
# 2008 Touring Models Service Manual

## 99483-08

# IMPORTANT NOTICE

**Harley-Davidson motorcycles conform to all applicable U.S.A. Federal Motor Vehicle Safety Standards and U.S.A. Environmental Protection Agency regulations effective on the date of manufacture.**

**To maintain the safety, dependability, and emission and noise control performance, it is essential that the procedures, specifications and service instructions in this manual are followed.**

**Any substitution, alteration or adjustment of emission system and noise control components outside of factory specifications may be prohibited by law.**

**Harley-Davidson Motor Company**

# 2008 Touring Models Service Manual


99483-08

Printed in the U.S.A.

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**2008 Touring Models Service Manual (99483-08)**

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# NOTES

# ABOUT THIS MANUAL

## GENERAL

This Service Manual has been prepared with two purposes in mind. First, it will acquaint the user with the construction of the Harley-Davidson product and assist in the performance of basic maintenance and repair. Secondly, it will introduce to the professional Harley-Davidson Technician the latest field-tested and factory-approved major repair methods. We sincerely believe that this Service Manual will make your association with Harley-Davidson products more pleasant and profitable.

## HOW TO USE YOUR SERVICE MANUAL

Refer to the table below for the content layout of this manual.

| NO. | CHAPTER |
|---|---|
| 1 | Maintenance |
| 2 | Chassis |
| 3 | Engine |
| 4 | Fuel System |
| 5 | Starter |
| 6 | Drive |
| 7 | Transmission |
| 8 | Electrical |
| A | Appendix A Connector Repair |
| B | Appendix B Wiring |
| C | Appendix C ABS |
| D | Appendix D Conversions |
| E | Appendix E Glossary |

Use the TABLE OF CONTENTS (which follows this FOREWORD) and the INDEX (at the back of this manual) to quickly locate subjects. Sections and topics in this manual are sequentially numbered for easy navigation.

For example, a cross-reference shown as **2.1 SPECIFICATIONS** refers to chapter 2 CHASSIS, heading 2.1 SPECIFICATIONS.

For quick and easy reference, all pages contain a section number followed by a page number. For example, **page 3-5** refers to page 5 in section 3.

A number of acronyms and abbreviations are used in this document. See the E.1 GLOSSARY for a list of acronyms, abbreviations and definitions.

## PREPARATION FOR SERVICE

**⚠WARNING**

**Stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near gasoline. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00002a)**

Good preparation is very important for efficient service work. A clean work area at the start of each job will allow you to perform the repair as easily and quickly as possible, and will reduce the incidence of misplaced tools and parts. A motorcycle that is excessively dirty should be cleaned before work starts. Cleaning will occasionally uncover sources of trouble. Tools, instruments and any parts needed for the job should be gathered before work is started. Interrupting a job to locate tools or parts is a distraction and causes needless delay.

*NOTES*

- *To avoid unnecessary disassembly, carefully read all relative service information before repair work is started.*
- *In figure legends, the number which follows the name of a part indicates the quantity necessary for one complete assembly.*
- *When servicing a vehicle equipped with the Harley-Davidson Smart Security System (H-DSSS), you must first disarm the security system. Either keep the fob in close proximity to the vehicle, or use Digital Technician to disable the security system while the vehicle is being serviced and re-enable the system after service is completed.*

## SERVICE BULLETINS

In addition to the information presented in this Service Manual, Harley-Davidson Motor Company will periodically issue Service Bulletins to Harley-Davidson dealers. Service Bulletins cover interim engineering changes and supplementary information. Consult the Service Bulletins to keep your product knowledge current and complete.

## USE GENUINE REPLACEMENT PARTS

**⚠WARNING**

**Do not use aftermarket parts and custom made front forks which can adversely affect performance and handling. Removing or altering factory installed parts can adversely affect performance and could result in death or serious injury. (00001a)**

To ensure satisfactory and lasting repairs, carefully follow the Service Manual instructions and use only genuine Harley-Davidson replacement parts. Behind the emblem bearing the words GENUINE HARLEY-DAVIDSON stand more than 100 years of design, research, manufacturing, testing and inspecting experience. This is your assurance that the parts you are using will fit right, operate properly and last longer.

## WARNINGS AND CAUTIONS

Statements in this service manual preceded by the following words are of special significance.

**⚠WARNING**

**WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. (00119a)**

**⚠CAUTION**

**CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. (00139a)**

**CAUTION**

**CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage. (00140a)**

*NOTE*

*Refers to important information, and is placed in italic type. It is recommended that you take special notice of these items.*

Proper service and repair is important for the safe, reliable operation of all mechanical products. The service procedures recommended and described in this service manual are effective methods for performing service operations.

**⚠WARNING**

**Always wear proper eye protection when using hammers, arbor or hydraulic presses, gear pullers, spring compressors, slide hammers and similar tools. Flying parts could result in death or serious injury. (00496b)**

Some of these service operations require the use of tools specially designed for the purpose. These special tools should be used when and as recommended. It is important to note that some warnings against the use of specific service methods, which could damage the motorcycle or render it unsafe, are stated in this service manual. However, please remember that these warnings are not all-inclusive. Inadequate safety precautions could result in death or serious injury.

Since Harley-Davidson could not possibly know, evaluate or advise the service trade of all possible ways in which service might be performed, or of the possible hazardous consequences of each method, we have not undertaken any such broad evaluation. Accordingly, anyone who uses a service procedure or tool which is not recommended by Harley-Davidson must first thoroughly satisfy himself that neither his nor the operator's safety will be jeopardized as a result. Failure to do so could result in death or serious injury.

## PRODUCT REFERENCES

**⚠WARNING**

**Read and follow warnings and directions on all products. Failure to follow warnings and directions can result in death or serious injury. (00470b)**

When reference is made in this manual to a specific brand name product, tool or instrument, an equivalent product, tool or instrument may be substituted.

### Kent-Moore Products

All tools mentioned in this manual with an "HD", "J" or "B" preface must be ordered through SPX Kent-Moore. For ordering information or product returns, warranty or otherwise, visit www.spx.com.

### Loctite Sealing and Threadlocking Products

Some procedures in this manual call for the use of Loctite products. If you have any questions regarding Loctite product usage or retailer/wholesaler locations, please contact Loctite Corp. at www.loctite.com.

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All photographs, illustrations and procedures may not necessarily depict the most current model or component, but are based on the latest production information available at the time of publication.

Since product improvement is our continual goal, Harley-Davidson reserves the right to change specifications, equipment or designs at any time without notice and without incurring obligation.

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# NOTES

## SERVICING A NEW MOTORCYCLE

**⚠WARNING**

**Perform the service and maintenance operations as indicated in the regular service interval table. Lack of regular maintenance at the recommended intervals can affect the safe operation of your motorcycle, which could result in death or serious injury. (00010a)**

Service operations to be performed before customer delivery are specified in the applicable model year PREDELIVERY AND SET-UP MANUAL.

The performance of new motorcycle initial service is required to keep warranty in force and to ensure proper emissions systems operation. See 1.2 MAINTENANCE SCHEDULE.

## SAFE OPERATING MAINTENANCE

*NOTES*

- *Do not attempt to retighten engine head bolts. Retightening can cause engine damage.*
- *During the initial break-in period, use only Harley-Davidson 20W50 engine oil. Failure to use the recommended oil will result in improper break-in of the engine cylinders and piston rings.*

A careful check of certain equipment is necessary after periods of storage, and frequently between regular service intervals, to determine if additional maintenance is required.

Check:

1. Tires for abrasions, cuts and correct pressure.
2. Secondary drive belt for proper tension and condition.
3. Brakes, steering and throttle for responsiveness.
4. Brake fluid level and condition. Hydraulic lines and fittings for leaks. Also, check brake pads and rotors for wear.
5. Cables for fraying, crimping and free operation.
6. Engine oil and transmission fluid levels.
7. Headlamp, auxiliary lamp, tail lamp, brake lamp, horn and turn signal operation.

## SHOP PRACTICES

### Repair Notes

General maintenance practices are given in this section.

*NOTES*

- *Repair = Disassembly/Assembly.*
- *Replacement = Substitute a **new** part for existing component.*

All special tools and torque values are noted at the point of use.

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. Protect yourself and bystanders with approved eye protection. 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.

**⚠WARNING**

**Be sure to check capacity rating and condition of hoists, slings, chains and cables before use. Exceeding capacity ratings or using lifting devices that are in poor condition can lead to an accident, which could result in death or serious injury. (00466c)**

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.

When you are instructed in a step to clean fastener threads or threaded holes, proceed as follows: Clean all LOCTITE material from fastener threads and threaded holes. Use a wire brush to clean fastener threads. Use a thread chaser or other suitable tool to clean threaded holes. Use PJ-1 cleaner or equivalent to remove all traces of oil and contaminants from threads. Blow out all threaded holes with low pressure compressed air.

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 a screw with dirt, water or oil in the hole 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.

## Magnetic Parts Trays

Magnetic parts trays are becoming common in the service facility because they are convenient and can keep parts from becoming lost during a repair procedure.

However, hardened steel parts can become magnetized when held in magnetic parts trays. Metal fragments that would ordinarily be washed away in the oil and trapped in the oil filter or magnetic drain plug during vehicle operation could be captured by magnetized parts in the engine, potentially causing accelerated engine wear and damage.

Parts that will be returned to service inside the vehicle's powertrain such as gears, thrust washers and especially bearings should never be kept in magnetic parts trays.

# 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 pipe sealant or LOCTITE 565 THREAD SEALANT on pipe fitting threads.

## Threadlocking Agents

Always follow specific service manual procedures when working with fasteners containing preapplied threadlocking agents when fastener replacement is recommended. When re-using fasteners containing threadlocking agents, be sure to completely remove all existing threadlocking agent from fastener threads with a wire brush or wire wheel. Also, be sure to remove residual threadlocking agent from fastener hole using an appropriate thread chasing device and compressed air when using new or existing fasteners. Always use the recommended threadlocking agent for your specific procedure.

## Wiring, Hoses and Lines

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.

When bearings are installed against shoulders, be sure that the chamfered side of the bearing always faces the shoulder. 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. Install bearings with numbered side facing out.

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

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

## Bushings

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

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

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

## Gaskets

Always discard gaskets after removal. Replace with **new** gaskets. Never use the same gasket twice. Be sure that gasket holes match up with holes in the mating part. But be aware that sections of a gasket may be used to seal passages.

If a gasket must be made, be sure to cut holes that match up with the mating part. Serious 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.

### Exhaust System Leakage

In the event of an exhaust system leak at a muffler or header pipe connection location, disassemble and clean all mating surfaces. Replace any damaged components. If leak still exists, disassemble and repair the leak by applying a bead of Harley-Davidson High-Performance Sealant (Part No. 99650-02) (or an equivalent 02 Sensor/Catalyst-safe alternative). Reassemble components, wipe off any excess sealant and allow adequate curing time following sealant product instructions before operating vehicle.

## 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 priming and 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.

**⚠WARNING**

**Using compressed air to "spin dry" bearings can cause bearing to fly apart, which could result in death or serious injury. (00505b)**

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 with compressed air. Do not spin bearings while they are drying.

## TOOL SAFETY

### 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/Pry bars

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

## Hammers

- Never strike a 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

- Do not 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.
- Do not interchange POZIDRIV, PHILLIPS or REED AND PRINCE screwdrivers.
- Screwdriver handles are not intended to act as insulation. Do not use on live electrical circuits.
- Do not 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

- Do not 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.
- Do not 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 workspace.

## GENERAL

The table below lists the periodic maintenance requirements for Touring model motorcycles. If you are familiar with the procedures, just refer to the table for the recommended service interval. If necessary, see the quick reference table (Table 1-2.) for the required specifications.

If more detailed information is needed, turn to the sections which follow for step-by-step instructions.

Also, throughout this manual, you will be instructed to use various lubricants, greases and sealants. Refer to Table 1-3. for the correct part numbers of these items.

**Table 1-1. Regular Service Intervals: 2008 Touring Models**

| ITEM SERVICED | PROCEDURE | 1000 MI. 1600 KM | 5000 MI. 8000 KM | 10,000 MI. 16,000 KM | 15,000 MI. 24,000 KM | 20,000 MI. 32,000 KM | 25,000 MI. 40,000 KM | NOTES |
|---|---|---|---|---|---|---|---|---|
| Engine oil and filter | Replace | X | X | X | X | X | X | |
| Oil lines and brake system | Inspect for leaks | X | X | X | X | X | X | 1 |
| Air cleaner | Inspect, service as required | X | X | X | X | X | X | |
| Tires | Check pressure, inspect tread | X | X | X | X | X | X | |
| Wheel spokes | Check tightness | X | X | | | X | | 1 |
| Primary chaincase lubricant | Replace | X | | X | | X | | |
| Transmission lubricant | Replace | X | | | | X | | |
| Clutch | Check adjustment | X | X | X | X | X | X | 1 |
| Drive belt and compensator sprocket | Inspect, adjust belt | X | X | X | X | X | X | 1 |
| Compensator sprocket isolators | Inspect for wear | | | | | | | 5 |
| Brake and clutch controls | Check, adjust and lubricate | X | X | X | X | X | X | 1 |
| Jiffy stand | Inspect and lubricate | X | X | X | X | X | X | 1 |
| Fuel lines and fittings | Inspect for leaks | X | X | X | X | X | X | 1 |
| Fuel tank filter | Replace | | | | | | X | 1 |
| Brake fluid | Check levels and condition | X | X | X | X | X | X | 4 |
| Brake pads and discs | Inspect for wear | X | X | X | X | X | X | |
| Spark plugs | Inspect | X | X | X | X | | X | |
| | Replace | | | | | X | | |
| Electrical equipment and switches | Check operation | X | X | X | X | X | X | |
| Front fork oil | Replace | | | | | | | 1, 2 |
| Steering head bearings | Lubricate | X | | X | | X | | 2 |
| | Adjust | | | | | | X | 1 |
| Air suspension | Check pressure, operation and leakage | X | X | X | X | X | X | 1 |
| Windshield bushings (if applicable) | Inspect | | | X | | X | | 1 |
| Fuel door, Tour-Pak, saddlebags | Lubricate hinges and latches | X | X | X | X | X | X | |
| Critical fasteners | Check tightness | X | | X | | X | | 1 |
| Engine mounts and stablizers | Inspect, check tightness | | | X | | X | | 1 |
| Battery | Check battery and clean connections | | | | | | | 3 |
| Exhaust system | Inspect for leaks, cracks, and loose or missing fasteners or heat shields | X | X | X | X | X | X | 3 |
| Road test | Verify component and system functions | X | X | X | X | X | X | |
| **NOTES:** | 1. Should be performed by an authorized Harley-Davidson dealer, unless you have the proper tools, service data and are mechanically qualified.<br>2. Disassemble, lubricate and inspect every 50,000 miles (80,000 kilometers).<br>3. Perform annually.<br>4. Change D.O.T. 4 and flush brake system every two years.<br>5. Perform at each rear tire change. | | | | | | | |

**Table 1-2. Quick Reference Maintenance Chart: 2008 Touring Models**

| ITEM SERVICED | SPECIFICATION | DATA |
|---|---|---|
| Engine oil and filter | Drain plug torque | 14-21 ft-lbs (19.0-28.5 Nm) |
| | Oil capacity | 4 qt. (3.8 L) |
| | Filter | Hand tighten 1/2-3/4 turn after gasket contact |
| | Chrome filter part number | 63798-99A |
| | Black filter part number | 63731-99A |
| Primary chain lubricant | Lubricant type and capacity | FORMULA+ TRANSMISSION AND PRIMARY CHAIN LUBRICATION (Part No. 99851-05)<br>Wet: 38 oz. (1124 ml)<br>Dry: 45 oz. (1331 ml) |
| | Primary chaincase drain plug torque | 14-21 ft-lbs (19.0-28.5 Nm) |
| Clutch adjustment | Adjuster screw free play | 1/2-1 turn |
| | Adjuster screw locknut torque | 72-120 **in-lbs** (8.1-13.6 Nm) |
| | Free play at hand lever | 1/16-1/8 in. (1.6-3.2 mm) |
| | Clutch inspection cover torque | 84-108 **in-lbs** (9.5-12.2 Nm) |
| Transmission lubricant | Lubricant level | Dipstick at FULL with motorcycle on jiffy stand and filler plug resting on threads. |
| | Lubricant type and capacity | FORMULA+ TRANSMISSION AND PRIMARY CHAIN LUBRICATION (Part No. 99851-05)<br>32 oz (0.95 liters) |
| | Transmission drain plug torque | 14-21 ft-lbs (19.0-28.5 Nm) |
| | Transmission filler plug/dipstick torque | 25-75 **in-lbs** (2.8-8.5 Nm) |
| Tire pressure and wear | Pressure: solo rider | Front: 36 psi (248 kPA)<br>Rear: 36 psi (248 kPA) |
| | Pressure: rider with passenger | Front: 36 psi (248 kPA)<br>Rear: 40 psi (276 kPA) |
| | Wear | Replace if less than 1/32 in. (0.8 mm) of tread pattern |
| Wheel spokes | Spoke nipple torque | 55 **in-lbs** (6.2 Nm) minimum |
| Brake fluid level | D.O.T. 4 hydraulic brake fluid part number | 99953-99A (12 oz.) |
| | Fluid level (from top of master cylinder reservoir) | Front: 0.20 in. (5.0 mm)<br>Rear: 0.26 in. (6.5 mm) |
| | Master cylinder reservoir cover screw torque | Front: 7-10 **in-lbs** (0.8-1.1 Nm)<br>Rear: 12-15 **in-lbs** (1.4-1.7 Nm) |
| Brake pads and discs | Minimum brake pad thickness | 0.016 in. (0.4 mm) |
| | Brake caliper pad pin torque | 75-102 **in-lbs** (8.5.-11.5 Nm) |
| | Minimum brake disc thickness | Front: 0.18 in. (4.5 mm)<br>Rear: 0.25 in. (6.3 mm) |
| | Maximum brake disc lateral runout (warpage) | 0.008 in. (0.2 mm) |
| Drive belt deflection | Upward force applied at midpoint of bottom belt strand | 10 lb. (4.5 kg) |
| | FLHR/C, FLHT/C/U, FLTR | 3/8-7/16 in. (9.5-11.1 mm) |
| | FLHX | 1/4-5/16 in. (6.4-7.9 mm) |
| Air cleaner | Air cleaner cover bracket screw torque | 40-60 **in-lbs** (4.5-6.8 Nm) |
| | Air cleaner cover screw torque | 36-60 **in-lbs** (4.1-6.8 Nm) |
| | Air cleaner cover screw Threadlocker | LOCTITE MEDIUM STRENGTH THREADLOCKER 243 (BLUE)<br>Part No. 99642-97 (6 ml) |

**Table 1-2. Quick Reference Maintenance Chart: 2008 Touring Models**

| ITEM SERVICED | SPECIFICATION | DATA |
|---|---|---|
| Clutch cable | Lubricant part number | LUBIT-8 SUPER OIL, Part No. 94968-85TV (1/4 fl. oz.) |
| | Handlebar switch housing screw torque | 35-45 **in-lbs** (4.0-5.1 Nm) |
| Spark plugs | Type | HD-6R12 |
| | Gap | 0.038-0.043 in. (0.97-1.09 mm) |
| | Torque | 12-18 ft-lbs (16.3-24.4 Nm) |
| Front fork oil | Amount | See 2.17 FRONT FORK. |
| | Type and part number | HYDRAULIC FORK OIL (TYPE E)<br>Part No. 99884-80 (16 oz.) |
| Battery | Terminal bolt torque | 60-96 **in-lbs** (6.8-10.9 Nm) |
| | Top caddy clamp screw torque | 15-20 ft-lbs (20-27 Nm) |

**Table 1-3. Lubricants, Greases, Sealants**

| ITEM | PART NUMBER | PACKAGE |
|---|---|---|
| Anti-Seize Lubricant | 98960-97 | 1 oz squeeze tube |
| CCI #20 Brake Grease | 42830-05 (included in master cylinder rebuild kit) | squeeze packet |
| D.O.T. 4 Brake Fluid | 99953-99A | 12 oz. bottle |
| Electrical Contact Lubricant | 99861-02 | 1 oz squeeze tube |
| Genuine Harley-Davidson Formula+ Transmission and Primary Chaincase Lubricant | 99851-05 | 1 qt bottle |
| G40M Brake Grease | 42820-04 | squeeze packet |
| Gray High Performance Sealant | 99650-02 | 1.9 oz squeeze tube |
| HYLOMAR Gasket and Thread Sealant | 99653-85 | 3.5 oz tube |
| Loctite Pipe Sealant With Teflon 565 | 99818-97 | 6 ml squeeze tube |
| Loctite Prism Primer (770) | | |
| Loctite Prism Superbonder (411) | | |
| Loctite Superbonder 420 Adhesive | | |
| Loctite Threadlocker 243 (blue) | 99642-97 | 6 ml squeeze tube |
| Loctite Threadlocker 262 (red) | 94759-99 | 6 ml squeeze tube |
| Loctite Threadlocker 272 | 98618-03 | 10 ml bottle |
| Special Purpose Grease | 99857-97 | 14 oz. cartridge |
| Super Oil | 94968-85TV | 1/4 fl. oz |
| Type "E" Hydraulic Fork Oil | 99884-80 | 16 oz bottle |

## FUEL

Refer to Table 1-4. Always use a good quality unleaded gasoline. Octane ratings are usually found on the pump.

**⚠WARNING**

**Avoid spills. Slowly remove filler cap. Do not fill above bottom of filler neck insert, leaving air space for fuel expansion. Secure filler cap after refueling. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00028a)**

**⚠WARNING**

**Use care when refueling. Pressurized air in fuel tank can force gasoline to escape through filler tube. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00029a)**

Modern service station pumps dispense a high flow of gasoline into a motorcycle fuel tank making air entrapment and pressurization a possibility.

**Table 1-4. Octane Ratings**

| SPECIFICATION | RATING |
|---|---|
| Pump Octane (R+M)/2 | 91 (95 RON) |

## GASOLINE BLENDS

Your motorcycle was designed to get the best performance and efficiency using unleaded gasoline. Most gasoline is blended with alcohol and/or ether to create oxygenated blends. The type and amount of alcohol or ether added to the fuel is important.

**CAUTION**

**Do not use gasoline that contains methanol. Doing so can result in fuel system component failure, engine damage and/or equipment malfunction. (00148a)**

- Gasoline containing METHYL TERTIARY BUTYL ETHER (MTBE): Gasoline/MTBE blends are a mixture of gasoline and as much as 15% MTBE. Gasoline/MTBE blends can be used in your motorcycle.
- 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, leaving fewer tailpipe emissions. They are also formulated to evaporate less when you are filling your tank. Reformulated gasolines use additives to oxygenate the gas. Your motorcycle will run normally using this type of gas and Harley-Davidson recommends you use it when possible, as an aid to cleaner air in our environment.
- Do not use race gas or octane boosters. Use of these fuels will damage the fuel system.

Some gasoline blends might adversely affect the starting, driveability or fuel efficiency of the motorcycle. If any of these problems are experienced, try a different brand of gasoline or gasoline with a higher octane blend.

## ENGINE LUBRICATION

**CAUTION**

**Do not switch lubricant brands indiscriminately because some lubricants interact chemically when mixed. Use of inferior lubricants can damage the engine. (00184a)**

Engine oil is a major factor in the performance and service life of the engine. Always use the proper grade of oil for the lowest temperature expected before the next scheduled oil change. Refer to Table 1-5. Your authorized dealer has the proper oil to suit your requirements.

If it is necessary to add oil and Harley-Davidson oil is not available, use an oil certified for diesel engines. Acceptable diesel engine oil designations include: CF-4, CG-4, CH-4 and CI-4.

The preferred viscosities for the diesel engine oils in descending order are: 20W50, 15W40 and 10W40.

At the first opportunity, see an authorized dealer to change back to 100 percent Harley-Davidson oil.

**Table 1-5. Recommended Engine Oils**

| H-D TYPE | VISCOSITY | H-D RATING | LOWEST AMBIENT TEMPERATURE | COLD WEATHER STARTS BELOW 50° F (10° C) |
|---|---|---|---|---|
| H-D Multi-grade | SAE 10W40 | HD 360 | Below 40° F (4° C) | Excellent |
| H-D Multi-grade | SAE 20W50 | HD 360 | Above 40° F (4° C) | Good |
| H-D Regular Heavy | SAE 50 | HD 360 | Above 60° F (16° C) | Poor |
| H-D Extra Heavy | SAE 60 | HD 360 | Above 80° F (27° C) | Poor |

## WINTER LUBRICATION

In colder climates, the engine oil should be changed often. If motorcycle is used frequently for short trips, less than 15 miles (24 kilometers), in ambient temperatures below 60° F (16° C), oil change intervals should be reduced to 1500 miles (2400 kilometers). Motorcycles used only for short runs must have a thorough tank flush-out before **new** oil is put in. The tank flush-out should be performed by an authorized dealer or qualified technician.

*NOTE*

*The further below freezing the temperature drops, the shorter the oil change interval should be.*

Water vapor is a normal by-product of combustion in any engine. During cold weather operation, some of the water vapor condenses to liquid form on the cool metal surfaces inside the engine. In freezing weather this water will become slush or ice and, if allowed to accumulate too long, may block the oil lines and cause damage to the engine.

If the engine is run frequently and allowed to thoroughly warm up, most of this water will become vapor again and will be blown out through the crankcase breather.

If the engine is not run frequently and allowed to thoroughly warm up, this water will accumulate, mix with the engine oil and form a sludge that is harmful to the engine.

# BULB REQUIREMENTS 1.4

## GENERAL

Use the table to identify the bulb location and part number. Refer to Table 1-6.

*NOTE*

*The speedometer, tachometer, odometer and indicator lamps are illuminated with LEDs. LEDs are non-repairable. The entire assembly must be replaced if an LED fails.*

**Table 1-6. Bulb Chart: 2008 Touring Models**

| LAMP | DESCRIPTION (ALL LAMPS 12 VOLT) | BULBS REQUIRED | CURRENT DRAW AMPERAGE | HARLEY-DAVIDSON PART NUMBER |
|---|---|---|---|---|
| Headlamp | FLHT/C/U, FLHR, FLHX | 1 | 4.58/5.0 | 68329-03 |
| | FLTR | 2 | 4.58/5.0 | 68329-03 |
| | Position lamp international | 1 | 0.32 | 53438-92 |
| Tail and stop lamp | Tail lamp | 1 | 0.59 | 68167-04 |
| | Stop lamp | 1 | 2.10 | 68167-04 |
| | Tail lamp international | 1 | 0.59 | 68167-04 |
| | Stop lamp international | 1 | 2.10 | 68167-04 |
| Turn signal lamp | Front/running | 2 | 2.25/0.59 | 68168-89A |
| | Front international | 2 | 1.75 | 68163-84 |
| | Rear | 2 | 2.25 | 68572-64B |
| | Rear international | 2 | 1.75 | 68163-84 |
| Additional lighting | Tour-Pak side lamps<br>FLHTCU* | N/A | 0.14<br>0.14 | 53788-06 (right side)<br>53789-06 (left side) |
| | Fender tip lamps | 2 | 0.30 | 53439-79 |
| | License plate lamp international | 1 | 0.37 | 53436-97 |
| | License plate lamp FLHX domestic | 2 | 0.35 | 52441-95 |
| | Auxiliary lamps | 2 | 2.1 | 68453-05 |
| | Auxiliary lamps international | 2 | 2.7 | 68851-98 |
| Instrument panel lamps<br>FLHT/C/U<br>FLHR/C<br>FLTR<br>FLHX | High beam indicator | Instrument panel is illuminated with LEDs. Replace entire assembly upon failure. | | |
| | Oil pressure indicator | | | |
| | Neutral indicator | | | |
| | Turn signal indicator | | | |
| Gauge lamps<br>FLHR/C | speedometer | N/A | N/A | N/A |
| | Odometer | N/A | N/A | N/A |
| | Fuel gauge | 1 | 0.19 | 67136-85 |
| | Engine | N/A | N/A | N/A |
| Gauge lamps<br>FLHT/C/U<br>FLTR<br>FLHX | speedometer | N/A | N/A | N/A |
| | Tachometer | N/A | N/A | N/A |
| | Voltmeter | 1 | 0.24 | 67445-00 |
| | Oil pressure indicator<br>FLHT/C/U | 1 | 0.24 | 67445-00 |
| | Air temperature gauge<br>FLHT/C/U | 1 | 0.24 | 67445-00 |
| | Fuel gauge | 1 | 0.24 | 67445-00 |
| Items with * | Illuminated with LEDs. Replace entire assembly upon failure. | | | |

## CHECKING OIL LEVEL: TOURING MODELS

**CAUTION**

**Oil level cannot be accurately measured on a cold engine. For pre-ride 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. (00185a)**

For dipstick location, see Figure 1-1.

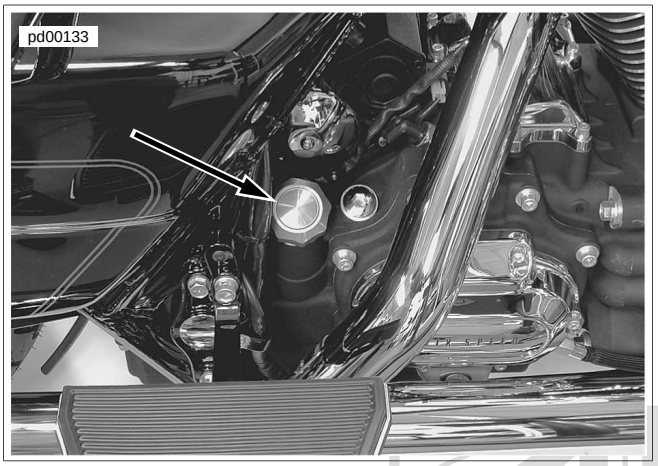



**Figure 1-1. Engine Oil Filler Cap**

### Oil Level Cold Check

Perform engine oil level **COLD CHECK** as follows:

1. For preride inspection, place vehicle on level ground and rest the vehicle on its jiffy stand (unless sidecar is attached).
2. Turn filler plug/dipstick counterclockwise. Remove and wipe off the dipstick. Insert the dipstick back into the oil pan with the plug screwed completely into the fill spout.
3. See Figure 1-2. Remove the dipstick and verify the level of the oil. The correct oil level should register between the two marks on the dipstick. If sidecar is attached, check oil level using the opposite side of dipstick as shown in Figure 1-3.

*NOTE*

*If oil level is at or below the lower arrow, add only enough oil to bring the level to the middle of the two marks on the dipstick.*

### Oil Level Hot Check

Perform engine oil level **HOT CHECK** as follows:

1. Ride motorcycle until engine is at normal operating temperature.
2. Place vehicle on level ground and rest the vehicle on its jiffy stand (unless sidecar is attached). Allow engine to idle for 1-2 minutes. Turn engine off.
3. Turn filler plug/dipstick counterclockwise. Remove and wipe off the dipstick. Insert it back with the plug screwed completely into the fill spout.
4. See Figure 1-2. Remove the dipstick and note the level of the oil. If sidecar is attached, check oil level using the opposite side of dipstick as shown in Figure 1-3. Add only enough oil to bring the level to the FULL mark on the dipstick. Do not overfill.

*NOTE*

*Refer to Table 1-5. Use only recommended oil specified in 1.3 FUEL AND OIL, Engine Lubrication.*

5. Start engine and carefully check for oil leaks around drain plug and oil filter.

Engine oil level should be checked only when engine is at normal operating temperature.

*NOTE*

*The engine will require a longer warm up period in colder weather.*

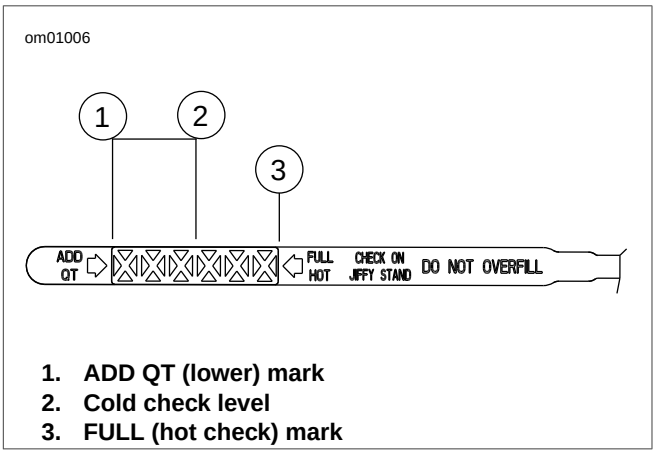
**CAUTION**

**Do not allow hot oil level to fall below Add/Fill mark on dipstick. Doing so can result in equipment damage and/or equipment malfunction. (00189a)**

**CAUTION**

**Do not overfill oil tank. Doing so can result in oil carryover to the air cleaner leading to equipment damage and/or equipment malfunction. (00190a)**

- Check engine oil supply at each complete fuel refill.
- Refer to Table 1-1. Oil should be changed at specified intervals in normal service at warm or moderate temperatures.
- Oil change intervals should be shorter in cold weather or severe operating conditions. See 1.3 FUEL AND OIL, Winter Lubrication.



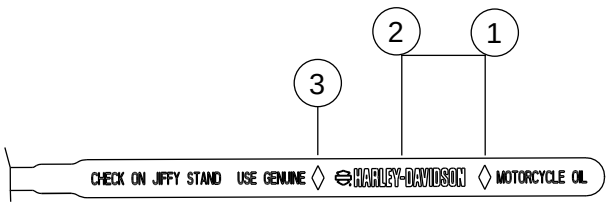

1. **ADD QT (lower) mark**
2. **Cold check level**
3. **FULL (hot check) mark**

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

*NOTES*

*The engine oil dipstick has different markings on its two sides. Figure 1-2 shows the engine oil level when the motorcycle is on its jiffy stand. Figure 1-3 shows the engine oil level with a sidecar attached (motorcycle upright).*

*For cold check level, do not exceed the midpoint (2) when filling with oil.*




1. **ADD QT (lower) mark**
2. **Cold check level**
3. **FULL (hot check) mark**

**Figure 1-3. Engine Oil Dipstick (Sidecar Use)**

## CHANGING OIL AND OIL FILTER: TOURING MODELS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-42311 | OIL FILTER WRENCH |
| HD-42311 | OIL FILTER WRENCH |
| HD-44067A | OIL FILTER WRENCH |

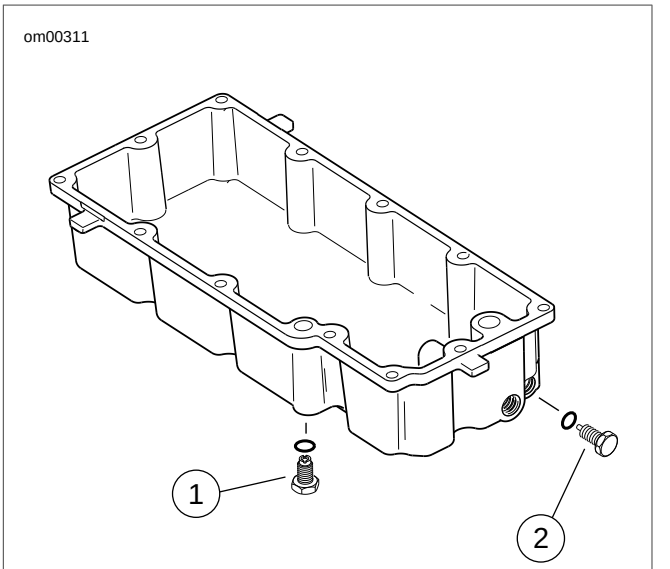
**CAUTION**

**Do not switch lubricant brands indiscriminately because some lubricants interact chemically when mixed. Use of inferior lubricants can damage the engine. (00184a)**

Twin Cam equipped vehicles require the premium oil filter (Part No. 63798-99A Chrome or Part No. 63731-99A Black).

Refer to Table 1-1. Oil should be changed after the first 1000 miles (1600 kilometers) for a new engine and at regular intervals in normal service at warm or moderate temperatures.

1. Ride motorcycle until engine is warmed up to normal operating temperature. Turn engine off.
2. Locate oil filler plug/dipstick on right side of vehicle at top of transmission case. Turn filler plug/dipstick counterclockwise to remove.
3. See Figure 1-4. Locate oil drain plug at front left side of the oil pan. Remove the oil drain plug. Do not remove Allen plug. Allow oil to drain completely.




1. **Transmission drain plug (right side)**
2. **Engine oil drain plug and o-ring**

**Figure 1-4. Oil Pan**

4. Inspect the oil drain plug o-ring for cuts, tears or signs of deterioration. Replace as necessary.

**WARNING**

**Be sure that no lubricants or fluids get on tires, wheels or brakes when changing fluid. Traction can be adversely affected, which could result in loss of control of the motorcycle and death or serious injury. (00047d)**

**CAUTION**

**Use Harley-Davidson oil filter wrench for filter removal. This tool can prevent damage to crankshaft position sensor and/or sensor cable. (00192b)**

5. See Figure 1-5. Remove the oil filter using the OIL FILTER WRENCH (Part No. HD-42311) or OIL FILTER WRENCH (Part No. HD-44067A). These tools allow easy removal of the oil filter without risk of damage to the crankshaft position sensor or cable.
6. Place the jaws of the wrench over the oil filter with the tool oriented vertically. Using a 3/8 inch drive with a 4 inch extension, turn wrench in a counterclockwise direction. Do not use with air tools.
7. Clean the oil filter mount flange of any old gasket material.

*NOTE*

*Dispose of oil and oil filter in accordance with local regulations.*

8. See Figure 1-6. 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 (Part No. HD-42311) for oil filter installation.
9. Install engine oil drain plug and tighten to 14-21 ft-lbs (19.0-28.5 Nm).
10. Refer to Table 1-5. With vehicle resting on jiffy stand, initially add 3.5 quarts (3.3 liters) of engine oil. Use the

proper grade of oil for the lowest temperature expected before the next oil change.

11. Verify proper oil level. See 1.5 ENGINE OIL AND FILTER, Checking Oil Level: Touring Models.
    a. Check engine oil level using **COLD CHECK** procedure.
    b. Start engine and carefully check for oil leaks around drain plug and oil filter.
    c. Check engine oil level using **HOT CHECK** procedure.

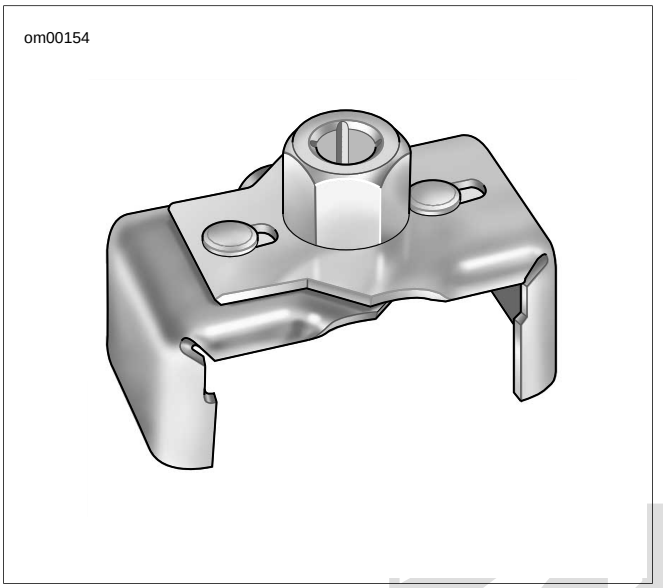
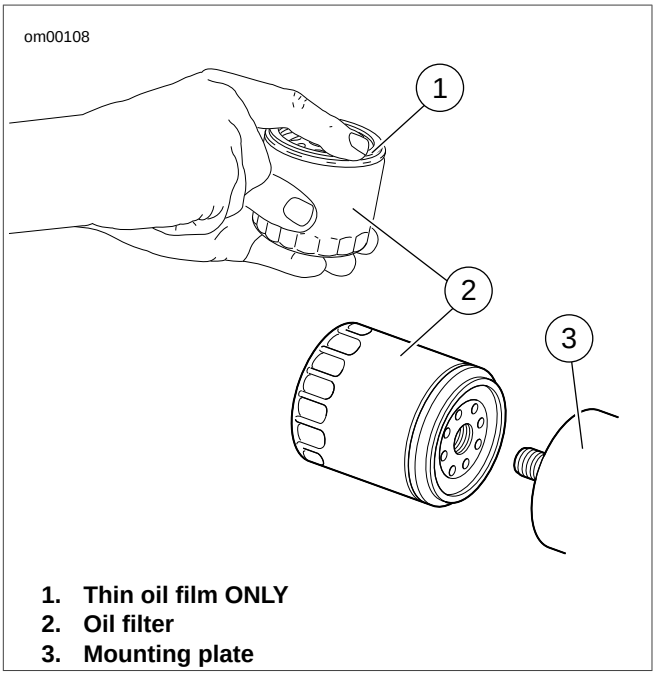



**Figure 1-5. Oil Filter Wrench (Part No. HD-42311)**




1. **Thin oil film ONLY**
2. **Oil filter**
3. **Mounting plate**

**Figure 1-6. Applying Thin Oil Film**

## FLUID INSPECTION

**⚠CAUTION**

**Direct contact of D.O.T. 4 brake fluid with eyes can cause irritation. Avoid eye contact. In case of eye contact flush with large amounts of water and get medical attention. Swallowing large amounts of D.O.T. 4 brake fluid can cause digestive discomfort. If swallowed, obtain medical attention. Use in well ventilated area. KEEP OUT OF REACH OF CHILDREN. (00240a)**

**CAUTION**

**D.O.T. 4 brake fluid will damage painted and body panel surfaces it comes in contact with. Always use caution and protect surfaces from spills whenever brake work is performed. Failure to comply can result in cosmetic damage. (00239b)**

**CAUTION**

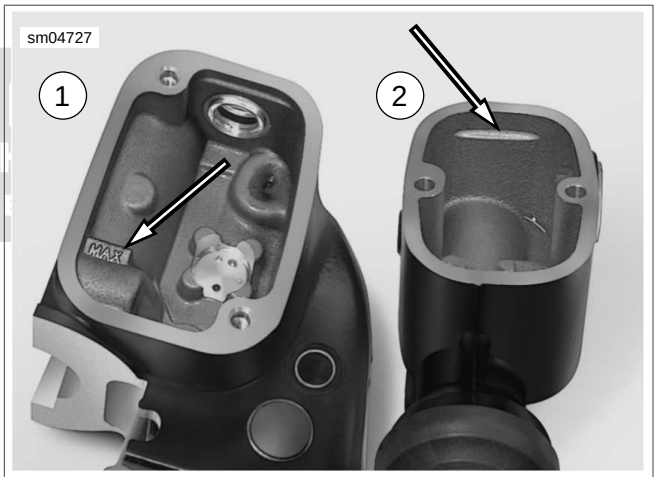
**Do not allow dirt or debris to enter the master cylinder reservoir. Dirt or debris in the reservoir can cause improper operation and equipment damage. (00205c)**

1. Check level in rear master cylinder reservoir.
   a. Stand motorcycle upright, so that master cylinder reservoir is level.
   b. Remove two screws to release cover from master cylinder reservoir.
   c. Check brake fluid level. If necessary, add D.O.T. 4 BRAKE FLUID until level is flush with top of ledge cast at front of reservoir. See Figure 1-7.
   d. Install master cylinder reservoir cover. Install cover screws and tighten to 12-15 **in-lbs** (1.4-1.7 Nm).
2. Check level in front master cylinder reservoir.
   a. Resting motorcycle on jiffy stand, turn front wheel toward left fork stop until front master cylinder reservoir is level.
   b. Remove two screws to release cover from master cylinder reservoir.
   c. Check brake fluid level. If necessary, add D.O.T. 4 BRAKE FLUID until level is flush with step (marked MAX) cast at rear of reservoir. See Figure 1-7.
   d. Install master cylinder reservoir cover. Install cover screws and tighten to 7-10 **in-lbs** (0.8-1.1 Nm).

**⚠WARNING**

**After repairing the brake system, test brakes at low speed. If brakes are not operating properly, testing at high speeds can cause loss of control, which could result in death or serious injury. (00289a)**

3. Verify that front brake lever and rear brake pedal have a firm feel when applied. Bleed appropriate system if brake feels spongy. See 1.14 BLEEDING BRAKES.




**1. Front master cylinder reservoir**
**2. Rear master cylinder reservoir**

**Figure 1-7. Brake Fluid Level**

## REMOVAL

1. See Figure 1-8. Remove screw from air cleaner cover. Remove air cleaner cover with rubber seal.
2. Remove three 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. Inspect the breather tubes and rubber seal for cuts, tears, holes or signs of deterioration. Replace as necessary.

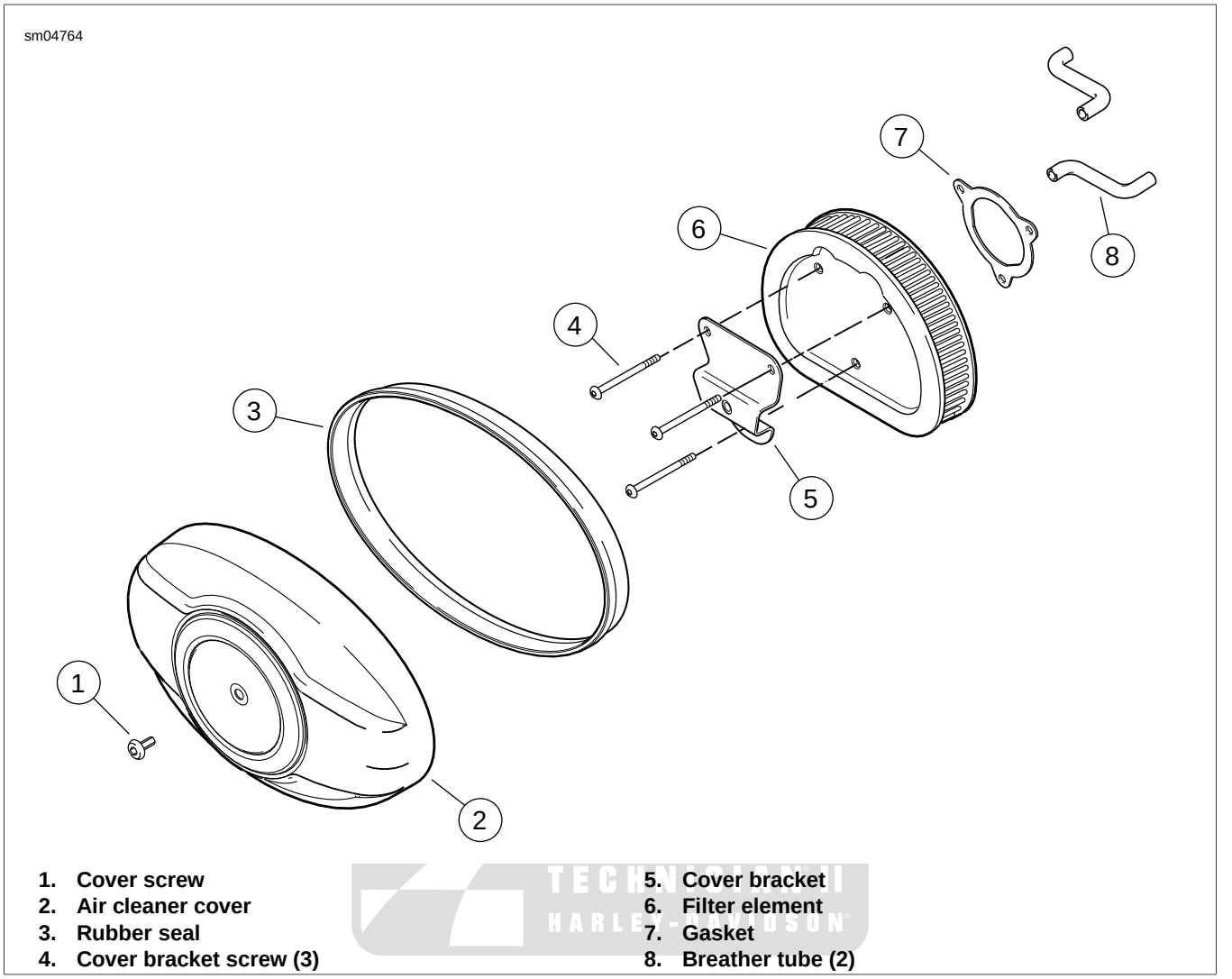
**⚠WARNING**

**Do not use gasoline or solvents to clean filter element. Flammable cleaning agents can cause an intake system fire, which could result in death or serious injury. (00101a)**

**⚠WARNING**

**Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)**

7. Clean filter element.
   a. Wash the paper/wire mesh filter element (and breather tubes) in lukewarm water with a mild detergent. Do not strike filter element on a hard surface to dislodge dirt.
   b. Allow filter element to either air dry or blow it dry, from the inside, with low pressure air. Do NOT use air cleaner filter oil on the Harley-Davidson paper/wire mesh air filter element.
   c. Hold the filter element up to a strong light source. The element is sufficiently clean if light is uniformly visible through the media.
   d. Replace the filter element if damaged or if filter media cannot be adequately cleaned.




1. **Cover screw**
2. **Air cleaner cover**
3. **Rubber seal**
4. **Cover bracket screw (3)**
5. **Cover bracket**
6. **Filter element**
7. **Gasket**
8. **Breather tube (2)**

**Figure 1-8. Air Cleaner Assembly**

## INSTALLATION

1. Slide **new** gasket over sleeve on inboard side of filter element.
2. Insert breather tubes about 0.25 inch (6.4 mm) into holes on inboard side of filter element.
3. 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.*

4. Place filter element onto backplate with the flat side down.
5. Align holes in cover bracket with those in filter element and start three screws. Alternately tighten screws to 40-60 **in-lbs** (4.5-6.8 Nm).
6. Verify that rubber seal is properly seated around perimeter of air cleaner cover.
7. Fit air cleaner cover into backplate. Apply a small dab of LOCTITE MEDIUM STRENGTH THREADLOCKER 243 (BLUE) to threads of cover screw. Install screw and tighten to 36-60 **in-lbs** (4.1-6.8 Nm).

## EXHAUST SYSTEM LEAK CHECK

Check the exhaust system for leaks at every scheduled service interval as follows:

1. Check entire exhaust system for loose or missing fasteners, broken pipe clamps or brackets, and obvious signs of leakage (carbon tracks at pipe joints, etc.).
2. Check for loose or broken heat shields. Repair or replace as necessary.
3. Start engine, cover muffler ends with clean, dry shop towels and listen for audible signs of exhaust leakage.
4. Correct any leaks detected. See 4.18 EXHAUST SYSTEM for exhaust system removal and installation procedures.

## TIRES

**WARNING**

**Match tires, tubes, air valves and caps to the correct wheel rim. Contact a Harley-Davidson dealer. Mismatching can result in damage to the tire bead, allow tire slippage on the rim or cause tire failure, which could result in death or serious injury. (00023a)**

**WARNING**

**Use only Harley-Davidson approved tires. See a Harley-Davidson dealer. Using non-approved tires can adversely affect stability, which could result in death or serious injury. (00024a)**

**WARNING**

**Use inner tubes on laced (wire spoked) wheels. Using tubeless tires on laced wheels can cause air leaks, which could result in death or serious injury. (00025a)**

*NOTES*

- *Tubeless tires are used on all Harley-Davidson cast and disc wheels.*
- *Tire sizes are molded on the tire sidewall. Inner tube sizes are printed on the tube.*
- *New tires should be stored on a horizontal tire rack. Avoid stacking new tires in a vertical stack. The weight of the stack compresses the tires and closes down the beads.*

Check tire pressure and tread:

- As part of the pre-ride inspection.
- At every scheduled service interval.

1. Inspect each tire for punctures, cuts and breaks.
2. Inspect each tire for wear. Replace tires before they reach the tread wear indicator bars.

*NOTE*

*Missing indicator wear bars represent less than 1/32 in. (0.8 mm) tread pattern depth remaining.*

3. Check for proper front and rear tire pressures when tires are cold. Compare results against Table 1-7.

**Table 1-7. Tire Pressures: 2008 Touring Models**

| MODEL | LOAD | TIRE PRESSURE (COLD) | | | |
|---|---|---|---|---|---|
| | | FRONT | | REAR | |
| | | PSI | kPa | PSI | kPa |
| All | Solo rider | 36 | 248 | 36 | 248 |
| | Rider and passenger | 36 | 248 | 40 | 276 |

## TIRE REPLACEMENT

### Inspection

**WARNING**

**Harley-Davidson tires are equipped with wear bars that run horizontally across the tread. When wear bars become visible and only 1/32 in. (0.8 mm) tread depth remains, replace tire immediately. Using a worn tire can adversely affect stability and handling, which could result in death or serious injury. Use only Harley-Davidson approved replacement tires. (00090b)**

See Figure 1-9. Arrows on tire sidewalls pinpoint location of wear bar indicators.

Tread wear indicator bars will appear on tire tread surfaces when 1/32 in. (0.8 mm) or less of tire tread remains. See Figure 1-10. Always replace tires before the tread wear indicator bars appear.

### When To Replace Tires

New tires are needed if any of the following conditions exist:

1. Tread wear indicator bars become visible on the tread surfaces.
2. Tire cords or fabric become visible through cracked sidewalls, snags or deep cuts.
3. A bump, bulge or split in the tire.
4. Puncture, cut or other damage to the tire that cannot be repaired.

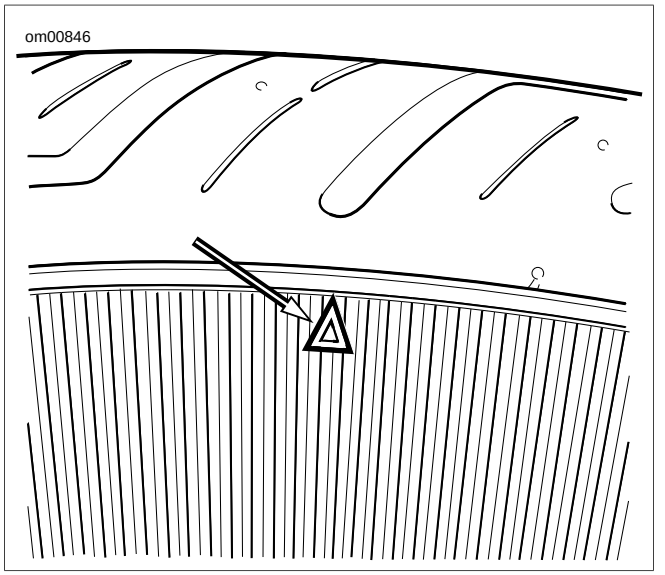



**Figure 1-9. Tire Sidewall Wear Bar Locator**

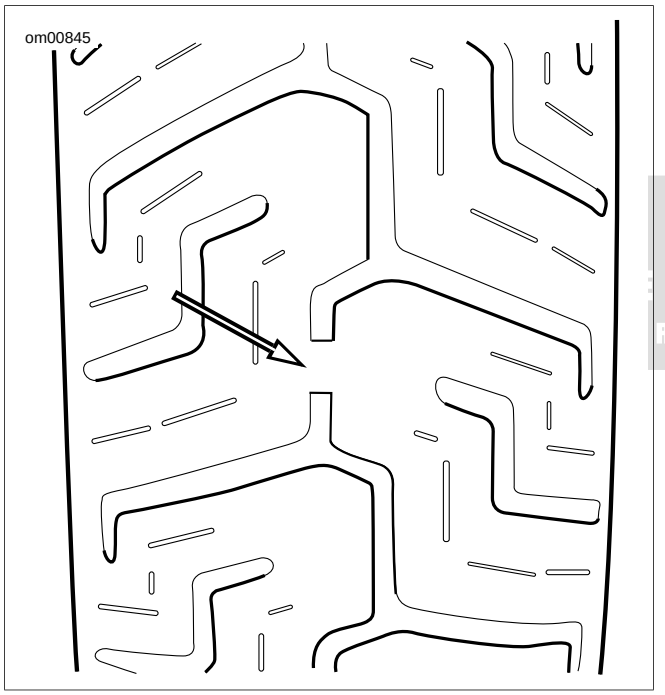



**Figure 1-10. Wear Bar Appearance**

## WHEEL BEARINGS

Service wheel bearings:

1. Replace wheel bearings if end play exceeds 0.002 in. (0.051 mm). See 2.8 SEALED WHEEL BEARINGS.
2. If wheel is already removed, check wheel bearings as follows:
   a. Insert finger into wheel bearing and rotate the inner race in both directions. Repeat step on opposite side of wheel. See Figure 1-11.
   b. Replace the wheel bearings if there is drag, rough rotation, abnormal noise or anything unusual.
3. Check axle spacers for wear and corrosion. Replace as necessary.

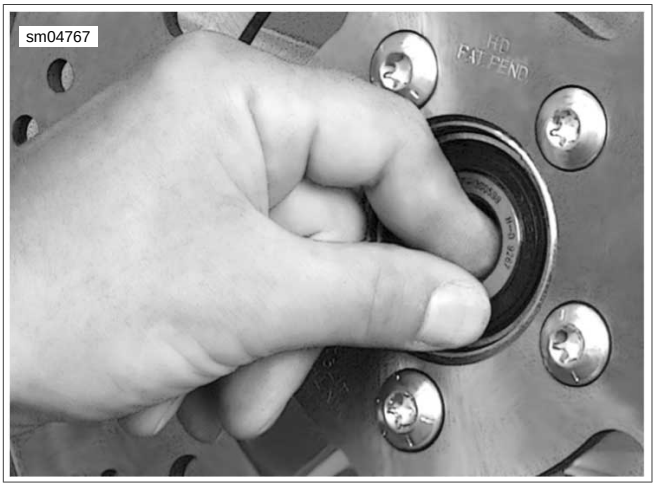



**Figure 1-11. Inspect Wheel Bearings**

## WHEEL SPOKES

**WARNING**

**Spokes that are too tight can draw nipples through the rim or distort hub flanges. Spokes that are too loose can continue to loosen when put in service. Either condition can adversely affect stability and handling, which could result in death or serious injury. (00286a)**

**CAUTION**

**If nipples require more than one full turn to tighten spoke, remove tire to check that spoke protrusion has not damaged tube. (00526b)**

4. Raise motorcycle wheel off the ground.

*NOTE*

*Perform the entire procedure for each spoke, one at a time.*

5. Mark one of the spokes with a reference mark to the rim.
6. Loosen spoke 1/4 turn.

*NOTES*

- *Use a spoke torque wrench to tighten spokes.*
- *Do not tighten spoke more than 1/4 turn past reference mark. If more tension is needed, label spoke and check after completing rest of wheel.*

7. Tighten spoke to reference mark. If torque is less then the value listed in Table 1-8, continue to tighten spoke until it reaches the listed torque.
8. Once the entire wheel has been checked, repeat procedure for each labeled spoke.

9. If more than a few spokes were loose, true the entire wheel following procedure under 2.9 TRUING LACED WHEELS.

**Table 1-8. Spoke Nipple Torque Specification**

| RIM TYPE | MINIMUM TORQUE |
|---|---|
| All | 55 **in-lbs** (6.2 Nm) |

## GENERAL

All models have an automatic chain tensioner. For primary chain service procedures, see 6.3 DRIVE COMPONENTS.

## CHAINCASE LUBRICANT: TOURING MODELS

### General

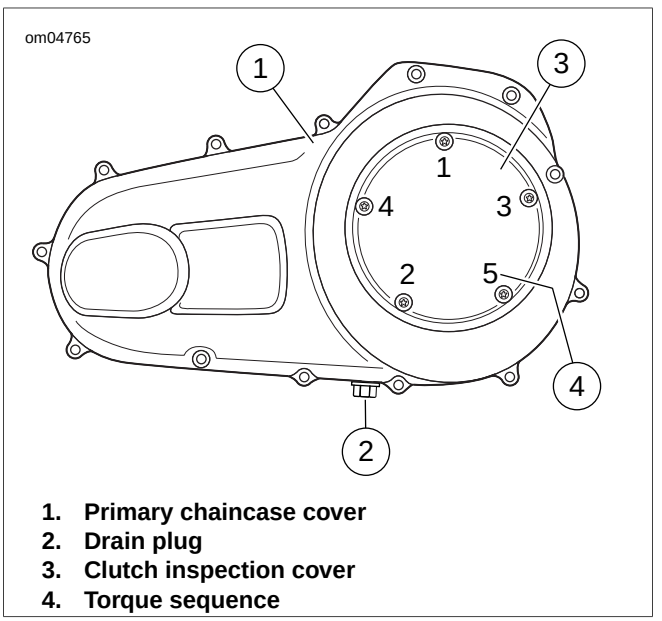
Refer to Table 1-1. The primary chaincase lubricant should be drained and refilled with fresh lubricant at specified intervals.

### Check Lubricant Level

1. Ride motorcycle until engine is warmed up to normal operating temperature.
2. Stand motorcycle upright, so that primary chaincase is level.
3. See Figure 1-12. Remove five screws to free clutch inspection cover from primary chaincase cover.
4. Remove seal ring from clutch inspection cover and discard.
5. If the fluid level can be seen, it is adequate. Otherwise, pour enough GENUINE Harley-Davidson FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05, U.S. quart) in through the clutch inspection cover opening until it is visible along the bottom portion of the clutch assembly.
6. Refer to Changing Chaincase Lubricant to install seal ring and clutch inspection cover.

**CAUTION**

**Do not overfill the primary chaincase with lubricant. Overfilling can cause rough clutch engagement, incomplete disengagement, clutch drag and/or difficulty in finding neutral at engine idle. (00199b)**




1. **Primary chaincase cover**
2. **Drain plug**
3. **Clutch inspection cover**
4. **Torque sequence**

**Figure 1-12. Primary Chaincase**

### Changing Chaincase Lubricant

**CAUTION**

**When draining or adding lubricant, do not allow dirt, debris or other contaminants to enter the engine. (00198a)**

1. Ride motorcycle until engine is warmed up to normal operating temperature.
2. Remove five screws to free clutch inspection cover from primary chaincase cover.
3. Remove drain plug at bottom of primary chaincase. Drain lubricant into suitable container.

*NOTE*

*Dispose of chaincase lubricant in accordance with local regulations.*

4. Clean drain plug magnet. If plug has accumulated a lot of debris, inspect the condition of chaincase components.
5. Inspect drain plug O-ring for cuts, tears or signs of deterioration. Replace as necessary.
6. Install drain plug into primary chaincase and tighten to 14-21 ft-lbs (19.0-28.5 Nm).
7. Pour 38 fl. oz. (1124 ml) of GENUINE Harley-Davidson FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05 quart) through the clutch inspection cover opening.

*NOTE*

*Only add 45 fl. oz. (1331 ml) after service that involves removal of the primary chaincase or primary chaincase cover.*

**CAUTION**

**Do not overfill the primary chaincase with lubricant. Overfilling can cause rough clutch engagement, incomplete disengagement, clutch drag and/or difficulty in finding neutral at engine idle. (00199b)**

**WARNING**

**Be sure that no lubricants or fluids get on tires, wheels or brakes when changing fluid. Traction can be adversely affected, which could result in loss of control of the motorcycle and death or serious injury. (00047d)**

8. Swab all lubricant from seal ring groove in clutch inspection cover. Install **new** seal ring in groove with nubs contacting ring groove walls.
9. Install five screws to fasten clutch inspection cover to primary chaincase cover. Alternately tighten screws to 84-108 **in-lbs** (9.5-12.2 Nm) in the sequence shown in Figure 1-12.

## TRANSMISSION LUBRICATION: TOURING MODELS

### General

The transmission lubricant level should be checked monthly.

Refer to Table 1-1. The transmission should be drained and refilled with fresh lubricant at specified intervals.

*NOTE*

*When checking the transmission lubricant level, the motorcycle should be leaning on the jiffy stand. Allow a short period of time to equalize lubricant level in the transmission compartments.*

### Check Lubricant Level

1. Park motorcycle on its jiffy stand.
2. See Figure 1-13. Remove the threaded filler plug/dipstick.
3. See Figure 1-14. Wipe off filler plug/dipstick. Place in filler hole and remove. (Dipstick should rest on lip of filler. Do not screw in.) Lubricant level should be between the full and low marks on the plug/dipstick when removed.

**⚠WARNING**

**Be sure that no lubricants or fluids get on tires, wheels or brakes when changing fluid. Traction can be adversely affected, which could result in loss of control of the motorcycle and death or serious injury. (00047d)**

**CAUTION**

**When draining or adding lubricant, do not allow dirt, debris or other contaminants to enter the engine. (00198a)**

4. Add lubricant, if necessary. Do not overfill or leakage may occur. When filling the transmission, use GENUINE Harley-Davidson FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05 quart). The transmission fluid capacity is approximately 32 fluid ounces (0.95 liters).
5. Inspect o-ring for tears or damage. Replace if required. Wipe any foreign material from plug.
6. Install threaded filler/check plug and tighten clockwise to 25-75 **in-lbs** (2.8-8.5 Nm).

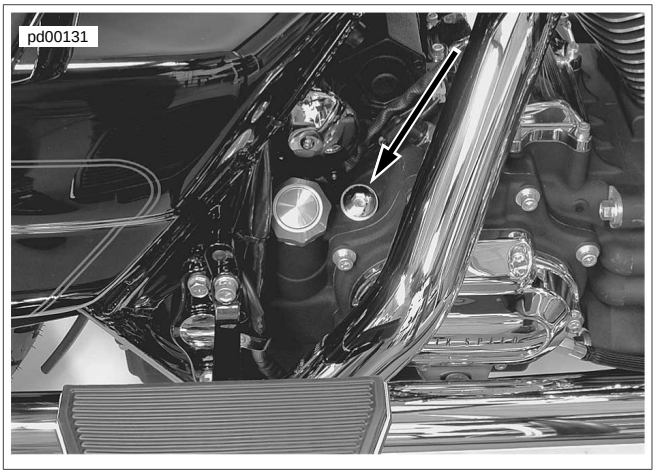
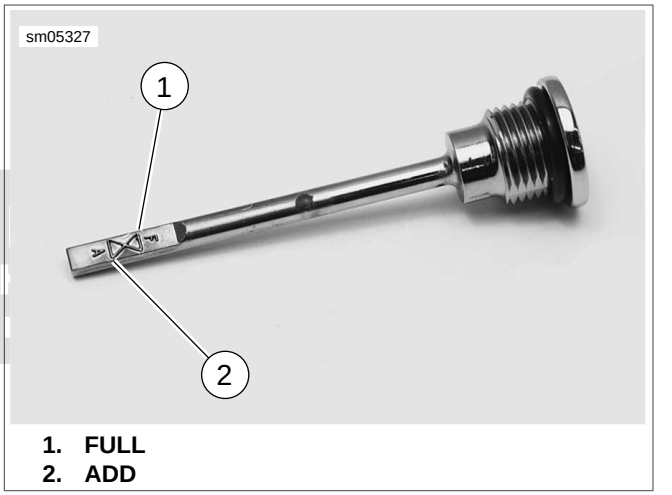



**Figure 1-13. Transmission Filler Plug/Dipstick Location**




1. **FULL**
2. **ADD**

**Figure 1-14. Transmission Filler Plug/Dipstick Lubricant Level**

### Changing Transmission Fluid

1. See Figure 1-13. Remove the threaded filler plug/dipstick.
2. See Figure 1-4. Remove transmission drain plug from the right side of the oil pan and drain lubricant into a suitable container.

**CAUTION**

**When draining or adding lubricant, do not allow dirt, debris or other contaminants to enter the engine. (00198a)**

**⚠WARNING**

**Be sure that no lubricants or fluids get on tires, wheels or brakes when changing fluid. Traction can be adversely affected, which could result in loss of control of the motorcycle and death or serious injury. (00047d)**

*NOTE*

*Dispose of transmission lubricant in accordance with local regulations.*

3. Inspect o-ring for tears or damage on the drain plug. Replace if required. Wipe any foreign material from plug.
4. Install drain plug and tighten to 14-21 ft-lbs (19.0-28.5 Nm). Fill the transmission with 32 fl. oz. (0.95 liters) of GENUINE Harley-Davidson FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05 quart).

*NOTE*

*Do not overfill or leakage may occur. The transmission fluid capacity is approximately 32 fl. oz. (0.95 liters).*

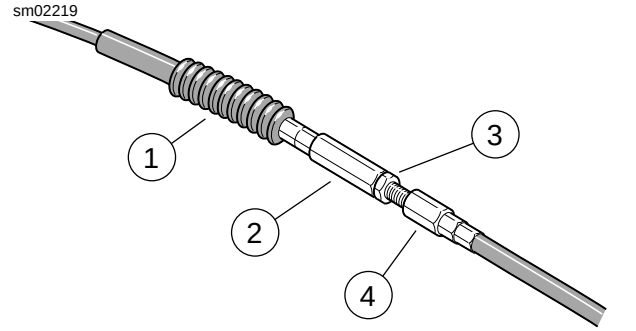
5. Install threaded filler plug/dipstick and tighten clockwise to 25-75 **in-lbs** (2.8-8.5 Nm).
6. Start engine and carefully check for oil leaks around drain plug.

## ADJUSTMENT

*NOTE*

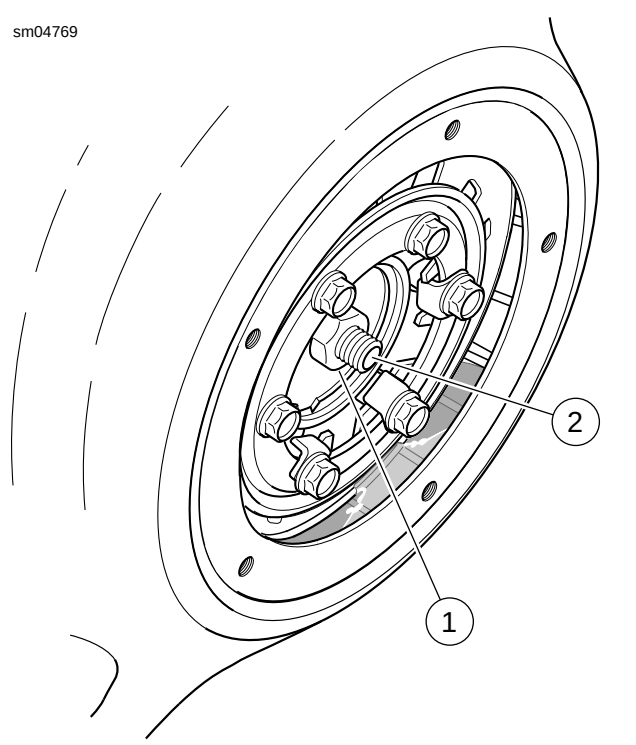
*Perform the clutch adjustment with the motorcycle at room temperature. The clearance at the adjuster screw will increase as the powertrain temperature increases. If adjuster screw is adjusted with powertrain hot, clearance at push rod bearing could be insufficient with powertrain cold and clutch slippage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

1. Stand motorcycle upright and level.
2. Remove five screws to free clutch inspection cover from primary chaincase cover.
3. Remove seal ring from clutch inspection cover and discard.
4. See Figure 1-15. Add freeplay to cable.
   a. Slide rubber boot off cable adjuster.
   b. Holding cable adjuster with 1/2 in. wrench, loosen jam nut using a 9/16 in. wrench. Back jam nut away from cable adjuster.
   c. Move adjuster toward jam nut to introduce a large amount of free play at hand lever.
5. See Figure 1-16. Loosen jam nut on clutch adjuster screw. To take up all free play, turn screw inward (clockwise) until lightly seated.
6. Back out adjuster screw 1/2 to 1 full turn. While holding adjuster screw with an allen wrench, tighten jam nut to 72-120 **in-lbs** (8.1-13.6 Nm), while holding adjusting screw with an Allen wrench.
7. Squeeze clutch lever to maximum limit three times to set ball and ramp release mechanism.
8. Check freeplay.
   a. Turn cable adjuster away from jam nut until slack is eliminated at hand lever.
   b. See Figure 1-17. Pull clutch cable ferrule away from clutch lever bracket to check free play. Turn cable adjuster as necessary to obtain 1/16-1/8 in. (1.6-3.2 mm) free play between end of cable ferrule and clutch lever bracket.
9. Hold adjuster with 1/2 in. wrench. Using 9/16 in. wrench, tighten jam nut against cable adjuster. Cover cable adjuster mechanism with rubber boot.
10. Swab all lubricant from seal ring groove in clutch inspection cover. Install **new** seal ring in groove with nubs contacting ring groove walls.
11. Install five screws to fasten clutch inspection cover to primary chaincase cover. Alternately tighten screws to 84-108 **in-lbs** (9.5-12.2 Nm) in the sequence shown in Figure 1-12.



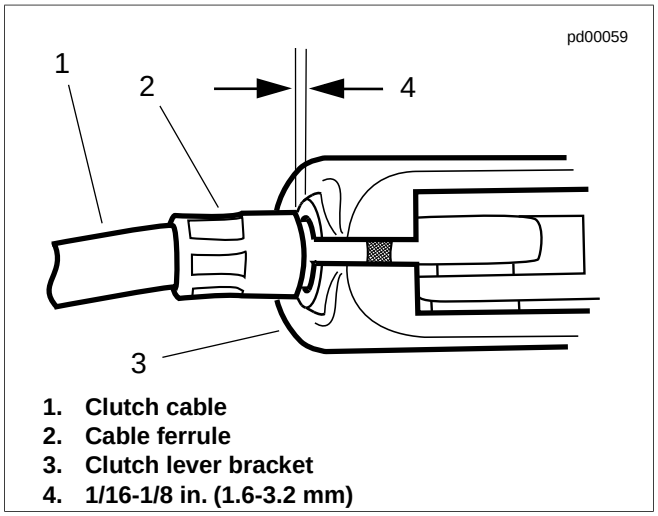

**1. Rubber boot**
**2. Cable adjuster**
**3. Jam nut**
**4. Cable end**

**Figure 1-15. Clutch Cable Adjuster**




**1. Jam nut**
**2. Clutch adjuster screw**

**Figure 1-16. Clutch Adjuster Screw**




1. **Clutch cable**
2. **Cable ferrule**
3. **Clutch lever bracket**
4. **1/16-1/8 in. (1.6-3.2 mm)**

**Figure 1-17. Clutch Hand Lever**

## GENERAL

When a drive belt is replaced for any reason other than stone damage, it is recommended that the transmission and rear sprockets also be replaced to increase the longevity of the new drive belt. In the case of stone damage, inspect sprockets for damage and replace as required.

**⚠WARNING**

**Never bend belt forward into a loop smaller than the drive sprocket diameter. Never bend belt into a reverse loop. Over bending can damage belt resulting in premature failure, which could cause loss of control and death or serious injury. (00339a)**

## CLEANING

Keep dirt, grease, oil, and debris off the belt and sprockets. Clean the belt with a rag slightly dampened with a light cleaning agent.

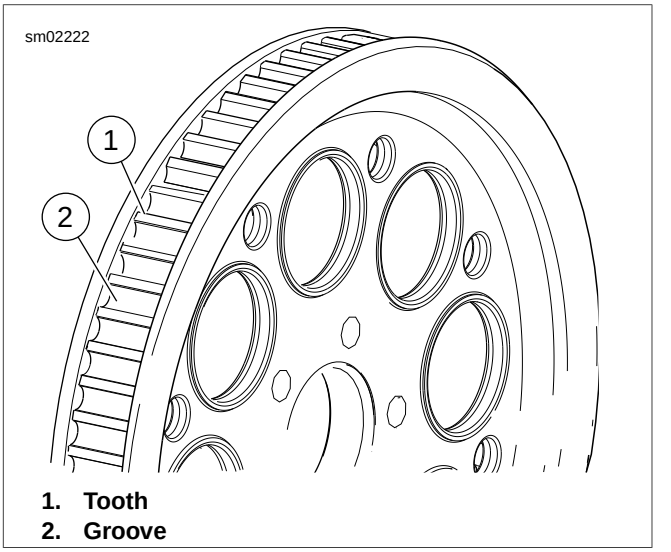
## INSPECTION

### Sprockets

*NOTE*

*If chrome chips or gouges to rear sprocket are large enough to be harmful, they will leave a pattern on the belt face.*

1. See Figure 1-18. Inspect each tooth (1) of rear sprocket for:
   a. Major tooth damage.
   b. Large chrome chips with sharp edges.
   c. Gouges caused by hard objects.
   d. Excessive loss of chrome plating (see next step).
2. To check if chrome plating has worn off, drag a scribe or sharp knife point across the bottom of a groove (2) (between two teeth) with medium pressure.
   a. If scribe or knife point slides across groove without digging in or leaving a visible mark, chrome plating is still good.
   b. If scribe or knife points digs in and leaves a visible mark, it is cutting the bare aluminum. A knife point will not penetrate the chrome plating.
3. Replace rear sprocket if major tooth damage or loss of chrome exists.




**1. Tooth**
**2. Groove**

**Figure 1-18. Rear Sprocket**

### Rear Belt

See Figure 1-19. Inspect drive belt for:

- Cuts or unusual wear patterns.
- Outside edge bevelling (8). Some bevelling is common, but it indicates that sprockets are misaligned.
- Outside ribbed surface for signs of stone puncture (7). If cracks/damage exists near edge of belt, replace belt immediately. Damage to center of belt will require belt replacement eventually, but when cracks extend to edge of belt, belt failure is imminent.
- Inside (toothed portion) of belt for exposed tensile cords (normally covered by nylon layer and polyethylene layer). This condition will result in belt failure and indicates worn transmission sprocket teeth. Replace belt and transmission sprocket.
- Signs of puncture or cracking at the base of the belt teeth. Replace belt if either condition exists.
- Replace belt if conditions 2, 3, 6 or 7 (on edge of belt) exist.

*NOTE*

*Condition 1 may develop into 2 or 3 over time. Condition 1 is not grounds for replacing the belt, but it should be watched closely before condition 2 develops which will require belt replacement.*

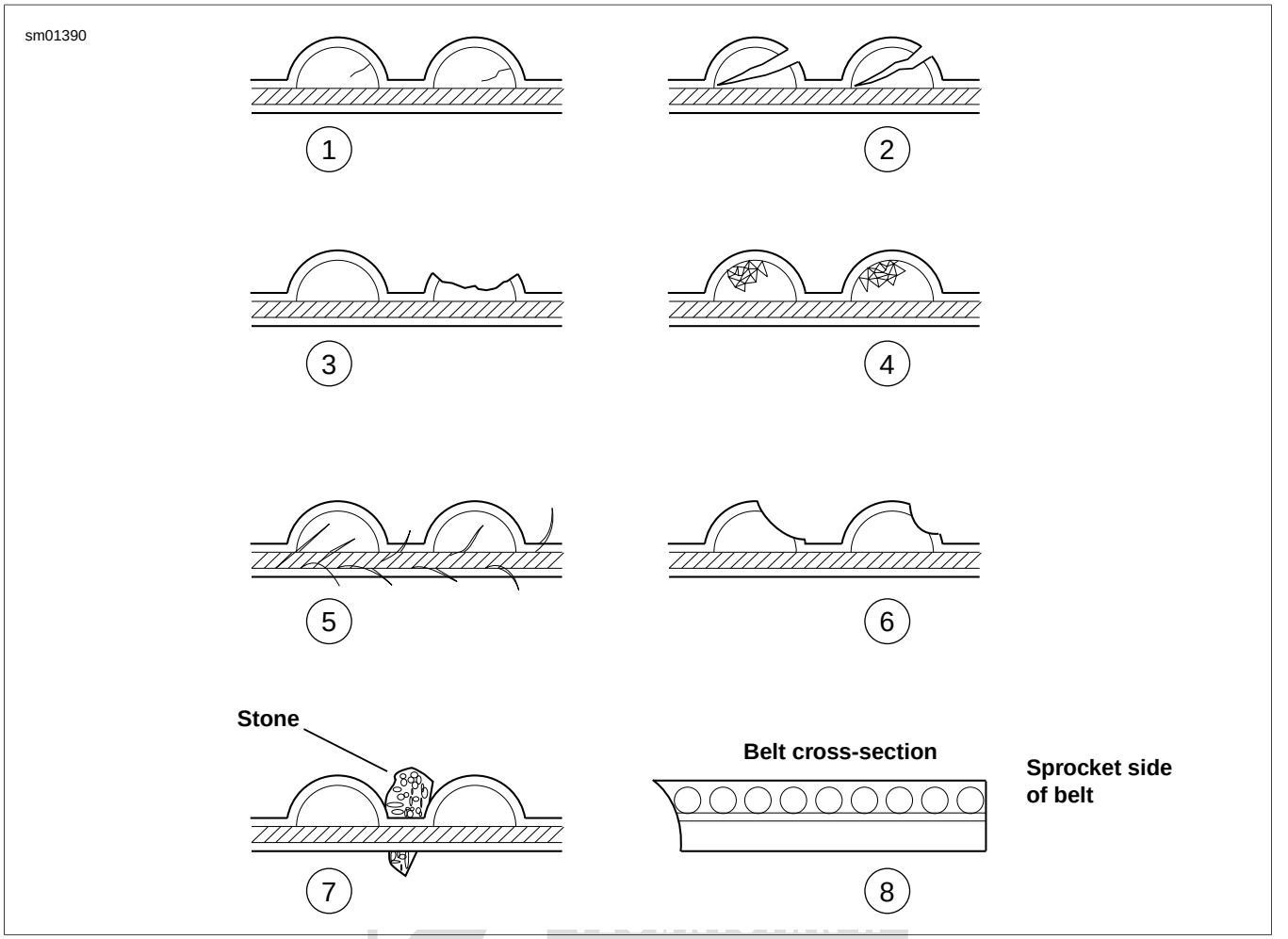



**Figure 1-19. Drive Belt Wear Patterns**

**Table 1-9. Drive Belt Wear Analysis**

| PATTERN | CONDITION | REQUIRED ACTION |
|---|---|---|
| 1 | Internal tooth cracks (hairline) | OK to run, but monitor condition. |
| 2 | External tooth cracks | Replace belt. |
| 3 | Missing teeth | Replace belt. |
| 4 | Chipping (not serious) | OK to run, but monitor condition. |
| 5 | Fuzzy edge cord | OK to run, but monitor condition. |
| 6 | Hook wear | Replace belt and sprocket. |
| 7 | Stone damage | Replace belt if damage is on the edge. |
| 8 | Bevel wear (outboard edge only) | OK to run, but monitor condition. |
| 9 | Excess edge wear (XR only) | Check idler bearings and bracket attachment. |

## CHECKING BELT DEFLECTION

| PART NUMBER | TOOL NAME |
|---|---|
| HD-35381A | BELT TENSION GAUGE |

Check rear belt deflection:

- As part of pre-ride inspection.
- At every scheduled service interval.

Check belt deflection:

- With transmission in neutral.
- At loosest spot in belt.
- With motorcycle at ambient temperature.
- With motorcycle upright and rear wheel in air or on jiffy stand without rider or luggage.

1. Remove left side saddlebag.
2. See Figure 1-20. Obtain BELT TENSION GAUGE (Part No. HD-35381A).

*NOTE*

*Customers may purchase gauge from an authorized Harley-Davidson dealer.*

3. To use the belt tension gauge:
   a. Slide O-ring toward 0 lbs (0 kg) mark.
   b. Fit cradle against bottom of belt half way between transmission and rear wheel compensator sprockets. See Figure 1-21.
   c. While observing belt deflection through the window on the debris deflector, push upward on knob until O-ring slides down to the 10 lbs (4.5 kg) mark.

*NOTE*

*Next to the deflection window is a graduated scale. Each graduation represents 1/8 in. (3.2 mm) of belt deflection.*

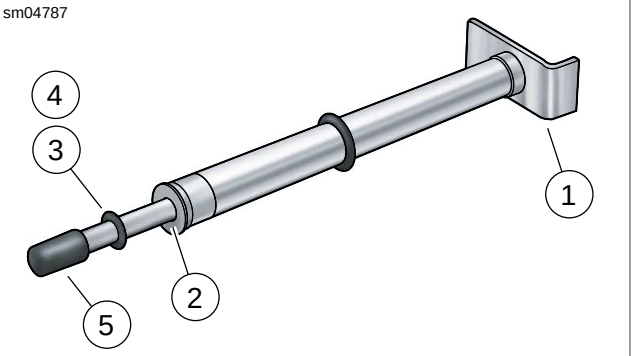
4. Rotate rear wheel and measure deflection at different spots on the belt. Compare results with specifications in Table 1-10.
   a. If deflection is within specification, install left side saddlebag.
   b. If deflection is not within specification, see 1.13 REAR BELT DEFLECTION, Setting Belt Deflection.

*NOTE*

*Always use BELT TENSION GAUGE (Part No. HD-35381A) to measure belt deflection. Do not rely on "feel" as this can result in belts that are under tensioned. Loose belts will fail due to "ratcheting" (jumping a tooth) with resultant tensile cord crimping and breakage.*

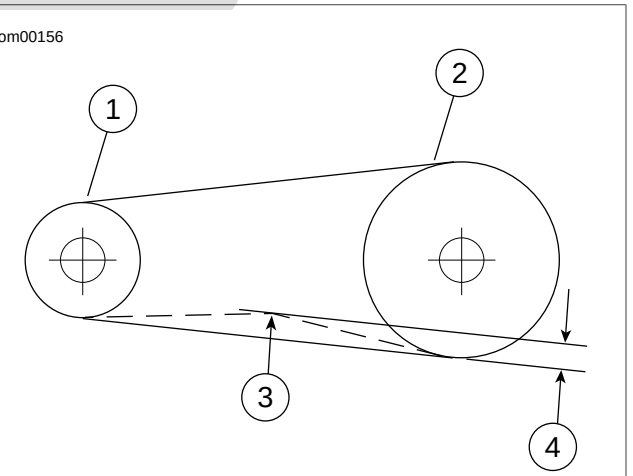
**Table 1-10. Belt Deflection**

| MODEL | INCHES | MILLIMETERS |
|---|---|---|
| FLHR/C<br>FLHT/C/U<br>FLTR | 3/8-7/16 | 9.5-11.1 |
| FLHX | 1/4-5/16 | 6.4-7.9 |




1. **Cradle**
2. **0 lbs (0 kg) mark**
3. **O-ring**
4. **10 lbs (4.5 kg) mark**
5. **Knob**

**Figure 1-20. Belt Tension Gauge (Part No. HD-35381A)**




1. **Transmission sprocket**
2. **Rear wheel sprocket**
3. **10 lbs (4.5 kg) of force**
4. **Amount of deflection**

**Figure 1-21. Checking Belt Deflection**

## SETTING BELT DEFLECTION

| PART NUMBER | TOOL NAME |
|---|---|
| HD-35381A | BELT TENSION GAUGE |
| HD-47925 | AXLE NUT TORQUE ADAPTER |

### Initial Set-up

1. Remove right side saddlebag.
2. Remove E-clip from groove at end of axle.

*NOTE*

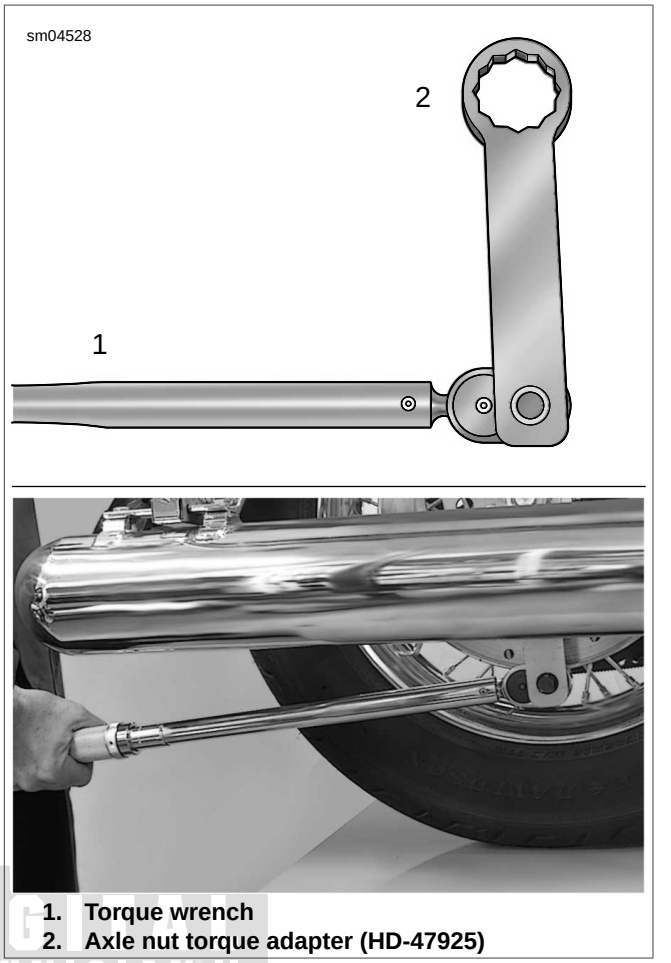
*The Axle Nut Torque Adapter simplifies the belt adjustment procedure by allowing the cone nut to be loosened and tightened without having to remove the right side muffler. The tool also can be used to rotate the weld nut on the left side.*

3. Loosen cone nut as follows:
   a. Obtain breaker bar with 1/2 inch drive head and AXLE NUT TORQUE ADAPTER (Part No. HD-47925).
   b. Install torque adapter perpendicular to breaker bar.
   c. Insert tool up between rear wheel and muffler to capture cone nut. For best clearance with muffler, be sure torque adapter is on the outboard side.
   d. Rotate cone nut in a counter-clockwise direction until loose.
4. Obtain torque wrench with 1/2 inch drive head and AXLE NUT TORQUE ADAPTER (Part No. HD-47925). Proceed as follows:
   a. Install torque adapter perpendicular to torque wrench. See upper frame of Figure 1-22.
   b. Insert tool up between rear wheel and muffler to capture cone nut. For best clearance with muffler, be sure torque adapter is on the outboard side. See lower frame of Figure 1-22.

   *NOTE*

   *Since any extension can act as a torque multiplier, the torque wrench must be perpendicular to the torque adapter when the cone nut is tightened. The 90° orientation between the tools cancels the multiplier effect and prevents the cone nut from being over-tightened. If the torque adapter is kept in-line with the torque wrench, the multiplier effect is in force and parts damage will occur.*

   c. Verify that cam just contacts weld nub on both sides of rear swingarm. If necessary, push wheel forward slightly to achieve the desired result. See Figure 1-23.
   d. Snug the cone nut to 15-20 ft-lbs (20-27 Nm).
5. Use BELT TENSION GAUGE (Part No. HD-35381A) to check belt deflection. See 1.13 REAR BELT DEFLECTION, Checking Belt Deflection.
   a. If belt is too loose, see Belt Too Loose.
   b. If belt is too tight, see Belt Too Tight.
   c. If belt deflection is within specification, see Reassembly.




1. **Torque wrench**
2. **Axle nut torque adapter (HD-47925)**

**Figure 1-22. Install Tool Perpendicular to Torque Wrench**

### Belt Too Loose

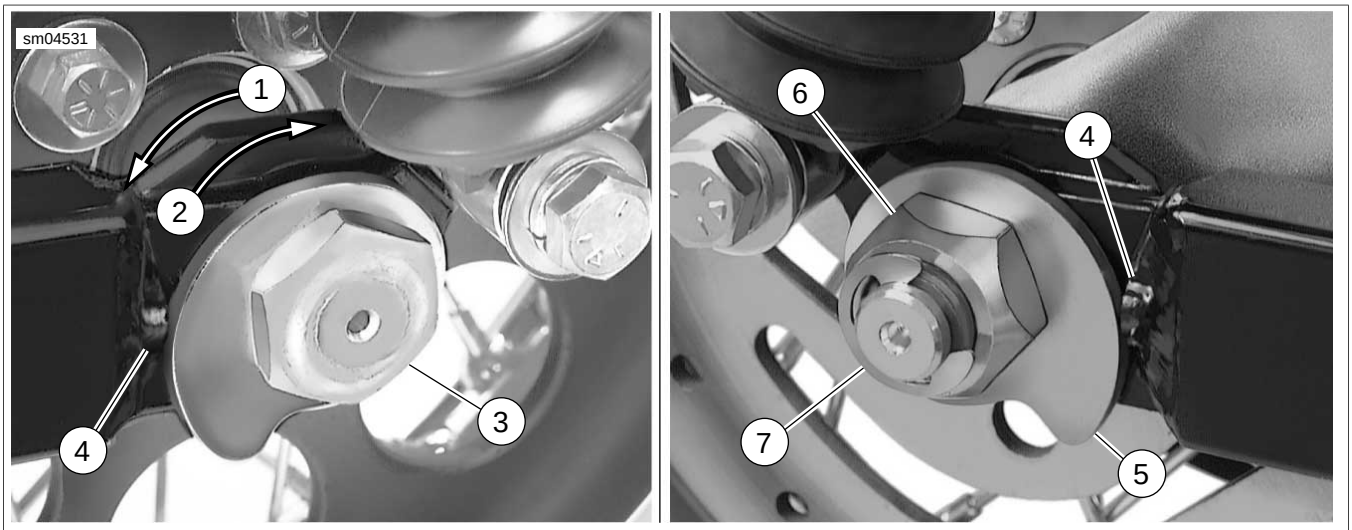
Reduce belt deflection as follows:

1. Rotate weld nut on left side of axle in a clockwise direction.
2. Use BELT TENSION GAUGE (Part No. HD-35381A) to check belt deflection. See 1.13 REAR BELT DEFLECTION, Checking Belt Deflection.
   a. Repeat steps if belt is still too loose.
   b. If belt is now too tight, see Belt Too Tight.
   c. If belt deflection is within specification, see Reassembly.

### Belt Too Tight

Increase belt deflection as follows:

1. Rotate weld nut on left side of axle in a counterclockwise direction.
2. Push wheel forward slightly so that adjuster cam just contacts weld nub on both sides of rear fork. See Figure 1-23.




1. **Increase belt deflection**
2. **Reduce belt deflection**
3. **Weld nut**
4. **Weld nub**
5. **Adjuster cam**
6. **Cone nut**
7. **E-clip**

**Figure 1-23. Rear Wheel Adjuster Cams**

3. Use BELT TENSION GAUGE (Part No. HD-35381A) to check belt deflection. See 1.13 REAR BELT DEFLECTION, Checking Belt Deflection.
   a. Repeat steps if belt is still too tight.
   b. If belt is now too loose, see Belt Too Loose.
   c. If belt deflection is within specification, see Reassembly.

## Reassembly

*NOTE*

*The compensator sprocket bearing has a split inner race that requires proper compression. Deviation from the following procedure may lead to premature bearing failure.*

1. Holding weld nut on left side of axle, proceed as follows:
   a. Tighten cone nut to 95-105 ft-lbs (128.8-142.4 Nm).
   b. Loosen cone nut one full turn.
   c. Retighten cone nut to above specification.

*NOTE*

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

2. 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 Belt Too Loose or Belt Too Tight.
3. With the flat side out, install **new** E-clip in groove on right side of axle.
4. Install saddlebags.

## GENERAL

**⚠WARNING**

**Use denatured alcohol to clean brake system components. Do not use mineral-based solvents (such as gasoline or paint thinner), which will deteriorate rubber parts even after assembly. Deterioration of these components can cause brake failure, which could result in death or serious injury. (00291a)**

**⚠CAUTION**

**Direct contact of D.O.T. 4 brake fluid with eyes can cause irritation. Avoid eye contact. In case of eye contact flush with large amounts of water and get medical attention. Swallowing large amounts of D.O.T. 4 brake fluid can cause digestive discomfort. If swallowed, obtain medical attention. Use in well ventilated area. KEEP OUT OF REACH OF CHILDREN. (00240a)**

**CAUTION**

**D.O.T. 4 brake fluid will damage painted and body panel surfaces it comes in contact with. Always use caution and protect surfaces from spills whenever brake work is performed. Failure to comply can result in cosmetic damage. (00239b)**

**CAUTION**

**Do not allow dirt or debris to enter the master cylinder reservoir. Dirt or debris in the reservoir can cause improper operation and equipment damage. (00205c)**

Front brake hand lever and rear brake foot pedal must have a firm feel when brakes are applied. If not, bleed system as described.

## PROCEDURE

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48650 | DIGITAL TECHNICIAN II |
| SNAP-ON BB200A | BASIC VACUUM BRAKE BLEEDER |

*NOTES*

- *For best results, use the BASIC VACUUM BRAKE BLEEDER (Part No. Snap-On BB200A) or equivalent tool, particularly if the brake system was completely drained. Refer to the instructions provided with the tool. If a vacuum brake bleeder is not available, use the procedure which follows.*
- *When removing or replacing a bleeder valve in the rear brake caliper or front banjo bleeder bolts, remove the o-ring from the bleeder valve groove or bore and discard. The o-ring is required only for brake bleeding at the factory. Although not sold separately, it may be present in certain assemblies as currently sold. If care is not taken to remove and discard the o-ring, it may become lodged in the caliper/banjo bleeder bolt bore during bleeder valve installation and prevent proper torquing or sealing.*
- *After bleeding the brake system on ABS equipped motorcycles, confirm that the brake lines are properly connected if either the ABS module or more than one brake line was removed. To accomplish this, install master cylinder reservoir cover, connect motorcycle to DIGITAL TECHNICIAN II (Part No. HD-48650) and perform "ABS Service" procedure in the "Toolbox" menu.*

1. Remove bleeder valve cap. Install end of a length of clear plastic tubing over caliper bleeder valve. Place free end of tube in a clean container.
2. If bleeding rear brake system, stand motorcycle upright, so that rear master cylinder reservoir is level. If bleeding front brake system, rest motorcycle on jiffy stand and turn front wheel toward left fork stop until front master cylinder reservoir is level.

*NOTE*

*Wrap a clean shop cloth around the outside of the master cylinder reservoir to protect paint from brake fluid spills.*

3. Remove two screws to release cover from master cylinder reservoir.
4. See Figure 1-24. Add D.O.T. 4 BRAKE FLUID to master cylinder reservoir as follows:
   a. Front master cylinder reservoir: flush with step (marked MAX) cast at rear of reservoir or 0.20 in. (5.0 mm) from the top.
   b. Rear master cylinder reservoir: flush with ledge cast at front of reservoir or 0.26 in. (6.5 mm) from the top.
5. Pump the brake lever/pedal to build up hydraulic pressure.
6. While holding the brake lever/pedal, open brake caliper bleeder valve about 3/4 turn. Close bleeder valve as soon as a loss of hydraulic pressure is detected (or 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.
7. Repeat steps 4-6 until all air bubbles are purged and a solid column of fluid is observed in the bleeder tube. Pay careful attention to the level of the fluid in the master cylinder reservoir. To avoid drawing air into the brake lines, always add fluid to the master cylinder reservoir before it empties.
8. Tighten bleeder valve to 80-100 **in-lbs** (9.0-11.3 Nm). Install bleeder valve cap.

*NOTE*

*If bleeding the front brake system, repeat applicable steps to bleed the line to the second brake caliper.*

9. Add brake fluid to the master cylinder reservoir as described in step 4.

**⚠WARNING**

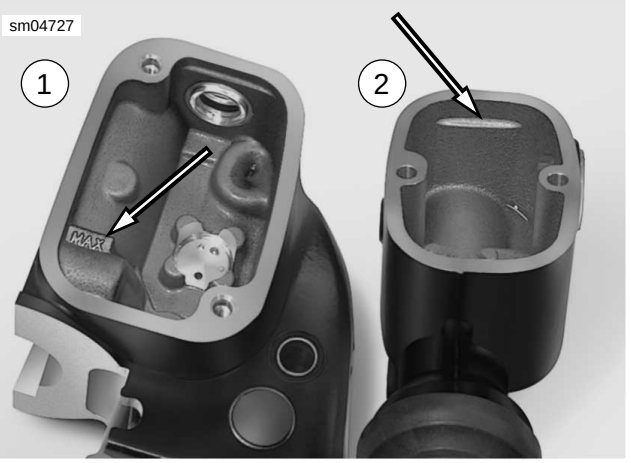
**A plugged or covered relief port can cause brake drag or lock-up, which could lead to loss of control, resulting in death or serious injury. (00288a)**

10. 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 if all internal components are working properly.
11. Install master cylinder reservoir cover, but first verify that the cover gasket bellows is not extended or brake fluid will be ejected from the reservoir. Install two cover screws and alternately tighten as follows:
    a. Front master cylinder reservoir: 7-10 **in-lbs** (0.8-1.1 Nm).
    b. Rear master cylinder reservoir: 12-15 **in-lbs** (1.4-1.7 Nm).
12. If motorcycle is ABS equipped, and either the ABS module or more than one brake line was removed, confirm that brake system is properly connected. To accomplish this, connect motorcycle to DIGITAL TECHNICIAN II (Part No. HD-48650) and perform "ABS Service" procedure in the "Toolbox" menu.
13. With the Ignition/Light Key Switch turned to IGNITION, alternately apply front and rear brakes to verify operation of the brake lamp.

**⚠WARNING**

**After repairing the brake system, test brakes at low speed. If brakes are not operating properly, testing at high speeds can cause loss of control, which could result in death or serious injury. (00289a)**

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




**1. Front master cylinder reservoir**
**2. Rear master cylinder reservoir**

**Figure 1-24. Brake Fluid Level**

## INSPECTION

Check brake pads and discs:

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

### Brake Pads

**⚠CAUTION**

**Direct contact of D.O.T. 4 brake fluid with eyes can cause irritation. Avoid eye contact. In case of eye contact flush with large amounts of water and get medical attention. Swallowing large amounts of D.O.T. 4 brake fluid can cause digestive discomfort. If swallowed, obtain medical attention. Use in well ventilated area. KEEP OUT OF REACH OF CHILDREN. (00240a)**

**CAUTION**

**D.O.T. 4 brake fluid will damage painted and body panel surfaces it comes in contact with. Always use caution and protect surfaces from spills whenever brake work is performed. Failure to comply can result in cosmetic damage. (00239b)**

**⚠WARNING**

**Always replace brake pads in complete sets for correct and safe brake operation. Improper brake operation could result in death or serious injury. (00111a)**

Replace both rear brake pads (inner and outer) if the friction material of either pad is worn to 0.016 in. (0.4 mm) or less above the backing plate.

Replace all front brake pads (inner and outer pads of both the left and right side calipers) if the friction material of any single pad is worn to 0.016 in. (0.4 mm) or less above the backing plate.

*NOTE*

*Refer to the wear indicator lines for a general indication of pad wear. See Figure 1-26.*

Always install a **new** pad pin (provided in brake pad service kit) whenever the brake pads are replaced.

Inspect the brake lines and hoses for damage or wear.

### Brake Disc Thickness

The minimum front brake disc thickness is 0.18 in. (4.5 mm) and is stamped on the side of the disc.

The minimum rear brake disc thickness is 0.25 in. (6.3 mm) and is stamped on the side of the disc.

Replace any disc that is excessively worn or badly scored.

### Brake Disc Lateral Runout

Maximum brake disc lateral runout or warpage is 0.008 in. (0.2 mm) when measured near the outside diameter of the disc.

## BRAKE PAD REPLACEMENT

### Rear Brake Caliper

1. Remove right side saddlebag. See 2.27 SADDLEBAGS, Removal.
2. If ABS equipped, carefully cut cable strap to release rear wheel speed sensor cable from brake hose to brake caliper.
3. Remove two screws to release brake caliper from caliper bracket.
4. Remove brake caliper from brake disc.

*NOTE*

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

5. Stand motorcycle upright, so that rear master cylinder reservoir is level. Wrap a clean shop cloth around the outside of the reservoir to protect paint from brake fluid spills.
6. Remove two screws to release cover from master cylinder reservoir.

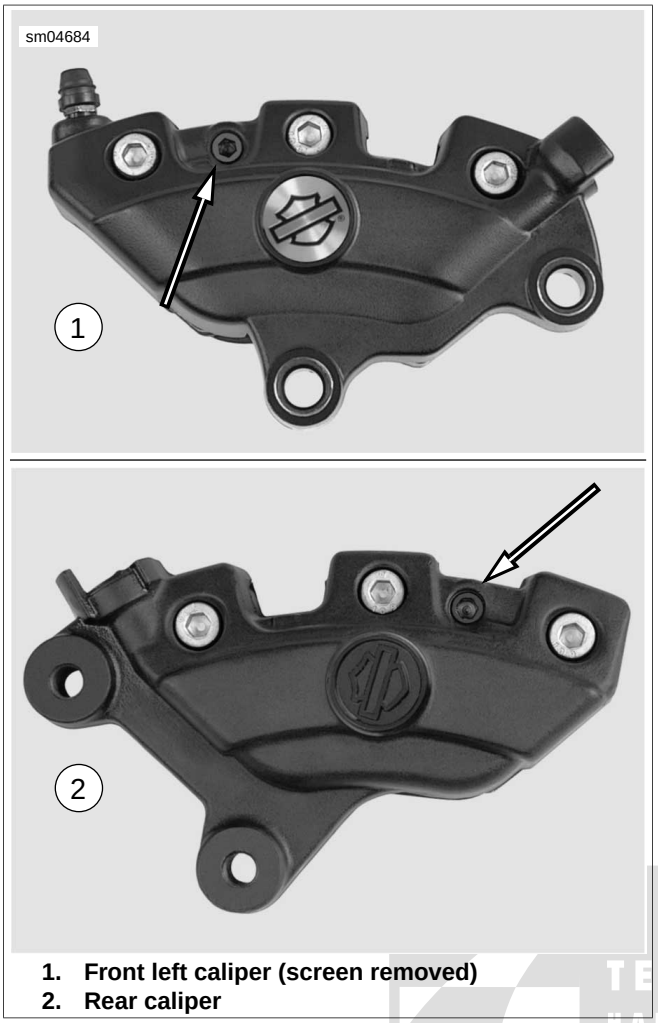
*NOTE*

*Fluid level will rise as pistons are pushed back into the caliper, possibly overflowing the master cylinder reservoir. Remove some fluid from the reservoir if necessary.*

7. Alternately push each pad back until pistons are fully seated in the bores.
8. Pull retaining clip from groove in pad pin. See Figure 1-28.
9. Remove pad pin (metric). See Figure 1-25.
10. Pull on pad pin side of brake pads to release from caliper.
11. Remove pad spring if damaged or worn.
12. If removed, seat **new** pad spring on flat in caliper, so that clips on spring engage indentations in caliper. Be sure that forked end of pad spring is on the pad pin side of the caliper.

**⚠WARNING**

**Always replace brake pads in complete sets for correct and safe brake operation. Improper brake operation could result in death or serious injury. (00111a)**




1. **Front left caliper (screen removed)**
2. **Rear caliper**

**Figure 1-25. Brake Caliper Pad Pin**

13. Install **new** brake pads as follows:
    a. Hold inner brake pad, so that pad pin tab is on the same side as pad pin hole in caliper. See Figure 1-26.
    b. Insert opposite side of brake pad into caliper engaging square shaped corner of pad in slot of caliper. See Figure 1-27.
    c. Push pad pin tab side of brake pad into caliper until seated.
    d. Verify that brake pad friction material faces brake disc gap in caliper.
    e. Repeat step to install outer brake pad.
14. Turn caliper over. Verify that pad pin tabs are centered under forks of pad spring. Adjust pads if necessary.
15. Install **new** pad pin and tighten to 75-102 **in-lbs** (8.5-11.5 Nm).
16. Install retaining clip in groove of pad pin, so that lip overhangs caliper housing. See Figure 1-28.
17. Install brake caliper onto brake disc. Align holes in brake caliper with those in caliper bracket and install two screws. Alternately tighten screws to 43-48 ft-lbs (58.3-65.1 Nm).
18. If ABS equipped, install **new** cable strap 1.25 in. (31.8 mm) in front of the brake hose crimp capturing rear wheel speed sensor cable and brake hose.

**WARNING**

**After servicing brakes and before moving motorcycle, pump brakes to build brake system pressure. Insufficient pressure can adversely affect brake performance, which could result in death or serious injury. (00279a)**

19. Depress brake pedal several times to set brake pads to proper operating position within caliper.
20. Check brake fluid level in master cylinder reservoir. If necessary, add D.O.T. 4 BRAKE FLUID until level is flush with ledge cast at front of reservoir. See Figure 1-29.
21. Install master cylinder reservoir cover. Install cover screws and tighten to 12-15 **in-lbs** (1.4-1.7 Nm).
22. Install right side saddlebag. See 2.27 SADDLEBAGS, Installation.

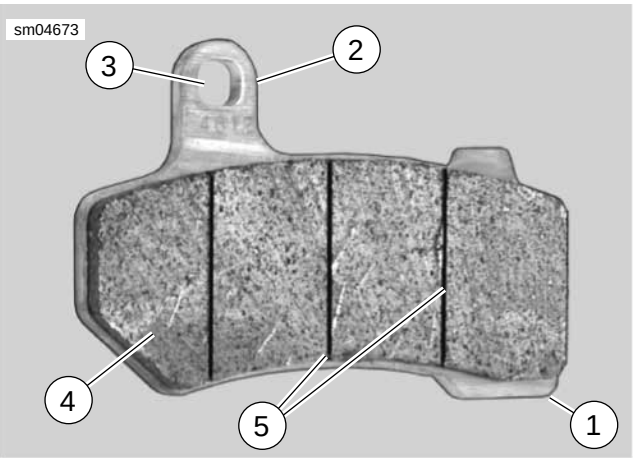
**WARNING**

**After repairing the brake system, test brakes at low speed. If brakes are not operating properly, testing at high speeds can cause loss of control, which could result in death or serious injury. (00289a)**

23. Test brake system.
    a. Turn ignition switch ON. Depress brake pedal to verify operation of brake lamp.
    b. Test ride motorcycle. Bleed the system if brakes feel spongy. See 1.14 BLEEDING BRAKES.

*NOTE*

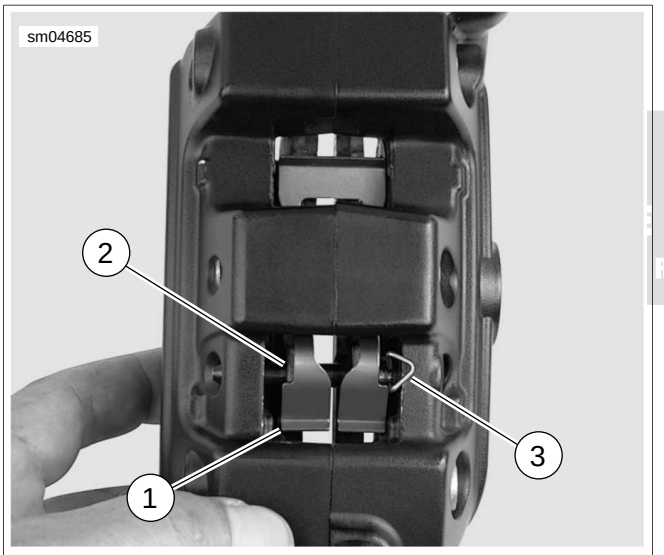
*Avoid making hard stops for the first 100 miles (160 km). This allows the **new** pads to become conditioned to the brake discs.*




1. **Square corner**
2. **Pad pin tab**
3. **Pad pin hole**
4. **Friction material**
5. **Wear indicator lines**

**Figure 1-26. Brake Pad**


**Figure 1-27. Brake Caliper (Bottom View)**




1. **Pad spring (forked end)**
2. **Pad pin tab**
3. **Pad pin retaining clip**

**Figure 1-28. Brake Caliper (Top View)**

## Front Brake Calipers

1. If present, carefully cut two cable straps to release front wheel speed sensor cable and front fender tip lamp wires from brake hose to left brake caliper.
2. On ABS equipped motorcycles, release front wheel speed sensor cable from clip as follows:
   a. Push on lip at rear of clip to disengage from bracket.
   b. Rotate tab (stamped ABS) rearward until clip is perpendicular to bracket and remove cable.
3. Remove two brake caliper mounting screws (with cable clip/bracket if ABS equipped). Slide brake caliper straight down to remove from brake disc. Allow the brake caliper to hang loose.

*NOTE*

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

4. Resting motorcycle on jiffy stand, turn front wheel toward left fork stop until front master cylinder reservoir is level. Wrap a clean shop cloth around the outside of the reservoir to protect paint from brake fluid spills.
5. Remove two screws to release cover from master cylinder reservoir.

*NOTE*

*Fluid level will rise as pistons are pushed back into the caliper, possibly overflowing the master cylinder reservoir. Remove some fluid from the reservoir if necessary.*

6. Alternately push each pad back until pistons are fully seated in the bores.
7. Pull screen from caliper.
8. Pull retaining clip from groove in pad pin. See Figure 1-28.
9. Remove pad pin (metric). See Figure 1-25.
10. Pull on pad pin side of brake pads to release from caliper.
11. Remove pad spring if damaged or worn.
12. If removed, seat **new** pad spring on flat in caliper, so that clips on spring engage indentations in caliper. Be sure that forked end of pad spring is on the pad pin side of the caliper.

**⚠WARNING**

**Always replace brake pads in complete sets for correct and safe brake operation. Improper brake operation could result in death or serious injury. (00111a)**

13. Install **new** brake pads as follows:
    a. Hold inner brake pad, so that pad pin tab is on the same side as pad pin hole in caliper. See Figure 1-26.
    b. Insert opposite side of brake pad into caliper engaging square shaped corner of pad in slot of caliper. See Figure 1-27.
    c. Push pad pin tab side of brake pad into caliper until seated.
    d. Verify that brake pad friction material faces brake disc gap in caliper.
    e. Repeat step to install outer brake pad.
14. Turn caliper over. Verify that pad pin tabs are centered under forks of pad spring. Adjust pads if necessary.
15. Install **new** pad pin and tighten to 75-102 **in-lbs** (8.5-11.5 Nm).
16. Install retaining clip in groove of pad pin, so that lip overhangs caliper housing. See Figure 1-28.
17. Engaging two prongs on screen beneath forked end of pad spring, push on single prong side of screen until engaged.

18. Install brake caliper as follows:
    a. With the bleeder valve topside, install caliper at bottom of brake disc.
    b. Slide brake caliper straight up until holes are aligned with lugs on fork slider. Start two mounting screws (with cable clip/bracket if ABS equipped).

*NOTE*

*Be sure that tab (stamped ABS) on clip is installed in slot of bracket from inboard side. Clip cannot be installed once mounting screws are started.*

    c. Alternately tighten mounting screws to 28-38 ft-lbs (37.9-51.5 Nm)

**WARNING**

**After servicing brakes and before moving motorcycle, pump brakes to build brake system pressure. Insufficient pressure can adversely affect brake performance, which could result in death or serious injury. (00279a)**

19. If ABS equipped, install two **new** cable straps as follows:
    a. Install cable strap 2.5 in. (63.5 mm) above the bottom brake hose crimp capturing front wheel speed sensor cable and brake hose.
    b. Install cable strap 2.5 in. (63.5 mm) below the top brake hose crimp capturing front wheel speed sensor cable, brake hose and front fender tip lamp wires, if equipped.
20. If ABS equipped, install front wheel speed sensor cable in clip as follows:
    a. Rotate tab (stamped ABS) until clip is perpendicular to bracket and install cable.
    b. Rotate tab forward until clip is in-line with bracket and then apply pressure to tab until lip engages. Gently pull on cable to verify that clip is properly installed.
21. Repeat applicable steps to replace brake pads in right side caliper.

**WARNING**

**After servicing brakes and before moving motorcycle, pump brakes to build brake system pressure. Insufficient pressure can adversely affect brake performance, which could result in death or serious injury. (00279a)**

22. Depress brake lever several times to set brake pads to proper operating position within caliper.
23. Check brake fluid level in master cylinder reservoir. If necessary, add D.O.T. 4 BRAKE FLUID until level is flush with step (marked MAX) cast at rear of reservoir. See Figure 1-29.
24. Install master cylinder reservoir cover. Install cover screws and tighten to 7-10 **in-lbs** (0.8-1.1 Nm).

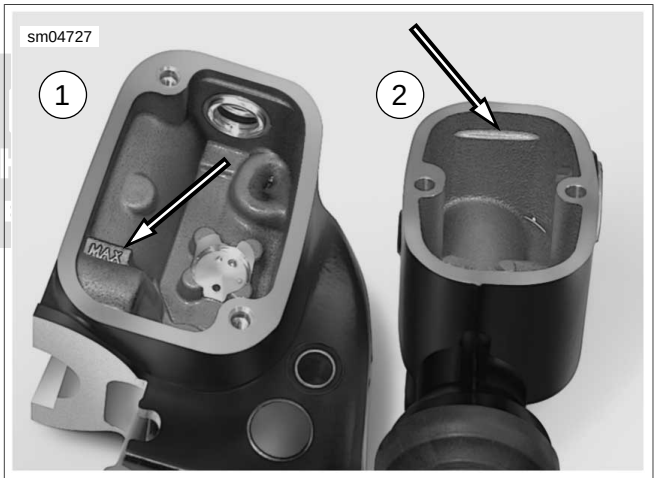
**WARNING**

**After repairing the brake system, test brakes at low speed. If brakes are not operating properly, testing at high speeds can cause loss of control, which could result in death or serious injury. (00289a)**

25. Test brake system.
    a. Turn ignition switch ON. Depress brake lever to verify operation of brake lamp.
    b. Test ride motorcycle. Bleed system if brakes feel spongy. See 1.14 BLEEDING BRAKES.

*NOTE*

*Avoid making hard stops for the first 100 miles (160 km). This allows the **new** pads to become conditioned to the brake discs.*




1. **Front master cylinder reservoir**
2. **Rear master cylinder reservoir**

**Figure 1-29. Brake Fluid Level**

## GENERAL

**⚠WARNING**

**Batteries contain sulfuric acid, which could cause severe burns to eyes and skin. Wear a protective face shield, rubberized gloves and protective clothing when working with batteries. KEEP BATTERIES AWAY FROM CHILDREN. (00063a)**

**⚠WARNING**

**Never remove warning label attached to top of battery. Failure to read and understand all precautions contained in warning, could result in death or serious injury. (00064a)**

**⚠WARNING**

**Batteries, battery posts, terminals and related accessories contain lead and lead compounds, and other chemicals known to the State of California to cause cancer, and birth defects or other reproductive harm. Wash hands after handling. (00019e)**

All AGM 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.

*NOTE*

*For charging information, see 1.16 BATTERY MAINTENANCE, Charging Battery. For testing information, see ELECTRICAL DIAGNOSTIC MANUAL.*

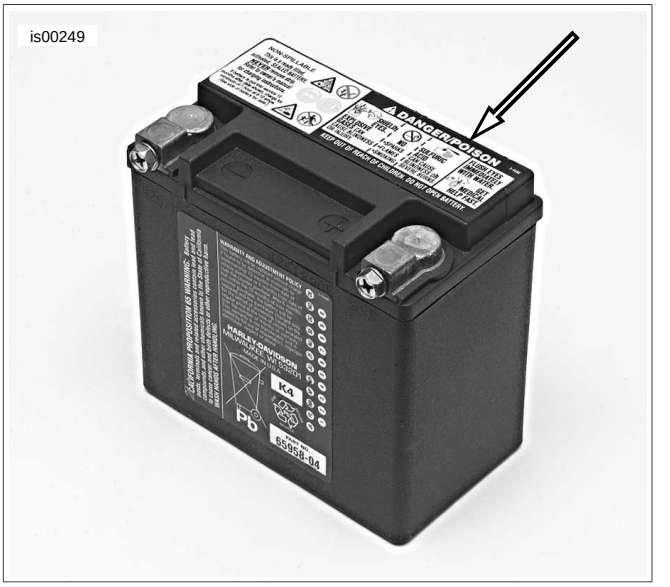
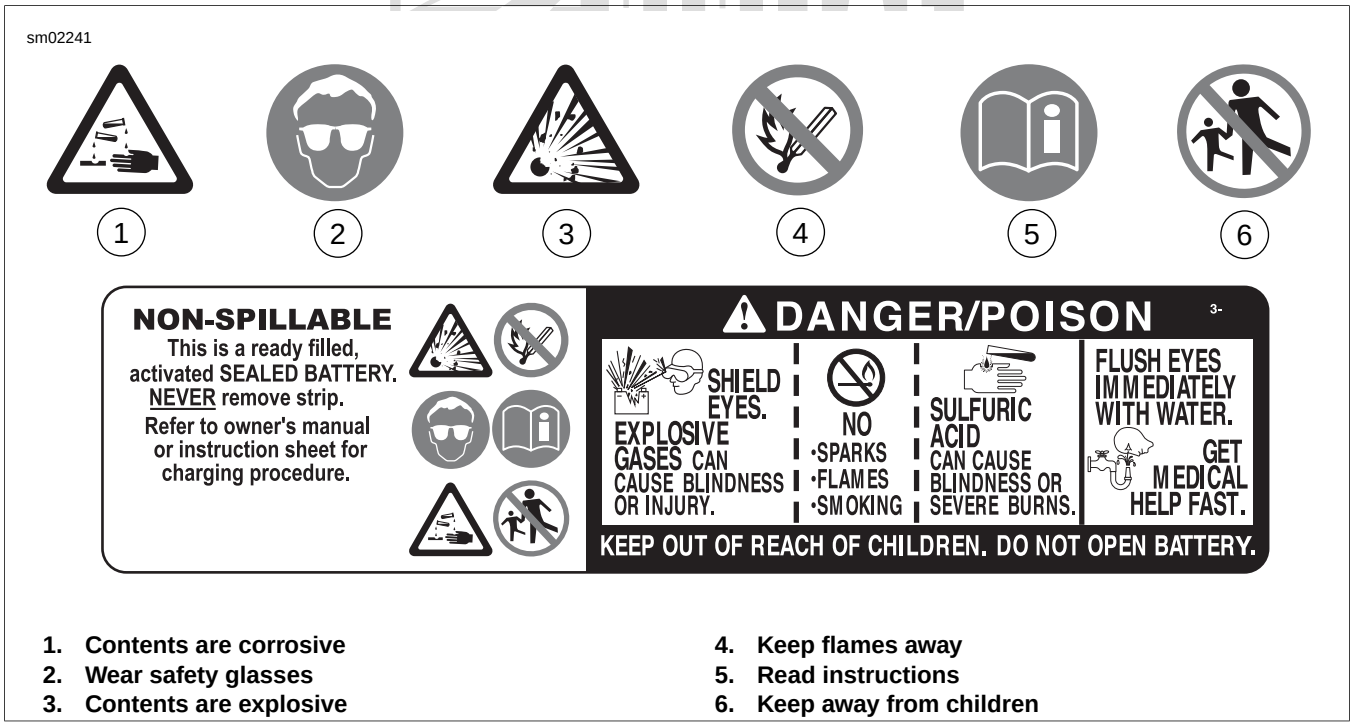



**Figure 1-30. AGM Battery with Warning Label**




1. **Contents are corrosive**
2. **Wear safety glasses**
3. **Contents are explosive**
4. **Keep flames away**
5. **Read instructions**
6. **Keep away from children**

**Figure 1-31. Battery Warning label**

**Table 1-11. Antidotes for Battery Acid**

| CONTACT | TREATMENT |
|---|---|
| External | Flush with water. |
| Internal | Drink large quantities of milk or water, followed by milk of magnesia, vegetable oil or beaten eggs. Get immediate medical attention. |
| Eyes | Flush with water. Get immediate medical attention. |

## 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: TOURING MODELS

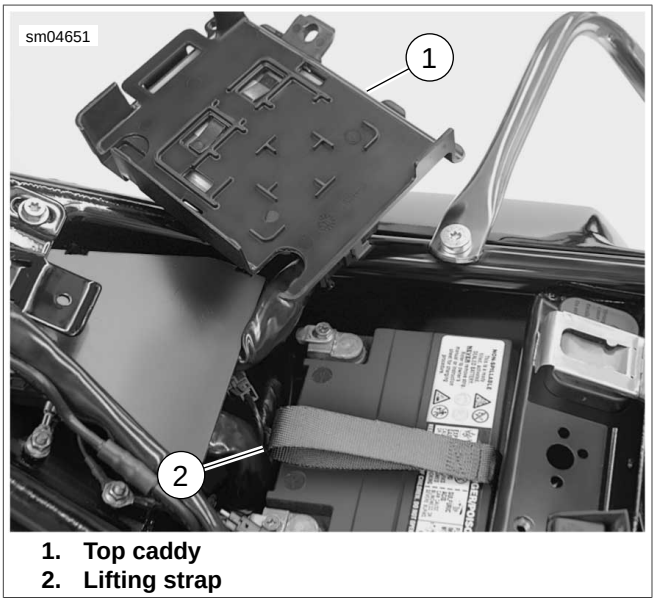
### Disconnection and Removal

1. Remove seat. See 2.26 SEAT.
2. If present, release tongue on HFSM antenna from groove at front of top caddy. Move connector and conduit out of the way.
3. Remove screw to release clamp on top caddy from frame crossmember.
4. Rotate ECM connector conduit so that top caddy is positioned above upper right frame tube. See Figure 1-32.

**⚠WARNING**

**Disconnect negative (-) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00049a)**

5. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
6. Unthread bolt and remove battery positive cable (red) from battery positive (+) terminal.
7. Unfold lifting strap. Grasp loop at end of lifting strap and pull up to raise battery. When battery is extracted far enough to get a good grip, remove the rest of the way by hand.




1. **Top caddy**
2. **Lifting strap**

**Figure 1-32. Move Top Caddy Aside**

### Installation and Connection

**CAUTION**

**Connect the cables to the correct battery terminals. Failure to do so could result in damage to the motorcycle electrical system. (00215a)**

**⚠WARNING**

**Connect positive (+) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00068a)**

**⚠WARNING**

**Do not allow positive (+) battery cable to contact ground with negative (-) cable connected. Resulting sparks can cause a battery explosion, which could result in death or serious injury. (00069a)**

1. Run lifting strap rearward first down the center of the battery tray, then up and across the frame crossmember.
2. Place the fully charged battery into the battery tray, terminal side forward.

**CAUTION**

**Do not over-tighten bolts on battery terminals. Use recommended torque values. Over-tightening battery terminal bolts could result in damage to battery terminals. (00216a)**

3. 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).
4. 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).

**CAUTION**

**Keep battery clean and lightly coat terminals with petroleum jelly to prevent corrosion. Failure to do so could result in damage to battery terminals. (00217a)**

5. Apply a light coat of petroleum jelly or ELECTRICAL CONTACT LUBRICANT, Part No. 99861-02 (1 oz tube), to both battery terminals.
6. Fold lifting strap forward over top of battery. See Figure 1-32.
7. Rotate ECM connector conduit so that top caddy is positioned above battery.
8. Install screw to fasten clamp on top caddy to frame crossmember. Tighten screw to 15-20 ft-lbs (20-27 Nm).
9. Routing conduit along inboard side of left upper frame tube, engage tongue on HFSM antenna in groove at front of top caddy, if present.
10. Install seat. See 2.26 SEAT.

## VOLTMETER TEST

**WARNING**

**Batteries contain sulfuric acid, which could cause severe burns to eyes and skin. Wear a protective face shield, rubberized gloves and protective clothing when working with batteries. KEEP BATTERIES AWAY FROM CHILDREN. (00063a)**

**WARNING**

**Never remove warning label attached to top of battery. Failure to read and understand all precautions contained in warning, could result in death or serious injury. (00064a)**

### Voltmeter Test

Refer to Table 1-12. 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 12.7V or above, perform a load test. See the ELECTRICAL DIAGNOSTIC MANUAL for the load test procedure.

**Table 1-12. Voltmeter Test For Battery Charge Conditions**

| VOLTAGE (OCV) | STATE OF CHARGE |
|---|---|
| 12.7 V | 100% |
| 12.6 V | 75% |
| 12.3 V | 50% |
| 12.0 V | 25% |
| 11.8 V | 0% |

## CHARGING BATTERY

### 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 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 gets hotter than 110° F (43° C) during charging, discontinue charger and allow the battery to cool.
- Always turn the charger off before removing charger leads from the battery to avoid dangerous sparks.

### Using a Battery Charger

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**

**Explosive hydrogen gas, which escapes during charging, could cause death or serious injury. Charge battery in a well-ventilated area. Keep open flames, electrical sparks and smoking materials away from battery at all times. KEEP BATTERIES AWAY FROM CHILDREN. (00065a)**

**CAUTION**

**If battery releases an excessive amount of gas during charging, decrease the charging rate. Overheating can result in plate distortion, internal shorting, drying out or damage. (00413b)**

1. Perform a voltmeter test to determine the state of charge. See the ELECTRICAL DIAGNOSTIC MANUAL. If battery needs to be charged, proceed to the next step.

*NOTE*

*The figures listed in the table 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.*

**Table 1-13. 28 Amp-Hour Battery Charging Rate/Times**

| READING (VOLTS) | PERCENT OF CHARGE | 3 AMP CHARGER | 6 AMP CHARGER | 10 AMP CHARGER | 20 AMP CHARGER |
|---|---|---|---|---|---|
| 12.7 | 100 | - | - | - | - |
| 12.6 | 75 | 2.5 hours | 1.25 hours | 45 minutes | 25 minutes |
| 12.3 | 50 | 5 hours | 2.5 hours | 1.5 hours | 50 minutes |
| 12.0 | 25 | 7.5 hours | 3.75 hours | 2.25 hours | 70 minutes |
| 11.8 | 0 | 10 hours | 5 hours | 3 hours | 1.5 hours |

*NOTE*

*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.*

**WARNING**

**Unplug or turn OFF battery charger before connecting charger cables to battery. Connecting cables with charger ON can cause a spark and battery explosion, which could result in death or serious injury. (00066a)**

**CAUTION**

**Do not reverse the charger connections described in the following steps or the charging system of the motorcycle could be damaged. (00214a)**

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

4. Step away from the battery and turn on the charger. See the charging instructions in Table 1-13.

**WARNING**

**Unplug or turn OFF battery charger before disconnecting charger cables from battery. Disconnecting clamps with charger ON can cause a spark and battery explosion, which could result in death or serious injury. (00067a)**

5. After the battery is fully charged, disconnect the black battery charger lead to the negative (-) terminal of the battery.
6. Disconnect the red battery charger lead to the positive (+) terminal of the battery.
7. Mark the charging date on the battery.
8. Perform either a conductance test or load test to determine the condition of the battery. See the ELECTRICAL DIAGNOSTIC MANUAL.
9. If charging battery because voltmeter test reading was below 12.6 V, perform voltmeter test. See the ELECTRICAL DIAGNOSTIC MANUAL.

## STORAGE

| PART NUMBER | TOOL NAME |
|---|---|
| 99863-01A | GLOBAL BATTERY CHARGER |

**WARNING**

**Batteries contain sulfuric acid, which could cause severe burns to eyes and skin. Wear a protective face shield, rubberized gloves and protective clothing when working with batteries. KEEP BATTERIES AWAY FROM CHILDREN. (00063a)**

**CAUTION**

**Do not allow battery to completely discharge. The electrolyte in a discharged battery will freeze. The more discharged a battery is, the more easily it can freeze and crack the battery case. (00218a)**

If the motorcycle is to be stored with the security system armed, connect a GLOBAL BATTERY CHARGER (Part No. 99863-01A) to maintain battery charge.

If the motorcycle is to be stored with the battery installed, a GLOBAL BATTERY CHARGER unavailable, and with the security system **not** armed, unplug the maxi-fuse.

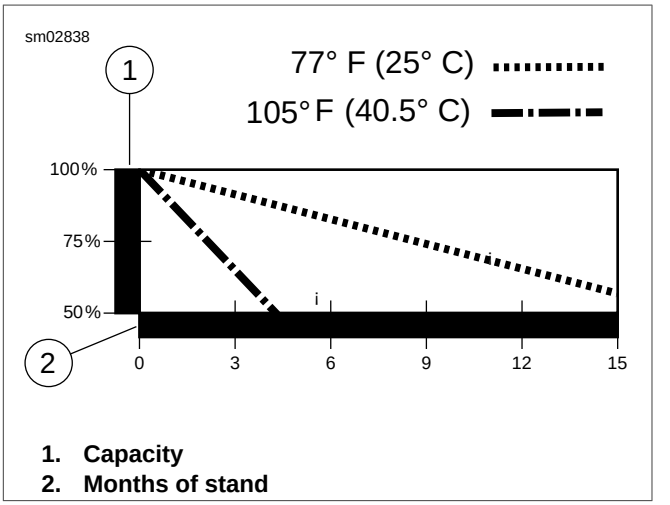
If the motorcycle will not be operated for several months, such as during the winter season, remove the battery from the motorcycle and fully charge.

See Figure 1-33. Self-discharge is a normal condition and occurs continuously at a rate that depends on the ambient temperature and the battery's state of charge. Batteries discharge at a faster rate at higher ambient temperatures. To reduce the self-discharge rate, store battery in a cool (not freezing), dry place.

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

*NOTES*

- *The GLOBAL BATTERY CHARGER (Part No. 99863-01A) 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, see ELECTRICAL DIAGNOSTIC MANUAL.*




**1. Capacity**
**2. Months of stand**

**Figure 1-33. Battery Self-Discharge Rate**

## GENERAL

| PART NUMBER | TOOL NAME |
|---|---|
| HD-34633A | AIR SUSPENSION PUMP AND GAUGE |

Adjust the rear air suspension pressure by adding or removing air from the air valve located just below the frame cover on the left side of the motorcycle. See Figure 1-34. Always adjust pressures with the motorcycle on the jiffy stand.

Air pressure may be varied to suit load conditions, riding style and personal comfort. Less initial pressure does not necessarily result in a softer ride. Refer to the tables below for the recommended air suspension pressures.

**⚠WARNING**

**Do not exceed the motorcycle's Gross Vehicle Weight Rating (GVWR) or Gross Axle Weight Rating (GAWR). Exceeding these weight ratings can affect stability and handling, which could result in death or serious injury. (00016e)**

Use these tables 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 50 psi (345 kPa) for FLHX models and 35 psi (241 kPa) for all others.

**CAUTION**

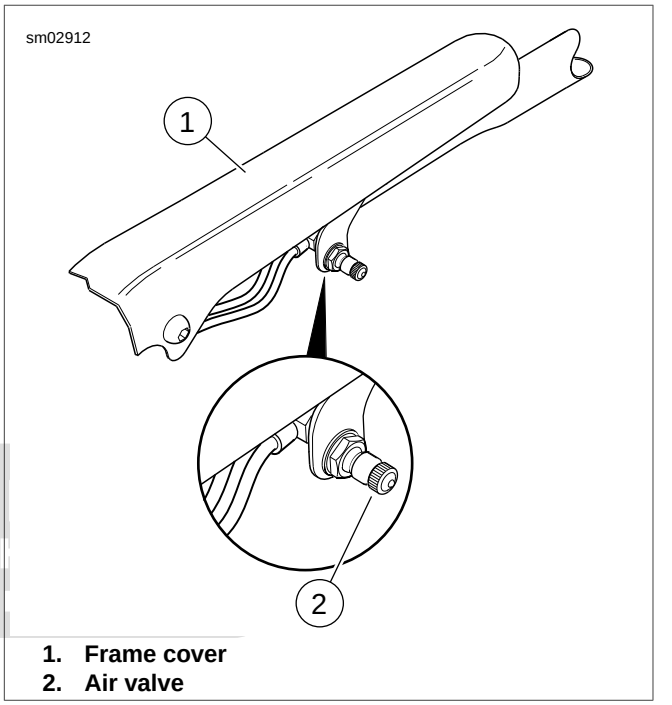
**Do not exceed maximum air pressure for rear suspension. Air components fill rapidly. Therefore, use low air line pressure. Failure to do so may result in possible damage to components. (00165a)**

*NOTES*

- *An AIR SUSPENSION PUMP AND GAUGE (Part No. HD-34633A) is available at your Harley-Davidson dealer.*
- *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.*
- *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.*

**⚠WARNING**

**Use caution when bleeding air from the suspension. Moisture combined with lubricant may leak onto the rear wheel, tire and/or brake components and adversely affect traction, which could result in death or serious injury. (00084a)**




1. **Frame cover**
2. **Air valve**

**Figure 1-34. Rear Air Suspension Air Valve**

**Table 1-14. Standard Rear Suspension Recommended Air Pressure: FLHR/C, FLHT/C/U and FLTR**

| SHOCK LOAD | TOTAL WEIGHT | | PRESSURE | |
|---|---|---|---|---|
| | LB. | KG | PSI | kPa |
| Solo rider | up to 150 | 0-68 | 0 | 0 |
| Solo rider | 150-200 | 68-91 | 0-10 | 0-69 |
| Solo rider | 200-250 | 91-113 | 5-15 | 35-103 |
| Rider with passenger weight of | up to 150 | 0-68 | 10-15 | 69-103 |
| Rider with passenger weight of | up to 200 | 0-91 | 20-25 | 138-172 |
| Maximum GVWR | see label | | 20-35 | 138-241 |

**Table 1-15. Low Profile Rear Suspension Recommended Air Pressure: FLHX**

| SHOCK LOAD | TOTAL WEIGHT | | PRESSURE | |
|---|---|---|---|---|
| | LB. | KG | PSI | kPa |
| Solo rider | up to 160 | 0-73 | 0-5 | 0-35 |
| Solo rider | 160-200 | 73-91 | 0-10 | 0-69 |
| Solo rider | over 200 | 91 | 5-10 | 35-69 |
| Rider with passenger weight of | up to 150 | 0-68 | 20-30 | 138-207 |
| Rider with passenger weight of | over 150 | over 68 | 25-35 | 172-241 |
| Maximum GVWR | see label | | 40-50 | 276-345 |

## INSPECTION

**⚠WARNING**

**Disconnecting spark plug cable with engine running can result in electric shock and death or serious injury. (00464b)**

1. After the engine has cooled to room temperature, disconnect cables from both spark plugs.
2. Remove spark plugs. If a plug has eroded electrodes, heavy deposits or a cracked insulator, discard it.
3. See Figure 1-35. Compare your observations of the plug deposits with the descriptions provided below.
   a. A wet, black and shiny deposit on plug base, electrodes and ceramic insulator tip indicates an oil fouled plug. The condition may be caused by one or more of the following: worn pistons, worn piston rings, worn valves, worn valve guides, worn valve seals, a weak battery or a faulty ignition system.
   b. A dry, fluffy or sooty black deposit indicates an air-fuel mixture that is too rich.
   c. A light brown, glassy deposit indicates an overheated plug. This condition may be accompanied by cracks in the insulator or by erosion of the electrodes and is caused by an air-fuel mixture that is too lean, a hot-running engine, valves not seating or improper ignition timing. The glassy deposit on the spark plug is a conductor when hot and may cause high-speed misfiring. A plug with eroded electrodes, heavy deposits or a cracked insulator must be replaced.
   d. A plug with a white, yellow, tan or rusty brown powdery deposit indicates balanced combustion. Clean off spark plug deposits at regular intervals.

**⚠WARNING**

**Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)**

4. If the plugs require cleaning between tune-ups, proceed as follows:
   a. Degrease firing end of spark plug using ELECTRICAL CONTACT CLEANER. Dry plug with compressed air.
   b. Use a thin file to flatten spark plug electrodes. A spark plug with sharp edges on its electrodes requires 25-40% less firing voltage than one with rounded edges.
   c. If the plugs cannot be cleaned, replace with **new** spark plugs.
5. Check electrode gap with a wire-type feeler gauge. Bend the outside of the electrode so only a slight drag on the gauge is felt when passing it between electrodes. Proper gap measurement is 0.038-0.043 in. (0.97-1.09 mm).
6. Check condition of threads on cylinder head and plug. If necessary to remove deposits, apply penetrating oil and clean out with a thread chaser.
7. Apply LOCTITE ANTI-SEIZE to the spark plug threads. Install and tighten to 12-18 ft-lbs (16.3-24.4 Nm).
8. Connect spark plug cables. Rear cylinder plug cable attaches to top coil terminal. Verify that cables are securely connected to coil and spark plugs.

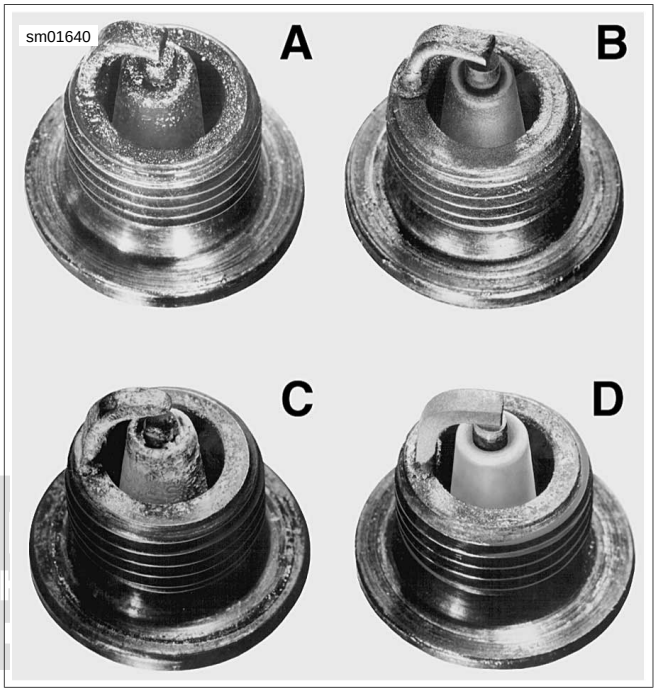



**Figure 1-35. Typical Spark Plug Deposits**

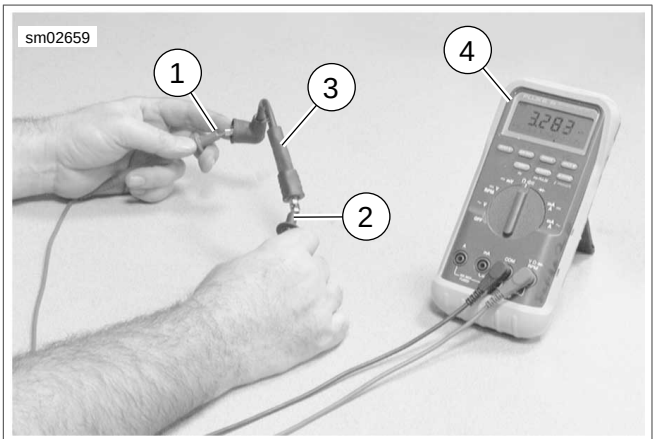
## SPARK PLUG CABLE INSPECTION

1. Inspect spark plug cables. Replace cables that are worn or damaged.
   a. Check for cracks or loose terminals.
   b. Check for loose fit on ignition coil and spark plugs.
2. Check cable boots/caps for cracks or tears. Replace boots/caps that are worn or damaged.

3. See Figure 1-36. Check spark plug cable resistance with an ohmmeter. Compare values from test with Table 1-16. Replace cables not meeting resistance specifications.

**Table 1-16. Spark Plug Cable Resistance**

| POSITION | CABLE LENGTH | RESISTANCE (OHMS) |
|---|---|---|
| Front/Rear | 5.7 in. (145 mm) | 1,350 - 3,465 |




1. **Ohmmeter positive lead**
2. **Ohmmeter negative lead**
3. **Spark plug cable**
4. **Ohmmeter**

**Figure 1-36. Testing Resistance**

## LUBRICATION

At the 1000 mile (1600 km) service interval and at every 10,000 mile (16,000 km) service interval thereafter, grease the steering head bearings using Special Purpose Grease, Part No. 99857-97.

1. See Figure 1-37.Turn handlebar to the right fork stop to access grease fitting at the left side of the steering head.
2. Connect grease gun to fitting.
3. Inject grease until it exudes from top and bottom of steering head.

At every 25,000 mile (40,000 km) service interval, check the swing-by following the CHECKING procedure.

At every 50,000 mile (80,000 km) service interval, disassemble the steering head and inspect the bearings for brinelling, scoring, or other damage. Replace and/or repack the bearings as required.

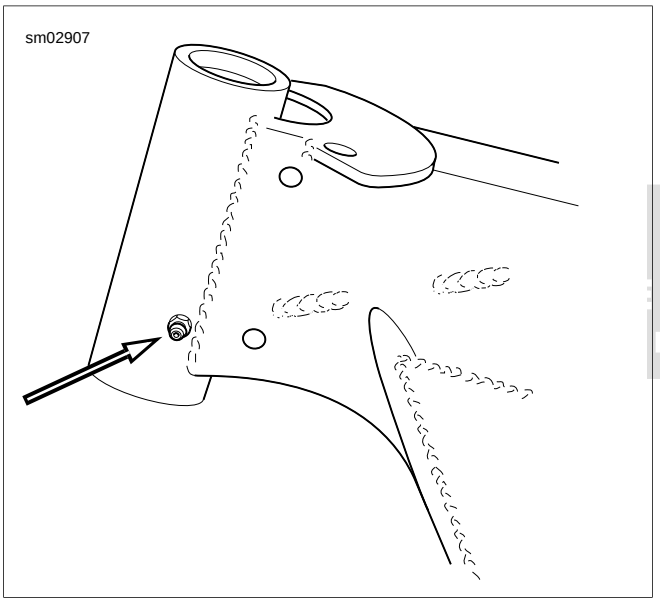



**Figure 1-37. Steering Head Bearing Grease Fitting**

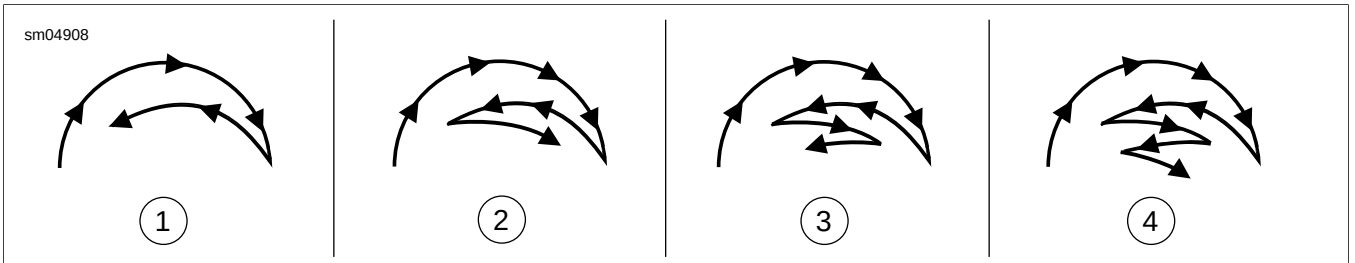
## CHECKING

1. Using an hydraulic center stand on a level surface, raise the motorcycle 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 from side to side finally stopping in either the third or fourth swing. If it stops in the third swing, it should be at or after the center or straight-forward position. See Figure 1-38.
4. If the clutch cable or main harness appears to be influencing swing momentum, proceed as follows:
   a. **Clutch cable:** Disconnect clutch cable at hand lever. Release cable from P-clamp fastened to upper fork bracket (FLHR/C), remove from inner fairing (FLHT/C/U), or release from cable clip on instrument nacelle (FLTR). See 2.23 CLUTCH CABLE if necessary.
   b. **Main harness:** Remove screw and P-clamp to release main harness from right side of steering head.
   c. Repeat previous step.

*NOTE*

*A steering head that is too tight can interfere with the vehicle's ability to absorb a weave. A steering head that is too loose can interfere with the vehicle's ability to absorb a wobble.*

5. To correct a swing pattern that is too short or too long, see 1.19 STEERING HEAD BEARINGS, Adjustment.

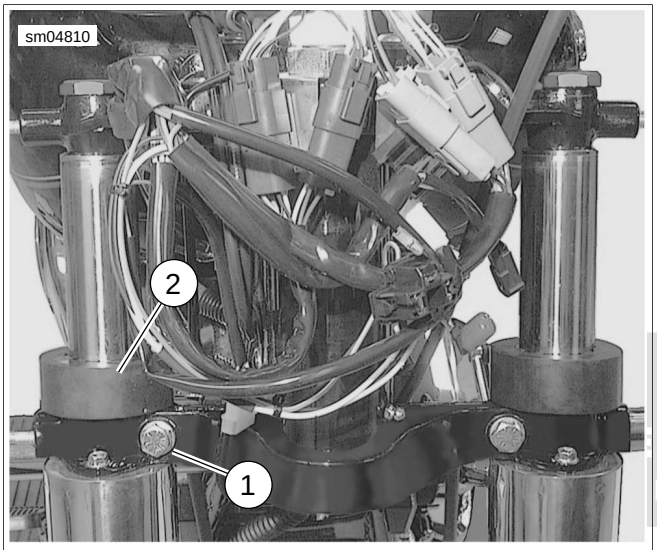



1. **Too tight- wheel stops in first or second swing**
2. **Correct- wheel stops in third swing**
3. **Correct- wheel stops in fourth swing**
4. **Too loose- wheel stops in fifth swing**

**Figure 1-38. Check Steering Head Bearing Swing-by**

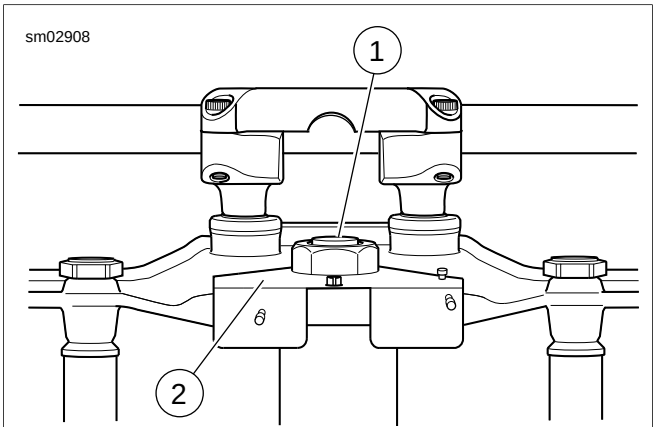
## ADJUSTMENT

1. Disassemble motorcycle as follows:
   a. **FLHR/C:** Remove headlamp nacelle. See 2.45 HEADLAMP NACELLE: FLHR/C.
   b. **FLHX, FLHT/C/U:** Remove outer fairing and radio (storage box on FLHT). See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U and 8.32 ADVANCED AUDIO SYSTEM, respectively.
   c. **FLTR:** Remove instrument bezel. See 2.40 INSTRUMENT BEZEL: FLTR.
2. Loosen pinch bolts on lower fork bracket and slide 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 1-39.




1. **Pinch bolt**
2. **Fork stop**

**Figure 1-39. Loosen Pinch Bolts (FLHR/C Shown)**




1. **Fork stem nut**
2. **Lock plate**

**Figure 1-40. Fork Stem Nut**


**Figure 1-41. Bearing Adjuster Nut**

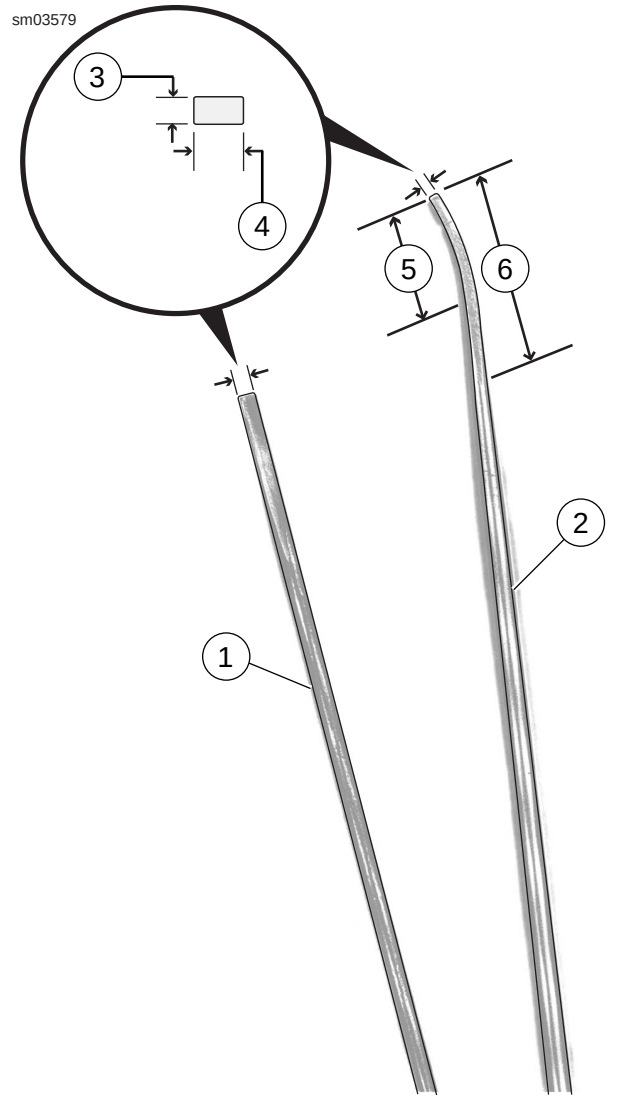
3. Bend tab on lock plate away from flat of fork stem nut. Loosen the fork stem nut. See Figure 1-40.
4. Fashion a bearing adjuster tool using a drill rod 1/4 in. (6.4 mm) in diameter and 16 in. (406.4 mm) long. See Figure 1-42.

*NOTE*

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

5. Turn bearing adjuster nut as follows:
   a. To decrease the number of swings, stand on left side of motorcycle and insert rod to engage notches of bearing adjuster nut at bottom of upper fork bracket. Push forward to rotate nut **clockwise**. See Figure 1-41.
   b. To increase the number of swings, stand on right side of motorcycle and insert rod to engage notches of bearing adjuster nut. Push forward to rotate nut **counterclockwise**.
6. Tighten fork stem nut to 60-80 ft-lbs (81-109 Nm). The tightness of the nut will affect the swing pattern.
7. Recheck the swing pattern. See step 3 under CHECKING. Repeat steps 5-6 above until swing pattern is correct.
8. Alternately tighten pinch bolts to 30-35 ft-lbs (41-48 Nm). Move rubber fork stops down fork tubes until contact is made with top of lower fork bracket.
9. 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.

10. Assemble motorcycle as follows:
    a. **FLHR/C:** Install headlamp nacelle. See 2.45 HEADLAMP NACELLE: FLHR/C.
    b. **FLHX, FLHT/C/U:** Install radio (storage box on FLHT) and outer fairing. See 8.32 ADVANCED AUDIO SYSTEM and 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U, respectively.
    c. **FLTR:** Install instrument bezel. See 2.40 INSTRUMENT BEZEL: FLTR.
11. Recheck the swing pattern and adjust if necessary.




1. **All models except FLTR**
2. **FLTR**
3. **1/8 in.**
4. **5/32 in.**
5. **5/32 in. goes back for 1-1/4 in.**
6. **2 in. to start of bend**

**Figure 1-42. Fashion Bearing Adjuster Tool**

# CABLE AND CHASSIS LUBRICATION 1.20

## GENERAL

Inspect and lubricate the following at scheduled service intervals as specified in 1.2 MAINTENANCE SCHEDULE.

- Front brake hand lever.
- Clutch hand lever.
- Clutch cable.
- Foot shift lever pivot (if applicable).
- Rear brake lever pivot.
- Steering head bearings.
- Jiffy stand.

If service is on muddy or dusty roads, clean and lubricate at shorter intervals.

Use SUPER OIL (Part no. HD-94968-85TV) for hand levers and cables.

## STEERING HEAD BEARINGS

Lubricate the steering head bearings with HARLEY-DAVIDSON SPECIAL PURPOSE GREASE. See 1.19 STEERING HEAD BEARINGS for procedure.

## JIFFY STAND

Clean and lubricate the jiffy stand. For more information, see 2.50 JIFFY STAND.

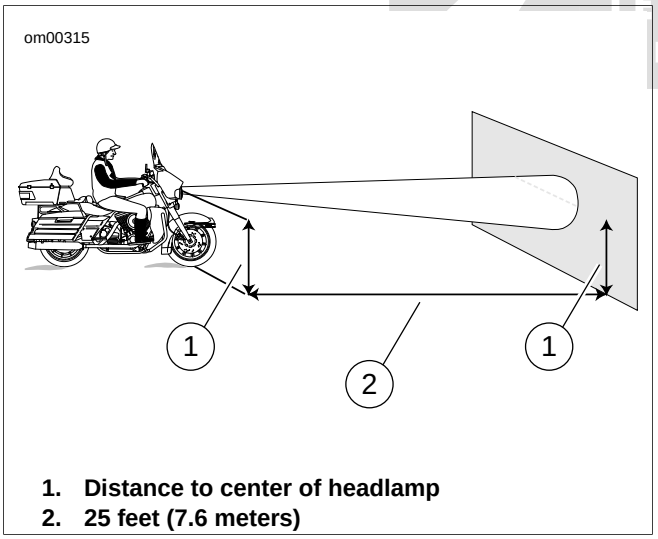
## HEADLAMP ALIGNMENT: TOURING MODELS

### Check Alignment

**⚠WARNING**

**The automatic-on headlamp feature provides increased visibility of the rider to other motorists. Be sure headlamp is on at all times. Poor visibility of rider to other motorists can result in death or serious injury. (00030b)**

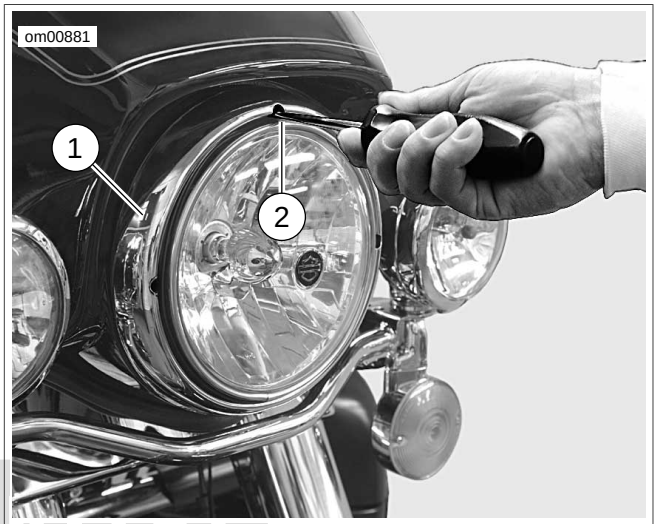
1. Verify that front and rear tire inflation pressures are correct. Refer to Table 1-7.
2. Place motorcycle on level floor or pavement in an area with minimum light.
3. See Figure 1-43. Move motorcycle, so that patch of front tire directly below axle is 25 feet (7.6 meters) from wall.
4. Stand motorcycle upright with the front wheel pointing straight forward at wall. Draw a horizontal line on wall that is exactly the same height above the floor as the headlamp horizontal centerline. Now draw a vertical line through the horizontal line that corresponds to the headlamp vertical centerline.
5. As the weight of the rider will compress the suspension slightly, have a person whose weight is roughly the same as that of the principal rider sit on the motorcycle.




1. **Distance to center of headlamp**
2. **25 feet (7.6 meters)**

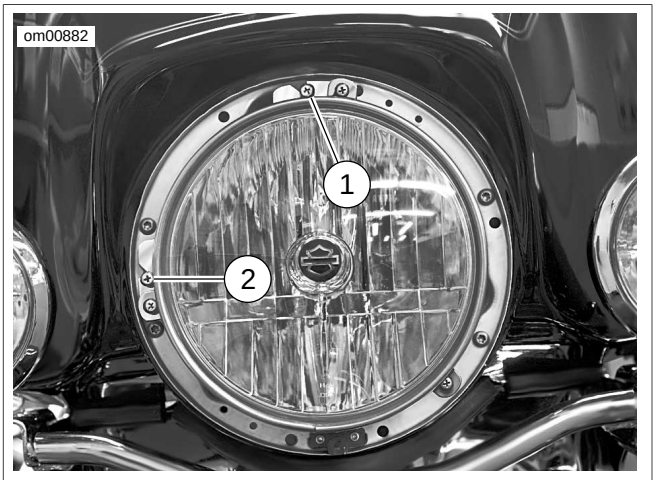
**Figure 1-43. Check Headlamp Alignment: Touring Models**

6. Stand the motorcycle upright with the front wheel pointing straight forward at the wall. Turn the ignition/light key switch to IGNITION and set the light switch to high beam.
7. Verify headlamp alignment.
   a. Check the light beam for proper vertical alignment. The center of the main beam should be even with the horizontal line on the wall.
   b. Check the light beam for proper horizontal alignment. The main beam should project an equal area of light to the right and left of the vertical line on the wall.
   c. Adjust headlamp alignment if necessary.




1. **Headlamp door**
2. **Slot**

**Figure 1-44. Headlamp Door: 2008 Touring Models**




1. **Vertical adjusting screw**
2. **Horizontal adjusting screw**

**Figure 1-45. Headlamp Adjustment: FLHT, FLHX, FLHTC, FLHTCU, FLHR and FLHRC**

## Adjust FLHR/FLHT Headlamp

*NOTE*

*Headlamp adjustment can be performed without removing the headlamp door (chrome ring).*

1. See Figure 1-44. Using adjuster slots in headlamp door, insert Phillips screwdriver between headlamp housing and rubber gasket.
2. See Figure 1-45. Adjust beam.
   a. **Horizontal:** Turn the horizontal adjusting screw to adjust headlamp horizontally.
   b. **Vertical:** Turn the vertical adjusting screw to adjust headlamp vertically.

## Adjust FLTR Headlamps

1. See Figure 1-46. Using a 4.5 mm deepwell socket with a flexible driver, rotate hex adjusters located near bottom edge of inner fairing.
2. Adjust beam.
   a. **Horizontal:** Turn either the left or right adjuster to adjust headlamp horizontally.
   b. **Vertical:** Turn both adjusters equally to adjust headlamp vertically. Refer to Table 1-17 for directions to move headlamp beam.


**1. Hex adjuster**

**Figure 1-46. Headlamp Adjustment: FLTR**

**Table 1-17. FLTR Hex Adjuster Rotation**

| HEX ADJUSTER | ROTATION | BEAM MOVEMENT |
|---|---|---|
| Left only | clockwise | to the right |
| Right only | counterclockwise | |
| Left only | counterclockwise | to the left |
| Right only | clockwise | |
| Left and right equally | clockwise | upward |
| Left and right equally | counterclockwise | downward |

## INSPECTION

Inspect critical fasteners at the scheduled service intervals.

Refer to Table 1-18. Tighten all critical fasteners to specifications. Replace any fasteners that are damaged or missing.

**Table 1-18. Critical Fasteners**

| SYSTEM | FASTENER | TORQUE | |
|---|---|---|---|
| Hand controls | Switch housing screws | 35-45 **in-lbs** | 4-5 Nm |
| | Clutch lever bracket handlebar clamp screws | 72-108 **in-lbs** | 8-12 Nm |
| | Master cylinder reservoir handlebar clamp screws | 72-80 **in-lbs** | 8-9 Nm |
| Brakes | Brake caliper banjo bolts | 17-19 ft-lbs | 23-26 Nm |
| | Master cylinder banjo bolts | 13-15 ft-lbs | 18-20 Nm |
| | ABS module banjo bolts | 14.5-22 ft-lbs | 20-30 Nm |
| | Front brake disc screws | 16-24 ft-lbs | 22-33 Nm |
| | Rear brake disc screws | 30-45 ft-lbs | 41-61 Nm |
| | Front master cylinder reservoir cover screws | 7-10 **in-lbs** | 0.8-1.1 Nm |
| | Rear master cylinder reservoir cover screws | 12-15 **in-lbs** | 1.4-1.7 Nm |
| | Rear master cylinder to frame screws | 10.5-12.5 ft-lbs | 14-17 Nm |
| | Front brake caliper mounting screws | 28-38 ft-lbs | 38-52 Nm |
| | Rear brake caliper to caliper bracket screws | 43-48 ft-lbs | 58-65 Nm |
| | Brake caliper pad pin | 75-102 **in-lbs** | 8.5-11.5 Nm |
| Axle nuts | Front | 60-65 ft-lbs | 81-88 Nm |
| | Rear | 95-105 ft-lbs | 129-142 Nm |
| Front forks | Front axle holder nuts | 132-180 **in-lbs** | 15-20 Nm |
| Pivot shaft | Locknuts | 40-45 ft-lbs | 54-61 Nm |
| | Swingarm bracket bolts | 34-42 ft-lbs | 46-57 Nm |
| Other | Horn bracket to cylinder head bolts | 35-40 ft-lbs | 48-54 Nm |
| | Transmission to crankcase bolts | 34-39 ft-lbs | 46-53 Nm |
| | Engine mount bolts | See 1.23 ENGINE MOUNTS. | |

## INSPECTION

### General

Inspect the condition and tightness of the stabilizer links and engine mounts. Replace fasteners if damaged.

### Top

1. Tighten top stabilizer link eyelet to top engine mounting bracket bolt: 18-22 ft-lbs (24-30 Nm).
2. Tighten top stabilizer link eyelet to frame weldment bolt: 18-22 ft-lbs (24-30 Nm).
3. Verify tightness of jam nuts on top stabilizer link.

### Front

1. See Figure 1-47. Tighten front stabilizer link eyelet to frame weldment bolt: 18-22 ft-lbs (24-30 Nm).
2. Tighten front stabilizer link eyelet to front engine mounting bracket bolt: 18-22 ft-lbs (24-30 Nm).
3. Verify tightness of jam nuts on front stabilizer link.
4. Tighten two engine to front engine mounting bracket bolts: 36-40 ft-lbs (49-54 Nm).
5. Tighten front engine mounting bracket to rubber mount bolt: 15-20 ft-lbs (20-27 Nm).
6. Tighten two front rubber mount to frame crossmember bolts: 15-20 Nm (20-27 Nm).

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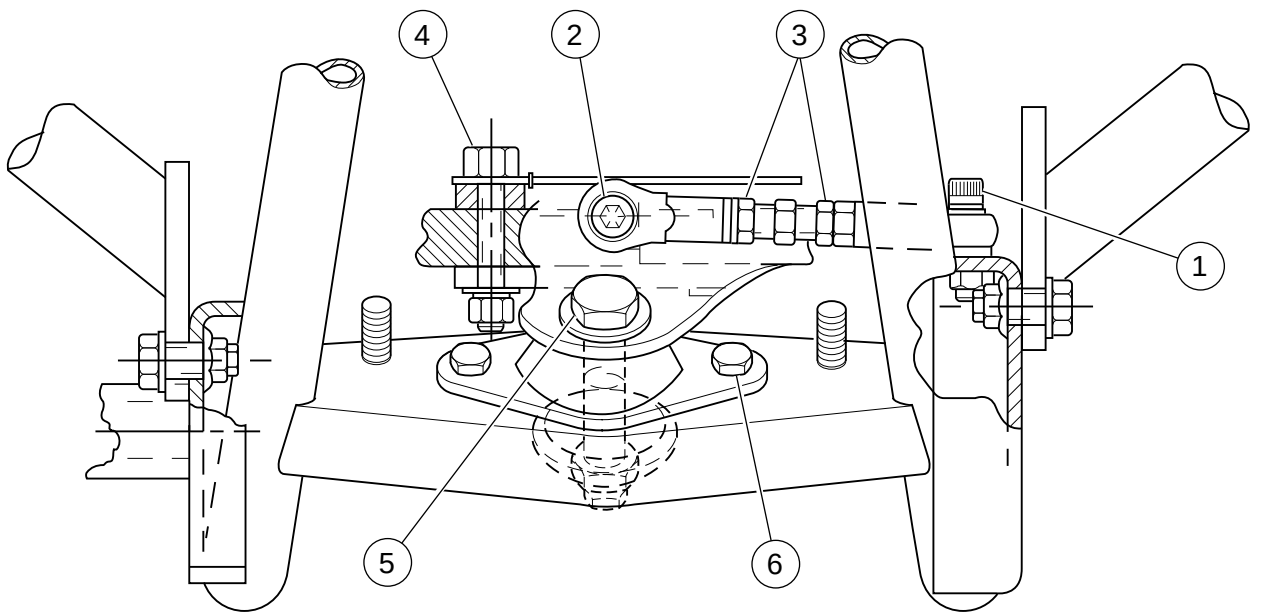



1. **Stabilizer link eyelet to frame weldment**
2. **Stabilizer link eyelet to engine mounting bracket**
3. **Stabilizer link jam nuts**
4. **Engine to engine mounting bracket**
5. **Engine mounting bracket to rubber mount**
6. **Rubber mount to frame crossmember**

**Figure 1-47. Front Engine Mount**

## GENERAL

If the motorcycle will not be operated for several months, such as during the winter season, there are several things which should be done to protect parts against corrosion, to preserve the battery and to prevent the buildup of gum and varnish in the fuel system.

This work should be performed by your local Harley-Davidson dealer or other qualified technician following Service Manual procedures.

## PLACING IN STORAGE

| PART NUMBER | TOOL NAME |
|---|---|
| 98716-87A | STORAGE COVER |

**WARNING**

**Do not store motorcycle with gasoline in tank within the home or garage where open flames, pilot lights, sparks or electric motors are present. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00003a)**

1. Run motorcycle until engine is at normal operating temperature. Stop the engine then drain the oil pan, install a **new** oil filter, and fill oil pan with the proper grade oil. Check the transmission lubricant level.

**WARNING**

**Avoid spills. Slowly remove filler cap. Do not fill above bottom of filler neck insert, leaving air space for fuel expansion. Secure filler cap after refueling. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00028a)**

**WARNING**

**Use care when refueling. Pressurized air in fuel tank can force gasoline to escape through filler tube. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00029a)**

2. Prepare your fuel system by filling fuel tank and adding a gasoline stabilizer. Use one of the commercially available gasoline stabilizers following the manufacturer's instructions.
3. Remove the spark plugs, inject a few squirts of engine oil into each cylinder and crank the engine 5-6 revolutions. Reinstall spark plugs.
4. Inspect rear belt deflection. See 1.13 REAR BELT DEFLECTION.
5. Inspect rear belt and sprockets. See 1.12 REAR BELT AND SPROCKETS.
6. Inspect air cleaner filter. See 1.7 AIR CLEANER AND EXHAUST SYSTEM.
7. Lubricate controls. See 1.20 CABLE AND CHASSIS LUBRICATION.
8. Inspect operation of all electrical equipment and switches.
9. Check tire inflation and inspect tires for wear and/or damage. See 1.8 TIRES AND WHEELS. If the motorcycle will be stored for an extended period of time, securely support the motorcycle under the frame so that all weight is off the tires.

**WARNING**

**Be sure that brake fluid or other lubricants do not contact brake pads or discs. Such contact can adversely affect braking ability, which could cause loss of control, resulting in death or serious injury. (00290a)**

10. Wash painted and chrome-plated surfaces. Apply a light film of oil to exposed unpainted surfaces.

**WARNING**

**Unplug or turn OFF battery charger before connecting charger cables to battery. Connecting cables with charger ON can cause a spark and battery explosion, which could result in death or serious injury. (00066a)**

**WARNING**

**Explosive hydrogen gas, which escapes during charging, could cause death or serious injury. Charge battery in a well-ventilated area. Keep open flames, electrical sparks and smoking materials away from battery at all times. KEEP BATTERIES AWAY FROM CHILDREN. (00065a)**

11. Remove battery from vehicle. Charge battery until the correct voltage is obtained. Charge the battery every other month if it is stored at temperatures below 60° F (16° C). Charge battery once a month if it is stored at temperatures above 60° F (16° C). See 1.16 BATTERY MAINTENANCE.

**WARNING**

**Unplug or turn OFF battery charger before disconnecting charger cables from battery. Disconnecting clamps with charger ON can cause a spark and battery explosion, which could result in death or serious injury. (00067a)**

12. If the motorcycle is to be covered, use a material that will breathe, such as STORAGE COVER (Part No. 98716-87A) or light canvas. Plastic materials that do not breathe promote the formation of condensation, which leads to corrosion.

## REMOVAL FROM STORAGE

**WARNING**

**The clutch failing to disengage can cause loss of control, which could result in death or serious injury. Prior to starting after extended periods of storage, place transmission in gear and push vehicle back and forth several times to assure proper clutch disengagement. (00075a)**

1. Charge and install the battery.

2. Remove and inspect the spark plugs. Replace if necessary.
3. Clean the air cleaner element.
4. If fuel tank was drained, fill fuel tank with fresh gasoline.
5. Start the engine and run until it reaches normal operating temperature.
6. Check engine oil level. Check the transmission lubricant level. Fill to proper levels with correct fluids, if required.
7. Perform all of the checks in the PRE-RIDING CHECKLIST in the Owner's Manual.

## GENERAL

**⚠WARNING**

**The Troubleshooting section of this manual is a guide to diagnose problems. Read the appropriate sections of this manual before performing any work. Improper repair and/or maintenance could result in death or serious injury. (00528b)**

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

*NOTE*

*For further troubleshooting information, see the ELECTRICAL DIAGNOSTIC MANUAL.*

## ENGINE

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

1. Ignition switch not in IGNITION position.
2. Engine run switch in OFF position.
3. Discharged battery, loose or corroded connections (solenoid chatters).
4. Starter control circuit, relay, or solenoid faulty.
5. Electric starter shaft pinion gear not engaging or overrunning clutch slipping.
6. TSM/TSSM/HFSM Bank Angle Sensor tripped and ignition/light key switch not cycled OFF then back to IGNITION.
7. Security system activated.
8. Motorcycle in gear and clutch not pulled in.
9. Jiffy stand down and transmission in gear (HDI models only)
10. Maxi fuse not in place

### Engine Turns Over But Does Not Start

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

*NOTE*

*For cold weather starts, always disengage clutch.*

5. Spark plug cables in bad condition and shorting, cable connections loose or cables connected to incorrect cylinders.
6. Damaged wire or loose wire connection at ignition coil, battery, or ECM connector.
7. Ignition timing incorrect due to faulty ignition coil, ECM or sensors.
8. Bank Angle Sensor tripped and ignition switch not cycled OFF then back to IGNITION.
9. Fuel filter clogged.
10. Sticking or damaged valve(s) or wrong length push rod(s).
11. Plugged fuel injectors.

### Starts Hard

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

*NOTE*

*For cold weather starts, always disengage clutch.*

9. Ignition not functioning properly (possible sensor failure).
10. Faulty ignition coil.
11. Valves sticking.
12. Partially plugged fuel injector(s).

### Starts But Runs Irregularly or Misses

1. Spark plugs in poor condition or partially fouled.
2. Spark plug cables in poor condition and shorting or leaking.
3. Spark plug gap too close or too wide.
4. Faulty ignition coil, ECM, or sensor.
5. Battery nearly discharged.
6. Damaged wire or loose connection at battery terminals, ignition coil or ECM connector.
7. Intermittent short circuit due to damaged wire insulation.
8. Water or dirt in fuel system.
9. Fuel tank vent system plugged.
10. Air leak at intake manifold or air cleaner.
11. Loose or dirty ECM connector.
12. Faulty Sensor(s): Temperature Manifold Absolute Pressure (TMAP), Crank Position (CKP) or Oxygen (O2).
13. Incorrect valve timing.
14. Weak or broken valve springs.
15. Damaged intake or exhaust valve.

16. Partially plugged fuel injector(s).

## A Spark Plug Fouls Repeatedly

1. Fuel mixture too rich.
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 (TMAP and/or CKP).
6. Ignition timing advanced due to ECM or sensors (CKP, ET or TMAP) defective.
7. Intake manifold vacuum leak.

## Overheating

1. Insufficient oil supply or oil not circulating.
2. Insufficient air flow over engine.
3. Heavy carbon deposits.
4. Ignition timing retarded due to defective ECM or faulty sensor(s) (TMAP and/or CKP).
5. Leaking valve(s).

## Valve Train Noise

1. Low oil pressure caused by oil feed pump not functioning properly or oil passages obstructed.
2. Faulty hydraulic lifter(s).
3. Bent push rod(s).
4. Incorrect push rod length.
5. Rocker arm binding on shaft.
6. Valve sticking in guide.
7. Chain tensioning spring or shoe worn.
8. Cam(s), cam gear(s) or cam bushing(s) worn.
9. Cam timing incorrect.

## Excessive Vibration

1. Wheels bent or damaged and/or tires worn or damaged.
2. Engine/Transmission/Rear Wheel not aligned properly.
3. Primary chain badly worn or links tight as a result of insufficient lubrication or misalignment.
4. Engine to transmission mounting bolts loose.
5. Upper engine mounting bracket loose/broken or mounting bracket pre-loaded.
6. Ignition timing advanced due to faulty sensor inputs (TMAP and/or CKP)/poorly tuned engine.
7. Internal engine problem.
8. Broken frame.
9. Stabilizer links worn or loose, or stabilizer link brackets loose or broken.
10. Isolators worn or isolator bolts loose or broken.
11. Rubber mounts loose or worn.
12. Rear fork pivot shaft fasteners loose.
13. Front engine mounting bolts loose.

## Check Engine Light Illuminates During Operation

1. Fault detected. See the ELECTRICAL DIAGNOSTIC MANUAL for more information.

# LUBRICATION SYSTEM

## Oil Does Not Return To Oil Reservoir

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

## Engine Uses Too Much Oil Or Smokes Excessively

1. Oil reservoir overfilled.
2. Restricted oil return line to oil reservoir.
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 or damaged.
8. O-ring damaged or missing from oil pump/crankcase junction (also results in poor engine performance).
9. Plugged crankcase scavenge port.
10. Oil diluted with gasoline.

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

1. Loose parts.
2. Imperfect seal at gaskets, push rod covers, washers, etc.
3. Restricted breather passages or hose to air cleaner.
4. Restricted oil filter.
5. Oil reservoir overfilled.
6. Lower rocker housing gasket installed incorrectly (upside down).
7. Restricted oil return line to oil reservoir.
8. Porosity.

### Low Oil Pressure

1. Oil reservoir underfilled.
2. Faulty low oil pressure switch.
3. Oil pump o-ring damaged or missing.
4. Bypass valve stuck in open position.
5. Ball missing or leaking in cam support plate.
6. Worn oil pump gerotor(s).
7. Oil diluted with gasoline.

### High Oil Pressure

1. Oil reservoir overfilled.
2. Bypass valve stuck in closed position.

## ELECTRICAL SYSTEM

*NOTE*

*For diagnostic information see the ELECTRICAL DIAGNOSTIC MANUAL.*

### Alternator Does Not Charge

1. Voltage regulator module not grounded.
2. Engine ground wire loose or broken.
3. Faulty voltage regulator 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 voltage regulator module.
4. Faulty stator and/or rotor.

### Speedometer Operates Erratically

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

## TRANSMISSION

### Shifts Hard

1. Primary chaincase overfilled with lubricant.
2. Clutch not fully disengaging.
3. Transmission lubricant too heavy (winter operation).
4. Shifter return spring (inside transmission) bent or broken.
5. Bent shifter rod.
6. Shifter forks (inside transmission) sprung.
7. Corners worn off shifter clutch dog rings (inside transmission).

### Jumps Out Of Gear

1. Shifter rod improperly adjusted.
2. Shifter drum (inside transmission) improperly adjusted or damaged/worn.
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. Lubricant level too high in primary chaincase.
2. Clutch controls improperly adjusted.
3. Primary chain badly misaligned or too tight.
4. Insufficient clutch spring tension.
5. Clutch discs warped.

### Clutch Chatters

Friction discs or steel discs worn or warped.

## 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. Damaged tire(s) or improper front-rear tire combination.
3. Irregular or peaked front tire tread wear.
4. Incorrect tire pressure.
5. Shock absorber not functioning normally.
6. Incorrect air suspension pressure.
7. Loose wheel axle nuts. Tighten to recommended torque specification.
8. Excessive wheel hub bearing play.
9. Rear wheel out of alignment with frame and front wheel.
10. Steering head bearings improperly adjusted. Correct adjustment and replace pitted or worn bearings and races.
11. Loose spokes (laced wheel vehicles only).
12. Tire and wheel unbalanced.
13. Rims and tires out-of-round or eccentric with hub.
14. Rims and tires out-of-true sideways.
15. Rear fork pivot assembly: improperly tightened or assembled, or loose/pitted or damaged pivot bearings.
16. Engine mounts and/or stabilizer links loose, worn or damaged..

## BRAKES

### Brake Does Not Hold Normally

1. Master cylinder reservoir low on fluid, system leaking or pads worn.
2. Brake system contains air bubbles.
3. Master cylinder or caliper piston seals worn or parts damaged.
4. Brake pads contaminated with grease or oil.
5. Brake pads badly worn.
6. Brake disc badly worn or warped.
7. Brake drags - insufficient brake pedal or hand lever free-play, caliper piston worn or damaged, or excessive brake fluid in reservoir.
8. Brake fades due to heat build up - brake pads dragging or excessive braking.
9. Brake fluid leak when under pressure.

# NOTES

## SPECIFICATIONS

**Table 2-1. Dimensions: 2008 FLHT, FLHTC/U, FLTR and FLHX**

| ITEM | FLHT | | FLHTC | | FLHTCU | | FLTR | | FLHX | |
|---|---|---|---|---|---|---|---|---|---|---|
| | IN. | MM | IN. | MM | IN. | MM | IN. | MM | IN. | MM |
| Wheel base | 63.5 | 1612.9 | 63.5 | 1612.9 | 63.5 | 1612.9 | 63.5 | 1612.9 | 63.5 | 1612.9 |
| Overall length (Tour-Pak in rearmost position) | 93.7 | 2380.0 | 97.5 | 2476.5 | 98.3 | 2496.8 | 93.7 | 2380.0 | 94.5 | 2400.3 |
| Overall width | 39.0 | 990.6 | 39.0 | 990.6 | 39.0 | 990.6 | 35.8 | 909.3 | 39.0 | 990.6 |
| Road clearance | 5.1 | 129.5 | 5.1 | 129.5 | 5.1 | 129.5 | 5.1 | 129.5 | 4.7 | 119.4 |
| Overall height | 61.0 | 1549.4 | 61.0 | 1549.4 | 61.0 | 1549.4 | 55.0 | 1397.0 | 52.2 | 1325.9 |
| Saddle height* | 27.3 | 693.4 | 27.3 | 693.4 | 27.3 | 693.4 | 26.9 | 683.3 | 26.3 | 668.0 |
| *With 180 lb. (81.7 kg) rider on seat | | | | | | | | | | |

**Table 2-2. Dimensions: 2008 FLHR and FLHRC**

| ITEM | FLHR | | FLHRC | |
|---|---|---|---|---|
| | IN. | MM | IN. | MM |
| Wheel base | 63.5 | 1612.9 | 63.5 | 1612.9 |
| Overall length | 93.7 | 2380.0 | 93.7 | 2380.0 |
| Overall width | 34.5 | 876.3 | 34.5 | 876.3 |
| Road clearance | 5.1 | 129.5 | 5.1 | 129.5 |
| Overall height | 55.1 | 1399.5 | 55.1 | 1399.5 |
| Saddle height* | 27.3 | 693.4 | 26.9 | 683.3 |
| *With 180 lb. (81.7 kg) rider on seat | | | | |



**Table 2-3. Capacities: 2008 Touring Models**

| ITEM | U.S. | LITERS |
|---|---|---|
| Fuel tank (total) | 6.0 gal | 22.7 |
| Oil tank with filter | 4.0 U.S. qt. | 3.8 |
| Transmission (approximate) | 32.0 fl. oz. | 0.95 |
| Primary chaincase (approximate) | 45.0 fl. oz. | 1.32 |

**Table 2-4. Weights: 2008 FLHT, FLHTC/U, FLTR and FLHX**

| ITEM | FLHT | | FLHTC | | FLHTCU | | FLTR | | FLHX | |
|---|---|---|---|---|---|---|---|---|---|---|
| | LB. | KG | LB. | KG | LB. | KG | LB. | KG | LB. | KG |
| Weight as shipped from factory | 743 | 337 | 791 | 359 | 814 | 369 | 752 | 341 | 749 | 341 |
| GVWR | 1259 | 571 | 1259 | 571 | 1259 | 571 | 1259 | 571 | 1259 | 571 |
| GAWR front | 500 | 227 | 500 | 227 | 500 | 227 | 500 | 227 | 500 | 227 |
| GAWR rear | 827 | 375 | 827 | 375 | 827 | 375 | 827 | 375 | 827 | 375 |

**Table 2-5. Weights: 2008 FLHR and FLHRC**

| ITEM | FLHR | | FLHRC | |
|---|---|---|---|---|
| | LB. | KG | LB. | KG |
| Weight as shipped from factory | 740 | 336 | 738 | 335 |
| GVWR | 1259 | 571 | 1259 | 571 |
| GAWR front | 500 | 227 | 500 | 227 |
| GAWR rear | 827 | 375 | 827 | 375 |

*NOTES*

- *Gross vehicle weight rating (GVWR) (maximum allowable loaded vehicle weight) and corresponding gross axle weight rating (GAWR) are given on a label located on the frame steering head.*
- *For important information regarding tire data and tire inflation, see 1.8 TIRES AND WHEELS.*

## VEHICLE IDENTIFICATION NUMBER: TOURING MODELS

The full 17-digit serial number, or Vehicle Identification Number (V.I.N.), is stamped on the right side of the frame backbone at the rear of the steering head. A label bearing the V.I.N. code is also affixed to the left side of the steering head.

An abbreviated V.I.N. is stamped between the front and rear cylinders on the left side of the crankcase.

*NOTE*

*Always give the full 17-digit Vehicle Identification Number when ordering parts or making any inquiry about your motorcycle.*

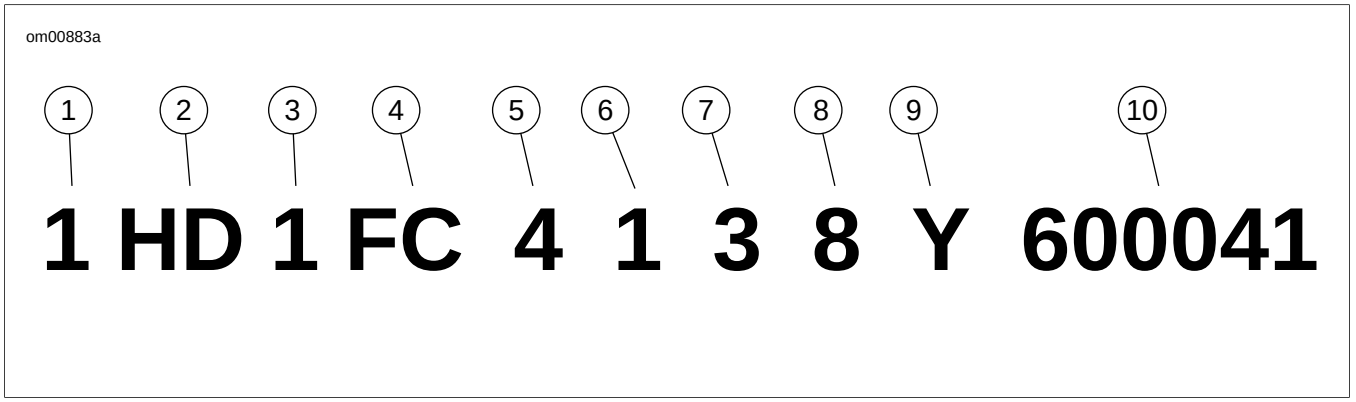



**Figure 2-1. Typical Harley-Davidson V.I.N.: 2008 Touring Models**

**Table 2-6. Harley-Davidson V.I.N. Breakdown: 2008 Touring Models**

| POSITION | DESCRIPTION | POSSIBLE VALUES |
|---|---|---|
| 1 | Market designation | 1=Originally manufactured for sale **within** the United States<br>5=Originally manufactured for sale **outside** of the United States |
| 2 | Manufacturer | HD=Harley-Davidson |
| 3 | Motorcycle type | 1=Heavyweight motorcycle (901 cc or larger) |
| 4 | Model | See V.I.N. model table |
| 5 | Engine type | 4=Twin Cam 96™, 1584 cc air cooled, fuel injected |
| 6 | Introduction date | 1=Regular<br>2=Mid-year<br>3=California/regular<br>4=Cosmetic changes and/or special introductory date<br>5=California/cosmetic changes and/or special introductory date<br>6=California/mid-year |
| 7 | V.I.N. check digit | Can be 0-9 or X |
| 8 | Model year | 8=2008 |
| 9 | Assembly plant | Y=York, PA U.S.A. |
| 10 | Sequential number | Varies |

**Table 2-7. V.I.N. Model Codes: 2008 Touring Models**

| CODE | MODEL | CODE | MODEL |
|---|---|---|---|
| FB | FLHR Road King® | FC | FLHTCU Ultra Classic® Electra Glide® |
| FG | FLHTCU Ultra Classic® Electra Glide® with sidecar | FL | FLHTCU Ultra Classic® Electra Glide® Shrine |
| FS | FLTR Road Glide® | FV | FLHT Electra Glide® Standard |

**Table 2-7. V.I.N. Model Codes: 2008 Touring Models**

| CODE | MODEL | CODE | MODEL |
|---|---|---|---|
| FF | FLHTC Electra Glide® Classic | KB | FLHX Street Glide™ |
| FW | FLHR Road King® Shrine | FR | FLHRC Road King® Classic |

## 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 1.25 TROUBLESHOOTING for possible causes.

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

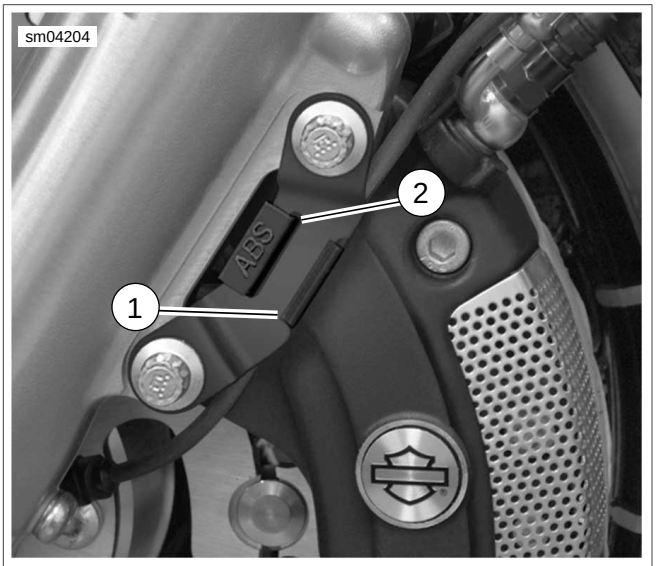
## REMOVAL

1. Place the motorcycle on a hydraulic center stand with the front wheel raised off the ground.
2. Inspect wheel bearings. See 2.8 SEALED WHEEL BEARINGS.
3. If present, carefully cut two cable straps to release front wheel speed sensor cable and front fender tip lamp wires from brake hose to left brake caliper.
4. See Figure 2-2. On ABS equipped motorcycles, release front wheel speed sensor cable from clip as follows:
   a. Push on lip at rear of clip to disengage from bracket.
   b. Rotate tab (stamped ABS) rearward until clip is perpendicular to bracket and remove cable.
5. Remove two brake caliper mounting screws (with cable clip/bracket if ABS equipped). Slide brake caliper straight down to remove from brake disc. Using thru hole, cable strap caliper to rail of engine guard, so that it is not suspended by brake hose.
6. Remove brake caliper on right 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 brake caliper.*

7. See Figure 2-3. Insert screwdriver or steel rod through hole in axle on right side of motorcycle. While holding axle stationary, remove the axle nut and flat washer on the left side.
8. Loosen the two axle holder nuts at bottom of right side fork slider.




**1. Push lip to disengage**
**2. Push tab to engage**

**Figure 2-2. Front Wheel Speed Sensor Cable Clip (ABS Equipped)**

9. Using a soft mallet, gently tap end of axle towards right side of motorcycle. Catching external spacer(s), pull axle free of fork sliders, front wheel speed sensor (if ABS equipped), and wheel hub.

*NOTE*

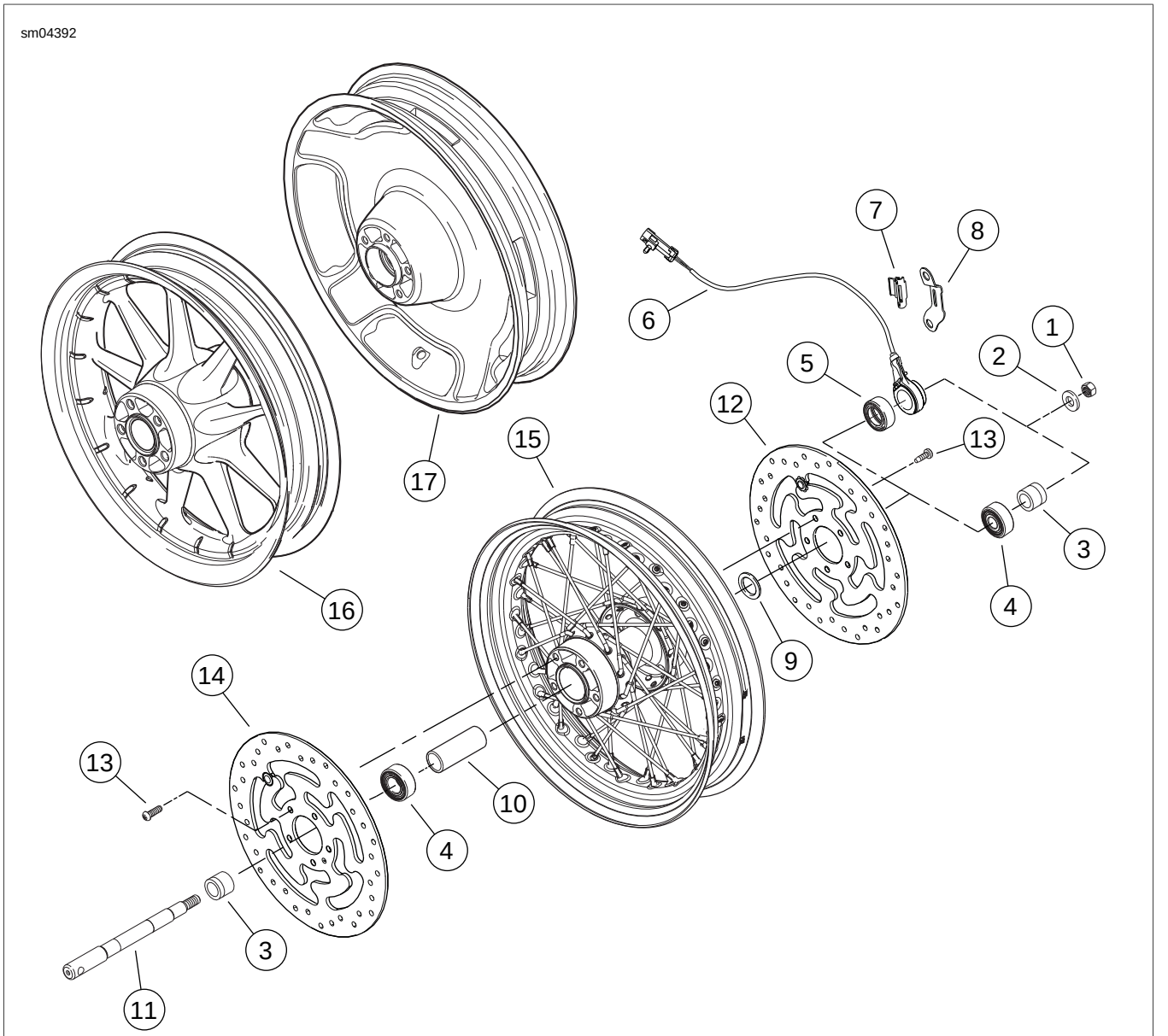
*If ABS equipped, never pull wheel speed sensor cable taut or use to retain wheel, axle or other components. Always keep wheel speed sensor (and ABS encoder bearing) away from magnetic fields (such as magnetic parts trays, magnetic base dial indicators, alternator rotors, etc.) or damage will occur.*

10. Move wheel to bench area.

*NOTE*

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

11. If necessary, remove five screws to release brake discs from hub.




1. **Axle nut**
2. **Flat washer**
3. **External spacer**
4. **Standard bearing**
5. **ABS encoder bearing**
6. **Front wheel speed sensor**
7. **Cable clip**
8. **Clip bracket**
9. **Spacer washer**
10. **Spacer sleeve**
11. **Axle**
12. **Brake disc (left side)**
13. **T40 TORX screw (10)**
14. **Brake disc (right side)**
15. **Laced wheel**
16. **Cast wheel**
17. **Slotted cast wheel**

**Figure 2-3. Front Wheel (Exploded View)**

## CLEANING AND INSPECTION

1. Thoroughly clean all parts in solvent (wheel speed sensor and bearings excepted) and inspect for damage or excessive wear.
2. Replace brake discs if warped or badly scored. Measure disc thickness for excessive wear. Minimum acceptable thickness is stamped on side of disc.

## INSTALLATION

1. If removed, install five **new** screws to fasten brake discs to hub. Alternately tighten screws to 16-24 ft-lbs (22-33 Nm).
2. Place wheel into position between fork sliders with the valve stem on the right side of the motorcycle.

3. Apply a light coat of LOCTITE ANTI-SEIZE lubricant to axle, bearing bores and bore of spacer sleeve.
4. Slide axle through right fork slider and external spacer into wheel hub.

*NOTE*

*Be sure that grooves on external spacer(s), or index pin on front wheel speed sensor (if ABS equipped), are on the outboard side. If motorcycle is not ABS equipped, external spacers on left and right side of wheel hub are interchangeable.*

5. When axle emerges from hub on left side of wheel, push it through front wheel speed sensor (if ABS equipped) or second external spacer, and then through left fork slider.
6. Install flat washer and axle nut.
7. See Figure 2-4. If ABS equipped, rotate front wheel speed sensor in a counter-clockwise direction until index pin makes contact with shoulder on left fork slider.
8. Insert screwdriver or steel rod through hole in axle on right side of motorcycle. While holding axle stationary, tighten axle nut to 60-65 ft-lbs (81.4-88.1 Nm).
9. Push right fork slider inboard until it contacts external spacer, and then holding it in this position, tighten axle holder nuts to 132-180 **in-lbs** (14.9-20.3 Nm).
10. Install left side brake caliper as follows:
    a. Install caliper at bottom of brake disc. Pry inner and outer brake pads back for additional clearance, if necessary.
    b. Slide brake caliper straight up until holes are aligned with lugs on fork slider. Start two mounting screws (with cable clip/bracket if ABS equipped).

    *NOTE*

    *Be sure that tab (stamped ABS) on clip is installed in slot of bracket from inboard side. Clip cannot be installed once mounting screws are started.*

    c. Alternately tighten mounting screws to 28-38 ft-lbs (37.9-51.5 Nm)
    d. Repeat applicable steps to install caliper on right side of wheel.

**⚠WARNING**

**After servicing brakes and before moving motorcycle, pump brakes to build brake system pressure. Insufficient pressure can adversely affect brake performance, which could result in death or serious injury. (00279a)**

11. Depress front brake hand lever several times to set brake pads to proper operating position within caliper.
12. If ABS equipped, install two **new** cable straps as follows:
    a. Install cable strap 2.5 in. (63.5 mm) above the bottom brake hose crimp capturing front wheel speed sensor cable and brake hose.
    b. Install cable strap 2.5 in. (63.5 mm) below the top brake hose crimp capturing front wheel speed sensor cable, brake hose and front fender tip lamp wires, if equipped.
13. If ABS equipped, install front wheel speed sensor cable in clip as follows:
    a. Rotate tab (stamped ABS) until clip is perpendicular to bracket and install cable.
    b. Rotate tab forward until clip is inline with bracket and then apply pressure to tab until lip engages. Gently pull on cable to verify that clip is properly installed.

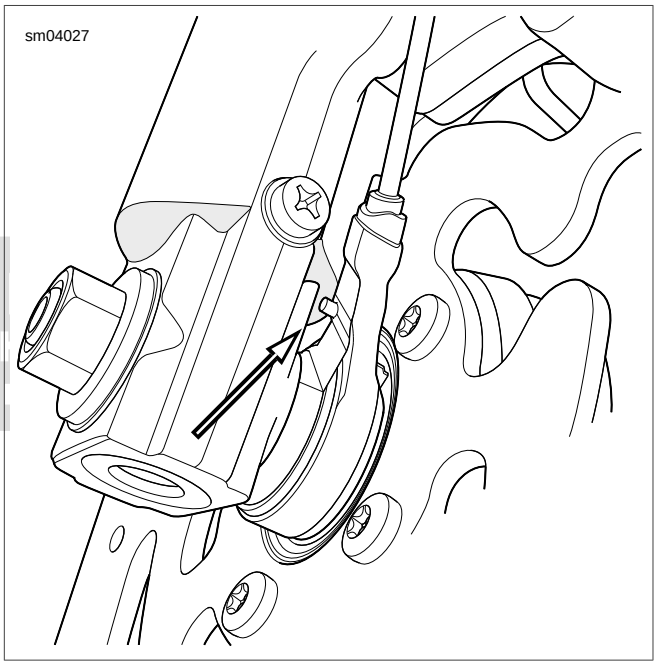



**Figure 2-4. Front Wheel Speed Sensor Index Pin (ABS Equipped)**

## 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 1.25 TROUBLESHOOTING for possible causes.

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

## REMOVAL

| PART NUMBER | TOOL NAME |
|---|---|
| HD-47925 | AXLE NUT TORQUE ADAPTER |

1. Remove saddlebags. See 2.27 SADDLEBAGS, Removal.
2. Place motorcycle on center stand with the rear wheel raised off the ground.
3. Inspect wheel bearings. See 2.8 SEALED WHEEL BEARINGS.
4. Remove left side muffler as follows:
   a. Open two worm drive clamps to remove heat shield from crossover pipe on left side of motorcycle.
   b. Using a bungee cord, tie the muffler to the lower saddlebag support rail.
   c. Loosen TORCA clamp between crossover pipe and muffler.

   *NOTE*

   *To facilitate removal, spray suitable penetrating oil in and around joint of exhaust pipes. Allow sufficient time for the penetrating oil to work.*

   d. Remove two screws (with lockwashers) to detach muffler from lower saddlebag support rail.
   e. Remove bungee cord to release muffler from lower saddlebag support rail.
5. On models equipped with low profile shock absorbers (FLHX), remove left side lower saddlebag support rail as follows:
   a. Remove outside screw (and flange nut) to release saddlebag support rail from saddlebag support bracket.
   b. Remove screw to release opposite end of saddlebag support rail from frame weldment.
6. If ABS equipped, carefully cut cable strap to release rear wheel speed sensor cable from brake hose to brake caliper.
7. Remove two socket head screws to release brake caliper from caliper bracket.
8. Remove brake caliper from brake disc. 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. Set brake caliper on passenger footboard.
9. See Figure 2-5. Remove E-clip from groove at end of axle.
10. Loosen cone nut as follows:
    a. Obtain breaker bar with 1/2 inch drive head and AXLE NUT TORQUE ADAPTER (Part No. HD-47925).
    b. Install torque adapter perpendicular to breaker bar. See upper frame of Figure 2-6.
    c. Insert tool up between rear wheel and muffler to capture cone nut. For best clearance with muffler, be sure torque adapter is on the outboard side.
    d. Rotate cone nut in a counter-clockwise direction.
11. Remove cone nut and adjuster cam from axle.
12. Rotate weld nut on opposite side of axle in a counter-clockwise direction until wheel is loose.
13. Using a soft mallet, gently tap end of axle towards left side of motorcycle. Catching external spacer(s), pull axle free of rear swingarm, caliper bracket, rear wheel speed sensor (if ABS equipped), and wheel hub.

    *NOTE*

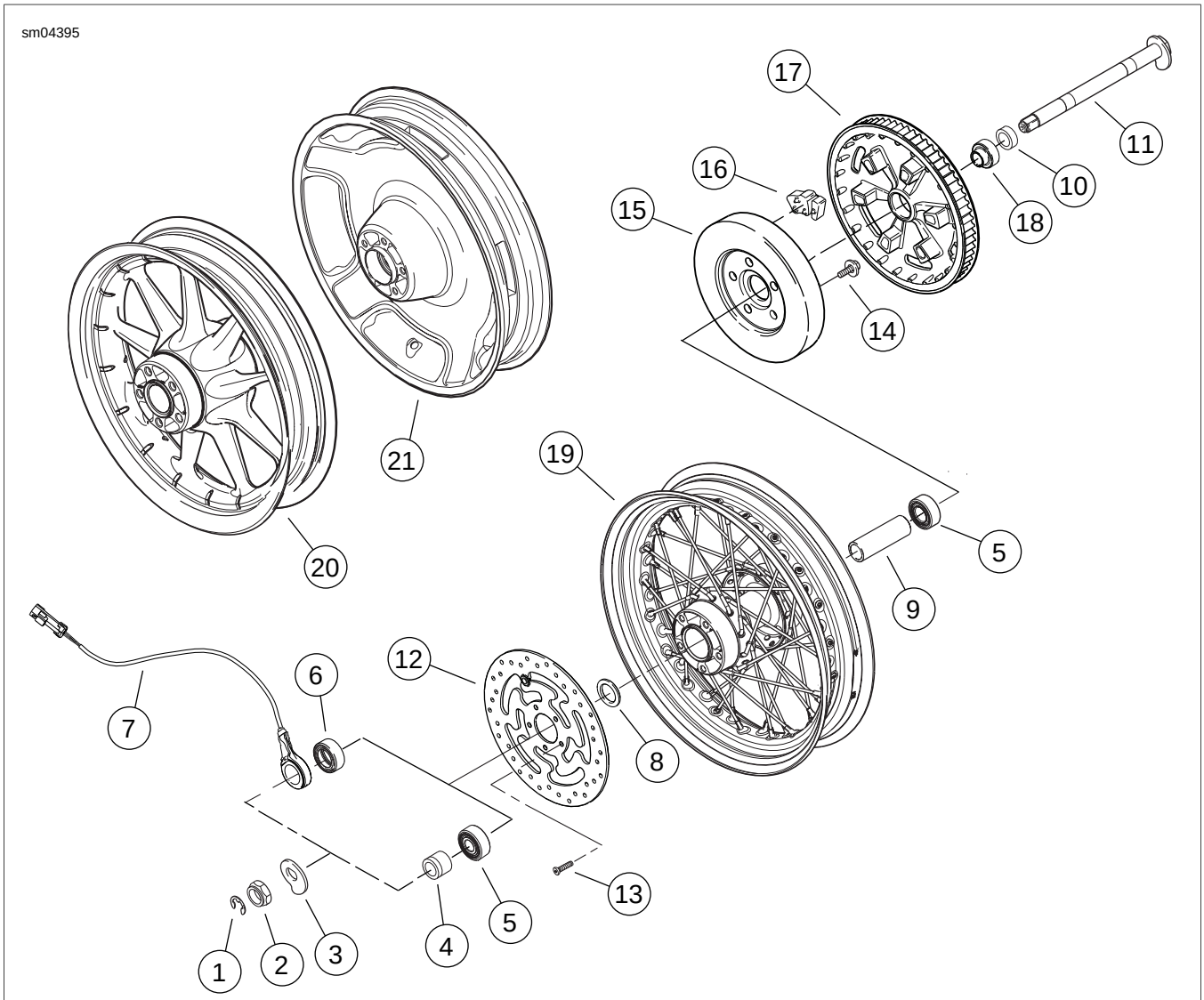
    *If ABS equipped, never pull wheel speed sensor cable taut or use to retain wheel, axle or other components. Always keep wheel speed sensor (and ABS encoder bearing) away from magnetic fields (such as magnetic parts trays, magnetic base dial indicators, alternator rotors, etc.) or damage will occur.*
14. Remove caliper bracket from anchor weldment on rear swingarm.
15. Move wheel forward and slip belt off compensator sprocket.

    *NOTE*

    *Hold onto compensator sprocket while removing rear wheel. Compensator sprocket may drop from bowl if isolators are excessively worn, possibly resulting in parts damage.*

    *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.*
16. If necessary, remove five screws to release brake disc from hub. If 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.




1. **E-clip**
2. **Cone nut**
3. **Adjuster cam**
4. **External spacer (thick)**
5. **Standard bearing**
6. **ABS encoder bearing**
7. **Rear wheel speed sensor**
8. **Spacer washer**
9. **Spacer sleeve**
10. **External spacer (thin)**
11. **Axle**
12. **Brake disc**
13. **T45 TORX screw (5)**
14. **Hex screw (5)**
15. **Bowl**
16. **Isolator (6)**
17. **Compensator sprocket**
18. **Sprocket bearing**
19. **Laced wheel**
20. **Cast wheel**
21. **Slotted cast wheel**

**Figure 2-5. Rear Wheel (Exploded View)**

## CLEANING AND INSPECTION

1. Thoroughly clean all parts in solvent (wheel speed sensor and bearings excepted) and inspect for damage or excessive wear.
2. Replace brake disc if warped or badly scored. Measure disc thickness for excessive wear. Minimum acceptable thickness is stamped on side of disc.
3. Check the compensator sprocket for wear, tooth damage, cracks or pitting. Check each isolator for crumbling, flaking, excessive wear or general deterioration. Replace parts as necessary.

## INSTALLATION

| PART NUMBER | TOOL NAME |
|---|---|
| HD-35381A | BELT TENSION GAUGE |

1. If removed, install five **new** screws to fasten brake disc to hub. Alternately tighten screws to 30-45 ft-lbs (41-61 Nm). Always install brake disc in its original position.
2. Verify that compensator sprocket is square and fully seated on bowl.
3. Place wheel in rear swingarm. Slide wheel far enough forward to slip belt over compensator sprocket and then slide the wheel back.

**⚠WARNING**

**Never bend belt forward into a loop smaller than the drive sprocket diameter. Never bend belt into a reverse loop. Over bending can damage belt resulting in premature failure, which could cause loss of control and death or serious injury. (00339a)**

4. Seat caliper bracket on anchor weldment of rear swingarm.
5. Apply a light coat of LOCTITE ANTI-SEIZE lubricant to axle, bearing bores and bore of spacer sleeve.
6. Slide axle through left side of rear swingarm, external spacer (thin), and rear wheel compensator sprocket into wheel hub.
7. When axle emerges from hub on brake disc side of wheel, push it through rear wheel speed sensor (if ABS equipped) or external spacer (thick), caliper bracket, and right side of rear swingarm.

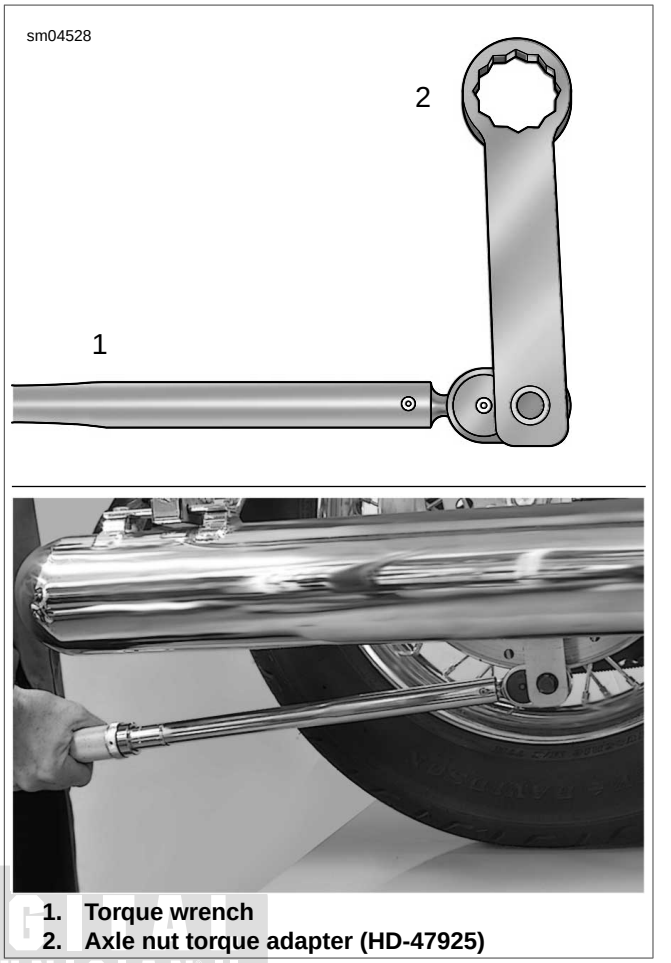
*NOTE*

*Be sure that grooves on external spacer, or index pin on rear wheel speed sensor (if ABS equipped), are on the outboard side.*

8. 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.
9. Apply a thin film of LOCTITE ANTI-SEIZE lubricant to the inboard side of the cone nut avoiding contact with threads. Install cone nut on axle, but finger tighten only.

*NOTE*

*The Axle Nut Torque Adapter simplifies the belt adjustment procedure by allowing the cone nut to be properly tightened without having to remove the right side muffler. The tool also can be used to loosen the cone nut, as well as rotate the weld nut on the left side.*




1. **Torque wrench**
2. **Axle nut torque adapter (HD-47925)**

**Figure 2-6. Install Tool Perpendicular to Torque Wrench**

10. Obtain torque wrench with 1/2 inch drive head and AXLE NUT TORQUE ADAPTER (Part No. HD-47925). Proceed as follows:
    a. Install torque adapter perpendicular to torque wrench. See upper frame of Figure 2-6.
    b. Insert tool up between rear wheel and muffler to capture cone nut. For best clearance with muffler, be sure torque adapter is on the outboard side. See lower frame of Figure 2-6.

*NOTE*

*Since any extension can act as a torque multiplier, the torque wrench must be perpendicular to the torque adapter when the cone nut is tightened. The 90° orientation between the tools cancels the multiplier effect and prevents the cone nut from being over-tightened. If the torque*

*adapter is kept in-line with the torque wrench, the multiplier effect is in force and parts damage will occur.*

c. Verify that cam just contacts weld nub on both sides of rear swingarm. If necessary, push wheel forward slightly to achieve the desired result. See Figure 2-7.

d. If ABS equipped, route sensor cable forward outboard of caliper bracket and then continue forward progression following top of rear swingarm. Rotate rear wheel speed sensor in a counter-clockwise direction until index pin makes contact with caliper bracket at point shown in Figure 2-8.

e. Snug the cone nut to 15-20 ft-lbs (20-27 Nm).

11. Install brake caliper, so that brake disc is centered between brake pads. Align holes in brake caliper with those in caliper bracket and install two socket head screws. Alternately tighten screws to 43-48 ft-lbs (58.3-65.1 Nm).

12. Install **new** cable strap 1.25 in. (31.8 mm) in front of the brake hose crimp capturing rear wheel speed sensor cable and brake hose. Cut any excess cable strap material, but exercise caution to avoid cutting or nicking the brake hose.

13. Using BELT TENSION GAUGE (Part No. HD-35381A), 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 2-8.

**Table 2-8. Belt Deflection**

| MODEL | INCHES | MILLIMETERS |
|---|---|---|
| FLHR/C<br>FLHT/C/U<br>FLTR | 3/8-7/16 | 9.5-11.1 |
| FLHX | 1/4-5/16 | 6.4-7.9 |

*NOTE*

*Always check deflection at the loosest spot in the belt with the transmission in neutral and the motorcycle at ambient temperature. Also, motorcycle should be upright with rear wheel in air or on jiffy stand without rider or luggage.*

14. **If belt is too loose:** Reduce belt deflection by rotating weld nut on left side of axle in a clockwise direction.

15. **If belt is too tight:** Increase belt deflection as follows:

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

b. Push wheel forward slightly so that adjuster cam just contacts weld nub on both sides of rear swingarm.

16. Recheck 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 2-8. If belt is still not within specified range, readjust accordingly.

*NOTE*

*The compensator sprocket bearing has a split inner race that requires proper compression. Deviation from the following procedure may lead to premature bearing failure.*

17. Holding weld nut on left side of axle, proceed as follows:

a. Tighten cone nut to 95-105 ft-lbs (128.8-142.4 Nm).

b. Loosen cone nut one full turn.

c. Retighten cone nut to above specification.

*NOTE*

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

18. 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 14.

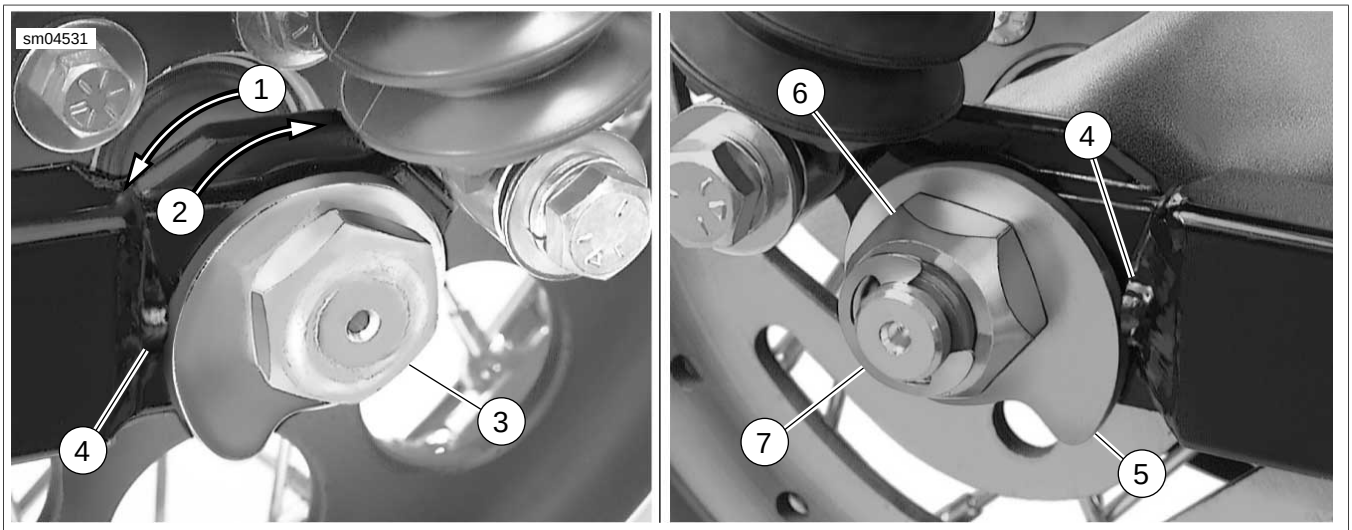
19. With the flat side out, install **new** E-clip in groove on right side of axle.

20. On models equipped with low profile shock absorbers (FLHX), install left side lower saddlebag support rail as follows:

a. At rear left side of motorcycle, start outside screw (and flange nut) to fasten saddlebag support rail to saddlebag support bracket.

b. Start screw to fasten opposite end of saddlebag support rail to frame weldment.

c. Alternately tighten screws to 15-20 ft-lbs (20-27 Nm).




1. **Increase belt deflection**
2. **Reduce belt deflection**
3. **Weld nut**
4. **Weld nub**
5. **Adjuster cam**
6. **Cone nut**
7. **E-clip**

**Figure 2-7. Rear Wheel Adjuster Cams**

21. Install left side muffler as follows:
    a. Slide **new** TORCA clamp onto free end of crossover pipe.

    *NOTE*

    *Always use **new** TORCA clamps to ensure sealing integrity and prevent the possibility of leakage.*

    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. Install two screws (with lockwashers) to fasten the muffler to the lower saddlebag support rail. Alternately tighten screws to 96-144 **in-lbs** (10.8-16.3 Nm).

    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 on left side of motorcycle. 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).

    g. Remove bungee cord from muffler.

**⚠WARNING**

**After servicing brakes and before moving motorcycle, pump brakes to build brake system pressure. Insufficient pressure can adversely affect brake performance, which could result in death or serious injury. (00279a)**

22. Depress rear brake pedal several times to set brake pads to proper operating position within caliper.
23. Install saddlebags. See 2.27 SADDLEBAGS.

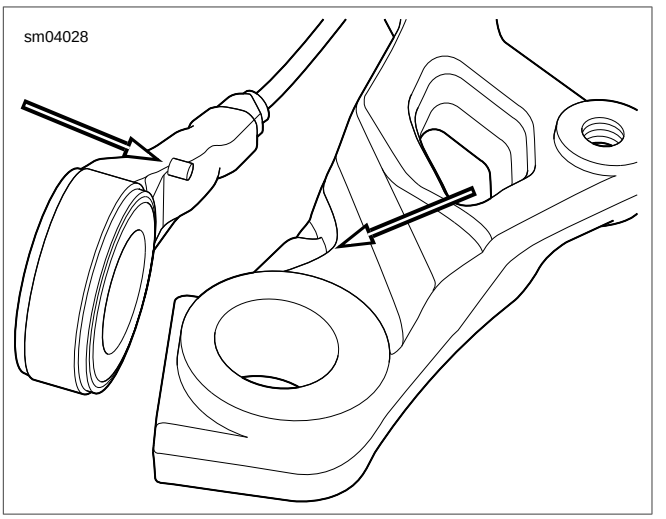



**Figure 2-8. Rear Wheel Speed Sensor Index Pin (ABS Equipped)**

## ISOLATOR REPLACEMENT

### Removal

1. Remove rear wheel. See 2.4 REAR WHEEL.
2. Pull sprocket from bowl.
3. Remove six isolators from bowl.
4. If bowl replacement is necessary, remove five hex screws (with captive washers) to release bowl from wheel hub.

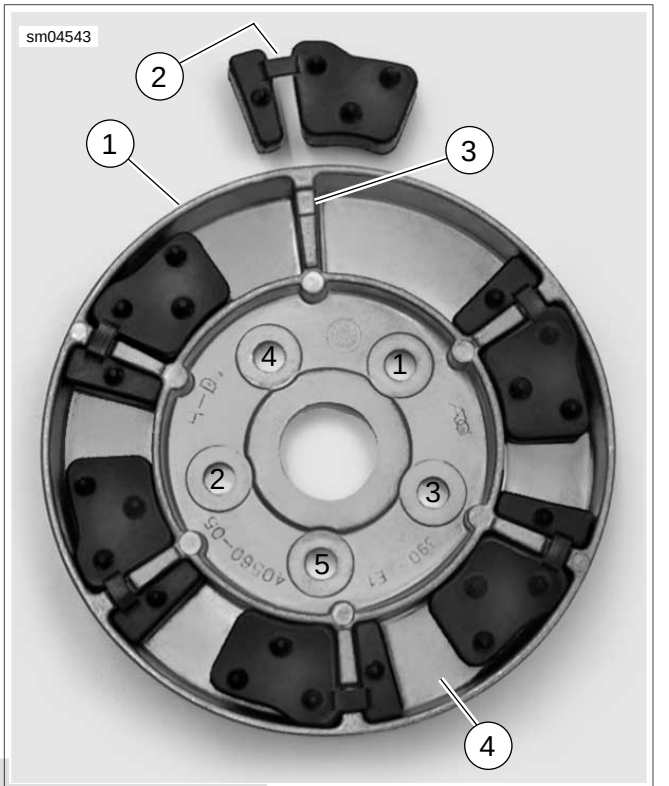
### Installation

1. If bowl was removed from wheel hub, proceed as follows:
   a. With the concave side out, align holes in bowl with those in wheel hub and start five **new** hex screws (with captive washers).
   b. Alternately tighten hex screws to 55-65 ft-lbs (74.6-88.1 Nm) in the pattern shown in Figure 2-9.

*NOTE*

*Always replace isolators in complete sets only.*

2. Obtain six **new** isolators and proceed as follows:
   a. Lubricate each isolator with 50/50 mix of isopropyl alcohol and water. Do not use a petroleum based lubricant.
   b. Push each isolator into bowl, so that strap engages slot in rib.
   c. Verify that each isolator bottoms in bowl and that each segment is flush against side walls of rib.
3. Using a 50/50 mix of isopropyl alcohol and water, lubricate sides of each isolator where contact occurs with sprocket lugs.
4. Aligning lugs on inboard side of sprocket with gaps between isolators, push sprocket onto bowl.
5. Install rear wheel. See 2.4 REAR WHEEL.




**1. Bowl**
**2. Isolator strap**
**3. Rib slot**
**4. Sprocket lug gap**

**Figure 2-9. Install Isolators in Bowl**

## SPROCKET BEARING REPLACEMENT

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48921 | REAR WHEEL COMPENSATOR SPROCKET BEARING REMOVER/INSTALLER |

### Removal

1. Remove rear wheel. See 2.4 REAR WHEEL.
2. Pull sprocket from bowl.
3. Obtain the REAR WHEEL COMPENSATOR SPROCKET BEARING REMOVER/INSTALLER (Part No. HD-48921). See Figure 2-10.
4. Place parallel press blocks on deck of arbor press. Leave gap between press blocks to accommodate base pin in next step.
5. Position base on press blocks with the large OD topside.
6. Slide sleeve over base pin. See upper frame of Figure 2-11.
7. With the inboard side facing up, slide sprocket over sleeve until it rests on base.

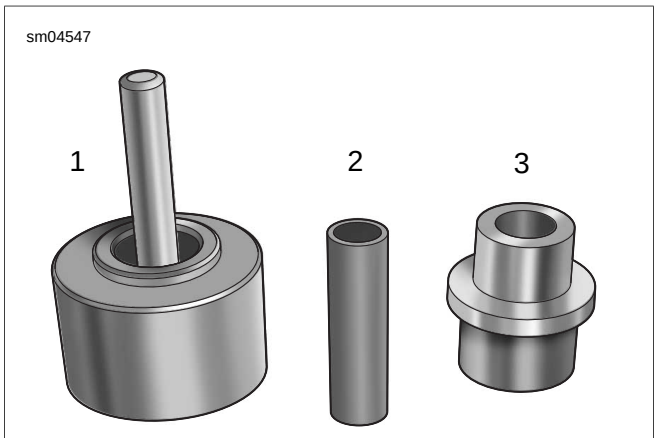
8. Slide small OD of driver over sleeve until contact is made with extended inner race of bearing. See lower frame of Figure 2-11.
9. Center driver under ram and apply pressure until bearing drops into base. Disassemble tool and discard bearing.

## Installation

*NOTE*

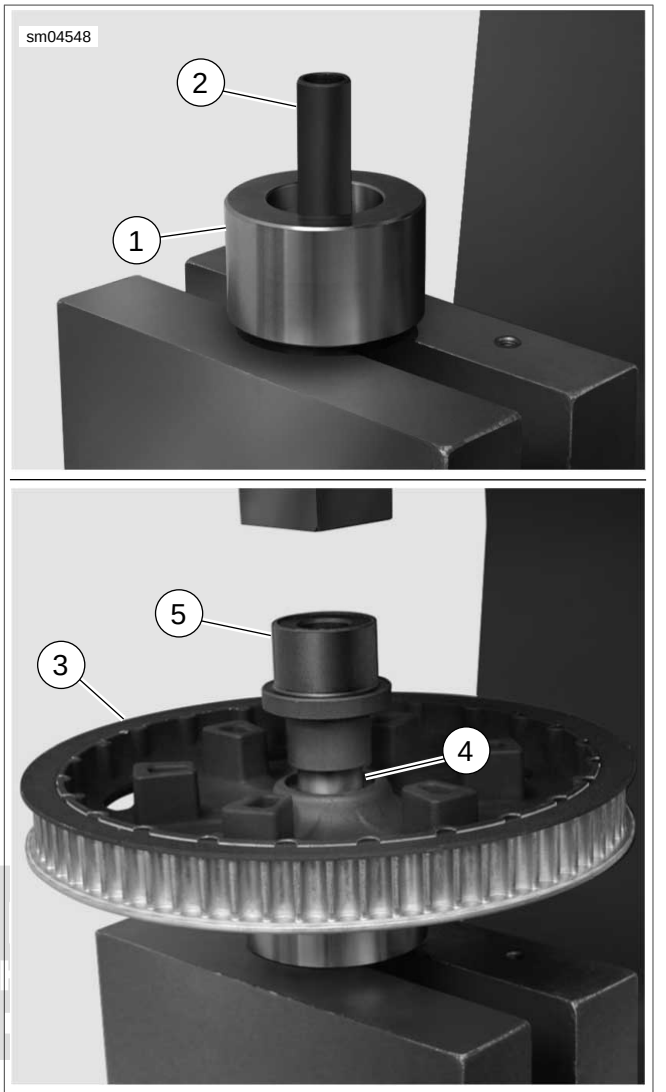
*Due to the split race, the sprocket bearing cannot be spun by hand to determine if it is good or bad. Even a good bearing will feel rough when tested this way.*

1. Obtain the REAR WHEEL COMPENSATOR SPROCKET BEARING REMOVER/INSTALLER (Part No. HD-48921). See Figure 2-10.
2. Position base on deck of arbor press with the small OD topside.
3. Slide sleeve over base pin. See upper frame of Figure 2-12.
4. Verify that sprocket bearing bore is clean and dry.
5. With the outboard side facing up, slide sprocket over sleeve until it rests on base.
6. Slide bearing over sleeve with the extended inner race down.
7. Slide large OD of driver over sleeve until contact is made with outer race of bearing. See lower frame of Figure 2-12.
8. Center driver under ram and apply pressure until bearing makes firm contact with counterbore in sprocket.
9. Turn sprocket over and verify that bearing is fully seated.
10. Using a 50/50 mix of isopropyl alcohol and water, lubricate sides of each isolator where contact occurs with sprocket lugs.
11. Aligning lugs on inboard side of sprocket with gaps between isolators, push sprocket onto bowl.
12. Install rear wheel. See 2.4 REAR WHEEL.



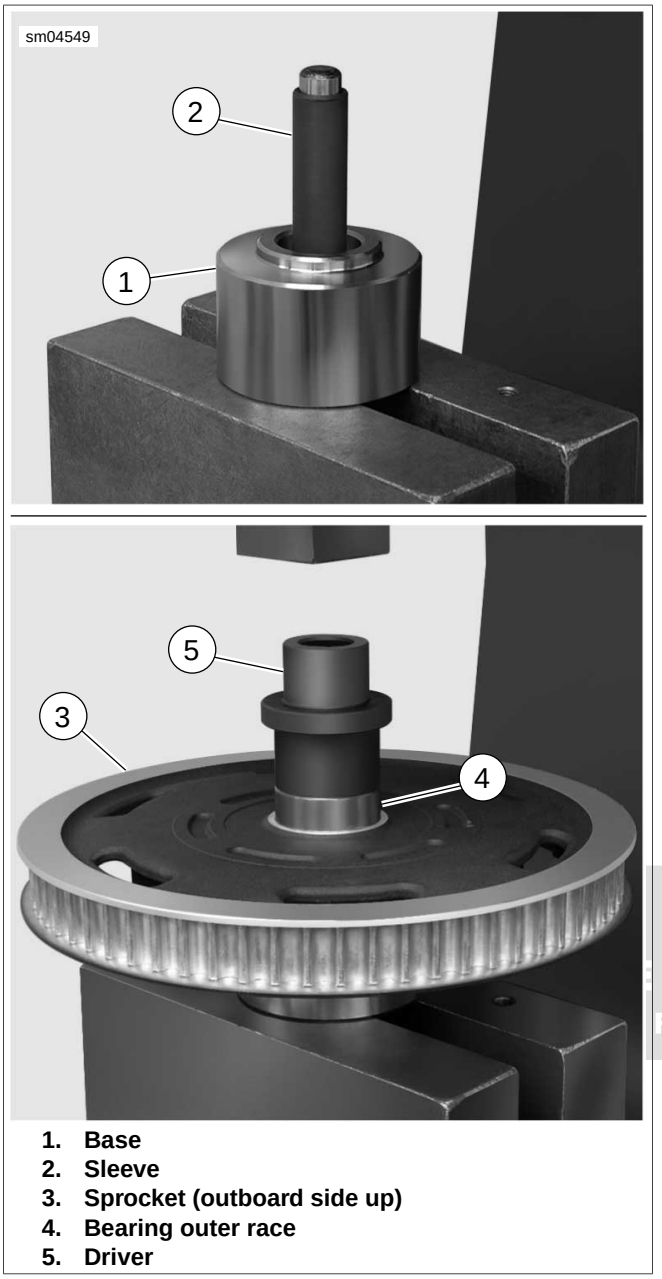

1. **Base**
2. **Sleeve**
3. **Driver**

**Figure 2-10. Rear Wheel Compensator Bearing Remover/Installer (HD-48921)**




1. **Base**
2. **Sleeve**
3. **Sprocket (inboard side up)**
4. **Bearing inner race**
5. **Driver**

**Figure 2-11. Remove Compensator Sprocket Bearing**




1. Base
2. Sleeve
3. Sprocket (outboard side up)
4. Bearing outer race
5. Driver

**Figure 2-12. Install Compensator Sprocket Bearing**

## INSPECTION

| PART NUMBER | TOOL NAME |
|---|---|
| HD-99500-80 | WHEEL TRUING STAND |

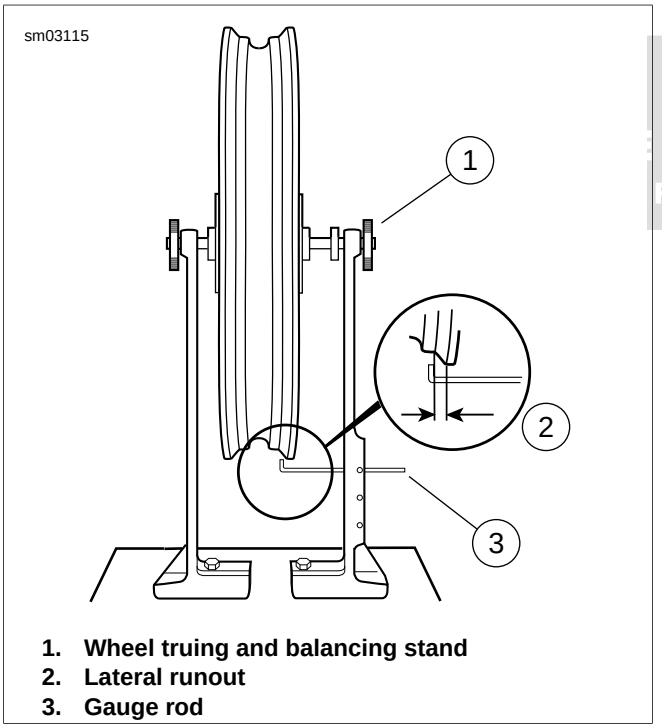
Check wheels for lateral and radial runout before installing a new tire or tube.

1. Install truing arbor in wheel hub and place wheel in WHEEL TRUING STAND (Part No. HD-99500-80).
2. See Figure 2-13. To check rim lateral runout, place a gauge rod or dial indicator near the rim bead. If lateral runout exceeds 0.040 in. (1.02 mm), replace the wheel if cast. Retrue the wheel if laced.
3. See Figure 2-14. Check the rim radial runout as shown. If radial runout exceeds 0.030 in. (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 2.9 TRUING LACED WHEELS.*

4. If working with a laced wheel, proceed to 2.9 TRUING LACED WHEELS to check the wheel offset dimension.




1. **Wheel truing and balancing stand**
2. **Lateral runout**
3. **Gauge rod**

**Figure 2-13. Checking Cast Wheel Lateral Runout**

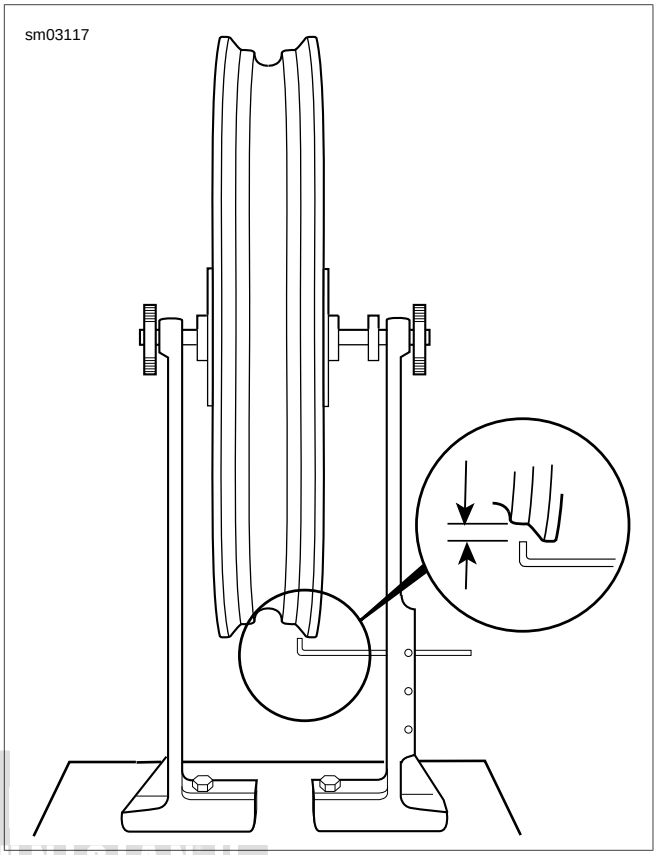



**Figure 2-14. Rim Radial Runout**

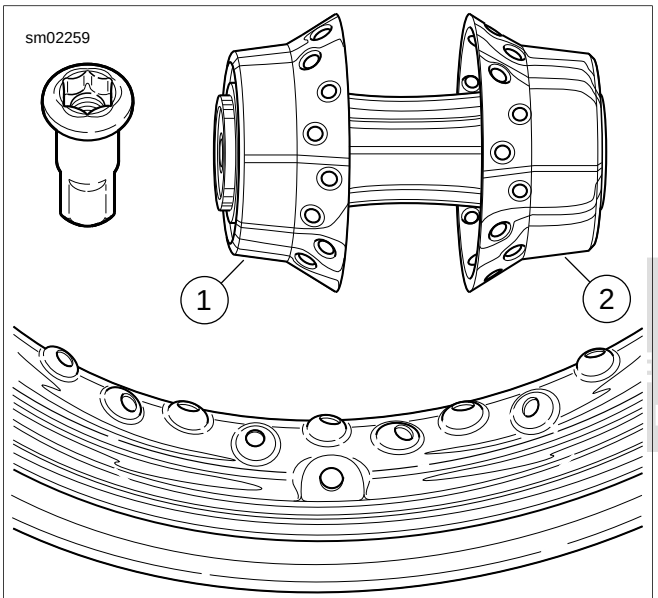
## GENERAL

| PART NUMBER | TOOL NAME |
|---|---|
| HD-42135 | T-30 I.P. (TORX PLUS) DRIVER |

*NOTE*

*Do not install incorrect spokes or spoke nipples on rim. Steel laced rims use zinc plated spokes and spoke nipples. Chrome aluminum profile laced rims use chrome plated spokes and spoke nipples. Using incorrect spokes can result in improper thread engagement which could result in damage to rim, tubes or tire.*

The spoke nipple fittings use a TORX style fastener and requires a special T-30 I.P. (TORX PLUS) DRIVER (Part No. HD-42135) for removal and installation. See Figure 2-15. Use of a standard T-30 TORX bit will result in nipple damage.




1. **Narrow flange (brake side)**
2. **Wide flange (sprocket side)**

**Figure 2-15. Rim, Hub and Spoke Nipple**

## PROCEDURE

1. See Figure 2-16. If front wheel, place hub on table with wider flange side up. If rear wheel, place hub on table with narrow flange (brake disc side) up. Insert a spoke in each hole of **lower** row as shown in the figure. Angle spokes clockwise.

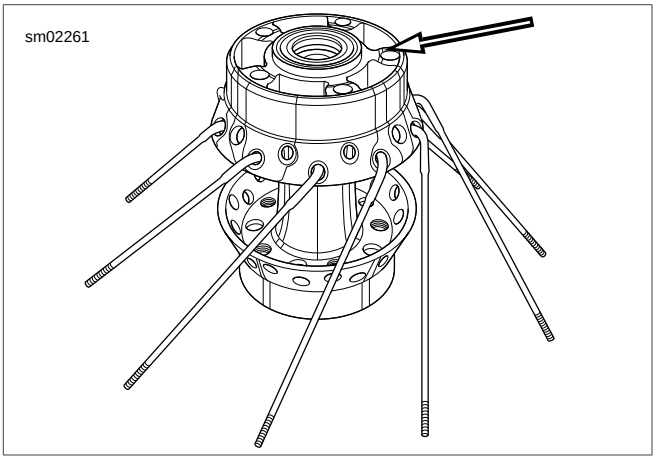



**Figure 2-16. Hub: Primary Brake Disc Side Up**

2. See Figure 2-17. Center rim over hub assembly with valve stem hole facing upward.
3. Using any **lower** row spoke, place first spoke into rim hole to left of valve stem hole on upper half of rim centerline.

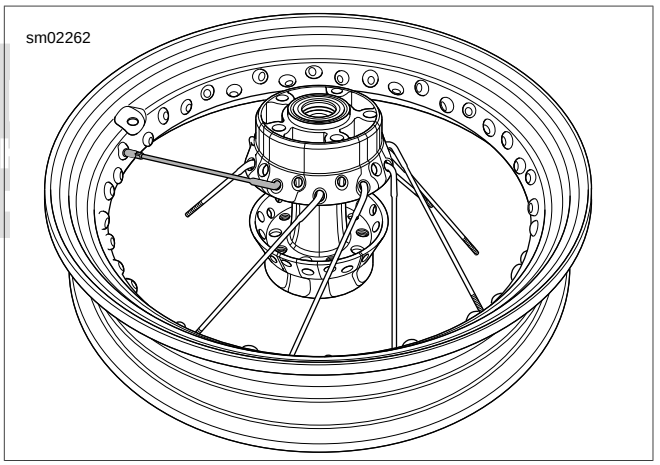



**Figure 2-17. Brake Side Up: Start First Spoke of Bottom Row**

4. See Figure 2-18. Install remaining lower row spokes, one in every fourth hole.

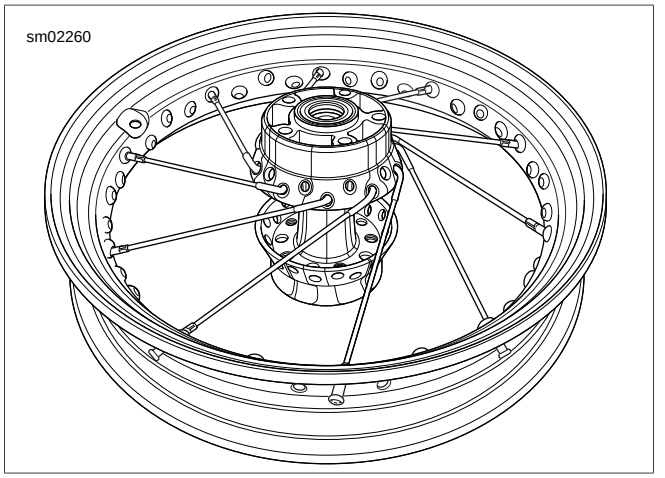



**Figure 2-18. Brake Side Up: Bottom Row of Spokes Laced**

5. See Figure 2-19. Place first **upper** row spoke into hub as shown. Angle spoke counterclockwise, **crossing four lower row spokes**. Spoke must enter hole to left of valve stem hole.

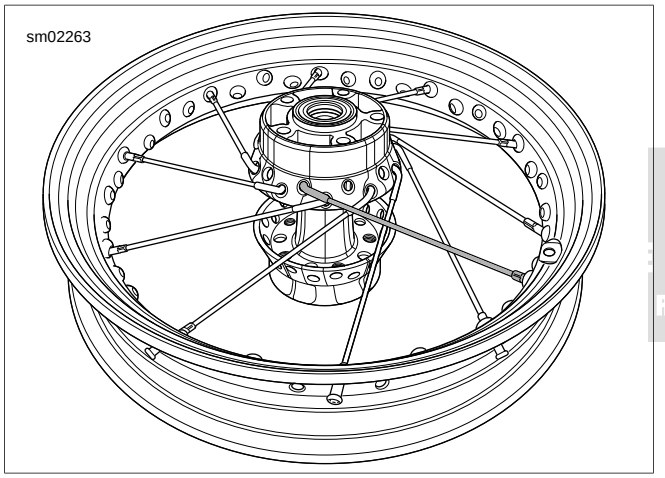



**Figure 2-19. Brake Side Up: Start First Spoke of Top Row**

6. See Figure 2-20. Install remaining nine upper row spokes, one into every fourth remaining hole above rim centerline. This completes spoke installation on one side.

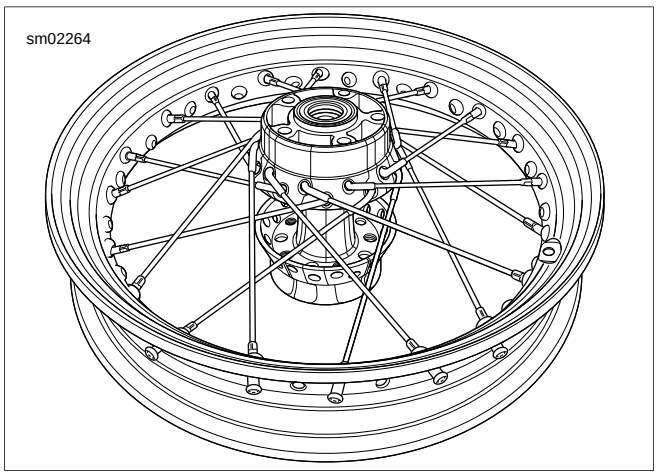



**Figure 2-20. Brake Side Up: Top Row of Spokes Laced**

7. See Figure 2-21. Turn wheel assembly over. Place any **lower** row spoke into hub. Angle spoke clockwise and place into rim hole angled to accept it.

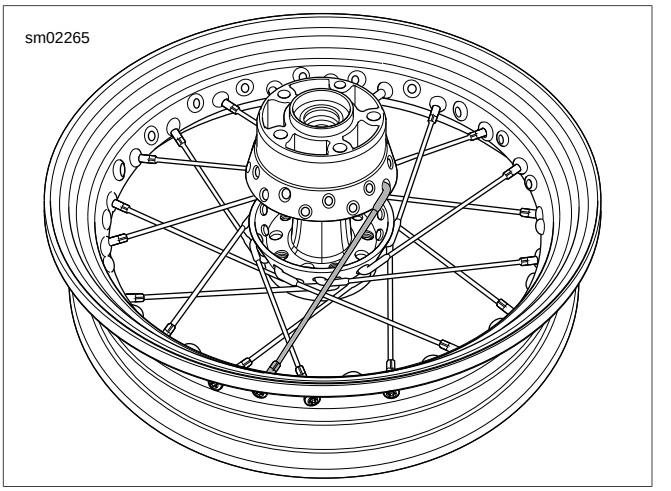



**Figure 2-21. Sprocket Side Up: Start First Spoke of Bottom Row**

8. See Figure 2-22. Place remaining nine lower row spokes, angled clockwise, into hub and rim.

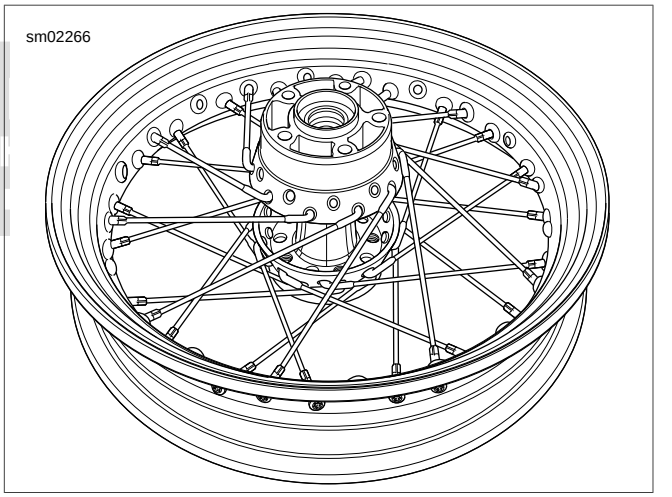



**Figure 2-22. Sprocket Side Up: Bottom Row of Spokes Laced**

9. See Figure 2-23. Insert any **upper** row spoke into hub and angle spoke counterclockwise. Place spoke into appropriate rim hole.

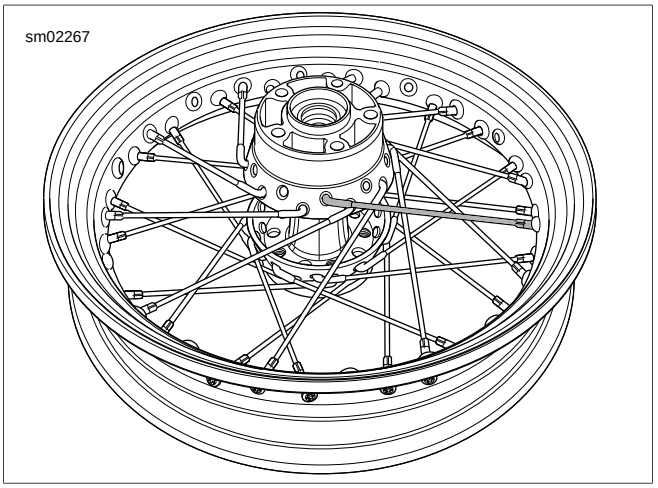



**Figure 2-23. Sprocket Side Up: Start First Spoke of Top Row**

10. See Figure 2-24. Install remaining nine upper row spokes into hub and rim.

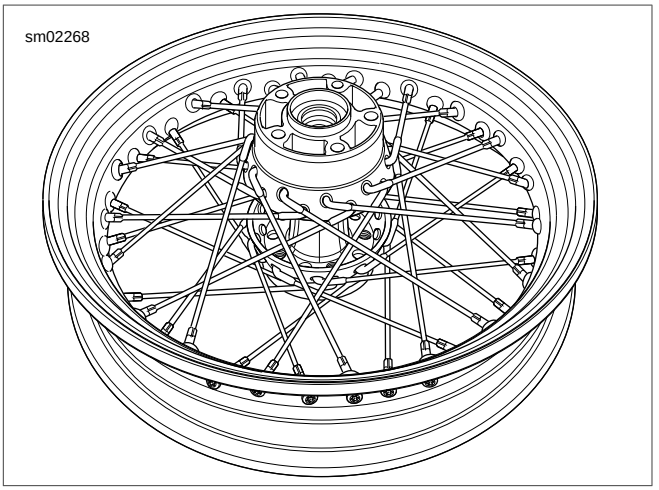



**Figure 2-24. Wheel Completely Laced**

11. Tighten spoke nipples to specification listed in Table 2-9.
12. True wheel. See 2.9 TRUING LACED WHEELS

**Table 2-9. Spoke Nipple Torque Specification**

| RIM TYPE | MINIMUM TORQUE |
|---|---|
| All | 55 **in-lbs** (6.2 Nm) |

## SPOKE TIGHTNESS

See 1.8 TIRES AND WHEELS.

## INSPECTION

1. Turn the wheel through several rotations.

*NOTE*

*If ABS equipped, keep magnetic base dial indicator as far away from wheel speed sensor and ABS encoder bearing as possible, or damage will occur.*

2. Check end play as follows:
   a. Mount a magnetic base dial indicator to the brake disc. Set the indicator contact point on the end of the axle. See Figure 2-25.
   b. Firmly push the wheel to one side as far as it will go. While pushing on the wheel, zero the dial indicator gauge.
   c. Firmly pull the wheel back as far as it will go. While pulling on the wheel, note the reading of the dial indicator.
   d. Repeat the procedure to verify the reading.
   e. Bearings pass end play inspection if the reading is less than 0.002 in. (0.051 mm).
   f. Replace the bearings if end play exceeds specification, or if there is drag, rough rotation, abnormal noise or anything unusual.

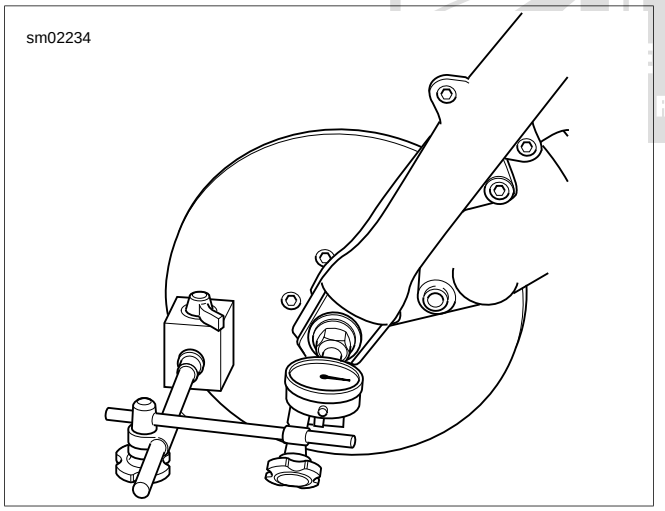
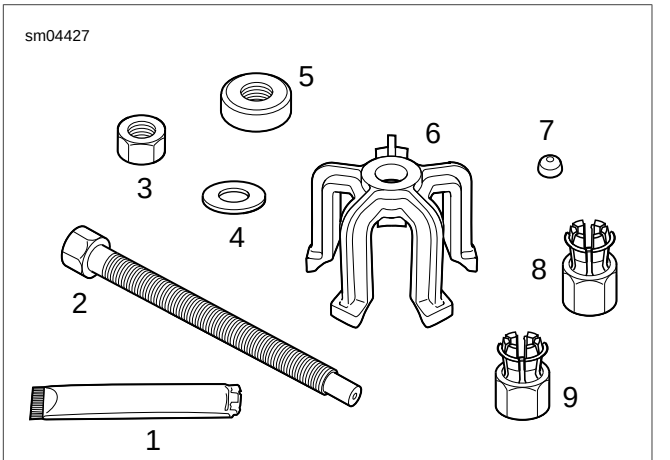



**Figure 2-25. Wheel Bearing Inspection (Front Wheel Shown)**

## REMOVAL

| PART NUMBER | TOOL NAME |
|---|---|
| HD-44060B | WHEEL BEARING REMOVER/INSTALLER |

1. Remove wheel. See 2.3 FRONT WHEEL or 2.4 REAR WHEEL.




1. **Graphite lubricant**
2. **Forcing screw**
3. **Hex nut**
4. **Flat washer**
5. **Nice bearing**
6. **Bridge**
7. **Steel ball**
8. **Standard 25mm collet**
9. **ABS 25mm collet**

**Figure 2-26. Wheel Bearing Remover Tools (HD-44060B)**

**Table 2-10. Primary Brake Disc Side**

| WHEEL | SIDE | VISUAL CUE |
|---|---|---|
| FRONT | LEFT | Side Opposite Valve Stem |
| REAR | RIGHT | Valve Stem Side |

2. If servicing rear wheel, remove compensator sprocket and bowl. See 2.5 REAR WHEEL COMPENSATOR.
3. Obtain the WHEEL BEARING REMOVER/INSTALLER (Part No. HD-44060B). Proceed as follows:
   a. Pick out the wheel bearing remover tools. See Figure 2-26.
   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.
   d. Always remove the bearing from the primary brake disc side of the wheel first. Position wheel accordingly. Refer to Table 2-10.
   e. Select the appropriate 25 mm collet. Pick HD-44060-11 if the motorcycle is ABS equipped, pick HD-44060-10 if it is not.

*NOTE*

*As ABS equipped motorcycles use both a special encoder bearing and a standard bearing in the same hub, two dif-*

*ferent 25 mm collets are required for bearing removal. The ABS encoder bearing is always installed on the primary brake disc side of the wheel. To aid in identification, the outboard side of the ABS encoder bearing is greenish tan in color, while the standard bearing is black.*

f. Install steel ball inside selected collet. Install collet at end of forcing screw.

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

h. Holding hex on forcing screw to prevent rotation, turn hex on collet until lip makes firm contact with inside edge of bearing. See upper frame of Figure 2-27.

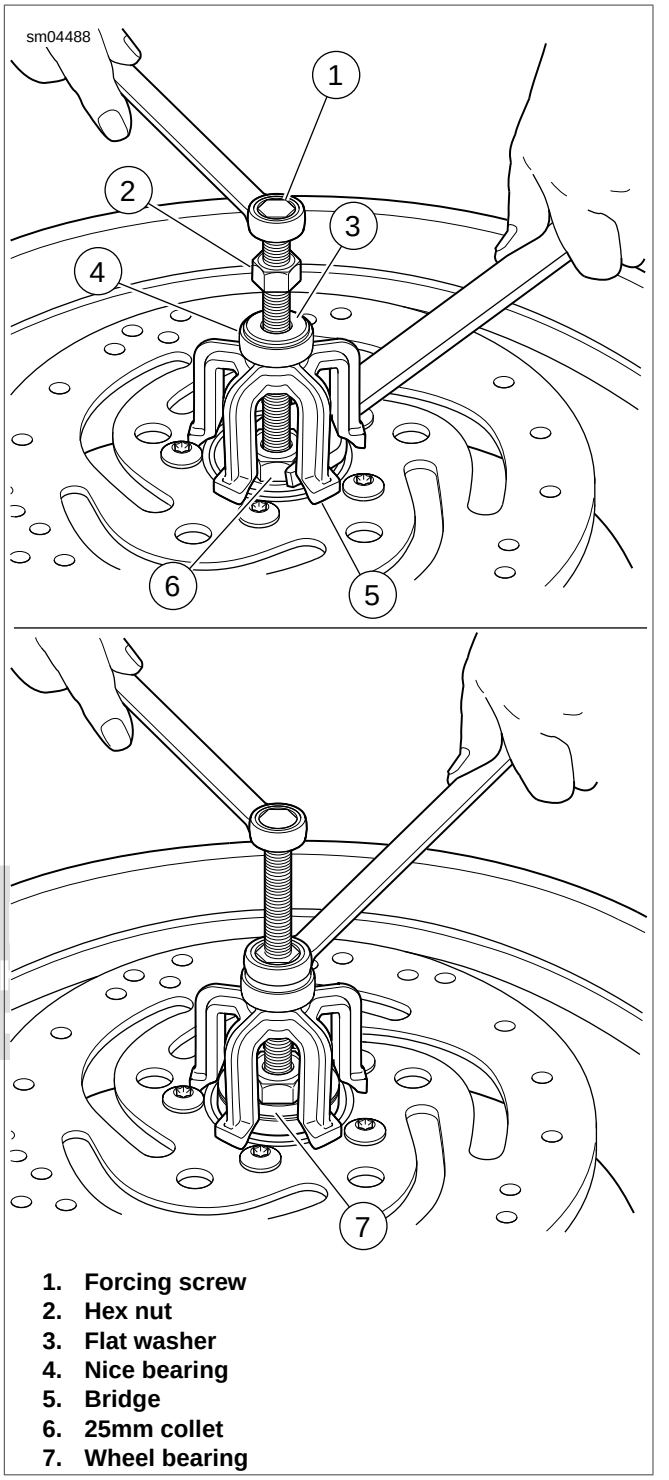
i. Turn hex nut until bearing is free. See lower frame of Figure 2-27. Discard bearing.

j. Remove spacer washer from hub. See Figure 2-28.

k. If ABS encoder bearing was removed from primary brake disc side of wheel, remove ABS collet from forcing screw and install standard collet.

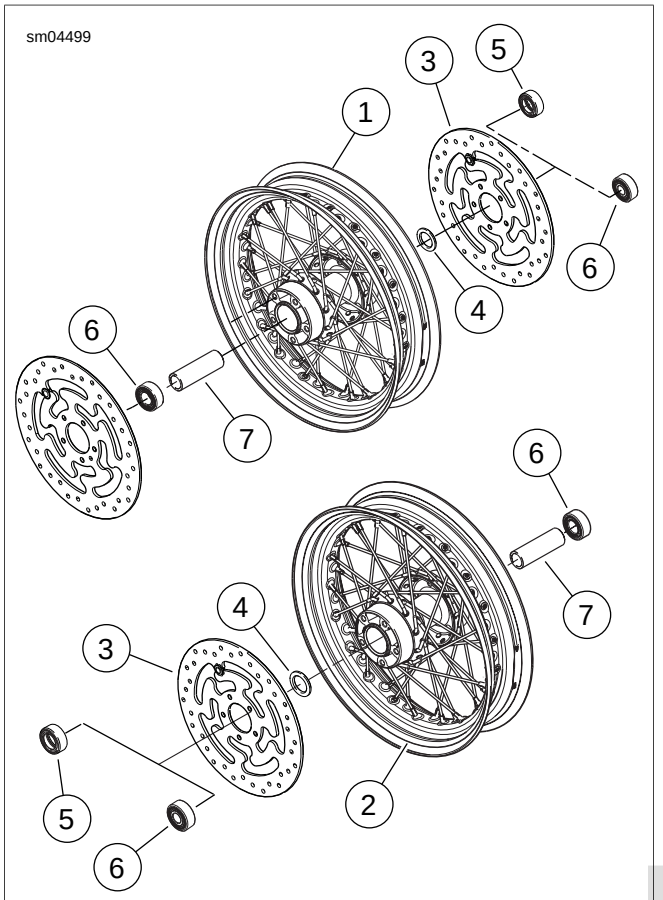
l. Repeat applicable steps to remove standard bearing from opposite side of wheel. Discard bearing.

m. Remove spacer sleeve from hub.




1. **Forcing screw**
2. **Hex nut**
3. **Flat washer**
4. **Nice bearing**
5. **Bridge**
6. **25mm collet**
7. **Wheel bearing**

**Figure 2-27. Remove Wheel Bearings**




1. **Front wheel (left side)**
2. **Rear wheel (right side)**
3. **Brake disc (primary)**
4. **Spacer washer**
5. **ABS encoder bearing**
6. **Standard bearing**
7. **Spacer sleeve**

**Figure 2-28. Wheel Bearing Assemblies**

## INSTALLATION

| PART NUMBER | TOOL NAME |
|---|---|
| HD-44060B | WHEEL BEARING REMOVER/INSTALLER |

*NOTE*

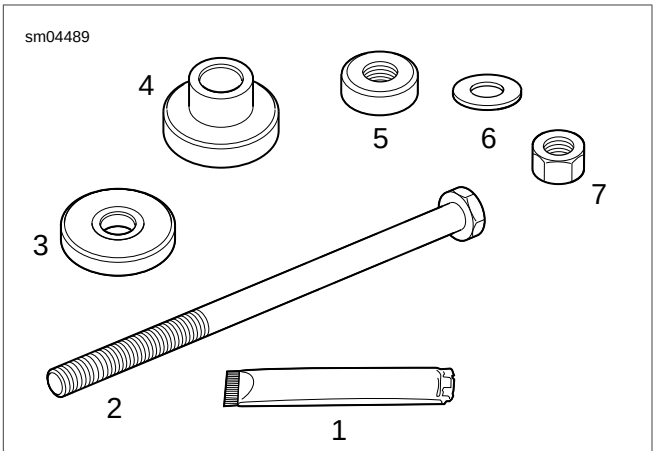
*Always keep ABS encoder bearings away from magnetic fields (such as magnetic parts trays, magnetic base dial indicators, alternator rotors, etc.) or damage will occur.*

1. Obtain two **new** wheel bearings. Always replace bearings as a complete set. Never replace just one bearing.
2. Obtain the WHEEL BEARING REMOVER/INSTALLER (Part No. HD-44060B). Proceed as follows:
   a. Pick out the wheel bearing installer tools. See Figure 2-29.
   b. To prolong service life and ensure smooth operation, sparingly apply graphite lubricant to threads of rod.
   c. Install support plate onto rod.

*NOTE*

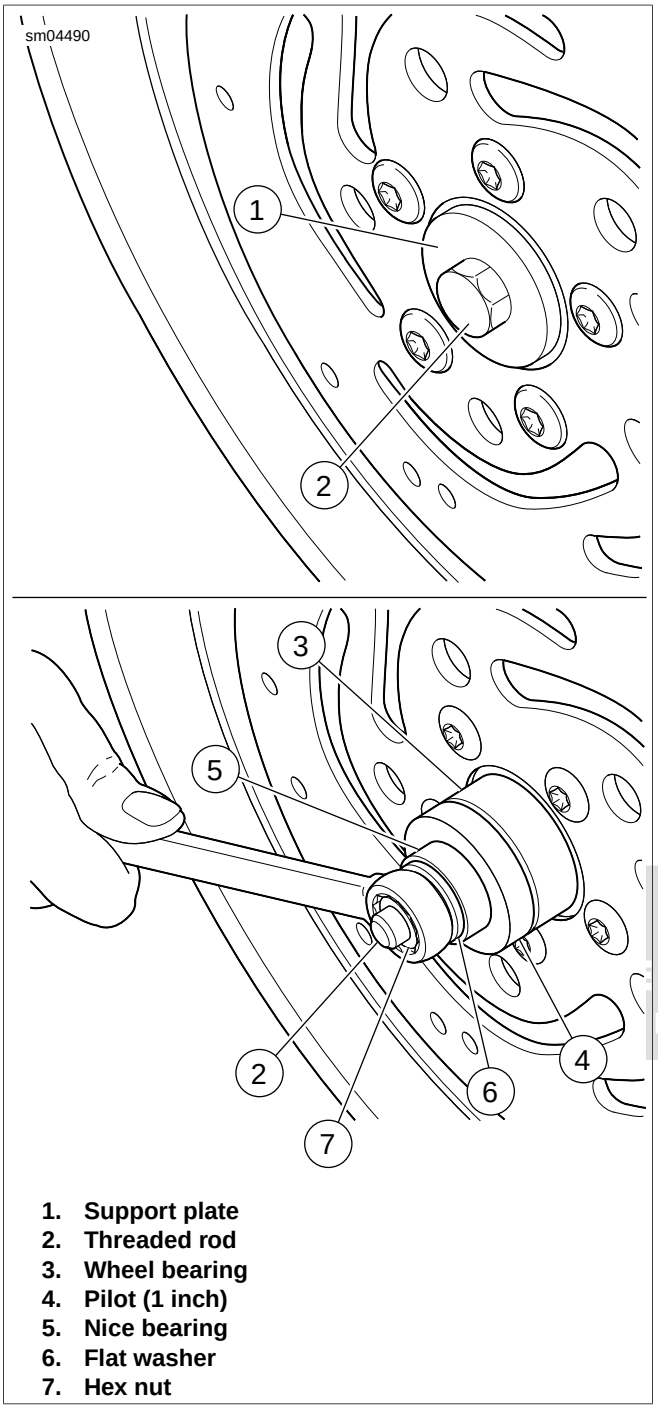
*Always install the bearing on the primary brake disc side of the wheel first. Refer to Table 2-10. On ABS equipped motorcycles, the special encoder bearing is always installed at this location.*

   d. Slide rod through hub, so that threaded end exits the primary brake disc side of the wheel.
   e. Slide spacer washer down rod until seated on counterbore in hub.
   f. If ABS equipped, slide encoder bearing down rod oriented with the red side in and the greenish tan side out. If not ABS equipped, install standard bearing on rod with the lettered side out.
   g. Install 1 inch pilot, Nice bearing, flat washer and hex nut onto rod.
   h. Holding hex on rod to prevent rotation, turn hex nut to install bearing. See upper and lower frames of Figure 2-30. Bearing is fully seated when it makes firm contact with spacer washer.
   i. Disassemble and remove tool, but leave support plate on rod.
   j. Slide rod through installed bearing and hub.
   k. On opposite side of the wheel, slide spacer sleeve down rod until it contacts installed bearing.
   l. Repeat applicable steps to install standard bearing.
3. If servicing rear wheel, install bowl and compensator sprocket. See 2.5 REAR WHEEL COMPENSATOR.
4. Install wheel. See 2.3 FRONT WHEEL or 2.4 REAR WHEEL.




1. **Graphite lubricant**
2. **Threaded rod**
3. **Support plate**
4. **Pilot (1 inch)**
5. **Nice bearing**
6. **Flat washer**
7. **Hex nut**

**Figure 2-29. Wheel Bearing Installer Tools (HD-44060B)**




1. **Support plate**
2. **Threaded rod**
3. **Wheel bearing**
4. **Pilot (1 inch)**
5. **Nice bearing**
6. **Flat washer**
7. **Hex nut**

**Figure 2-30. Install Wheel Bearings**

## GENERAL

The rim must be trued both laterally and radially. If **new** bearings were installed, wheels may be trued with only the bearings and center spacer installed.

## LATERAL TRUING

| PART NUMBER | TOOL NAME |
|---|---|
| HD-94681-80 | SPOKE WRENCH |
| HD-99500-80 | WHEEL TRUING STAND |

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 degrees apart. Tighten the spokes in these four groups finger tight.
2. See Figure 2-31. 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.

*NOTE*

*The primary brake disc side of the hub can be identified by having one or two grooves cut into the disc mounting surface.*

3. Lay a straightedge across primary brake disc mounting surface of hub and one of the marked spoke groups.
4. See Figure 2-32 and Table 2-11. Measure distance "A" from the straightedge to the location as shown.

*NOTES*

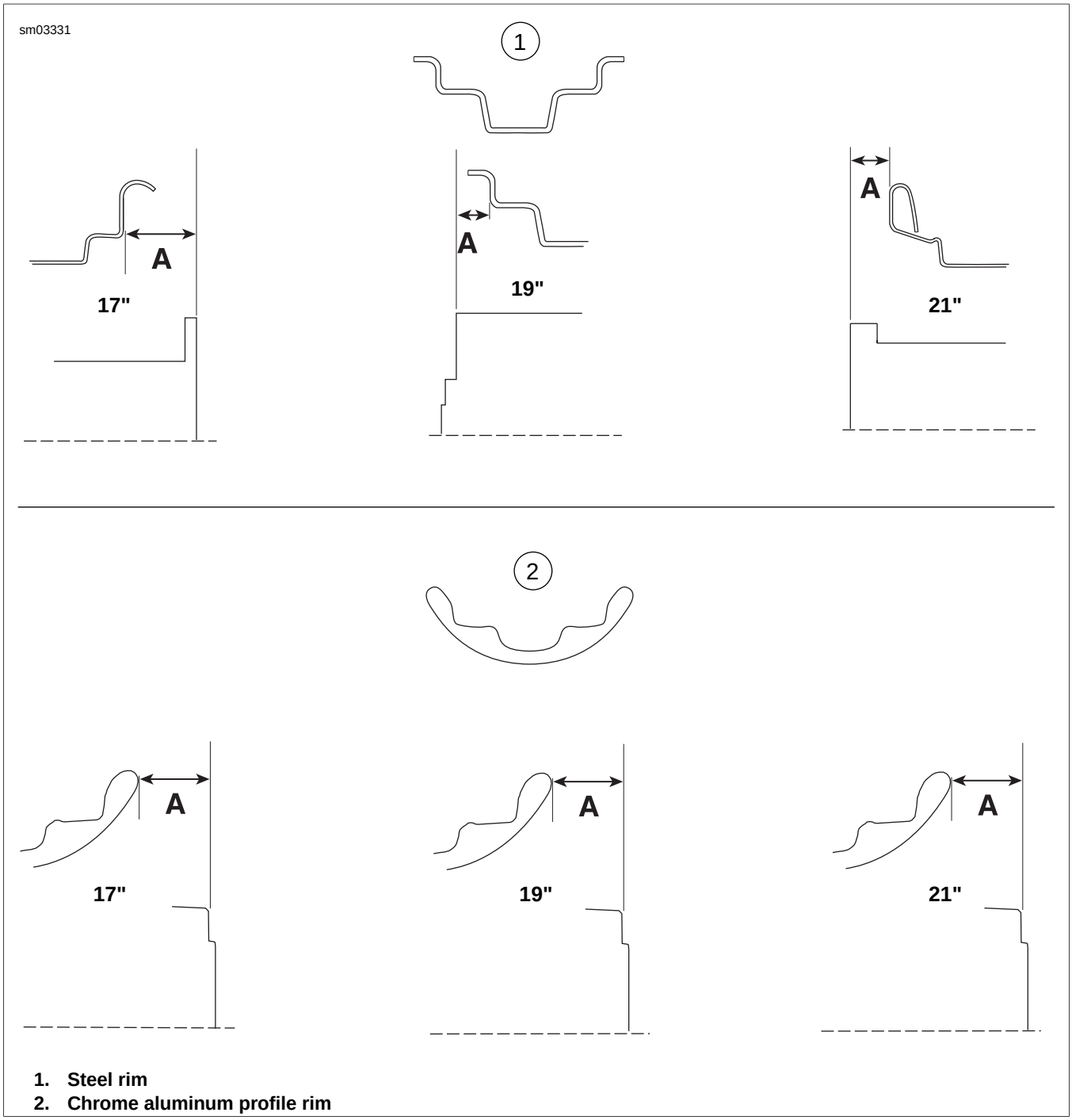
- *Tighten or loosen spoke, one flat at a time, and recheck measurement.*
- *Always loosen the appropriate spokes before tightening the other two. Reversing this procedure will cause the rim to become out-of-round.*

5. If the dimension is not correct, tighten the four spokes accordingly. Use SPOKE WRENCH (Part No. HD-94681-80). 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.
6. Repeat the previous step for all ten groups on the wheel.


**Figure 2-31. Front Wheel Hub Offset Dimension**

**Table 2-11. Laced Wheel Hub Offset Dimensions**

| LACED WHEEL TYPE | WHEEL SIZE | OFFSET (A) | |
|---|---|---|---|
| | | IN. | MM |
| Steel (1) | 17" | 0.615-0.645 | 15.62-16.38 |
| | 19" | 1.135-1.165 | 28.83-29.59 |
| | 21" | 1.525-1.555 | 38.74-39.50 |
| Chrome aluminum profile (2) | 17" | 0.385-0.415 | 9.78-10.54 |
| | 19" | 0.885-0.915 | 22.48-23.24 |
| | 21" | 1.555-1.585 | 39.48-40.26 |




1. **Steel rim**
2. **Chrome aluminum profile rim**

**Figure 2-32. Laced Wheel Hub Offset Dimensions**

## RADIAL TRUING

1. See Figure 2-33. Adjust truing stand gauge to the rim's tire bead seat as shown. The rim should be trued within 0.030 in. (0.76 mm).

*NOTES*

- *Tighten or loosen spoke one flat at a time and recheck measurement.*
- *Always loosen the appropriate spokes before tightening the other two. Reversing this procedure will cause the rim to become out-of-round.*

2. Spin the rim slowly.
   a. 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.
   b. 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.

3. When the wheel is centered and trued, start at the valve hole and tighten the rest of the spoke nipples one turn at a time until they are snug.
4. Seat each spoke head in the hub flange using a flat nose punch and mallet. Then check wheel trueness again and tighten the nipples accordingly.

**⚠WARNING**

**Spokes that are too tight can draw nipples through the rim or distort hub flanges. Spokes that are too loose can continue to loosen when put in service. Either condition can adversely affect stability and handling, which could result in death or serious injury. (00286a)**

5. Verify spokes are tightened to specification listed in Table 2-12.
6. File or grind off ends of spokes protruding through nipples to prevent puncturing tube when tire is mounted.

*NOTE*

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

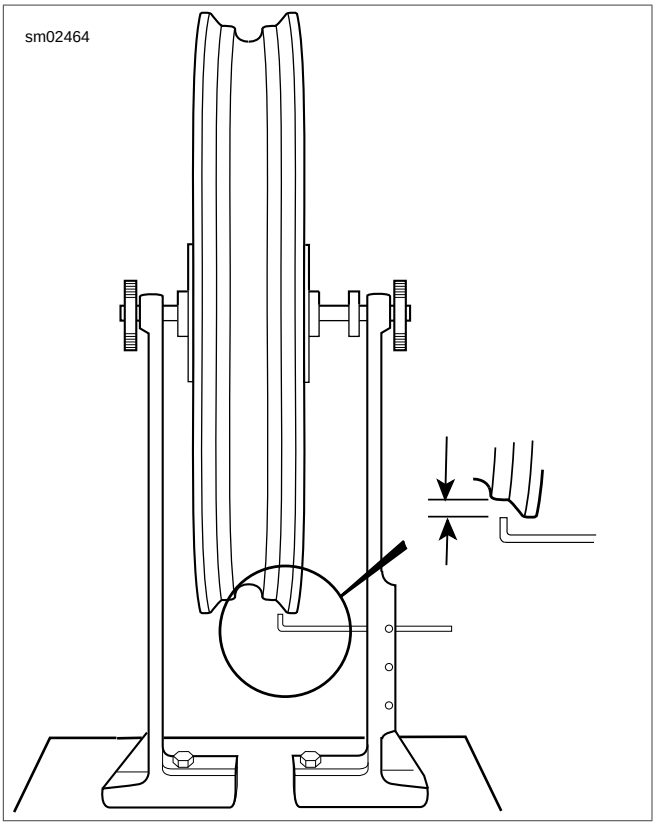



**Figure 2-33. Truing Rim Radially**

**Table 2-12. Spoke Nipple Torque Specification**

| RIM TYPE | MINIMUM TORQUE |
|---|---|
| All | 55 **in-lbs** (6.2 Nm) |

# CHECKING CAST WHEEL RUNOUT 2.10

## GENERAL

The die-cast wheels should be checked for lateral and radial runout before installing a new tire or tube.

## LATERAL RUNOUT

See Figure 2-34. Install arbor in the wheel hub and place wheel in the truing stand. To check rim lateral runout, place a gauge rod or dial indicator near the rim bead. If lateral runout exceeds 0.030 in. (0.76 mm), replace the wheel.

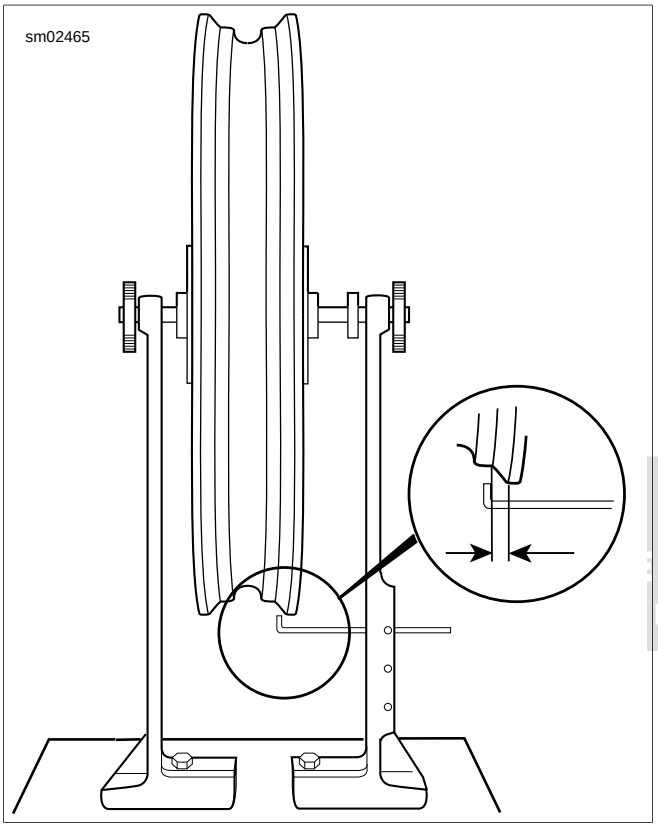
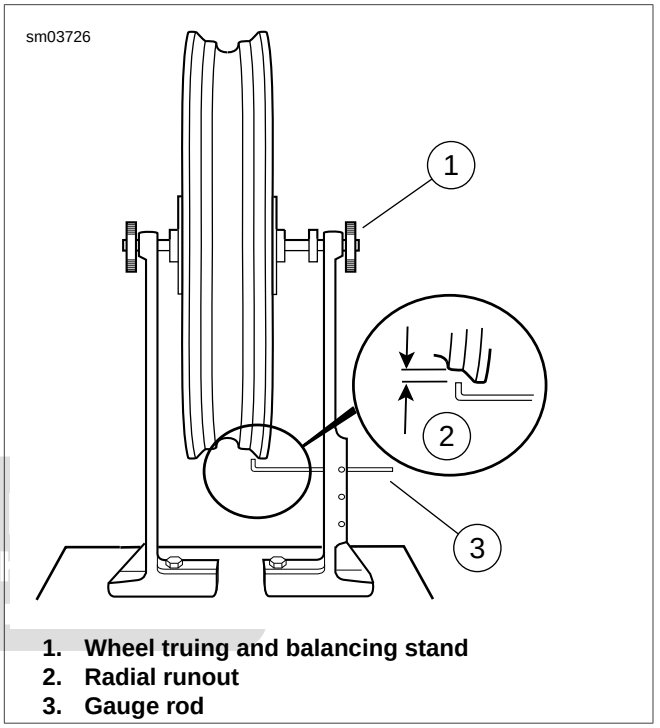



**Figure 2-34. Checking Lateral Runout**

## RADIAL RUNOUT

| PART NUMBER | TOOL NAME |
|---|---|
| HD-99500-80 | WHEEL TRUING AND BALANCING STAND |

See Figure 2-35. Using WHEEL TRUING AND BALANCING STAND (Part No. HD-99500-80), check for radial runout as shown. Replace the wheel if runout exceeds 0.030 in. (0.76 mm).




1. **Wheel truing and balancing stand**
2. **Radial runout**
3. **Gauge rod**

**Figure 2-35. Checking Cast Wheel Radial Runout**

## METHOD A

| PART NUMBER | TOOL NAME |
|---|---|
| HD-46247A | VEHICLE ALIGNMENT TOOL |

**⚠WARNING**

**Check vehicle alignment according to following procedures. Incorrect alignment can adversely affect stability and handling, which could result in death or serious injury. (00287a)**

*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 2.11 VEHICLE ALIGNMENT, 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 2.26 SEAT.
6. Top Engine Mount:
   a. Tighten the two top engine mounting bracket to front cylinder head bolts to 35-40 ft-lbs (48-54 Nm).
   b. Tighten the top stabilizer link eyelet to frame weldment bolt to 18-22 ft-lbs (24-30 Nm).
   c. Loosen both top stabilizer link jam nuts.
   d. Remove the top stabilizer link eyelet to top engine mounting bracket bolt.

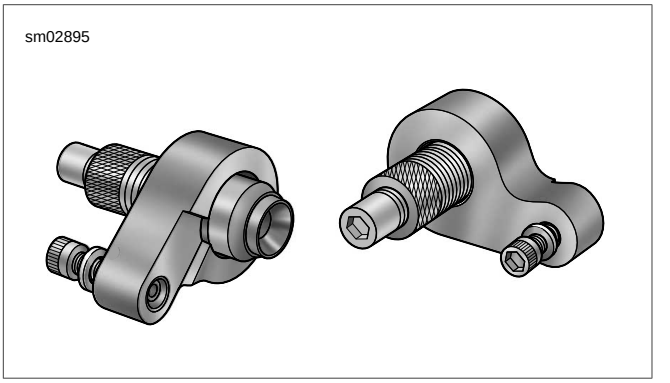
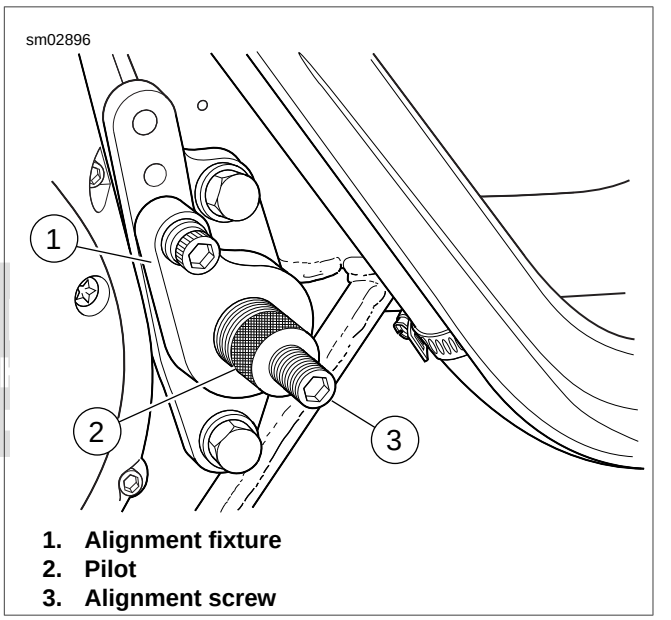



**Figure 2-36. Vehicle Alignment Tool (HD-46247A)**




1. **Alignment fixture**
2. **Pilot**
3. **Alignment screw**

**Figure 2-37. Install Vehicle Alignment Tool (Left Side)**

7. 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 36-40 ft-lbs (49-54 Nm). See (4) of Figure 2-38.
   c. Tighten front stabilizer link eyelet to front engine mounting bracket bolt to 18-22 ft-lbs (24-30 Nm). See (2) of Figure 2-38.
   d. Loosen both front stabilizer link jam nuts. See (3) of Figure 2-38.
   e. Remove front stabilizer link eyelet to frame weldment bolt. See (1) of Figure 2-38.
   f. Remove the front engine mounting bracket to rubber mount bolt (with large and small flat washers and hex nut). See (5) of Figure 2-38.

8. Obtain the VEHICLE ALIGNMENT TOOL (Part No. HD-46247A) and proceed as follows:
   a. Install alignment screws and pilots in appropriate alignment fixtures. See Figure 2-36.

*NOTE*

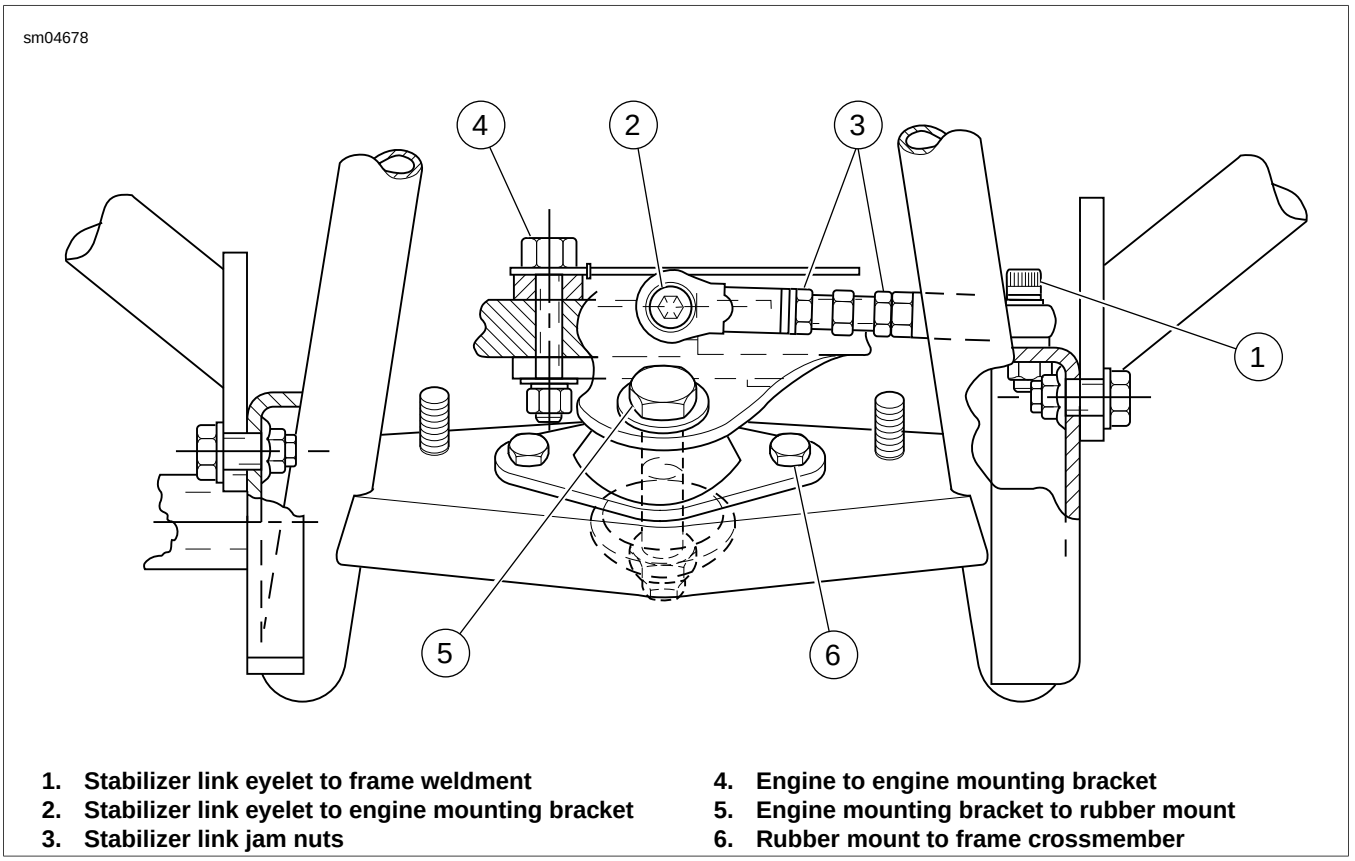
*Be sure to use the alignment fixtures for 2007-08 model motorcycles, Part No's. HD-46247-7 (Left Side) and HD-46247-8 (Right Side).*

   b. Back off alignment screws and pilots so that no contact is made with pivot shaft during initial installation.
   c. Position alignment fixture so that pilot begins to engage hole in rear swingarm bracket and then start 5/16 inch 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. Reliefs allow the right side fixture to be installed without removing the hex screws to the brake hose and exhaust valve actuator cable (HDI) P-clamps.*

   d. 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-lb (24-30 Nm). Repeat step on other side of motorcycle.
   e. Hand turn alignment screw until it bottoms against end of pivot shaft. Repeat step on other side of motorcycle.
   f. Tighten alignment screw to 60-80 **in-lbs** (6.8-9.0 Nm). Repeat step on other side of motorcycle. See Figure 2-37.




**1. Stabilizer link eyelet to frame weldment**
**2. Stabilizer link eyelet to engine mounting bracket**
**3. Stabilizer link jam nuts**
**4. Engine to engine mounting bracket**
**5. Engine mounting bracket to rubber mount**
**6. Rubber mount to frame crossmember**

**Figure 2-38. Front Engine Mount**

9. Adjust each stabilizer link as follows:
   a. Install bolts removed under steps 6(d) and 7(e), and using the center hex to maintain equal thread engagement at both eyelets, adjust stabilizer links so that bolts thread in without any stress or engine movement.
   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.
10. Remove vehicle alignment tool from rear swingarm brackets.
11. Snap the chrome plugs back into the rear swingarm brackets.
12. Install socket screw with lockwasher to fasten passenger footboard to rear swingarm bracket. Tighten screw to 30-35 ft-lbs (40.7-47.5 Nm). Repeat step on other side of motorcycle.

*NOTE*

*If removed or replaced, be sure front rubber mount is installed with the flat plate topside and the larger OD at the bottom. See Figure 2-39.*

13. Verify that front rubber mount is centered under the front engine mounting bracket bolt hole and is free of binding. If centering or relaxation of the rubber mount is required, proceed as follows:
    a. Loosen the two front rubber mount to frame cross-member bolts. See (6) of Figure 2-38.
    b. Push on front rubber mount to center it under the bolt hole. Bounce or wiggle the engine if necessary to unload the front rubber mount and prevent binding.
14. If the front rubber mount passes inspection, proceed as follows:
    a. Tighten the two front rubber mount to frame cross-member bolts to 15-20 ft-lbs (20-27 Nm). See (6) of Figure 2-38.
    b. Install front engine mounting bracket to rubber mount bolt (with large and small flat washers and hex nut) and tighten to 15-20 ft-lbs (20-27 Nm). See (5) of Figure 2-38.
15. Slide voltage regulator over studs on lower frame cross-member. Install flange locknuts on studs and tighten to 70-100 **in-lbs** (7.9-11.3 Nm).

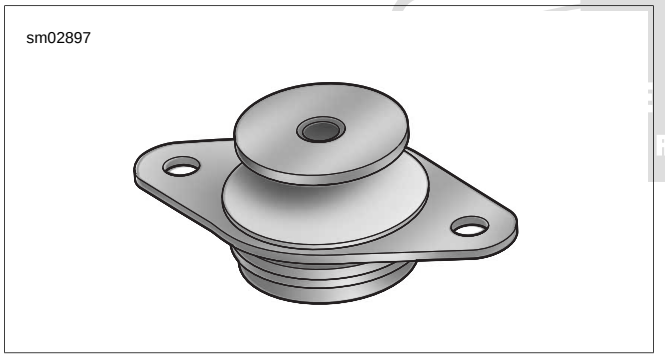



**Figure 2-39. Front Rubber Mount Orientation**

16. Verify **minimum clearance** between the powertrain and the following components:
    a. Inner Primary Chaincase to Passenger Footboard Bracket: 0.190 in. (4.8 mm).
    b. Inner Primary Chaincase to Frame (at Engine Crank) 0.190 in. (4.8 mm).
    c. Horn Bracket to Fuel Tank: 0.375 in. (9.5 mm).
    d. Top Engine Mounting Bracket to Frame: 0.190 in. (4.8 mm).
    e. Front Rocker Cover to Fuel Tank: 0.375 in. (9.5 mm).
    f. Rear Rocker Cover to Fuel Tank: 0.375 in. (9.5 mm).
    g. Rear Rocker Cover to Frame: 0.375 in. (9.5 mm).
    h. Perform the procedure under Method B to troubleshoot clearance problems and to identify offending component(s).
17. Install seat. See 2.26 SEAT.
18. Test ride the motorcycle.

*NOTE*

*Vehicle leads that require more than 2-lbs pull to correct need further diagnosis. Perform the procedure under 2.11 VEHICLE ALIGNMENT, Method B.*

## METHOD B

| PART NUMBER | TOOL NAME |
|---|---|
| HD-46247A | VEHICLE ALIGNMENT TOOL |

**⚠WARNING**

**Check vehicle alignment according to following procedures. Incorrect alignment can adversely affect stability and handling, which could result in death or serious injury. (00287a)**

*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 (Part No. HD-46247A) 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 2.11 VEHICLE ALIGNMENT, 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 2.26 SEAT.
6. Top Engine Mount:
    a. Tighten the two top engine mounting bracket to front cylinder head bolts to 35-40 ft-lbs (48-54 Nm).
    b. Tighten the top stabilizer link eyelet to frame weldment bolt to 18-22 ft-lbs (24-30 Nm).
    c. Loosen both top stabilizer link jam nuts.
    d. Remove the top stabilizer link eyelet to top engine mounting bracket bolt.

7. 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 36-40 ft-lbs (49-54 Nm). See (4) of Figure 2-38.
   c. Tighten front stabilizer link eyelet to frame weldment bolt to 18-22 ft-lbs (24-30 Nm). See (1) of Figure 2-38.
   d. Tighten front stabilizer link eyelet to front engine mounting bracket bolt to 18-22 ft-lbs (24-30 Nm). See (2) of Figure 2-38.
   e. Remove the front engine mounting bracket to rubber mount bolt (with large and small flat washers and hex nut). See (5) of Figure 2-38.

*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.*

8. To verify alignment, install alignment bars or other suitable device on both the left and right side of motorcycle. Proceed as follows:
   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 8(d). Measurements from left to right should be equal +/- 0.030 in. (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 in. (0.76 mm). See Figure 2-40.

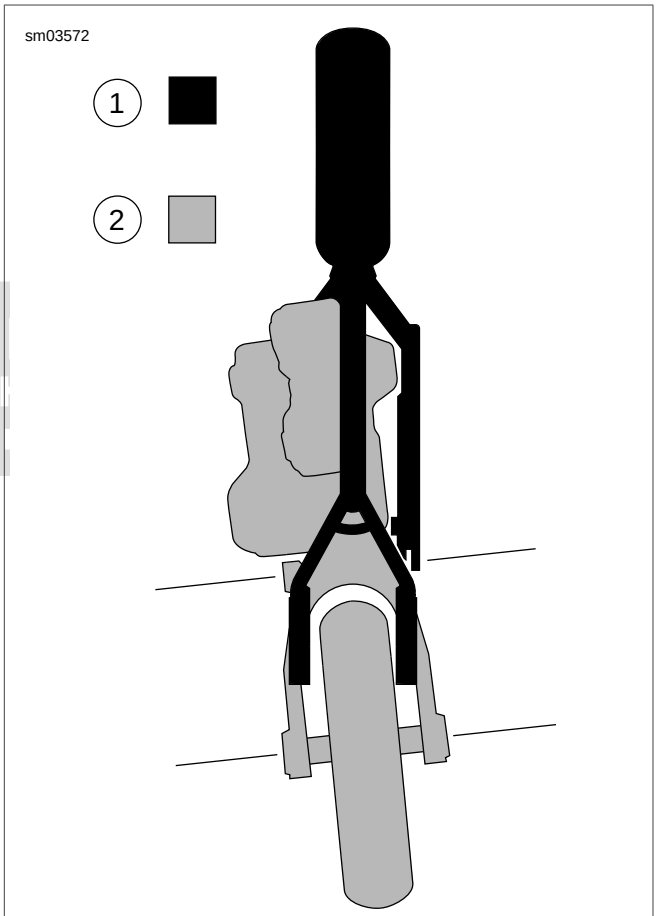
*NOTE*

*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.

9. Verify that front rubber mount is centered under the front engine mounting bracket bolt hole and is free of binding. If centering or relaxation of the rubber mount is required, proceed as follows:
   a. Loosen the two front rubber mount to frame crossmember bolts. See (6) of Figure 2-38.
   b. Push on front rubber mount to center it under the bolt hole. Bounce or wiggle the engine if necessary to unload the front rubber mount and prevent binding.

10. If the front rubber mount passes inspection, proceed as follows:
   a. Tighten the two front rubber mount to frame crossmember bolts to 15-20 ft-lbs (20-27 Nm). See (6) of Figure 2-38.
   b. Install front engine mounting bracket to rubber mount bolt (with large and small flat washers and hex nut) and tighten to 15-20 ft-lbs (20-27 Nm). See (5) of Figure 2-38.

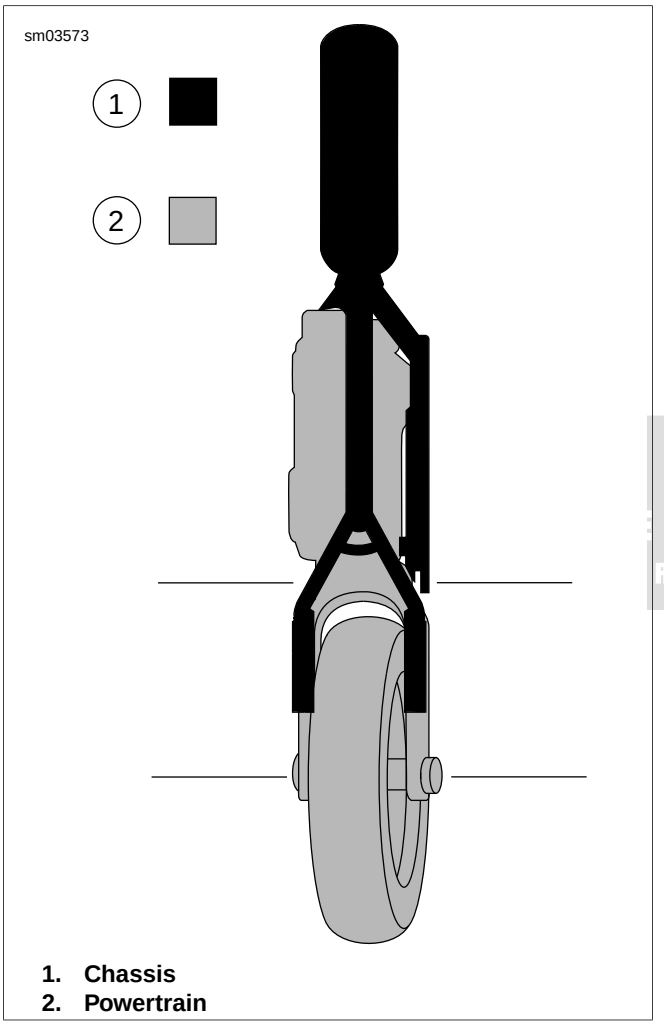



**1. Chassis**
**2. Powertrain**

**Figure 2-40. Horizontally Misaligned**

11. Slide voltage regulator over studs on lower frame crossmember. Install flange locknuts on studs and tighten to 70-100 **in-lbs** (7.9-11.3 Nm).

12. 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 6(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).
    c. Holding the top stabilizer link adjuster and mounting eyelets to prevent movement or binding, tighten both jam nuts.
13. Lower motorcycle to floor and remove hydraulic center stand or blocking.




1. **Chassis**
2. **Powertrain**

**Figure 2-41. Vertically Misaligned**

14. After verifying that the motorcycle is level, check vertical alignment placing an inclinometer on both front and rear brake discs. 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. 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 2.11 VEHICLE ALIGNMENT, Inspection.
15. Remove the alignment bars from both the left and right side of the motorcycle.
16. Snap the chrome plugs back into the rear swingarm brackets.
17. Install socket screw with lockwasher to fasten passenger footboard to rear swingarm bracket. Tighten screw to 30-35 ft-lbs (40.7-47.5 Nm). Repeat step on other side of motorcycle.
18. Verify **minimum clearance** between the powertrain and the following components:
    a. Inner Primary Chaincase to Passenger Footboard Bracket: 0.190 in. (4.8 mm).
    b. Inner Primary Chaincase to Frame (at Engine Crank) 0.190 in. (4.8 mm).
    c. Horn Bracket to Fuel Tank: 0.375 in. (9.5 mm).
    d. Top Engine Mounting Bracket to Frame: 0.190 in. (4.8 mm).
    e. Front Rocker Cover to Fuel Tank: 0.375 in. (9.5 mm).
    f. Rear Rocker Cover to Fuel Tank: 0.375 in. (9.5 mm).
    g. Rear Rocker Cover to Frame: 0.375 in. (9.5 mm).
19. Install seat. See 2.26 SEAT.
20. Test ride the motorcycle.

*NOTE*

*Vehicle leads that require more than 2-lbs pull to correct need further diagnosis. See 2.11 VEHICLE ALIGNMENT, Inspection.*

## INSPECTION

See 1.2 MAINTENANCE SCHEDULE for the required service interval. Perform inspection sooner if there are abnormal handling characteristics/vibrations or any sag in the powertrain.

### 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 in. (0.64 mm) of play or wear.

## GENERAL

**CAUTION**

**Do not allow dirt or debris to enter the master cylinder reservoir. Dirt or debris in the reservoir can cause improper operation and equipment damage. (00205c)**

**⚠CAUTION**

**Direct contact of D.O.T. 4 brake fluid with eyes can cause irritation. Avoid eye contact. In case of eye contact flush with large amounts of water and get medical attention. Swallowing large amounts of D.O.T. 4 brake fluid can cause digestive discomfort. If swallowed, obtain medical attention. Use in well ventilated area. KEEP OUT OF REACH OF CHILDREN. (00240a)**

**CAUTION**

**D.O.T. 4 brake fluid will damage painted and body panel surfaces it comes in contact with. Always use caution and protect surfaces from spills whenever brake work is performed. Failure to comply can result in cosmetic damage. (00239b)**

*NOTE*

*Immediately wipe up any brake fluid spillage with a clean, dry, soft cloth. Follow up by thoroughly wiping affected area with a clean, damp, soft cloth (small spills) or washing with a large quantity of soapy water (large spills).*

## REMOVAL AND DISASSEMBLY

### Removal

1. Resting motorcycle on jiffy stand, turn front wheel toward the left fork stop until the master cylinder reservoir is level.
2. To prevent dirt and other contaminants from entering the master cylinder reservoir, thoroughly clean the cover before removal.
3. Remove two screws to release cover from master cylinder reservoir.

*NOTE*

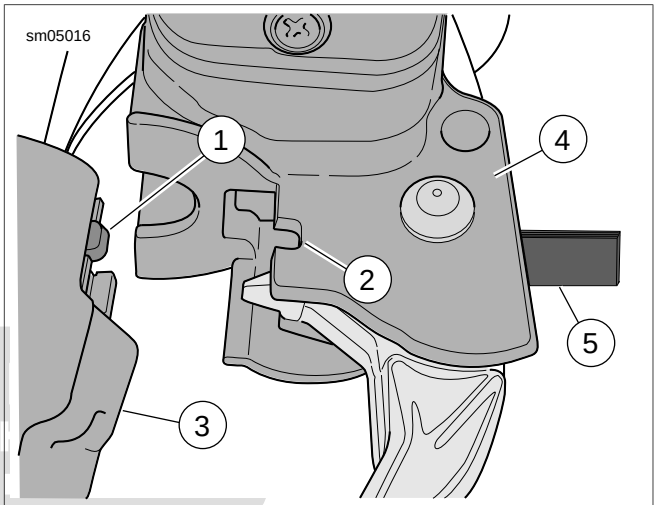
*Wrap banjo fitting with piece of shop towel to absorb any loss of brake fluid.*

4. Remove banjo bolt to release brake line from master cylinder reservoir. Hold suitable container under banjo bolt bore to allow reservoir to drain. Discard copper washers.
5. Using a clean shop cloth, wipe out any remaining fluid in the master cylinder reservoir.

**CAUTION**

**Do not remove or install the master cylinder assembly without first positioning a 5/32-inch (4 mm) thick insert between the brake lever and lever bracket. Removing or installing the master cylinder assembly without the insert in place may result in damage to the rubber boot and plunger on the front stoplight switch. (00324a)**

6. Place cardboard insert between brake lever and lever bracket. Use the eyelet of a small cable strap if the cardboard insert is not available.
7. Remove two screws to release handlebar clamp from master cylinder reservoir. Remove clamp and master cylinder reservoir/brake lever assembly from handlebar. See Figure 2-42.
8. Remove cardboard insert between brake lever and lever bracket.
9. Remove retaining ring from pivot pin groove at bottom of brake lever bracket. Discard retaining ring.
10. Remove pivot pin and brake lever from brake lever bracket.




1. **Tab**
2. **Groove**
3. **Switch housing assembly**
4. **Brake lever bracket**
5. **Cardboard insert**

**Figure 2-42. Remove Master Cylinder/Brake Lever Assembly**

### Disassembly

*NOTE*

*Exercise care to avoid scratching or nicking banjo sealing surface during handling. Damage to the sealing surface requires replacement of the master cylinder reservoir.*

1. Pull dust boot (with pushrod) from piston bore. Remove dust boot from pushrod. See Figure 2-43.
2. Remove retaining ring from groove in piston bore. As the piston assembly is spring loaded, hold parts together as retaining ring is removed.
3. Pull piston assembly from piston bore.

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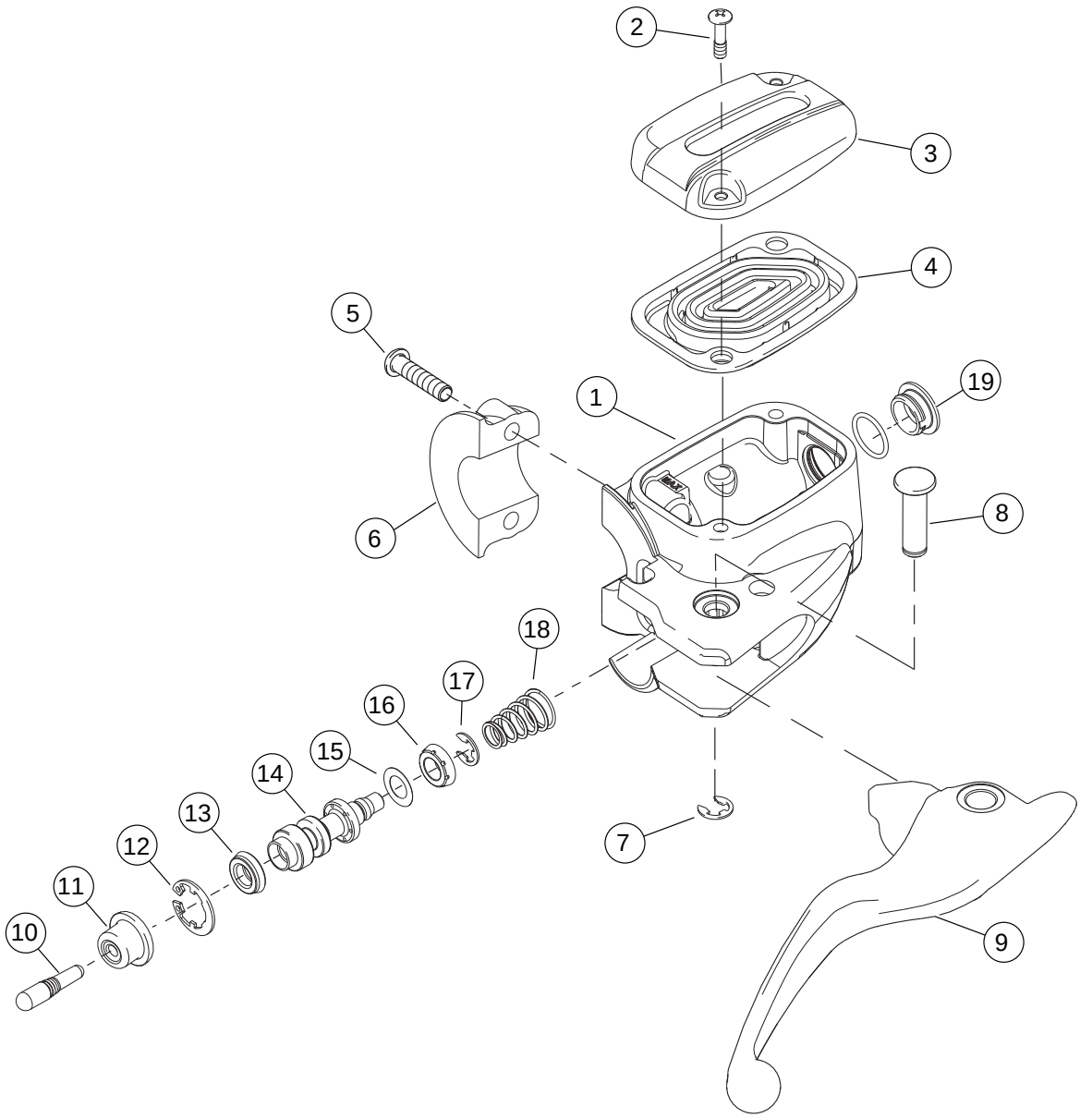



1. Master cylinder reservoir
2. Cover screw (2)
3. Cover
4. Gasket
5. Clamp screw (2)
6. Handlebar clamp
7. Retaining ring
8. Pivot pin
9. Brake hand lever
10. Pushrod
11. Dust boot
12. Retaining ring
13. Secondary seal
14. Piston
15. Flat washer
16. Primary seal
17. E-clip
18. Spring
19. Sight glass/O-ring

**Figure 2-43. Front Brake Master Cylinder Assembly**

## CLEANING AND INSPECTION

**WARNING**

**Use denatured alcohol to clean brake system components. Do not use mineral-based solvents (such as gasoline or paint thinner), which will deteriorate rubber parts even after assembly. Deterioration of these components can cause brake failure, which could result in death or serious injury. (00291a)**

**WARNING**

**Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)**

1. Clean all parts with denatured alcohol. Wipe dry with a clean, lint free cloth.
2. Inspect banjo seating surface for scratches or nicks.
3. Verify that reservoir is completely free of dust, dirt or residue.
4. Using a clean air supply, blow out piston bore and other drilled passages. Do not use a wire or similar instrument.
5. Inspect piston bore for scratches, nicks, scoring, pitting, corrosion or other damage.
6. Inspect retaining ring for wear or distortion. Inspect retaining ring groove for damage.
7. Inspect spring for stretching, distortion, kinks, cracks or broken coils.
8. Inspect piston seals, dust boot and reservoir cover gasket for cuts, tears or general deterioration.

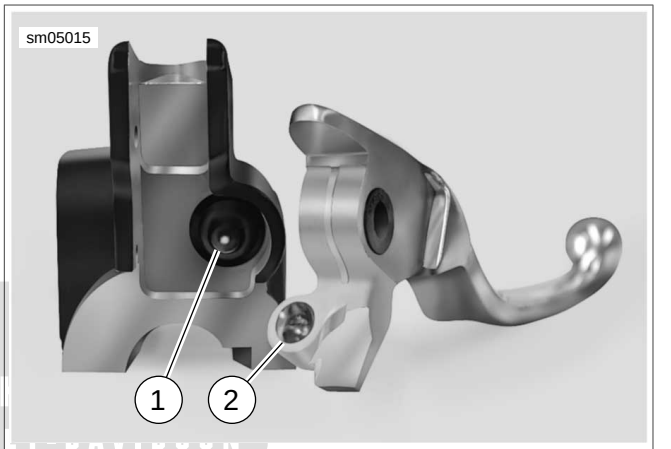
## ASSEMBLY AND INSTALLATION

### Assembly

1. Lightly lubricate piston bore and OD of piston seals with D.O.T. 4 brake fluid.
2. Insert spring end of piston assembly into piston bore.
3. While pushing on piston to compress spring, install retaining ring in groove of piston bore (with the flat side in). Verify that retaining ring is completely seated in groove.
4. Install dust boot onto pushrod, so that ID on tapered end engages groove in pushrod.
5. Install dust boot into piston bore fitting ball end of pushrod into piston socket. Verify that collar on OD of dust boot is inboard of lip in piston bore.

### Installation

1. Place dab of G-40M grease (HD Part No. 42820-04) into pocket of hand lever. See Figure 2-44.
2. Align hole in brake hand lever with hole in brake lever bracket. Slide pivot pin through brake lever bracket and hand lever.
3. Install **new** retaining ring in pivot pin groove. Verify that retaining ring is completely seated in groove.
4. Place cardboard insert between brake lever and brake lever bracket. Use the eyelet of an ordinary cable strap if the cardboard insert is not available.
5. Position brake lever/master cylinder reservoir assembly inboard of switch housing assembly engaging tab on lower switch housing in groove at top of brake lever bracket.
6. Align holes in handlebar clamp with those in master cylinder reservoir and start two screws (with flat washers). Position for rider comfort. Beginning with the top screw, tighten screws to 72-80 **in-lbs** (8-9 Nm).
7. Start banjo bolt (with **new** copper washers) to secure brake line to master cylinder reservoir.
8. Tighten banjo bolt to master cylinder to 13-15 ft-lbs (17.6-20.3 Nm).
9. Fill and bleed brake system. See 1.14 BLEEDING BRAKES.




1. **Pushrod**
2. **Lever pocket**

**Figure 2-44. Apply Grease to Lever Pocket**

## FRONT BRAKE LINE

### Removal

1. **FLHR/C:**
   a. Remove right side headlamp nacelle. See 2.45 HEADLAMP NACELLE: FLHR/C.
   b. Cut cable strap to release right handlebar switch conduit and brake hose from right handlebar riser. See Figure 2-45.
   c. Carefully cut cable strap to release front fender tip lamp wires from left brake caliper hose. See Figure 2-46.

2. **FLHX, FLHT/C/U:**
   a. Remove outer fairing and fairing cap. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U and 2.36 FAIRING CAP: FLHX, FLHT/C/U, respectively.
   b. Just outboard of fairing cap opening, cut cable strap to release right handlebar switch conduit and brake line from right handlebar.
   c. Carefully cut cable strap to release front fender tip lamp wires from left brake caliper hose. See Figure 2-46.
3. **FLTR:**
   a. Remove right side instrument nacelle. See 2.41 INSTRUMENT NACELLE: FLTR.
   b. If present, remove hex screw to release P-clip from front right side of upper fork bracket. Remove P-clip from brake line.
4. Remove screw at bottom of lower fork bracket to release front brake line bracket.
5. Resting motorcycle on jiffy stand, turn front wheel toward the left fork stop until the master cylinder reservoir is level.
6. To prevent dirt and other contaminants from entering the master cylinder reservoir, thoroughly clean the cover before removal.
7. Remove two screws to release cover from master cylinder reservoir.

*NOTE*

*Wrap banjo fittings with pieces of shop towel to absorb any loss of brake fluid.*

8. Remove banjo bolt to release brake line from master cylinder reservoir. Hold suitable container under banjo bolt bore to allow reservoir to drain. Discard copper washers.
9. Using a clean shop cloth, wipe out any remaining fluid in the master cylinder reservoir.
10. Remove banjo bleeder bolt to disconnect brake line from left brake caliper. Discard copper washers. Repeat step to release brake line from right brake caliper.
11. Remove front brake line from motorcycle.

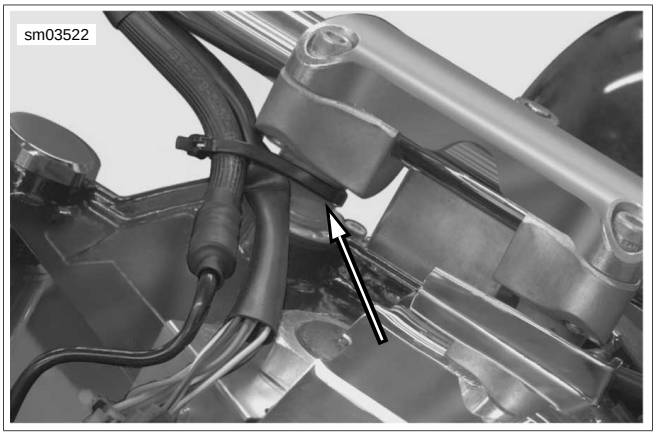



**Figure 2-45. Capture Brake Hose and Right Handlebar Riser (FLHR/C)**

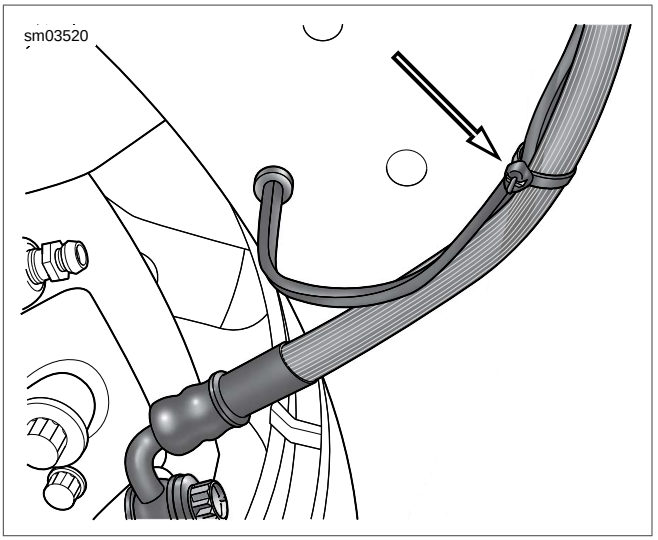



**Figure 2-46. Capture Brake Hose and Front Fender Tip Lamp Wires**

## Installation

1. Position the front brake line bracket at the bottom of the lower fork bracket, so that single brake line runs up along the front right side of the fork brackets before turning to follow the bottom of the right handlebar to the master cylinder reservoir.
2. Align larger hole in front brake line bracket with threaded boss at bottom of lower fork bracket. Start screw into threaded boss. Verify that brake lines to the front brake calipers, as viewed at the rear of the lower fork bracket, are equal distance from the left and right fork sliders, and then tighten screw until snug.
3. Start banjo bolt (with **new** copper washers) to secure brake line to master cylinder reservoir.
4. Start banjo bleeder bolts (with **new** copper washers) to secure brake lines to both left and right brake calipers.
5. Tighten banjo bolt to master cylinder reservoir to 13-15 ft-lbs (17.6-20.3 Nm).
6. Tighten banjo bleeder bolts to brake calipers to 17-19 ft-lbs (23.1-25.8 Nm).
7. Tighten screw at bottom of lower fork bracket to 120-180 **in-lbs** (13.6-20.3 Nm).
8. Fill and bleed brake system. See 1.14 BLEEDING BRAKES.
9. **FLHR/C:**
   a. Install **new** cable strap to secure right handlebar switch conduit and brake hose to right handlebar riser. See Figure 2-45.
   b. Install right side headlamp nacelle. See 2.45 HEADLAMP NACELLE: FLHR/C.
   c. Install **new** cable strap to secure front fender tip lamp wires to left brake caliper hose. See Figure 2-46.

10. **FLHX, FLHT/C/U:**
    a. Just outboard of fairing cap opening, install **new** cable strap to secure right handlebar switch conduit and brake line to right handlebar.
    b. Install fairing cap and outer fairing. See 2.36 FAIRING CAP: FLHX, FLHT/C/U and 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U, respectively.
    c. Install **new** cable strap to secure front fender tip lamp wires to left brake caliper hose. See Figure 2-46.
11. **FLTR:**
    a. If present, capture brake line in P-clip. Install hex screw to fasten P-clip to front right side of upper fork bracket.
    b. Install right side instrument nacelle. See 2.41 INSTRUMENT NACELLE: FLTR.

## REMOVAL

*NOTE*

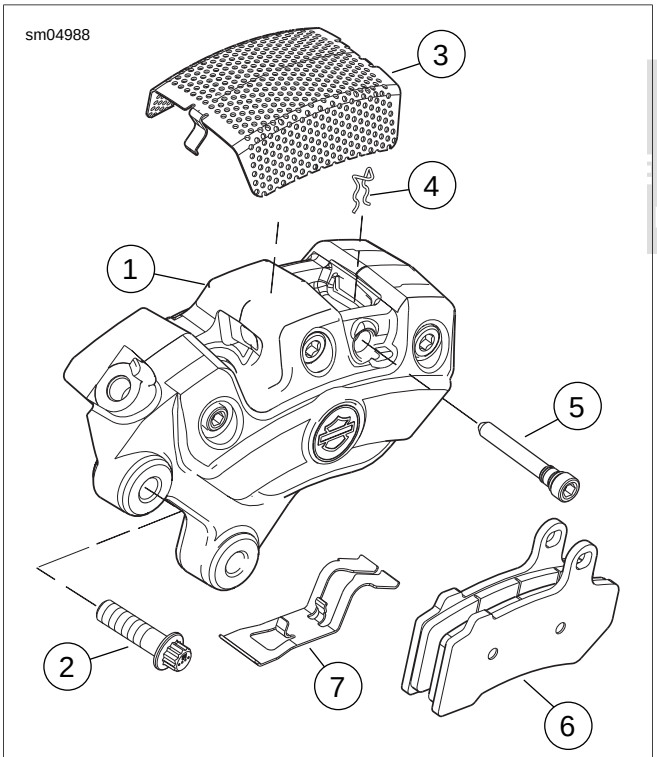
*If only replacing brake pads, see 1.15 BRAKE PADS AND DISCS.*

1. Remove banjo bleeder bolt to release brake line to caliper. Discard copper washers.

*NOTE*

*Wrap banjo fitting with piece of shop towel to absorb any loss of brake fluid.*

2. **Left side caliper of ABS equipped motorcycles only:** Release front wheel speed sensor cable from clip as follows:
   a. Push on lip at rear of clip to disengage from bracket.
   b. Rotate tab (stamped ABS) rearward until clip is perpendicular to bracket and remove cable.
3. Remove two caliper mounting screws (with front wheel speed sensor cable clip/bracket if left side caliper of ABS equipped motorcycle). Remove caliper from brake disc. See Figure 2-47.




1. **Caliper**
2. **Caliper mounting screw**
3. **Screen**
4. **Retaining clip**
5. **Pad pin**
6. **Brake pads**
7. **Pad spring**

**Figure 2-47. Front Brake Caliper Assembly**

## INSTALLATION

1. If necessary, assemble caliper installing pad spring, brake pads, pad pin, retaining clip and screen. See 1.15 BRAKE PADS AND DISCS.
2. Slide caliper onto brake disc, so that holes are aligned with lugs on fork slider.
3. Start two mounting screws (with cable clip/bracket if left side caliper on ABS equipped motorcycle), and alternately tighten to 28-38 ft-lbs (37.9-51.5 Nm)
4. **Left side caliper of ABS equipped motorcycles only:** Install front wheel speed sensor cable into clip as follows:
   a. Rotate tab (stamped ABS) until clip is perpendicular to bracket and install cable.
   b. Rotate tab forward until clip is inline with bracket and then apply pressure to tab until lip engages. Gently pull on cable to verify that clip is properly installed.
5. Start banjo bleeder bolt (with **new** copper washers) to secure brake line to caliper. Tighten bolt to 17-19 ft-lbs (23.1-25.8 Nm).

*NOTE*

*When replacing or installing the bleeder valve, remove the o-ring from the bleeder valve groove or bore and discard. The o-ring is required only for brake bleeding at the factory. Although not sold separately, it may be present in certain assemblies as currently sold. If care is not taken to remove and discard the o-ring, it may become lodged in the banjo bleeder bolt bore during bleeder valve installation and prevent proper torquing or sealing.*

6. Fill and bleed brake system. See 1.14 BLEEDING BRAKES.

## GENERAL

**CAUTION**

**Do not allow dirt or debris to enter the master cylinder reservoir. Dirt or debris in the reservoir can cause improper operation and equipment damage. (00205c)**

**⚠CAUTION**

**Direct contact of D.O.T. 4 brake fluid with eyes can cause irritation. Avoid eye contact. In case of eye contact flush with large amounts of water and get medical attention. Swallowing large amounts of D.O.T. 4 brake fluid can cause digestive discomfort. If swallowed, obtain medical attention. Use in well ventilated area. KEEP OUT OF REACH OF CHILDREN. (00240a)**

**CAUTION**

**D.O.T. 4 brake fluid will damage painted and body panel surfaces it comes in contact with. Always use caution and protect surfaces from spills whenever brake work is performed. Failure to comply can result in cosmetic damage. (00239b)**

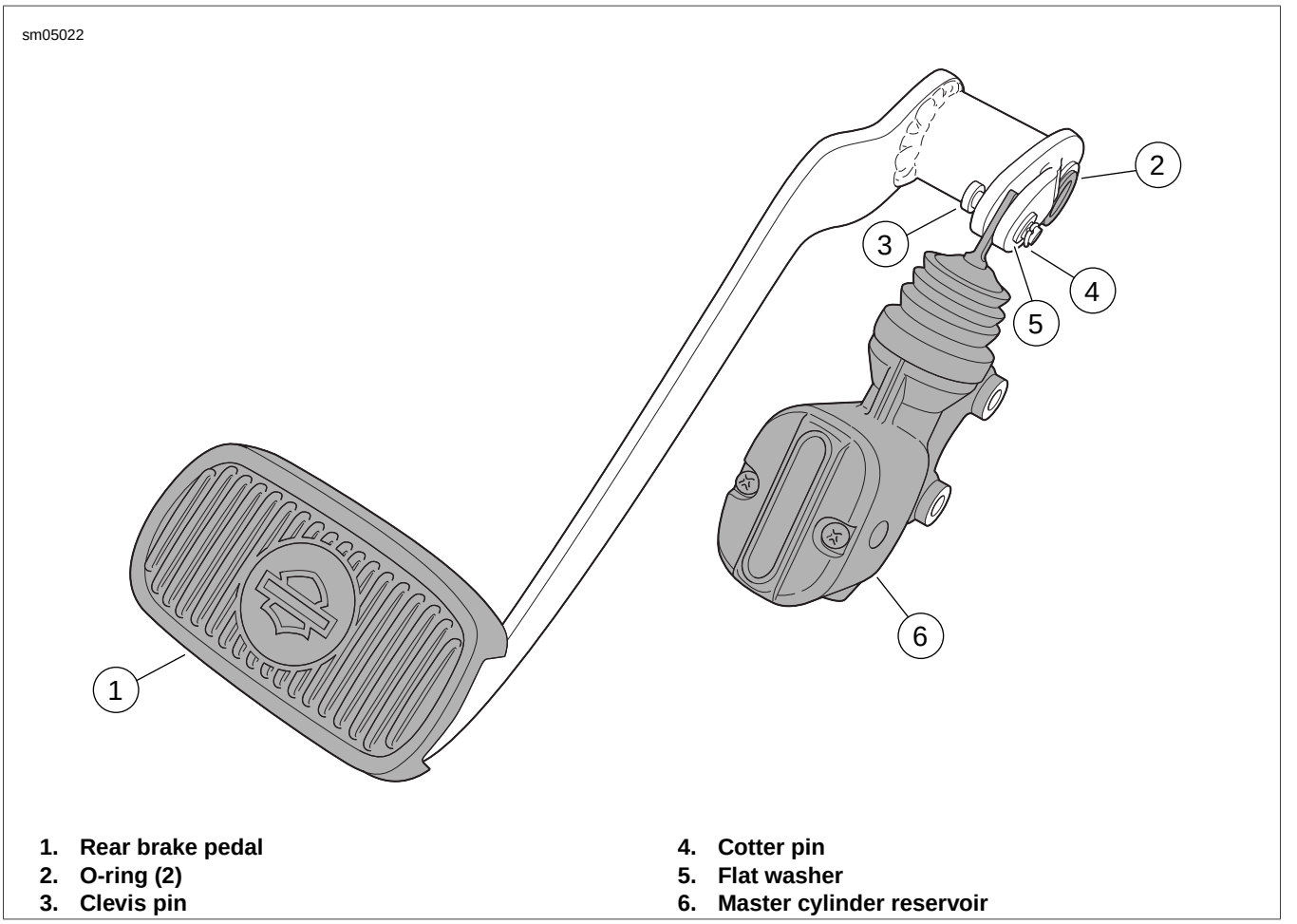
*NOTE*

*Immediately wipe up any brake fluid spillage with a clean, dry, soft cloth. Follow up by thoroughly wiping affected area with a clean, damp, soft cloth (small spills) or washing with a large quantity of soapy water (large spills).*

## REMOVAL AND DISASSEMBLY

### Removal

1. Remove right fairing lower, if present. See 2.34 LOWER FAIRING AND ENGINE GUARD.
2. Remove right side rider footboard. See 2.49 FOOTBOARDS AND FOOTRESTS.
3. Stand motorcycle upright, so that rear master cylinder reservoir is level.
4. To prevent dirt and other contaminants from entering the master cylinder reservoir, thoroughly clean the cover before removal.
5. Remove two screws to release cover from master cylinder reservoir.




1. **Rear brake pedal**
2. **O-ring (2)**
3. **Clevis pin**
4. **Cotter pin**
5. **Flat washer**
6. **Master cylinder reservoir**

**Figure 2-48. Rear Master Cylinder/Brake Pedal Assembly**

*NOTE*

*Wrap banjo fitting with piece of shop towel to absorb any loss of brake fluid.*

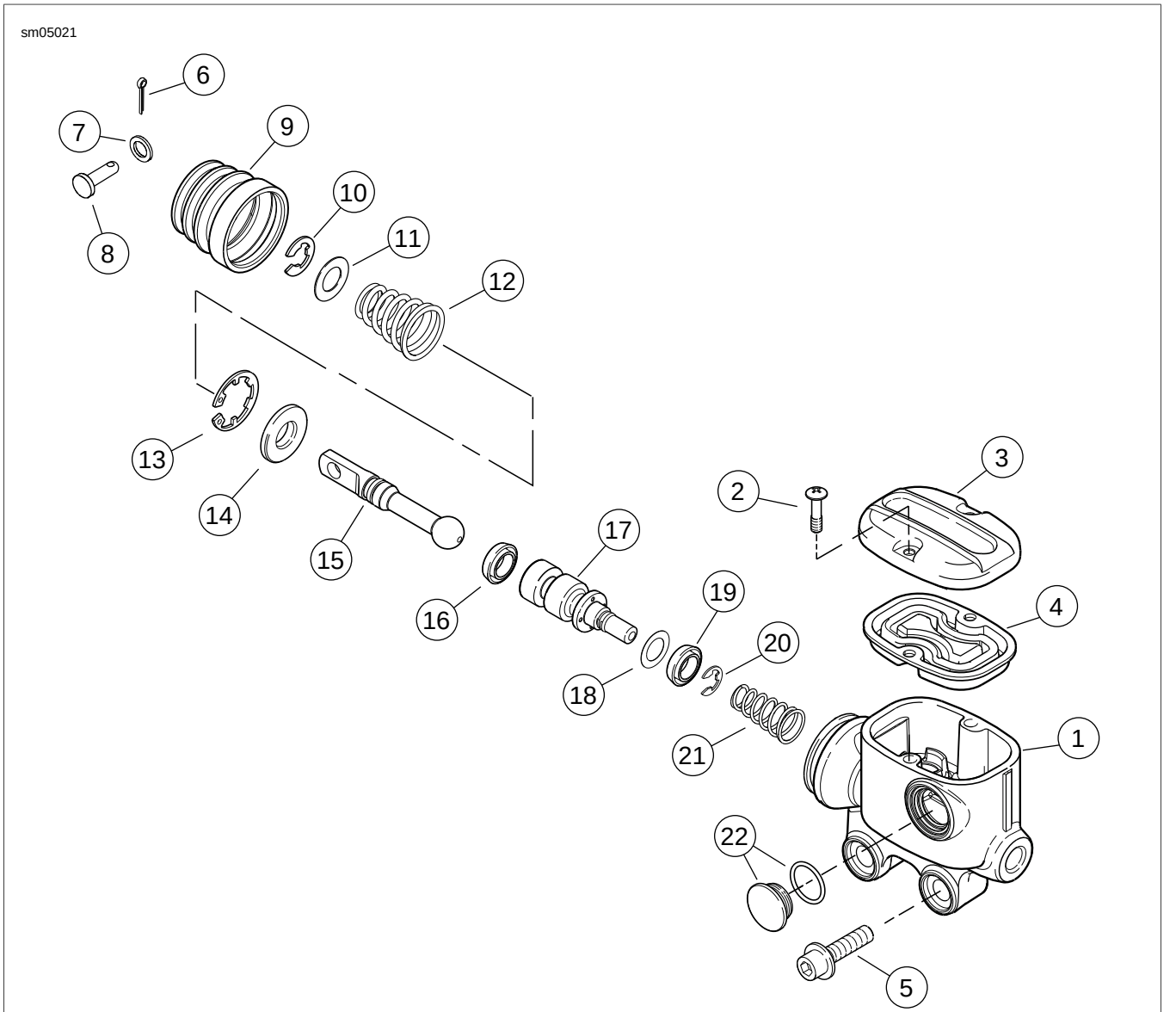
6. Remove banjo bolt to release brake line from master cylinder reservoir. Hold suitable container under banjo bolt bore to allow reservoir to drain. Discard copper washers.
7. Using a clean shop cloth, wipe out any remaining fluid in the master cylinder reservoir.
8. Remove two screws to release master cylinder from frame weldment.
9. Remove locknut with flat washer and pull brake pedal/master cylinder assembly from pedal shaft. Remove and discard O-ring on each side of brake pedal shaft bore.
10. Remove cotter pin and flat washer from clevis pin. Remove clevis pin to separate master cylinder assembly from brake pedal flange. See Figure 2-48.

## Disassembly

*NOTE*

*Exercise care to avoid scratching or nicking banjo sealing surface during handling. Damage to the sealing surface requires replacement of the master cylinder reservoir.*

1. Remove dust boot from reservoir pulling it over slotted end of pushrod. See Figure 2-49.
2. Pushing down on flat washer to compress pedal return spring, remove E-clip from groove in pushrod, and then carefully release spring.
3. Remove flat washer and pedal return spring from pushrod.
4. Remove retaining ring from groove in piston bore. As the piston assembly is also spring loaded, hold parts together as retaining ring is removed.
5. Remove pushrod and special washer.
6. Pull piston assembly from piston bore.




1. **Master cylinder reservoir**
2. **Cover screw (2)**
3. **Cover**
4. **Gasket**
5. **Screw (2)**
6. **Cotter pin**
7. **Flat washer**
8. **Clevis pin**
9. **Dust boot**
10. **E-clip**
11. **Flat washer**
12. **Pedal return spring**
13. **Retaining ring**
14. **Special washer**
15. **Pushrod**
16. **Secondary seal**
17. **Piston**
18. **Flat washer**
19. **Primary seal**
20. **E-clip**
21. **Spring**
22. **Sight glass/O-ring**

**Figure 2-49. Rear Brake Master Cylinder Assembly**

## CLEANING AND INSPECTION

**WARNING**

**Use denatured alcohol to clean brake system components. Do not use mineral-based solvents (such as gasoline or paint thinner), which will deteriorate rubber parts even after assembly. Deterioration of these components can cause brake failure, which could result in death or serious injury. (00291a)**

**WARNING**

**Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)**

1. Clean all parts with denatured alcohol. Wipe dry with a clean, lint free cloth.
2. Inspect banjo seating surface for scratches or nicks.
3. Verify that reservoir is completely free of dust, dirt or residue.
4. Using a clean air supply, blow out piston bore and other drilled passages. Do not use a wire or similar instrument.
5. Inspect piston bore for scratches, nicks, scoring, pitting, corrosion or other damage.
6. Inspect retaining ring and E-clip for wear or distortion. Inspect retaining ring and E-clip grooves for damage.
7. Inspect springs for stretching, distortion, kinks, cracks or broken coils.
8. Inspect piston seals, dust boot and reservoir cover gasket for cuts, tears or general deterioration.

## ASSEMBLY AND INSTALLATION

### Assembly

1. Lightly lubricate piston bore and OD of piston seals with D.O.T. 4 brake fluid.
2. Insert spring end of piston assembly into piston bore.
3. Slide special washer and retaining ring over pushrod. Collar on ID of special washer should face slotted end of pushrod, while flat side of retaining ring should face ball end.
4. Fitting ball end of pushrod into piston socket, compress spring and install retaining ring in groove of piston bore. Verify that retaining ring is completely seated in groove.
5. Slide pedal return spring over pushrod until larger diameter coil is seated on retaining ring in piston bore.
6. Slide flat washer over pushrod until seated on smaller diameter coil of pedal return spring.
7. Using a suitable spring compressor, compress pedal return spring and install E-clip in inboard groove of pushrod.
8. Slide open end of dust boot over pushrod and onto reservoir until ID on closed end is captured in outboard groove of pushrod.

### Installation

1. Install master cylinder assembly onto brake pedal flange. Install clevis pin from the outboard side. Install flat washer and cotter pin on clevis pin.
2. Apply a light coat of Wheel Bearing Grease (HD Part No. 99855-89) to the brake pedal shaft and bore. Install **new** O-ring on each side of bore.
3. Install brake pedal/master cylinder assembly on the pedal shaft. Install flat washer and **new** locknut on pedal shaft.
4. Install two screws to fasten master cylinder to frame weldment. Alternately tighten screws to 10.5-12.5 ft-lbs (14-17 Nm).
5. Tighten brake pedal shaft locknut to 15-20 ft-lbs (20-27 Nm).
6. Start banjo bolt (with new copper washers) to secure brake line to master cylinder reservoir. Tighten banjo bolt to 13-15 ft-lbs (17.6-20.3 Nm).
7. Fill and bleed brake system. See 1.14 BLEEDING BRAKES.
8. Install right side rider footboard. See 2.49 FOOTBOARDS AND FOOTRESTS.

## REAR BRAKE LINE

### Removal

1. Remove right side saddlebag. See 2.27 SADDLEBAGS.
2. Remove right side cover.
3. Remove right fairing lower, if present. See 2.34 LOWER FAIRING AND ENGINE GUARD.
4. Remove right side rider footboard. See 2.49 FOOTBOARDS AND FOOTRESTS.
5. Cut cable straps to free rear brake line from two rubber saddles anchored on T-studs at top of lower frame tube. See Figure 2-50.
6. Remove hex screw to free brake hose P-clamp from rear swingarm bracket.
7. Remove socket terminals from rear brake light switch spade contacts. Cut cable strap to free rear brake light switch wires from lower frame tube, if necessary.
8. Remove hex screw to free brake light switch bracket from frame weldment. Push on bracket to release locating tab from slot in frame weldment.
9. Open two cable clips on rear swingarm T-studs. Free rear brake line hose from cable clips.

*NOTE*

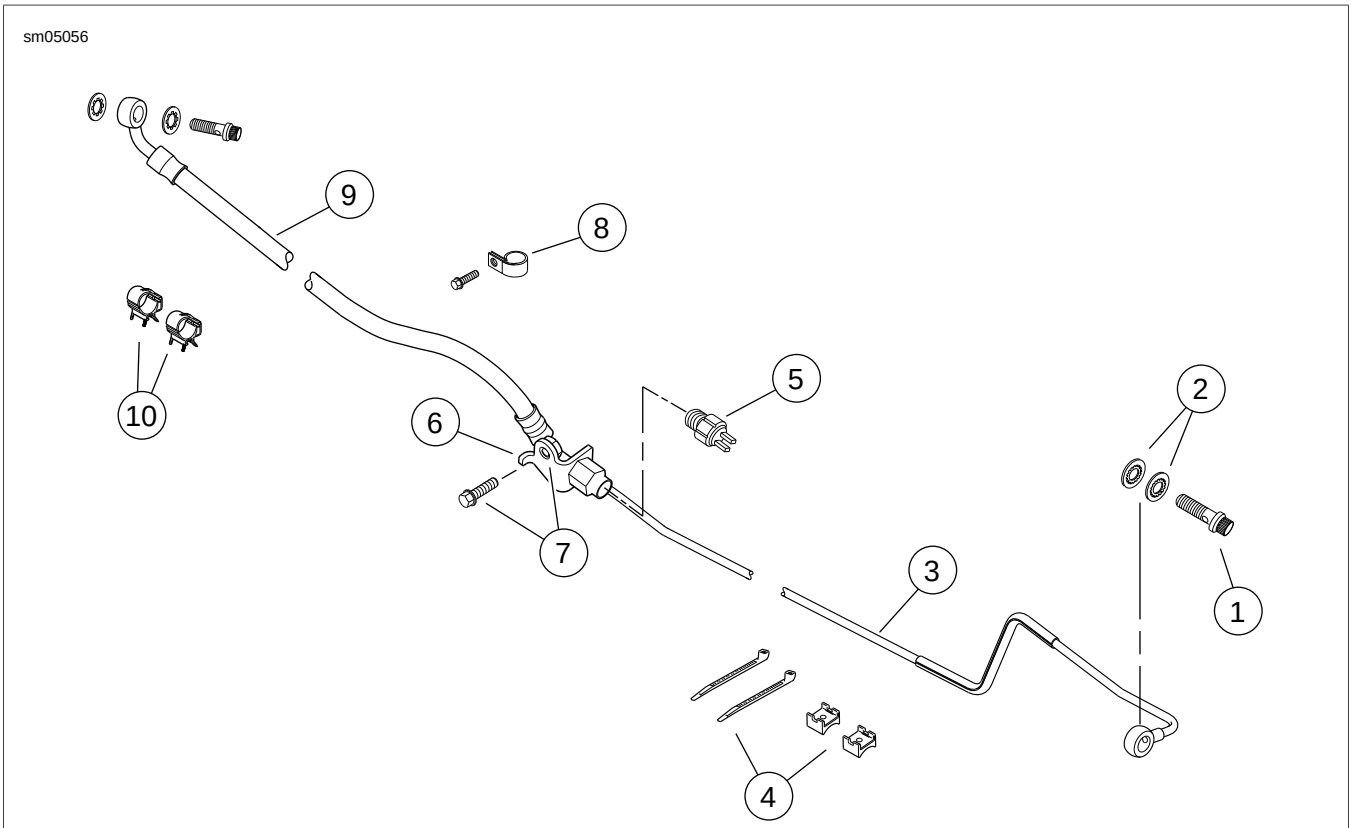
*For best results, insert blade of small screwdriver into gap at side of clip and gently rotate end of screwdriver to pop open.*

10. Stand motorcycle upright, so that rear master cylinder reservoir is level.
11. To prevent dirt and other contaminants from entering the master cylinder reservoir, thoroughly clean the cover before removal.
12. Remove two screws to release cover from master cylinder reservoir.

*NOTE*

*Wrap banjo fittings with pieces of shop towel to absorb any loss of brake fluid.*

13. Remove banjo bolt to release brake line from master cylinder reservoir. Hold suitable container under banjo bolt bore to allow reservoir to drain. Discard copper washers.
14. Using a clean shop cloth, wipe out any remaining fluid in the master cylinder reservoir.
15. Remove two screws to release master cylinder from frame weldment.
16. Remove locknut with flat washer and pull brake pedal/master cylinder assembly from pedal shaft. Remove and discard O-ring on each side of brake pedal shaft bore.
17. Remove banjo bolt to release brake line from rear brake caliper. Discard copper washers.
18. Feed rear brake line hose forward to area in front of rear swingarm bracket. Remove rear brake line from motorcycle.




1. **Banjo bolt**
2. **Copper washers**
3. **Brake line tube**
4. **Rubber saddles and cable straps**
5. **Rear brake light switch**
6. **Locating tab**
7. **Screw and weld nut**
8. **P-clamp and screw**
9. **Brake line hose**
10. **Cable clips**

**Figure 2-50. Rear Brake Line Assembly**

## Installation

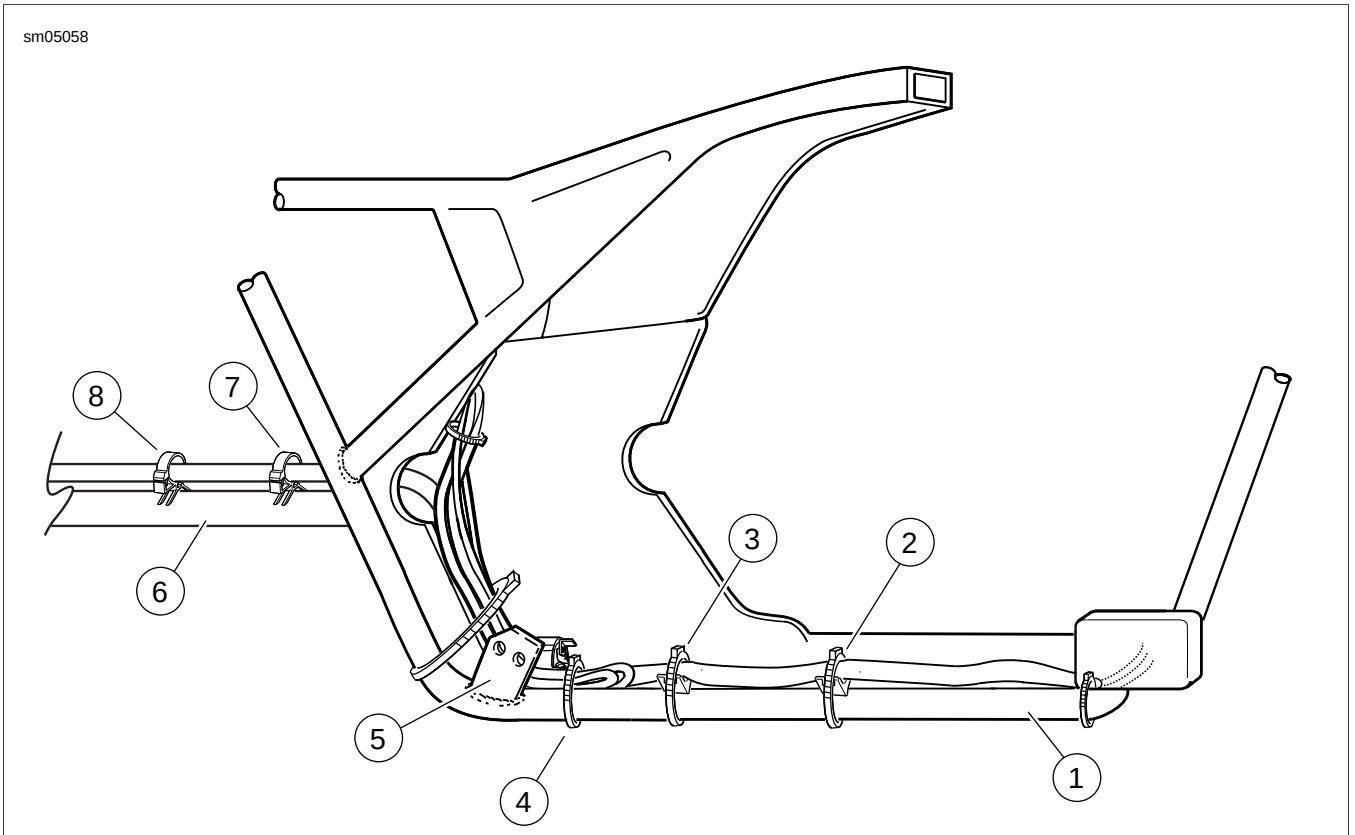
1. Place rear brake line into approximate position along top of lower right frame tube. From area in front of rear swingarm bracket, feed brake line hose rearward following top of rear swingarm.
2. Start banjo bolt (with **new** copper washers) to secure brake line to caliper.
3. Capture rear brake line hose in two cable clips on rear swingarm T-studs. Snap cable clips closed. See Figure 2-51.
4. Index locating tab on brake light switch bracket in slot of frame weldment. Install hex screw to secure brake light switch bracket to frame weldment.
5. Install socket terminals onto rear brake light switch spade contacts. If removed, install **new** cable strap to secure rear brake light switch wires (and main harness conduit) to lower frame tube.
6. Install hex screw to secure brake hose P-clamp to rear swingarm bracket. Tighten screw to 35-45 **in-lbs** (4.0-5.1 Nm).
7. Seat rear brake line on two rubber saddles anchored on T-studs at top of lower frame tube. Engaging slots in rubber saddles, install **new** cable straps capturing rear

brake line, main harness conduit and lower frame tube. Cut any excess cable strap material.

*NOTE*

*Replace rubber saddles if damaged, deteriorated or missing. With the slotted side up, push hole in rubber saddle over T-stud to install.*

8. Move front section of brake line (with rubber sleeve) inboard of frame weldment at bottom of front frame downtube.
9. Apply a light coat of Wheel Bearing Grease (HD Part No. 99855-89) to the brake pedal shaft and bore. Install **new** O-ring on each side of bore.
10. Install brake pedal/master cylinder assembly on the pedal shaft. Install flat washer and **new** locknut on pedal shaft.
11. Install two screws to fasten master cylinder to frame weldment. Alternately tighten screws to 10.5-12.5 ft-lbs (14-17 Nm).
12. Tighten brake pedal shaft locknut to 15-20 ft-lbs (20-27 Nm).
13. Start banjo bolt (with new copper washers) to secure brake line to master cylinder reservoir. Tighten banjo bolt to 13-15 ft-lbs (17.6-20.3 Nm).
14. Tighten banjo bolt to brake caliper to 17-19 ft-lbs (23.1-25.8 Nm).
15. Fill and bleed brake system. See 1.14 BLEEDING BRAKES.
16. Install right side rider footboard. See 2.49 FOOTBOARDS AND FOOTRESTS.
17. Install right fairing lower, if present. See 2.34 LOWER FAIRING AND ENGINE GUARD.
18. Install right side cover.
19. Install right side saddlebag. See 2.27 SADDLEBAGS.




1. **Lower frame tube**
2. **1st saddle with cable strap**
3. **2nd saddle with cable strap**
4. **Cable strap**
5. **Frame weldment**
6. **Rear swingarm**
7. **1st cable clip**
8. **2nd cable clip**

**Figure 2-51. Rear Brake Line Routing (Right Side View)**

## REMOVAL

*NOTE*

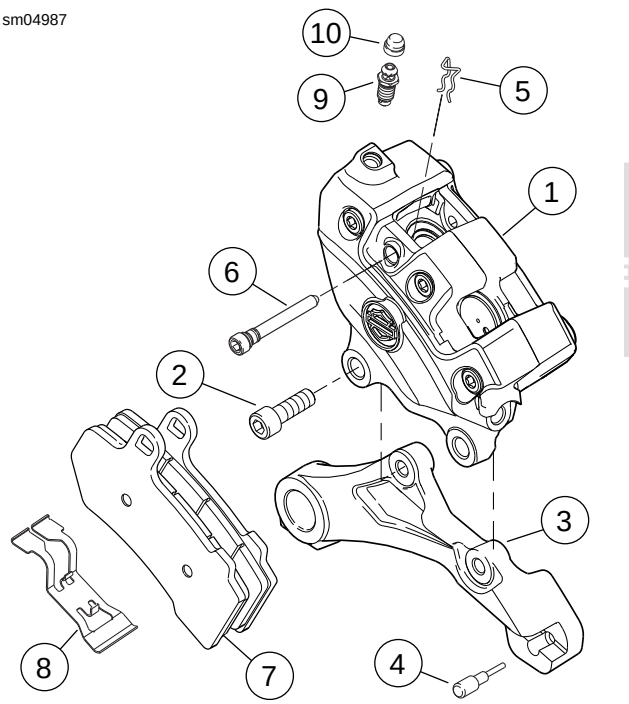
*If only replacing brake pads, see 1.15 BRAKE PADS AND DISCS.*

1. Remove right side saddlebag. See 2.27 SADDLEBAGS.

*NOTE*

*Wrap banjo fitting with piece of shop towel to absorb any loss of brake fluid.*

2. Remove banjo bolt to release brake line from caliper. Discard copper washers.
3. Remove two screws to release caliper from caliper bracket. See Figure 2-52.
4. Remove caliper from brake disc.
5. If necessary, retract rear axle to remove caliper bracket. See 2.4 REAR WHEEL.




1. **Caliper**
2. **Caliper bracket screw**
3. **Caliper bracket**
4. **Rubber bumper**
5. **Retaining clip**
6. **Pad pin**
7. **Brake pads**
8. **Pad spring**
9. **Bleeder valve**
10. **Bleeder valve cap**

**Figure 2-52. Rear Brake Caliper Assembly**

## INSTALLATION

1. Install caliper bracket, if removed. Proceed as follows:
   a. Replace rubber bumper if damaged, worn or missing. Lubricate anchor of **new** bumper with isopropyl alcohol or glass cleaner and pull rubber bead through hole to the inboard side of the caliper bracket.
   b. Seat caliper bracket on anchor weldment of rear swingarm.
   c. Complete installation of rear wheel. See 2.4 REAR WHEEL.
2. If necessary, assemble caliper installing pad spring, brake pads, pad pin and retaining clip. See 1.15 BRAKE PADS AND DISCS.

*NOTE*

*When replacing or installing the bleeder valve, remove the o-ring from the bleeder valve groove or bore and discard. The o-ring is required only for brake bleeding at the factory. Although not sold separately, it may be present in certain assemblies as currently sold. If care is not taken to remove and discard the o-ring, it may become lodged in the caliper bore during bleeder valve installation and prevent proper torquing or sealing.*

3. Install caliper onto brake disc. Align holes in caliper with those in caliper bracket and install two screws. Alternately tighten screws to 43-48 ft-lbs (58.3-65.1 Nm).
4. Start banjo bolt (with **new** copper washers) to secure brake line to caliper. Tighten banjo bolt to 17-19 ft-lbs (23.1-25.8 Nm).
5. Fill and bleed brake system. See 1.14 BLEEDING BRAKES.
6. Install right side saddlebag. See 2.27 SADDLEBAGS.

## GENERAL

**WARNING**

**Use only Harley-Davidson approved tires. See a Harley-Davidson dealer. Using non-approved tires can adversely affect stability, which could result in death or serious injury. (00024a)**

**WARNING**

**Be sure tires are properly inflated, balanced and have adequate tread. Inspect your tires regularly and see a Harley-Davidson dealer for replacements. Riding with excessively worn, unbalanced or under-inflated tires can adversely affect stability and handling, which could result in death or serious injury. (00014a)**

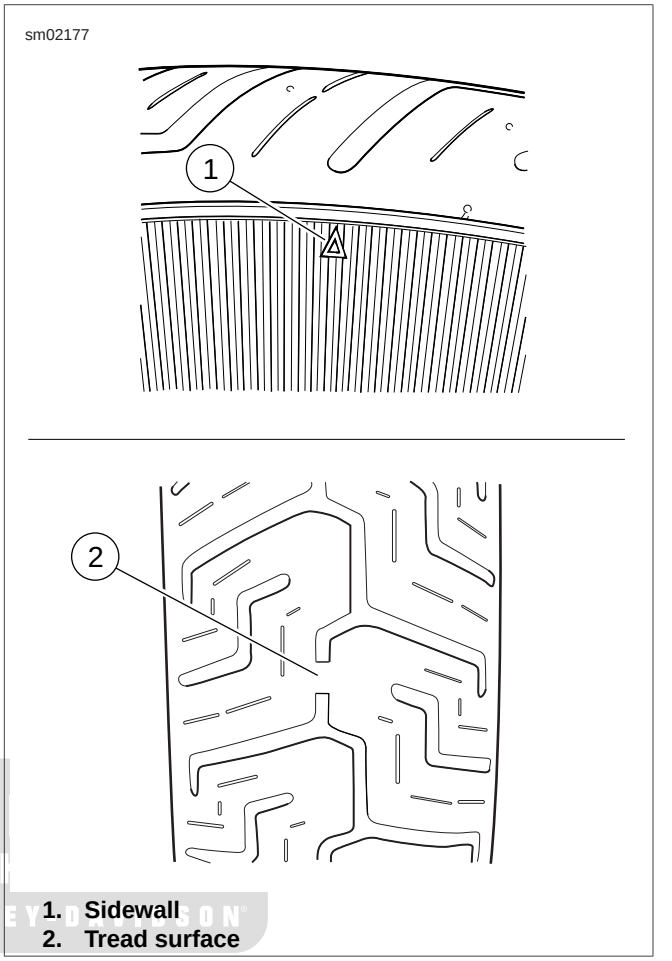
New tires should be stored on a horizontal tire rack. Avoid stacking new tires in a vertical stack. The weight of the stack compresses the tires and closes down the beads.

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

See Figure 2-53. The tread wear indicator bars will appear on tire tread surfaces when 1/32 in. (0.8 mm) or less of tread remains. Always remove tires from service before they reach the tread wear indicator bars.

New tires are needed if any of the following conditions exist. See 1.8 TIRES AND WHEELS.

1. Tire wear indicator bars are visible on the tread surfaces.
2. Tire cords or fabric are visible through cracked sidewalls, snags or deep cuts.
3. A bump, bulge or split in the tire.
4. Puncture, cut or other damage to the tire that cannot be repaired.




1. **Sidewall**
2. **Tread surface**

**Figure 2-53. Tread Wear Indicators**

## REMOVAL

*NOTE*

*Care must be taken when removing and installing tire to prevent cosmetic damage to wheel. This is especially true with wheels that feature painted surfaces.*

1. Remove wheel from motorcycle:
   a. **Front wheel:** see 2.3 FRONT WHEEL, Removal.
   b. **Rear wheel:** see 2.4 REAR WHEEL, Removal.
2. Deflate tire.

*NOTE*

*On tube type wheels, it is not necessary to completely remove tire from rim. Removing one side allows the tube to be replaced and allows for inspection of tire.*

3. Loosen both tire beads from rim flange. In most cases, a bead breaker machine will be required to loosen the beads from the rim.
4. Remove tire.

## CLEANING, INSPECTION AND REPAIR

1. Clean the inside of tire and outer surface of tube.

2. If rim is dirty or rusty, clean with a stiff wire brush.
3. Check wheels for lateral and radial runout before installing a new tire.
   a. **Models with laced wheels:** see 2.9 TRUING LACED WHEELS.
   b. **Models with cast wheels:** see 2.10 CHECKING CAST WHEEL RUNOUT.
4. Inspect the tire and tube for wear and damage. Inspect tread depth. Replace worn tires. Replace damaged tubes.

**WARNING**

**Replace punctured or damaged tires. In some cases, small punctures in the tread area may be repaired from within the demounted tire by a Harley-Davidson dealer. Speed should NOT exceed 50 mph (80 km/h) for the first 24 hours after repair, and the repaired tire should NEVER be used over 80 mph (130 km/h). Failure to follow this warning could result in death or serious injury. (00015a)**

5. Tubeless tires may be repaired in the tread area only if the puncture is 1/4 in. (6.4 mm) or smaller. All repairs must be made from inside the tire.
6. Acceptable repair method involves the use of a patch and plug combination.

## INSTALLATION

**WARNING**

**Harley-Davidson front and rear tires are not the same. Interchanging front and rear tires can cause tire failure, which could result in death or serious injury. (00026a)**

**WARNING**

**Do not exceed manufacturer's recommended pressure to seat beads. Exceeding recommended bead seat pressure can cause tire rim assembly to burst, which could result in death or serious injury. (00282a)**

**WARNING**

**Do not inflate tire beyond maximum pressure as specified on sidewall. Over inflated tires can blow out, which could result in death or serious injury. (00027a)**

For tire pressures, see 1.8 TIRES AND WHEELS, Tires.

Some tires have arrows molded into the tire sidewall. These tires should be mounted on the rim with the arrow pointing in the direction of forward rotation. The colored dot on the sidewall is a balance mark and should be located next to the valve stem hole.

### Tube Type Tires

**WARNING**

**Match tires, tubes, air valves and caps to the correct wheel rim. Contact a Harley-Davidson dealer. Mismatching can result in damage to the tire bead, allow tire slippage on the rim or cause tire failure, which could result in death or serious injury. (00023a)**

**WARNING**

**Use inner tubes on laced (wire spoked) wheels. Using tubeless tires on laced wheels can cause air leaks, which could result in death or serious injury. (00025a)**

*NOTES*

- *For correct tire and tube types, see 2.1 SPECIFICATIONS.*
- *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 or patched tube as soon as possible. Rim bands must be used on all laced wheels.*

1. See Figure 2-54. 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 valve stem hole in rim.
2. Install tube and tire.


**Figure 2-54. Installing Rim Strip**

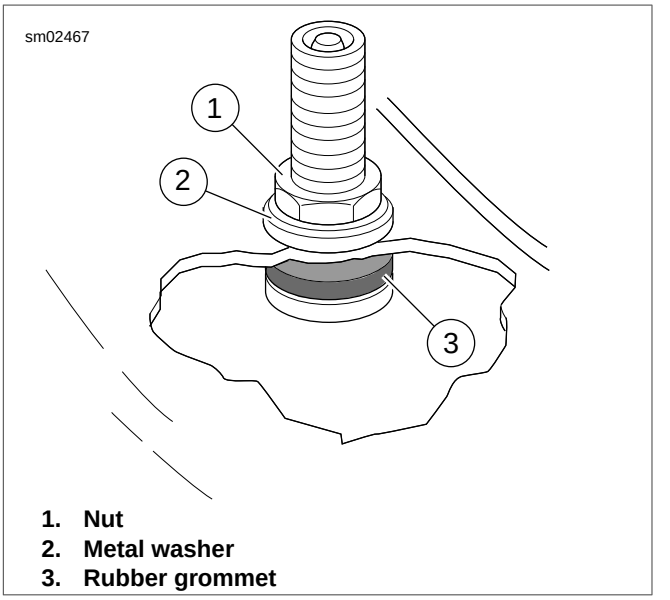
### Tubeless Tires

**WARNING**

**Only install original equipment tire valves and valve caps. A valve, or valve and cap combination, that is too long or too heavy can strike adjacent components and damage the valve, causing rapid tire deflation. Rapid tire deflation can cause loss of vehicle control, which could result in death or serious injury. (00281a)**

1. See Figure 2-55. On tubeless wheels, damaged or leaking valve stems must be replaced. Install rubber grommet (3) on valve stem.
2. Insert valve stem into rim hole.

3. Install metal washer (2).
4. Install nut and tighten to 12-15 **in-lbs** (1.4-1.7 Nm).
5. Install tire.




1. **Nut**
2. **Metal washer**
3. **Rubber grommet**

**Figure 2-55. Tubeless Tire Valve Stem**

## CHANGING FORK OIL

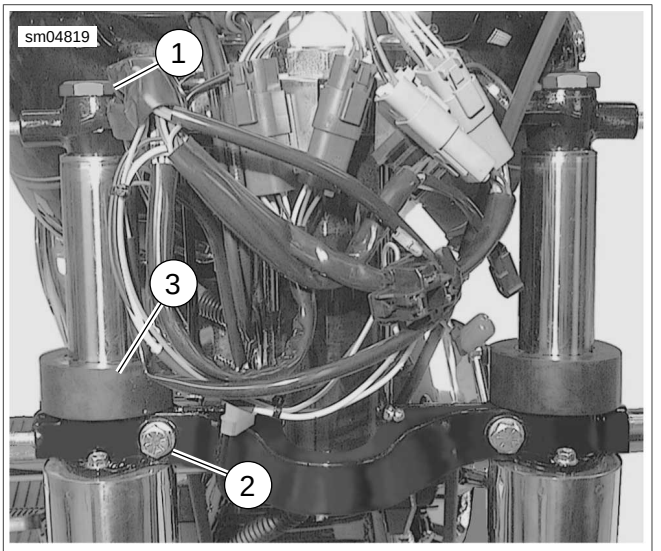
*NOTE*

*If changing the fork oil at the 50,000 mile (80,000 km) service interval, or if fork is leaking or fails visual inspection, see 2.17 FRONT FORK, Removal and 2.17 FRONT FORK, Disassembly, as complete disassembly and inspection of the fork is required. However, if a decision has been made to replace the fork oil before the recommended service interval, and the fork passes visual inspection, see steps 1-5 below.*

1. Disassemble motorcycle and remove fork. See 2.17 FRONT FORK, Removal.
2. Partially disassemble fork. See 2.17 FRONT FORK, Disassembly.
3. Position fork assembly upside down over drain pan. Allow sufficient time for fork to thoroughly drain (about 10-15 minutes).
4. Fill and assemble fork. See 2.17 FRONT FORK, Assembly.
5. Install fork and assemble motorcycle. See 2.17 FRONT FORK, Installation.

## 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 2.46 FRONT FENDER.
3. **FLHR/C:** Remove headlamp nacelle. See 2.45 HEADLAMP NACELLE: FLHR/C.
4. **FLHX, FLHT/C/U:**
   a. Remove outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
   b. Remove fairing cap. See 2.36 FAIRING CAP: FLHX, FLHT/C/U.
   c. Remove two screws to release front turn signal lamp/auxiliary lamp bracket, chrome skirt and inner fairing from lower fork bracket. If necessary, see 8.14 TURN SIGNAL LAMPS or 8.11 AUXILIARY LAMPS AND BRACKETS.
5. **FLTR:** Remove instrument nacelle. See 2.41 INSTRUMENT NACELLE: FLTR.
6. Standing at front of motorcycle, loosen fork cap bolt from fork tube plug at top of fork tube, but do not remove.




1. **Fork cap bolt**
2. **Pinch bolt**
3. **Rubber fork stop**

**Figure 2-56. Remove Fork Cap Bolt (FLHR/C Shown)**

7. Loosen pinch bolt (with lockwasher) in lower fork bracket, but do not remove. See Figure 2-56.
8. 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.
9. 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.
10. Thread fork cap bolt back into fork tube plug to prevent loss of fork oil while handling.
11. Move front fork to bench area. Place suitable drain pan on floor beneath vise.
12. In the same fashion, remove other fork.

## DISASSEMBLY

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41177 | FORK TUBE HOLDER |

1. Remove the fork assembly. See 2.17 FRONT FORK, Removal.
2. On right side fork, 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. (00421b)**

3. Obtain the FORK TUBE HOLDER (Part No. HD-41177). See Figure 2-57. 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 2-58.
4. Remove fork cap bolt from fork tube plug. Remove and discard quad ring seal.
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 O-ring from fork tube plug. Discard O-ring.
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. Be aware that damper valve, if equipped, may fall out of inverted fork tube while draining. With the wear ring at the bottom (spring side up), slide damper valve back into fork tube when drained.

*NOTE*

*If just changing the fork oil, continue procedure at ASSEMBLY, step 14. If overhauling the fork assembly, continue with step below.*

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, damper valve (if equipped) and damper tube from fork tube.
12. Remove wear ring and rebound spring from damper tube. Remove wear ring from damper valve, if equipped.

*NOTE*

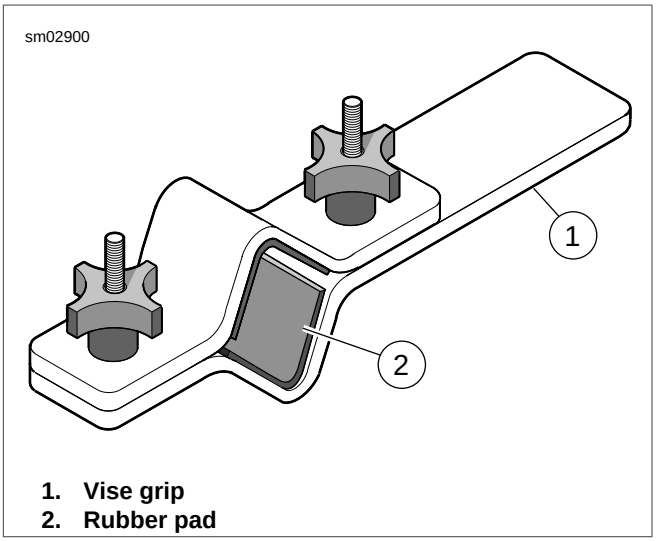
*Do not expand or stretch retaining clip to remove from fork tube or clip may become bent or distorted.*

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

*NOTE*

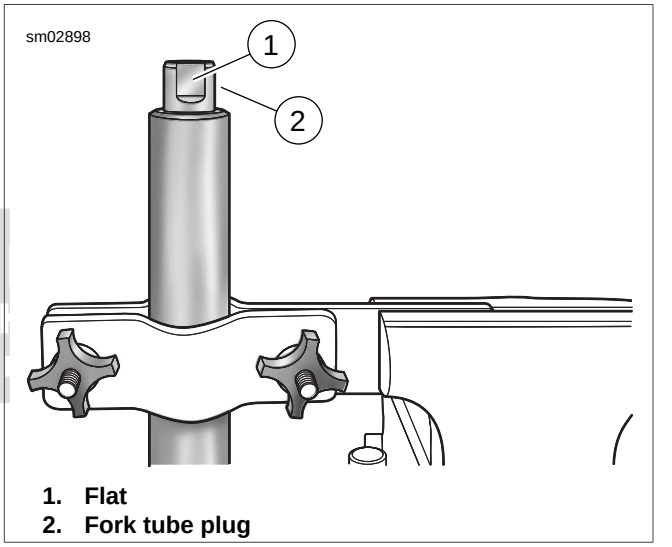
*To overcome any resistance, use the fork tube as a slide hammer, that is, first push fork tube into fork slider and then pull it outward with a moderate amount of force. Repeat this sequence until fork tube separates from fork slider.*

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 lower stop from fork slider.




**1. Vise grip**
**2. Rubber pad**

**Figure 2-57. Fork Tube Holder (HD-41177)**




**1. Flat**
**2. Fork tube plug**

**Figure 2-58. Install Fork Tube Into Fork Holder**

## 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 bushing is damaged or worn.

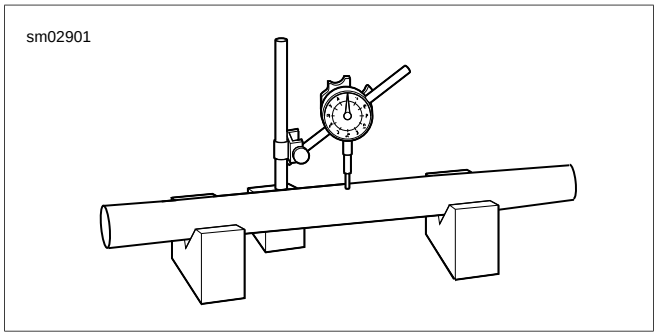



**Figure 2-59. Measure Fork Tube Runout**

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 in. (0.2 mm). See Figure 2-59.
6. Inspect upper fork spring and rebound spring for damage or distortion. Replace upper fork spring if free length is less than 18.4 in. (467.3 mm). Replace rebound spring if free length is less than 0.938 in. (23.8 mm) or whenever the upper fork spring requires replacement.

## ASSEMBLY

| PART NUMBER | TOOL NAME |
|---|---|
| HD-34634 | FORK OIL SEAL INSTALLER |
| HD-59000B | FORK OIL LEVEL GAUGE |

**CAUTION**

**Exercise caution to avoid scratching or nicking fork tube. Damaging tube can result in fork oil leaks after assembly. (00421b)**

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 (Part No. HD-34634). See Figure 2-60. 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 2-61. Remove tool.

*NOTE*

*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.

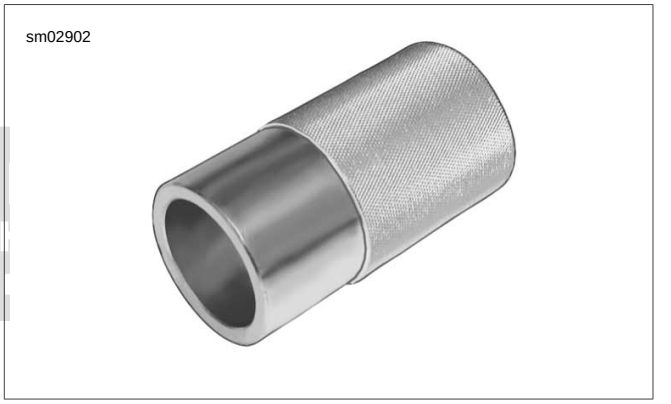



**Figure 2-60. Fork Oil Seal Installer (HD-34634)**

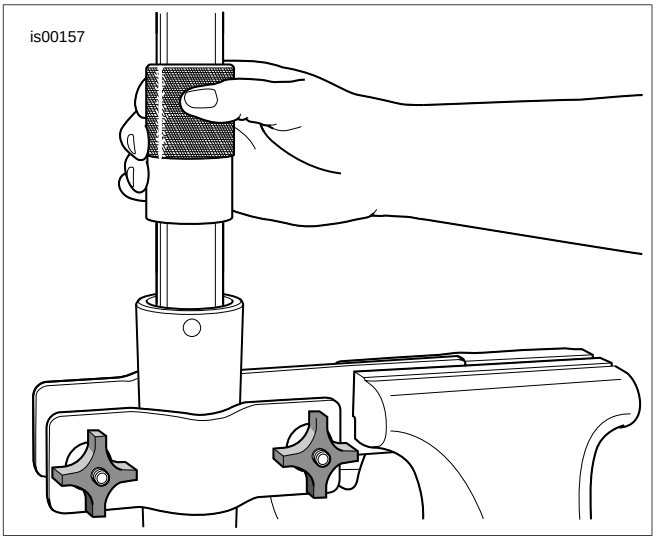



**Figure 2-61. Install Fork Oil Seal**

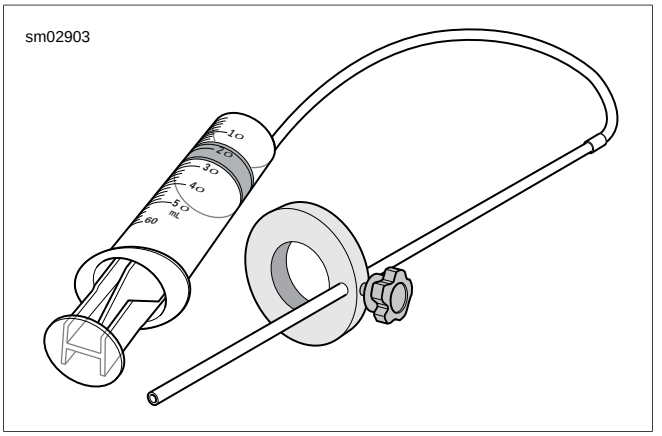



**Figure 2-62. Fork Oil level Gauge (HD-59000B)**

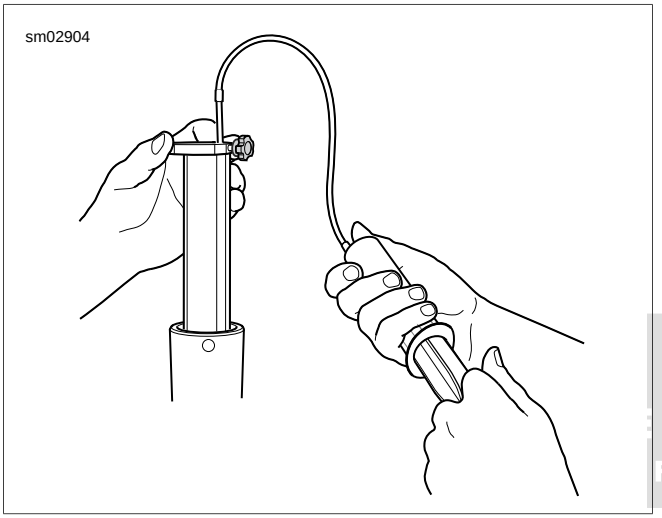



**Figure 2-63. Remove Excess Fork Oil**

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

*NOTE*

*All touring models with the exception of Road King have the damper valve type fork on both the left and right sides. Road King uses the conventional type fork on both sides. See step 16 to set fork oil level on a damper valve type fork; see step 17 to set fork oil level on a conventional type fork.*

**Table 2-13. Fork Oil Requirements**

| Model | Fork Type | Amount | | | |
|---|---|---|---|---|---|
| | | OZ. | ML | IN. | MM |
| All models **except** Road King | Damper Valve | 10.8 | 319 | 5.59 | 142 |
| Road King | Conventional | 11.1 | 328 | 5.24 | 133 |

16. Set fork oil level on damper valve type fork (FLHX, FLHT/C/U, FLTR) as follows:
    a. Pour slightly more than 10.8 oz. (319 ml) of Harley-Davidson Type E Fork Oil directly into the fork tube.
    b. Slowly pump fork tube until some resistance is felt and then pump a few more times.
    c. Install **new** wear ring in groove of damper valve. With the wear ring at the bottom (spring side up), slide damper valve into fork tube.
    d. Install fork spring into fork tube. Use fork spring to push damper valve to bottom of fork tube. Remove fork spring from fork tube.
    e. Slowly pump fork tube a few more times to discharge air from damper valve.
    f. See Figure 2-62. Obtain the FORK OIL LEVEL GAUGE (Part No. HD-59000B).
    g. Loosen thumbscrew on metal ring of tool and move it up or down the rod until bottom of ring is 5.59 in. (142 mm) from end of rod. Tighten thumbscrew.
    h. Push the plunger on the cylinder all the way in.
    i. With the fork tube bottomed in the fork slider, insert rod until metal ring rests flat on top of fork tube. See Figure 2-63.
    j. Pull out plunger 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.
    k. Remove rod from fork tube. Push plunger into cylinder to eject excess fork oil into suitable container.
    l. If necessary, repeat steps 16(i) thru 16(k). Level is correct when no fork oil is observed being drawn through transparent tube.

**⚠WARNING**

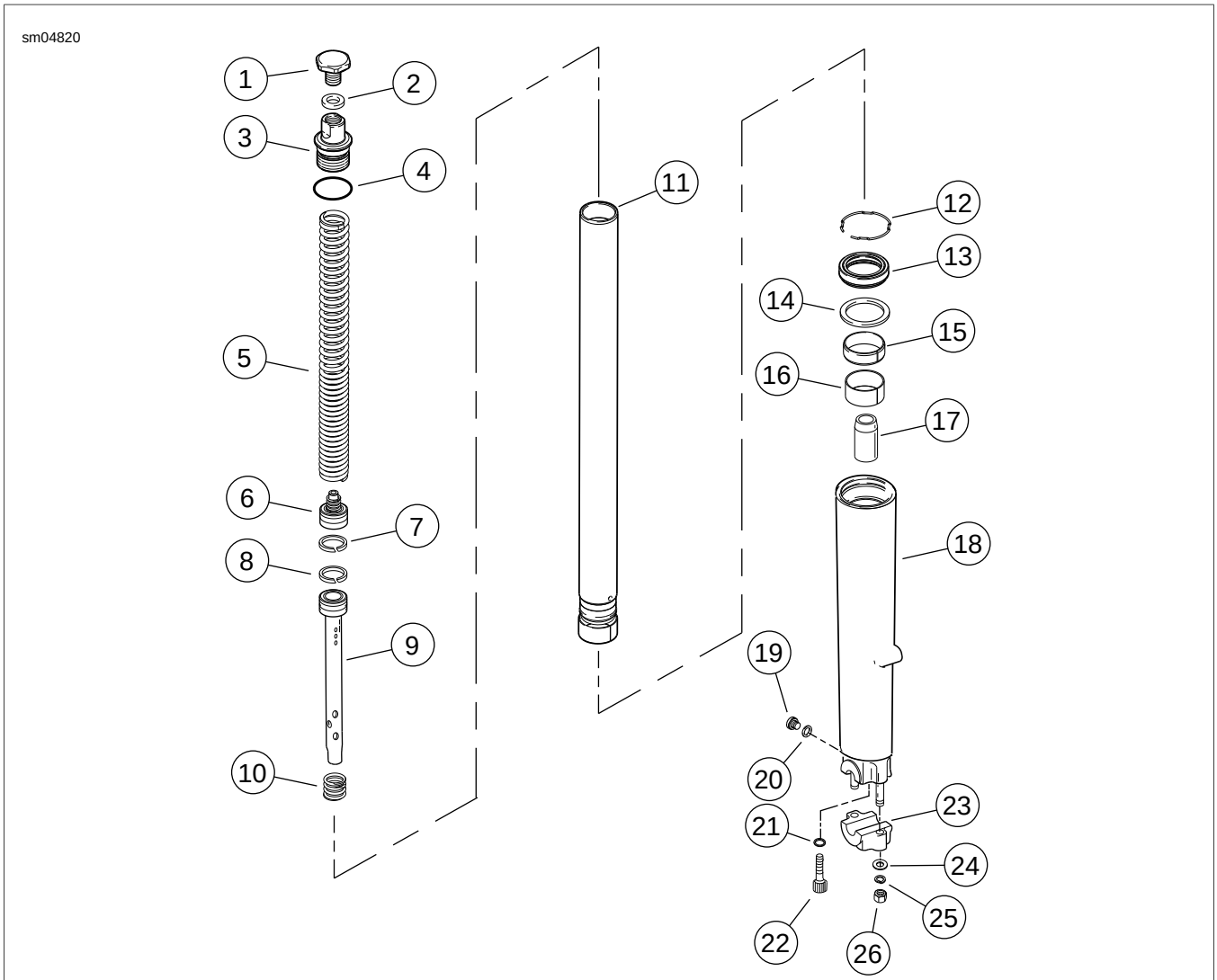
**Incorrect amount of fork oil can adversely affect handling and lead to loss of vehicle control, which could result in death or serious injury. (00298a)**

17. Set fork oil level on conventional type fork (FLHR/C) as follows:
    a. Pour slightly more than 11.1 oz. (328 ml) of Harley-Davidson Type E Fork Oil directly into the fork tube.
    b. Slowly pump fork tube until some resistance is felt and then pump a few more times.
    c. See Figure 2-62. Obtain the FORK OIL LEVEL GAUGE (HD-59000B).
    d. Loosen thumbscrew on metal ring of tool and move it up or down the rod until the bottom of ring is 5.24 in. (133 mm) from end of rod. Tighten thumbscrew.
    e. Push the plunger on the cylinder all the way in.
    f. With the fork tube bottomed in the fork slider, insert rod until metal ring rests flat on top of fork tube. See Figure 2-63.
    g. Pull out plunger 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.
    h. Remove rod from fork tube. Push plunger into cylinder to eject excess fork oil into suitable container.
    i. If necessary, repeat steps 17(f) thru 17(h). Level is correct when no fork oil is observed being drawn through transparent tube.

**⚠WARNING**

**Incorrect amount of fork oil can adversely affect handling and lead to loss of vehicle control, which could result in death or serious injury. (00298a)**

18. With the closer spaced coils at the bottom, slide fork spring into fork tube.
19. Remove fork slider from fork tube holder. Clamp fork tube into fork tube holder.
20. 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).
21. 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.
22. On right side fork, loosely install axle holder, flat washers, lockwashers and nuts on studs at end of fork slider.




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

**Figure 2-64. Right Side Fork**

## INSTALLATION

1. Remove fork cap bolt.
2. Standing at front of motorcycle, 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) in lower fork bracket. See Figure 2-56. 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 previous steps on other fork, if removed.

7. Install the front fender and wheel. See 2.46 FRONT FENDER.
8. **FLHR/C:** Install headlamp nacelle. See 2.45 HEADLAMP NACELLE: FLHR/C.
9. **FLHX, FLHT/C/U:**
   a. Install two screws to fasten inner fairing, chrome skirt and auxiliary lamp/front turn signal lamp bracket to lower fork bracket. If necessary, see 8.14 TURN SIGNAL LAMPS or 8.11 AUXILIARY LAMPS AND BRACKETS.
   b. Install fairing cap. See 2.36 FAIRING CAP: FLHX, FLHT/C/U.
   c. Install outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
10. **FLTR:** Install instrument nacelle. See 2.41 INSTRUMENT NACELLE: FLTR.

## AIR DAM (FLTR)

### Removal

*NOTE*

*By allowing the flow of air to pass under the fuel tank and over the cylinder heads, removing the air dam evacuates heated air and provides some relief to the rider in warmer temperatures: 70°F. (21°C.) or above.*

1. Moving to the back of the lower fork bracket, remove two hex screws (with flat washers) to release air dam. See Figure 2-65.
2. Reinstall two hex screws (with flat washers) to keep dirt and debris out of holes in lower fork bracket. Tighten screws to 120-144 **in-lbs** (13.6-16.3 Nm).

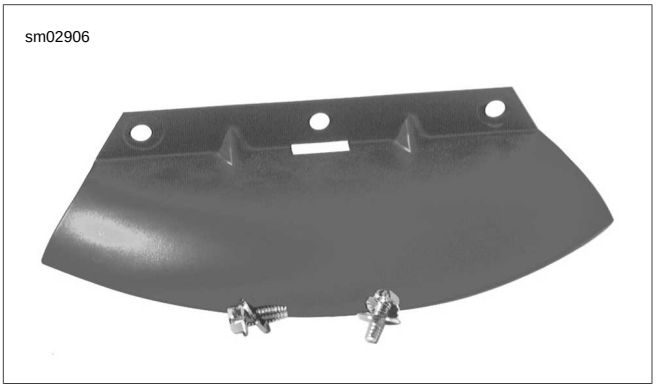



**Figure 2-65. Air Dam**

### Installation

*NOTE*

*Reinstall air dam in colder weather.*

1. With the concave side down, align holes in air dam with holes at back of the lower fork bracket. Start two hex screws (with flat washers).

*NOTE*

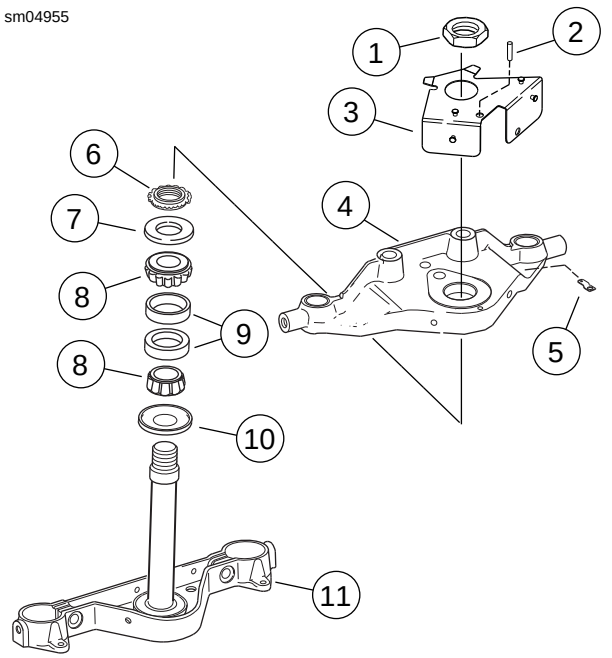
*Plastic plug(s) at back of lower fork bracket will prevent proper cover installation. Remove and discard plug(s), if present.*

2. Alternately tighten hex screws to 120-144 **in-lbs** (13.6-16.3 Nm).

## REMOVAL

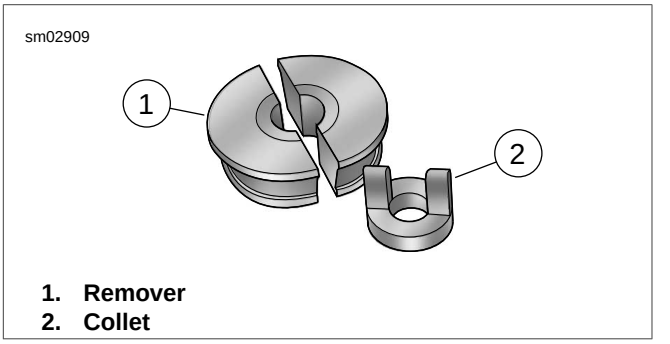
| PART NUMBER | TOOL NAME |
|---|---|
| HD-33416 | UNIVERSAL DRIVER |
| HD-39301A | STEERING HEAD BEARING CUP REMOVER |

1. Disassemble motorcycle as follows:
   a. **FLHR/C:** Remove headlamp nacelle. See 2.45 HEADLAMP NACELLE: FLHR/C.
   b. **FLHX, FLHT/C/U:** Remove the auxiliary lamp bracket, outer fairing and radio (storage box on FLHT). See 8.11 AUXILIARY LAMPS AND BRACKETS, 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U and 8.32 ADVANCED AUDIO SYSTEM, respectively.
   c. **FLTR:** Remove instrument nacelle. See 2.41 INSTRUMENT NACELLE: FLTR.
2. Remove front forks. See 2.17 FRONT FORK.




1. **Fork stem nut**
2. **Roll pin**
3. **Lock plate**
4. **Upper fork bracket**
5. **Spade contact**
6. **Bearing adjuster nut**
7. **Dust shield**
8. **Bearing cone**
9. **Bearing cup**
10. **Dust shield**
11. **Lower fork bracket**

**Figure 2-66. Steering Head/Fork Bracket Assembly**




1. **Remover**
2. **Collet**

**Figure 2-67. Steering Head Bearing Cup Remover (Part No. HD-39301A)**

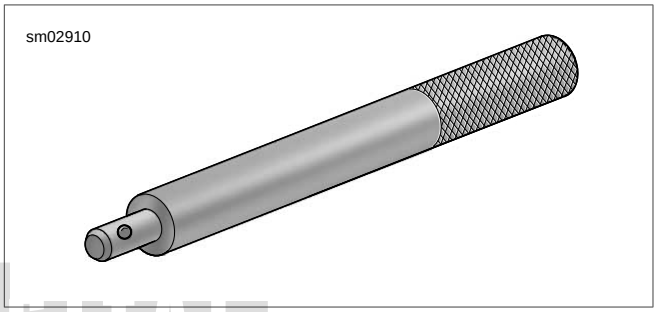


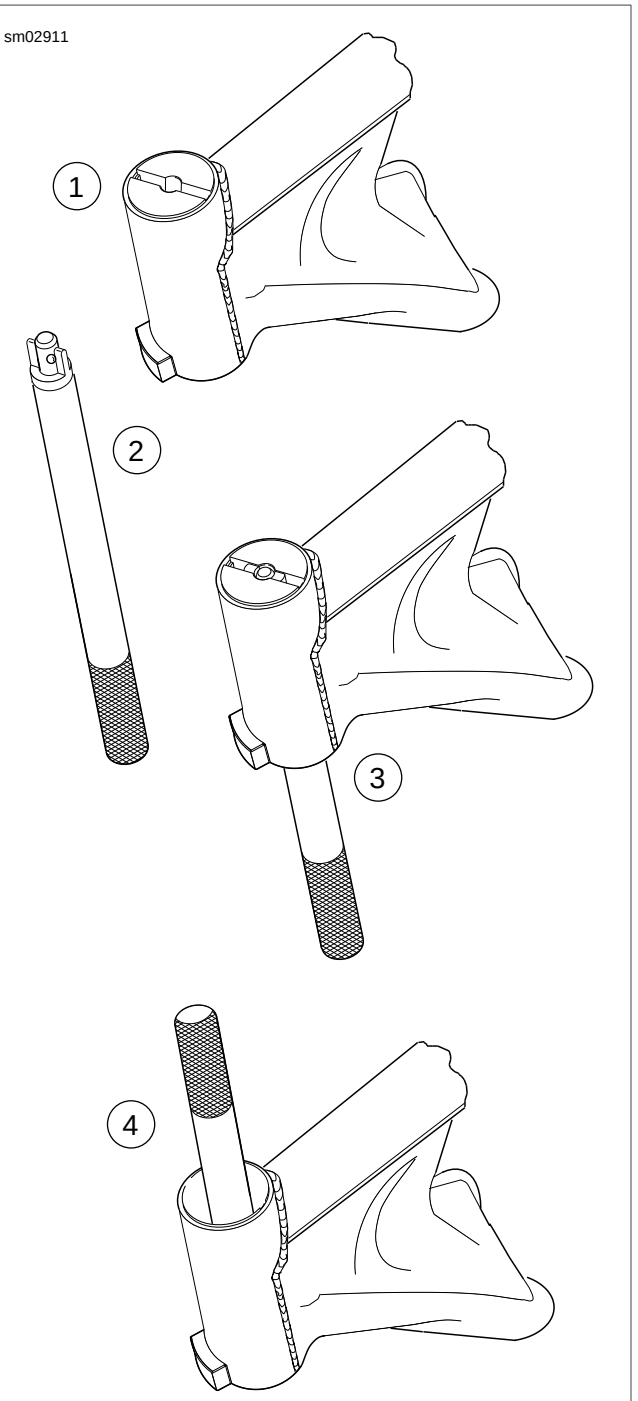

**Figure 2-68. Universal Driver (Part No. HD-33416)**

3. Remove screw at bottom of lower fork bracket to release brake line bracket.
4. **FLTR:** Remove two screws (with flat washers) to release air dam at back of lower fork bracket.
5. Bend tab on lock plate away from flat of fork stem nut. Remove fork stem nut. See Figure 2-66.
6. Remove roll pin and lock plate.
7. Disconnect ignition switch [33], left handlebar switch [24], right handlebar switch [22] and twist grip sensor jumper harness [204] connectors. On fairing equipped motorcycles, remove interconnect harness ground socket terminal from spade contact at front of upper fork bracket (left side).
8. Remove upper fork bracket.
9. Remove bearing adjuster nut from stem of lower fork bracket.
10. Using a rubber mallet, tap on stem of lower fork bracket to free from upper bearing cone. Draw stem of lower fork bracket out through bottom of steering head.
11. Remove dust shield and upper bearing cone at top of steering head.
12. Remove lower bearing cone and dust shield from stem of lower fork bracket.

*NOTE*

*Bearing cones are a slip fit on stem of lower fork bracket. If necessary, gently pry bearing cones off stem with a pair of flat blade screwdrivers.*

13. See Figure 2-67 and Figure 2-68. Obtain STEERING HEAD BEARING CUP REMOVER (Part No. HD-39301A) and UNIVERSAL DRIVER (Part No. HD-33416). Proceed as follows:
    a. With the tapered side down, seat the two-piece remover tool on the upper bearing cup leaving a gap in the middle. See Figure 2-69.
    b. Install collet on driver.
    c. Insert driver up through bottom of steering head, and while holding remover tool on upper bearing cup, center collet in gap. Tap driver to remove upper bearing cup.
    d. Reverse tool and repeat procedure to remove lower bearing cup.




1. **Install remover on upper cup**
2. **Install collet on driver**
3. **Install driver in remover and remove upper cup**
4. **Remove lower cup**

**Figure 2-69. Remove Steering Head Bearing Cups**

## 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.

## INSTALLATION

| PART NUMBER | TOOL NAME |
|---|---|
| HD-39302 | STEERING HEAD BEARING CUP INSTALLER |

1. See Figure 2-70. Obtain STEERING HEAD BEARING CUP INSTALLER (Part No. HD-39302). Proceed as follows:
   a. Start upper bearing cup into top of steering head with the beveled side facing outboard.
   b. Fit smaller OD of installer tool into upper bearing cup.
   c. Slide forcing screw through installer tool and bearing cup until threaded end exits bottom of steering head.
   d. Sparingly apply graphite lubricant to threads of forcing screw.
   e. With the beveled side facing outboard, slide lower bearing cup up forcing screw.
   f. Slide second half of installer tool up forcing screw fitting smaller OD into lower bearing cup.
   g. Install Nice bearing, flat washers and hex nut onto forcing screw.
   h. Tighten hex nut by hand until assembly is square and snug.
   i. While holding head of forcing screw, turn hex nut to simultaneously draw both upper and lower bearing cups into steering head. Continue turning hex nut until cups makes contact with counterbores. See Figure 2-71.
   j. Disassemble and remove tool.
2. Slide **new** dust shield down stem until contact is made with top of lower fork bracket.
3. Pack **new** bearing cones with Harley-Davidson SPECIAL PURPOSE GREASE, Part No. 99857-97.
4. With the tapered side up, place bearing cone over stem of lower fork bracket. Using the thumbs of both hands, lightly press on bearing cone until it bottoms against dust shield.
5. Insert stem of lower fork bracket up into steering head.
6. At top of steering head, push upper bearing cone onto stem with the tapered side down.
7. Slide **new** dust shield down stem until flush with top of steering head.
8. Install bearing adjuster nut onto stem.
9. Snug adjuster nut until bearing play is taken up and stem turns freely. Overtightening nut will cause excessive bearing wear.
10. Install upper fork bracket.
11. Install lock plate and roll pin.
12. Install fork stem nut and tighten to 60-80 ft-lbs (81-109 Nm).
13. Bend tab on lock plate against flat of fork stem nut.

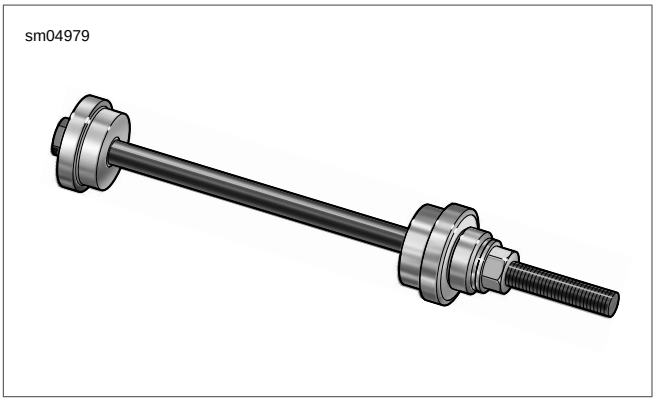



**Figure 2-70. Steering Head Bearing Cup Installer (Part No. HD-39302)**

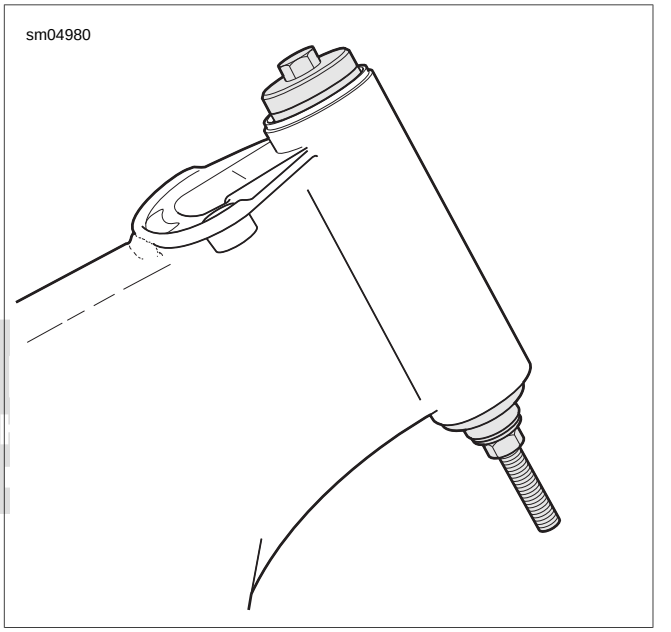



**Figure 2-71. Install Steering Head Bearing Cups**

14. Connect ignition switch [33], left handlebar switch [24], right handlebar switch [22] and twist grip sensor jumper harness [204] connectors. On fairing equipped motorcycles, connect interconnect harness ground socket terminal to spade contact at front of upper fork bracket (left side).
15. Install front forks. See 2.17 FRONT FORK.
16. Start screw to fasten brake line bracket at bottom of lower fork bracket. Verify that brake lines to calipers, as viewed at the rear, are equal distance from the left and right fork sliders, and then tighten screw to 120-180 **in-lbs** (13.6-20.3 Nm).
17. **FLTR:** Install two screws (with flat washers) to fasten air dam at back of lower fork bracket. Alternately tighten screws to 120-144 **in-lbs** (13.6-16.3 Nm).

18. Assemble motorcycle as follows:
    a. **FLHR/C:** Install headlamp nacelle. See 2.45 HEADLAMP NACELLE: FLHR/C.
    b. **FLHX, FLHT/C/U:** Install radio (storage box on FLHT), outer fairing and auxiliary lamp bracket. See 8.32 ADVANCED AUDIO SYSTEM, 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U and 8.11 AUXILIARY LAMPS AND BRACKETS, respectively.
    c. **FLTR:** Install instrument nacelle. See 2.41 INSTRUMENT NACELLE: FLTR.

**WARNING**

**Properly adjust fork stem bearings. Improper adjustments affect stability and handling, which could result in death or serious injury. (00301a)**

19. Check swing-by and adjust as necessary. See 1.19 STEERING HEAD BEARINGS.

## REMOVAL AND INSTALLATION

| PART NUMBER | TOOL NAME |
|---|---|
| HD-34633A | AIR SUSPENSION PUMP AND GAUGE |

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

1. Remove left side saddlebag. See 2.27 SADDLEBAGS.
2. Remove protective cap from air valve. Install AIR SUSPENSION PUMP AND GAUGE (Part No. HD-34633A)and set to correct pressure. See 1.17 SUSPENSION ADJUSTMENTS. 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.

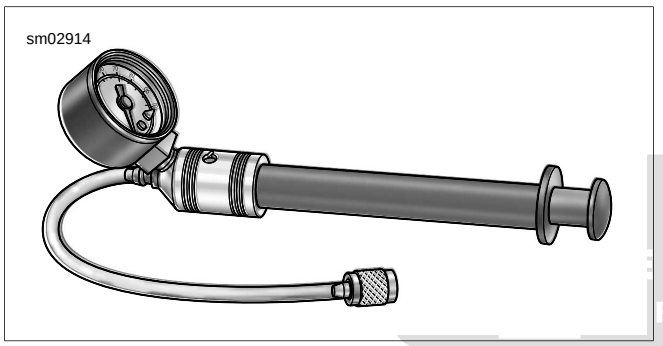



**Figure 2-72. Air Suspension Pump and Gauge (Part No. HD-34633A)**

### 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. Depress collar on compression fitting and pull out air tube. See inset of Figure 2-74. 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 compression fitting until it bottoms. Gently tug on tube to verify that it is locked in place.
   c. Pressurize rear air suspension system and check for leaks. If leakage continues, proceed to step 5(d).
   d. Depress collar on compression fitting and pull out air tube. 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. Insert air tube into the compression fitting until it bottoms. Gently tug on tube to verify that it is locked in place.
   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.

### 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. Depress collar on air inlet tee and pull out air tube. 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 air inlet tee until it bottoms. Gently tug on tube to verify that it is locked in place. Repeat step with remaining tube.

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 2-74.

h. Push on valve head to free air valve assembly from mounting bracket. See Figure 2-73.

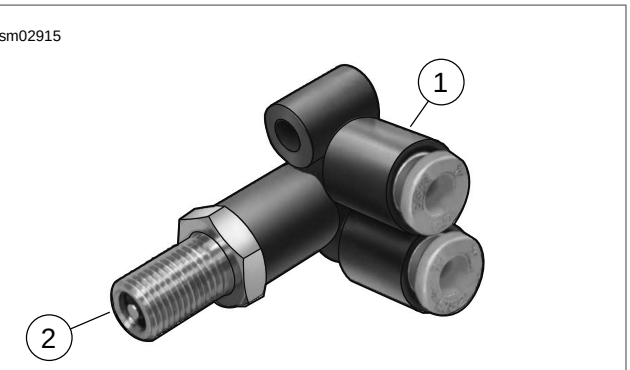
i. Depress collars on air inlet tee and pull out air tubes.

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.

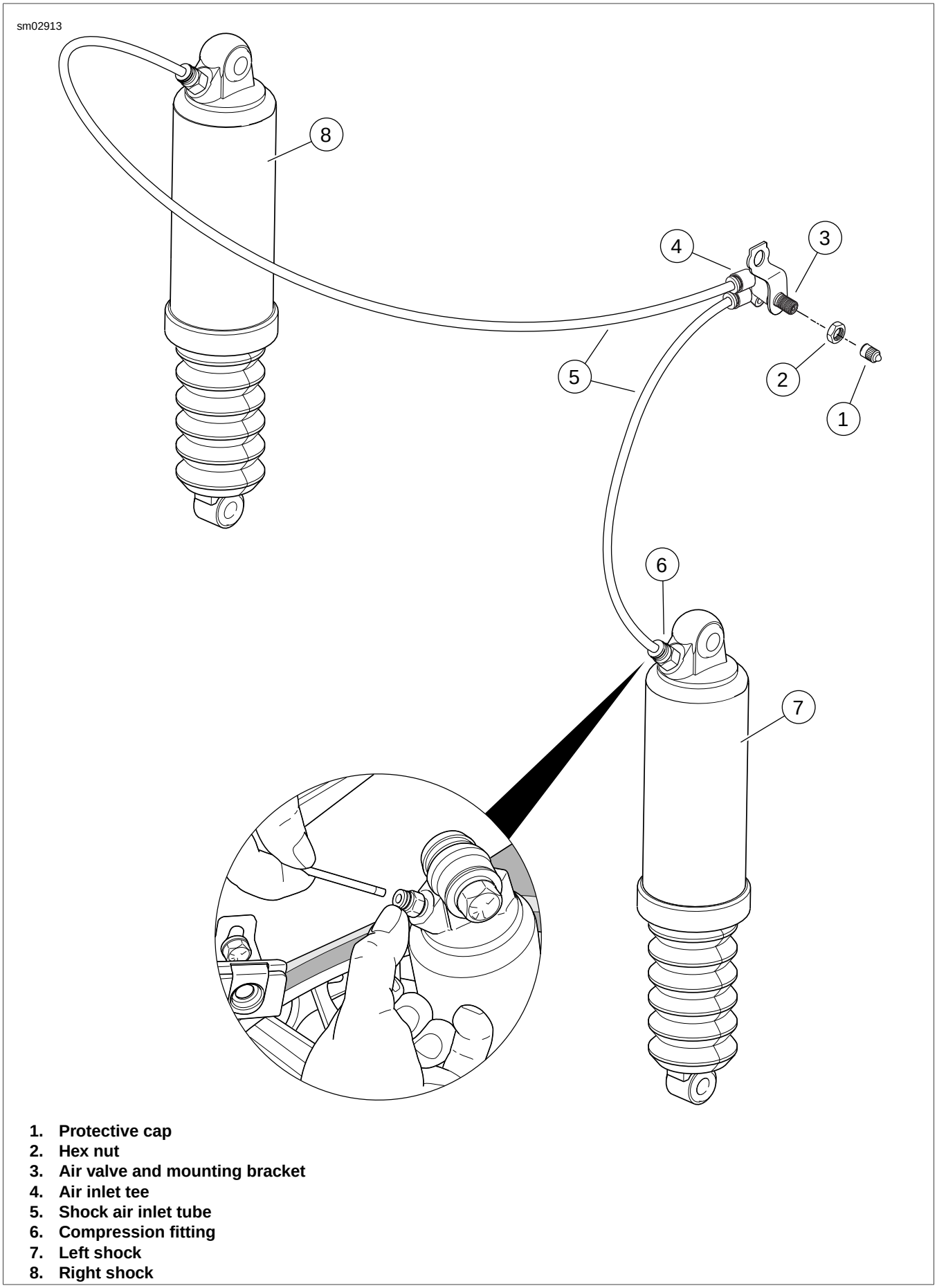



**1. Air inlet tee**
**2. Valve head**

**Figure 2-73. Air Valve Assembly**

## 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 2.26 SEAT.
   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. Depress collars on air inlet tee and pull out air tubes. Remove opposite end of tubes from compression fittings. See Figure 2-74.
   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 2.26 SEAT.
8. Install protective cap on air valve.
9. Install left side saddlebag. See 2.27 SADDLEBAGS.




1. **Protective cap**
2. **Hex nut**
3. **Air valve and mounting bracket**
4. **Air inlet tee**
5. **Shock air inlet tube**
6. **Compression fitting**
7. **Left shock**
8. **Right shock**

**Figure 2-74. Rear Air Suspension System**

## ADJUSTMENT

For the correct air pressure, see 1.17 SUSPENSION ADJUSTMENTS.

## REMOVAL

| PART NUMBER | TOOL NAME |
|---|---|
| HD-34633 | AIR SUSPENSION PUMP AND GAUGE |

*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 2.27 SADDLEBAGS.

**WARNING**

**Use caution when bleeding air from the suspension. Moisture combined with lubricant may leak onto the rear wheel, tire and/or brake components and adversely affect traction, which could result in death or serious injury. (00084a)**

3. Remove protective cap from air valve. Using the 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 Figure 2-75.
6. Remove the upper shock mounting bolt with lockwasher and flat washer. See lower frame of Figure 2-76.
7. Remove the lower shock mounting bolt with lockwasher and flat washer. Remove the shock absorber assembly from the motorcycle.

*NOTE*

*Never lay the shock absorber down. Always keep the shock absorber upright in a fully vertical position. Laying the shock absorber down with the air line removed can cause the oil to drain out through the compression fitting. Any loss of oil requires replacement of the shock absorber.*

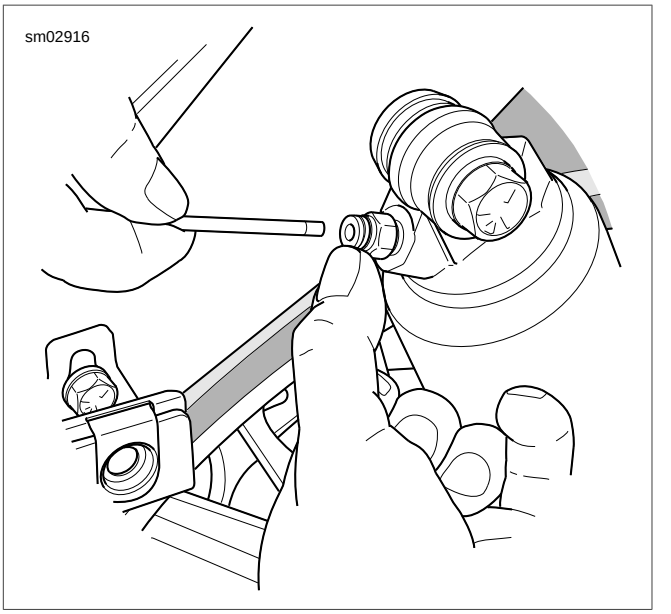
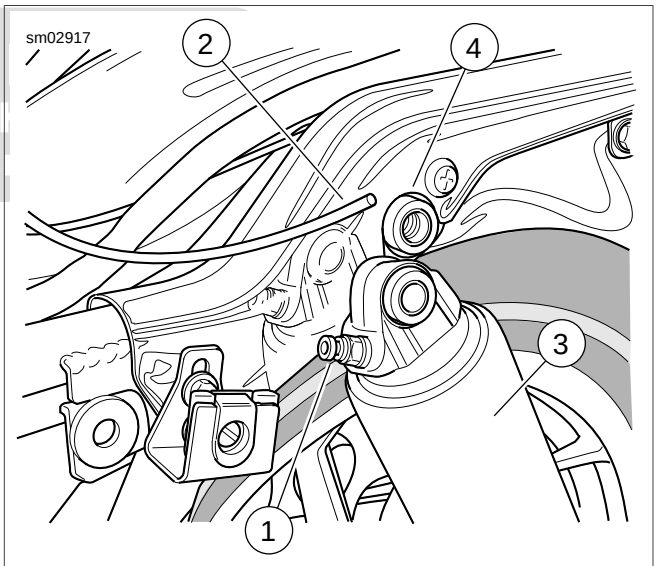



**Figure 2-75. Depress Collar on Fitting and Pull Out Air Inlet Tube**




1. **Compression fitting**
2. **Air inlet tube**
3. **Shock absorber**
4. **Frame boss**

**Figure 2-76. Remove Upper Shock Mounting Bolt (Left Side View)**

## 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.

## DISASSEMBLY AND ASSEMBLY

*NOTES*

- *Air shocks are not repairable. Replace the shocks if damaged, worn or any sign of leakage is observed.*
- *If the compression fittings were removed, apply PIPE SEALANT WITH TEFLON to the threads before assembly.*

## INSTALLATION

*NOTE*

*Never lay the shock absorber down. Always keep the shock absorber upright in a fully vertical position. Laying the shock absorber down with the air line removed can cause the oil to drain out through the compression fitting. Any loss of oil requires replacement of the shock absorber.*

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. See 1.17 SUSPENSION ADJUSTMENTS and 2.20 REAR AIR SUSPENSION, respectively.
9. Install saddlebags. See 2.27 SADDLEBAGS, Installation.

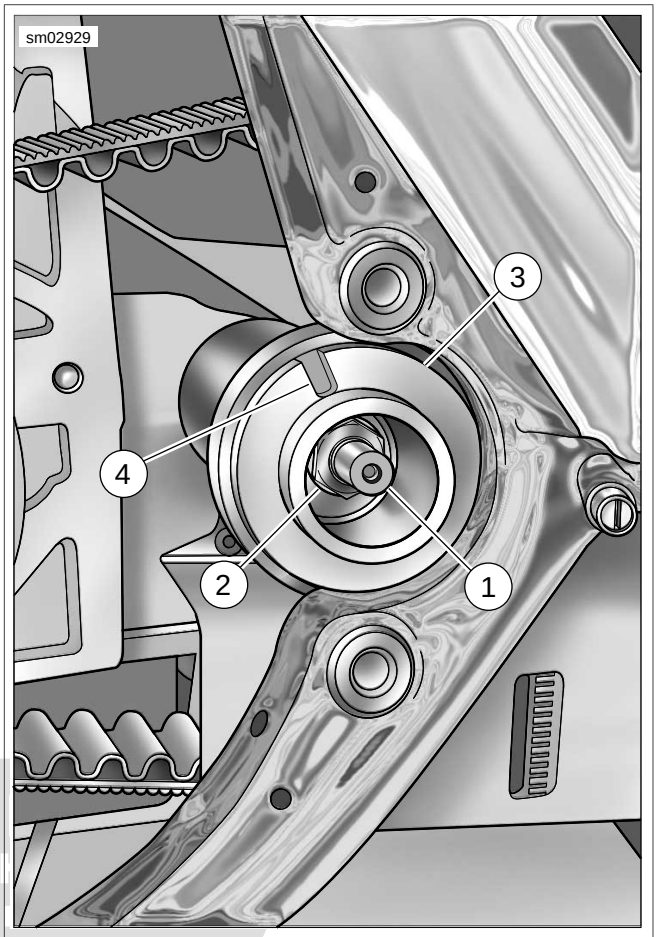
## REMOVAL

1. 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.
2. Remove rear wheel. See 2.4 REAR WHEEL.
3. Remove caliper bracket from anchor weldment on rear swingarm.
4. 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 motorcycle until screw engages large end of slot, and then remove.
5. Remove lower shock mounting bolt (with lockwasher and flat washer) to release shock absorber from rear swingarm mount. Repeat step on opposite side of motorcycle.
6. Remove socket screw with lockwasher to remove passenger footboard from rear swingarm bracket. Repeat step on opposite side of motorcycle.
7. Remove two bolts (with lockwashers) to free rear swingarm bracket from left side of motorcycle frame. See Figure 2-77.
8. Moving to right side of motorcycle, leave rear swingarm bracket installed, but remove decorative chrome plug.
9. Open two cable clips on T-studs at top of right side swingarm. Free rear brake line hose and rear wheel speed sensor (if ABS equipped) 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. Holding left side nut within rubber mount, remove right side locknut from end of pivot shaft. Remove cup washer.
11. Using a suitable drift, tap pivot shaft toward left side of motorcycle.
12. See Figure 2-82. 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.
13. Standing at rear of motorcycle, work rear swingarm free of transmission mount and rear swingarm brackets.
14. Remove outer spacer from right side swingarm tube.
15. Remove rubber mount from behind right side swingarm bracket.




1. **Pivot shaft**
2. **Locknut**
3. **Rubber mount**
4. **Slot**

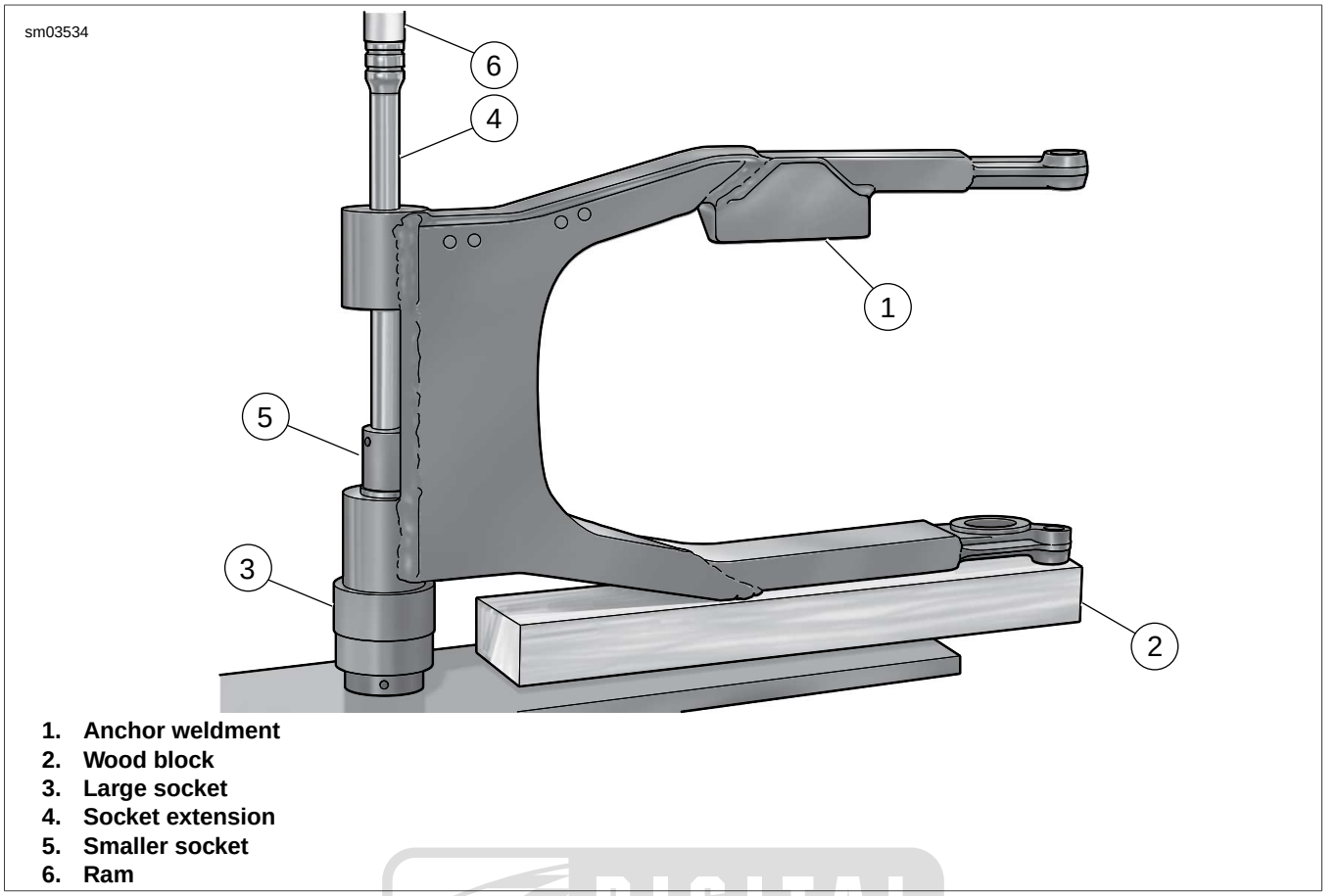
**Figure 2-77. Remove Rear Swingarm Bracket (Left Side View)**

## DISASSEMBLY AND ASSEMBLY

| PART NUMBER | TOOL NAME |
|---|---|
| HD-45327 | REAR SWINGARM BEARING INSTALLER |

### 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 2-78. Verify that assembly is square and the bearing bore is completely vertical.
4. Slide driver handle (or long socket extension) through the brake side swingarm tube and bearing until it contacts driver (or smaller socket) placed on inboard side of drive side bearing.




1. **Anchor weldment**
2. **Wood block**
3. **Large socket**
4. **Socket extension**
5. **Smaller socket**
6. **Ram**

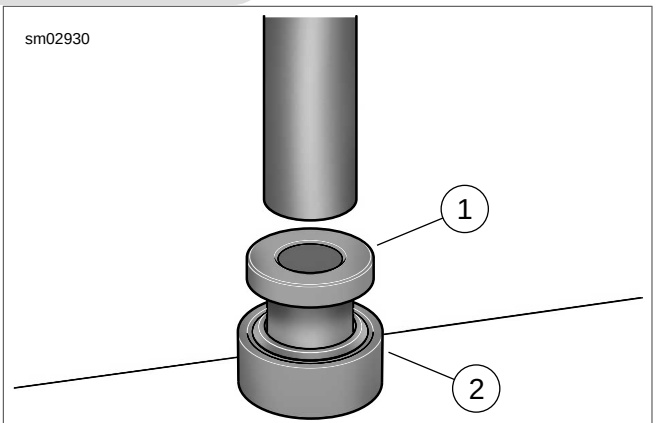
**Figure 2-78. Press Out Drive Side Bearing**



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 previous steps to press out brake side bearing.

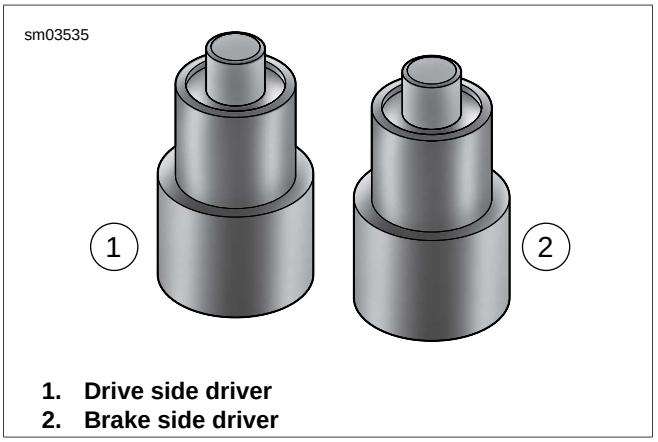
## Bearing Installation

1. Obtain **new** rear swingarm bearings. Bearings and spacers must be assembled before installation. Proceed as follows:
   a. Place bearing flat on suitable press plate.
   b. With the collar topside, start spacer into bearing. See Figure 2-79.
   c. Center assembly under ram of hydraulic press.
   d. Apply pressure to spacer until it bottoms against press plate.
   e. Repeat step to assemble second swingarm bearing.



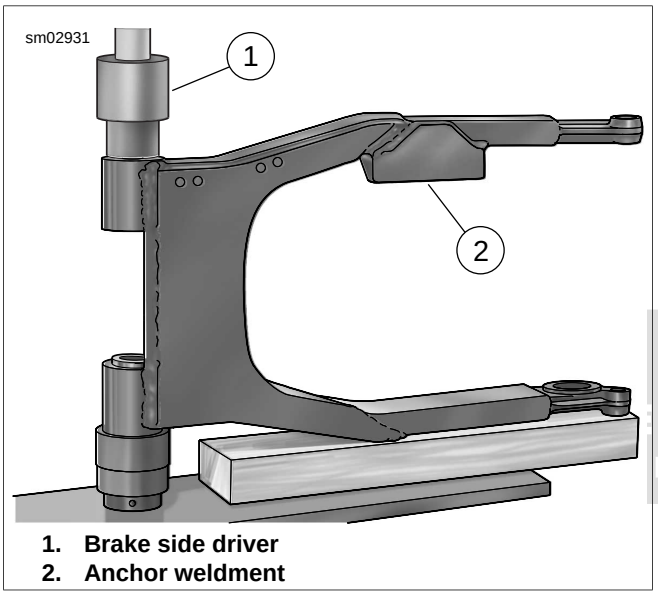

1. **Spacer**
2. **Bearing**

**Figure 2-79. Press Spacer into Bearing**




1. **Drive side driver**
2. **Brake side driver**

**Figure 2-80. Rear Swingarm Bearing Installer (HD-45327)**




1. **Brake side driver**
2. **Anchor weldment**

**Figure 2-81. Press in Brake Side Bearing**

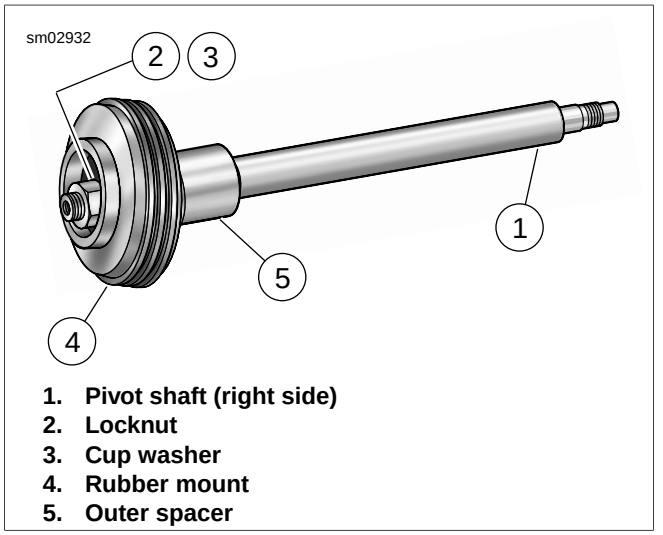
2. Install assembled bearings into rear swingarm. Proceed as follows:
   a. Obtain REAR SWINGARM BEARING INSTALLER (Part No. HD-45327). See Figure 2-80.
   b. Place swingarm on its side, so that the brake side is on top. The brake side is easily recognized by the anchor weldment for mounting of the brake caliper.
   c. With the spacer inboard, insert bearing into outboard side of brake side swingarm tube.
   d. 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 2-81.
   e. Remove tool and turn rear swingarm over. With the spacer inboard, insert bearing into outboard side of drive side swingarm tube.
   f. 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.
   g. 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 2-82.
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.
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.




1. **Pivot shaft (right side)**
2. **Locknut**
3. **Cup washer**
4. **Rubber mount**
5. **Outer spacer**

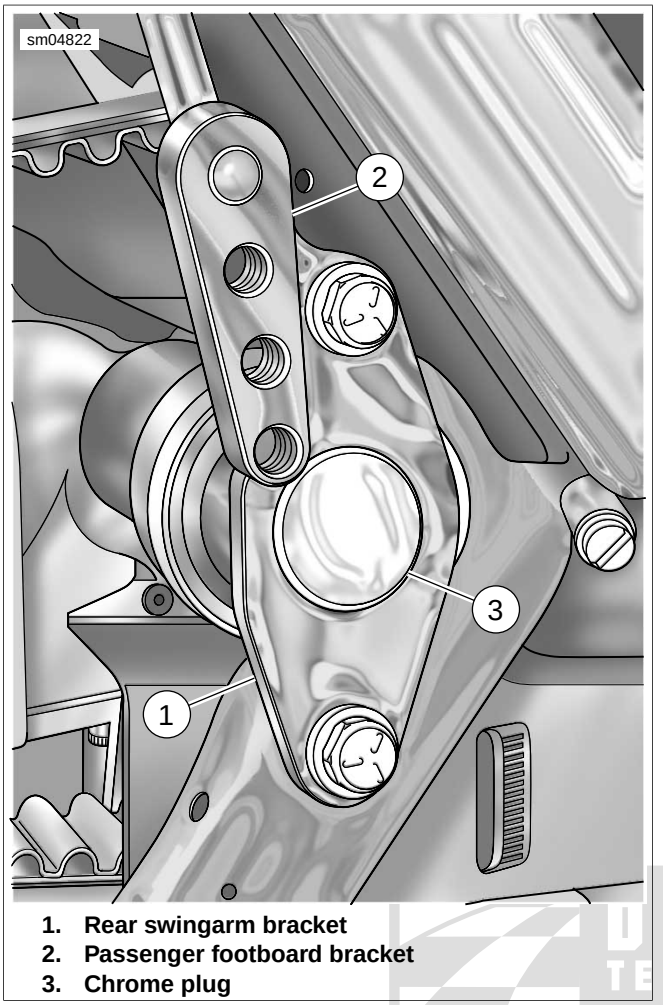
**Figure 2-82. Pivot Shaft Assembly**

## 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 motorcycle. 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 motorcycle frame. See Figure 2-82. Install the pivot shaft as follows:
   a. Coat pivot shaft with Loctite Anti-Seize Lubricant.
   b. From left side of motorcycle, 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 motorcycle, 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 2-77.
   h. Install two bolts (with lockwashers) to secure left side swingarm bracket to motorcycle frame. Tighten bolts to 34-42 ft-lbs (46-57 Nm).
5. Install socket screw with lockwasher to fasten passenger footboard to rear swingarm bracket. Tighten screw to 30-35 ft-lbs (40.7-47.5 Nm). Repeat step on opposite side of motorcycle.
6. 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 motorcycle.
7. Install belt guard at bottom of left side swingarm. Push belt guard toward the rear of the motorcycle until front screw engages small end of slot. Install two rear screws, and then tighten front screw.
8. Seat caliper bracket on anchor weldment of rear swingarm.
9. Capture rear brake line hose in two cable clips at top of right side swingarm. Rear cable clip also captures rear wheel speed sensor cable on ABS equipped motorcycles. Snap cable clips closed.
10. Install rear wheel. See 2.4 REAR WHEEL.

*NOTE*

*At the required service interval (see 1.2 MAINTENANCE SCHEDULE), remove the decorative chrome plugs in the rear swingarm brackets and check the torque on the pivot shaft locknuts. See Figure 2-83. 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.*

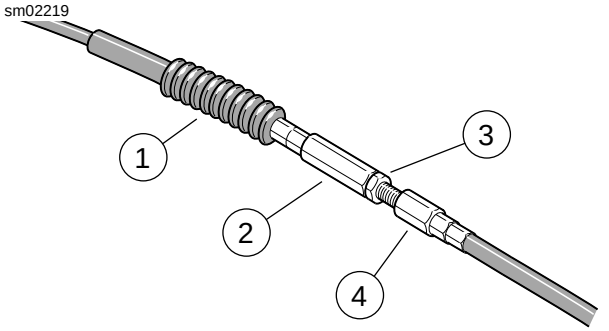



1. Rear swingarm bracket
2. Passenger footboard bracket
3. Chrome plug

**Figure 2-83. Remove Chrome Plugs and Check Locknut Torque**

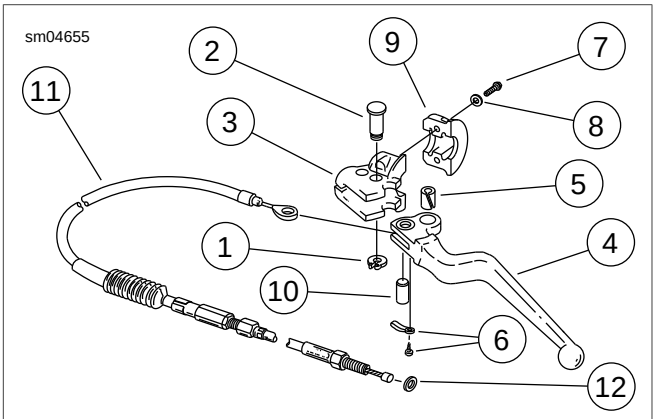
## REMOVAL

1. Remove maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
2. Remove right side exhaust system. See 4.18 EXHAUST SYSTEM.
3. 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 2-84.
4. Remove retaining ring from pivot pin groove at bottom of clutch lever bracket. Remove pivot pin. See Figure 2-85.
5. Remove clutch hand lever from clutch lever bracket. If necessary, remove two T27 TORX screws (with flat washers) to release handlebar clamp from clutch lever bracket.
6. Remove anchor pin and clutch cable eyelet from clutch hand lever.
7. 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.
8. Remove six socket head screws (with captive washers) to free clutch release cover from two dowel pins on transmission side door flange. Remove and discard gasket.




1. **Rubber boot**
2. **Cable adjuster**
3. **Jam nut**
4. **Cable end**

**Figure 2-84. Clutch Cable Adjuster**




1. **Retaining ring**
2. **Pivot pin**
3. **Clutch lever bracket**
4. **Hand lever**
5. **Bushing**
6. **Anti-rattle spring and screw**
7. **Screw**
8. **Flat washer**
9. **Handlebar clamp**
10. **Anchor pin**
11. **Clutch cable**
12. **O-ring**

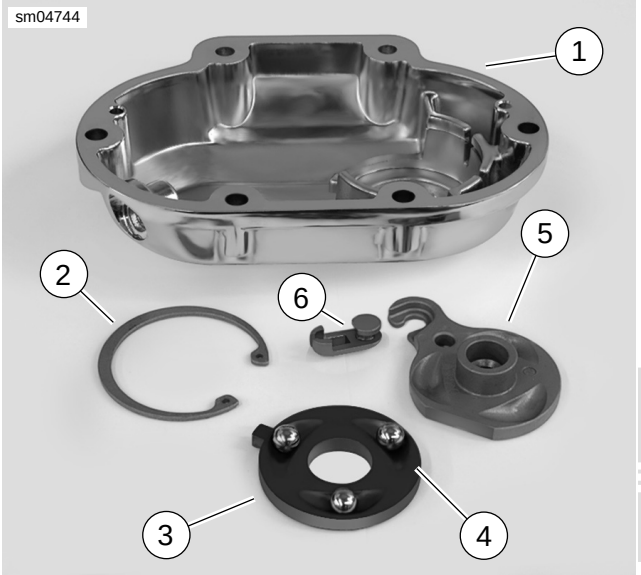
**Figure 2-85. Clutch Hand Lever Assembly**

**WARNING**

**Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)**

9. Remove retaining ring securing ball and ramp mechanism to clutch release cover. See Figure 2-86.
10. 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 clutch cable barrel from recess in coupling.
11. Remove balls from outer ramp sockets. Remove outer ramp from clutch release cover.
12. Unscrew the clutch cable fitting from the clutch release cover. Remove clutch release cover from motorcycle.

13. Cut cable strap in hole of crossbrace to free clutch cable from right frame downtube. See Figure 2-87. Continue as follows:
    a. **FLHR/C:** Remove acorn nut to release P-clamp from stud in upper fork bracket. Remove clutch cable from P-clamp. See Figure 2-88.
    b. **FLHX, FLHT/C/U:** Remove outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U. Cut cable strap to release clutch cable from left fairing bracket. See Figure 2-89.
    c. **FLTR:** Release clutch cable from cable clip anchored in hole on left side of instrument nacelle.
14. Remove clutch cable from motorcycle.

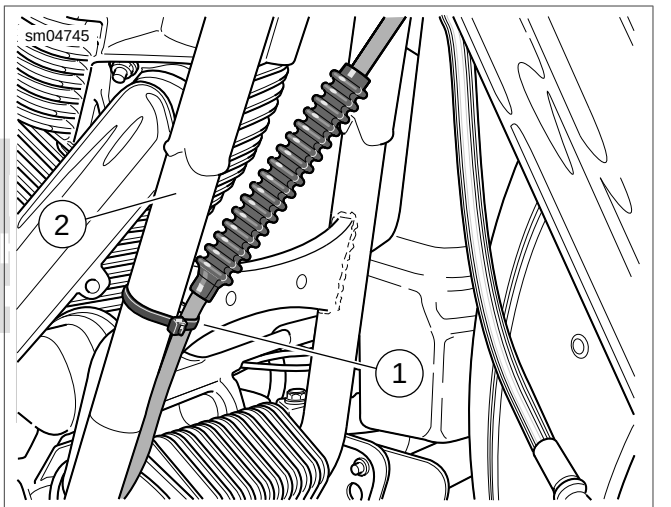



1. **Clutch release cover**
2. **Retaining ring**
3. **Outer ramp**
4. **Ball and socket**
5. **Inner ramp**
6. **Coupling**

**Figure 2-86. Disassemble Clutch Release Cover**

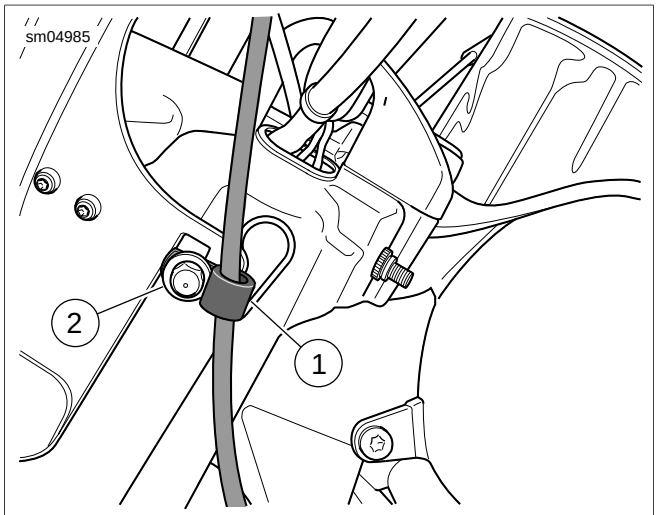
## INSTALLATION

1. See Figure 2-85. 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. If removed, install two T27 TORX screws (with flat washers) to secure handlebar clamp to clutch lever bracket. See Figure 2-85. Starting with the top screw, tighten screws to 60-80 **in-lbs** (6.8-9.0 Nm).
5. Start clutch cable routing as follows:
    a. **FLHR/C:** Capture clutch cable in P-clamp. Slide P-clamp on stud in upper fork bracket and install acorn nut. Orient P-clamp as shown in Figure 2-88. On left side of steering head, run cable downward between engine guard and front of left frame downtube.
    b. **FLHX, FLHT/C/U:** Feed clutch cable through grommet on left side of inner fairing. Route cable on inboard side of left fairing bracket between upper and lower wings of radio (or storage box) support bracket. Cable strap clutch cable to left fairing bracket using oblong hole at this location. See Figure 2-89. Run the cable downward along left side of steering head, and then between engine guard and front of left frame downtube. Install the outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
    c. **FLTR:** Capture clutch cable in cable clip and anchor clip in hole on left side of instrument nacelle. Run cable forward and then rearward beneath instrument nacelle following left side of steering head. Run cable downward between engine guard and front of left frame downtube.




1. **Cable strap**
2. **Right frame downtube**

**Figure 2-87. Clutch Cable Routing (Right Side View)**




1. **P-clamp**
2. **Acorn nut**

**Figure 2-88. FLHR/C Clutch Cable Routing (Left Side View)**

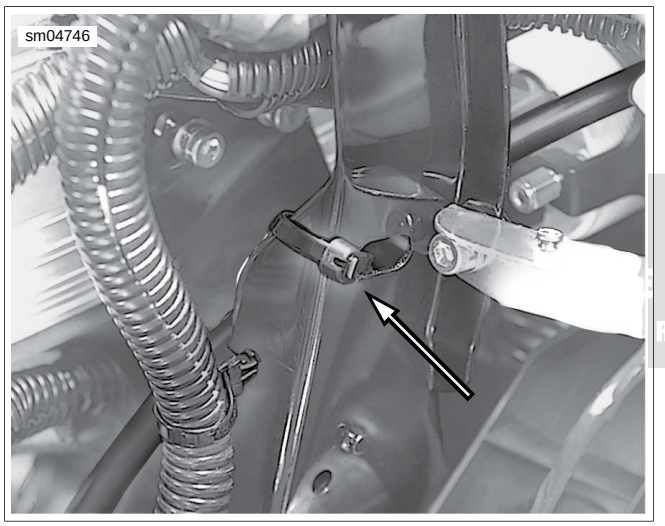


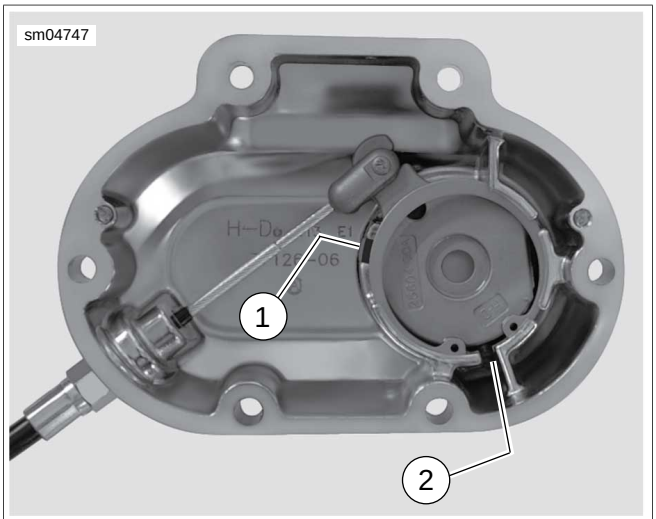

**Figure 2-89. Secure Clutch Cable to Fairing Bracket**

6. **All Models,** Continue downward progression while crossing to right side of motorcycle and then run cable between outboard side of voltage regulator and inboard side of right frame downtube. Threading cable strap through hole in crossbrace, secure clutch cable to downtube as shown in Figure 2-87. 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.
7. Inspect cable fitting O-ring and replace if damaged or deformed. Install clutch cable fitting into clutch release cover. Do not tighten cable fitting at this time.
8. Place outer ramp (ball socket side up) in clutch release cover with tab in cover slot. See Figure 2-90.
9. Apply a multi-purpose grease to the balls and outer ramp sockets. Place a ball in each of three outer ramp sockets.
10. Hold coupling with button facing outboard. Install clutch cable barrel 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.
11. Place inner ramp (ball socket side down) over balls in outer ramp sockets.

**⚠WARNING**

**Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)**

12. Install retaining ring, so that the gap is centered above the break in the ribbing at bottom of clutch release cover. See Figure 2-90.
13. Verify that two dowel pins are in place on transmission side door flange. Hang a new gasket on the dowel pins.
14. Holding the clutch release cover in position, install six socket head screws (with captive washers). Tighten screws to 84-108 **in-lbs** (9.5-12.2 Nm) in the sequence shown in Figure 2-91.
15. Tighten clutch cable fitting to 90-120 **in-lbs** (10.2-13.6 Nm).
16. Check the O-ring on the transmission drain plug for tears, cuts or general deterioration. Replace as necessary.
17. Install transmission drain plug. Tighten the plug to 14-21 ft-lbs (19-28 Nm).
18. Remove the transmission lubricant filler plug from the right side of the transmission case. Inspect the O-ring for cuts, tears or general deterioration. Replace the O-ring if necessary.
19. Pour 32 oz. (946 ml) of transmission lubricant through the fill hole. Use only Harley-Davidson FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT, Part No. 99851-05 (quart).
20. With the motorcycle resting on the jiffy stand on level ground, insert the filler plug into the fill hole so that it is resting on the threads. Do not screw the filler plug into the fill hole. Remove the filler plug and note the level of the lubricant on the dipstick. Lubricant level should be between the A(dd) and F(ull) marks.




1. **Outer ramp tab and slot**
2. **Retaining ring gap**

**Figure 2-90. Assemble Clutch Release Cover**

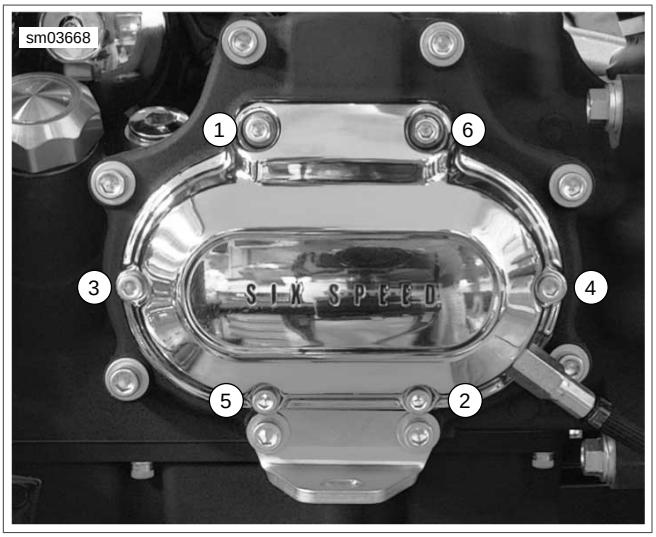



**Figure 2-91. Clutch Release Cover Torque Sequence (Short Screws at Locations 1 and 6)**

21. Install the filler plug in the transmission case and tighten to 25-75 **in-lbs** (2.8-8.5 Nm).
22. Adjust the clutch cable. See 1.11 CLUTCH.
23. Install right side exhaust system. See 4.18 EXHAUST SYSTEM.
24. Install maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.

## ADJUSTMENT

1. Remove maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
2. Gain access to upper handlebar clamp:
   a. **FLHR/C:** Remove decorative plate from handlebar clamp shroud. See Figure 2-92 and Figure 2-93.
   b. **FLHX, FLHT/C/U:** Remove fairing cap. See 2.36 FAIRING CAP: FLHX, FLHT/C/U.
   c. **FLTR:** Remove instrument bezel. See 2.40 INSTRUMENT BEZEL: FLTR.
3. Loosen rear screws on the upper handlebar clamp. On FLTR models, loosen the front screws instead.
4. Position handlebars for rider posture and comfort.
5. 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.
6. Snug upper handlebar clamp screws.
7. 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.
8. Tighten the upper handlebar clamp screws to 16-20 ft-lbs (21.7-27.1 Nm).
9. Reassemble:
   a. **FLHR/C:** Install decorative plate onto handlebar clamp shroud. See Figure 2-92.
   b. **FLHX, FLHT/C/U:** Install fairing cap. See 2.36 FAIRING CAP: FLHX, FLHT/C/U.
   c. **FLTR:** Install instrument bezel. See 2.40 INSTRUMENT BEZEL: FLTR.
10. If necessary, adjust left and right handlebar switch controls as follows:
    a. Loosen two screws securing handlebar clamp to clutch lever bracket (left) or master cylinder reservoir (right).
    b. Position switch controls for rider posture and comfort.
    c. Beginning with top screw, tighten screws securing handlebar clamp to clutch lever bracket to 72-108 **in-lbs** (8-12 Nm).
    d. Beginning with top screw, tighten screws securing handlebar clamp to master cylinder reservoir to 72-80 **in-lbs** (8-9 Nm).
11. Install maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.


**Figure 2-92. Remove Decorative Plate (FLHR/C)**


**Figure 2-93. Loosen Upper Handlebar Clamp Screws (FLHR/C)**

## REMOVAL

1. Remove maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
2. Remove or disconnect twist grip sensor jumper harness depending upon whether the handlebar is being replaced or just removed. See 4.9 TWIST GRIP SENSOR.
3. Place blanket or protective cover over front of fuel tank to protect against scratches or other damage.

4. Gain access to upper handlebar clamp:
   a. **FLHR/C:** Remove handlebar clamp shroud. See 2.45 HEADLAMP NACELLE: FLHR/C.
   b. **FLHX, FLHT/C/U:** Remove fairing cap. See 2.36 FAIRING CAP: FLHX, FLHT/C/U. Remove radio (or storage box). See 8.32 ADVANCED AUDIO SYSTEM.
   c. **FLTR:** Remove instrument nacelle. See 2.41 INSTRUMENT NACELLE: FLTR.
5. Remove right and left handlebar switch controls. See 8.39 HANDLEBAR SWITCH ASSEMBLIES and 8.39 HANDLEBAR SWITCH ASSEMBLIES, respectively.
6. Remove upper handlebar clamp screws. Remove upper handlebar clamp and handlebar.

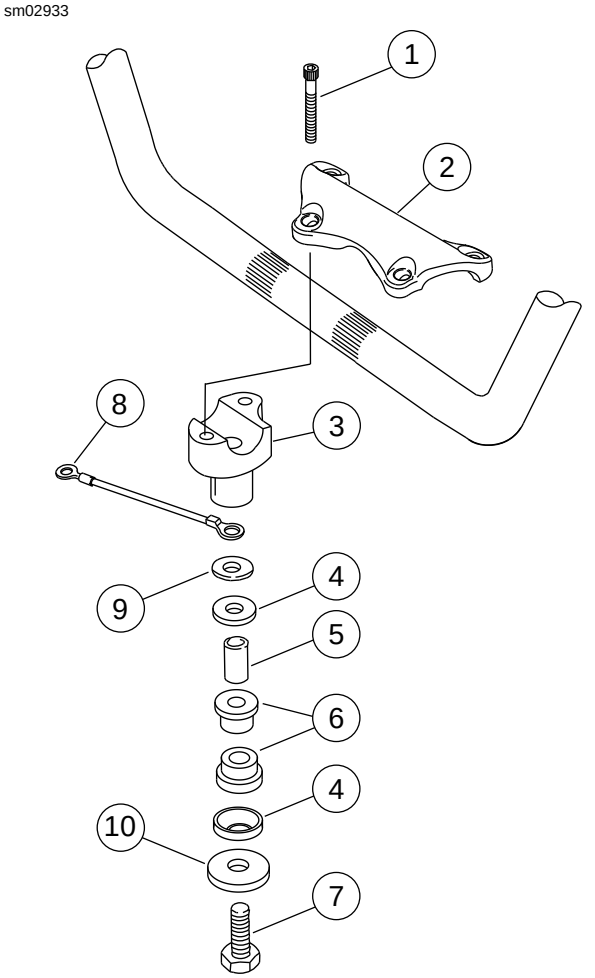
## INSTALLATION

1. Place **new** handlebars on lower handlebar clamps. Install upper handlebar clamp and loosely install clamp screws.
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.
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 16-20 ft-lbs (21.7-27.1 Nm).
   c. Tighten front screws to 16-20 ft-lbs (21.7-27.1 Nm).

*NOTE*

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

6. Install left hand grip, if removed. See 2.24 HANDLEBARS, Left Hand Grip.
7. Install right and left handlebar switch controls. See 8.39 HANDLEBAR SWITCH ASSEMBLIES and 8.39 HANDLEBAR SWITCH ASSEMBLIES, respectively.
8. Reassemble:
   a. **FLHR/C:** Install handlebar clamp shroud. See 2.45 HEADLAMP NACELLE: FLHR/C.
   b. **FLHX, FLHT/C/U:** Install fairing cap. See 2.36 FAIRING CAP: FLHX, FLHT/C/U. Install radio (or storage box). See 8.32 ADVANCED AUDIO SYSTEM.
   c. **FLTR:** Install instrument nacelle. See 2.41 INSTRUMENT NACELLE: FLTR.
9. Install or connect twist grip sensor jumper harness depending upon whether the handlebar was replaced or just removed. See 4.9 TWIST GRIP SENSOR.
10. Install maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
11. Turn 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.




1. **Screw**
2. **Upper clamp**
3. **Lower clamp**
4. **Cup washer**
5. **Spacer**
6. **Rubber bushing**
7. **Bolt**
8. **Ground cable (left clamp only)**
9. **Flat washer (right clamp only)**
10. **Large flat washer (right clamp only)**

**Figure 2-94. Handlebar Clamp Assemblies**

## LEFT HAND GRIP

### Removal

1. Remove left handlebar switch controls. See 8.39 HANDLEBAR SWITCH ASSEMBLIES.
2. Use a sharp blade to carefully cut rubber and then peel off handlebar.
3. Thoroughly clean handlebar to remove all residual adhesive.

## Installation

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 1.0 in. (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. (21°C.) to allow adhesive to fully cure.
4. Install left handlebar switch controls. See 8.39 HANDLEBAR SWITCH ASSEMBLIES.

# 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 2.24 HANDLEBARS, Removal.

## Removal: Right Side

1. Holding lower handlebar clamp to prevent rotation, turn bolt at bottom of upper fork bracket until free.
2. Remove lower handlebar clamp, flat washer and cup washer at top of upper fork bracket. See Figure 2-95.
3. Pull bushing from fork bracket bore and discard. See Figure 2-96.
4. Moving to bottom of upper fork bracket, remove bolt, large flat washer and cup washer. See Figure 2-97.
5. Pull bushing and spacer from fork bracket bore. Remove spacer from bushing. See Figure 2-98. Discard bushing.

## Removal: Left Side

1. Holding lower handlebar clamp to prevent rotation, turn bolt at bottom of upper fork bracket until free.
2. Remove lower handlebar clamp, ground wire ring terminal and cup washer at top of upper fork bracket.
3. Pull bushing from fork bracket bore and discard. See Figure 2-96.
4. Moving to bottom of upper fork bracket, remove bolt and cup washer.
5. Pull bushing and spacer from fork bracket bore. Remove spacer from bushing. See Figure 2-98. Discard bushing.

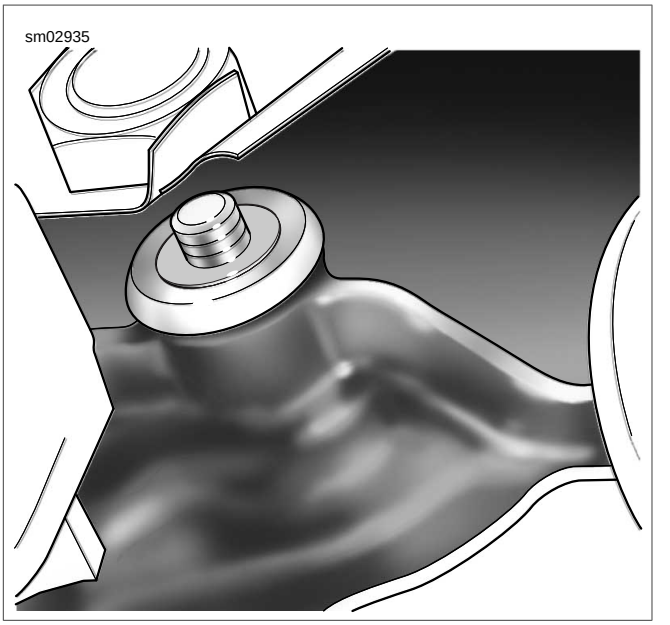



**Figure 2-95. Remove Flat Washer and Upper Cup Washer (Right Side)**

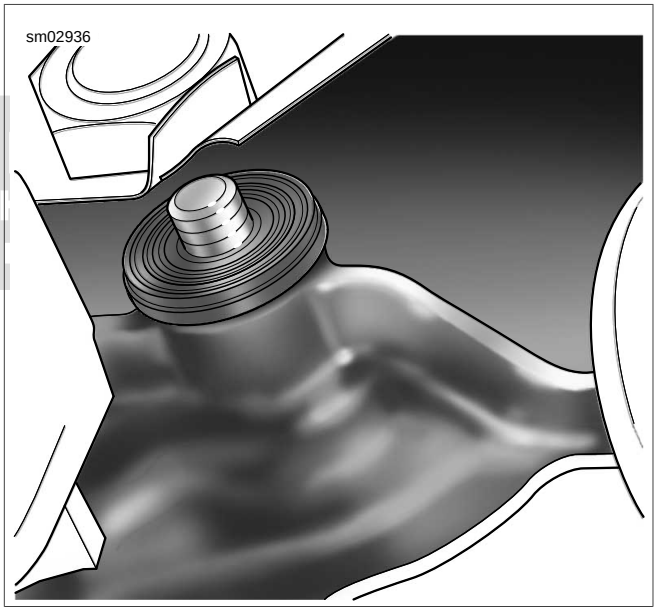



**Figure 2-96. Remove Upper Bushing (Right Side)**

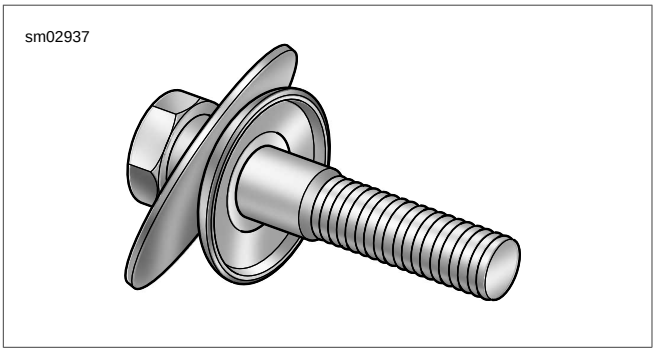



**Figure 2-97. Remove Bolt, Large Washer, and Lower Cup Washer (Right Side)**

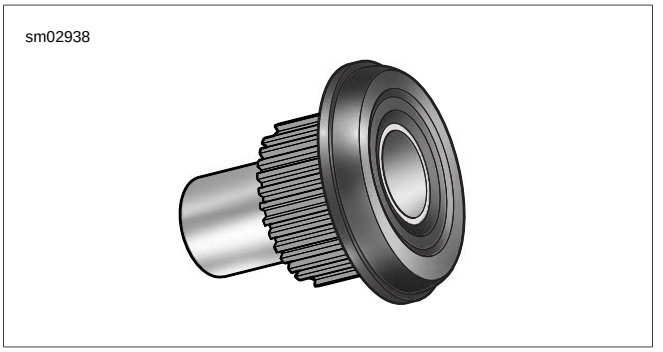



**Figure 2-98. Remove Spacer from Lower Bushing**

## Installation: Right Side

1. Insert spacer into **new** bushing until flush with outboard side of collar. See Figure 2-98.
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 2-97. 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 2-96.
5. Install cup washer over threaded end of bolt fitting concave side over collar of bushing. Install flat washer. See Figure 2-95.
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.

## Installation: Left Side

1. Insert spacer into **new** bushing until flush with outboard side of collar. See Figure 2-98.
2. Insert bushing into bore at bottom of upper fork bracket fitting collar of bushing over lip of boss.
3. Install cup washer on bolt. 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 2-96.
5. Install cup washer over threaded end of bolt fitting concave side over collar of bushing. Install ground wire ring terminal.
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.

## Installation: General

1. Install handlebars and upper handlebar clamp. See 2.24 HANDLEBARS, Installation.
2. 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.
3. Complete assembly of motorcycle. See 2.24 HANDLEBARS, Installation.

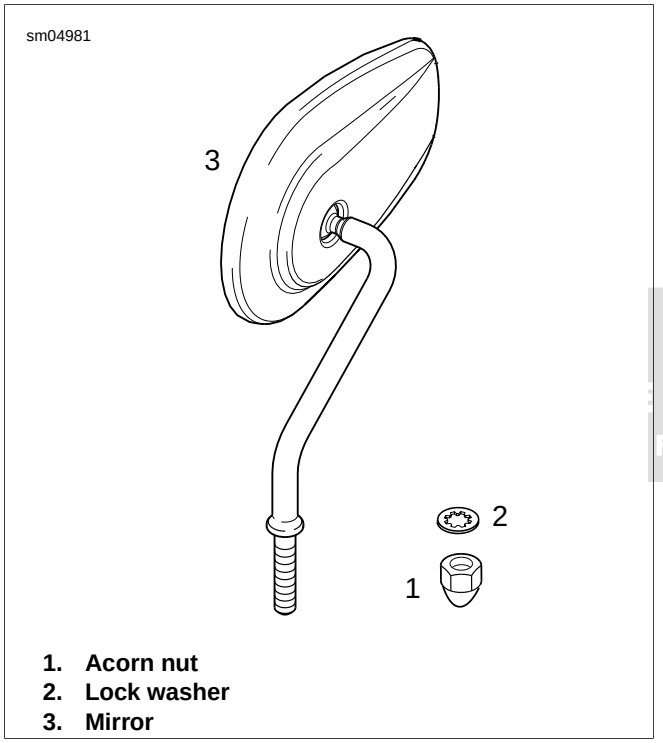
## ALL MODELS EXCEPT FLHX

### Removal

1. Remove acorn nut and lock washer.
2. Remove threaded stem of mirror from hole in clutch or brake lever bracket. See Figure 2-99.

### Installation

1. Insert threaded stem of mirror into hole in clutch or brake lever bracket.
2. Install lock washer and acorn nut.
3. Adjust mirror as necessary and tighten acorn nut to 60-96 **in-lbs** (6.8-10.8 Nm).




1. **Acorn nut**
2. **Lock washer**
3. **Mirror**

**Figure 2-99. Mirror Assembly (All Models Except FLHX)**

## FLHX

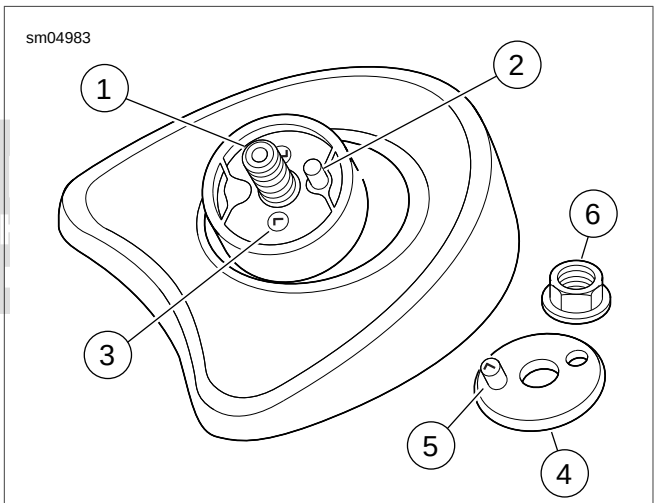
### Removal

1. Remove outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
2. Remove flange nut and plastic washer. Remove mirror. See Figure 2-100.

### Installation

1. With the rounded side of the mirror on the outboard side (and the bar and shield logo right side up), insert threaded stud and index pin on swivel block through holes in inner fairing. See Figure 2-101.


**Figure 2-100. Remove Outer Fairing (FLHX)**




1. **Threaded stud**
2. **Index pin**
3. **Swivel block stamp**
4. **Plastic washer**
5. **Stamped post**
6. **Flange nut**

**Figure 2-101. Left Side Mirror Assembly (FLHX)**

*NOTE*

*The letters "L" or "R" are stamped on the swivel blocks to differentiate between left and right side mirrors.*

2. With the post on the outboard side, place the plastic washer against the inner fairing engaging two holes in washer with threaded stud and index pin.

*NOTE*

*The letters "L" or "R" are stamped on the posts to differentiate between left and right side washers.*

3. Install flange nut on threaded stud and tighten to 30-40 **in-lbs** (3.4-4.5 Nm). See Figure 2-100.
4. Adjust mirror as necessary.
5. Install outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.

## SEAT: FLHT

### Removal

**CAUTION**

**Detach passenger seat strap before removing seat. Failure to do so can result in damage to rear fender paint. (00225a)**

1. Open left side saddlebag.
2. Remove screw to release passenger seat strap from seat strap bracket. A firm tug may be necessary to free end of strap from slot of seat strap bracket. See Figure 2-102.
3. Draw free end of passenger seat strap to right side of motorcycle.
4. Remove screw to detach seat mounting bracket from top of rear fender.
5. Push seat rearward to free slot from tongue on rear fuel tank bracket. See Figure 2-103.

### Installation

1. Place seat on frame.
2. Firmly push front of seat downward and then forward until slot engages tongue on rear fuel tank bracket. See Figure 2-103.
3. Align hole in seat mounting bracket with seat retention nut in rear fender. Install screw and tighten to 20-40 **in-lbs** (2.3-4.5 Nm).

*NOTE*

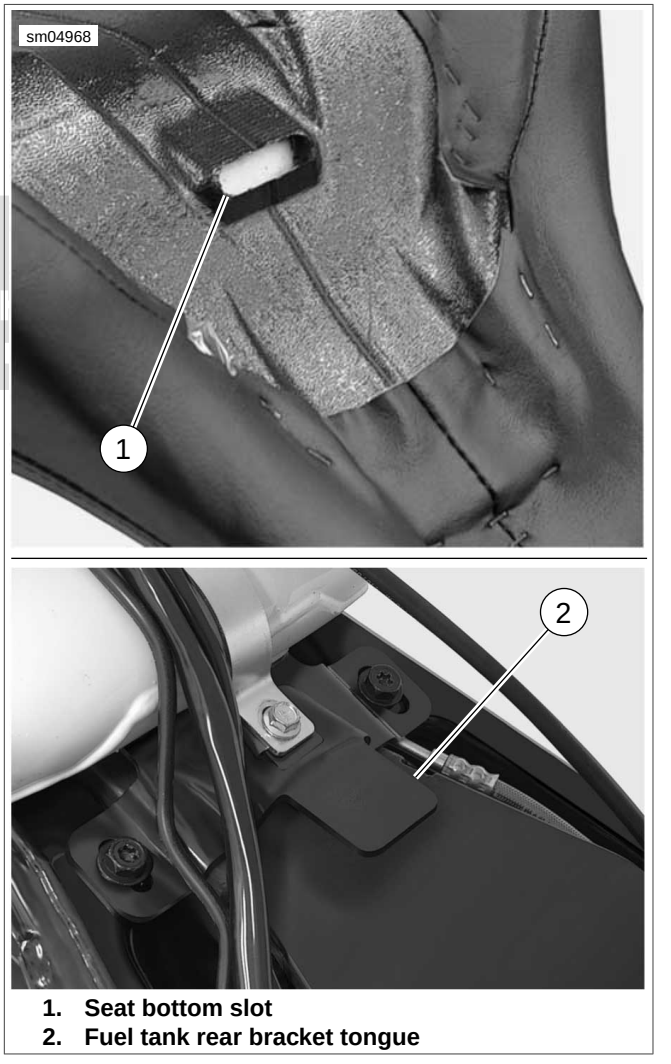
*If seat retention nut is damaged or lost, see 2.26 SEAT, Seat Retention Nut Replacement for instructions.*

4. Draw free end of passenger seat strap to left side of motorcycle.
5. Start screw to fasten passenger seat strap to seat strap bracket. Feed end of strap into slot of seat strap bracket and tighten screw to 48-72 **in-lbs** (5.4-8.1 Nm). See Figure 2-102.
6. Close left side saddlebag

**WARNING**

**After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)**


**Figure 2-102. Seat Strap Bracket Screw (FLHT/C/U)**




1. **Seat bottom slot**
2. **Fuel tank rear bracket tongue**

**Figure 2-103. Seat Mounting**

## SEAT: FLHTC/U

### Removal

1. Open left side saddlebag.
2. Remove screw to release passenger seat strap from seat strap bracket. A firm tug may be necessary to free end of strap from slot of seat strap bracket. See Figure 2-102.
3. Draw free end of passenger seat strap to right side of motorcycle.
4. Open Tour-Pak to move passenger seat backrest out of the way.

*NOTE*

*The Tour-Pak must be moved to the rearward position to access the seat mounting bracket screw. If installed in the forward position, remove Tour-Pak and install in the rearward position. See 2.29 TOUR-PAK for more information.*

5. Remove screw to detach seat mounting bracket from top of rear fender. To protect finish of Tour-Pak, cover rear seat mounting bracket with palm of hand.
6. While pushing seat forward, raise rear of seat until bracket clears Tour-Pak. Push seat rearward to free slot from tongue on rear fuel tank bracket. See Figure 2-103.
7. Remove seat from frame.

### Installation

1. See Figure 2-103. Place seat on frame.
2. To protect finish of Tour-Pak, cover rear seat mounting bracket with palm of hand.
3. While raising rear of seat approximately 3 in. (76.2 mm), use other hand to firmly push front of seat downward and then forward until slot engages tongue on rear fuel tank bracket.
4. Align hole in seat mounting bracket with seat retention nut in rear fender. Install screw and tighten to 20-40 **in-lbs** (2.3-4.5 Nm).

*NOTE*

*If seat retention nut is damaged or lost, see SEAT RETENTION NUT REPLACEMENT for instructions.*

5. Draw free end of passenger seat strap to left side of motorcycle.
6. Start screw to fasten passenger seat strap to seat strap bracket. Feed end of strap into slot of seat strap bracket and tighten screw to 48-72 **in-lbs** (5.4-8.1 Nm). See Figure 2-102.
7. Close left side saddlebag

**WARNING**

**After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)**

## SEAT: FLHR/C, FLHX, FLTR

### Removal

1. Remove left side saddlebag.
2. Remove screw (with flat washer) to remove passenger seat strap and saddlebag front mounting bracket from chrome frame tube cover.
3. Draw free end of passenger seat strap to right side of motorcycle (passing through slots in seat on FLHRC models). See Figure 2-104.
4. Remove screw to detach seat mounting bracket from top of rear fender.
5. Push seat rearward to free slot from tongue on rear fuel tank bracket. See Figure 2-103.
6. Remove seat from frame.

### Installation

1. Place seat on frame.
2. Firmly push front of seat downward and then forward until slot engages tongue on rear fuel tank bracket. See Figure 2-103.
3. Align hole in seat mounting bracket with seat retention nut in rear fender. Install screw and tighten to 20-40 **in-lbs** (2.3-4.5 Nm).

*NOTE*

*If seat retention nut is damaged or lost, see 2.26 SEAT, Seat Retention Nut Replacement for instructions.*

4. Draw free end of passenger seat strap to left side of motorcycle (passing through slots in seat on FLHRC models). See Figure 2-104.

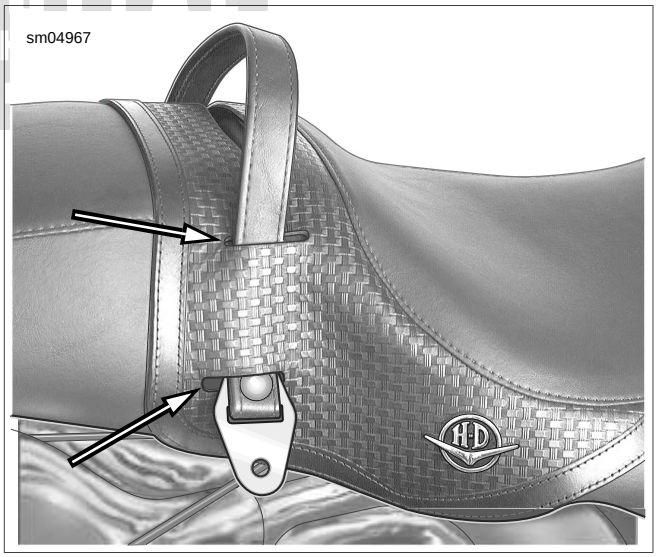



**Figure 2-104. Route Passenger Seat Strap Through Slots (FLHRC)**

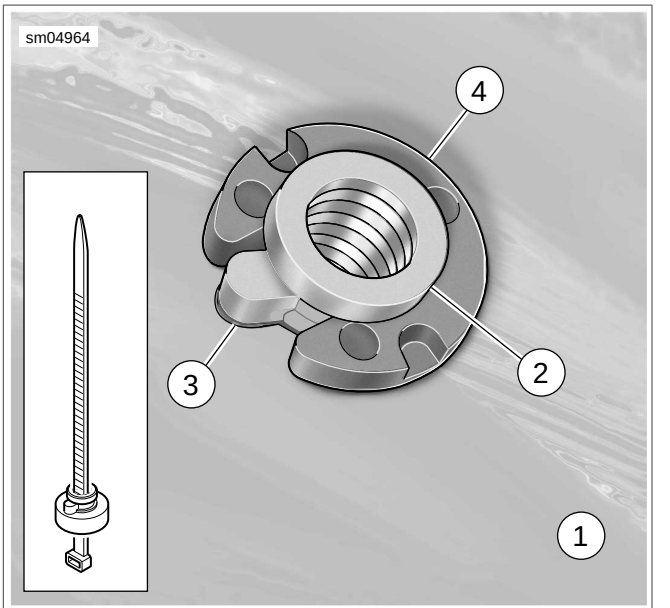
5. Insert screw with flat washer through passenger seat strap and slotted hole of saddlebag front mounting bracket. Insert screw into forward hole in chrome frame tube cover. Snug screw, but do not tighten.
6. Install left side saddlebag.
7. Tighten saddlebag front mounting bracket screw to 60-96 **in-lbs** (6.8-10.8 Nm).

**WARNING**

**After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)**

## 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. See inset of Figure 2-105.
2. 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.




1. **Rear fender**
2. **Retention nut**
3. **Tab**
4. **Retention washer**

**Figure 2-105. Install Seat Retention Nut**

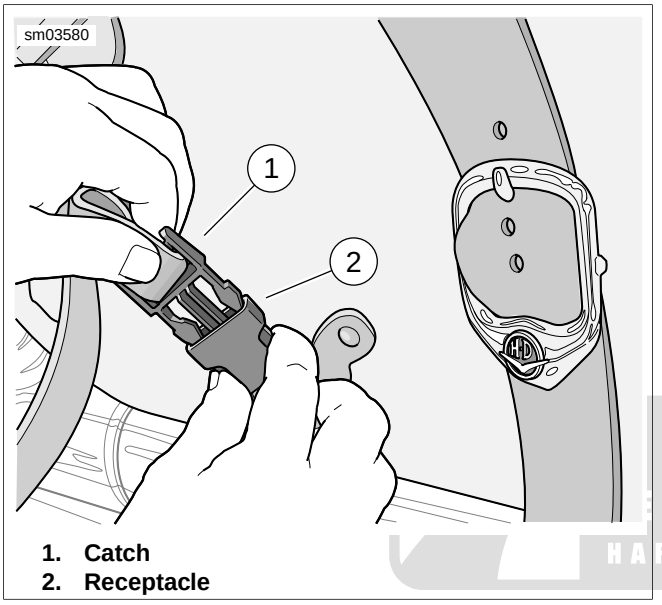
## OPENING

*NOTE*

*Maximum recommended load for each saddlebag is 15 lbs (6.8 kg).*

### FLHRC

1. Raise the decorative buckle and press tabs on both sides of catch to release from receptacle. Repeat step to release second catch. See Figure 2-106.
2. Rotate hinge on outboard side of saddlebag to open lid.

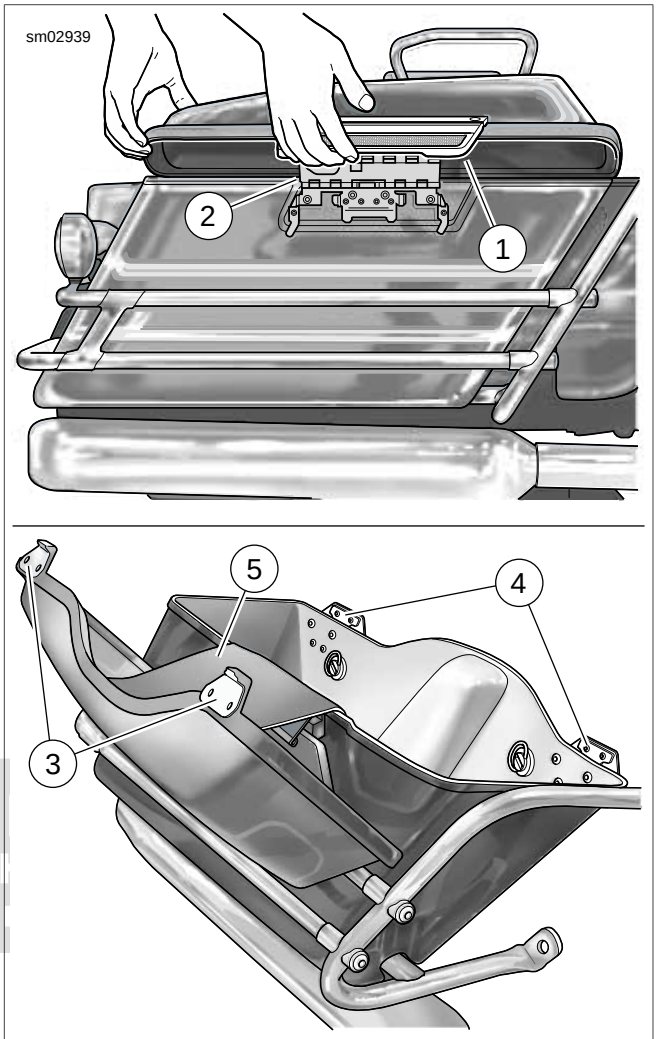



1. **Catch**
2. **Receptacle**

**Figure 2-106. Open Saddlebag (FLHRC)**

### FLHR, FLHX, FLHT/C/U, FLTR

1. Use key to unlock lid latch if locked.
2. Pull bottom of latch outward and then lift upward raising outboard corners of saddlebag lid. See upper frame of Figure 2-107.
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 2-107.




1. **Latch**
2. **Hinge**
3. **Anchor tabs**
4. **Anchor brackets**
5. **Check strap**

**Figure 2-107. Open Saddlebag (FLHR, FLHX, FLHT/C/U, FLTR)**

## CLOSING

### FLHRC

1. Rotate hinge on outboard side of saddlebag to close lid.
2. Insert catch into receptacle until tabs fully engage. Repeat step to secure second catch. See upper frame of Figure 2-106.

### FLHR, FLHX, FLHT/C/U, FLTR

1. Rotate lid to closed position engaging both anchor tabs with bottom of anchor brackets. Press bottom of latch inward until it snaps closed. See lower frame of Figure 2-107.
2. Use key to lock lid latch.

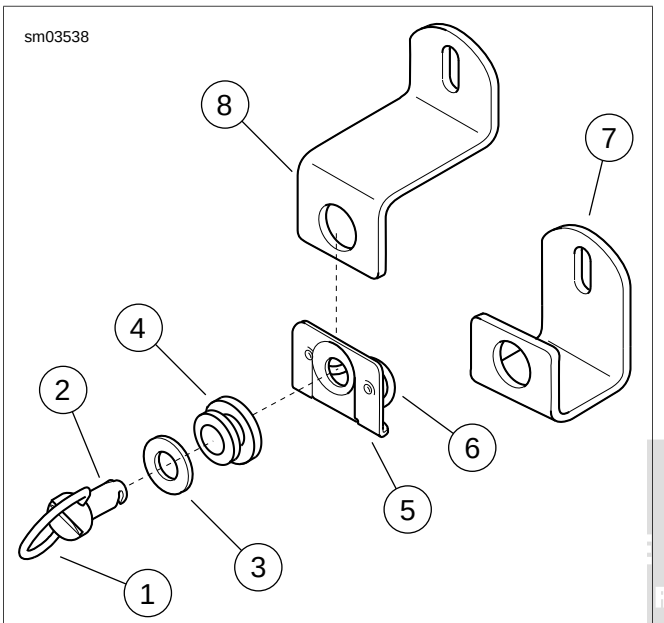
## REMOVAL

1. Open saddlebag. See 2.27 SADDLEBAGS, Opening.
2. Grasp bail wire inside saddlebag and rotate each stud a full 1/4 turn in a counterclockwise direction. Remove bail head studs with flat washers from grommets. See Figure 2-108.

*NOTE*

*On some HDI motorcycles, 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.




1. **Bail wire**
2. **Stud**
3. **Flat washer**
4. **Grommet**
5. **Spring plate**
6. **Wire form**
7. **Front bracket**
8. **Rear bracket**

**Figure 2-108. Saddlebag Quick-Release Fasteners**

## INSTALLATION

1. Position saddlebag on motorcycle aligning holes in grommets with those in front and rear mounting brackets.

*NOTE*

*Replace grommets if torn or deteriorated. Moisten **new** grommet with glass cleaner or soapy water and work smaller OD through hole into saddlebag. See Figure 2-108.*

2. Place flat washers on bail head studs, if removed.
3. With groove at end of stud held in a horizontal position, insert stud through holes in grommet 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 locks in place. Install rear bail head stud in the same manner.

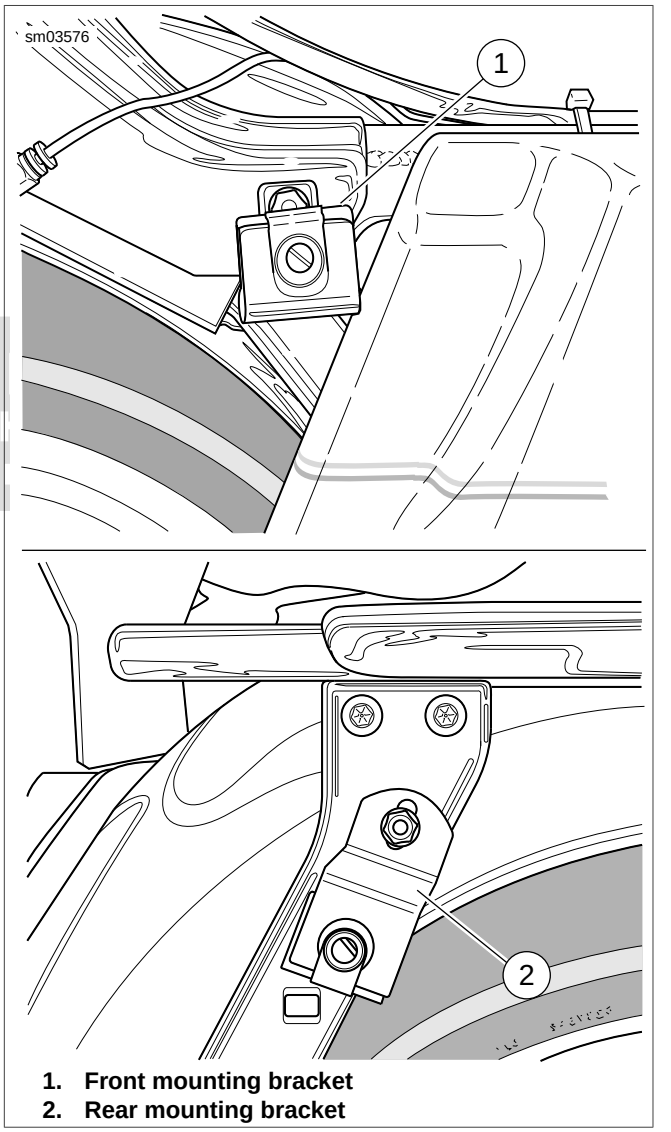
*NOTE*

*On some HDI motorcycles, 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 2-109. Alternately tighten bolts to 60-96 **in-lbs** (7-11 Nm) after seating saddlebag.*

4. Close saddlebag. See 2.27 SADDLEBAGS, Closing.




1. **Front mounting bracket**
2. **Rear mounting bracket**

**Figure 2-109. Saddlebag Mounting Brackets (Right Side View)**

## SADDLEBAG HARDWARE

### 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 2.27 SADDLEBAGS.
3. Lay saddlebag flat on pad with the inboard side facing up and the lid closest to you.
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.

*NOTE*

*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.
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 2-110.
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 2-110.

*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 2-111. 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 2-111.

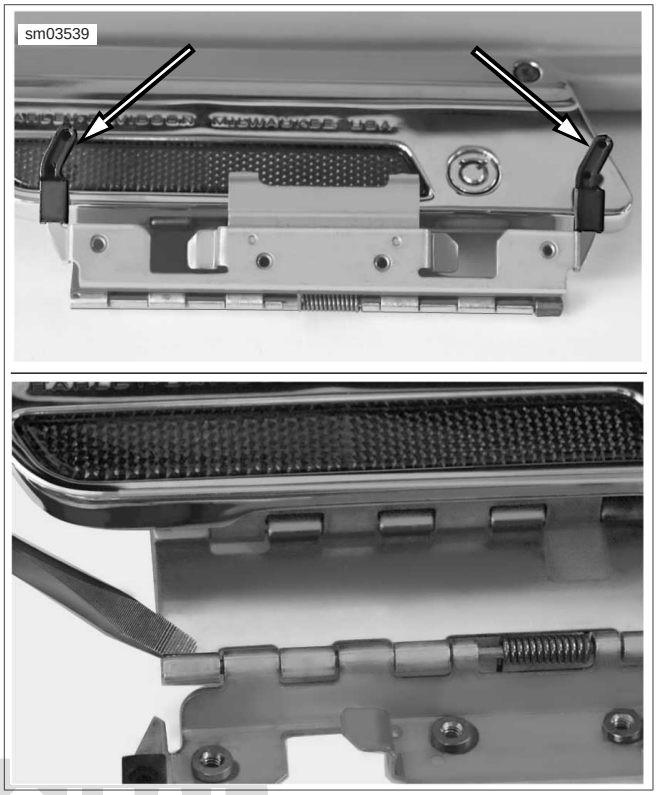



**Figure 2-110. Lid Right Side Up With Latch on Near Side**

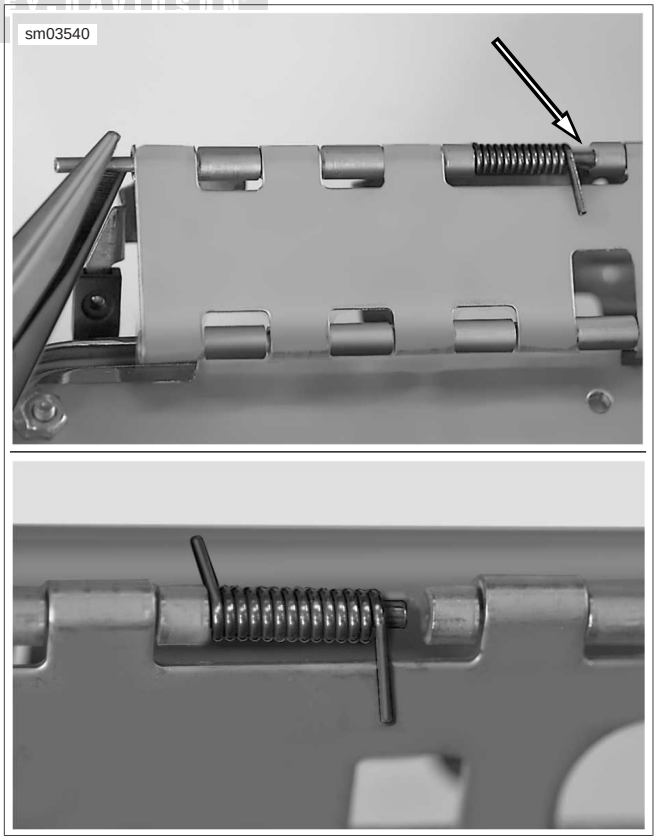



**Figure 2-111. Lid Up Side Down With Latch on Far Side**

## Installation

1. Slide **new** spring onto end of pin. Orient spring as shown in lower frame of Figure 2-111.
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 2-110.
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 2.27 SADDLEBAGS.

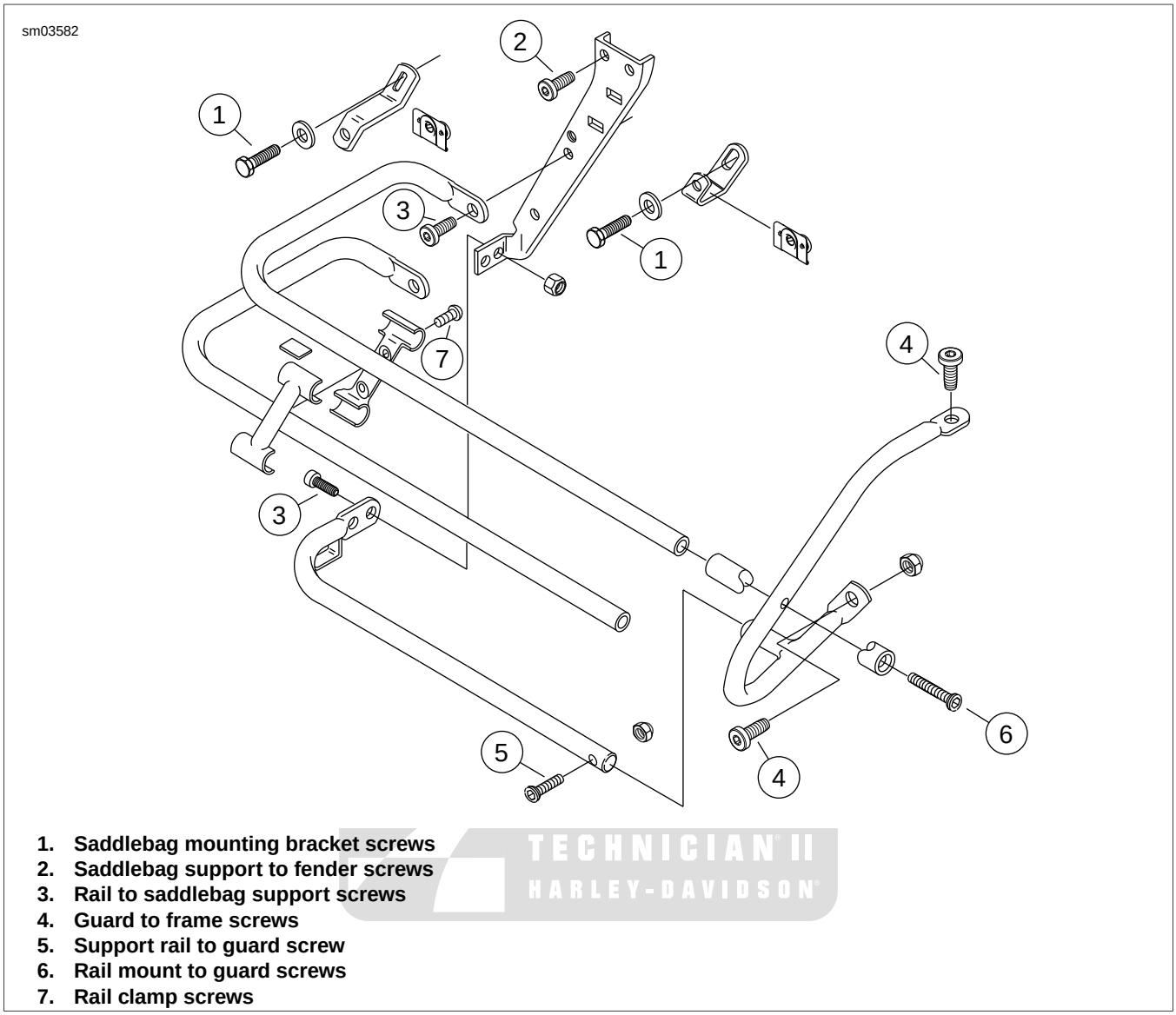
# SADDLEBAG GUARD/SUPPORT RAIL

## Removal

1. Remove saddlebag. See 2.27 SADDLEBAGS.
2. Disassemble saddlebag guard, support and/or rails as necessary. See Figure 2-112, Figure 2-113 or Figure 2-114.

## Installation

1. Assemble saddlebag guard, support and/or rails as necessary. Replace any damaged parts. See Figure 2-112, Figure 2-113 or Figure 2-114. Refer to the table associated with each figure for the correct fastener torque specifications.
2. Install saddlebag. See 2.27 SADDLEBAGS.



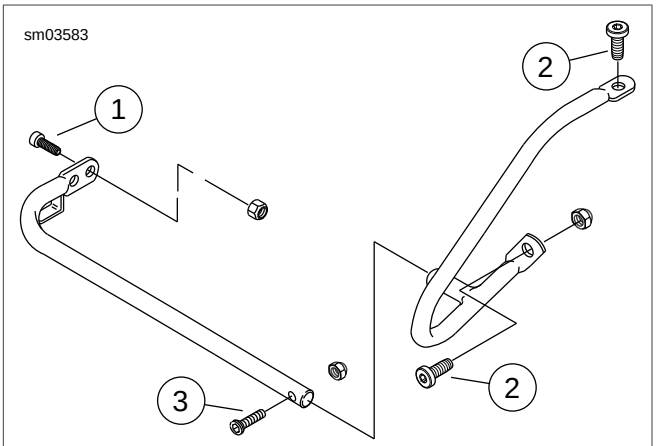

1. **Saddlebag mounting bracket screws**
2. **Saddlebag support to fender screws**
3. **Rail to saddlebag support screws**
4. **Guard to frame screws**
5. **Support rail to guard screw**
6. **Rail mount to guard screws**
7. **Rail clamp screws**



**Figure 2-112. Multi-Rail Saddlebag Guard (FLHTC/U)**

**Table 2-14. Multi-Rail Saddlebag Guard (FLHTC/U): Fastener Torque Specifications**

| ITEM | TORQUE |
|---|---|
| 1 | 60-96 **in-lbs** (7.0-11.0 Nm) |
| 2 | 15-20 ft-lbs (20.0-27.0 Nm) |
| 3 | 15-20 ft-lbs (20.0-27.0 Nm) |
| 4 | 15-20 ft-lbs (20.0-27.0 Nm) |
| 5 | 70-100 **in-lbs** (8.0-11.0 Nm) |
| 6 | 72-120 **in-lbs** (8.0-14.0 Nm) |
| 7 | 30-50 **in-lbs** (3.0-6.0 Nm) |

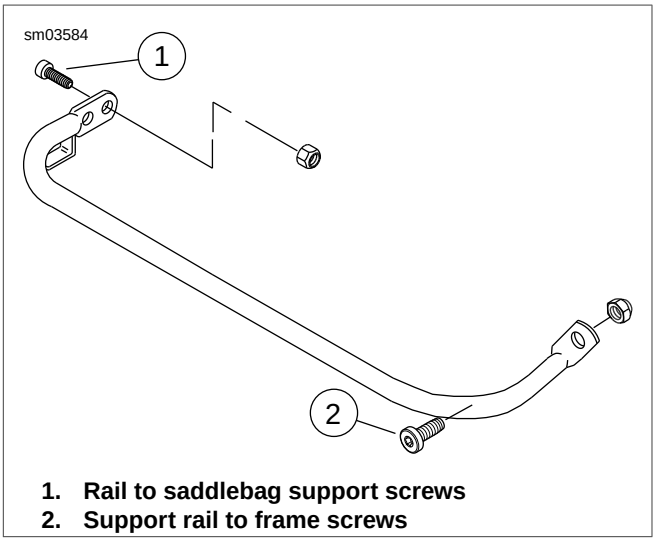



1. **Rail to saddlebag support screws**
2. **Guard to frame screws**
3. **Support rail to guard screw**

**Figure 2-113. Saddlebag Guard (FLHR/C, FLHT)**

**Table 2-15. Saddlebag Guard (FLHR/C, FLHT): Fastener Torque Specifications**

| ITEM | TORQUE |
|---|---|
| 1 | 15-20 ft-lbs (20.0-27.0 Nm) |
| 2 | 15-20 ft-lbs (20.0-27.0 Nm) |
| 3 | 70-100 **in-lbs** (8.0-11.0 Nm) |




1. **Rail to saddlebag support screws**
2. **Support rail to frame screws**

**Figure 2-114. Saddlebag Support Rail (FLHX, FLTR)**

**Table 2-16. Saddlebag Support Rail (FLHX, FLTR): Fastener Torque Specifications**

| ITEM | TORQUE |
|---|---|
| 1 | 15-20 ft-lbs (20.0-27.0 Nm) |
| 2 | 15-20 ft-lbs (20.0-27.0 Nm) |

## FLHTC

### Removal

1. Open Tour-Pak. Remove rubber mat.
2. Rotate knurled lock ring in a counter-clockwise direction to separate pin and socket halves of radio antenna cable connector [51]. Release cable from two adhesive clips at bottom of Tour-Pak.
3. Disconnect Tour-Pak lights connector [12], 3-place Multilock. See Figure 2-115.
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 2-116.
6. Holding nylon cap locknuts at bottom of luggage rack rail, remove four hex head bolts (with flat washers) from inside Tour-Pak. Luggage rack spacers will become free as locknuts are removed.
7. Holding button head bolt at rear center hole, remove locknut (and flat washer) from inside Tour-Pak to release Tour-Pak from luggage rack. Be sure to have a firm grasp on the Tour-Pak as the bolt is removed. See Figure 2-117.

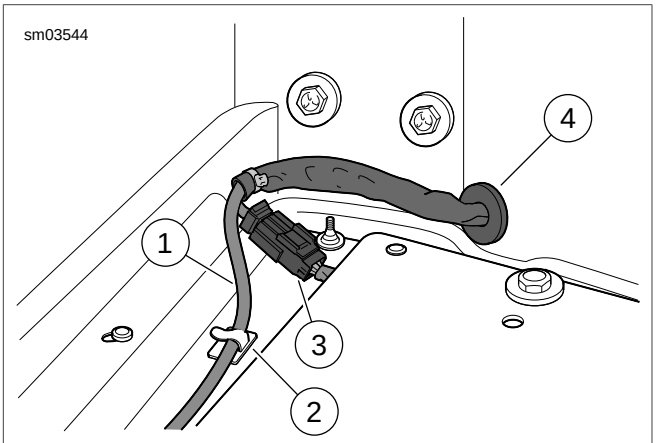
### Installation

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 button head bolt through spacer (concave side up), luggage rack and Tour-Pak holes. From inside Tour-Pak, install flat washer, radio antenna ground ring terminal and locknut on bolt. With concavity on spacer inline with the rail, hold locknut and tighten bolt until snug.

*NOTE*

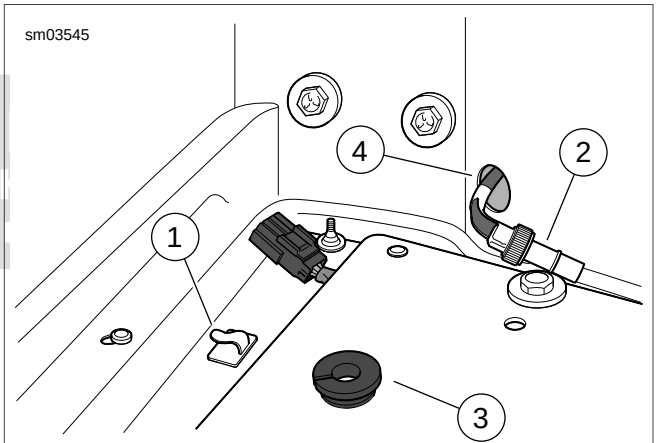
*Always install hex head bolts from inside Tour-Pak. If hex head bolts are installed upside down, then loss of a nylon cap could cause the end of a bolt to tear the molded liner and scratch objects, such as helmets, stored inside the Tour-Pak.*

3. From inside Tour-Pak, install two hex head bolts (with flat washers) in two front Tour-Pak and luggage rack holes (one each side). At bottom of luggage rack, install spacer (concave side up) and nylon cap locknut on each bolt. With concavity on spacer inline with the rail, hold locknut and tighten each bolt until snug.
4. Position two spacers between bottom of luggage rack and tabs of license plate bracket. Slide two hex head 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 head 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 2-117.




1. **Radio antenna cable**
2. **Adhesive clip**
3. **Tour-pak lights connector [12]**
4. **Grommet**

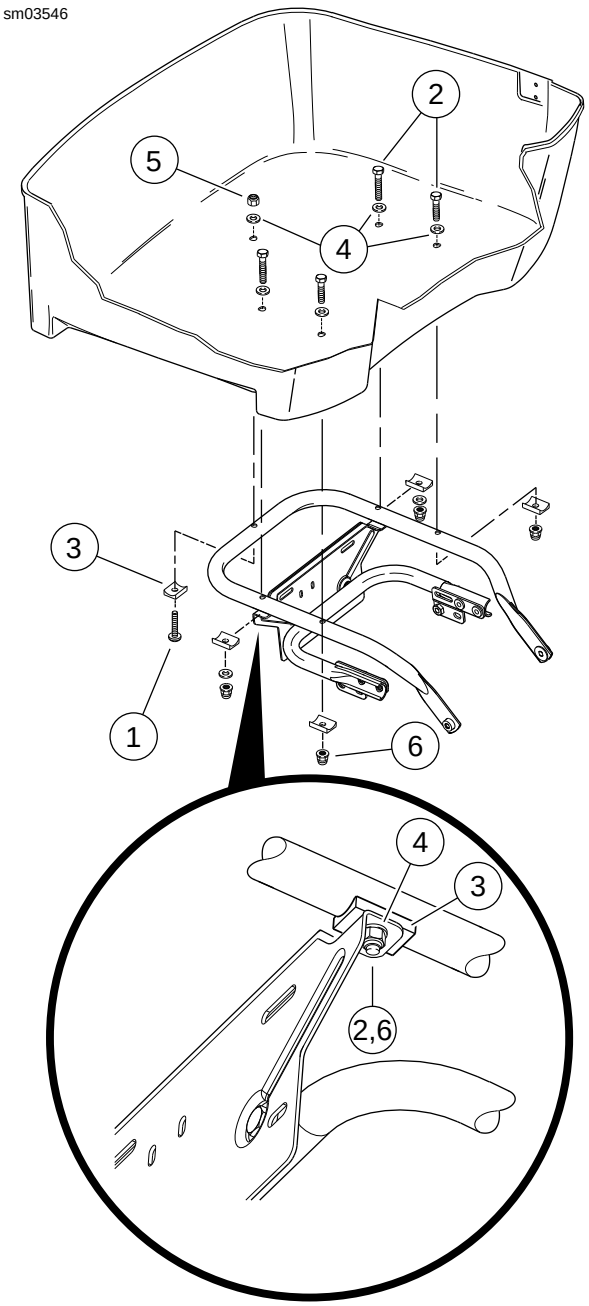
**Figure 2-115. Disconnect Tour-Pak Lights Connector**




1. **Adhesive clip**
2. **Radio antenna cable connector [51D]**
3. **Grommet**
4. **Tour-pak hole**

**Figure 2-116. Feed Main Harness Through Tour-Pak Hole**

5. In a crosswise pattern, alternately tighten five bolts to 96-108 **in-lbs** (10.8-12.2 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 motorcycle, 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. Connect Tour-pak lights connector [12], 3-place Multilock. See Figure 2-115.




1. **Button head bolt - rear center hole (cap down)**
2. **Hex head bolts (4), 1-3/4 inch (cap up)**
3. **Spacers (5)**
4. **Flat washers (7)**
5. **Locknut**
6. **Nylon cap locknuts (4)**

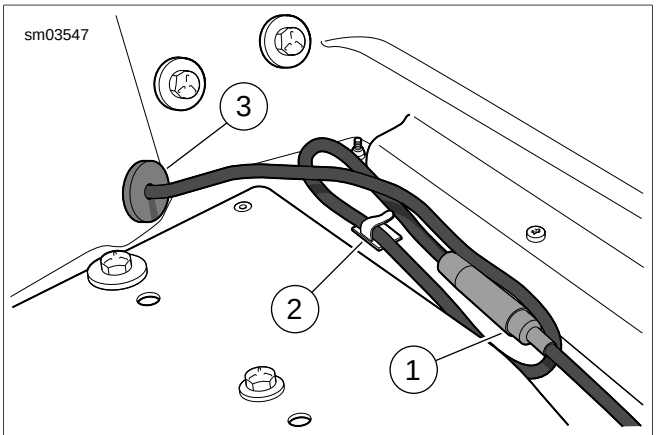
**Figure 2-117. Install Tour-Pak Mounting Bolts**

8. Rotate knurled lock ring in a clockwise direction to mate pin and socket halves of radio antenna cable connector [51]. Capture cable in two adhesive 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 [51]. Release cable from two adhesive clips at bottom of Tour-Pak.
4. Disconnect Tour-Pak lights connector [12], 3-place Multi-lock. See Figure 2-115.
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 2-116.
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 rear speaker/passenger controls connector [42], 6-place Deutsch, 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 motorcycle, disconnect CB antenna cable connector [50]. Release cable from two adhesive clips at bottom of Tour-Pak. See Figure 2-118.
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 rear speaker/passenger controls connector [41], 6-place Deutsch, out of right side speaker box. Depress external latch and use a rocking motion to separate pin and socket halves.
12. Holding nylon cap locknuts at bottom of luggage rack rail, remove four hex head bolts (with flat washers) from inside Tour-Pak. Luggage rack spacers will become free as locknuts are removed.
13. Holding button head bolt at rear center hole, remove locknut (and flat washer) from inside Tour-Pak to release Tour-Pak from luggage rack. Be sure to have a firm grasp on the Tour-Pak as the bolt is removed. See Figure 2-117.




1. **CB antenna cable connector [50]**
2. **Adhesive clip**
3. **Grommet**

**Figure 2-118. Disconnect CB Antenna Cable Connector**

## 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 button head bolt through spacer (concave side up), luggage rack and Tour-Pak holes. From inside Tour-Pak, install flat washer, radio antenna ground ring terminal and locknut on bolt. With concavity on spacer inline with the rail, hold locknut and tighten bolt until snug.

*NOTE*

*Always install hex head bolts from inside Tour-Pak. If hex head bolts are installed upside down, then loss of a nylon cap could cause the end of a bolt to tear the molded liner and scratch objects, such as helmets, stored inside the Tour-Pak.*

3. From inside Tour-Pak, install two hex head bolts (with flat washers) in two front Tour-Pak and luggage rack holes (one each side). At bottom of luggage rack, install spacer (concave side up) and nylon cap locknut on each bolt. With concavity on spacer inline with the rail, hold locknut and tighten each bolt until snug.
4. Position two spacers between bottom of luggage rack and tabs of license plate bracket. Slide two hex head 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 head 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 2-117.
5. In a crosswise pattern, alternately tighten five bolts to 96-108 **in-lbs** (10.8-12.2 Nm). Be sure that concavity on each spacer is inline with the rail and has not rotated out of position.
6. Connect rear speaker/passenger controls connector [41], 6-place Deutsch. 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. Connect CB antenna cable connector [50]. Capture cable in two adhesive clips at bottom of Tour-Pak. See Figure 2-118.
9. Moving to opposite side of motorcycle, connect rear speaker/passenger controls connector [42], 6-place Deutsch. 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. Connect Tour-pak lights connector [12], 3-place Multilock. See Figure 2-115.
13. Rotate knurled lock ring in a clockwise direction to mate pin and socket halves of radio antenna cable connector [51]. Capture cable in two adhesive 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.

## ADJUSTMENT

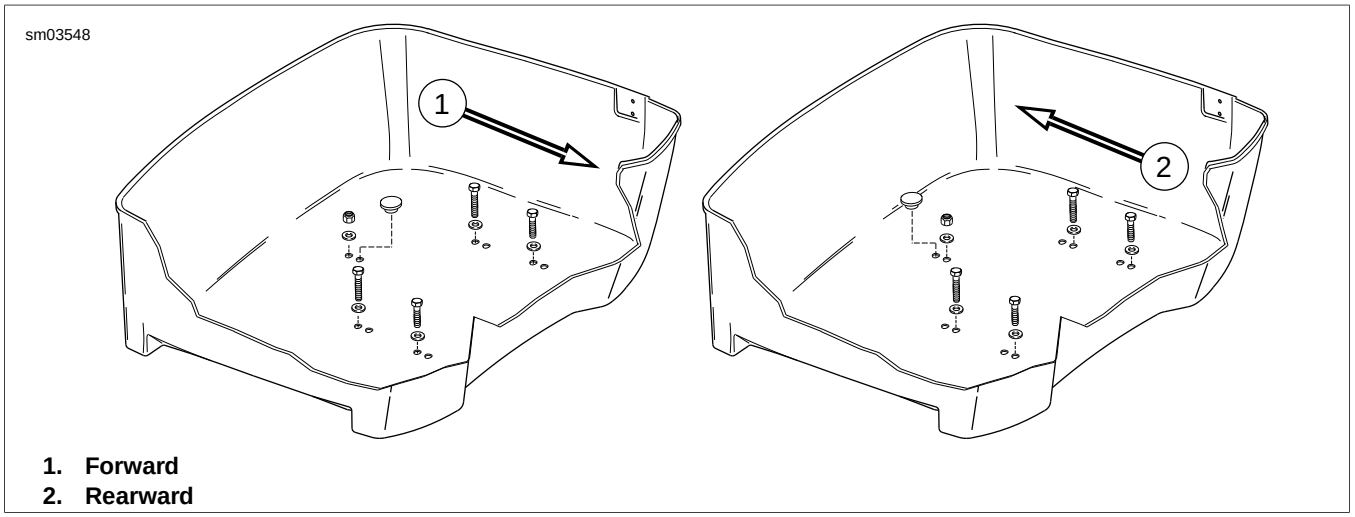
*NOTE*

*The Tour-Pak can be moved forward/rearward approximately one inch for best passenger comfort.*

1. Proceed as follows:
   a. **FLHTC:** Open Tour-Pak. Remove rubber mat.
   b. **FLHTCU:** Open Tour-Pak. Open map pocket and remove acorn nuts (with flat washers). Remove map pocket and molded liner from Tour-Pak.
2. From inside Tour-Pak, remove plastic plug from unused rear center hole.
3. Holding nylon cap locknuts at bottom of luggage rack rail, remove four hex head bolts (with flat washers) from inside Tour-Pak. Luggage rack spacers will become free as locknuts are removed.
4. Holding button head bolt at rear center hole, remove locknut (and flat washer) from inside Tour-Pak to release Tour-Pak from luggage rack. Be sure to have a firm grasp on the Tour-Pak as the bolt is removed. See Figure 2-117.
5. Move Tour-Pak to the forward/rearward position. See Figure 2-119.
6. Align rear center hole in Tour-Pak with same hole in luggage rack. Slide button head bolt through spacer (concave side up), luggage rack and Tour-Pak holes. From inside Tour-Pak, install flat washer, radio antenna ground ring terminal and locknut on bolt. With concavity on spacer inline with the rail, hold locknut and tighten bolt until snug.

*NOTE*

*Always install hex head bolts from inside Tour-Pak. If hex head bolts are installed upside down, then loss of a nylon cap could cause the end of a bolt to tear the molded liner and scratch objects, such as helmets, stored inside the Tour-Pak.*




1. **Forward**
2. **Rearward**

**Figure 2-119. Adjust Position of Tour-Pak for Passenger Comfort**

7. From inside Tour-Pak, install two hex head bolts (with flat washers) in two front Tour-Pak and luggage rack holes (one each side). At bottom of luggage rack, install spacer (concave side up) and nylon cap locknut on each bolt and tighten until snug.
8. Verify that two spacers are in position between bottom of luggage rack and tabs of license plate bracket. Slide two hex head bolts (with flat washers) through two center holes in Tour-Pak and luggage rack, and then through spacers and tabs of license plate bracket. Install flat washers and nylon cap locknuts on bolts and tighten until snug. See inset of Figure 2-117.
9. In a crosswise pattern, alternately tighten five bolts to 96-108 **in-lbs** (10.8-12.2 Nm).
10. Verify that wire harness to Tour-pak is not bunched or stretched at any point. Rearrange wire harness slightly if necessary. Install **new** cable straps capturing wire harness and luggage rack rails if rearrangement required cutting of existing cable straps. See Figure 2-120.
11. From inside Tour-Pak, install plastic plug in unused rear center hole. See Figure 2-119.
12. Proceed as follows:
    a. **FLHTC:** Install rubber mat. Close Tour-Pak.
    b. **FLHTCU:** Install molded liner in Tour-Pak. Install map pocket and secure using acorn nuts (with flat washers). Close Tour-Pak.

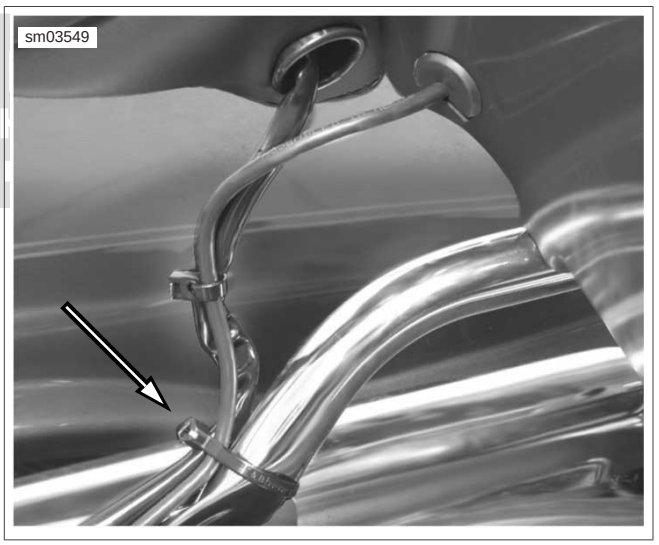



**Figure 2-120. Right Side Luggage Rack Rail (FLHTCU)**

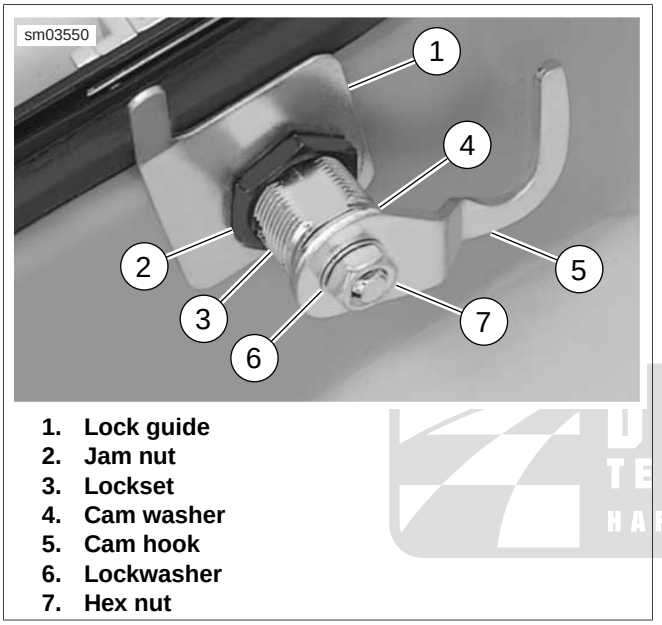
## LOCKSET

### Removal

*NOTE*

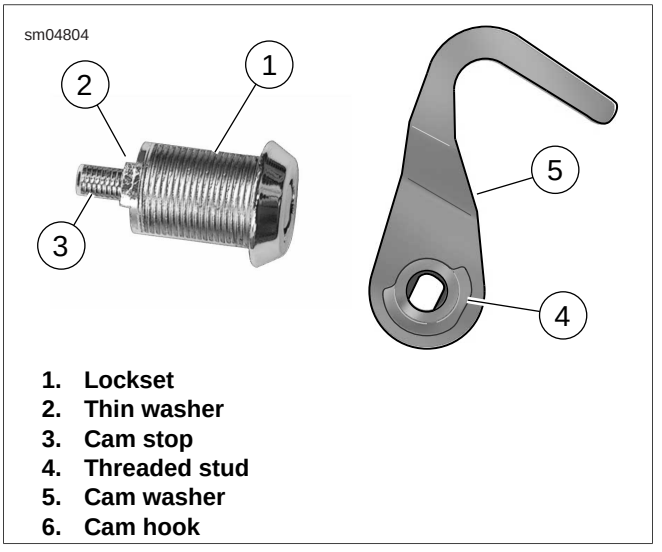
*For replacement of the lockset catch, see 2.30 TOUR-PAK SERVICE, Latches/Lockset Catch.*

1. At inside of Tour-Pak lid, remove hex nut, internal tooth lockwasher, cam hook and cam washer. Remove jam nut and lock guide. See Figure 2-121.
2. At outside of Tour-Pak, remove lockset. Remove thin washer from threaded body of lockset. See Figure 2-122.




1. **Lock guide**
2. **Jam nut**
3. **Lockset**
4. **Cam washer**
5. **Cam hook**
6. **Lockwasher**
7. **Hex nut**

**Figure 2-121. Lockset Assembly**




1. **Lockset**
2. **Thin washer**
3. **Cam stop**
4. **Threaded stud**
5. **Cam washer**
6. **Cam hook**

**Figure 2-122. Lockset Mechanism**

### Installation

1. Slide thin washer down threaded body of lockset. See Figure 2-122.
2. With cam stop facing toward front of Tour-Pak lid, install lockset into hole.
3. Install lock guide over threaded body of lockset oriented with finger at rear and pointing toward bottom of Tour-Pak lid. See Figure 2-121.
4. Install jam nut and tighten to 30-45 **in-lbs** (3.4-5.1 Nm).
5. Verify that groove in threaded stud of lockset is facing rear of Tour-Pak lid. Use key to rotate threaded stud, if necessary.
6. Align cam hook and cam washer as shown in Figure 2-122. With the cam hook toward the front of Tour-Pak lid and cam washer on the inboard side, slide assembly down threaded stud.
7. Install internal tooth lockwasher and hex nut onto threaded stud. Tighten hex nut to 25-35 **in-lbs** (2.8-4.0 Nm).

## HINGES

| PART NUMBER | TOOL NAME |
|---|---|
| HD-39787A | RIVET TOOL |

### Removal

1. Remove tether. See 2.30 TOUR-PAK SERVICE, Tether.
2. Holding hinge pin with a T25 TORX bit (inboard side), remove T15 TORX screw (outboard side).
3. Remove hinge pin from hinge.
4. Repeat previous steps to remove second hinge pin. Remove Tour-Pak lid.
5. Using a 3/16 inch drill bit, drill out eight rivets from inside Tour-Pak.
6. Remove hinge and backplates.

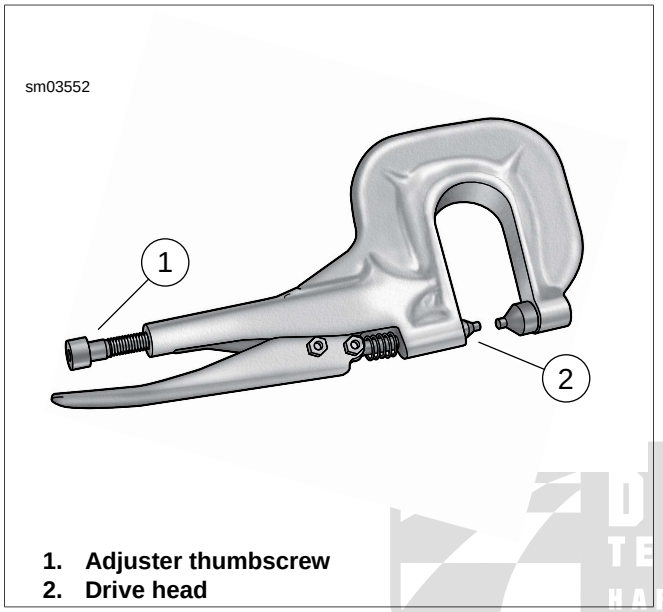
### Installation

1. With the head of the **new** rivet on the outboard side of the Tour-Pak, slide rivet through holes in hinge, Tour-Pak and backplate.
2. Obtain RIVET TOOL (Part No. HD-39787A). See Figure 2-123.
3. Orient tool so that head of rivet is seated in depression of drive head. Turn adjuster thumbscrew in or out of handle until both ends of rivet are captured.
4. Slowly squeeze handle of tool to compress rivet. Turn adjuster thumbscrew slightly in a clockwise direction and then squeeze handle again to further compress rivet. Repeat step as necessary until rivet is fully installed.

*NOTE*

*Compress rivet in small increments only. This method provides for best retention and alignment of parts and avoids possible damage to tool and painted surfaces of Tour-Pak.*

5. Repeat previous steps to install remaining rivets.
6. Install lid onto Tour-Pak engaging upper and lower hinges.
7. Install hinge pin with the T25 TORX bit recess on the inboard side of the hinge.
8. Apply a small dab of Loctite High Strength Threadlocker 262 (red) to threads of T15 TORX screw.
9. Install T15 TORX screw into hinge pin and tighten to 20-25 **in-lbs** (2.3-2.8 Nm).
10. Repeat previous steps to install second hinge pin.
11. Install tether. See 2.30 TOUR-PAK SERVICE, Tether.




1. **Adjuster thumbscrew**
2. **Drive head**

**Figure 2-123. Rivet Tool (HD-39787A)**

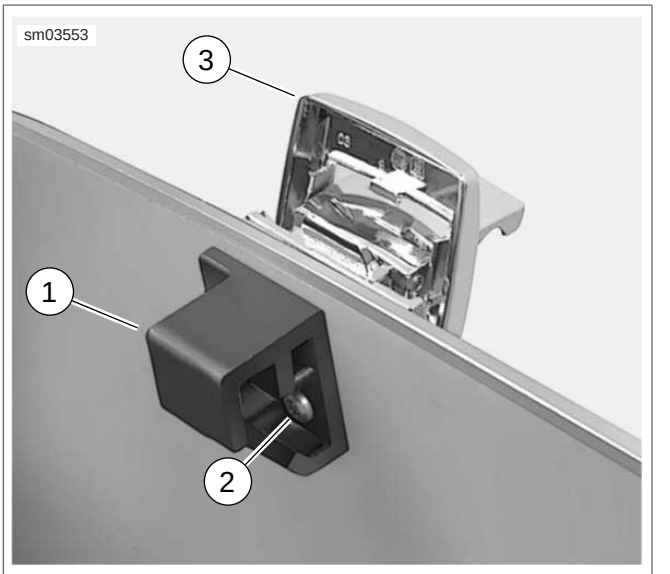
## LATCHES/LOCKSET CATCH

### Removal

1. Remove two T15 TORX screws (with flat washers) to release rear latch and spacer from right side of Tour-Pak.
2. Remove two T15 TORX screws to release front latch, spacer and lockset catch from Tour-Pak. See Figure 2-124.

### Installation

1. From inside Tour-Pak, slide two short T15 TORX screws (with flat washers) through rear holes on right side of Tour-Pak.
2. With open side of spacer facing Tour-Pak and rib at bottom, slide spacer over ends of screws.
3. Apply a small dab of Loctite Medium Strength Threadlocker 243 (blue) to threads of screws and start into threaded bosses on latch. Properly oriented, portion of latch not mated with spacer should be at the top.
4. Alternately tighten screws to 20-25 **in-lbs** (2.3-2.8 Nm).
5. Slide two long T15 TORX screws through holes in lockset catch. From inside Tour-Pak, slide screws through front holes on right side of Tour-Pak. Properly oriented, flat side of lockset catch should be topside. See Figure 2-124.
6. With open side of spacer facing Tour-Pak and rib at bottom, slide spacer over ends of screws.
7. Apply a small dab of Loctite Medium Strength Threadlocker 243 (blue) to threads of screws and start into threaded bosses on latch. Properly oriented, portion of latch not mated with spacer should be at the top.
8. Alternately tighten screws to 20-25 **in-lbs** (2.3-2.8 Nm).




1. **Lockset catch**
2. **T15 TORX screw**
3. **Front latch**

**Figure 2-124. Front Latch Assembly**



## CATCHES

### Removal

1. Using a 3/16 inch drill bit, drill out two rivets from inside Tour-Pak lid.
2. Remove catch and backplate.

### Installation

1. With the head of the **new** rivet on the outboard side of the Tour-Pak, slide rivet through holes in catch, Tour-Pak lid and backplate.
2. Install rivets. See 2.30 TOUR-PAK SERVICE, Hinges.

## TETHER

### Removal

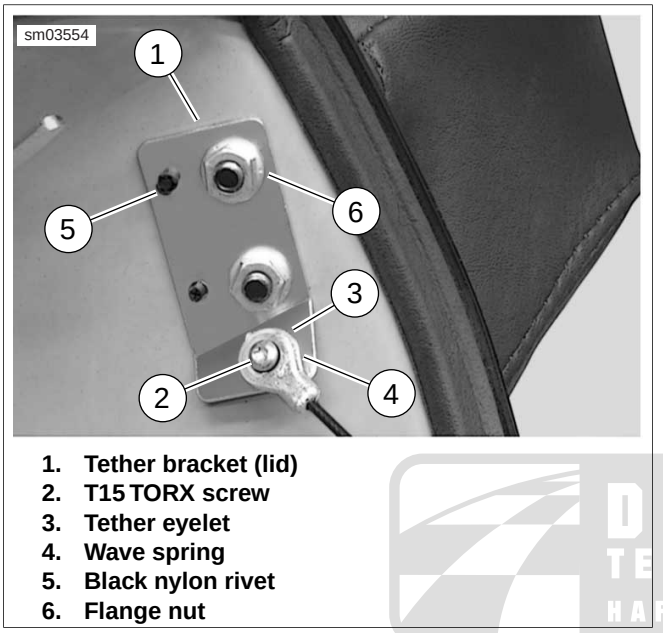
*NOTE*

*Exercise caution to keep lid from opening beyond the normal 90° of travel or damage to painted surfaces can occur.*

1. Remove T15 TORX screw from threaded boss on tether bracket. See Figure 2-125.
2. Remove tether eyelet and wave spring from threaded boss.
3. Repeat previous steps to remove opposite end of tether from second tether bracket.

## Installation

1. With the concave side toward the tether bracket, install wave spring onto threaded boss.
2. Install tether eyelet onto threaded boss.
3. Apply a small dab of Loctite High Strength Threadlocker 262 (red) to threads of T15 TORX screw.
4. Install screw into threaded boss and tighten to 20-25 **in-lbs** (2.3-2.8 Nm). See Figure 2-125.
5. Repeat previous steps to fasten opposite end of tether to second tether bracket.




1. **Tether bracket (lid)**
2. **T15 TORX screw**
3. **Tether eyelet**
4. **Wave spring**
5. **Black nylon rivet**
6. **Flange nut**

**Figure 2-125. Tour-Pak Tether Bracket Assembly**

# TETHER BRACKETS

## Removing Tether Bracket from Tour-Pak

1. Remove tether. See 2.30 TOUR-PAK SERVICE, Tether.
2. Using a 3/16 inch drill bit, drill out four rivets from inside Tour-Pak.
3. Remove tether bracket and backplate.

## Removing Tether Bracket from Tour-Pak Lid

1. Remove tether. See 2.30 TOUR-PAK SERVICE, Tether.
2. From inside Tour-Pak lid, center a 3/32 inch punch on pin at center of black nylon rivet. Using a small hammer, gently tap pin out of rivet. At outside of Tour-Pak, pull rivet from holes in tether bracket, Tour-Pak lid and passenger backrest bracket. Repeat step to remove second nylon rivet. See Figure 2-125.
3. Remove two flange nuts from studs of passenger backrest bracket and remove tether bracket.

## Installing Tether Bracket on Tour-Pak Lid

1. From inside Tour-Pak lid, install tether bracket on studs of passenger backrest bracket and start flange nuts. See Figure 2-125.
2. At outside of Tour-Pak, insert black nylon rivet through holes in passenger backrest bracket, Tour-Pak lid and tether bracket. Insert pin into head of rivet until flush. Install second rivet in the same manner.
3. Alternately tighten flange nuts to 40-60 **in-lbs** (4.5-6.8 Nm).
4. Install tether. See 2.30 TOUR-PAK SERVICE, Tether.

## Installing Tether Bracket on Tour-Pak

1. With the head of the **new** rivet on the outboard side of the Tour-Pak, slide rivet through holes in backplate, Tour-Pak and tether bracket (with the threaded boss topside).
2. Install rivets. See 2.30 TOUR-PAK SERVICE, Hinges.
3. Install tether. See 2.30 TOUR-PAK SERVICE, Tether.

## GENERAL

All domestic model Ultra Tour-Paks are equipped with side marker lights. Ultra models also have rear wrap-around lights, each of which contains a 2-filament lamp. One filament is a supplemental brake light and the other a supplemental tail lamp.

## SIDE MARKER LIGHTS (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. Disconnect side marker lights connector, 2-place Multilock.
3. Remove two T15 TORX screws and feed socket through hole in Tour-Pak to release side marker lights. See Figure 2-126.

### Installation

1. Feeding socket through hole in Tour-Pak, place side marker lights into position. See Figure 2-126.
2. Align threaded bosses in side marker lights with holes in Tour-Pak. Install two T15 TORX screws and alternately tighten to 20-25 **in-lbs** (2.3-2.8 Nm).
3. Connect side marker lights connector, 2-place Multilock.
4. Install molded liner in Tour-Pak. Install map pocket and secure using acorn nuts (with flat washers). Close Tour-Pak.


**Figure 2-126. Side Marker Lights Assembly (FHLTCU)**

## TOUR-PAK LIGHTS HARNESS

### Removal

1. Remove Tour-Pak. See 2.29 TOUR-PAK.
2. Open Tour-Pak. Holding hex head screw inside Tour-Pak (rear right corner), remove flange nut at bottom to release loading coil bracket. Remove hex head screw with external tooth lockwasher.
3. Depress external latch and remove bulb socket of both left and right side wrap-around lights. See Figure 2-127.
4. Disconnect two side marker lights connectors, 2-place Multilocks. Release conduit from two adhesive clips at rear of Tour-Pak.
5. Close Tour-Pak. Turn Tour-Pak over and remove five remaining flange nuts at bottom.
6. Place Tour-Pak topside up and open lid. Reach inside Tour-Pak and remove metal plate pulling threaded studs from holes at bottom.
7. Remove masking tape as necessary to release Tour-Pak lights harness.

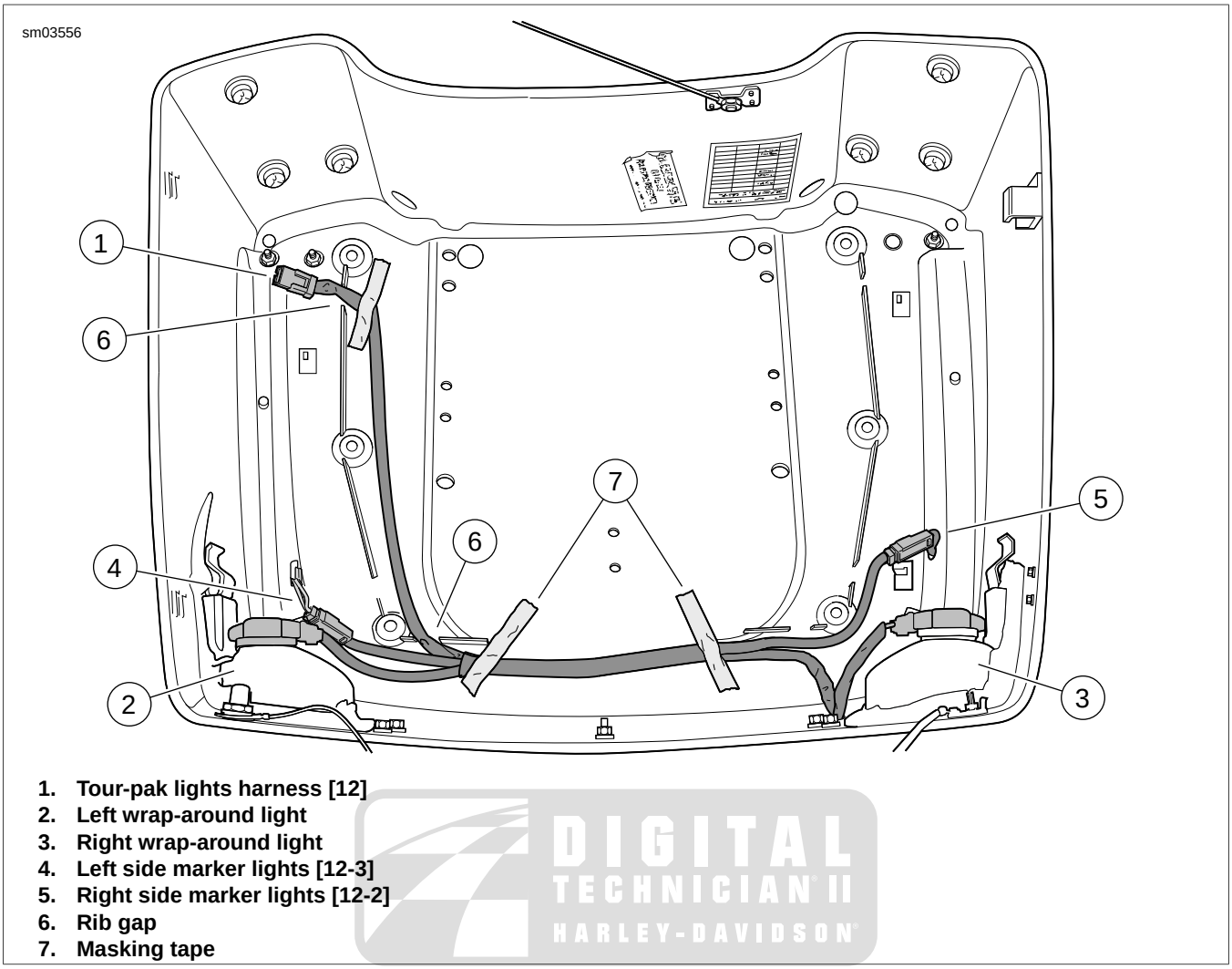
### Installation

1. Place Tour-Pak lights harness at bottom of Tour-Pak as shown in Figure 2-127.
2. Adjust harness so that Multilock connectors are outboard of the metal plate, when installed. Note that conduit to Tour-Pak lights harness connector [12] is the only length routed through gaps in ribbing. All other conduit is outboard of ribbing. Use masking tape as necessary to fix position of conduit and connectors.

*NOTE*

*If conduit overlaps ribbing or connectors are not outboard of the metal plate, tightening flange nuts on threaded studs of metal plate can pinch wires or crack connectors.*

3. Install metal plate at bottom of Tour-Pak so that threaded studs exit holes at bottom.
4. Connect two side marker lights connectors, 2-place Multilocks. Capture conduit in two adhesive clips at rear of Tour-Pak.
5. Install bulb socket of both left and right side wrap-around lights.
6. Align hole in loading coil bracket with holes in rear right corner of metal plate and Tour-Pak. Slide hex head screw (with external tooth lockwasher) through holes. At bottom of Tour-Pak, install flange nut.
7. Close lid and turn Tour-Pak over. Install five remaining flange nuts on threaded studs of metal plate. Alternately tighten six flange nuts to 65-70 **in-lbs** (7.3-7.9 Nm).
8. Install Tour-Pak on motorcycle. See 2.29 TOUR-PAK.




1. **Tour-pak lights harness [12]**
2. **Left wrap-around light**
3. **Right wrap-around light**
4. **Left side marker lights [12-3]**
5. **Right side marker lights [12-2]**
6. **Rib gap**
7. **Masking tape**



**Figure 2-127. Tour-Pak Lights Harness (FLHTCU)**

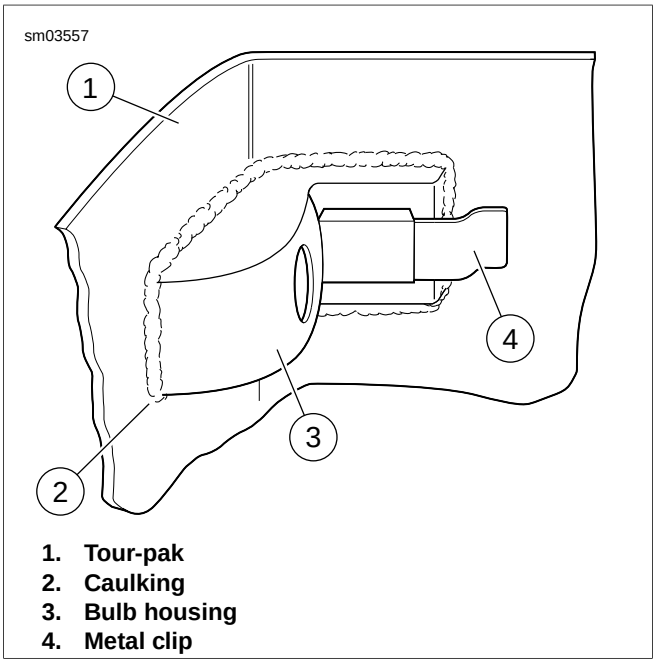
## WRAP-AROUND LIGHTS (FLHTCU)

### Bulb Replacement

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 remove bulb socket of left or right side wrap-around light. See Figure 2-127.
3. Remove bulb from socket. Install **new** bulb.
4. Install bulb socket of left or right side wrap-around light.
5. Install molded liner in Tour-Pak. Install map pocket and secure using acorn nuts (with flat washers). 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.
2. Depress external latch and remove bulb socket of both left and right side wrap-around lights. See Figure 2-127.
3. Disconnect CB antenna cable connector [50] on right side of Tour-Pak. Release cable from rear adhesive clip at bottom of Tour-Pak.
4. Remove Keps nut, ring terminal and flat washer from loading coil stud.
5. Holding hex head screw, remove flange nut at bottom of Tour-Pak to release loading coil bracket. Remove hex head screw (with external tooth lockwasher) and loading coil from motorcycle.
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 disconnect radio antenna cable connector [51]. 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.




1. **Tour-pak**
2. **Caulking**
3. **Bulb housing**
4. **Metal clip**

**Figure 2-128. Wrap-around Light Assembly**

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 2-128.

## 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 2-128.
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 [51]. 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 hex head screw (with external tooth lockwasher) through holes. At bottom of Tour-Pak, install flange nut on hex head screw.
7. Install flat washer, ring terminal and Keps nut onto loading coil stud. Tighten Keps nut.
8. Connect CB antenna cable connector [50]. Capture antenna cable in rear adhesive clip at bottom of Tour-Pak.
9. Install bulb socket of both left and right side wrap-around lights.
10. Install molded liner in Tour-Pak. Install map pocket and secure using acorn nuts. Close Tour-Pak.
11. Check SWR and adjust if necessary. Follow the SWR Adjustment procedure in ELECTRICAL DIAGNOSTIC MANUAL. Remove SWR meter, install antenna connector and tighten antenna connector stud.

## PASSENGER BACKREST

### Removal

1. Open Tour-Pak.
2. Remove two flange nuts and backplate to release center backrest from Tour-Pak lid. See Figure 2-129.
3. Remove two flange nuts to release left side backrest.

*NOTE*

*Be sure that black nylon rivets are in place before removing flange nuts to release right side backrest or tether bracket will come free. Unexpected release of the tether bracket can allow the Tour-Pak lid to swing fully open, which may result in damage to hinges and painted surfaces. If black nylon rivets are missing, be sure to hold Tour-Pak lid as the second flange nut is removed.*


1. **Center flange nuts and backplate**
2. **Left side flange nuts**
3. **Right side flange nuts, tether bracket and black nylon rivets**
4. **Passenger backrest**

**Figure 2-129. Tour-Pak Lid (Underside)**

4. Remove two flange nuts to release right side backrest.
5. Carefully pull studs on backrest brackets from holes in Tour-Pak lid.

### Installation

1. Slide studs on center backrest cushion plate through holes in Tour-Pak lid. With the nylon side facing the Tour-Pak, install backplate on studs and start flange nuts.
2. Slide studs on left side backrest "L" bracket through holes in Tour-Pak lid and start flange nuts.
3. Slide studs on right side backrest "L" bracket through holes in Tour-Pak lid and tether bracket and start flange nuts.
4. Alternately tighten six flange nuts to 40-60 **in-lbs** (4.5-6.8 Nm).
5. Close Tour-Pak.

## RUBBER ISOLATORS

### Removal

1. Remove passenger backrest. See 2.32 TOUR-PAK BACKREST, Passenger Backrest.
2. **Center isolator:** Remove flange nut with lockwasher to release cushion plate from rubber isolator stud. Remove flange nut with lockwasher to release other stud from backrest support bracket. See Figure 2-130.
3. **Outside isolator:** Remove flange nut with lockwasher to release "L" bracket from rubber isolator stud. Rotate rubber isolator to remove other stud from threaded hole in backrest. See Figure 2-131.

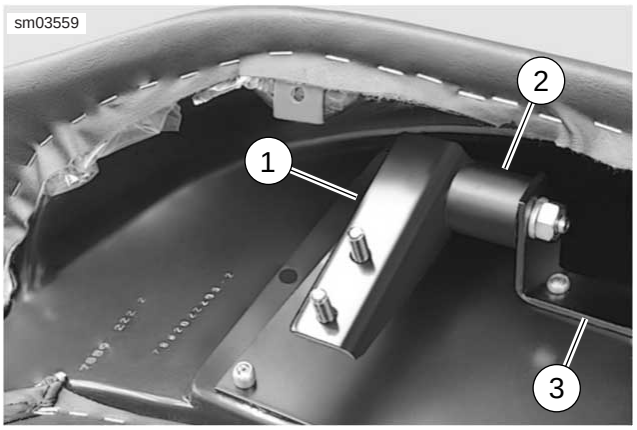
### Installation

1. **Center isolator:** Insert stud of **new** rubber isolator into hole of backrest support bracket and install lockwasher and flange nut. Tighten flange nut until snug. Install cushion plate, lockwasher and flange nut on other stud. Orient cushion plate so that it is parallel to backrest and then finger tighten flange nut only. See Figure 2-130.
2. **Outside isolator:** Install stud of **new** rubber isolator into threaded hole in backrest until snug. Install "L" bracket, lockwasher and flange nut on other stud. Finger tighten flange nut only. See Figure 2-131.

*NOTE*

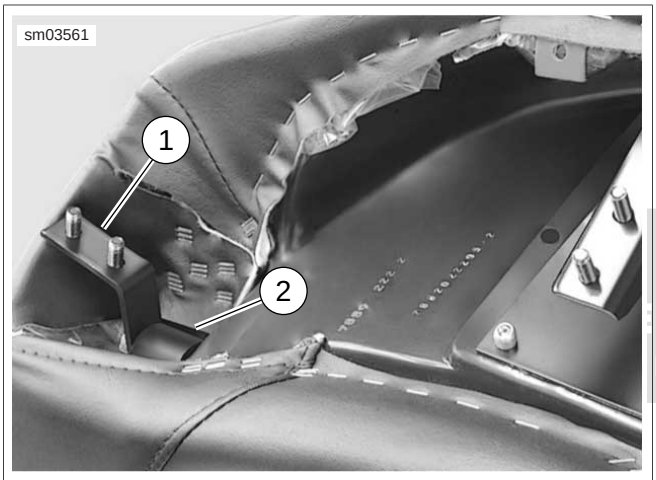
*Always hold rubber isolator on end to be installed. Do not grasp middle of rubber isolator or opposite end as excessive twisting can result in separation of molded parts or other damage.*

3. Install passenger backrest. See 2.32 TOUR-PAK BACKREST, Passenger Backrest.
4. Gently pull back cover material of backrest to expose underside and final tighten flange nuts only finger tightened in step 1.
5. Verify that each side of rubber isolator is not twisted or under any torsional load. Loosen flange nuts and adjust rubber isolator if necessary.




1. **Cushion plate**
2. **Rubber isolator**
3. **Backrest support bracket**

**Figure 2-130. Center Isolator**




1. **"L" bracket**
2. **Rubber isolator**

**Figure 2-131. Outside Isolator**

## PASSENGER BACKREST FLAP (FLHTCU)

### Removal

1. Open Tour-Pak. Open map pocket and remove two acorn nuts (with flat washers). Remove map pocket and molded liner from Tour-Pak.
2. Holding acorn nuts inside Tour-Pak, remove two T25 TORX screws (with flat washers) at front.
3. Remove backrest flap.

### Installation

1. Align holes in backrest flap with those at front of Tour-Pak.
2. Slide two T25 TORX screws (with flat washers) through holes in backrest flap and Tour-Pak. Inside Tour-Pak, install acorn nuts.
3. Holding acorn nuts, alternately tighten screws to 21-24 **in-lbs** (2.4-2.7 Nm).
4. 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 rear speaker/passenger controls connector [41/42], 6-place Deutsch, 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.

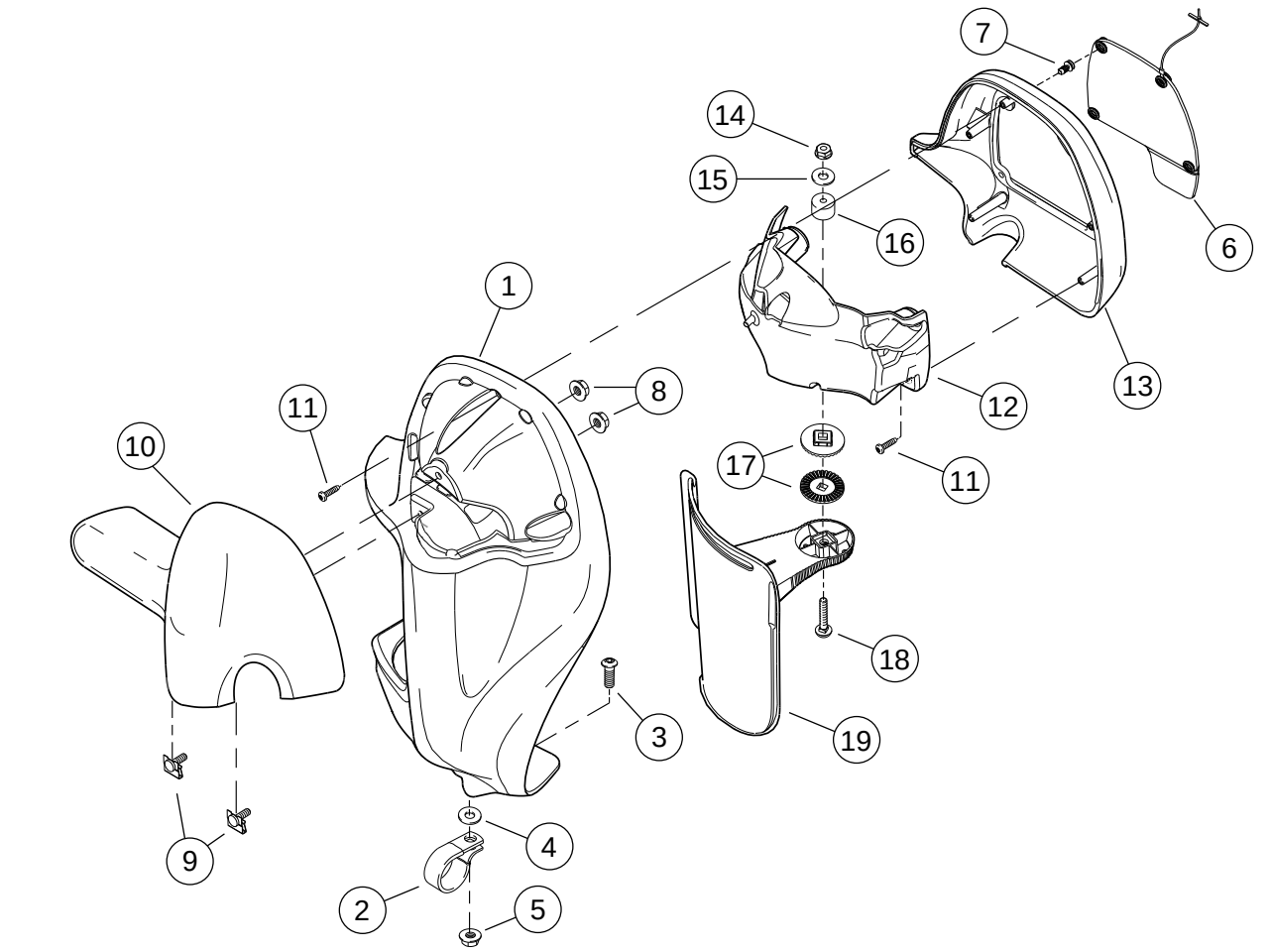
### Installation

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. Connect rear speaker/passenger controls connector [41/42], 6-place Deutsch. Feed connector back up into speaker box pressing trim ring into hole.

## LOWER FAIRING (FLHTCU)

### Removal

1. Unfasten snaps to release glove box door flap. Release anchor on draw string from hole in glove box door. Set door flap aside.
2. Reaching into glove box, remove two flange nuts from clip studs and remove fairing cap. If necessary, push ends of studs through holes in glove box tray and fairing lower to release fairing cap. Do not twist or rotate fairing cap or damage may result. See Figure 2-132.
3. Hold locknut at bottom of fairing lower and turn inside T40 TORX screw to free assembly from engine guard clamp. Discard rubber washer.
4. Repeat procedure on other side of motorcycle.




1. **Fairing lower**
2. **Engine guard clamp**
3. **T40 TORX screw**
4. **Rubber washer**
5. **Locknut**
6. **Door flap**
7. **Snap, push-in (4)**
8. **Flange nut (2)**
9. **Clip stud (2)**
10. **Fairing cap**
11. **T20 TORX screw (5)**
12. **Glove box tray**
13. **Glove box door**
14. **Locknut**
15. **Flat washer**
16. **Compression spring**
17. **Serrated washer (1 black, 1 white)**
18. **Pivot screw**
19. **Vent door**

**Figure 2-132. Lower Fairing Assembly**

## Disassembly

1. Remove three T20 TORX screws to release glove box door and glove box tray from fairing lower.
2. Remove two T20 TORX screws to release glove box door from glove box tray.
3. Remove locknut, flat washer, compression spring (rubber sleeve), glove box tray and two serrated washers from pivot screw in vent door arm.
4. Remove pivot screw from vent door arm.

## Assembly

1. Slide threaded end of pivot screw up through hole in center of vent door arm.
2. With the teeth facing upward, slide serrated washer over end of pivot screw. Square shaped boss at bottom of serrated washer should engage square recess in vent door arm.
3. Slide second serrated washer over pivot screw so that teeth engage those on first serrated washer.

*NOTE*

*Use one black and one white serrated washer. Using two washers of the same color may result in a chirping noise when the fairing lowers are adjusted.*

4. Slide square hole on glove box tray over end of pivot screw until it engages square shaped boss at top of second serrated washer.
5. Install compression spring (rubber sleeve), flat washer and locknut on pivot screw. Verify that pin at front of glove box tray engages slot at top of vent door.
6. Tighten locknut only until flat washer is snug (does not rotate) and then tighten an additional 1-1/2 turns. Verify proper vent door operation.

*NOTE*

*For best results, the 0.50 in. (12.7 mm) compression spring must be compressed to a height of 0.420 to 0.460 in. (10.7-11.7 mm).*

7. Align bottom two holes in glove box tray with bosses on glove box door and start two T20 TORX screws. Alternately tighten screws to 20-25 **in-lbs** (2.3-2.8 Nm).
8. Fit glove box tray into top of fairing lower and align three holes in fairing lower with holes in glove box tray and bosses in glove box door. Install three T20 TORX screws. Alternately tighten screws to 20-25 **in-lbs** (2.3-2.8 Nm).
9. Install anchor on draw string of glove box door flap into hole in glove box door. Fasten snaps to install glove box door flap.

## Installation

1. Place fairing lower into position at front of engine guard.
2. Holding screw inside fairing lower, install new rubber washer, clamp and locknut to attach bottom of fairing lower to engine guard. Do not tighten locknut.
3. Verify that two clip studs are fully installed on fairing cap.
4. Position fairing cap at front of engine guard and against fairing lower so that clip studs engage holes in fairing lower and glove box tray. Reaching into glove box, start two flange nuts on clip studs.
5. Verify that fairing lower is square, and then alternately tighten flange nuts on clip studs to 35-40 **in-lbs** (4.0-4.5 Nm).
6. Hold locknut at bottom of fairing lower and turn inside T40 TORX screw to fasten assembly to engine guard clamp. Tighten screw to 90-100 **in-lbs** (10.2-11.3 Nm).
7. Repeat procedure on other side of motorcycle.

# SERRATED WASHER REPLACEMENT

## Removal

1. Unfasten snaps to release glove box door flap.
2. Reaching into glove box, remove locknut, flat washer and compression spring (rubber sleeve) from pivot screw in vent door arm. Remove pivot screw.
3. Carefully extract first serrated washer at top of vent door arm. Remove second washer at bottom of glove box tray. Discard washers.

## Installation

1. Obtain two **new** serrated washers.

*NOTE*

*Use one black and one white serrated washer. Using two washers of the same color may result in a chirping noise when the fairing lowers are adjusted.*

2. With the teeth up, carefully install first serrated washer at top of vent door arm. Be sure that square shaped boss on washer engages square recess in arm.
3. With the teeth down, carefully install second serrated washer at bottom of glove box tray. Be sure that square shaped boss on washer engages square hole in tray.
4. Slide threaded end of pivot screw up through hole in center of vent door arm.
5. Reaching into glove box, install compression spring (rubber sleeve), flat washer and locknut on pivot screw.
6. Tighten locknut only until flat washer is snug (does not rotate) and then tighten an additional 1-1/2 turns. Verify proper vent door operation.

*NOTE*

*For best results, the 0.50 in. (12.7 mm) compression spring must be compressed to a height of 0.420 to 0.460 in. (10.7-11.7 mm).*

# ENGINE GUARD

## Removal

1. Remove fairing lowers, if present. See 2.34 LOWER FAIRING AND ENGINE GUARD, Lower Fairing (FLHTCU). 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 2.34 LOWER FAIRING AND ENGINE GUARD, Lower Fairing (FLHTCU).

## OUTER FAIRING AND WINDSHIELD

### Removal

1. Remove maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
2. **Loosen** the three screws (with flat washers) just below the windshield. See Figure 2-133.
3. Raise and remove the windshield from between the inner and outer fairings.
4. Remove the two screws outboard of the speakers on the left and right side.
5. Turn the handlebar to the right fork stop and remove screw by reaching in below the left side of the fairing cap. Turn the handlebar to the left fork stop and remove screw below right side of the fairing cap.

*NOTE*

*On FLHX models, be sure to hold the outer fairing in position as the last screw is removed. Without auxiliary lamps to hold it in position, the outer fairing will drop, possibly resulting in fairing or fender damage.*

6. Remove the three screws below the windshield.
7. Tilting the outer fairing forward, remove headlamp connector [38] at the back of the headlamp assembly.
8. Lift the outer fairing off the motorcycle.

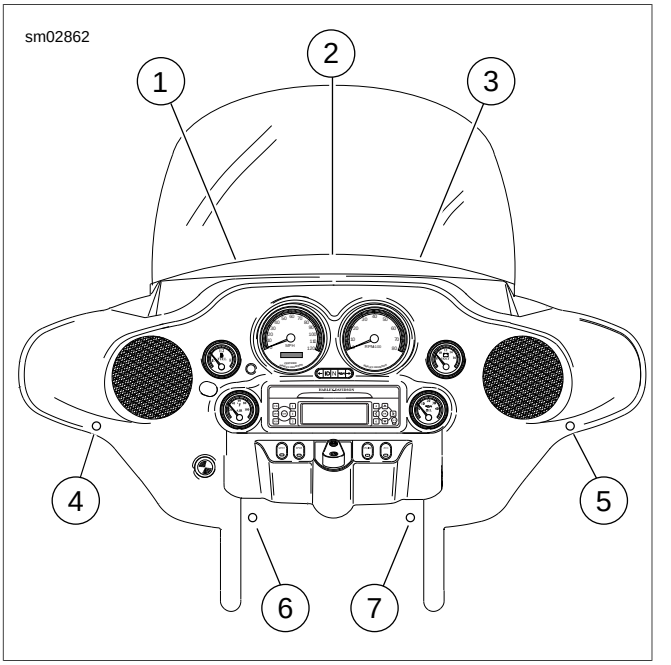



**Figure 2-133. Outer Fairing Screws**

### Installation

1. Place the outer fairing on the motorcycle and install headlamp connector [38] at the back of the headlamp assembly.
2. Start the three screws (with flat washers) just below the windshield. See Figure 2-133.
3. Start the two screws outboard of the speakers on the left and right side.
4. Turn the handlebar to the left fork stop and start screw by reaching in below the right side of the fairing cap. Turn the handlebar to the right fork stop and start screw below left side of the fairing cap.
5. Alternately tighten the four screws on the inner fairing side to 20-30 **in-lbs** (2.3-3.4 Nm).
6. Place the windshield into position between the inner and outer fairings engaging the slotted holes in the windshield with the threaded bosses on the inner fairing.
7. Alternately tighten the three screws below the windshield to 25-30 **in-lbs** (2.8-3.4 Nm).
8. Install maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.

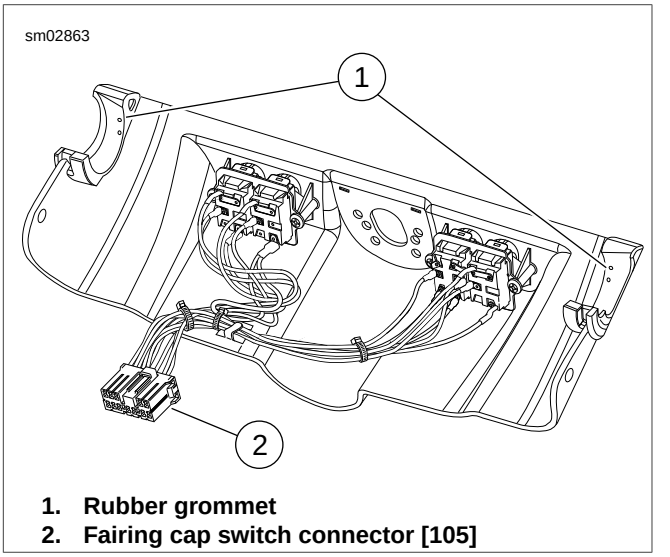
## FAIRING CAP

### Removal

1. Partially disassemble ignition switch: remove ignition switch knob, spring, nut, collar, spacer and switch position plate. See 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK.
2. Remove two screws (with flat washers) to release fairing cap from left and right sides of inner fairing.
3. With the front forks turned to the left fork stop, reach behind right side of fairing cap and disconnect fairing cap switch connector [105], 12-place Multilock (black).
4. Remove fairing cap from motorcycle. See Figure 2-134.

### Installation

1. Verify that rubber grommets are installed on each side of fairing cap. Barbs on cap fit into holes in grommets. See Figure 2-134.
2. Connect fairing cap switch connector [105], 12-place Multilock (black).
3. Install fairing cap over ignition switch housing. Verify that grommets in fairing cap fully capture handlebar, handlebar switch conduit, and brake line from front master cylinder reservoir (right side).




**1. Rubber grommet**
**2. Fairing cap switch connector [105]**

**Figure 2-134. Fairing Cap Assembly**

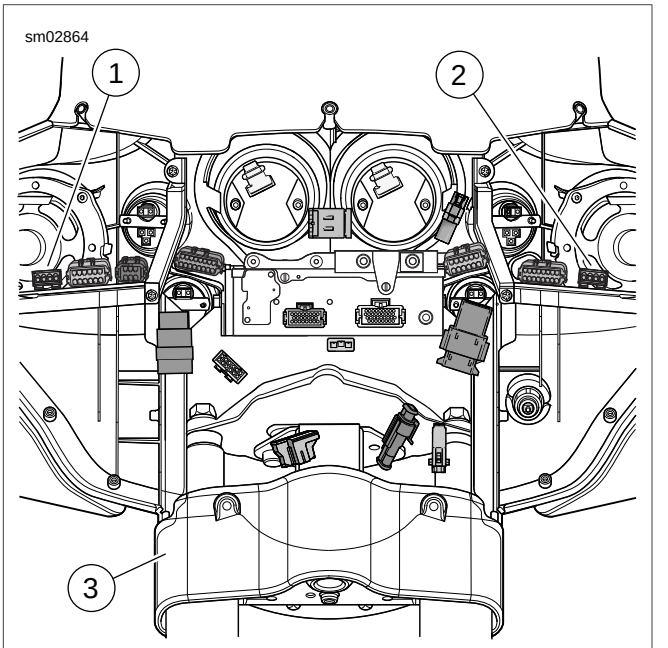
4. Start two screws (with flat washers) to fasten fairing cap to left and right sides of inner fairing. Alternately tighten screws to 25-30 **in-lbs** (2.8-3.4 Nm).
5. Assemble ignition switch: install switch position plate, spacer, collar, nut, spring and knob. See 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK.

## REMOVAL

*NOTE*

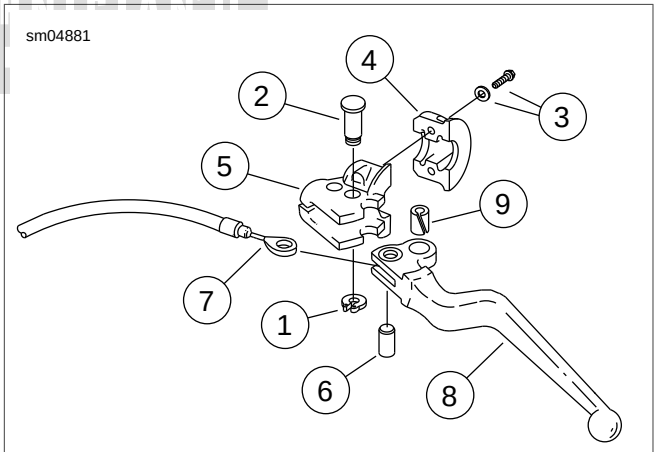
*To avoid scratches or other damage, place protective material over front fender, fuel tank and fairing lowers, if present.*

1. Remove outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U, Outer Fairing and Windshield.
2. Disconnect left and right front turn signal/auxiliary lamp connectors [31L/R], 4-place Multilocks, on T-studs at top of left and right fairing support braces (outboard side). See Figure 2-135.
3. Remove four screws to release auxiliary lamp bracket from upper and lower fork brackets.
4. Remove fairing cap. See 2.36 FAIRING CAP: FLHX, FLHT/C/U, Fairing Cap.
5. Pull chrome skirt from inner fairing. See Figure 2-135.
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 free play at hand lever.
7. Remove retaining ring from pivot pin groove at bottom of clutch lever bracket. Remove pivot pin.
8. Remove two screws (with flat washers) to release handlebar clamp from clutch lever bracket. Remove clutch hand lever from clutch lever bracket.
9. Remove anchor pin and clutch cable eyelet from clutch hand lever. See Figure 2-136.
10. Feed clutch cable through inner fairing grommet to front of motorcycle.
11. See Figure 2-137. Remove cigarette lighter from socket. Pull socket terminals [132] from spade contacts on socket and outer shell. Holding socket to prevent rotation, unscrew outer shell. Remove socket from inner fairing.
12. Pull socket terminals [35] from left side speaker spade contacts. Remove three screws to release speaker adapter from inner fairing. Repeat step on right side of motorcycle.
13. Unthread rubber boot from odometer reset switch. Pull switch from hole in inner fairing.
14. Disconnect speedometer [39] and tachometer [108] gauge connectors. See Figure 2-137. Leaving anchors on interconnect harness installed in ears of brackets, if present, remove screws to release brackets from gauges. Remove gauges from inner fairing.



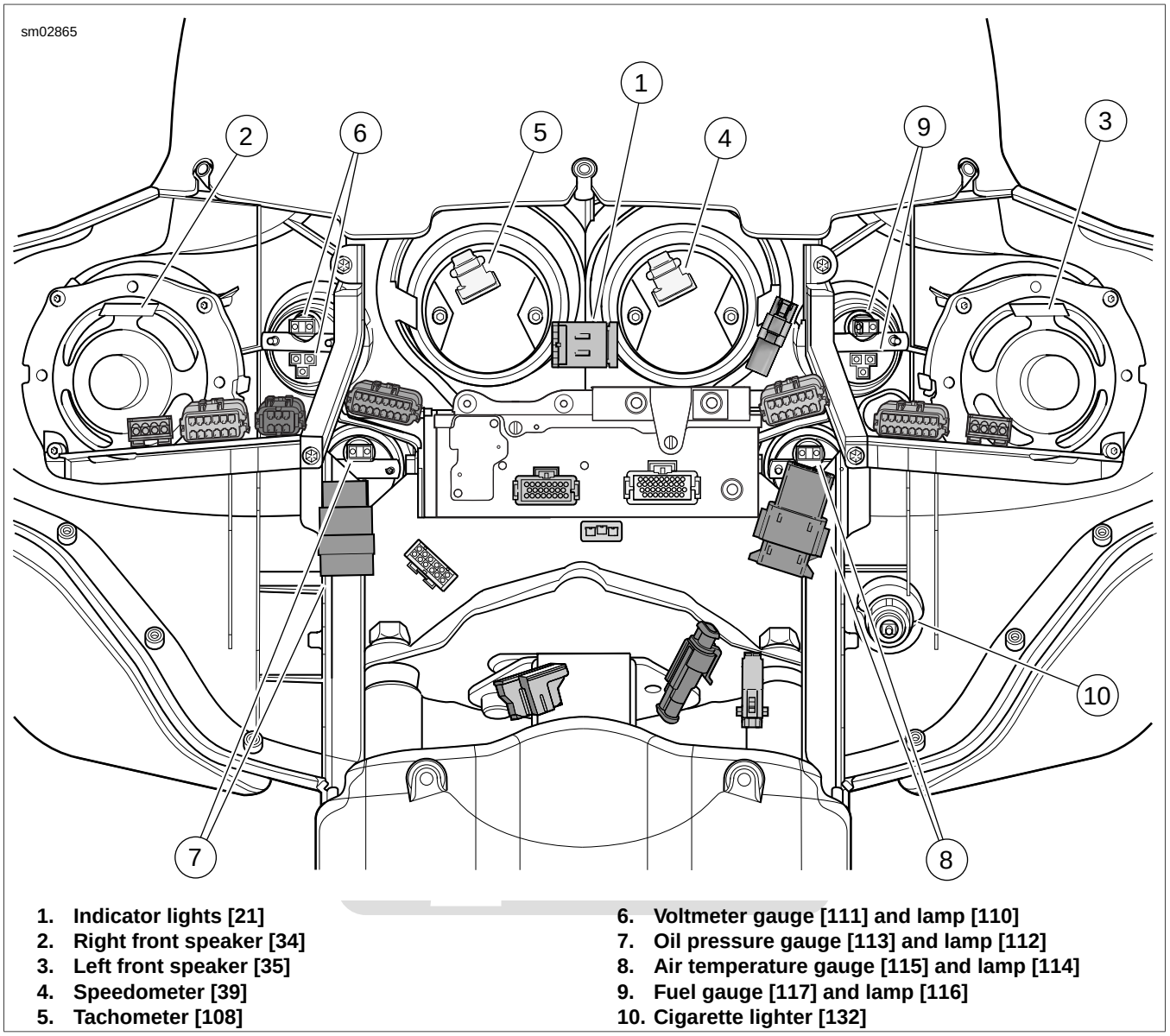

1. **Right front turn signal/auxiliary lamp [31R]**
2. **Left front turn signal/auxiliary lamp [31L]**
3. **Chrome skirt**

**Figure 2-135. Inner Fairing (Front View)**




1. **Retaining ring**
2. **Pivot pin**
3. **Screw (with flat washer)**
4. **Handlebar clamp**
5. **Clutch lever bracket**
6. **Anchor pin**
7. **Clutch cable eyelet**
8. **Hand lever**
9. **Bushing**

**Figure 2-136. Disconnect Clutch Cable From Hand Lever**




1. **Indicator lights [21]**
2. **Right front speaker [34]**
3. **Left front speaker [35]**
4. **Speedometer [39]**
5. **Tachometer [108]**
6. **Voltmeter gauge [111] and lamp [110]**
7. **Oil pressure gauge [113] and lamp [112]**
8. **Air temperature gauge [115] and lamp [114]**
9. **Fuel gauge [117] and lamp [116]**
10. **Cigarette lighter [132]**

**Figure 2-137. Inner Fairing Connectors (FLHX, FLHT/C/U)**

15. Disconnect indicator lights connector [21], 10-place Multilock. See Figure 2-137. Release each paddle on lens from between pair of index tabs on indicator lights assembly. Remove lens from inner fairing.
16. Disconnect voltmeter gauge [111] and lamp [110] connectors. Disconnect fuel gauge [117] and lamp [116] connectors.
17. Remove four screws to free inner fairing from fairing bracket. See Figure 2-138.
18. Spread bottom of inner fairing to free from threaded dowels in lower fork bracket. Spread bottom of fairing bracket to release from same dowels. Raise inner fairing and fairing bracket slightly to prevent re-engagement with dowels.
19. **Classic and Ultra models:** Disconnect oil pressure gauge [113] and lamp [112] connectors. Disconnect air temperature gauge [115] and lamp [114] connectors.
20. Raise inner fairing and fairing bracket together and then separate by pulling fairing bracket toward the front and inner fairing toward the rear.
21. When inner fairing becomes free of the radio, remove from motorcycle and move to bench area.
22. Install fairing bracket (with radio and interconnect harness) back onto motorcycle aligning holes with threaded dowels in lower fork bracket. Loosely install screws to secure fairing bracket to lower fork bracket.
23. At bench area, remove hex nuts from studs at back of voltmeter and fuel gauges. Remove mounting brackets from gauges and remove gauges from inner fairing. On Classic and Ultra models, repeat step to remove oil pressure and air temperature gauges.
24. Remove clutch cable grommet from inner fairing.

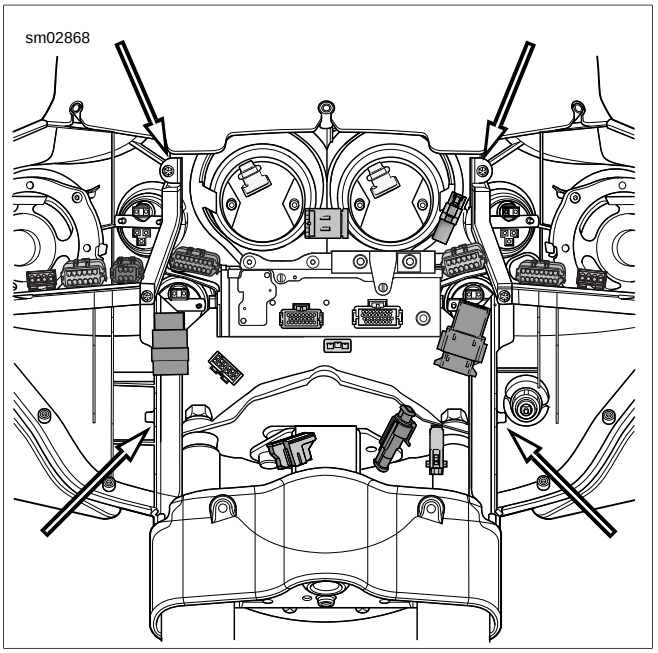



**Figure 2-138. Remove Fairing Bracket Screws**

## INSTALLATION

1. Install clutch cable grommet in inner fairing.
2. Install voltmeter and fuel gauges in inner fairing. Slide mounting brackets over studs. Verify that tabs on top and bottom of brackets engage slots in inner fairing. Loosely install hex nuts on studs. Verify that gauge is properly aligned and tighten nuts to 10-20 **in-lbs** (1.1-2.3 Nm). See Figure 2-139.
3. **Classic and Ultra models:** Repeat last step to install air temperature and oil pressure gauges.

*NOTE*

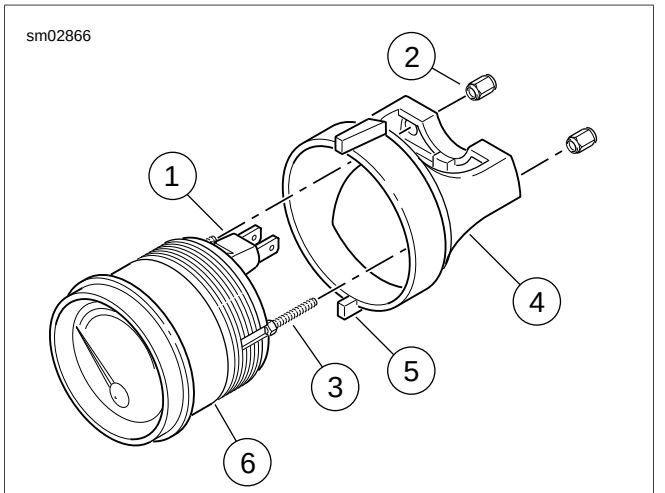
*To avoid scratches or other damage, place protective material over front fender, fuel tank and fairing lowers, if present.*

4. Remove screws to free fairing bracket (with radio and interconnect harness) from lower fork bracket. Raise fairing bracket and then tilt forward at a 45° angle.
5. Position inner fairing at rear of fairing bracket. Tilting inner fairing rearward at a 45° angle, align upper and lower fork bracket thru holes with those in fairing bracket. Draw fairing bracket and inner fairing together fitting radio into slot of inner fairing.
6. Align upper thru holes in fairing bracket and inner fairing with threaded holes in bosses of upper fork bracket and start two screws. Align lower thru holes in fairing bracket and inner fairing with threaded dowels in lower fork bracket and start two screws. Alternately tighten four screws until snug.
7. Install four screws to fasten inner fairing to fairing bracket. See Figure 2-138.
8. Connect voltmeter gauge [111] and lamp [110] connectors. Connect fuel gauge [117] and lamp [116] connectors.
9. **Classic and Ultra models:** Connect oil pressure gauge [113] and lamp [112] connectors. Connect air temperature gauge [115] and lamp [114] connectors.
10. Install lens of indicator lights, so that bottom slot engages index tab in inner fairing. With the word "TOP" facing up, engage each paddle on lens between pair of index tabs on indicator lights assembly. Connect indicator lights connector [21], 10-place Multilock. See Figure 2-140.
11. Install speedometer and tachometer gauges in inner fairing. Align holes in brackets with those in gauges and start two screws. Rotate brackets until top and bottom tabs engage slots in inner fairing. Verify that gauges are properly aligned and tighten screws to 10-20 **in-lbs** (1.1-2.3 Nm). Connect speedometer [39] and tachometer [108] gauge connectors.
12. Slide odometer reset switch through hole in inner fairing and install rubber boot.
13. With the widest edge at the top, align holes in speaker adapter with those in inner fairing. Install two long screws at top of speaker adapter. Capturing fairing support brace, install short screw in lower outboard hole (positioning flat washer between adapter and support brace). Tighten lower screw to 22-28 **in-lbs** (2.5-3.2 Nm). Tighten two upper screws to 35-50 **in-lbs** (4.0-5.7 Nm).

*NOTE*

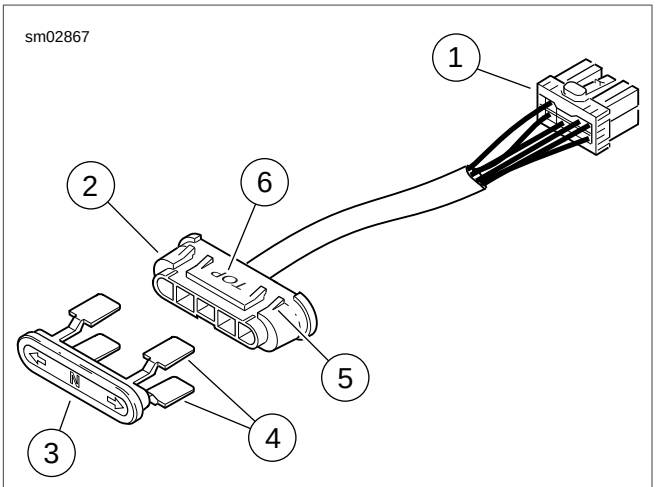
*The screw hole on the lower inboard side of the speaker adapter is not used.*

14. Install socket terminals onto speaker spade contacts. Different size spade contacts prevent improper assembly.
15. Repeat last two steps on opposite side of motorcycle.
16. Slide socket of cigarette lighter through hole in inner fairing. Thread outer shell onto socket until tight. Install cigarette lighter in socket. Connect the orange/white wire terminal to the socket spade contact, the black wire terminal to the outer shell contact.
17. Feed clutch cable through inner fairing grommet.
18. Insert clutch cable eyelet into groove of clutch hand lever aligning eyelet with hole without bushing. Insert anchor pin through lever and eyelet.
19. Insert lever into groove of clutch lever bracket fitting sleeve at end of cable housing into bore on inboard side of bracket.
20. Align hole in hand lever with hole in bracket and install pivot pin. Install retaining ring in pivot pin groove.
21. Install two screws (with flat washers) to secure handlebar clamp to clutch lever bracket. Starting with the top screw, tighten screws to 72-108 **in-lbs** (8-12 Nm).
22. Adjust clutch. See 1.11 CLUTCH.
23. Install fairing cap. See 2.36 FAIRING CAP: FLHX, FLHT/C/U.
24. Remove two screws from lower fork bracket. Install chrome skirt aligning thru holes with those in lower fork bracket. Reinstall screws. See Figure 2-135.
25. Loosen two screws in upper fork bracket.




1. **Pin housing**
2. **Hex nut**
3. **Stud**
4. **Mounting bracket**
5. **Tab**
6. **Gauge**

**Figure 2-139. 2 Inch Diameter Gauges**




1. **Indicator lights connector [21]**
2. **Indicator lights assembly**
3. **Lens**
4. **Paddles**
5. **Index tabs**
6. **Orientation stamp**

**Figure 2-140. Indicator Lights Assembly**

26. Slide slots of auxiliary lamp bracket onto upper and lower fork bracket screws. Alternately tighten four screws to 15-20 ft-lbs (20-27 Nm) in a crosswise pattern.
27. Mate left and right front turn signal/auxiliary lamp connectors [31L/R], 4-place Multilocks. Install on T-studs at top of left and right fairing support braces (outboard side). Verify that conduit is routed inboard using relief in upper outboard corner of chrome skirt.
28. Install outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.

## AIR DEFLECTORS (FLHTCU)

### Removal

1. Remove four screws to release air deflector at side of inner fairing. See Figure 2-141.
2. Repeat step to remove air deflector on opposite side of motorcycle.

### Installation

1. Install four screws to fasten air deflector at side of inner fairing. Alternately tighten screws to 25-30 **in-lbs** (2.8-3.4 Nm).
2. Repeat step to install air deflector on opposite side of motorcycle.

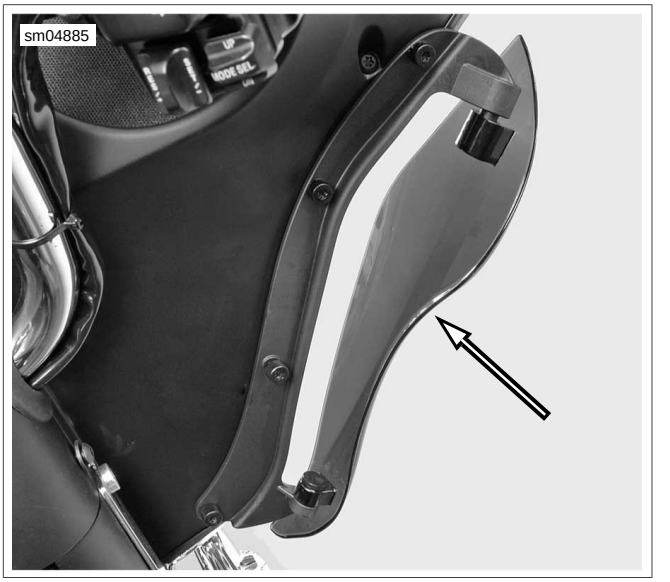



**Figure 2-141. Air Deflector (Adjustable)**

## WINDSHIELD

### Removal

1. Alternately loosen and then remove five screws (with plastic flat washers) at base of windshield.
2. Remove windshield from outer fairing.
3. Carefully remove wellnuts (with rubber flat washers) from holes in outer fairing. See Figure 2-142.

*NOTE*

*Exercise caution to avoid pushing wellnuts into fairing during removal. Inspect wellnuts and rubber flat washers for cuts, tears or signs of deterioration. Replace as necessary.*

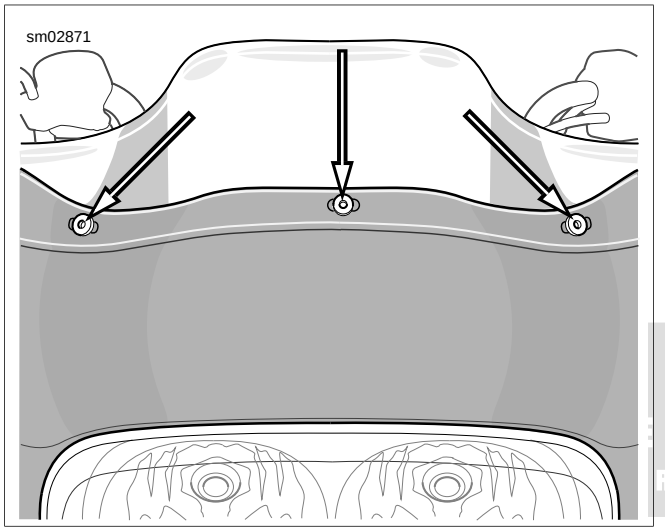
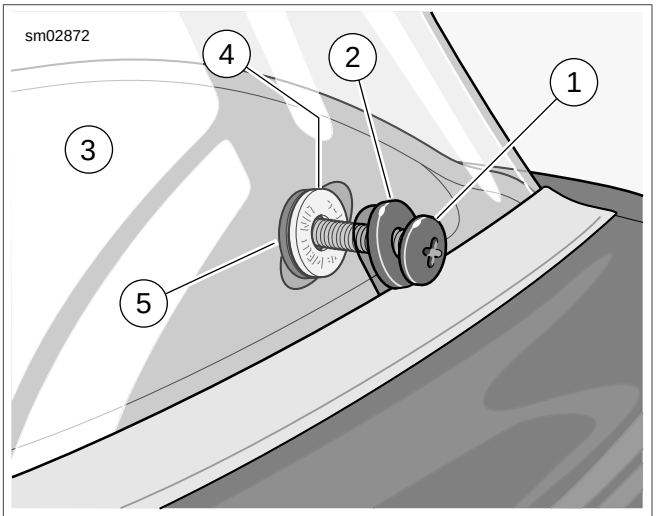



**Figure 2-142. Remove Wellnuts from Outer Fairing**

### Installation

1. **Preinstall** hardware on windshield as follows:
   a. Slide plastic flat washers onto screws.
   b. Slide screws through slots in windshield.
   c. Slide rubber flat washers onto wellnuts.
   d. Start wellnuts onto screws.
2. Push wellnuts into holes in outer fairing. See Figure 2-143.
3. Starting with center screw, alternately tighten five screws to 6-13 **in-lbs** (0.7-1.5 Nm).




1. **Screw**
2. **Plastic flat washer**
3. **Windshield**
4. **Wellnut**
5. **Rubber flat washer**

**Figure 2-143. Install Windshield**

## OUTER FAIRING

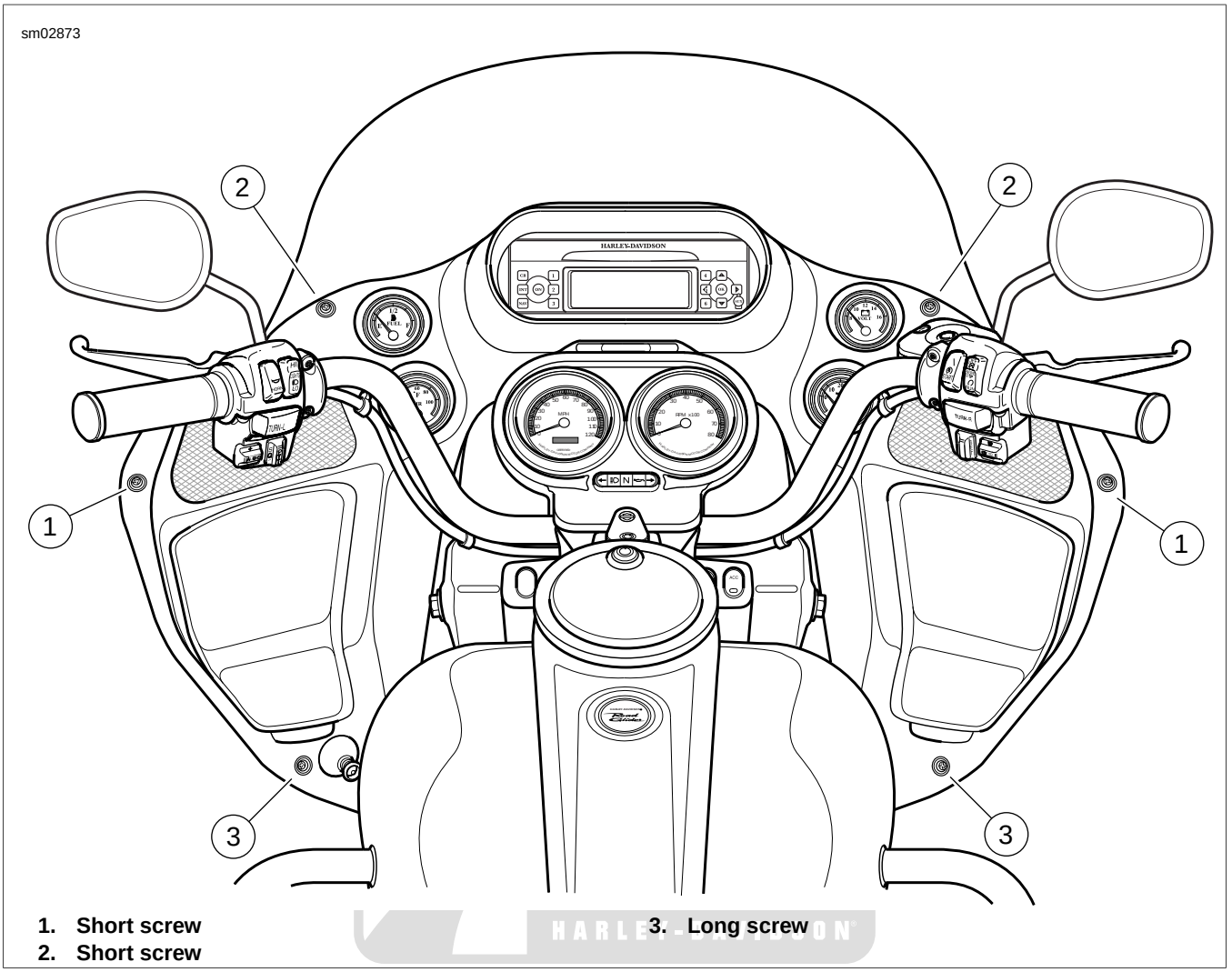
### Removal

*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. Remove screw at edge of fairing outboard of left speaker. See Figure 2-144. Remove screw outboard of right speaker.
3. **Loosen** top left and right screws just outboard of the fuel and volt gauges, respectively.
4. Remove screw just below left side glove compartment. Remove screw below right side glove compartment.
5. On inboard side of right fairing support, remove rear acorn nut (with flat washer) from stud of front turn signal lamp bracket. Remove front acorn nut with flat washer.

   Pull front turn signal lamp assembly from motorcycle and allow to hang at front of engine guard. Repeat step to remove front turn signal lamp assembly on left side. See Figure 2-145.




1. **Short screw**
2. **Short screw**
3. **Long screw**

**Figure 2-144. Remove/Install Six Outer Fairing Screws**

6. Remove top left and right screws just outboard of the fuel and volt gauges, respectively (previously loosened).
7. Raise outer fairing slightly and then rest on protective fender pad.
8. Squeeze two external tabs to disconnect headlamp jumper harness connector.
9. To avoid possible wire damage, disconnect front turn signal lamp connectors [31L] and [31R], 3-place Multilocks, and move to bench area. See Figure 2-146.

## Installation

1. Place protective material on top of front fender to protect paint from scratches or other damage.
2. Connect front turn signal lamp connectors [31L] and [31R], 3-place Multilocks. Capture conduit in adhesive clips on inner fairing. Allow front turn signal lamp assemblies to hang at front of engine guard until outer fairing installation is complete.

*NOTE*

*The front turn signal lamp assemblies are not interchangeable. Note that the letters R(ight) or L(eft) are stamped on the inboard side of the turn signal lamp bracket to help ensure proper assembly.*

3. To avoid chafing wires of interconnect harness, verify that trim strips are installed inboard of hooks on radio bracket.
4. Rest outer fairing on front fender pad and connect headlamp jumper harness connector.
5. 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.

*NOTE*

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

6. 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 motorcycle.

*NOTE*

*Although the tightening sequence described below begins on the left side of the motorcycle, if the left side of the outer fairing*

*fits the inner fairing better than the right, then start the first screw on the right side. In other words, install the first screw on the side that does* ***not*** *have the best fit.*

7. Install screw at edge of fairing outboard of the left speaker. Install screw outboard of the right speaker. Mounting bosses on inner fairing are painted white for easier alignment of holes.
8. Install the top left and right screws just outboard of the fuel and volt gauges, respectively.
9. Moving to left side of motorcycle, install the first of two long screws just below the glove compartment. Install the second long screw below the right side glove compartment.
10. 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). Use the torque pattern shown in Figure 2-144.
11. Slide studs on front turn signal lamp bracket through holes in fairings and fairing support. Loosely install acorn nuts with flat washers. Alternately tighten acorn nuts to 40-50 **in-lbs** (4.5-5.7 Nm).
12. Repeat last step to install front turn signal lamp assembly on opposite side of motorcycle.

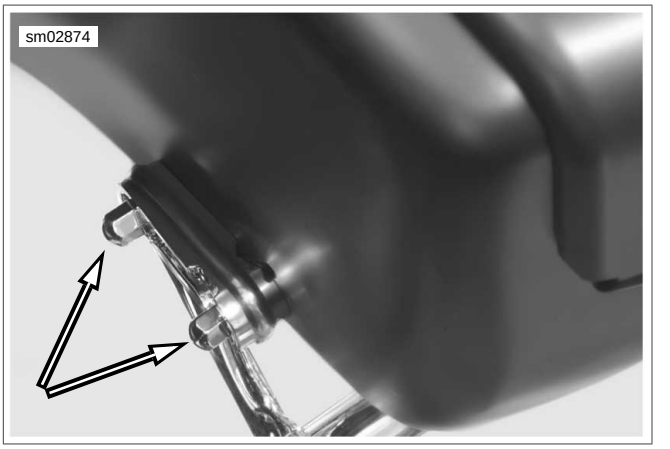


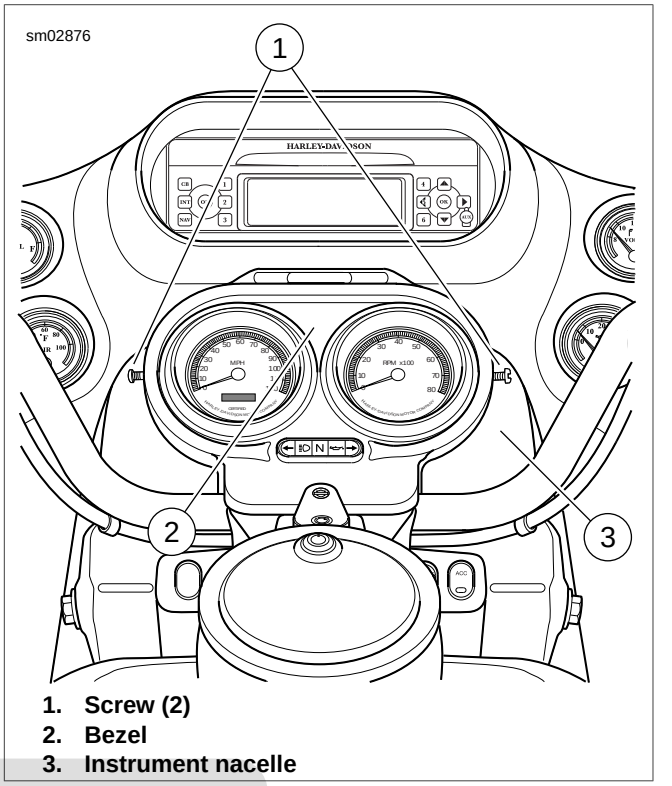

**Figure 2-145. Remove Acorn Nuts to Release Turn Signal Lamp and Bracket**


**Figure 2-146. Front Turn Signal Lamp**

## BEZEL

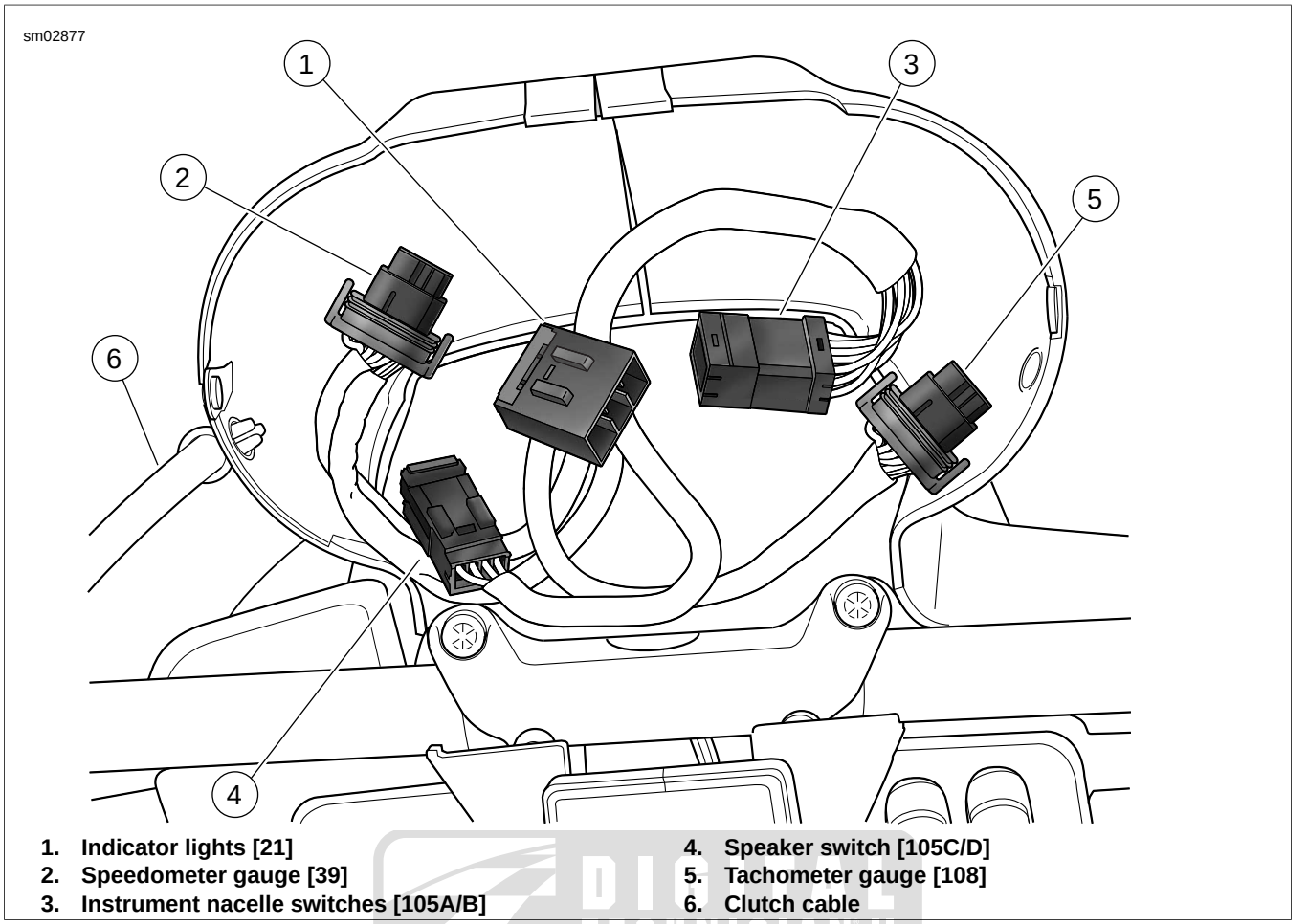
### Removal

1. Remove screw on each side of bezel. See Figure 2-147.
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).




1. **Screw (2)**
2. **Bezel**
3. **Instrument nacelle**

**Figure 2-147. Remove Bezel Screws**




1. **Indicator lights [21]**
2. **Speedometer gauge [39]**
3. **Instrument nacelle switches [105A/B]**
4. **Speaker switch [105C/D]**
5. **Tachometer gauge [108]**
6. **Clutch cable**

**Figure 2-148. Instrument Nacelle (Bezel Removed)**

3. See Figure 2-148. Raising bezel slightly, disconnect instruments and indicator lights from interconnect harness as follows:
   a. Speedometer connector [39], 12-place Packard.
   b. Tachometer connector [108], 12-place Packard.
   c. Indicator lights connector [21], 10-place Multilock.
4. Remove bezel from motorcycle.

## Installation

1. See Figure 2-148. Looking into the instrument nacelle, connect instruments and indicator lights to interconnect harness as follows:
   a. Speedometer connector [39], 12-place Packard.
   b. Tachometer connector [108], 12-place Packard.
   c. Indicator lights connector [21], 10-place Multilock.
2. Verify that left and right sides of instrument nacelle are properly mated. Pins on left side of nacelle must fully engage holes on right.
3. 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*

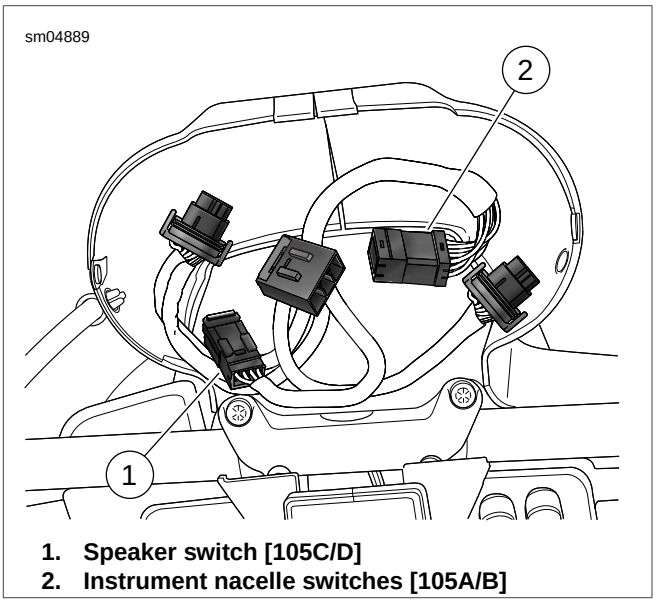
*If tabs do not properly engage slot at front of bezel, then a loose fit will result. Remove decorative adhesive strip by gently prying up outer edges, and using a flat bladed screwdriver, carefully raise tabs so that they engage lip in slot. If damaged, install **new** decorative adhesive strip.*

4. Install screw on each side of bezel. Alternately tighten screws to 25-35 **in-lbs** (2.8-4.0 Nm). See Figure 2-147.

## INSTRUMENT NACELLE

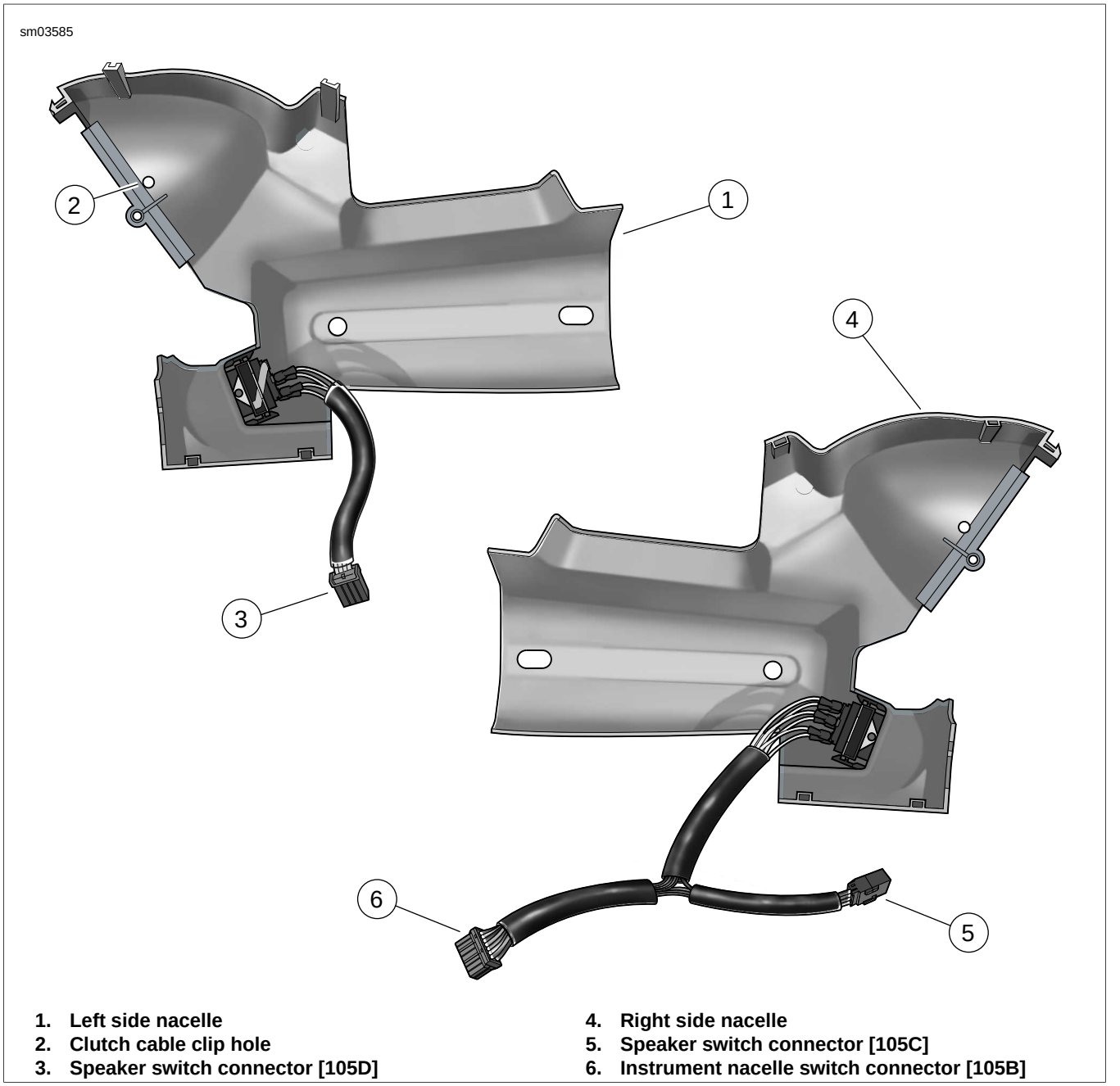
### Removal

1. Partially disassemble ignition switch: remove ignition switch knob, spring, nut, collar, spacer and switch position plate. See 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK.
2. Remove bezel. See 2.40 INSTRUMENT BEZEL: FLTR.
3. Disconnect speaker switch connector [105C/D], 4-place Multilock, from instrument nacelle switch harness. See Figure 2-148.
4. Pull clutch cable clip from hole on left side of instrument nacelle.
5. Remove two screws (with flat washers) to release left side of instrument nacelle from upper and lower fork brackets. See Figure 2-150.
6. Unthread rubber boot from odometer reset switch, and while carefully removing left side instrument nacelle from motorcycle, pull odometer reset switch from hole.
7. Disconnect instrument nacelle switch connector [105A/B], 12-place Multilock, from interconnect harness. See Figure 2-148.
8. Remove two screws (with flat washers) to release right side of instrument nacelle from upper and lower fork brackets. See Figure 2-150.




**1. Speaker switch [105C/D]**
**2. Instrument nacelle switches [105A/B]**

**Figure 2-149. Instrument Nacelle Connectors**




1. **Left side nacelle**
2. **Clutch cable clip hole**
3. **Speaker switch connector [105D]**
4. **Right side nacelle**
5. **Speaker switch connector [105C]**
6. **Instrument nacelle switch connector [105B]**

**Figure 2-150. Instrument Nacelle Halves**

## Installation

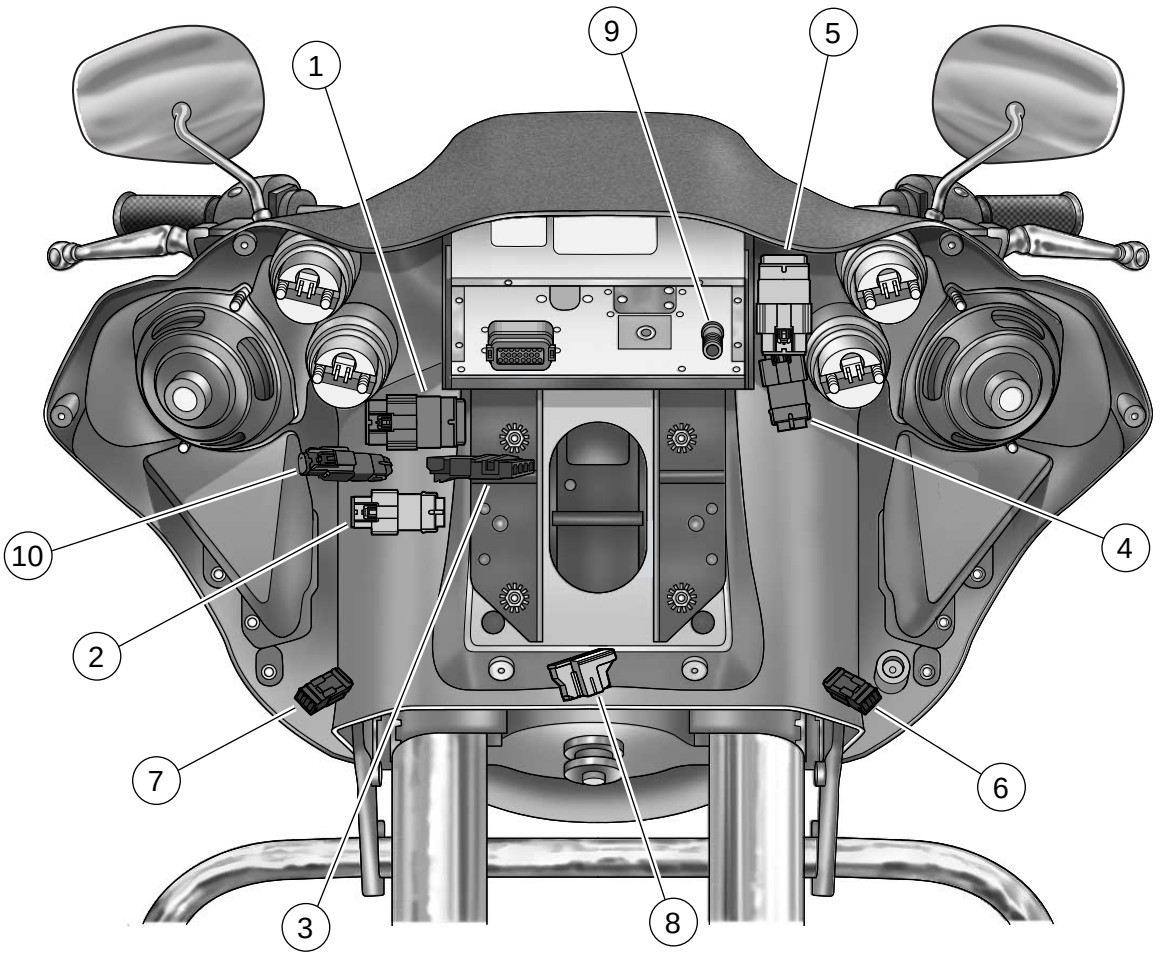
1. Install right side of instrument nacelle on motorcycle.
2. Connect instrument nacelle switch connector [105A/B], 12-place Multilock, to interconnect harness. See Figure 2-148.
3. While carefully placing left side of instrument nacelle on motorcycle, slide odometer reset switch through hole and install rubber boot.
4. Connect speaker switch connector [105C/D], 4-place Multilock, to instrument nacelle switch harness. See Figure 2-148.
5. Verify that left and right sides of nacelle are properly mated. Four pins on left side of nacelle must fully engage holes on right.
6. Install two screws (with flat washers) to fasten left side instrument nacelle to upper and lower fork brackets. Alternately tighten screws to 15-20 ft-lbs (20-27 Nm).
7. Capture clutch cable in cable clip. Insert cable clip into hole in left side of instrument nacelle.
8. Install two screws (with flat washers) to fasten right side instrument nacelle to upper and lower fork brackets. Tighten screws to 15-20 ft-lbs (20-27 Nm).
9. Install bezel. See 2.40 INSTRUMENT BEZEL: FLTR.

10. Assemble ignition switch: install switch position plate, spacer, collar, nut, spring and knob. See 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK.

## REMOVAL

| PART NUMBER | TOOL NAME |
|---|---|
| HD-45961 | IGNITION SWITCH CONNECTOR REMOVER |

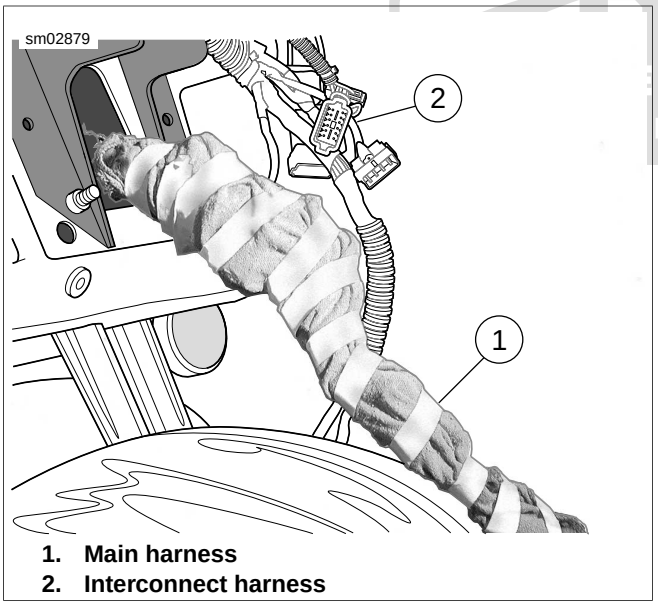
1. Place protective material on top of front fender to protect paint from scratches or other damage.
2. Remove outer fairing. See 2.39 UPPER FAIRING AND WINDSHIELD: FLTR.
3. Carefully cut two cable straps to free wire bundles and conduit from convoluted tubing of interconnect harness and allow to hang naturally.
4. See Figure 2-151. Disconnect main harness from interconnect harness as follows:
   a. Main to interconnect harness connector [1], 16-place Molex (black); below radio (right side).
   b. Main to interconnect harness connector [2], 12-place Molex (gray); below radio (right side).
   c. Main to interconnect harness connector [15], 4-place Packard (black); below radio (right side).
5. Disconnect radio antenna cable connector [51] at back of radio (left side).
6. Disconnect twist grip sensor jumper harness connector [204], 6-place Molex (black), from main harness.




1. **Main to interconnect harness [1]**
2. **Main to interconnect harness [2]**
3. **Main to interconnect harness [15]**
4. **Right handlebar switches [22]**
5. **Left handlebar switches [24]**
6. **Left turn signal [31L]**
7. **Right turn signal [31R]**
8. **Headlamp [38]**
9. **Radio antenna [51]**
10. **Twist grip sensor jumper harness [204]**

**Figure 2-151. Inner Fairing Connectors (FLTR)**

7. See Figure 2-151. Disconnect handlebar switches from interconnect harness. Proceed as follows:
   a. Left handlebar switch connector [24], 16-place Molex (gray); T-stud on left side of radio bracket.
   b. Right handlebar switch connector [22], 12-place Molex (black); T-stud on left side of radio bracket.
8. Remove interconnect harness ground socket terminal from spade contact at front of upper fork bracket (left side).
9. Draw the main harness conduit, radio antenna cable, twist grip sensor jumper harness conduit, and handlebar switch conduit as far forward as possible. Rest the connectors of the longer harnesses on the front fender.
10. Remove left side of instrument nacelle. See 2.41 INSTRUMENT NACELLE: FLTR.
11. Disconnect instrument nacelle switch connector [105A/B], 12-place Multilock, from interconnect harness.
12. Disconnect ambient temperature sensor connector [107], 3-place Multilock, from sensor anchored in hole on left side of steering head. Feed connector and conduit in through opening on left side of fairing bracket.
13. See Figure 2-148. Draw branches of interconnect harness (terminating in odometer reset switch and speedometer, tachometer, indicator lights, instrument nacelle switches and ambient temperature sensor connectors) through tunnel of fairing bracket to front of inner fairing.




1. **Main harness**
2. **Interconnect harness**

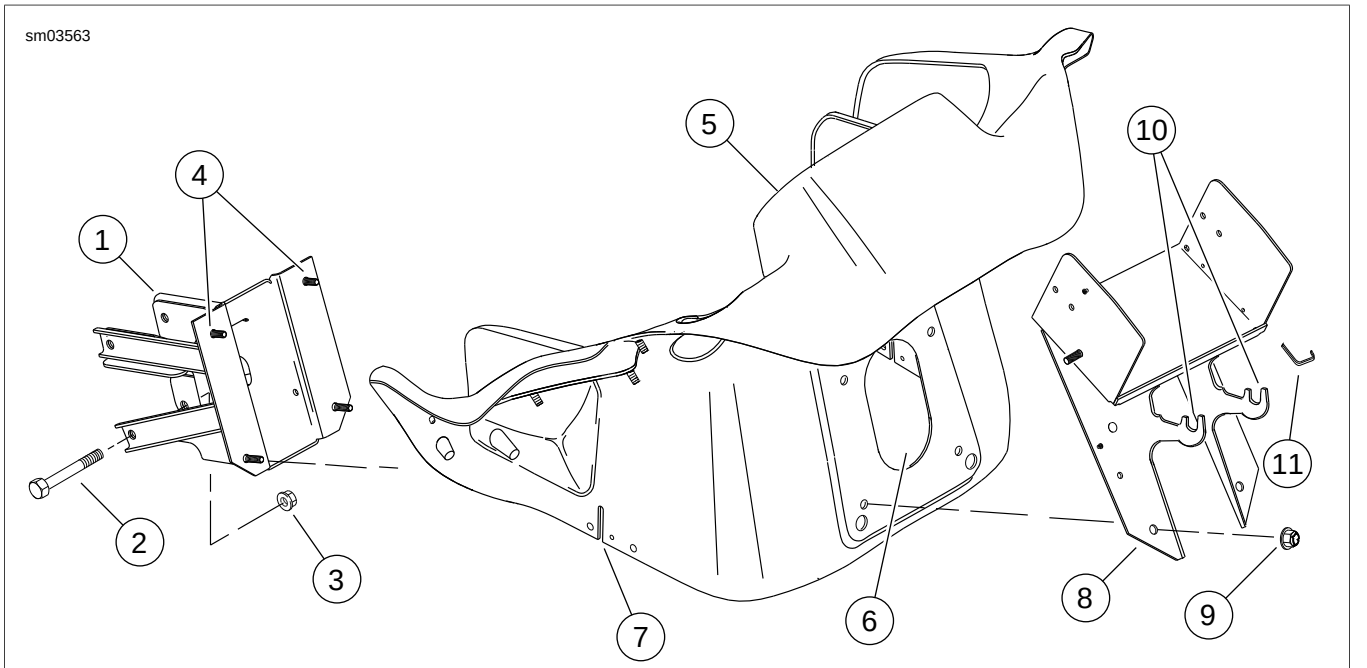
**Figure 2-152. Wrap Main Harness in Shop Towels**

14. Disconnect ignition switch connector [33], 3-place Packard, at front of ignition switch housing. Proceed as follows:
   a. Obtain the IGNITION SWITCH CONNECTOR REMOVER (Part No. HD-45961).
   b. Gently insert end of tool into slot in ignition switch housing until it stops.
   c. Grasping main harness conduit and tool, pull both at the same time to release socket housing from ignition switch housing.
15. Draw branch of main harness terminating in ignition switch connector from instrument nacelle through tunnel of fairing bracket to front of inner fairing.
16. Separate any branches of the interconnect harness that may be intermingled with the main harness conduit. Allow the interconnect harness to hang along the left side of the front fender.
17. Capturing all connectors, tightly wrap clean shop towels around the main harness conduit, radio antenna cable, twist grip sensor jumper harness conduit, and handlebar switch conduit, and secure with masking tape. See Figure 2-152.
18. Remove four locknuts to release radio bracket and inner fairing from studs of fairing bracket. See Figure 2-153.
19. Lift inner fairing (with attached radio bracket and interconnect harness) from fairing bracket studs and move to bench area.

*NOTE*

*To remove the fairing bracket, proceed with remaining steps.*

20. Remove right side instrument nacelle. See 2.41 INSTRUMENT NACELLE: FLTR.
21. Remove shop towels and masking tape from around the harness bundle. Separate main harness conduit, radio antenna cable, twist grip sensor jumper harness conduit, and handlebar switch conduit.
22. Pull main harness conduit, terminating in the radio antenna cable [51], twist grip sensor jumper harness [204], ignition switch [33], and main to interconnect harness connectors, [1] and [15], out through opening on right side of fairing bracket. Hang conduit and connectors over top of engine guard.
23. Pull cable to draw front wheel speed sensor connector [167], 2-place Amp (Tyco), out through opening on left side of fairing bracket. Disconnect from main harness if ABS equipped.
24. Continue pulling main harness conduit to draw main to interconnect harness connector [2] out left side of fairing bracket. Hang conduit and connectors over top of engine guard.
25. Pull handlebar switch conduit and twist grip sensor jumper harness conduit out through opening at top of fairing bracket.
26. Remove locknuts and bolts to release fairing bracket from holes at rear of steering head.




1. **Fairing bracket**
2. **Bolt**
3. **Locknut**
4. **Studs**
5. **Inner fairing**
6. **Opening**
7. **Slot**
8. **Radio bracket**
9. **Locknut**
10. **Outer fairing hooks**
11. **Trim strip**

**Figure 2-153. Inner Fairing Assembly**



## INSTALLATION

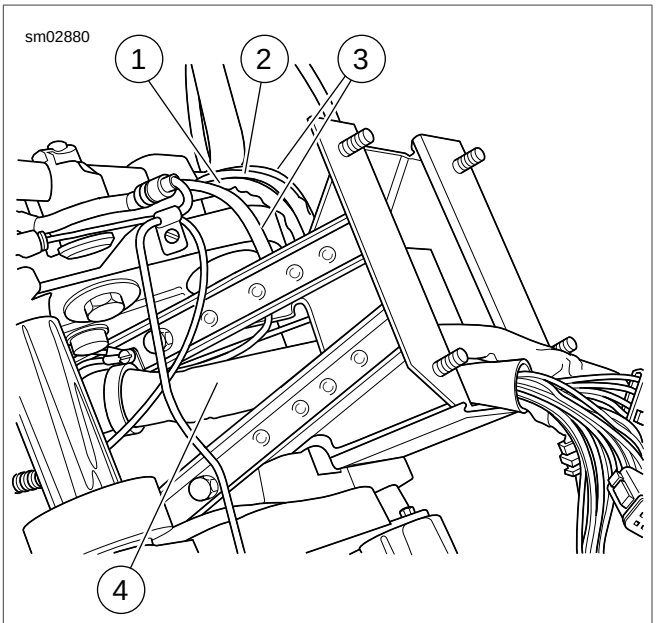
### Outer Fairing

1. 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 motorcycle. Install locknuts and tighten to 20-30 ft-lbs (27.1-40.7 Nm).
2. Route handlebar switch conduit and twist grip sensor jumper harness conduit in through opening at top of fairing bracket. See Figure 2-154.
3. Route main harness conduit terminating in the main to interconnect harness [2] and front wheel speed sensor [167] connectors in through opening on left side of fairing bracket, but first connect front wheel speed sensor connector if ABS equipped.Figure 2-154.
4. Route main harness conduit, terminating in the radio antenna cable [51], twist grip sensor jumper harness [204], ignition switch [33], and main to interconnect harness connectors, [1] and [15], in through opening on right side of fairing bracket. See Figure 2-154.
5. Draw wire harnesses and conduit out tunnel of fairing bracket and pull as far forward as possible. Tightly wrap clean shop towels around the main harness conduit, radio antenna cable, twist grip sensor jumper harness conduit, and handlebar switch conduit, and secure with masking tape. See Figure 2-152.
6. Install right side instrument nacelle. See 2.41 INSTRUMENT NACELLE: FLTR.

### Inner Fairing

1. Place protective material on top of front fender to protect paint from scratches or other damage. Rest inner fairing (with attached radio bracket and interconnect harness) on front fender.
2. Place inner fairing over four fairing bracket studs while feeding end of harness bundle through opening beneath radio. See Figure 2-153. Verify that sides of inner fairing are positioned outboard of both fairing supports (on engine guards).
3. 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).
4. Draw the harness bundle as far forward as possible, resting the end of the bundle on the front fender. See Figure 2-152.
5. Find branch of interconnect harness terminating in ambient temperature sensor connector, 3-place Multilock. Feed connector and conduit from front of inner fairing into tunnel and then out through opening on left side of fairing bracket. Install connector on ambient temperature sensor anchored in hole on left side of steering head.
6. Find branch of interconnect harness terminating in odometer reset switch and speedometer, tachometer, indicator lights and instrument nacelle switch connectors. Feed connectors and conduit from front of inner fairing through tunnel of fairing bracket and then out through opening at top of fairing bracket to instrument nacelle.

7. Connect instrument nacelle switch connector [105A/B], 12-place Multilock, to interconnect harness. See Figure 2-148.
8. Returning to front of inner fairing, remove shop towels and masking tape from around the harness bundle. Separate main harness conduit, radio antenna cable, twist grip sensor jumper harness conduit, and handlebar switch conduit.
9. Find branch of main harness terminating in ignition switch connector. Feed connector and conduit from front of inner fairing through tunnel of fairing bracket and then out through opening at top of fairing bracket to instrument nacelle.
10. Connect ignition switch connector [33], 3-place Packard, at front of ignition switch housing.
11. Connect interconnect harness ground socket terminal to spade contact at front of upper fork bracket (left side).
12. See Figure 2-151. Connect handlebar switches to interconnect harness. Proceed as follows:
    a. Left handlebar switch connector [24], 16-place Molex (gray); T-stud on left side of radio bracket.
    b. Right handlebar switch connector [22], 12-place Molex (black); T-stud on left side of radio bracket.
13. Connect twist grip sensor jumper harness connector [204], 6-place Molex (black), to main harness.
14. Connect radio antenna cable connector [51] at back of radio (left side).
15. See Figure 2-151. Connect main harness to interconnect harness as follows:
    a. Main to interconnect harness connector [1], 16-place Molex (black); below radio (right side).
    b. Main to interconnect harness connector [2], 12-place Molex (gray); below radio (right side).
    c. Main to interconnect harness connector [15], 4-place Packard (black); below radio (right side).




1. **Ignition switch**
2. **Twist grip sensor jumper harness**
3. **Left and right handlebar switches**
4. **Main harness**

**Figure 2-154. Route Main Harness and Conduit Thru Fairing Bracket**

16. Orient connectors as shown in Figure 2-151. Install two **new** cable straps outboard of radio bracket hooks to secure wire bundles and conduit to convoluted tubing of interconnect harness. Cut any excess cable strap material.

*NOTE*

*To avoid chafing wires of interconnect harness, verify that trim strips are installed inboard of hooks on radio bracket.*

17. Install outer fairing. See 2.39 UPPER FAIRING AND WINDSHIELD: FLTR.
18. Install left side of instrument nacelle. See 2.41 INSTRUMENT NACELLE: FLTR.
19. Install bezel. See 2.40 INSTRUMENT BEZEL: FLTR.

## GLOVE BOX DOOR AND HINGE

### Removal

1. Remove the outer fairing. See 2.39 UPPER FAIRING AND WINDSHIELD: FLTR.
2. To access glove box door fasteners, pull out screw cap cover below hinge.
3. Holding locknuts at front of inner fairing, 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*

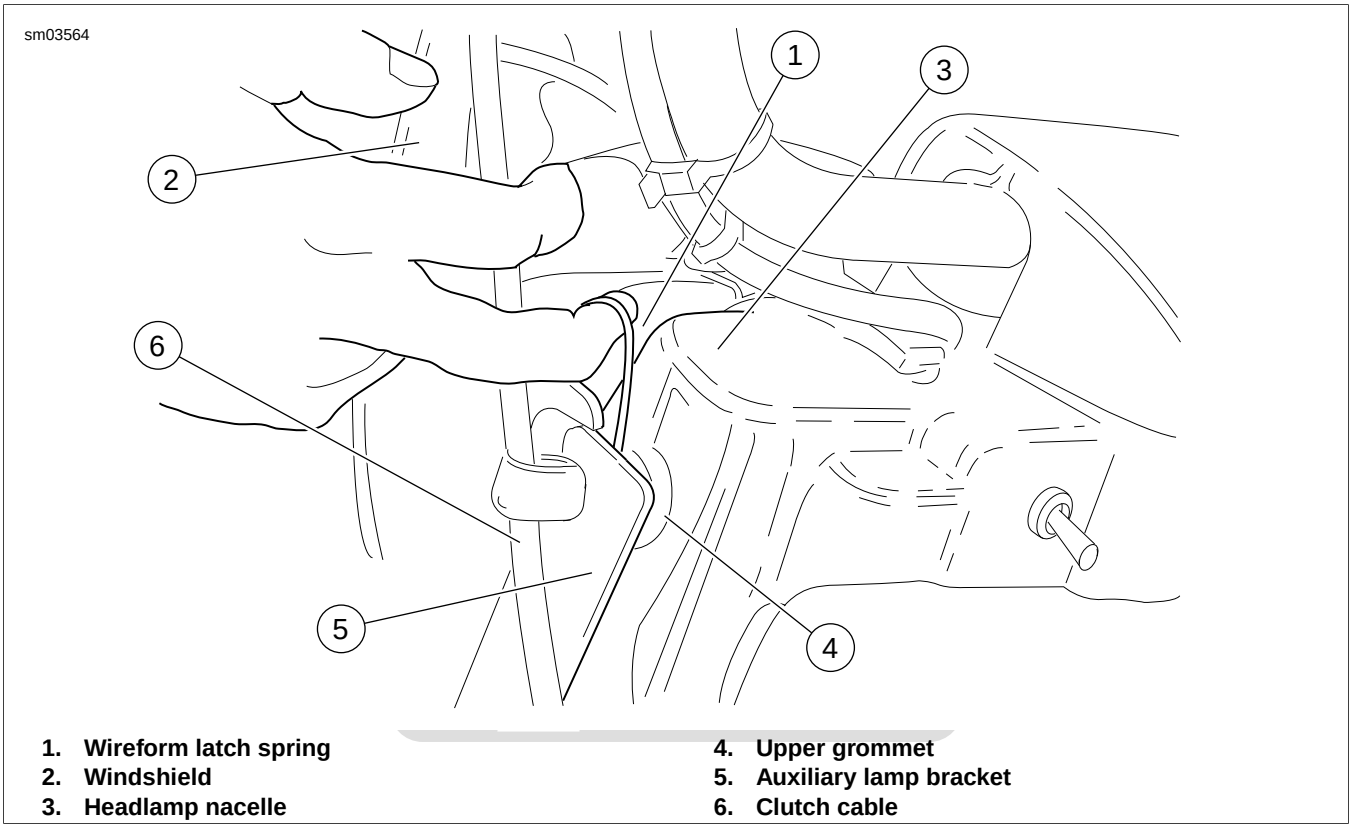
*Install **new** glove box door bumpers in inner fairing if damaged or missing. Insert tail of rubber bumper into hole, and moving to front of inner fairing, pull anchor through hole.*

4. Place glove box door into position against inner fairing. Holding locknuts (with flat washers) at front of inner fairing, tighten hinge screws.
5. To conceal glove door fasteners, snap screw cap cover into place below hinge.
6. Install the outer fairing. See 2.39 UPPER FAIRING AND WINDSHIELD: FLTR.

## WINDSHIELD

### Removal

1. See Figure 2-155. Standing at the front of the motorcycle, use a finger to raise the wireform latch springs on both sides of the windshield.
2. Gently pull on the top of the windshield until the upper notches on the windshield brackets are free of the upper grommets.
3. Carefully raise the windshield until the lower notches are free of the lower grommets.
4. Remove windshield from motorcycle.




1. **Wireform latch spring**
2. **Windshield**
3. **Headlamp nacelle**
4. **Upper grommet**
5. **Auxiliary lamp bracket**
6. **Clutch cable**

**Figure 2-155. Windshield (FLHR/C)**

### Installation

*NOTE*

*To avoid scratching headlamp nacelle or auxiliary lamp bracket, be sure that all four notches on the windshield brackets are firmly seated on a rubber grommet.*

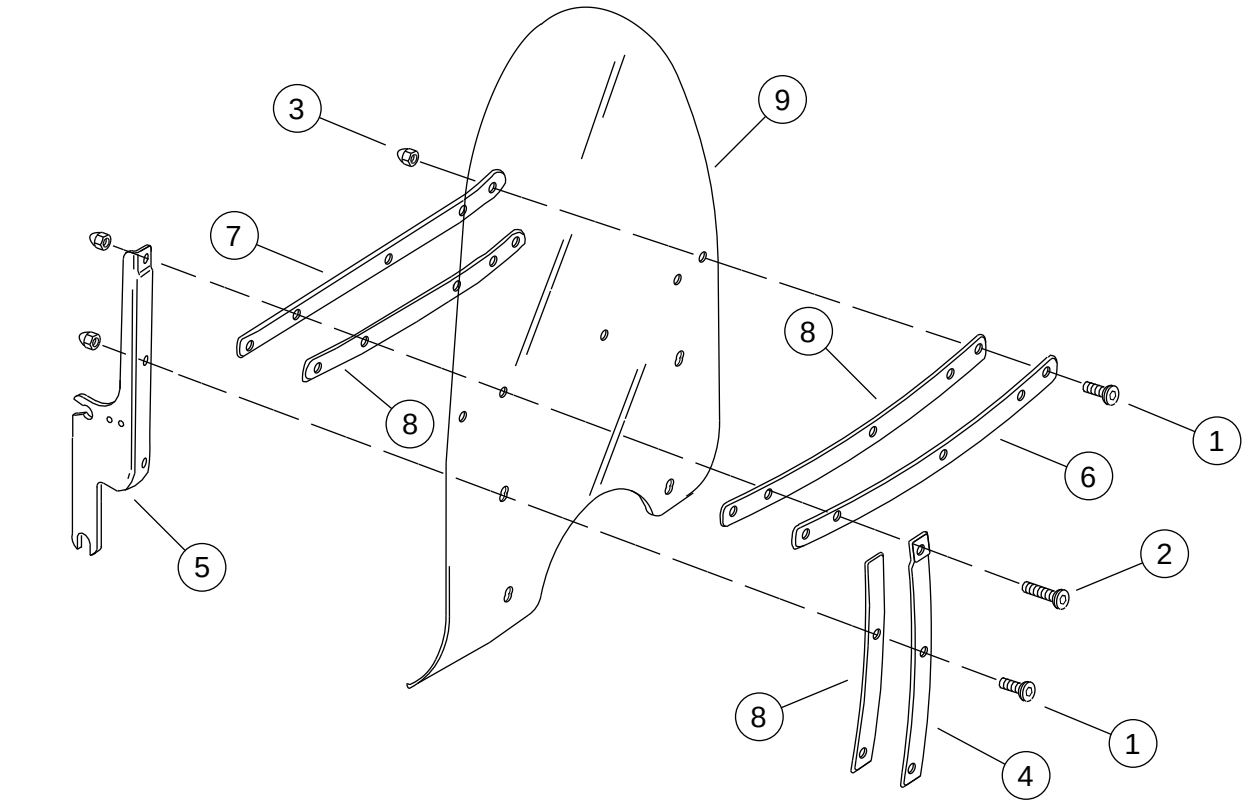
1. Standing at the front of the motorcycle, carefully insert the windshield brackets between the headlamp nacelle and the auxiliary lamp bracket. Lower the windshield into position until the lower notches on the windshield brackets are seated on the lower grommets.
2. Gently push the top of the windshield toward the rear until the upper notches fully engage the upper grommets. See Figure 2-155.
3. Push down on the wireform latch springs, so that they overhang the rubber grommets. If some adjustment is necessary, loosen the retaining screws and rotate the latch springs into the proper position.

## WINDSHIELD WINDOW

| PART NUMBER | TOOL NAME |
|---|---|
| HD-25070 | ROBINAIR HEAT GUN |

### Removal

1. Remove windshield. See 2.44 WINDSHIELD: FLHR/C.
2. Place windshield front side up on clean padded surface.
3. Holding acorn nuts on rear side, remove three T27 TORX screws from one of two vertical braces to release mounting bracket. Repeat step to remove second mounting bracket. See Figure 2-156.
4. Remove three remaining screws from horizontal brace.




1. **T27 TORX screws, short (7)**
2. **T27 TORX screws, long (2)**
3. **Acorn nuts (9)**
4. **Vertical brace (right side)**
5. **Mounting bracket (right side)**
6. **Horizontal brace (front)**
7. **Horizontal brace (rear)**
8. **Two-sided adhesive strip**
9. **Windshield**

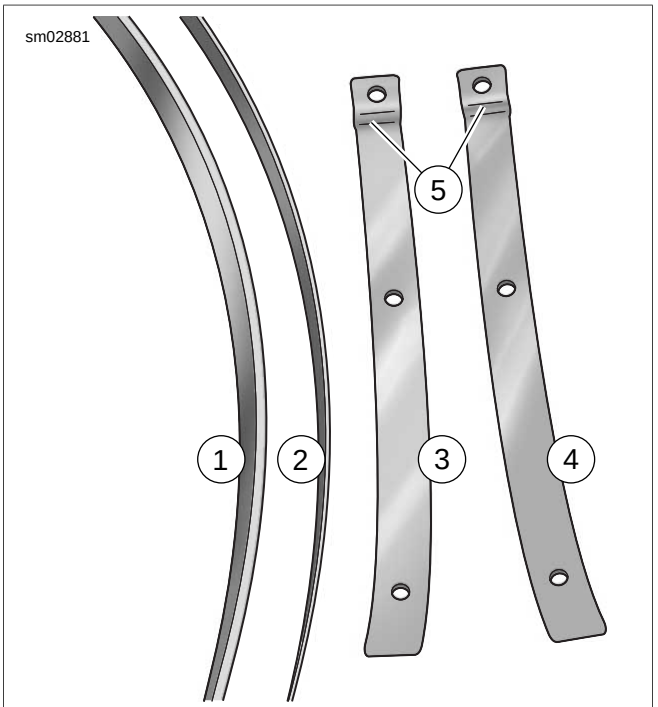


**Figure 2-156. Windshield Assembly**

5. Carefully pry two vertical and one horizontal brace from front of windshield, and then turn windshield over and carefully pry horizontal brace from rear. Discard windshield.
6. Remove adhesive strip from braces. Proceed as follows:
   a. Liberally apply 3M general purpose adhesive remover (Part No. 051135) and allow to soak.
   b. Carefully apply heat with ROBINAIR HEAT GUN (Part No. HD-25070).
   c. Peel adhesive strip from braces.
   d. Remove any remaining adhesive with 3M general Purpose adhesive remover (Part No. 051135).

## Installation

1. Obtain four **new** two-sided adhesive strips, one for each brace.
2. Remove paper backing from one side of each adhesive strip and apply to respective brace.
3. Place **new** windshield front side down on clean padded surface.
4. Locate the two vertical braces with the step on one end and set these aside for later use. Now pick the thicker of the two horizontal braces that remain. See Figure 2-157.
5. Remove paper backing from adhesive strip on thicker horizontal brace, and aligning holes in brace with horizontal set of holes in windshield, press brace into position.
6. Turn windshield over, so that the front side is up.
7. Remove paper backing from adhesive strip and fix thinner horizontal brace to windshield. Properly positioned, holes in brace must be aligned with horizontal set of holes in windshield and edges must be even with the edges of the thicker brace already installed.
8. Locate the two long T27 TORX screws and set these aside for later use.




1. **Horizontal brace - thick (rear)**
2. **Horizontal brace - thin (front)**
3. **Vertical brace (right side)**
4. **Vertical brace (left side)**
5. **Stepped ends**

**Figure 2-157. Windshield Braces**

9. Apply one drop of Loctite Medium Strength Threadlocker 243 (blue) to threads of three short screws. Slide screws through the middle and outer holes of the horizontal braces. Loosely install acorn nuts on rear side.
10. Remove paper backing from adhesive strip on vertical brace. With the stepped end overlapping the installed horizontal brace (and the slight bend on the opposite end angled outward), align holes in brace with vertical set of holes in windshield, and press into position. See Figure 2-157.
11. Position mounting bracket on rear side of windshield with the wireform facing inboard. Align three holes in mounting bracket with those in vertical brace.
12. Apply one drop of Loctite Medium Strength Threadlocker 243 (blue) to threads of two short screws and one long screw. Slide screws through holes in vertical brace and mounting bracket, the longer screw at the stepped end where the vertical brace overlaps the horizontal brace. Loosely install acorn nuts on rear side.
13. Repeat previous steps to install second vertical brace and mounting bracket.
14. Holding acorn nuts on rear side, alternately tighten nine T27 TORX screws to 20-25 **in-lbs** (2.3-2.8 Nm) in the pattern shown in Figure 2-158.
15. Install windshield. See 2.44 WINDSHIELD: FLHR/C.

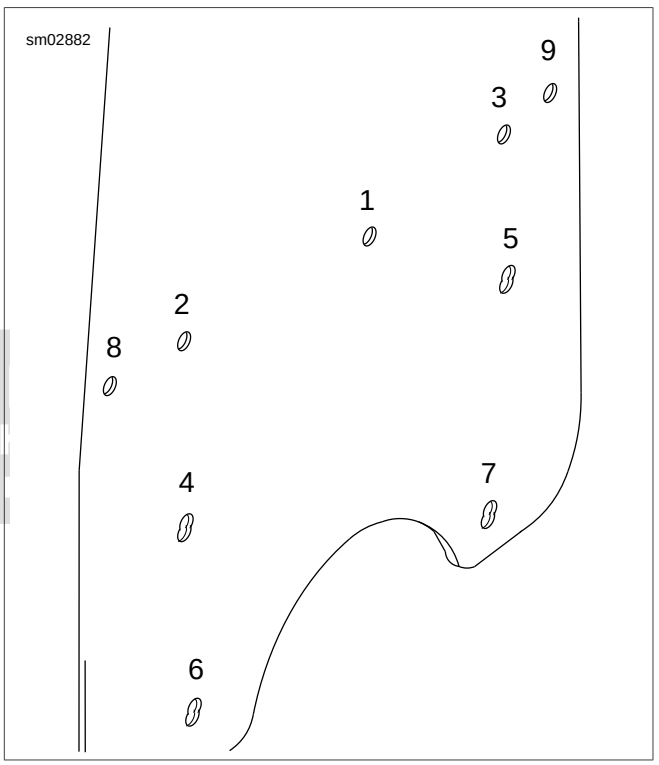
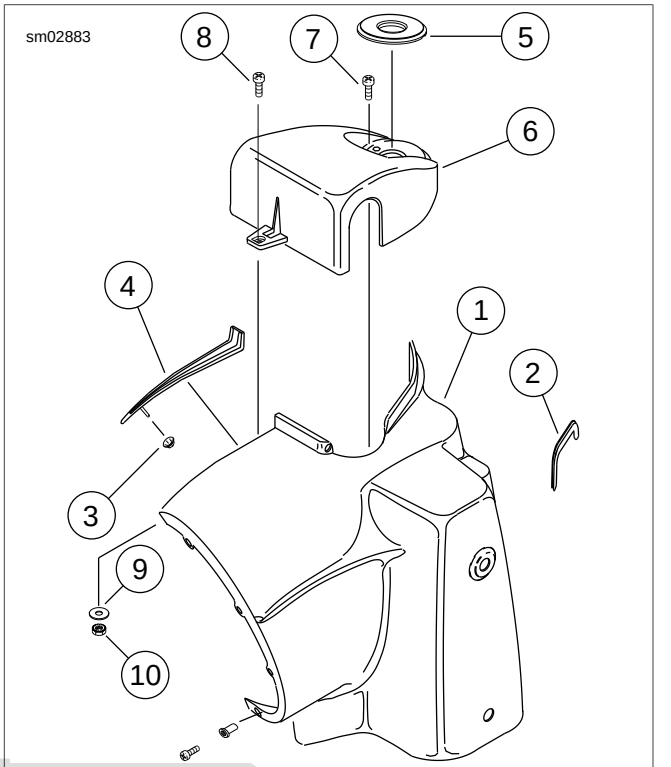



**Figure 2-158. Windshield Torque Sequence**

## REMOVAL

1. Remove windshield. See 2.44 WINDSHIELD: FLHR/C.
2. Remove the Phillips screw at the bottom of the headlamp door (chrome ring). Remove the headlamp door.
3. Remove the seven Phillips screws to free the headlamp housing from the headlamp nacelle.
4. Remove headlamp connector [38] at back of headlamp bulb. Remove the headlamp housing assembly from the motorcycle.
5. Reaching inside the headlamp nacelle, remove the flange nut to release the chrome strip at the top of the nacelle. See Figure 2-159.
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 Keps nut and flat washer).
8. Remove the two acorn nuts from the left side fork bracket studs. Remove acorn nuts from the right side fork bracket studs.
9. Cover the front fender with suitable material to protect the fender paint. Remove the auxiliary lamp bracket from the left and right side fork bracket studs and carefully set on front fender.
10. Remove the grommets (and clutch cable clamp) from the left and right side fork bracket studs.
11. Raise the handlebar clamp shroud, and after separating the halves of the headlamp nacelle slightly, slide the shroud forward running the shaft of the Phillips screw down the gap. See Figure 2-160.
12. Reaching inside the headlamp nacelle, disconnect accessory switch connector [67] and auxiliary lamp switch connector [109]. See Figure 2-161.
13. Carefully separate the halves of the headlamp nacelle and remove from motorcycle.




1. **Headlamp nacelle (left side**
2. **Trim strip**
3. **Flange nut**
4. **Chrome strip**
5. **Fork lock plate**
6. **Handlebar clamp shroud**
7. **Phillips screw (2)**
8. **Phillips screw**
9. **Flat washer**
10. **Keps nut**

**Figure 2-159. Headlamp Nacelle Assembly**

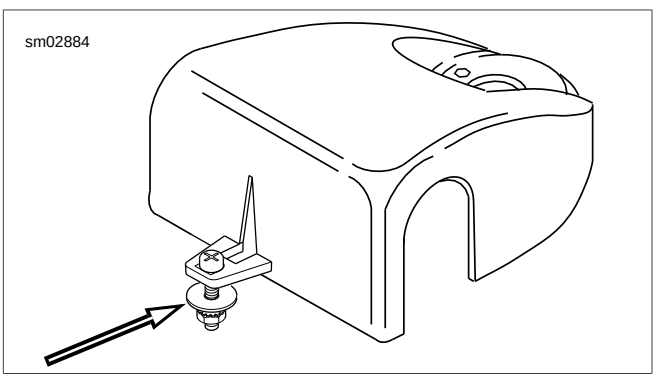



**Figure 2-160. Handlebar Clamp Shroud and Screw Assembly**

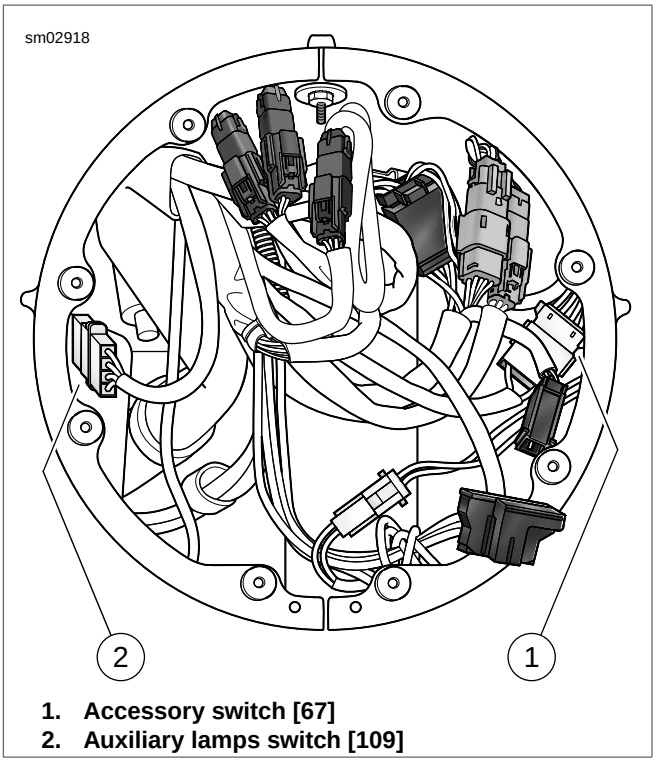
## INSTALLATION

1. Fit halves of the headlamp nacelle together engaging the holes in the nacelle with the left and right side fork bracket studs.
2. Reaching inside the headlamp nacelle, connect accessory switch connector [67] and auxiliary lamp switch connector [109]. See Figure 2-161.
3. If disassembled, install Phillips screw, flat washer and Keps nut on the handlebar clamp shroud as shown in Figure 2-160.
4. Part the halves of the headlamp nacelle slightly. With the flat washer on the inboard side of the nacelle, slide the shroud rearward running the shaft of the Phillips screw down the gap. Position the shroud over the flange at the top of the nacelle.
5. Mate the halves of the headlamp nacelle and tighten the Phillips screw to 10-20 **in-lbs** (1.1-2.3 Nm).
6. Install two Phillips screws to secure handlebar clamp shroud to the fork lock mechanism. Alternately tighten screws to 10-20 **in-lbs** (1.1-2.3 Nm). Install fork lock plate.

*NOTE*

*To avoid possible damage to the brake hose and/or handlebar switch wires, verify that trim strips are installed on inside edges of the headlamp nacelle. Cutting or severe chafing of the brake hose and/or handlebar switch wires could cause loss of function while riding.*

7. Verify that trim strips are installed on inside edges of headlamp nacelle. Install new trim strips if cracked, broken or missing.
8. 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).
9. Install the grommets on the left and right side fork studs.
10. Slide the auxiliary lamp bracket onto the left and right side fork bracket studs. Verify that the four grommets are in place on the inboard side of the auxiliary lamp brackets.




1. **Accessory switch [67]**
2. **Auxiliary lamps switch [109]**

**Figure 2-161. Headlamp Nacelle (FLHRC)**

11. Install the acorn nuts on the fork bracket 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.
12. Install headlamp connector [38] at back of headlamp bulb.
13. Align holes in headlamp housing with wellnuts in headlamp nacelle (headlamp door bracket at bottom). Install the seven Phillips screws and alternately tighten to 9-18 **in-lbs** (1.0-2.0 Nm).
14. 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).
15. Install windshield. See 2.44 WINDSHIELD: FLHR/C.

## REMOVAL

*NOTE*

*Start procedure at step 4 if fender tip lamp is absent.*

1. **FLHR:**
   a. Remove screw at bottom of headlamp door (chrome ring). Remove headlamp door.
   b. Remove seven screws to free headlamp housing from headlamp nacelle.
   c. Remove headlamp connector [38] at back of headlamp bulb.
   d. Remove headlamp housing assembly from motorcycle.
   e. Disconnect front fender tip lamp jumper harness connector [32], 2-place Multilock. See Figure 2-162.
2. **FLHT/C/U:** Reaching in below the fairing cap on the left side of the steering head, disconnect front fender tip lamp jumper harness connector [32], 2-place Multilock. See Figure 2-163.

*NOTE*

*Remove outer fairing only if necessary. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.*

3. Draw socket housing down to fender area.
4. Remove front wheel. See 2.3 FRONT WHEEL.
5. Bend tabs on lockplates away from heads of four front fender mount screws. Remove screws and lockplates. Remove fender from motorcycle.

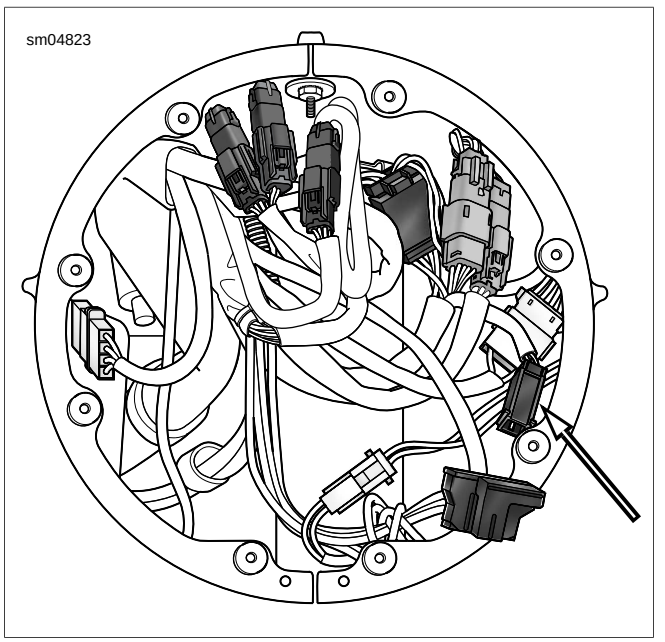



**Figure 2-162. Front Fender Tip Lamp Jumper Harness Connector (FLHR/C)**

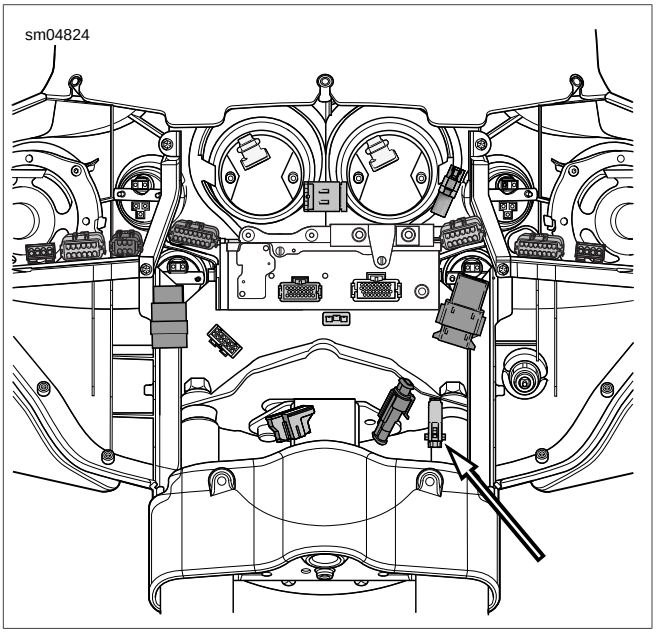



**Figure 2-163. Front Fender Tip Lamp Jumper Harness Connector (FLHT/C/U)**

## INSTALLATION

1. Install lockplates on four front fender mount screws. Align holes in fender with those in fork sliders and start screws.
2. Alternately tighten screws to 16-20 ft-lbs (22-27 Nm). Bend tabs on lockplates against flats on screw heads.

*NOTE*

*Skip the next step if fender tip lamp is absent.*

3. Route socket housing upward behind chrome skirt (FLHT/C/U) or through bottom of headlamp nacelle (FLHR) to area beneath upper fork bracket. Connect front fender tip lamp jumper harness connector [32].

*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.*

4. Install front wheel. See 2.3 FRONT WHEEL.
5. **FLHR:**
   a. Install headlamp connector [38] at back of headlamp bulb.
   b. Align holes in headlamp housing with wellnuts in headlamp nacelle (headlamp door bracket at bottom).
   c. Install seven screws and alternately tighten to 9-18 **in-lbs** (1.0-2.0 Nm).
   d. Install headlamp door (chrome ring) and door screw. Tighten screw to 9-18 **in-lbs** (1.0-2.0 Nm).
6. **FLHT/C/U:** Install outer fairing, if removed. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.

## REMOVAL

*NOTE*

*Skip first step for all models except FLHX.*

1. **FLHX:** Remove rear fascia and rear fascia lamp. See 2.48 REAR FACIA: FLHX.
2. Remove rear wheel. See 2.4 REAR WHEEL.
3. Remove seat. See 2.26 SEAT.
4. Disconnect rear fender lights connector [7] anchored at front of rear fender. Release anchor from fender hole. See Figure 2-164.
5. Remove left and right side covers.
6. Remove four screws with lockwashers (two each on FLHR/C and FLTR) to release license plate bracket from luggage rack.

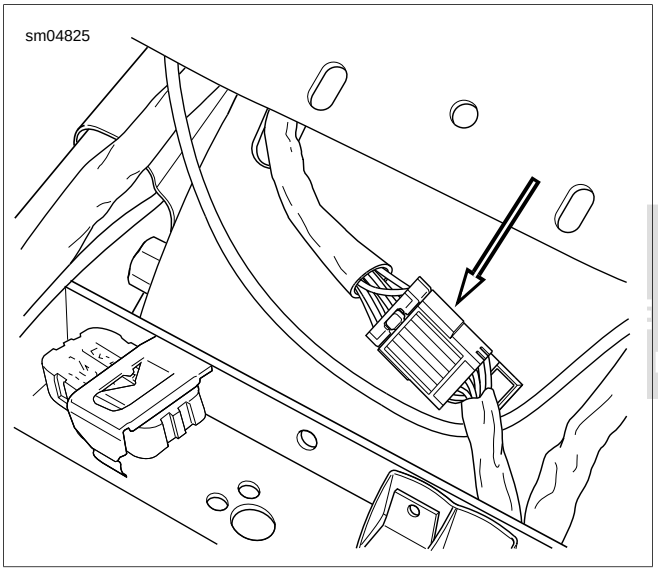



**Figure 2-164. Rear Fender Lights Connector**

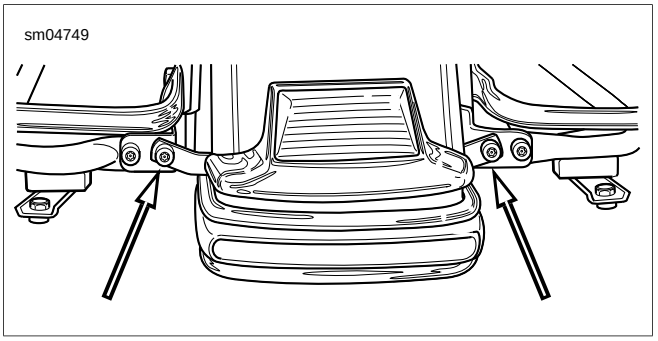



**Figure 2-165. Rear Bumper Screws**

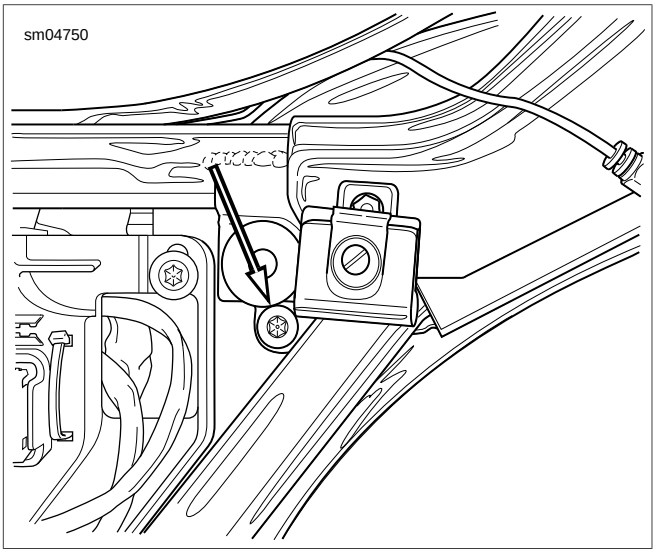



**Figure 2-166. Rear Fender Side Mounting Screw (Left Side)**

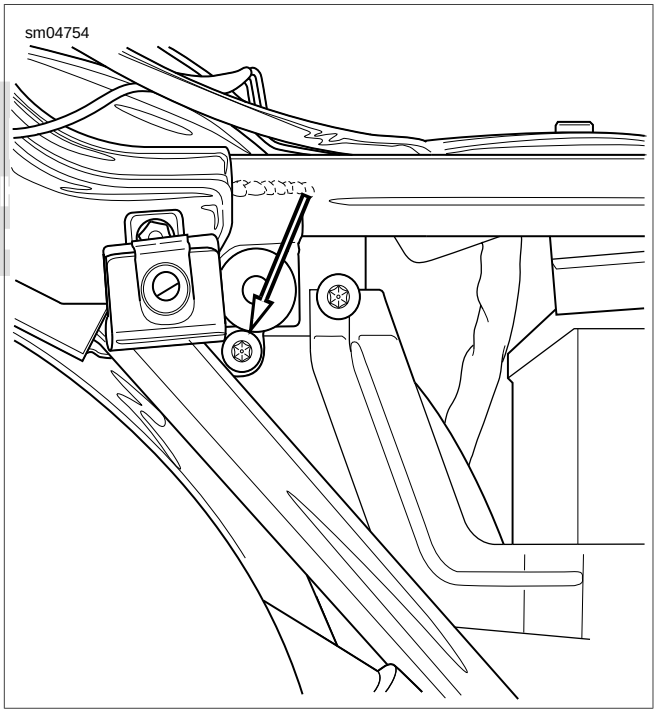



**Figure 2-167. Rear Fender Side Mounting Screw (Right Side)**

7. At rear of motorcycle, remove inside screw (and flange nut) to release rear bumper bracket from saddlebag support bracket and saddlebag support rail. Repeat step on opposite side of motorcycle. See Figure 2-165.
8. Reaching under rear bumper, remove flange nut (with flat washer) to free rear bumper bracket from weld stud on fender. Remove bumper from motorcycle.

9. Remove fender side mounting screw located just below side cover grommet. Repeat step on opposite side of motorcycle. See Figure 2-166 and Figure 2-167.
10. Remove upper rear screw from saddlebag support bracket. Repeat step on opposite side of motorcycle. See Figure 2-168.
11. Remove upper front screw from saddlebag support bracket. Be aware that rear fender will drop when both forward screws are removed. Repeat step on opposite side of motorcycle.
12. Exercising caution to avoid scratching fender paint on luggage rack or other bracketry, carefully roll the fender out. See Figure 2-169. If necessary, have one person spread the saddlebag support brackets while the fender is rolled out.

## INSTALLATION

1. Exercising caution to avoid scratching fender paint on luggage rack or other bracketry, carefully roll the fender in. See Figure 2-169. 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, start upper front screw in saddlebag support bracket. Repeat step on opposite side of motorcycle. See Figure 2-168.
3. Start upper rear screw in saddlebag support bracket. Repeat step on opposite side of motorcycle.
4. Engaging hole in frame and fender front spacer nut, start fender side mounting screw located just below side cover grommet. Repeat step on opposite side of motorcycle. See Figure 2-166 and Figure 2-167.

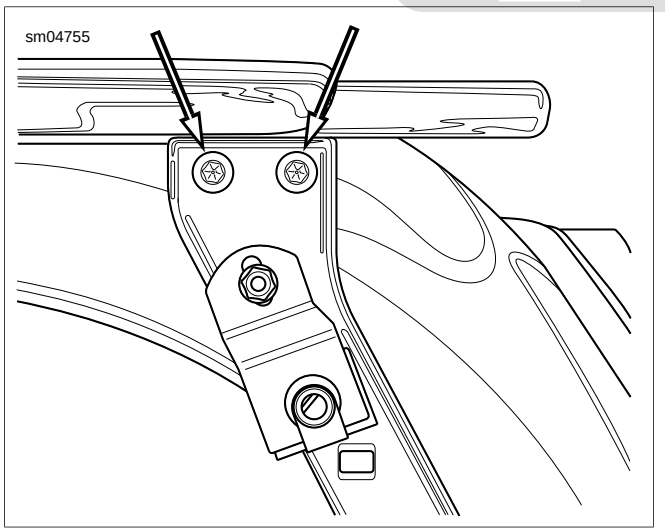



**Figure 2-168. Saddlebag Support Bracket Screws**

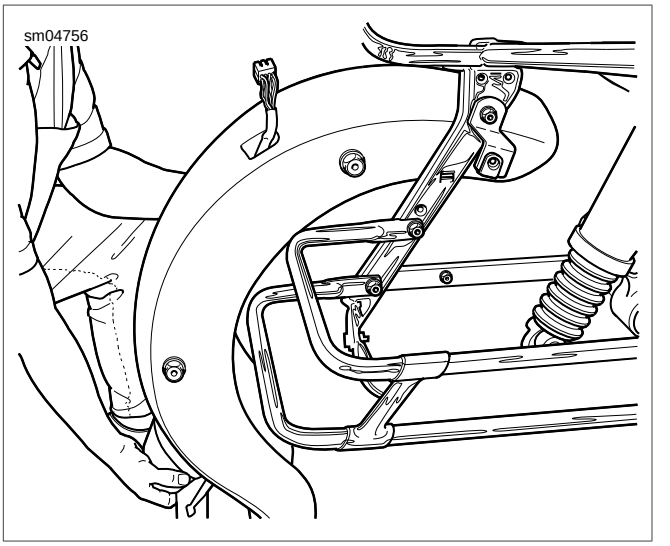



**Figure 2-169. Carefully Roll Out Rear Fender**

5. Reaching under rear fender, hang rear bumper bracket on weld stud. Install flat washer and start flange nut on weld stud.
6. Start inside screw (with flange nut) to fasten rear bumper bracket to saddlebag support bracket and saddlebag support rail. Repeat step on opposite side of motorcycle. See Figure 2-165.
7. Alternately tighten all rear fender mounting screws to 15-20 ft-lbs (20-27 Nm).
8. Reaching under rear fender, tighten flange nut on weld stud to 45-85 **in-lbs** (5.1-9.6 Nm).
9. Install four hex screws with lockwashers (two each on FLHR/C and FLTR) to secure license plate bracket to luggage rack. Alternately tighten screws to 15-20 ft-lbs (20-27 Nm).
10. Connect rear fender lights connector [7] and snap anchor in rear fender hole. See Figure 2-164.
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 motorcycle.
12. Install rear wheel. See 2.4 REAR WHEEL.
13. Install seat. See 2.26 SEAT.
14. **FLHX:** Install rear fascia lamp and rear fascia. See 2.48 REAR FACIA: FLHX.

## REAR FENDER LIGHTS CONDUIT

### Removal

1. Remove rear fender.
2. Remove rear fender lights harness. See 8.12 TAIL LAMP, Rear Fender Lights Harness.
3. Carefully cut adhesive conduit and remove wire harness.
4. Remove terminals from socket housing of rear fender lights connector [94], 6-place Multilock.

*NOTE*

*For instructions on properly removing wire terminals, see A.2 AMP MULTILOCK CONNECTORS.*

## Installation

1. Draw rear fender lights harness through **new** adhesive conduit until progress is halted by installed cable strap. If absent, install **new** cable strap as follows:
   a. Adjust conduit so that end is 0.25 in. (6.35 mm) or less from wire end of connector [7B].
   b. Install cable strap 8.75 in. (222.25 mm) from mating end of connector as shown in Figure 2-170. Cut any excess cable strap material.

*NOTE*

*Proper placement of the cable strap prevents rearward movement of the rear fender lights harness. Gradual accumulation or bunching of the harness rear of the adhesive conduit can result in damage through contact with rear tire.*

2. Install terminals into socket housing of rear fender lights connector [94], 6-place Multilock.

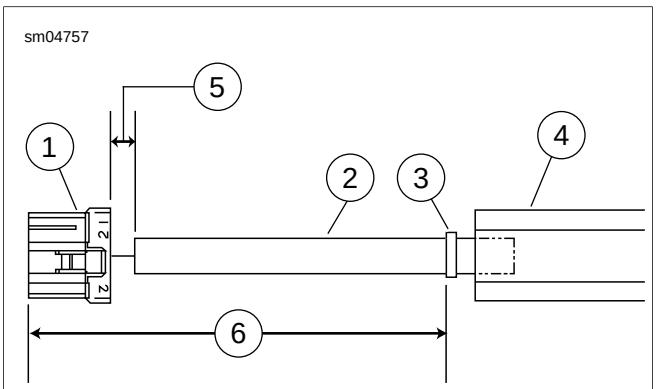
**Table 2-17. Rear Fender Lights [94]**

| WIRE COLOR | CHAMBER NUMBER | WIRE COLOR | CHAMBER NUMBER |
|---|---|---|---|
| Orange/White | 1 | Red/Yellow | 4 |
| Brown | 2 | Violet | 5 |
| Blue | 3 | Black | 6 |

*NOTE*

*For instructions on properly installing wire terminals, see A.2 AMP MULTILOCK CONNECTORS.*

3. Install rear fender lights harness. See 8.12 TAIL LAMP, Rear Fender Lights Harness.
4. Install rear fender.




1. **Connector [7B]**
2. **Conduit**
3. **Cable Strap**
4. **Adhesive Conduit**
5. **0.25 in. (6.35 mm)**
6. **8.75 in. (222.25 mm)**

**Figure 2-170. Install Cable Strap on Conduit**

# REAR FENDER CLOISONNE

| PART NUMBER | TOOL NAME |
|---|---|
| HD-25070 | ROBINAIR HEAT GUN |

## Removal

1. Apply 3M general purpose adhesive remover (Part No. 051135) to edge of adhesive backing visible behind cloisonne. Allow to soak.

*NOTE*

*Avoid excess heat which will damage the painted surface.*

2. Carefully apply heat directly onto cloisonne with ROBINAIR HEAT GUN (Part No. 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 paper backing off cloisonne.
2. Place cloisonne into 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 2-171. Rear Fender Cloisonne (FLTR)**

## REMOVAL

1. Remove saddlebags. See 2.27 SADDLEBAGS.
2. Remove six flange nuts from studs at sides of rear fender. See Figure 2-172.
3. On left side of motorcycle, loosen set screw and unthread radio antenna mast.
4. Gently open adhesive conduit at split line to release rear facia lamp wires.
5. At rear of motorcycle, spread top of facia to release from top studs at sides of fender and then pull bottom in a downward direction to release facia from fender. If necessary, gently wiggle facia while pulling.
6. Remove two T20 TORX screws to release lamp assembly from facia.

## INSTALLATION

1. Install two T20 TORX screws to fasten lamp assembly to facia. Alternately tighten screws to 18-22 **in-lbs** (2.0-2.5 Nm).
2. At rear of motorcycle, insert flange at top of facia between flap and fender. Notch in flange engages locator bump on flap when facia is fully installed. Spread top of facia to engage top studs at sides of fender.
3. See Figure 2-172. Start six flange nuts on studs at sides of fender. Apply a small dab of Loctite Medium Strength Threadlocker 243 (blue) to threads of studs. Alternately tighten flange nuts to 30-45 **in-lbs** (3.4-5.1 Nm).

*NOTE*

*As it is necessary to overcome the resistance of the lock patch on the stud threads, note that the flange nut torque specification is higher when using a **new** stud plate.*

4. On left side of motorcycle, gently open adhesive conduit at split line and insert rear facia lamp wires.
5. Install radio antenna mast and tighten set screw.
6. Install saddlebags. See 2.27 SADDLEBAGS.

## STUD PLATE

### Removal

1. Remove rear wheel as necessary to gain access to fender well. See 2.4 REAR WHEEL.
2. Remove flange nuts from studs at sides of rear fender. See Figure 2-172.
3. Reaching into fender well, carefully pry stud plate away from rear fender.

*NOTE*

*Stud plates installed in production use adhesive strips as an assembly aid. Beginning at the edges, carefully work stud plate free using a small putty knife or gasket scraper.*


**Figure 2-172. Remove Flange Nuts**

### Installation

1. Install **new** stud plate.
2. Install flange nuts on studs and alternately tighten to 80 **in-lbs** (9.0 Nm). See Figure 2-172.

*NOTE*

*As it is necessary to overcome the resistance of the lock patch on the stud threads, note that the flange nut torque specification is higher when using a **new** stud plate.*

3. Install rear wheel. See 2.4 REAR WHEEL.

## REAR FACIA LAMP

### Removal

1. Remove rear facia. See 2.48 REAR FACIA: FLHX.
2. On left side of motorcycle, remove bolt (with flat washer) to remove passenger seat strap and saddlebag front mounting bracket from chrome frame tube cover.
3. Remove Phillips screw and chrome frame tube cover.
4. Release rear facia lamp wires from cable clip at top of radio antenna bracket. See Figure 2-173.
5. Cut cable strap to release rear facia lamp wires and radio antenna cable from slotted hole in rear fender support.
6. Cut cable strap to release rear facia lamp wires and radio antenna cable from shoulder of upper frame tube (just in front of air valve mounting bracket).
7. Disconnect rear facia lamp connector [12], 3-place Multi-lock, inboard of upper frame tube.

*NOTE*

*Connector [12] serves as the Tour-Pak lights connector on FLHTC/U models.*

## Installation

1. Route rear facia lamp wires forward through cable clip at top of radio antenna bracket and then upward in front of saddlebag rear mounting bracket to inboard side of upper frame tube.
2. On inboard side of upper frame tube, mate pin and socket housings of rear facia lamp connector [12], 3-place Multi-lock.
3. Using slotted hole, install **new** cable strap to secure rear facia lamp wires and radio antenna cable to rear fender support. See Figure 2-173.
4. Install **new** cable strap to secure rear facia lamp wires and radio antenna cable to shoulder of upper frame tube (just in front of air valve mounting bracket).
5. Install chrome frame tube cover on frame tube. Install Phillips screw and tighten to 25-40 **in-lbs** (2.8-4.5 Nm).
6. 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.

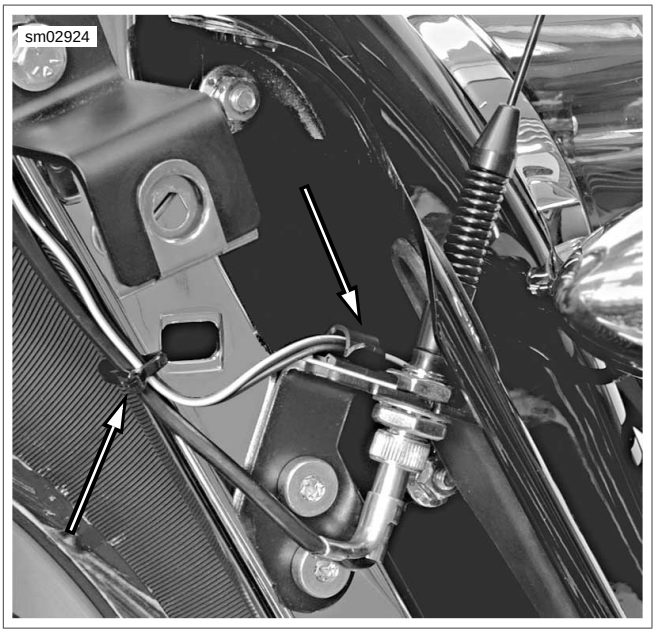



**Figure 2-173. Capture Rear Facia Lamp Wires**

7. Install rear facia. See 2.48 REAR FACIA: FLHX.
8. Using an open end/box wrench, tighten saddlebag front mounting bracket bolt to 60-96 **in-lbs** (6.8-10.8 Nm).

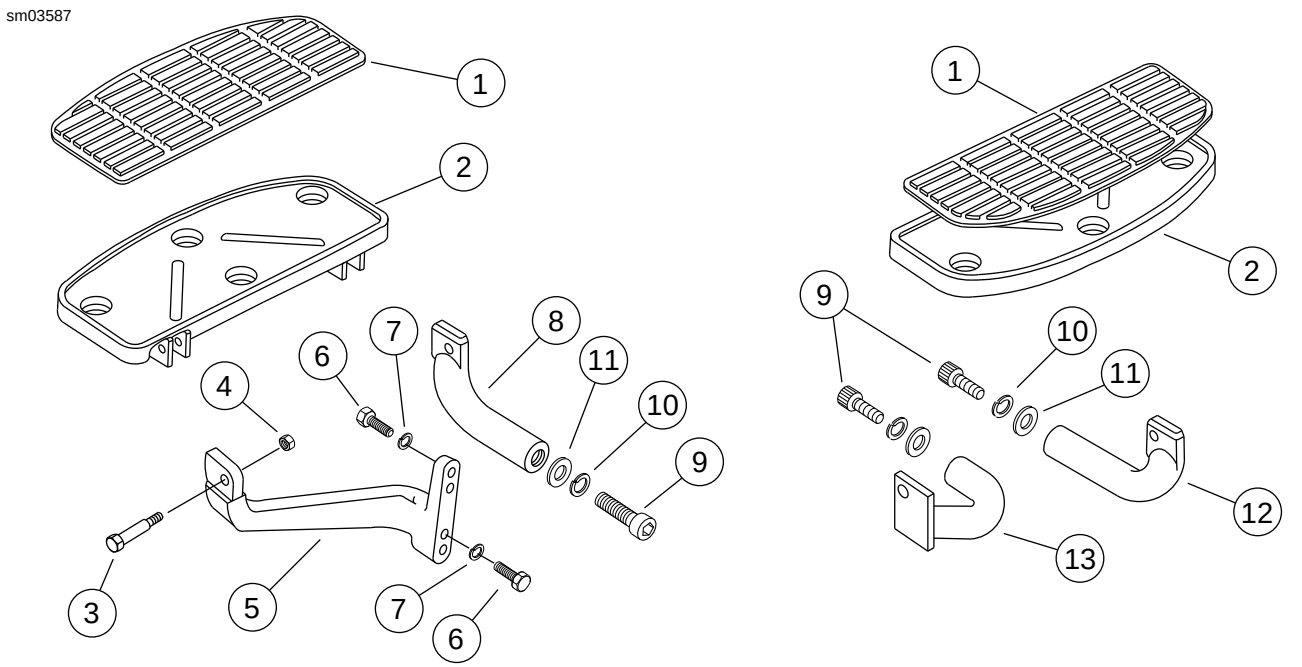
## RIDER FOOTBOARDS

### Removal

1. Remove right side footboard and bracket assembly as follows: Remove two allen head socket screws (with lock washers and flat washers) to release footboard brackets from frame weldment. See Figure 2-174 or Figure 2-175. For best results, approach from left side of motorcycle using a 3/8 inch ball allen with extension.
2. Remove left side footboard and bracket assembly as follows:
   a. Raise motorcycle on center stand so that weight is not resting on jiffy stand.
   b. Remove socket screw (with lockwasher and flat washer) to release footboard forward bracket from frame weldment. See Figure 2-174 or Figure 2-175. For best results, approach from opposite side of motorcycle using a 3/8 inch ball allen with extension.
   c. Remove two hex screws (with lockwashers) to free jiffy stand bracket and footboard rear bracket from frame weldment.

### Installation

1. Install right side footboard and bracket assembly as follows:
   a. Insert two allen head socket screws (with lockwashers and flat washers) through frame weldment into footboard brackets. See Figure 2-174 or Figure 2-175. For best results, approach from left side of motorcycle using a 3/8 inch ball allen with extension.
   b. Alternately tighten socket screws to 30-35 ft-lbs (41-48 Nm).




1. **Rubber pad (2)**
2. **Footboard (2)**
3. **Pivot screw (4)**
4. **Pivot screw nut (4)**
5. **Left rear bracket**
6. **Hex screw (2)**
7. **Lockwasher (2)**
8. **Left front bracket**
9. **Socket screw (3)**
10. **Lockwasher (3)**
11. **Flat washer (3)**
12. **Right front bracket**
13. **Right rear bracket**

**Figure 2-174. Rider Footboards (All Models Except FLHX)**

2. Install left side footboard and bracket assembly as follows:
   a. Insert allen head socket screw (with lockwasher and flat washer) through frame weldment into footboard forward bracket. See Figure 2-174 or Figure 2-175. For best results, approach from opposite side of motorcycle using a 3/8 inch ball allen with extension.
   b. Start upper hex screw (with lockwasher) to fasten jiffy stand bracket and footboard rear bracket to frame weldment. Slide lower hex screw (with lockwasher) through frame weldment and jiffy stand bracket thru holes into footboard rear bracket.

*NOTE*

*The threaded insert for the upper hex screw is not replaceable. Drive the insert from the frame weldment if it should become stripped, cross-threaded or loose. Replace with a 5/16 inch Grade 5 screw of suitable length with lock washer, flat washer and locknut. Be sure flat washer is positioned against inboard side of frame weldment and screw is tightened to 15-20 ft-lbs (20.3-27.1 Nm).*

   c. Tighten front bracket socket screw to 30-35 ft-lbs (41-48 Nm).
   d. Alternately tighten rear bracket hex screws to 15-20 ft-lbs (20-27 Nm).

## Disassembly

*NOTE*

*If only replacing the rubber pad, refer to step 1 below and then see steps 4-5 under ASSEMBLY.*

1. Tilt footboard upward. From bottom of footboard, use a large flat blade screwdriver to push four rubber anchors on pad up through holes in footboard.
2. Remove nuts from pivot screws at underside of footboard.
3. Remove pivot screws to release footboard from brackets.
4. Remove footboard brackets. See REMOVAL.

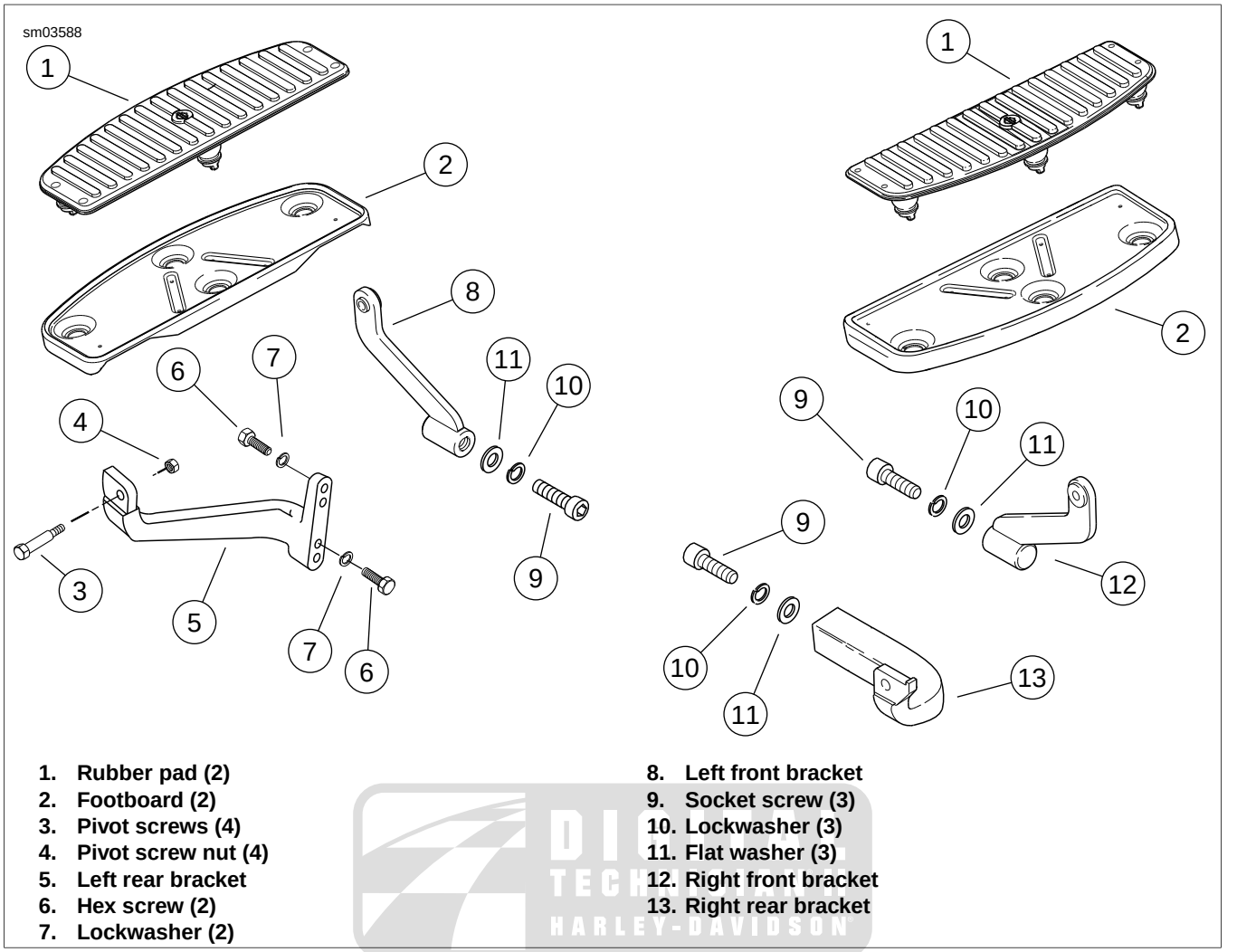
## Assembly

1. Install footboard brackets. See INSTALLATION.
2. Place footboard into position between brackets and install pivot screws so that the nuts will be on the inboard side.

*NOTE*

*The bottom of FLHX footboards are stamped L(eft) or R(ight) to ensure proper installation.*

3. Install nuts onto pivot screws and alternately tighten to 60-80 **in-lbs** (6.8-9.0 Nm).
4. Moisten four rubber anchors on **new** pad with soapy water.
5. Place pad into position on footboard. From bottom of footboard, use pliers to pull rubber anchors down through holes in footboard.




1. **Rubber pad (2)**
2. **Footboard (2)**
3. **Pivot screws (4)**
4. **Pivot screw nut (4)**
5. **Left rear bracket**
6. **Hex screw (2)**
7. **Lockwasher (2)**
8. **Left front bracket**
9. **Socket screw (3)**
10. **Lockwasher (3)**
11. **Flat washer (3)**
12. **Right front bracket**
13. **Right rear bracket**

**Figure 2-175. Rider Footboards (FLHX)**

## PASSENGER FOOTBOARD

### Removal

Remove socket screw with lockwasher to remove footboard bracket from rear swingarm bracket.

### Installation

1. Insert pin on footboard bracket into hole in rear swingarm bracket.

*NOTE*

*Passenger footboards can be adjusted to one of three positions. To move footboards to a new position, remove plastic plugs from holes in rear swingarm bracket as necessary.*

2. Install socket screw with lockwasher. Tighten socket screw to 30-35 ft-lbs (40.7-47.5 Nm).

### Disassembly

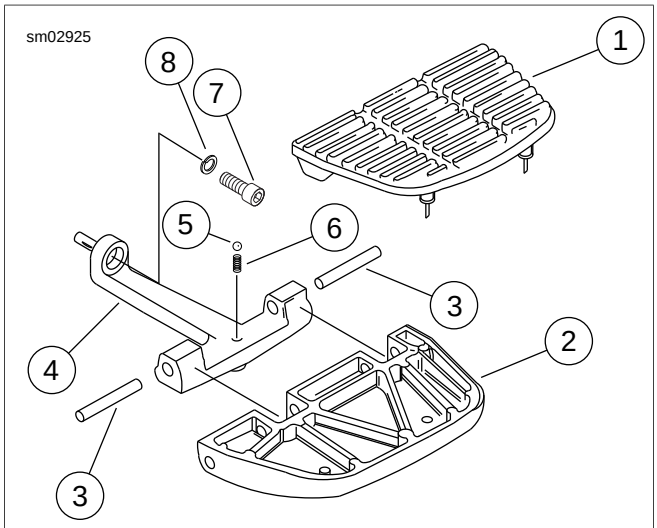
*NOTE*

*If only replacing the rubber pad, refer to step 1 below and then see steps 4-5 under ASSEMBLY.*

1. Tilt footboard upward. From bottom of footboard, use a small flat blade screwdriver to push rubber beads on pad up through holes in footboard. Remove pad. See Figure 2-176.
2. Using a brass drift and rubber mallet, tap two pivot pins toward center of footboard and remove.
3. Remove footboard from footboard bracket.
4. Remove steel ball and spring from hole in footboard bracket.
5. Remove footboard bracket from rear swingarm bracket. See REMOVAL.

### Assembly

1. Install footboard bracket. See INSTALLATION.
2. Place spring into hole in footboard bracket. Place ball on top of spring. See Figure 2-176.
3. Place footboard into position on bracket and install pivot pins from the outboard side. Using a brass drift and rubber mallet, tap pins until centered in lugs of bracket.




1. **Rubber pad**
2. **Footboard**
3. **Pivot pin (2)**
4. **Footboard bracket**
5. **Steel ball**
6. **Spring**
7. **Socket screw**
8. **Lockwasher**

**Figure 2-176. Passenger Footboard (All Models Except FLHX)**

4. Moisten rubber beads on **new** pad with soapy water. Place pad into position on footboard. From bottom of footboard, use needle nose pliers to pull rubber beads down through holes in footboard.
5. Engage nubs on inboard corners of pad with holes in footboard.

## PASSENGER FOOTREST (FLHX)

### Removal

Remove socket screw with lockwasher to remove footrest bracket from rear swingarm bracket.

### Installation

1. Insert pin on footrest bracket into hole in rear swingarm bracket.

*NOTE*

*Passenger footrests can be adjusted to one of three positions. To move footrests to a new position, remove plastic plugs from holes in rear swingarm bracket as necessary.*

2. Install socket screw with lockwasher. Tighten socket screw to 30-35 ft-lbs (40.7-47.5 Nm).

### Disassembly

*NOTE*

*If only replacing the rubber pad, refer to step 1 below and then see steps 7-9 under ASSEMBLY.*

1. Remove socket screw from end of footrest. Remove rubber pad from footrest. See Figure 2-177.
2. Remove footrest from footrest mount.
3. Remove retaining ring from groove at end of pivot pin. Remove pivot pin.
4. Remove footrest mount and wave spring from footrest bracket.
5. Remove footrest bracket from rear swingarm bracket. See REMOVAL.

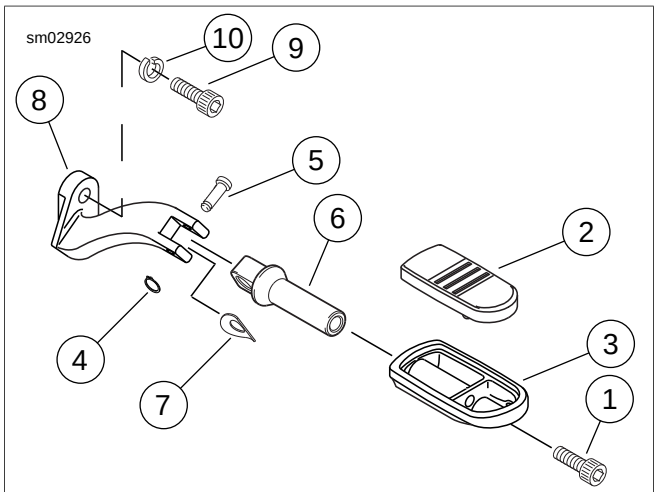
### Assembly

1. Install footrest bracket. See INSTALLATION.
2. Align hole in wave spring with bottom hole in footrest bracket. See Figure 2-177. Be sure that the concave side is down and the flat edge is against the inboard side of the footrest bracket.
3. Holding wave spring in place, install footrest mount between arms of bracket with the rounded side of the pivot pin end up.
4. Install pivot pin into top hole in footrest bracket. Top hole is countersunk so that head of pivot pin is flush after installation.

*NOTE*

*Verify operation of footrest mount before installing retaining ring. The ease with which the footrest mount pivots is based on the curvature of the wave spring. Flattening the wave spring allows the footrest mount to move more easily, while increasing the curvature makes movement more difficult.*

5. Install **new** retaining ring in groove at end of pivot pin.
6. Slide footrest onto footrest mount.
7. Place rubber pad into footrest.
8. Apply a small dab of Loctite Medium Strength Threadlocker 243 (blue) to threads of socket screw.
9. Start socket screw into end of footrest. Rotate footrest so that the rubber pad is topside and tighten socket screw to 15-20 ft-lbs (20-27 Nm).




1. **Socket screw**
2. **Rubber pad**
3. **Footrest**
4. **Retaining ring**
5. **Pivot pin**
6. **Footrest mount**
7. **Wave spring**
8. **Footrest bracket**
9. **Socket screw**
10. **Lockwasher**

**Figure 2-177. Passenger Footrest (FLHX)**

## GENERAL

**WARNING**

**The jiffy stand locks when placed in the full forward (down) position with vehicle weight on it. If the jiffy stand is not in the full forward (down) position with vehicle weight on it, the vehicle can fall over which could result in death or serious injury. (00006a)**

**WARNING**

**Always park motorcycle on a level, firm surface. An unbalanced motorcycle can fall over, which could result in death or serious injury. (00039a)**

## REMOVAL

**WARNING**

**Block vehicle under frame such that vehicle will not fall when jiffy stand is removed. Failure to properly block vehicle could result in death or serious injury. (00462b)**

1. Block motorcycle under frame, so that motorcycle is securely upright and level. Jiffy stand should be able to move through its full range of travel without the weight of the motorcycle resting on it.
2. Move jiffy stand to the full forward (down) position. Remove hex screw, lockwasher, flat washer and leg stop from threaded end of jiffy stand. See Figure 2-178.
3. Swing jiffy stand forward beyond the normal down position and remove end of spring from hole in jiffy stand weldment. Remove jiffy stand from bracket. Remove other end of spring from hole in frame weldment.
4. Inspect jiffy stand assembly for worn or damaged parts. Replace parts as necessary.

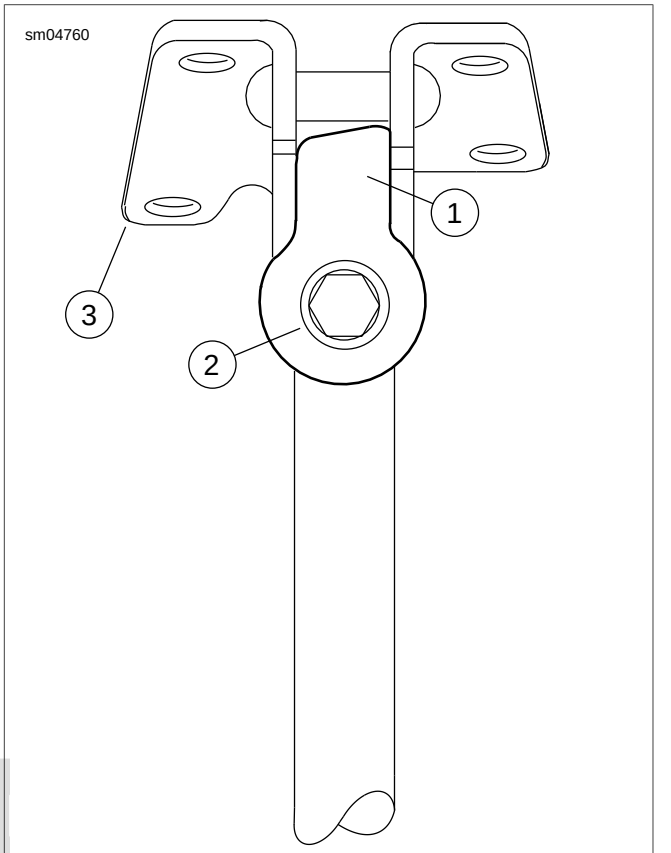
## INSTALLATION

1. Lubricate jiffy stand with Loctite Aerosol Anti-Seize Lubricant. Restrict application to area of jiffy stand that rotates within the bracket.
2. Install end of spring into hole in frame weldment. Insert threaded end of jiffy stand up through bottom of bracket. Swing jiffy stand forward beyond the normal down position and install other end of spring into hole in jiffy stand weldment.

*NOTE*

*Verify that end of spring enters hole at front of jiffy stand weldment. See Figure 2-179. If end of spring enters hole at rear of weldment, spring coil will rub on jiffy stand when exercised.*

3. Holding jiffy stand at the full forward (down) position, install leg stop over threaded end with the stamped side down. Install flat washer, lockwasher and hex screw. Tighten hex screw to 15-20 ft-lbs (20.3-27.1 Nm).




1. **Leg stop (longer side faces rear)**
2. **Hex screw, lockwasher and flat washer**
3. **Bracket**

**Figure 2-178. Leg Stop Orientation in Full Forward (Down) Position**

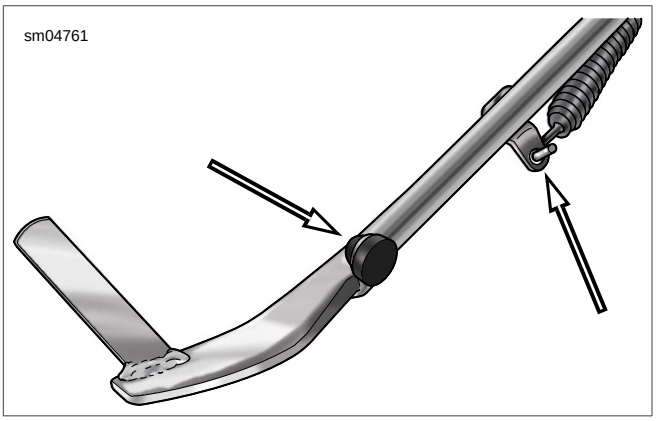



**Figure 2-179. Rubber Stop and Spring Orientation**

**WARNING**

**If leg stop is incorrectly installed, excessive wear can allow vehicle to fall when rested on jiffy stand, which could result in death or serious injury. (00479b)**

4. Verify that the longer side of the leg stop faces the rear of the motorcycle. See Figure 2-178.

5. Extend and retract jiffy stand 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 (down) position. Carefully remove support blocking from beneath motorcycle frame and rest motorcycle on jiffy stand.

*NOTE*

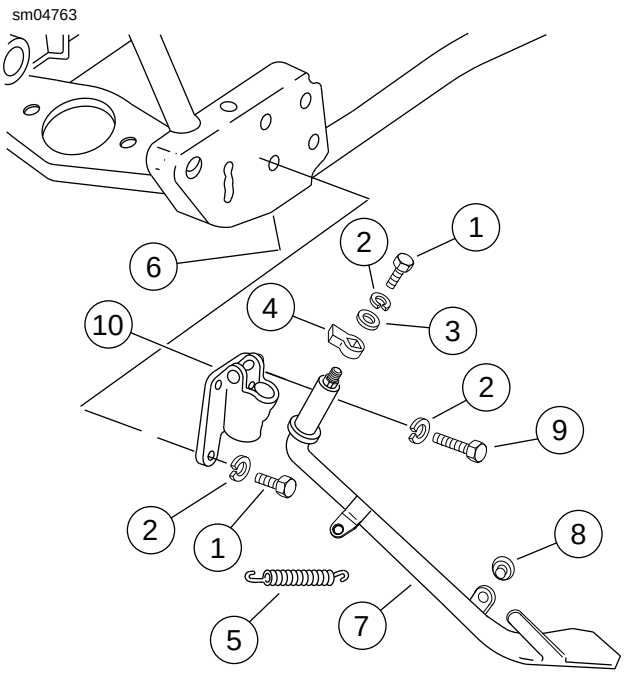
*Verify that rubber stop is installed in hole of jiffy stand weldment. Without the rubber stop, the jiffy stand will make hard contact with the lower frame tube when retracted, possibly resulting in chipping or nicking of the powder coat. Install new rubber stop if damaged or missing. See Figure 2-179.*

## JIFFY STAND BRACKET

### Removal

1. Remove jiffy stand.

2. Remove two short hex screws (with lockwashers) to release front of jiffy stand bracket from frame weldment. See Figure 2-180.




1. **Short hex screw (3)**
2. **Lockwasher (5)**
3. **Flat washer**
4. **Leg stop**
5. **Spring**
6. **Frame hole**
7. **Jiffy stand**
8. **Rubber stop**
9. **Long hex screw (2)**
10. **Bracket**

**Figure 2-180. Jiffy Stand Assembly**

3. Remove two long hex screws (with lockwashers) to free rear of jiffy stand bracket and rider footboard rear bracket from frame weldment.

### Installation

1. Start two short hex screws (with lockwashers) to fasten front of jiffy stand bracket to frame weldment.

2. Start two long hex screws (with lockwashers) to fasten rear of jiffy stand bracket and rider footboard rear bracket to frame weldment.

3. Alternately tighten four hex screws to 15-20 ft-lbs (20.3-27.1 Nm) using a crosswise pattern.

*NOTE*

*The threaded inserts for the three jiffy stand bracket screws are not replaceable. Drive the insert from the frame weldment if it should become stripped, cross-threaded or loose. Replace with a 5/16 inch Grade 5 screw of suitable length with lock washer, flat washer and locknut. Be sure flat washer is positioned against inboard side of frame weldment and screw is tightened to 15-20 ft-lbs (20.3-27.1 Nm).*

4. Install jiffy stand.

## JIFFY STAND INTERLOCK SENSOR

### Removal

1. Push anchor on jiffy stand interlock sensor connector [133], 3-place Molex, from hole in front electrical caddy. Disconnect connector.

2. Cut anchored cable strap at top of frame weldment to release cable.

3. Move jiffy stand to full forward (down) position.

4. Remove socket head screw and pull sensor from bore of jiffy stand bracket. See Figure 2-181.

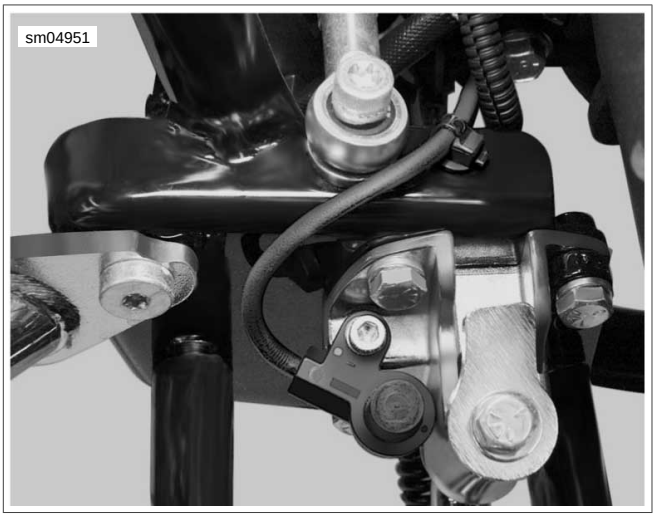


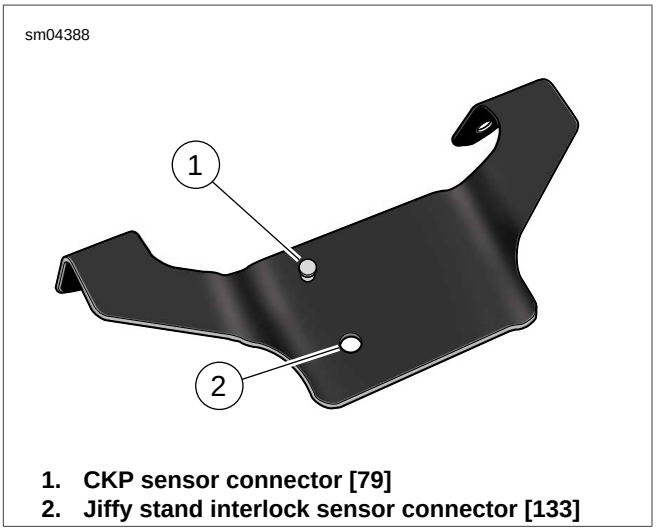

**Figure 2-181. Jiffy Stand Interlock Sensor**

### Installation

1. Move jiffy stand to full forward (down) position.

2. Install sensor into bore of jiffy stand bracket.

3. Install socket head screw and tighten to 96-120 **in-lbs** (10.8-13.6 Nm). If reusing screw, apply a small dab Use Loctite Medium Strength Threadlocker 243 (blue) to threads before installation.
4. Route connector and cable over top of frame weldment staying rear of front engine stabilizer link, and then down to front electrical caddy.
5. Connect jiffy stand interlock sensor connector [133] and push anchor into hole in front electrical caddy. See Figure 2-182.
6. Install **new** anchored cable strap into hole at top of frame weldment and capture cable. Cut any excess cable strap material.




**1. CKP sensor connector [79]**
**2. Jiffy stand interlock sensor connector [133]**

**Figure 2-182. Front Caddy**

# NOTES

# NOTES

## SPECIFICATIONS

**Table 3-1. General Specifications**

| GENERAL | DATA |
|---|---|
| Number of cylinders | 2 |
| Type | 4-cycle, 45 degree, air-cooled V-twin |
| Torque (with shorty, dual exhaust) | 91 ft-lbs @ 3000 RPM |
| | 123 Nm @ 3000 RPM |
| Bore | 3.75 in. |
| | 95.25 mm |
| Stroke | 4.375 in. |
| | 111.13 mm |
| Piston displacement (approx.) | 96 cubic in. |
| | 1584 cc |
| Maximum sustained engine speed | 5500 RPM |
| Idle speed | 1000 RPM +/- 50 |

**Table 3-2. Oil Pump Specifications**

| OIL PUMP | DATA |
|---|---|
| Type | Twin geroter, 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 | 5 micron media, filtered between pump and engine |

**Table 3-3. Rocker Arms Specifications**

| ROCKER ARMS | IN. | MM |
|---|---|---|
| Shaft fit in bushing (loose) | 0.0005-0.0020 | 0.013-0.051 |
| End clearance | 0.003-0.013 | 0.08-0.33 |
| Bushing fit in rocker arm (tight) | 0.002-0.004 | 0.051-0.102 |

**Table 3-4. Rocker Arm Shaft Specifications**

| ROCKER ARM SHAFTS | IN. | MM |
|---|---|---|
| Shaft fit in rocker arm support plate (loose) | 0.0007-0.0022 | 0.018-0.056 |

**Table 3-5. Hydraulic Lifter Specifications**

| HYDRAULIC LIFTERS | IN. | MM |
|---|---|---|
| Fit in crankcase (loose) | 0.0008-0.0020 | 0.02-0.05 |

**Table 3-6. Cylinder Head Specifications**

| CYLINDER HEAD | IN. | MM |
|---|---|---|
| Valve guide in head (tight) | 0.0022-0.0033 | 0.051-0.084 |
| Valve seat in head (tight) | 0.003-0.0045 | 0.076-0.114 |
| Head gasket surface (flatness) | 0-0.006 | 0-0.152 |

**Table 3-7. Valve Specifications**

| VALVES | IN. | MM |
|---|---|---|
| Exhaust: fit in guide | 0.001-0.003 | 0.0254-0.0762 |
| Intake: fit in guide | 0.001-0.003 | 0.0254-0.0762 |
| Seat Width | 0.040-0.062 | 1.02-1.58 |
| Stem protrusion from cylinder head boss | 2.012-2.032 | 51.10-51.61 |

**Table 3-8. Valve Springs Specifications**

| VALVE SPRINGS | IN. | MM |
|---|---|---|
| Closed | 135 lbs @ 1.850 in. | 61.2 kg @ 47.0 mm |
| Open | 312 lbs @ 1.300 in. | 141.5 kg @ 33.0 mm |
| Free length | 2.325 in. | 59.1 mm |

**Table 3-9. Piston**

| PISTON | | REPLACE IF WEAR EXCEEDS | |
|---|---|---|---|
| | | IN. | MM |
| Fit in cylinder (loose) | | 0.0014-0.0025 | 0.036-0.064 |
| Piston pin fit (loose) | | 0.0002-0.0005 | 0.00-0.013 |
| Ring end gap | Top compression | 0.010-0.020 | 0.254-0.508 |
| | 2nd compression | 0.014-0.024 | 0.356-0.610 |
| | Oil control ring | 0.010-0.050 | 0.254-1.27 |
| Ring side clearance | Top compression | 0.0012-0.0037 | 0.030-0.094 |
| | 2nd compression | 0.0012-0.0037 | 0.030-0.094 |
| | Oil control rails | 0.0031-0.0091 | 0.079-0.231 |

**Table 3-10. Connecting Rod Specifications**

| 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 |

**Table 3-11. Flywheel Specifications**

| FLYWHEELS | IN. | MM |
|---|---|---|
| Runout (shaft measured in case) | 0.000-0.010 | 0.0-0.254 |
| Runout (measured in truing stand) | 0.000-0.004 | 0.0-0.102 |
| End play | 0.003-0.010 | 0.076-0.254 |

**Table 3-12. Crankshaft/Sprocket Shaft Bearing Specifications**

| CRANKSHAFT/SPROCKET SHAFT BEARINGS | IN. | MM |
|---|---|---|
| Roller bearing fit (loose) | 0.0002-0.0015 | 0.005-0.038 |
| 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 |

## GENERAL

Wear limits are given here as a guideline for measuring used engine components. Replace components when they exceed values listed here.

**Table 3-13. Rocker Arm/Rocker Arm Shaft**

| 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 (loose) | 0.0035 | 0.089 |

**Table 3-14. Hydraulic Lifter**

| HYDRAULIC LIFTER | REPLACE IF WEAR EXCEEDS | |
|---|---|---|
| | IN. | MM |
| Fit in crankcase | 0.003 | 0.076 |
| Roller fit | 0.0015 | 0.038 |
| Roller end clearance | 0.022 | 0.559 |

**Table 3-15. Cam Support Plate**

| CAM SUPPORT PLATE | REPLACE IF | |
|---|---|---|
| | IN. | MM |
| Cam chain tensioner shoe | More than 0.090 | More than 2.29 |
| | 1/2 thickness of shoe | |
| Crankshaft bushing maximum ID | More than 0.8545 | More than 21.704 |
| Camshaft bore | 1.1023 | 27.998 |

**Table 3-16. Cylinder Head**

| 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 |

**Table 3-17. Cylinder**

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

**Table 3-18. Cylinder Bore**

| 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 |

**Table 3-19. Piston**

| 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 | 0.762 |
| | 2nd compression | 0.034 | 0.864 |
| | Oil control rails | 0.050 | 1.27 |
| Ring side clearance | Top compression | 0.0045 | 0.114 |
| | 2nd compression | 0.0045 | 0.114 |
| | Oil control rails | 0.010 | 0.254 |

**Table 3-20. Connecting Rod**

| 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 |

**Table 3-21. Breather Assembly**

| BREATHER ASSEMBLY | REPLACE IF WEAR EXCEEDS | |
|---|---|---|
| | IN. | MM |
| Breather cover warpage | 0.005 | 0.13 |
| Breather baffle warpage | 0.005 | 0.13 |

**Table 3-22. Valve Stem to Guide**

| VALVE STEM TO GUIDE | REPLACE IF WEAR EXCEEDS | |
|---|---|---|
| | IN. | MM |
| Intake | 0.0038 | 0.0965 |
| Exhaust | 0.0038 | 0.0965 |

**Table 3-23. Flywheel**

| FLYWHEEL | REPLACE IF WEAR EXCEEDS | |
|---|---|---|
| | IN. | MM |
| Runout (shaft measured in case) | 0.012 | 0.305 |
| Runout (measured in truing stand) | 0.005 | 0.127 |
| End play | 0.010 | 0.254 |

**Table 3-24. Crankshaft Roller Bearing**

| CRANKSHAFT ROLLER BEARING | REPLACE IF | |
|---|---|---|
| | IN. | MM |
| Roller bearing fit (loose) | More than 0.0015 | More than 0.038 |
| Bearing fit in crankcase (tight) | Less than 0.0038 | Less than 0.097 |
| Inner race on crankshaft (tight) | Less than 0.0004 | Less than 0.010 |

## OIL FEED

*NOTE*

*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.*

Two illustrations accompany this explanation.

- Cam support plate oil flow is shown in Figure 3-1.
- Top end oil flow is shown in Figure 3-2.

Oil flows from the oil pan through an internal passageway at the front of the transmission housing, and enters the lower passageway (A1) cast into the rear right side of the crankcase.

Running through a passageway in the crankcase, 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 3.4 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 relief valve spring ( 35 psi (241.3 kPa) ), the orfice 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 off-center 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 center 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 in 3.3 ENGINE OIL FLOW, Top End and 3.3 ENGINE OIL FLOW, Bottom End which follow.

## TOP END

Two illustrations accompany this explanation.

- Cam support plate oil flow is shown in Figure 3-1.
- Top end oil flow is shown in Figure 3-2.

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.

*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 dowel pin (H20) on the "down side" of the cylinder flange. The oil runs through a vertical passageway in the cylinder, passes through a second dowel pin 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 dowel pin (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).

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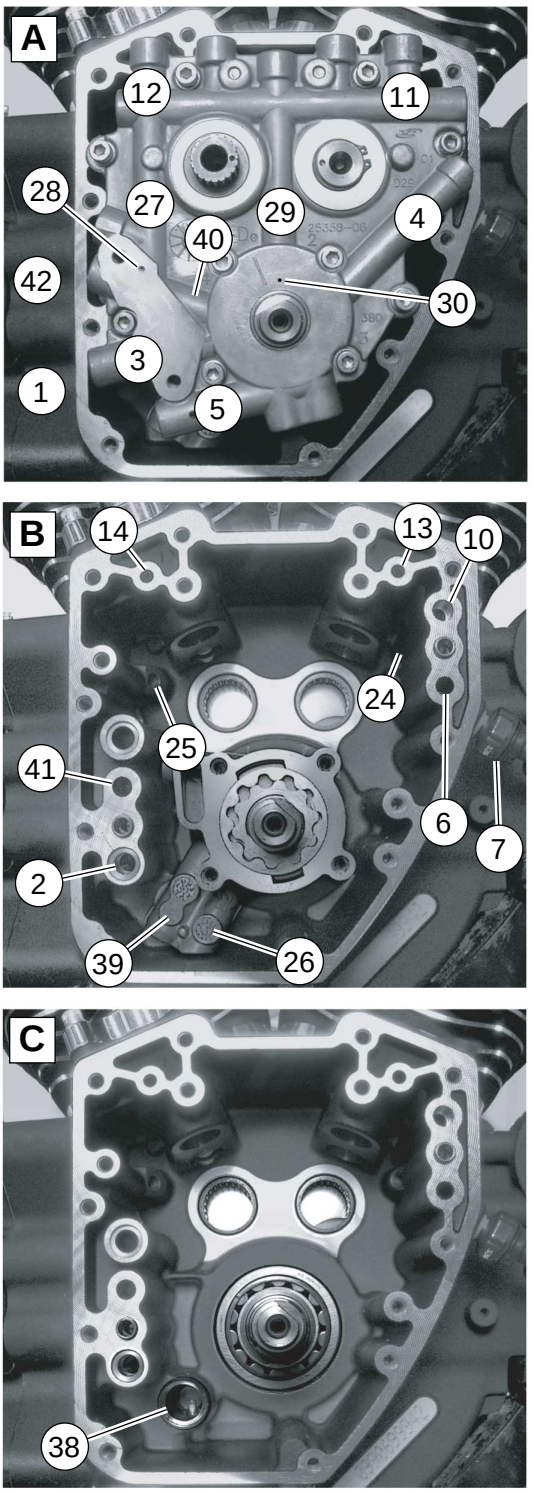



**Figure 3-1. Engine Oil Flow - Cam Support Plate/Right Crankcase Half**

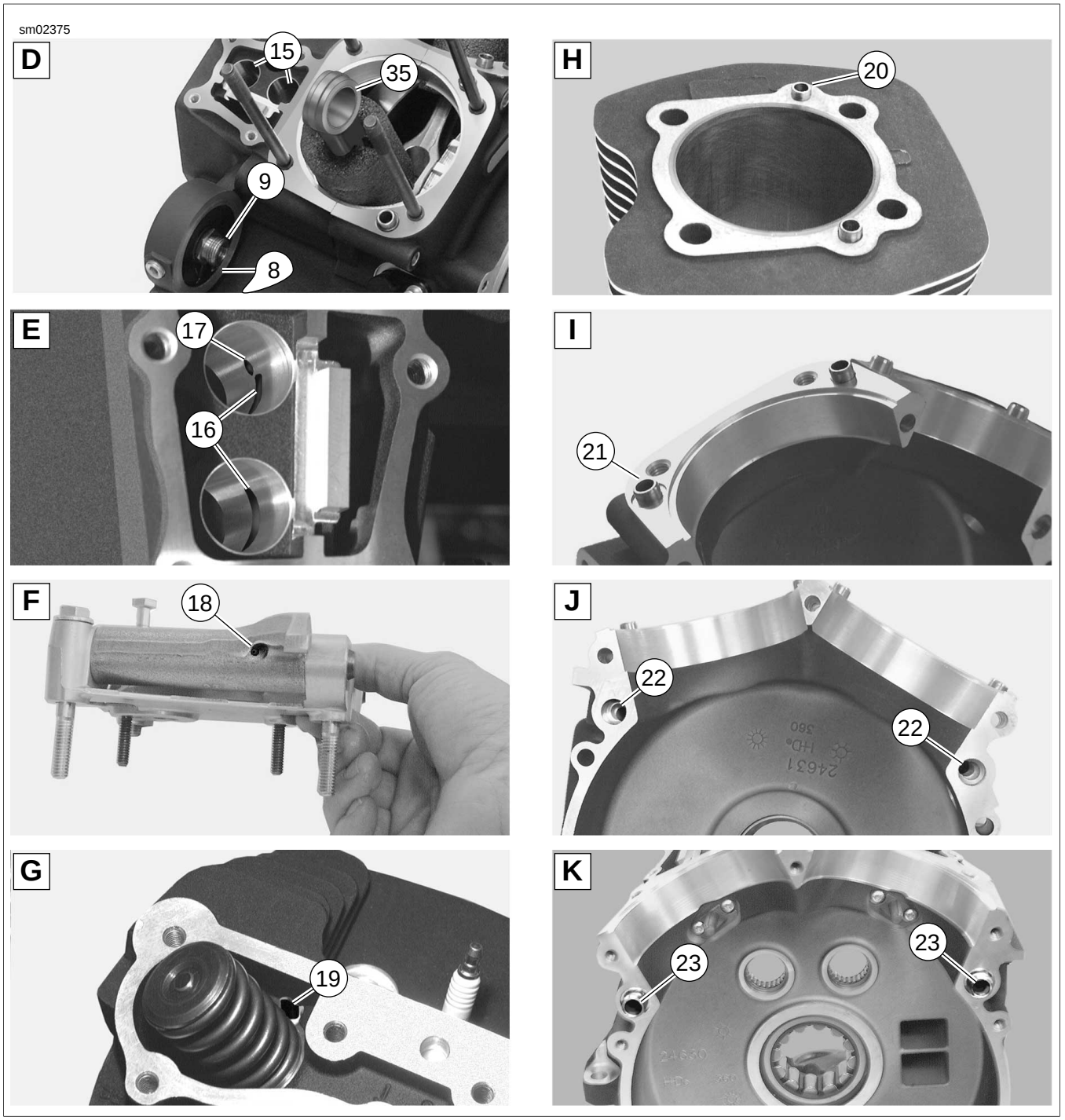



**Figure 3-2. Engine Oil Flow - Top End**

## BOTTOM END

Three illustrations accompany this explanation.

- Cam support plate oil flow is shown in Figure 3-1.
- Top end oil flow is shown in Figure 3-2.
- Bottom end oil flow is shown in Figure 3-3.

Oil traveling through the horizontal passage at the top of the cam support plate (enroute to the front and rear cylinders)also passes through a hole at the top of each camshaft bore to lubricate the journals of the plain bearing cams. On the inboard side of the passage leading to the rear cylinder, oil sprays out through a pin hole to lubricate the secondary cam chain.

The flow of oil to the rear cylinder also travels down the vertical passage at the rear of the cam support plate (A27)and exits a hole on the outboard side to supply oil to the primary cam chain tensioner (A28).

The flow of oil in the vertical passage at the center of the cam support plate (A29) passes through a hole on the inboard side to supply oil to the secondary cam chain tensioner and also sprays out through a pin hole on the outboard side to lubricate the primary cam chain (A30). The flow of oil then passes

through a hole in the crankshaft bushing where it enters a drilling in the crankshaft (L31).

Oil runs down the center of the crankshaft and then up across 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 (M32).

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 pis-ton downstroke.

The piston jets (N33), 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 (82.7-103.4 kPa), at which point the engine is operating above idle speed. At idle speeds ( 9-12 PSI (62.1-82.7 kPa)), 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 (O34) for lubrication of the piston pin. The spray also allows a portion of the oil to reach the upper rod bushing (D35).

Surplus oil falls back to the bottom of the flywheel compartment where it collects in the sump area (P36). Oil in the sump is drawn to the cam compartment through an internal channel (P37, C38) that connects with the second scavenge lobe of the oil pump (B39).

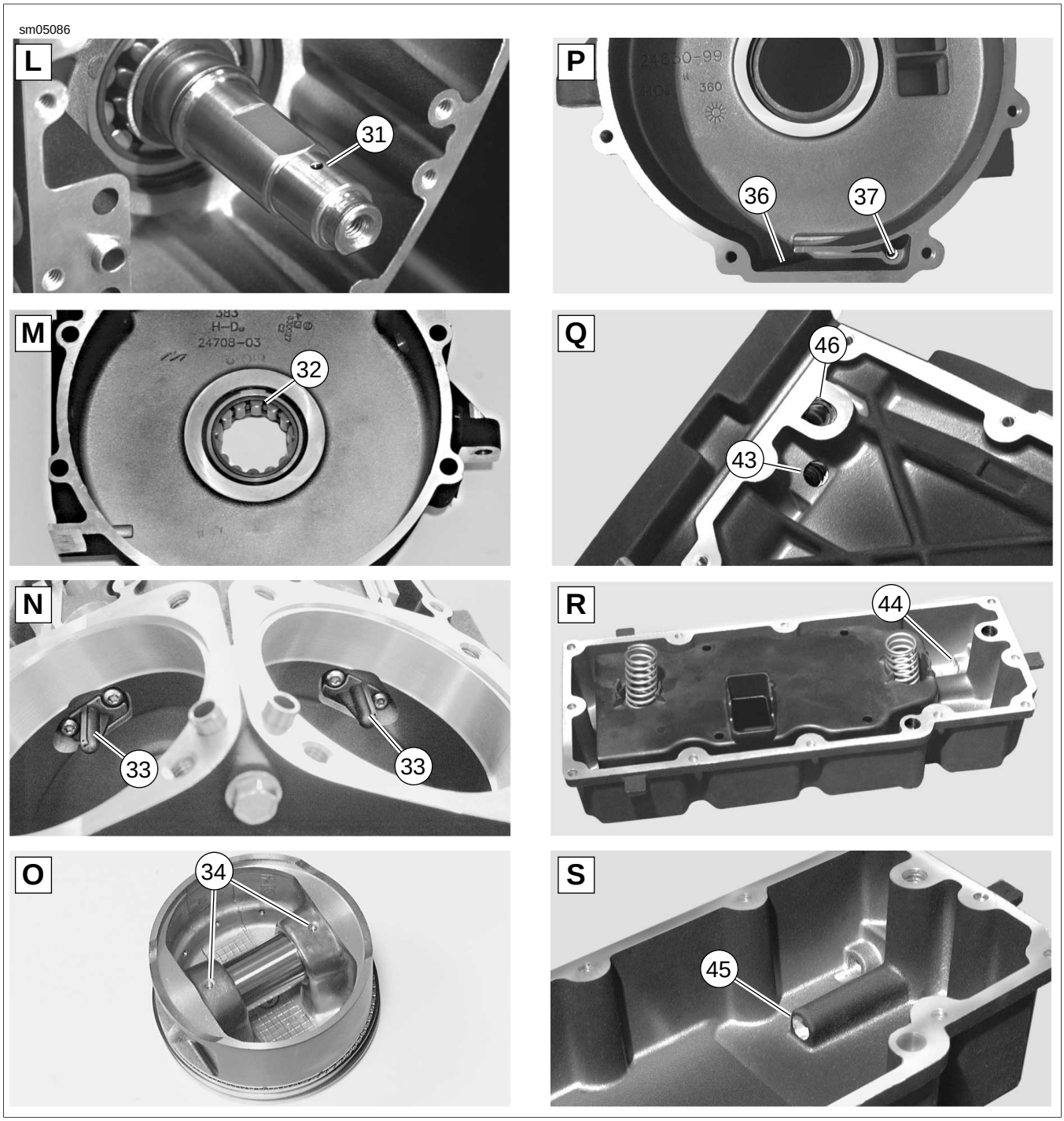



**Figure 3-3. Engine Oil Flow - Bottom End**

## OIL RETURN

Two illustrations accompany this explanation.

- Cam support plate oil flow is shown in Figure 3-1.
- Bottom end oil flow is shown in Figure 3-3.

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 (A40). See 3.4 OIL PUMP OPERATION.

Exiting a hole on the inboard side of the cam support plate,the oil enters the upper hole in the crankcase flange (B41).

The oil flows through the upper passageway in the crankcase (A42), enters a passageway at the front of the transmission housing and empties into the oil pan at the front of the baffle (Q43, R44).

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

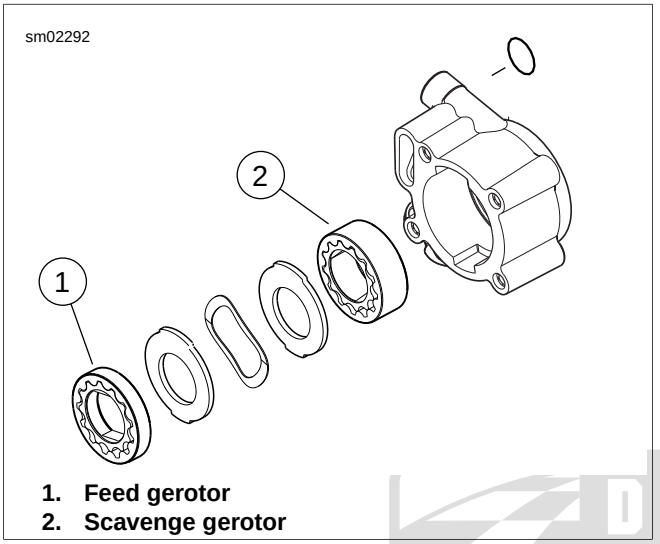
perimeter of the baffle. At the back of the oil pan, the oil enters the open side of the baffle where it is redirected for-ward. The baffle plates slow the circulation of the oil through the pan to enhance cooling.

Oil pickup occurs in the front compartment of the baffle where a passageway in the casting (S45) directs the flow upward. Passing through a second passageway in the trans-mission housing (Q46), the flow of oil enters the lower passageway in the crankcase (A1) to repeat the circuit.

## GENERAL

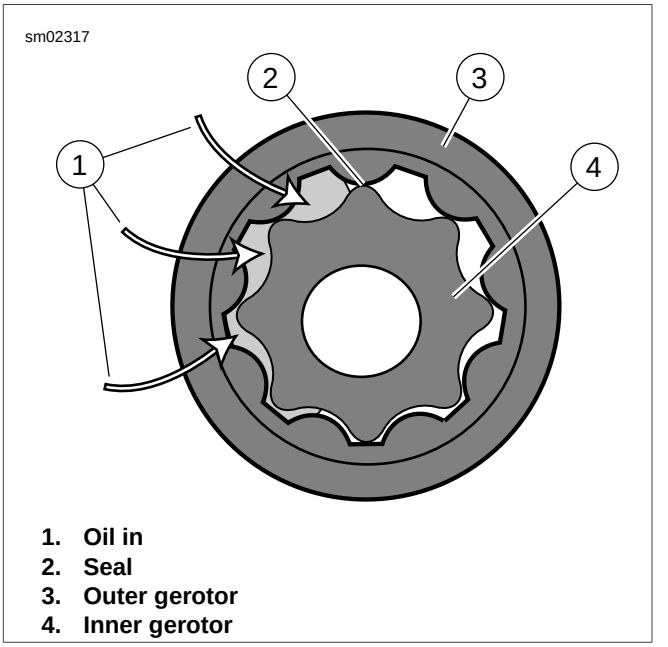
See Figure 3-4. The oil pump consists of a housing containing two gerotor gear sets, one feed and the other scavenge. Driven by the crankshaft, the feed gerotor set distributes oil to the engine, while the scavenge gerotor set draws oil from the cam and flywheel compartments and returns it to the oil pan.

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.




1. **Feed gerotor**
2. **Scavenge gerotor**

**Figure 3-4. Oil Pump Gerotors**




1. **Oil in**
2. **Seal**
3. **Outer gerotor**
4. **Inner gerotor**

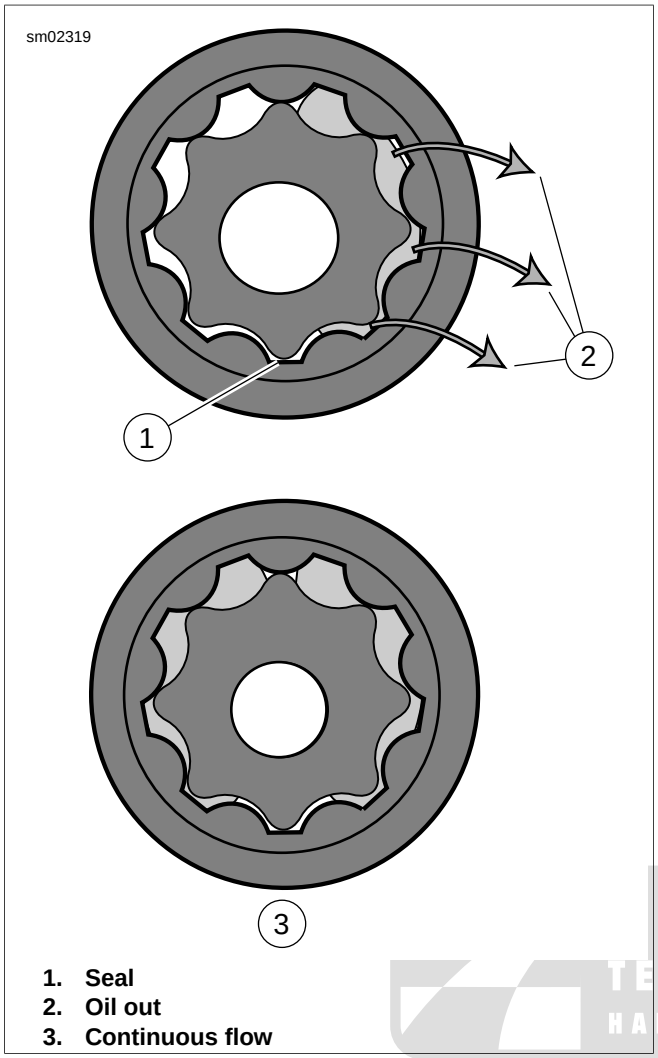
**Figure 3-5. Inlet Side Oil Flow**



## OPERATION

See Figure 3-5. 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. Note that the inlet and outlet sides of the pump are sealed by the tips and lobes of the inner and outer gerotors.

See Figure 3-6. 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). In operation, the gerotors provide a continuous flow of oil.




1. **Seal**
2. **Oil out**
3. **Continuous flow**

**Figure 3-6. Outlet Side Oil Flow**

## GENERAL

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.

See Figure 3-7. As each piston pushes downward on its power and intake stroke, displaced air in the flywheel compartment is vented through the crankshaft roller bearing into the cam compartment and then up the push rod covers (1) 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 (2).

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.

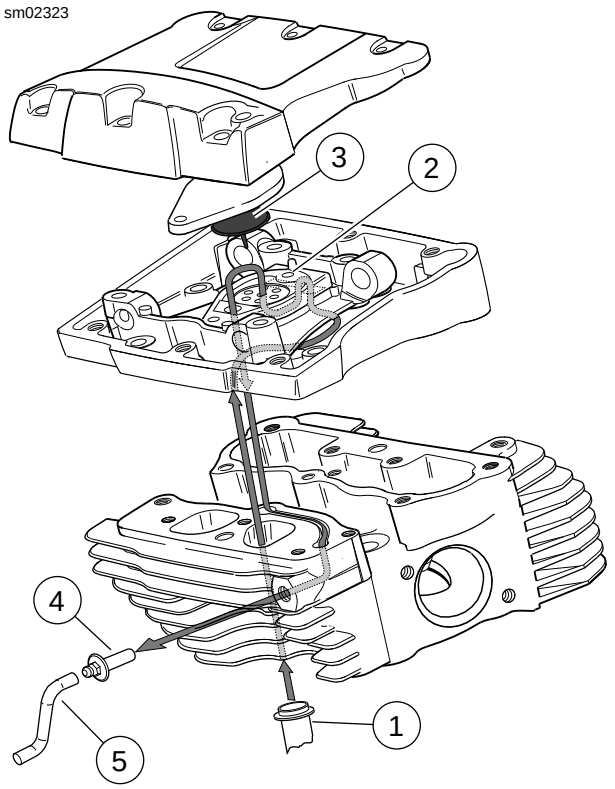
Passing through the oil filter gauze, the flow of air passes through the umbrella valve (3) into the breather compartment. The flaps of the umbrella valve only allow air to be vented one way, rising to allow the passage of air, but then falling back into place to seal the vent holes as the flow of air 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 (4) and then through a breather tube (5) 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.*




1. **Push rod cover**
2. **Breather baffle compartment**
3. **Umbrella valve**
4. **Air cleaner backplate bolt**
5. **Breather tube**

**Figure 3-7. Breather Air Flow**

## OIL PRESSURE INDICATOR LAMP

See Figure 3-8. 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**

**If the oil pressure indicator lamp remains lit, always check the oil supply first. If the oil supply is normal and the lamp is still lit, stop the engine at once and do not ride further until the trouble is located and the necessary repairs are made. Failure to do so may result in engine damage. (00157a)**

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 problem 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 oil pan. If oil does not return, shut off the engine until the problem is located and corrected.

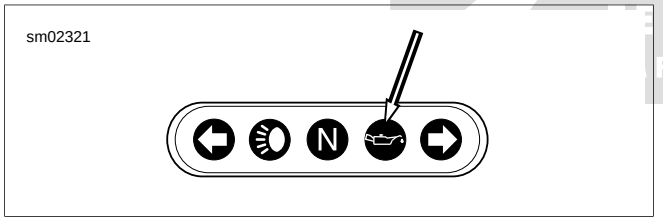



**Figure 3-8. Oil Pressure Indicator Lamp**

## CHECKING OIL PRESSURE

| PART NUMBER | TOOL NAME |
|---|---|
| HD-96921-52C | OIL PRESSURE GAUGE SET |

Check operating oil pressure as follows:

1. Ensure engine oil is at the proper level. See 1.5 ENGINE OIL AND FILTER.
2. See Figure 3-9. Remove oil pressure switch from crankcase. See 8.24 OIL PRESSURE SWITCH AND SENDER.
3. See Figure 3-10. Install OIL PRESSURE GAUGE SET (Part No. HD-96921-52C).
   a. Install adapter (2) in oil pressure switch mounting hole. Tighten adapter until snug.
   b. Assemble banjo bolt (3), washer (4), oil pressure gauge (1) banjo fitting and second washer onto adapter and tighten until snug.
4. Start engine and allow to reach operating temperature.

*NOTE*

*Engine oil should be at normal operating temperature, 230° F (110° C), for an accurate reading.*

5. Oil pressure should be 30-38 PSI (207-262 kPa) at 2000 RPM and normal operating temperature.
6. Stop engine. Remove oil pressure gauge assembly from oil pressure switch mounting hole in crankcase.
7. Install oil pressure switch. See 8.24 OIL PRESSURE SWITCH AND SENDER.

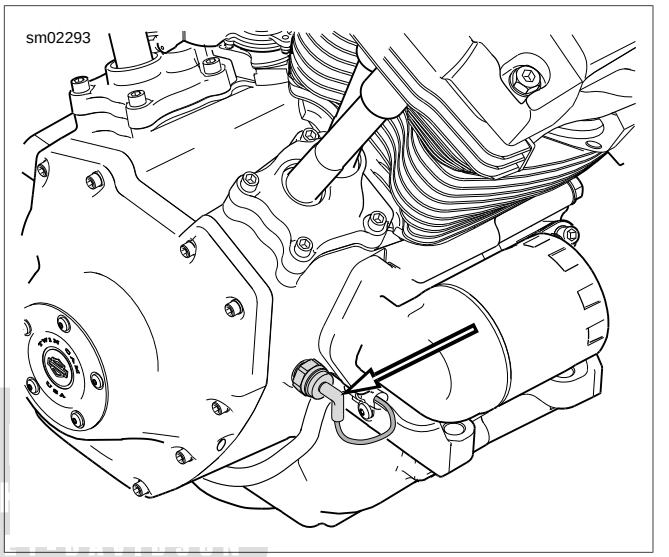
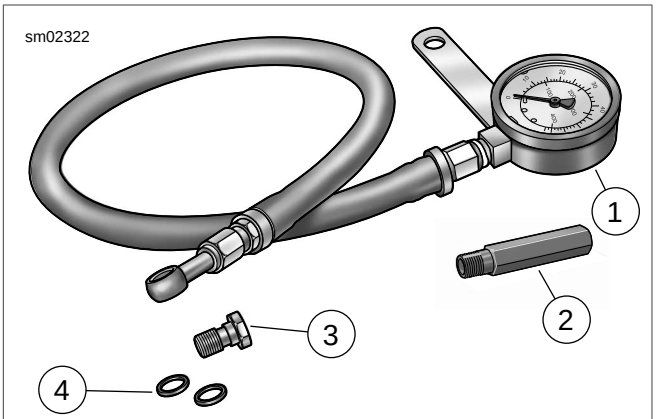



**Figure 3-9. Oil Pressure Switch**




1. **Gauge**
2. **Adapter**
3. **Banjo bolt**
4. **Washer (2)**

**Figure 3-10. Oil Pressure Gauge Set**

## DIAGNOSING VALVE TRAIN NOISE

To diagnose and correct noisy hydraulic lifters and valve train components, use the following procedures:

1. With engine and oil at normal operating temperature, check oil pressure at 2000 RPM. If oil pressure is above 50 PSI (345 kPa) or below 5 PSI (34 kPa), inspect oil pump, crankcase passages, and oil hoses for restrictions or blockage. Repair or replace parts as necessary.
2. If oil is not reaching the hydraulic lifters, remove and inspect. See 3.21 PUSH RODS, LIFTERS AND COVERS, Lifter Inspection. Clean lifter bore of all foreign material. Replace hydraulic lifter if required.
3. Examine push rod, lifter and lifter block for proper fit and any signs of unusual wear. Replace parts as necessary.
4. Visually inspect camshaft lobes for abnormal wear.
5. Check cam chain tensioning shoe for wear.
6. Remove cylinder head and rocker box assemblies. Check rocker arm end play and check for binding. Inspect valve stems for scuffing and check stem to guide clearance. Check valve seats for signs of looseness or shifting.
7. Grind valves and valve seats. See 3.22 CYLINDER HEAD, Valve and Seat Refacing.

## COMPRESSION TEST

| PART NUMBER | TOOL NAME |
|---|---|
| HD-33223-1 | CYLINDER COMPRESSION GAUGE |

Satisfactory engine performance depends upon a mechanically sound engine. In many cases, unsatisfactory performance is caused by combustion chamber leakage. A compression test can help determine the source of cylinder leakage. Use CYLINDER COMPRESSION GAUGE (Part No. HD-33223-1).

A proper compression test should be performed with the engine at normal operating temperature when possible.

1. Disconnect spark plug wires, clean around plug base and remove plugs.
2. Remove air cleaner. See 4.3 AIR CLEANER ASSEMBLY.
3. Connect compression tester to front cylinder per manufacturer's instructions.
4. Make sure transmission is in neutral. With throttle body butterfly plate in wide open position, crank engine continuously through 5 to 7 full compression strokes.
5. Note gauge readings at the end of the first and last compression strokes. Record test results.
6. Repeat steps 3 through 5 on rear cylinder.
7. If the final readings are 125 PSI (862 kPa) or more, and if the final readings do not indicate more than a 10% variance between cylinders, compression is considered normal. If compression does not meet specifications, refer to Table 3-25.
8. Inject approximately 1/2 oz. (15 ml) engine oil into each cylinder and repeat the compression tests on both cylinders. Readings that are considerably higher during the second test indicate worn piston rings.

*NOTE*

*After installing spark plugs, be sure that throttle plate is in the closed position before starting the engine.*

**Table 3-25. Compression Test Results**

| DIAGNOSIS | TEST RESULTS |
|---|---|
| Ring trouble | Compression low on first stroke, tends to build up on the following strokes, but does not reach normal. Improves considerably when oil is added to cylinder. |
| Valve trouble | Compression low on first stroke, does not build up much on following strokes. Does not improve considerably with the addition of oil. Check for correct push rod length. |
| Head gasket leak | Same reaction as valve trouble. |

## CYLINDER LEAKDOWN TEST

| PART NUMBER | TOOL NAME |
|---|---|
| HD-35667-A | CYLINDER LEAKDOWN TESTER |

*NOTE*

*This procedure should not be used on vehicles with an automatic compression release.*

The cylinder leakage test will pinpoint engine problems including leaking valves, worn, broken or stuck piston rings and blown head gaskets. The cylinder leakage tester applies compressed air to the cylinder at a controlled pressure and volume and measures the percent of leakage from the cylinder.

Use the CYLINDER LEAKDOWN TESTER (Part No. HD-35667-A) and follow the specific instructions supplied with the tester.

The following are some general instructions that apply to Harley-Davidson V-twin engines:

1. Run engine until it reaches normal operating temperature.
2. Stop engine. Clean dirt from around spark plugs and remove the spark plugs.
3. Remove the air cleaner and set the throttle to the wide open position.
4. The piston in the cylinder being tested must be at top dead center of compression stroke (both valves closed) during the test.
5. To keep the engine from turning over when air pressure is applied to the cylinder, engage transmission in highest gear and lock the rear brake.

*NOTE*

*Before performing the cylinder leakage test, verify that the tester itself is free from leakage to obtain the most accurate test results. With a soap solution (applied around all tester fittings), connect the cylinder leakdown tester to the compressed*

*air source and look for any bubbles that would indicate leakage from the tester.*

6. Following the manufacturer's instructions, perform a cylinder leakage test on the front cylinder. Make a note of the percent of leakage. Leakage greater than 10% indicates internal engine problems.
7. Listen for air leaks at throttle body intake, exhaust pipe, and head gasket. Air escaping through the throttle body indicates a leaking intake valve. Air escaping through the exhaust pipe indicates a leaking exhaust valve.

*NOTE*

*If air is escaping through valves, check for correct push rod length.*

8. Repeat procedure on rear cylinder.

*NOTE*

*After installing spark plugs, be sure that throttle plate is in the closed position before starting the engine.*

## DIAGNOSING SMOKING ENGINE OR HIGH OIL CONSUMPTION

Perform both a compression test and a cylinder leakage test. See 3.7 TROUBLESHOOTING, Compression Test and 3.7 TROUBLESHOOTING, Cylinder Leakdown Test. If further testing is needed, remove suspect head(s) and inspect for the following:

### Check Prior To Cylinder Head Removal

1. Oil level overfull.
2. Oil carryover.
3. Breather hose restricted.
4. Restricted oil filter.

### Check After Cylinder Head Removal

1. Oil return passages for clogging.
2. Valve guide seals.
3. Valve guide to valve stem clearance.
4. Gasket surface of both head and cylinder.
5. Cylinder head casting's porosity allowing oil to drain into combustion chamber.
6. O-ring damaged or missing from oil pump/crankcase junction.

## 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 top end components, see 3.11 STRIPPING MOTORCYCLE FOR SERVICE , and then proceed to 3.15 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 3.13 REMOVING ENGINE FROM CHASSIS in lieu of 3.11 STRIPPING MOTORCYCLE FOR SERVICE.*

In the top end disassembly instructions, references are made to 3.19 BREATHER ASSEMBLY through 3.24 PISTON for service of all top end subassemblies: breathers, rocker arms, pushrods, cylinder heads, cylinders, pistons and upper connecting rods.

To rebuild the engine after a top end overhaul is complete, perform the steps under 3.16 TOP END OVERHAUL: ASSEMBLY, immediately following the disassembly instructions. Then, refer to 3.12 ASSEMBLING MOTORCYCLE AFTER SERVICE to complete the project.

*NOTE*

*For clarity, all artwork in this section shows the engine removed from the chassis for service.*

**Table 3-26. Top End Service**

| TOP END SERVICE | |
|---|---|
| **Engine in Chassis** | **Engine Removed** |
| Stripping Motorcycle For Service. | Removing Engine From Chassis. |
| Top End Overhaul, Disassembly. | Top End Overhaul, Disassembly. |
| Subassembly Service and Repair, Top End. | Subassembly Service and Repair, Top End. |
| Top End Overhaul, Assembly. | Top End Overhaul, Assembly. |
| Assembling Motorcycle After Service. | Installing Engine In Chassis. |



## 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 3.13 REMOVING ENGINE FROM CHASSIS.

After the motorcycle has been stripped and the engine removed, follow all of the steps under 3.15 TOP END OVERHAUL: DISASSEMBLY. When finished, continue with disassembly of the bottom half by performing those steps listed under 3.17 BOTTOM END OVERHAUL: DISASSEMBLY.

As with the top end disassembly instructions, references are made to 3.25 COVER AND CAM SUPPORT PLATE through 3.28 FLYWHEEL AND CONNECTING RODS for service of bottom end subassemblies- cam support plate, oil pump, crankcase and flywheel.

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 3.3 ENGINE OIL FLOW.

To rebuild the engine after a bottom end overhaul is complete, perform the steps under 3.18 BOTTOM END OVERHAUL: ASSEMBLY, and then proceed to 3.16 TOP END OVERHAUL: ASSEMBLY, to rebuild the upper end.

Once the engine is assembled, refer to 3.14 INSTALLING ENGINE IN CHASSIS to complete the project.

The flow charts in this section show how the same subsections are used for various levels of service.

**Table 3-27. Bottom End Service**

| BOTTOM END SERVICE | |
|---|---|
| **Engine in Chassis (Cam Compartment)** | **Engine Removed (Flywheel Compartment or Complete Engine Overhaul)** |
| Stripping Motorcycle For Service. | Removing Engine From Chassis. |
| Top End Overhaul, Disassembly. | Top End Overhaul, Disassembly. |

**Table 3-27. Bottom End Service**

| BOTTOM END SERVICE | |
|---|---|
| **Engine in Chassis (Cam Compartment)** | **Engine Removed (Flywheel Compartment or Complete Engine Overhaul)** |
| Bottom End Overhaul, Disassembly. | Bottom End Overhaul, Disassembly. |
| Subassembly Service and Repair, Bottom End. | Subassembly Service and Repair, Top End. |
| Bottom End Overhaul, Assembly. | Subassembly Service and Repair, Bottom End. |
| Top End Overhaul, Assembly. | Bottom End Overhaul, Assembly. |
| Assembling Motorcycle After Service. | Top End Overhaul, Assembly. |
| | Installing Engine In Chassis. |

## SUBASSEMBLY SERVICE AND REPAIR

Finally, if the task entails servicing of only one particular subassembly, then move directly to the appropriate section for all service instructions.

For example, if just installing new cams, then refer to 3.25 COVER AND CAM SUPPORT PLATE.

The specific steps under 3.16 TOP END OVERHAUL: ASSEMBLY and 3.18 BOTTOM END OVERHAUL: ASSEMBLY 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.

## ENGINE IN CHASSIS

**Table 3-28. Engine In Chassis**

| SERVICE PROCEDURE | | COMPONENT REPAIR PROCEDURE |
|---|---|---|
| Remove parts to gain access to all components above cylinder deck. See 3.11 STRIPPING MOTORCYCLE FOR SERVICE. | | |
| Disassemble top end. See 3.15 TOP END OVERHAUL: DISASSEMBLY. | | |
| | BREATHER ASSEMBLY | Inspect and repair. See 3.19 BREATHER ASSEMBLY*. |
| | ROCKER ARM SUPPORT | Inspect and repair. See 3.20 ROCKER ARM SUPPORT PLATE*. |
| | PUSH RODS, LIFTERS AND COVERS | Inspect and repair. See 3.21 PUSH RODS, LIFTERS AND COVERS*. |
| | CYLINDER HEAD | Inspect and repair. See 3.22 CYLINDER HEAD*. |
| | CYLINDER | Inspect and repair. See 3.23 CYLINDER*. |
| | PISTON | Inspect and repair. See 3.24 PISTON*. |
| Assemble top end. See 3.16 TOP END OVERHAUL: ASSEMBLY. | | |
| Assemble motorcycle. See 3.12 ASSEMBLING MOTORCYCLE AFTER SERVICE. | | |
| Note: * If no other work is to be done, you may advance to 3.16 TOP END OVERHAUL: ASSEMBLY when this step is completed during top end service. | | |

## ENGINE REMOVED FROM CHASSIS

**Table 3-29. Engine Removed From Chassis**

| SERVICE PROCEDURE | | COMPONENT REPAIR PROCEDURE |
|---|---|---|
| Remove engine from motorcycle. See 3.13 REMOVING ENGINE FROM CHASSIS. | | |
| Disassemble top end. See 3.15 TOP END OVERHAUL: DISASSEMBLY. | | |
| | BREATHER ASSEMBLY | Inspect and repair. See 3.19 BREATHER ASSEMBLY*. |
| | ROCKER ARM SUPPORT | Inspect and repair. See 3.20 ROCKER ARM SUPPORT PLATE*. |
| | PUSH RODS, LIFTERS AND COVERS | Inspect and repair. See 3.21 PUSH RODS, LIFTERS AND COVERS*. |
| | CYLINDER HEAD | Inspect and repair. See 3.22 CYLINDER HEAD*. |
| | CYLINDER | Inspect and repair. See 3.23 CYLINDER*. |
| | PISTON | Inspect and repair. See 3.24 PISTON. |
| Assemble top end. See 3.16 TOP END OVERHAUL: ASSEMBLY. | | |
| Install engine in motorcycle. See 3.14 INSTALLING ENGINE IN CHASSIS. | | |
| Note: * If no other work is to be done, you may advance to 3.16 TOP END OVERHAUL: ASSEMBLY when this step is completed during top end service. | | |

## ENGINE IN CHASSIS

**Table 3-30. Engine In Chassis: Cam Compartment Service**

| SERVICE PROCEDURE | | COMPONENT REPAIR PROCEDURES |
|---|---|---|
| Remove parts to gain access to all components above cylinder deck. See 3.11 STRIPPING MOTORCYCLE FOR SERVICE. | | |
| Dissassemble top end. See 3.15 TOP END OVERHAUL: DISASSEMBLY. | | |
| | BREATHER ASSEMBLY. | Inspect and repair. See 3.19 BREATHER ASSEMBLY. |
| | ROCKER ARM SUPPORT PLATE. | Inspect and repair. See 3.20 ROCKER ARM SUPPORT PLATE. |
| | PUSH RODS, LIFTERS AND COVERS. | Inspect and repair. See 3.21 PUSH RODS, LIFTERS AND COVERS. |
| Disassemble bottom end. See 3.17 BOTTOM END OVERHAUL: DISASSEMBLY. | | |
| | COVER AND CAM SUPPORT PLATE | Inspect and repair. See 3.25 COVER AND CAM SUPPORT PLATE*. |
| | OIL PUMP | Inspect and repair. See 3.26 OIL PUMP. |
| Assemble bottom end. See 3.18 BOTTOM END OVERHAUL: ASSEMBLY. | | |
| Assemble motorcycle. See 3.12 ASSEMBLING MOTORCYCLE AFTER SERVICE. | | |
| Note: * If no other work is to be done, you may advance to 3.18 BOTTOM END OVERHAUL: ASSEMBLY when this step is completed during bottom end service. | | |

## ENGINE REMOVED FROM CHASSIS

**Table 3-31. Engine Removed: Flywheel Compartment Service or Complete Engine Overhaul**

| SERVICE PROCEDURE | | COMPONENT REPAIR PROCEDURES |
|---|---|---|
| Remove engine from motorcycle. See 3.13 REMOVING ENGINE FROM CHASSIS. | | |
| Dissassemble top end. See 3.15 TOP END OVERHAUL: DISASSEMBLY. | | |
| | BREATHER ASSEMBLY. | Inspect and repair.<br>See 3.19 BREATHER ASSEMBLY. |
| | ROCKER ARM SUPPORT PLATE. | Inspect and repair.<br>See 3.20 ROCKER ARM SUPPORT PLATE. |
| | PUSH RODS, LIFTERS AND COVERS. | Inspect and repair.<br>See 3.21 PUSH RODS, LIFTERS AND COVERS. |
| | CYLINDER HEAD | Inspect and repair.<br>See 3.22 CYLINDER HEAD. |
| | CYLINDER | Inspect and repair.<br>See 3.23 CYLINDER. |
| | PISTON | Inspect and repair.<br>See 3.24 PISTON. |
| Disassemble bottom end. See 3.15 TOP END OVERHAUL: DISASSEMBLY. | | |
| | COVER AND CAM SUPPORT PLATE | Inspect and repair.<br>See 3.25 COVER AND CAM SUPPORT PLATE. |
| | CRANKCASE | Inspect crankcase and repair.<br>See 3.27 CRANKCASE. |
| | | Inspect and repair flywheel/connecting rod assembly.<br>See 3.28 FLYWHEEL AND CONNECTING RODS. |
| Assemble bottom end. See 3.18 BOTTOM END OVERHAUL: ASSEMBLY. | | |
| Assemble top end. See 3.16 TOP END OVERHAUL: ASSEMBLY. | | |
| Install engine in motorcycle. See 3.14 INSTALLING ENGINE IN CHASSIS. | | |

## PROCEDURE

### Cam Compartment Service Only

1. Remove exhaust system. See 4.18 EXHAUST SYSTEM.
2. Remove fuel tank. See 4.4 FUEL TANK.
3. Remove air cleaner and backplate. See 4.3 AIR CLEANER ASSEMBLY.
4. Remove spark plug cables. Remove spark plugs. See 1.18 SPARK PLUGS.
5. Remove ignition coil. See 8.4 IGNITION COIL.
6. Remove purge solenoid if equipped. See 4.21 EVAPORATIVE EMISSIONS CONTROL (CA MODELS).

### Top End Service

1. Complete all steps under Cam Compartment Service Only.
2. Remove induction module. See 4.12 INDUCTION MODULE.
3. Gather disconnected branches of main harness and tape to top of wire trough to keep out of the way.
4. Remove two hex head bolts (with flat washers) to release top engine mounting bracket from front cylinder head. Remove hex head bolt to release stabilizer link from frame weldment.

## PROCEDURE

### After Top End Service

1. Start two hex head bolts (with flat washers) to fasten top engine mounting bracket to front cylinder head. Alternately tighten bolts to 30-35 ft-lbs (41-48 Nm).
2. Start hex head bolt to fasten stabilizer link to frame weldment. Tighten bolt to 18-22 ft-lbs (24-30 Nm).
3. Start bolt (with flat washer) to fasten horn bracket to front cylinder head.
4. Remove tape to release disconnected branches of main harness from top of wire trough.
5. Install induction module. See 4.12 INDUCTION MODULE.
6. Continue with steps under After Cam Compartment Service.

### After Cam Compartment Service

1. Install purge solenoid if equipped. See 4.21 EVAPORATIVE EMISSIONS CONTROL (CA MODELS).
2. Install ignition coil. See 8.4 IGNITION COIL.
3. Install spark plugs and connect spark plug cables.
4. Install backplate and air cleaner. See 4.3 AIR CLEANER ASSEMBLY.
5. Install fuel tank. See 4.4 FUEL TANK.
6. Install exhaust system. See 4.18 EXHAUST SYSTEM.

## PROCEDURE

| PART NUMBER | TOOL NAME |
|---|---|
| HD-42310 | BENCH STAND |
| HD-42310-2 | TWIN CAM 88 CRADLE |
| HD-43646A | ROLLING STAND |

1. Remove exhaust system. See 4.18 EXHAUST SYSTEM.
2. Remove fuel tank. See 4.4 FUEL TANK.
3. Remove air cleaner and backplate. See 4.3 AIR CLEANER ASSEMBLY.
4. Remove spark plug cables. Remove spark plugs. See 1.18 SPARK PLUGS.
5. Remove ignition coil. See 8.4 IGNITION COIL.
6. Remove purge solenoid if equipped. See 4.21 EVAPORATIVE EMISSIONS CONTROL (CA MODELS).
7. Remove induction module. See 4.12 INDUCTION MODULE.
8. Gather disconnected branches of main harness and tape to top of wire trough. If wiring is not moved out of the way, it may be damaged during engine removal.
9. Remove voltage regulator. See 8.2 VOLTAGE REGULATOR.
10. Remove CKP sensor. See 8.20 CRANKSHAFT POSITION SENSOR (CKP).
11. Remove oil filter. See 1.5 ENGINE OIL AND FILTER.
12. Remove oil pressure switch/sender. See 8.24 OIL PRESSURE SWITCH AND SENDER.
13. Coil main harness conduit and allow to hang below lower frame tube at front of motorcycle. If wiring is not moved out of the way, it may be damaged during engine removal.
14. Remove primary chaincase. See 6.4 PRIMARY CHAINCASE HOUSING.
15. Remove rotor and stator. See 8.21 ALTERNATOR.
16. Wrap rear master cylinder reservoir with foam padding or bubble pack.
17. 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 and main harness conduit at the top of the right frame tube.
18. Cover rocker covers of front and rear cylinders with foam padding or bubble pack.
19. Place a jack under the oil pan and use a block of wood between the jack and oil pan to distribute pressure across the length of the casting. Raise the jack until firm contact is made with the bottom of the oil pan.
20. Remove two hex head bolts (with flat washers) to release top engine mounting bracket from front cylinder head. Remove hex head bolt to release stabilizer link from frame weldment.
21. Remove four bolts (with flat washers) to free transmission from crankcase. Loosen and remove bolts in a crosswise pattern.
22. Remove two hex head bolts (with flat washers) to free front of crankcase from front engine mounting bracket.
23. Move engine forward far enough to clear two ring dowels at bottom of transmission flange. Raise engine and remove from right side of motorcycle. Exercise caution to avoid contact with rear brake line and main harness conduit at top of lower frame tube. Also be sure to avoid the rear brake master cylinder reservoir.
24. Using the TWIN CAM 88 CRADLE (Part No. HD-42310-2), install engine in BENCH STAND (Part No. HD-42310) or ROLLING STAND (Part No. HD-43646A). See Figure 3-11.
25. Thoroughly wipe all engine oil from pockets in crankcase flange. Remove gasket pulling two index pins from holes in transmission flange. Discard gasket.
26. Remove and clean the oil pan under any of the following conditions. See 3.29 OIL PAN.
    a. Metal debris is found in the engine or crankcase.
    b. Oil contamination is suspected.
    c. A complete engine overhaul is being performed as a result of a major engine failure.
    d. The engine is being replaced with a new one.

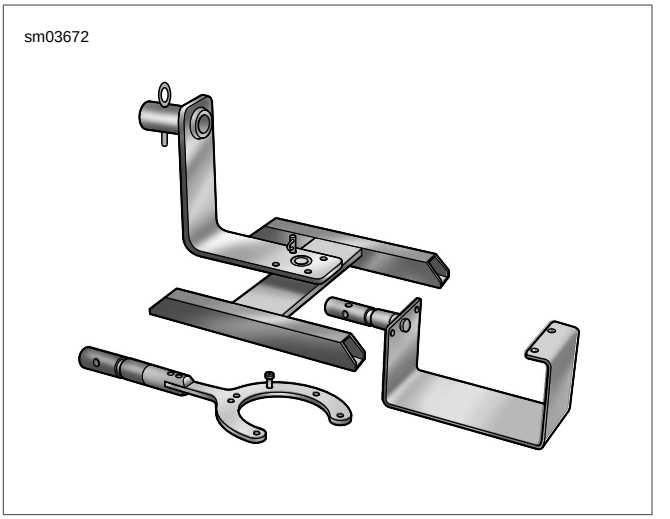



**Figure 3-11. Engine/Transmission Bench Stand (HD-42310)**

## PROCEDURE

| PART NUMBER | TOOL NAME |
|---|---|
| HD-42310 | BENCH STAND |
| HD-43646A | ROLLING STAND |

1. Install oil pan, if removed. See 3.29 OIL PAN.
2. Cover rocker covers of front and rear cylinders with foam padding or bubble pack.
3. 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 and main harness conduit at the top of the right frame tube.
4. Wrap rear master cylinder reservoir with foam padding or bubble pack.
5. Remove engine from BENCH STAND (Part No. HD-42310) or ROLLING STAND (Part No. HD-43646A) and set on floor on right side of chassis.
6. Raise engine and install in chassis from right side of motorcycle 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. Exercise caution to avoid contact with rear brake master cylinder reservoir. Also be sure to avoid brake line and main harness conduit at top of lower right frame tube.
7. Install **new** gasket engaging two index pins in holes at center of transmission flange. Move engine rearward to fully engage two ring dowels at bottom of transmission flange.
8. Secure the engine as follows:
   a. Using a crosswise pattern, hand tighten four bolts (with flat washers) to secure transmission to crankcase. Install the shorter 1/2 inch bolts at the top, the longer 9/16 inch bolts at the bottom.
   b. Hand tighten two bolts (with flat washers) to secure front of crankcase to front engine mounting bracket.
   c. Alternately tighten the four transmission to crankcase bolts to 15 ft-lbs (20.3 Nm) in the crosswise pattern previously used.

   *NOTE*

   *For best results, use Open End Crowfoot (Snap-On FC018) on upper left and upper right transmission to crankcase bolts.*

   d. Repeating the crosswise pattern again, final tighten the four transmission to crankcase bolts to 34-39 ft-lbs (46.1-52.9 Nm).
   e. Install two hex head bolts (with flat washers) to fasten crankcase to front engine mounting bracket. Alternately tighten bolts to 36-40 ft-lbs (48.8-54.2 Nm).
   f. Install two hex head bolts (with flat washers) to secure top engine mounting bracket to front cylinder head. Alternately tighten bolts to 30-35 ft-lbs (41-48 Nm).
   g. Install hex head bolt to secure stabilizer link to frame weldment. Tighten bolt to 18-22 ft-lbs (24-30 Nm).
9. Remove jack and wooden block from under oil pan.
10. Install oil filter. See 1.5 ENGINE OIL AND FILTER.
11. Install stator and rotor. See 8.21 ALTERNATOR.
12. Install primary chaincase. See 6.4 PRIMARY CHAINCASE HOUSING.
13. Uncoil main harness conduit and allow to hang below lower frame tube at front of motorcycle.
14. Install oil pressure switch/sender. See 8.24 OIL PRESSURE SWITCH AND SENDER.
15. Install CKP sensor. See 8.20 CRANKSHAFT POSITION SENSOR (CKP).
16. Install voltage regulator. See 8.2 VOLTAGE REGULATOR.
17. Remove tape to release disconnected branches of main harness from top of wire trough.
18. Install induction module. See 4.12 INDUCTION MODULE.
19. Install purge solenoid if equipped. See 4.21 EVAPORATIVE EMISSIONS CONTROL (CA MODELS).
20. Install spark plugs. See 1.18 SPARK PLUGS.
21. Install ignition coil and spark plug cables. See 8.4 IGNITION COIL.
22. Install backplate and air cleaner. See 4.3 AIR CLEANER ASSEMBLY.
23. Install fuel tank. See 4.4 FUEL TANK.
24. Install exhaust system. See 4.18 EXHAUST SYSTEM.
25. Verify proper oil level. See 1.5 ENGINE OIL AND FILTER
    a. If oil pan was drained, add appropriate amount and type of engine oil before checking oil level.
    b. If oil pan was **not** drained, perform **COLD CHECK** and **HOT CHECK** only.

## GENERAL

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

To perform a complete top end overhaul, follow all steps listed in this section including inspection and repair procedures.

## ROCKER COVERS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-47248 | LOWER ROCKER BOX WRENCH |
| HD-47258 | UPPER ROCKER BOX WRENCH |

*NOTE*

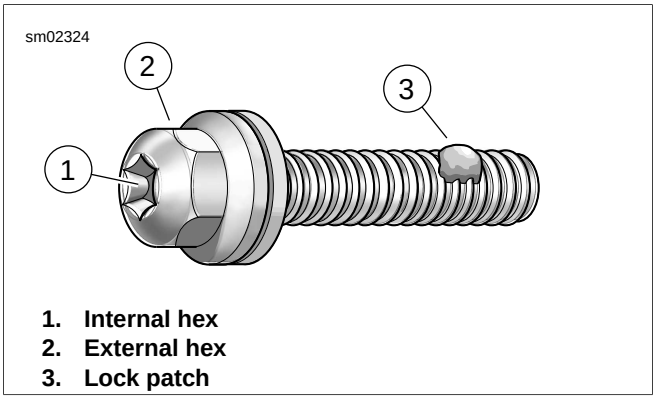
*Dirt caked on cooling fins and other areas can fall into crankcase bore or stick to subassemblies as parts are removed. Abrasive particles can damage machined surfaces or plug oil passageways. Remove all dirt and particles before disassembly to prevent component damage.*

1. Use low pressure spray to thoroughly clean exterior surfaces of engine prior to disassembly.

*NOTE*

*See Figure 3-12. If the engine is left in the chassis for service, use the UPPER ROCKER BOX WRENCH (Part No. HD-47258) and LOWER ROCKER BOX WRENCH (Part No. HD-47248) to remove the rocker cover and rocker housing bolts, respectively. These tools are especially useful when removing the bolts on the left side of the engine (particularly the rear) where there is close proximity to the frame. With both an external and internal hex, the bolts also can be removed with either a 7/16 inch socket or open end/box wrench (open spaces), or a short 3/16 inch allen wrench (tight spaces).*

2. See Figure 3-13. Following the sequence shown, alternately loosen the six rocker cover bolts. Remove the rocker cover bolts and their captive washers.
3. Remove the rocker cover and gasket. Discard gasket.




1. **Internal hex**
2. **External hex**
3. **Lock patch**

**Figure 3-12. Rocker Cover Bolt (Rocker Housing Bolt Similar)**

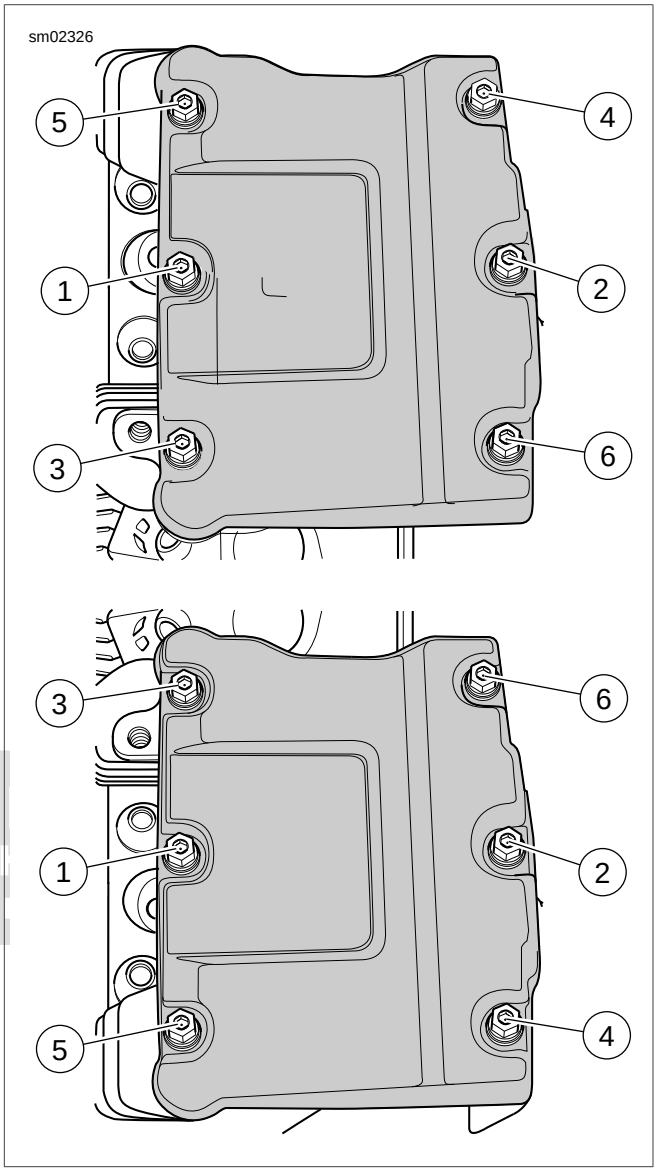



**Figure 3-13. Rocker Cover Bolt Removal Sequence**

## ROCKER ARM SUPPORT PLATE

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48283 | CRANKSHAFT ROTATING WRENCH |

1. See Figure 3-14. Insert the blade of a small screwdriver into cast loop of spring cap retainer (at top of upper push rod cover). While pushing down on spring cap, rotate bottom of screwdriver toward outboard side to remove. Repeat step on second push rod cover.

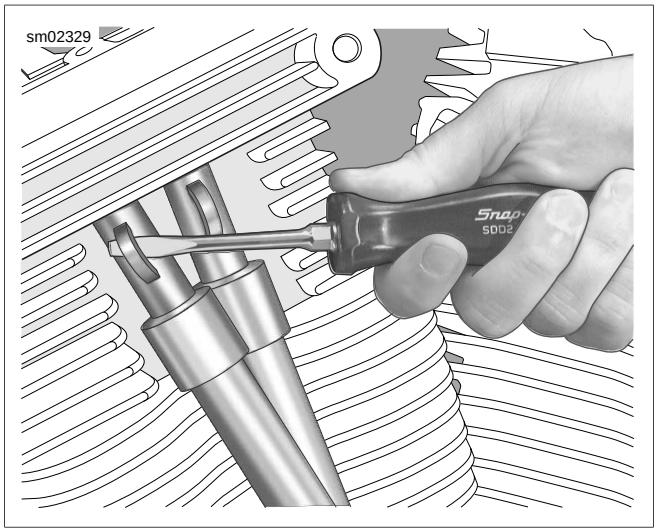



**Figure 3-14. Removing Spring Cap Retainer**

2. Collapse upper and lower push rod covers.
3. To remove the rocker arm support plate, both lifters of the cylinder being serviced must be on the base circle (lowest position) of the cam. To find the base circle, it is first necessary to rotate the engine. Based on the level of disassembly required, three methods of engine rotation are presented below.
   a. **With primary cover installed -** Remove spark plugs. With the rear wheel raised, place the transmission in 6th gear and rotate rear wheel in a clockwise direction (as viewed from right side) until the base circle is found. Continue with next numbered step.
   b. **With primary cover removed -** Remove spark plugs. Place the transmission in neutral. Fit a socket on the compensating sprocket shaft nut. Rotate nut in a counterclockwise direction until the base circle is found. Continue with step 4.

   *NOTE*

   *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. See Figure 3-15. **With engine mounted in engine stand -** Install CRANKSHAFT ROTATING WRENCH (Part No. HD-48283) on sprocket shaft and rotate in a counterclockwise direction until the base circle is found.

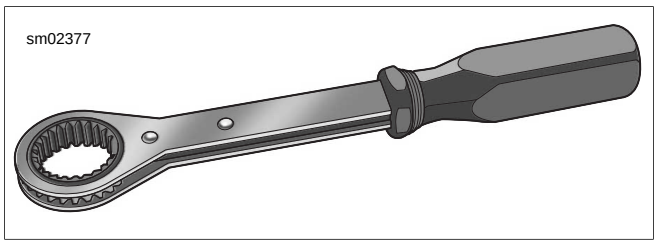



**Figure 3-15. Crankshaft Rotating Wrench**

4. Using one of the methods above, rotate engine until piston is at top dead center (TDC) of compression stroke.
   a. To accomplish this, first raise lower push rod cover to access intake lifter (inside hole of lifter cover).
   b. Place index finger on top of the intake lifter. While rotating engine, feel lifter rise (valve open) and fall (valve closed).
   c. 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.
   d. 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 (loose) position.
5. See Figure 3-16. Remove two bolts to release breather assembly (arrow) and filter element from the rocker arm support plate. For inspection and repair information, see 3.19 BREATHER ASSEMBLY.
6. Alternately loosen each of the four rocker arm support plate bolts 1/4 turn in the pattern shown the figure. Continue turning the bolts in these increments until loose. Remove the rocker arm support plate bolts with flat washers.
7. Remove the rocker arm support plate assembly from the rocker housing. For inspection and repair information, see 3.20 ROCKER ARM SUPPORT PLATE.

*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.*

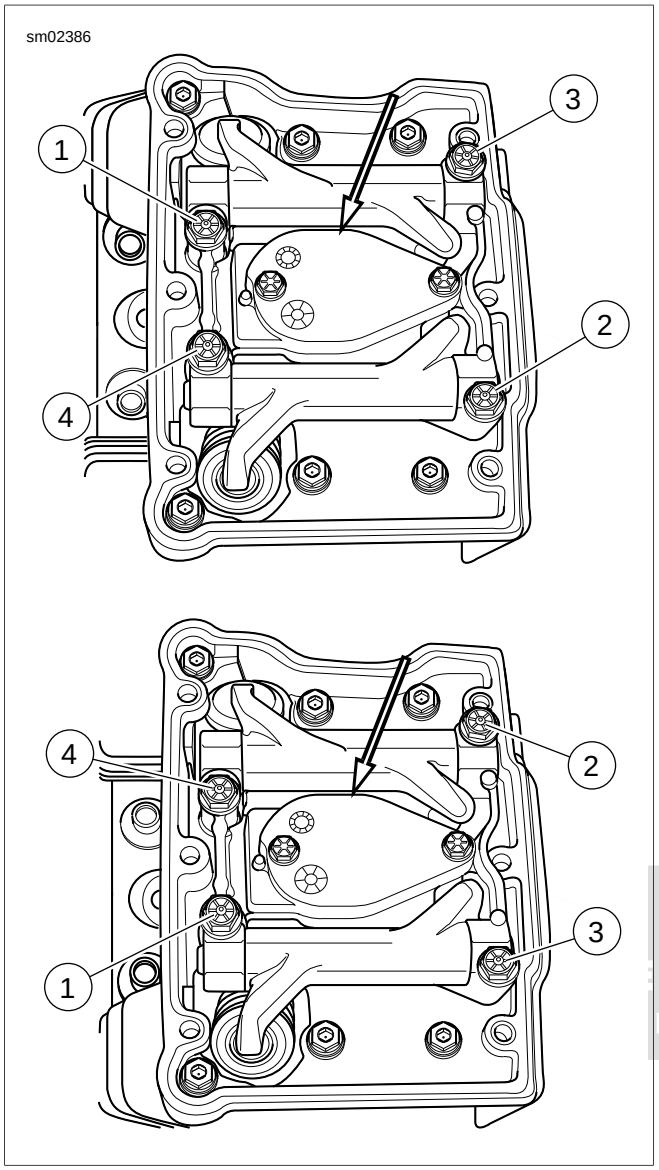
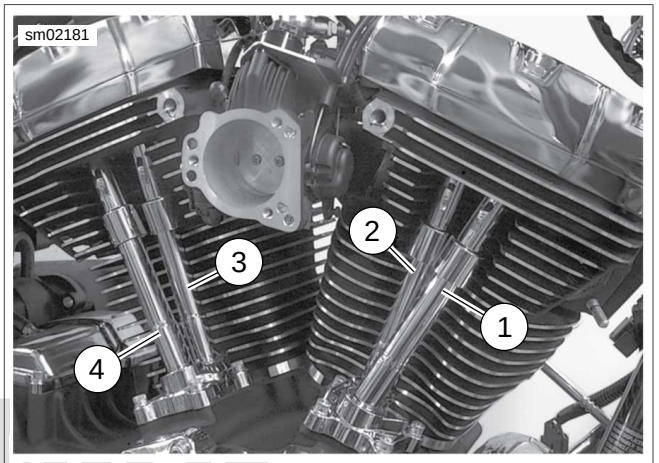



**Figure 3-16. 1/4 Turn Rocker Arm Bolts in Sequence**

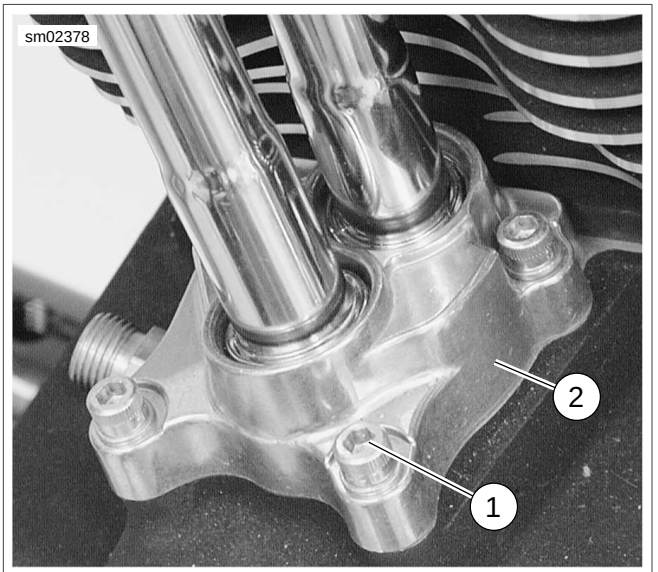
## PUSH RODS, LIFTERS AND COVERS

1. See Figure 3-17. Remove the intake and exhaust push rods and push rod covers.
   a. Tag the push rods for location (front/rear cylinder), and orientation (top/bottom) as they are removed. This will simplify installation.
   b. Remove push rod covers from cylinder head and lifter cover bores.
   c. 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.
2. See Figure 3-18. Remove lifter covers.
   a. Using a crosswise pattern, remove four screws with captive washers (1) to release the lifter cover (2).
   b. Remove the lifter cover and gasket. Discard gasket.
3. Remove lifters.
   a. Remove the anti-rotational pin to free the hydraulic lifters.
   b. Tag the lifters for location (front/rear cylinder) and function (intake/exhaust) as they are removed. This will simplify installation.
   c. Place the lifters in clean plastic bags to keep out dust, dirt and debris.
4. See Figure 3-19. Remove and discard o-ring from groove around breather baffle hole in rocker housing.
5. For inspection and repair information, see 3.21 PUSH RODS, LIFTERS AND COVERS.




1. **Front cylinder exhaust push rod**
2. **Front cylinder intake push rod**
3. **Rear cylinder intake push rod**
4. **Rear cylinder exhaust push rod**

**Figure 3-17. Push Rod Locations**




1. **Screw with captive washer (4)**
2. **Lifter cover**

**Figure 3-18. Lifter Cover**

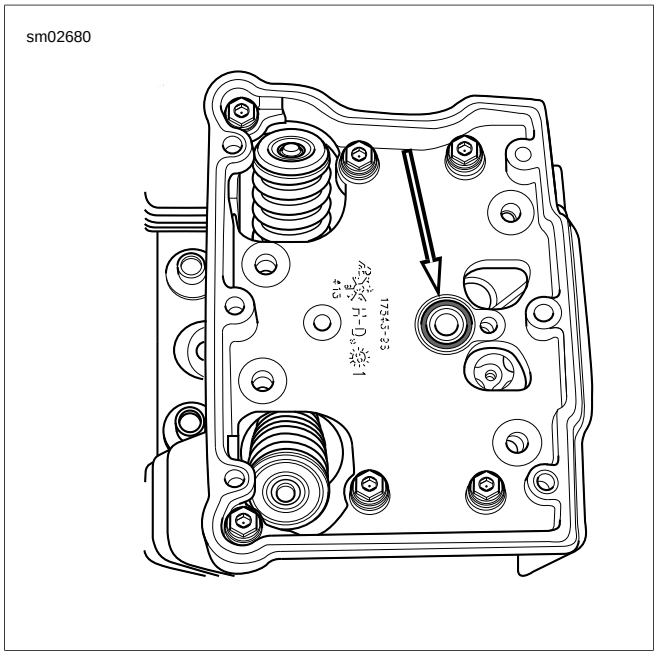



**Figure 3-19. Breather Baffle Hole O-Ring**

## CYLINDER HEAD

| PART NUMBER | TOOL NAME |
|---|---|
| HD-42324-A | CYLINDER TORQUE PLATES |

1. See Figure 3-20. Following the sequence shown, alternately loosen the six rocker housing bolts. Remove rocker housing bolts and their captive washers.
2. Remove rocker housing and gasket. Discard gasket.

*NOTE*

*To prevent distortion of the cylinder head, cylinder and cylinder studs, gradually loosen the cylinder head bolts in the specified sequence.*

3. See Figure 3-21. Remove cylinder head bolts.
   a. Following the sequence shown, alternately loosen each of the four cylinder head bolts just 1/4 turn.
   b. Continue turning the bolts in these increments until loose.
   c. Remove the cylinder head bolts.
4. Remove cylinder head and head gasket.

*NOTE*

*Save the cylinder head gasket (if salvageable) for use with the CYLINDER TORQUE PLATES (Part No. HD-42324-A) when measuring, boring or honing of the cylinder is required.*

5. For inspection and repair information, see 3.22 CYLINDER HEAD.

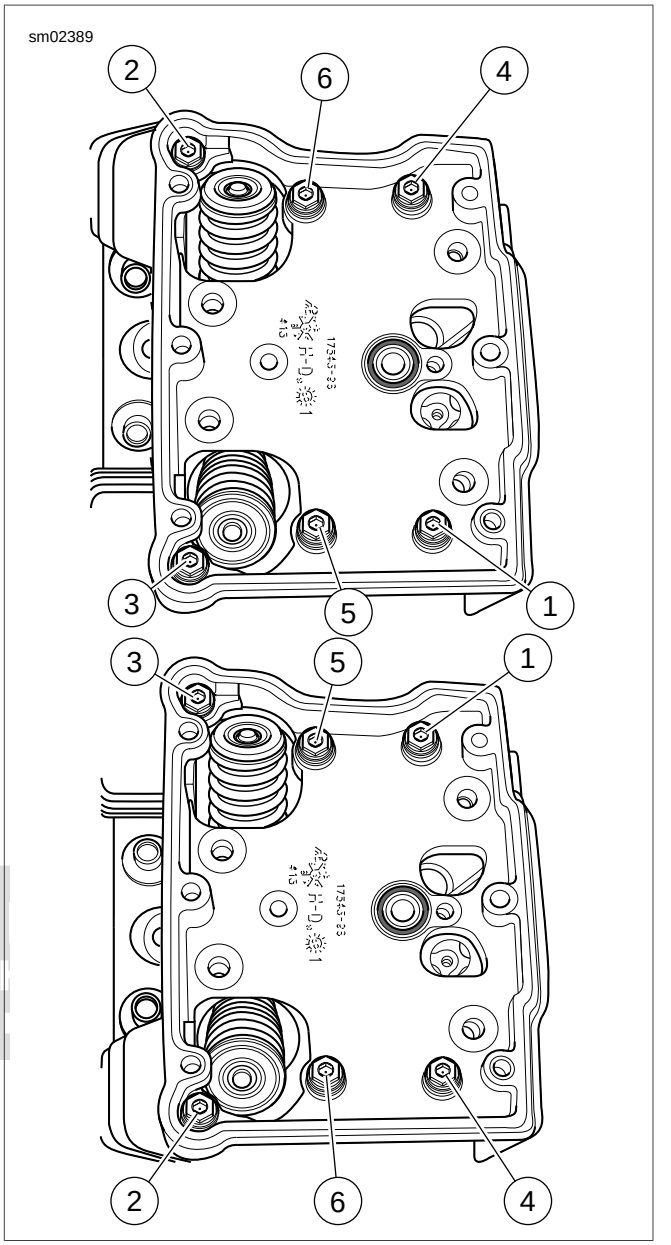



**Figure 3-20. Rocker Housing Bolts Removal Sequence**

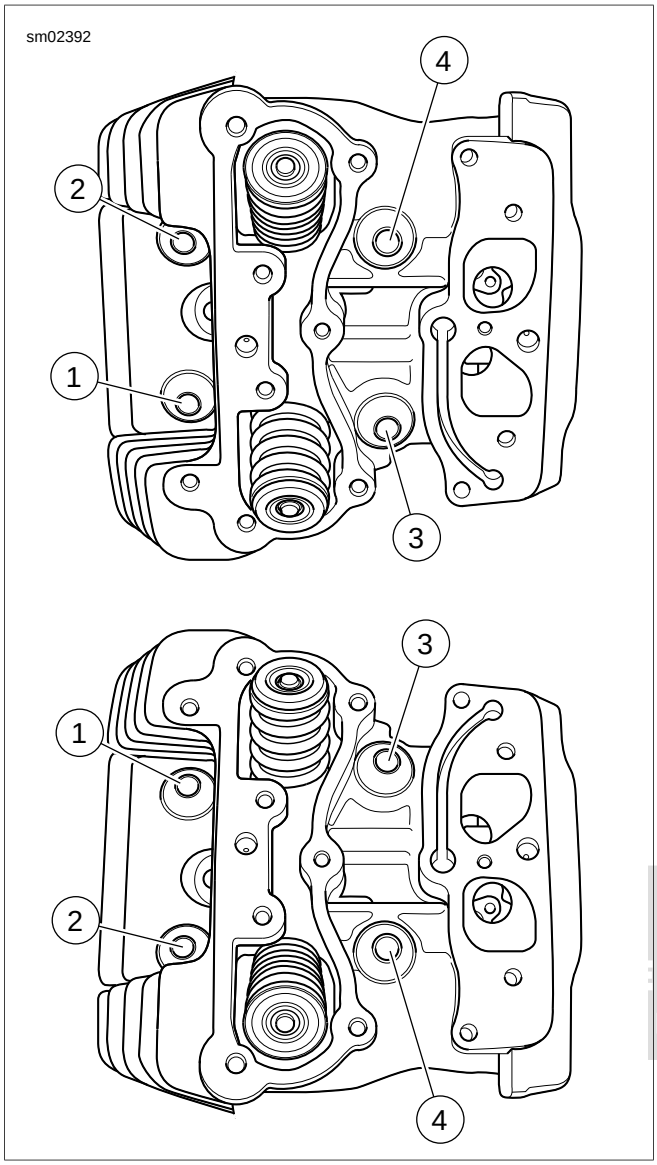



**Figure 3-21. 1/4 Turn Head Bolts in Sequence**

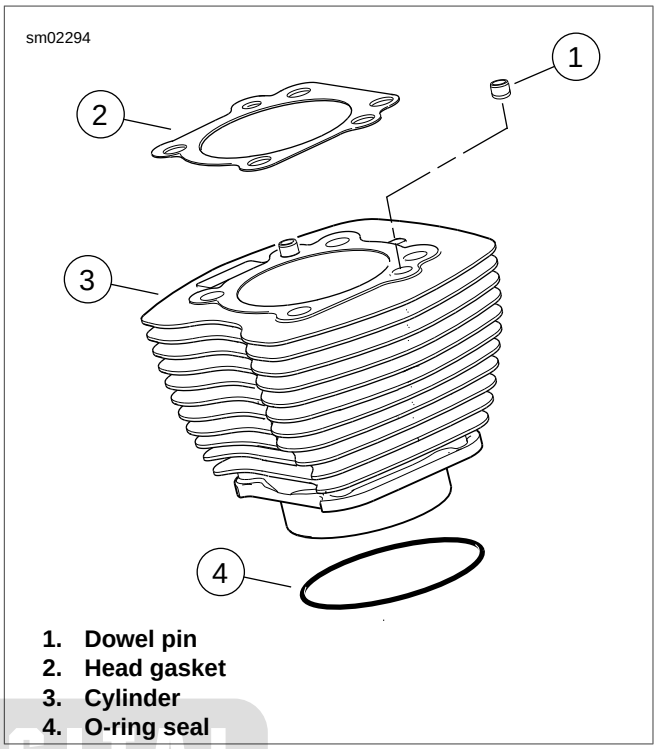
## CYLINDER

1. 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.

*NOTE*

*Exercise caution to avoid bending the cylinder studs. Even a slight bend or nick can cause a stress riser leading to stud failure.*

2. Carefully remove the cylinder. Exercise caution 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.
3. Mark cylinder FRONT or REAR as appropriate.
4. Slide approximately 6.0 in. (152 mm) of plastic tubing, rubber hose or conduit over each cylinder stud. Use material with I.D. of 0.5 in. (12.7 mm) to protect cylinder studs and piston from damage.
5. See Figure 3-22. Remove o-ring seal (4) from the bottom of the cylinder liner. Discard o-ring seal.
6. See Figure 3-23. Remove o-ring from dowel pin (4) on base of cylinder deck. Discard o-ring.
7. For inspection and repair information, see 3.23 CYLINDER.




1. **Dowel pin**
2. **Head gasket**
3. **Cylinder**
4. **O-ring seal**

**Figure 3-22. Cylinder Assembly**

## PISTON

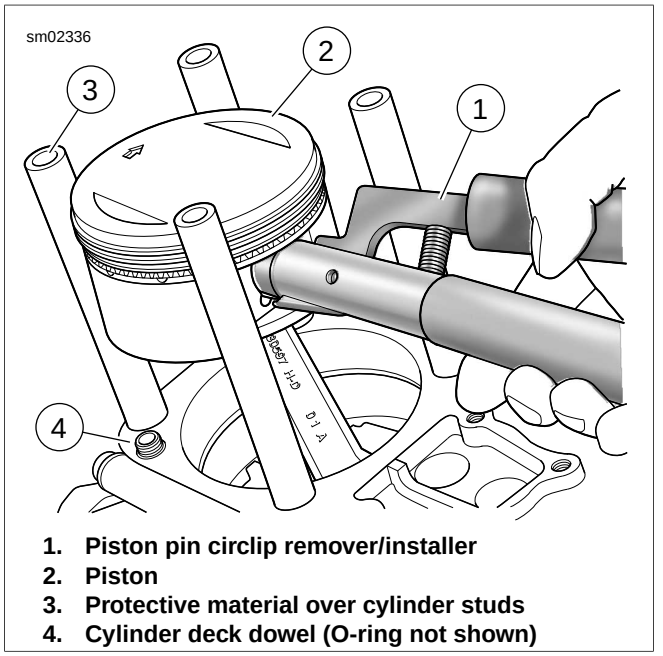
| PART NUMBER | TOOL NAME |
|---|---|
| HD-42317-A | PISTON PIN CIRCLIP REMOVER/INSTALLER |
| HD-42320-A | PISTON PIN REMOVER |

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

**⚠WARNING**

**Wear safety glasses or goggles when removing or installing piston pin retaining rings. Piston pin retaining rings are compressed in the ring groove and can fly out when removed from the groove, which could result in serious eye injury. (00293a)**

2. See Figure 3-23. Remove the piston pin circlip.
   a. Insert the PISTON PIN CIRCLIP REMOVER/INSTALLER (Part No. HD-42317-A) (1) into the piston pin bore. Position claw on tool in slot of piston (2) (directly under circlip).
   b. Hold a shop towel over the piston pin bore in case a circlip should fly out during removal. Squeeze the handles of the tool together and pull from bore. Remove circlip from claw and discard.



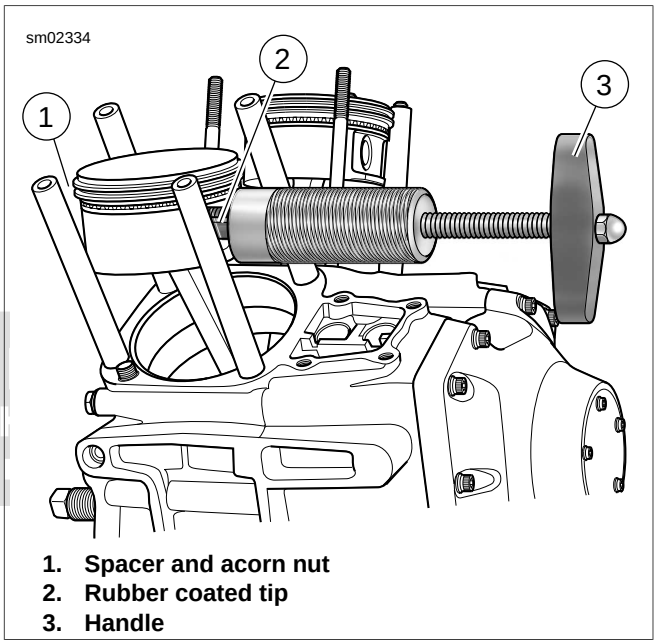

1. **Piston pin circlip remover/installer**
2. **Piston**
3. **Protective material over cylinder studs**
4. **Cylinder deck dowel (O-ring not shown)**

**Figure 3-23. Piston Pin Circlip Removal (Part No. HD-42317)**

*NOTE*

*It is not necessary to remove both piston pin circlips during piston removal. Leave the second circlip in the pin bore.*

3. See Figure 3-24. Remove the piston pin. If piston pin is difficult to remove, use PISTON PIN REMOVER (Part No. HD-42320-A).
   a. Remove acorn nut and spacer from rod end of tool.
   b. Slide rod end through piston pin. Install spacer and acorn nut (1) on end of rod.
   c. Position rubber-coated tips (2) of tool on flat each side of pin bore.
   d. Turn handle (3) in a clockwise direction until piston pin is pulled free of bore.
4. Remove the piston. Be sure to hold the connecting rod shank upright to prevent it from striking the crankcase. Place a 3.0 in. (76.2 mm) long piece of foam-type water pipe insulation around each connecting rod. Use material with an O.D. of 2.25 in. (57.1 mm) and an I.D. of 1.0 in. (25.4 mm) to prevent damage.
5. Turn the piston over. Mark the pin boss with the letters F(ront) or R(ear) to identify location.
6. Service as needed. For inspection and repair information, see 3.24 PISTON.
7. Complete engine work.
   a. If performing a top end overhaul only, see 3.16 TOP END OVERHAUL: ASSEMBLY.
   b. If performing a complete engine overhaul, see 3.17 BOTTOM END OVERHAUL: DISASSEMBLY.




1. **Spacer and acorn nut**
2. **Rubber coated tip**
3. **Handle**

**Figure 3-24. Piston Pin Remover (Part No. HD-42320-A)**

## GENERAL

*NOTES*

- *It is assumed that each step performed on one cylinder is automatically repeated on the other.*
- *Do not mix 2007 and later pistons with earlier style pistons. New style pistons have tapered wrist pin boss. The wrist pin portion of the connecting rod is also tapered.*

This section provides a sequential process for engine reassembly after a complete 3.15 TOP END OVERHAUL: DISASSEMBLY. If you reached this section after an inspection or repair procedure, start where necessary and continue to the end of the section.

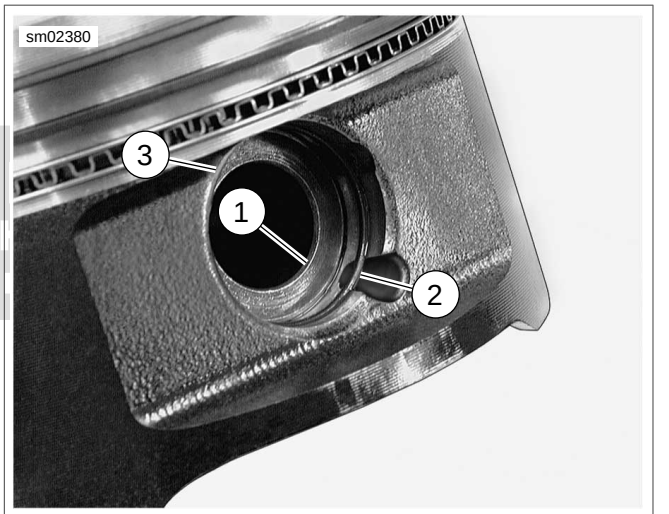
- Piston installation-see 3.16 TOP END OVERHAUL: ASSEMBLY, Piston.
- Cylinder installation-see 3.16 TOP END OVERHAUL: ASSEMBLY, Cylinder.
- Cylinder head installation-see 3.16 TOP END OVERHAUL: ASSEMBLY, Cylinder Head.
- Push rods, lifters and covers installation-see 3.16 TOP END OVERHAUL: ASSEMBLY, Push Rods, Lifters and Covers.
- Rocker arm support plate installation-see 3.15 TOP END OVERHAUL: DISASSEMBLY, Rocker Arm Support Plate.
- Breather assembly installation-see 3.16 TOP END OVERHAUL: ASSEMBLY, Breather Assembly.

## PISTON

| PART NUMBER | TOOL NAME |
|---|---|
| HD-42317-A | PISTON PIN CIRCLIP REMOVER/INSTALLER |

1. Slide approximately 6.0 in. (152 mm) of plastic tubing, rubber hose or conduit over each cylinder stud, if removed. Use material with I.D. of 0.5 in. (12.7 mm) to 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 connecting rod shank.
4. See Figure 3-25. Place piston over rod end so that the arrow stamped at the top of the piston points toward the front of the engine.
5. See Figure 3-26. Insert piston pin (1) through pin bore and upper connecting rod bushing. Push pin until it contacts circlip installed in opposite pin boss. Verify that end gap (3) for circlip is 180 degrees from opening (2).
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.


**Figure 3-25. Piston Installation Arrow**




1. **Piston pin**
2. **Circlip opening**
3. **End gap location**

**Figure 3-26. Preinstalled Circlip**

*NOTE*

*Do not reuse piston pin circlips. The circlips could weaken during removal causing them to break or dislodge during engine operation, a condition that will result in engine damage.*

7. Install **new** piston pin circlip with the PISTON PIN CIRCLIP REMOVER/INSTALLER (Part No. HD-42317-A).
   a. See Figure 3-27. 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.
   d. See Figure 3-28. Insert the tool (1) into the piston pin bore until claw is aligned with slot (2) 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.

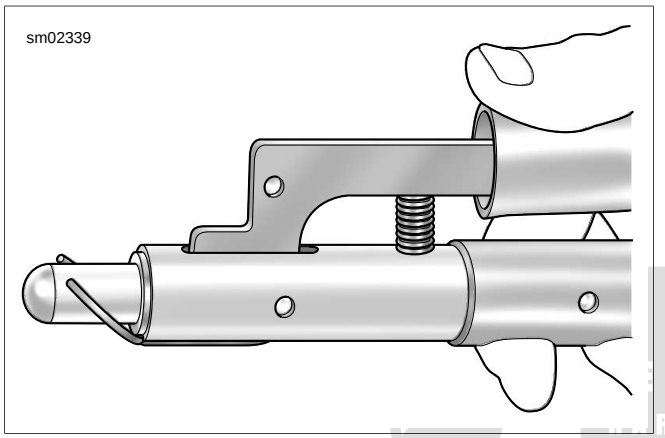
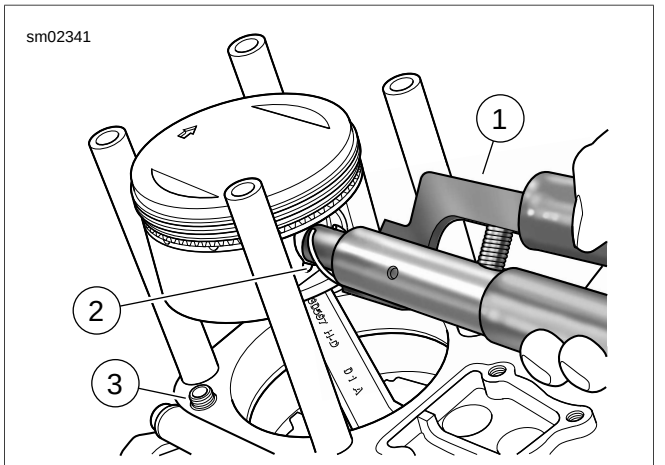



**Figure 3-27. Aligning Circlip**




1. **Piston pin circlip remover/installer**
2. **Slot**
3. **Cylinder deck dowel (O-ring not shown)**

**Figure 3-28. Pin Circlip Remover/Installer (Part No. HD-42317)**

## CYLINDER

| PART NUMBER | TOOL NAME |
|---|---|
| HD-42322 | PISTON SUPPORT PLATE |
| HD-95952-1 | THREADED CYLINDERS |
| HD-95952-33C | CONNECTING ROD CLAMPING TOOL |
| HD-96333-51E | PISTON RING COMPRESSOR |

*NOTE*

*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. See Figure 3-28. Apply a very thin film of clean H-D 20W50 engine oil to **new** o-rings for both lower cylinder deck dowels. Install and verify that o-ring is properly seated in groove.
2. See Figure 3-29. Apply a very thin film of clean H-D 20W50 engine oil to **new** o-ring seal for the bottom of the cylinder liner. Install **new** o-ring seal.

*NOTE*

*Excessive lubrication of cylinder sleeve o-ring seal will result in oil weepage between cylinder and crankcase as engine is run. This condition may be incorrectly diagnosed as an oil leak.*

3. See Figure 3-30. Verify that the piston ring end gaps are staggered. Rotate each ring to position the gap 90 to 180 degrees from the gap in the ring above it. Locate the top piston ring (5) gap towards the intake port.
4. Apply clean H-D 20W50 engine oil to piston, piston rings and cylinder bore.
5. Remove protective covers from cylinder studs. Rotate engine until piston is at top dead center. If necessary, see 3.15 TOP END OVERHAUL: DISASSEMBLY, Rocker Arm Support Plate for three methods of engine rotation.
6. See Figure 3-31. Install the PISTON SUPPORT PLATE (Part No. HD-42322).
   a. Slide both adjustable knobs (2) on support plate (1) down 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.

7. See Figure 3-32. Install cylinder using PISTON RING COMPRESSOR (Part No. HD-96333-51E).
   a. Fit tabs on pliers (1) into slots of ring compressor band (2). 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.
   b. 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 ratcheting action of the tool allows release of the handles after the rings are compressed.
   c. 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.
   d. 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.
   e. 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
8. Remove shop towels from around the crankcase bore exercising caution to keep out any dirt or debris.
9. Carefully set the cylinder over the two dowel pins in the cylinder deck. Push down on the cylinder until it is fully seated in the crankcase bore.

*NOTE*

*See Figure 3-33. To hold the first cylinder in position while installing the second, install THREADED CYLINDERS (Part No. HD-95952-1) from CONNECTING ROD CLAMPING TOOL (Part No. HD-95952-33C) 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.*

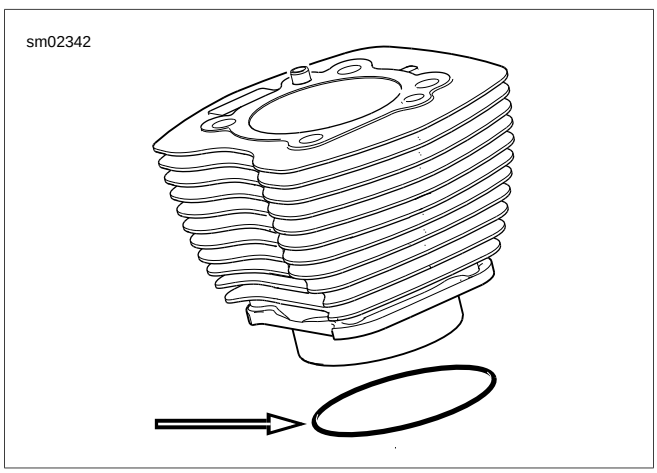
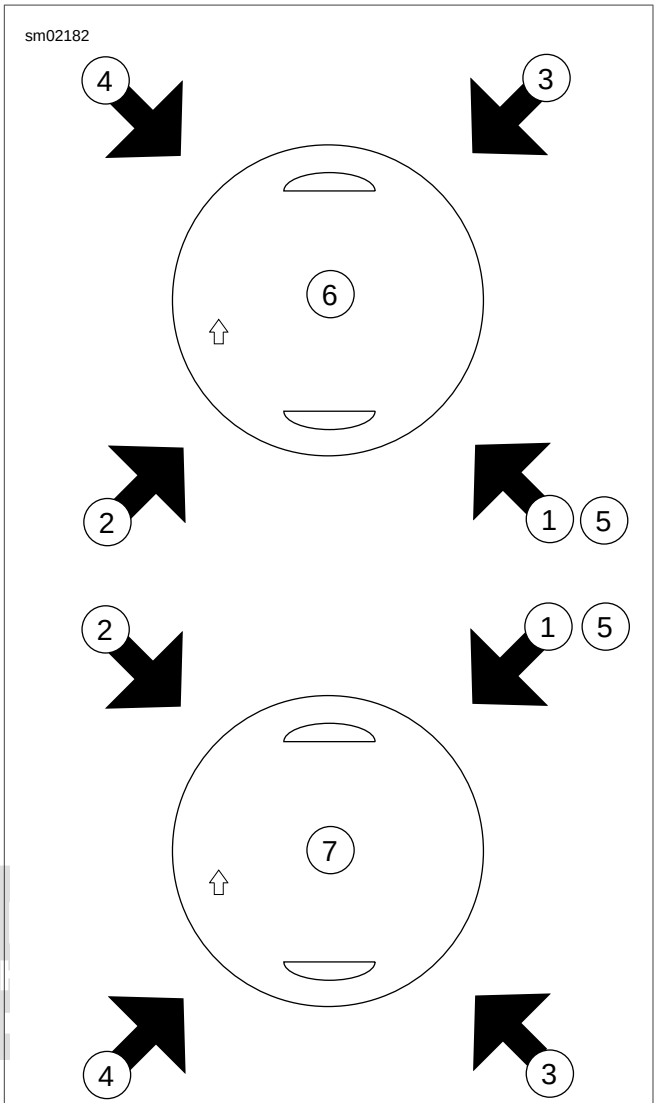
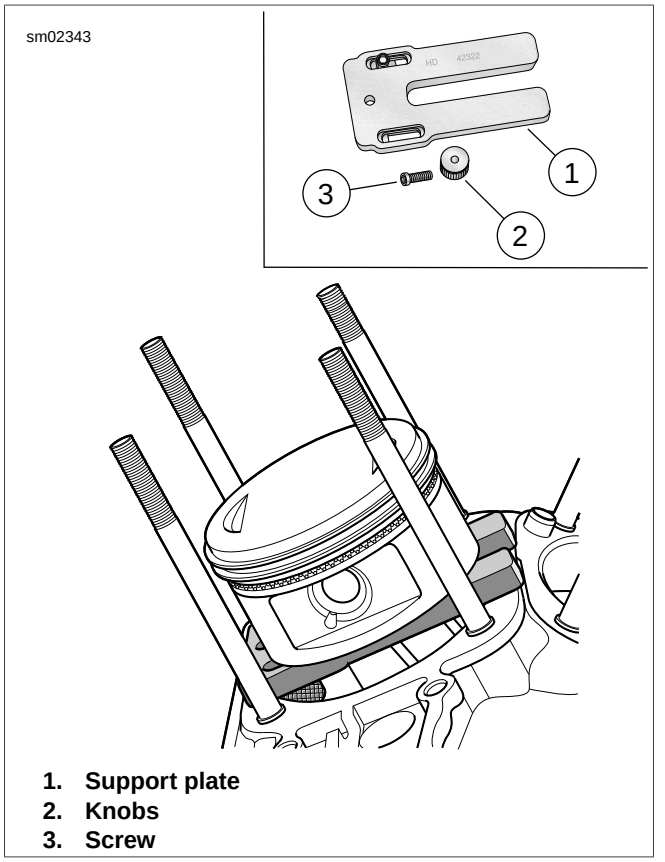



**Figure 3-29. O-ring Seal For Cylinder**



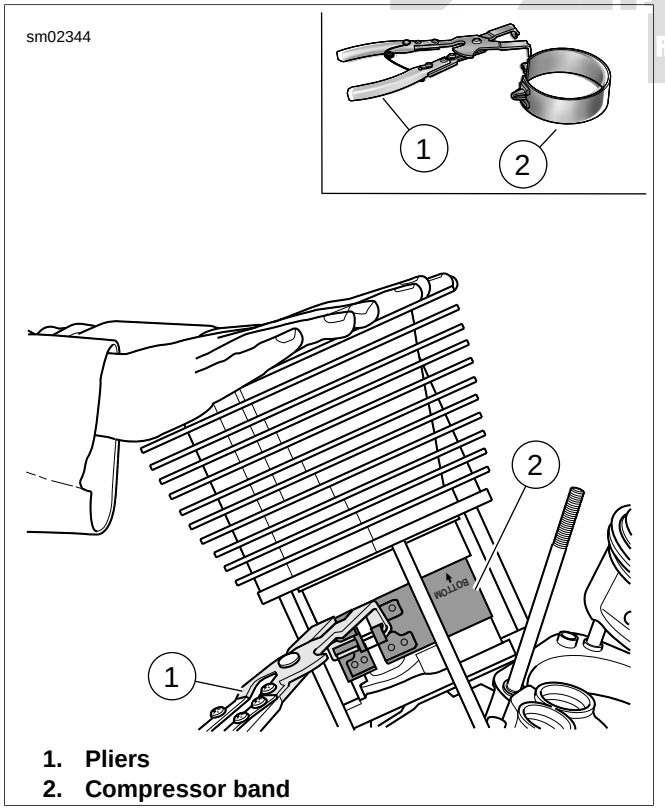

1. **Expander spring**
2. **Bottom oil rail**
3. **Top oil rail**
4. **Second compression ring**
5. **Top compression ring**
6. **Front**
7. **Rear**

**Figure 3-30. Piston Ring Alignment**




1. **Support plate**
2. **Knobs**
3. **Screw**

**Figure 3-31. Piston Support Plate**




1. **Pliers**
2. **Compressor band**

**Figure 3-32. Piston Ring Compressor**

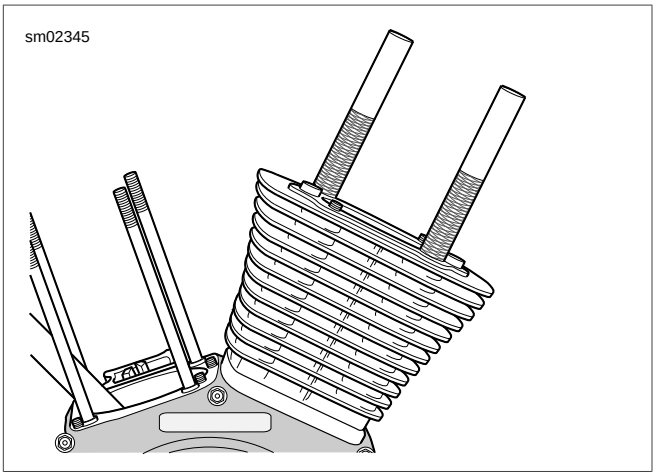



**Figure 3-33. Install Threaded Cylinders to Studs**

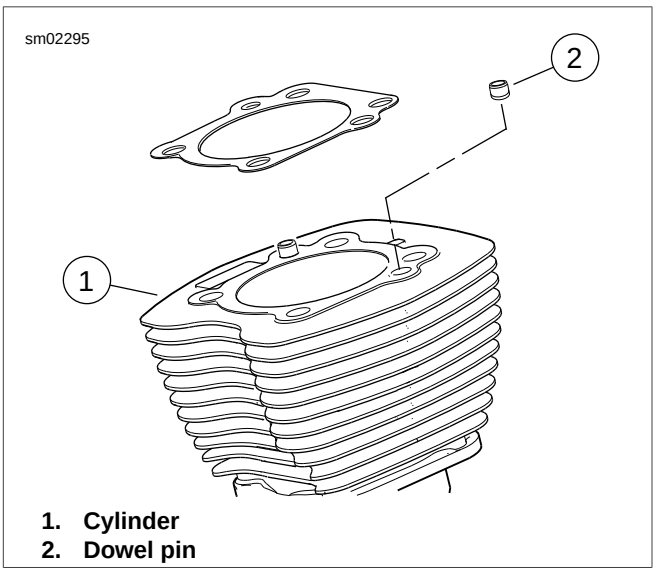
## CYLINDER HEAD

1. See Figure 3-34. With the part number topside, place the head gasket over the two dowel pins in the upper flange of the cylinder.
2. 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, gently slide cylinder head over the two cylinder flange dowel pins. Lower the cylinder head at an angle that closely approximates the angle of the crankcase to avoid damage to machined surfaces or the dowel pins.

*NOTE*

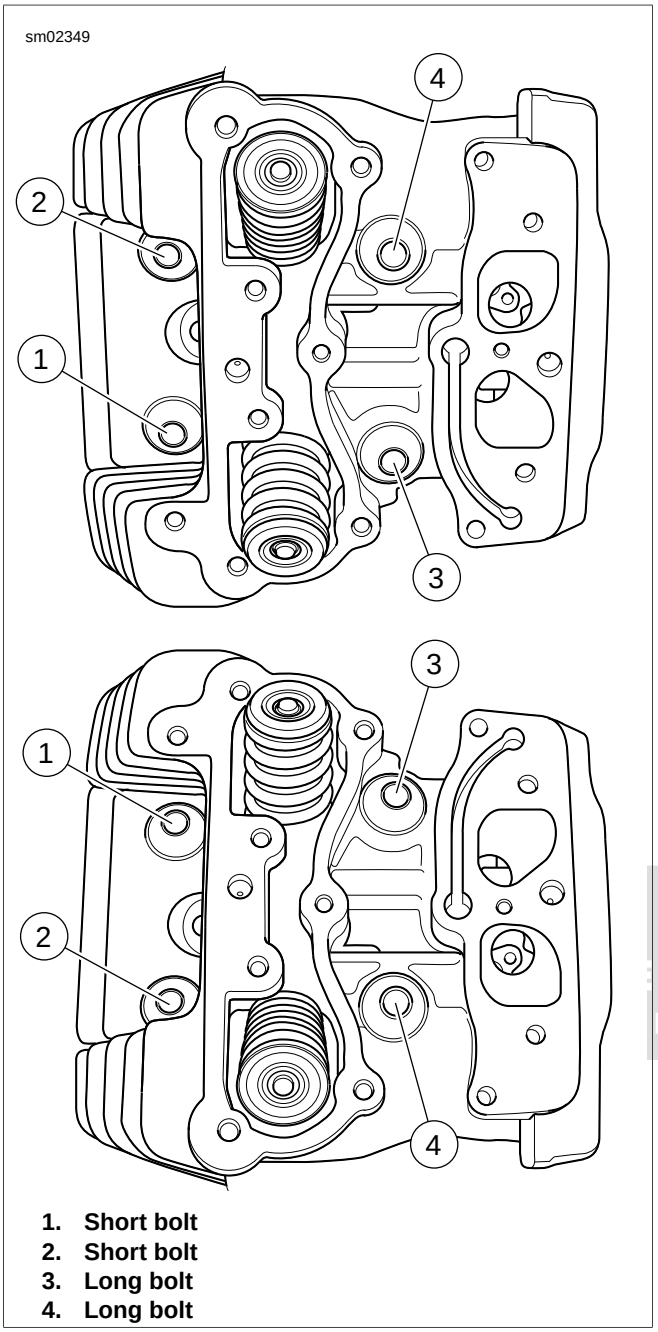
*Thoroughly clean and lubricate the threads of the cylinder head bolts before installation. Friction caused by dirt and grime will result in a false torque indication.*

3. Lightly coat the threads and bottom face of the cylinder head bolts in clean H-D 20W50 engine oil. Wipe off any excess oil.
4. See Figure 3-35. Loosely install the cylinder head bolts onto the cylinder studs. Place two short bolts on the left side of the engine and two long bolts on the right.




1. **Cylinder**
2. **Dowel pin**

**Figure 3-34. Cylinder Dowel Pins**




1. **Short bolt**
2. **Short bolt**
3. **Long bolt**
4. **Long bolt**

**Figure 3-35. Cylinder Head Bolt Torque Sequence (Top: Front Cylinder Head, Bottom: Rear Cylinder Head)**

*NOTE*

*Improperly tightened cylinder head bolts may result in gasket leaks, stud failure and distortion of the cylinder and/or cylinder head.*

5. Tighten the four cylinder head bolts.
   a. Following sequence shown, alternately turn each cylinder head bolt until finger tight.
   b. Following the same sequence, tighten the cylinder head bolts to 120-144 **in-lbs** (13.5-16.2 Nm).
   c. Continuing the same sequence, tighten each bolt to 15-17 ft-lbs (20.3-23.0 Nm).
   d. See Figure 3-36. Using a grease pencil, mark a straight line on the cylinder head bolt continuing the line over onto the cylinder head.
   e. Using the marks as a guide, turn each bolt 1/4 turn or 90 degrees. Be sure to tighten the cylinder head bolts in the sequence shown in Figure 3-35.

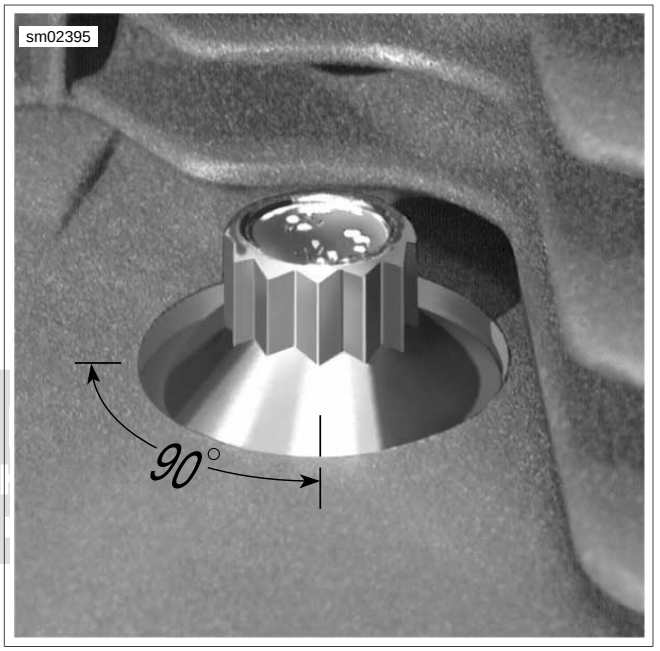
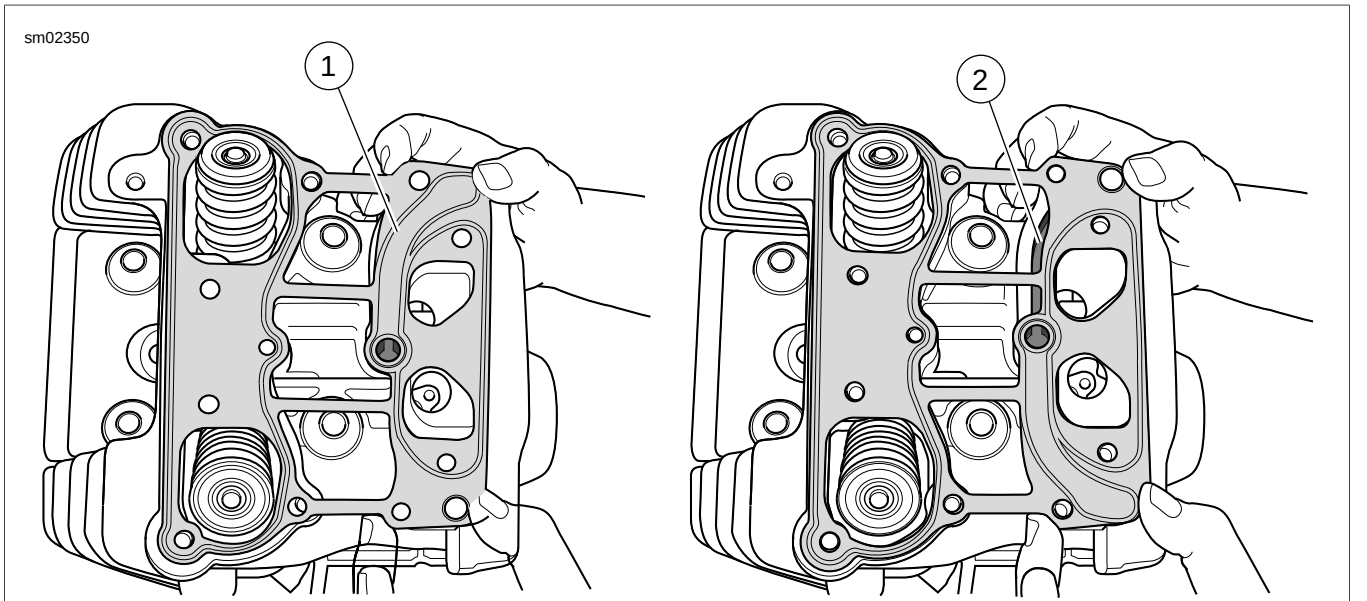



**Figure 3-36. Final Tightening for Cylinder Head Bolts**

*NOTES*

- *For best results, use SNAP-ON TORQUE ANGLE GAUGE TA360.*
- *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 a major oil leak when the vehicle is started, possibly resulting in engine and/or property damage.*
- *On front cylinder head, install side of gasket marked "front" facing up. On rear cylinder head, install side of gasket marked "rear" facing up.*

6. See Figure 3-37. Install a **new** rocker housing gasket on the cylinder head. Verify that the rocker housing gasket covers the breather channel.




1. **CORRECT: Breather channel covered**
2. **INCORRECT: Breather channel exposed**

**Figure 3-37. Install Rocker Housing Gasket (Rear Cylinder Shown)**

7. See Figure 3-39. With the indent (1) facing forward, place the rocker housing into position aligning the holes in the housing with those in the gasket.
8. See Figure 3-38. Apply a small dab of LOCTITE THREADLOCKER 243 (blue) to threads of six rocker housing bolts. Loosely install the rocker housing bolts. Place two long bolts on the left side of the engine and four intermediate bolts in the interior. Alternately tighten the bolts to 120-168 **in-lbs** (13.6-19.0 Nm) in the sequence shown.

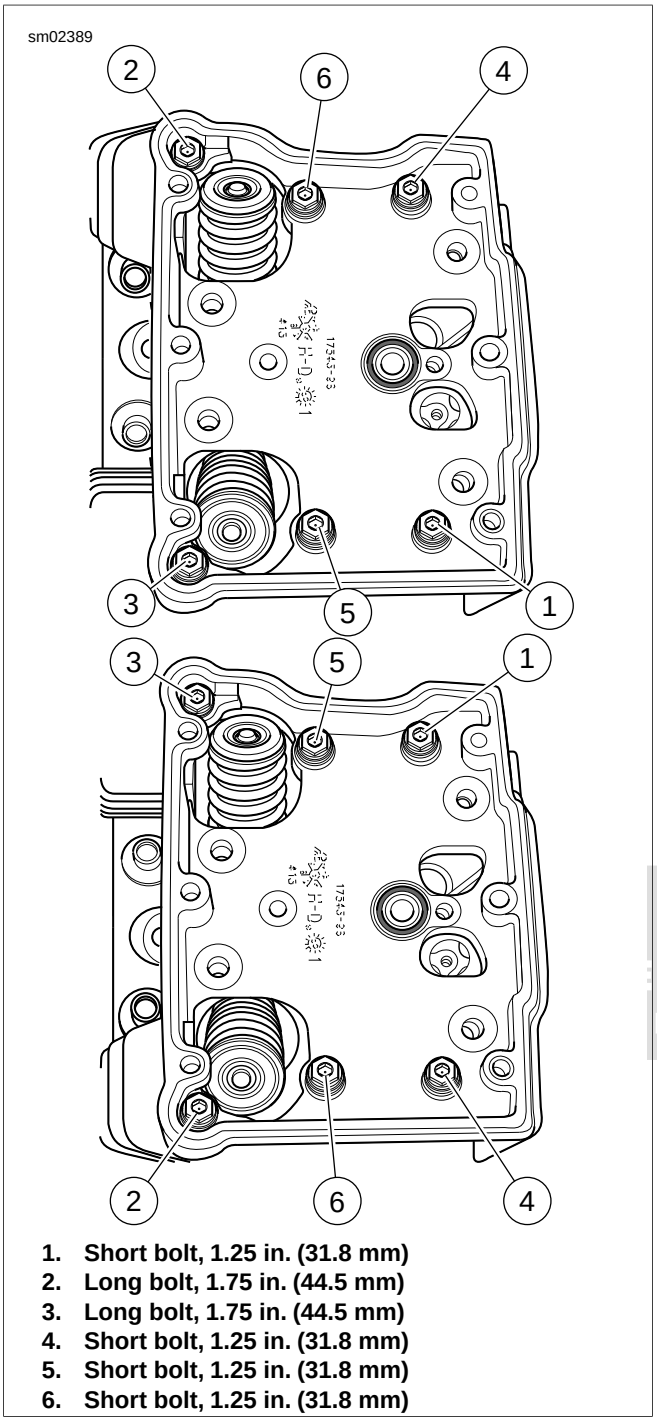
*NOTES*

- *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 in. drive.*
- *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.*

9. See Figure 3-39. Apply a very thin film of clean H-D 20W50 engine oil to **new** baffle hole o-ring (2). Install **new** o-ring in groove around breather baffle hole in rocker housing.

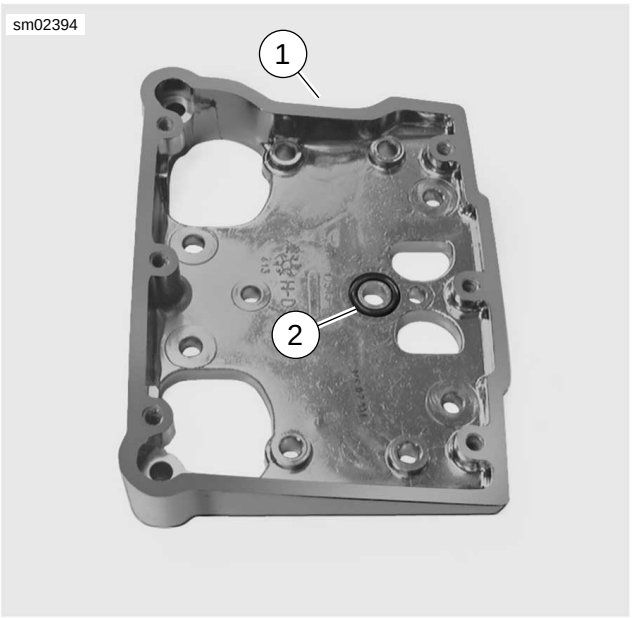
*NOTE*

*Do not confuse breather baffle hole o-ring (Part No. 11270, large inner diameter) with the top push rod o-ring (Part No. 11293, small inner diameter).*




1. **Short bolt, 1.25 in. (31.8 mm)**
2. **Long bolt, 1.75 in. (44.5 mm)**
3. **Long bolt, 1.75 in. (44.5 mm)**
4. **Short bolt, 1.25 in. (31.8 mm)**
5. **Short bolt, 1.25 in. (31.8 mm)**
6. **Short bolt, 1.25 in. (31.8 mm)**

**Figure 3-38. Rocker Housing Torque Sequence and Bolt Size**




1. **Indent**
2. **Breather baffle hole O-ring**

**Figure 3-39. Rocker Housing Alignment**

## PUSH RODS, LIFTERS AND COVERS

1. Remove any labels used on the hydraulic lifters. Install lifters in the crankcase bores with the oil hole on the inboard side and the flats on the lifters facing forward and rearward. To avoid damage, do not drop lifters onto cam lobes.
2. See Figure 3-40. Place the anti-rotational pin (4) on the machined flat between the blocks cast into the crankcase.
3. Install a **new** lifter cover gasket (2) aligning the holes in the gasket with those in the cover (1).

*NOTE*

*Movement or loss of the pin can result in lifter rotation causing engine damage.*

4. Install the lifter cover and start the four allen head socket screws (1/4 x 1.0 in). During installation, verify that the anti-rotational pin (4) is held in place by the ribs (3) cast into the inboard side of the lifter cover. Tighten the lifter cover screws to 90-120 **in-lbs** (10.2-13.6 Nm) in a cross-wise pattern.
5. Install push rod covers.
   a. Hand compress the push rod cover assembly and fit the o-ring end of the lower push rod cover into the lifter cover bore.
   b. Extending the assembly, fit the o-ring end of the upper push rod cover into the cylinder head bore.
   c. Do not install the spring cap retainers at this time.

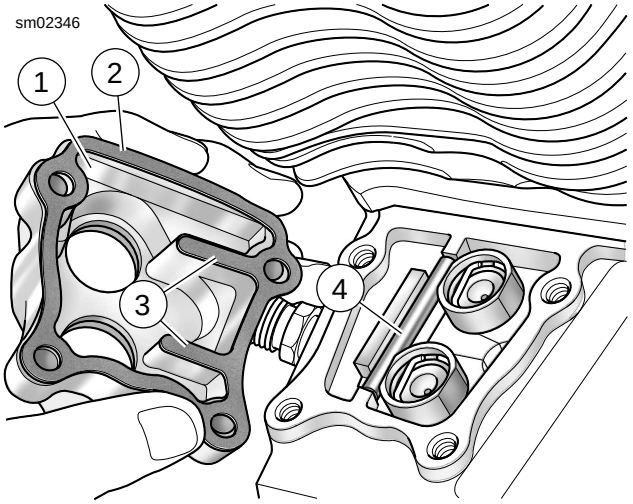
*NOTE*

*To install spring cap retainers, see 3.16 TOP END OVERHAUL: ASSEMBLY, Rocker Arm Support Plate.*

6. Refer to Table 3-32. Install the push rods in their original positions. Be sure to remove any tags that may have been used for identification.
   a. See Figure 3-41. 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.
   b. 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.

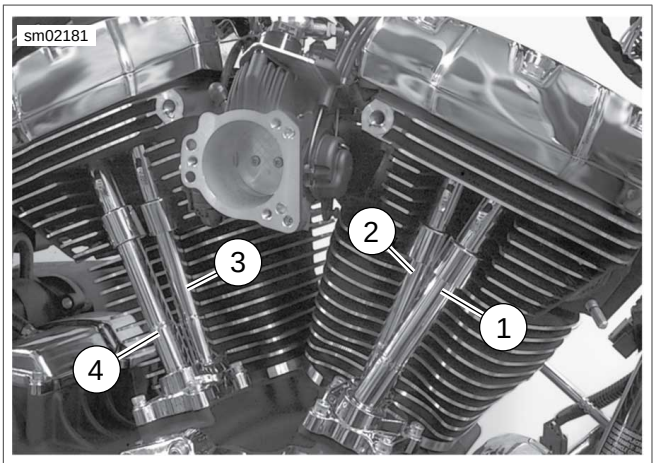
**Table 3-32. Push Rod/Lifter Locations**

| CYL-INDER | COVER & PUSH ROD | LIFTER BORE COVER | CYLINDER HEAD/ROCKER HOUSING BORE |
|---|---|---|---|
| Front | Intake | Inside | Rear |
| | Exhaust | Outside | Front |
| Rear | Intake | Inside | Front |
| | Exhaust | Outside | Rear |




1. **Cover**
2. **Gasket**
3. **Ribs on cover**
4. **Anti-rotational pin**

**Figure 3-40. Installing Lifters**




1. **Front cylinder exhaust push rod**
2. **Front cylinder intake push rod**
3. **Rear cylinder intake push rod**
4. **Rear cylinder exhaust push rod**

**Figure 3-41. Push Rod Locations**

## ROCKER ARM SUPPORT PLATE

Installing the rocker arms and rotating the engine with the valve train loaded can result in bent push rods, damaged bushings or a warped support plate.

1. 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. To rotate engine, see 3.16 TOP END OVERHAUL: ASSEMBLY, Rocker Arm Support Plate.
2. See Figure 3-42. Place the rocker arm support plate assembly into the rocker housing. Loosely install the four rocker arm support plate bolts with flat washers.

*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 in. drive torque wrench with a 1/2 in. flank drive "dog bone" torque adapter (Snap-on FRDH161). Failure to properly use this combination will overtighten the bolts causing distortion of the rocker housing.*

3. Tighten rocker arm support plate bolts.
   a. Following the sequence shown, alternately tighten each of the four rocker arm support plate bolts just 1/4 turn. Continue turning the bolts in these increments until snug.
   b. Following the same sequence, tighten the bolts to 18-22 ft-lbs (24.4-29.8 Nm).
4. 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.*

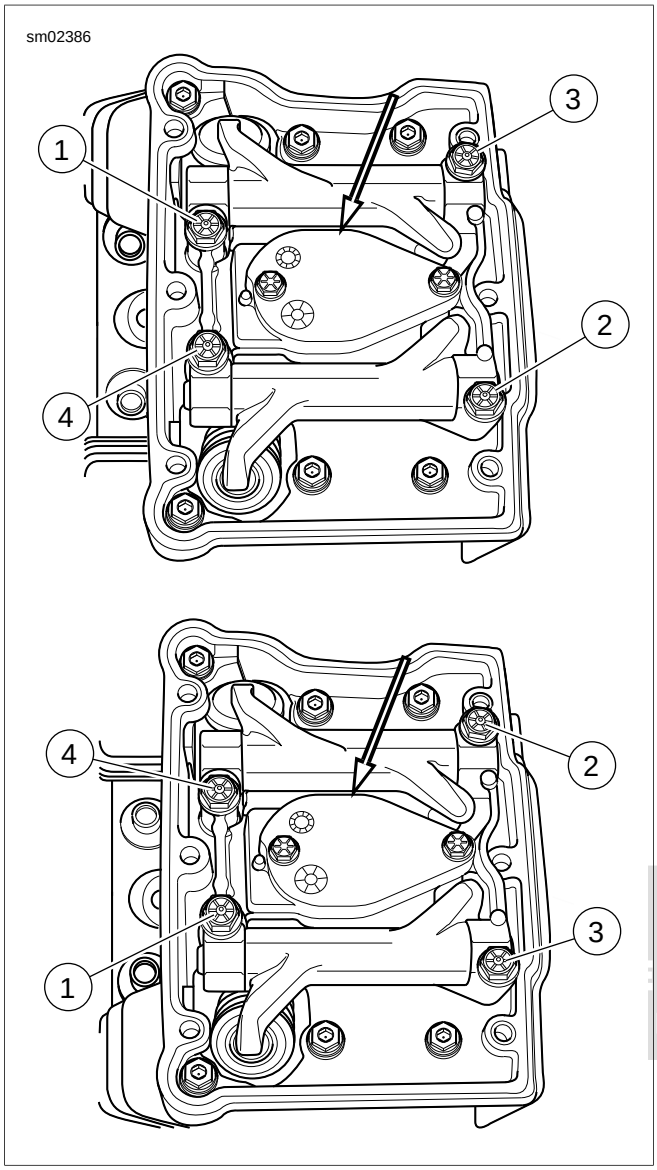



**Figure 3-42. Rocker Arm Torque Sequence**

5. Complete installation of the push rod covers.
   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. Insert 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.

*NOTE*

*For best results, be sure that screwdriver, spring cap and spring cap retainer are free of grease and oil.*

   d. See Figure 3-43. 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.
   e. Verify that spring cap retainer is seated tightly against upper push rod cover.


**Figure 3-43. Install Spring Cap Retainers**

## BREATHER ASSEMBLY

*NOTE*

*For breather assembly service procedures, see 3.19 BREATHER ASSEMBLY.*

1. See Figure 3-45. Alternately tighten the two bolts to secure breather assembly to 90-120 **in-lbs** (10.2-13.6 Nm).
2. See Figure 3-44. Install a **new** rocker cover gasket with indent facing forward on the rocker housing flange. Place the rocker cover into position aligning the holes in the cover with those in the gasket.

*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 in. drive torque wrench with a 7/16 in. flank drive "dog bone" torque adapter (Snap-on FRDH141). Failure to properly use this combination will overtighten the bolts causing distortion of the rocker cover.*

3. Figure 3-45. Install rocker cover bolts.
   a. Apply a small dab of LOCTITE THREADLOCKER 243 (blue) to threads of six rocker cover bolts.
   b. Loosely install bolts in the rocker cover.
   c. Following the sequence shown, tighten bolts to 15-18 ft-lbs (20.3-24.4 Nm).
4. Complete motorcycle assembly.
   a. If engine was left in the chassis for service, see 3.12 ASSEMBLING MOTORCYCLE AFTER SERVICE.
   b. If engine was removed for service, see 3.14 INSTALLING ENGINE IN CHASSIS.

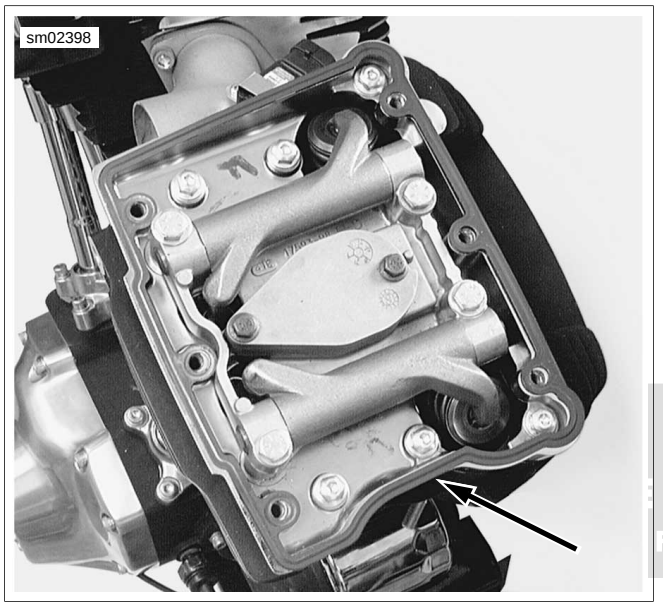
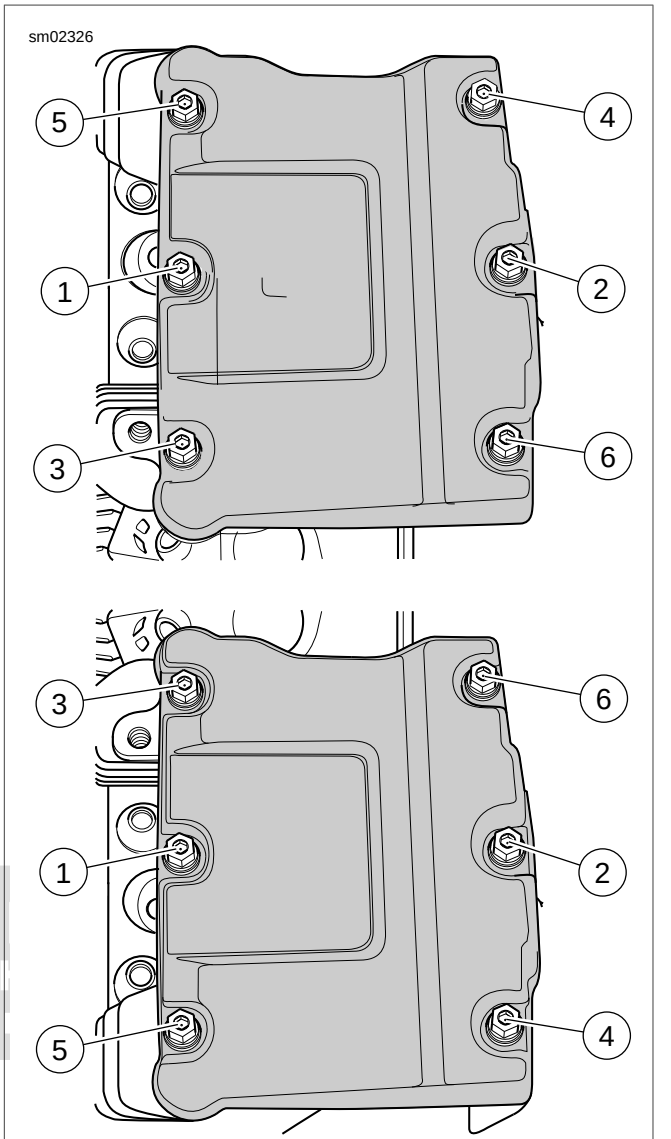



**Figure 3-44. Rocker Cover Gasket Indent (Front Cylinder Shown)**




1. **Short bolt, 1.0 in. (25.4 mm)**
2. **Long bolt, 1.75 in. (44.5 mm)**
3. **Short bolt, 1.0 in. (25.4 mm)**
4. **Long bolt, 1.75 in. (44.5 mm)**
5. **Short bolt, 1.0 in. (25.4 mm)**
6. **Long bolt, 1.75 in. (44.5 mm)**

**Figure 3-45. Rocker Cover Bolts Torque Sequence**

## GENERAL

To perform a complete bottom end overhaul, follow all steps listed in this section including inspection and repair procedures.

## COVER AND CAM SUPPORT PLATE

| PART NUMBER | TOOL NAME |
|---|---|
| HD-47941 | CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL |

### Prepare Engine

1. If performing a complete engine overhaul, perform all steps under 3.15 TOP END OVERHAUL: DISASSEMBLY.
2. If only servicing cam compartment components, partial top end disassembly is required. Remove breather assembly, rocker arm support plate, push rods and push rod covers. Do not remove lifters. See appropriate topics under 3.15 TOP END OVERHAUL: DISASSEMBLY.
3. Support lifters using improvised tool as described under 3.25 COVER AND CAM SUPPORT PLATE.
4. See Figure 3-46. Remove the ten allen head socket screws with captive washers to release the cam cover. Remove and discard the cam cover gasket.

*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 in.). Only the cam cover uses the longer screw (1/4 x 1-1/4 in.). For ease of assembly, do not mix the short and long screws. Store the long screws inside the cam cover to avoid confusion. The short screws are interchangeable.*

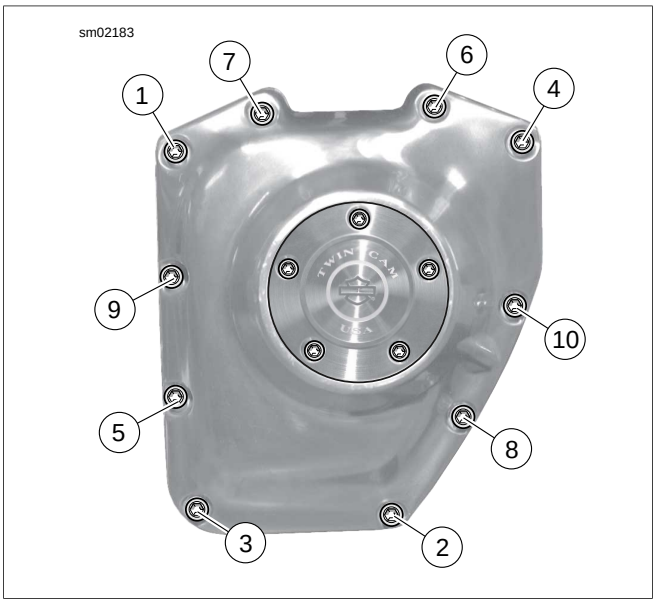



**Figure 3-46. Cam Cover Screws**

### Cam Chain and Sprockets

1. See Figure 3-47. Using a colored marker, mark one of the links (1) of the primary cam chain. Maintaining the original direction of rotation during assembly may prolong service life.

**WARNING**

**Be sure to follow manufacturer's instructions when using propane torches. Failure to follow manufacturer's instructions can cause a fire, which could result in death or serious injury. (00465c)**

- Avoid directing heat toward any fuel system component. Extreme heat can cause fuel ignition/explosion resulting in death or serious injury.
- Avoid directing heat toward any electrical system component other than the connectors on which heat shrink work is being performed.
- Always keep hands away from tool tip area and heat shrink attachment.

*NOTE*

*A piece of wire can be inserted into retention hole (6) to keep cam chain tensioner components assembled.*

2. Remove primary cam chain tensioner fasteners (4) and primary cam chain tensioner (3).

*NOTE*

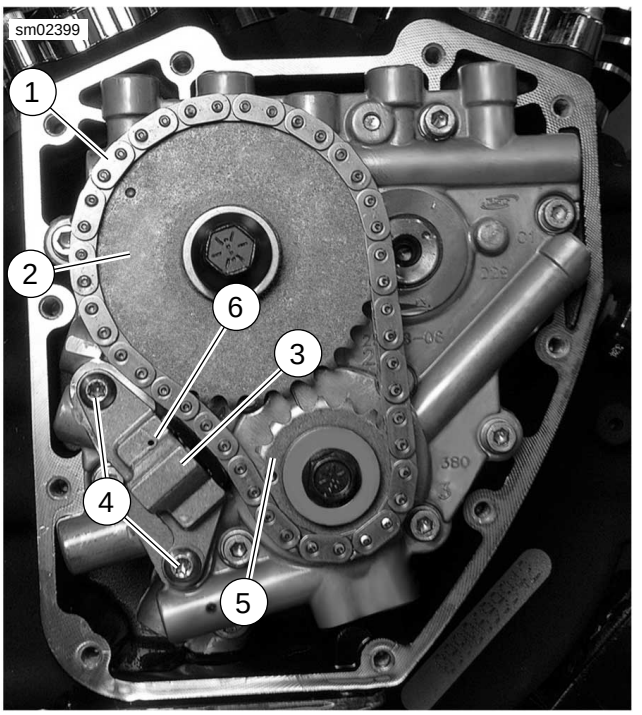
*In next step, be sure side of tool labeled "crank side" faces crank sprocket.*

3. See Figure 3-48. Install CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL (Part No. HD-47941) between cam sprocket (2) and crank sprocket (5).

*NOTES*

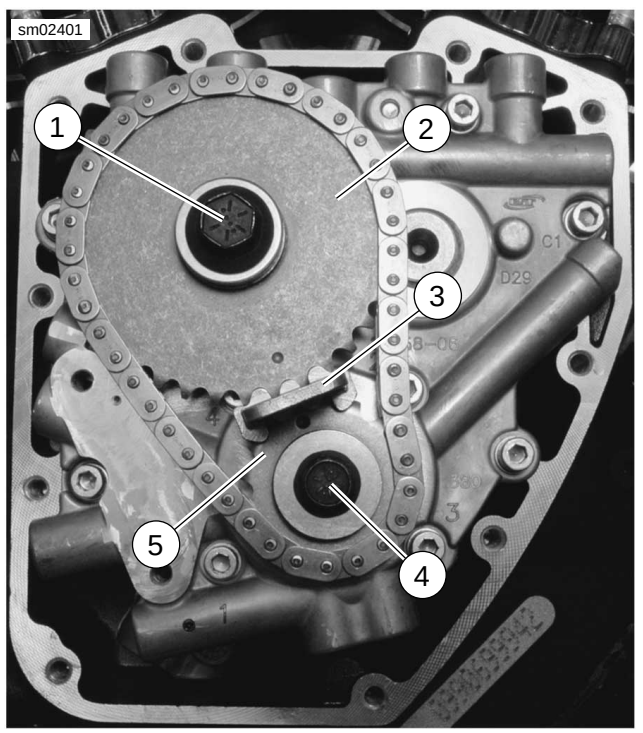
- *Only use approved methods for removing rear cam bolt. Other methods of removal, such as the use of a large breaker bar, may result in damage to chain drive and other components.*
- *If too much LOCTITE or perhaps the wrong LOCTITE was used to install the rear cam bolt, it may be very difficult to remove. In these cases, break down LOCTITE by using heat from a small propane torch. Apply flame evenly around bolt in a circular motion, but not for so long as to turn bolt blue.*

4. Remove the rear cam sprocket bolt and flat washer (1) from the rear cam sprocket (2).
5. Remove the crank sprocket bolt and flat washer (4) from the crank sprocket (5).
6. Remove CAMSHAFT LOCKING TOOL.
7. Insert small pry bar (seal remover) between inboard side of rear cam sprocket and cam support plate. Working around its circumference, carefully ease off rear cam sprocket until loose on camshaft.
8. Ease off crank sprocket with a slightly smaller pry bar (seal remover). Remove the rear cam sprocket, primary cam chain and crank sprocket.




1. Link
2. Rear cam sprocket
3. Primary cam chain tensioner
4. Primary cam chain tensioner fasteners
5. Crank sprocket
6. Retention hole

**Figure 3-47. Cam Support Plate Assembly**




1. Rear cam sprocket bolt (large) and flat washer
2. Rear cam sprocket
3. Camshaft locking tool (HD-47941)
4. Crank sprocket bolt (small) and flat washer
5. Crank sprocket

**Figure 3-48. Cam Support Plate Assembly**



## Cam Support Plate

1. See Figure 3-49. Following the sequence shown, alternately loosen and then remove the four allen head socket screws with captive washers to release the cam support plate from the oil pump flange.
2. See Figure 3-50. Following the sequence shown, alternately loosen and then remove the six allen head socket screws with captive washers to release the cam support plate from the crankcase flange.

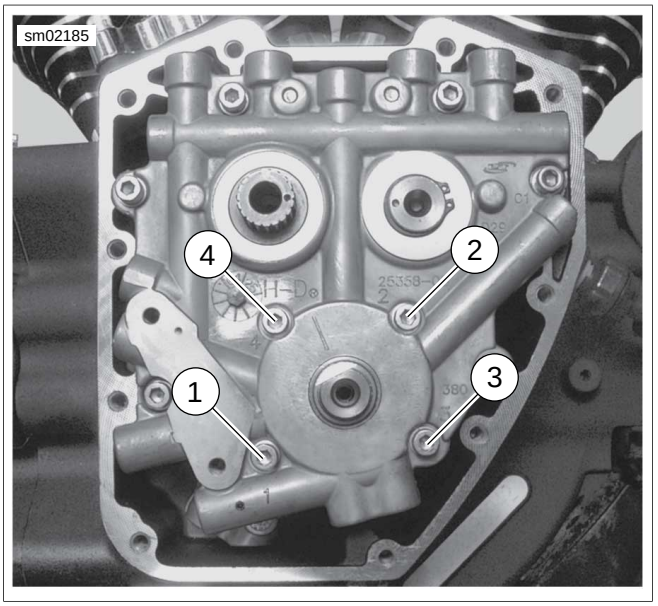



**Figure 3-49. Oil Pump Torque Sequence**

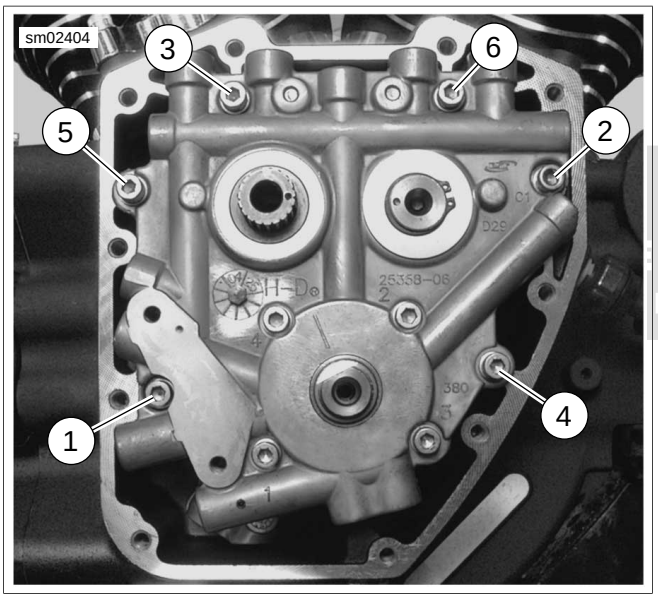
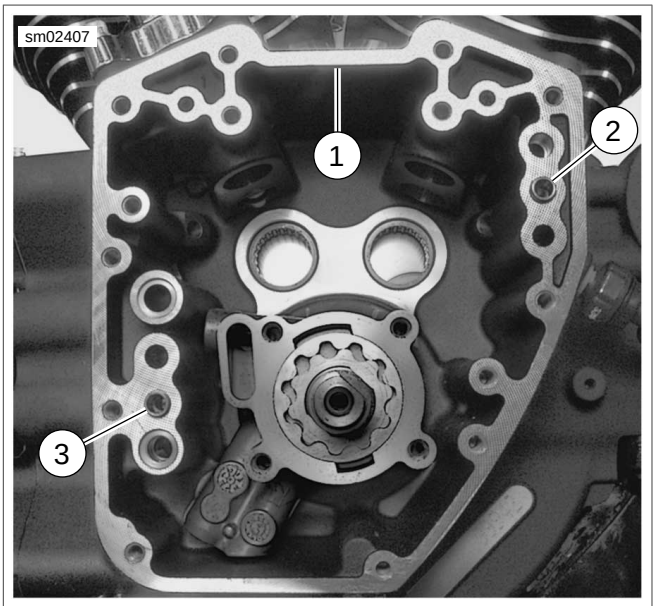



**Figure 3-50. Cam Support Plate Torque Sequence**

3. See Figure 3-51. Two ring dowels (2, 3) in crankcase flange locate cam support plate.
   a. Insert small pry bar (seal remover) between inboard side of cam support plate and crankcase flange in area adjacent to ring dowels.
   b. Alternately work each side free and then carefully ease cam support plate and camshafts from end of crankshaft.
4. See 3.25 COVER AND CAM SUPPORT PLATE for inspection and repair information.




1. **Right crankcase half**
2. **Forward ring dowel**
3. **Rear ring dowel**

**Figure 3-51. Ring Dowels**

## CRANKCASE

1. Carefully pull oil pump from crankshaft.
2. See Figure 3-52. Remove o-rings (1, 2) from crankcase housing. Discard o-rings. See 3.26 OIL PUMP for inspection and repair information.

*NOTE*

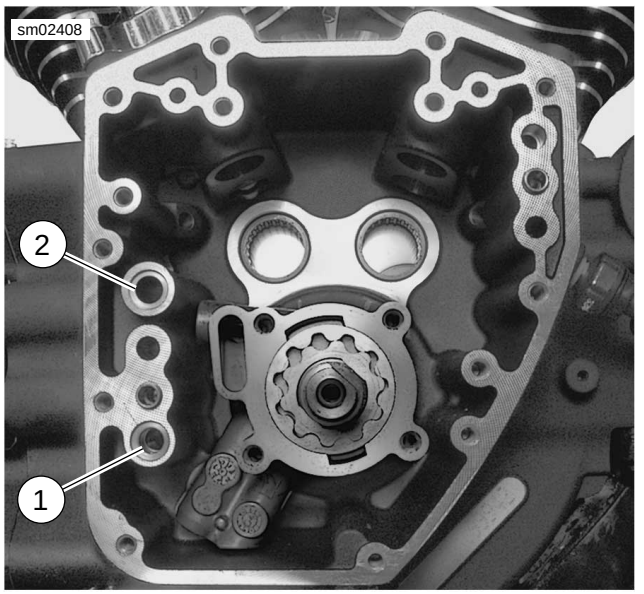
*Do NOT rotate left crankcase half in the engine stand so the flywheel sprocket shaft is facing up. The flywheel assembly will fall out of the case.*

3. Rotate crankcase in the engine stand so that the cam cover flange is facing straight upward.
4. See Figure 3-53. Remove the nine crankcase bolts in the sequence shown.

*NOTE*

*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.*

5. Using pry points, loosen case halves. Lift right crankcase half off end of crankshaft.
6. See Figure 3-54. Remove two dowel pins in split line face of right case half.
7. For inspection and repair information, see 3.27 CRANKCASE.




1. Oil feed hole O-ring
2. O-ring on crankcase post

**Figure 3-52. Oil Pump O-rings**

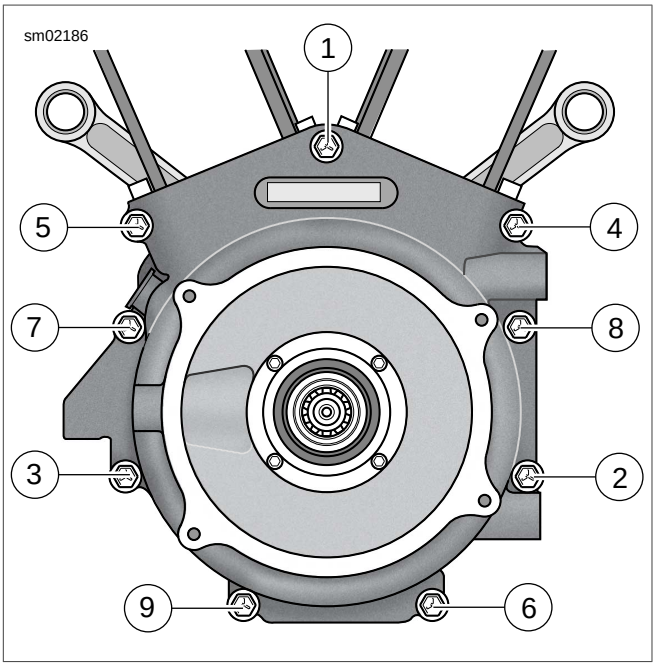



**Figure 3-53. Crankcase Bolt Sequence**

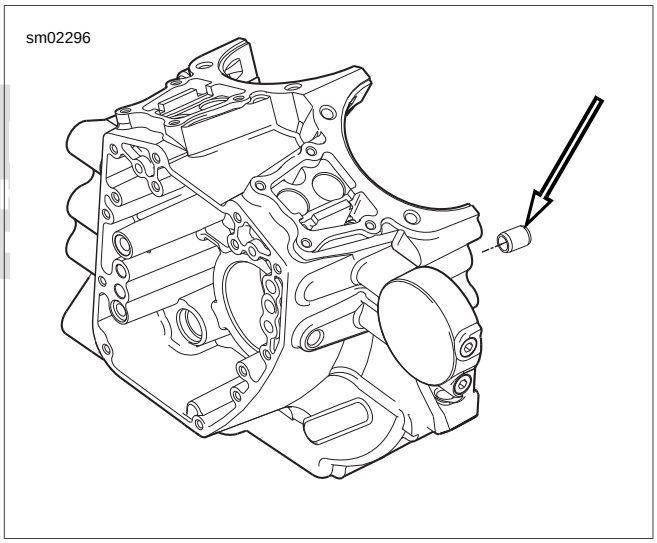



**Figure 3-54. Right Crankcase Forward Dowel Pin (Rear Dowel Pin Not Shown)**

## GENERAL

This section lists a sequential process for engine reassembly after a complete bottom end disassembly and overhaul. If you reached this section after an inspection or repair procedure, start where necessary and continue to the end of the section.

- Crankcase installation: see 3.27 CRANKCASE.
- Cover and cam support plate installation: see 3.18 BOTTOM END OVERHAUL: ASSEMBLY, Cover and Cam Support Plate.

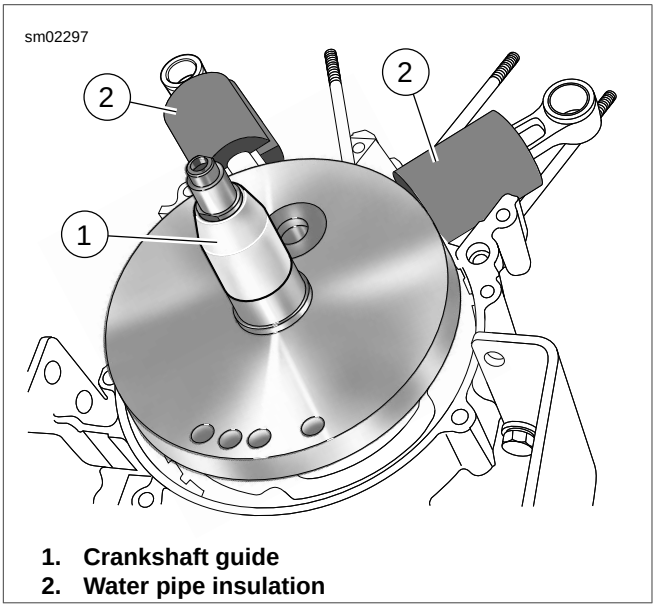
## CRANKCASE

| PART NUMBER | TOOL NAME |
|---|---|
| 99650-02 | HIGH-PERFORMANCE SEALANT, GRAY |
| HD-39361-B | SPROCKET SHAFT OIL SEAL INSTALLER |
| HD-42326-B | CRANKSHAFT GUIDE |
| HD-97225-55C | SPROCKET SHAFT BEARING INSTALLER |

*NOTE*

*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. Bolt left crankcase half upright in engine stand.
2. To facilitate assembly and prevent damage to the crankshaft (roller) bearing in the left crankcase half, slide CRANKSHAFT GUIDE (Part No. HD-42326-B) onto flywheel sprocket shaft.
3. Slide flywheel assembly into left crankcase half. Remove CRANKSHAFT GUIDE tool.
4. Tip crankcase assembly in engine stand so that flywheel sprocket shaft is pointing straight up.
5. Ensure both dowel pins are installed in split line face of right case half.
6. With the right crankcase half resting on the cam cover flange, apply a bead of sealant approximately 0.056 in. (1.42 mm) wide to the split line face and around the two dowel pins. For best results, use HIGH-PERFORMANCE SEALANT, GRAY (Part No. 99650-02).
7. See Figure 3-55. To facilitate assembly and prevent damage to the crankshaft (roller) bearing in the right crankcase half, place CRANKSHAFT GUIDE (1) (Part No. HD-42326-B) over end of crankshaft until it contacts shoulder on shaft.
8. Mate case halves sliding bearing roller in right crankcase half over end of crankshaft. Remove CRANKSHAFT GUIDE.




1. **Crankshaft guide**
2. **Water pipe insulation**

**Figure 3-55. Crankshaft Guide (Part No. HD-42326-A)**

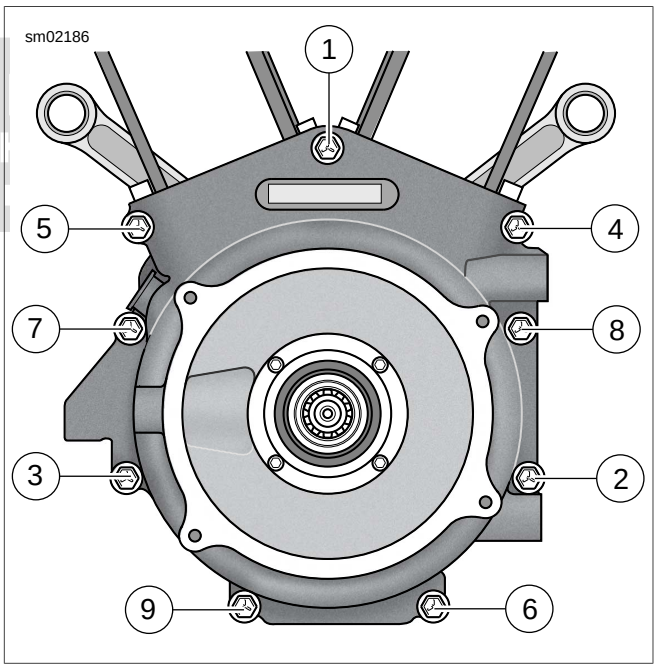
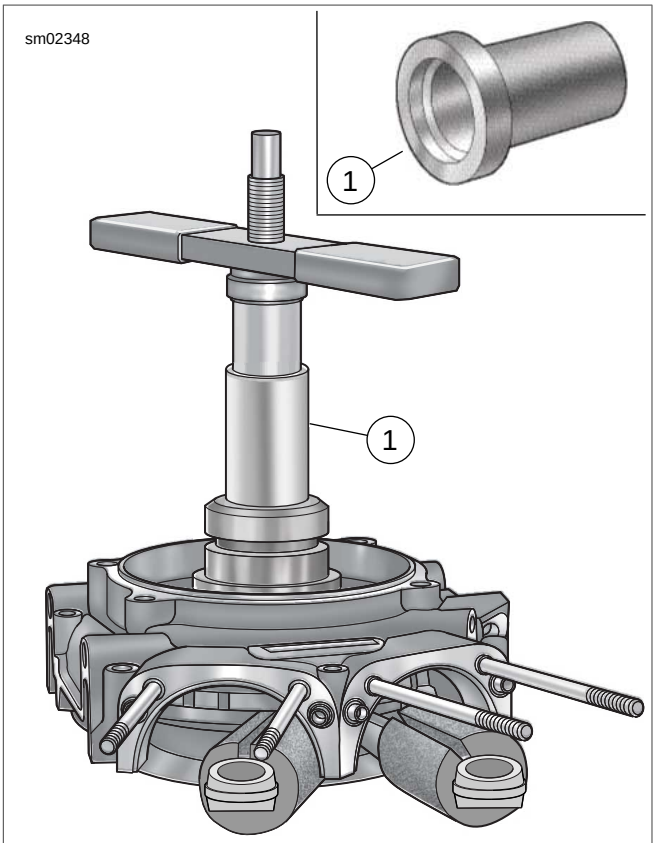



**Figure 3-56. Tightening Crankcase Bolts**

9. See Figure 3-56. Start the nine crankcase bolts and tighten in the following sequence.
   a. Alternately turn each crankcase bolt until finger tight.
   b. Tighten the crankcase bolts to 10 ft-lbs (13.6 Nm) in the order shown.
   c. Following the same sequence, tighten each bolt to to 15-19 ft-lbs (20.3-25.8 Nm).
10. Tip crankcase assembly so that sprocket shaft is pointing straight up.

11. Install thrust washer on sprocket shaft with "THIS SIDE OUT" facing out (and the chamfer inboard). If using OE part without markings, orient as required to preserve existing wear pattern.
12. See Figure 3-57. Install **new** oil seal into bearing bore. Obtain pilot adapter, pilot shaft, short collar, Nice bearing, large flat washer and handle from SPROCKET SHAFT BEARING INSTALLER (Part No. HD-97225-55C).
    a. Thread pilot adapter into sprocket shaft.
    b. Thread pilot shaft onto pilot adapter.
    c. Verify that lip garter spring is in place on both sides of oil seal.
    d. Install sprocket shaft spacer in oil seal bore.
    e. With the lettering on the oil seal facing outside, slide sprocket shaft spacer and oil seal over pilot shaft until it contacts bearing bore.
    f. Slide SPROCKET SHAFT OIL SEAL INSTALLER (Part No. HD-39361-B) over pilot shaft until it contacts oil seal.
    g. Slide short collar over pilot shaft until it contacts seal installer.
    h. Slide Nice bearing and large flat washer over pilot shaft.
    i. Sparingly apply graphite lubricant to threads of pilot shaft to prolong service life and ensure smooth operation.
    j. Thread handle onto pilot shaft to complete assembly of tool.
13. Rotate handle in a clockwise direction until oil seal installer makes firm contact with crankcase stator mount.
14. Remove handle, flat washer, Nice bearing, short collar, seal installer, pilot shaft and pilot adapter from sprocket shaft.
15. Rotate crankcase in engine stand so that cam cover flange is facing upward.




**1. Seal Installer**

**Figure 3-57. Sprocket Shaft Oil Seal Installer**



*NOTE*

*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.*

16. See Figure 3-58. Assemble and install oil pump. Lubricate parts with clean H-D 20W50 engine oil during assembly.
    a. Apply a very thin film of clean H-D 20W50 engine oil to **new** scavenge port stub o-ring (6). Install **new** o-ring on scavenge port stub of oil pump housing.
    b. Slide oil pump housing (5) 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 (4) (scavenge) and the other narrow (1) (feed).

*NOTE*

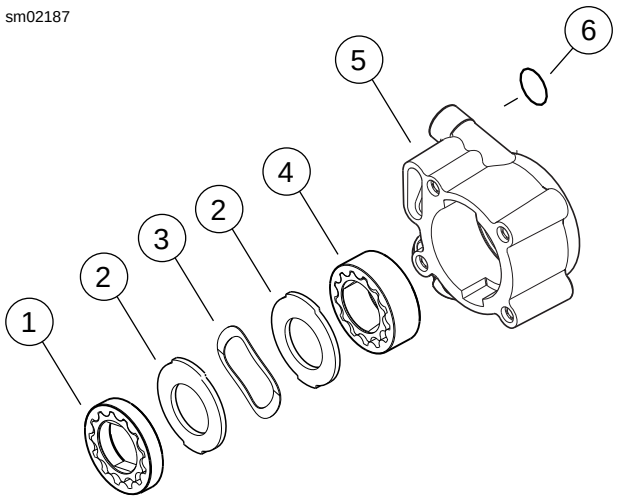
*Lubricate oil pump parts with clean H-D 20W50 motor oil during assembly.*

d. Fit the smaller of the wide gerotor gears into the larger. Slide the wide gerotor set (4) down the crankshaft until it bottoms in the oil pump housing.

e. Slide inside separator plate (2) down the crankshaft until it contacts the wide gerotor set (4). Install wave washer (3) and outside separator plate (2).

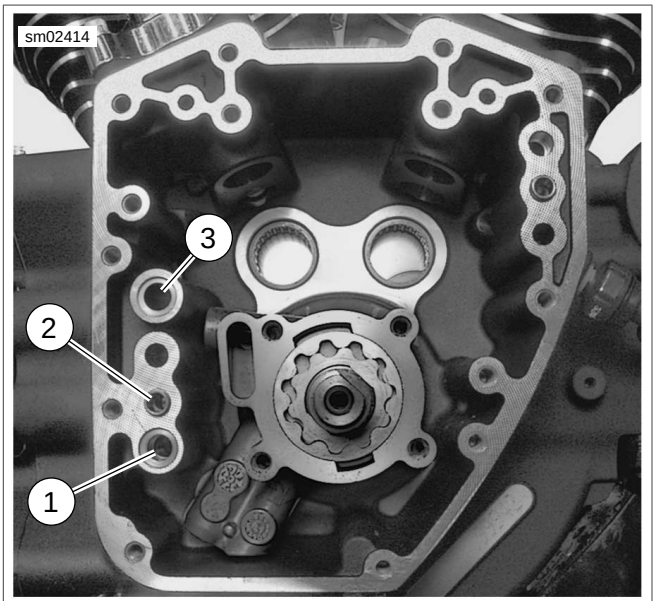
f. Fit the smaller of the narrow gerotor gears into the larger. Slide the narrow gerotor set (1) down the crankshaft until it contacts the outside separator plate (2).

g. See Figure 3-59. Apply a very thin film of clean H-D 20W50 engine oil to **new** o-ring (3) for crankcase post. Install **new** o-ring in groove on crankcase post.




1. **Narrow gerotor set (feed)**
2. **Separator plate**
3. **Wave washer**
4. **Wide gerotor set (scavenge)**
5. **Oil pump housing**
6. **Scavenge port O-ring**

**Figure 3-58. Assembling Oil Pump**




1. **Oil feed hole O-ring**
2. **Rear ring dowel**
3. **O-ring on crankcase post**

**Figure 3-59. Oil Feed Hole**

## COVER AND CAM SUPPORT PLATE

| PART NUMBER | TOOL NAME |
|---|---|
| HD-47941 | CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL |

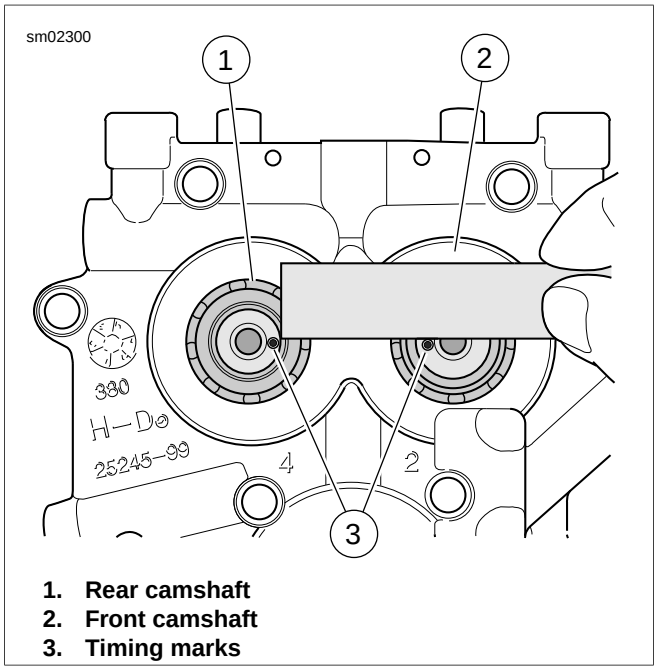
*NOTE*

*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. See Figure 3-59. Apply a very thin film of clean H-D 20W50 engine oil to **new** o-ring (1) for crankcase flange. Install **new** o-ring in groove around oil feed hole directly below rear ring dowel (2).

2. Lubricate cam needle bearings with clean H-D 20W50 engine oil.

3. See Figure 3-60. Using a straightedge, verify that the timing marks on the ends of the front and rear camshafts are in alignment. If necessary, rotate camshafts in order to make this observation.




1. **Rear camshaft**
2. **Front camshaft**
3. **Timing marks**

**Figure 3-60. Verify Alignment of Timing Marks**

4. 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.
5. See Figure 3-61. Install cam support plate screws.
   a. Loosely install the six screws (1/4 x 1.0 in.) to secure the cam support plate to the crankcase flange.
   b. Tighten screws to 90-120 **in-lbs** (10.2-13.6 Nm) in the sequence shown.
6. See Figure 3-62. Install oil pump.
   a. Start four screws (1/4 x 1.0 in.) to secure oil pump.

   *NOTE*

   *For methods of engine rotation, see 3.15 TOP END OVERHAUL: DISASSEMBLY, Rocker Arm Support Plate.*

   b. While rotating the engine, enabling the pump to find its natural center, alternately tighten screws (1 and 2) until snug.
   c. Tighten the screws (3 and 4) until snug.
   d. Tighten all four screws to 40-45 **in-lbs** (4.5-5.1 Nm) in sequence shown.
   e. Final tighten all four screws to 90-120 **in-lbs** (10.2-13.6 Nm) in the sequence shown. Numbers cast adjacent to the bolt holes also indicate the oil pump torque sequence.
7. With the lettering facing inboard, install rear cam sprocket spacer onto the rear camshaft.

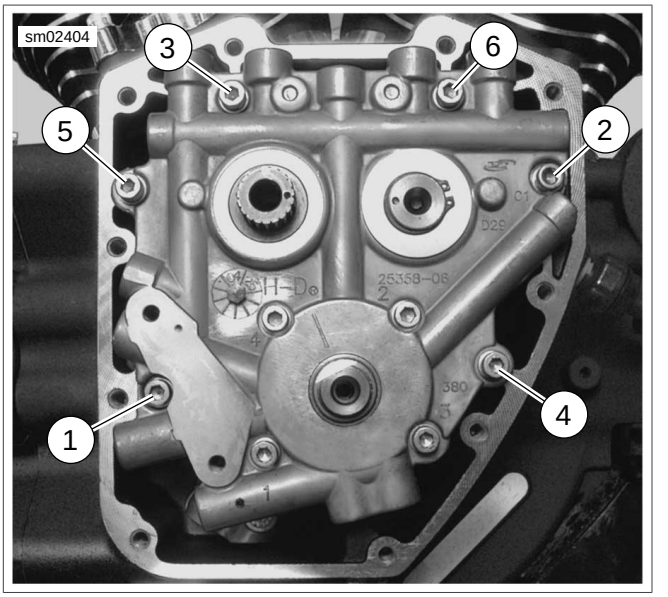



**Figure 3-61. Cam Support Plate Torque Sequence**

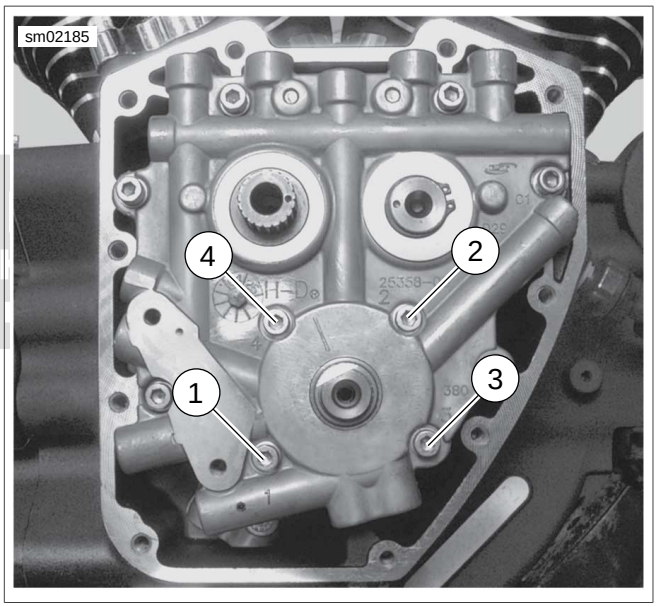



**Figure 3-62. Oil Pump Torque Sequence**

8. If using the original cam support plate, camshafts, primary cam sprocket, crank sprocket and flywheel assembly, then move to next step. 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 a temporary smaller diameter flat washer from bulk inventory.

*NOTE*

*Use of smaller diameter flat washer with crank sprocket flange bolt allows room on sprocket face for placement of straightedge.*

c. See Figure 3-63. To prevent rotation, position the CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL (Part No. HD-47941) between the crank and primary cam sprockets. 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. Rotate engine stand so cam compartment is pointing upward. Push on crankshaft and rear camshaft to eliminate endplay.

   If engine was not removed from motorcycle, install compensating sprocket assembly to pull the crankshaft to the left side of the engine. Push on crankshaft and rear camshaft to eliminate endplay.

e. See Figure 3-64. Place a straightedge across the crank and primary sprocket faces. Attempt to insert a 0.010 in. (0.254 mm) feeler gauge between the straightedge and the each sprocket face. If the feeler gauge will not fit at either location, sprocket offset is within specification. Remove both sprockets and discard temporary small washer.

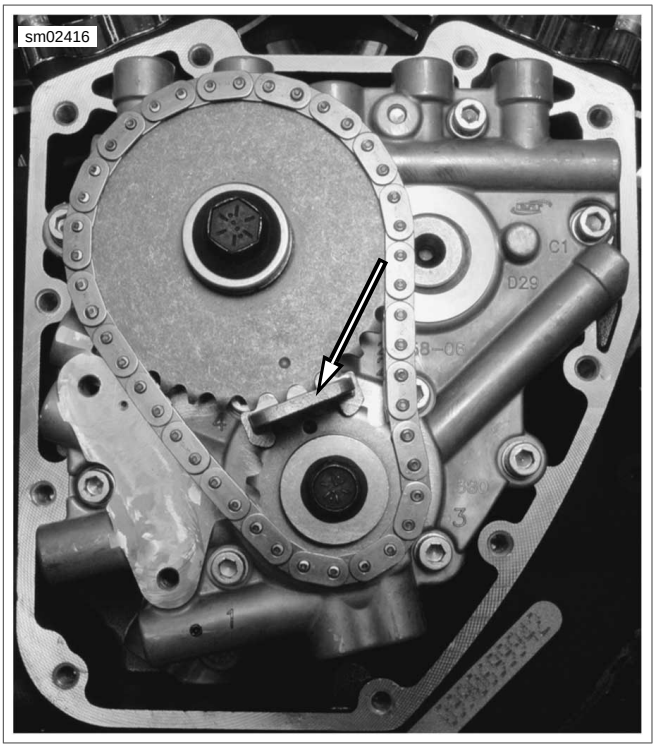



**Figure 3-63. Camshaft Locking Tool**

*NOTE*

*Height differences between rear cam sprocket and crank sprocket can be addressed by changing the spacer behind the rear cam sprocket. See spacer sizes in Table 3-33.*

f. If the crank sprocket rises above the face of the rear cam sprocket more than 0.010 in. (0.254 mm), remove the flange bolt and rear cam sprocket. Note the part number stamped on the existing spacer behind rear cam sprocket. Replace spacer with the next larger size.

   If the rear cam sprocket rises above the face of the crank sprocket more than 0.010 in. (0.254 mm), replace the spacer with the next smaller size only.

g. Repeat height inspection with the **new** spacer installed. Remove both sprockets when measurement is within specification and discard temporary small washer.

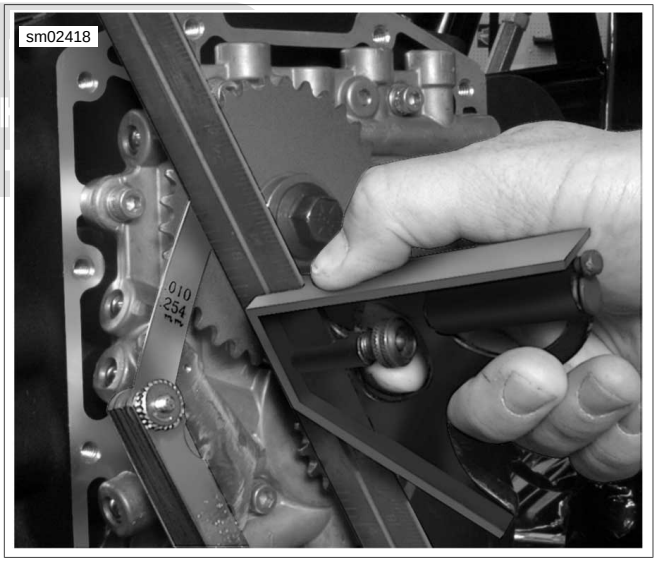



**Figure 3-64. Check Alignment of Crank and Rear Cam Sprocket Faces**

**Table 3-33. Rear Cam Sprocket Spacers**

| PART NO. | IN. | MM. |
|---|---|---|
| 25729-06 | 0.100 | 2.54 |
| 25731-06 | 0.110 | 2.79 |
| 25734-06 | 0.120 | 3.05 |
| 25736-06 | 0.130 | 3.30 |
| 25737-06 | 0.140 | 3.56 |
| 25738-06 | 0.150 | 3.81 |

9. See Figure 3-65. Apply a light amount of clean H-D 20W50 oil to splines on rear cam. Install the primary cam chain and sprocket assembly.
   a. Place the rear cam sprocket (2) in the primary chain. Hold the sprocket allowing the chain to hang loose. Rotate the sprocket so that the timing 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 (7) and crank sprocket (4) is visible during installation.*

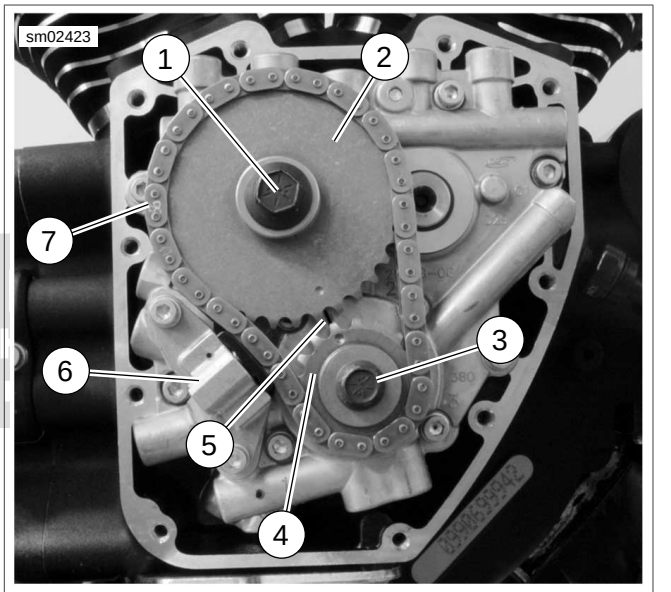
   b. Place the crank sprocket (4) in the opposite end of the chain with the timing mark on the sprocket tooth facing straight upward (directly toward the cam sprocket timing mark).
   c. Maintaining the position of the sprockets on the chain with the timing marks in alignment, start the rear cam sprocket onto the end of the rear camshaft. Note that the sprocket has an integral key that must be aligned with the keyway in the camshaft.
   d. Maintaining the position of the crank sprocket on the chain, rotate the rear 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.

10. Rotate the rear cam sprocket in a clockwise direction until the timing mark on the root is aligned with the timing mark on the crank sprocket tooth. Locate alignment mark (5) on cam support plate to verify that the timing marks are in alignment.

*NOTES*

- *If the timing marks are not in alignment, then the sprockets must be removed and reinstalled. Misaligned sprockets will make the engine run erratically.*
- *Rear sprocket bolt and crank sprocket bolt must install freely by hand. Before installing bolts, remove any build-up of LOCTITE THREADLOCKER from the bolt holes with the proper sized thread chaser.*
- *Both crank and rear cam sprocket flange bolts are specially hardened while the flat washers are of a special diameter. Use only genuine Harley-Davidson parts when replacement is necessary. If **new** flange bolts are not available, thoroughly clean both internal and external threads and apply a **small** amount LOCTITE THREADLOCKER 262 (red) before installation. The crank and rear cam sprocket flange bolts and flat washers are **not** interchangeable.*

11. Apply oil to bottom of **new** crank flange bolt head and washer (3). Loosely install to secure crank sprocket (4) to end of crankshaft.
12. Apply oil to bottom of **new** rear cam sprocket bolt head and washer (1). Loosely install to secure rear cam sprocket (2) to end of camshaft.
13. Position the CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL (Part No. HD-47941) between the crank and rear cam sprockets to prevent rotation. The handle of the tool is stamped "Crank" and "Cam" to ensure proper orientation.
   a. Tighten both sprocket bolts (1, 3) to 15 ft-lbs (20.3 Nm).
   b. Loosen both bolts one revolution (360 degrees).
   c. Final tighten the rear cam sprocket bolt (1) to 34 ft-lbs (46.1 Nm).
   d. Final tighten the crank sprocket bolt (3) to 24 ft-lbs (32.5 Nm).
   e. Remove the sprocket locking tool.
14. Install primary cam chain tensioner. Tighten fasteners to 100-120 **in-lbs** (11.3-13.6 Nm).
15. Apply clean H-D 20W50 engine oil to crank and rear cam sprockets.
16. See Figure 3-66. Align holes in **new** cam cover gasket with those in the crankcase flange.




1. **Rear cam sprocket bolt (large) and flat washer**
2. **Rear cam sprocket**
3. **Crank sprocket bolt (small) and flat washer**
4. **Crank sprocket**
5. **Alignment mark on support plate**
6. **Primary chain tensioner**
7. **Marked link**

**Figure 3-65. Primary Chain and Sprockets**

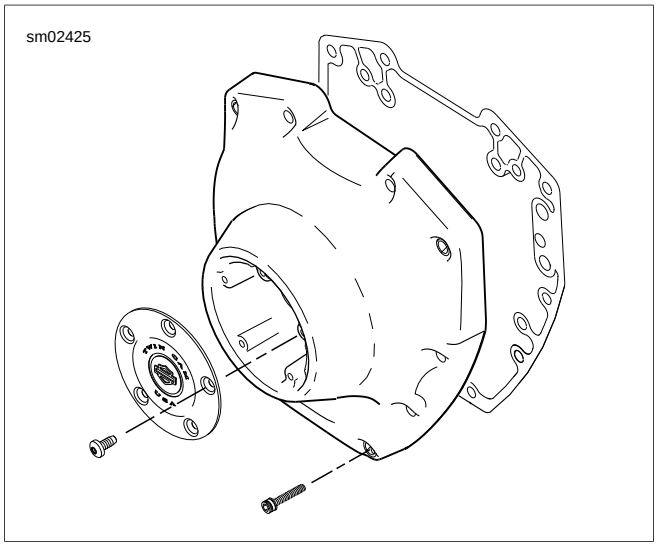



**Figure 3-66. Cam Cover Gasket**

*NOTE*

*Before installing cam cover, verify cleanliness of blind holes in the crankcase flange. Tightening a screw with dirt, water or oil in the hole can cause the casting to crack or break. Damage to the casting requires replacement of the right crankcase half.*

17. See Figure 3-65. Install the cam cover using ten allen head socket screws (1/4 x 1-1/4 in.). Following the sequence shown, alternately tighten the screws to 125-155 **in-lbs** (14.1-17.5 Nm). If cam cover assembly was completely removed continue as follows.

18. Complete motorcycle assembly.
    a. If engine was completely overhauled, see 3.16 TOP END OVERHAUL: ASSEMBLY. Perform all steps.
    b. If only cam compartment components were serviced, install push rod covers, push rods, rocker arm support plate and breather assembly. See appropriate topics under 3.16 TOP END OVERHAUL: ASSEMBLY.

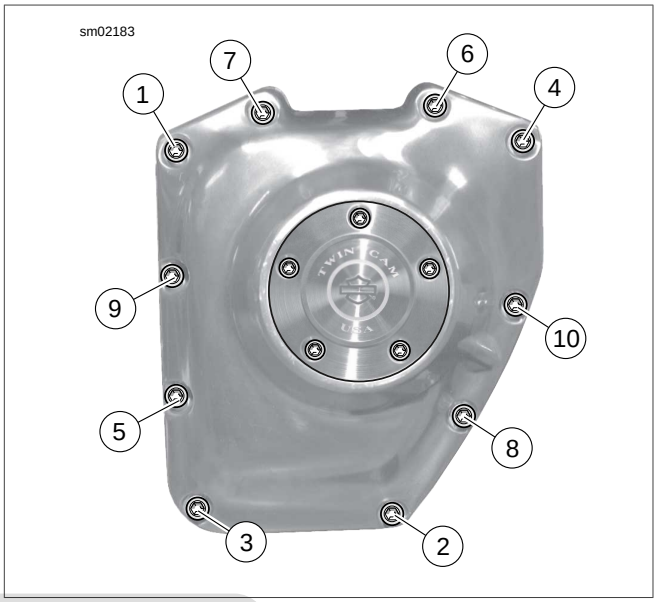



**Figure 3-67. Cam Cover Screws**

## REMOVAL OVERVIEW

To remove breather assembly, see 3.15 TOP END OVERHAUL: DISASSEMBLY.

## DISASSEMBLY

1. See Figure 3-68. Remove two fasteners (1) from the breather assembly cover (2) and remove breather assembly from rocker arm support plate (8).
2. Remove the breather cover and cover gasket (3). Discard gasket. Remove breather baffle (5) and breather baffle gasket (7). Discard gasket. Pull filter element (6) from bore on underside of breather baffle. Pull umbrella valve (4) from hole at top of breather baffle. Discard both filter element and umbrella valve.

## CLEANING AND INSPECTION

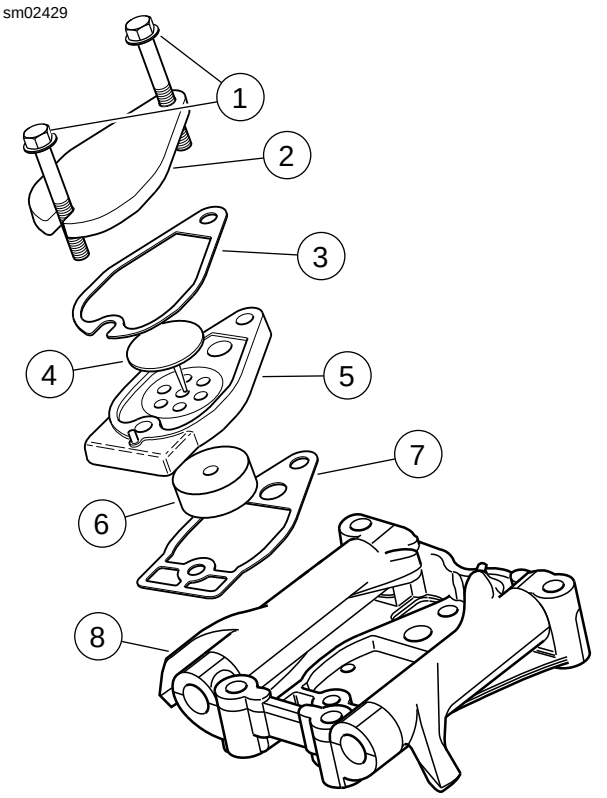
**⚠WARNING**

**Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)**

1. Clean all parts in a non-volatile cleaning solution or solvent. Blow parts dry with low pressure compressed air.
2. See Figure 3-68. Set a straightedge diagonally across the length of the breather cover (2) intersecting the opposite corners of the gasket surface. Slide a feeler gauge beneath the straightedge to check the breather cover for warpage. Repeat the step checking the opposite diagonal. Discard the breather cover if any low spot exceeds 0.005 in. (0.13 mm).
3. Using method outlined in previous step, inspect the breather baffle (5) gasket surface for flatness. Discard the breather baffle if any low spot exceeds 0.005 in. (0.13 mm).

## ASSEMBLY

1. See Figure 3-68. Insert stem of **new** umbrella valve (4) through center hole at top of breather baffle (5). Carefully pull rubber bead on stem through hole in baffle. Use denatured alcohol or glass cleaner to lubricate stem, if necessary. Verify that rubber bead is pulled completely through hole and resides on bottom side of baffle.
2. Press **new** filter element (6) into bore at bottom of baffle. Hole in filter element accommodates umbrella valve stem.
3. Place breather baffle gasket (7) on a clean flat surface.
   a. Aligning holes, place breather baffle (5), cover gasket (3) and breather cover (2) on top of breather baffle gasket.
   b. Slide two fasteners (1) through stackup to keep assembly together until time of installation.




1. **Fasteners (2)**
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 3-68. Breather Assembly**

## INSTALLATION OVERVIEW

See 3.16 TOP END OVERHAUL: ASSEMBLY, Breather Assembly.

1. Install breather assembly.
2. Continue with vehicle assembly as directed.

## REMOVAL OVERVIEW

See 3.15 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.

## DISASSEMBLY

1. See Figure 3-69. Remove four bolts with flat washers (1) from the rocker arm support plate (5). The rocker arm shafts (4) on the push rod side (right) are notched to lock them in position.
2. Using a hammer and brass drift, tap left side of rocker arm shafts (4) so that the notched ends exit the rocker arm support plate (5) 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

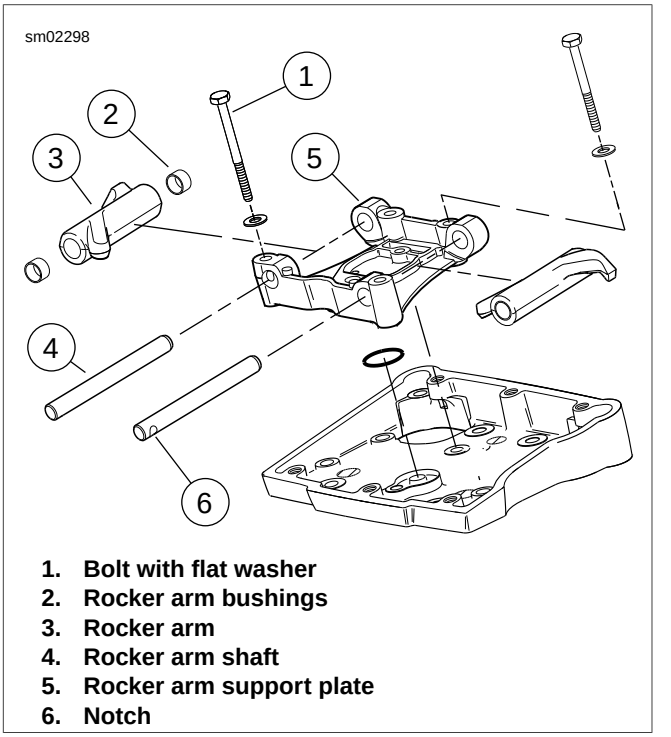
| PART NUMBER | TOOL NAME |
|---|---|
| HD-94804-57 | ROCKER ARM BUSHING REAMER |

### Inspection

**WARNING**

**Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)**

1. Clean all parts in a non-volatile cleaning solution or solvent. Blow parts dry with low pressure compressed air.
2. See Figure 3-69. Check rocker arms (3) 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 (5) are clean and open.
4. Inspect rocker arm shafts (4) for scratches, burrs, scoring or excessive wear. Replace as necessary.




1. **Bolt with flat washer**
2. **Rocker arm bushings**
3. **Rocker arm**
4. **Rocker arm shaft**
5. **Rocker arm support plate**
6. **Notch**

**Figure 3-69. Rocker Arm Assembly**

### Rocker Shaft Fit

1. See Figure 3-70. Measure the inside diameter of the rocker arm support plate bore.
2. See Figure 3-71. Measure the outside diameter of the rocker arm shaft where it fits in the bore.
3. Repeat the measurement on opposite side of support plate and shaft. Replace shaft or support plate if clearance equals or exceeds 0.0035 in. (0.089 mm).

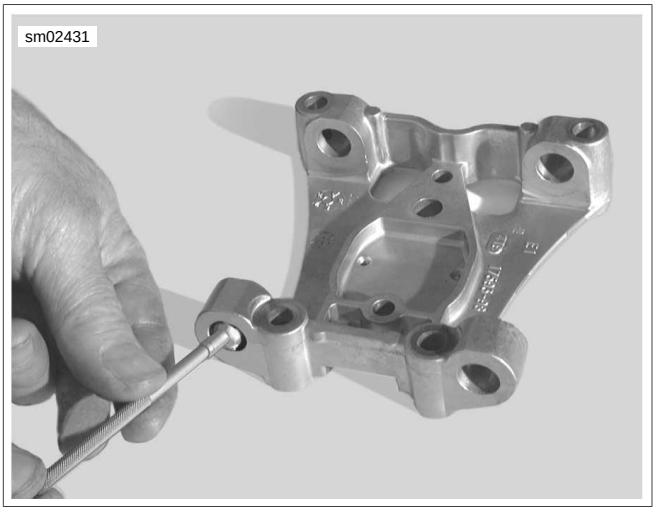



**Figure 3-70. Checking Support Plate Bore**


**Figure 3-71. Checking Shaft to Support Plate Fit**


**Figure 3-73. Checking Shaft to Bushing Fit**

## Rocker Arm Shaft to Bushing

1. Check rocker arm shaft to bushing fit.
   a. See Figure 3-72. Measure the inside diameter of the rocker arm bushing.
   b. See Figure 3-73. Measure the outside diameter of the rocker arm shaft where it rides in the bushing.
2. Repeat measurement on opposite side of rocker arm and shaft. Replace shaft or bushings if clearance equals or exceeds service wear limit of 0.0035 in. (0.089 mm).

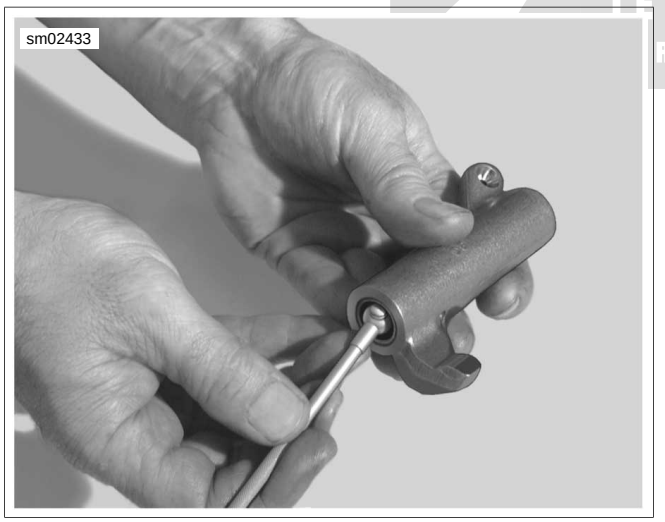



**Figure 3-72. Checking Bushings**

## Replace Rocker Arm Bushings

*NOTE*

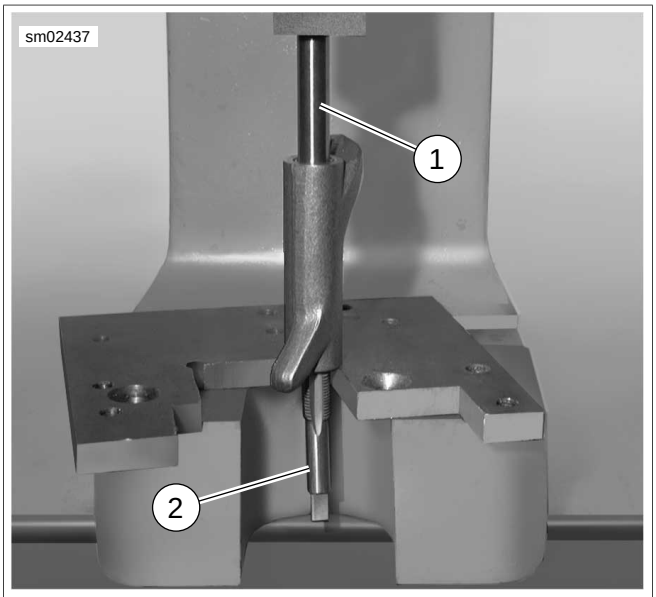
*Bushing replacement and reaming must be done one at a time to ensure proper alignment. Follow all steps for one bushing and then repeat for the other bushing.*

1. See Figure 3-74. Turn a 9/16"-18 tap (2) into bushing until tight. Place rocker arm under ram of arbor press with tap at bottom. Slide a discarded rocker arm shaft (1) 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.
2. See Figure 3-75. Using a suitable driver, press **new** bushing into side of rocker arm until flush with casting. Be sure to orient bushing so that split line faces top of rocker arm.

*NOTE*

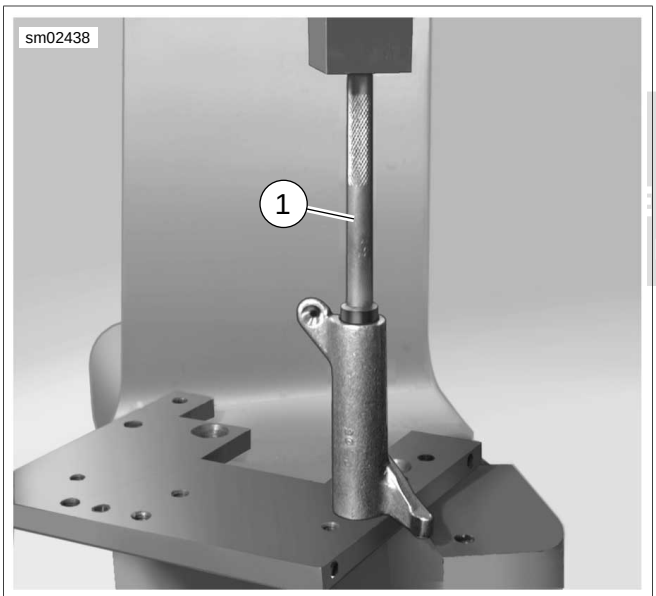
*Never back reamer out of rocker arm or new bushing will be damaged.*

3. See Figure 3-76. 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 (Part No. HD-94804-57) into old bushing in rocker arm. Note that old bushing on drive side of reamer as pilot. Rotate reamer until the **new** bushing on the far side is reamed, and then continuing in the same direction, draw drive side of reamer from **new** bushing.
4. Repeat steps to remove, install and ream second bushing.



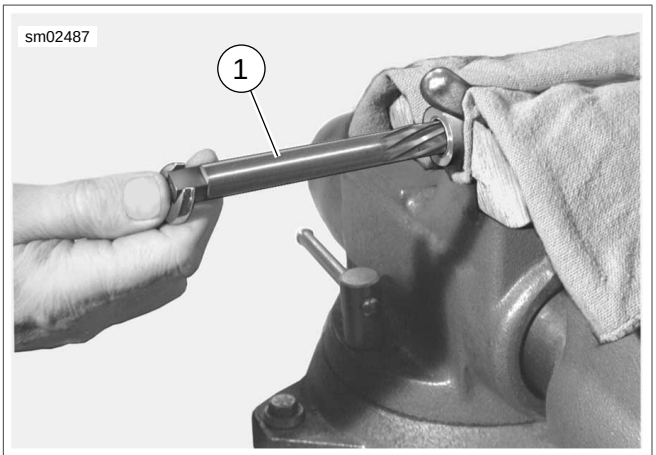

1. **Discarded shaft used as driver**
2. **Tap**

**Figure 3-74. Removing Bushing**




1. **Driver**

**Figure 3-75. Installing Bushing**




1. **Reamer**

**Figure 3-76. Ream 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.
3. See Figure 3-77. Check for proper end play.
   a. Insert a feeler gauge between the rocker arm and support plate.
   b. Repeat measurement on other rocker arm.
   c. Replace the rocker arm, rocker arm support plate or both if end play exceeds 0.025 in. (0.635 mm).
4. Install the four bolts with flat washers in the rocker arm support plate. Remember that the two bolts on the push rod side (right) must engage the notches in the rocker arm shafts for proper assembly.


**Figure 3-77. Check End Play**

## INSTALLATION OVERVIEW

See 3.16 TOP END OVERHAUL: ASSEMBLY.

1. Install rocker arm support plate.

2. Install breather assembly.
3. Continue with vehicle assembly as directed.

## REMOVAL OVERVIEW

See 3.15 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.
3. Remove push rods, lifters and covers.

## DISASSEMBLY

See Figure 3-78. 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:

1. Separate upper (2) and lower push rod covers (8).
2. Remove o-ring (9) from seat at bottom of lower push rod cover. Discard o-ring.
3. Remove o-ring (1) from seat at top of upper push rod cover. Slide o-ring (7), flat washer (6), spring (5) and spring cap (4) from body of upper push rod cover (2). Discard o-rings.

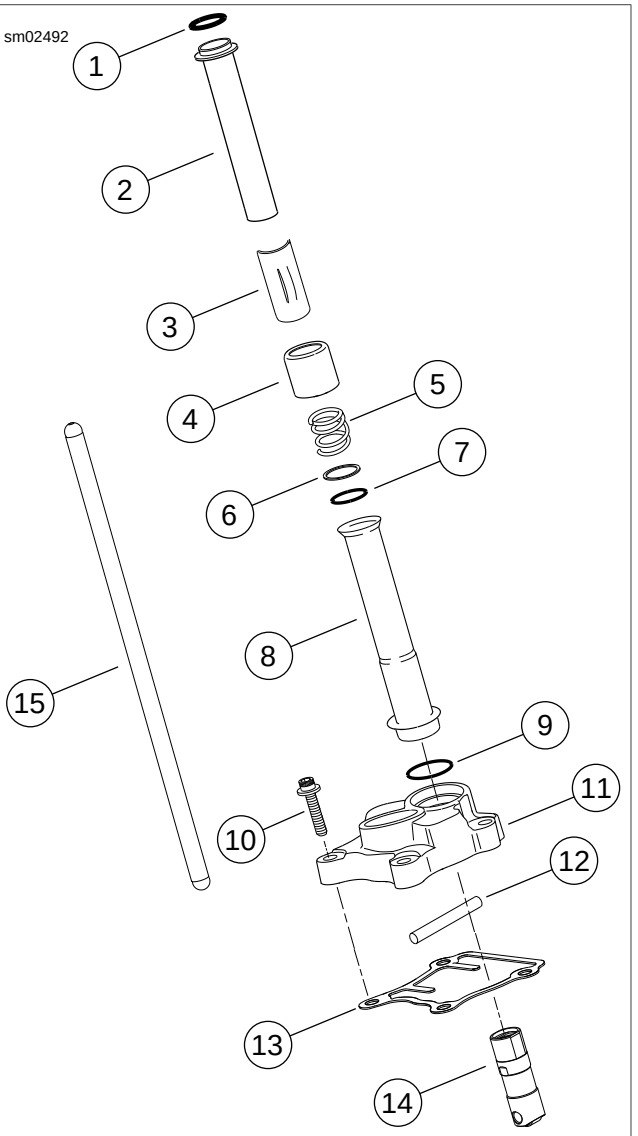
## CLEANING AND INSPECTION

1. See Figure 3-78. Scrape old gasket material from the lifter cover (11) flange. Old gasket material left on mating surfaces will cause leaks.
2. With the exception of the hydraulic lifters (14), 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 (2, 8) are completely clean.

**⚠WARNING**

**Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)**

3. Blow parts dry 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 (15). 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.




1. **Upper O-ring (small)**
2. **Upper push rod cover**
3. **Spring cap retainer**
4. **Spring cap**
5. **Spring**
6. **Flat washer**
7. **Middle O-ring (intermediate)**
8. **Lower push rod cover**
9. **Lower O-ring (large)**
10. **Lifter cover screw**
11. **Lifter cover**
12. **Anti-rotational pin**
13. **Lifter cover gasket**
14. **Hydraulic lifter**
15. **Push rod**

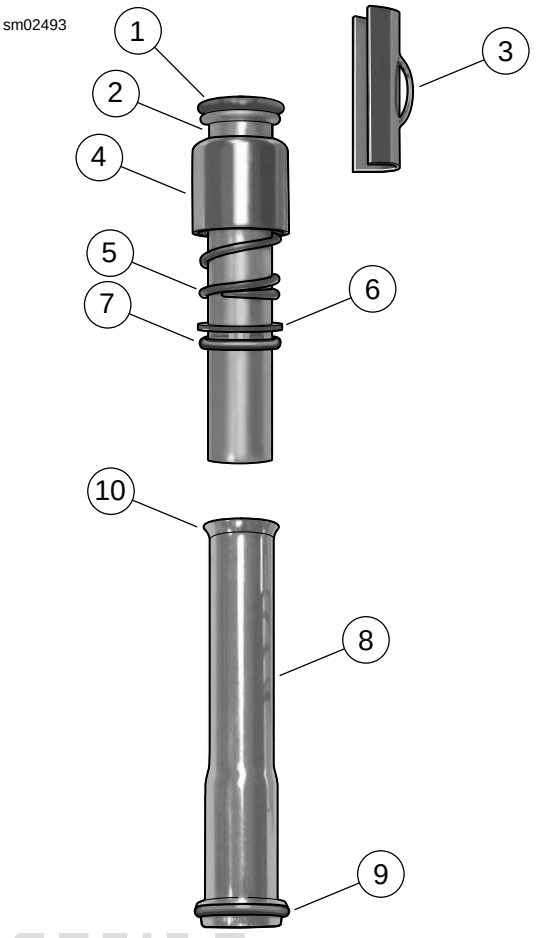
**Figure 3-78. Push Rods, Lifters and Covers**

## LIFTER INSPECTION

*NOTE*

*Inside and outside micrometers used for measuring lifters and lifter bores must be calibrated to ensure accurate readings.*

1. Inspect lifters for excessive clearance in bores. Accurately measure the lifter outer diameter and record the measurement.
2. Accurately measure lifter bore inner diameter with a snap gauge. Subtract this measurement from the lifter measurement to determine clearance.
   a. Clearance should be within 0.0008-0.0020 in. (0.0203-0.0508 mm).
   b. Install new lifters and/or replace crankcases if clearance exceeds SERVICE WEAR LIMIT of 0.0030 in (0.076 mm).
3. Check lifter roller radial play.
   a. Roller radial movement should be within 0.0006-0.0010 in (0.0152-0.0254 mm).
   b. Replace lifters if radial movement exceeds SERVICE WEAR LIMIT of 0.0015 in. (0.0381 mm).
4. Check lifter roller end clearance.
   a. End clearance should be within 0.008-0.022 in. (0.203-0.559 mm).
   b. Replace lifters if end clearance exceeds SERVICE WEAR LIMIT of 0.022 in. (0.559 mm).
5. Soak lifters in clean engine oil. Keep covered until assembly.




1. **Upper O-ring (small)**
2. **Upper push rod cover**
3. **Spring cap retainer**
4. **Spring cap**
5. **Spring**
6. **Flat washer**
7. **Middle O-ring (intermediate)**
8. **Lower push rod cover**
9. **Lower O-ring (large)**
10. **Flared end of lower push rod cover**

**Figure 3-79. Assembled Push Rod Cover**

## ASSEMBLY

With the exception of the push rod covers, all parts will be assembled during the installation procedure. Assemble the push rod covers as follows:

*NOTE*

*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. See Figure 3-79. Obtain three **new** o-rings (1, 7 and 9). Apply a very thin film of clean H-D 20W50 engine oil to o-rings before installation.
2. Install **new** small o-ring (1) on seat at the top of the upper push rod cover (2).

3. Slide the spring cap (4), spring (5), flat washer (6) and **new** intermediate size o-ring (7) onto the body of the upper push rod cover. Move parts up body until spring cap (4) contacts upper o-ring seat.
4. Fit the straight end of the upper push rod cover into the flared end of the lower push rod cover (8).
5. Install **new** large o-ring (9) on seat at bottom of lower push rod cover.

## INSTALLATION OVERVIEW

See 3.16 TOP END OVERHAUL: ASSEMBLY.

1. Install push rods, lifters and lifter covers.
2. Install rocker arm support plate.
3. Install breather assembly.
4. Continue with vehicle assembly as directed.

## REMOVAL OVERVIEW

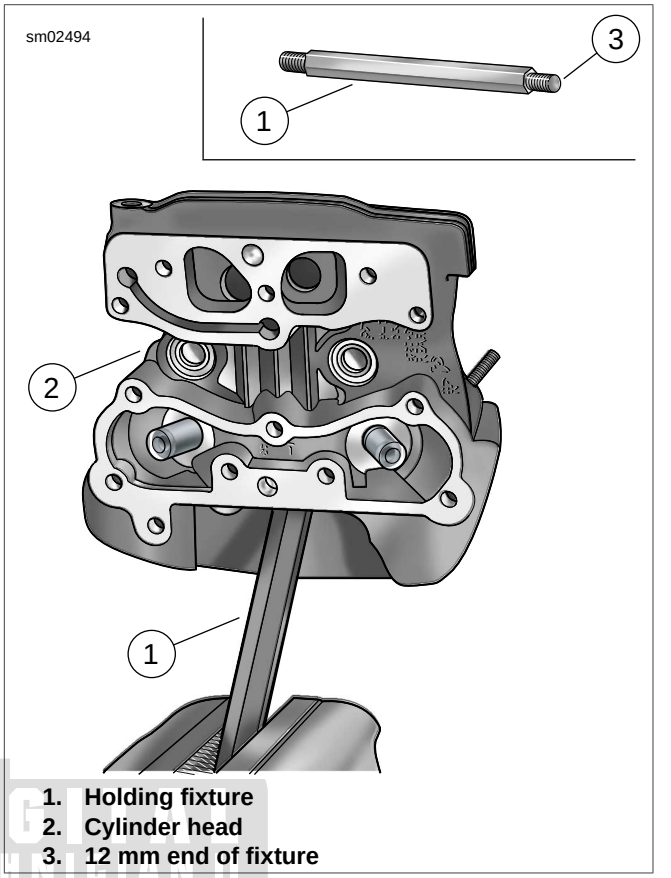
See 3.15 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.
3. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
4. Remove cylinder head.

## DISASSEMBLY

| PART NUMBER | TOOL NAME |
|---|---|
| HD-34736-B | VALVE SPRING COMPRESSOR |
| HD-39786 | CYLINDER HEAD HOLDING FIXTURE |

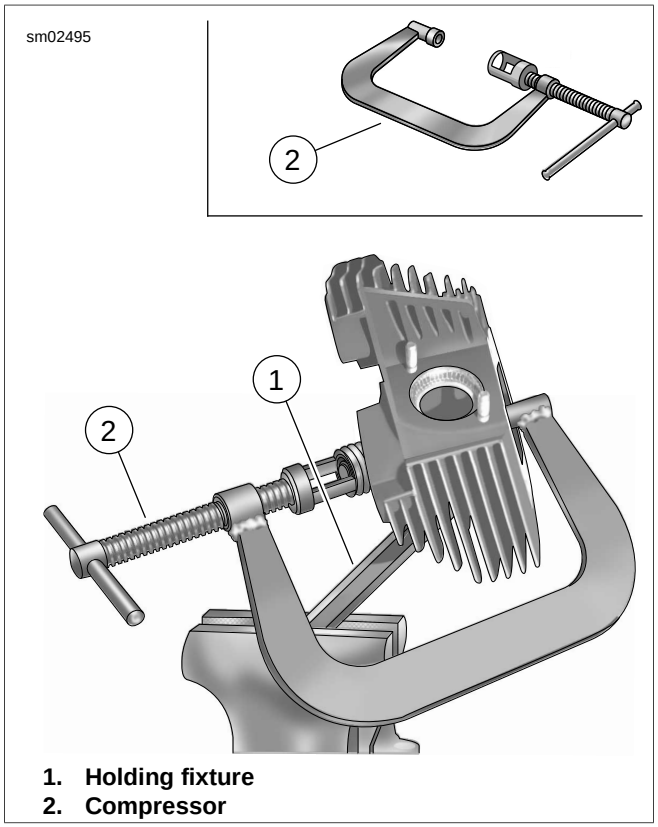
1. Before proceeding with the disassembly procedure, determine if cylinder head reconditioning is necessary.
   a. Raise valve ports of cylinder head to strong light source. If light is visible around edges of seats, then move to step 2 to recondition cylinder head.
   b. Fill ports at top of cylinder 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.
2. See Figure 3-80. Secure cylinder head for service.
   a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (Part No. HD-39786) (1) into cylinder head (2) spark plug hole.
   b. Clamp tool in vise at a 45 degree angle or one that offers a comfortable working position.




**1. Holding fixture**
**2. Cylinder head**
**3. 12 mm end of fixture**

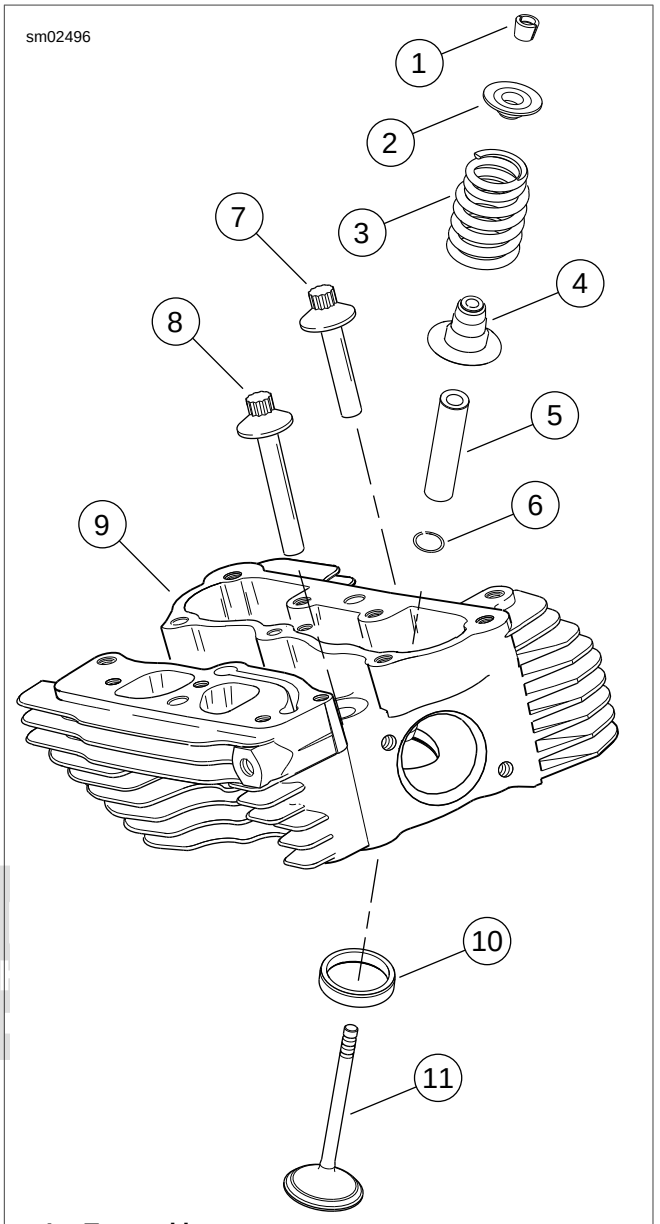
**Figure 3-80. Cylinder Head Holding Fixture**

3. See Figure 3-81. Release valve spring compression.
   a. Place VALVE SPRING COMPRESSOR (Part No. HD-34736-B) (2) over cylinder head. Center blunt end on the valve head. Seat adapter at end of forcing screw on the valve spring retainer.
   b. Rotate forcing screw to compress valve spring.
   c. See Figure 3-82. If spring retainer (2) has not broken free of tapered keepers (1), give head of tool a sharp tap with a soft mallet. Using magnetic rod or small screwdriver, remove the keepers (1) from the valve stem (11) groove.
   d. Rotate forcing screw to release the valve spring compression.
4. Remove the spring retainer (2) and valve spring (3).
5. Slide the valve (11) from the valve guide (5).
6. Remove valve seal assembly.
7. Mark the bottom of the valve F(ront) or R(ear) for identification. Also, separate and tag tapered keepers, valve spring and spring retainer so that they are installed on the same valve at time of assembly.
8. Repeat steps 3-7 to remove the other valve components.
9. Release the cylinder head holding fixture from the vise. Remove fixture tool from spark plug hole.




1. Holding fixture
2. Compressor

**Figure 3-81. Valve Spring Compressor (Part No. HD-34736-B)**




1. Tapered keepers
2. Spring retainer
3. Valve spring
4. Spring seat/valve stem seal
5. Valve guide
6. Lock ring
7. Cylinder head bolt, short
8. Cylinder head bolt, long
9. Cylinder head
10. Valve seat
11. Valve

**Figure 3-82. Cylinder Head Assembly**

## CLEANING

1. See Figure 3-82. Remove old gasket material from cylinder head (9). Gasket material left on sealing surfaces will cause leaks.

**CAUTION**

**Do not use glass or sand to bead blast surfaces exposed to engine oil. Blasting materials can lodge in pores of the casting. Heat expansion releases this material which can contaminate oil resulting in engine damage. (00534b)**

*NOTE*

*Bead blasting materials could also enter threaded holes adversely affecting fastener engagement and torque indication. Cover all threaded holes before bead blasting.*

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.
4. Thoroughly clean the cylinder head, spring retainers, tapered keepers, valves and valve springs in a non-volatile cleaning solution or solvent. Follow up with a thorough wash in hot soapy water.

**WARNING**

**Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)**

5. Blow parts dry with low pressure compressed air.

## INSPECTION

| PART NUMBER | TOOL NAME |
|---|---|
| B-45525 | VALVE GUIDE HONE |
| HD-34751 | VALVE GUIDE CLEANING BRUSH |
| HD-96796-47 | VALVE SPRING TESTER |

## Cylinder Head

1. Check for scratches and nicks on all gasket sealing surfaces.
2. Check for warpage.
   a. 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.
   b. Slide a feeler gauge beneath the straightedge to check the head for warpage.
   c. 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 0.006 in. (0.152 mm) or greater.

*NOTE*

*For best results, use one of the CYLINDER TORQUE PLATES (HD-42324-A) in lieu of the straightedge. Lay the upper plate (without vise grip) 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, particularly the combustion chamber side, for cracks. Replace the guide if any cracks are found.
2. Prepare valve guides for inspection.
   a. Lightly hone bore using the VALVE GUIDE HONE (Part No. B-45525).
   b. Scrub with the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751) to remove any dust or debris.
   c. Polish the valve stem with fine emery cloth or steel wool to remove carbon buildup.
3. Check valve stem to guide clearance:
   a. Carefully measure the **inside** diameter of the valve guide using an inside ball micrometer.
   b. Measure the **outside** diameter of the valve stem with an outside micrometer.
   c. Refer to Table 3-34. If the clearance between stem and guide exceeds the limits shown, the valve stem and/or guide are excessively worn.
   d. Repeat measurements with a **new** valve to determine if the guide must be replaced.

**Table 3-34. Valve Stem to Guide Clearance Service Wear Limits**

| VALVE | IN. | MM |
|---|---|---|
| Intake | 0.0038 | 0.0965 |
| Exhaust | 0.0038 | 0.0965 |

## 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 valve guide inspection.

## 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. Too much height corresponds to a reduction in spring pressure which results in sluggish valve action.

3. Check free length of springs using a dial vernier caliper or load test with the VALVE SPRING TESTER (Part No. HD-96796-47). Replace springs if free length or compression force do not meet specifications. See 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 3.22 CYLINDER HEAD, Valve and Seat Refacing.

# VALVE GUIDE REPLACEMENT

| PART NUMBER | TOOL NAME |
|---|---|
| B-45523 | VALVE GUIDE REAMER |
| B-45524-1 | VALVE GUIDE DRIVER |
| B-45524-2A | VALVE GUIDE INSTALLER SLEEVE |
| B-45525 | VALVE GUIDE HONE |
| HD-34751 | VALVE GUIDE CLEANING BRUSH |
| HD-34751 | VALVE GUIDE CLEANING BRUSH |
| HD-39782-1 | CYLINDER HEAD SUPPORT STAND |
| HD-39782-3 | INTAKE SEAT ADAPTER |
| HD-39782-4 | EXHAUST SEAT ADAPTER |
| HD-39782-A | CYLINDER HEAD SUPPORT STAND KIT |
| HD-39786 | CYLINDER HEAD HOLDING FIXTURE |
| HD-39847 | REAMER T-HANDLE |
| HD-39964 | REAMER LUBRICANT |

## Removal

*NOTES*

- *If valve guide replacement is necessary, always install **new** guide before refacing valve seat.*
- *CYLINDER HEAD SUPPORT STAND KIT (Part No. HD-39782-A) 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.*

1. See Figure 3-83. Prepare cylinder head for valve guide replacement.
   a. Obtain CYLINDER HEAD SUPPORT STAND KIT (Part No. HD-39782-A).
   b. Insert sleeve of INTAKE SEAT ADAPTER (Part No. HD-39782-3) (3) or EXHAUST SEAT ADAPTER (Part No. HD-39782-4) (4) seat adapter into tube at top CYLINDER HEAD SUPPORT STAND (Part No. HD-39782-1) (2).
   c. Position cylinder head so that valve seat is centered on seat adapter.

*NOTE*

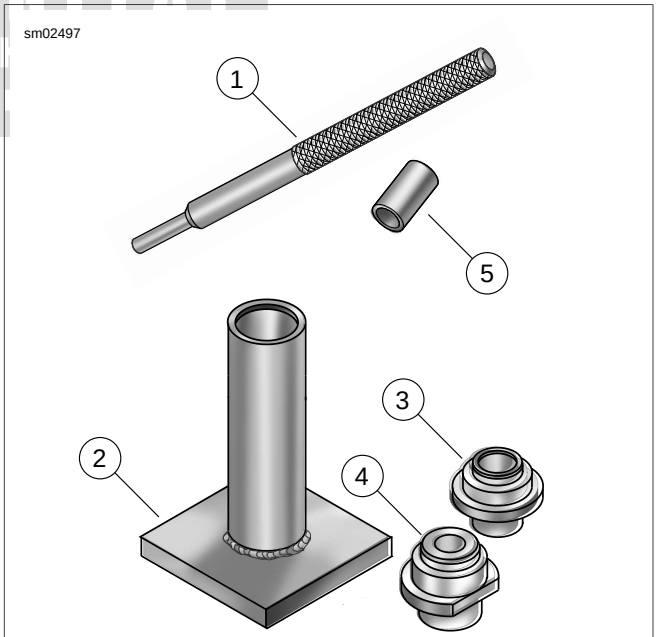
*Do not press out the valve guide from the bottom of the cylinder head. Carbon buildup on the combustion chamber side of the guide can deeply gouge the cylinder head bore diminishing the likelihood of achieving the proper interference fit and possibly requiring replacement of the cylinder head casting.*

2. Remove and discard lock ring from valve guide groove.

*NOTE*

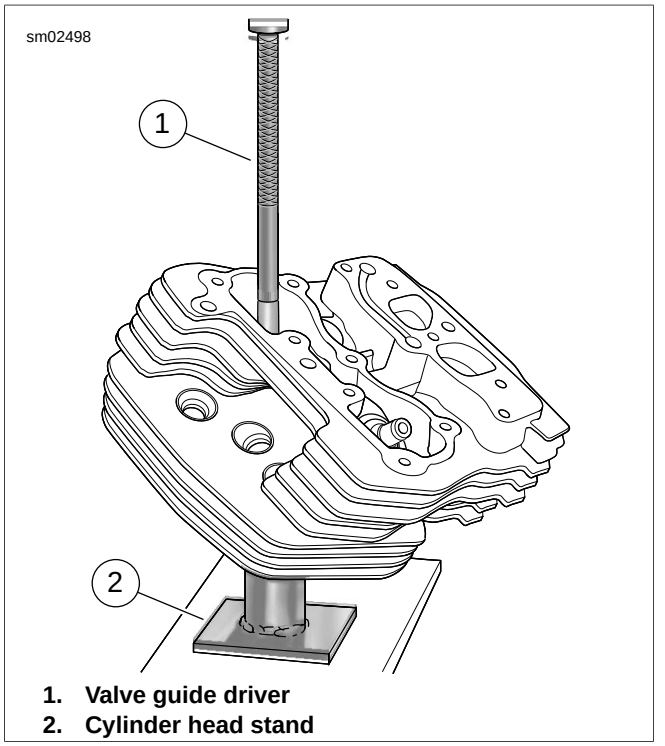
*Lock ring is present on OEM intake and exhaust valve guides.*

3. At top of the cylinder head, insert VALVE GUIDE DRIVER (Part No. B-45524-1) (1) into valve guide bore until stopped by shoulder.
4. See Figure 3-84. Center valve guide driver under ram of arbor press. Apply pressure until valve guide drops free of cylinder head. Discard valve guide.




1. **Valve guide driver**
2. **Cylinder head support stand**
3. **Intake seat adapter**
4. **Exhaust seat adapter**
5. **Valve guide installer sleeve**

**Figure 3-83. Valve Guide Replacement Tools**




**1. Valve guide driver**
**2. Cylinder head stand**

**Figure 3-84. Remove Valve Guide**

## Installation

1. Check valve guide to valve bore clearance.
   a. Measure the outside diameter of a new standard valve guide.
   b. Measure the cylinder head valve guide bore. The valve guide should be 0.0020-0.0033 in. (0.051-0.084 mm) larger than the bore.
   c. If clearance is not within specification, then select one of the following oversize guides: 0.001 in. (0.025 mm), 0.002 in. (0.05 mm) or 0.003 in. (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.

*NOTE*

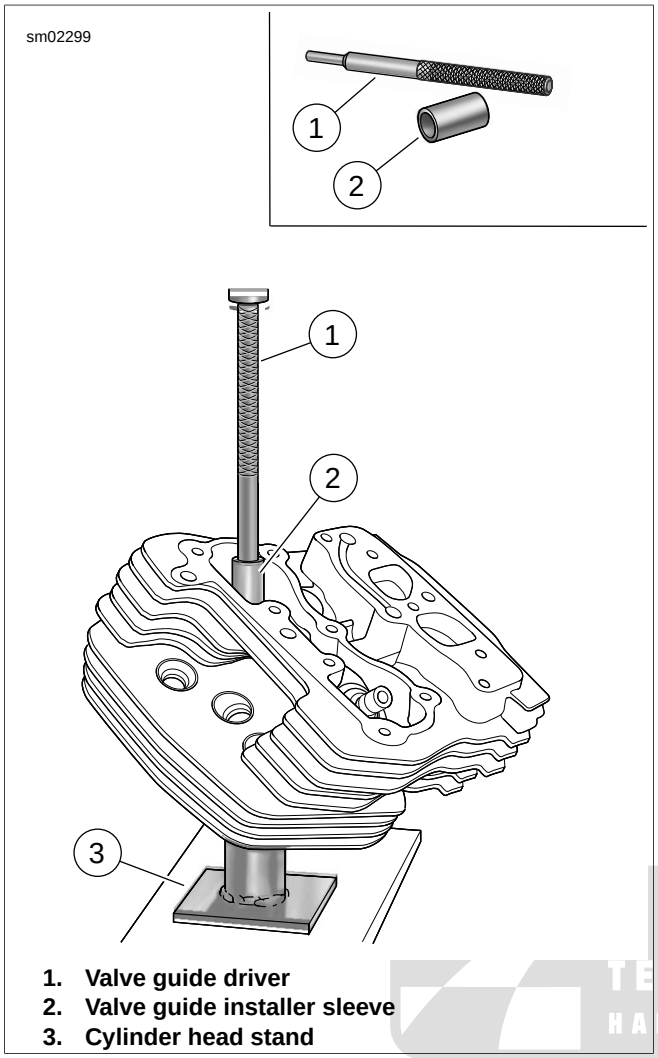
*Support stand ensures that valve guide and seat are perpendicular. If perpendicularity is not achieved, cylinder head valve guide bore will be damaged during the press procedure.*

3. Prepare cylinder head for valve guide replacement.
   a. See Figure 3-83. Insert sleeve of INTAKE SEAT ADAPTER (Part No. HD-39782-3) (3) or EXHAUST SEAT ADAPTER (Part No. HD-39782-4) (4) into tube at top of support stand (2). Position cylinder head so that valve seat is centered on seat adapter.
   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. See Figure 3-85. Place VALVE GUIDE INSTALLER SLEEVE (Part No. B-45524-2A) (2) over valve guide and then insert tapered end of valve guide driver (1) into 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.

*NOTE*

*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 (3) and driver (1) 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 previous step and then apply pressure to driver until installer sleeve contacts machined area of cylinder head.
   h. Install **new** lock ring into valve guide groove. Verify that lock ring is square and fully seated in the groove.



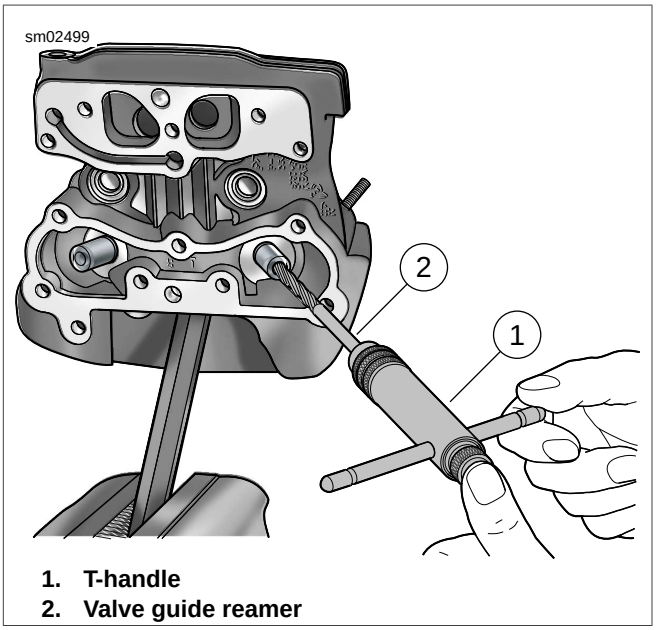

1. **Valve guide driver**
2. **Valve guide installer sleeve**
3. **Cylinder head stand**

**Figure 3-85. Install Valve Guide**

4. Secure cylinder head for service.
   a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (Part No. HD-39786) into cylinder head spark plug hole.
   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 in. (0.013-0.0025 mm) of finished size.*




1. **T-handle**
2. **Valve guide reamer**

**Figure 3-86. Reaming Valve Guide Bore**

5. See Figure 3-86. Obtain the VALVE GUIDE REAMER (Part No. B-45523), REAMER T-HANDLE (Part No. HD-39847) and REAMER LUBRICANT (Part No. HD-39964).
   a. Install T-handle (1) on reamer (2).
   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. Squirt additional lubricant onto reamer and into guide as necessary.

*NOTE*

*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.
   e. Remove T-handle from reamer, and carefully pulling on bit, draw shaft of reamer out combustion chamber side of valve guide.

**⚠WARNING**

**Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)**

6. Direct compressed air into the valve guide bore to remove any metal shavings or debris.
7. See Figure 3-87. Clean valve guide bore with the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751).

8. See Figure 3-88. Obtain the VALVE GUIDE HONE (Part No. B-45525) and REAMER LUBRICANT (Part No.HD-39964).
   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. Work for a crosshatch pattern of approximately 60°.
9. Direct compressed air into the valve guide bore to remove any debris. Clean with the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751).

*NOTE*

*Always verify valve stem to valve guide clearance after honing, since a worn reamer may cut the bore undersize.*

10. Check valve stem to valve guide clearance.
    a. Measure the inside diameter of the valve guide with an inside ball micrometer.
    b. Measure the outside diameter of the valve stem with an outside micrometer.
    c. Refer to Table 3-35. If the clearance between stem and guide is not within the limits shown, the low end being preferable, then the valve stem may be excessively worn or the valve guide bore undercut.

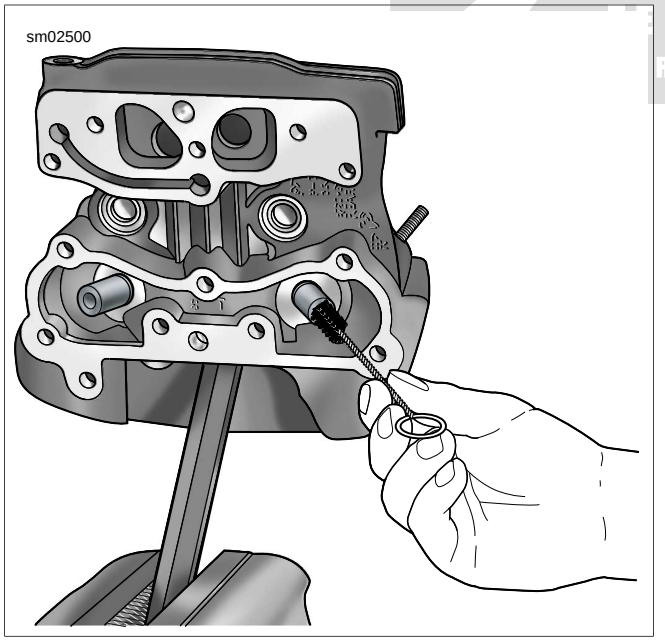



**Figure 3-87. Scrubbing Valve Guide Bore**

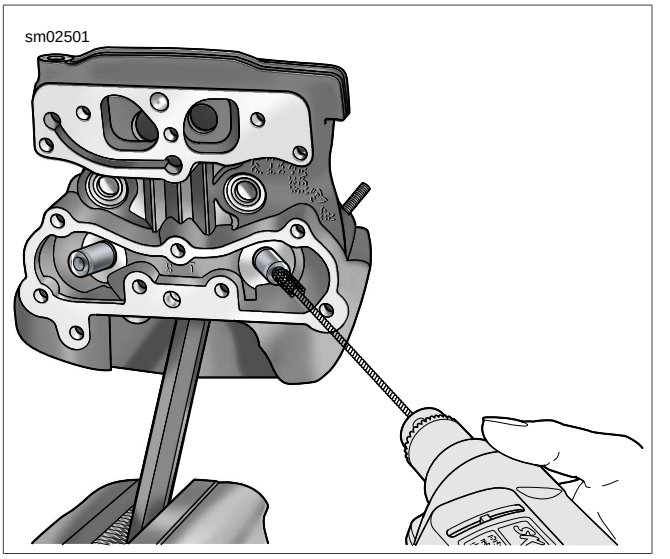



**Figure 3-88. Honing Valve Guide Bore**

11. Clean cylinder head assembly again.
    a. Using cleaning solvent, thoroughly clean cylinder head and valve guide bore.
    b. Scrub valve guide bore with the VALVE GUIDE CLEANING BRUSH (Part No. 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.
    c. Continue to wipe bore until clean cloth shows no evidence of dirt or debris. Follow up with a thorough wash in hot soapy water.

**⚠WARNING**

**Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)**

12. Blow parts dry with low pressure compressed air.

**Table 3-35. Valve Stem to Guide Clearance**

| VALVE | IN. | MM |
|---|---|---|
| Intake | 0.001-0.003 | 0.0254-0.0762 |
| Exhaust | 0.001-0.003 | 0.0254-0.0762 |

## VALVE AND SEAT REFACING

| PART NUMBER | TOOL NAME |
|---|---|
| HD-34751 | VALVE GUIDE CLEANING BRUSH |
| HD-35758-C | NEWAY VALVE SEAT CUTTER SET |
| HD-39786 | CYLINDER HEAD HOLDING FIXTURE |

*NOTES*

- *Verify correct valve stem to valve guide clearance before refacing. Refer to Table 3-35. If **new** guides must be installed, complete that task before refacing valve seats.*
- *This procedure is not based on the lapping of valves. The end result is an interference fit between the 45° valve face and the valve seat which will be 46°.*

1. Hold the valve firmly against a wire wheel in a bench grinder. Remove all carbon deposits from the valve head, face and stem, but exercise caution to avoid removing any metal. Carbon left on the stem may affect alignment in the valve refacer. Polish the valve stem with steel wool or crocus cloth to remove any marks that might be left by the wire wheel.
2. Install valve (both intake and exhaust) in a valve refacer set to a 45° 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.

*NOTES*

- *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. See Figure 3-91. 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 in (0.795 mm). A valve in this condition does not seat normally, burns easily and may crack or cause pre-ignition.*

3. Wipe valve seats and valve faces clean. From the bottom of the cylinder head, insert the valve stem into the valve guide. Push on head of valve until it contacts the valve seat.
4. See Figure 3-89. Measure valve stem protrusion. Seat wear causes the valve stem protrusion to change.
   a. 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.
   b. Seat wear and valve refacing causes the valve stem protrusion to change. If protrusion exceeds 2.069 in. (52.553 mm), then replace the valve, valve seat or cylinder head as necessary.

*NOTE*

*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.*

5. Secure cylinder head for servicing.
   a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (Part No. HD-39786) into cylinder head spark plug hole.
   b. Clamp fixture in vise and further tighten cylinder head onto the fixture to prevent any movement during operation.
   c. Place cylinder head at a 45° angle or one that offers a comfortable working position.
6. In order to determine the correct location of the 46° valve seat in the head, measure the width of the valve to be used and subtract 0.080 in. (2.032 mm) from that number.
7. Set your dial caliper to the lesser measurement and lock down for quick reference. This is the location of your valve seat.
8. Use a permanent magic marker to highlight the valve seat area that is going to be cut. Be sure to highlight all three angles. Allow marker to dry before proceeding.

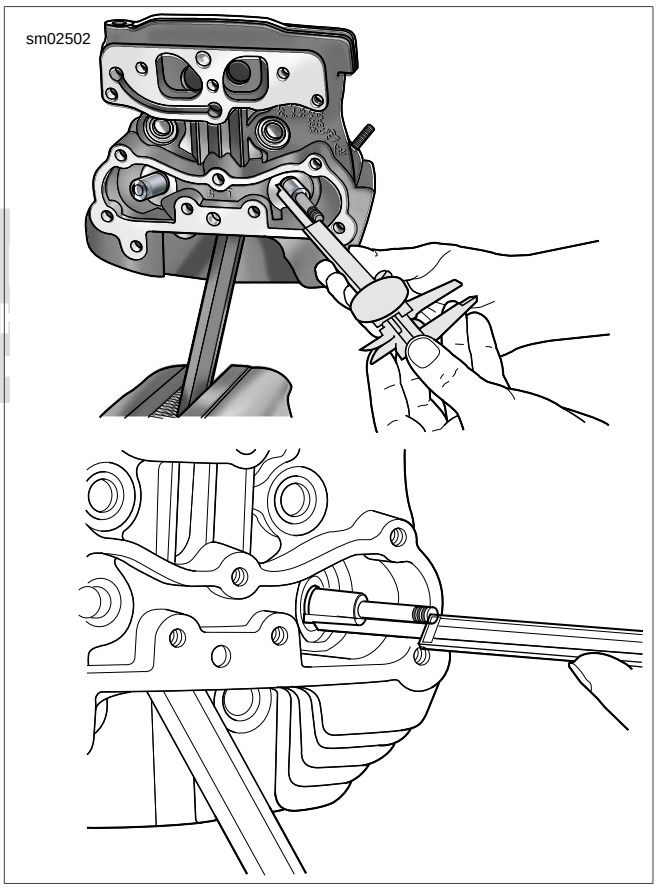



**Figure 3-89. Checking Valve Stem Protrusion**

*NOTES*

- *Always ensure cutter blades and cutter pilot are clean before beginning the cutting process. The correct cleaning brush is supplied with the Neway tool set.*
- *Always ensure the inside of the valve guide is clean by using VALVE GUIDE CLEANING BRUSH (Part No. HD-34751).*

9. See Figure 3-90. Obtain the NEWAY VALVE SEAT CUTTER SET (Part No. HD-35758-C). Choose the cutter pilot that fits properly into the valve guide hole. Securely seat the pilot by pushing down and turning using the installation tool supplied in the tool set.
10. Choose the proper 46° cutter (intake or exhaust) and gently slide the cutter onto the pilot. Be careful not to drop the cutter onto the seat.
11. While applying a constant and consistent pressure, remove just enough material to show a complete clean-up on the 46° angle. Do not remove any more metal than is necessary to clean up the seat (that is, to provide a uniform finish and remove pitting).

*NOTES*

- *If the width of the clean-up angle is greater on one side of the seat than the other, the guide may need to be replaced due to improper installation.*
- *After making the 46° cut, if you discover a groove cut completely around the seat, this means the blades of the cutter are in alignment and need to be staggered. This is accomplished by loosening all of the blades from the cutter body and moving each blade slightly in its cradle in opposite directions on the cutter. The tool needed to loosen the blades is supplied in the tool set. A permanent magic marker mark every 90° will help in determining where new angles are.*

12. Next, with your dial caliper locked to the predetermined setting, measure the 46° cut at the outermost edge at the widest point of the circle to determine what cut needs to be made next.
    a. If the 46° cut is too high (towards the combustion chamber), use the 31° cutter to lower the valve seat closer to the port.
    b. If the 46° cut is too low, use the 60° cutter to raise the valve seat or move it away from the port.

*NOTES*

- *Because you are using the top measurement of the valve seat as a reference point it will usually be necessary to use the 31° cutter following the initial 46° cut.*
- *Always highlight the valve seat with the permanent magic marker in order to ensure the location of the 46° valve seat.*

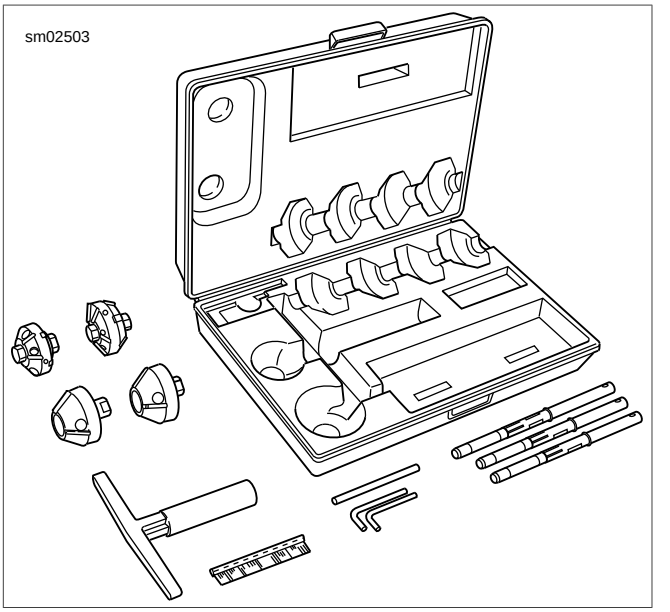



**Figure 3-90. Neway Valve Seat Cutter Set**

13. If the location of the valve seat is not correct, repeat steps 10 and 11.
14. When you accomplish a complete clean-up of the 46° angle and the width is at least 0.062 in. (1.575 mm), proceed to the next step.
15. Select the proper 60° cutter and gently slide the cutter down the cutter pilot to the valve seat.
16. Remove just enough material to provide an even valve seat width of 0.040-0.062 in. (1.016-1.575 mm).
17. Remove cutter and cutter pilot.
18. Insert valve to be used in the valve guide and bottom on the valve seat. Positioning the cylinder head port upwards and with slight thumb pressure against the valve, completely fill the port with solvent to verify proper seal between the valve and the valve seat.

*NOTE*

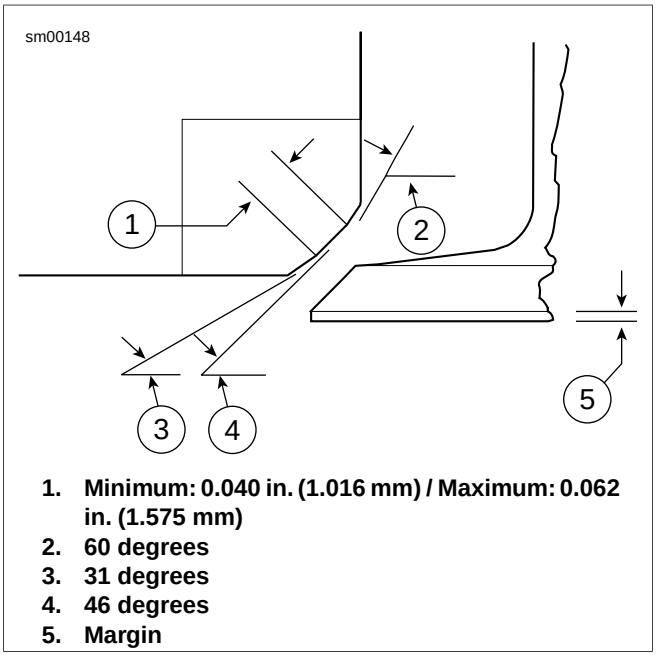
*Hold pressure against the valve for a minimum of 10 seconds. If any leakage occurs, examine the valve and valve seat for irregularities or defects and if necessary repeat the above valve grinding or valve seat cutting process.*

19. Repeat the process on any valve seat that needs service.
20. Clean valves, cylinder head and valve seats in solvent. Follow up with a thorough wash in hot soapy water.

**⚠WARNING**

**Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)**

21. Blow parts dry with low pressure compressed air.




1. **Minimum: 0.040 in. (1.016 mm) / Maximum: 0.062 in. (1.575 mm)**
2. **60 degrees**
3. **31 degrees**
4. **46 degrees**
5. **Margin**

**Figure 3-91. Valve and Seat Dimensions**

## ASSEMBLY

| PART NUMBER | TOOL NAME |
|---|---|
| HD-34736-B | VALVE SPRING COMPRESSOR |
| HD-34751 | VALVE GUIDE CLEANING BRUSH |
| HD-39786 | CYLINDER HEAD HOLDING FIXTURE |

1. Secure cylinder head for service.
   a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (Part No. HD-39786) into cylinder head spark plug hole.
   b. Clamp tool in vise at a 45 degree angle or one that offers a comfortable working position.

*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).*

2. Run the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751) through the valve guide bore to verify cleanliness.
3. Using TORCO MPZ or another suitable product, apply a liberal amount of engine assembly lube to valve stem.
4. From the bottom of the cylinder head, insert the valve stem into the valve guide.
5. 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.
6. Remove the valve and apply a second coat of assembly lube to the valve stem. Install the valve in the valve guide.

**CAUTION**

**Failure to install plastic capsule can cause the valve stem seal to catch the edge of the valve stem keeper groove. The resulting damage can cause leakage around the valve stem, excessive oil consumption and valve sticking. (00535b)**

7. See Figure 3-92. 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.
8. Apply a very thin film of clean H-D 20W50 engine oil to capsule.
9. See Figure 3-93. Obtain **new** valve stem seal.
10. Slide new valve stem seal/spring seat over capsule and down valve stem until contact is made with top of valve guide and machined area of cylinder head casting. Remove capsule from valve stem tip.

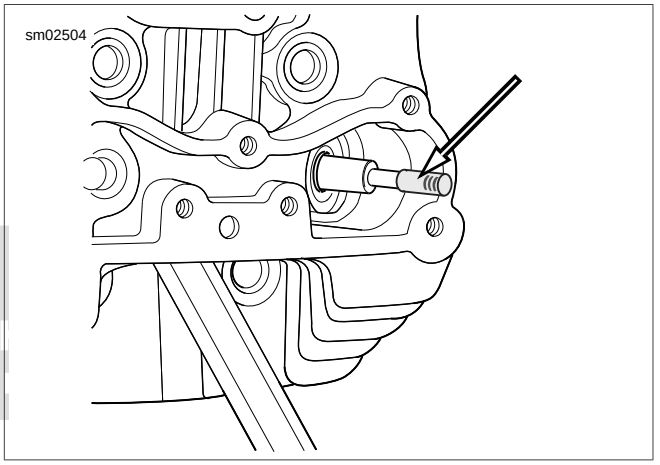



**Figure 3-92. Plastic Capsule**

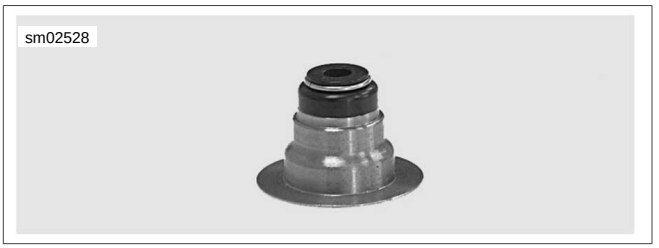
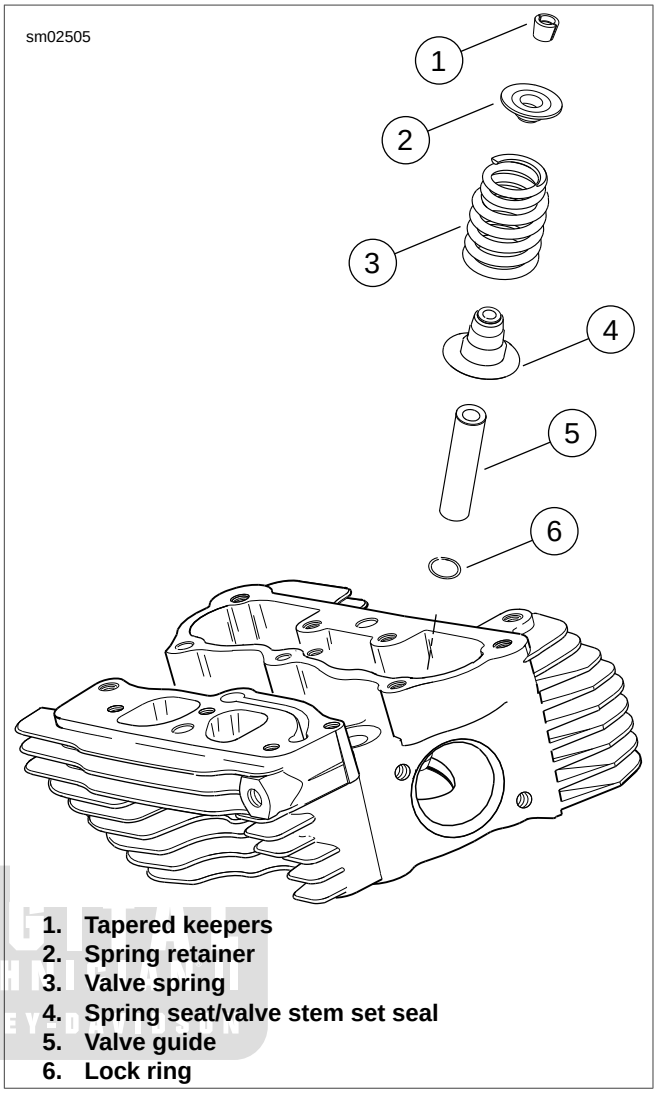



**Figure 3-93. Valve Stem Seal/Spring Seat Assembly**

11. See Figure 3-94. Apply a liberal amount of assembly lube to valve stem tip and keeper groove (1).
12. With the smaller diameter coils topside, install the valve spring (3) over the valve guide (5). Place the spring retainer (2) on top of the valve spring.

13. Obtain the VALVE SPRING COMPRESSOR (Part No. HD-34736-B) 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.
    b. Rotate forcing screw to compress valve spring.
    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.
14. 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.
15. Repeat previous steps to install the other valve components.
16. Release the cylinder head holding fixture from the vise. Remove fixture tool from spark plug hole.
17. Cover the cylinder head to protect it from dust and dirt until time of installation.




1. **Tapered keepers**
2. **Spring retainer**
3. **Valve spring**
4. **Spring seat/valve stem set seal**
5. **Valve guide**
6. **Lock ring**

**Figure 3-94. Valve Assembly**

## INSTALLATION OVERVIEW

See 3.16 TOP END OVERHAUL: ASSEMBLY.

1. Install cylinder head.
2. Install push rod covers and push rods.
3. Install rocker arm support plate.
4. Install breather assembly.
5. Continue with vehicle assembly as directed.

## REMOVAL OVERVIEW

See 3.15 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.
3. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
4. Remove cylinder head.
5. Remove cylinder.

## CLEANING

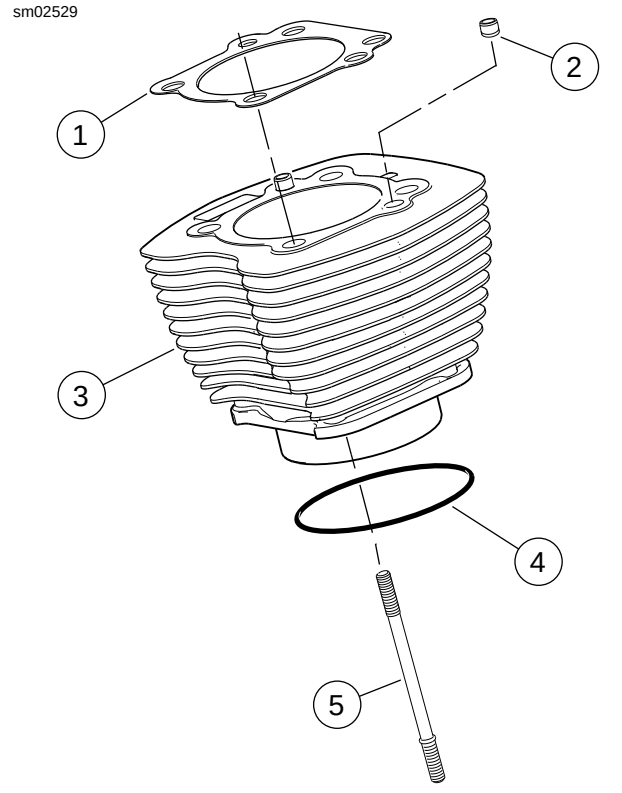
| PART NUMBER | TOOL NAME |
|---|---|
| HD-42324-A | CYLINDER TORQUE PLATES |

1. See Figure 3-95. Scrape old gasket material from the machined surface at the top of the cylinder (3). Old gasket (1) material left on the mating surface will cause leaks.

**WARNING**

**Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)**

2. Clean cylinder in a non-volatile cleaning solution or solvent. Blow parts 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. See Figure 3-96. Check the machined surfaces for flatness using a feeler gauge and CYLINDER TORQUE PLATES (Part No. HD-42324-A) as follows:
   a. Lay gasket side of the upper torque plate (3) (without vise grip step) flat against the head gasket surface of the cylinder.
   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 in. (0.15 mm).
   e. Now turn the cylinder upside down and lay the seal side of the lower torque plate (2) (with vise grip step) flat against the o-ring seal surface. Repeat steps 6b and 6c above.
   f. The o-ring seal surface must be flat within 0.004 in. (0.102 mm).
   g. Replace the cylinder (and piston) if either surface is not within specification.




1. **Cylinder head gasket**
2. **Dowel pin**
3. **Cylinder**
4. **O-ring seal**
5. **Cylinder stud**

**Figure 3-95. Cylinder Assembly**

## INSPECTION

| PART NUMBER | TOOL NAME |
|---|---|
| HD-42324-A | CYLINDER TORQUE PLATES |

*NOTE*

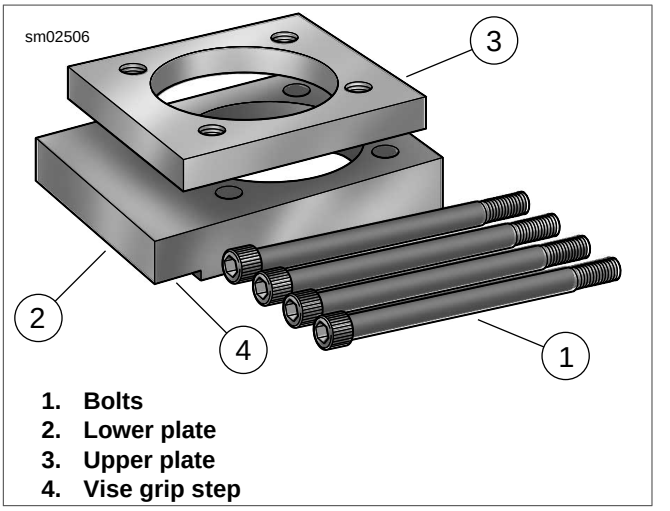
*Failure to use cylinder torque plates can produce measurements that vary by as much as 0.001 in. (0.025 mm), possibly resulting in the use of parts that are not suitable for service.*

1. See Figure 3-97. 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 (Part No. HD-42324-A). Install the torque plates as follows:
   a. Remove o-ring seal from cylinder sleeve, if installed.
   b. Place used head gasket over two dowel pins at top of cylinder.
   c. See Figure 3-97. 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. Lightly oil threads and shoulders of four bolts (1) with clean H-D 20W50 engine oil. Slide four bolts all the way through holes of lower plate (2).
   e. Slide cylinder down bolts with the indent in the cooling fins facing upward.
   f. With the two dowel pins and head gasket in place, align holes in upper plate with ends of bolts. Blind holes in upper plate accommodate dowel pins in cylinder. Tighten four bolts into upper plate until finger tight.
   g. See Figure 3-98. Tighten the bolts to 120-144 **in-lbs** (13.6-16.3 Nm) in the sequence shown.
   h. Following the same sequence, tighten each bolt to 15-17 ft-lbs (20.3-23.1 Nm).
   i. Using a grease pencil, mark a straight line on one of the bolts continuing the line over onto the lower plate. Repeat step for remaining three bolts.
   j. Using the marks as a guide, turn each bolt 1/4 turn or 90°. Be sure to tighten the bolts in the sequence shown in Figure 3-98.

*NOTE*

*For best results, obtain SNAP-ON TORQUE ANGLE GAUGE TA360.*

   k. For purposes of inspection, remove the assembly from the vise and place on bench top.



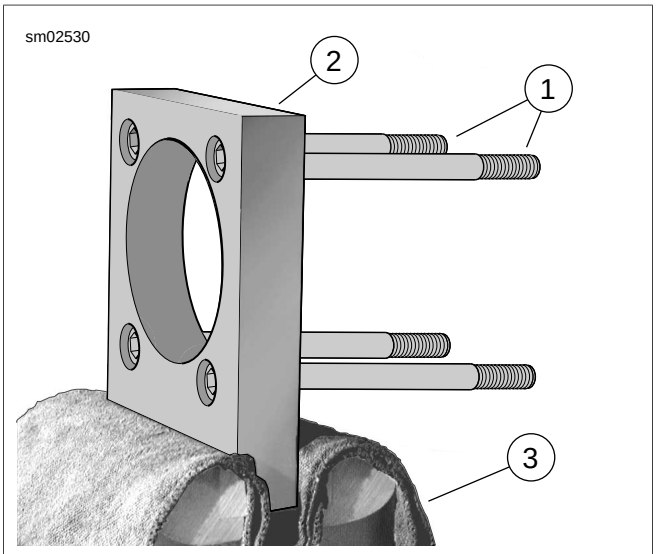

1. **Bolts**
2. **Lower plate**
3. **Upper plate**
4. **Vise grip step**

**Figure 3-96. Cylinder Torque Plates (Part No. HD-42324-A)**

*NOTE*

*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.*

2. See Figure 3-99. 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 in. (12.70 mm) or from the top of the cylinder, measure the cylinder diameter at two locations; parallel and perpendicular to the crankshaft. Record the readings.
   b. Repeat the two measurements at the center of the piston ring travel zone.
   c. Repeat the measurements again at the bottom of the bore at a point below the piston ring travel zone.
   d. Rebore the cylinder if the parallel and perpendicular measurements at either the top, middle or bottom of the bore vary by more than 0.002 in. (0.051 mm). This indicates an out-of-round condition.
   e. Rebore the cylinder if the top, middle and bottom bore diameters either parallel or perpendicular to the crankshaft vary by more than 0.002 in. (0.051 mm). This indicates excessive taper.
3. Continue with cylinder service.
   a. If cylinders are not scuffed or scored and are not worn beyond the service limits, see 3.23 CYLINDER, Deglazing Cylinder.
   b. If cylinders are worn beyond the service limits, then they must be rebored and/or honed to accept the next standard oversize piston. See 3.23 CYLINDER, Boring and Honing Cylinder.




1. **Bolt (4)**
2. **Lower plate**
3. **Vise**

**Figure 3-97. Attaching Cylinder Torque Plates**

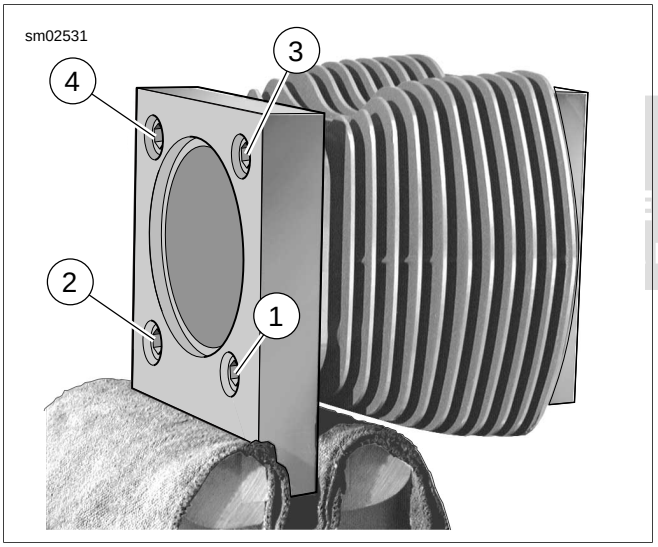



**Figure 3-98. Cylinder Torque Plate Bolt Sequence**

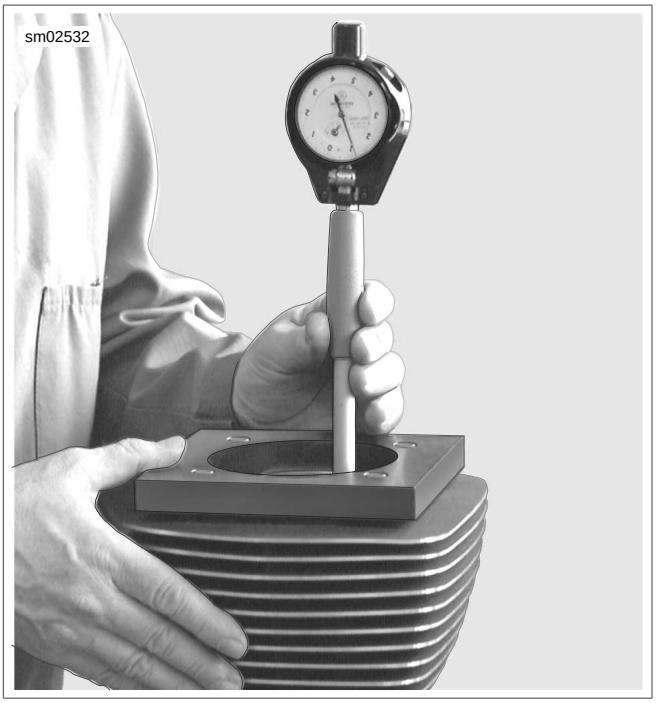



**Figure 3-99. Measure for Out-of-Round and Taper**

## 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 incorrect cross hatch pattern will result in insufficient oil retention and possible piston seizure and/or high oil consumption. (00536b)**

**CAUTION**

**Failure to remove all abrasive particles may result in premature cylinder, piston and ring wear and engine failure. (00537b) .**

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 of 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 a clean white paper towel and thoroughly wipe the inside of the cylinder to prevent 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.*

8. With the cylinder at room temperature, check the piston clearance in the cylinder in which the piston will run. See 3.24 PISTON, Inspection.

## BORING AND HONING CYLINDER

1. Bore cylinder with gaskets and torque plates attached. Refer to Table 3-36. Bore the cylinder to 0.003 in. (0.08 mm) under the desired finished size.

**CAUTION**

**An incorrect cross hatch pattern or too fine a hone will result in insufficient oil retention and possible piston seizure and/or high oil consumption. (00538b)**

2. 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.
3. Stop frequently to examine the cylinder bore and/or take measurements. Remember, a precise 60° crosshatch pattern in the piston travel area is important.

**CAUTION**

**Failure to remove all abrasive particles may result in premature cylinder, piston and ring wear and engine failure. (00537b) .**

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 of dirt or debris.

*NOTE*

*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.
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 3.24 PISTON, Inspection.



**Table 3-36. Oversize Pistons/Cylinder Bores**

| PISTON | | | CYLINDER BORE FINISHED SIZE | |
|---|---|---|---|---|
| SIZE | IN. | MM | IN. | MM |
| Standard | N/A | N/A | 3.7500-3.7505 | 95.250-95.263 |
| Oversize | 0.005 | 0.13 | 3.7550-3.7555 | 95.377-95.390 |
| | 0.010 | 0.25 | 3.7600-3.7605 | 95.504-95.517 |

## INSTALLATION OVERVIEW

See 3.16 TOP END OVERHAUL: ASSEMBLY.

1. Install cylinder.
2. Install cylinder head.
3. Install push rod covers and push rods.
4. Install rocker arm support plate.
5. Install breather assembly.
6. Continue with vehicle assembly as directed.

## REMOVAL OVERVIEW

*NOTE*

*Do not mix 2007 and later pistons with earlier style pistons. New style pistons have tapered wrist pin boss. The wrist pin portion of the connecting rod is also tapered.*

See 3.15 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.
3. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
4. Remove cylinder head.
5. Remove cylinder.
6. Remove piston.

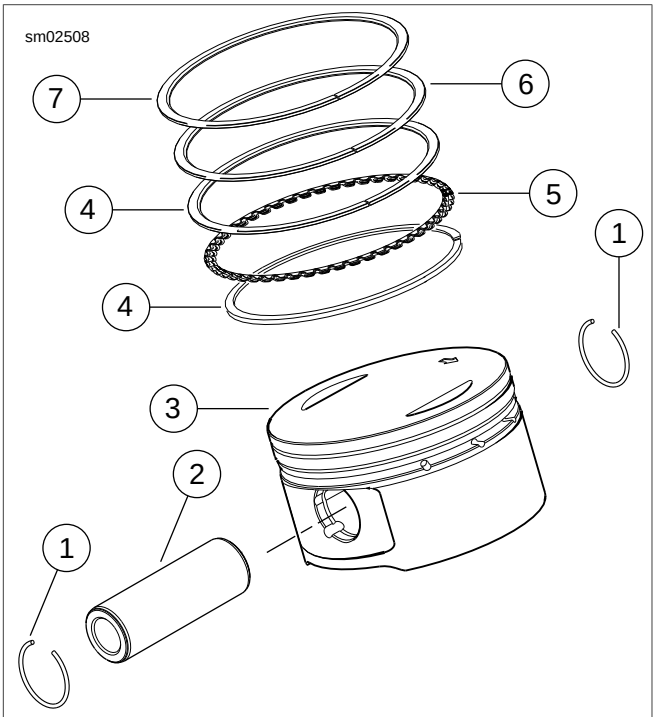
## DISASSEMBLY

### Piston Rings

**WARNING**

**Wear safety glasses or goggles when removing or installing compression rings. Compression rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00469c)**

1. See Figure 3-100. Carefully remove top (7) and second (6) compression rings using the proper piston ring expander (Snap-on PRS8).
2. Using your fingers, remove top and bottom oil rails (4) from the third ring groove. Remove the oil rail expansion ring (5).
3. Discard the piston rings.




1. **Circlip**
2. **Piston pin**
3. **Piston**
4. **Oil rail**
5. **Expansion ring**
6. **Second compression ring**
7. **Top compression ring**

**Figure 3-100. Piston Assembly**

## CLEANING

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).

*NOTE*

*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.*

**WARNING**

**Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)**

2. Thoroughly rinse the pistons. Blow parts 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.

*NOTE*

*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. See Figure 3-101. Check piston pin.
   a. 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.
   b. Replace piston and/or pin if clearance exceeds 0.0008 in. (0.02 mm).

*NOTE*

*Pistons with superficial wear marks, minor scratching or mild scoring may continue to be used.*

2. Carefully inspect the pistons for damage or excessive wear.
   a. Discard pistons with cracked, broken or bent ring lands.
   b. Check the piston skirt for cracks, gouges, deep scratches or heavy scoring.
   c. Check the piston heads for evidence of burning, etching or melting.
   d. Look for marks or imprints caused by contact with valves.

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.

*NOTE*

*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. See Figure 3-102. Measure piston ring side clearance.
   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.
   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).
   d. Discard the piston if the oil control ring side clearance exceeds 0.010 in. (0.25 mm).

*NOTES*

- *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.*
- *This inspection is very heat sensitive. Do not check piston running clearance immediately after honing or deglazing cylinder. Even holding the piston in your hand for too long can cause measurements to vary by as much as 0.0002 in. (0.0051 mm). Both piston and cylinder must be at room temperatures before proceeding.*
- *Piston 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 3-103. 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 3-103.*

5. See Figure 3-103. Measure running clearance of pistons as follows:
   a. Holding outside micrometer, measure piston skirt diameter across the thrust faces (perpendicular to piston pin bore). Start below the bottom ring land and move micrometer towards bottom of skirt. Micrometer will be loose, then tight, about 0.5 in. (12.7 mm), from bottom and then loose again.
   b. Measure the piston skirt at the tightest spot and then transfer that measurement to dial bore gauge.
   c. Using a grease pencil, mark the top, middle and bottom of the piston ring travel zone in the cylinder bore. Measure at markings in cylinder parallel and perpendicular to crankshaft.
   d. Replace piston and/or cylinder if running clearance exceeds 0.003 in. (0.076 mm).


**1. Pin must slide without binding or pivoting**

**Figure 3-101. Piston Pin Clearance**

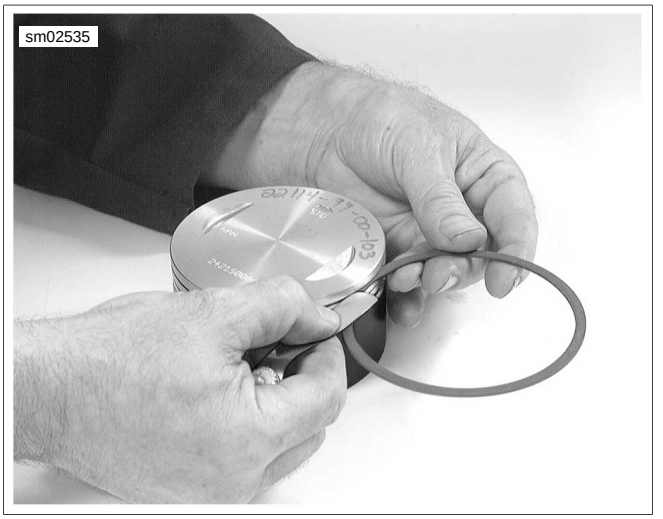
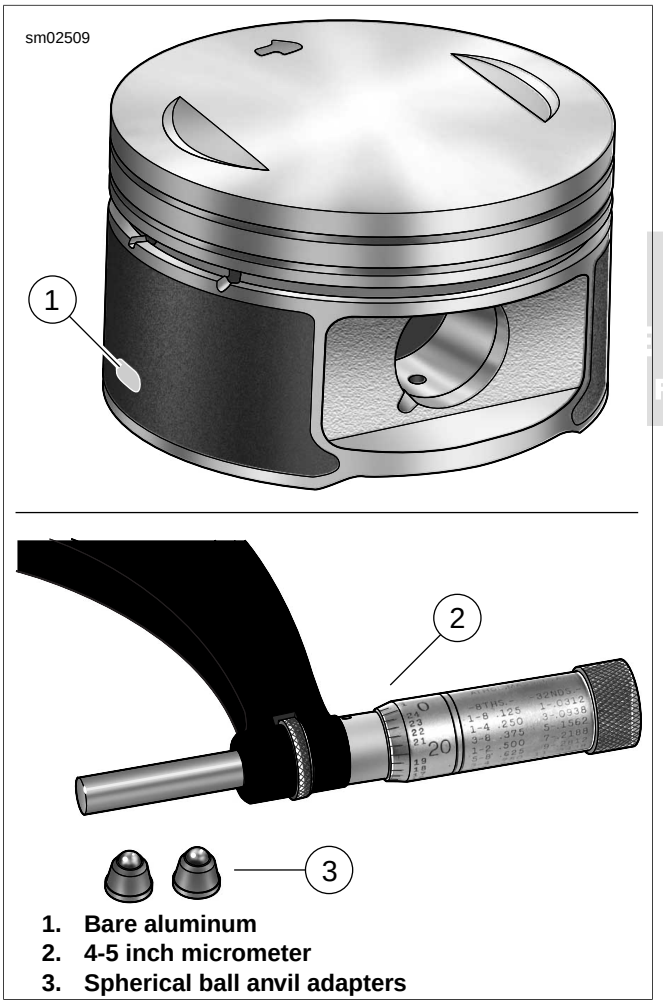



**Figure 3-102. Measure Piston Ring Side Clearance**




1. **Bare aluminum**
2. **4-5 inch micrometer**
3. **Spherical ball anvil adapters**

**Figure 3-103. Measuring Running Clearance of Piston**

# ASSEMBLY

## Checking Piston Ring Gap

*NOTES*

- *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.*
- *Insufficient ring gap may cause the ends to abut at engine operating temperatures, resulting in ring breakage, cylinder scuffing and/or piston seizure.*
- *Excessive ring 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.*

1. See Figure 3-104. Check ring gap before placing each ring on the piston.
   a. Insert the **new** ring into the cylinder and square it in the bore using the top of the piston. Measure the ring gap with a feeler gauge.
   b. Top compression ring gap must be 0.010-0.020 in. (0.25-0.51 mm).
   c. Second compression ring gap must be 0.014-0.024 in. (0.36-0.61 mm).
   d. Oil control rail gap must be 0.010-0.050 in. (0.25-1.27 mm).

*NOTE*

*Ring end gap dimensions also apply to oversize rings. Replace ring if end gap exceeds specification. If end gap is under specification, filing is permissible.*

**WARNING**

**Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)**

2. Use compressed air to remove any dirt or dust that may have settled in the oil drain holes and piston ring grooves.


**Figure 3-104. Measuring Ring Gap**

## Installing Piston Rings

1. See Figure 3-105. Apply clean H-D 20W50 engine oil to three piston ring grooves.
2. Install expansion ring (4) into third ring groove.
3. Spiral bottom oil rail (5) into space below expansion ring (4). Position gap 90° from the gap in the expansion ring.
4. Spiral top oil rail (3) into space above expansion ring (4). Position gap 180° from the gap in the bottom oil rail.

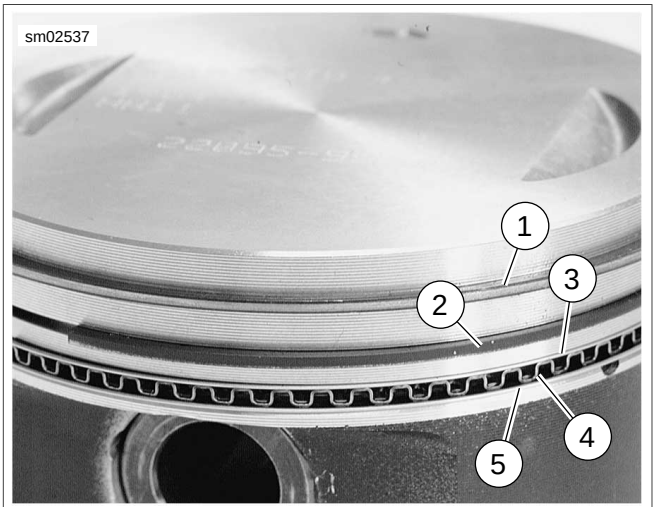
**⚠WARNING**

**Wear safety glasses or goggles when removing or installing compression rings. Compression rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00469c)**

*NOTES*

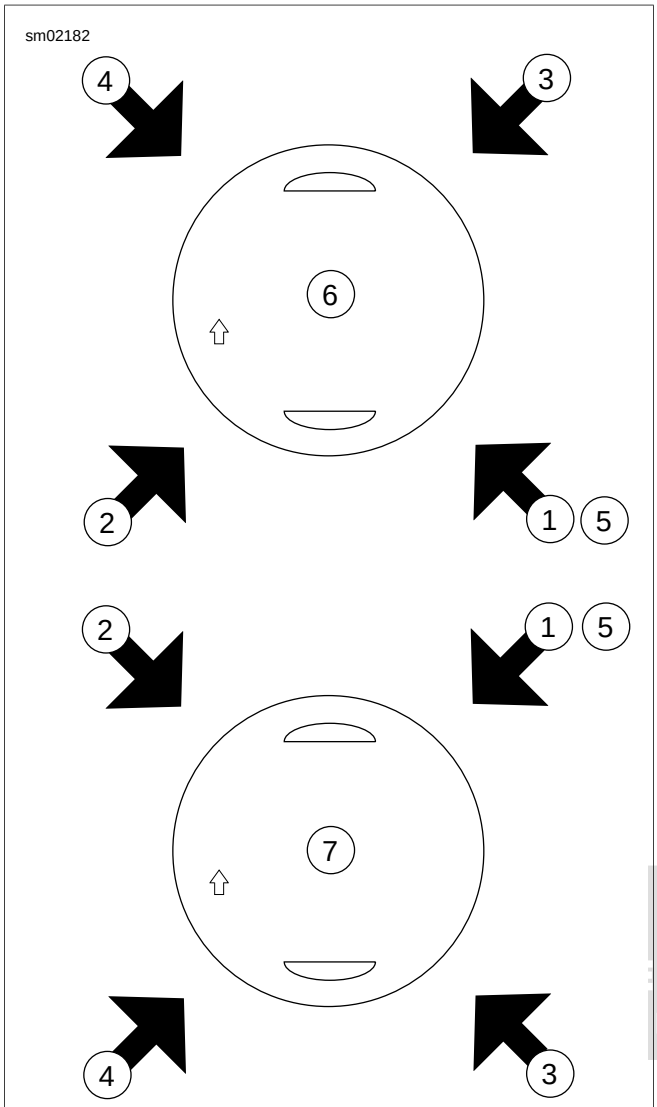
- *Use the proper piston ring spreader to prevent excessive ring twist and expansion. Over expansion may cause the ring to crack opposite the ring gap. Damaged or distorted rings result in blow-by of exhaust gases, increased oil consumption and lower service life on valves and other components.*
- *Installing 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.*

5. Using the proper piston ring expander (Snap-on PRS8), carefully install the second compression ring. Make sure the dot (punch mark) near the ring gap faces the piston crown. Rotate the ring so the gap is 180° from the gap in the expansion ring.
6. Using the proper piston ring expander (Snap-on PRS8), carefully install the top compression ring. Make sure the dot (punch mark) near the ring gap faces the piston crown. Rotate the ring so the gap is 180° from the gap in the second compression ring.
7. Rotate the three piston rings using the palms of both hands. The rings must rotate freely without sticking.
8. See Figure 3-106. Verify the ring gaps are still properly staggered.




1. **Top compression ring**
2. **Second compression ring**
3. **Top oil rail**
4. **Expansion ring**
5. **Bottom oil rail**

**Figure 3-105. Piston Rings**




1. **Expander ring**
2. **Bottom oil rail**
3. **Top oil rail**
4. **Second compression ring**
5. **Top compression ring**
6. **Front**
7. **Rear**

**Figure 3-106. Piston Ring Gap Alignment**

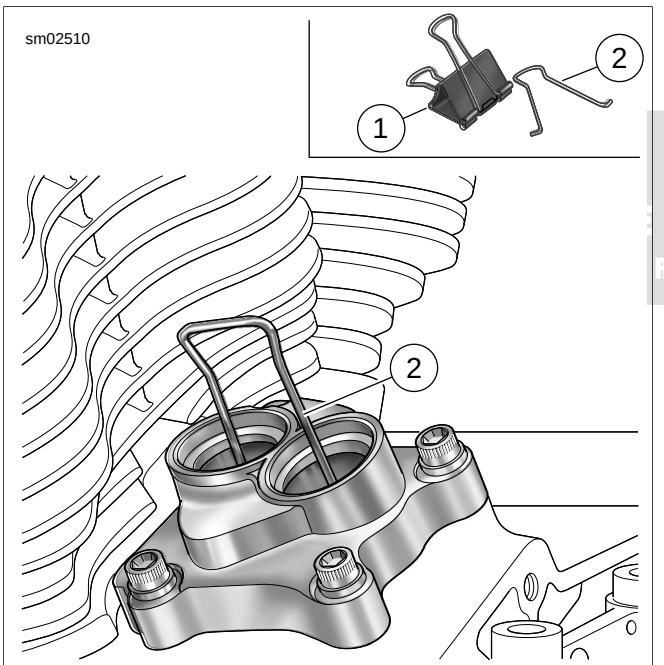
## INSTALLATION OVERVIEW

See 3.16 TOP END OVERHAUL: ASSEMBLY.

1. Attach piston to connecting rod.
2. Install cylinder.
3. Install cylinder head.
4. Install push rod covers and push rods.
5. Install rocker arm support plate.
6. Install breather assembly.
7. Continue with vehicle assembly as directed.

## REMOVAL OVERVIEW

1. See 3.15 TOP END OVERHAUL: DISASSEMBLY.
   a. Remove breather assembly.
   b. Remove rocker arm support plate.
   c. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
2. See Figure 3-107. Fashion lifter holding tool to prevent the hydraulic lifters from dropping into the cam compartment during cam support plate removal.
   a. Obtain a large binder clip (1) which is available at any office supply store. Squeeze wireforms (2) to remove from binder clip.
   b. Compress wireform (2) slightly and insert free ends into outer and inner lifter cover bores so that legs engage walls of both hydraulic lifter sockets.
3. To remove cover and cam support plate, see 3.17 BOTTOM END OVERHAUL: DISASSEMBLY.




1. **Binder clip**
2. **Wireform**

**Figure 3-107. Hydraulic Lifter Holding Tool**

## CAMSHAFTS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-47956 | CAMSHAFT ASSEMBLY TOOL |

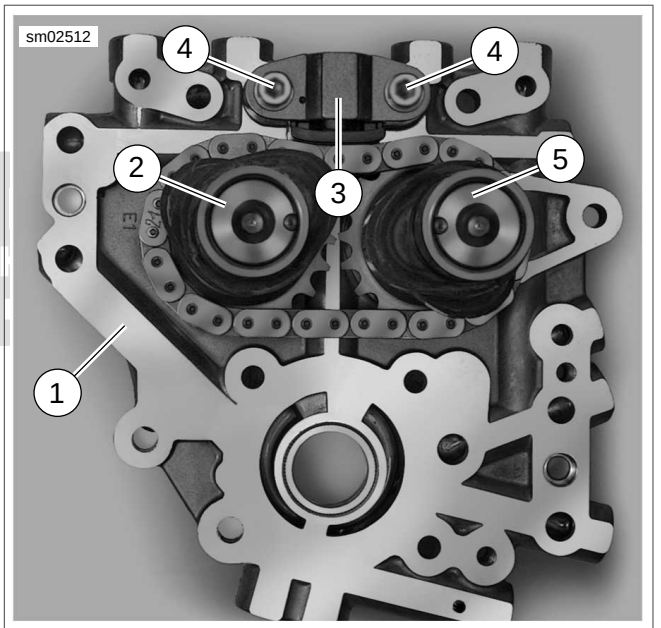
### Removal

1. See Figure 3-108. Remove screws (4) and remove secondary cam chain tensioner (3).

**WARNING**

**Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)**

2. Remove retaining ring from groove at end of front camshaft. Discard retaining ring.
3. Remove spacer from front camshaft. Do not mix front and rear camshaft spacers. Front spacer is 0.100 in. (2.54 mm) thick.
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.
5. Slide camshafts and secondary cam chain out of cam support plate.
6. Remove secondary cam chain from cam sprockets.




1. **Cam support plate**
2. **Front cam**
3. **Secondary cam chain tensioner**
4. **Secondary cam chain tensioner fasteners**
5. **Rear cam**

**Figure 3-108. Camshafts**

### Assembly

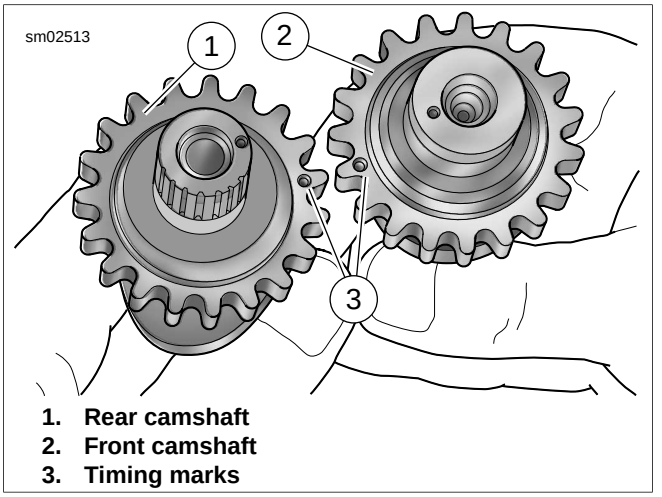
1. See Figure 3-109. Align timing marks on teeth of secondary cam sprockets (outboard faces).

*NOTE*

*Do not mix camshafts during the installation procedure. The rear camshaft, which can be identified by the splined shaft, must go into the hole at the rear of the cam support plate.*

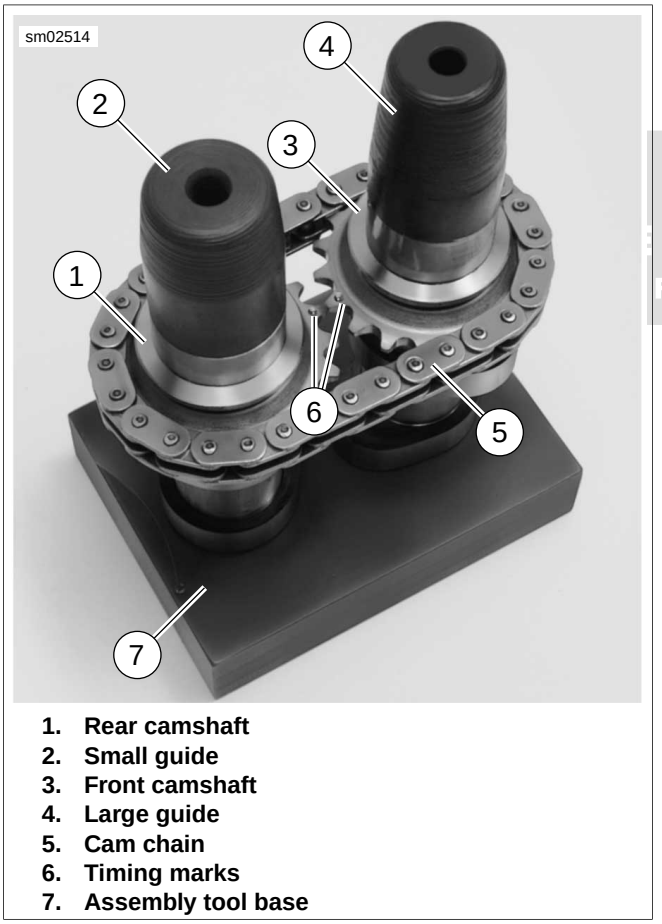
2. Place the secondary cam chain around the sprockets of both the front and rear camshafts while keeping the timing

marks (3) in alignment. To maintain the original direction of rotation, be sure that the mark placed on the chain link during disassembly is visible during installation.




1. **Rear camshaft**
2. **Front camshaft**
3. **Timing marks**

**Figure 3-109. Camshaft Timing Marks**




1. **Rear camshaft**
2. **Small guide**
3. **Front camshaft**
4. **Large guide**
5. **Cam chain**
6. **Timing marks**
7. **Assembly tool base**

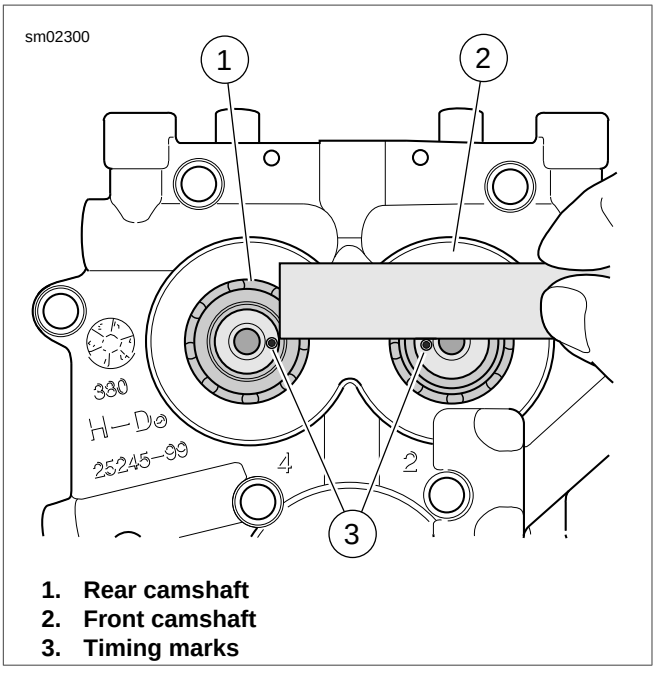
**Figure 3-110. Camshaft Assembly Tool**

3. See Figure 3-110. Obtain CAMSHAFT ASSEMBLY TOOL (Part No. HD-47956). Place crankcase side of camshaft/cam chain assembly into assembly tool base (7) while maintaining cam timing mark (6) alignment.
4. Place small guide (2) on rear camshaft (1). Place large guide (4) on front camshaft (3).
5. Lubricate support plate camshaft cavities with clean H-D 20W50 engine oil.
6. Install cam support plate over guides.
7. Remove guides and base.
8. See Figure 3-111. Using a straightedge, verify that the timing marks are in alignment. If they are not, then the camshafts must be removed, realigned and reinstalled.

**WARNING**

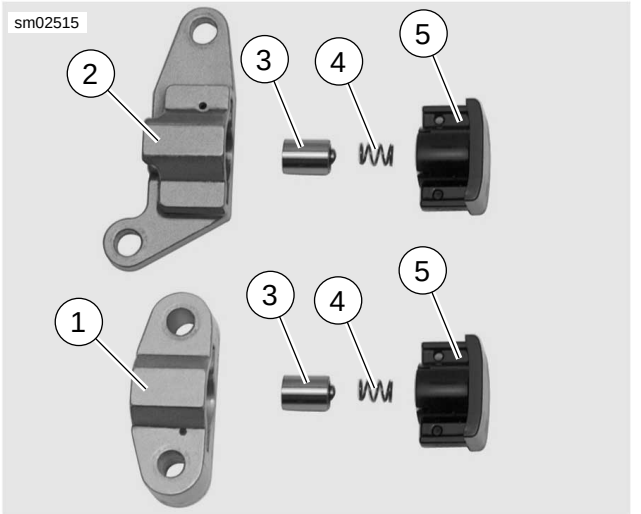
**Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)**

9. Install 0.100 in. (2.54 mm) thick front camshaft spacer over end of front camshaft.
10. With the sharp edge out, install **new** retaining ring in groove at end of front camshaft.
11. Inspect primary and secondary cam chain tensioners.
    a. Inspect tensioners for wear. Replace tensioners if damaged or if chain contact portion of shoe material is less than 0.060 in. (1.52 mm) thick.
    b. See Figure 3-112. Be sure primary and secondary cam chain tensioners are assembled as shown. If assembled incorrectly, tensioners will not function properly.
12. Install secondary cam chain tensioner. Tighten fasteners to 100-120 **in-lbs** (11.3-13.6 Nm).




1. **Rear camshaft**
2. **Front camshaft**
3. **Timing marks**

**Figure 3-111. Verify Alignment of Timing Marks**




1. **Secondary cam chain tensioner**
2. **Primary cam chain tensioner**
3. **Piston**
4. **Spring**
5. **Shoe**

**Figure 3-112. Cam Chain Tensioner Assemblies**

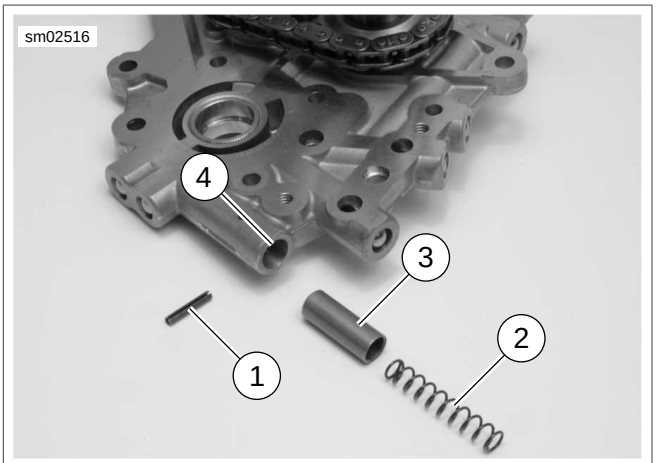
## OIL PRESSURE RELIEF VALVE

### Removal

1. Before removal, see 3.26 OIL PUMP, Cleaning and Inspection.
2. Secure the cam support plate in a vise with access to the roll pin. Be sure to install a pair of brass jaw inserts in the vise to avoid damage to the casting.
3. See Figure 3-113. Using a 1/8 in. punch with a small hammer, carefully tap roll pin (1) from pin hole in cam support plate. Discard roll pin.
4. Remove spring (2) and valve body (3) from bypass port.

### Installation

1. Secure the cam support plate in a vise. Be sure to install a pair of brass jaw inserts to avoid damage to the casting.
2. See Figure 3-113. Lubricate valve body (3) with clean H-D 20W50 engine oil. Slide valve body into bypass port of cam support plate with the open side facing outward.
3. Slide spring (2) into bypass port until seated in open side of valve body.
4. Start **new** roll pin (1) into hole in cam support plate. Compress spring in port using the blade of a small screwdriver.
5. Holding spring compressed, tap roll pin into cam support plate until it approaches pin hole on opposite side.
6. Remove screwdriver to release spring. Verify that spring is straight and square in bore.
7. Using a 1/8 in. punch with a small hammer, carefully tap roll pin until flush with casting.




1. **Roll pin**
2. **Spring**
3. **Valve body**
4. **Bypass port**

**Figure 3-113. Oil Pressure Relief Valve Assembly**

### Inspection

*NOTE*

*If diagnosing low oil pressure, start with step 1. If diagnosing high oil pressure, then begin with step 2.*

1. 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 in. (57.15 mm). If it is not, continue with next step.
2. Remove oil pressure relief valve.
3. Inspect spring for stretching, kinking or distortion.
4. 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.
5. Install piston in bore and measure running clearance. If running clearance exceeds 0.003 in. (0.076 mm), install **new** piston and remeasure. Replace cam support plate if running clearance still exceeds specification.

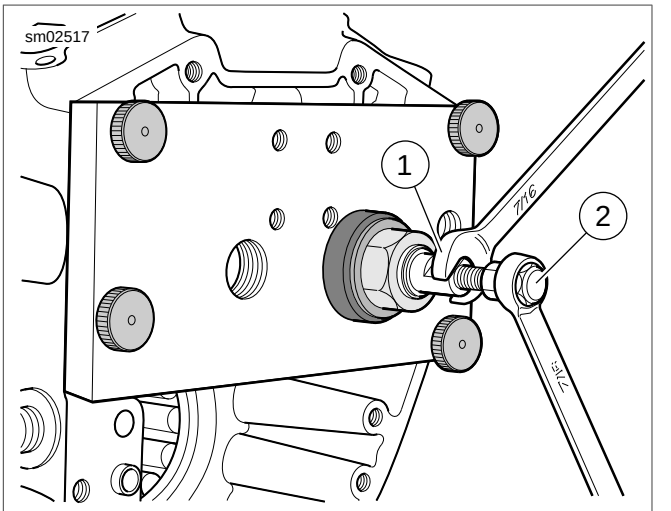
## CAM NEEDLE BEARINGS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-42325-A | CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER |

### Removal

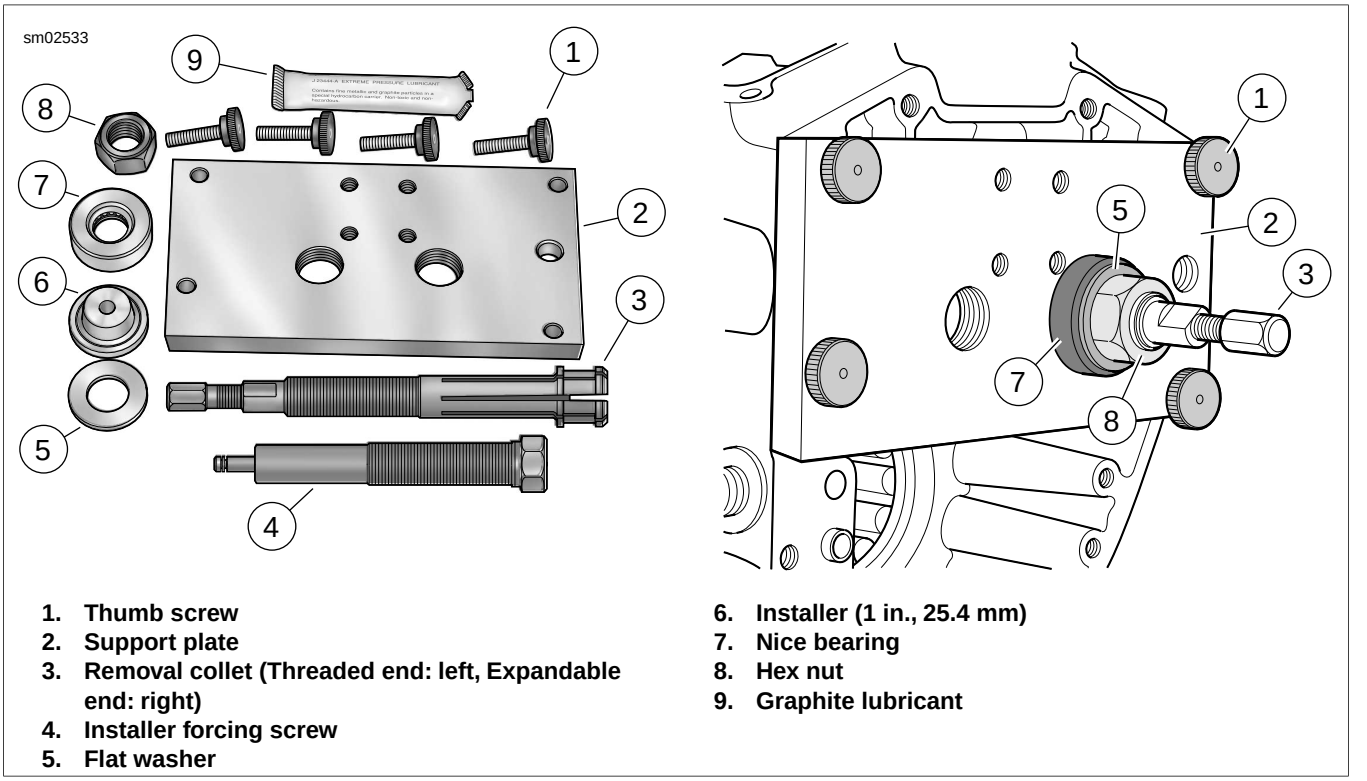
1. Obtain the CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER (Part No. HD-42325-A).
2. See Figure 3-115. Remove four thumb screws (1) from threaded holes in support plate (2), if installed.
3. Sparingly apply graphite lubricant (9) to threads of collet (3) to prolong service life and ensure smooth operation.
4. Slide collet through support plate so that threaded end exits stamped side of plate.

5. Aligning two large holes in support plate with needle bearing bores, hang right side of plate on ring dowel in crankcase flange.
6. Align four holes at corners of support plate with threaded holes in crankcase flange. Install thumb screws in these holes to secure support plate to crankcase.
7. Center expandable end of collet in bearing bore and slide Nice bearing (7) and flat washer (5) on threaded end. Start hex nut (8) 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.




1. **Flat**
2. **Hex**

**Figure 3-114. Expanding Collet by Turning Hex Clockwise**




1. **Thumb screw**
2. **Support plate**
3. **Removal collet (Threaded end: left, Expandable end: right)**
4. **Installer forcing screw**
5. **Flat washer**
6. **Installer (1 in., 25.4 mm)**
7. **Nice bearing**
8. **Hex nut**
9. **Graphite lubricant**

**Figure 3-115. Camshaft Needle Bearing Remover/Installer (Part No. HD-42325-A)**

9. Holding collet to prevent lateral movement, finger tighten hex nut until Nice bearing contacts support plate.
10. See Figure 3-119. Using a 7/16 in. open end wrench, hold flat on collet to prevent rotation. Using a second 7/16 in. open end wrench, expand collet by turning hex at end of shaft in a clockwise direction. Expandable end of collet makes contact with needle bearing ID.
11. See Figure 3-114. Using a 15/16 in. open end wrench, turn hex nut in a clockwise direction until bearing is free. If necessary, hold flat on collet to prevent rotation.
12. Remove four thumb screws and pull support plate from crankcase.
13. Holding flat on collet, turn hex at end of shaft in a counter-clockwise 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. Repeat this procedure to remove second needle bearing.

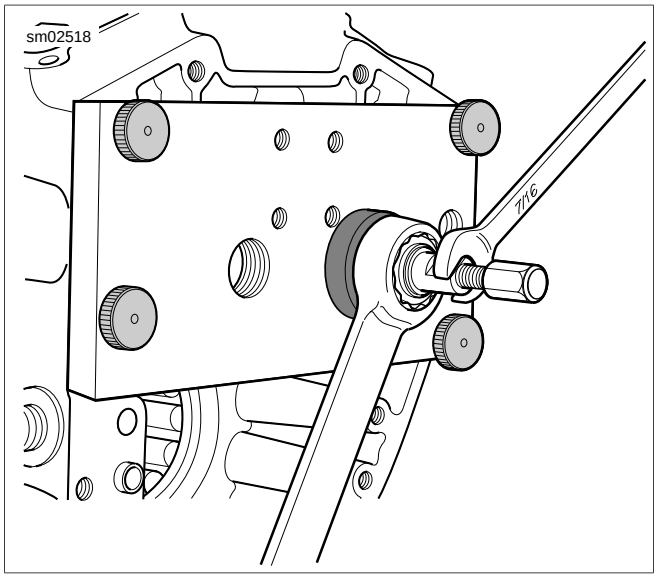



**Figure 3-116. Bearing Removal**

## Installation

1. Obtain the CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER (Part No. HD-42325-A).

*NOTE*

*To avoid engine damage, care must be taken to install needle bearings to the correct depth. The correct depth is achieved only when the edge of the needle bearing is 3.10 in. (78.7 mm) from the cam cover flange.*

2. Since measuring from the top of the support plate is easier and produces the most accurate and consistent results, proceed as follows:
   a. See Figure 3-117. Using a dial caliper, measure thickness of support plate.
   b. To determine the required distance from the top of the support plate to the edge of the installed needle bearing, add measurement obtained in the previous step to 3.10 in. (78.7 mm).

*NOTE*

*For example, if the support plate is 0.50 in. (12.7 mm) thick, then the measurement from the top of the support plate to the edge of the needle bearing should be 3.60 in. (91.4 mm).*

3. See Figure 3-115. Sparingly apply graphite lubricant (9) to threads of installer forcing screw (4) to prolong service life and ensure smooth operation.
4. Thread installer forcing screw into stamped side of support plate (2) until threads begin to emerge from opposite side.
5. Place installer (6) at end of installer forcing screw.
6. Place **new** needle bearing on installer with lettered side facing shoulder.
7. See Figure 3-118. Aligning two large holes in support plate with needle bearing bores, hang right side of plate on ring dowel in crankcase flange.
8. Align four holes at corners of support plate with threaded holes in crankcase flange. Install thumb screws in these holes to secure support plate to crankcase.

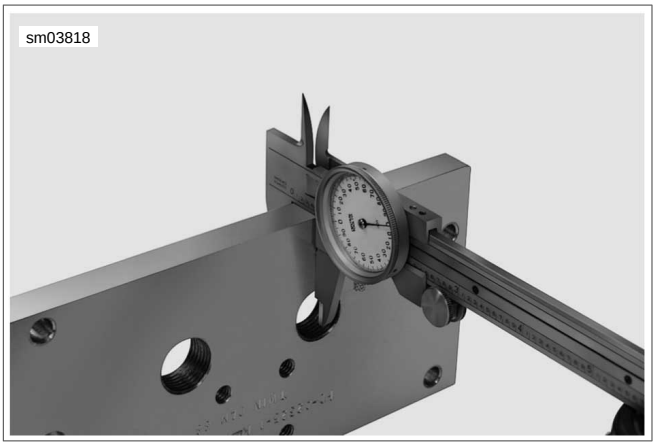



**Figure 3-117. Measure Thickness of Support Plate**

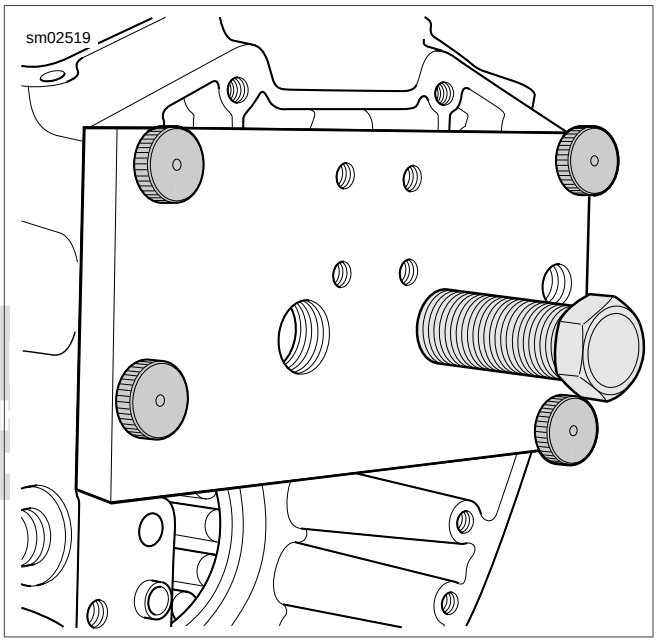



**Figure 3-118. Installer Forcing Screw Installation**

9. Install first needle bearing as follows:
   a. Obtain torque wrench and set to 25 ft-lbs (33.9 Nm).

*NOTE*

*In next step, do not exceed 25 ft-lbs (33.9 Nm) to install bearing. If this specification is exceeded, bearing could push through case causing damage to case and bearing.*

b. See Figure 3-119. Using torque wrench, turn hex at end of installer forcing screw in a clockwise direction to press needle bearing into bore

c. Back out forcing screw. Reaching into crankcase, remove installer. Remove forcing screw from support plate.

d. See Figure 3-120. Inserting dial caliper through forcing screw bore, measure distance from top of support plate to edge of needle bearing.

e. Install forcing screw in support plate. Reaching into crankcase, place installer at end of forcing screw. Hand turn forcing screw until shoulder on installer makes contact with edge of needle bearing.

f. Repeat the previous steps until needle bearing is installed to the correct depth (as calculated previously).

*NOTE*

*In the next step, a measurement will be taken of the distance from the head of the installer forcing screw to the support plate. For an accurate measurement, be sure the shoulder on the installer is in contact with the edge of the needle bearing.*

10. See Figure 3-121. Using a dial caliper, measure from head (top) of installer forcing screw to support plate. Record this measurement for use in installing second needle bearing.
11. Back out forcing screw. Reaching into crankcase, remove installer. Remove forcing screw from support plate.
12. Install forcing screw in support plate over second needle bearing bore. Reaching into crankcase, place installer at end of forcing screw. Place **new** needle bearing on installer with lettered side facing shoulder.

*NOTE*

*In next step, do not exceed 25 ft-lbs (33.9 Nm) to install bearing. If this specification is exceeded, bearing could push through case causing damage to case and bearing.*

13. Using torque wrench, turn hex on forcing screw in a clockwise direction until distance from head (top) of forcing screw to support plate equals measurement obtained previously.

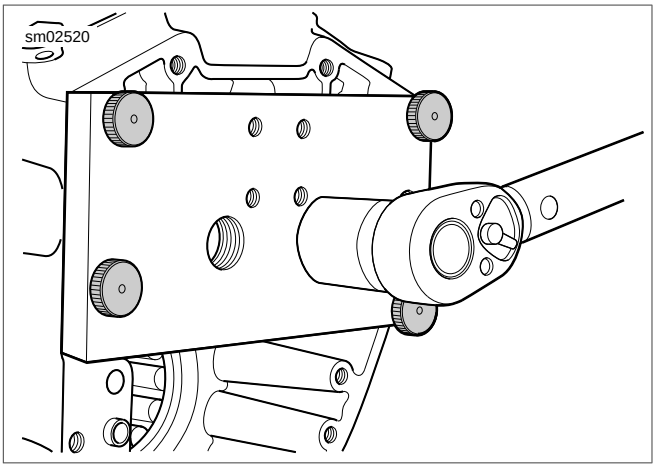



**Figure 3-119. 1 Inch (25.4 mm) Bearing Installation**

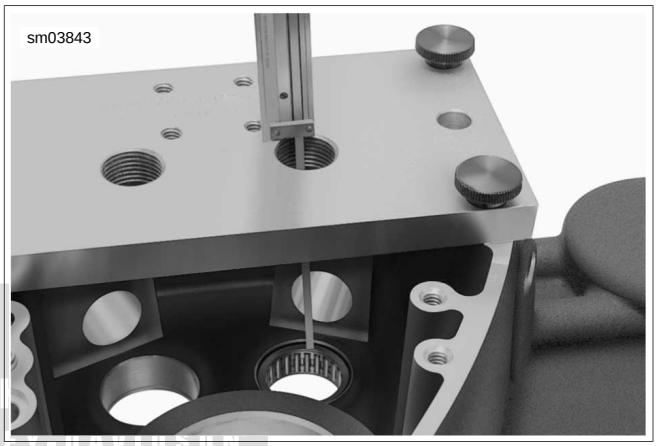



**Figure 3-120. Measure from Top of Support Plate to Edge of Needle Bearing**

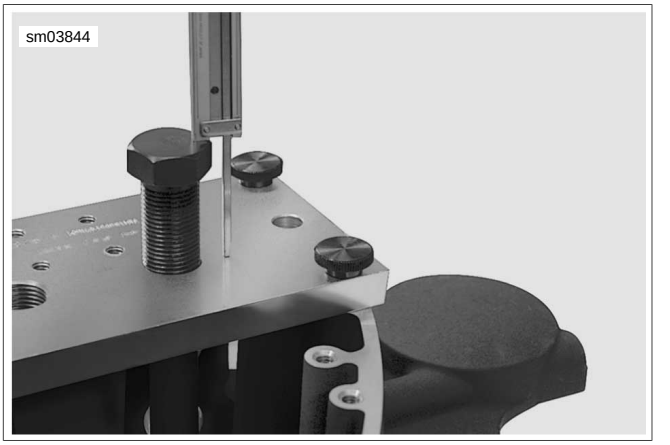



**Figure 3-121. Measure from Top of Forcing Screw to Support Plate**

## CLEANING AND INSPECTION

### Oil Pressure Valve

See 3.25 COVER AND CAM SUPPORT PLATE, Oil Pressure Relief Valve.

## Cam Support Plate

Verify that all oil holes are clean and open.

*NOTE*

*Exercise caution to avoid enlarging the oil holes or oil pressure will be adversely affected.*

## INSTALLATION OVERVIEW

1. Begin with 3.18 BOTTOM END OVERHAUL: ASSEMBLY, Cover and Cam Support Plate.
2. Continue with 3.16 TOP END OVERHAUL: ASSEMBLY.

## REMOVAL OVERVIEW

1. See 3.15 TOP END OVERHAUL: DISASSEMBLY.
   a. Remove breather assembly.
   b. Remove rocker arm support plate.
   c. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
2. Fashion lifter holding tool to prevent the hydraulic lifters from dropping into the cam compartment during cam support plate removal. See 3.25 COVER AND CAM SUPPORT PLATE.
3. To remove cover and cam support plate, see 3.17 BOTTOM END OVERHAUL: DISASSEMBLY. Remove oil pump after removing cam support plate.

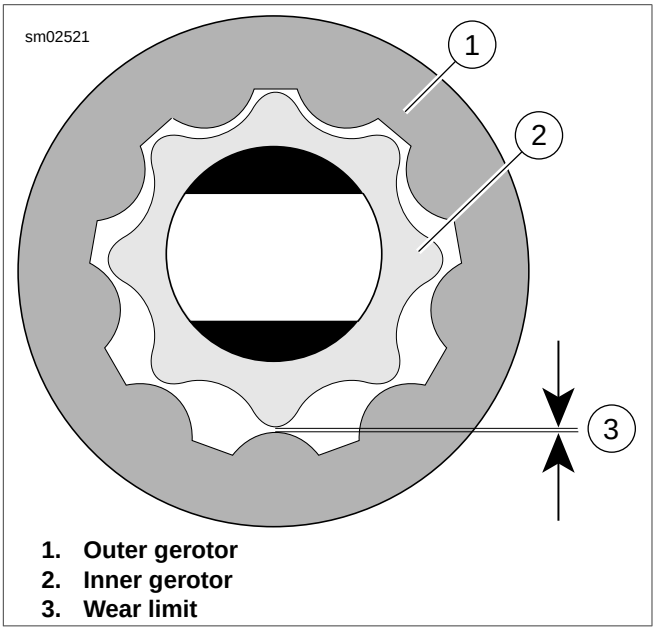
## CLEANING AND INSPECTION

1. Clean all parts in a non-volatile cleaning solution or solvent.

**⚠WARNING**

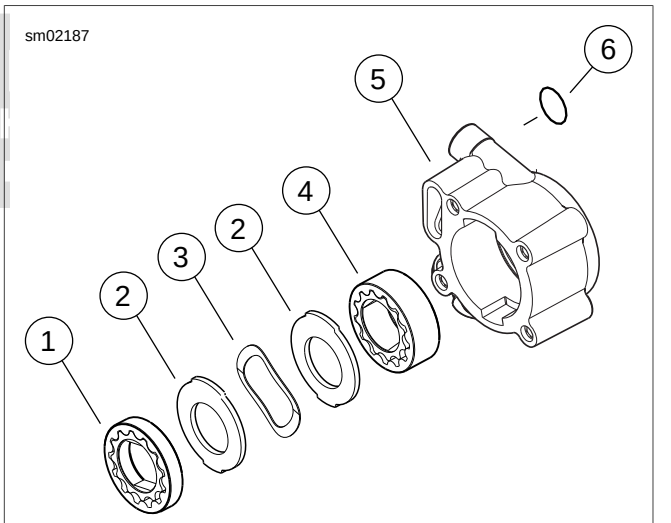
**Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)**

2. Blow parts dry with low pressure compressed air. Verify that all oil passages are clean and open.
3. Look for scoring, gouging or cracking caused by foreign material that may have passed through the oil pump.
4. Look for grooves or scratches on the cam support plate, which serves as the outboard side of the oil pump.
5. Check for excessive wear or damage on lobes of outer gerotor gears and between lobes on inner gerotor gears.
6. See Figure 3-122. Check gerotor wear.
   a. Mesh pieces of one gerotor set together.
   b. Use a feeler gauge to determine clearance between tips of lobes on inner and outer gerotors.
   c. Replace gerotors as a set if clearance exceeds 0.004 in. (0.10 mm). 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 in. (0.025 mm). Inspect second gerotor set in the same manner.
8. See Figure 3-123. Assemble the oil pump. Verify that feed gerotors stand proud of the oil pump surface 0.080-0.090 in. (2.03-2.29 mm). If measurement is less than 0.080 in. (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.




1. **Outer gerotor**
2. **Inner gerotor**
3. **Wear limit**

**Figure 3-122. Measure Gerotor Sets for Wear**




1. **Narrow gerotor set (feed)**
2. **Separator plate**
3. **Wave washer**
4. **Wide gerotor set (scavenge)**
5. **Oil pump housing**
6. **Scavenge port O-ring**

**Figure 3-123. Assembling Oil Pump**

## INSTALLATION OVERVIEW

1. See 3.25 COVER AND CAM SUPPORT PLATE, Installation Overview.
2. Continue with 3.16 TOP END OVERHAUL: ASSEMBLY.

## REMOVAL OVERVIEW

1. Perform all steps under 3.15 TOP END OVERHAUL: DISASSEMBLY.
2. Perform all steps under 3.17 BOTTOM END OVERHAUL: DISASSEMBLY.

## RIGHT CRANKCASE HALF

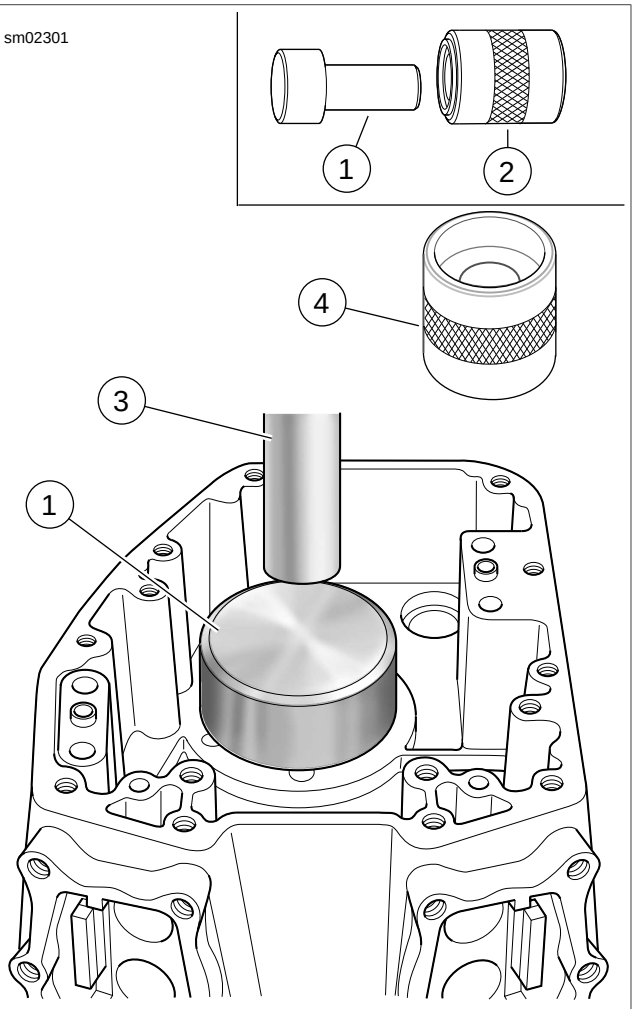
| PART NUMBER | TOOL NAME |
|---|---|
| B-45655 | CRANKCASE BEARING REMOVER/INSTALLER |
| HD-42720-5 | CRANKCASE BEARING REMOVER/INSTALLER BASE |

### Main Bearing Removal

*NOTE*

*Do not move or lift the crankcase by grasping the cylinder studs. The crankcase is too heavy to be carried in this manner and could be dropped.*

1. See Figure 3-124. Obtain CRANKCASE BEARING REMOVER/INSTALLER (Part No. B-45655) and CRANKCASE BEARING REMOVER/INSTALLER BASE (Part No. HD-42720-5).
2. Place support tube (2) on hydraulic press table with the "A" end up. Note that the sides of the support tube are stamped to ensure proper orientation.
3. With the outboard side of the right crankcase half facing upward, position main bearing bore over support tube. During removal it is important that the curved edges on the pilot/driver (1) match the curved edges of the crankcase.
4. Slide pilot/driver (1) through bearing into support tube.
5. Center pilot/driver under ram (3) of press. Apply pressure to pilot/driver until bearing is free.
6. Remove crankcase, pilot/driver and bearing from support tube. Discard bearing.



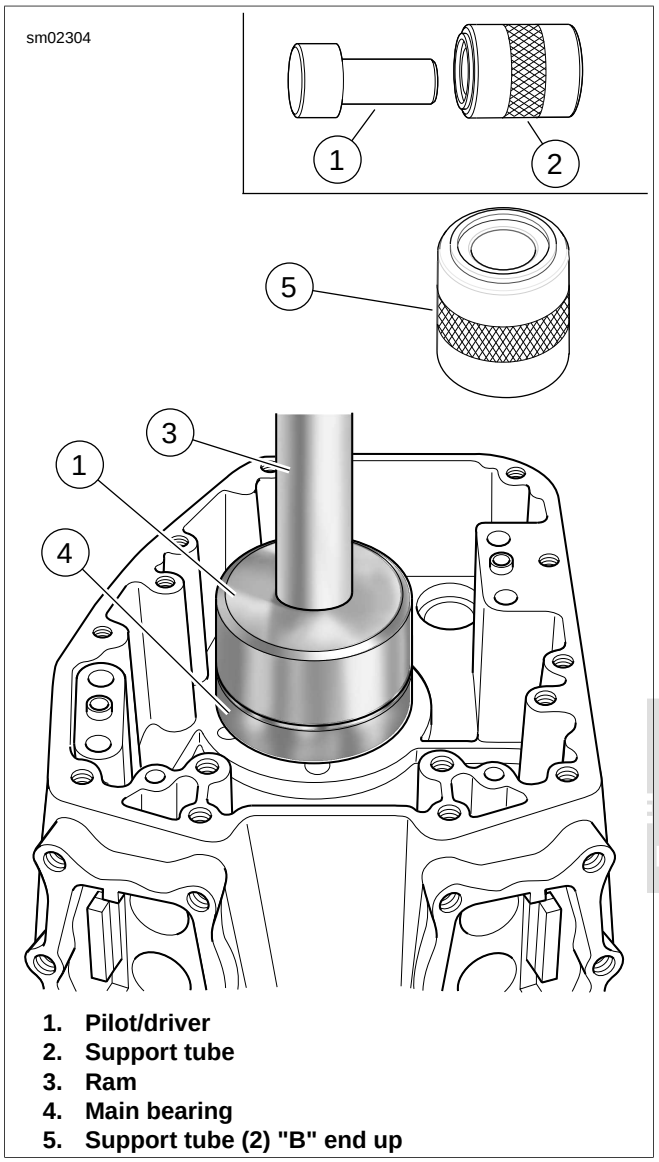

1. **Pilot/driver**
2. **Support tube**
3. **Ram**
4. **Support tube (2) "A" end up**

**Figure 3-124. Right Main Bearing Removal**

### Main Bearing Installation

1. See Figure 3-125. Obtain CRANKCASE BEARING REMOVER/INSTALLER (Part No. B-45655) and CRANKCASE BEARING REMOVER/INSTALLER BASE (Part No. HD-42720-5).
2. Obtain **new** main bearing (4). Spread a thin film of clean engine oil on O.D. of **new** bearing.
3. Turn support tube (2) over so that the "B" end is up. The sides of the support tube are stamped "A" and "B" to ensure proper orientation.
4. With the outboard side of the right crankcase half facing upward, position main bearing bore over support tube.
5. Lubricate leading edge (letter side) of **new** main bearing with clean engine oil. Start leading edge of bearing in bearing bore.
6. Slide pilot/driver (1) through bearing into support tube.

7. Center pilot/driver under ram (3) of press. Apply pressure to pilot/driver until resistance is felt and bearing is bottomed on the support tube.
8. Remove pilot/driver and crankcase half from support tube.

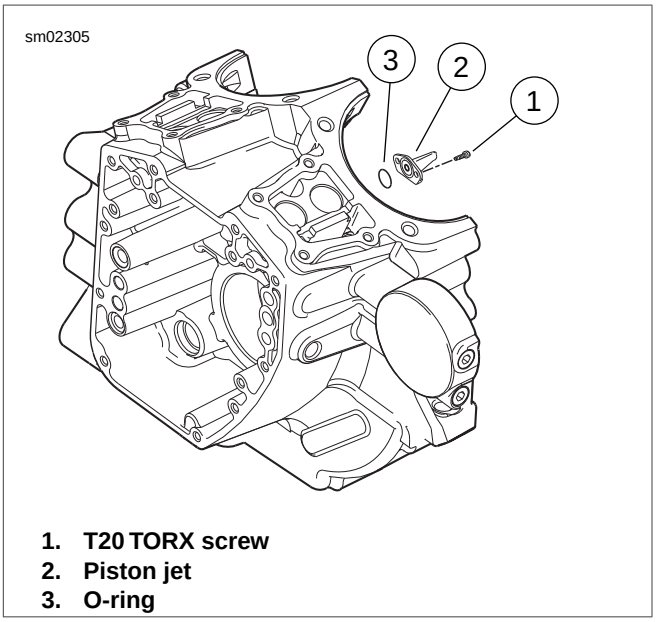



1. **Pilot/driver**
2. **Support tube**
3. **Ram**
4. **Main bearing**
5. **Support tube (2) "B" end up**

**Figure 3-125. Right Main Bearing Installation**

## Piston Jets Removal

1. See Figure 3-126. Remove two T20 TORX screws (1) to free piston jet (2) from crankcase.
2. Remove o-ring (3) from groove in mounting flange of jet. Discard o-ring.




1. **T20 TORX screw**
2. **Piston jet**
3. **O-ring**

**Figure 3-126. Piston Jets**

## Piston Jets Installation

*NOTES*

- *If piston jet is being reused, apply LOCTITE THREADLOCKER 222 (purple) to threads of TORX screws before installation.*
- *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. See Figure 3-126. Apply a very thin film of clean H-D 20W50 engine oil to **new** o-ring (3) for piston jet. Install **new** o-ring in groove of jet mounting flange.
2. With jet pointed upward, start two T20 TORX screws (1) to secure piston jet (2) to crankcase. Tighten to 25-35 **in-lbs** (2.8-3.9 Nm).

## LEFT CRANKCASE HALF

| PART NUMBER | TOOL NAME |
|---|---|
| B-45655 | CRANKCASE BEARING REMOVER/INSTALLER |
| HD-42720-5 | CRANKCASE BEARING REMOVER/INSTALLER BASE |

## Main Bearing Removal

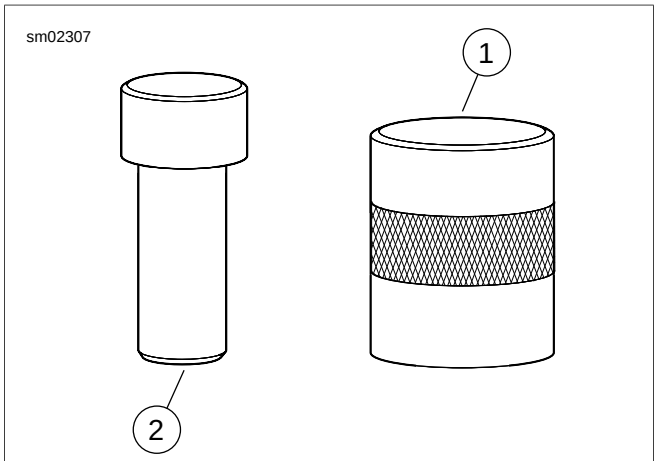
*NOTE*

*Never move or lift the crankcase by grasping the cylinder studs. The crankcase is too heavy to be carried in this manner and could be dropped.*

**⚠CAUTION**

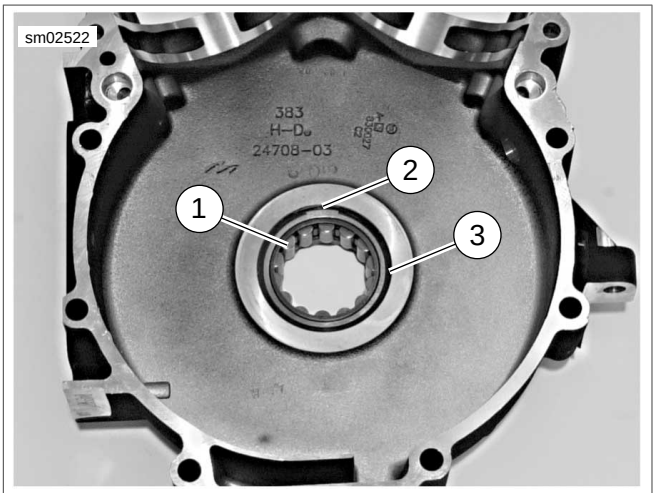
**Do not rotate left crankcase half in engine stand such that flywheel sprocket shaft is facing up. The flywheel assembly can fall out, resulting in parts damage or moderate injury. (00552b)**

1. While holding flywheel assembly so that it does not fall out of left crankcase half, rotate bottom end assembly in engine stand so assembly is upright and flywheel shafts are horizontal.
2. Carefully slide flywheel assembly out of left crankcase and place it in a clean safe place.
3. Unbolt left crankcase half from stand and move it to bench area. Remove thrust washer from outboard side of crankcase half by pulling it past oil seal. Set thrust washer aside for inspection or reuse.
4. Remove oil seal from crankcase bore. Discard oil seal.
5. See Figure 3-127. Obtain CRANKCASE BEARING REMOVER/INSTALLER (Part No. B-45655) and CRANKCASE BEARING REMOVER/INSTALLER BASE (Part No. HD-42720-5).
6. Place support tube on work bench with "B" end up. Note that the sides of the support tube are stamped "A" and "B" to indicate proper orientation. With inboard side of left crankcase half facing upward, position main bearing bore over support tube.
7. See Figure 3-128. The left main bearing (1) is press-fit into the main bearing bore (2) in the left crankcase and secured with a retaining ring (3) on the inboard side. See Figure 3-129. Using the tip of a flat blade screwdriver, carefully lift the edge of the retaining ring up out of its groove in the crankcase. Slide the screwdriver tip around the edge of the bearing, lifting the retaining ring up and out of the groove. Be careful not to damage the lip of the groove in the crankcase.




1. **Support tube**
2. **Pilot/driver**

**Figure 3-127. Left Main Bearing Remover and Installer Tools**




1. **Main bearing**
2. **Main bearing bore**
3. **Retaining ring**

**Figure 3-128. Left Main Bearing Assembly**

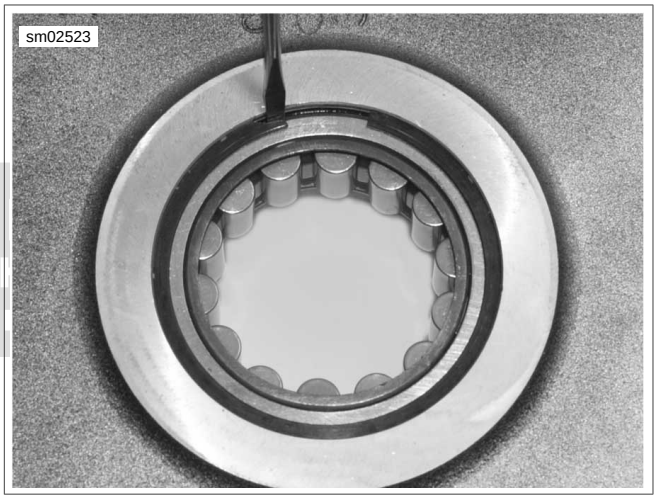
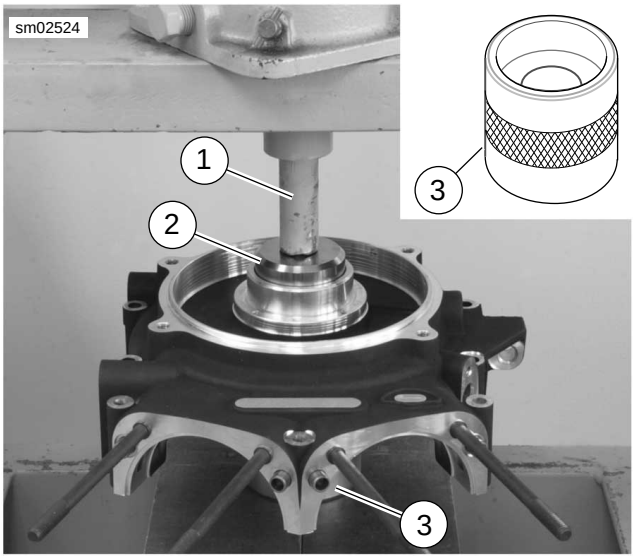



**Figure 3-129. Removing Retaining Ring**




1. **Ram**
2. **Pilot/driver**
3. **Support tube ("A" end up)**

**Figure 3-130. Left Main Bearing Removal**

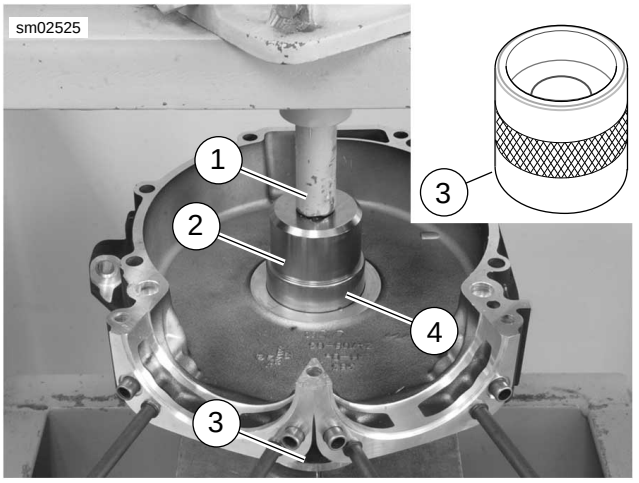
8. See Figure 3-130. Place support tube (3) on hydraulic press table with the "A" end up. Note that the sides of the support tube are stamped "A" and "B" to ensure proper orientation.
9. With the outboard side of the left crankcase half facing upward, position main bearing bore over support tube.
10. Slide pilot/driver (2) through main bearing into support tube.
11. Center pilot/driver under ram (1) of press. Apply pressure to pilot/driver until bearing is free.
12. Remove crankcase half, pilot/driver and bearing from support tube. Discard bearing.

## Main Bearing Installation

*NOTE*

*Never move or lift the crankcase by grasping the cylinder studs. The crankcase is too heavy to be carried in this manner and could be dropped.*

1. See Figure 3-127. Obtain CRANKCASE BEARING REMOVER/INSTALLER (Part No. B-45655) and CRANKCASE BEARING REMOVER/INSTALLER BASE (Part No. HD-42720-5).




1. **Ram**
2. **Pilot/driver**
3. **Support tube ("A" end up)**
4. **Main bearing**

**Figure 3-131. Left Main Bearing Installation**

2. See Figure 3-131. Obtain **new** main bearing (4). Place a thin film of clean engine oil on outer diameter of bearing.
3. Place support tube (3) on hydraulic press table with the "B" end up.
4. With the inboard side of the left crankcase half facing upward, position main bearing bore over support tube.
5. Lubricate leading edge of **new** main bearing before placement. Start **new** main bearing in bearing bore, letter side down.
6. Slide pilot/driver (2) through bearing into support tube.
7. Center pilot/driver (2) under ram (1) of press. Apply pressure to pilot/driver until bearing is lightly bottomed in main bearing bore.
8. Remove crankcase half and pilot/driver from support tube.
9. Obtain **new** retaining ring and install in bearing bore in inboard side of crankcase half. Work retaining ring into groove, being careful not to damage edges of groove. Make sure retaining ring is fully seated in groove.

*NOTE*

*If retaining ring will not fit into groove in bearing bore, it is a sign that the bearing is not fully seated in the bore. Examine the bearing and bore. If necessary, remove bearing, clean bore and reinstall bearing. Then install retaining ring.*

## SPROCKET SHAFT BEARING INNER RACE

| PART NUMBER | TOOL NAME |
|---|---|
| HD-25070 | ROBINAIR HEAT GUN |
| HD-34902-B | MAINSHAFT BEARING INNER RACE PULLER/INSTALLER |
| HD-44358 | FLYWHEEL SUPPORT FIXTURE |
| HD-95637-46B | WEDGE ATTACHMENT |
| HD-97225-55C | SPROCKET SHAFT BEARING INSTALLER |

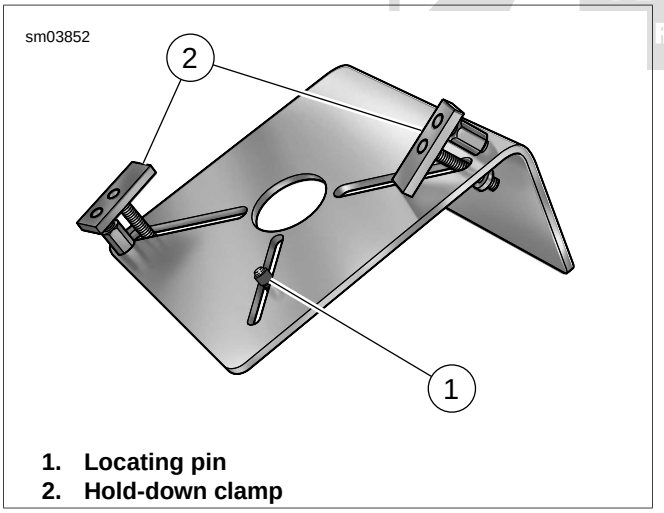
### Removal

If reusing flywheel, remove bearing inner race and thrust washer as follows:

1. Obtain FLYWHEEL SUPPORT FIXTURE (Part No. HD-44358). See Figure 3-132. Install brass jaws or shop towels around teeth of vise to prevent damage to tool. Clamp tool in vise with the round hole topside.
2. 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.
3. 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.*




1. **Locating pin**
2. **Hold-down clamp**

**Figure 3-132. Flywheel Fixture (Part No. HD-44358)**

4. Position WEDGE ATTACHMENT (Part No. HD-95637-46B) 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 bearing inner race. Installing tool with more contact than necessary will result in damage to the flywheel (00500b)**

5. Obtain two 3/8-16 inch bolts 7-1/2 inches long (with flat washers). Install flat washers on bolts. Obtain bridge and forcing screw from MAINSHAFT BEARING INNER RACE PULLER/INSTALLER (Part No. HD-34902-B). Also obtain a suitable hardened washer to use between the puller screw and the end of the shaft.
6. 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.
7. 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.

*NOTE*

*Failure to use hardened washer may result in damage to forcing screw and/or sprocket shaft.*

8. Place hardened washer 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 washer.
9. Using the ROBINAIR HEAT GUN (Part No. 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**

**Do not use heating devices with penetrating oil. Penetrating oil is flammable which could result in death or serious injury. (00375a)**

10. Turn forcing screw until thrust washer and bearing inner race move approximately 1/8 in. (3.2 mm).
11. Turn hex nuts an equal number of turns to separate halves of WEDGE ATTACHMENT (Part No. HD-95637-46B).
12. After bottoming thrust washer on shaft, reposition WEDGE ATTACHMENT (Part No. HD-95637-46B) 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 necessary will result in damage to the flywheel (00500b)**

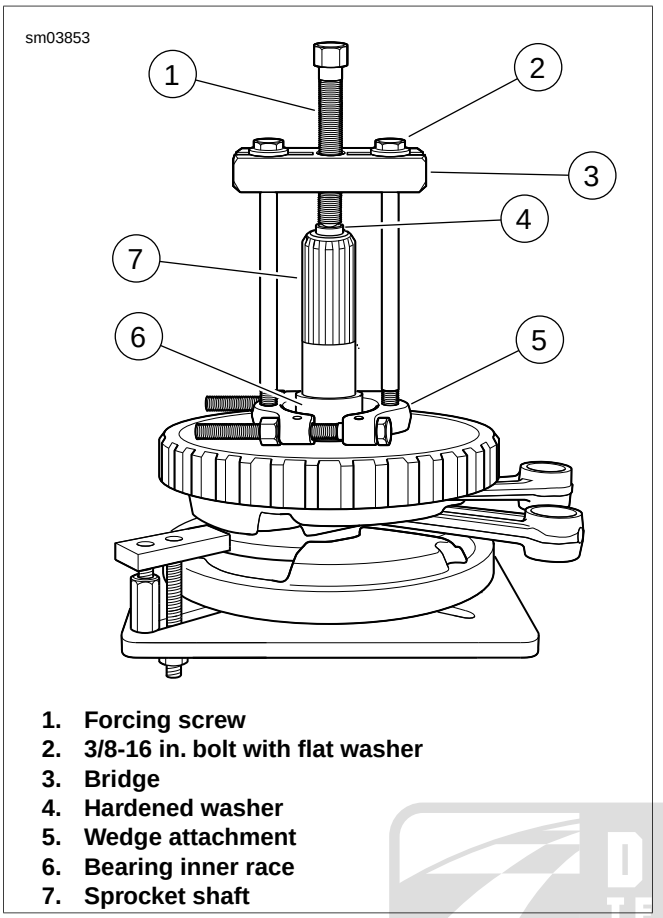
13. See Figure 3-133. Verify that the tool assembly is square, so that the bearing inner race is not cocked during removal.
14. Using the ROBINAIR HEAT GUN (Part No. HD-25070), uniformly heat the bearing inner race for about 30 seconds using a circular motion.

*NOTE*

*To facilitate removal without heat, apply a light penetrating oil to shaft and leading edge of bearing inner race.*

15. Turn forcing screw until bearing inner race is pulled free of sprocket shaft.

16. Remove thrust washer from sprocket shaft.




1. **Forcing screw**
2. **3/8-16 in. bolt with flat washer**
3. **Bridge**
4. **Hardened washer**
5. **Wedge attachment**
6. **Bearing inner race**
7. **Sprocket shaft**

**Figure 3-133. Remove Inner Race from Sprocket Shaft**

## Installation

1. Place **new** thrust washer over sprocket shaft.
2. Place **new** bearing inner race on bench top. Using the ROBINAIR HEAT GUN (Part No. 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 facilitate installation without heat, apply a light penetrating oil to shaft and leading edge of bearing inner race.*

**⚠WARNING**

**Do not use heating devices with penetrating oil. Penetrating oil is flammable which could result in death or serious injury. (00375a)**

4. See Figure 3-134. Obtain the SPROCKET SHAFT BEARING INSTALLER (Part No. HD-97225-55C). Assemble tool as described below.
   a. See Figure 3-135. Thread pilot adapter into sprocket shaft.
   b. Thread pilot shaft onto pilot adapter.
   c. Slide long collar over pilot shaft until it contacts bearing inner race.
   d. Slide short collar over pilot shaft until it contacts long collar.
   e. Slide Nice bearing and large flat washer over pilot shaft.
   f. Sparingly apply graphite lubricant to threads of pilot shaft to prolong service life and ensure smooth operation.
   g. See Figure 3-136.Thread handle onto pilot shaft.
5. See Figure 3-137. Rotate handle of tool in a clockwise direction until bearing inner race makes firm contact with thrust washer. Verify that thrust washer cannot be rotated by hand.
6. Remove handle, flat washer, Nice bearing, short collar, long collar, pilot shaft and pilot adapter from sprocket shaft.

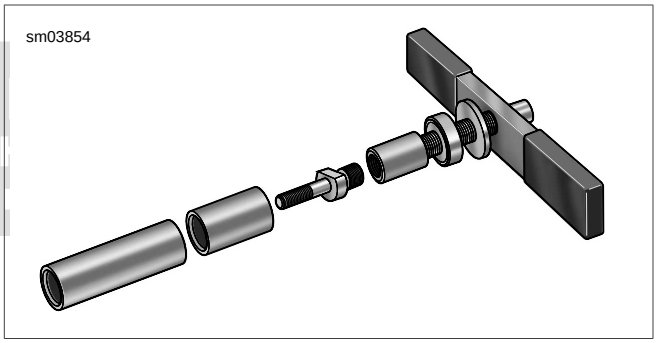



**Figure 3-134. Sprocket Shaft Bearing Installer (Part No. HD-97225-55C)**

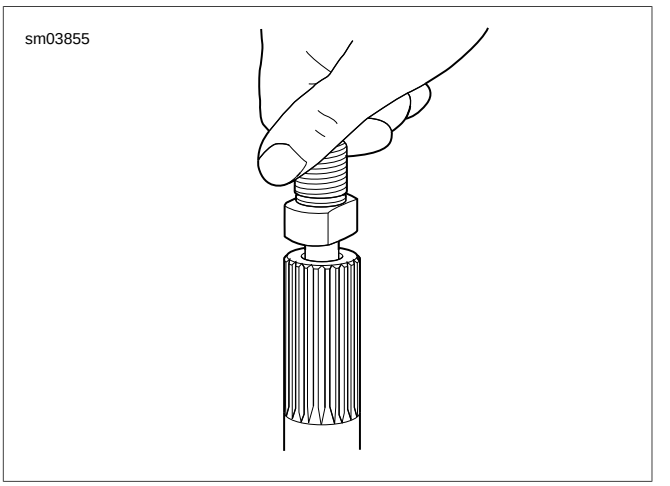
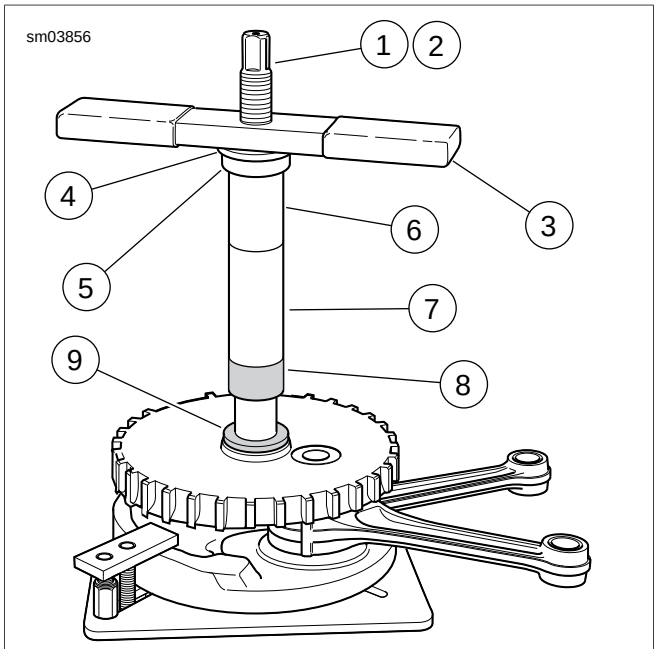



**Figure 3-135. Thread Pilot Adapter into Sprocket Shaft**




1. **Pilot adapter**
2. **Pilot shaft**
3. **Handle**
4. **Flat washer**
5. **Nice bearing**
6. **Short collar**
7. **Long collar**
8. **Inner race**
9. **Thrust washer**

**Figure 3-136. Press Inner Race onto Sprocket Shaft: Setup**

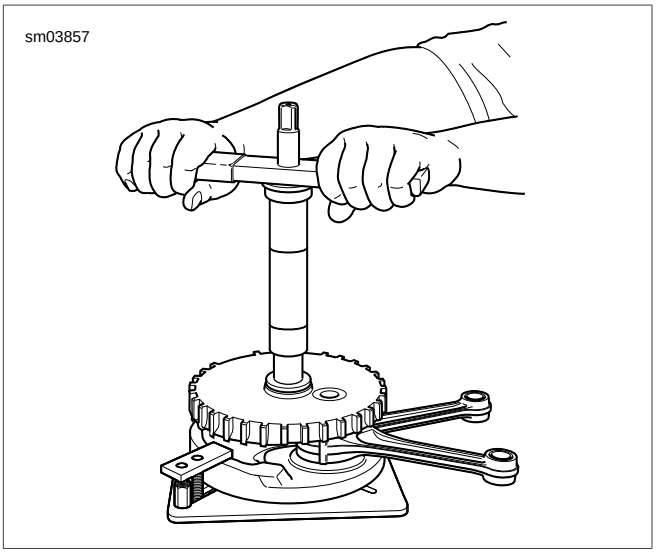



**Figure 3-137. Press Inner Race onto Sprocket Shaft: Operation**

## CYLINDER STUDS

### Removal

1. Thread a 3/8"-16 nut onto cylinder stud.
2. Thread a second nut onto stud until it contacts the first.
3. Placing wrench on first nut installed, remove stud.

### Installation

1. Place a steel ball inside a head screw. Put the head screw on the end of the cylinder stud without the collar.
2. Start the stud in the cylinder deck with the collar side down. Tighten using air gun until collar reaches crankcase.
3. Hand tighten stud to 10-20 ft-lbs (3.6-27.1 Nm).

## PIPE PLUG AND OIL FITTINGS

### Removal

See Figure 3-138. Turn pipe plug counterclockwise until free.

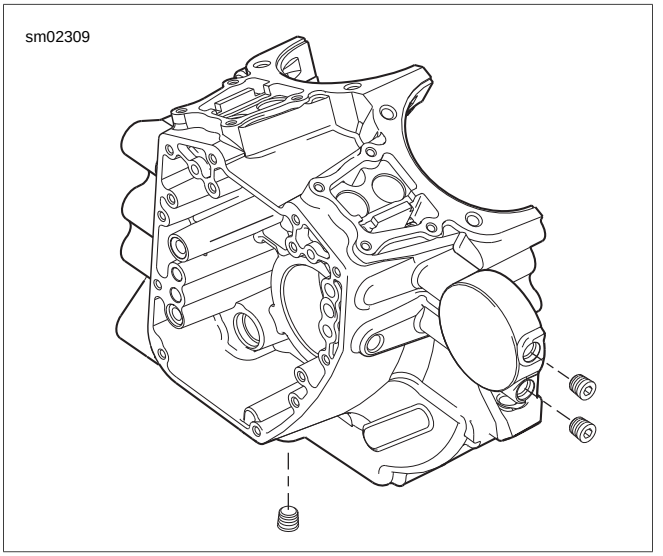



**Figure 3-138. Pipe Plug**

### Installation

1. Apply LOCTITE PIPE SEALANT 565 to threads.
2. Install pipe plug. Tighten pipe plug to 120-144 **in-lbs** (13.6-16.3 Nm).

## CLEANING AND INSPECTION

1. Scrape old gasket material from the crankcase flanges. Old gasket material left on mating surfaces will cause leaks.
2. Clean all parts in a non-volatile cleaning solution or solvent.

**WARNING**

**Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)**

3. Blow parts dry with low pressure compressed air.
4. Verify that all oil holes and passageways are clean and open.
5. Check ring dowels for looseness, wear or damage. Replace as necessary.
6. Use a file to carefully remove any nicks or burrs from machined surfaces.
7. Clean out tapped holes and clean up damaged threads.
8. Check the top of the crankcase for flatness with a straightedge and feeler gauge. Replace if warped.
9. Spray all machined surfaces with clean engine oil.

## INSTALLATION OVERVIEW

1. Perform all steps under 3.18 BOTTOM END OVERHAUL: ASSEMBLY.
2. Perform all steps under 3.16 TOP END OVERHAUL: ASSEMBLY.

## REMOVAL OVERVIEW

1. Perform all steps under 3.15 TOP END OVERHAUL: DISASSEMBLY.
2. Perform all steps under 3.17 BOTTOM END OVERHAUL: DISASSEMBLY.

## INSPECTION

*NOTE*

*Do not attempt to straighten connecting rods. Straightening rods will damage both the upper bushing and lower bearing.*

1. Replace the flywheel/connecting rod assembly if any of the following conditions are noted:
   a. Connecting rods are bent or twisted.
   b. Connecting rods do not fall under their own weight or are in a bind.
   c. Sprocket teeth are worn in an irregular pattern or chipped.
   d. The crankshaft (roller) bearing inner races are brinelled, burnt, scored, blued or damaged.

*NOTE*

*Bluing on connecting rods is part of the hardening process and is considered a normal condition.*

2. Check connecting rod bearing clearance. Orient the assembly as shown in Figure 3-139.
   a. Holding the shank of each rod just above the bearing bore, pull up and down on the connecting rods.
   b. Any discernible up and down movement indicates excessive lower bearing clearance. Replace the flywheel/connecting rod assembly.
3. See Figure 3-140. Check connecting rod side play.
   a. Insert a feeler gauge between the thrust washer and the outboard side of the connecting rod.
   b. Replace the assembly if rod side play exceeds 0.020 in. (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.*

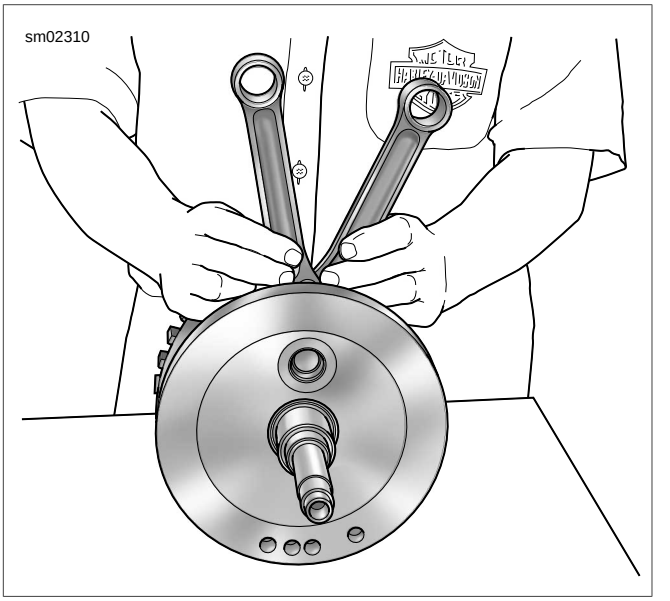



**Figure 3-139. Connecting Rod Bearing Clearance**

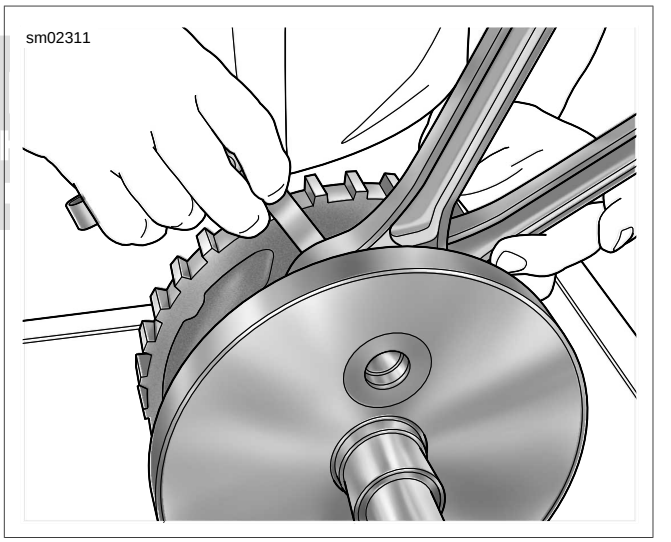



**Figure 3-140. Connecting Rod Side Play**

## INSTALLATION OVERVIEW

1. Perform all steps under 3.18 BOTTOM END OVERHAUL: ASSEMBLY.
2. Perform all steps under 3.16 TOP END OVERHAUL: ASSEMBLY.

## REMOVAL

1. Position motorcycle on a suitable lift.
2. See Figure 3-141. Drain fluids.
   a. Remove engine oil drain plug, fill plug/dipstick and oil filter. Drain oil into suitable container. See 1.5 ENGINE OIL AND FILTER.
   b. Remove transmission drain plug. Drain transmission fluid into suitable container. See 1.10 TRANSMISSION LUBRICANT.
3. Remove rear wheel. See 2.4 REAR WHEEL.
4. See Figure 3-141. Remove 12 screws (4) that secure the oil pan to the transmission.

*NOTES*

- *Use holes in lower frame crossmember to access some of the screws.*
- *Verify engine oil fill plug/dipstick is removed before attempting to slide the oil pan rearward. Contact with the oil pan will result in damage to the dipstick.*

5. Slide oil pan (8) rearward to remove. Remove and discard oil pan gasket (3).
6. Remove serpentine baffle (2) and baffle springs (1) from oil pan.

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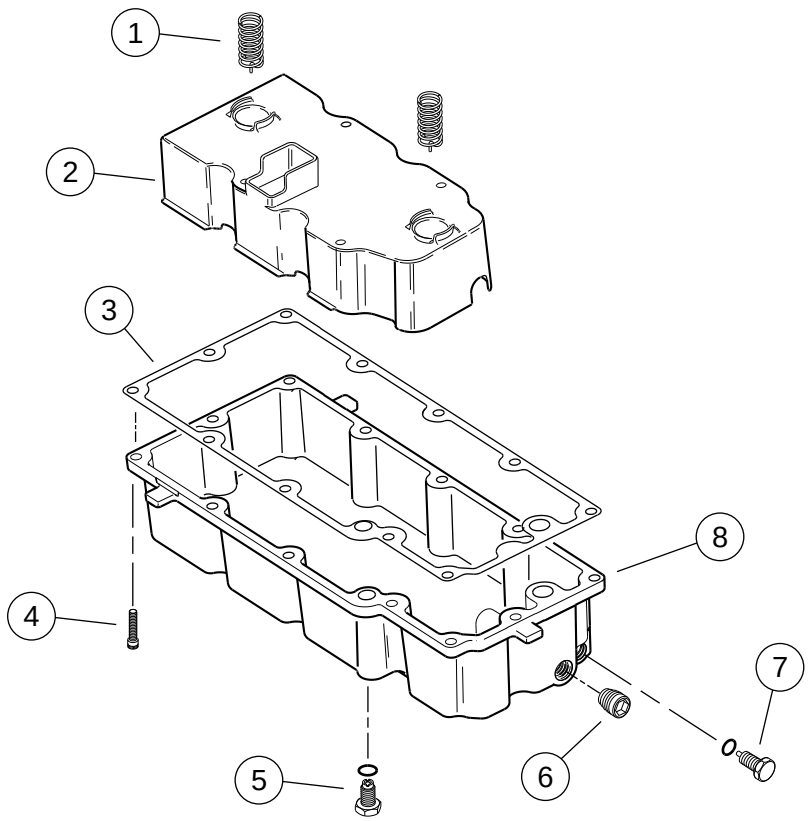


1. **Baffle spring (2)**
2. **Serpentine baffle**
3. **Oil pan gasket**
4. **Screw (12)**
5. **Transmission drain plug and o-ring**
6. **Pipe plug**
7. **Engine oil drain plug and o-ring**
8. **Oil pan**

**Figure 3-141. Oil Pan Assembly: Touring Models**

## INSTALLATION

1. See Figure 3-141. Clean and examine transmission and oil pan flanges.
2. Apply a thin coat of HYLOMAR® gasket sealer to oil pan flange.
3. Place **new** gasket (3) on oil pan flange. Allow sealer to dry until tacky.
4. Install serpentine baffle (2) and baffle springs (1) in oil pan.

5. Position gasket and oil pan at bottom of transmission. Install 12 screws (4), but only tighten about two turns after initial engagement.

*NOTE*

*It is normal for the baffle springs to hold the oil pan away from the transmission. Use a long screwdriver to compress the springs as necessary. Exercise caution to avoid cocking or distorting the springs.*

6. Inspect the oil pan gasket to ensure that it is properly positioned. If gasket has shifted out of position, remove screws and adjust as necessary.
7. Alternately tighten the oil pan screws to 84-132 **in-lbs** (9.5-14.9 Nm) following sequence shown in Figure 3-142.
8. Install drain plugs.
   a. Wipe any foreign material from engine and transmission drain plugs.
   b. Examine drain plug o-rings for tears or damage. Replace o-rings as required.
   c. Install transmission drain plug and o-ring. Tighten to 14-21 ft-lbs (19.0-28.5 Nm).
   d. Install engine oil drain plug and o-ring. Tighten to 14-21 ft-lbs (19.0-28.5 Nm).
9. Install rear wheel. See 2.4 REAR WHEEL
10. Add fluids.
    a. Add transmission fluid and check level. See 1.10 TRANSMISSION LUBRICANT.
    b. Install engine oil filter. Add engine oil and check level. See 1.5 ENGINE OIL AND FILTER.

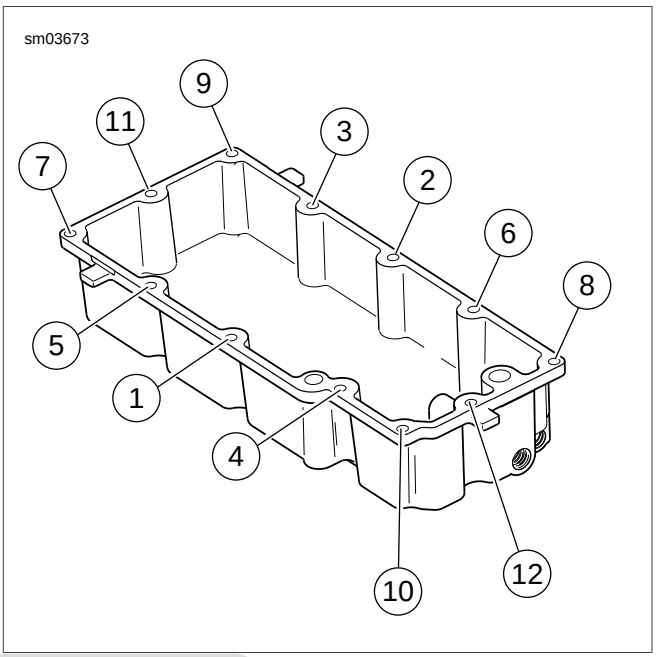


**Figure 3-142. Oil Pan Torque Sequence**

# NOTES

## SPECIFICATIONS

**Table 4-1. Fuel Capacity: 2008 Touring Models**

| FUEL TANK CAPACITY | GALLONS | LITERS |
|---|---|---|
| Total | 6.0 | 22.7 |
| Reserve (warning light on) | 1.0 | 3.79 |

## TROUBLESHOOTING

See the ELECTRICAL DIAGNOSTIC MANUAL for troubleshooting and diagnostic information.

## REMOVAL

1. See Figure 4-1. Remove screw from air cleaner cover. Remove air cleaner cover with rubber seal.
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.
7. Remove backplate from cylinder heads.
8. Remove seal ring from groove on inboard side of backplate. Discard seal ring.

**⚠WARNING**

**Do not use gasoline or solvents to clean filter element. Flammable cleaning agents can cause an intake system fire, which could result in death or serious injury. (00101a)**

9. Inspect filter element. See 1.7 AIR CLEANER AND EXHAUST SYSTEM. Replace the filter element if damaged or if filter media cannot be adequately cleaned.

## INSTALLATION

1. With the nubs contacting the ring groove walls, install seal ring on inboard side of backplate.
2. Align holes in backplate with those in cylinder heads and install cylinder head breather bolts. Alternately tighten bolts to 22-24 ft-lbs (29.8-32.5 Nm).
3. Slide **new** gasket over sleeve on inboard side of filter element.
4. Insert breather tubes about 0.25 inch (6.4 mm) into holes on inboard side of filter element.
5. 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.*

6. Place filter element onto backplate with the flat side down.
7. Align holes in cover bracket with those in filter element and start three T27 TORX screws. Alternately tighten screws to 40-60 **in-lbs** (4.5-6.8 Nm).
8. Verify that rubber seal is properly seated around perimeter of air cleaner cover.
9. Fit air cleaner cover into backplate. Apply a small dab of LOCTITE MEDIUM STRENGTH THREADLOCKER 243 (BLUE) to threads of cover screw. Install screw and tighten to 36-60 **in-lbs** (4.1-6.8 Nm).

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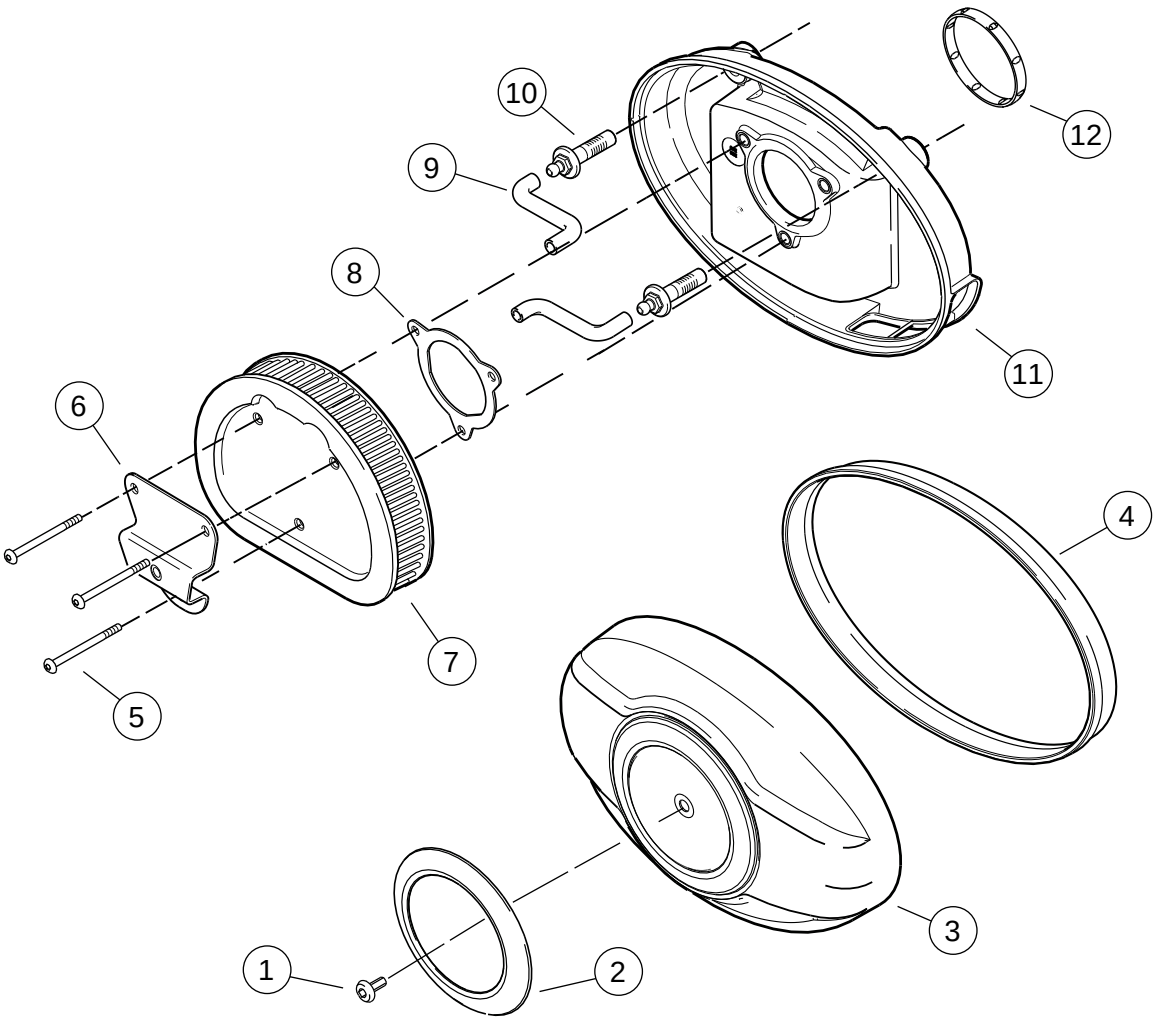



1. Cover screw
2. Cover trim
3. Air cleaner cover
4. Rubber seal
5. T27 Torx screw (3)
6. Cover bracket
7. Filter element
8. Gasket
9. Breather tube (2)
10. Breather bolt (2)
11. Backplate
12. Seal ring

**Figure 4-1. Air Cleaner Assembly**

## GENERAL

**WARNING**

**Stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near gasoline. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00002a)**

The fuel tank is treated to resist rusting. However, when the motorcycle is not operated for a long period of time, see 1.24 STORAGE for specific information regarding fuel tank treatment.

## REMOVAL

*NOTE*

*The fuel tank can be removed without draining. However, draining is necessary whenever the fuel tank or internal components are serviced.*

**WARNING**

**To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)**

*NOTE*

*The gasoline in the fuel supply line is under high pressure: 58 psi (400 kPA). To avoid an uncontrolled discharge or spray of gasoline, always purge the line before disconnecting.*

1. Purge the fuel supply line as follows:
   a. Remove left side saddlebag. See 2.27 SADDLEBAGS.
   b. Remove left side cover.
   c. Remove 15 amp fuel pump fuse. See Figure 4-2.
   d. Start the engine and allow the motorcycle to run.
   e. When the engine stalls, operate starter for 3 seconds to remove remaining fuel from fuel supply line.
   f. Remove maxi-fuse.
   g. Reinstall 15 amp fuel pump fuse.
2. Remove seat. See 2.26 SEAT.
3. Remove console. Proceed as follows:
   a. Remove socket screw to release front of console from fuel tank weldment.
   b. Remove hex screw to release rear console bracket from clip nut on rear fuel tank bracket.
   c. Lay a clean shop towel on forward part of rear fender.
   d. **FLHR/C:** Remove console and lay upside down on shop towel.
   e. **FLHX, FLHT/C/U, FLTR:** Press button to open fuel door on console. Remove filler cap. Remove console and lay upside down on shop towel. Install filler cap.
4. Gently pry fuel vapor vent tube from vapor valve fitting on top plate.
5. Remove fuel level sender/fuel pump connector [141], 4-place Delphi.
6. On FLHR/C models, move to bottom left side of fuel tank. Gently pull on convoluted tubing to draw fuel gauge connector [117], 4-place Multilock, out of tunnel at front of fuel tank. Disconnect connector.

**WARNING**

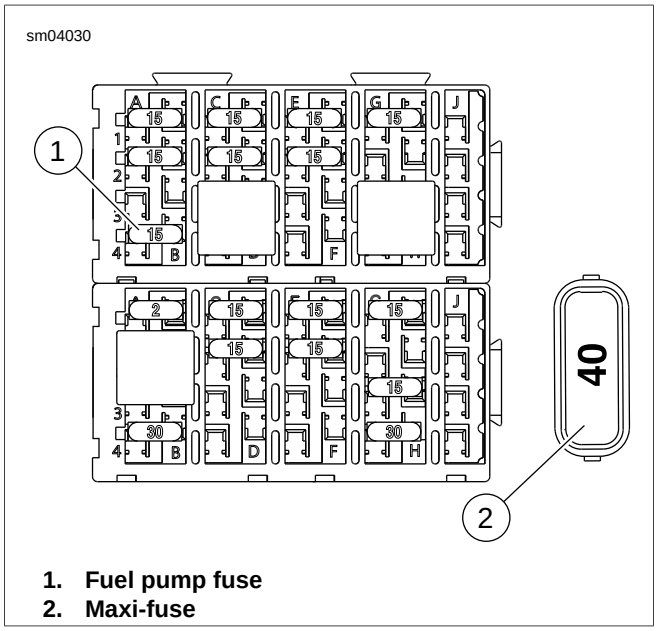
**Gasoline can drain from the fuel line when disconnected from fuel tank. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00260a)**

7. 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 4-3.
8. Remove rubber caps to reveal two front fuel tank screws. Remove screws to release flanges from frame bosses.
9. Remove plastic trim cover over rear fuel tank bracket. Remove two screws to release bracket from frame backbone.

*NOTE*

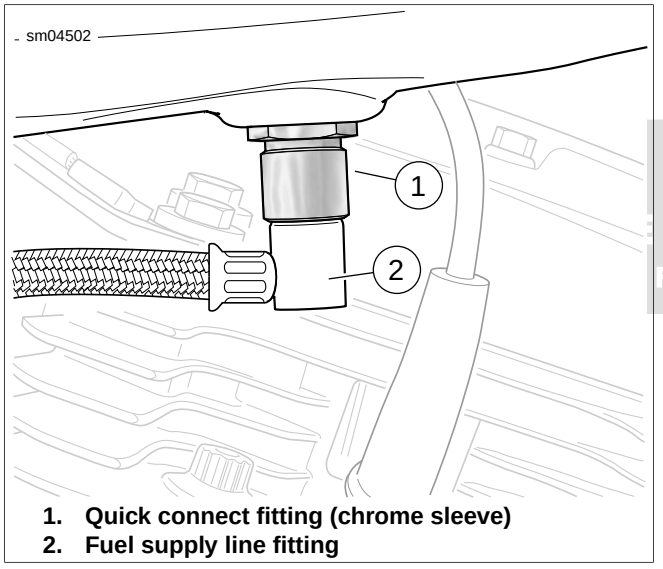
*The fuel tank screws have both a T40 TORX recess and an external hex. Use of an open end/box wrench on the external hex allows the front screws to be removed without having to loosen or remove the fairing lowers, if installed.*

10. Remove fuel tank from motorcycle.




1. **Fuel pump fuse**
2. **Maxi-fuse**

**Figure 4-2. Fuse Blocks**




1. **Quick connect fitting (chrome sleeve)**
2. **Fuel supply line fitting**

**Figure 4-3. Fuel Tank (Left Side View)**

## INSTALLATION

1. Install fuel tank onto frame backbone aligning front flange holes with bosses on left and right side of frame. Be sure that ignition coil connector conduit exiting front left side of wire trough does not become pinched between fuel tank flange and ignition coil bracket.
2. Start front fuel tank screws.

**⚠WARNING**

**To prevent spray of fuel, be sure quick-connect fittings are properly mated. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00268a)**

3. 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. A slight tug on the fuel supply line fitting will verify that it is locked in position.
4. On FLHR/C models, move to bottom left side of fuel tank. Mate pin and socket halves of fuel gauge connector [117], 4-place Multilock. Feed connector into tunnel at front of fuel tank.
5. Install two screws to fasten rear fuel tank bracket to frame backbone. Alternately tighten screws to 15-20 ft-lbs (20.3-27.1 Nm). Install plastic trim cover over bracket.
6. Alternately tighten front fuel tank screws to 15-20 ft-lbs (20.3-27.1 Nm). Install rubber caps over screws. Properly installed, relief on inboard side of cap is at the bottom and lip is inboard of frame boss flange.
7. Connect fuel vapor vent tube to vapor valve fitting on top plate.
8. Install fuel level sender/fuel pump connector [141], 4-place Delphi. For best clearance with cam ring, tilt connector at 35° angle before installation.
9. Install console. Proceed as follows:
   a. **FLHR/C:** Exercising caution to avoid pinching wire harness and vent tube, position console on fuel tank.
   b. **FLHX, FLHT/C/U, FLTR:** Remove filler cap, if installed. Exercising caution to avoid pinching wire harness, fuel overflow hose and vent tube, position console on fuel tank. Install filler cap.
   c. Start socket screw to fasten front of console to fuel tank weldment.
   d. Start hex screw to fasten rear console bracket to clip nut on rear fuel tank bracket.
   e. Alternately tighten socket/hex screws to 36-60 **in-lbs** (4.1-6.8 Nm).

   *NOTE*

   *If console rear bracket requires replacement, install **new** bracket alternately tightening two screws to 20-30 **in-lbs** (2.7-3.4 Nm).*
10. Install seat. See 2.26 SEAT.
11. Install maxi-fuse.
12. Install left side cover.
13. Install left side saddlebag. See 2.27 SADDLEBAGS.

## FUEL SUPPLY CHECK VALVE/TUBE

### Removal

*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.*

1. Remove top plate. See 4.5 FUEL TANK TOP PLATE.

**⚠WARNING**

**Gasoline can drain from the fuel line when disconnected from fuel tank. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00260a)**

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.
3. Slide a deepwell socket over chrome sleeve engaging hex on quick-connect fitting. See Figure 4-4.
4. Looking down at top of fuel tank, rotate fitting in a **clockwise** direction until it turns easily. Remove the fitting by hand drawing fuel supply tube out through hole at bottom of fuel tank. See Figure 4-5.

## Installation

*NOTE*

*Carefully inspect fuel supply 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 light film of clean engine oil to **new** o-ring. Slide o-ring down fuel supply tube and into groove of **new** quick-connect fitting.
2. Feeding fuel supply tube through hole at bottom of fuel tank, hand thread quick-connect fitting into bore. Looking down at top of fuel tank, rotate fitting in a **counterclockwise** direction until snug.
3. Slide a deepwell socket over chrome sleeve engaging hex on quick-connect fitting. Tighten fitting to 22-26 ft-lbs (29.8-35.3 Nm).

**⚠WARNING**

**To prevent spray of fuel, be sure quick-connect fittings are properly mated. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00268a)**

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. A slight tug on the fuel supply line fitting will verify that it is locked in position.
5. Install top plate. See 4.5 FUEL TANK TOP PLATE.

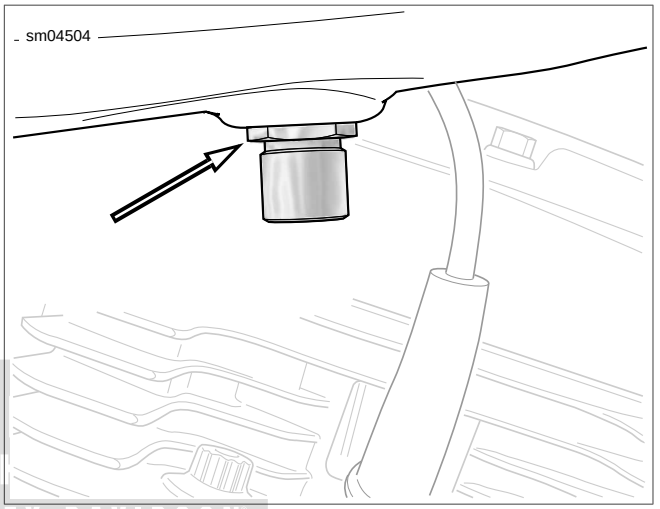



**Figure 4-4. Engage Hex on Quick-Connect Fitting**

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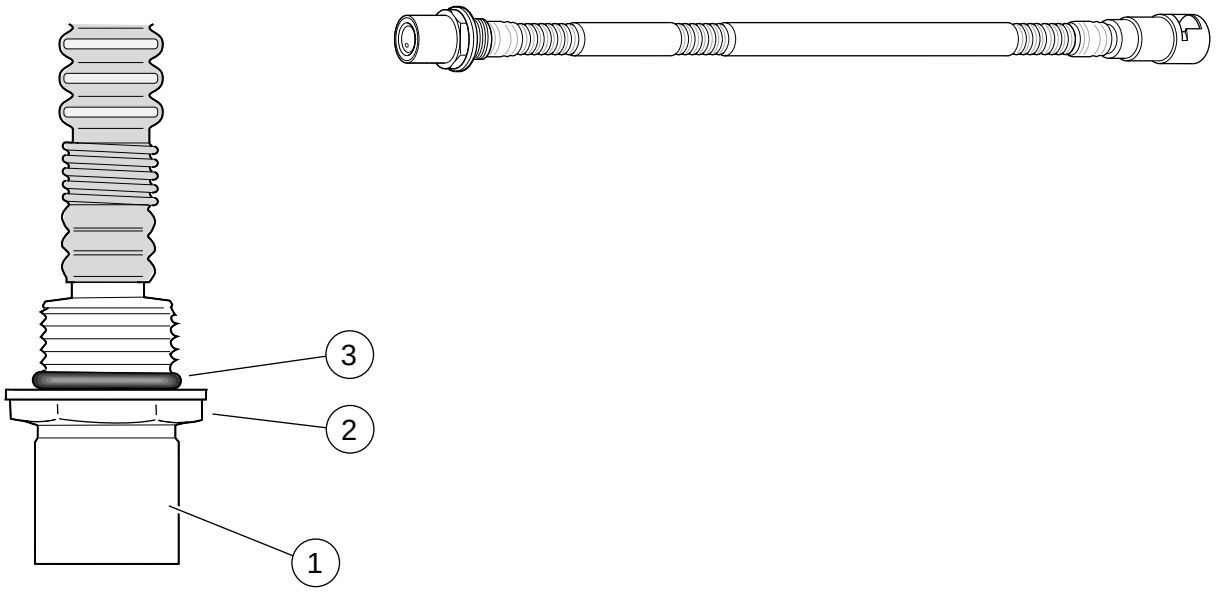



1. **Chrome sleeve**
2. **Body hex**
3. **O-ring**

**Figure 4-5. Fuel Supply Check Valve/Tube**

## REMOVAL

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48646 | CAM RING REMOVER/INSTALLER |

*NOTE*

*The gasoline in the fuel supply line is under high pressure (58 psi). To avoid an uncontrolled discharge or spray of gasoline, always purge the line before top plate removal.*

1. Purge the fuel supply line as follows:
   a. Remove left side saddlebag. See 2.27 SADDLEBAGS.
   b. Remove left side cover.
   c. Remove 15 amp fuel pump fuse.
   d. Start the engine and allow the motorcycle to run.
   e. When the engine stalls, operate starter for 3 seconds to remove remaining fuel from fuel supply line.
   f. Remove maxi-fuse.
   g. Reinstall 15 amp fuel pump fuse.
2. Remove filler cap and drain fuel tank. Use a common pump or siphon and an approved gasoline storage container of sufficient capacity.
3. Remove seat. See 2.26 SEAT.
4. Remove console. Proceed as follows:
   a. Remove socket screw to release front of console from fuel tank weldment.
   b. Remove hex screw to release rear console bracket from clip nut on rear fuel tank bracket.
   c. Lay a clean shop towel on forward part of rear fender.
   d. Remove console and lay upside down on shop towel.
5. Obtain CAM RING REMOVER/INSTALLER (Part No. HD-48646) See Figure 4-6.
6. Place tool over top plate aligning four notches at bottom with four tabs on cam ring.
7. Install 1/2 inch drive ratchet and rotate in a counterclockwise direction until cam ring is free. Push down on tool during rotation to maintain full engagement with cam ring. If disengagement occurs, tool may skip across the surface of the fuel tank, resulting in scratches or other damage. Remove tool.

*NOTE*

*Always hold onto both the Cam Ring Remover/Installer and ratchet during handling or separation of parts may cause one to be dropped, possibly resulting in hard contact with fuel tank. See Figure 4-7.*

8. Remove cam ring and raise top plate.
9. Remove connector at bottom of top plate. For best results, insert small flat blade screwdriver between latch and top plate. Depress either side of latch while gently tugging on harness.
10. Locate ground wire spade terminal in slot of top plate. Insert tip of small flat blade screwdriver through window to depress tang, and then pull terminal from slot. See Figure 4-8.
11. Depress collars to remove tubes from fittings on fuel filter shell. Move top plate to bench area.
12. If top plate replacement is necessary, remove fuel filter shell. See 4.6 FUEL FILTER. See Figure 4-9.

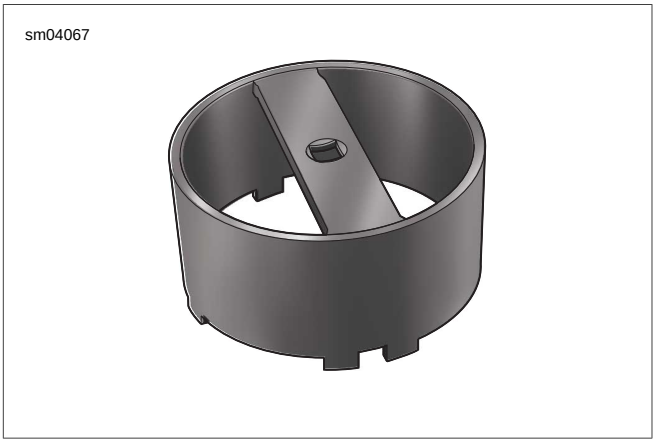



**Figure 4-6. Cam Ring Remover/Installer (HD-48646)**

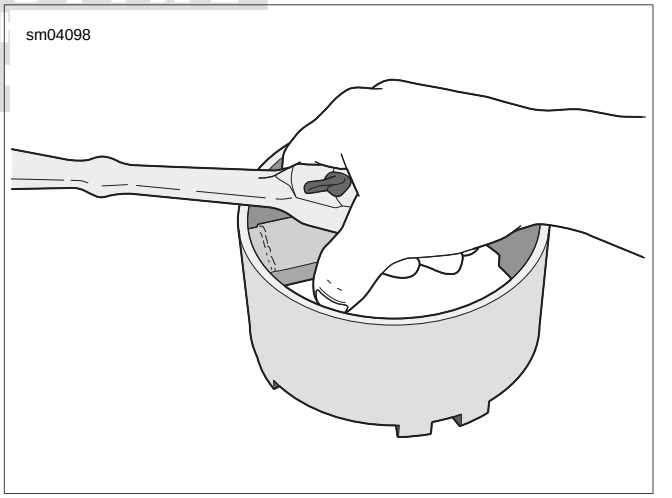
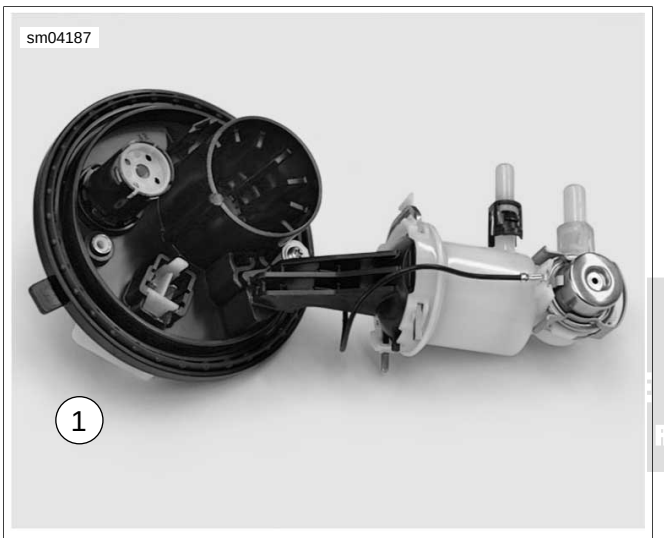
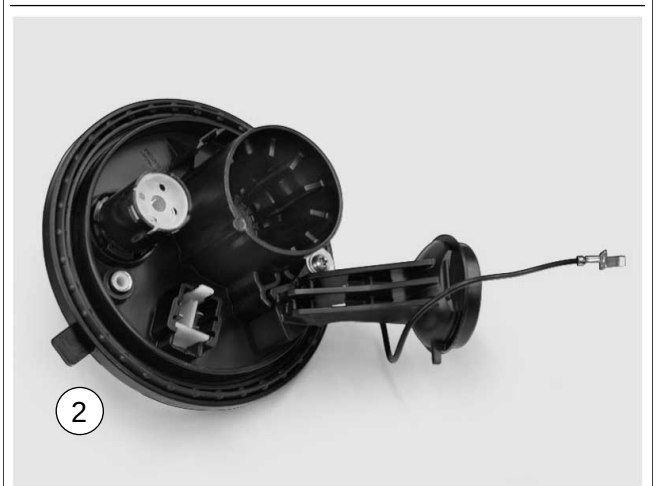



**Figure 4-7. Hold Both Tool and Ratchet During Handling**


**Figure 4-8. Remove Ground Wire Spade Terminal From Top Plate**




1. **With Fuel Filter Shell**
2. **Without Fuel Filter Shell**

**Figure 4-9. Top Plate Assembly**

## INSTALLATION

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48646 | CAM RING REMOVER/INSTALLER |

1. If installing a **new** top plate, first install fuel filter shell. See 4.6 FUEL FILTER.
2. Inspect seal ring at bottom of top plate for cuts, tears or signs of deterioration. If necessary, install **new** seal ring with the nubs contacting the ring groove walls.
3. Move top plate to motorcycle.
4. Connect tubes to fittings on fuel filter shell. Note that the fittings are of different sizes to prevent improper assembly. The tube with the smaller diameter fitting runs from the fuel pump to the fuel filter housing, while the tube with the larger diameter fitting runs from the fuel pressure regulator housing to the fuel supply valve.
5. Install connector at bottom of top plate.
6. Route ground wire (from top plate connector) along inboard side of vapor valve and install spade terminal into slot in top plate. Gently tug on wire to verify that terminal is locked.

*NOTE*

*If terminal does not lock, use a thin flat blade, like that on a hobby knife, to bend tang outward slightly away from terminal body.*

7. Install fuel tank top plate engaging index tab on OD in slot at front of fuel tank collar.
8. Install cam ring over fuel tank top plate with the TOP stamp up. See Figure 4-10.

*NOTE*

*Remove filler cap from top plate on fairing equipped models, if installed.*

9. Obtain CAM RING REMOVER/INSTALLER (Part No. HD-48646).
10. Place tool over top plate aligning four notches at bottom with four index tabs on cam ring. Pushing down on tool with both hands, rotate in a clockwise direction until each of four index tabs begin to engage slots in fuel tank collar.
11. Install 1/2 inch drive ratchet and continue rotation of tool until cam ring is fully installed. Push down on tool during rotation to maintain full engagement with cam ring. If disengagement occurs, tool may skip across the surface of the fuel tank, resulting in scratches or other damage. Remove tool.

*NOTE*

*Always hold onto both the Cam Ring Remover/Installer and ratchet during handling or separation of parts may cause one to be dropped, possibly resulting in hard contact with fuel tank. See Figure 4-7.*

12. Install console. Proceed as follows:
    a. **FLHR/C:** Exercising caution to avoid pinching wire harness and vent tube, position console on fuel tank.
    b. **FLHX, FLHT/C/U, FLTR:** Exercising caution to avoid pinching wire harness, fuel overflow hose and vent tube, position console on fuel tank. Install filler cap
    c. Start socket screw to fasten front of console to fuel tank weldment.
    d. Start hex screw to fasten rear console bracket to clip nut on rear fuel tank bracket.
    e. Alternately tighten socket/hex screws to 36-60 **in-lbs** (4.1-6.8 Nm).
13. Install seat. See 2.26 SEAT.
14. Install maxi-fuse.
15. Install left side cover.
16. Install left side saddlebag. See 2.27 SADDLEBAGS.
17. Fill fuel tank. Carefully inspect for leaks. Start engine and repeat inspection.

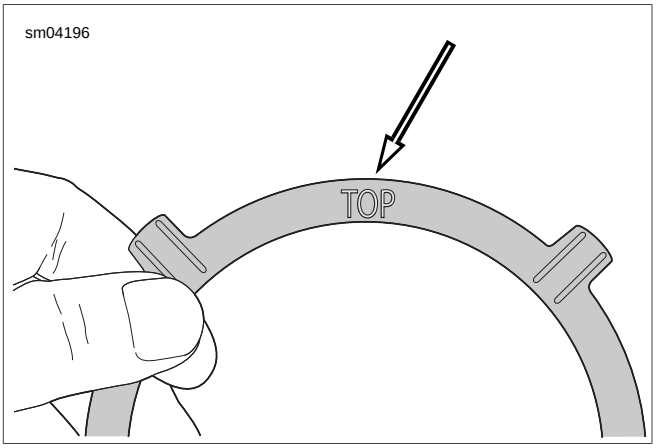



**Figure 4-10. Cam Ring Stamp**

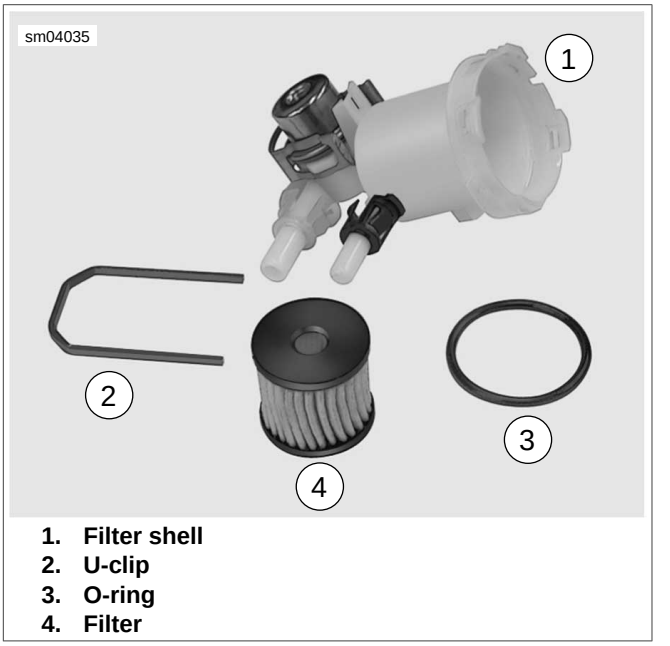
## REMOVAL

**⚠WARNING**

**Stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near gasoline. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00002a)**

1. Remove top plate. See 4.5 FUEL TANK TOP PLATE.
2. Locate ground wire spade terminal in slot of fuel filter shell. Insert tip of small flat blade screwdriver through window to depress tang, and then pull terminal from slot. See Figure 4-11.
3. Gently raise locking arm and pull U-clip from holes in fuel filter shell.
4. Remove fuel filter shell from end cap.
5. Remove o-ring and filter from fuel filter shell. See Figure 4-12.


**Figure 4-11. Remove Ground Wire Spade Terminal From Fuel Filter Shell**




1. **Filter shell**
2. **U-clip**
3. **O-ring**
4. **Filter**

**Figure 4-12. Fuel Filter Assembly**

## INSTALLATION

1. Install **new** filter in fuel filter shell.
2. Seat o-ring on counterbore at top of filter.
3. Install fuel filter shell over end cap, so that slot in fuel filter shell engages index pin on end cap.
4. Holding parts together, slide U-clip through holes on locking arm side of fuel filter shell. Push U-clip until ends exit holes on opposite side. Retract U-clip until contact is made with step in locking arm.
5. Route ground wire (from top plate TORX screw) around index pin side of end cap and install spade terminal into slot in fuel filter shell. Gently tug on wire to verify that terminal is locked.

*NOTE*

*If terminal does not lock, use a thin flat blade, like that on a hobby knife, to bend tang outward slightly away from terminal body.*

6. Install top plate. See 4.5 FUEL TANK TOP PLATE.

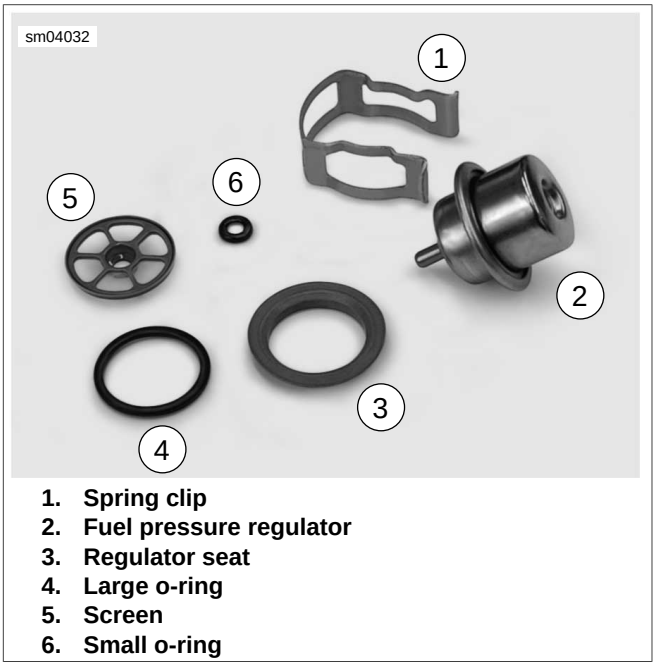
## REMOVAL

**⚠WARNING**

**Stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near gasoline. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00002a)**

1. Remove top plate. See 4.5 FUEL TANK TOP PLATE.
2. Locate ground wire spade terminal in slot of fuel filter shell. Insert tip of small flat blade screwdriver through window to depress tang, and then pull terminal from slot. See Figure 4-13.
3. Remove spring clip from fuel pressure regulator. For best results, free one side first and then the other.
4. Remove fuel pressure regulator, regulator seat, large o-ring, screen and small o-ring. See Figure 4-14.


**Figure 4-13. Remove Ground Wire Spade Terminal From Fuel Filter Shell**




1. **Spring clip**
2. **Fuel pressure regulator**
3. **Regulator seat**
4. **Large o-ring**
5. **Screen**
6. **Small o-ring**

**Figure 4-14. Fuel Pressure Regulator Assembly**

## INSTALLATION

1. Insert small o-ring at top of pressure port bore.
2. Install screen at top of pressure regulator bore, so that sleeve on ID faces small o-ring. Install regulator seat to evenly press screen into bore. Remove regulator seat.
3. Install large o-ring at top of screen.
4. Install regulator seat and fuel pressure regulator.
5. Install spring clip, so that indented sides engage top of center rib on fuel pressure regulator, while rounded side engages bottom of tabs on housing.
6. Route ground wire (from top plate TORX screw) around index pin side of end cap and install spade terminal into slot in fuel filter shell. Gently tug on wire to verify that terminal is locked.

*NOTE*

*If terminal does not lock, use a thin flat blade, like that on a hobby knife, to bend tang outward away from terminal body.*

7. Install top plate. See 4.5 FUEL TANK TOP PLATE.

## REMOVAL

**⚠WARNING**

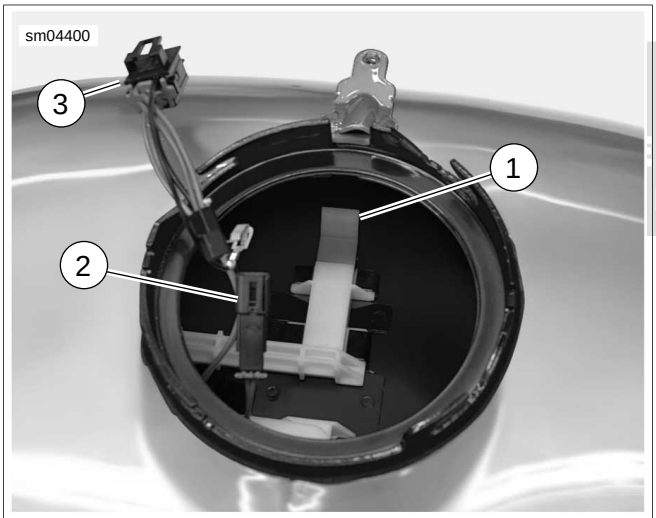
**Stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near gasoline. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00002a)**

1. Remove top plate. See 4.5 FUEL TANK TOP PLATE.
2. Disconnect 2-place connector to release fuel level sender from wire harness.

*NOTE*

*Looking into fuel tank at bracketry at top of tunnel, note that finger on front bracket points forward, while finger on rear bracket points rearward. See Figure 4-15.*

3. Reaching into fuel tank, pull up on front finger and slide fuel level sender bracket rearward until four ears on bracket are free of catches at top of tunnel.
4. Remove fuel level sender from left side of fuel tank. See Figure 4-16.




1. **Fuel level sender bracket (front finger)**
2. **Fuel level sender connector**
3. **Top plate connector**

**Figure 4-15. Front Finger (Fuel Level Sender Bracket)**

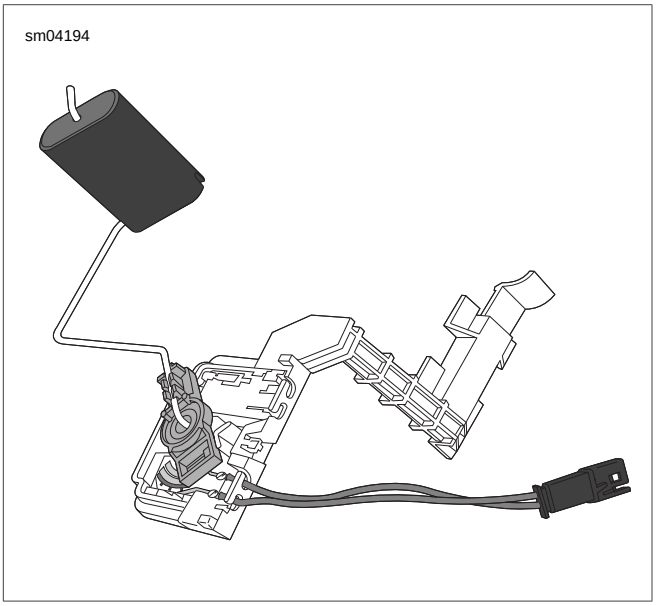



**Figure 4-16. Fuel Level Sender**

## INSTALLATION

1. With the finger on the fuel level sender bracket pointing forward, install fuel level sender into left side of fuel tank.
2. Engage four ears on fuel level sender bracket with front set of catches at top of tunnel. Push fuel level sender bracket forward until ears are fully engaged.
3. Connect 2-place connector to attach fuel level sender to wire harness.
4. Install top plate. See 4.5 FUEL TANK TOP PLATE.

## REMOVAL

1. Remove left side saddlebag. See 2.27 SADDLEBAGS.
2. Remove left side cover
3. Remove maxi-fuse.

*NOTE*

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

4. Place the cardboard insert between the brake lever and lever bracket.
5. Using a T25 TORX drive head, remove the upper and lower switch housing screws.
6. 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.
7. Separate the upper and lower switch housings and remove the throttle grip from the end of the handlebar.

*NOTE*

*To remove the throttle grip, a slight tug may be necessary to release index pins in grip from receptacle in seal cap of twist grip sensor.*

8. If present, pull two cable clips on right side handlebar switch conduit from holes in handlebar.
9. **FLHR/C:** Remove headlamp and handlebar clamp shroud. See 2.45 HEADLAMP NACELLE: FLHR/C. Remove twist grip sensor jumper harness connector [204], 6-place Molex (black), from T-stud on fork stem nut lock plate (right side) and disconnect. See Figure 4-17.
10. **FLHX, FLHT/C/U:** Remove outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U. Remove twist grip sensor jumper harness connector [204], 6-place Molex (black), from T-stud at top of right fairing support brace (inboard side) and disconnect. See Figure 4-18.
11. **FLTR:** Remove outer fairing and bezel. See 2.39 UPPER FAIRING AND WINDSHIELD: FLTR and 2.40 INSTRUMENT BEZEL: FLTR, respectively. Disconnect twist grip sensor jumper harness connector [204], 6-place Molex (black).

*NOTE*

*The external latch on the pin housing of the twist grip sensor connector will break if the twist grip sensor is pulled too hard. A broken latch prevents positive engagement of the pin and socket housings. Since the connector is not serviceable, any damage requires replacement of the twist grip sensor jumper harness.*

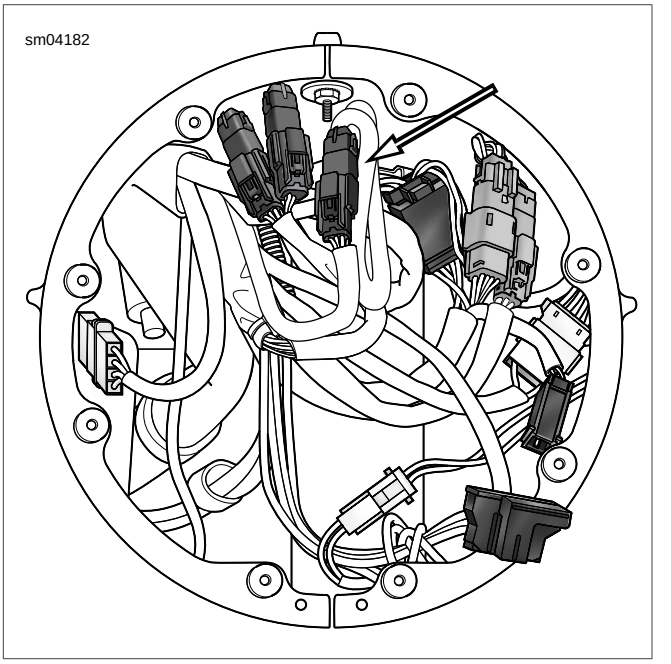



**Figure 4-17. Twist Grip Sensor Jumper Harness Connector (FLHR/C)**

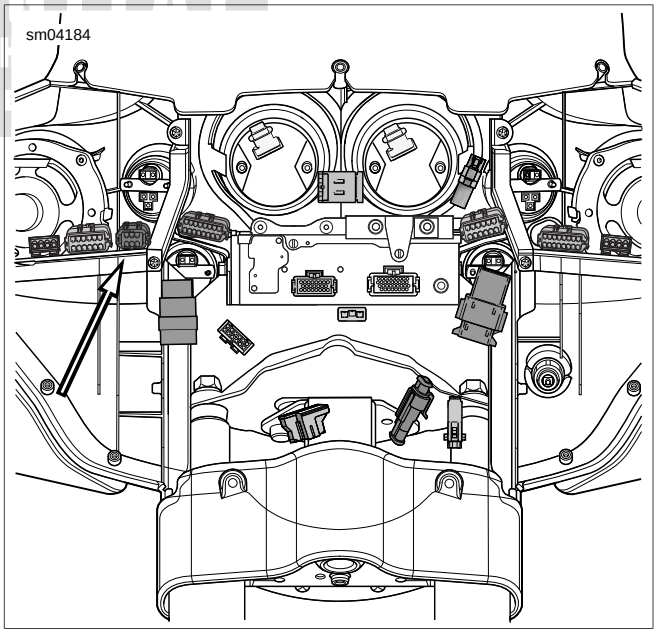



**Figure 4-18. Twist Grip Sensor Jumper Harness Connector (FLHX, FLHT/C/U)**

12. Gently pull twist grip sensor out of handlebar only as far as necessary to access green twist grip sensor connector. For best results, proceed as follows:
    a. Straighten conduit on Molex connector end of jumper harness and feed through slot at front of handlebar while pulling.
    b. If harness sticks inside handlebar while pulling twist grip sensor, pull Molex connector end to retract harness slightly, and then try again; gently work harness back and forth in this manner until twist grip sensor connector is accessible.

*NOTE*

*The external latch on the pin housing of the twist grip sensor connector will break if pried. A broken latch prevents positive engagement of the pin and socket housings. Since the connector is not serviceable, any damage requires replacement of the twist grip sensor jumper harness.*

13. Gently insert a small flat blade screwdriver between pin and socket housings as shown in Figure 4-19. Once bottom edge of latch is engaged, pull pin housing from socket housing. Do not pivot or rotate screwdriver after insertion or damage to pin housing will occur.
14. Remove twist grip sensor. See Figure 4-20.

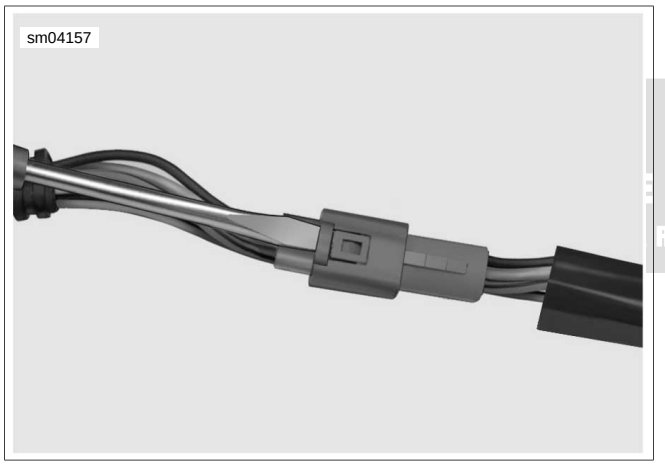



**Figure 4-19. Gently Insert Screwdriver to Disconnect Twist Grip Sensor Connector**


**Figure 4-20. Twist Grip Sensor**

## INSTALLATION

*NOTE*

*Each twist grip sensor contains the terminals for installation of a heated throttle grip available through P&A. While the seal cap protects the terminals from dirt and moisture, it also serves as a retention device for installation of the throttle grip.*

1. Verify that seal cap is installed at end of twist grip sensor. If seal cap is not present, proceed as follows:
    a. See if seal cap is engaged on index pins inside throttle grip. If found, use a stiff piece of mechanics wire to lasso seal cap and pull free of index pins. Obtain **new** seal cap if damaged or missing.
    b. Check condition of o-ring on seal cap. As o-ring is not sold separately, install **new** seal cap if o-ring replacement is necessary.
    c. Install seal cap engaging legs in slots at end of twist grip sensor. For best results, install one leg first. Depressing second leg slightly with a small flat blade screwdriver, push down on seal cap until fully installed. See Figure 4-21.
2. Connect green twist grip sensor connector.
3. Gently pull Molex connector end of jumper harness to draw twist grip sensor into handlebar. Fit index tabs on twist grip sensor into slots in handlebar. One index tab and slot are smaller than the others to prevent improper assembly. See Figure 4-22.
4. Slide the throttle grip over the end of the handlebar. Rotate the grip to verify that internal splines are engaged with those on the twist grip sensor.

*NOTE*

*It is not necessary to hold the throttle grip onto the handlebar. Index pins in grip engage receptacle in seal cap of twist grip sensor to prevent grip from sliding off.*

5. Position the lower switch housing beneath the throttle grip, so that ribs at end of throttle grip engage slot in lower switch housing.
6. Position the upper switch housing over the handlebar and lower switch housing.
7. Start the upper and lower switch housing screws, but do not tighten. Verify that the wire harness conduit runs in depression at bottom of handlebar.
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.

*NOTE*

*Do not pull the switch housings so far inboard as to cause the throttle grip to bind or drag on the handlebar. Rotate the throttle grip to verify that it freely returns to the idle position.*

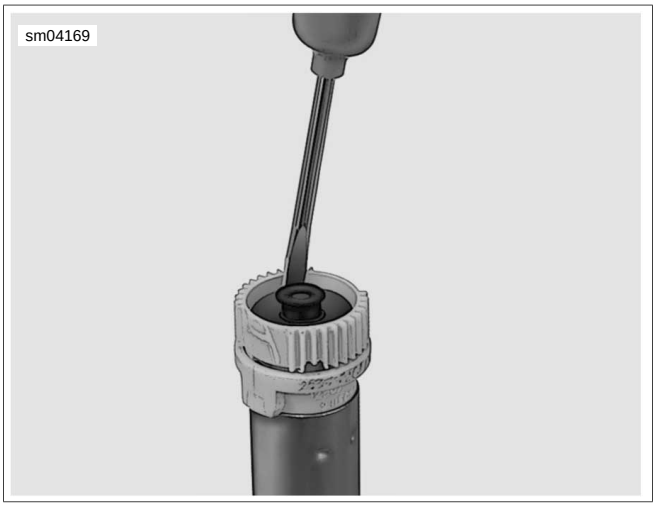



**Figure 4-21. Install Seal Cap If Removed**


**Figure 4-22. Install Twist Grip Sensor**

10. Beginning with the top screw, tighten the handlebar clamp screws to 72-80 **in-lbs** (8-9 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 assembly.*

12. Remove the cardboard insert between the brake lever and lever bracket.
13. **FLHR/C:** Connect twist grip sensor jumper harness connector and install on T-stud on fork stem nut lock plate (right side). Install handlebar clamp shroud and headlamp. See 2.45 HEADLAMP NACELLE: FLHR/C.
14. **FLHX, FLHT/C/U:** Draw twist grip sensor jumper harness connector and conduit forward to front of upper fork bracket, and then route under right radio support bracket to area behind fairing support brace. Connect connector and install on T-stud at top of fairing support brace (inboard side). Install outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
15. **FLTR:** Connect twist grip sensor jumper harness connector. Install outer fairing and bezel. See 2.39 UPPER FAIRING AND WINDSHIELD: FLTR and 2.40 INSTRUMENT BEZEL: FLTR, respectively.
16. If present, install two cable clips on right side handlebar switch conduit into holes in handlebar.
17. Install maxi-fuse.
18. Install left side cover.
19. Install left side saddlebag. See 2.27 SADDLEBAGS.

*NOTE*

*Whenever a **new** twist grip sensor (or ECM) is installed, place the engine run/stop switch in the RUN position and turn the ignition/light keyswitch to IGNITION and then back to OFF four times (without starting engine). Allow at least three seconds to elapse between ignition cycles. As the ECM uses the first four ignition cycles to establish the optimum idle speed, there may be initial performance problems if the procedure is not performed, such as high idle or hesitation when the throttle is opened.*

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

## TWIST GRIP SENSOR JUMPER HARNESS

### Removal

1. Remove twist grip sensor.
2. Obtain length of strong flexible mechanics wire.

*NOTE*

*Be sure that mechanics wire is of sufficient strength to pull conduit and connector through handlebar without breaking. Wire length must also be long enough, so that free end is not lost in handlebar when pulled.*

3. Securely attach mechanics wire to jumper harness inboard of twist grip sensor connector pin housing. For best results, install mechanics wire on conduit to keep it from bunching up inside handlebar when pulled. See Figure 4-23.
4. Gently pull Molex connector end of jumper harness to draw conduit, connector and mechanics wire out through slot at front of handlebar. If harness sticks inside handlebar, pull on twist grip sensor connector end to retract harness slightly, and then try again; gently work harness back and forth in this manner until free. Remove mechanics wire from jumper harness.

### Installation

1. Move to mechanics wire exiting slot at front of handlebar. Securely attach mechanics wire to jumper harness inboard of twist grip sensor connector pin housing. For best results, install mechanics wire on conduit to keep it from bunching up inside handlebar when pulled.

2. Gently pull opposite end of mechanics wire to draw connector and conduit back through handlebar. For best results, proceed as follows:
   a. Guide leading edge of connector and conduit through slot at front of handlebar. Keep harness straight and feed through slot while pulling.
   b. If harness sticks inside handlebar, pull Molex connector end to retract it slightly, and then try again; gently work harness back and forth in this manner until twist grip sensor connector is accessible.
3. Remove mechanics wire from jumper harness.
4. Install twist grip sensor.


**Figure 4-23. Fix Mechanics Wire to Twist Grip Sensor Jumper Harness**

## GENERAL

*NOTE*

*The TCA is not sold separately. Damage or failure requires complete replacement of the induction module. Also note that tampering or removing TCA cover voids warranty. See Figure 4-24.*

Refer to the ELECTRICAL DIAGNOSTIC MANUAL for information on the function and testing of the TCA.

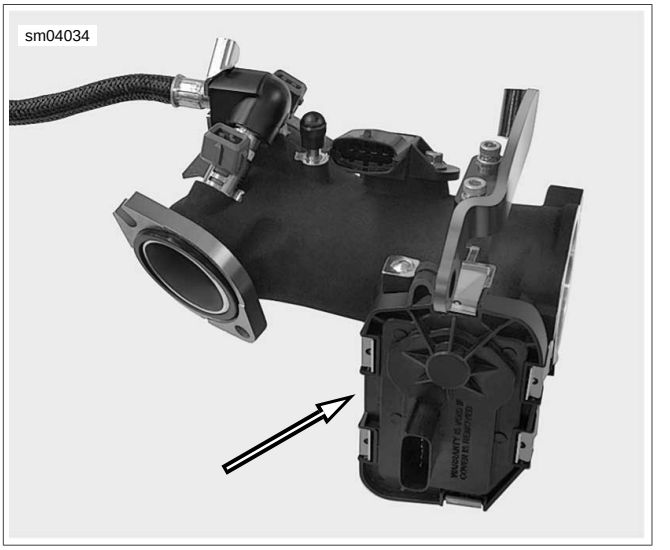



**Figure 4-24. TCA**

## GENERAL

**⚠WARNING**

**Stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near gasoline. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00002a)**

Refer to the ELECTRICAL DIAGNOSTIC MANUAL for information on the function and testing of the engine temperature sensor (ET sensor).

## REMOVAL

1. Remove maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
2. Loosen horn bracket bolt to front cylinder head. Remove horn bracket bolt (with flat washer) from rear cylinder head and swing horn bracket forward.
3. Pull back boot at back of front cylinder and remove ET sensor connector [90].
4. Slide a deepwell socket over the sensor body hex and turn counter-clockwise to loosen. When sensor turns easily, pull out the deepwell socket and remove sensor by hand. See Figure 4-25.

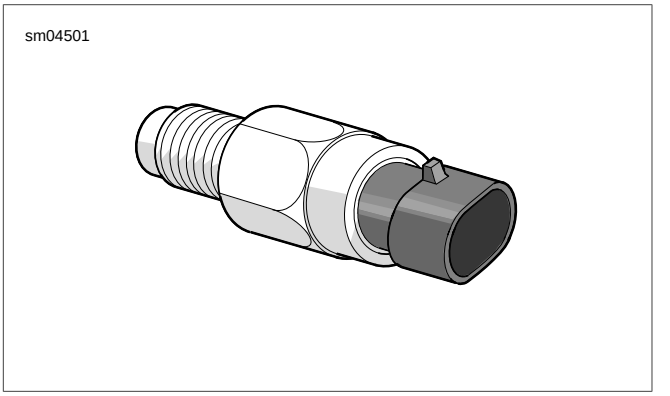



**Figure 4-25. ET Sensor**

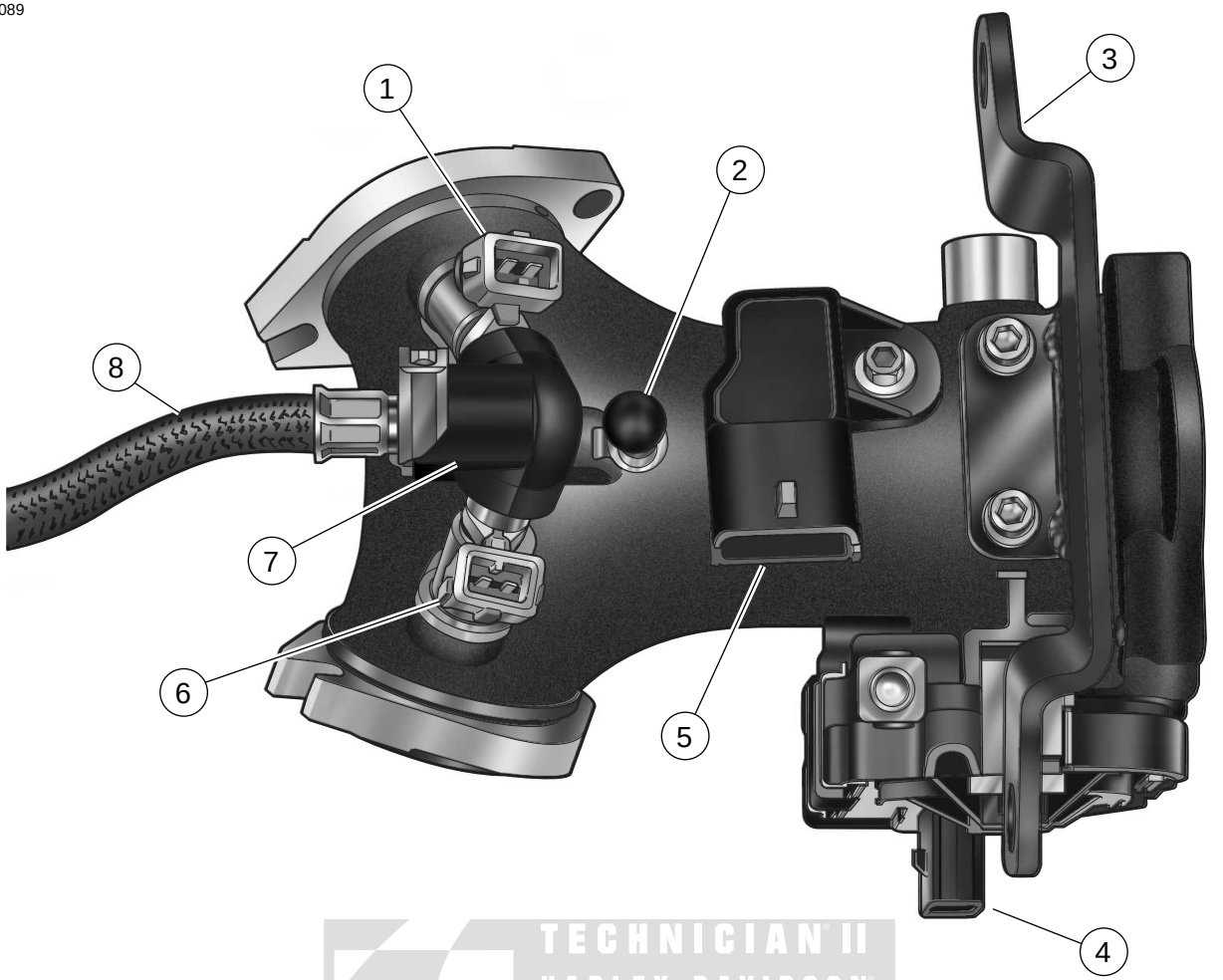
## INSTALLATION

1. Hand start **new** ET sensor into bore at back of front cylinder.
2. Slide deepwell socket over sensor body hex and tighten to 120-180 **in-lbs** (13.6-20.3 Nm).
3. Install ET sensor connector [90]. Pull boot over connector to keep out dirt and debris.
4. Install maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.

## REMOVAL

| PART NUMBER | TOOL NAME |
|---|---|
| HD-47250 | INTAKE MANIFOLD WRENCH |

1. Remove fuel tank. See 4.4 FUEL TANK.
2. Remove air cleaner and backplate. See 4.3 AIR CLEANER ASSEMBLY.
3. Pull purge tube from fitting at top of induction module (California models only). See Figure 4-26.
4. Remove T-MAP sensor connector [80].
5. Remove front fuel injector connector [84] and rear fuel injector connector [85].
6. Remove TCA connector [211]. Cut anchored cable strap to release connector conduit from front right side of induction module.
7. Remove right side socket screws from front and rear cylinder head flange adapters. For best results, use the INTAKE MANIFOLD WRENCH (Part No. HD-47250). See Figure 4-27.
8. Loosen left side socket screws from flange adapters. Slots in flanges make removal of screws unnecessary. For best access, proceed as follows:
   a. Loosen horn bracket screw to front cylinder head. Remove horn bracket screw (with flat washer) from rear cylinder head and swing horn bracket forward.
   b. Remove elbow terminals from horn spade contacts and release harness conduit from J-clamp.
   c. Pull back boot at back of front cylinder and remove ET sensor connector [90].
9. Slide induction module out right side of motorcycle.
10. Remove seals from flange adapters. Discard seals. Remove flange adapters from outlet ports of induction module.




1. **Front fuel injector [84]**
2. **Purge tube fitting/cap**
3. **Mounting bracket**
4. **TCA [211]**
5. **T-MAP sensor [80]**
6. **Rear fuel injector [85]**
7. **Fuel rail**
8. **Fuel supply tube**

**Figure 4-26. Induction Module Assembly**

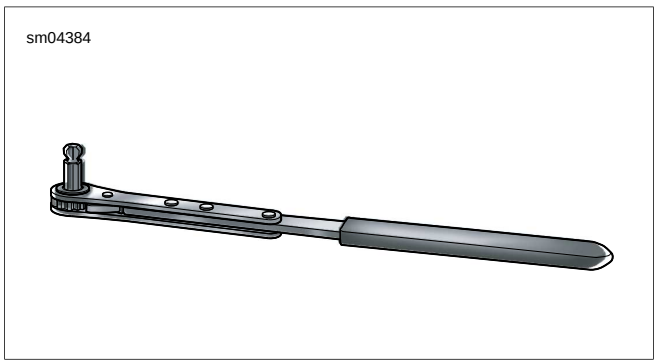



**Figure 4-27. Intake Manifold Wrench (HD-47250)**

## INSTALLATION

| PART NUMBER | TOOL NAME |
|---|---|
| HD-47250 | INTAKE MANIFOLD WRENCH |

1. With the counterbore facing outward, slide cylinder head flange adapters onto outlet ports of induction module.
2. Place a **new** seal in each flange adapter with the beveled side in against the counterbore.
3. Orient the induction module as shown in Figure 4-26. Standing on right side of motorcycle, slide induction module toward installed position so that open-ended slots on flange adapters engage socket screws loosely installed on left side.
4. Align fixed holes in flange adapters with holes in cylinder heads and start socket screws. For best results, use the INTAKE MANIFOLD WRENCH (Part No. HD-47250).

5. Use mounting bracket to properly locate induction module. Start two breather bolts to fasten mounting bracket to front and rear cylinder heads.
6. Tighten socket screws in fixed holes of flange adapters until snug. Moving to left side, tighten screws in slotted holes to 96-144 **in-lbs** (10.9-16.3 Nm).
7. Tighten socket screws in fixed holes of flange adapters to 96-144 **in-lbs** (10.9-16.3 Nm).
8. If parts were removed for access to left side flange adapter screws, proceed as follows:
   a. Install ET sensor connector [90] at back of front cylinder. Pull boot over sensor to keep out dirt and debris.
   b. Install elbow terminals onto horn spade contacts. Capture harness conduit in J-clamp.
   c. Install screw (with flat washer) to fasten horn bracket to rear cylinder head. Alternately tighten front and rear horn bracket screws to 35-40 ft-lbs (48-54 Nm).
9. Remove breather bolts to release mounting bracket from front and rear cylinder heads.
10. Install rear fuel injector connector [85] and front fuel injector connector [84].
11. Install T-MAP sensor connector [80].
12. Route TCA connector and conduit straight down between induction module and front cylinder staying inboard of mounting bracket. Install **new** anchored cable strap in hole at front right side of induction module and loosely capture TCA conduit.
13. Route conduit rearward under induction module and install TCA connector [211]. Tighten cable strap and cut any excess cable strap material.
14. Connect purge tube to fitting at top of induction module (California models only). On non-California models, inspect rubber cap for tears, cracks or signs of deterioration. Replace cap if damaged or missing. Operation without cap can result in engine damage.
15. Install fuel tank. See 4.4 FUEL TANK.
16. Install backplate and air cleaner. See 4.3 AIR CLEANER ASSEMBLY.

# MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP) 4.13

## GENERAL

Refer to the ELECTRICAL DIAGNOSTIC MANUAL for information on the function and testing of the temperature/manifold absolute pressure (T-MAP) sensor.

## REMOVAL

1. Remove fuel tank. See 4.4 FUEL TANK.
2. Remove hex screw to release T-MAP sensor bracket from induction module. Discard screw.
3. While rotating T-MAP sensor slightly, pull straight up to release pressure port from hole in induction module. See Figure 4-28.

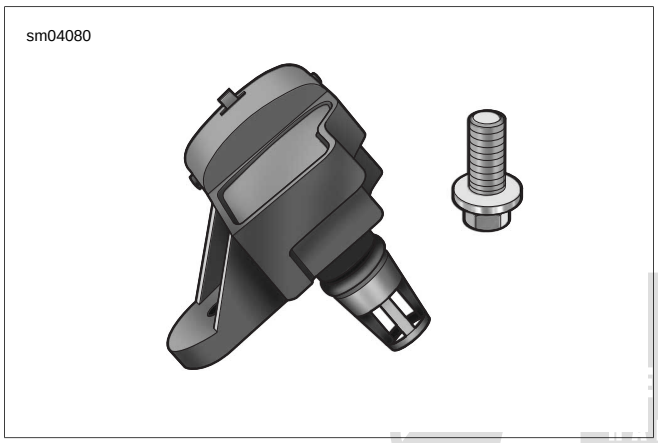



**Figure 4-28. T-MAP Sensor**

## INSTALLATION

1. Inspect o-ring on pressure port for cuts, tears or signs of deterioration. Install **new** o-ring if necessary.
2. With the electrical connector facing toward the rear of the induction module, insert pressure port on T-MAP sensor into hole in induction module.
3. Align hole in T-MAP sensor bracket with threaded hole in induction module.
4. Install **new** hex screw and tighten to 84-108 **in-lbs** (9.5-12.2 Nm).
5. Install fuel tank. See 4.4 FUEL TANK.

## GENERAL

Refer to the ELECTRICAL DIAGNOSTIC MANUAL for information on the function and testing of the oxygen sensor (O2).

## REMOVAL

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48262 | O2 SENSOR SOCKET |

1. Remove maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
2. **Front Exhaust Header:** Cut cable strap and disconnect front O2 sensor connector [138], 2-place Amp (Tyco), at back of cross brace between front frame downtubes (left side).
3. **Rear Exhaust Header:** Disconnect rear O2 sensor connector [137], 2-place Amp (Tyco), under chrome starter cover.
4. Obtain O2 SENSOR SOCKET (Part No. HD-48262) with drive extension. See Figure 4-29.
5. Positioned on left side of motorcycle, slide socket over sensor body hex on inboard side of exhaust header and turn counterclockwise to loosen. See Figure 4-30.
6. When sensor turns easily, pull out socket and remove sensor by hand. See Figure 4-31.

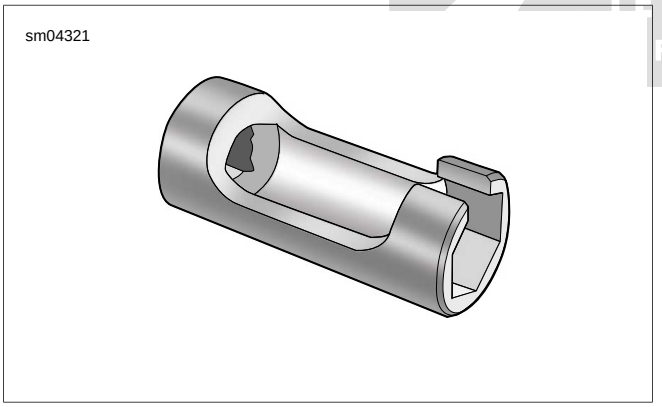



**Figure 4-29. O2 Sensor Socket (HD-48262)**


**Figure 4-30. Remove/Install Front O2 Sensor**

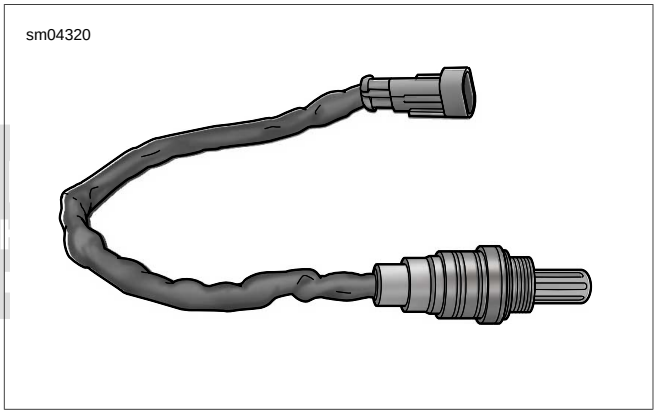



**Figure 4-31. Front O2 Sensor**

## INSTALLATION

*NOTE*

*Do not reuse sensors that have been dropped or impacted by other components. Damage to the sensing element may have occurred.*

1. If reusing O2 sensor, proceed as follows:
   a. Install **new** seal washer.
   b. Apply a light coating of Loctite Anti-Seize Lubricant (Part No. 98960-97) to threads. Use of any other grease or sealant can result in signal trouble and sensor failure.

   *NOTE*

   *Anti-seize is applied to the threads of new sensors at the factory.*

2. Positioned on left side of motorcycle, hand start O2 sensor into threaded boss on inboard side of exhaust header.

3. Obtain O2 SENSOR SOCKET (HD-48262) with drive extension. Slide socket over sensor body hex and tighten to 30-44 ft-lbs (40.7-59.7 Nm).

*NOTE*

*Do not apply dielectric grease, cleaning agents, or any other lubricants, sealants or fluids to O2 sensor connectors. Any such application will result in signal trouble and sensor failure.*

4. **Front Exhaust Header:** Connect front O2 sensor connector [138], 2-place Amp (Tyco). Install **new** cable strap to secure connector to back of cross brace between front frame downtubes (left side). Cut any excess cable strap material.
5. **Rear Exhaust Header:** Connect rear O2 sensor connector [137], 2-place Amp (Tyco), and tuck under chrome starter cover.
6. Install maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.

## GENERAL

**⚠WARNING**

**Stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near gasoline. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00002a)**

Refer to the ELECTRICAL DIAGNOSTIC MANUAL for information on the function and testing of the fuel injectors.

## REMOVAL

1. Remove induction module. See 4.12 INDUCTION MODULE.
2. Remove T25 TORX screw to release fuel supply tube clamp from fuel rail.
3. Rotate fuel supply tube clamp 90° in a clockwise direction and then remove from groove in fuel supply tube fitting. See Figure 4-32.
4. Pull fuel supply tube from fuel rail bore and remove two o-rings and two sealing washers. Discard o-rings and sealing washers.
5. Pull fuel injectors with attached fuel rail from induction module. To overcome the resistance of the bottom o-ring on both fuel injectors, gently rock assembly back and forth while pulling.
6. Pull fuel injectors from fuel rail. To overcome the resistance of the top o-ring, gently rock each fuel injector while pulling.
7. Remove o-rings from fuel injectors. Discard o-rings.

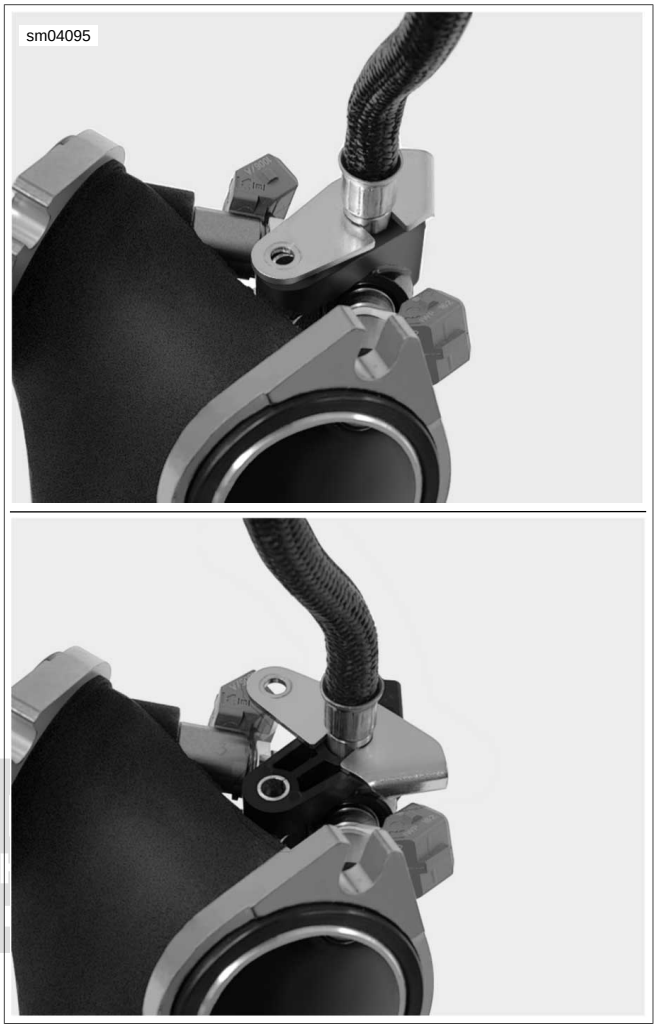



**Figure 4-32. Rotate Fuel Supply Tube Clamp**

## INSTALLATION

1. Apply a very light film of clean engine oil to **new** o-rings. Install o-rings on fuel injectors.
2. Push open end of fuel injectors (opposite cone spray) into fuel rail.
3. Rotate fuel injectors, so that the electrical connectors are on the outboard side. Push cone spray end of fuel injectors into bores of induction module until slot at bottom of fuel rail engages machined tab at top of induction module.
4. Install **new** o-ring and sealing washer in fuel rail bore. Install second o-ring and second sealing washer.
5. Push fuel supply tube into fuel rail bore.
6. Rotate fuel supply tube in a clockwise direction until tapered end of quick connect fitting is pointing upward. Now rotate tube an additional 90°, so that fitting is pointing rearward (toward TCA on induction module).
7. Engage slot on fuel supply tube clamp in groove of fuel supply tube fitting. Rotate fuel supply tube clamp 90° in a

counter-clockwise direction until curled lip on fuel supply tube clamp engages flange on fuel rail.

8. Align thru holes in fuel rail and fuel supply tube clamp with threaded hole in induction module. Install T25 TORX screw and tighten to 66-82 **in-lbs** (7.5-9.3 Nm).
9. Install induction module. 4.12 INDUCTION MODULE.

## GENERAL

**⚠WARNING**

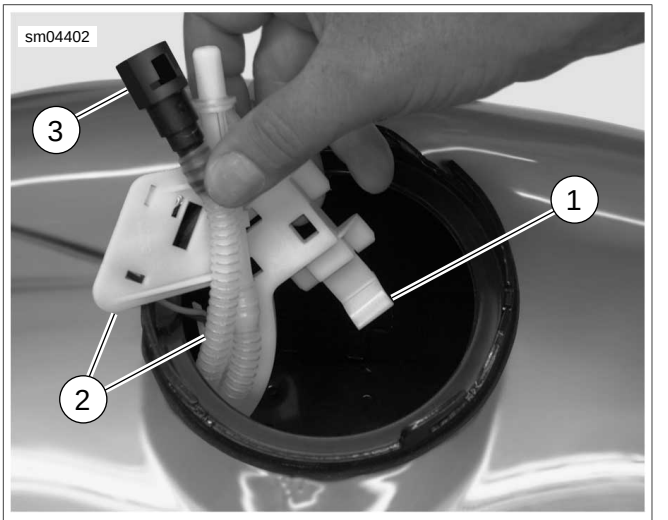
**When servicing the fuel system, do not smoke or allow open flame or sparks in the vicinity. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00330a)**

Carefully inspect tubes for cuts, tears, holes or other damage. Replace fuel pump if any damage is found. Even a small hole can cause a reduction in fuel pressure.

Refer to the electrical diagnostic manual for information on the function and testing of the fuel pump.

## REMOVAL

1. Remove top plate. See 4.5 FUEL TANK TOP PLATE.
2. Remove fuel level sender. See 4.8 FUEL LEVEL SENDER.
3. Pull up on transfer tube bracket to release two tabs at bottom from slots at top of fuel pump bracket.
4. Depress collar on each side of fitting to disconnect transfer tube from transfer tube bracket.
5. Reaching into fuel tank, pull up on rear finger and slide fuel pump bracket forward until four ears on bracket are free of catches at top of tunnel. See Figure 4-33.
6. Remove fuel pump from left side of fuel tank. For best results, rotate fuel pump assembly 90° in a clockwise direction until transfer tube connection is pointing rearward, and then pull from fuel tank. See Figure 4-34.
7. If necessary, further disassemble fuel pump assembly as follows:
   a. Reaching into fuel tank, release transfer tube from weld clip on right side of tunnel and remove from fuel tank.
   b. Depress arms on fuel inlet strainer and remove from slots in fuel pump housing.
   c. Inspect the condition of the fuel pump wiring. If the wiring needs to be replaced, see 4.16 FUEL PUMP, Fuel Pump and Fuel Level Sender Wire Harness.




**1. Fuel pump bracket (rear finger)**
**2. Transfer tube/bracket**
**3. Fuel pump to fuel filter fitting**

**Figure 4-33. Rear Finger (Fuel Pump Bracket)**

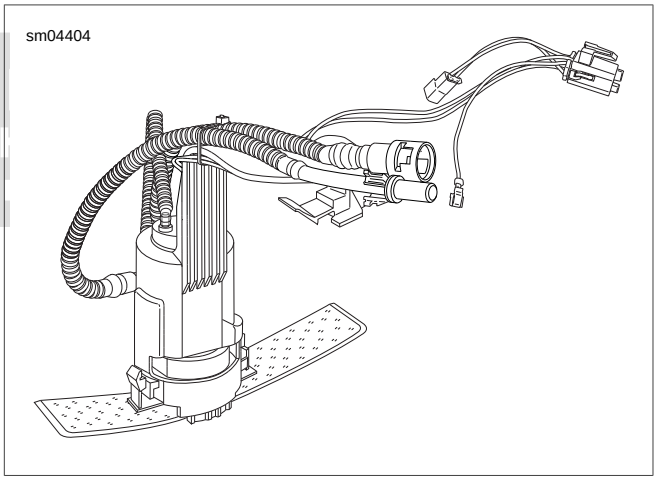



**Figure 4-34. Fuel Pump Assembly**

## INSTALLATION

1. If removed, assemble fuel pump assembly as follows:
   a. Reaching into fuel tank, capture transfer tube in weld clip on right side of tunnel.
   b. Install fuel inlet strainer at bottom of fuel pump engaging arms in slots of fuel pump housing.
2. Install fuel pump into left side of fuel tank. For best results, hold fuel pump assembly, so that transfer tube connection is pointing rearward, and then insert into fuel tank. Now rotate assembly 90° in a counter-clockwise direction.
3. Look into fuel tank to verify that fuel inlet strainer lies flat and that ends are not folded under fuel pump. Also verify that wire harness is still captured in molded clip at front of fuel pump bracket.

4. With the finger on the fuel pump bracket pointing rearward, engage four ears on bracket with rear set of catches at top of tunnel. Push fuel pump bracket rearward until ears are fully engaged.
5. Install transfer tube onto transfer tube bracket. Fit two tabs at bottom of transfer tube bracket into slots at top of fuel pump bracket. Verify that transfer tube is still captured in weld clip on right side of tunnel and that free end is in contact with bottom of fuel tank.
6. Install fuel level sender. See 4.8 FUEL LEVEL SENDER.
7. Install top plate. See 4.5 FUEL TANK TOP PLATE.

## FUEL PUMP AND FUEL LEVEL SENDER WIRE HARNESS

### Removal

*NOTE*

*Damaged wiring, terminals and/or connectors requires replacement of the wire harness. Do not replace the special teflon coated wiring with ordinary bulk wire. Ordinary insulation materials may deteriorate when in contact with gasoline.*

1. Remove fuel pump. See 4.16 FUEL PUMP.
2. Cut cable strap to release wire harness and both fuel pump and transfer tubes from arm of fuel pump bracket.
3. Release wire harness from molded clip at front of fuel pump bracket.
4. Remove connector at top of fuel pump.

### Installation

1. Install connector at top of fuel pump.
2. Route wire harness rearward and then forward under arm of fuel pump bracket. Install **new** cable strap at elbow capturing fuel pump and transfer tubes at top of arm and wire harness at bottom. See Figure 4-35.
3. Route wire harness through molded clip at front of fuel pump bracket. See Figure 4-36.
4. Install fuel pump. See 4.16 FUEL PUMP.

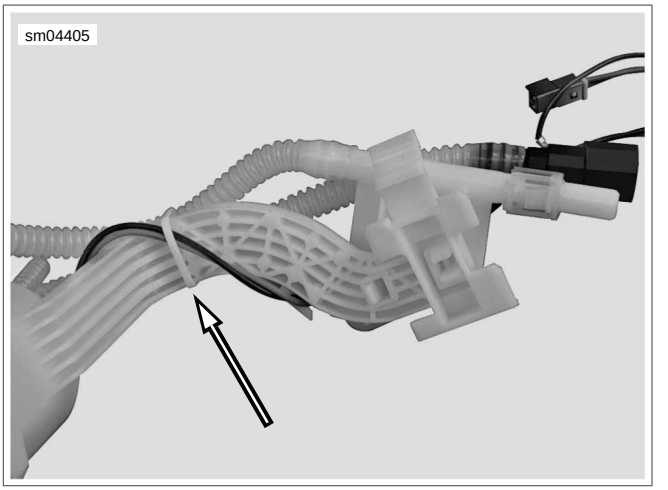



**Figure 4-35. Cable Wires in Cable Strap**

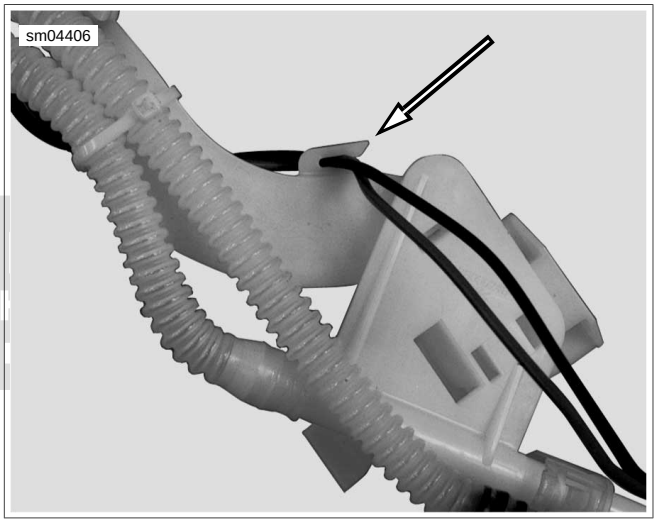



**Figure 4-36. Capture Wires in Molded Clip**

## GENERAL

See Figure 4-37. The fuel pump fuse is located in the fuse block under the left side cover. The fuel pump can be turned on with Digital Technician 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.

*NOTE*

*Refer to the electrical diagnostic manual for further information on the function and testing of the fuel system.*

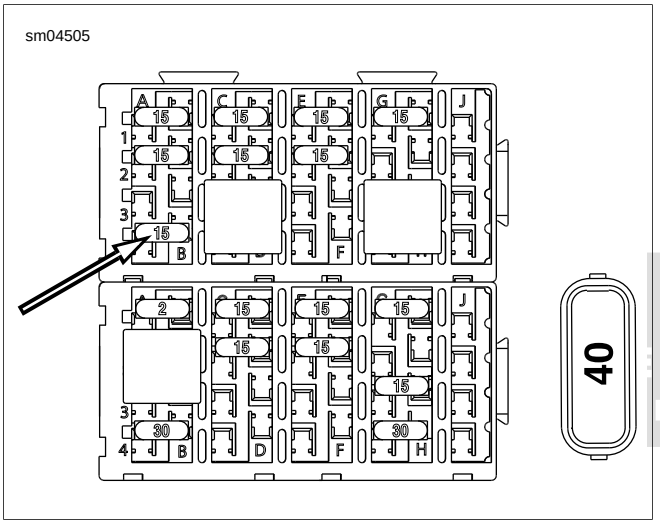



**Figure 4-37. Fuel Pump Fuse**

## TESTING

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41182 | FUEL PRESSURE GAUGE |
| HD-44061 | FUEL PRESSURE GAUGE ADAPTER |

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.

Avoid kinking the fuel supply line when installing/removing the fuel pressure gauge and adapters.

**⚠WARNING**

**To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)**

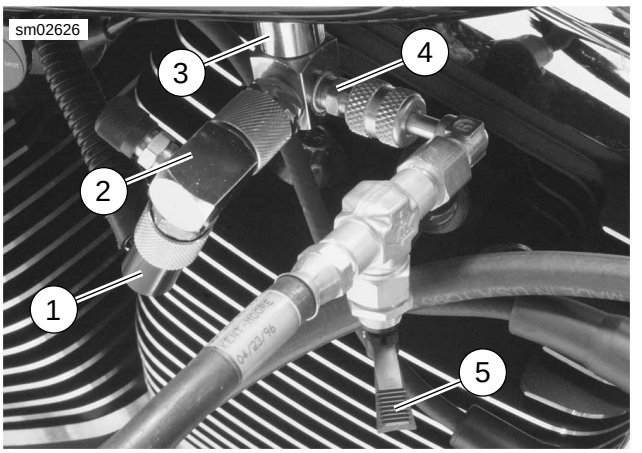
1. Purge the fuel supply line as follows:
   a. Remove left side saddlebag. See 2.27 SADDLEBAGS.
   b. Remove left side cover.
   c. Remove 15 amp fuel pump fuse.
   d. Start the engine and allow the motorcycle to run.
   e. When the engine stalls, operate starter for 3 seconds to remove remaining fuel from fuel supply line.
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.

*NOTE*

*Use of two fuel pressure gauge adapters is required. Using only one adapter will cause excessive twisting of the fuel supply line.*

3. Install fuel pressure gauge adapters as follows:
   a. Push up on knurled sleeve of FUEL PRESSURE GAUGE ADAPTER (Part No. HD-44061), insert neck of second adapter, and then pull down on knurled sleeve until locked. Tug on adapters to be sure that they will not come free. See Figure 4-38.
   b. Pull up on knurled sleeve of fuel pressure gauge adapter, insert neck of fuel supply line fitting, and then pull down on knurled sleeve until locked. Gently tug on fuel supply line fitting to be sure that it will not come free.
   c. Pull up on chrome sleeve of quick-connect fitting on fuel tank, insert neck of fuel pressure gauge adapter, and then pull down on chrome sleeve until locked. Gently tug on adapter to be sure that it will not come free.


**Figure 4-38. 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 4-39. Fuel Line**

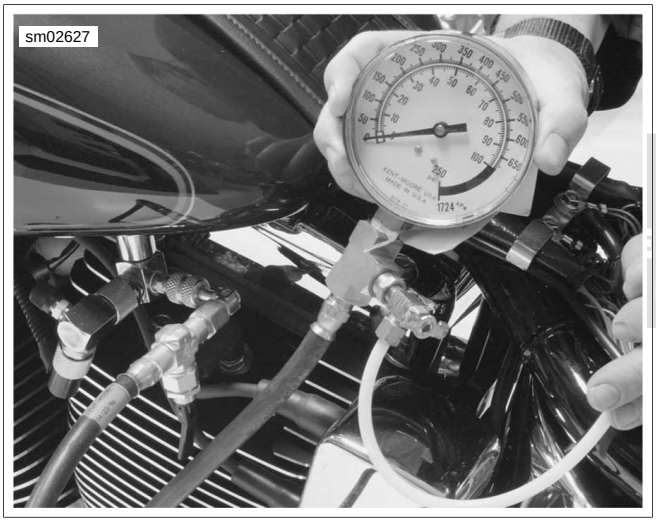



**Figure 4-40. Fuel Pressure Gauge Installed (Typical)**

**⚠WARNING**

**To prevent spray of fuel, be sure quick-connect fittings are properly mated. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00268a)**

4. Verify that the fuel valve and air bleed petcock on the FUEL PRESSURE GAUGE (Part No. HD-41182) are closed.
5. Remove protective cap from Schroeder valve on fuel pressure gauge adapter closest to the fuel tank. Connect fuel pressure gauge to Schroeder valve. See Figure 4-39.
6. Install fuel pump fuse.
7. 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.
8. 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.
9. Open and close the throttle to change engine speed. Note the reading of the pressure gauge. Fuel pressure should remain steady at 55-62 psi (380-425 kPa).

*NOTE*

*If the fuel pressure is not within specification, see electrical diagnostic manual for further diagnosis.*

10. 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 fuel pressure gauge of gasoline.

**⚠WARNING**

**Gasoline can drain from the adapter when gauge is removed. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00254a)**

11. Remove fuel pressure gauge from Schroeder valve. Install protective cap.

**⚠WARNING**

**Gasoline can drain from the fuel line and adapter when removed. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00255a)**

12. Pull up on knurled sleeve of fuel pressure gauge adapter and remove fuel supply line fitting. Pull up on chrome sleeve of quick-connect fitting on fuel tank and remove fuel pressure gauge adapter.

**⚠WARNING**

**To prevent spray of fuel, be sure quick-connect fittings are properly mated. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00268a)**

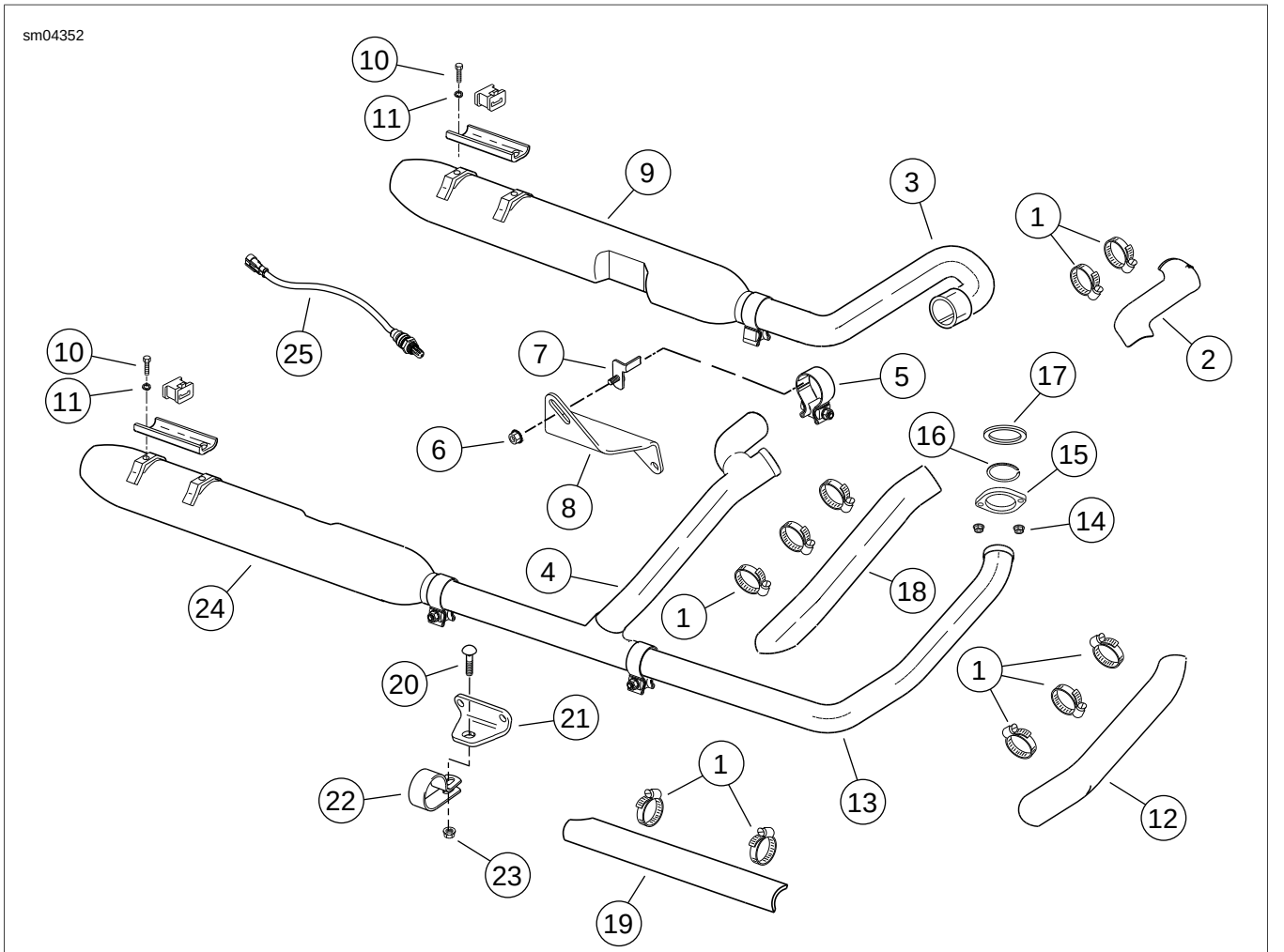
13. Pull up on chrome sleeve of quick-connect fitting, insert neck of fuel supply line fitting, and then pull down on chrome sleeve until locked. Gently tug on fuel supply line fitting to be sure that it will not come free.
14. Install left side cover.
15. Install left side saddlebag. See 2.27 SADDLEBAGS.

## REMOVAL

*NOTE*

*To access engine and/or transmission components, use the following procedure to remove the exhaust with minimal disassembly. To completely disassemble the exhaust system, see 4.18 EXHAUST SYSTEM, Disassembly.*

1. Remove saddlebags. See 2.27 SADDLEBAGS.
2. Remove seat. See 2.26 SEAT.
3. On Ultra models, remove fairing lowers. See 2.34 LOWER FAIRING AND ENGINE GUARD.
4. 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 motorcycle using a 3/8 inch ball allen with extension.
5. On HDI models, disconnect cable to exhaust valve actuator as follows:
   a. Locate active exhaust valve just forward of the right side muffler. Push cam rearward to remove tension from cable, and then release ball end from slot.
   b. Remove cable clip from slotted flange at front of active exhaust valve.
6. Cut cable strap and disconnect front O2 sensor connector [138], 2-place Amp (Tyco), at back of cross brace between front frame downtubes (left side). Disconnect rear O2 sensor connector [137] under chrome starter cover.
7. See Figure 4-41. Remove exhaust system in two sections as follows:
   a. Open worm drive clamps to release heat shield over rear header pipe to crossover pipe connection (above starter).
   b. Loosen TORCA clamp (special) 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, respectively.
   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 motorcycle, remove two screws (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 motorcycle. For best results, be sure to allow sufficient time for the penetrating oil to work.
   f. Remove TORCA clamp from crossover pipe. Discard TORCA clamp.
   g. Moving to right side of motorcycle, open 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 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 worm drive clamps to release heat shield over front header pipe to rear header pipe connection (outboard of transmission side door).
   j. Remove carriage bolt (with flange locknut) to release exhaust bracket clamp from transmission exhaust bracket. Use a channel lock to open clamp and then remove from front header pipe, if necessary.
   k. Remove two screws (with lockwashers) to detach right side muffler from the lower saddlebag support rail.
   l. Depressing rear brake pedal, remove right side exhaust from motorcycle.
   m. Remove and discard gaskets from front and rear exhaust ports.




1. **Worm drive clamp (10)**
2. **Heat shield, crossover pipe**
3. **Crossover pipe**
4. **Rear header pipe**
5. **TORCA clamp (special)**
6. **Keps nut**
7. **Bracket tab**
8. **Exhaust support bracket**
9. **Left muffler**
10. **Screw (4)**
11. **Lockwasher (4)**
12. **Heat shield, front header pipe**
13. **Front header pipe**
14. **Flange nut (4)**
15. **Exhaust flange (2)**
16. **Circlip (2)**
17. **Cylinder head gasket (2)**
18. **Heat shield, rear header pipe**
19. **Heat shield, front header to rear header pipe**
20. **Carriage bolt**
21. **Transmission exhaust bracket**
22. **Exhaust bracket clamp**
23. **Flange locknut**
24. **Right muffler**
25. **O2 Sensor (2)**

**Figure 4-41. Remove/Install Exhaust System**

## INSTALLATION

1. Install **new** gaskets in both the front and rear cylinder head exhaust ports (with the tapered side out).
2. Place right side exhaust into position on motorcycle and start two exhaust flange nuts to secure front header pipe to studs of front cylinder head.
3. Start two screws (with lockwashers) to secure right side muffler to the lower saddlebag support rail.

   Start two exhaust flange nuts to secure rear header pipe to studs of rear cylinder head.
4. Capture front header pipe in exhaust bracket clamp, if necessary. Use a channel lock to close clamp. Install carriage bolt engaging transmission exhaust bracket and exhaust bracket clamp. Finger tighten flange locknut.
5. Moving to left side of motorcycle, slide **new** TORCA clamp (special) onto crossover pipe.
6. Twist and push crossover pipe onto right side exhaust.
7. Start two screws (with lockwashers) to secure left side muffler to the lower saddlebag support rail.

8. Position TORCA clamp (special) 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.

*NOTE*

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

9. Tighten the exhaust system as follows:
   a. 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 100-120 **in-lbs** (11.3-13.6 Nm). Final tighten the top nut to 100-120 **in-lbs** (11.3-13.6 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 100-120 **in-lbs** (11.3-13.6 Nm). Final tighten the bottom nut to 100-120 **in-lbs** (11.3-13.6 Nm).
   c. Tighten flange locknut on exhaust bracket clamp carriage bolt to 20-25 ft-lbs (27.1-33.9 Nm).
   d. Snug two screws (with lockwashers) holding the right side muffler to the lower saddlebag support rail. Alternately tighten screws to 96-144 **in-lbs** (10.8-16.3 Nm).
   e. Snug two screws (with lockwashers) holding the left side muffler to the lower saddlebag support rail. Alternately tighten screws to 96-144 **in-lbs** (10.8-16.3 Nm).
   f. Verify that all exhaust pipes are in alignment and do not contact the motorcycle frame or mounted components.
   g. Tighten the TORCA clamp (special) between the rear header pipe and crossover pipe to 45-60 ft-lbs (61-81 Nm).
   h. Tighten Keps nut on stud of bracket tab to 12-15 ft-lbs (16.3-20.3 Nm).

*NOTE*

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

10. Open worm drive clamps and install heat shields as follows:
    a. Over front header pipe (below exhaust port).
    b. Over rear header pipe (below exhaust port).
    c. Over front header pipe to rear header pipe connection (outboard of transmission side door).
    d. Over rear header pipe to crossover pipe connection (above starter).
11. 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).
12. Connect front O2 sensor connector [138], 2-place Amp (Tyco), and install **new** cable strap to secure to back of cross brace between front frame downtubes (left side). Connect rear O2 sensor connector [137] and tuck under chrome starter cover.
13. On HDI models, connect cable to exhaust valve actuator as follows:
    a. Install cable clip onto slotted flange at front of active exhaust valve.
    b. Push cam rearward and install ball end of cable into slot. Verify that cable is properly seated in channel of active exhaust valve.
14. 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 motorcycle using a 3/8 inch ball allen with extension. Alternately tighten screws to 30-35 ft-lbs (41-48 Nm).
15. On Ultra models, install fairing lowers. See 2.34 LOWER FAIRING AND ENGINE GUARD.
16. Install seat. See 2.26 SEAT.
17. Install saddlebags. See 2.27 SADDLEBAGS.

## DISASSEMBLY

*NOTE*

*Use the following procedure to completely disassemble the exhaust system. If just removing the exhaust to access engine and/or transmission components, see REMOVAL.*

1. Remove saddlebags. See 2.27 SADDLEBAGS.
2. On Ultra models, remove fairing lowers. See 2.34 LOWER FAIRING AND ENGINE GUARD.
3. 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 motorcycle using a 3/8 inch ball allen with extension.
4. On HDI models, disconnect cable to exhaust valve actuator as follows:
   a. Locate active exhaust valve just forward of the right side muffler. Push cam rearward to remove tension from cable, and then release ball end from slot.
   b. Remove cable clip from slotted flange at front of active exhaust valve.
5. Remove O2 sensors from front and rear header pipes. See 4.14 OXYGEN SENSORS (O2).
6. Open worm drive clamps and remove six heat shields from exhaust pipes. Mark the location of the heat shields to ensure proper assembly. See Figure 4-42.
7. Using a bungee cord, tie the muffler on the left side of the motorcycle to the lower saddlebag support rail.
8. 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.

9. On right side of motorcycle, loosen TORCA clamps as follows:
   a. Front header pipe to rear header pipe.
   b. Rear header pipe to right side muffler.
10. On left side of motorcycle, loosen TORCA clamps as follows:
   a. Rear header pipe to crossover pipe.
   b. Crossover pipe to left side muffler.

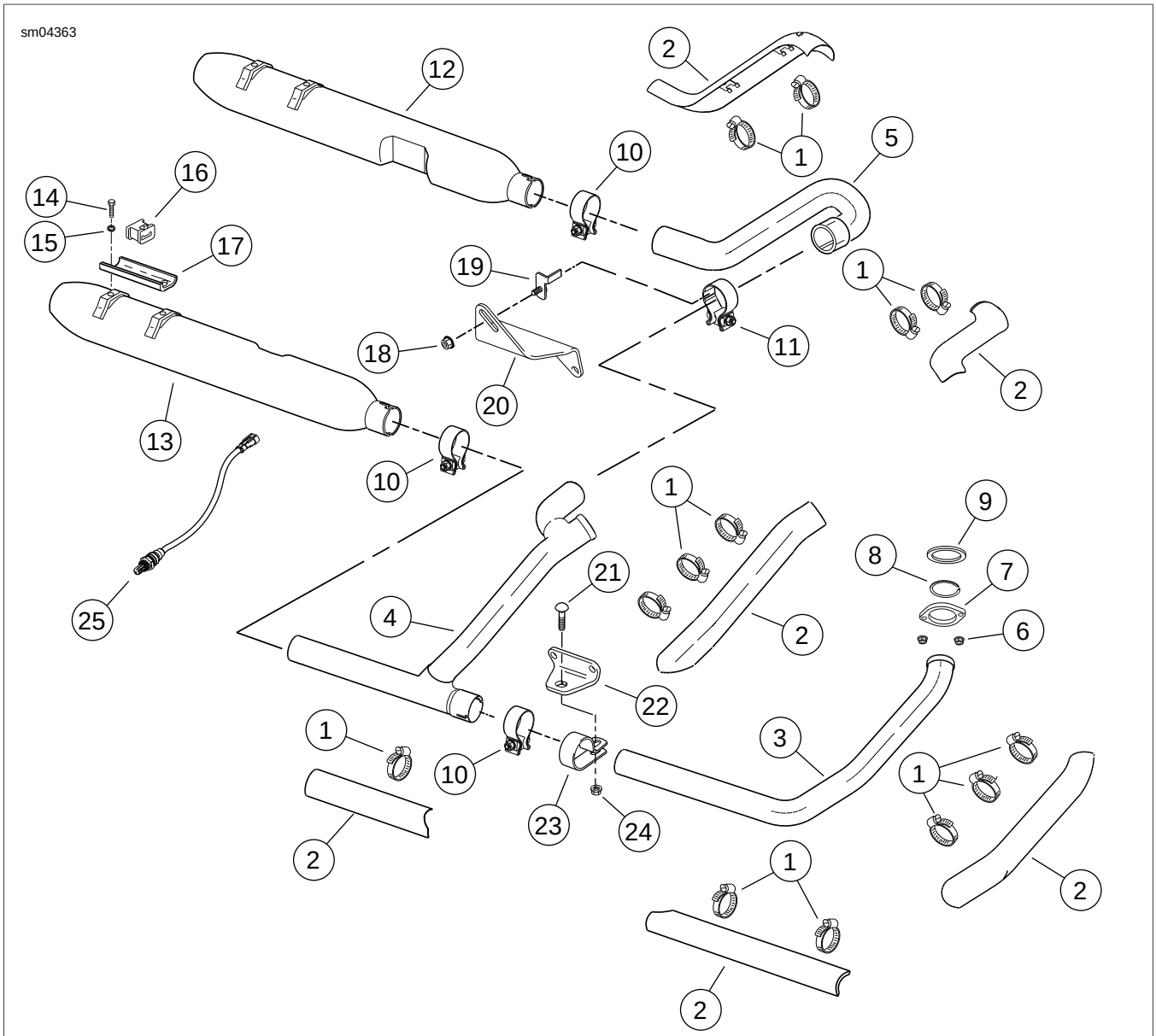
*NOTE*

*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.*

11. Remove four screws (with lockwashers) to detach left and right side mufflers from the lower saddlebag support rails.
12. Standing on right side of motorcycle, remove muffler from rear header pipe.
13. Remove Keps nut and pull bracket tab and stud from slots in TORCA clamp (special) and exhaust support bracket, respectively.
14. Remove rear header pipe from front header pipe, crossover pipe and rear cylinder head. Remove bracket tab from slot in TORCA clamp (special).
15. Remove carriage bolt (with flange locknut) to release exhaust bracket clamp from transmission exhaust bracket. Use a channel lock to open clamp and then remove from front header pipe. Remove front header pipe exhaust flange from front cylinder head.
16. Moving to left side of motorcycle, remove crossover pipe from left side muffler.
17. Remove bungee cord to release left side muffler from lower saddlebag support rail.
18. Remove and discard gaskets from front and rear exhaust ports. Discard TORCA clamps.

*NOTE*

*TORCA clamps have eliminated the need for silicone or graphite tape during assembly. To ensure sealing integrity and prevent the possibility of leakage, always discard TORCA clamps whenever they are removed.*




1. **Worm drive clamp (13)**
2. **Heat shield (6)**
3. **Front header pipe**
4. **Rear header pipe**
5. **Crossover pipe**
6. **Flange nut (4)**
7. **Exhaust flange (2)**
8. **Circlip (2)**
9. **Cylinder head gasket (2)**
10. **TORCA clamp (3)**
11. **TORCA clamp (special)**
12. **Left muffler**
13. **Right muffler**
14. **Screw (4)**
15. **Lockwasher (4)**
16. **Rubber mount (2)**
17. **Saddlebag support rail bracket (2)**
18. **Keps nut**
19. **Bracket tab**
20. **Exhaust support bracket**
21. **Carriage bolt**
22. **Transmission exhaust bracket**
23. **Exhaust bracket clamp**
24. **Flange locknut**
25. **O2 sensor (2)**

**Figure 4-42. Disassemble/Assemble Exhaust System**

## ASSEMBLY

*NOTE*

*Always loosely assemble exhaust system on motorcycle 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 front header pipe exhaust flange onto front cylinder head. Start flange nuts on cylinder head studs.

3. Capture front header pipe in exhaust bracket clamp. Use a channel lock to close clamp, if necessary. Install carriage bolt engaging transmission exhaust bracket and exhaust bracket clamp. Finger tighten flange locknut.
4. Slide a **new** TORCA clamp onto free end of front header pipe.
5. 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.
6. 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.
7. Slide right side muffler onto rear header pipe. Finger tighten two screws (with lockwashers) to attach muffler to lower saddlebag support rail. Place TORCA clamp into position between rear header pipe and right side muffler.
8. Moving to left side of motorcycle, install crossover pipe onto remaining end of rear header pipe (above starter). Place TORCA clamp into position between rear header pipe and crossover pipe.
9. Fit bracket tab into slot of TORCA clamp engaging stud in slot of exhaust support bracket. Start Keps nut on stud.
10. Slide **new** TORCA clamp onto free end of crossover pipe.
11. 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 two screws (with lockwashers) to attach muffler to saddlebag support rail.

*NOTE*

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

12. 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 100-120 **in-lbs** (11.3-13.6 Nm). Final tighten the top nut to 100-120 **in-lbs** (11.3-13.6 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 100-120 **in-lbs** (11.3-13.6 Nm). Final tighten the bottom nut to 100-120 **in-lbs** (11.3-13.6 Nm).
    c. Tighten flange locknut on exhaust bracket clamp carriage bolt to 20-25 ft-lbs (27.1-33.9 Nm).
    d. Snug two screws (with lockwashers) holding the right side muffler to the lower saddlebag support rail. Alternately tighten screws to 96-144 **in-lbs** (10.8-16.3 Nm).
    e. Snug two screws (with lockwashers) holding the left side muffler to the lower saddlebag support rail. Alternately tighten screws to 96-144 **in-lbs** (10.8-16.3 Nm).
    f. Verify that all exhaust pipes are in alignment and do not contact the motorcycle 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 muffler, rear header pipe to right side muffler, front header pipe to rear header pipe, and rear header pipe to crossover pipe.
13. Tighten Keps nut on stud of bracket tab to 12-15 ft-lbs (16.3-20.3 Nm).
14. Open worm drive clamps and install six heat shields on exhaust pipes as marked during removal. 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).
15. Remove bungee cord from left side muffler.
16. Install O2 sensors in front and rear header pipes. See 4.14 OXYGEN SENSORS (O2).
17. On HDI models, connect cable to exhaust valve actuator as follows:
    a. Install cable clip onto slotted flange at front of active exhaust valve.
    b. Push cam rearward and install ball end of cable into slot. Verify that cable is properly seated in channel of active exhaust valve.
18. 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 motorcycle using a 3/8 inch ball allen with extension. Alternately tighten screws to 30-35 ft-lbs (41-48 Nm).
19. On Ultra models, install fairing lowers. See 2.34 LOWER FAIRING AND ENGINE GUARD.
20. Install saddlebags. See 2.27 SADDLEBAGS.

## EXHAUST VALVE ACTUATOR

### Removal

1. Remove right side caddy. See 8.6 ELECTRICAL CADDIES.
2. Remove two T27 TORX screws (with flat washers) to release active exhaust valve actuator from caddy.

### Installation

1. Install two T27 TORX screws (with flat washers) to fasten active exhaust valve actuator to right side caddy. Alternately tighten screws to 32-40 **in-lbs** (3.6-4.5 Nm).
2. Install right side caddy. See 8.6 ELECTRICAL CADDIES.

## EXHAUST VALVE ACTUATOR CABLE

### Removal

1. Remove exhaust valve actuator. See EXHAUST VALVE ACTUATOR in this section.
2. Remove cable as follows:
   a. Push on metal sleeve at end of cable housing to release plastic insert from slot in cable guide.
   b. Release cable from groove at center of actuator wheel and gently pull barrel end from hole.

### Installation

1. Install cable as follows:
   a. Gently push barrel end into hole in actuator wheel until cable engages groove at center.
   b. Push on metal sleeve at end of cable housing to engage plastic insert in slot of cable guide.
2. Install exhaust valve actuator. See EXHAUST VALVE ACTUATOR in this section.

## ACTIVE EXHAUST VALVE

### General

The active exhaust valve is not repairable. Replace the rear exhaust header pipe if the valve is damaged or fails. See 4.18 EXHAUST SYSTEM.

## GENERAL

**WARNING**

**Do not allow open flame or sparks near propane. Propane is extremely flammable, which could cause death or serious injury. (00521b)**

**WARNING**

**Read and follow warnings and directions on propane bottle. Failure to follow warnings and directions can result in death or serious injury. (00471b)**

*NOTES*

- *To prevent false readings, keep air cleaner cover installed when performing test.*
- *Do not direct propane into air cleaner; false readings will result.*
- *Be careful when testing vehicle with Screamin' Eagle air cleaner assembly. This type of air cleaner has an open backing plate. Even with air cleaner cover on, directing nozzle too close to backing plate can give false readings.*

## LEAK TESTER

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41417 | PROPANE ENRICHMENT KIT |

### Parts List

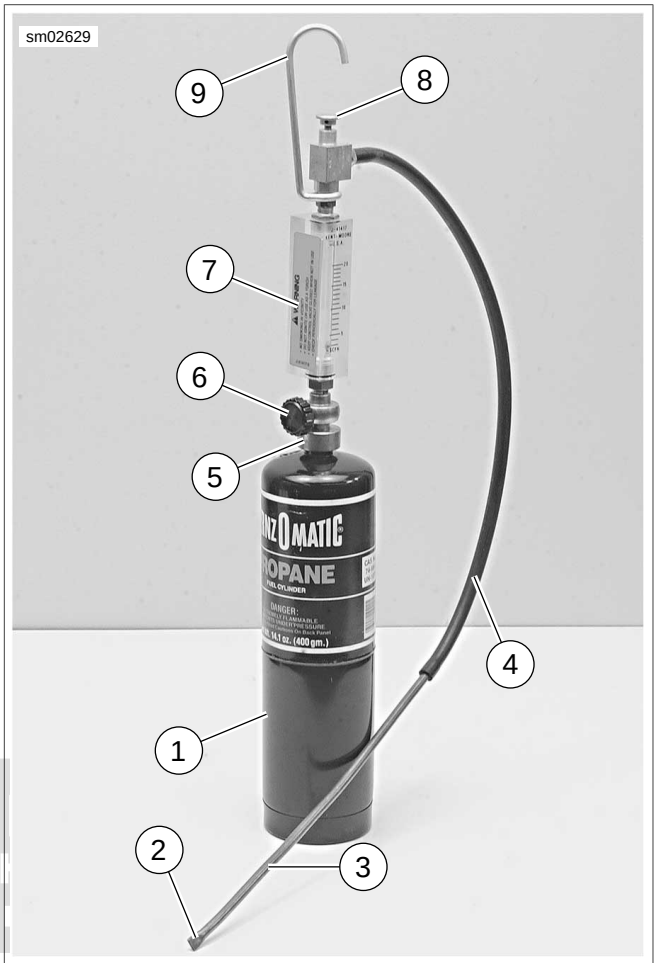
- Standard 14 oz. propane cylinder.
- PROPANE ENRICHMENT KIT (Part No. HD-41417).

### Tester Assembly

1. See Figure 4-43. Make sure valve knob (6) is closed (fully clockwise).
2. Screw valve assembly (5) onto propane bottle (1).

### Tester Adjustment

1. See Figure 4-43. Press and hold trigger button (8).
2. Slowly open valve knob (6) until pellet in flow gauge (7) rises to between 5 and 10 SCFH on gauge.
3. Release trigger button.




1. **Propane bottle**
2. **Nozzle**
3. **Copper tube**
4. **Hose**
5. **Valve assembly**
6. **Valve knob**
7. **Flow gauge**
8. **Trigger button**
9. **Hanger**

**Figure 4-43. Leak Tester**

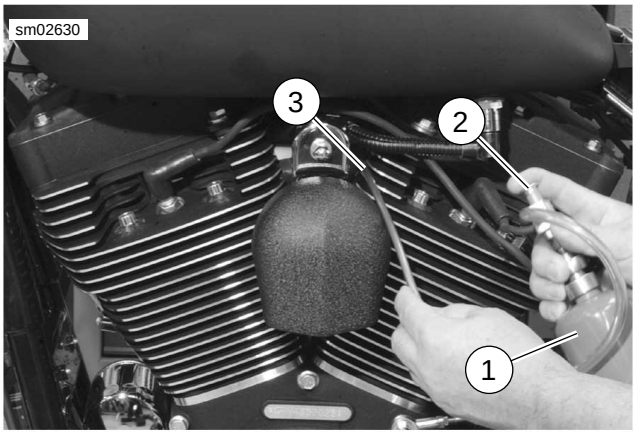
## PROCEDURE

1. Start engine.
2. Warm up engine to operating temperature.

*NOTE*

*Do not direct propane stream toward air cleaner. If propane enters air cleaner, a false reading will be obtained.*

3. See Figure 4-44. Aim nozzle (3) toward possible sources of leak such as intake manifold mating surfaces.
4. Press and release trigger button (2) to dispense propane. Tone of engine will change when propane enters source of leak. Repeat as necessary to detect leak.
5. When test is finished, close valve knob (turn knob fully clockwise).




1. **Propane bottle**
2. **Trigger button**
3. **Nozzle**

**Figure 4-44. Checking for Leaks**

# EVAPORATIVE EMISSIONS CONTROL (CA MODELS) 4.21

## GENERAL

Motorcycles sold in some markets are equipped with an evaporative (EVAP) emissions control system. See Figure 4-45. The EVAP system functions as follows:

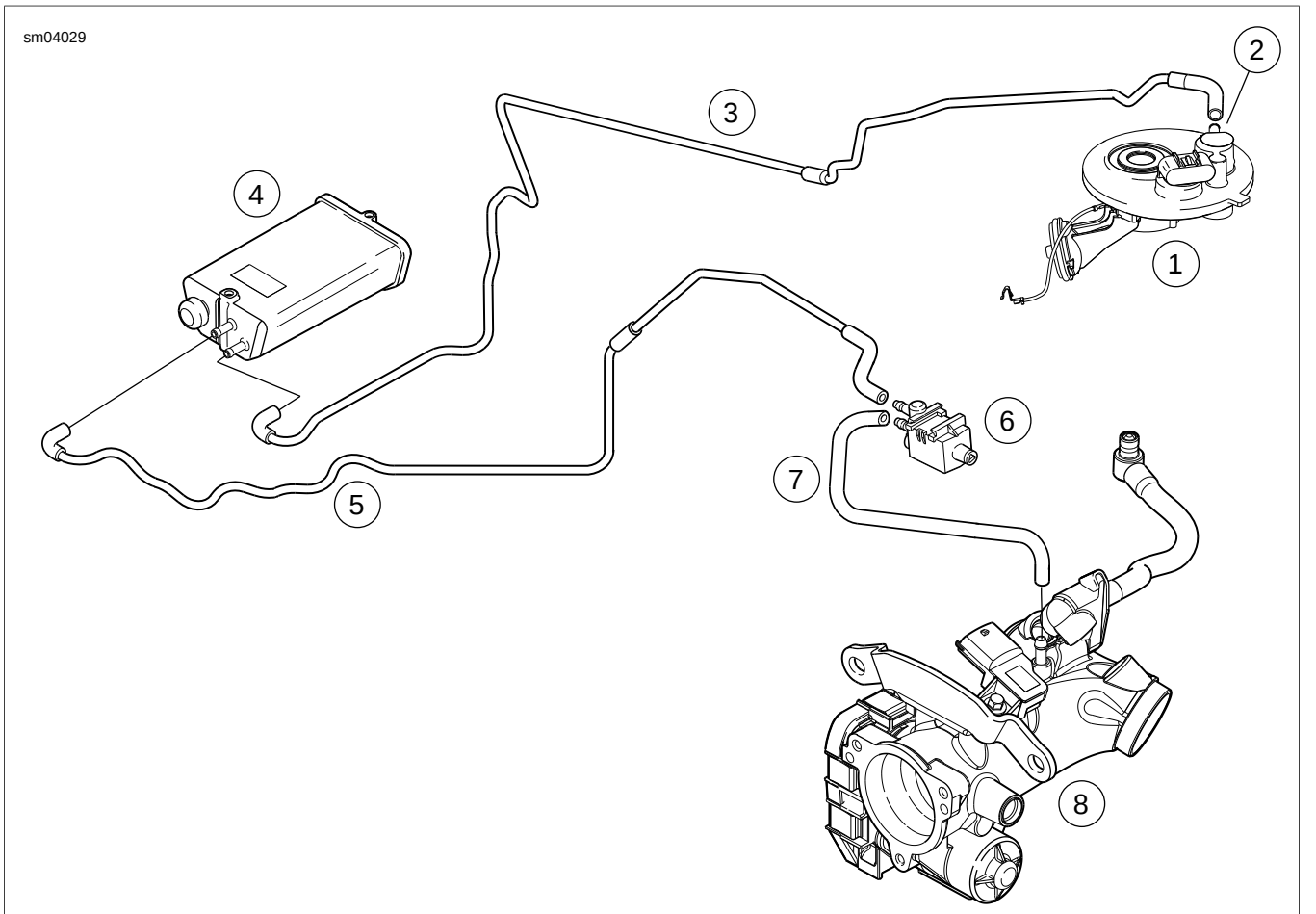
- The fuel vapor vent tube connected to the vapor valve on the fuel tank top plate allows fuel vapors in the fuel tank to be vented to the charcoal canister. If the motorcycle is tipped, the vapor valve also prevents the loss of gasoline through the vent tube.
- Under certain engine conditions, the ECM (working in conjunction with the EFI system relay) opens the purge solenoid. Negative pressure (vacuum) draws the fuel vapors stored in the charcoal canister through the purge tube to the induction module, where they are burned as part of the normal combustion process.

**WARNING**

**Keep evaporative emissions vent lines away from exhaust and engine. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00266a)**

*NOTE*

*The EVAP system has been designed to operate with a minimum of maintenance. Check that all tubes are correctly routed and properly connected. Also, verify that the tubes are not pinched or kinked, and that there is no contact with the drive belt and hot exhaust or engine parts.*




1. **Fuel tank top plate**
2. **Vapor valve**
3. **Fuel vapor vent tube**
4. **Charcoal canister**
5. **Purge tube (long)**
6. **Purge solenoid**
7. **Purge tube (short)**
8. **Induction module**

**Figure 4-45. Evaporative Emissions Control System (EVAP)**

## VAPOR VALVE

*NOTE*

*See Figure 4-46. The vapor valve is not serviceable. Damage or failure of the vapor valve requires replacement of the fuel tank top plate. See 4.5 FUEL TANK TOP PLATE.*

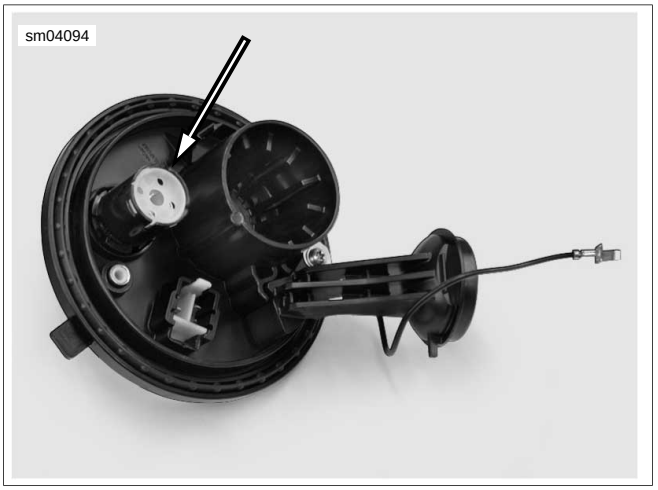



**Figure 4-46. Fuel Tank Top Plate With Vapor Valve**

## FUEL VAPOR VENT TUBE

### Removal

1. Remove fuel tank console as follows:
   a. Remove socket screw to release front of console from fuel tank weldment.
   b. Remove hex screw to release rear console bracket from clip nut on rear fuel tank bracket.
   c. Lay a clean shop towel on forward part of rear fender.
   d. **FLHR/C:** Remove console and lay upside down on shop towel.
   e. **FLHX, FLHT/C/U, FLTR:** Press button to open fuel door on console. Remove filler cap. Remove console and lay upside down on shop towel. Install filler cap.
2. Remove fuel vapor vent tube from fitting on vapor valve.
3. Remove charcoal canister. See CHARCOAL CANISTER in this section.
4. Raise battery tray as necessary to release fuel vapor vent tube from channel at bottom of battery tray.
5. Carefully draw fuel vapor vent tube out through opening on right side of motorcycle.

### Installation

1. Feed end of fuel vapor vent tube (opposite elbow fitting) under battery tray to left side of motorcycle.
2. From front left corner of battery tray, route fuel vapor vent tube forward first following rear of frame crossmember and then top of upper left frame tube to top plate.
3. Install fuel vapor vent tube onto fitting of vapor valve.
4. Install fuel vapor vent tube into channel at bottom of battery tray (positioned below purge tube).
5. Install charcoal canister. See CHARCOAL CANISTER in this section.
6. Install fuel tank console as follows:
   a. **FLHR/C:** Exercising caution to avoid pinching wire harness and vent tube, position console on fuel tank.
   b. **FLHX, FLHT/C/U, FLTR:** Remove filler cap, if installed. Exercising caution to avoid pinching wire harness, fuel overflow hose and vent tube, position console on fuel tank. Install filler cap.
   c. Start socket screw to fasten front of console to fuel tank weldment.
   d. Start hex screw to fasten rear console bracket to clip nut on rear fuel tank bracket.
   e. Alternately tighten socket/hex screws to 36-60 **in-lbs** (4.1-6.8 Nm).

*NOTE*

*In those markets where the charcoal canister, purge solenoid and purge tube are absent, the fuel vapor vent tube is vented to the atmosphere. Properly installed, it runs from the vapor valve rearward along the inboard side of the upper left frame tube, and then downward following the rear of the middle frame downtube. The free end of the tube is then routed to the outboard side of the frame weldment (holding the side cover grommet) through the opening at the bottom. To avoid contact with hot exhaust parts, the tube must hug the downtube at rear of the swingarm bracket as shown in Figure 4-47. If it does not, disconnect tube at the rubber coupling, rotate as necessary until the desired result is achieved, and then reconnect.*

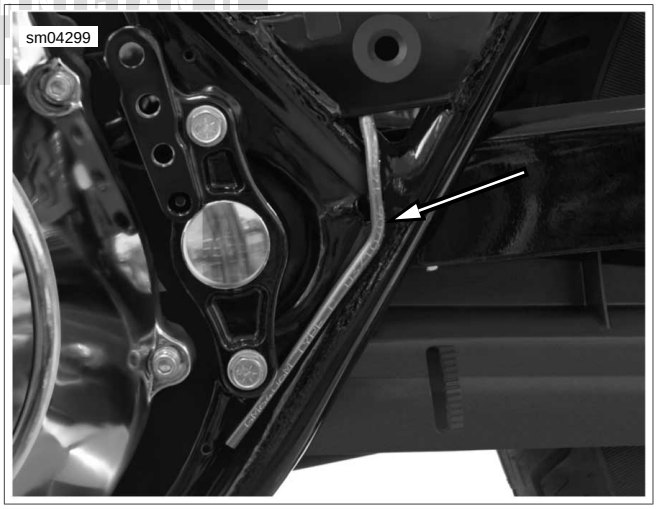



**Figure 4-47. Fuel Vapor Vent Tube Routing Absent EVAP System**

## CHARCOAL CANISTER

### Removal

1. Remove saddlebags. See 2.27 SADDLEBAGS.
2. Remove side covers.
3. Remove battery. See 1.16 BATTERY MAINTENANCE.
4. Remove spring clip and pull TSM/HFSM module out of cavity in frame crossmember.

5. Remove right side caddy, if present. See 8.6 ELECTRICAL CADDIES.

*NOTE*

*The right side caddy is only present on California motorcycles equipped with ABS. If not provided, simply remove the socket head screw and spacer to release support arm of battery tray from frame weldment.*

6. Remove front socket head screw to release left side caddy from battery tray.
7. Note the three fingers at the front of the battery tray. Remove socket head screw (with lifting strap) to release middle finger from frame crossmember.
8. Pull up on battery tray to release tab on left side caddy from slot. See Figure 4-48.
9. Disconnect fuel vapor vent tube (vapor valve to charcoal canister) from front fitting stamped "TANK."
10. Disconnect purge tube (charcoal canister to purge solenoid) from rear fitting stamped "PURGE."
11. Remove two T25 TORX screws (with flat washers) to release charcoal canister from bottom of battery tray.
12. Raise battery tray and slide charcoal canister out opening on right side of motorcycle. See Figure 4-49.

## Installation

1. Slide charcoal canister under battery tray using opening on right side of motorcycle.
2. Align holes in charcoal canister with those in battery tray and start two T25 TORX screws (with flat washers). Alternately tighten screws to 10-15 **in-lbs** (1.1-1.7 Nm).
3. Connect purge tube (charcoal canister to purge solenoid) to rear fitting stamped "PURGE."
4. Connect fuel vapor vent tube (vapor valve to charcoal canister) to front fitting stamped "TANK."
5. Start socket head screw (with lifting strap) to fasten middle finger of battery tray to frame crossmember.
6. Push down on battery tray to engage tab on left side caddy in slot.
7. Start front socket head screw to fasten left side caddy to battery tray.
8. Alternately tighten two socket head screws to 72-96 **in-lbs** (8.1-10.9 Nm).

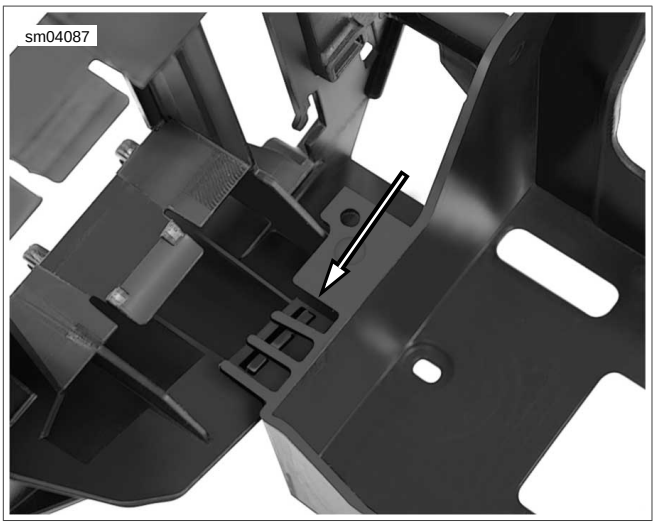



**Figure 4-48. Disengage Left Side Caddy Tab From Battery Tray Slot**

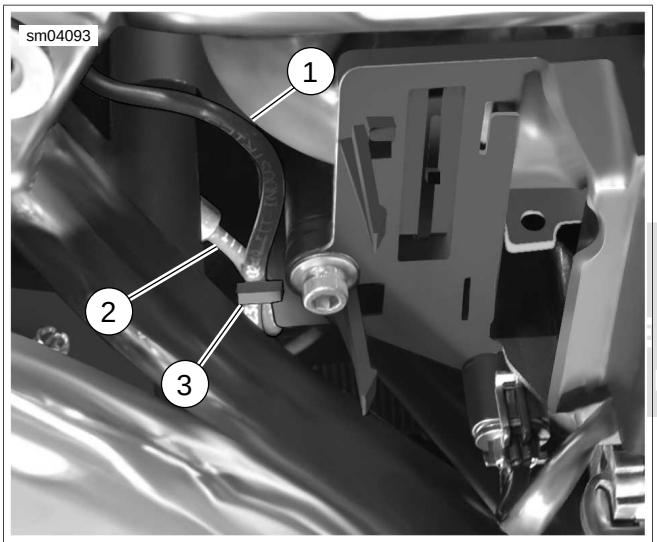

**Figure 4-49. Charcoal Canister**

9. Verify that fuel vapor vent tube and purge tube are still captured in channel at bottom of battery tray. See Figure 4-50. Also, to avoid possible contact with drive belt, be sure that tubes are positioned inboard of tab at front of left side caddy. See Figure 4-51.
10. Check all routing to be sure that tubes are not pinched or kinked, and that there is no contact with hot exhaust or engine parts.
11. Install right side caddy, if present. See 8.6 ELECTRICAL CADDIES.

*NOTE*

*The right side caddy is only present on California motorcycles equipped with ABS. If not provided, simply install the socket head screw and spacer to fasten support arm of battery tray to frame weldment. Tighten screw to 72-96* ***in-lbs*** *(8.1-10.9 Nm).*


**Figure 4-50. Capture Tubes in Channel of Battery Tray**




1. **Fuel vapor vent tube**
2. **Purge tube**
3. **Caddy tab**

**Figure 4-51. Move Tubes Inboard of Left Side Caddy Tab**

12. Install TSM/HFSM module into cavity in frame cross-member and install spring clip.
13. Install battery. See 1.16 BATTERY MAINTENANCE.
14. Install side covers.
15. Install saddlebags. See 2.27 SADDLEBAGS.

## PURGE TUBE (LONG)

### Removal

1. Remove fuel tank. See 4.4 FUEL TANK.
2. Remove purge tube from top fitting of purge solenoid.
3. Pull two cable clips on purge tube from holes at bottom of frame crossmember.
4. Remove charcoal canister. See CHARCOAL CANISTER in this section.
5. Raise battery tray as necessary to release purge tube from channel at bottom.
6. Carefully draw purge tube out through opening on right side of motorcycle.

### Installation

1. Feed end of purge tube (opposite elbow fitting) under battery tray to left side of motorcycle.
2. From front left corner of battery tray, route purge tube forward first following front of frame crossmember and then bottom of upper left frame tube to purge solenoid.
3. Install purge tube onto top fitting of purge solenoid.
4. Install two cable clips on purge tube into holes at bottom of frame crossmember.
5. Install purge tube into channel at bottom of battery tray (positioned above fuel vapor vent tube).
6. Install charcoal canister. See CHARCOAL CANISTER in this section.
7. Install fuel tank. See 4.4 FUEL TANK.

## PURGE SOLENOID

### Removal

1. Remove fuel tank. See 4.4 FUEL TANK.
2. Remove purge solenoid connector [95], 2-place Packard.
3. Remove purge tube from charcoal canister from top fitting of purge solenoid.
4. Remove purge tube to induction module from bottom fitting of purge solenoid.
5. Insert a small flat blade screwdriver between purge solenoid and bracket on left side of motorcycle. Rotate screwdriver slightly to depress middle locking finger on bracket and pull purge solenoid from motorcycle. See Figure 4-52 and Figure 4-53.


**Figure 4-52. Depress Locking Finger to Release Purge Solenoid**


**Figure 4-53. Purge Solenoid**

## Installation

1. Slide purge solenoid onto bracket on left side of motorcycle. If it does not lock into position, remove purge solenoid and bend middle locking finger on bracket downward slightly using a small flat blade screwdriver. Reinstall purge solenoid.
2. Install purge tube to induction module onto bottom fitting of purge solenoid.
3. Install purge tube from charcoal canister onto top fitting of purge solenoid.
4. Install purge solenoid connector [95], 2-place Packard.
5. Check all routing to be sure that tube is not pinched or kinked, and that there is no contact with hot exhaust or engine parts.
6. Install fuel tank. See 4.4 FUEL TANK.

# PURGE TUBE (SHORT)

## Removal

1. Remove fuel tank. See 4.4 FUEL TANK.
2. Remove purge tube from bottom fitting of purge solenoid.
3. Remove purge tube from fitting at top of induction module.

## Installation

1. Install purge tube onto fitting at top of induction module.
2. Install purge tube onto bottom fitting of purge solenoid.
3. Check all routing to be sure that tubes are not pinched or kinked, and that there is no contact with hot exhaust or engine parts.
4. Install fuel tank. See 4.4 FUEL TANK.

# NOTES

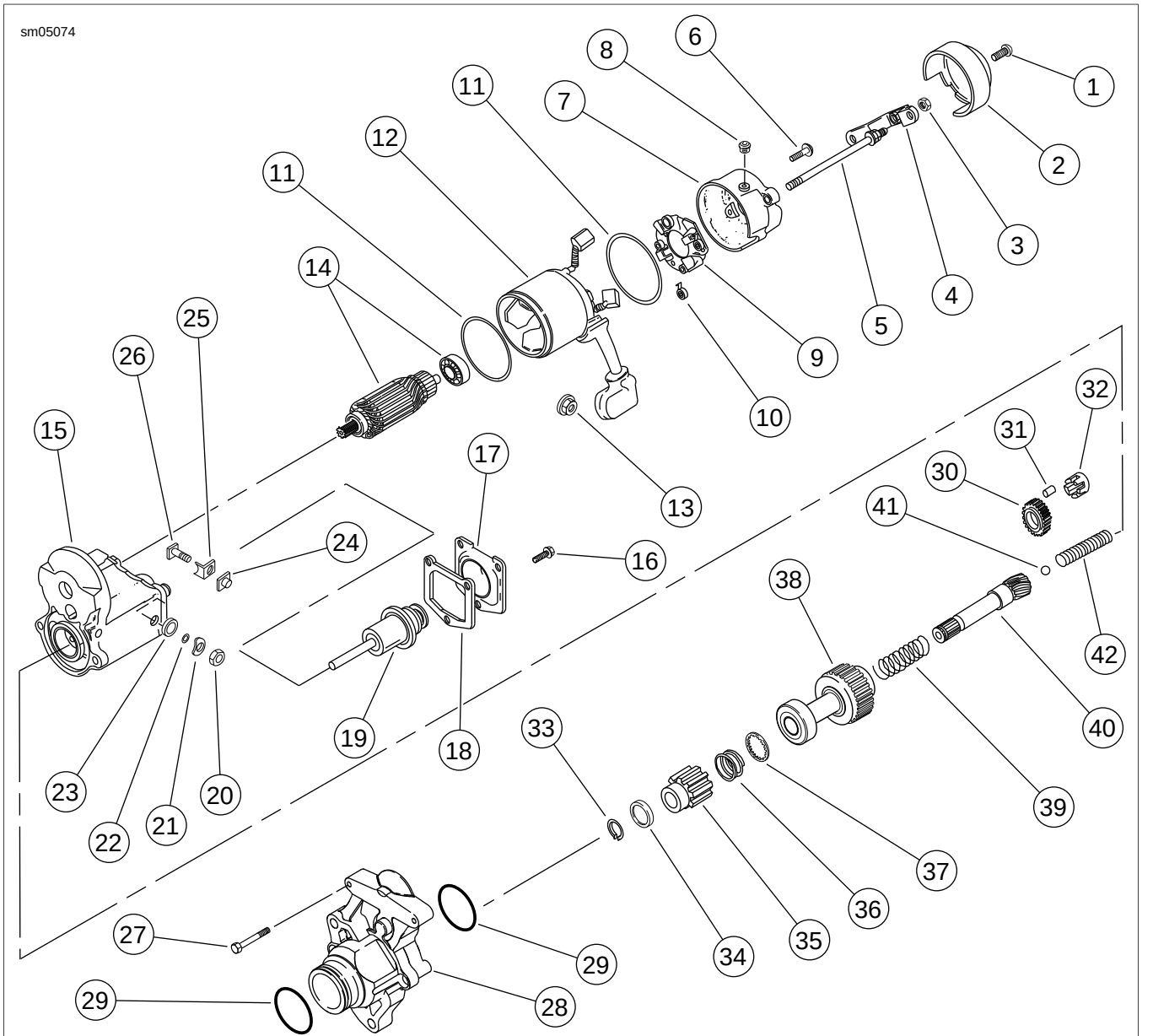
## SPECIFICATIONS

**Table 5-1. Starter Specifications**

| STARTER DATA | |
|---|---|
| Free speed | 3000 RPM (min.) @ 11.5 V |
| Free current | 90 amp (max.) @ 11.5 V |
| Cranking current | 200 amp (max.) @ 68°F |
| Stall torque | 8.0 ft-lbs (10.8 Nm) @ 2.4 V |

**Table 5-2. Service Wear Limits Specifications**

| SERVICE WEAR LIMITS | IN. | MM |
|---|---|---|
| Brush length minimum | 0.433 | 11.0 |
| Commutator diameter minimum | 1.141 | 28.981 |




1. Allen head screw
2. Chrome end cover
3. Keps nut (2)
4. End cover bracket
5. Thru bolt (2)
6. Phillips screw (2)
7. End cap
8. Drain vent
9. Brush holder
10. Brush spring
11. O-ring (2)
12. Field coil
13. Field wire hex nut
14. Armature and bearing
15. Solenoid
16. Hex screw (3)
17. Solenoid cover
18. Rubber gasket
19. Plunger
20. Jam nut (2)
21. Wave washer (2)
22. O-ring (2)
23. Round bushing (2)
24. Square bushing (2)
25. Contact plate (2)
26. Post bolt (2)
27. Hex screw (2)
28. Drive housing
29. O-ring (2)
30. Idler gear
31. Steel cylinder (5)
32. Bearing cage
33. Snap ring
34. Cup
35. Pinion gear
36. Short spring
37. Spring seat
38. Starter clutch
39. Long spring
40. Drive shaft
41. Steel ball
42. Return spring

**Figure 5-1. Starter Assembly**

## GENERAL

The starter is made up of a field coil assembly, solenoid assembly and drive assembly. The repair instructions contained in this section are divided into three major service areas accordingly.

*NOTE*

*For troubleshooting and diagnostic information, see the ELECTRICAL DIAGNOSTIC MANUAL for this motorcycle.*

### Wiring Diagrams

The starting circuit wiring diagram contains information about wiring configuration. For additional information, see the ELECTRICAL DIAGNOSTIC MANUAL for this motorcycle.

## REMOVAL

1. Remove seat. See 2.26 SEAT.

**⚠WARNING**

**To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. Remove starter front and rear mounting screws with captive washers.
4. Remove Keps nut from stud of bracket tab and remove exhaust support bracket.
5. Pull back rubber boot and remove hex nut from battery post. Remove battery positive and main power cable ring terminals.
6. Remove starter solenoid connector [128] at front of starter.
7. Remove engine oil filler cap/dipstick. Cover fill spout with clean shop cloth to keep out dirt and debris.

*NOTE*

*To facilitate starter removal, if necessary, remove two worm drive clamps to release heat shield from rear header pipe.*

8. Remove starter from motorcycle carefully sliding it out through space between rear exhaust header pipe and side cover. Exercise caution to avoid losing two ring dowels loosely installed in the primary chaincase (or starter) flange.

## INSTALLATION

1. Verify that two ring dowels are installed in the primary chaincase (or starter) flange.
2. Lubricate o-ring on starter and bore of primary chaincase with light film of clean primary chaincase lubricant.
3. Carefully slide starter in through space between rear exhaust header pipe and side cover. With starter solenoid connector at front, move starter into its installed position.
4. Remove shop cloth over fill spout and install engine oil filler cap/dipstick at top of transmission case.
5. Install slot of exhaust support bracket onto stud of bracket tab aligning other holes with those in starter flange. Start Keps nut on stud.
6. Engaging hole in exhaust support bracket, install starter front mounting screw with captive washer. Install starter rear mounting screw with captive washer.
7. Alternately tighten starter front and rear mounting screws to 25-27 ft-lbs (33.9-36.6 Nm).
8. Tighten Keps nut on stud of bracket tab to 12-15 ft-lbs (16.3-20.3 Nm).
9. Install main power and battery positive cable ring terminals onto battery post. Install hex nut and tighten to 70-90 **in-lbs** (7.9-10.2 Nm). Pull down rubber boot over terminal connections.
10. Install starter solenoid connector [128] at front of starter.

*NOTE*

*If removed, install three worm drive clamps to secure heat shield to rear header pipe. Tighten clamp screws to 20-40 **in-lbs** (2.3-4.5 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. Install seat. See 2.26 SEAT.

## TESTING

### Armature

1. Remove armature and brush holder from field coil. See 5.2 STARTER, Field Coil Assembly.
2. 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).
3. 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.

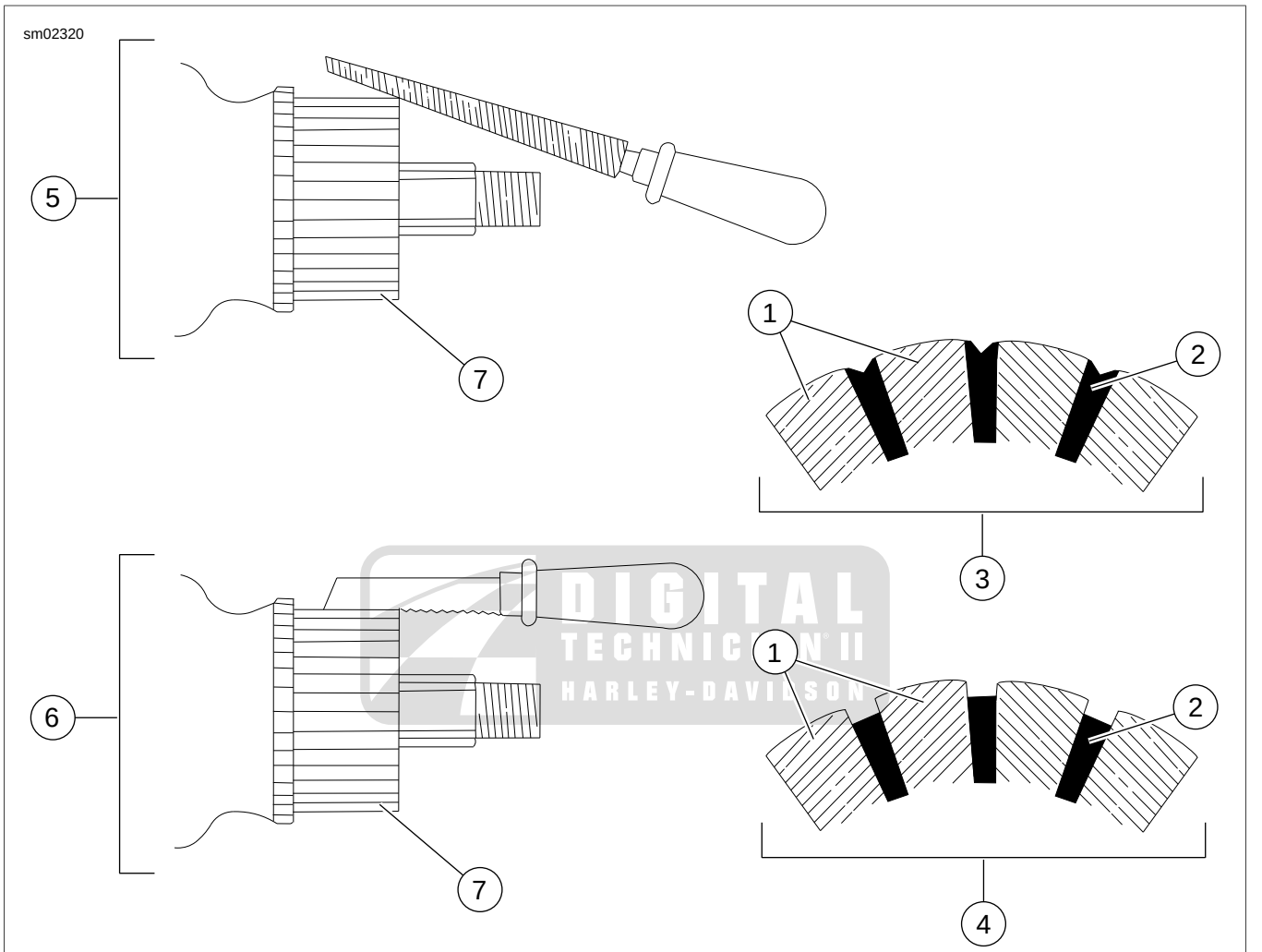
*NOTES*

- *See Figure 5-2. 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.*
- *Do not use sandpaper or emery cloth on commutator. The abrasive grit may remain on commutator segments and could cause excessive brush wear.*

4. See Figure 5-3. Check for a SHORTED ARMATURE.
   a. Place armature on growler (1).
   b. Hold a thin steel strip (2) (hacksaw blade), against the armature core and slowly turn armature.
   c. A shorted armature will cause the steel strip to vibrate and be attracted to the core. Replace the armature if shorted.

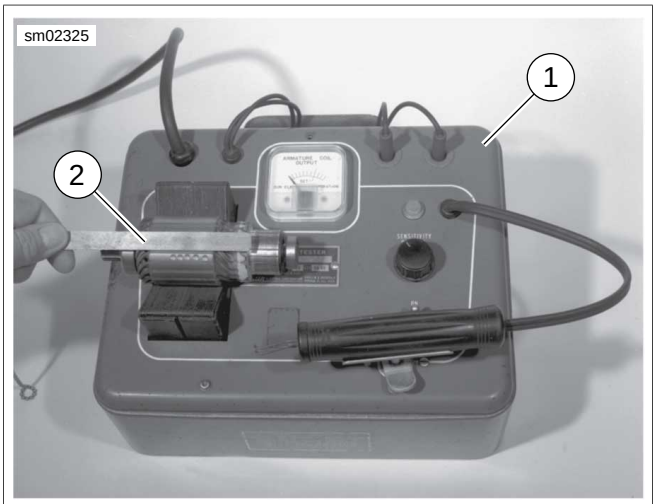
5. See Figure 5-6. Check for a GROUNDED ARMATURE with an ohmmeter or continuity tester.
   a. Touch one probe to any commutator segment.
   b. Touch the other probe to the armature core.
   c. There should be no continuity (infinite ohms). If there is continuity, the armature is grounded. Replace a grounded armature.

6. See Figure 5-5. Check for an OPEN ARMATURE with an ohmmeter or continuity tester.
   a. Check for continuity between all commutator segments.
   b. There should be continuity (0 ohms) at all test points. If there is no continuity at any test point, then the armature is open. Replace an open armature.




1. **Segments**
2. **Mica**
3. **Incorrect (Mica must not be left with a thin edge next to segments)**
4. **Correct (Mica must be cut away clean between segments)**
5. **Starting groove in mica with 3 cornered file**
6. **Undercutting mica with piece of hacksaw blade**
7. **Commutator**

**Figure 5-2. Undercutting Mica Separators**




1. **Growler**
2. **Thin steel strip (hacksaw blade)**

**Figure 5-3. Shorted Armature Test Using Growler**

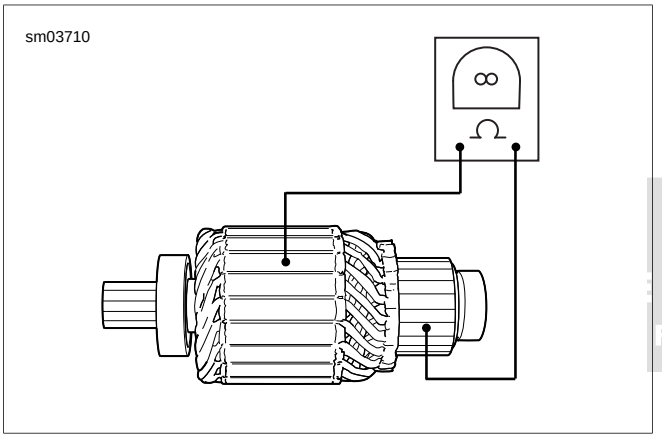



**Figure 5-4. Grounded Armature Test**

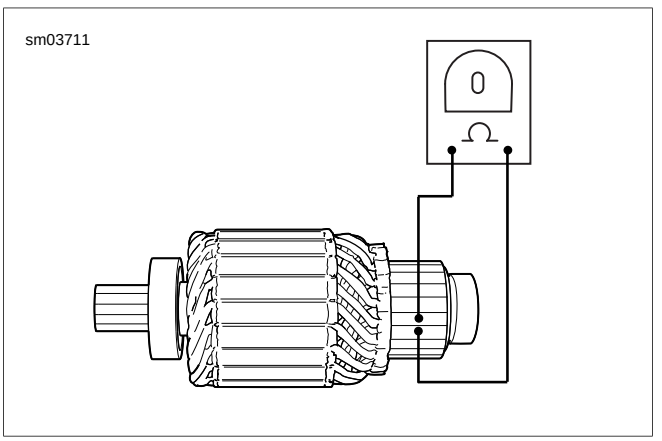



**Figure 5-5. Armature Open Test**

## Brushes and Brush Holder

1. Remove armature and brush holder from field coil. See 5.2 STARTER, Field Coil Assembly.
2. Measure the brush length. If any one of four brushes is less than 0.433 in. (11 mm), replace the field coil and brush holder assembly. No further testing is necessary.
3. See Figure 5-6. Check for a GROUNDED FIELD COIL WINDING with an ohmmeter or continuity tester.
   a. Touch one probe to the field coil housing (frame).
   b. Touch the other probe to each of two brushes attached to the field coil winding.
   c. There should be no continuity (infinite ohms). If there is continuity at either brush, then the field coil winding is grounded. Replace the field coil/brush holder assembly if grounded.
4. See Figure 5-7. Check for an OPEN FIELD COIL WINDING with an ohmmeter or continuity tester.
   a. Touch one probe to the field wire.
   b. Touch the other probe to each of the two brushes attached to the field coil winding(s).
   c. There should be continuity (0 ohms). If there is no continuity at either brush, then the field coil winding(s) are open. Replace the field coil/brush holder assembly if open.
5. See Figure 5-8. Test the BRUSH HOLDER INSULATION with an ohmmeter or continuity tester.
   a. Touch one probe to the holder plate.
   b. Touch the other probe to each of the positive (insulated) brush holders.
   c. There should be no continuity (infinite ohms). If there is continuity at either brush holder, replace the field coil/brush holder assembly.
   d. Touch one probe to the non-insulated brush holders and the other probe to the holder plate. If any resistance is measured, replace the field coil/brush holder assembly.

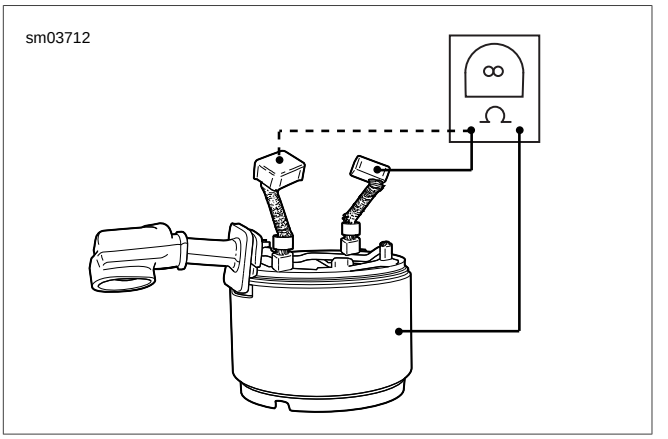



**Figure 5-6. Grounded Field Test**

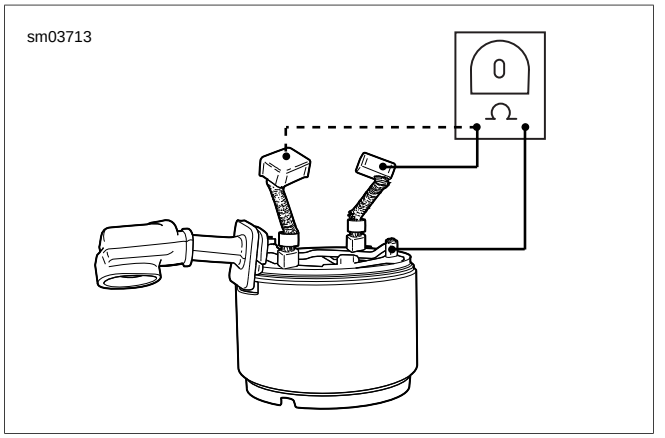



**Figure 5-7. Open Field Test**

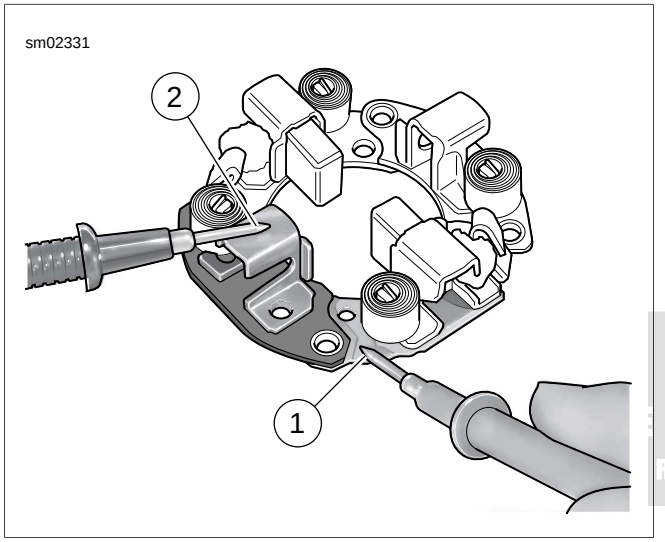



**Figure 5-8. Brush Holder Insulation Test**

## FIELD COIL ASSEMBLY

### Disassembly

1. Remove allen head screw to release chrome end cover, if equipped.
2. Remove two Keps nuts to release end cover bracket from thru bolts, if equipped.
3. Pull up rubber boot and remove hex nut with captive lockwasher to release field wire ring terminal from post on solenoid housing.
4. Using a 5/16 inch socket, loosen two thru bolts to release field coil from solenoid housing.
5. Pull field coil with end cap from solenoid housing.
6. Remove armature from field coil. Separating end cap and field coil flanges will facilitate removal.
7. Placing field coil on wooden block to prevent damage, use impact driver to remove two Phillips screws with captive washers from end cap. Discard screws.
8. Remove end cap from field coil.
9. Locate the two brushes attached to the field coil winding. Pushing on inboard side of one brush, grasp free end of brush spring on outboard side with the hooked end of a suitable pick. Raise end of brush spring only as far as necessary to free brush from brush holder. Repeat step to release second brush and then remove brush holder from field coil.

### Inspection

1. For testing procedures, see 5.2 STARTER, Testing.
2. Inspect two o-rings in field coil bore for cuts, tears or signs of deterioration.
3. Inspect armature roller bearings. Bearings must rotate freely without drag or sticking. Replace the bearings if pitted or grooved.
4. Replace brush springs if bent or distorted.

### Assembly

1. Attach brush holder to field coil. Locate the two brushes attached to the field coil winding. Catch free end of brush spring with the hooked end of a suitable pick. Raise end of brush spring only as far as necessary to install brush into brush holder. Repeat step to install second brush.
2. Retract all four brushes for armature installation. For good results, obtain four paper clips. Bend free end of each paper clip outward approximately 90°. Then, pushing on inboard side of brush, insert straight end of paper clip between outboard side of brush and inboard side of brush spring. Properly installed, the paper clip contacts the framework of the brush holder to keep spring pressure off the brush. Repeat step on remaining three brushes as shown in Figure 5-9.
3. Install armature in solenoid housing so that larger bearing on splined end seats in counterbore. Lubricate armature bearings with high temperature grease, such as LUBRI-PLATE 110, before installation.
4. Mate field coil and solenoid housings. For proper assembly, a nub on the field coil housing flange must engage the slot on solenoid housing flange closest to the short (field wire) post on the solenoid housing.
5. Carefully place brush holder over armature. If additional clearance is needed, use a small flat blade screwdriver to gently push back the brushes slightly.
6. When the brush holder is centered over the armature, remove four paper clips to release brush springs. Verify that ends of brush springs make proper contact with brush sides.
7. Install end cap aligning holes in cap with those in brush holder. Start two **new** Phillips screws with captive washers. Alternately tighten Phillips screws until snug.
8. Install thru bolts to fasten field coil to solenoid housing. Using a 5/16 inch socket, alternately tighten thru bolts to 39-65 **in-lbs** (4.4-7.3 Nm).
9. Attach field wire ring terminal to short post on solenoid housing and install hex nut with captive lockwasher. Tighten hex nut to 70-90 **in-lbs** (7.9-10.2 Nm). Cover field wire ring terminal with rubber boot.

10. Install end cover bracket onto threaded end of thru bolts, if equipped. For proper orientation, be sure that the longest end of the bracket (before the bend) is on the field wire side. Install two Keps nuts and alternately tighten until snug.
11. Install allen head screw to fasten chrome end cover to end cover bracket, if equipped. Tighten screw to 90-110 **in-lbs** (10.2-12.4 Nm).

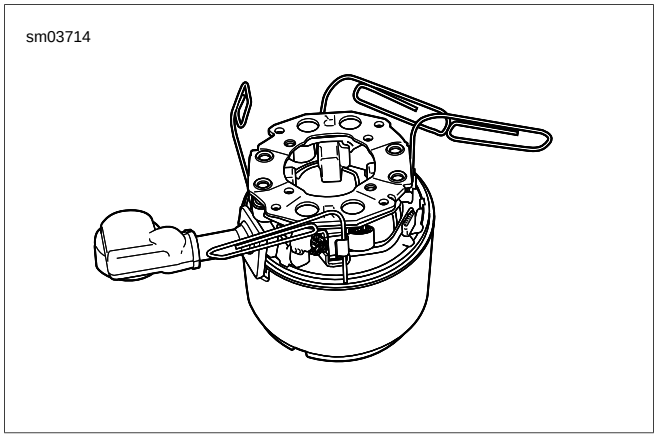



**Figure 5-9. Install Paper Clips to Hold Brush Springs**

## DRIVE ASSEMBLY

### Disassembly

1. Remove field coil. See 5.2 STARTER, Field Coil Assembly.
2. Pull field coil with end cap from solenoid housing. Hold end cap to field coil to avoid pulling armature out of brush holder. If armature is pulled from brush holder, further disassembly is required.
3. Using a 9 mm socket, remove two hex screws with Phillips recess to release drive housing from solenoid housing.
4. Use a rubber mallet to separate drive and solenoid housings, if necessary.
5. Remove idler gear from bearing cage in drive housing. Remove bearing cage with five steel cylinders from shaft in drive housing.
6. Push on end of drive shaft to remove starter clutch assembly from drive housing.
7. Compressing internal springs, remove snap ring from groove at end of drive shaft.
8. Remove cup, pinion gear, short spring and spring seat from splined end of drive shaft.
9. Push on splined end of drive shaft to remove from starter clutch bore.
10. Remove long spring from drive shaft. Remove steel ball from drive shaft bore.
11. Remove return spring from solenoid plunger shaft.

### Inspection

1. Inspect two o-rings in drive housing bore for cuts, tears or signs of deterioration.
2. Replace springs if kinked, elongated or distorted.
3. Inspect pinion gear and drive shaft gear. Replace if pitted, scored, rounded, cracked, chipped or worn.
4. Inspect roller bearings. Bearings must rotate freely without drag or sticking. Replace the bearings if pitted or grooved.
5. Inspect the steel ball for wear, pitting, surface breakdown or other damage.
6. Replace snap ring if bent or distorted.

### Assembly

1. Install long spring onto drive shaft. Install steel ball in drive shaft bore. Insert splined end of drive shaft into starter clutch bore (gear side).
2. Insert a deepwell socket into starter clutch bore and stand assembly upright on work bench with the socket side down.
3. Push down on starter clutch, so that installed socket pushes against the drive shaft gear to compress the spring. Holding assembly with spring compressed, install spring seat, short spring, pinion gear and cup on splined end of drive shaft. Be sure that the collar on the pinion gear and the concave side of the cup both face the splined end of the drive shaft.
4. While pushing down to simultaneously compress both the long and short springs installed, install snap ring in groove at splined end of drive shaft. Verify that snap ring is fully seated in the groove and that it resides in concave portion of cup when spring tension is released.
5. Remove deepwell socket from starter clutch bore.
6. Install bearing cage with five steel cylinders onto shaft in drive housing. Be sure that all five steel cylinders are installed in grooves of bearing cage. Install idler gear over bearing cage. Lubricate parts with high temperature grease, such as LUBRIPLATE 110, during assembly.
7. Install starter clutch assembly in drive housing seating the larger bearing in the counterbore. Lubricate bearings with LUBRIPLATE 110 before installation.
8. Apply a light film of Lubriplate 110 to solenoid plunger shaft. Install return spring on solenoid plunger shaft.
9. Mate the solenoid and drive housings and install two hex screws using a 9 mm socket. Alternately tighten hex screws until snug.
10. Lubricate armature bearing with LUBRIPLATE 110. Seating armature bearing in counterbore, mate field coil and solenoid housings. For proper assembly, a nub on the field coil housing flange must engage the slot on solenoid housing flange closest to the short (field wire) post on the solenoid housing.
11. Install field coil. See 5.2 STARTER, Field Coil Assembly.

## SOLENOID ASSEMBLY

### Disassembly

1. Remove field coil. See 5.2 STARTER, Field Coil Assembly.
2. Pull field coil with end cap from solenoid housing. Hold end cap to field coil to avoid pulling armature out of brush holder. If armature is pulled from brush holder, further disassembly is required.
3. Using a 9 mm socket, remove two hex screws with Phillips recess to release solenoid housing from drive housing.
4. Use a rubber mallet to separate solenoid and drive housings, if necessary.
5. Remove return spring from solenoid plunger shaft.

### Assembly

1. Install return spring on solenoid plunger shaft.
2. Mate the solenoid and drive housings and install two hex screws using a 9 mm socket. Alternately tighten hex screws until snug.
3. Lubricate armature bearing with LUBRIPLATE 110. Seating armature bearing in counterbore, mate field coil and solenoid housings. For proper assembly, a nub on the field coil housing flange must engage the slot on solenoid housing flange closest to the short (field wire) post on the solenoid housing.
4. Install field coil. See 5.2 STARTER, Field Coil Assembly.

## SOLENOID PLUNGER

### Disassembly

1. Remove three hex screws to release solenoid cover.
2. Remove rubber gasket from solenoid cover flange.
3. Remove plunger and return spring.

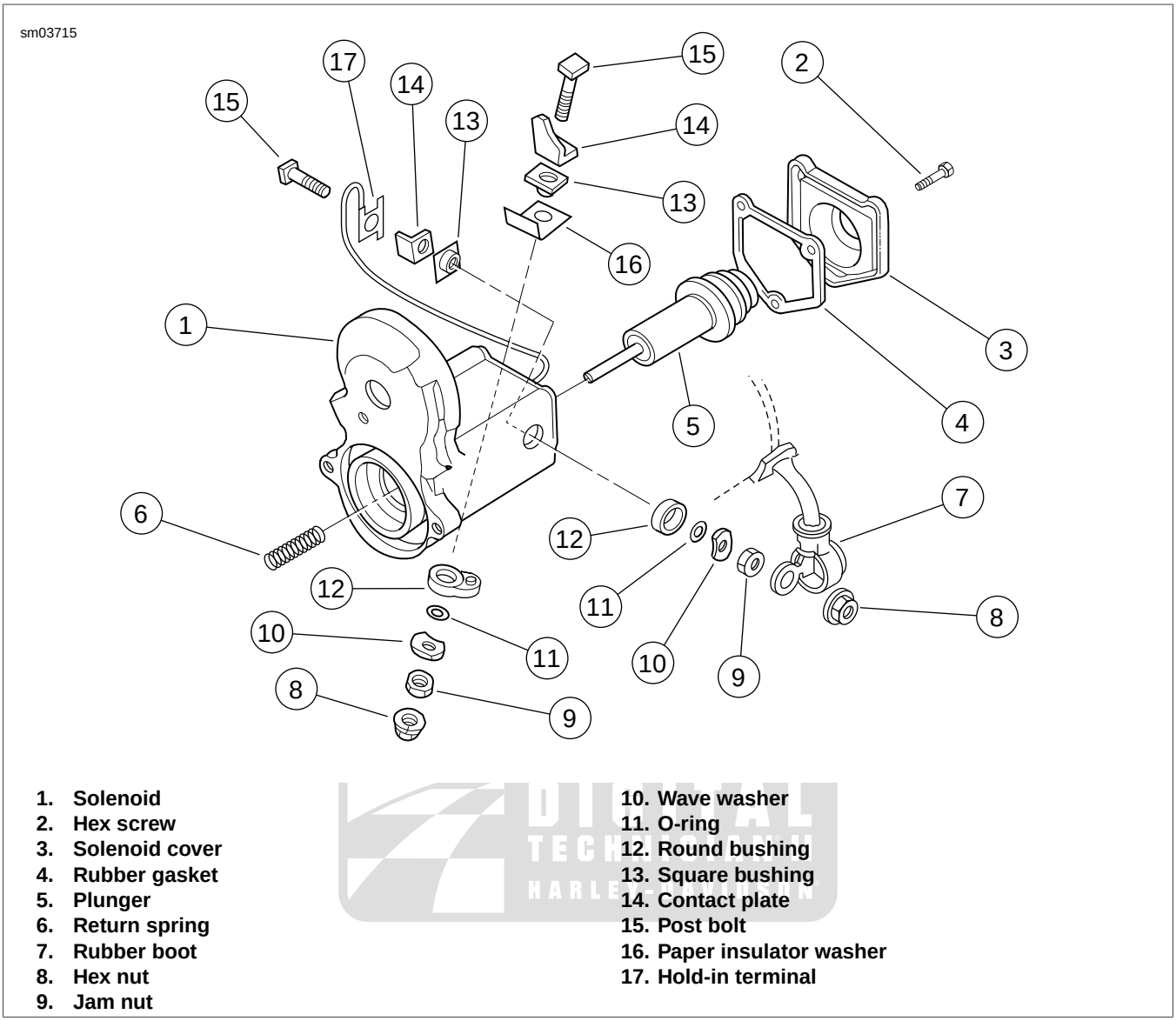
### Assembly

1. Apply a light film of LUBRIPLATE 110 to plunger shaft and install return spring. Install plunger in solenoid.
2. Install **new** rubber gasket on solenoid cover flange.
3. Install three hex screws to secure solenoid cover. Alternately tighten hex screws until snug.

## SOLENOID CONTACTS

### Disassembly

1. Remove three hex screws to release solenoid cover.
2. Remove rubber gasket from solenoid cover flange.
3. Remove plunger and return spring.
4. Obtain Solenoid Contact Repair Kit.
5. Disassemble short post (field coil):
   a. See Figure 5-10. Remove hex nut from post, if still installed. Remove jam nut, wave washer, round bushing and o-ring from post.
   b. On inside of solenoid housing, remove post bolt, hold-in terminal, contact plate and square bushing.
6. Disassemble long post (battery):
   a. Remove hex nut from post, if still installed. Remove jam nut, wave washer, round bushing and o-ring from post.
   b. On inside of solenoid housing, remove post bolt, contact plate, square bushing and paper insulator washer.




1. **Solenoid**
2. **Hex screw**
3. **Solenoid cover**
4. **Rubber gasket**
5. **Plunger**
6. **Return spring**
7. **Rubber boot**
8. **Hex nut**
9. **Jam nut**
10. **Wave washer**
11. **O-ring**
12. **Round bushing**
13. **Square bushing**
14. **Contact plate**
15. **Post bolt**
16. **Paper insulator washer**
17. **Hold-in terminal**

**Figure 5-10. Solenoid Assembly**

## Assembly

1. Assemble short post (field coil):
   a. From inside solenoid housing, insert sleeve on square bushing into hole in solenoid housing.
   b. With the foot inboard against solenoid winding, align hole in contact plate with hole in square bushing.
   c. Slide short post bolt through holes in hold-in terminal, contact plate, square bushing and solenoid housing.
   d. At outside of solenoid housing, install round bushing, O-ring and wave washer onto end of post. Install jam nut, but do not tighten.
2. Assemble long post (battery):
   a. On inside of solenoid housing, align hole in paper insulator washer with hole in solenoid housing. Insert sleeve on square bushing into holes.
   b. With the foot inboard against solenoid winding, align hole in contact plate with hole in square bushing.
   c. Slide long post bolt through holes in contact plate, square bushing, paper insulator washer and solenoid housing.
   d. At outside of solenoid housing, install round bushing, o-ring and wave washer onto end of post. Verify that index pin on round bushing engages blind hole in solenoid housing. Install jam nut, but do not tighten.
3. Apply a light film of LUBRIPLATE 110 to plunger shaft and install return spring. Install plunger in solenoid.

4. While depressing plunger, alternately tighten jam nuts to 65-80 **in-lbs** (7.3-9.0 Nm). Verify that contact plates have not rotated out of alignment with plunger.
5. Install **new** rubber gasket on solenoid cover flange.
6. Install three hex screws to secure solenoid cover. Alternately tighten hex screws until snug.

# NOTES

## SPECIFICATIONS

**Table 6-1. Sprocket Specifications**

| SPROCKETS | NO. OF TEETH |
|---|---|
| | DOM/HDI |
| Compensating | 34 |
| Clutch | 46 |
| Transmission | 32 |
| Rear Wheel | 66 |

**Table 6-2. Clutch Specifications**

| CLUTCH | DESCRIPTION |
|---|---|
| Type | Wet-multiple disc |
| Clutch lever freeplay (after internal adjustment) | 1/16-1/8 in. (1.6-3.2 mm) |

**Table 6-3. Gear Specifications**

| GEAR | OVERALL GEAR RATIO |
|---|---|
| | DOM/HDI |
| First (low) | 9.312 |
| Second | 6.421 |
| Third | 4.774 |
| Fourth | 3.926 |
| Fifth | 3.279 |
| Sixth (high) | 2.790 |

*NOTE*

*Overall gear ratios indicate number of engine revolutions required to drive rear wheel one revolution.*

## GENERAL

The primary chaincase is a sealed housing containing the primary chain, chain tensioner, clutch, engine compensating sprocket and alternator.

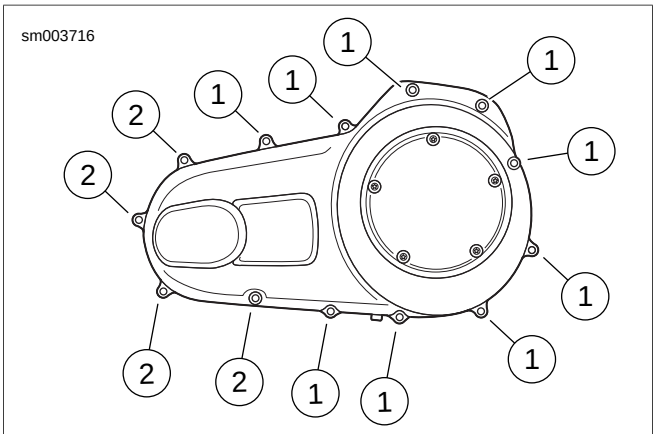
For information on primary chain lubrication, see 1.9 PRIMARY CHAIN.

## REMOVAL

**WARNING**

**To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)**

1. Disconnect negative battery cable.
2. Drain the primary chaincase lubricant. See 1.9 PRIMARY CHAIN, Chaincase Lubricant: Touring Models.
3. Remove fastener to remove passenger footboard from rear swingarm bracket.
4. Remove fastener to release front footboard forward bracket from frame weldment. Remove two fasteners to free jiffy stand and front footboard rear bracket from frame weldment.
5. Remove heel and toe shift lever fasteners from shift lever shaft and pull shift levers from shift lever shaft. Remove rubber spacer. An alternate method is to remove socket head fastener to release inner shift arm then pull shift lever shaft and heel toe shift lever assembly from primary chaincase bore.
6. See Figure 6-1. Remove short (1) and long (2) cover fasteners and cover.




**1. Short cover fasteners**
**2. Long cover fasteners**

**Figure 6-1. Primary Chaincase Cover: Touring Models**

## INSTALLATION

*NOTE*

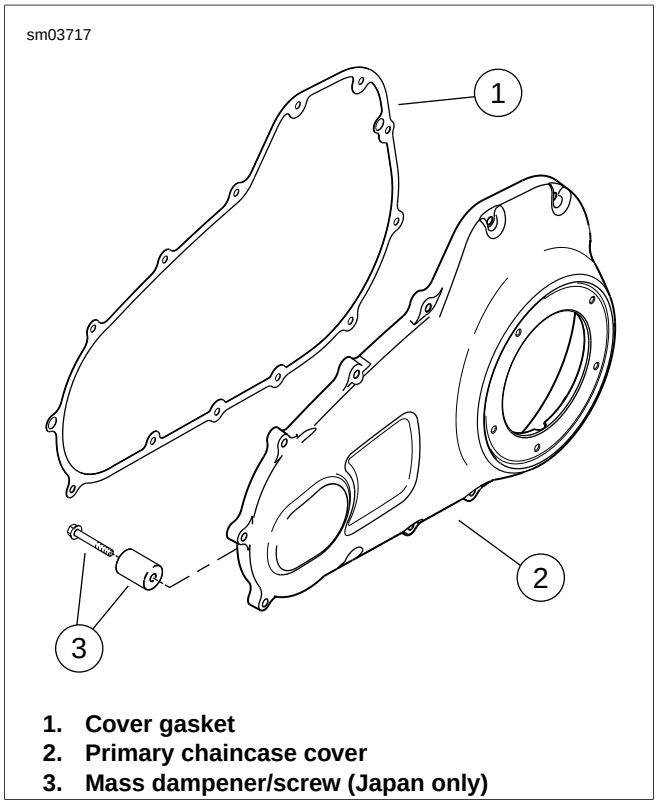
*The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.*

1. See Figure 6-2. Install **new** cover gasket (1).
2. See Figure 6-1. Install short (1) and long (2) primary cover fasteners in positions shown. Snug fasteners.
3. See Figure 6-3. Tighten primary cover fasteners (1-13) to 108-120 **in-lbs** (12.2-13.6 Nm) in the sequence shown.

**CAUTION**

**Do not overfill the primary chaincase with lubricant. Overfilling can cause rough clutch engagement, incomplete disengagement, clutch drag and/or difficulty in finding neutral at engine idle. (00199b)**

4. Place motorcycle in an upright position and fill primary chaincase. See 1.9 PRIMARY CHAIN, Chaincase Lubricant: Touring Models.
5. If installing heel-toe shift levers onto shift lever shaft:
   a. Install inboard shift lever (toe) onto splines of shift lever shaft. When properly installed, fastener hole is countersunk at the top.
   b. Install outboard shift lever (heel) onto splines of shift lever shaft. When properly installed, fastener hole is countersunk at the bottom.
   c. Install fasteners to fasten heel-toe shift levers to shift lever shaft. Tighten shift lever fasteners to 18-22 ft-lbs (24-30 Nm)
6. If just installing inner shift arm onto shift lever shaft:
   a. Install rubber spacer onto shift lever shaft. Install shift lever shaft into primary chaincase bore.
   b. Install inner shift arm onto splines of shift lever shaft.
   c. Install fastener to attach inner shift arm to shift lever shaft. Tighten fastener to 90-110 **in-lbs** (10.2-12.4)
7. Connect negative battery cable.




1. **Cover gasket**
2. **Primary chaincase cover**
3. **Mass dampener/screw (Japan only)**

**Figure 6-2. Primary Chaincase Cover Gasket: Touring Models**

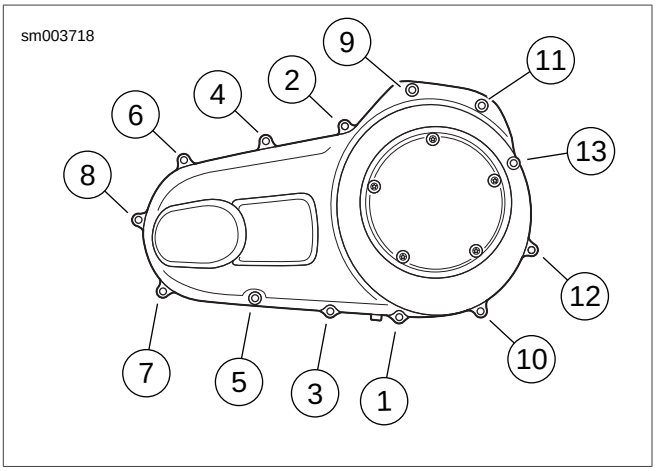



**Figure 6-3. Primary Chaincase Cover Torque Sequence: Touring Models**

## REMOVAL

| PART NUMBER | TOOL NAME |
|---|---|
| HD-47977 | PRIMARY DRIVE LOCKING TOOL |

*NOTES*

*To remove the primary chain, remove compensating sprocket, clutch assembly and primary chain as an assembly:*

1. Disconnect the battery, negative cable first.
2. Remove primary chaincase cover. See 6.2 PRIMARY CHAINCASE COVER, Removal.
3. See Figure 6-4. Secure chain tensioner with a cable tie as shown. Make sure the tail of the cable tie hangs down past the primary housing when secured. This will serve as a reminder to remove the cable tie before installing the primary cover during assembly.
4. See Figure 6-5. Remove chain tensioner fasteners (2) then remove chain tensioner (1).
5. Using a colored marker, mark one of the links of the primary chain. Maintaining the original direction of rotation during assembly may prolong service life.

**⚠WARNING**

**Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)**

6. See Figure 6-6. Loosen locknut (3).
7. Remove retaining ring (1) and release plate (2).

**⚠WARNING**

**Do not apply heat to remove the clutch hub nut. Fuel vapor and possible fuel mixture in crankcase oil is extremely flammable and highly explosive, which could result in death or serious injury. (00440b)**

*NOTES*

- *See Figure 6-7. When removing the clutch hub mainshaft nut the PRIMARY DRIVE LOCKING TOOL (Part No. HD-47977) (2) must be placed between the teeth of the engine and clutch sprockets.*
- *Do not use PRIMARY DRIVE LOCKING TOOL (Part No. HD-41214) to remove or install components. Damage to components can occur if this tool is used. Use only PRIMARY DRIVE LOCKING TOOL (Part No. HD-47977) to remove and install components.*
- *The mainshaft nut has left-hand threads, so turn clockwise to remove.*

8. Using a breaker bar, rotate clutch hub mainshaft nut in direction shown to remove.

*NOTE*

*See Figure 6-8. When removing the compensating sprocket bolt, the PRIMARY DRIVE LOCKING TOOL (Part No. HD-47977) must be placed between the teeth of the engine and clutch sprockets.*

9. Using a breaker bar, rotate compensating sprocket bolt in direction shown to remove.
10. See Figure 6-9. Remove bolt (6) and washer (5).

*NOTE*

*Using a colored marker or paint pen, mark one of the outboard links of the primary chain. Maintaining the original direction of rotation during assembly may prolong service life.*

11. Remove clutch assembly, primary chain and compensating sprocket assembly as a single assembly.

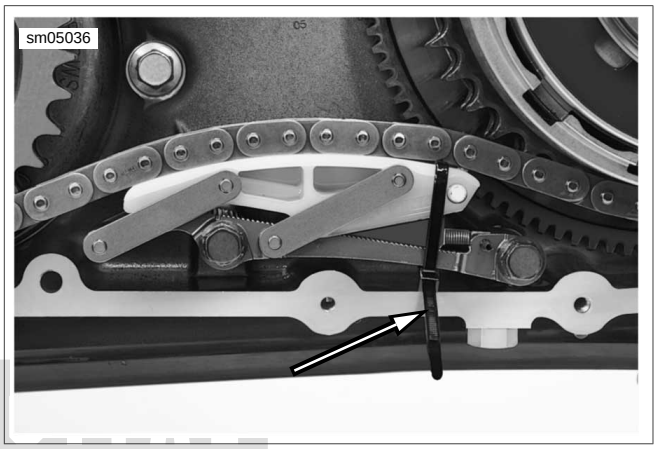
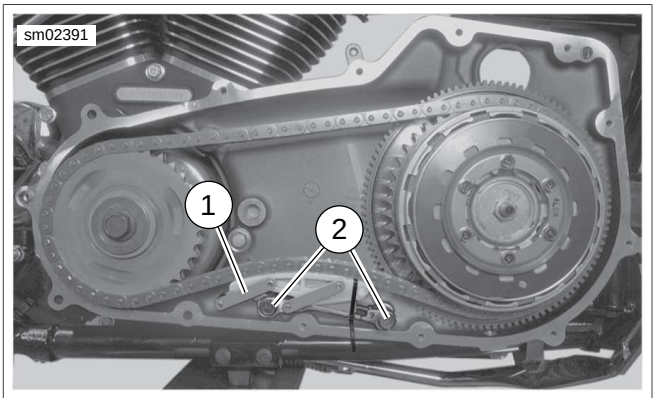
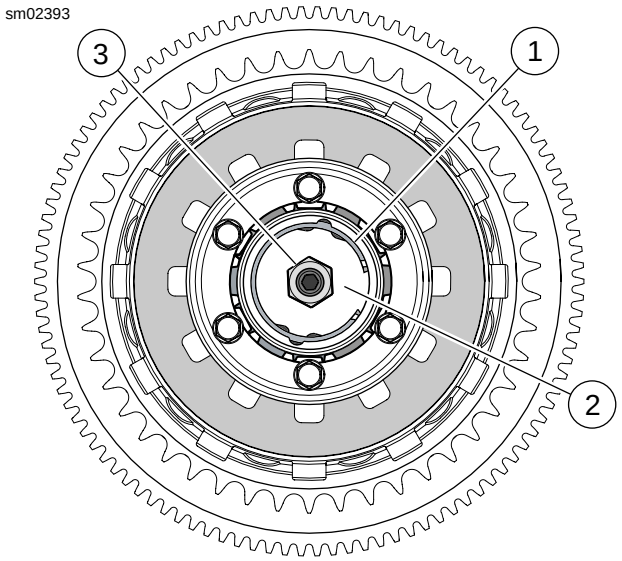



**Figure 6-4. Securing Chain Tensioner**



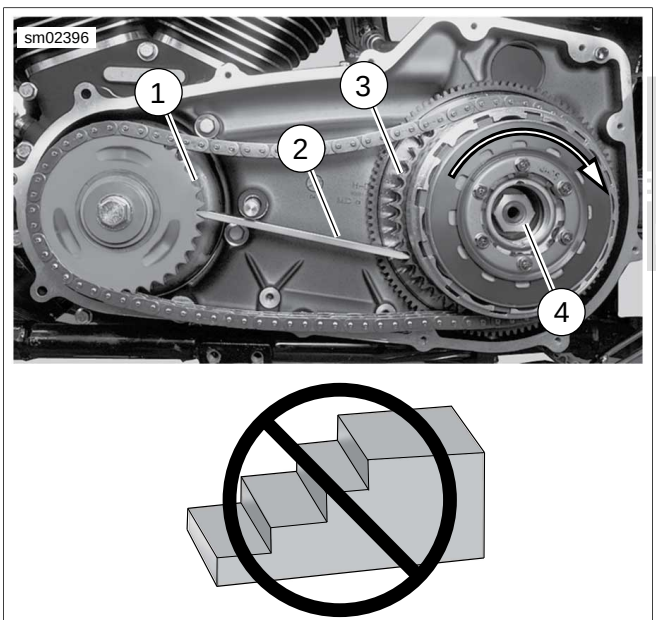

1. **Chain tensioner**
2. **Chain tensioner fasteners**

**Figure 6-5. Chain Tensioner**



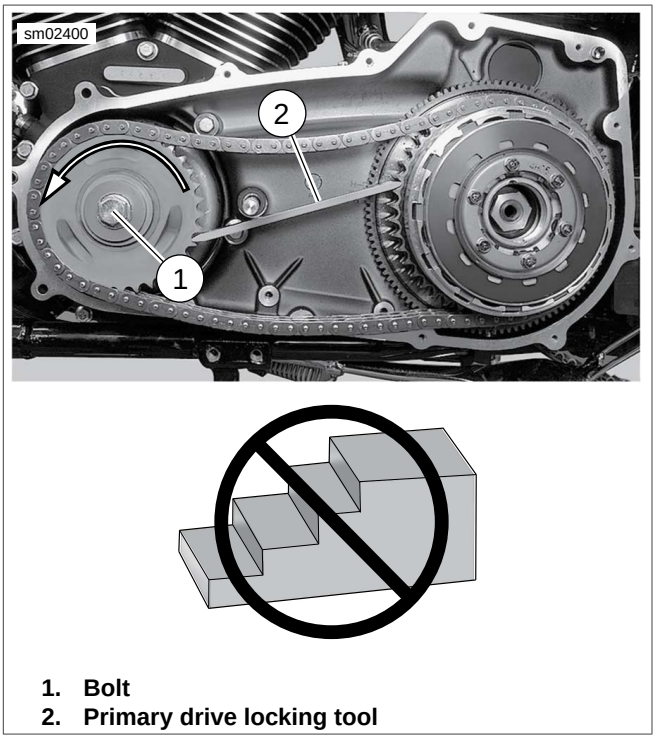

1. Retaining ring
2. Release plate
3. Locknut

**Figure 6-6. Clutch**



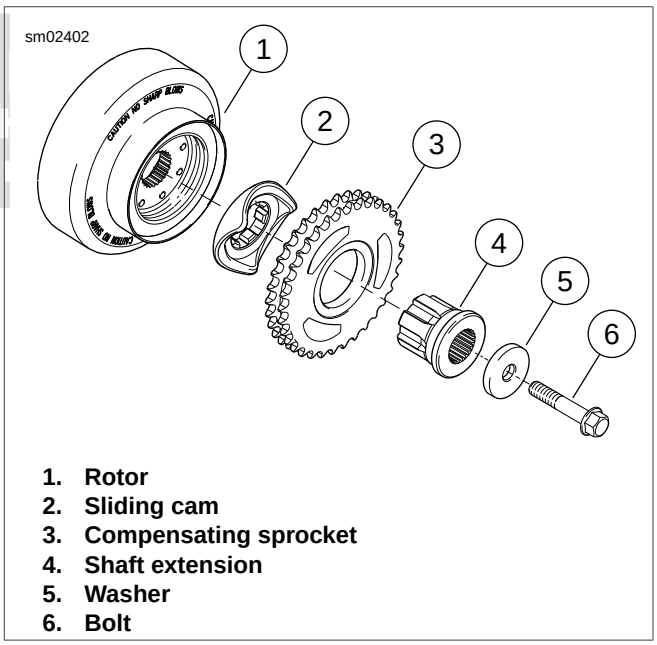

1. Engine sprocket
2. Primary drive locking tool
3. Clutch sprocket
4. Mainshaft nut

**Figure 6-7. Removing Clutch Hub Mainshaft Nut**




1. Bolt
2. Primary drive locking tool

**Figure 6-8. Removing Compensating Sprocket Bolt**




1. Rotor
2. Sliding cam
3. Compensating sprocket
4. Shaft extension
5. Washer
6. Bolt

**Figure 6-9. Compensating Sprocket**

## INSTALLATION

| PART NUMBER | TOOL NAME |
|---|---|
| HD-47977 | PRIMARY DRIVE LOCKING TOOL |

*NOTE*

*The primary chain, compensating sprocket and clutch assembly must be installed as an assembly.*

1. See Figure 6-10. Apply a thin layer of primary chaincase oil, to the inner diameter of the compensating sprocket

(3). and the splines of shaft extension (4). Assemble shaft extension, compensating sprocket and sliding cam (2). Place primary chain over compensating sprocket assembly.

2. Place drive components (primary chain, compensating sprocket assembly, and clutch assembly) into position. The clutch hub and shaft extension are splined, so a slight rotation of the chain drive will aid installation.

3. If reusing bolt (6), remove threadlocking material from bolt and engine sprocket shaft. Clean and prime threads of bolt and sprocket shaft. Apply two drops of LOCTITE THREADLOCKER 262 (red) to the threads of bolt. Install bolt and washer (5) hand tight.

*NOTE*

*Clutch hub mainshaft nut has left-hand threads.*

4. Clean and prime threads of nut. Apply two drops of LOCTITE THREADLOCKER 262 (red) to the threads of the clutch hub mainshaft nut. Start nut onto mainshaft and tighten hand tight.

*NOTE*

*See Figure 6-11. When tightening the compensating sprocket bolt, the PRIMARY DRIVE LOCKING TOOL (Part No. HD-47977) must be placed between the teeth of the engine and clutch sprockets.*

5. Tighten compensating sprocket bolt to 155-165 ft-lbs (210.1-223.7 Nm). Remove primary drive locking tool.

*NOTE*

*See Figure 6-12. When tightening the clutch hub mainshaft nut the PRIMARY DRIVE LOCKING TOOL (Part No. HD-47977) must be placed between the teeth of the engine and clutch sprockets.*

6. Tighten clutch hub mainshaft nut to 70-80 ft-lbs (94.9-108.5 Nm). Remove primary drive locking tool.

7. See Figure 6-13. Install release plate (5) with locknut (2) and adjuster screw (3) into clutch hub bore. The word "OUT" stamped on the release plate should face outward.

**⚠WARNING**

**Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)**

8. Inspect retaining ring (4) and replace if necessary. Install retaining ring in clutch hub bore to lock release plate in position. Verify that the retaining ring is completely seated in the groove.

9. Adjust clutch. See 1.11 CLUTCH, Adjustment.

*NOTE*

*Primary chain tensioner is non-repairable. If tensioner is worn or damaged, assembly must be replaced.*

10. See Figure 6-14. Although primary chain tensioner is sold as an assembly, tensioner parts can be disassembled. If primary chain tensioner becomes disassembled, assemble in order shown.

11. See Figure 6-15. Locate end of spring rod (2) on roll pin (3).

12. See Figure 6-16. Slide wedge (2) of primary chain tensioner in direction of arrow until all travel is removed.

13. Push shoe (1) down until it contacts wedge. Keep tension on shoe so wedge stays in place.

14. See Figure 6-17. Insert cable tie (2) as shown to hold wedge in place. Make sure end of cable tie is located below primary chain tensioner. If cable tie is installed this way, it will hang below primary cover gasket surface and serve as a reminder to remove cable tie before installing primary cover.

*NOTE*

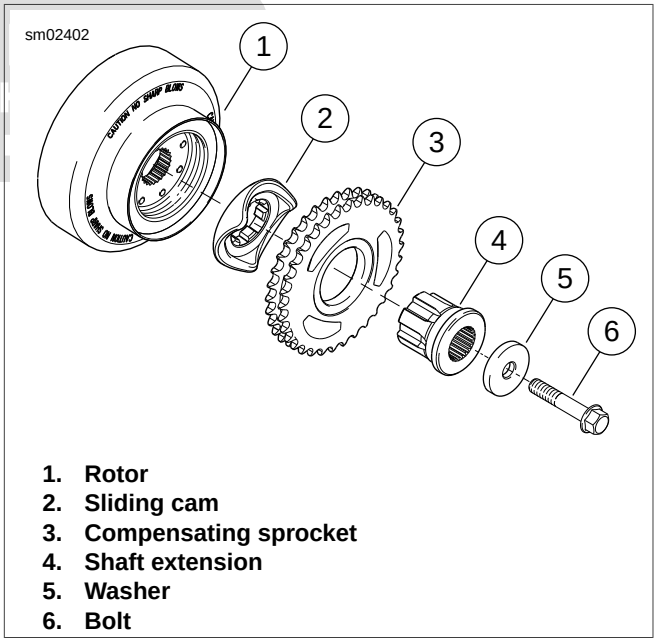
*Primary chain tensioner will not complete chain adjustment until vehicle is ridden. Vehicle must be test ridden after tensioner removal/installation to ensure proper adjustment.*

15. See Figure 6-18. Install primary chain tensioner (1) into place. Install chain tensioner fasteners (2) and tighten to 15-19 ft-lbs (20.3-25.8 Nm). Remove cable tie.

*NOTE*

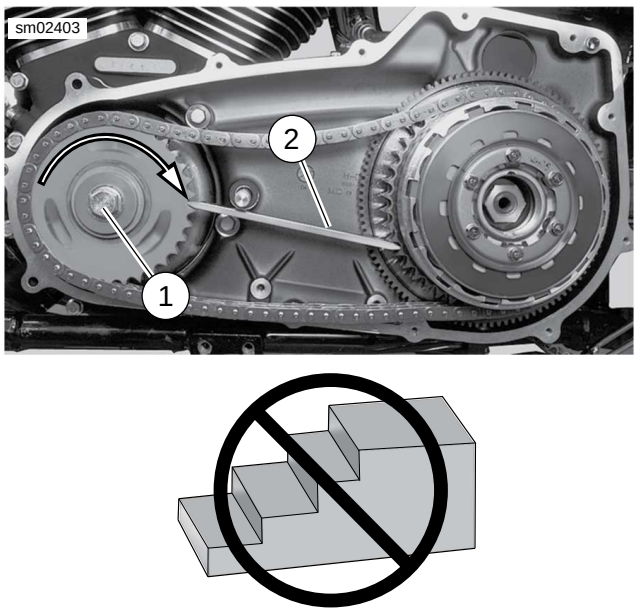
*The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.*

16. Install primary chaincase cover and fill with lubricant. See 6.2 PRIMARY CHAINCASE COVER, Installation.



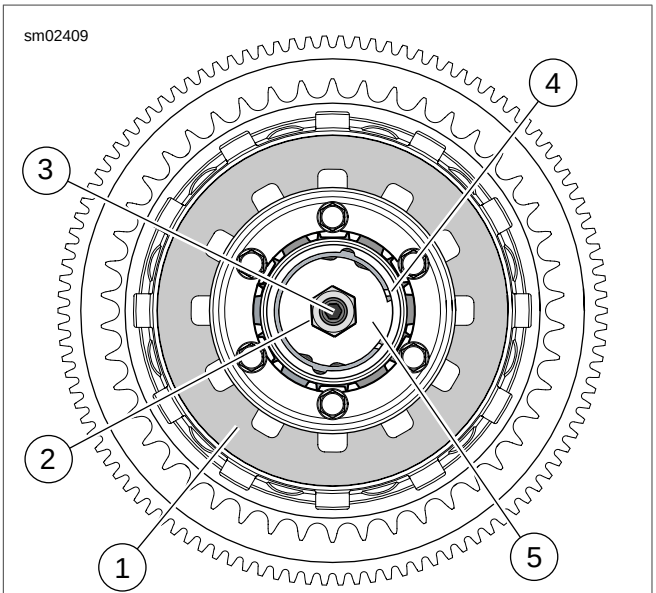

1. **Rotor**
2. **Sliding cam**
3. **Compensating sprocket**
4. **Shaft extension**
5. **Washer**
6. **Bolt**

**Figure 6-10. Compensating Sprocket**



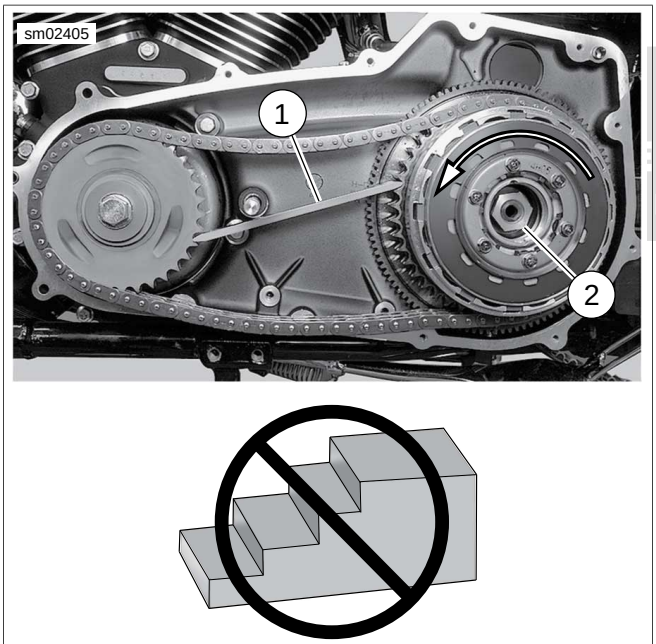

1. Bolt
2. Primary drive locking tool

**Figure 6-11. Installing Compensating Sprocket Bolt**



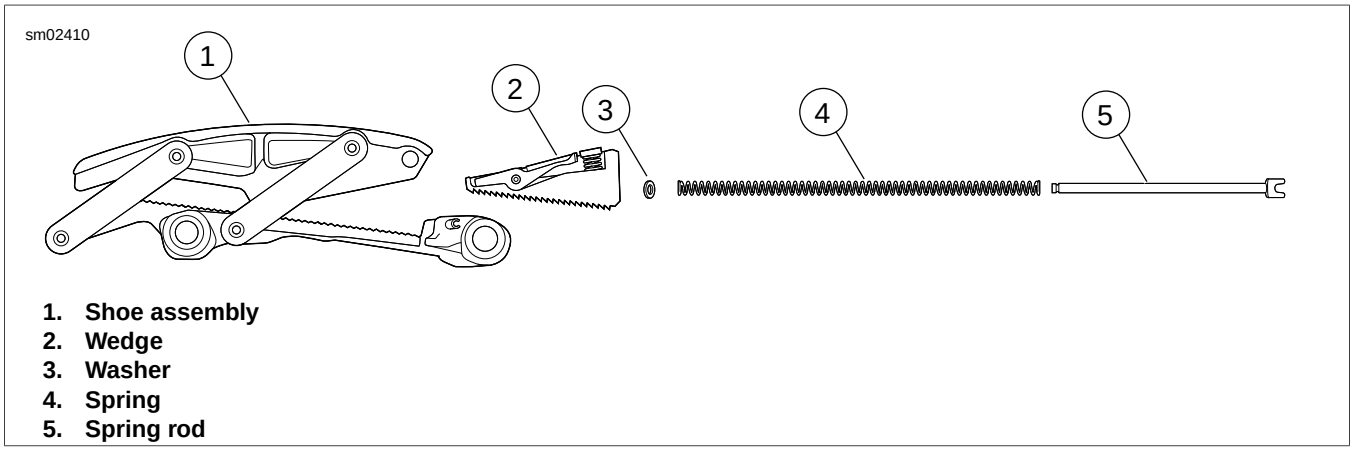

1. Diaphragm spring
2. Locknut
3. Adjuster screw
4. Retaining ring
5. Release plate

**Figure 6-13. Clutch**



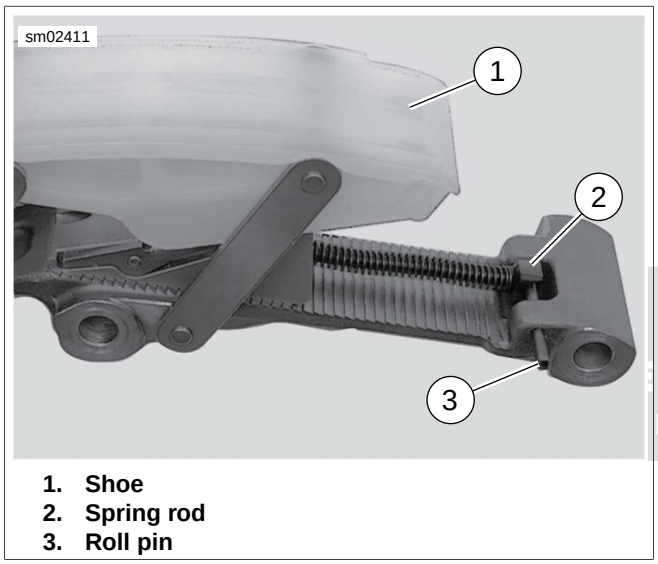

1. Primary drive locking tool
2. Mainshaft nut

**Figure 6-12. Installing Clutch Hub Mainshaft Nut**



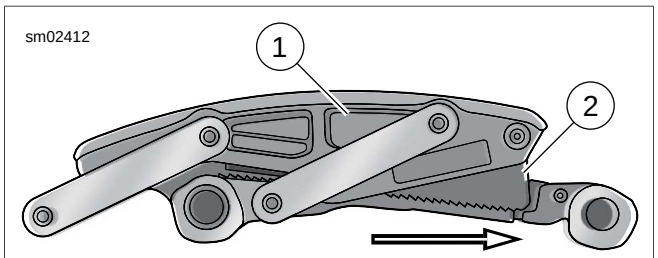

1. Shoe assembly
2. Wedge
3. Washer
4. Spring
5. Spring rod

**Figure 6-14. Primary Chain Tensioner Assembly**



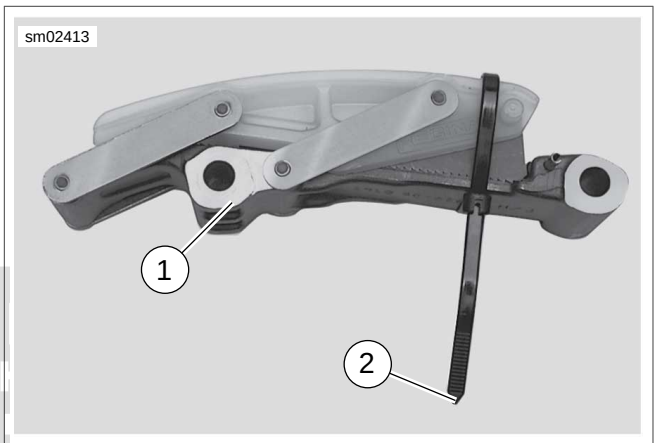

1. Shoe
2. Spring rod
3. Roll pin

**Figure 6-15. Spring Rod Location**



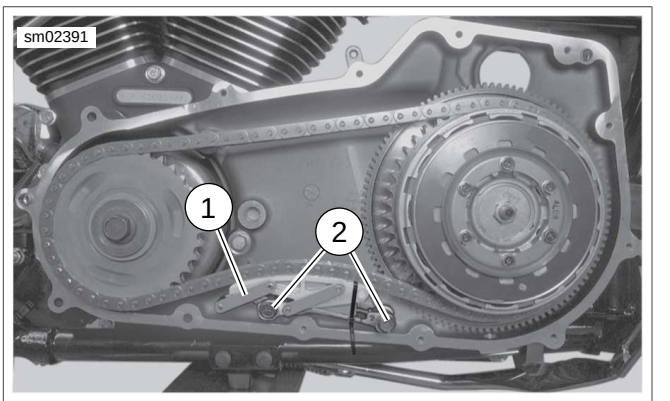

1. Shoe
2. Wedge

**Figure 6-16. Primary Chain Tensioner**




1. Primary chain tensioner
2. Cable tie

**Figure 6-17. Securing Primary Chain Tensioner**




1. Chain tensioner
2. Chain tensioner fasteners

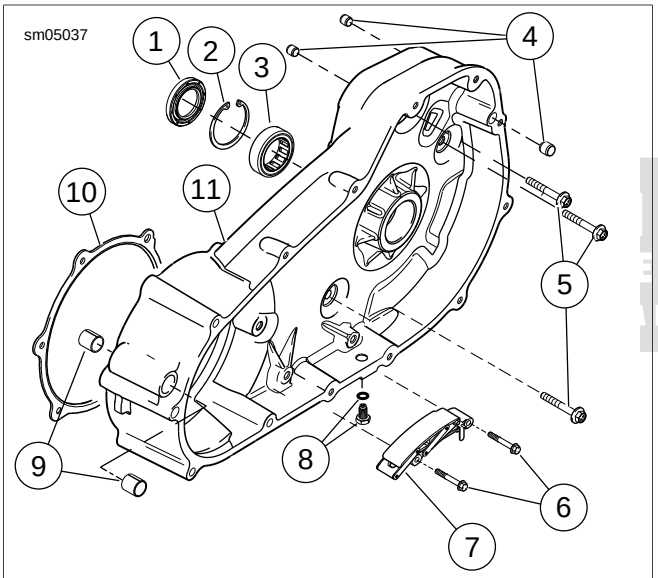
**Figure 6-18. Chain Tensioner**

## REMOVAL

**WARNING**

**To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)**

1. Disconnect battery cable, negative cable only.
2. Remove primary chaincase cover. See 6.2 PRIMARY CHAINCASE COVER, Removal.
3. Remove starter. See 5.2 STARTER, Removal.
4. Remove primary chain, clutch, and compensating sprocket. See 6.3 DRIVE COMPONENTS, Removal.
5. See Figure 6-19. Remove five sealing fasteners (5) securing primary chaincase housing (11) to crankcase and transmission. Discard the crankcase gasket (10) and sealing fasteners.




1. **Seal**
2. **Lock ring**
3. **Bearing**
4. **Dowel pin**
5. **Sealing fastener (5)**
6. **Chain tensioner fasteners**
7. **Chain tensioner**
8. **Drain plug and o-ring**
9. **Shifter shaft bushings**
10. **Crankcase gasket**
11. **Primary chaincase housing**

**Figure 6-19. Primary Chaincase Housing**

## INSPECTION

1. Inspect primary chaincase for cracks or damaged gasket surface.
2. Check the mainshaft bearing. Replace if bearing does not rotate freely. Replace the lip seal. See 6.4 PRIMARY CHAINCASE HOUSING, Mainshaft Bearing and Lip Seal.
3. Inspect shifter shaft bushings. Replace if worn or damaged. See 6.4 PRIMARY CHAINCASE HOUSING, Shifter Shaft Bushings.

## MAINSHAFT BEARING AND LIP SEAL

### Removal

**WARNING**

**Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)**

1. Pull lip seal from bearing bore on transmission side of primary chaincase. Use a seal remover or rolling head pry bar for best results.
2. Remove retaining ring from groove on transmission side of bearing.
3. Support inner primary chaincase on transmission side of bearing.

*NOTE*

*Support inner primary chain case area on transmission side while pressing bearing out of primary chaincase. The force needed to remove bearing may cause damage to primary chain case.*

4. Place primary chaincase in arbor press. Press out bearing from clutch side applying pressure to the outer race.

### Installation

1. Inspect the bearing bore to verify that it is clean and smooth. Install retaining ring in groove on pulley side of primary chaincase.
2. Place primary chaincase in arbor press with the transmission side up.
3. Support the bearing support area on the clutch side of the primary chaincase.

*NOTE*

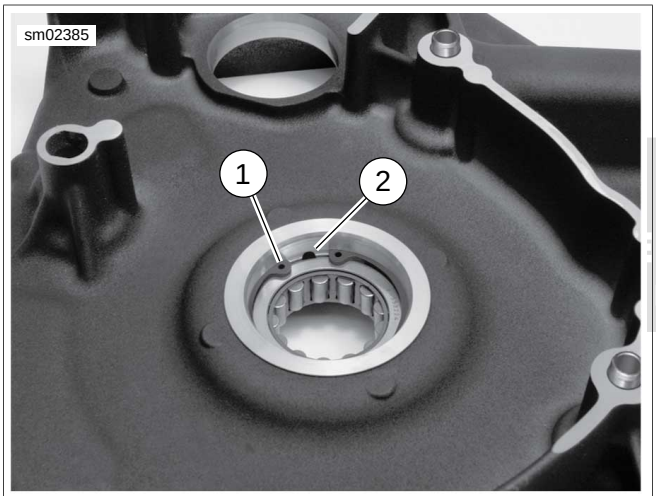
*Support the bearing support area on clutch side while pressing bearing into bore. The force needed to press bearing into position may force and unsupported primary chain case to become damaged.*

4. Apply a thin film of oil to outer diameter of bearing
5. Applying pressure to the outer race, press **new** bearing letter side up, into bore until it makes solid contact with the bearing support area.
6. See Figure 6-20. Retaining ring (1) must be oriented as shown to prevent blocking of oil passage (2). Install retaining ring to lock position of bearing in bore. Verify that the ring is fully seated in the groove and is in proper orientation.

*NOTES*

- *The lip garter spring side of the oil seal is also identified by the words "OIL SIDE".*
- *Install oil seal with a seal driver that will press only against outer rim of oil seal, NOT against the inner area.*
- *The minimum allowable depth of the seal is reached when the outer edge of the seal carrier is flush with the machined surface of the primary housing. The maximum allowable depth of the seal is reached when the seal carrier contacts the mainshaft bearing snap ring.*

7. Install mainshaft oil seal:
   a. Lubricate the O.D. of the new seal with clean engine oil.
   b. See Figure 6-21. With the lip garter spring side (stamped "oil side") facing toward the bearing, press squarely on the outer edge of a **new** oil seal until outer edge of seal is flush with machined surface of inner primary housing.
8. Lubricate the bearing and seal lip with multi-purpose grease or clean engine oil.




1. **Retaining ring**
2. **Oil passage**

**Figure 6-20. Retaining Ring Orientation**

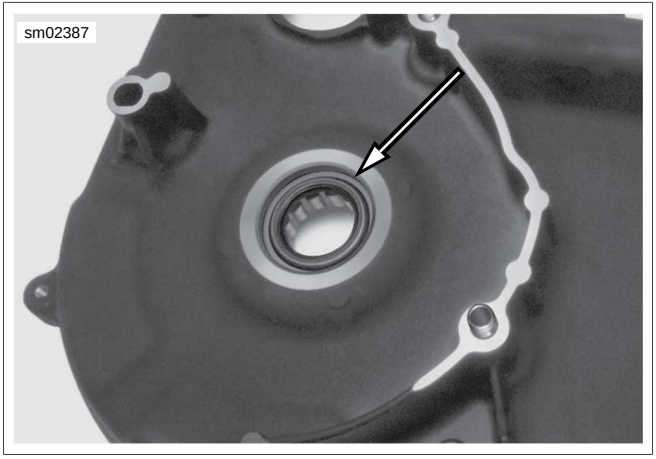



**Figure 6-21. Oil Seal**

## MAINSHAFT BEARING INNER RACE

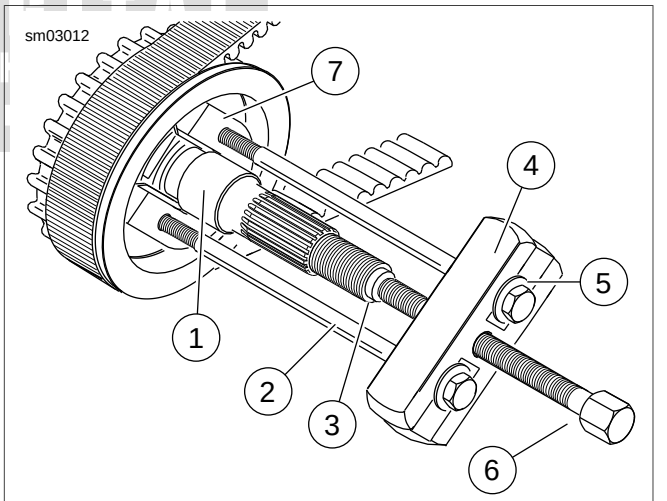
| PART NUMBER | TOOL NAME |
|---|---|
| HD-34902-B | MAINSHAFT BEARING INNER RACE REMOVER/INSTALLER |

### Removal

*NOTE*

*The bearing inner race must be positioned on the shaft a precise distance to properly 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-34902-B).*

1. See Figure 6-22. Install washers (5) on bolts (2). Slide one bolt into channel on each side of bridge (4) so that washer is between bridge and bolt head.
2. Thread bolts into stamped side of puller plate (7) an equal number of turns.
3. Apply graphite lubricant to threads of forcing screw (6). Thread forcing screw into bridge.
4. Position puller plate between inner race (1) and sprocket nut.
5. Install end cap into end of mainshaft. Thread forcing screw into bridge until the forcing screw seats in the end cap. Continue turning forcing screw until the bearing inner race is free of the mainshaft.




1. **Bearing inner race**
2. **Bolt (2)**
3. **End cap**
4. **Bridge**
5. **Washer (2)**
6. **Forcing screw**
7. **Puller plate**

**Figure 6-22. Pulling Mainshaft Inner Bearing Race**

### Installation

1. See Figure 6-24. Slide bearing inner race (1), chamfer edge first, onto mainshaft.

*NOTE*

*Extension shaft has left-hand threads.*

2. Thread extension shaft (2) onto end of mainshaft .
3. Position installer sleeve (4) over extension shaft and against bearing inner race. Apply graphite lubricant to threads of extension shaft.
4. Place two washers (5) over threaded portion of extension shaft and install nut.
5. Tighten nut (6) while holding extension shaft stationary with wrench on flats (3) at end of screw threads. Press race onto shaft so inside edge is 0.100-0.125 in. (2.540-3.180 mm) from main drive gear.
6. Lubricate race with primary chaincase lubricant.

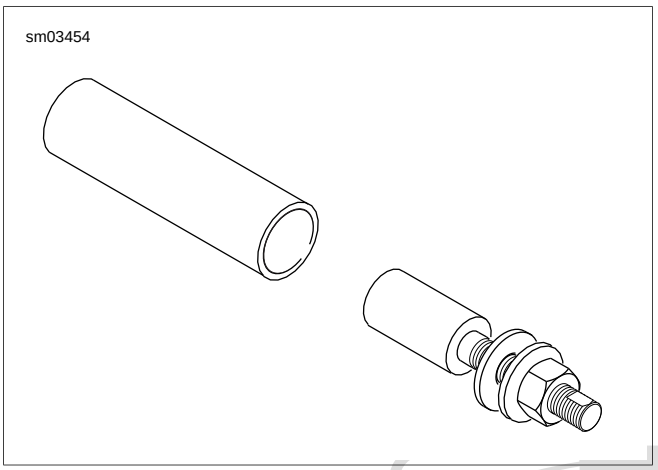
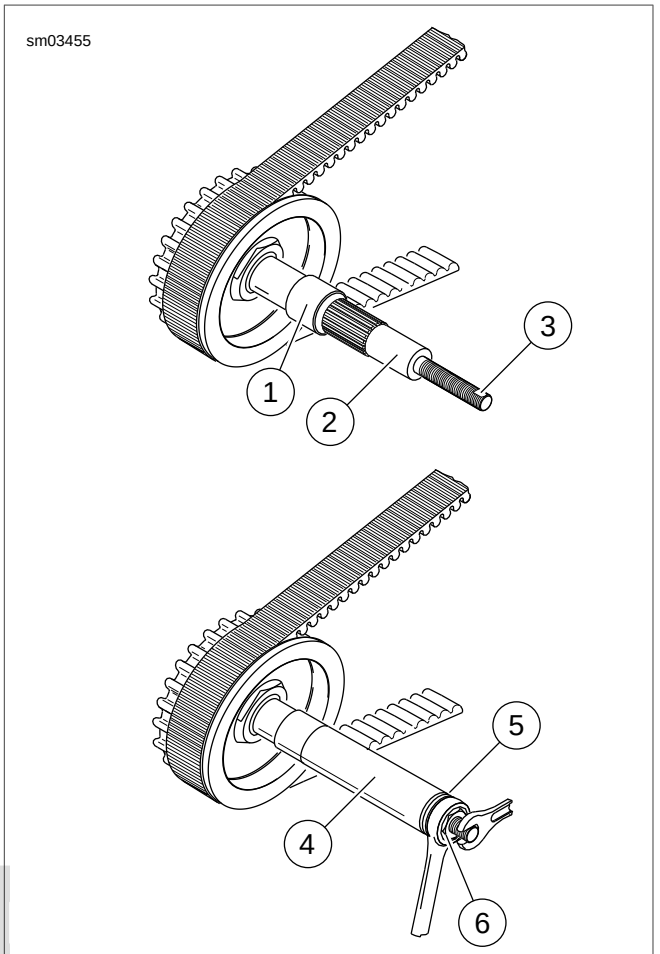



**Figure 6-23. Mainshaft Bearing Inner Race Installer**

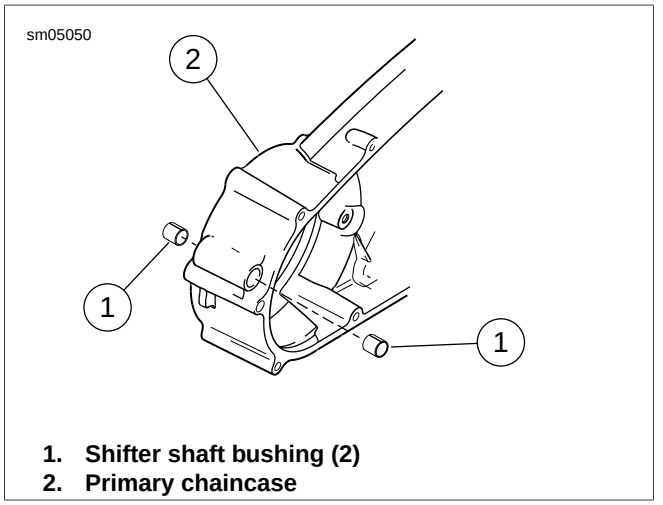



1. **Bearing inner race**
2. **Extension shaft**
3. **Wrench flat**
4. **Installer sleeve**
5. **Washers**
6. **Nut**

**Figure 6-24. Installing Bearing Race**

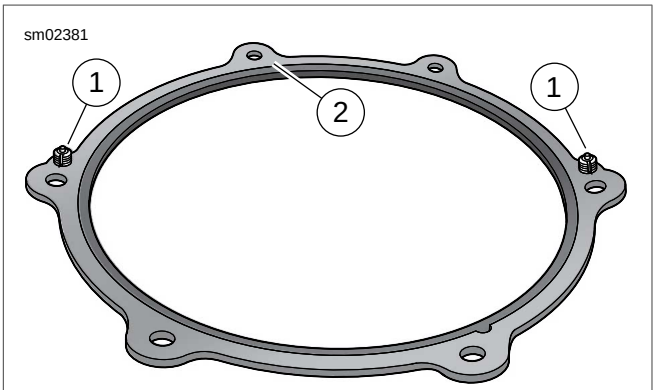
## SHIFTER SHAFT BUSHINGS

1. See Figure 6-25. Press out old bushings (1) using an arbor press. Inspect the bushing bore to verify that it is clean and smooth.
2. Press **new** bushings into each side of the bore using an arbor press. Installed bushing must be flush to 0.010 in. (0.25 mm) below edge of bore.




1. **Shifter shaft bushing (2)**
2. **Primary chaincase**

**Figure 6-25. Shifter Shaft Bushings**




1. **Dowel**
2. **Crankcase gasket**

**Figure 6-26. Crankcase Gasket**

## INSTALLATION

*NOTES*

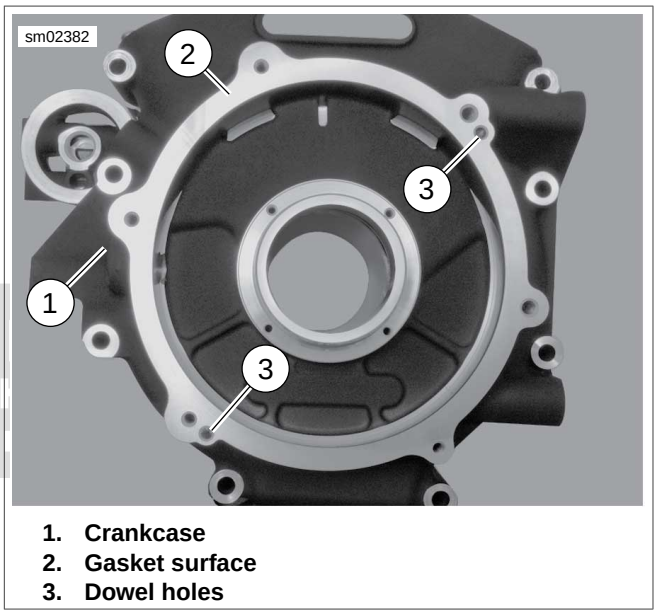
- *Cover mainshaft clutch hub splines with tape to prevent the splines damaging the inner primary cover oil seal.*
- *See Figure 6-26. In next step, be sure dowels (1) in crankcase gasket (2) engage holes in crankcase.*

1. Verify pivot shaft torque. See 2.22 REAR FORK, Installation.
2. See Figure 6-27. Place crankcase gasket in place on gasket surface (2). Be sure dowels in gasket engage dowel holes (3).
3. Spread a thin film of oil on mainshaft oil seal lip and rubber portion of crankcase gasket. Be careful not to damage mainshaft seal when installing chaincase over the primary bearing inner race on the mainshaft.
4. See Figure 6-28. Insert **new** sealing fasteners.
5. See Figure 6-29. Tighten fasteners in sequence shown to 25-27 ft-lbs (33.9-36.6 Nm).
6. Install the primary chain, clutch, and compensating sprocket as an assembly. See 6.3 DRIVE COMPONENTS, Installation.
7. Install chain tensioner assembly.
8. Install starter. See 5.2 STARTER, Installation.

*NOTE*

*The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks .*

9. Install primary chaincase cover. See 6.2 PRIMARY CHAINCASE COVER, Installation.
10. Fill primary chaincase with lubricant. See 1.9 PRIMARY CHAIN, Chaincase Lubricant: Touring Models.
11. Adjust rear belt tension.
12. Connect negative battery cable.




1. **Crankcase**
2. **Gasket surface**
3. **Dowel holes**

**Figure 6-27. Crankcase**

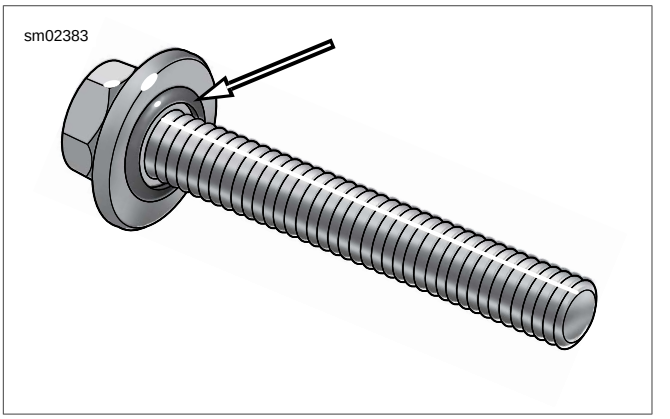



**Figure 6-28. Sealing Fastener**

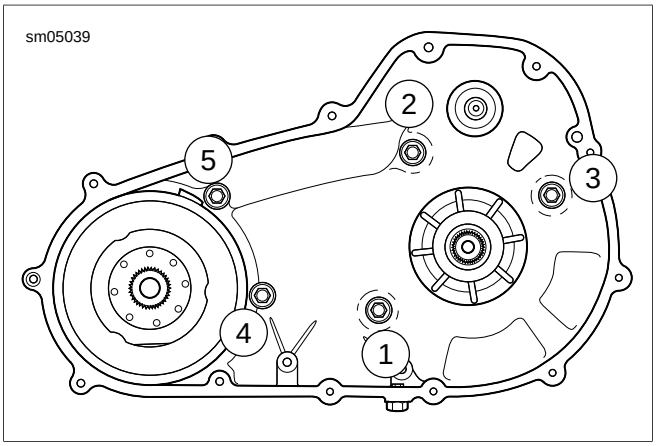



**Figure 6-29. Sealing Fastener Torque Sequence**

## REMOVAL AND INSTALLATION

To remove the clutch without disassembly or for installation instructions, see 6.3 DRIVE COMPONENTS, Removal.

## CLUTCH PACK ONLY

### Partial Disassembly

This procedure can be performed on the motorcycle without removing the clutch shell or hub.

1. Remove primary chaincase cover. See 6.2 PRIMARY CHAINCASE COVER, Removal.
2. See Figure 6-30. Remove six bolts (1) (metric) to release diaphragm spring retainer (2) from clutch hub. Loosen each bolt gradually and in a star sequence around the hub.
3. Remove diaphragm spring retainer, diaphragm spring (3) and pressure plate (4) from clutch hub.
4. Remove friction plates (5, 7), steel plates (6), damper spring (8) and damper spring seat (9) from clutch hub (11). Continue with Cleaning And Inspection.

### Cleaning And Inspection

**⚠WARNING**

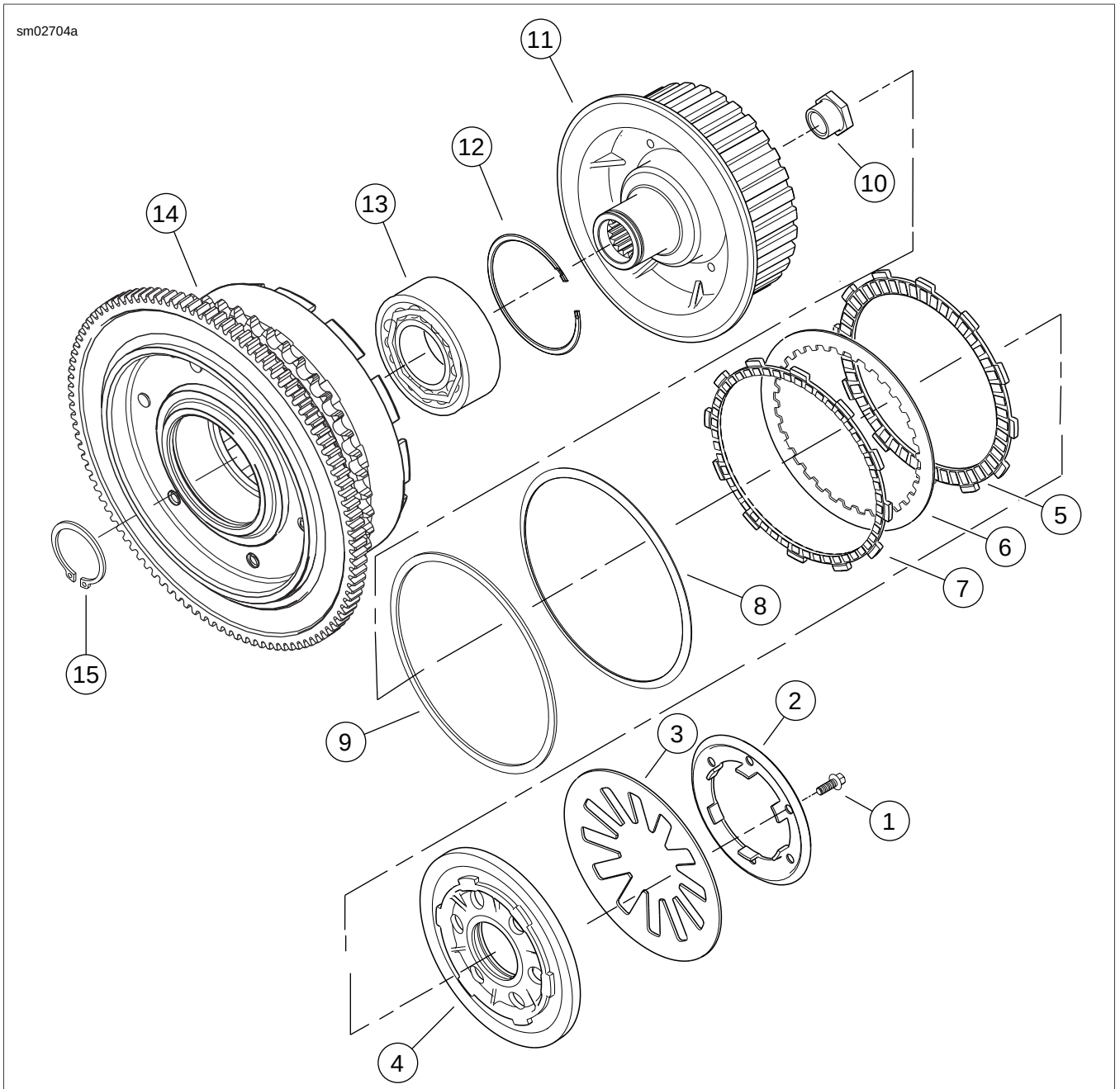
**Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)**

1. Wash all parts in cleaning solvent, except for friction plates and bearing, if removed. Blow parts dry with low pressure compressed air.
2. Check **friction plates** as follows:
   a. Blow off all lubricant from the friction plates. Do not wipe off with a rag.
   b. Measure the thickness of each plate with a dial caliper or micrometer.
   c. If the thickness of any plate is less than 0.143 in. (3.62 mm), discard all friction plates and replace with an entirely **new** set.
   d. 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. Submerge and soak all friction plates in FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05, qt.) for at least five minutes.*

3. Check the **steel plates** as follows:
   a. Discard any plate that is grooved or bluish in color. Blue plates are likely warped or distorted.
   b. 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 in. (0.15 mm).
4. Holding the clutch hub, rotate the clutch shell to check bearing for smoothness. Replace the bearing if it runs rough, binds or has any end play.
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.




1. **Bolt (6) (metric)**
2. **Diaphragm spring retainer**
3. **Diaphragm spring**
4. **Pressure plate**
5. **Friction plate (9)**
6. **Steel plate (8)**
7. **Narrow friction plate**
8. **Damper spring**
9. **Damper spring seat**
10. **Mainshaft nut (metric)**
11. **Clutch hub**
12. **Retaining ring**
13. **Bearing**
14. **Clucth shell**
15. **Retaining ring**

**Figure 6-30. Clutch Shell Assembly**

## Assembly

*NOTE*

*Submerge and soak all friction plates in FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05, qt.) for at least five minutes.*

1. See Figure 6-31. Install the narrow friction plate on the clutch hub. Engage tabs on plate with slots in clutch shell.
2. See Figure 6-30. Install damper spring seat (9) on clutch hub (11). It must sit inboard of narrow friction plate (7).

*NOTE*

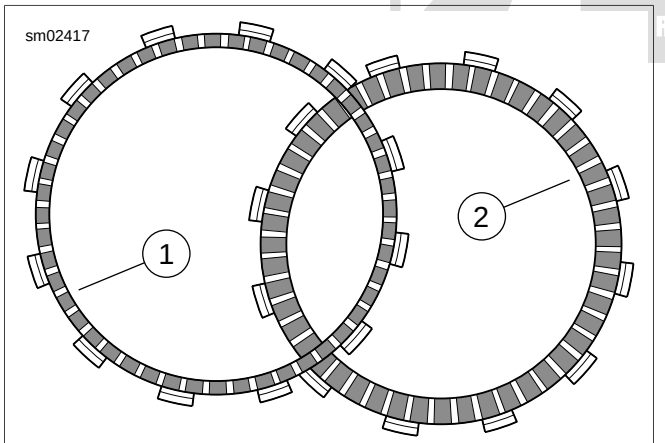
*See Figure 6-36. Notice damper spring (4) orientation with respect to damper spring seat (3).*

3. See Figure 6-30. Install damper spring (8) on clutch hub with the concave side out (facing away from damper spring seat).
4. Install a steel plate (6) with round edge outward and then a friction plate (5) on the clutch hub. Install seven remaining sets in the same manner, alternating between steel plates and friction plates.
5. Install pressure plate (4) on clutch hub aligning holes in plate with threaded bosses on hub.
6. Seat diaphragm spring (3) in recess of pressure plate with the concave side inward.
7. Align holes in diaphragm spring retainer (2) with threaded bosses on clutch hub. Tabs on spring retainer contact flats on inboard side of bosses.
8. Install six bolts (1) (metric) to secure diaphragm spring retainer to clutch hub. Alternately tighten the bolts to 90-110 **in-lbs** (10.2-12.4 Nm).

*NOTE*

*The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.*

9. Install primary chaincase cover and gasket. See 6.2 PRIMARY CHAINCASE COVER, Installation.
10. Fill primary chaincase with lubricant. See 1.9 PRIMARY CHAIN, Chaincase Lubricant: Touring Models.




**1. Narrow plate**
**2. Regular plate**

**Figure 6-31. Friction Plates**

## CLUTCH PACK AND BEARING

### Complete Disassembly

1. Remove the primary chaincase cover. See 6.2 PRIMARY CHAINCASE COVER, Removal.
2. Remove clutch assembly. See 6.3 DRIVE COMPONENTS, Removal.
3. Follow all partial disassembly information under 6.5 CLUTCH, Clutch Pack Only.

*NOTE*

*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.*

**⚠WARNING**

**Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)**

4. See Figure 6-32. With the transmission side up, remove retaining ring from clutch hub groove.
5. See Figure 6-33. Supporting clutch shell in same orientation, use arbor press and a suitable press plug to press hub from bearing in clutch shell.
6. See Figure 6-34. With the transmission side up, remove retaining ring from groove in clutch shell bore.
7. See Figure 6-35. Turn clutch shell over so that transmission side is down. Using arbor press and a suitable press plug, press on inner race to remove bearing from clutch shell bore.
8. Continue with Cleaning and Inspection found under 6.5 CLUTCH, Clutch Pack Only.


**Figure 6-32. Clutch Hub Retaining Ring**


**Figure 6-33. Pressing Clutch Hub From Bearing**

## Assembly

1. Orient clutch shell in arbor press with transmission side up. Be sure to support clutch shell bore on sprocket side to avoid damage to ears on clutch basket. Using a suitable press plug, press against outer race until bearing contacts shoulder in clutch shell bore.

**⚠WARNING**

**Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)**

2. See Figure 6-34. Install retaining ring in groove of clutch shell bore so that flat side of retaining ring is towards bearing.
3. Turn clutch shell over so sprocket side is up. Center hub in bearing. Be sure that bearing inner race is supported with sleeve on transmission side. Press hub into bearing until hub shoulder contacts bearing inner race.
4. See Figure 6-32. Turn assembly over so that the transmission side is up. Install retaining ring in groove of clutch hub.
5. Place clutch assembly on bench oriented with the transmission side down.
6. Soak all friction and steel plates in FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05, qt.) for at least five minutes.
7. See Figure 6-36. Install the narrow friction plate on the clutch hub engaging tabs on plate with slots in clutch shell.
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).
10. Install a steel plate and than a friction plate on the clutch hub. Install seven remaining sets in the same manner, alternating between steel plates and frictions plates.
11. Install pressure plate on clutch hub aligning holes in plate with threaded bosses on hub.
12. See Figure 6-37. Seat diaphragm spring (1) 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 (5) (metric) to secure diaphragm spring retainer to clutch hub. Alternately tighten 90-110 **in-lbs** (10.2-12.4 Nm).
15. Install clutch. See 6.3 DRIVE COMPONENTS, Installation.

*NOTE*

*The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.*

16. Install primary chaincase cover and gasket. See 6.2 PRIMARY CHAINCASE COVER, Installation.
17. Fill primary chaincase with lubricant. See 1.9 PRIMARY CHAIN, Chaincase Lubricant: Touring Models.


**Figure 6-34. Install Clutch Shell Retaining Ring with Flat Side Against Bearing**

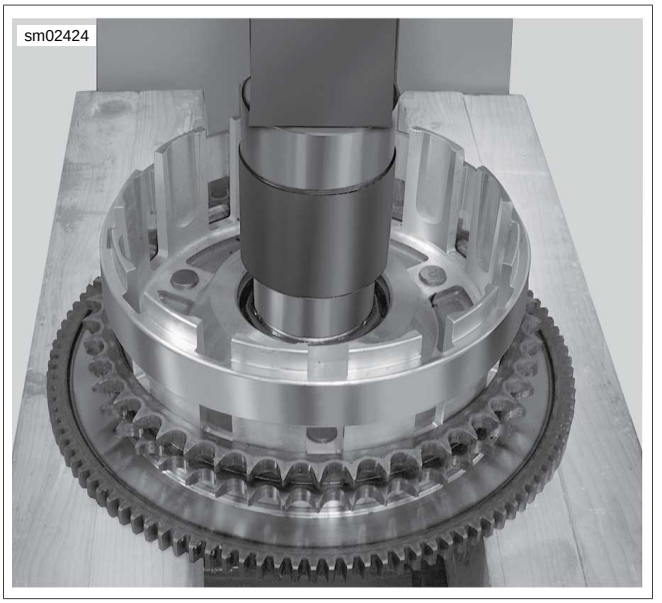
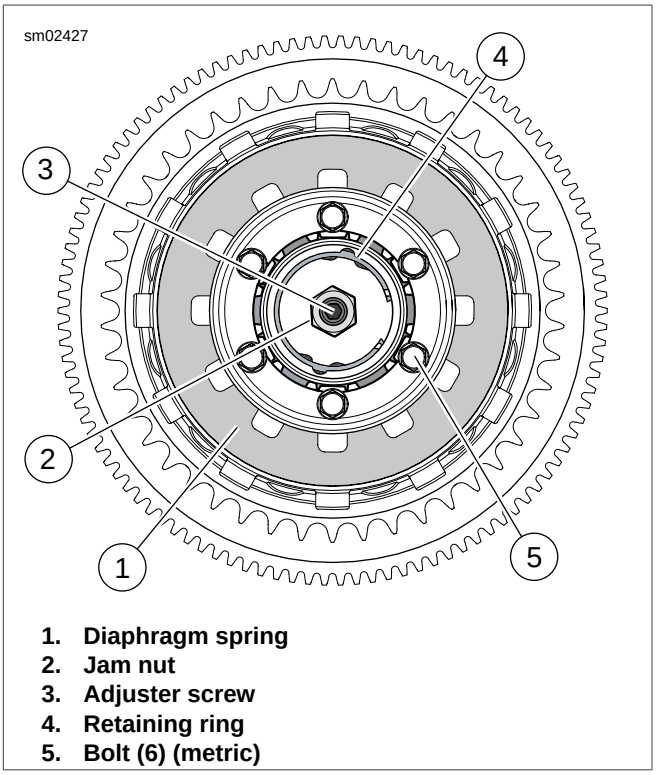
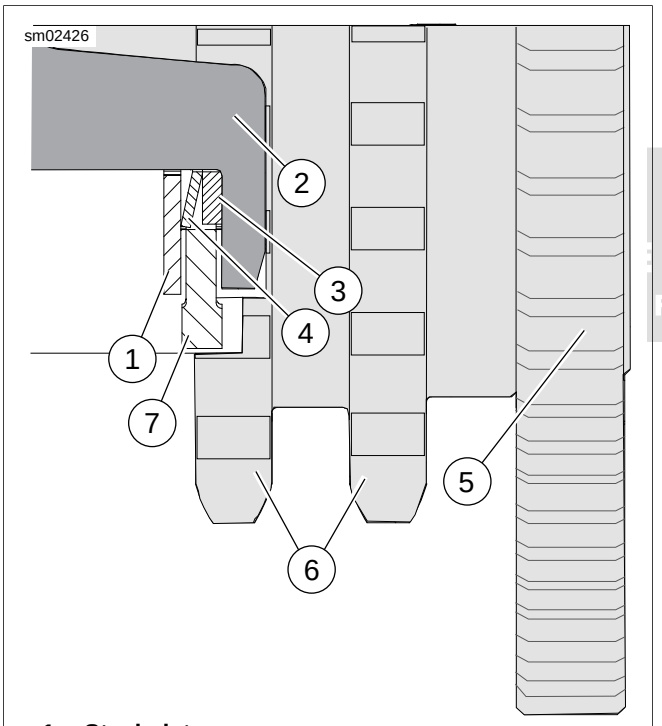



**Figure 6-35. Pressing Bearing From Clutch Shell**




1. **Diaphragm spring**
2. **Jam nut**
3. **Adjuster screw**
4. **Retaining ring**
5. **Bolt (6) (metric)**

**Figure 6-37. Assembled Clutch**




1. **Steel plate**
2. **Clutch hub**
3. **Damper spring seat**
4. **Damper spring**
5. **Starter ring gear**
6. **Primary chain sprocket**
7. **Narrow friction plate**

**Figure 6-36. Clutch Stackup**

## REMOVAL

| PART NUMBER | TOOL NAME |
|---|---|
| HD-46282 | FINAL DRIVE SPROCKET LOCKING TOOL |
| HD-47910 | MAINSHAFT LOCKNUT WRENCH |
| HD-94660-2 | PILOT |

1. Remove primary chaincase. See 6.4 PRIMARY CHAINCASE HOUSING.
2. See Figure 6-38. Remove E-clip from groove at end of axle.
3. Loosen axle nut.
4. See Figure 6-39. Turn adjuster cam in a counterclockwise direction until belt tension is relieved.

*NOTE*

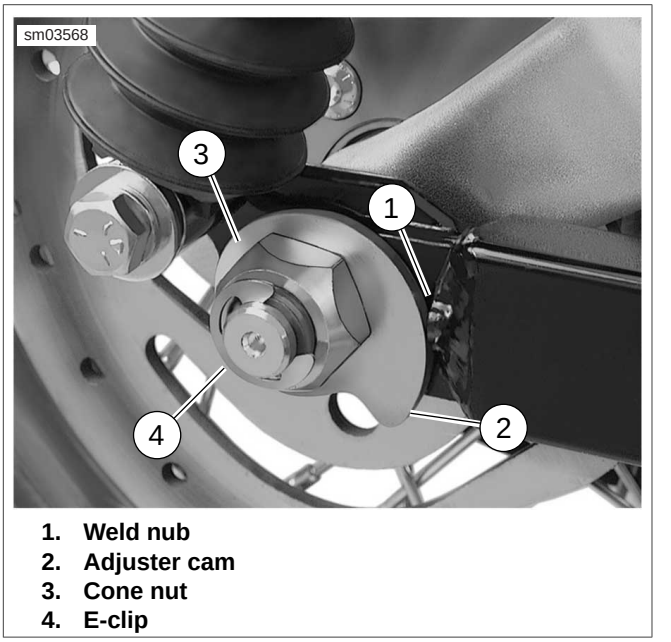
*Only remove sprocket nut while transmission is installed in frame. Failure to do so will result in damage to transmission and/or transmission stand.*

5. Remove transmission sprocket.
   a. See Figure 6-40. Remove both screws (1) and lockplate (2).
   b. See Figure 6-41. Secure sprocket using FINAL DRIVE SPROCKET LOCKING TOOL (Part No. HD-46282)(3). Final drive sprocket locking tool must rest against lower portion of swingarm pivot nut (2).

   *NOTE*

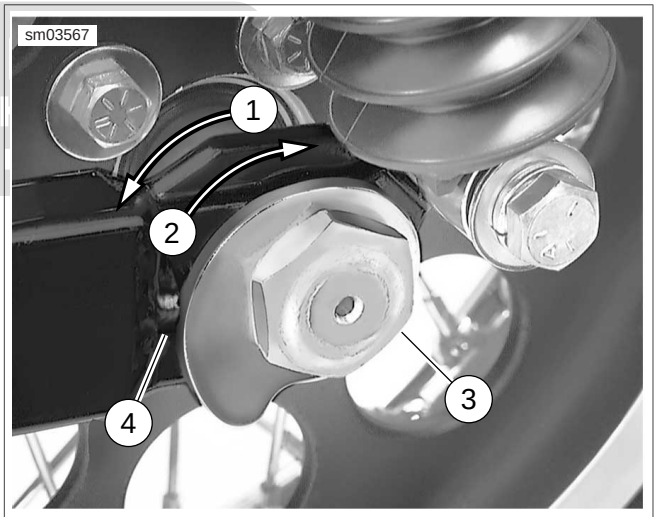
   *Sprocket nut has a right-hand thread.*

   c. Install PILOT (Part No. HD-94660-2) on mainshaft.
   d. Remove the sprocket nut using MAINSHAFT LOCKNUT WRENCH (Part No. HD-47910) (1).
6. Remove belt from sprocket as sprocket is removed.



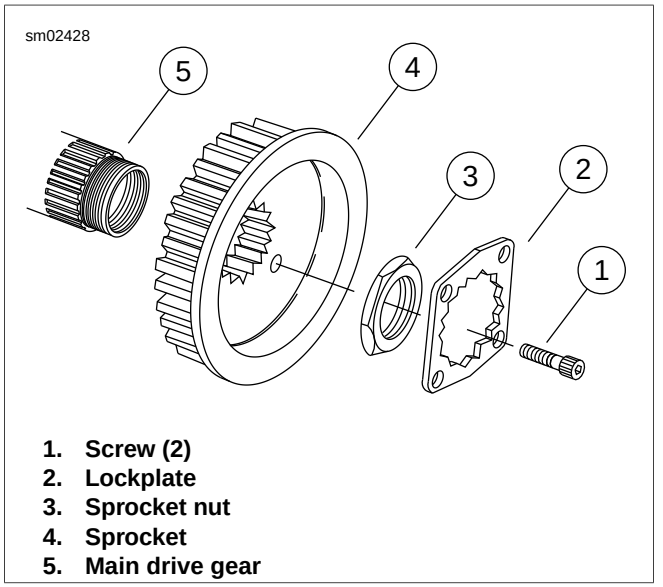

1. **Weld nub**
2. **Adjuster cam**
3. **Cone nut**
4. **E-clip**

**Figure 6-38. Rear Wheel and Adjuster Cam (Right Side)**



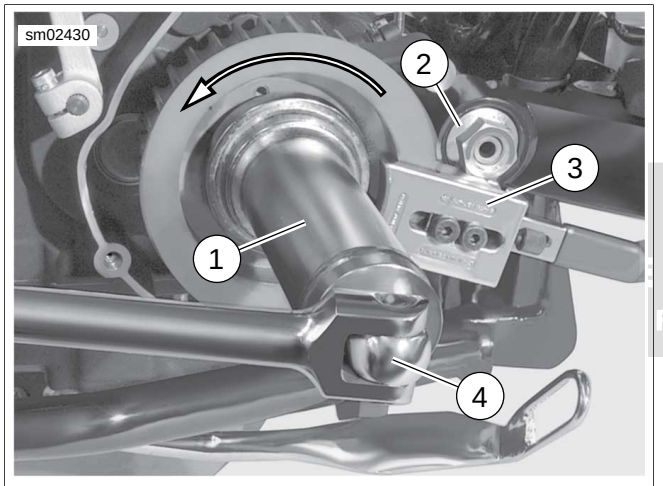

1. **Increase belt deflection**
2. **Reduce belt deflection**
3. **Weld nut**
4. **Weld nub**

**Figure 6-39. Rear Wheel and Adjuster Cam (Left Side)**




1. **Screw (2)**
2. **Lockplate**
3. **Sprocket nut**
4. **Sprocket**
5. **Main drive gear**

**Figure 6-40. Transmission Sprocket**




1. **Mainshaft locknut wrench**
2. **Rear fork pivot nut**
3. **Final drive sprocket locking tool**
4. **3/4 inch breaker bar**

**Figure 6-41. Sprocket Nut Removal (Typical)**

## CLEANING AND INSPECTION

1. Using a non-volatile cleaning solvent, clean sprocket of all grease and dirt.
2. Inspect belt and sprocket. See 1.12 REAR BELT AND SPROCKETS, Inspection.
3. Inspect both main drive gear and mainshaft seals. Replace if damaged.

## INSTALLATION

| PART NUMBER | TOOL NAME |
|---|---|
| HD-46282 | FINAL DRIVE SPROCKET LOCKING TOOL |
| HD-47910 | MAINSHAFT LOCKNUT WRENCH |
| HD-94660-2 | PILOT |

*NOTE*

*Only install sprocket nut while transmission is installed in frame. Failure to do so will result in damage to transmission and/or transmission stand.*

1. Place transmission sprocket in position. Install the belt on the sprocket as the sprocket is installed on the main drive gear.

*NOTES*

- *Exercise caution to avoid getting oil on the threads of the sprocket nut or the integrity of the lock patch may be compromised.*
- *The transmission sprocket nut has **right-handed** threads. Turn the nut **clockwise** to install on the main drive gear.*

2. See Figure 6-40. Install the sprocket nut. The following procedure is based on whether a new or used nut is being used.
   a. **New sprocket nut:** spread a small quantity of clean engine oil on the inside face of the sprocket nut and the outside face of the sprocket. Limit the application to where the surfaces of the two parts contact each other. Install the sprocket nut until finger tight.
   b. **Used sprocket nut:** apply Loctite High Strength Threadlocker 271 (red) to the threads of the sprocket nut. Also spread a small quantity of clean engine oil on the inside face of the sprocket nut and the outside face of the sprocket. Limit the application to where the surfaces of the two parts contact each other. Install the sprocket nut until finger tight.
3. See Figure 6-42. Lock transmission sprocket with the FINAL DRIVE SPROCKET LOCKING TOOL (Part No. HD-46282) (2). Final drive sprocket locking tool must rest against upper portion of rear fork pivot nut (3).
4. Install PILOT (Part No. HD-94660-2) on mainshaft.
5. Using MAINSHAFT LOCKNUT WRENCH (Part No. HD-47910) (1), tighten sprocket nut to 35 ft-lbs (47.5 Nm) initial torque.
6. Loosen sprocket nut to remove initial torque.
7. Tighten sprocket nut to 35 ft-lbs (47.5 Nm).

**CAUTION**

**Failure to use Main Drive Gear Remover and Installer can cause premature failure of bearing and related parts. (00540b)**

8. See Figure 6-43. Scribe a line (3) on the transmission sprocket nut (1). Continue the line on the transmission sprocket (2) as shown.
9. Tighten the transmission sprocket nut an additional 35° to 40°.

10. Install lockplate over transmission sprocket nut so that two of lockplate's four drilled holes (diagonally opposite) align with sprocket's two tapped holes. To find the best fit, lockplate can be rotated to a number of positions and can be placed with either side facing sprocket.

*NOTE*

*Maximum allowable tightening of sprocket nut is 45° of clockwise rotation after a torque of 35 ft-lbs (47.5 Nm). Do not loosen sprocket nut to align holes or nut will be under tightened.*

11. If holes in lockplate do not align with those in sprocket, continue to tighten sprocket nut (up to the 45° maximum) until sprocket and lockplate holes are in alignment.

*NOTES*

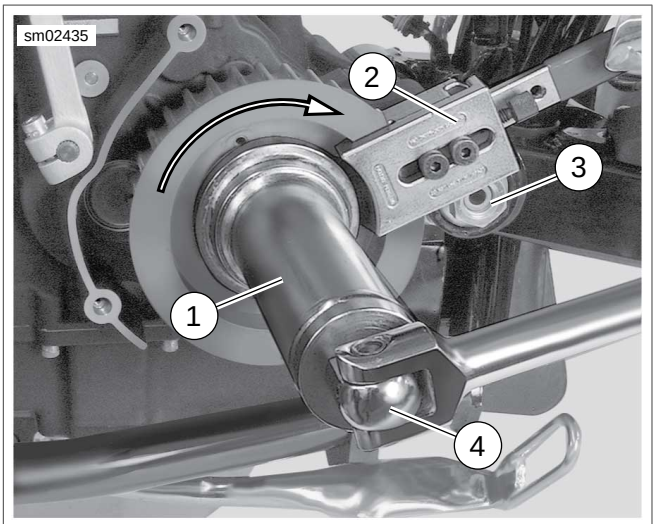
- ***New** screws have LOCTITE patches. With LOCTITE High Strength Threadlocker 271 (red) reapplied before installation, the screws can be re-used up to three times.*
- *To ensure the lockplate's security, BOTH screws must be installed in the lockplate.*

12. See Figure 6-40. Install two screws (1) to secure lockplate (2) to sprocket (4).
13. Tighten screws to 84-108 **in-lbs** (9.5-12.2 Nm).
14. Install primary chain assembly. See 6.3 DRIVE COMPONENTS.

*NOTE*

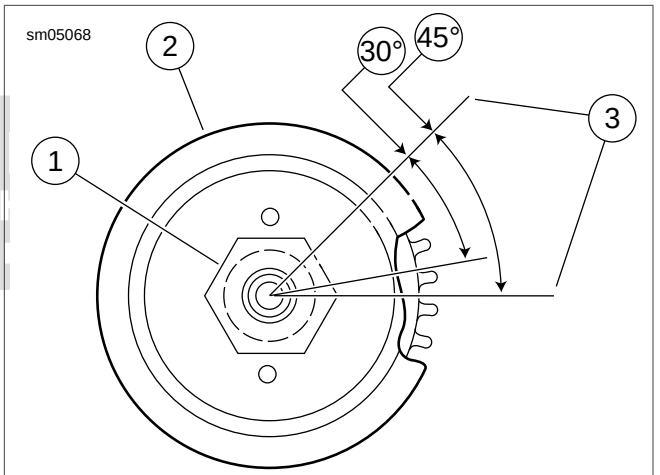
*The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.*

15. Install primary chaincase cover and **new** gasket. See 6.2 PRIMARY CHAINCASE COVER.
16. Fill primary chaincase with lubricant. See 1.9 PRIMARY CHAIN.
17. Verify pivot shaft torque. See 2.22 REAR FORK.
18. Adjust belt tension. See 1.13 REAR BELT DEFLECTION.
19. Verify vehicle alignment and tighten rear axle. See 2.11 VEHICLE ALIGNMENT.




1. **Mainshaft locknut wrench**
2. **Final drive sprocket locking tool**
3. **Rear fork pivot nut**
4. **3/4 inch breaker bar**

**Figure 6-42. Sprocket Nut Installation (Typical)**




1. **Transmission sprocket nut**
2. **Transmission sprocket**
3. **Scribed lines**

**Figure 6-43. Transmission Sprocket Nut Final Tightening**

## REMOVAL AND ADJUSTMENT

### Adjustment

See 1.13 REAR BELT DEFLECTION, Setting Belt Deflection.

### Removal

1. Remove rear wheel and rear fork. See 2.22 REAR FORK.
2. Remove primary chain, clutch, engine compensating sprocket, and chain adjuster as an assembly. See 6.3 DRIVE COMPONENTS.
3. Remove primary chaincase housing. See 6.4 PRIMARY CHAINCASE HOUSING, Removal.
4. Remove belt from transmission sprocket.

## INSTALLATION

**WARNING**

**Never bend belt forward into a loop smaller than the drive sprocket diameter. Never bend belt into a reverse loop. Over bending can damage belt resulting in premature failure, which could cause loss of control and death or serious injury. (00339a)**

1. Install belt over transmission sprocket.
2. Install the primary chaincase housing. See 6.4 PRIMARY CHAINCASE HOUSING, Installation.

*NOTE*

*The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.*

3. Install primary chain assembly and primary chaincase cover. Fill primary chaincase with lubricant. See 6.3 DRIVE COMPONENTS.
4. Install rear fork and rear wheel. See 2.22 REAR FORK.
5. Align vehicle. See 2.11 VEHICLE ALIGNMENT.
6. Adjust belt tension. See 1.13 REAR BELT DEFLECTION.

# NOTES

## SPECIFICATIONS

**Table 7-1. Transmission Specifications**

| TRANSMISSION | DATA |
|---|---|
| Type | 6-speed forward constant mesh |
| FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT | Part No. 99851-05 (qt) |
| Capacity | 32 oz. |
| | 946.4 ml |

**Table 7-2. Gear Specifications**

| GEAR | OVERALL GEAR RATIO |
|---|---|
| First (low) | 3.34 |
| Second | 2.31 |
| Third | 1.72 |
| Fourth | 1.39 |
| Fifth | 1.18 |
| Sixth (high) | 1.00 |

*NOTE*

*Final gear ratios indicate the number of mainshaft revolutions required to drive the output sprocket one revolution.*

## SERVICE WEAR LIMITS

**Table 7-3. Main Drive Gear Specifications**

| MAIN DRIVE GEAR (6th) | IN. | MM |
|---|---|---|
| Bearing fit in transmission case (loose) | 0.0003-0.0017 | 0.0076-0.043 |
| Fit in bearing (press-fit) | 0.001-0.003 | 0.025-0.076 |
| End play | none | none |

**Table 7-4. Mainshaft Tolerance Specifications**

| MAINSHAFT TOLERANCE | IN. | MM |
|---|---|---|
| Mainshaft runout | 0.000-0.003 | 0.00-0.08 |
| Mainshaft end play | none | none |
| 5th gear end play (axial) | 0.00-0.026 | 0.05-0.66 |
| 5th gear clearance (radial) | 0.0004-0.0015 | 0.010-0.038 |
| Main drive gear (6th) fit | 0.0009-0.0022 | 0.023-0.056 |

**Table 7-5. Countershaft Tolerance Specifications**

| COUNTERSHAFT TOLERANCE | IN. | MM |
|---|---|---|
| Countershaft runout | 0.000-0.003 | 0.00-0.08 |
| Countershaft end play | 0.001-0.003 | 0.025-0.08 |
| 1st gear end play (axial) | 0.002-0.023 | 0.05-0.58 |
| 1st gear clearance (radial) | 0.0004-0.0015 | 0.010-0.038 |
| 2nd gear end play (axial) | 0.002-0.40 | 0.05-1.02 |
| 2nd gear clearance (radial) | 0.0005-0.0012 | 0.0127-0.030 |
| 3rd gear end play (axial) | 0.002-0.042 | 0.05-1.07 |
| 3rd gear clearance (radial) | 0.0004-0.0015 | 0.010-0.038 |
| 4th gear end play (axial) | 0.001-0.028 | 0.03-0.71 |
| 4th gear clearance (radial) | 0.0004-0.0015 | 0.010-0.038 |

**Table 7-6. Shifter Dog Wear Limit Specifications**

| SHIFTER DOG | IN. | MM |
|---|---|---|
| 1st | 0.015-0.112 | 0.381-2.845 |
| 2nd | 0.021-0.136 | 0.533-3.454 |
| 3rd | 0.014-0.118 | 0.356-2.997 |
| 4th | 0.033-0.115 | 0.838-2.921 |
| 5th | 0.016-0.115 | 0.406-2.921 |
| 6th | 0.026-0.123 | 0.660-3.124 |

**Table 7-7. Side Door Bearing Specifications**

| SIDE DOOR BEARING | IN. | MM |
|---|---|---|
| Fit in side door (tight) | 0.0001-0.0014 | 0.0025-0.0356 |
| Fit on countershaft (tight) | -0.0007 | -0.018 |
| Fit on countershaft (loose) | +0.001 | +0.025 |
| Fit on mainshaft (tight) | -0.0007 | -0.018 |
| Fit on mainshaft (loose) | +0.001 | +0.025 |

**Table 7-8. Shifter Fork Specifications**

| SHIFTER FORKS | IN. | MM |
|---|---|---|
| Shifter fork to cam groove end play | 0.004-0.012 | 0.102-0.305 |
| Shifter fork to dog ring end play | 0.004-0.013 | 0.102-0.330 |
| First and second gear shift fork pad thickness wear limit | 0.258 | 6.55 |
| Third and fourth gear shift fork pad thickness wear limit | 0.198 | 5.03 |
| Fifth and sixth gear shift fork pad thickness wear limit | 0.258 | 6.55 |

## POWER FLOW

See Figure 7-1. The 6-speed transmission consists of two parallel shafts supporting six gears each. The longer, or mainshaft (7), also supports the clutch and serves as the input shaft. The shorter shaft is called the countershaft (8).

Each gear on the mainshaft is in constant mesh with a corresponding gear on the countershaft. Each of these six pairs of gears makes up a different speed in the transmission.

The transmission gears are divided into two types, gears that rotate with the shaft, and freewheeling gears that ride on bearings and spin freely on the shaft. A gear that rotates with the shaft always meshes with a freewheeling gear. Also, three dog rings are able to slide sideways on the shaft. These dog rings are used to change transmission speeds. The dogs, or projections, on the sides of the dog rings, 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 dog rings that slide on the guide hubs. The position of the shifter forks is controlled by a drum-shaped shifter cam located in the transmission side door.

### Neutral

Power is introduced to the transmission through the clutch. In neutral, with the clutch engaged, the mainshaft 1st, 2nd, 3rd and 4th gears are rotating, but no power is transferred to the countershaft since countershaft 1st, 2nd, 3rd and 4th gears are freewheeling gears.

### 1st Gear

When the transmission is shifted into first gear, the dog ring between countershaft 1st and 2nd, which rotates with the countershaft, engages countershaft 1st, which has been spinning freely on the countershaft driven by mainshaft 1st.

Now countershaft 1st is no longer freewheeling, but locked to the countershaft causing the countershaft and countershaft 6th to turn. Countershaft 6th transmits the power to the main drive gear and the sprocket as shown (1).

### 2nd Gear

Second gear is engaged when the dog ring between countershaft 1st and 2nd is shifted out of countershaft 1st and engages countershaft 2nd. This locks countershaft 2nd to the countershaft to complete the power flow as shown (2).

### 3rd Gear

Two shifter forks are used to make the shift from second to third. One fork moves the dog ring between countershaft 1st and 2nd to its neutral position, while another fork engages the dog ring between countershaft 3rd and 4th with countershaft 3rd. This locks countershaft 3rd to the countershaft to complete the power flow as shown (3).

### 4th Gear

Fourth gear is engaged when the dog ring between countershaft 3rd and 4th is shifted out of countershaft 3rd and engages countershaft 4th. This locks countershaft 4th to the countershaft to complete the power flow as shown (4).

### 5th Gear

Two shifter forks are used to make the shift from fourth to fifth. One fork moves the dog ring between countershaft 3rd and 4th to its neutral position, while another fork engages the dog ring between mainshaft 5th and 6th with mainshaft 5th. This locks mainshaft 5th to the mainshaft to complete the power flow as shown (5).

### 6th Gear

The shift from fifth to sixth gear occurs when the dog ring between mainshaft 5th and 6th is shifted out of mainshaft 5th, and is shifted directly into the main drive gear (6th gear). The main drive gear is locked to the mainshaft resulting in a direct one-to-one drive ratio from the clutch to the sprocket as shown (6).

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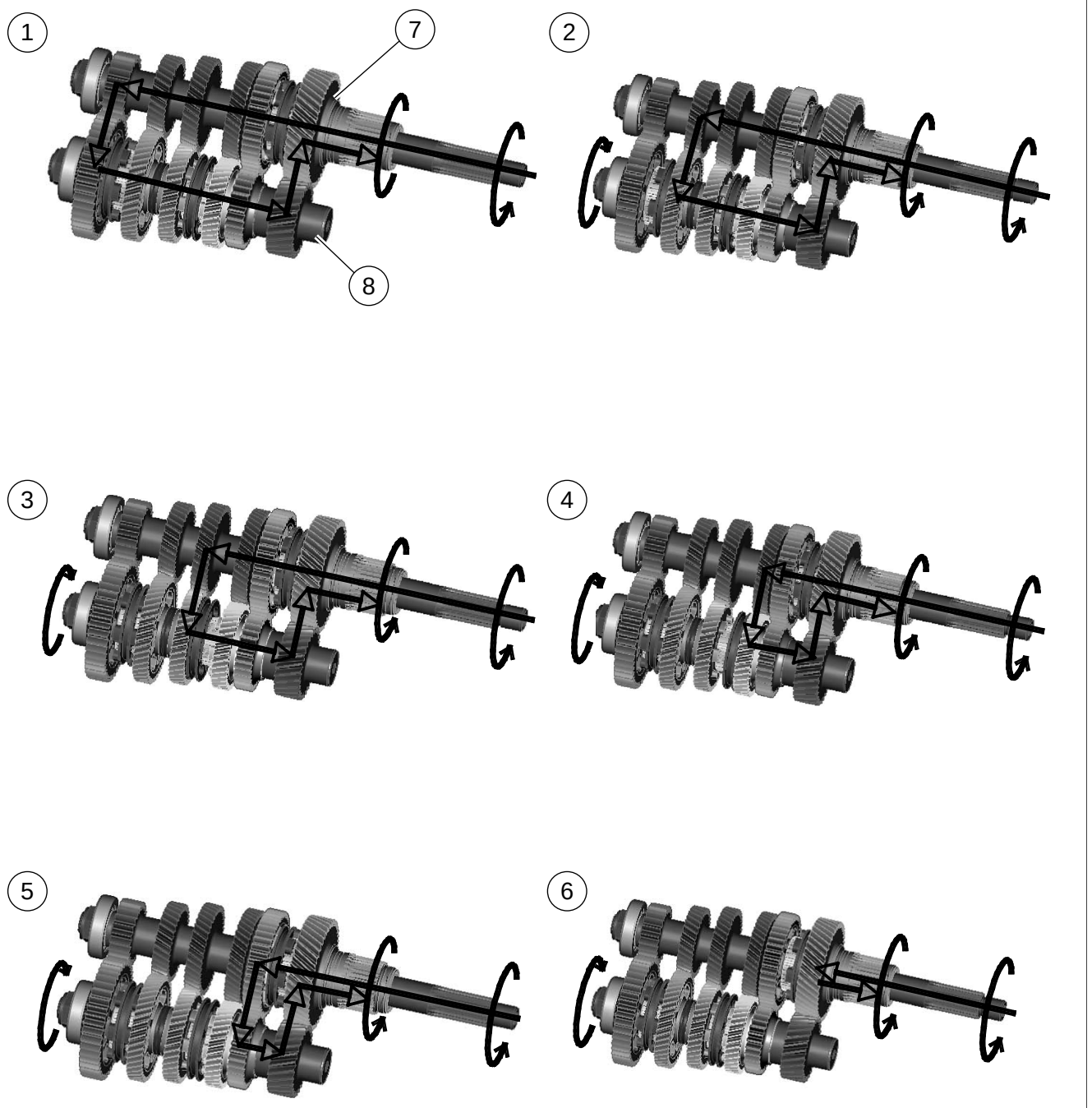



1. First gear
2. Second gear
3. Third gear
4. Fourth gear
5. Fifth gear
6. Sixth gear
7. Mainshaft
8. Countershaft

**Figure 7-1. Transmission Power Flow**

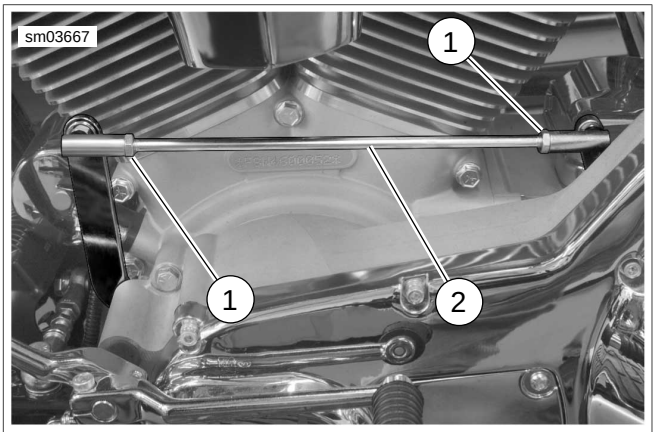
## SHIFTER ROD

The shifter rod 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 shifter rod.

*NOTE*

*To ensure proper gear engagement and avoid possible damage to transmission, the shift levers should not contact the footboard when shifting.*

1. See Figure 7-2. Remove locknut, lockwasher and flat washer to free front end of shifter rod from inner shift arm.
2. Loosen locknuts (1) and adjust rod (2) as necessary.
3. Install flat washer, lockwasher and locknut to fasten front end of shifter rod to inner shift arm.
4. Tighten locknuts (1) to 80-120 **in-lbs** (9.0-13.6 Nm).




**1. Locknut (2)**
**2. Shifter rod**

**Figure 7-2. Shifter Rod**

## REMOVAL AND DISASSEMBLY

1. Remove maxi-fuse.
2. Remove exhaust system if needed. See 4.18 EXHAUST SYSTEM.
3. Drain transmission. See 1.10 TRANSMISSION LUBRICANT, Transmission Lubrication: Touring Models.

*NOTE*

*Actuating the clutch hand lever after removing the six screws will help break the cover free.*

4. See Figure 7-3. Remove the six screws that hold the clutch release cover in place. Remove the clutch release cover and discard the gasket.
5. Add freeplay to clutch cable. See 1.11 CLUTCH, Adjustment.

**⚠WARNING**

**Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)**

6. See Figure 7-4. Remove retaining ring (4). Lift inner ramp (5) and ramp coupling (3) out of clutch release cover. Disconnect clutch cable end (2) from the ramp coupling (3).
7. Remove coupling (3) from inner ramp.
8. See Figure 7-5. Remove balls (4) and outer ramp (2).
9. Unscrew clutch cable fitting from clutch release cover.

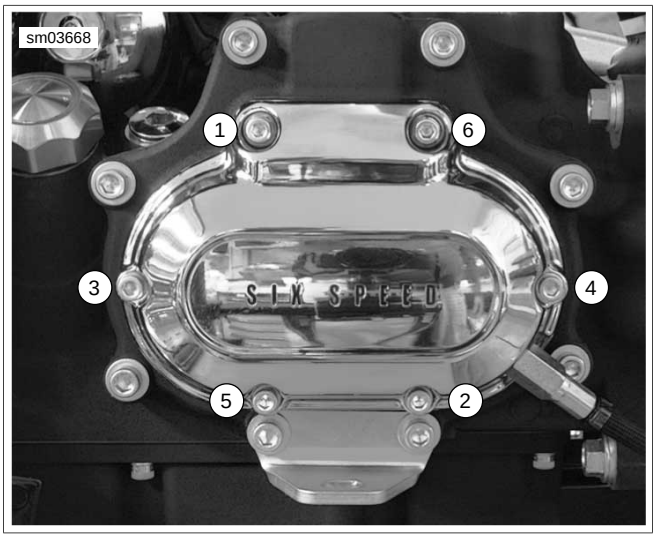
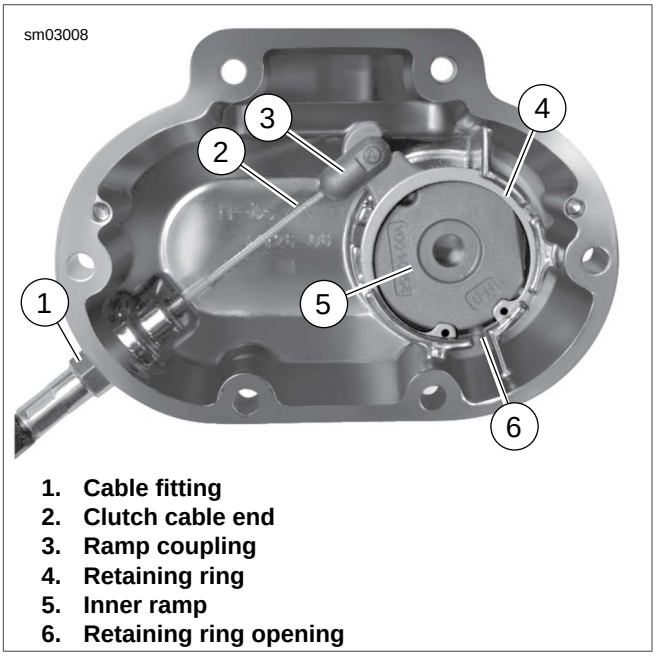
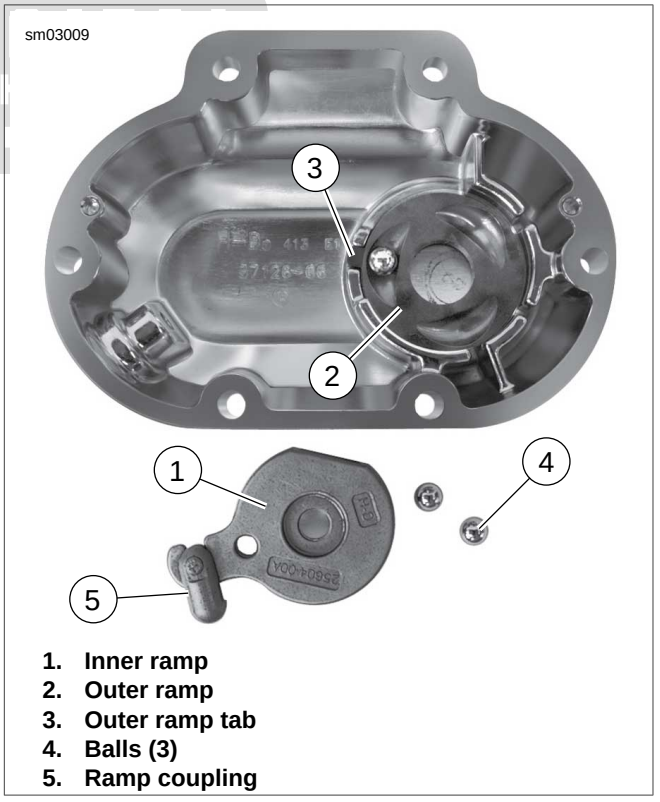



**Figure 7-3. Clutch Release Cover Torque Sequence (Short Screws at Locations 1 and 6)**




1. **Cable fitting**
2. **Clutch cable end**
3. **Ramp coupling**
4. **Retaining ring**
5. **Inner ramp**
6. **Retaining ring opening**

**Figure 7-4. Clutch Cable Connection**



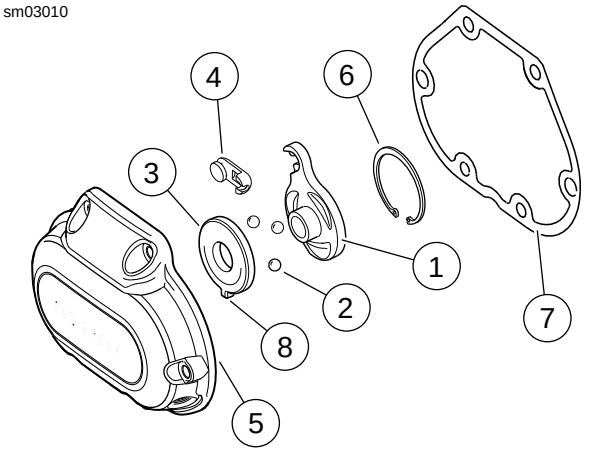

1. **Inner ramp**
2. **Outer ramp**
3. **Outer ramp tab**
4. **Balls (3)**
5. **Ramp coupling**

**Figure 7-5. Coupling and Ramp Assembly**

## CLEANING AND INSPECTION

1. See Figure 7-6. Wash the ball and ramp mechanism components in cleaning solvent.

2. Inspect the three balls (2) and ball socket surfaces on ramps (1, 3) for wear, pitting, surface breakdown and other damage. Replace damaged parts.
3. Check fit of the ramp coupling (4) on inner ramp (1). Replace both parts if there is excessive wear.
4. Inspect the retaining ring (6) for damage or distortion.
5. Check clutch cable end for frayed or worn ends. Replace cable if damaged or worn. Check cable fitting o-ring for cuts, tears or signs of deterioration.
6. Check the bore in the cover (5) where the ramps (1, 3) are retained. There should be no wear that would cause the ramps to cock, causing improper clutch adjustment.




1. **Inner ramp**
2. **Balls (3)**
3. **Outer ramp**
4. **Ramp coupling**
5. **Clutch release cover**
6. **Retaining ring**
7. **Gasket**
8. **Tab**

**Figure 7-6. Release Mechanism Assembly**

## ASSEMBLY AND INSTALLATION

*NOTE*

*Replace cable fitting o-ring if damaged or deformed.*

1. See Figure 7-4. Screw clutch cable fitting (1) into clutch release cover. Do not tighten at this time.
2. See Figure 7-6. Place outer ramp (3) with ball socket side up in clutch release cover. Be sure tab (8) is in clutch release cover slot.
3. Apply a multi-purpose grease to the balls and outer ramp sockets. Place a ball in each of the outer ramp sockets.
4. See Figure 7-4. Connect cable end to ramp coupling (3). Install coupling on inner ramp (5) and place inner ramp and coupling in position in clutch release cover.

**⚠WARNING**

**Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)**

*NOTE*

*Retaining ring opening (6) must be centered above the break in the ribbing at bottom of the clutch release cover.*

5. Install retaining ring (4).
6. Verify that two dowel pins are in place on transmission side door flange. Place a **new** gasket on dowel pins.

*NOTE*

*See Figure 7-3. Clutch release cover screws in positions (1) and (6) are shorter than the others.*

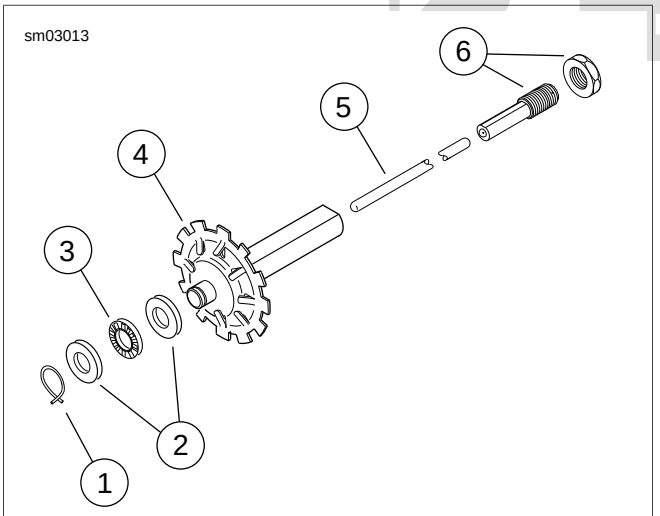
7. See Figure 7-3. Install clutch release cover. Tighten screws to 84-108 **in-lbs** (9.5-12.2 Nm) in sequence shown.
8. Tighten clutch cable fitting to 90-120 **in-lbs** (10.2-13.6 Nm).
9. Fill transmission to proper level with fresh transmission fluid. See 1.10 TRANSMISSION LUBRICANT, Transmission Lubrication: Touring Models.
10. Adjust clutch cable. See 1.11 CLUTCH.
11. Install exhaust system if removed. See 4.18 EXHAUST SYSTEM.
12. Install maxi-fuse.

## REMOVAL

*NOTE*

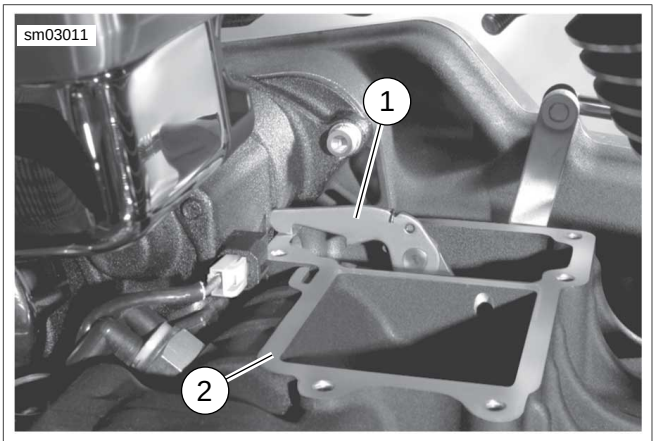
*Leave the transmission case in the frame unless the case itself requires replacement. For illustration purposes, some photographs may show the case removed. For information on case removal see 7.7 TRANSMISSION CASE.*

1. Remove exhaust system. See 4.18 EXHAUST SYSTEM.
2. Remove primary chaincase cover, clutch assembly, primary chain, compensating sprocket assembly and primary chaincase. See 6.4 PRIMARY CHAINCASE HOUSING, Removal.
3. Remove the bearing inner race from the transmission mainshaft. See 6.4 PRIMARY CHAINCASE HOUSING, Mainshaft Bearing Inner Race.
4. Remove the clutch release cover from the transmission side door. See 7.4 CLUTCH RELEASE COVER, Removal and Disassembly.
5. See Figure 7-7. Remove oil slinger assembly from mainshaft. Insert long rod through mainshaft bore and remove push rod.
6. Remove transmission top cover, leaving the cover gasket in place.
7. See Figure 7-8. Rotate the shifter pawl forward enough to raise the free end and place shifter cam pawl on top cover gasket.




1. **Retaining ring**
2. **Thrust washer (2)**
3. **Throw out bearing**
4. **Oil slinger**
5. **Push rod**
6. **Push rod end, left side**

**Figure 7-7. Push Rod Assembly**




1. **Shifter pawl**
2. **Top cover gasket surface**

**Figure 7-8. Set Shifter Pawl on Gasket**

*NOTES*

- *Remove and install sprocket nut only while transmission is in vehicle frame. Trying to remove and install sprocket nut with transmission in transmission stand may cause damage to transmission or stand.*
- *The main drive gear bearing and retainer must be replaced if the main drive gear is removed. The bearing will be damaged during the removal procedure.*

8. If main drive gear is to be removed, see 7.6 MAIN DRIVE GEAR AND BEARING, Removal.
9. Cover mainshaft clutch hub splines with tape to prevent the splines damaging the main drive gear bearings.
10. See Figure 7-10. Remove the transmission side door mounting hardware. Remove exhaust bracket, if equipped.

*NOTE*

*See Figure 7-9. Never attempt to remove side door by tapping on shafts from opposite side. Tapping them with a hammer will damage the side door bearings. If the side door sticks or binds on the ring dowels, pry open using indents at each side of side door.*

11. Pry the side door loose and remove side door, mainshaft, countershaft and shifter cam from transmission case as an assembly. Discard gasket.

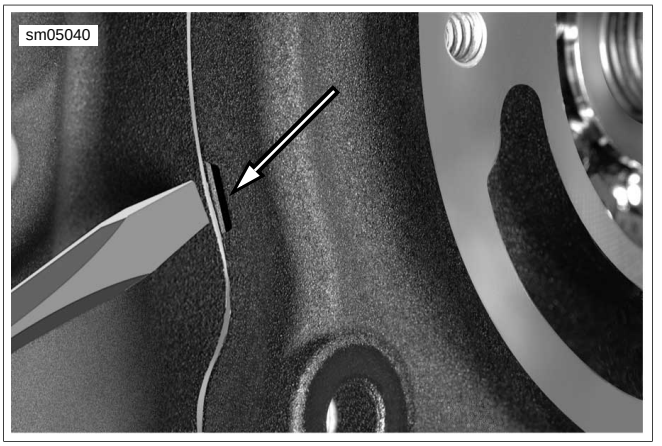
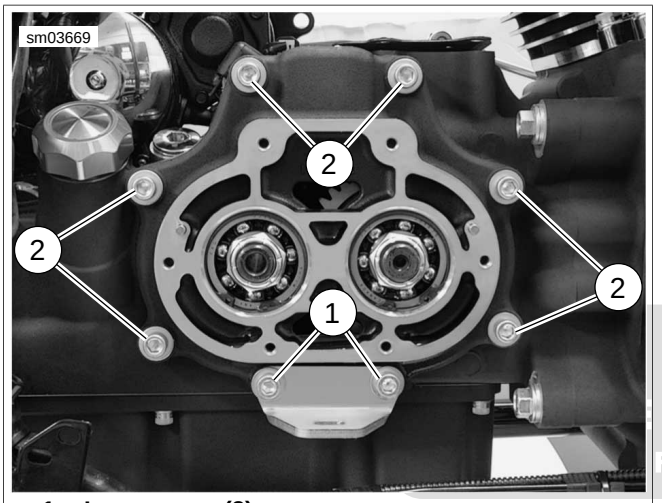



**Figure 7-9. Side Door Pry Point**




1. **Long screw (2)**
2. **Short screw (6)**

**Figure 7-10. Side Door hardware**

## DISASSEMBLY

| PART NUMBER | TOOL NAME |
|---|---|
| J-5586A | TRANSMISSION SHAFT RETAINING RING PLIERS |

### Shifter Cam/Shifter Forks

1. See Figure 7-11. With side door on end (shafts pointing upward), remove shift fork shafts using easy-out screw extractor (14) (non-flute design). Shafts have slight interference fit. Shafts can be reused, do not damage end of shaft. Mark end of shaft so same end can be reinserted during reassembly.

*NOTE*

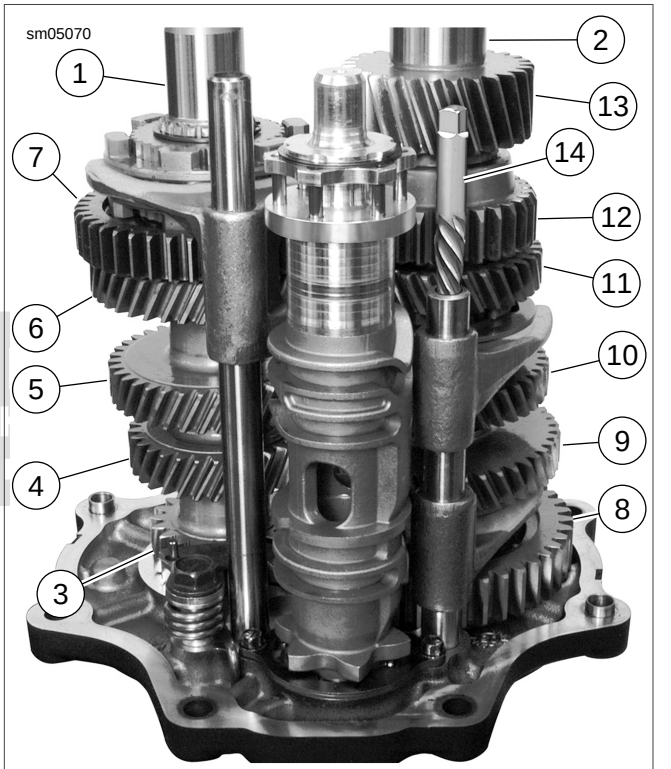
*Shifter shafts have a slight interference fit. Shifter shafts can be reused, so avoid damaging end of shaft. Mark shafts so they can be reinstalled in original position during assembly.*

2. Remove shift forks from dog rings.
3. See Figure 7-12. Remove lock plate fasteners (3) from lock plate (2). Discard fasteners.
4. See Figure 7-13. Insert screwdriver and gently pry back detent arm (4) to remove detent spring (3) tension from shift cam (5). Remove shift cam.
5. If servicing detent assembly, remove detent screw (2), detent arm (4), sleeve and detent spring (3). Discard detent screw.

*NOTE*

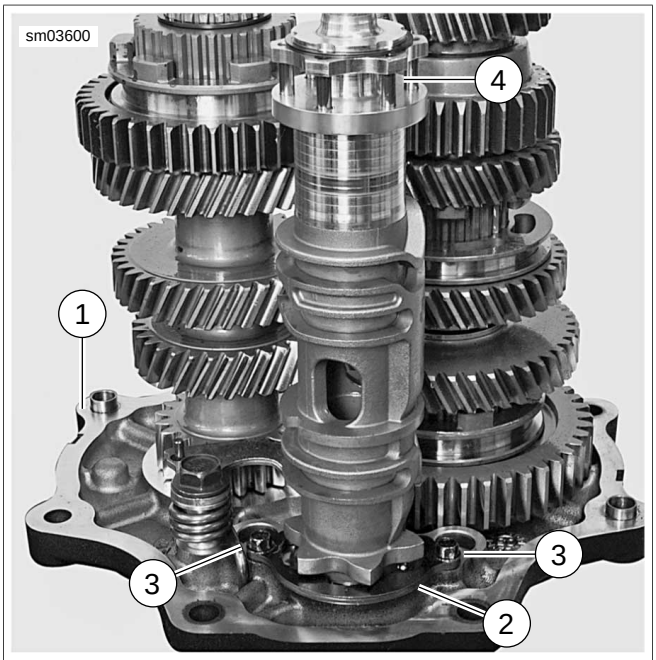
*Although many transmission parts can be installed in either direction, make sure used parts are installed in same direction as when removed to prolong usable life.*

6. See Figure 7-14. Using dog rings, lock two gears in place. Temporarily place transmission assembly into transmission case.
7. Remove mainshaft and countershaft locknuts.
8. Remove transmission assembly from transmission case.



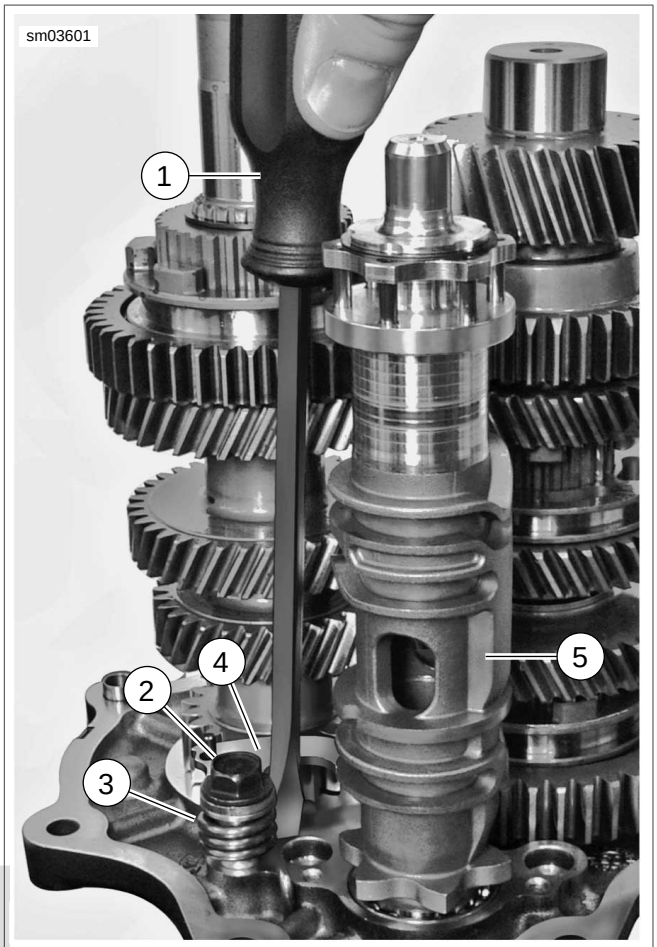

1. **Mainshaft**
2. **Countershaft**
3. **Mainshaft 1st gear**
4. **Mainshaft 2nd gear**
5. **Mainshaft 3rd gear**
6. **Mainshaft 4th gear**
7. **Mainshaft 5th gear**
8. **Countershaft 1st gear**
9. **Countershaft 2nd gear**
10. **Countershaft 3rd gear**
11. **Countershaft 4th gear**
12. **Countershaft 5th gear**
13. **Countershaft 6th gear**
14. **Screw extractor**

**Figure 7-11. Gear Set**



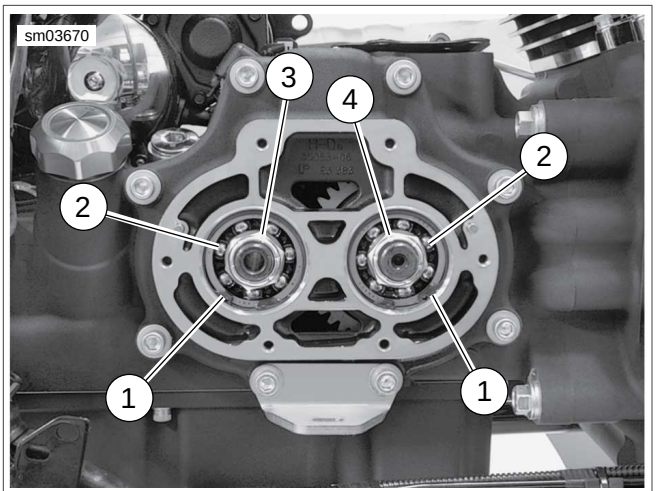

1. Side door
2. Lock plate
3. Lock plate fastener (2)
4. Shift cam

**Figure 7-12. Shift Drum**




1. Screwdriver
2. Detent fastener
3. Detent spring
4. Detent arm
5. Shift cam

**Figure 7-13. Detent Assembly**




1. Retaining ring (2)
2. Bearing (2)
3. Mainshaft locknut
4. Countershaft locknut

**Figure 7-14. Side Door Locknuts**

## Mainshaft

**WARNING**

**Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)**

*NOTE*

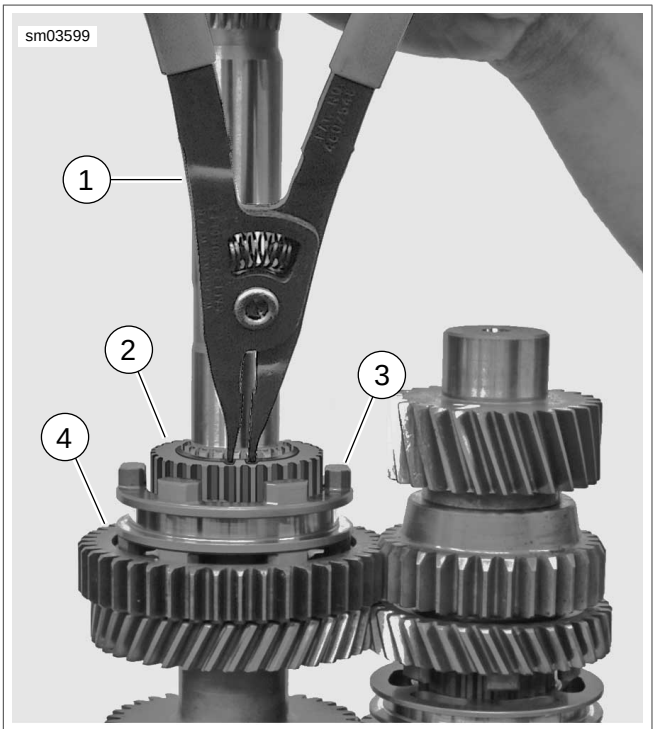
*As mainshaft 4th gear, 3rd gear, 2nd gear and 1st gear are an integral part of the shaft, damage to any gear requires mainshaft replacement.*

1. See Figure 7-15. Using TRANSMISSION SHAFT RETAINING RING PLIERS (Part No. J-5586A), remove retaining ring. Remove dog ring (3), guiding hub (2), mainshaft 5th gear (4) and bearing.

*NOTE*

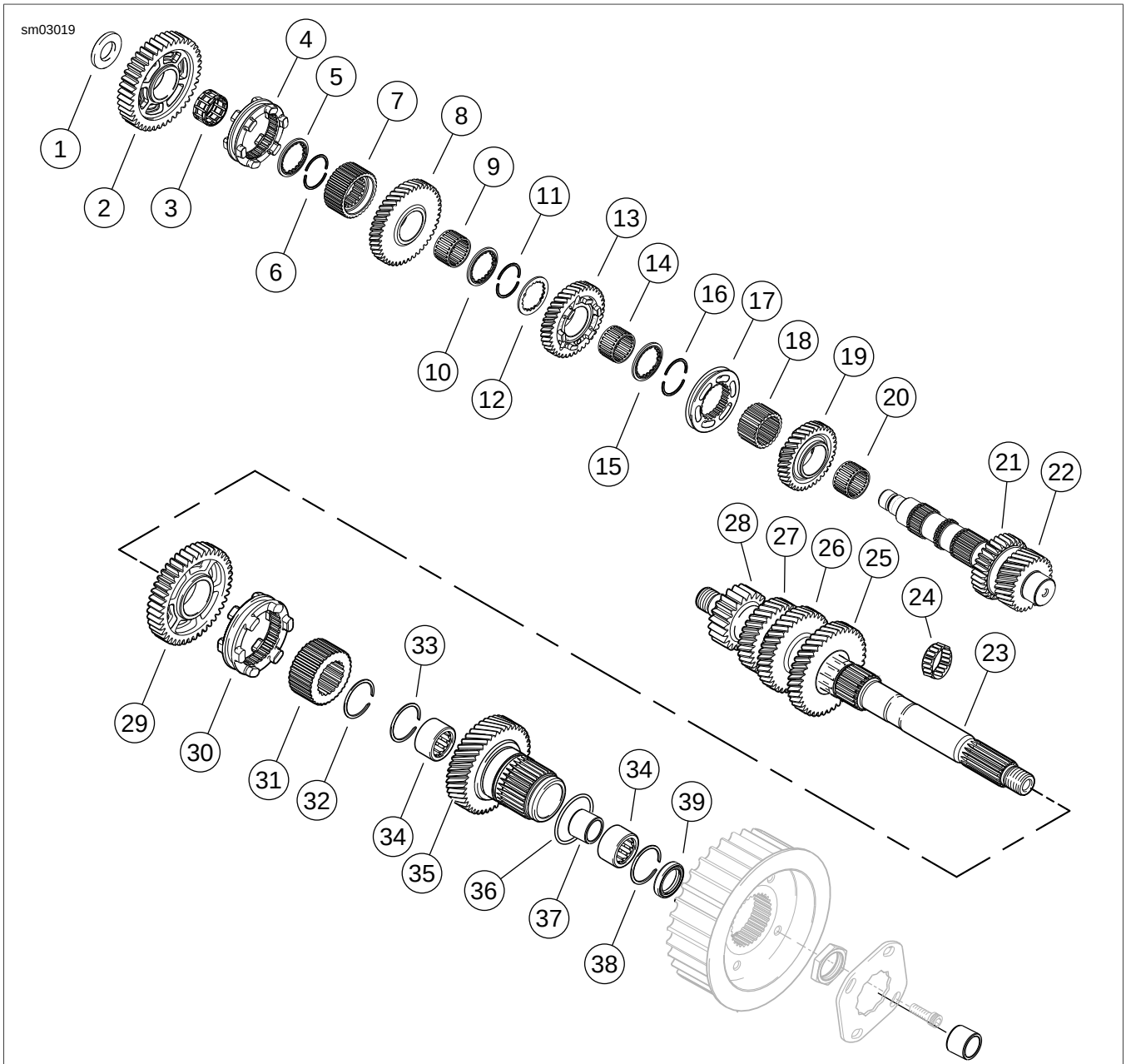
*Do not press directly on the end of the mainshaft. Place a spacer such as a washer between the end of the mainshaft and the press ram.*

2. Place transmission assembly in arbor press and press mainshaft out of side door bearings.




1. **Retaining ring pliers**
2. **Guiding hub**
3. **Dog ring**
4. **Mainshaft 5th gear**

**Figure 7-15. Mainshaft Retaining Ring**




1. Spacer
2. Countershaft 1st gear
3. Bearing
4. Dog ring
5. Lock ring
6. Securing segment (2)
7. Guiding hub
8. Countershaft 2nd gear
9. Bearing
10. Lock ring
11. Securing segment (2)
12. Internal spline washer
13. Countershaft 3rd gear
14. Bearing
15. Lock ring
16. Securing segment (2)
17. Dog ring
18. Guiding hub
19. Countershaft 4th gear
20. Bearing
21. Countershaft 5th gear (part of countershaft)
22. Countershaft 6th gear (part of countershaft)
23. Mainshaft
24. Bearing
25. Mainshaft 4th gear
26. Mainshaft 3rd gear
27. Mainshaft 2nd gear
28. Mainshaft 1st gear
29. Mainshaft 5th gear
30. Dog ring
31. Guiding hub
32. Retaining ring
33. Retaining ring
34. Main drive gear bearing (2)
35. Main drive gear
36. O-ring
37. Bearing spacer
38. Retaining ring
39. Oil seal

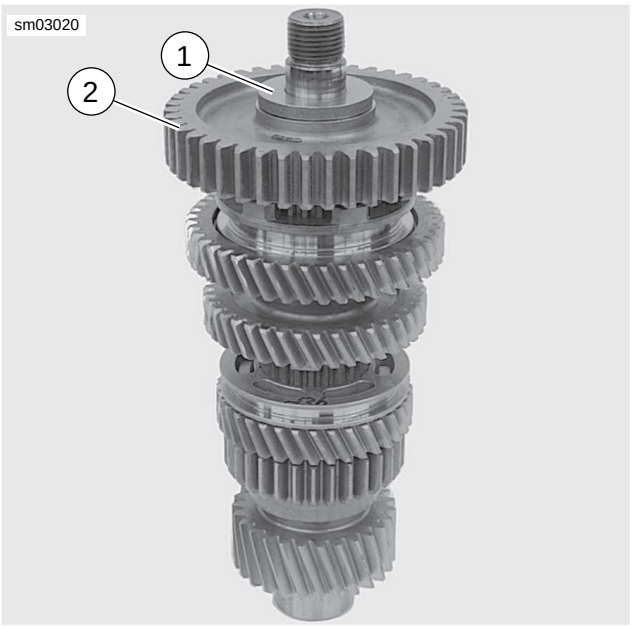
**Figure 7-16. Mainshaft and Countershaft Assembly**

## Countershaft

*NOTES*

- *If removing countershaft without removing the mainshaft, hold countershaft 3rd and 4th gear shift dog up while pressing countershaft out of side door bearings.*
- *Do not press directly on the end of the countershaft. Place a spacer such as a washer between the end of the countershaft and the press ram.*

1. Press countershaft out of side door bearings.
2. See 7.5 TRANSMISSION ASSEMBLY, Disassembly, Replacing Side Door Bearings for side door bearing replacement.
3. See Figure 7-17. Remove washer (1), countershaft 1st gear (2) and bearing.
4. See Figure 7-18. Remove countershaft 2nd gear lock ring.
5. See Figure 7-19. Remove securing segments (1). Remove dog ring (3), guiding hub (2), countershaft 2nd gear (4) and bearing.




1. **Washer**
2. **Countershaft 1st gear**

**Figure 7-17. Countershaft 1st Gear**

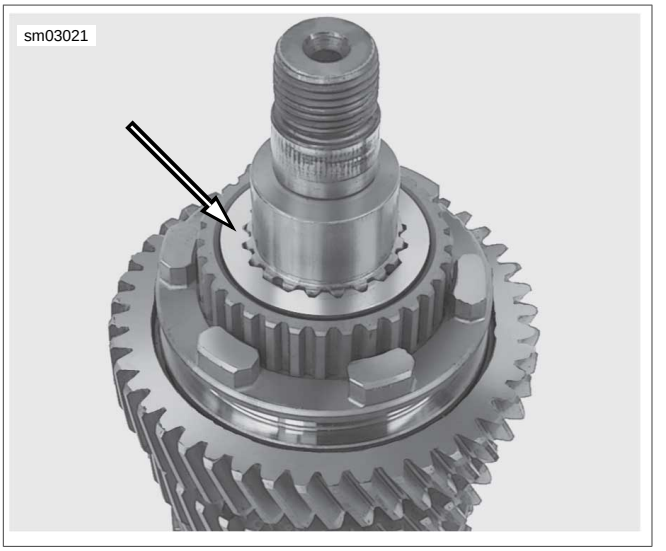
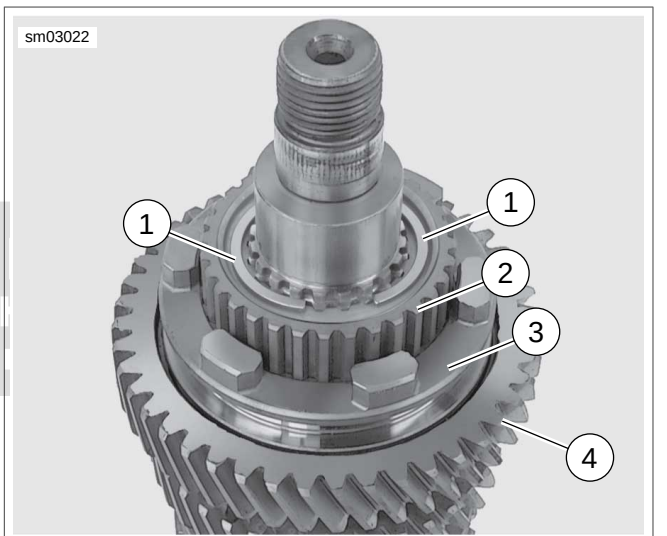



**Figure 7-18. Lock Ring**




1. **Securing segment**
2. **Guiding hub**
3. **Dog ring**
4. **Countershaft 2nd gear**

**Figure 7-19. Securing Segment**

6. See Figure 7-20. Remove countershaft 3rd gear lock ring.
7. See Figure 7-21. Remove securing segments (1), internal spline washer (2), countershaft 3rd gear (3) and bearing.
8. See Figure 7-22. Remove 4th gear lock ring (1), securing segments, dog ring (3), guiding hub (2), and countershaft 4th gear (4) and bearing.

*NOTE*

*As countershaft 5th gear and 6th gear are an integral part of the shaft, damage to either gear requires countershaft replacement.*

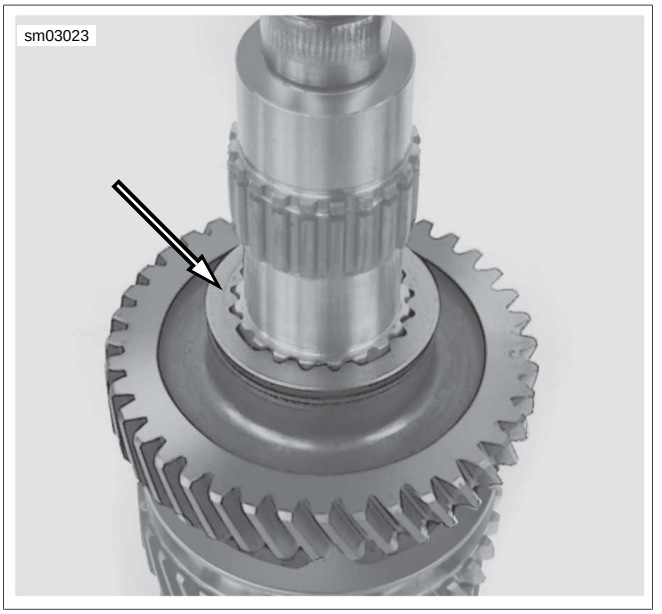
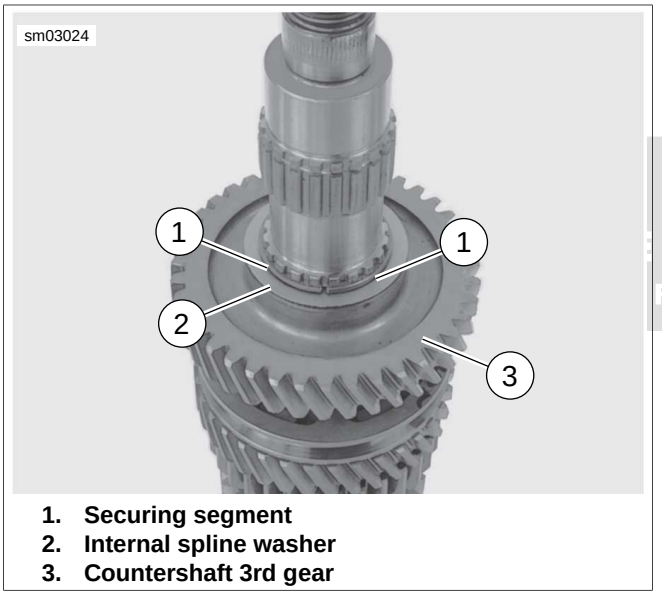
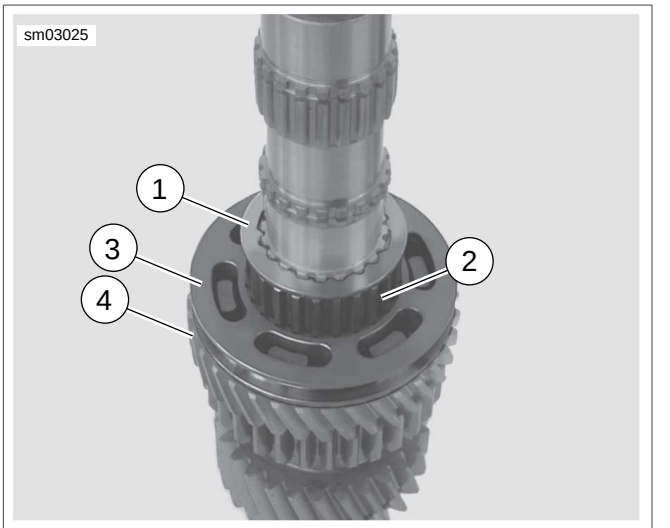



**Figure 7-20. Third Gear Lock Ring**




1. **Securing segment**
2. **Internal spline washer**
3. **Countershaft 3rd gear**

**Figure 7-21. Countershaft Third Gear**




1. **4th gear lock ring**
2. **Guiding hub**
3. **Dog ring**
4. **Countershaft 4th gear**

**Figure 7-22. Countershaft Assembly**

## Replacing Side Door Bearings

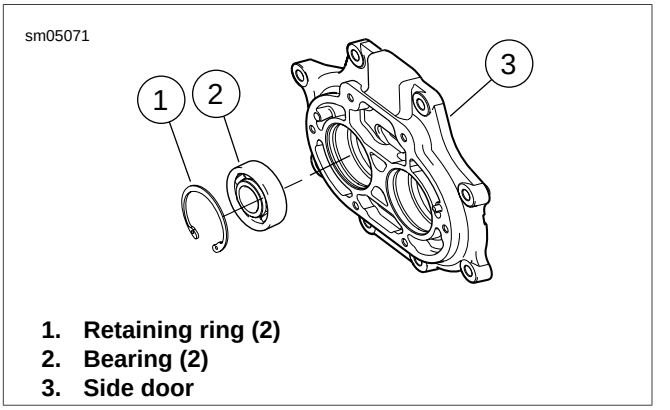
*NOTE*

*Always replace side door bearing if the shaft is pressed out.*

**WARNING**

**Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)**

1. See Figure 7-23. Remove the retaining rings (2).
2. Press the bearings out of the side door.




1. **Retaining ring (2)**
2. **Bearing (2)**
3. **Side door**

**Figure 7-23. Side Door Bearings**

## CLEANING AND INSPECTION

**WARNING**

**Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)**

1. Clean all parts with solvent. Blow parts dry with low pressure compressed air.
2. Check gear teeth for damage. If gears are pitted, scored, rounded, cracked or chipped, they should be replaced.
3. Inspect the engaging dogs and pockets on the dog rings. Replace the dog rings if dogs and/or pockets are rounded, battered or chipped.
4. Inspect guiding hubs. Replace guiding hubs if splines are rounded, battered or chipped.
5. Inspect shift fork shafts. Replace if bent or damaged.
6. Inspect shift forks for wear or signs of overheating. Replace a shift fork if it is excessively worn or shows signs of overheating.
7. See Figure 7-24. Using a small carpenter's square, verify the shift forks are square. If shift fork does not rest directly on the square, then it is bent and must be replaced.
8. Inspect shift drum and bearing. Replace shift drum assembly if drum or bearing are damaged.
9. Clean shift cam lock plate mounting holes in transmission bearing housing.
10. Inspect side door bearings. Bearings must rotate freely without drag. Replace the bearings if pitted, grooved or if the shafts were removed.

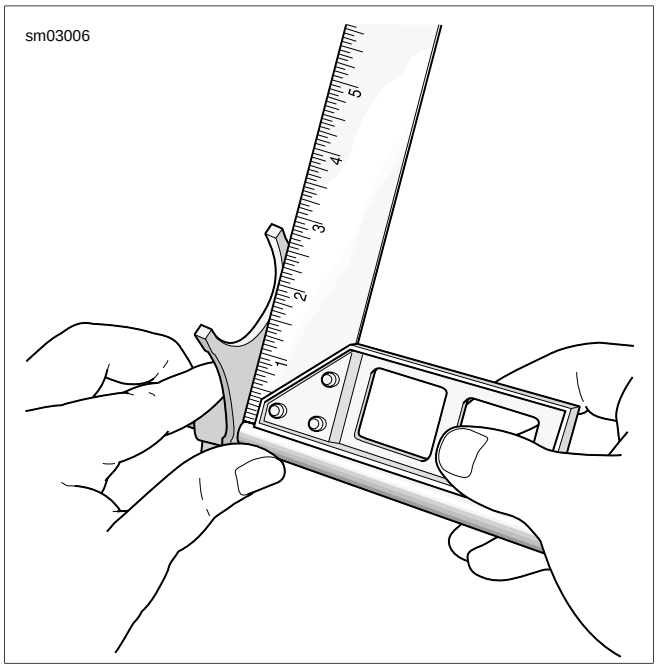



**Figure 7-24. Checking Fork**

## ASSEMBLY

| PART NUMBER | TOOL NAME |
|---|---|
| J-5586A | TRANSMISSION SHAFT RETAINING RING PLIERS |

### Installing Side Door Bearings

*NOTES*

- *Always replace side door bearing if the shaft was pressed out.*
- *To perform the next step, you must use a plate for support or the bearing door will be damaged.*
- *When pressing **new** bearings into side door, press on the outside diameter of the bearing side with the numbers stamped on it.*

1. Support the door from the opposite side at the bearing bores with a flat plate.
2. Position **new** bearing over bore with number side UP.
3. Using a press, apply pressure to the outer diameter of the bearing until the bearing is seated in the bore.

**WARNING**

**Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)**

4. See Figure 7-23. Install beveled retaining ring (2) with the flat side next to the bearing.

### Countershaft

*NOTES*

- *Replace retaining ring and all gear roller bearings with **new** parts during assembly. Lubricate needle bearings and races with clean transmission lubricant before installation.*
- *Install securing segments so the side with the rounded edge is facing up and the side with the straight edge is down. Be sure segments fully engage grooves in countershaft.*
- *One side of the lock rings have a stepped face. The stepped face always faces the securing segments.*

1. See Figure 7-22. Install **new** needle bearing, countershaft 4th gear (4), guiding hub (2), dog ring (3) securing segments and internal splined washer (1) on countershaft.
2. See Figure 7-21. Install **new** needle bearing, countershaft 3rd gear (3), internal spline washer (2) and securing segments (1).
3. See Figure 7-20. Place countershaft 3rd gear lock ring over securing segments.

*NOTES*

- *In next step, the side of the guiding hub with the deeper counterbore, faces countershaft 2nd gear.*
- *Countershaft 2nd gear bearing is wider than other bearings on the countershaft*

4. See Figure 7-19. Install **new** needle bearing, countershaft 2nd gear (4), guiding hub (2), dog ring (3) and securing segments (1) on countershaft.
5. See Figure 7-18. Place lock ring over securing segments.
6. See Figure 7-17. Install **new** needle bearing, countershaft 1st gear (2) and washer (1).

*NOTES*

- *If installing countershaft only, hold countershaft 3rd and 4th gear shift dog up while pressing side door bearing on to countershaft.*
- *Failure to press on inner bearing races while pressing bearings on the shafts will damage the bearings.*

7. See Figure 7-25. Place countershaft in an arbor press supporting countershaft 6th gear. Using a suitable socket, press on inner bearing race until side door bearing contacts countershaft 1st gear washer.


**Figure 7-25. Installing Countershaft**

## Mainshaft

*NOTES*

- *Failure to press on inner bearing race while pressing bearing on the shaft will damage the bearing.*
- *See Figure 7-26. Hold dog ring so that it is engaged with countershaft 3rd gear during the press procedure. If press is performed with dog ring engaged with countershaft 4th gear, contact with mainshaft 4th gear will push shafts out of alignment and result in possible bearing and gear damage.*

1. Place mainshaft in an arbor press, supporting mainshaft 4th gear.
2. Place rear side door bearing over mainshaft. Using a suitable socket, press on inner bearing race until side door bearing contacts mainshaft 1st gear.
3. See Figure 7-15. With side door on end (shafts pointing upward), install **new** bearing and mainshaft 5th gear (4).
4. Be sure guiding hub counterbore is facing mainshaft 5th gear and install guiding hub (2) and dog ring (3).
5. Install **new** retaining ring using TRANSMISSION SHAFT RETAINING RING PLIERS (Part No. J-5586A) (1).

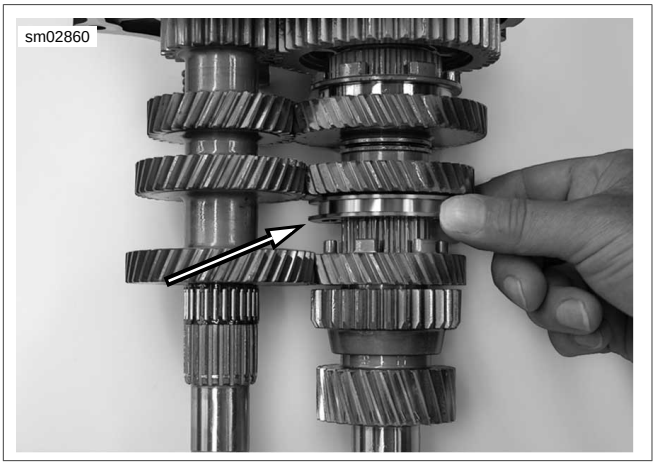



**Figure 7-26. Raise and Hold Dog Ring**

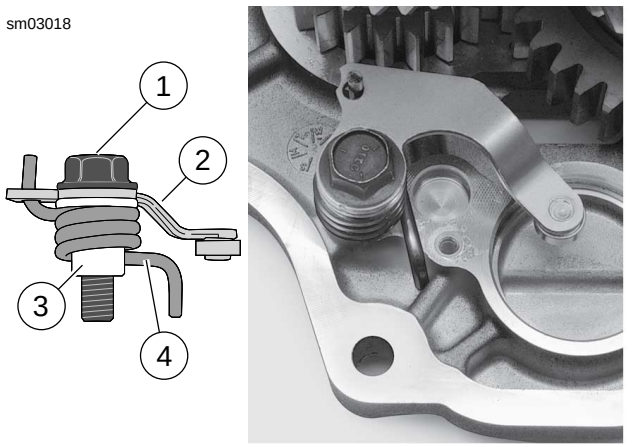
## Shifter Cam/Shifter Forks

1. Using dog rings, lock two gears in place. Temporarily place transmission assembly into transmission case.
2. Install **new** nuts on mainshaft and countershaft. Tighten nuts to 45-55 ft-lbs (61.0-74.6 Nm).
3. Remove transmission assembly from case.
4. Place side door on bench with shafts pointing upward.
5. If removed, install detent arm assembly:
   a. See Figure 7-27. Clean detent screw mounting hole in transmission side door.
   b. Assemble **new** detent screw, detent arm, sleeve and detent spring. Mount detent assembly in bearing housing as shown. Make certain to orient spring and detent arm as shown in the figure. Tighten screw to 120-150 **in-lbs** (13.6-17.0 Nm).
6. See Figure 7-28. Using screwdriver (1), pull detent arm back to allow installation of shift cam assembly.
7. Install shift cam assembly (5).
8. See Figure 7-29. Install lock plate (2) and **new** lock plate fasteners (3). Tighten fasteners to 57-63 **in-lbs** (6.4-7.1 Nm).
9. See Figure 7-30. The forks are different from each other and are identified as shown.
10. See Figure 7-31. Insert shifter fork (2) into the slot of the dog ring in between mainshaft 5th and 6th gear. Slide long shift shaft through 5th and 6th gear shifter fork and install shaft in hole in side door.
11. Insert shifter fork (6) into the slot of the dog ring in between countershaft 3rd and 4th gear. Insert shifter fork (9) into the slot of the dog ring in between countershaft 1st and

2nd gear. Slide short shift shaft through countershaft shifter forks and install shaft in hole in side door.

*NOTE*

*If main drive gear was removed, install it now. See 7.6 MAIN DRIVE GEAR AND BEARING.*

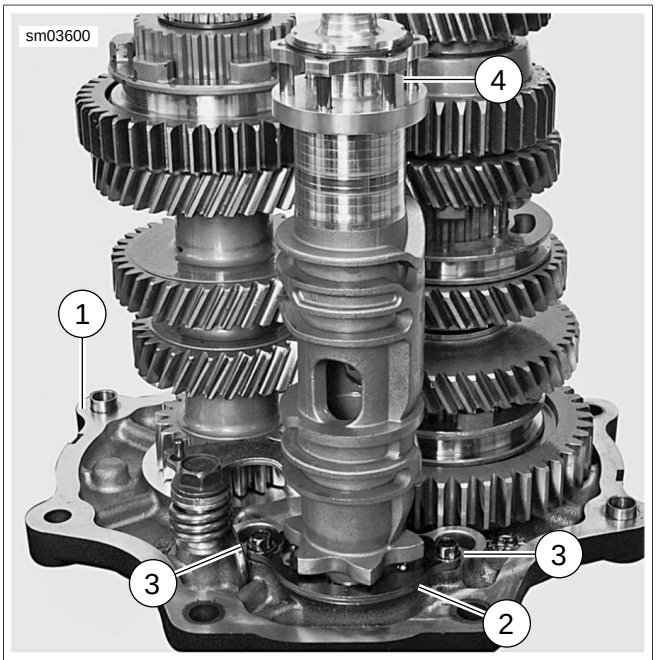



1. **Detent screw**
2. **Detent arm**
3. **Sleeve**
4. **Detent spring**

**Figure 7-27. Detent Assembly**

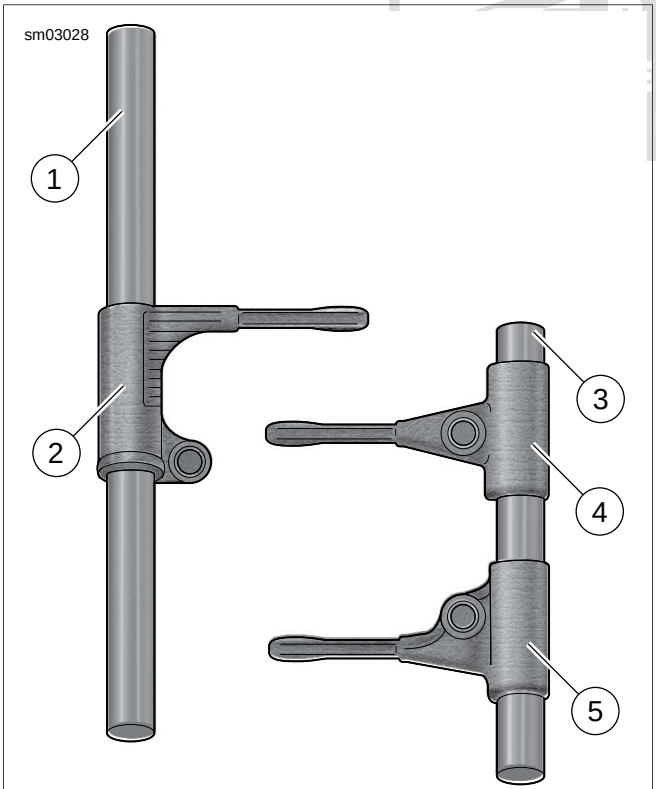

1. **Screwdriver**
2. **Detent fastener**
3. **Detent spring**
4. **Detent arm**
5. **Shift cam**

**Figure 7-28. Detent Assembly**



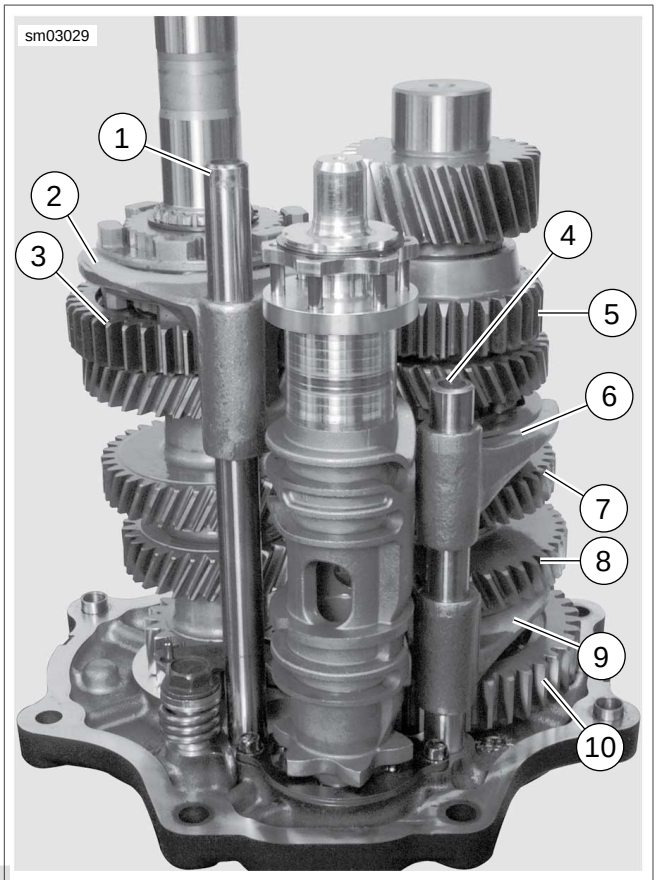

1. **Side door**
2. **Lock plate**
3. **Lock plate fastener (2)**
4. **Shift cam**

**Figure 7-29. Shift Drum**




1. **Long shift shaft**
2. **5th and 6th gear shifter fork**
3. **Short shift shaft**
4. **3rd and 4th gear shifter fork**
5. **1st and 2nd gear shifter fork**

**Figure 7-30. Shifter Forks and Shafts**




1. **Long shift shaft**
2. **5th and 6th gear shifter fork**
3. **5th gear**
4. **Short shift shaft**
5. **4th gear**
6. **3rd and 4th gear shifter fork**
7. **3rd gear**
8. **2nd gear**
9. **1st and 2nd gear shifter fork**
10. **1st gear**

**Figure 7-31. Transmission Gears and Shifter Forks**

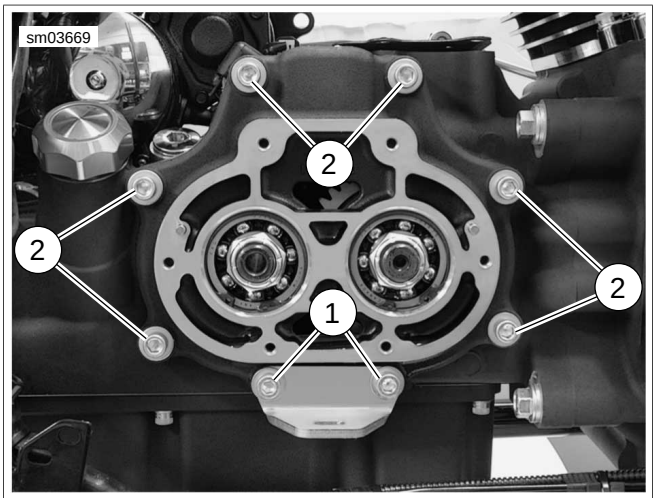
## INSTALLATION

1. Cover mainshaft clutch hub splines with tape to prevent the splines damaging the main drive gear oil seal.
2. Verify that two ring dowels are in place on side door flange. place a **new** gasket on the ring dowels.
3. Apply clean transmission lubricant to the main drive gear bearings.

*NOTE*

*Be sure the transmission filler plug/dipstick is removed before installing transmission assembly. Contact with the filler plug/dipstick will prevent installation of transmission assembly.*

4. Install the transmission assembly in the transmission case with a **new** gasket.
5. See Figure 7-32. Install exhaust bracket using long screws (1). Install remaining side door screws (2).
6. Figure 7-33. Tighten all side door hardware in the sequence shown to 13-18 ft-lbs (17.6-24.4 Nm).




1. **Long screw (2)**
2. **Short screw (6)**

**Figure 7-32. Side Door hardware**

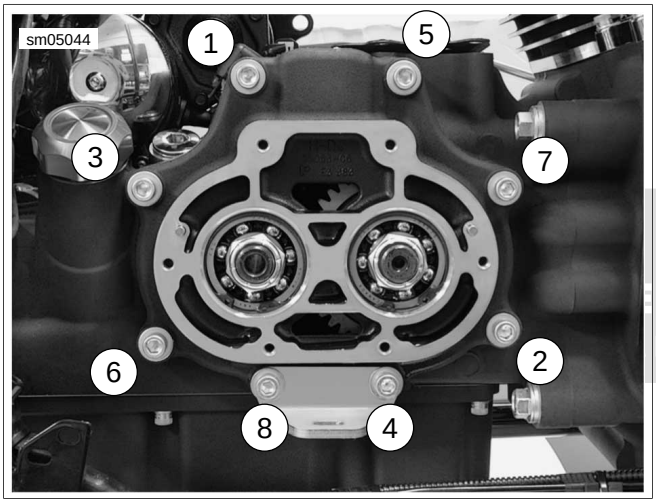
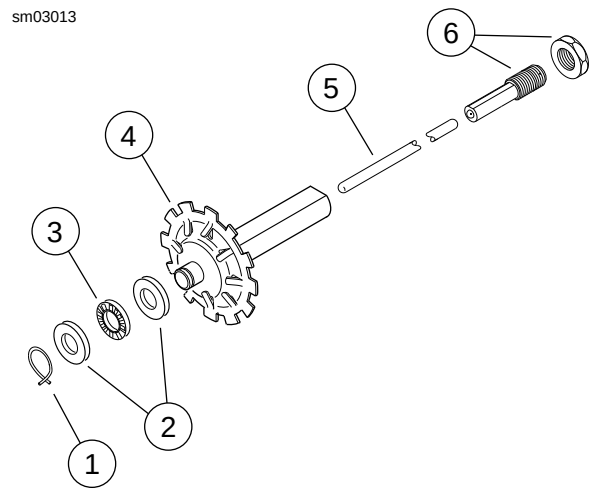



**Figure 7-33. Side Door Torque Sequence**

7. Install mainshaft bearing inner race. See 6.6 TRANSMISSION SPROCKET.
8. See Figure 7-34. Install push rod assembly (items 2-5) in mainshaft hole. Secure with **new** retaining ring (1) if removed.
9. Install the clutch release cover, using a **new** gasket. See 7.4 CLUTCH RELEASE COVER.
10. Rotate shifter cam pawl forward and lower into place on shift cam. Install **new** transmission top cover gasket. Install transmission top cover. Tighten fasteners to 84-132 **in-lbs** (9.5-14.9 Nm).
11. Install vent hose to top cover fitting, if removed.
12. Install transmission sprocket nut. See 6.6 TRANSMISSION SPROCKET.
13. Install primary chaincase, clutch assembly and primary cover. See 6.2 PRIMARY CHAINCASE COVER, Installation.
14. Replace o-ring on plug. Clean and install transmission drain plug. Tighten to 14-21 ft-lbs (19.0-28.5 Nm).
15. Fill transmission to proper level with fresh transmission fluid. See 1.10 TRANSMISSION LUBRICANT.
16. Install exhaust system. See 4.18 EXHAUST SYSTEM.




1. **Retaining ring**
2. **Thrust washer (2)**
3. **Throw out bearing**
4. **Oil slinger**
5. **Push rod**
6. **Push rod end, left side**

**Figure 7-34. Push Rod Assembly**

## REMOVAL

| PART NUMBER | TOOL NAME |
|---|---|
| HD-35316-10 | PILOT |
| HD-35316-11 | RECEIVER CUP |
| HD-35316-3A | CROSS PLATE |
| HD-35316-4A | 8 IN. BOLT |
| HD-35316-5 | 12 IN. BOLT |
| HD-35316-7 | WASHER |
| HD-35316-9 | BEARING DRIVER |
| HD-35316-C | MAIN DRIVE GEAR/BEARING REMOVER AND INSTALLER |
| HD-95637-10 | LONG BOLTS |
| HD-95637-46B | WEDGE ATTACHMENT |
| RS-25100-200 | NICE BEARING |
| RS-25100-200 | NICE BEARING |

*NOTE*

*Leave the transmission case in the frame unless the case itself must be replaced. For illustration purposes, some photographs may show the case removed.*

1. Remove the exhaust system. See 4.18 EXHAUST SYSTEM.
2. Remove the primary chaincase cover, clutch assembly, primary chain, compensating sprocket, and primary chaincase. See 6.4 PRIMARY CHAINCASE HOUSING.
3. Remove the bearing inner race from the transmission mainshaft. See 6.4 PRIMARY CHAINCASE HOUSING, Mainshaft Bearing Inner Race.
4. Remove the transmission side door. See 7.5 TRANSMISSION ASSEMBLY.

**CAUTION**

**Failure to use Main Drive Gear Remover and Installer can cause premature failure of bearing and related parts. (00540b)**

*NOTE*

*Main drive gear and bearing can be removed with the transmission case in the frame after removing door assembly. Use MAIN DRIVE GEAR/BEARING REMOVER AND INSTALLER (Part No. HD-35316-C).*

5. Remove retaining ring.

*NOTES*

- *The main drive gear bearing and retaining ring must be replaced if the main drive gear is removed. The bearing will be damaged during the removal procedure.*
- *The CROSS PLATE (Part No. HD-35316-3A) is stamped, "UP 6 SPEED". Mount cross plate with this end pointing up.*

6. See Figure 7-35. Place CROSS PLATE (Part No. HD-35316-3A) (1) on right side of transmission case as shown, and secure with two screws (2). Position cross plate so that large bolt hole in cross plate is lined up with center of main drive gear (4).
7. Apply a light coat of graphite lubricant to the threads of the 12 IN. BOLT (Part No. HD-35316-5) (3) and insert through cross plate and main drive gear.
8. At left side of transmission case, place WASHER (Part No. HD-35316-7), NICE BEARING (Part No. RS-25100-200) (6), flat washer (7) and nut (8) over end of bolt. Tighten nut until main drive gear is free.

*NOTES*

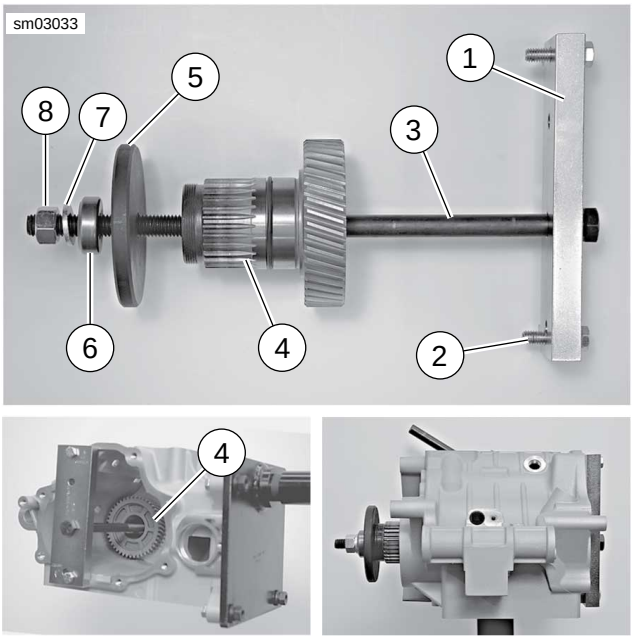
- *When removing the main drive gear, the gear is pressed out against the resistance of the bearing inner race. Without any support at the inner race, the bearing is destroyed. Whenever the main drive gear is removed the main drive gear bearing must also be replaced.*
- *See Figure 7-36. When the main drive gear is removed, a portion of the bearing inner race remains attached to the main drive gear. If the main drive gear is to be re-used, this inner race must be removed first.*

9. Remove tool and remove gear from gearcase.
10. See Figure 7-36. Use WEDGE ATTACHMENT (Part No. HD-95637-46B) and LONG BOLTS (Part No. HD-95637-10) to remove inner race from main drive gear.
11. Remove large main drive gear oil seal.
12. Remove retaining ring from bearing bore.
13. See Figure 7-37. Slide PILOT (Part No. HD-35316-10) (3) over small end of BEARING DRIVER (Part No. HD-35316-9) (2).
14. Apply a light coat of graphite lubricant to the threads of the 8 IN. BOLT (Part No. HD-35316-4A) (1) and insert through bearing driver and pilot.
15. Insert bolt with bearing driver and pilot into right side of transmission case, through main drive gear bearing (4). Make sure bearing driver fits up against main drive gear bearing and pilot is centered in bearing bore.
16. At left side of case, slide RECEIVER CUP (Part No. HD-35316-11) (5) onto bolt and over main drive gear bearing. Install NICE BEARING (Part No. RS-25100-200) (6), flat washer (7) and nut (8) over end of bolt.

*NOTE*

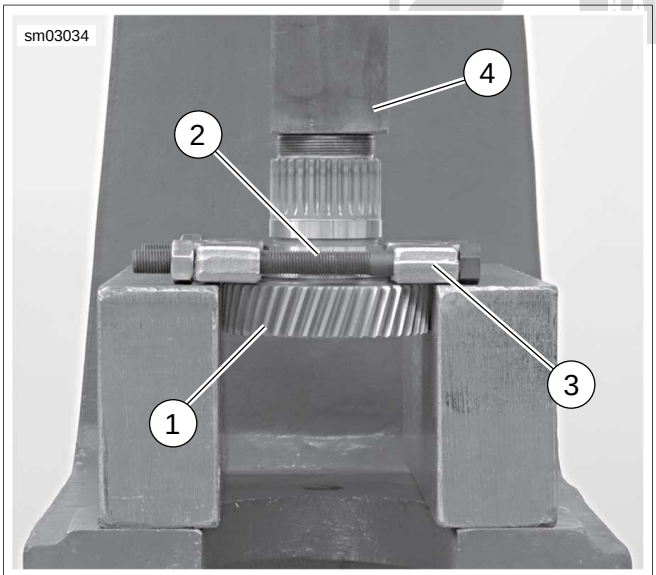
*Support bearing remover assembly as you remove bearing in the following step. Entire assembly will fall out of transmission case when bearing comes free.*

17. Tighten nut until main drive gear bearing is free.
18. Discard main drive gear bearing.



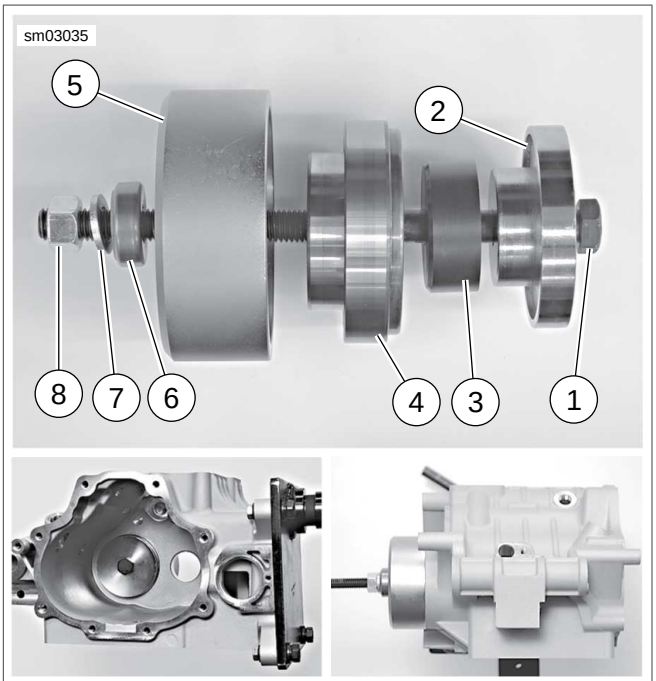

1. Cross plate
2. Screw (2)
3. 12 in. bolt
4. Main drive gear
5. Washer
6. Nice bearing
7. Flat washer
8. Nut

**Figure 7-35. Removing Main Drive Gear**




1. Main drive gear
2. Long bolt (2)
3. Wedge attachment
4. Press ram

**Figure 7-36. Removing Inner Bearing Race From Main Drive Gear**




1. 8 in. Bolt
2. Bearing driver
3. Pilot
4. Main drive gear bearing
5. Receiver cup
6. Nice bearing
7. Flat washer
8. Nut

**Figure 7-37. Removing Main Drive Gear Bearing**



## CLEANING AND INSPECTION

| PART NUMBER | TOOL NAME |
|---|---|
| HD-47932 | MAIN DRIVE GEAR BEARING AND SEAL INSTALLATION TOOL |

**⚠WARNING**

**Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)**

1. Clean all parts in solvent except the transmission case and needle bearings. Blow dry with compressed air.

*NOTE*

*Never wash the transmission case and needle bearings with solvent unless the needle bearings are to be replaced. Normal cleaning methods will wash dirt or other contaminants into the bearing case (behind the needles) and leads to bearing failure.*

2. Inspect the main drive gear for pitting and wear. Replace if necessary.
3. Inspect the needle bearings inside the main drive gear. Replace the needle bearings if the mainshaft race is pitted or grooved.

4. Replace the sprocket if teeth are cracked or worn. See 6.6 TRANSMISSION SPROCKET, Cleaning and Inspection for more information.

5. Inspect the needle bearings on the inside of the main drive gear. If mainshaft race surface appears pitted or grooved, replace these bearings.

*NOTE*

*If the main drive gear needle bearings and/or seal need to be replaced, continue as follows. Otherwise, proceed to 7.7 TRANSMISSION CASE, Assembly.*

## Needle Bearing Replacement

**WARNING**

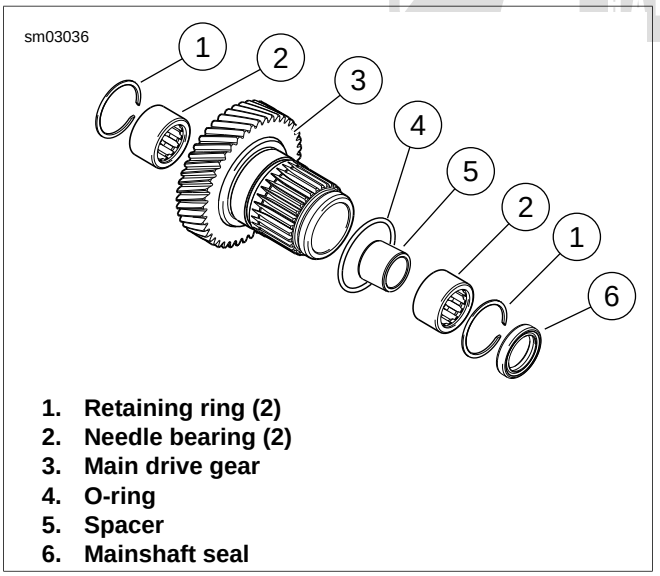
**Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)**

*NOTES*

- *See Figure 7-39. When replacing needle bearings, discard original retaining rings (1) and install replacement retaining rings (2).*
- *To install the inner main drive gear needle bearings and mainshaft seal, use MAIN DRIVE GEAR BEARING AND SEAL INSTALLATION TOOL (Part No. HD-47932).*

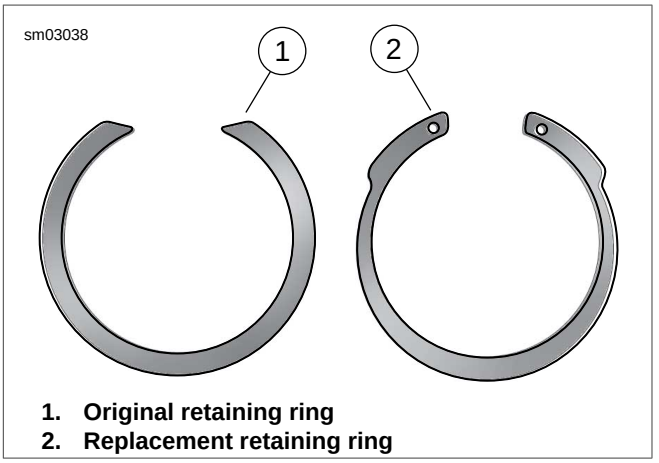
1. See Figure 7-38. Remove mainshaft seal (6). Remove retaining rings (1), needle bearings (2) and spacer (5) from main drive gear (3). Discard retaining rings.

2. Remove and discard o-ring (4).




1. **Retaining ring (2)**
2. **Needle bearing (2)**
3. **Main drive gear**
4. **O-ring**
5. **Spacer**
6. **Mainshaft seal**

**Figure 7-38. Main Drive Gear Assembly**




1. **Original retaining ring**
2. **Replacement retaining ring**

**Figure 7-39. Main Drive Gear Retaining Rings**

3. See Figure 7-40. Install clutch side needle bearing using an arbor press and the 0.400 in. step end of tool as shown. Press until tool contacts gear.

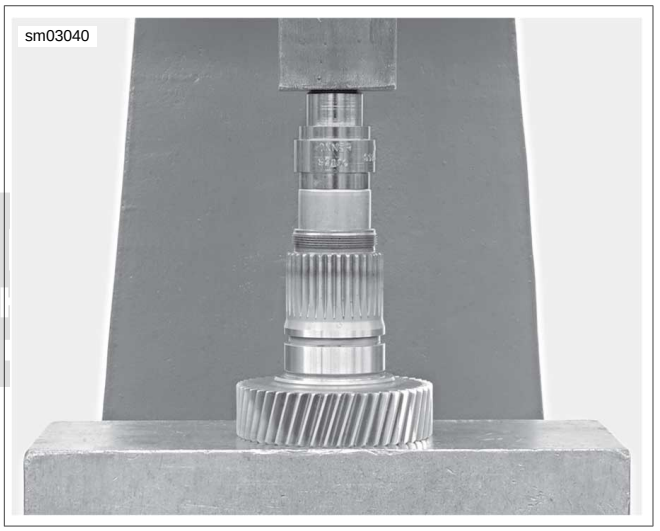



**Figure 7-40. Installing Clutch Side Needle Bearing in Main Drive Gear**

*NOTE*

*An alternative method is provided which allows the mainshaft seal to be pressed into place after installation of the main drive gear. See 7.6 MAIN DRIVE GEAR AND BEARING, Mainshaft Seal Replacement.*

4. See Figure 7-41. Turn over tool and press in mainshaft seal using the 0.090 in. step with garter spring side down.

5. Install spacer.

6. See Figure 7-42. Turn over the main drive gear in the arbor press. With the tool at the 0.188 in. step, press inner bearing until tool contacts gear.

**⚠WARNING**

**Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)**

7. See Figure 7-38. Install **new** retaining rings (1).
8. Install **new** o-ring (4) into groove in main drive gear.

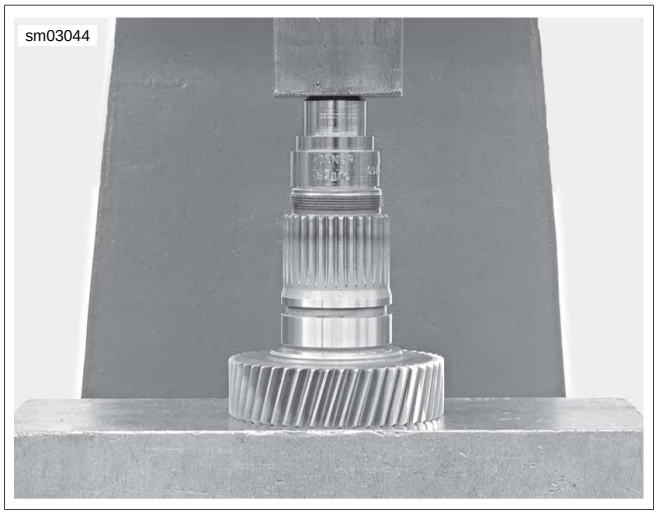



**Figure 7-41. Pressing in Seal**

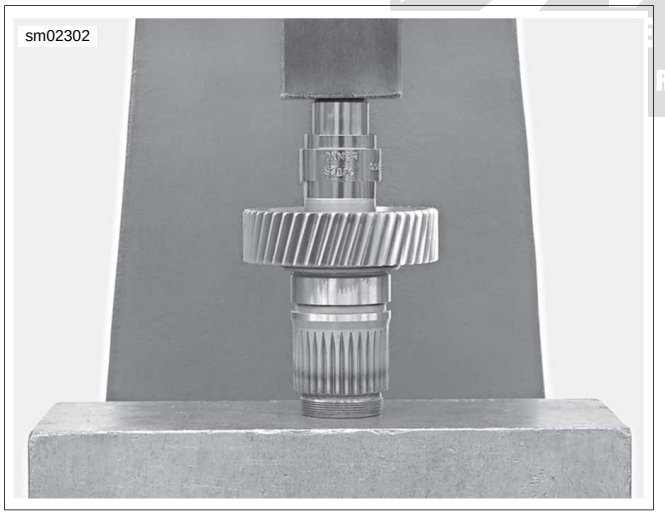
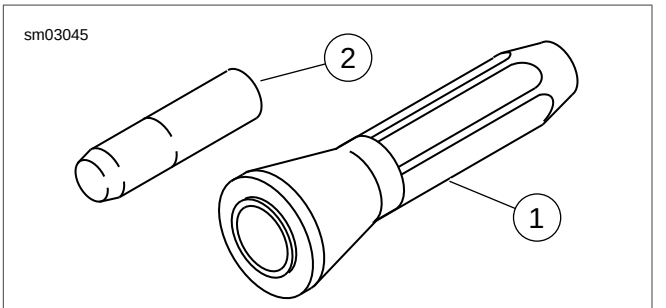



**Figure 7-42. Installing Transmission Side Needle Bearing in Main Driver Gear**

## MAINSHAFT SEAL REPLACEMENT

| PART NUMBER | TOOL NAME |
|---|---|
| HD-47933 | MAIN DRIVE GEAR SEAL INSTALLER |

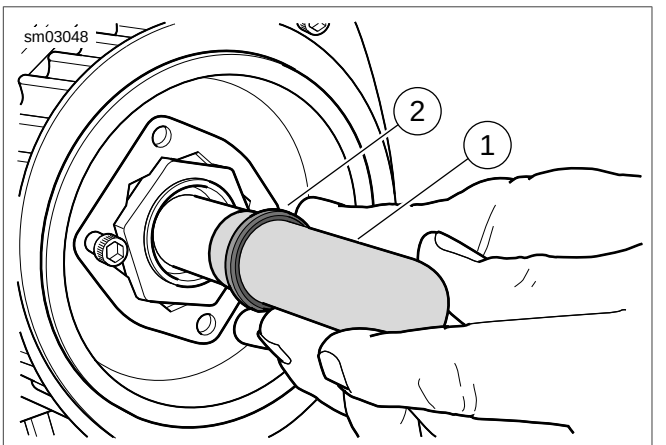
See Figure 7-43. If the mainshaft seal was not installed with the main drive gear needle bearings (or if a faulty seal is discovered with the main drive gear installed in the transmission case), the seal can be installed using the MAIN DRIVE GEAR SEAL INSTALLER (Part No. HD-47933).




**1. Driver**
**2. Seal protector sleeve**

**Figure 7-43. Main Drive Gear Seal Installer (Part No. HD-47933)**

1. Remove the damaged seal using a seal remover or rolling head pry bar.
2. Inspect bore to be sure it is clean and smooth.
3. See Figure 7-44. Place the seal protector sleeve (1) over the end of the mainshaft. Lightly lubricate the protector sleeve and seal ID with clean transmission oil.
4. Verify that the garter spring is in place on the lip of the **new** oil seal. Apply a light coat of H-D 20W-50 engine oil to the seal lip.
5. Squarely seat the mainshaft seal (2) on the seal protector sleeve with the garter spring facing the bearing.
6. See Figure 7-45. Using MAIN DRIVE GEAR SEAL INSTALLER (Part No. HD-47933), hand press seal onto mainshaft and into end of main drive gear. A rubber mallet may be used to lightly tap driver, if necessary. Seal is properly installed when seal driver contacts end of main drive gear.




**1. Seal protector sleeve**
**2. Seal**

**Figure 7-44. Seal Protector Sleeve**

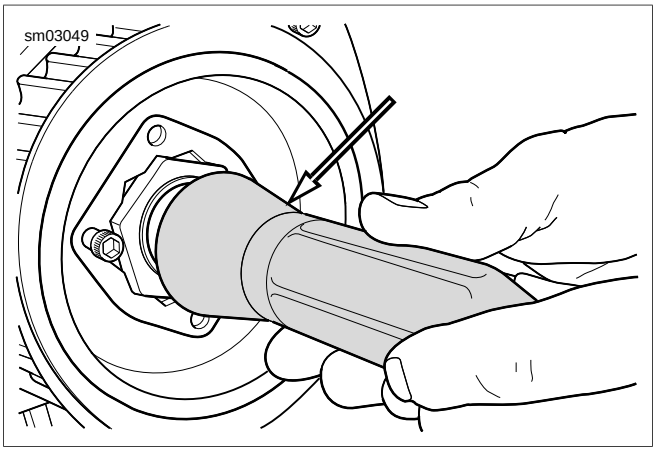



**Figure 7-45. Seal Driver**

## INSTALLATION

| PART NUMBER | TOOL NAME |
|---|---|
| HD-35316-12 | INSTALLER CUP |
| HD-35316-3A | CROSS PLATE |
| HD-35316-4A | 8 IN. BOLT |
| HD-35316-5 | 12 IN. BOLT |
| HD-35316-7 | WASHER |
| HD-35316-8 | BEARING DRIVER |
| HD-47856-1 | INSTALLER |
| HD-47856-2 | PILOT |
| HD-47856-3 | ADAPTER |
| HD-47856-6 | NUT |
| HD-47856-7 | CROW'S FOOT WRENCH |

**CAUTION**

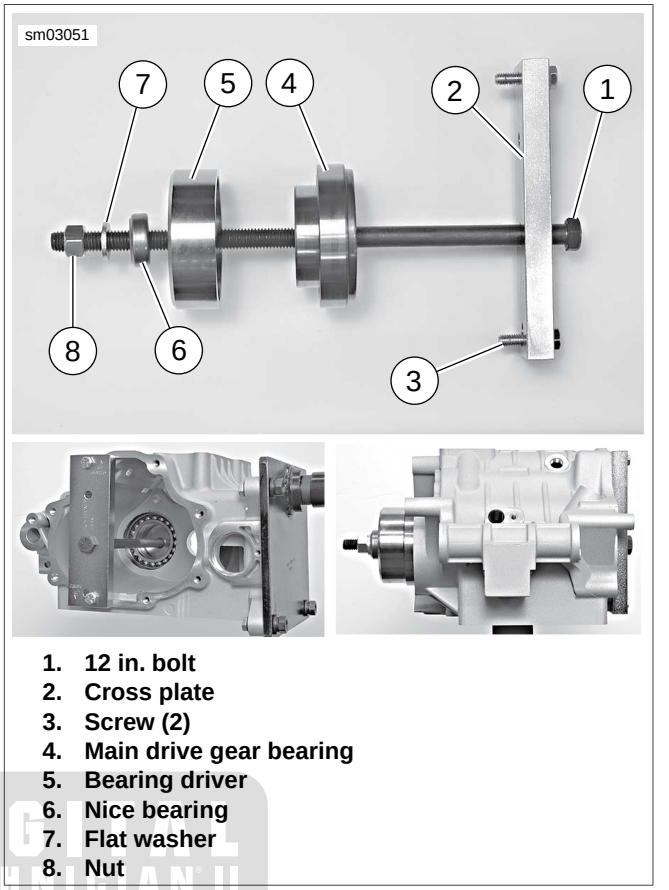
**Improper tightening of sprocket nut can cause drive component damage. (00541b)**

### Installing Main Drive Gear Bearing

*NOTE*

*CROSS PLATE (Part No. HD-35316-3A) will retrofit to earlier transmissions. Note that one end of cross plate is stamped, "UP 6 SPEED". Mount cross plate with this end pointing up for 6 speed transmissions.*

1. See Figure 7-46. Place CROSS PLATE (Part No. HD-35316-3A) (2) on right side of transmission case as shown, and secure with two screws (3). Position cross plate so that large bolt hole in cross plate is lined up with center of main drive gear bearing bore in left side of transmission case.
2. Apply a light coat of graphite lubricant to the threads of 12 IN. BOLT (Part No. HD-35316-5) (1) and install through cross plate and main drive gear bearing bore.
3. At left side of case, place main drive gear bearing (4), BEARING DRIVER (Part No. HD-35316-8) (5), NICE BEARING (6), FLAT WASHER (7) and NUT (8) over end of bolt.
4. Tighten nut until main drive gear bearing bottoms against lip cast into transmission case bearing bore.




1. **12 in. bolt**
2. **Cross plate**
3. **Screw (2)**
4. **Main drive gear bearing**
5. **Bearing driver**
6. **Nice bearing**
7. **Flat washer**
8. **Nut**

**Figure 7-46. Installing Main Drive Gear Bearing (Typical)**

### Installing Main Drive Gear

*NOTE*

*See Figure 7-47. Make sure **new** o-ring (4) is installed onto main drive gear (3). Lubricate o-ring with clean engine oil before installing drive gear into transmission case.*

1. See Figure 7-47. Apply a light coat of graphite lubricant to the threads of 8 IN. BOLT (Part No. HD-35316-4A) (1) and insert through WASHER (Part No. HD-35316-7) (2) and main drive gear (3). Insert assembly into transmission case, through main drive gear bearing.
2. At outside of case, place INSTALLER CUP (Part No. HD-35316-12) (5), NICE BEARING (6), FLAT WASHER (7) and NUT (8) over end of bolt.
3. Tighten nut until main drive gear contacts main drive gear bearing.

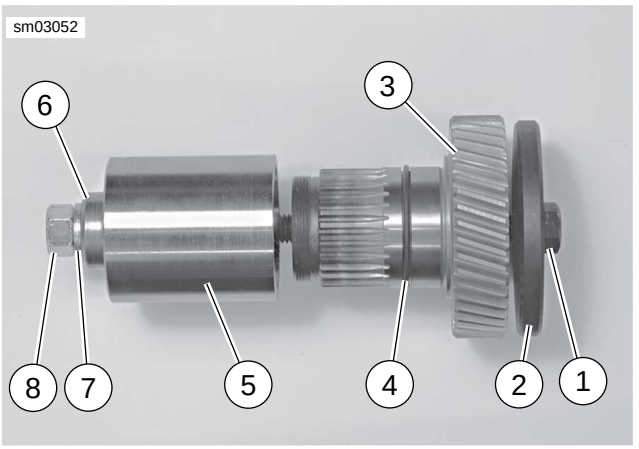
*NOTE*

*See Figure 7-48. In next step, bearing retaining ring must be installed with the flat side facing the bearing and the opening in the ninety degree range shown.*

**⚠WARNING**

**Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)**

4. See Figure 7-49. Install **new** retaining ring (2).




1. **8 in. bolt**
2. **Washer**
3. **Main drive gear**
4. **O-ring**
5. **Installer cup**
6. **Nice bearing**
7. **Flat washer**
8. **Nut**

**Figure 7-47. Installing Main Drive Gear (Typical)**

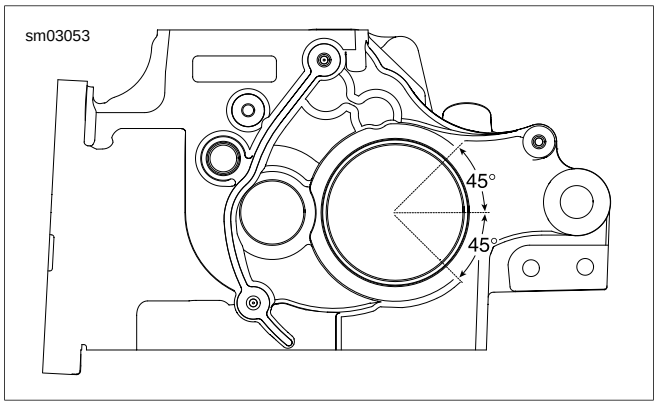



**Figure 7-48. Retaining Ring Opening**

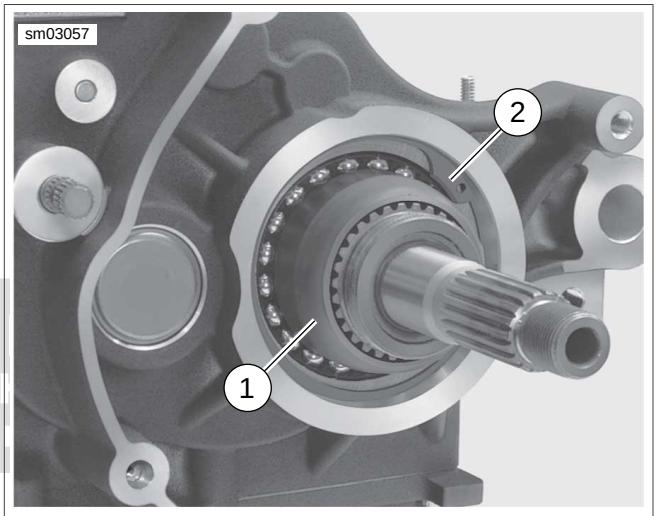
## Installing Main Drive Gear Large Seal

1. See Figure 7-49. From outside of crankcase, install PILOT (Part No. HD-47856-2) over end of main drive gear bearing inner race.
2. Coat lips of **new** main drive gear seal with FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05, qt).
3. See Figure 7-50. Place seal over pilot with garter spring facing bearing, and position seal squarely in end of crankcase bore.

*NOTE*

*ADAPTER (Part No. HD-47856-3) and main drive gear have right-hand threads.*

4. See Figure 7-51. Thread ADAPTER (Part No. HD-47856-3) onto end of main drive gear until it contacts main drive gear.




1. **Pilot**
2. **Retaining Ring**

**Figure 7-49. Install Pilot**

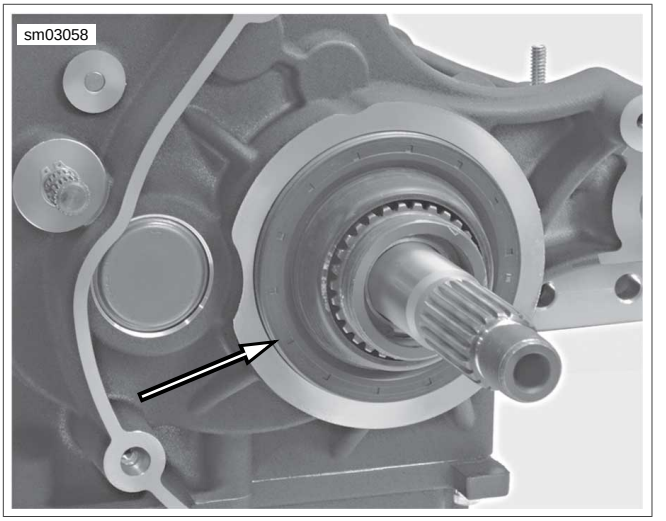



**Figure 7-50. Place Main Drive Gear Seal Over Pilot**

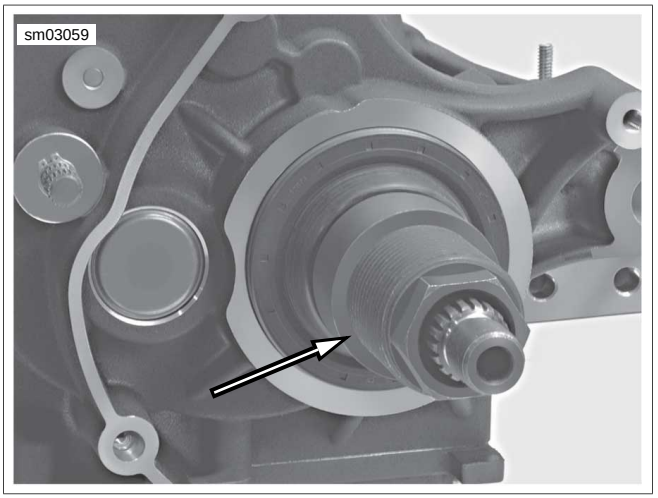


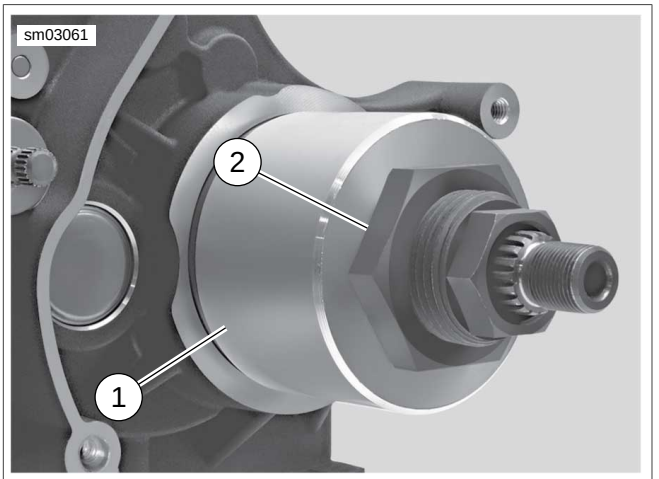

**Figure 7-51. Install Adapter**

5. See Figure 7-52. Slide INSTALLER (Part No. HD-47856-1) (1) over adapter until cupped end of installer is flat against seal.
6. Thread NUT (Part No. HD-47856-6) (2) onto end of adapter, until it tightens against installer.
7. See Figure 7-53. Place CROW'S FOOT WRENCH (Part No. HD-47856-7) (1) with 1/2 inch drive breaker bar (2) on large nut. Place an adjustable wrench (3) on flats of hex head cast into end of adapter.
8. Holding adjustable wrench, tighten large nut with crow's foot wrench until outer face of seal is flush with outer edge of transmission bore.

*NOTE*

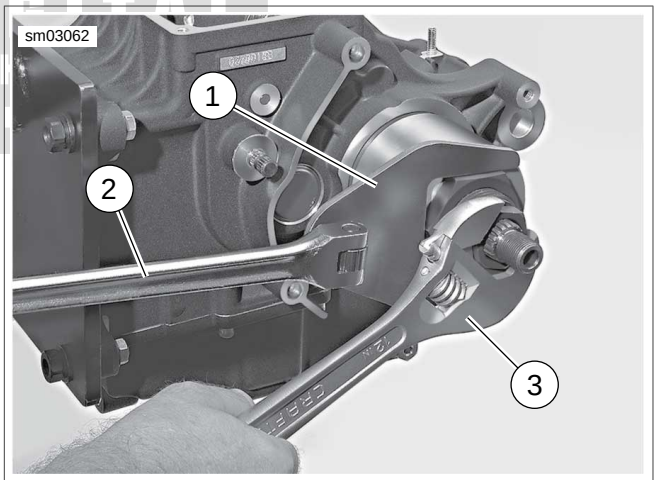
*It is acceptable to recess seal as much as 0.030 in. (0.762 mm) below outer edge of bore. Seal depth will be controlled by tool.*

9. Remove nut, installer, adapter and pilot.
10. Install side door and transmission components. See 7.5 TRANSMISSION ASSEMBLY, Installation.
11. Install sprocket and drive belt. See 6.6 TRANSMISSION SPROCKET. Do not adjust belt at this time.
12. Install the bearing inner race on the transmission mainshaft. See 7.5 TRANSMISSION ASSEMBLY, Assembly.
13. Install the primary chaincase housing. See 6.4 PRIMARY CHAINCASE HOUSING, Installation.
14. Install the clutch assembly, primary chain, chain tensioner assembly and compensating sprocket components See 6.3 DRIVE COMPONENTS, Installation.
15. Install the primary chaincase cover. See 6.2 PRIMARY CHAINCASE COVER, Installation.
16. Adjust the drive belt. See 1.13 REAR BELT DEFLECTION, Setting Belt Deflection.
17. Install exhaust system. See 4.18 EXHAUST SYSTEM, Installation.




1. **Installer**
2. **Nut**

**Figure 7-52. Installer and Nut**




1. **Crow's foot wrench**
2. **1/2 inch breaker bar**
3. **Adjustable wrench**

**Figure 7-53. Press Seal Into Crankcase**

## REMOVAL

**WARNING**

**Disconnect negative (-) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00049a)**

1. Disconnect battery, negative (-) cable first.
2. Drain engine oil. See 1.5 ENGINE OIL AND FILTER, Changing Oil and Oil Filter: Touring Models.
3. Drain transmission lubricant. See 1.10 TRANSMISSION LUBRICANT, Transmission Lubrication: Touring Models.
4. Remove starter. See 5.2 STARTER, Removal.
5. Remove transmission assembly. See 7.5 TRANSMISSION ASSEMBLY, Removal.
6. Remove oil pan. See 3.29 OIL PAN.
7. Position jack under lower frame crossmember to support rear of motorcycle. Slide wooden blocks beneath the crankcase to support the weight of the engine and transmission assembly.
8. Remove rear fork. See 2.22 REAR FORK, Removal.
9. Disconnect vehicle speed sensor (VSS). See 8.22 VEHICLE SPEED SENSOR (VSS), VSS.
10. Disconnect neutral switch. See 8.23 NEUTRAL SWITCH, Removal.
11. Remove fastener from ground post at top of transmission case and remove battery negative ring terminal.
12. Move O2 sensor, starter solenoid, neutral switch and VSS harness out of the way.
13. Mark splines on shift arm and shift shaft to assist in assembly. Remove shift arm from shift shaft.
14. In a crosswise pattern, remove four fasteners that connect transmission to engine.

*NOTE*

*See Figure 7-54. Do not use a hammer to remove transmission. If the transmission sticks or binds on the ring dowels, gently pry away from crankcase using the indent.*

15. Move transmission rearward until two ring dowels in lower flange are free of crankcase. Remove transmission case from left side of the motorcycle.

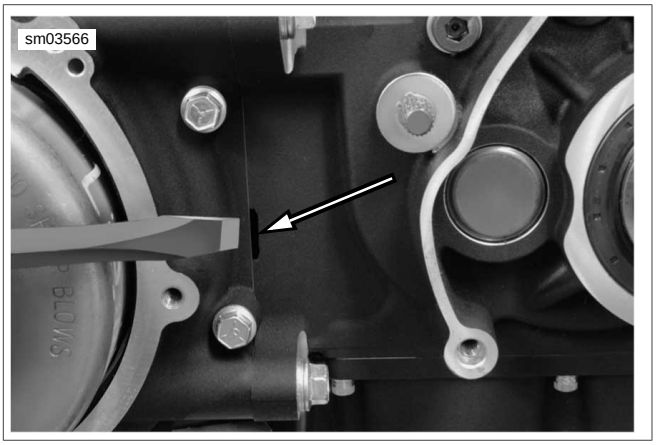



**Figure 7-54. Transmission Case Pry Point**

## INSTALLATION

1. Install **new** ground post at top of transmission case. Tighten ground post until snug.

*NOTE*

*A **new** transmission case comes with the shifter shaft sleeve and seal, centering screw, countershaft needle bearing and main drive gear bearing and seal installed.*

2. Thoroughly wipe all engine oil from pockets in crankcase flange.
3. Install **new** engine-to-transmission gasket engaging two index pins in holes of transmission flange.
4. Verify that transmission dowels are seated. Place transmission case into position behind crankcase. Mate engine and transmission flanges.
5. Install and tighten fasteners.
   a. Shorter bolts are installed at the top, longer fasteners are installed at the bottom. Using a crosswise pattern, **hand tighten** fasteners.
   b. See Figure 7-55. Tighten bolts in the sequence shown to 15 ft-lbs (20.3 Nm) in the same crosswise pattern.
   c. Final tighten bolts to 30-35 ft-lbs (40.7-47.5 Nm).
6. Install oil pan. See 3.29 OIL PAN
7. Install rear fork. See 2.22 REAR FORK, Installation.
8. Install shift arm on shift shaft. Align marks made during disassembly.
9. Install transmission and side door assembly. See 7.5 TRANSMISSION ASSEMBLY, Installation.
10. Connect battery ground (-) cable to ground post at top of transmission case. Tighten securely.
11. Adjust drive belt tension. 1.13 REAR BELT DEFLECTION.
12. Verify vehicle alignment. 2.11 VEHICLE ALIGNMENT.
13. Install primary chaincase. 6.4 PRIMARY CHAINCASE HOUSING.

14. Install drive components. See 6.3 DRIVE COMPONENTS.

*NOTE*

*The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.*

15. Install primary chaincase cover. 6.2 PRIMARY CHAINCASE COVER.
16. Install neutral switch and tighten to 120-180 **in-lbs** (13.6-20.3 Nm).
17. Install VSS and tighten screw to 84-132 **in-lbs** (9.5-14.9 Nm)
18. Mate VSS, O2 sensors, starter solenoid and neutral switch connectors to main harness.
19. Install the exhaust system. 4.18 EXHAUST SYSTEM.
20. Clean transmission drain plug and install. Tighten to 14-21 ft-lbs (19.0-28.5 Nm). Place motorcycle in an upright position. Fill transmission to proper level with fresh transmission fluid. See 1.10 TRANSMISSION LUBRICANT.

**CAUTION**

**Do not overfill the primary chaincase with lubricant. Overfilling can cause rough clutch engagement, incomplete disengagement, clutch drag and/or difficulty in finding neutral at engine idle. (00199b)**

21. Fill primary. 1.9 PRIMARY CHAIN, Chaincase Lubricant: Touring Models.
22. Fill engine oil. 1.5 ENGINE OIL AND FILTER, Changing Oil and Oil Filter: Touring Models.

**WARNING**

**Connect positive (+) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00068a)**

23. Connect battery cables.

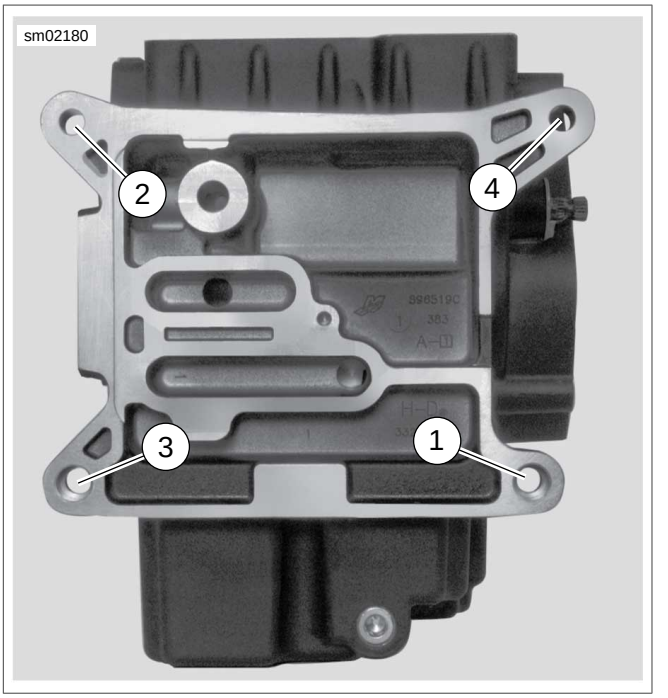



**Figure 7-55. Transmission Housing to Crankcase Torque Sequence**

## DISASSEMBLY

### Shifter Arm Assembly

1. See Figure 7-56. After removing door assembly, remove screw (8) and shifter rod lever (9) from the shifter pawl lever assembly (1).
2. Remove retaining ring (7), washer (6) and seal (5). Discard retaining ring and seal. Pull shifter pawl lever assembly out of the transmission case.
3. Inspect sleeve (2) inside transmission case.

## CLEANING AND INSPECTION

**WARNING**

**Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)**

1. Clean all parts in solvent except the case and main drive gear needle bearings. Blow parts dry with low pressure compressed air.

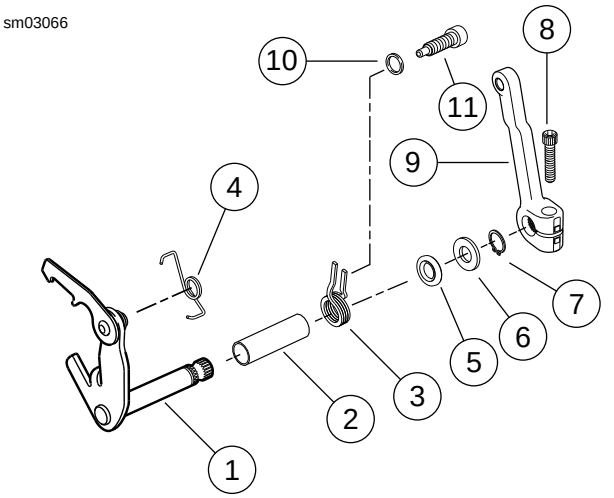
*NOTE*

*Never wash the transmission case and needle bearings with solvent unless the needle bearings are to be replaced. Normal cleaning methods will wash dirt or other contaminants into the bearing case (behind the needles) and leads to bearing failure.*

2. See Figure 7-56. Inspect the shifter pawl lever assembly (1) for wear. Replace assembly if pawl ends are damaged. Replace centering spring (3) if elongated.
3. Inspect the shifter spring (4). Replace if the spring fails to hold the pawl on the cam pins.

4. Thoroughly clean the oil pan with solvent.

5. Inspect preformed transmission top cover vent hose for nicks, cuts or general deterioration. Replace as necessary. Use low-pressure compressed air to verify that hose and fitting are unobstructed.




1. **Shifter pawl lever assembly**
2. **Sleeve (inside transmission case)**
3. **Shift lever centering spring**
4. **Shifter shaft lever spring**
5. **Seal**
6. **Washer**
7. **Retaining ring**
8. **Screw**
9. **Shifter rod lever**
10. **Washer**
11. **Screw**

**Figure 7-56. Shifter Arm Assembly**

## ASSEMBLY

### Countershaft Needle Bearing Replacement

1. Find a suitable bearing driver 1.25 in. (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 in. (0.76 mm).

3. Lubricate the bearing with transmission lubricant.

### Shifter Pawl Lever Assembly

1. See Figure 7-56. Verify that sleeve (2) is inside transmission case.

2. See Figure 7-57. Slide shifter lever centering spring (3) over shaft of shifter pawl lever assembly (2). Align opening on spring with tab on lever.

3. Place shifter shaft lever spring (4) on shifter pawl lever assembly.

*NOTE*

*Do not bend shifter shaft lever spring more than necessary for assembly.*

4. See Figure 7-58. Insert the assembly into the transmission case.

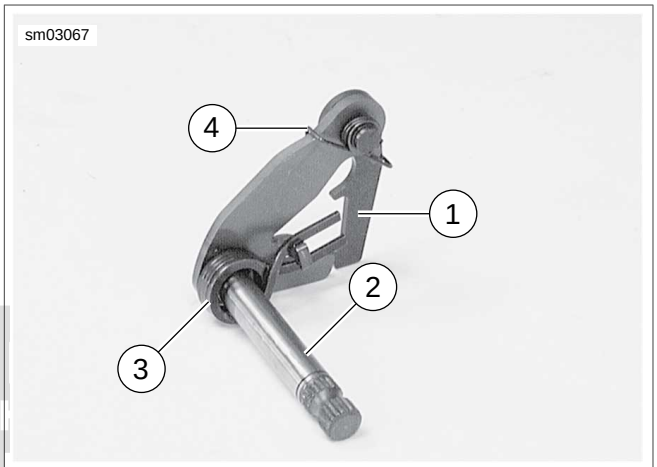
5. See Figure 7-59. Verify that pin sits inside shifter shaft lever spring.

6. See Figure 7-58. Install a **new** seal. Install washer (1) and a **new** retaining ring (2).

*NOTE*

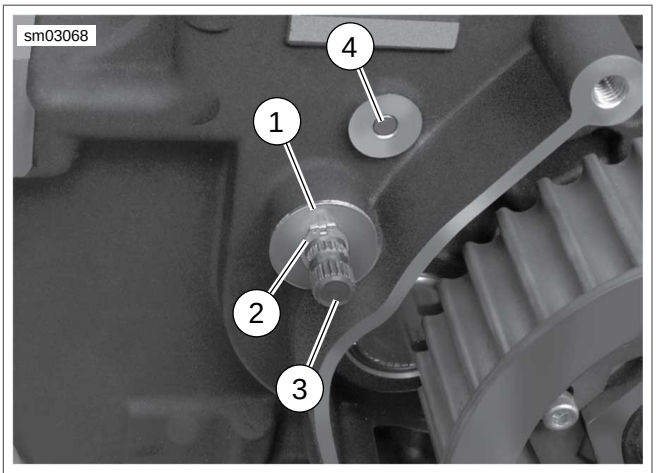
*In next step, shifter rod lever must be installed so angle of lever is toward front of vehicle, one spline from vertical.*

7. See Figure 7-56. Install shifter rod lever (9) on the shifter pawl lever assembly shaft end using screw (8). Tighten to 18-22 ft-lbs (24.4-29.8 Nm).




1. **Pawl (part of shifter pawl lever assembly)**
2. **Shifter pawl lever assembly**
3. **Shifter lever centering spring**
4. **Shifter shaft lever spring**

**Figure 7-57. Shifter Pawl Lever Assembly**




1. **Washer (with seal behind)**
2. **Retaining ring**
3. **Shifter shaft lever**
4. **Pin**

**Figure 7-58. Shifter Shaft Lever, Exterior View**

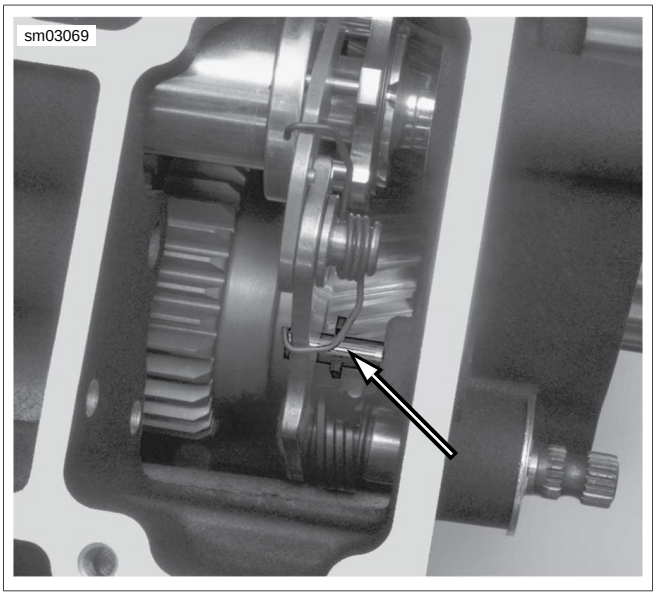



**Figure 7-59. Shifter Shaft Lever Spring**

# NOTES

**SUBJECT** **PAGE NO.**

# NOTES

## SPECIFICATIONS

**Table 8-1. Ignition**

| 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 | 0.5-0.7 ohms |
| Ignition coil secondary resistance | 5500-7500 ohms |

**Table 8-2. Fuses**

| FUSE | AMPS |
|---|---|
| Maxi-fuse | 40 |
| Brakes | 15 |
| Accessory | 15 |
| P&A | 15 |
| Radio power/siren | 15 |
| ECM power | 15 |
| Ignition | 15 |
| Engine control: active exhaust (HDI only) | 15 |
| Lighting | 15 |
| Instruments | 15 |
| Headlamp | 15 |
| ABS | 30 |
| P&A ignition | 15 |
| Fuel pump | 15 |
| Battery | 15 |
| Radio memory | 15 |

**Table 8-3. Charging System**

| CHARGING SYSTEM | DATA |
|---|---|
| Battery | 19 amp hour/270 CCA |
| Alternator AC voltage output | 16-23 VAC per 1000 RPM |
| Alternator stator coil resistance | 0.1-0.2 ohms |
| Regulator voltage output @ 3600 RPM | 14.3-14.7 @ 75° F (24° C) |
| Regulator amperes @ 3000 RPM | 35-50 amps |

## REMOVAL

1. Remove maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
2. Remove locknuts from studs on lower frame crossmember. Lift voltage regulator off studs.
3. Release conduit from P-clips under left and right side legs of voltage regulator. Allow voltage regulator to hang upside down at front of lower frame crossmember. See Figure 8-2.
4. Pull away locking latch and remove socket of voltage regulator connector [77], 2-place Lyall, at bottom right side of voltage regulator.
5. Pull away locking latch and remove socket of stator connector [46], 3-place Lyall, at bottom left side of voltage regulator.

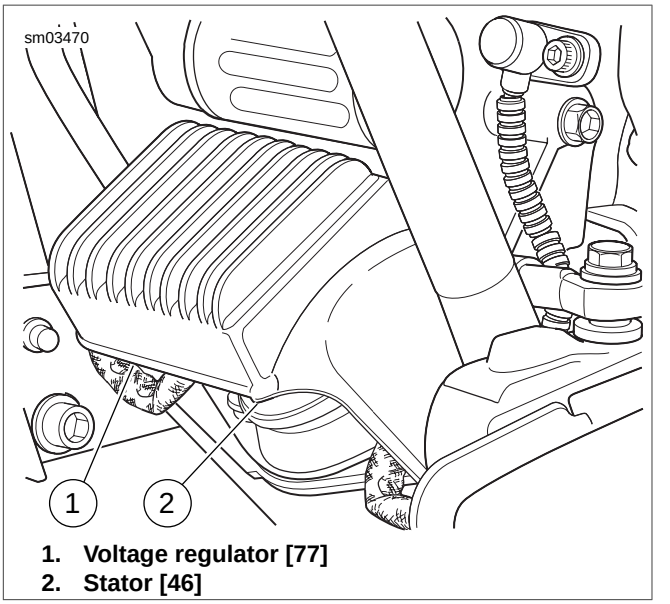
*NOTE*

*The rubber molded voltage regulator and stator connectors are not serviceable. Damage to terminals, molding or locking latches requires voltage regulator and/or stator replacement.*

6. Remove voltage regulator from motorcycle.

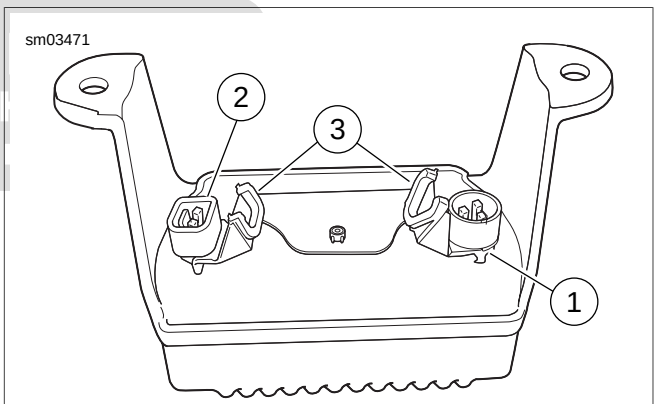
## INSTALLATION

1. Position voltage regulator upside down at front of lower frame crossmember. See Figure 8-2.
2. Install socket of stator connector [46], 3-place Lyall, at bottom left side of voltage regulator. Push against locking latch until socket is fully engaged.
3. Install socket of voltage regulator connector [77], 2-place Lyall, at bottom right side of voltage regulator. Push against locking latch until socket is fully engaged.
4. Turning voltage regulator right side up, start onto studs on lower frame crossmember.
5. Capture stator connector conduit in left side P-clip. Capture voltage regulator connector conduit in right side P-clip. See Figure 8-1. Remove slack to ensure that stator conduit does not contact front engine stabilizer link.
6. Install locknuts on studs and alternately tighten to 70-100 **in-lbs** (7.9-11.3 Nm).
7. Install maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
8. Load test charging system.




**1. Voltage regulator [77]**
**2. Stator [46]**

**Figure 8-1. Voltage Regulator (Left Side View)**




**1. Stator [46A]**
**2. Voltage regulator [77A]**
**3. Locking latch**

**Figure 8-2. Voltage Regulator (Bottom View)**

## ECM

### Removal

1. Remove seat. See 2.26 SEAT.
2. Pushing rear catch away, lift up ECM until free of top caddy.
3. Disconnect ECM connector [78] as follows:
   a. While depressing button on socket housing, rotate locking bar until seated in the rearward position (index pin on locking bar engages rear notch in socket housing).

   *NOTE*

   *Internal latches are not fully disengaged until locking bar is seated in the rearward position. Forcing socket housing with latches partially engaged will result in connector damage.*

   b. Gently pully apart pin and socket housings.

### Installation

1. Connect ECM connector [78] as follows:
   a. Verify that locking bar is seated in the rearward position (index pin on locking bar engages rear notch in socket housing).
   b. Aligning large ground pin (73) with blue socket, mate pin and socket housings.

   *NOTE*

   *If pin and socket housings are not properly aligned during the installation attempt, damage to large ground pin (73) will likely occur. Damage to pin requires ECM replacement.*

   c. Rotate locking bar until seated in the forward position (index pin on locking bar engages front notch in socket housing).

   *NOTE*

   *Pin and socket housings must be fully engaged before locking bar is rotated to the forward position. Forcing locking bar without full engagement will result in connector damage.*

2. Place ECM in approximate position on top caddy (oriented to the right of the left side stop and rear of the front catch).
3. Push ECM forward until front catch engages, and then push down on rear of ECM to engage rear catch.
4. Slide ECM toward left side stop until holes engage two index pins on right side of top caddy.
5. Install seat. See 2.26 SEAT.

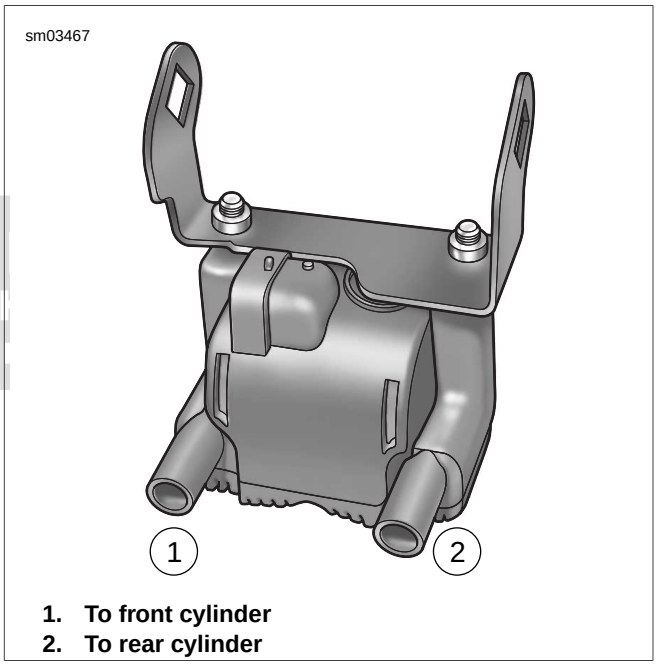
## REMOVAL

1. Remove fuel tank. See 4.4 FUEL TANK.
2. Unplug spark plug cables from ignition coil towers.
3. See Figure 8-3. Remove ignition coil connector [83].
4. Pull sides of ignition coil bracket outward to remove from bosses of front fuel tank mount.
5. Remove two screws to free ignition coil from bracket.

## INSTALLATION

1. See Figure 8-4. Align holes in **new** ignition coil with holes in bracket. Install two screws and alternately tighten to 84-144 **in-lbs** (9.5-16.3 Nm).
2. See Figure 8-3. With the coil towers facing rear, hold ignition coil and bracket at bottom of frame backbone. Pull sides of bracket outward and install on bosses of front fuel tank mount.
3. Install ignition coil connector [83].
4. See Figure 8-5. 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.
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.
6. Install fuel tank. See 4.4 FUEL TANK.

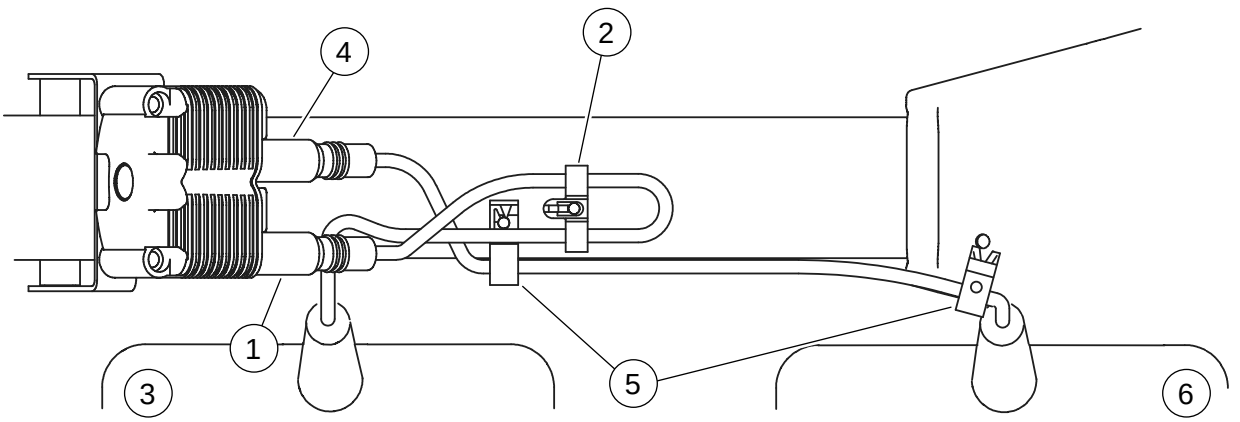

**Figure 8-3. Remove Ignition Coil Bracket From Vehicle**




1. **To front cylinder**
2. **To rear cylinder**

**Figure 8-4. Install Bracket to Ignition Coil**

sm05131




1. **Left side ignition coil tower**
2. **Double-sided clip**
3. **Front cylinder**
4. **Right side ignition coil tower**
5. **Single-sided clip (2)**
6. **Rear cylinder**

**Figure 8-5. Spark Plug Cable Routing (Bottom Left Side View)**

## MAXI-FUSE

### Removal

1. Remove left side saddlebag. See 2.27 SADDLEBAGS.
2. Remove left side cover.
3. Pull maxi-fuse from maxi-fuse holder. See Figure 8-6.

### Installation

1. Insert maxi-fuse into maxi-fuse holder. See Figure 8-6.
2. Install left side cover.
3. Install left side saddlebag. See 2.27 SADDLEBAGS.

## MAXI-FUSE HOLDER

### Removal

1. Remove left side saddlebag. See 2.27 SADDLEBAGS.
2. Remove left side cover.
3. Pull maxi-fuse from maxi-fuse holder.
4. Remove battery. See 1.16 BATTERY MAINTENANCE.
5. Inboard of left side caddy:
   a. Cut front cable strap to release main harness bundle and main power cable (to maxi-fuse holder). Remove and discard cable strap.
   b. Push up on tongue at bottom of harness cover to release from slot in caddy, and then rotate up and disengage hinges.
   c. Depress latches on maxi-fuse holder and pull from hole in caddy.

*NOTE*

*If further disassembly of the left side caddy is necessary, see 8.6 ELECTRICAL CADDIES.*

6. Remove socket terminals from maxi-fuse holder. See A.5 DELPHI MAXI FUSE HOUSING.

### Installation

1. Install socket terminals into maxi-fuse holder. See A.5 DELPHI MAXI FUSE HOUSING.
2. Inboard of left side caddy:
   a. Push maxi-fuse holder into hole until it locks in place.
   b. Install **new** cable strap through front slot in caddy capturing main harness bundle and main power cable (to maxi-fuse holder).
   c. Engage hinges and rotate harness cover down over main harness bundle. Push up on tongue at bottom of cover to engage slot in caddy.

*NOTE*

*If further assembly of the left side caddy is necessary, see 8.6 ELECTRICAL CADDIES.*

3. Install battery. See 1.16 BATTERY MAINTENANCE.
4. Insert maxi-fuse into maxi-fuse holder.
5. Install left side cover.
6. Install left side saddlebag. See 2.27 SADDLEBAGS.

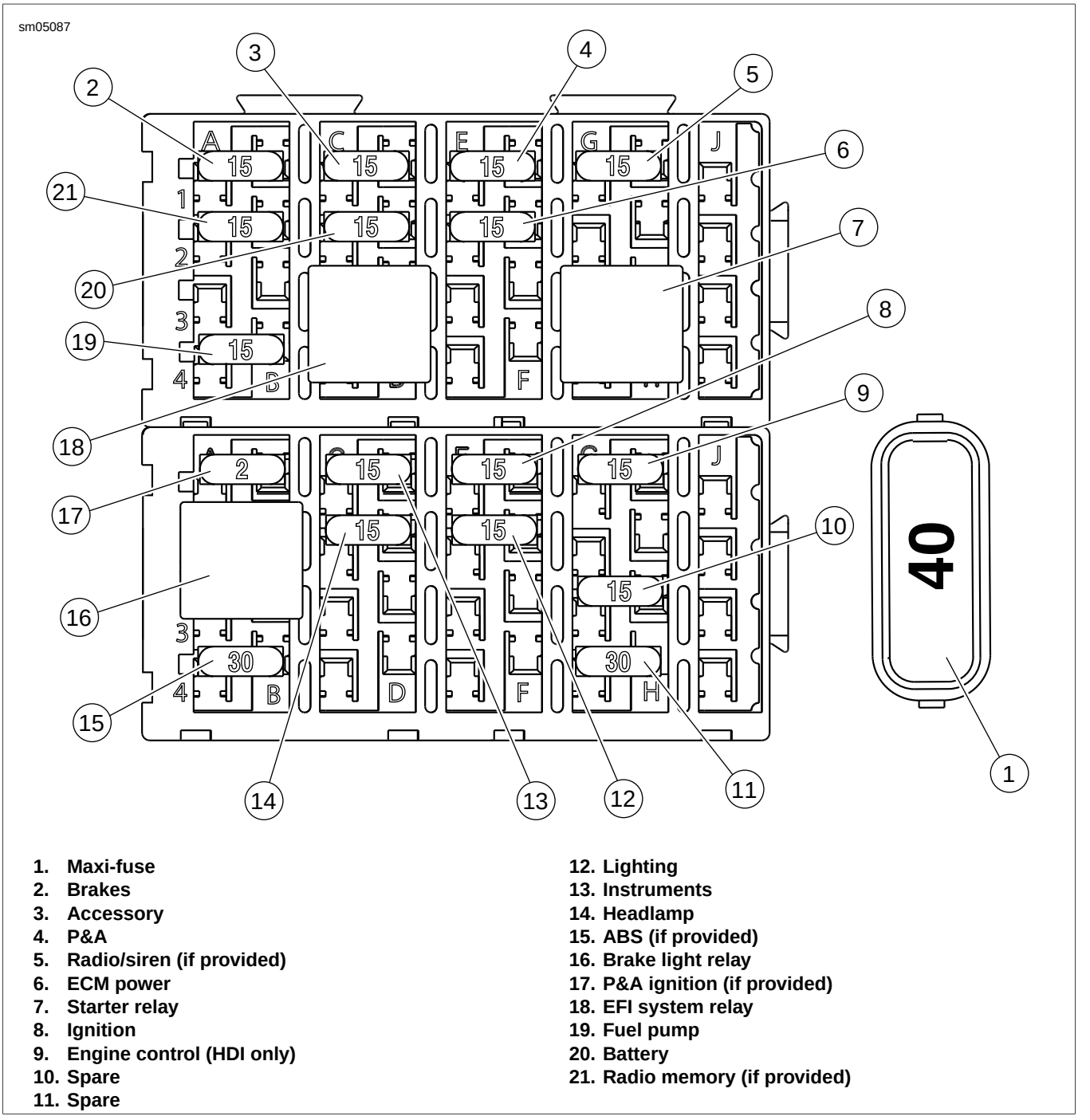
## SYSTEM FUSES AND RELAYS

### Removal

1. Remove left side saddlebag. See 2.27 SADDLEBAGS.
2. Remove left side cover.
3. Pull maxi-fuse from maxi-fuse holder.
4. Push up on tongue at bottom of fuse block cover to release from slot in caddy, and then rotate up and disengage hinge.
5. Remove system fuse/relay from fuse block. Replace fuse if the element is burned or broken. Automotive type ATO fuses are used. See Figure 8-6.

### Installation

1. Install system fuse/relay in fuse block. See Figure 8-6.
2. Engage hinge and rotate fuse block cover down over fuse blocks. Push up on tongue at bottom of cover to engage slot in caddy.
3. Insert maxi-fuse into maxi-fuse holder.
4. Install left side cover.
5. Install left side saddlebag. See 2.27 SADDLEBAGS.




1. **Maxi-fuse**
2. **Brakes**
3. **Accessory**
4. **P&A**
5. **Radio/siren (if provided)**
6. **ECM power**
7. **Starter relay**
8. **Ignition**
9. **Engine control (HDI only)**
10. **Spare**
11. **Spare**
12. **Lighting**
13. **Instruments**
14. **Headlamp**
15. **ABS (if provided)**
16. **Brake light relay**
17. **P&A ignition (if provided)**
18. **EFI system relay**
19. **Fuel pump**
20. **Battery**
21. **Radio memory (if provided)**

**Figure 8-6. Fuse Blocks**

## FUSE BLOCKS

### Removal

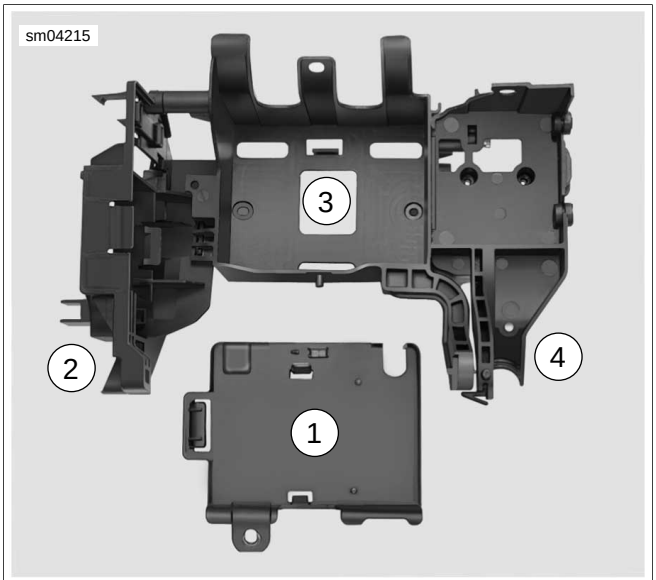
1. Remove left side caddy as necessary to release fuse blocks. See 8.6 ELECTRICAL CADDIES.
2. Remove system fuses and relays from fuse blocks.
3. Remove socket terminals from fuse blocks. See A.12 PACKARD 280 METRI-PACK RELAY AND FUSE BLOCK CONNECTORS.

### Installation

1. Install socket terminals into fuse blocks. See A.12 PACKARD 280 METRI-PACK RELAY AND FUSE BLOCK CONNECTORS.
2. Install system fuses and relays into fuse blocks. See Figure 8-6.
3. Install fuse blocks into left side caddy. Install left side caddy. See 8.6 ELECTRICAL CADDIES.

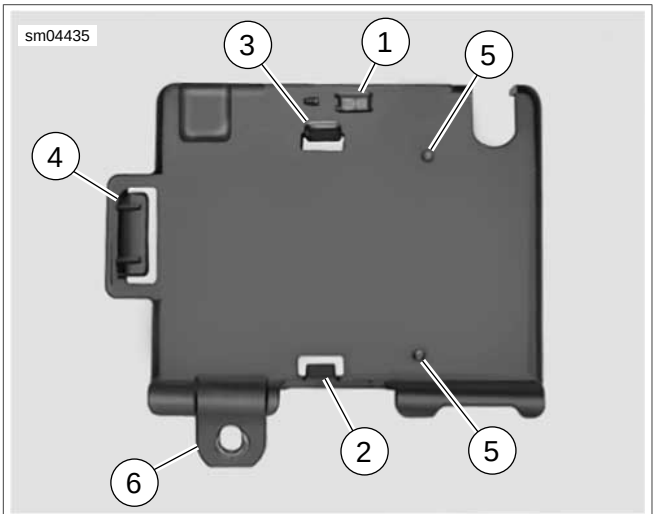
## GENERAL

The battery tray and the left and right side caddies consist of three interlocking segments. While the left and right side caddies can be removed separately, both caddies must be removed to extract the battery tray. See Figure 8-7.




1. **Top caddy**
2. **Left side caddy**
3. **Battery tray**
4. **Right side caddy**

**Figure 8-7. Battery Tray With Interlocking Caddies (Top View)**




1. **Tongue**
2. **Rear catch**
3. **Front catch**
4. **Left side stop**
5. **Index pin**
6. **Clamp**

**Figure 8-8. Top Caddy**

## TOP CADDY

### Removal

1. Remove seat. See 2.26 SEAT.
2. If present, release groove on HFSM antenna from tongue at front of caddy. Move connector and conduit out of the way. See Figure 8-8.
3. Pushing rear catch away, lift up ECM until free of caddy.
4. Remove screw to release clamp on caddy from frame crossmember.
5. Remove caddy from motorcycle.

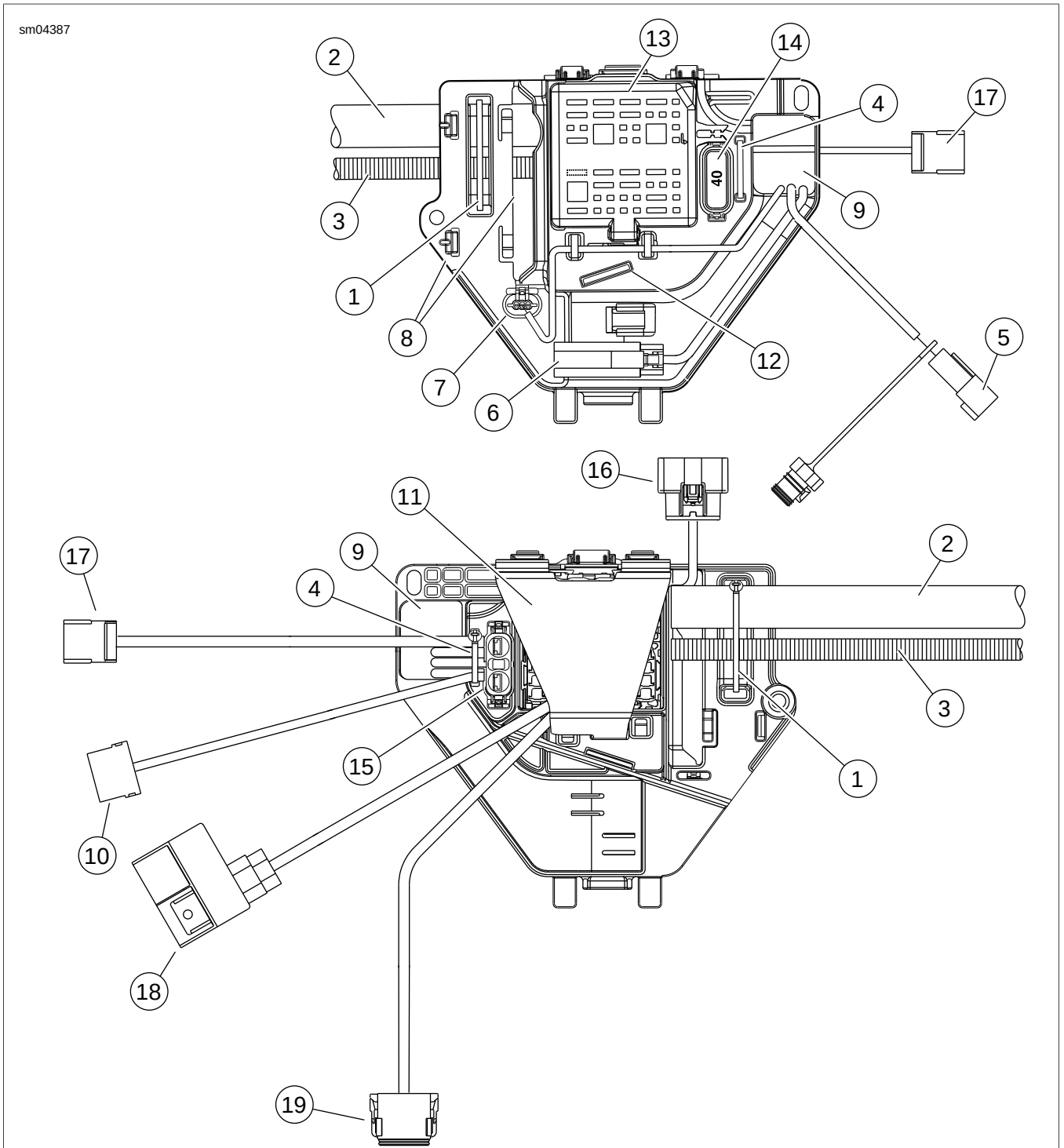
### Installation

1. With the clamp at the rear, install caddy above battery.
2. Install screw to fasten clamp on caddy to frame crossmember. Tighten screw to 15-20 ft-lbs (20-27 Nm).
3. Place ECM in approximate position on caddy (oriented to the right of the left side stop and rear of the front catch).
4. Push ECM forward until front catch engages, and then push down on rear of ECM to engage rear catch.
5. Slide ECM toward left side stop until holes engage two index pins on right side of caddy.
6. Routing conduit along inboard side of left upper frame tube, engage groove on HFSM antenna on tongue at front of caddy, if present.
7. Install seat. See 2.26 SEAT.

## LEFT SIDE CADDY

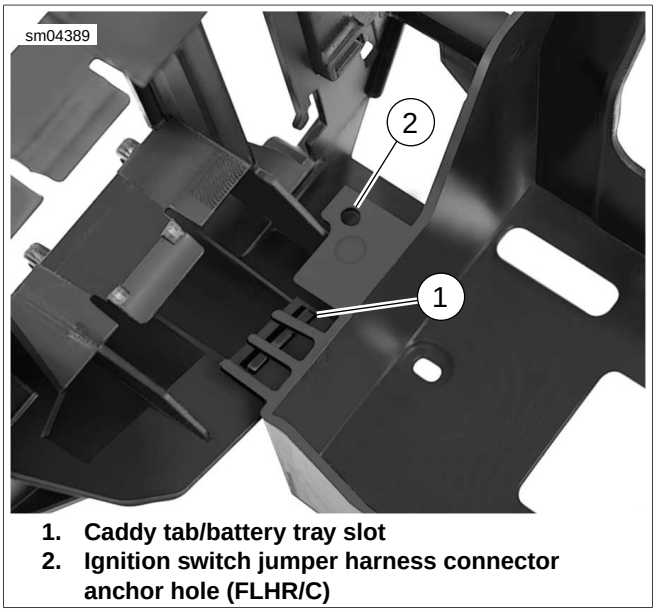
### Removal

1. Remove left side saddlebag. See 2.27 SADDLEBAGS.
2. Remove left side cover.
3. Remove battery. See 1.16 BATTERY MAINTENANCE.
4. Remove front screw to release caddy from battery tray. Remove rear screw to release caddy from frame weldment.
5. Disconnect socket housing from siren, if equipped, and then push two retaining latches forward and pull siren from compartment in caddy.
6. Cut front cable strap to release main harness bundle and main power cable (to maxi-fuse holder) from inboard side of caddy. Remove and discard cable strap. See Figure 8-9.




1. **Front cable strap**
2. **Main harness bundle**
3. **Main power cable**
4. **Rear cable strap**
5. **Data link [91]**
6. **ABS diode pack [201]**
7. **P&A siren [142]**
8. **Siren compartment/retaining latches**
9. **Square shaped opening**
10. **Ignition switch jumper harness [222]**
11. **Harness cover**
12. **Harness cover tongue slot**
13. **Fuse block cover**
14. **Maxi-fuse**
15. **Maxi-fuse holder**
16. **Instrument console [20]**
17. **Rear fender lights harness [7]**
18. **Ignition keyswitch relay [126]**
19. **TSM/HFSM [30]**

**Figure 8-9. Left Side Caddy (FLHR/C)**




1. **Caddy tab/battery tray slot**
2. **Ignition switch jumper harness connector anchor hole (FLHR/C)**

**Figure 8-10. Disengage Left Side Caddy Tab From Battery Tray Slot**

7. Cut rear cable strap to release data link, diode pack (ABS only), siren, rear fender lights and ignition switch jumper harness (FLHR/C) connector conduit from inboard side of caddy. Remove and discard cable strap.
8. Release tongue on data link connector from top groove on caddy. If ABS equipped, release tongue on diode pack connector from bottom groove. Feed conduit and connectors through small square shaped opening to inboard side of caddy.
9. Disconnect siren socket housing from mock pin housing on caddy if siren is not provided. Free conduit from hooks and feed through square shaped opening to inboard side of caddy.
10. On FLHR/C models, pull anchor on ignition switch jumper harness connector, 4-place Packard, from hole in left side of battery tray.
11. Loosen screw (with lifting strap) in middle finger of battery tray.
12. While pulling up on battery tray, pull out caddy until tab is free of slot on battery tray. See Figure 8-10.
13. Pull up on caddy to unseat from weldment between frame downtubes.
14. Remove harness cover from inboard side of caddy. Push up on tongue at bottom of cover to release from slot in caddy and then rotate up to disengage hinges.
15. Remove fuse block cover. Push up on tongue at bottom of cover to release from slot in caddy and rotate up to disengage hinge.
16. Push on bottom of fuse block to move inboard slightly, and then lifting up on top center ear on caddy, push on top of fuse block to remove.
17. Depress latches on maxi-fuse holder and pull from oblong hole in caddy.
18. Remove caddy from motorcycle.

## Installation

1. Start bottom of fuse block into large square shaped opening on inboard side of caddy, and then lifting up on top center ear on caddy, start top of fuse block into opening. Alternately work bottom and top of fuse block into opening until it locks in place.
2. Install fuse block cover. Engage hinge and rotate down over fuse blocks. Push up on tongue at bottom of cover to engage slot in caddy.
3. From inboard side of caddy, push maxi-fuse holder into oblong hole until it locks in place.
4. Feed data link, diode pack (ABS only) and siren connectors and conduit through small square shaped opening to outboard side of caddy.
5. Loosely install **new** cable strap through front slot in caddy capturing main harness bundle and main power cable (to maxi-fuse holder) on inboard side.
6. Loosely install **new** cable strap through rear slot in caddy capturing data link, diode pack (ABS only), siren, rear fender lights and ignition switch jumper harness (FLHR/C) connector conduit on inboard side.
7. Install harness cover on inboard side of caddy. Engage hinges and rotate down over main harness bundle. Be sure to capture both the ignition keyswitch relay and TSM/HFSM connector conduit. Push up on tongue at bottom of cover to engage slot in caddy.
8. Seat caddy on weldment between frame downtubes.
9. While pulling up on battery tray, push on caddy until tab engages slot on battery tray.
10. Engage tongue on data link connector in top groove on caddy. If ABS equipped, engage tongue on diode pack connector in bottom groove.
11. Start front screw to fasten caddy to battery tray. Start rear screw to fasten caddy to frame weldment. Alternately tighten screws to 72-96 **in-lbs** (8.1-10.9 Nm).
12. Tighten screw (with lifting strap) in middle finger of battery tray to 72-96 **in-lbs** (8.1-10.9 Nm).
13. Tighten front and rear cable straps in slots of caddy. Cut any excess cable strap material.
14. If equipped with siren, push two retaining latches forward and slide siren into compartment in caddy. Connect siren socket housing to siren (or mock pin housing on caddy if siren is not provided). Engage conduit in hooks on caddy.
15. On FLHR/C models, install anchor on ignition switch jumper harness connector, 4-place Packard, into hole in left side of battery tray.
16. Install battery. See 1.16 BATTERY MAINTENANCE.
17. Install left side cover.
18. Install left side saddlebag. See 2.27 SADDLEBAGS.

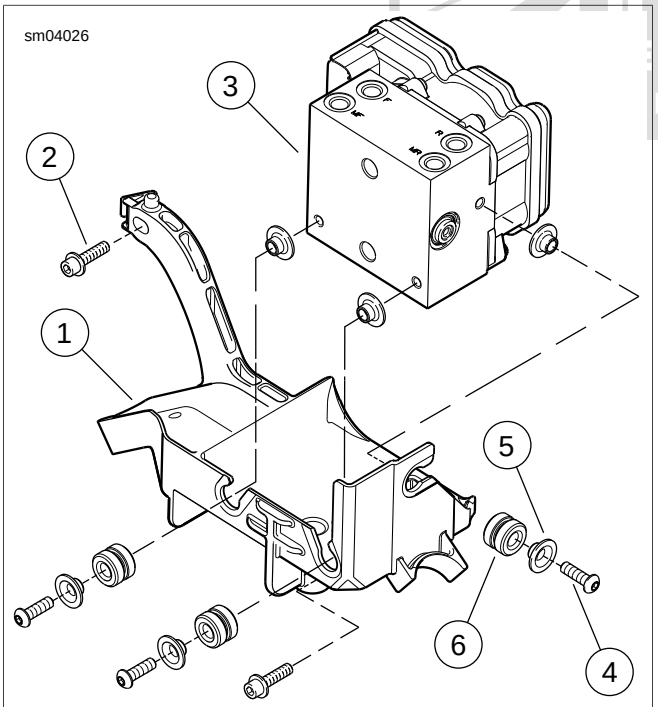
## RIGHT SIDE CADDY

### Removal

*NOTE*

*The right side caddy is only present on motorcycles equipped with ABS and/or active exhaust. If equipped with both ABS and active exhaust, follow all steps provided. If ABS equipped only, see steps 1-2 and 8-12. If only equipped with active exhaust, see steps 1-7 and 10-13.*

1. Remove right side saddlebag. See 2.27 SADDLEBAGS.
2. Remove right side cover.
3. Remove cable clip from slotted flange at front of active exhaust valve (just forward of the right side muffler).
4. Push cam rearward to remove tension from actuator cable, and then release ball end from slot.
5. Release actuator cable from J-clamp fastened to rear swingarm bracket.
6. Pull anchored cable strap from hole in middle frame downtube (adjacent to rear swingarm bracket) to release main harness conduit. Push main harness conduit forward to create clearance for actuator cable.
7. Disconnect active exhaust valve actuator connector [179], 5-place Amp (Tyco).
8. Remove three screws to release ABS module from caddy. See Figure 8-11.




1. **Right side caddy**
2. **Socket head screw (2)**
3. **ABS module**
4. **Socket head screw (3)**
5. **Bushing (6)**
6. **Rubber mount (3)**

**Figure 8-11. Right Side Caddy (ABS Equipped)**

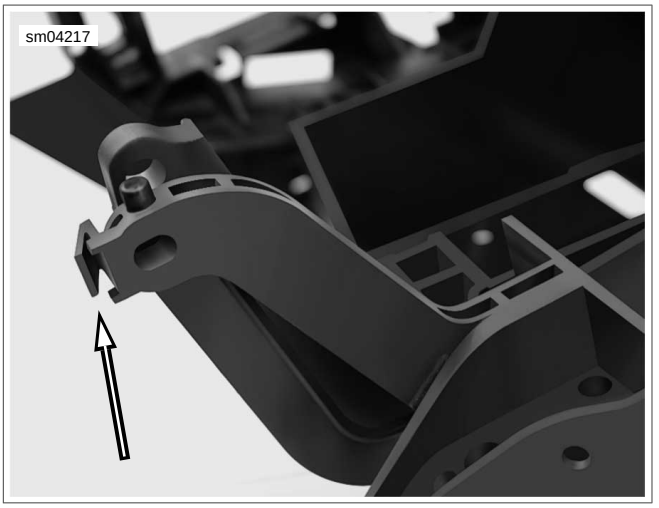



**Figure 8-12. Right Side Caddy Support Arm Lip**

9. Pull anchor on rear wheel speed sensor connector [168], 2-place Amp (Tyco), from hole at rear of caddy.
10. Remove front screw to release caddy from battery tray. Remove rear screw to release support arms of battery tray and caddy from frame weldment.
11. Pull caddy forward to release lip on support arm from behind frame weldment (for side cover grommet). See Figure 8-12.
12. Holding ABS module in place (if equipped), pull caddy outward to release saddles from frame downtubes.
13. If necessary, remove two screws (with flat washers) to release active exhaust valve actuator from caddy.

### Installation

*NOTE*

*The right side caddy is only present on motorcycles equipped with ABS and/or active exhaust. If equipped with both ABS and active exhaust, follow all steps provided. If ABS equipped only, see steps 3-6 and 12-13. If only equipped with active exhaust, see steps 1-4 and 7-13.*

1. If removed, install two screws (with flat washers) to fasten active exhaust valve actuator to caddy. Alternately tighten screws to 32-40 **in-lbs** (3.6-4.5 Nm).
2. Holding caddy, feed actuator cable inboard at rear of middle frame downtube (staying rear of exhaust valve actuator connector conduit), and then outboard again between front of downtube and main harness conduit.
3. Move caddy into position resting front and rear saddles against frame downtubes and engaging lip on rear support arm behind frame weldment (for side cover grommet).
4. Start front screw to fasten caddy to battery tray. Start rear screw to fasten support arms of battery tray and caddy to frame weldment. If necessary, loosen screw in middle finger of battery tray. Alternately tighten screws to 72-96 **in-lbs** (8.1-10.9 Nm).
5. Install anchor on rear wheel speed sensor connector [168], 2-place Amp (Tyco), into hole at rear of caddy.

6. Start three screws to fasten ABS module to caddy. Alternately tighten screws to 39-60 **in-lbs** (4.4-6.8 Nm).
7. Connect active exhaust valve actuator connector [179], 5-place Amp (Tyco)
8. Push cam rearward and install ball end of actuator cable into slot of active exhaust valve (just forward of the right side muffler). Verify that actuator cable is properly seated in channel.
9. Install cable clip onto slotted flange at front of active exhaust valve.
10. Install actuator cable in J-clamp. Install hex screw to fasten J-clamp to rear swingarm bracket, if removed, and tighten to 35-45 **in-lbs** (4.0-5.1 Nm). Pinch J-clamp to ensure that actuator cable remains captured.
11. Install anchored cable strap into hole in frame downtube (inboard of rear swingarm bracket) to secure main harness conduit.
12. Install right side cover.
13. Install right side saddlebag. See 2.27 SADDLEBAGS.

## BATTERY TRAY

### Removal

1. Remove battery. See 1.16 BATTERY MAINTENANCE.
2. Remove left side saddlebag. See 2.27 SADDLEBAGS.
3. Remove left side cover.
4. Remove front screw to release left side caddy from battery tray. Remove rear screw to release caddy from frame weldment.
5. On FLHR/C models, pull anchor on ignition switch connector, 4-place Packard, from hole in left side of battery tray.
6. Note the three fingers at the front of the battery tray. Loosen screw (with lifting strap) to release middle finger from frame crossmember. See Figure 8-13.
7. While pulling up on battery tray, pull out caddy until tab on caddy is free of slot on battery tray. When free, pull up on caddy to remove from weldment between frame downtubes. See Figure 8-10.
8. Remove right side caddy. See 8.6 ELECTRICAL CADDIES, Right Side Caddy.

*NOTES*

- *The right side caddy is only present on motorcycles equipped with ABS and/or active exhaust. If neither is provided, simply remove the right side saddlebag and side cover, and then the screw and spacer to release support arm of battery tray from frame weldment.*
- *If active exhaust valve actuator is not provided, disconnect unused socket housing from mock pin housing at side of battery tray.*

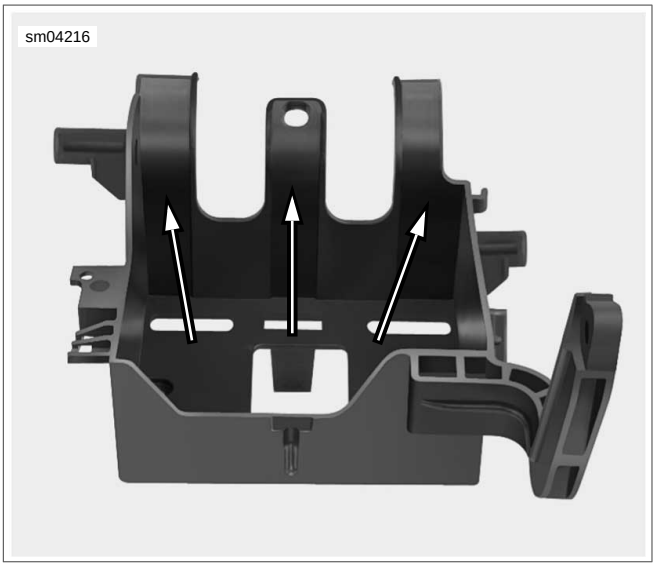
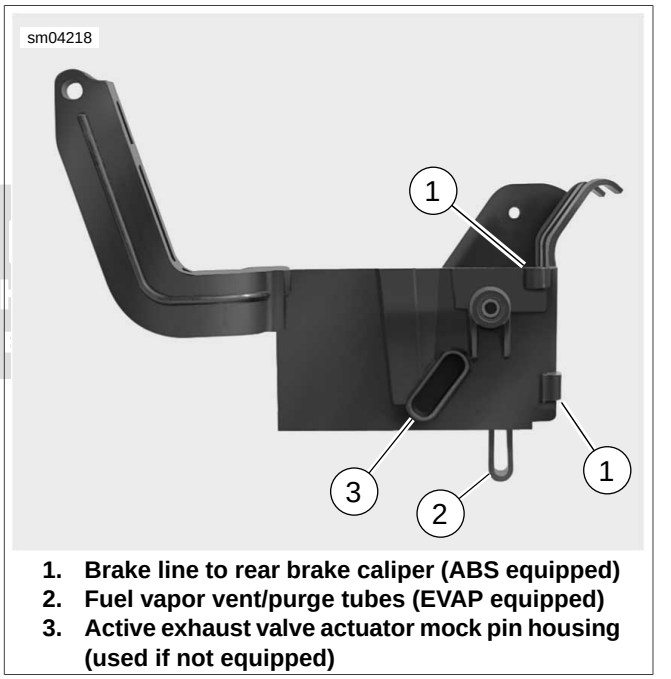



**Figure 8-13. Battery Tray Fingers (Rear View)**




1. **Brake line to rear brake caliper (ABS equipped)**
2. **Fuel vapor vent/purge tubes (EVAP equipped)**
3. **Active exhaust valve actuator mock pin housing (used if not equipped)**

**Figure 8-14. Battery Tray Routing (Right Side View)**

9. Remove spring clip and pull TSM/HFSM module out of opening on right side of frame crossmember. If present, draw HFSM antenna and jumper harness below frame crossmember thru empty slot of rubber boot on left side, and then pull back up and out thru right side opening. Lay jumper harness across rear fender.
10. Note the three fingers at the front of the battery tray. Remove screw to release middle finger (with lifting strap) from frame crossmember.
11. Pulling up on left finger, work main power cable (to maxi-fuse holder) from inboard to outboard side.
12. Feed battery positive cable forward under frame crossmember to area of starter.

13. Remove flange nut from rear ground stud on left side of frame backbone and remove chassis ground ring terminal. Draw chassis ground ring terminal and battery negative cable into battery tray and then feed forward under frame crossmember to area of starter.
14. Work branches of main harness bundle in front of right finger on battery tray.
15. On FLHX, FLHT/C/U and FLTR models, locate fuel overflow hose following rear of forward frame downtube to area of oil pan. Pull fuel overflow hose up and out of the way.
16. If equipped, rotate ABS module outward releasing brake line (to rear brake caliper) from channels at side of battery tray. See Figure 8-14.
17. On California models, proceed as follows:
    a. Disconnect fuel vapor vent tube (vapor valve to charcoal canister) from front fitting stamped "TANK."
    b. Disconnect purge tube (charcoal canister to purge solenoid) from rear fitting stamped "PURGE."
    c. Remove two screws (with flat washers) to release charcoal canister from bottom of battery tray.
    d. Slide charcoal canister out opening on right side of motorcycle.
    e. Raise battery tray as necessary to release fuel vapor vent tube and purge tube from channel at bottom of battery tray.
18. Remove battery tray. For best results, rotate in a counterclockwise direction until three fingers at front are pointing upward. Move battery tray rearward, so that fingers are under rear frame crossmember, and then pull out through opening on right side of motorcycle.

## Installation

1. Install battery tray. For best results, hold with the three fingers at front pointing upward. Slide into opening on right side of motorcycle, so that fingers are under rear frame crossmember. Move battery tray forward until fingers are in front of crossmember, and then rotate in a clockwise direction.
2. Work branches of main harness bundle rear of right finger on battery tray, so that bundles straddle finger.
3. Pulling up on left finger, work main power cable (to maxifuse holder) from the outboard to inboard side.
4. Start screw (with lifting strap) to fasten middle finger to frame crossmember.
5. Start screw to fasten support arm of battery tray to frame weldment.
6. On California models, proceed as follows:
    a. Install fuel vapor vent tube and purge tube into channel at bottom of battery tray.
    b. Slide charcoal canister under battery tray using opening on right side of motorcycle.
    c. Align holes in charcoal canister with those in battery tray and start two screws (with flat washers). Alternately tighten screws to 10-15 **in-lbs** (1.1-1.7 Nm).
    d. Connect purge tube (charcoal canister to purge solenoid) to rear fitting stamped "PURGE."
    e. Connect fuel vapor vent tube (vapor valve to charcoal canister) to front fitting stamped "TANK."
7. If equipped, rotate ABS module inward engaging brake line (to rear brake caliper) in channels at side of battery tray. See Figure 8-14.
8. From area of starter, feed battery positive cable rearward under frame crossmember into battery tray inboard of left finger.
9. From area of starter, feed chassis ground ring terminal and battery negative cable rearward under frame crossmember into battery tray inboard of right finger.
10. Install chassis ground ring terminal onto rear ground stud on left side of frame backbone. Install flange nut and tighten to 50-90 **in-lbs** (5.7-10.2 Nm).
11. Start screw (with lifting strap) to fasten middle finger of battery tray to frame crossmember.
12. Remove screw to release support arm of battery tray from frame weldment.
13. On FLHX, FLHT/C/U and FLTR models, route fuel overflow hose down to area of oil pan following rear of forward frame downtube.
14. If present, feed HFSM antenna and jumper harness down through opening on right side of frame crossmember, and then pull back up and out thru empty slot of rubber boot on left side. Lay jumper harness across rear fender.
15. Install TSM/HFSM module into opening in frame crossmember and install spring clip.
16. Install right side caddy. See RIGHT SIDE CADDY in this section.

*NOTES*

- *The right side caddy is only present on those motorcycles equipped with ABS and/or active exhaust. If neither is provided, simply install screw and spacer to fasten support arm of battery tray to frame weldment. Tighten screw to 72-96* ***in-lbs*** *(8.1-10.9 Nm). Install side cover and right side saddlebag.*
- *If active exhaust valve actuator is not provided, connect unused socket housing to mock pin housing at side of battery tray.*

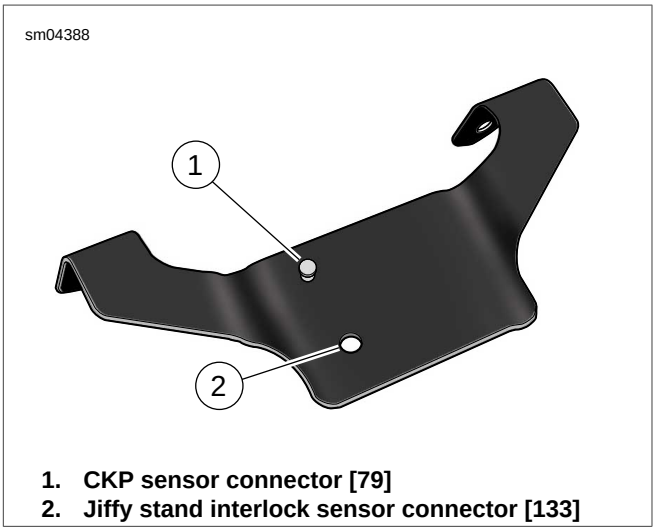
17. While pulling up on battery tray, push on caddy until tab on caddy engages slot on battery tray.
18. Start front screw to fasten left side caddy to battery tray. Start rear screw to fasten caddy to frame weldment.

19. Snug screw (with lifting strap) to fasten middle finger of battery tray to frame crossmember.
20. Alternately tighten three screws to 72-96 **in-lbs** (8.1-10.9 Nm).
21. On FLHR/C models, install anchor on ignition switch connector, 4-place Packard, into hole in left side of battery tray.
22. Install battery. See 1.16 BATTERY MAINTENANCE.
23. Install left side cover.
24. Install left side saddlebag. See 2.27 SADDLEBAGS.

## FRONT CADDY

### Removal

1. Remove voltage regulator. See 8.2 VOLTAGE REGULATOR.
2. Remove P-clips from studs on lower frame crossmember.
3. Push CKP sensor connector [79], 2-place Deutsch, toward right side of motorcycle to disengage attachment clip from T-stud on caddy. See Figure 8-15.
4. Push anchor on jiffy stand interlock sensor connector [133], 3-place Molex, from hole in caddy.
5. Remove caddy from studs on lower frame crossmember. For best results, raise rear of caddy until it almost contacts bottom of crankcase, and then remove from studs.




1. **CKP sensor connector [79]**
2. **Jiffy stand interlock sensor connector [133]**

**Figure 8-15. Front Caddy**

### Installation

1. Install caddy onto studs on lower frame crossmember. For best results, position caddy at rear of lower frame crossmember, and then before engaging studs, raise rear of caddy until it almost contacts bottom of crankcase.
2. Push CKP sensor connector [79], 2-place Deutsch, toward left side of motorcycle to engage attachment clip on T-stud.
3. Push anchor on jiffy stand interlock sensor connector [133], 3-place Molex, into hole in caddy.
4. Install P-clips onto studs on lower frame crossmember. Properly oriented, P-clips are positioned at front of studs with the open sides up.
5. Install voltage regulator. See 8.2 VOLTAGE REGULATOR.

## REMOVAL

1. Remove left side saddlebag. See 2.27 SADDLEBAGS.
2. Remove left side cover.
3. Pull maxi-fuse from maxi-fuse holder.
4. Disconnect security siren connector [142].
5. Push two retaining latches forward and pull siren from compartment in left side caddy.

## INSTALLATION

1. Push two retaining latches forward and slide siren into compartment in left side caddy.
2. Connect security siren connector [142].

*NOTE*

*If siren is not provided, connect siren socket housing to mock pin housing on left side caddy. Be sure conduit is engaged in hooks on caddy.*

3. Install maxi-fuse into maxi-fuse holder.
4. Install left side cover.
5. Install left side saddlebag. See 2.27 SADDLEBAGS.

## BATTERY TESTING

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48053 | ELECTRICAL SYSTEM ANALYZER WITH WIRELESS PRINTER |

**⚠WARNING**

**Batteries contain sulfuric acid, which could cause severe burns to eyes and skin. Wear a protective face shield, rubberized gloves and protective clothing when working with batteries. KEEP BATTERIES AWAY FROM CHILDREN. (00063a)**

**⚠WARNING**

**Never remove warning label attached to top of battery. Failure to read and understand all precautions contained in warning, could result in death or serious injury. (00064a)**

### General

See 1.16 BATTERY MAINTENANCE for removal, installation, inspection and storage information.

Three different procedures may be performed to provide a good indicator of battery condition: a voltage test, a conductance test, or a load test. For the voltage test, see 1.16 BATTERY MAINTENANCE, Voltmeter Test.

A battery may be tested, whether fully charged or not, via conductance test. In order to perform a load test, however, the battery must be fully charged.

### Conductance Test

Test the battery using the ELECTRICAL SYSTEM ANALYZER WITH WIRELESS PRINTER (Part No. HD-48053). Perform a battery test as follows:

1. Connect the electrical system analyzer leads to the vehicle's battery.
2. Follow the instructions in the analyzer's instruction manual to perform a battery test.

The test results will include a decision on the battery's condition, the measured state of charge and the measured CCA.

See Figure 8-16. The analyzer's printer will provide you with a printout including one of five possible test results:

- GOOD BATTERY -- Return the battery to service.
- GOOD-RECHARGE -- Fully charge the battery and return to service.
- CHARGE/RETEST -- Fully charge the battery and retest.
- REPLACE BATTERY -- Replace the battery and retest.
- BAD CELL-REPLACE -- Replace the battery and retest.

*NOTE*

*A REPLACE BATTERY test result may also mean a poor connection between the battery cables and the vehicle. After disconnecting the battery cables from the battery, retest the battery using the out-of-vehicle test before replacing.*

### Load Test

The load test measures battery performance under full current load. To load test the battery, proceed as follows:

1. Remove battery from motorcycle.

*NOTE*

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

2. Always fully charge the battery before testing or test readings will be incorrect.
3. After charging, allow battery to stand for at least one hour before testing.

**⚠WARNING**

**Turn battery load tester OFF before connecting tester cables to battery terminals. Connecting tester cables with load tester ON can cause a spark and battery explosion, which could result in death or serious injury. (00252a)**

4. See Figure 8-17. Connect tester leads to battery posts and place induction pickup over negative (black) cable.

*NOTE*

*To avoid load tester and/or battery damage, do not leave the load tester switch turned ON for more than 20 seconds.*

5. Refer to 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).

**⚠WARNING**

**Turn battery load tester OFF before disconnecting tester cables to battery terminals. Disconnecting tester cables with load tester ON can cause a spark and battery explosion, which could result in death or serious injury. (00253a)**

6. Install the battery on the motorcycle.

**Table 8-4. Battery Load Test**

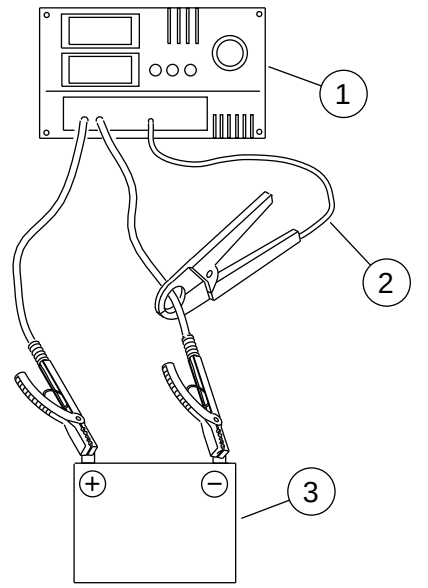
| COLD CRANKING AMPERAGE (CCA) | 100% | 50% |
|---|---|---|
| Touring models | 370 | 185 |

sm00396

```
MCR-101 HD V1.0
(C) MIDTRONICS

MON 02/21/05
3:45 PM
LAST 6 OF VIN
012345
DATE CODE
B5

BATTERY TEST
RATING:
295 CCA
65958-94

12.32V 95CCA
REPLACE BATTERY

WARRANTY CODE
9J9G9N-0132N8
```

**Figure 8-16. Battery Test Results-Printout**

sm02555




1. **Load tester**
2. **Induction pickup**
3. **Battery**

**Figure 8-17. Load Test Battery**

## HEADLAMP ASSEMBLY

### Removal

1. Remove screw at bottom of headlamp door (chrome ring). Remove headlamp door.
2. Proceed as follows:
   a. **FLHR/C:** Remove seven screws from headlamp housing and carefully pull headlamp assembly from headlamp nacelle.
   b. **FLHX, FLHT/C/U:** Remove three screws from retaining ring and carefully pull headlamp assembly from outer fairing. See Figure 8-18.
3. Remove headlamp connector [38] at back of headlamp bulb.

### Installation

1. Install headlamp connector [38] at back of headlamp bulb.
2. Proceed as follows:
   a. **FLHR/C:** Align holes in headlamp housing with wellnuts in headlamp nacelle (headlamp door bracket at bottom). Install seven screws and alternately tighten to 9-18 **in-lbs** (1.0-2.0 Nm).
   b. **FLHX, FLHT/C/U:** Align holes in retaining ring of headlamp assembly with those in outer fairing (headlamp door bracket at bottom). Install three screws and alternately tighten to 23-28 **in-lbs** (2.6-3.2 Nm). See Figure 8-18.
3. Fit the square-shaped portion of the headlamp door spring into slot at top of headlamp housing and then snap the headlamp door (chrome ring) into place. Install screw at bottom of headlamp door and tighten to 9-18 **in-lbs** (1.0-2.0 Nm).

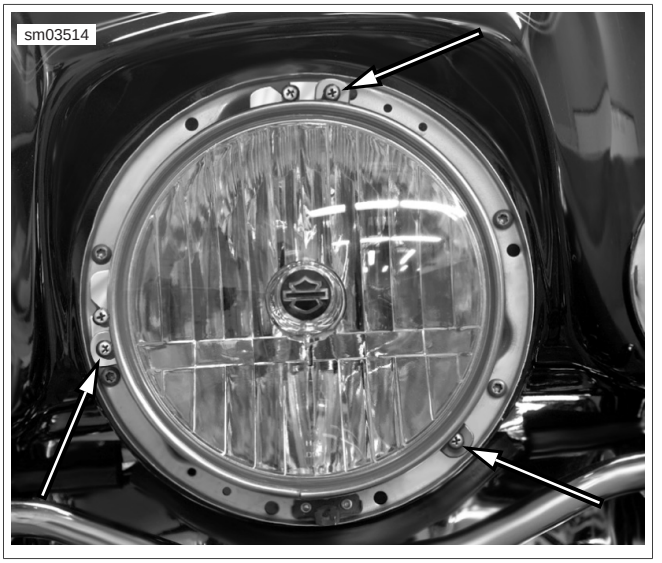



**Figure 8-18. Remove Retaining Ring Screws (FLHX, FLHT/C/U)**

## 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 headlamp assembly.
2. Remove rubber boot at back of lens.
3. Press down on wireform loop and push pin end out from under lip of retainer to release. See Figure 8-19. Use hinge to swing wireform out of the way.

*NOTE*

*If it is difficult to free pin end of wireform from under lip of retainer, loosen retainer screw 1/2-1 turn and then repeat step 3.*

**⚠WARNING**

**Handle bulb carefully and wear eye protection. Bulb contains gas under pressure, which, if not handled carefully, could cause serious eye injury. (00062b)**

4. Remove and discard bulb.

**CAUTION**

**Never touch the quartz bulb. Fingerprints will etch the glass and decrease bulb life. Grab the bulb with paper or a clean, dry cloth. Failure to do so could result in bulb damage. (00210a)**

5. Install **new** bulb in lens. Rotate bulb as necessary so that wider ear on backplate points toward the top of the headlamp assembly.

*NOTE*

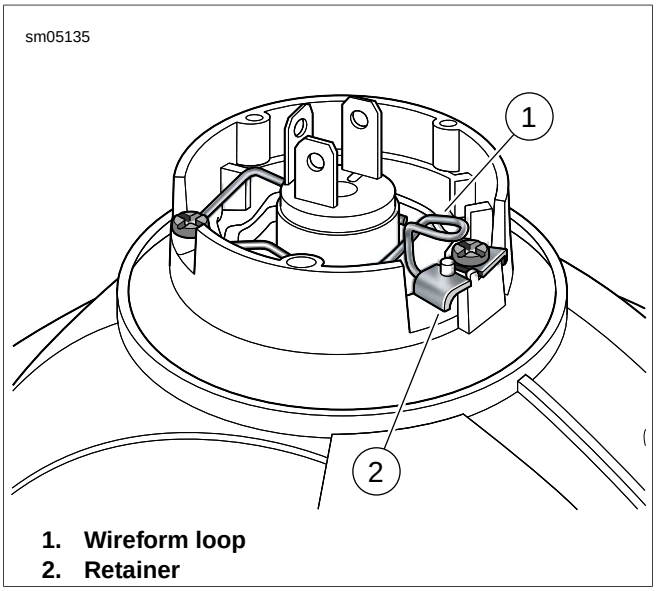
*The top of the headlamp assembly can be determined by the orientation of the decorative logo on the opposite side, or the location of the headlamp door bracket, which is always at the bottom of the assembly.*

6. Use hinge to rotate wireform over socket at back of bulb. Press down on loop and push pin end under lip of retainer to secure. See Figure 8-19.

*NOTE*

*If retainer screw was loosened to release wireform, use finger to hold retainer in place and then slowly tighten screw until snug. Turning headlamp assembly over, verify that reflector cone is still centered under decorative logo. If it is not, loosen retainer screw and repeat step until the proper results are achieved.*

7. Install rubber boot at back of lens.
8. Install headlamp assembly.




1. **Wireform loop**
2. **Retainer**

**Figure 8-19. Headlamp Bulb Assembly**

## HEADLAMP ASSEMBLY

### Removal

1. Remove outer fairing. See 2.39 UPPER FAIRING AND WINDSHIELD: FLTR.
2. Move outer fairing assembly to bench area.
3. Remove headlamp harness connectors.

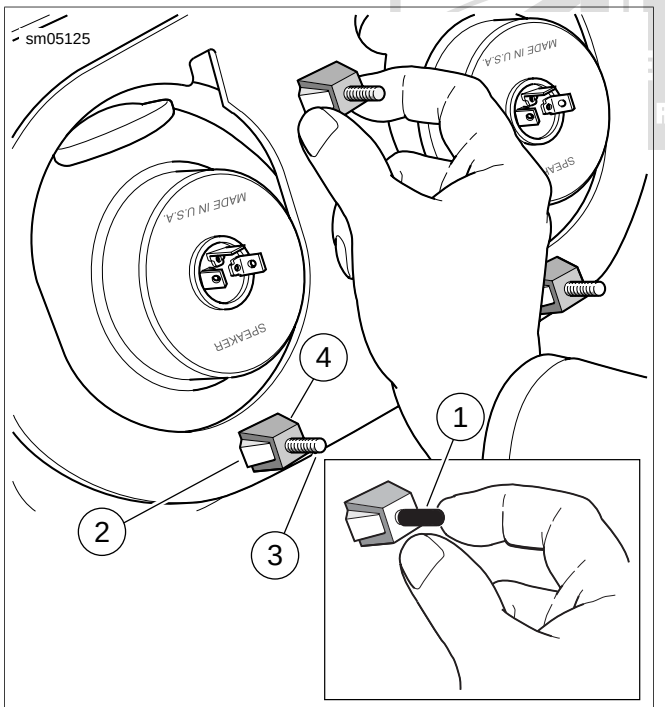
*NOTE*

*Wrap electrical tape around blade of screwdriver to prevent damage to tabs of transparent lens cover.*

4. From inboard side of outer fairing, release top of transparent lens cover from slots in fairing by gently depressing two tabs with blade of screwdriver. Depress two bottom tabs and remove lens cover from fairing.
5. See inset of Figure 8-20. Remove protective sleeve from top center hex adjuster stud.
6. Depress mounting clips on all three hex adjuster studs and pull headlamp assembly out front of outer fairing.

### Installation

1. At front of outer fairing, align ends of hex adjuster studs with holes in plastic bosses. Push headlamp assembly into position until mounting clips engage outer fairing.




1. **Protective sleeve**
2. **Mounting clip**
3. **Hex adjuster stud**
4. **Plastic boss**

**Figure 8-20. Depress Mounting Clips**

*NOTE*

*See inset of Figure 8-20. To avoid cutting or chafing wires, be sure to install protective sleeve on top center stud of headlamp assembly.*

2. Carefully snap bottom tabs of transparent lens cover into bottom slots of outer fairing. Carefully snap upper tabs of lens cover into upper slots of fairing.
3. Install headlamp harness connectors.
4. Install outer fairing. See 2.39 UPPER FAIRING AND WINDSHIELD: FLTR.

## HEADLAMP BULB REPLACEMENT

*NOTES*

- *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.*
- *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 outer fairing. See 2.39 UPPER FAIRING AND WINDSHIELD: FLTR.
2. Move outer fairing assembly to bench area.
3. Remove headlamp harness connector.
4. Remove rubber boot at back of bulb housing.
5. Rotate retainer in a counter-clockwise direction to remove from bulb housing. See Figure 8-21.

**⚠WARNING**

**Handle bulb carefully and wear eye protection. Bulb contains gas under pressure, which, if not handled carefully, could cause serious eye injury. (00062b)**

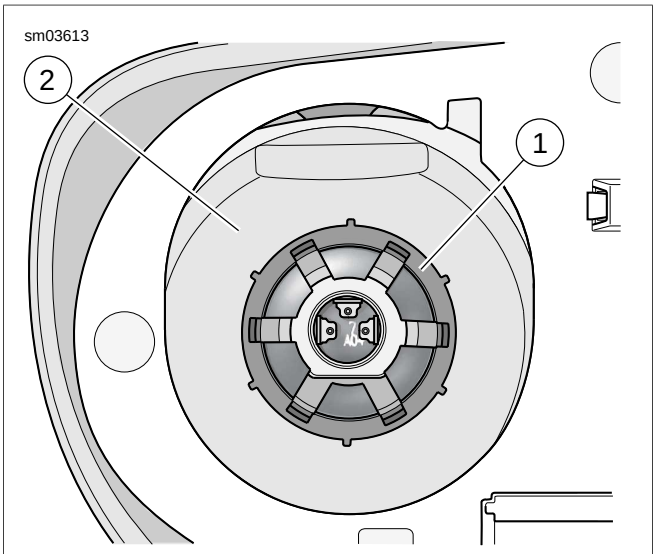
6. Remove and discard bulb.

### Installation

**CAUTION**

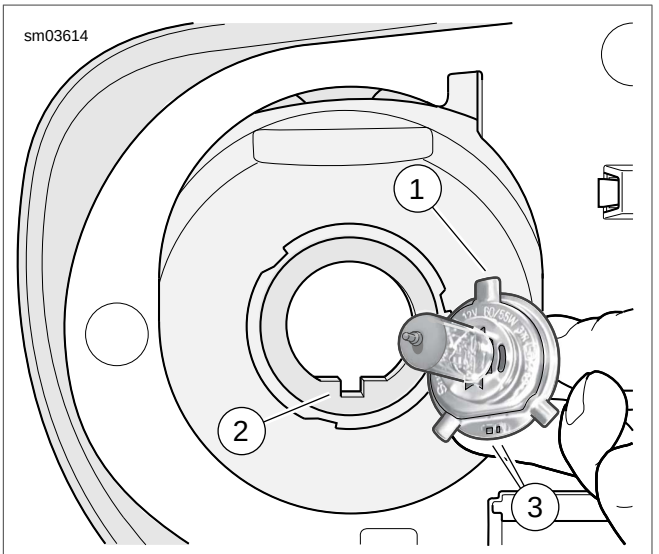
**Never touch the quartz bulb. Fingerprints will etch the glass and decrease bulb life. Grab the bulb with paper or a clean, dry cloth. Failure to do so could result in bulb damage. (00210a)**

1. See Figure 8-22 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.
2. See Figure 8-21. Place retainer over bulb housing and rotate in a clockwise direction until tight.




1. **Retainer**
2. **Bulb housing**

**Figure 8-21. Remove Retainer to Release Bulb**




1. **Wider ear**
2. **Slot**
3. **Tabs**

**Figure 8-22. Install New Bulb in Bulb Housing**

3. Install rubber boot over retainer until flush with base of bulb socket.
4. Install headlamp harness connector.
5. Install outer fairing. See 2.39 UPPER FAIRING AND WINDSHIELD: FLTR.

## AUXILIARY LAMP BULB

### Removal

1. Loosen auxiliary lamp door screw as required to pull lamp door from lip of lamp housing. See Figure 8-23.
2. Disconnect auxiliary lamp connector [199L/R], 2-place Packard. See Figure 8-24.
3. Remove nesting ring at back of lens.

**⚠WARNING**

**Handle bulb carefully and wear eye protection. Bulb contains gas under pressure, which, if not handled carefully, could cause serious eye injury. (00062b)**

4. Rotate bulb/pin housing 1/4 turn in a counterclockwise direction and remove from lens. Discard bulb/pin housing. See Figure 8-25.

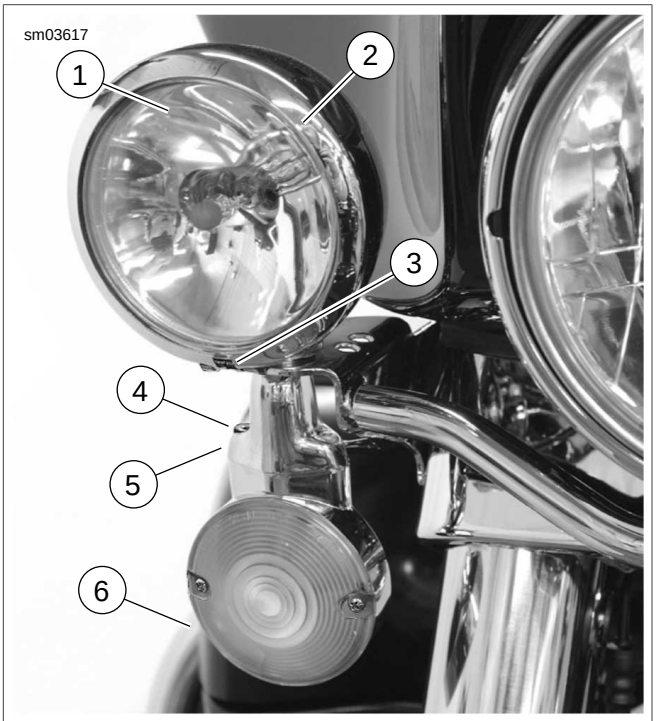
**CAUTION**

**Never touch the quartz bulb. Fingerprints will etch the glass and decrease bulb life. Grab the bulb with paper or a clean, dry cloth. Failure to do so could result in bulb damage. (00210a)**

5. Install **new** bulb/pin housing in lens and rotate 1/4 turn in a clockwise direction. See Figure 8-25.

### Installation

1. Place nesting ring at back of lens with the concave side up. See Figure 8-24.
2. Connect auxiliary lamp connector [199L/R], 2-place Packard. See Figure 8-24.
3. Place nesting ring over edge of lamp housing. Rotate nesting ring until index tab engages slot at bottom of lamp housing.
4. Holding nesting ring in place, rotate lens so that index tabs at back engage slots in nesting ring.
5. 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.




1. **Auxiliary lamp**
2. **Door**
3. **Door screw**
4. **Allen head screw (2)**
5. **Mounting bracket**
6. **Turn signal lamp**

**Figure 8-23. Auxiliary and Front Turn Signal Lamp**


1. **Lamp index tab**
2. **Nesting ring index tab**

**Figure 8-24. Auxiliary Lamp Assembly**


**Figure 8-25. Auxiliary Lamp Bulb/Pin Housing**

## AUXILIARY LAMP HOUSING

### Removal

*NOTE*

*If replacing only the lamp housing, as shown in Figure 8-28, begin at step 1. Start at step 2 if replacing the entire lamp assembly.*

1. Disassemble auxiliary lamp. See 8.11 AUXILIARY LAMPS AND BRACKETS, Auxiliary Lamp Bulb.
2. Proceed as follows:
   a. **FLHR/C:** Remove headlamp assembly. See 8.9 HEADLAMP: ALL EXCEPT FLTR. Disconnect auxiliary lamps connector [73], 2-place Multilock. See Figure 8-26.
   b. **FLHT/C/U:** Remove outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U. Disconnect the left or right front turn signal/auxiliary lamp connector [31L/R], 4-place Multilock, on T-stud at top of left or right fairing support brace (outboard side). See Figure 8-27.
3. Remove appropriate terminal(s) from socket housing.

**Table 8-5. FLHR/C Auxiliary Lamps [73]**

| LEFT SIDE | | RIGHT SIDE | |
|---|---|---|---|
| WIRE COLOR | CHAMBER | WIRE COLOR | CHAMBER |
| Gray/Black | 1 | Gray/Black | 2 |

**Table 8-6. FLHT/C/U Auxiliary Lamps [31L/R]**

| LEFT SIDE [31L] | | RIGHT SIDE [31R] | |
|---|---|---|---|
| WIRE COLOR | CHAMBER | WIRE COLOR | CHAMBER |
| Gray/Black | 4 | Gray/Black | 4 |
| Note: Terminals 1, 2 and 3 are reserved for the turn signal lamp. | | | |

*NOTE*

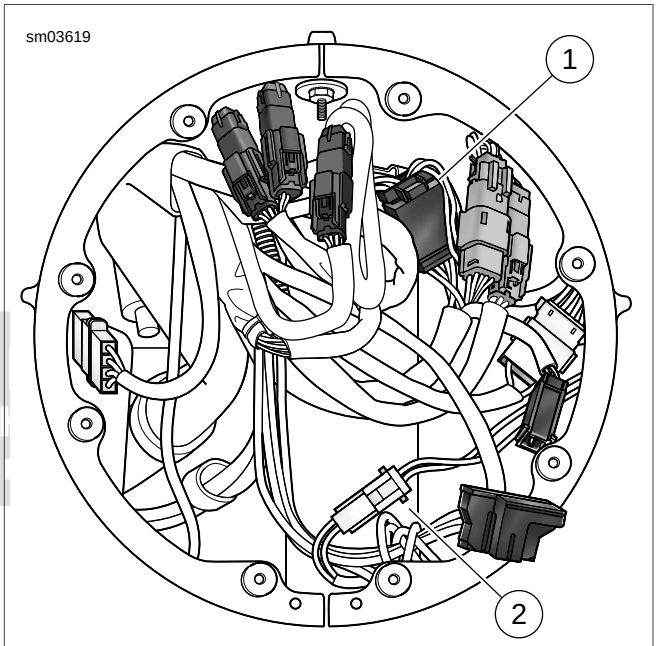
*For instructions on removing terminals, see A.2 AMP MULTI-LOCK CONNECTORS.*

4. Remove two allen head screws to release turn signal lamp from mounting bracket. See Figure 8-23.
5. Obtain length 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 8-29.

*NOTE*

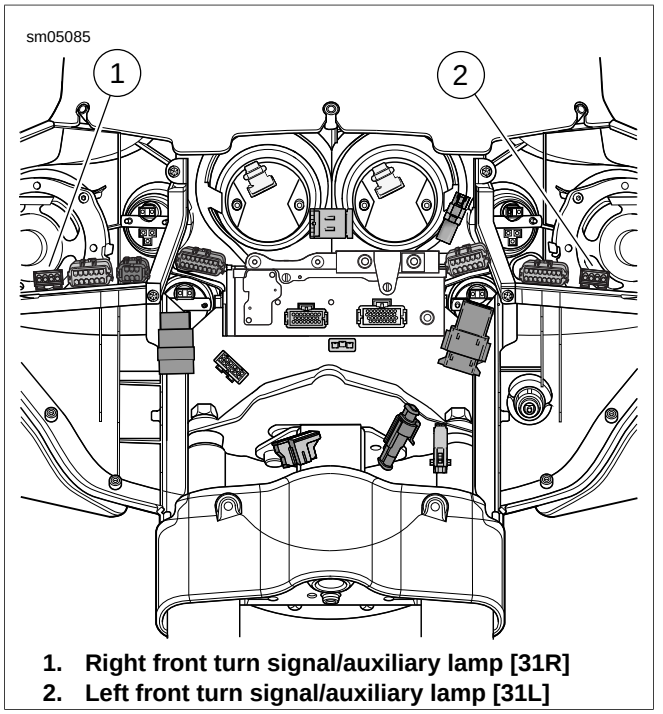
*Be sure that mechanics wire is of sufficient strength to pull terminal through conduit without breaking. Wire length must also be long enough so that free end is not lost in conduit when pulled.*

6. Carefully pull wire to draw socket terminal through conduit.
7. Unravel mechanics wire to release socket terminal.
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 auxiliary lamp (with Belleville washer and swivel block) from the auxiliary lamp bracket.




1. **Front turn signal lamps [31]**
2. **Auxiliary lamps [73]**

**Figure 8-26. Headlamp Nacelle (FLHRC)**




1. **Right front turn signal/auxiliary lamp [31R]**
2. **Left front turn signal/auxiliary lamp [31L]**

**Figure 8-27. Inner Fairing (FLHT/C/U)**

## Installation

1. Lay old auxiliary lamp next to **new** auxiliary lamp and cut wire to length.
2. Strip 3/16 in (4.8 mm) of insulation off wire and crimp on **new** socket terminal.

*NOTE*

*For instructions on crimping terminals, see A.2 AMP MULTI-LOCK CONNECTORS.*

3. If removed, slide swivel block and Belleville washer down wire onto auxiliary lamp stud. Be sure that rounded side of swivel block and concave side of Belleville washer face auxiliary lamp.
4. Feed wire through slot at top of auxiliary lamp bracket and insert threaded stud into forward slot. Slide clamp block (rounded side up), turn signal mounting bracket and locknut up wire onto auxiliary lamp stud at bottom of bracket.
5. Using flare nut socket (Snap-on® FRX181), tighten locknut to 15-18 ft-lbs (20.3-24.4 Nm).
6. Reattach mechanics wire to socket terminal and carefully pull end of mechanics wire to draw socket terminal back through conduit.
7. Carefully remove mechanics wire to avoid damage to terminal.
8. Install terminal into socket housing. Refer to Table 8-5 or Table 8-6.

*NOTE*

*For instructions on installing terminals, see A.2 AMP MULTI-LOCK CONNECTORS.*

9. Connect front turn signal/auxiliary lamp connector.
10. Turn Ignition/Light Key Switch to IGNITION and test for proper operation and alignment. Adjust if necessary.
11. Start two allen head screws to secure turn signal lamp to mounting bracket. See Figure 8-23. Verify that conduit fits in slot at back of bracket and is not pinched. Alternately tighten screws to 36-60 **in-lbs** (4.1-6.8 Nm).
12. Proceed as follows:
    a. **FLHR/C:** Install headlamp assembly. See 8.9 HEADLAMP: ALL EXCEPT FLTR.
    b. **FLHT/C/U:** Install connector on T-stud at top of left or right fairing support brace (outboard side). Verify that conduit is routed inboard using relief in upper outboard corner of chrome skirt. Install outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
13. Assemble auxiliary lamp, if necessary. See 8.11 AUXILIARY LAMPS AND BRACKETS, Auxiliary Lamp Bulb.

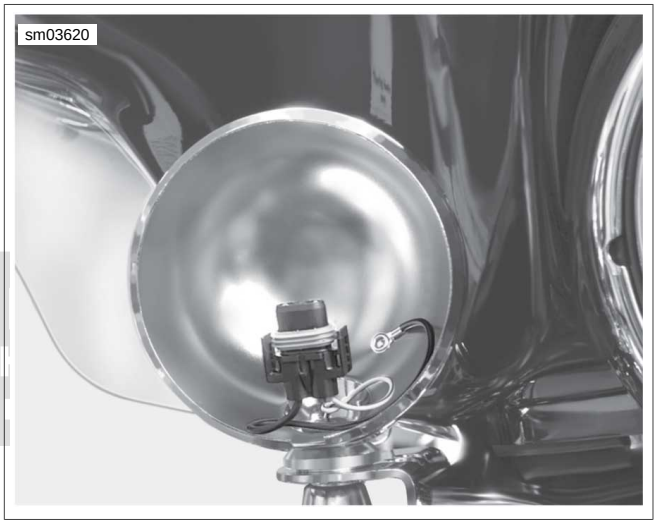



**Figure 8-28. Auxiliary Lamp Housing**

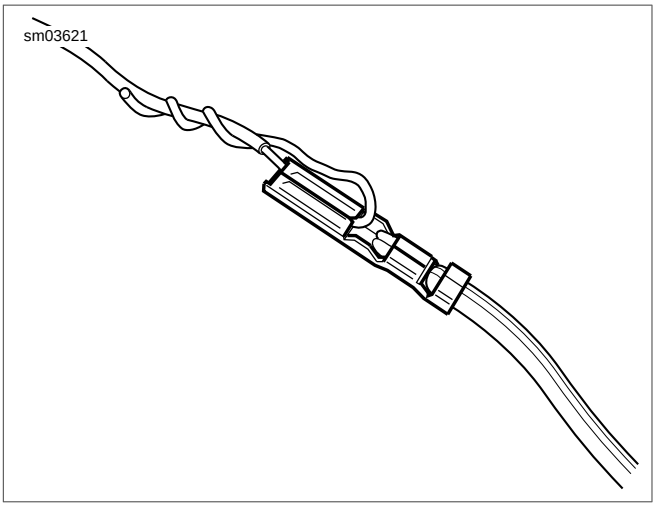



**Figure 8-29. Fix Mechanics Wire to Socket Terminal**

## AUXILIARY LAMP BRACKET

### Removal

1. Proceed as follows:
   a. **FLHR/C:** Remove headlamp assembly. See 8.9 HEADLAMP: ALL EXCEPT FLTR. Disconnect auxiliary lamps connector [73], white 2-place Multilock. Disconnect front turn signal lamps connector [31], 6-place Multilock, anchored in hole of fork stem nut lockplate (left side). See Figure 8-26.
   b. **FLHT/C/U:** Remove outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U. Disconnect the left and right front turn signal/auxiliary lamp connectors [31L/R], 4-place Multilocks, on T-studs at top of left and right fairing support braces (outboard sides). See Figure 8-27.
2. Proceed as follows:
   a. **FLHR/C:** Remove acorn nuts from fork bracket studs.
   b. **FLHT/C/U:** Loosen screws in upper and lower fork brackets.
3. Remove auxiliary lamp bracket from motorcycle.

### Installation

1. Install auxiliary lamp bracket on motorcycle. Proceed as follows:
   a. **FLHR/C:** Slide slots of auxiliary lamp bracket onto upper and lower fork bracket studs. Install acorn nuts on studs. Alternately tighten acorn nuts to 72-108 **in-lbs** (8.1-12.2 Nm) using a crosswise pattern.
   b. **FLHT/C/U:** Slide slots of auxiliary lamp bracket onto screws in upper and lower fork brackets. Alternately tighten screws to 15-20 ft-lbs (20-27 Nm) using a crosswise pattern.
2. Proceed as follows:
   a. **FLHR/C:** Connect auxiliary lamps connector [73], white 2-place Multilock. Connect front turn signal lamps connector [31], 6-place Multilock. Install anchor on connector into hole of fork stem nut lockplate (left side). Install headlamp assembly. See 8.9 HEADLAMP: ALL EXCEPT FLTR.
   b. **FLHT/C/U:** Connect the left and right front turn signal/auxiliary lamp connectors [31L/R], 4-place Multilocks. Install connectors on T-studs at top of left and right fairing support braces (outboard sides). Verify that conduit is routed inboard using reliefs in upper outboard corners of chrome skirt. Install outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.

## ADJUSTMENT

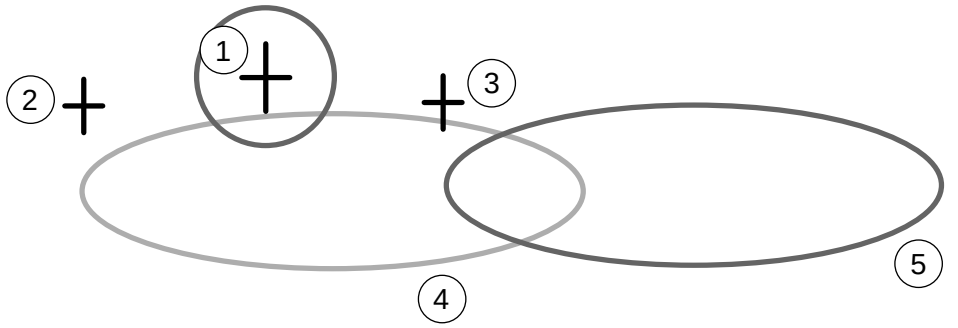
### Headlamp High Beam

1. Adjust the headlamp high beam for proper height and lateral alignment. See 1.21 HEADLAMP ALIGNMENT.
2. With a rider seated on the motorcycle and the front wheel pointed straight ahead, turn on the headlamp high beam.
3. Mark the center of the headlamp high beam by making a vertical line through the horizontal line already drawn on the wall. Properly adjusted, the beam should project an equal area of light to the left and right of the vertical centerline. See item 1 in Figure 8-30.

### Auxiliary Lamps

1. Turn the headlamp off and move to the front of the motorcycle.
2. Measure the distance from the headlamp horizontal centerline down to the horizontal centerline of the left side auxiliary lamp. Now measure the distance from the headlamp vertical centerline out to the vertical centerline of the same lamp.
3. Repeat measurements performed in previous step on right side auxiliary lamp.
4. From the headlamp high beam centerlines, perform the measurements taken in steps 5-6 to locate the left and right side auxiliary lamp centerlines on the wall. See items 2 and 3 in Figure 8-30.
5. Turn on the headlamp high beam again, and with a rider seated on the motorcycle, verify that it is still aligned with the horizontal and vertical centerlines.
6. Turn on the headlamp low beam and then cover both the headlamp and the right side auxiliary lamp. Adjust the left side auxiliary lamp as necessary so that the entire high intensity zone is both below and to the right of the left side auxiliary lamp centerlines. See item 4 in Figure 8-30.
7. Leaving the headlamp covered, remove cover from right side auxiliary lamp and place over left side auxiliary lamp. Adjust the right side auxiliary lamp as necessary so that the entire high intensity zone is both below and to the right of the right side auxiliary lamp centerlines. See item 5 in Figure 8-30.
8. Verify that auxiliary lamps are properly tightened. Proceed as follows:
   a. Remove two screws to release turn signal lamp from mounting bracket.
   b. Insert flare nut socket (Snap-on® FRX181) at bottom of turn signal mounting bracket and tighten locknut to 18 ft-lbs (24.4 Nm).
   c. 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. Alternately tighten screws to 36-60 **in-lbs** (4.1-6.8 Nm).

sm03622




1. **Adjust headlamp high beam for proper height and lateral alignment.**
2. **Locate left side auxiliary lamp relative to high beam centerlines.**
3. **Locate right side auxiliary lamp relative to high beam centerlines.**
4. **Adjust high intensity beam below and right of left side auxiliary lamp centerlines.**
5. **Adjust high intensity beam below and right of right side auxiliary lamp centerlines.**

**Figure 8-30. Properly Aim Auxiliary Lamps**

## TAIL LAMP/TAIL LAMP BULB

### Removal

1. Remove two screws from lens to release tail lamp assembly from chrome base. See left side of Figure 8-31.
2. Disconnect tail lamp connector [93], 4-place Multilock. See right side of Figure 8-31.
3. Rotate bulb socket 1/4 turn in a counterclockwise direction and remove from tail lamp assembly. Gently pull bulb from socket.

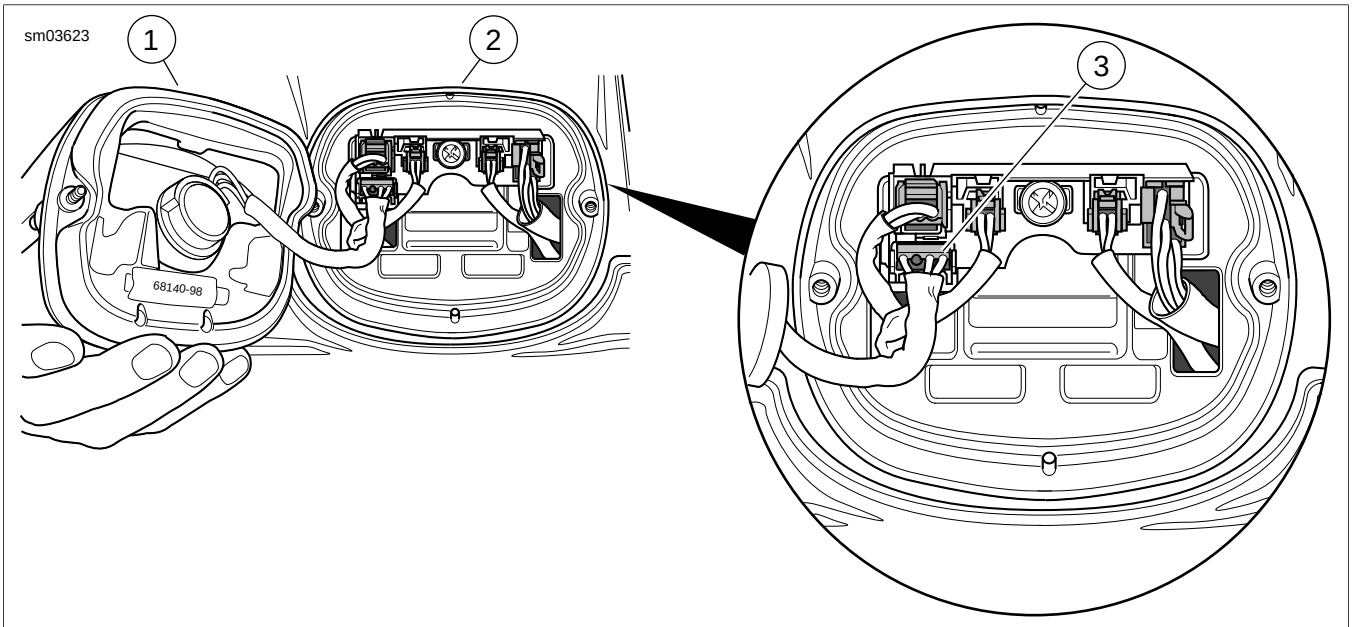
### Installation

1. Gently push **new** bulb into socket. Insert socket into tail lamp assembly and rotate 1/4 turn in a clockwise direction.
2. Connect tail lamp connector [93], 4-place Multilock. See right side of Figure 8-31.
3. Place tail lamp into position against chrome base.
4. Install two screws and alternately tighten to 20-24 **in-lbs** (2.3-2.7 Nm).

*NOTE*

*Over tightening screws can crack the lens or result in scratching of the fender paint.*

5. Turn the Ignition/Light Key Switch to IGNITION and test lamp for proper operation.




1. **Tail lamp assembly**
2. **Chrome base**
3. **Tail lamp connector [93]**

**Figure 8-31. Remove Tail Lamp and Depress Button to Release Socket Housing**

## CIRCUIT BOARD/CHROME BASE

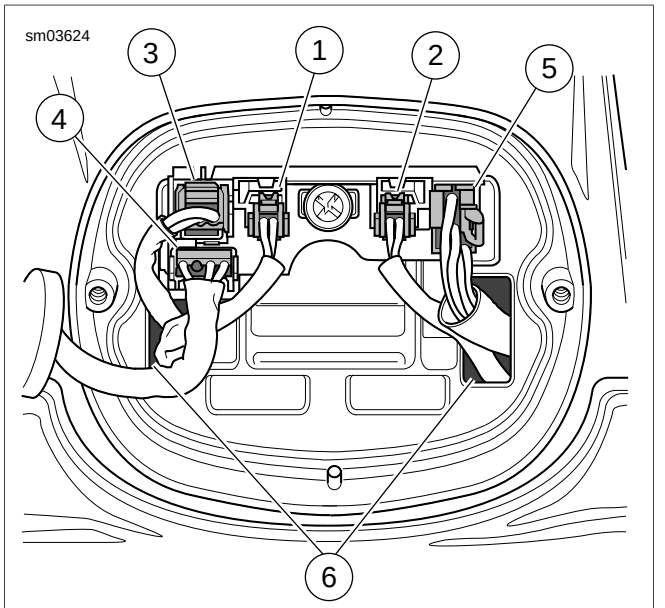
### Removal

1. Remove two screws to release tail lamp assembly from chrome base. See left side of Figure 8-31.
2. Disconnect tail lamp connector [93], 4-place Multilock. See right side of Figure 8-31.
3. Disconnect remaining connectors. See Figure 8-32. To release socket housings of left and right turn signal lamps, use a pick or small screwdriver to depress button as shown in Figure 8-33.

*NOTE*

*The rear fender tip lamp is present on FLHR and FLHT/C/U models only. As the lamp is absent on FLHX models, the circuit board location is used for power to the license plate lamps, a feature unique to that model. On FLHRC and FLTR models, the location is unused.*

4. Remove screw (with captive washer) at center of chrome base. Use both thumbs to push chrome base upward until it becomes free of fender and then pull out of fender hole.
5. Feed socket housings through openings to inboard side of chrome base. See Figure 8-32. For best results, free the smaller socket housings first.




1. **Left turn signal lamp [18]**
2. **Right turn signal lamp [19]**
3. **Rear fender tip lamp [45]**
4. **Tail lamp [93]**
5. **Rear fender lights harness [94]**
6. **Opening**

**Figure 8-32. Rear Fender Lights Assembly**

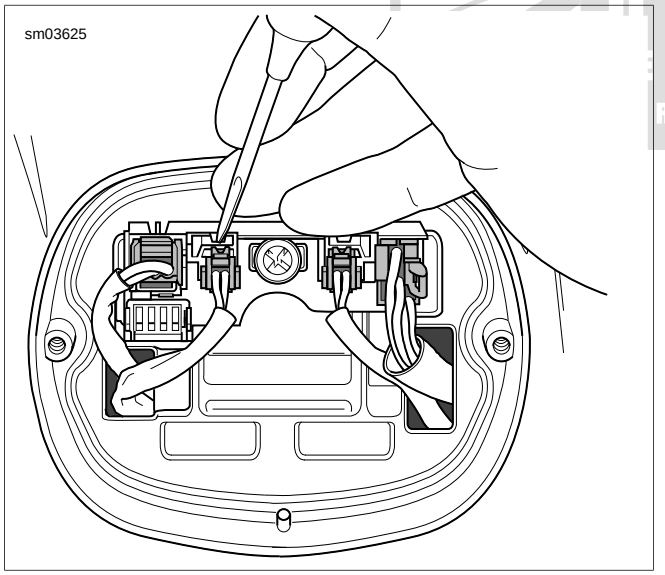



**Figure 8-33. Use Pick Tool to Release Left Turn Signal Lamp Socket**

6. Remove pin housing/circuit board from chrome base. For best results, push index pins on pin housing from holes in chrome base.

## Installation

1. Feed socket housings through openings to outboard side of chrome base. See Figure 8-32. For best results, feed the larger socket housings first.
2. Fit bottom of chrome base into fender hole and then push down to align center hole with clip nut on fender flange.
3. Place pin housing over circuit board, if removed. See Figure 8-34.
4. Insert index pins at back of pin housing into holes in chrome base.
5. Install screw (with captive washer) to secure pin housing/circuit board and chrome base to clip nut on fender flange. Tighten screw to 40-48 **in-lbs** (4.5-5.4 Nm).

*NOTE*

*Over tightening screw can crack the chrome base or result in scratching of the fender paint.*

6. Install socket housings into pin housing/circuit board. 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. To avoid stressing wires, verify that tail lamp conduit is positioned on the outboard side of the rear fender tip lamp and left turn signal lamp conduit as shown in Figure 8-31.
8. Place tail lamp into position against chrome base.
9. Install two screws and alternately tighten to 20-24 **in-lbs** (2.3-2.7 Nm).

*NOTE*

*Over tightening screws can crack the lens or result in scratching of the fender paint.*

10. Turn the Ignition/Light Key Switch to IGNITION and test lamp for proper operation.

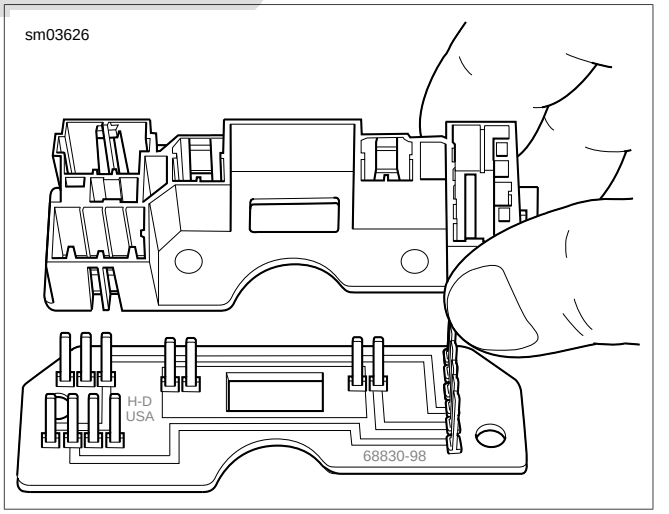



**Figure 8-34. Place Pin Housing Over Circuit Board**

# REAR FENDER LIGHTS HARNESS

## Removal

1. Remove rear fender. See 2.47 REAR FENDER.
2. See Figure 8-31. Remove two screws to release tail lamp assembly from chrome base.

3. Disconnect tail lamp connector [93], 4-place Multilock. Set tail lamp assembly aside.
4. See Figure 8-32. Disconnect rear fender lights connector [94], 6-place Multilock. Feed socket housing through opening to inboard side of fender.
5. Release left and right rear turn signal lamp conduit from respective cable clip anchored on T-stud. On FLHX models, also release license plate lamps conduit from left side cable clip. On FLHR and FLHT/C/U models, release rear fender tip lamp conduit from both left side cable clip and stamped fender clip.
6. Release rear fender lights harness from channel in stud plate. Loosen two flange nuts, if necessary.
7. Draw socket housing of rear fender lights connector [7], 8-place Multilock, through hole to inboard side of fender.
8. Remove wire harness and adhesive conduit from fender well.

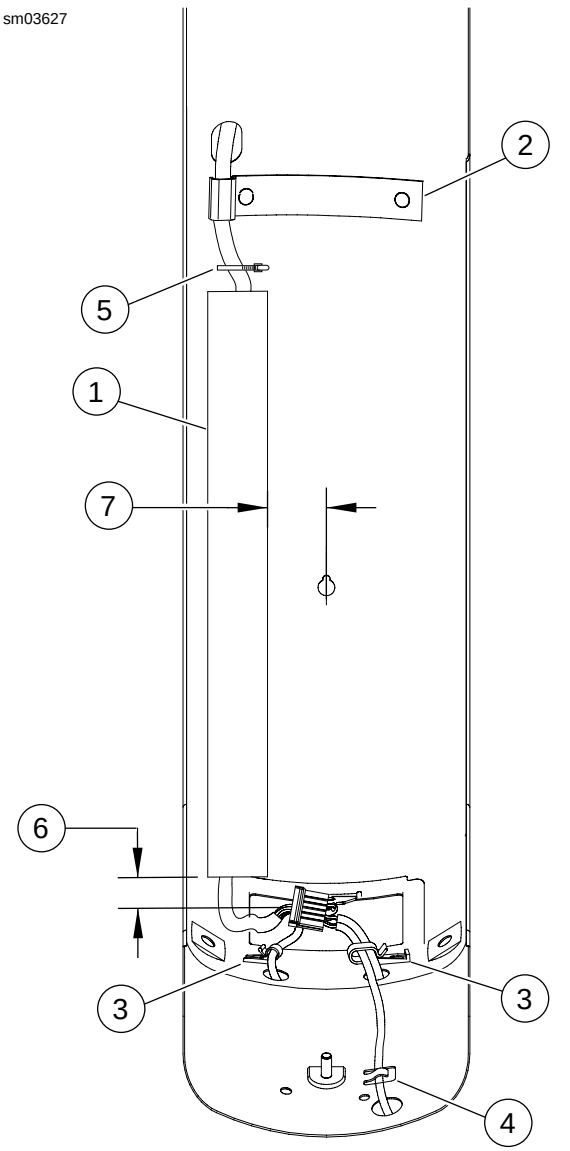
## Installation

1. Proceed as follows:
   a. Thoroughly clean fender well with soap and water. Do not use solvents or harsh chemicals or damage to painted surfaces may occur.
   b. Remove remnants of old conduit, as well as all residual adhesive. For good results, use 3M general Purpose adhesive remover (Part No. 051135).
   c. See Figure 8-35. Using a soapy Scotch Brite® pad, thoroughly clean fender well in area of adhesive conduit.
   d. Rinse with clear water and thoroughly dry with a clean white cloth. Repeat step until clean cloth shows no evidence of dirt.
   e. Swab area with isopropyl alcohol and allow to dry.
   f. Obtain new harness with adhesive conduit. Remove paper backing to expose adhesive and lightly press into place in the right side fender well.

   *NOTE*

   *See Figure 8-35. Adhesive conduit should be approximately 0.88 in (22.4 mm) from the chrome base hole and 1.43 in (36.3 mm) from the fender seat screw centerline.*

   g. Using a wallpaper seam roller (available at most home improvement stores), work roller over adhesive conduit to purge air from between fender and adhesive. Be aware that most other installation methods will produce unsatisfactory results.
   h. Allow the adhesive 72 hours to fully cure. Installation of the fender may proceed, but exercise caution to avoid pulling or repositioning adhesive conduit.
2. Feed socket housing of rear fender lights connector [7], 8-place Multilock, through hole to outboard side of fender.




1. **Adhesive conduit**
2. **Stud plate**
3. **T-stud cable clips (2)**
4. **Stamped fender clip**
5. **Cable strap**
6. **0.88 in. (22.4 mm) between conduit and chrome base hole**
7. **1.43 in. (36.3 mm) between conduit and fender seat screw centerline**

**Figure 8-35. Rear Fender Well**

3. Capture rear fender lights harness in channel of stud plate. If loosened, tighten two flange nuts to 60-96 **in-lbs** (6.8-10.9 Nm).
4. See Figure 8-32. Feed socket housing of rear fender lights connector [94] through opening to outboard side of fender. Connect socket housing to pin housing/circuit board.
5. Capture left and right rear turn signal lamp conduit in respective cable clip anchored on T-stud. On FLHX models, also capture license plate lamps conduit in left side cable clip. On FLHR and FLHT/C/U models, capture

rear fender tip lamp conduit in both left side cable clip and stamped fender clip.

6. Connect tail lamp connector [93], 4-place Multilock.
7. To avoid stressing wires, verify that tail lamp conduit is positioned on the outboard side of the rear fender tip lamp and left turn signal lamp conduit as shown in Figure 8-31. Place tail lamp into position against chrome base.

*NOTE*

*Over tightening screws can crack the lens or result in scratching of the fender paint.*

8. Install two screws and alternately tighten to 20-24 **in-lbs** (2.3-2.7 Nm).
9. Install rear fender. See 2.47 REAR FENDER.

## FRONT FENDER TIP LAMP

### Removal

1. Insert blade of small screwdriver into slot at top of fender tip lamp lens. Rotate end of screwdriver to unsnap lens from lamp bracket.
2. Holding Keps nuts at inboard side of rear fender, remove two screws to release fender tip lamp bracket.
3. Disconnect front fender tip lamp connector [143], 2-place Multilock. See Figure 8-38.

### Installation

1. Connect front fender tip lamp connector [143], 2-place Multilock. See Figure 8-38.
2. With wires routed along bottom left side, place fender tip lamp bracket into position aligning holes in bracket with those in fender.
3. Slide 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).

*NOTE*

*Over tightening screws can crack the bracket or result in scratching of the fender paint.*

4. Insert tab at bottom of lens into slot of fender tip lamp bracket. Apply thumb pressure at top of lens until it snaps into place.
5. Turn the Ignition/Light Key Switch to IGNITION and test lamp for proper operation.

## FRONT FENDER TIP LAMP JUMPER HARNESS

### Removal

1. **FLHR:** Remove headlamp assembly. See 8.9 HEADLAMP: ALL EXCEPT FLTR. Disconnect the front fender tip lamp jumper harness connector [32], 2-place Multilock. See Figure 8-36.
2. **FLHT/C/U:** Reaching in below the fairing cap on the left side of the steering head, disconnect the front fender tip lamp jumper harness connector [32], 2-place Multilock. See Figure 8-37. Remove outer fairing only if necessary. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
3. Draw socket housing down to fender area.
4. Carefully cut cable strap to release front fender tip lamp wires from brake caliper hose.
5. Remove terminals from socket housing.

*NOTE*

*For instructions on removing terminals, see A.2 AMP MULTI-LOCK CONNECTORS.*

6. Place the motorcycle on a hydraulic center stand with the front wheel raised off the ground.

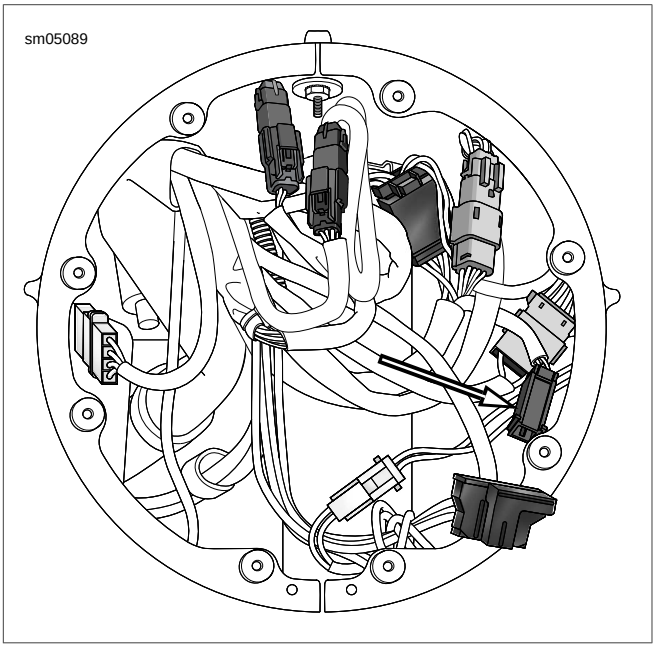



**Figure 8-36. Front Fender Tip Lamp Jumper Harness Connector (FLHR)**

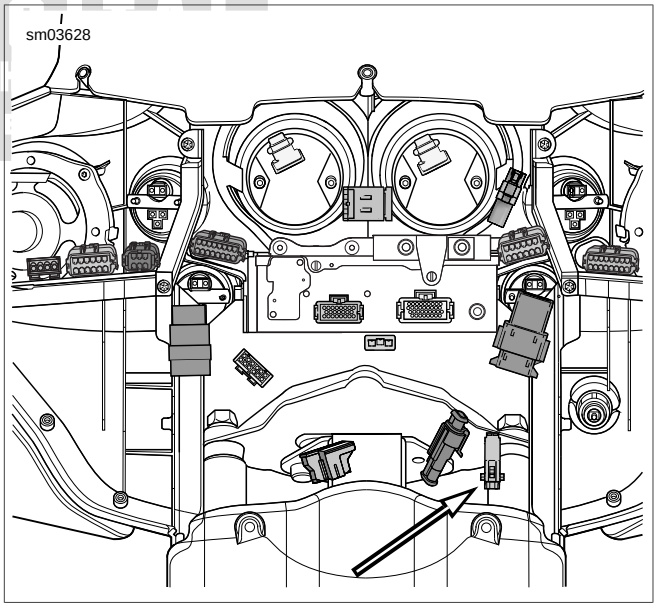
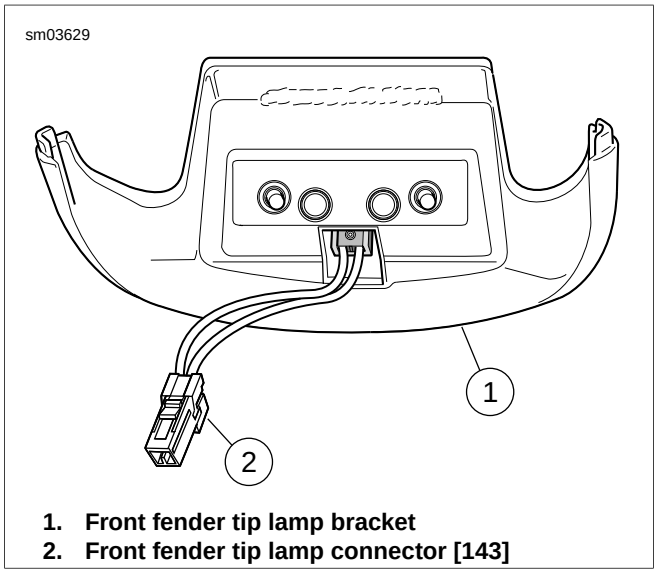



**Figure 8-37. Front Fender Tip Lamp Jumper Harness Connector (FLHX, FLHT/C/U)**

7. Remove front wheel. See 2.3 FRONT WHEEL.
8. From inboard side of front fender, remove two nuts to release trim strip from left side of fender. See Figure 8-39.
9. Pull wires and socket terminals through grommet to inboard side of fender. See Figure 8-40. Reaching under left side of fender, draw wires forward out from beneath fender bracket.
10. Feed wires through oblong hole to outboard side of fender.




1. **Front fender tip lamp bracket**
2. **Front fender tip lamp connector [143]**

**Figure 8-38. Front Fender Tip Lamp Assembly**

11. Insert blade of small screwdriver into slot at top of fender tip lamp lens. Rotate end of screwdriver to unsnap lens from lamp bracket.
12. Holding Keps nuts at inboard side of front fender, remove two screws to release fender tip lamp bracket.
13. Disconnect front fender tip lamp connector [143], 2-place Multilock, to release fender tip lamp assembly from jumper harness. See Figure 8-38.

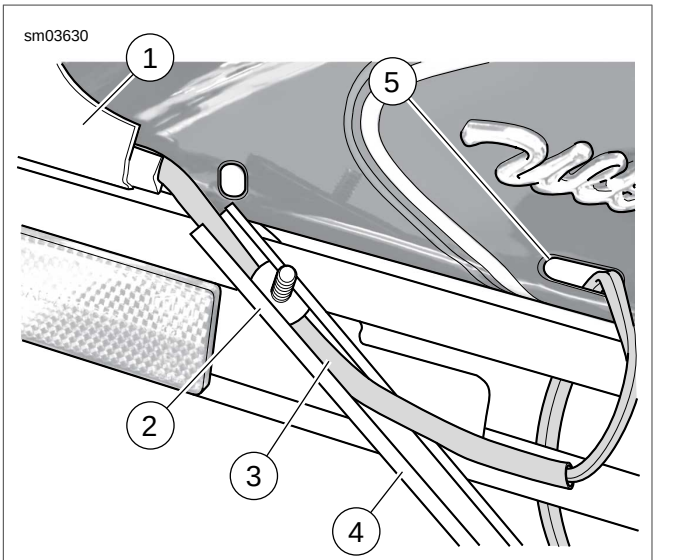
## Installation

1. Connect front fender tip lamp connector [143], 2-place Multilock, to attach fender tip lamp assembly to jumper harness. See Figure 8-38.
2. Pull jumper harness conduit as close to fender tip lamp connector [143] as possible, for the conduit is not easily routed beneath the fender bracket.
3. With conduit routed along bottom left side, place fender tip lamp bracket into position aligning holes in bracket with those in fender.
4. Slide 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).

*NOTE*

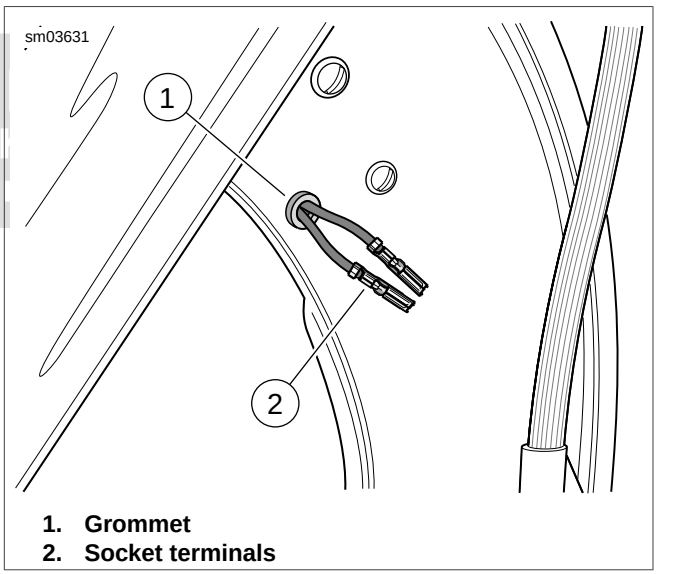
*Over tightening screws can crack the bracket or result in scratching of the fender paint.*

5. Insert tab at bottom of lens into slot of fender tip lamp bracket. Apply thumb pressure at top of lens until it snaps into place.
6. Route wire conduit inside trim strip and slide front tee bolt over conduit. See Figure 8-39. Verify that second tee bolt is in position at rear of trim strip.




1. **Fender tip lamp bracket**
2. **Tee bolt**
3. **Wire conduit**
4. **Trim strip**
5. **Oblong hole**

**Figure 8-39. Install Conduit in Trim Strip**




1. **Grommet**
2. **Socket terminals**

**Figure 8-40. Pull Fender Tip Lamp Wires and Terminals Through Fender Grommet**

7. Feed socket terminals and wires through oblong hole to inboard side of fender.

*NOTE*

*Use the rearmost oblong hole as the front may be used for installation of certain P&A accessories.*

8. While removing slack from wires on outboard side of fender, align tee bolts with fender holes. With 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).

9. Reaching under left side of fender, route wires of the jumper harness rearward between tee bolt nut and fender bracket and then beneath fender bracket to grommet. See Figure 8-41.

10. Feed socket terminals and wires through grommet to outboard side of fender. See Figure 8-40.

*NOTE*

*If any portion of the jumper harness is above the height of the fender bracket, contact with the tire can cause chafing or other damage. Damage to the wiring can lead to loss of lighting.*

11. Remove slack from wires on inboard side of fender. Verify that no portion of the jumper harness is above the height of the fender bracket.

12. Install terminals into socket housing.

*NOTE*

*For instructions on installing terminals, see A.2 AMP MULTI-LOCK CONNECTORS.*

13. Route socket housing upward behind chrome skirt (FLHT/C/U) or through bottom of headlamp nacelle (FLHR) to area beneath upper fork bracket. Connect front fender tip lamp jumper harness connector [32].

*NOTE*

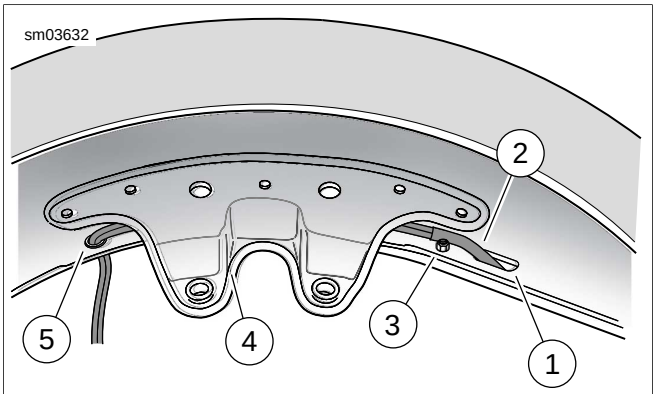
*To connect jumper harness connector with the outer fairing installed (FLHT/C/U models), reach in below the fairing cap on the left side of the steering head.*

14. Install front wheel. See 2.3 FRONT WHEEL.

15. Install **new** cable strap to secure front fender tip lamp wires to brake caliper hose. See Figure 8-42.

16. **FLHR:** Install headlamp assembly. See 8.9 HEADLAMP: ALL EXCEPT FLTR.

17. **FLHT/C/U:** Install outer fairing, if removed. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.




1. **Oblong hole**
2. **Jumper harness**
3. **T-bolt nut**
4. **Fender bracket**
5. **Grommet**

**Figure 8-41. Left Side Front Fender Well**

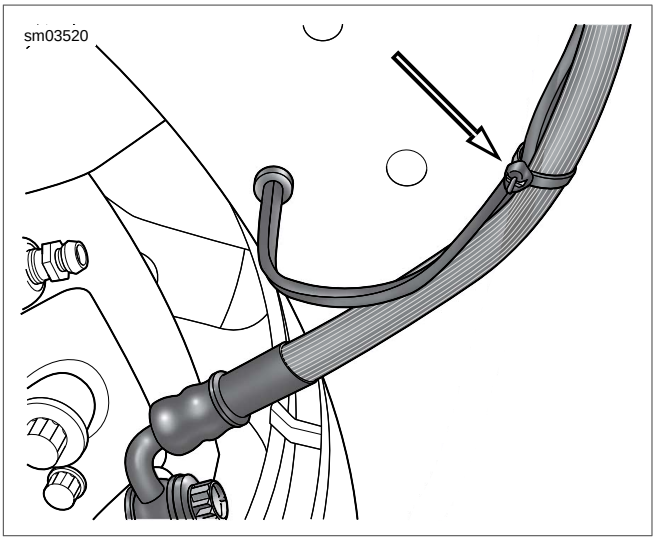



**Figure 8-42. Capture Brake Hose and Front Fender Tip Lamp Wires**

18. Turn Ignition/Light Key Switch to IGNITION and test lamp for proper operation.

## REAR FENDER TIP LAMP

### Removal

1. Remove two screws to release tail lamp assembly from chrome base.

2. Disconnect tail lamp connector [93], 4-place Multilock. Set tail lamp assembly aside. See Figure 8-43.

3. Disconnect rear fender tip lamp connector [45], 3-place Multilock.

4. Feed socket housing through opening in chrome base to inboard side of rear fender.

5. Reaching under left side of rear fender, release conduit from cable clip anchored on T-stud. Release conduit from stamped fender clip.

6. Insert blade of small screwdriver into slot at top of fender tip lamp lens. Rotate end of screwdriver to unsnap lens from lamp bracket. See upper frame of Figure 8-44.

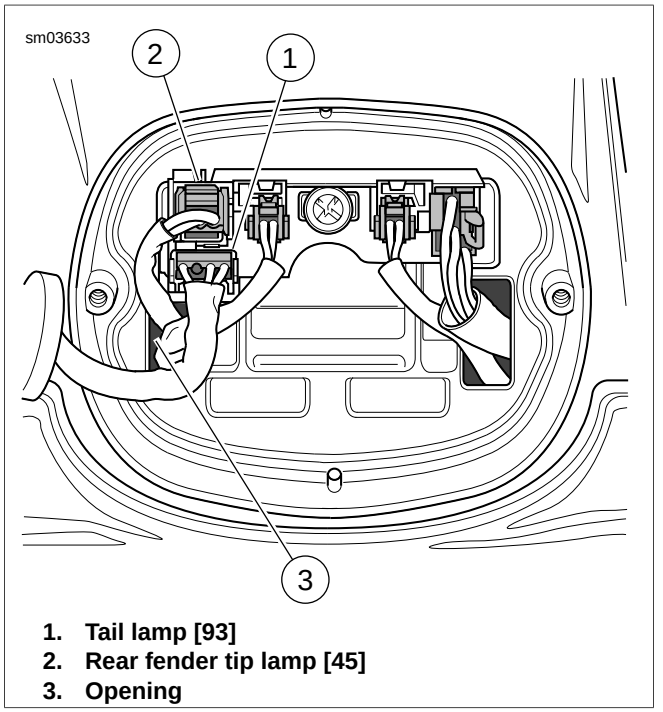
7. Holding nuts at inboard side of rear fender, remove two screws to release fender tip lamp bracket. See lower frame of Figure 8-44.

8. Draw conduit and socket housing out through bottom fender hole. See Figure 8-45.

9. Remove terminals from socket housing.

*NOTE*

*For instructions on removing terminals, see A.2 AMP MULTI-LOCK CONNECTORS.*




1. **Tail lamp [93]**
2. **Rear fender tip lamp [45]**
3. **Opening**

**Figure 8-43. Depress Button to Release Socket from Pin Housing**

## 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 terminals, see A.2 AMP MULTI-LOCK CONNECTORS.*

3. Install terminals into socket housing.

**Table 8-7. Rear Fender Tip Lamps [45]**

| WIRE COLOR | CHAMBER NUMBER |
|---|---|
| Black | 1 |
| Not Used | 2 |
| Black | 3 |

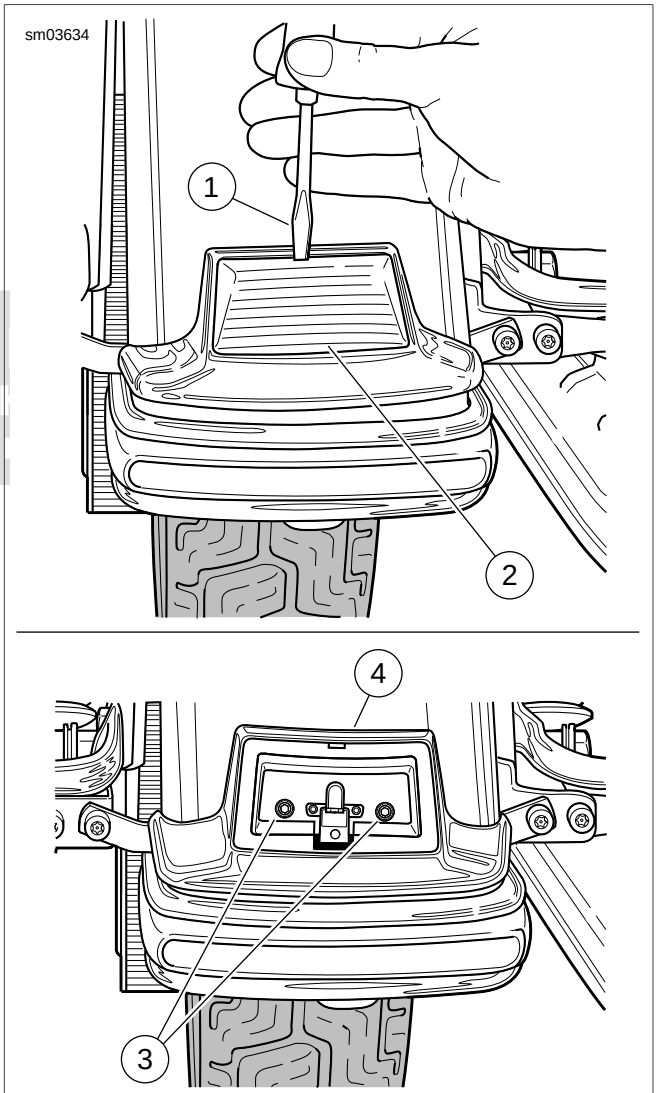
*NOTE*

*For instructions on installing terminals, see A.2 AMP MULTI-LOCK CONNECTORS.*

4. Feed socket housing and conduit through bottom fender hole. See Figure 8-45.
5. Place fender tip lamp bracket into position aligning holes in bracket with those in fender. Slide screws through bracket and fender holes and install nuts. See lower frame of Figure 8-44.
6. Insert tab at bottom of lens into slot of fender tip lamp bracket. Apply thumb pressure at top of lens until it snaps into place.
7. Reaching under left side of rear fender, capture conduit in cable clip anchored on T-stud. Capture conduit in stamped fender clip next to fender hole.
8. Feed socket housing through opening on left side of chrome base to outboard side of rear fender. Oriented with the release button at the top, insert socket housing into pin housing/circuit board.
9. 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. To avoid stressing wires, verify that tail lamp conduit is positioned on the outboard side of the rear fender tip lamp and left turn signal lamp conduit as shown in Figure 8-43.
10. Place tail lamp into position against chrome base.
11. Install two screws and alternately tighten to 20-24 **in-lbs** (2.3-2.7 Nm).

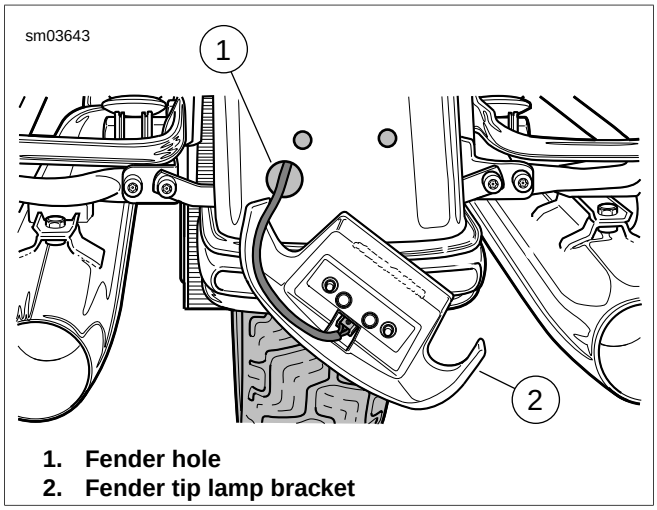
*NOTE*

*Over tightening screws can crack the lens or result in scratching of the fender paint.*




1. **Screwdriver**
2. **Lens**
3. **Screws**
4. **Rear fender tip lamp bracket**

**Figure 8-44. Remove Rear Fender Tip Lamp Lens and Bracket**




**1. Fender hole**
**2. Fender tip lamp bracket**

**Figure 8-45. Feed Fender Tip Lamp Socket and Conduit Through Fender Hole**

**⚠WARNING**

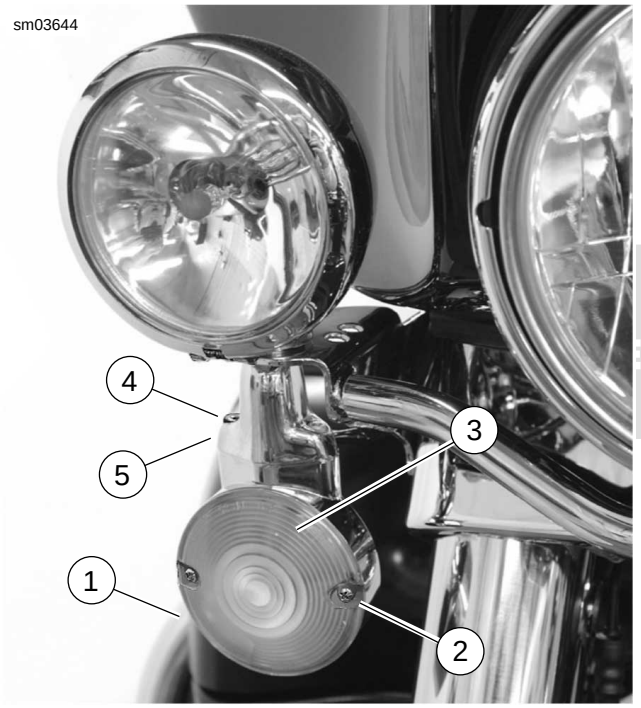
**Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)**

12. Turn the Ignition/Light Key Switch to IGNITION and test lamp for proper operation.

## BULB REPLACEMENT

### Removal

1. Proceed as follows:
   a. **FLHR/C, FLHT/C/U:** Remove two screws to release lens from lamp. See Figure 8-46.
   b. **FLHX, FLTR:** Insert blade of small screwdriver into slot at bottom of lens. Gently rotate end of screwdriver to unsnap lens from lamp.
2. Push in bulb and rotate in a counterclockwise direction to remove.
3. Inspect condition of electrical contacts in socket. If necessary, clean with a small wire brush and electrical contact cleaner.




1. **Turn signal lamp**
2. **Phillips screw (2)**
3. **Lens**
4. **Allen head screw (2)**
5. **Mounting bracket**

**Figure 8-46. Front Turn Signal Lamp (FLHR/C, FLHT/C/U)**

### Installation

1. Liberally apply dielectric grease to contacts in socket and at bottom of **new** bulb. For correct bulb type, see 1.4 BULB REQUIREMENTS.
2. Push in bulb and rotate in a clockwise direction to install.
3. Proceed as follows:
   a. **FLHR/C, FLHT/C/U:** Seat lens in lamp and install two screws.
   b. **FLHX, FLTR:** Seat lens in lamp and gently apply thumb pressure until it snaps into place. Rotate lens to position slot at bottom of lamp.

## FRONT TURN SIGNAL LAMP

### Removal: FLHR/C, FLHT/C/U

1. **FLHR/C:** Remove headlamp assembly. See 8.9 HEADLAMP: ALL EXCEPT FLTR. See Figure 8-47. Disconnect front turn signal lamps connector [31], 6-place Multilock, anchored in hole of fork stem nut lockplate (left side).
2. **FLHT/C/U:** Remove outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U. See Figure 8-48. Disconnect the left or right front turn signal/auxiliary lamp connector [31L/R], 4-place Multilock, on T-stud at top of left or right fairing support brace (outboard side).
3. Remove appropriate terminal(s) from socket housing as follows:

**Table 8-8. FLHR/C Front Turn Signal Lamps [31]**

| LEFT SIDE | | RIGHT SIDE | |
|---|---|---|---|
| WIRE COLOR | CHAMBER | WIRE COLOR | CHAMBER |
| Blue (DOM) | 4 | Black | 1 |
| Violet | 5 | Brown | 2 |
| Black | 6 | Blue (DOM) | 3 |

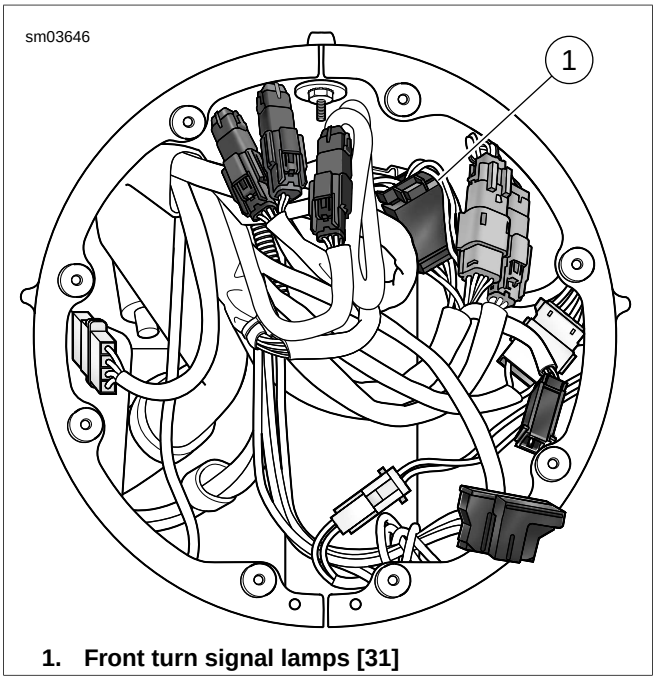
**Table 8-9. FLHT/C/U Front Turn Signal Lamps [31L/R]**

| LEFT SIDE [31L] | | RIGHT SIDE [31R] | |
|---|---|---|---|
| WIRE COLOR | CHAMBER | WIRE COLOR | CHAMBER |
| Blue | 1 | Blue | 1 |
| Violet | 2 | Brown | 2 |
| Black | 3 | Black | 3 |
| Note: Terminal 4 is reserved for the auxiliary lamp. | | | |

*NOTE*

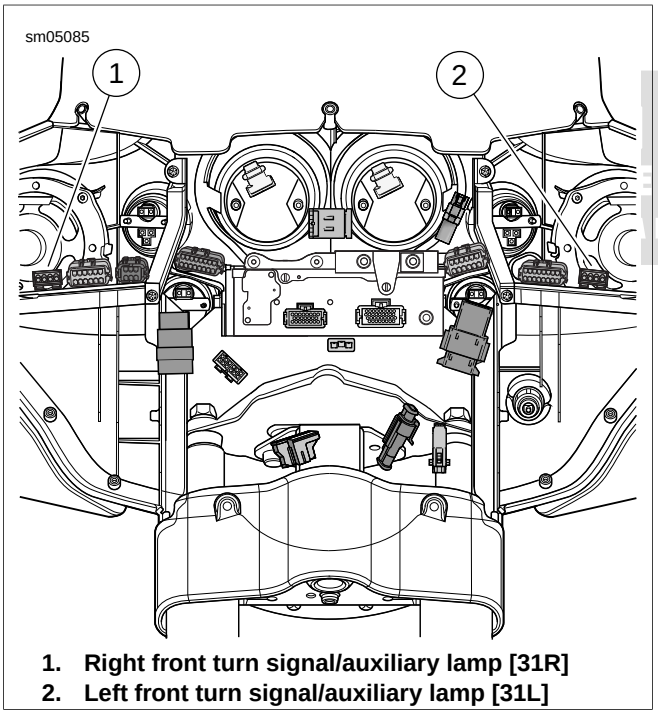
*For instructions on removing terminals, see A.2 AMP MULTILOCK CONNECTORS.*

4. See Figure 8-46. Remove two screws to release turn signal lamp from mounting bracket.
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 8-49. Repeat step with remaining socket terminals.




1. **Front turn signal lamps [31]**

**Figure 8-47. Headlamp Nacelle (FLHR/C)**




1. **Right front turn signal/auxiliary lamp [31R]**
2. **Left front turn signal/auxiliary lamp [31L]**

**Figure 8-48. Inner Fairing (FLHT/C/U)**

*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: FLHR/C, FLHT/C/U

1. Lay old turn signal lamp next to **new** turn signal lamp and cut wires to length.
2. Strip 3/16 in. (4.8 mm) of insulation off lamp wires and crimp on **new** socket terminals.

*NOTE*

*For instructions on crimping terminals, see A.2 AMP MULTI-LOCK CONNECTORS.*

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. For correct terminal locations refer to Table 8-8 or Table 8-9.

*NOTE*

*For instructions on installing terminals, see A.2 AMP MULTI-LOCK CONNECTORS.*

6. See Figure 8-46. 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. Alternately tighten screws to 30-60 **in-lbs** (4.1-6.8 Nm).
7. Connect front turn signal/auxiliary lamp connector.
8. **FLHR/C:** Install anchor on connector into hole of fork stem nut lockplate (left side). See Figure 8-47. Install headlamp assembly. See 8.9 HEADLAMP: ALL EXCEPT FLTR.
9. **FLHT/C/U:** Install connector on T-stud at top of left or right fairing support brace (outboard side). Verify that conduit is routed inboard using relief in upper outboard corner of chrome skirt. Install outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.

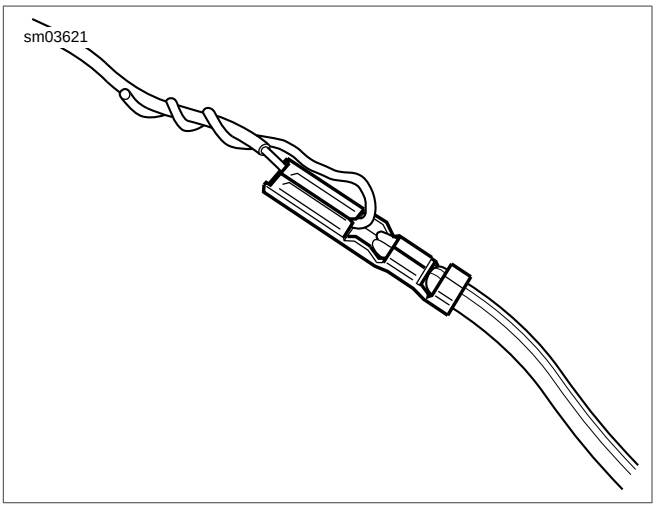



**Figure 8-49. Fix Mechanics Wire to Socket Terminal**

**WARNING**

**Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)**

10. Turn Ignition/Light Key Switch to IGNITION and test for proper operation.

## Removal: FLXH

1. Remove outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
2. See Figure 8-48. Disconnect the left or right front turn signal lamp connector [31L/R], 4-place Multilock. Connector is attached to T-stud at top of left or right fairing support brace (outboard side).
3. See Figure 8-50. Remove two screws to release turn signal lamp mounting bracket from upper and lower fork brackets.
4. To remove socket/isolator assembly, proceed as follows:
   a. Remove terminals from socket housing.

   *NOTE*

   *For instructions on removing terminals, see A.2 AMP MULTILOCK CONNECTORS.*

   b. Pull mounting bracket from conduit.
   c. Insert blade of small screwdriver into slot at bottom of lens. Gently rotate end of screwdriver to unsnap lens from lamp.
   d. Push in bulb and rotate counterclockwise to remove.
   e. Inserting blade of small screwdriver between outer edge of rubber isolator and inside of lamp housing, gently pry up socket assembly until free.
   f. Pull socket assembly to draw conduit and terminals into lamp and then out through lens opening.
   g. Remove rubber isolator from lamp if still installed.

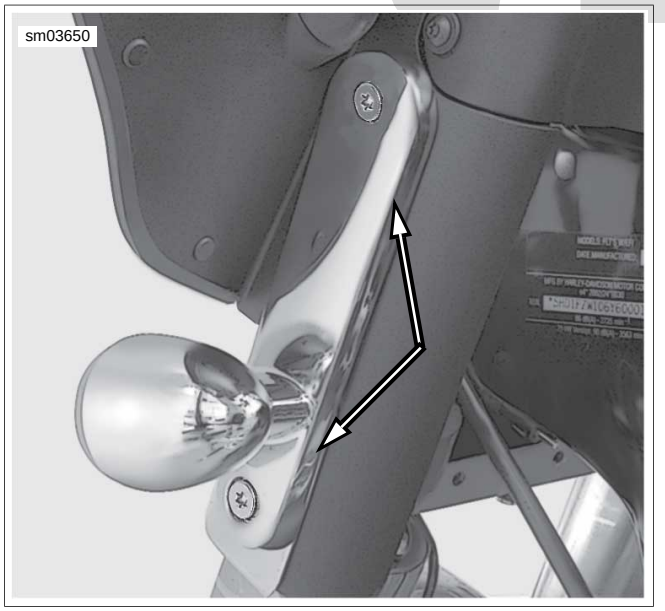



**Figure 8-50. Front Turn Signal Lamp (FLHX)**


**Figure 8-51. Route Conduit Through Mounting Bracket and Chrome Skirt Reliefs (FLHX)**

## Installation: FLHX

*NOTE*

*If turn signal lamp is already assembled, begin procedure at step 2.*

1. To install socket/isolator assembly, proceed as follows:
   a. Seat socket assembly in rubber isolator aligning tab on socket with slot in isolator.
   b. Feed terminals and conduit into lamp through lens opening and then out through unthreaded hole.
   c. Install socket assembly aligning tab on socket with slot inside lamp.
   d. Using thumbs of both hands, apply even pressure around outer edge of socket assembly until fully seated.
   e. Liberally apply dielectric grease to contacts in socket and at bottom of bulb. Push in bulb and rotate clockwise to install.
   f. Install lens in lamp and gently apply thumb pressure until it snaps into place. Rotate lens to position slot at bottom of lamp.
   g. Feed terminals and conduit through triangular shaped hole in mounting bracket.
   h. Align thru hole in mounting bracket with threaded hole in lamp and start hex screw. Tighten hex screw to 15-20 ft-lbs (20-27 Nm).

   *NOTE*

   *For instructions on installing terminals, see A.2 AMP MULTILOCK CONNECTORS.*

   i. Install terminals into socket housing as follows:

**Table 8-10. FLHX, FLTR Front Turn Signal Lamps [31L/R]**

| LEFT SIDE [31L] | | RIGHT SIDE [31R] | |
|---|---|---|---|
| WIRE COLOR | CHAMBER | WIRE COLOR | CHAMBER |
| Blue | 1 | Blue | 1 |
| Violet | 2 | Brown | 2 |
| Black | 3 | Black | 3 |
| Empty | 4 | Empty | 4 |

2. Start two screws to fasten turn signal lamp mounting bracket to upper and lower fork brackets.
3. To avoid pinching wires, verify that conduit is routed forward through relief at front of mounting bracket, and then inboard using relief in upper outboard corner of chrome skirt. See Figure 8-51.
4. Alternately tighten screws to 15-20 ft-lbs (20-27 Nm).
5. See Figure 8-48. Connect front turn signal lamp connector. Install connector on T-stud at top of left or right fairing support brace (outboard side).
6. Install outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.

## Removal: FLTR

1. See Figure 8-52. Remove outer fairing and front turn signal lamp. See 2.39 UPPER FAIRING AND WINDSHIELD: FLTR.
2. To remove socket/isolator assembly, proceed as follows:
   a. Remove terminals from socket housing.

   *NOTE*

   *For instructions on removing terminals, see A.2 AMP MULTILOCK CONNECTORS.*

   b. Pull lamp from mounting bracket.
   c. Insert blade of small screwdriver into slot at bottom of lens. Gently rotate end of screwdriver to unsnap lens from lamp.
   d. Push in bulb and rotate counterclockwise to remove.
   e. Inserting blade of small screwdriver between outer edge of rubber isolator and inside of lamp housing, gently pry up socket assembly until free.
   f. Pull socket assembly to draw conduit and terminals into lamp and then out through lens opening.
   g. Remove rubber isolator from lamp if still installed.

## Installation: FLTR

*NOTE*

*If turn signal lamp is already assembled, begin procedure at step 2.*

1. Assemble front turn signal lamp as follows:
   a. Seat socket assembly in rubber isolator aligning tab on socket with slot in isolator.
   b. Feed terminals and conduit into lamp through lens opening and then out through unthreaded hole.
   c. Install socket assembly aligning tab on socket with slot inside lamp.
   d. Using thumbs of both hands, apply even pressure around outer edge of socket assembly until fully seated.
   e. Liberally apply dielectric grease to contacts in socket and at bottom of bulb. Push in bulb and rotate clockwise to install.
   f. Install lens in lamp and gently apply thumb pressure until it snaps into place. Rotate lens to position slot at bottom of lamp.
   g. Install lamp onto mounting bracket. See Figure 8-52.

   *NOTE*

   *For instructions on installing terminals, see A.2 AMP MULTILOCK CONNECTORS.*

   h. Install terminals into socket housing. For correct terminal locations refer to Table 8-10.
2. Install outer fairing and front turn signal lamp. See 2.39 UPPER FAIRING AND WINDSHIELD: FLTR.

**WARNING**

**Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)**

3. Turn Ignition/Light Key Switch to IGNITION and test for proper operation.

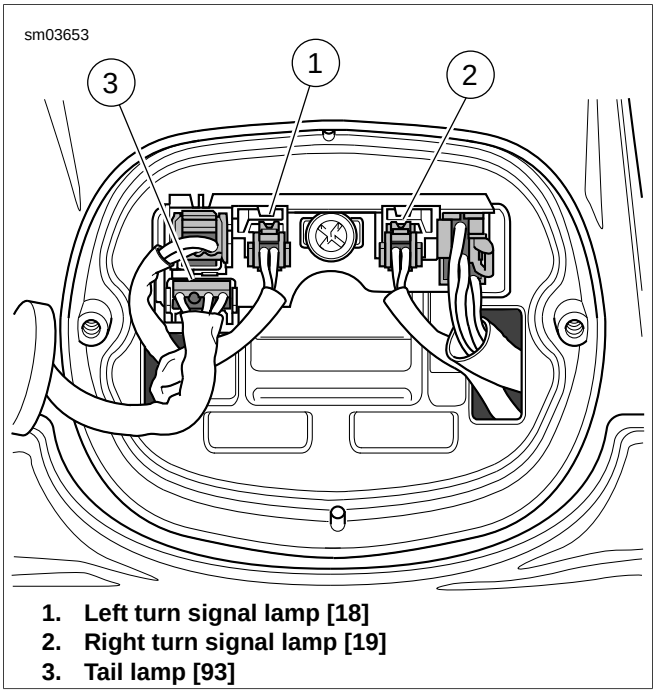

**Figure 8-52. Front Turn Signal Lamp (FLTR)**

# REAR TURN SIGNAL LAMP

## Removal: FLHR/C, FLHT/C/U

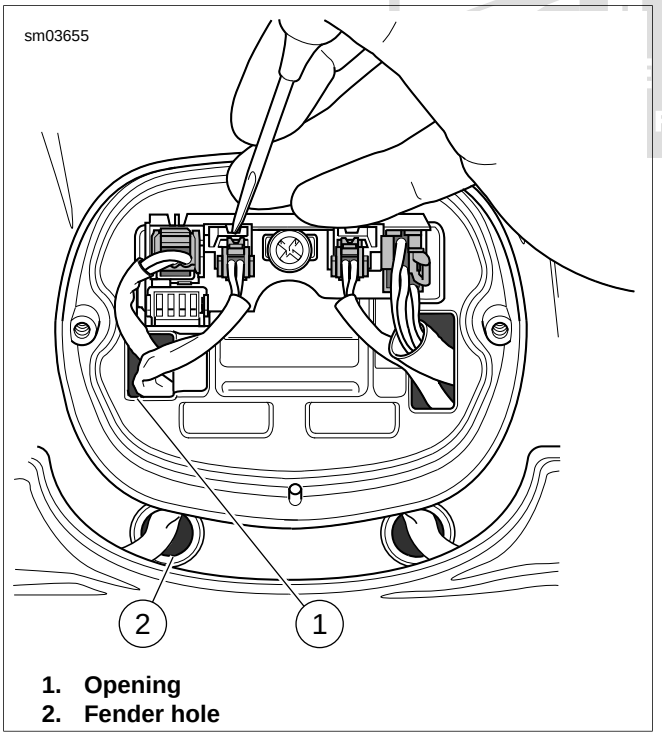
1. Remove saddlebag on same side of motorcycle. See 2.27 SADDLEBAGS.

2. Remove two screws to release tail lamp assembly from chrome base.




1. **Left turn signal lamp [18]**
2. **Right turn signal lamp [19]**
3. **Tail lamp [93]**

**Figure 8-53. Release Tail Lamp Socket**




1. **Opening**
2. **Fender hole**

**Figure 8-54. Use Pick Tool to Release Left Turn Signal Lamp Socket**

3. Disconnect tail lamp connector [93], 4-place Multilock. Set tail lamp assembly aside. See Figure 8-53.
4. Disconnect turn signal lamp assembly, 2-place Multilock. For best results, use a pick or small screwdriver to depress release button as shown in Figure 8-54.
5. Feed socket housing through opening in chrome base to inboard side of rear fender.
6. Reaching under rear fender, release conduit from cable clip anchored on T-stud.
7. Draw conduit and socket housing out through fender hole just below chrome base. See Figure 8-54.
8. Draw socket housing through channel on inboard side of rear turn signal lamp bracket, so that length of conduit hangs below turn signal lamp.
9. Inserting a long shank ball end socket (Snap-on® FABL5) through channel in bracket, remove two screws to release turn signal lamp assembly.
10. Remove terminals from socket housing.

*NOTE*

*For instructions on removing terminals, see A.2 AMP MULTI-LOCK CONNECTORS.*

## Installation: FLHR/C, FLHT/C/U

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 terminals, see A.2 AMP MULTI-LOCK CONNECTORS.*

3. Install terminals into socket housing.

**Table 8-11. Rear Turn Signal Lamps [18/19]**

| WIRE COLOR | CHAMBER NUMBER |
|---|---|
| Violet/Brown | 1 |
| Black | 2 |

*NOTE*

*For instructions on installing terminals, see A.2 AMP MULTI-LOCK CONNECTORS.*

4. Align holes in turn signal lamp assembly with those in rear turn signal lamp bracket and start two screws. For best results, insert a long shank ball end socket (Snap-on® FABL5) through channel on inboard side of bracket. Alternately tighten screws to 30-50 **in-lbs** (3.4-5.6 Nm).
5. Route socket housing through channel in bracket, and then feed through fender hole just below chrome base. See Figure 8-54.
6. Reaching under rear fender, capture conduit in cable clip anchored on T-stud.
7. Feed socket housing through opening in chrome base to outboard side of rear fender.
8. Orient socket housing so that the release button is at the top and insert into pin housing/circuit board.
9. 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." To avoid stressing wires, verify that tail lamp conduit is positioned on the outboard side of the rear fender tip lamp and left turn signal lamp conduit as shown Figure 8-53.

10. Place tail lamp into position against chrome base.
11. Install two screws and alternately tighten to 20-24 **in-lbs** (2.3-2.7 Nm).

*NOTE*

*Over tightening screws can crack the lens or result in scratching of the fender paint.*

12. Turn the Ignition/Light Key Switch to IGNITION and test lamp for proper operation.
13. Install saddlebag. See 2.27 SADDLEBAGS.

## Removal: FLHX, FLTR

*NOTE*

*This procedure entails replacement of the rear turn signal lamp socket/ isolator assembly. To remove and install the turn signal lamps bracket, see 8.14 TURN SIGNAL LAMPS, Rear Turn Signal Lamps Bracket in this section.*

1. Remove chrome base and circuit board assembly. See 8.12 TAIL LAMP.
2. Remove terminals from socket housing of rear turn signal lamp connector.

*NOTE*

*For instructions on removing terminals, see A.2 AMP MULTI-LOCK CONNECTORS.*

3. Reaching inside rear fender, release conduit from cable clip anchored on T-stud.
4. Draw conduit and terminals through hole to outboard side of fender.
5. Remove socket/isolator assembly as follows:
   a. Insert blade of small screwdriver into slot at bottom of lens. Gently rotate end of screwdriver to unsnap lens from lamp.
   b. Push grommet at end of conduit into lamp housing. Lightly lubricate grommet with glass cleaner, if necessary.
   c. Push in bulb and rotate in a counterclockwise direction to remove.
   d. Inserting blade of small screwdriver between outer edge of rubber isolator and inside of lamp housing, gently pry up socket assembly until free.
   e. Pull socket assembly to draw conduit and terminals into lamp and then out through lens opening.
   f. Remove rubber isolator from lamp if still installed.

## Installation: FLHX, FLTR

1. Place **new** socket/isolator assembly next to discarded unit and cut wires to proper length. Crimp new socket terminals onto wires.

*NOTE*

*For instructions on crimping terminals, see A.2 AMP MULTI-LOCK CONNECTORS.*

2. Install socket/isolator assembly as follows:
   a. Seat socket assembly in rubber isolator aligning tab on socket with slot in isolator.
   b. Feed terminals and conduit into lamp through lens opening and then out through unthreaded hole.
   c. Exercising caution to avoid pulling on wires, carefully pull grommet out through hole in lamp. For best results, grasp edge of grommet with needle nose pliers. Lightly lubricate grommet with glass cleaner, if necessary.
   d. Install socket assembly aligning tab on socket with slot inside lamp.
   e. Using thumbs of both hands, apply even pressure around outer edge of socket assembly until fully seated.
   f. Liberally apply dielectric grease to contacts in socket and at bottom of bulb. Push in bulb and rotate in a clockwise direction to install.
   g. Install lens in lamp and gently apply thumb pressure until it snaps into place. Rotate lens to position slot at bottom of lamp.
3. Feed socket terminals through hole to inboard side of fender.
4. Install terminals into socket housing. See Table 8-11.

*NOTE*

*For instructions on installing terminals, see A.2 AMP MULTI-LOCK CONNECTORS.*

5. Reaching inside rear fender, capture conduit in cable clip anchored on T-stud.
6. Install chrome base and circuit board assembly. See 8.12 TAIL LAMP.

# REAR TURN SIGNAL LAMPS BRACKET

## Removal: FLHR/C, FLHT/C/U

1. Remove chrome base and circuit board assembly. See 8.12 TAIL LAMP.
2. Remove rear turn signal lamps from bracket. See 8.14 TURN SIGNAL LAMPS, Rear Turn Signal Lamp in this section.
3. Remove two screws to free rear turn signal lamps bracket from rear fender.

## Installation: FLHR/C, FLHT/C/U

1. Apply one drop of Loctite High Strength Threadlocker 271 (red) to two screws.
2. Install screws to fasten rear turn signal lamps bracket to rear fender. Alternately tighten screws to 84-144 **in-lbs** (9.5-16.3 Nm).
3. Install rear turn signal lamps to bracket. See 8.14 TURN SIGNAL LAMPS, Rear Turn Signal Lamp in this section.
4. Install chrome base and circuit board assembly. See 8.12 TAIL LAMP.

## Removal: FLHX, FLTR

*NOTE*

*To remove the rear turn signal lamps bracket on FLHX models, see 8.15 LICENSE PLATE LAMPS AND BRACKET: FLHX.*

1. Remove circuit board and chrome base. See 8.12 TAIL LAMP.
2. Reaching inside rear fender, release left and right rear turn signal lamp conduit from respective cable clips anchored on T-studs.
3. Remove two screws to release rear turn signal lamps bracket.
4. Pull rear turn signal lamps bracket away from motorcycle drawing socket housings out through fender holes.

## Installation: FLHX, FLTR

*NOTE*

*To install the rear turn signal lamps bracket on FLHX models, see 8.15 LICENSE PLATE LAMPS AND BRACKET: FLHX.*

1. Feed socket housings of left and right rear turn signal lamps through respective holes to inboard side of fender.
2. Apply one drop of Loctite High Strength Threadlocker 271 (red) to two screws.
3. Install screws to fasten rear turn signal lamps bracket to rear fender. Alternately tighten screws to 84-144 **in-lbs** (9.5-16.3 Nm).
4. Install chrome base and circuit board assembly. See 8.12 TAIL LAMP.

## BULB REPLACEMENT

### Removal

1. Remove two screws to release lens of license plate lamp from rear turn signal lamps bracket.
2. See Figure 8-55. Exercising caution to avoid stressing wires, carefully pull down lamp assembly only as far as necessary to access bulbs. Remove bulbs from sockets.

### Installation

1. Liberally apply dielectric grease to contacts in sockets and at bottom of new bulbs. Install bulbs in sockets. For correct bulb type, see 1.4 BULB REQUIREMENTS.
2. Install two screws to fasten lens of license plate lamp to rear turn signal lamps bracket.

## LICENSE PLATE LAMPS

### Removal

1. Remove two screws to release lens of license plate lamp from rear turn signal lamps bracket.
2. See Figure 8-55. Exercising caution to avoid stressing wires, carefully pull down lamp assembly only as far as necessary to access bulbs.
3. Remove circuit board and chrome base. See 8.12 TAIL LAMP.
4. Remove terminals from socket housing of license plate lamps connector [45].

*NOTE*

*For instructions on removing terminals, see A.2 AMP MULTI-LOCK CONNECTORS.*

5. Reaching inside rear fender, release conduit from left side cable clip anchored on T-stud.
6. Draw conduit and socket terminals through hole to outboard side of fender, and then down through slot in center of turn signal lamps bracket. See Figure 8-56.


**Figure 8-55. Release Lamp Assembly**


**Figure 8-56. Draw Wires Through Fender Hole**

### Installation

1. Place **new** lamp assembly next to discarded unit and cut wires to proper length.
2. Crimp **new** socket terminals onto license plate lamp wires.

*NOTE*

*For instructions on crimping terminals, see A.2 AMP MULTI-LOCK CONNECTORS.*

3. Feed socket terminals and conduit up through slot in center of turn signal lamps bracket, and then through hole to inboard side of fender. See Figure 8-56.
4. Install terminals into socket housing.

**Table 8-12. FLHX License Plate Lamps [45]**

| WIRE COLOR | CHAMBER NUMBER |
|---|---|
| Black | 1 |
| Not Used | 2 |
| Black | 3 |

*NOTE*

*For instructions on installing terminals, see A.2 AMP MULTI-LOCK CONNECTORS.*

5. Install two screws to fasten lens to rear turn signal lamps bracket.
6. Reaching inside rear fender, capture conduit in cable clip anchored on T-stud. Reaching inside rear fender, capture conduit in cable clip anchored on T-stud.
7. Install chrome base and circuit board assembly. See 8.12 TAIL LAMP.

## LICENSE PLATE BRACKET

### Removal

1. Remove circuit board and chrome base. See 8.12 TAIL LAMP.

2. Remove terminals from socket housing of license plate lamps connector [45].

*NOTE*

*For instructions on removing terminals, see A.2 AMP MULTI-LOCK CONNECTORS.*

3. Reaching inside rear fender, release license plate lamps conduit from left side cable clip anchored on T-stud.
4. Draw socket terminals through hole to outboard side of fender. See Figure 8-56.
5. Reaching inside rear fender, release left and right rear turn signal lamp conduit from respective cable clips anchored on T-studs.
6. Remove two screws to release rear turn signal lamps bracket.
7. Pull rear turn signal lamps bracket away from motorcycle drawing socket housings out through fender holes.
8. Remove two screws to release license plate bracket from rear turn signal lamps bracket. See Figure 8-57.

## Installation

1. Install two screws to fasten license plate bracket to rear turn signal lamps bracket. See Figure 8-57.
2. Feed socket housings of left and right rear turn signal lamps through respective holes to inboard side of fender.
3. Apply one drop of Loctite High Strength Threadlocker 271 (red) to two flange bolts.
4. Install screws to fasten rear turn signal lamps bracket to rear fender. Alternately tighten screws to 84-144 **in-lbs** (9.5-16.3 Nm).
5. Feed socket terminals of license plate lamp connector [45] through left side hole to inboard side of fender. See Figure 8-56.
6. Install terminals into socket housing. Refer to Table 8-12.

*NOTE*

*For instructions on installing terminals, see A.2 AMP MULTI-LOCK CONNECTORS.*

7. Reaching inside rear fender, capture conduit of rear turn signal lamps connectors in respective cable clips anchored on T-studs. Also capture license plate lamps conduit in left side cable clip.
8. Install chrome base and circuit board assembly. See 8.12 TAIL LAMP.

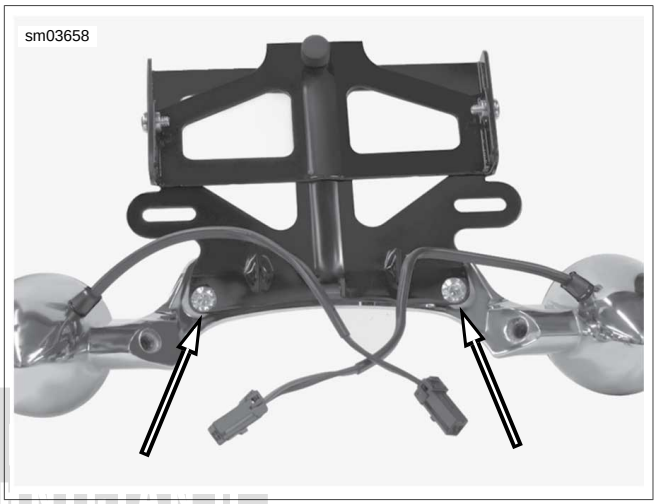



**Figure 8-57. Remove License Plate Bracket**

## REMOVAL

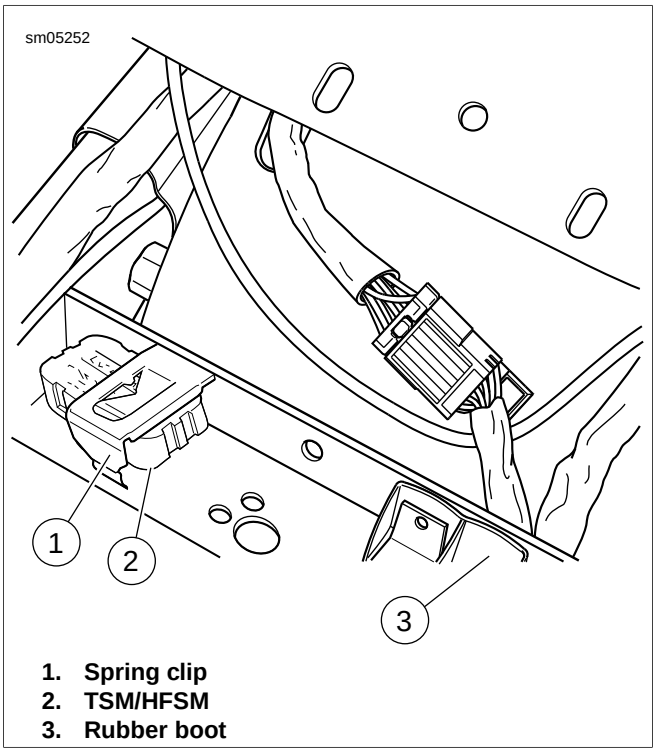
*NOTE*

*If equipped with the optional "Harley-Davidson Smart Security System," verify that the security status lamp in speedometer face is not flashing before proceeding (security system disarmed).*

1. Remove seat. See 2.26 SEAT.
2. Depress tab at front of spring clip and lift to release index pins from holes in frame crossmember. See Figure 8-58.
3. Remove module from hole in frame crossmember and disconnect TSM/HFSM connector [30], 12-place Deutsch.
4. If equipped, disconnect HFSM antenna jumper harness connector [208], 4-place Deutsch.

## INSTALLATION

1. Connect TSM/HFSM connector [30], 12-place Deutsch, to module.
2. If equipped, connect HFSM antenna jumper harness connector [208], 4-place Deutsch.
3. Install module into hole on right side of frame crossmember.
4. Insert index pins on spring clip into holes in frame crossmember and push down until tab at front snaps in place.
5. Install seat. See 2.26 SEAT.
6. Test all turn signal functions. Test all security system functions, if equipped.




**1. Spring clip**
**2. TSM/HFSM**
**3. Rubber boot**

**Figure 8-58. Frame Crossmember (Under Seat)**

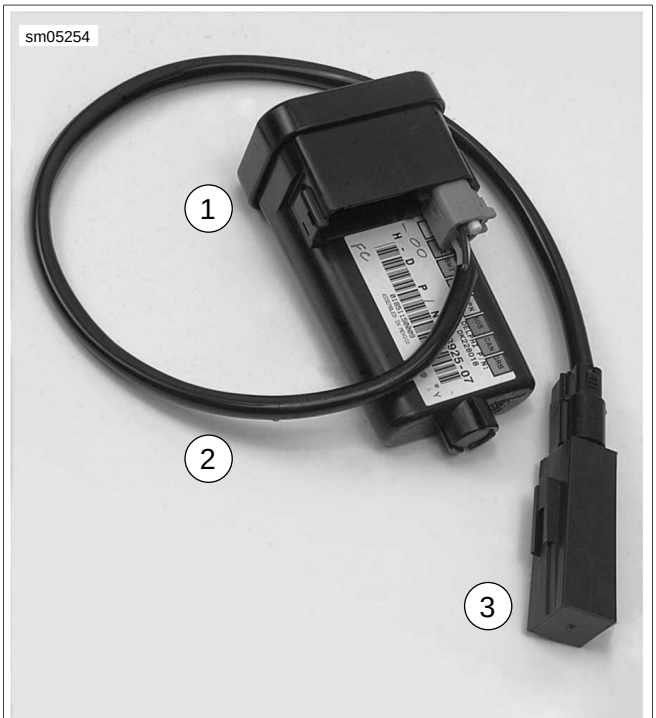
## HFSM ANTENNA

### Removal

1. Remove seat. See 2.26 SEAT.
2. Release groove on HFSM antenna from tongue at front of top caddy.
3. Disconnect HFSM antenna connector [209], 2-place Molex, from jumper harness. See Figure 8-59.
4. Remove HFSM antenna jumper harness as follows:
   a. Remove HFSM module. See 8.16 TSM/HFSM, Removal.
   b. Disconnect jumper harness connector [208], 4-place Deutsch, from HFSM module.
   c. Draw jumper harness below frame crossmember thru empty slot of rubber boot on left side, and then pull back up and out thru right side opening.

### Installation

1. Install HFSM antenna jumper harness as follows:
   a. Connect jumper harness connector [208], 4-place Deutsch, to HFSM module.
   b. Feed jumper harness down through opening on right side of frame crossmember, and then pull back up and out thru empty slot of rubber boot on left side.
   c. Install HFSM module. See 8.16 TSM/HFSM, Installation
2. Connect HFSM antenna connector [209], 2-place Molex, to jumper harness.
3. Routing jumper harness conduit along inboard side of left upper frame tube, engage groove on HFSM antenna on tongue at front of top caddy.
4. Install seat. See 2.26 SEAT.
5. Test all security system functions.




1. **HFSM**
2. **Jumper harness**
3. **HFSM antenna**

**Figure 8-59. HFSM/HFSM Antenna and Jumper Harness**

## FLHX, FLHT/C/U, FLTR

| PART NUMBER | TOOL NAME |
|---|---|
| HD-45961 | IGNITION SWITCH CONNECTOR REMOVER |
| HD-45962 | IGNITION SWITCH ALIGNMENT TOOL |

### Removal

1. Remove maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
2. 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° in a counterclockwise direction. See Figure 8-60.


**Figure 8-60. Ignition Switch Knob Release Button (Top and Bottom Views)**

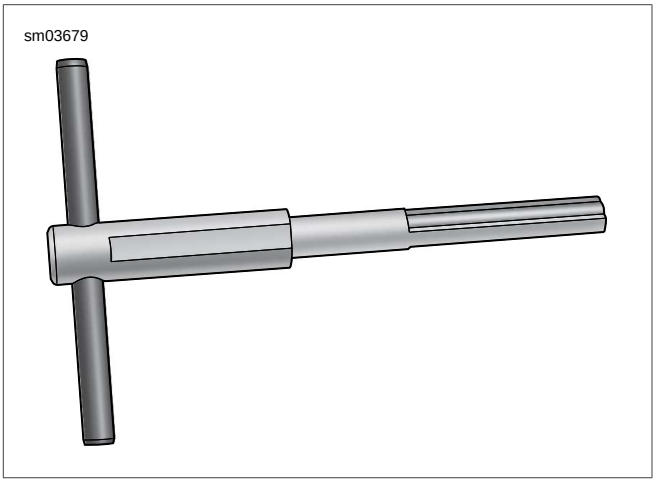



**Figure 8-61. Ignition Switch Alignment Tool (HD-45962)**

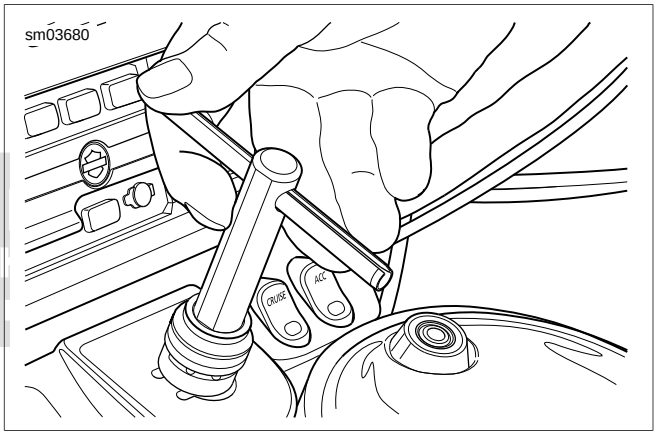



**Figure 8-62. Bottom Alignment Tool in Threaded Post and Rotate to Desired Position**

3. Lift and remove knob. Be aware that spring will drop out of bore at underside of knob when removed.

*NOTE*

*After removal of the knob, the IGNITION SWITCH ALIGNMENT TOOL (Part No. 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.*

4. Turn the front forks to the right fork stop, and using a 7/8 inch open end/box wrench on flats, remove nut from threaded post of ignition switch housing.
5. Pull collar and spacer from threaded post.
6. Remove the switch position plate by pulling tabs from slots in fairing cap (FLHX, FLHT/C/U) or instrument nacelle (FLTR).

7. **FLHX, FLHT/C/U:**
   a. Remove outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
   b. Using a long shank ball end socket (Snap-on® FABL6E), remove four socket head screws to release radio (storage box on FLHT) from left and right radio support brackets. Use oblong holes in fairing brackets to access screws. Lift radio slightly.
   c. Carefully cut anchored cable strap to release main harness conduit from bottom right corner of radio.
   d. Remove fairing cap. See 2.36 FAIRING CAP: FLHX, FLHT/C/U.
8. **FLTR:** Remove instrument nacelle. See 2.41 INSTRUMENT NACELLE: FLTR.
9. Disconnect ignition switch connector [33], 3-place Packard, at front of ignition switch housing. Proceed as follows:
   a. Obtain the IGNITION SWITCH CONNECTOR REMOVER (Part No. HD-45961). See Figure 8-63.
   b. Gently insert end of tool into slot in ignition switch housing until it stops.
   c. Grasping main harness conduit and tool, pull both at the same time to release socket housing from ignition switch housing. See Figure 8-64.

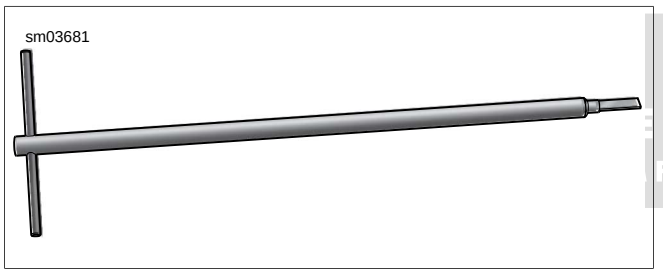



**Figure 8-63. Ignition Switch Connector Remover (HD-45961)**

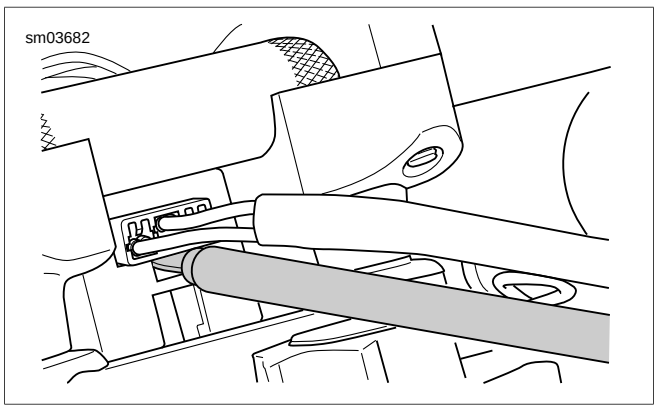
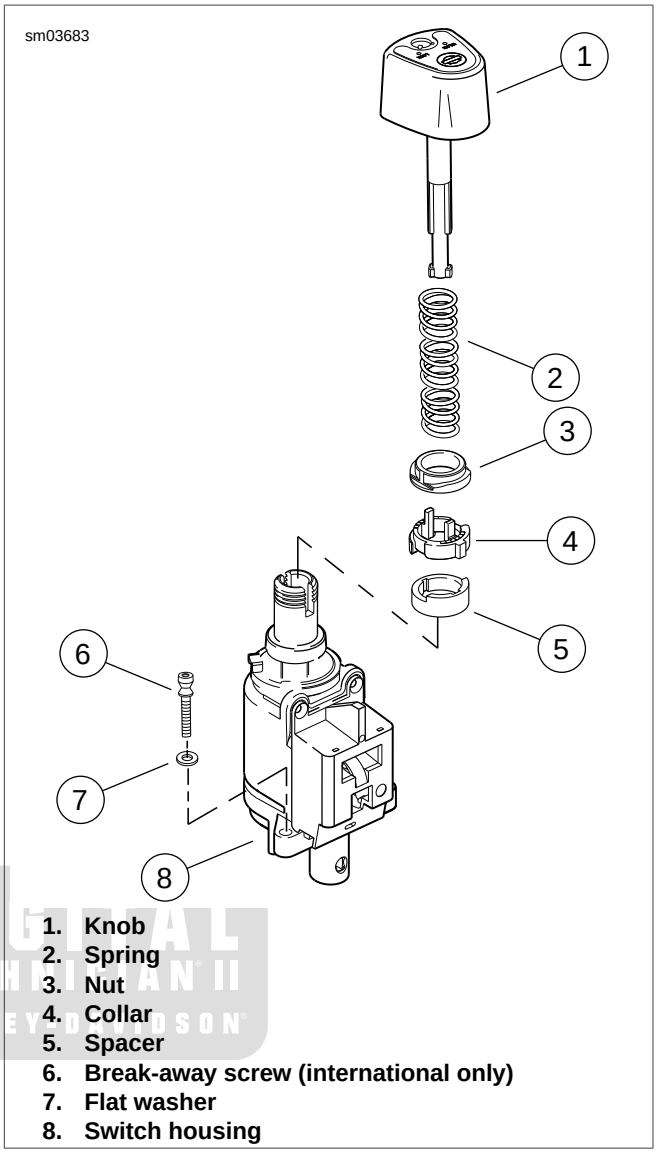



**Figure 8-64. Pull Main Harness Conduit and Tool to Release Socket Housing**




1. **Knob**
2. **Spring**
3. **Nut**
4. **Collar**
5. **Spacer**
6. **Break-away screw (international only)**
7. **Flat washer**
8. **Switch housing**

**Figure 8-65. Ignition Switch Assembly (International)**

10. Remove upper handlebar clamp. Support handlebars out of the way. See 2.24 HANDLEBARS, Removal.
11. **Domestic:** Remove two screws (with flat washers) at base of ignition switch housing.

**⚠CAUTION**

**Always wear proper eye protection when drilling or grinding. Flying debris could cause serious eye injury. (00402e)**

12. **International:** Remove two break-away screws (with flat washers) 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.

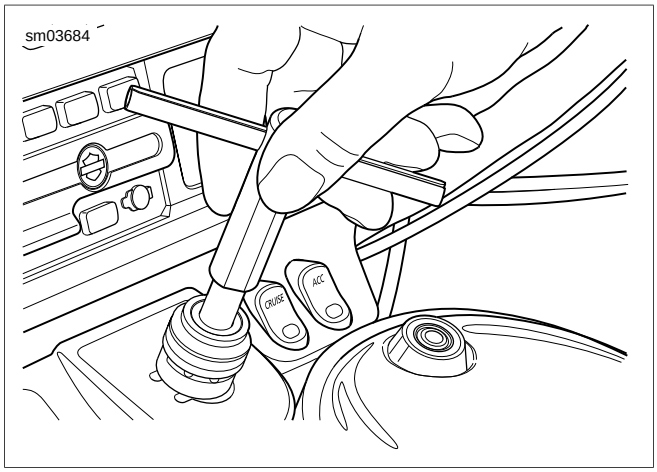



**Figure 8-66. Rotate Alignment Tool Without Bottoming**

*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.*

13. Remove ignition switch housing from bore of upper fork bracket. See Figure 8-65.

## Installation

1. Slide base of ignition switch housing into bore of upper fork bracket.
2. **Domestic:** Install two screws (with flat washers) at base of ignition switch housing. Alternately tighten screws to 36-60 **in-lbs** (4.1-6.8 Nm).
3. **International:** Install two **new** break-away screws (with flat washers) as follows.
   a. 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.

   *NOTE*

   *Exercise care to avoid losing heads of break-away screws in motorcycle. Vibration may cause captured heads to scratch finished surfaces, chafe wires or cause other damage.*

   b. Rotate break-away screws in a clockwise direction until heads snap off.
4. Install handlebars. See 2.24 HANDLEBARS, Installation.
5. Install ignition switch connector [33], 3-place Packard, at front of ignition switch housing.
6. Install anchor of **new** cable strap in hole at bottom right side of radio. Tighten cable strap capturing main harness conduit (to ignition switch).
7. **FLHX, FLHT/C/U:**
   a. Install fairing cap. See 2.36 FAIRING CAP: FLHX, FLHT/C/U.
   b. Using oblong holes in fairing brackets and a long shank ball end socket (Snap-on® FABL6E), install four socket head screws to fasten radio (storage box on FLHT) to left and right radio support brackets. Alternately tighten screws to 35-45 **in-lbs** (4.0-5.1 Nm).
   c. Install outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
8. **FLTR:** Install instrument nacelle. See 2.41 INSTRUMENT NACELLE: FLTR.
9. Install switch position plate fitting tabs in slots of fairing cap (FLHX, 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.
10. 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.
11. 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.
12. 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).
13. Install spring into bore at underside of knob.
14. 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, proceed as follows:
   a. Verify that button at bottom of knob is depressed and key is turned 60° beyond the UNLOCK position. See Figure 8-60.
   b. Repeat this step.
   c. If knob does not install properly, move to previous step.
15. 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 previous step.
   c. If knob does not install properly, move to next step.
16. 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 16(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 counterclockwise direction or one position in a clockwise direction. Repeat step 14.

17. Install maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.

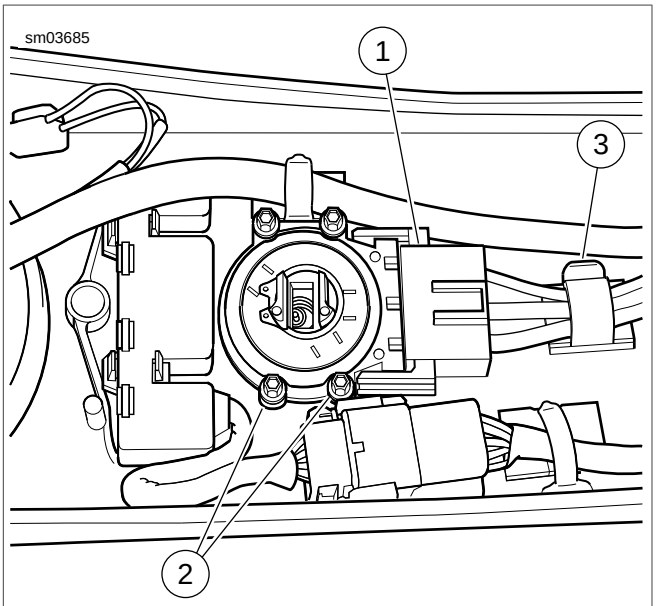
## FLHR/C

### Ignition/Light Key Switch: Removal

1. Remove maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
2. Remove seat. See 2.26 SEAT.
3. Remove socket screw to release front of console from fuel tank weldment.
4. Remove hex screw to release rear console bracket from clip nut on rear fuel tank bracket.
5. Lay a clean shop towel on forward part of rear fender. Remove console and lay upside down on shop towel.
6. Disconnect ignition switch connector [33], 3-place Packard. See Figure 8-67. Release ignition switch conduit from plastic clip, if necessary.
7. Remove four screws to release ignition switch from console.

### Ignition/Light Key Switch: Installation

1. Align holes in **new** ignition 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 connector [33], 3-place Packard. Capture ignition switch conduit in plastic clip, if removed.
4. Exercising caution to avoid pinching wire harness and vent tube, position console on fuel tank.
5. Start socket screw to fasten front of console to fuel tank weldment.




1. **Ignition switch connector [33]**
2. **Screw (4)**
3. **Plastic clip**

**Figure 8-67. Instrument Console (FLHR/C)**

6. Start hex screw to fasten rear console bracket to clip nut on rear fuel tank bracket.
7. Alternately tighten socket/hex screws to 36-60 **in-lbs** (4.1-6.8 Nm).
8. Install seat. See 2.26 SEAT.
9. Install maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.

### Fork Lock: Removal

1. Remove handlebar clamp shroud. See 2.45 HEADLAMP NACELLE: FLHR/C, steps 1-11.
2. Start acorn nuts on both the left and right side fork bracket studs to keep halves of headlamp nacelle on motorcycle.
3. Remove two 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.*

### Fork Lock: Installation

1. Install **new** fork lock assembly into bore of upper fork bracket. See Figure 8-68.
2. Install two socket screws (with flat washers) and alternately tighten to 36-60 **in-lbs** (4.1-6.8 Nm).

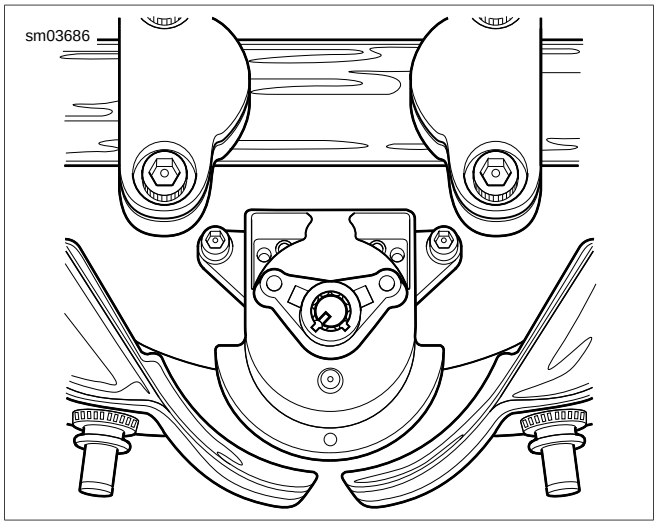



**Figure 8-68. Fork Lock (FLHR/C)**

*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 motorcycle as vibration may cause captured heads to scratch finished surfaces, chafe wires or cause other damage.*

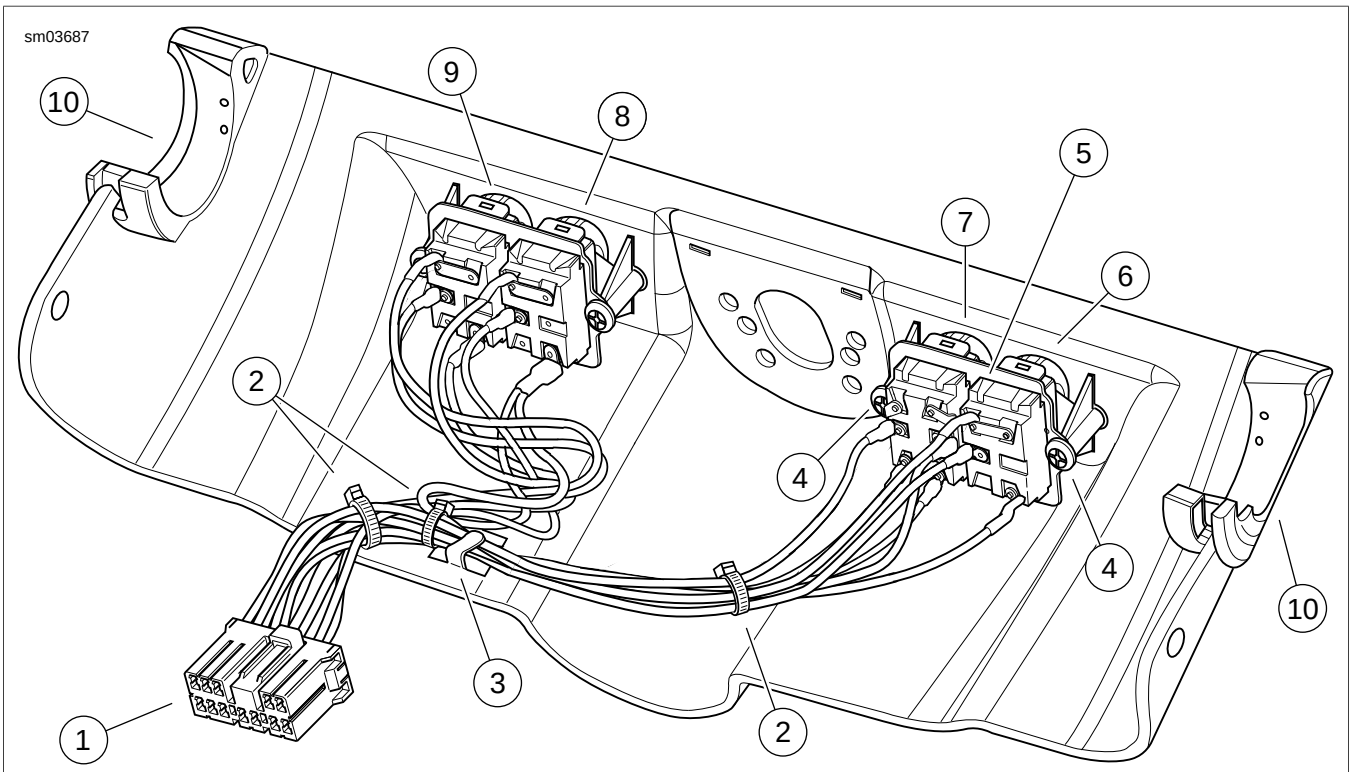
3. Install handlebar clamp shroud. See 2.45 HEADLAMP NACELLE: FLHR/C, steps 3-15.

## REMOVAL

1. Partially disassemble ignition switch: remove ignition switch knob, spring, nut, collar, spacer and switch position plate. See 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK.
2. Remove two screws (with flat washers) to release fairing cap from left and right sides of inner fairing.
3. With the front forks turned to the left fork stop, reach behind right side of fairing cap and disconnect the fairing cap switch connector [105], 12-place Multilock.
4. Remove fairing cap from motorcycle. See Figure 8-69.
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. Remove two screws to release switch bracket from fairing cap.
7. Gently pry two latches on bracket outward to release tabs on switch. Remove switch from bracket. See Figure 8-70.
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 8-71 and Table 8-13 for the applicable chamber numbers. For wire location purposes, numbers are stamped into the secondary locks of both the pin and socket housings.
10. Remove the appropriate terminals from the socket housing.

*NOTE*

*For instructions on properly removing wire terminals, see A.2 AMP MULTILOCK CONNECTORS.*




1. **Fairing cap switch connector [105]**
2. **Cable strap**
3. **Flexible clamp**
4. **Switch bracket screws**
5. **Switch bracket**
6. **Auxiliary lamp switch**
7. **Speaker switch**
8. **Cruise switch**
9. **Accessory switch**
10. **Grommet**

**Figure 8-69. FLHTCU Fairing Cap (Inboard Side)**

## 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*

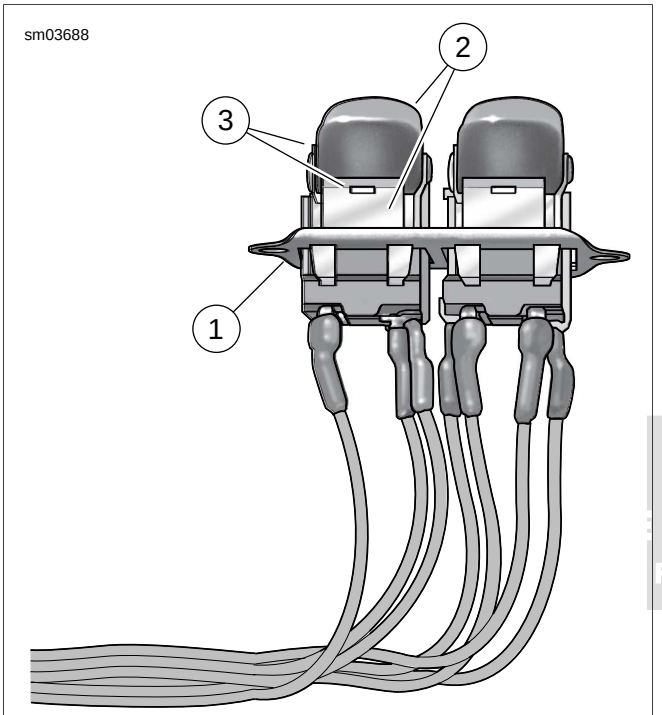
*For instructions on properly installing wire terminals, see A.2 AMP MULTILOCK CONNECTORS.*

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 A.18 SEALED SPLICE CONNECTORS.*

4. 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 8-69.
6. Verify that the rubber grommets are installed on each side of the fairing cap. Barbs on cap fit into holes in grommets.




1. **Switch bracket**
2. **Latch**
3. **Tab**

**Figure 8-70. Bend Latches Outward to Release Tabs**

**Table 8-13. 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 |
| Auxiliary Lamp | Yellow | 6 |
| | Gray/Black | 7 |
| | Black | 8 |
| Speaker Ultra Only | Orange/Blue | 9 |
| | Violet/Orange | 10 |
| | Brown/Orange | 11 |
| | Black/Green | To Cruise Switch |

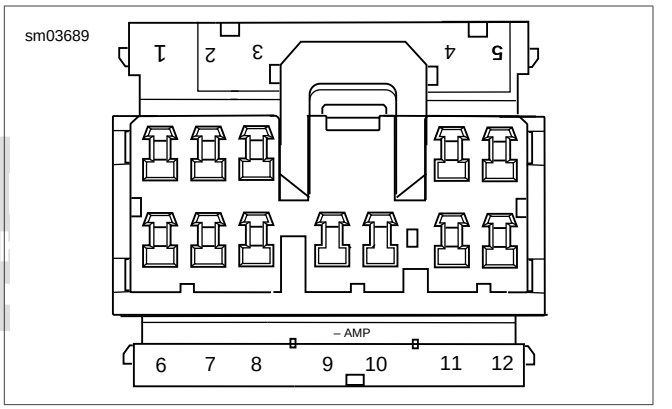



**Figure 8-71. Socket Housing (Secondary Locks Open)**

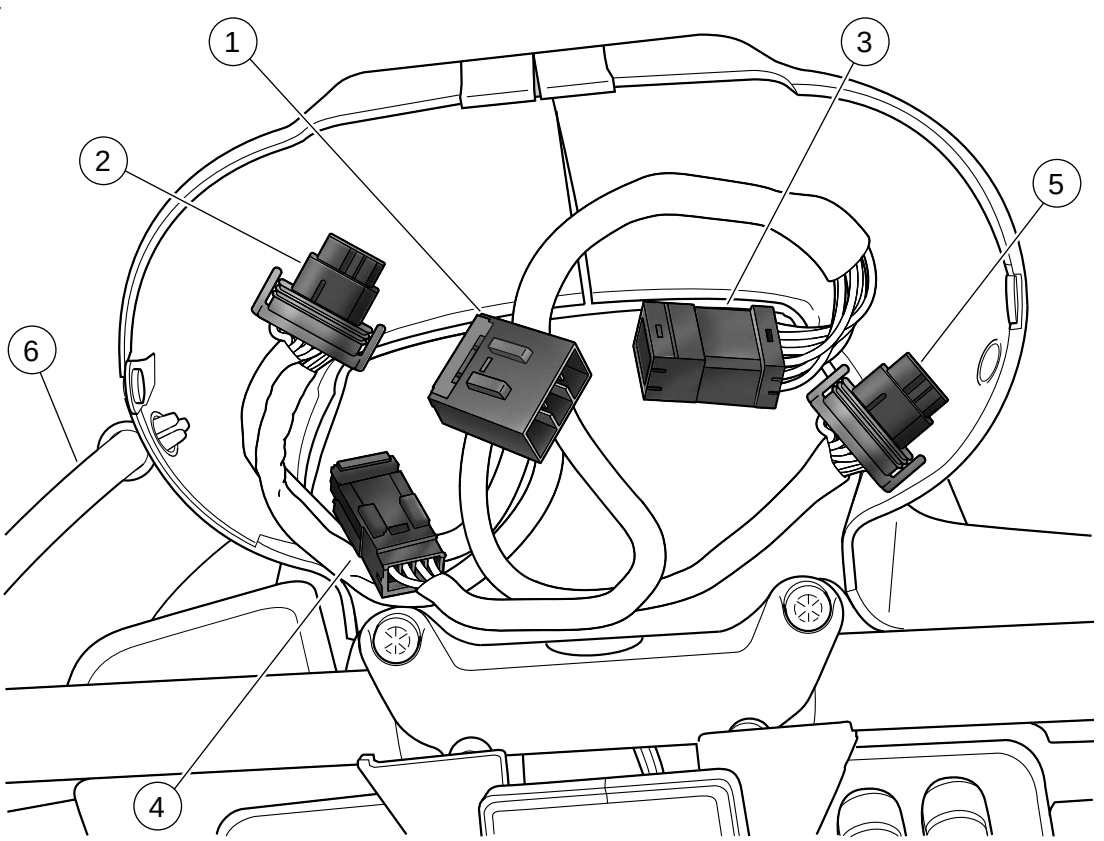
7. Connect the fairing cap switch connector [105], 12-place Multilock, on the right side of fairing cap.
8. With the front forks turned to the left fork stop, install fairing cap over ignition switch housing. Verify that grommets in fairing cap fully capture handlebar, handlebar switch conduit, and brake line from front master cylinder reservoir (right side).
9. Start two screws (with flat washers) to fasten fairing cap to left and right sides of inner fairing. Alternately tighten screws to 25-30 **in-lbs** (2.8-3.4 Nm).
10. Assemble ignition switch: install switch position plate, spacer, collar, nut, spring and knob. See 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK.

## REMOVAL

1. Partially disassemble ignition switch: remove ignition switch knob, spring, nut, collar, spacer and switch position plate. See 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK.
2. Remove screw on each side of bezel.
3. 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).
4. See Figure 8-72. Raising bezel slightly, disconnect instruments and indicator lights from interconnect harness as follows:
   a. Speedometer connector [39], 12-place Packard.
   b. Tachometer connector [108], 12-place Packard.
   c. Indicator lights connector [21], 10-place Multilock.
5. Remove bezel from motorcycle.
6. Follow instructions based on location of defective switch.

### Left Side Switch

1. See Figure 8-72. Disconnect speaker switch connector [105], 4-place Multilock.
2. Pull clutch cable clip from hole on left side of instrument nacelle.
3. Remove two screws (with flat washers) to release left side of instrument nacelle from upper and lower fork brackets.
4. Unthread rubber boot from odometer reset switch, and while carefully removing left side instrument nacelle from motorcycle, pull odometer reset switch from hole. Move left side of nacelle to bench area leaving right side on motorcycle. See Figure 8-72.
5. Gently bend back molded retainer to release switch bracket assembly from instrument nacelle.
6. Carefully pry two latches on bracket outward to release tabs on switch. Remove switch from bracket. See Figure 8-73.




1. **Indicator lights [21]**
2. **Speedometer gauge [39]**
3. **Instrument nacelle switches [105A/B]**
4. **Speaker switch [105C/D]**
5. **Tachometer gauge [108]**
6. **Clutch cable**

**Figure 8-72. Instrument Nacelle (Bezel Removed)**

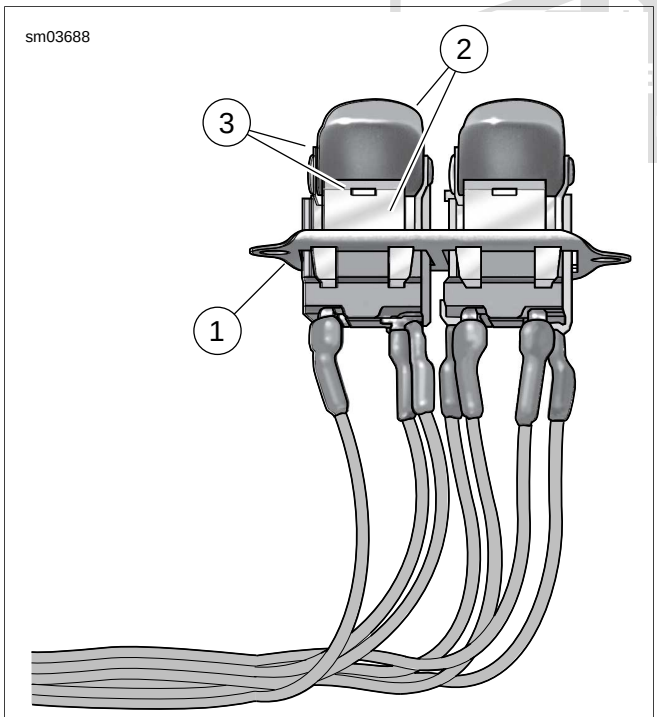
## Right Side Switches

1. See Figure 8-72. Disconnect speaker switch connector [105], 4-place Multilock.
2. See Figure 8-72. Disconnect instrument nacelle switch connector [105], 12-place Multilock.
3. Remove two screws (with flat washers) to release right side of instrument nacelle from upper and lower fork brackets. Move right side of nacelle to bench area leaving left side on motorcycle. See Figure 8-72.
4. Gently bend back molded retainer to release switch bracket assembly from instrument nacelle.
5. Carefully pry two latches on bracket outward to release tabs on switch. Remove switch from bracket. See Figure 8-73.
6. Remove the appropriate terminals from the socket and/or pin housings. Follow the wires of the faulty switch or reference Table 8-14 for the applicable chamber numbers. For wire location purposes, numbers are stamped into the secondary locks. See Figure 8-74.

*NOTE*

*For instructions on properly removing wire terminals, see A.2 AMP MULTILOCK CONNECTORS.*

7. Carefully pull wires to draw terminals through conduit to backside of switch. For best results, pull one wire at a time.




1. **Switch bracket**
2. **Latch**
3. **Tab**

**Figure 8-73. Bend Latches Outward to Release Tabs**

**Table 8-14. Right Side Instrument Nacelle Switches**

| SWITCH | WIRE COLOR | CHAMBER NUMBER | |
|---|---|---|---|
| | | 12-PLACE SOCKET | 4-PLACE PIN |
| Accessory | Orange/Red | 1 | |
| | Orange | 2 | |
| | Black | 3 | |
| Cruise | Orange/Violet | 4 | |
| | Red/Green | 5 | |
| | Black/Green (Double Lugged) | 12 | 4 |

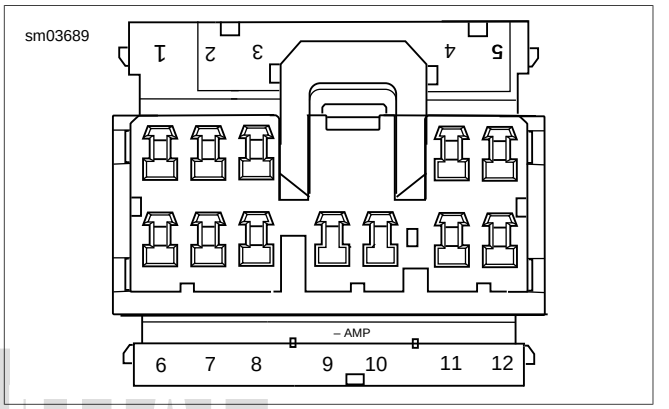



**Figure 8-74. Socket Housing (Secondary Locks Open)**

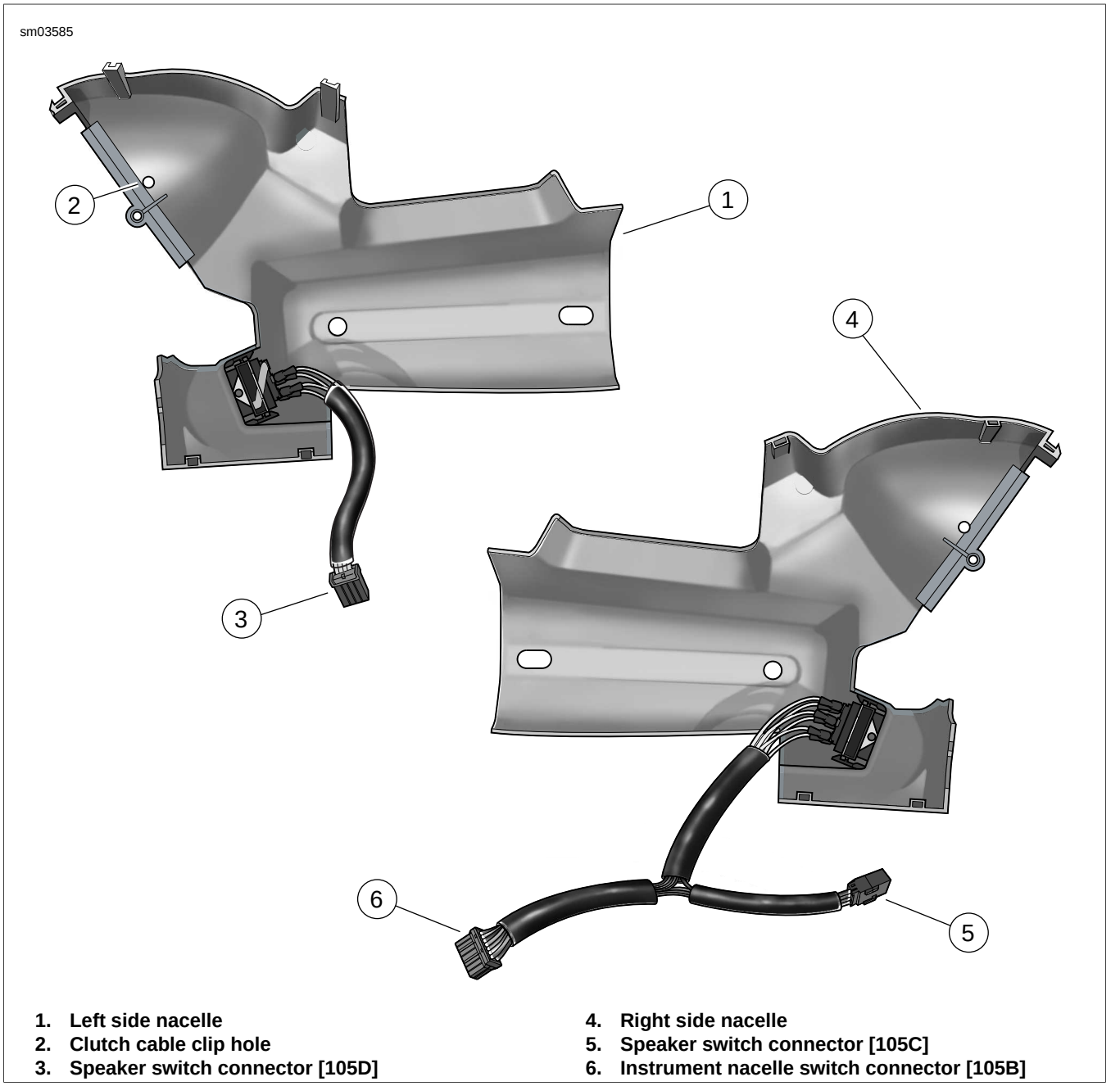
# INSTALLATION

## Left Side Switch

1. Place **new** switch into position in bracket. Engaging tabs on switch in slots of latches, gently bend tabs upward to lock position of switch in bracket.
2. Snap switch bracket into molded retainer in instrument nacelle.
3. While carefully placing left side of instrument nacelle on motorcycle, slide odometer reset switch through hole and install rubber boot. See Figure 8-75.
4. See Figure 8-72. Connect speaker switch connector [105], 4-place Multilock.
5. Install two screws (with flat washers) to fasten left side instrument nacelle to upper and lower fork brackets. Alternately tighten screws to 15-20 ft-lbs (20-27 Nm).
6. Capture clutch cable in cable clip. Insert cable clip into hole in left side of instrument nacelle.

## Right Side Switches

1. See Figure 8-73. Place **new** switch into position in bracket. Engaging tabs on switch in slots of latches, gently bend tabs upward to lock position of switch in bracket.




1. **Left side nacelle**
2. **Clutch cable clip hole**
3. **Speaker switch connector [105D]**
4. **Right side nacelle**
5. **Speaker switch connector [105C]**
6. **Instrument nacelle switch connector [105B]**

**Figure 8-75. Instrument Nacelle Halves**

2. Push terminals through two lengths of conduit to wire end of socket or pin housing. For best results, push one wire through conduit at a time.
3. Refer to Table 8-14. See Figure 8-74. Install terminals into socket or pin housing.

*NOTE*

*For instructions on properly installing wire terminals, see A.2 AMP MULTILOCK CONNECTORS.*

4. Snap switch bracket into molded retainer in instrument nacelle.
5. Install right side of instrument nacelle on motorcycle. See Figure 8-75.
6. See Figure 8-72. Connect speaker switch connector [105], 4-place Multilock.
7. Connect instrument nacelle switch connector [105], 12-place Multilock.
8. Install two screws (with flat washers) to fasten right side instrument nacelle to upper and lower fork brackets. Alternately tighten screws to 15-20 ft-lbs (20-27 Nm).
9. Looking into instrument nacelle, connect instruments and indicator lights to interconnect harness as follows:
   a. Speedometer connector [39], 12-place Packard.
   b. Tachometer connector [108], 12-place Packard.
   c. Indicator lights connector [21], 10-place Multilock.

10. Verify that left and right sides of instrument nacelle are properly mated. Pins on left side of nacelle must fully engage holes on right.
11. 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.*

12. Install screw on each side of bezel. Alternately tighten screws to 25-35 **in-lbs** (2.8-4.0 Nm).
13. Assemble ignition switch. See 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK.

## GENERAL

The crank position sensor is a variable reluctance (VR) sensor that generates an AC signal by sensing the passing of the 30 teeth machined in the left side flywheel. Two consecutive teeth are missing in the flywheel to establish a reference point. The crank position sensor sends a signal to the electronic control module which is used to reference engine position (TDC) and engine speed.

*NOTE*

*CKP sensor connector is not serviceable. If connector or sensor fails, the entire assembly must be replaced.*

## REMOVAL

1. Remove maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
2. Locate CKP sensor connector [79], 2-place Deutsch, fixed to front caddy at bottom of lower frame crossmember.
3. Push connector toward right side of motorcycle to disengage small end of slot on attachment clip from T-stud on front caddy. Lift connector off T-stud.
4. Depress button on socket terminal side and pull apart pin and socket halves.
5. Remove screw to free CKP sensor mount from front left side of crankcase. Pull sensor from bore. See Figure 8-76 and Figure 8-77.

## INSTALLATION

1. Install **new** o-ring on sensor body if missing, distorted, pinched or otherwise damaged. Apply a thin film of clean H-D 20W50 engine oil to o-ring before installation.
2. Push sensor into bore aligning hole in sensor mount with hole in spot face. Install screw and tighten to 90-120 **in-lbs** (10.2-13.6 Nm). See Figure 8-76.
3. Route connector and convoluted tubing downward at rear of front engine stabilizer link to front caddy at bottom of lower frame crossmember.
4. Mate pin and socket halves of CKP sensor connector [79].

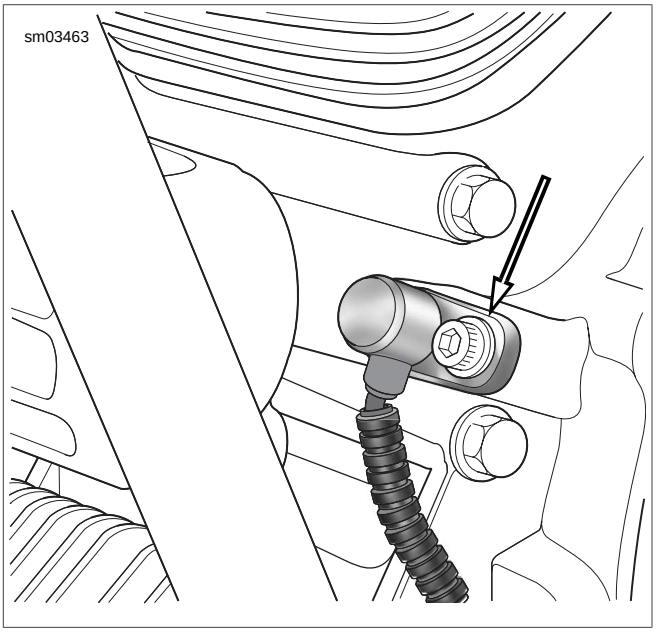



**Figure 8-76. Remove CKP Sensor Mount Screw**

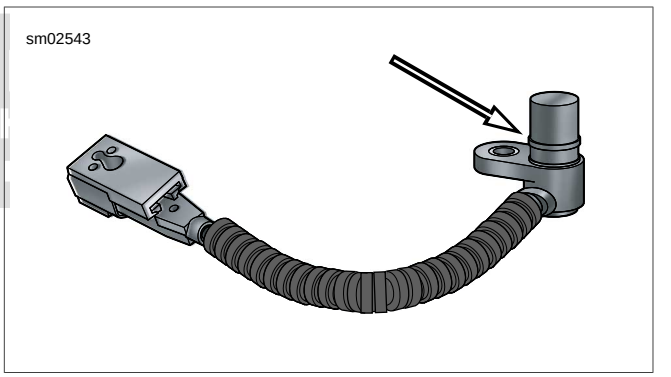



**Figure 8-77. CKP Sensor O-Ring**

5. Place large end of slot on attachment clip over T-stud on front caddy. Push connector toward left side of motorcycle to engage small end of slot.
6. Install maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.

## REMOVAL

1. Remove seat. See 2.26 SEAT.

**⚠WARNING**

**To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)**

2. Unthread bolt and remove battery negative cable (black) from battery negative (-) terminal.
3. Remove the primary chaincase. See 6.4 PRIMARY CHAINCASE HOUSING.

**⚠CAUTION**

**The high-output rotor contains powerful magnets. Exercise caution to prevent possible hand injury during removal and installation. (00558b)**

4. Grasp the rotor/spring cover assembly with both hands and pull from the engine compensating sprocket shaft. See Figure 8-78.
5. Loosen locknuts on studs of lower frame crossmember. Lift voltage regulator and release conduit from P-clip under left side leg of voltage regulator.
6. Pull away locking latch and remove socket of stator connector [46], 3-place Lyall, at bottom left side of voltage regulator. See Figure 8-79.

*NOTE*

*The rubber molded stator connector is not serviceable. Damage to terminals or molding requires stator and/or voltage regulator replacement.*

7. Draw stator conduit and socket to rear of front engine stabilizer link and then up to area in front of primary chaincase.
8. Remove four screws to free stator from crankcase. Discard screws.
9. Using point of awl, carefully lift capped rib on grommet away from crankcase and then insert into bore between grommet and casting. See Figure 8-80. Tilt awl slightly, squirting isopropyl alcohol or glass cleaner into opening. Repeat this step at one or two other locations around grommet.
10. 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.
11. Draw conduit and socket through crankcase bore.

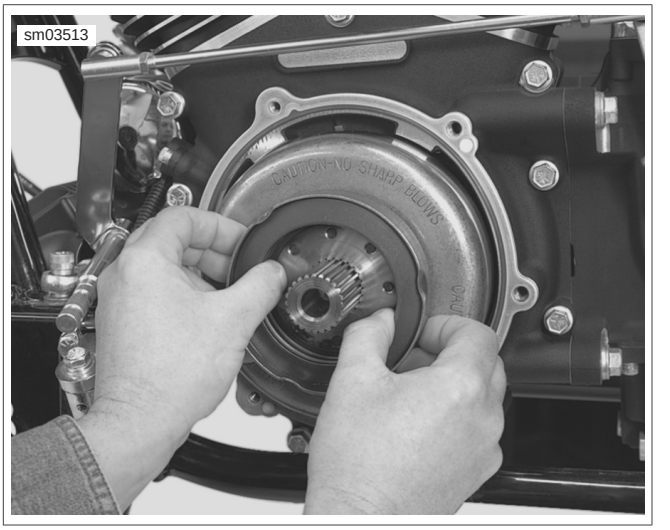
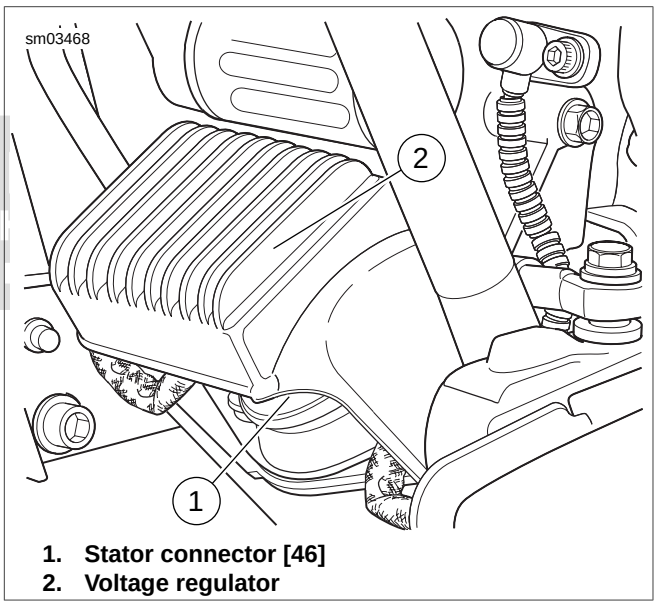



**Figure 8-78. Remove Rotor/Spring Cover Assembly**

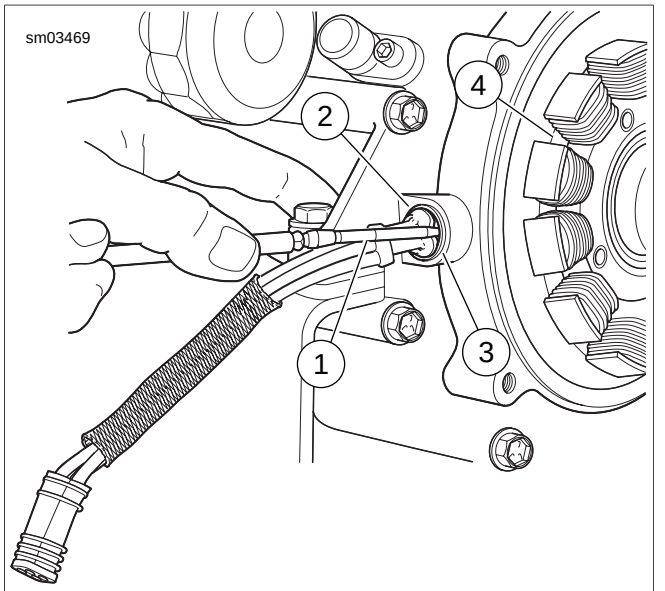



1. **Stator connector [46]**
2. **Voltage regulator**

**Figure 8-79. Voltage Regulator (Left Side View)**

## 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.




1. **Awl**
2. **Capped rib**
3. **Opening**
4. **Stator**

**Figure 8-80. Remove Grommet From Crankcase**

## INSTALLATION

1. From inside crankcase, feed socket and conduit through hole in crankcase.
2. Thoroughly 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.

*NOTE*

*Do not reuse stator mounting 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. Install four **new** screws to fasten stator to crankcase. Alternately tighten screws to 55-75 **in-lbs** (6.2-8.5 Nm).

**⚠CAUTION**

**The high-output rotor contains powerful magnets. Exercise caution to prevent possible hand injury during removal and installation. (00558b)**

6. Grasp the rotor/spring cover assembly with both hands and ease onto the engine compensating sprocket shaft.
7. Feed socket and conduit under front engine stabilizer link and then forward along outboard side of voltage regulator leg. See Figure 8-79.
8. Capture conduit in P-clip under left side leg of voltage regulator. Remove slack to ensure that conduit does not contact front engine stabilizer link.
9. Install socket of stator connector [46], 3-place Lyall, at bottom left side of voltage regulator. Push against locking latch until socket is fully engaged.
10. Alternately tighten locknuts on studs of lower frame crossmember to 70-100 **in-lbs** (7.9-11.3 Nm).
11. Install the primary chaincase. See 6.4 PRIMARY CHAIN-CASE HOUSING.
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 2.26 SEAT.

## VSS

### Removal

1. Remove starter. See 5.2 STARTER.
2. Disconnect VSS connector [65], 3-place Delphi, at top of transmission case. See Figure 8-81.
3. Remove screw and pull sensor from transmission case.

### Installation

1. Inspect VSS O-ring for cuts, tears or general deterioration. Replace as necessary.
2. Insert sensor into transmission case. Install screw and tighten to 84-132 **in-lbs** (9.5-14.9 Nm).
3. Connect VSS connector [65], 3-place Delphi.
4. Install starter. See 5.2 STARTER.


**Figure 8-81. VSS Location**

## GENERAL

The neutral switch is located on the transmission case. The two terminal switch is normally closed. When the transmission shifter is in neutral and the ignition switch is in the IGNITION position, the switch causes the NEUTRAL indicator light to illuminate.

## REMOVAL

1. Verify that transmission is in NEUTRAL.
2. Remove two elbow connectors from neutral switch posts. See Figure 8-82.
3. Using open end/box wrench on flats, remove neutral switch from transmission case.

## INSTALLATION

1. Inspect O-ring for cuts, tears or general deterioration. Replace as necessary. Lightly lubricate **new** O-ring with clean transmission oil before installation. See Figure 8-83.
2. Roll motorcycle back and forth to verify that transmission is in NEUTRAL.
3. Install neutral switch in transmission case. Using open end/box wrench on flats, tighten to 120-180 **in-lbs** (13.6-20.3 Nm).
4. Install two elbow connectors onto neutral switch posts.

*NOTE*

*The neutral switch is not polarity sensitive, so the elbow connectors can be installed on either post.*

5. Test neutral switch for proper operation. Proceed as follows:
   a. Roll motorcycle back and forth to verify that transmission is in NEUTRAL.
   b. Turn Ignition/Light Key Switch to IGNITION.
   c. Verify that neutral indicator light illuminates.

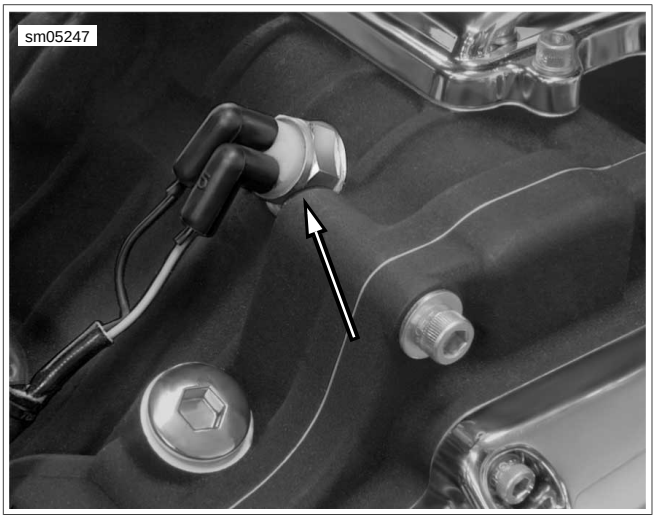



**Figure 8-82. Neutral Switch**

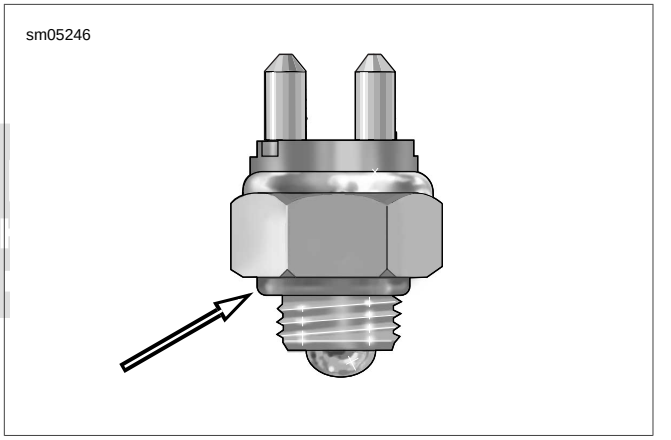



**Figure 8-83. Neutral Switch O-Ring**

## REMOVAL

1. Locate the oil pressure switch/sender at the front right side of the crankcase.
2. **FLHR/C:**
   a. Pull elbow connector [120] from post terminal of oil pressure switch.
   b. Use a 15/16 inch Open End Crow Foot (Snap-on® FC30B) to remove switch from crankcase.
3. **FLHX, FLHT/C/U, FLTR:**
   a. Remove 4-place Delphi connector [139] from oil pressure sender.
   b. Use 1-1/16 inch Open End Crow Foot (Snap-on® FC34A) to remove sender from crankcase.

## INSTALLATION

*NOTE*

*If reusing oil pressure switch/sender, apply Loctite Pipe Sealant with Teflon 565 to threads.*

1. Start oil pressure switch/sender into crankcase bore.
2. **FLHR/C:**
   a. Use a 15/16 inch Open End Crow Foot (Snap-On FC30B) to tighten oil pressure switch to 96-120 **in-lbs** (11-14 Nm).
   b. Install elbow connector [120] onto post terminal.
3. **FLHX, FLHT/C/U, FLTR:**
   a. Use 1-1/16 inch Open End Crow Foot (Snap-On FC34A) to tighten oil pressure sender to 96-120 **in-lbs** (11-14 Nm).
   b. Install 4-place Delphi connector [139].
4. Test oil pressure switch/sender for proper operation.

## FRONT STOPLIGHT SWITCH

### Removal/Installation

See 8.39 HANDLEBAR SWITCH ASSEMBLIES.

## REAR STOPLIGHT SWITCH

### Removal

**CAUTION**

**D.O.T. 4 brake fluid will damage painted and body panel surfaces it comes in contact with. Always use caution and protect surfaces from spills whenever brake work is performed. Failure to comply can result in cosmetic damage. (00239b)**

*NOTE*

*Immediately wipe up any brake fluid spillage with a clean, dry, soft cloth. Follow up by thoroughly wiping affected area with a clean, damp, soft cloth (small spills) or washing with a large quantity of soapy water (large spills).*

1. Using wrench on flats, remove rear stoplight switch from rear brake line. See Figure 8-84.

*NOTE*

*Wrap rear brake line with piece of shop towel to absorb any loss of brake fluid.*

### Installation

1. Apply Loctite Pipe Sealant with Teflon 565 to threads of rear stoplight switch.
2. Install rear stoplight switch into rear brake line. See Figure 8-84.
3. Using wrench on flats, tighten rear stoplight switch to 12-15 ft-lbs (16.3-20.3 Nm).
4. Fill and bleed rear brake system. See 1.14 BLEEDING BRAKES.

**WARNING**

**Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)**

5. Verify proper operation of tail lamp/rear brake light.

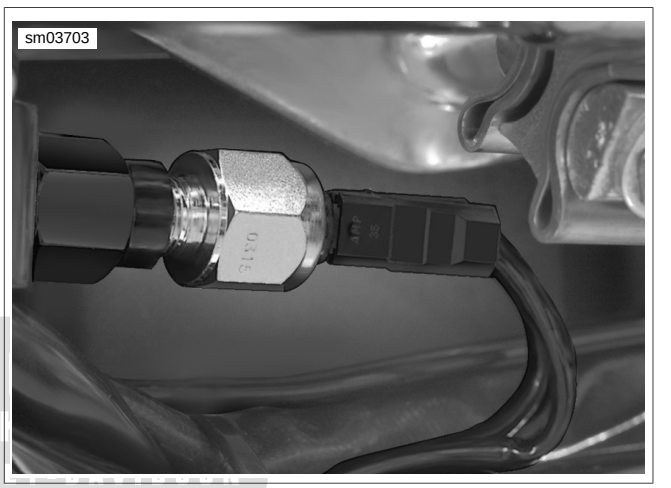



**Figure 8-84. Rear Stoplight Switch**

## INSPECTION

If the horn fails to sound or does not sound satisfactorily, check for loose, frayed or damaged wires leading to horn terminal, discharged battery or corroded ground.

The horn is permanently sealed and non-repairable. Only the mounting hardware is replaceable.

*NOTE*

*No tonal adjustments may be made to this horn.*

## REMOVAL

1. Remove acorn nut and flat washer to free horn assembly from rubber mount stud.
2. Remove elbow terminals from spade contacts and release main harness conduit from J-clamp.
3. 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 Low Strength Threadlocker 222 (purple) to threads of horn stud.

*NOTE*

*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 spade contacts.

*NOTE*

*The horn is not polarity sensitive. Elbow terminals may be attached to either spade contact.*

4. Capture main harness conduit in J-clamp and install horn bracket onto rubber mount stud. Install flat washer and acorn nut. Tighten acorn nut to 80-120 **in-lbs** (9.0-13.6 Nm).

## GENERAL

FLHX, FLHT/C/U 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 outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U or 2.39 UPPER FAIRING AND WINDSHIELD: FLTR.
2. Disconnect socket terminals from spade contacts on cigarette lighter.
3. Remove lighter from socket. Holding socket, unscrew outer shell. Remove socket and outer shell from inner 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 socket terminals onto spade contacts of cigarette lighter. Connect orange wire terminal to center socket spade contact, the black wire terminal to outer shell contact.
3. Install outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U or 2.39 UPPER FAIRING AND WINDSHIELD: FLTR.

## 2 INCH DIAMETER GAUGES: FUEL LEVEL, AMBIENT AIR TEMPERATURE, VOLTMETER, OIL PRESSURE

### Removal

1. Remove outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U or 2.39 UPPER FAIRING AND WINDSHIELD: FLTR.
2. Pull 2-place and 3-place socket housings to release interconnect harness from lamp and gauge, respectively.

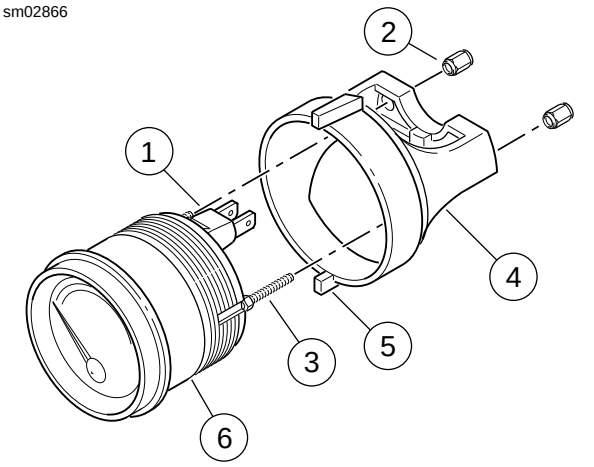
*NOTE*

*To replace lamp, pull pin housing from gauge and then pull lamp from slot of pin housing. Install **new** lamp in slot and insert pin housing back into gauge. See Figure 8-85.*

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 tabs on top and bottom of bracket engage slots in inner fairing. See Figure 8-85.
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 3-place and 2-place socket housings to connect interconnect harness to gauge and lamp, respectively.
5. Install outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U or 2.39 UPPER FAIRING AND WINDSHIELD: FLTR.




1. **Pin housing**
2. **Hex nut**
3. **Stud**
4. **Mounting bracket**
5. **Tab**
6. **Gauge**

**Figure 8-85. 2 Inch Diameter Gauges**

## TACHOMETER

### Removal

1. Proceed as follows:
   a. **FLHX, FLHT/C/U:** Remove outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
   b. **FLTR:** Remove bezel. See 2.40 INSTRUMENT BEZEL: FLTR.
2. Remove tachometer connector [108], 12-place Packard, at back of tachometer.
3. Remove two screws to free tachometer bracket from back of tachometer gauge.
4. Push tachometer gauge toward rear of motorcycle to remove from inner fairing (FLHX, FLHT/C/U) or bezel bore (FLTR).

### Installation

1. Insert tachometer gauge into inner fairing (FLHX, FLHT/C/U) or bezel bore (FLTR).
2. Align holes in tachometer bracket with those at back of tachometer gauge and start two screws.
3. Rotate tachometer gauge until tabs at top and bottom of bracket engage slots in inner fairing (FLHX, FLHT/C/U) or bezel (FLTR).
4. Verify that gauge is properly aligned and tighten two screws to 10-20 **in-lbs** (1.1-2.3 Nm).

5. Install tachometer connector [108], 12-place Packard, at back of tachometer.
6. Proceed as follows:
   a. **FLHX, FLHT/C/U:** Install outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
   b. **FLTR:** Install bezel. See 2.40 INSTRUMENT BEZEL: FLTR.

## SPEEDOMETER

### Removal

1. Proceed as follows:
   a. **FLHX, FLHT/C/U:** Remove outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
   b. **FLTR:** Remove bezel. See 2.40 INSTRUMENT BEZEL: FLTR.
2. Remove speedometer connector [39], 12-place Packard, at back of speedometer.
3. Remove two screws to free speedometer bracket from back of speedometer gauge. On FLHX, FLHT/C/U models, leave anchor on interconnect harness installed in lower ear of speedometer bracket, if present.
4. Push speedometer gauge toward rear of motorcycle to remove from inner fairing (FLHX, FLHT/C/U) or bezel bore (FLTR).

### Installation

1. Insert speedometer gauge into inner fairing (FLHX, FLHT/C/U) or bezel bore (FLTR).
2. Align holes in speedometer bracket with those at back of speedometer gauge and start two screws.

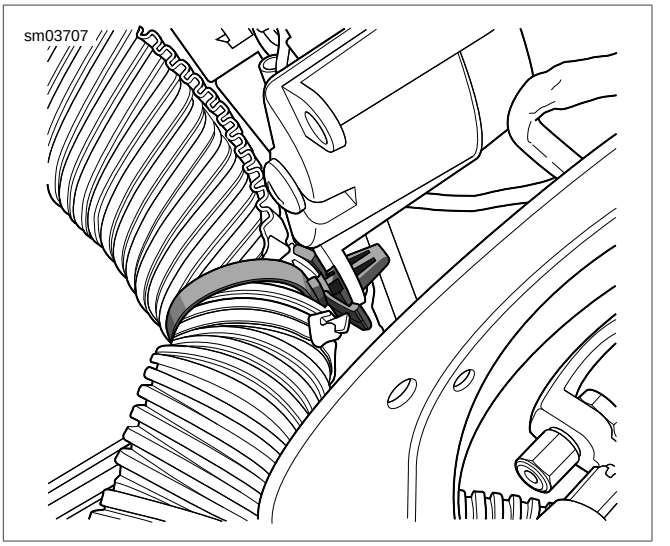



**Figure 8-86. Anchor Interconnect Harness in Ear of Speedometer Bracket**

3. Rotate speedometer gauge until tabs at top and bottom of bracket engage slots in inner fairing (FLHX, FLHT/C/U) or bezel (FLTR).
4. Verify that gauge is properly aligned and tighten two screws to 10-20 **in-lbs** (1.1-2.3 Nm).
5. Install speedometer connector [39], 12-place Packard, at back of speedometer.
6. Proceed as follows:
   a. **FLHX, FLHT/C/U:** Verify that anchor on interconnect harness is installed in lower ear of speedometer bracket. Install outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
   b. **FLTR:** Install bezel. See 2.40 INSTRUMENT BEZEL: FLTR.

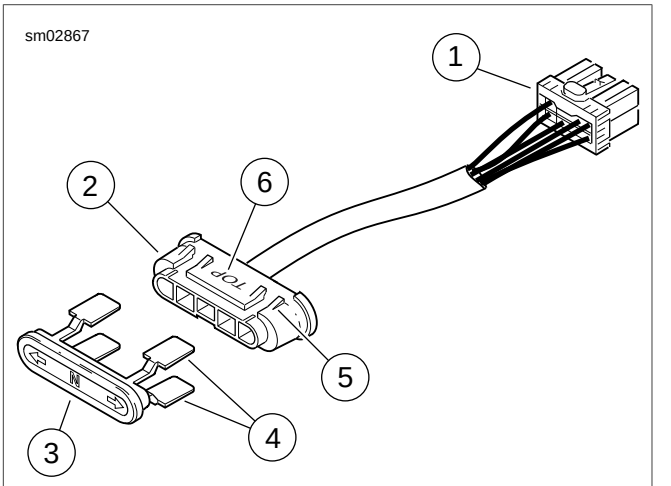
## INDICATOR LIGHTS

### Removal

*NOTE*

*All 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.*

1. Proceed as follows:
   a. **FLHX, FLHT/C/U:** Remove outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
   b. **FLTR:** Remove bezel. See 2.40 INSTRUMENT BEZEL: FLTR.
2. Disconnect indicator lights connector [21], 10-place Multilock (black).
3. On FLHX, FLHT/C/U models, remove tachometer gauge to access indicator lights assembly. See 8.28 GAUGES AND INSTRUMENTS: FLHX, FLHT/C/U, FLTR.
4. Release each paddle on lense from pair of index tabs on indicator lights assembly. See Figure 8-87. Remove lense from inner fairing (FLHX, FLHT/C/U) or bezel (FLTR), if damaged.




1. **Indicator lights connector [21]**
2. **Indicator lights assembly**
3. **Lens**
4. **Paddles**
5. **Index tabs**
6. **Orientation stamp**

**Figure 8-87. Indicator Lights Assembly**

### Installation

1. Place lense in inner fairing (FLHX, FLHT/C/U) or bezel (FLTR), if removed. Note position of oil icon on FLTR models to be sure that lense is right side up. On FLHX, FLHT/C/U models, slot at bottom of lense engages index tab in inner fairing to prevent improper orientation.
2. With the word "TOP" facing upward, engage each paddle on lense with pair of index tabs on indicator lights assembly.
3. Connect indicator lights connector [21], 10-place Multilock (black).
4. On FLHX, FLHT/C/U models, install tachometer gauge. See 8.28 GAUGES AND INSTRUMENTS: FLHX, FLHT/C/U, FLTR.
5. Proceed as follows:
   a. **FLHX, FLHT/C/U:** Install outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
   b. **FLTR:** Install bezel. See 2.40 INSTRUMENT BEZEL: FLTR.

## FUEL GAUGE

### Removal

1. Remove maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
2. At bottom left side of fuel tank, gently pull on convoluted tubing to draw fuel gauge connector [117], 4-place Multilock, out of tunnel. Disconnect pin and socket halves.
3. Remove terminals from pin housing.

*NOTE*

*For instructions on properly removing wire terminals, see A.2 AMP MULTILOCK CONNECTORS.*

4. Remove convoluted tubing from wires.
5. 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.
6. To remove fuel gauge from motorcycle, feed wires and pin terminals up into drain tube of fuel tank while carefully raising cap.
7. 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.

### 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 A.2 AMP MULTILOCK CONNECTORS.*

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.

*NOTE*

*For instructions on properly installing wire terminals, see A.2 AMP MULTILOCK CONNECTORS.*

6. Route pin housing and convoluted tubing forward and then inboard between front of crossover hose fitting and bottom of fuel tank. Connect fuel gauge connector [117], 4-place Multilock. Feed connector into tunnel of fuel tank. See lower frame of Figure 8-88.
7. Install maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.

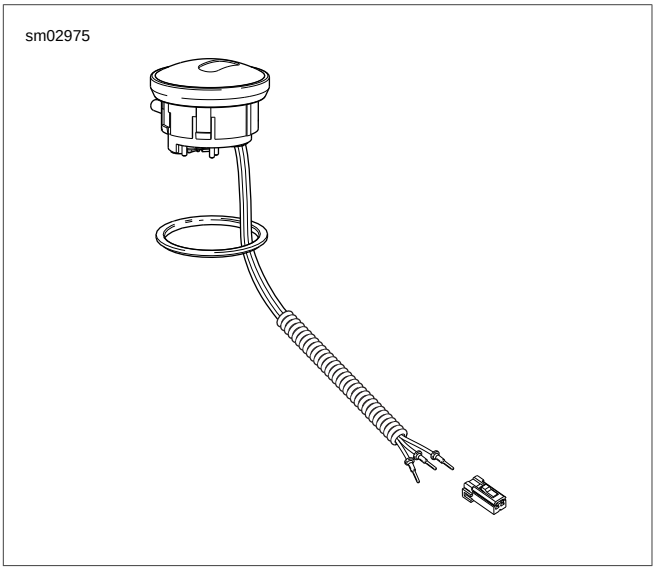



**Figure 8-88. Fuel Gauge (FLHR/C)**

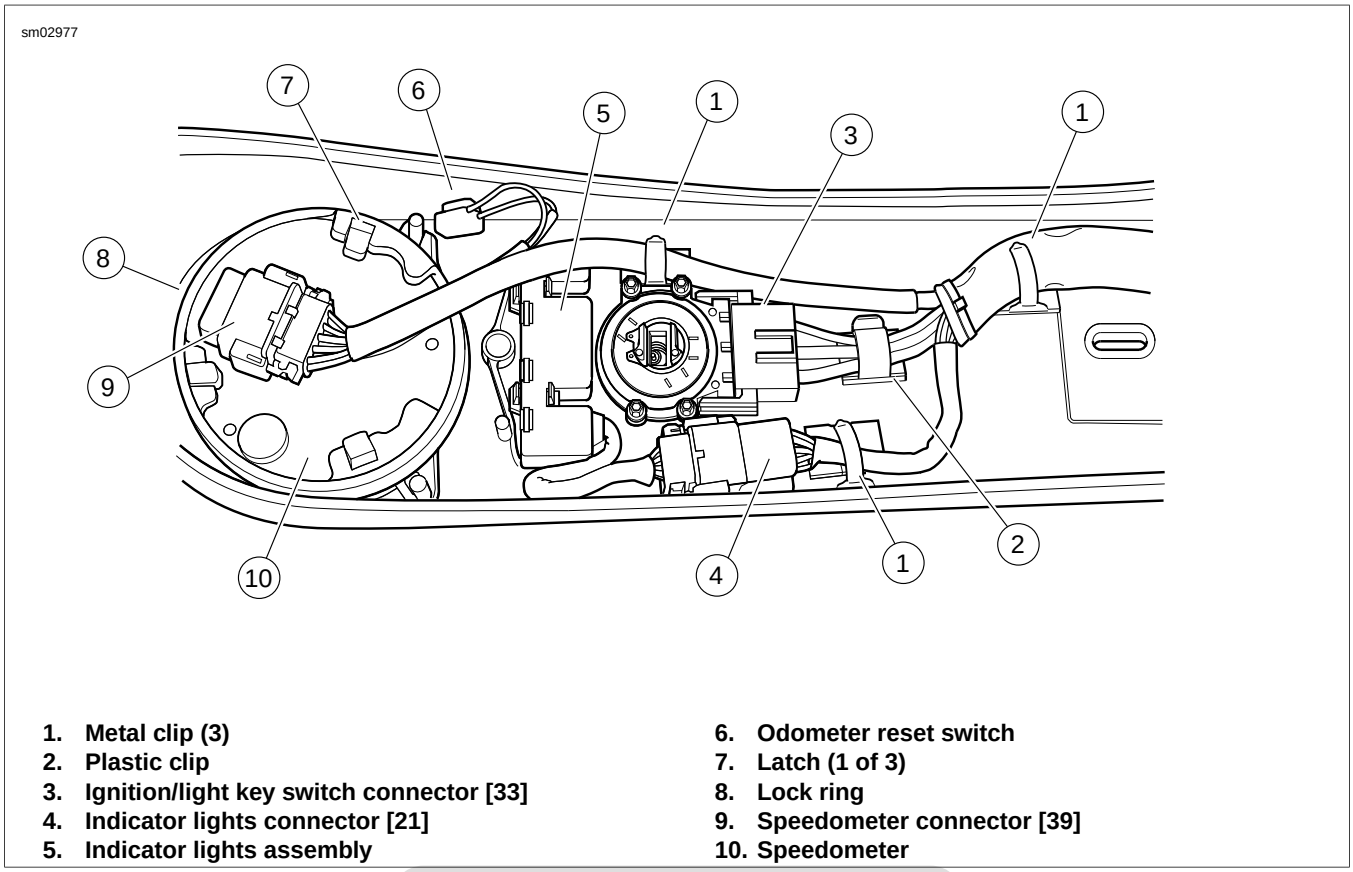
**Table 8-15. FLHR/C Fuel Gauge [17]**

| WIRE COLOR | CHAMBER NUMBER |
|---|---|
| Orange | 1 |
| Yellow/White | 2 |
| - | 3 |
| Black | 4 |

## SPEEDOMETER

### Removal

1. Remove maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
2. Remove seat. See 2.26 SEAT.
3. Remove socket screw to release front of console from fuel tank weldment.
4. Remove hex screw to release rear console bracket from clip nut on rear fuel tank bracket.
5. Lay a clean shop towel on forward part of rear fender. Remove console and lay upside down on shop towel.
6. Remove speedometer connector [39], 12-place Packard. If necessary, bend back flexible metal clips to free connector conduit. See Figure 8-89.
7. Gently pry three latches upward to release lock ring from back of speedometer.
8. Remove speedometer from top side of console.
9. Remove rubber gasket from console speedometer bore.




1. **Metal clip (3)**
2. **Plastic clip**
3. **Ignition/light key switch connector [33]**
4. **Indicator lights connector [21]**
5. **Indicator lights assembly**
6. **Odometer reset switch**
7. **Latch (1 of 3)**
8. **Lock ring**
9. **Speedometer connector [39]**
10. **Speedometer**

**Figure 8-89. Instument Console Assembly (FLHR/C)**



## Installation

1. Lubricate groove in rubber gasket with isopropyl alcohol or glass cleaner. Place the gasket into position around the console speedometer bore.
2. From top side of console, feed speedometer into rubber gasket. Lubricate gasket with isopropyl alcohol or glass cleaner, if necessary. The speedometer should fit snugly against the gasket without movement.
3. Turn console over. Place lock ring over back of speedometer aligning two slots with console bosses. Press latches down until they lock into position.
4. Install speedometer connector [39], 12-place Packard.
5. If released, bend flexible metal clips to capture connector conduit . See Figure 8-89.
6. Exercising caution to avoid pinching wire harness and vent tube, position console on fuel tank.
7. Start socket screw to fasten front of console to fuel tank weldment.
8. Start hex screw to fasten rear console bracket to clip nut on rear fuel tank bracket.
9. Alternately tighten socket/hex screws to 36-60 **in-lbs** (4.1-6.8 Nm).
10. Install seat. See 2.26 SEAT.
11. Install maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.

## INDICATOR LIGHTS

### Removal

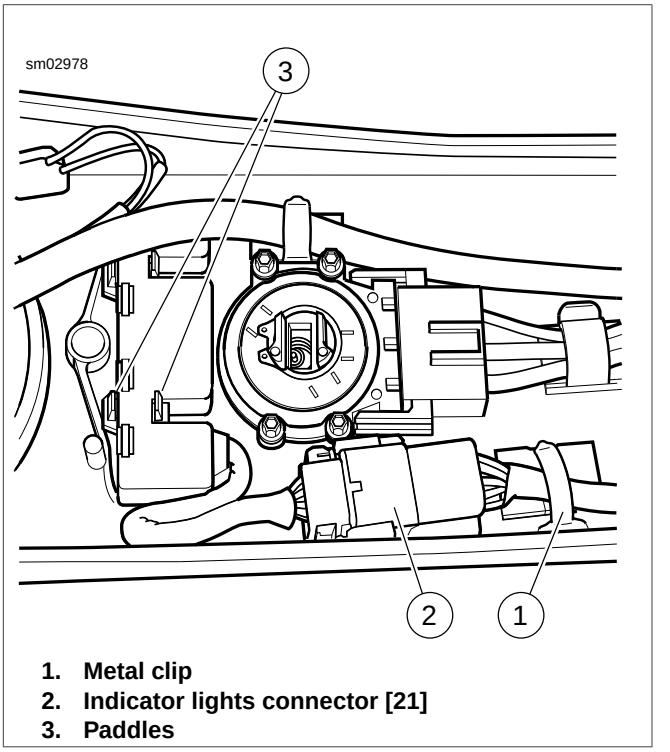
*NOTE*

*All models are equipped with Light Emitting Diodes (LEDs) in lieu of indicator lamps. The indicator light assembly is not serviceable. If one LED is bad, the indicator light assembly must be replaced.*

1. Remove maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
2. Remove seat. See 2.26 SEAT.
3. Remove socket screw to release front of console from fuel tank weldment.
4. Remove hex screw to release rear console bracket from clip nut on rear fuel tank bracket.
5. Lay a clean shop towel on forward part of rear fender. Remove console and lay upside down on shop towel.
6. Disconnect indicator lights connector [21], 8-place Deutsch (black). If necessary, bend flexible metal clip to free connector conduit. See Figure 8-90.
7. 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.
   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.




1. **Metal clip**
2. **Indicator lights connector [21]**
3. **Paddles**

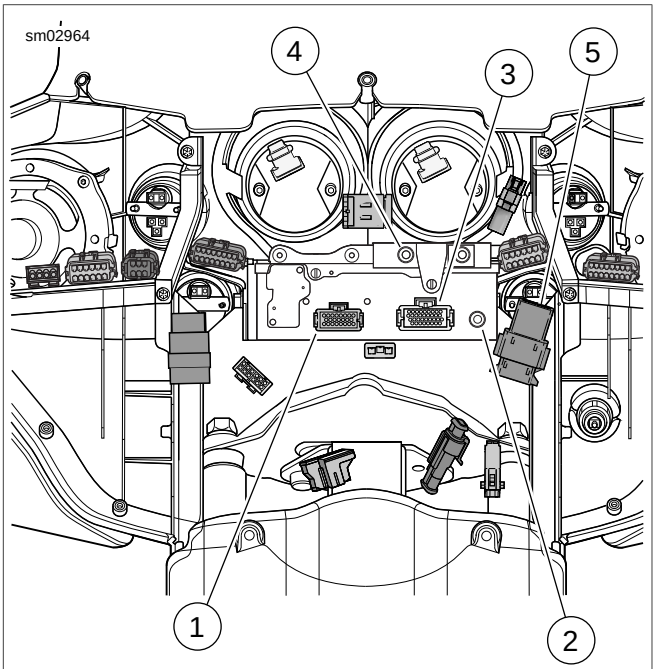
**Figure 8-90. Release Paddles to Free Indicator Lights Assembly (FLHR/C)**

2. Connect indicator lights connector [21], 8-place Deutsch (black). If released, bend flexible metal clip to capture connector conduit.
3. Exercising caution to avoid pinching wire harness and vent tube, position console on fuel tank.
4. Start socket screw to fasten front of console to fuel tank weldment.
5. Start hex screw to fasten rear console bracket to clip nut on rear fuel tank bracket.
6. Alternately tighten socket/hex screws to 36-60 **in-lbs** (4.1-6.8 Nm).
7. Install seat. See 2.26 SEAT.
8. Install maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.

## RADIO (STORAGE BOX)

### Removal

1. Remove maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
2. Remove outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U or 2.39 UPPER FAIRING AND WINDSHIELD: FLTR.
3. **FLHX, FLHTC, FLTR:**
   a. Disconnect radio connector [27], 23-place Amp.
   b. Disconnect radio antenna cable connector [51].
4. **FLHTCU:**
   a. Disconnect radio connector [27], 23-place Amp.
   b. Disconnect radio antenna cable connector [51].
   c. Disconnect radio connector [28], 35-place Amp.
   d. Disconnect CB antenna cable connector [50].
   e. Disconnect CB module connector [184], 12-place Deutsch (black).
   f. Remove screw to release flange of CB module from radio. Remove CB module.
5. Using a long shank ball end socket (Snap-on® FABL6E), remove four screws to release radio (storage box on FLHT) from left and right radio support brackets. Use oblong holes in fairing brackets to access screws. See Figure 8-92.
6. Pull radio (storage box on FLHT) forward to remove from opening in inner fairing.




1. **Radio [27]**
2. **Radio antenna cable [51]**
3. **Radio [28]**
4. **CB antenna cable [50]**
5. **CB module [184]**

**Figure 8-91. Radio/CB Connections (FLHTC/U)**

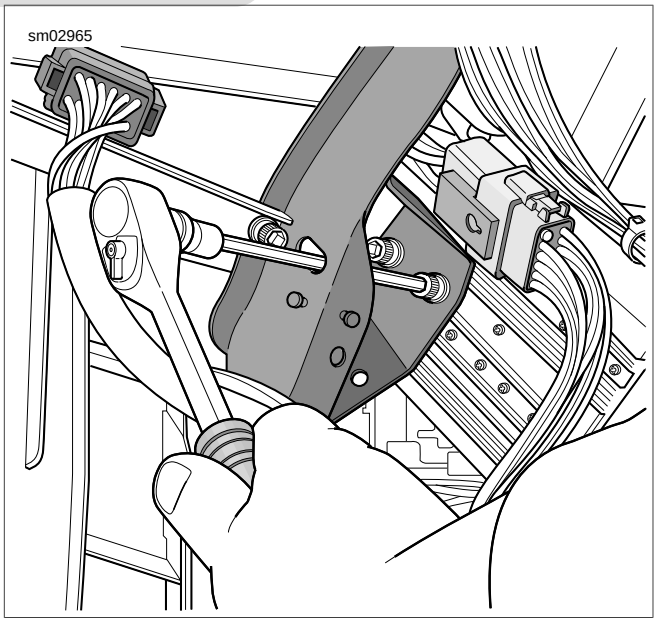



**Figure 8-92. Release Radio from Fairing Brackets (FLHTC/U)**

### Installation

1. Position radio (storage box on FLHT) between radio support brackets and push into opening in inner fairing.

2. Align threaded inserts in sides of radio (storage box on FLHT) with holes in left and right radio support brackets. Starting at the rear, install four screws. Alternately tighten screws to 35-45 **in-lbs** (4.0-5.1 Nm). Use oblong holes in fairing brackets to access screws.
3. **FLHX, FLHTC, FLTR:**
   a. Connect radio connector [27], 23-place Amp.
   b. Connect radio antenna cable connector [51].
4. **FLHTCU:**
   a. Fit metal cones on CB module into rubber grommets at top of radio. Use the position above radio connector [28], 35-place Amp, as the other location has been reserved for certain P&A accessories.
   b. Install screw to fasten flange of CB module to radio. Tighten screw to 35-45 **in-lbs** (4.0-5.1 Nm).
   c. Connect radio connector [28], 35-place Amp.
   d. Connect CB antenna cable connector [50].
   e. Connect CB module connector [184], 12-place Deutsch (black).
   f. Connect radio connector [27], 23-place Amp.
   g. Connect radio antenna cable connector [51].
5. Install outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U or 2.39 UPPER FAIRING AND WINDSHIELD: FLTR.
6. Install maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.

## FRONT FAIRING SPEAKERS

### Removal

1. Remove outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U or 2.39 UPPER FAIRING AND WINDSHIELD: FLTR.
2. Carefully pull socket terminals from speaker spade contacts.
3. Remove three screws to release speaker adapter assembly from 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. Start two long screws to secure top of speaker adapter assembly to inner fairing. Capturing fairing support brace, install short screw in lower outboard hole (positioning flat washer between adapter and support brace). The screw hole on the lower inboard side is not used.
5. Tighten lower speaker screw to 22-28 **in-lbs** (2.5-3.2 Nm). Tighten two upper speaker screws to 35-50 **in-lbs** (4.0-5.7 Nm).
6. Install socket terminals onto speaker spade contacts. Different size spade contacts prevent improper assembly.
7. Install outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U or 2.39 UPPER FAIRING AND WINDSHIELD: FLTR.

## FRONT HEADSET RECEPTACLE

*NOTE*

*The following instructions may also be used for replacement of the fuel tank console on which the front headset receptacle is mounted.*

### Removal

1. Remove seat. See 2.26 SEAT.
2. Remove left side saddlebag. See 2.27 SADDLEBAGS.
3. Remove left side cover.
4. Carefully cut two cable straps securing headset receptacle conduit and audio harness to inboard side of left upper frame tube (front and rear of saddlebag rail).
5. Release console connector [53], 12-place Deutsch, from attachment clip anchored in hole of frame crossmember (at rear of battery). Disconnect pin and socket halves.
6. Remove socket screw to release front of console from fuel tank weldment.
7. Remove hex screw to release rear console bracket from clip nut on rear fuel tank bracket.
8. Lay a clean shop towel on forward part of rear fender.
9. Press button to open fuel door on console. Remove filler cap. Remove console bending back flexible metal clips as necessary to release wire harness and front headset receptacle conduit.
10. Lay console upside down on shop towel. Install filler cap.
11. Raise headset receptacle cap. Place pin punch in either notch of lock ring and rotate in a counterclockwise direction until loose. See Figure 8-93.
12. Remove lock ring and cap from headset receptacle.
13. Remove headset receptacle from console.

### Installation

1. Insert threaded end of headset receptacle through hole in console.
2. Slide receptacle cap over threaded end of headset receptacle.
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. See Figure 8-93.
5. Remove filler cap, if installed. Position console on fuel tank bending flexible metal clips as necessary to capture wire harness and front headset receptacle conduit. Install filler cap.

6. Start socket screw to fasten front of console to fuel tank weldment.
7. Start hex screw to fasten rear console bracket to clip nut on rear fuel tank bracket.
8. Alternately tighten socket/hex screws to 36-60 **in-lbs** (4.1-6.8 Nm).
9. Connect console connector [53], 12-place Deutsch. Install connector onto attachment clip anchored in hole of frame crossmember (at rear of battery).
10. Install two **new** cable straps to secure headset receptacle conduit and audio harness to inboard side of left upper frame tube (front and rear of saddlebag rail).
11. Install left side cover.
12. Install left side saddlebag. See 2.27 SADDLEBAGS.
13. Install seat. See 2.26 SEAT.
14. Test operation of headset receptacle.

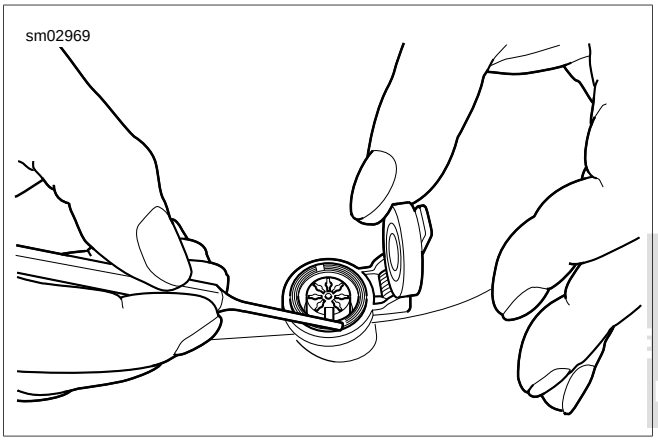



**Figure 8-93. Remove Lock Ring from Receptacle**

## REAR HEADSET RECEPTACLE

Replace audio harness. See 8.37 AUDIO HARNESS: FLHTCU.

## REAR PASSENGER SWITCHES

### Removal

*NOTE*

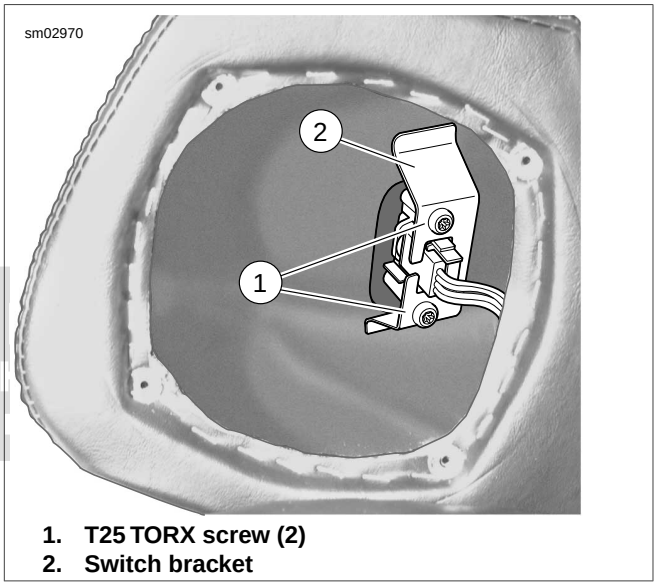
*Right and left side replacement passenger switch assemblies are interchangeable.*

1. Remove maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
2. Open Tour-Pak.
3. Remove four screws and pull speaker grille from speaker box.
4. Remove speaker from speaker box and carefully pull socket terminals from speaker spade contacts.
5. Remove trim ring and gently pull on wire harness to draw rear speaker/passenger controls connector, 6-place Deutsch, out of speaker box.
6. Disconnect pin and socket halves of connector.
7. Draw socket housing back into speaker box and pull out through speaker hole.
8. Remove two screws to release switch bracket from inside of speaker box. Remove bracket using slot to free switch wires. See Figure 8-94.
9. Pull switch housing assembly, wire harness, speaker terminals and socket housing from speaker box using switch housing hole on outboard side.
10. Carefully pull keycap from switch shaft. Remove switch from switch housing.
11. Remove terminals 1 through 4 from socket housing.

*NOTE*

*For instructions on properly removing wire terminals, see A.6 DEUTSCH ELECTRICAL CONNECTORS.*

12. Pulling one wire at a time, draw four switch wires from conduit.




1. **T25 TORX screw (2)**
2. **Switch bracket**

**Figure 8-94. Remove Passenger Switch Assembly**

### Installation

1. Inserting one wire at a time, push four switch wires through conduit.
2. Install terminals into socket housing. Refer to Table 8-16.

**Table 8-16. Rear Passenger Switches [41/42]**

| 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*

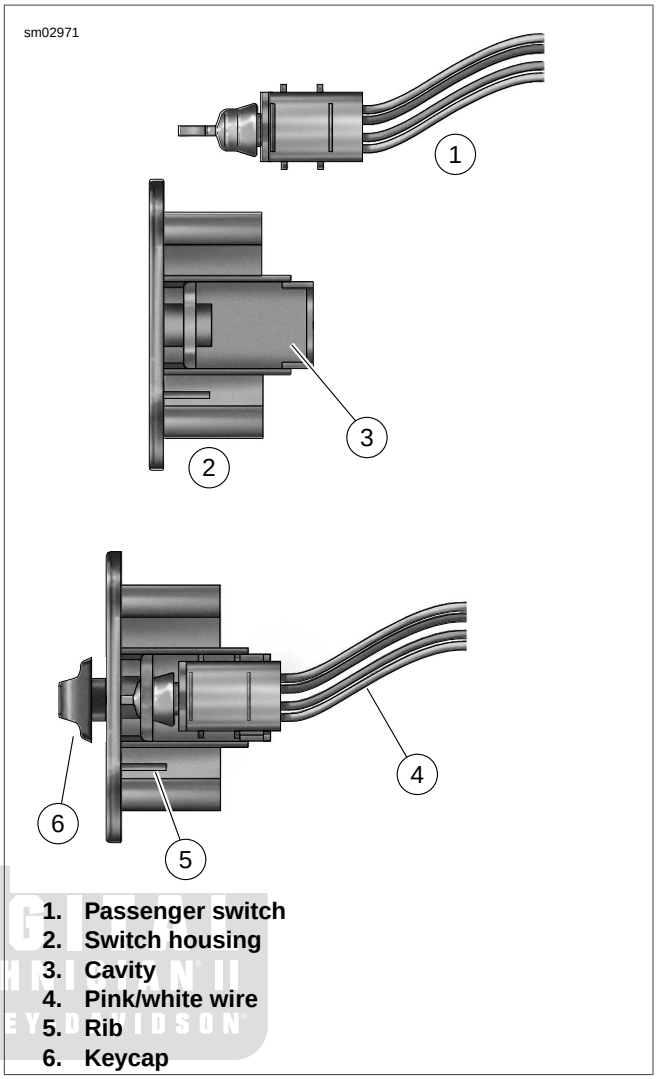
*For instructions on properly installing wire terminals, see A.6 DEUTSCH ELECTRICAL CONNECTORS.*

3. With the Pink/White wire at the bottom, place switch in cavity of switch housing. Bottom of assembly is determined by location of rib on switch housing. See Figure 8-95.
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.
5. Feed socket housing, speaker terminals and wire harness through switch housing hole on outboard side of speaker box until switch housing backplate contacts speaker box. Pull wire harness out through speaker hole.

*NOTE*

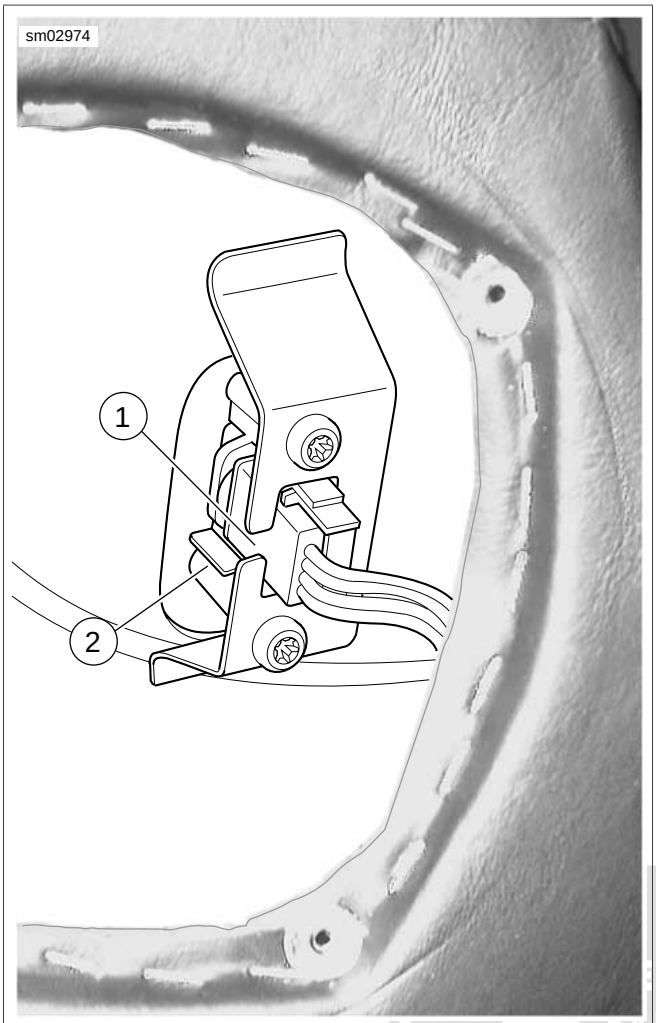
*To align bracket and switch housing holes, slot in bracket must face toward the front on right side switch assembly and toward the rear on left side switch assembly. See Figure 8-96. Switch also must be square in cavity of switch housing or bracket will not fit.*

6. Reaching into speaker box, align holes in bracket with holes in switch housing. Install two screws.
7. Feed socket housing through speaker hole into speaker box and pull out through harness hole on inboard side.
8. Mate pin and socket halves of connector. Feed connector back up into speaker box pressing trim ring into hole.
9. Install socket terminals onto speaker spade contacts. Different size spade contacts prevent improper assembly.
10. Align holes in speaker grille with those in speaker and slide four screws through grille and speaker holes.
11. With spade contacts at bottom rear corner, position speaker/grille assembly against speaker box. Start screws into speaker box and alternately tighten in a crosswise pattern.
12. Close Tour-Pak.
13. Install maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
14. Test switch for proper operation.




1. **Passenger switch**
2. **Switch housing**
3. **Cavity**
4. **Pink/white wire**
5. **Rib**
6. **Keycap**

**Figure 8-95. Install Switch in Housing**




1. **Slot faces front (right side), rear (left side)**
2. **Rib at bottom**

**Figure 8-96. Install Passenger Switch Assembly**

## REAR SPEAKERS

### Removal

1. Remove maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
2. Open Tour-Pak.
3. Remove four screws from speaker grille. Remove speaker grille from speaker box.
4. 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 and alternately tighten in a crosswise pattern.
5. Close Tour-Pak.
6. Install maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
7. Test speaker for proper operation.

## CB MODULE

### Removal

1. Remove maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
2. Remove outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
3. See Figure 8-91. Disconnect the following:
   a. CB antenna cable connector [50].
   b. CB module connector [184], 12-place Deutsch (black).
4. Remove screw to release flange of CB module from radio. Remove CB module.

### Installation

1. Fit metal cones on CB module into rubber grommets at top of radio. Use the position above radio connector [28], 35-place Amp, as the other location has been reserved for certain P&A accessories.
2. Install screw to fasten flange of CB module to radio. Tighten screw to 35-45 **in-lbs** (4.0-5.1 Nm).
3. See Figure 8-91. Connect the following:
   a. CB antenna cable connector [50].
   b. CB module connector [184], 12-place Deutsch (black).
4. Install outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
5. Install maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.

## CB LOADING COIL

### Removal

1. Remove maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
2. Open Tour-Pak. Open map pocket and remove acorn nuts. Remove map pocket and molded liner from Tour-Pak.
3. Disconnect CB antenna cable connector [50] on right side of Tour-Pak. Release cable from rear adhesive clip at bottom of Tour-Pak.
4. Remove Keps nut, ring terminal and flat washer from loading coil stud.
5. Holding hex head screw, remove flange nut at bottom of Tour-Pak to release loading coil bracket. Remove hex head screw (with external tooth lockwasher) and loading coil from motorcycle.

### Installation

1. Place new loading coil into position aligning hole in bracket with hole in rear right corner of Tour-Pak. Slide hex head screw (with external tooth lockwasher) through holes. At bottom of Tour-Pak, install flange nut on hex head screw.
2. Connect CB antenna cable connector [50]. Capture antenna cable in rear adhesive clip at bottom of Tour-Pak.

3. Install flat washer, ring terminal and Keps nut onto loading coil stud. Tighten Keps nut.
4. Install molded liner in Tour-Pak. Install map pocket and secure using acorn nuts. Close Tour-Pak.
5. Install maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
6. Check SWR and adjust if necessary. Follow the SWR Adjustment procedure in the ELECTRICAL DIAGNOSTIC MANUAL. Remove SWR meter, install antenna connector and tighten antenna connector stud.

## REMOVAL

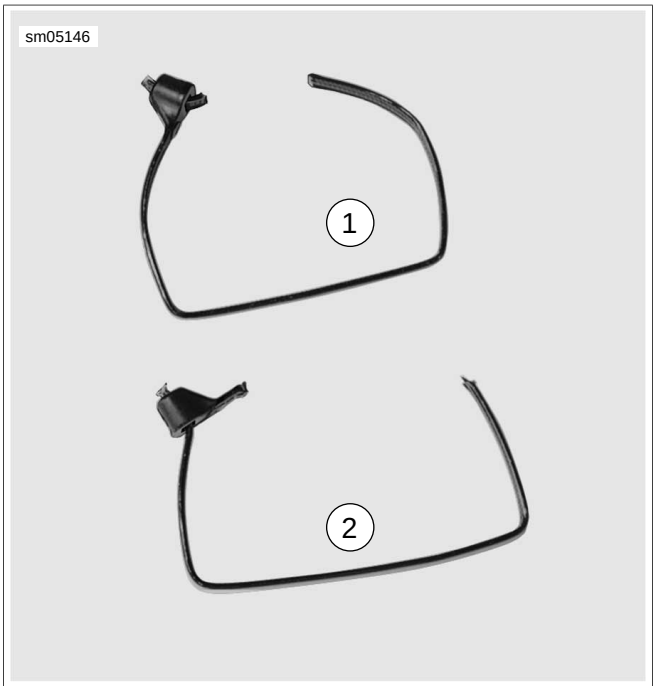
1. Remove maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
2. Remove fuel tank. See 4.4 FUEL TANK.
3. Proceed as follows:
   a. Remove purge solenoid connector [95]. If purge solenoid is not provided, release anchored cable strap on socket housing from hole in wire trough (below breakout compartment).
   b. Remove T-MAP sensor connector [80].
   c. Remove rear fuel injector connector [85].
   d. Remove TCA connector [211]. Cut anchored cable strap to release connector conduit from front right side of induction module.
   e. Remove front fuel injector connector [84].
   f. Moving to left side of motorcycle, remove acorn nut and flat washer to free horn cover from rubber mount stud. Remove elbow terminals from horn spade contacts and release harness conduit from J-clamp.
   g. Pull back boot and disconnect ET sensor connector [90] at back of front cylinder.
   h. Remove ignition coil connector [83].
4. Draw conduit and connectors removed in previous step, to right side of motorcycle.
5. On ABS equipped motorcycles, proceed as follows:
   a. Cut cable strap to release brake lines from narrow ledge at side of wire trough.
   b. Remove three double-sided clips to separate brake line from master cylinder from brake line to front calipers.
   c. Release brake lines from channel at front of wire trough.
6. Starting at front of wire trough, and working rearward, use a small flat blade screwdriver to release catches on cover. For best results, free one side of the cover and then the other. See Figure 8-97.
7. Using a paint pen, draw a line on the wire bundle and/or conduit on both sides of each cable strap. See Figure 8-98.

*NOTE*

*Note that there are a total of ten cable straps. Eight cable straps fix the position of the harness(es) inside the wire trough, while two more fix the position of the breakouts on the right side. As the latter two cable straps capture multiple branches of the harness, be sure to mark each length of conduit with the paint pen.*


**Figure 8-97. Release Catches From Cover**


**Figure 8-98. Mark Location of Cable Straps**




1. **Reusable (tail removed)**
2. **Not reusable (eyelet removed)**

**Figure 8-99. Cut Cable Straps**

8. Starting at the front, and cutting as close to the eyelet as possible, cut the first of eight cable straps inside the wire trough. Be sure to cut off the tail of the cable strap and not the eyelet. The cable strap can be reused for use in step 9 if only the tail is removed, but it must be replaced with a new cable strap if the eyelet is cut off. See Figure 8-99.
9. Remove cable strap from slots in wire trough and remove the tail remnant from the eyelet. Install the cable strap back on the harness just outside the painted lines. Be sure to capture each wire of the harness.
10. Repeat steps 8-9 for the seven remaining cable straps inside the wire trough.
11. Carefully cut two cable straps to release breakouts from right side of wire trough. Pull conduit out through slot in breakout compartment. For best results, work one length of conduit out at a time. If ABS equipped, move conduit outboard of brake lines.
12. Remove flange nut (10 mm) from front ground stud on left side of frame backbone. Remove two main harness ground ring terminals (with orange tape). Repeat step to remove main harness ground ring terminal (without orange tape) and chassis ground ring terminal from rear ground stud.
13. Gently pry anchor pins at rear of wire trough from holes in frame backbone. For best results, insert large flat blade screwdriver between bottom of wire trough and top of frame backbone when prying. See Figure 8-100.
14. Raise wire harness(es), and while pulling fuel gauge (FLHR/C) and ignition coil connectors and conduit up through bottom hole, carefully remove wire trough from right side of motorcycle.

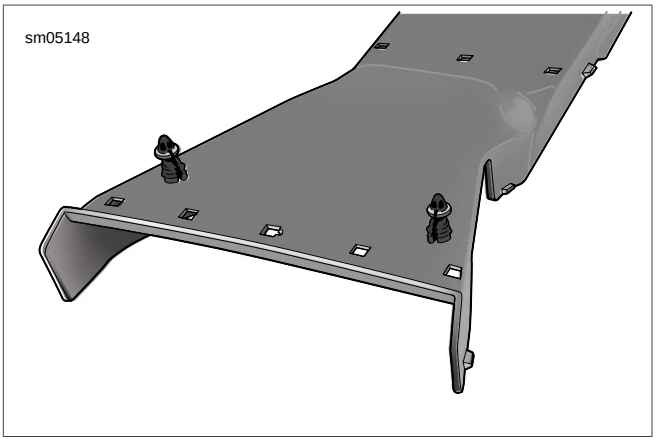



**Figure 8-100. Wire Trough Anchor Pins**

## INSTALLATION

1. Thread eight cable straps through slots inside **new** wire trough as shown in Figure 8-101.
2. Raise wire harness(es), and from right side of motorcycle, carefully slide wire trough into position on frame backbone.
3. See Figure 8-102. Install breakouts as follows:
   a. Locate the rear fuel injector connector conduit.
   b. Feed conduit into slot and move to rear of breakout compartment.
   c. Repeat step 3(b) with purge solenoid, T-MAP sensor, horn/ET sensor, TCA and front fuel injector connector conduit.
   d. Thread cable strap through rear slots at bottom of breakout compartment. Capturing rear fuel injector, purge solenoid and T-MAP sensor connector conduit, start tail end of cable strap into eyelet, but do not tighten.
   e. Thread cable strap through front slots at bottom of breakout compartment. Capturing the horn/ET sensor, TCA and front fuel injector connector conduit, start tail end of cable strap into eyelet, but do not tighten.
   f. Pull conduit exiting breakout compartment inboard of brake lines, if ABS equipped.
4. Adjust harness inside wire trough, so that it is positioned within the eight cable straps installed in step 1. Start tail end of each cable strap into eyelet, but do not tighten.
5. Carefully cut and remove the eight cable straps not threaded through the wire trough, that is, those installed just outside the painted lines in step 9 under 8.33 WIRE TROUGH, Removal.
6. On left side of wire trough, route main harness and audio harness conduit (if provided) through front channel, while also feeding fuel gauge (FLHR/C) and ignition coil connectors and conduit down through bottom hole.
7. Route main harness conduit through front channel on right side of wire trough.
8. Push anchor pins at rear of wire trough into holes in frame backbone. See Figure 8-100.

9. Install two main harness ground ring terminals (with orange tape) onto front ground stud on left side of frame backbone. Install flange nut (10 mm) and tighten to 50-90 **in-lbs** (5.7-10.2 Nm).
10. Install main harness ground ring terminal (without orange tape) onto rear ground stud. Route chassis ground cable forward along left side of wire trough and install ring terminal on rear ground stud. Install flange nut (10 mm) and tighten to 50-90 **in-lbs** (5.7-10.2 Nm).
11. Make final adjustments to harness(es), so that the painted lines are aligned with the cable straps loosely installed. Tighten cable straps and cut any excess cable strap material.
12. Alternately pull on each length of conduit exiting the breakout compartment until painted lines are aligned with cable straps loosely installed. See Figure 8-102. Tighten cable straps and cut any excess cable strap material.
13. Place cover over wire trough. Starting at the rear and working forward from side to side, engage catches to latch cover. Verify that all latches are fully engaged.
14. On ABS equipped motorcycles, secure brake line as follows:
    a. Press brake lines into channel at front of wire trough.
    b. Position brake lines on narrow ledge at side of wire trough. At rear of ledge, install **new** cable strap to secure brake lines to wire trough.
    c. Install three double-sided clips to secure brake line from master cylinder to brake line to front calipers. Place the clips as follows: in front of ignition coil bracket, above wire trough breakouts, and in front of threaded boss for the rear fuel tank bracket bolt
15. Proceed as follows:
    a. Install purge solenoid connector [95]. If purge solenoid is not provided, install anchored cable strap on socket housing into hole in wire trough (below breakout compartment).
    b. Install T-MAP sensor connector [80].
    c. Install rear fuel injector connector [85].
    d. Install TCA connector [211]. Install **new** anchored cable strap in hole at front right side of induction module. Tighten cable strap capturing connector conduit. Cut any excess cable strap material.
    e. Install front fuel injector connector [84].
    f. Moving to left side of motorcycle, install ET sensor connector [90] at back of front cylinder. Pull boot over sensor to keep out dirt and debris.
    g. Install elbow terminals onto horn spade contacts. Capture harness conduit in J-clamp and install horn cover onto rubber mount stud. Install flat washer and acorn nut. Tighten acorn nut to 80-120 **in-lbs** (9.0-13.6 Nm).
    h. Install ignition coil connector [83].
16. Install fuel tank. See 4.4 FUEL TANK.
17. Install maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.

**Table 8-17. Wire Trough Cable Straps**

| CABLE STRAP | LOCATION | MODELS |
|---|---|---|
| Captures Wire Bundles Inside Wire Trough | | |
| 1-8 | Main Harness | All |
| | Audio Harness | FLHTCU |
| Captures Conduit at Bottom of Breakout Compartment | | |
| 9 | Rear Fuel Injector, Purge Solenoid and T-MAP Sensor | All |
| 10 | Horn/ET Sensor, TCA and Front Fuel Injector | All |

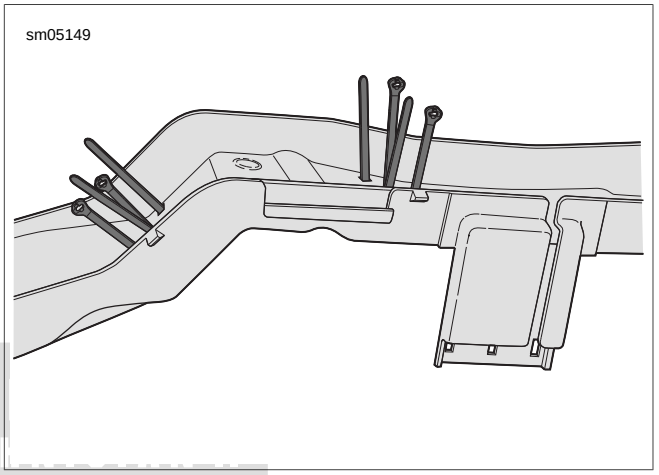



**Figure 8-101. Install New Cable Straps in Wire Trough**


1. **Rear fuel injector**
2. **Purge solenoid**
3. **T-MAP sensor**
4. **Horn/ET sensor**
5. **TCA**
6. **Front fuel injector**

**Figure 8-102. Feed Conduit Into Breakout Compartment**

## REMOVAL: ALL MODELS (PART 1)

1. Remove battery. See 1.16 BATTERY MAINTENANCE.
2. Remove fuel tank. See 4.4 FUEL TANK.
3. Remove saddlebags. See 2.27 SADDLEBAGS.
4. Remove side covers.

*NOTE*

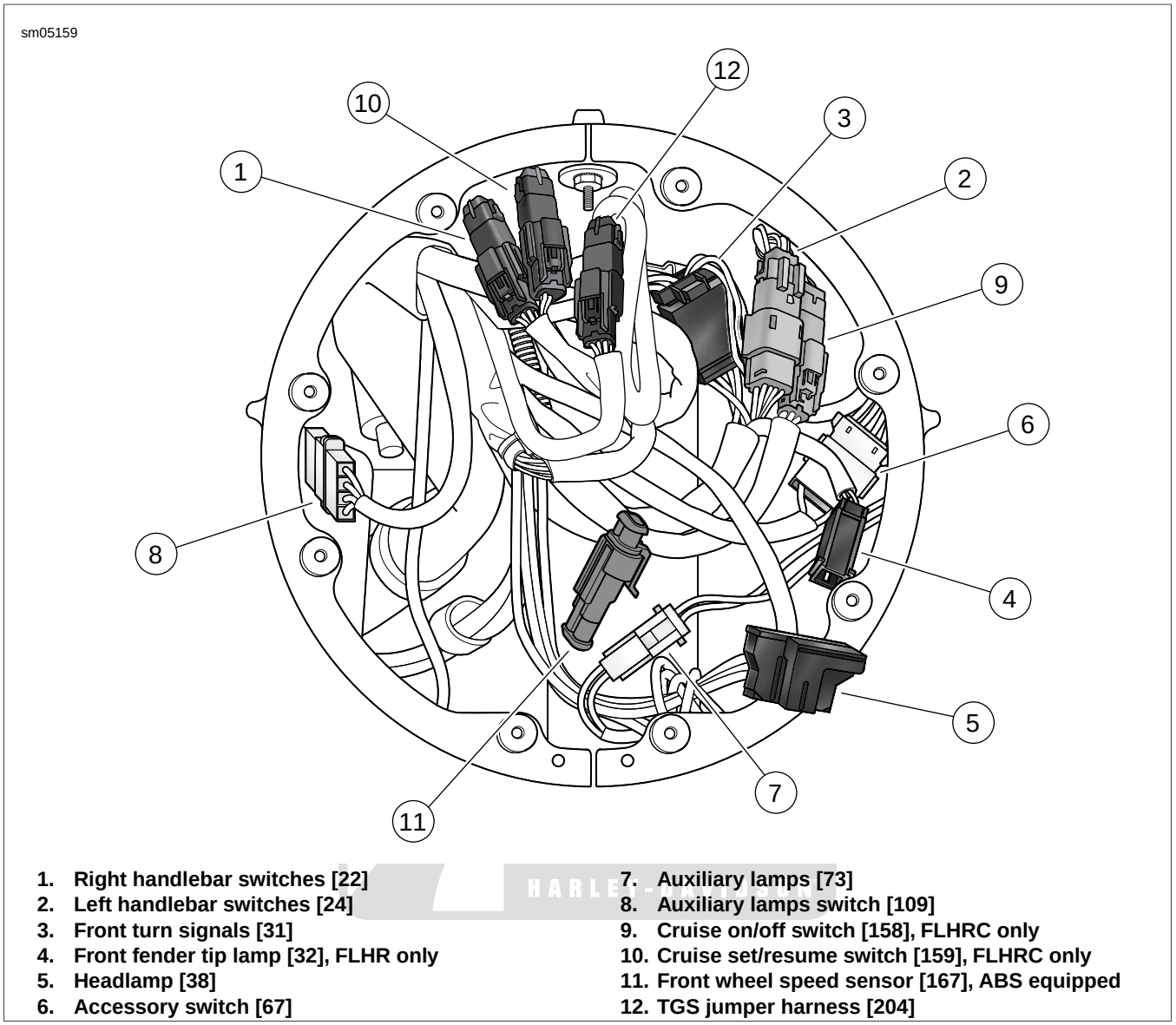
*Depending upon model, continue procedure at 8.34 MAIN WIRING HARNESS, Removal: FLHR/C (Part 2), 8.34 MAIN WIRING HARNESS, Removal: FLHX, FLHT/C/U (Part 2) or 8.34 MAIN WIRING HARNESS, Removal: FLTR (Part 2).*

## REMOVAL: FLHR/C (PART 2)

1. Remove headlamp assembly. See 8.9 HEADLAMP: ALL EXCEPT FLTR.
2. See Figure 8-103. Reaching inside headlamp nacelle, disconnect connectors and remove from their retaining devices, if present:
   a. Auxiliary lamps [73], 2-place Multilock (white).
   b. Auxiliary lamps switch [109], 4-place Amp.
   c. Right handlebar switches [22], 6-place Molex (black); T-stud on fork stem nut lockplate (right side)
   d. Cruise set/resume switch [159], 3-place Molex (black); used on FLHRC only.
   e. Twist grip sensor jumper harness [204], 6-place Molex (black).
3. Remove screw and P-clamp to release main harness conduit from right side of steering head.
4. Carefully pull main harness rearward under right side of headlamp nacelle allowing conduit and connectors to hang over top of engine guard.
5. Reaching inside headlamp nacelle, disconnect connectors and remove from their retaining devices, if present:
   a. Front fender tip lamp jumper harness [32], 2-place Multilock (black); used on FLHR only.
   b. Accessory switch [67], 4-place Amp.
   c. Front turn signal lamps [31], 6-place Multilock; anchored in hole of fork stem nut lock plate (left side).
   d. Left handlebar switches [24], 8-place Molex (gray); T-stud on fork stem nut lockplate (left side).
   e. Cruise on/off switch [158], 3-place Molex (gray); used on FLHRC only.
   f. Front wheel speed sensor [167], 2-place Amp (Tyco); used on ABS equipped motorcycles only.
6. Remove screw and P-clamp to release main harness conduit from left side of steering head.
7. Carefully pull main harness rearward under left side of headlamp nacelle allowing conduit and connectors to hang over top of engine guard.

*NOTE*

*Continue procedure at 8.34 MAIN WIRING HARNESS, Removal: All Models (Part 3).*




1. **Right handlebar switches [22]**
2. **Left handlebar switches [24]**
3. **Front turn signals [31]**
4. **Front fender tip lamp [32], FLHR only**
5. **Headlamp [38]**
6. **Accessory switch [67]**
7. **Auxiliary lamps [73]**
8. **Auxiliary lamps switch [109]**
9. **Cruise on/off switch [158], FLHRC only**
10. **Cruise set/resume switch [159], FLHRC only**
11. **Front wheel speed sensor [167], ABS equipped**
12. **TGS jumper harness [204]**

**Figure 8-103. Headlamp Nacelle- Main Harness Connectors (FLHR/C)**

## REMOVAL: FLHX, FLHT/C/U (PART 2)

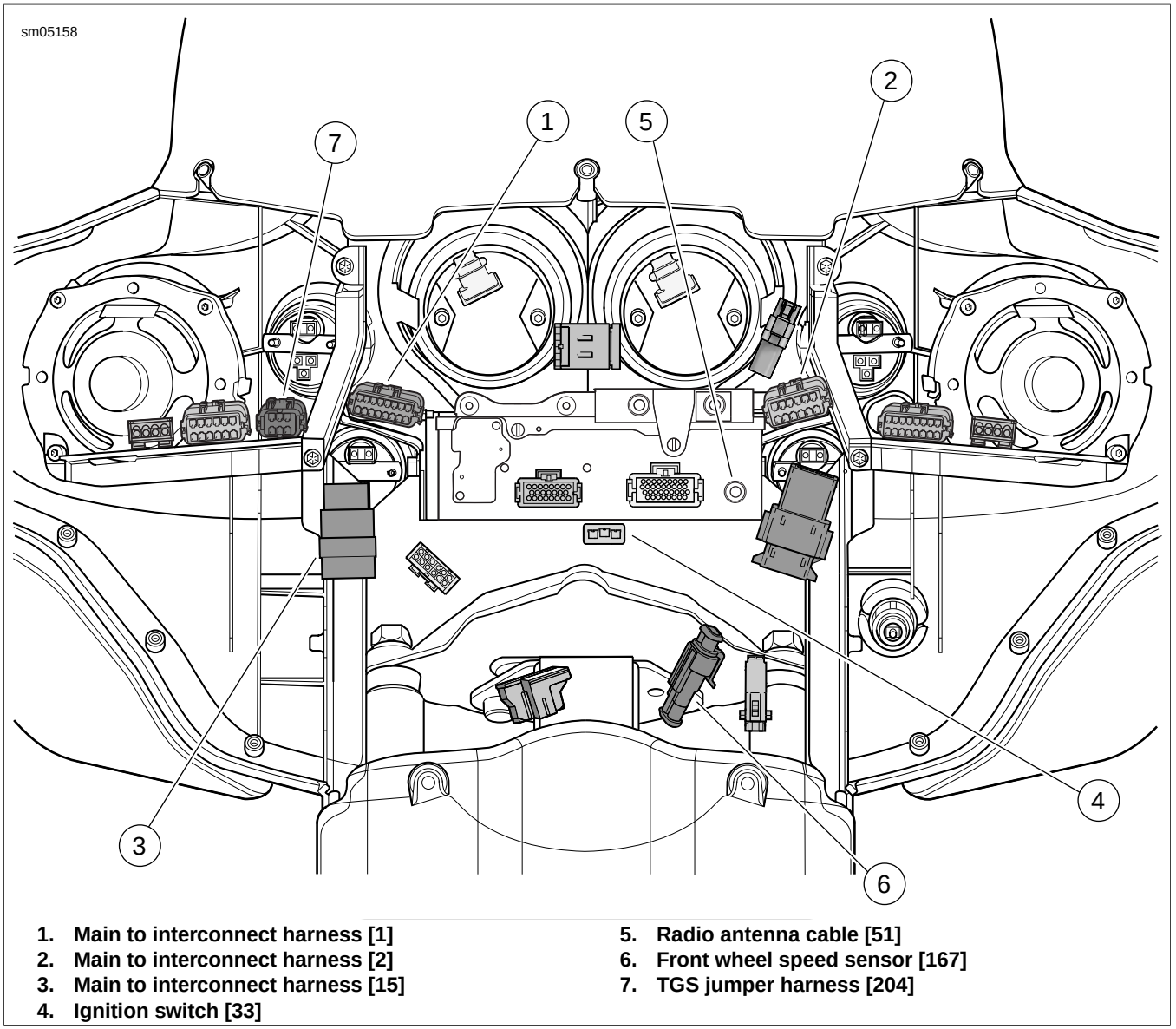
| PART NUMBER | TOOL NAME |
|---|---|
| HD-45961 | IGNITION SWITCH CONNECTOR REMOVER |

1. Remove outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
2. Cut cable strap to release conduit of main to interconnect harness connector [1] and main to interconnect harness connector [15] from right fairing bracket.
3. See Figure 8-104. Disconnect connectors and remove from their retaining devices, if present.
   a. Twist grip sensor jumper harness [204], 6-place Molex (black)); T-stud on right fairing support brace (inboard side).
   b. Main to interconnect harness [1], 16-place Molex (black); anchor in hole of right radio support bracket.
   c. Main to interconnect harness [15], 4-place Packard (black); anchored in hole at front of right fairing bracket.
   d. Radio antenna cable connector [51]; back of radio (left side).

4. Disconnect ignition switch connector [33], 3-place Packard, at front of ignition switch housing. Proceed as follows:
   a. Using a long shank ball end socket (Snap-on® FABL6E), remove four screws to release radio (storage box on FLHT) from left and right radio support brackets. Use oblong holes in fairing brackets to access screws.
   b. Remove anchor on ignition switch connector conduit from hole in bottom right corner of radio.
   c. Obtain the IGNITION SWITCH CONNECTOR REMOVER (Part No. HD-45961).
   d. Lift radio slightly and gently insert end of tool into slot in ignition switch housing until it stops.
   e. Grasping main harness conduit and tool, pull both at the same time to release socket housing from ignition switch housing.
5. Remove screw and P-clamp to release main harness from right side of steering head.
6. Carefully pull main harness conduit rearward under right side of fairing cap allowing conduit and connectors to hang over top of engine guard.
7. Cut cable strap to release conduit of main to interconnect harness connector [2] from left fairing bracket.
8. See Figure 8-104. Disconnect connectors and remove from their retaining devices, if present.
   a. Main to interconnect harness [2], 12-place Molex (gray); anchor in hole of left radio support bracket.
   b. Front wheel speed sensor [167], 2-place Amp (Tyco); below upper fork bracket (left side); used on ABS equipped motorcycles only.
9. Remove screw and P-clamp to release main harness (and audio harness on FLHTCU) from left side of steering head.
10. Carefully pull main harness conduit rearward under left side of fairing cap allowing conduit and connectors to hang over top of engine guard.
11. Disconnect audio harness on FLHTCU models. See 8.37 AUDIO HARNESS: FLHTCU, steps 6-7.

*NOTE*

*Continue procedure at 8.34 MAIN WIRING HARNESS, Removal: All Models (Part 3).*




1. **Main to interconnect harness [1]**
2. **Main to interconnect harness [2]**
3. **Main to interconnect harness [15]**
4. **Ignition switch [33]**
5. **Radio antenna cable [51]**
6. **Front wheel speed sensor [167]**
7. **TGS jumper harness [204]**

**Figure 8-104. Inner Fairing- Main Harness Connectors (FLHX, FLHT/C/U)**

## REMOVAL: FLTR (PART 2)

Remove inner fairing. See 2.42 INNER FAIRING: FLTR.

*NOTE*

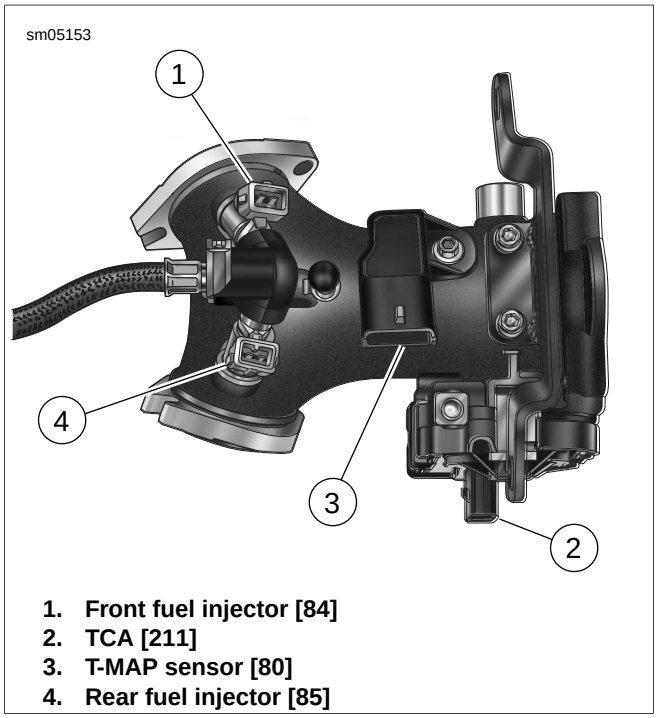
*Continue procedure at 8.34 MAIN WIRING HARNESS, Removal: All Models (Part 3).*

## REMOVAL: ALL MODELS (PART 3)

1. Remove air cleaner and backplate. See 4.3 AIR CLEANER ASSEMBLY.
2. See Figure 8-105. Remove connectors from induction module. Proceed as follows:
   a. Remove T-MAP sensor connector [80].
   b. Remove front fuel injector connector [84] and rear fuel injector connector [85].
   c. Remove TCA connector [211]. Cut anchored cable strap to release connector conduit from front right side of induction module.
3. Loosen horn bracket screw to front cylinder head. Remove horn bracket screw (with flat washer) from rear cylinder head and swing horn bracket forward. Remove elbow terminals from horn spade contacts and release conduit from J-clamp.
4. Pull back boot at back of front cylinder and remove ET sensor connector [90].

5. Remove purge solenoid connector [95], 2-place Packard. If not equipped, leave unused socket housing anchored in hole of wire trough (below breakout compartment).
6. Draw conduit and connectors to right side of motorcycle.
7. On ABS equipped motorcycles, proceed as follows:
   a. Cut cable strap to release brake lines from narrow ledge at side of wire trough.
   b. Remove three double-sided clips to separate brake line from master cylinder from brake line to front calipers.
   c. Release brake lines from channel at front of wire trough.
8. Remove ignition coil connector [83].
9. Disconnect ECM connector [78]. Remove ECM (with attached top caddy) from motorcycle.
10. Remove flange nut (10 mm) from front ground stud on left side of frame backbone. Remove two main harness ground ring terminals (with orange tape). Repeat step to remove main harness ground ring terminal (without orange tape) and chassis ground ring terminal from rear ground stud.
11. Gently pry anchor pins at rear of wire trough from holes in frame backbone. For best results, insert large flat blade screwdriver between bottom of wire trough and top of frame backbone when prying.
12. Remove front screw to release left side caddy from battery tray. Remove rear screw to release caddy from frame weldment.
13. Disconnect socket housing from siren, if equipped, and then push two retaining latches forward and pull siren from compartment at front of left side caddy.
14. **FLHR/C Only:**
   a. Pull anchor on ignition switch jumper harness connector [222], 4-place Packard, from hole in left side of battery tray. Disconnect connector.
   b. Disconnect instrument console connector [20], 16-place Molex, inboard of left upper frame tube. Remove instrument console from motorcycle.
15. Loosen screw (with lifting strap) in middle finger of battery tray.
16. While pulling up on battery tray, pull out left side caddy until tab is free of slot on battery tray.
17. Pull up on left side caddy to unseat from weldment between frame downtubes.
18. Disconnect rear fender lights connector [7], 8-place Multilock, anchored at front of rear fender. Detach pin housing from anchor.
19. Remove spring clip and pull TSM/HFSM module out of hole on right side of frame crossmember at rear of battery tray. Disconnect TSM/HFSM connector [30], 12-place Deutsch. If present, disconnect HFSM antenna jumper harness connector [208] from module and remove from motorcycle.
20. Release ignition keyswitch relay by pulling anchors on rubber boot from holes in frame crossmember. Push relay with rubber boot down into space below crossmember.
21. Pull rear fender lights, ignition keyswitch relay, and TSM/HFSM conduit and connectors out through opening at rear of left side caddy and allow to hang at side of motorcycle.
22. **FLHX Only:**
   a. On left side of motorcycle, remove screw (with flat washer) to remove passenger seat strap and saddlebag front mounting bracket. Remove screw and chrome frame tube cover.
   b. Cut cable strap to release radio antenna cable from shoulder of upper frame tube (just in front of air valve mounting bracket). Cut cable strap to release radio antenna cable from slotted hole in rear fender support.
   c. At bottom of radio antenna bracket, rotate knurled ring to disconnect radio antenna cable connector [29].
   d. Disconnect rear facia lamp connector [12], 3-place Multilock, inboard of upper frame tube.
   e. Draw radio antenna cable and rear facia lamp conduit forward and then out through opening at rear of left side caddy.
23. **FLHTC/U Only:**
   a. Open Tour-Pak and proceed as follows:
      **FLHTC:** Remove rubber mat.
      **FLHTCU:** Open map pocket and remove acorn nuts (with flat washers). Remove map pocket and molded liner from Tour-Pak.
   b. On FLHTCU models, depress latch and remove bulb socket from left side wrap-around light.
   c. Rotate knurled ring to disconnect radio antenna cable connector [29]. Release cable from two adhesive clips at bottom of Tour-Pak.
   d. On FLHTCU models, disconnect Tour-Pak lights connector [12], 3-place Multilock.
   e. Pull grommet into Tour-Pak and remove from main harness conduit.
   f. Pull Tour-Pak lights and radio antenna cable connectors out through hole at front of Tour-Pak. Cut cable strap to release conduit from luggage rack rail.
   g. Cut two cable straps securing main harness conduit to left upper frame tube.
   h. Draw Tour-Pak lights and radio antenna cable connectors forward and then out through opening at rear of left side caddy.
   i. Disconnect audio harness on FLHTCU models. See 8.37 AUDIO HARNESS: FLHTCU, steps 9-17. Cut two cable straps securing audio harness conduit to right upper frame tube. Feed conduit and connectors into battery tray and then pull out through opening at rear of left side caddy.

24. **FLTR Only:**
    a. On left side of motorcycle, remove screw (with flat washer) to remove passenger seat strap and saddlebag front mounting bracket. Remove screw and chrome frame tube cover.
    b. Cut cable strap to release radio antenna cable from shoulder of upper frame tube (just in front of air valve mounting bracket). Cut cable strap to release radio antenna cable from slotted hole in rear fender support.
    c. At bottom of radio antenna bracket, rotate knurled ring to disconnect radio antenna cable connector [29].
    d. Draw radio antenna cable forward and then out through opening at rear of left side caddy.
25. Pull accessory connector [4] and B+ connector [160] out through opening at rear of left side caddy.
26. Pull back boot at top of starter housing and remove flange nut and main power cable ring terminal from post. Draw main power cable into battery tray and then out through opening at rear of left side caddy.
27. Remove starter. See 5.2 STARTER.
28. Disconnect VSS connector [65], 3-place Delphi, at top of transmission case.
29. Remove two elbow connectors from neutral switch posts.
30. Disconnect rear O2 sensor connector [137], 2-place Amp (Tyco).
31. Carefully pull VSS, neutral switch, rear O2 sensor and starter solenoid conduit and connectors up through opening at front of battery tray (inboard of right side finger), and then feed branch out through opening at rear of left side caddy.
32. **ABS Equipped Only:**
    a. Disconnect ABS module connector [166], 20-place Molex.
    b. Pull anchor on rear wheel speed sensor connector [168], 2-place Amp (Tyco), from hole in right side caddy. Disconnect connector.
    c. Alternately feed conduit and connectors into battery tray and then out through opening at rear of left side caddy.
33. Disconnect voltage regulator as follows:
    a. Loosen locknuts on studs of lower frame crossmember.
    b. Lift voltage regulator and release voltage regulator connector conduit from P-clip at front of right side leg of voltage regulator.
    c. Pull away locking latch and remove socket of voltage regulator connector [77], 2-place Lyall, at bottom right side of voltage regulator.
34. Locate CKP sensor connector [79], 2-place Deutsch, fixed to front caddy at bottom of lower frame crossmember. Push connector toward right side of motorcycle to disengage attachment clip from T-stud. Disconnect connector.
35. Push anchor on jiffy stand interlock sensor connector [133], 3-place Molex, from hole in front caddy. Disconnect connector.
36. Locate oil pressure switch/sender at front right side of crankcase. On FLHR/C models, pull elbow from post of oil pressure switch. On FLHX, FLHT/C/U and FLTR models, remove Delphi connector from oil pressure sender.
37. Cut cable strap and disconnect front O2 sensor connector [138], 2-place Amp (Tyco), at back of cross brace between front frame downtubes. Cut cable straps to release conduit from right front frame downtube.
38. Cut cable strap to free main harness conduit from inboard side of rear brake pedal weldment.
39. Cut cable straps to free rear brake line and main harness conduit from two rubber saddles anchored on T-studs at top of lower frame tube.
40. Pull two socket terminals from spade contacts on rear brake light switch. Cut cable strap to free rear brake light switch wires from lower frame tube.
41. Cut cable strap at rear of rear brake light switch bracket to release main harness conduit from middle frame downtube.
42. Pull anchored cable strap from hole in middle frame downtube (adjacent to rear swingarm bracket) to release main harness conduit.
43. Disconnect active exhaust valve actuator connector [179], 5-place Amp (Tyco). If active exhaust valve actuator is not provided, disconnect unused socket housing from mock pin housing on right side of battery tray.
44. Carefully pull rear brake light switch, oil pressure switch/sender, CKP sensor, jiffy stand interlock sensor, voltage regulator and front O2 sensor conduit and connectors rearward, and then up through opening at front of battery tray (outboard of right side finger). Feed branch into battery tray pulling it out through opening at rear of left side caddy.
45. While pulling left side caddy away from motorcycle, feed rear end of wire trough out through opening between frame downtubes.




1. **Front fuel injector [84]**
2. **TCA [211]**
3. **T-MAP sensor [80]**
4. **Rear fuel injector [85]**

**Figure 8-105. Induction Module Assembly (Top View)**

## INSTALLATION: ALL MODELS (PART 1)

1. Standing on left side of motorcycle, feed front end of wire trough in through opening between frame downtubes, and then pull up and out through opening at top of battery tray. Lay wire trough on top of frame backbone.
2. Push anchor pins at rear of wire trough into holes in frame backbone.
3. Locate branch of main harness terminating in the active exhaust valve actuator, rear brake light switch, oil pressure switch/sender, CKP sensor, jiffy stand interlock sensor, voltage regulator and front O2 sensor connectors. Feed harness in through opening at rear of left side caddy, and then down through opening at front of battery tray (outboard of right side finger) to bottom of frame downtube. Route harness to front of motorcycle following inboard side of lower frame tube.
4. Locate branch terminating in the VSS, neutral switch, rear O2 sensor and starter solenoid connectors. Feed harness in through opening at rear of left side caddy, and then down through opening at front of battery tray (inboard of right side finger) to top of transmission.
5. If ABS equipped, locate branch terminating in the ABS module and rear wheel speed sensor connectors. Feed harness in through opening at rear of left side caddy and then pull out through opening at right side of battery tray.
6. Locate branch terminating in the Tour-Pak lights and radio antenna cable connectors. Feed harness in through opening at rear of left side caddy and then pull up and out through opening between frame crossmember and front of rear fender. Lay harness across left side of rear fender.
7. **FLHTCU Only:**
   a. Locate branch of audio harness terminating in the CB antenna cable, console and rear speaker/passenger controls connectors. Feed harness in through opening at rear of left side caddy and then pull up and out through opening at top of battery tray and lay across right side of rear fender.
   b. Locate branch terminating in the rear headset receptacle and rear speaker/passenger controls connector. Feed harness in through opening at rear of left side caddy and then pull up and out through opening at top of battery tray and lay across left side of rear fender.
8. Feeding main power cable ring terminal and B+, accessory, rear fender lights, ignition keyswitch relay, and TSM/HFSM connectors and conduit inboard, seat left side caddy on weldment between frame downtubes.
9. While pulling up on battery tray, push on left side caddy until tab engages slot on battery tray.
10. Start front screw to fasten left side caddy to battery tray. Start rear screw to fasten caddy to frame weldment. Alternately tighten screws to 72-96 **in-lbs** (8.1-10.9 Nm).

*NOTE*

*If equipped, push two retaining latches forward and slide siren into compartment at front of left side caddy. Connect connector.*

11. If loosened, tighten screw (with lifting strap) in middle finger of battery tray to 72-96 **in-lbs** (8.1-10.9 Nm).
12. Move main power cable ring terminal to front of battery tray and then feed down through opening (inboard of left side finger) to top of transmission.
13. Tuck B+ and accessory connectors and conduit into corner at front of battery tray. Move rear fender lights, ignition keyswitch relay, and TSM/HFSM connectors and conduit under frame crossmember at rear of battery tray.
14. Connect VSS connector [65], 3-place Delphi, at top of transmission case.
15. Install two elbow connectors onto neutral switch posts.
16. Install starter. See 5.2 STARTER.
17. Connect rear O2 sensor connector [137], 2-place Amp (Tyco), and tuck under chrome starter cover.
18. Install anchored cable strap in hole of frame downtube (inboard of rear swingarm bracket) to secure main harness conduit. See Figure 8-106.
19. Install **new** cable strap at rear of rear brake light switch bracket capturing main harness conduit and frame downtube.
20. Install two socket terminals onto spade contacts of rear brake light switch. Install **new** cable strap to secure rear brake light switch wires to lower frame tube.
21. Seat rear brake line on two rubber saddles anchored on T-studs at top of lower frame tube. Engaging slots in rubber saddles, install **new** cable straps capturing rear brake line, main harness conduit and lower frame tube.

*NOTE*

*Replace rubber saddles if damaged, deteriorated or missing. With the slotted side up, push hole in rubber saddle over T-stud to install.*

22. Route main harness conduit inboard of rear brake pedal weldment. Capturing main harness conduit and lower frame tube, install **new** cable strap through opening in weldment.

23. Connect front O2 sensor connector [138], 2-place Amp (Tyco). Install **new** cable strap to secure connector to back of cross brace between front frame downtubes. Install **new** cable straps to secure conduit to right front frame downtube.

24. Connect voltage regulator as follows:
    a. Route voltage regulator connector [77], 2-place Lyall, upward at front of lower frame crossmember capturing conduit in P-clip at front of right side leg of voltage regulator.
    b. Install socket at bottom right side of voltage regulator. Push against locking latch until socket is fully engaged.
    c. Alternately tighten locknuts on studs of lower frame crossmember to 70-100 **in-lbs** (7.9-11.3 Nm).

25. Connect CKP sensor connector [79]. Place large end of slot on attachment clip over T-stud on front caddy at bottom of lower frame crossmember. Push connector toward left side of motorcycle to engage small end of slot.

26. Connect jiffy stand interlock sensor connector [133], 3-place Molex. Push anchor on connector into hole in front caddy.

27. Install oil pressure switch/sender connector at front right side of crankcase. On FLHR/C models, install elbow connector on post terminal. On FLHX, FLHT/C/U and FLTR models, install 4-place Delphi connector.

28. Connect active exhaust valve actuator connector [179], 5-place Amp (Tyco). If active exhaust valve actuator is not provided, connect unused socket housing to mock pin housing on right side of battery tray.

29. **ABS Equipped Only:**
    a. Connect ABS module connector [166], 20-place Molex.
    b. Connect rear wheel speed sensor connector [168], 2-place Amp (Tyco). Install anchor on rear wheel speed sensor connector into hole in right side caddy.

30. **FLHX Only:**
    a. Feed radio antenna cable and rear facia lamp wires rearward following inboard side of upper frame tube.
    b. Mate pin and socket housings of rear facia lamp connector [12], 3-place Multilock.
    c. Install **new** cable strap to secure rear facia lamp wires and radio antenna cable to shoulder of upper frame tube (just in front of air valve mounting bracket).
    d. Using slotted hole, install **new** cable strap to secure rear facia lamp wires and radio antenna cable to rear fender support.
    e. At bottom of radio antenna bracket, rotate knurled ring to connect radio antenna cable connector [29].
    f. Install chrome frame tube cover on frame tube. Install screw and tighten to 25-40 **in-lbs** (2.8-4.5 Nm). Install screw (with flat washer) to fasten saddlebag front mounting bracket and passenger seat strap to chrome frame tube cover.

31. **FLHTC/U Only:**
    a. 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.
    b. Connect Tour-Pak lights connector [12], 3-place Multilock.
    c. Rotate knurled ring to connect radio antenna cable connector [29]. Capture cable in two adhesive clips at bottom of Tour-Pak.
    d. On FLHTCU models, install bulb socket of left side wrap-around light.
    e. Install **new** cable strap to secure main harness conduit to luggage rack rail.
    f. Connect audio harness on FLHTCU models. See 8.37 AUDIO HARNESS: FLHTCU, steps 8-19.
    g. Proceed as follows:

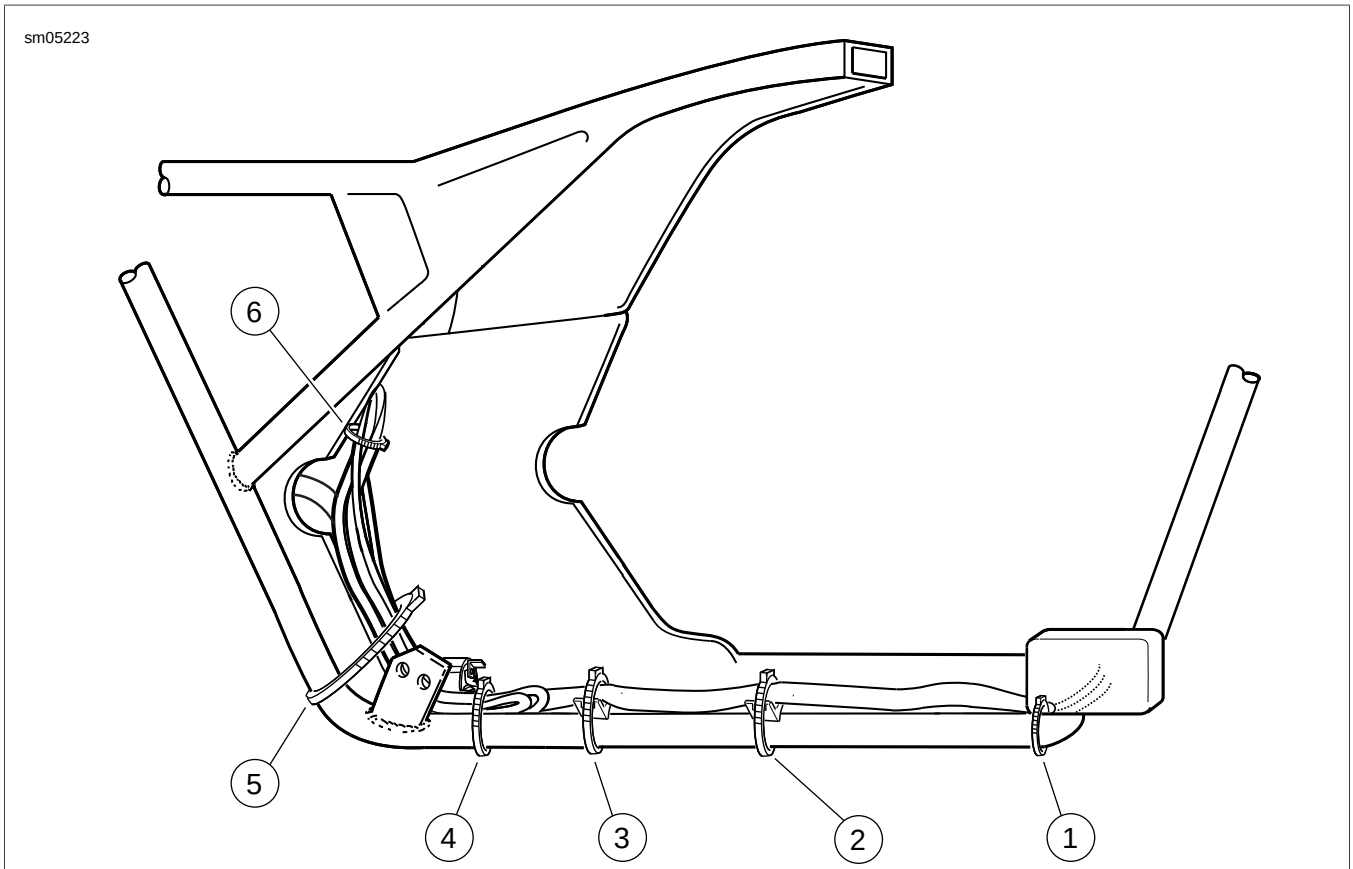
       **FLHTC:** Install rubber mat in Tour-Pak.

       **FLHTCU:** Install molded liner in Tour-Pak. Install map pocket and secure using acorn nuts (with flat washers).

32. **FLTR Only:**
    a. Feed radio antenna cable and 3-place Multilock connector (unused) rearward following inboard side of upper frame tube.
    b. Install **new** cable strap to secure radio antenna cable to shoulder of upper frame tube (just in front of air valve mounting bracket).
    c. Using slotted hole, install **new** cable strap to secure radio antenna cable to rear fender support.
    d. At bottom of radio antenna bracket, rotate knurled ring to connect radio antenna cable connector [29].
    e. Install chrome frame tube cover on frame tube. Install screw and tighten to 25-40 in-lbs (2.8-4.5 Nm). Install screw (with flat washer) to fasten saddlebag front mounting bracket and passenger seat strap to chrome frame tube cover.
33. Routing connector up between frame crossmember and rear fender, connect rear fender lights connector [7], 8-place Multilock, and attach to anchor at front of rear fender.
34. Feed ignition keyswitch relay with rubber boot up through hole on left side of frame crossmember. Install anchors on rubber boot into holes in frame crossmember.
35. Feed TSM/HFSM connector [30] up through hole on right side of frame crossmember and connect to module. If present, feed HFSM antenna down through same hole, and then pull back up and out through empty slot of rubber boot on left side. Install module into hole in crossmember and install spring clip.
36. **FLHR/C Only:**
    a. Lay a clean shop towel on forward part of rear fender. Lay console upside down on shop towel.
    b. Connect instrument console connector [20], 16-place Molex, inboard of left upper frame tube.
    c. Connect ignition switch jumper harness connector [222], 4-place Packard. Install anchor on connector into hole in left side of battery tray.
37. Move ECM (with attached top caddy) to motorcycle. Connect ECM connector [78].
38. Install two main harness ground ring terminals (with orange tape) onto front ground stud on left side of frame backbone. Install flange nut (10 mm) and tighten to 50-90 **in-lbs** (5.7-10.2 Nm).
39. Install main harness ground ring terminal (without orange tape) onto rear ground stud. Route chassis ground cable forward along left side of wire trough and install ring terminal on rear ground stud. Install flange nut (10 mm) and tighten to 50-90 **in-lbs** (5.7-10.2 Nm).
40. Install connectors to induction module as follows:
    a. Install T-MAP sensor connector [80].
    b. Install TCA connector [211]. Install **new** anchored cable strap in hole at front right side of induction module. Tighten cable strap capturing connector conduit.
    c. Install front fuel injector connector [84] and rear fuel injector connector [85].
41. Install purge solenoid connector [95]. If purge solenoid is not provided, install anchored cable strap on socket housing into hole in wire trough (below breakout compartment).
42. Install ET sensor connector [90] at back of front cylinder. Pull boot over sensor to keep out dirt and debris.
43. Install elbow terminals onto horn spade contacts. Capture conduit in J-clamp. Install screw (with flat washer) to fasten horn bracket to rear cylinder head. Alternately tighten front and rear horn bracket screws to 35-40 ft-lbs (48-54 Nm).
44. Install ignition coil connector [83].
45. On ABS equipped motorcycles, secure brake line as follows:
    a. Press brake lines into channel at front of wire trough.
    b. Position brake lines on narrow ledge at side of wire trough. At rear of ledge, install **new** cable strap to secure brake lines to wire trough.
    c. Install three double-sided clips to secure brake line from master cylinder to brake line to front calipers. Place the clips as follows: in front of ignition coil bracket, above wire trough breakouts, and in front of threaded boss for the rear fuel tank bracket bolt.
46. Install backplate and air cleaner. See 4.3 AIR CLEANER ASSEMBLY.

*NOTE*

*Depending upon model, continue procedure at 8.34 MAIN WIRING HARNESS, Installation: FLHR/C (Part 2), 8.34 MAIN WIRING HARNESS, Installation: FLHX, FLHT/C/U (Part 2) or 8.34 MAIN WIRING HARNESS, Installation: FLTR (Part 2).*




1. Captures main harness and lower frame tube
2. Captures rear brake line, main harness and lower frame tube
3. Captures rear brake line, main harness and lower frame tube
4. Captures rear brake light switch wires, main harness and lower frame tube
5. Captures main harness and frame downtube
6. Captures main harness

**Figure 8-106. Cable Strap Locations (Right Side View)**

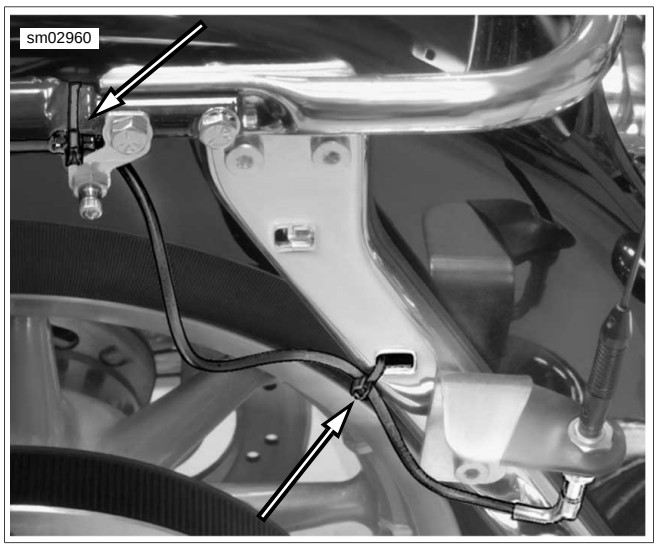



**Figure 8-107. Capture Radio Antenna Cable (FLTR)**


**Figure 8-108. Capture Radio Antenna Cable (FLHX)**

## INSTALLATION: FLHR/C (PART 2)

1. Route front right section of main harness forward along right side of steering head and into headlamp nacelle.
2. See Figure 8-103. Reaching inside headlamp nacelle, connect connectors and install onto their retaining devices, if present:
   a. Auxiliary lamps [73], 2-place Multilock (white).
   b. Auxiliary lamps switch [109], 4-place Amp.
   c. Right handlebar switches [22], 6-place Molex (black); T-stud on fork stem nut lockplate (right side)
   d. Cruise set/resume switch [159], 3-place Molex (black); used on FLHRC only.
   e. Twist grip sensor jumper harness [204], 6-place Molex (black).
3. Install P-clamp and screw to fasten main harness conduit to right side of steering head.
4. Route front left section of main harness forward along left side of steering head and into headlamp nacelle.
5. Reaching inside headlamp nacelle, connect connectors and install onto their retaining devices, if present:
   a. Front fender tip lamp jumper harness [32], 2-place Multilock (black); used on FLHR only.
   b. Accessory switch [67], 4-place Amp.
   c. Front turn signal lamps [31], 6-place Multilock; anchored in hole of fork stem nut lock plate (left side).
   d. Left handlebar switches [24], 8-place Molex (gray); T-stud on fork stem nut lockplate (left side).
   e. Cruise on/off switch [158], 3-place Molex (gray); used on FLHRC only.
   f. Front wheel speed sensor [167], 2-place Amp (Tyco); used on ABS equipped motorcycles only.
6. Install P-clamp and screw to fasten main harness conduit to left side of steering head.
7. Install headlamp assembly. See 8.9 HEADLAMP: ALL EXCEPT FLTR.

*NOTE*

*Continue procedure at 8.34 MAIN WIRING HARNESS, Installation: All Models (Part 3).*

## INSTALLATION: FLHX, FLHT/C/U (PART 2)

1. Route front right section of main harness forward along right side of steering head and then under fairing cap to front of inner fairing.
2. Proceed as follows:
   a. Connect ignition switch connector [33], 3-place Packard, at front of ignition switch housing.
   b. Using oblong holes in fairing brackets and a long shank ball end socket (Snap-on® FABL6E), install four screws to fasten radio (storage box on FLHT) to left and right radio support brackets. Alternately tighten screws to 35-45 **in-lbs** (4.0-5.1 Nm).
   c. Install anchor on ignition switch connector conduit into hole at bottom right corner of radio.
3. See Figure 8-104. Connect connectors and install onto their retaining devices, if present.
   a. Twist grip sensor jumper harness [204], 6-place Molex (black); T-stud on right fairing support brace (inboard side).
   b. Main to interconnect harness [1], 16-place Molex (black); anchor in hole of right radio support bracket.
   c. Main to interconnect harness [15], 4-place Packard (black); anchored in hole at front of right fairing bracket.
   d. Radio antenna cable connector [51]; back of radio (left side).
4. Using oval shaped hole at side of right fairing bracket, install **new** cable strap capturing conduit of main to interconnect harness connector [1], main to interconnect harness connector [15], right handlebar switch connector [22] and radio connector [27].
5. Install screw and P-clamp to fasten main harness to right side of steering head.
6. Route front left section of main harness (and audio harness on FLHTCU) forward along left side of steering head and then under fairing cap to front of inner fairing.
7. Connect connectors and install onto their retaining devices, if present.
   a. Main to interconnect harness [2], 12-place Molex (gray); anchor in hole of left radio support bracket.
   b. Front wheel speed sensor [167], 2-place Amp (Tyco); below upper fork bracket (left side); used on ABS equipped motorcycles only.
8. Using round hole at side of left fairing bracket, install **new** cable strap capturing conduit of main to interconnect harness connector [2], left handlebar switch connector [24] and headlamp connector [38].
9. Connect audio harness on FLHTCU models. See 8.37 AUDIO HARNESS: FLHTCU, step 7.
10. Install screw and P-clamp to fasten main harness (and audio harness on FLHTCU) to left side of steering head.
11. Install outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.

*NOTE*

*Continue procedure at 8.34 MAIN WIRING HARNESS, Installation: All Models (Part 3).*

## INSTALLATION: FLTR (PART 2)

1. Install inner fairing. See 2.42 INNER FAIRING: FLTR.

*NOTE*

*Continue procedure at 8.34 MAIN WIRING HARNESS, Installation: All Models (Part 3).*

## INSTALLATION: ALL MODELS (PART 3)

1. Install side covers.
2. Install saddlebags. See 2.27 SADDLEBAGS.
3. Install fuel tank. See 4.4 FUEL TANK.
4. Install battery. See 1.16 BATTERY MAINTENANCE.

## FLHX, FLHT/C/U

### Removal

*NOTE*

*When referencing inner fairing 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.*

1. Remove maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
2. Remove outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
3. Release anchor on convoluted tubing of interconnect harness from lower ear of speedometer bracket. For best results, squeeze anchor with needle nose pliers before pulling from hole in ear. See Figure 8-109.
4. Cut cable strap to release convoluted tubing of headlamp connector [38] and conduit of main to interconnect harness connector [2] and left handlebar switch connector [24] from left fairing bracket.
5. Remove anchor on convoluted tubing of headlamp connector [38] from hole at front of left fairing bracket.
6. Cut cable strap to release convoluted tubing of radio connector [27] and conduit of main to interconnect harness connector [1], main to interconnect harness connector [15] and right handlebar switch connector [22] from right fairing bracket.
7. See Figure 8-110. Disconnect connectors and remove from their retaining devices, if present.
   a. Left front turn signal/auxiliary lamp [31L], 4-place Multilock (black); T-stud on left fairing support brace (outboard side).
   b. Left handlebar switches [24], 16-place Molex (gray); T-stud on left fairing support brace (inboard side).
   c. Main to interconnect harness [2], 12-place Molex (gray); anchor in hole of left radio support bracket.
   d. Audio to interconnect harness [6], if present; 6-place Deutsch (black); left side of radio.
   e. Indicator lights [21]; 10-place Multilock (black); above radio (between speedometer and tachometer gauges).
   f. Speedometer [39]; 12-place Packard; back of speedometer. Unthread rubber boot from odometer reset switch and pull switch from hole in inner fairing.
   g. Tachometer [108]; 12-place Packard; back of tachometer.
   h. Main to interconnect harness [1], 16-place Molex (black); anchor in hole of right radio support bracket.
   i. Right handlebar switches [22], 12-place Molex (black); T-stud on right fairing support brace (middle).
   j. Right front turn signal/auxiliary lamp [31R], 4-place Multilocks (black); T-stud on right fairing support brace (outboard side).
   k. Main to interconnect harness [15], 4-place Packard (black); anchored in hole at front of right fairing bracket.
   l. Fairing cap switches [105], 12-place Multilock (black); top of upper fork bracket (right side).
   m. Radio [27], 23-place Amp (black); back of radio (right side).
   n. Front fender tip lamp jumper harness [32], if present; 2-place Multilock (black); below upper fork bracket (left side).
   o. Ambient temperature sensor [107], if present; 3-place Multilock (black); anchored in hole on left side of steering head.
8. See Figure 8-111. Remove left side connectors from spade contacts as follows:
   a. Cigarette lighter [132].
   b. Left front speaker [35].
   c. Fuel gauge [117] and lamp [116].
   d. Air temperature gauge [115] and lamp [114], if present.
9. Feed left front turn signal/auxiliary lamp [31L], left handlebar switch [24], left side speaker, fuel gauge, air temperature gauge (if present), and cigarette lighter conduit and connectors to mid section of inner fairing (area between left and right fairing brackets).

10. Pull harness ground socket terminal from spade contact fastened to top of upper fork bracket (left side).
11. Remove right side connectors from spade contacts as follows:
    a. Right front speaker [34].
    b. Voltmeter gauge [111] and lamp [110].
    c. Oil pressure gauge [113] and lamp [112], if present.
12. Feed right front turn signal/auxiliary lamp [31R], right handlebar switch [22], right side speaker, voltmeter gauge, and oil pressure gauge (if present) conduit and connectors to mid section of inner fairing (area between left and right fairing brackets).
13. Remove interconnect harness from motorcycle.

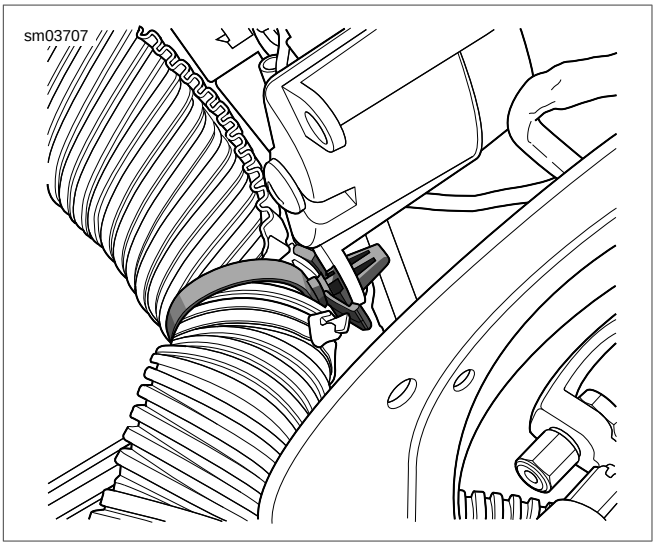
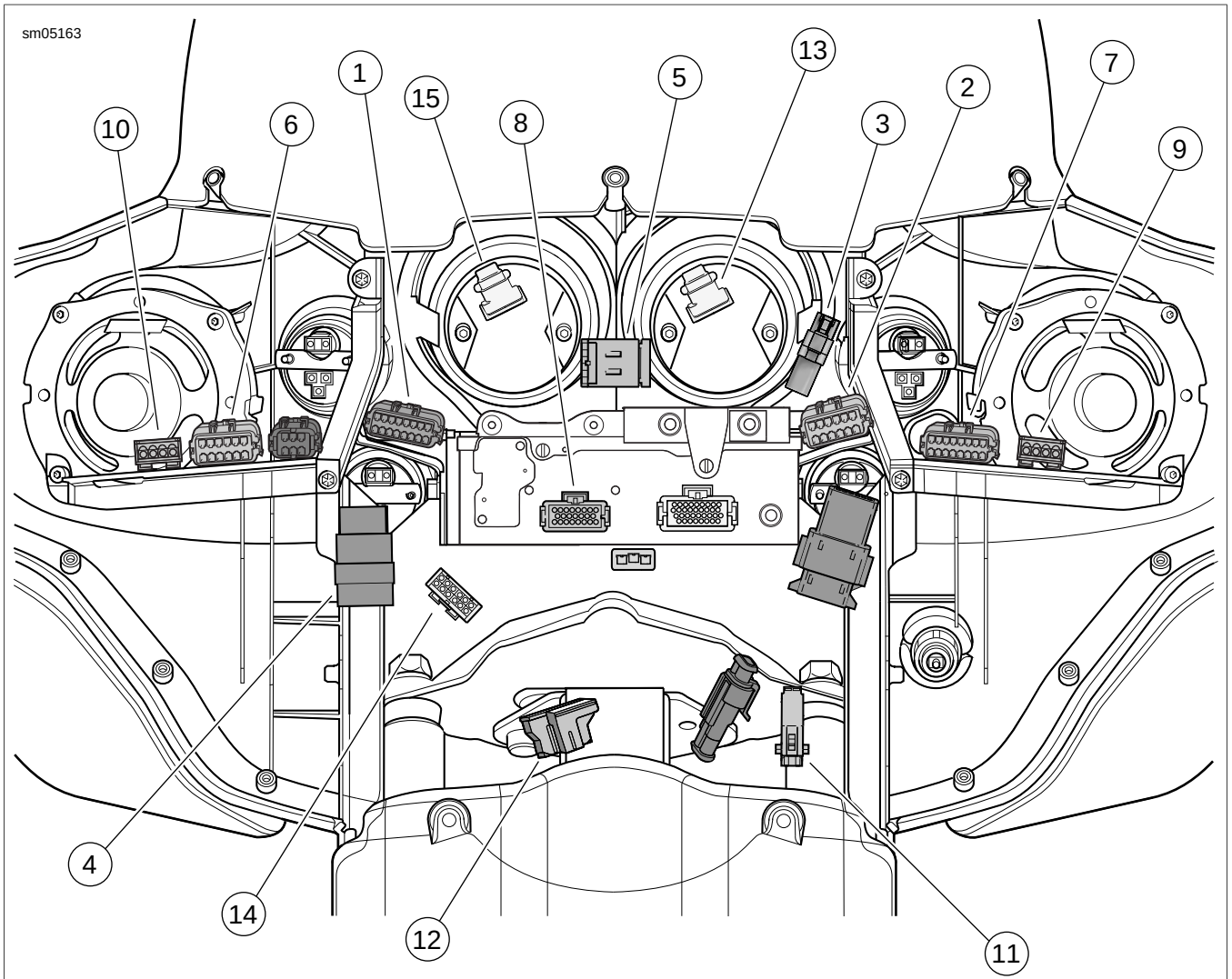
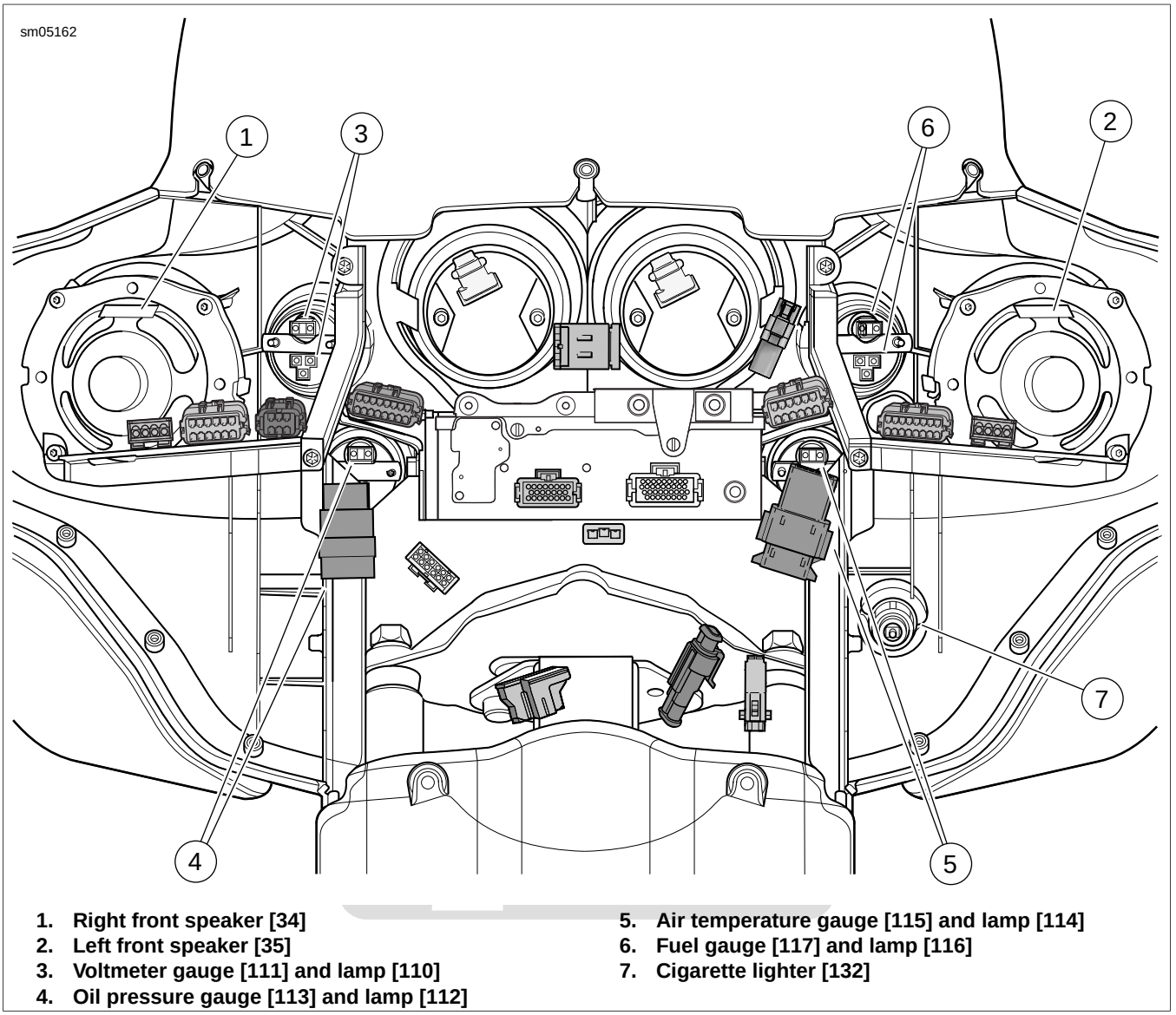



**Figure 8-109. Anchor Interconnect Harness in Ear of Speedometer Bracket**




1. Main to interconnect harness [1]
2. Main to interconnect harness [2]
3. Audio to interconnect harness [6]
4. Main to interconnect harness [15]
5. Indicator lights [21]
6. Right handlebar switches [22]
7. Left handlebar switches [24]
8. Radio [27]
9. Left front turn signal/auxiliary lamp [31L]
10. Right front turn signal/auxiliary lamp [31R]
11. Front fender tip lamp [32]
12. Headlamp [38]
13. Speedometer gauge [39]
14. Fairing cap switches [105]
15. Tachometer gauge [108]

**Figure 8-110. Inner Fairing- Interconnect Harness Connectors (FLHX, FLHT/C/U)**




1. **Right front speaker [34]**
2. **Left front speaker [35]**
3. **Voltmeter gauge [111] and lamp [110]**
4. **Oil pressure gauge [113] and lamp [112]**
5. **Air temperature gauge [115] and lamp [114]**
6. **Fuel gauge [117] and lamp [116]**
7. **Cigarette lighter [132]**

**Figure 8-111. Inner Fairing- Interconnect Harness Connectors (FLHX, FLHT/C/U)**

## Installation

*NOTE*

*When referencing inner fairing 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.*

1. Center interconnect harness on top of radio (or storage box). To verify proper orientation, be sure that convoluted tubing of headlamp connector [38] is on left side of motorcycle, while conduit of fairing cap switch connector [105] is on the right.
2. From mid section of inner fairing (area between left and right fairing brackets), feed left side speaker, fuel gauge, air temperature gauge (if present), cigarette lighter, left front turn signal/auxiliary lamp [31L], and left handlebar switch [24] connectors and conduit behind left fairing bracket to area of left support brace.
3. From mid section of inner fairing (area between left and right fairing brackets), feed right side speaker, voltmeter gauge, oil pressure gauge (if present), right front turn signal/auxiliary lamp [31R], and right handlebar switch [22] connectors and conduit behind right fairing bracket to area of right support brace.
4. Install anchor on convoluted tubing of interconnect harness into lower ear of speedometer bracket.
5. See Figure 8-111. Install left side connectors onto spade contacts as follows:
   a. Air temperature gauge [115] and lamp [114], if present; identified by black tape.
   b. Fuel gauge [117] and lamp [116]; identified by orange tape.
   c. Left front speaker [35].
   d. Cigarette lighter [132]; connect the orange/white wire socket terminal to the socket spade contact, the black wire socket terminal to the shell contact.

6. Push harness ground socket terminal onto spade contact fastened to top of upper fork bracket (left side).
7. Install right side connectors onto spade contacts as follows:
   a. Oil pressure gauge [113] and lamp [112], if present; identified by black tape.
   b. Voltmeter gauge [111] and lamp [110]; identified by orange tape.
   c. Right front speaker [34].
8. See Figure 8-110. Connect connectors and install onto their retaining devices, if present.
   a. Left front turn signal/auxiliary lamp [31L], 4-place Multilock (black); T-stud on left fairing support brace (outboard side).
   b. Left handlebar switches [24], 16-place Molex (gray); T-stud on left fairing support brace (inboard side).
   c. Main to interconnect harness [2], 12-place Molex (gray); anchor in hole of left radio support bracket.
   d. Audio to interconnect harness [6], if present; 6-place Deutsch (black); left side of radio.
   e. Indicator lights [21]; 10-place Multilock (black); above radio (between speedometer and tachometer gauges).
   f. Speedometer [39]; 12-place Packard; back of speedometer. Unthread rubber boot from odometer reset switch and pull switch from hole in inner fairing.
   g. Tachometer [108]; 12-place Packard; back of tachometer.
   h. Main to interconnect harness [1], 16-place Molex (black); anchor in hole of right radio support bracket.
   i. Right handlebar switches [22], 12-place Molex (black); T-stud on right fairing support brace (middle).
   j. Right front turn signal/auxiliary lamp [31R], 4-place Multilocks (black); T-stud on right fairing support brace (outboard side).
   k. Main to interconnect harness [15], 4-place Packard (black); anchored in hole at front of right fairing bracket.
   l. Fairing cap switches [105], 12-place Multilock (black); top of upper fork bracket (right side).
   m. Radio [27], 23-place Amp (black); back of radio (right side).
   n. Front fender tip lamp jumper harness [32], if present; 2-place Multilock (black); below upper fork bracket (left side).
   o. Ambient temperature sensor [107], if present; 3-place Multilock (black); anchored in hole on left side of steering head.
9. Install anchor on convoluted tubing of headlamp connector [38] into hole at front of left fairing bracket. See Figure 8-112.
10. Using round hole at side of left fairing bracket, install **new** cable strap capturing convoluted tubing of headlamp connector [38] and conduit of main to interconnect harness connector [2] and left handlebar switch connector [24].
11. Using oval shaped hole at side of right fairing bracket, install **new** cable strap capturing convoluted tubing of radio connector [27] and conduit of main to interconnect harness connector [1], main to interconnect harness connector [15] and right handlebar switch connector [22]. See Figure 8-113.
12. Install outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
13. Install maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.

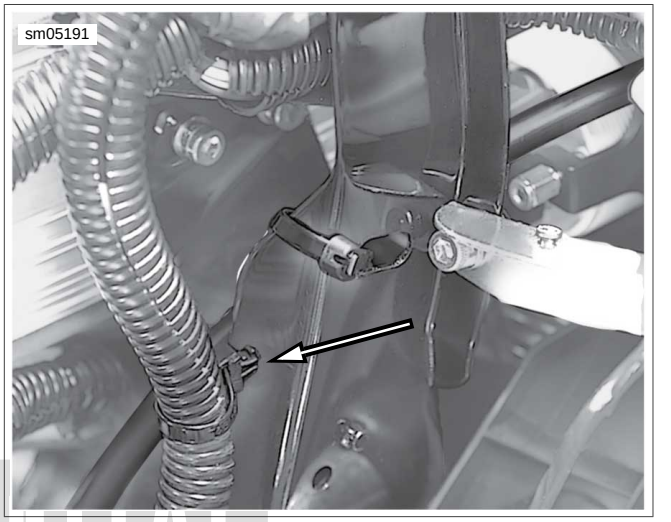



**Figure 8-112. Anchor Convoluted Tubing of Headlamp Connector to Fairing Bracket (Left Side)**

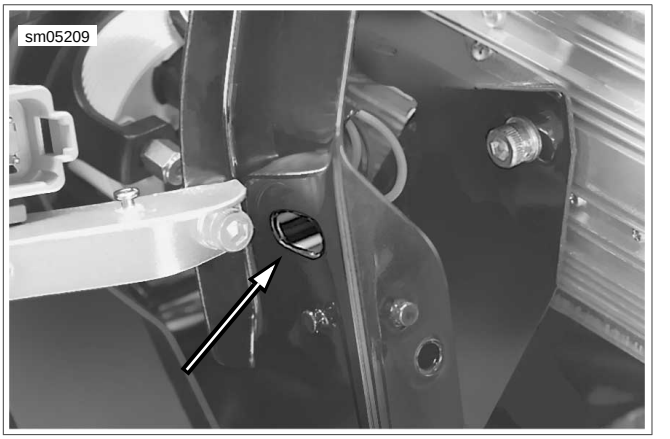



**Figure 8-113. Cable Strap Conduit to Fairing Bracket (Right Side)**

## FLTR

### Removal

1. Remove maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.
2. Place protective material on top of front fender to protect paint from scratches or other damage.

3. Remove outer fairing. See 2.39 UPPER FAIRING AND WINDSHIELD: FLTR.
4. Carefully cut two cable straps to free wire bundles and conduit from convoluted tubing of interconnect harness and allow to hang naturally.
5. See Figure 8-114. Disconnect connectors and remove from their retaining devices, if present.
   a. Main to interconnect harness [1], 16-place Molex (black); below radio (right side).
   b. Main to interconnect harness [2], 12-place Molex (gray); below radio (right side).
   c. Main to interconnect harness [15], 4-place Packard (black); below radio (right side).
   d. Left handlebar switches [24], 16-place Molex (gray); T-stud on left side of radio bracket.
   e. Right handlebar switches [22], 12-place Molex (black); T-stud on left side of radio bracket.
   f. Radio [27], 23-place Amp (black); back of radio (right side).
6. Disconnect ambient temperature sensor connector [107], 3-place Multilock, from sensor anchored in hole on left side of steering head. Feed connector and conduit in through opening on left side of fairing bracket.
7. Proceed as follows:
   a. Remove left side of instrument nacelle. See 2.41 INSTRUMENT NACELLE: FLTR. See Figure 8-115.
   b. Disconnect Instrument nacelle switch connector [105], 12-place Multilock.
   c. Pull harness ground socket terminal from spade contact fastened to top of upper fork bracket (left side).
8. Draw branches of interconnect harness (terminating in odometer reset switch and speedometer, tachometer, indicator lights, instrument nacelle switches and ambient temperature sensor connectors) through tunnel of fairing bracket to front of inner fairing.
9. Remove left side connectors from spade contacts as follows:
   a. Cigarette lighter [132].
   b. Left speaker [35].
   c. Fuel gauge [117] and lamp [116].
   d. Air temperature gauge [115] and lamp [114].
10. Remove right side connectors from spade contacts as follows:
   a. Right speaker [34].
   b. Voltmeter gauge [111] and lamp [110].
   c. Oil pressure gauge [113] and lamp [112].
11. Free conduit of front turn signal lamp connectors [31L] and [31R], 3-place Multilocks, from flexible clips on sides of inner fairing.
12. Remove interconnect harness from motorcycle. Remove radio antenna cable connector [51] at back of radio (left side), if necessary.

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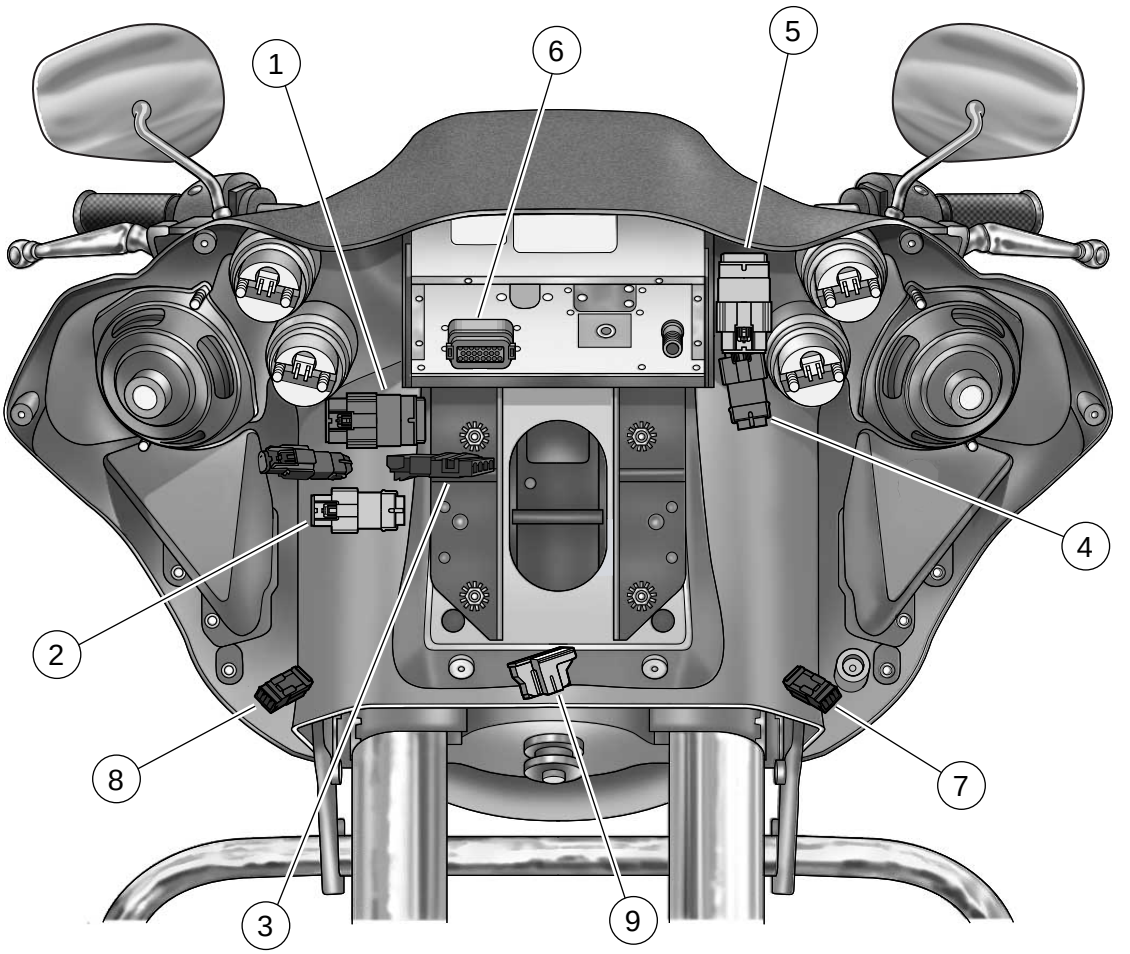
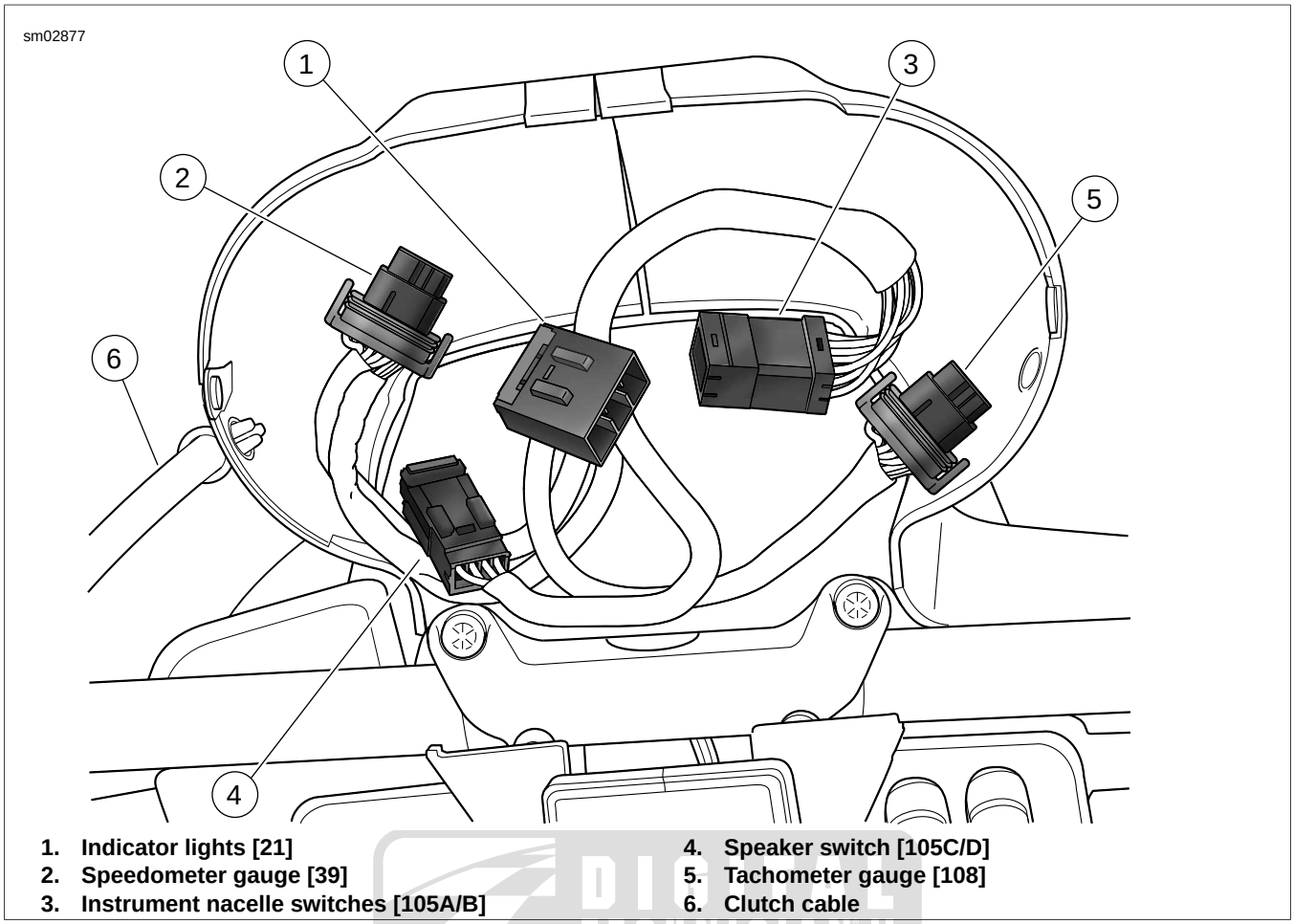



1. **Main to interconnect harness [1]**
2. **Main to interconnect harness [2]**
3. **Main to interconnect harness [15]**
4. **Right handlebar switches [22]**
5. **Left handlebar switches [24]**
6. **Radio [27]**
7. **Left turn signal [31L]**
8. **Right turn signal [31R]**
9. **Headlamp [38]**

**Figure 8-114. Inner Fairing- Interconnect Harness Connectors (FLTR)**




1. **Indicator lights [21]**
2. **Speedometer gauge [39]**
3. **Instrument nacelle switches [105A/B]**
4. **Speaker switch [105C/D]**
5. **Tachometer gauge [108]**
6. **Clutch cable**

**Figure 8-115. Instrument Nacelle (Bezel Removed)**

## Installation

*NOTE*

*To avoid chafing wires of interconnect harness, verify that trim strips are installed on hooks of radio bracket.*

1. Center convoluted tubing of interconnect harness above and inboard of hooks on radio bracket. To verify proper orientation, be sure that long length of conduit terminating in socket terminals of cigarette lighter is on left side of motorcycle. Install radio antenna cable connector [51] at back of radio (left side), if removed.
2. Install left side connectors onto spade contacts as follows:
   a. Cigarette lighter [132]; connect the orange/white wire socket terminal to the socket spade contact, the black wire socket terminal to the shell contact.
   b. Left speaker [35].
   c. Fuel gauge [117] and lamp [116].
   d. Air temperature gauge [115] and lamp [114].
3. Install right side connectors onto spade contacts as follows:
   a. Right speaker [34].
   b. Voltmeter gauge [111] and lamp [110].
   c. Oil pressure gauge [113] and lamp [112].
4. Find branch of interconnect harness terminating in odometer reset switch and speedometer, tachometer, indicator lights and instrument nacelle switch connectors. Feed connectors and conduit from front of inner fairing through tunnel of fairing bracket and then out through opening at top of fairing bracket to instrument nacelle.
5. Proceed as follows:
   a. Push harness ground socket terminal onto spade contact fastened to top of upper fork bracket (left side).
   b. Connect Instrument nacelle switch connector [105], 12-place Multilock. See Figure 8-115.
   c. Install left side of instrument nacelle. 2.41 INSTRUMENT NACELLE: FLTR.

6. See Figure 8-114. Connect connectors and install onto their retaining devices, if present.
   a. Main to interconnect harness [1], 16-place Molex (black); below radio (right side).
   b. Main to interconnect harness [2], 12-place Molex (gray); below radio (right side).
   c. Main to interconnect harness [15], 4-place Packard (black); below radio (right side).
   d. Left handlebar switches [24], 16-place Molex (gray); T-stud on left side of radio bracket.
   e. Right handlebar switches [22], 12-place Molex (black); T-stud on left side of radio bracket.
   f. Radio [27], 23-place Amp (black); back of radio (right side).
7. Orient connectors as shown in Figure 8-114. Install two **new** cable straps outboard of radio bracket hooks to secure wire bundles and conduit to convoluted tubing of interconnect harness. Cut any excess cable strap material. See Figure 8-116.
8. Capture conduit of front turn signal lamp connectors [31L] and [31R], 3-place Multilocks, in flexible clips on sides of inner fairing.
9. Install outer fairing. See 2.39 UPPER FAIRING AND WINDSHIELD: FLTR.
10. Install maxi-fuse. See 8.5 SYSTEM FUSES AND RELAYS.

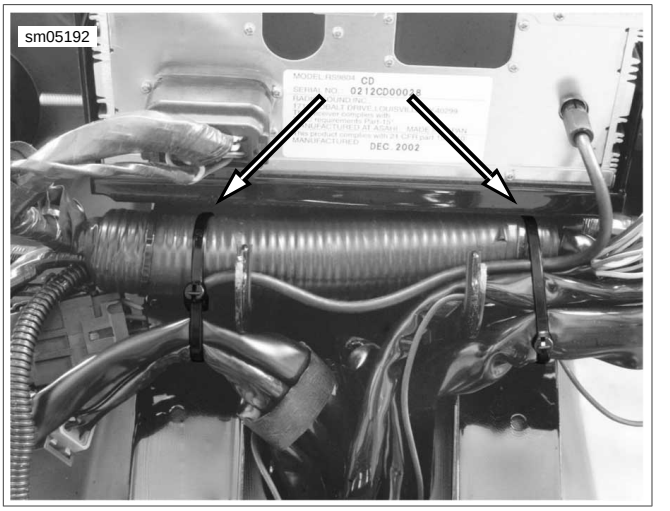



**Figure 8-116. Cable Strap Convoluted Tubing and Conduit**

## FLHTC/U

### Removal

1. Remove fuel tank. See 4.4 FUEL TANK.
2. Remove left side saddlebag. See 2.27 SADDLEBAGS.
3. Remove left side cover.
4. Remove outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
5. Remove radio antenna cable connector [51] at back of radio (left side). See Figure 8-117. Carefully cut cable where it exits main harness conduit.
6. Remove screw and P-clamp to release main harness conduit from right side of steering head.
7. Starting at front of wire trough, and working rearward, use a small flat blade screwdriver to release catches on cover. For best results, free one side of the cover and then the other.
8. Carefully cut two cable straps securing main harness conduit to left upper frame tube. Cut cable strap securing main harness conduit to luggage rack rail.
9. Open Tour-Pak and proceed as follows:
   a. **FLHTC:** Remove rubber mat.
   b. **FLHTCU:** Open map pocket and remove acorn nuts (with flat washers). Remove map pocket and molded liner from Tour-Pak.
10. On FLHTCU models, depress external latch and remove bulb socket from left side wrap-around light.
11. Rotate knurled ring to disconnect radio antenna cable connector [29]. Release cable from two adhesive clips at bottom of Tour-Pak.
12. Disconnect Tour-Pak lights connector [12], 3-place Multilock. See Figure 8-118.
13. Pull grommet into Tour-Pak and remove from main harness conduit.
14. Pull Tour-Pak lights and radio antenna cable connectors out through hole at front of Tour-Pak. See Figure 8-119.
15. Carefully cut radio antenna cable where it exits main harness conduit.

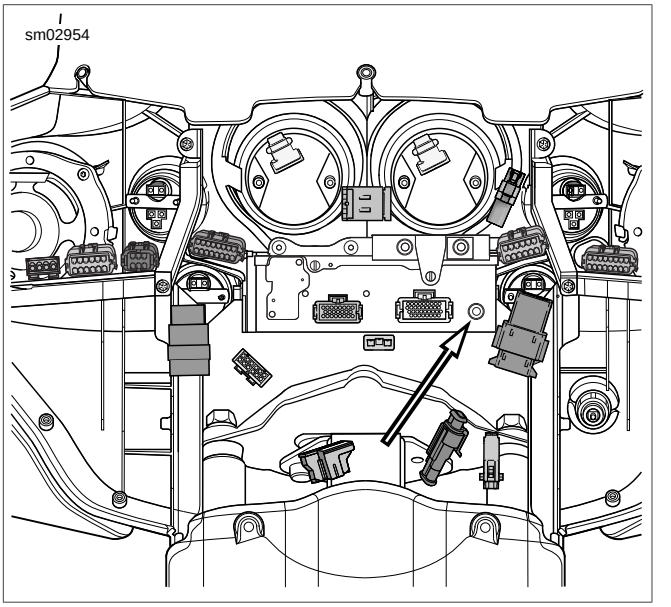
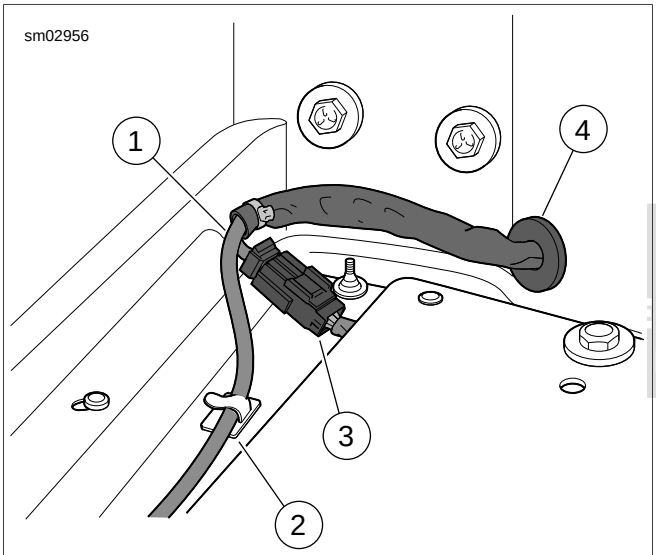



**Figure 8-117. Radio Antenna Cable Connector (FLHX, FLHTC/U)**

### Installation

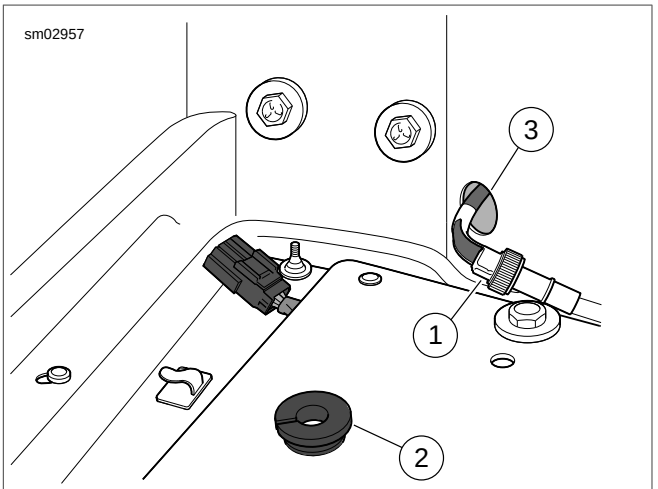
1. Connect radio antenna cable connector [51] at back of radio (left side). See Figure 8-117.
2. Route free end of radio antenna cable rearward along right side of steering head.
3. Capture radio antenna cable and main harness conduit in P-clamp. Install screw to fasten P-clamp to right side of steering head.
4. Route radio antenna cable rearward through opening at front right side of wire trough. Exiting wire trough at rear left side, route cable along inboard side of left upper frame tube. Continue rearward progression following luggage rack rail to front of Tour-Pak.
5. Loosely install two **new** cable straps to secure radio antenna cable and main harness conduit to left upper frame tube. On FLHTCU models, also capture audio harness conduit at this location.
6. Loosely install **new** cable strap to secure radio antenna cable and main harness conduit to luggage rack rail.
7. Feed Tour-Pak lights and radio antenna cable connectors through hole at front of Tour-Pak. Capture cable and conduit in grommet. Install grommet in hole with the larger OD facing inside.
8. Connect Tour-Pak lights connector [12], 3-place Multilock. See Figure 8-118.
9. Rotate knurled ring to connect radio antenna cable connector [29]. Capture cable in two adhesive clips at bottom of Tour-Pak.
10. On FLHTCU models, install bulb socket of left side wrap-around light.

11. Tighten three cable straps securing radio antenna cable and main harness conduit to left upper frame tube and luggage rack rail. Cut any excess cable strap material.
12. Proceed as follows:
    a. **FLHTC:** Install rubber mat in Tour-Pak. Close Tour-Pak.
    b. **FLHTCU:** Install molded liner in Tour-Pak. Install map pocket and secure using acorn nuts (with flat washers). Close Tour-Pak.
13. Place cover over wire trough. Starting at the rear and working forward from side to side, engage catches to latch cover. Verify that all latches are fully engaged.
14. Install fuel tank. See 4.4 FUEL TANK.
15. Install left side cover.
16. Install left side saddlebag. See 2.27 SADDLEBAGS.
17. Install outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.




1. **Radio antenna cable**
2. **Adhesive clip**
3. **Tour-pak lights connector [12]**
4. **Grommet**

**Figure 8-118. Disconnect Tour-Pak Lights Connector**




1. **Radio antenna cable connector [29]**
2. **Grommet**
3. **Tour-pak hole**

**Figure 8-119. Feed Main Harness Through Tour-Pak Hole**

## FLHX, FLTR

### Removal

1. Remove fuel tank. See 4.4 FUEL TANK.
2. Remove left side saddlebag. See 2.27 SADDLEBAGS.
3. Remove left side cover.
4. Remove outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U or 2.39 UPPER FAIRING AND WINDSHIELD: FLTR.
5. Remove radio antenna cable connector [51] at back of radio (left side). See Figure 8-120. Carefully cut cable where it exits main harness conduit.
6. Remove screw and P-clamp to release main harness conduit from right side of steering head, if present.
7. Starting at front of wire trough, and working rearward, use a small flat blade screwdriver to release catches on cover. For best results, free one side of the cover and then the other.
8. Carefully cut two cable straps securing main harness conduit to left upper frame tube.
9. On left side of motorcycle, remove screw (with flat washer) to remove passenger seat strap and saddlebag front mounting bracket from chrome frame tube cover.
10. Remove screw and chrome frame tube cover.
11. Carefully cut cable strap to release radio antenna cable from shoulder of upper frame tube (just in front of air valve mounting bracket). Cut cable strap to release radio antenna cable from slotted hole in rear fender support. See Figure 8-121.
12. At bottom of radio antenna bracket, rotate knurled ring to disconnect radio antenna cable connector [29].
13. Carefully cut radio antenna cable where it exits main harness conduit.

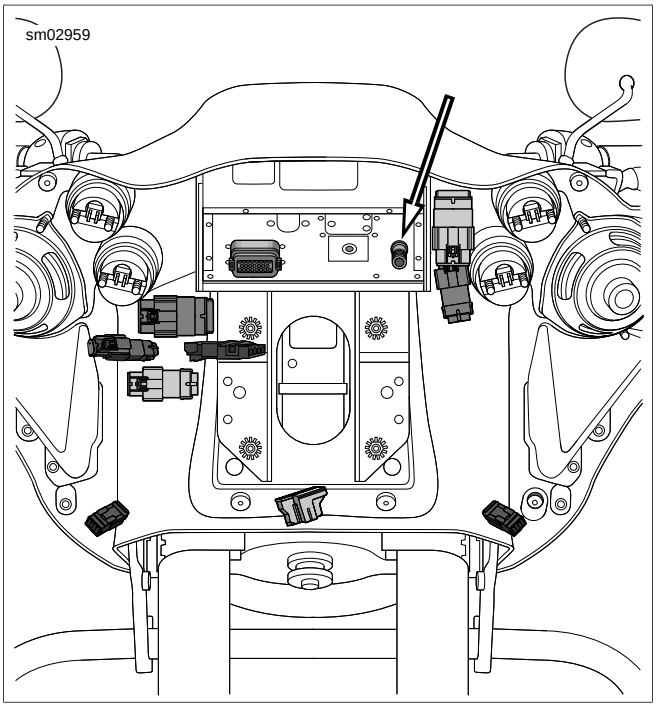



**Figure 8-120. Radio Antenna Cable Connector (FLTR)**

## Installation

1. Connect radio antenna cable connector [51] at back of radio (left side). See Figure 8-120.
2. Proceed as follows:
   a. **FLHX:** Route free end of radio antenna cable rearward along right side of steering head.
   b. **FLTR:** Route free end of radio antenna cable into tunnel of fairing bracket pulling it out through opening on right side of bracket and then continuing rearward along right side of steering head.
3. Capture radio antenna cable and main harness conduit in P-clamp, if present. Install screw to fasten P-clamp to right side of steering head.
4. Route radio antenna cable rearward through opening at front right side of wire trough. Exiting wire trough at rear left side, route cable along inboard side of left upper frame tube to area of rear fender support.
5. Loosely install two **new** cable straps to secure radio antenna cable and main harness conduit to left upper frame tube.
6. Install **new** cable strap to secure radio antenna cable (and rear facia lamp wires on FLHX) to shoulder of left upper frame tube (just in front of rear shock air valve mounting bracket). Using slotted hole, install **new** cable strap to secure radio antenna cable (and rear facia lamp wires on FLHX) to rear fender support. See Figure 8-121 or Figure 8-122.
7. At bottom of radio antenna bracket, rotate knurled ring to connect radio antenna cable connector [29].
8. Tighten four cable straps securing radio antenna cable to left upper frame tube and rear fender support. Cut any excess cable strap material.
9. Install chrome frame tube cover on frame tube. Install screw and tighten to 25-40 **in-lbs** (2.8-4.5 Nm).
10. Insert screw (with flat washer) through passenger seat strap and slotted hole of saddlebag front mounting bracket. Insert screw into forward hole in chrome frame tube cover. Snug screw, but do not tighten.
11. Place cover over wire trough. Starting at the rear and working forward from side to side, engage catches to latch cover. Verify that all latches are fully engaged.
12. Install fuel tank. See 4.4 FUEL TANK.
13. Install left side cover.
14. Install left side saddlebag. See 2.27 SADDLEBAGS.
15. Tighten saddlebag front mounting bracket screw to 60-96 **in-lbs** (6.8-10.8 Nm).
16. Install outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U or 2.39 UPPER FAIRING AND WINDSHIELD: FLTR.

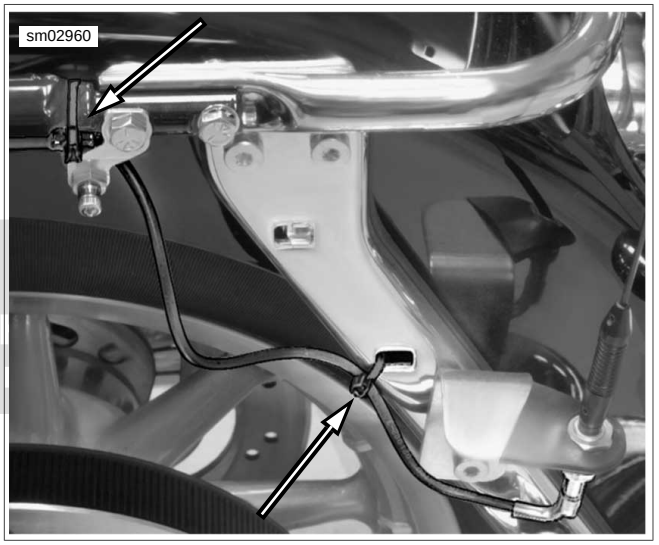



**Figure 8-121. Capture Radio Antenna Cable (FLTR)**

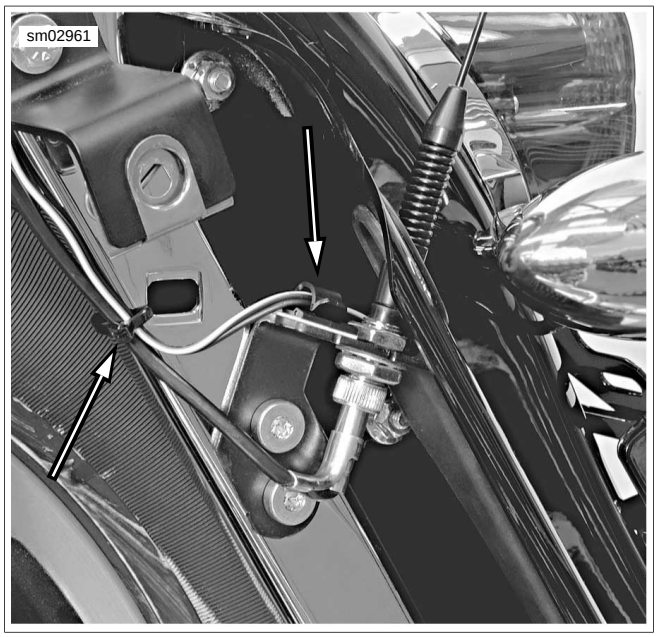
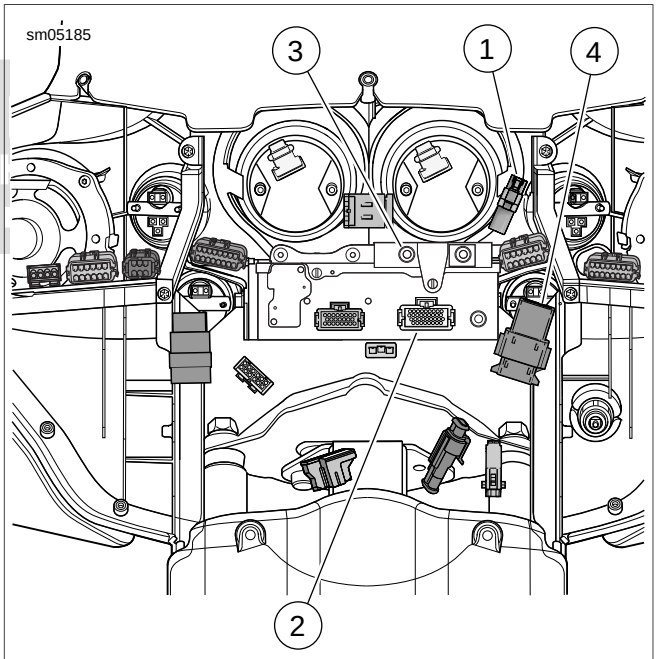



**Figure 8-122. Capture Radio Antenna Cable (FLHX)**

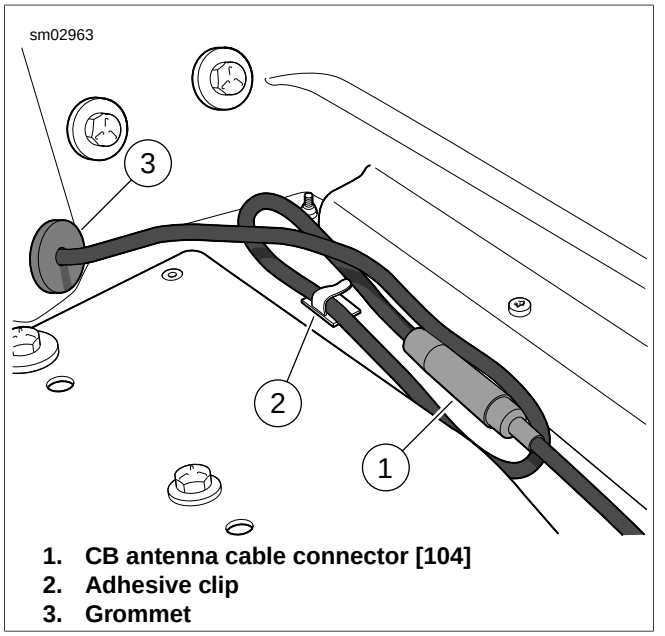
## REMOVAL

1. Remove fuel tank. See 4.4 FUEL TANK.
2. Remove right side saddlebag. See 2.27 SADDLEBAGS.
3. Remove right side cover.
4. Repeat applicable steps to remove left side saddlebag and side cover.
5. Remove outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
6. See Figure 8-123. Disconnect the following connectors:
   a. CB antenna cable [50], back of CB module (right side).
   b. Audio to interconnect harness [6], 6-place Deutsch; left side of radio.
   c. Radio [28], 35-place Amp; back of radio (left side).
   d. CB module [184], 12-place Deutsch; left side of radio.
7. Remove screw and P-clamp to release audio and main harness conduit from left side of steering head.
8. Carefully pull audio harness rearward under left side of fairing cap and allow conduit and connectors to hang over top of engine guard.
9. Open Tour-Pak. Open map pocket and remove acorn nuts (with flat washers). Remove map pocket and molded liner from Tour-Pak.
10. Disconnect CB antenna cable connector [104]. Release cable from front adhesive clip at bottom of Tour-Pak. See Figure 8-124.
11. Pull grommet into Tour-Pak and remove from CB antenna cable. Pull CB antenna cable out through hole at front of Tour-Pak.
12. Remove trim ring and gently pull on conduit to draw rear speaker/passenger controls connector [41], 6-place Deutsch, out of right side speaker box. Disconnect connector.
13. Carefully cut cable strap securing audio harness and CB antenna cable to luggage rack rail.
14. Draw rear right section of audio harness forward allowing conduit and connectors to hang beside the right side passenger footboard.
15. Remove trim ring and gently pull on wire harness to draw rear speaker/passenger controls connector [42], 6-place Deutsch, out of left side speaker box. Disconnect connector.
16. Release rear headset receptacle from bracket at bottom of left side speaker box. Disengage spring loop in wire jacket from tab on right side of license plate bracket.
17. Draw rear left section of audio harness forward allowing conduit and connectors to hang beside the left side passenger footboard.
18. Release console connector [53], 12-place Deutsch, from attachment clip anchored in hole of frame weldment at rear of battery tray. Disconnect connector.
19. Carefully cut four cable straps securing audio harness to left and right upper frame tubes.
20. Starting at front of wire trough, and working rearward, use a small flat blade screwdriver to release catches on cover. For best results, free one side of the cover and then the other.
21. Using a paint pen, draw a line where the audio harness conduit enters the wire trough at the front and also where it exits the left and right sides at the rear.
22. Draw a line on both sides of each cable strap capturing the audio harness. A gentle tug on the harness will indicate whether the cable strap must be cut. Carry the line over onto the main harness where possible.
23. Carefully cut and remove all cables straps marked with the paint pen.
24. Gently pull on audio harness to separate from the main harness.




1. **Audio to interconnect harness [6]**
2. **Radio [28]**
3. **CB antenna cable [50]**
4. **CB module [184]**

**Figure 8-123. Audio Harness Connectors (FLHTCU)**




1. **CB antenna cable connector [104]**
2. **Adhesive clip**
3. **Grommet**

**Figure 8-124. CB Antenna Cable Connector [104]**

## INSTALLATION

1. Lay **new** and used audio harnesses side by side. Transfer painted lines drawn on used harness to their approximate locations on the new harness.
2. Thread **new** cable straps through slots of wire trough where removed. Properly installed, both ends of the cable strap will be pointing upward.

*NOTE*

*If additional clearance is needed for installation of the cable straps, gently pry up rear of wire trough to release anchor pins from holes in frame backbone. Reinstall wire trough after placement of cable straps.*

3. Adjust main harness as necessary, so that the painted lines are aligned with the cable straps installed in the wire trough.
4. Place audio harness on top of main harness aligning the entrance and exit lines with the openings at front and rear of wire trough. Verify that branch containing rear headset receptacle runs down left side of wire trough, while branch containing CB antenna cable connector runs down right side.
5. Start tail end of each cable strap into eyelet, but do not tighten.
6. Route front section of audio harness forward along left side of steering head and then under left side of fairing cap to front of inner fairing.
7. Connect the following connectors:
   a. CB antenna cable [50], back of CB module (right side).
   b. Audio to interconnect harness [6], 6-place Deutsch; left side of radio.
   c. Radio [28], 35-place Amp; back of radio (left side).
   d. CB module [184], 12-place Deutsch; left side of radio.
8. Install screw and P-clamp to fasten audio and main harness conduit to left side of steering head.
9. From where the audio harness exits rear right side of wire trough, continue rearward progression along inboard side of right upper frame tube (and chrome frame tube cover), and then up the luggage rack rail to front of Tour-Pak.
10. Loosely install two **new** cable straps to secure audio harness conduit to right upper frame tube.
11. Loosely install **new** cable strap to secure audio harness conduit to luggage rack rail.
12. Feed CB antenna cable connector through hole at front of Tour-Pak. Capture cable in grommet. Install grommet in hole with the larger OD facing inside.
13. Connect CB antenna cable connector [104]. Capture cable in front adhesive clip at bottom of Tour-Pak.
14. Tighten three cable straps securing audio harness conduit to right upper frame tube and luggage rack rail. Cut any excess cable strap material.
15. Connect rear speaker/passenger controls connector [41], 6-place Deutsch. Feed connector back up into right side speaker box pressing trim ring into hole.
16. Connect console connector [53], 12-place Deutsch. Install connector onto attachment clip anchored in hole of frame weldment at rear of battery tray.
17. From where the audio harness exits rear left side of wire trough, continue rearward progression along inboard side of left upper frame tube (and chrome frame tube cover) to the luggage rack rail.
18. Connect rear speaker/passenger controls connector [42], 6-place Deutsch. Feed connector back up into left side speaker box pressing trim ring into hole.
19. Engage spring loop in wire jacket of rear headset receptacle onto tab on right side of license plate bracket. Capture headset receptacle in bracket at bottom of left side speaker box.
20. Install two **new** cable straps to secure audio harness conduit to left upper frame tube. Cut any excess cable strap material.
21. Install molded liner in Tour-Pak. Install map pocket and secure using acorn nuts (with flat washers). Close Tour-Pak.
22. Verify that audio harness runs through channel on front left side of wire trough. Make final adjustments to harness, so that painted lines are aligned with cable straps loosely installed. Tighten cable straps and cut any excess cable strap material.
23. Place cover over wire trough. Starting at the rear and working forward from side to side, engage catches to latch cover. Verify that all latches are fully engaged.
24. Install fuel tank. See 4.4 FUEL TANK.
25. Install side covers and saddlebags, right side first. See 2.27 SADDLEBAGS.
26. Install outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.

## REMOVAL

1. Remove fuel tank. See 4.4 FUEL TANK.
2. Remove right side saddlebag. See 2.27 SADDLEBAGS.
3. Remove right side cover.
4. Remove outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.
5. Rotate knurled ring to disconnect CB antenna cable connector [50] at back of CB module (right side). See Figure 8-125. Carefully cut cable where it exits audio harness conduit.
6. Starting at front of wire trough, and working rearward, use a small flat blade screwdriver to release catches on cover. For best results, free one side of the cover and then the other.
7. Carefully cut two cable straps securing audio harness conduit to right upper frame tube. Cut two cable straps securing audio harness to luggage rack rail and speaker/passenger controls conduit.
8. Open Tour-Pak. Open map pocket and remove acorn nuts (with flat washers). Remove map pocket and molded liner from Tour-Pak.
9. Disconnect CB antenna cable connector [104]. Release cable from front adhesive clip at bottom of Tour-Pak. See Figure 8-126.
10. Pull grommet into Tour-Pak and remove from CB antenna cable. Pull CB antenna cable out through hole at front of Tour-Pak.
11. Carefully cut CB antenna cable where it exits audio harness conduit.

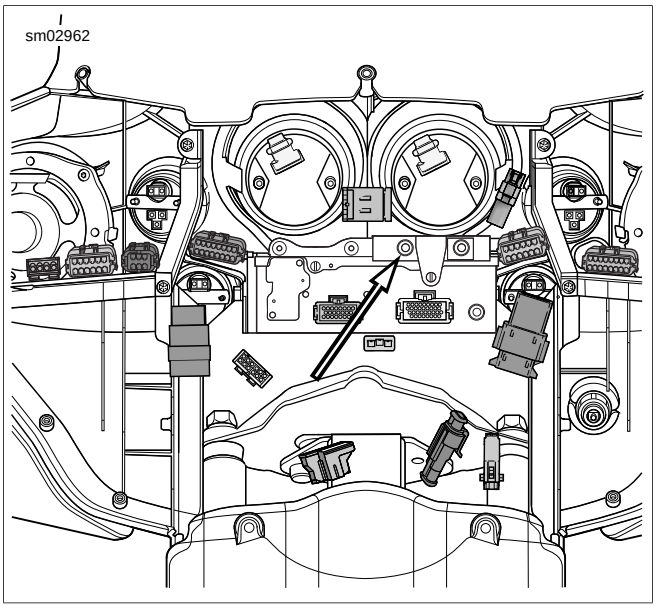
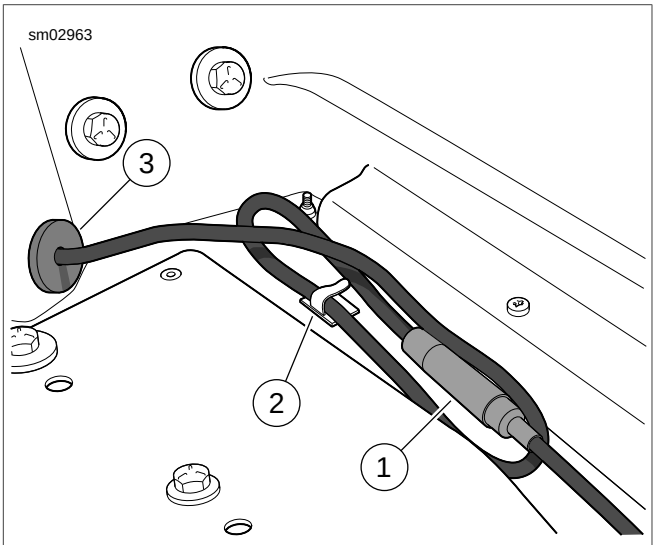



**Figure 8-125. CB Antenna Cable Connector [50]**




1. **CB antenna cable connector [104]**
2. **Adhesive clip**
3. **Grommet**

**Figure 8-126. CB Antenna Cable Connector [104]**

## INSTALLATION

1. Rotate knurled ring to connect CB antenna cable connector [50] at back of CB module (right side).
2. Route free end of CB antenna cable rearward along left side of steering head.
3. Remove screw and P-clamp to release audio and main harness conduit from left side of steering head. Capture CB antenna cable in P-clamp and reinstall.
4. Route CB antenna cable through opening at front left side of wire trough. Exiting wire trough at rear right side, route cable along inboard side of right upper frame tube. Continue rearward progression following luggage rack rail to front of Tour-Pak.
5. Loosely install two **new** cable straps to secure CB antenna cable and audio harness conduit to right upper frame tube.
6. Loosely install **new** cable strap to secure CB antenna cable and audio harness conduit to luggage rack rail. Loosely install **new** cable strap to secure CB antenna cable to speaker/passenger controls conduit. See Figure 8-127.
7. Feed CB antenna cable connector through hole at front of Tour-Pak. Capture cable in grommet. Install grommet in hole with the larger OD facing inside.
8. Connect CB antenna cable connector [104]. Capture cable in front adhesive clip at bottom of Tour-Pak.
9. Tighten three cable straps securing CB antenna cable and audio harness conduit to right upper frame tube and luggage rack rail. Tighten cable strap securing CB antenna cable to speaker/passenger controls conduit. Cut any excess cable strap material.

10. Install molded liner in Tour-Pak. Install map pocket and secure using acorn nuts (with flat washers). Close Tour-Pak.
11. Place cover over wire trough. Starting at the rear and working forward from side to side, engage catches to latch cover. Verify that all latches are fully engaged.
12. Install fuel tank. See 4.4 FUEL TANK.
13. Install right side cover.
14. Install right side saddlebag. See 2.27 SADDLEBAGS.
15. Install outer fairing. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U.

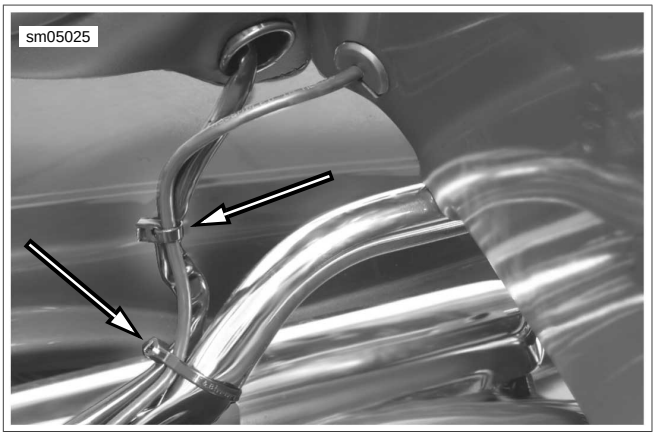



**Figure 8-127. Capture Audio Harness and CB Antenna Cable**

## 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 or install the master cylinder assembly without first positioning a 5/32-inch (4 mm) thick insert between the brake lever and lever bracket. Removing or installing the master cylinder assembly without the insert in place may result in damage to the rubber boot and plunger on the front stoplight switch. (00324a)**

*NOTE*

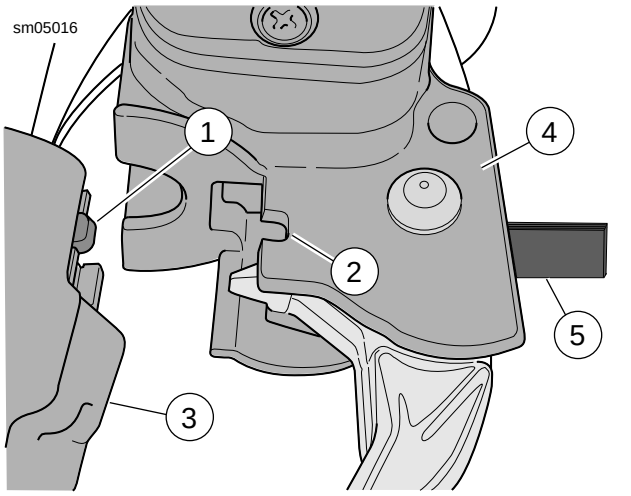
*Use the eyelet of a cable strap if the cardboard insert is not available.*

1. Place cardboard insert between brake lever and lever bracket. See Figure 8-128.
2. Remove two screws (with flat washers) securing handlebar clamp to master cylinder housing. Remove brake lever/master cylinder assembly and clamp from handlebar.
3. Remove upper and lower switch housing screws.
4. Remove friction shoe from end of tension adjuster screw (non cruise equipped models only).

*NOTE*

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

5. Cut two cable straps to release wire harness conduit from handlebar, if present.




1. **Tab**
2. **Groove**
3. **Switch housing assembly**
4. **Brake lever bracket**
5. **Cardboard insert**

**Figure 8-128. Remove Master Cylinder/Brake Lever Assembly**

### Left Handlebar Controls

1. Remove two screws (with flat washers) securing handlebar clamp to clutch lever bracket. Remove clutch hand lever assembly and clamp from handlebar.
2. Remove upper and lower switch housing screws.
3. Cut two cable straps to release wire harness conduit from handlebar, if present.
4. Remove hand grip from handlebar, if damaged. See 2.24 HANDLEBARS, Left Hand Grip.

## DISASSEMBLY

### Right Side Handlebar Switches

**CAUTION**

**Do not remove or install the master cylinder assembly without first positioning a 5/32-inch (4 mm) thick insert between the brake lever and lever bracket. Removing or installing the master cylinder assembly without the insert in place may result in damage to the rubber boot and plunger on the front stoplight switch. (00324a)**

*NOTE*

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

1. Place cardboard insert between brake lever and lever bracket.
2. Remove upper and lower switch housing screws.
3. If replacing lower housing switches, proceed to next step. If replacing upper housing switches, proceed to

8.39 HANDLEBAR SWITCH ASSEMBLIES, Specific Repair Procedures: Upper Switch Housings.

4. Loosen upper screw securing handlebar clamp to master cylinder housing. Remove lower clamp screw (with flat washer).
5. Remove friction shoe from end of tension adjuster screw (non cruise equipped models only).

*NOTE*

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

## Left Side Handlebar Switches

1. Remove upper and lower switch housing screws.
2. If replacing lower housing switches, proceed to next step. If replacing upper housing switches, proceed to 8.39 HANDLEBAR SWITCH ASSEMBLIES, Specific Repair Procedures: Upper Switch Housings.
3. Loosen upper screw securing handlebar clamp to clutch lever bracket. Remove lower clamp screw (with flat washer).

# SPECIFIC REPAIR PROCEDURES: UPPER SWITCH HOUSINGS

*NOTES*

- *Regardless of model or option, all motorcycles use the same upper switch housings.*
- *Replace 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)

1. From inside switch housing, remove screw to release bracket. Remove bracket and switch assembly from housing. See Figure 8-129.
2. Move cable conduit from beneath wing of bracket. Cut wires 0.25 in. (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 0.5 in. (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.

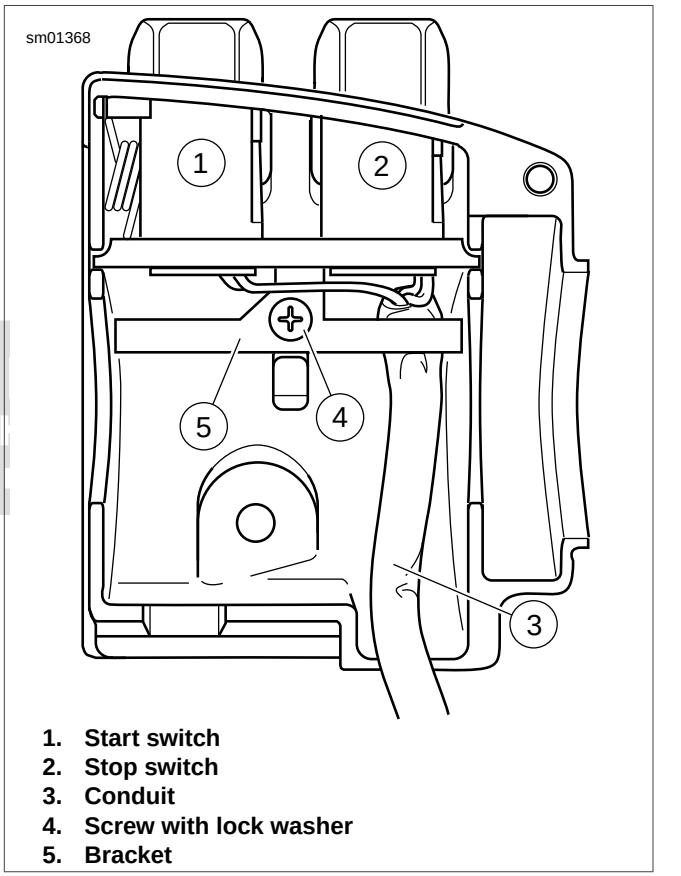
*NOTE*

*Replacement Stop Switch and Start Switch wires are cut to length, 2.5 in. (63.5 mm) and 2.0 in. (50.8 mm), respectively, and partially stripped.*

5. See 8.39 HANDLEBAR SWITCH ASSEMBLIES, General Repair Procedures.
6. Loop switch wires, so that spliced lengths are positioned as shown in Figure 8-130. Route wires downstream of splices beneath wing on Engine Stop Switch side of bracket as seen in Figure 8-129.
7. Install **new** 7.0 in. (178 mm) cable strap beneath wing on Engine Start Switch side of bracket and capture wire splices.
8. Place switch assembly into upper housing aligning hole in bracket with threaded hole in boss. Be sure that bracket is fully seated. The step at edge of boss captures bottom edge of bracket, while tabs on each side of bracket fit in slots cast into housing.
9. Install screw to secure bracket inside housing. Verify that wing on Engine Stop Switch side of bracket captures edge of conduit as shown in Figure 8-129.
10. Securely tighten cable strap to draw splices to bracket. Remove any excess cable strap material.
11. See 8.39 HANDLEBAR SWITCH ASSEMBLIES, Assembly: Right Side Handlebar Switches.

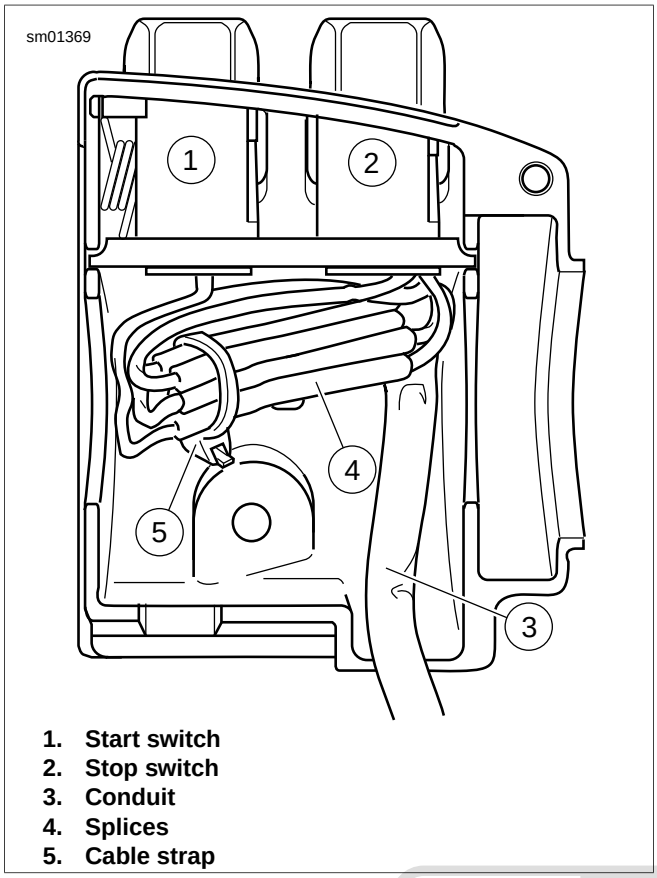
*NOTE*

*Replace Horn and High/Low Beam Switches as a single assembly even if only one switch is determined to be faulty.*




1. **Start switch**
2. **Stop switch**
3. **Conduit**
4. **Screw with lock washer**
5. **Bracket**

**Figure 8-129. Upper Right Handlebar Switch Housing (Without Splices)**




1. **Start switch**
2. **Stop switch**
3. **Conduit**
4. **Splices**
5. **Cable strap**

**Figure 8-130. Upper Right Handlebar Switch Housing (With Splices)**

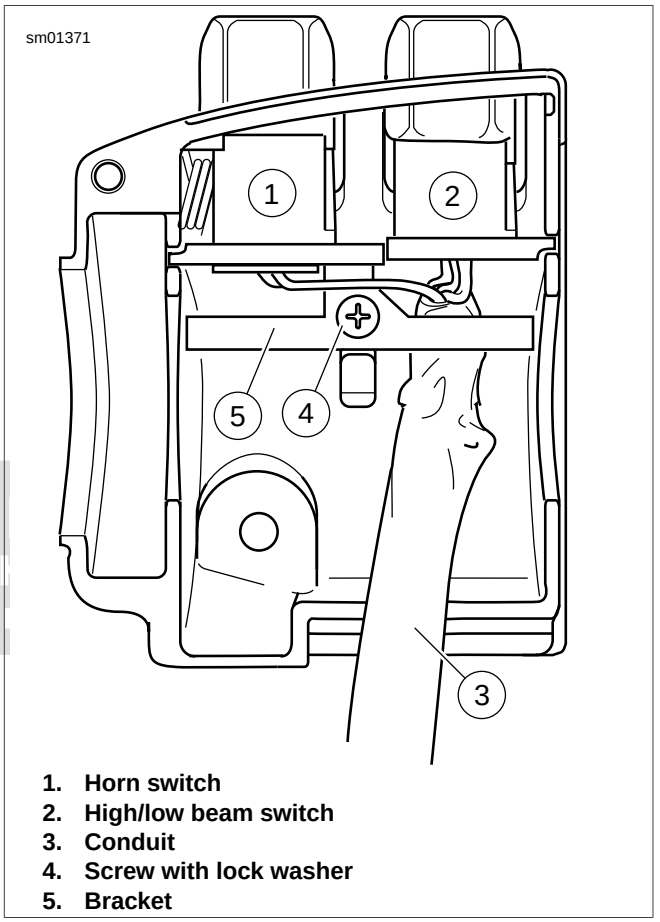
## Left Side Handlebar (All Models)

1. See Figure 8-131. From inside switch housing, remove screw to release bracket. Remove bracket and switch assembly from housing.
2. Move cable conduit from beneath wing of bracket. Cut wires 0.25 in. (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 0.5 in. (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*

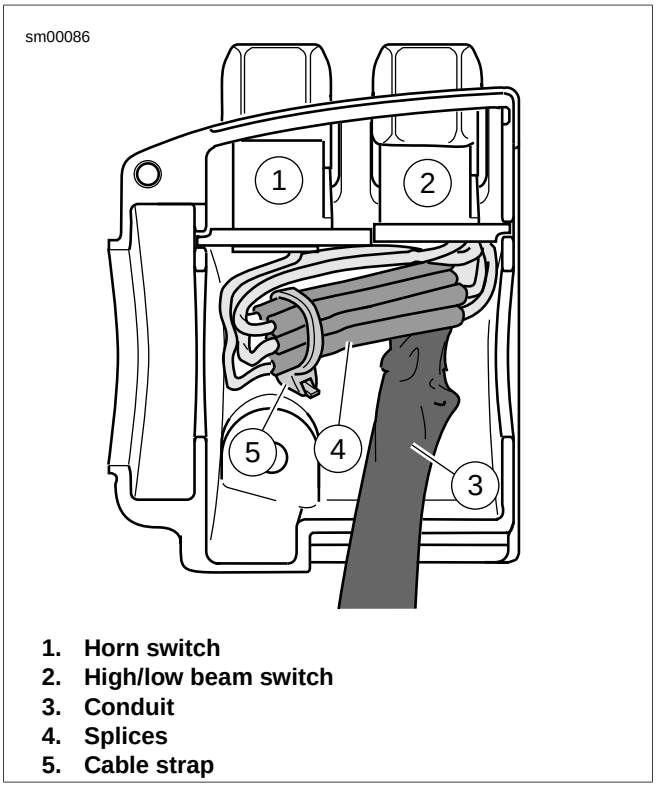
*Replacement High/Low Beam Switch and Horn Switch wires are cut to length, 2.5 in. (63.5 mm) and 2.0 in. (50.8 mm), respectively, and partially stripped.*

5. See 8.39 HANDLEBAR SWITCH ASSEMBLIES, General Repair Procedures.
6. Loop switch wires, so that spliced lengths are positioned as shown in Figure 8-132. Route wires downstream of splices beneath wing on High/Low Beam Switch side of bracket as seen in Figure 8-131.
7. Install **new** 7.0 in. (178 mm) 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 edge of boss captures bottom edge of bracket, while tabs on each side of bracket fit in slots cast into housing.
9. Install 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 8-131.
10. Securely tighten cable strap to draw splices to bracket. Remove any excess cable strap material. See Figure 8-132.
11. See 8.39 HANDLEBAR SWITCH ASSEMBLIES, Assembly: Left Side Handlebar Switches.




1. **Horn switch**
2. **High/low beam switch**
3. **Conduit**
4. **Screw with lock washer**
5. **Bracket**

**Figure 8-131. Upper Left Handlebar Switch Housing (Without Splices)**




1. **Horn switch**
2. **High/low beam switch**
3. **Conduit**
4. **Splices**
5. **Cable strap**

**Figure 8-132. Upper Left Handlebar Switch Housing (With Splices)**

## SPECIFIC REPAIR PROCEDURES: RIGHT SIDE LOWER SWITCH HOUSINGS

### Preliminary Instructions

1. From inside switch housing, carefully cut cable strap to free conduit from turn signal switch bracket, if present.
2. Remove screw to release turn signal switch bracket. Remove bracket and switch assembly from housing.

*NOTE*

*On Classic and Ultra models, pull conduit back to introduce some slack in wires or the tight fit of the bundle will prevent removal of turn signal switch bracket.*

### Turn-Right Signal Switch (All Models)

1. Cut wires 1.5 in. (38.1 mm) from old switch. Discard old switch assembly.

*NOTE*

*Replacement Turn-Right Signal Switch wires are cut to length, 1.5 in. (38.1 mm), and partially stripped.*

2. See 8.39 HANDLEBAR SWITCH ASSEMBLIES, General Repair Procedures.

### Front Stoplight Switch (All Models)

1. Carefully remove wedge between switch and switch housing, if present. To remove switch from housing, depress plunger and slowly rotate switch upward while rocking slightly.
2. Cut wires 1.0 in. (25.4 mm) from old switch. Discard old switch.

*NOTE*

*Replacement Stoplight Switch wires are cut to length, 2.5 in. (63.5 mm), and partially stripped.*

3. See 8.39 HANDLEBAR SWITCH ASSEMBLIES, General Repair Procedures.
4. Carefully depress plunger against inside wall of switch housing. With thumb over plunger bore, move switch into installed position in switch housing cavity. When plunger is positioned against thumb, slowly rotate switch downward while rocking slightly. Release plunger only after switch is properly positioned in cavity.
5. Verify that plunger is square in bore and that boot is not compressed, collapsed or torn. If necessary, gently work 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 concave side facing outward, insert wedge between switch and outboard side of switch housing. See Figure 8-133.
7. Push wedge down until it also bottoms against housing. Verify that plunger is still square in bore and then place a drop of RTV Silicone Sealant on upper corner of wedge.

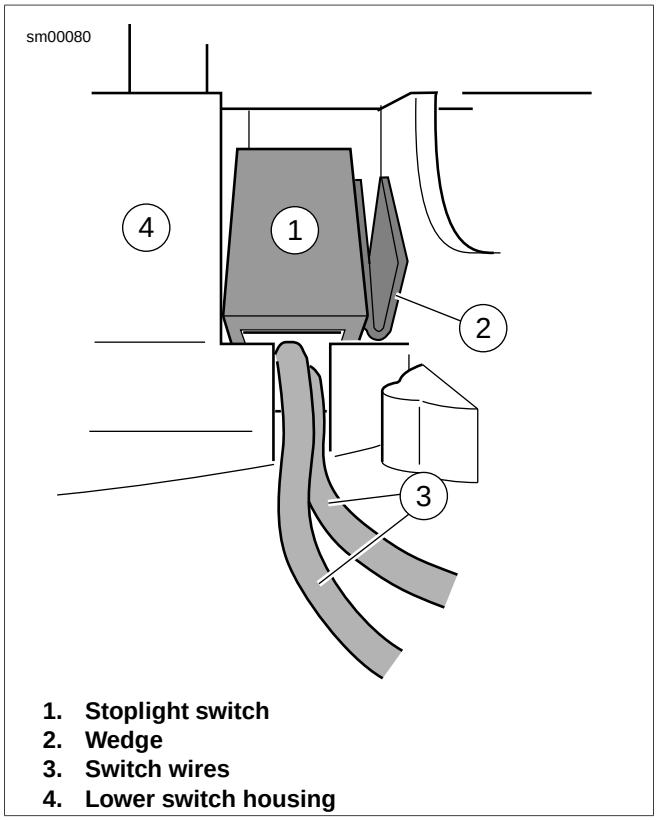
### Mode Select Switch (Classic and Ultra Models)

1. Pull keycap from switch shaft.
2. Remove two lower bracket screws. Pull bracket and switch from switch housing. See Figure 8-134.
3. Cut wires 1.25 in. (31.8 mm) from old switch. Discard switch assembly.

*NOTE*

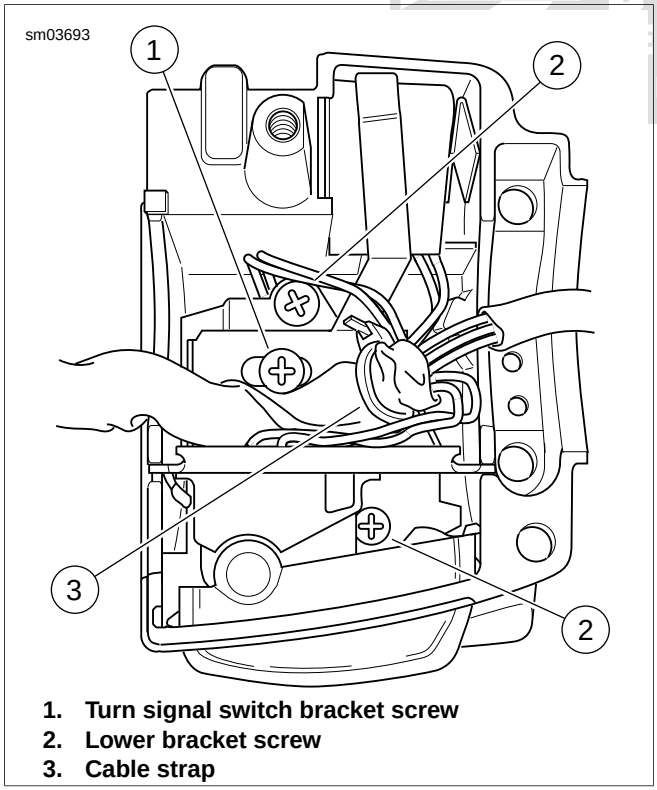
*Replacement Mode Select Switch wires are cut to length, 2.25 in. (57.2 mm), and partially stripped.*

4. See 8.39 HANDLEBAR SWITCH ASSEMBLIES, General Repair Procedures.
5. Fit **new** switch into cavity, so that it sits on edge in a vertical position (gray/white wire topside). Properly installed, switch is captured by blocks cast into lower housing. Verify that switch shaft is aligned for proper keycap operation.
6. Place lower bracket into housing (with weld nut side down), but keep splices above bracket. Verify that slots in upper step of 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.



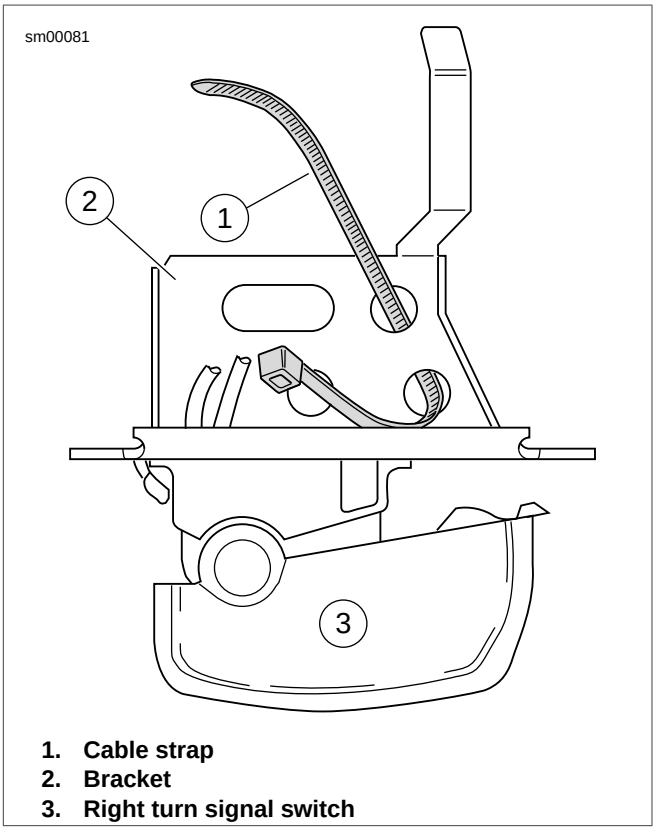

1. **Stoplight switch**
2. **Wedge**
3. **Switch wires**
4. **Lower switch housing**

**Figure 8-133. Install Stoplight Switch**




1. **Turn signal switch bracket screw**
2. **Lower bracket screw**
3. **Cable strap**

**Figure 8-134. Lower Right Handlebar Switch Housing (Without Splices) - Classic/Ultra Models**




1. **Cable strap**
2. **Bracket**
3. **Right turn signal switch**

**Figure 8-135. Insert Cable Strap in Switch Bracket**

## 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 1.5 in. (38.1 mm) from old switch. Discard switch assembly.

*NOTE*

*Replacement Cruise Set/Resume Switch wires are cut to length, 2.0 in. (50.8), and partially stripped.*

4. See 8.39 HANDLEBAR SWITCH ASSEMBLIES, General Repair Procedures.
5. Fit **new** switch into cavity, so that it sits in a horizontal position (blue/black wire towards master cylinder). Properly installed, switch is captured by blocks cast into lower housing.
6. Keeping splices above bracket, install lower bracket (weld nut side down), so that lower step is positioned over switch. Slots in upper step engage two tabs on plastic insert (Road King Classic) or on body of 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.

## Final Instructions

1. Insert tapered end of **new** 7.0 in. (178 mm) cable strap into round hole in turn signal switch bracket and then feed back through using adjacent hole. Reserve oblong hole for bracket screw. See Figure 8-135.

*NOTE*

*Be sure that all splices are positioned above the turn signal switch bracket.*

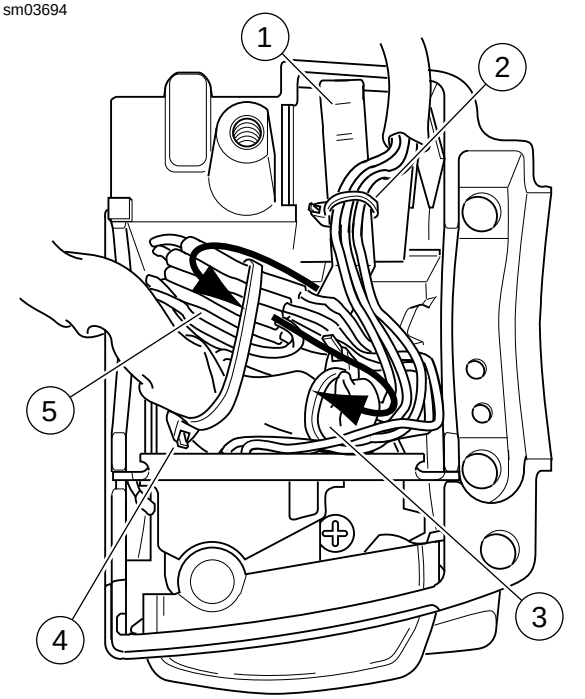
2. Place turn signal switch assembly into housing aligning oblong hole in bracket with lower bracket weld nut (threaded boss on Road King Standard models). Be sure that bracket is fully seated. Tabs on each side of bracket are captured in slots cast into switch housing.
3. Start screw to secure bracket inside housing.

**CAUTION**

**If routed incorrectly, wires can be pinched by casting or handlebar resulting in switch failure. (00542b)**

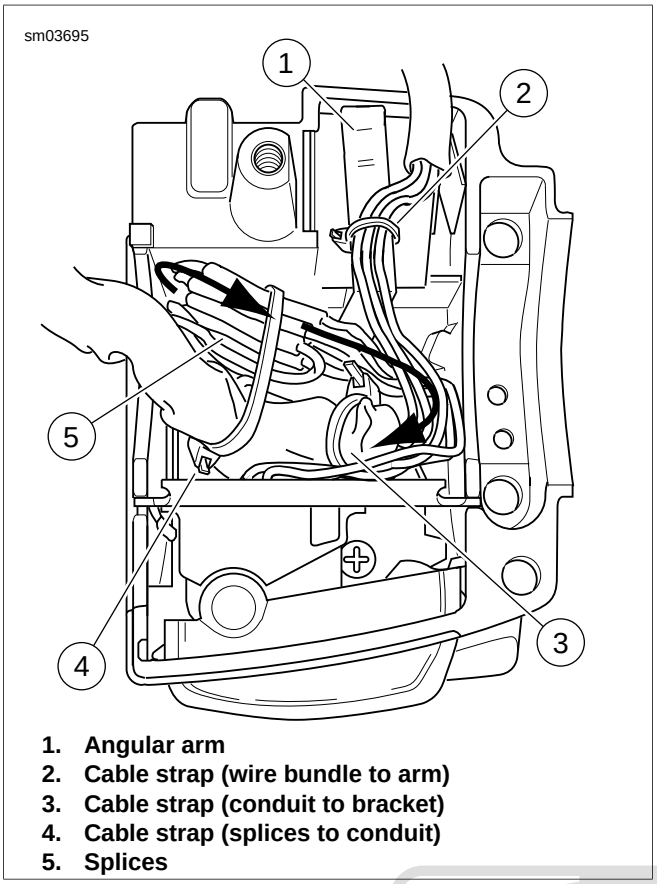
4. Loop switch wires, so that spliced lengths are positioned as shown in Figure 8-136 or Figure 8-137.
5. Capturing conduit about 0.25 in. (6.4 mm) from end, securely tighten cable strap to draw conduit to bracket. Remove any excess cable strap material.
6. Install second 7.0 in. (178 mm) cable strap capturing conduit and wire splices. Securely tighten cable strap to draw splices to conduit. Remove any excess cable strap material.
7. Tighten 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 8.39 HANDLEBAR SWITCH ASSEMBLIES, Assembly: Right Side Handlebar Switches.




1. **Angular arm**
2. **Cable strap (wire bundle to arm)**
3. **Cable strap (conduit to bracket)**
4. **Cable strap (splices to conduit)**
5. **Splices**

**Figure 8-136. Mode Select Handlebar Switch Housing (Lower Right) - Classic/Ultra Models**




1. **Angular arm**
2. **Cable strap (wire bundle to arm)**
3. **Cable strap (conduit to bracket)**
4. **Cable strap (splices to conduit)**
5. **Splices**

**Figure 8-137. Cruise Control Handlebar Switch Housing (Lower Right) - Classic/Ultra Models**

## SPECIFIC REPAIR PROCEDURES: LEFT SIDE LOWER SWITCH HOUSINGS

### Preliminary Instructions

1. From inside switch housing, carefully cut cable strap to free conduit from turn signal switch bracket, if present.
2. Remove screw to release turn signal switch bracket. Remove bracket and switch assembly from housing.

*NOTE*

*On Classic and Ultra models, pull conduit back to introduce some slack in wires or the tight fit of the bundle will prevent removal of the switch bracket.*

### Turn-Left Signal Switch (All Models)

1. Cut wires 1.5 in. (38.1 mm) from old switch. Discard old switch assembly.

*NOTE*

*Replacement Turn-Left Signal Switch wires are cut to length, 1.5 in. (38.1 mm), and partially stripped.*

2. See 8.39 HANDLEBAR SWITCH ASSEMBLIES, General Repair Procedures.

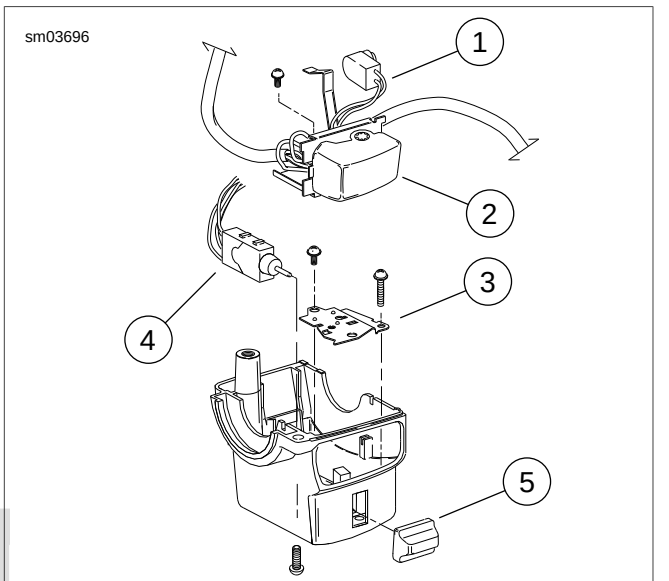
### Clutch Interlock Switch

1. Cut wires 0.25 in. (6.4 mm) from old switch. Discard switch assembly.

*NOTE*

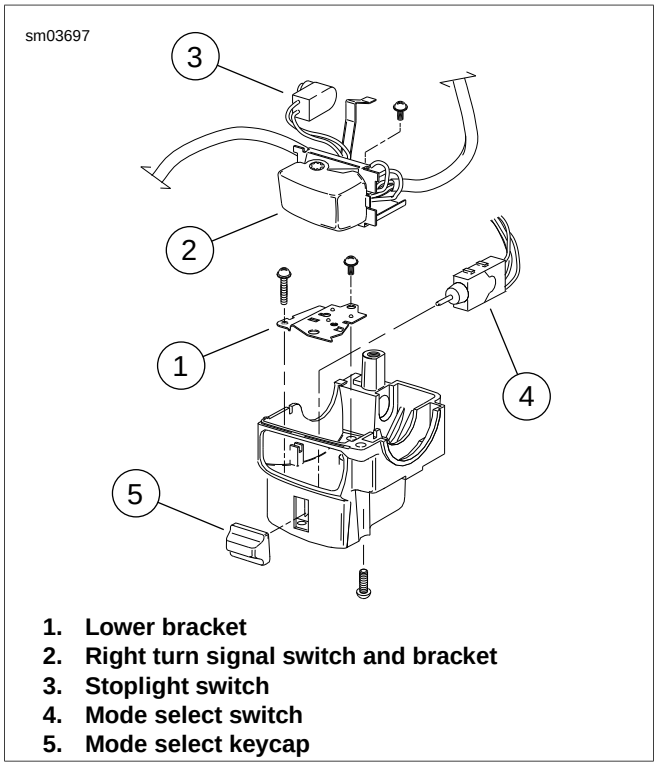
*Replacement Clutch Interlock Switch wires are cut to length and partially stripped. Looking at backside, left side switch wire is 2.25 in. (57.2 mm) long, right side is 2.75 in. (70 mm) long.*

2. See 8.39 HANDLEBAR SWITCH ASSEMBLIES, General Repair Procedures.
3. Seat switch in cavity. Verify that plunger is square in bore and that boot is not compressed, collapsed or torn. Push down on switch, so that it bottoms against housing and wires run in groove at base of cavity.



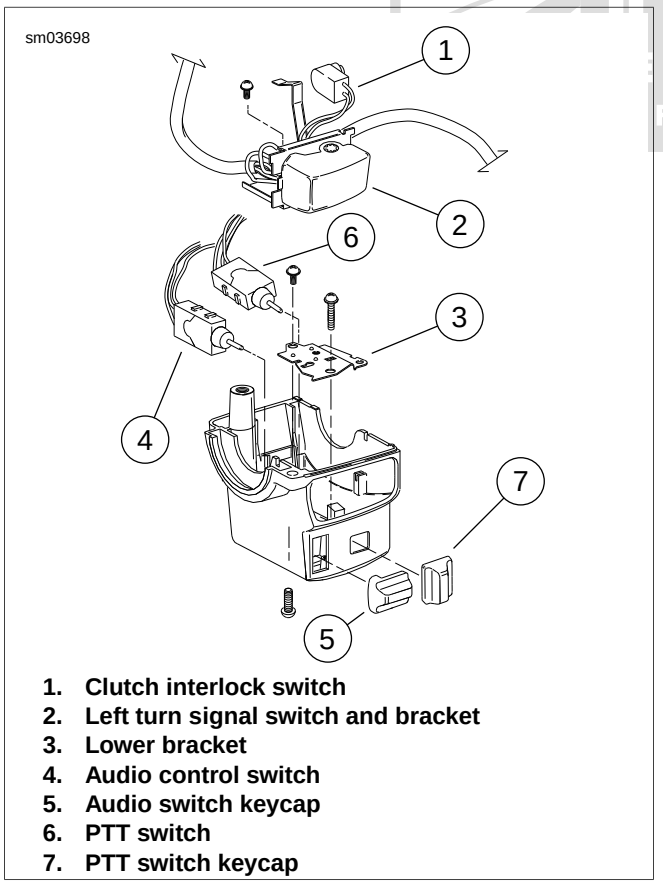

1. **Clutch interlock switch**
2. **Left turn signal switch and bracket**
3. **Lower bracket**
4. **Audio control switch**
5. **Audio switch keycap**

**Figure 8-138. Lower Left Handlebar Switch Assembly (Classic)**



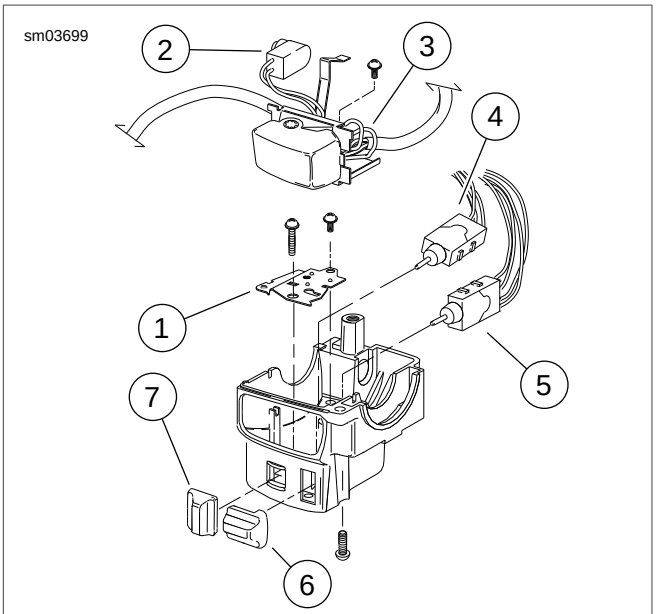

1. Lower bracket
2. Right turn signal switch and bracket
3. Stoplight switch
4. Mode select switch
5. Mode select keycap

**Figure 8-139. Lower Right Handlebar Switch Assembly (Classic)**



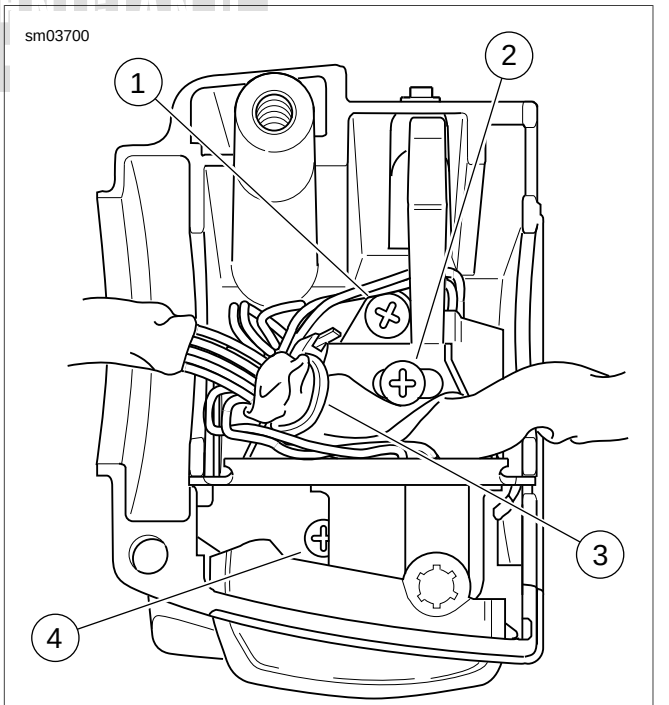

1. Clutch interlock switch
2. Left turn signal switch and bracket
3. Lower bracket
4. Audio control switch
5. Audio switch keycap
6. PTT switch
7. PTT switch keycap

**Figure 8-140. Lower Left Handlebar Switch Assembly (Ultra)**




1. Lower bracket
2. Stoplight switch
3. Right turn signal switch and bracket
4. Cruise control switch
5. Mode select switch
6. Mode select keycap
7. Cruise switch keycap

**Figure 8-141. Lower Right Handlebar Switch Assembly (Ultra)**




1. Lower bracket screw
2. Turn signal switch bracket screw
3. Cable strap
4. Lower bracket screw

**Figure 8-142. Lower Left Handlebar Switch Housing (Without Splices) - Classic/Ultra Models**

## Audio Control Switch (Classic and Ultra Models)

1. Pull keycap from switch shaft.
2. Remove two lower bracket screws. See Figure 8-142. Pull bracket and switch from switch housing.
3. Cut wires 1.25 in. (31.8 mm) from old switch. Discard switch assembly.

*NOTE*

*Replacement Audio Control Switch wires are cut to length, 2.25 in. (57.2 mm), and partially stripped.*

4. See 8.39 HANDLEBAR SWITCH ASSEMBLIES, General Repair Procedures.
5. Fit **new** switch into cavity, so that it sits on edge in a vertical position (gray/green wire topside). Properly installed, switch is captured by blocks cast into lower housing. Verify that switch shaft is aligned for proper keycap operation.
6. Place lower bracket into housing (with weld nut side down), but keep splices above bracket. Verify that slots in upper step of 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.

## CB Push-To-Transmit Switch (Ultra Models)

1. Pull keycap from switch shaft.
2. Remove two lower bracket screws. See Figure 8-142. Pull bracket and switch from switch housing.
3. Cut wires 1.5 in. (38.1 mm) from old switch. Discard switch assembly.

*NOTE*

*Replacement Push-to-Transmit Switch wires are cut to length, 2.0 in. (50.8), and partially stripped.*

4. See 8.39 HANDLEBAR SWITCH ASSEMBLIES, General Repair Procedures.
5. Fit **new** switch into cavity, so that it sits in a horizontal position (brown/black wire towards clutch lever bracket). Properly installed, switch is captured by blocks cast into lower housing.
6. Keeping splices above bracket, install lower bracket (weld nut side down), so that lower step is positioned over Push-to-Transmit Switch (horizontally oriented). Slots in 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.

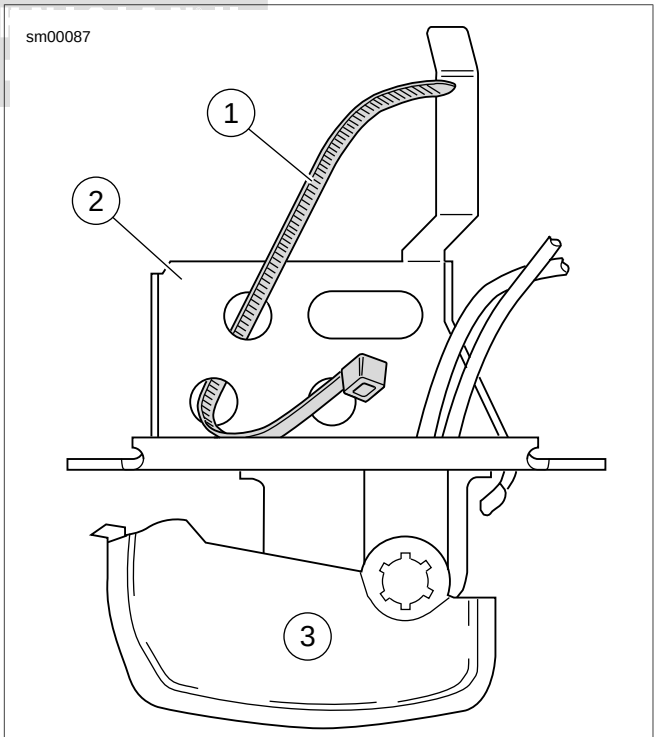
## Cruise On/Off Switch (Road King Classic Models)

1. Pull keycap from switch shaft.
2. Remove two lower bracket screws. Pull bracket and switch from switch housing.
3. Cut wires 1.5 in. (38.1 mm) from old switch. Discard switch assembly.

*NOTE*

*Cut replacement Cruise On/Off Switch wires to 2.0 in. (50.8 mm) and strip 0.5 (12.7 mm) of insulation.*

4. See 8.39 HANDLEBAR SWITCH ASSEMBLIES, General Repair Procedures.
5. Fit **new** switch into cavity, so that it sits in a horizontal position (orange/white wire towards clutch lever bracket). Properly installed, switch is captured by blocks cast into lower housing.
6. Keeping splices above bracket, install lower bracket (weld nut side down), so that lower step is positioned over switch. Slots in upper step engage two tabs on plastic insert.
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.




1. **Cable strap**
2. **Bracket**
3. **Left turn signal switch**

**Figure 8-143. Insert Cable Strap in Switch Bracket**

## Final Instructions

1. Insert tapered end of **new** 7 in. cable strap into round hole in turn signal switch bracket and then feed back through using adjacent hole. Reserve oblong hole for bracket screw. See Figure 8-143.

*NOTE*

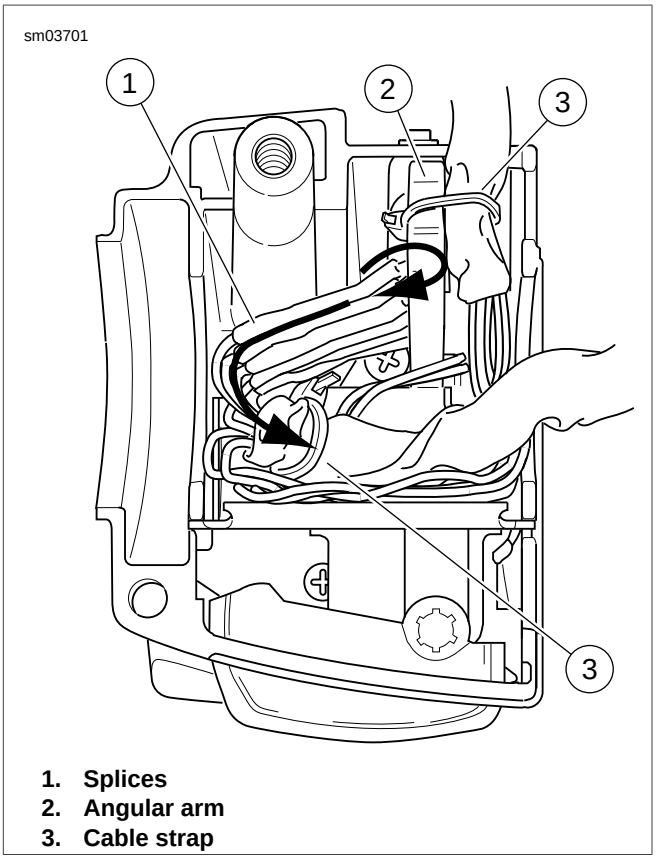
*Be sure that all splices are positioned above the turn signal switch bracket.*

2. Place turn signal switch assembly into housing aligning oblong hole in bracket with 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 screw to secure bracket inside housing.

**CAUTION**

**If routed incorrectly, wires can be pinched by casting or handlebar resulting in switch failure. (00542b)**

4. Loop switch wires, so that spliced lengths are positioned as shown in Figure 8-144.
5. Capturing conduit about 0.25 in. (6.4 mm) from end, securely tighten cable strap to draw conduit to bracket. Remove any excess cable strap material.
6. Tighten 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 8-144. Secure bundle to arm using **new** cable strap. Cut any excess cable strap material.
8. See 8.39 HANDLEBAR SWITCH ASSEMBLIES, Assembly: Left Side Handlebar Switches.




1. **Splices**
2. **Angular arm**
3. **Cable strap**

**Figure 8-144. Lower Left Handlebar Switch Housing (With Splices) - Classic/Ultra Models**

## GENERAL REPAIR PROCEDURES

1. To better access wires and avoid damaging conduit with radiant heating device, push conduit back and secure with extra 7.0 in. (178 mm) cable strap in kit.
2. Strip 0.5 in. (12.7 mm) 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 1.0 in. (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 7.0 in. (178 mm) cable straps (Part No. 10181).*

4. See Figure 8-145. Matching wire colors, mate old and new switch wires and splice as follows:
   a. Hold the wires so that the stripped ends cross (1). 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 (2).
   c. Tightly coil the remaining two-thirds of the left hand wire around the right (3).
   d. Solder the spliced connections.

*NOTE*

*For best results, do one wire at a time.*

5. Center the heat-shrink tubing over the soldered splices.

**⚠WARNING**

**Be sure to follow manufacturer's instructions when using the UltraTorch UT-100 or any other radiant heating device. Failure to follow manufacturer's instructions can cause a fire, which could result in death or serious injury. (00335a)**

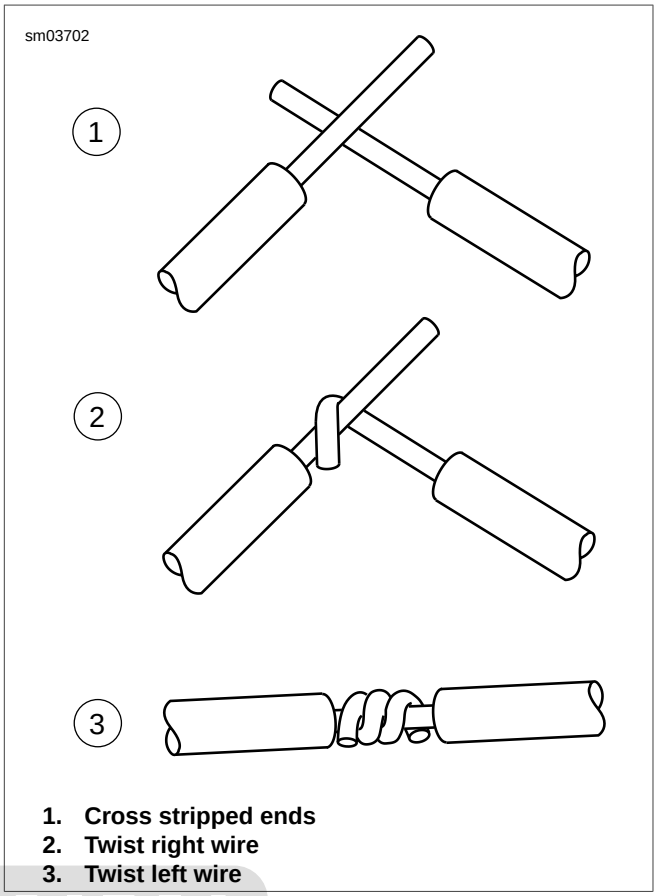
- **Avoid directing heat toward any fuel system component. Extreme heat can cause fuel ignition/explosion resulting in death or serious injury.**
- **Avoid directing heat toward any electrical system component other than the connectors on which heat shrink work is being performed.**
- **Always keep hands away from tool tip area and heat shrink attachment.**

6. See Figure 8-146. 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.

*NOTE*

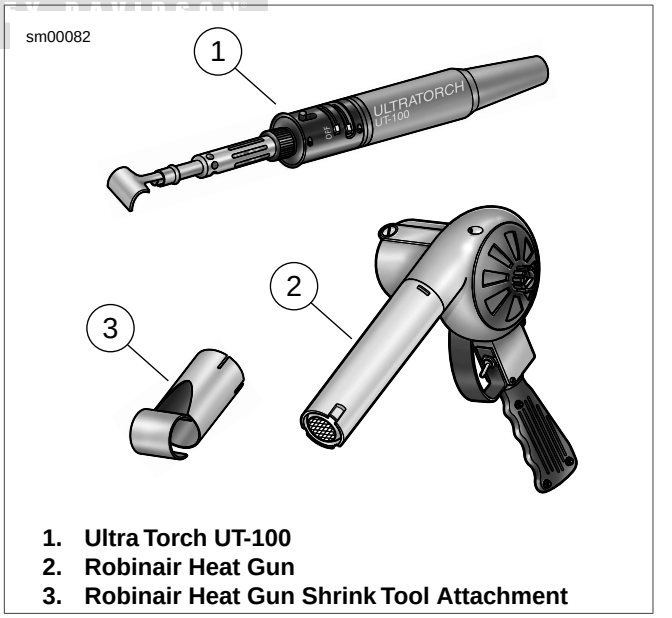
*Electrically connected solder outside the tubing may cause a short to ground resulting in switch failure.*

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.




1. **Cross stripped ends**
2. **Twist right wire**
3. **Twist left wire**

**Figure 8-145. Splice Switch Wires**




1. **Ultra Torch UT-100**
2. **Robinair Heat Gun**
3. **Robinair Heat Gun Shrink Tool Attachment**

**Figure 8-146. Radiant Heating Devices**

## ASSEMBLY: RIGHT SIDE HANDLEBAR SWITCHES

1. If replacing lower housing switches, proceed to next step. If replacing upper housing switches, proceed to step 8.

2. With concave side facing upward, install friction shoe so that pin hole is over point of adjuster screw (non cruise equipped models only).

*NOTE*

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

3. Position lower switch housing beneath throttle grip.
4. Position upper switch housing over handlebar and lower switch housing. Verify that wire harness conduit runs in depression at bottom of handlebar.
5. Start upper and lower switch housing screws, but do not tighten.
6. Position brake lever/master cylinder assembly inboard of switch housing assembly engaging tab on lower switch housing in groove at top of brake lever bracket.
7. Align holes in handlebar clamp with those in master cylinder housing and start lower screw (with flat washer). Position for rider comfort. Beginning with top screw, tighten screws to 72-80 **in-lbs** (8.0-9.0 Nm).
8. Tighten lower and upper switch housing screws to 35-45 **in-lbs** (4.0-5.0 Nm).

*NOTE*

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

9. Remove cardboard insert between brake lever and lever bracket.
10. Test switches for proper operation.

## ASSEMBLY: LEFT SIDE HANDLEBAR SWITCHES

1. If replacing lower housing switches, proceed to next step. 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 wire harness conduit runs in depression at bottom of handlebar.
3. Start upper and lower switch housing screws, but do not tighten.
4. Position clutch hand lever assembly inboard of switch housing assembly engaging tab on lower switch housing in groove at bottom of clutch lever bracket.
5. Align holes in handlebar clamp with those in clutch lever bracket and start lower screw (with flat washer). Position for rider comfort. Beginning with top screw, tighten screws to 72-108 **in-lbs** (8.0-12.0 Nm).
6. Tighten lower and upper switch housing screws to 35-45 **in-lbs** (4.0-5.0 Nm).

*NOTE*

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

7. Test switches for proper operation.

## 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 concave side facing upward, install friction shoe so that pin hole is over point of adjuster screw (non cruise equipped models only).

*NOTE*

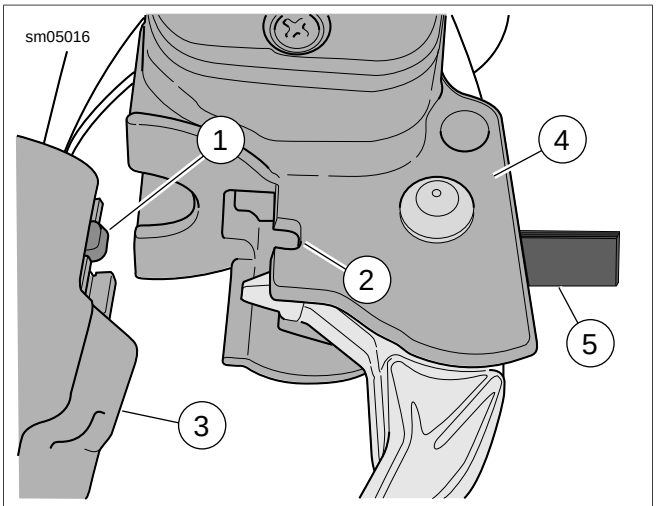
*The friction shoe is a loose fit and may fall out or become dislodged if lower switch housing is turned upside down or shaken.*

2. Position lower switch housing beneath the throttle grip.
3. Position upper switch housing over handlebar and lower switch housing.
4. Verify that wire harness conduit runs in the depression at bottom of handlebar. Be sure that upper switch housing harness will not be pinched under handlebar when switch housing screws are tightened.
5. Start upper and lower switch housing screws, but do not tighten.
6. Position brake lever/master cylinder assembly inboard of switch housing assembly engaging tab on lower switch housing in groove at top of brake lever bracket. See Figure 8-147.
7. Align holes in handlebar clamp with those in master cylinder housing and start two screws (with flat washers). Position for rider comfort. Beginning with top screw, tighten screws to 72-80 **in-lbs** (8.0-9.0 Nm).
8. Tighten lower and upper switch housing screws to 35-45 **in-lbs** (4.0-5.0 Nm).

*NOTE*

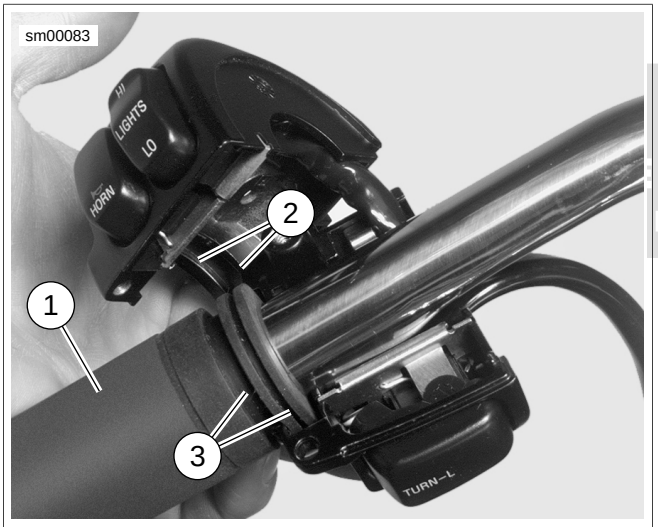
*Always tighten lower switch housing screw first, so that any gap between upper and lower housings is at front of switch.*

9. Remove cardboard insert between brake lever and lever bracket.
10. Secure wire harness conduit to handlebar using two new cable straps. Position first cable strap approximately 4.0-5.0 in. (102-127 mm) from handlebar clamp. Cut any excess cable strap material.
11. Test switches for proper operation.




1. **Tab**
2. **Groove**
3. **Switch housing assembly**
4. **Brake lever bracket**
5. **Cardboard insert**

**Figure 8-147. Remove Master Cylinder/Brake Lever Assembly**




1. **Grip sleeve**
2. **Ribs**
3. **Grooves**

**Figure 8-148. Install Left Handlebar Switch Housings**

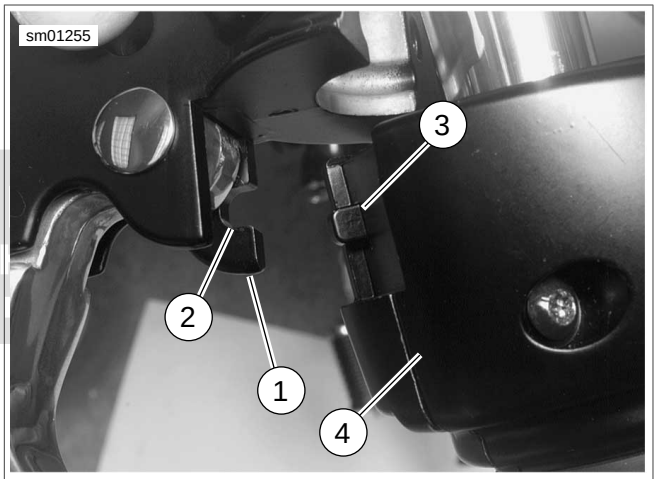
## Left Handlebar Controls

1. Install **new** hand grip, if removed. See 2.24 HANDLEBARS, Left Hand Grip.
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 8-148.
3. Verify that wire harness conduit runs in groove at bottom of handlebar. Be sure that upper switch housing harness will not be pinched under handlebar when switch housing screws are tightened.
4. Start upper and lower switch housing screws, but do not tighten.
5. Position clutch hand lever assembly inboard of switch housing assembly engaging tab on lower switch housing in groove at bottom of clutch lever bracket. See Figure 8-149.
6. Align holes in handlebar clamp with those in clutch lever bracket and start two screws (with flat washers). Position for rider comfort. Beginning with top screw, tighten screws to 72-108 **in-lbs** (8.0-12.0 Nm).
7. Tighten lower and upper switch housing screws to 35-45 **in-lbs** (4.0-5.0 Nm).

*NOTE*

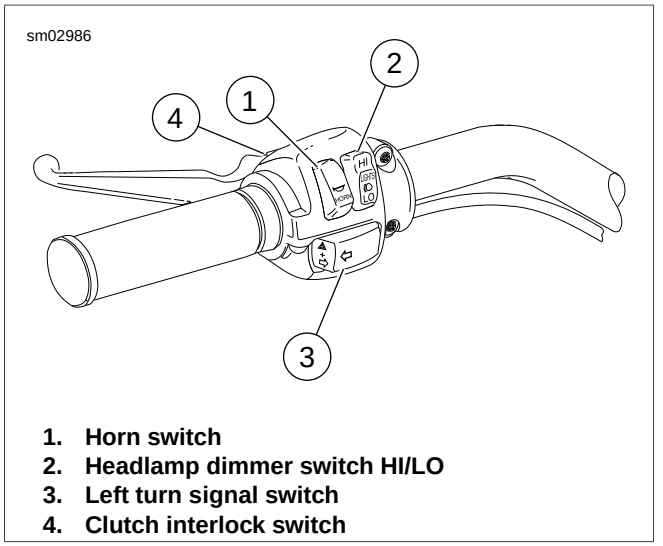
*Always tighten lower switch housing screw first, so that any gap between upper and lower housings is at front of switch.*

8. Secure wire harness conduit to handlebar using two **new** cable straps. Position first cable strap approximately 4.0-5.0 in. (102-127 mm) from handlebar clamp. Cut any excess cable strap material.
9. Test switches for proper operation.



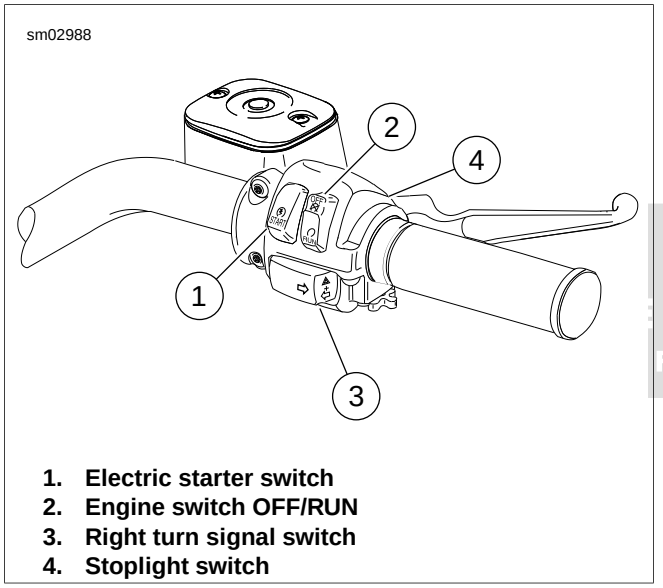

1. **Clutch lever bracket**
2. **Groove**
3. **Tab**
4. **Switch housing assembly**

**Figure 8-149. Fit Clutch Lever Bracket to Left Handlebar Switch Housing**



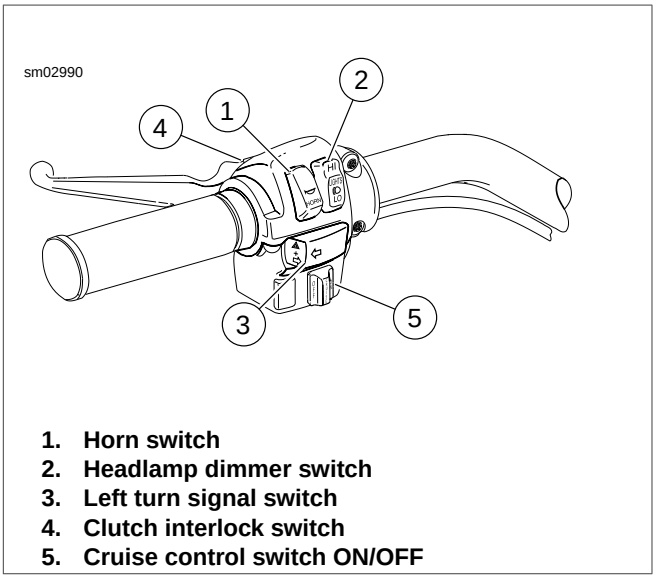

1. Horn switch
2. Headlamp dimmer switch HI/LO
3. Left turn signal switch
4. Clutch interlock switch

**Figure 8-150. Road King Left Handlebar Controls**



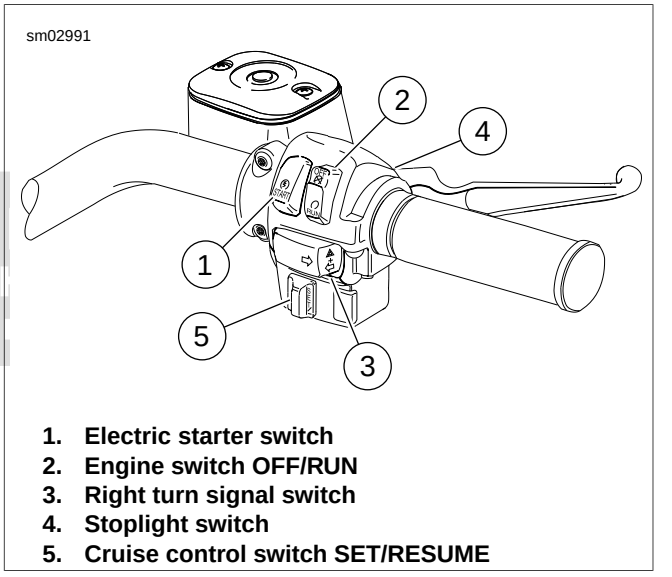

1. Electric starter switch
2. Engine switch OFF/RUN
3. Right turn signal switch
4. Stoplight switch

**Figure 8-151. Road King Right Handlebar Controls**



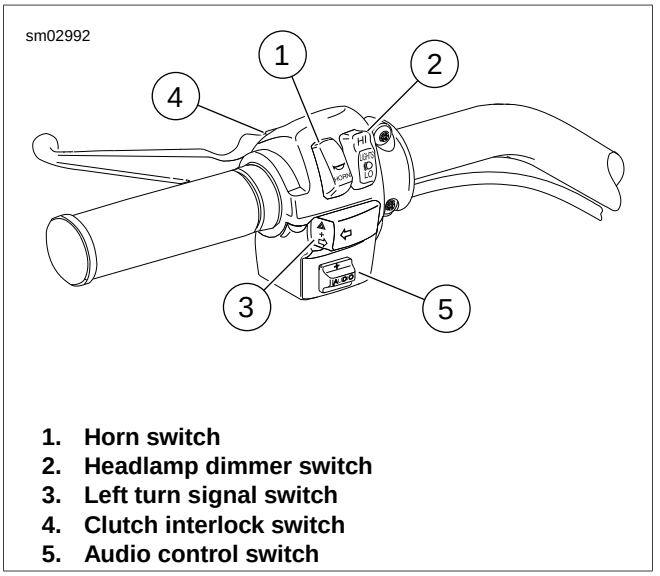

1. Horn switch
2. Headlamp dimmer switch
3. Left turn signal switch
4. Clutch interlock switch
5. Cruise control switch ON/OFF

**Figure 8-152. Road King Classic Left Handlebar Controls**



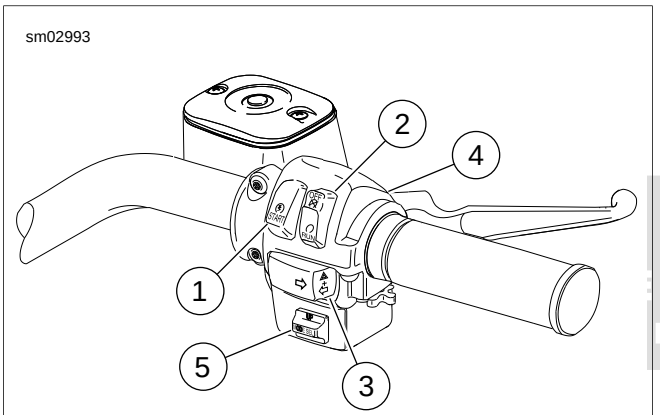

1. Electric starter switch
2. Engine switch OFF/RUN
3. Right turn signal switch
4. Stoplight switch
5. Cruise control switch SET/RESUME

**Figure 8-153. Road King Classic Right Handlebar Controls**



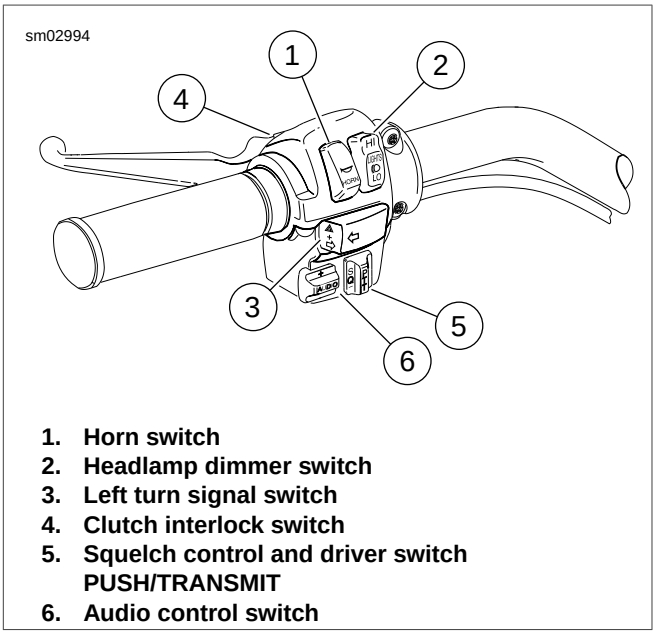

1. **Horn switch**
2. **Headlamp dimmer switch**
3. **Left turn signal switch**
4. **Clutch interlock switch**
5. **Audio control switch**

**Figure 8-154. Classic Left Handlebar Controls**



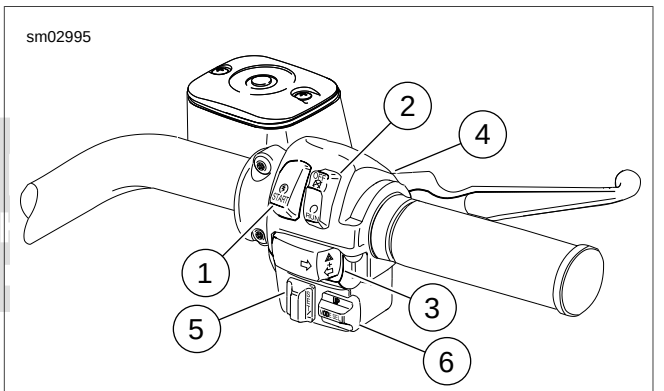

1. **Electric starter switch**
2. **Engine switch OFF/RUN**
3. **Right turn signal switch**
4. **Stoplight switch**

**Figure 8-155. Classic Right Handlebar Controls**




1. **Horn switch**
2. **Headlamp dimmer switch**
3. **Left turn signal switch**
4. **Clutch interlock switch**
5. **Squelch control and driver switch PUSH/TRANSMIT**
6. **Audio control switch**

**Figure 8-156. Ultra Left Handlebar Controls**




1. **Electric starter switch**
2. **Engine switch OFF/RUN**
3. **Right turn signal swtich**
4. **Stoplight switch**
5. **Mode select switch**
6. **Cruise control switch SET/RESUME**

**Figure 8-157. Ultra Right Handlebar Controls**

# NOTES

**SUBJECT** **PAGE NO.**

# NOTES

## AMP 1-PLACE CONNECTOR REPAIR

| PART NUMBER | TOOL NAME |
|---|---|
| HD-38125-7 | PACKARD TERMINAL CRIMPER |
| HD-39621-27 | SOCKET TERMINAL TOOL |
| HD-39621-28 | PIN TERMINAL REMOVER |

### General

Obtain the necessary tools to repair the connector or terminals.

For terminal crimping, use the PACKARD TERMINAL CRIMPER (Part No. HD-38125-7).

### Separating Pin and Socket Housings

Bend back the ears on the pin housing slightly and separate the pin and socket halves of the connector.

### Mating Pin and Socket Housings

Push the pin and socket halves of the connector together until the latches click.

### Removing Socket Terminals

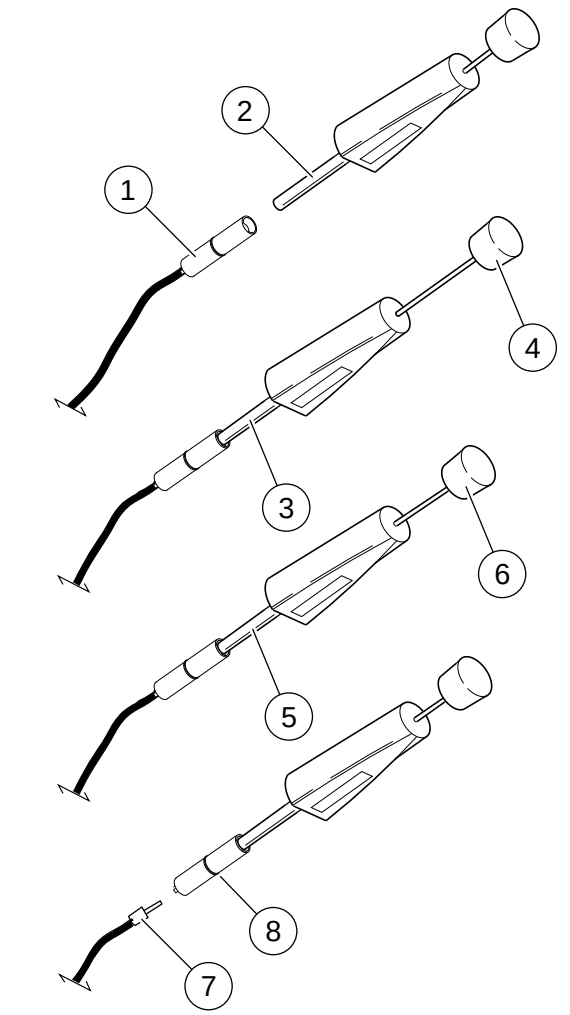
1. See Figure A-1. Grasp the lead on the wire end of the socket housing (1) and push the terminal forward toward the mating end of the connector until it stops. This will disengage the locking tang from the groove in the connector.
2. Fit the barrel (2) of the SOCKET TERMINAL TOOL (Part No. HD-39621-27) over the socket.
3. While rotating the tool slightly, push until it bottoms (3) in the socket housing.
4. Allow the plunger (4) to "back out" of the handle.
5. Holding the socket housing while keeping the tool firmly bottomed (5), depress the plunger (6). The terminal (7) 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.*

### Installing Socket Terminal

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.




1. **Socket housing**
2. **Barrel**
3. **Barrel bottomed in connector**
4. **Plunger "backed out"**
5. **Hold barrel bottomed**
6. **Plunger pressed**
7. **Socket terminal**
8. **Connector lip**

**Figure A-1. Socket Terminal Tool (HD-39621-27)**

### Removing Pin Terminal

1. 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.

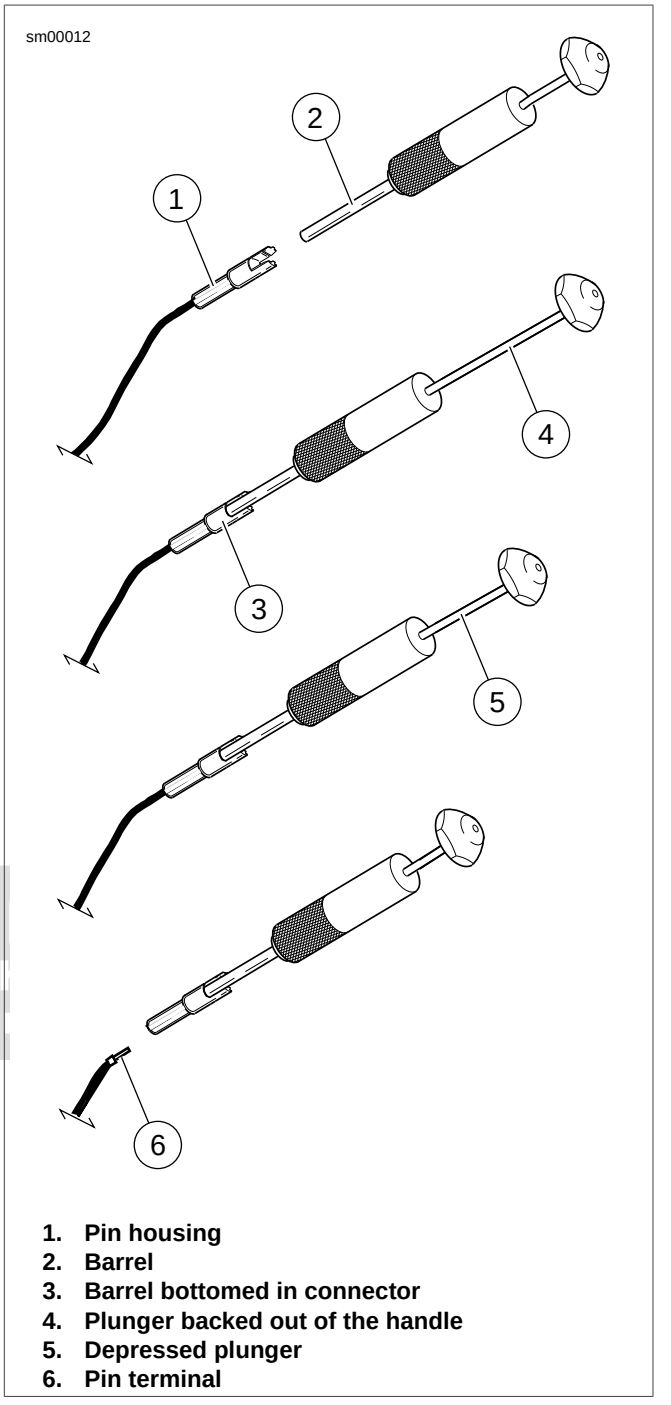
2. See Figure A-2.
   a. Fit the barrel of the PIN TERMINAL REMOVER (Part No. HD-39621-28) over the pin, and while rotating the tool slightly, push until it bottoms in the housing. Allow the plunger to "back out" of the handle.
   b. Holding the pin housing while keeping the tool firmly bottomed, depress 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.*

## Installing Pin Terminal

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.




1. **Pin housing**
2. **Barrel**
3. **Barrel bottomed in connector**
4. **Plunger backed out of the handle**
5. **Depressed plunger**
6. **Pin terminal**

**Figure A-2. AMP Pin Terminal Remover (HD-39621-28)**

## AMP MULTILOCK CONNECTOR REPAIR

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41609 | AMP MULTILOCK CRIMPER |

### General

AMP Multilock connectors are found between wire harnesses and component wiring and may be either floating or anchored to the frame with attachment clips.

See Figure A-3. Attachment clips (1) on the pin housings are fitted to T-studs on the motorcycle frame. The T-studs identify OE connector locations. To maintain serviceability, always return connectors to OE locations after service.

Obtain the necessary tools to repair the connector and terminals.

*NOTE*

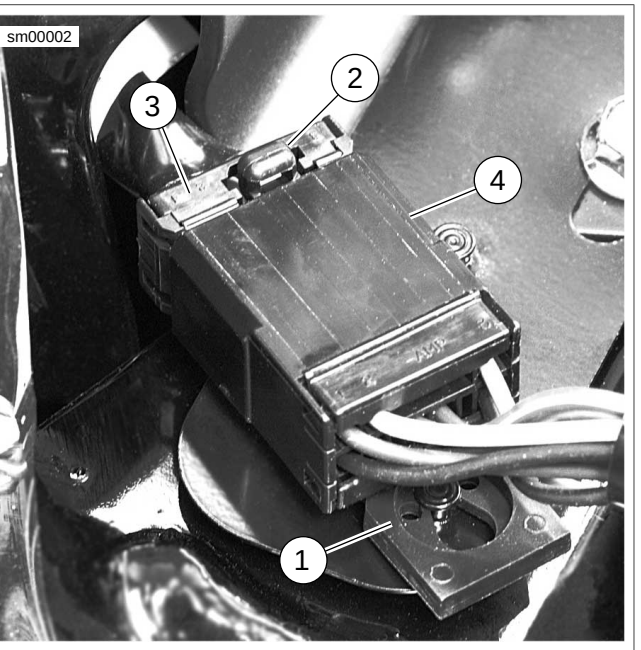
*For terminal crimping use the AMP MULTILOCK CRIMPER (Part No. HD-41609).*

### Separating Pin and Socket Housings

1. If necessary, slide connector attachment clip T-stud to the large end of the opening.
2. See Figure A-3. Depress the release button (2) on the socket terminal side of the connector and pull the socket housing (3) out of the pin housing (4).

### Mating Pin and Socket Housings

1. Hold the housings to match wire color to wire color.
2. Insert the socket housing into the pin housing until it snaps in place.
3. If OE location is a T-stud, fit large opening end of attachment clip over T-stud and slide connector to engage T-stud to small end of opening.




1. **Attachment clip**
2. **Release button**
3. **Socket housing**
4. **Pin housing**

**Figure A-3. AMP Multilock Connector**

### Removing Terminals from Housing

1. See Figure A-4. Bend back the latch (1) to free one end of secondary lock (2) then repeat on the opposite end. Hinge the secondary lock outward.
2. Look in the terminal side of the connector (opposite the secondary lock) and note the cavity next to each terminal.
3. Insert a pick or pin into the terminal cavity until it stops.

*NOTE*

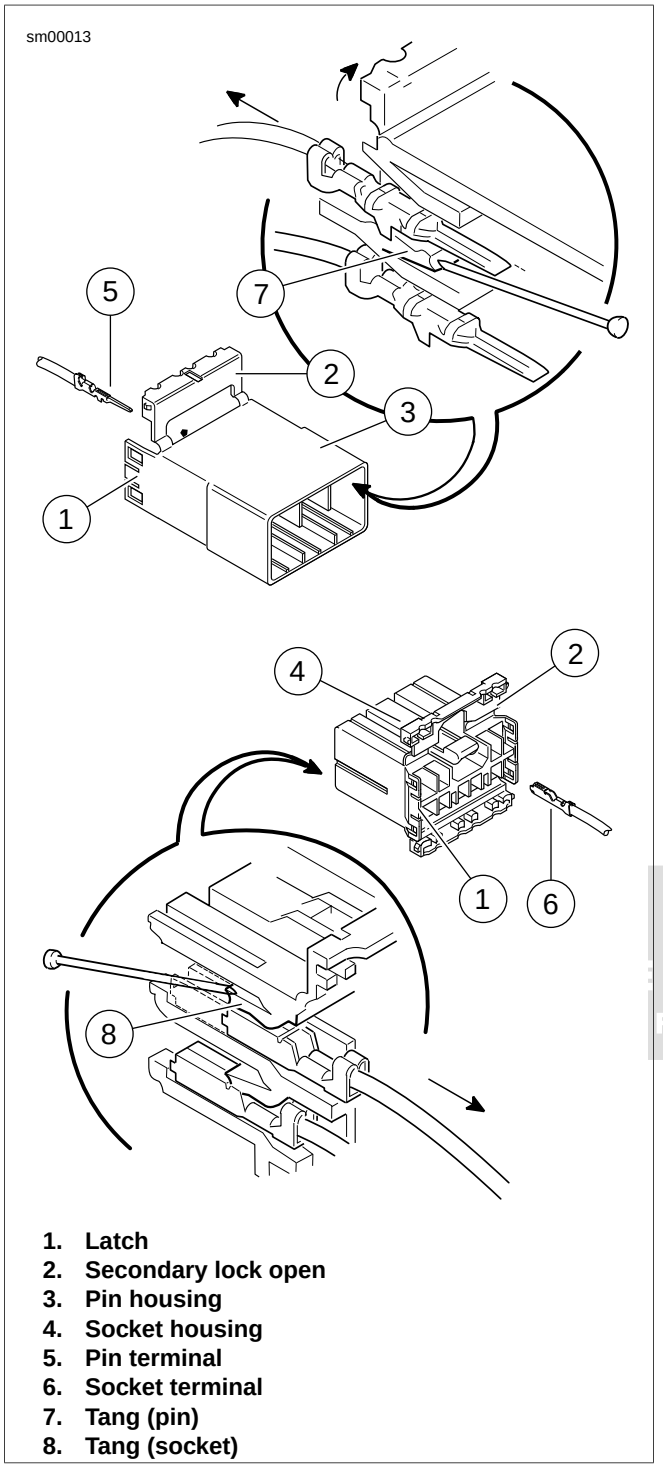
*If socket/pin terminal tool is not available, a push pin/safety pin or a Snap-on pick (Part No. TT600-3) may be used.*

4. Press the tang in the housing to release the terminal.
   a. **Socket:** Lift the socket tang (8) up.
   b. **Pin:** Press the pin tang (7) down.

*NOTE*

*A "click" is heard if the tang is released.*

5. Gently tug on wire to pull wire and terminal from cavity.




1. **Latch**
2. **Secondary lock open**
3. **Pin housing**
4. **Socket housing**
5. **Pin terminal**
6. **Socket terminal**
7. **Tang (pin)**
8. **Tang (socket)**

**Figure A-4. AMP Multilock Connector: Socket and Pin Housings**

## Inserting Terminals into Housing

*NOTE*

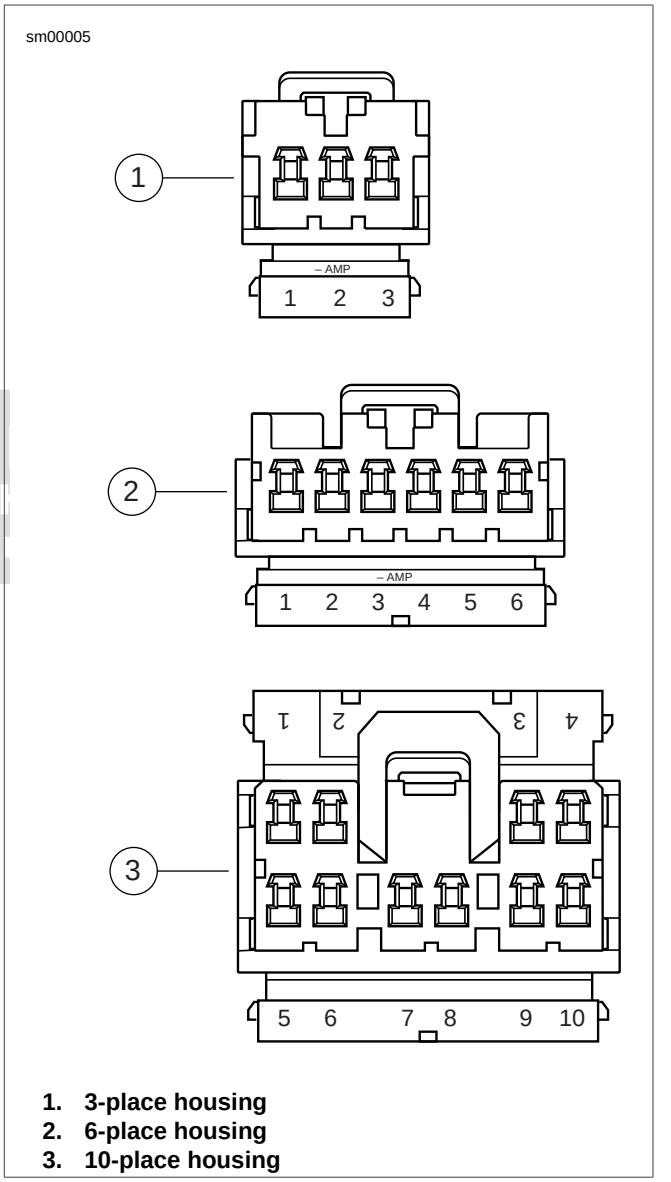
*See Figure A-5. Cavity numbers are stamped into the secondary locks of both the socket and pin housings. Match the wire color to the cavity number found on the wiring diagram.*

1. Hold the terminal so the catch faces the tang in the chamber. Insert the terminal into its numbered cavity until it snaps in place.

*NOTES*

- *Up and down can be determined by the position of the release button, the button is the top of the connector.*
- *On the pin side of the connector, tangs are positioned at the bottom of each cavity, 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 cavity, so the socket terminal slot (on the same side as the crimp tails) must face upward.*

2. Gently tug on wire end to verify that the terminal is locked in place.
3. Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.




1. **3-place housing**
2. **6-place housing**
3. **10-place housing**

**Figure A-5. AMP Multilock Connector: Cavity Numbers on Secondary Locks (Socket Housings Shown)**

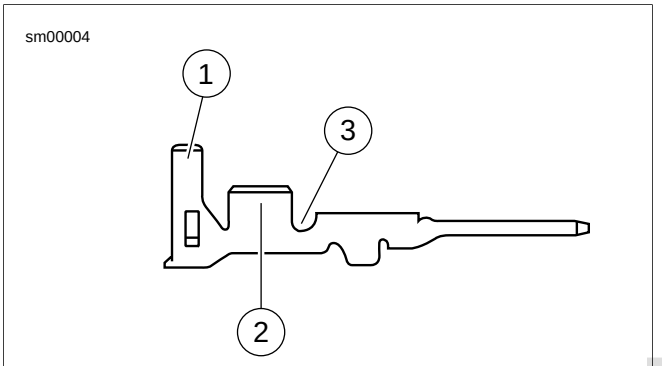
## Preparing Wire Leads for Crimping

1. Strip 5/32 in. (4.0 mm) of insulation from the wire lead.

2. See Figure A-6 and Figure A-7. Select the pin/socket terminals from the parts catalog and identify the insulation crimp tails (1) and the wire crimp tails (2) and the groove for the crimp tool locking bar (3).
3. Identify the wire lead gauge and the corresponding crimper tool and nesting die. Refer to Table A-1.

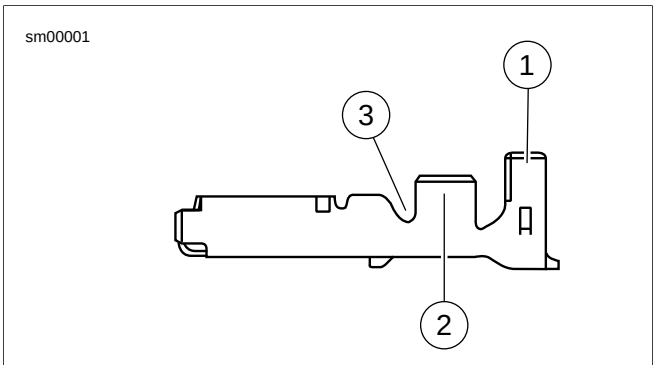
**Table A-1. AMP Multilock Connector: Crimp Tool Wire Gauge/Nest**

| WIRE GAUGE | NEST |
|---|---|
| 20 | Front |
| 16 | Middle |
| 18 | Rear |




1. **Insulation crimp tail**
2. **Wire crimp tail**
3. **Locking bar groove**

**Figure A-6. AMP Multilock Connector: Pin Terminal**




1. **Insulation crimp tail**
2. **Wire crimp tail**
3. **Locking bar groove**

**Figure A-7. AMP Multilock Connector: Socket Terminal**

## Crimping Terminals to Leads

*NOTE*

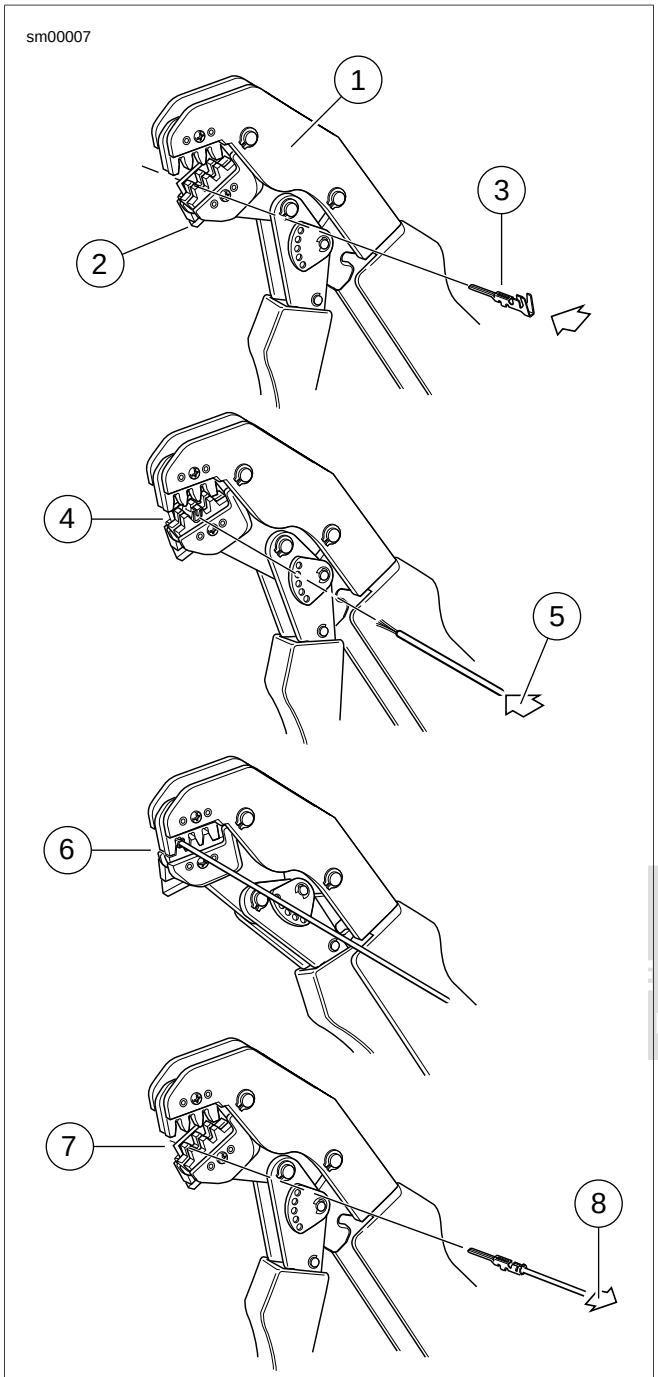
*Crimping with an Amp Multilock tool is a one step operation. One squeeze crimps both the wire core and the insulation tails.*

1. See Figure A-8. Squeeze the handles to cycle the AMP MULTILOCK CRIMPER (Part No. HD-41609) to the fully open position (1).
2. Raise locking bar by pushing up on bottom flange (2).

*NOTE*

*See Figure A-6 and Figure A-7. Hold the terminal with the insulation crimp tail (1) facing up. The tool will hold the terminal by the locking bar groove (3) and crimp the wire crimp tail (2) around the bare wire of the stripped lead and the insulation crimp tail around the insulation.*

3. See Figure A-8. With the insulation crimp tail facing upward, insert terminal (pin or socket) (3) through the locking bar, so that the closed side of the terminal rests on the nest of the crimp tool.
4. Release locking bar to lock position of contact (4). When correctly positioned, the locking bar fits snugly in the space at the front of the core crimp tails.
5. Insert stripped end of lead (5) until ends make contact with locking bar.
6. Verify that wire is positioned so that wire crimp tails squeeze bare wire strands, while insulation crimp tails fold over the wire lead insulation.
7. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.
8. Raise up locking bar (8) and remove crimped terminal.

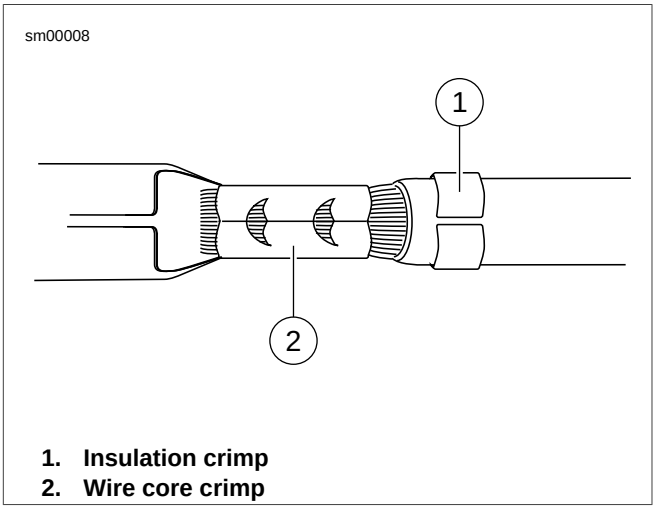



1. Open position
2. Locking bar flange
3. Insert contact
4. Release locking bar
5. Insert lead
6. Squeeze
7. Raise locking bar
8. Remove crimped terminal

**Figure A-8. AMP Multilock Connector: Terminal Crimping Procedure**

## Inspecting Crimped Terminals

See Figure A-9. Inspect the wire core crimp (2) and insulation crimp (1). Distortion should be minimal.




1. Insulation crimp
2. Wire core crimp

**Figure A-9. AMP Multilock Connector: Terminal Crimp**

## AUTOFUSE CONNECTOR REPAIR

| PART NUMBER | TOOL NAME |
|---|---|
| GA500A | SNAP-ON TERMINAL PICK |

### General

Autofuse electrical connector terminals are found in ignition switches and some fuse blocks.

### Disassembly

1. Obtain SNAP-ON TERMINAL PICK (Part No. GA500A).
2. See Figure A-10 or Figure A-11. 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.

### Assembly

1. Using a thin flat blade, like that on a hobby 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.

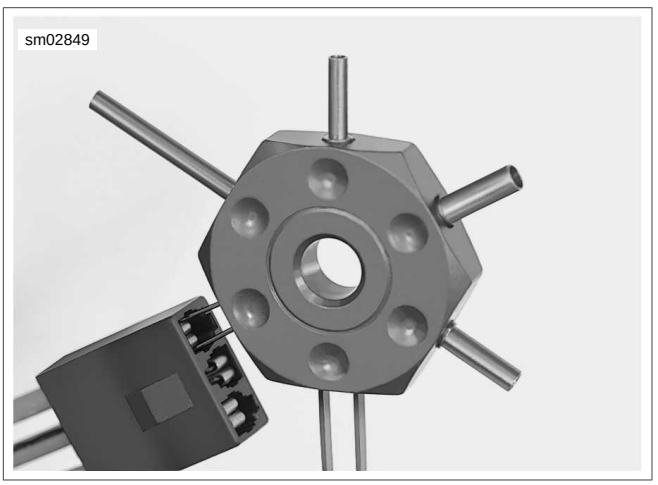



**Figure A-10. Removing Autofuse Terminal from Ignition Switch**

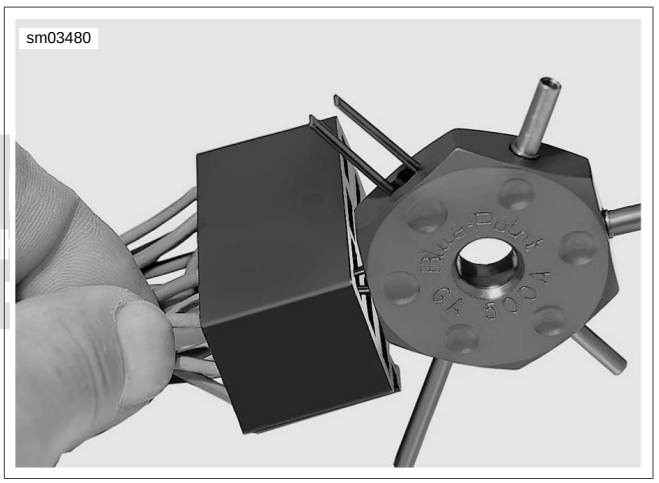



**Figure A-11. Removing Autofuse Terminal from Fuse Block**

## DELPHI CONNECTOR REPAIR

### General

Delphi connectors are embossed with the brand name, Delphi, on the housing latch.

### Separating Pin and Socket Housings

See Figure A-12. Bend back the external latch(es) slightly and separate pin and socket halves of connector.

### Mating Pin and Socket Housings

Push pin and socket halves of connector together until external latch(es) engage.

### Removing Socket Terminals

*NOTE*

*Although the parts of the different Delphi connectors vary in appearance, the instructions which follow will work for all. The only exception is the oil pressure sender connector [139B], the terminals of which are removed like the Packard push-to-seat connectors. Therefore, see A.11 PACKARD 150 METRI-PACK CONNECTORS to remove/install terminals in this connector.*

1. See Figure A-13. If present, free one side of wire lock (1) from ear on wire end of socket housing, then release the other side. Release wires from channels in wire lock and remove from socket housing.
2. Use a fingernail to pry colored terminal lock (2) loose and then remove from mating end of socket housing.
3. Using a thin flat blade, like the unsharpened edge of a hobby knife, gently pry tang (3) outward away from terminal, and then tug on wire to back terminal out wire end of chamber. Do not pull on wire until tang is released or terminal will be difficult to remove.

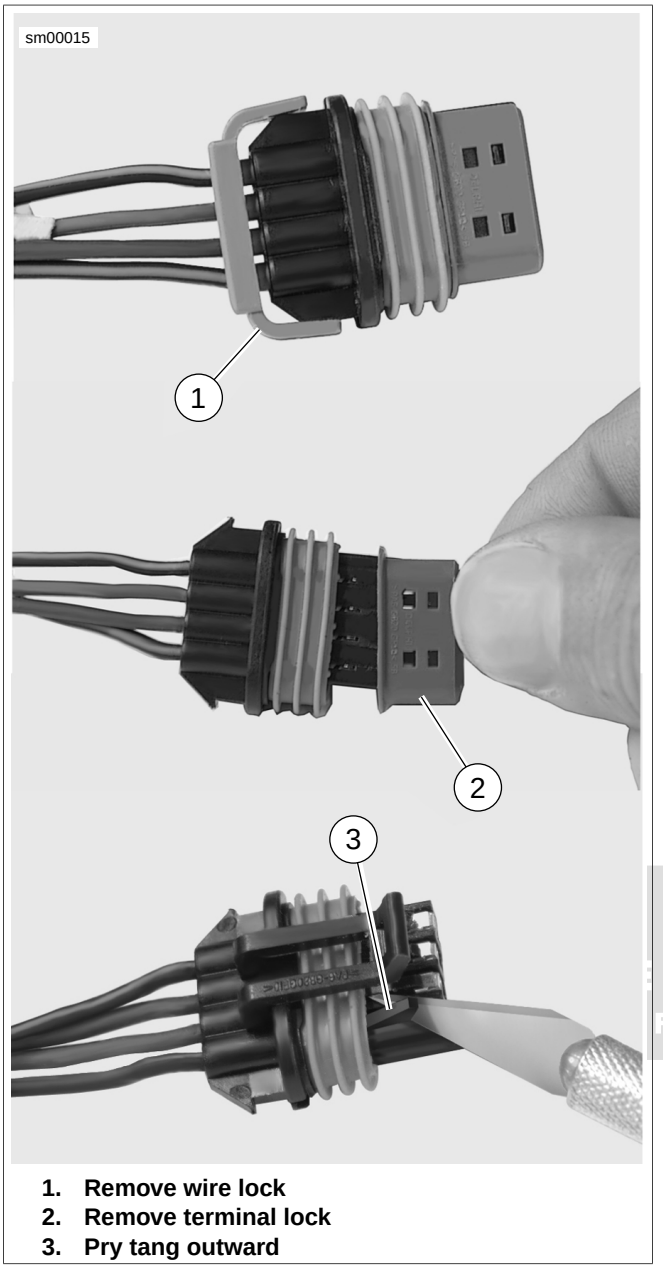
### Installing Socket Terminals

*NOTE*

*For wire location purposes, alpha or numeric characters are stamped into the wire end of each socket housing.*

1. Gently push tang on socket housing inward toward chamber. With the open side of the terminal facing the tang, push terminal into chamber at wire end of socket housing.
2. Gently tug on wire to verify that terminal is locked and will not back out of chamber. If necessary, use fingernail to push tang into engagement with terminal.
3. Install colored terminal lock onto mating end of socket housing.
4. If present, seat wires in separate channels of wire lock and then push channels **inside** chambers at wire end of socket housing. Fully installed, slot on each side of wire lock engages ear on socket housing.


**Figure A-12. Delphi Connector: Socket Housing Latch**




1. **Remove wire lock**
2. **Remove terminal lock**
3. **Pry tang outward**

**Figure A-13. Delphi Connector: Removing Socket Terminals**

## DELPHI MAXI-FUSE HOUSING REPAIR

### General

A Delphi Maxi-fuse connector completes the circuit through the main fuse (Maxi-fuse).

### Removing Maxi-Fuse

1. See Figure A-14. Depress latches on Maxi-fuse cover (1) and then slide cover off of connector (2).
2. Holding the connector (fuse holder), pull the Maxi-fuse out of the connector.

### Installing Maxi-Fuse

1. Insert the blade terminals of the Maxi-fuse into the sockets of the connector and press the Maxi-fuse into the connector.
2. Slide the cover over the fuse until the cover clicks into place.

*NOTE*

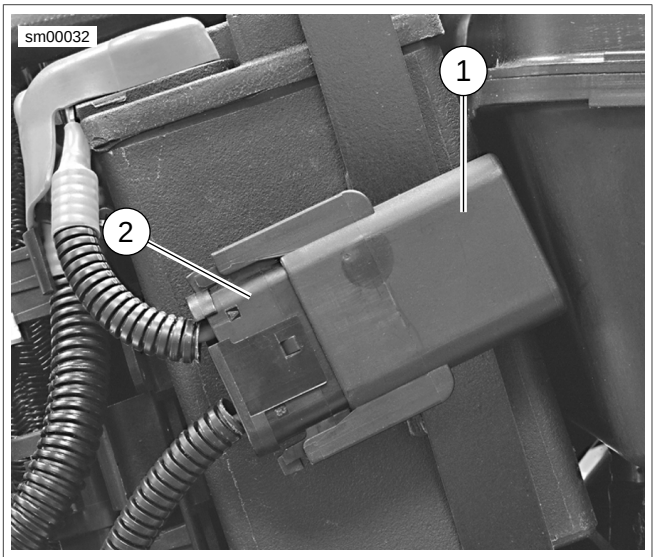
*If removed from an OE attachment such as a grooved fuse block cover, engage cover and slide into place.*

### Removing Socket Terminals

1. See Figure A-15. Gently pull socket housing to disengage slots (1) on secondary lock (2) from tabs (3) on socket housing. Free secondary lock from cables and set aside.
2. Take note of the opening on one side of the socket terminal. Gently insert flat blade of pick (Snap-On TT600-5) or small screwdriver into opening (4) until it stops. Pivot the pick toward the terminal body and hold in position.
3. Tug on cable to pull socket from wire end of socket housing. A firm tug is necessary to overcome the resistance of the rubber seal.
4. Repeat to remove remaining socket terminal.

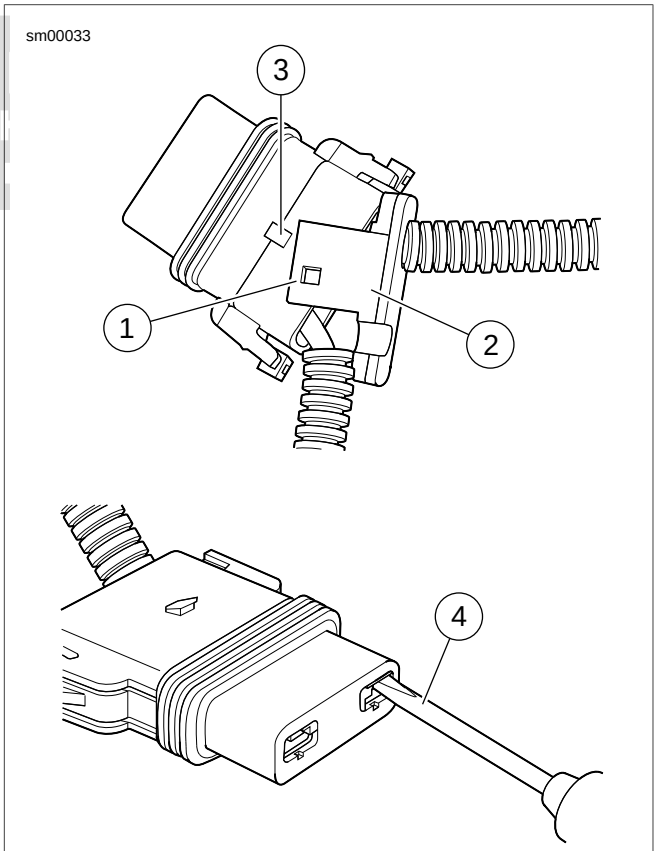
### Installing Socket Terminals

1. See Figure A-16. Carefully bend tang outward away from the terminal body.
2. Feed socket into wire end of socket housing until it clicks in place. Verify that socket will not back out of chamber. A slight tug on the cable will confirm that it is locked.
3. Push rubber seal into wire end of socket housing.
4. Repeat to install remaining socket terminal.
5. Install secondary lock onto cables and then push onto wire end of socket housing until slots engage tabs on sides of socket housing.




1. **Maxi-fuse cover**
2. **Delphi Maxi-fuse housing**

**Figure A-14. Delphi Connector Housing: Maxi-Fuse**




1. **Secondary lock slot**
2. **Secondary lock**
3. **Tab**
4. **Insert flat blade into opening**

**Figure A-15. Delphi Maxi-Fuse Housing: Remove Socket Terminals**

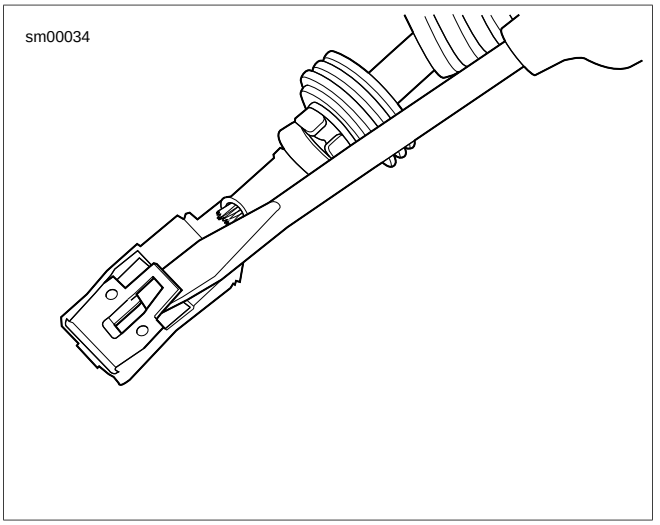



**Figure A-16. Delphi Maxi-Fuse Housing: Bend Tang**

## DEUTSCH CONNECTOR REPAIR

| PART NUMBER | TOOL NAME |
|---|---|
| HD-41475 | DEUTSCH CONNECTOR SERVICE KIT |
| HD-41475-100 | FLAT BLADE L-HOOK |

### General

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**.

*NOTE*

*A DEUTSCH CONNECTOR SERVICE KIT (Part No. 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 a FLAT BLADE L-HOOK (Part No. HD-41475-100) is used for the removal of all types of locking wedges.*

### Separating Pin and Socket Housings

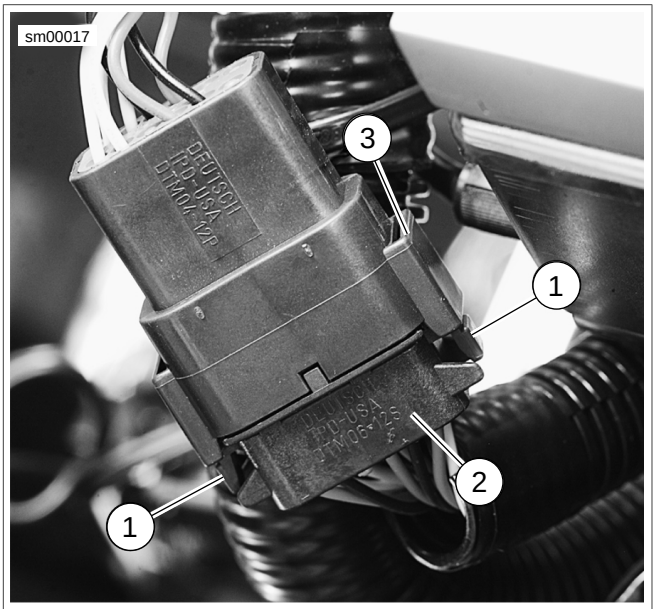
See Figure A-17. To separate the connector halves, depress the external latch(es) (1) on the socket housing (2) while rocking the pin (3) and socket housings.

*NOTES*

- *Generally, the socket housing is found on the accessory side, while the pin housing is plumbed to the wiring harness.*
- *Two-, three-, four- and six-place Deutsch connectors have one latch on the connector.*
- *Eight- and twelve-place connectors have a latch on each side. Simultaneously press both latches to separate the connector.*

### Mating Pin and Socket Housings

1. Align the connectors to match the wire lead colors.
   a. **For One External Latch:** 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.
   b. **For Two External Latches:** (8-place and 12-place) Align the tabs on the socket housing with the grooves on the pin housing.
2. Insert socket housing into pin housing until it snaps or clicks into place.
   **For Two External Latches:** (8-place and 12-place) 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.
3. If necessary, fit the attachment clip to the pin housing.
4. Place large end of slot on attachment clip over T-stud on frame. Push assembly forward to engage small end of slot.




1. **External latch**
2. **Socket housing**
3. **Pin housing**

**Figure A-17. Deutsch Connector**

### Removing Socket Terminals

1. See Figure A-18. Insert a small screwdriver between the socket housing and locking wedge in-line with the groove (in-line with the pin holes if the groove is absent). Turn the screwdriver 90 degrees to pop the wedge up and remove the secondary locking wedge.
2. See Figure A-21. Use a pick or small screwdriver to depress terminal latches inside socket housing and back out sockets through holes in rear wire seal.

*NOTE*

*If wire leads require **new** terminals, see the instructions for crimping terminals.*

### Installing Socket Terminals

1. Match wire lead color to connector cavity.
2. See Figure A-20. Fit rear wire seal (1) into back of socket housing (2), if removed.
3. Grasp wire lead (3) approximately 1.0 in. (25.4 mm) behind the socket terminal. Gently push socket through hole in wire seal into its chambers until it "clicks" in place.
4. A tug on the wire will confirm that it is properly locked in place.

*NOTE*

*Seal plugs (6) are installed through the wire seals of unused chambers. If removed, seal plugs must be replaced to seal the connector.*

5. Install internal seal (4) on lip of socket housing, if removed.
6. Insert tapered end of secondary locking wedge (5) 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.

*NOTES*

- *See Figure A-19. 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 (1) pointing toward the external latch.*
- *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.*

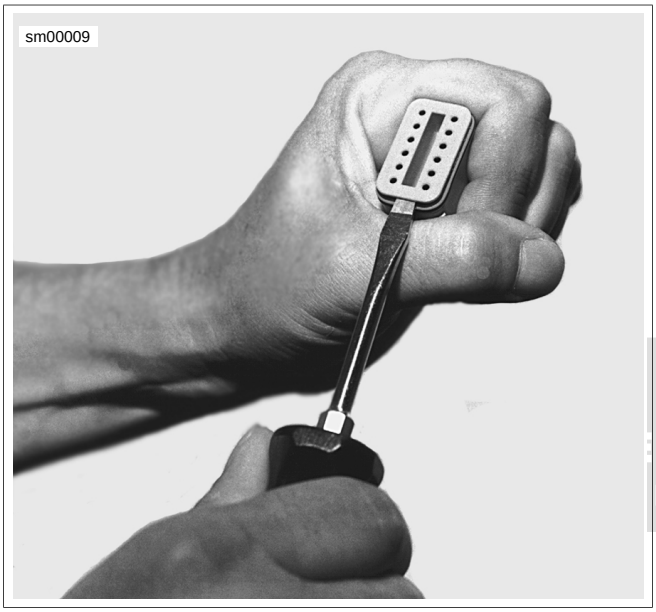
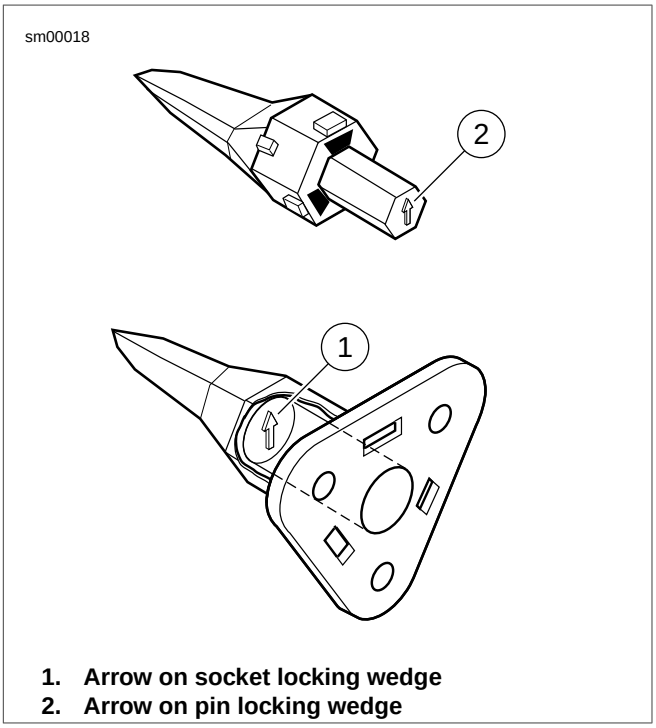
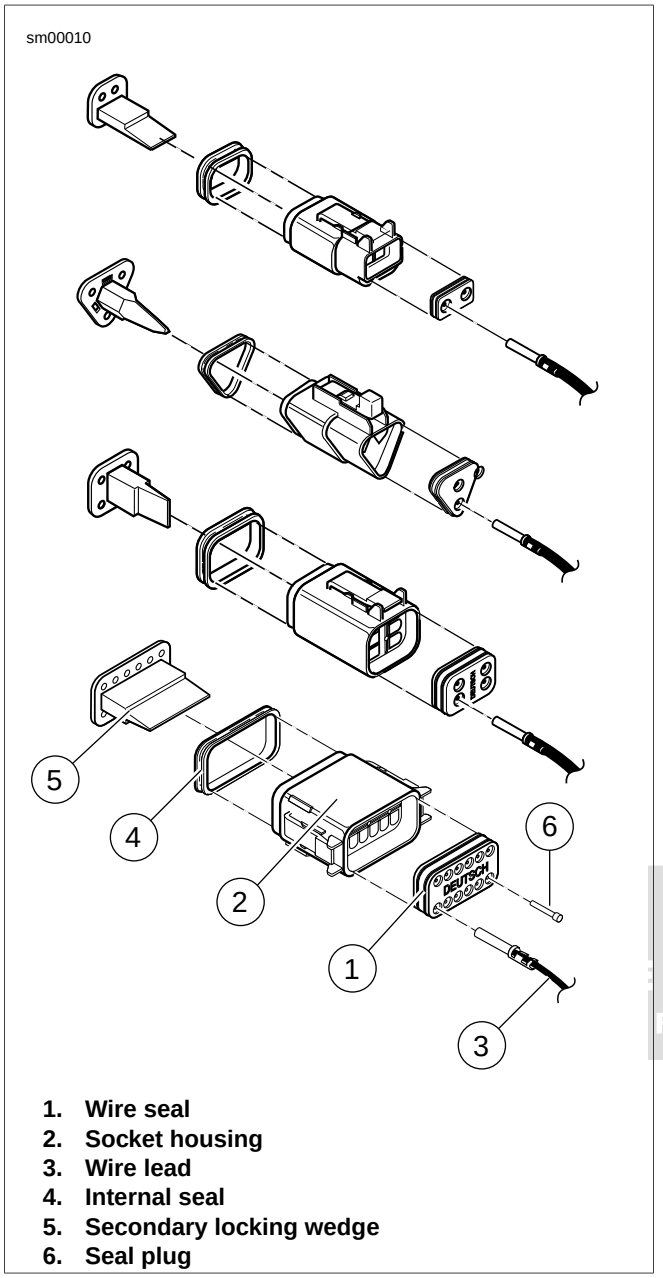



**Figure A-18. Deutsch Connector: Remove Secondary Locking Wedge**




**1. Arrow on socket locking wedge**
**2. Arrow on pin locking wedge**

**Figure A-19. Deutsch Connector: 3-Place Locking Wedges**




1. **Wire seal**
2. **Socket housing**
3. **Wire lead**
4. **Internal seal**
5. **Secondary locking wedge**
6. **Seal plug**

**Figure A-20. Deutsch Connector: 2, 3, 4 and 12-Place Socket Housings**

## Removing Pin Terminals

1. Use the hooked end of a stiff piece of mechanics wire, a needle nose pliers or the FLAT BLADE L-HOOK (Part No. HD-41475-100) to remove the secondary locking wedge.
2. Gently depress terminal latches inside pin housing and back out pins through holes in wire seal.

*NOTES*

- *If wire leads require **new** terminals, see the instructions for crimping terminals.*
- *If it should become necessary to replace a pin or socket housing, 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.*
- *When replacing both socket and pin housings, then the black may be substituted for the gray, and vice versa. The socket and pin housings 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.*

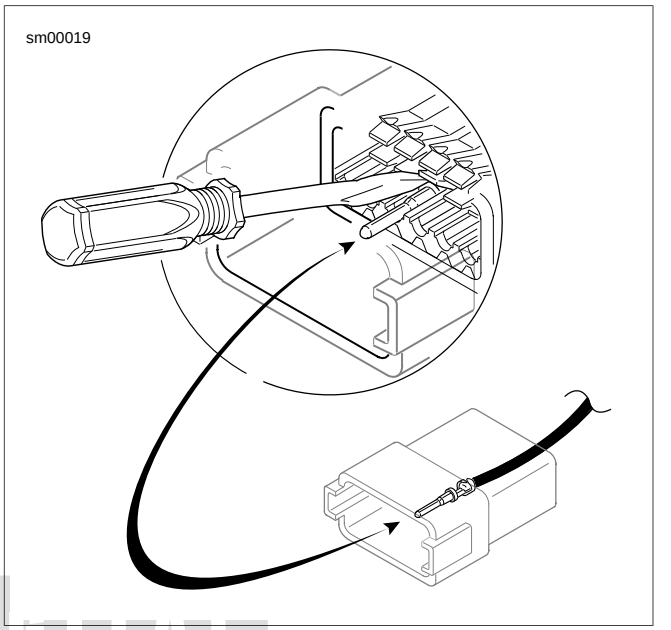



**Figure A-21. Deutsch Connector: Depress Terminal Latch and Back Out Pin**

## Installing Pin Terminals

1. See Figure A-22. Fit wire seal (1) into back of pin housing (2).
2. Grasp wire lead approximately 1.0 in. (25.4 mm) behind the pin terminal (3). Gently push pin through holes in wire seal into its respective numbered chamber until it "clicks" in place.

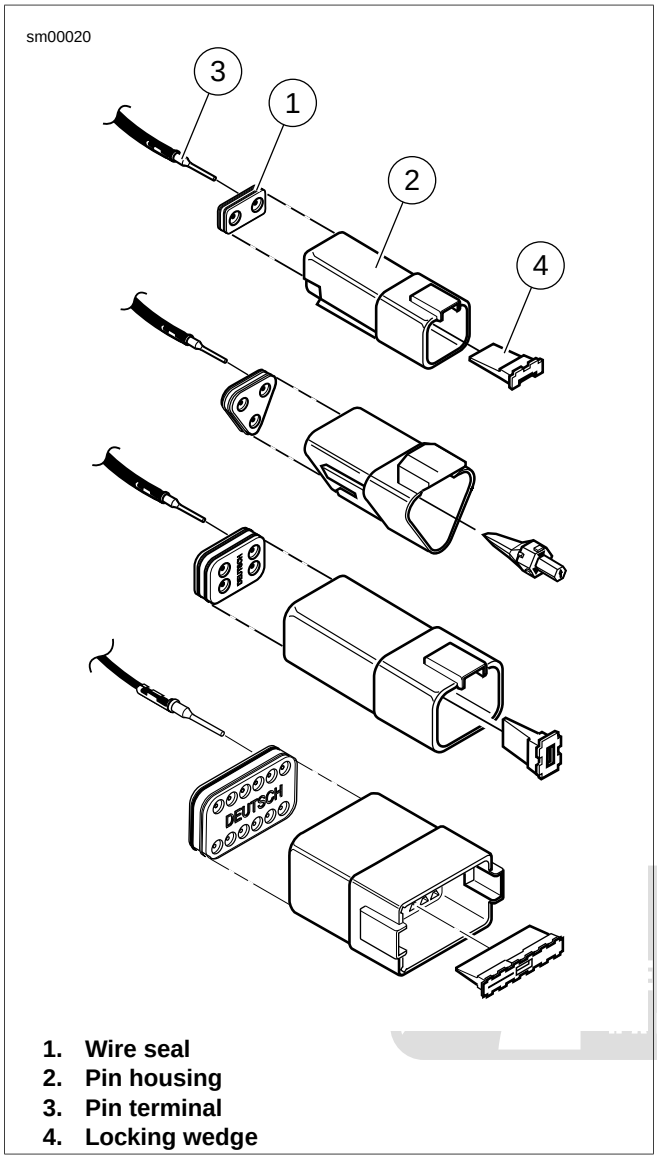
*NOTE*

*A tug on the wire lead will confirm that a pin is locked in place.*

3. Insert tapered end of secondary locking wedge (4) into pin housing and press down until it snaps in place.

*NOTES*

- *The wedge fits in the center groove of the pin housing and holds the terminal latches tightly closed.*
- *See Figure A-19. 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 (2) pointing toward the external latch.*
- *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.*




1. **Wire seal**
2. **Pin housing**
3. **Pin terminal**
4. **Locking wedge**

**Figure A-22. Deutsch Connector: 2, 3, 4 and 12-Place Pin Housings**

## Crimping Terminals

Identify which of the types of Deutsch terminals are used with the connector and follow the corresponding crimping instructions. Refer to Table A-2.

**Table A-2. Deutsch Connector: Terminal Crimping Instructions**

| TYPE | CRIMPING INSTRUCTIONS |
|---|---|
| Standard (with crimp tails) | A.7 DEUTSCH STANDARD TERMINAL REPAIR |
| Mini Terminal (solid barrel) | A.8 DEUTSCH SOLID BARREL MINI TERMINAL REPAIR |
| Mini Terminal (with crimp tails) | A.9 DEUTSCH MINI TERMINAL REPAIR |

## DEUTSCH STANDARD TERMINAL CRIMPS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-39965-A | DEUTSCH TERMINAL CRIMP TOOL |

### Preparing Wire Leads for Crimping

1. Use a shop gauge to determine gauge of wire lead.
2. Strip lead removing 5/32 in. (4.0 mm) of insulation.

### Crimping Terminal to Lead

1. See Figure A-23. Squeeze the handles of the DEUTSCH TERMINAL CRIMP TOOL (Part No. HD-39965-A) to open the jaws. Push the locking bar (1) up.
2. Insert (2) terminal (socket/pin) through hole of the locking bar, so that the rounded side of the contact barrel rests in the nest (concave split level area) with the crimp tails facing upward. To match the wire gauge to the crimp tool die, refer to Table A-3.
3. Release locking bar to lock terminal in die.

*NOTE*

*If the crimp tails are slightly out of vertical alignment, the crimp tool automatically rotates the terminal so that the tails face straight upward. When positioned, the locking bar fits snugly in the space between the contact band and the core crimp tails.*

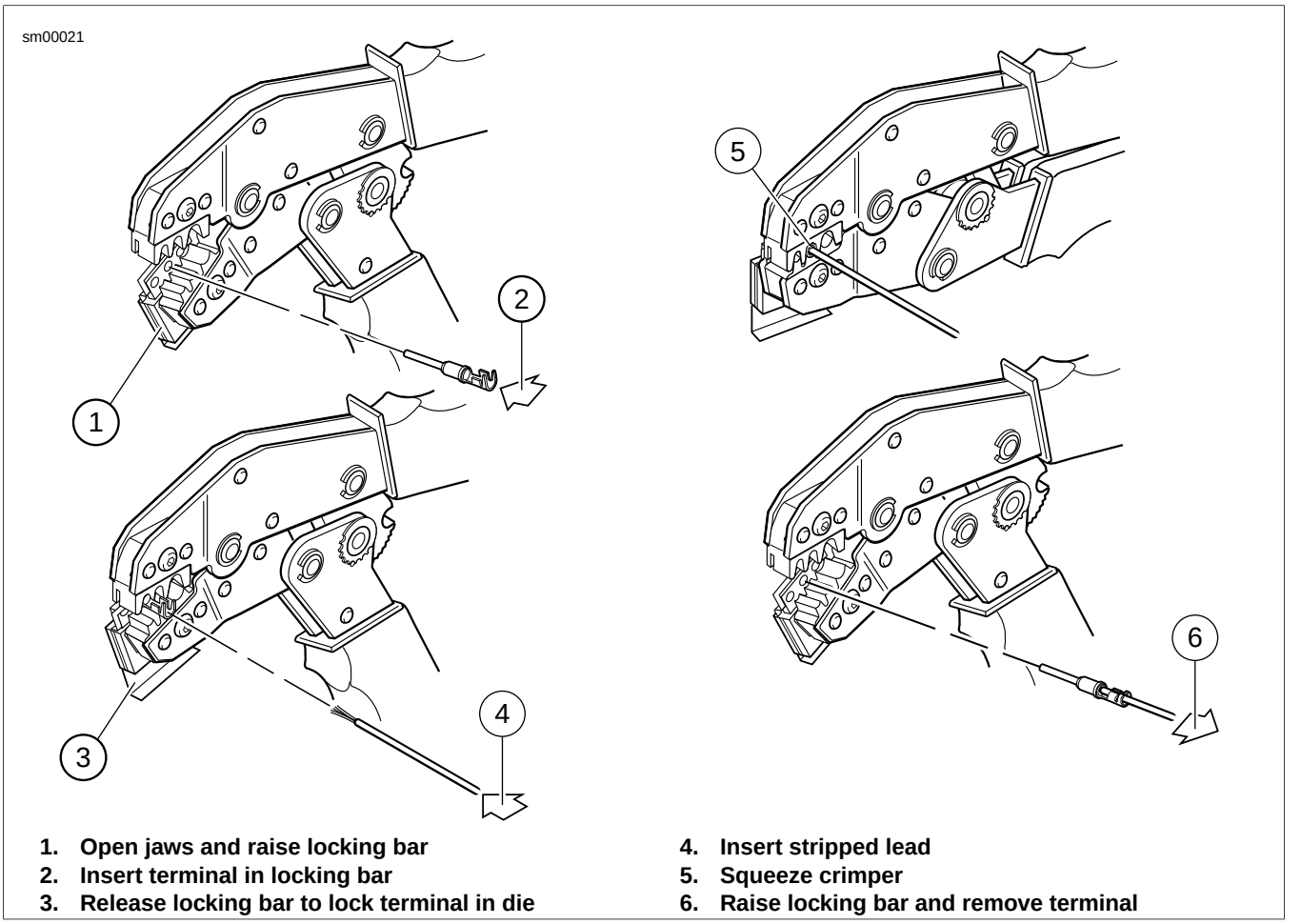
4. Insert stripped wire core between crimp tails until ends make contact with locking bar. Verify that wire is positioned so that short pair of crimp tails squeeze bare wire strands, while long pair folds over the insulation.
5. Squeeze handle of crimp tool until tightly closed. Tool automatically opens after the terminal is crimped.
6. Raise locking bar up and remove wire lead and terminal.

### Inspecting Crimps

Inspect the wire core and insulation crimps. Distortion should be minimal.

**Table A-3. Deutsch Standard Terminal Crimp: Wire Gauge To Die**

| WIRE GAUGE (AWG) | CRIMP TOOL DIE |
|---|---|
| 20 | Front |
| 16-18 | Middle |




1. **Open jaws and raise locking bar**
2. **Insert terminal in locking bar**
3. **Release locking bar to lock terminal in die**
4. **Insert stripped lead**
5. **Squeeze crimper**
6. **Raise locking bar and remove terminal**

**Figure A-23. Crimping a Deutsch Standard Terminal**

## DEUTSCH SOLID BARREL TERMINAL CRIMPS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-42879 | ELECTRICAL CRIMPER TOOL |

### Preparing Wire Leads For Crimping

For size 20, 16 and 12 contacts, wire ranges 26-12 AWG.

Strip wire lead removing 1/4 in. (6.4 mm) of insulation.

### Adjusting Crimper Tool

1. See Figure A-24. Squeeze the ELECTRICAL CRIMPER TOOL (Part No. HD-42879) handles to cycle the crimp tool to open.
2. Remove locking pin (1) from selector knob (2).
3. Raise selector knob and rotate until selected wire size stamped on wheel is aligned with "SEL. NO." arrow (3).
4. Loosen knurled locknut (4) and turn adjusting screw (5) clockwise (in) until it stops.

### Crimping a Barrel Contact To Wire Lead

1. See Figure A-25. Turn tool over and drop contact barrel (1) into indentor cover (2) hole with the wire end out.
2. Turn adjusting screw counterclockwise (out) until contact is flush with bottom of depression in indentor cover. Tighten knurled locknut.
3. Slowly squeeze handles of crimp tool until contact is centered between the four indentor points (3).
4. Insert bare wire core strands of stripped wire lead (4) into contact barrel. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.
5. Remove wire lead with crimped contact from indentor.

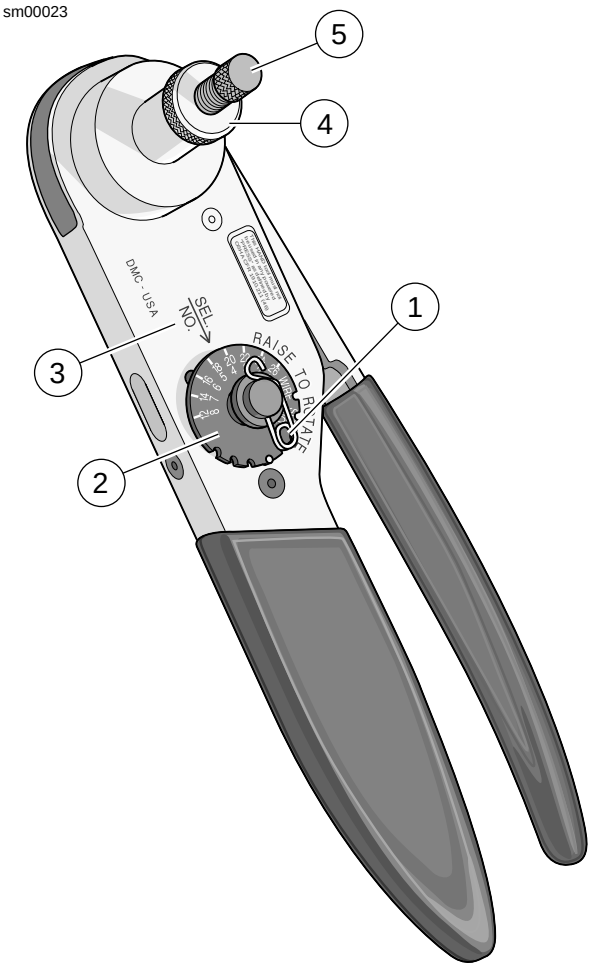
*NOTE*

*Tool must be readjusted when changing contact size/type.*

6. Install pin to lock selector knob.

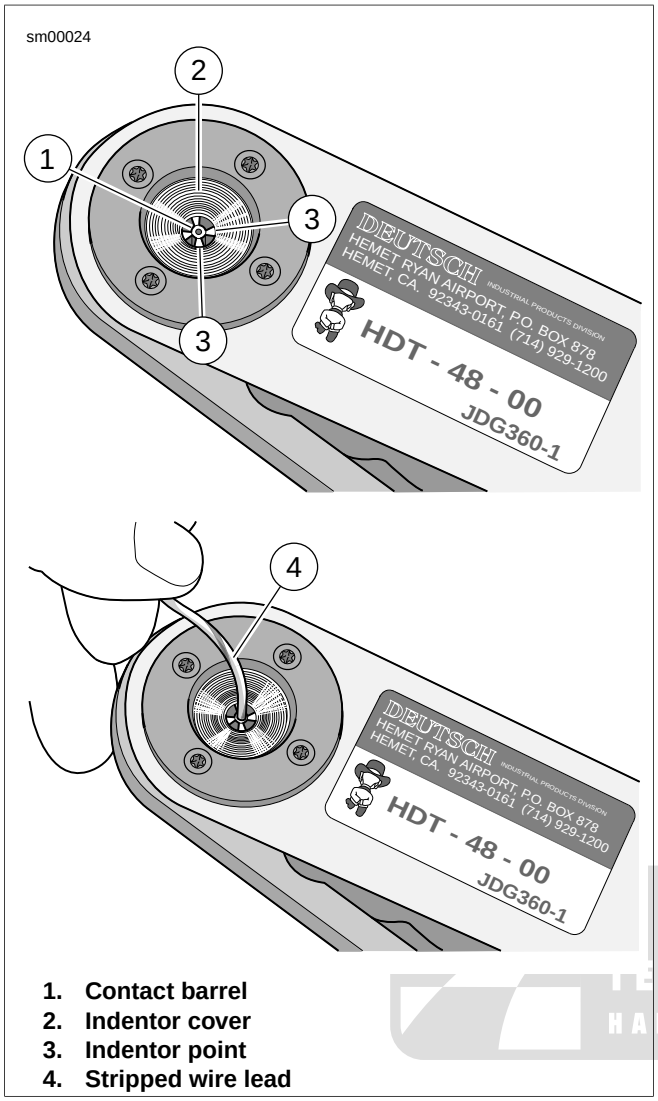
### Inspecting Crimps

Inspect the crimp. All core wire strands are to be crimped in the barrel.




1. **Locking pin**
2. **Selector knob**
3. **SEL. NO. arrow**
4. **Knurled locknut**
5. **Adjusting screw**

**Figure A-24. Electrical Crimper Tool (HD-42879)**




1. **Contact barrel**
2. **Indentor cover**
3. **Indentor point**
4. **Stripped wire lead**

**Figure A-25. Deutsch Solid Barrel**

## DEUTSCH MINI TERMINAL CRIMPS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-38125-7 | PACKARD TERMINAL CRIMPER |

### Preparing Wire Leads for Crimping

Strip wire lead removing 5/32 in. (4.0 mm) of insulation.

### Crimping a Mini Terminal to Wire Lead

1. See Figure A-26. Compress the handles of PACKARD TERMINAL CRIMPER (Part No. HD-38125-7) until the ratchet (2) automatically opens.

*NOTE*

*Always perform core crimp before insulation crimp.*

2. Position the core crimp on die E (1) of the crimper. Be sure the core crimp tails are facing the forming jaws.
3. Gently apply pressure to handles of tool until crimpers just secure the core crimp tails.
4. Insert stripped wire core stands between crimp tails. Position wire so that short pair of crimp tails squeeze bare wire strands, while long pair squeeze over the insulation.
5. Squeeze handle of crimper until tightly closed. Tool automatically opens when the crimping sequence is complete.

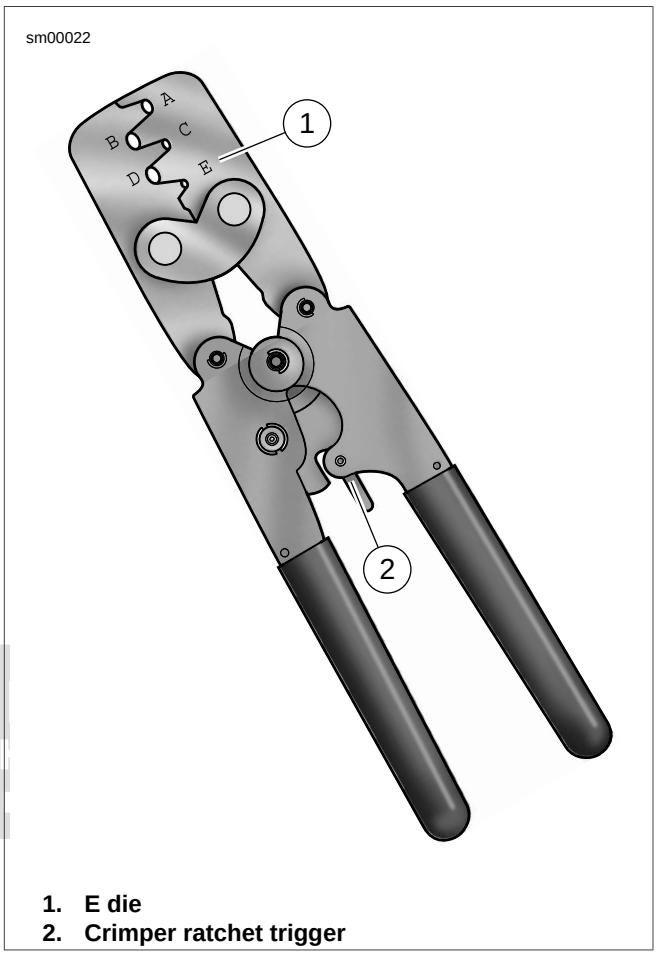
*NOTE*

*If the crimper does not open, it can be opened by squeezing the ratchet trigger (2).*

6. Position the insulation crimp on nest C of the crimper. Be sure the insulation crimp tails are facing the forming jaws.
7. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.

### Inspecting Crimps

Inspect the core and insulation crimps. Distortion should be minimal.




**1. E die**
**2. Crimper ratchet trigger**

**Figure A-26. Packard Terminal Crimper (HD-38125-7)**

## MOLEX CONNECTOR REPAIR

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48114 | MOLEX ELECTRICAL CONNECTOR TERMINAL REMOVER |

### Separating Pin and Socket Housings

See Figure A-27. Depress the latch while pulling the pin and socket housings apart.

### Mating Pin and Socket Housings

1. Orient the latch on the pin housing to the latch pocket on the socket housing so the rails on the outside of the pin housings lines up with the tunnels on the socket housing.
2. Press the housings together until the latch clicks.

### Removing Terminals

1. Pull the secondary lock up, approximately 3/16 in. (4.8 mm), until it stops.
   a. **Socket Housing:** See Figure A-28. Use a small screwdriver in the pry slot. The slot next to the external latch provides a pivot point.
   b. **Pin Housing:** See Figure A-29. Use needle nose pliers to engage the D-holes in the center of the secondary lock.

*NOTE*

*Do not remove the secondary lock from the connector housing.*

2. See Figure A-30. Insert MOLEX ELECTRICAL CONNECTOR TERMINAL REMOVER (Part No. HD-48114) into the pin hole next to the terminal until the tool bottoms.
   a. **Socket Housing:** The pin holes are inside the terminal openings.
   b. **Pin Housing:** The pin holes are outside the pins.
3. Pressing the terminal remover to the bottom of the pin hole, gently pull on the wire to remove wire terminal from its cavity.

### Installing Terminals

1. See Figure A-31. From the wiring diagram, match the wire color to its numbered terminal cavity.

*NOTE*

*Cavity numbers (1) are stamped on the housing at the ends of the cavity rows. The cavity number can be determined by counting the cavities up or down along the row from each stamped number.*

2. Orient the terminal so that the tang (2) opposite the open crimp engages the slot (3) in the cavity.
3. Push the terminal into the cavity.
4. Gently tug on wire to verify that the terminal is captured by the secondary lock.
5. With all terminals installed, push the secondary lock into the socket housing to lock the wire terminals into the housing.

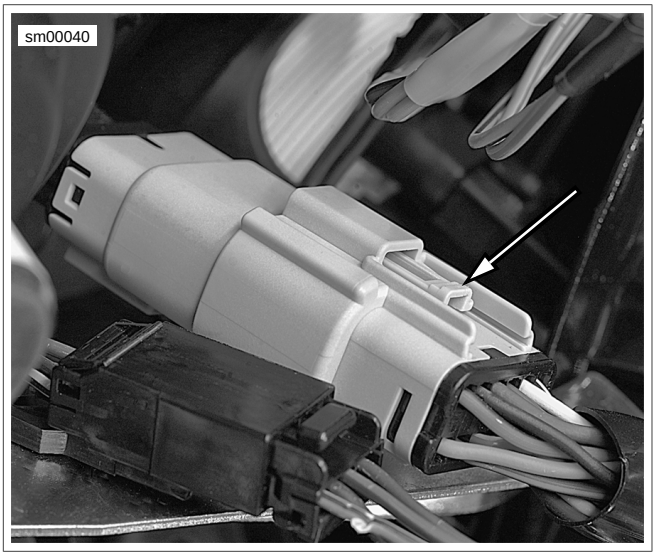



**Figure A-27. Molex Connector: Latch**


**Figure A-28. Secondary Lock Pry Slot (Socket Housing)**

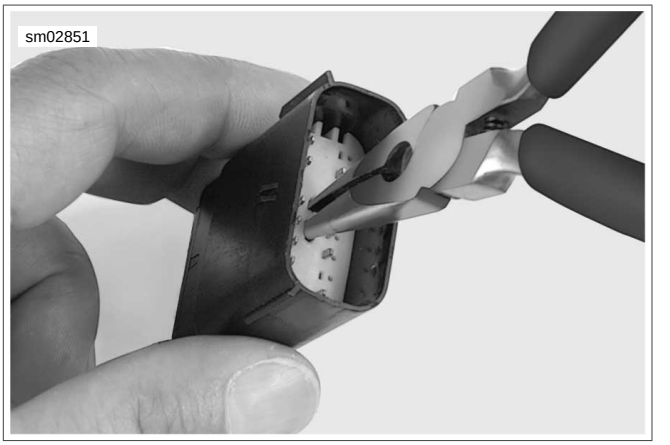



**Figure A-29. Pull Up Secondary Lock (Pin Housing)**

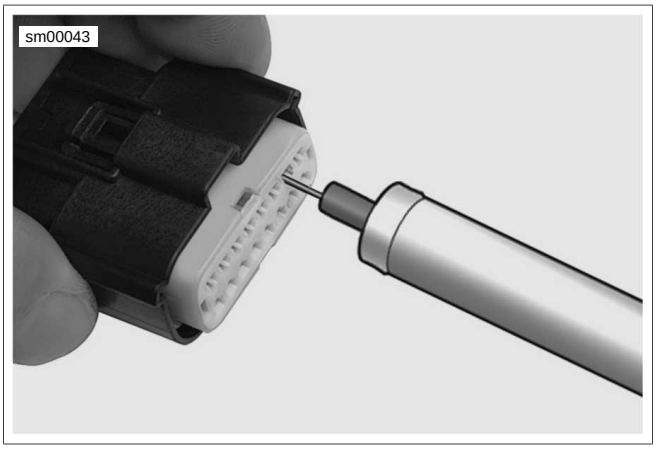
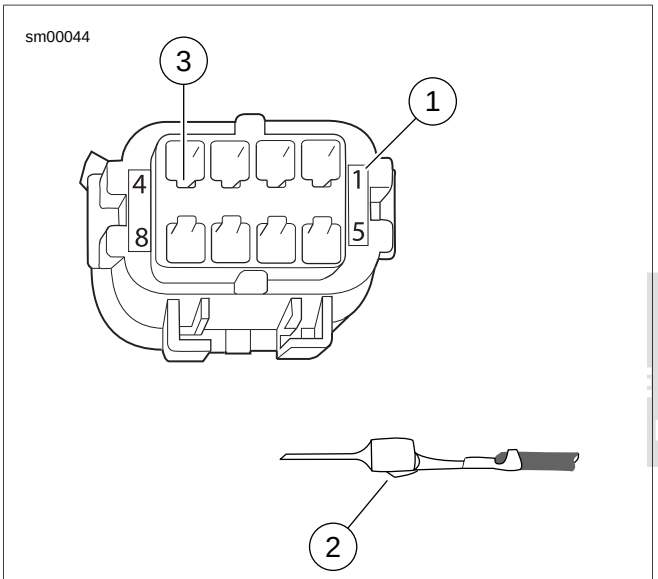



**Figure A-30. Molex Connector: Terminal Remover (HD-48114)**




1. **Cavity number**
2. **Tang**
3. **Cavity slot**

**Figure A-31. Molex Connector: Pin Cavities and Wire Terminal**

## CRIMP TERMINAL TO LEAD

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48119 | ELECTRICAL CRIMP TOOL |

### Prepare Lead

1. Cut the damaged terminal close to the back of the terminal to leave as much wire length as possible.
2. Strip approximately 3/16 in. (4.70-5.60 mm) of insulation from the end of the wire lead.

*NOTE*

*The strip length is the same for both pin and socket terminals and for wire gauges from 22 to 14.*

### Prepare Tool

1. Identify the punch/die in the jaws of the ELECTRICAL CRIMP TOOL (Part No. HD-48119) for the wire gauge. Refer to Table A-4.
2. Squeeze and release the handles to open the tool.

*NOTE*

*The crimp tool automatically opens when the handles are released.*

3. See Figure A-32. Hold fully open tool at approximately 45 degrees.

*NOTE*

*Do NOT tighten the locknut holding the locator bars. The bars must float to accommodate the different terminal gauges.*

**Table A-4. Crimp Tool Wire Gauge Punch/Die**

| AWG (WIRE GAUGE) | PUNCH/DIE |
|---|---|
| 22 | Left |
| 18-20 | Middle |
| 14-16* | Right |
| * Crimp 16 AWG **pin** terminals in the 18-20 middle die. | |

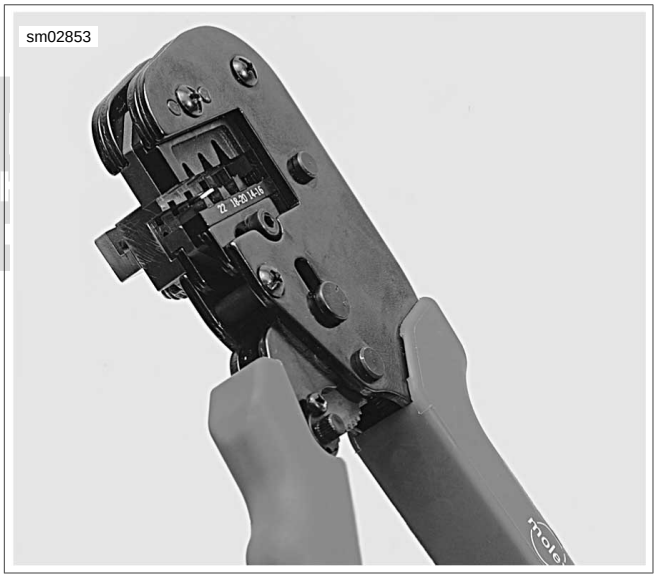
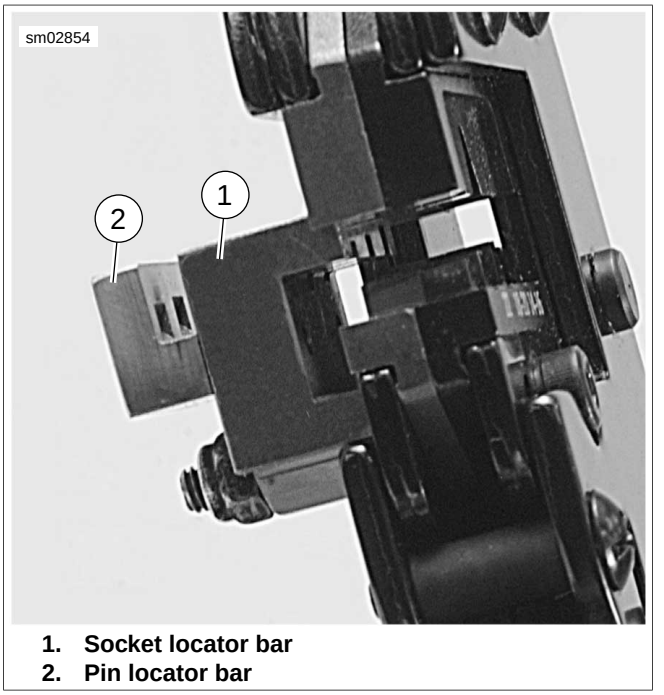



**Figure A-32. Open Electrical Crimp Tool (HD-48119) at 45 Degrees**




1. **Socket locator bar**
2. **Pin locator bar**

**Figure A-33. Terminal Locator Bars**

## Position Terminal in the Punch/Die

1. See Figure A-34. With the crimp tails up, place the terminal through the punch/die into the square opening in the socket locator bar.
   a. **Socket Terminal:** See Figure A-33. A socket terminal stops against the back face of the socket locator bar (1).
   b. **Pin Terminal:** See Figure A-35. The tip of a pin terminal passes through the socket locator bar and stops in the notch in the face of the pin locator bar.
2. See Figure A-36. Ratchet the handles together until the crimp tails are held in vertical alignment between the punch and the die.

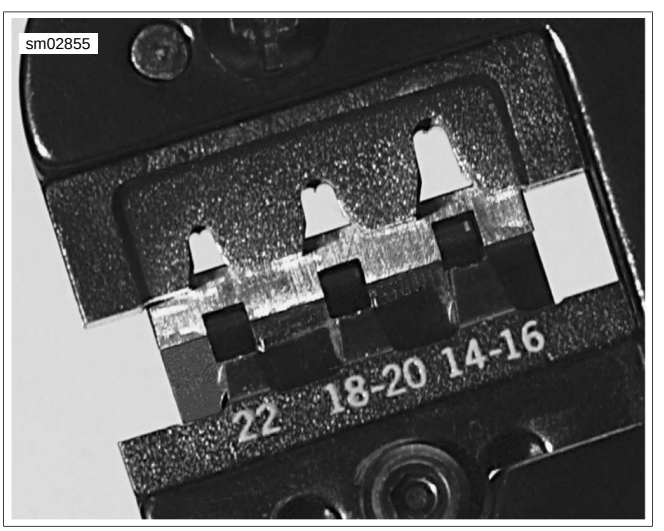



**Figure A-34. Square Openings in Socket Locator Bar**

## Insert Stripped Lead

See Figure A-37. Insert the stripped end (wire core) between the crimp tails at an up angle until the wire core touches the face of the socket locator bar above the square opening.

*NOTES*

- *The insulation must extend through the insulation crimp tails.*
- *Insert the wire with little or no pressure. Pressing on the lead will bend the wire core.*

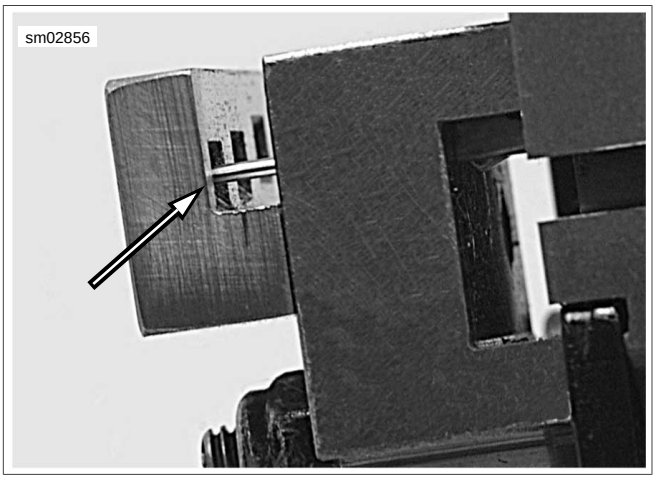



**Figure A-35. Pin Terminal against Pin Locator Bar**

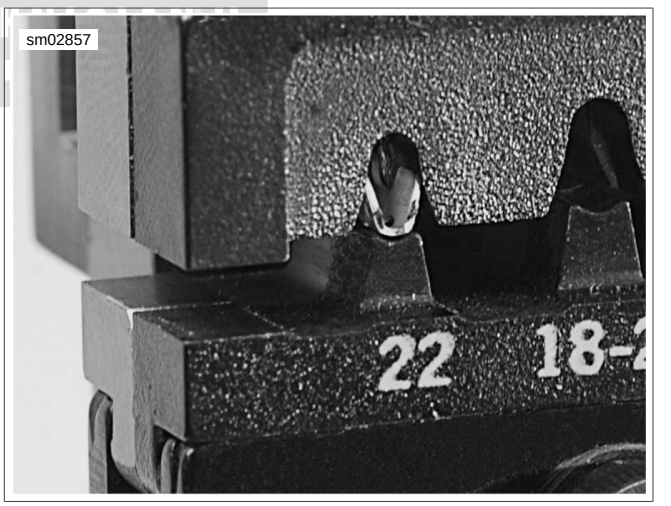



**Figure A-36. Crimp Tails in Vertical Alignment between Punch and Die**

## Crimp Terminal to Lead

1. Holding the wire lead in position touching the locator face at an angle, quickly and smoothly squeeze the crimp tool closed.
2. Final squeeze the handles to open the tool and release the terminal.

*NOTE*

*A stuck or jammed tool can be opened by pressing the ratchet release lever found between the handles. Do **not** force the handles open or closed.*

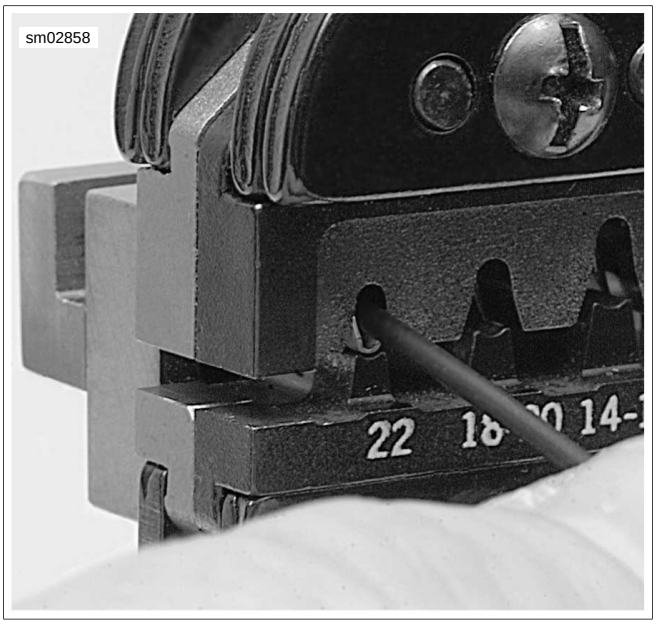
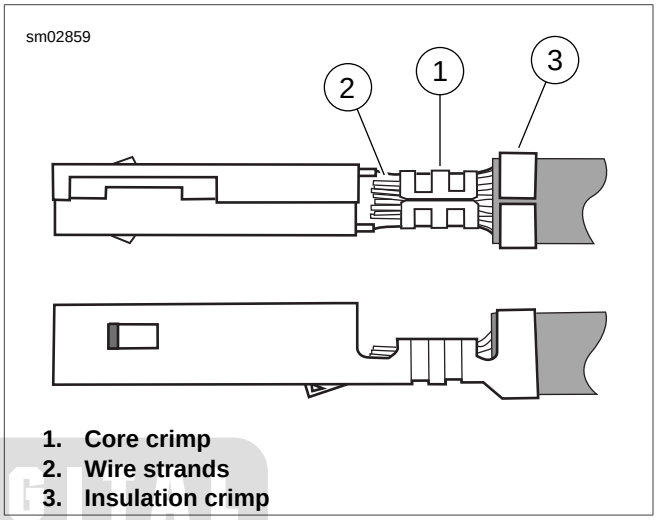



**Figure A-37. Stripped Lead at Up Angle**

## Inspect Crimp

1. **Inspect Crimp:** Inspect the core and insulation crimp.
   a. See Figure A-38. The core tails should be creased into the wire strands at the core crimp (1).
   b. Strands (2) of wire should be visible beyond the core crimp but not forward into the terminal shell.
   c. The insulation tails should be folded into the insulation (3) without piercing or cutting the insulation.
   d. Distortion should be minimal.
2. **Test Crimp:** Hold the terminal and pull the lead.




1. **Core crimp**
2. **Wire strands**
3. **Insulation crimp**

**Figure A-38. Terminal Crimp**

## 150 METRI-PACK CONNECTOR REPAIR

### General

Metri-Pack connectors are embossed with the initials (P.E.D.).

There are two types of connectors in this series:

- Pull-to-Seat
- Push-to-Seat

### Separating Pin and Socket Housings

Bend back the external latch slightly and separate the pin and socket halves of the connector.

### Mating Pin and Socket Housings

Align the wire colors and push the pin and socket halves of the connector together.

### Removing Socket Terminal

1. See Figure A-39 for pull-to-seat connector or Figure A-40 for push to seat connector. Remove wire lock (1) from wire end of socket housing on push-to-seat type connectors.

*NOTE*

*For best results, free one side of wire lock first and then release the other side.*

2. Find the locking tang in the mating end of the connector.

*NOTE*

*The tangs are always positioned in the middle of the chamber and are on the same side as the external latch.*

3. Gently insert a safety pin into the chamber about 1/8 in. (3.2 mm).
   a. **For pull-to-seat:** Stay between the terminal and the chamber wall and pivot the end of the pin toward the terminal body.
   b. **For push-to-seat:** There is a small opening for the pin.
4. When a click is heard, remove the pin and repeat the procedure.

*NOTE*

*The click is the sound of the tang returning to the locked position as it slips from the point of the pin.*

5. Pick at the tang until the clicking stops and the pin seems to slide in deeper than it had previously. This is an indication that the tang has been depressed.

*NOTE*

*On those terminals that have been extracted on multiple occasions, the click may not be heard, but pivot the pin as if the click was heard at least 3 times.*

6. Remove the pin.
   a. **For pull-to-seat:** Push on the lead to extract the terminal from the mating end of the connector.
   b. **For push-to-seat:** Pull on the lead to draw the terminal out the wire end.

### Inserting Socket Terminal

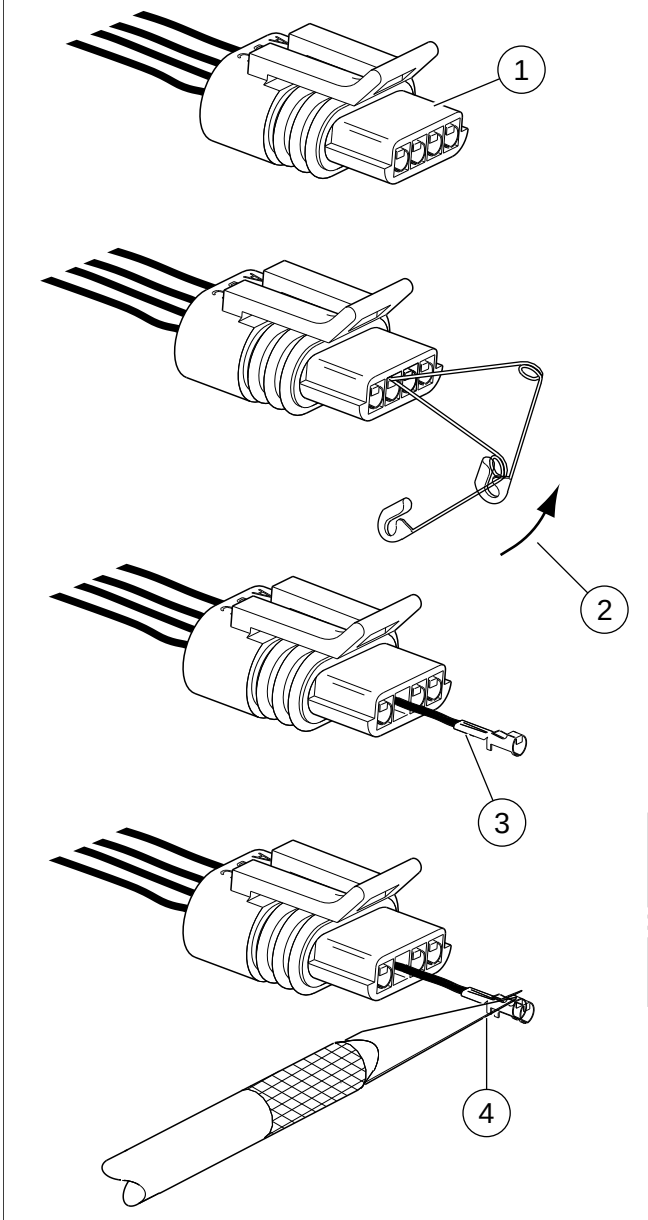
*NOTE*

*For wire location purposes, alpha characters are stamped into the socket housings.*

1. See Figure A-39 for pull-to-seat connector or Figure A-40 for push to seat connector. Using a thin flat blade, like that on a hobby knife, carefully bend the tang outward away from the terminal body.
2. Gently pull or push on the lead to install the terminal back into the chamber. A click is heard when the terminal is properly seated.
3. Gently pull or push on the lead to verify that the terminal is locked in place.

   **For push-to-seat:** See Figure A-40. Seat wires in separate channels of wire lock and then push channels **inside** chambers at wire end of socket housing. Fully installed, slot on each side of wire lock engages ear on socket housing.

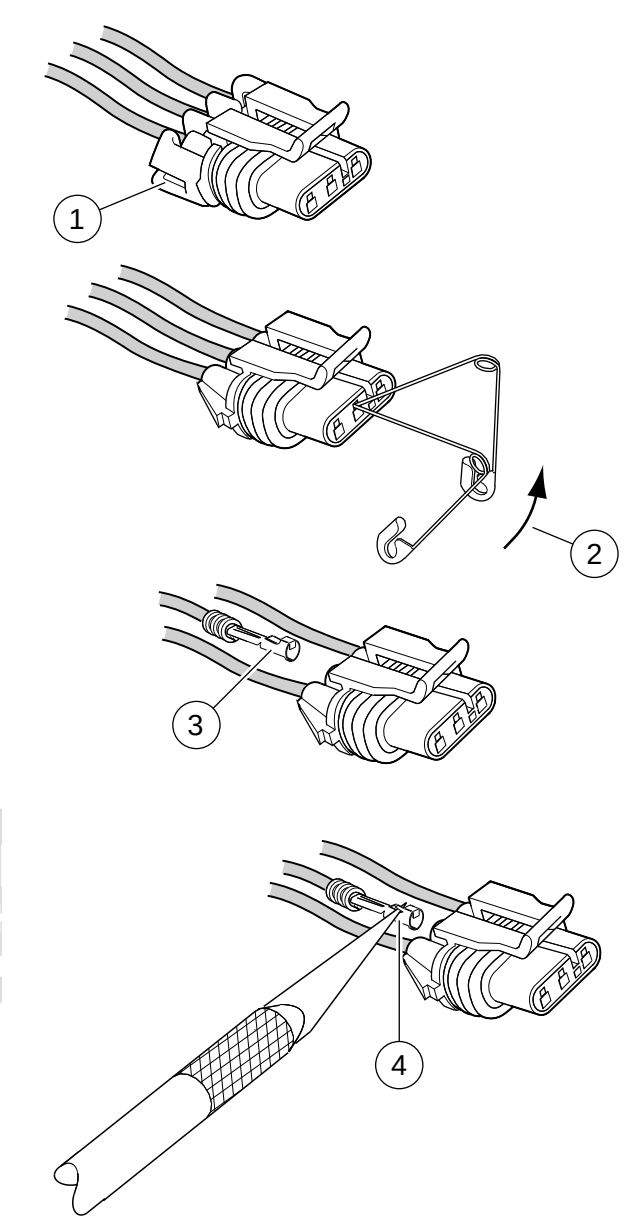
sm00027




1. Locate tang in chamber
2. Pivot pin to depress tang
3. Push to remove
4. Raise tang to install

**Figure A-39. 150 Metri-Pack Connector: Pull-to-Seat**

sm00028




1. Remove wire lock
2. Pivot pin to depress tang
3. Pull to remove
4. Raise tang to install

**Figure A-40. 150 Metri-Pack Connector: Push-to-Seat**

## FUSE BLOCK REPAIR

### Removing Socket Terminals

1. See Figure A-41. To remove secondary locks, insert end of small flat blade screwdriver (1) under lip of locking wedge (2) and gently pry up secondary lock.

*NOTE*

*For best results, start with locking wedge on outboard side of secondary lock.*

2. Looking into chamber at top of fuse block, note the tang next to each socket terminal.
3. Using a thin flat blade, like that on a hobby knife, gently push tang away from terminal, and then tug on wire to back terminal out.

### Installing Socket Terminals

1. Match the wire lead color to the fuse block terminal cavity.

*NOTES*

- *Refer to the main harness wiring diagram for wire lead color codes.*
- *See Figure A-42. The main fuse block terminal cavity is identified as alpha (1) and numeric (2) coordinates. Refer to the main harness wiring diagram for fuse block terminal cavity coordinates.*

2. With the open side of the socket terminal facing the tang, push lead into chamber at the wire end of the fuse block. A click is heard when the terminal is properly engaged.
3. Gently tug on the wire to verify that the terminal is locked in place and will not back out of the chamber.
4. Install the secondary locks. With the locking wedges positioned above the tangs in each chamber, slide flat side of secondary lock into slot (between rows), and push down until it bottoms.

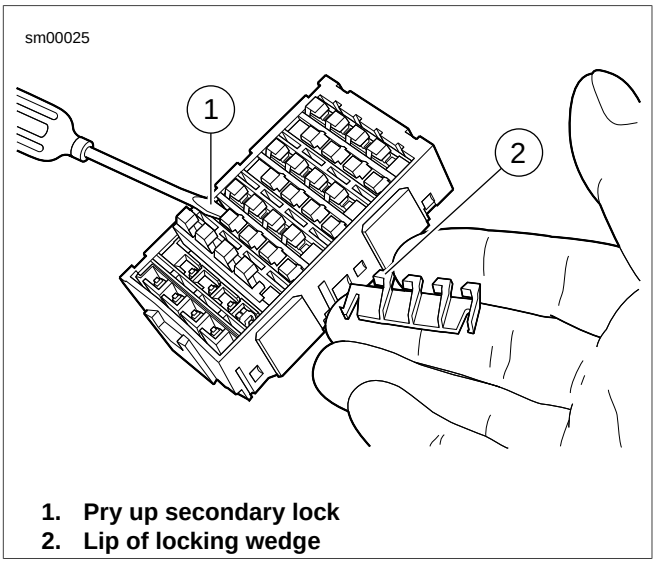
### Crimping Terminals

Terminals are crimped twice; once over the wire core and a second time over the insulation/seal.

A correctly crimped terminal may require different crimping dies found on separate crimpers.

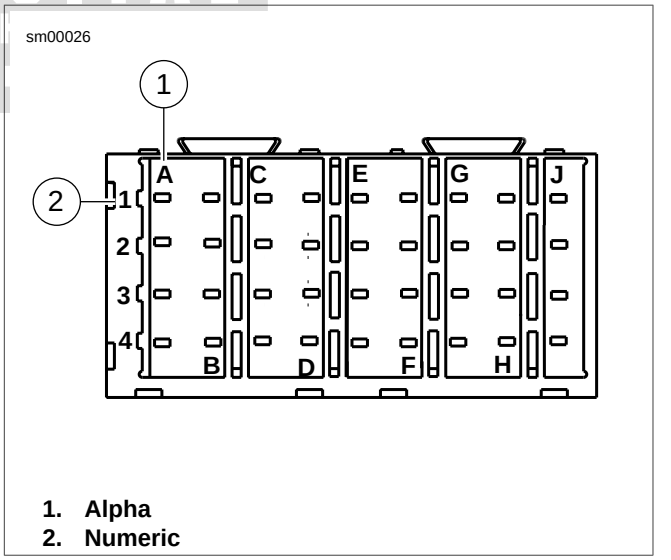
*NOTE*

*The wiring diagram indicates when one socket terminal is be crimped to two wire leads.*




**1. Pry up secondary lock**
**2. Lip of locking wedge**

**Figure A-41. Fuse Block: Remove Secondary Locks**




**1. Alpha**
**2. Numeric**

**Figure A-42. Fuse Block: Coordinates (typical)**

## 480 METRI-PACK CONNECTOR REPAIR

### General

A 480 Metri-Pack (P.E.D.) connector is frequently used for the B+ (battery voltage) connector to power P&A accessories.

Referred to as Packard connectors, Metri-Pack connectors are embossed with the initials P.E.D.

### Separating Pin and Socket Housings

*NOTE*

*Cut any cable strap anchoring the wire conduits of the pin (accessory connector housing) and the socket (B+) housing.*

See Figure A-43. Using small flat blade screwdriver, depress button (1) on pin housing (red wire) side of the connector and pull apart the pin and socket housings.

### Mating Pin and Socket Housings

Orient the latch on the socket housing to the button catch on the pin housing and press the housings together.

### Removing Socket Terminals

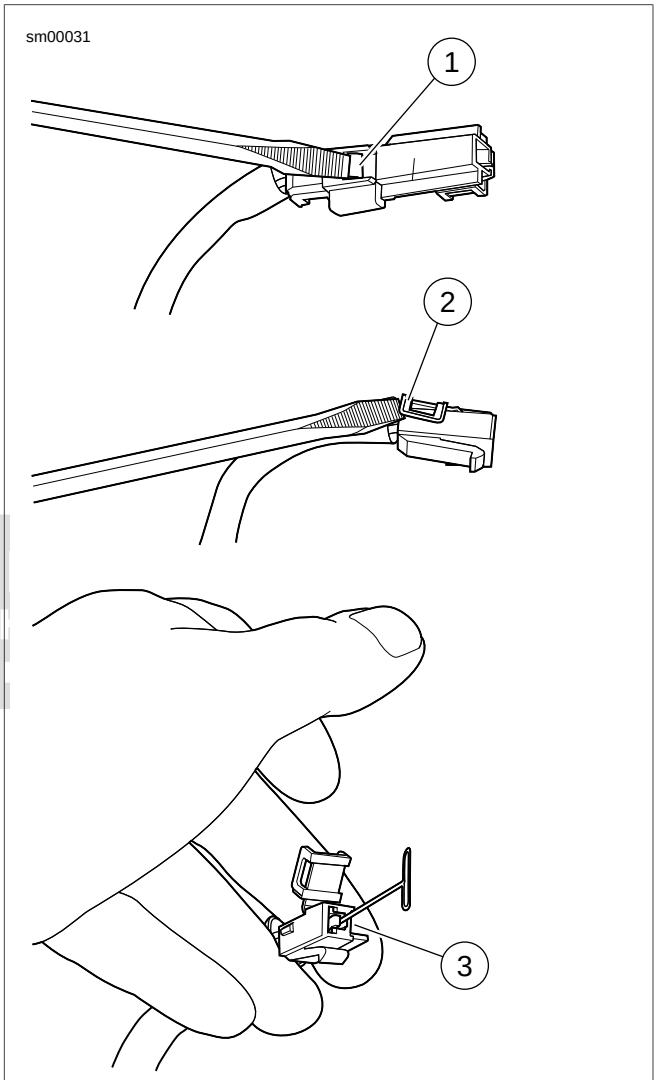
1. See Figure A-43. Bend back the latch (2) slightly and free one side of secondary lock, then repeat to release the opposite side. Rotate the secondary lock outward on hinge to access terminal in chamber of connector housing.
2. On the mating end of the connector, note the tang in the square shaped opening centered next to the terminal. Gently insert the point of a stick pin or large safety pin into the opening (3) between the tang and the chamber wall until it stops.
3. Pivot the end of the pin toward the terminal body to depress the tang.
4. Remove the pin and then pull terminal out of the wire end of connector housing.
5. If necessary, crimp **new** terminals on wires. See A.15 PACKARD METRI-PACK TERMINALS.

### Installing Socket Terminals

1. Carefully bend the tang outward away from the terminal body.
2. With the tang on the same side as the square shaped opening in the mating end of the connector housing, feed terminal into wire end of connector housing until it "clicks" in place.
3. Verify that terminal will not back out of the chamber. A slight tug on the cable will confirm that it is locked.
4. Rotate the hinged secondary lock inward until latches fully engage tabs on both sides of connector housing.

*NOTE*

*If removed, install **new** anchored cable strap in O.E. location. Tighten cable strap to capture conduit of both accessory connector and B+ connector approximately 1.0 in. (25.4 mm) from housings.*




**1. Button on pin housing**
**2. Secondary lock latch**
**3. Opening between tang and chamber wall**

**Figure A-43. 480 Metri-Pack Connector: Remove Socket Terminal**

## 630 METRI-PACK CONNECTOR REPAIR

| PART NUMBER | TOOL NAME |
|---|---|
| SNAP-ON TT600-3 | SNAP-ON PICK |

### General

Referred to as Packard connectors, Metri-Pack 630 series connectors are embossed with the initials P.E.D.

### Separating Pin and Socket Housings

*NOTE*

*If necessary, remove connector from barbed anchor or other retaining device.*

Bend back the external latch slightly and separate pin and socket halves of the connector.

### Mating Pin and Socket Housings

Orient the latch to the catch and push the pin and socket halves of the connector together until the latch "clicks".

*NOTE*

*If removed, install connector on barbed anchor or other OE retaining device.*

### Removing Socket Terminal

1. Bend back the latch slightly and free one side of the secondary lock. Repeat the step to unlatch the other side.
2. 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.
3. Moving to the mating end of the connector, take note of the small opening on the chamber wall side of each terminal.
4. Insert SNAP-ON PICK (Part No. SNAP-ON TT600-3) into opening until it stops. Pivot the end of the pick toward the terminal to depress the locking tang.
5. 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.
6. If necessary, crimp **new** terminals on wires. Refer to A.15 PACKARD METRI-PACK TERMINALS.

### Installing Socket Terminal

*NOTE*

*Refer to the wiring diagrams to match wire lead colors to alpha characters molded into the secondary locks of each connector housing.*

1. Using a thin flat blade, like that of a hobby 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.

## METRI-PACK TERMINAL CRIMPS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-38125-6 | PACKARD TERMINAL CRIMP TOOL |
| HD-38125-7 | PACKARD TERMINAL CRIMPER |
| HD-38125-8 | PACKARD CRIMPING TOOL |

### Matching Terminal To Crimper

Metri-Pack connectors embossed with the initials P.E.D. require Packard crimp tools to crimp terminals to wire leads.

Terminals are crimped twice to a wire lead, once over the wire core and a second time over the insulation/seal.

See Figure A-44. A completed crimp may require two different crimping dies found on PACKARD TERMINAL CRIMP TOOL (Part No. HD-38125-6) and/or PACKARD TERMINAL CRIMPER (Part No. HD-38125-7). The terminal (pin or socket) and the wire lead gauge will determine the core crimp die and the insulator/seal die.

*NOTE*

*The PACKARD CRIMPING TOOL (Part No. HD-38125-8) will also crimp sealed splice connectors in wire gauge sizes 18-20, 14-16 and 10-12.*

### Preparing Wire Lead

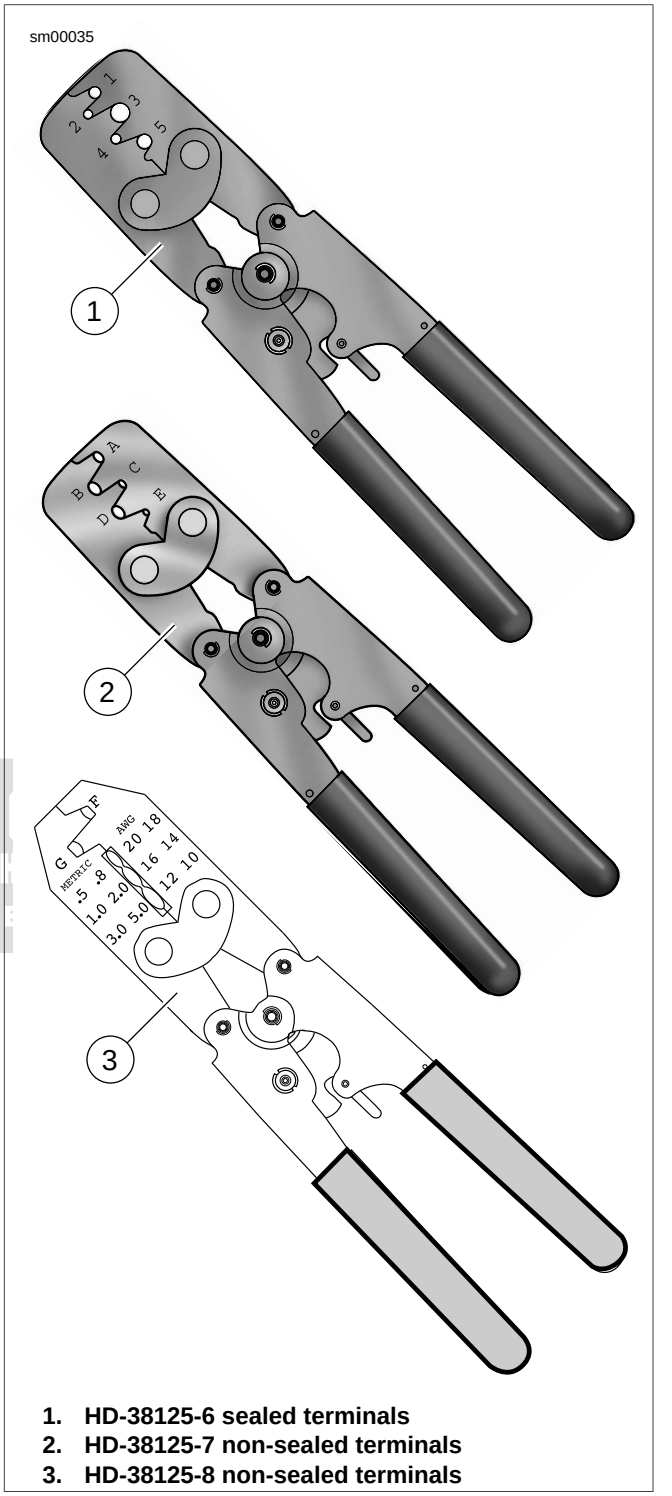
Use a wire striper to strip off the insulation and expose 5/32 in. (4.0 mm) of wire core.

### Crimping Wire Core

*NOTE*

*Metri-Pack terminal crimps require two steps. Always perform **Crimping Wire Core** before **Crimping Insulation/Seal**.*

1. Squeeze and release handles until ratchet automatically opens.
2. Identify the corresponding sized nest for the core crimp.
3. Position the core crimp in the die. Be Sure the core crimp tails are facing the forming jaws.
4. Gently squeeze the handles until crimpers just secure the core crimp tails.
5. Insert stripped wire between crimp tails. Verify that wire is positioned so that short pair of crimp tails squeeze core wire strands, while long pair is positioned over the insulation or seal material.
6. Squeeze handles tightly closed. Release grip and the tool will automatically open.




1. **HD-38125-6 sealed terminals**
2. **HD-38125-7 non-sealed terminals**
3. **HD-38125-8 non-sealed terminals**

**Figure A-44. Metri-Pack Terminal Crimp Tools**

### Crimping Insulation/Seal

*NOTE*

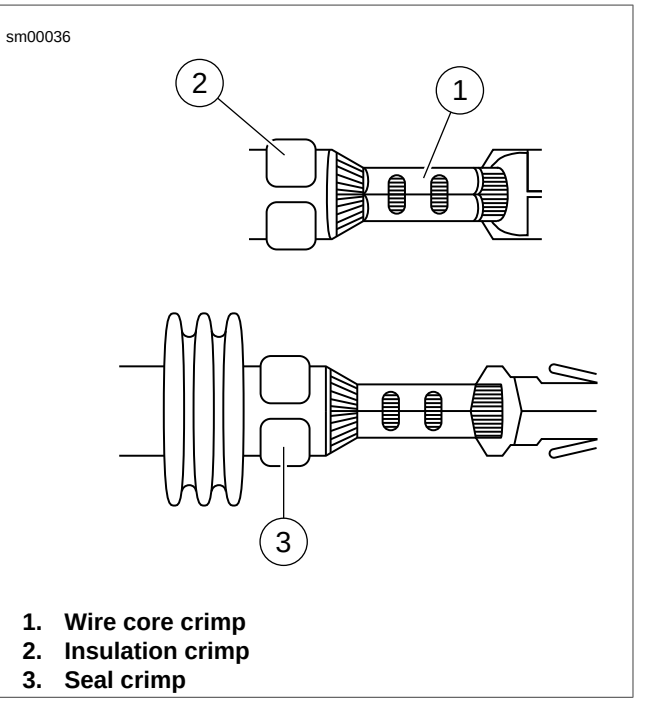
*Always perform **Crimping Wire Core** before **Crimping Insulation/Seal**.*

1. See Figure A-45. Identify the correct die for the insulation/seal crimp (2).

2. Position the insulation/seal crimp in the nest. Be sure the insulation/seal crimp tails are facing the forming jaws.
3. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimp is complete.

## Inspecting Crimps

1. See Figure A-45. Inspect the wire core crimp (1). The tails should be folded in on the wire core without any distortion or excess wire strands.
2. Inspect the insulation (2) or seal (3) crimp. The tails of the terminal should be wrapped around the insulation without distortion.




1. **Wire core crimp**
2. **Insulation crimp**
3. **Seal crimp**

**Figure A-45. Metri-Pack Connector: Inspect Core and Insulation/Seal Crimps**

## PACKARD 100W CONNECTOR REPAIR

### General

A Packard 100W connector connects the the electronic control module (ECM) to the main harness.

*NOTE*

*For vehicles with 73-pin connectors, see A.17 PACKARD MICRO-64 CONNECTORS and A.15 PACKARD METRI-PACK TERMINALS.*

### Separating Socket Housing From ECM

See Figure A-46. While pressing the connector into the ECM, press the thumb lever (1) against the connector until the latch (2) pops out of the catch (3) on the ECM.

### Mating Socket Housing To ECM

Push the connector into the ECM until the latch is captured by the catch on the ECM.

### Removing Socket Terminal

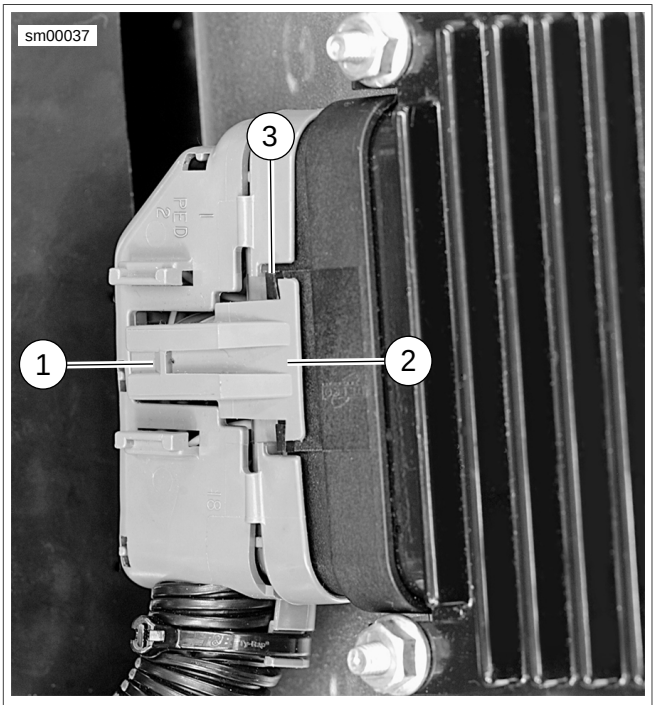
1. See Figure A-47. Gently depress latch (1) on each side of the clear plastic secondary lock (2) and remove. For best results, release one side at a time.
2. Carefully cut cable strap (3) to free strain relief collar (4) from conduit (5).
3. See Figure A-48. Using a thin blade, gently pry at seam at back of socket housing to release three plastic pins (1) from slots in housing. Separate and spread halves of socket housing.
4. Push on wire lead to free terminal from chamber.

### Installing Socket Terminal

1. From inside socket housing, gently pull on wire to draw terminal into chamber.
2. Exercising caution to avoid pinching wires, press halves of socket housing together until three plastic pins fully engage slots in housing.
3. Install **new** cable strap in groove of strain relief collar capturing cable conduit.
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.

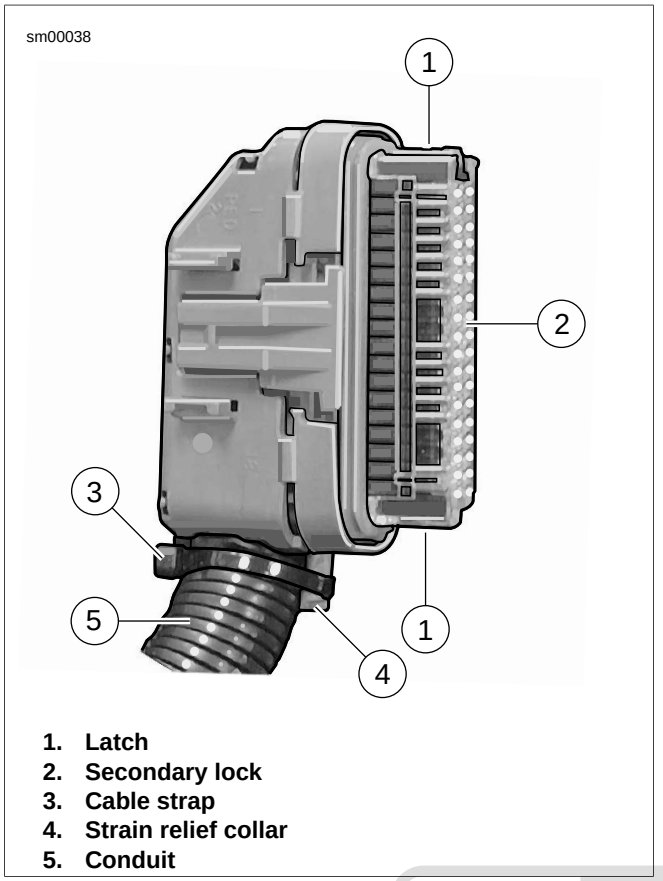
### Crimping Terminals

If necessary, crimp new terminals on wire leads. See A.15 PACKARD METRI-PACK TERMINALS.



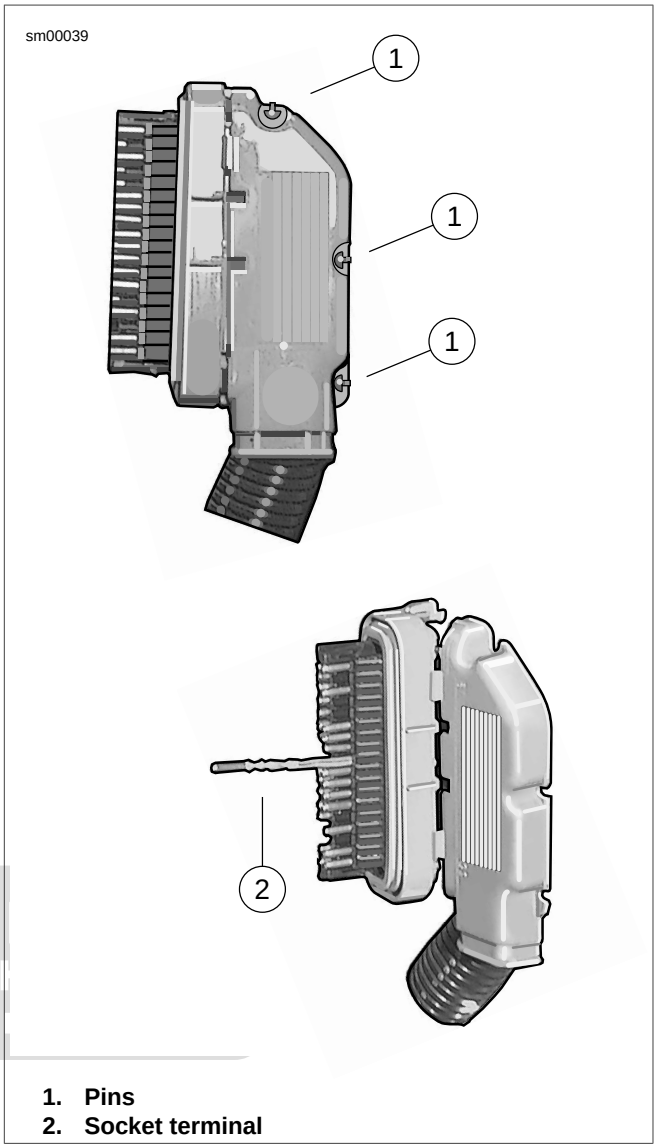

1. **Thumb lever**
2. **Latch**
3. **Catch (ECM)**

**Figure A-46. Packard 100W to ECM (Typical)**




1. Latch
2. Secondary lock
3. Cable strap
4. Strain relief collar
5. Conduit

**Figure A-47. Packard 100W Connector**




1. Pins
2. Socket terminal

**Figure A-48. Packard 100W Connector: Separate Halves of Socket Housing**

## PACKARD MICRO-64 CONNECTOR REPAIR

| PART NUMBER | TOOL NAME |
|---|---|
| HD-45928 | PACKARD MICRO-64 TERMINAL REMOVER |
| HD-45929 | PACKARD MICRO-64 TERMINAL CRIMPER |

### General

Packard Micro-64 connectors are frequently found on speedometers, tachometers and the ECM of Touring Models. For pin 73 of these ECMs, see A.11 PACKARD 150 METRI-PACK CONNECTORS.

### Separating Pin and Socket Housings

Bend back the external latches slightly and separate the pin and socket housings.

### Mating Pin and Socket Housings

Orient the wire lead colors and push the pin and socket housings of the connector together until the latches click.

### Removing Terminal

1. See Figure A-51. Locate the head of the secondary lock (1) on one side of the connector housing.
2. Insert the blade of a small screwdriver between the center ear of the lock and the connector housing and gently pry out lock. When partially removed, pull lock from connector housing.
3. Locate pin hole (2) between terminals on mating end of connector.
4. See Figure A-52. Obtain the PACKARD MICRO-64 TERMINAL REMOVER (Part No. HD-45928).
5. See Figure A-50. Push the adjacent terminals all the way into the connector housing and then insert tool into hole until it bottoms.
6. Leaving the tool installed, gently tug on wires to pull either one or both terminals from wire end of connector. Remove tool.


**Figure A-49. Packard Micro 64 Terminal Remover (HD-45928)**

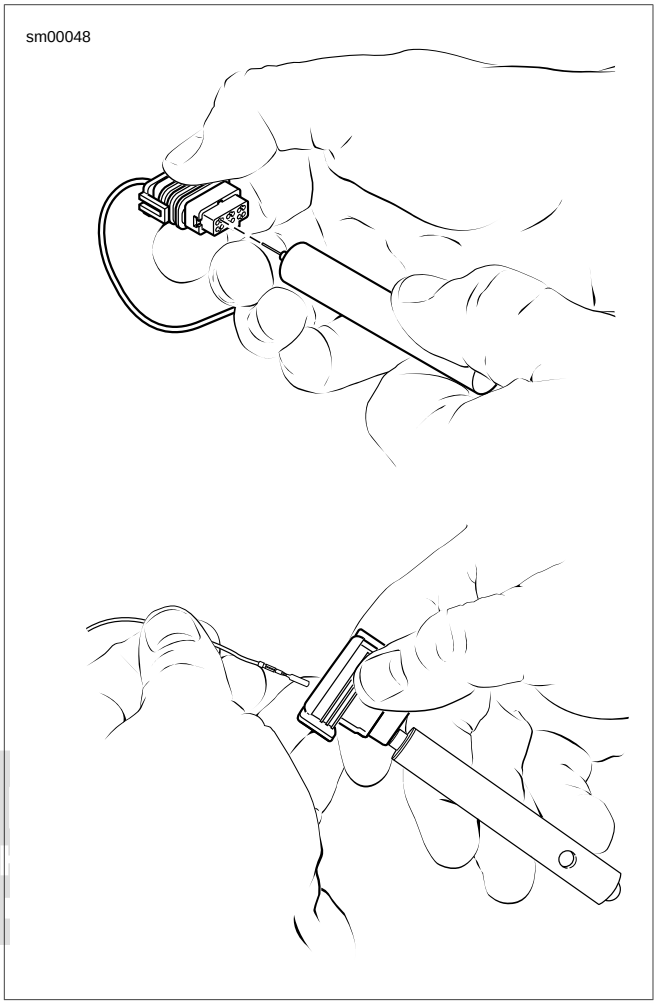



**Figure A-50. Packard Micro 64 Connector: Insert Tool and Remove Terminal**

### Installing Terminal

1. Insert terminal into its respective numbered chamber on wire end of connector. No special orientation of the terminal is necessary.

*NOTE*

*See Figure A-51. For wire location purposes, the corners of the socket housing are stamped (3) with the numbers 1, 6, 7 and 12, representing terminals 1-6 on one side, and 7-12 on the other.*

2. Bottom the terminal in the chamber and then gently tug on the wire to verify that it is locked in place.

*NOTE*

*Once the terminal is removed it may not lock in place when first reinstalled. Until the lock engages, move the terminal back and forth slightly while wiggling the lead.*

3. Since the terminal remover tool releases two terminals simultaneously, repeat step 2 on the adjacent terminal even if it was not pulled from the connector housing.

4. With the center ear on the head of the secondary lockpin facing the mating end of the connector, push secondary lock in until head is flush with the connector housing.

## Preparing Wire Leads for Crimping

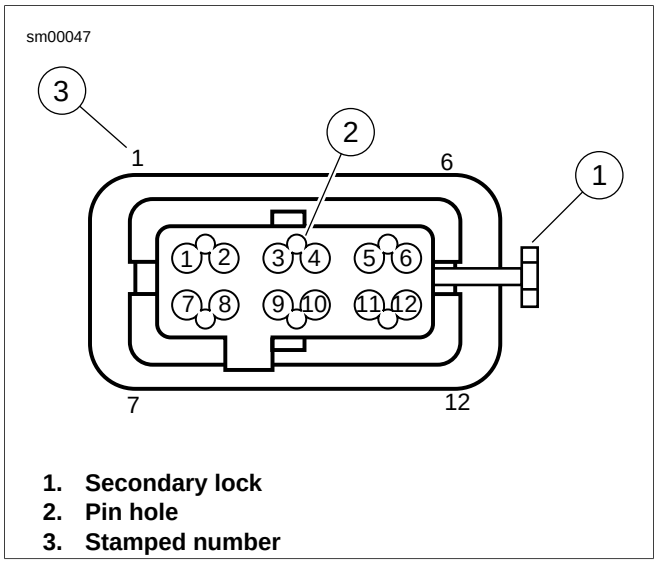
Strip lead removing 1/8 in. (3.0 mm) of insulation.

## Crimping Terminals

1. Inspect **new** socket terminal for bent or deformed contact and crimp tails. Replace as necessary.
2. See Figure A-53. Squeeze the handles of the PACKARD MICRO-64 TERMINAL CRIMPER (Part No. HD-45929) to cycle the tool to the fully open position (1).
3. Raise locking bar and barrel holder by pushing up on bottom tab with index finger (2).
4. With the crimp tails facing upward, insert terminal through locking bar into front hole in barrel holder (20-22 gauge wire) (3).
5. 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 and the closed side of the terminal rests on the outer nest of the crimp tool.
6. Insert wires between crimp tails until ends make contact with locking bar. Verify that wire is positioned so that wide pair of crimp tails squeeze bare wire strands, while the narrow pair folds over the insulation material.
7. Squeeze handle of crimp tool until tightly closed (4). Tool automatically opens when the crimping sequence is complete.
8. Raise locking bar and barrel holder to remove contact.

## Inspecting Crimps

Inspect the quality of the core and insulation crimps. Distortion should be minimal.




1. **Secondary lock**
2. **Pin hole**
3. **Stamped number**

**Figure A-51. Packard Micro 64 Connector: Housing**

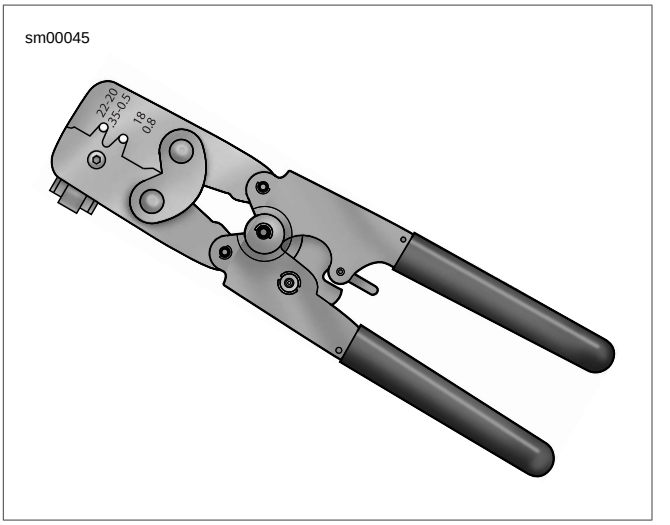
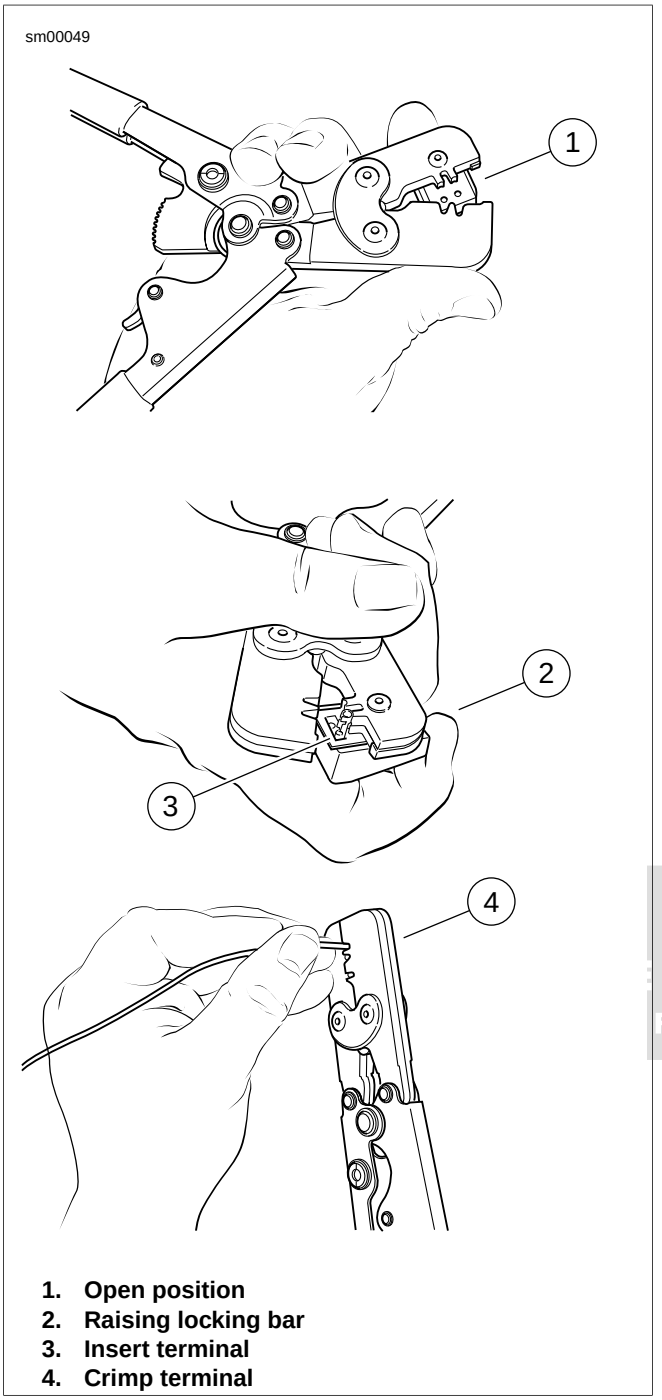



**Figure A-52. Packard Micro 64 Terminal Crimper (HD-45929)**




1. **Open position**
2. **Raising locking bar**
3. **Insert terminal**
4. **Crimp terminal**

**Figure A-53. Packard Micro 64 Connector: Terminal in Crimper**

## SEALED SPLICE CONNECTOR REPAIR

| PART NUMBER | TOOL NAME |
|---|---|
| HD-25070 | ROBINAIR HEAT GUN |
| HD-38125-8 | PACKARD CRIMPING TOOL |
| HD-39969 | ULTRA TORCH UT-100 |
| HD-41183 | HEAT SHIELD ATTACHMENT |

### General

Splice connectors and several OE ring terminal connectors use heat shrink covering to seal the connection.

### Preparing Wire Leads

*NOTE*

*If adjacent wires are to be spliced, stagger the splices so that the sealed splice connectors will not touch each other but are located at different positions along the length of the wires.*

1. Using a shop gauge, identify the gauge of the wire.
2. Match the wire gauge to a sealed splice connector by color and part number. Refer to Table A-5.
3. Using a wire stripper, cut and strip a length of insulation off the wire ends. Refer to Table A-5 for the strip length.

**Table A-5. Sealed Splice Connectors**

| WIRE GAUGE | COLOR | PART NO. | STRIP LENGTH |
|---|---|---|---|
| 18-20 (0.5-0.8 mm) | Red | 70585-93 | 3/8 in. (9.5 mm) |
| 14-16 (1.0-2.0 mm) | Blue | 70586-93 | 3/8 in. (9.5 mm) |
| 10-12 (3.0-5.0 mm) | Yellow | 70587-93 | 3/8 in. (9.5 mm) |

*NOTE*

*If any copper wire strands are cut off of the wire core, trim the end and strip the wire again in a larger gauge stripper.*

### Splicing Wire Leads

*NOTE*

*See Figure A-55. The connector is crimped twice - one side and then the other.*

1. See Figure A-54. Open the PACKARD CRIMPING TOOL (Part No. HD-38125-8) ratchet by squeezing the handles closed.
2. Match the connector color to the wire gauge crimp die in the jaws and insert one end of the sealed connector.
3. Gently squeeze the handles until the connector is held in the jaws.
4. See Figure A-55. Feed the stripped end of a wire into the connector until the wire stops inside the metal insert (1).
5. Squeeze the handles tightly closed to crimp the lead in the insert (2). The tool automatically opens when the crimping is complete.
6. Slide the connector to the other half of the metal insert. Insert the stripped wire lead (1) until it stops, and crimp the lead in the insert (2).

**⚠WARNING**

**Be sure to follow manufacturer's instructions when using the UltraTorch UT-100 or any other radiant heating device. Failure to follow manufacturer's instructions can cause a fire, which could result in death or serious injury. (00335a)**

- Avoid directing heat toward any fuel system component. Extreme heat can cause fuel ignition/explosion resulting in death or serious injury.
- Avoid directing heat toward any electrical system component other than the connectors on which heat shrink work is being performed.
- Always keep hands away from tool tip area and heat shrink attachment.

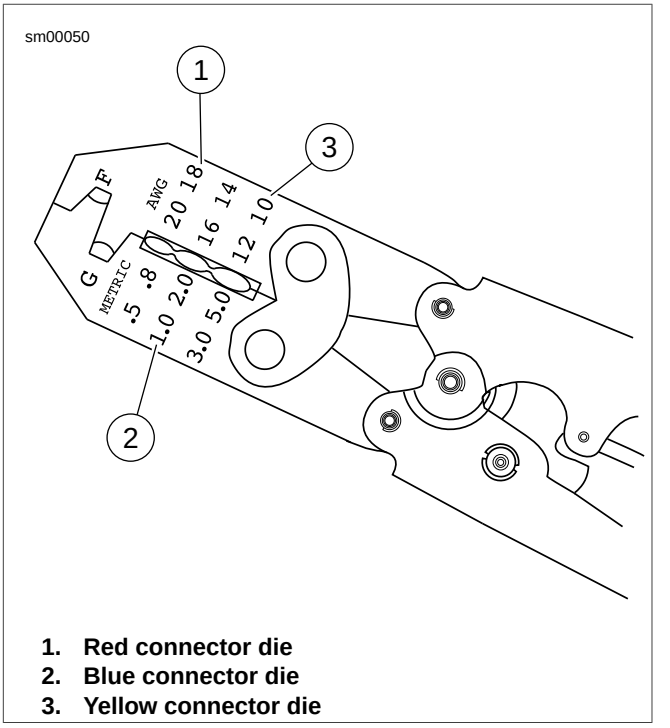
7. Use an ULTRA TORCH UT-100 (Part No. HD-39969), or a ROBINAIR HEAT GUN (Part No. HD-25070) with a HEAT SHIELD ATTACHMENT (Part No. HD-41183), to heat the connector from the center of the crimp (3) out to each end.

*NOTE*

*It is acceptable for the splice to rest against the heat shrink tool attachment.*

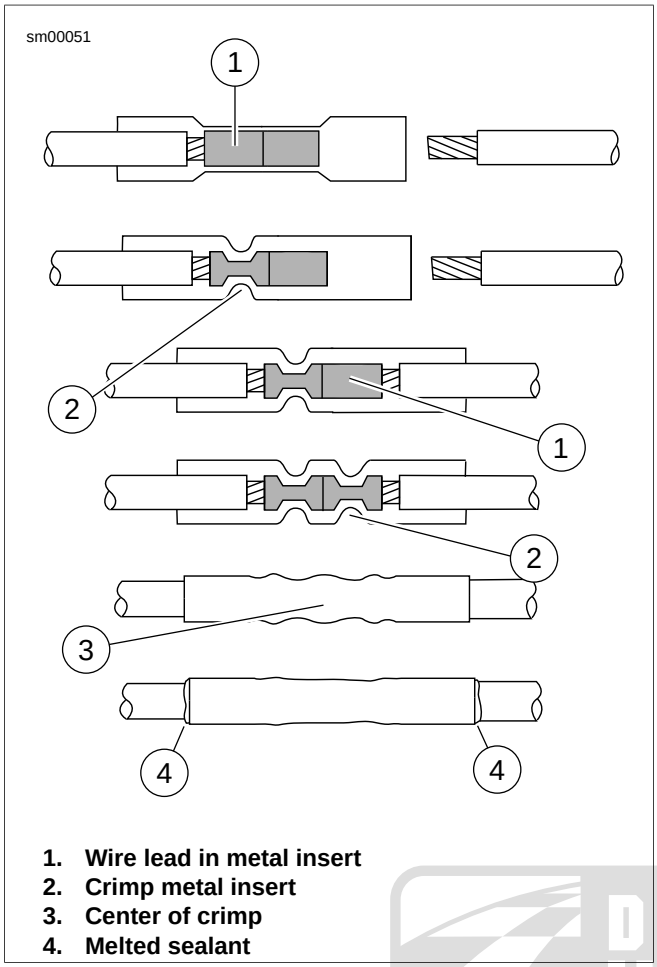
### Inspecting Seals

See Figure A-55. Allow the splice to cool and inspect the seal. The insulation should appear smooth and cylindrical. Melted sealant will have extruded out the ends (4) of the insulation.




1. **Red connector die**
2. **Blue connector die**
3. **Yellow connector die**

**Figure A-54. Packard Crimping Tool (HD-38125-8)**




1. **Wire lead in metal insert**
2. **Crimp metal insert**
3. **Center of crimp**
4. **Melted sealant**

**Figure A-55. Sealed Splice Connector**

# NOTES

# NOTES

## CONNECTOR LOCATIONS

### Function/Location

Refer to Table B-1, Table B-2 or Table B-3. On the motorcycle, a connector can be identified by its function and location.

### Place and Color

The place (number of wire cavities of a connector housing) and color of the connector can also aid identification.

### Connector Number

On wiring diagrams and in service/repair instructions, connectors are identified by a number in brackets.

### Repair Instructions

The repair instructions in this Service Manual are by connector type. Refer to Table B-1, Table B-2 or Table B-3.

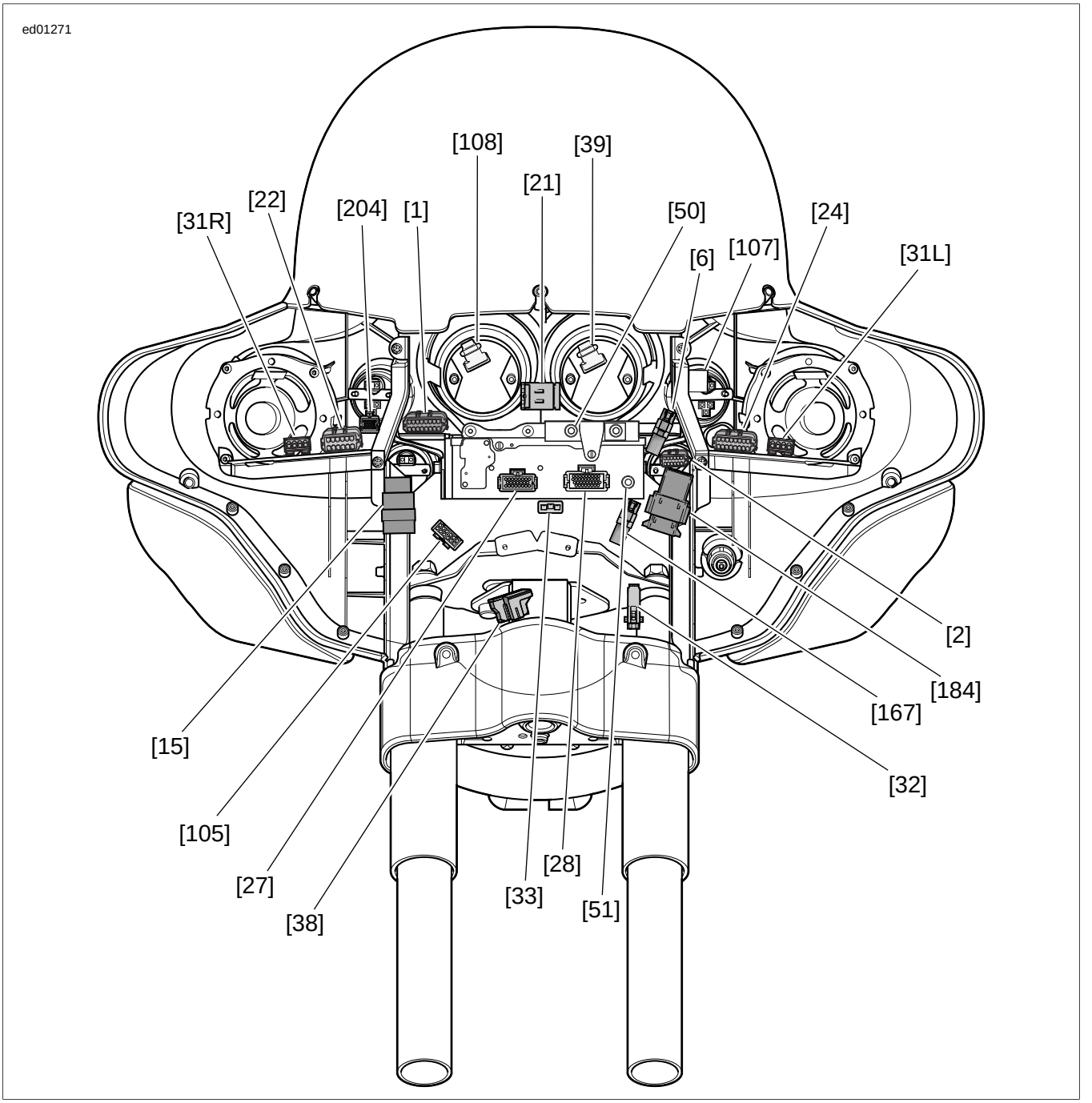



**Figure B-1. Inner Fairing Connectors (FLHX, FLHT/C/U)**

**Table B-1. FLHX, FLHT/C/U Connector Locations**

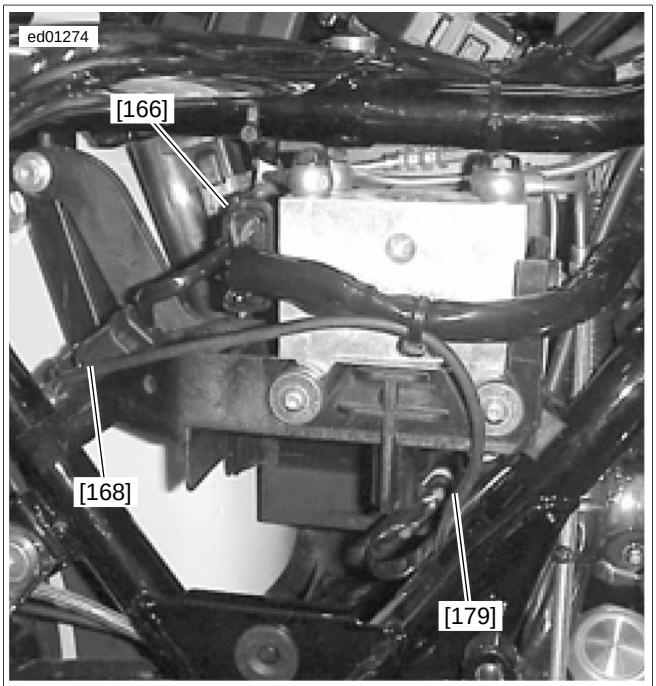
| NO. | DESCRIPTION | TYPE | LOCATION |
|---|---|---|---|
| [1] | Main to interconnect harness | 16-place Molex (black) | Inner fairing - right radio support bracket |
| [2] | Main to interconnect harness | 12-place Molex (gray) | Inner fairing - left radio support bracket |
| [4] | Accessory | 4-place Deutsch | Under seat |
| [5] | MAXIFUSE | 2-place Packard | Under left side cover |
| [7] | Rear fender lights harness | 8-place Multilock | Top of rear fender (under seat) |
| [12] | Tour-Pak lights (rear facia lamp on FLHX) | 3-place Multilock | Inside Tour-Pak (inboard of upper frame tube on FLHX) |
| [13] | Fuel tank harness | 4-place Multilock | Behind fuel tank (under seat) |
| [15] | Main to interconnect harness | 4-place Delphi | Inner fairing - right fairing bracket |
| [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 |
| [20] | Console harness | 16-place Molex | Under seat |
| [21] | Indicator lamps | 10-place Multilock | Inner fairing - above radio |
| [22] | Interconnect to right handlebar switches | 12-place Molex (black) | Inner fairing - right fairing support brace |
| [24] | Interconnect to left handlebar switches | 16-place Molex (gray) | Inner fairing - left fairing support brace |
| [27] | Radio* | 23-place Amp (Tyco) | Inner fairing - back of radio (right side) |
| [28] | Radio** | 35-place Amp (Tyco) | Inner fairing - back of radio (left side) |
| [30] | TSM/TSSM/HFSM | 12-place Deutsch | Crossmember at rear of battery box (under seat) |
| [31L] | Left front turn signal/auxiliary lamp | 4-place Multilock | Inner fairing - left fairing support brace (outboard side) |
| [31R] | Right front turn signal/auxiliary lamp | 4-place Multilock | Inner fairing - right fairing support brace (outboard side) |
| [32] | Front fender tip lamp jumper harness (DOM) | 2-place Multilock (black) | Inner fairing - below upper for bracket (left side) |
| [33] | Ignition Switch | 3-place Packard | Inner fairing - under radio (front of ignition switch housing) |
| [34] | Right front speaker | Spade terminals | Inner fairing (back of speaker) |
| [34] | Left front speaker | Spade terminals | Inner fairing (back of speaker) |
| [38] | Headlamp | Headlamp connector | Inner fairing (back of headlamp) |
| [39] | Speedometer | 12-place Packard | Inner fairing - back of speedometer |
| [41] | Rear right speaker/passenger controls** | 6-place Deutsch | Inside rear right speaker box |
| [42] | Rear left speaker/passenger controls** | 6-place Deutsch | Inside rear left speaker box |
| [45] | Rear fender tip lamp (DOM) | 3-place Multilock | Circuit board under tail lamp assembly |
| [47] | Stator | 3-place Lyall | Bottom of voltage regulator (left side) |
| [50] | CB antenna cable** | - | Inner fairing - back of CB module |
| [51] | Radio antenna cable** | - | Inner fairing - back of radio (left side) |
| [53] | Console pod** | 12-place Deutsch | Rear of battery box (under seat) |
| [64] | Fuse block | Packard | Under left side cover |
| [65] | Vehicle Speed Sensor (VSS) | 3-place Delphi | Top of transmission case (under starter) |
| [76] | Passenger headset | 7-place DIN | Below rear left speaker box |
| [77] | Voltage regulator | 2-place Lyall | Bottom of voltage regulator (right side) |
| [78] | Electronic Control Module (ECM) | 73-place Delphi | Under seat |

**Table B-1. FLHX, FLHT/C/U Connector Locations**

| NO. | DESCRIPTION | TYPE | LOCATION |
|---|---|---|---|
| [79] | Crankshaft Position (CKP) sensor | 2-place Deutsch | Electrical caddy at bottom of lower frame crossmember |
| [80] | Temperature Manifold Absolute Pressure (TMAP) sensor | 4-place Bosch | Top of induction module |
| [83] | Ignition coil | 4-place Delphi | Below fuel tank (left side) |
| [84] | Front injector | 2-place Delphi | Below fuel tank (left side) |
| [85] | Rear injector | 2-place Delphi | Below fuel tank (left side) |
| [87] | Idle Air Control (IAC) | 4-place Delphi | Top of induction module |
| [90] | Engine Temperature (ET) sensor | 2-place Delphi | Back of front cylinder (left side) |
| [91] | Data link connector | 4-place Deutsch | Under left side cover |
| [93] | Tail lamp | 4-place Multilock | Circuit board under tail lamp assembly |
| [94] | Rear fender lights harness in circuit board | 6-place Multilock | Circuit board under tail lamp assembly |
| [95] | Purge solenoid | 2-place Delphi | Below fuel tank (left side) |
| [105] | Fairing cap switches | 12-place Multilock | Inner fairing - above upper fork bracket (right side) |
| [107] | Ambient Air Temperature (AAT) sensor* | 3-place Multilock | Inner fairing - left fairing bracket (outboard side) |
| [108] | Tachometer | 12-place Packard | Inner fairing (back of tachometer) |
| [111] | Voltmeter lamp | Spade terminals | Inner fairing (back of voltmeter) |
| [112] | Oil pressure gauge lamp | Spade terminals | Inner fairing (back of oil pressure gauge) |
| [113] | Oil pressure gauge | Spade terminals | Inner fairing (back of oil pressure gauge) |
| [114] | Air temperature gauge lamp | Spade terminals | Inner fairing (back of air temperature gauge) |
| [115] | Air temperature gauge | Spade terminals | Inner fairing (back of air temperature gauge) |
| [116] | Fuel gauge lamp | Spade terminals | Inner fairing (back of fuel gauge) |
| [117] | Fuel gauge | Spade terminals | Inner fairing (back of fuel gauge) |
| [119] | EFI fuses | Fuse terminals | Fuse block (under right side cover) |
| [121] | Rear brake light switch | Spade terminals | Bottom of rear frame downtube (right side) |
| [122] | Horn | Spade terminals | Between cylinders (right side) |
| [126] | Lighting relay | Relay | Crossmember at rear of battery box (under seat) |
| [128] | Starter solenoid | Spade terminals | Top of starter |
| [129] | Harness grounds | Ring terminals | Upper frame crossmember (under seat) |
| [131] | Neutral switch | Post terminals | Top of transmission (right side) |
| [132] | Cigarette lighter* | Spade terminals | Inner fairing |
| [133] | Jiffy Stand Sensor | 3-place Molex (black) | Domestic (not used): Electrical caddie at bottom of lower frame crossmember. |
| | | | HDI: Electrical caddie at bottom of lower frame crossmember. |
| [134] | Sidecar Bank Angle Sensor (BAS) | 3-place Packard | Under seat |
| [136] | Neutral switch | 1-place molded jumper, black | Right side frame, beneath gearcase cover |
| [137] | $O_2$ sensor rear exhaust header | 2-place Amp (Tyco) | Under chrome starter cover |

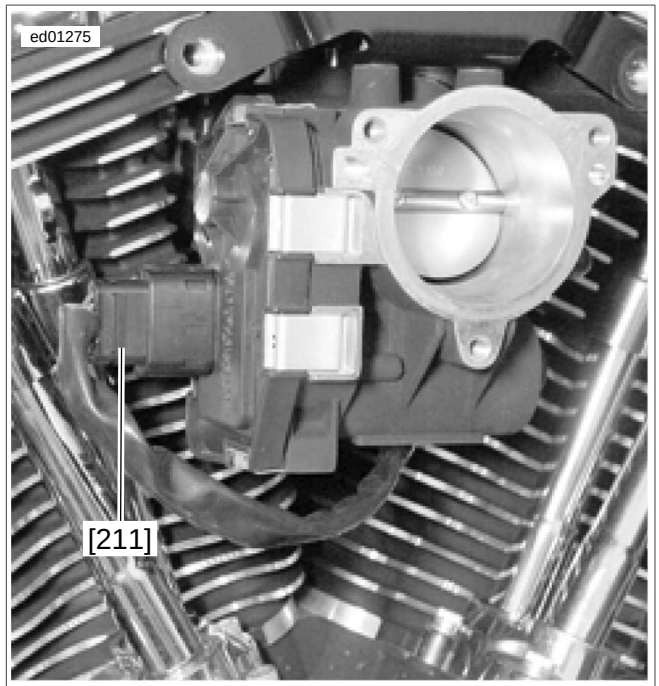
**Table B-1. FLHX, FLHT/C/U Connector Locations**

| NO. | DESCRIPTION | TYPE | LOCATION |
|---|---|---|---|
| [138] | $O_2$ sensor front exhaust header | 2-place Amp (Tyco) | Back of cross brace between front frame downtubes (left side) |
| [141] | Fuel pump and fuel level sender | 4-place Packard | Front right crankcase |
| [142] | Security siren (optional) | 3-place Delphi | Under right side cover (behind electrical bracket) |
| [143] | Front fender tip lamp (DOM) | 2-place Multilock | Under front fender tip lamp bracket |
| [160] | B+ | 1-place Delphi | Upper frame crossmember (under seat) |
| [166] | ABS module | 20-place Molex | Under right side cover |
| [167] | Front wheel speed sensor | 2-place Packard | Inner fairing - below upper fork bracket (left side) |
| [168] | Rear wheel speed sensor | 2-place Packard | Under right side cover |
| [179] | Active exhaust actuator | 5-place Amp (Tyco) | Domestic (not used): Under right side cover |
| | | | HDI: Under right side cover (behind electrical bracket) |
| [184] | CB module | 12-place Deutsch | Inner fairing - left side of radio |
| [201] | ABS diode | 4-place Deutsch | Under left side cover (below fuse box) |
| [204] | Twist Grip Sensor (TGS) harness | 6-place Molex (black) | Inner fairing - right radio support bracket |
| [208] | HFSM antenna jumper harness | 4-place Deutsch | HFSM in crossmember at rear of battery box (under seat) |
| [209] | HFSM antenna | 2-place Molex | Top of rear fender - under seat |
| [211] | Throttle Control Actuator | 6-place Molex | Throttle body |
| [222] | Main to ignition harness | 4-place Packard | Rear of fuel tank |
| [224] | Twist Grip Sensor (TGS) | 7-place Amp (Tyco) | Handlebar throttle (inside right side handlebar) |
| *Classic and Ultra<br>**Ultra Only | | | |



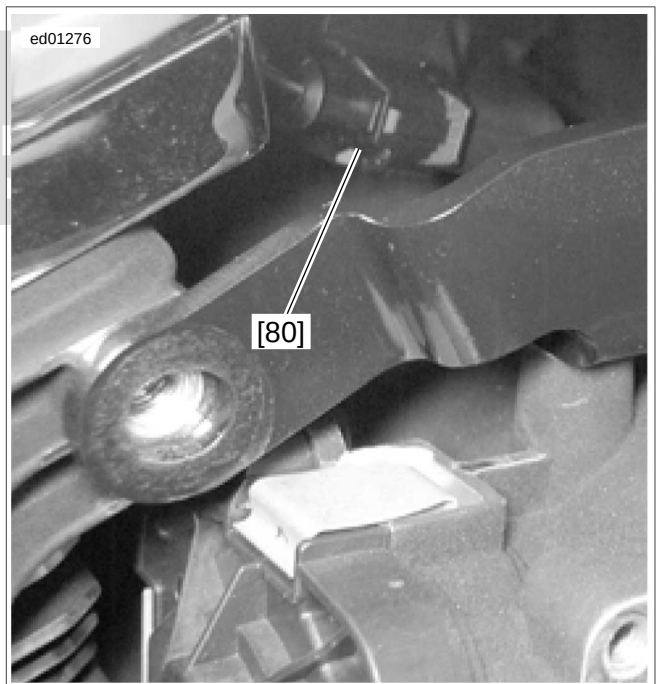

1. [166] ABS Control Module
2. [167] Front Wheel Speed Sensor
3. [168] Rear Wheel Speed Sensor

**Figure B-2. ABS Connector**



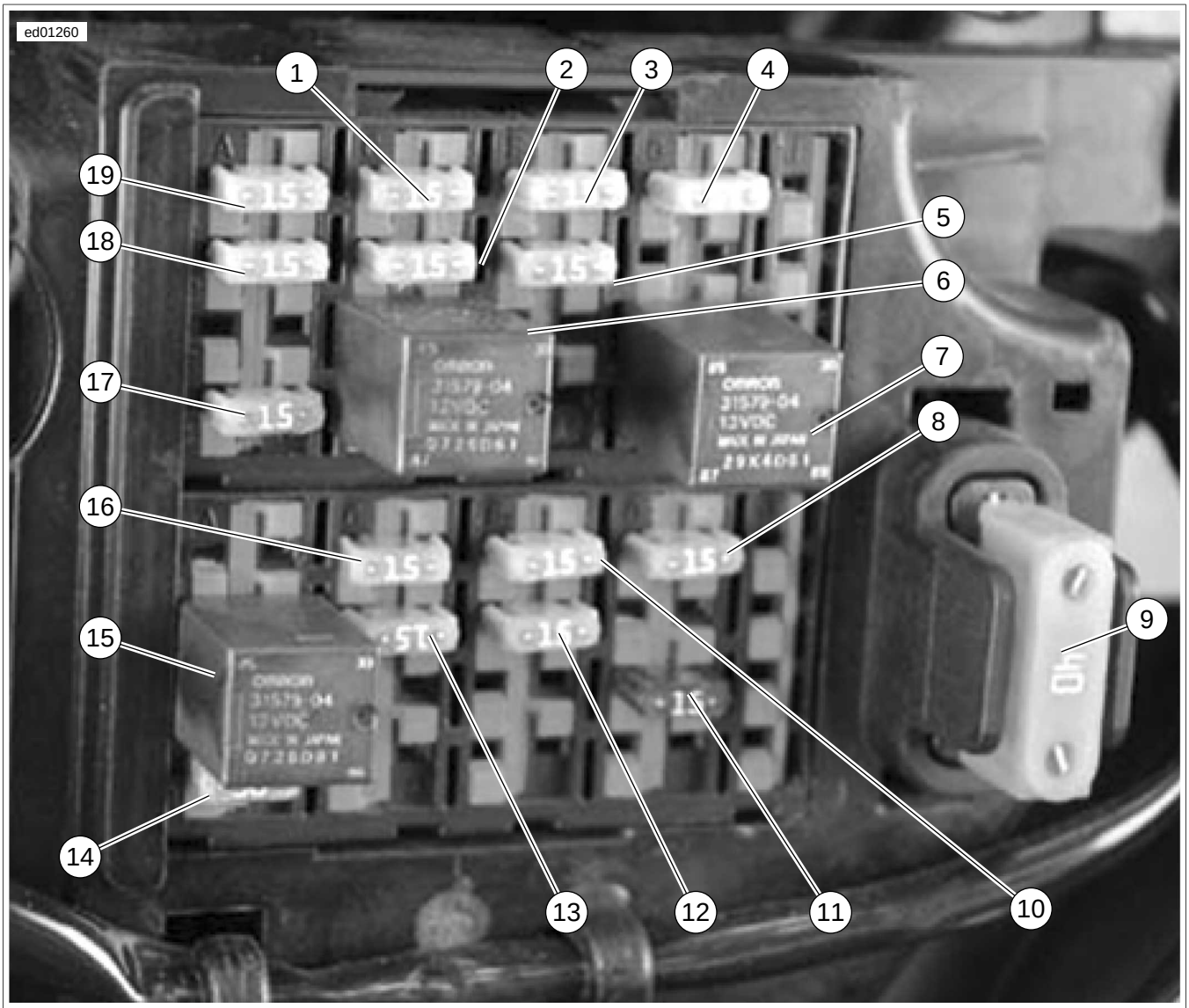

1. [211] Throttle Control Actuator and TP Sensor

**Figure B-3. Throttle Control Connector**



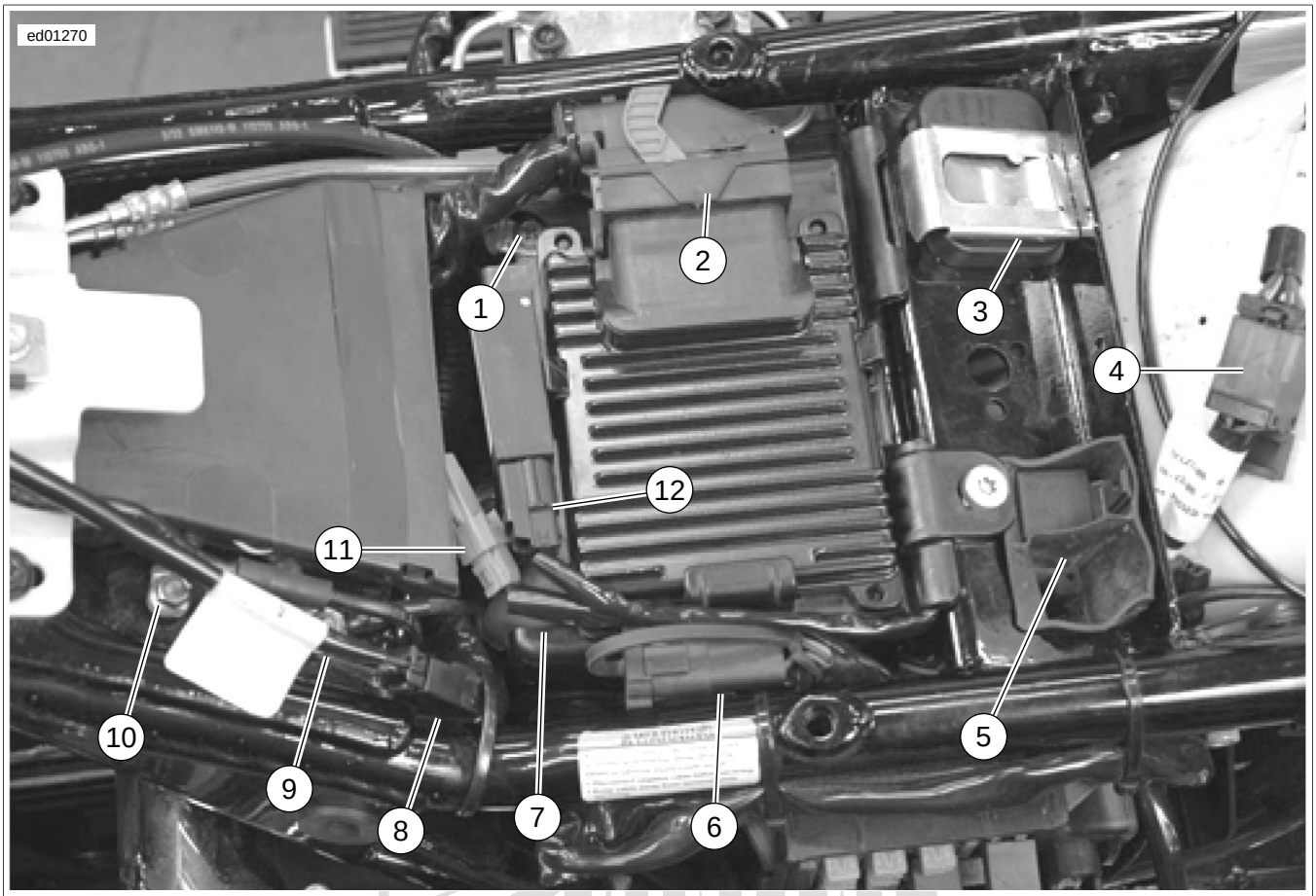

1. [80] TMAP Sensor

**Figure B-4. TMAP Connector**




1. Accessory
2. Battery
3. P&A
4. Radio power/Siren (if equipped)
5. ECM power
6. System relay
7. Start relay
8. Engine control
9. MAXIFUSE
10. Ignition
11. Spare
12. Lights
13. Headlamp
14. ABS (if equipped)
15. Brake relay
16. Instruments
17. Fuel pump
18. Radio memory (if equipped)
19. Brake/Cruise

**Figure B-5. Fuse and Relay Locations**




1. **Negative Battery Terminal**
2. **[78] ECM**
3. **[30] HFSM**
4. **[7] Tail Light Connector**
5. **[126] Lighting Relay**
6. **[4] P&A Accessory Connector**
7. **Positive Battery Terminal**
8. **[13] Fuel Pump Subharness Connector**
9. **[GND2] Rear (clean) Ground**
10. **[GND1] Front (dirty) Ground**
11. **[160] B+ Connector**
12. **[209] Hands-Free Antenna Connector**



**Figure B-6. Electrical Connectors - Under Seat**

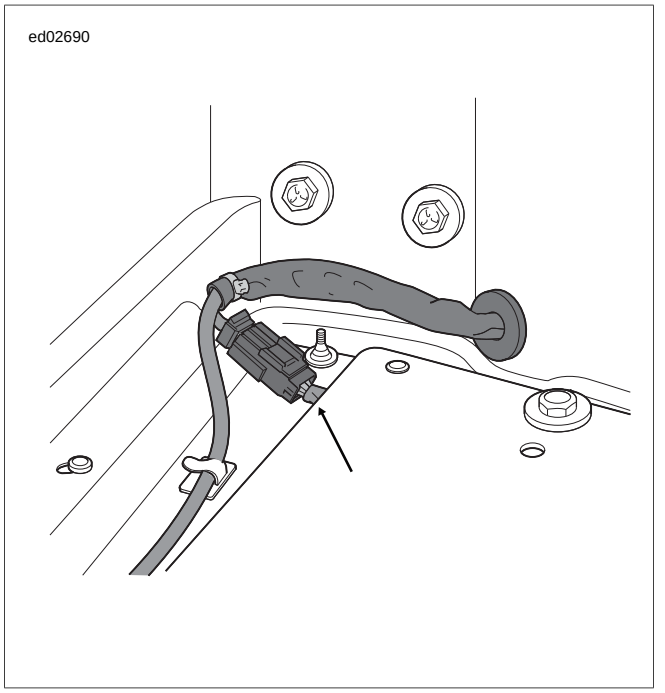



**Figure B-7. Tour-Pak Connectors (Left Side)**

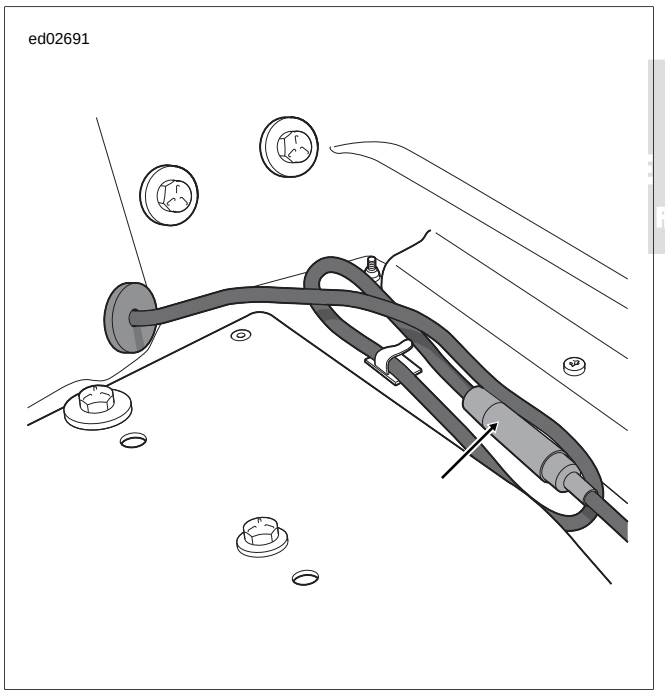
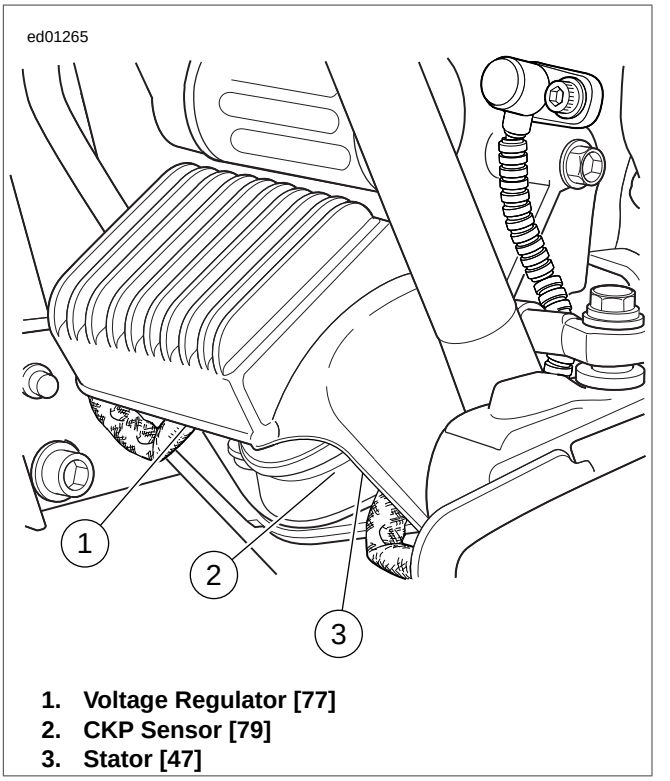
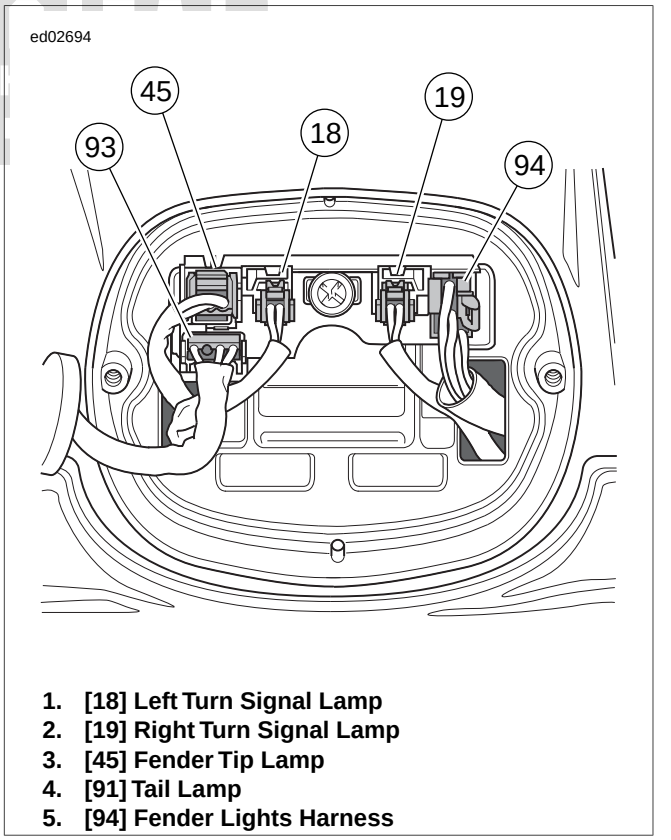



**Figure B-8. Tour-Pak Connectors (Right Side)**




1. **Voltage Regulator [77]**
2. **CKP Sensor [79]**
3. **Stator [47]**

**Figure B-9. Voltage Regulator (Left Side View)**




1. **[18] Left Turn Signal Lamp**
2. **[19] Right Turn Signal Lamp**
3. **[45] Fender Tip Lamp**
4. **[91] Tail Lamp**
5. **[94] Fender Lights Harness**

**Figure B-10. Rear Fender Lights Assembly**

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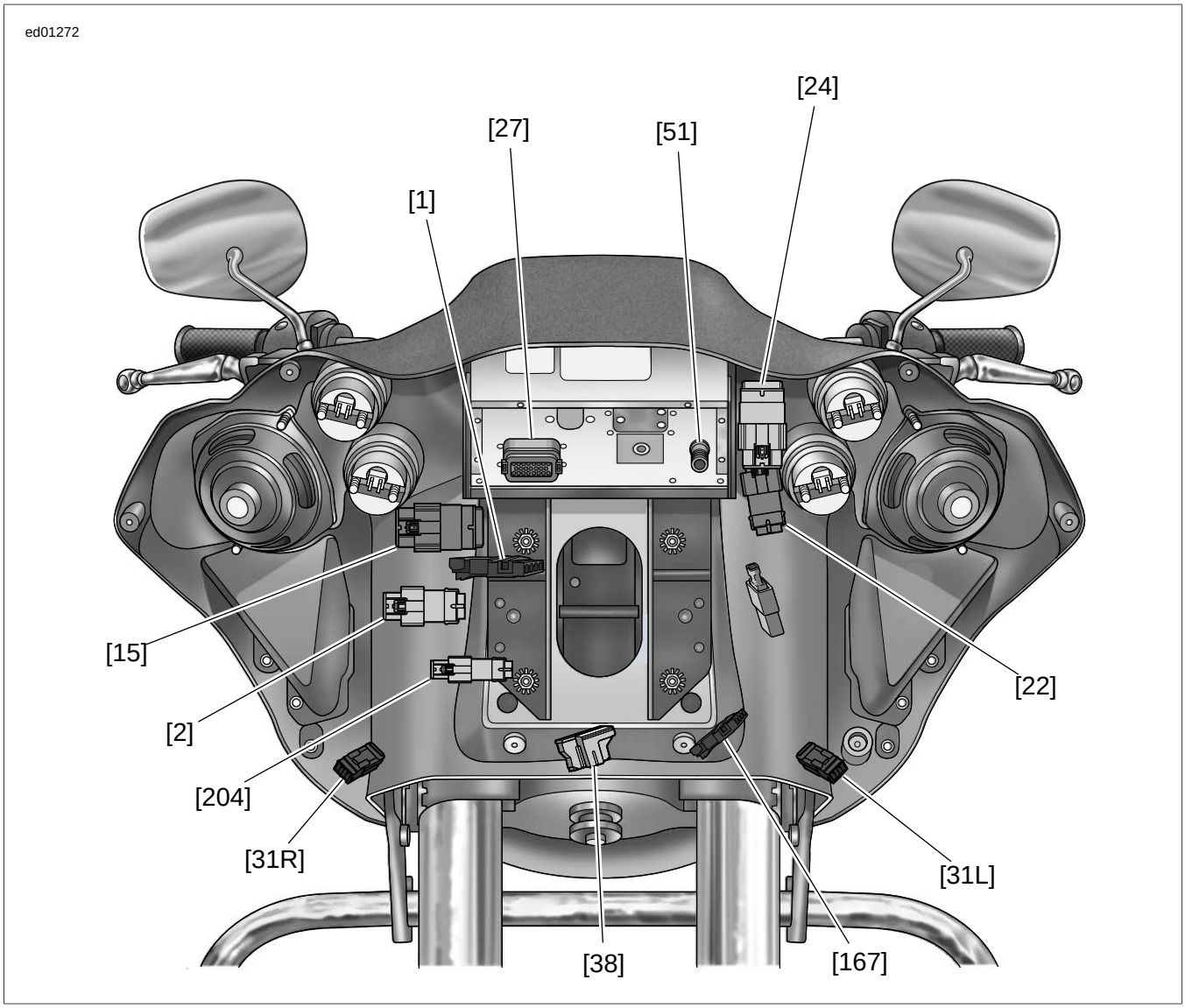
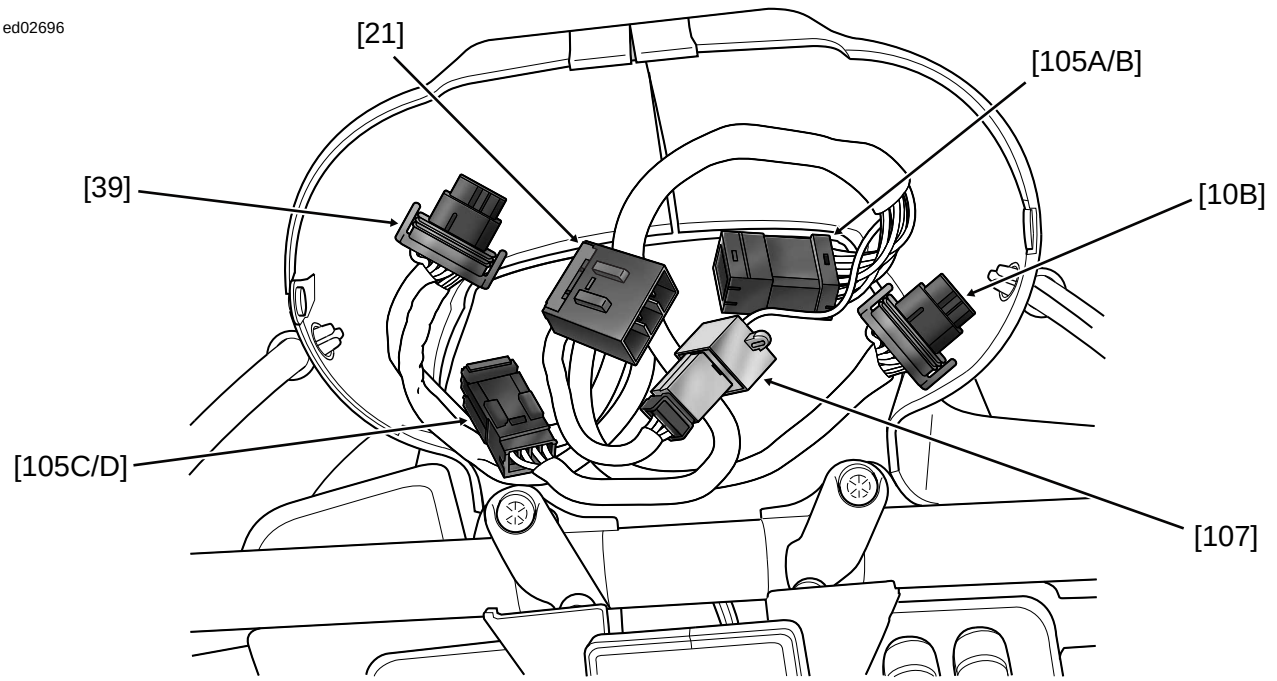



**Figure B-11. Inner Fairing Connectors (FLTR)**




1. **[21] Indicator Lamps**
2. **[39] Speedometer**
3. **[105A/B] Instrument Nacelle Switches**
4. **[105C/D] Speaker Switch**
5. **[107] Ambient Temperature Sensor**
6. **[108] Tachometer**



**Figure B-12. Instrument Nacelle Connectors (FLTR)**

**Table B-2. FLTR Connector Locations**

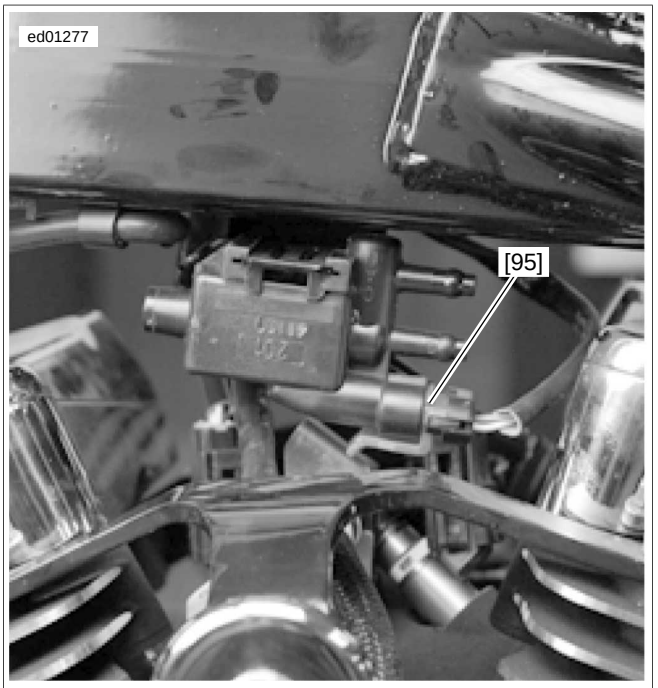
| NO. | DESCRIPTION | TYPE | LOCATION |
|---|---|---|---|
| [1] | Main to interconnect harness | 16-place Molex (black) | Inner fairing - right radio support bracket |
| [2] | Main to interconnect harness | 12-place Molex (gray) | Inner fairing - leftt radio support bracket |
| [4] | Accessory | 4-place Deutsch | Upper frame crossmember (under seat) |
| [5] | MAXIFUSE | 2-place Packard | Under left side cover |
| [7] | Rear fender lights harness | 8-place Multilock | Top of rear fender (under seat) |
| [13] | Fuel tank harness | 4-place Multilock | Behind fuel tank (under seat) |
| [15] | Main to interconnect harness | 4-place Delphi | Inner fairing - below radio (right side) |
| [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 |
| [21] | Indicator lamps | 10-place Multilock | Inner fairing - above radio |
| [22] | Interconnect to right handlebar switches | 12-place Molex (black) | Inner fairing - right fairing support brace |
| [24] | Interconnect to left handlebar switches | 16-place Molex (gray) | Inner fairing - left fairing support brace |
| [27] | Radio | 23-place Amp (Tyco) | Inner fairing - back of radio (right side) |

**Table B-2. FLTR Connector Locations**

| NO. | DESCRIPTION | TYPE | LOCATION |
|---|---|---|---|
| [30] | TSM/HFSM | 12-place Deutsch | Crossmember at rear of battery box (under seat) |
| [31L] | Left front turn signal/auxiliary lamp | 4-place Multilock | Inner fairing - left fairing support brace (outboard side) |
| [31R] | Right front turn signal/auxiliary lamp | 4-place Multilock | Inner fairing - right fairing support brace (outboard side) |
| [33] | Ignition switch | 3-place Packard | Inner fairing - under radio (front of ignition switch housing) |
| [34] | Right front speaker | Spade terminals | Inner fairing (back of speaker) |
| [34] | Left front speaker | Spade terminals | Inner fairing (back of speaker) |
| [38] | Headlamp | Headlamp connector | Inner fairing (back of headlamp) |
| [39] | Speedometer | 12-place Packard | Inner fairing - back of speedometer |
| [45] | Rear fender tip lamp (DOM) | 3-place Multilock | Circuit board under tail lamp assembly |
| [47] | Stator | 3-place Lyall | Bottom of voltage regulator (left side) |
| [51] | Radio antenna cable | - | Inner fairing - back of radio (left side) |
| [64] | Fuse block | Packard | Under left side cover |
| [65] | Vehicle Speed Sensor (VSS) | 3-place Delphi | Top of transmission case (under starter) |
| [77] | Voltage regulator | 2-place Lyall | Bottom of voltage regulator (right side) |
| [78] | Electronic Control Module (ECM) | 73-place Delphi | Under seat |
| [79] | Crankshaft Position (CKP) sensor | 2-place Deutsch | Electrical caddie at bottom of lower frame crossmember |
| [80] | Temperature Manifold Absolute Pressure (TMAP) sensor | 4-place Bosch | Top of induction module |
| [83] | Ignition coil | 4-place Delphi | Below fuel tank (left side) |
| [84] | Front injector | 2-place Delphi | Below fuel tank (left side) |
| [85] | Rear injector | 2-place Delphi | Below fuel tank (left side) |
| [87] | Idle Air Control (IAC) | 4-place Delphi | Below fuel tank (right side) |
| [90] | Engine Temperature (ET) sensor | 2-place Delphi | Back of front cylinder (left side) |
| [91] | Data link connector | 4-place Deutsch | Under left side cover |
| [93] | Tail lamp | 4-place Multilock | Circuit board under tail lamp assembly |
| [94] | Rear fender lights harness in circuit board | 6-place Multilock | Circuit board under tail lamp assembly |
| [95] | Purge solenoid | 2-place Delphi | Below fuel tank (left side) |
| [105] | Instrument nacelle switches | | |
| | Interconnect to nacelle switch harness (105A, 105B) | 12-place Multilock | Inside instrument nacelle (under bezel) |
| | Nacelle switch harness to speaker switch (105C, 105D) | 4-place Multilock | Inside instrument nacelle (under bezel) |
| [107] | Ambient Air Temperature (AAT) sensor | 3-place Multilock | Inside instrument nacelle (under bezel) |
| [108] | Tachometer | 12-place Packard (gray) | Inside instrument nacelle (back of tachometer) |
| [111] | Voltmeter lamp | Spade terminals | Inner fairing (back of voltmeter) |
| [112] | Oil pressure gauge lamp | Spade terminals | Inner fairing (back of oil pressure gauge) |
| [113] | Oil pressure gauge | Spade terminals | Inner fairing (back of oil pressure gauge) |

**Table B-2. FLTR Connector Locations**

| NO. | DESCRIPTION | TYPE | LOCATION |
|---|---|---|---|
| [114] | Air temperature gauge lamp | Spade terminals | Inner fairing (back of air temperature gauge) |
| [115] | Air temperature gauge | Spade terminals | Inner fairing (back of air temperature gauge) |
| [116] | Fuel gauge lamp | Spade terminals | Inner fairing (back of fuel gauge) |
| [117] | Fuel gauge | Spade terminals | Inner fairing (back of fuel gauge) |
| [119] | EFI fuses | Fuse terminals | Fuse block (under right side cover) |
| [121] | Rear brake light switch | Spade terminals | Bottom of rear frame downtube (right side) |
| [122] | Horn | Spade terminals | Between cylinders (right side) |
| [123] | Start relay | Relay | Fuse block (under left side cover) |
| [124] | Brake light relay | Relay | Fuse block (under left side cover) |
| [126] | Lighting relay | Relay | Crossmember at rear of battery box (under seat) |
| [128] | Starter solenoid | Spade terminals | Top of starter |
| [129] | Harness grounds | Ring terminals | Upper frame crossmember (under seat) |
| [131] | Neutral switch | Post terminals | Top of transmission (right side) |
| [132] | Cigarette lighter | Spade terminals | Inner fairing |
| [133] | Jiffy Stand Sensor | 3-place Molex (black) | Domestic (not used): Electrical caddie at bottom of lower frame crossmember. |
| | | | HDI: Electrical caddy at bottom of lower frame crossmember. |
| [135] | EFI system relay | Relay | Fuse block (under right side cover) |
| [137] | $O_2$ sensor rear exhaust header | 2-place Amp (Tyco) | Under chrome starter cover |
| [138] | $O_2$ sensor front exhaust header | 2-place Amp (Tyco) | Back of cross brace between front frame downtubes (left side) |
| [141] | Fuel pump and fuel level sender | 4-place Packard | Top of canopy (under console) |
| [142] | Security siren (optional) | 3-place Delphi | Under right side cover (behind electrical bracket) |
| [160] | B+ | 1-place Delphi | Upper frame crossmember (under seat) |
| [166] | ABS module | 20-place Molex | Under right side cover |
| [167] | Front wheel speed sensor | 2-place Delphi (black) | Inner fairing - below upper fork bracket (left side) |
| [168] | Rear wheel speed sensor | 2-place Delphi (black) | Under right side cover |
| [179] | Active exhaust actuator | 5-place Amp (Tyco) | Domestic (not used): Under right side cover |
| | | | HDI: Under right side cover (behind electrical bracket) |
| [201] | ABS diode | 4-place Deutsch | Under left side cover (below fuse box) |
| [204] | Twist Grip Sensor (TGS) | 6-place Molex (black) | Inner fairing - right radio support bracket |
| [208] | HFSM antenna jumper harness | 4-place Deutsch | HFSM in crossmember at rear of battery box (under seat) |
| [209] | HFSM antenna | 2-place Molex | Top of rear fender - under seat |
| [211] | Throttle Control Actuator (TCA) | 6-place Molex | Throttle body |
| [222] | Console ignition switch interconnect | 4-place Packard | Under seat |




1. **[95] Purge Solenoid**

**Figure B-13. Below Fuel Tank (Left Side)**

**Table B-3. FLHR/C/S Connector Locations**

| NO. | DESCRIPTION | TYPE | LOCATION |
|---|---|---|---|
| [4] | Accessory | 4-place Deutsch | Upper frame crossmember (under seat) |
| [5] | MAXIFUSE | 2-place Packard | Under left side cover |
| [7] | Rear fender lights harness | 6-place Multilock | Top of rear fender (under seat) |
| [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 |
| [20] | Console harness | 16-place Molex | Under seat |
| [21] | Indicator lamps | 8-place Deutsch | Under console |
| [22] | Right handlebar switches | 6-place Molex (black) | Inside headlamp nacelle - fork stern nut lock plate (right side) |
| [24] | Left handlebar switches | 8-place Molex (gray) | Inside headlamp nacelle - fork stern nut lock plate (left side) |
| [30] | TSM//HFSM | 12-place Deutsch | Crossmember at rear of battery box (under seat) |
| [31] | Front turn signals | 6-place Multilock | Inside headlamp nacelle - fork stern nut lock plate (left side) |
| [32] | Front fender tip lamp jumper harness (DOM) | 2-place Multilock | Inside headlamp nacelle |
| [33] | Ignition switch | 3-place Packard | Under console |
| [38] | Headlamp | Headlamp connector | Inside headlamp nacelle |
| [39] | Speedometer | 12-place Packard | Back of speedometer (back of console) |
| [45] | Rear fender tip lamp (DOM) | 3-place Multilock | Circuit board under tail lamp assembly |
| [47] | Stator | 3-place Lyall | Bottom of voltage regulator (left side) |
| [64] | Fuse block | Packard | Under left side cover |
| [65] | Vehicle Speed Sensor (VSS) | 3-place Delphi | Top of transmission case (under starter) |
| [67] | Accessory switch | 4-place Amp (Tyco) | Inside headlamp nacelle |
| [73] | Auxiliary lamps | 2-place Multilock (white) | Inside headlamp nacelle |

**Table B-3. FLHR/C/S Connector Locations**

| NO. | DESCRIPTION | TYPE | LOCATION |
|---|---|---|---|
| [75] | Cruise roll-off switch** | Spade terminals | Right side of steering head |
| [77] | Voltage regulator | 2-place Lyall | Bottom of voltage regulator (right side) |
| [78] | Electronic Control Module (ECM) | 73-place Delphi | Under seat |
| [79] | Crankshaft Position (CKP) sensor | 2-place Deutsch | Electrical caddie at bottom of lower frame crossmember |
| [80] | Temperature Manifold Absolute Pressure (TMAP) sensor | 3-place Packard | Top of induction module |
| [83] | Ignition coil | 4-place Delphi | Below fuel tank (left side) |
| [84] | Front injector | 2-place Delphi | Below fuel tank (left side) |
| [85] | Rear injector | 2-place Delphi | Below fuel tank (left side) |
| [87] | Idle Air Control (IAC) | 4-place Delphi | Below fuel tank (right side) |
| [90] | Engine Temperature (ET) sensor | 2-place Delphi | Back of front cylinder (left side) |
| [91] | Data link connector | 4-place Deutsch | Under right side cover |
| [93] | Tail lamp | 4-place Multilock | Circuit board under tail lamp assembly |
| [94] | Rear fender lights harness in circuit board | 6-place Multilock | Circuit board under tail lamp assembly |
| [95] | Purge solenoid | 2-place Delphi | Below fuel tank (left side) |
| [108] | Optional tachometer | 1-place Amp (Tyco) | Inside headlamp nacelle |
| [109] | Auxiliary lamps switch | 4-place Amp (Tyco) | Inside headlamp nacelle |
| [117] | Fuel gauge | Spade terminals | Inner fairing (back of fuel gauge) |
| [119] | EFI fuses | Fuse terminals | Fuse block (under right side cover) |
| [121] | Rear brake light switch | Spade terminals | Bottom of rear frame downtube (right side) |
| [119] | Oil pressure switch | Post terminal | Front right crankcase |
| [122] | Horn | Spade terminals | Between cylinders (right side) |
| [123] | Start relay | Relay | Fuse block (under left side cover) |
| [124] | Brake light relay | Relay | Fuse block (under left side cover) |
| [126] | Lighting relay | Relay | Crossmember at rear of battery box (under seat) |
| [128] | Starter solenoid | Spade terminals | Top of starter |
| [129] | Harness grounds | Ring terminals | Upper frame crossmember (under seat) |
| [131] | Neutral switch | Post terminals | Top of transmission (right side) |
| [133] | Jiffy Stand Sensor | 3-place Molex (black) | Domestic (not used): Electrical caddie at bottom of lower frame crossmember. |
| | | | HDI: Electrical caddie at bottom of lower frame crossmember. |
| [135] | EFI system relay | Relay | Fuse block (under right side cover) |
| [137] | $O_2$ sensor rear exhaust header | 2-place Amp (Tyco) | Under chrome starter cover |
| [138] | $O_2$ sensor front exhaust header | 2-place Amp (Tyco) | Back of cross brace between front frame downtubes (left side) |
| [141] | Fuel pump and fuel level sender | 4-place Packard | Top of canopy (under console) |
| [142] | Security siren (optional) | 3-place Delphi | Under right side cover (behind electrical bracket) |
| [143] | Front fender tip lamp (DOM) | 2-place Multilock (black) | Under front fender tip lamp bracket |
| [158] | Left handlebar switches (cruise control)** | 3-place Molex (black) | Inside headlamp nacelle |

**Table B-3. FLHR/C/S Connector Locations**

| NO. | DESCRIPTION | TYPE | LOCATION |
|---|---|---|---|
| [159] | Right handlebar switches (cruise control)** | 3-place Molex (gray) | Inside headlamp nacelle |
| [160] | B+ | 1-place Packard | Upper frame crossmember (under seat) |
| [166] | ABS module | 20-place Molex | Under right side cover |
| [167] | Front wheel speed sensor | 2-place Delphi (black) | Inner fairing - below upper fork bracket (left side) |
| [168] | Rear wheel speed sensor | 2-place Delphi (black) | Under right side cover |
| [178] | Active intake solenoid | 2-place Amp (Tyco) | |
| [179] | Active exhaust actuator | 5-place Amp (Tyco) | Domestic (not used): Under right side cover |
| | | | HDI: Under right side cover (behind electrical bracket) |
| [201] | ABS diode | 4-place Deutsch | Under left side cover (below fuse box) |
| [204] | Twist Grip Sensor (TGS) | 6-place Molex (black) | Inner fairing - right radio support bracket |
| [208] | HFSM antenna jumper harness | 4-place Deutsch | HFSM in crossmember at rear of battery box (under seat) |
| [209] | HFSM antenna | 2-place Molex | Top of rear fender (under seat) |
| [211] | Throttle Control Actuator (TCA) | 6-place Molex | Throttle body |
| [222] | Console ignition switch interconnect | 4-place Packard | Under seat |
| ** FLHRC Only | | | |

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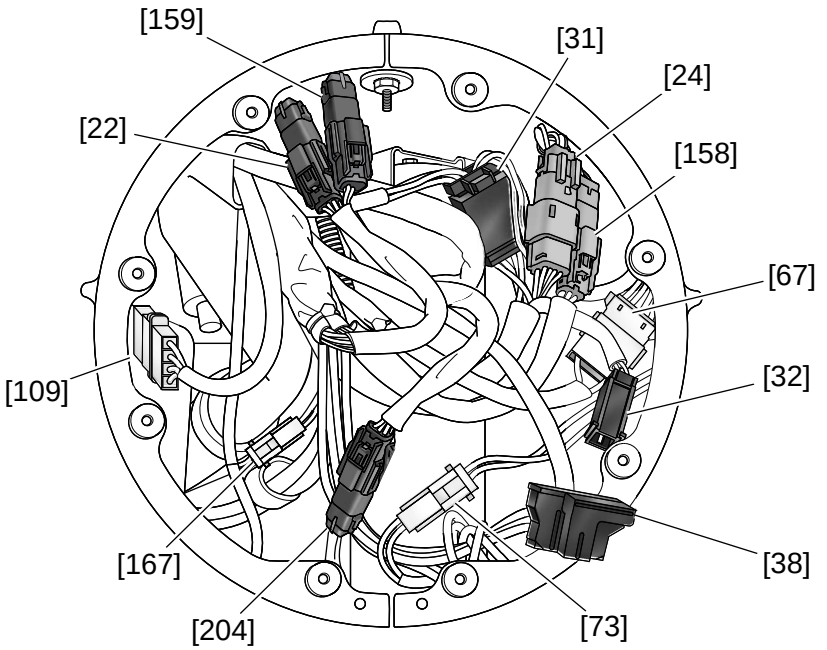


1. **[22] Right Handlebar Switches**
2. **[24] Left Handlebar Switches**
3. **[31] Front Turn Signals**
4. **[32] Front Fender Tip Lamp (Used on FLHR Only)**
5. **[38] Headlamp**
6. **[67] Accessory Switch**
7. **[73] Auxiliary Lamps (Used on FLHR/C Only)**
8. **[109] Auxiliary Lamps Switch (Used on FLHR/C Only)**
9. **[158] Cruise On/Off Switch (Used on FLHR/C Only)**
10. **[159] Cruise Set/Resume Switch (Used on FLHR/C Only)**

**Figure B-14. Headlamp Nacelle Connectors (FLHR/C/S)**

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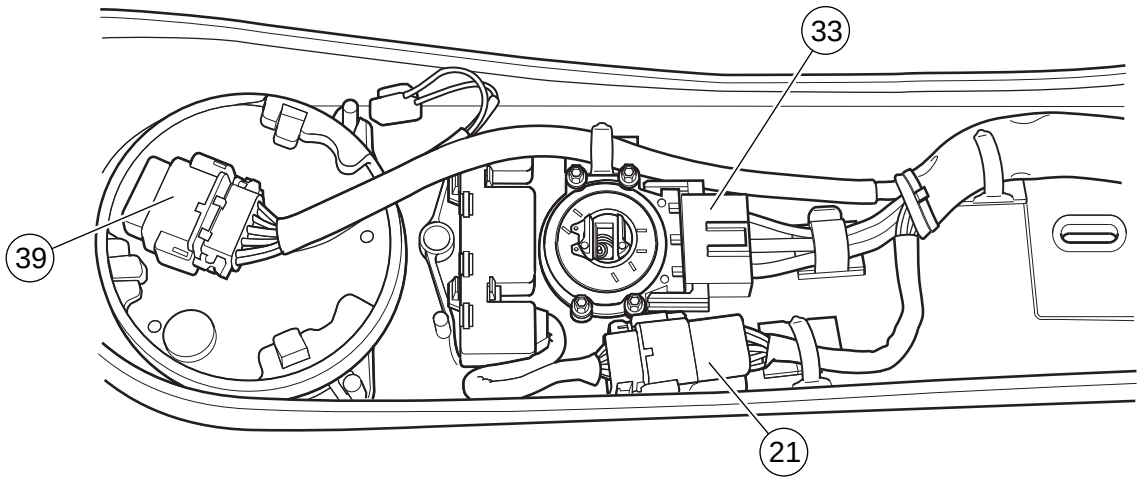



1. **[21] Indicator Lights**
2. **[33] Ignition/Light Key Switch**
3. **[39] Speedometer**

**Figure B-15. Instrument Console Connectors (FLHR/C)**

## WIRING DIAGRAM INFORMATION

### Wire Color Codes

Wire traces on wiring diagrams are labeled with alpha codes. Refer to Table B-4.

**For Solid Color Wires:** See Figure B-16. The alpha code identifies wire color (3).

**For Striped Wires:** The code is written with a slash (/) between the solid color code and the stripe code (4). For example, a trace labeled GN / Y is a green wire with a yellow stripe.

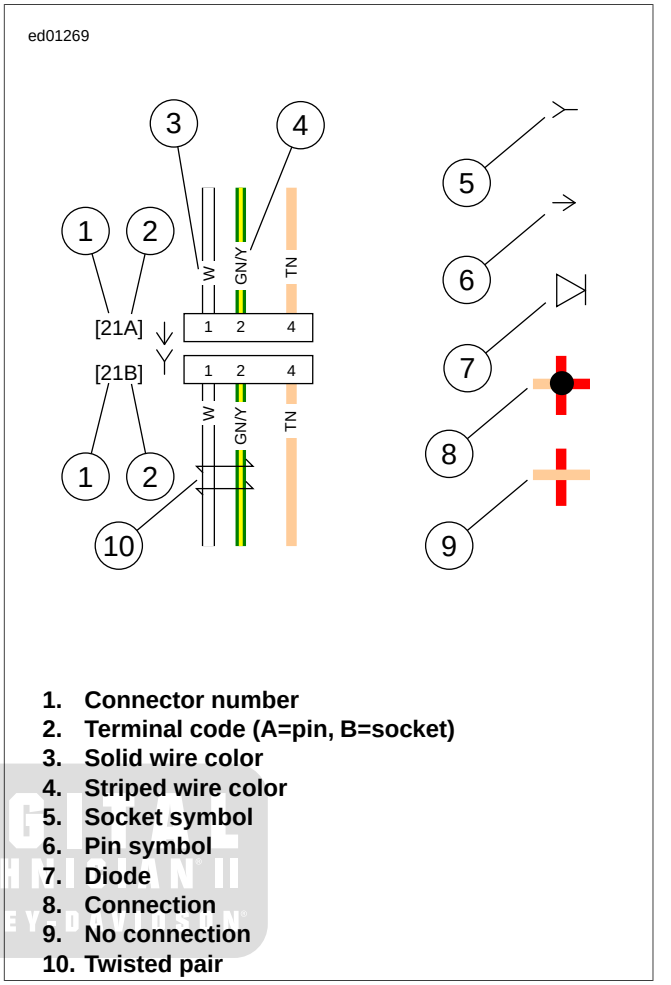
### Wiring Diagram Symbols

See Figure B-16. On wiring diagrams and in service/repair instructions, connectors are identified by a number in brackets (1). The letter (2) inside the brackets identifies whether the housing is a socket or pin housing.

**A=Pin:** The letter A after a connector number and the pin symbol (6) identifies a pin housing.

**B=Socket:** The letter B after a connector number and the socket symbol (5) identifies a socket housing.

Other symbols found on the wiring diagrams include the symbol for a diode (7), a symbol for a wire-to-wire connection (8), a symbol that verifies that no connection (9) between two wire traces exists and a symbol identifying two wires that are twisted together (10).




1. **Connector number**
2. **Terminal code (A=pin, B=socket)**
3. **Solid wire color**
4. **Striped wire color**
5. **Socket symbol**
6. **Pin symbol**
7. **Diode**
8. **Connection**
9. **No connection**
10. **Twisted pair**

**Figure B-16. Connector/Wiring Diagram Symbols (typical)**

**Table B-4. Wire Color Codes**

| ALPHA CODE | WIRE COLOR |
|---|---|
| BE | Blue |
| BK | Black |
| BN | Brown |
| GN | Green |
| GY | Grey |
| LGN | Light Green |
| O | Orange |
| PK | Pink |
| R | Red |
| TN | Tan |
| V | Violet |
| W | White |
| Y | Yellow |

# Wiring Diagram List

| DIAGRAM | LOCATION |
|---|---|
| 2008 FLHT, FLHX, FLHTC, FLHTCU, FLTR, FLTRU & FLHTP DOMESTIC & INTERNATIONAL MODELS, MAIN HARNESS (1 OF 2) | Figure B-17 |
| 2008 FLHT, FLHX, FLHTC, FLHTCU, FLTR, FLTRU & FLHTP DOMESTIC & INTERNATIONAL MODELS MAIN HARNESS W/ABS | Figure B-18 |
| 2008 FLHT, FLHX, FLHTC, FLHTCU, FLTR, FLTRU & FLHTP DOMESTIC & INTERNATIONAL MODELS MAIN HARNESS (2 of 2) | Figure B-19 |
| 2008 FLHT, FLHX, FLHTC, FLHTCU & FLTR DOMESTIC & INTERNATIONAL MODELS INTERCONNECT HARNESS | Figure B-20 |
| 2008 FLT, FLHX, FLHTC, FLHTCU, FLTR & FLTRU DOMESTIC & INTERNATIONAL MODELS MAIN HARNESS | Figure B-21 |
| 2008 FLHT, FLHX, FLHTC, FLHTCU & FLTR DOMESTIC & INTERNATIONAL MODELS STARTING AND CHARGING | Figure B-22 |
| 2008 FLHT, FLHX, FLHTC, FLHTCU, FLTR, FLTRU & FLTHP DOMESTIC & INTERNATIONAL MODELS HANDLEBAR SWITCHES, INDICATOR LAMPS, FAIRING CAP/INSTRUMENT NACELLE SWITCHES AND HFSM/ANTENNA | Figure B-23 |
| 2008 FLHT, FLHX, FLHTC, FLHTCU, FLTR, FLTRU, & FLTHP DOMESTIC & INTERNATIONAL MODELS TAIL LAMP, AUXILIARY LAMPS, DIRECTIONAL LAMPS & TOUR-PAK LIGHTS | Figure B-24 |
| 2008 TLE, TLE-U SIDECARS DOMESTIC & INTERNATIONAL MODELS AMPLIFIER, SIDECAR SPEAKERS AND SWITCHES | Figure B-25 |
| 2008 FLHX, FLHTC, FLHTCU AND FLTR DOMESTIC & INTERNATIONAL MODELS RADIO, CB/INTERCOM, REAR SPEAKERS, XM, HANDS-FREE PHONE AND NAVIGATION | Figure B-26 |
| 2008 FLHR, FLHRC & FLHRS DOMESTIC & INTERNATIONAL MODELS MAIN HARNESS | Figure B-27 |
| 2008 FLHR, FLHRC & FLHRS DOMESTIC & INTERNATIONAL MODELS MAIN HARNESS W/ABS | Figure B-28 |
| 2008 FLHR, FLHRC, FLHRS, FLHP & FLHP/E DOMESTIC & INTERNATIONAL MODELS MAIN HARNESS | Figure B-29 |
| 2008 FLHR, FLHRC AND FLHRS DOMESTIC & INTERNATIONAL MODELS STARTING AND CHARGING | Figure B-30 |
| 2008 FLHR, FLHRC DOMESTIC & INTERNATIONAL MODELS HANDLEBAR SWITCHES, SPEEDOMETER, INDICATOR LAMPS, TAIL LAMP, AUXILIARY LAMPS, DIRECTIONAL LAMPS, FENDER TIP LAMPS AND AUX LAMP/ACCESSORY SWITCHES | Figure B-31 |

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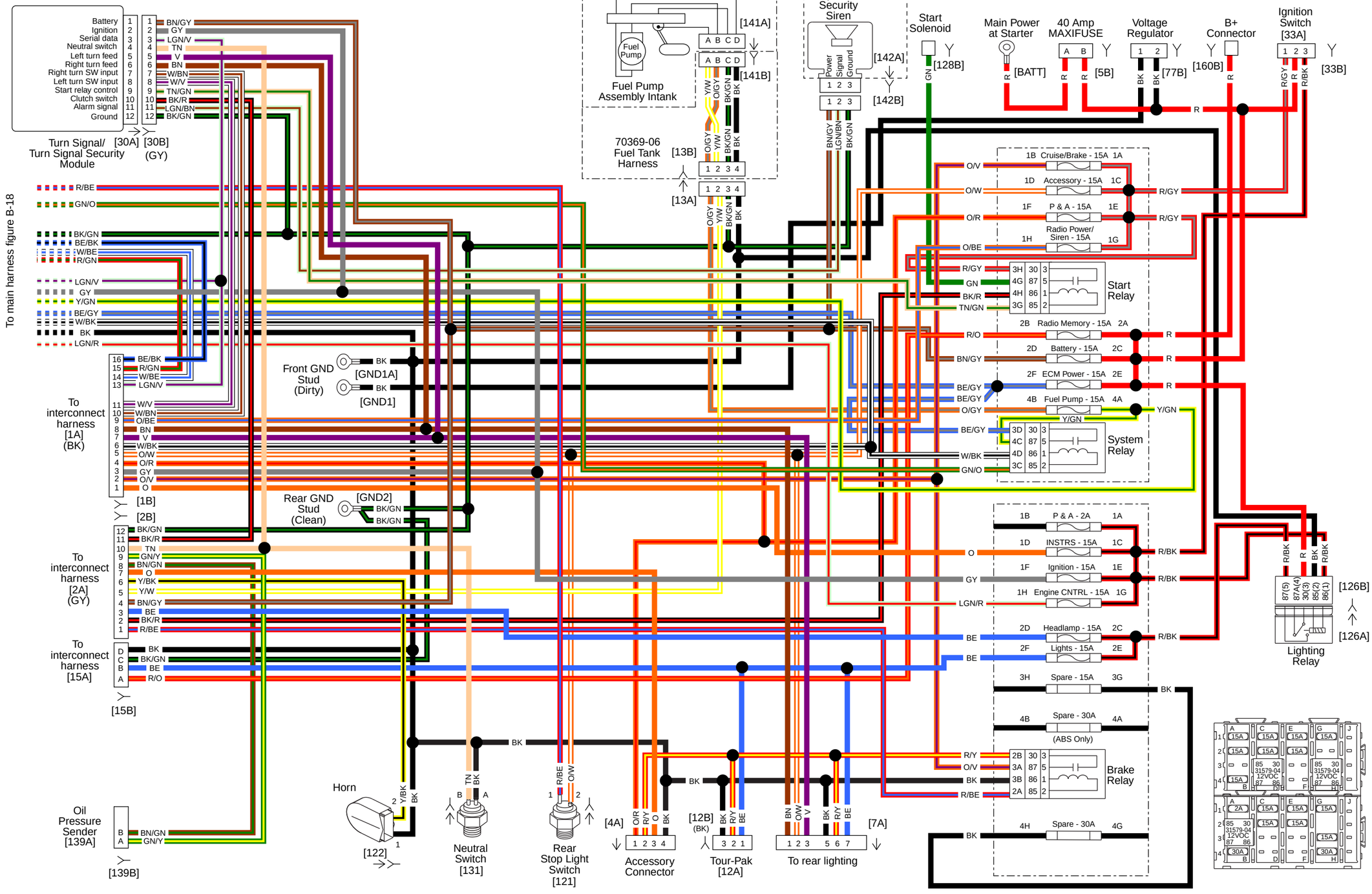


**Figure B-17. 2008 FLHT, FLHX, FLHTC, FLHTCU, FLTR, FLTRU & FLHTP DOMESTIC & INTERNATIONAL MODELS, MAIN HARNESS (1 OF 2)**

**Figure B-17.**
**2008 FLHT, FLHX, FLHTC, FLHTCU, FLTR, FLTRU & FLHTP DOMESTIC & INTERNATIONAL MODELS, MAIN HARNESS (1 OF 2)**

**Figure B-17.**
**2008 FLHT, FLHX, FLHTC, FLHTCU, FLTR, FLTRU & FLHTP DOMESTIC & INTERNATIONAL MODELS, MAIN HARNESS (1 OF 2)**

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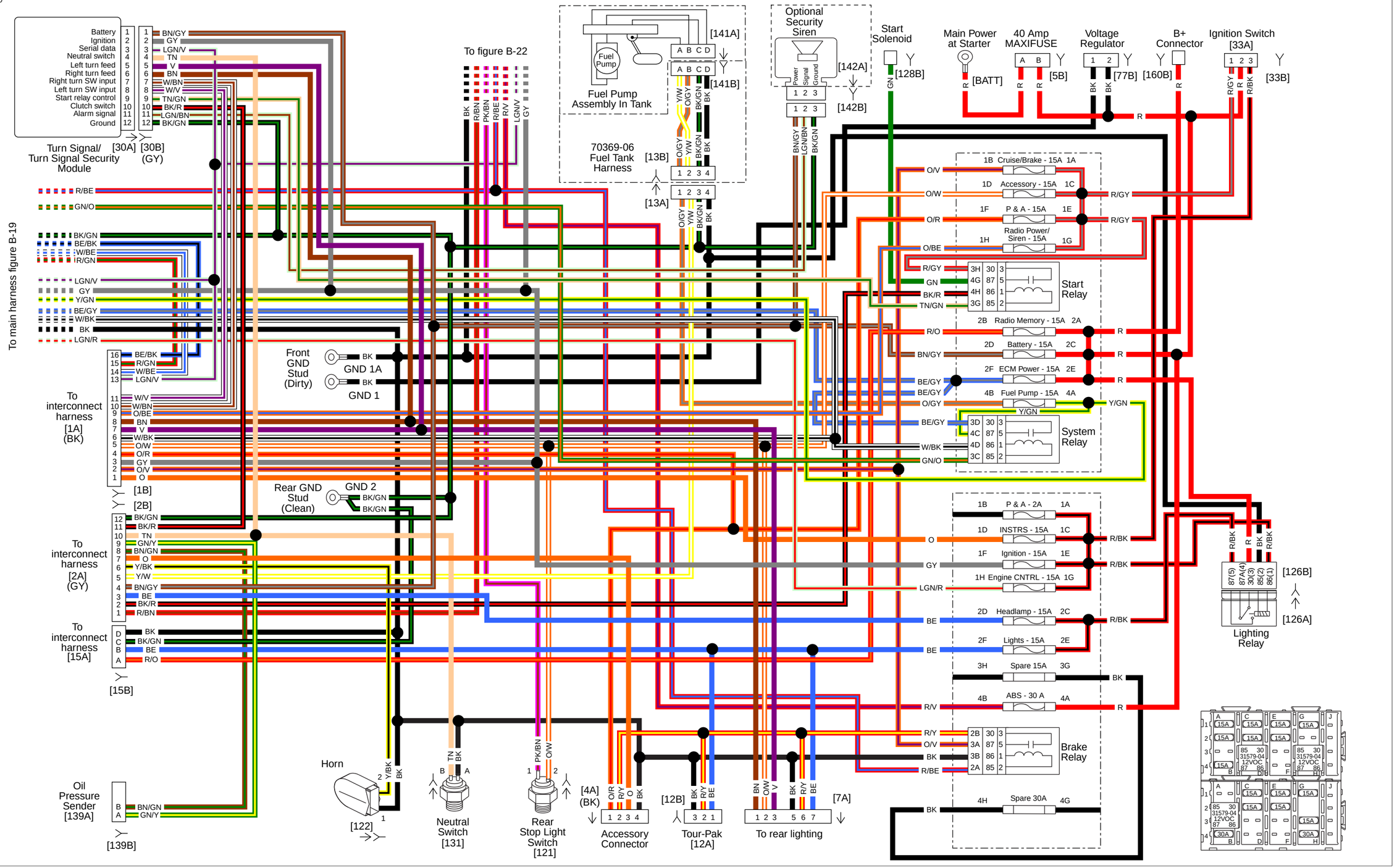


**Figure B-18. 2008 FLHT, FLHX, FLHTC, FLHTCU, FLTR, FLTRU & FLHTP DOMESTIC & INTERNATIONAL MODELS MAIN HARNESS W/ABS**

**Figure B-18.**
**2008 FLHT, FLHX, FLHTC, FLHTCU, FLTR, FLTRU & FLHTP**
**DOMESTIC & INTERNATIONAL MODELS MAIN HARNESS W/ABS**

**Figure B-18.**
**2008 FLHT, FLHX, FLHTC, FLHTCU, FLTR, FLTRU & FLHTP**
**DOMESTIC & INTERNATIONAL MODELS MAIN HARNESS W/ABS**

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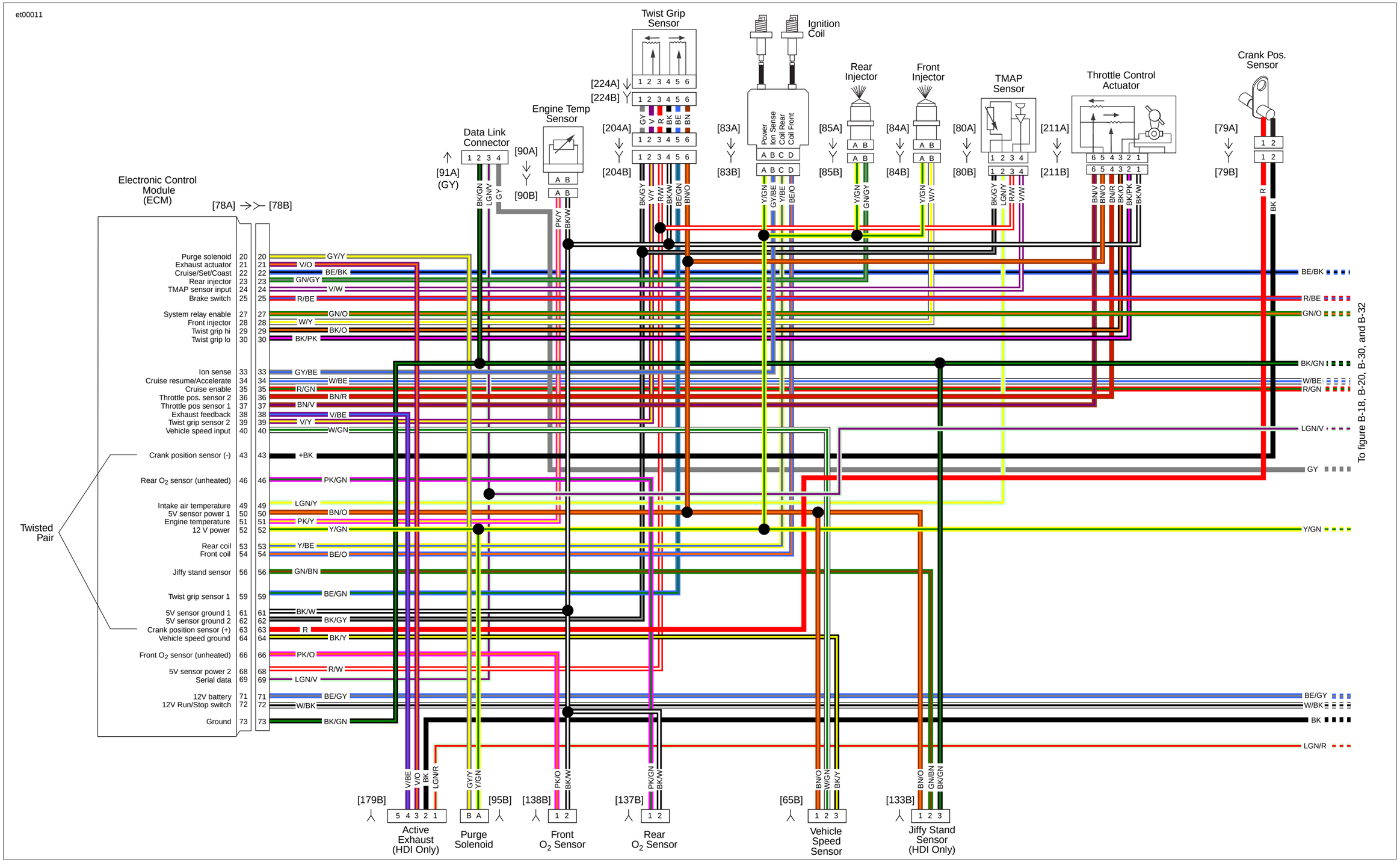


**Figure B-19. 2008 FLHT, FLHX, FLHTC, FLHTCU, FLTR, FLTRU & FLHTP DOMESTIC & INTERNATIONAL MODELS MAIN HARNESS (2 of 2)**

**Figure B-19.**
**2008 FLHT, FLHX, FLHTC, FLHTCU, FLTR, FLTRU & FLHTP DOMESTIC & INTERNATIONAL MODELS MAIN HARNESS (2 of 2)**

**Figure B-19.**
**2008 FLHT, FLHX, FLHTC, FLHTCU, FLTR, FLTRU & FLHTP DOMESTIC & INTERNATIONAL MODELS MAIN HARNESS (2 of 2)**

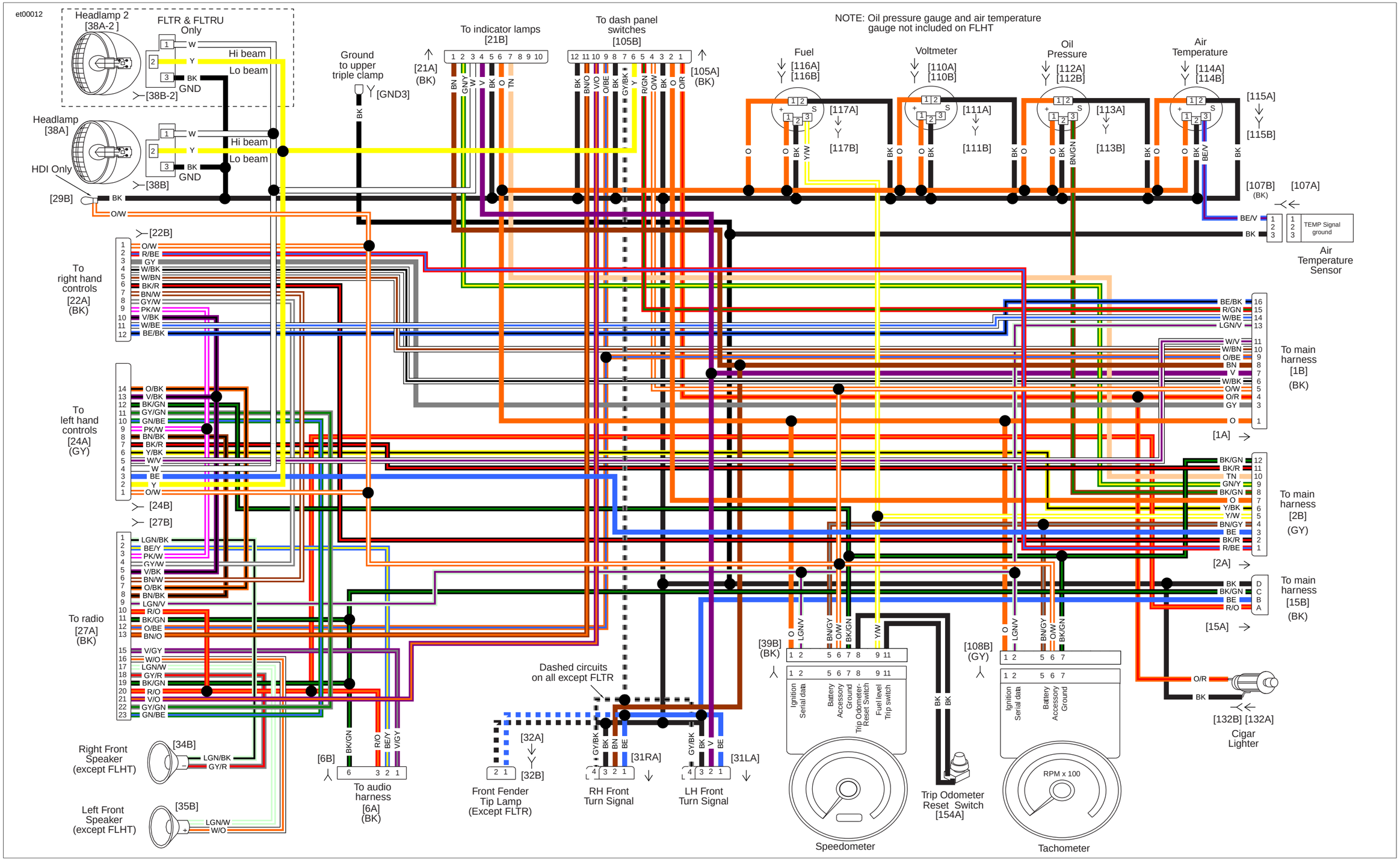


**Figure B-20. 2008 FLHT, FLHX, FLHTC, FLHTCU & FLTR DOMESTIC & INTERNATIONAL MODELS INTERCONNECT HARNESS**

**Figure B-20.**
**2008 FLHT, FLHX, FLHTC, FLHTCU & FLTR DOMESTIC & INTERNATIONAL MODELS INTERCONNECT HARNESS**

**Figure B-20.**
**2008 FLHT, FLHX, FLHTC, FLHTCU & FLTR DOMESTIC & INTERNATIONAL MODELS INTERCONNECT HARNESS**

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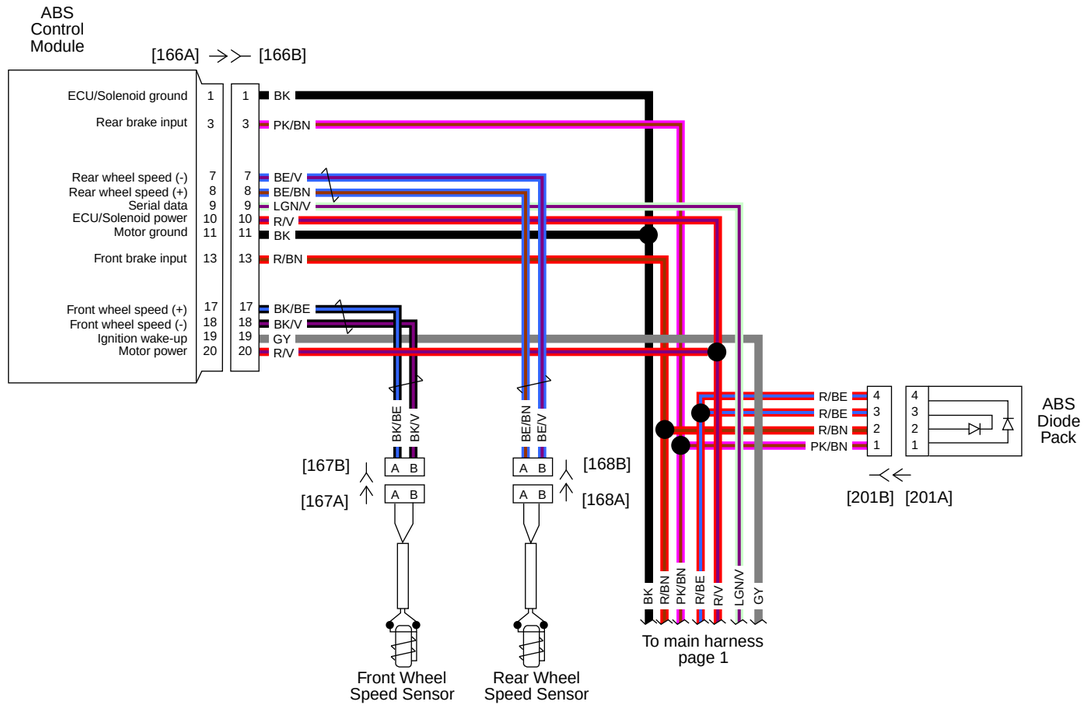


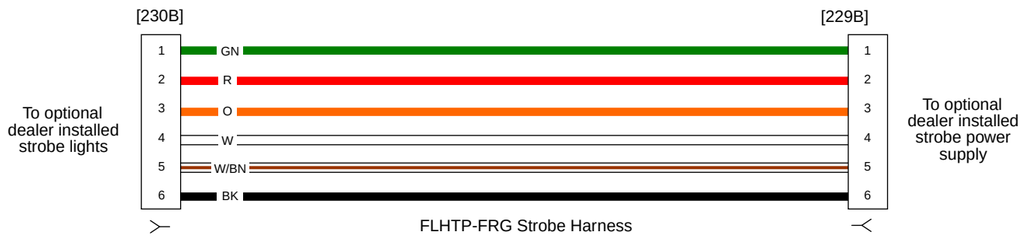


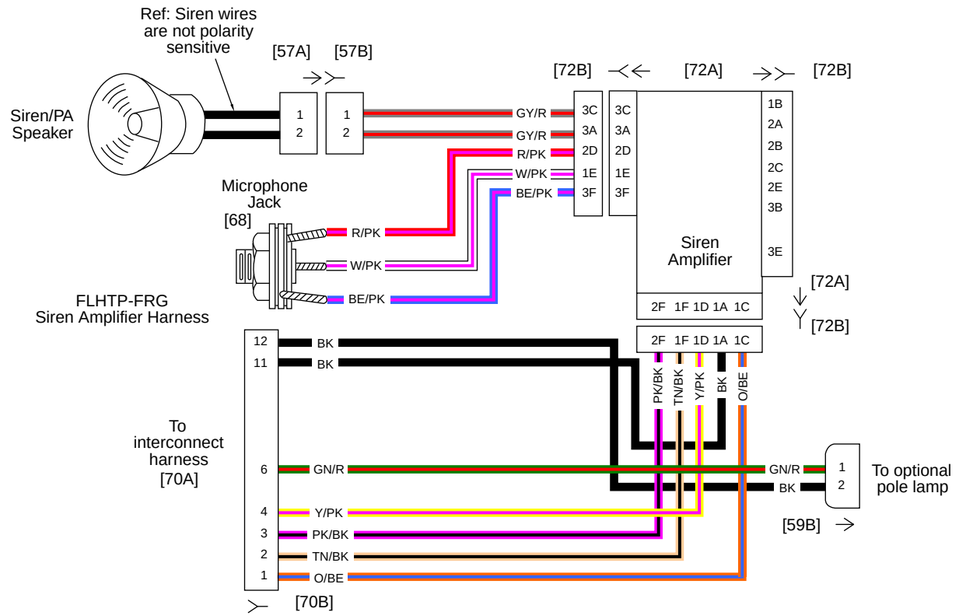


**Figure B-21. 2008 FLT, FLHX, FLHTC, FLHTCU, FLTR & FLTRU DOMESTIC & INTERNATIONAL MODELS MAIN HARNESS**

**Figure B-21.**
**2008 FLT, FLHX, FLHTC, FLHTCU, FLTR & FLTRU DOMESTIC & INTERNATIONAL MODELS MAIN HARNESS**

**Figure B-21.**
**2008 FLT, FLHX, FLHTC, FLHTCU, FLTR & FLTRU DOMESTIC & INTERNATIONAL MODELS MAIN HARNESS**

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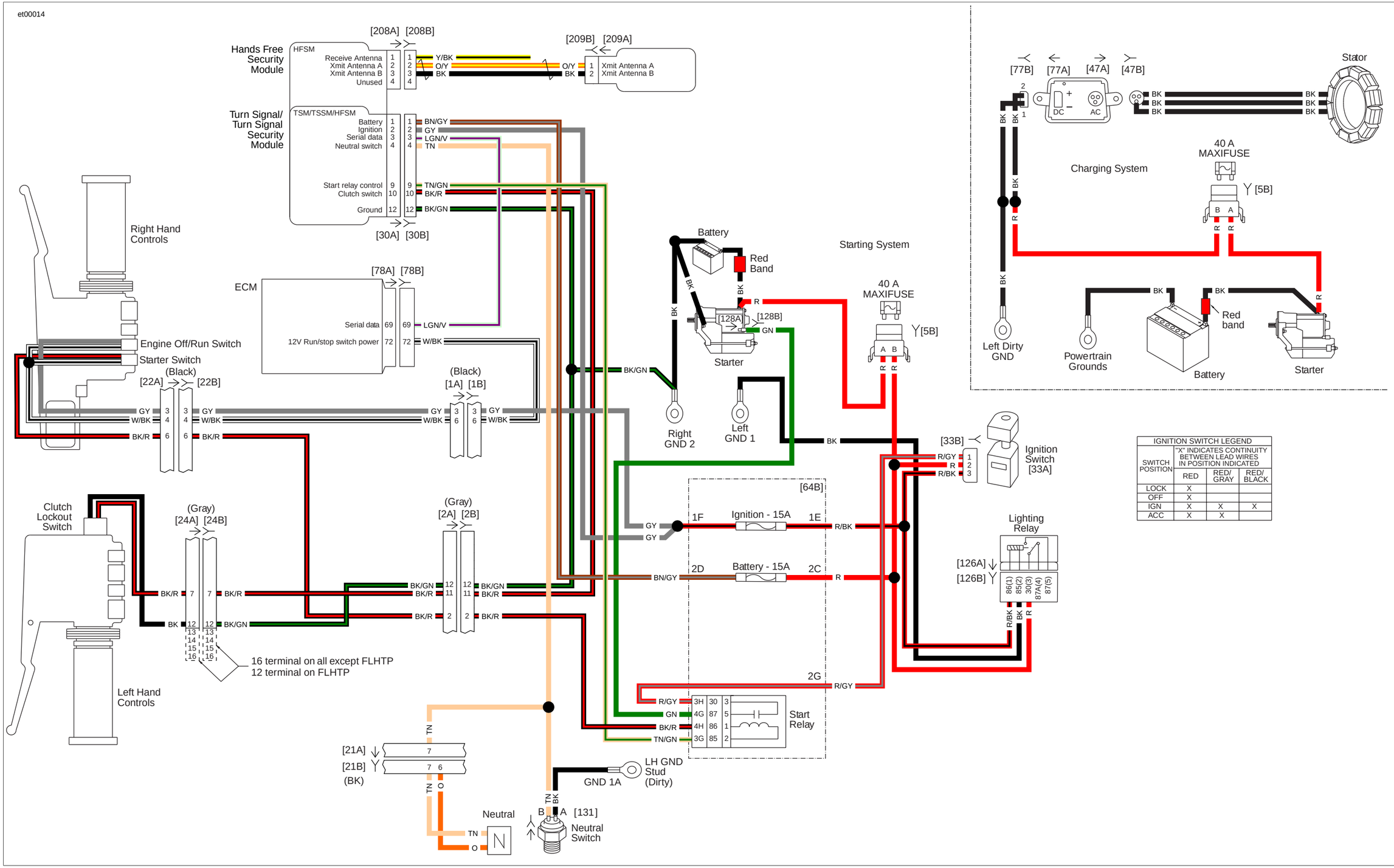


IGNITION SWITCH LEGEND

| 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 | |

**Figure B-22. 2008 FLHT, FLHX, FLHTC, FLHTCU & FLTR DOMESTIC & INTERNATIONAL MODELS STARTING AND CHARGING**

**Figure B-22.**
**2008 FLHT, FLHX, FLHTC, FLHTCU & FLTR DOMESTIC & INTERNATIONAL MODELS STARTING AND CHARGING**

**Figure B-22.**
**2008 FLHT, FLHX, FLHTC, FLHTCU & FLTR DOMESTIC & INTERNATIONAL MODELS STARTING AND CHARGING**

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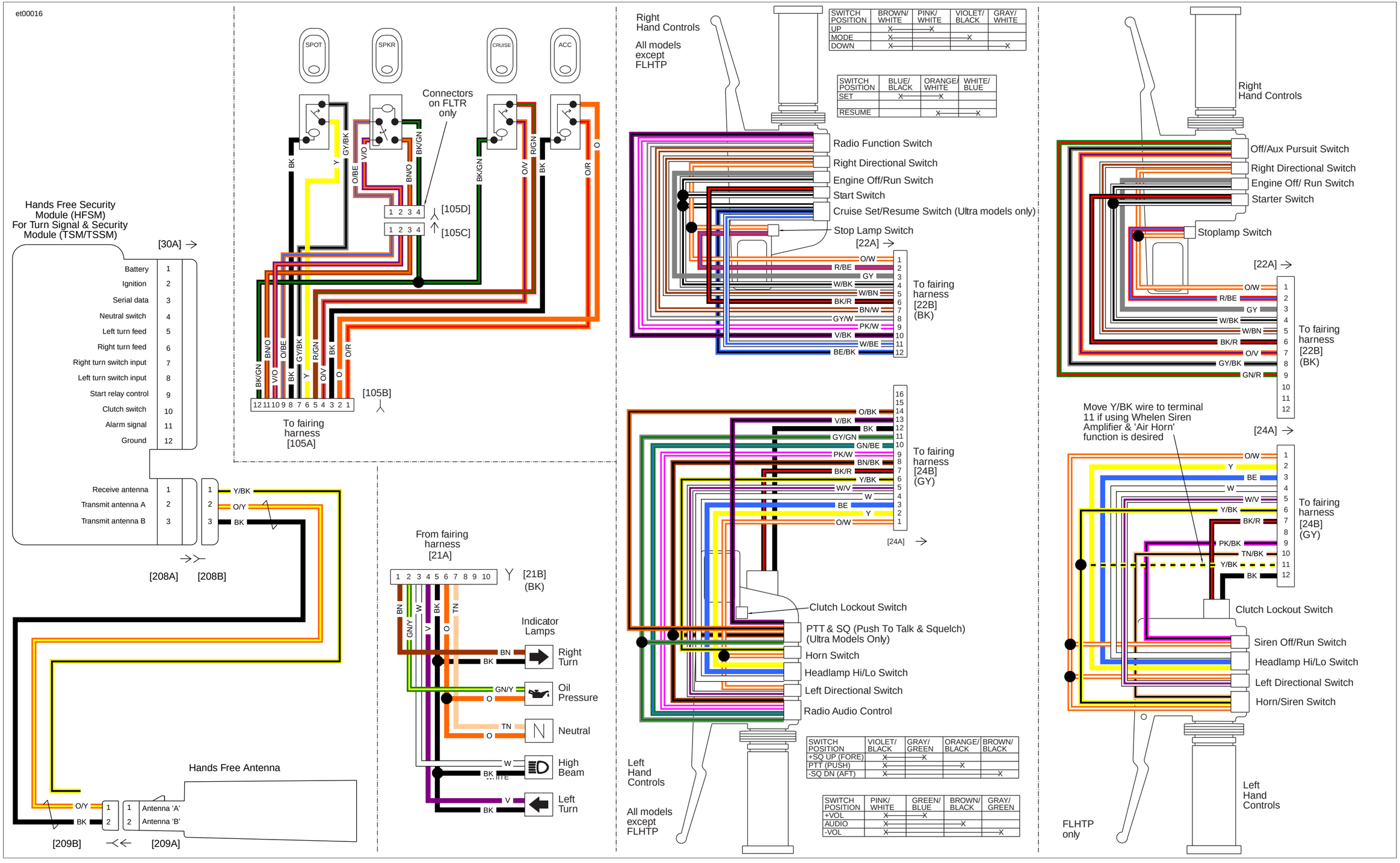


**Figure B-23. 2008 FLHT, FLHX, FLHTC, FLHTCU, FLTR, FLTRU & FLTHP DOMESTIC & INTERNATIONAL MODELS HANDLEBAR SWITCHES, INDICATOR LAMPS, FAIRING CAP/INSTRUMENT NACELLE SWITCHES AND HFSM/ANTENNA**

**Figure B-23.**
**2008 FLHT, FLHX, FLHTC, FLHTCU, FLTR, FLTRU & FLTHP DOMESTIC & INTERNATIONAL MODELS HANDLEBAR SWITCHES, INDICATOR LAMPS, FAIRING CAP/INSTRUMENT NACELLE SWITCHES AND HFSM/ANTENNA**

**Figure B-23.**
**2008 FLHT, FLHX, FLHTC, FLHTCU, FLTR, FLTRU & FLTHP DOMESTIC & INTERNATIONAL MODELS HANDLEBAR SWITCHES, INDICATOR LAMPS, FAIRING CAP/INSTRUMENT NACELLE SWITCHES AND HFSM/ANTENNA**

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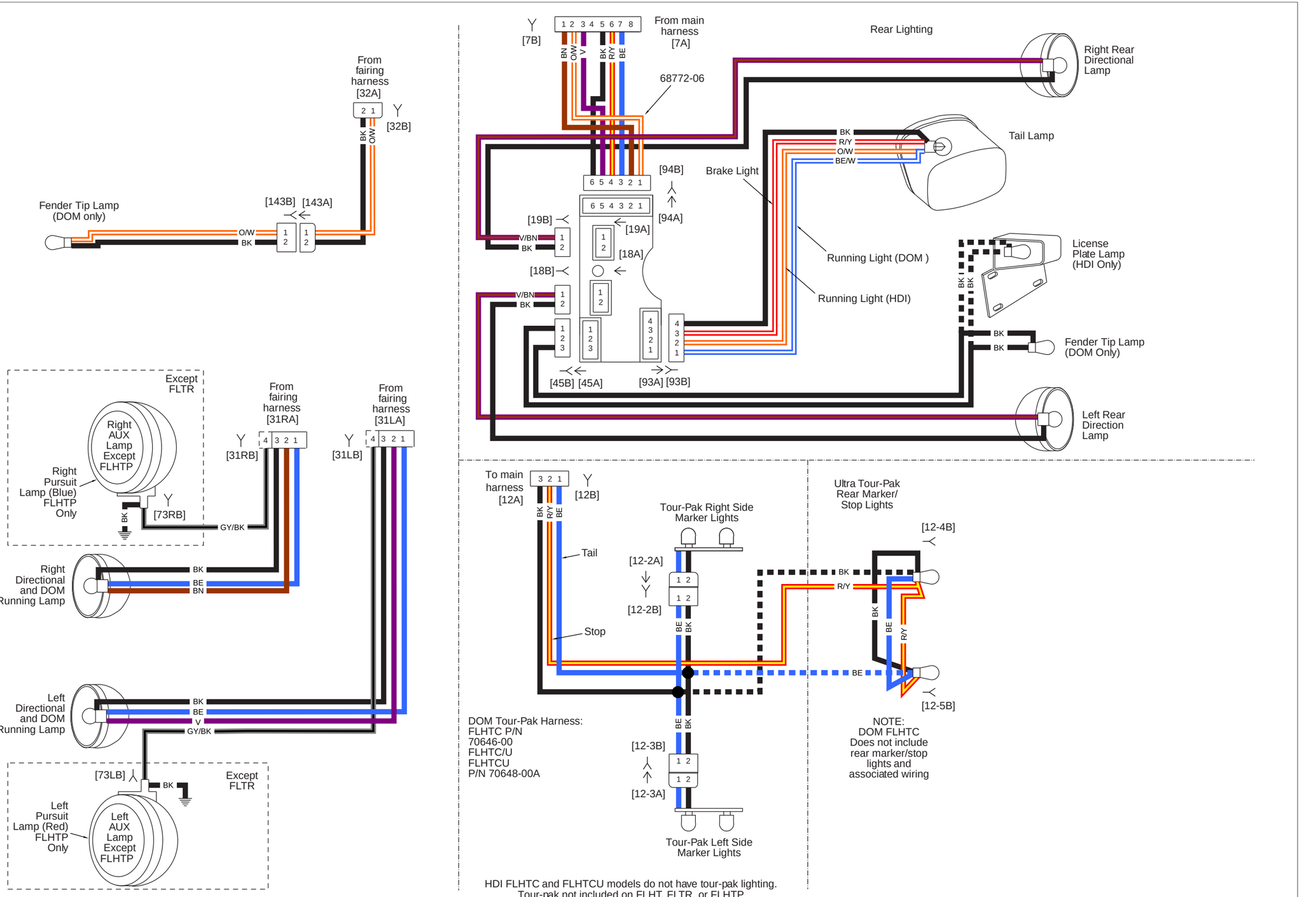


**Figure B-24. 2008 FLHT, FLHX, FLHTC, FLHTCU, FLTR, FLTRU, & FLTHP DOMESTIC & INTERNATIONAL MODELS TAIL LAMP, AUXILIARY LAMPS, DIRECTIONAL LAMPS & TOUR-PAK LIGHTS**

**Figure B-24.**
**2008 FLHT, FLHX, FLHTC, FLHTCU, FLTR, FLTRU, & FLTHP DOMESTIC & INTERNATIONAL MODELS TAIL LAMP, AUXILIARY LAMPS, DIRECTIONAL LAMPS & TOUR-PAK LIGHTS**

**Figure B-24.**
**2008 FLHT, FLHX, FLHTC, FLHTCU, FLTR, FLTRU, & FLTHP DOMESTIC & INTERNATIONAL MODELS TAIL LAMP, AUXILIARY LAMPS, DIRECTIONAL LAMPS & TOUR-PAK LIGHTS**

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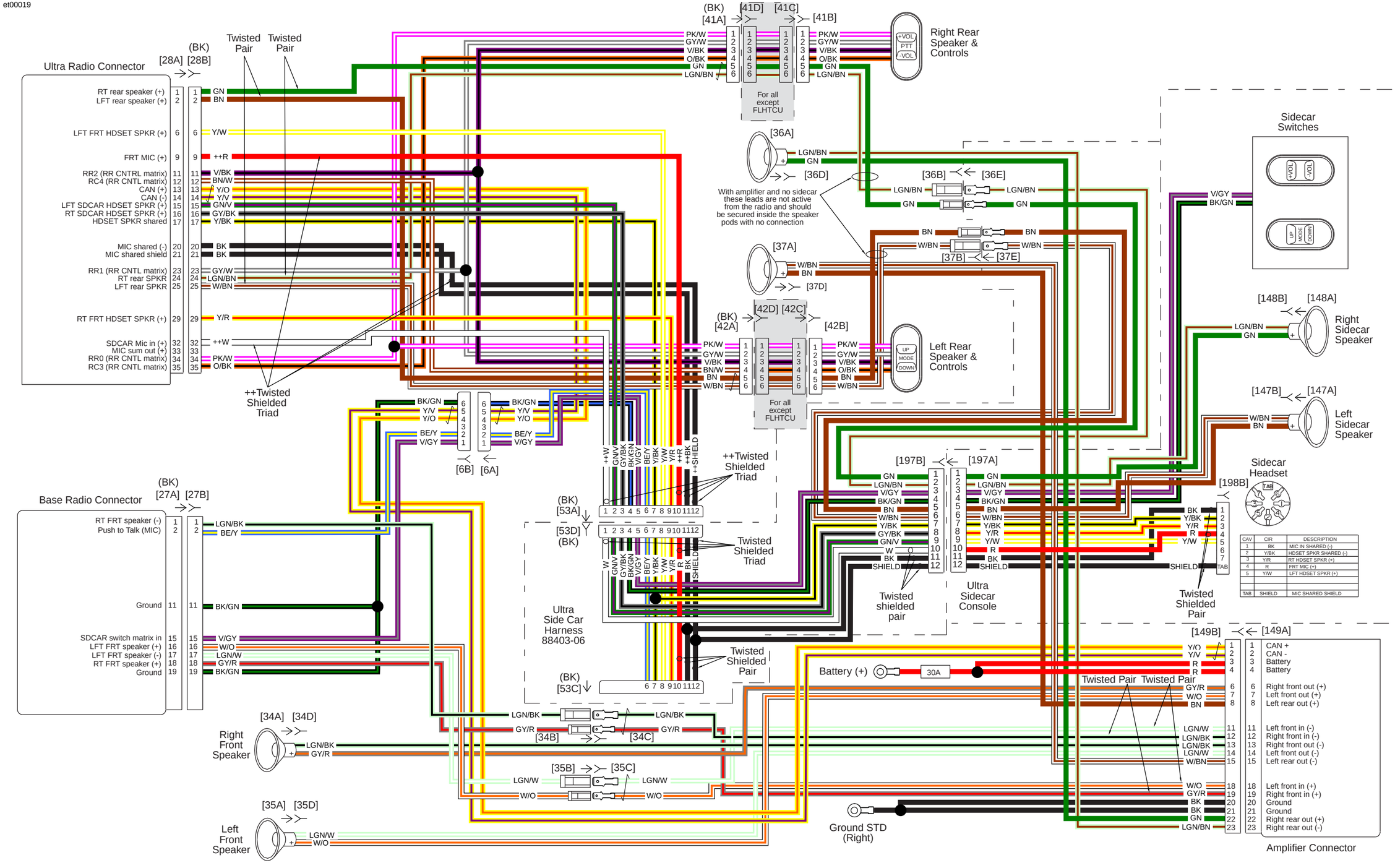


**Figure B-25. 2008 TLE, TLE-U SIDECARS DOMESTIC & INTERNATIONAL MODELS AMPLIFIER, SIDECAR SPEAKERS AND SWITCHES**

**Figure B-25.**
**2008 TLE, TLE-U SIDECARS DOMESTIC & INTERNATIONAL MODELS AMPLIFIER, SIDECAR SPEAKERS AND SWITCHES**

**Figure B-25.**
**2008 TLE, TLE-U SIDECARS DOMESTIC & INTERNATIONAL MODELS AMPLIFIER, SIDECAR SPEAKERS AND SWITCHES**

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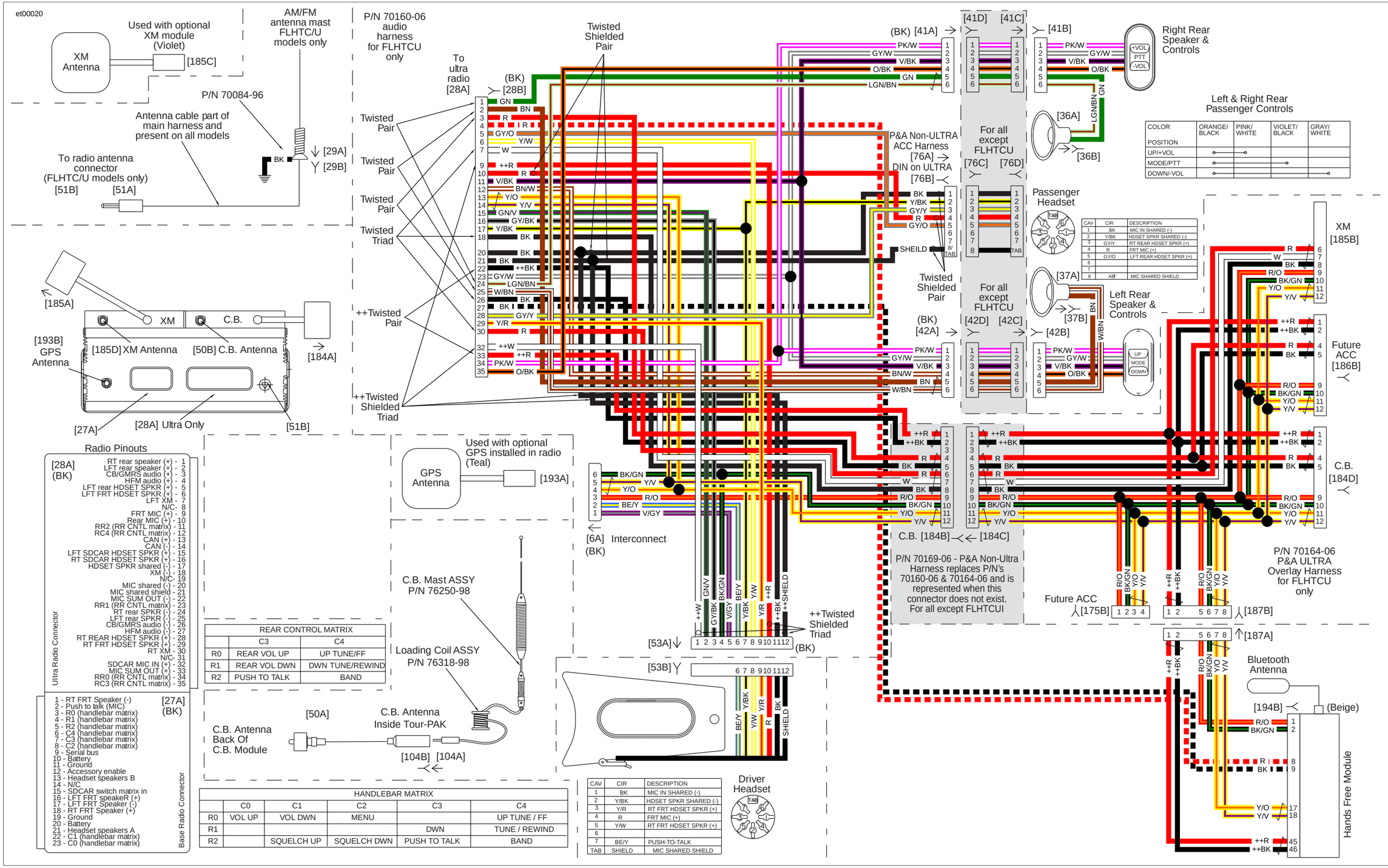



**Figure B-26. 2008 FLHX, FLHTC, FLHTCU AND FLTR DOMESTIC & INTERNATIONAL MODELS RADIO, CB/INTERCOM, REAR SPEAKERS, XM, HANDS-FREE PHONE AND NAVIGATION**

**Figure B-26.**
**2008 FLHX, FLHTC, FLHTCU AND FLTR DOMESTIC & INTERNATIONAL MODELS RADIO, CB/INTERCOM, REAR SPEAKERS, XM, HANDS-FREE PHONE AND NAVIGATION**

**Figure B-26.**
**2008 FLHX, FLHTC, FLHTCU AND FLTR DOMESTIC & INTERNATIONAL MODELS RADIO, CB/INTERCOM, REAR SPEAKERS, XM, HANDS-FREE PHONE AND NAVIGATION**

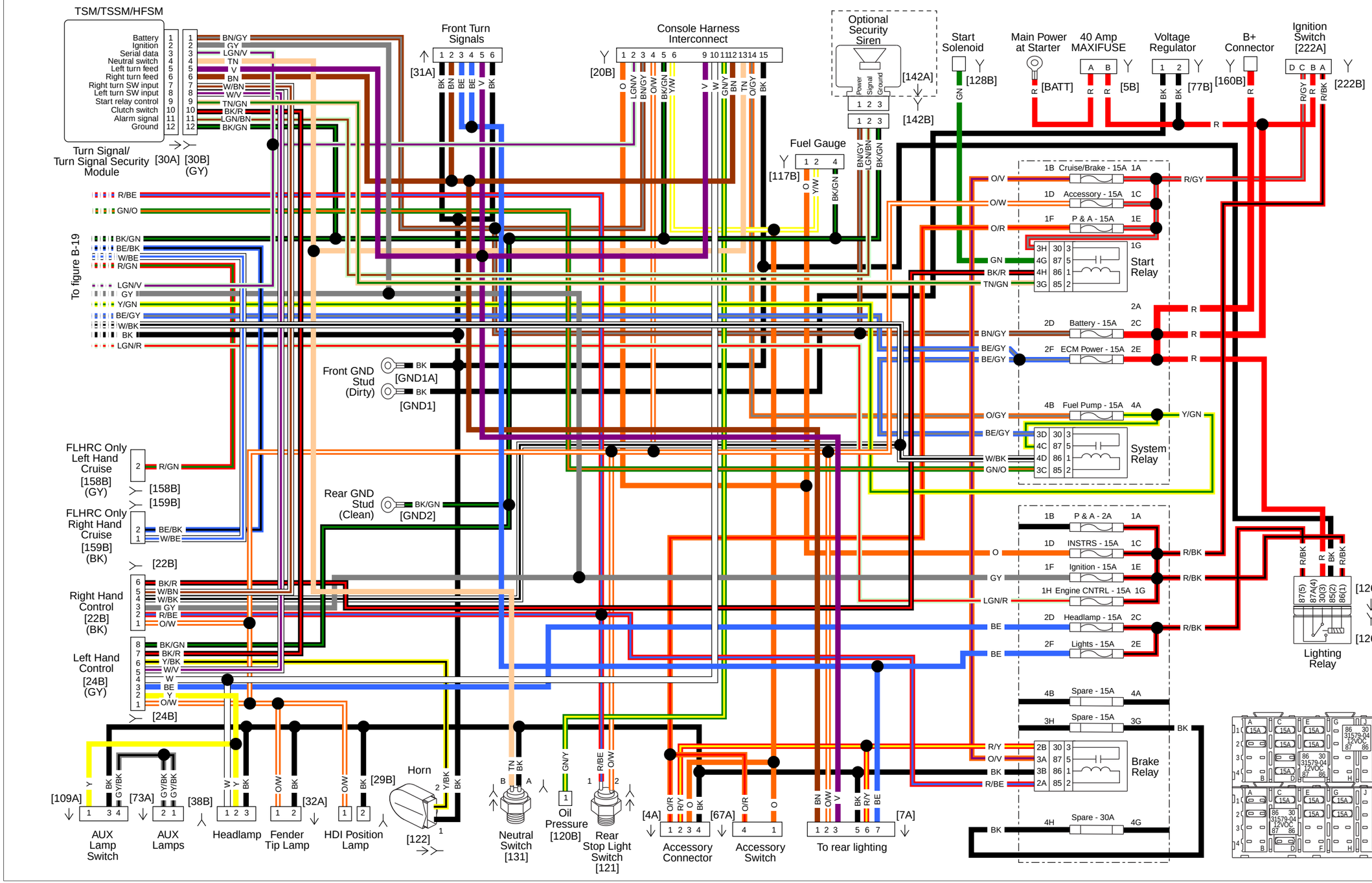



**Figure B-27. 2008 FLHR, FLHRC & FLHRS DOMESTIC & INTERNATIONAL MODELS MAIN HARNESS**

**Figure B-27.**
**2008 FLHR, FLHRC & FLHRS DOMESTIC & INTERNATIONAL MODELS MAIN HARNESS**

**Figure B-27.**
**2008 FLHR, FLHRC & FLHRS DOMESTIC & INTERNATIONAL MODELS MAIN HARNESS**

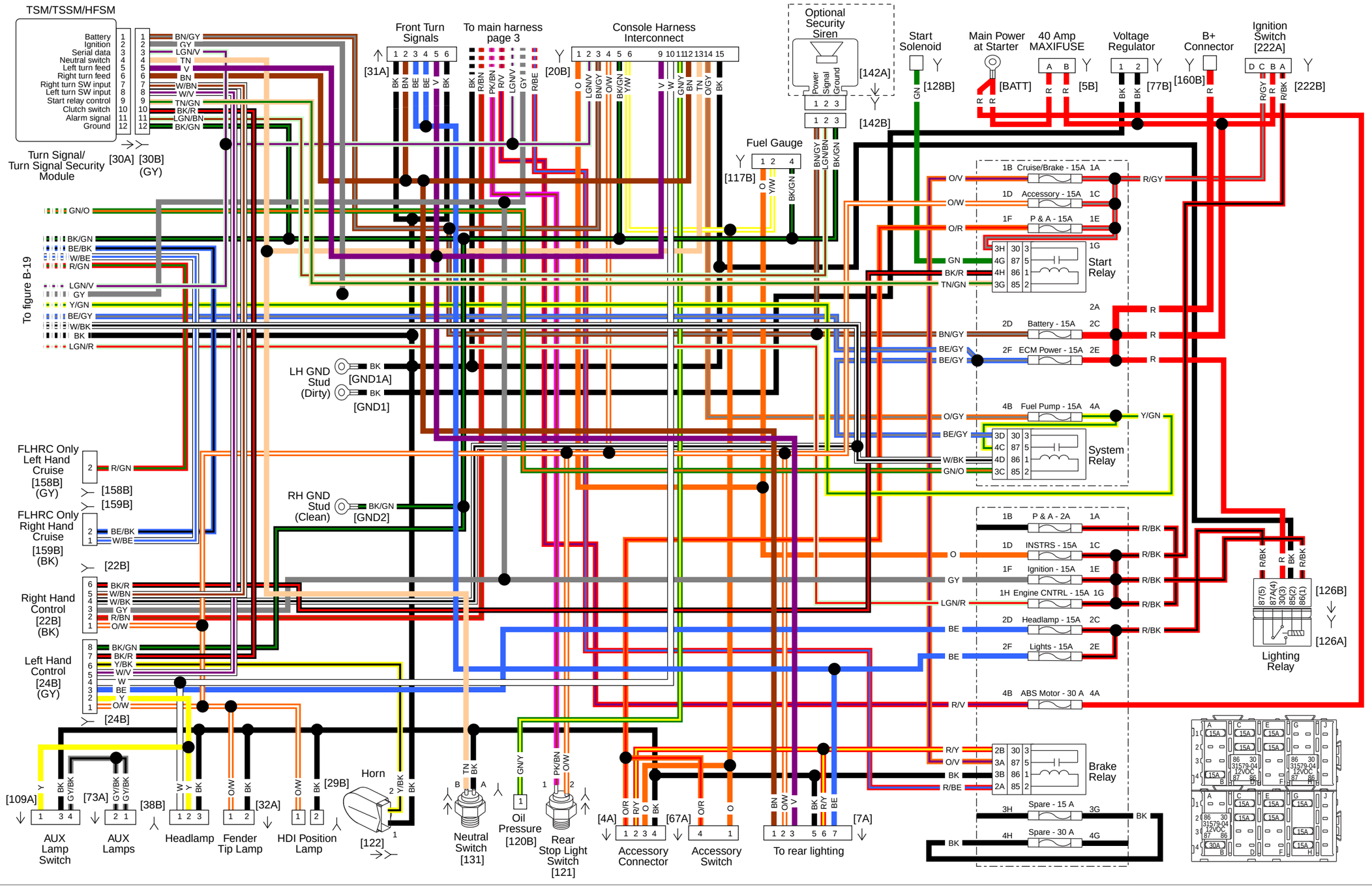



**Figure B-28. 2008 FLHR, FLHRC & FLHRS DOMESTIC & INTERNATIONAL MODELS MAIN HARNESS W/ABS**

**Figure B-28.**
**2008 FLHR, FLHRC & FLHRS DOMESTIC & INTERNATIONAL MODELS MAIN HARNESS W/ABS**

**Figure B-28.**
**2008 FLHR, FLHRC & FLHRS DOMESTIC & INTERNATIONAL MODELS MAIN HARNESS W/ABS**

et00023

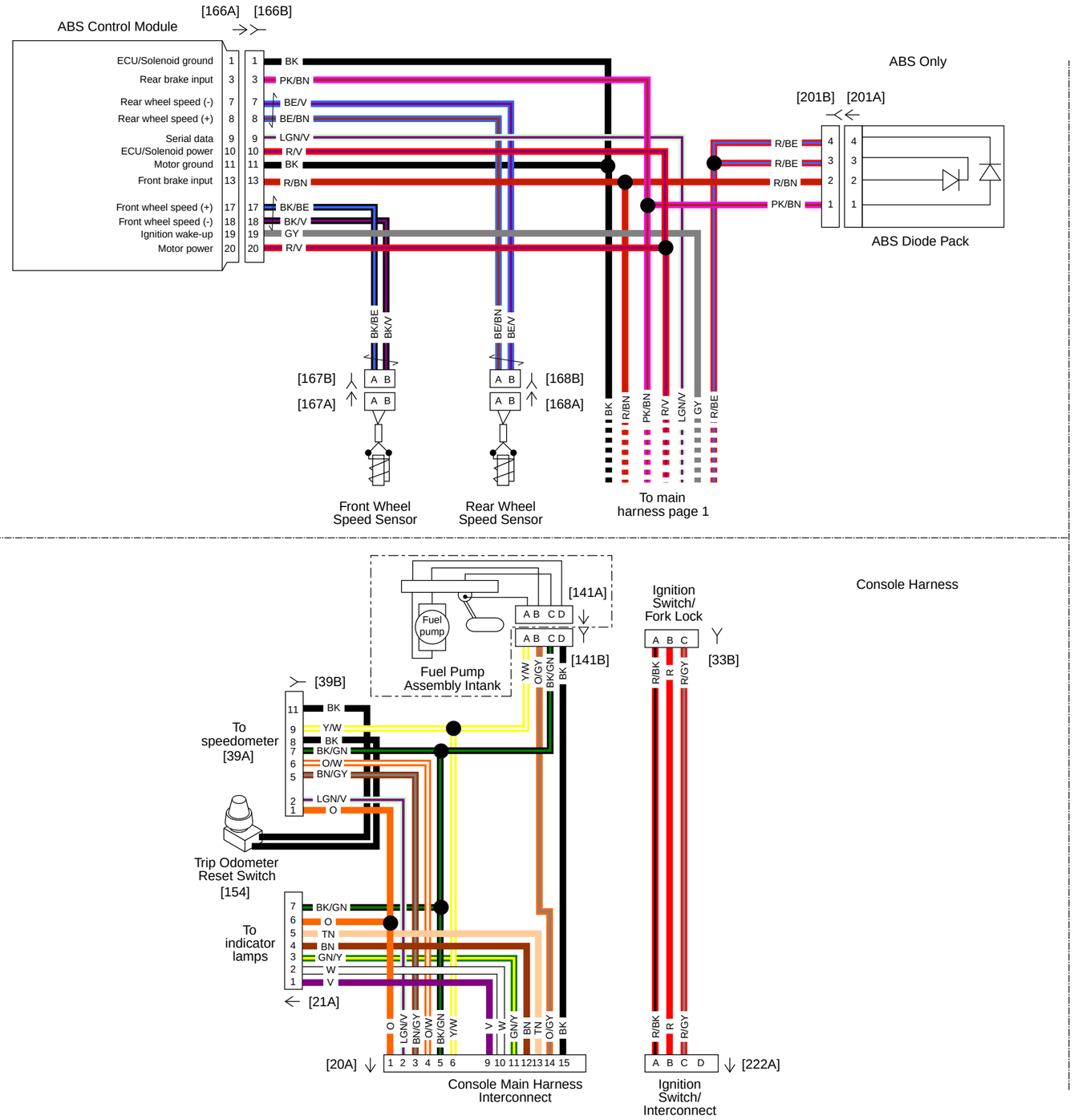



**Figure B-29. 2008 FLHR, FLHRC, FLHRS, FLHP & FLHP/E DOMESTIC & INTERNATIONAL MODELS MAIN HARNESS**

**Figure B-29.**
**2008 FLHR, FLHRC, FLHRS, FLHP & FLHP/E DOMESTIC & INTERNATIONAL MODELS MAIN HARNESS**

**Figure B-29.**
**2008 FLHR, FLHRC, FLHRS, FLHP & FLHP/E DOMESTIC & INTERNATIONAL MODELS MAIN HARNESS**

et00015

TSM/TSSM/HFSM

Turn Signal/ Turn Signal Security Module

Battery 1 — BN/GY
Ignition 2 — GY
Serial Data 3 — LGN/V
Neutral Switch 4 — TN
Start Relay Control 9 — TN/GN
Clutch Switch 10 — BK/R
Ground 12 — BK/GN

[30A] [30B]

ECM [78A] [78B]

Serial Data 69 — LGN/V
12V Run/Stop Switch 72 — W/BK

Right Hand Controls

Engine Off/Run Switch
Start Switch
GY

[22A] [22B]
GY 3 4 GY
W/BK 3 4 W/BK
BK/R 6 6 BK/R

[24A] [24B]
BK/R 7 8 BK/R
BK 7 8 BK/GN

Clutch Lockout Switch

Left Hand Controls

[21A] [21B] (BK)
TN 5
5 6 BK

Neutral
TN
BK

[131] Neutral Switch
B A TN BK

TN 13 13 TN
[20A] [20B]

GND 1A
LH GND Stud (Dirty)

Starting System

Battery
BK BK
Red Band
R
[128A] [128B]
GN
BK

Starter
BK

Rear GND 2
Front GND 1

MAXIFUSE 40 Amp
[5B]
A B
R R

[64B]
1F Ignition - 15A 1E
GY — R/BK
2D Battery - 15A 2C
BN/GY — R
R/GY

R/GY 3H 30 3
GN 4G 87 5
BK/R 4H 86 1
TN/GN 3G 85 2
Start Relay

[222B] [222A]
R/GY 3 2 1 R/GY
R 3 2 1 R
R/BK 3 2 1 R/BK

[33B] [33A]
C B A
A B C I
Ignition Switch

Lighting Relay
[126A] [126B]
86(1) 85(2) 30(3) 87A(4) 87(5)
R/BK BK R

Stator
[77B] [77A] [47A] [47B]
2 1
DC + − AC
BK BK BK
BK BK BK

Charging System

40 Amp MAXIFUSE
[5B]
B A
R R

Front Dirty GND
Powertrain Grounds
Battery
Red Band
Starter

IGNITION SWITCH LEGEND

| 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 | |

**Figure B-30. 2008 FLHR, FLHRC AND FLHRS DOMESTIC & INTERNATIONAL MODELS STARTING AND CHARGING**

**Figure B-30.**
**2008 FLHR, FLHRC AND FLHRS DOMESTIC & INTERNATIONAL MODELS STARTING AND CHARGING**

**Figure B-30.**
**2008 FLHR, FLHRC AND FLHRS DOMESTIC & INTERNATIONAL MODELS STARTING AND CHARGING**

et00018

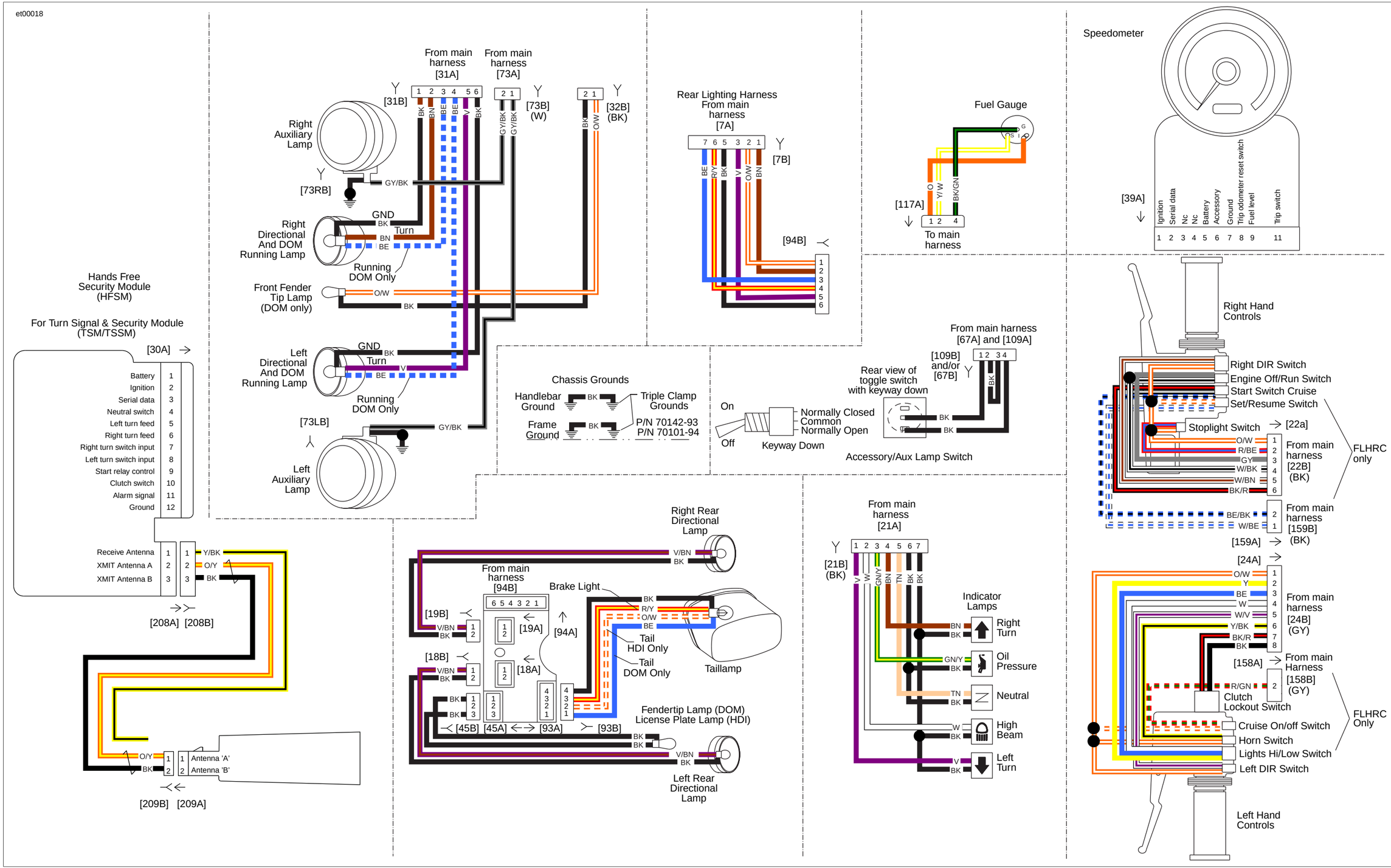



**Figure B-31. 2008 FLHR, FLHRC DOMESTIC & INTERNATIONAL MODELS HANDLEBAR SWITCHES, SPEEDOMETER, INDICATOR LAMPS, TAIL LAMP, AUXILIARY LAMPS, DIRECTIONAL LAMPS, FENDER TIP LAMPS AND AUX LAMP/ACCESSORY SWITCHES**

**Figure B-31.**
**2008 FLHR, FLHRC DOMESTIC & INTERNATIONAL MODELS HANDLEBAR SWITCHES, SPEEDOMETER, INDICATOR LAMPS, TAIL LAMP, AUXILIARY LAMPS, DIRECTIONAL LAMPS, FENDER TIP LAMPS AND AUX LAMP/ACCESSORY SWITCHES**

**Figure B-31.**
**2008 FLHR, FLHRC DOMESTIC & INTERNATIONAL MODELS HANDLEBAR SWITCHES, SPEEDOMETER, INDICATOR LAMPS, TAIL LAMP, AUXILIARY LAMPS, DIRECTIONAL LAMPS, FENDER TIP LAMPS AND AUX LAMP/ACCESSORY SWITCHES**

# NOTES

## REMOVAL

| PART NUMBER | TOOL NAME |
|---|---|
| SNAP-ON BB200A | BASIC VACUUM BRAKE BLEEDER |

*NOTE*

*The ABS module consists of the hydraulic control unit (HCU) and the electronic control unit (ECU). These parts are not sold separately. Failure of either unit requires replacement of the ABS module.*

1. Remove right side saddlebag. See 2.27 SADDLEBAGS.
2. Remove right side cover.
3. Drain brake systems.

*NOTE*

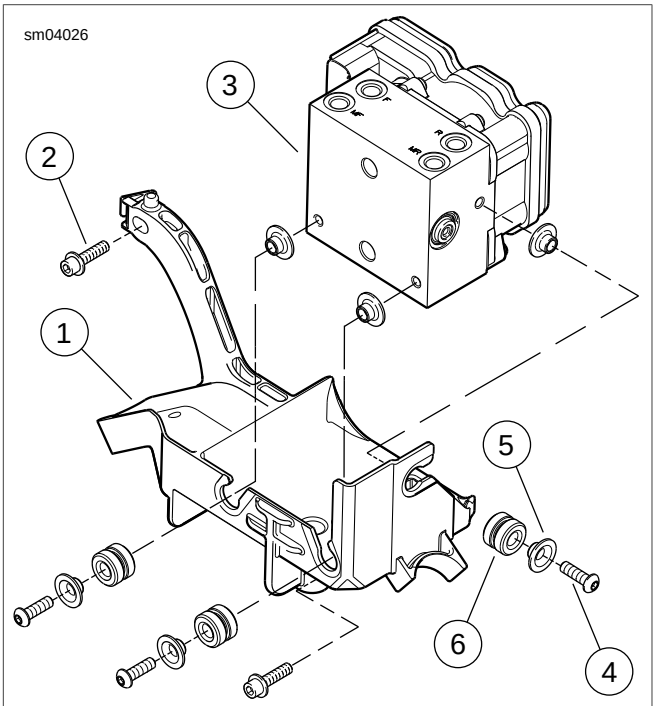
*For best results, use the BASIC VACUUM BRAKE BLEEDER (Part No. Snap-On BB200A) or equivalent tool.*

4. Remove battery. See 8.8 BATTERY.
5. Remove ABS module connector [166], 20-place Molex.

*NOTE*

*Wrap banjo fittings with pieces of shop towel to absorb leakage of residual brake fluid.*

6. Remove four banjo bolts to release brake lines from ABS module. Discard copper washers.
7. Remove three socket head screws to release ABS module from right side caddy. See Figure C-1.
8. Reaching into battery box, remove ABS module from caddy.




1. **Right side caddy**
2. **Socket head screw (2)**
3. **ABS module**
4. **Socket head screw (3)**
5. **Bushing (6)**
6. **Rubber mount (3)**

**Figure C-1. ABS Module**

## INSTALLATION

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48650 | DIGITAL TECHNICIAN II |

1. Inspect three rubber mounts in right side caddy for damage or deterioration. If replacement is necessary, proceed as follows:
   a. Remove bushing from each side of rubber mount. Remove rubber mount from caddy.
   b. Install **new** rubber mount in caddy. Install bushing in each side of rubber mount.
2. Reaching into battery box, position ABS module on caddy.
3. Start three socket head screws to fasten ABS module to right side caddy. Alternately tighten screws to 39-60 **in-lbs** (4.4-6.8 Nm). See Figure C-1.
4. Position banjo fittings adjacent to their respective ports on the ABS module. Be sure to route banjo fitting of brake line to front brake calipers beneath brake line from front master cylinder. Refer to Table C-1.

**Table C-1. ABS Module Brake Lines**

| BRAKE LINE BANJO FITTINGS | ABS MODULE PORT STAMP |
|---|---|
| To Front Brake Calipers | F |
| To Rear Brake Caliper | R |
| From Front Master Cylinder | MF |
| From Rear Master Cylinder | MR |

5. Start two inboard banjo bolts (with **new** copper washers) to secure brake lines to front and rear brake calipers (ports stamped F and R, respectively).
6. Install two outboard banjo bolts (with **new** copper washers) to secure brake lines from front and rear master cylinders (ports stamped MF and MR, respectively).
7. Alternately tighten four banjo bolts to 12.5-14.5 ft-lbs (17-20 Nm).
8. Connect ABS module connector.
9. Install battery. See 8.8 BATTERY.
10. Fill and bleed brake systems. See 1.14 BLEEDING BRAKES.

*NOTE*

*For best results, use the BASIC VACUUM BRAKE BLEEDER (Part No. Snap-On BB200A) or equivalent tool.*

11. To confirm that brake systems are properly connected, install master cylinder reservoir covers, connect motorcycle to DIGITAL TECHNICIAN II (Part No. HD-48650) and perform "ABS Service" procedure in the "Toolbox" menu.
12. Repeat step 10 if brakes feel spongy.
13. Install right side cover.
14. Install right side saddlebag. See 2.27 SADDLEBAGS.

## FRONT WHEEL SPEED SENSOR

### Removal

1. **FLHR/C, FLHX, FLHT/C/U:** Turn front wheel to right fork stop. Reaching under headlamp nacelle (FLHR/C) or fairing cap (FLHX, FLHT/C/U) on left side of steering head, disconnect front wheel speed sensor connector [167], 2-place Amp (Tyco). Draw pin housing down through opening in front of lower fork bracket.
2. **FLTR:** Turn front wheel to left fork stop. Gently pull cable to draw front wheel speed sensor connector [167], 2-place Amp (Tyco), out left side of fairing bracket. Disconnect connector.
3. Carefully cut two cable straps to release front wheel speed sensor cable from brake hose and front fender tip lamp wires, if equipped.
4. See Figure C-2. Release front wheel speed sensor cable from clip as follows:
   a. Push on lip at rear of clip to disengage from bracket. Rotate tab (stamped ABS) rearward until clip is perpendicular to bracket and remove cable.

   *NOTE*

   *If clip is not reinstalled as described below, tab can slip out of slot in bracket. If this occurs, remove caliper mounting screws to release bracket from fork slider and then reinstall tab in slot. Reinstall bracket alternately tightening screws to 28-38 ft-lbs (37.9-51.5 Nm).*

   b. Rotate tab forward until clip is inline with bracket and then apply pressure to tab until lip engages.
5. Retract axle until front wheel speed sensor is free. See 2.3 FRONT WHEEL.

*NOTE*

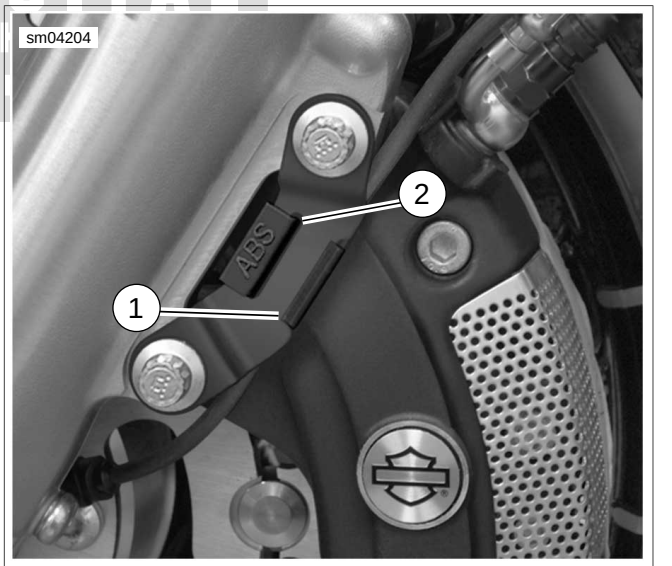
*The wheel speed sensor works in conjunction with the ABS encoder bearing installed in the wheel hub. If necessary, see 2.8 SEALED WHEEL BEARINGS for special removal and installation instructions.*

### Installation

*NOTE*

*Always keep the wheel speed sensor away from magnetic fields (such as magnetic parts trays, magnetic base dial indicators, alternator rotors, etc.) or damage will occur. Never pull wheel speed sensor cable taut or use to retain wheel, axle or other components.*

1. Push axle through **new** front wheel speed sensor and left fork slider.
2. Install front wheel. See 2.3 FRONT WHEEL. Be sure to rotate front wheel speed sensor until index pin makes contact with shoulder on fork slider. See Figure C-3.
3. Route wheel speed sensor cable up to lower fork bracket following brake hose and front fender tip lamp wires, if equipped.
4. **FLHR/C, FLHX, FLHT/C/U:** Turn front wheel to right fork stop. Reaching under headlamp nacelle (FLHR/C) or fairing cap (FLHX, FLHT/C/U) on left side of steering head, locate socket housing of front wheel speed sensor connector. Feed pin housing up through opening in front of lower fork bracket and connect to socket housing.
5. **FLTR:** Turn front wheel to left fork stop. Connect front wheel speed sensor connector. Feed connector under main harness conduit into left side of fairing bracket.
6. Install two **new** cable straps as follows:
   a. Install cable strap 2.5 in. (63.5 mm) above the bottom brake hose crimp capturing front wheel speed sensor cable, brake hose and front fender tip lamp wires, if equipped.
   b. Install second cable strap 2.5 in. (63.5 mm) below the top brake hose crimp capturing front wheel speed sensor cable, brake hose and front fender tip lamp wires, if equipped.
7. See Figure C-2. Install front wheel speed sensor cable in clip as follows:
   a. If installed, push on lip at rear of clip to disengage from bracket. Rotate tab (stamped ABS) rearward until clip is perpendicular to bracket and install cable.
   b. Rotate tab forward until clip is inline with bracket and then apply pressure to tab until lip engages. Gently tug on cable to verify that clip is properly installed.




**1. Push lip to disengage**
**2. Push tab to engage**

**Figure C-2. Front Wheel Speed Sensor Cable Clip**

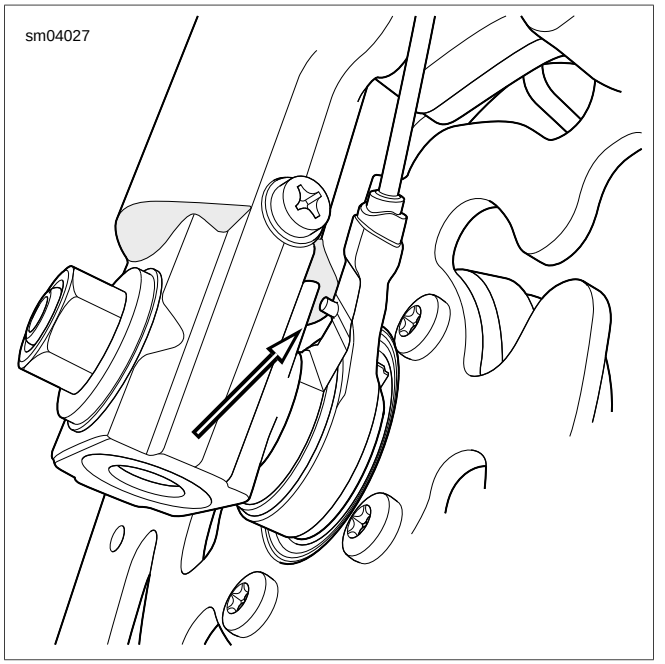



**Figure C-3. Front Wheel Speed Sensor Index Pin**

## REAR WHEEL SPEED SENSOR

### Removal

1. Remove saddlebags. See 2.27 SADDLEBAGS.
2. Remove right side cover.
3. Pull anchor on rear wheel speed sensor connector [168], 2-place Amp (Tyco), from hole in right side caddy. Disconnect connector.
4. Open rear cable clip on T-stud at top of rear swingarm. Free rear wheel speed sensor cable from cable clip.

*NOTE*

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

5. Retract axle until rear wheel speed sensor is free. See 2.4 REAR WHEEL.

*NOTE*

*The wheel speed sensor works in conjunction with the ABS encoder bearing installed in the wheel hub. If necessary, see 2.8 SEALED WHEEL BEARINGS for special removal and installation instructions.*

### Installation

*NOTE*

*Always keep the wheel speed sensor away from magnetic fields (such as magnetic parts trays, magnetic base dial indicators, alternator rotors, etc.) or damage will occur. Never pull wheel speed sensor cable taut or use to retain wheel, axle or other components.*

1. Push axle through **new** rear wheel speed sensor, caliper bracket and right side of rear swingarm.
2. Install rear wheel. See 2.4 REAR WHEEL. Be sure to rotate rear wheel speed sensor until index pin makes contact with caliper bracket at point shown in Figure C-4.
3. Route rear wheel speed sensor cable forward outboard of caliper bracket and then continue forward progression following top of rear swingarm.
4. Capture rear wheel speed sensor cable (and brake hose to rear brake caliper) in rear cable clip on T-stud at top of rear swingarm. Snap cable clip closed.
5. At front of rear frame downtube, feed cable to outboard side of motorcycle staying below right side caddy. Connect pin and socket housings.
6. Install anchor on rear wheel speed sensor connector into hole in right side caddy.
7. Install right side cover.
8. Install saddlebags. See 2.27 SADDLEBAGS.

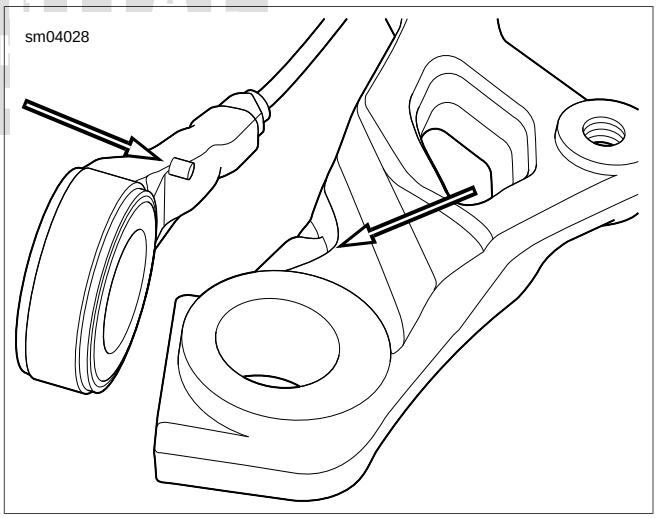



**Figure C-4. Rear Wheel Speed Sensor Index Pin**

## FRONT MASTER CYLINDER TO ABS MODULE

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48650 | DIGITAL TECHNICIAN II |

### Removal

1. Remove right side saddlebag. See 2.27 SADDLEBAGS.
2. Remove right side cover.
3. Remove fuel tank. See 4.4 FUEL TANK.
4. Remove top caddy. See 8.6 ELECTRICAL CADDIES.
5. **FLHR/C:** Remove right side headlamp nacelle. See 2.45 HEADLAMP NACELLE: FLHR/C.
6. **FLHX, FLHT/C/U:** Remove outer fairing and fairing cap. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U and 2.36 FAIRING CAP: FLHX, FLHT/C/U, respectively.
7. **FLTR:** Remove bezel. See 2.40 INSTRUMENT BEZEL: FLTR.
8. See Figure C-5 and Figure C-6. Release brake line as follows:
   a. Cut cable strap to release brake line from right handlebar riser (FLHR/C, FLTR) or right handlebar (FLHX, FLHT/C/U).
   b. Cut cable strap to release brake lines from brake line bracket at right side of steering head.
   c. Cut cable strap to release brake lines from narrow ledge at side of wire trough.
   d. Remove three double-sided clips to separate brake line from master cylinder from brake line to calipers.
   e. Release brake lines from channel at front of wire trough.
   f. On FLHTCU models, cut cable strap to release audio harness from upper right frame tube.

*NOTE*

*Wrap banjo fittings with pieces of shop towel to absorb any loss of brake fluid.*

9. Remove banjo bolt to release brake line from MF port of ABS module. Discard copper washers.
10. Remove two screws to release cover from master cylinder reservoir.
11. Remove banjo bolt to release brake line from master cylinder reservoir. Hold suitable container under banjo bolt bore to allow reservoir to drain. Discard copper washers.
12. Feed front section of brake line forward to front of upper fork bracket and then pull brake line rearward to remove from motorcycle.

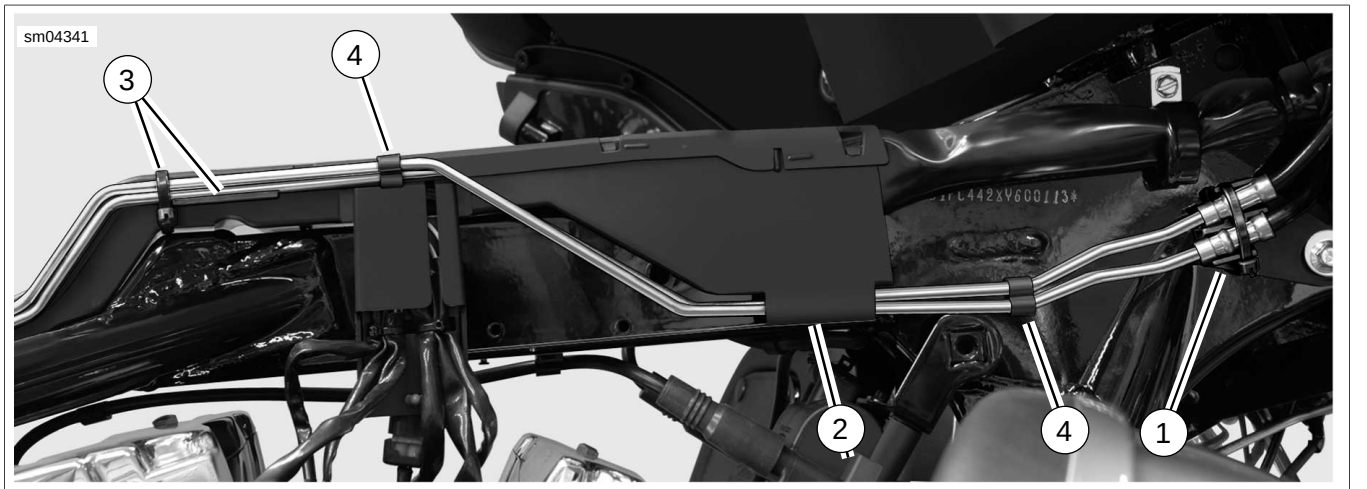
### Installation

1. Orient brake line on motorcycle as follows:
   a. Position brake line along right side of wire trough with rear banjo fitting adjacent to ABS module.
   b. Feed front section of brake line forward along right side of steering head, upward to top of upper fork bracket, and then rearward following right handlebar to master cylinder.
2. Start banjo bolt (with **new** copper washers) to secure brake line to master cylinder.
3. Start banjo bolt (with **new** copper washers) to secure brake line to MF port of ABS module.
4. See Figure C-5 and Figure C-6. Secure brake line as follows:
   a. **FLHR/C, FLTR:** Loosely install **new** cable strap to secure handlebar switch conduit and brake hose to right handlebar riser.
   b. **FLHX, FLHT/C/U:** Install **new** cable strap 2.5 in. (63.5 mm) rear of fairing cap opening to secure handlebar switch conduit and brake line to right handlebar.
   c. Install **new** cable strap to secure brake lines to brake line bracket at right side of steering head. Capture brake line from master cylinder in top channel, brake line to calipers in bottom channel.

*NOTE*

*If installing **new** brake line bracket, tighten flange screw to 20-30 **in-lbs** (2.3-3.4 Nm).*

   d. Press brake lines into channel at front of wire trough.
   e. Position brake lines on narrow ledge at side of wire trough. At rear of ledge, install **new** cable strap to secure brake lines to wire trough.
   f. Install three double-sided clips to secure brake line from master cylinder to brake line to calipers. Place the clips as follows: one in front of ignition coil bracket, one above wire trough breakouts and one in front of threaded boss for the rear fuel tank bracket bolt.
   g. On FLHTCU models, install **new** cable strap to secure audio harness to upper right frame tube.
5. Tighten banjo bolt to master cylinder to 13-15 ft-lbs (17.6-20.3 Nm).
6. Tighten banjo bolt to ABS module to 12.5-14.5 ft-lbs (17-20 Nm).
7. Fill and bleed brake system. See 1.14 BLEEDING BRAKES.




1. **Brake Line Bracket and Cable Strap**
2. **Wire Trough Channel**
3. **Wire Trough Ledge and Cable Strap**
4. **Double-Sided Clips (2 of 3)**

**Figure C-5. Brake Line Routing and Retention**


**Figure C-6. Double-Sided Clip (3 of 3)**

8. If more than one brake line was removed:
   a. Confirm that brake system is properly connected. To accomplish this, install master cylinder reservoir cover, connect motorcycle to DIGITAL TECHNICIAN II (Part No. HD-48650) and perform "ABS Service" procedure in the "Toolbox" menu.
   b. Repeat step 7 if brake feels spongy.
9. **FLHR/C:** Install right side headlamp nacelle. See 2.45 HEADLAMP NACELLE: FLHR/C.
10. **FLHX, FLHT/C/U:** Install outer fairing and fairing cap. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U and 2.36 FAIRING CAP: FLHX, FLHT/C/U, respectively.
11. **FLTR:** Install bezel. See 2.40 INSTRUMENT BEZEL: FLTR.
12. Install top caddy. See 8.6 ELECTRICAL CADDIES.
13. Install fuel tank. See 4.4 FUEL TANK.
14. Install right side cover.
15. Install saddlebags. See 2.27 SADDLEBAGS.

## ABS MODULE TO FRONT BRAKE CALIPERS

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48650 | DIGITAL TECHNICIAN II |

### Removal

1. Remove right side saddlebag. See 2.27 SADDLEBAGS.
2. Remove right side cover.
3. Remove fuel tank. See 4.4 FUEL TANK.
4. Remove top caddy. See 8.6 ELECTRICAL CADDIES.
5. **FLHR/C:** Remove left side headlamp nacelle. See 2.45 HEADLAMP NACELLE: FLHR/C.
6. **FLHX, FLHT/C/U:**
   a. Remove outer fairing and fairing cap. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U and 2.36 FAIRING CAP: FLHX, FLHT/C/U, respectively.
   b. Remove front turn signal lamps (FLHX) or auxiliary lamps (FLHT/C/U). See 8.14 TURN SIGNAL LAMPS or 8.11 AUXILIARY LAMPS AND BRACKETS.
   c. Remove chrome skirt.

*NOTE*

***FLTR:*** *No disassembly required.*

7. Carefully cut two cable straps to release left caliper brake hose from front wheel speed sensor cable and front fender tip lamp wires, if equipped.

8. See Figure C-5 and Figure C-6. Release brake line as follows:
   a. Cut cable strap to release brake lines from brake line bracket at right side of steering head.
   b. Cut cable strap to release brake lines from narrow ledge at side of wire trough.
   c. Remove three double-sided clips to separate brake line to calipers from brake line from master cylinder.
   d. Release brake lines from channel at front of wire trough.
   e. On FLHTCU models, cut cable strap to release audio harness from upper right frame tube.
9. Remove T40 TORX screw at bottom of lower fork bracket to release brake line bracket.

*NOTE*

*Wrap banjo fittings with pieces of shop towel to absorb any loss of brake fluid.*

10. Remove banjo bolt to release brake line from F port of ABS module. Discard copper washers. Pull banjo fitting inboard to remove from under brake line from master cylinder.
11. Remove banjo bleeder bolts to release brake lines to calipers. Discard copper washers.
12. Pull brake line forward to remove from motorcycle.

## Installation

1. Standing at front of motorcycle, feed long section of brake line rearward first at bottom of lower fork bracket and then along right side of steering head and wire trough. When rear banjo fitting is adjacent to ABS module, route under brake line from master cylinder.
2. Align hole in brake line bracket with threaded boss at bottom of lower fork bracket and start T40 TORX screw.
3. Start banjo bleeder bolts (with **new** copper washers) to secure brake lines to calipers.
4. Start banjo bolt (with **new** copper washers) to secure brake line to F port of ABS module.
5. See Figure C-5 and Figure C-6. Secure brake line as follows:
   a. Install **new** cable strap to secure brake lines to brake line bracket at right side of steering head. Capture brake line from master cylinder in top channel, brake line to calipers in bottom channel.

*NOTE*

*If installing **new** brake line bracket, tighten flange screw to 20-30 **in-lbs** (2.3-3.4 Nm).*

   b. Press brake lines into channel at front of wire trough.
   c. Position brake lines on narrow ledge at side of wire trough. At rear of ledge, install **new** cable strap to secure brake lines to wire trough.
   d. Install three double-sided clips to secure brake line to calipers to brake line from master cylinder. Place the clips as follows: one in front of ignition coil bracket, one above wire trough breakouts and one in front of threaded boss for the rear fuel tank bracket bolt.
   e. On FLHTCU models, install **new** cable strap to secure audio harness to upper right frame tube.
6. Verify that brake lines to calipers, as viewed at the rear, are equal distance from the left and right fork sliders, and then tighten T40 TORX screw at bottom of lower fork bracket to 120-180 **in-lbs** (13.6-20.3 Nm).
7. Tighten banjo bleeder bolts to calipers to 17-19 ft-lbs (23.1-25.8 Nm).
8. Tighten banjo bolt to ABS module to 12.5-14.5 ft-lbs (17-20 Nm).
9. Install two **new** cable straps as follows:
   a. Install cable strap 2.5 in. (63.5 mm) above the bottom brake hose crimp capturing brake hose, front wheel speed sensor cable and front fender tip lamp wires, if equipped.
   b. Install second cable strap 2.5 in. (63.5 mm) below the top brake hose crimp capturing brake hose, front wheel speed sensor cable and front fender tip lamp wires, if equipped.
10. Fill and bleed brake system. See 1.14 BLEEDING BRAKES.
11. If more than one brake line was removed:
   a. Confirm that brake system is properly connected. To accomplish this, install master cylinder reservoir cover, connect motorcycle to DIGITAL TECHNICIAN II (Part No. HD-48650) and perform "ABS Service" procedure in the "Toolbox" menu.
   b. Repeat step 10 if brake feels spongy.
12. **FLHR/C:** Install left side headlamp nacelle. See 2.45 HEADLAMP NACELLE: FLHR/C.
13. **FLHX, FLHT/C/U:**
   a. Install chrome skirt. Do not capture brake line between chrome skirt and front of steering head, as it may become pinched or kinked when handlebar is turned. Route brake line above chrome skirt as shown in Figure C-7.
   b. Install front turn signal lamps (FLHX) or auxiliary lamps (FLHT/C/U). See 8.14 TURN SIGNAL LAMPS or 8.11 AUXILIARY LAMPS AND BRACKETS.
   c. Install outer fairing and fairing cap. See 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U and 2.36 FAIRING CAP: FLHX, FLHT/C/U, respectively.

14. Install top caddy. See 8.6 ELECTRICAL CADDIES.
15. Install fuel tank. See 4.4 FUEL TANK.
16. Install right side cover.
17. Install right side saddlebag. See 2.27 SADDLEBAGS.


**Figure C-7. Route Brake Line to Front Calipers Above Chrome Skirt**

## REAR MASTER CYLINDER TO ABS MODULE

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48650 | DIGITAL TECHNICIAN II |

### Removal

1. Remove right side saddlebag. See 2.27 SADDLEBAGS.
2. Remove right side cover.
3. Remove right side rider footboard. See 2.49 FOOTBOARDS AND FOOTRESTS.
4. Cut cable straps to free brake line from two rubber saddles anchored on T-studs at top of lower frame tube.
5. Remove socket terminals from spade contacts of rear brake light switch.
6. Remove hex screw to free brake light switch bracket from frame weldment. Push on bracket to release locating tab from slot in frame weldment.
7. Cut anchored cable strap in hole of middle frame downtube (adjacent to rear swingarm bracket) to release brake line and main harness conduit.

*NOTE*

*Wrap banjo fittings with pieces of shop towel to absorb any loss of brake fluid.*

8. Remove banjo bolt to release brake line from MR port of ABS module. Discard copper washers.
9. Remove two screws to release cover from master cylinder reservoir.
10. Remove banjo bolt to release brake line from master cylinder reservoir. Hold suitable container under banjo bolt bore to allow reservoir to drain. Discard copper washers.
11. Remove two screws to release master cylinder from frame weldment.
12. Remove locknut with flat washer and pull brake pedal/master cylinder assembly from pedal shaft.
13. Remove brake line from motorcycle.

### Installation

1. Orient brake line on motorcycle as follows:
   a. Set front section of brake line (with rubber sleeve) on brake pedal shaft. From bottom inboard side of rear exhaust header, feed rear section of brake line upward at front of middle frame downtube crossing to rear of downtube at bottom of frame crossmember.
   b. Move front section of brake line (with rubber sleeve) inboard of frame weldment at bottom of front frame downtube.
2. Start banjo bolt (with new copper washers) to secure brake line to MR port of ABS module.
3. Apply light coat of Wheel Bearing Grease (Part No. 99855-89) to brake pedal shaft and bore. Install brake pedal/master cylinder assembly on pedal shaft.
4. Install two screws to fasten master cylinder to frame weldment. Alternately tighten screws to 10.5-12.5 ft-lbs (14-17 Nm).
5. Install flat washer and **new** locknut on brake pedal shaft and tighten to 15-20 ft-lbs (20-27 Nm).
6. Start banjo bolt (with new copper washers) to secure brake line to master cylinder.
7. Engage locating tab on brake light switch bracket in slot of frame weldment. Install hex screw to fasten bracket to weldment.
8. Install socket terminals onto spade contacts of rear brake light switch.

*NOTE*

*If installing **new** rear brake light switch, apply Loctite Pipe Sealant with Teflon 565 to threads and start switch into rear brake line. Using flats on switch, tighten to 12-15 ft-lbs (16.3-20.3 Nm).*

9. Position brake line above two rubber saddles anchored on T-studs at top of lower frame tube. Install **new** cable straps capturing brake line, main harness conduit and lower frame tube.
10. Install **new** anchored cable strap in hole of middle frame downtube (adjacent to rear swingarm bracket) capturing brake line and main harness conduit.
11. Tighten banjo bolt to master cylinder to 13-15 ft-lbs (17.6-20.3 Nm).
12. Tighten banjo bolt to ABS module to 12.5-14.5 ft-lbs (17-20 Nm).
13. Fill and bleed brake system. See 1.14 BLEEDING BRAKES.

14. If more than one brake line was removed:
    a. Confirm that brake system is properly connected. To accomplish this, install master cylinder reservoir cover, connect motorcycle to DIGITAL TECHNICIAN II (Part No. HD-48650) and perform "ABS Service" procedure in the "Toolbox" menu.
    b. Repeat step 13 if brake feels spongy.
15. Install right side rider footboard. See 2.49 FOOTBOARDS AND FOOTRESTS.
16. Install right side cover.
17. Install right side saddlebag. See 2.27 SADDLEBAGS.

## ABS MODULE TO REAR BRAKE CALIPER

| PART NUMBER | TOOL NAME |
|---|---|
| HD-48650 | DIGITAL TECHNICIAN II |

### Removal

1. Remove right side saddlebag. See 2.27 SADDLEBAGS.
2. Remove right side cover.
3. Remove right side caddy. See 8.6 ELECTRICAL CADDIES.
4. Open two cable clips on T-studs at top of rear swingarm. Free brake 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.*

5. Carefully cut cable strap to release rear wheel speed sensor cable from brake hose.

*NOTE*

*Wrap banjo fittings with pieces of shop towel to absorb any loss of brake fluid.*

6. Remove banjo bolt to release brake line from R port of ABS module. Discard copper washers.
7. Remove banjo bolt to release brake line from caliper. Discard copper washers.
8. Pull brake line from channels on front edge of battery tray (top and bottom).
9. Remove brake line from motorcycle.

### Installation

1. Orient brake line on motorcycle as follows:
    a. Position brake line at top of rear swingarm with rear banjo fitting adjacent to caliper.
    b. Adjust brake line, so that forward section turns upward to ABS module just rear of frame crossmember.
2. Capture brake hose in two cable clips on T-studs at top of rear swingarm. Rear cable clip also captures rear wheel speed sensor cable. Snap cable clips closed.
3. Install brake line into channels on front edge of battery tray (top and bottom). See Figure C-8.
4. Start banjo bolt (with **new** copper washers) to secure brake line to R port of ABS module.
5. Start banjo bolt (with **new** copper washers) to secure brake line to caliper.
6. Tighten banjo bolt to caliper to 17-19 ft-lbs (23.1-25.8 Nm).
7. Tighten banjo bolt to ABS module to 12.5-14.5 ft-lbs (17-20 Nm).
8. Install **new** cable strap 1.25 in. (31.8 mm) in front of the rear brake hose crimp capturing rear wheel speed sensor cable and brake hose.
9. Install right side caddy. See 8.6 ELECTRICAL CADDIES.
10. Fill and bleed brake system. See 1.14 BLEEDING BRAKES.
11. If more than one brake line was removed:
    a. Confirm that brake system is properly connected. To accomplish this, install master cylinder reservoir cover, connect motorcycle to DIGITAL TECHNICIAN II (Part No. HD-48650) and perform "ABS Service" procedure in the "Toolbox" menu.
    b. Repeat step 10 if brake feels spongy.
12. Install right side cover.
13. Install right side saddlebag. See 2.27 SADDLEBAGS.


**Figure C-8. Capture Brake Line in Channels of Battery Tray**

# NOTES

# NOTES

## CONVERSION TABLE

**Table D-1. Metric Conversions**

| MILLIMETERS to INCHES (MM x 0.03937 = IN.) | | | | | | | | INCHES to MILLIMETERS (IN. 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 |

# FLUID CONVERSIONS D.2

## 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.)

## UNITED STATES SYSTEM

The U.S. units of torque, foot pounds and inch pounds, are used in this service manual. To convert units, use the following equations:

- foot pounds (ft-lbs) X 12.00000 = inch pounds (**in-lbs**).
- inch pounds (**in-lbs**) X 0.08333 = foot pounds (ft-lbs).

## METRIC SYSTEM

All metric torque specifications are written in Newton-meters (Nm). To convert metric to United States units and United States to metric, use the following equations:

- Newton meters (Nm) X 0.737563 = foot pounds (ft-lbs).
- Newton meters (Nm) X 8.85085 = inch pounds (**in-lbs).**
- foot pounds (ft-lbs) X 1.35582 = Newton meters (Nm).
- inch pounds (**in-lbs**) X 0.112985 = Newton meters (Nm).

# NOTES

# NOTES

## ACRONYMS AND ABBREVIATIONS

**Table E-1. Acronyms and Abbreviations**

| ACRONYM OR ABBREVIATION | DESCRIPTION |
|---|---|
| A | Amperes |
| AC | Alternating Current |
| ACC | Accessory |
| ACR | Automatic Compression Release |
| AGM | Absorbed Glass Mat (battery) |
| AMP | Ampere |
| AWG | American Wire Gauge |
| B+ | Battery Voltage |
| BAS | Bank Angle Sensor |
| BTDC | Before Top Dead Center |
| C | Celsius (Centigrade) |
| CA | California |
| CAL | Calibration |
| CC | Cubic Centimeters |
| CCA | Cold Cranking Amps |
| CKP | Crankshaft Position |
| cm | Centimeter |
| DC | Direct Current |
| DLC | Data Link Connector |
| DOM | Domestic |
| DTC | Diagnostic Trouble Code |
| DVOM | Digital Volt Ohm Meter |
| ECM | Electronic Control Module |
| ECT | Engine Coolant Temperature |
| EEPROM | Electrically Erasable Programmable Read Only Memory |
| EFI | Electronic Fuel Injection |
| ET | Engine Temperature |
| EVAP | Evaporative Emissions Control System |
| F | Fahrenheit |
| ft-lbs | Foot-Pounds |
| fl oz. | Fluid Ounce |
| g | Gram |
| GAL | Gallon |
| GAWR | Gross Axle Weight Rating |
| GND | Ground (electrical) |
| GVWR | Gross Vehicle Weight Rating |
| HDI | Harley-Davidson International |
| H-DSSS | Harley-Davidson Smart Security System |
| HFSM | Hands Free Security Module |
| Hg | Mercury |
| IAC | Idle Air Control |

**Table E-1. Acronyms and Abbreviations**

| ACRONYM OR ABBREVIATION | DESCRIPTION |
|---|---|
| IAT | Intake Air Temperature |
| ID | Inside Diameter |
| IGN | Ignition Light/Key Switch |
| IM | Instrument Module |
| In. | Inch |
| INJ PW | Injector Pulse Width |
| in-lbs | Inch-Pounds |
| Kg | Kilogram |
| Km | Kilometer |
| kPa | Kilopascal |
| km/hr | Kilometers Per Hour |
| L | Liter |
| LCD | Liquid Crystal Display |
| LED | Light Emitting Diode |
| mA | Milliampere |
| MAP | Manifold Absolute Pressure |
| ml | milliliter |
| mm | millimeter |
| MPH | Miles Per Hour |
| ms | millisecond |
| Nm | Newton-Meter |
| N/A | Not Applicable |
| no. | Number |
| O2 | Oxygen |
| OD | Outside Diameter |
| OEM | Original Equipment Manufacturer |
| oz | Ounce |
| P&A | Parts and Accessories |
| PN | Part Number |
| PSI | Pounds per Square Inch |
| RES | Reserve |
| RPM | Revolutions Per Minute |
| SCFH | Cubic Feet per Hour at Standard Conditions |
| TCA | Throttle Control Actuator |
| TDC | Top Dead Center |
| TGS | Twist Grip Sensor |
| TP | Throttle Position |
| TMAP | Intake Air Temperature/Manifold Absolute Pressure |
| TSM | Turn Signal Module |
| TSSM | Turn Signal/Security Module |
| V | Volt |
| VAC | Volts of Alternating Current |
| VDC | Volts of Direct Current |

**Table E-1. Acronyms and Abbreviations**

| ACRONYM OR ABBREVIATION | DESCRIPTION |
|---|---|
| VIN | Vehicle Identification Number |
| VSS | Vehicle Speed Sensor |

# NOTES

# Tools Used in This Manual

| PART NUMBER | TOOL NAME | NOTES |
|---|---|---|
| 98716-87A | STORAGE COVER | 1.24 STORAGE, Placing in Storage |
| 99650-02 | HIGH-PERFORMANCE SEALANT, GRAY | 3.18 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase |
| 99863-01A | GLOBAL BATTERY CHARGER | 1.16 BATTERY MAINTENANCE, Storage |
| B-45523 | VALVE GUIDE REAMER | 3.22 CYLINDER HEAD, Valve Guide Replacement |
| B-45524-1 | VALVE GUIDE DRIVER | 3.22 CYLINDER HEAD, Valve Guide Replacement |
| B-45524-2A | VALVE GUIDE INSTALLER SLEEVE | 3.22 CYLINDER HEAD, Valve Guide Replacement |
| B-45525 | VALVE GUIDE HONE | 3.22 CYLINDER HEAD, Inspection |
| B-45525 | VALVE GUIDE HONE | 3.22 CYLINDER HEAD, Valve Guide Replacement |
| B-45655 | CRANKCASE BEARING REMOVER/INSTALLER | 3.27 CRANKCASE, Right Crankcase Half |
| B-45655 | CRANKCASE BEARING REMOVER/INSTALLER | 3.27 CRANKCASE, Left Crankcase Half |
| GA500A | SNAP-ON TERMINAL PICK | A.3 AUTOFUSE ELECTRICAL CONNECTORS, Autofuse Connector Repair |
| HD-25070 | ROBINAIR HEAT GUN | 2.44 WINDSHIELD: FLHR/C, Windshield Window |
| HD-25070 | ROBINAIR HEAT GUN | 3.27 CRANKCASE, Sprocket Shaft Bearing Inner Race |
| HD-25070 | ROBINAIR HEAT GUN | A.18 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair |
| HD-33223-1 | CYLINDER COMPRESSION GAUGE | 3.7 TROUBLESHOOTING, Compression Test |
| HD-33416 | UNIVERSAL DRIVER | 2.19 STEERING HEAD BEARINGS, Removal |
| HD-34633 | AIR SUSPENSION PUMP AND GAUGE | 2.21 REAR SHOCK ABSORBERS, Removal |
| HD-34633A | AIR SUSPENSION PUMP AND GAUGE | 1.17 SUSPENSION ADJUSTMENTS, General |
| HD-34633A | AIR SUSPENSION PUMP AND GAUGE | 2.20 REAR AIR SUSPENSION, Removal and Installation |
| HD-34634 | FORK OIL SEAL INSTALLER | 2.17 FRONT FORK, Assembly |
| HD-34736-B | VALVE SPRING COMPRESSOR | 3.22 CYLINDER HEAD, Disassembly |
| HD-34736-B | VALVE SPRING COMPRESSOR | 3.22 CYLINDER HEAD, Assembly |
| HD-34751 | VALVE GUIDE CLEANING BRUSH | 3.22 CYLINDER HEAD, Inspection |
| HD-34751 | VALVE GUIDE CLEANING BRUSH | 3.22 CYLINDER HEAD, Valve Guide Replacement |
| HD-34751 | VALVE GUIDE CLEANING BRUSH | 3.22 CYLINDER HEAD, Valve Guide Replacement |
| HD-34751 | VALVE GUIDE CLEANING BRUSH | 3.22 CYLINDER HEAD, Valve and Seat Refacing |
| HD-34751 | VALVE GUIDE CLEANING BRUSH | 3.22 CYLINDER HEAD, Assembly |
| HD-34902-B | MAINSHAFT BEARING INNER RACE PULLER/INSTALLER | 3.27 CRANKCASE, Sprocket Shaft Bearing Inner Race |
| HD-34902-B | MAINSHAFT BEARING INNER RACE REMOVER/INSTALLER | 6.4 PRIMARY CHAINCASE HOUSING, Mainshaft Bearing Inner Race |
| HD-35316-10 | PILOT | 7.6 MAIN DRIVE GEAR AND BEARING, Removal |
| HD-35316-11 | RECEIVER CUP | 7.6 MAIN DRIVE GEAR AND BEARING, Removal |
| HD-35316-12 | INSTALLER CUP | 7.6 MAIN DRIVE GEAR AND BEARING, Installation |
| HD-35316-3A | CROSS PLATE | 7.6 MAIN DRIVE GEAR AND BEARING, Removal |
| HD-35316-3A | CROSS PLATE | 7.6 MAIN DRIVE GEAR AND BEARING, Installation |
| HD-35316-4A | 8 IN. BOLT | 7.6 MAIN DRIVE GEAR AND BEARING, Removal |
| HD-35316-4A | 8 IN. BOLT | 7.6 MAIN DRIVE GEAR AND BEARING, Installation |
| HD-35316-5 | 12 IN. BOLT | 7.6 MAIN DRIVE GEAR AND BEARING, Removal |
| HD-35316-5 | 12 IN. BOLT | 7.6 MAIN DRIVE GEAR AND BEARING, Installation |
| HD-35316-7 | WASHER | 7.6 MAIN DRIVE GEAR AND BEARING, Removal |
| HD-35316-7 | WASHER | 7.6 MAIN DRIVE GEAR AND BEARING, Installation |

# Tools Used in This Manual

| PART NUMBER | TOOL NAME | NOTES |
|---|---|---|
| HD-35316-8 | BEARING DRIVER | 7.6 MAIN DRIVE GEAR AND BEARING, Installation |
| HD-35316-9 | BEARING DRIVER | 7.6 MAIN DRIVE GEAR AND BEARING, Removal |
| HD-35316-C | MAIN DRIVE GEAR/BEARING REMOVER AND INSTALLER | 7.6 MAIN DRIVE GEAR AND BEARING, Removal |
| HD-35381A | BELT TENSION GAUGE | 1.13 REAR BELT DEFLECTION, Checking Belt Deflection |
| HD-35381A | BELT TENSION GAUGE | 1.13 REAR BELT DEFLECTION, Setting Belt Deflection |
| HD-35381A | BELT TENSION GAUGE | 2.4 REAR WHEEL, Installation |
| HD-35667-A | CYLINDER LEAKDOWN TESTER | 3.7 TROUBLESHOOTING, Cylinder Leakdown Test |
| HD-35758-C | NEWAY VALVE SEAT CUTTER SET | 3.22 CYLINDER HEAD, Valve and Seat Refacing |
| HD-38125-6 | PACKARD TERMINAL CRIMP TOOL | A.15 PACKARD METRI-PACK TERMINALS, Metri-Pack Terminal Crimps |
| HD-38125-7 | PACKARD TERMINAL CRIMPER | A.1 AMP 1-PLACE CONNECTORS, AMP 1-Place Connector Repair |
| HD-38125-7 | PACKARD TERMINAL CRIMPER | A.9 DEUTSCH MINI TERMINAL REPAIR, Deutsch Mini Terminal Crimps |
| HD-38125-7 | PACKARD TERMINAL CRIMPER | A.15 PACKARD METRI-PACK TERMINALS, Metri-Pack Terminal Crimps |
| HD-38125-8 | PACKARD CRIMPING TOOL | A.15 PACKARD METRI-PACK TERMINALS, Metri-Pack Terminal Crimps |
| HD-38125-8 | PACKARD CRIMPING TOOL | A.18 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair |
| HD-39301A | STEERING HEAD BEARING CUP REMOVER | 2.19 STEERING HEAD BEARINGS, Removal |
| HD-39302 | STEERING HEAD BEARING CUP INSTALLER | 2.19 STEERING HEAD BEARINGS, Installation |
| HD-39361-B | SPROCKET SHAFT OIL SEAL INSTALLER | 3.18 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase |
| HD-39621-27 | SOCKET TERMINAL TOOL | A.1 AMP 1-PLACE CONNECTORS, AMP 1-Place Connector Repair |
| HD-39621-28 | PIN TERMINAL REMOVER | A.1 AMP 1-PLACE CONNECTORS, AMP 1-Place Connector Repair |
| HD-39782-1 | CYLINDER HEAD SUPPORT STAND | 3.22 CYLINDER HEAD, Valve Guide Replacement |
| HD-39782-3 | INTAKE SEAT ADAPTER | 3.22 CYLINDER HEAD, Valve Guide Replacement |
| HD-39782-4 | EXHAUST SEAT ADAPTER | 3.22 CYLINDER HEAD, Valve Guide Replacement |
| HD-39782-A | CYLINDER HEAD SUPPORT STAND KIT | 3.22 CYLINDER HEAD, Valve Guide Replacement |
| HD-39786 | CYLINDER HEAD HOLDING FIXTURE | 3.22 CYLINDER HEAD, Disassembly |
| HD-39786 | CYLINDER HEAD HOLDING FIXTURE | 3.22 CYLINDER HEAD, Valve Guide Replacement |
| HD-39786 | CYLINDER HEAD HOLDING FIXTURE | 3.22 CYLINDER HEAD, Valve and Seat Refacing |
| HD-39786 | CYLINDER HEAD HOLDING FIXTURE | 3.22 CYLINDER HEAD, Assembly |
| HD-39787A | RIVET TOOL | 2.30 TOUR-PAK SERVICE, Hinges |
| HD-39847 | REAMER T-HANDLE | 3.22 CYLINDER HEAD, Valve Guide Replacement |
| HD-39964 | REAMER LUBRICANT | 3.22 CYLINDER HEAD, Valve Guide Replacement |
| HD-39965-A | DEUTSCH TERMINAL CRIMP TOOL | A.7 DEUTSCH STANDARD TERMINAL REPAIR, Deutsch Standard Terminal Crimps |

# Tools Used in This Manual

| PART NUMBER | TOOL NAME | NOTES |
|---|---|---|
| HD-39969 | ULTRA TORCH UT-100 | A.18 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair |
| HD-41177 | FORK TUBE HOLDER | 2.17 FRONT FORK, Disassembly |
| HD-41182 | FUEL PRESSURE GAUGE | 4.17 FUEL PRESSURE TEST, Testing |
| HD-41183 | HEAT SHIELD ATTACHMENT | A.18 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair |
| HD-41417 | PROPANE ENRICHMENT KIT | 4.20 INTAKE LEAK TEST, Leak Tester |
| HD-41475 | DEUTSCH CONNECTOR SERVICE KIT | A.6 DEUTSCH ELECTRICAL CONNECTORS, Deutsch Connector Repair |
| HD-41475-100 | FLAT BLADE L-HOOK | A.6 DEUTSCH ELECTRICAL CONNECTORS, Deutsch Connector Repair |
| HD-41609 | AMP MULTILOCK CRIMPER | A.2 AMP MULTILOCK CONNECTORS, AMP Multilock Connector Repair |
| HD-42135 | T-30 I.P. (TORX PLUS) DRIVER | 2.7 WHEEL LACING: 16 INCH RIM, General |
| HD-42310 | BENCH STAND | 3.13 REMOVING ENGINE FROM CHASSIS, Procedure |
| HD-42310 | BENCH STAND | 3.14 INSTALLING ENGINE IN CHASSIS, Procedure |
| HD-42310-2 | TWIN CAM 88 CRADLE | 3.13 REMOVING ENGINE FROM CHASSIS, Procedure |
| HD-42311 | OIL FILTER WRENCH | 1.5 ENGINE OIL AND FILTER, Changing Oil and Oil Filter: Touring Models |
| HD-42311 | OIL FILTER WRENCH | 1.5 ENGINE OIL AND FILTER, Changing Oil and Oil Filter: Touring Models |
| HD-42317-A | PISTON PIN CIRCLIP REMOVER/INSTALLER | 3.15 TOP END OVERHAUL: DISASSEMBLY, Piston |
| HD-42317-A | PISTON PIN CIRCLIP REMOVER/INSTALLER | 3.16 TOP END OVERHAUL: ASSEMBLY, Piston |
| HD-42320-A | PISTON PIN REMOVER | 3.15 TOP END OVERHAUL: DISASSEMBLY, Piston |
| HD-42322 | PISTON SUPPORT PLATE | 3.16 TOP END OVERHAUL: ASSEMBLY, Cylinder |
| HD-42324-A | CYLINDER TORQUE PLATES | 3.15 TOP END OVERHAUL: DISASSEMBLY, Cylinder Head |
| HD-42324-A | CYLINDER TORQUE PLATES | 3.23 CYLINDER, Cleaning |
| HD-42325-A | CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER | 3.25 COVER AND CAM SUPPORT PLATE, Cam Needle Bearings |
| HD-42326-B | CRANKSHAFT GUIDE | 3.18 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase |
| HD-42720-5 | CRANKCASE BEARING REMOVER/INSTALLER BASE | 3.27 CRANKCASE, Right Crankcase Half |
| HD-42720-5 | CRANKCASE BEARING REMOVER/INSTALLER BASE | 3.27 CRANKCASE, Left Crankcase Half |
| HD-42879 | ELECTRICAL CRIMPER TOOL | A.8 DEUTSCH SOLID BARREL MINI TERMINAL REPAIR, Deutsch Solid Barrel Terminal Crimps |
| HD-43646A | ROLLING STAND | 3.13 REMOVING ENGINE FROM CHASSIS, Procedure |
| HD-43646A | ROLLING STAND | 3.14 INSTALLING ENGINE IN CHASSIS, Procedure |
| HD-44060B | WHEEL BEARING REMOVER/INSTALLER | 2.8 SEALED WHEEL BEARINGS, Removal |
| HD-44061 | FUEL PRESSURE GAUGE ADAPTER | 4.17 FUEL PRESSURE TEST, Testing |
| HD-44067A | OIL FILTER WRENCH | 1.5 ENGINE OIL AND FILTER, Changing Oil and Oil Filter: Touring Models |
| HD-44358 | FLYWHEEL SUPPORT FIXTURE | 3.27 CRANKCASE, Sprocket Shaft Bearing Inner Race |

# Tools Used in This Manual

| PART NUMBER | TOOL NAME | NOTES |
|---|---|---|
| HD-45327 | REAR SWINGARM BEARING INSTALLER | 2.22 REAR FORK, Disassembly and Assembly |
| HD-45928 | PACKARD MICRO-64 TERMINAL REMOVER | A.17 PACKARD MICRO-64 CONNECTORS, Packard Micro-64 Connector Repair |
| HD-45929 | PACKARD MICRO-64 TERMINAL CRIMPER | A.17 PACKARD MICRO-64 CONNECTORS, Packard Micro-64 Connector Repair |
| HD-45961 | IGNITION SWITCH CONNECTOR REMOVER | 2.42 INNER FAIRING: FLTR, Removal |
| HD-45961 | IGNITION SWITCH CONNECTOR REMOVER | 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHX, FLHT/C/U, FLTR |
| HD-45962 | IGNITION SWITCH ALIGNMENT TOOL | 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHX, FLHT/C/U, FLTR |
| HD-46247A | VEHICLE ALIGNMENT TOOL | 2.11 VEHICLE ALIGNMENT, Method A |
| HD-46282 | FINAL DRIVE SPROCKET LOCKING TOOL | 6.6 TRANSMISSION SPROCKET, Removal |
| HD-46282 | FINAL DRIVE SPROCKET LOCKING TOOL | 6.6 TRANSMISSION SPROCKET, Installation |
| HD-47248 | LOWER ROCKER BOX WRENCH | 3.15 TOP END OVERHAUL: DISASSEMBLY, Rocker Covers |
| HD-47250 | INTAKE MANIFOLD WRENCH | 4.12 INDUCTION MODULE, Removal |
| HD-47258 | UPPER ROCKER BOX WRENCH | 3.15 TOP END OVERHAUL: DISASSEMBLY, Rocker Covers |
| HD-47856-1 | INSTALLER | 7.6 MAIN DRIVE GEAR AND BEARING, Installation |
| HD-47856-2 | PILOT | 7.6 MAIN DRIVE GEAR AND BEARING, Installation |
| HD-47856-3 | ADAPTER | 7.6 MAIN DRIVE GEAR AND BEARING, Installation |
| HD-47856-6 | NUT | 7.6 MAIN DRIVE GEAR AND BEARING, Installation |
| HD-47856-7 | CROW'S FOOT WRENCH | 7.6 MAIN DRIVE GEAR AND BEARING, Installation |
| HD-47910 | MAINSHAFT LOCKNUT WRENCH | 6.6 TRANSMISSION SPROCKET, Removal |
| HD-47910 | MAINSHAFT LOCKNUT WRENCH | 6.6 TRANSMISSION SPROCKET, Installation |
| HD-47925 | AXLE NUT TORQUE ADAPTER | 1.13 REAR BELT DEFLECTION, Setting Belt Deflection |
| HD-47925 | AXLE NUT TORQUE ADAPTER | 2.4 REAR WHEEL, Removal |
| HD-47932 | MAIN DRIVE GEAR BEARING AND SEAL INSTALLATION TOOL | 7.6 MAIN DRIVE GEAR AND BEARING, Cleaning and Inspection |
| HD-47933 | MAIN DRIVE GEAR SEAL INSTALLER | 7.6 MAIN DRIVE GEAR AND BEARING, Mainshaft Seal Replacement |
| HD-47941 | CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL | 3.17 BOTTOM END OVERHAUL: DISASSEMBLY, Cover and Cam Support Plate |
| HD-47941 | CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL | 3.18 BOTTOM END OVERHAUL: ASSEMBLY, Cover and Cam Support Plate |
| HD-47956 | CAMSHAFT ASSEMBLY TOOL | 3.25 COVER AND CAM SUPPORT PLATE, Camshafts |
| HD-47977 | PRIMARY DRIVE LOCKING TOOL | 6.3 DRIVE COMPONENTS, Removal |
| HD-48053 | ELECTRICAL SYSTEM ANALYZER WITH WIRELESS PRINTER | 8.8 BATTERY, Battery Testing |
| HD-48114 | MOLEX ELECTRICAL CONNECTOR TERMINAL REMOVER | A.10 MOLEX CONNECTORS, Molex Connector Repair |
| HD-48119 | ELECTRICAL CRIMP TOOL | A.10 MOLEX CONNECTORS, Crimp Terminal to Lead |
| HD-48262 | O2 SENSOR SOCKET | 4.14 OXYGEN SENSORS (O2), Removal |
| HD-48283 | CRANKSHAFT ROTATING WRENCH | 3.15 TOP END OVERHAUL: DISASSEMBLY, Rocker Arm Support Plate |

# Tools Used in This Manual

| PART NUMBER | TOOL NAME | NOTES |
|---|---|---|
| HD-48646 | CAM RING REMOVER/INSTALLER | 4.5 FUEL TANK TOP PLATE, Removal |
| HD-48650 | DIGITAL TECHNICIAN II | 1.14 BLEEDING BRAKES, Procedure |
| HD-48650 | DIGITAL TECHNICIAN II | C.1 ABS MODULE, Installation |
| HD-48921 | REAR WHEEL COMPENSATOR SPROCKET BEARING REMOVER/INSTALLER | 2.5 REAR WHEEL COMPENSATOR, Sprocket Bearing Replacement |
| HD-59000B | FORK OIL LEVEL GAUGE | 2.17 FRONT FORK, Assembly |
| HD-94660-2 | PILOT | 6.6 TRANSMISSION SPROCKET, Removal |
| HD-94660-2 | PILOT | 6.6 TRANSMISSION SPROCKET, Installation |
| HD-94681-80 | SPOKE WRENCH | 2.9 TRUING LACED WHEELS, Lateral Truing |
| HD-94804-57 | ROCKER ARM BUSHING REAMER | 3.20 ROCKER ARM SUPPORT PLATE, Cleaning and Inspection |
| HD-95637-10 | LONG BOLTS | 7.6 MAIN DRIVE GEAR AND BEARING, Removal |
| HD-95637-46B | WEDGE ATTACHMENT | 3.27 CRANKCASE, Sprocket Shaft Bearing Inner Race |
| HD-95637-46B | WEDGE ATTACHMENT | 7.6 MAIN DRIVE GEAR AND BEARING, Removal |
| HD-95952-1 | THREADED CYLINDERS | 3.16 TOP END OVERHAUL: ASSEMBLY, Cylinder |
| HD-95952-33C | CONNECTING ROD CLAMPING TOOL | 3.16 TOP END OVERHAUL: ASSEMBLY, Cylinder |
| HD-96333-51E | PISTON RING COMPRESSOR | 3.16 TOP END OVERHAUL: ASSEMBLY, Cylinder |
| HD-96796-47 | VALVE SPRING TESTER | 3.22 CYLINDER HEAD, Inspection |
| HD-96921-52C | OIL PRESSURE GAUGE SET | 3.6 OIL PRESSURE, Checking Oil Pressure |
| HD-97225-55C | SPROCKET SHAFT BEARING INSTALLER | 3.18 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase |
| HD-97225-55C | SPROCKET SHAFT BEARING INSTALLER | 3.27 CRANKCASE, Sprocket Shaft Bearing Inner Race |
| HD-99500-80 | WHEEL TRUING STAND | 2.6 CHECKING RIM RUNOUT, Inspection |
| HD-99500-80 | WHEEL TRUING STAND | 2.9 TRUING LACED WHEELS, Lateral Truing |
| HD-99500-80 | WHEEL TRUING AND BALANCING STAND | 2.10 CHECKING CAST WHEEL RUNOUT, Radial Runout |
| J-5586A | TRANSMISSION SHAFT RETAINING RING PLIERS | 7.5 TRANSMISSION ASSEMBLY, Disassembly |
| RS-25100-200 | NICE BEARING | 7.6 MAIN DRIVE GEAR AND BEARING, Removal |
| RS-25100-200 | NICE BEARING | 7.6 MAIN DRIVE GEAR AND BEARING, Removal |
| SNAP-ON BB200A | BASIC VACUUM BRAKE BLEEDER | 1.14 BLEEDING BRAKES, Procedure |
| SNAP-ON BB200A | BASIC VACUUM BRAKE BLEEDER | C.1 ABS MODULE, Removal |
| SNAP-ON TT600-3 | SNAP-ON PICK | A.14 PACKARD 630 METRI-PACK CONNECTORS, 630 Metri-Pack Connector Repair |

# NOTES

| FASTENER | TORQUE VALUE | | NOTES |
|---|---|---|---|
| 2 inch diameter gauge nuts | 10-20 **in-lbs** | 1.1-2.3 Nm | 2.37 INNER FAIRING: FLHX, FLHT/C/U, Installation |
| 2 inch diameter gauge nuts | 10-20 **in-lbs** | 1.1-2.3 Nm | 8.28 GAUGES AND INSTRUMENTS: FLHX, FLHT/C/U, FLTR, 2 Inch Diameter Gauges: Fuel Level, Ambient Air Temperature, Voltmeter, Oil Pressure |
| ABS module screws | 39-60 **in-lbs** | 4.4-6.8 Nm | 8.6 ELECTRICAL CADDIES, Right Side Caddy |
| ABS module to right side caddy socket head screws | 39-60 **in-lbs** | 4.4-6.8 Nm | C.1 ABS MODULE, Installation |
| Adjuster screw jam nut | 72-120 **in-lbs** | 8.1-13.6 Nm | 1.11 CLUTCH, Adjustment |
| Air cleaner cover bracket screw | 40-60 **in-lbs** | 4.5-6.8 Nm | 1.2 MAINTENANCE SCHEDULE, General |
| Air cleaner cover bracket screws | 40-60 **in-lbs** | 4.5-6.8 Nm | 1.7 AIR CLEANER AND EXHAUST SYSTEM, Installation / metric |
| Air cleaner cover screw | 36-60 **in-lbs** | 4.1-6.8 Nm | 1.2 MAINTENANCE SCHEDULE, General |
| Air cleaner cover screw | 36-60 **in-lbs** | 4.1-6.8 Nm | 1.7 AIR CLEANER AND EXHAUST SYSTEM, Installation / Use Loctite Medium Strength Threadlocker 243 (Blue) |
| Air dam hex screws (FLTR) | 120-144 **in-lbs** | 13.6-16.3 Nm | 2.18 AIR DAM: FLTR, Air Dam (FLTR) |
| Air dam hex screws (FLTR) | 120-144 **in-lbs** | 13.6-16.3 Nm | 2.18 AIR DAM: FLTR, Air Dam (FLTR) |
| Air dam screws (FLTR) | 120-144 **in-lbs** | 13.6-16.3 Nm | 2.19 STEERING HEAD BEARINGS, Installation |
| Air deflector screws | 25-30 **in-lbs** | 2.8-3.4 Nm | 2.38 AIR DEFLECTORS: FLHTCU, Air Deflectors (FLHTCU) |
| Air valve mount hex nut | 40-50 **in-lbs** | 4.5-5.6 Nm | 2.20 REAR AIR SUSPENSION, Removal and Installation |
| Auxiliary lamp bracket to fork bracket screws | 15-20 ft-lbs | 20-27 Nm | 2.37 INNER FAIRING: FLHX, FLHT/C/U, Installation |
| Auxiliary lamp bracket to fork bracket screws (FLHT/C/U) | 15-20 ft-lbs | 20-27 Nm | 8.11 AUXILIARY LAMPS AND BRACKETS, Auxiliary Lamp Bracket |
| Auxiliary lamp bracket to fork bracket stud acorn nuts (FLHR/C) | 72-108 **in-lbs** | 8.1-12.2 Nm | 8.11 AUXILIARY LAMPS AND BRACKETS, Auxiliary Lamp Bracket |
| Banjo bleeder bolts to calipers | 17-19 ft-lbs | 23.1-25.8 Nm | C.3 ABS BRAKE LINES, ABS Module to Front Brake Calipers |
| Banjo bleeder bolt to caliper | 17-19 ft-lbs | 23.1-25.8 Nm | 2.13 FRONT BRAKE CALIPER, Installation |
| Banjo bleeder bolt to front brake caliper | 17-19 ft-lbs | 23.1-25.8 Nm | 2.12 FRONT BRAKE MASTER CYLINDER, Front Brake Line |
| Banjo bolt to ABS module | 12.5-14.5 ft-lbs | 17-20 Nm | C.1 ABS MODULE, Installation |
| Banjo bolt to ABS module | 12.5-14.5 ft-lbs | 17-20 Nm | C.3 ABS BRAKE LINES, Front Master Cylinder to ABS Module |
| Banjo bolt to ABS module | 12.5-14.5 ft-lbs | 17-20 Nm | C.3 ABS BRAKE LINES, ABS Module to Front Brake Calipers |
| Banjo bolt to ABS module | 12.5-14.5 ft-lbs | 17-20 Nm | C.3 ABS BRAKE LINES, Rear Master Cylinder to ABS Module |
| Banjo bolt to ABS module | 12.5-14.5 ft-lbs | 17-20 Nm | C.3 ABS BRAKE LINES, ABS Module to Rear Brake Caliper |
| Banjo bolt to caliper | 17-19 ft-lbs | 23.1-25.8 Nm | 2.14 REAR BRAKE MASTER CYLINDER, Rear Brake Line |
| Banjo bolt to caliper | 17-19 ft-lbs | 23.1-25.8 Nm | 2.15 REAR BRAKE CALIPER, Installation |
| Banjo bolt to caliper | 17-19 ft-lbs | 23.1-25.8 Nm | C.3 ABS BRAKE LINES, ABS Module to Rear Brake Caliper |
| Banjo bolt to master cylinder | 13-15 ft-lbs | 17.6-20.3 Nm | 2.12 FRONT BRAKE MASTER CYLINDER, Assembly and Installation |

| FASTENER | TORQUE VALUE | | NOTES |
|---|---|---|---|
| Banjo bolt to master cylinder | 13-15 ft-lbs | 17.6-20.3 Nm | 2.14 REAR BRAKE MASTER CYL-INDER, Assembly and Installation |
| Banjo bolt to master cylinder | 13-15 ft-lbs | 17.6-20.3 Nm | 2.14 REAR BRAKE MASTER CYLINDER, Rear Brake Line |
| Banjo bolt to master cylinder | 13-15 ft-lbs | 17.6-20.3 Nm | C.3 ABS BRAKE LINES, Front Master Cylinder to ABS Module |
| Banjo bolt to master cylinder | 13-15 ft-lbs | 17.6-20.3 Nm | C.3 ABS BRAKE LINES, Rear Master Cylinder to ABS Module |
| Banjo bolt to master cylinder reservoir | 13-15 ft-lbs | 17.6-20.3 Nm | 2.12 FRONT BRAKE MASTER CYLINDER, Front Brake Line |
| Battery cable terminal bolt (10mm) | 60-96 **in-lbs** | 6.8-10.9 Nm | 8.21 ALTERNATOR, Installation |
| Battery terminal bolt | 60-96 **in-lbs** | 6.8-10.9 Nm | 1.2 MAINTENANCE SCHEDULE, General |
| Battery terminal bolt | 60-96 **in-lbs** | 6.8-10.9 Nm | 1.16 BATTERY MAINTENANCE, Battery: Touring Models |
| Battery terminal bolt | 60-96 **in-lbs** | 6.8-10.9 Nm | 1.16 BATTERY MAINTENANCE, Battery: Touring Models |
| Battery terminal bolt | 60-96 **in-lbs** | 6.8-10.9 Nm | 5.2 STARTER, Installation |
| Battery tray screws | 72-96 **in-lbs** | 8.1-10.9 Nm | 4.21 EVAPORATIVE EMISSIONS CONTROL (CA MODELS), Charcoal Canister / metric |
| Brake caliper (front) mounting screws | 28-38 ft-lbs | 37.9-51.5 Nm | 1.15 BRAKE PADS AND DISCS, Brake Pad Replacement / metric |
| Brake caliper (front) mounting screws | 28-38 ft-lbs | 37.9-51.5 Nm | 2.3 FRONT WHEEL, Installation / metric |
| Brake caliper (front) mounting screws | 28-38 ft-lbs | 37.9-51.5 Nm | 2.13 FRONT BRAKE CALIPER, Installation / metric |
| Brake caliper (rear) socket head screws | 43-48 ft-lbs | 58.3-65.1 Nm | 2.4 REAR WHEEL, Installation / metric |
| Brake caliper (rear) to caliper bracket screws | 43-48 ft-lbs | 58.3-65.1 Nm | 1.15 BRAKE PADS AND DISCS, Brake Pad Replacement / metric |
| Brake caliper (rear) to caliper bracket screws | 43-48 ft-lbs | 58.3-65.1 Nm | 2.15 REAR BRAKE CALIPER, Installation / metric |
| Brake caliper bleeder valve | 80-100 **in-lbs** | 9.0-11.3 Nm | 1.14 BLEEDING BRAKES, Procedure |
| Brake caliper pad pin | 75-102 **in-lbs** | 8.5.-11.5 Nm | 1.2 MAINTENANCE SCHEDULE, General |
| Brake caliper pad pin | 75-102 **in-lbs** | 8.5-11.5 Nm | 1.15 BRAKE PADS AND DISCS, Brake Pad Replacement / Always use new pin |
| Brake caliper pad pin | 75-102 **in-lbs** | 8.5-11.5 Nm | 1.15 BRAKE PADS AND DISCS, Brake Pad Replacement / Always use new pin |
| Brake disc (front) screws | 16-24 ft-lbs | 22-33 Nm | 2.3 FRONT WHEEL, Installation / Always use new screws |
| Brake disc (rear) screws | 30-45 ft-lbs | 41-61 Nm | 2.4 REAR WHEEL, Installation / Always use new screws |
| Brake hose P-clamp to rear swingarm bracket hex screw | 35-45 **in-lbs** | 4.0-5.1 Nm | 2.14 REAR BRAKE MASTER CYLINDER, Rear Brake Line |
| Brake line bracket flange screw | 20-30 **in-lbs** | 2.3-3.4 Nm | C.3 ABS BRAKE LINES, Front Master Cylinder to ABS Module |
| Brake line bracket flange screw | 20-30 **in-lbs** | 2.3-3.4 Nm | C.3 ABS BRAKE LINES, ABS Module to Front Brake Calipers |
| Brake line bracket to lower fork bracket screw | 120-180 **in-lbs** | 13.6-20.3 Nm | 2.19 STEERING HEAD BEARINGS, Installation |

| FASTENER | TORQUE VALUE | | NOTES |
|---|---|---|---|
| Brake pedal shaft locknut | 15-20 ft-lbs | 20-27 Nm | 2.14 REAR BRAKE MASTER CYL-INDER, Assembly and Installation |
| Brake pedal shaft locknut | 15-20 ft-lbs | 20-27 Nm | 2.14 REAR BRAKE MASTER CYLINDER, Rear Brake Line |
| Brake pedal shaft locknut | 15-20 ft-lbs | 20-27 Nm | C.3 ABS BRAKE LINES, Rear Master Cylinder to ABS Module |
| Breather assembly bolts | 90-120 **in-lbs** | 10.2-13.6 Nm | 3.16 TOP END OVERHAUL: ASSEMBLY, Breather Assembly |
| Breather bolts | 22-24 ft-lbs | 29.8-32.5 Nm | 4.3 AIR CLEANER ASSEMBLY, Installation / metric |
| Cam chain tensioner fasteners | 100-120 **in-lbs** | 11.3-13.6 Nm | 3.18 BOTTOM END OVERHAUL: ASSEMBLY, Cover and Cam Support Plate |
| Cam cover screws | 125-155 **in-lbs** | 14.1-17.5 Nm | 3.18 BOTTOM END OVERHAUL: ASSEMBLY, Cover and Cam Support Plate |
| Cam support plate screws | 90-120 **in-lbs** | 10.2-13.6 Nm | 3.18 BOTTOM END OVERHAUL: ASSEMBLY, Cover and Cam Support Plate |
| Cam support plate screws | 90-120 **in-lbs** | 10.2-13.6 Nm | 3.18 BOTTOM END OVERHAUL: ASSEMBLY, Cover and Cam Support Plate |
| CB module to radio screw | 35-45 **in-lbs** | 4.0-5.1 Nm | 8.32 ADVANCED AUDIO SYSTEM, Radio (Storage Box) |
| CB module to radio screw | 35-45 **in-lbs** | 4.0-5.1 Nm | 8.32 ADVANCED AUDIO SYSTEM, CB Module |
| Chain tensioner fasteners | 15-19 ft-lbs | 20.3-25.8 Nm | 6.3 DRIVE COMPONENTS, Installation |
| Charcoal canister screws | 10-15 **in-lbs** | 1.1-1.7 Nm | 4.21 EVAPORATIVE EMISSIONS CONTROL (CA MODELS), Charcoal Canister / metric |
| Charcoal canister screws | 10-15 **in-lbs** | 1.1-1.7 Nm | 8.6 ELECTRICAL CADDIES, Battery Tray |
| CKP sensor mount screw | 90-120 **in-lbs** | 10.2-13.6 Nm | 8.20 CRANKSHAFT POSITION SENSOR (CKP), Installation |
| Clutch adjuster screw locknut | 72-120 **in-lbs** | 8.1-13.6 Nm | 1.2 MAINTENANCE SCHEDULE, General |
| Clutch cable fitting | 90-120 **in-lbs** | 10.2-13.6 Nm | 2.23 CLUTCH CABLE, Installation |
| Clutch cable fitting | 90-120 **in-lbs** | 10.2-13.6 Nm | 7.4 CLUTCH RELEASE COVER, Assembly and Installation |
| Clutch diaphragm spring retainer bolts | 90-110 **in-lbs** | 10.2-12.4 Nm | 6.5 CLUTCH, Clutch Pack Only |
| Clutch hub mainshaft nut | 70-80 ft-lbs | 94.9-108.5 Nm | 6.3 DRIVE COMPONENTS, Installation |
| Clutch inspection cover | 84-108 **in-lbs** | 9.5-12.2 Nm | 1.2 MAINTENANCE SCHEDULE, General |
| Clutch inspection cover screws | 84-108 **in-lbs** | 9.5-12.2 Nm | 1.9 PRIMARY CHAIN, Chaincase Lubricant: Touring Models |
| Clutch inspection cover screws | 84-108 **in-lbs** | 9.5-12.2 Nm | 1.11 CLUTCH, Adjustment |
| Clutch lever bracket handlebar clamp screws | 72-108 **in-lbs** | 8-12 Nm | 2.37 INNER FAIRING: FLHX, FLHT/C/U, Installation |
| Clutch release cover screws | 84-108 **in-lbs** | 9.5-12.2 Nm | 7.4 CLUTCH RELEASE COVER, Assembly and Installation |
| Clutch release cover socket head screws | 84-108 **in-lbs** | 9.5-12.2 Nm | 2.23 CLUTCH CABLE, Installation |
| Compensating sprocket bolt | 155-165 ft-lbs | 210.1-223.7 Nm | 6.3 DRIVE COMPONENTS, Installation |
| Console rear bracket screws | 20-30 **in-lbs** | 2.7-3.4 Nm | 4.4 FUEL TANK, Installation |
| Console socket/hex screw | 36-60 **in-lbs** | 4.1-6.8 Nm | 4.5 FUEL TANK TOP PLATE, Installation / metric |
| Console socket/hex screw | 36-60 **in-lbs** | 4.1-6.8 Nm | 4.21 EVAPORATIVE EMISSIONS CONTROL (CA MODELS), Fuel Vapor Vent Tube / metric |

| FASTENER | TORQUE VALUE | | NOTES |
|---|---|---|---|
| Cover bracket screws | 40-60 **in-lbs** | 4.5-6.8 Nm | 4.3 AIR CLEANER ASSEMBLY, Installation / metric |
| Cover screw | 36-60 **in-lbs** | 4.1-6.8 Nm | 4.3 AIR CLEANER ASSEMBLY, Installation / Use Loctite Medium Strength Threadlocker 243 (Blue) |
| Cranckase bolts, final | 15-19 ft-lbs | 20.3-25.8 Nm | 3.18 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase |
| Crankcase bolts, initial | 10 ft-lbs | 13.6 Nm | 3.18 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase |
| Crankcase pipe plugs | 120-144 **in-lbs** | 13.6-16.3 Nm | 3.27 CRANKCASE, Pipe Plug and Oil Fittings |
| Crankcase to front engine mounting bracket bolts | 36-40 ft-lbs | 48.8-54.2 Nm | 3.14 INSTALLING ENGINE IN CHASSIS, Procedure |
| Crank sprocket bolt, final torque | 24 ft-lbs | 32.5 Nm | 3.18 BOTTOM END OVERHAUL: ASSEMBLY, Cover and Cam Support Plate |
| Cylinder head bolts, final | 15-17 ft-lbs | 20.3-23.0 Nm | 3.16 TOP END OVERHAUL: ASSEMBLY, Cylinder Head / See special method to tighten |
| Cylinder head bolts, final | 15-17 ft-lbs | 20.3-23.1 Nm | 3.23 CYLINDER, Inspection |
| Cylinder head bolts, initial | 120-144 **in-lbs** | 13.5-16.2 Nm | 3.16 TOP END OVERHAUL: ASSEMBLY, Cylinder Head / See special method to tighten |
| Cylinder head bolts, initial | 120-144 **in-lbs** | 13.6-16.3 Nm | 3.23 CYLINDER, Inspection |
| Cylinder head flange adapter screws | 96-144 **in-lbs** | 10.9-16.3 Nm | 4.12 INDUCTION MODULE, Installation / metric |
| Cylinder head flange adapter screws | 96-144 **in-lbs** | 10.9-16.3 Nm | 4.12 INDUCTION MODULE, Installation / metric |
| Cylinder stud | 10-20 ft-lbs | 3.6-27.1 Nm | 3.27 CRANKCASE, Cylinder Studs |
| Diaphragm spring retainer bolts | 90-110 **in-lbs** | 10.2-12.4 Nm | 6.5 CLUTCH, Clutch Pack and Bearing |
| Electrical caddy/battery tray screws | 72-96 **in-lbs** | 8.1-10.9 Nm | 8.6 ELECTRICAL CADDIES, Left Side Caddy |
| Electrical caddy/battery tray screws | 72-96 **in-lbs** | 8.1-10.9 Nm | 8.6 ELECTRICAL CADDIES, Left Side Caddy |
| Electrical caddy/battery tray screws | 72-96 **in-lbs** | 8.1-10.9 Nm | 8.6 ELECTRICAL CADDIES, Right Side Caddy |
| Electrical caddy/battery tray screws | 72-96 **in-lbs** | 8.1-10.9 Nm | 8.6 ELECTRICAL CADDIES, Battery Tray |
| Electrical caddy/battery tray screws | 72-96 **in-lbs** | 8.1-10.9 Nm | 8.6 ELECTRICAL CADDIES, Battery Tray |
| Electrical caddy/battery tray screws | 72-96 **in-lbs** | 8.1-10.9 Nm | 8.34 MAIN WIRING HARNESS, Installation: All Models (Part 1) |
| Electrical caddy/battery tray screws | 72-96 **in-lbs** | 8.1-10.9 Nm | 8.34 MAIN WIRING HARNESS, Installation: All Models (Part 1) |
| Electrical caddy screws | 72-96 **in-lbs** | 8.1-10.9 Nm | 4.21 EVAPORATIVE EMISSIONS CONTROL (CA MODELS), Charcoal Canister / metric |
| Engine guard T40 TORX screws | 15-20 ft-lbs | 20.3-27.1 Nm | 2.34 LOWER FAIRING AND ENGINE GUARD, Engine Guard |
| Engine oil drain plug | 14-21 ft-lbs | 19.0-28.5 Nm | 1.2 MAINTENANCE SCHEDULE, General |
| Engine oil drain plug | 14-21 ft-lbs | 19.0-28.5 Nm | 1.5 ENGINE OIL AND FILTER, Changing Oil and Oil Filter: Touring Models |
| Engine oil drain plug w/o-ring | 14-21 ft-lbs | 19.0-28.5 Nm | 3.29 OIL PAN, Installation / Clean plug before installation |
| Engine to front engine mounting bracket | 36-40 ft-lbs | 49-54 Nm | 1.23 ENGINE MOUNTS, Inspection |
| Engine to front engine mounting bracket bolts | 36-40 ft-lbs | 49-54 Nm | 2.11 VEHICLE ALIGNMENT, Method A |
| Engine to front engine mounting bracket bolts | 36-40 ft-lbs | 49-54 Nm | 2.11 VEHICLE ALIGNMENT, Method B |

| FASTENER | TORQUE VALUE | | NOTES |
|---|---|---|---|
| ET sensor | 120-180 **in-lbs** | 13.6-20.3 Nm | 4.11 ENGINE TEMPERATURE SENSOR (ET), Installation |
| Exhaust bracket clamp carriage bolt | 20-25 ft-lbs | 27.1-33.9 Nm | 4.18 EXHAUST SYSTEM, Installation |
| Exhaust bracket clamp carriage bolt | 20-25 ft-lbs | 27.1-33.9 Nm | 4.18 EXHAUST SYSTEM, Assembly |
| Exhaust bracket tab stud Keps nut | 12-15 ft-lbs | 16.3-20.3 Nm | 4.18 EXHAUST SYSTEM, Installation |
| Exhaust bracket tab stud Keps nut | 12-15 ft-lbs | 16.3-20.3 Nm | 4.18 EXHAUST SYSTEM, Assembly |
| Exhaust flange adapter nuts | 100-120 **in-lbs** | 11.3-13.6 Nm | 4.18 EXHAUST SYSTEM, Installation |
| Exhaust flange adapter nuts | 100-120 **in-lbs** | 11.3-13.6 Nm | 4.18 EXHAUST SYSTEM, Installation |
| Exhaust flange adapter nuts | 100-120 **in-lbs** | 11.3-13.6 Nm | 4.18 EXHAUST SYSTEM, Installation |
| Exhaust flange adapter nuts | 100-120 **in-lbs** | 11.3-13.6 Nm | 4.18 EXHAUST SYSTEM, Installation |
| Exhaust heat shield worm drive clamp screw | 20-40 **in-lbs** | 2.3-4.5 Nm | 2.4 REAR WHEEL, Installation / metric |
| Exhaust heat shield worm drive clamp screw | 20-40 **in-lbs** | 2.3-4.5 Nm | 4.18 EXHAUST SYSTEM, Installation |
| Exhaust heat shield worm drive clamp screw | 20-40 **in-lbs** | 2.3-4.5 Nm | 4.18 EXHAUST SYSTEM, Assembly |
| Exhaust muffler to saddlebag support rail screws | 96-144 **in-lbs** | 10.8-16.3 Nm | 2.4 REAR WHEEL, Installation / metric |
| Exhaust muffler to saddlebag support rail screws | 96-144 **in-lbs** | 10.8-16.3 Nm | 4.18 EXHAUST SYSTEM, Installation |
| Exhaust muffler to saddlebag support rail screws | 96-144 **in-lbs** | 10.8-16.3 Nm | 4.18 EXHAUST SYSTEM, Installation |
| Exhaust muffler to saddlebag support rail screws | 96-144 **in-lbs** | 10.8-16.3 Nm | 4.18 EXHAUST SYSTEM, Assembly |
| Exhaust muffler to saddlebag support rail screws | 96-144 **in-lbs** | 10.8-16.3 Nm | 4.18 EXHAUST SYSTEM, Assembly |
| Exhaust TORCA clamp nut | 45-60 ft-lbs | 61-81 Nm | 4.18 EXHAUST SYSTEM, Installation / Always use a new clamp |
| Exhaust TORCA clamp nut | 45-60 ft-lbs | 61-81 Nm | 4.18 EXHAUST SYSTEM, Assembly |
| Exhaust TORCA clamp nut | 45-60 ft-lbs | 61-81 Nm | 2.4 REAR WHEEL, Installation / metric |
| Exhaust valve actuator cable J-clamp hex screw | 35-45 **in-lbs** | 4.0-5.1 Nm | 8.6 ELECTRICAL CADDIES, Right Side Caddy |
| Exhaust valve actuator screws | 32-40 **in-lbs** | 3.6-4.5 Nm | 8.6 ELECTRICAL CADDIES, Right Side Caddy |
| Exhaust valve actuator T27 TORX screws | 32-40 **in-lbs** | 3.6-4.5 Nm | 4.19 ACTIVE EXHAUST (HDI), Exhaust Valve Actuator |
| Fairing bracket/steering head thru bolt locknuts (FLTR) | 20-30 ft-lbs | 27.1-40.7 Nm | 2.42 INNER FAIRING: FLTR, Installation |
| Fairing cap screws | 25-30 **in-lbs** | 2.8-3.4 Nm | 2.36 FAIRING CAP: FLHX, FLHT/C/U, Fairing Cap |
| Fairing cap screws | 25-30 **in-lbs** | 2.8-3.4 Nm | 8.18 FAIRING CAP SWITCHES: FLHTC/U, Installation |
| Fairing lower clip stud flange nuts | 35-40 **in-lbs** | 4.0-4.5 Nm | 2.34 LOWER FAIRING AND ENGINE GUARD, Lower Fairing (FLHTCU) |
| Fairing lower glove box tray T20 TORX screws | 20-25 **in-lbs** | 2.3-2.8 Nm | 2.34 LOWER FAIRING AND ENGINE GUARD, Lower Fairing (FLHTCU) |
| Fairing lower glove box tray T20 TORX screws | 20-25 **in-lbs** | 2.3-2.8 Nm | 2.34 LOWER FAIRING AND ENGINE GUARD, Lower Fairing (FLHTCU) |

| FASTENER | TORQUE VALUE | | NOTES |
|---|---|---|---|
| Fairing lower to engine guard clamp T40 TORX screws | 90-100 **in-lbs** | 10.2-11.3 Nm | 2.34 LOWER FAIRING AND ENGINE GUARD, Lower Fairing (FLHTCU) |
| Fairing speaker lower screw (FLHX, FLHTC/U) | 22-28 **in-lbs** | 2.5-3.2 Nm | 2.37 INNER FAIRING: FLHX, FLHT/C/U, Installation |
| Fairing speaker lower screw (FLHX, FLHTC/U) | 22-28 **in-lbs** | 2.5-3.2 Nm | 8.32 ADVANCED AUDIO SYSTEM, Front Fairing Speakers |
| Fairing speaker upper screws (FLHX, FLHTC/U) | 35-50 **in-lbs** | 4.0-5.7 Nm | 2.37 INNER FAIRING: FLHX, FLHT/C/U, Installation |
| Fairing speaker upper screws (FLHX, FLHTC/U) | 35-50 **in-lbs** | 4.0-5.7 Nm | 8.32 ADVANCED AUDIO SYSTEM, Front Fairing Speakers |
| Fork cap bolt | 50-60 ft-lbs | 68-81 Nm | 2.17 FRONT FORK, Installation |
| Fork damper tube screw (6mm) | 132-216 **in-lbs** | 14.9-24.4 Nm | 2.17 FRONT FORK, Assembly |
| Fork lock screws (FLHR/C) | 36-60 **in-lbs** | 4.1-6.8 Nm | 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHR/C |
| Fork oil drain plug | 72-96 **in-lbs** | 8-11 Nm | 2.17 FRONT FORK, Assembly |
| Fork stem nut | 60-80 ft-lbs | 81-109 Nm | 1.19 STEERING HEAD BEARINGS, Adjustment |
| Fork stem nut | 60-80 ft-lbs | 81-109 Nm | 1.19 STEERING HEAD BEARINGS, Adjustment |
| Fork stem nut | 60-80 ft-lbs | 81-109 Nm | 2.19 STEERING HEAD BEARINGS, Installation |
| Fork tube plug | 22-58 ft-lbs | 30-79 Nm | 2.17 FRONT FORK, Assembly |
| Frame tube cover Phillips screw | 25-40 **in-lbs** | 2.8-4.5 Nm | 2.48 REAR FACIA: FLHX, Rear Facia Lamp |
| Frame tube cover screw | 25-40 **in-lbs** | 2.8-4.5 Nm | 8.34 MAIN WIRING HARNESS, Installation: All Models (Part 1) |
| Frame tube cover screw | 25-40 **in-lbs** | 2.8-4.5 Nm | 8.36 RADIO ANTENNA CABLE, FLHX, FLTR |
| Front axle holder nuts | 132-180 **in-lbs** | 14.9-20.3 Nm | 2.3 FRONT WHEEL, Installation / metric |
| Front axle nut | 60-65 ft-lbs | 81.4-88.1 Nm | 2.3 FRONT WHEEL, Installation / metric |
| Front brake caliper mounting screws | 28-38 ft-lbs | 37.9-51.5 Nm | C.2 WHEEL SPEED SENSORS, Front Wheel Speed Sensor |
| Front brake line bracket screw | 120-180 **in-lbs** | 13.6-20.3 Nm | 2.12 FRONT BRAKE MASTER CYLINDER, Front Brake Line |
| Front cylinder head exhaust flange nut | 9-18 **in-lbs** | 1-2 Nm | 4.18 EXHAUST SYSTEM, Installation |
| Front cylinder head exhaust flange nut, bottom | 100-120 **in-lbs** | 11.3-13.6 Nm | 4.18 EXHAUST SYSTEM, Assembly |
| Front cylinder head exhaust flange nut, final | 100-120 **in-lbs** | 11.3-13.6 Nm | 4.18 EXHAUST SYSTEM, Assembly |
| Front cylinder head exhaust flange nut, initial | 9-18 **in-lbs** | 1-2 Nm | 4.18 EXHAUST SYSTEM, Assembly |
| Front engine mounting bracket to rubber mount | 15-20 ft-lbs | 20-27 Nm | 1.23 ENGINE MOUNTS, Inspection |
| Front engine mounting bracket to rubber mount bolt | 15-20 ft-lbs | 20-27 Nm | 2.11 VEHICLE ALIGNMENT, Method B |
| Front fender mount screws | 16-20 ft-lbs | 22-27 Nm | 2.46 FRONT FENDER, Installation |
| Front fender tip lamp bracket screws | 20-25 **in-lbs** | 2.3-2.8 Nm | 8.13 FENDER TIP LAMPS, Front Fender Tip Lamp |
| Front fender tip lamp bracket screws | 20-25 **in-lbs** | 2.3-2.8 Nm | 8.13 FENDER TIP LAMPS, Front Fender Tip Lamp Jumper Harness |
| Front fender tip lamp trim strip tee bolt nuts | 10-15 **in-lbs** | 1.1-1.7 Nm | 8.13 FENDER TIP LAMPS, Front Fender Tip Lamp Jumper Harness |

| FASTENER | TORQUE VALUE | | NOTES |
|---|---|---|---|
| Front master cylinder reservoir cover screws | 7-10 **in-lbs** | 0.8-1.1 Nm | 1.6 BRAKES, Fluid Inspection |
| Front master cylinder reservoir cover screws | 7-10 **in-lbs** | 0.8-1.1 Nm | 1.14 BLEEDING BRAKES, Procedure |
| Front master cylinder reservoir cover screws | 7-10 **in-lbs** | 0.8-1.1 Nm | 1.15 BRAKE PADS AND DISCS, Brake Pad Replacement |
| Front rubber mount to frame cross-member | 15-20 Nm | 20-27 Nm | 1.23 ENGINE MOUNTS, Inspection |
| Front rubber mount to frame cross-member bolts | 15-20 ft-lbs | 20-27 Nm | 2.11 VEHICLE ALIGNMENT, Method B |
| Front turn signal lamp bracket stud acorn nuts (FLTR) | 40-50 **in-lbs** | 4.5-5.7 Nm | 2.39 UPPER FAIRING AND WINDSHIELD: FLTR, Outer Fairing |
| Front turn signal lamp mounting bracket screws (FLHR/C, FLHT/C/U) | 30-60 **in-lbs** | 4.1-6.8 Nm | 8.14 TURN SIGNAL LAMPS, Front Turn Signal Lamp |
| Front turn signal lamp mounting bracket screws (FLHX) | 15-20 ft-lbs | 20-27 Nm | 8.14 TURN SIGNAL LAMPS, Front Turn Signal Lamp |
| Fuel supply line quick-connect fitting | 22-26 ft-lbs | 29.8-35.3 Nm | 4.4 FUEL TANK, Fuel Supply Check Valve/Tube / metric |
| Fuel supply tube clamp screw | 66-82 **in-lbs** | 7.5-9.3 Nm | 4.15 FUEL INJECTORS, Installation / metric |
| Fuel tank console screws | 36-60 **in-lbs** | 4.1-6.8 Nm | 4.4 FUEL TANK, Installation |
| Fuel tank console screws | 36-60 **in-lbs** | 4.1-6.8 Nm | 8.32 ADVANCED AUDIO SYSTEM, Front Headset Receptacle |
| Fuel tank front screws | 15-20 ft-lbs | 20.3-27.1 Nm | 4.4 FUEL TANK, Installation |
| Fuel tank rear bracket screws | 15-20 ft-lbs | 20.3-27.1 Nm | 4.4 FUEL TANK, Installation |
| Ground stud flange nut (10 mm) | 50-90 **in-lbs** | 5.7-10.2 Nm | 8.6 ELECTRICAL CADDIES, Battery Tray |
| Guard to frame screws | 15-20 ft-lbs | 20.0-27.0 Nm | 2.28 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail |
| Guard to frame screws | 15-20 ft-lbs | 20.0-27.0 Nm | 2.28 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail |
| Handlebar clamp screws | 72-80 **in-lbs** | 8-9 Nm | 4.9 TWIST GRIP SENSOR, Installation / metric |
| Handlebar clamp to clutch lever bracket screws | 72-108 **in-lbs** | 8-12 Nm | 2.24 HANDLEBARS, Adjustment |
| Handlebar clamp to clutch lever bracket screws | 72-108 **in-lbs** | 8.0-12.0 Nm | 8.39 HANDLEBAR SWITCH ASSEMBLIES, Assembly: Left Side Handlebar Switches |
| Handlebar clamp to clutch lever bracket screws | 72-108 **in-lbs** | 8.0-12.0 Nm | 8.39 HANDLEBAR SWITCH ASSEMBLIES, Installation |
| Handlebar clamp to clutch lever bracket T27 TORX screws | 60-80 **in-lbs** | 6.8-9.0 Nm | 2.23 CLUTCH CABLE, Installation |
| Handlebar clamp to master cylinder reservoir screws | 72-80 **in-lbs** | 8-9 Nm | 2.24 HANDLEBARS, Adjustment |
| Handlebar clamp to master cylinder screws | 72-80 **in-lbs** | 8.0-9.0 Nm | 8.39 HANDLEBAR SWITCH ASSEMBLIES, Assembly: Right Side Handlebar Switches |
| Handlebar clamp to master cylinder screws | 72-80 **in-lbs** | 8.0-9.0 Nm | 8.39 HANDLEBAR SWITCH ASSEMBLIES, Installation |
| Handlebar lower clamp bolts (risers) | 30-40 ft-lbs | 40.7-54.2 Nm | 2.24 HANDLEBARS, Rubber Mounts |
| Handlebar switch housing screw | 35-45 **in-lbs** | 4.0-5.1 Nm | 1.2 MAINTENANCE SCHEDULE, General |
| Handlebar switch housing screws | 35-45 **in-lbs** | 4-5 Nm | 4.9 TWIST GRIP SENSOR, Installation / metric |

| FASTENER | TORQUE VALUE | | NOTES |
|---|---|---|---|
| Handlebar switch housing screws | 35-45 **in-lbs** | 4.0-5.0 Nm | 8.39 HANDLEBAR SWITCH ASSEMBLIES, Assembly: Right Side Handlebar Switches |
| Handlebar switch housing screws | 35-45 **in-lbs** | 4.0-5.0 Nm | 8.39 HANDLEBAR SWITCH ASSEMBLIES, Assembly: Left Side Handlebar Switches |
| Handlebar switch housing screws | 35-45 **in-lbs** | 4.0-5.0 Nm | 8.39 HANDLEBAR SWITCH ASSEMBLIES, Installation |
| Handlebar switch housing screws | 35-45 **in-lbs** | 4.0-5.0 Nm | 8.39 HANDLEBAR SWITCH ASSEMBLIES, Installation |
| Handlebar upper clamp screws | 16-20 ft-lbs | 21.7-27.1 Nm | 2.24 HANDLEBARS, Adjustment |
| Handlebar upper clamp screws | 16-20 ft-lbs | 21.7-27.1 Nm | 2.24 HANDLEBARS, Installation |
| Handlebar upper clamp screws | 16-20 ft-lbs | 21.7-27.1 Nm | 2.24 HANDLEBARS, Installation |
| Harness ground ring terminal flange nuts | 50-90 **in-lbs** | 5.7-10.2 Nm | 8.33 WIRE TROUGH, Installation / metric (10 mm) |
| Harness ground ring terminal flange nuts | 50-90 **in-lbs** | 5.7-10.2 Nm | 8.33 WIRE TROUGH, Installation / metric (10 mm) |
| Harness ground stud flange nuts | 50-90 **in-lbs** | 5.7-10.2 Nm | 8.34 MAIN WIRING HARNESS, Installation: All Models (Part 1) / (10 mm) |
| Harness ground stud flange nuts | 50-90 **in-lbs** | 5.7-10.2 Nm | 8.34 MAIN WIRING HARNESS, Installation: All Models (Part 1) / (10 mm) |
| Headlamp door screw | 9-18 **in-lbs** | 1.0-2.0 Nm | 2.46 FRONT FENDER, Installation |
| Headlamp door screw | 9-18 **in-lbs** | 1.0-2.0 Nm | 8.9 HEADLAMP: ALL EXCEPT FLTR, Headlamp Assembly |
| Headlamp housing Phillips screws | 9-18 **in-lbs** | 1.0-2.0 Nm | 2.45 HEADLAMP NACELLE: FLHR/C, Installation |
| Headlamp housing Phillips screws | 9-18 **in-lbs** | 1.0-2.0 Nm | 2.45 HEADLAMP NACELLE: FLHR/C, Installation |
| Headlamp housing screws (FLHR/C/S) | 9-18 **in-lbs** | 1.0-2.0 Nm | 2.46 FRONT FENDER, Installation |
| Headlamp housing screws (FLHR/C) | 9-18 **in-lbs** | 1.0-2.0 Nm | 8.9 HEADLAMP: ALL EXCEPT FLTR, Headlamp Assembly |
| Headlamp nacelle handlebar chrome strip flange nut | 15-20 **in-lbs** | 1.7-2.3 Nm | 2.45 HEADLAMP NACELLE: FLHR/C, Installation |
| Headlamp nacelle handlebar clamp shroud Phillips screws | 10-20 **in-lbs** | 1.1-2.3 Nm | 2.45 HEADLAMP NACELLE: FLHR/C, Installation |
| Headlamp nacelle handlebar clamp shroud Phillips screws | 10-20 **in-lbs** | 1.1-2.3 Nm | 2.45 HEADLAMP NACELLE: FLHR/C, Installation |
| Headlamp nacelle to fork bracket stud acorn nuts | 72-108 **in-lbs** | 8.1-12.2 Nm | 2.45 HEADLAMP NACELLE: FLHR/C, Installation |
| Headlamp retaining ring screws (FLXH, FLHT/C/U) | 23-28 **in-lbs** | 2.6-3.2 Nm | 8.9 HEADLAMP: ALL EXCEPT FLTR, Headlamp Assembly |
| Horn bracket acorn nut | 80-120 **in-lbs** | 9.0-13.6 Nm | 8.26 HORN, Installation |
| Horn bracket acorn nut to rubber mount stud | 80-120 **in-lbs** | 9.0-13.6 Nm | 8.33 WIRE TROUGH, Installation |
| Horn bracket to cylinder head screws | 35-40 ft-lbs | 48-54 Nm | 4.12 INDUCTION MODULE, Installation / metric |
| Horn bracket to cylinder head screws | 35-40 ft-lbs | 48-54 Nm | 8.34 MAIN WIRING HARNESS, Installation: All Models (Part 1) |
| Horn stud flange nut | 80-100 **in-lbs** | 9.0-11.3 Nm | 8.26 HORN, Installation |
| Ignition coil bracket screws | 84-144 **in-lbs** | 9.5-16.3 Nm | 8.4 IGNITION COIL, Installation |
| Ignition switch housing nut | 125-150 **in-lbs** | 14.1-16.9 Nm | 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHX, FLHT/C/U, FLTR |
| Ignition switch housing screws | 36-60 **in-lbs** | 4.1-6.8 Nm | 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHX, FLHT/C/U, FLTR |

| FASTENER | TORQUE VALUE | | NOTES |
|---|---|---|---|
| Ignition switch screws (FLHR/C) | 20-30 **in-lbs** | 2.3-3.4 Nm | 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHR/C |
| Instrument bezel screws | 25-35 **in-lbs** | 2.8-4.0 Nm | 8.19 INSTRUMENT NACELLE SWITCHES: FLTR, Installation |
| Instrument bezel screws (FLTR) | 25-35 **in-lbs** | 2.8-4.0 Nm | 2.40 INSTRUMENT BEZEL: FLTR, Bezel |
| Instrument console screws | 36-60 **in-lbs** | 4.1-6.8 Nm | 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHR/C |
| Instrument console screws | 36-60 **in-lbs** | 4.1-6.8 Nm | 8.30 GAUGES AND INSTRUMENTS: FLHR/C, Speedometer |
| Instrument console screws | 36-60 **in-lbs** | 4.1-6.8 Nm | 8.31 INDICATOR LAMPS: FLHR/C, Indicator Lights |
| Instrument nacelle to fork bracket screws | 15-20 ft-lbs | 20-27 Nm | 8.19 INSTRUMENT NACELLE SWITCHES: FLTR, Installation |
| Instrument nacelle to fork bracket screws | 15-20 ft-lbs | 20-27 Nm | 8.19 INSTRUMENT NACELLE SWITCHES: FLTR, Installation |
| Instrument nacelle to fork bracket screws (FLTR) | 15-20 ft-lbs | 20-27 Nm | 2.41 INSTRUMENT NACELLE: FLTR, Instrument Nacelle |
| Instrument nacelle to fork bracket screws (FLTR) | 15-20 ft-lbs | 20-27 Nm | 2.41 INSTRUMENT NACELLE: FLTR, Instrument Nacelle |
| Isolator bowl hex screws | 55-65 ft-lbs | 74.6-88.1 Nm | 2.5 REAR WHEEL COMPENSATOR, Isolator Replacement / Always use new screws |
| Jiffy stand bracket hex screws | 15-20 ft-lbs | 20.3-27.1 Nm | 2.49 FOOTBOARDS AND FOOTRESTS, Rider Footboards |
| Jiffy stand bracket hex screws | 15-20 ft-lbs | 20.3-27.1 Nm | 2.50 JIFFY STAND, Jiffy Stand Bracket |
| Jiffy stand bracket hex screws | 15-20 ft-lbs | 20.3-27.1 Nm | 2.50 JIFFY STAND, Jiffy Stand Bracket |
| Jiffy stand interlock sensor screw | 96-120 **in-lbs** | 10.8-13.6 Nm | 2.50 JIFFY STAND, Jiffy Stand Interlock Sensor / Use Loctite Medium Strength Threadlocker 243 (blue) if reusing screw |
| Jiffy stand leg stop hex screw | 15-20 ft-lbs | 20.3-27.1 Nm | 2.50 JIFFY STAND, Installation |
| Keps nut | 12-15 ft-lbs | 16.3-20.3 Nm | 5.2 STARTER, Installation |
| License plate bracket to luggage rack screws | 15-20 ft-lbs | 20-27 Nm | 2.47 REAR FENDER, Installation |
| Lifter cover screws | 90-120 **in-lbs** | 10.2-13.6 Nm | 3.16 TOP END OVERHAUL: ASSEMBLY, Push Rods, Lifters and Covers |
| Long post jam nut | 65-80 **in-lbs** | 7.3-9.0 Nm | 5.3 STARTER SOLENOID, Solenoid Contacts |
| Lower fork bracket pinch bolt | 30-35 ft-lbs | 41-48 Nm | 2.17 FRONT FORK, Installation |
| Lower fork bracket pinch bolts | 30-35 ft-lbs | 41-48 Nm | 1.19 STEERING HEAD BEARINGS, Adjustment |
| Lower fork bracket T40 TORX screw | 120-180 **in-lbs** | 13.6-20.3 Nm | C.3 ABS BRAKE LINES, ABS Module to Front Brake Calipers |
| Lower frame crossmember stud locknut | 70-100 **in-lbs** | 7.9-11.3 Nm | 8.34 MAIN WIRING HARNESS, Installation: All Models (Part 1) |
| Mainshaft/countershaft nuts | 45-55 ft-lbs | 61.0-74.6 Nm | 7.5 TRANSMISSION ASSEMBLY, Assembly |
| Master cylinder reservoir cover | 7-10 **in-lbs** | 0.8-1.1 Nm | 1.2 MAINTENANCE SCHEDULE, General |
| Master cylinder reservoir cover | 12-15 **in-lbs** | 1.4-1.7 Nm | 1.2 MAINTENANCE SCHEDULE, General |
| Master cylinder reservoir handlebar clamp screws | 72-80 **in-lbs** | 8-9 Nm | 2.12 FRONT BRAKE MASTER CYL-INDER, Assembly and Installation |

| FASTENER | TORQUE VALUE | | NOTES |
|---|---|---|---|
| Master cylinder to frame weldment screws | 10.5-12.5 ft-lbs | 14-17 Nm | C.3 ABS BRAKE LINES, Rear Master Cylinder to ABS Module |
| Mirror flange nut (FLHX) | 30-40 **in-lbs** | 3.4-4.5 Nm | 2.25 MIRRORS, FLHX / metric |
| Mirror stem acorn nut | 60-96 **in-lbs** | 6.8-10.8 Nm | 2.25 MIRRORS, All Models Except FLHX / metric |
| Neutral switch | 120-180 **in-lbs** | 13.6-20.3 Nm | 7.7 TRANSMISSION CASE, Installation |
| Neutral switch | 120-180 **in-lbs** | 13.6-20.3 Nm | 8.23 NEUTRAL SWITCH, Installation |
| O2 sensor | 30-44 ft-lbs | 40.7-59.7 Nm | 4.14 OXYGEN SENSORS (O2), Installation / metric |
| Oil pan screws | 84-132 **in-lbs** | 9.5-14.9 Nm | 3.29 OIL PAN, Installation |
| Oil pressure sender | 96-120 **in-lbs** | 11-14 Nm | 8.24 OIL PRESSURE SWITCH AND SENDER, Installation |
| Oil pressure switch | 96-120 **in-lbs** | 11-14 Nm | 8.24 OIL PRESSURE SWITCH AND SENDER, Installation |
| Oil pump screws, initial torque | 40-45 **in-lbs** | 4.5-5.1 Nm | 3.18 BOTTOM END OVERHAUL: ASSEMBLY, Cover and Cam Support Plate |
| Outer fairing long screws (FLTR) | 10-15 **in-lbs** | 1.1-1.7 Nm | 2.39 UPPER FAIRING AND WINDSHIELD: FLTR, Outer Fairing |
| Outer fairing screws (FLHX, FLHT/C/U) | 20-30 **in-lbs** | 2.3-3.4 Nm | 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U, Outer Fairing and Windshield |
| Outer fairing short screws (FLTR) | 6-12 **in-lbs** | 0.7-1.4 Nm | 2.39 UPPER FAIRING AND WINDSHIELD: FLTR, Outer Fairing |
| Passenger footboard/footrest socket screw | 30-35 ft-lbs | 40.7-47.5 Nm | 2.11 VEHICLE ALIGNMENT, Method A |
| Passenger footboard/footrest socket screw | 30-35 ft-lbs | 40.7-47.5 Nm | 2.11 VEHICLE ALIGNMENT, Method B |
| Passenger footboard/footrest socket screw | 30-35 ft-lbs | 40.7-47.5 Nm | 2.22 REAR FORK, Installation |
| Passenger footboard/footrest socket screw | 30-35 ft-lbs | 40.7-47.5 Nm | 2.49 FOOTBOARDS AND FOOTRESTS, Passenger Footboard |
| Passenger footboard/footrest socket screw | 30-35 ft-lbs | 40.7-47.5 Nm | 2.49 FOOTBOARDS AND FOOTRESTS, Passenger Footrest (FLHX) |
| Passenger footrest pad socket screw (FLHX) | 15-20 ft-lbs | 20-27 Nm | 2.49 FOOTBOARDS AND FOOTRESTS, Passenger Footrest (FLHX) / Use Loctite Medium Strength Threadlocker 243 (blue) |
| Piston jet screws | 25-35 **in-lbs** | 2.8-3.9 Nm | 3.27 CRANKCASE, Right Crankcase Half |
| Primary cam sprocket flange bolts, final torque | 34 ft-lbs | 46.1 Nm | 3.18 BOTTOM END OVERHAUL: ASSEMBLY, Cover and Cam Support Plate |
| Primary cam sprocket flange bolts, initial torque | 15 ft-lbs | 20.3 Nm | 3.18 BOTTOM END OVERHAUL: ASSEMBLY, Cover and Cam Support Plate |
| Primary cam sprocket flange bolts, initial torque | 15 ft-lbs | 20.3 Nm | 3.18 BOTTOM END OVERHAUL: ASSEMBLY, Cover and Cam Support Plate |
| Primary chaincase drain plug | 14-21 ft-lbs | 19.0-28.5 Nm | 1.2 MAINTENANCE SCHEDULE, General |
| Primary chaincase drain plug | 14-21 ft-lbs | 19.0-28.5 Nm | 1.9 PRIMARY CHAIN, Chaincase Lubricant: Touring Models |
| Primary cover fasteners | 108-120 **in-lbs** | 12.2-13.6 Nm | 6.2 PRIMARY CHAINCASE COVER, Installation |
| Radio (storage box) to support bracket screws | 35-45 **in-lbs** | 4.0-5.1 Nm | 8.32 ADVANCED AUDIO SYSTEM, Radio (Storage Box) |

| FASTENER | TORQUE VALUE | | NOTES |
|---|---|---|---|
| Radio bracket/inner fairing to fairing bracket stud locknuts (FLTR) | 96-144 **in-lbs** | 10.9-16.3 Nm | 2.42 INNER FAIRING: FLTR, Installation |
| Radio mounting screw | 35-45 **in-lbs** | 4.0-5.1 Nm | 8.34 MAIN WIRING HARNESS, Installation: FLHX, FLHT/C/U (Part 2) |
| Radio support bracket screws | 35-45 **in-lbs** | 4.0-5.1 Nm | 8.17 IGNITION/LIGHT KEY SWITCH AND FORK LOCK, FLHX, FLHT/C/U, FLTR |
| Rail clamp screws | 30-50 **in-lbs** | 3.0-6.0 Nm | 2.28 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail |
| Rail mount to guard screws | 72-120 **in-lbs** | 8.0-14.0 Nm | 2.28 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail |
| Rail to saddlebag support screws | 15-20 ft-lbs | 20.0-27.0 Nm | 2.28 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail |
| Rail to saddlebag support screws | 15-20 ft-lbs | 20.0-27.0 Nm | 2.28 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail |
| Rail to saddlebag support screws | 15-20 ft-lbs | 20.0-27.0 Nm | 2.28 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail |
| Rear axle cone nut | 95-105 ft-lbs | 128.8-142.4 Nm | 2.11 VEHICLE ALIGNMENT, Method A |
| Rear axle cone nut | 95-105 ft-lbs | 128.8-142.4 Nm | 2.11 VEHICLE ALIGNMENT, Method B |
| Rear axle cone nut | 15-20 ft-lbs | 20-27 Nm | 1.13 REAR BELT DEFLECTION, Setting Belt Deflection / For belt adjustment only |
| Rear axle cone nut | 95-105 ft-lbs | 128.8-142.4 Nm | 1.13 REAR BELT DEFLECTION, Setting Belt Deflection / Loosen 360° and retighten |
| Rear axle cone nut | 15-20 ft-lbs | 20-27 Nm | 1.13 REAR BELT DEFLECTION, Setting Belt Deflection / For belt adjustment only |
| Rear axle cone nut (final) | 95-105 ft-lbs | 128.8-142.4 Nm | 2.4 REAR WHEEL, Installation / metric |
| Rear axle cone nut (preliminary) | 15-20 ft-lbs | 20-27 Nm | 2.4 REAR WHEEL, Installation / metric |
| Rear axle cone nut (preliminary) | 15-20 ft-lbs | 20-27 Nm | 2.4 REAR WHEEL, Installation / metric |
| Rear bracket hex screws | 15-20 ft-lbs | 20-27 Nm | 2.49 FOOTBOARDS AND FOOTRESTS, Rider Footboards |
| Rear brake light switch | 12-15 ft-lbs | 16.3-20.3 Nm | C.3 ABS BRAKE LINES, Rear Master Cylinder to ABS Module / Use Loctite Pipe Sealant with Teflon 565 |
| Rear cylinder head exhaust flange nut | 9-18 **in-lbs** | 1-2 Nm | 4.18 EXHAUST SYSTEM, Installation |
| Rear cylinder head exhaust flange nut, final | 100-120 **in-lbs** | 11.3-13.6 Nm | 4.18 EXHAUST SYSTEM, Assembly |
| Rear cylinder head exhaust flange nut, initial | 9-18 **in-lbs** | 1-2 Nm | 4.18 EXHAUST SYSTEM, Assembly |
| Rear cylinder head exhaust flange nut, top | 100-120 **in-lbs** | 11.3-13.6 Nm | 4.18 EXHAUST SYSTEM, Assembly |
| Rear facia flange nuts to new stud plate (FLHX) | 80 **in-lbs** | 9.0 Nm | 2.48 REAR FACIA: FLHX, Stud Plate / See next entry if reusing stud plate |
| Rear facia flange nuts to used stud plate (FLHX) | 30-45 **in-lbs** | 3.4-5.1 Nm | 2.48 REAR FACIA: FLHX, Installation |
| Rear facia lamp T20 TORX screws (FLHX) | 18-22 **in-lbs** | 2.0-2.5 Nm | 2.48 REAR FACIA: FLHX, Installation |
| Rear fender bumper weld stud flange nut | 45-85 **in-lbs** | 5.1-9.6 Nm | 2.47 REAR FENDER, Installation |
| Rear fender lights harness stud plate flange nuts | 60-96 **in-lbs** | 6.8-10.9 Nm | 8.12 TAIL LAMP, Rear Fender Lights Harness |

| FASTENER | TORQUE VALUE | | NOTES |
|---|---|---|---|
| Rear fender mounting screws | 15-20 ft-lbs | 20-27 Nm | 2.47 REAR FENDER, Installation |
| Rear master cylinder reservoir cover screws | 12-15 **in-lbs** | 1.4-1.7 Nm | 1.6 BRAKES, Fluid Inspection |
| Rear master cylinder reservoir cover screws | 12-15 **in-lbs** | 1.4-1.7 Nm | 1.14 BLEEDING BRAKES, Procedure |
| Rear master cylinder reservoir cover screws | 12-15 **in-lbs** | 1.4-1.7 Nm | 1.15 BRAKE PADS AND DISCS, Brake Pad Replacement |
| Rear master cylinder to frame weldment screws | 10.5-12.5 ft-lbs | 14-17 Nm | 2.14 REAR BRAKE MASTER CYL-INDER, Assembly and Installation |
| Rear master cylinder to frame weldment screws | 10.5-12.5 ft-lbs | 14-17 Nm | 2.14 REAR BRAKE MASTER CYLINDER, Rear Brake Line |
| Rear stoplight switch | 12-15 ft-lbs | 16.3-20.3 Nm | 8.25 STOPLIGHT SWITCHES, Rear Stoplight Switch / Use Loctite Pipe Sealant with Teflon 565 |
| Rear swingarm bracket bolts | 34-42 ft-lbs | 46-57 Nm | 2.11 VEHICLE ALIGNMENT, Method A |
| Rear swingarm bracket bolts | 34-42 ft-lbs | 46-57 Nm | 2.11 VEHICLE ALIGNMENT, Method B |
| Rear swingarm bracket bolts | 34-42 ft-lbs | 46-57 Nm | 2.22 REAR FORK, Installation |
| Rear swingarm pivot shaft locknuts | 40-45 ft-lbs | 54-61 Nm | 2.11 VEHICLE ALIGNMENT, Method A |
| Rear swingarm pivot shaft locknuts | 40-45 ft-lbs | 54-61 Nm | 2.11 VEHICLE ALIGNMENT, Method A |
| Rear swingarm pivot shaft locknuts | 40-45 ft-lbs | 54-61 Nm | 2.11 VEHICLE ALIGNMENT, Method B |
| Rear swingarm pivot shaft locknuts | 40-45 ft-lbs | 54-61 Nm | 2.11 VEHICLE ALIGNMENT, Method B |
| Rear swingarm pivot shaft locknuts | 40-45 ft-lbs | 54-61 Nm | 2.22 REAR FORK, Disassembly and Assembly |
| Rear swingarm pivot shaft locknuts | 40-45 ft-lbs | 54-61 Nm | 2.22 REAR FORK, Installation |
| Rear swingarm pivot shaft locknuts | 40-45 ft-lbs | 54-61 Nm | 2.22 REAR FORK, Installation |
| Rear turn signal lamps bracket screws | 84-144 **in-lbs** | 9.5-16.3 Nm | 8.14 TURN SIGNAL LAMPS, Rear Turn Signal Lamps Bracket / Use LOCTITE High Strength Threadlocker 271 (red) |
| Rear turn signal lamps bracket screws | 84-144 **in-lbs** | 9.5-16.3 Nm | 8.14 TURN SIGNAL LAMPS, Rear Turn Signal Lamps Bracket / Use LOCTITE High Strength Threadlocker 271 (red) |
| Rear turn signal lamps bracket screws | 84-144 **in-lbs** | 9.5-16.3 Nm | 8.15 LICENSE PLATE LAMPS AND BRACKET: FLHX, License Plate Bracket / Use LOCTITE High Strength Threadlocker 271 (red) |
| Rear turn signal lamp to rear turn signal lamps bracket screws | 30-50 **in-lbs** | 3.4-5.6 Nm | 8.14 TURN SIGNAL LAMPS, Rear Turn Signal Lamp |
| Rider footboard bracket socket screws | 30-35 ft-lbs | 41-48 Nm | 2.49 FOOTBOARDS AND FOOTRESTS, Rider Footboards |
| Rider footboard bracket socket screws | 30-35 ft-lbs | 41-48 Nm | 2.49 FOOTBOARDS AND FOOTRESTS, Rider Footboards |
| Rider footboard bracket socket screws | 30-35 ft-lbs | 41-48 Nm | 4.18 EXHAUST SYSTEM, Installation |
| Rider footboard bracket socket screws | 30-35 ft-lbs | 41-48 Nm | 4.18 EXHAUST SYSTEM, Assembly |
| Rider footboard pivot bolt nut | 60-80 **in-lbs** | 6.8-9.0 Nm | 2.49 FOOTBOARDS AND FOOTRESTS, Rider Footboards |
| Rocker arm support plate bolts | 18-22 ft-lbs | 24.4-29.8 Nm | 3.16 TOP END OVERHAUL: ASSEMBLY, Rocker Arm Support Plate |
| Rocker cover bolts | 15-18 ft-lbs | 20.3-24.4 Nm | 3.16 TOP END OVERHAUL: ASSEMBLY, Breather Assembly |

| FASTENER | TORQUE VALUE | | NOTES |
|---|---|---|---|
| Rocker housing bolts | 120-168 **in-lbs** | 13.6-19.0 Nm | 3.16 TOP END OVERHAUL: ASSEMBLY, Cylinder Head |
| Saddlebag latch/check strap T15 TORX screws | 20-25 **in-lbs** | 2.3-2.8 Nm | 2.28 SADDLEBAG SERVICE, Saddlebag Hardware |
| Saddlebag latch/check strap T15 TORX screws | 20-25 **in-lbs** | 2.3-2.8 Nm | 2.28 SADDLEBAG SERVICE, Saddlebag Hardware |
| Saddlebag lid check strap T20 TORX screws | 18-20 **in-lbs** | 2.0-2.3 Nm | 2.28 SADDLEBAG SERVICE, Saddlebag Hardware |
| Saddlebag mounting bracket screw | 60-96 **in-lbs** | 6.8-10.8 Nm | 2.26 SEAT, Seat: FLHR/C, FLHX, FLTR |
| Saddlebag mounting bracket screw | 60-96 **in-lbs** | 7.0-11.0 Nm | 2.28 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail |
| Saddlebag mounting bracket screw | 60-96 **in-lbs** | 6.8-10.8 Nm | 8.36 RADIO ANTENNA CABLE, FLHX, FLTR |
| Saddlebag mounting bracket to saddlebag support screws | 60-96 **in-lbs** | 7-11 Nm | 2.27 SADDLEBAGS, Installation |
| Saddlebag mounting bracket to saddlebag support screws | 60-96 **in-lbs** | 6.8-10.8 Nm | 2.48 REAR FACIA: FLHX, Rear Facia Lamp |
| Saddlebag rail to saddlebag support bracket/frame screws | 15-20 ft-lbs | 20-27 Nm | 2.4 REAR WHEEL, Installation / metric |
| Saddlebag support to fender screws | 15-20 ft-lbs | 20.0-27.0 Nm | 2.28 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail |
| Sealing fasteners | 25-27 ft-lbs | 33.9-36.6 Nm | 6.4 PRIMARY CHAINCASE HOUSING, Installation |
| Seat mounting screw | 20-40 **in-lbs** | 2.3-4.5 Nm | 2.26 SEAT, Seat: FLHT |
| Seat mounting screw | 20-40 **in-lbs** | 2.3-4.5 Nm | 2.26 SEAT, Seat: FLHTC/U |
| Seat mounting screw | 20-40 **in-lbs** | 2.3-4.5 Nm | 2.26 SEAT, Seat: FLHR/C, FLHX, FLTR |
| Seat strap screw | 48-72 **in-lbs** | 5.4-8.1 Nm | 2.26 SEAT, Seat: FLHT |
| Seat strap screw | 48-72 **in-lbs** | 5.4-8.1 Nm | 2.26 SEAT, Seat: FLHTC/U |
| Secondary cam chain tensioner fastener | 100-120 **in-lbs** | 11.3-13.6 Nm | 3.25 COVER AND CAM SUPPORT PLATE, Camshafts |
| Shift drum detent arm fastener | 120-150 **in-lbs** | 13.6-17.0 Nm | 7.5 TRANSMISSION ASSEMBLY, Assembly |
| Shift drum lock plate fasteners | 57-63 **in-lbs** | 6.4-7.1 Nm | 7.5 TRANSMISSION ASSEMBLY, Assembly |
| Shifter rod lever screw | 18-22 ft-lbs | 24.4-29.8 Nm | 7.7 TRANSMISSION CASE, Assembly |
| Shifter rod locknut | 80-120 **in-lbs** | 9.0-13.6 Nm | 7.3 SHIFTER LINKAGE, Shifter Rod |
| Shift lever fasteners | 18-22 ft-lbs | 24-30 Nm | 6.2 PRIMARY CHAINCASE COVER, Installation |
| Shift lever shaft fastener | 90-110 **in-lbs** | 10.2-12.4 | 6.2 PRIMARY CHAINCASE COVER, Installation |
| Shock bottom mounting bolt | 35-40 ft-lbs | 47-54 Nm | 2.21 REAR SHOCK ABSORBERS, Installation / Use LOCTITE MEDIUM STRENGTH THREADLOCKER 243 (blue) |
| Shock bottom mounting bolt | 35-40 ft-lbs | 47-54 Nm | 2.22 REAR FORK, Installation / Apply two or three drops of Loctite Medium Strength Threadlocker 243 (blue) to threads |
| Shock top mounting bolt | 33-35 ft-lbs | 45-48 Nm | 2.21 REAR SHOCK ABSORBERS, Installation / Use LOCTITE MEDIUM STRENGTH THREADLOCKER 243 (blue) |
| Side door fasteners | 13-18 ft-lbs | 17.6-24.4 Nm | 7.5 TRANSMISSION ASSEMBLY, Installation |
| Solenoid ring terminal nut | 70-90 **in-lbs** | 7.9-10.2 Nm | 5.2 STARTER, Field Coil Assembly |
| Spark plug | 12-18 ft-lbs | 16.3-24.4 Nm | 1.18 SPARK PLUGS, Inspection |
| Spark plugs | 12-18 ft-lbs | 16.3-24.4 Nm | 1.2 MAINTENANCE SCHEDULE, General |

| FASTENER | TORQUE VALUE | | NOTES |
|---|---|---|---|
| Speedometer/tachometer bracket screws | 10-20 **in-lbs** | 1.1-2.3 Nm | 2.37 INNER FAIRING: FLHX, FLHT/C/U, Installation |
| Speedometer bracket screws | 10-20 **in-lbs** | 1.1-2.3 Nm | 8.28 GAUGES AND INSTRUMENTS: FLHX, FLHT/C/U, FLTR, Speedometer |
| Spoke nipple | 55 **in-lbs** | 6.2 Nm | 1.8 TIRES AND WHEELS, Wheel Spokes |
| Spoke nipple | 55 **in-lbs** | 6.2 Nm | 2.7 WHEEL LACING: 16 INCH RIM, Procedure |
| Spoke nipple | 55 **in-lbs** | 6.2 Nm | 2.9 TRUING LACED WHEELS, Radial Truing |
| Spoke nipples | 55 **in-lbs** | 6.2 Nm | 1.2 MAINTENANCE SCHEDULE, General |
| Stabilizer link to frame weldment bolt | 18-22 ft-lbs | 24-30 Nm | 2.11 VEHICLE ALIGNMENT, Method A |
| Stabilizer link to frame weldment bolt | 18-22 ft-lbs | 24-30 Nm | 2.11 VEHICLE ALIGNMENT, Method B |
| Stabilizer link to frame weldment bolt | 18-22 ft-lbs | 24-30 Nm | 2.11 VEHICLE ALIGNMENT, Method B |
| Stabilizer link to front engine mounting bracket bolt | 18-22 ft-lbs | 24-30 Nm | 2.11 VEHICLE ALIGNMENT, Method A |
| Stabilizer link to front engine mounting bracket bolt | 18-22 ft-lbs | 24-30 Nm | 2.11 VEHICLE ALIGNMENT, Method B |
| Stabilizer link to top engine mounting bracket bolt | 18-22 ft-lbs | 24-30 Nm | 2.11 VEHICLE ALIGNMENT, Method A |
| Stabilizer link to top engine mounting bracket bolt | 18-22 ft-lbs | 24-30 Nm | 2.11 VEHICLE ALIGNMENT, Method B |
| Stabilizer link to top engine mounting bracket bolt | 18-22 ft-lbs | 24-30 Nm | 2.11 VEHICLE ALIGNMENT, Method B |
| Starter end cover screw | 90-110 **in-lbs** | 10.2-12.4 Nm | 5.2 STARTER, Field Coil Assembly |
| Starter mounting screw | 25-27 ft-lbs | 33.9-36.6 Nm | 5.2 STARTER, Installation |
| Starter terminal post nut | 70-90 **in-lbs** | 7.9-10.2 Nm | 5.2 STARTER, Installation |
| Starter thru bolts | 39-65 **in-lbs** | 4.4-7.3 Nm | 5.2 STARTER, Field Coil Assembly |
| Stator mounting screws | 55-75 **in-lbs** | 6.2-8.5 Nm | 8.21 ALTERNATOR, Installation / Always use new screws |
| Support rail to frame screws | 15-20 ft-lbs | 20.0-27.0 Nm | 2.28 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail |
| Support rail to guard screw | 70-100 **in-lbs** | 8.0-11.0 Nm | 2.28 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail |
| Support rail to guard screw | 70-100 **in-lbs** | 8.0-11.0 Nm | 2.28 SADDLEBAG SERVICE, Saddlebag Guard/Support Rail |
| Tachometer bracket screws | 10-20 **in-lbs** | 1.1-2.3 Nm | 8.28 GAUGES AND INSTRUMENTS: FLHX, FLHT/C/U, FLTR, Tachometer |
| Tail lamp circuit board/chrome base screw | 40-48 **in-lbs** | 4.5-5.4 Nm | 8.12 TAIL LAMP, Circuit Board/Chrome Base |
| Tail lamp screws | 20-24 **in-lbs** | 2.3-2.7 Nm | 8.12 TAIL LAMP, Tail Lamp/Tail Lamp Bulb |
| Tail lamp screws | 20-24 **in-lbs** | 2.3-2.7 Nm | 8.12 TAIL LAMP, Circuit Board/Chrome Base |
| Tail lamp screws | 20-24 **in-lbs** | 2.3-2.7 Nm | 8.12 TAIL LAMP, Rear Fender Lights Harness |
| Tail lamp screws | 20-24 **in-lbs** | 2.3-2.7 Nm | 8.13 FENDER TIP LAMPS, Rear Fender Tip Lamp |
| Tail lamp screws | 20-24 **in-lbs** | 2.3-2.7 Nm | 8.14 TURN SIGNAL LAMPS, Rear Turn Signal Lamp |
| T-MAP hex screw | 84-108 **in-lbs** | 9.5-12.2 Nm | 4.13 MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP), Installation / metric |
| Top/front stabilizer link eyelet | 18-22 ft-lbs | 24-30 Nm | 1.23 ENGINE MOUNTS, Inspection |

| FASTENER | TORQUE VALUE | | NOTES |
|---|---|---|---|
| Top/front stabilizer link eyelet | 18-22 ft-lbs | 24-30 Nm | 1.23 ENGINE MOUNTS, Inspection |
| Top/front stabilizer link eyelet | 18-22 ft-lbs | 24-30 Nm | 1.23 ENGINE MOUNTS, Inspection |
| Top/front stabilizer link eyelet | 18-22 ft-lbs | 24-30 Nm | 1.23 ENGINE MOUNTS, Inspection |
| Top caddy clamp screw | 15-20 ft-lbs | 20-27 Nm | 1.2 MAINTENANCE SCHEDULE, General |
| Top caddy clamp screw | 15-20 ft-lbs | 20-27 Nm | 1.16 BATTERY MAINTENANCE, Battery: Touring Models |
| Top caddy clamp screw | 15-20 ft-lbs | 20-27 Nm | 8.6 ELECTRICAL CADDIES, Top Caddy |
| Top engine mounting bracket stabilizer link to frame weldment bolt | 18-22 ft-lbs | 24-30 Nm | 3.12 ASSEMBLING MOTORCYCLE AFTER SERVICE, Procedure |
| Top engine mounting bracket stabilizer link to frame weldment bolt | 18-22 ft-lbs | 24-30 Nm | 3.14 INSTALLING ENGINE IN CHASSIS, Procedure |
| Top engine mounting bracket to front cylinder head bolts | 35-40 ft-lbs | 48-54 Nm | 2.11 VEHICLE ALIGNMENT, Method A |
| Top engine mounting bracket to front cylinder head bolts | 35-40 ft-lbs | 48-54 Nm | 2.11 VEHICLE ALIGNMENT, Method B |
| Top engine mounting bracket to front cylinder head bolts | 30-35 ft-lbs | 41-48 Nm | 3.12 ASSEMBLING MOTORCYCLE AFTER SERVICE, Procedure |
| Top engine mounting bracket to front cylinder head bolts | 30-35 ft-lbs | 41-48 Nm | 3.14 INSTALLING ENGINE IN CHASSIS, Procedure |
| Tour-Pak lockset hex nut | 25-35 **in-lbs** | 2.8-4.0 Nm | 2.30 TOUR-PAK SERVICE, Lockset |
| Tour-Pak lockset hex nut | 25-35 **in-lbs** | 2.8-4.0 Nm | 2.33 TOUR-PAK SPEAKER BOX: FLHTCU, Speaker Box (FLHTCU) |
| Tour-Pak lockset jam nut | 30-45 **in-lbs** | 3.4-5.1 Nm | 2.30 TOUR-PAK SERVICE, Lockset |
| Tour-Pak metal plate flange nuts | 65-70 **in-lbs** | 7.3-7.9 Nm | 2.31 TOUR-PAK LIGHTS, Tour-Pak Lights Harness |
| Tour-Pak mounting bolts | 96-108 **in-lbs** | 10.8-12.2 Nm | 2.29 TOUR-PAK, FLHTC |
| Tour-Pak mounting bolts | 96-108 **in-lbs** | 10.8-12.2 Nm | 2.29 TOUR-PAK, FLHTCU |
| Tour-Pak mounting bolts | 96-108 **in-lbs** | 10.8-12.2 Nm | 2.29 TOUR-PAK, Adjustment |
| Tour-Pak passenger backrest flange nuts | 40-60 **in-lbs** | 4.5-6.8 Nm | 2.30 TOUR-PAK SERVICE, Tether Brackets |
| Tour-Pak passenger backrest flange nuts | 40-60 **in-lbs** | 4.5-6.8 Nm | 2.32 TOUR-PAK BACKREST, Passenger Backrest |
| Tour-Pak passenger backrest flap T25 TORX screws | 21-24 **in-lbs** | 2.4-2.7 Nm | 2.32 TOUR-PAK BACKREST, Passenger Backrest Flap (FLHTCU) |
| Tour-Pak side marker lights T15 TORX screws | 20-25 **in-lbs** | 2.3-2.8 Nm | 2.31 TOUR-PAK LIGHTS, Side Marker Lights (FLHTCU) |
| Tour-Pak tether T15 TORX screw | 20-25 **in-lbs** | 2.3-2.8 Nm | 2.30 TOUR-PAK SERVICE, Hinges / Use Loctite High Strength Threadlocker 262 (red) |
| Tour-Pak tether T15 TORX screw | 20-25 **in-lbs** | 2.3-2.8 Nm | 2.30 TOUR-PAK SERVICE, Latches/Lockset Catch / Use Loctite Medium Strength Threadlocker 243 (blue) |
| Tour-Pak tether T15 TORX screw | 20-25 **in-lbs** | 2.3-2.8 Nm | 2.30 TOUR-PAK SERVICE, Latches/Lockset Catch / Use Loctite Medium Strength Threadlocker 243 (blue) |
| Tour-Pak tether T15 TORX screw | 20-25 **in-lbs** | 2.3-2.8 Nm | 2.30 TOUR-PAK SERVICE, Tether / Use Loctite High Strength Threadlocker 262 (red) |
| Transmission drain plug | 14-21 ft-lbs | 19.0-28.5 Nm | 1.2 MAINTENANCE SCHEDULE, General |
| Transmission drain plug | 14-21 ft-lbs | 19.0-28.5 Nm | 1.10 TRANSMISSION LUBRICANT, Transmission Lubrication: Touring Models |

| FASTENER | TORQUE VALUE | | NOTES |
|---|---|---|---|
| Transmission drain plug | 14-21 ft-lbs | 19.0-28.5 Nm | 7.5 TRANSMISSION ASSEMBLY, Installation |
| Transmission drain plug | 14-21 ft-lbs | 19.0-28.5 Nm | 7.7 TRANSMISSION CASE, Installation |
| Transmission drain plug w/o-ring | 14-21 ft-lbs | 19.0-28.5 Nm | 3.29 OIL PAN, Installation / Clean plug before installation |
| Transmission filler/check plug | 25-75 **in-lbs** | 2.8-8.5 Nm | 1.10 TRANSMISSION LUBRICANT, Transmission Lubrication: Touring Models |
| Transmission filler/check plug | 25-75 **in-lbs** | 2.8-8.5 Nm | 1.10 TRANSMISSION LUBRICANT, Transmission Lubrication: Touring Models |
| Transmission filler plug/dipstick | 25-75 **in-lbs** | 2.8-8.5 Nm | 1.2 MAINTENANCE SCHEDULE, General |
| Transmission lockplate screws | 84-108 **in-lbs** | 9.5-12.2 Nm | 6.6 TRANSMISSION SPROCKET, Installation / LOCTITE patch, use 3-5 times |
| Transmission lubricant drain plug | 14-21 ft-lbs | 19-28 Nm | 2.23 CLUTCH CABLE, Installation |
| Transmission lubricant filler plug/dipstick | 25-75 **in-lbs** | 2.8-8.5 Nm | 2.23 CLUTCH CABLE, Installation |
| Transmission mounting bolts, final torque | 30-35 ft-lbs | 40.7-47.5 Nm | 7.7 TRANSMISSION CASE, Installation |
| Transmission mounting bolts, initial torque | 15 ft-lbs | 20.3 Nm | 7.7 TRANSMISSION CASE, Installation |
| Transmission sprocket nut | 35 ft-lbs | 47.5 Nm | 6.6 TRANSMISSION SPROCKET, Installation / Right hand threads, initial torque only, apply several drops of LOCTITE THREADLOCKER 271 (red) to last few threads. |
| Transmission sprocket nut | 35 ft-lbs | 47.5 Nm | 6.6 TRANSMISSION SPROCKET, Installation |
| Transmission to crankcase bolts | 15 ft-lbs | 20.3 Nm | 3.14 INSTALLING ENGINE IN CHASSIS, Procedure |
| Transmission to crankcase bolts | 34-39 ft-lbs | 46.1-52.9 Nm | 3.14 INSTALLING ENGINE IN CHASSIS, Procedure |
| Transmission top cover | 84-132 **in-lbs** | 9.5-14.9 Nm | 7.5 TRANSMISSION ASSEMBLY, Installation |
| Turn signal lamp to auxiliary lamp bracket mount socket screws | 36-60 **in-lbs** | 4.1-6.8 Nm | 8.11 AUXILIARY LAMPS AND BRACKETS, Auxiliary Lamp Housing |
| Turn signal lamp to auxiliary lamp stud locknut | 15-18 ft-lbs | 20.3-24.4 Nm | 8.11 AUXILIARY LAMPS AND BRACKETS, Auxiliary Lamp Housing |
| Turn signal lamp to mounting bracket screws | 36-60 **in-lbs** | 4.1-6.8 Nm | 8.11 AUXILIARY LAMPS AND BRACKETS, Adjustment |
| Turn signal mounting bracket locknut | 18 ft-lbs | 24.4 Nm | 8.11 AUXILIARY LAMPS AND BRACKETS, Adjustment |
| Valve stem nut | 12-15 **in-lbs** | 1.4-1.7 Nm | 2.16 TIRES, Installation |
| Voltage regulator locknuts | 70-100 **in-lbs** | 7.9-11.3 Nm | 2.11 VEHICLE ALIGNMENT, Method A |
| Voltage regulator locknuts | 70-100 **in-lbs** | 7.9-11.3 Nm | 2.11 VEHICLE ALIGNMENT, Method B |
| Voltage regulator locknuts | 70-100 **in-lbs** | 7.9-11.3 Nm | 8.21 ALTERNATOR, Installation |
| Voltage regulator locknuts and studs | 70-100 **in-lbs** | 7.9-11.3 Nm | 8.2 VOLTAGE REGULATOR, Installation |
| VSS fastener | 84-132 **in-lbs** | 9.5-14.9 Nm | 7.7 TRANSMISSION CASE, Installation |
| VSS Screw | 84-132 **in-lbs** | 9.5-14.9 Nm | 8.22 VEHICLE SPEED SENSOR (VSS), VSS |
| Windshield screws (FLHX, FLHT/C/U) | 25-30 **in-lbs** | 2.8-3.4 Nm | 2.35 UPPER FAIRING AND WINDSHIELD: FLHX, FLHT/C/U, Outer Fairing and Windshield |
| Windshield wellnut screws (FLTR) | 6-13 **in-lbs** | 0.7-1.5 Nm | 2.39 UPPER FAIRING AND WINDSHIELD: FLTR, Windshield |
| Windshield window T27 TORX screws (Road King Models) | 20-25 **in-lbs** | 2.3-2.8 Nm | 2.44 WINDSHIELD: FLHR/C, Windshield Window |

| FASTENER | TORQUE VALUE | | NOTES |
|---|---|---|---|
| Work drive clamp screw | 20-40 **in-lbs** | 2.3-4.5 Nm | 5.2 STARTER, Installation |

# NOTES

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## F



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## V



## W

# INSIDE BACK COVER GOES HERE

# OUTSIDE BACK COVER GOES HERE