Ignition Module - Carbureted Models (Under Right Side Cover)

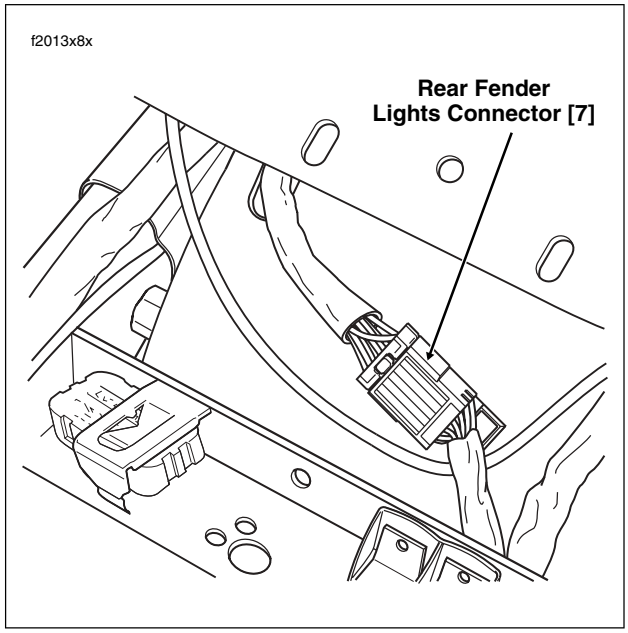


Figure 8-9. Rear Fender (Under Seat)

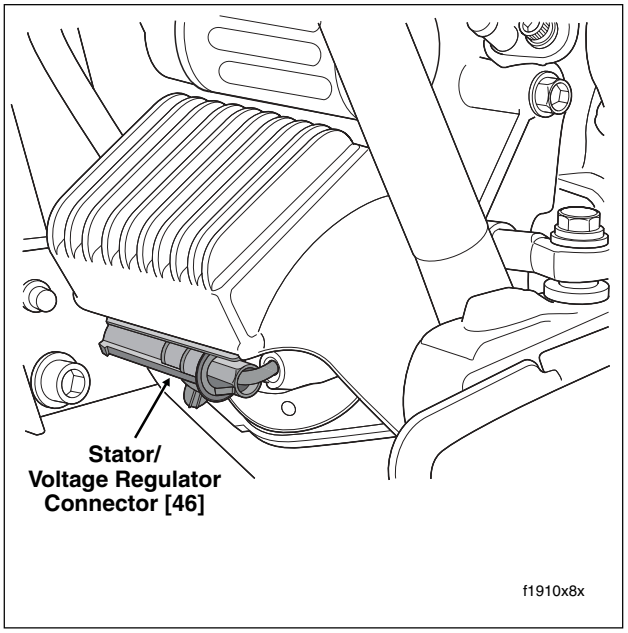


Figure 8-11. Stator/Voltage Regulator Connector

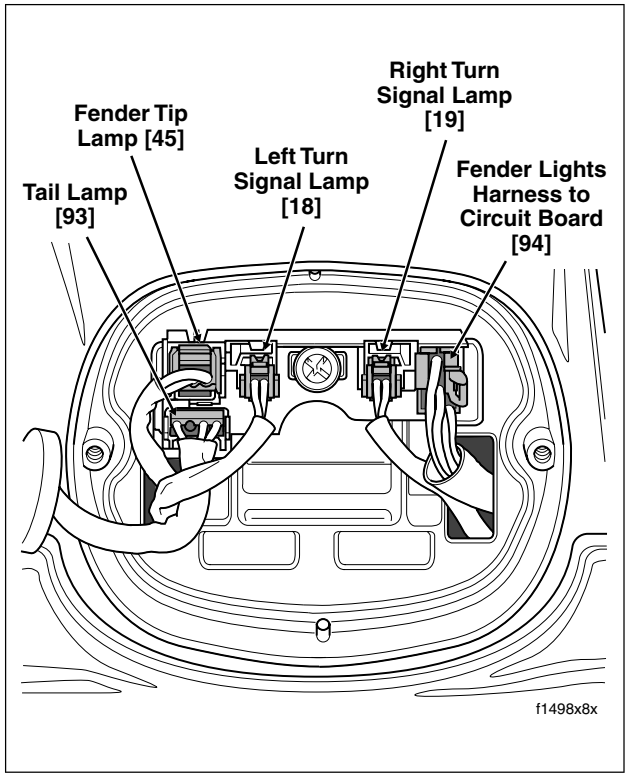


Figure 8-10. Rear Fender Lights Assembly

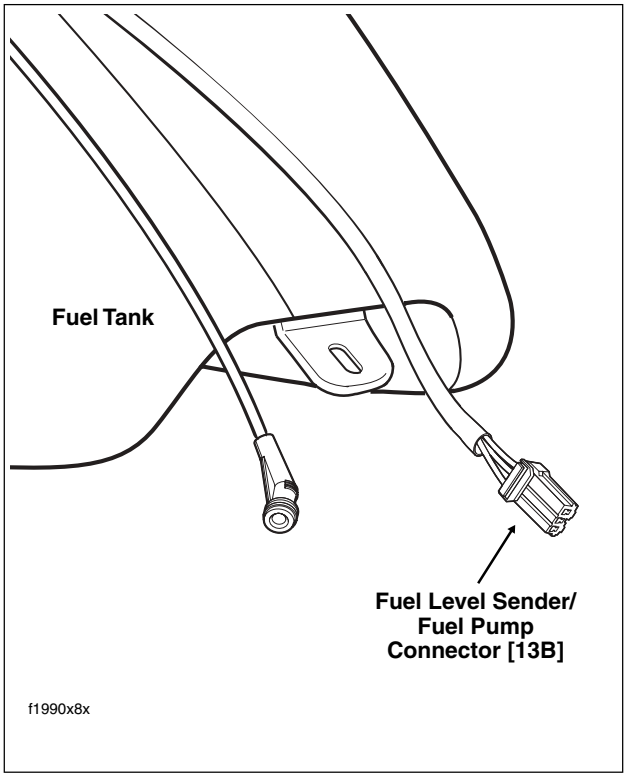


Figure 8-12. Rear of Fuel Tank (Under Seat)
FLHT/C/U, FLTR

FLHR/C WIRE HARNESS CONNECTORS

No.	Description	Type	Location	Fig.
[4]	Accessory	4 - Place Deutsch	Upper Frame Cross Member (Under Seat)	6
[5]	Main Circuit Breaker	Ring Terminals	Upper Frame Cross Member (Under Seat)	6
[7]	Rear Fender Lights Harness	8 - Place Multilock	Top of Rear Fender (Under Seat)	9
[8]	Ignition Harness (Main to EFI Harness on EFI models)	12 - Place Deutsch (Gray)	Under Right Side Cover	5
[10]	Ignition Module ****	12 - Place Deutsch (Black)	Under Right Side Cover	8
[11]	Ignition Module ****	12 - Place Deutsch (Gray)	Under Right Side Cover	8
[13]	Fuel Level Sender (and Fuel Pump on EFI models)	3 - Place Multilock	Behind Fuel Tank (Under Seat)	12
[18]	Left Rear Turn Signal	2 - Place Multilock	Circuit Board Under Tail Lamp Assembly	10
[19]	Right Rear Turn Signal	2 - Place Multilock	Circuit Board Under Tail Lamp Assembly	10
[21]	Indicator Lamps	8 - Place Mini-Deutsch	Under Console	14
[22]	Right Handlebar Controls	6 - Place Deutsch	Inside Headlamp Nacelle	13
[24]	Left Handlebar Controls	6 - Place Deutsch	Inside Headlamp Nacelle	13
[30]	Turn Signal/Security Module	12 - Place Deutsch	Cavity at Rear of Battery Box (Under Seat)	7
[31]	Front Turn Signals	6 - Place Multilock	Inside Headlamp Nacelle	13
[32]	Front Fender Tip Lamp (DOM)	2 - Place Multilock (Black)	Inside Headlamp Nacelle	13
[33]	Ignition/Light Key Switch	3 - Place Packard	Under Console	14
[38]	Headlamp	Headlamp Connector	Inside Headlamp Nacelle	-
[39]	Speedometer	12 - Place Mini-Deutsch	Back of Speedometer (Under Console)	14
[45]	Rear Fender Tip Lamp (DOM)	3 - Place Multilock	Circuit Board Under Tail Lamp Assembly	10
[46]	Stator/Voltage Regulator	2 - Place Packard	Bottom of Voltage Regulator	11
[62]	Rear Fuse Block	Fuse Terminals	Under Left Side Cover	3,4
[64]	Front Fuse Block	Fuse Terminals	Under Left Side Cover	3,4
[65]	Speedometer Sensor	3 - Place Deutsch	Upper Frame Cross Member (Under Seat)	-
[66]	Passing Lamp Switch	4 - Place Amp	Inside Headlamp Nacelle	13
[67]	Accessory Switch	4 - Place Amp	Inside Headlamp Nacelle	13

Continued ...

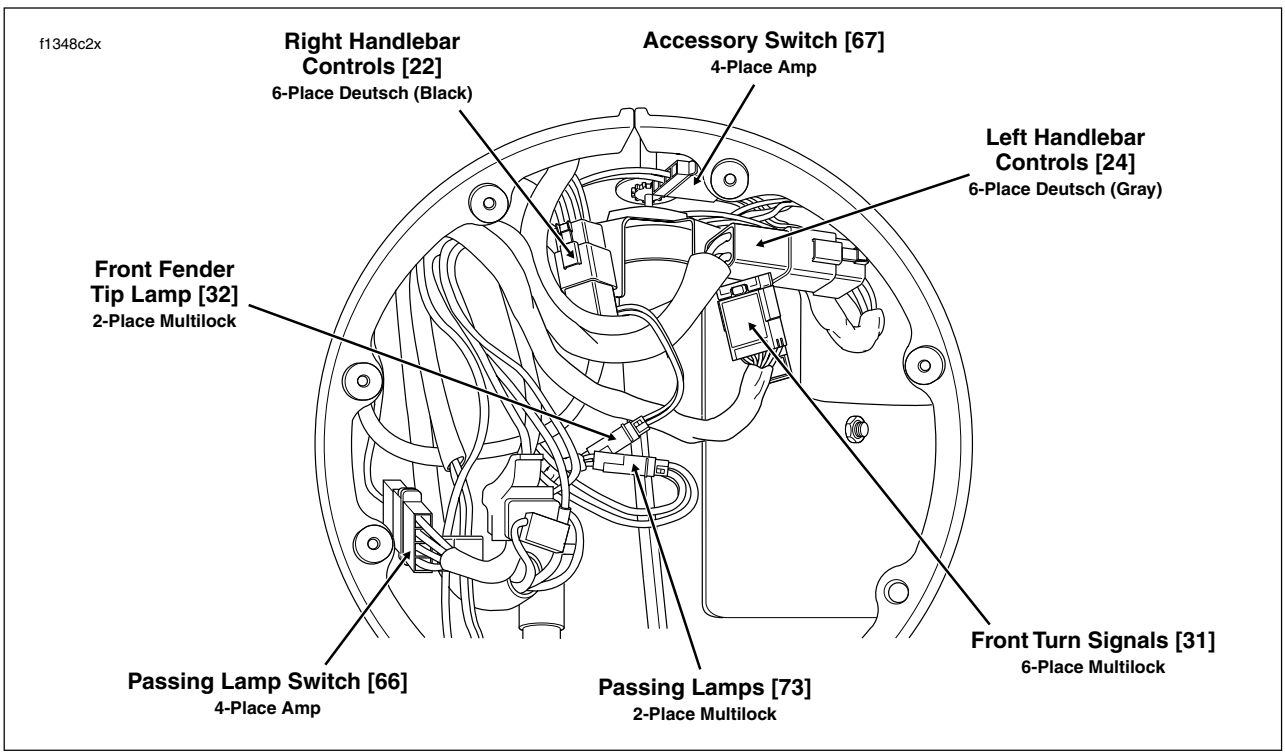


Figure 8-13. Headlamp Nacelle Connectors (FLHR)

FLHR/C WIRE HARNESS CONNECTORS (Continued)

No.	Description	Type	Location	Fig.
[73]	Passing Lamps	2 - Place Multilock (White)	Inside Headlamp Nacelle	13
[75]	Cruise Roll-Off Switch **	Spade Contacts	Right Side of Steering Head	-
[78]	Electronic Control Module (ECM) ***	36 - Place Packard	Under Right Side Cover	5
[79]	Crankshaft Position (CKP) Sensor	2 - Place Mini-Deutsch	Under Right Side Cover (Behind Electrical Bracket)	5
[80]	Manifold Absolute Pressure (MAP) Sensor	3 - Place Packard	Top of Intake Manifold/Induction Module	-
[83]	Ignition Coil	4 - Place Packard	Below Fuel Tank (Left Side)	-
[84]	Front Injector ***	2 - Place Packard	Below Fuel Tank (Left Side)	-
[85]	Rear Injector ***	2 - Place Packard	Below Fuel Tank (Left Side)	-
[87]	Idle Air Control (IAC) ***	4 - Place Packard	Below Fuel Tank (Right Side)	-
[88]	Throttle Position Sensor (TP Sensor) ***	3 - Place Packard	Below Fuel Tank (Right Side)	-
[89]	Intake Air Temperature Sensor (IAT Sensor) ***	2 - Place Packard	Below Fuel Tank (Right Side)	-
[90]	Engine Temperature Sensor (ET Sensor) ***	2 - Place Packard	Back of Front Cylinder (Left Side)	-
[91]	Data Link	4 - Place Deutsch	Under Right Side Cover	5
[93]	Tail Lamp	4 - Place Multilock	Circuit Board Under Tail Lamp Assembly	10
[94]	Rear Fender Lights Harness to Circuit Board	6 - Place Multilock	Circuit Board Under Tail Lamp Assembly	10
[98]	Oil Pressure Sending Unit	Post Terminal	Front Right Crankcase	-
[108]	Optional Tachometer	1 - Place Amp	Inside Headlamp Nacelle	-
[117]	Fuel Gauge	4 - Place Multilock	Below Fuel Tank (Left Side)	-
[119]	EFI Fuses ***	Fuse Terminals	Fuse Block (Under Right Side Cover)	5
[121]	Rear Brake Light Switch	Spade Terminals	Beneath Transmission	-
[122]	Horn	Spade Terminals	Between Cylinders (Left Side)	-
[123]	Starter Relay	Relay Connector	Rear Fuse Block (Under Left Side Cover)	-
[124]	Brake Light Relay	Relay Connector	Rear Fuse Block (Under Left Side Cover)	4
[126]	Ignition Keyswitch Relay	Relay Connector	Rear of Battery Box (Under Seat) - Left Side	7
[128]	Starter Solenoid	Spade Terminals	Top of Starter	-
[129]	Harness Grounds	Ring Terminals	Upper Frame Cross Member (Under Seat)	6
[131]	Neutral Switch	Post Terminals	Top of Transmission	-
[135]	EFI System Relay ***	Relay Connector	Fuse Block (Under Right Side Cover)	5
[140]	Oil Pressure Sending Unit	2 - Place Mini-Deutsch	Under Right Side Cover (Behind Electrical Bracket)	5
[141]	Fuel Tank Harness ***	3 - Place Mini-Deutsch	Top of Canopy (Under Console)	-
[142]	Siren (Optional)	3 - Place Packard	Under Right Side Cover (Behind Electrical Bracket)	5
[158]	Left Handlebar Controls (Cruise Switches) **	4 - Place Deutsch (Gray)	Inside Headlamp Nacelle	-
[159]	Right Handlebar Controls (Cruise Switches) **	4 - Place Deutsch (Black)	Inside Headlamp Nacelle	-

** FLHRCI Only *** Fuel Injected Models **** Carbureted Models

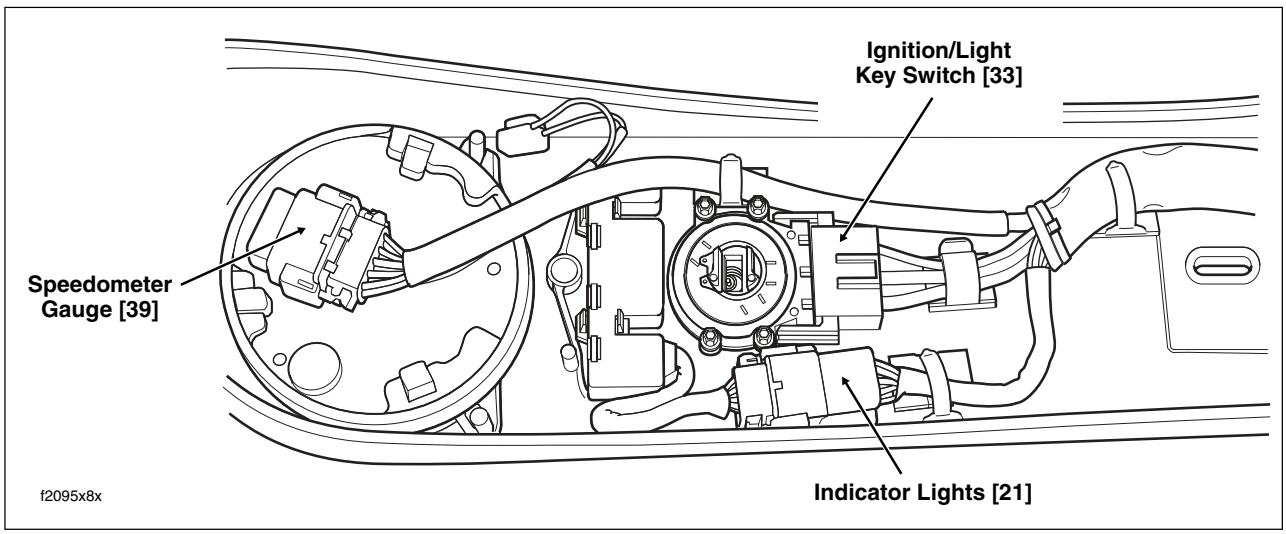


Figure 8-14. Instrument Console Connectors (FLHR/C)

FLTR WIRE HARNESS CONNECTORS

No.	Description	Type	Location	Fig.
[1]	Main to Interconnect Harness	12 - Place Deutsch (Black)	Inner Fairing - Below Radio (Right Side)	16
[2]	Main to Interconnect Harness	12 - Place Deutsch (Gray)	Inner Fairing - Front of Radio Bracket (Right Side)	16
[4]	Accessory	4 - Place Deutsch	Upper Frame Cross Member (Under Seat)	6
[5]	Main Circuit Breaker	Ring Terminals	Upper Frame Cross Member (Under Seat)	6
[7]	Rear Fender Lights Harness	8 - Place Multilock	Top of Rear Fender (Under Seat)	9
[8]	Ignition Harness (Main to EFI Harness on EFI models)	12 - Place Deutsch (Gray)	Under Right Side Cover	5
[10]	Ignition Module ****	12 - Place Deutsch (Black)	Under Right Side Cover	8
[11]	Ignition Module ****	12 - Place Deutsch (Gray)	Under Right Side Cover	8
[13]	Fuel Level Sender (and Fuel Pump on EFI models)	3 - Place Multilock	Behind Fuel Tank (Under Seat)	12
[15]	Main Power	4 - Place Packard	Inner Fairing - Below Radio	16
[17]	Cruise Control Module	10 - Place Packard	Under Left Side Cover	3
[18]	Left Rear Turn Signal	2 - Place Multilock	Circuit Board Under Tail Lamp Assembly	10
[19]	Right Rear Turn Signal	2 - Place Multilock	Circuit Board Under Tail Lamp Assembly	10
[21]	Indicator Lamps			
	[21B, 21C] Indicator Lamps to Jumper Harness	10 - Place Multilock	Inside Instrument Nacelle (Under Bezel)	15
	[21D, 21A] Jumper Harness to Interconnect	10 - Place Multilock	Inner Fairing - Below Radio	16
[22]	Interconnect to Right Handlebar Switch Controls	12 - Place Deutsch (Black)	Inner Fairing - Right Side of Radio Bracket	16
[24]	Interconnect to Left Handlebar Switch Controls	12 - Place Deutsch (Gray)	Inner Fairing - Left Side of Radio Bracket	16
[27]	Radio	23 - Place Amp (Black)	Inner Fairing - Back of Radio (Right Side)	16
[30]	Turn Signal/Security Module	12 - Place Deutsch (Gray)	Cavity at Rear of Battery Box (Under Seat)	7
[31]	Front Turn Signals	6 - Place Multilock	Inner Fairing - Below Radio	16
[33]	Ignition/Light Key Switch	4 - Place Packard	Inner Fairing - Inside Fairing Bracket Tunnel (Right Side)	16
[38]	Headlamp	Headlamp Connector	Inner Fairing	-
[39]	Speedometer	12 - Place Packard	Inside Instrument Nacelle (Back of Speedometer)	15
[45]	Rear Fender Tip Lamp (DOM)	3 - Place Multilock	Circuit Board Under Tail Lamp Assembly	10

Continued ...

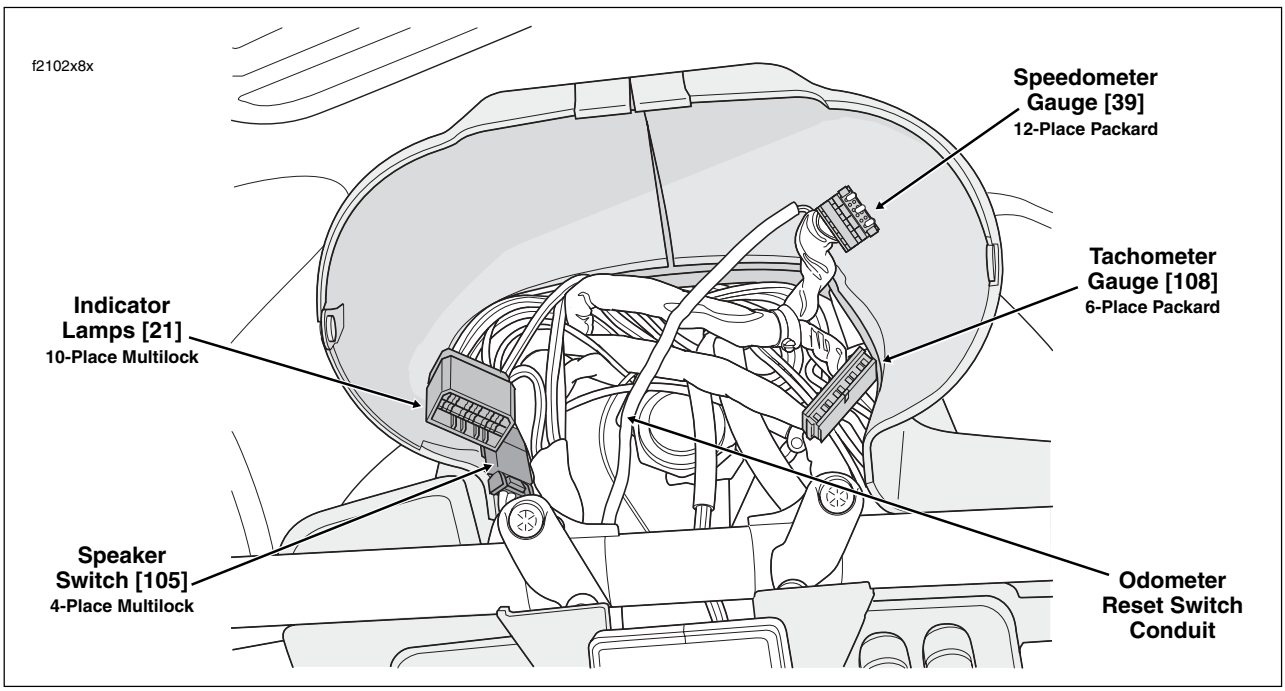


Figure 8-15. Instrument Nacelle Connectors (FLTR)

FLTR WIRE HARNESS CONNECTORS (Continued)

No.	Description	Type	Location	Fig.
[46]	Stator/Voltage Regulator	2 - Place Packard	Bottom of Voltage Regulator	11
[51]	Radio Antenna Cable	-	Inner Fairing - Back of Radio (Left Side)	16
[62]	Rear Fuse Block	Fuse Terminals	Under Left Side Cover	3,4
[64]	Front Fuse Block	Fuse Terminals	Under Left Side Cover	3,4
[65]	Speedometer Sensor	3 - Place Deutsch	Upper Frame Cross Member (Under Seat)	-
[75]	Cruise Roll-Off Switch	Spade Contacts	Right Side of Steering Head	-
[78]	Electronic Control Module (ECM) ***	36 - Place Packard	Under Right Side Cover	5
[79]	Crankshaft Position (CKP) Sensor	2 - Place Mini-Deutsch	Under Right Side Cover (Behind Electrical Bracket)	5
[80]	Manifold Absolute Pressure (MAP) Sensor	3 - Place Packard	Top of Intake Manifold/Induction Module	-
[83]	Ignition Coil	4 - Place Packard	Below Fuel Tank (Left Side)	-
[84]	Front Injector ***	2 - Place Packard	Below Fuel Tank (Left Side)	-

Continued ...

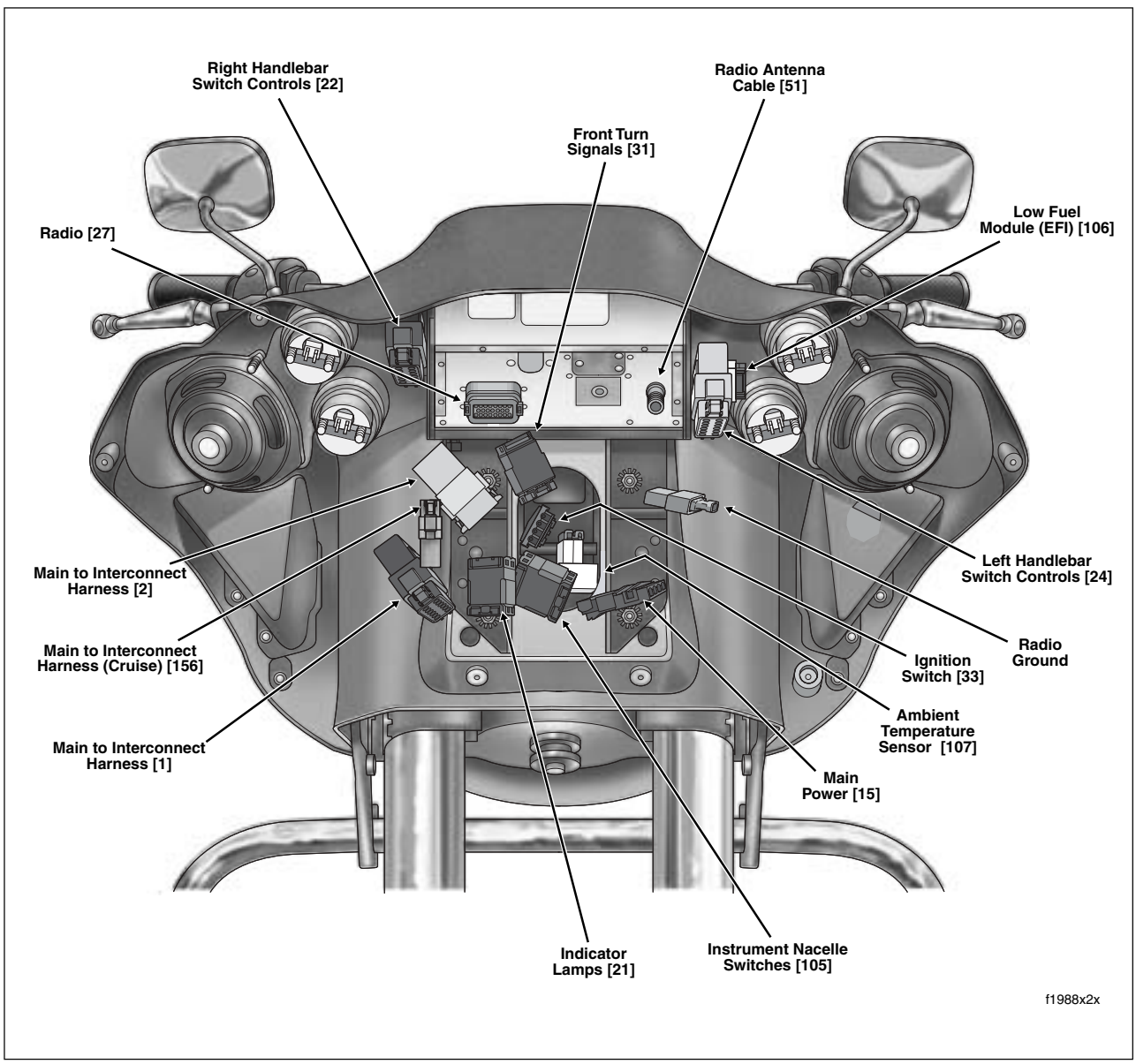


Figure 8-16. Inner Fairing Connectors (FLTR)

FLTR WIRE HARNESS CONNECTORS (Continued)

No.	Description	Type	Location	Fig.
[85]	Rear Injector ***	2 - Place Packard	Below Fuel Tank (Left Side)	-
[87]	Idle Air Control (IAC) ***	4 - Place Packard	Below Fuel Tank (Right Side)	-
[88]	Throttle Position Sensor (TP Sensor) ***	3 - Place Packard	Below Fuel Tank (Right Side)	-
[89]	Intake Air Temperature Sensor (IAT Sensor) ***	2 - Place Packard	Below Fuel Tank (Right Side)	-
[90]	Engine Temperature Sensor (ET Sensor) ***	2 - Place Packard	Back of Front Cylinder (Left Side)	-
[91]	Data Link	4 - Place Deutsch	Under Right Side Cover	5
[93]	Tail Lamp	4 - Place Multilock	Circuit Board Under Tail Lamp Assembly	10
[94]	Rear Fender Lights Harness to Circuit Board	6 - Place Multilock	Circuit Board Under Tail Lamp Assembly	10
[105]	Instrument Nacelle Switches			
	[105D, 105C] Speaker Switch to Jumper Harness	4 - Place Multilock	Inside Instrument Nacelle (Under Bezel)	15
	[105B, 105A] Jumper Harness to Interconnect	12 - Place Multilock	Inner Fairing - Below Radio	16
[106]	Low Fuel Module ***	6 - Place Multilock	Inner Fairing - Left Side of Radio Bracket	16
[107]	Ambient Air Temperature Sensor	3 - Place Multilock	Inner Fairing - Inside Fairing Bracket Tunnel (Left Side)	16
[108]	Tachometer	6 - Place Packard	Inside Instrument Nacelle (Back of Tachometer)	15
[110]	Voltmeter Lamp	Spade Connector	Inner Fairing	-
[111]	Voltmeter	Spade Connector	Inner Fairing	-
[112]	Oil Pressure Gauge Lamp	Spade Connector	Inner Fairing	-
[113]	Oil Pressure Gauge	Spade Connector	Inner Fairing	-
[114]	Air Temperature Gauge Lamp	Spade Connector	Inner Fairing	-
[115]	Air Temperature Gauge	Spade Connector	Inner Fairing	-
[116]	Fuel Gauge Lamp	Spade Connector	Inner Fairing	-
[117]	Fuel Gauge	Spade Connector	Inner Fairing	-
[119]	EFI Fuses ***	Fuse Terminals	Fuse Block (Under Right Side Cover)	5
[120]	Oil Pressure Sending Unit	4 - Place Packard	Front Right Crankcase	-
[121]	Rear Brake Light Switch	Spade Terminals	Beneath Transmission (Right Side)	-
[122]	Horn	Spade Terminals	Between Cylinders (Left Side)	-
[123]	Starter Relay	Relay Connector	Rear of Battery Box (Under Seat) - Left Side	7
[124]	Brake Light Relay	Relay Connector	Rear Fuse Block (Under Left Side Cover)	4
[126]	Ignition Keyswitch Relay	Relay Connector	Rear of Battery Box (Under Seat) - Left Side	7
[128]	Starter Solenoid	Spade Terminals	Top of Starter	-
[129]	Harness Grounds	Ring Terminals	Upper Frame Cross Member (Under Seat)	6
[131]	Neutral Switch	Post Terminals	Transmission Top Cover	-
[132]	Cigarette Lighter	Spade Terminals	Inner Fairing	-
[135]	EFI System Relay ***	Relay Connector	Fuse Block (Under Right Side Cover)	5
[140]	Oil Pressure Sending Unit	2 - Place Mini-Deutsch	Under Right Side Cover (Behind Electrical Bracket)	5
[141]	Fuel Tank Harness ***	3 - Place Mini-Deutsch	Top of Canopy (Under Console)	-
[142]	Siren (Optional)	3 - Place Packard	Under Right Side Cover (Behind Electrical Bracket)	5

*** Fuel Injected Models **** Carbureted Models

NOTES

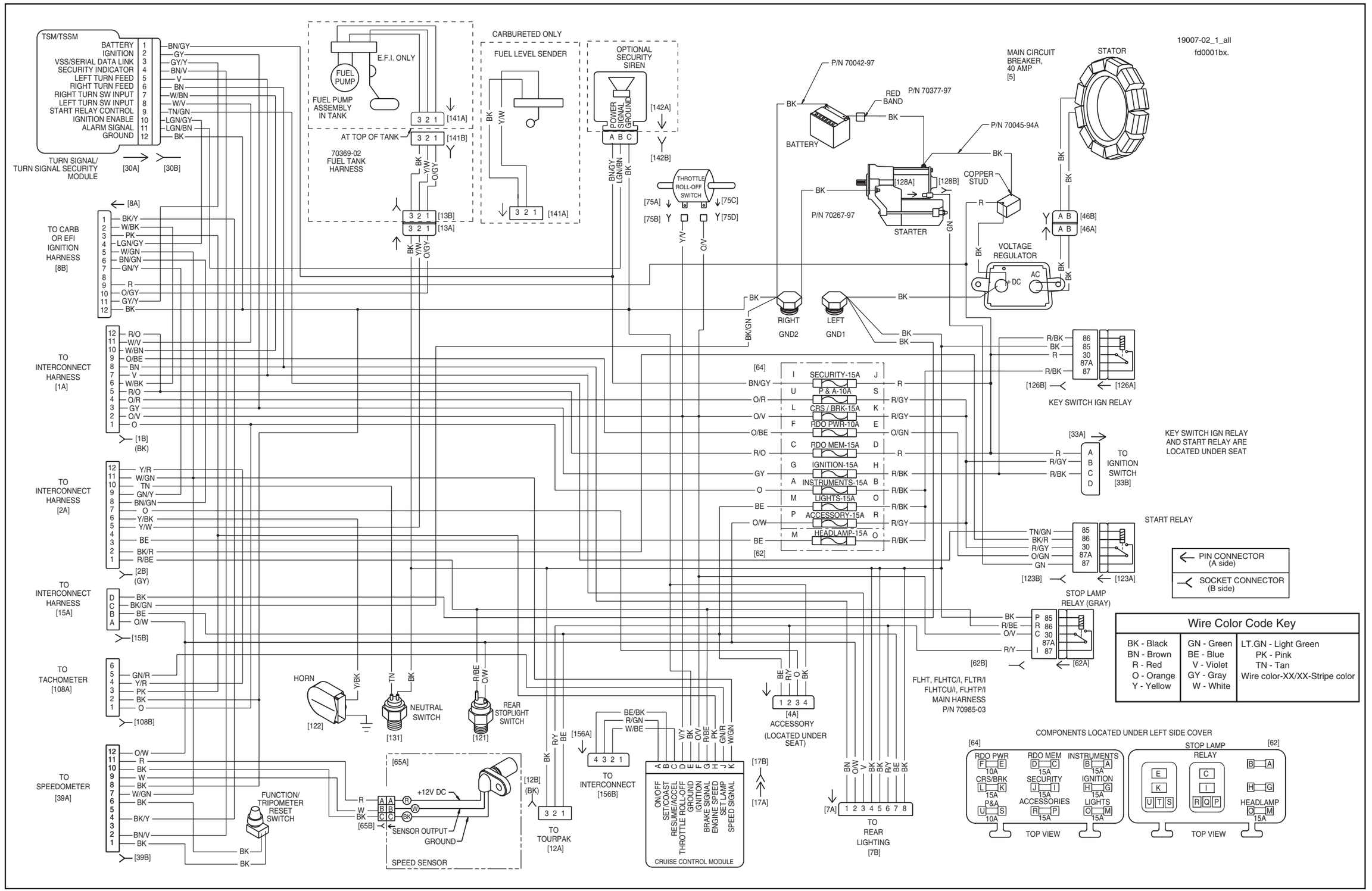
WIRING DIAGRAMS 8.2

SUBJECT	PAGE NO.
FLHT, FLHTC, FLHTCU	
Main Harness	8-15
Interconnect Harness	8-16
Ignition Harness	8-17
Engine Sensor Harness	8-17
Engine Management Circuitry	8-17
Ignition Switch	8-18
Tail Lamp, Passing Lamps, Directional Lamps and Tour-Pak Lights	8-18
Starting and Charging	8-19
Handlebar Controls, Speedometer, Tachometer and Indicator Lamps	8-20
Dash Panel Switches	8-20
Radio, CB/Intercom and Rear Speakers	8-21
FLTR	
Main Harness	8-15
Interconnect Harness	8-16
Ignition Harness	8-17
Engine Sensor Harness	8-17
Engine Management Circuitry	8-17
Ignition Switch	8-18
Tail Lamp and Directional Lamps	8-18
Starting and Charging	8-19
Handlebar Controls, Speedometer, Tachometer and Indicator Lamps	8-20
Dash Panel Switches	8-20
Radio	8-21
FLHR, FLHRC	
Main Harness	8-22
Ignition Harness	8-23
Engine Sensor Harness	8-23
Engine Management Circuitry	8-23
Starting and Charging	8-24
Handlebar Controls, Speedometer, Indicator Lamps, Tail Lamp, Passing Lamps and Directional Lamps	8-25
TLE Sidecar, TLE Ultra Sidecar	
Chassis	8-26
Audio Harness	8-26

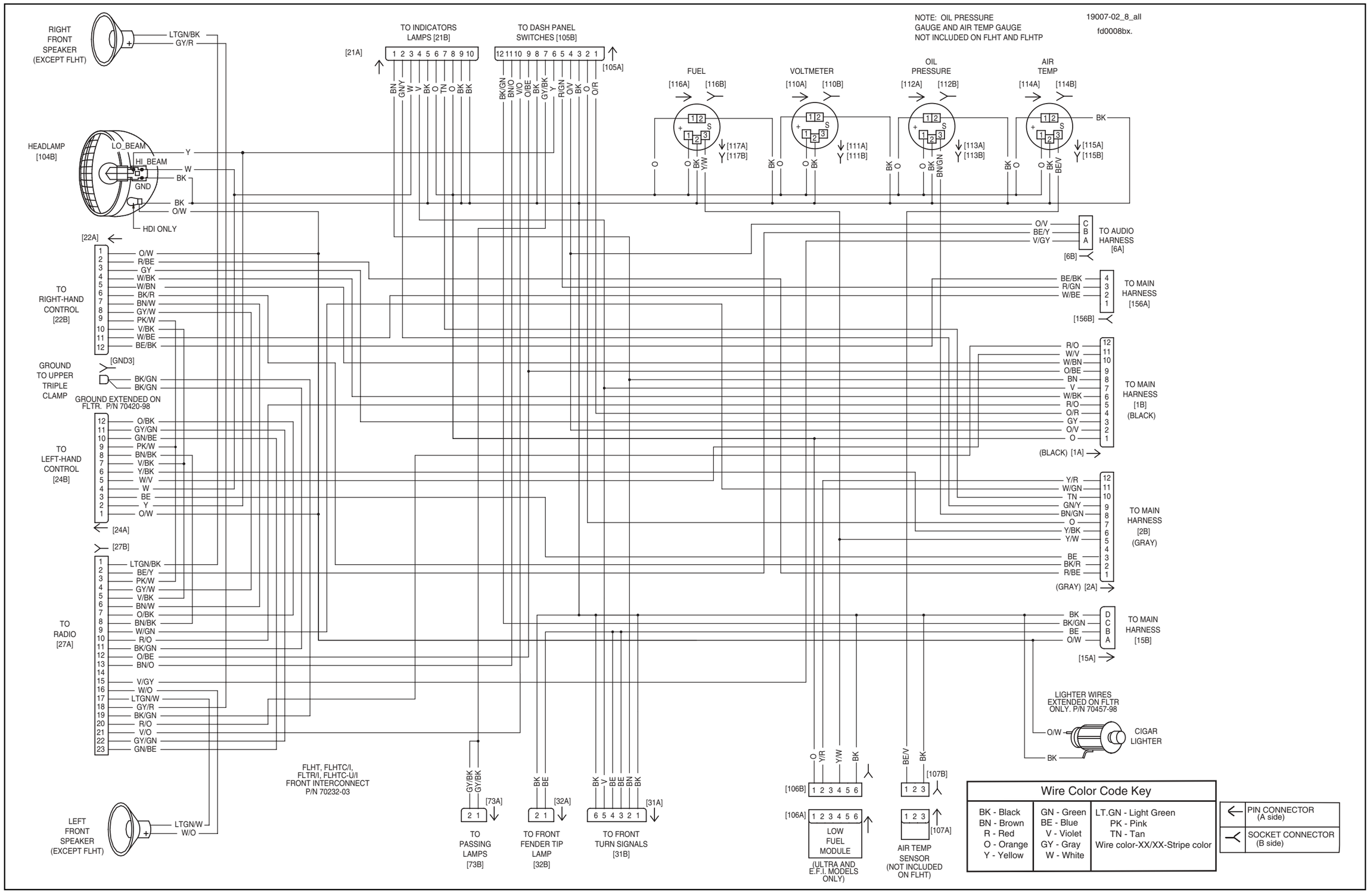
NOTE

Harness Part No.'s may be included on some wiring diagrams. Use these numbers for reference only. ALWAYS REFER TO THE PARTS CATALOG WHEN ORDERING WIRING HARNESSES.

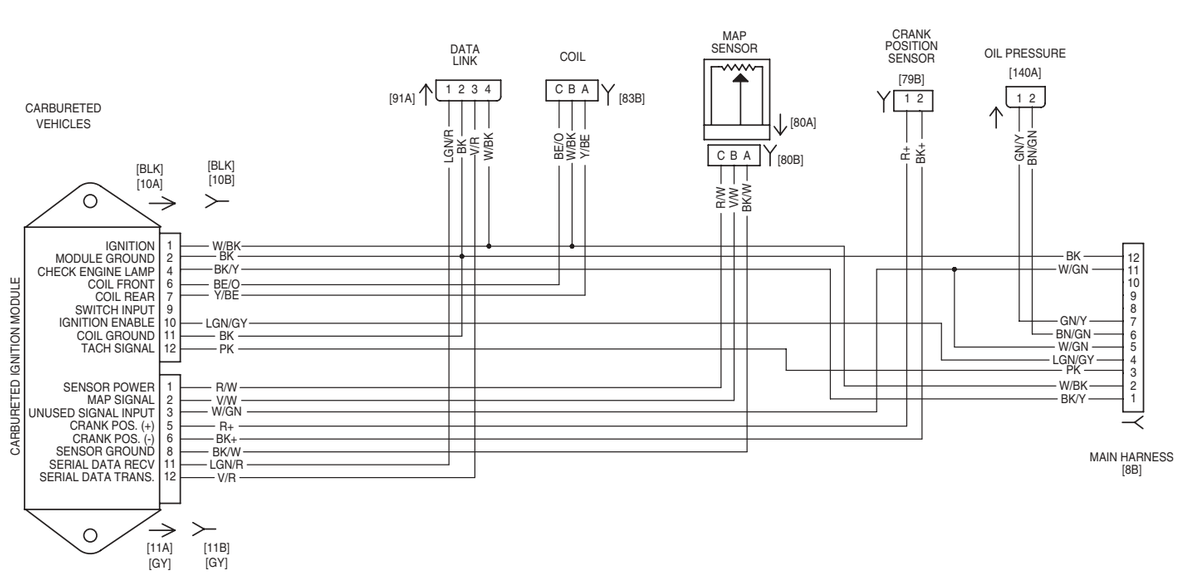
NOTES

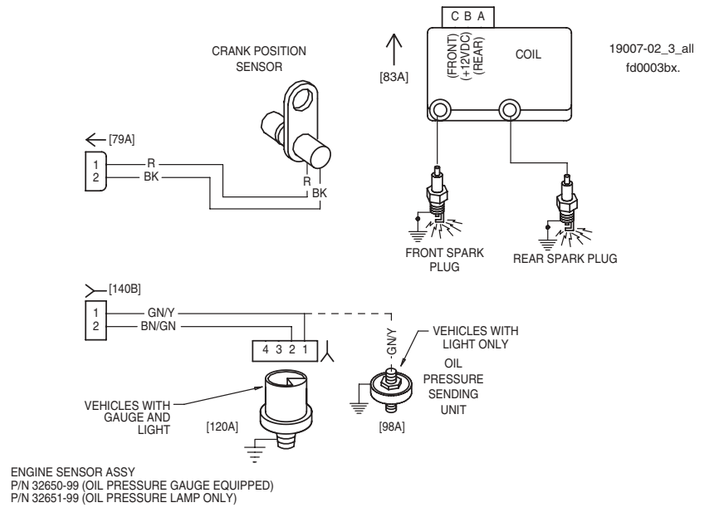


2003 FLHT, FLHTC, FLHTCU and FLTR, DOMESTIC and INTERNATIONAL Models, Main Harness

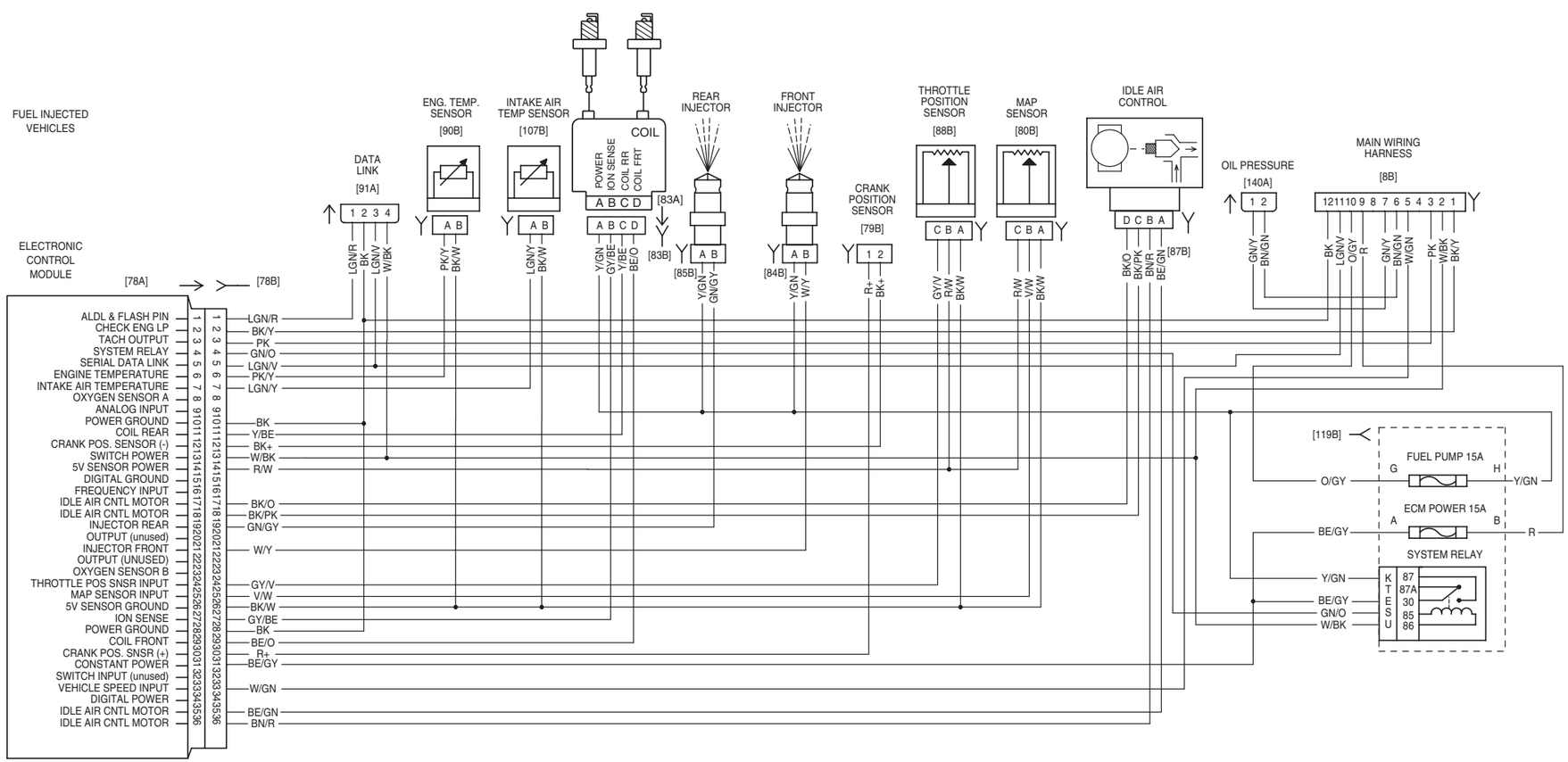


2003 FLHT, FLHTC, FLHTCU and FLTR, DOMESTIC and INTERNATIONAL Models, Interconnect Harness

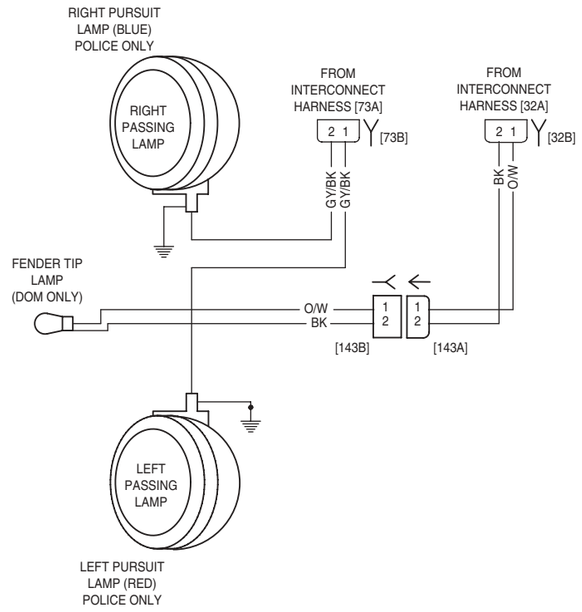


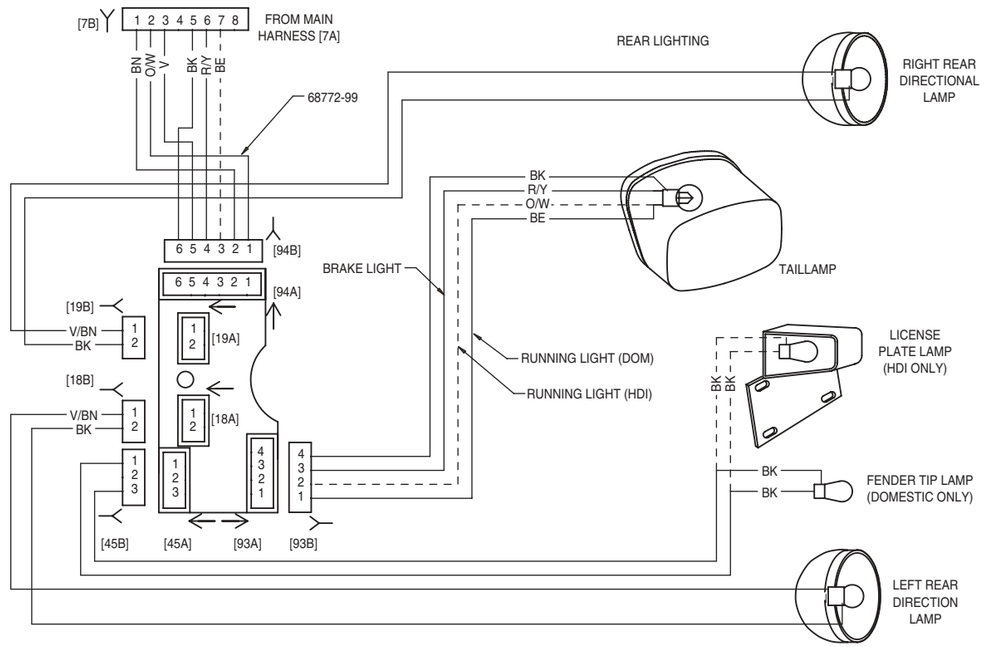


ENGINE SENSOR ASSY
P/N 32650-99 (OIL PRESSURE GAUGE EQUIPPED)
P/N 32651-99 (OIL PRESSURE LAMP ONLY)

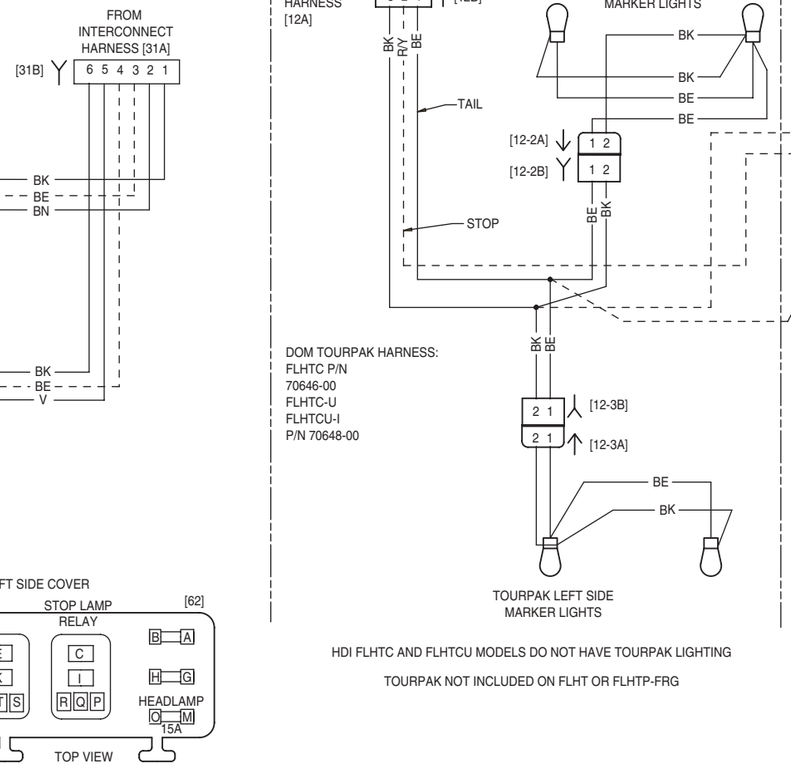


2003 FLHT, FLHTC, FLHTCU and FLTR, DOMESTIC and INTERNATIONAL Models, Ignition Harness, Engine Sensor Harness and Engine Management Circuitry



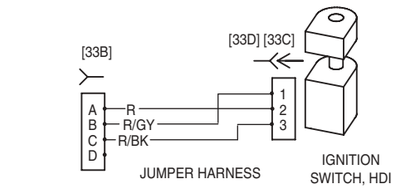


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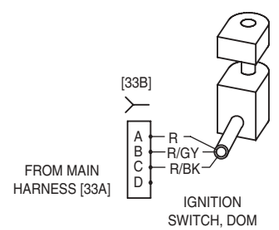


HDI FLHTC AND FLHTCU MODELS DO NOT HAVE TOURPAK LIGHTING

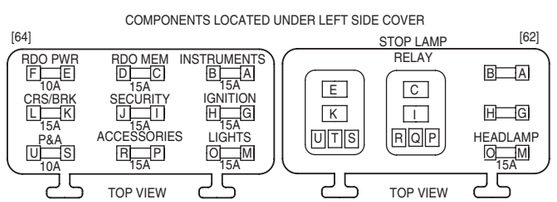
TOURPAK NOT INCLUDED ON FLHT OR FLHTP-FRG



IGNITION SWITCH LEGEND (HDI)			
SWITCH POSITION	"X" INDICATES CONTINUITY BETWEEN LEAD WIRES IN POSITION INDICATED		
	RED	RED/ GRAY	RED/ BLACK
LOCK	X		
OFF	X		
IGN	X	X	X
ACC	X	X	



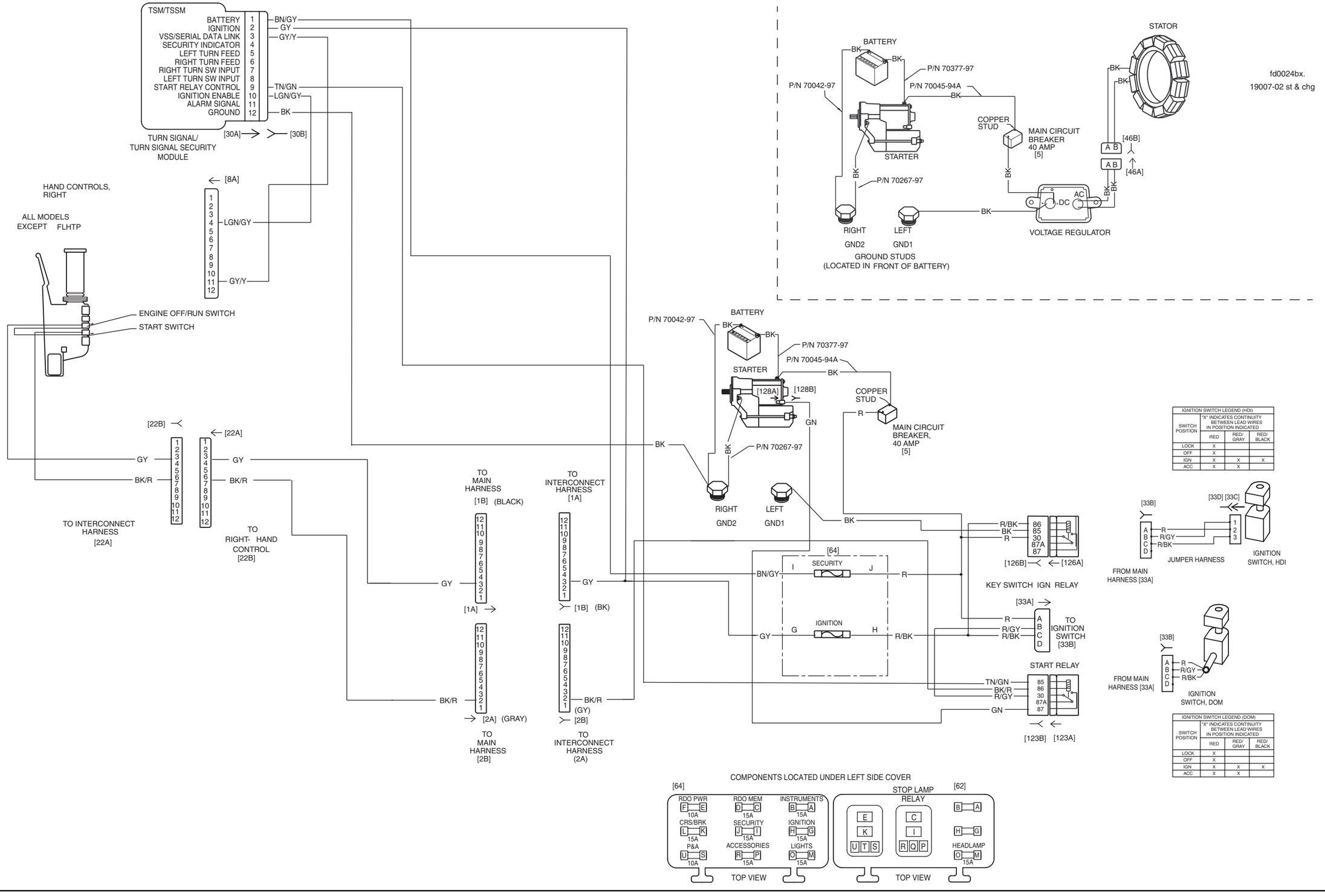
IGNITION SWITCH LEGEND (DOM)			
SWITCH POSITION	"X" INDICATES CONTINUITY BETWEEN LEAD WIRES IN POSITION INDICATED		
	RED	RED/ GRAY	RED/ BLACK
LOCK	X		
OFF	X		
IGN	X	X	X
ACC	X	X	



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

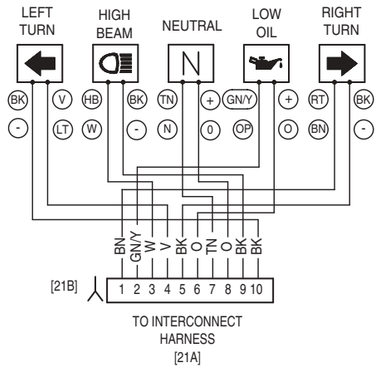
← PIN CONNECTOR (A side)

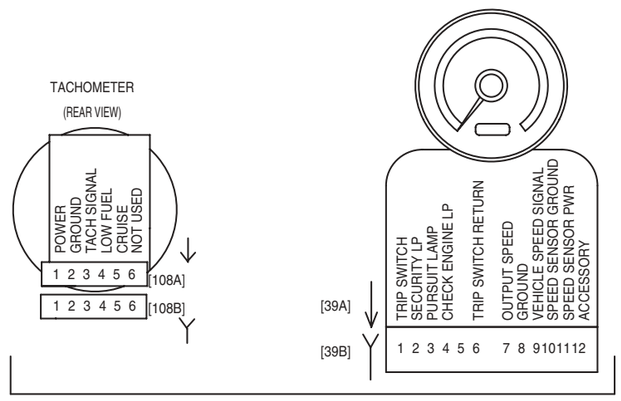
SOCKET CONNECTOR (B side)

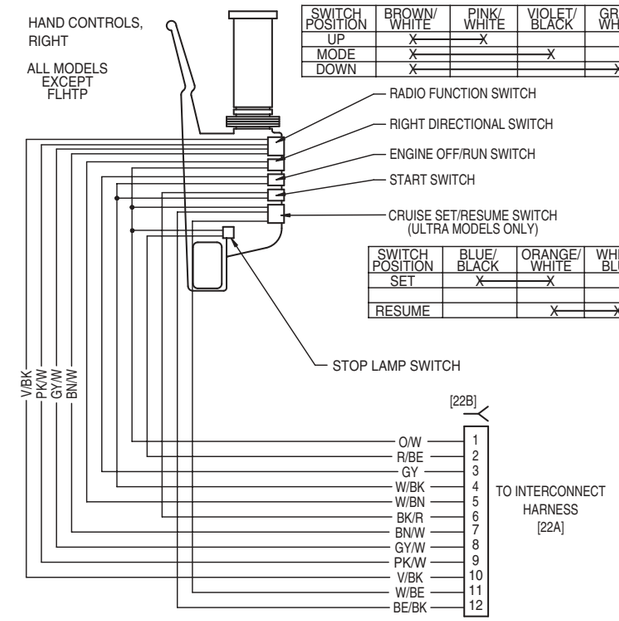

TSM/TSSM
BATTERY 1
IGNITION 2
VSS/SERIAL DATA LINK 3
SECURITY INDICATOR 4
LEFT TURN FEED 5
RIGHT TURN FEED 6
RIGHT TURN SW INPUT 7
LEFT TURN SW INPUT 8
START RELAY CONTROL 9
IGNITION ENABLE 10
ALARM SIGNAL 11
GROUND 12
BN/GY
GY
GY/Y
TN/GN
LGN/GY
BK
[30A]
[30B]
TURN SIGNAL/
TURN SIGNAL SECURITY
MODULE
HAND CONTROLS,
RIGHT
ALL MODELS
EXCEPT FLHTP
[8A]
LGN/GY
GY/Y
ENGINE OFF/RUN SWITCH
START SWITCH
[22B]
[22A]
GY
BK/R
TO INTERCONNECT
HARNESS
[22A]
TO
RIGHT- HAND
CONTROL
[22B]
BK
TO
MAIN
HARNESS
[1B] (BLACK)
TO
INTERCONNECT
HARNESS
[1A]
GY
[1A]
[1B] (BK)
BK/R
[2A] (GRAY)
[2B]
(GY)
TO
MAIN
HARNESS
[2B]
TO
INTERCONNECT
HARNESS
(2A)
BATTERY
P/N 70042-97
P/N 70377-97
P/N 70045-94A
STARTER
[128A]
[128B]
COPPER
STUD
MAIN CIRCUIT
BREAKER,
40 AMP
[5]
P/N 70267-97
RIGHT
GND2
LEFT
GND1
[64]
SECURITY
IGNITION
BN/GY
GY
R
R/BK
[126B]
[126A]
KEY SWITCH IGN RELAY
[33A]
TO
IGNITION
SWITCH
[33B]
START RELAY
TN/GN
BK/R
R/GY
GN
[123B]
[123A]
STATOR
BATTERY
P/N 70042-97
P/N 70377-97
P/N 70045-94A
COPPER
STUD
MAIN CIRCUIT
BREAKER
40 AMP
[5]
STARTER
P/N 70267-97
[46B]
[46A]
AC
DC
VOLTAGE REGULATOR
RIGHT
GND2
LEFT
GND1
GROUND STUDS
(LOCATED IN FRONT OF BATTERY)
fd0024bx.
19007-02 st & chg
IGNITION SWITCH LEGEND (HDI)
SWITCH POSITION
"X" INDICATES CONTINUITY BETWEEN LEAD WIRES IN POSITION INDICATED
RED
RED/ GRAY
RED/ BLACK
LOCK X
OFF X
IGN X X X
ACC X X
[33B]
[33D] [33C]
R
R/GY
R/BK
JUMPER HARNESS
IGNITION
SWITCH, HDI
FROM MAIN
HARNESS [33A]
IGNITION SWITCH LEGEND (DOM)
SWITCH POSITION
"X" INDICATES CONTINUITY BETWEEN LEAD WIRES IN POSITION INDICATED
RED
RED/ GRAY
RED/ BLACK
LOCK X
OFF X
IGN X X X
ACC X X
COMPONENTS LOCATED UNDER LEFT SIDE COVER
[64]
RDO PWR F E 10A
RDO MEM D C 15A
INSTRUMENTS B A 15A
CRS/BRK L K 15A
SECURITY J I 15A
IGNITION H G 15A
P&A U S 10A
ACCESSORIES R P 15A
LIGHTS O M 15A
TOP VIEW
STOP LAMP
RELAY
E K U T S
C I R Q P
[62]
B A
H G
HEADLAMP O M 15A
TOP VIEW

fd0004bx.

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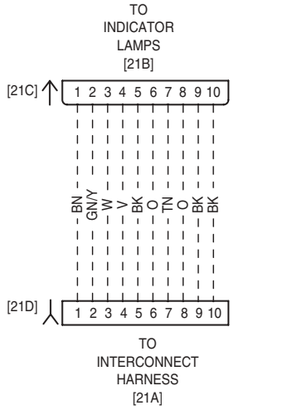


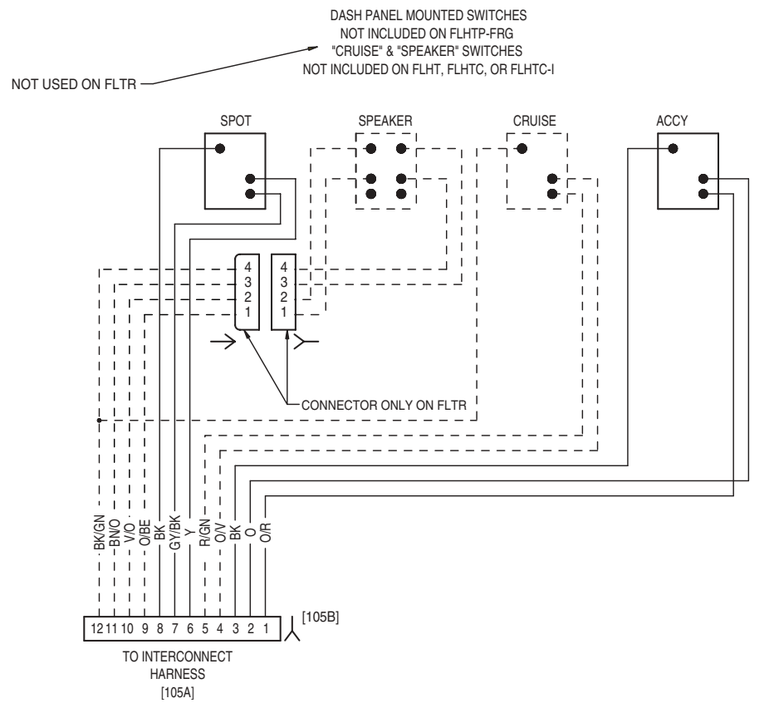


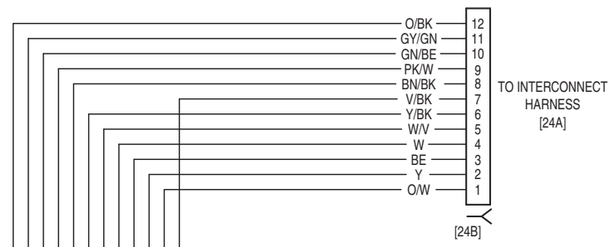
SWITCH POSITION	BROWN/ WHITE	PINK/ WHITE	VIOLET/ BLACK	GRAY/ WHITE
UP	X	X		
MODE	X		X	
DOWN	X			X

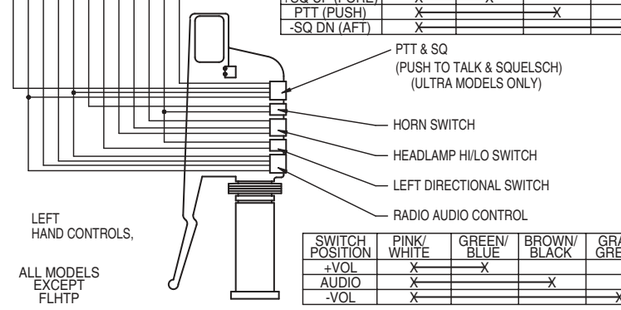
SWITCH POSITION	BLUE/ BLACK	ORANGE/ WHITE	WHITE/ BLUE
SET	X	X	
RESUME		X	X

THIS JUMPER USED ON FLTR ONLY
P/N 71625-98



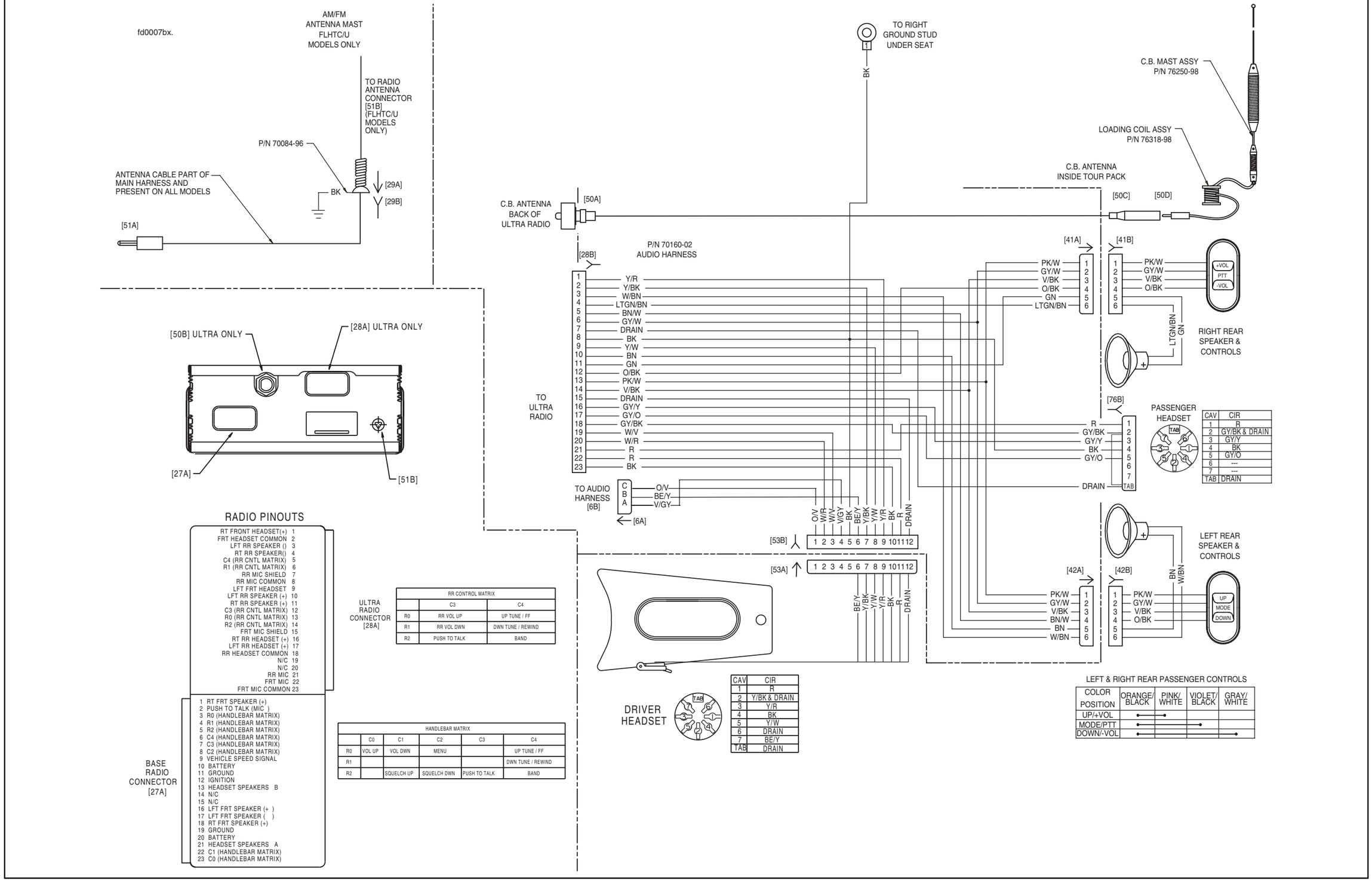




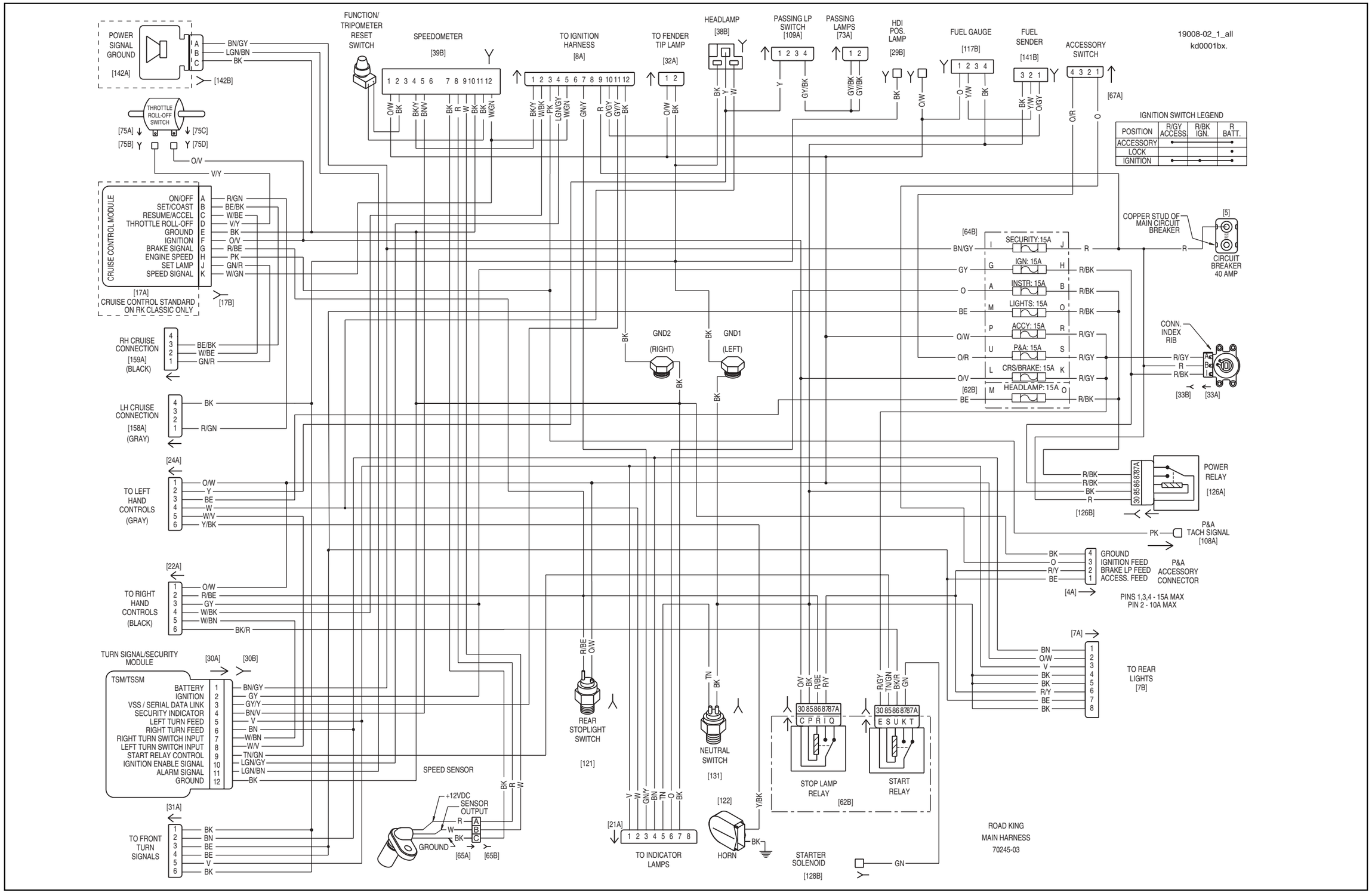


SWITCH POSITION	VIOLET/ BLACK	GRAY/ GREEN	ORANGE/ BLACK	BROWN/ BLACK
+SQ UP (FORE)	X	X		
PTT (PUSH)	X		X	
-SQ DN (AFT)	X			X

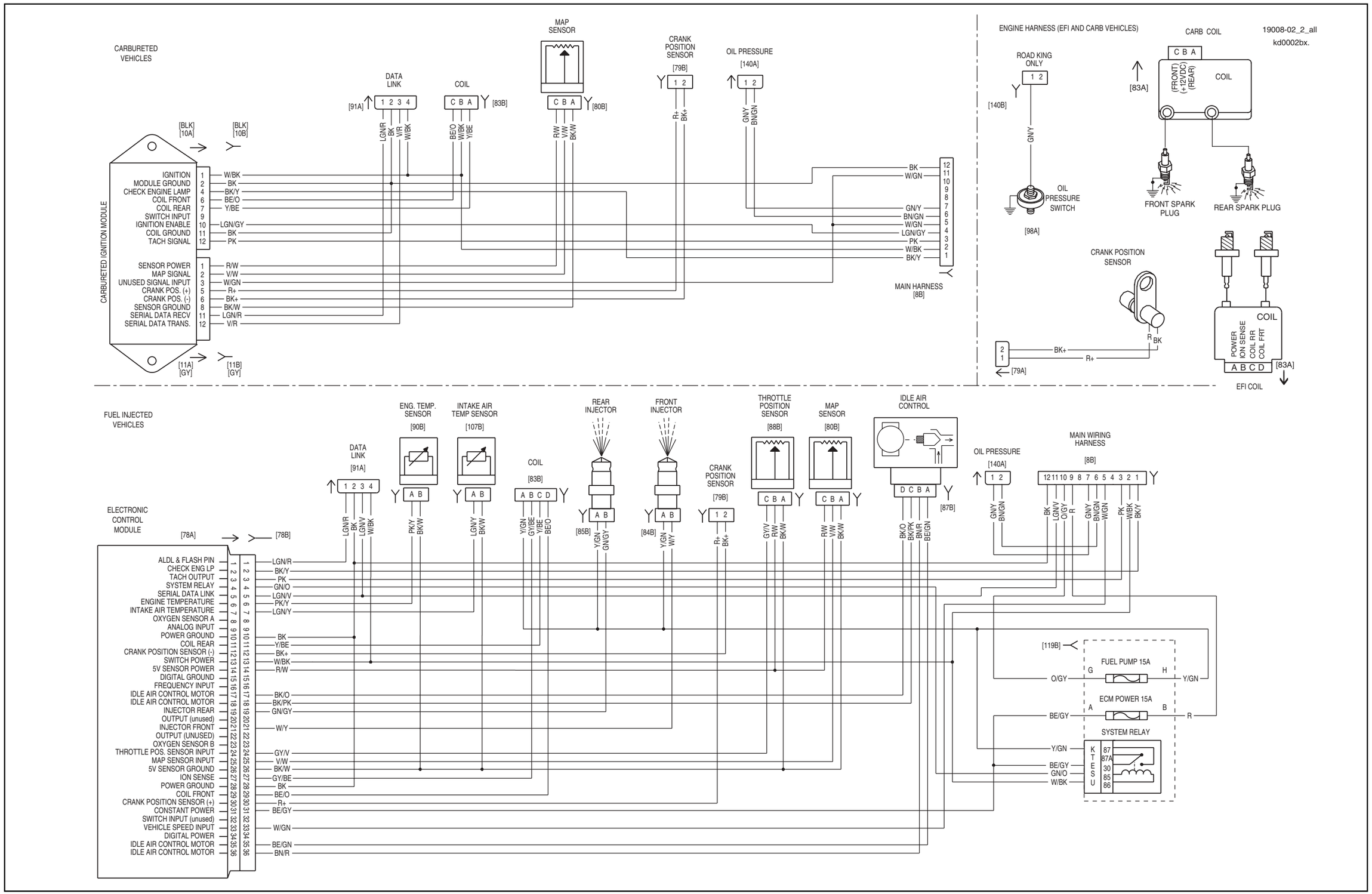
SWITCH POSITION	PINK/ WHITE	GREEN/ BLUE	BROWN/ BLACK	GRAY/ GREEN
+VOL	X	X		
AUDIO	X		X	
-VOL	X			X



2003 FLHTC, FLHTCU and FLTR, DOMESTIC and INTERNATIONAL Models,
Radio, CB/Intercom and Rear Speakers



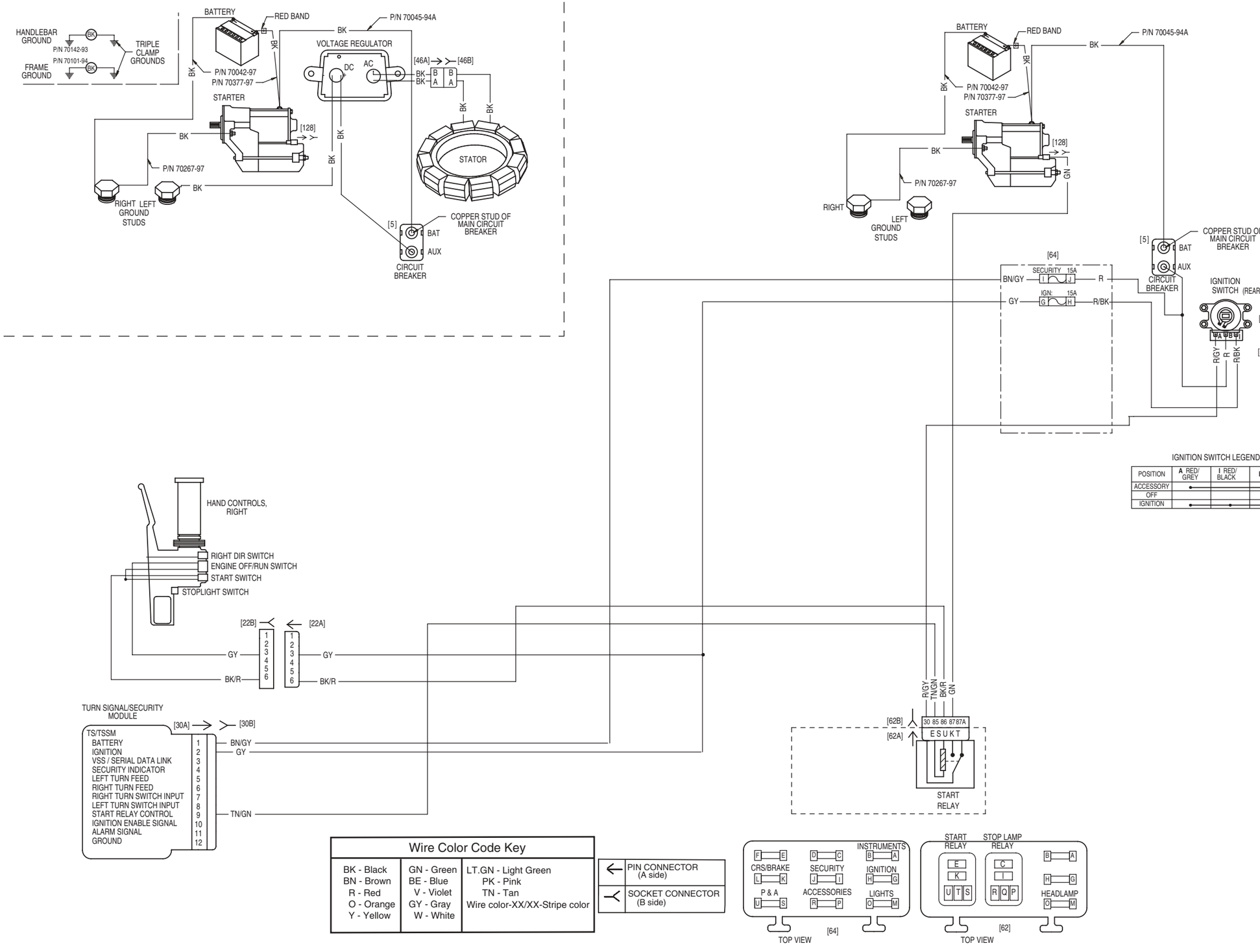
2003 FLHR and FLHRC, DOMESTIC and INTERNATIONAL Models,
Main Harness

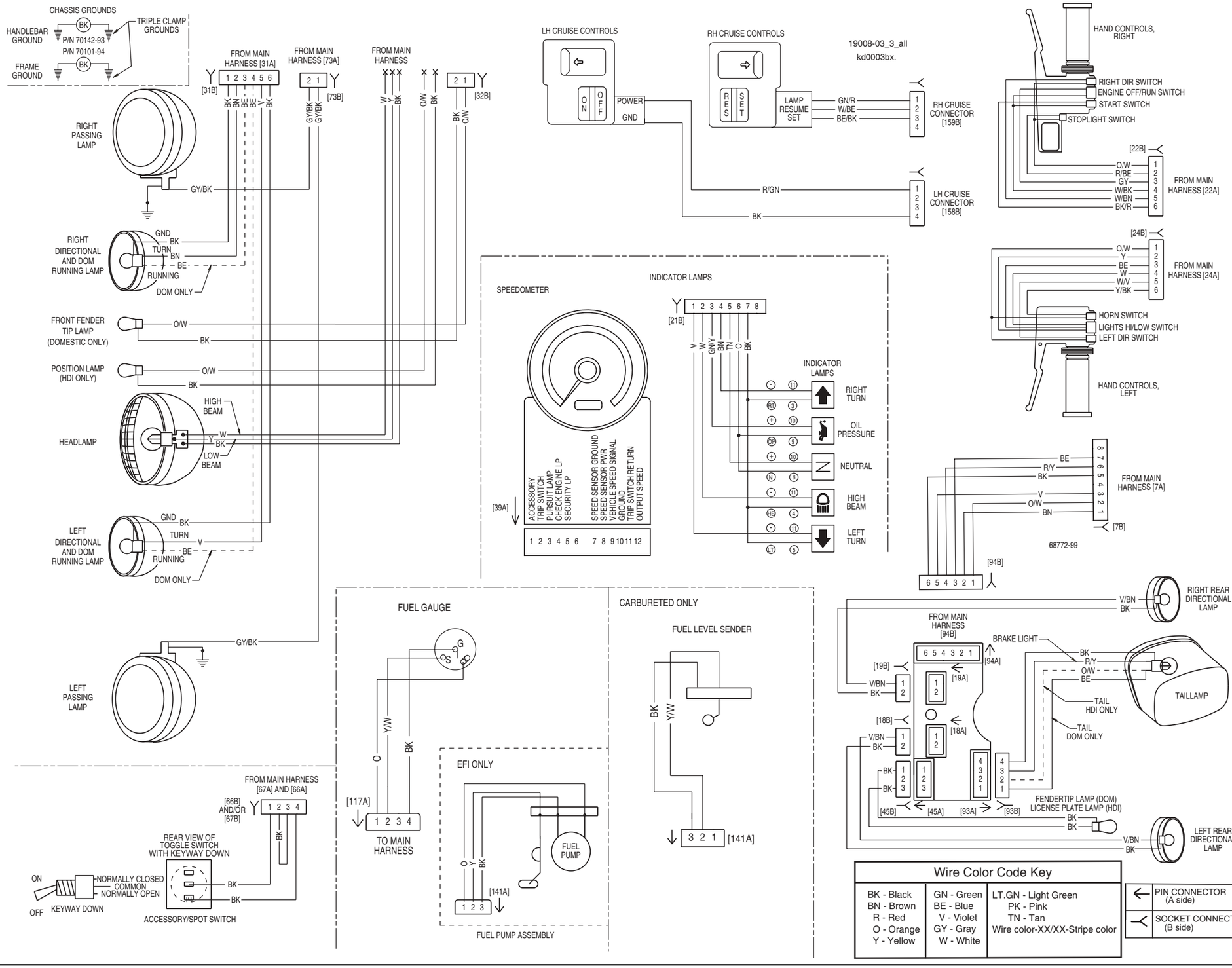


2003 FLHR and FLHRC, DOMESTIC and INTERNATIONAL Models,
Ignition Harness, Engine Sensor Harness and Engine Management Circuitry

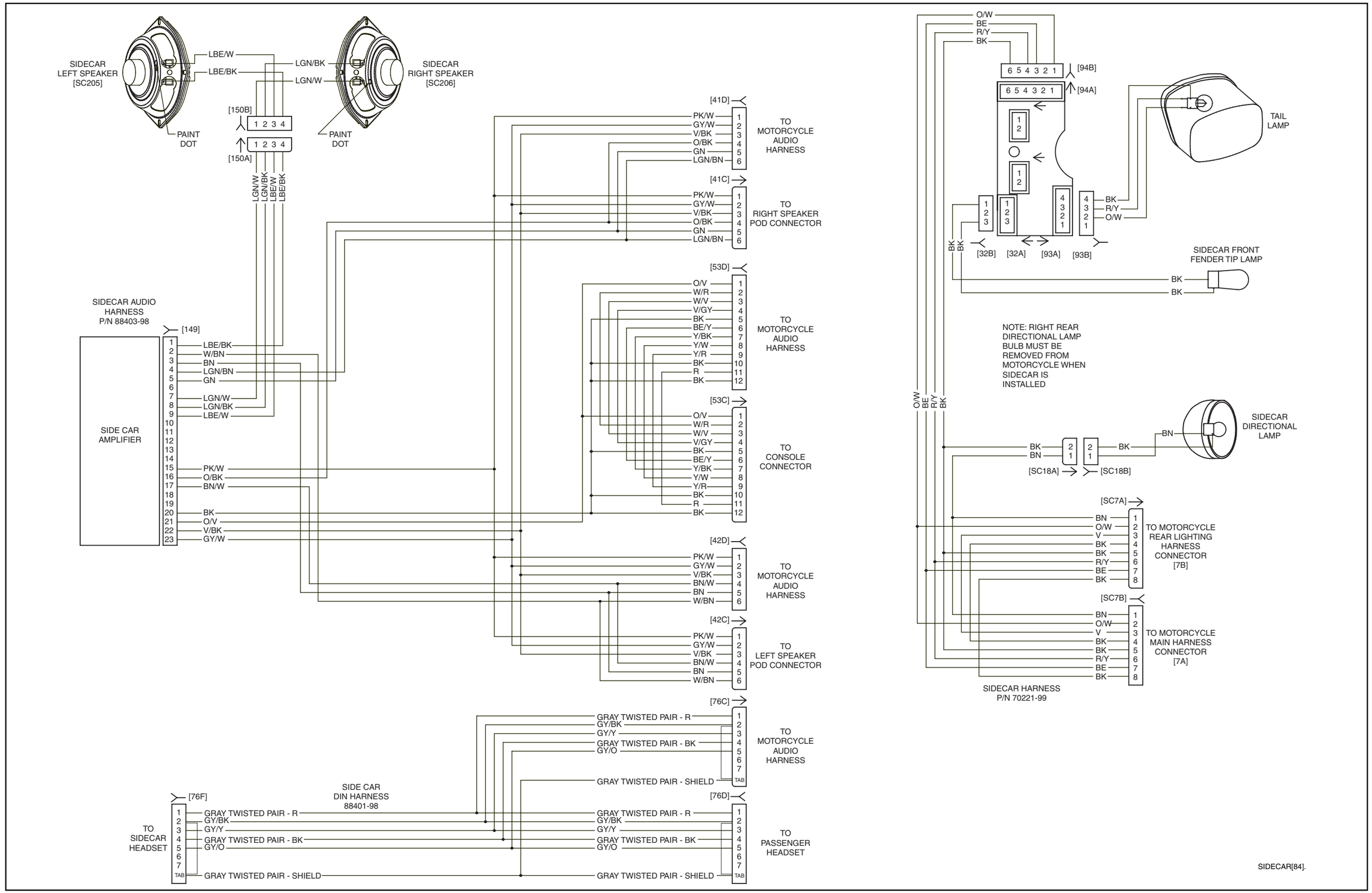
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2003 FLHR and FLHRC, DOMESTIC and INTERNATIONAL Models,
Handlebar Controls, Speedometer, Indicator Lamps, Tail Lamp, Passing Lamps, Directional Lamps and Fender Tip Lamps


SIDECAR LEFT SPEAKER [SC205]
LBE/W
LBE/BK
PAINT DOT
LGN/BK
LGN/W
SIDECAR RIGHT SPEAKER [SC206]
PAINT DOT
[150B]
[150A]
LGN/W
LGN/BK
LBE/W
LBE/BK
SIDECAR AUDIO HARNESS P/N 88403-98
[149]
SIDE CAR AMPLIFIER
LBE/BK
W/BN
BN
LGN/BN
GN
LGN/W
LGN/BK
LBE/W
PK/W
O/BK
BN/W
BK
O/V
V/BK
GY/W
[41D]
PK/W
GY/W
V/BK
O/BK
GN
LGN/BN
TO MOTORCYCLE AUDIO HARNESS
[41C]
PK/W
GY/W
V/BK
O/BK
GN
LGN/BN
TO RIGHT SPEAKER POD CONNECTOR
[53D]
O/V
W/R
W/V
V/GY
BK
BE/Y
Y/BK
Y/W
Y/R
BK
R
BK
TO MOTORCYCLE AUDIO HARNESS
[53C]
O/V
W/R
W/V
V/GY
BK
BE/Y
Y/BK
Y/W
Y/R
BK
R
BK
TO CONSOLE CONNECTOR
[42D]
PK/W
GY/W
V/BK
BN/W
BN
W/BN
TO MOTORCYCLE AUDIO HARNESS
[42C]
PK/W
GY/W
V/BK
BN/W
BN
W/BN
TO LEFT SPEAKER POD CONNECTOR
[76C]
GRAY TWISTED PAIR - R
GY/BK
GY/Y
GRAY TWISTED PAIR - BK
GY/O
GRAY TWISTED PAIR - SHIELD
TAB
TO MOTORCYCLE AUDIO HARNESS
SIDE CAR DIN HARNESS 88401-98
[76F]
TO SIDECAR HEADSET
GRAY TWISTED PAIR - R
GY/BK
GY/Y
GRAY TWISTED PAIR - BK
GY/O
GRAY TWISTED PAIR - SHIELD
TAB
[76D]
GRAY TWISTED PAIR - R
GY/BK
GY/Y
GRAY TWISTED PAIR - BK
GY/O
GRAY TWISTED PAIR - SHIELD
TAB
TO PASSENGER HEADSET
O/W
BE
R/Y
BK
[94B]
[94A]
TAIL LAMP
[32B]
[32A]
[93A]
[93B]
BK
R/Y
O/W
SIDECAR FRONT FENDER TIP LAMP
BK
BK
NOTE: RIGHT REAR DIRECTIONAL LAMP BULB MUST BE REMOVED FROM MOTORCYCLE WHEN SIDECAR IS INSTALLED
SIDECAR DIRECTIONAL LAMP
BK
BN
[SC18A]
[SC18B]
[SC7A]
BN
O/W
V
BK
BK
R/Y
BE
BK
TO MOTORCYCLE REAR LIGHTING HARNESS CONNECTOR [7B]
[SC7B]
BN
O/W
V
BK
BK
R/Y
BE
BK
TO MOTORCYCLE MAIN HARNESS CONNECTOR [7A]
SIDECAR HARNESS P/N 70221-99
SIDECAR[84].

MAINTENANCE 1

Table Of Contents

SUBJECT **PAGE NO.**

1.1 Scheduled Maintenance 1-1
1.2 Scheduled Maintenance Procedures 1-6
1.3 Engine Oil Filter 1-7
1.4 Critical Fasteners 1-8

NOTE

This section provides information unique to FLHRSEI^2 model motorcycles. Any information not presented in this supplement can be found in the Touring Models Service Manual.

SCHEDULED MAINTENANCE 1.1

GENERAL

The scheduled maintenance table in this section lists the maintenance requirements for touring models. Refer to Table 1-2. for recommended maintenance intervals, maintenance, and lubrication. Refer to Table 1-1. for the part numbers of required lubricants. See the Touring Models Service Manual for detailed service procedures.

Table 1-1. Lubricants

LUBRICANT		PART NO.
Engine Oil		See Table 1-3. Recommended Oil Grades.
Hydraulic Fork Oil, Type "E"		99884-80 (16 oz.)
D.O.T. 5 Hydraulic Brake Fluid		99902-77 (12 oz.)
Semi-Synthetic Transmission Lubricant	Quart	99892-84
	Case of Quarts	98853-96
	Gallon	99891-84
	Case of Gallons	98852-96
Primary Chaincase Lubricant	Quart	99887-84
	Gallon	99886-84
Throttle Cable Lubricant		Super Oil 94968-85TV
Steering Head Bearing Lubricant		Special Purpose Grease 99857-97 (cartridge)
Electrical Contact Grease		99861-02

Table 1-2. Scheduled Maintenance

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
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.

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
Engine Oil Filter (*)		R		R		R		R		R		R		R		R		R		R		R	Hand tighten 1/2-3/4 turn after gasket contact.
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 capacity* 32 oz (946 mL) Part No.'s 99887-84 (qt) 99886-84 (gal)
Clutch Fluid		I		I		I		I		I		I		I		I		I		I		I	D.O.T. 5 Silicone Brake Fluid Part No. 99902-77 See BLEEDING CLUTCH FLUID LINE.
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. 99892-84 (qt), 99891-84 (gal) *Transmission drain plug torque* 14-21 ft-lbs (19-28 Nm). *Filler plug torque* 25-75 **in-lbs** (2.8-8.5 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
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 Touring Models Service Manual.
Steering Head Bearing Swing-By		X				X				X				X				X				X	See SWING-BY in Touring Models Service Manual.
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 STEERING HEAD in Touring Models Service Manual.
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. 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* 0.04 in. (1.02 mm)
Rear Shock Absorbers		I		I		I		I		I		I		I		I		I		I		I	See 2.16 REAR AIR SUSPENSION.

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	Pride	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
Fuel Filter												R										R	
Drive Belt Tension(*)	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	*On ground without rider* 5/16-3/8 in. (7.9-9.5 mm) in bottom strand with 10 lb. (4.5 kg) upward force
Air Cleaner Torque(*)		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* 36-60 **in-lbs** (4-7 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.
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)
Critical Fastener Torque		T				T				T				T				T				T	Verify tightness. See CRITICAL FASTENERS in Touring Models Service Manual.

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	Pride	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
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* 12-18 ft-lbs (16-24 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
Front Fork Oil										R								R					*Fork oil (Type E)* Part No. 99884-80 (16 oz)
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

CLUTCH

The clutch is hydraulically actuated. A hand lever actuated master cylinder creates pressure in a clutch fluid line that activates a secondary clutch actuator mounted in the clutch release cover. The secondary clutch actuator piston extends and contacts a pushrod which releases the clutch.

CAUTION

D.O.T. 5 SILICONE BRAKE FLUID is used for the hydraulic clutch and is referred to as clutch fluid in this manual. Do not use other types of fluid as they are not compatible.

CHECKING CLUTCH FLUID LEVEL

Even though a clear sight gauge in the reservoir cover indicates a low clutch fluid, the cover should always be removed to verify fluid level.

⚠WARNING

Be sure NO clutch fluid gets on tires, wheels or brakes when adding clutch fluid. Traction will be adversely affected which could result in loss of control of the motorcycle and death or serious injury.

⚠WARNING

Do NOT allow foreign matter to enter the clutch master cylinder reservoir. Dirt or debris in the reservoir may cause improper operation of the clutch and equipment damage. This could result in loss of control of the motorcycle and death or serious injury.

⚠WARNING

Direct contact of D.O.T. 5 SILICONE BRAKE FLUID with eyes may cause eye irritation, swelling, and redness. Avoid eye contact. In case of eye contact flush with large amounts of water and seek medical attention immediately. Swallowing large amounts of D.O.T. 5 SILICONE BRAKE FLUID may cause digestive discomfort. If swallowed, seek medical attention immediately. Use in well ventilated area. KEEP OUT OF REACH OF CHILDREN.

1. Clean and remove reservoir cover.
2. Stand motorcycle upright and turn handlebars right lock as required to level clutch reservoir.

CAUTION

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

3. See Figure 1-1. Verify that fluid level is at FILL LEVEL marked on ledge on rear inside wall of reservoir.
4. If necessary, add D.O.T. 5 SILICONE BRAKE FLUID, (HD-99902-77) to master cylinder reservoir. Fluid level should not exceed FILL LEVEL.
5. Tighten reservoir cover screws to 6-8 **in-lbs (**0.7-0.9 Nm).

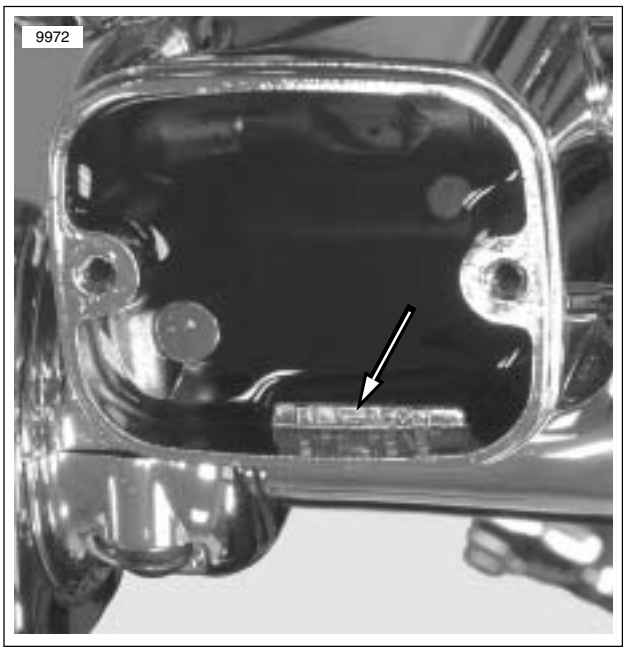


Figure 1-1. Fill Level (reservoir cover removed)

ENGINE OIL FILTER 1.3

REPLACEMENT

PART NO.	SPECIALTY TOOL
HD-42311	Oil filter wrench

1. Drain engine oil. See ENGINE OIL/ENGINE OIL FILTER in Touring Models Service Manual.
2. Position a suitable container under oil filter.
3. Bend a cardboard funnel and fit to motorcycle to route fluid away from regulator and oil cooler to container.
4. Remove oil filter as follows
   a. Place jaws of OIL FILTER WRENCH (HD-42311) over oil filter with jaws oriented vertically.
   b. With a 3/8 in. drive with 4 in. extension, turn the wrench counterclockwise (CCW). Do not use an air tool.
   c. Clean oil filter mount flange of gasket material.

NOTE

Dispose of engine oil according to local regulations.

5. Lubricate **new** filter gasket with clean engine oil and hand install **new** oil filter on filter mount.

NOTE

Use of the Premium 10 micron synthetic media oil filter (Part No. 63798-99) is highly recommended.

6. Hand tighten oil filter 1/2-3/4 turn after gasket contacts mounting surface.

NOTE

*Do **NOT** use OIL FILTER WRENCH (HD-42311) to tighten oil filter.*

7. Install engine oil drain plug and tighten to 14-21 ft-lbs (19-28 Nm).
8. Select a grade of oil from Table 1-3.
9. With motorcycle on jiffy stand, add 3-1/2 quarts (3.3 liters) engine oil of the grade selected from Table 1-3. Use the grade of oil for the lowest temperature expected before the next oil change.
10. Perform engine oil level COLD CHECK followed by an engine oil level HOT CHECK. See ENGINE OIL/ENGINE OIL FILTER in the Touring Models Service Manual.
11. With engine running check for oil leaks around drain plug and oil filter.

Table 1-3. Recommended Oil Grades

HARLEY-DAVIDSON TYPE	VISCOSITY	HD RATING	LOWEST AMBIENT TEMPERATURE	COLD WEATHER STARTS BELOW 50˚ F (10˚ C)
HD Multi-grade	SAE 10W40	HD 360	Below 40˚ F (4.4˚ C)	Excellent
HD Multi-grade	SAE 20W50	HD 360	Above 40˚ F (4.4˚ C)	Good
HD Regular Heavy	SAE 50	HD 360	Above 60˚ F (15.5˚ C)	Poor
HD Extra Heavy	SAE 60	HD 360	Above 80˚ F (26.6˚ C)	Poor

CRITICAL FASTENERS 1.4

INSPECTION

Inspect critical fasteners, except head bolts:

- At the first scheduled service interval.
- At every 10,000 mile (16,000 km) service interval thereafter.

Refer to Table 1-4. Tighten all critical fasteners, except head bolts, to service manual specifications. Replace any damaged or missing hardware.

Table 1-4. Critical Fasteners

COMPONENT	FASTENER	TORQUE	
Axle	Front axle nut	50-55 ft-lbs	68-75 Nm
	Rear axle cone nut	95-105 ft-lbs	129-142 Nm
Brakes	Banjo bolts	17-22 ft-lbs	23-30 Nm
	Front brake disc mounting screws	16-24 ft-lbs	22-33 Nm
	Front brake caliper mounting bolts	28-38 ft-lbs	38-52 Nm
	Brake caliper pad pins	180-200 **in-lbs**	20-23 Nm
	Rear brake disc mounting screws	30-45 ft-lbs	41-61 Nm
	Rear master cylinder mounting nut	30-40 ft-lbs	41-54 Nm
	Reservoir cover screws	6-8 **in-lbs**	0.7-0.9 Nm
Front forks	Axle holder nuts	132-180 **in-lbs**	14.9-20.3 Nm
Hand controls	Clutch master cylinder/handlebar clamp	60-80 **in-lbs**	6.8-9.0 Nm
	Brake master cylinder/handlebar clamp screws	60-80 **in-lbs**	6.8-9.0 Nm
	Upper/lower switch housing screws	35-45 **in-lbs**	4-5 Nm
Handlebars	Lower clamp (riser) bolts	30-40 ft-lbs	40.7-54.2 Nm
Pivot shaft	Locknuts	40-45 ft-lbs	54-61 Nm
	Swingarm bracket bolts	34-42 ft-lbs	46-57 Nm
Engine	Engine mounting bracket to cylinder head bolts	25-30 ft-lbs	34-41 Nm
	Top stabilizer link to top engine mounting bracket bolt	18-22 ft-lbs	24-30 Nm
	Top stabilizer link to frame weldment bolt	18-22 ft-lbs	24-30 Nm
	Front stabilizer link to frame weldment bolt	18-22 ft-lbs	24-30 Nm
	Front stabilizer link to front engine mounting bracket bolt	18-22 ft-lbs	24-30 Nm
	Center front engine mounting bracket to rubber mount bolt	35-45 ft-lbs	48-61 Nm
	Front engine mount to frame crossmember bolts	33-38 ft-lbs	45-52 Nm
	Engine to front engine mounting bracket bolts	33-38 ft-lbs	45-52 Nm
	Engine to transmission bolts	30-35 ft-lbs	41-48 Nm
Clutch	Banjo bolts	17-22 ft-lbs	23-30 Nm
	Clutch fluid line flare nut	80-115 **in-lbs**	9-13 Nm
	Secondary actuator bleeder valve	80-100 **in-lbs**	9-11 Nm
	Reservoir cover screws	6-8 **in-lbs**	0.7-0.9 Nm

NOTES

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NOTE

This section provides information unique to FLHRSEI^2 model motorcycles. Any information not presented in this supplement can be found in the Touring Models Service Manual.

SPECIFICATIONS 2.1

Table 2-1. Dimensions

ITEM	IN.	MM
Wheel base	63.50	1612.9
Overall length	93.70	2380
Overall width	35.75	908.1
Road clearance	5.00	127
Overall height	49.50	1257.3
Saddle height	27	685.8

NOTE

Gross Vehicle Weight Rating (GVWR) (maximum allowable loaded vehicle weight) and corresponding Gross Axle Weight Ratings (GAWR) are given on an information decal located on the steering head.

Table 2-2. Weight

ITEM	LBS.	KG
Weight (as shipped from factory)	745.0	337.9
GVWR	1259	571.0
GAWR - front	500.0	226.8
GAWR - rear	829.0	376.0

Table 2-3. Tire Pressures

DUNLOP HARLEY-DAVIDSON TIRES ONLY	TIRE PRESSURE (COLD)			
	FRONT		REAR	
	PSI	kPa	PSI	kPa
Solo rider	36	248	36	248
Rider & one passenger	36	248	40	275

Table 2-4. Capacities

ITEM	U.S.	LITERS
Fuel tank	5.0 gallons	18.9
Oil tank (w/filter)	4.0 quarts	3.785
Transmission (approximate)	24 ounces	0.71
Primary chaincase	32 ounces	0.95
Front forks (each)	11.1 ounces	0.328

TORQUE VALUES 2.2

ITEM	TORQUE		NOTES
Actuator bleeder valve	80-100 **in-lbs**	9-11 Nm	page 2-33, 2-35
Banjo bolt	17-22 ft-lbs	23-31 Nm	page 2-33, 2-35
Brake caliper banjo bolts	17-22 ft-lbs	23-29 Nm	page 2-24
Brake caliper pad pins	180-200 **in-lbs**	21-22 Nm	page 2-7
Brake fluid reservoir cover	6-8 **in-lbs**	0.7-0.9 Nm	page 2-7
Brake pedal to brake arm	25-29 ft-lbs	34-39 Nm	page 2-10
Clutch fluid line flare nut	80-115 **in-lbs**	9-13 Nm	page 2-33, 2-35
Clutch fluid reservoir cover	6-8 **in-lbs**	0.7-0.9 Nm	page 2-30
Clutch lever clamp	60-80 **in-lbs**	6.8-9.0 Nm	page 2-21
Clutch master cylinder banjo bolt	17-22 ft-lbs	23-31 Nm	page 2-30
Clutch reservoir cover screws	6-8 **in-lbs**	0.7-0.9 Nm	page 2-33, 2-35
Fender mounting bolt	15-20 ft-lbs	20.4-27.1 Nm	page 2-44
Fender support bracket to saddlebag support bracket	15-20 ft-lbs	20.4-27.1 Nm	page 2-49
Filler strip	15-20 ft-lbs	20.4-27.1 Nm	page 2-47
Footboard hinge bolts	84-108 **in-lbs**	9.5-12.2 Nm	page 2-8
Fork lock	15-20 **in-lbs**	1.7-2.2 Nm	page 2-12
Frame mounted clip nut	35-40 ft-lbs	47.5-54.2 Nm	page 2-49
Front axle cover set screw	60-84 **in-lbs**	6.8-9.5 Nm	page 2-11
Front brake lever clamp	60-80 **in-lbs**	6.8-9.0 Nm	page 2-21
Handlebar clamp screws	71-80 **in-lbs**	8-9 Nm	page 2-30
Handlebar cover to fork lock	10-20 **in-lbs**	1.2-2.2 Nm	page 2-13
Handlebar cover to nacelle	10-20 **in-lbs**	1.2-2.2 Nm	page 2-13
Handlebar top clamp	12-16 ft-lbs	16.3-20.3 Nm	page 2-20
Left footboard brackets	15-20 ft-lbs	20.4-27.1 Nm	page 2-8
Left rear view mirror acorn nut	144 **in-lbs**	16.3 Nm	page 2-22
Muffler heat shield clamps	20-40 **in-lbs**	7.2-54.2 Nm	page 2-51
Nacelle top trim fastener	15-20 **in-lbs**	1.7-2.2 Nm	page 2-13
Pad pins	180-200 **in-lbs**	21-22 Nm	page 2-7
Passenger backrest docking points	15-20 ft-lbs	20.4-27.1 Nm	page 2-44
Passenger backrest mounting bracket	15-20 ft-lbs	20.4-27.1 Nm	page 2-47
Passenger footrest supports	15-18 ft-lbs	20.4-24.4 Nm	page 2-10
Passenger footrest to footrest support	15-18 ft-lbs	20.4-24.4 Nm	page 2-10
Passenger mounting bracket fasteners	15-20 ft-lbs	20.4-27.1 Nm	page 2-44
Rear axle cone nut	95-105 ft-lbs	128.9-142.4 Nm	page 2-5
Rear fender fasteners	15-20 ft-lbs	20.4-27.1 Nm	page 2-49
Release handle and cable to bracket	4-6 **in-lbs**	0.5-0.7 Nm	page 2-41
Release handle bracket to frame	96-144 **in-lbs**	10.8-16.2 Nm	page 2-41

ITEM	TORQUE		NOTES
Right footboard brackets	30-35 ft-lbs	41.7-47.4 Nm	page 2-8
Saddlebag brackets	15-20 ft-lbs	20.4-27.1 Nm	page 2-49
Saddlebag support guard	15-20 ft-lbs	20.4-27.1 Nm	page 2-47
Saddlebag support to support bracket	15-20 ft-lbs	20.4-27.1 Nm	page 2-47
Secondary actuator bleeder valve	80-100 **in-lbs**	9-11 Nm	page 2-30
Shift lever clamp bolts	90-110 **in-lbs**	10.2-12.4 Nm	page 2-10
Shift lever peg	144-168 **in-lbs**	16.3-18.9 Nm	page 2-10
Switch housings	35-45 **in-lbs**	4-5 Nm	page 2-21
Tach can	10-20 **in-lbs**	1.2-2.2 Nm	page 2-13
Triple clamp cover backside fasteners	70-110 **in-lbs**	7.9-12.4 Nm	page 2-14
Triple clamp lower Allen head fastener	120-180 **in-lbs**	13.5-20.3 Nm	page 2-14
Wind deflector grommet acorn nuts	72-108 **in-lbs**	8.2-12.2 Nm	page 2-13

VEHICLE IDENTIFICATION NUMBER (V.I.N.) 2.3

GENERAL

See Figure 2-1. An abbreviated V.I.N. is stamped on the left side crankcase at the base between the cylinders.

NOTE

Always give the full 17 digit Vehicle Identification Number when ordering parts or making any inquiry about your motorcycle.

See Figure 2-2. The full 17 digit serial, or Vehicle Identification Number (V.I.N.) is stamped on the steering head and on a label located on the right front frame down tube.

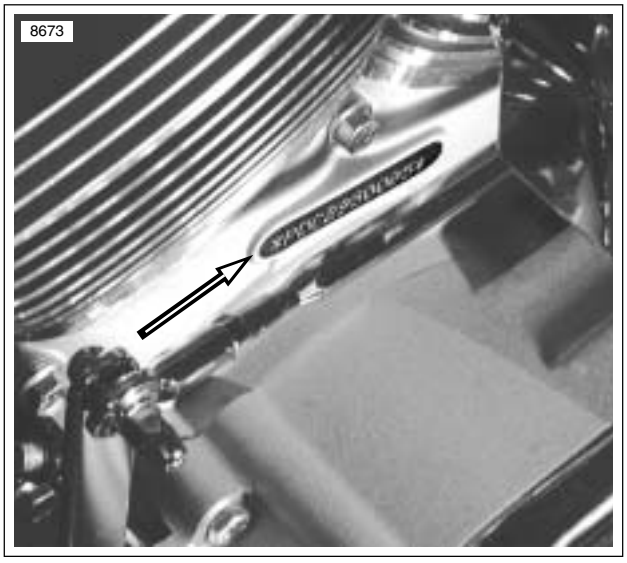


Figure 2-1. Abbreviated V.I.N. Location

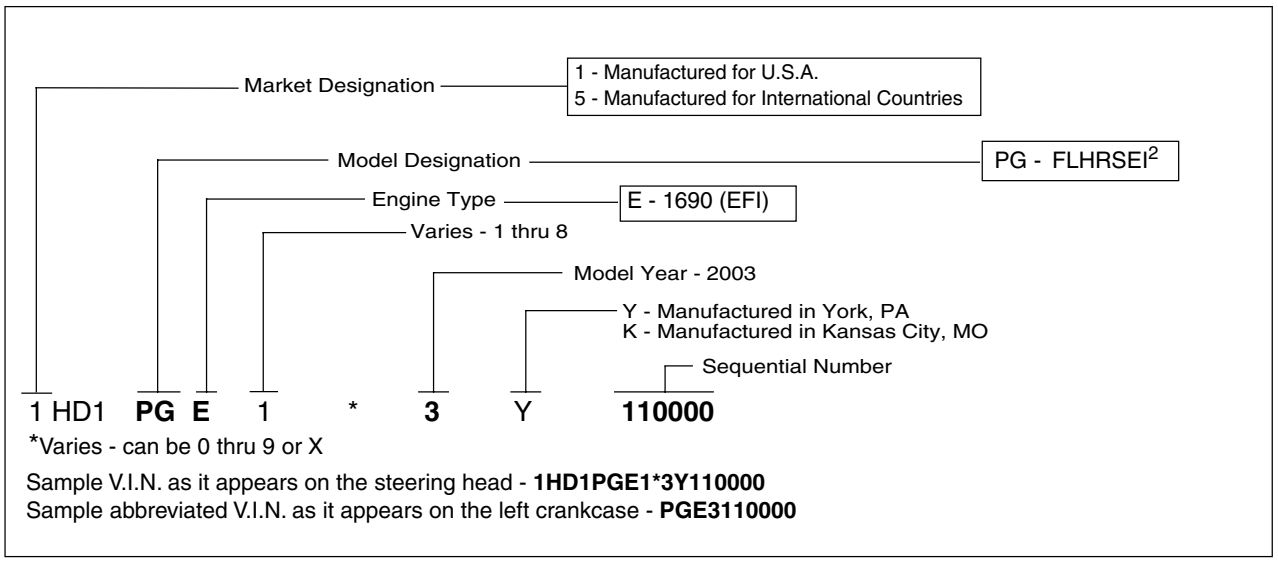


Figure 2-2. Vehicle Identification Number

REAR WHEEL 2.4

REMOVAL

1. Block motorcycle under frame so rear wheel is off the ground.
2. Remove saddlebags. See SADDLEBAG in Touring Models Service Manual.
3. Remove mufflers. See REAR WHEEL in Touring Models Service Manual.
4. Remove e-clip from groove on right end of rear axle.
5. Remove cone nut and adjuster cam from axle.
6. Using a soft mallet, gently tap end of axle towards left side to loosen.
7. Pull the axle out to saddlebag support.
8. To clear the saddlebag support, rotate the axle to lowest cam position and push the bottom of the tire to the right to angle the assembly in the fender with the left end of axle tilted down.
9. Pull the axle the rest of the way out.
10. 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 scratching the brake disc.

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.

11. Move wheel forward to slip belt off sprocket and remove wheel from rear fork.

NOTE

Removal of the rear wheel can be also facilitated by removing the lower shock bolts and dropping the rear fork below the saddlebag support brackets. This provides access to the rear axle.

INSTALLATION

1. Place rear wheel in rear fork. Slide wheel forward and slip belt over sprocket.

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 fork. Position wheel in rear fork, so that brake disc is centered between brake pads.
3. Coat the axle with LOCTITE ANTI-SEIZE.
4. Tilt the bottom of the tire to the right.
5. Orient the axle to the lowest cam position and angle the axle to match angle of rear wheel.
6. With the larger OD on the outboard side, hold external spacer between the rear fork and belt sprocket. Slide the axle through left side of rear swingarm, external spacer, and sprocket into the wheel hub.
7. When the axle emerges from the hub, straighten the wheel and push axle through short external spacer, caliper bracket and rear fork.
8. Rotate flat on threaded end of axle to the top. With the thumb down and the cam forward, install adjuster cam on end of axle.
9. Apply a thin film of LOCTITE ANTI-SEIZE to inboard side of cone nut. Install cone nut on axle, but finger tighten only.
10. Verify that adjuster cam just contacts weld nub on both sides of rear fork. If necessary push wheel forward slightly to achieve the desired result. Snug the cone nut to 15-20 ft-lbs (20-27 Nm).
11. Lower motorcycle to ground.
12. Rotate weld nut on left side of axle in a clockwise direction.
13. Check belt deflection. See DRIVE BELT under SCHEDULED MAINTENANCE PROCEDURES.
14. When belt deflection is within specifications, hold weld nut and final tighten cone nut to 95-105 ft-lbs (128.9-142.4 Nm).
15. With the flat side out, install **new** e-clip in axle groove.
16. Install mufflers. See REAR WHEEL in the Touring Models Service Manual.

⚠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.

17. Press rear brake pedal several times to set brake pads.
18. Install saddelbags. See SADDLEBAG in the Touring Models Service Manual.

REAR BRAKE PADS 2.5

GENERAL

Follow service instructions for INSPECTION, BRAKE DISC THICKNESS/WARPAGE, BRAKE PADS, and BRAKE LINE/HOSE INSPECTION. See REAR BRAKE CALIPER in Touring Models Service Manual.

Procedures for rear brake pad replacement are similar. However, the brake pads must be rotated along the arc of the brake disc to clear the disc rivets and spring washers during brake pad removal and installation.

REPLACEMENT

1. Raise the rear wheel off the ground.
2. Remove right side saddlebag. See SADDLEBAGS, REMOVAL in Touring Models Service Manual.
3. See Figure 2-3. Loosen both pad pins (2), but do not remove.
4. 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.

5. Pry the inner 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.

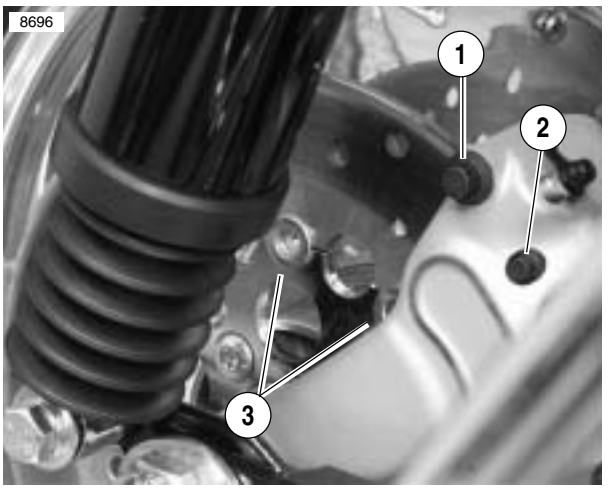
CAUTION

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

6. Once the pistons have been retracted, pull the pad pins (2) part way out to free the inside pad.
7. Slide the inside pad along the arc of the brake disc to remove pads from calipers. Note the orientation of the pad.

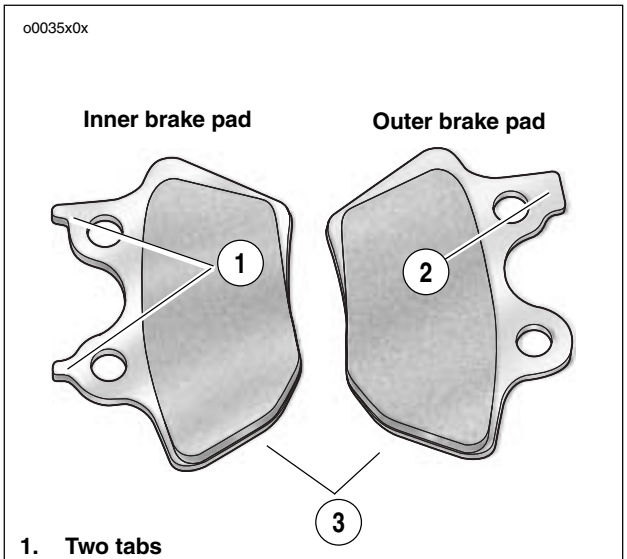
WARNING

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.



1. **Bridge bolt**
2. **Pad pin**
3. **Spring washer and rivet**

Figure 2-3. Rear Brake Disc and Caliper



1. **Two tabs**
2. **Single tab**
3. **Curved portion faces rear**

Figure 2-4. Rear Brake Pad Orientation

8. See Figure 2-4. Orient **new** inner brake pad against the brake disc. Curved portion (3) must face rear of motorcycle.
9. Hold brake pad against brake disc and rotate the rear wheel to rotate the pad forward into caliper.
10. Install pad pins, but do not fully tighten.
11. Pump rear brake pedal to move inside pistons out until they contact inner brake pad.
12. 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.
13. Verify that inner pad is captured between brake disc and pistons.
14. Completely remove pad pins to free outer brake pad. Note the orientation of the outer brake pad.
15. Orient **new** outer brake pad against the brake disc. Curved portion (3) of pad must face rear of motorcycle.
16. Hold brake pad against brake disc and rotate the rear wheel to rotate the pad forward into caliper. If the inside pad moved during the previous step, reinstall.
17. Inspect pad pins and clean or replace as required.
18. 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.

19. Pump rear brake pedal to move pistons out until they contact both brake pads. Verify piston location against pads.
20. 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).
21. Install right side saddlebag. See SADDLEBAGS, INSTALLATION in Touring Models Service Manual.
22. 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.

23. Test ride motorcycle. If the brakes fell spongy, bleed the brake lines. See BLEEDING HYDRAULIC BRAKE LINES in Touring Models Service Manual.

RIDER FOOTBOARDS

NOTE

Unless the covers or footboards are being replaced, they do not have to be removed from footboard brackets.

Removal

1. See Figure 2-5. With footboards in up position, use a screwdriver to work cover rubber collars out through footboards. Remove covers.
2. See Figure 2-6. Remove right footboard pivot bolts and nuts (1) and remove footboard (3).
3. Remove fasteners (7), washer (5), lock washer (6) and right rear footboard bracket (4).
4. Remove fasteners (8), lock washers (6), nuts (9) and right front footboard bracket (4).
5. Remove left footboard pivot bolts and nuts (1) and remove footboard (3).
6. Remove fasteners (7), washers (5), lock washers (6) and both front and rear left footboard brackets (9).

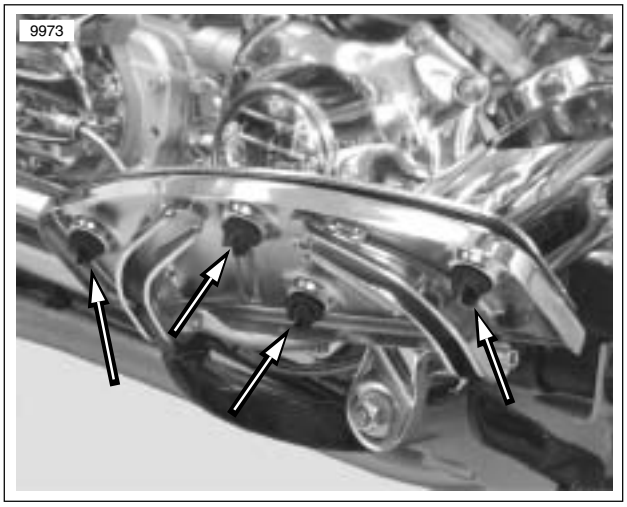


Figure 2-5. Footboard Cover Rubber Collars

Installation

1. See Figure 2-6. Install right front footboard bracket (4). Position for rider posture. Install lock washers (6), washers (5), nuts (9) and fasteners (8). Tighten fasteners (8) to 30-35 ft-lbs (41.7-47.4 Nm).
2. Install right rear footboard bracket (4). Position for rider posture. Install lock washer (6), washer (5) and fastener (7). Tighten fastener (7) to 30-35 ft-lbs (41.7-47.4 Nm).

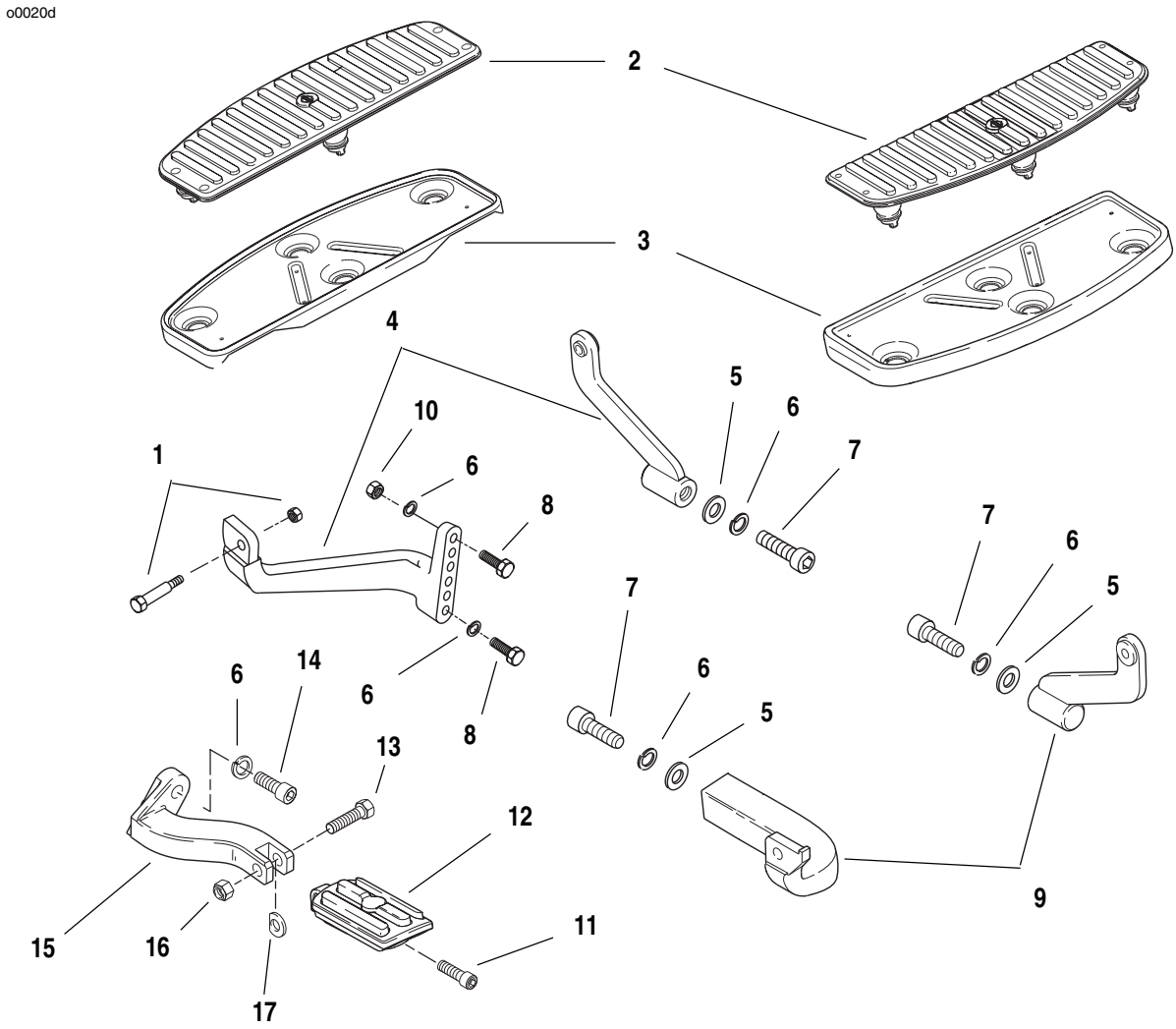
NOTE

The right and left footboard frame mounts allow a small variance in height and angle.

3. Install right footboard (3). Install and tighten pivot bolts and nut (1) to 84-108 **in-lbs** (9.5-13.5 Nm).
4. Install left footboard brackets (9). Position for rider posture. Install washers (5), lock washers (6), and fasteners (7). Tighten fasteners (7) to 15-20 ft-lbs (20.5-27 Nm).
5. Install left footboard (3). Install and tighten pivot bolts and nut (1) to 84-108 **in-lbs** (9.5-13.5 Nm).
6. Moisten footboard cover (2) rubber collars with soapy water.
7. With footboard (3) in up position, hold **new** footboard cover (2) in position.
8. From underside of footboard (3) use a pliers to pull each rubber collar through footboard hole.

CAUTION

Avoid contacting chrome surfaces with abrasive materials (stones, sand, etc.) as damage will result.



1. Pivot bolt and nut
2. Footboard covers
3. Footboard
4. Right footboard brackets
5. Washer
6. Lock washer
7. Fastener
8. Fastener
9. Left footboard bracket
10. Nut
11. Fastener
12. Passenger footrest
13. Footrest pivot
14. Fastener
15. Footrest support
16. Lock nut
17. Spring washer

Figure 2-6. Footboard and Passenger Footrest Components

SHIFT LEVER

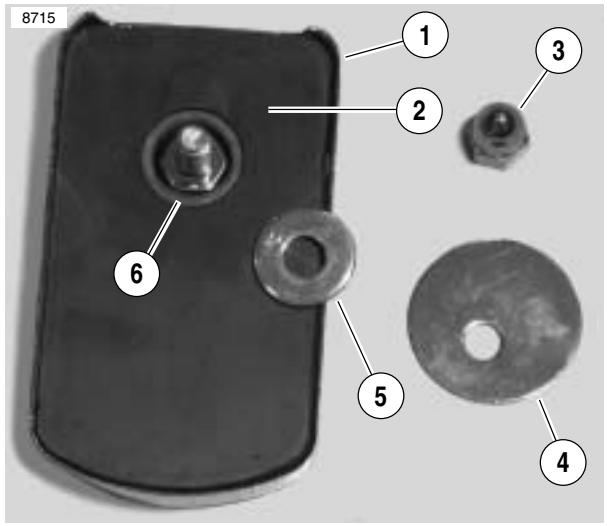
Replacement

1. Remove and replace shift lever pegs. Tighten fasteners to 144-168 **in-lbs** (16.3-18.9 Nm).
2. If necessary, loosen clamp bolts and pull shift levers off splined shaft.
3. Position shift levers on splined shaft for rider posture and tighten clamp bolts to 90-110 **in-lbs** (10.2-12.4 Nm).

REAR BRAKE PEDAL

Replacement

1. Remove nut and remove brake pedal from brake arm. Disassemble.
2. See Figure 2-7. Assemble metal brake pedal cover (1) to rubber tread (2).
3. Insert washer (5) in countersink (6) in rubber tread (2).
4. Install pedal to brake arm with large eccentric washer (4) rotated to cover slot in brake arm. Tighten nut (3) to 25-29 ft-lbs (34-39 Nm).



1. **Metal brake pedal cover**
2. **Rubber tread**
3. **Nut**
4. **Offset hole washer**
5. **Washer**
6. **Countersink**

Figure 2-7. Rear Brake Pedal

PASSENGER FOOTRESTS

Removal

1. See Figure 2-6. Remove pivot (13), lock nut (16), spring washers (17). Remove footrest (12).
2. Remove fastener (14), lock washer (6) and footrest supports (15) from frame.
3. Repeat for opposite side.

Installation

1. See Figure 2-6. Install footrest support (15). Install fastener (14) and lock washer (6). Tighten to 15-18 ft-lbs (20.5-24 Nm).
2. Install pivot (13), spring washer (16), lock nut (15) and passenger footrest (12) to footrest support (14). Tighten to 15-18 ft-lbs (20.5-24.4 Nm).
3. If it is necessary to adjust passenger footrest, perform the following:
   a. Remove fastener (11) and rubber covered footrest.
   b. Apply LOCTITE THREADLOCKER 271 (red) to fastener (10) and install rubber covered footrest (12).
   c. Position for passenger posture and tighten fastener (11).

FRONT AXLE COVERS 2.7

REPLACEMENT

1. See Figure 2-8. Loosen but do not remove set screw under cover. Remove cover.
2. Remove set screws from cover.
3. Liberally apply LOCTITE THREADLOCKER 262 (red) (HD-94759-77) to threads of set screw.
4. Orient cover over axle end so that set screw is on the bottom and will tighten down against a flat on the axle nut.
5. Install and tighten set screw to 60-84 **in-lbs** (6.8-9.5 Nm).
6. Repeat for opposite side.



Figure 2-8. Front Axle Cover Set Screw

HEADLAMP NACELLE 2.8

REMOVAL

1. Remove seat. See 2.18 SEAT.

⚠WARNING

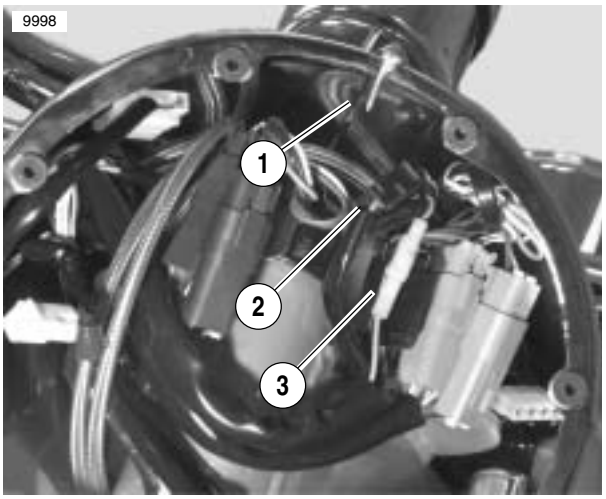
To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

2. Remove negative battery cable from battery.
3. See Figure 2-9. Remove headlamp assembly. See HEADLAMP in 2003 Touring Models Service Manual.
4. Separate tach wire harness connectors [32, 108] (2, 3).
5. Remove top trim fastener (1) holding top trim to nacelle halves inside front of nacelle.
6. See Figure 2-10. Gently pry up with a screwdriver to remove fork lock trim (3) from handlebar cover (5).
7. Remove fasteners (4) holding handlebar cover to fork lock.
8. Partially remove tachometer fastener (16). Push on the fastener to disengage the tachometer from tach gasket. Remove fastener and tach can (17). See 8.4 TACHOMETER.

CAUTION

Wrap tachometer can in shop towel to prevent damage to finish and lay it aside.

9. Lift up front of top trim (6) and unhook top trim from handlebar cover (5).
10. Loosen but do not remove nacelle top trim nut (15) and large washer holding handlebar cover (5) to nacelle.
11. Remove acorn nuts holding the wind deflector grommets to the nacelle.
12. Spread the nacelle to remove handlebar cover (5), tach bracket (22), tach gasket (2) and tachometer (1).
13. Remove fasteners and disconnect the accessory toggle switch (9) from the wire harness. Remove the nacelle halves (7).
14. Remove the toggle switches (9), boot (11) and plate (10) as required.



1. Top trim fastener
2. Fender tip lamp connector [32]
3. Tach signal connector [108]

Figure 2-9. Headlamp Nacelle (headlamp assembly removed)

FORK LOCK

1. See Figure 2-10. Remove fasteners (23) holding fork lock assembly (12) in place.
2. Remove fork lock (12).
3. Orient fork lock assembly (12) and fit into upper triple clamp.
4. Install and tighten fasteners (23) to 15-20 **in-lbs** (1.7-2.2 Nm).

INSTALLATION

1. See Figure 2-10. Install accessory and passing lamp toggle switches (9), plates and boots as required.
2. Be sure the edge protective trim (8) is in place.
3. Loosely install nacelle halves (7) and wind deflector grommets and fasteners.
4. Connect accessory and passing lamp wiring connectors to toggle switches (9).
5. Install handlebar cover (5) with tach bracket (22) with screw, washer and nut (15, 21).
6. Tighten wind deflector grommet acorn nuts to 72-108 **in-lbs** (8.2-12.2 Nm).
7. Tighten the handlebar cover nacelle screw (21) to 10-20 **in-lbs** (1.2-2.2 Nm).
8. Install fasteners (4) to fork lock (12) and tighten to 10-20 **in-lbs** (1.2-2.2 Nm). Align and press-in fork lock trim (3).
9. Inset nacelle top trim (6) hook into handlebar cover (5) and lower onto nacelle. Install top trim fastener (18) and tighten to 15-20 **in-lbs** (1.7-2.2 Nm).
10. Install tach can (17). Push tachometer (1) into tach gasket (2) and tighten fastener (16) to 10-20 **in-lbs** (1.2-2.2 Nm). See 8.4 TACHOMETER.
11. Verify routing of wire conduits, brake line and clutch fluid line. See 2.15 CLUTCH FLUID LINE.
12. Install headlamp assembly (14). See HEADLAMP in 2003 Touring Models Service Manual.
13. Install headlamp door (chrome ring). The spring clip must be at the top of the headlamp door or 180° opposite the screw hole.
14. Connect negative battery cable to battery.

⚠WARNING

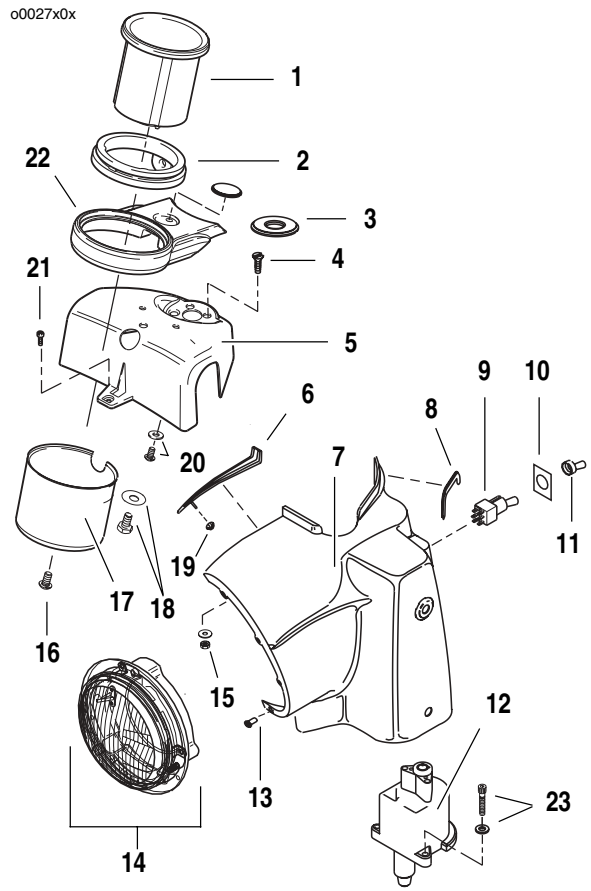
After installing the seat, pull upward on the front of the seat to be sure it is locked into position. If seat is loose, it could shift during operation, resulting in loss of control of the motorcycle and death or serious injury.

15. Install seat. See 2.18 SEAT.

⚠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.

16. Check headlamp beam for proper height and lateral alignment.



1. **Tachometer**
2. **Tach gasket**
3. **Fork lock trim**
4. **Fastener**
5. **Handlebar cover**
6. **Nacelle top trim**
7. **Nacelle half**
8. **Protective trim**
9. **Toggle switch**
10. **Plate**
11. **Toggle boot**
12. **Fork lock**
13. **Rubber insert**
14. **Headlamp assembly**
15. **Nacelle top trim nut and washer**
16. **Tachometer fastener**
17. **Tach can**
18. **Fastener and washer**
19. **Top trim fastener**
20. **Fastener and washer**
21. **Cover screw**
22. **Tachometer bracket**
23. **Fastener and washer**

Figure 2-10. Headlamp Nacelle Components

LOWER TRIPLE CLAMP COVER 2.9

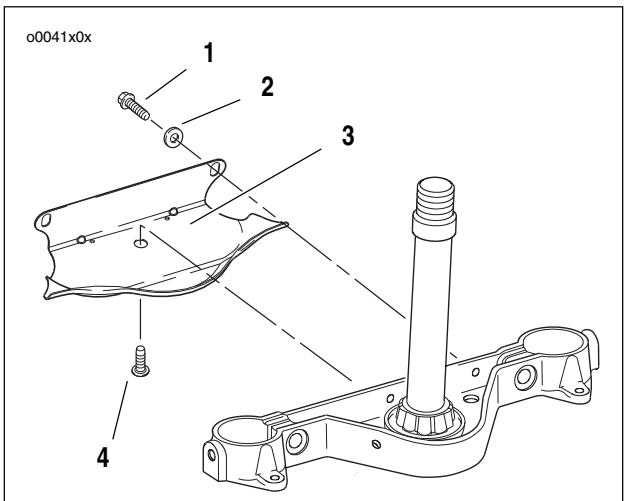
REPLACEMENT

1. See Figure 2-11. Loosen but do not remove the two fasteners (1) on the backside of cover (3).
2. Remove the lower Allen fastener (4) through the brake line manifold on bottom.
3. Remove two backside fasteners (1) and washers (2) and remove cover (3).
4. To replace cover (3), fit cover inside bottom of nacelle and around triple clamp. Hold in place.
5. Install but do not tighten all three fasteners (1, 4) and washers (2). Verify that the cover (3) is snug against the rear surface of triple clamp.

NOTE

Plastic plugs in locator holes in rear surface of triple clamp can cause interference with the cover. Verify that the center plug has been removed.

6. Tighten backside fasteners (1) to 70-110 **in-lbs** (7.9-12.4 Nm).
7. Tighten lower Allen head fastener (4) to 120-180 **in-lbs** (Nm).
8. Verify that the brake line does not rub on cover. Adjust line or cover (3) as necessary.



1. **Backside fasteners**
2. **Washer**
3. **Lower triple clamp cover**
4. **Lower Allen head fastener**

Figure 2-11. Lower Triple Clamp Cover

REMOVAL/REPLACEMENT

1. Remove seat. See 2.18 SEAT.

⚠WARNING

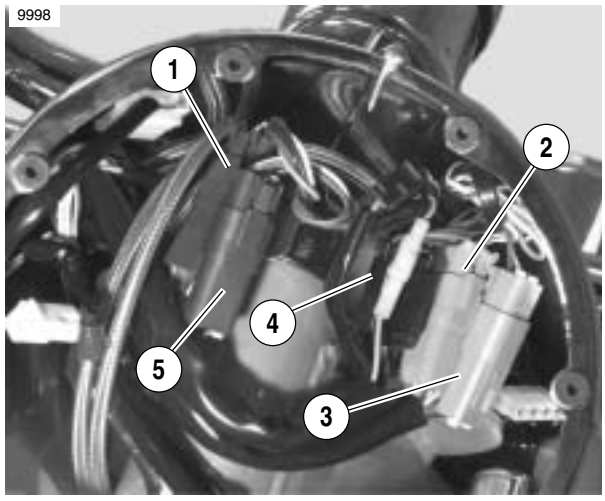
To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

2. Remove negative battery cable from battery.
3. Remove headlamp assembly. See HEADLAMP in 2003 Touring Models Service Manual.
4. See Figure 2-12. Separate connectors:
   a. Turn signal control connectors [22] and [24] (1, 2).
   b. Cruise control connectors [158] and [159] (3, 5).
   c. Turn signal lamp multilock connector [31] (4).
5. See Figure 2-13. Remove turn signal and cruise control socket side housings from socket terminal wires:
   a. Use a screw driver to pry out the secondary locking wedges (1). See DEUTSCH ELECTRICAL CONNECTORS in Touring Models Service Manual.
   b. See Figure 2-14. Depress internal terminal latches and pull socket terminals out of the wire seal.
6. See Figure 2-15. Remove turn signal lamp multilock connector from socket terminal (1) wires:
   a. Bend back latches (4) to open the secondary lock (2). See AMP MULTILOCK ELECTRICAL CONNECTORS in Touring Models Service Manual.
   b. Insert a pick (Snap-On TT600-3) into square half of terminal cavity until it stops.
   c. Pivot end of the pick (3) away from terminal and gently tug on socket wire until tang is released.
7. See Figure 2-19. Using mechanics wire, neatly wrap the socket terminals and wires with 1 or 2 twists to form leaders for turn signal and cruise control wires.
8. String wire along the turn signal lamp wire. String sufficient wire to pull conduits through handlebars.
9. Wrap with electrical tape from the open end of the conduit past the turn signal lamp sockets to form a leader.
10. Remove tachometer can and remove nacelle top trim. See 2.8 HEADLAMP NACELLE.
11. Loosen fastener but do not remove handlebar cover retaining nut and large washer inside nacelle.
12. Loosen but do not remove four acorn nuts to separate nacelle halves.

CAUTION

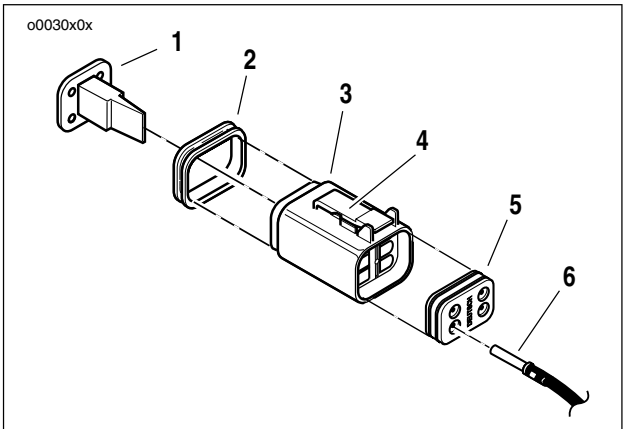
Wrap tachometer and case in shop towel to prevent damage to finish and lay them aside.

13. Remove handlebar cover with tachometer and bracket by lifting cover over handlebars and sliding cover and cover fastener forward between the nacelle halves.



1. **LH turn signal connector [22]**
2. **RH turn signal connector [24]**
3. **RH cruise control connector [159]**
4. **Turn signal multilock connector [31]**
5. **LH cruise control connector [158]**

Figure 2-12. Turn Signal and Cruise Switch Connectors



1. **Locking wedge**
2. **Internal seal**
3. **Socket housing**
4. **External latch**
5. **Wire seal**
6. **Socket terminal**

Figure 2-13. 4-place Deutsch Socket Side Connector

14. Remove right rear view mirror acorn nut, lock washer and mirror from bracket. Retain tapered spacer.

15. Remove left rear mirror acorn nut, lock washer and mirror from bracket. Retain tapered spacer.

NOTE

The turn signal wires enter the control housings through a relief grommet in the housing. The turn signal bullet housings and brackets must be supported throughout this procedure to prevent pulling the grommet or the turn signal wires out of the housing.

16. Shorten throttle and idle cable adjustors and pull idle and throttle cable inserts and elbows from switch housing.

17. Remove upper and lower fasteners holding right turn signal and cruise control housings to handlebars.

18. See Figure 2-16. Use a screwdriver to rotate cable ferrules in throttle grip notches. Remove cables from notches on inboard side of throttle grip and remove throttle grip from handlebar.

19. Remove the cables from the housing.

20. Protect chrome and painted surfaces and tie idle and throttle cables away from chrome and paint finishes. Maintain the routing of the cables.

21. See Figure 2-18. Insert a 5/32 in. (4 mm) cardboard between front brake lever and lever bracket.

22. Remove fasteners securing handlebar clamp to master cylinder and front brake lever.

CAUTION

See Figure 2-18. Do not remove the 5/32 in. (4 mm) cardboard insert 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.

23. Protect chrome and painted surfaces and tie the master cylinder, reservoir and brake line out of the way.

24. Remove upper and lower fasteners holding left turn signal and cruise control housings to handlebars.

25. Remove fasteners and washers securing the handlebar clamp to the clutch lever bracket.

26. Protect chrome and painted surfaces and tie the master cylinder, reservoir and clutch fluid line out of the way.

27. Pull the conduits and wire and tape wrapped socket terminals back out of the nacelle.

28. Remove upper handlebar clamps and lift handlebars, turn signal housings, and wire harness from motorcycle.

NOTE

If handlebar rubber mounts require service. See HANDLEBARS in the Touring Models Service Manual.

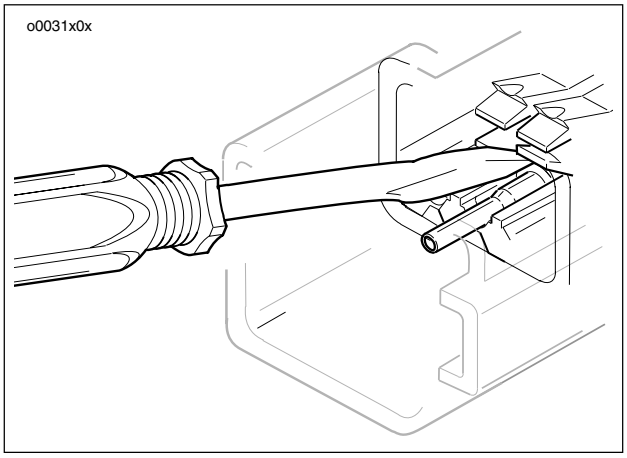
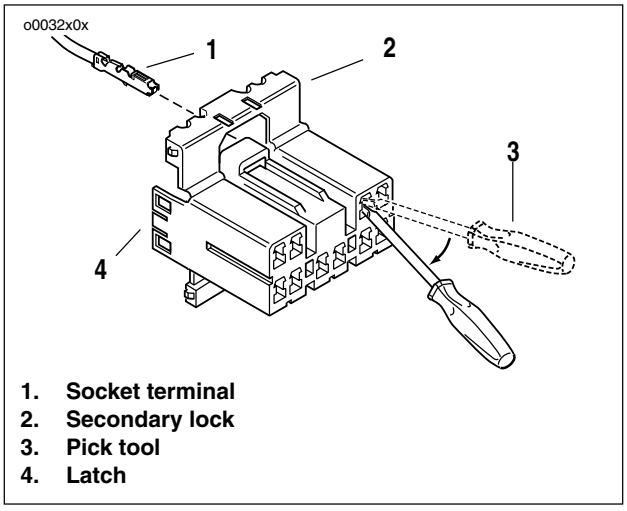


Figure 2-14. Internal Deutsch Terminal Latches



1. **Socket terminal**
2. **Secondary lock**
3. **Pick tool**
4. **Latch**

Figure 2-15. Multilock Socket Terminal Removal

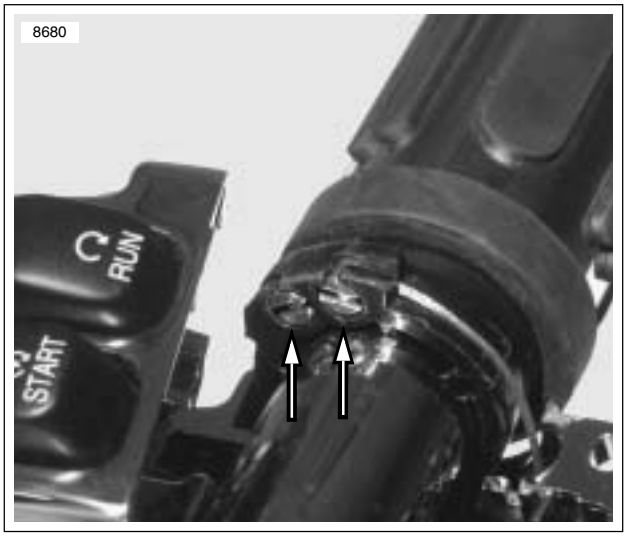
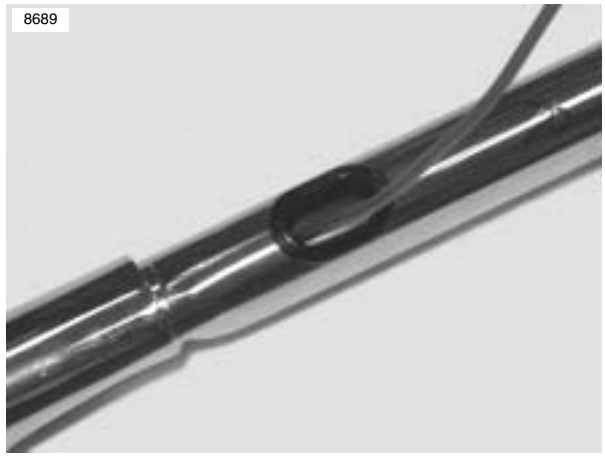


Figure 2-16. Throttle and Idle Cable Ferrules

29. Place handlebars and wiring on work bench.
30. Cut plastic tie.
31. See Figure 2-19. Lightly lubricate conduits and tape with glass cleaner then pull the left and right side wiring and conduits from the handgrip ends through the handlebar and handlebar grommets.
32. See Figure 2-20. If installing original handlebars, leave the wire leader in each handlebar half. If installing new bars, string wire leader through grommets on outside ends of bars and through the center hole.
33. If necessary to repair wires, unwrap the electrical tape and wire from the socket terminals.
34. Repair and replace switches and socket wires as necessary.

NOTE

For handlebar switch repair procedures, see HANDLEBAR SWITCHES in Touring Models Service Manual.



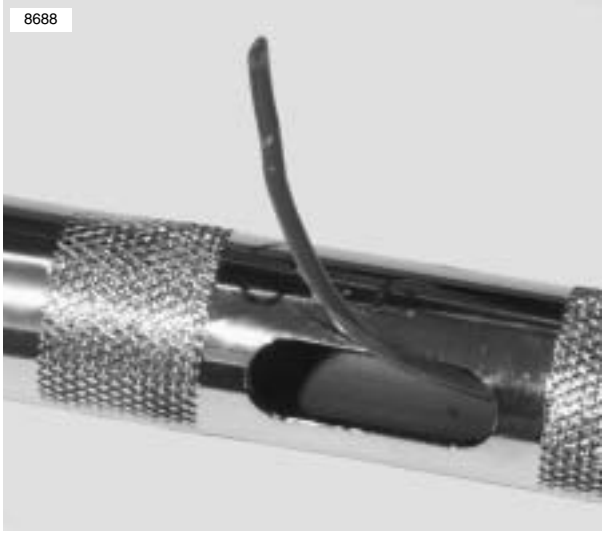
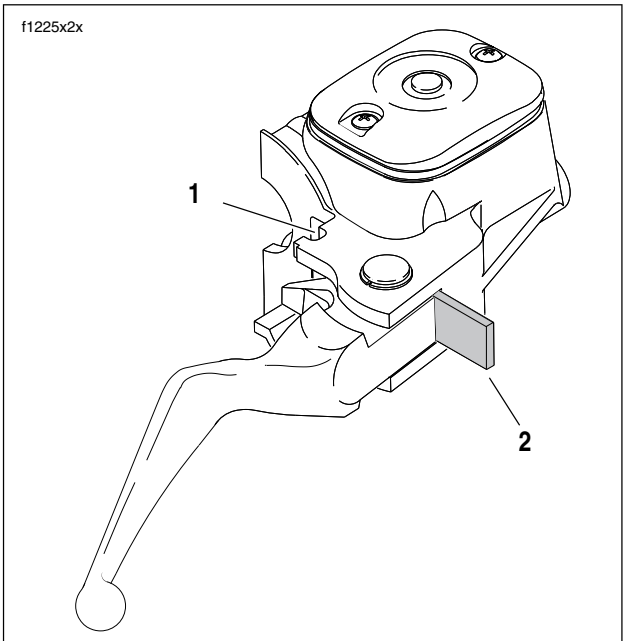


Figure 2-17. Wire Leader in Handlebars



1. Notch for switch housing
2. 5/32 in. (4 mm) cardboard

Figure 2-18. Cardboard Insert

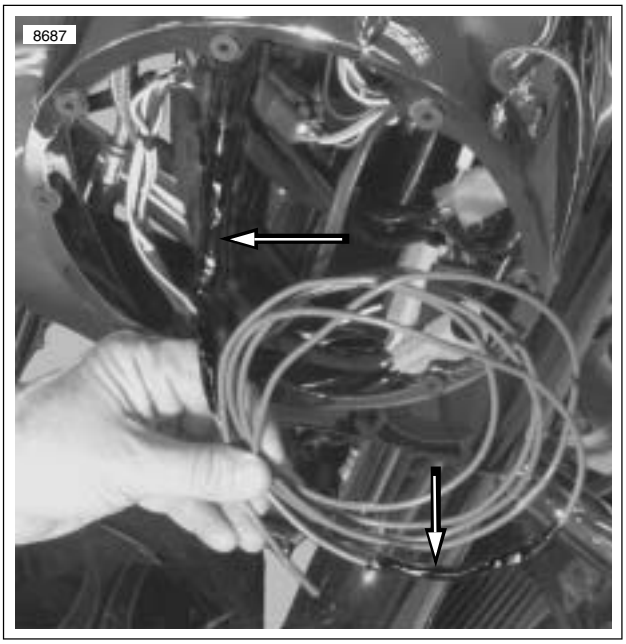


Figure 2-19. Mechanics Wire Leader (taped socket wires)

HANDGRIPS

NOTE

It is not necessary to remove the handlebars from the motorcycle to replace the handgrips. Remove the control levers and control housings according to the instructions in this section and replace the hand grips.

1. Replace right hand throttle grip. Slide throttle grip on in operating position.
2. Pry off end cap from left hand grip and using a sharp blade carefully cut rubber between metal sleeve until the metal sleeve can be pulled off the bars.
3. Clean left handlebar end.

NOTE

Before installing left hand grip, remove end cap to prevent trapping air.

⚠WARNING

FLAMMABLE, INJURIOUS TO EYES, HARMFUL IF SWALLOWED, VAPOR HARMFUL. FLAMMABLE: CONTAINS METHYL ETHYL KETONE. Use only in well ventilated areas. Avoid contact with eyes, mucous membranes, and prolonged skin contact. KEEP OUT OF REACH OF CHILDREN. If swallowed, do not induce vomiting. Call a physician immediately.

⚠WARNING

This product contains a chemical(s) known to the State of California to cause cancer or other reproductive harm.

4. Apply a coat of HARLEY-DAVIDSON ADHESIVE (Part No. 99839-95) to inside surface of **new** left hand grip at a point 1 in. (25.4 mm) from open end. Apply a coat of adhesive to handlebar end.
5. Immediately push grip completely onto the handlebar end. Install grip with a twisting motion while aligning the horizontal pattern on the left hand grip to the pattern on the right hand grip in the closed position.

NOTE

Do not hesitate when installing left grip or adhesive will dry before installation is complete. Allow 6-8 hours at 70° F (21° C) to achieve full cure of the adhesive.

6. Install end caps.

ASSEMBLY/INSTALLATION

1. See Figure 2-19. Using mechanics wire, neatly wrap the socket terminals and wires with a few twists to form leaders for turn signal and cruise control wires and conduit.

NOTE

If installing the original handle bars, use the wire end left in the handlebar half to wrap the socket terminals.

2. String wire along the turn signal lamp wire. String sufficient wire to pull conduits through handlebars.
3. See Figure 2-19. Wrap socket wires with electrical tape.

⚠WARNING

Without protective grommets around wire entry openings in handlebars, wires can rub against sharp metal edges of opening. A short or broken connection can cause loss of electrical control which can lead to death or serious injury.

4. Replace grommets on handlebar wire entry openings if necessary.
5. Lubricate wire conduits with glass cleaner. With the wire leader, pull wire bundles through grommets and handlebar to the handlebars center hole.
6. See Figure 2-20. Orient wires in housings. The right hand RUN and STOP wires (1) are wrapped over the front of the bars and back and into the handlebar through the grommet (3). The wires should be to the outside of the clamping post (5) inside the housing.
7. Loosely install left and right turn signal and cruise control housings.
8. Pull wire leaders and unwrap the tape and mechanics wire.
9. Cable wrap wire conduits at exit from handlebars.
10. See Figure 2-13. Fit wire seal (5) into back of Deutsch socket housings (3).
11. Insert wire color coded socket terminals into numbered chambers in socket housings:
    a. Hold socket terminal (6) 1 in. (25.4 mm) behind contact barrel.
    b. Gently push socket terminal (6) through hole in wire seal (5) into chamber until it “clicks” in place.
    c. Verify that socket will not back out of chamber. Tug on the wire to confirm that is locked.

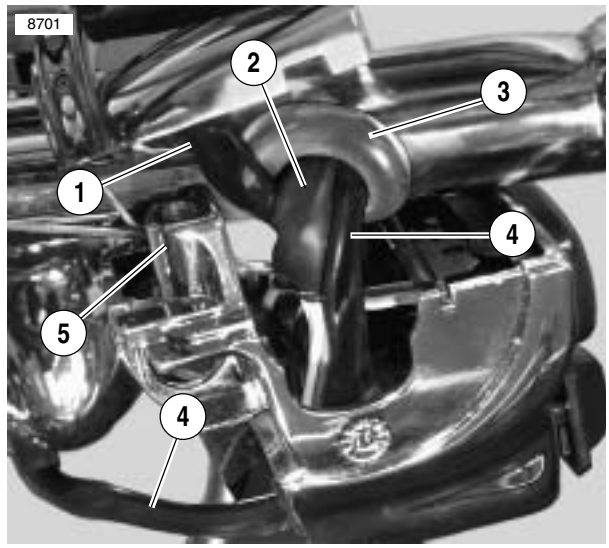
NOTE

An ELECTRICAL TERMINAL CRIMP TOOL (Part No. HD-39965) can be used to install Deutsch pin and socket terminals on wires.

12. Install internal seals (2) on lip of socket housings (3).
13. Snap tapered end of locking wedges (1) into socket housings (3).

NOTE

If the locking wedge does not snap into position, verify that all terminals are fully seated in the socket housing.



1. RUN/STOP switch wiring
2. Turn signal/cruise control wiring
3. Handlebar grommet
4. Turn signal lamp wiring
5. Clamping post

Figure 2-20. Wiring in Right Hand Control Housing

Table 2-5. Handlebar Deutsch Connectors

WIRE COLOR	CHAMBER NO.
RH Black Cruise Connector [159]	
Blue/Black (BE/BK)	3
White/Blue (W/BE)	2
Green/Red (GN/R)	1
LH Grey Cruise Connector [158]	
Black (BK)	4
Red/Green (R/GN)	1
LH Grey Turn Signal Connector [24]	
Orange/White (O/W)	1
Yellow (Y)	2
Blue (BE)	3
White (W)	4
White/Violet (W/V)	5
Yellow/Black (Y/BK)	6
RH Black Turn Signal Connector [22]	
Orange/White (O/W)	1
Red/Blue (R/BE)	2
Grey (GY)	3
White/Black (W/BK)	4
White/Brown (W/BN)	5
Black/Red (BK/R)	6

14. Repeat for right [22} and left hand turn signal [22, 24] and left and right hand cruise control connectors [158, 159]. See DEUTSCH ELECTRICAL CONNECTORS in Touring Models Service Manual.
15. Insert multilock socket terminals into corresponding numbered chambers of turn signal lamp multilock connector [32] until it snaps in place. The slot in terminal must face the tang in chamber.
16. Gently tug on wire ends to verify that all terminals are locked.

NOTE

An ELECTRICAL TERMINAL CRIMP TOOL (Part No. HD-41609) can be used to install multilock socket terminals on wires.

17. Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.

CAUTION

Improperly aligned handlebars can hit tank when turned lock to lock. Verify turning clearance before maneuvering or riding motorcycle.

18. Carry handlebars with supported turn signal bullets and control housings to the motorcycle.
19. Set handlebars on lower clamps and loosely install upper handle bar clamps and fasteners.

CAUTION

Never adjust handlebars using excessive force. Doing so may result in damage to handlebar.

NOTE

If handlebars are positioned for a rider of normal size, postpone adjustment until rider has checked their position. If customer requests changing handlebar position, perform the adjustment before delivering the motorcycle.

20. Center handlebars laterally (sideways) in clamps.
21. Snug front fasteners until upper clamp contacts lower clamps.
22. Position handlebars in normal rider posture.
23. Tighten fasteners in the following order:
    a. Rear fasteners - 12-16 ft-lbs (16.3-20.3 Nm).
    b. Front fasteners - 12-16 ft-lbs (16.3-20.3 Nm).
24. Thread wire harness conduits into headlamp nacelle.
25. Route conduits under brake line and clutch fluid line. See 2.12 FRONT BRAKE LINE and 2.15 CLUTCH FLUID LINE.
26. Push turn signal and cruise control Deutsch connectors into the pin side housings.
27. Push multilock connector halves together.
28. Slide handle bar cover through gap in separated nacelle halves over handlebar clamps. See 2.8 HEADLAMP NACELLE.

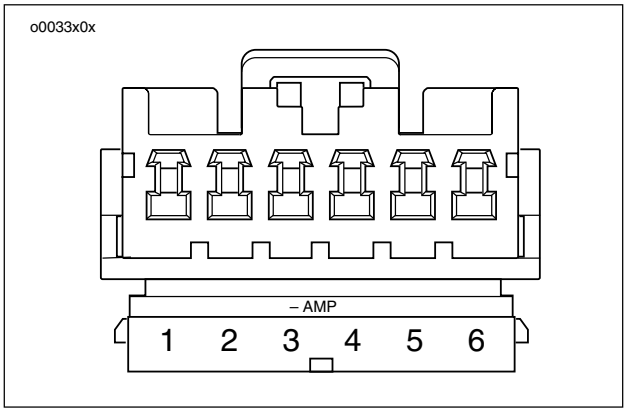


Figure 2-21. Numbered Terminal Chambers on 6-Place Multilock Connector [31]

Table 2-6. Handlebar Turn Signal Multilock [31]

HAND	WIRE COLOR	CHAMBER NO.
Left	Black (BK)	1
	Brown (BN)	2
	Blue (BE)	3
Right	Blue (BE)	4
	Violet (V)	5
	Black (BK)	6

29. Tighten nacelle acorn nuts to 72-108 **in-lbs** (8.2-12.2 Nm).

30. Tighten cover fastener to 10-20 **in-lbs** (1.2-2.2 Nm).

31. Hook top trim to cover and install fastener to nacelle. Tighten to 15-20 **in-lbs** (1.6-2.2 Nm).

32. Install tachometer can and tighten fastener to 10-20 **in-lbs** (1.2-2.2 Nm).

33. Remove loosely installed control housing fasteners.

34. Push throttle and idle control cable inserts into the lower switch housing.

NOTE

The smaller idle cable insert is gold while the larger throttle cable insert is silver. The inserts only fit their corresponding hole in the switch housing.

35. Slide throttle control grip onto handlebar until it bottoms. Pull grip back about 1/8 in. (3.2 mm).

36. Use a screw driver to rotate the barrels and fit the cables through the notches in the throttle control grip. Be sure the cables ride in the grooves of throttle control grip.

CAUTION

See Figure 2-18. Do not remove the 5/32 in. (4 mm) cardboard insert 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.

37. Assemble upper and lower control housing to handlebars and brake lever bracket.

    a. Position the upper switch housing so the wire conduit wraps around the outside of the handlebar and sets in the clearance at the bottom of handlebar.

    b. Verify that the wires will not be pinched when fasteners are tightened.

    c. Verify that throttle and idle control cables work freely.

    d. Install switch housing fasteners.

38. Loosely assemble handlebar clamp to front brake control lever bracket master cylinder and reservoir. Do not tighten.

    a. Engage the tab on the switch with notch at the top of the brake lever bracket.

    b. Alternately tighten housing and bracket fasteners until all components fit and the wires route without interference. The fasteners should be only snug.

    c. Verify housing and bracket clamp are tight against handgrip shoulder/edge of hand bar.

39. Remove cardboard insert between brake lever and bracket.

40. Position controls for rider posture and tighten fasteners:

    a. Control lever clamps beginning with the top fastener to 60-80 **in-lbs** (6.8-9.0 Nm). The gap, if any, must be at the clearance flat on the handlebar.

    b. Turn signal and cruise control housings beginning with the bottom fastener to 35-45 **in-lbs** (4-5 Nm). The rear gap, if any, should be tighter.

41. Loosely assemble clutch master cylinder/reservoir and clamp to handlebar. Alternately tighten the fasteners until the clamp is snug to the bracket.

42. Install left turn signal and cruise control housings.

    a. Position the upper switch housing so the wire conduit wraps around the front of the handlebar.

    b. Verify that the wires will not be pinched when fasteners are tightened.

    c. Position the upper switch housing so the wire conduit sets in the clearance at the bottom of handlebar and the upper harness will not be pinched when the fasteners are tightened.

    d. Engage lower switch housing tab with notch in the clutch master cylinder/reservoir.

43. Install but do not tighten switch housing fasteners.

44. Position controls for rider posture and tighten fasteners:

    a. Clutch master cylinder/reservoir clamp beginning with the top fastener to 60-80 **in-lbs** (6.8-9.0 Nm). The top gap, if any, must be at handlebar clearance.

    b. Turn signal and cruise control housings beginning with the bottom fastener to 35-45 **in-lbs** (4-5 Nm). The rear gap, if any, should be tighter.

CAUTION

Gently turn handlebars full right and full left while checking that turn signals do not contact and damage fuel tank. Raise handlebars to obtain clearance.

45. Verify routing of wire conduits, brake line and clutch fluid line. See 2.12 FRONT BRAKE LINE and 2.15 CLUTCH FLUID LINE.

46. See Figure 2-22. Install right rear view mirror stem through mirror spacer, the brake control lever bracket, and the turn signal bracket (2). Install lock washer (5) and acorn nut (6) on mirror stem.
47. Install left rear view mirror stem through tapered spacer, clutch master cylinder and turn signal bracket. Install lock washer and acorn nut.
48. With motorcycle upright and with front fork pointed straight ahead, adjust mirrors to clearly reflect area behind motorcycle.

NOTE

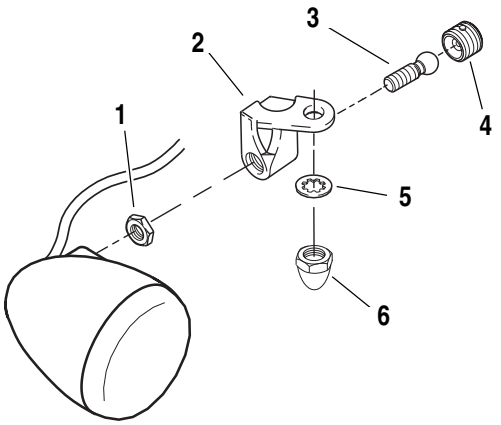
Adjust mirrors so a small portion of the rider's shoulder is visible in each mirror. This visually established the distance of vehicles to the rear of the motorcycle.

49. Tighten acorn nuts to 144 **in-lbs** (16.3 Nm).
50. If necessary, adjust turn signals. See 8.3 TURN SIGNALS.
51. Install headlamp assembly. See HEADLAMP in the Touring Models Service Manual.
52. Install headlamp door (chrome ring). The spring clip must be at the top of the headlamp door or 180° opposite the screw hole.
53. Connect negative battery cable to battery.

⚠WARNING

After installing the seat, pull upward on the front of the seat to be sure it is locked into position. If seat is loose, it could shift during operation, resulting in loss of control of the motorcycle and death or serious injury.

54. Install seat. See 2.18 SEAT.
55. Test clutch lever and front brake lever for pressure and operation.
56. Turn throttle and idle adjustors out.
57. Verify throttle and idle cable routing. Test for correct operation. Adjust as required. See CRUISE CONTROL in the Touring Models Service Manual.
58. Verify brake and clutch fluid line routing.
59. Turn the ignition/light key switch to IGNITION and test switches for proper operation.
60. Apply brake lever to test stop light lamp. Adjust as required.



1. **Jam nut**
2. **Bracket**
3. **Ball stud**
4. **Set screw**
5. **Lock washer**
6. **Acorn nut**

Figure 2-22. Right Turn Signal

CABLE ROUTING

1. See CRUISE CONTROL in the Touring Models Service Manual for removal and installation instructions to the throttle control grip.
2. Route the cables down underneath the brake line through the opening under the handlebars and shroud into the back of the nacelle.
3. Guide both cables over the top of the brake fluid line and the steering head.
4. See Figure 2-23. Loop the cables forward and back along the right side of the steering head.
5. See Figure 2-24. Capture the cables in the p-clamp on the side of the frame.
6. See CRUISE CONTROL in the Touring Models Service Manual for removal and installation instructions to the induction module side.
7. See Figure 2-25. Cable wrap the throttle and idle cables to the brake fluid line 3/4 inch (19 mm) below the crimped banjo fitting.

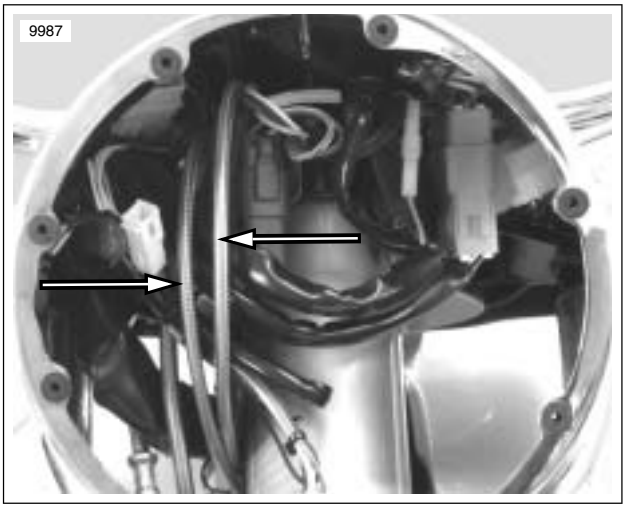


Figure 2-23. Looped Throttle and Idle Cables

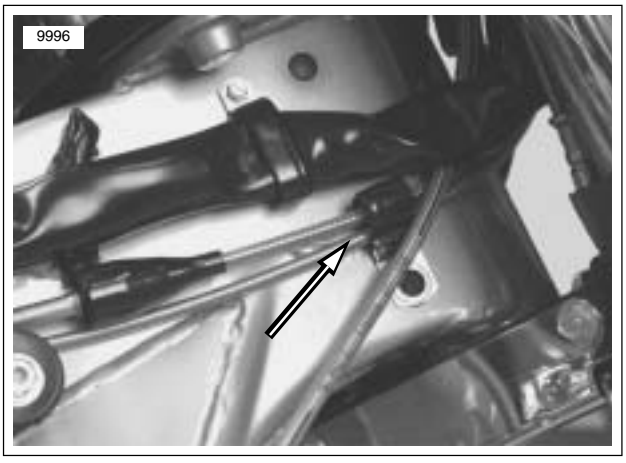
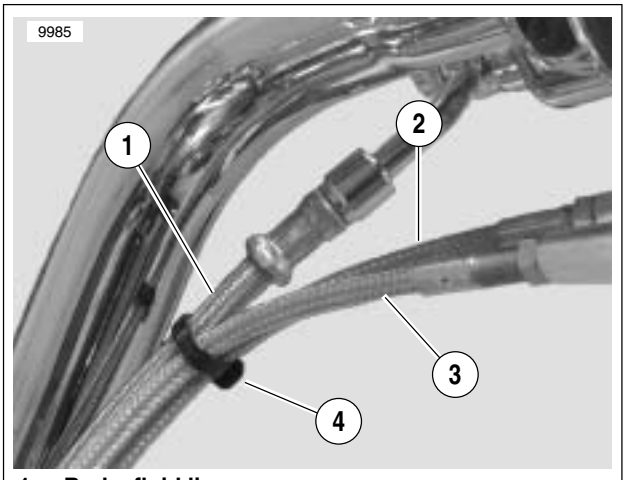


Figure 2-24. Cable Routing and P-clamp



1. **Brake fluid line**
2. **Throttle cable**
3. **Idle cable**
4. **Cable wrap (3/4 in. below banjo fitting)**

Figure 2-25. Cable Wrapped Cables and Brake Fluid Line

FRONT BRAKE LINE 2.12

REMOVAL

1. Place a suitable container under each brake caliper.

CAUTION

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

2. Remove caliper banjo bolts and steel/rubber washers to detach front brake line from calipers.
3. Allow brake fluid to drain and discard steel/rubber washers.
4. Place a suitable container under front brake master cylinder/reservoir.
5. Remove the banjo bolts and steel/rubber washers from the master cylinder/reservoir.
6. Allow brake fluid to drain and discard steel/rubber washers.

IMPORTANT NOTE

Dispose of brake fluid in accordance with local regulations.

7. Remove headlamp door and headlamp assembly. See HEADLAMP in the Touring Models Service Manual.
8. Cut cable wrap holding brake line to throttle and idle cables.
9. Remove the two fasteners on rear of lower triple tree cover and the single fastener underneath. Remove the cover.
10. Gently pull brake line down through the p-clamp that holds main wiring harness.
11. Remove brake line, manifold and two braided lines to calipers.

INSTALLATION

1. Gently thread single brake line along side in front of lower triple clamp.
2. See Figure 2-26. Route brake line behind the wire harness conduits on the left side of nacelle. Loop the line over the upper triple clamp and out the protected edge of the nacelle along side the throttle and idle control cables.

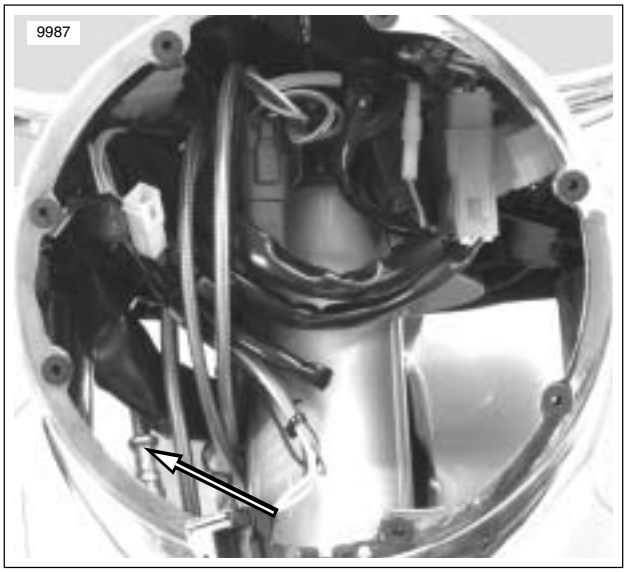


Figure 2-26. Brake Line through Nacelle

3. Position lower triple clamp cover over brake line manifold and loosely install all fasteners.
4. Install fasteners holding cover and manifold to lower triple clamp and tighten in sequence. See 2.9 LOWER TRIPLE CLAMP COVER.

CAUTION

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

5. Lubricate **new** steel/rubber washers with D.O.T. 5 SILICONE BRAKEFLUID. Install banjo bolt with lubricated steel/rubber washers at master cylinder/reservoir.
6. Cable wrap brake line to throttle and idle control cables. See 2.11 THROTTLE CABLE.
7. Lubricate **new** steel/rubber washers with D.O.T. 5 SILICONE BRAKE FLUID. Install caliper banjo bolts with lubricated steel/rubber washers at each caliper. Tighten to 17-22 ft-lbs (23-29 Nm).
8. Remove cover from master cylinder/reservoir. Fill master cylinder with D.O.T. 5 SILICONE BRAKE FLUID. Verify that fluid level is 1/8 in. (3.2 mm) below top of reservoir with master cylinder level.

⚠WARNING

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

9. Bleed brake system. See BLEEDING HYDRAULIC BRAKE SYSTEM in the Touring Models Service Manual.

⚠WARNING

Verify proper operation of the master cylinder relief port. 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.

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

11. Install gasket and cover on master cylinder. Tighten cover screws to 6-8 **in-lbs** (0.7-0.9 Nm).

⚠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.

12. Test brake system.

    a. Turn ignition switch ON. Pump brake hand lever to verify operation of the brake lamp.

    b. Test ride motorcycle. If brakes feel spongy, bleed the system again. See BLEEDING HYDRAULIC BRAKE SYSTEM in the Touring Models Service Manual.

CLUTCH MASTER CYLINDER/RESERVOIR 2.13

GENERAL

The clutch is hydraulically actuated. Squeezing the clutch hand lever causes the clutch master cylinder to apply pressure via the clutch fluid in the clutch line to the secondary clutch actuator mounted in the clutch release cover. The secondary clutch actuator piston extends and contacts the clutch release bearing which disengages the clutch.

A bleeder valve at the secondary clutch actuator is used to bleed air from the clutch line. D.O.T. 5 SILICONE BRAKE FLUID is used in the clutch system.

Check the clutch fluid level in the clutch fluid reservoir on left handlebar. If the sight gauge is dark, the fluid level in the reservoir is above the sight gauge prism and the reservoir is full. If the sight gauge appears clear, the fluid level is below the sight gauge prism and the fluid level should be checked. Clutch fluid should be level with the internal shelf marked FILL LEVEL with the motorcycle upright and the gasket surface level.

CAUTION

D.O.T. 5 SILICONE BRAKE FLUID is used for the hydraulic clutch and is referred to as clutch fluid in this manual. Do not use other types of fluid as they are not compatible.

CAUTION

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

REMOVAL

1. Remove acorn nut, washer and rear view mirror with tapered spacer. Support turn sign bullet housing and bracket.
2. Remove electrical controls.

CAUTION

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

3. See Figure 2-27. Loosen, but do not remove, screws (10) with flat washers (9) that detach handlebar clamp (8) from clutch master cylinder/reservoir.
4. Loosen both screws (3) on cover (1) to relieve pressure in master cylinder reservoir.

⚠WARNING

Be sure NO clutch fluid gets on tires, wheels, or brakes when draining clutch fluid. Traction will be adversely affected which could result in loss of control of the motorcycle and death or serious injury.

NOTE

Place a large cup under the banjo fitting. Hydraulic fluid will begin draining from the reservoir as the banjo bolt is removed.

CAUTION

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

5. Slowly loosen banjo bolt (6) and allow clutch fluid from reservoir to drain into cup.

IMPORTANT NOTE

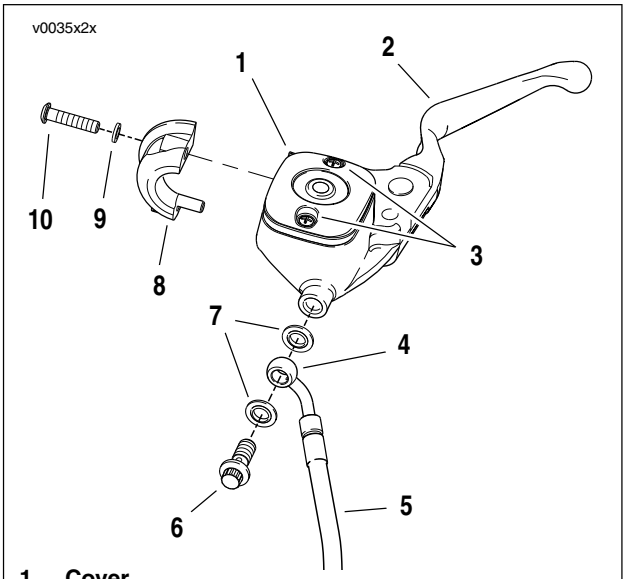
Dispose of clutch fluid in accordance with local regulations.

6. Remove banjo bolt (6) and two steel/rubber washers (7) to disconnect fitting of hydraulic clutch fluid line (5) from clutch reservoir and master cylinder. Discard steel/rubber washers.

NOTE

To prevent the rest of the clutch fluid from draining from the clutch line and secondary clutch actuator, support the banjo fitting and clutch fluid line upright. Plug the banjo bolt hole with a finger to transfer the assembly to a workbench without spilling clutch fluid.

7. Remove handlebar clamp screws and take clamp and clutch master cylinder/reservoir assembly to a workbench.



1. **Cover**
2. **Clutch hand lever**
3. **Cover hold down screws**
4. **Banjo fitting**
5. **Clutch fluid line**
6. **Banjo bolt**
7. **Steel/rubber washers**
8. **Handlebar clamp**
9. **Washer**
10. **Clamp screw**

Figure 2-27. Clutch Master Cylinder/Reservoir

DISASSEMBLY

CAUTION

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

1. Drain additional clutch fluid from master cylinder/reservoir.
2. Remove screws securing master cylinder cover. Remove cover and gasket. Turn housing upside down to remove remaining clutch fluid from reservoir.

⚠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 could propel the ring with force which could cause death or serious injury.

3. Remove retaining ring from pivot pin groove.

NOTE

To take the piston spring load off the pin and remove the pivot pin, gently force the clutch lever toward the piston (as if operating the clutch).

4. Remove pivot pin through top of housing. Remove and save pivot pin and clutch lever.
5. See Figure 2-28. Using a toothpick or small screwdriver, gently pry outer edge of piston boot (1) out of piston bore.
6. Remove piston (2) and spring (4).

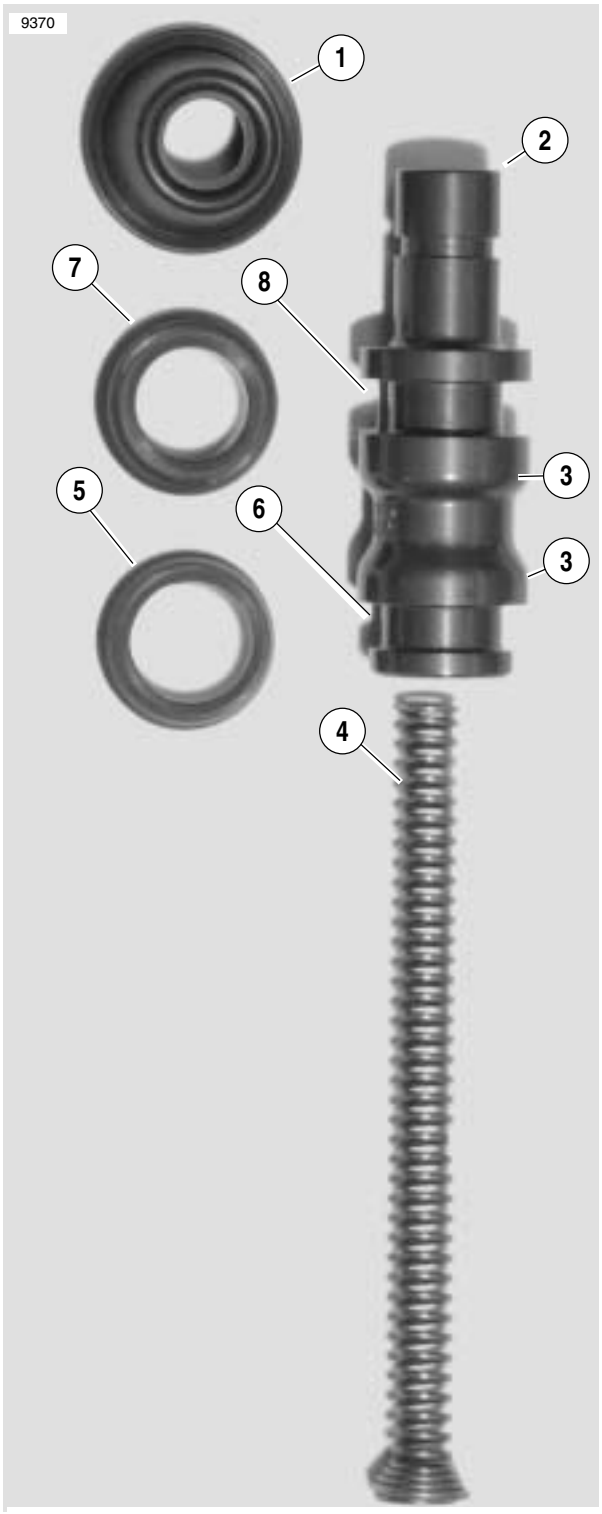
⚠WARNING

Always use denatured alcohol or D.O.T. 5 SILICONE BRAKE FLUID to clean clutch system components. Do not use mineral base solvents (such as gasoline or paint thinner) or deterioration of rubber parts may occur after assembly. Deterioration of components may result in premature brake failure and death or serious injury. Wipe the housing with a lint free cloth. With a clean air supply, blow out drilled passages and bore in the master cylinder housing.

NOTE

Do not use a wire or sharp instrument to clean drilled oil passages.

7. Inspect cylinder housing bore for scoring, pitting or corrosion. Also check outlet port for damage. Replace housing if necessary.
8. Inspect the cover, sight glass, and gasket for cuts, tears or general deterioration.



1. **Boot**
2. **Piston**
3. **Shoulder**
4. **Spring**
5. **Primary cup**
6. **Groove - primary cup**
7. **Secondary cup**
8. **Groove - secondary cup**

Figure 2-28. Clutch Master Cylinder Components

ASSEMBLY

To rebuild clutch master cylinder, use the components found in the SERVICE PARTS KIT No. 46244-01.

1. See Figure 2-28. Lightly lubricate inside of primary cup (5) and fit over lip on spring end of piston (2) so the closed end (small ID) contacts evenly with the shoulder (3) in primary cup grove (6).
2. Lightly lubricate inside of secondary cup (steep taper from center to outside diameter) (7) and fit over the lip on outboard end of piston (2) so that flared end is open toward the shoulder (3) of the secondary cup groove (8).
3. Install boot (1), large sealing ID first, on piston (2) until seal on smaller ID fits snugly into thin groove in piston.

NOTE

See Figure 2-29. The flared ends of the primary cup (3) and the secondary cup (2) face the spring end of the piston.

4. Using lubricant in SERVICE PARTS KIT (Part No. 46244-01) thoroughly coat outside diameters of primary and secondary cups. Coat master cylinder piston bore.
5. With tapered end out, install spring (4) into opening on inboard side of piston assembly.
6. Align and install piston assembly into bore. Firmly press on flat end of piston, compressing spring, until the entire assembly slides into cylinder bore.

NOTE

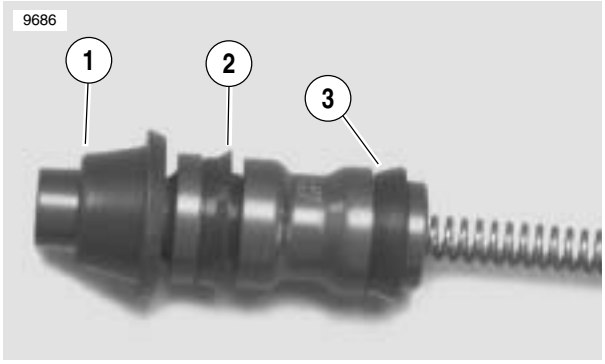
When fitting the piston sealing boot, be careful not to tear, perforate or damage the piston sealing boot.

7. Compress piston until it is even with the end of bore. Using a small dull bladed screwdriver or similar tool, gently work around sealing edges of boot until entire circumference of boot is seated in cylinder bore groove.
8. If cover 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 lubrication is necessary, use clean D.O.T. 5 SILICONE BRAKE FLUID.
9. Install cover with gasket on master cylinder reservoir. Install two screws to fasten the cover to reservoir, but do not tighten.

⚠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 could propel the ring with force which could cause death or serious injury.

10. To install existing clutch hand lever, install clutch hand lever, pivot pin, and a **new** retaining ring.
11. To install a replacement clutch hand lever, use SERVICE PARTS KIT No. 46243-01. See 2.14 CLUTCH HAND LEVER.



1. **Boot in piston groove**
2. **Secondary cup flare**
3. **Primary cup**

Figure 2-29. Assembled Cups and Piston

INSTALLATION

1. See Figure 2-27. Attach master cylinder/reservoir to handlebars with handlebar clamp (8). Orient lever to rider position and tighten two clamp screws (10).
2. Attach banjo fitting (4) of clutch fluid line to master cylinder with **new** steel/rubber washers. Install electrical controls.
3. Loosen bleeder valve on clutch release cover. See 7.4 CLUTCH RELEASE COVER.
4. Fill reservoir with D.O.T. 5 SILICONE BRAKE FLUID. Allow fluid to fill clutch line until a steady flow of clutch fluid flows from bleeder valve. Finger tighten bleeder valve.
5. Bleed clutch line. See BLEEDING CLUTCH FLUID LINE.
6. Verify that fluid level in clutch fluid reservoir is at FILL LEVEL with motorcycle upright and gasket surface level.

CAUTION

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

7. Verify pressure by squeezing clutch hand lever.
8. Tighten fasteners as follows:
   a. Banjo bolt (6) to 17-22 ft-lbs (23-31 Nm).
   b. Bleeder screw to 80-100 **in-lbs (**9-11 Nm).
   c. Reservoir cover screws to 6-8 **in-lbs (**0.7-0.9 Nm).
9. Install rear view mirror and turn signals with bracket. See 8.3 TURN SIGNALS.

⚠WARNING

Check for proper turn signal lamp operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper lamp operation could result in death or serious injury.

10. Test ride motorcycle.

INSTALLATION

1. See Figure 2-30. Slide bushing cups onto pins of roller with cup flanges against roller.

NOTE

Be careful when handling the bushing cups. The bushing cups are hard plastic and can be easily broken.

2. With connector bow (3) portion of the bushing cups parallel with groove in clutch handle, snap roller (4) pin with the bushing cups installed into clutch lever roller groove. If bushing is positioned correctly, roller/bushing assembly will install with a snap and will be held securely.

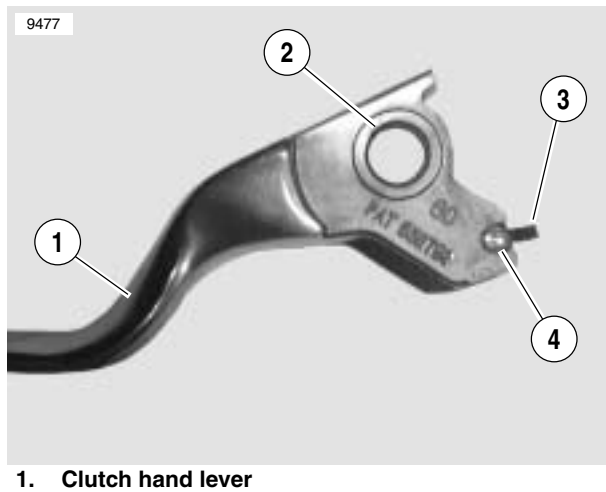
3. Lightly grease pivot bushing (2) and install into clutch hand lever (1) pivot hole. Position bushing until it is flush with both sides of lever.

NOTE

If the clutch master cylinder/reservoir is full of clutch fluid under pressure, it may be necessary to apply force to the hydraulic piston (in the clutch hand lever mount) in order to align the clutch hand lever and to allow the pivot pin to be inserted.

4. Orient clutch lever in lever mounting bracket. Insert pivot pin from top and tap into place.

5. Install **new** retaining ring on pivot pin.



1. Clutch hand lever
2. Pivot bushing
3. Bushing cups connector bow
4. Roller pin

Figure 2-30. Clutch Hand Lever

REPLACEMENT

1. Remove the headlamp door (chrome ring) and headlamp assembly.

⚠WARNING

Be sure NO clutch fluid gets on rear tire, wheel or brakes when draining clutch fluid. Traction will be adversely affected which could result in loss of control of the motorcycle and death or serious injury.

2. See Figure 2-32. Place a suitable container under clutch release cover.
3. Loosen the clutch master cylinder/reservoir cover.
4. Loosen flare nut and allow clutch fluid to drain.
5. Remove flare nut on outside of the clutch release cover.
6. Drain clutch fluid line.

IMPORTANT NOTE

Dispose of clutch fluid in accordance with local regulations.

7. See Figure 2-33. Remove and discard o-ring.

NOTE

Clutch fluid line o-ring may stick to inside of clutch release cover. Use a pick to remove old o-ring and other debris.

8. Remove banjo bolt and two steel/rubber washers to disconnect fitting of hydraulic clutch fluid line from clutch reservoir and master cylinder. Discard washers.
9. Carefully pull banjo bolt end of clutch fluid line steering head and out through nacelle.
10. See Figure 2-31. Route **new** clutch fluid line back through nacelle retracing path of old.
11. Loosely install banjo bolt and tie free end away from chrome and painted surfaces.
12. See Figure 2-35. Cut cable wraps around old clutch fluid line along left frame down tube and behind cam cover around the rear brake line in front of the clamp.
13. Remove old clutch fluid line.
14. Route **new** clutch fluid line down right from frame tube, under cam cover and up to clutch release cover. See CLUTCH FLUID LINE ROUTING.
15. See Figure 2-33. Install **new** o-ring on end of clutch fluid line.
16. Thread in and finger tighten flare nut fastening clutch fluid line to clutch release cover.
17. Attach banjo fitting of the clutch fluid line to master cylinder with **new** steel/rubber washers.
18. Cable wrap clutch fluid line in original two places on right front down tube and behind cam cover around the rear brake line in front of the clamp.
19. Install headlamp assembly. See HEADLAMP in the Touring Models Service Manual.

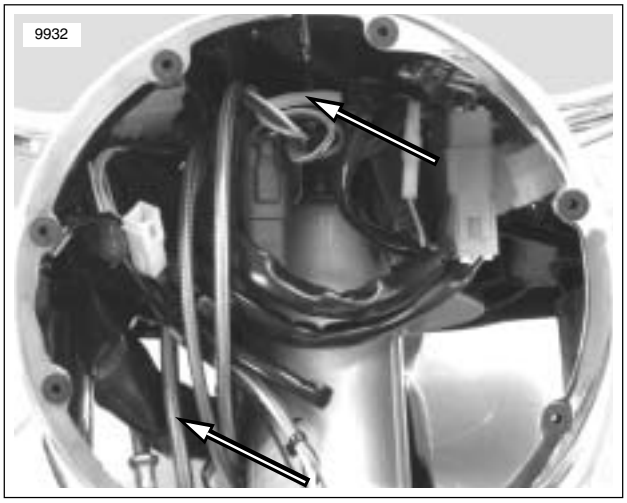
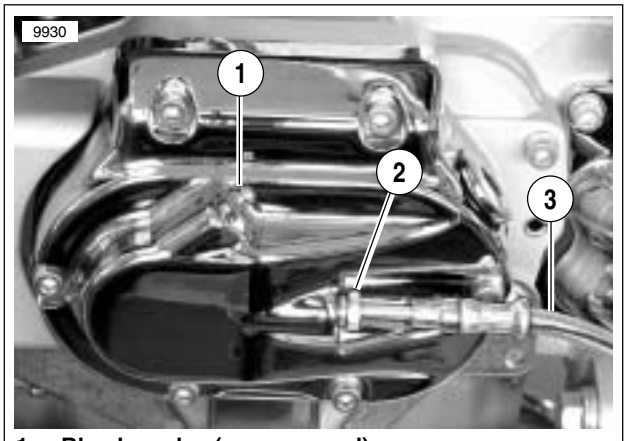


Figure 2-31. Clutch Fluid Line through Nacelle



1. **Bleeder valve (cap removed)**
2. **Flare nut**
3. **Clutch fluid line**

Figure 2-32. Clutch Release Cover (exhaust system removed)

20. Install headlamp door (chrome ring). The spring clip must be at the top of the headlamp door or 180° opposite the screw hole.

⚠WARNING

Be sure NO clutch fluid gets on tires, wheels or brakes when adding clutch fluid. Traction will be adversely affected which could result in loss of control of the motorcycle and death or serious injury.

⚠WARNING

Do NOT allow foreign matter to enter the clutch master cylinder reservoir. Dirt or debris in the reservoir may cause improper operation of the clutch and equipment damage which could result in death or serious injury.

⚠WARNING

Direct contact of D.O.T. 5 SILICONE BRAKE FLUID with eyes may cause eye irritation, swelling, and redness. Avoid eye contact. In case of eye contact flush with large amounts of water and seek medical attention immediately. Swallowing large amounts of D.O.T. 5 SILICONE BRAKE FLUID may cause digestive discomfort. If swallowed, seek medical attention immediately. Use in well ventilated area. KEEP OUT OF REACH OF CHILDREN.

21. Loosen bleeder valve.
22. Remove clutch master cylinder/reservoir cover and fill reservoir with D.O.T. 5 SILICONE BRAKE FLUID. Allow fluid to fill clutch line until a steady flow of clutch fluid flows from bleeder screw. Finger tighten bleed screw.

NOTE

A Snap-on BASIC VACUUM BRAKE BLEEDER with a fitting that mates to the bleeder valve can be used to draw the fluid down the clutch line.

23. Bleed clutch fluid line. See BLEEDING CLUTCH FLUID LINE.

CAUTION

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

24. Verify that fluid level in clutch fluid reservoir is at FILL LEVEL with motorcycle upright and gasket surface level.
25. Test pressure by squeezing clutch hand lever.
26. Tighten fasteners as follows:
    a. Clutch fluid reservoir banjo bolt to 17-22 ft-lbs (23-31 Nm).
    b. Clutch line flare nut to 80-115 **in-lbs (**9-13 Nm**).**
    c. Actuator bleeder valve to 80-100 **in-lbs (**9-11 Nm).
    d. Reservoir cover screws to 6-8 **in-lbs (**0.7-0.9 Nm).
27. Test ride motorcycle. Incorrect pressure or fluid lever can cause:
    a. Dragging clutch.
    b. Hard shifting.



Figure 2-33. Clutch Fluid Line O-ring

CLUTCH FLUID LINE ROUTING

1. Remove headlamp assembly. See HEADLAMP in 2003 Touring Models Service Manual.
2. Route clutch fluid line:
   a. Route line through the protected edge of the left side of the nacelle.
   b. See Figure 2-31. Route line around top of steering head and back out the right side of nacelle passing to the inside of main wire harness conduit.
   c. Run line behind engine guard and in front of right frame downtube.
   d. Run line behind foot controls bracket.
   e. Following inboard side of frame downtube, route cable between bottom of cam cover and top of lower frame tube.
   f. See Figure 2-35. Line is cable wrapped at three locations. Two on the right front downtube and one along rear brake line just in front of main wire harness conduit.
   g. Route line up to clutch release cover.
3. See Figure 2-34. Cable wrap clutch fluid line at two locations around right frame downtube.
4. See Figure 2-35. Cable wrap clutch fluid line once around rear brake line running along lower frame rail.
5. Install headlamp assembly. See HEADLAMP in the Touring Models Service Manual.
6. Install headlamp door (chrome ring). The spring clip must be at the top of the headlamp door 180° opposite the screw hole.

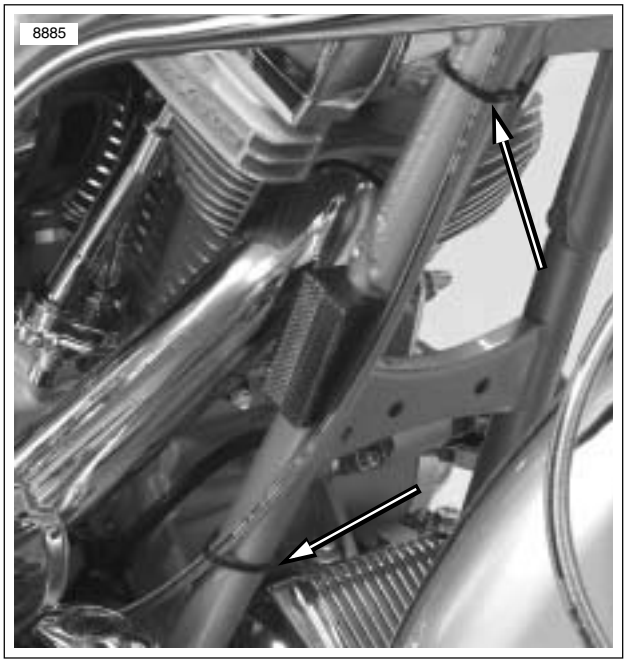


Figure 2-34. Cable Wrap Locations on Frame Down Tube



Figure 2-35. Cable Wrap Location around Brake Line

BLEEDING CLUTCH FLUID LINE

⚠WARNING

Be sure NO clutch fluid gets on tires, wheels or brakes when adding clutch fluid. Traction will be adversely affected which could result in loss of control of the motorcycle and death or serious injury.

⚠WARNING

Do NOT allow foreign matter to enter the clutch master cylinder reservoir. Dirt or debris in the reservoir may cause improper operation of the clutch and equipment damage. This could result in loss of control of the motorcycle and death or serious injury.

⚠WARNING

Direct contact of D.O.T. 5 SILICONE BRAKE FLUID with eyes may cause eye irritation, swelling, and redness. Avoid eye contact. In case of eye contact flush with large amounts of water and seek medical attention immediately. Swallowing large amounts of D.O.T. 5 SILICONE BRAKE FLUID may cause digestive discomfort. If swallowed, seek medical attention immediately. Use in well ventilated area. KEEP OUT OF REACH OF CHILDREN.

NOTE

When filling an empty clutch fluid line, a Snap-on BASIC VACUUM BRAKE BLEEDER with a fitting that mates to the secondary clutch actuator bleeder valve can be used to initially draw the fluid down the clutch line.

1. Stand motorcycle upright and turn handlebars right lock as required to level clutch reservoir. Remove reservoir cover.

CAUTION

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

2. If necessary, add D.O.T. 5 SILICONE BRAKE FLUID, (HD-99902-77) to master cylinder reservoir. Initial fluid level should not exceed FILL LEVEL with reservoir level.

⚠CAUTION

Loosen banjo bolt only enough to allow air bubbles to escape. Clutch fluid under pressure can squirt a steady stream several feet.

3. While holding reservoir cover in place:
   a. Pump clutch hand lever 5 times.
   b. Hold clutch hand lever against handlebar.
   c. Hold shop towel under fitting and loosen banjo bolt.
   d. Watch banjo fitting for air bubbles.
   e. Retighten banjo fitting.
   f. Release hand lever.
4. Fill reservoir to FILL LEVEL and repeat the previous step three times or more until only a steady flow of clutch fluid escapes banjo fitting and fluid level in reservoir is at FILL LEVEL with motorcycle in an upright position.
5. Cover exhaust with towel and place a suitable pan under clutch release cover to catch excess clutch fluid.

IMPORTANT NOTE

Dispose of clutch fluid in accordance with local regulations.

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

CAUTION

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

8. Test pressure by squeezing clutch hand lever.
9. Tighten fasteners as follows:
   a. Clutch fluid reservoir banjo bolt to 17-22 ft-lbs (23-31 Nm).
   b. Clutch line flare nut to 80-115 **in-lbs (**9-13 Nm**).**
   c. Actuator bleeder valve to 80-100 **in-lbs (**9-11 Nm).
   d. Reservoir cover screws to 6-8 **in-lbs (**0.7-0.9 Nm).
10. Replace cap on actuator bleeder valve.
11. Test ride motorcycle. Incorrect pressure or fluid level can cause:
    a. Dragging clutch.
    b. Hard shifting.

GENERAL

The FLHRSEI[2] motorcycle is equipped with air-adjustable rear suspension. Lower pressures give a softer ride while higher pressures give a firmer ride.

For rear shock air suspension removal and installation instructions, see REAR AIR SUSPENSION in Touring Models Service Manual.

ADJUSTMENT

PART NO.	SPECIALTY TOOL
HD-34633	Air suspension pump and gauge

CAUTION

Pressure in air shocks should be checked weekly if in daily use or before each trip if used occasionally. Failure to do so may result in component damage.

1. Support motorcycle on jiffy stand.

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

Use a no-loss air gauge to check air pressure. A small hand pump is the best way to add air to suspension components. Failure to do so may result in damage to components.

2. See Figure 2-36. Remove valve cap.
3. Using AIR SUSPENSION PUMP AND GAUGE (HD-34633), add 3-5 psi before checking air pressure at air valve.

⚠WARNING

Exercise caution when bleeding air from the air valves. Moisture combined with lubricant (either from shock assembly or a drip oiler in the air compressor lines) may be ejected onto the rear wheel, tire and/or brake components. Failure to exercise caution may adversely affect traction and could result in death or serious injury.

4. Refer to Table 2-7. Release air from gauge air valve as required to meet specifications.

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. Do not exceed maximum air pressure of 50 psi (345 kPa) for rear suspension. Air components fill rapidly; therefore, use low air line pressure. Failure to do so may result in possible damage to components.

5. Using AIR SUSPENSION PUMP AND GAUGE (HD-34633), fill air valve with air as required to meet specifications.
6. Install valve cap.

Table 2-7. Air Suspension Recommended Pressures

LOAD	PRESSURE	
	PSI	kPa
Solo rider up to 160 lbs (73 kg)	0-5	0-34.5
Solo rider 160-200 lbs (73-91 kg)	0-10	0-68.9
Solo rider over 200 lbs (91 kg)	5-10	34.5-68.9
Average rider with passenger up to 150 lbs (68 kg)	20-30	137.9-206.8
Average rider with passenger over 150 lbs (68 kg)	25-35	172.0-241.3
Max GVWR	40-50	276.7-345.0

NOTES

- *Do not exceed the max GVWR.*
- *Always clear the line by adding 3-5 psi before releasing air from the pump's valve, but do not exceed 50 psi.*
- *The pressures listed in Table 2-7. are recommended starting points. Adjust the air pressure to suit load conditions, riding style and comfort.*

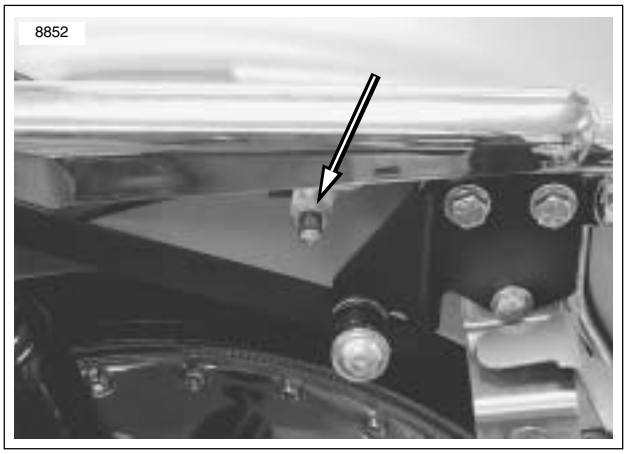


Figure 2-36. Rear Suspension Air Valve

WIND DEFLECTOR 2.17

REMOVAL

1. See Figure 2-37. Standing in front of the motorcycle, use a finger to raise the wireform latch springs on each side of the wind deflector.
2. Gently pull on the top of the wind deflector until the upper notches on the side brackets are free of the rubber grommets.
3. Raise the wind deflector until the lower notches in the adjusting brackets are free of the lower grommets.

DISASSEMBLY/CLEANING

1. See Figure 2-38. Remove fasteners holding outer vertical braces (5) to wind deflector (1) and right and left adjusting brackets (10, 15).
2. Remove fasteners (6) holding outer horizontal brace (3) to wind deflector (1) and inner horizontal brace (14).
3. Remove fasteners holding wireform spring latches (12) to right and left adjusting brackets (10, 15).
4. To remove the rubber grommets from the headlamp nacelle, remove the acorn nuts and washers.

CAUTION

Do not clean Lexan® in hot sun or high temperature.

- **Powdered, abrasive or alkaline cleanser will damage the windshield.**
- **Never scrape the windshield with a razor blade or other sharp instruments.**
- **Do not use liquid windshield "protectors" on your windshield. Use only HARLEY GLAZE POLISH AND SEALANT ® (Part No. 99701-84).**
- **Do not use benzine, paint thinner, gasoline, or other harsh cleaning agents.**

CAUTION

Do not use harsh chemicals including rain sheeting products on Harley-Davidson windshields. They may cause dulling or hazing. If you want to use a windshield protectant on your windshield, try HARLEY GLAZE POLISH AND SEALANT® (Part No. 99701-84).

5. Use mild soap and warm water to wash the wind deflector. Wipe dray with a soft, clean towel.

To remove minor surface scratches, use NOVUS® No. 2 Scratch Remover (Part No. 99836-94T).

ASSEMBLY

1. See Figure 2-38. Attach the wireform spring latches (12) to the right and left adjusting brackets (10, 15) with fasteners (4), washers (9) and acorn nuts (8).
2. Assemble the wind deflector (1), the inner and outer horizontal tape (2, 16) and the inner and outer horizontal brace (3, 14).

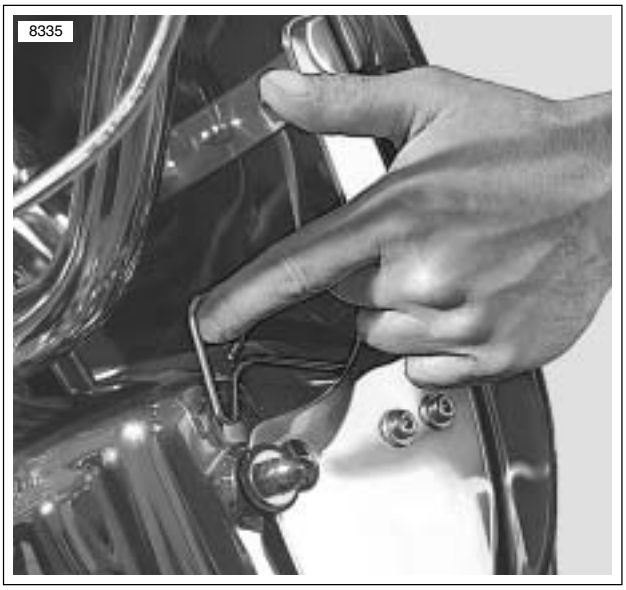


Figure 2-37. Removing/Installing Wind Deflector

3. Assemble the vertical brace tape (7), the outer vertical braces (5) and the wind deflector (1) to the right and left adjusting brackets (10, 15). Tighten all the fasteners (6, 4).

CAUTION

Do not use benzine, paint thinner, gasoline, lubricants (including Armorall), or other cleaning agents on the rubber grommets. They will damage the grommets.

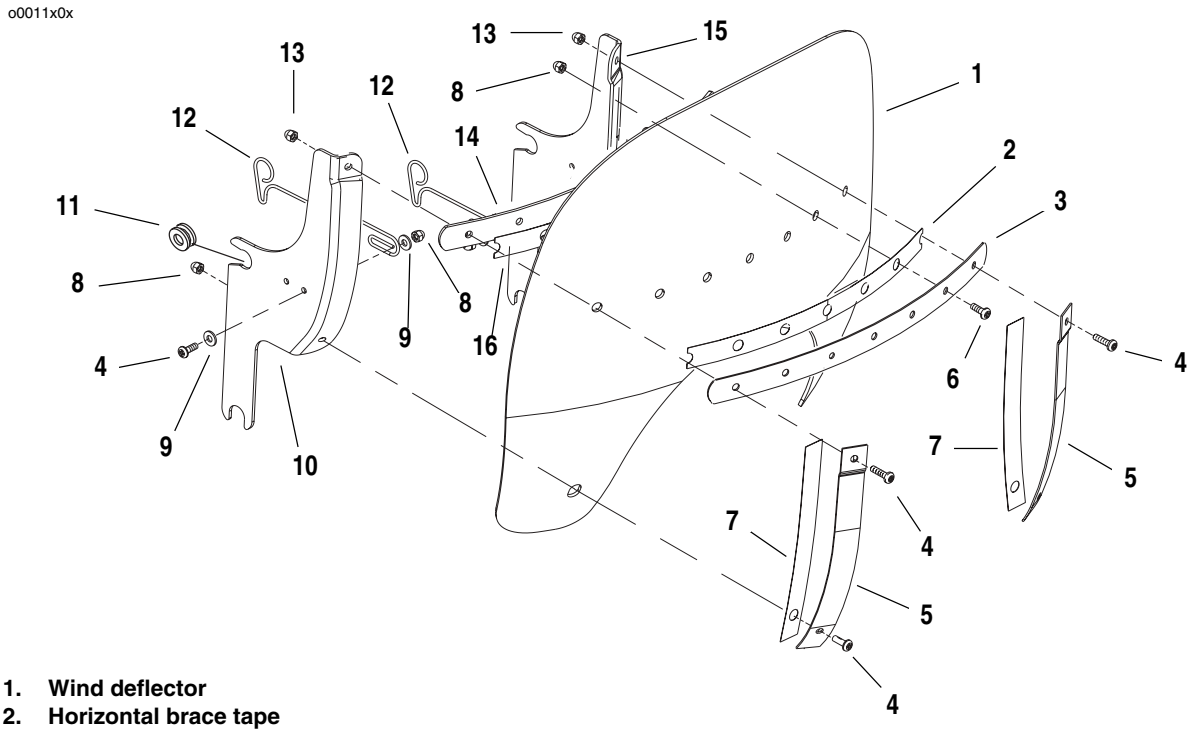
4. Install **new** grommets and acorn nuts on the headlamp nacelle. Tighten to 72-108 **in-lbs** (8.2-12.2 Nm).

INSTALLATION

1. See Figure 2-37. Standing in front of motorcycle, lower wind deflector into position on the lower rubber grommets.
2. Raise the wireform latch springs and push the wind deflector in until the upper notches engage the upper rubber grommets and the wireform latch springs overhang the grommets behind the bracket.

NOTE

If adjustment is necessary, loosen screws on right and left adjusting brackets and slide the wireform latch spring into position.



1. Wind deflector
2. Horizontal brace tape
3. Outer horizontal brace
4. Fastener
5. Outer vertical brace
6. Fasteners
7. Vertical brace tape
8. Acorn nut
9. Washer
10. Right adjusting bracket
11. Rubber grommet
12. Wireform spring latch
13. Acorn nut
14. Inner horizontal brace
15. Left adjusting bracket
16. Inner horizontal tape

Figure 2-38. Wind Deflector Components

REMOVAL

1. Remove saddlebag.
2. See Figure 2-39. Remove fastener with flat washer holding one side of passenger grabstrap (1).
3. Remove fastener (3) holding seat (2) to fender.
4. Slide seat backward to free tongue (4) on bottom front of seat from slot in frame backbone. and remove seat.
5. If it is necessary to remove retention nut (6) from fender, see SEAT in Touring Models Service Manual.

CLEANING AND INSPECTION

CAUTION

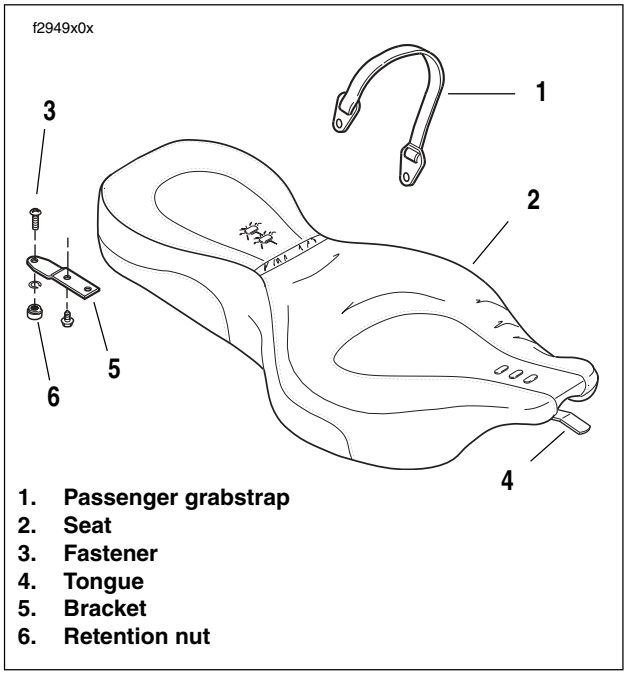
Do NOT use bleach or detergents containing bleach on saddlebags, seats, or tank panels. Doing so may result in equipment damage.

- **Do not use ordinary soap to clean leather. It could dry or remove the oils from the leather.**
- **Use ONLY a good quality saddle soap to clean leather. Be sure to rinse saddle soap off thoroughly before treating leather.**
- **Never try to dry leather quickly, using artificial means. Always let leather dry naturally at room temperature.**

NOTE

HARLEY-DAVIDSON LEATHER DRESSING (Part No. 98261-91V) has been tested and approved for materials used in FLHRSEI^2 seats.

6. Inspect seat and seat buttons for wear or damage. If required, replace seat buttons per FLHRSEI^2 Seat Button Repair Kit instructions.
7. Clean underside of pillion and seat. Clean fender and frame mounting surfaces.



1. **Passenger grabstrap**
2. **Seat**
3. **Fastener**
4. **Tongue**
5. **Bracket**
6. **Retention nut**

Figure 2-39. Seat Components

INSTALLATION

1. See Figure 2-39. Set seat (2) on frame and slide seat forward until tongue (4) engages slot in frame backbone.
2. Push seat (2) forward until retention nut (6) in fender is centered in hole of bracket (5). Install fastener (3).

⚠WARNING

After installing the seat, pull upward on the front of the seat to be sure it is locked into position. If seat is loose, it could shift during operation, resulting in loss of control of the motorcycle and death or serious injury.

3. Pull up on seat to verify that it is properly secured.
4. Install passenger grabstrap (1) to saddlebag mounting bracket.

RIDER BACKREST 2.19

ADJUSTMENT

WARNING

Do not adjust the rider backrest while riding your motorcycle. Adjusting the rider backrest while riding could lead to an accident which could result in death or serious injury.

1. See Figure 2-40. Sitting on motorcycle, pull out backrest release handle and lean back to position backrest.
2. Release handle to lock backrest into position.
3. Press button in center of back of backrest and adjust backrest up or down.
4. Release button to lock the height into the next closes notch.



Figure 2-40. Backrest Release Handle

REMOVAL

1. Pull outward on the backrest release handle to tilt backrest forward.
2. Slide seat strap aside.
3. See Figure 2-41. Spread covering at base of backrest to access lift latch and backrest bracket.
4. Pull lift latch to release locking pins.
5. Pull backrest forward and out of lift latch bracket.



Figure 2-41. Rider Backrest Lift Latch and Bracket (seat removed)

INSTALLATION

1. Spread seat covering to access backrest bracket.
2. See Figure 2-41. Pull lift latch back while sliding bottom of rider backrest into bracket opening. Lock pins in place.
3. Slide seat strap to backrest.

WARNING

After installing backrest, pull up and ensure it is properly installed. If backrest is loose, it could startle the rider, shift during vehicle operation and cause loss of control of vehicle and death or serious injury.

4. Verify backrest is locked in bracket.

RELEASE HANDLE CABLE

Removal

1. Confirm security lamp is not blinking (vehicle security is disarmed).
2. Remove seat. See 2.18 SEAT.

⚠WARNING

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

3. Disconnect negative (-) battery cable.
4. Remove left saddlebag and side cover.
5. Gently pull side cover from frame tubes.
6. See Figure 2-42. Remove cable wrap (4) around release cable and piston shaft (1) on backrest bracket.
7. Slide the hexagonal sheath end (5) from the bracket and the ball end (2) from the actuation lever (3).
8. Remove fasteners holding release handle to mounting bracket.
9. Cut cable wraps holding cable to the wire harness on the left side of the vehicle.
10. Pull backrest release handle and cable forward through the release handle holding bracket.
11. If required, remove release handle bracket and fastener from frame.

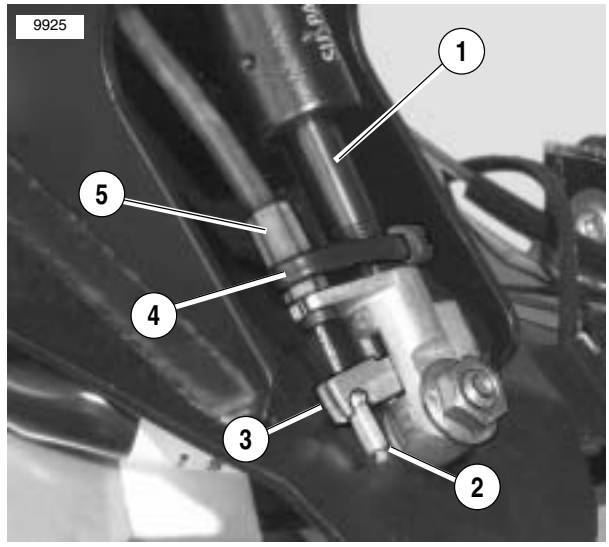
Installation

1. If required, install release handle bracket to frame. Tighten fastener to 96-144 **in-lbs** (10.8-16.2 Nm).
2. Install release handle and cable to the release handle holding bracket. Tighten fasteners to 4-6 **in-lbs** (0.5-0.7 Nm).
3. Feed cable through hole in frame and route on top of wire conduit and air valve hose. Cable wrap to frame tube.
4. Fit cable ball end into actuation lever and press hexagon cable sheath end into bracket. Cable wrap to piston shaft.
5. Install backrest. Test cable operation by adjusting position. Remove backrest.
6. Connect the negative (-) battery cable.

⚠WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift position during vehicle operation causing loss of control of vehicle and death or serious injury.

7. Install seat. See 2.18 SEAT.
8. Install saddlebag.



1. **Piston shaft**
2. **Ball end**
3. **Actuation lever**
4. **Cable wrap**
5. **Hexagonal sheath end**

Figure 2-42. Backrest Bracket

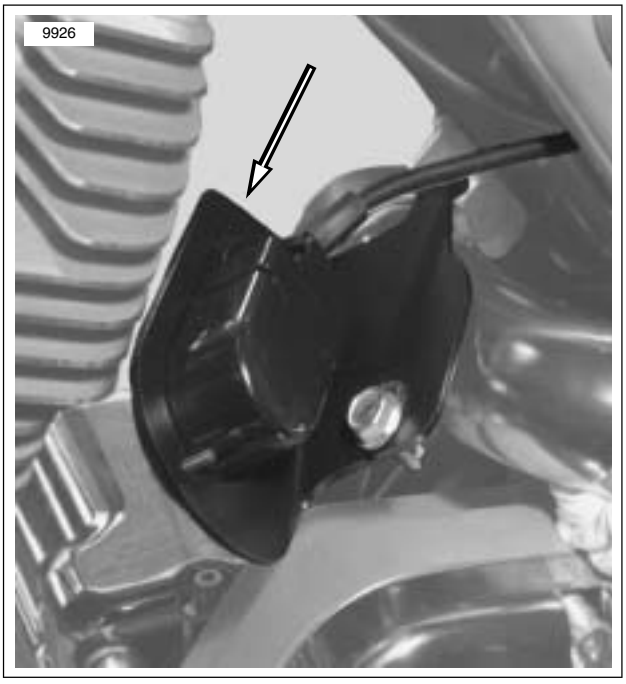


Figure 2-43. Release Handle Bracket and Fastener (removed from motorcycle)

BACKREST ASSEMBLY

Removal

1. Remove seat. See 2.18 SEAT.

⚠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. Disconnect negative (-) battery cable.
3. Remove cable wrap holding cable to piston shaft.
4. Slide hexagonal sheath end from bracket and remove cable ball end from actuation lever.
5. See Figure 2-44. Remove fastener with stay clip (2) from frame cross member.
6. Remove fasteners (1) holding backrest assembly to fender.

IMPORTANT NOTE

The rider backrest assembly bracket is non-repairable. Replace as an assembly.

Installation

1. Install backrest assembly to fender. Tighten fastener with stay clip and two fender fasteners to 120 **in-lbs** (13.5 Nm).

NOTE

The taillight harness connector is mounted under the rider backrest assembly. The air valve hose is routed under both the backrest cable and the wiring conduit to the taillamp harness.

2. Insert cable ball end in the actuation lever and press the hexagonal cable sheath end into the bracket.
3. Cable wrap backrest assembly piston and the grommet to hold the cable in place.
4. Install backrest and test adjustment operation for pollution/height. Remove backrest.
5. Connect the negative (-) battery cable.

⚠WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift position during vehicle operation causing loss of control of vehicle and death or serious injury.

6. Install seat. See 2.18 SEAT.



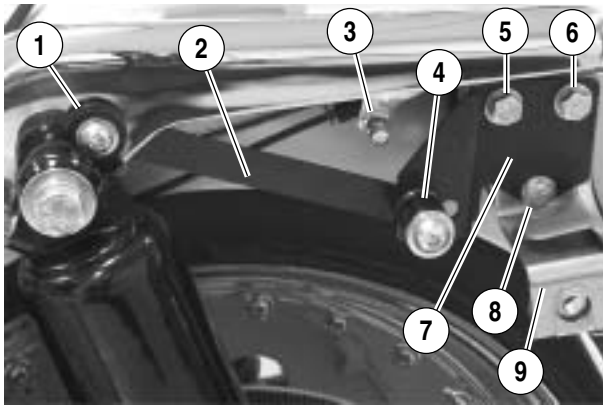
1. **Fastener**
2. **Fastener with stay clip**

Figure 2-44. Backrest Assembly

PASSENGER BACKREST 2.20

REMOVAL

1. Remove the saddlebags. See SADDLEBAG, REMOVAL in Touring Models Service Manual.
2. Push in the spring-loaded locking latch and pull the swivel latch rearward on the passenger backrest.
3. Lift the backrest off by lifting upward and then toward the rear of the motorcycle.
4. See Figure 2-45. Remove front docking point bolt, washer and front docking bushing (1).
5. Remove rear docking point bolt, washer, docking point (4), nut and docking point bracket (2).
6. Remove fender mounting bolt (5).
7. Remove rear mounting bolt (6), lock washer, washer and nut.
8. Cover filler strip to protect finish and remove lower mounting bolt (8), washer and nut.
9. Remove mounting bracket (7) and saddlebag mounting bracket (9).
10. Repeat for opposite side.
11. Inspect all parts and replace as required.

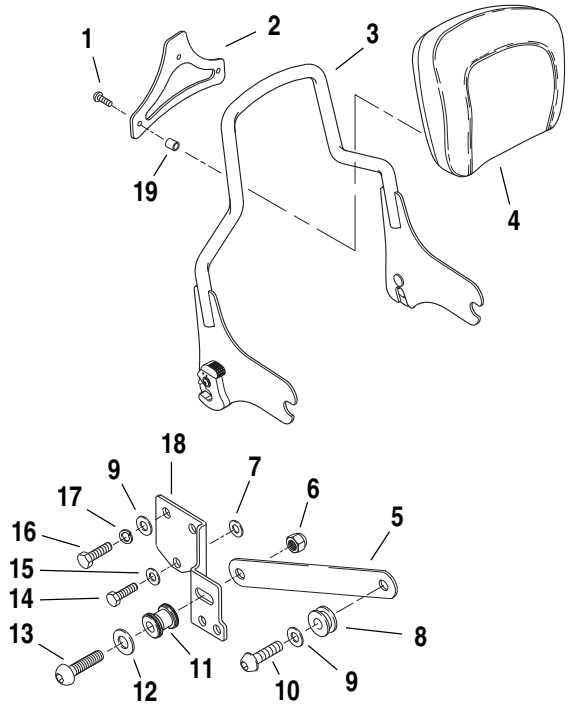


1. **Front docking bushing**
2. **Docking points bracket**
3. **Air suspension valve**
4. **Rear docking point**
5. **Fender mounting bolt**
6. **Rear mounting bolt**
7. **Mounting bracket**
8. **Lower mounting bolt**
9. **Saddlebag mounting bracket**

Figure 2-45.

INSTALLATION

1. See Figure 2-46. Install mounting bracket (18) with fender mounting bolt.
2. Install upper mounting bolt (16), lock washer (17) and washer (9).
3. Cover filler strip to protect finish.
4. Install lower mounting bolt (14) and washer (15) with saddlebag mounting bracket.
5. Install rear docking point (11), fastener (13), washer (12) and nut (6) with the dock point bracket.
6. Install the front docking bushing (8) with fastener (10) and washer (9) through the dock point bracket (5) into the frame.
7. Align saddlebag mounting hole with saddlebag.
8. Tighten fasteners:
   a. Fender mounting bolt (16) to 15-20 ft-lbs (12-27 Nm).
   b. Upper and lower mounting bolts (14, 16) to 15-20 ft-lbs (20.3-27 Nm).
   c. Front and rear docking point bolts (10, 13) to 15-20 ft-lbs (20.3-27 Nm).
9. Repeat for opposite side.
10. Install passenger backrest by sliding bracket c-guides onto front docking bushing and pushing down on the rear of the bracket with latches aligned to rear docking points.
11. Check that passenger backrest is locked in place before operating motorcycle.



1. **Fastener**
2. **Backrest mounting bracket**
3. **Passenger backrest**
4. **Pad**
5. **Docking points bracket**
6. **Nut**
7. **Washer**
8. **Front docking bushing**
9. **Washer**
10. **Docking point bolt**
11. **Rear docking point**
12. **Washer**
13. **Docking point bolt**
14. **Lower mounting bolt**
15. **Washer**
16. **Upper mounting bolt**
17. **Lock washer**
18. **Mounting bracket**
19. **Spacer**

Figure 2-46. Passenger Backrest Components

REMOVAL

1. Remove seat. See 2.18 SEAT.

⚠WARNING

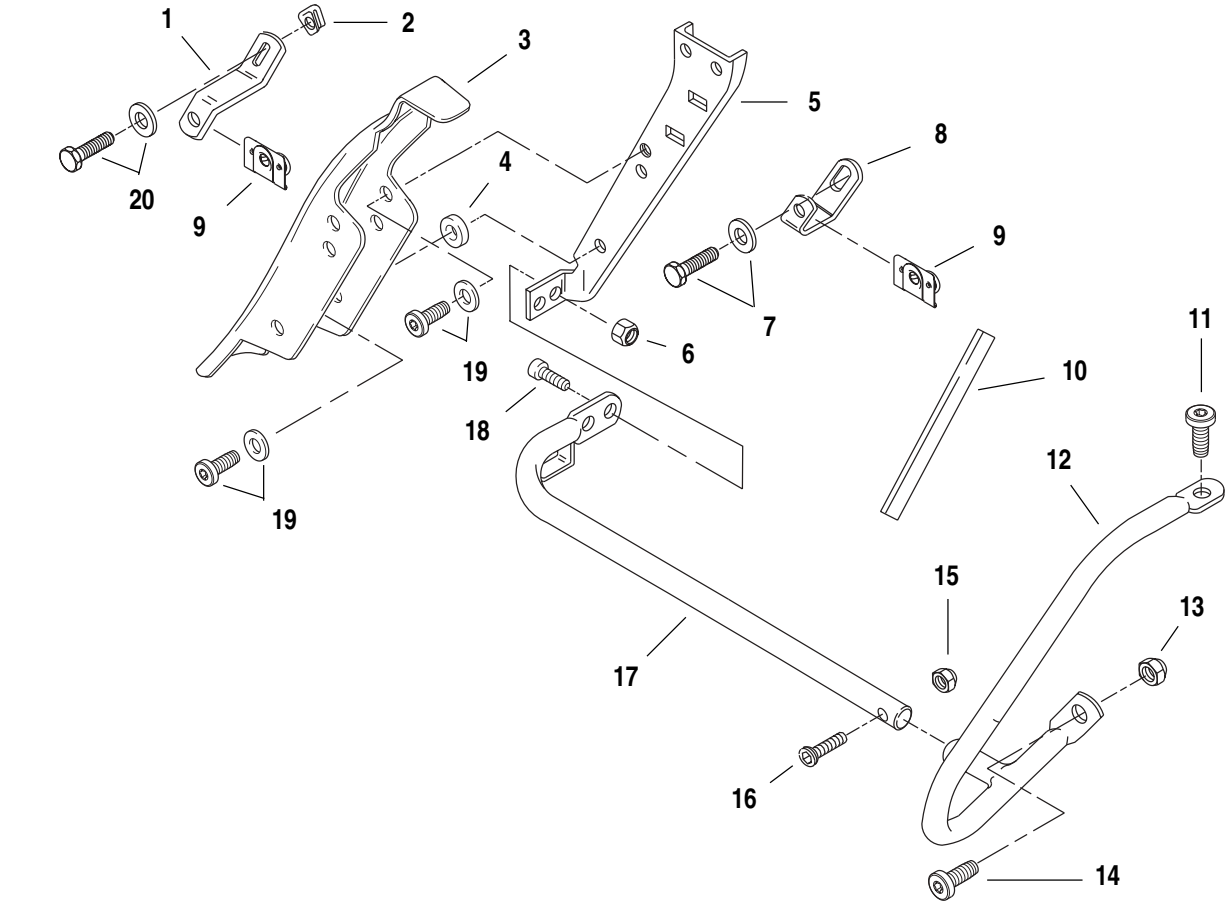
To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

2. Remove negative battery cable from battery.
3. Remove the saddlebags. See SADDLEBAG, REMOVAL in Touring Models Service Manual.
4. Remove side cover.
5. See Figure 2-48. Remove filler strip fasteners (19) and remove filler strip (3).



Figure 2-47. Removing Filler Strip

6. Remove fastener (18) holding support to support bracket (5).
7. Remove fastener holding saddlebag support (17) to fender support bracket. See 2.22 REAR FENDER.
8. Remove the three fasteners holding the passenger backrest mounting bracket. Remove the rear saddlebag bracket (1). See 2.20 PASSENGER BACKREST.
9. Loosen but do not remove the rear docking point fastener and the front docking point fastener. Fold the docking points bracket out of the way.
10. Remove the support bracket (5) and trim (10).
11. Remove fasteners holding support (17) to muffler.
12. Remove fasteners holding support (17) to guard (12) and remove support (17).
13. Remove guard (12) from frame.
14. Repeat for opposite side.



1. Rear saddlebag bracket
2. Clip nut
3. Filler strip
4. Washer
5. Support bracket
6. Locknut
7. Fastener and washer
8. Front saddlebag bracket
9. Receptacle
10. Edge trim
11. Fastener
12. Guard
13. Nut
14. Fastener
15. Locknut
16. Fastener
17. Support
18. Fastener
19. Filler strip fastener and washer
20. Fastener and washer

Figure 2-48. Saddlebag Support Components

INSTALLATION

1. See Figure 2-48. Install the guard (12) onto the frame. Tighten fasteners to 15-20 ft-lbs (20.4-27 Nm).
2. Install the trim (10) to the support bracket (5). Loosely fasten support bracket (5) to fender support bracket.
3. Install passenger backrest mounting bracket to support bracket. Pull docking points bracket and docking points into place.
4. Loosely install fasteners into passenger backrest bracket and rear saddlebag bracket (1). Be sure the washers are in place behind and in front of passenger backrest bracket.
5. Fasten the support (17) onto the guard (12).
6. Tighten fasteners:
   a. Passenger backrest mounting bracket to support bracket - 15-20 ft-lbs (20.4-27 Nm).
   b. Fender support bracket to support bracket (5) - 15-20 ft-lbs (20.4-27 Nm).
   c. Support (17) to support bracket (5) - 15-20 ft-lbs (20.4-27 Nm).
7. Install filler strip (3) with washers between filler strip and support bracket. Tighten fasteners to 15-20 ft-lbs (20.3-27 Nm).
8. Replace side cover and saddlebags.
9. Replace negative battery cable.

⚠WARNING

After installing the seat, pull upward on the front of the seat to be sure it is locked into position. If seat is loose, it could shift during operation, resulting in loss of control of the motorcycle and death or serious injury.

10. Replace seat. See 2.18 SEAT.

REAR FENDER 2.22

REMOVAL

1. Support motorcycle with rear wheel off the ground.
2. Remove rider backrest and remove seat. See 2.18 SEAT.

⚠WARNING

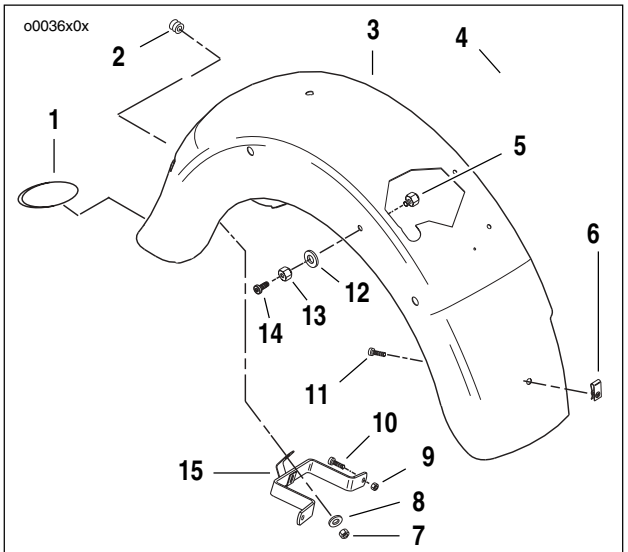
To protect against shock and accidental start-up of vehicle, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

3. Remove negative battery cable from battery terminal.
4. Remove both saddlebags.
5. Remove rear wheel. See 2.4 REAR WHEEL.
6. Press the socket side button to separate the taillamp connector [3]. Pull the pin side connector straight off the plastic clip on the fender.
7. See Figure 2-49. Remove fasteners holding fender support bracket (15) to right and left saddlebag support bracket.
8. Remove the single fastener (11) to the clip nut (6) on the frame.
9. Remove the right and left fasteners through the passenger backrest brackets into the fender mounting bosses. Retain the washers and mounting bosses.

NOTE

Only the top front fastener on the backrest bracket threads into a fender mounting boss. The other two fasteners attach to the saddlebag support bracket only. See 2.20 PASSENGER BACKREST.

10. Remove left and right fasteners (14) through the outer (13) and inner (5) fender bosses. Retain the washers and mounting bosses.
11. Cover frame rails and brackets with shop towels to prevent scratches to paint finish.
12. Carefully lower rear fender out of frame rails.
13. Disassemble fender as required:
    a. Remove fender support bracket (15).
    b. Remove taillamp assembly, taillamp wire harness and turn signal bar. See 8.3 TURN SIGNALS.
    c. Remove the rider backrest bracket and stud plate. See 2.19 RIDER BACKREST.
    d. Remove the Cloisonne (1).



1. **Cloisonne**
2. **Turn signal access hole grommet**
3. **Rear fender**
4. **Stud plate**
5. **Inner fender boss**
6. **Clip nut**
7. **Fastener**
8. **Washer**
9. **Nut**
10. **Fastener**
11. **Fastener**
12. **Fender mounting washer**
13. **Outer fender boss**
14. **Fastener**
15. **Fender support bracket**

Figure 2-49. Rear Fender Components

INSTALLATION

1. Assemble fender as required.
    a. Install fender support bracket (15).
    b. Install taillamp assembly, taillamp wire harness and turn signal bar. See 8.3 TURN SIGNALS.
    c. Install the rider backrest bracket and stud plate. See 2.19 RIDER BACKREST.
    d. Install the cloisonne. See 2.23 CLOISONNE.
2. Avoiding scratching paint, carefully lift the rear fender into position.
3. See Figure 2-49. Install the fasteners (14) and inner (5) and outer (13) mounting bosses. Install the washers (12) where required. Do not tighten.
4. Install the right and left fasteners through the passenger backrest brackets and mounting bosses in the rear fender frame assembly. Install the washers where required. Do not tighten.
5. Install the single fastener (11) to the clip nut (6) on the frame. Do not tighten.
6. Install fender support bracket (15) fasteners to saddlebag support bracket.
7. Alternately, tighten and loosen fasteners until fender is correctly aligned.
8. Tighten fasteners:
    a. Inner (5) and outer (13) fender bosses - 15-20 ft-lbs (20.3-27 Nm).
    b. Passenger backrest bracket through fender - 15-20 ft-lbs (20.3-27 Nm).
    c. Frame mounted clip nut (6) - 35-40 ft-lbs (47.5-57.2 Nm).
    d. Fender support bracket (15) to saddlebag support bracket - 15-20 ft-lbs (20.3-27 Nm).
9. Replace rear wheel. See 2.4 REAR WHEEL.
10. Replace saddlebags. Loosen and adjust fasteners holding saddlebag brackets until saddlebags lock into place. Tighten saddlebag bracket fasteners to 15-20 ft-lbs (21-27 Nm).
11. Connect negative battery cable.

⚠WARNING

After installing the seat, pull upward on the front of the seat to be sure it is locked into position. If seat is loose, it could shift during operation, resulting in loss of control of the motorcycle and death or serious injury.

12. Replace seat and rider backrest. See 2.18 SEAT.
13. Replace saddlebags.

REMOVAL

PART NO.	SPECIALTY TOOL
HD-25070	Robinair Heat Gun

1. Apply 3M GENERAL PURPOSE ADHESIVE REMOVER (Part No. 051135) to edge of adhesive backing visible behind cloisonne. Allow to soak.

CAUTION

Avoid excess heat which will damage the painted surface.

2. Carefully apply heat directly onto cloisonne with ROBIN-AIR HEAT GUN (HD-25070).
3. Lift the cloisonne from fender.

NOTE

Dental floss can be used to gently saw the heated cloisonne free of the rear fender.

4. Remove remaining adhesive with 3M GENERAL PURPOSE ADHESIVE REMOVER (Part No. 051135).

INSTALLATION

1. Peel backing paper off medallion.
2. Place medallion in position over recess in rear fender.

NOTE

The cloisonne is centered left to right over the dimpled recess in the rear fender with the bottom edge of the cloisonne 1.75 in. (44.45 mm) above the bottom edge of the fender.

3. Press firmly to affix cloisonne.

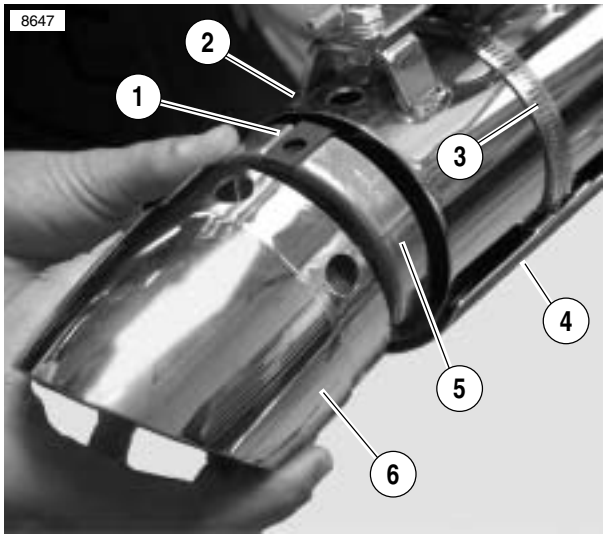


Figure 2-50. FLHRSEI^2 Rear Fender Cloisonne

MUFFLER END CAP 2.24

REPLACEMENT

1. See Figure 2-51. Loosen clamps (3) on muffler heat shield (4). Rotate heat shield out of way.
2. Loosen and remove three fasteners holding muffler end cap in place. Remove end cap (6).
3. To rotate orientation of end cap, remove and rotate clip nut ring (5) to match clip nuts (1) to fastener holes in end cap and muffler (2). Install and tighten fasteners.
4. Return heat shield to original orientation and tighten clamps to 20-40 **in-lbs** (2.26 Nm-4.51 Nm).



1. **Clip nut**
2. **Muffler**
3. **Clamp @ 20-40 in-lbs (2.26 Nm-4.51 Nm)**
4. **Heat shield**
5. **Clip nut ring**
6. **End cap**

Figure 2-51. Muffler End Cap

NOTES

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NOTE

This section provides information unique to the FLHRSEI^2 motorcycles. Any information not presented in this supplement can be found in the current Touring Models Service Manual.

SPECIFICATIONS 3.1

Table 3-1. General

Number of cylinders	2
Type	4-cycle, 45˚ V^2, air-cooled
Torque	100 ft-lbs (138 Nm) @ 3500 RPM, chrome duals exhaust
Bore	3.875 in. (98.425 mm)
Stroke	4.375 in. (111.125 mm)
Piston displacement (approx.)	103 cu. in. (1690 cc)
Compression ratio	9.0:1
Combustion chamber	Hemispherical
Cam system	Twin cams, chain driven with spring loaded tensioners
Max. sustained engine speed	5800 RPM
Idle speed	1000 RPM ± 50
Weight	165 lbs (74.8 kg)

Table 3-2. Ignition System

Type	Sequential, non waste spark, MAP-N control
Ignition timing: 1050 RPM (hot idle)	20˚-30˚
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	12-18 ft-lbs (16.3-24.4 Nm)

Table 3-3. 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˚ F (110˚ C)
Filtration	10 micron media, filtered between pump and engine
Cooling	Thermostat controlled oil cooler

MANUFACTURING TOLERANCES 3.2

Table 3-4. Rocker Arms

	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

Table 3-5. Rocker Arm Shaft

	IN.	MM
Shaft fit in rocker arm support plate (loose)	0.0007-0.0022	0.018-0.056

Table 3-6. Hydraulic Lifters

	IN.	MM
Fit in crankcase (loose)	0.0008-0.0020	0.02-0.05

Table 3-7. Cylinder Heads

	IN.	MM
Valve guide in head (tight)	0.0020-0.0033	0.051-0.084
Valve seat in head (tight)	0.003-0.0045	0.076-0.114
Head gasket surface (flatness)	0.006	0.0152

Table 3-8. Valves

	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

Table 3-9. Valve Spring Assembly

	PRESSURE	DIMENSION
Closed	165 lbs (75 kg).	1.820 in (46.2 mm).
Open	416 lbs (189 kg)	1.290 in. (32.7 mm)
Free length	n/a	2.210 in (56.1 mm)

Table 3-10. Pistons

	IN.	MM
Fit in cylinder	0.0014-0.0025	0.036-0.064
Ring end gap:		
Top compression ring	0.010-0.020	0.254-0.508
2nd compression ring	0.014-0.024	0.3556-0.6096
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	0.079-0.231
Piston pin fit (loose)	0.0002-0.0005	0.005- 0.013

Table 3-11. Connecting Rods

	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

Table 3-12. Flywheels

	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	0.003-0.010	0.076-0.254

Table 3-13. 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)	0.0038-0.0054	0.097-0.137
Bearing inner race on crankshaft (tight)	0.0001-0.0010	0.0025-0.0254

SERVICE WEAR LIMITS 3.3

Table 3-14. Rocker Arm/Rocker 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

Table 3-15. Hydraulic Lifters

	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

Table 3-16. 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	
Warpage	0.010	0.25
Crankshaft bushing fit	0.0008-0.001	0.0203-0.0254

Table 3-17. Cylinder Heads

	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Valve guide (tight)	< 0.002	< 0.051
Valve seat (tight)	< 0.002	< 0.051
Head warpage	> 0.006	> 0.15

Table 3-18. Cylinders

	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Taper	0.002	0.051
Out of round	0.002	0.051
Warpage of gasket or O-ring surfaces: top	0.006	0.152
Warpage of gasket or O-ring surfaces: base	0.004	0.102

Table 3-19. Cylinder Bore

	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Standard	3.877	98.48
0.005 in. oversize	3.882	98.60
0.010 in. oversize	3.887	98.73

Table 3-20. Pistons

REPLACE IF WEAR EXCEEDS			
		IN.	MM
Fit in cylinder (loose)		0.003	0.076
Piston pin fit (loose)		0.0008	0.020
Ring end gap	Top compression	0.030	0.762
	2nd compression	0.034	0.863
	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

Table 3-21. Connecting Rods

	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

Table 3-22. Flywheels

	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Flywheel runout at rim	0.015	0.38
Shaft runout at flywheel	0.003	0.08
End play	0.010	0.254

Table 3-23. Crankshaft Sprocket Shaft Bearing

	IN.	MM
Bearing fit (loose)	0.0015	0.038
Crankshaft runout	0.003	0.076
Bearing fit in crankcase (tight)	0.0038-0.0054	0.097-0.137
Bearing inner race on crankshaft (tight)	0.0001	0.0254

TORQUE VALUES 3.4

ITEM	TORQUE		NOTES
Chrome oil vent line nuts	60-80 **in-lbs**	6.8-9.0 Nm	page 3-18
Head bolt cover set screw	60-84 **in-lbs**	6.8-9.5 Nm	page 3-10
Oil cooler to mounting backet	80-110 **in-lbs**	9.1-12.4 Nm	page 3-22
Oil filter adapter	12-16 ft-lbs	16.3-21.7 Nm	page 3-24
Oil filter mount	130-150 **in-lbs**	14.7-16.9 Nm	page 3-24
Oil fittings	120-168 **in-lbs**	13.6-19.0 Nm	page 3-18
Oil vent line crankcase fitting	130-150 **in-lbs**	14.7-16.9 Nm	page 3-18
Rocker housing bolts	120-168 **in-lbs**	13.6-18.9 Nm	page 3-9
Spark plugs	12-18 ft-lbs	16.5-24.4 Nm	page 3-10
Thermostat plug	15-20 ft-lbs	20.4-27.1 Nm	page 3-24, 3-25
Transfer passage cover	90-120 **in-lbs**	10.2-13.5 Nm	page 3-24

BREATHER ASSEMBLY 3.5

REMOVAL

See TOP END OVERHAUL in the Touring Models Service Manual.

NOTE

If breather style is different from that illustrated, see BREATHER ASSEMBLY under TOP END under SUBASSEMBLY SERVICE AND REPAIR, in the Touring Models Service Manual.

DISASSEMBLY

1. See Figure 3-1. Remove two fasteners (1) from breather assembly.
2. Remove breather cover (2) and gasket (3). Discard cover gasket (3).
3. Remove the breather baffle (5) and gasket (7). Discard gasket (7).
4. Pull filter element (6) from bore on inboard side of breather baffle (5). Discard filter element (6).
5. Pull stem of umbrella valve (4) from hole at top of breather baffle (4). Discard umbrella valve (4).

CLEANING AND INSPECTION

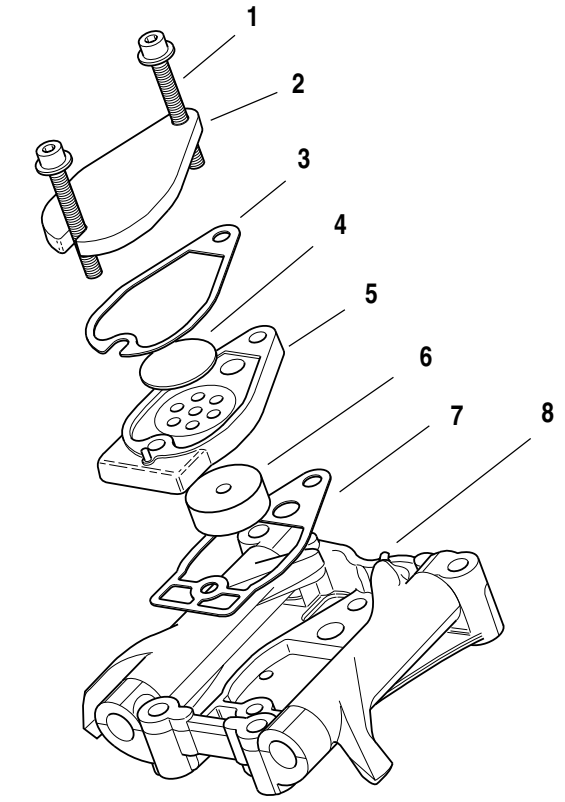
1. Clean all parts in a non-volatile cleaning solution or solvent.
2. Thoroughly dry all parts with low pressure compressed air.

ASSEMBLY

1. See Figure 3-1. Insert stem of **new** umbrella valve (4) through center hole at top of breather baffle (5). Use denatured alcohol or glass cleaner to lubricate stem. Carefully pull rubber bead on stem through hole in baffle. Verify that rubber bead is pulled completely through hole and resides on bottom side of baffle (5).
2. Press **new** filter element (6) into bore at bottom of baffle (5). Hole in filter element accommodates umbrella valve (4) stem.
3. Place breather baffle gasket (7) on a clean flat surface. Aligning holes, place breather baffle (5), cover gasket (3) and breather cover (2) on top. Slide two screws (1) through stackup to keep assembly together until time of installation.

INSTALLATION

See TOP END OVERHAUL in the Touring Models Service Manual.



1. **Fastener**
2. **Breather cover**
3. **Cover gasket**
4. **Umbrella valve**
5. **Breather baffle**
6. **Filter element**
7. **Breather baffle gasket**
8. **Rocker arm support plate**

Figure 3-1. Breather Components

VALVE SPRING TO ROCKER HOUSING CLEARANCE

1. After torquing cylinder head bolts, continue top end overhaul by installing the rocker housings. See ASSEMBLY under TOP END OVERHAUL in the Touring Models Service Manual.

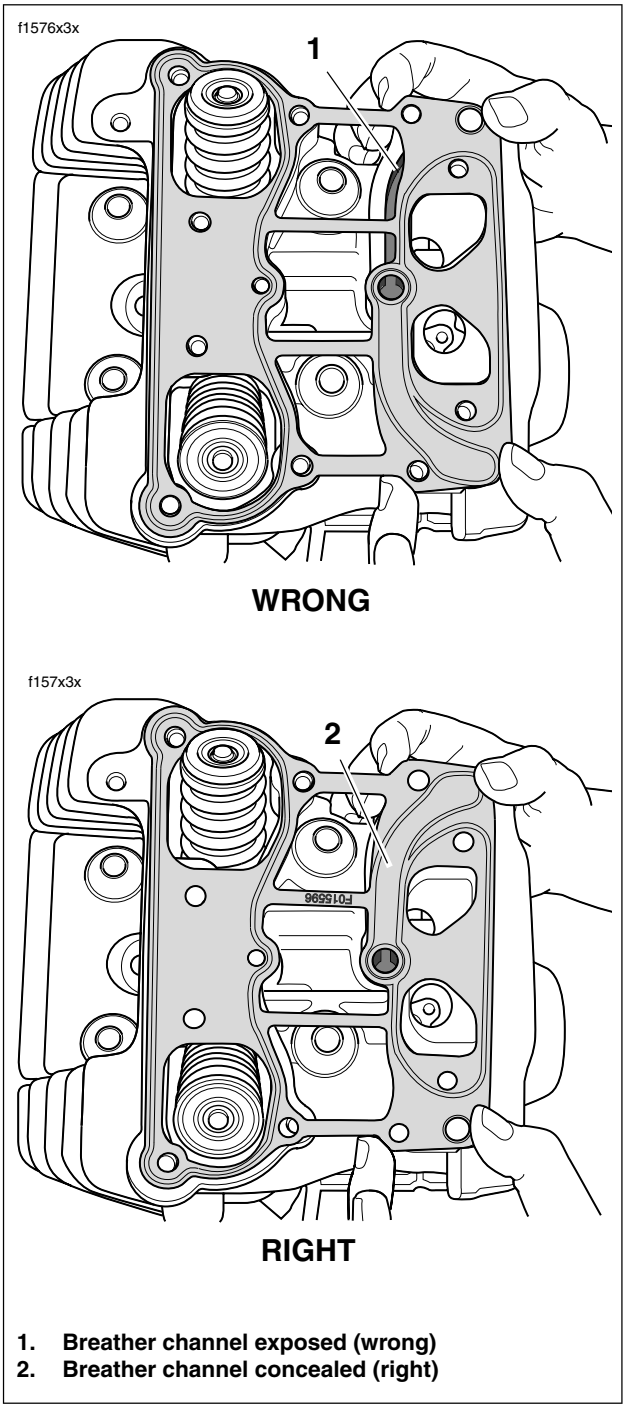
2. Install a **new** rocker housing gasket on the cylinder head flange.

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.

3. See Figure 3-2. Verify that the rocker housing gasket is installed correctly by noting that the breather channel is concealed.

4. With the indent facing forward, place the rocker housing into position aligning the holes in the housing with those in the gasket.



1. **Breather channel exposed (wrong)**
2. **Breather channel concealed (right)**

Figure 3-2. Rocker Housing Gasket

5. Apply a small dab of LOCTITE THREADLOCKER 243 (blue) (HD-99642-97) to threads of six rocker housing bolts.

6. See Figure 3-3. Start the rocker housing bolts, two long bolts on the left side of the engine, four intermediate bolts in the interior.

NOTE

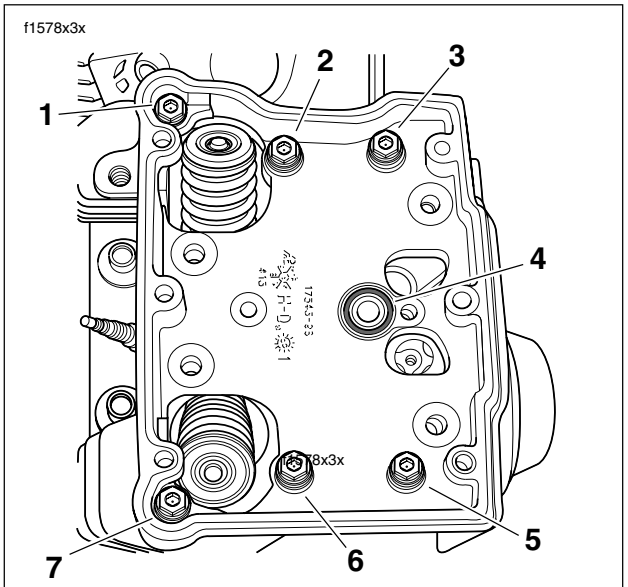
Rocker housing and rocker cover bolts have both an internal and external hex, which allows the bolts to be installed with either a short 3/16 inch allen wrench (tight spaces), or a 7/16 inch socket or open end/box wrench (open spaces). If the engine is left in the chassis for service, the short 3/16 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.

7. From the cam cover side, press rocker cover diagonally toward the intake valve.

8. See Figure 3-5. Snug bolts in torque sequence to hold housing in position. Do not torque.

9. See Figure 3-4. Using a feeler gauge, check for clearance around both valve spring assemblies and the rocker housing.

10. If spring assembly contacts rocker housing at any point around springs, loosen rocker cover bolts and press on side of cover opposite contact point to produced noticeable clearance between housing and valve assembly.



1. **Long bolt 1-3/4 in.**
2. **Intermediate bolt 1-1/4 in.**
3. **Intermediate bolt 1-1/4 in.**
4. **O-ring**
5. **Intermediate bolt 1-1/4 in.**
6. **Intermediate bolt 1-1/4 in.**
7. **Long bolt 1-3/4 in.**

Figure 3-3. Rocker Housing Bolt Lengths

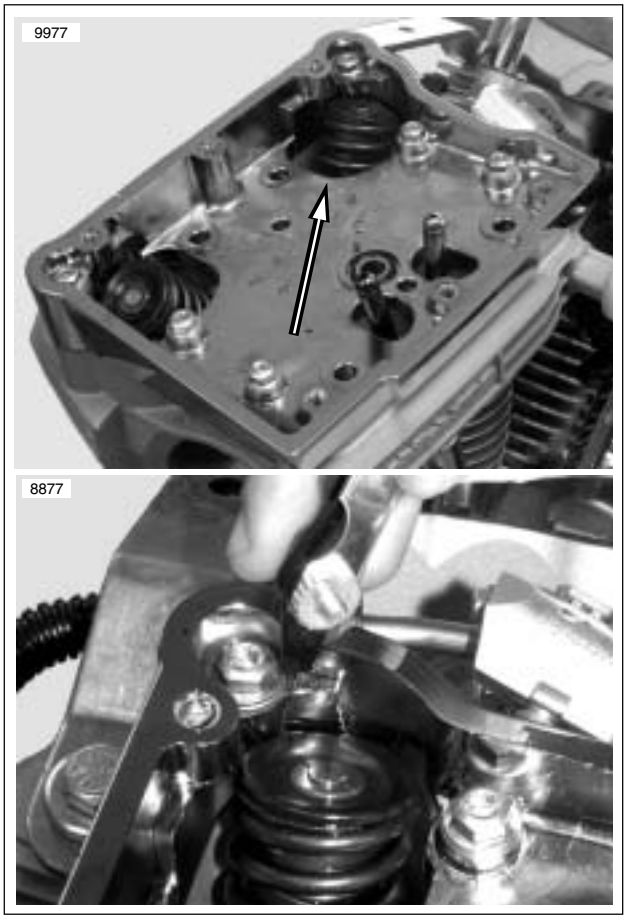


Figure 3-4. Valve Spring to Rocker Housing Clearance

11. Tighten rocker housing bolts to 120-168 **in-lbs** (13.6-18.9 Nm) in the pattern shown in Figure 3-5.

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****.*

12. Re-check clearance at both valve spring assemblies and repeat until there is sufficient clearance between spring assemblies and rocker housing with the bolts torqued.

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.

13. Install **new** o-ring in groove around breather baffle hole in rocker housing. Apply a thin film of clean HD 20W50 engine oil to o-ring before installation.

14. Continue the top end overhaul by installing the hydraulic lifters in the crankcase bores. See ASSEMBLY under TOP END OVERHAUL in the Touring Models Service Manual.

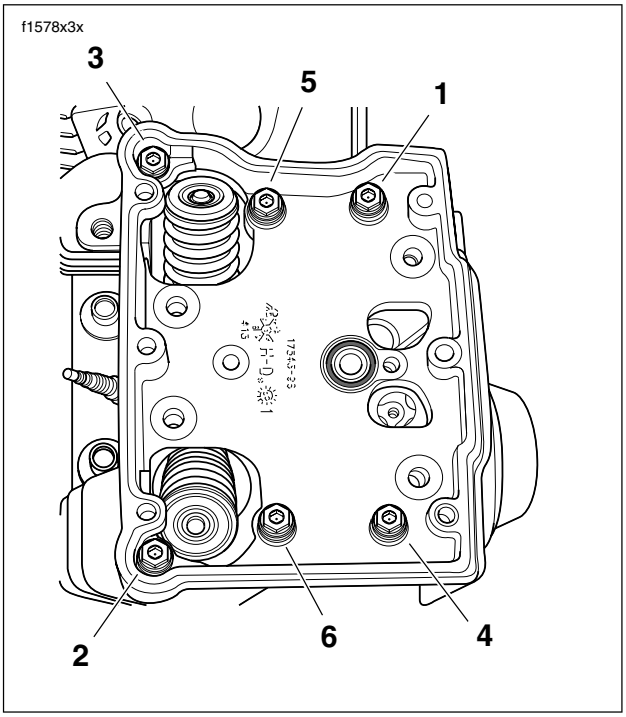


Figure 3-5. Rocker Housing Torque Sequence (10-14 ft-lbs)

HEAD BOLT COVERS 3.7

REPLACEMENT

⚠CAUTION

To avoid burns to hands and fingers, do not work on head bolt covers until after engine has cooled.

1. Remove spark plug cable and remove spark plug. See SPARK PLUGS/SPARK PLUG CABLES in current Touring Models Service Manual.

CAUTION

Avoid getting debris or small parts into open spark plug hole. This may result in damage to the engine.

2. FIll spark plug hole with shop towel or plastic plug.
3. Loosen but do not remove set screws and remove head bolt covers from engine.
4. To install, orient covers over head bolts to hide set screws from view but accessible for tightening.
5. Tighten set screws into notch between head bolt points. Tighten to 60-84 **in-lbs** (6.8-9.5 Nm).

NOTE

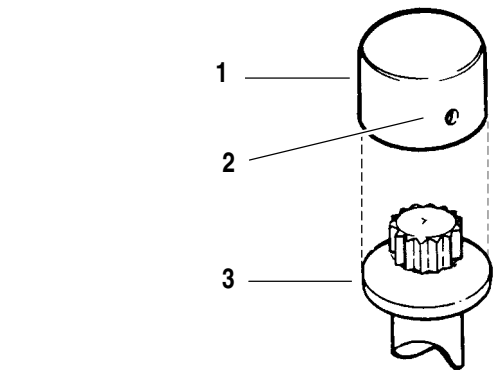
See Figure 3-7. Hidden from view but accessible for removal, the left cover set screw will be approximately at the 2:00 o'clock position and the right cover set screw at the 10:00 o'clock position.

6. Remove spark plug hole fill.
7. Apply a light coat of LOCTITE ANTI-SEIZE (HD-98960-97) to threads of spark plugs. Replace spark plug and tighten to 12-18 ft-lbs (16.5-24.4 Nm). See SPARK PLUGS in the Touring Models Service Manual.
8. Replace spark plug cable.
9. Repeat for other cylinder head.

⚠CAUTION

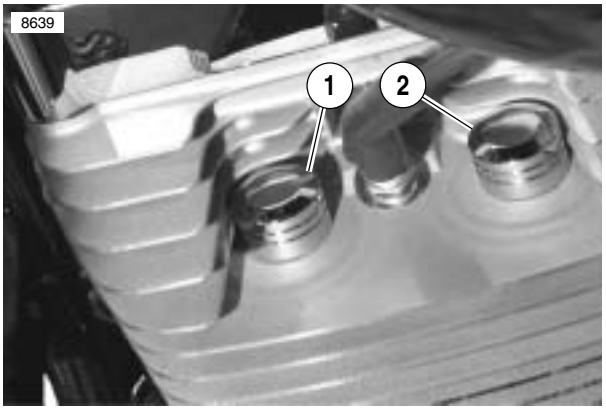
To avoid burns to hands and fingers, do not work on head bolt covers until after engine has cooled.

10. Run motorcycle at operating temperature and check set screws for tightness.



1. **Head bolt cover**
2. **Set screw**
3. **Head bolt**

Figure 3-6. Head Bolt Cover



1. **Left set screw @ 2:00 o'clock**
2. **Right set screw @ 10:00 o'clock**

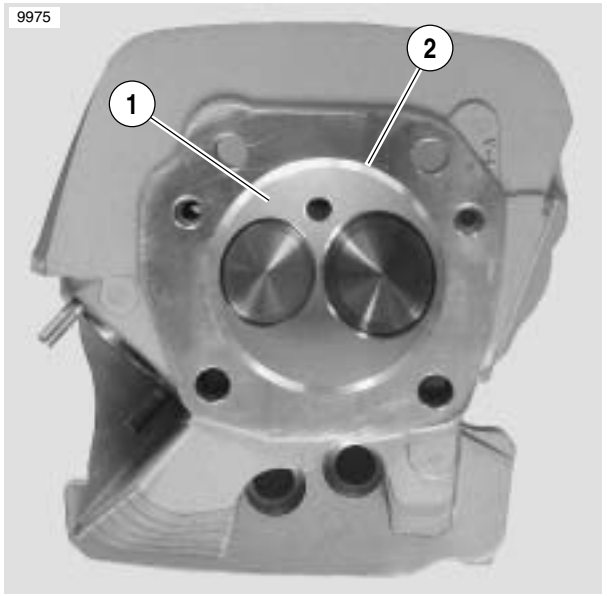
Figure 3-7. Set Screw Clock Positions

CYLINDER HEADS 3.8

GENERAL

Major components of the FLHRSEI^2 engine differ from other touring models in specification and appearance. However, service procedures for the following components are the same as those found in the Touring Models Service Manual. See CYLINDER HEAD under SUBASSEMBLY SERVICE AND REPAIR in the Touring Models Service Manual.

For service wear limits, refer to Table 3-17.



1. **Hemispherical combustion chamber**
2. **Machined relief**

Figure 3-8. FLHRSEI^2 Front Cylinder Head

GENERAL

Major components of the FLHRSEI^2 engine differ from other touring models in specification and appearance. However, service procedures for the following components are the same as those found in the Touring Models Service Manual. See PISTON on SUBASSEMBLY SERVICE AND REPAIR in the Touring Models Service Manual.

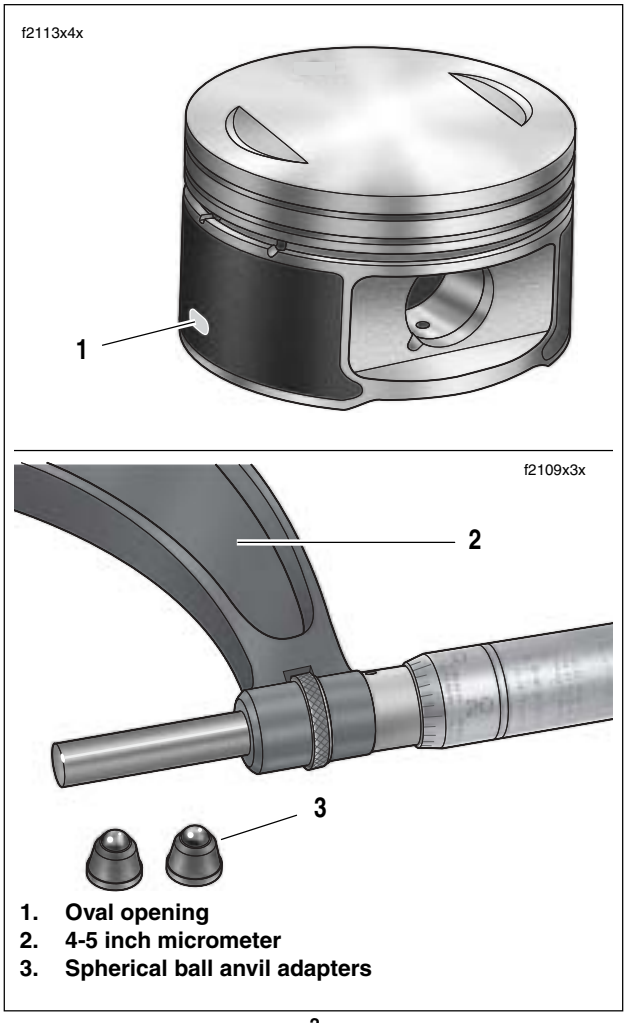
For service wear limits, refer to Table 3-20. and Table 3-19.

NOTE

The piston is measured on the bare aluminum to avoid measuring errors. An oval-shaped spot is present on each side of the piston for proper placement of the micrometer. See upper frame of Figure 3-10. Since the oval openings are too small for a standard flat anvil micrometer, which would result in measuring errors, use a 4-5 inch micrometer with spherical ball anvil adapters. See lower frame of Figure 3-10.



Figure 3-9. FLHRSEI^2 Piston Orientation Arrow (arrow points to front of engine)



1. **Oval opening**
2. **4-5 inch micrometer**
3. **Spherical ball anvil adapters**

Figure 3-10. FLHRSEI^2 Piston Measurement

BORING AND HONING CYLINDERS 3.10

CYLINDER BORE FINISHED SIZE

1. For cylinder removal, cleaning, inspection, boring and honing and installation, see CYLINDER in the Touring Models Service Manual.
2. Refer to Table 3-24. Bore the cylinder to 0.003 in. (0.08 mm) under the desired finished size. See BORING and HONING CYLINDER in the Touring Models Service Manual. Refer to Table 3-24.

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.

3. Hone the cylinder to its finished size using a 280 grit rigid hone followed by a 240 grit flexible ball hone. Honing must be done with the torque plates attached. All honing must be done from the bottom (crankcase end of the cylinder. Work for a 60˚ crosshatch pattern.
4. 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.
5. Thoroughly wash the cylinder bore with liquid dish soap and warm water to remove all abrasive particles and residual girt. Continue cleaning until a clean cloth shows no evidence or dirt or debris.
6. Immediately apply a thin film of clean engine oil to a clean white paper towel and thoroughly wipe the inside of the cylinder. This prevents the cylinder bore from rusting.

NOTE

After wiping the cylinder with a clean, oiled paper towel, the towel will be dark with contamination. Repeat this process using a new lightly oiled paper towel each time until the towel remains white. The cylinder is now clean.

7. With the cylinder at room temperature, check the piston clearance in the cylinder in which the piston will run. See INSPECTION under PISTON in Touring Models Service Manual.
8. For cylinder installation, see CYLINDER in Touring Models Service Manual.

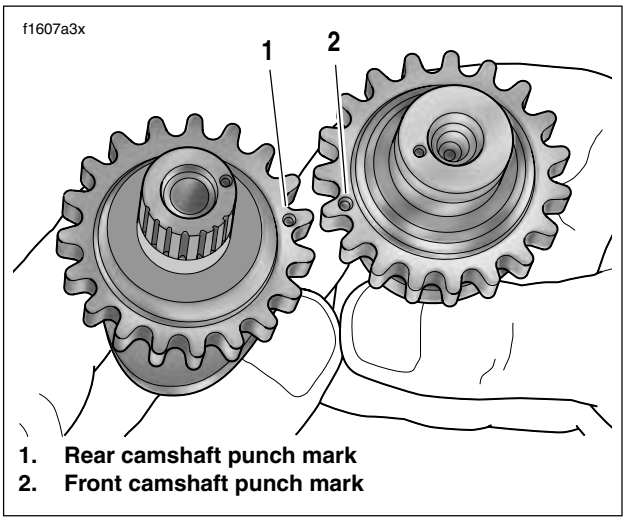
Table 3-24. Oversize Pistons/Cylinder Bores

PISTON		CYLINDER BORE FINISHED SIZE	
TYPE	**SIZE**	**MINIMUM**	**MAXIMUM**
Standard	STD	3.8750 in. (98.4250 mm)	3.8755 in. (98.438 mm)
Oversize	0.005 in. (0.13 mm)	3.8800 in. (98.552 mm)	3.8805 in. (98.565 mm)
	0.010 (0.25 mm)	3.8850 in. (98.679 mm)	3.8855 in. (98.692 mm)

CAMS AND TIMING MARKS 3.11

GENERAL

Major components of the FLHRSEI^2 engine differ from other touring models in specification and appearance. However, service procedures for the following components are the same as those found in the Touring Models Service Manual. See Camshafts and Camshaft Bearings under CAM SUPPORT PLATE under SUBASSEMBLY SERVICE AND REPAIR in the Touring Models Service Manual.



1. Rear camshaft punch mark
2. Front camshaft punch mark

Figure 3-11. FLHRSEI^2 Cam Timing Marks

FLYWHEEL/CONNECTING ROD ASSEMBLY 3.12

GENERAL

For removal, inspection, and installation, see FLYWHEEL/CONNECTING ROD ASSEMBLY under SUBASSEMBLY SERVICE AND REPAIR in the Touring Models Service Manual.

For service wear limits, refer to Table 3-21. and Table 3-22.

NOTE

If the flywheel or connecting rods need to be replaced, then they must be replaced together as one assembly.



Figure 3-12. FLHRSEI^2 Flywheel/Connecting Rod Assembly

SPROCKET SHAFT BEARING INNER RACE REPLACEMENT

PART NO.	SPECIALTY TOOL
HD-44358	Flywheel support fixture
HD-95637-46A	Wedge attachment
HD-34902B	Mainshaft bearing inner race puller/installer
HD-25070	Robinair heat gun

1. If reusing flywheel, remove bearing inner race and thrust washer as follows:
   a. Obtain FLYWHEEL SUPPORT FIXTURE (HD-44358). See Figure 3-13. 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 thrust washer and turn hex nuts an equal number of turns to draw halves of wedge together.

CAUTION

Install wedge attachment only so far as necessary to ensure positive contact with thrust washer. Installing tool with more contact than absolutely necessary will result in damage to flywheel.

   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.
   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. Using the ROBINAIR HEAT GUN (HD-25070), uniformly heat the bearing inner race for about 30 seconds using a circular motion.

NOTE

To facilitate removal without heat, apply a light penetrating oil to shaft and leading edge of bearing inner race.

⚠WARNING

Never use both heat and penetrating oil. Use only one or the other. Excessive heat can cause the penetrating oil to ignite resulting in flames or fire. Inadequate safety precautions can result in death or serious injury.

j. Turn forcing screw until thrust washer and bearing inner race move approximately 1/8 inch (3.2 mm).

k. Turn hex nuts an equal number of turns to separate halves of WEDGE ATTACHMENT.

l. After bottoming thrust washer on shaft, reposition WEDGE ATTACHMENT (HD-95637-46A) on inboard side of bearing inner race. Turn hex nuts an equal number of turns to draw halves of wedge together.

CAUTION

Install wedge attachment only so far as necessary to ensure positive contact with bearing inner race. Installing tool with more contact than absolutely necessary will result in damage to flywheel.

m. Verify that the tool assembly is square, so that the bearing inner race is not cocked during removal. See Figure 3-14.

n. Using the ROBINAIR HEAT GUN (HD-25070), uniformly heat the bearing inner race for about 30 seconds using a circular motion.

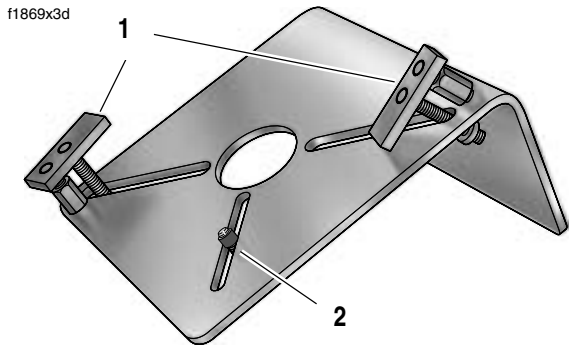
NOTE

To facilitate removal without heat, apply a light penetrating oil to shaft and leading edge of bearing inner race.

o. Turn forcing screw until bearing inner race is pulled free of sprocket shaft.

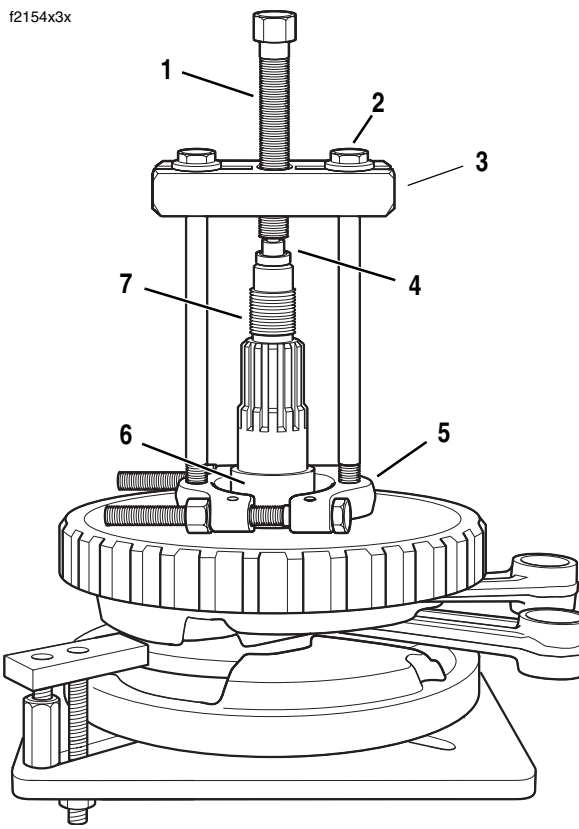
p. Remove thrust washer from sprocket shaft.

q. Discard thrust washer and bearing inner race.



1. **Hold-down clamp**
2. **Locating pin**

Figure 3-13. Flywheel Support Fixture (Part No. HD-44358)



1. **Forcing screw**
2. **3/8-16 Inch bolt with flat washer**
3. **Bridge**
4. **Hardened plug**
5. **Wedge attachment**
6. **Bearing inner race**
7. **Sprocket shaft**

Figure 3-14. Remove Inner Race From Sprocket Shaft

2. Place **new** thrust washer over sprocket shaft with the ink stamp facing outside (and the chamfer on the ID inboard).

3. Place **new** bearing inner race on bench top. Using the ROBINAIR HEAT GUN (HD-25070), uniformly heat bearing inner race for about 60 seconds using a circular motion.

4. Wearing suitable gloves to protect hands from burns, place heated bearing inner race over sprocket shaft.

NOTE

To facilitate installation without heat, apply a light penetrating oil to shaft and leading edge of bearing inner race.

⚠WARNING

Never use both heat and penetrating oil. Use only one or the other. Excessive heat can cause the penetrating oil to ignite resulting in flames or fire. Inadequate safety precautions can result in death or serious injury.

5. See Figure 3-15. Obtain the SPROCKET SHAFT TIMKEN BEARING CONE INSTALLER (HD-97225-55B). Assemble tool as described below.

   a. See Figure 3-16. Thread pilot shaft (1) onto sprocket shaft until contact is made with shoulder.

   b. Sparingly apply graphite lubricant to threads of pilot shaft (1) to prolong service life and ensure smooth operation.

   c. Slide sleeve (5) over pilot (1) until it contacts bearing inner race (6).

   d. Slide Nice bearing (4) and large flat washer (3) over pilot (1) until contact is made with sleeve (5).

   e. Thread handle (2) onto pilot shaft (1). See upper frame of Figure 3-16.

6. Rotate handle of tool in a clockwise direction until bearing inner race (6) bottoms against thrust washer (7). See lower frame of Figure 3-16.

7. Remove handle (2), flat washer (3), Nice bearing(4), sleeve (5) and pilot (1) from sprocket shaft.

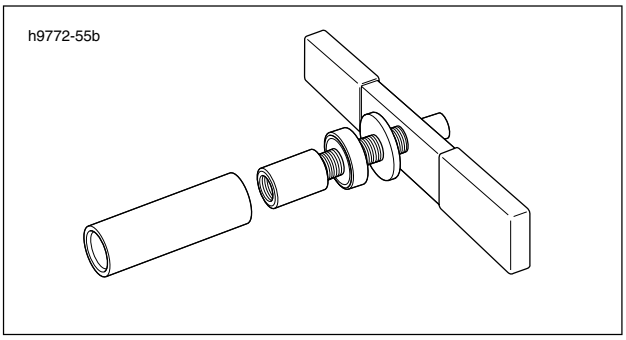
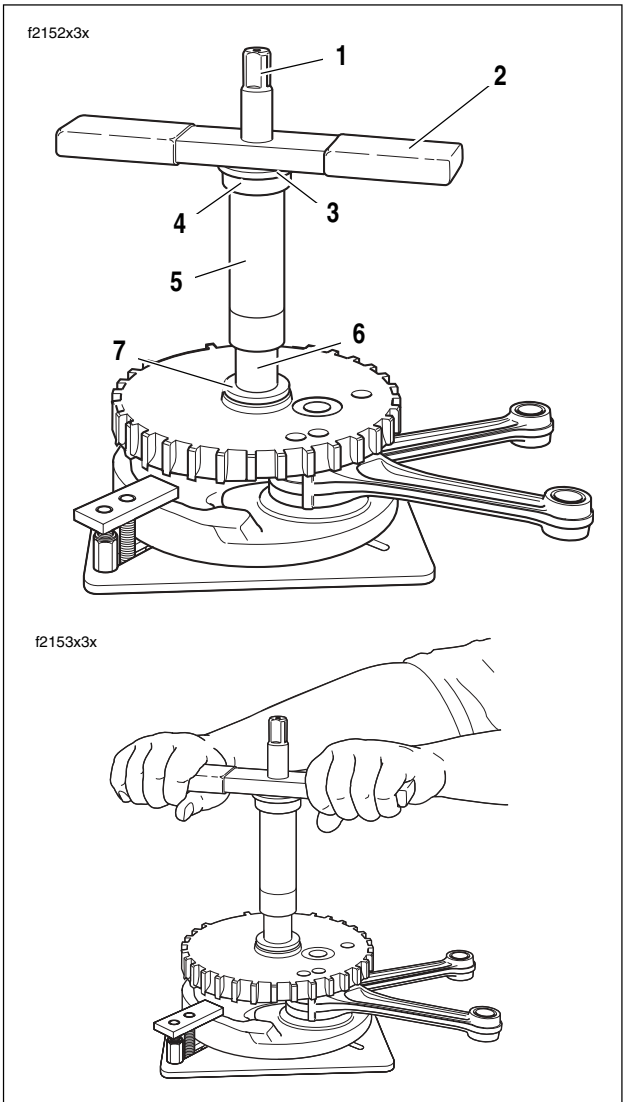


Figure 3-15. Sprocket Shaft Timken Bearing Cone Installer (Part No. HD-97225-55B)



1. **Pilot shaft**
2. **Handle**
3. **Flat washer**
4. **Nice bearing**
5. **Sleeve**
6. **Inner race**
7. **Thrust washer**

Figure 3-16. Press Inner Race Onto Sprocket Shaft

OIL VENT LINE 3.13

REPLACEMENT

PART NO.	SPECIALTY TOOL
HD-41137	Hose clamp pliers

IMPORTANT NOTE

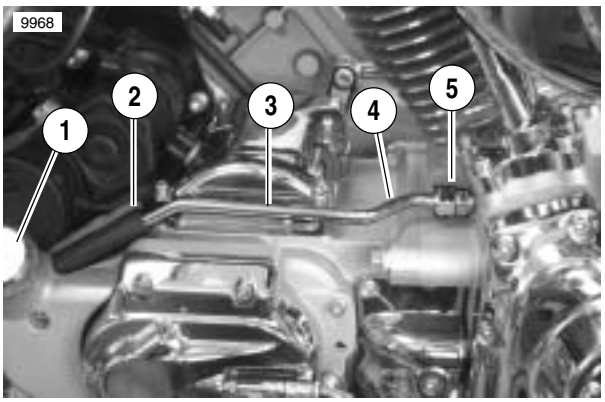
Dispose of oil in accordance with local regulations.

1. See Figure 3-17. Back the chrome nut off of the crankcase oil fitting (5).
2. Using side cutters, cut the clamps on the short length of hose (2) at the oil spout end of the vent line.
3. Remove the oil vent line.
4. If necessary, remove both fittings and clean sealant from threads in crankcase and oil fill.

NOTE

The spout fitting is a nipple styled fitting.

5. If removed, identify the crankcase end fitting and using pipe sealant or TEFLON® tape, prepare the tapered threaded end of fitting. Thread fitting into crankcase and tighten to 130-150 **in-lbs** (14.7-16.9 Nm).
6. If removed, identify oil spout fitting and using pipe sealant or TEFLON® tape, prepare the tapered threaded end of fitting. Thread fitting into oil spout and tighten to 130-150 **in-lbs** (14.7-16.9 Nm).
7. Slide crankcase fitting nut (5) and rubber ferrule on crankcase end of vent line.
8. Push **new** hose with **new** clamps on the oil spout end of chrome vent line.
9. Orient s-bend (4) in vent line toward crankcase and slide chrome vent line into case fitting.
10. Push hose onto oil spout fitting.
11. Position line parallel (3) with transmission cover and with clearance to other components.
12. Push rubber ferrule into crankcase fitting. Thread chrome nut over ferrule and hand tighten.
13. Tighten chrome nut to 60-80 **in-lbs** (6.8-9.0 Nm).
14. Using HOSE CLAMP PLIERS (HD-41137), crimp the clamps on the hose (2).
15. Operate motorcycle and inspect for leaks.



1. **Oil spout fitting**
2. **Hose**
3. **Oil vent line parallel to transmission cover**
4. **S-bend**
5. **Crankcase fitting nut**

Figure 3-17. Oil Vent Line (clamps removed)

OIL COOLER OPERATION 3.14

GENERAL

For engine oil flow through the engine, See ENGINE OIL FLOW under GENERAL INFORMATION in Touring Models Service Manual.

See Figure 3-18. The FLHRSEI^2 is equipped with a factory installed oil cooler (8) controlled by a thermostat in the oil filter mount (1).

Engine oil flows from the crankcase through the oil filter mount (1) to the oil cooler (8) through a supply hose (6). The oil circulates through the finned tubes of the cooler (8) to dissipate heat and returns to the oil filter mount through a return hose (7).

See Figure 3-22. Under pressure from the crankcase, engine oil enters the lower port (4) in the oil filter mount. A passage way (2) directs oil to flow to the oil filter. The oil circulates through the oil filter element and out the oil filter threaded fitting (1).

From the oil filter, the filtered oil flows in two directions:

1. From the oil filter adapter (1) Into the thermostat chamber.
2. Through a side passage (6) and out the supply oil fitting to the oil cooler.

See Figure 3-20.The thermostat chamber is located in line with the return port to the engine crankcase. The thermostat assembly consists of a temperature sensitive plunger (2) compressed between a spring-loaded piston (3), spring (4) and an open cage spreader (1).

While the engine oil temperature is below 180˚ F (82˚ C), the thermostat is in its closed position. See Closed Thermostat under 3.14 OIL COOLER OPERATION.

The filtered oil is circulated through the transfer passage where it returns to the crankcase. At the same time, oil is supplied under pressure to the oil cooler even though the oil cooler return port is blocked.

While the engine operates at average temperatures, approximately 195˚ F (91˚ C), the thermostat partially opens allowing cooler oil from the cooler to mix with warmer oil from the oil transfer passage as the oil returns to the crankcase. See Partially Open Thermostat under 3.14 OIL COOLER OPERATION.

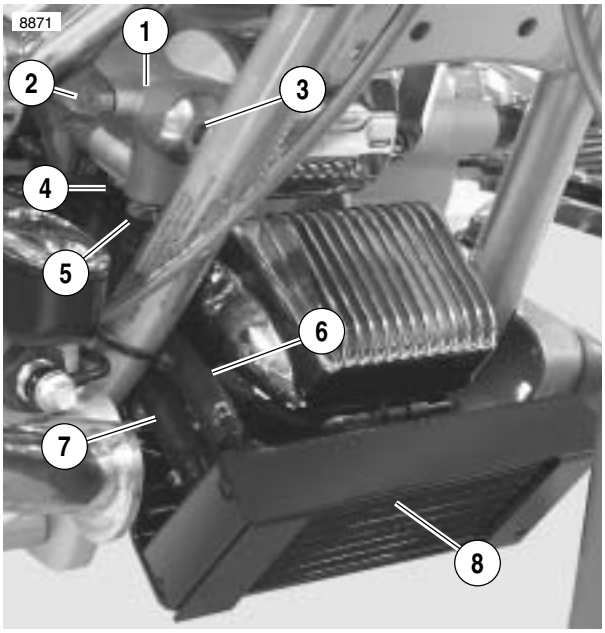
When the engine oil exceeds 210˚ F (99˚ C), the thermostat is in its fully open position. See Fully Open Thermostat under under 3.14 OIL COOLER OPERATION.

In this position, all the oil flows through the oil cooler and back through the oil filter mount before returning to the crankcase.

NOTE

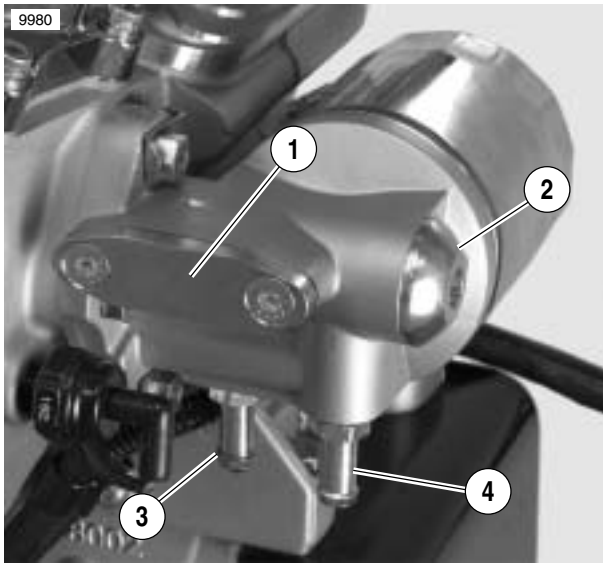
*Regardless of whether the thermostat is closed, partially open or fully open, oil is **always** pressurized in the transfer passage, the oil cooler supply hose, the oil cooler and the oil return hose.*

The oil cooler should always be checked for dirt and debris to maintain cooler efficiency at every service interval.



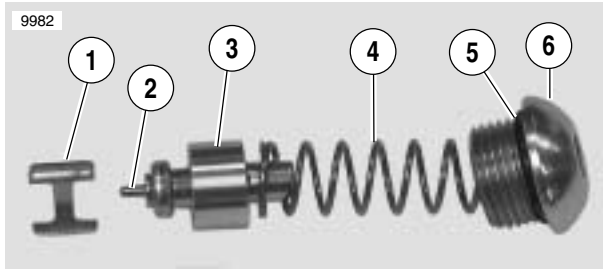
1. **Oil filter mount**
2. **Transfer passage cover**
3. **Thermostat plug**
4. **Oil return fitting**
5. **Oil supply fitting**
6. **Supply hose**
7. **Return hose**
8. **Oil cooler**

Figure 3-18. Oil Cooler and Bracket



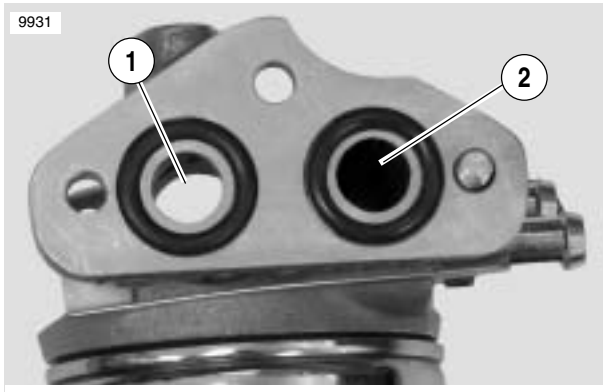
1. Transfer passage cover
2. Thermostat plug
3. Return hose fitting
4. Supply hose fitting

Figure 3-19. Oil Filter Mount on Engine



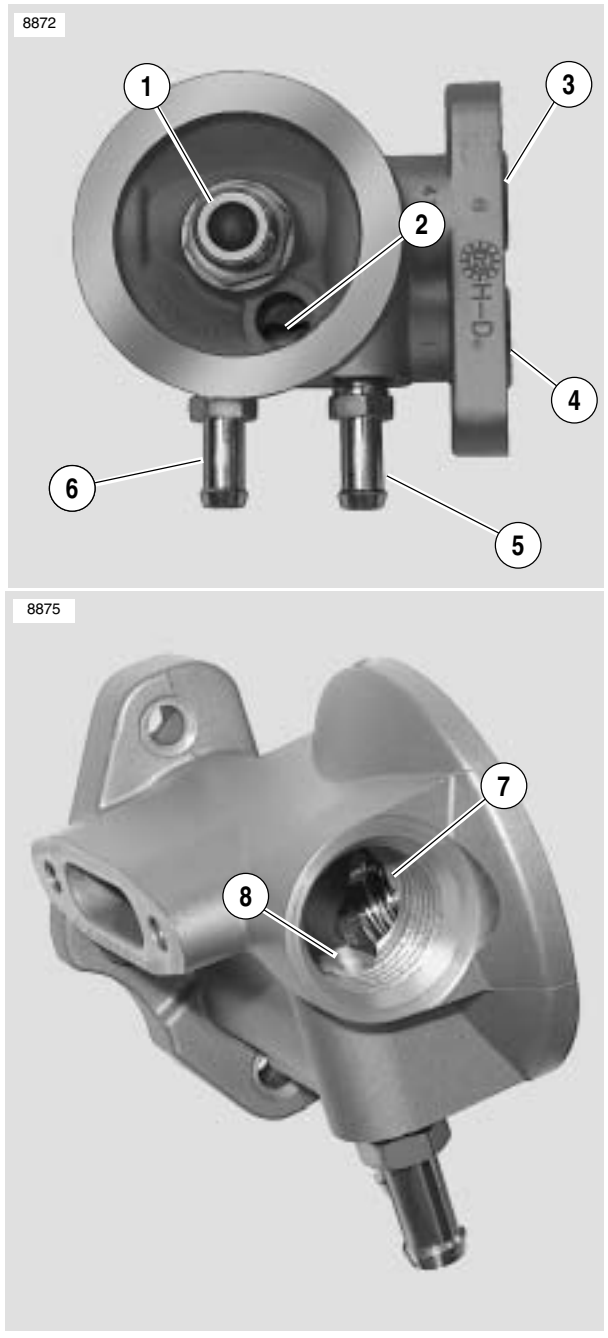
1. Open cage spreader
2. Thermostat plunger
3. Piston
4. Spring
5. O-ring
6. Thermostat plug

Figure 3-20. Thermostat Assembly



1. Return port to crankcase (thermostat removed)
2. Supply port from crankcase

Figure 3-21. Oil Filter Mount Ports to Crankcase



1. Oil filter adapter
2. Passage to oil filter element
3. Return to crankcase
4. Supply from crankcase
5. Return hose fitting
6. Supply hose fitting
7. Open passage from oil filter
8. Open passage to oil cooler supply

Figure 3-22. Oil Filter Mount

Closed Thermostat

See Figure 3-23. While the engine oil is cool, the thermostat is in its closed position. The spring holds the piston over the return passage (1) from the oil cooler. Even though oil pressure is supplied to the oil cooler, oil is blocked from returning from the oil cooler.

See Figure 3-24. When closed, the piston opens a port (3) in the transfer passage (2) along the side of the thermostat chamber. The filtered oil is circulated around the piston through the transfer passage and into a port (1) in the thermostat chamber where it flows through the open cage spreader and returns to the crankcase.

Partially Open Thermostat

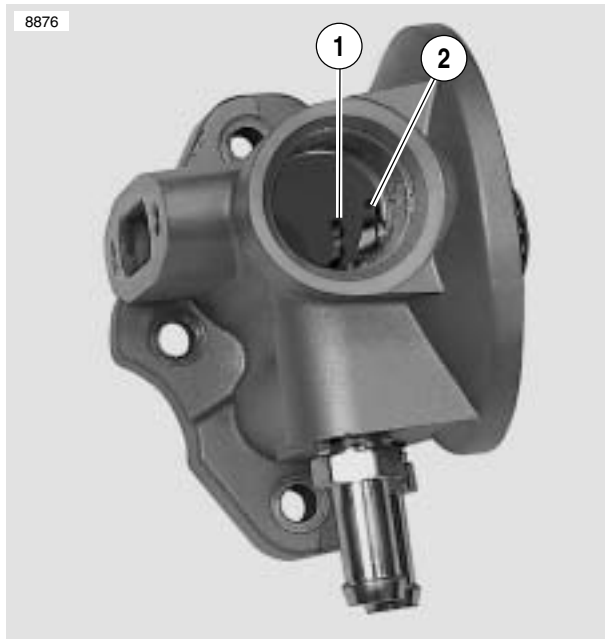
As the engine oil exceeds 180˚ F (82˚ C), the thermostat plunger begins to expand and compresses the spring pushing against the piston. The piston partially opens the return passage from the oil cooler and partially closes the port (3) from the chamber to the transfer passage.

While the engine operates at an average temperature, 195˚ F (91˚ C), the thermostat remains partially open allowing cooler oil from the cooler to mix with warmer oil from the oil filter.

Fully Open Thermostat

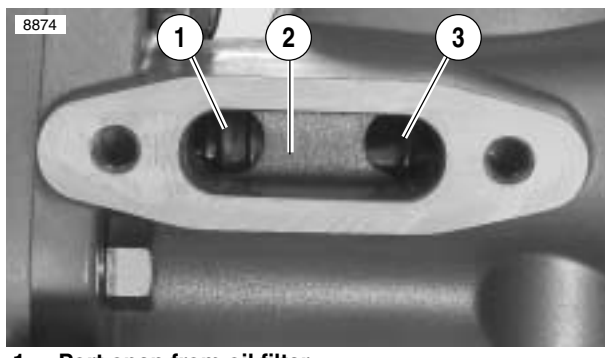
See Figure 3-25. The thermostat fully opens when the engine oil temperature exceeds 210˚ F (99˚ C). The piston fully closes the port (3) to the transfer passage and opens the return passage from the oil cooler.

In this position, all the oil flows from the oil filter through the oil cooler and back through the return passage before returning to the crankcase. The oil from the oil cooler return (1) will back up under pressure in the transfer passage (2) even though the port (3) from the oil filter is closed.



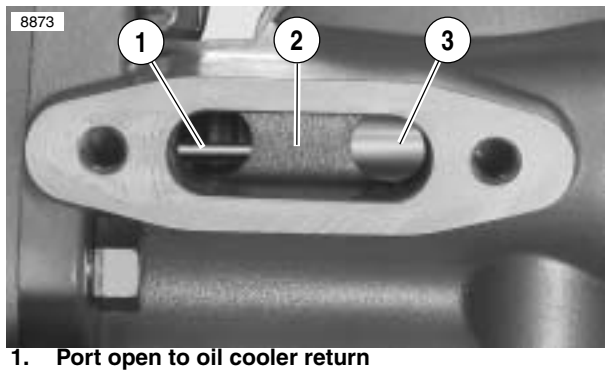
1. **Return passage from oil cooler**
2. **Open passage from oil filter**

Figure 3-23. Thermostat Chamber



1. **Port open from oil filter**
2. **Oil under pressure**
3. **Port open to crankcase return**

Figure 3-24. Closed Thermostat



1. **Port open to oil cooler return**
2. **Oil under pressure**
3. **Port closed from oil filter**

Figure 3-25. Fully Open Thermostat

OIL COOLER 3.15

REMOVAL

1. Cover the front fender to protect finish.

IMPORTANT NOTE

Dispose of oil in accordance with local regulations.

2. Place a container under the motorcycle to catch excess oil.
3. Remove the fasteners holding the oil cooler to mounting bracket.
4. Pull the cooler forward and, using side cutters, cut the clamps on the supply and return hoses.
5. Remove the oil cooler with guard (3).

NOTE

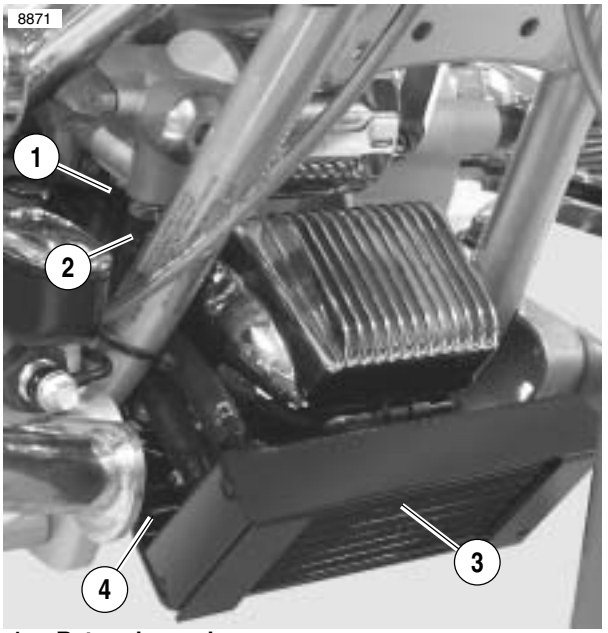
The oil cooler guard is held in place with adhesive tape.

6. If replacing the oil hoses, reaching under the frame rails and cut the clamps at the oil filter mount. Remove the oil hoses.
7. The oil cooler should be checked for dirt and debris.

INSTALLATION

PART NO.	SPECIALTY TOOL
HD-41137	Hose clamp pliers

1. If replacing the hoses, install **new** hoses with clamps at the oil filter mount. Using HOSE CLAMP PLIERS (HD-41137), clamp the supply and return hoses at the oil filter mount.
2. Attach hoses to oil cooler. Using HOSE CLAMP PLIERS (HD-41137), clamp the supply and return hoses at the oil cooler.
3. Install oil cooler and guard to mounting bracket. Tighten fasteners to 80-110 **in-lbs** (9.1-12.4 Nm).
4. Operate motorcycle and inspect for leaks.



1. **Return hose clamp**
2. **Supply hose clamp**
3. **Oil cooler and guard**
4. **Bracket**

Figure 3-26. Oil Cooler and Mount

OIL FILTER MOUNT 3.16

REMOVAL

PART NO.	SPECIALTY TOOL
HD-42311 or HD-44067	Oil filter wrench

1. Place a container under motorcycle to catch excess oil.
2. Bend a cardboard funnel and fit to motorcycle to route fluid away from regulator and oil cooler to container.
3. Using OIL FILTER WRENCH (HD-42311 or HD-44067), remove oil filter. Discard oil filter

IMPORTANT NOTE

Dispose of oil in accordance with local regulations.

4. If necessary, remove the threaded oil filter adapter.
5. Using side cutters, cut the clamps and remove oil cooler hoses.
6. If necessary, loosen but do not remove thermostat plug.
7. Bend tabs of the lockplate away from bolt heads.
8. Remove oil filter mount lockplate fasteners and flat washers. Discard lockplate.
9. Remove middle bolt with flat washer and remove oil filter mount.

DISASSEMBLY

1. If necessary, remove the thermostat. See 3.17 THERMOSTAT.
2. See Figure 3-28. Remove the o-rings in the oil filter mount.
3. Remove the transfer passage cover.
4. Remove the transfer passage cover gasket.
5. Remove the two oil cooler line fittings.
6. Clean the oil passages in a cleaning solution or solvent.
7. Remove thread locking adhesive from the threads of the oil filter adapter.
8. Inspect the oil passages and the oil filter mount.



Figure 3-27. Oil Filter Mount (engine removed from frame)

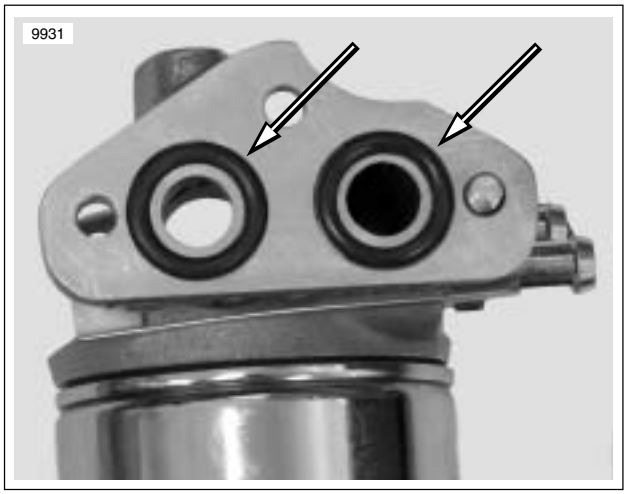


Figure 3-28. Oil Filter Mount O-rings (thermostat removed)

ASSEMBLY

1. See Figure 3-29. Install a **new** gasket on the transfer passage cover.
2. Install the transfer passage cover. Tighten to 90-120 **in-lbs** (10.2-13.5 Nm).
3. Using pipe sealant or TEFLON tape, prepare the tapered threaded end of oil supply and return fittings and install fittings.
4. If removed, replace the thermostat components:
   a. Replace the spreader.
   b. Replace the thermostat plunger and piston.
   c. Replace the spring.
   d. Install a **new** o-ring and loosely install thermostat plug.

INSTALLATION

PART NO.	SPECIALTY TOOL
HD-41137	Hose clamp pliers

1. Install the oil cooler oil hoses to the filter mount with **new** clamps.
2. Using HOSE CLAMP PLIERS (HD-41137), crimp the clamps.
3. Place flat washers in recessed bolt holes at top and bottom of filter mount flange.
4. Align holes in lockplate with holes in flat washers.
5. Slide two fasteners through lockplate, flat washers and filter mount flange. Apply LOCTITE 243 (blue) (HD-99642-97) to threads of installed bolts.
6. See Figure 3-28. Install **new** o-rings into grooves in oil filter mount.

CAUTION

To avoid cross threading tapped holes, exercise care when starting hex head bolts in crankcase.

7. Align holes in filter mount flange with holes in crankcase and tighten bolts until snug.
8. Install flat washer on remaining fastener, apply LOCTITE to threads and install in middle hole of mount flange.
9. Starting at the top, alternately tighten the fasteners to 130-150 **in-lbs** (14.7-16.9) Nm.
10. Bend the ends of the lockplate to capture the top and bottom fasteners.
11. If disassembled, tighten the Thermostat plug to 15-20 ft-lbs (20.4-27.1 Nm).
12. Apply LOCTITE THREADLOCKER 243 (blue) to tapered threads of oil filter adapter. Install oil filter adapter and tighten to 12-16 ft-lbs (16.3-21.7 Nm).
13. Install a **new** oil filter. See SCHEDULED MAINTENANCE in Touring Models Service Manual.



Figure 3-29. Transfer Passage Cover and Gasket

THERMOSTAT 3.17

TEST PROCEDURE

1. Using an infrared thermometer, measure the temperature at the oil pan and at the oil cooler while operating motorcycle.
2. Compare temperatures.
   a. If the temperature of the oil cooler follows the temperature of the oil pan at temperatures below 180˚ F (82˚ C), then the thermostat may be stuck open. Allow the engine to cool, remove the thermostat. and proceed.
   b. If the temperature of the oil cooler is less than that of the oil pan below 180˚ F (82˚ C) but, above 180˚ F (82˚ C), follows the temperature of the oil pan, the thermostat is operating correctly.
   c. If the oil pan exceeds 210˚ F (99˚ C) and the oil cooler is cooler, then the thermostat may be stuck closed. Allow the engine to cool, remove the thermostat and proceed.
3. Verify that thermostat plunger is fully retracted.
4. Place thermostat plunger in a container of water with a thermometer.
5. Refer to Table 3-25. Heat water to START TO OPEN temperature. Verify that the plunger extends.
6. Heat water pass START TO OPEN temperature to FULL OPEN temperature and verify that plunger is fully extended.
7. If plunger does not extend per specifications, replace thermostat assembly.

Table 3-25. Thermostat Operating Range

ITEM	FAHRENHEIT	CELSIUS
START TO OPEN (closed)	180˚	82˚
AVERAGE (partially open)	195˚	91˚
FULL OPEN (fully open)	210˚	99˚

REMOVAL

1. Allow the motorcycle to cool.
2. Place a catch pan under motorcycle.
3. Bend a cardboard funnel and fit to motorcycle to route fluid away from regulator and oil cooler to container.

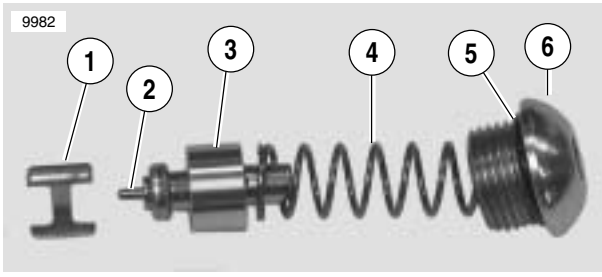
IMPORTANT NOTE

Dispose of oil in accordance with local regulations.

4. See Figure 3-30. With a ball Allen wrench, loosen and remove the thermostat plug (6).
5. Remove the spring (4).
6. Remove the thermostat plunger (2) and piston (3) with a pair of needle nosed pliers.
7. Remove the open cage spreader (1) with a pick.

INSTALLATION

1. See Figure 3-30. Insert the open cage spreader (1) part way into thermostat chamber.
2. Install the thermostat plunger (2) and piston (3) together.
3. Locate the plunger (2) in the spreader (1) and push in to bottom of chamber.
4. Install the spring (4).
5. Fit a **new** o-ring (5) and install thermostat plug (6). Tighten to 15-20 ft-lbs (20.4-27.1 Nm).



1. **Open cage spreader**
2. **Thermostat plunger**
3. **Piston**
4. **Spring**
5. **O-ring**
6. **Thermostat plug**

Figure 3-30. Thermostat Components

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FUEL SYSTEM 4

NOTE

This section provides information unique to FLHRSEI^2 model motorcycles. Any information not presented in this supplement can be found in the Touring Models Service Manual.

ELECTRIC STARTER 5

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NOTE

This section provides information unique to FLHRSEI[2] model motorcycles. Any information not presented in this supplement can be found in the Touring Models Service Manual.

SPECIFICATIONS 5.1

Table 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	8.7 ft-lbs (11.8 Nm) min. @ 2.4 V (500 Amps max.)

TORQUE VALUES 5.2

ITEM	TORQUE		NOTES
Jackshaft bolt	84-108 **in-lbs**	9.5-12.2 Nm	page 5-3
Negative battery cable	60-96 **in-lbs**	6.8-10.9 Nm	page 5-3
Starter mounting screws	13-20 ft-lbs	18-27 Nm	page 5-3

STARTER 5.3

REMOVAL

1. Remove seat. See 2.18 SEAT.

⚠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 PRIMARY CHAINCASE REMOVAL in Touring Models Service Manual.
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 lock washer. Remove rear mounting screw (with lock washer) and disconnect chassis ground cable ring terminal. Remove Keps nut from stud of bracket tab and remove exhaust support bracket.
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.
10. Remove the starter from the right side of the vehicle, carefully sliding it through the space between the exhaust pipe and side cover.

NOTE

To remove starter, tilt the starter to facilitate removal from transmission. Avoid damage to starter, engine or frame.

11. Remove the coupling from the starter motor output shaft, if necessary.
12. Before disassembly, perform tests on the assembled starter. See STARTER, DISASSEMBLY, TESTING AND REPAIR in Touring Models Service Manual.

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. From right side of vehicle, tilt the starter and work into its installed position. Starter coupler must remain on shaft and mate to starter jackshaft. SEE STARTER JACKSHAFT in Touring Models Service Manual.
3. Install filler spout in oil tank.
4. Install slot of exhaust support bracket onto stud of bracket tab aligning other holes with those in starter flange. Start Keps nut on stud.
5. Engaging hole in exhaust support bracket, install starter front mounting screw with lock washer. Slide chassis ground cable ring terminal onto rear mounting screw (with lock washer) and install in the same manner.
6. Alternately tighten starter front and rear mounting screws to 13-20 ft-lbs (18-27 Nm). Tighten Keps nut on stud of bracket tab.
7. 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.
8. Snap solenoid connector to terminal at top of starter housing.
9. Slide lockplate and **new** thrust washer onto jackshaft bolt, if removed. Insert bolt into jackshaft bore.
10. 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.
11. Holding pinion gear to prevent rotation, tighten jackshaft bolt to 84-108 **in-lbs** (9.5-12.2 Nm). Bend tab on lockplate against flat of bolt head to secure.
12. Install the primary chaincase cover. See PRIMARY CHAINCASE, INSTALLATION in Touring Models Service Manual.
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. Check engine oil and add as necessary. See GENERAL INFORMATION, CHANGING ENGINE OIL AND FILTER in Touring Models Service Manual.
15. Start engine and carefully check for leaks around oil filler spout.
16. Install seat. See 2.18 SEAT.

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6.2 Torque Values 6-2
6.3 Clutch Release Bearing 6-3

NOTE

This section provides information unique to FLHRSEI[2] model motorcycles. Any information not presented in this supplement can be found in the Touring Models Service Manual.

DRIVE 6

SPECIFICATIONS 6.1

Table 6-1. Gear Ratios

GEAR	RATIO
1	10.11
2	6.958
3	4.953
4	3.862
5	3.15

Table 6-2. Primary Chain Free Play

FREE PLAY	IN.	MM
COLD Engine	5/8-7/8	15.9-22.2
HOT Engine	3/8-5/8	9.5-15.9

Table 6-3. Primary Chaincase Lubricant

	OZ	ML
Amount	32	946
	QT	**GAL**
Part No.	99887-84	99886-84

Table 6-4. Drive Belt Deflection

DEFLECTION	IN.	MM
On Ground Without Rider	5/16-3/8 at 10 lbs force	7.9-9.5 at 4.5 kg force
On Ground With Rider*	1/4-5/16 at 10 lbs force	6.4-7.9 at 4.5 kg force

* 11.5 inches between shock eyelets

Table 6-5. Sprockets

SPROCKET	NUMBER OF TEETH
Engine	25
Clutch	36
Transmission	32
Rear wheel	70

TORQUE VALUES 6.2

ITEM	TORQUE		NOTES
Clutch inspection cover	84-108 **in-lbs**	10-12 Nm	page 6-3

CLUTCH RELEASE BEARING 6.3

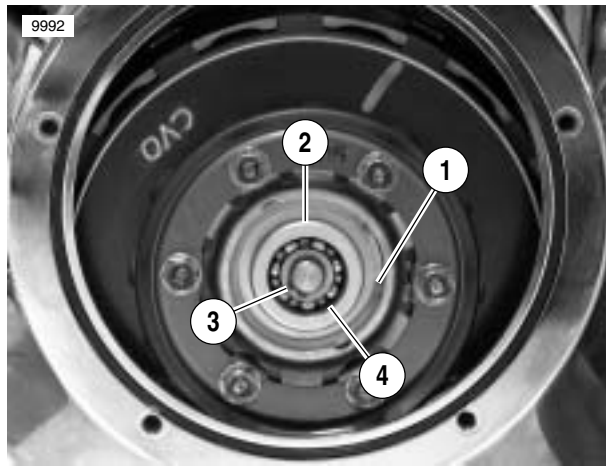
REMOVAL

1. Remove seat. See 2.18 SEAT.

⚠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. Remove negative battery cable from battery.
3. Remove clutch inspection cover.
4. See Figure 6-1. Remove outer retainer clip (1).
5. Pull out release bearing plate (2) with push rod.
6. Remove push rod retainer (3).
7. Press out bearing (4).



1. **Outer retainer clip**
2. **Release bearing plate**
3. **Push rod retainer**
4. **Release bearing**

Figure 6-1. Clutch Release Bearing

INSTALLATION

1. See Figure 6-1. Pressing on the outer race, press a **new** bearing (4) into plate (2).
2. Assemble push rod to plate (2).
3. Snap in push rod retainer (3).
4. Slide push rod and clutch release bearing through clutch pack to secondary clutch actuator.
5. Snap in outer retainer (1).
6. See Figure 6-2. Install clutch inspection cover. In sequence, tighten fasteners to 84-108 **in-lbs** (10-12 Nm).
7. Connect negative battery cable to battery.

⚠WARNING

After installing the seat, pull upward on the front of the seat to be sure it is locked into position. If seat is loose, it could shift during operation, resulting in loss of control of the motorcycle and death or serious injury.

8. Install seat. See 2.18 SEAT.

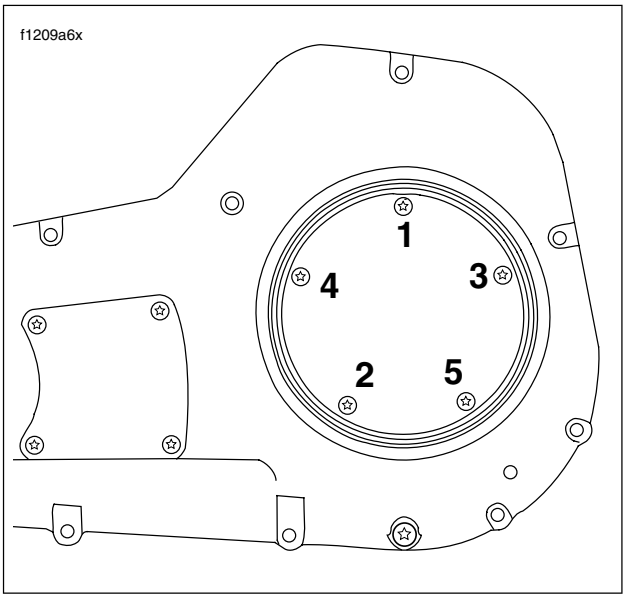


Figure 6-2. Clutch Inspection Cover Torque Sequence

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7.3 Torque Values 7-3
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7.5 Secondary Clutch Actuator.....7-6

NOTE

This section provides information unique to FLHRSEI^2 model motorcycles. Any information not presented in this supplement can be found in the Touring Models Service Manual.

TRANSMISSION 7

SPECIFICATIONS 7.1

Table 7-1. Transmission Data

TRANSMISSION		DATA
Type		5-speed forward - constant mesh
Semi-synthetic transmission lubricant	Quart	Part No. 99892-84
	Case of quarts	Part No. 98853-96
	Gallon	Part No. 99891-84
	Case of gallons	Part No. 98852-96
Capacity (dry)		24 oz.
		710 ml
Capacity (wet)		Approximately 20-24 oz.
		590-710 ml

Table 7-2. Internal Gear Ratios

GEAR	INTERNAL GEAR RATIOS
First	3.21
Second	2.21
Third	1.57
Fourth	1.23
Fifth	1.00

SERVICE WEAR LIMITS 7.2

Table 7-3. Shifter Forks

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

Table 7-4. Mainshaft

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

Table 7-5. Main Drive Gear (5th)

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
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

Table 7-6. Countershaft

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

Table 7-7. Shifter Dogs

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 7.3

ITEM	TORQUE		NOTES
Bleeder valve	80-100 **in-lbs**	9-11 Nm	page 5
Clutch fluid line flare nut	80-115 **in-lbs**	9-13 Nm	page 5
Clutch fluid reservoir banjo bolt	17-22 ft-lbs	23-31 Nm	page 5
Clutch fluid reservoir cover	6-8 **in-lbs**	0.7-0.9 Nm	page 5
Clutch release cover	120-144 **in-lbs**	14-16 Nm	page 5
Filler plug/dipstick	25-75 **in-lbs**	2.8-8.5 Nm	page 5
Negative battery cable	60-96 **in-lbs**	6.8-10.9 Nm	page 5
Transmission drain plug	14-21 ft-lbs	19-28 Nm	page 5

CLUTCH RELEASE COVER 7.4

REMOVAL

1. Remove filler plug/dipstick.
2. Place a suitable container under transmission. Remove magnetic drain plug at bottom right of oil pan and drain transmission lubricant.
3. Remove seat. See 2.18 SEAT.

⚠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. Remove negative battery cable (black) from negative (-) battery terminal.
5. Remove the right side of the exhaust system. See EXHAUST in the Touring Models Service Manual.
6. See Figure 7-1. Place a suitable container under clutch release cover. Remove cap and open bleeder valve (1) and loosen flare nut (2) and allow clutch fluid to drain.
7. Remove flare nut (2) on outside of the clutch release cover. Remove clutch fluid line (3) and drain line.

IMPORTANT NOTE

Dispose of clutch fluid in accordance with local regulations.

8. See Figure 7-3. Remove o-ring on end of clutch fluid line. Discard o-ring.

NOTE

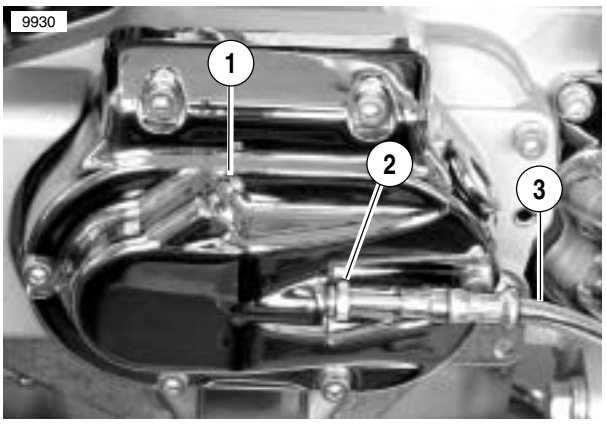
Clutch fluid line o-ring may stick to inside of clutch release cover. Use a pick to remove old o-ring and other debris.

9. Remove clutch release cover fasteners, cover and gasket.
10. Clean and inspect clutch release cover. Clean with denatured alcohol or D.O.T. 5 SILICONE BRAKE FLUID, only.

NOTE

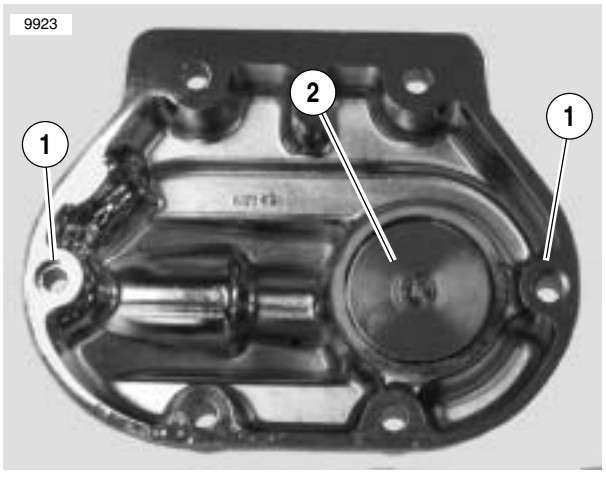
If required, replace locating dowels in transmission side door.

11. See Figure 7-2. Disassemble and inspect secondary clutch actuator (2). Rebuild if required. See 7.5 SECONDARY CLUTCH ACTUATOR.



1. **Bleeder valve (cap removed)**
2. **Flare nut**
3. **Clutch fluid line**

Figure 7-1. Clutch Release Cover (exhaust system removed)



1. **Hole for locating dowel**
2. **Secondary clutch actuator**

Figure 7-2. Inside Clutch Release Cover

INSTALLATION

1. Place a **new** clutch release gasket on locating dowels and position clutch release cover on transmission side door.
2. Install fasteners with the two short fasteners at the top of the release cover. Tighten fasteners to 120-144 **in-lbs** (14-16 Nm).
3. See Figure 7-3. Install a **new** clutch fluid line o-ring on the end of the clutch fluid line.
4. Install clutch fluid line flare nut to clutch release cover. Tighten to 80-115 **in-lbs** (9-13 Nm).
5. Loosen bleeder valve.

⚠WARNING

Be sure NO clutch fluid gets on rear tire, wheel or brakes when adding clutch fluid. Traction will be adversely affected which could result in loss of control of the motorcycle and death or serious injury.

⚠WARNING

Do NOT allow foreign matter to enter the clutch master cylinder reservoir. Dirt or debris in the reservoir may cause improper operation of the clutch and equipment damage.

⚠WARNING

Direct contact of D.O.T. 5 SILICONE BRAKE FLUID with eyes may cause eye irritation, swelling, and redness. Avoid eye contact. In case of eye contact flush with large amounts of water and seek medical attention immediately. Swallowing large amounts of D.O.T. 5 SILICONE BRAKE FLUID may cause digestive discomfort. If swallowed, seek medical attention immediately. Use in well ventilated area. KEEP OUT OF REACH OF CHILDREN.

⚠WARNING

The piston in the secondary clutch actuator is under pressure. Squeezing the clutch hand lever could force the piston out of its housing with sufficient force to cause death or serious injury.

6. Remove clutch fluid reservoir cover and fill with D.O.T. 5 SILICONE BRAKE FLUID. Allow fluid to fill clutch line until a steady flow of clutch fluid flows from bleeder valve. Tighten bleeder valve.

NOTE

When filling an empty clutch fluid line, a Snap-on BASIC VACUUM BRAKE BLEEDER with a fitting that mates to the bleeder valve threads can be used to initially draw the fluid down the clutch line with little or no air in the line.

7. Bleed clutch fluid line. See BLEEDING CLUTCH FLUID LINE.

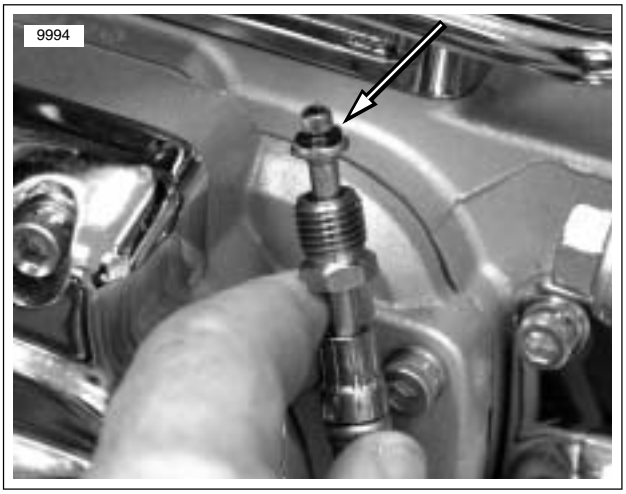


Figure 7-3. Clutch Fluid Line O-ring

8. Tighten fasteners as follows:
   a. Reservoir banjo bolt to 17-22 ft-lbs (23-31 Nm).
   b. Bleeder valve to 80-100 **in-lbs (**9-11 Nm).
   c. Reservoir cover screws to 6-8 **in-lbs (**0.7-0.9 Nm).
9. Install bleeder valve cap.
10. Inspect o-ring on transmission lubricant drain plug and replace as necessary. Install drain plug and tighten to 14-21 ft-lbs (19-28 Nm).
11. Fill the transmission with 20-24 oz. (590-710 ml) of transmission lubricant or until the lubricant level on the dipsitck of the filler plug is at the F (full) mark with the motorcycle level and upright 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).
12. Inspect the filler plug/dipstick o-ring and install filler plug/dipstick. Tighten the plug to 25-75 **in-lbs** (2.8-8.5 Nm).
13. Install exhaust system. See EXHAUST in Touring Models Service Manual.
14. Install negative battery cable. Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
15. Install seat. See 2.18 SEAT.

SECONDARY CLUTCH ACTUATOR 7.5

REBUILD

1. Remove the clutch release cover. See 7.4 CLUTCH RELEASE COVER.

⚠WARNING

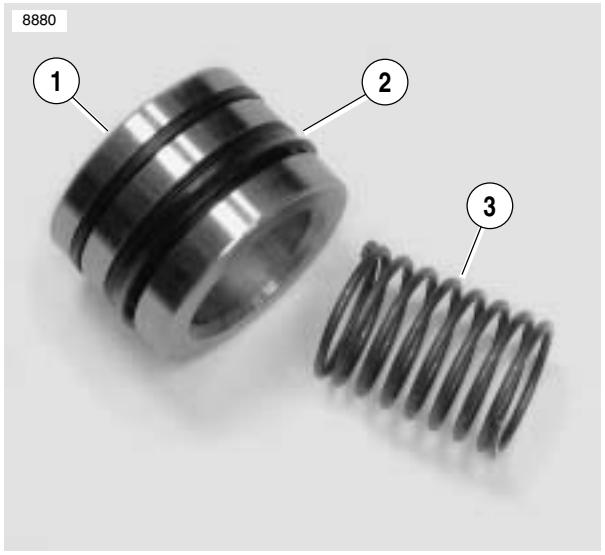
Pressurized air can blow debris into your face and eyes. Always wear eye protection or a face shield when using pressurized air. Failure to take adequate safety precautions could result in death or serious injury.

2. Remove piston.
   a. If the bleeder valve was removed, reinstall.
   b. Support on a wooden block and apply low pressure compressed air to clutch fluid line hole to remove piston from cover bore.
3. See Figure 7-4. If necessary, wiggle piston (1) from actuator bore to completely remove.
4. Remove the spring (3). Discard spring (3) and piston (1) assembly.

CAUTION

Damaged pistons or piston bores will leak when reassembled. Do not use metal objects to remove or install objects from piston bores. Prevent damage to bores by only using a wooden toothpick when servicing secondary clutch actuator.

5. Lubricate **new** piston assembly (1) and piston bore with the service kit lubricant.
6. Install **new** spring (3).
7. While pushing piston into actuator bore, use a wooden tooth pick or the end of a cable wrap to prevent primary cup (2) from rolling over.



1. **Piston**
2. **Primary cup**
3. **Spring**

Figure 7-4. Secondary Clutch Actuator Components

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NOTE

This section provides information unique to the FLHRSEI^2 model motorcycles. Any information not presented in this supplement can be found in the current Touring Model Service Manual.

ELECTRICAL 8

TORQUE VALUES 8.1

ITEM	TORQUE		NOTES
Console fastener with washer	12-60 **in-lbs**	1.4-6.7 Nm	page 8-2
Electrical control housings	35-45 **in-lbs**	4-5 Nm	page 8-8
Ignition switch	20-30 **in-lbs**	2.3-3.3 Nm	page 8-4
Instrument console acorn nut	50-90 **in-lbs**	5.7-10.9 Nm	page 8-2
Instrument console retainer clips	20-30 **in-lbs**	2.3-3.3 Nm	page 8-2
Rear turn signal bar	84-144 **in-lbs**	9.5-16.3 Nm	page 8-9
Rear view mirror acorn nuts	60-96 **in-lbs**	6.8-10.8 Nm	page 8-8
Tach bracket	60-84 **in-lbs**	6.8-9.5 Nm	page 8-11
Tach can	10-20 **in-lbs**	1.2-2.2 Nm	page 8-11
Taillamp lens	20-24 **in-lbs**	2.3-2.7 Nm	page 8-9
Turn signal housings setscrew	50-60 **in-lbs**	5.7-6.8 Nm	page 8-8
Turn signal lamp assemblies	30-50 **in-lbs**	3.4-5.6 Nm	page 8-9

INSTRUMENT CONSOLE 8.2

REMOVAL

1. Cover finish and chrome on fuel gauge side of tank with clean shop towel.
2. Remove acorn nut from in front of LED indicator display.
3. Remove fastener and washer from the rear of the console. Lay console over to fuel gauge side.
4. See Figure 8-1. Unthread odometer reset boot (1).
5. Separate:
   a. Speedometer connector [39] (2).
   b. Ignition harness connector [33] (7).
   c. Indicator lamps connector [21] (3).

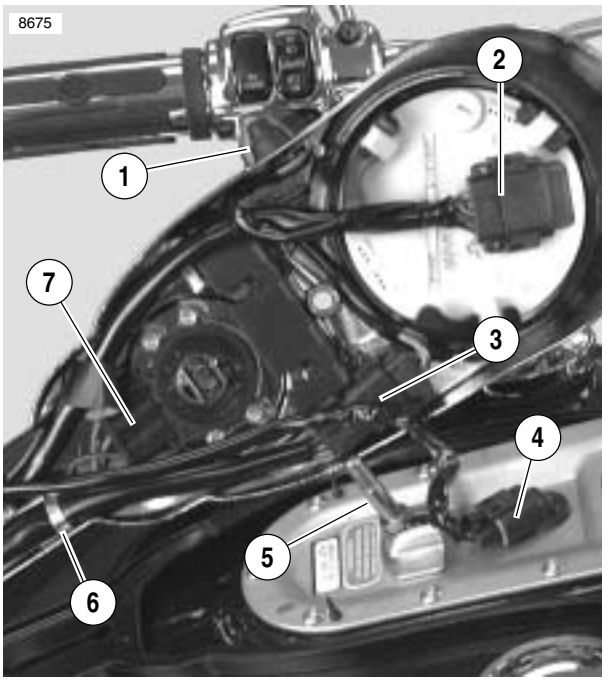
NOTE

Fuel sender connector [141] (4) can remain connected. Wire harness will remain after the instrument console is removed.

6. Bend metal retainer clips (6) away from wire harness conduits. Remove retainer clips if damaged.
7. Remove console.
8. Remove rubber molding trim from tank.

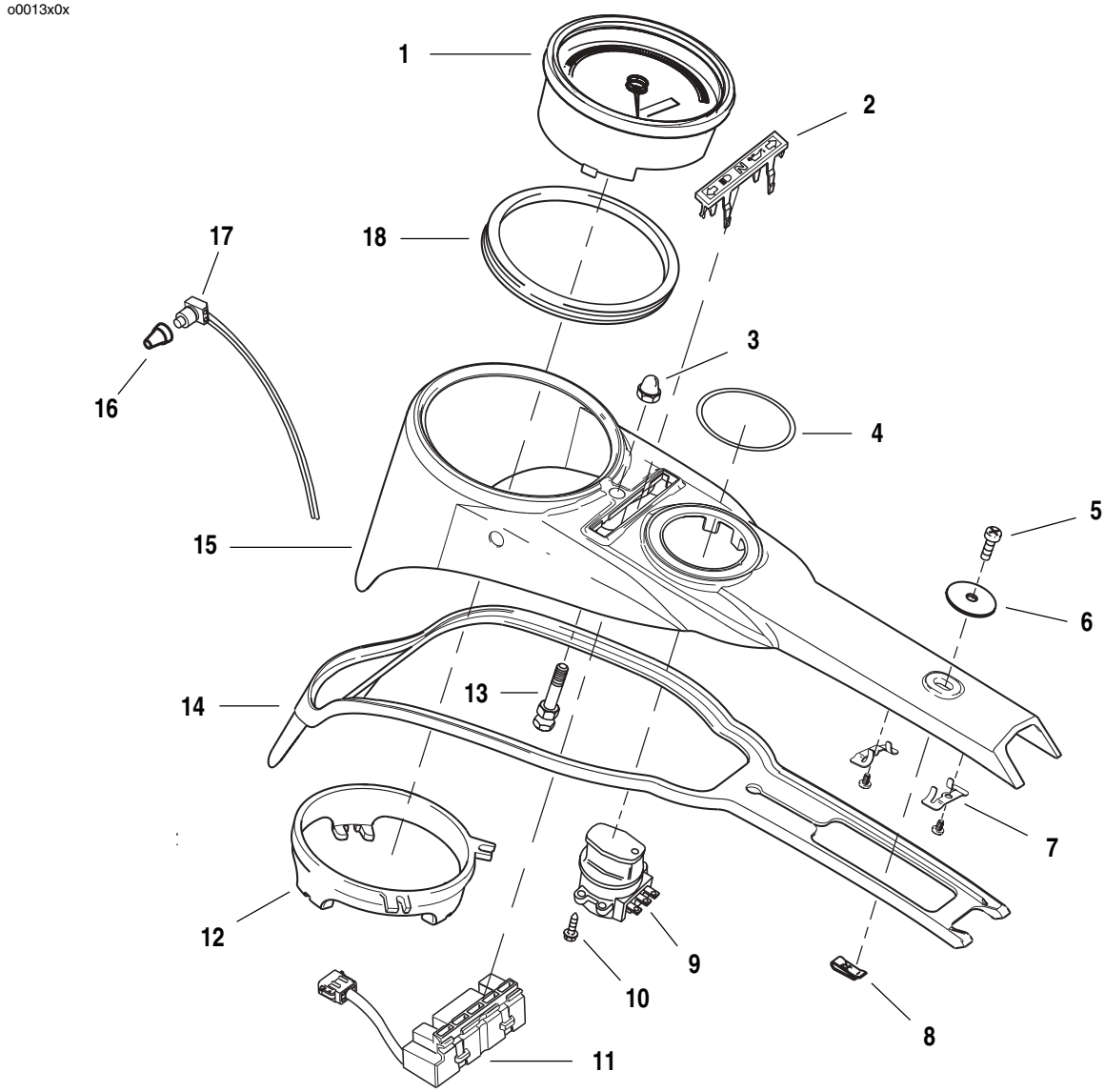
INSTALLATION

1. Replace retainer clips if necessary. Tighten to 20-30 **in-lbs** (2.3-3.3 Nm).
2. Replace rubber molding trim.
3. See Figure 8-1. Route the wire harness conduits as shown and push together connectors:
   a. Speedometer connector [39] (2).
   b. Ignition harness [33] (7).
   c. Indicator lamps connector [21] (3).
4. Install odometer reset button and wire with rubber boot (1).
5. Bend metal retainer clips (6) to capture wire harness conduits.
6. Slide head of console mounting stud (5) into slot on fuel tank. Align hole in console with mounting stud and thread on fastener.
7. Install fastener and washer at rear of console.
8. Tighten fasteners:
   a. Acorn nut on mounting stud to 50-90 **in-lbs** (5.7-10.9 Nm).
   b. Fastener with washer to 12-60 **in-lbs** (4.1-6.7 Nm).



1. **Odometer reset boot**
2. **Speedometer connector [39]**
3. **Indicator lamps connector [21]**
4. **Fuel sender connector [141]**
5. **Console mounting stud**
6. **Metal retainer clip**
7. **Ignition harness connector [33]**

Figure 8-1. Console Wire Routing



1. Speedometer
2. LED indicator bezel
3. Acorn nut
4. Ignition switch nameplate
5. Fastener
6. Washer
7. Metal retaining clip and fastener
8. Clip nut
9. Ignition switch
10. Fastener @ 20-30 in-lbs (2.3-3.3 Nm)
11. LED indicator light housing
12. Back clamp
13. Mounting stud
14. Mold trim
15. Instrument panel
16. Odometer reset switch boot
17. Odometer reset switch
18. Speedometer seal

Figure 8-2. Console Components

SPEEDOMETER

1. If replacing speedometer only, remove console and separate speedometer connector [39].
2. See Figure 8-3. Gently pry the three latches outward to release back clamp from the back of the speedometer.
3. Remove the speedometer from the top side of the console.
4. See Figure 8-2. Remove the speedometer seal (18).
5. Lubricate rubber speedometer seal with isopropyl alcohol or glass cleaner. Fit seal to console.
6. From the top side of the console, orient speedometer to riders vision and push speedometer into seal.
7. Align the slots of the back clamp with the console bosses. Use both thumbs to press the latches down until they lock into position on the speedometer.
8. Install console.



Figure 8-3. Back Clamp and Speedometer

IGNITION SWITCH

1. If replacing switch only, remove console from tank and separate ignition connector [33].
2. Release locking tabs.
3. Remove fasteners securing ignition switch to console. Remove ignition switch.
4. Replace switch and tighten fasteners to 20-30 **in-lbs** (2.3-3.3 Nm).
5. Install console.

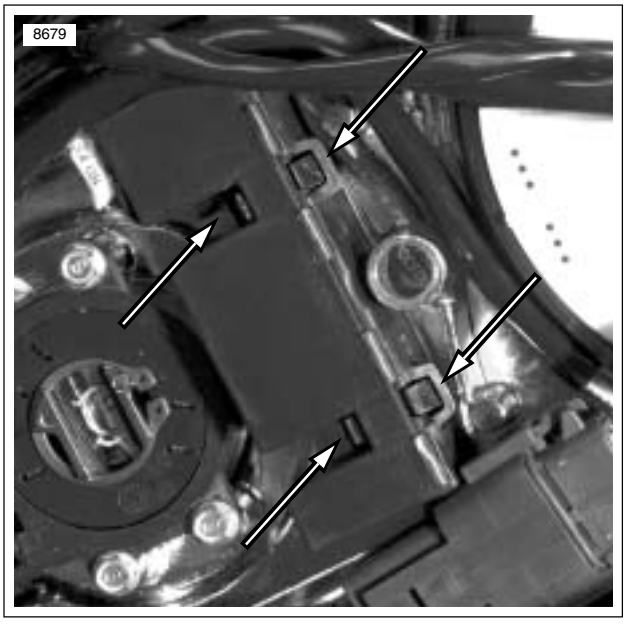


Figure 8-4. Indicator Lamp Housing Paddles

LED INDICATOR LIGHTS

1. If replacing LED indicator lights only, remove console from tank and separate connector [21].
2. Insert blade of a large screwdriver under rear corner of LED housing.
3. See Figure 8-4. Squeeze front and rear paddles of the console indicator bezel on the same side of the housing while rotating screwdriver.
4. When one side of housing is free, repeat on opposite set of paddles to release housing.
5. If necessary, replace console indicator bezel.
6. To install, set housing slots over paddles of console indicator bezel and press down on housing while pressing up on console indicator bezel.
7. Install console.

FUEL GAUGE WIRE ROUTING

Pulling Gauge Wires

1. Remove seat. See 2.18 SEAT.

⚠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 the front left side of fuel tank, 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 and slide conduit off.

NOTE

For instructions on properly removing wire terminals, see APPENDIX B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, INSTALLING SOCKET/PIN TERMINALS in the Touring Models Service Manual.

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.
7. To remove fuel gauge from vehicle, feed wires and pin terminals up into drain tube of fuel tank while carefully raising cap.
8. 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.

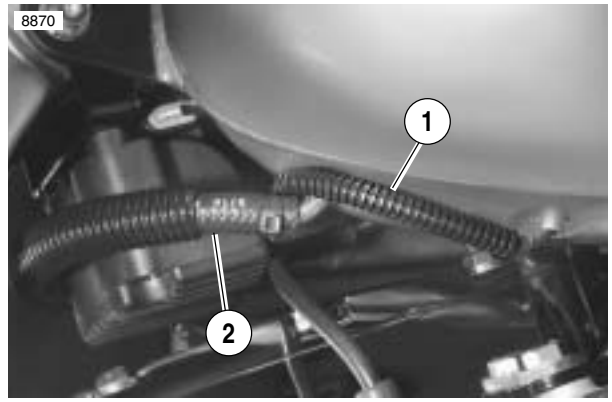
Threading Gauge Wires

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.2 AMP MULTILOCK ELECTRICAL CONNECTORS, INSTALLING SOCKET/PIN TERMINALS in the Touring Models Service Manual.

3. While carefully lowering cap, feed wires 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.



1. Fuel gauge wire conduit
2. Fuel tank crossover

Figure 8-5. Fuel Gauge Wire Conduit

Table 8-1. Fuel Gauge [117]

WIRE COLOR	CHAMBER NO.
Orange	1
Yellow/White	2
-	3
Black	4

NOTE

For instructions on properly installing wire terminals, see APPENDIX B.2 AMP MULTILOCK ELECTRICAL CONNECTORS, INSTALLING SOCKET/PIN TERMINALS in the Touring Models Service Manual.

4. Slip conduit over wires.
5. Install terminals into pin housing of 4-place Multilock. Refer to Table 8-1.
6. At bottom left side of fuel tank, mate pin and socket halves of 4-place Multilock connector.
7. Feed connector conduit into tunnel over the top of the crossover and tuck up into the tunnel.
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 2.18 SEAT.

BULB REPLACEMENT

1. Locate latch slot on circumference of turn signal lamp lens. Press in with small screw driver to remove lens.
2. Push bulb in and rotate 1/4 turn counterclockwise to remove.
3. Inspect contacts in socket. If necessary, clean contacts with a small wire brush and electrical contact cleaner.
4. Evenly apply dielectric grease to the contacts and bottom of the **new** bulb.
5. Push and rotate bulb into socket. See BULB CHART in Touring Models Service Manual.
6. Snap-in and rotate lens to position latch slot on bottom.

FRONT TURN SIGNAL LAMPS

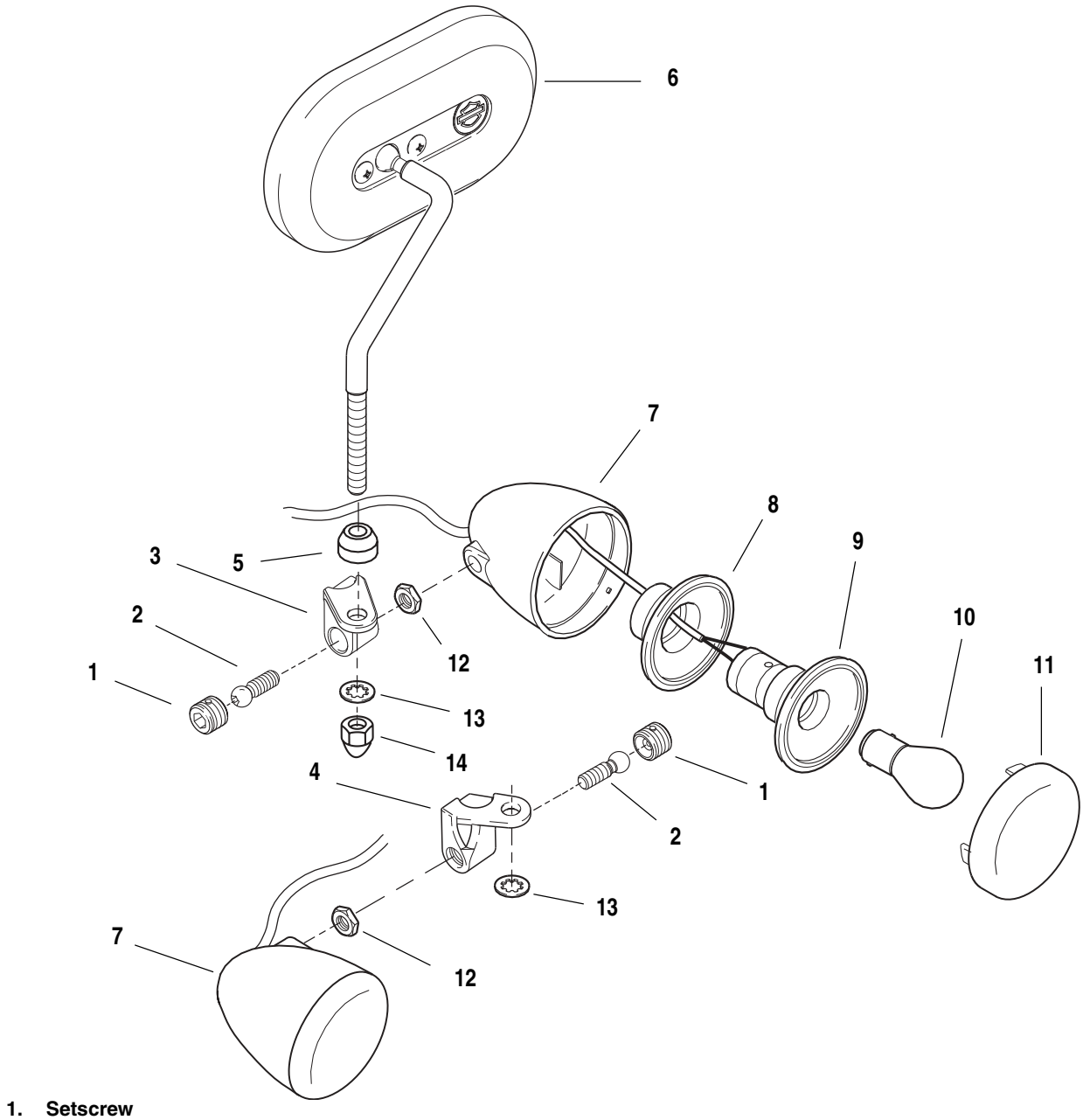
Removal

1. Remove seat. See 2.18 SEAT.

⚠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. Disconnect negative battery terminal.
3. See Figure 8-6. Remove setscrew (1) from turn signal brackets (3, 4).
4. Loosen jam nuts (9).
5. Use a ball Allen wrench to remove ball studs (2).
6. Turn left rear view mirror off acorn nut (13).
7. Turn right rear view mirror off acorn nut (13).
8. Separate the control housings from the clutch and brake lever brackets.
9. Cut the turn signal lamp conduit and wires at the exit from the housing. Remove the turn signal bullet housings.



1. Setscrew
2. Ball stud
3. Left turn signal bracket
4. Right turn signal bracket
5. Tapered spacer
6. Rear view mirror
7. Bullet housing
8. Isolator
9. Socket
10. Bulb
11. Lens - amber
12. Jam nut
13. Lock washer
14. Acorn nut
15. Right turn signal bracket

Figure 8-6. Front Turn Sign Lamp Components

Installation

1. See Figure 8-6. Trim back the conduit and strip 1/2 in. (12.7 mm) off the turn signal lamp wires from the handlebars grommet inside the control housings.
2. Strip 1/2 in. (12.7 mm) of insulation off wires of the **new** turn signal bullet housing assemblies (9) and thread them through into grommets in control housings.
3. Slide shrink tubing over wires. Twist matching wire colors, solder and heat shrink tubing over each separate splice. See GENERAL REPAIR PROCEDURES under HANDLEBAR SWITCHES in Touring Models Service Manual.
4. Loosely install housings over lever brackets and clamp.
5. Determine left turn signal bracket (4) and right turn signal bracket (3) by orientation.
6. Install right front turn signal:
   a. With tapered spacer (5), slide mirror (6) stem through brake lever bracket.
   b. Assemble right turn signal bracket (4) to mirror (6) stem with **new** lock washer (13) and acorn nut (14).
   c. Install ball stud (2) through thru signal bracket (4) from inboard side.
   d. Thread on jam nut (11) all the way onto ball stud (2).
   e. Thread ball stud (2) into bullet housing (7).
   f. Finger tighten jam nut (11) against bullet housing (7).
   g. Install but do not tighten setscrew (1) into bracket (4).
7. Install left front turn signal:
   a. With tapered spacer (5), slide mirror (6) stem through clutch master cylinder/reservoir bracket.
   b. Assemble left turn signal bracket (3) to mirror with **new** lock washer (9) and acorn nut (10).
   c. Install ball stud (2) through thru signal bracket (3) from inboard side.
   d. Thread on jam nut (12) all the way onto ball stud (2).
   e. Thread ball stud (2) into bullet housing (4).
   f. Finger tighten jam nut (8) against bullet housing (7).
   g. Install but do not tighten setscrew (1) into bracket (3).
8. With motorcycle upright with front fork pointed straight ahead, adjust mirrors to clearly reflect area behind motorcycle.

NOTE

Adjust mirrors so a small portion of the rider's shoulder is visible in each mirror. This visually establishes the distance of vehicles to the rear of the motorcycle.

9. Tighten acorn nuts (14) to 60-96 **in-lbs** (6.8-10.8 Nm).
10. Position bullet housings (7) to point lenses (11) straight ahead. Tighten each setscrew (1) to 50-60 **in-lbs** (5.7-6.8 Nm).

NOTE

After setscrew is tightened, it is not necessary, nor desirable, to completely remove setscrew to adjust housing. Loosen setscrew 1/8 turn, adjust housing and tighten setscrew to 50-60 ***in-lbs*** *(5.7-6.8 Nm). Nylon lock pellet on setscrew maintains locking ability after many adjustments. If set screw is completely removed, replace.*

11. Hold each bullet housing (7) and tighten jam nut (12).
12. Adjust the wire conduits inside and outside the housings to avoid pinching the wires. Tighten the housing fasteners to 35-45 **in-lbs** (4-5 Nm).
13. Connect negative battery cable to battery.

⚠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.

14. Install the seat.
15. Test handlebar switches to make sure they are functioning properly and wiring is not pinched.

REAR TURN SIGNAL BAR

Removal

1. Support motorcycle with rear wheel off ground to access turn signal bar fasteners.
2. Remove the fasteners holding the taillamp lens and pull lens to one side.
3. See Figure 8-7. Disconnect left and right turn signal socket connectors [18B, 19B] (1, 3) from circuit board (2). Feed turn signal wires out through taillamp base and disconnect from clips.

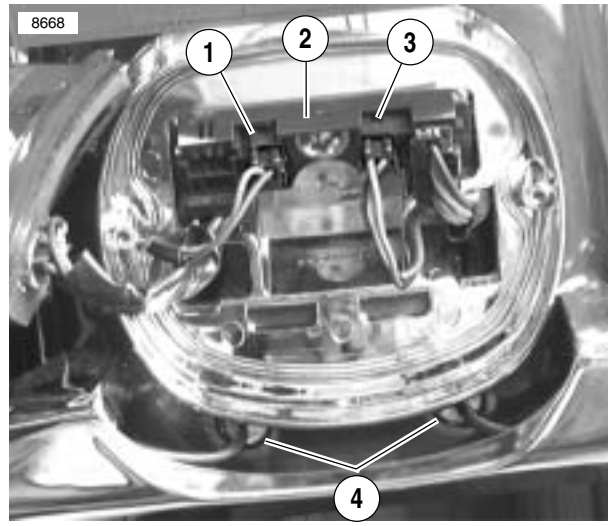
NOTE

To release socket housings, use a pick or small screwdriver to depress top release button.

4. See Figure 8-8. From under rear fender, remove turn signal bar fasteners (2). Remove turn signal bar (1) and pull wiring (4) through fender access holes.
5. Remove fasteners (3) holding turn signal lamp assemblies (5) to bar (1).

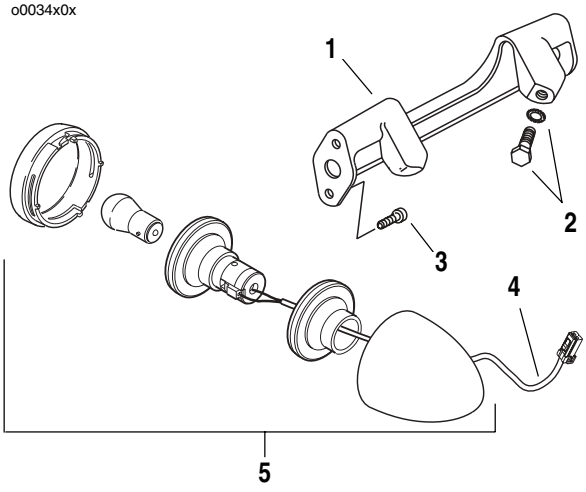
Installation

1. See Figure 8-8. Thread turn signal wiring (4) through holes in end of turn signal bar (1) and install turn signal lamp assemblies (5). Tighten fasteners (3) to 30-50 **in-lbs** (3.4-5.6 Nm).
2. Install bar (1) to fender with fasteners (2). Do not tighten.
3. See Figure 8-7. Thread turn signal conduit wires through fender access holes (4).
4. See Figure 8-8. Apply a drop of LOCTITE THREADLOCKER 271 (Red) to the turn signal bar fasteners (2) and tighten to 84-144 **in-lbs** (9.5-16.3 Nm).
5. See Figure 8-7. Feed connectors and conduit wired back through taillamp base. With release button up, push turn signal connectors [18B, 19B] (1, 3) into circuit board (2) and press wire conduits into clips.
6. Install taillamp lens. Tighten fasteners to 20-24 **in-lbs** (2.3-2.7 Nm).



1. **Left turn signal socket connector [18B]**
2. **Circuit board**
3. **Right turn signal socket connector [19B]**
4. **Fender access hole**

Figure 8-7. Turn Signal Connectors



1. **Turn signal bar**
2. **Fastener and lock washer**
3. **Fastener**
4. **Turn signal conduit wiring**
5. **Turn signal lamp assembly**

Figure 8-8. Rear Turn Signal Components

TACHOMETER 8.4

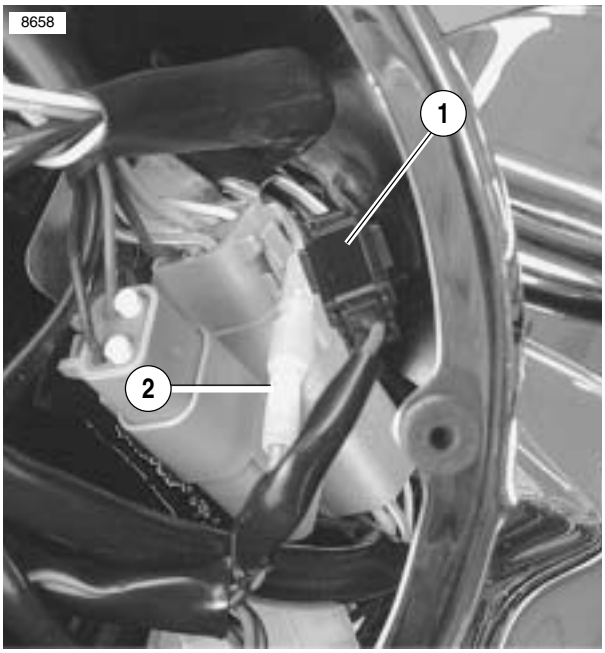
REMOVAL

1. Remove headlamp assembly from front of nacelle. See 8.10 HEADLAMP (FLHR/C, FLHT/C/U) in Touring Models Service Manual.
2. See Figure 8-9. Separate tach wire harness connectors [32, 108] inside nacelle.
3. See Figure 8-12. Loosen tach can (10) fastener (9) and push on fastener to press tachometer (1) out of tach bracket (3).

NOTE

A ground or shortened Allen wrench can be used to easily access the tach can fastener.

4. Remove fastener (9) and tach can (10).
5. Pull wire harness (7). If replacing tach wire harness (7), remove wire connectors (8) from terminals on back of tachometer (1). Retain nuts and lock washers.
6. If necessary, use a flat screwdriver to remove tach bulb.
7. Inspect tach gasket (2), tach bracket (3) and other components. Replace as necessary.
8. If replacing tach bracket, remove handlebar cover and remove tach bracket. See 2.8 HEADLAMP NACELLE.



1. **Fender tip lamp connector [32]**
2. **P&A tach signal connector [108]**

Figure 8-9. Tach Wire Harness Connectors



Figure 8-10. Wiring Through Tach Gasket

INSTALLATION

1. See Figure 8-12. If replacing tach bracket (3), attach bracket to handlebar cover (4) and tighten fasteners (11) to 60-84 **in-lbs** (6.8-9.5 Nm). See 2.10 HANDLEBARS.
2. Fit rubber tach gasket (2) to tach bracket (3) and center gasket wiring guide at back of bracket.
3. See Figure 8-11. If necessary, install **new** tach bulb (3).
4. If replacing tach wire harness, attach **new** harness wires to tachometer terminals (1, 2, 4). Tighten terminal nuts.

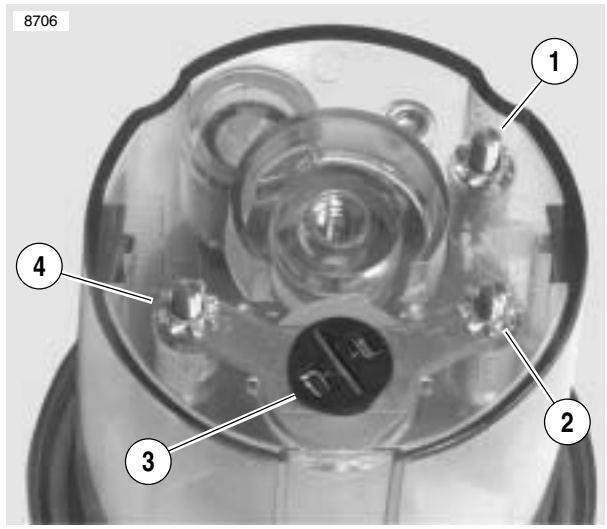
Table 8-2. Tachometer Connections

WIRE COLOR	TERMINAL	DESCRIPTION
Orange and White (O/W)	+	Power
Black (BK)	G	Ground
Pink (PK)	S	Tach Signal

5. See Figure 8-10. Route wire harness through tach gasket and through opening in cover.
6. See Figure 8-12. Orient tach face to rider and fit tachometer (1) to slots in groove of gasket (2).
7. Lubricate gasket with isopropyl alcohol. Fit can slot to tach gasket wiring guide and press tach can into tach gasket until the gasket captures the flare all the way around the circumference of the can opening.
8. Tighten tach can (10) fastener (9) to 10-20 **in-lbs** (1.2-2.2 Nm).
9. Connect tach wire harness (7) connectors [32, 108] (5, 6) to main harness wiring.
10. Replace headlamp assembly. See 8.10 HEADLAMP (FLHR/C, FLHT/C/U) in 2003 Touring Models Service Manual (Part No. 99483-03).

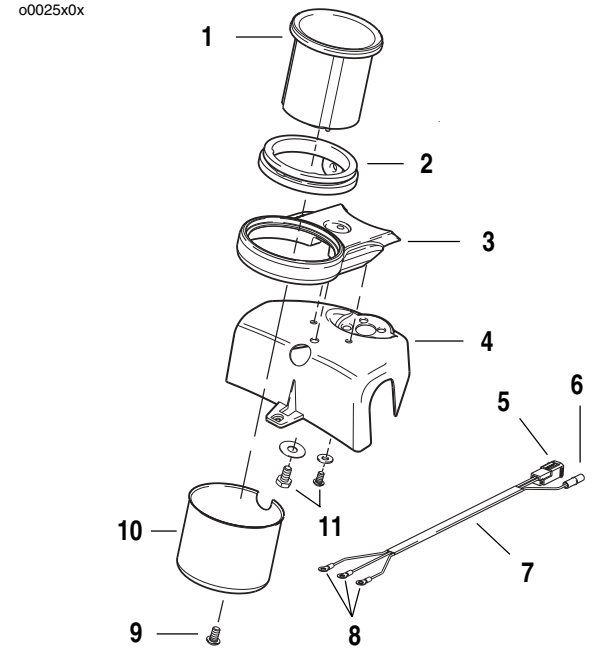
Table 8-3. Tachometer Wire Harness Connectors

NO.	TYPE	WIRE COLORS	DESCRIPTION
[32]	2-Place Multilock	Orange and White (O/W) Black (BK)	Power/Ground (Labeled Fender Tip Lamp on 2003 FLHR Wiring Harness Schematic)
[108]	1-Place AMP	Pink (PK)	Tach Signal



1. **S tach signal terminal**
2. **G ground terminal**
3. **Tach bulb**
4. **+ power terminal**

Figure 8-11. Tachometer Terminals and Bulb



1. **Tachometer**
2. **Gasket**
3. **Bracket**
4. **Handlebar cover**
5. **Fender tip lamp connector [32]**
6. **P&A tach signal connector [108]**
7. **Tach wire harness**
8. **Tach wire connectors**
9. **Fastener**
10. **Can**
11. **Fasteners**

Figure 8-12. Tachometer and Handlebar Cover

NOTES

Table Of Contents

NOTE

All fuel injection service procedures in the current Touring Models Service Manual apply to the FLHRSEI^2 model motorcycle. See the Electrical Diagnostic Manual for all system diagnostic and electrical troubleshooting information.

FUEL INJECTION 9