The Harley-Davidson Service Communications Department maintains a continuous effort to improve the quality and usefulness of its publications. To do this effectively, we need user feedback - your critical evaluation of this manual.

Please comment on the completeness, accuracy, organization, usability, and readability of this manual.

Please list the page, item, and part number(s) of any errors you find in this manual.

Please tell us how we can improve this manual.

Occupation:

Name: Dealership:

Street: Department:

City: State: Zip:

2015 Harley-Davidson Softail Models Service Manual (99482-15)
Please clip out and mail to:
Service Communications Department
Harley-Davidson Motor Company
P.O. Box 653
Milwaukee, WI USA 53201
GENERAL

WARNING

The rider's safety depends upon proper motorcycle service and maintenance. If a procedure in this manual is not within your capabilities or you do not have the correct tools, have a Harley-Davidson dealer perform the procedure. Improper service or maintenance could result in death or serious injury. (06628b)

This service manual has been prepared with the following purposes in mind:

- To acquaint the user with the construction of the Harley-Davidson product and assist in the performance of basic maintenance and repair.
- To introduce the professional Harley-Davidson technician to 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 MANUAL

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

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

For example, a cross-reference shown as 2.2 SPECIFICATIONS refers to chapter 2 CHASSIS, heading 2.2 SPECIFICATIONS.

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

A number of acronyms and abbreviations are used in this document. See the C.4 GLOSSARY for a list of acronyms, abbreviations and definitions.

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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. Start each job with a clean work area. This will allow the repair to proceed as smoothly as possible. It will also reduce the incidence of misplaced tools and parts.

Clean a motorcycle that is excessively dirty before work starts. Cleaning will occasionally uncover sources of trouble. Gather any tools, instruments and any parts needed for the job before work begins. Interrupting a job to locate tools or parts is a distraction and causes needless delay.

NOTES

- To avoid unnecessary disassembly, carefully read all related service information before repair work begins.
- 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), first disarm the system. Keep the fob close to the vehicle or use DIGITAL TECHNICIAN II (Part No. HD-48650) to disable the system. Activate the system after service is completed.

SERVICE BULLETINS

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

USE GENUINE REPLACEMENT PARTS

WARNING

Harley-Davidson parts and accessories are designed for Harley-Davidson motorcycles. Using non-Harley-Davidson parts or accessories can adversely affect performance, stability or handling, which could result in death or serious injury. (00001b)

To achieve 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.
WARNING AND CAUTIONS

Statements in this 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)

NOTICE

NOTICE indicates a potentially hazardous situation which, if not avoided, may result in property damage. (00140b)

NOTE

Refers to important information. It is recommended that you take special notice of these items.

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

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.

Special Tools

All tools mentioned in this manual with a part number beginning with "HD", "J" or "B" must be ordered through your local Harley-Davidson dealer. Special tools may only be purchased, serviced or warranted through a Harley-Davidson dealer.

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, contact Loctite Corp. at www.loctite.com.

PRODUCT REGISTERED MARKS

Apple, Alcantara S.p.A., Allen, Amp Multilock, Bluetooth, Brembo, Delphi, Deutsch, Dunlop, Dynojet, Fiiite, G.E. Fusetru, Garmin, Gunck, Hydrosheal, Hyloxm, iPhone, iPod, Kevlar, Lexan, Loctite, Lubriplate, Keps, K.N. Magnafloc, Marson Thread-Setter Tool Kit, MAXI fuse, Molex, Michelin, M2, Multilock, nano, NGK, Nuvos, Pacard, Pirelli, Permatex, Philips, PJ1, Pozidriv, Robinair, S100, Sema, SiriusXM, Snap-on, Teflon, Threadlocker, Torca, Torco, TORX, Tufo, Tyco, Ultrasound, Velcro, X-Acto, XM Satellite Radio, and zûmo are among the trademarks of their respective owners.

H-D U.S.A., LLC TRADEMARK INFORMATION


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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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1.3 FUEL AND OIL

1.4 BULB REQUIREMENTS

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## FASTENER TORQUE VALUES IN THIS CHAPTER

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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. (08010a)

Perform necessary set-up tasks before customer delivery. See applicable model year pre-delivery and set-up instructions.

The performance of new motorcycle initial service is required to keep warranty in force and to verify proper emissions systems operation. See 1.5 MAINTENANCE SCHEDULE.

SAFE OPERATING MAINTENANCE

NOTES

- Do not attempt to tighten engine headbolts or engine damage may result.
- During the initial break-in period, use only GENUINE HARLEY-DAVIDSON H-D 360 MOTORCYCLE OIL 20W50. Failure to use the recommended oil will result in improper break-in of the engine cylinders and piston rings.

Inspect motorcycle on a regular basis for additional maintenance needs. Routinely check components between regular maintenance intervals. Always inspect motorcycle after periods of storage before riding.

Check:
1. Tires for correct pressure, excessive wear or any signs of tire damage.
2. Drive belt tension and condition.
3. Brakes, steering and throttle for responsiveness.
5. Check brake pads and discs for wear.
6. Cables for fraying, crimping and free operation.
7. Engine oil and transmission fluid levels.
8. Headlamp, auxiliary fog lamp, tail lamp, stop lamp, horn and turn signal operation.

DISPOSAL AND RECYCLING

Help protect our environment! Many communities maintain facilities for recycling used fluids, plastics and metals. Dispose of or recycle used oil, lubricants, fuel, coolant, brake fluid and batteries in accordance with local regulations. Many Harley-Davidson parts and accessories are made of plastics and metals which can also be recycled.

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 parts catalog.

Safety

Safety is always the most important consideration when performing any job.

- Always have a complete understanding of the task.
- 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. If a hoist and adjustable lifting beam or sling are needed to remove some parts, verify that:

- The lengths of multiple chains or cables from the hoist to the part are equal and parallel.
- Slings, chains and cables are positioned directly over the center of the part.
- No obstructions will interfere with the lifting operation.
- Parts are not left suspended.

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. (034666)

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. Verify that no parts are in the way of the part being removed.

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

Cleaning

Always clean around lines or covers before they are removed. Plug, tape or cap holes and openings to keep out dirt, dust and debris. Clean and inspect all parts as they are removed. Verify all holes and passages are clean and open. After cleaning, cover all parts with clean lint-free cloth, paper or other material. Verify the part is clean when installed.

Thoroughly clean all parts to be reused before assembly. Clean parts promote better component operation and longer life. Seals, filters and covers used in this vehicle keep out...
extraneous dirt and dust. Keep these items in good condition to guarantee satisfactory operation.

When instructed to clean fastener threads or threaded holes, always:

- Clean all threadinglocking 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 PJ1 cleaner or equivalent to remove all traces of oil and contaminants from threads.
- Clean all threaded holes with low pressure compressed air.

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. Make all necessary adjustments. Inspect your work when finished to verify that everything is done.

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

Checking Torques on Fasteners

Check torque using a torque wrench set to the minimum specification for that fastener. If the fastener does not rotate, the torque has been maintained. If the fastener rotates, remove it to determine if it has a threadinglocking agent.

If it has a threadinglocking agent, clean all material from the threaded hole. Replace the fastener with a new one or clean the original fastener threads and apply the appropriate threadinglocking product. Install and tighten the fastener to specification.

If the fastener does not use a threadinglocking agent, install and tighten it to specification.

Magnetic Parts Trays

Magnetic parts trays are common in the service facility because they are convenient and can keep parts. Magnetic parts trays can become magnetized when held in magnetic parts trays.

Metal fragments from normal wear are usually trapped in the oil filter or by the magnetic drain plug. Magnets can retain these fragments, potentially causing accelerated engine wear and damage.

Never place parts from inside the vehicle's powertrain on a magnetic parts tray.

REPAIR AND REPLACEMENT PROCEDURES

Hardware and Threaded Parts

Install thread repair inserts when threaded holes 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 damaged. Clean up or repair minor thread damage with a suitable tap or die.

Replace all damaged or missing lubrication fittings.

Use LOCTITE 565 THREAD SEALANT on pipe fitting threads.

Threadlocking Agents

Always follow specific service manual procedures when working with fasteners containing presheathed threadlocking agents when fastener replacement is recommended. When reusing fasteners containing threadlocking agents, thoroughly clean all fasteners and threaded holes. Always use the recommended threadlocking agent for the specific procedure.

Wiring, Hoses and Lines

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

 Instruments and Gauges

Replace damaged or defective instruments and gauges.

Bearings

Always use the proper tools and fixtures when servicing 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.

When bearings are installed against shoulders, always verify that the chamfered side of the bearing 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.

Only remove bearings if necessary. Removal usually damages bearings requiring replacement with new parts.

Bushings

Do not remove a bushing unless damaged, excessively worn or close in its bore. Press out bushings requiring replacement.

When pressing or driving bushings, always 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.

Verify that all oil holes are properly aligned during installation.

Gaskets

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

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.

Do not remove seals unless necessary. Only remove seals 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

Always discard O-rings after removal. Many O-rings are similar in size and appearance. Always use new O-rings when replacing them packaged until use to avoid confusion. To prevent leaks, lubricate the O-rings before installation with 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 to remove.

Shafts fitted to tapered splines should be very tight. If shafts are not tight, disassemble and inspect tapered splines. Discard parts that are worn. Verify that 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

Harley-Davidson parts and accessories are designed for Harley-Davidson motorcycles. Using non-Harley-Davidson parts or accessories can adversely affect performance, stability or handling, which could result in death or serious injury. (00001b)

Always install new genuine Harley-Davidson parts and accessories. This will provide best service life and maintain compliance with noise and emissions regulations.

Installing non-Harley-Davidson, off-road or competition parts can void warranty or result in an unsafe vehicle.

CLEANING

Protecting Rubber Parts

Before cleaning, protect rubber parts (such as hoses, boots and electrical insulation) from cleaning solutions. Use a greaseproof 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.

Never use cleaners containing chlorine or ammonia on plastic parts. Chlorine will cause parts to become distorted and brittle resulting in cracks. Ammonia will cause cloudiness and brittleness in windshields and non-painted parts to form a white haze.

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

Wash bearings in a non-flammable petroleum cleaning solution. Never use a solution that contains chlorine. Knock out packed lubricant by tapping the bearing against a wooden block. Wash bearings again.

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

Cover bearings with a clean shop towel and allow to air dry. Do not spin bearings while they are drying. Never use compressed air to dry bearings.

When dry, coat bearings with clean oil. Wrap bearings in clean paper.

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 suddenly releases.
- Always keep the wrench squarely installed on the fastener.
- Never use a hammer on any wrench other than a STRIKING FACE wrench.
- Discard any wrench with damaged 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 them 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 or cracked handle.
- 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 grinder.
- 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.
- Always 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 of the screwdriver 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 them on live electrical circuits.
- Do not use a screwdriver with rounded edges because it will slip. Redress with a grinder.

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 on a ratchet or put a pipe extension on a ratchet 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 a fastener loose, 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 only impact sockets for use with air or electric impact wrenches.
- Select the right size socket for the job.
- Always keep the wrench or socket squarely on the fastener.
- 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 another to prevent the cabinet from unexpectedly tipping over.
- Close iris and lock drawers and doors before moving storage units.
- Do not pull on a tool cabinet. Always push tool cabinets in front of you.
- Set the brakes on the locking casters after the cabinet has been rolled into position.
FUEL

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

**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. This can cause air entrapment and pressurization.

<table>
<thead>
<tr>
<th>Table 1-1. Octane Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECIFICATION (R+M)/2</td>
</tr>
<tr>
<td>Pump Octane</td>
</tr>
</tbody>
</table>

**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.

**NOTICE**

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

- Gasoline/METHYL TERTIARY BUTYL ETHER (MTBE) blends are a mixture of gasoline and as much as 15 percent MTBE. Gasoline/MTBE blends use in your motorcycle is approved.
- ETHANOL fuel is a mixture of ethanol (grain alcohol) and unleaded gasoline and can have an impact on fuel mileage. Fuels with an ethanol content of up to 10 percent may be used in your motorcycle without affecting vehicle performance. U.S. EPA regulations currently indicate that fuels with 15 percent ethanol (E15) are restricted from use in motorcycles at the time of this publication. Some motorcycles are calibrated to operate with higher ethanol concentrations to meet the fuel standards in certain countries.
- REFORMULATED OR OXYGENATED GASOLINES (RFG) describes gasoline blends that are specifically designed to burn cleaner than other types of gasoline. This results in fewer tailpipe emissions. They are also formulated to evaporate less when filling the tank. Reformulated gasolines use additives to oxygenate the gas. Your motorcycle will run normally using this type of fuel. Harley-Davidson recommends using it whenever possible as an aid to cleaner air in our environment.
  - Do not use racing fuel or fuel containing methanol. Use of these fuels will damage the fuel system.
  - Using fuel additives other than those approved for use by Harley-Davidson may damage the engine, fuel system and other components.

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

**ENGINE LUBRICATION**

**CAUTION**

Prolonged or repeated contact with used motor oil may be harmful to skin and could cause skin cancer. Promptly wash affected areas with soap and water. (00358b)

**CAUTION**

If engine oil is swallowed, do not induce vomiting. Contact a physician immediately. In case of contact with eyes, immediately flush with water. Contact a physician if irritation persists. (00357d)

**NOTICE**

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. Use the proper grade of oil for the lowest temperature expected before the next oil change. Refer to Table 1-2.

This motorcycle was originally equipped with GENUINE HARLEY-DAVIDSON H-D 360 MOTORCYCLE OIL 20W50. H-D 360 is the preferred oil under normal operating conditions. If operation under extreme cold or heat are expected, refer to Table 1-2 for alternative choices.

If necessary and H-D 360 is not available, add oil certified for diesel engines. Acceptable designations include: CH-4, CI-4 and CJ-4. The preferred viscosities, 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>
<thead>
<tr>
<th>TYPE</th>
<th>VISCOSITY</th>
<th>RATING</th>
<th>LOWEST AMBIENT TEMPERATURE</th>
<th>COLD-WEATHER STARTS BELOW 50 °F (10 °C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screamin' Eagle SYN 3 Full Synthetic Motorcycle Lubricant</td>
<td>SAE 20W50</td>
<td>HD 360</td>
<td>Above 30 °F (-1 °C)</td>
<td>Excellent</td>
</tr>
<tr>
<td>Genuine Harley-Davidson H-D 360 Motorcycle Oil</td>
<td>SAE 20W50</td>
<td>HD 360</td>
<td>Above 40 °F (4 °C)</td>
<td>Good</td>
</tr>
<tr>
<td>Genuine Harley-Davidson H-D 360 Motorcycle Oil</td>
<td>SAE 50</td>
<td>HD 360</td>
<td>Above 60 °F (16 °C)</td>
<td>Poor</td>
</tr>
<tr>
<td>Genuine Harley-Davidson H-D 360 Motorcycle Oil</td>
<td>SAE 60</td>
<td>HD 360</td>
<td>Above 80 °F (27 °C)</td>
<td>Poor</td>
</tr>
<tr>
<td>Genuine Harley-Davidson H-D 360 Motorcycle Oil</td>
<td>SAE 10W40</td>
<td>HD 360</td>
<td>Below 40 °F (4 °C)</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

**WINTER LUBRICATION**

Change engine oil often in colder climates. If motorcycle is frequently used for trips less than 15 mi (24 km), in ambient temperatures below 60 °F (16 °C), reduce oil change intervals to 1500 mi (2400 km).

**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 water vapor condenses to liquid form on the cool metal surfaces inside the engine. In freezing weather this water will become slush or ice. Over time, accumulated slush or ice may block the oil lines and cause engine damage.

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 not allowed to thoroughly warm up, this water will accumulate, mix with the engine oil and form a sludge that is harmful to the engine.
## Table 1-3. Bulb Chart

<table>
<thead>
<tr>
<th>LAMP</th>
<th>DESCRIPTION (ALL LAMPS 12 V)</th>
<th>BULBS REQUIRED</th>
<th>CURRENT DRAW (AMPERAGE)</th>
<th>HARLEY-DAVIDSON PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headlamp</td>
<td>High beam/low beam</td>
<td>1</td>
<td>4.7 (high beam)</td>
<td>4.3 (low beam)</td>
</tr>
<tr>
<td></td>
<td>Position lamp international</td>
<td>1</td>
<td>0.32</td>
<td></td>
</tr>
<tr>
<td>Tail and stop lamp (FLSTN)</td>
<td>Tail/stop lamp</td>
<td>1</td>
<td>0.59/2.10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tail/stop lamp international</td>
<td>1</td>
<td>0.59/2.10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>License plate lamp</td>
<td>1</td>
<td>0.35</td>
<td></td>
</tr>
<tr>
<td></td>
<td>License plate lamp international</td>
<td>1</td>
<td>0.37</td>
<td></td>
</tr>
<tr>
<td>Tail and stop lamp (Canada FLS and FXSB)</td>
<td>Tail/stop lamp</td>
<td>Illuminated with LEDs. Replace assembly upon failure.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tail and stop lamp (other models, except international FLS and FXSB)</td>
<td>Tail/stop lamp</td>
<td>1</td>
<td>0.59/2.10</td>
<td>88167-04</td>
</tr>
<tr>
<td>License plate lamp</td>
<td>Domestic/Canada FLS and FXSB</td>
<td>1</td>
<td>0.35</td>
<td></td>
</tr>
<tr>
<td></td>
<td>International FLS and FXSB</td>
<td>2</td>
<td>0.35</td>
<td></td>
</tr>
<tr>
<td>Turn signal lamps</td>
<td>Front/running</td>
<td>2</td>
<td>2.25 (turn signals)</td>
<td>0.59 (front running)</td>
</tr>
<tr>
<td></td>
<td>Front international (except FLSTC)</td>
<td>2</td>
<td>1.75</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Front international (FLSTC)</td>
<td>2</td>
<td>1.75</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rear (FLSTC)</td>
<td>2</td>
<td>2.25</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rear (Domestic/Canada FLS and FXSB)</td>
<td>2</td>
<td>2.25</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rear turn signal (international FLS and FXSB)</td>
<td>2</td>
<td>2.25</td>
<td>Illuminated with LEDs. Replace assembly upon failure.</td>
</tr>
<tr>
<td></td>
<td>Rear (other models)</td>
<td>2</td>
<td>1.75</td>
<td></td>
</tr>
<tr>
<td>Auxiliary/fog lamps (FLSTC/FLSTN)</td>
<td>Domestic</td>
<td>2</td>
<td>2.50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>International</td>
<td>2</td>
<td>2.10</td>
<td></td>
</tr>
<tr>
<td>Fender tip lamp</td>
<td>FLSTC</td>
<td>2</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>Instrument panel lamps</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** All Softail model speedometers, tachometers, indicator lamps and odometers are illuminated with LEDs.
### General

At each regular service interval, perform the required maintenance. Refer to Table 1-4.

Use the quick reference maintenance chart for torque values, lubricants or cross references to maintenance procedures. Refer to Table 1-5.

Use the lubricants, greases and sealants table to identify maintenance supplies. Refer to Table 1-6.

**Table 1-4. Regular Service Intervals: 2015 Softail Models**

<table>
<thead>
<tr>
<th>ITEM SERVICED</th>
<th>PROCEDURE</th>
<th>1000 Mi 1600 KM</th>
<th>5000 Mi 8000 KM</th>
<th>11000 Mi 18000 KM</th>
<th>15000 Mi 24000 KM</th>
<th>20000 Mi 32000 KM</th>
<th>25000 Mi 40000 KM</th>
<th>30000 Mi 48000 KM</th>
<th>35000 Mi 56000 KM</th>
<th>40000 Mi 64000 KM</th>
<th>45000 Mi 72000 KM</th>
<th>50000 Mi 80000 KM</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical equipment and switches</td>
<td>Check operation</td>
<td>X X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Front tire</td>
<td>Check pressure, inspect tread</td>
<td>X X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Front wheel spokes (if equipped)</td>
<td>Check torque</td>
<td>X X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2, 3, 4</td>
</tr>
<tr>
<td>Front brake fluid</td>
<td>Inspect slight glass</td>
<td>X X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Reservoir cover screw: front</td>
<td>Check torque</td>
<td>X X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1, 2, 6</td>
</tr>
<tr>
<td>Steering head bearings</td>
<td>Adjust</td>
<td>X X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Lower fork bracket pinch bolt</td>
<td>Check torque</td>
<td>X X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1, 2, 6</td>
</tr>
<tr>
<td>Upper fork bracket pinch bolt: all but F&amp;ST</td>
<td>Check torque</td>
<td>X X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1, 2, 6</td>
</tr>
<tr>
<td>Windshield bushings (if applicable)</td>
<td>Inspect</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Throttle controls</td>
<td>Check, adjust and lubricate</td>
<td>X X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Hand controls: upper and lower switch housing screws</td>
<td>Check torque</td>
<td>X X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1, 2, 6</td>
</tr>
<tr>
<td>Clutch lever handlebar clamp screws</td>
<td>Check torque</td>
<td>X X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1, 2, 6</td>
</tr>
<tr>
<td>Master cylinder handlebar clamp screws</td>
<td>Check torque</td>
<td>X X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1, 2, 6</td>
</tr>
<tr>
<td>Air cleaner</td>
<td>Inspect, service as required</td>
<td>X X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Engine oil and filter</td>
<td>Replace</td>
<td>X X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1, 4, 6</td>
</tr>
<tr>
<td>Primary chaincase lubricant</td>
<td>Replace</td>
<td>X X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Transmission lubricant</td>
<td>Replace</td>
<td>X X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Oil lines and brake system</td>
<td>Inspect for leaks, contact, or abrasion</td>
<td>X X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1, 2, 6</td>
</tr>
<tr>
<td>Fuel lines and fittings</td>
<td>Inspect for leaks, contact or abrasion</td>
<td>X X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1, 2, 6</td>
</tr>
<tr>
<td>Rear brake fluid</td>
<td>Inspect slight glass</td>
<td>X X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Reservoir cover screw: rear</td>
<td>Check torque</td>
<td>X X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1, 2, 6</td>
</tr>
<tr>
<td>Brake pads and discs</td>
<td>Inspect for wear</td>
<td>X X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Front axle nut</td>
<td>Check torque</td>
<td>X X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1, 2, 6</td>
</tr>
<tr>
<td>Brake master cylinder and caliper banjo bolts</td>
<td>Check torque</td>
<td>X X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1, 2, 6</td>
</tr>
<tr>
<td>ABS HCU banjo bolts</td>
<td>Check torque</td>
<td>X X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1, 2, 6</td>
</tr>
</tbody>
</table>
### Table 1-4. Regular Service Intervals: 2015 Softail Models

<table>
<thead>
<tr>
<th>ITEM SERVICED</th>
<th>PROCEDURE</th>
<th>1000 MI 1600 KM</th>
<th>5000 MI 8000 KM</th>
<th>10000 MI 16000 KM</th>
<th>15000 MI 24000 KM</th>
<th>20000 MI 32000 KM</th>
<th>25000 MI 40000 KM</th>
<th>30000 MI 48000 KM</th>
<th>35000 MI 56000 KM</th>
<th>40000 MI 64000 KM</th>
<th>45000 MI 72000 KM</th>
<th>50000 MI 80000 KM</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jiffy stand</td>
<td>Inspect and lubricate</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>2, 4</td>
<td></td>
</tr>
<tr>
<td>Clutch</td>
<td>Check adjustment</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>2, 4</td>
<td></td>
</tr>
<tr>
<td>Brake and clutch controls</td>
<td>Check, adjust and lubricate</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>2, 4</td>
<td></td>
</tr>
<tr>
<td>Rear wheel spokes (if equipped)</td>
<td>Check torque</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2, 3, 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rear tire</td>
<td>Check pressure, inspect tread</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>2, 3, 4</td>
<td></td>
</tr>
<tr>
<td>Drive belt and sprockets</td>
<td>Inspect, adjust belt</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>2, 3, 4</td>
<td></td>
</tr>
<tr>
<td>Rear axle nut</td>
<td>Check torque</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1, 2, 6</td>
<td></td>
</tr>
<tr>
<td>Exhaust system</td>
<td>Inspect for leaks, cracks, and loose or missing fasteners or gaskets</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>1, 4</td>
<td></td>
</tr>
<tr>
<td>Battery</td>
<td>Check battery, terminal torque and clean connections annually.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Spark plugs</td>
<td>Replace every two years or every 30,000 mi (48,000 km), whichever comes first.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Front fork</td>
<td>Disassemble, inspect, rebuild forks and replace front fork oil every 50,000 mi (80,000 km)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Fuel filter element</td>
<td>Replace every 100,000 mi (160,000 km)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Road test</td>
<td>Verify component and system functions</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**
1. Perform annually or at specified intervals, whichever comes first.
2. Should be performed by an authorized Harley-Davidson dealer, unless you have the proper tools, service data and are mechanically qualified.
3. Perform spoke tension check at the 1000 mi (1600 km), 5000 mi (8000 km), 20,000 mi (32,000 km) services and every 15,000 mi (24,000 km) interval thereafter. Not all vehicles are equipped with spoke wheels. Consult appropriate topic in service manual.
4. Perform maintenance more frequently in severe riding conditions (such as extreme temperatures, dusty environments, mountainous or rough roads, long storage conditions, short runs, heavy stop-and-go traffic or poor fuel quality).
5. Replace DOT 4 brake fluid and clutch fluid every two years.
6. Attempt to turn the fastener using a torque wrench set to the minimum torque specification for that fastener. If fastener does not rotate, the fastener torque has been maintained. No further attention is necessary. If fastener moves, tighten to specification.
7. Disassemble, lubricate and inspect every 30,000 mi (48,000 km).

### Table 1-5. Quick Reference Maintenance and Torque Chart

<table>
<thead>
<tr>
<th>ITEM SERVICED</th>
<th>SPECIFICATION</th>
<th>DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air cleaner</td>
<td>Bracket screw torque</td>
<td>40-60 in-lbs (4.5-6.8 Nm)</td>
</tr>
<tr>
<td></td>
<td>Cover screw torque</td>
<td>36-50 in-lbs (4.1-6.8 Nm)</td>
</tr>
<tr>
<td></td>
<td>Cover screw adhesive</td>
<td>LOCTITE 243 MEDIUM STRENGTH THREAD-LOCKER AND SEALANT (blue)</td>
</tr>
<tr>
<td>Axles</td>
<td>Front nut torque</td>
<td>70-75 ft-lbs (95.0-101.8 Nm)</td>
</tr>
<tr>
<td></td>
<td>Rear nut torque</td>
<td>95-105 ft-lbs (128.1-142.4 Nm)</td>
</tr>
<tr>
<td>Battery</td>
<td>Lubricent</td>
<td>ELECTRICAL CONTACT LUBRICANT</td>
</tr>
<tr>
<td></td>
<td>Terminal screw torque</td>
<td>60-72 in-lbs (6.8-8.1 Nm)</td>
</tr>
<tr>
<td>ITEM SERVICED</td>
<td>SPECIFICATION</td>
<td>DATA</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>----------------------------------------------------</td>
<td>-------------------------------------------</td>
</tr>
<tr>
<td>Brakes</td>
<td>Fluid type</td>
<td>DOT 4 hydraulic brake fluid</td>
</tr>
<tr>
<td></td>
<td>Fluid level</td>
<td>1/4 ± 1/8 in. (6.35 ± 3.18 mm) from top</td>
</tr>
<tr>
<td></td>
<td>Master cylinder, front, cover screw torque</td>
<td>12-15 in-lbs (1.4-1.7 Nm)</td>
</tr>
<tr>
<td></td>
<td>Master cylinder, rear, cover screw torque</td>
<td>6-8 in-lbs (0.7-0.9 Nm)</td>
</tr>
<tr>
<td></td>
<td>Caliper banjo bolt torque</td>
<td>17-22 ft-lbs (23.1-29.9 Nm)</td>
</tr>
<tr>
<td></td>
<td>HCU banjo bolt torque</td>
<td>120-144 in-lbs (13.6-16.3 Nm)</td>
</tr>
<tr>
<td></td>
<td>Master cylinder banjo bolt torque</td>
<td>17-22 ft-lbs (23.1-29.9 Nm)</td>
</tr>
<tr>
<td></td>
<td>Minimum pad thickness</td>
<td>0.04 in. (1.02 mm)</td>
</tr>
<tr>
<td></td>
<td>Minimum disc thickness</td>
<td>See stamp on side of disc</td>
</tr>
<tr>
<td>Cables, clutch and throttle</td>
<td>Lubricant</td>
<td>HARLEY LUBE</td>
</tr>
<tr>
<td>Clutch</td>
<td>Free play at adjuster screw</td>
<td>1/2-1 turn</td>
</tr>
<tr>
<td></td>
<td>Adjuster screw jamnut torque</td>
<td>72-120 in-lbs (8.1-13.6 Nm)</td>
</tr>
<tr>
<td></td>
<td>Free play at hand lever</td>
<td>1/16-1/8 in. (1.6-3.2 mm)</td>
</tr>
<tr>
<td></td>
<td>Inspection cover screw torque</td>
<td>84-108 in-lbs (9.5-12.2 Nm)</td>
</tr>
<tr>
<td>Drive belt</td>
<td>Apply upward measurement force at midpoint of</td>
<td>10 lb (4.5 kg)</td>
</tr>
<tr>
<td></td>
<td>bottom bell strand</td>
<td></td>
</tr>
<tr>
<td></td>
<td>With motorcycle on Jiffy Stand without rider or</td>
<td>FXSB, FLS, FLSTN, FLSTFB (LO): 1/4-5/16 in.</td>
</tr>
<tr>
<td></td>
<td>luggage</td>
<td>(6.4-7.9 mm)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FXST, FLSTC, FLSTFB/B: 9/16-5/8 in. (14.3-15.9 mm)</td>
</tr>
<tr>
<td>Engine idle speed</td>
<td>Idle speed</td>
<td>950-1050 RPM</td>
</tr>
<tr>
<td>Engine oil and filter</td>
<td>Oil capacity (with filter)</td>
<td>3.0 qt (2.84 L) wet</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.5 qt (3.31 L) dry</td>
</tr>
<tr>
<td></td>
<td>Filter</td>
<td>Hand tighten 1/2-3/4 turn after gasket</td>
</tr>
<tr>
<td></td>
<td></td>
<td>contact</td>
</tr>
<tr>
<td></td>
<td>Drain plug torque</td>
<td>14-21 ft-lbs (19.0-28.5 Nm)</td>
</tr>
<tr>
<td>Fork, front</td>
<td>Oil type</td>
<td>HYDRAULIC FORK OIL (TYPE E)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>See 2.19 FRONT FORK.</td>
</tr>
<tr>
<td></td>
<td>Lower pinch bolt torque: all but FXSB</td>
<td>55-60 ft-lbs (74.6-81.4 Nm)</td>
</tr>
<tr>
<td></td>
<td>Lower pinch bolt torque: FXSB</td>
<td>30-35 ft-lbs (40.7-47.5 Nm)</td>
</tr>
<tr>
<td></td>
<td>Upper pinch bolt torque: all but FXSB</td>
<td>25-30 ft-lbs (33.9-40.7 Nm)</td>
</tr>
<tr>
<td></td>
<td>Upper pinch bolt torque: FXSB</td>
<td>30-35 ft-lbs (40.7-47.5 Nm)</td>
</tr>
<tr>
<td>Handlebar/hand controls</td>
<td>Handlebar clamp screw torque</td>
<td>12-15 ft-lbs (16.3-20.3 Nm)</td>
</tr>
<tr>
<td></td>
<td>Switch housing screw torque</td>
<td>35-45 in-lbs (4.0-5.1 Nm)</td>
</tr>
<tr>
<td></td>
<td>Clutch lever clamp screw torque</td>
<td>60-80 in-lbs (6.8-9.0 Nm)</td>
</tr>
<tr>
<td></td>
<td>Master cylinder lever clamp screw torque</td>
<td>60-80 in-lbs (6.8-9.0 Nm)</td>
</tr>
<tr>
<td>Primary chaincase</td>
<td>Lubricant type</td>
<td>FORMULA+ TRANSMISSION AND PRIMARY CHAIN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LUBRICATION</td>
</tr>
<tr>
<td></td>
<td>Lubricant capacity</td>
<td>32 oz (0.95 L) wet</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40 oz (1.18 L) dry</td>
</tr>
<tr>
<td></td>
<td>Drain plug torque</td>
<td>14-21 ft-lbs (19.0-28.5 Nm)</td>
</tr>
<tr>
<td>Spark plugs</td>
<td>Type</td>
<td>HD-6R12</td>
</tr>
<tr>
<td></td>
<td>Gap</td>
<td>0.038-0.043 in. (0.97-1.09 mm)</td>
</tr>
<tr>
<td></td>
<td>Torque</td>
<td>12-18 ft-lbs (16.3-24.4 Nm)</td>
</tr>
<tr>
<td>Steering head bearings</td>
<td>Lubricant for neck fitting</td>
<td>SPECIAL PURPOSE GREASE</td>
</tr>
<tr>
<td>ITEM SERVICED</td>
<td>SPECIFICATION</td>
<td>DATA</td>
</tr>
<tr>
<td>---------------------</td>
<td>--------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Transmission</td>
<td>Lubricant level (cold)</td>
<td>Dipstick between ADD and FULL marks with motorcycle on jiffy stand. Thread dipstick in until O-ring makes contact with case. Do not tighten.</td>
</tr>
<tr>
<td></td>
<td>Lubricant type and capacity *</td>
<td>FORMULA+ TRANSMISSION AND PRIMARY CHAIN LUBRICATION or SYN3 20W50 OIL 32 oz (0.95 L)</td>
</tr>
<tr>
<td></td>
<td>Drain plug Torque</td>
<td>14-21 ft-lbs (19.0-28.5 Nm)</td>
</tr>
<tr>
<td></td>
<td>Filler plug torque</td>
<td>25-75 in-lbs (2.8-8.5 Nm)</td>
</tr>
</tbody>
</table>
| Tires               | Pressure for rider and passenger     | FLSTC, FLSTN, FLS Models:  
                      Front: 36 psi (248 kPa)  
                      Rear: 40 psi (270 kPa)  
                      FXST Model:  
                      Front: 30 psi (207 kPa)  
                      Rear: 42 psi (290 kPa)  
                      FLSTF/B Models:  
                      Front: 36 psi (248 kPa)  
                      Rear: 42 psi (290 kPa)  
                      FXSFB Models:  
                      Front: 36 psi (248 kPa)  
                      Rear: 42 psi (290 kPa)  
|                     | Wear                                 | Replace tire if 1/32 in. (0.8 mm) or less of tread pattern remains. |
| Wheel spokes         | Nipple torque (minimum)              | Steel laced wheel:  
                      55 in-lbs (6.2 Nm)  
                      Chrome aluminum laced wheel:  
                      55 in-lbs (6.2 Nm)  |

* Capacity is approximate. When changing lubricant, initially add 28 oz (0.83 L). Check and fill as necessary.

---

### Table 1-6. Lubricants, Greases, Sealants

<table>
<thead>
<tr>
<th>ITEM</th>
<th>PART NUMBER</th>
<th>PACKAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3M 847 Adhesive</td>
<td>021200-19718*</td>
<td>5 oz tube</td>
</tr>
<tr>
<td>3M General Purpose Adhesive Remover</td>
<td></td>
<td>1 oz aerosol</td>
</tr>
<tr>
<td>Anti-Seize Lubricant</td>
<td>96960-97</td>
<td>1 oz squeeze tube</td>
</tr>
<tr>
<td>CCI #20 Brake Grease</td>
<td>42830-05</td>
<td>squeeze packet (included in master cylinder rebuild kit)</td>
</tr>
<tr>
<td>DOT 4 Brake Fluid</td>
<td>99953-99A</td>
<td>12 oz bottle</td>
</tr>
<tr>
<td>Dow Corning Moty 44 Grease</td>
<td>94674-99</td>
<td>2 cc packet</td>
</tr>
<tr>
<td>Electrical Contact Lubricant</td>
<td>11300004</td>
<td>1 oz squeeze tube</td>
</tr>
<tr>
<td>Formula+ Transmission and Primary Chaincase Lubricant</td>
<td>99851-05</td>
<td>1 qt bottle</td>
</tr>
<tr>
<td>G40M Brake Grease</td>
<td>42620-04</td>
<td>squeeze packet</td>
</tr>
<tr>
<td>Genuine Harley-Davidson Extended Life Antifreeze and Coolant</td>
<td>99822-02</td>
<td>1 gal container</td>
</tr>
<tr>
<td>Genuine Harley-Davidson H-D 360 20W50 Motorcycle Oil</td>
<td>99816-2050/00QT</td>
<td>1 qt bottle</td>
</tr>
<tr>
<td>Harley-Davidson Adhesive (Griplock)</td>
<td>99839-95</td>
<td>10 g tube</td>
</tr>
<tr>
<td>Harley-Davidson High Performance Sealant - Gray</td>
<td>99650-02</td>
<td>1.9 oz squeeze tube</td>
</tr>
<tr>
<td>ITEM</td>
<td>PART NUMBER</td>
<td>PACKAGE</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>---------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Harley-Davidson Leather Dressing</td>
<td>98261-91V</td>
<td>6 oz can</td>
</tr>
<tr>
<td>Harley-Davidson Seal Grease</td>
<td>11300005</td>
<td>1 oz tube</td>
</tr>
<tr>
<td>Harley Lube</td>
<td>94968-09</td>
<td>1/4 oz needle dispenser</td>
</tr>
<tr>
<td>Hylomar Gasket and Thread Sealant</td>
<td>99653-65i</td>
<td>3.5 oz tube</td>
</tr>
<tr>
<td>Loctite 222 Low Strength Threadlocker and Sealant (purple)</td>
<td>99811-97</td>
<td>6 mL tube</td>
</tr>
<tr>
<td>Loctite 243 Medium Strength Threadlocker and Sealant (blue)</td>
<td>99642-97</td>
<td>6 mL tube</td>
</tr>
<tr>
<td>Loctite 246 Medium Strength/High Temperature Threadlocker (blue)</td>
<td></td>
<td>50 mL bottle</td>
</tr>
<tr>
<td>Loctite 262 High Strength Threadlocker and Sealant (red)</td>
<td>94759-99</td>
<td>6 mL tube</td>
</tr>
<tr>
<td>Loctite 271 High Strength Threadlocker and Sealant (red)</td>
<td>11100006</td>
<td>6 mL tube</td>
</tr>
<tr>
<td>Loctite 411 Prism Instant Adhesive</td>
<td></td>
<td>50 mL bottle</td>
</tr>
<tr>
<td>Loctite 420 Super Bonder Adhesive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loctite 565 Thread Sealant</td>
<td>99818-97</td>
<td>6 mL tube</td>
</tr>
<tr>
<td>Loctite 770 Prism Primer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loctite 7649 Cleaner/Primer</td>
<td>99669-99</td>
<td>1.75 oz bottle</td>
</tr>
<tr>
<td>RTV Silicone Sealer</td>
<td>99650-02</td>
<td>1.9 oz tube</td>
</tr>
<tr>
<td>Screamin' Eagle Assembly Lube</td>
<td>11300002</td>
<td>4 oz bottle</td>
</tr>
<tr>
<td>Screamin' Eagle SYN3 Full Synthetic Motorcycle Lubricant 20W50</td>
<td>99824-03/00QT</td>
<td>1 qt bottle</td>
</tr>
<tr>
<td>Special Purpose Grease</td>
<td>99857-97A</td>
<td>14 oz cartridge</td>
</tr>
<tr>
<td>Type &quot;E&quot; Hydraulic Fork Oil</td>
<td>62600028</td>
<td>16 oz bottle</td>
</tr>
<tr>
<td>Wheel Bearing Grease</td>
<td>99855-89</td>
<td>1 lb can</td>
</tr>
<tr>
<td>* Not a Harley-Davidson part number</td>
<td>99856-92</td>
<td>14 oz cartridge</td>
</tr>
</tbody>
</table>
CHECKING AND ADDING OIL

NOTICE

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)

NOTICE

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)

NOTICE

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

1. Ride motorcycle until engine is warmed up to operating temperature.
2. Idle motorcycle on jiffy stand for 1-2 minutes.
4. See Figure 1-2. Check oil level on dipstick. If necessary, add oil until oil registers at upper groove on dipstick (FULL HOT). Do not overfill oil tank.

CHANGING OIL AND FILTER

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-42311</td>
<td>OIL FILTER WRENCH</td>
</tr>
<tr>
<td>HD-44067</td>
<td>OIL FILTER WRENCH</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine oil drain plug</td>
<td>14-21 ft-lbs</td>
</tr>
</tbody>
</table>

NOTES

- Change engine oil at shorter intervals if ridden extremely hard, used in competition or driven on dusty roads.
- All Softail models are shipped from the factory with SAE 20W50 Harley-Davidson 360 Motor Oil.
- Softail models come equipped from the factory with a premium 5 micron synthetic media oil filter, Part No. 63798-99A (Chroma) or 63731-99A (Black). These are the only recommended replacement filters.

1. Run motorcycle until engine is at normal operating temperature.
2. See Figure 1-1. Remove the engine oil dipstick.
3. See Figure 1-3. Remove the engine oil drain plug with O-ring (2). Drain engine oil.

NOTICE

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

4. See Figure 1-4. Remove the oil filter using the OIL FILTER WRENCH (Part No. HD-42311) or OIL FILTER WRENCH (Part No. HD-44067). Clean the oil filter mounting surface of any old gasket material.
5. See Figure 1-5. Lubricate the gasket on new oil filter with engine oil. Install filter. Hand tighten oil filter 1/2 to 3/4 turn after gasket contacts filter mounting surface. Do not use oil filter wrench for oil filter installation.
6. See Figure 1-3. Install oil tank drain plug (2).
   a. Inspect O-ring for tears or damage. Replace if necessary. Clean magnetic drain plug.
   b. Install O-ring and drain plug. Tighten to 14-21 ft-lbs (19.0-28.5 Nm).

7. Refer to Table 1-7. Initially add 2.0 quarts (1.90 liters) of engine oil. Use the proper grade of oil for the lowest temperature expected before the next oil change. Refer to Table 1-2.

Table 1-7. Engine Oil Capacity

<table>
<thead>
<tr>
<th>ITEM</th>
<th>CAPACITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine oil (wet refill)</td>
<td>3.0 qt (2.84 L)</td>
</tr>
<tr>
<td>Engine oil (dry refill)</td>
<td>3.5 qt (3.31 L)</td>
</tr>
</tbody>
</table>

Use wet capacity values for engines that have just had the oil drained. Use dry capacity values for engines that have been disassembled, cleaned in solvent and dried.

8. See Figure 1-1. Fully install oil filter plug/dipstick in oil tank.

9. Perform engine oil level hot check.

10. See Figure 1-2. Add engine oil to bring oil level to the upper groove on the dipstick (FULL HOT).

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

Figure 1-3. Oil Tank Drain Plug

1. Frame connection for oil tank drain hose
2. Oil tank drain plug and O-ring

Figure 1-4. Oil Filter Wrenches

Figure 1-5. Lubricating New Oil Filter Gasket
REMOVAL

1. See Figure 1-6. Remove screw (1) and air cleaner cover (2).
2. Remove three screws (4) and bracket (5) from filter element (6).
3. Gently pull both rubber breather hoses (9) from the element. Remove filter element (6) and gasket (7).
4. Replace the filter element if damaged or if filter media cannot be adequately cleaned.

Cleaning and Inspection

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)

1. Gently pull the breather hoses from the breather bolts on the backplate (8).

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 filter element.
   a. Wash the paper/wire mesh air filter element and breather hoses in lukewarm water with a mild detergent. Do not strike filter element on a hard surface to dislodge dirt.
   b. Allow filter 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. If light is uniformly visible through the element, it is sufficiently clean.

3. Inspect seal ring (3) on cover for cracks or tears. Verify that it seals tightly to backplate. Replace as required.

4. Inspect breather hoses for tears, cuts, holes or other damage. Replace as necessary.

   NOTE
   The breather hoses allow crankcase vapors to be directed into the air filter element. Unless breather hoses are properly mounted, crankcase vapors can be vented into the atmosphere. This is a violation of legal emissions standards. This will also cause problems with the engine's breather system. It will cause the umbrella valve to flutter.

5. Wipe inside of air cleaner cover and backplate with damp cloth to remove dust.
FIGURE 1-6. Air Cleaner Assembly

1. Screw
2. Air cleaner cover
3. Seal ring
4. Screw (3)
5. Bracket
6. Filter element
7. Gasket
8. Backplate
9. Breather hose (2)
10. Air cleaner assembly: oval
11. Air cleaner assembly: round

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air cleaner bracket screws</td>
<td>40-60 in-lbs</td>
</tr>
<tr>
<td>Air cleaner cover screw</td>
<td>35-60 in-lbs</td>
</tr>
</tbody>
</table>

1. See Figure 1-7. Position new gasket on backplate.
2. Oval air cleaner: See Figure 1-8. Insert two breather hoses into the holes in back of the filter element and place the element back into position. Attach breather hoses to breather screws on backplate.
3. Round air cleaner: Place filter element back into position on backplate and then insert two breather hoses into the holes on front of the filter element. Place breather hoses on breather screws on backplate.
4. See Figure 1-6. Install air filter element and bracket.
   a. Make sure gasket holes are aligned with backplate holes.
   b. Use three screws (4) to secure bracket and filter element. Tighten to 40-60 in-lbs (4.5-6.8 Nm).
5. Install air filter cover (2).
   a. Apply a drop of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to threads of air cleaner cover screw (1).
   b. Install air cleaner cover using screw. Tighten to 35-60 in-lbs (4.1-6.8 Nm).
EXHAUST SYSTEM LEAK CHECK

Check exhaust system for leaks at every scheduled service interval.

1. Check entire exhaust system for loose or missing fasteners and fractured pipe clamps or brackets. Check exhaust system for obvious signs of leakage such as carbon tracks at pipe joints.

2. Check for loose or fractured exhaust shields. Replace or repair 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.

Exhaust System Leakage

If an exhaust system leak is evident at a muffler or header pipe connection, disassemble and clean all mating surfaces. See 4.17 EXHAUST SYSTEM.

- Replace any damaged components and assemble.
- If leak continues, disassemble and apply Permatex Ultra Copper or LOCTITE 5920 FLANGE SEALANT. If neither are available, use an equivalent oxygen sensor/catalyst-safe alternative.
- Assemble components. Wipe off excess sealant.
- Follow sealant product instructions. Allow adequate curing time before operating vehicle.
**WARNING**

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

**WARNING**

Be sure tires are properly inflated, balanced, undamaged, and have adequate tread. Inspect your tires regularly and see a Harley-Davidson dealer for replacements. Riding with excessively worn, unbalanced, improperly inflated, overloaded or damaged tires can lead to tire failure and adversely affect stability and handling, which could result in death or serious injury. (00014b)

**WARNING**

Do not use liquid tire balancers or seatants in aluminum wheels. Using liquid tire balancers or seatants can cause rapid corrosion of the rim surface, which could cause tire deflation. Tire deflation can cause loss of vehicle control, which could result in death or serious injury. (00631b)

Always maintain proper tire pressure as specified in Table 1-8. Do not load tires beyond GAWR specified in Table 2-4 and Table 2-5. Under-inflated, over-inflated or overloaded tires can fail.

Use only tires listed in Table 1-8.

**NOTE**

ABS equipped motorcycles must always use properly inflated tires and wheels that are the same as the original equipment. The ABS system monitors rotational speed of the wheels through individual wheel speed sensors to determine the application of ABS.

Different diameter wheels or tires can:

- Alter the rotational speed which can upset the calibration of the ABS.
- Adversely affect its ability to detect and prevent lockups.

Operating with inflation pressure other than those specified in Table 1-8 can reduce ABS performance.

**WARNING**

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

**NOTES**

- Tubeless tires are used on all Harley-Davidson cast and disc wheels, and tubeless profile laced wheels with MTM designation.
- 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:

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.

**WARNING**

Be sure tires are properly inflated, balanced, undamaged, and have adequate tread. Inspect your tires regularly and see a Harley-Davidson dealer for replacements. Riding with excessively worn, unbalanced, improperly inflated, overloaded or damaged tires can lead to tire failure and adversely affect stability and handling, which could result in death or serious injury. (00014b)

**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 1-8.

**NOTE**

Harley-Davidson does not perform any testing with only nitrogen in tires. Harley-Davidson neither recommends nor discourages the use of pure nitrogen to inflate tires.

<table>
<thead>
<tr>
<th>Model</th>
<th>Mount</th>
<th>Size</th>
<th>Specified Tire</th>
<th>Pressure (Cold)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLSTC, FLS</td>
<td>front</td>
<td>16 in</td>
<td>Dunlop D402F MTQ9B16</td>
<td>36</td>
</tr>
<tr>
<td>FLSTN, FLSTC (whitewall)</td>
<td>front</td>
<td>16 in</td>
<td>Dunlop D402F MTQ9B16</td>
<td>36</td>
</tr>
<tr>
<td>FLSTF, FLSTFB</td>
<td>front</td>
<td>17 in</td>
<td>Dunlop D408F 140/75R17</td>
<td>36</td>
</tr>
<tr>
<td>FXST</td>
<td>front</td>
<td>21 in</td>
<td>Dunlop D408F MH90-21</td>
<td>30</td>
</tr>
<tr>
<td>FXSB</td>
<td>front</td>
<td>21 in</td>
<td>Dunlop D408F 130/60B21</td>
<td>36</td>
</tr>
</tbody>
</table>

1-20 2015 Softail Service: Maintenance
Table 1-8. Specified Tires

<table>
<thead>
<tr>
<th>MODEL</th>
<th>MOUNT</th>
<th>SIZE</th>
<th>SPECIFIED TIRE</th>
<th>PRESSURE (COLD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLSTC</td>
<td>rear</td>
<td>16 in</td>
<td>Dunlop D401 150/80B16</td>
<td>40</td>
</tr>
<tr>
<td>FLSTN, FLSTC (white wall)</td>
<td>rear</td>
<td>16 in</td>
<td>Dunlop D402 MU85B16</td>
<td>40</td>
</tr>
<tr>
<td>FLS</td>
<td>rear</td>
<td>16 in</td>
<td>Dunlop D402 MU85B16</td>
<td>40</td>
</tr>
<tr>
<td>FLSTF, FXST, FLSTFB</td>
<td>rear</td>
<td>17 in</td>
<td>Dunlop D407 200/55R17</td>
<td>42</td>
</tr>
<tr>
<td>FXSB</td>
<td>rear</td>
<td>18 in</td>
<td>Dunlop D407 240/40R18</td>
<td>42</td>
</tr>
</tbody>
</table>

TIRE REPLACEMENT

Inspection

**WARNING**

Replace tire immediately with a Harley-Davidson specified tire when wear bars become visible or only 1/32 in (0.8 mm) tread depth remains. Riding with a worn tire could result in death or serious injury. (00090c)

Harley-Davidson tires are equipped with wear bars that run horizontally across the tread. When a tire is worn to the point that the wear bars are visible, or 1/32 in. (0.8 mm) tread depth remains, the tire can:

- Be more easily damaged leading to tire failure.
- Provide reduced traction.
- Adversely affect stability and handling.

Arrows on tire sidewalls pinpoint location of wear bar indicators.

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.

**NOTES**

- When installing tires on rims, do not rely on tread design to determine direction of rotation. Always be sure the rotational arrows molded into the sidewalls point in the direction of rotation when the vehicle is moving forward.
- Never install a tire and inner tube on a faced rim with TUBELESS and MTM designations etched into the rim. These rims are specially designed for tubeless use only.
- Replace rim strip and rim seal whenever the tire is removed.

WHEEL BEARINGS

**NOTE**

Replace bearings in sets only. See 2.8 SEALED WHEEL BEARINGS.

1. Replace when bearings exceed end play service wear limit of 0.002 in (0.051 mm).
2. Inspect any time the wheels are removed.
   a. Inspect the play of the wheel bearings by finger while they are in the wheel.
   b. Rotate the inner bearing race and check for abnormal noise.
   c. Make sure bearing rotates smoothly.
3. Check wheel bearings and axle spacers for wear and corrosion. Excessive play or roughness indicates worn bearings.

WHEEL SPOKES

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOLS NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48985</td>
<td>SPOKE TORQUE WRENCH</td>
</tr>
<tr>
<td>HD-94681-80</td>
<td>SPOKE NIPPLE WRENCH</td>
</tr>
</tbody>
</table>

**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)

**WARNING**

Do not overtighten spoke nipples. Protruding spoke nipples can damage rim seal, resulting in rapid tire deflation, which could cause death or serious injury. (00511b)

**NOTICE**

When lifting a motorcycle using a jack, be sure jack contacts both lower frame tubes where down tubes and lower frame tubes converge. Never lift by jacking on cross-members, oil pan, mounting brackets, components or housings. Failure to comply can cause serious damage resulting in the need to perform major repair work. (00586d)
Identify Wheel Spoke Groups

NOTE

Spokes are grouped in sets of four.

1. Raise wheel with a suitable lifting device.
2. See Figure 1-9. Starting at the valve stem, identify the first group of four spokes (1-4).
3. Using a different color for each spoke in the group, draw an alignment mark across the spoke nipple and onto the rim.
4. Continue around the wheel marking the rest of the spokes the same as they were marked in the previous way.

Wheel Spoke Adjustment

NOTES

- Do not tighten spoke more than 1/4 turn past alignment mark. If more tension is needed, label spoke and check after completing rest of wheel.
- Do not use the spoke torque wrench to loosen spokes. Use SPOKE NIPPLE WRENCH (Part No. HD-94681-80) to loosen spokes.

1. See Figure 1-9. Starting with the first group of spokes, loosen spoke (1) 1/4 turn using SPOKE NIPPLE WRENCH (Part No. HD-94681-80).
2. Using SPOKE TORQUE WRENCH (Part No. HD-48965) tighten spoke (1) to the value listed in Table 1-9.
   a. While tightening, if the torque wrench clicks before the alignment marks align, continue to turn the spoke nipple until the marks align.
   b. If the alignment marks align and the torque specification has not been reached, continue to tighten the spoke nipple until the correct torque is achieved, but do not turn spoke nipple more than 1/4 turn past alignment mark.
3. Repeat previous two steps for spoke (4) in the same group.
4. Continue around the wheel checking spokes 1 and 4 until all groups are done.
5. Repeat procedure for spokes (2, 3) in each group.

NOTE

When checking any spokes that were labeled as not reaching the proper torque value after tightening 1/4 turn past alignment mark.

6. Check spokes, if any, that were labeled as not reaching the proper torque value after tightening 1/4 turn past alignment mark.
   a. Loosen spoke 1/4 turn past original alignment mark using SPOKE NIPPLE WRENCH (Part No. HD-94681-80).
   b. While tightening, if the torque wrench clicks before the alignment marks align, continue to turn the spoke nipple until the marks align.
   c. If the alignment marks align and the torque specification has not been reached, continue to tighten the spoke nipple until the correct torque is achieved, but do not turn spoke nipple more than 1/4 turn past alignment mark.

7. True the wheel. See 2.7 CHECKING AND TRUING WHEELS.

Table 1-9. Spoke Nipple Torque Specification

<table>
<thead>
<tr>
<th>RIM TYPE</th>
<th>MINIMUM TORQUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>55 in-lbs (6.2 Nm)</td>
</tr>
</tbody>
</table>

![Figure 1-9. Tightening Laced Wheels (typical)](image-url)
GENERAL
All models have an automatic chain tensioner. For primary chain service procedures, see 5.4 DRIVE COMPONENTS.

CHANGING PRIMARY CHAINCASE LUBRICANT

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary chaincase drain plug</td>
<td>14-21 ft-lbs</td>
</tr>
<tr>
<td>Clutch inspection cover</td>
<td>84-106 in-lbs</td>
</tr>
</tbody>
</table>

1. Run motorcycle until engine is at normal operating temperature.
2. Turn off ignition switch and STOP/RUN switch.

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)

NOTICE
When draining or adding lubricant, do not allow dirt, debris or other contaminants to enter the engine. (00198a)
3. See Figure 1-10. Drain primary chaincase.
4. Clean drain plug. If plug has accumulated much debris, inspect the condition of chaincase components.
5. Install new O-ring on drain plug.
6. Install drain plug into primary chaincase cover. Tighten to 14-21 ft-lbs (19.0-28.5 Nm).
7. See Figure 1-11. Remove screws and captive washers (3) and clutch inspection cover (2).
8. Remove seal (1). Wipe oil from groove in chaincase cover and mounting surface.

NOTICE
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)
9. Place motorcycle in an upright position to fill primary chaincase.
10. Pour specified amount of FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT through clutch inspection cover opening. Refer to Table 1-10.

Table 1-10. Primary Chaincase Lubricant Refill Capacity

<table>
<thead>
<tr>
<th>ITEM</th>
<th>CAPACITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary chaincase lubricant</td>
<td>32 oz (0.95 L) wet</td>
</tr>
<tr>
<td></td>
<td>40 oz (1.18 L) dry</td>
</tr>
</tbody>
</table>

11. Install clutch inspection cover and new seal:
   a. Thoroughly wipe all lubricant from cover mounting surface and groove in chaincase cover.
   b. See Figure 1-11. Position new seal (1) in groove in clutch inspection cover. Press each of the tabs on seal into the groove.
   c. Secure inspection cover with screws and captive washers (3).
   d. See Figure 1-12. Tighten in sequence shown to 84-106 in-lbs (9.5-12.2 Nm).

Figure 1-10. Removal/Installation of Chaincase Drain Plug

Figure 1-11. Clutch Cover
Figure 1-12. Clutch Cover Torque Sequence
CHECKING TRANSMISSION LUBRICANT

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission filler plug/dipstick</td>
<td>25-75 in-lbs</td>
</tr>
</tbody>
</table>

**NOTE**

Check transmission fluid with the motorcycle at room temperature.

1. Park on level ground on the jiffy stand.
2. See Figure 1-13. Remove transmission lubricant dipstick. Wipe dipstick clean.
3. Insert dipstick into transmission. Thread dipstick in until O-ring makes contact with case. Do not tighten.
4. See Figure 1-14. Remove dipstick. Check lubricant level on dipstick.

**NOTICE**

Mixing mineral-based lubricants with SYN-3 in the transmission can damage the transmission. (00452b)

5. The level should be between the A and F marks. Add only enough lubricant to bring level to between the A mark and the F mark. Refer to Table 1-11.
6. Install dipstick. Tighten to 25-75 in-lbs (2.8-8.5 Nm).

**Figure 1-13. Transmission Lubricant Check/Fill**

![Figure 1-14. Transmission Dipstick Lubricant Level](image)

**Table 1-11. Recommended Lubricant**

<table>
<thead>
<tr>
<th>LUBRICANT</th>
<th>REFILL QUANTITY *</th>
</tr>
</thead>
<tbody>
<tr>
<td>FORMULA+ TRANSMISSION AND PRIMARY CHAIN LUBRICANT</td>
<td>128 oz (0.83 L)</td>
</tr>
<tr>
<td>SCREAMIN' EAGLE SYN3 FULL SYNTHETIC MOTORCYCLE LUBRICANT 20W50</td>
<td></td>
</tr>
</tbody>
</table>

*Approximate. Check and add as needed to bring level within specification.

**CHANGING TRANSMISSION LUBRICANT**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission drain plug</td>
<td>14-21 ft-lbs</td>
</tr>
<tr>
<td>Transmission filler plug/dipstick</td>
<td>25-75 in-lbs</td>
</tr>
</tbody>
</table>

1. See Figure 1-13. Remove transmission filler plug/dipstick.

**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)

**NOTICE**

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

2. See Figure 1-15. Remove transmission drain plug. Drain primary chaincase.
3. Clean and inspect drain plug and O-ring.
NOTICE

Do not over-tighten filler or drain plug. Doing so could result in a lubricant leak. (00200b)


5. Fill the transmission with 28 oz (0.83 L) of recommended Harley-Davidson lubricant. Refer to Table 1-11.

6. Check lubricant level and add enough lubricant to bring the level between the ADD (A) and FULL (F) marks. See 1.10 TRANSMISSION LUBRICANT, Checking Transmission Lubricant.

7. Install filler plug/dipstick. Tighten to 25-75 in-lbs (2.8-8.5 Nm).

Figure 1-15. Transmission Drain Plug (Bottom View)
ADJUSTMENT

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clutch adjuster screw jamnut</td>
<td>72-120 in-lbs</td>
</tr>
<tr>
<td></td>
<td>8.1-13.6 Nm</td>
</tr>
<tr>
<td>Clutch cable adjuster jamnut</td>
<td>120 in-lbs</td>
</tr>
<tr>
<td></td>
<td>13.6 Nm</td>
</tr>
<tr>
<td>Clutch inspection cover screws</td>
<td>84-108 in-lbs</td>
</tr>
<tr>
<td></td>
<td>9.5-12.2 Nm</td>
</tr>
</tbody>
</table>

NOTES

- Perform clutch adjustment with motorcycle at room temperature.
- Clearance at adjuster screw will increase as powertrain temperature increases.
- If adjuster screw is adjusted with powertrain hot, clutch slippage could occur when powertrain is cold.

1. Position motorcycle on a suitable lift, upright and level. Point front wheel straight ahead.
2. Remove clutch inspection cover.
3. Remove end discard seal.
4. See Figure 1-16. Add free play to cable.
   a. Slide rubber boot (1) off cable adjuster.
   b. Loosen jamnut (3).
   c. Turn cable adjuster (2) until there is a large amount of free play at clutch hand lever.
5. See Figure 1-17. Loosen jamnut (1) on clutch adjuster screw (2). To take up all free play, turn screw inward (clockwise) until lightly seated. Activate the clutch lever to verify the balls are seated in the ramps.
6. Back out adjusting screw (counterclockwise) 1/2 to 1 full turn. Tighten jamnut 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 free play.
   a. Turn cable adjuster away from jamnut until slack is eliminated at hand lever.
   b. See Figure 1-18. Pull clutch cable ferrule (2) away from clutch lever bracket (3) 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. Tighten jamnut against cable adjuster to 120 in-lbs (13.6 Nm). Cover cable adjuster mechanism with rubber boot.
1. **Clutch cable**
2. **Cable ferrule**
3. **Clutch lever bracket**
4. Free play: 1/16-1/8 in (1.6-3.2 mm)

*Figure 1-18. Clutch Cable Free Play*

10. Install clutch inspection cover and new seal as follows:
   a. Thoroughly wipe all lubricant from cover mounting surface and groove in chaincase.
   b. Position new seal in groove in clutch inspection cover.
   c. Insert screw with captive washer through clutch inspection cover. Carefully thread it into the top cover screw hole.
   d. Start the remaining four screws with captive washers.
   e. Following the torque sequence shown in Figure 1-19: Alternately tighten screws to 84-108 in-lbs (9.5-12.2 Nm).

*Figure 1-19. Clutch Cover Torque Sequence*
GENERAL

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)

In the case of stone damage to belt, inspect the sprockets for damage and replace as required. If replacing belt, always replace both transmission and rear sprockets.

CLEANING

Keep dirt, grease, oil, and debris off the drive 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 1-20. Inspect each tooth (1) of rear sprocket for:
   • Major tooth damage
   • Large chrome chips with sharp edges
   • Gouges caused by hard objects
   • 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.

Drive Belt

See Figure 1-21. Inspect drive belt for:

• Cuts or unusual wear patterns.
• Outside edge beveling (6). Some beveling is common, but it indicates that sprockets are misaligned.
• Outside ribbed surface for signs of stone puncture (7). If cracks or other damage exists near edge of belt, replace belt immediately. Damage to center of belt will require belt replacement eventually. However, when cracks extend to edge of 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 1-21. Drive Belt Wear Patterns

Table 1-12. Drive Belt Wear Analysis

<table>
<thead>
<tr>
<th>PATTERN</th>
<th>CONDITION</th>
<th>REQUIRED ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Internal tooth cracks (hairline)</td>
<td>OK to run, but monitor condition.</td>
</tr>
<tr>
<td>2</td>
<td>External tooth cracks</td>
<td>Replace belt.</td>
</tr>
<tr>
<td>3</td>
<td>Missing teeth</td>
<td>Replace belt.</td>
</tr>
<tr>
<td>4</td>
<td>Chipping (not serious)</td>
<td>OK to run, but monitor condition.</td>
</tr>
<tr>
<td>5</td>
<td>Fuzzy edge cord</td>
<td>OK to run, but monitor condition.</td>
</tr>
<tr>
<td>6</td>
<td>Hook wear</td>
<td>Replace belt and sprocket.</td>
</tr>
<tr>
<td>7</td>
<td>Stone damage</td>
<td>Replace belt if damage is on the edge.</td>
</tr>
<tr>
<td>8</td>
<td>Bevel wear (outboard edge only)</td>
<td>OK to run, but monitor condition.</td>
</tr>
</tbody>
</table>

CHECKING DRIVE BELT DEFLECTION

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-35381-A</td>
<td>BELT TENSION GAUGE</td>
</tr>
</tbody>
</table>

NOTE
Always use BELT TENSION GAUGE (Part No. HD-35381-A) to measure belt deflection. Failure to use tension gauge may cause under-tensioned belts. Loose belts can fail due to "ratcheting" (jumping a tooth) which causes tensile cord crimping and breakage.

Check deflection:
- As part of pre-ride inspection.
- At every scheduled service interval.
- With transmission in neutral.
- With motorcycle at ambient temperature.
- With motorcycle upright or on jiffy stand with rear wheel on the ground.
- With the vehicle unladen: no rider, no luggage and saddlebags (if equipped) empty.
To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

1. Disarm security system. Remove main fuse. See 7.10 FUSES, Removal.

2. See Figure 1-22. Obtain H-D BELT TENSION GAUGE (Part No. HD-35381-A).

NOTE
Gauge is available from an authorized Harley-Davidson dealer.

3. To use the belt tension gauge:
   a. Slide O-ring (4) to 0 lb (0 kg) mark (3).
   b. Models equipped with belt deflection window: Fit belt cradle (2) against bottom of drive belt in line with belt deflection window.
   c. All other models: Fit belt cradle (2) against bottom of drive belt half-way between drive pulleys.
   d. Press upward on knob (6) until O-ring slides down to 10 lb (4.5 kg) mark (5) and hold steady.

NOTE
Measure belt deflection with motorcycle unladen and upright or on jiffy stand with rear wheel on the ground.

4. Measure belt deflection:
   a. Models equipped with belt deflection window: See Figure 1-24. Measure belt deflection as viewed through belt deflection viewing window while holding gauge steady. Each deflection graduation is approximately 1/16 in (1.59 mm).
   b. All other models: See Figure 1-23. Measure belt deflection (4) while holding gauge steady.

5. Compare with specifications listed in Table 1-13. Adjust as necessary.

6. Install main fuse.

Table 1-13. Drive Belt Deflection

<table>
<thead>
<tr>
<th>VEHICLE</th>
<th>FXSB , FLSTN , FLS*, FLSTFB**</th>
<th>OTHER MODELS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upright or on jiffy stand without rider or luggage</td>
<td>1/4-5/16 in (6.4-7.9 mm)</td>
<td>9/16-5/8 in (14.3-15.9 mm)</td>
</tr>
</tbody>
</table>

* FLS (DOM/CAL/CAN/HDI/JPN configurations)
** FLSTFB (DOM/CAL/CAN/JPN/AUS configurations)

Refer to Table 2-11 to determine vehicle configuration.
1. Drive belt
2. Deflection graduation

Figure 1-24. Belt Deflection Window

ADJUSTING BELT DEFLECTION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axle nut, rear</td>
<td>95-105 ft-lbs, 128.8-142.4 Nm</td>
</tr>
</tbody>
</table>

1. All but FXSB: See Figure 1-25. Remove e-clip (1). Loosen rear axle nut (2).
2. FXSB: See Figure 1-26. Loosen rear axle nut (2).
3. Adjust belt tension by turning the axle adjuster (3) an equal number of turns to keep the wheel aligned until the specification in Table 1-13 is achieved.
4. Tighten axle nut (2) to 95-105 ft-lbs (128.8-142.4 Nm).
5. All but FXSB: See Figure 1-25. Install e-clip.
6. Verify rear wheel alignment. See 2.10 VEHICLE ALIGNMENT.

⚠️ WARNING

Check wheel bearing end play after tightening axle nut to specified torque. Excessive end play can adversely affect stability and handling and can cause loss of control, which could result in death or serious injury. (00285b)
CABLE INSPECTION, LUBRICATION AND ADJUSTMENT

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handlebar switch housing</td>
<td>35-45 in-lbs</td>
</tr>
<tr>
<td>screws</td>
<td>4.0-5.1 Nm</td>
</tr>
</tbody>
</table>

Inspection and Lubrication

1. See Figure 1-27. Remove two screws (1) to separate the upper handlebar module housing from the lower housing.
2. Unhook each female and cable from the throttle grip and remove the throttle sleeve.
3. Apply a light coat of graphite to the handlebar and replace throttle grip.
4. Put one or two drops of HARLEY LUBE into the housing of each cable.

NOTE
Always tighten the lower module housing screw first. Any gap between the upper and lower housings is at the front of the housing.
5. Assemble handlebar module housing. Tighten screws (1) to 35-45 in-lbs (4.0-5.1 Nm).

Adjustment

The throttle control must operate freely without binding. With throttle friction adjustment screw loosened, throttle grip must freely return to closed (idle) position.

The throttle control must operate freely when front wheel is turned to right and left fork stops. If throttle grip does not return to idle position freely, check throttle friction adjustment screw tension. If adjuster screw is loosened, inspect cables for tight bends.

⚠️ WARNING

Before starting engine, be sure throttle control will snap back to idle position when released. A throttle control that prevents engine from automatically returning to idle can lead to loss of control, which could result in death or serious injury. (08390a)

⚠️ WARNING

Do not tighten throttle friction adjustment screw to the point where the engine will not return to idle automatically. Over-tightening can lead to loss of vehicle control, which could result in death or serious injury. (00031b)

Adjust throttle cables:

1. See Figure 1-27. Slide rubber boot off throttle cable adjuster mechanism (2).
2. Loosen jamnut (clockwise).
3. Back jamnut (3) away from cable adjuster until it stops. Turn cable adjuster clockwise until it contacts jamnut. Repeat procedure on idle cable adjuster.
4. See Figure 1-28. Point front wheel straight ahead. Gently turn throttle grip so throttle is wide open. Hold this position. Turn throttle cable adjuster counterclockwise until throttle cam (2) just touches cam stop (5) on induction module.
5. Release the throttle grip, turn throttle cable adjuster counterclockwise an additional one-half to one full turn, and then tighten the jamnut against the cable adjuster. Cover cable adjuster mechanism with rubber boot.
6. Turn the front wheel full right. Turn the idle cable adjuster counterclockwise until the idle cable housing (4) just touches the spring (6) in the cable guide (as seen through slot).
7. Operate the throttle grip to verify that the throttle cable returns to the idle position when released. If the cable does not return to idle, turn the cable adjuster clockwise slightly until the correct response is achieved.
8. Tighten jamnut against the cable adjuster and cover cable adjuster mechanism with rubber boot.

Figure 1-27. Throttle Cable Adjusters
1. Throttle cable
2. Throttle cam
3. Idle cable
4. Idle cable housing
5. Cam stop
6. Spring

Figure 1-28: Induction Module Cable Connection
GENERAL
Inspect and lubricate the following items according to 1.5 MAINTENANCE SCHEDULE.
- Front brake hand lever
- Clutch hand lever
- Throttle control cables
- Throttle control grip sleeve
- Clutch cable
- Steering head bearings
- Jiffy stand

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

CABLES AND HAND LEVERS
For throttle cables, see 1.13 THROTTLE CABLES.
Use HARLEY® LUBE for clutch lever and cable.
Use G40M BRAKE GREASE on front brake lever pin pivot hole and on the end of piston that contacts brake lever.

JIFFY STAND
Clean and lubricate the jiffy stand. For more information, see 2.39 JIFFY STAND.

STEERING HEAD BEARINGS
Lubricate the steering head bearings with HARLEY-DAVIDSON SPECIAL PURPOSE GREASE. See 7.18 STEERING HEAD BEARINGS.
FLUID INSPECTION

**WARNING**
Clean filler cap before removing. Use only D.O.T. 4 brake fluid from a sealed container. Contaminated fluid can adversely affect braking, which could result in death or serious injury. (02504c)

**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. (0240a)

**NOTICE**
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. (0239b)

**NOTICE**
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. (0205c)

**NOTE**
- Fluid level in reservoir will decrease with brake wear.
- Reservoir volume is adequate to provide fluid to the wear limits of the pads and rotors. If fluid level is below low level, check brake pad and rotor wear. If pads and rotors are within limits, check for leaks.

1. Properly position vehicle:
   a. Front brake: Level the master cylinder by turning the handlebar and/or standing the motorcycle upright (not leaning on jiffy stand).
   b. Rear brake: Position the motorcycle so the master cylinder reservoir is level.

2. See Figure 1-29. View reservoir sight glass:
   a. Front: Verify fluid is visible in the sight glass (1). If the fluid level is below the minimum mark (2) or not present, see 2.18 BLEEDING BRAKES.
   b. Rear: Verify fluid presence. The sight glass (3) appears dark when fluid is present. If the sight glass is clear, see 2.18 BLEEDING BRAKES.

3. Verify front brake hand lever and rear brake foot pedal have a firm feel when applied. If brakes are not firm, the brake system must be bled. see 2.18 BLEEDING BRAKES.

**REAR BRAKE PEDAL**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake pedal screw, rear</td>
<td>12-16 ft-lbs</td>
</tr>
</tbody>
</table>

**Pedal Height**
The rear brake pedal is nonadjustable. When brake system components are properly assembled, brake pedal is correctly adjusted.

**Pedal Lubrication**
See Figure 1-30. Rear brake pedal contains greaseless bushings (4, 5). Replace bushings if worn. Tighten brake pedal screw (1) to 12-16 ft-lbs (16.3-21.7 Nm).

**Pedal Pad**
If replacing brake pedal pad (6), slide old pad off brake pedal (7) then slide new pad on pedal.
BRAKE LINES INSPECTION

Inspect brake lines for leaks, contact or abrasion. Refer to Table 1-14.

1. Screw
2. Washer
3. O-ring
4. Bushing
5. Bushing
6. O-ring
7. Brake pedal
8. Pad
9. Cotter pin
10. Washer
11. Master cylinder pushrod
12. Clevis pin

Figure 1-30. Rear Brake Pedal (typical)

Table 1-14. Brake Line Inspection

<table>
<thead>
<tr>
<th>LINE TYPE</th>
<th>INSPECTION</th>
<th>REMEDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel lines</td>
<td>No marks</td>
<td>OK/Monitor</td>
</tr>
<tr>
<td></td>
<td>Slight mark in paint or plating*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Copper colored paint/plating worn off*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Silver colored base material-no noticeable feel of wear*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Silver colored base material-noticable feel of wear*</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>Brake fluid leak or other damage</td>
<td></td>
</tr>
<tr>
<td>Flexible lines</td>
<td>No marks</td>
<td>OK/Monitor</td>
</tr>
<tr>
<td></td>
<td>Slight dent in protective cover or flattening of ribs*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Worn through protective cover or to bottom of ribs</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>Brake fluid leak or other damage</td>
<td></td>
</tr>
<tr>
<td>Protective cover</td>
<td>No marks</td>
<td>OK/Monitor</td>
</tr>
<tr>
<td>(steel, rubber, plastic or braided)</td>
<td>Slight dent in covering*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Slight dent or flattening of plastic covering*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Worn or cut-through covering-exposed brake line material</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>Brake fluid leak or other damage</td>
<td></td>
</tr>
</tbody>
</table>

* If there is line contact, reposition the line. If base material is visible, prevent corrosion with touch-up paint.
INSPECTION

Check brake pads and discs:

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

Brake Pads

**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)

**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)

**NOTICE**

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. (00238b)

See Figure 1-31. Replace brake pads (3) if brake pad friction material on either the front or rear caliper is worn to 0.04 in. (1.02 mm) or less above the backing plate (4). Always replace both pads in a caliper as a set. See 1.16 BRAKE PADS AND DISCS. Brake Pad Replacement.

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

Brake Disc

- The minimum brake disc (2) thickness is stamped on the side of the disc.
- Maximum brake disc lateral runout and warpage is 0.008 in. (0.2 mm) when measured near the outside diameter.

Replace disc if badly scored or warped. See 2.4 FRONT WHEEL or 2.5 REAR WHEEL.

---

![Figure 1-31. Brake Pad Inspection](image)

1. Front brake caliper (viewed from below)
2. Brake disc
3. Brake pads
4. Backing plate
5. Rear brake caliper (viewed from above)

---

### BRAKE PAD REPLACEMENT

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake caliper, rear, pad pin</td>
<td>80-120 in-lbs</td>
</tr>
<tr>
<td>Brake caliper, rear, mounting</td>
<td>16-20 ft-lbs</td>
</tr>
<tr>
<td>fasteners</td>
<td></td>
</tr>
<tr>
<td>Brake caliper mounting bolts,</td>
<td>28-38 ft-lbs</td>
</tr>
<tr>
<td>front</td>
<td></td>
</tr>
<tr>
<td>Brake pad screws, front</td>
<td>130.1-173.5 in-lbs</td>
</tr>
</tbody>
</table>

---

### Rear Brake Caliper

1. Remove right saddlebag, if present.
2. **ABS models:** Remove cable strap securing wheel speed sensor cable to rear brake hose at caliper.
3. See Figure 1-32. Loosen, but do not remove pad pin (2).
4. Remove mounting bolt (1) and slider pin (3). Pull rear caliper away from brake disc.

5. Remove pad pin (2) and pads.

**NOTE**
Loosening the reservoir cap allows air to escape and helps prevent contamination. It also helps prevent fluid from squirting out of the reservoir.


**NOTE**
As the pistons are pushed back into the caliper, verify fluid does not overflow reservoir. Remove fluid if necessary.

7. Using the old brake pad and a C-clamp, retract the pistons fully into 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)

8. Inspect pad pin for grooving and wear. Measure the pad pin diameter in an unworn area. Then in the area of any grooving or wear. If wear exceeds 0.015 in. (0.38 mm), replace pin.

9. See Figure 1-33. Inspect torque clip. Replace parts if necessary.

10. See Figure 1-34. Inspect anti-rattle spring. Replace parts if necessary.

11. See Figure 1-35. Install new brake pads and pad pin. Tab (1) must engage clip (2) in caliper housing. Tighten pad pin to 80-120 in-lbs (9.0-13.6 Nm).

12. See Figure 1-32. Install caliper. Tighten mounting bolt (1) and slider pin (3) to 16-20 ft-lbs (21.7-27.1 Nm).

13. **ABS models:** Secure wheel speed sensor cable to rear brake hose with a cable strap near the 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. (06279a)
Always replace brake pads in complete sets for correct and safe brake operation. Improper brake operation could result in death or serious injury. (00111a)

7. Install new pads into caliper.

NOTE
See Figure 1-36. Brake pad spring (4) must be installed with the stamped arrow facing up.

8. Loosely install new brake pad screws (3) and new brake pad spring (4).

9. Attach caliper to front fork.
   a. Install caliper.
   b. ABS models: Place wheel speed sensor cable retainer (2) in position.
   c. Install caliper mounting bolts (1). Tighten to 28-38 ft-lbs (38.0-51.5 Nm).
   d. Tighten brake pad screws to 130.1-173.5 in-lbs (14.7-19.6 Nm).

10. Pump brake hand lever to move pistons outward until they contact both brake pads. Verify piston location against pads. If the front wheel is off the ground, rotate wheel to check for excessive brake pad drag.

11. Check fluid level in brake master cylinder reservoir. See 2.18 BLEEDING BRAKES.

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)

12. Test brakes.
   a. Turn ignition switch ON. Check operation of rear lamps.
   b. Test ride motorcycle. Repeat the bleeding procedure if brakes feel spongy. See 2.18 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.

Front Brake Caliper
1. See Figure 1-36. Remove brake pad screws (3).
2. Remove brake pad spring (4).
3. Remove caliper mounting bolts (1). Detach caliper from front forks and brake disc.
4. Remove brake pads.

NOTE
Loosening the reservoir cap allows air to escape and helps prevent contamination. It also helps prevent fluid from squirting out of the reservoir.

5. Loosen front master cylinder reservoir cap.

NOTE
As the pistons are pushed back into the caliper, verify fluid does not overflow reservoir. Remove fluid if necessary.

6. Using the old brake pad and a C-clamp, retract the pistons fully into the caliper.
1. Caliper mounting bolt (2) (metric)
2. Wheel speed sensor cable retainer (ABS only)
3. Brake pad screw (2) (metric)
4. Brake pad spring

Figure 1-36. Front Brake Caliper
REMOVAL

**WARNING**

Disconnecting spark plug cable with engine running can result in electric shock and death or serious injury. (0046d)

**NOTE**

Allow the engine to cool before servicing.

1. Disconnect spark plug cables.
2. Remove spark plugs.

INSPECTION

**NOTE**

Discard plugs with eroded electrodes, heavy deposits or a cracked insulator.

See Figure 1-37. Compare plug deposits to Table 1-15.

![Spark Plug Deposits](image)

Figure 1-37. Spark Plug Deposits

Table 1-15. Spark Plug Deposit Analysis

<table>
<thead>
<tr>
<th>PLUG</th>
<th>DEPOSITS</th>
<th>POSSIBLE CAUSE</th>
</tr>
</thead>
</table>
| 1    | Wet, black and shiny | Worn pistons  
Worn piston rings  
Worn valves  
Worn valve guides  
Worn valve seals  
Weak battery  
Faulty ignition system |
| 2    | Dry, fluffy or sooty and black | Air-fuel mixture too rich |
| 3    | Light brown and glassy*  
May be accompanied by cracks in the insulator or by electrode erosion. | Air-fuel mixture too lean  
Hot running engine  
Valves not seating  
Improper ignition timing |
| 4    | White, gray or tan and powdery | Balanced combustion  
Clean off deposits at regular intervals |

* The glassy deposit on a spark plug may cause high-speed misfiring.

CLEANING

**WARNING**

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

If the plugs require cleaning between tune-ups:

1. Clean electrodes and insulator with electrical contact cleaner. Dry plug with compressed air.
2. Use a thin file to flatten electrodes.

**NOTE**

Electrodes with sharp edges require 25-40 percent less voltage than ones with rounded edges.

3. Check condition of threads in cylinder head. Use a penetrating oil and clean out with a thread chaser. Verify that plug threads are clean.
4. If necessary, replace with new spark plugs.

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spark plug</td>
<td>12-18 ft-lbs</td>
</tr>
</tbody>
</table>

1. Verify proper gap before installing new or cleaned spark plugs.
   a. Select a wire-type feeler gauge within specification. Refer to Table 1-16.
NOTE
If there is a slight drag on the gauge, the spark plug gap is within specification.

b. Pass the wire gauge between the center and the outer electrodes.

c. If necessary use the proper tool to bend the outer electrode to bring the gap to within specification.

2. Apply ANTI-SEIZE LUBRICANT to the spark plug threads. Tighten to 12-18 ft-lbs (16.3-24.4 Nm).

3. See Figure 1-38. Connect spark plug cables. Verify that the cables are connected to coil, spark plugs and anchor clips or harness caddies.

2. Check cable boots/caps for cracks or tears. Replace boots/caps that are worn or damaged.

3. See Figure 1-39. Check spark plug cable resistance with an ohmmeter. Replace cables not meeting resistance specifications. Refer to Table 1-17.

Table 1-17. SPARK PLUG CABLE RESISTANCE VALUES

<table>
<thead>
<tr>
<th>Description</th>
<th>Length</th>
<th>Resistance Value (Ohms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All except FXSB: front cable</td>
<td>19.00</td>
<td>483</td>
</tr>
<tr>
<td>All except FXSB: rear cable</td>
<td>6.50</td>
<td>165</td>
</tr>
<tr>
<td>FXSB: both cables</td>
<td>7.25</td>
<td>184</td>
</tr>
</tbody>
</table>

Figure 1-39. Testing Resistance

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

Figure 1-38. Spark Plug Cable Routing

Table 1-16. Spark Plug Gap

<table>
<thead>
<tr>
<th>MODEL</th>
<th>TYPE</th>
<th>in</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Models</td>
<td>HD-SR12</td>
<td>0.038-0.043</td>
<td>0.97-1.09</td>
</tr>
</tbody>
</table>

SPARK PLUG CABLE INSPECTION

1. Inspect spark plug cables. Replace if necessary.
   a. Check for cracks or loose terminals.
   b. Check for loose fit on ignition coil and spark plugs.
ADJUSTMENT: FLSTC, FLSTF/B, FLSTN, FLS

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fork bracket pinch screw, upper, FLSTC, FLSTF/B, FLSTN, FLS</td>
<td>25-30 ft-lbs, 33.9-40.7 Nm</td>
</tr>
<tr>
<td>Fork bracket pinch screws, lower, FLSTC, FLSTF/B, FLSTN, FLS</td>
<td>55-60 ft-lbs, 74.6-81.4 Nm</td>
</tr>
<tr>
<td>Rear back panel screw</td>
<td>20-30 in-lbs, 2.3-3.4 Nm</td>
</tr>
<tr>
<td>Windshield mounting screw</td>
<td>96-120 in-lbs, 10.8-13.6 Nm</td>
</tr>
</tbody>
</table>

Bearing Adjustment (Fall-away)

1. Support motorcycle upright so the front fork is suspended and the vehicle is level.

2. Remove all accessory weight, such as a windshield, that could influence the way the front fork swings. Disconnect clutch and throttle cables.

3. ABS models: see Figure 1-40. Disconnect brake line from steering head.

4. Place a suitable marking material, such as marking tape, over the fender tip.

5. Install a pointer so the base is stationary on the floor and the pointer indicates the center of the fender. The front fork should point straight ahead, however the balance point could be slightly off center.

6. Check steering head bearing fall-away.
   a. Rotate the front fork from steering stop to steering stop three times. Center front fork moving from the left steering stop to the center.
   b. Tap the fender on right side toward the left steering stop until the front fork begins to fall-away by itself. Label this point on the marking material.
   c. Rotate the front fork from steering stop to steering stop three times. Center front fork moving from the right steering stop to the center.
   d. Tap the fender on left side toward the right steering stop until the front fork begins to fall-away by itself. Label this point on the marking material.
   e. Repeat steps a through d until the points become consistent.
   f. Measure distance between the two marks. This distance is the fall-away measurement.

7. The distance between the fall-away marks must be 1.0-2.0 in (25.4-50.8 mm). If the distance is within specification, no further action is necessary. Otherwise, proceed to the next step.

8. Cover fuel tank with a blanket or other protective material.

9. Loosen, but do not remove, windshield mounting screws.

10. Remove screws and right and left rear back panels from fork bracket. When removing left rear back panel, disconnect spare terminals from auxiliary lamp switch.

11. Remove fork stem cap.

12. See Figure 1-41. Loosen the upper fork stem pinch screw (4).

13. See Figure 1-42. Using a ratchet handle, socket extension (1) and a torque adapter (2), loosen, but do not remove, lower fork bracket pinch screws (3).

14. See Figure 1-41. Adjust fall-away to specification:
   a. If the distance (fall-away measurement) exceeds 2.0 in (50.8 mm), loosen the fork stem bolt (2) slightly.
   b. If the distance (fall-away measurement) is less than 1.6 in (25.4 mm), tighten the fork stem bolt (2) slightly.

15. Tighten the upper fork bracket pinch screw to 25-30 ft-lbs (33.9-40.7 Nm).

16. Strike both fork tubes with a composite dead blow hammer to free the tubes if they are stuck in the lower fork bracket.

   **NOTE**
   See Figure 1-42. The torque adapter must be positioned at a 90 degree angle to the torque wrench handle to obtain an accurate torque reading.

17. Using a socket extension and torque adapter, tighten lower fork bracket pinch bolts to 65-80 ft-lbs (74.6-81.4 Nm).

18. Repeat procedure to determine if fall-away is within specifications.
19. Plug auxiliary lamp spade terminals into switch mounted on left rear back panel.
20. Install left and right rear back panels onto fork bracket. Tighten screws to 20-30 in-lbs (2.3-3.4 Nm).
21. Tighten windshield mounting screws to 96-120 in-lbs (10.8-13.6 Nm).
22. **ABS models**: see Figure 1-40 and 2.15 BRAKE LINES. Connect brake line to steering head.
23. Connect clutch and/or throttle cables, if disconnected.
24. Install windshield and any other accessories, if removed.

![Figure 1-41. Steering Head: FLSTC, FLSTF/B, FLSTN, FLS](image)

1. Fork stem cap
2. Fork stem bolt
3. Washer
4. Pinch screw
5. Upper bracket
6. Upper dust shield
7. Upper bearing
8. Upper bearing race
9. Lower bearing race
10. Lower bearing
11. Lower dust shield
12. Fork stem and bracket

![Figure 1-42. Accessing Lower Fork Bracket Pinch Screws](image)

**ADJUSTMENT: FXST**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fork stem nut, FXST</td>
<td>70-80 ft-lbs, 94.9-108.4 Nm</td>
</tr>
<tr>
<td>Fork bracket pinch bolt, lower, FXST</td>
<td>55-60 ft-lbs, 74.6-81.4 Nm</td>
</tr>
<tr>
<td>Fork stem nut, FXST</td>
<td>70-80 ft-lbs, 94.9-108.4 Nm</td>
</tr>
<tr>
<td>Fork bracket pinch bolt, lower, FXST</td>
<td>55-60 ft-lbs, 74.6-81.4 Nm</td>
</tr>
</tbody>
</table>

**Bearing Adjustment (Fall-away)**

1. Support motorcycle upright so the front fork is completely suspended and the vehicle is level.
2. Remove all accessory weight, such as a windshield, that may influence the way the front fork swings. If clutch cable is routed so it pulls the front fork one way or the other, disconnect it.
3. **ABS models**: disconnect brake line from steering head.
4. Place a suitable marking material, such as masking tape, over the fender tip.
5. Install a pointer so the base is stationary on the floor and the pointer indicates the center of the fender. The front fork should be straight ahead, however the balance point may be slightly off center.
6. Check steering head bearing fall-away:
   a. Rotate the front fork from steering stop to steering stop three times and then center the front fork.
   b. Tap the fender on one side until the front fork begins to fall-away by itself. Label this point on the marking material.
   c. Repeat the previous step in the other direction.
   d. Repeat until marks are consistent. If marks vary, use the average.
   e. Measure distance between marks.

7. The distance between the fall-away marks must be 1.0-2.0 in. (25.4-50.8 mm). If fall-away is not within specifications, see next steps.

8. If the distance exceeds 2.0 in. (50.8 mm):
   a. See Figure 1-43. Loosen the upper fork stem bracket pinch bolts (5).
   b. Loosen the lower fork stem pinch bolts.
   c. Loosen the fork stem nut (2).
   d. Loosen the bearing adjustment nut (6) slightly.
   e. Tighten the fork stem nut to 70-80 ft-lbs (94.9-108.4 Nm).
   f. Tighten lower fork bracket pinch bolts to 55-60 ft-lbs (74.6-81.4 Nm).
   g. Repeat procedure to determine if fall-away is within specifications.

9. If the distance is less than 1.0 in. (25.4 mm):
   a. See Figure 1-43. Loosen the upper fork stem bracket pinch bolts (5).
   b. Loosen the lower fork stem pinch bolts.
   c. Loosen the fork stem nut (2).
   d. Tighten the bearing adjustment nut (6) slightly.
   e. Tighten the fork stem nut to 70-80 ft-lbs (94.9-108.4 Nm).
   f. Tighten lower fork bracket pinch bolts to 55-60 ft-lbs (74.6-81.4 Nm).
   g. Repeat procedure to determine if fall-away is within specifications.

NOTE
If adjustment seems to have no impact, check to see if fork tubes are stuck in clamps. If necessary, strike tubes with a dead blow hammer to free. Test steering head bearing fall-away after freeing forks.

ADJUSTMENT: FXSB

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fork stem nut, FXSB</td>
<td>70-80 ft-lbs</td>
</tr>
<tr>
<td>Fork bracket pinch bolt, lower</td>
<td>30-35 ft-lbs</td>
</tr>
<tr>
<td>Fork stem nut, FXSB</td>
<td>70-80 ft-lbs</td>
</tr>
<tr>
<td>Fork bracket pinch bolt, lower</td>
<td>30-35 ft-lbs</td>
</tr>
</tbody>
</table>

Bearing Adjustment (Fall-away)

1. Support motorcycle upright so front fork is completely suspended and the vehicle is level.

2. Remove all accessory weight, such as a windshield, that may influence the way the front fork swings.

3. ABS models: disconnect brake line from steering head.

4. Place a suitable marking material, such as masking tape over the fender tip.

5. Install a pointer so the base is stationary on the floor and the pointer indicates the center of the fender. The front
fork should be straight ahead, however the balance point may be slightly off center.

6. Check steering head bearing fall-away.
   a. Rotate the front fork from steering stop to steering stop three times and then center the front fork.
   b. Tap the fender on one side until the front fork begins to fall-away by itself. Label this point on the marking material.
   c. Repeat the previous step in the other direction.
   d. Repeat until marks are consistent. If marks vary, use the average.
   e. Measure distance between marks.

7. The distance between the fall-away marks must be 2.0–4.0 in. (50.8–101.6 mm). If fall-away is not within specifications, see next steps.

8. If the distance exceeds 4.0 in. (101.6 mm):
   a. See Figure 1-44. Loosen the lower pinch bolts (5).
   b. Remove fork stem cap (1).
   c. Loosen the fork stem nut (2).
   d. Loosen the bearing adjustment nut (4) slightly.
   e. Tighten the fork stem nut to 70-80 ft-lbs (94.9-108.4 Nm).
   f. Tighten pinch bolts to 30-35 ft-lbs (40.7-47.5 Nm).
   g. Install fork stem cap (1).
   h. Repeat procedure to determine if fall-away is within specifications.

9. If the distance is less than 2.0 in. (50.8 mm):
   a. See Figure 1-44. Loosen lower pinch bolts (5).
   b. Remove fork stem cap (1).
   c. Loosen fork stem nut (2).
   d. Tighten bearing adjustment nut (4) slightly.
   e. Tighten fork stem nut to 70-80 ft-lbs (94.9-108.4 Nm).
   f. Tighten lower pinch bolts to 30-35 ft-lbs (40.7-47.5 Nm).
   g. Install fork stem cap (1).
   h. Repeat procedure to determine if fall-away is within specifications.

NOTE
If adjustment seems to have no impact, check to see if fork tubes are stuck in clamps. If necessary, strike tubes with a dead blow hammer to free. Test steering head bearing fall-away after freeing forks.

LUBRICATION
See Figure 1-45. Use SPECIAL PURPOSE GREASE every 10,000 mile (16,000 km) service interval. Fill grease fitting on steering neck until grease begins to come out the top and bottom of the steering head.

Figure 1-44. Steering Head: FXSB

Figure 1-45. Grease Fitting

2015 Softail Service: Maintenance 1-47
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 1.19 BATTERY MAINTENANCE, Charging Battery. For testing information, see the electrical diagnostic manual.

---

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)

---

1. Contents are corrosive
2. Wear safety glasses
3. Contents are explosive
4. Keep flames away
5. Read instructions
6. Keep away from children
Table 1-18. Antidotes for Battery Acid

<table>
<thead>
<tr>
<th>CONTACT</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>External</td>
<td>Flush with water.</td>
</tr>
<tr>
<td>Internal</td>
<td>Drink large quantities of milk or water, followed by milk of magnesia, vegetable oil or beaten eggs. Get immediate medical attention.</td>
</tr>
<tr>
<td>Eyes</td>
<td>Flush with water. Get immediate medical attention.</td>
</tr>
</tbody>
</table>

CLEANING AND INSPECTION

NOTE
Battery top must be clean and dry. Dirt and electrolyte on top of the battery causes battery to self-discharge.

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

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)

The voltmeter test provides a general indicator of battery condition. Check the voltage of the battery to verify that it is fully charged.

1. If the open circuit (disconnected) voltage reading is below 12.6 V:
   a. Charge the battery.
   b. Check the voltage after the battery has set for at least one hour.

2. If the voltage reading is 12.7 V or above:
   a. Perform a battery diagnostic test. See the electrical diagnostic manual for the load test procedure.
   b. Refer to Table 1-19.

Table 1-19. Voltmeter Test For Battery Charge Conditions

<table>
<thead>
<tr>
<th>VOLTAGE (OCV)</th>
<th>STATE OF CHARGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.7 V</td>
<td>100%</td>
</tr>
<tr>
<td>12.6 V</td>
<td>75%</td>
</tr>
<tr>
<td>12.3 V</td>
<td>50%</td>
</tr>
<tr>
<td>12.0 V</td>
<td>25%</td>
</tr>
<tr>
<td>11.8 V</td>
<td>0%</td>
</tr>
</tbody>
</table>

CHARGING BATTERY

Safety Precautions
An automatic, constant monitoring battery charger/tender with a charging rate of 5 amps maximum at no more than 14.8 volts is recommended. The use of constant current chargers (including trickle chargers) to charge sealed AGM batteries is not recommended.

Any overcharge will cause dry-out and premature battery failure. Always review charger instructions before charging a battery. 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 or disconnecting 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. Black negative lead to the negative terminal. If the battery is still in the vehicle, connect the negative lead to the chassis ground. Verify that the ignition and all electrical accessories are turned off.
- Verify that charger leads to battery are not separated, frayed or loose.
- If the battery temperature exceeds 110 °F (43 °C) during charging, discontinue charger and allow the battery to cool.

Using a Battery Charger
Charge the battery if:

- 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)
**NOTICE**

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. (00415b)

1. Check charge state with voltmeter test. If battery voltage is less than 12.7 volts, see the next step.

**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. (00068a)

**NOTICE**

Do not reverse the charger connections described in the following steps or the charging system of the motorcycle could be damaged. (0214a)

**NOTES**

- Most constant monitoring battery chargers are completely automatic. They can be left connected to both AC power and to the battery that is being charged. When leaving this type of charger connected for extended periods of time, periodically check the battery to see if it is unusually warm. This is an indication that the battery may have a weak cell or internal short. Read the manufacturer’s instructions for the charger.

- Do not use battery chargers that produce excessively high voltage designed for flooded batteries or excessively high current designed for much larger batteries. Charging should be limited to 5 amps maximum at no more than 14.6 volts.

2. Connect red battery charger lead to the positive terminal and 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.

3. Step away from the battery and turn on the charger.

**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)

4. After the battery is fully charged, turn the charger OFF. Disconnect the black battery charger lead from the negative terminal of the battery.

5. Disconnect the red battery charger lead from the positive terminal of the battery.

6. Mark the charging date on the battery.

7. Perform a battery diagnostic test to determine the condition of the battery. See the electrical diagnostic manual.

8. If charging a battery because voltmeter test reading was below 12.6 V, perform voltmeter test. See the electrical diagnostic manual.

**BATTERY DISCONNECTION AND 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)

Security siren: To prevent the optional siren from sounding, turn on the ignition with the hands-free fob present to disarm the security system.

1. Remove seat.

2. See Figure 1-48. Remove battery negative cable (black) from battery negative terminal.

3. Remove battery positive cable (red) from battery positive terminal.

4. Remove battery.

![Figure 1-48, Battery Connections](image)

**STORAGE**

**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)

If the motorcycle is stored with the security system armed, connect an automatic, constant monitoring battery charger/tender to maintain battery charge. Refer to the Harley-Davidson Parts and Accessories catalog.
If the motorcycle is stored with the battery installed, without a Harley-Davidson constant monitoring battery charger/tender and with the security system not armed, remove main fuse.

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

See Figure 1-49. A battery that is removed from the vehicle is affected by self-discharge. A battery that is stored in the vehicle is affected by self-discharge and, more significantly, by parasitic loads. A parasitic load is caused by things like diode leakage or maintaining computer memory with the vehicle turned off.

Batteries self-discharge at a faster rate at higher ambient temperatures. To reduce the self-discharge rate, store battery in a cool, dry place.

Charge the battery every two weeks if stored in the vehicle.

Charge the battery once per month if stored out of the vehicle.

NOTE
Use a Harley-Davidson constant monitoring battery charger/tender to maintain battery charge for extended periods of time without risk of overcharging or boiling.

[Image of temperature and capacity graph]

Figure 1-49. Battery Self-Discharge Rate

1. Capacity
2. Months of non-use

BATTERY INSTALLATION AND CONNECTION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starter nut</td>
<td>70-90 in-lbs</td>
</tr>
<tr>
<td>Battery terminal fasteners</td>
<td>60-72 in-lbs</td>
</tr>
<tr>
<td>Battery terminal fasteners</td>
<td>60-72 in-lbs</td>
</tr>
</tbody>
</table>

3. See Figure 1-51. Place battery caddy into position and install battery caddy clip (1) under front of battery tray (3). Make sure tabs (2) of battery caddy fit over rear of battery tray.

4. See Figure 1-52. Install positive battery cable (1) into clip in caddy. Place an S-shaped bend in the positive battery cable at the starter end of the cable. This properly positions the terminal end for battery installation.

5. Route rear O2 sensor harness (2) through clip (3).

NOTICE
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)

6. See Figure 1-53. Install battery. Tighten positive battery terminal fastener to 60-72 in-lbs (6.8-8.1 Nm).

7. Install negative battery cable at battery frame ground (1) before any accessory ground wires.

8. Install negative battery cable (2) at battery. Tighten negative battery terminal fastener to 60-72 in-lbs (6.8-8.1 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)

9. Install seat.

[Image of battery cable routing]

Figure 1-50. Positive Battery Cable Routing

1. See Figure 1-50. Position positive battery cable properly at starter. Cable end must face 35 +/-10 degrees forward from left side of vehicle.

WARNING
Be sure rubber boot covers starter solenoid terminal connected to positive (+) battery cable. An uncovered terminal can short and cause sparks, which could result in a battery explosion and death or serious injury. (00463c)

2. Tighten starter nut to 70-90 in-lbs (7.9-10.2 Nm). Cover with boot.
1. Clip
2. Tabs
3. Battery tray

Figure 1-51. Battery Caddy

1. Battery frame ground
2. Negative battery cable
3. Positive battery cable

Figure 1-53. Battery Connections

1. Positive battery cable
2. Rear oxygen sensor harness
3. Clip

Figure 1-52. Battery Caddy Wire Routing
HEADLAMP 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. (000309)

NOTE

Adjust the headlamps of motorcycles with multiple beam headlamps to converge into one pattern.

1. Check the tire pressure.
2. Fill fuel tank or add an equal amount of ballast.
3. Adjust the rear shocks for the rider and intended load.

NOTE

Choose a wall in minimum light.

4. See Figure 1-54. Park the motorcycle in a line (1) perpendicular to the wall.
5. Position motorcycle so that front axle is 25 ft (7.6 m) from wall.
6. Draw a vertical line (2) on the wall.
7. With the motorcycle loaded, point the front wheel straight forward at wall. Measure the distance (4) from the floor to the center of the high beam bulb.
8. Draw a horizontal line (5) through the vertical line on the wall. Place line 2.1 in (53.3 mm) lower than the measured bulb centerline.

NOTE

See Figure 1-54. The headlamp is aligned when the light beam hot spot is located over the intersection of the lines.

9. With the high beam activated, verify headlamp alignment. Adjust as necessary.

1. Perpendicular line
2. Vertical line
3. 25 ft (7.6 m)
4. High beam bulb centerline
5. Horizontal line 2.1 in (53.3 mm) lower than bulb centerline

Figure 1-54. Headlamp Alignment

HEADLAMP ADJUSTMENT

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headlamp horizontal adjustment fastener</td>
<td>30-35 ft-lbs</td>
</tr>
<tr>
<td>Headlamp vertical adjusting bolt</td>
<td>25-30 ft-lbs</td>
</tr>
</tbody>
</table>

1. See Figure 1-55. Loosen horizontal adjustment fastener (2). Tilt headlamp left or right to direct light beam straight ahead.
2. Tighten horizontal adjustment fastener (2) to 30-35 ft-lbs (40.7-47.5 Nm).
3. Loosen vertical adjustment fastener (1). Tilt headlamp up or down in relationship to the horizontal line from the headlamp alignment inspection.
4. Tighten vertical adjustment fastener (1) to:
   a. FXSB: 25-30 ft-lbs (33.9-40.7 Nm).
1. Vertical adjusting bolt
2. Horizontal adjusting bolt

Figure 1-55. Headlamp Adjustment (typical)
SHOCK ABSORBERS

PART NUMBER | TOOL NAME
--- | ---
94448-82B | SHOCK ADJUSTMENT SPANNER

Calculate Number of Turns

Softail models feature adjustable rear shock absorbers located under the motorcycle. The rear shock spring preload is adjusted to the total load or may be varied to suit your own personal comfort.

**NOTE**

Refer to Table 2-11. To determine the motorcycle configuration for an FLS or FLSTFB, check the configuration/calibration character stamped on the VIN.

1. Identify the number of preload turns for the weight of the rider.
   a. FLSTC, FLSTF, FXST, FLS (APC, AUS), FLSTFB (HDI, ENG, IND, BRZ): Refer to Table 1-20.
   b. FXSB, FLSTN, FLS (all except APC/AUS), FLSTFB (all except HDI, ENG, IND, BRZ): Refer to Table 1-21.

2. Calculate the number of turns for the intended passenger and cargo.

3. Add the number of turns for the rider to the number of turns required for the total weight of the passenger and/or cargo.

<table>
<thead>
<tr>
<th>RIDER WEIGHT</th>
<th>TURNS**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 185 lb (84 kg)</td>
<td>0</td>
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<tr>
<td>185-235 lb (84-107 kg)</td>
<td>1</td>
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<tr>
<td>235-285 lb (107-129 kg)</td>
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<tr>
<td>285-340 lb (129-154 kg)</td>
<td>3</td>
</tr>
<tr>
<td>340 lb (154 kg) to maximum added weight allowed (refer to Table 2-4 and Table 2-5)</td>
<td>4</td>
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</table>

*Passenger/Cargo: For every 35 lb (15.8 kg) increase preload one turn.
**Turns out (counterclockwise) from minimum preload.

Table 1-21. Shock Preload: FXSB, FLSTN, FLS (all except APC, AUS), FLSTFB (all except HDI, ENG, IND, BRZ)

Adjustment

**NOTES**

- Adjust the shocks with the motorcycle resting on the jiffy stand.
- Adjust both shocks the same number of turns.

1. See Figure 1-56. Hold the shaft with a wrench on the flats of the shock shaft and loosen the jamnut (2).

2. Use the tangs of the SHOCK ADJUSTMENT SPANNER (Part No. 94448-82B) in the holes in the rear shock canister (1) to turn the canister clockwise until it stops. This position is the minimum preload position.

3. Mark the face of the canister for reference.

4. Turn the canister counterclockwise the number of turns calculated for the total load.

5. Tighten the jamnut.

![Figure 1-56. Rear Shock Adjustment](image)

1. Rear shock canister
2. Jamnut
3. Spring adjuster plate

2015 Softail Service: Maintenance 1-55
GENERAL
Always prepare motorcycle for extended storage following service manual procedures. This will help protect parts against corrosion, preserve the battery and prevent buildup of gum and varnish in the fuel system.

PLACING IN STORAGE

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. (0003a)

1. Run motorcycle until engine is at normal operating temperature. Stop the engine then drain the oil tank, install a new oil filter, and fill oil tank 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. Install spark plugs.

4. Inspect drive belt deflection. See 1.12 DRIVE BELT AND SPROCKETS.

5. Inspect drive belt and sprockets. See 1.12 DRIVE BELT AND SPROCKETS.

6. Inspect air cleaner filter. See 1.7 AIR CLEANER AND EXHAUST SYSTEM.

7. Lubricate controls. See 1.14 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 1.19 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 a Harley-Davidson storage cover of 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)

Use the symptoms listed for general troubleshooting. More than one condition may be present at a time. Check all possible items to keep motorcycle in good operating condition.

NOTE

See the electrical diagnostic manual for additional information.

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. ECM Bank Angle Sensor tripped and ignition/ignition 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. Main fuse not in place

Engine Turns Over But Does Not Start
1. Fuel tank empty.
2. Fouled spark plugs.
3. Discharged battery, loose or damaged battery terminal connections.
4. Engine lubricant too heavy (winter operation).
5. Spark plug cables in bad condition and shorting, cable connections loose or cables connected to incorrect cylinders.
6. Loose wire connection at coil, battery, or ECM connector.
7. Ignition timing incorrect due to faulty coil, ECM or sensors.
8. Bank Angle Sensor tripped and ignition switch not cycled OFF then back to IGNITION.
10. Sticking or damaged valve(s) or wrong length pushrod(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).

NOTES

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.
10. Air leak at intake manifold or air cleaner.
11. Loose or dirty ECM connector.
12. Faulty Sensor(s): Manifold Absolute Pressure (MAP), Crank Position (CKP) or Oxygen (O2).
13. Incorrect idle timing.
14. Weak or damaged valve springs.
15. Damaged intake or exhaust valve.
16. Partially plugged fuel injector(s).
17. Air cleaner EVAP solenoid (if equipped) stuck closed or inoperative.
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 damaged.
4. Valve guides or seals badly worn.

Pre-Ignition or Detonation (Knocks or Pings)
1. Fuel octane rating too low.
2. Faulty spark plugs.
3. Incorrect spark plug for the kind of service.
4. Excessive carbon deposit on piston head or in combustion chamber.
5. Ignition timing advanced due to faulty sensor inputs (MAP and/or CKP).
6. Ignition timing advanced due to ECM or sensors (CKP, ET or MAP) defective.
7. Intake manifold vacuum leak.

Overheating
1. Insufficient oil supply or oil not circulating.
2. Insufficient airflow over engine.
3. Heavy carbon deposits.
4. Ignition timing retarded due to defective ECM or faulty sensor(s); Manifold Absolute Pressure (MAP) and/or Crank Position (CKP).
5. Leaking valve(s).
6. O-ring damaged or missing from oil pump/crankcase junction (also results in poor engine performance).

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 pushrod(s).
4. Incorrect pushrod length.
5. Rocker arm binding on shaft.
6. Valve sticking or guides.
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. Primary chain badly worn or links tight as a result of insufficient lubrication or misalignment.
3. Engine to transmission mounting bolts loose.
4. Upper engine mounting bracket loose.
5. Ignition timing advanced due to faulty sensor inputs (MAP, CKP) or poorly tuned engine.
7. Damaged frame.
8. Engine counterbalancer out of time or bearing failed.
9. Rear fork pivot shaft fasteners loose.
10. 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 Tank
1. Oil tank empty.
2. Oil pump not functioning.
3. Return oil pump gears damaged.
4. Restricted oil lines or fittings.
5. Restricted oil filter.
6. Oil pump misaligned or in poor condition.
7. 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 tank overfilled.
2. Restricted oil return line to oil tank.
3. Restricted breather operation.
4. Restricted oil filter.
5. Oil pump misaligned or in poor condition.
6. Piston rings badly worn or damaged.
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).
10. Oil diluted with gasoline.

Engine Leaks Oil From Cases, Pushrods, Hoses, Etc.
1. Loose parts.
2. Imperfect seal at gaskets, pushrod cover, washers, etc.
3. Restricted breather passages or hose to air cleaner.
4. Restricted oil filter.
5. Oil tank overfilled.
6. Lower rocker housing gasket installed incorrectly (upside down).
7. Restricted oil return line to oil tank.
8. Porosity.
Low Oil Pressure
1. Oil tank 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. Restricted feed hose from oil tank.
8. Oil diluted with gasoline.

High Oil Pressure
1. 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 damaged.
3. Faulty voltage regulator module.
4. Loose or damaged 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 and 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. See 1.6 TIRES AND WHEELS
5. Shock absorber not functioning normally.
6. Loose wheel axle nuts. Tighten to recommended torque specification.
7. Rear wheel out of alignment with frame and front wheel.
8. Steering head bearings improperly adjusted. Correct adjustment and replace pitted or worn bearings and races.
9. Loose spokes (laced wheel vehicles only).
10. Tire and wheel unbalanced.
11. Rims and tires out-of-round or eccentric with hub.
12. Rims and tires out-of-true sideways.
13. Rear fork pivot-improper torque.
14. Incorrect, non-specified tire(s) mounted on front or rear wheel.

BRAKES

Brake Does Not Hold Normally
1. Brake fluid reservoir low, system leaking or pads worn.
2. Brake system contains air bubbles.
3. Master cylinder/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.
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# FASTENER TORQUE VALUES

## FASTENER TORQUE VALUES IN THIS CHAPTER

The table below lists torque values for all fasteners presented in this chapter.

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<td>Brake hose bracket bolt, front</td>
<td>96-120 in-lbs</td>
<td>10.8-13.6 Nm</td>
</tr>
<tr>
<td>Brake hose bracket bolt, front</td>
<td>96-120 in-lbs</td>
<td>10.8-13.6 Nm</td>
</tr>
<tr>
<td>Brake hose bracket bolt, front</td>
<td>96-120 in-lbs</td>
<td>10.8-13.6 Nm</td>
</tr>
<tr>
<td>FASTENER</td>
<td>TORQUE VALUE</td>
<td>NOTES</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>--------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>Brake master cylinder, front, reservoir cover screws</td>
<td>8.9-17.7 in-lbs</td>
<td>2.18 BLEEDING BRAKES, Procedure</td>
</tr>
<tr>
<td>Brake master cylinder, rear, reservoir cover screws</td>
<td>6-8 in-lbs</td>
<td>2.18 BLEEDING BRAKES, Procedure</td>
</tr>
<tr>
<td>Brake pad pin, rear caliper</td>
<td>80-120 in-lbs</td>
<td>2.14 REAR BRAKE CALIPER, Assembly</td>
</tr>
<tr>
<td>Fender, rear, support fasteners, lower-front, 1st torque: FLSTC</td>
<td>30-35 ft-lbs</td>
<td>2.31 REAR FENDER: FLSTC, Installation/Initial torque</td>
</tr>
<tr>
<td>Fender, rear, support fasteners, lower-front, 1st torque: FLSTF/B</td>
<td>30-35 ft-lbs</td>
<td>2.32 REAR FENDER: FLSTF/B, Installation/Initial torque</td>
</tr>
<tr>
<td>Fender, rear, support fasteners, lower-front, 1st torque: FLSTN</td>
<td>30-35 ft-lbs</td>
<td>2.33 REAR FENDER: FLSTN, Installation/Initial torque</td>
</tr>
<tr>
<td>Fender, rear, support fasteners, lower-front, 1st torque: FXST</td>
<td>30-35 ft-lbs</td>
<td>2.34 REAR FENDER: FXST, Installation/Initial torque</td>
</tr>
<tr>
<td>Fender, rear, support fasteners, final torque: FLSTC</td>
<td>38-42 ft-lbs</td>
<td>2.35 REAR FENDER: FLSTC, Installation/Initial torque</td>
</tr>
<tr>
<td>Fender, rear, support fasteners, final torque: FLSTF/B</td>
<td>38-42 ft-lbs</td>
<td>2.36 REAR FENDER: FLSTF/B, Installation/Initial torque</td>
</tr>
<tr>
<td>Fender, rear, support fasteners, final torque: FLSTN</td>
<td>38-42 ft-lbs</td>
<td>2.37 REAR FENDER: FLSTN, Installation/Initial torque</td>
</tr>
<tr>
<td>Fender, rear, support fasteners, final torque: FXST</td>
<td>38-42 ft-lbs</td>
<td>2.38 REAR FENDER: FXST, Installation/Initial torque</td>
</tr>
<tr>
<td>Fender, rear, support fasteners, upper: FLSTC</td>
<td>21-27 ft-lbs</td>
<td>2.39 REAR FENDER: FLSTC, Installation</td>
</tr>
<tr>
<td>Fender, rear, support fasteners, upper: FLSTF/B</td>
<td>21-27 ft-lbs</td>
<td>2.40 REAR FENDER: FLSTF/B, Installation</td>
</tr>
<tr>
<td>Fender, rear, support fasteners, upper: FLSTN</td>
<td>21-27 ft-lbs</td>
<td>2.41 REAR FENDER: FLSTN, Installation</td>
</tr>
<tr>
<td>Fender, rear, support fasteners, upper: FXST</td>
<td>21-27 ft-lbs</td>
<td>2.42 REAR FENDER: FXST, Installation</td>
</tr>
<tr>
<td>Fender fasteners, front</td>
<td>15-21 ft-lbs</td>
<td>2.43 REAR FENDER: FLS, Installation/Initial torque</td>
</tr>
<tr>
<td>Fender support fasteners, rear, 1st torque: FLS</td>
<td>30-35 ft-lbs</td>
<td>2.44 REAR FENDER: FLS, Installation/Initial torque</td>
</tr>
<tr>
<td>Fender support fasteners, rear, final torque: FLS</td>
<td>38-42 ft-lbs</td>
<td>2.45 REAR FENDER: FLS, Installation/Initial torque</td>
</tr>
<tr>
<td>Fender support fasteners - final torque</td>
<td>38-42 ft-lbs</td>
<td>2.46 REAR FENDER: FLS, Installation/Initial torque</td>
</tr>
<tr>
<td>Fender support fasteners - first torque</td>
<td>30-35 ft-lbs</td>
<td>2.47 REAR FENDER: FLS, Installation/Initial torque</td>
</tr>
<tr>
<td>Fender support studs: FLSTC</td>
<td>21-27 ft-lbs</td>
<td>2.48 REAR FENDER: FLS, Installation/Initial torque</td>
</tr>
<tr>
<td>Fender support to fender fasteners, rear: FLS</td>
<td>21-27 ft-lbs</td>
<td>2.49 REAR FENDER: FLS, Installation/Initial torque</td>
</tr>
<tr>
<td>Footrest support screw, passenger</td>
<td>25-30 ft-lbs</td>
<td>2.50 FOOTBOARDS AND FOOTRESTS, Passenger Footrest</td>
</tr>
<tr>
<td>Footrest support screw, passenger, left-side: FLSTN</td>
<td>25-30 ft-lbs</td>
<td>2.51 FOOTBOARDS AND FOOTRESTS, Passenger Footrest</td>
</tr>
<tr>
<td>Fork damper tube screw, front</td>
<td>130-216 in-lbs</td>
<td>2.52 FOOTBOARDS AND FOOTRESTS, Passenger Footrest</td>
</tr>
<tr>
<td>Fork drain screw</td>
<td>52-78 in-lbs</td>
<td>2.53 FRONT FORK, Replacing Fork Oil</td>
</tr>
<tr>
<td>Fork lock set screw</td>
<td>10-12 in-lbs</td>
<td>2.54 FOlk LOCK, Installation</td>
</tr>
<tr>
<td>Fork stem nut: FXSB</td>
<td>70-80 ft-lbs</td>
<td>2.55 STEERING HEAD, Installation</td>
</tr>
<tr>
<td>Fork stem nut: FXST</td>
<td>70-80 ft-lbs</td>
<td>2.56 STEERING HEAD, Installation</td>
</tr>
<tr>
<td>Fork stem pinch bolts, lower: all but FXSB</td>
<td>55-60 ft-lbs</td>
<td>2.57 FRONT FORK, Installation</td>
</tr>
<tr>
<td>FASTENER</td>
<td>TORQUE VALUE</td>
<td>NOTES</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>--------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>Fork stem pinch bolts, upper and lower: FXSB</td>
<td>30-35 ft-lbs</td>
<td>2.19 FRONT FORK, Installation</td>
</tr>
<tr>
<td>Fork stem upper bracket pinch bolt: FLSTC, FLSTF/B, FLSTN, FLS</td>
<td>25-30 ft-lbs</td>
<td>2.20 STEERING HEAD, Installation</td>
</tr>
<tr>
<td>Fork tube cap</td>
<td>60-70 ft-lbs</td>
<td>2.19 FRONT FORK, Replacing Fork Oil</td>
</tr>
<tr>
<td>Handlebar clamp fasteners, lower: FLSTC, FLSTN, FLS, FXST</td>
<td>30-40 ft-lbs</td>
<td>2.27 HANDLEBAR: FLSTC, FLSTN, FLS, FXST, Installation</td>
</tr>
<tr>
<td>Handlebar clamp front fasteners</td>
<td>12-16 ft-lbs</td>
<td>2.29 HANDLEBAR: FXSB, Installation</td>
</tr>
<tr>
<td>Handlebar clamp front fasteners: FLSTC, FLSTN, FLS, FXST</td>
<td>12-15 ft-lbs</td>
<td>2.27 HANDLEBAR: FLSTC, FLSTN, FLS, FXST, Installation</td>
</tr>
<tr>
<td>Handlebar clamp rear fasteners</td>
<td>12-16 ft-lbs</td>
<td>2.29 HANDLEBAR: FXSB, Installation</td>
</tr>
<tr>
<td>Handlebar clamp rear fasteners: FLSTC, FLSTN, FLS, FXST</td>
<td>12-15 ft-lbs</td>
<td>2.27 HANDLEBAR: FLSTC, FLSTN, FLS, FXST, Installation</td>
</tr>
<tr>
<td>Handlebar lower clamp fastener: FLSTF/B</td>
<td>30-40 ft-lbs</td>
<td>2.28 HANDLEBAR: FLSTF/B, Installation</td>
</tr>
<tr>
<td>Handlebar switch clamp screw</td>
<td>60-80 in-lbs</td>
<td>2.11 FRONT BRAKE MASTER CYLINDER, Assembly and Installation</td>
</tr>
<tr>
<td>Handlebar upper clamp fasteners: FLSTF/B</td>
<td>12-18 ft-lbs</td>
<td>2.28 HANDLEBAR: FLSTF/B, Installation</td>
</tr>
<tr>
<td>HCU, rear, bracket screws</td>
<td>36-72 in-lbs</td>
<td>2.17 ABS: HYDRAULIC CONTROL UNIT (HCU), Rear Hydraulic Control Unit (HCU)</td>
</tr>
<tr>
<td>HCU, rear, clamp screw</td>
<td>24-42 in-lbs</td>
<td>2.17 ABS: HYDRAULIC CONTROL UNIT (HCU), Rear Hydraulic Control Unit (HCU)</td>
</tr>
<tr>
<td>HCU screws, lower front</td>
<td>54-84 in-lbs</td>
<td>2.17 ABS: HYDRAULIC CONTROL UNIT (HCU), Front Hydraulic Control Unit (HCU)</td>
</tr>
<tr>
<td>HCU screws, rear cover to front</td>
<td>24-36 in-lbs</td>
<td>2.17 ABS: HYDRAULIC CONTROL UNIT (HCU), Front Hydraulic Control Unit (HCU)</td>
</tr>
<tr>
<td>HCU screws, upper front</td>
<td>48-72 in-lbs</td>
<td>2.17 ABS: HYDRAULIC CONTROL UNIT (HCU), Front Hydraulic Control Unit (HCU)</td>
</tr>
<tr>
<td>Jiffy stem bracket assembly screws</td>
<td>25-30 ft-lbs</td>
<td>2.39 JIFFY STAND, Installation</td>
</tr>
<tr>
<td>Jiffy stem sensor screw</td>
<td>96-144 in-lbs</td>
<td>2.39 JIFFY STAND, Sensor: HDI Models</td>
</tr>
<tr>
<td>License plate bracket to mounting bracket lower fasteners: FLS</td>
<td>12-18 in-lbs</td>
<td>2.34 REAR FENDER: FLS, Installation/Rear mount license plate.</td>
</tr>
<tr>
<td>License plate bracket to mounting bracket upper fasteners: FLS</td>
<td>60-80 in-lbs</td>
<td>2.34 REAR FENDER: FLS, Installation/Rear mount license plate.</td>
</tr>
<tr>
<td>Lower handlebar clamp fasteners</td>
<td>30-40 ft-lbs</td>
<td>2.29 HANDLEBAR: FXSB, Installation</td>
</tr>
<tr>
<td>Luggage rack front fasteners: FLSTN</td>
<td>96-120 in-lbs</td>
<td>2.44 LUGGAGE RACK: FLSTN, Removal and Installation</td>
</tr>
<tr>
<td>Luggage rack rear fasteners: FLSTN</td>
<td>12-14 ft-lbs</td>
<td>2.44 LUGGAGE RACK: FLSTN, Removal and Installation</td>
</tr>
<tr>
<td>Pivot shaft nut</td>
<td>90-110 ft-lbs</td>
<td>2.23 REAR FORK, Installation</td>
</tr>
<tr>
<td>Rear brake master cylinder retainer fastener</td>
<td>29-34 ft-lbs</td>
<td>2.13 REAR BRAKE MASTER CYLINDER, Installation</td>
</tr>
<tr>
<td>Rear caliper banjo bolt</td>
<td>17-22 ft-lbs</td>
<td>2.14 REAR BRAKE CALIPER, Installation</td>
</tr>
<tr>
<td>Rear fender support to fender, FXSB</td>
<td>21-27 ft-lbs</td>
<td>2.35 REAR FENDER: FXSB, Installation</td>
</tr>
<tr>
<td>Rear fender support to frame fasteners: 1st torque, FXSB</td>
<td>30-35 ft-lbs</td>
<td>2.35 REAR FENDER: FXSB, Installation</td>
</tr>
<tr>
<td>Rear fender support to frame fasteners: final torque, FXSB</td>
<td>38-42 ft-lbs</td>
<td>2.35 REAR FENDER: FXSB, Installation</td>
</tr>
<tr>
<td>Rear master cylinder banjo bolt</td>
<td>17-22 ft-lbs</td>
<td>2.13 REAR BRAKE MASTER CYLINDER, Installation</td>
</tr>
<tr>
<td>FASTENER</td>
<td>TORQUE VALUE</td>
<td>NOTES</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>--------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>Rear master cylinder nut</td>
<td>30-40 ft-lbs</td>
<td>40.7-54.2 Nm</td>
</tr>
<tr>
<td>Rider footboard screws</td>
<td>60-80 in-lbs</td>
<td>6.6-9.0 Nm</td>
</tr>
<tr>
<td>Rider footrest support screws</td>
<td>32-37 ft-lbs</td>
<td>43.4-50.2 Nm</td>
</tr>
<tr>
<td>Saddlebag flange nuts: FLSTC</td>
<td>120-144 in-lbs</td>
<td>13.6-16.3 Nm</td>
</tr>
<tr>
<td>Saddlebag lower bracket accom nut: FLSTC</td>
<td>120-144 in-lbs</td>
<td>13.6-16.3 Nm</td>
</tr>
<tr>
<td>Saree guard, lower, fasteners</td>
<td>21-27 ft-lbs</td>
<td>28.5-36.6 Nm</td>
</tr>
<tr>
<td>Saree guard, upper, fasteners: all but FXSB</td>
<td>21-27 ft-lbs</td>
<td>28.5-36.6 Nm</td>
</tr>
<tr>
<td>Saree guard, upper, fasteners: FXSB</td>
<td>21-27 ft-lbs</td>
<td>28.5-36.6 Nm</td>
</tr>
<tr>
<td>Saree guard, upper, nut: all but FXSB</td>
<td>21-27 ft-lbs</td>
<td>28.5-36.6 Nm</td>
</tr>
<tr>
<td>Shock bolt, rear</td>
<td>121-136 ft-lbs</td>
<td>164.0-184.4 Nm</td>
</tr>
<tr>
<td>Shock locknut, rear</td>
<td>32-39 ft-lbs</td>
<td>43.4-52.9 Nm</td>
</tr>
<tr>
<td>Slider tube cap</td>
<td>60-70 ft-lbs</td>
<td>81.3-95.0 Nm</td>
</tr>
<tr>
<td>Splash guard screw: all but FXSB</td>
<td>36-46 in-lbs</td>
<td>4.1-5.4 Nm</td>
</tr>
<tr>
<td>Spoke nipple</td>
<td>55 in-lbs</td>
<td>6.2 Nm</td>
</tr>
<tr>
<td>Stoptlight switch, rear</td>
<td>12-15 ft-lbs</td>
<td>16.3-20.3 Nm</td>
</tr>
<tr>
<td>Stoptlight switch bracket fastener</td>
<td>30-35 ft-lbs</td>
<td>40.6-47.4 Nm</td>
</tr>
<tr>
<td>Throttle control housing screws</td>
<td>35-45 in-lbs</td>
<td>4.0-5.1 Nm</td>
</tr>
<tr>
<td>Valve stem nut</td>
<td>12-15 in-lbs</td>
<td>1.4-1.7 Nm</td>
</tr>
</tbody>
</table>
### Table 2-1. Capacities

<table>
<thead>
<tr>
<th>ITEM</th>
<th>U.S.</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel tank (total)</td>
<td>6.0 gal</td>
<td>18.9</td>
</tr>
<tr>
<td>Low fuel warning light on</td>
<td>1.0 gal</td>
<td>3.8</td>
</tr>
<tr>
<td>Oil tank with filter *</td>
<td>3.8 qt</td>
<td>2.8</td>
</tr>
<tr>
<td><strong>Transmission (approximate)</strong></td>
<td>1.0 qt</td>
<td>0.95</td>
</tr>
<tr>
<td>Primary chaincase (approximate)</td>
<td>1.0 qt</td>
<td>0.95</td>
</tr>
</tbody>
</table>

* When refilling, initially add 2.0 qt (1.90 L) and add as needed to bring level within specification.
** When refilling, initially add 28 oz (0.83 L) and add as needed to bring level within specification.

### Table 2-2. Dimensions: FLSTFB, FLSTC, FLSTF and FLSTN

<table>
<thead>
<tr>
<th>ITEM</th>
<th>FLSTFB</th>
<th>FLSTC</th>
<th>FLSTF</th>
<th>FLSTN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>93.9 in</td>
<td>2385 mm</td>
<td>94.7 in</td>
<td>2405 mm</td>
</tr>
<tr>
<td>Overall width</td>
<td>39.0 in</td>
<td>990 mm</td>
<td>37.6 in</td>
<td>955 mm</td>
</tr>
<tr>
<td>Overall height</td>
<td>43.1 in</td>
<td>1095 mm</td>
<td>56.4 in</td>
<td>1408 mm</td>
</tr>
<tr>
<td>Wheel base</td>
<td>64.2 in</td>
<td>1630 mm</td>
<td>64.4 in</td>
<td>1635 mm</td>
</tr>
<tr>
<td>Road clearance</td>
<td>4.9 in</td>
<td>125 mm</td>
<td>5.2 in</td>
<td>131 mm</td>
</tr>
<tr>
<td>Seat height*</td>
<td>24.3 in</td>
<td>616 mm</td>
<td>25.5 in</td>
<td>648 mm</td>
</tr>
</tbody>
</table>

* With 180 lb (81.6 kg) rider on seat

### Table 2-3. Dimensions: FLS, FXST and FXSB

<table>
<thead>
<tr>
<th>ITEM</th>
<th>FLS</th>
<th>FXST</th>
<th>FXSB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>92.5 in</td>
<td>2350 mm</td>
<td>94.9 in</td>
</tr>
<tr>
<td>Overall width</td>
<td>39.0 in</td>
<td>990 mm</td>
<td>36.0 in</td>
</tr>
<tr>
<td>Overall height</td>
<td>43.3 in</td>
<td>1100 mm</td>
<td>48.4 in</td>
</tr>
<tr>
<td>Wheel base</td>
<td>64.4 in</td>
<td>1635 mm</td>
<td>66.9 in</td>
</tr>
<tr>
<td>Road clearance</td>
<td>4.5 in</td>
<td>115 mm</td>
<td>6.2 in</td>
</tr>
<tr>
<td>Seat height*</td>
<td>23.8 in</td>
<td>605 mm</td>
<td>26.1 in</td>
</tr>
</tbody>
</table>

* With 180 lb (81.6 kg) rider on seat.
### Table 2-4. Weights: FLSTC, FLSTF, FLSTFB and FLSTN

<table>
<thead>
<tr>
<th>ITEM</th>
<th>FLSTC</th>
<th>FLSTF</th>
<th>FLSTFB</th>
<th>FLSTN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Running weight*</td>
<td>761</td>
<td>345</td>
<td>725</td>
<td>329</td>
</tr>
<tr>
<td>Maximum added weight allowed**</td>
<td>399</td>
<td>181</td>
<td>435</td>
<td>197</td>
</tr>
<tr>
<td>GVWR</td>
<td>1160</td>
<td>526</td>
<td>1160</td>
<td>526</td>
</tr>
<tr>
<td>GAWR front</td>
<td>430</td>
<td>195</td>
<td>430</td>
<td>195</td>
</tr>
<tr>
<td>GAWR rear</td>
<td>730</td>
<td>331</td>
<td>730</td>
<td>331</td>
</tr>
</tbody>
</table>

* The total weight of the motorcycle as delivered with all oil/fluids and approximately 90% of fuel.
** The total weight of accessories, cargo, riding gear, passenger and rider must not exceed this weight.

### Table 2-5. Weights: FLS, FXST and FXSB

<table>
<thead>
<tr>
<th>ITEM</th>
<th>FLS</th>
<th>FXST</th>
<th>FXSB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Running weight*</td>
<td>701</td>
<td>318</td>
<td>699</td>
</tr>
<tr>
<td>Maximum added weight allowed**</td>
<td>469</td>
<td>208</td>
<td>426</td>
</tr>
<tr>
<td>GVWR</td>
<td>1160</td>
<td>526</td>
<td>1125</td>
</tr>
<tr>
<td>GAWR front</td>
<td>430</td>
<td>195</td>
<td>415</td>
</tr>
<tr>
<td>GAWR rear</td>
<td>730</td>
<td>331</td>
<td>710</td>
</tr>
</tbody>
</table>

* The total weight of the motorcycle as delivered with all oil/fluids and approximately 90% of fuel.
** The total weight of accessories, cargo, riding gear, passenger and rider must not exceed this weight.

---

**WARNING**

Do not exceed the motorcycle’s Gross Vehicle Weight Rating (GVWR) or Gross Axle Weight Rating (GAWR). Exceeding these weight ratings can lead to component failure and adversely affect stability, handling and performance, which could result in death or serious injury. (004186)

- GVWR is the sum of the weight of the motorcycle, accessories, and the maximum weight of the rider, passenger and cargo that can be safely carried.
- GAWR is the maximum amount of weight that can be safely carried on each axle.
- The GVWR and GAWR are shown on the information plate, located on the frame down tube.

**NOTES**

- The maximum additional weight allowed on the motorcycle equals the Gross Vehicle Weight Rating (GVWR) minus the running weight. For example, a motorcycle with GVWR of 1200 lbs (544 kg) having a running weight of 800 lbs (363 kg), would allow a maximum of an additional 400 lbs (181 kg) combined weight of the rider, passenger, riding gear, cargo and installed accessories.
- For important information regarding tire data and tire inflation, see 1.8 TIRES AND WHEELS.

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**Tire Specifications**

**WARNING**

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

NOTE

ABS equipped motorcycles must always use tires and wheels that are the same as the original equipment. ABS monitors rotational speed of the wheels through individual wheel speed sensors to determine the application of ABS. Changing to different diameter wheels or different size tires can alter the rotational speed. This will upset the system calibration and have an adverse effect on its ability to detect and prevent lockups. Operating with inflation pressure other than those specified in Table 2-10 can reduce ABS performance.

Tire sizes are molded on the sidewall. Refer to the tire fitment tables below. Rim size and contour are cast or stamped into the exterior surface of the rim.

Example: T21 x 2.15 TLA DOT. "T" indicates that the rim conforms to Tire and Rim Association standards. The "21" is the normal diameter of the rim in inches, measured at the bead seat diameter. The "2.15" is the width of the bead seat measured in inches. "TLA" designates the rim contour. "DOT" means that the rim meets Department of Transportation Federal Motor Vehicle Safety Standards.
### Table 2-6. Fitment - Tubeless Cast Wheels

<table>
<thead>
<tr>
<th>Wheel Size and Position</th>
<th>Rim Size and Contour</th>
<th>Rim Valve Hole Dia.</th>
<th>Specified Tire</th>
</tr>
</thead>
<tbody>
<tr>
<td>17 in. - Front</td>
<td>T17 x 3.50 MT</td>
<td>0.35 in.</td>
<td>Dunlop D408F 140/75R16 67V</td>
</tr>
<tr>
<td>21 in. - Front</td>
<td>T21 x 3.50 MT</td>
<td>0.35 in.</td>
<td>Dunlop D408F 130/60B21 78V</td>
</tr>
<tr>
<td>17 in. - Rear</td>
<td>T17 x 6.00 MT</td>
<td>0.35 in.</td>
<td>Dunlop D407 200/55R17 78V</td>
</tr>
<tr>
<td>18 in. - Rear</td>
<td>T18 x 8.00 MT</td>
<td>0.35 in.</td>
<td>Dunlop D407 240/40R18 78V</td>
</tr>
</tbody>
</table>

### Table 2-7. Tire Fitment - Tubeless Aluminum Profile Laced Wheels

<table>
<thead>
<tr>
<th>Wheel Size &amp; Position</th>
<th>Rim Size &amp; Contour</th>
<th>Specified Tire</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 in. - Front</td>
<td>T16x3.0 MT</td>
<td>Dunlop D402F MT90B16 72H</td>
</tr>
<tr>
<td>16 in. - Rear</td>
<td>T16x3.0 MT</td>
<td>Dunlop D402 MU85B16 77H</td>
</tr>
</tbody>
</table>

### Table 2-8. Tire Fitment - Tube Type Steel Laced Wheels

<table>
<thead>
<tr>
<th>Wheel Size &amp; Position</th>
<th>Rim Size &amp; Contour</th>
<th>Tube Size</th>
<th>Specified Tire</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 in. - Front</td>
<td>T16x3.00 D</td>
<td>MT90-16</td>
<td>Dunlop D402F MT90B16 72H</td>
</tr>
<tr>
<td>16 in. - Rear (FLSTN)</td>
<td>T16x3.00 D</td>
<td>MT90-16/MU85-16</td>
<td>Dunlop D402 MU85B16 77H</td>
</tr>
<tr>
<td>21 in. - Front</td>
<td>T21x2.15 TLA</td>
<td>MH90-21</td>
<td>Dunlop D408F MH90-21 54H</td>
</tr>
<tr>
<td>16 in. - Rear (FLSTC)</td>
<td>T16x3.00 D</td>
<td>MT90-16/MU85-16</td>
<td>Dunlop D401 150/80B16</td>
</tr>
</tbody>
</table>

### Table 2-9. Tire Fitment - Tube Type Aluminum Profile Laced Wheels

<table>
<thead>
<tr>
<th>Wheel Size &amp; Position</th>
<th>Rim Size &amp; Contour</th>
<th>Tube Size</th>
<th>Specified Tire</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 in. - Rear (FLSTN)</td>
<td>T16x3.0 MT</td>
<td>MT90-16/MU85-16</td>
<td>Dunlop D402 MU85B16 77H</td>
</tr>
</tbody>
</table>

### Table 2-10. Specified Tires

<table>
<thead>
<tr>
<th>Model</th>
<th>Mount</th>
<th>Size</th>
<th>Specified Tire</th>
<th>Pressure (Cold)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLSTC, FLS</td>
<td>front</td>
<td>16 in</td>
<td>Dunlop D402F MT90B16</td>
<td>36 psi 248 kPa</td>
</tr>
<tr>
<td>FLSTN, FLSTC (whitewall)</td>
<td>front</td>
<td>16 in</td>
<td>Dunlop D402F MT90B16</td>
<td>36 psi 248 kPa</td>
</tr>
<tr>
<td>FLSTF, FLSTFB</td>
<td>front</td>
<td>17 in</td>
<td>Dunlop D408F 140/75R17</td>
<td>36 psi 248 kPa</td>
</tr>
<tr>
<td>FXST</td>
<td>front</td>
<td>21 in</td>
<td>Dunlop D408F MH90-21</td>
<td>30 psi 207 kPa</td>
</tr>
<tr>
<td>FXSB</td>
<td>front</td>
<td>21 in</td>
<td>Dunlop D408F 130/60B21</td>
<td>36 psi 248 kPa</td>
</tr>
<tr>
<td>MODEL</td>
<td>MOUNT</td>
<td>SIZE</td>
<td>SPECIFIED TIRE</td>
<td>PRESSURE (COLD)</td>
</tr>
<tr>
<td>---------------------</td>
<td>-------</td>
<td>------</td>
<td>-----------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>FLSTC</td>
<td>rear</td>
<td>16 in</td>
<td>Dunlop D401 150/80R16</td>
<td>40</td>
</tr>
<tr>
<td>FLSTN, FLSTC (whitewall)</td>
<td>rear</td>
<td>16 in</td>
<td>Dunlop D402 MU85B16</td>
<td>40</td>
</tr>
<tr>
<td>FLS</td>
<td>rear</td>
<td>16 in</td>
<td>Dunlop D402 MU85B16</td>
<td>40</td>
</tr>
<tr>
<td>FLSTF, FXST, FLSTFB</td>
<td>rear</td>
<td>17 in</td>
<td>Dunlop D407 200/55R17</td>
<td>42</td>
</tr>
<tr>
<td>FXSB</td>
<td>rear</td>
<td>18 in</td>
<td>Dunlop D407 240/40R18</td>
<td>42</td>
</tr>
</tbody>
</table>
VEHICLE IDENTIFICATION NUMBER

See Figure 2-1. The full 17 digit serial or Vehicle Identification Number (V.I.N.) is stamped on the steering head. In some destinations, a printed V.I.N. label will also be affixed to the right front frame down tube.

An abbreviated V.I.N. is stamped on the left side crankcase at the base of the rear cylinder.

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

![Figure 2-1. V.I.N. Stamping Location](om00992)

![Figure 2-2. Typical Harley-Davidson VIN: 2015 Softail Models](om00941a)

1HD 1 BW V 1 3 F B 111000

**Table 2-11. Harley-Davidson VIN Breakdown: 2015 Softail Models**

<table>
<thead>
<tr>
<th>POSITION</th>
<th>DESCRIPTION</th>
<th>POSSIBLE VALUES</th>
</tr>
</thead>
</table>
| 1        | World manufacturer identifier | 1HD=Originally manufactured in the United States  
5HD=Originally manufactured in the United States for sale outside of the United States  
932=Originally manufactured in Brazil  
MEG=Originally manufactured in India |
| 2        | Motorcycle type | 1=Heavyweight motorcycle (901 cm³ or larger) |
| 3        | Model        | See VIN model table |
| 4        | Engine type  | 5=Twin Cam 96B™, 1585 cm³ air-cooled, fuel-injected, balanced  
V=Twin Cam 103B™, 1690 cm³ air-cooled, fuel-injected, balanced |
Table 2-11. Harley-Davidson VIN Breakdown: 2015 Softail Models

<table>
<thead>
<tr>
<th>POSITION</th>
<th>DESCRIPTION</th>
<th>POSSIBLE VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Calibration/configuration, introduction</td>
<td>Normal Introduction (Domestic: DOM, California: CAL, Canada: CAN, HDI, Japan: JPN, Australia: AUS, Brazil: BRZ, Asia Pacific: APC, India: IND)</td>
</tr>
<tr>
<td>6</td>
<td>VIN check digit</td>
<td>Can be 0-9 or X</td>
</tr>
<tr>
<td>7</td>
<td>Model year</td>
<td>F=2015</td>
</tr>
<tr>
<td>8</td>
<td>Assembly plant</td>
<td>B=York, PA U.S.A., C=Kansas City, MO U.S.A., D=H-D Brazil-Manaus, Brazil (CKD), N=Haryana India (Bawal District Rewari)</td>
</tr>
<tr>
<td>9</td>
<td>Sequential number</td>
<td>Varies</td>
</tr>
</tbody>
</table>

Table 2-12. VIN Model Codes: 2015 Softail Models

<table>
<thead>
<tr>
<th>CODE</th>
<th>MODEL</th>
<th>CODE</th>
<th>MODEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>BF</td>
<td>FXSB Breakout®</td>
<td>JD</td>
<td>FLSTN Softail® Deluxe</td>
</tr>
<tr>
<td>BV</td>
<td>FXST Softail® Standard (Australia only)</td>
<td>JR</td>
<td>FLS Softail® Slim®</td>
</tr>
<tr>
<td>BX</td>
<td>FLSTF Fat Boy®</td>
<td>JN</td>
<td>FLSTFB Fat Boy® Lo</td>
</tr>
<tr>
<td></td>
<td>FLSTFB Fat Boy® Special (some international markets)</td>
<td></td>
<td>FLSTFB Fat Boy® Special (some international markets)</td>
</tr>
<tr>
<td>BW</td>
<td>FLSTC Heritage Softail® Classic</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
FRONT WHEEL

REMOVAL

1. Raise the front end.
2. Inspect wheel bearing end play and service bearings if necessary. See 2.8 SEALED WHEEL BEARINGS.
3. See Figure 2-3. Remove mounting bolts (1). Move caliper away from wheel. Support caliper using a rubber bungee cord. Verify that caliper does not contact fender.

NOTE
Do not operate front brake lever with the front wheel removed. The caliper piston will be forced out of piston bore. Resealing the piston requires disassembly of the caliper.

4. Remove axle nut, lockwasher and washer (2).
5. Label wheel spacers for location (left or right) and orientation (fork side or wheel side).
6. See Figure 2-4. Loosen the slider cap fasteners (2). Pull the axle (1) free.

NOTES

- ABS models: never pull wheel speed sensor cable test or use to retain wheel, axle or other components.
- Always keep the wheel speed sensor and ABS encoder bearing away from magnetic fields. Items such as magnetic parts trays, magnetic base dial indicators, alternator rotors will damage sensor.
7. Remove wheel from forks.

NOTE
FLSTC models: the hub cap comes off with the wheel.

DISASSEMBLY

Disc Wheel

NOTE
See 2.9 TIRES to service tire or valve stem assembly.

If necessary, remove brake disc (6). On left side of wheel, remove five screws (10) to detach brake disc. Discard screws.

Laced Wheel

1. See Figure 2-6. If necessary, remove brake disc (7). On left side of wheel, remove five screws (11) to detach left brake disc. Discard screws.

2. To disassemble FLSTC hub cap, remove retaining ring from hub spacer. Discard retaining ring.
1. Axle
2. Right bearing spacer
3. Bearing (2)
4. Sleeve
5. Disc wheel
6. Brake disc
7. Left bearing spacer
8. Washer
9. Axle nut
10. Screw (5)
11. Cable clip
12. Clip bracket
13. Wheel speed sensor
14. ABS encoder bearing

Figure 2-5. Disc Front Wheel: FLSTF/B
CLEANING AND INSPECTION

1. Inspect all parts for damage or excessive wear. If sealed wheel bearings must be serviced, see 2.8 SEALED WHEEL BEARINGS.

**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)

2. Inspect brake disc and pads. See 1.16 BRAKE PADS AND DISCS.

ASSEMBLY

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake disc screws, front</td>
<td>16-24 ft-lbs</td>
</tr>
<tr>
<td>Brake disc screws, front</td>
<td>16-24 ft-lbs</td>
</tr>
</tbody>
</table>

**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)

**NOTICE**

Do not re-use brake disc/rotor screws. Re-using these screws can result in torque loss and damage to brake components. (00319c)

Disc Wheel

1. Verify that wheel and tire are true. See 2.7 CHECKING AND TRUING WHEELS.
2. See Figure 2-5. If removed, install brake disc (6). Verify that brake disc is clean. Install five new screws (10) to attach brake disc. Tighten to 16-24 ft-lbs (21.7-32.5 Nm).

Laced Wheel
1. If hub and rim were disassembled, see 2.6 WHEEL LACING.
2. Verify that wheel and tire are true. See 2.7 CHECKING AND TRUING WHEELS.
3. On FLSTC models, attach hub cap to spacer with new retaining ring.
4. See Figure 2-6. If necessary, install brake disc in its original position. Verify that brake disc is clean. Install five new screws (11) to attach brake disc (7). Tighten to 16-24 ft-lbs (21.7-32.5 Nm).

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axle nut, front</td>
<td>70-75 ft-lbs</td>
</tr>
<tr>
<td>Axle slider cap fasteners, front</td>
<td>132-180 in-lbs</td>
</tr>
<tr>
<td>Brake caliper mounting bolt, front</td>
<td>28-38 ft-lbs</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Axle nut, front</td>
<td>95.0-101.8 Nm</td>
</tr>
<tr>
<td>Axle slider cap fasteners, front</td>
<td>14.9-20.3 Nm</td>
</tr>
<tr>
<td>Brake caliper mounting bolt, front</td>
<td>38.0-51.5 Nm</td>
</tr>
</tbody>
</table>

1. Apply a light coat of ANTI-SEIZE LUBRICANT to the axle, bearing bores, and bore of inner sleeve.

2. Place wheel into front fork and install axle. Verify that axle spacers on right and left side and wheel speed sensor (if ABS equipped) are properly installed.

3. **ABS models:** see Figure 2-7. Rotate front wheel speed sensor counterclockwise until index pin makes contact with shoulder on left fork slider.

4. See Figure 2-3. Install the washer and axle nut (2). Insert screwdriver or steel rod through hole in axle on right side of vehicle. While holding axle stationary, tighten axle nut to 70-75 ft-lbs (95.0-101.8 Nm).

   **NOTE**
   In next step, make sure front and rear gaps between slider cap and slider are even.

5. See Figure 2-4. Tighten the slider cap nuts to 132-180 in-lbs (14.9-20.3 Nm).

6. **ABS models:** see Figure 2-5 or Figure 2-6. Install wheel speed sensor cable bracket (12 or 13) when installing brake caliper. Secure wheel speed sensor cable to clip bracket with cable clip (11 or 12).

7. Install the brake caliper and clip bracket, if equipped, to the fork leg using mounting bolts (1).

8. Tighten fasteners to 28-38 ft-lbs (38.0-51.5 Nm).

9. **ABS models:** make sure wheel speed sensor cable is properly secured to brake line with all three retainer clips and both cable straps.

**WARNING**
Whenever a wheel is installed and before moving the motorcycle, pump brakes to build brake system pressure. Insufficient pressure can adversely affect brake performance, which could result in death or serious injury. (00284a)

9. Pump brake hand lever to move pistons out until they contact both brake pads. Verify piston location against pads.
REAR WHEEL

REMOVAL

1. Block motorcycle underneath frame so weight of motorcycle is off of rear wheel.

2. Remove saddlebags if equipped.

3. Remove belt guard and debris deflector from rear fork. See 2.21 BELT GUARD AND DEBRIS DEFLECTOR.

4. Inspect wheel bearing end play and service bearings if necessary. See 2.8 SEALED WHEEL BEARINGS.

5. Label wheel spacers for location (left or right) and orientation (fork side or wheel side).

6. If ABS equipped: Cut cable strap to release rear wheel speed sensor cable from rear brake hose.

7. Remove rear brake caliper from caliper mount and support using an elastic cord or similar. See 2.14 REAR BRAKE CALIPER.

8. All but FXSB: See Figure 2-8. Remove e-clip (1). Loosen rear axle nut (2).

9. FXSB: See Figure 2-9. Loosen rear axle nut (2).

10. Loosen both axle adjuster screws (3) an equal number of turns to remove tension from drive bell.

NOTES

- If ABS equipped, never pull wheel speed sensor cable taut or use to retain wheel, axle or other components.
- Always keep the wheel speed sensor and ABS encoder bearing away from magnetic fields. Items such as magnetic parts trays, magnetic base dial indicators, alternator rotors, etc., will damage sensor.
- Support rear wheel from underneath during removal.

11. Tap axle towards right side and remove. Remove spacers, caliper mounting bracket, and rear wheel speed sensor (if ABS equipped).

12. Move wheel forward and slip belt off sprocket.

13. Raise motorcycle to allow enough clearance to remove rear wheel.

14. Pull wheel from rear fork.

NOTE

Do not operate rear brake pedal with the rear wheel removed or the caliper piston may be forced out of piston bores. Re-seating the piston requires disassembly of the caliper.

DISASSEMBLY

1. If necessary, remove brake disc and/or rear sprocket.
   a. Remove five screws (18) to detach rear sprocket (13). Discard screws.
   b. Remove five screws (5) to remove rear brake disc (6). Discard screws.

---

Figure 2-8. Axle Adjusters

1. E-Clip
2. Axle nut
3. Axle adjuster

---

Figure 2-9. Axle Adjusters: FXSB

1. Retainer
2. Axle nut
3. Axle adjuster
CLEANING AND INSPECTION

1. Inspect all parts for damage or excessive wear.
2. Inspect brake disc and pads. See 1.16 BRAKE PADS AND DISCS.
3. Inspect drive belt and sprocket. See 1.12 DRIVE BELT AND SPROCKETS.

ASSEMBLY

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake disc screws, rear</td>
<td>30-45 ft-lbs</td>
</tr>
<tr>
<td>Belt sprocket screws, first torque</td>
<td>50 ft-lbs</td>
</tr>
<tr>
<td>Belt sprocket screws, final torque</td>
<td>67-73 ft-lbs</td>
</tr>
</tbody>
</table>

1. See Figure 2-10. If laced wheel (10) was disassembled, see 2.6 WHEEL LACING.
NOTICE

Do not re-use brake disc/rotor screws. Re-using these screws can result in torque loss and damage to brake components. (00319c)

2. Using new screws (5), install brake disc (6) if removed. Tighten screws to 30-45 ft-lbs (40.7-61.0 Nm).

NOTICE

Do not re-use sprocket mounting screws. Re-using sprocket mounting screws can result in torque loss and damage to the sprocket and/or belt assembly. (00480b)

3. Using new screws (18), install belt sprocket (13) if removed. Tighten screws using the following sequence:
   a. Tighten screws (18) to an initial torque of 50 ft-lbs (67.8 Nm).
   b. Back screws off 1/2 turn (180 degrees).
   c. Tighten screws to a final torque of 67-73 ft-lbs (90.9-99.0 Nm).

4. Verify that wheel and tire are true. See 2.7 CHECKING AND TRUING WHEELS.

INSTALLATION

1. See Figure 2-10. Apply a light coat of ANTI-SEIZE LUBRICANT to the axle (1), bearing bores, and the bore of the inner sleeve (6).

2. Roll wheel into rear fork and slide drive belt over drive sprocket.

3. Position left bearing spacer (14) between wheel and fork.

4. From right side, carefully insert axle through right rear fork, short spacer (3), rear caliper mounting bracket, wheel speed sensor (4) (if ABS equipped) or long spacer (3) and into bearing bore.
   Continue sliding axle through wheel hub sleeve, left side spacer and left rear fork.

5. Install washer (15) and axle nut (16). Do not tighten axle nut at this time.

6. If ABS equipped: see Figure 2-11. Rotate rear wheel speed sensor counterclockwise until index pin makes contact with caliper bracket at point shown.

7. Verify correct axle alignment (see 2.10 VEHICLE ALIGNMENT) and check belt deflection (see 1.12 DRIVE BELT AND SPROCKETS).

WARNING

Check wheel bearing end play after tightening axle nut to specified torque. Excessive end play can adversely affect stability and handling and can cause loss of control, which could result in death or serious injury. (00285b)

8. Install bolt guard and debris deflector. See 2.21 BELT GUARD AND DEBRIS DEFLECTOR.

9. Install brake caliper and pads. See 2.14 REAR BRAKE CALIPER.

10. If ABS equipped: secure wheel speed sensor cable to rear brake line near brake caliper with a cable strap.

11. Install saddlebag, if equipped.

WARNING

Whenever a wheel is installed and before moving the motorcycle, pump brakes to build brake system pressure. Insufficient pressure can adversely affect brake performance, which could result in death or serious injury. (00284a)

12. Pump brake pedal to move pistons out until they contact both brake pads. Verify piston location against pads.

Figure 2-11. Rear Wheel Speed Sensor Index Pin (ABS Equipped)
WHEEL LACING: ANGLE FLANGE HUB

NOTES

- See Figure 2-12. The following procedure is valid for wheels that use an angle flange hub regardless of rim style or diameter.
- The primary brake side of the hub has one or two grooves cut into the disc mounting surface.

Figure 2-12. Angle Flange Hub

1. Outer spoke hole
2. Inner spoke hole

Figure 2-13. Spokes Gathered

1. Outer spoke
2. Inner spoke

1. Place hub on workbench:
   a. Front: primary brake side up.
   b. Rear: brake side down.

2. Install all spokes in the lower flange.

3. See Figure 2-13. Flip hub over. Gather all outer spokes and hold upright with a rubber band. Repeat with the inner spokes using a second rubber band.

4. Install spokes in remaining flange.

5. Rotate the lower flange spokes as far as they will go:
   a. Outer spokes clockwise.
   b. Inner spokes counterclockwise.

6. Center the rim over the hub and spokes assembly and support on wooden blocks approximately 1.5 in (38.1 mm) thick.
   a. If valve is not located in the center of the rim, place valve hole facing up.
   b. If the valve located in the center of the rim can be placed either side up.

NOTE
Install nipples until approximately 1/8 in (3.2 mm) of spoke thread shows.

7. Install lower flange outer spokes and loosely install spoke nipples:
   a. Rim with side valve hole: See Figure 2-14. Start at the valve stem hole (1).
   b. Rim with center valve hole: See Figure 2-15. Start at the first hole counterclockwise (1) from valve stem hole.

8. Install remaining outer spokes in every 4th hole.

9. Install lower flange inner spokes and loosely install spoke nipples:
   a. Starting at the 2nd hole counterclockwise (2) from first spoke installed, install inner spoke.
   b. Install remaining inner spokes in every 4th hole.

10. Carefully release upper flange inner spokes and fan out around rim, rotating them clockwise.

11. Starting at the first hole counterclockwise (3) from first spoke installed, install inner spoke. Install all remaining inner spokes in every 4th hole.

12. Carefully release upper flange outer spokes and fan out around rim, rotating them counterclockwise.

13. Install outer spokes in remaining holes (4).

14. Verify spoke heads are seated. See 2.7 CHECKING AND TRUING WHEELS.
   a. Evenly hand-tighten spoke nipples until snug.
   b. Only tighten until slack is removed.
   c. Proper torque will be applied when the wheel is trued.
   d. Adjust offset and true the wheel.
Figure 2-14. Side Valve Rim

Figure 2-15. Center Valve Rim
GENERAL

Check wheels for lateral and radial runout before installing a new tire, tube, rim, or seal. Checking cast or laced wheels is performed using the same procedure.

Laced wheels having excess runout can be trued. However, cast wheels must be replaced. Never attempt to straighten cast wheels.

Always check condition of the wheel bearings before checking or adjusting wheel runout. See 1.8 TIRES AND WHEELS, Wheel Bearings.

CHECKING WHEEL RUNOUT

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-99500-80</td>
<td>WHEEL TRUING AND BALANCING STAND</td>
</tr>
</tbody>
</table>

Check wheels for both radial runout and lateral runout. If either measurement is not within specification:

- Cast wheel: Replace the wheel.
- Laced wheel: Adjust the bearing to true the wheel. See steps in this section.

Checking Radial Runout

1. See Figure 2-16. Mount wheel in WHEEL TRUING AND BALANCING STAND (Part No. HD-99500-80).
2. Adjust gauge rod or dial indicator to the rim’s tire bead safety hump.
3. Rotate wheel and measure distance at several locations. Runout must not exceed 0.030 in (0.76 mm).

Checking Lateral Runout

1. See Figure 2-17. Mount wheel in WHEEL TRUING AND BALANCING STAND (Part No. HD-99500-80).

   NOTE

Dial indicators are more accurate than gauge rods.

2. Place a gauge rod near, or dial indicator on the rim bead flange.
3. Measure distance at several locations. Lateral runout must not exceed 0.030 in (0.76 mm).
LACED WHEEL RIM OFFSET

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-94681-80</td>
<td>SPOKE NIPPLE WRENCH</td>
</tr>
<tr>
<td>HD-99500-80</td>
<td>WHEEL TRUING STAND</td>
</tr>
</tbody>
</table>

1. See Figure 2-18. Place a piece of tape to mark the center of each group of four spokes as shown. The groups should be directly opposite one another and approximately 90 degrees apart. Using different colors of tape or numbering each group is helpful.

2. See Figure 2-19. Mount wheel in WHEEL TRUING STAND (Part No. HD-99500-80) using truing arbor. Tighten arbor nuts so hub will turn on its bearings.

   **NOTE**
   The primary brake disc side of the hub has one or two grooves cut into the disc mounting surface.

3. Lay a straightedge across the primary brake disc mounting surface of hub and one of the marked spoke groups.

4. See Figure 2-20. Determine the distance from the straightedge to the location shown, based on rim design, to determine distance A. Refer to Table 2-13.

   **NOTES**
   - Always loosen the appropriate spokes before tightening the other two. Reversing this procedure will cause the rim to become out-of-round.
   - Tighten or loosen spokes one at a time and recheck measurement.
   - Always work on groups that are opposite each other to maintain radial runout.

5. If the dimension is not correct, adjust the four spokes using SPOKE NIPPLE WRENCH (Part No. HD-94681-80). For example: if the right side is less than specification, loosen the two spokes on the hub right side. Then tighten the two spokes attached to the hub left side. Turn all four spokes an equal number of turns until offset is to specification.

6. Repeat the previous step for all groups on the wheel. Verify the offset.

7. True the wheel. See 2.7 CHECKING AND TRUING WHEELS, Truing Laced Wheels.
Figure 2-19. Checking Wheel Hub Offset Dimension (typical)

Table 2-13. Wheel Offset Dimensions

<table>
<thead>
<tr>
<th>RIM TYPE</th>
<th>MODEL</th>
<th>SIZE</th>
<th>WHEEL</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel Laced (1)</td>
<td>FXST</td>
<td>21 x 2.15</td>
<td>Front</td>
<td>1.660-1.690</td>
<td>42.16-42.93</td>
</tr>
<tr>
<td></td>
<td>FLSTC, FLSTN, FLS</td>
<td>16 x 3</td>
<td>Rear</td>
<td>1.187-1.417</td>
<td>35.23-35.99</td>
</tr>
<tr>
<td>Aluminum Profile Laced (2)</td>
<td>FLSTC, FLSTN</td>
<td>16 x 3</td>
<td>Front</td>
<td>1.002-1.032</td>
<td>25.46-26.22</td>
</tr>
<tr>
<td></td>
<td>FLSTC, FLSTN</td>
<td>16 x 3</td>
<td>Rear</td>
<td>1.123-1.153</td>
<td>28.52-29.28</td>
</tr>
</tbody>
</table>

1. Steel rim
2. Aluminum profile rim

Figure 2-20. Laced Wheel Hub Offset Dimensions
TRUING LACED WHEELS

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48985</td>
<td>SPOKE TORQUE WRENCH</td>
</tr>
<tr>
<td>HD-94681-80</td>
<td>SPOKE NIPPLE WRENCH</td>
</tr>
<tr>
<td>HD-99500-80</td>
<td>WHEEL TRUING AND BALANCING STAND</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spoke nipple</td>
<td>55 in-lbs</td>
</tr>
<tr>
<td></td>
<td>6.2 Nm</td>
</tr>
</tbody>
</table>

NOTES

- Dial indicators are more accurate than gauge rods.
- Perform radial truing before lateral truing.

Radial Runout

1. See Figure 2-21. With the wheel mounted in WHEEL TRUING AND BALANCING STAND (Part No. HD-99500-80), adjust the truing stand gauge (3) near to the tire bead safety hump (4). If using a dial indicator, place the tip on the safety bead hump.

2. If working with a straight flange hub, seat each spoke head in the hub flange using a flat nose punch and mallet.

NOTES

- Always loosen the appropriate spokes, using SPOKE NIPPLE WRENCH (Part No. HD-94681-80), before tightening the other two. Reversing this procedure will cause the rim to become out of round.

- Tighten or loosen spoke, one flat at a time, and recheck measurement. Small changes in the spokes can make large changes in the runout.

- Always work on groups that are opposite each other to maintain radial runout.

3. Spin the rim slowly and check distance (2). The rim should be true within 0.030 in (0.76 mm).

   a. If the rim contacts the gauge on or near a marked group of spokes, loosen the spokes in the group on the opposite side of the rim. Then tighten the spokes in the group where the rim makes contact an equal number of turns.

   b. If the rim contacts the gauge between two marked groups, loosen the spokes in both groups on the opposite side of the rim. Then tighten the spoke groups on the side of the rim that makes contact an equal number of turns.

4. When the wheel is centered and trued, start at the valve stem hole and tighten any loose spoke nipples one turn at a time until they are snug.

5. Working alternately across the wheel, use SPOKE TORQUE WRENCH (Part No. HD-48985) evenly tighten all spokes to specification listed in Table 2-14.

6. If working with a straight flange hub, verify each spoke head is seated in the hub flange using a flat nose punch and mallet.

7. Verify radial runout is still within specification.

8. After you have verified that radial runout is still within specification, proceed to lateral runout.

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. (90286a)

Figure 2-21. Checking Radial Runout

Table 2-14. Spoke Nipple Torque Specification

<table>
<thead>
<tr>
<th>RIM TYPE</th>
<th>MINIMUM TORQUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>55 in-lbs (6.2 Nm)</td>
</tr>
</tbody>
</table>

Lateral Runout

NOTE

Dial indicators are more accurate than gauge rods.

1. See Figure 2-22. With the wheel mounted in WHEEL TRUING AND BALANCING STAND (Part No. HD-99500-80), adjust the gauge rod (3) near the rim bead flange.

2. Rotate the rim slowly and check lateral runout (2). If runout exceeds 0.030 in (0.76 mm), adjust spokes as follows.
Always loosen the appropriate spokes before tightening the other two. Reversing this procedure will cause the rim to become out of round.

Tighten or loosen spoke, one flat at a time, and recheck measurement. Small changes in the spokes can make large changes in the runout.

3. Again working in groups of four, loosen two spokes on the tight side and tighten the two spokes on the loose side.

4. Repeat with each group until wheel is within specification.

5. Verify that all spoke nipples are tightened to the specification. Refer to Table 2-14.

6. If the tire is removed from the rim, file or grind off ends of spokes that protrude through the nipples to prevent puncturing tube or rim seal when tire is mounted.

NOTE
After installation, verify the wheel is approximately centered between the fork fender bosses.

Figure 2-22. Checking Lateral Runout
INSPECTION

NOTICE

When lifting a motorcycle using a jack, be sure jack contacts both lower frame tubes where down tubes and lower frame tubes converge. Never lift by jacking on cross-members, oil pan, mounting brackets, components or housings. Failure to comply can cause serious damage resulting in the need to perform major repair work. (00586d)

1. Raise the wheel with a suitable lifting device.
2. Turn the wheel through several rotations.

NOTES

- Keep ABS encoder bearings away from magnetic fields (such as magnetic parts trays, magnetic base dial indicators, alternator rotors) or damage occurs.
- When checking end play, pull or push on the wheel not the brake disc. Pulling or pushing brake disc can distort disc causing a false end play reading.

3. Check end play:
   a. See Figure 2-23. Mount a magnetic base dial indicator to the brake disc. Set the indicator contact point on the end of the axle.
   b. Firmly push the wheel to one side and zero the dial indicator gauge.
   c. Firmly pull the wheel back as far as it goes and note the reading of the dial indicator.
   d. Repeat the procedure to verify the reading.
   e. Replace the bearings if end play exceeds 0.002 in (0.051 mm) or if there is drag, rough rotation or abnormal noise.

Figure 2-23. Wheel Bearing Inspection (Front Wheel Shown)

REMOVAL

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-44060-10A</td>
<td>25MM BEARING REMOVER (NON-ABS)</td>
</tr>
<tr>
<td>HD-44060-11A</td>
<td>25MM BEARING REMOVER (ABS)</td>
</tr>
<tr>
<td>HD-44060C</td>
<td>WHEEL BEARING INSTALLER/REMOVER</td>
</tr>
</tbody>
</table>

1. Remove wheel. See 2.4 FRONT WHEEL or 2.5 REAR WHEEL.
2. If present, remove hub plate from wheel on opposite side of front brake disc.

NOTES

- See Figure 2-25. Some wheel hubs may not provide adequate support for the puller bridge. In these cases center a used brake disc over the hub to support the puller bridge while removing the bearings.
- ABS equipped motorcycles use both a special encoder bearing (greenish tan in color) on the primary brake disc side. They use a standard bearing (black) on the opposite side. Select 25MM BEARING REMOVER (ABS) (Part No. HD-44060-11A) or 25MM BEARING REMOVER (NON-ABS) (Part No. HD-44060-10A).

3. See Figure 2-24. Obtain WHEEL BEARING INSTALLER/REMOVER (Part No. HD-44060C) and assemble using 25MM BEARING REMOVER (ABS) (Part No. HD-44060-11A) or 25MM BEARING REMOVER (NON-ABS) (Part No. HD-44060-10A) (6).
   a. Sparingly apply GRAPHITE LUBRICANT to forcing screw (1) to maintain smooth operation and prolong service life.
   b. Install nut (2), washer (3) and bearing (4) on screw. Insert assembly through hole in bridge (5).
   c. Drop ball bearing inside 25 mm collet (6). Fasten collet and ball bearing to forcing screw.

4. Hold end of forcing screw and turn collet to expand edges of collet.
5. See Figure 2-26. When expanded collet has gripped bearing edges, hold end of forcing screw and turn the nut to remove bearing from wheel.
6. Remove spacer from inside wheel hub.
7. Repeat procedure for opposite side bearing. Discard all bearings upon removal.
1. Forcing screw
2. Nut
3. Washer
4. Bearing
5. Bridge
6. Collet with ball bearing inside

Figure 2-24. Wheel Bearing Removal Tool

Figure 2-25. Brake Disk as Puller Aid
INSTALLATION

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-44060C</td>
<td>WHEEL BEARING INSTALLED/REMOVER</td>
</tr>
</tbody>
</table>

NOTES

- Install first bearing on primary brake disc side of hub, which is identified by having one or two grooves cut into the disc mounting surface.
- Keep ABS encoder bearings away from magnetic fields (such as magnetic parts trays, magnetic base dial indicators, alternator rotors, etc.) or damage will occur.
- ABS equipped motorcycles use a special encoder bearing (greenish tan in color) on the primary brake disc side and a standard bearing (black) on the opposite side.

1. Obtain WHEEL BEARING INSTALLER/REMOVER (Part No. HD-44060C) and assemble.
   a. Sparingly apply graphite lubricant to threads of threaded rod to prolong service life and maintain smooth operation.
   b. See Figure 2-27. Place threaded rod through support plate. Insert assembly through wheel.
   c. See Figure 2-28. Place the new bearing (6) on rod (1) with lettered side facing away from wheel centerline. ABS bearing with greenish tan side against pilot (5).
   d. Install pilot (5), bearing (4), washer (3) and nut (2) over rod.

2. Hold hex end of threaded rod (1) and turn nut (2) to install bearing (6) into primary side of hub. Bearing will be fully seated when nut can no longer be turned. Remove tool.

3. Install spacer inside wheel hub.

4. Reverse tool and install opposite side bearing until bearing contacts inner spacer.
1. Bridge, (Part No. HD-44060-5)
2. Steel ball, (Part No. 12547)
3. Forcing screw, (Part No. HD-44060-4)
4. Nut, (Part No. 10210)
5. Washer, (Part No. 12004)
6. Bearing, (Part No. 217801)
7. Lubricant, (Part No. J-23444)
8. Collet, 3/4 in, (Part No. HD-44060-3A)
9. Collet (ABS), 25 mm, (Part No. HD-44060-11A)
10. Collet, 1.0 in, (Part No. HD-44060-7)
11. Collet, 25 mm, (Part No. HD-44060-10A)
12. Pilot, 1.0 in, (Part No. HD-44060-8)
13. Support plate, (Part No. HD-44060-1)
14. Pilot, 3/4 in, (Part No. HD-44060-6)
15. Threaded rod, (Part No. 280850)

Figure 2-29. Wheel Bearing Installer/Remover Components

NOTES
- Parts 1-7 are common to removal and installation.
- Parts 8-10 are used for removal only.
- Parts 11-15 are used for installation only.
GENERAL

WARNING

Be sure tires are properly inflated, balanced, undamaged, and have adequate tread. Inspect your tires regularly and see a Harley-Davidson dealer for replacements. Riding with excessively worn, unbalanced, improperly inflated, overloaded or damaged tires can lead to tire failure and adversely affect stability and handling, which could result in death or serious injury. (00014b)

Always maintain proper tire pressure as specified in Table 2-10. Do not load tires beyond GAWR specified in Table 2-4 or Table 2-5. Underinflated, over-inflated or overloaded tires can fail.

NOTES

• Check runout on all cast or spoke wheels before installing a new tire. See 2.7 CHECKING AND TRUING WHEELS.

• Store new tires 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.

• Inspect tires for punctures, cuts, breaks and wear at least weekly.

• See Figure 2-30. The tread wear indicator bars will appear on tire tread surfaces when 1/32 in (0.8 mm) or less of tread remains. Always replace tires 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.

• Tire wear indicator bars are visible on the tread surfaces.

• Tire cords or fabric are visible through cracked sidewalls, snags or deep cuts.

• A hump, bulge or split in the tire.

• Puncture, cut or other damage to the tire that cannot be repaired.

REMOVAL

NOTE

Take care 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 2.4 FRONT WHEEL, Removal.
   b. Rear wheel: see 2.5 REAR WHEEL, Removal.

2. Deflate tire.

NOTE

On tube type wheels, it is not necessary to completely remove tire from rim to replace tube. 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 tire. See 2.7 CHECKING AND TRUEING WHEELS.

4. Inspect the tire for wear and damage.

5. Inspect tread depth. Replace worn tires.

![WARNING]

Replace punctured or damaged tires. In some cases, small punctures in the tread area may be repaired from within the removed 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 lead to tire failure and result in death or serious injury. (00015b)

6. Repair tread on tubeless tires if puncture is 1/4 in (6.4 mm) or smaller. Make repairs from inside the tire.

7. Always combine a patch and plug when repairing damaged tires.

### INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve stem nut</td>
<td>12-15 in-lbs</td>
</tr>
</tbody>
</table>

![WARNING]

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

![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. (00028a)

For tire pressures, see 1.8 TIRES AND WHEELS, Tires.

Some tires have arrows molded into the tire sidewall. Mount these tires with the arrow pointing in the direction of forward rotation. The colored dot on the sidewall is a balance mark. Align it with the valve stem.

### Tube Type Tires

![WARNING]

Match tires, tubes, rim strips or seals, air valves and caps to the correct wheel. Contact a Harley-Davidson dealer. Mismatching can lead to tire damage, allow tire slippage on the wheel or cause tire failure, which could result in death or serious injury. (00029c)

### NOTES

- For correct tire and tube types, see 2.2 SPECIFICATIONS.
- When replacing a tube type tire, replace the tube. Inner tubes should be patched only as an emergency measure. Replace a damaged or patched tube as soon as possible. Always use a rim strip on all tube-type laced wheels.

1. See Figure 2-31. On tube type laced wheels, verify that no spokes protrude through nipples. Install a rim strip into the rim well. Check to align the valve stem hole in rim strip with valve stem hole in rim.

2. Install tube and tire.

![Figure 2-31. Installed Rim Strip](un02468a)

### Tubeless Tires: Cast Wheels

![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)

On tubeless cast wheels, replace damaged or leaking valve stems.

1. See Figure 2-32. Install rubber grommet (5) on valve stem.
2. Insert valve stem into rim hole.
3. Install metal washer (4) and nut (3).
4. Tighten to 12-15 in-lbs (1.4-1.7 Nm).
5. Install tire.
Radial Runout

1. Check tire pressure.

2. See Figure 2-34. Turn the wheel on the axle and measure tire radial runout at the tread centerline.

3. Tire radial runout should not exceed 0.090 in (2.29 mm). If tire runout exceeds this specification, remove tire from rim and check rim radial runout. See 2.7 CHECKING AND TRUING WHEELS.
   a. If rim radial runout is within specification, the tire is at fault and must be replaced.
   b. If rim radial runout is not within specification, correct by adjusting selected spokes on laced wheels or replace cast wheels. See 2.7 CHECKING AND TRUING WHEELS.

4. Install the tire. Check tire radial runout of replacement tire.

WHEEL BALANCING

Static vs Dynamic

Wheel balancing is recommended to improve handling. Balancing wheels reduces vibration especially at high speeds.

Static balancing produces satisfactory results for normal highway speeds. Dynamic balancing can produce better results for deceleration.

Weights

The maximum weight permissible to balance a wheel is 3.5 oz (99.2 g) (total weight applied to the rim). If more than 3.5 oz (99.2 g) of weight is required, rotate the tire 180 degrees on the rim and again balance the assembly. Balance wheels to within 0.5 oz (14 g).

All wheel weights currently supplied by Harley-Davidson are made from zinc which is lighter than lead. The weight of each zinc segment is 0.18 oz (6 g) as compared to 0.25 oz (7 g) for lead. Weights are stamped for easy identification.
NOTES

- If adding more than 1.5 oz (43 g) of weight at one location, divide the amount to apply half to each side of rim.
- On cast wheels without a flat area near the bead, place the weights crosswise through the opening.

1. See Figure 2-36. Place weights on a smooth surface of the wheel rim such that centrifugal force keeps them in place. Make sure that the area of application is clean, dry and free of oil and grease.

NOTE

See Figure 2-35. When installing wheel weights, consider cosmetics. Keep snaking (1) within 0.040 in (1.02 mm) (2) of straight. Also keep the angle alignment of individual segments (3) within three degrees.

2. Remove paper backing from the weight. Press firmly in place and hold for ten seconds.

Figure 2-35. Weight Segment Alignment

1. Snaking
2. Not to exceed 0.040 in (1.02 mm)
3. Not to exceed 3 degree

Figure 2-36. Wheel Weight Placement

1. Laced steel
2. Laced profile
3. Cast (typical with flat bead area)
4. Cast (special with no flat bead area)
AXLE ALIGNMENT

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48856-A</td>
<td>AXLE ALIGNMENT PLUGS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axle nut, rear</td>
<td>95-105 ft-lbs 129-142 Nm</td>
</tr>
</tbody>
</table>

Checking Axle Alignment

**WARNING**
Only a Harley-Davidson dealer should perform vehicle alignment. Improper alignment can adversely affect stability and handling, which could result in death or serious injury. (00060a)

**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)

1. Verify wheels are true to specifications. See 2.7 CHECKING AND TRUING WHEELS.

2. Check steering head bearing adjustment and adjust if necessary. See 1.18 STEERING HEAD BEARINGS.

3. Remove exhaust components as necessary.

4. See Figure 2-37. Insert alignment plugs (1, 2) from the AXLE ALIGNMENT PLUGS (Part No. HD-48856-A) into left and right ends of rear axle. Turn handle until plug is firmly held in the axle.

5. See Figure 2-38. Fabricate an alignment tool using a piece of 1/8 in (3.175 mm) diameter aluminum welding rod approximately 20 in (508 mm) long:
   a. Grind one end down to a blunt point (1).
   b. Use pliers to bend rod at a 90 degree angle (3), 1.75 in (44.45 mm) from the blunt point.
   c. Place a snug-fitting rubber grommet (2) on rod to act as a slide measurement indicator.

6. Gauge distance between rear fork pivot bolt and rear axle alignment plug center:
   a. See Figure 2-39. Measure outer diameter of rear fork pivot bolt and divide measurement by two. Using a pencil, draw a line from two different directions to mark an X.
   b. See Figure 2-40. Place blunt point of alignment tool (1) in the center of the X marked on the rear fork pivot bolt (2).
   c. Slide rubber grommet (3) along tool shaft until it aligns with hole in center of alignment plug (4).
   d. Without moving grommet, position alignment tool on left side of rear fork.

7. Check measurements on both sides of vehicle. Left and right measurements must be equal within 0.03125 in. (0.79375 mm) on both sides of vehicle. Adjust if necessary. See Adjusting Axle Alignment which follows.

---

![Figure 2-37. Axle Alignment Plugs](sm0037)

1. Alignment plug (left side)
2. Alignment plug (right side)
3. Alignment hole

![Figure 2-38. Axle Alignment Tool](sm0142)

1. Blunt point
2. Rubber grommet
3. 1.75 in (44.45 mm)
4. 18 in (457 mm)

![Figure 2-39. Pivot Bolt Center Marking](sm0756)

---

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Adjusting Axle Alignment

1. **All but FXSB**: See Figure 2-41. Remove e-clip (1). Loosen rear axle nut (2).
2. **FXSB**: See Figure 2-42. Loosen rear axle nut (2).
3. On side of rear fork that has longer distance from pivot bolt to axle center, turn nut on axle adjuster (3) counterclockwise to shorten distance. Adjust axle until left and right side alignment measurements are equal.

**NOTES**
- Keep axle adjuster mechanisms firmly seated (under tension) on each side of rear fork during wheel alignment procedures above. Do so by applying moderate upward force on lower span of drive belt. This tensions drive belt, which holds rear axle forward against both adjuster mechanisms.
- Do not tighten rear axle nut or install new E-clip until after checking drive belt deflection.

4. Verify drive belt deflection after aligning rear wheel. Adjust if required. See 1.12 DRIVE BELT AND SPROCKETS, Adjusting Belt Deflection.

**WARNING**

Do not exceed specified torque when tightening axle nut. Exceeding torque can cause wheel bearings to seize during vehicle operation, which could result in death or serious injury. (90488e)
GENERAL

NOTICE

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)

NOTICE

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)

REMOVAL AND DISASSEMBLY

1. Drain brake fluid.
   a. Open bleeder nipple cap on front brake caliper.
   b. Install end of a length of clear plastic tubing over caliper bleeder valve, while placing free end in a suitable container.
   c. Open bleeder valve about 1/2-turn.
   d. Pump brake hand lever to drain brake fluid.
   e. Close bleeder valve.

NOTICE

Avoid leakage. Be sure gaskets, banjo bolt(s), brake line and master cylinder bore are clean and undamaged before assembly. (00322a)

2. Remove bolt and two steel/rubber washers to disconnect fitting of hydraulic brake line from master cylinder. Discard washers.

---

**Figure 2-43. Front Brake master Cylinder**

1. Screws (2)
2. Cover
3. Gasket
4. Site glass
5. Seal
6. Pivot pin
7. Bushing
8. Brake hand lever
9. Retaining ring
10. Master cylinder reservoir
11. Primary cup
12. Dust boot
13. Retaining ring
14. Piston
15. Secondary cup
16. Spring
17. Handlebar clamp
18. Washer (2)
19. Screw (2)
3. If necessary, remove mirror and turn signal. See 7.18 TURN SIGNALS AND RUNNING LIGHTS.

4. See Figure 2-43. Remove screws (19) and washers (18) to detach handlebar clamp (17) from master cylinder reservoir (10).

5. Remove retaining ring (9) from pivot pin groove at bottom of master cylinder bracket.

6. Remove pivot pin (6) and brake hand lever (8).

7. Remove dust boot (12) and discard.

8. Remove retaining ring (13).

9. Remove and discard piston assembly (11, 14-16).

10. Remove screws (1), cover (2) and gasket (3).

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 or DOT 4 BRAKE FLUID.
   a. Wipe parts dry with a clean, lint-free cloth.
   b. Clear drilled passages and bore with clean compressed air.

   **NOTE**

   Do not use a wire or similar instrument to clean drilled passages in bottom of reservoir.

2. Inspect parts for wear or damage. Replace parts if necessary.

3. Inspect the piston bore in the master cylinder housing for scoring, pitting or corrosion. Replace as necessary.

4. Carefully inspect the outlet port that mates with the brake line fitting. As a critical sealing surface, replace the master cylinder assembly if any damage is noted.

5. Carefully inspect the cover gasket for damage. Replace as necessary.

### ASSEMBLY AND INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handlebar switch clamp screw</td>
<td>60-80 in-lbs</td>
</tr>
<tr>
<td></td>
<td>6.8-9.0 Nm</td>
</tr>
<tr>
<td>Brake caliper/master cylinder banjo bolt</td>
<td>14-18 ft-lbs</td>
</tr>
</tbody>
</table>

**NOTES**

- Always reassemble the master cylinder using new parts from the correct repair kit.
- Use CCI #20 Brake Grease, included in kit, to lubricate cylinder bore, cups and seals prior to assembly.

1. See Figure 2-43. Coat piston bore of master cylinder reservoir (10), piston (14), primary cup (11) and secondary cup (15) with CCI #20 BRAKE GREASE (supplied in kit).

2. Install piston assembly into piston bore of master cylinder reservoir.
   a. Press small end of spring (16) onto piston (14).
   b. Install piston/spring assembly into master cylinder reservoir (10) bore.

3. Press in on piston (14) and install new retaining ring (13).

4. Install new dust boot (12). Press large end against retaining ring. Small end should fit into groove on shaft.

5. Install gasket (3), cover (2) and screws (1). Do not tighten at this time.

6. Assemble brake hand lever (8) with pivot pin (6) to master cylinder reservoir (10).

### 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. Install new retaining ring (9).

8. See Figure 2-44. Position the brake lever/master cylinder assembly inboard of the switch housing assembly, engaging the tab (2) on the lower switch housing (1) in the groove (3) at the top of the brake lever bracket (4).

9. Secure the handlebar clamp to master cylinder with two screws (with flat washers). Position hand lever and controls for rider comfort. Beginning with the top screw, tighten to 60-80 in-lbs (6.8-9.0 Nm).

10. If removed, install mirror and turn signal housing. See 7.18 TURN SIGNALS AND RUNNING LIGHTS.

### NOTICE

Avoid leakage. Be sure gaskets, banjo bolt(s), brake line and caliper bore are clean and undamaged before assembly. (00321a)

11. Start banjo bolt (with new steel/rubber washers) to secure brake line fitting to master cylinder reservoir. Tighten to 14-18 ft-lbs (19.0-24.4 Nm).
When any hydraulic brake component, line or connection is loosened or replaced on an ABS motorcycle, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to properly bleed the brake system could adversely affect braking, which could result in death or serious injury. (00585c)

12. Bleed front brake system. See 2.18 BLEEDING BRAKES.

NOTE
The shelf life of an unopened bottle of DOT 4 brake fluid is one year. The shelf life of an uncontaminated bottle that has been opened and then resealed is one week.

1. Switch housing assembly
2. Tab
3. Groove
4. Brake lever bracket

Figure 2-44. Attach Master Cylinder to Right Handlebar Switches
REMOVAL

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)

NOTICE

Avoid leakage. Be sure gaskets, banjo bolt(s), brake line and caliper bore are clean and undamaged before assembly. (00321a)

NOTICE

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

If only replacing brake pads, see 1.16 BRAKE PADS AND DISCS.

1. See Figure 2-45. Remove the banjo bolt (4) and both steel/rubber washers (3) to detach front brake line (5) from caliper. Discard washers.

2. Remove the mounting bolts (1). Lift caliper upward to remove from brake disc.

Figure 2-45. Front Brake Caliper

DISASSEMBLY

1. Remove one brake pad. See 1.16 BRAKE PADS AND DISCS.

2. Verify remaining brake pad is installed with brake pad pins.

3. Verify bleeder valve is installed.

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)

CAUTION

When removing piston with compressed air, piston can develop considerable force and fly out of caliper bore. Keep hands away from piston to avoid possible injury. (00599b)

NOTE

Do not damage banjo bolt sealing surface or threads of banjo bolt hole in brake caliper. Use an air nozzle with a rubber tip.

4. Gently apply low pressure compressed air to banjo bolt hole to force pistons from caliper bores.

5. Remove brake pad pins and brake pad.

6. See Figure 2-46. Remove bridge bolts (11, 12) and separate caliper housings.

7. Remove pistons from each housing by hand. If necessary, wiggle pistons gently to completely remove.

NOTE

Damaged piston bores will leak when reassembled. Do not use metal objects to remove or install objects from piston bores. Prevent damage to pistons, seals and bores by only using a wooden toothpick when servicing calipers.

8. Using a wooden toothpick, remove dust seals (6, 8) and piston seals (5, 9) from each caliper bore. Discard seals.

9. If necessary, remove bleeder valve (1).
Figure 2-46. Front Caliper

CLEANING, INSPECTION AND REPAIR

**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)

1. Clean all rubber parts with DOT 4 BRAKE FLUID. Do not contaminate with mineral oil or other solvents. Clean all metal parts with denatured alcohol. Wipe parts dry with a clean, lint-free cloth.

**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 airflow rates. (0061a)

2. Blow out drilled passages and piston bore with low pressure compressed air from a clean air supply. Do not use a wire or similar instrument to clean drilled passages.

3. Carefully inspect all components. Replace as necessary.
   a. Check pistons for pitting, scratches or corrosion on outside surfaces.
   b. Inspect piston bores. Do not hone bores. Replace as necessary.

**NOTE**
The pad pins are manufactured with a relief near the center of their length, where the pad spring touches. Do not use this area as a measurement point to determine pad pin wear.

   c. Inspect pad pin for grooving and wear at the pad contact points. Measure the pad pin diameter in an unworn area and in an area of any grooving or wear. If wear exceeds 0.011 in (0.28 mm), replace pad pin.
   d. Inspect pad spring for wear or cracks. Replace if necessary.
   e. Always replace all seals after disassembly.

**WARNING**

Always replace brake pads in complete sets for correct and safe brake operation. Improper brake operation could result in death or serious injury. (0011a)

4. Inspect brake pads and brake disc. Replace if necessary.
   a. Specifications: See 1.16 BRAKE PADS AND DISCS.
   b. Brake Disc: See 2.4 FRONT WHEEL.
**NOTICE**

- **ABS Models:** Install wheel speed sensor cable retainer (2) when installing caliper to front fork.
  
  b. Install caliper mounting bolts (1). Tighten to 28-38 ft-lbs (38.0-51.5 Nm).

**NOTE**

Avoid leakage. Be sure gaskets, banjo bolt(s), brake line and master cylinder bore are clean and undamaged before assembly. (00322a)

2. Lubricate new steel/rubber washers (3) with DOT 4 BRAKE FLUID. Connect the brake line (5) to caliper using two new steel/rubber washers and banjo bolt (4). Tighten to 14-18 ft-lbs (19.0-24.4 Nm).

**WARNING**

When any hydraulic brake component, line or connection is loosened or replaced on an ABS motorcycle, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to properly bleed the brake system could adversely affect braking, which could result in death or serious injury. (00585c)

3. Bleed brake system. See 2.18 BLEEDING BRAKES.

**NOTE**

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

---

### INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake caliper, front, mounting bolts</td>
<td>28-38 ft-lbs</td>
</tr>
<tr>
<td>Brake caliper, front, banjo bolt</td>
<td>14-18 ft-lbs</td>
</tr>
</tbody>
</table>

1. See Figure 2-47. Attach caliper to fork leg.
   
   a. Place caliper over brake disc with bleeder screw facing upwards.
GENERAL

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)

NOTICE

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)

NOTICE

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)

NOTES

• Use only CCI #20 BRAKE GREASE to lubricate master cylinder bores, pistons, primary cups and secondary cups.
• Use only KSS2E assembly grease on caliper pistons and piston seals.
• Use only G40M BRAKE GREASE on the caliper pins and booms.

REMOVAL

NOTICE

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)

1. See Figure 2-53. Remove fastener (1) and retainer (2).
2. See Figure 2-52. Remove banjo bolt (1) and two steel/rubber washers (2) to disconnect brake line from master cylinder. Discard washers.
3. Remove nut (4) to free assembly from mounting bracket.
4. Figure 2-54. Remove cotter pin (4) and washer (5) from clevis pin (8). Remove master cylinder assembly from brake pedal.
5. If disassembling master cylinder, remove retaining ring (3).

DISASSEMBLY

NOTE

Do not disassemble the cartridge body. The cartridge body components are not sold separately.

1. Thoroughly clean exterior of master cylinder assembly with denatured alcohol.
2. Stand master cylinder assembly upright on banjo sealing surface. For best results, suspend reservoir over edge of table. Be sure to lay down a clean shop cloth to protect the sealing surface from damage.

WARNING

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)

3. See Figure 2-48. Push down on large flat washer to compress spring. While holding the spring in a compressed state, remove retaining ring from groove in clevis and then carefully release spring. Discard retaining ring.

NOTE

See Figure 2-55. Pushrod/clevis/spacer washer (7) are a one-piece assembly.

4. Remove the large flat washer (17), dust boot (12) and spring (10) from pushrod/clevis/spacer washer (7) end of cartridge body (2). Remove spring (10) and spring retainer (11) from dust boot (12).
5. See Figure 2-49. Push on threaded end of cartridge body to remove from reservoir adapter. Use hand pressure only. Exercise care to keep cartridge body free of dirt and grease.

6. See Figure 2-55. Carefully remove two O-rings (1) from outside of cartridge body (2). Exercise caution to avoid scratching O-ring grooves.
7. Remove small retaining ring (8) from pushrod end of cartridge body. Assembly is spring loaded so be sure to hold the parts together as retaining ring is removed.
8. Remove pushrod/clevis/spacer washer (7) from cartridge body. Remove small retaining ring (8) from pushrod, if attached. Discard retaining ring.
4. Inspect the threads on the cartridge body and pushrod. Replace part if threads are damaged.

5. Inspect the spring for cracks or damaged coils. Replace as necessary.

6. Inspect O-ring grooves on the cartridge body for dirt. Carefully clean O-ring grooves using a soft cotton cloth moistened with alcohol and allow to dry. Inspect O-ring grooves for scratches. Replace cartridge body if grooves are scratched.

7. Inspect the reservoir cover gasket for cuts, tears or general deterioration. If gasket and/or sight glass replacement is necessary, proceed as follows:
   a. From inboard side, push sight glass toward top of cover until free.
   b. Pull rubber gasket from cover.
   c. Fill nipple of new gasket into hole of cover aligning gasket and cover through holes.
   d. From bottom of gasket, push flat end of sight glass through nipple until top of glass is flush with top of gasket. Verify that glass is square in bore. If some lubrication is necessary, use a small quantity of clean brake fluid.

ASSEMBLY

1. See Figure 2-55. To install piston (5) in cartridge body (2), proceed as follows:
   a. Install small spring (3) into cartridge body (2) making sure that spring is seated in counterbore.
   b. Lightly lubricate primary cup (4) and O-ring (6) on piston (5) with DOT 4 BRAKE FLUID.
   c. Install piston (5) over spring (3).

2. Install new large retaining ring (9) in groove on pushrod/clevis/spacer washer (7) side of cartridge body (2).

3. Position new retaining ring (8) on pushrod between spacer washer and clevis, or on clevis inboard of the retaining ring groove.

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)

1. Clean all metal parts, except the cartridge body assembly, and blow dry with compressed air. Clean all rubber parts using denatured alcohol.

2. Inspect the reservoir adapter bore for scratches. Replace the reservoir if scratches are present.

3. Check the dust boot for cuts or tears. Replace as necessary.
4. See Figure 2-50. Stand cartridge body upright on banjo sealing surface. Lay down a clean shop cloth to protect the sealing surface from damage.

**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)

5. Insert ball end of pushrod into piston cup. Pushing down on pushrod to compress spring, fit captured spacer washer into cartridge body. Further compressing spring as necessary, install retaining ring positioned in step 3 in groove of cartridge body bore.

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

7. See Figure 2-55. Lubricate new O-rings (1) with DOT 4 BRAKE FLUID and carefully install in grooves on outside of cartridge body (2).

8. Wipe bore of reservoir (18) adapter with DOT 4 BRAKE FLUID.

9. Insert cartridge body (2) into reservoir adapter. Align tab on adapter with slot on threaded end of cartridge. Use hand pressure only. Cartridge body is fully installed when reservoir adapter contacts large retaining ring.

10. See Figure 2-51. Stand master cylinder assembly upright on banjo sealing surface. For best results, suspend reservoir over edge of table. Be sure to lay down a clean shop cloth to protect the sealing surface from damage.

11. Install spring over pushrod and cartridge body until it contacts side of large retaining ring.

12. Place concave side of spring retainer over end of spring fitting inside tabs in slot of clevis.

13. Slide dust boot over spring and spring retainer.

14. Place large flat washer on top of dust boot fitting inside tabs in slot of clevis.

15. Push down on large flat washer to compress spring. While holding spring in a compressed state, install new retaining ring in groove of clevis.

16. Pull down dust boot as necessary to seat over lip on reservoir adapter.

17. Rotate boot so that hole is at the bottom. Bottom is the side opposite the index tab on reservoir adapter.

**INSTALLATION**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear master cylinder nut</td>
<td>30-40 ft-lbs</td>
</tr>
<tr>
<td>Rear master cylinder banjo</td>
<td>17-22 ft-lbs</td>
</tr>
<tr>
<td>Rear brake master cylinder</td>
<td>29-34 ft-lbs</td>
</tr>
<tr>
<td>retainer fastener</td>
<td></td>
</tr>
</tbody>
</table>

1. See Figure 2-54. If master cylinder was disassembled, install new retaining ring (3).

2. Install master cylinder assembly on brake pedal. Install washer (5) and new cotter pin (4) on clevis pin (6).

3. See Figure 2-52. Fit collar on cartridge body into hole of mounting bracket. Apply LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to threads of nut (4). Install nut on cartridge body until finger tight. Tighten to 30-40 ft-lbs (40.7-54.2 Nm).

4. Lubricate new steel/rubber washers (2) with DOT 4 BRAKE FLUID. Position new steel/rubber washers on each side of brake line (3). Insert the banjo bolt (1) through washers and fitting. Tighten to 17-22 ft-lbs (23.1-29.9 Nm).

5. See Figure 2-53. Install retainer (2) into position. Make sure tab on retainer is in alignment hole (3). Install fastener (1) and tighten to 29-34 ft-lbs (39.4-46.1 Nm).
When any hydraulic brake component, line or connection is loosened or replaced on an ABS motorcycle, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to properly bleed the brake system could adversely affect braking, which could result in death or serious injury.

6. Bleed brake system. See 2.18 BLEEDING BRAKES.

NOTE
A sight glass enables the rider to visually check the brake fluid level without removing the master cylinder cover. When the reservoir is full, the sight glass is dark. As the fluid level drops, the glass lightens up to indicate this condition to the rider.
1. Rear brake pedal
2. Master cylinder reservoir
3. Retaining ring
4. Cotter pin
5. Washer
6. Clevis pin

Figure 2-54. Rear Brake Control: Rear Mount
1. O-ring
2. Cartridge body
3. Spring
4. Primary cup
5. Piston
6. O-ring
7. Pushrod, Clevis, Spacer washer (one piece assembly)
8. Retaining ring
9. Retaining ring
10. Spring
11. Spring retainer
12. Dust boot
13. Clevis pin
14. Flat washer
15. Cotter pin
16. Retaining ring
17. Washer
18. Reservoir
19. Hex nut

Figure 2-55. Rear Master Cylinder Assembly
REAR BRAKE CALIPER

REMOVAL

NOTICE

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

If only replacing brake pads, do not remove rear brake caliper. If pad replacement is necessary, see 1.16 BRAKE PADS AND DISCS.

1. See Figure 2-56. Remove the banjo bolt (1) and both steel/rubber washers (2) to detach rear brake line from caliper. Discard washers.

2. Remove both the slider pin (3) and mounting bolt (4) (metric). Remove caliper assembly from brake disc.

3. To remove rear caliper mount:
   a. Remove axle from rear wheel. See 2.5 REAR WHEEL.
   b. Lift rear caliper mount away from axle and rear fork. Notch in caliper mount must clear tab on rear fork.

DISASSEMBLY

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48648</td>
<td>BRAKE CALIPER PISTON REMOVER</td>
</tr>
</tbody>
</table>

1. See Figure 2-57. Remove pad pin (3) and brake pads (12).

2. If necessary, remove bleeder screw (4).

NOTE

If phenolic insulators (8) are loose, remove from pistons.
1. Slider pin  
2. Bushing (upper)  
3. Pad pin  
4. Bleeder screw with O-ring  
5. Caliper housing  
6. Square seals (4)  
7. Piston (2)  
8. Phenolic insulator (available only in repair kit)  

9. Torque clip  
10. Rear caliper mount  
11. Rubber bumper  
12. Brake pads (2)  
13. Anti-rattle spring  
14. Rubber boot  
15. Bushing (lower)  
16. Mounting bolt  

Figure 2-57. Rear Brake Caliper

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**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)*

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**CAUTION**

When removing piston with compressed air, piston can develop considerable force and fly out of caliper bore. Keep hands away from piston to avoid possible injury. *(00530b)*

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**NOTE**

 Phenolic insulators may be loose when the brake pads are removed. Insulators can also loosen when the pistons are expanded from their bores. If insulators are not damaged, they can be reused.

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3. See Figure 2-58. Remove pistons.
   a. Place BRAKE CALIPER PISTON REMOVER (Part No. HD-48648) (3) into caliper housing. Install bolt (2) only enough to hold tool in place.

   **NOTE**

   Tool retaining bolt (2) is used only to keep tool from slipping out of the caliper during piston removal. Finger tighten bolt. Do not use a wrench to tighten.

   b. If the bleeder screw was removed, install it finger-tight.

   c. Apply low pressure compressed air to banjo bolt hole (1) to remove pistons from caliper bores. Listen for both pistons to “pop” against the tool.

   d. Remove piston remover tool.

4. Wiggle pistons to remove them completely from caliper bores.
Avoid leakage. Prevent damage to piston or piston bore. Use non-metallic tools when servicing components. (005236d)

5. See Figure 2-59. Using a wooden toothpick (1), remove two square seals (2) from each caliper bore. Discard all removed parts.

6. Pull anti-rattle spring (3) straight out to remove.

**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. (002391a)

**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 or DOT 4 BRAKE FLUID. Do not contaminate with mineral oil or other solvents. Wipe parts dry with a clean, lint-free cloth. Clear drilled passages and bore with clean compressed air. Do not use a wire or similar instrument to clean drilled passages.

2. Carefully inspect all components. Replace any parts that appear damaged or worn.
   a. Check pistons for pitting, scratches or corrosion on face and also on ground surfaces.
   b. Inspect phenolic insulators for damage.
   c. Inspect caliper piston bore. Do not hone bore. If bore should show pitting or corrosion, replace caliper.
   d. Inspect pad pin for grooving and wear. Measure the pad pin diameter in an unworn area and then in the area of any grooving or wear. If wear exceeds 0.015 in. (0.38 mm), replace both pins.
   e. See Figure 2-57. Inspect rubber boot (14) for cracks and damage. Inspect bushing (1S) for free movement. Inspect bushing (2) for free movement or damage.
   f. Always replace square seals after disassembly.

3. If decal on outside housing is removed, scrape remaining adhesive from surface with a razor blade.

4. Inspect brake pads and brake disc. See 1.16 BRAKE PADS AND DISCS.

**ASSEMBLY**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake caliper bleeder screw</td>
<td>80-100 in-lbs, 9.0-11.3 Nm</td>
</tr>
<tr>
<td>Brake pad pin, rear caliper</td>
<td>80-120 in-lbs, 9.0-13.6 Nm</td>
</tr>
</tbody>
</table>

**NOTE**

Do not use DOT 4 BRAKE FLUID for lubrication. Use of DOT 4 BRAKE FLUID will result in increased lever travel.
1. Lubricate the following parts before assembly using the lubricant supplied in the service parts kit. All other surfaces must be dry for assembly.
   a. Lubricate nose radius and outside diameter of piston. Apply lube to inside of caliper piston bores.
   b. Apply lube to inside diameter of square seals.

**NOTICE**

Avoid leakage. Prevent damage to piston or piston bore. Use non-metallic tools when servicing components. (00529d)

2. See Figure 2-59. Install two new square seals (2) into each piston bore. Use a wooden toothpick (1) to aid installation if needed.

3. Install anti-rattle spring (3). Verify that it is oriented correctly.

4. Carefully insert pistons, by hand, into bores of caliper housing. Press pistons squarely into place until they bottom in the bores. If installation shows resistance, remove piston and check that seals are properly installed.

5. See Figure 2-57. Install bleeder screw (4) (with O-ring) in caliper housing, if removed. Tighten to 80-100 in-lbs (9.0-11.3 Nm).

**NOTE**

Verify phenolic inserts (8) are in place before installing brake pads.

6. Insert brake pads into caliper with friction material facing opening for brake disc.

7. Install pin (3). Tighten to 80-120 in-lbs (9.0-13.6 Nm).

**NOTE**

If pad pins do not fit, check the following:
- You are using a set of pads, not two identical pads.
- Anti-rattle spring orientation matches Figure 2-57.

**REAR BRAKE LINE ROUTING**

See Figure 2-60. When routing the rear brake line (3), make sure it is placed over the pivot shaft (2) and held in place by hose clip (1). 2010 model year and earlier brake lines are routed under the pivot shaft.

**INSTALLATION**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake caliper mounting bolt, rear</td>
<td>16-20 ft-lbs</td>
</tr>
<tr>
<td>Rear caliper banjo bolt</td>
<td>17-22 ft-lbs</td>
</tr>
</tbody>
</table>

1. Install rear axle and caliper mount if removed. Verify notch in mount engages tab on rear fork. See 2.5 REAR WHEEL.

2. See Figure 2-57. Verify torque clip (9) is in place in caliper mount.

3. See Figure 2-66. Install caliper with pads on caliper mount. Tighten slider pin (3) and mounting bolt (4) (metric) to 16-20 ft-lbs (21.7-27.1 Nm). Verify tabs on brake pads engage slot (5) in caliper mount.

**NOTICE**

Avoid leakage. Be sure gaskets, banjo bolt(s), brake line and caliper bore are clean and undamaged before assembly. (00321a)

4. Lubricate new steel/rubber washers with DOT 4 BRAKE FLUID. Connect the brake line to caliper using two new washers (2) and banjo bolt (1). Tighten to 17-22 ft-lbs (23.1-29.9 Nm).

**WARNING**

When any hydraulic brake component, line or connection is loosened or replaced on an ABS motorcycle, Digital Technician must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to properly bleed the brake system could adversely affect braking, which could result in death or serious injury. (00585c)

5. Bleed brake system. See 2.18 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.
## FRONT MASTER CYLINDER TO FRONT HCU

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48650</td>
<td>DIGITAL TECHNICIAN II</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TO Torque VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banjo bolt-to-front master cylinder</td>
<td>17-22 ft-lbs 23.1-29.9 Nm</td>
</tr>
<tr>
<td>Banjo bolt to HCU</td>
<td>120-144 in-lbs</td>
</tr>
</tbody>
</table>

### Removal
1. See Figure 2-61. Cut cable strap (1).
2. Remove clip (2).
3. FLSTC: Remove brake line from handlebar clip.
   
   **NOTE**
   Wrap banjo fittings with pieces of lint-free shop towel to absorb any lost of brake fluid.
4. Remove banjo bolt from HCU. Discard sealing washers.
   
   **NOTE**
   Always clean master cylinder cover before removal.
5. Remove cover from master cylinder reservoir.
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 sealing washers.

![Figure 2-61. Master Cylinder-to-Front HCU Line](image)

### Installation
1. Start banjo bolt with new sealing washers to secure brake line to master cylinder.
2. Start banjo bolt with new sealing washers to secure brake line to HCU.
3. See Figure 2-61. Install clip (2).
4. Install new cable strap (1) to secure brake line to fuel tank vent hose.
5. FLSTC: install brake line through clip on right handlebar.
6. Tighten master cylinder banjo bolt to 17-22 ft-lbs (23.1-29.9 Nm).
7. Tighten HCU banjo bolt to 120-144 in-lbs (13.6-16.3 Nm).

### WARNING
When any hydraulic brake component, line or connection is loosened or replaced on an ABS motorcycle, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to properly bleed the brake system could adversely affect braking, which could result in death or serious injury.

8. Fill and bleed brake system. See 2.18 BLEEDING BRAKES.
9. To confirm that brake system is properly connected and that all air is purged, connect motorcycle to DIGITAL TECHNICIAN II (Part No. HD-48650) and perform "ABS Service" procedure in the "Tool Box" menu.

**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. (00295a)

10. Test brake system.
   a. Turn ignition switch ON. Pump brake hand lever to verify operation of the brake lamp.
   b. Test ride the motorcycle. If the brakes feel spongy, bleed the system again.

**HCU TO FRONT BRAKE CALIPER**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48650</td>
<td>DIGITAL TECHNICIAN II</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ABS front brake line 90 degree fitting bolt</td>
<td>36-48 in-lbs</td>
<td>4.1-5.4 Nm</td>
</tr>
<tr>
<td>Banjo bolt to front caliper</td>
<td>17-22 ft-lbs</td>
<td>23.1-29.9 Nm</td>
</tr>
<tr>
<td>Banjo bolt to HCU</td>
<td>120-144 in-lbs</td>
<td>13.6-16.3 Nm</td>
</tr>
</tbody>
</table>

**Removal**

1. See Figure 2-62. Disconnect clips (3) from brake line.
2. Remove cable straps (1) from brake line.
3. All but FLSTC: Remove clip (2).
4. FLSTC: Remove cable straps (4).
5. Remove clip securing brake line to left frame downtube.
6. Remove bolt securing brake line 90 degree fitting to bottom of fork stem.

**NOTE**

Wrap banjo fittings with pieces of lint-free shop towel to absorb any loss of brake fluid.

7. Remove banjo bolt to release brake line from HCU. Discard sealing washers.
8. Remove banjo bolt to release brake lines from caliper. Discard sealing washers.

**Installation**

1. Start banjo bolt with new sealing washers to secure brake line to caliper.
2. Start banjo bolt with new sealing washers to secure brake line to caliper to HCU.
3. Install brake line 90 degree fitting with bolt to bottom of fork stem. Tighten bolt to 36-48 in-lbs (4.1-5.4 Nm).
4. See Figure 2-62. Connect clips (3) securing WSS wire to brake line.
5. Install new cable straps (1) securing WSS wire to crimped ends on 90 degree fitting.
6. All but FLSTC: install clip (2).
7. FLSTC: Install new cable straps (4).
8. Install clip securing brake line to left frame downtube.
9. Tighten caliper banjo bolt to 17-22 ft-lbs (23.1-29.9 Nm).
10. Tighten HCU banjo bolt to 120-144 in-lbs (13.6-16.3 Nm).

**WARNING**

When any hydraulic brake component, line or connection is loosened or replaced on an ABS motorcycle, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to properly bleed the brake system could adversely affect braking, which could result in death or serious injury. (00585c)

11. Fill and bleed brake system. See 2.13 BLEEDING BRAKES.
12. To confirm that brake system is properly connected and that all air is purged, connect motorcycle to DIGITAL
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)

13. Test brake system.
   a. Turn ignition switch ON. Pump brake foot pedal to verify operation of the brake lamp.
   b. Test ride the motorcycle. If the brakes feel spongy, bleed the system again.

### REAR MASTER CYLINDER TO REAR HCU

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48650</td>
<td>DIGITAL TECHNICIAN II</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stoplight switch, rear</td>
<td>12-15 ft-lbs</td>
</tr>
<tr>
<td>Stoplight switch bracket fastener</td>
<td>30-35 ft-lbs</td>
</tr>
<tr>
<td>Banjo bolt to rear master cylinder</td>
<td>17-22 ft-lbs</td>
</tr>
<tr>
<td>Banjo bolt to rear HCU</td>
<td>120-144 in-lbs</td>
</tr>
</tbody>
</table>

### Removal

1. Remove electrical panel. See 7.3 ELECTRICAL PANEL.
2. See Figure 2-63. Remove electrical connectors (3) from stoplight switch (2).
3. Remove fastener (1) securing stoplight switch to frame.
   
   **NOTE**
   Record location of cable straps before removal to aid during installation.
4. Remove cable straps securing brake line with electrical harness to frame.
   
   **NOTE**
   Wrap banjo fittings with pieces of lint-free shop towel to absorb any loss of brake fluid.
5. See Figure 2-64. Remove alignment cover (7).
6. Remove banjo bolt from master cylinder-to-rear HCU line (8). Discard sealing washers.
7. Stand motorcycle upright so rear master cylinder reservoir is level.
   
   **NOTE**
   Always clean master cylinder cover before removal.
8. Remove cover from master cylinder reservoir.
   
   **NOTE**
   Wrap banjo fittings with pieces of lint-free shop towel to absorb any loss of brake fluid.
2. Place rear brake line into approximate position along top of lower right frame tube.

3. See Figure 2-64. Start banjo bolt with new sealing washers to secure brake line (8) to HCU.

4. Install alignment cover (7).

5. See Figure 2-65. Verify both brake lines at rear HCU are properly positioned.

6. See Figure 2-63. Install fastener (1) with washer securing stoplight switch to frame. Tighten to 30-35 ft-lbs (40.6-47.4 Nm).

7. Install electrical connectors (3) to stoplight switch (2).

8. Secure brake line to master cylinder reservoir using new sealing washers. Tighten banjo bolt (12) to 17-22 ft-lbs (23.1-29.9 Nm).

9. Tighten banjo bolt to HCU to 120-141 in-lbs (13.6-16.3 Nm).

10. Install new cable straps securing brake line and electrical harness to frame.

---

**WARNING**

When any hydraulic brake component, line or connection is loosened or replaced on an ABS motorcycle, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to properly bleed the brake system could adversely affect braking, which could result in death or serious injury. (00585c)

11. Fill and bleed brake system. See 2.18 BLEEDING BRAKES.

12. Install electrical panel. See 7.3 ELECTRICAL PANEL.

13. To confirm that the brake systems are properly connected and air is completely purged, perform the following tasks:
   a. Install master cylinder reservoir covers.
   b. Connect motorcycle to DIGITAL TECHNICIAN II (Part No. HD-48650).
   c. Perform "ABS Service" procedure in the "Tool Box" menu.

---

**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 brake system.
   a. Turn ignition switch ON. Pump brake hand lever to verify operation of the brake lamp.
   b. Test ride the motorcycle. If the brakes feel spongy, bleed the system again.

---

Installation

1. If installing new rear stoplight switch, apply LOCTITE 565 THREAD SEALANT to threads. Install switch into rear brake line. Tighten to 12-15 ft-lbs (16.3-20.3 Nm).
REAR HCU TO REAR BRAKE CALIPER

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48650</td>
<td>DIGITAL TECHNICIAN II</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banjo bolt to rear caliper</td>
<td>17-22 ft-lbs 23.1-29.9 Nm</td>
</tr>
<tr>
<td>Banjo bolt to HCU</td>
<td>120-144 in-lbs 13.6-16.3 Nm</td>
</tr>
</tbody>
</table>

Removal
1. Remove electrical panel. See 7.3 ELECTRICAL PANEL.
2. See Figure 2-66. Remove clips (3) and cut cable strap (1).
3. Remove brake line from weldment (2).

NOTE
Wrap banjo fittings with pieces of lint-free shop towel to absorb any loss of brake fluid.
4. See Figure 2-64. Remove alignment cover (7).
5. Remove banjo bolt to release rear HCU-to-caliper line (5) from HCU. Discard sealing washers.
6. Remove banjo bolt from rear brake caliper. Discard sealing washers.
7. Remove brake line.

Figure 2-66. WSS cable Routing
1. Cable strap
2. Weldment
3. Clip (2)

Figure 2-67. Rear HCU Fittings Properly Installed

1. Rear HCU-to-caliper line
2. Master cylinder-to-rear HCU line
3. Rear HCU
4. Alignment cover

Installation
1. See Figure 2-64. Start banjo bolt with new sealing washers to secure brake line (5) to HCU.
2. Install alignment cover (7).
3. See Figure 2-67. Verify both brake lines at rear HCU are properly positioned.
4. See Figure 2-66. Route brake line into weldment over pivot shaft and down rear fork frame. Attach brake line to weldment (2).
5. Install banjo bolt to caliper with new sealing washers and tighten to 17-22 ft-lbs (23.1-29.9 Nm).
6. Tighten banjo bolt at rear HCU to 120-144 in-lbs (13.6-16.3 Nm).
7. See Figure 2-66. Install clips (3) and new cable strap (1).

WARNING
When any hydraulic brake component, line or connection is loosened or replaced on an ABS motorcycle, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to properly bleed the brake system could adversely affect braking, which could result in death or serious injury. (00585c)

8. Fill and bleed brake system. See 2.18 BLEEDING BRAKES.
9. Install electrical panel. See 7.3 ELECTRICAL PANEL.
10. To confirm that brake system is properly connected and all air is purged, connect motorcycle to DIGITAL TECHNICIAN II (Part No. HD-48650) and perform "ABS Service" procedure in the "Tool Box" menu.

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)
11. Test brake system.
   a. Turn ignition switch ON. Pump brake foot pedal to verify operation of the brake lamp.
   b. Test ride the motorcycle. If the brakes feel spongy, bleed the system again.
REMOVAL: ALL BUT FXSB

1. Remove seat.

**WARNING**

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. Disarm security system, if equipped and remove main fuse.

3. Remove right side saddlebag, if present.

**NOTE**

Rear wheel may have to be raised slightly to allow for splash guard removal.

4. Remove splash guard.

5. See Figure 2-68. Detach body control module (BCM) (1) from electrical panel and remove both electrical connectors.

6. See Figure 2-69. Detach electronic control unit (ECU) (1) from electrical panel and remove electrical connector.

INSTALLATION: ALL BUT FXSB

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Splash guard screw: all but FXSB</td>
<td>36-48 in-lbs</td>
</tr>
</tbody>
</table>

1. See Figure 2-69. Connect ECU connector and install ECU (1) onto electrical panel.

2. See Figure 2-68. Connect both BCM connectors and install BCM (1) onto electrical panel.

3. Install splash guard with screw(s). Tighten to 36-48 in-lbs (4.1-5.4 Nm).

4. Install right side saddlebag, if removed.

5. Install main fuse.

**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)

6. Test for correct operation.

**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)

7. Install seat.

Figure 2-68. Body Control Module (BCM): All But FXSB
3. Remove splash guard.
4. See Figure 2-70. Remove WSS connector (1).
5. Disconnect ECU connector.
6. Remove ECU (2) from panel.

**INSTALLATION: FXSB**

1. See Figure 2-70. Install ECU (2).
2. Connect ECU connector.
3. Install WSS connector (1).
4. Install splash guard.
5. Install rear wheel. See 2.5 REAR WHEEL.
6. Install main fuse.

---

**REMOVAL: FXSB**

1. Remove main fuse.
2. Remove rear wheel. See 2.5 REAR WHEEL.

---

**Figure 2-69. Electrical Panel**

**Figure 2-70. ECU**
FRONT HYDRAULIC CONTROL UNIT (HCU)

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48650</td>
<td>DIGITAL TECHNICIAN II</td>
</tr>
<tr>
<td>SNAP-ON BB200A</td>
<td>BASIC VACUUM BRAKE BLEEDER</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCU screws, rear cover to front</td>
<td>24-36 in-lbs, 2.7-4.1 Nm</td>
</tr>
<tr>
<td>HCU screws, lower front</td>
<td>54-84 in-lbs, 6.7-9.5 Nm</td>
</tr>
<tr>
<td>HCU screws, upper front</td>
<td>48-72 in-lbs, 5.4-8.1 Nm</td>
</tr>
<tr>
<td>Banjo bolts to front HCU</td>
<td>120-144 in-lbs, 13.6-16.3 Nm</td>
</tr>
</tbody>
</table>

NOTE

For best results, use the BASIC VACUUM BRAKE BLEEDER (Part No. Snap-On BB200A) or equivalent tool to drain the brake systems.

6. To confirm that the brake systems are properly connected and air is completely purged, perform the following tasks:
   a. Install master cylinder reservoir covers.
   b. Connect motorcycle to DIGITAL TECHNICIAN II (Part No. HD-48650).
   c. Perform "ABS Service" procedure in the "Tool Box" menu.

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)

7. Test brake system.
   a. Turn ignition switch ON. Pump brake hand lever to verify operation of the brake lamp.
   b. Test ride the motorcycle. If the brakes feel spongy, bleed the system again.

REMoval

1. Disconnect front HCU electrical connector.

   NOTE

   For best results, use the BASIC VACUUM BRAKE BLEEDER (Part No. Snap-On BB200A) or equivalent tool to drain the brake systems.

2. Drain front brake system.

   NOTE

   Plug open HCU ports and seal banjo fittings to prevent leakage and contamination.

3. See Figure 2-71. Remove banjo bolts (6) to release brake lines from front HCU. Discard sealing washers.

4. Remove screws (4, 7, 11) and separate front HCU (13) from front and rear covers (8, 12).

INSTALLATION

1. See Figure 2-71. Place rear cover (12) on front HCU (13) and secure with screws (11). Tighten screws to 24-36 in-lbs (2.7-4.1 Nm).

2. Attach electrical connector to front HCU (13).

3. Place front cover (8) into position and secure with screws (4, 7). Tighten screws as follows.
   a. Screws (7) to 54-84 in-lbs (6.7-9.5 Nm).
   b. Screws (4) to 48-72 in-lbs (5.4-8.1 Nm).

4. Install banjo bolts (6) with new sealing washers (5). Tighten to 120-144 in-lbs (13.6-16.3 Nm).

WARNING

When any hydraulic brake component, line or connection is loosened or replaced on an ABS motorcycle, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to properly bleed the brake system could adversely affect braking, which could result in death or serious injury. (00585c)

5. Fill and bleed brake systems. See 2.18 BLEEDING BRAKES.
NOTE
For best results, use the BASIC VACUUM BRAKE BLEEDER (Part No. Snap-On BB200A) or equivalent tool to drain the brake systems.

3. Drain rear brake system.

NOTE
Plug open HCU ports and seal banjo fittings to prevent leakage and contamination.

4. See Figure 2-72. Remove banjo bolts (6) to release brake lines from rear HCU. Discard sealing washers.

5. Remove screw (9), clamp (10), and rear HCU (11).

Installation
1. See Figure 2-72. If bracket (1) was removed, install bracket with washers (2) and screws (3). Tighten screws to 36-72 in-lbs (5.0-10.0 Nm).

2. Install rear HCU, and secure with clamp (10) and screw (9). Tighten screw to 24-42 in-lbs (2.7-4.7 Nm).

3. Attach electrical connector to rear HCU (11).

4. Loosely install banjo bolts (6) with new sealing washers (5).

5. Install alignment cover (7) over banjo bolts.

6. Tighten banjo bolts to 120-144 in-lbs (13.6-16.3 Nm).

7. See Figure 2-73. Verify both brake lines at rear HCU are properly positioned.

WARNING
When any hydraulic brake component, line or connection is loosened or replaced on an ABS motorcycle, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to properly bleed the brake system could adversely affect braking, which could result in death or serious injury. (00535c)

8. Fill and bleed brake systems. See 2.18 BLEEDING BRAKES.

NOTE
For best results, use the BASIC VACUUM BRAKE BLEEDER (Part No. Snap-On BB200A) or equivalent tool.

9. Install electrical panel. See 7.3 ELECTRICAL PANEL.

10. To confirm that the brake systems are properly connected and air is completely purged, install master cylinder reservoir covers, connect motorcycle to DIGITAL TECHNICIAN II (Part No. HD-48650) and perform “ABS Service” procedure in the “Tool Box” menu.

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)
11. Test brake system.
   a. Turn ignition switch ON. Pump brake foot pedal to verify operation of the brake lamp.
   b. Test ride the motorcycle. If the brakes feel spongy, bleed the system again.

Figure 2-72. Rear Hydraulic Control Unit (HCU)

1. Bracket
2. Washer (2)
3. Screw (2)
4. Sealing washer (4)
5. Rear HCU-to-caliper line
6. Banjo bolt (2)
7. Alignment cover
8. Master cylinder-to-rear HCU line
9. Screw
10. Clamp
11. Rear HCU

Figure 2-73. Rear HCU Fittings Properly Installed
GENERAL

**WARNING**

When any hydraulic brake component, line or connection is loosened or replaced on an ABS motorcycle, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to properly bleed the brake system could adversely affect braking, which could result in death or serious injury. (00585c)

**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)

**NOTICE**

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)

- If DOT 4 brake fluid contacts painted surfaces, IMMEDIATELY flush area with clear water.

**NOTICE**

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

**PROEDURE**

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

**FASTENER** | **TORQUE VALUE**
--- | ---
Brake caliper, front, bleeder valve | 35-61 in-lbs | 3.9-6.9 Nm
Brake caliper, rear, bleeder valve | 80-100 in-lbs | 9.0-11.3 Nm
Brake master cylinder, front, reservoir cover screws | 8.9-17.7 in-lbs | 1.0-2.0 Nm
Brake master cylinder, rear, reservoir cover screws | 8-8 in-lbs | 0.7-0.9 Nm

**NOTES**

- For best results, use of BASIC VACUUM BRAKE BLEEDER (Part No. Snap-on BB200A) or equivalent tool is recommended, particularly if the brake system was completely drained. If a vacuum brake bleeder is not available, use the following procedure.

- **ABS models:** To confirm that the brake systems are properly connected and air is completely purged, install master cylinder reservoir covers, connect motorcycle to DIGITAL TECHNICIAN II (Part No. HD-48650) and perform "ABS Service" procedure.

1. Remove bleeder valve cap. Install end of clear plastic tubing over bleeder valve and place free and in a clean container.

2. Position vehicle or handlebar so master cylinder reservoir is level.

**NOTES**

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

3. Always clean master cylinder cover before removing.

3. Remove cover from master cylinder reservoir.

**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)

4. Top off the reservoir. Verify proper operation of the master cylinder relief port by actuating the brake pedal or lever. A slight spur of fluid will break the fluid surface in the reservoir if internal components are working properly. Refer to Table 2-15.

5. Operate the brake lever or pedal to build hydraulic pressure.

**NOTE**

Pay careful attention to fluid level in the master cylinder reservoir. Add fluid before it empties to avoid drawing air into the brake lines.

2015 Softail Service: Chassis 2-63
6. While holding pressure with the brake lever or pedal:
   a. Open bleeder valve about 3/4 turn.
   b. Close bleeder valve as soon as the lever or pedal has moved full range of travel.
   c. Allow brake lever or pedal to return slowly to its released position.

7. Repeat steps until all air bubbles are purged and a solid column of fluid is observed in the bleeder tube.

8. Tighten bleeder valve to specification. Refer to Table 2-16. Install bleeder valve cap.

9. Check and fill reservoir to specified level.

10. Refer to Table 2-16. Verify gasket and sealing surfaces are free of debris. Install master cylinder reservoir cover as follows:
    a. Front master cylinder reservoir: Orient the cover with the vent holes facing the rear. Install cover screws. Tighten to specification.
    b. Rear master cylinder reservoir: Install cover screws. Tighten to specification.

11. ABS equipped models: Connect DIGITAL TECHNICIAN II (Part No. HO-48650) and perform "ABS Service" procedure.

12. Verify stop lamp operation.

**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)

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

There are three varieties of hydraulic forks:
- All FLSTC, FLSTFB, FLSTN and FLSD models use the type shown in Figure 2-78.
- All FXST models use the type shown in Figure 2-79.
- All FXSB models use the type shown in Figure 2-80.

Use the following information to service the models listed above.

FORK OIL LEAK CHECK

Fork Oil Seals

The fork oil seal allows a fine film of oil to lubricate the fork sliding surface.
- The oil film is more visible after continuous high-speed compression and rebound movement.
- Due to greater lubrication needs, larger forks have a greater amount of oil film than smaller forks.

Oil Leak Check

1. Observe oil ring.
2. Wipe fork clean.
3. Ride motorcycle over bumpy road or complete six braking events.
4. See Figure 2-75. Check fork slider tube for oil.
   a. If a normal oil/dust film (1, 2) is present, there is no leak.
   b. If an oil run or drip (3) is present, perform procedure two or three more times to confirm oil leak.

REPLACING FORK OIL

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fork drain screw</td>
<td>52-78 in-lbs 5.9-8.9 Nm</td>
</tr>
<tr>
<td>Fork tube cap</td>
<td>60-70 ft-lbs 81.3-95.0 Nm</td>
</tr>
</tbody>
</table>

NOTES
- At the specified fork oil change service interval, inspect the front fork assembly. Look for oil leakage past the seals and excessive wear on slider tubes. Disassemble and clean components. Replace or repair as necessary.
- The FLSTC and FLSTFB models have a preloaded fork spring.
1. Support the motorcycle so the front wheel is off the floor and the fork is fully extended.

Figure 2-75. Front Forks
WARNING

Wear safety glasses or goggles when servicing fork assembly. Do not remove slider tube caps without relieving spring preload or caps and springs can fly out, which could result in death or serious injury. (00297a)

2. See Figure 2-76. Remove the fork tube caps.

NOTE
FXSB models require the fork tubes be removed and to drain fork oil.

3. Drain fork oil. See Figure 2-77. Remove and discard the drain screws and washers from each fork tube and drain the fork oil.

4. Install new drain screws and washers. Tighten to 52-78 in-lbs (5.9-8.9 Nm).

Figure 2-76. Fork Tube Cap

NOTE
Slowly pump slider 3 – 10 times to remove air from assembly before measurement.

5. Fill fork with Harley-Davidson TYPE E FORK OIL. Refer to Table 2-17.

6. Tighten fork tube caps to 60-70 ft-lbs (81.3-95.0 Nm).

Table 2-17. Type E Fork Oil Amounts

<table>
<thead>
<tr>
<th>MODEL</th>
<th>OZ</th>
<th>CC</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLSTC, FLSTN, FLB, FLSTF/B</td>
<td>13.4</td>
<td>395</td>
<td>4.41</td>
<td>112.0</td>
</tr>
<tr>
<td>FXST</td>
<td>12.5</td>
<td>370</td>
<td>6.69</td>
<td>170.0</td>
</tr>
<tr>
<td>FXSB</td>
<td>26.7</td>
<td>790</td>
<td>3.35</td>
<td>65.0</td>
</tr>
</tbody>
</table>

NOTE
Fork oil amounts can be measured two ways. Refer to Table 2-17.
- Use oz/cc measurement if fork is left in frame.
- Use in/mm measurement if fork is disassembled. In this case, oil level is measured from top of fork tube, with spring removed and fork fully compressed.

Figure 2-77. Fork Drain Screw: (Left Side Shown)

REMOVAL.

1. Support the motorcycle so the front wheel is off the ground and the fork is fully extended.

2. Remove front wheel and brake caliper. See 2.4 FRONT WHEEL.

NOTE
Fuel tank crossover hose does not need to be disconnected. Fuel tank can be slid back enough to remove required connectors.

3. All but FXST, FXSB:
   a. Slide fuel tank rearward. See 4.6 FUEL TANK.
   b. Remove headlamp assembly. See 7.14 HEADLAMP.
   c. Remove auxiliary lamps, if equipped. See 7.17 AUXILIARY LAMPS: FLSTC, FLSTN.
   d. See Figure 2-78. Remove front panel (51).

4. Remove front fender. See 2.30 FRONT FENDER.

5. All but FXSB: see Figure 2-78 or Figure 2-79.
   a. Remove slider tube cap (1).
   b. Remove spacer (2) and oil seal (3).

6. FXSB: see Figure 2-80. Loosen fork bracket pinch bolts (4,34) and pull each slider and tube assembly from brackets.

7. All but FXSB: see Figure 2-78 or Figure 2-79. Loosen lower fork stem bracket pinch bolts (4) and pull each slider and tube assembly from brackets.

DISASSEMBLY

WARNING

Wear safety glasses or goggles when servicing fork assembly. Do not remove slider tube caps without relieving spring preload or caps and springs can fly out, which could result in death or serious injury. (00297a)

1. See Figure 2-78, Figure 2-79, or Figure 2-80. Remove the fork tube plug (5) and O-ring (6). Pull spring (7) out of slider tube (8).
2. **All but FXSB**: Remove drain screw (9) and washer (10) to drain the fork.

3. **FXST**: See Figure 2-79. Remove dust cover (23) and dust shield (47).

4. **FXSB**: See Figure 2-80. Remove case cover (23) and dust seal (24).

5. See Figure 2-78, Figure 2-79, or Figure 2-80. Compress retaining ring (11) and remove the clip from the internal groove at the top of slider (12).

   **NOTE**
   
   *Since there is little resistance to rotation when removing socket screw (13), the job is done more easily with an air impact wrench.*

6. Remove socket head screw (13) with washer (14) from the bottom end of fork slider (12). This will free damper tube (15) and fork slider tube (8) from slider.

7. The upper slider tube bushing (16) is a slight interference fit in slider (12). The upper bushing, seal spacer (17) and slider oil seal (18) are removed together. Use the fork tube and lower slider bushing (19) as a slide hammer. Pull the fork tube in a quick continuous stroke. Continue this slide hammer action until the components are freed.

8. Push the damper tube (15) and damper tube spring (20) free of slider tube (8) by inserting a small diameter rod through the opening in the bottom of tube.

9. Remove lower stop (21) from the lower end of damper tube (15).

10. Damper tube ring (22) can now be removed from the grooves at the top end of damper tube (15). Do not remove lower slider bushing (19) unless it requires replacement. When replacing lower slider bushing (19), expand the new split bushing only enough to fit over slider tube (8). Slide bushing into the bushing groove.
1. Slider tube cap (2)
2. Spacer (2)
3. Oil seal (2)
4. Bolt (2)
5. Fork tube plug (2)
6. Fork tube plug O-ring (2)
7. Spring (2)
8. Slider tube (2)
9. Drain screw (2)
10. Washer (2)
11. Oil seal retaining ring (2)
12. Slider
13. Screw (2)
14. Washer (2)
15. Damper tube (2)
16. Upper slider tube bushing (2)
17. Seal spacer
18. Slider oil seal (2)
19. Lower slider bushing
20. Damper tube spring (2)
21. Lower stop (2)
22. Damper tube spring (2)
23. Clip nut
24. Stem and bracket
25. Fork stem cap
26. Bolt
27. Screw (2)
28. Fork stem washer
29. Upper bracket
30. Upper dust shield
31. Lower dust shield
32. Roller bearing (2)
33. Bearing cup (2)
34. Adjusting nut
35. Screw (4)
36. Screw (4)
37. Screw (4)
38. Washer (2)
39. Lockwasher (2)
40. Lockwasher (4)
41. Nut (2)
42. Warning label
43. Fork stem retaining ring
44. Axle cap (2)
45. Fork slider/tube asmb. right
46. Fork slider/tube asmb. left
47. Reflector (2)
48. Slider cover (2)
49. Stud (4)
50. Front panel bracket (2)
51. Front panel
52. Left rear back panel
53. Trim strip (2)
54. Right rear back panel
55. Bolt (2)

Figure 2-78. Front Fork: FLSTC, FLSTF/B, FLSTN, FLS
Figure 2-79. Front Fork: FXST

1. Slider tube cap (2)
2. Spacer (2)
3. Oil seal (2)
4. Bolt (2)
5. Fork tube plug (2)
6. Fork tube plug O-ring (2)
7. Spring (2)
8. Slider tube (2)
9. Drain screw (2)
10. Washer (2)
11. Oil seal retaining ring (2)
12. Slider
13. Screw (2)
14. Washer (2)
15. Damper tube (2)
16. Upper slider tube bushing (2)
17. Seal spacer
18. Slider oil seal (2)
19. Lower slider bushing
20. Damper tube spring (2)
21. Lower stop (2)
22. Damper tube ring (2)
23. Dust cover (2)
24. Stem and bracket
25. Fork stem cap
26. Fork stem nut
27. Screw (2)
28. Fork stem lockwasher
29. Upper bracket
30. Upper dust shield
31. Lower dust shield
32. Roller bearing (2)
33. Bearing race (2)
34. Adjusting nut
35. Lockwasher (2)
36. Washer (2)
37. Lockwasher (2)
38. Nut (2)
39. Pad (2)
40. Axle cap
41. Stud (2)
42. Fork slider and tube assy. left
43. Fork slider and tube assy. right
44. Reflector (2)
45. Headlamp mounting plate
46. Fork stem retaining ring
47. Dust shield (2)
CLEANING AND INSPECTION

1. Clean all parts.
2. Inspect parts for wear or damage. Replace any parts that are damaged.
3. Replace retaining clip if bent or distorted.
4. Inspect OD of slider bushing and ID of fork tube bushing:
   a. If coating is worn through (metallic substrate showing), replace bushing.
   b. Inspect for distortion.
   c. If deep scratches or scoring are found, replace bushing. Also inspect mating components for similar wear. Repair or replace as necessary.
5. Check fork tube and slider for scoring, scratches and abnormal wear.
6. Inspect fork tube for nicks from stones and road debris, especially in area where seal contacts it. Replace if necessary.
7. See Figure 2-81. Check runout with a dial indicator.
   a. Set fork tube on V-blocks.
   b. Replace fork if runout exceeds 0.008 in (0.2 mm).

![Figure 2-81. Measure Fork Tube Runout](image)

ASSEMBLY

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-34634</td>
<td>FORK SEAL INSTALLER</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fork damper tube screw, front</td>
<td>130-216 in-lbs</td>
</tr>
<tr>
<td></td>
<td>14.7-24.5 Nm</td>
</tr>
<tr>
<td>Fork stem pinch bolts, lower</td>
<td>55-60 ft-lbs</td>
</tr>
<tr>
<td>(all but FXSB)</td>
<td>74.6-81.3 Nm</td>
</tr>
<tr>
<td>Fork stem pinch bolts, upper</td>
<td>30-35 ft-lbs</td>
</tr>
<tr>
<td>and lower: FXSB</td>
<td>40.7-47.5 Nm</td>
</tr>
</tbody>
</table>

NOTE
Lubricate all seal lips, quad rings and O-rings with HARLEY DAVIDSON SEAL GREASE during assembly.

1. Install damper tube ring (22). Place damper tube spring (20) on damper tube (15). Insert damper tube into slider tube (8).
2. Insert spring (7) into slider tube (8), tapered side toward damper tube (15), and push bottom of damper tube through the opening at the bottom end of the fork tube. Place lower slop (21) over end of damper tube (15).
3. Apply LOCTITE 565 THREAD SEALANT to screw (13).
4. Position slider tube (8) and damper tube (15) in slider (12). Hold the assembly in place by exerting pressure on the spring and install socket screw (13) with washer (14).
5. Tighten screw (13) to 130-216 in-lbs (14.7-24.5 Nm).
6. Place upper slider tube bushing (16), seal spacer (17) and a new slider oil seal (18) (in that order) over fork slider (12). Be sure that the lettered side of the seal is facing upward.
7. Place FORK SEAL INSTALLER (Part No. HD-34634) over fork slider (12). Seat upper slider tube bushing (16), seal spacer (17), and slider oil seal (18) into the slider bore by lightly tapping the components into place with the installation tool.
8. Install oil seal retaining ring (11).
9. FXST: Install dust cover (23) and dust shield (47).
10. FXSB: Install case cover (23) and dust seal (24).
11. Fill forks with Harley-Davidson TYPE E FORK OIL. See 2.19 FRONT FORK, Replacing Fork Oil.

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slider tube cap</td>
<td>60-70 ft-lbs</td>
</tr>
<tr>
<td></td>
<td>81.3-95.0 Nm</td>
</tr>
<tr>
<td>Fork stem pinch bolts, lower</td>
<td>55-60 ft-lbs</td>
</tr>
<tr>
<td>(all but FXSB)</td>
<td>74.6-81.3 Nm</td>
</tr>
<tr>
<td>Fork stem pinch bolts, upper</td>
<td>30-35 ft-lbs</td>
</tr>
<tr>
<td>and lower: FXSB</td>
<td>40.7-47.5 Nm</td>
</tr>
</tbody>
</table>

1. Insert both fork side assemblies up through the fork stem and bracket (24) and upper bracket (29).
2. FXSB: see Figure 2-82. Adjust fork stem protrusion to 0.35 in. (8.9 mm).

NOTE
Be sure one flat on each fork tube plug (5) faces toward the inside of the fork.

3. All but FXSB: Install new oil seal (3), spacer (2), and slider tube cap (1). Tighten cap (1) to 60-70 ft-lbs (81.3-95.0 Nm).
4. Tighten fork bracket pinch bolt(s) (4) to the following:
   a. All but FXSB: 55-60 ft-lbs (74.6-81.3 Nm).
   b. FXSB upper and lower: 30-35 ft-lbs (40.7-47.5 Nm).
5. Install front fender. See 2.30 FRONT FENDER.
6. All but FXST, FXSB:
   a. See Figure 2-78. Install front panel (51).
   b. Install auxiliary lamps, if equipped. See 7.17 AUXILIARY LAMPS: FLSTC, FLSTN.
   c. Install headlamp assembly. See 7.14 HEADLAMP.
   d. Install fuel tank. See 4.6 FUEL TANK.
7. Install front wheel and brake caliper. See 2.4 FRONT WHEEL.
8. Check steering head bearing adjustment if fork stem was removed. See 1.18 STEERING HEAD BEARINGS.
1. Fork cap
2. Fork tube
3. Upper fork bracket
4. Measurement

Figure 2-82. Fork Tube Protrusion: FXSB
REMOVAL

NOTE
If bearing races are removed, the bearings cannot be reused. They must be replaced. See 2.20 STEERING HEAD, Disassembly, which follows.

FLSTC, FLSTFB, FLSTN, FLS Models

1. Remove fork shrouds.
2. Remove the fork sides. See 2.19 FRONT FORK.
3. Remove the headlamp and headlamp bracket.
4. See Figure 2-83. Remove the brake hose bracket from the bottom of the fork stem and bracket (12).
5. Remove the fork stem cap (1). Loosen pinch bolt (4) and remove fork stem bolt (2). Remove washer (3) with the handlebar and upper bracket (5) assembly.
6. Remove the fork stem and bracket (12) from the steering head. Remove the upper dust shield (6).
7. Remove upper bearing (7).

FXST Model

1. Remove the fork sides. See 2.19 FRONT FORK.
2. Remove the headlamp and headlamp bracket.
3. See Figure 2-84. Remove the brake hose bracket from the bottom of the fork stem and bracket (13).
4. Remove the fork stem cap (1). Remove the fork stem nut (2) with the handlebar and upper bracket (4) as an assembly.
5. Remove the adjusting nut (6) and pull the fork stem and bracket (13) out of the steering head.
6. Remove the upper dust shield (7) and upper bearing (8) from steering head.

Figure 2-84. Steering Head: FXST

FXSB Models

1. Remove the fork sides. See 2.19 FRONT FORK.
2. Remove the headlamp and headlamp bracket.
3. See Figure 2-85. Remove the brake hose bracket from the bottom of the fork stem and bracket (12).
4. Remove the fork sides. See 2.19 FRONT FORK.
5. Remove speedometer. See 7.26 SPEEDOMETER.

6. Remove the fork stem nut (1) with the handlebars and upper bracket (4) as an assembly.

7. Remove the adjusting nut (5) and pull the fork stem and bracket out of the steering head.

8. Remove the upper dust shield (6) and upper bearing (7) from steering head.

---

**DISASSEMBLY**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-33416</td>
<td>UNIVERSAL DRIVER HANDLE</td>
</tr>
<tr>
<td>HD-39301A</td>
<td>STEERING HEAD BEARING RACE REMOVER</td>
</tr>
</tbody>
</table>

---

**NOTICE**

Replace both bearing assemblies even if one assembly appears to be good. Mismatched bearings can lead to excessive wear and premature replacement. (00532c)

**Removing Lower Bearings From Fork Stem**

1. Chisel cage that holds rollers on bearing.

2. Turn the fork stem upside down and heat the inner race. The race will expand and fall off fork stem. Once the race is removed, you will be able to remove the lower dust shield.

**Steering Head Bearing Race Removal**

1. See Figure 2-86. With the tapered side down, seat the two-piece removal tool from the STEERING HEAD BEARING RACE REMOVER (Part No. HD-39301A) on the upper bearing race leaving a gap in the middle.

2. Install the driver handle adapter on the UNIVERSAL DRIVER HANDLE (Part No. HD-33416).

3. Insert the driver at the bottom of the steering head tube, and while holding the remover tool on the race, center the collet in the gap. Tap the driver to remove the upper race.

4. Reverse the tool and repeat the procedure to remove the lower bearing race.

---

**INSPECTION**

**All Models**

1. Check upper and lower bearing races in steering head. If they are pitted or grooved, replace the bearings and races in sets.

2. Check the roughness of the bearings by turning them in the race. Replace bearings if they do not turn freely and smoothly.
3. Pack the **new** bearings with SPECIAL PURPOSE GREASE.

4. Install the lower dust shield on the fork stem. Press the lower bearing into place. Use a sleeve that will contact only the inner race of the **new** bearing.

### INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake hose bracket bolt, front</td>
<td>96-120 in-lbs</td>
</tr>
<tr>
<td>Fork stem upper bracket pinch bolt: FLSTC, FLSTF/B, FLSTN, FLS</td>
<td>25-30 ft-lbs</td>
</tr>
<tr>
<td>Brake hose bracket bolt, front</td>
<td>96-120 in-lbs</td>
</tr>
<tr>
<td>Fork stem nut: FXST</td>
<td>70-80 ft-lbs</td>
</tr>
<tr>
<td>Brake hose bracket bolt, front</td>
<td>96-120 in-lbs</td>
</tr>
<tr>
<td>Fork stem nut: FXSB</td>
<td>70-80 ft-lbs</td>
</tr>
</tbody>
</table>

### FLSTC, FLSTF/B, FLSTN, FLS Models

1. See Figure 2-83. Insert the fork stem and bracket assembly (12) (with lower dust shield and bearing) into the frame steering head. Install the upper bearing (7) and dust shield (6).

2. Install the upper bracket (5), a **new** washer (3), and fork stem bolt (2). Tighten the fork stem bolt until the bearings have no noticeable shake. Fork stem must turn freely from side to side.

3. Fasten the brake hose bracket to bottom bracket using original hardware. Tighten bolt to 96-120 in-lbs (10.8-13.6 Nm).

4. Install the headlamp assembly.

5. Install the fork sides.

6. Fill neck with SPECIAL PURPOSE GREASE through grease fitting located in the steering head.

---

**WARNING**

Properly adjust fork stem bearings. Improper adjustments can adversely affect stability and handling, which could result in death or serious injury. (00301c)

7. Adjust fall-away. See 1.18 STEERING HEAD BEARINGS.

8. Apply ANTI-SEIZE LUBRICANT to upper bracket pinch bolt (4). Tighten to 25-30 ft-lbs (33.9-40.7 Nm).

9. Install the fork stem cap (1).

### FXST Models

1. See Figure 2-84. Insert the fork stem bracket assembly (13) (with lower dust shield and bearing) into the frame steering head and install the upper bearing (8) and dust shield (7). Secure with the adjusting nut (6).

2. Install the upper bracket (4), a **new** lockwasher (3), and fork stem nut (2). Be sure pin on lockwasher is engaged in upper bracket hole.

---

**ASSEMBLY**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-39302</td>
<td>STEERING HEAD BEARING RACE INSTALLER</td>
</tr>
</tbody>
</table>

1. Lubricate outside of the bearing races with engine oil.

2. Install the **new** races using STEERING HEAD BEARING RACE INSTALLER (Part No. HD-39302).

**NOTE**

Use care not to damage the **new** races' tapered surface. The race should be firmly seated against the shoulder in the bore.
3. Fasten the brake hose bracket to bottom bracket using original hardware. Tighten bolt to 96-120 in-lbs (10.8-13.6 Nm).
4. Install the headlamp assembly.
5. Install the fork sides.
6. Fill neck with SPECIAL PURPOSE GREASE through grease fitting located in the steering head.

**WARNING**

Properly adjust fork stem bearings. Improper adjustments can adversely affect stability and handling, which could result in death or serious injury. (00301c)

7. Adjust fall-away. See 1.18 STEERING HEAD BEARINGS.
8. Tighten fork stem nut (2) to 70-80 ft-lbs (94.9-108.4 Nm).
9. Install the fork stem cap (1).

**FXSB Model**

1. See Figure 2-85. Insert the fork stem bracket assembly (12), with lower dust shield and bearing, into the frame steering head and install the upper bearing (7) and dust shield (6). Secure with the adjusting nut (5).
2. Install the upper bracket (4), washer (2), and fork stem nut (1).
3. Fasten the brake hose bracket to bottom bracket using original hardware. Tighten bolt to 96-120 in-lbs (10.8-13.6 Nm).
4. Install the headlamp assembly.
5. Install the fork sides. See 2.19 FRONT FORK.
6. Fill neck with SPECIAL PURPOSE GREASE through grease fitting located in the steering head.

**WARNING**

Properly adjust fork stem bearings. Improper adjustments can adversely affect stability and handling, which could result in death or serious injury. (00301c)

7. Adjust fall-away. See 1.18 STEERING HEAD BEARINGS.
8. Tighten fork stem nut (1) to 70-80 ft-lbs (94.9-108.4 Nm).
REMOVAL

Belt Guard
1. Remove left saddlebag if present.
2. See Figure 2-87. Remove acorn bolt (9) from tee nut (7).
3. Remove acorn nut (4) to detach belt guard (5).

Debris Deflector
1. Remove left saddlebag if present.
2. Remove lower acorn bolt (3).
3. Loosen, but do not remove, bolt (1) at front (slotted) portion of deflector.
4. Remove acorn nut (4). Lift debris deflector up and away from frame.

INSTALLATION

Belt Guard
1. See Figure 2-87. Place the belt guard (5) into position. Tab for bolt and washer (6) must fit inboard of tab on debris deflector (2).
2. Install bolt and washer (6) through belt guard (5), debris deflector (2) and rear fork. Install acorn nut (4) securely.
3. Install acorn bolt (9) onto tee nut (7).
4. Install left saddlebag if removed.

Debris Deflector
1. Place debris deflector (2) into position. Slotted opening on front of deflector slides over bolt (1). Do not tighten bolt at this time.
2. Install bolt and washer (6) through belt guard (5), debris deflector (2) and rear fork. Install acorn nut (4) securely.
3. Install lower acorn bolt (3) and tighten bolt (1) at front of deflector.
4. Install left saddlebag if removed.

Figure 2-87. Belt Guard/Debris Deflector
GENERAL
The rear shock absorbers are not repairable. If either shock absorber becomes damaged, it must be replaced as an assembly.

NOTE
See 1.21 SUSPENSION ADJUSTMENTS for information regarding setting up the suspension for carrying cargo.

REMOVAL

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRES24</td>
<td>SNAP-ON-ADAPTER</td>
</tr>
</tbody>
</table>

1. Remove exhaust system. See 4.17 EXHAUST SYSTEM, System: FLSTC, FXST, FXSB.

2. Remove HCU lower clamp fastener to allow for enough clearance to remove left shock absorber. See 2.17 ABS: HYDRAULIC CONTROL UNIT (HCU), Rear Hydraulic Control Unit (HCU).

3. See Figure 2-88. Remove jounce bumper (6) to raise rear fork enough to remove right shock.

4. Using a suitable lift, support motorcycle under frame until rear tire is slightly off the ground.

5. Remove bolt and washer (1) attaching shock to rear fork.

6. Remove flange locknut (5) and washer with grommet (4) at front of shock.

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shock bolt, rear</td>
<td>121-136 ft·lbs 164.0-184.4 Nm</td>
</tr>
<tr>
<td>Shock locknut, rear</td>
<td>32-39 ft·lbs 43.4-52.9 Nm</td>
</tr>
</tbody>
</table>

1. See Figure 2-88. Place washer with grommet (4) inside frame. Install bushing (3) over stud end of shock. Insert stud end through keyed frame tab and loosely install the flange locknut (5).

2. Coat shoulder of bolt (1) with ANTI-SEIZE LUBRICANT and threads of bolt with LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue). Insert bolt and washer (1) through shock end. Pivot shock absorber to align bolt with hole in rear fork.

NOTE
Softail shock absorber bolt torquing procedure requires the use of a SNAP-ON-ADAPTER (Part No. SRES24). Since the adapter lengthens the torque wrench, torque must be computed with a SNAP-ON TORQUE COMPUTER (Part No. SS-306G).

3. Tighten rear shock hardware.
   a. Tighten bolt and washer (1) at rear of shock to 121-136 ft·lbs (164.0-184.4 Nm).
   b. Tighten the flange locknut (5) to 32-39 ft·lbs (43.4-52.9 Nm).

4. Adjust both shock absorbers equally. See 1.21 SUSPENSION ADJUSTMENTS.

5. Install jounce bumper (6).

6. Install HCU lower clamp fastener. See 2.17 ABS: HYDRAULIC CONTROL UNIT (HCU), Rear Hydraulic Control Unit (HCU).

7. Install exhaust system. See 4.17 EXHAUST SYSTEM, System: FLSTC, FXST, FXSB.
SHOCK DISPOSAL

1. Disassemble the shock absorber.

   NOTE
   The damper reservoir contains nitrogen gas and oil under pressure. Do not drill into the oil chamber.

2. See Figure 2-89. Center punch the reservoir between the weld and the reservoir can.

3. Support the reservoir in a vise.

   WARNING
   Do not expose shock absorber to heat source. Exposure to heat source can build excessive gas pressure, which could cause explosion and result in death or serious injury. (00600b)
   - Use sharp drill bit to prevent excessive heat build up when discharging.

   4. Install a 6/64-1/8 in. bit in a drill.

   WARNING
   Discharging pressurized oil and gas can pierce skin and cause flying debris, which could cause serious injury. Wear safety glasses and gloves. (00601b)

5. Drill at the punch mark retracting the drill as it penetrates the shell.

6. Allow the gas to escape.

7. Dispose of the shock absorber.
Figure 2-89. Center Punch/Drill Hole Location
REAR FORK

REMOVAL

1. Remove the rear wheel, rear brake caliper, and caliper mounting bracket. See 2.5 REAR WHEEL.

2. **All But FXSB**: See Figure 2-90. Remove bolt (1) from splash guard (2). Lift up on lower tabs and pull lower end of splash guard rearward. Remove splash guard from rear fork.

3. **FXSB**: Pull splash guard away from rear fork.

4. Remove the rear shock absorber bolts and washers (3) only. See 2.22 REAR SHOCK ABSORBERS.

   **NOTE**

   When removing pivot shaft, make note of spacer position on each side of transmission. Spacers differ slightly in length from each other and must be installed on the same side from which they were removed. Refer to Table 2-18.

5. Remove pivot shaft (4) and two spacers (11, 12). Remove the two bushings (10) inside the spherical bearings (7). The rear fork can now be removed from the frame.
CLEANING AND INSPECTION

The spherical bearings are lifetime lubricated. No further attention other than cleaning is required. The sleeve type spherical bearings, if not damaged, will last the life of the motorcycle.

Clean the bearing bore with a clean shop towel, removing any dirt or grit adhering to the bearing surface.

Rough check the rear fork for correct alignment. Replace the rear fork if bent.

PIVOT BEARING REPLACEMENT

1. Remove the rear fork from the vehicle. See 2.23 REAR FORK, Removal.

   NOTE
   The retaining ring fits into a machined groove on the bearing and can be removed with the bearing.

2. Press out the fork pivot bearing with a suitable driver from the center of the fork toward the outside.

3. Install a new retaining ring onto a new bearing.

Figure 2-90. Rear Fork
4. Position the bearing assembly against the outboard side of the rear fork pivot boss with the retaining ring outboard.

5. Press the bearing assembly into the rear fork pivot boss using a suitable driver.

6. Repeat for the other side.

7. Install rear fork on vehicle. See 2.23 REAR FORK, Installation.

**INSTALLATION**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pivot shaft nut</td>
<td>90-110 ft-lbs</td>
</tr>
</tbody>
</table>

1. See Figure 2-90. Install jounce bumper (15), if removed.

2. Place rear fork (3) in the frame so that the bores in the frame align with the bores in the fork. Insert the bushings (10) into the spherical bearings (7) from the inside.

3. Install pivot shaft (4).
   a. Apply ANTI-SEIZE LUBRICANT to pivot shaft.

   **NOTE**
   Spacers differ slightly in length from each other and must be installed on the same side from which they were removed. Spacers are identified by the number of machined lines. Refer to Table 2-18.

b. From the right side, install pivot shaft (4) and spacers (11, 12) with spacer collars facing transmission case.

c. Apply LOCTITE 262 HIGH STRENGTH THREAD-LOCKER AND SEALANT (red) to threads of pivot shaft nut. Install and tighten pivot shaft nut to 90-110 ft-lbs (122.1-149.3 Nm).

   **NOTE**
   Proper pivot shaft tightening is important to maintain rear fork alignment.

4. Check for freedom of rotation of the rear fork around the bearings and that the fork and frame side members have not been distorted when the pivot shaft nut was tightened.

5. Install the evaporative canister (California models). See 4.19 EVAPORATIVE EMISSIONS CONTROL SYSTEM.

6. Install splash guard (2). Install bolts (1), if equipped.

7. Install caliper mounting bracket, rear wheel and brake caliper. See 2.5 REAR WHEEL.

8. Install both rear shock absorbers (9) using bolts and washers (8). See 2.22 REAR SHOCK ABSORBERS.

<table>
<thead>
<tr>
<th>VEHICLE LEFT OR RIGHT SIDE</th>
<th>IN.</th>
<th>NM</th>
<th>NUMBER OF MACHINED LINES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left side</td>
<td>1.946</td>
<td>49.43</td>
<td>2</td>
</tr>
<tr>
<td>Right side</td>
<td>1.589</td>
<td>39.85</td>
<td>1</td>
</tr>
</tbody>
</table>
REMOVAL/DISASSEMBLY

1. See Figure 2-91. Loosen cable adjuster jam nuts (1). Screw throttle cable adjuster until it is as short as possible. Remove the two screws that hold the handlebar housing together to separate the upper and lower housings.

2. Unhook the ferrules and cables from the throttle grip and lower housing.

3. Remove air cleaner assembly. See 4.3 AIR CLEANER ASSEMBLY.


5. See Figure 2-92. Pull the cables from the housing by placing a drop of oil on the retaining ring that holds the cable in the housing, then firmly pull the bent tubing portion of the cable out of the housing using a rocking motion.

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 components in non-flammable cleaning solvent. Blow parts dry with low pressure compressed air.

2. Replace the control cables if frayed, kinked or bent.

3. Put one or two drops of oil into the housing of each control cable.

ASSEMBLY/INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throttle control housing</td>
<td>35-45 in-lbs</td>
</tr>
<tr>
<td>screws</td>
<td>4.0-5.1 Nm</td>
</tr>
</tbody>
</table>

1. Apply a light coating of graphite to the handlebar and inside surface of the housings.

2. See Figure 2-92. Attach the control cable assemblies to the lower housing.
   a. Push the silver insert of the throttle cable (1) housing into the hole in front of the tension adjuster screw.
   b. Push the gold insert of the idle cable (5) housing into the hole at the rear of the tension adjuster screw.
   c. Install adjusting screw, spring and friction pad in the lower housing if they were removed.

3. Position the throttle grip on the handlebar. Place the lower housing on the throttle. Position the ferrules and retaining rings over the cable balls and seat them in the throttle notches.

**WARNING**

Do not tighten throttle friction adjustment screw to the point where the engine will not return to idle automatically. Over-tightening can lead to loss of vehicle control, which could result in death or serious injury. (00031b)

4. Fasten upper housing to lower housing using two screws. Tighten to 35-45 in-lbs (4.0-5.1 Nm).

**WARNING**

Pinched throttle cables can restrict throttle response, which could result in loss of control and death or serious injury. (00423b)

5. Make sure throttle cables are routed below the handlebars and behind the fork bracket. They continue under the fuel tank through two cable clamps and back to throttle body.

7. Adjust throttle cables. See 1.13 THROTTLE CABLES.

8. Install air cleaner. See 4.3 AIR CLEANER ASSEMBLY.
REMOVAL

1. Loosen clutch adjuster so clutch cable is fully slack. See 1.11 CLUTCH.
2. See Figure 2-93. Remove the retaining ring (2) and pivot pin (4). Remove the clutch cable anchor pin (1) from the hand lever.

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)

3. Drain transmission lubricant and remove fill plug dipstick. Remove transmission side cover. See 6.5 CLUTCH RELEASE COVER.
4. See Figure 2-94. Note position of retaining ring (1) opening. Retaining ring opening must be positioned in approximately the same location during assembly. Remove retaining ring.
5. Pull inner ramp (2) and ramp coupling (3) out of side cover. Hold inner and outer ramps together to keep balls from falling free.
6. Rotate the inner ramp to a position which will allow the coupling to be disconnected from the inner ramp lever arm. Disconnect coupling from inner ramp. Disconnect cable end (4) from coupling.
7. Back out threaded cable fitting (5) from side cover.

INSTALLATION

1. See Figure 2-93. Insert anchor pin (1) through handle and clutch cable clevis (3).
2. Place handle in bracket and install pivot pin (4) and retaining ring (2).
3. Check that clutch cable is properly routed
   a. Route clutch cable across the front of handlebars for the following model: FXST. Route clutch cable behind handlebars for the following models: FLSTF/B, FLSTC, FLSTN.
   b. Route cable down to clamp on left frame downtube.
   c. Route cable under engine mount spacer, gear cover, and through bracket.
   d. Route cable to transmission cover.
4. See Figure 2-94. Install new O-ring on end of clutch cable threads. Apply a drop of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to clutch cable fitting. Screw fitting into clutch release cover. Do not tighten at this time.
5. Connect cable end to ramp coupling (3). Rotate ramps for best access and install coupling on inner ramp (2). Place ramp assembly in position in side cover.

![Figure 2-93, Clutch Cable Installation]

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. Install retaining ring (1). Position retaining ring opening to the right of outer ramp tang (the stop that prevents rotation).
7. Place new gasket on side cover and install, fully tightening the clutch cable fitting. See 6.5 CLUTCH RELEASE COVER.
8. Place a few drops of oil inside cable housing.

NOTE

Anchor pin does not require lubrication.
1. Retaining ring
2. Inner ramp
3. Ramp coupling
4. Clutch cable
5. Cable fitting

Figure 2-94. Clutch Cable Connection
LEFT HAND GRIP

REMOVAL AND INSTALLATION

Removal
Slice the hand grip open with a sharp knife. Peel the hand grip open to remove.

Installation
1. Rough the left grip end of the handlebar with emery cloth.
2. Clean the grip end with acetone.
3. Apply LOCTITE 770 PRISM PRIMER to the inside of a new hand grip. Remove any excess primer with a clean cloth. Wait two minutes for the primer to set.
4. Apply LOCTITE 411 PRISM INSTANT ADHESIVE to the inside of the new hand grip.

NOTE
LOCTITE 411 PRISM INSTANT ADHESIVE will set in four minutes and cure in 24 hours.
5. Install the new hand grip with a twisting motion.
REMOVAL

WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

1. Remove main fuse.
2. Cover fuel tank to protect from damage.
3. Remove front master cylinder, right handlebar switch assembly, and throttle. See 7.37 RIGHT HANDLEBAR CONTROL MODULE.
4. Remove clutch control and left handlebar switch assembly. See 7.38 LEFT HANDLEBAR CONTROL MODULE.

NOTE

Original equipment grip is glued in place and must be cut off. Remove grip only if necessary.

5. Remove left handlebar grip.
6. See Figure 2-95. Remove upper handlebar clamp fasteners (2).
   a. FLSTC/FXST: remove upper handlebar clamp (4).
   b. FLSTN/FLS: remove upper handlebar clamp (3).
7. Remove handlebar (1).
8. If removing lower handlebar clamps (6), remove two lower handlebar clamp fasteners (13), lockwashers (12), and lower handlebar clamps from upper fork bracket (10). Replace bushings (8) if necessary.

Figure 2-95. Handlebars: All but FLSTF/B
<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handlebar clamp rear</td>
<td>12-15 ft-lbs</td>
</tr>
<tr>
<td>fasteners: FLSTC, FLSTN,</td>
<td>16.3-20.3 Nm</td>
</tr>
<tr>
<td>FLS, FXST</td>
<td></td>
</tr>
<tr>
<td>Handlebar clamp front</td>
<td>12-15 ft-lbs</td>
</tr>
<tr>
<td>fasteners: FLSTC, FLSTN,</td>
<td>16.3-20.3 Nm</td>
</tr>
<tr>
<td>FLS, FXST</td>
<td></td>
</tr>
<tr>
<td>Handlebar clamp fasteners,</td>
<td>30-40 ft-lbs</td>
</tr>
<tr>
<td>lower: FLSTC, FLSTN, FLS,</td>
<td>40.7-54.3 Nm</td>
</tr>
<tr>
<td>FXST</td>
<td></td>
</tr>
</tbody>
</table>

1. See Figure 2-95. If lower handlebar clamps (6) were removed, install lockwashers (12) on lower handlebar clamp fasteners (13).

**NOTE**
In next step, make sure cup washers (7, 11), bushings (8) and spacer (9) are in position in upper fork bracket (10).

2. Slide lower handlebar clamp fasteners through upper fork bracket.

3. Loosely install lower handlebar clamps to upper fork bracket using lower handlebar clamp fasteners.

4. See Figure 2-96. Place handlebars on lower handlebar clamps. Install upper handlebar clamps. Install but do not tighten clamp fasteners.

5. Using knurled areas of handlebar as a guide, center handlebars between lower handlebar clamps.

**NOTE**
On some models, knurled areas of handlebar will be completely hidden by upper handlebar clamp and will not be visible at all when handlebar is centered properly.

6. Raise handlebars to normal riding position and hold in position.

7. Secure handlebars in clamp:
   a. Hand tighten two front screws (4).
   b. Tighten rear fasteners (3) to 12-15 ft-lbs (16.3-20.3 Nm).
   c. Final tighten two front screws (4) to 12-15 ft-lbs (16.3-20.3 Nm). Slight gap between upper and lower clamps should exist at front.

8. See Figure 2-95. Tighten lower handlebar clamp fasteners (15) to 30-40 ft-lbs (40.7-54.3 Nm).

9. Install right and left switch assemblies, throttle control, clutch lever assembly, and front master cylinder assembly.

10. Test front brake lever for pressure and operation.

11. Test throttle for correct operation. Adjust as required. See 1.13 THROTTLE CABLES.

12. Install main fuse.

**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)

13. Install seat.

**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)

14. Turn the ignition/light key switch to IGNITION and test lights and switches for proper operation.

15. Apply brake lever to test stop lamp.

---

**Figure 2-96. Handlebar Riser**

1. Lower clamp (2)
2. Cast-in spacers (2)
3. Rear screw (2)
4. Front screw (2)
5. Upper clamp

---

2015 Softail Service: Chassis
REMOVAL

WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

1. Remove main fuse.
2. See Figure 2-97. Remove acorn nut (1) and washer (2).
3. Remove instrument console and allow to hang off the left side. Suspend console using an elastic cord or piece of small rope to prevent strain on the harness.
4. Unplug fuel gauge connector located under the fuel tank.
5. Remove fuel tank fasteners, vent hose, and fuel supply fitting. Slide fuel tank back to access electrical connectors. See 4.6 FUEL TANK.
6. Place blanket or protective cover over front of fuel tank to protect against scratches and other damage.
7. Disconnect all left and right side hand control connectors from main harness.

NOTE
Make note of wire colors and locations in connector before removal to aid during installation.

8. Identify wire locations and remove terminals from hand control connector housings (left hand control connector [24], right hand control connector [22]). See A.19 MOLEX MX 150 SEALED CONNECTORS for connector information.
9. Remove terminals from turn signal lamp multilock connector. See A.21 TYCO 070 MULTILOCK UNSEALED CONNECTOR for connector information.
10. Remove front master cylinder, right handlebar switch assembly, and throttle. See 7.37 RIGHT HANDLEBAR CONTROL MODULE.
11. Remove clutch control and left handlebar switch assembly. See 7.38 LEFT HANDLEBAR CONTROL MODULE.

NOTE
Original equipment grip is glued in place and must be cut off to remove. Remove grip only if necessary.
12. Remove left handlebar grip.
13. Remove switch housings, turn signals and wiring from handlebars.
14. See Figure 2-98. Remove upper handlebar clamp fasteners (2) and upper handlebar clamps (3).
15. Remove handlebars.
16. If removing lower handlebar clamps (4), remove two lower handlebar clamp fasteners (12), lockwashers (11), washers (10), and lower handlebar clamps from upper fork bracket (8).
1. Handlebar
2. Upper handlebar clamp fastener (4)
3. Upper handlebar clamp
4. Lower handlebar clamp (2)
5. Upper cup washer (2)
6. Bushing (2)
7. Spacer (2)
8. Upper fork bracket
9. Lower cup washer (2)
10. Washer
11. Lockwasher (2)
12. Lower handlebar clamp fastener (2)

Figure 2-98. Handlebars: FLSTF/B

**INSTALLATION**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handlebar upper clamp fasteners; FLSTF/B</td>
<td>12-18 ft-lbs</td>
</tr>
<tr>
<td>Handlebar lower clamp fastener; FLSTF/B</td>
<td>30-40 ft-lbs</td>
</tr>
</tbody>
</table>

**NOTE**
The turn signal wires enter the switch housings through a relief grommet in the housing. The turn signals must be supported throughout this procedure to prevent pulling the grommet or the turn signal wires out of the housing.

1. Repair or replace switches, turn signal switches, wires and grommets as necessary.

**NOTE**
For handlebar switch repair procedures, see 7.36 HANDLEBAR CONTROL MODULES.

2. Wrap wire ends and open ends of conduit with electrical tape.
3. Cut a length of mechanics wire to use as a loader.
4. Lay mechanics wire along the wire harnesses so a few inches overlap and secure using electrical tape.
5. If necessary, replace grommets on handlebars wire openings.
6. Lubricate wire conduits with glass cleaner.
7. See Figure 2-99. Thread the wire leaders through the handlebar grommets and out the center hole.
8. Pull wire bundles through to the handlebar center hole.
9. Loosely install left and right switch housings.
10. Pull slack from wire harnesses and remove the tape and mechanics wire.
11. See Figure 2-98. If lower handlebar clamps (4) were removed, install washers (10), and lockwashers (ff) on lower handlebar clamp fasteners (12).

12. Slide lower handlebar clamp fasteners through upper fork bracket (8).

13. Loosely install lower handlebar clamps to upper fork bracket using lower handlebar clamp fasteners.

14. Place handlebars (1) on lower handlebar clamps. Install upper handlebar clamps (3), install but do not tighten clamp fasteners.

15. Insert wires into proper locations in wire connector housings. See B.2 WIRING DIAGRAMS for connector/wire assignments.

16. Connect left and right hand control connectors [22, 24].

17. Connect turn signal connector [31].

18. Slide fuel tank into position and install fuel tank fasteners. Connect vent hose and fuel supply fitting. See 4.6 FUEL TANK.

19. Connect fuel gauge connector [117].

20. Install instrument console and secure with washer and acorn nut.

21. Using knurled areas of handlebar as a guide, center handlebars between lower handlebar clamps.

**NOTE**
On some models, knurled areas of handlebar will be completely hidden by upper handlebar clamp when handlebar is centered properly.

22. Raise handlebars to normal riding position and hold in position.

**NOTE**
Gap between upper and lower clamps should be equal front and rear.

23. Tighten front and rear fasteners to 12-18 ft-lbs (16.3-24.4 Nm).

24. See Figure 2-98. Remove one lower handlebar clamp fastener (12). Apply LOCTITE 262 HIGH STRENGTH THREADLOCKER AND SEALANT (red) to fastener threads.

25. Install fastener and tighten to 30-40 ft-lbs (40.7-54.2 Nm). Repeat for other fastener.
Align housings and tighten fasteners. See 7.38 LEFT HANDLEBAR CONTROL MODULE or 7.37 RIGHT HANDLEBAR CONTROL MODULE.

27. Install main fuse.

**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)

28. Install seat.

29. Test throttle for correct operation. Adjust as required. See 1.13 THROTTLE CABLES.

**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)

30. Turn the ignition/night key switch to IGNITION and test lights and switches for proper operation.

31. Apply brake lever to test stop 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)

32. Test front brake lever for pressure and operation.

---

**NOTE**

See Figure 2-100 or Figure 2-101. When installing left and right handlebar switch assemblies, make sure that clamping surface (1) stays within the range marks (2) or damage to the wires will occur.

26. Install clutch control, front master cylinder, left handlebar switch assembly, and right handlebar switch assembly.
REMOVAL

Handlebars

NOTE
Note conduit routing and the location of cable straps for assembly.

WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

1. Remove main fuse.
2. Remove console. See 4.7 CONSOLE: FXSB.
3. Remove fuel tank fasteners, vent hose, fuel supply fitting and fuel pump connector. Slide fuel tank back to access electrical connectors. See 4.6 FUEL TANK.
4. Cover fuel tank to protect from damage.
5. See 7.38 LEFT HANDLEBAR CONTROL MODULE and 7.37 RIGHT HANDLEBAR CONTROL MODULE. Disconnect all left and right side handle control connectors from main harness. It is not necessary to remove connectors from wiring.
6. Remove front master cylinder, right handlebar switch assembly, and throttle. See 7.37 RIGHT HANDLEBAR CONTROL MODULE.
7. Remove clutch control and left handlebar switch assembly. See 7.38 LEFT HANDLEBAR CONTROL MODULE.

NOTE
Original equipment grip is glued in place and must be cut off to remove. Remove grip only if necessary.
8. Remove left handlebar grip.
9. See Figure 2-102. Remove upper handlebar clamp fasteners (2).
10. Remove the handlebar.

Lower Handlebar Clamps

1. See Figure 2-102. Remove two lower handlebar clamp fasteners (10), washers (9), cup washers (8) and upper bushings (7).
2. Remove lower handlebar clamps (3).
3. Remove upper spacers (6), bushings (5) and upper cup washers (4).

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handlebar clamp front</td>
<td>12-16 ft-lbs</td>
</tr>
<tr>
<td>fasteners</td>
<td>16.3-21.7 Nm</td>
</tr>
<tr>
<td>Handlebar clamp rear</td>
<td>12-16 ft-lbs</td>
</tr>
<tr>
<td>fasteners</td>
<td>16.3-21.7 Nm</td>
</tr>
<tr>
<td>Lower handlebar clamp</td>
<td>30-40 ft-lbs</td>
</tr>
<tr>
<td>fasteners</td>
<td>40.7-54.3 Nm</td>
</tr>
</tbody>
</table>

Lower Clamp

1. See Figure 2-102. Install lower bushings (7), spacers (6), upper bushings (5) and upper cup washers (4) in upper fork bracket.
2. Install washers (9) and lower cup washers (8) on lower handlebar clamp fasteners (10).
3. Install lower handlebar clamps and finger tighten lower handlebar clamp fasteners.
Handlebars

1. See Figure 2-103. Place handlebars on lower handlebar clamps. Using the two indicator marks near the center of the handlebar as a guide, center handlebars between lower handlebar clamps.

2. See Figure 2-102. Install upper handlebar clamp (1). Install but do not tighten clamp fasteners (2).

3. Rotate handlebar so that the seam of the clamps line up with the indicator marks.

4. Tighten upper handlebar clamp fasteners:
   a. Front upper clamp screws to 12-16 ft-lbs (16.3-21.7 Nm).

   NOTE
   The slight gap between upper and lower clamps should face the rider.

   b. Rear upper clamp fasteners to 12-16 ft-lbs (16.3-21.7 Nm).

   c. Lower handlebar clamp fasteners to 30-40 ft-lbs (40.7-54.3 Nm).

5. Install clutch control, front master cylinder, left handlebar switch assembly, and right handlebar switch assembly. Align housings and tighten fasteners. See 7.38 LEFT HANDLEBAR CONTROL MODULE or 7.37 RIGHT HANDLEBAR CONTROL MODULE.

6. Replace left and right rear view mirror with turn signal brackets. See 7.18 TURN SIGNALS AND RUNNING LIGHTS, Lamp Replacement.

   NOTICE
   Improperly aligned handlebars or components can contact the fuel tank when turned to the left or right. Contact with the fuel tank can cause cosmetic damage. (00372b)

7. Connect left and right hand control connectors [22, 24].

8. Replace wire conduits in frame clips and install cable strap.

Return to Service

1. Slide fuel tank forward and replace fuel tank fasteners, vent, fuel supply fitting. See 4.6 FUEL TANK.

2. Install main fuse.

   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)

3. Install seat.

   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)
4. Test front brake lever and clutch lever for pressure and operation.

**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. Test ride motorcycle.
REMOVAL

NOTE
See the appropriate figure for the model being serviced.

1. Remove front wheel. See 2.4 FRONT WHEEL.
2. FLSTC/FLSTN: Disconnect fender tip lamp.
3. Remove fasteners that hold fender in place and remove fender.

Figure 2-104. Front Fender: FXST

Figure 2-106. Front Fender: FLSTF/B

Figure 2-107. Front Fender: FLS

Figure 2-105. Front Fender: FLSTC

Figure 2-108. Front Fender: FXSB

2-98 2015 Softail Service: Chassis
### INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fender fasteners, front</td>
<td>15-21 ft-lbs</td>
</tr>
</tbody>
</table>

1. Put fender in position and install fasteners. Tighten to 15-21 ft-lbs (20.3-28.5 Nm).

2. **FLSTC/FLSTN**: Connect fender tip lamp.

3. Install front wheel. See 2.4 FRONT WHEEL.
REAR FENDER: FLSTC

REMOVAL
1. Remove seat.

WARNING
To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. Remove main fuse.
3. Remove saddlebags. See 2.45 SADDLEBAGS: FLSTC.

NOTE
To verify proper installation, make note of fender wire routing and hardware locations before removal.

4. Disconnect rear wiring harness connector under seat.
5. Disconnect left and right turn signal connectors from within tail lamp. See 7.15 TAIL LAMP, ALL BUT FLSTN.
6. See Figure 2-109. Remove nylon fastener from electrical box.
7. See Figure 2-110. Remove fasteners (2) and saddlebag support studs (3) from front (7) and rear (5) fender mounting brackets.
8. Lift fender from frame.

Figure 2-109. ECM Mount

Figure 2-110. Rear Fender: FLSTC

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fender, rear, support fasteners, upper: FLSTC</td>
<td>21-27 ft-lbs 28.5-36.6 Nm</td>
</tr>
<tr>
<td>Fender, rear, support fasteners, lower-front, 1st torque: FLSTC</td>
<td>30-35 ft-lbs 40.7-47.5 Nm</td>
</tr>
<tr>
<td>Fender, rear, support fasteners, lower-front, final torque: FLSTC</td>
<td>38-42 ft-lbs 51.5-56.9 Nm</td>
</tr>
</tbody>
</table>

1. Route turn signal wires through holes in fender. Install wires inside connector terminals.

2. See Figure 2-110. Carefully place the fender into position. Install fender supports using hardware shown.
   a. Tighten fasteners (2, 3) to 21-27 ft-lbs (28.5-36.6 Nm).
   b. Tighten fasteners (1) to an initial torque of 30-35 ft-lbs (40.7-47.5 Nm).
   c. Loosen fasteners (1) and final-tighten to 38-42 ft-lbs (51.5-56.9 Nm).

3. Connect the turn signal wiring harness at connector [7] under the seat. Also attach wiring for left and right turn signals.
4. See Figure 2-109. Install nylon fastener into electrical box and fender. Install saddlebags if equipped.

5. Install main fuse.

6. Install seat.

**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. (00316b)

7. Check turn signal and lamp operation.
REAR FENDER: FLSTF/B

REMOVAL

1. Remove seat.

WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. Remove main fuse.

NOTE

To verify proper installation, make note of fender wire routing and hardware locations before removal.


4. Disconnect left and right turn signal connectors from within tail lamp. See 7.15 TAIL LAMP: ALL BUT FLSTN.

5. Remove nylon fastener securing ECM electrical box to rear fender.

6. See Figure 2-111. Remove fasteners (2) from front fender mounting brackets (7), rear fender mounting brackets (5) and wire retaining plates (4).

7. Lift fender from frame.

Figure 2-111. Rear Fender: FLSTF/B

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fender, rear, support fasteners, upper: FLSTF/B</td>
<td>21-27 ft-lbs 28.5-36.6 Nm</td>
</tr>
<tr>
<td>Fender, rear, support fasteners, lower-front, 1st torque: FLSTF/B</td>
<td>30-35 ft-lbs 40.7-47.5 Nm</td>
</tr>
<tr>
<td>Fender, rear, support fasteners, lower-front, final torque: FLSTF/B</td>
<td>38-42 ft-lbs 51.5-56.9 Nm</td>
</tr>
</tbody>
</table>

1. Route turn signal wires through holes in fender. Install wires inside connector terminals.

2. See Figure 2-111. Carefully place the fender into position. Install fender supports using hardware shown.
   a. Tighten fasteners (2) to 21-27 ft-lbs (28.5-36.6 Nm).
   b. Tighten fasteners (1) to an initial torque of 30-35 ft-lbs (40.7-47.5 Nm).
   c. Loosen fasteners (1) and final-tighten to 38-42 ft-lbs (51.5-56.9 Nm).

3. Connect the turn signal wiring harness at connector [7] under the seat. Also attach wiring for left and right turn signals.

4. Install nylon fastener securing electrical box to fender.

5. Install main fuse.

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)

6. Install seat.

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)

7. Check turn signal and lamp operation.
REAR FENDER: FXST

REMOVAL

1. Remove seat.

WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. Remove main fuse.

3. Remove saddlebags, if equipped.

NOTE

To verify proper installation, make note of fender wire routing and hardware locations before removal.


5. Disconnect left and right turn signal connectors from within tail lamp. See 7.15 TAIL LAMP: ALL BUT FLSTN.

6. Remove electronic control module. See 7.4 ELECTRONIC CONTROL MODULE (ECM).

7. See Figure 2-112. Loosen but do not remove fender support fasteners (1).

8. Remove front fender screw (2) from front fender mounting bracket (8).

9. Remove middle fender mounting screw (3) from front fender mounting bracket.

10. Remove rear fender mounting screw (4) from rear fender mounting bracket (6).

11. Remove fender support fasteners (1). Remove fender support cover (7) and fender support (9).

12. Repeat for opposite side.

NOTE

After removing both fender supports and support covers, support fender by installing a long screwdriver through frame and fender holes.

13. Remove locknuts and washers (5) from rear fender mounting bracket.

14. Lift fender from frame.

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fender, rear, support fasteners, upper: FXST</td>
<td>21-27 ft-lbs 28.5-36.8 Nm</td>
</tr>
<tr>
<td>Fender, rear, support fasteners, lower-front, 1st torque: FXST</td>
<td>30-35 ft-lbs 40.7-47.5 Nm</td>
</tr>
<tr>
<td>Fender, rear, support fasteners, lower-front, final torque: FXST</td>
<td>38-42 ft-lbs 51.5-56.9 Nm</td>
</tr>
</tbody>
</table>

NOTE

In next step, verify wire harness is routed properly so tire will not contact wiring.

1. Route turn signal wires through holes in fender. Install wires inside connector terminals.

2. See Figure 2-112. Carefully place the fender into position.

3. Place fender supports into position.
4. Install fender supports hardware:
   a. Tighten fasteners (2, 3, 4) to 21-27 ft-lbs (28.5-36.6 Nm).
   b. Tighten fasteners (1) to an initial torque of 30-35 ft-lbs (40.7-47.5 Nm).
   c. Loosen fasteners (1) and final-tighten to 38-42 ft-lbs (51.5-56.9 Nm).

5. Connect the turn signal wiring harness at connector [7] under the seat. Also attach wiring for left and right turn signals.

6. Install electronic control module.

7. Install saddlebags if equipped.

8. Install main fuse.

~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)

9. Install seat.

---

Figure 2-113. FXST Rear Fender Wire Routing [Image]

---

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. Check turn signal and lamp operation.
REMOVAL

1. Remove seat.

**WARNING**

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. Remove main fuse.

**NOTE**

To verify proper installation, make note of fender wire routing and hardware location before removal.

3. See Figure 2-114. Disconnect all three rear wiring harness connectors [18, 19, 40] (1).

4. Remove nylon fastener that secures electronic control module (ECM) to rear fender. See 7.4 ELECTRONIC CONTROL MODULE (ECM).

5. Remove fender support fasteners (2) and pull rear fender assembly away from motorcycle.

6. See Figure 2-117. If replacing rear fender, remove fasteners (6) securing support brackets and license plate bracket assembly to rear fender.

![Figure 2-114. Rear Fender](image)

1. Rear wiring harness connectors [18, 19, 40]
2. Fender support fastener (4)

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>License plate bracket to mounting bracket upper fasteners: FLS</td>
<td>60-80 in-lbs</td>
</tr>
<tr>
<td>License plate bracket to mounting bracket lower fasteners: FLS</td>
<td>12-18 in-lbs</td>
</tr>
<tr>
<td>Fender support to fender fasteners, rear: FLS</td>
<td>21-27 ft-lbs</td>
</tr>
<tr>
<td>Fender support fasteners, rear, 1st torque: FLS</td>
<td>30-35 ft-lbs</td>
</tr>
<tr>
<td>Fender support fasteners, rear, final torque: FLS</td>
<td>38-42 ft-lbs</td>
</tr>
</tbody>
</table>

License Plate Bracket Assembly and Installation: FLS (all but Domestic and California models)

**NOTES**

- Verify wires are routed properly to prevent tire from contacting wiring.
- See Figure 2-117. If replacing adhesive tape (1), thoroughly clean affected areas with isopropyl alcohol.

1. Press new adhesive tape (1) onto surface for 1-3 minutes.

2. See Figure 2-115. Make sure wiring is properly routed through license plate bracket.

3. See Figure 2-116. Attach license plate bracket to mounting bracket. Make sure tabs (1, 2) are inserted as shown.

4. Install fasteners (3). Tighten to 60-80 in-lbs (6.8-9.0 Nm).

5. See Figure 2-117. Install screws (10) and tighten to 12-18 in-lbs (1.4-2.0 Nm).

6. Clean threadlocking compound from fasteners (6) and threaded holes before assembly.

**NOTE**

When installing license plate bracket assembly, verify wiring is routed through the four wire retainers (8) on the right side.

7. Place license plate bracket assembly into position. Install fender mounting brackets (7).

8. Route wiring through hole (5) to outside of fender.

9. Install new cable strap securing wiring to fender between last wire retainer (8) and hole (5).

**NOTE**

When installing fender supports to fender, make sure wire routing is correct. See 7.18 TURN SIGNALS AND RUNNING LIGHTS, Lamp Replacement.

10. Apply LOCTITE 243 MEDIUM STRENGTH THREAD-LOCKER AND SEALANT (blue) to fasteners (6) and install fender supports to fender with fasteners (6). Tighten fasteners to 21-27 ft-lbs (28.6-36.6 Nm).
11. Install wiring to connector housing, if removed. Refer to Table 2-19 or Table 2-20 and see A.16 DEUTSCH DTM SEALED SOLID BARREL MINI TERMINAL REPAIR.

License Plate Bracket Assembly and Installation: FLS (Domestic and California models)

See 7.18 TURN SIGNALS AND RUNNING LIGHTS.

Fender Installation

1. See Figure 2-114. Carefully place the fender into position.
2. Install fender support fasteners (2). Tighten fasteners to an initial torque of 30-35 ft-lbs (40.7-47.5 Nm). Loosen fasteners and final-tighten to 38-42 ft-lbs (51.5-56.9 Nm).
3. Install nylon fastener that secures ECM to rear fender. See 7.4 ELECTRONIC CONTROL MODULE (ECM).
4. Connect all three rear wiring harness connectors (1, 18, 19, 40) (1).
5. Install main fuse.

**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)

6. Install seat.

**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)

7. Check rear lighting for proper operation.

Table 2-19. License Plate Lighting Connector Pin Location (Domestic and HDI)

<table>
<thead>
<tr>
<th>PIN</th>
<th>COLOR</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BK</td>
<td>License plate lamp</td>
</tr>
<tr>
<td>2</td>
<td>-</td>
<td>Not used</td>
</tr>
<tr>
<td>3</td>
<td>BK</td>
<td>Ground</td>
</tr>
</tbody>
</table>

Figure 2-116. License Plate Bracket Clips

Table 2-20. Tail Light Connector Pin Location (Canada)

<table>
<thead>
<tr>
<th>PIN</th>
<th>COLOR</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BE</td>
<td>Running/License plate lamp</td>
</tr>
<tr>
<td>2</td>
<td>R/Y</td>
<td>Brake</td>
</tr>
<tr>
<td>3</td>
<td>BK</td>
<td>Ground</td>
</tr>
</tbody>
</table>

Figure 2-115. License Plate Bracket Wire Routing
1. Adhesive tape (3)
2. License plate bracket
3. Mounting bracket
4. Fastener (2)
5. Hole for license plate light wire routing
6. Fastener (6)
7. Fender mounting bracket (2)
8. Wire retainer (part of mounting bracket)
9. Connector
10. Mounting bracket-to-license plate bracket screw (2)
11. License plate light assembly screw and washer (2)
12. Nut and washer (2)
13. Screw and washer
14. License plate light assembly (Domestic)
15. License plate light assembly (HDI)
16. Tail light assembly (Canada)

Figure 2-117. License Plate Bracket Assembly
REAR FENDER: FXSB

REMOVAL

1. Remove seat.
2. Remove main fuse.

WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

3. Disconnect rear lighting harness connector housings:
   a. Right turn signal [18]
   b. License plate/running lamp [40]
   c. Left turn signal [19]

4. See Figure 2-118. Remove fasteners (6). Lift fender from frame.

5. If replacing fender, perform the following steps:
   a. Remove rear lighting. See 7.18 TURN SIGNALS AND RUNNING LIGHTS.
   b. Remove fasteners (1), fender supports (2) and brackets (4).

![Diagram of Rear Fender]

1. Fastener (8)
2. Fender support (2)
3. Retention pad (8)
4. Bracket (4)
5. Retainer bracket (HDI, Canada) (1)
6. Fastener (4)

Figure 2-118. Rear Fender
INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear fender support to fender, FXSB</td>
<td>21-27 ft-lbs 28.5-36.6 Nm</td>
</tr>
<tr>
<td>Rear fender support to frame fasteners: 1st torque, FXSB</td>
<td>30-35 ft-lbs 40.7-47.5 Nm</td>
</tr>
<tr>
<td>Rear fender support to frame fasteners: final torque, FXSB</td>
<td>38-42 ft-lbs 51.6-57.0 Nm</td>
</tr>
</tbody>
</table>

1. See Figure 2-118. If fender was replaced, perform the following steps.
   a. Install rear lighting. See 7.18 TURN SIGNALS AND RUNNING LIGHTS.

   **NOTE**
   
   **HDI and Canada Markets:** install retainer bracket (5) between front left bracket (4) and fender.

   b. Install fender supports (2) with brackets (4) and fasteners (1). Tighten outer fasteners first then inner fasteners to 21-27 ft-lbs (28.5-36.6 Nm).

2. Install rear fender using fasteners (6). Tighten fasteners to 30-35 ft-lbs (40.7-47.5 Nm) then loosen.

3. Final tighten fasteners (6) to 38-42 ft-lbs (51.6-57.0 Nm).

4. Connect rear lighting harness connector housings:
   a. Right turn signal [18]
   b. License plate/running lamp [40]
   c. Left turn signal [19]

5. Install main fuse.

   **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)

6. Install seat.

   **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)

7. Check turn signal and tail lamp operation.
REAR FENDER: FLSTN

REMOVAL

1. Remove seat.

[Image: Figure 2-119. Electrical Box: Typical]

WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. Remove main fuse.

3. See Figure 2-119. Disconnect rear wiring harness connector [7] (1) under seat.

4. Remove nylon fastener (3) from electronic control module tray (2).

NOTE

Note location of hardware for correct installation.

5. See Figure 2-120. Remove fender mounting bracket (19) by removing fender mounting fasteners (3). Insert rods through forward-most holes created by fastener removal. Rods will keep fender in place during next step.

6. Remove fender mounting fasteners (2).

7. Remove rods.

8. Slide fender towards rear of vehicle to disengage fender from frame rails.

DISASSEMBLY

1. See Figure 2-120. If rear fender is to be completely disassembled, detach fender support covers (1) by removing fender mounting fasteners (4).

2. Remove luggage rack (10). See 2.44 LUGGAGE RACK: FLSTN.

3. Remove fender support (16) and fender mounting brackets (20).

4. Remove tail lamp. See 7.16 TAIL LAMP: FLSTN.

5. Remove turn signal lamps. See 7.18 TURN SIGNALS AND RUNNING LIGHTS.
Figure 2-120. Rear Fender: FLSTN

**ASSEMBLY**

1. Fender support cover (2)
2. Fender mounting fasteners (lower-front, 4)
3. Fender mounting fasteners (center, 4)
4. Fender mounting fasteners (rear, 4)
5. Plugs
6. Nut
7. Fender tip
8. Turn signal grommet (2)
9. Fender
10. Luggage rack
11. Luggage rack fastener (rear)
12. Washer
13. Luggage rack fastener (front, 2)
14. Washer
15. Protective tape
16. Fender support
17. Washer (2)
18. Stud plate
19. Fender mounting bracket (front, 2)
20. Fender mounting bracket (rear, 2)
21. Fender support (2)

1. See 7.16 TAIL LAMP: FLSTN for tail lamp assembly.
2. See 7.18 TURN SIGNALS AND RUNNING LIGHTS for turn signal bracket assembly.

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NOTE
See Figure 2-120. If fender support (16) has been removed, do not tighten luggage rack hardware until rest of fender has been installed.

3. Assemble fender:
   a. Place fender support (16) into position in fender (9).
   b. Install but do not tighten luggage rack hardware. See 2.44 LUGGAGE RACK: FLSTN.

4. Install fender support covers (1) using fender mounting fasteners (4). Snug but do not fully tighten fasteners at this time.

### INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fender, rear, support fasteners, upper: FLSTN</td>
<td>21-27 ft-lbs</td>
</tr>
<tr>
<td>Fender, rear, support fasteners, lower-front, 1st torque: FLSTN</td>
<td>30-35 ft-lbs</td>
</tr>
<tr>
<td>Fender, rear, support fasteners, lower-front, final torque: FLSTN</td>
<td>38-42 ft-lbs</td>
</tr>
</tbody>
</table>

1. See Figure 2-120. Carefully place the fender into position. Install fender supports using hardware and brackets shown.
   a. Tighten fasteners (3, 4) to 21-27 ft-lbs (28.5-36.6 Nm).
   b. Tighten fasteners (2) to an initial torque of 30-35 ft-lbs (40.7-47.5 Nm).
   c. Loosen fasteners (2) and final-tighten to 38-42 ft-lbs (51.5-56.9 Nm).

2. Tighten luggage rack fasteners. See 2.44 LUGGAGE RACK: FLSTN.

3. See Figure 2-119. Install nylon fastener (3) into electronic control module tray (2) and fender.
5. Install main fuse.

**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)

6. Install seat.

**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)

7. Check turn signal and lamp operation.

---

1. Fender
2. Fender support
3. Wire conduit

Figure 2-121. Rear Fender Wire Routing: FLSTN
INSTALLATION

1. Remove wire terminals from harness connectors.
2. Remove wire harness from conduit.
3. Remove old conduit from fender.
4. Thoroughly clean inside surface of fender with soap and water until it is free of dirt, oil, or other debris.
5. Dry the surface, then wipe the area where conduit will be placed with isopropyl alcohol. Allow to dry completely.
6. Slide tail lamp wiring harness through new conduit and install wire terminals into connector housings. See B.2 WIRING DIAGRAMS for more information.
7. See Figure 2-122. Remove protective strip covering adhesive on conduit.
8. See Figure 2-124. Lightly position the conduit in place.
9. See Figure 2-123. Using a wallpaper corner roller (available at most home improvement stores), roll along conduit to purge the air from between the adhesive and the fender.

NOTES

- Do NOT rub the conduit to make it adhere to the fender. This will not do an adequate job of purging the air from between the adhesive and fender.
- Once the adhesive is in place, it requires 72 hours to fully cure. Continue with installation but do NOT pull or try to reposition the conduit during this period.

Figure 2-122. Removing Protective Strip From Conduit

Figure 2-123. Purging Air Between Adhesive and Fender

Figure 2-124. Conduit Placement

1. Conduit
2. Wallpaper corner roller

1. 1.15 in. (29.2 mm)
2. 8.00 in. (203.2 mm)
3. 0.75 in. (19.1 mm)
4. 3.00 in. (76.2 mm)
5. 2.25 in. (57.2 mm)
RIDER FOOTBOARDS

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rider footboard screws</td>
<td>60-80 in-lbs  6.8-9.0 Nm</td>
</tr>
</tbody>
</table>

Removal
1. See Figure 2-125. Remove pivot screws (5) and nuts (3).
2. Remove footboard from motorcycle.

Installation
1. See Figure 2-125. Install footboard and secure with pivot screws (5) and nuts (3).
2. Tighten screws to 60-80 in-lbs (6.8-9.0 Nm).

RIDER FOOTREST

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rider footrest support screws</td>
<td>32-37 ft-lbs  43.4-50.2 Nm</td>
</tr>
</tbody>
</table>

Removal
See Figure 2-126. Remove retaining ring (1) and clevis pin (4). Pull footrest (3) and spring washer (2) from support (6 or 7).

Installation
1. See Figure 2-126. If support (6 or 7) was removed, install with screws (5). Tighten to 32-37 ft-lbs (43.4-50.2 Nm).
2. Place footrest (3) and spring washer (2) into position on support (6).
3. Install clevis pin (4) and new retaining ring (1).

Figure 2-125. Rider Footboards (Typical)

Figure 2-126. Rider Footrests

PASSSENGER FOOTREST

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Footrest support screw, passenger, left-side: FLSTN</td>
<td>25-30 ft-lbs  33.9-40.7 Nm</td>
</tr>
<tr>
<td>Footrest support screw, passenger</td>
<td>25-30 ft-lbs  33.9-40.7 Nm</td>
</tr>
</tbody>
</table>

Removal
See Figure 2-127. Remove retaining ring (1) and clevis pin (4). Pull footrest (3) and spring washer (2) from support (6).
Installation

1. **FLSTN**: see Figure 2-127. If support (8) was removed, install support and tighten screw (7) to 25-30 ft-lbs (33.9-40.7 Nm).

2. See Figure 2-127. If support (8) was removed, install with screw (5). Tighten to 25-30 ft-lbs (33.9-40.7 Nm).

3. Place footrest (3) and spring washer (2) into position on support (6).

4. Install clevis pin (4) and **new** retaining ring (1).

![Figure 2-127. Passenger Footrests](image-url)
CLEANING

**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)

**WARNING**

Be sure jiffy stand is fully retracted before riding. If jiffy stand is not fully retracted, it can contact the road surface causing a loss of vehicle control, which could result in death or serious injury. (00007a)

1. Block motorcycle underneath frame so both wheels are raised off the ground.
2. See Figure 2-128. Inspect clevis pin (1) and bushings (2). If covered with dirt, wipe dirt off with a shop towel and lubricate clevis pin and bushings with ANTI-SEIZE LUBRICANT.
3. Move jiffy stand (9, 10) forward and back to infuse lubricant into mating parts.
4. Check that jiffy stand operates correctly before using.

Figure 2-128. Jiffy Stand

### SENSOR: HDI MODELS

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jiffy stand sensor screw</td>
<td>96-144 in-lbs, 10.8-16.3 Nm</td>
</tr>
</tbody>
</table>

1. See Figure 2-128. Make a note of harness routing for ease of assembly. Disconnect sensor connector located behind the regulator.
2. Remove any cable anchors and cable straps.
3. Remove screw (12) and remove sensor (11).
4. Installation is in reverse of removal. Tighten screw (12) to 96-144 in-lbs (10.8-16.3 Nm).
REMOVAL

**WARNING**

Block or jack vehicle under frame in a way that the vehicle will not fall over. Failure to properly block and/or raise the vehicle could result in death or serious injury. (00462c)

1. Detach shifter linkage.
2. See Figure 2-128. Remove the three fasteners (7) from jiffy stand bracket (5).
3. Detach spring (3) from jiffy stand and spring bracket (4).
4. Remove pretzel clip (6) from clevis pin (1).
5. Remove clevis pin and bushings (2) to free jiffy stand from jiffy stand bracket.

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jiffy stand bracket assembly screws</td>
<td>25-30 ft-lbs 33.9-40.7 Nm</td>
</tr>
</tbody>
</table>

**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)

1. See Figure 2-128. Install bracket.
   a. Apply ANTI-SEIZE LUBRICANT to clevis pin (1).
   b. Place jiffy stand into position.
   c. Install lower bushing (2) on clevis pin (1).
   d. Install clevis pin (1) through jiffy stand (9, 10) and jiffy stand bracket (5).
   e. Place top bushing (2) on clevis pin (1).
   f. Install pretzel clip (6) in clevis pin (1).

   **NOTE**

   See Figure 2-129. FXSB models have spring hook end facing up. All but FXSB models have spring hook facing down.

   g. Attach spring (3) to jiffy stand (9,10) and spring bracket (4).
   h. Install jiffy stand and bracket assembly with three fasteners (7). Tighten to 25-30 ft-lbs (33.9-40.7 Nm).

2. Attach shifter linkage.
3. Check that jiffy stand operates correctly before using.

Figure 2-129. Spring Orientation: FXSB
REMOVAL

1. Remove steering stem. See 2.20 STEERING HEAD.
2. See Figure 2-130. Remove set screw (1). 
3. Insert key (3) in lock (2) and turn partially. 
4. Wiggle lock and pull until enough of the lock comes out to get a grip with pliers or other suitable tool. 
5. Pull fork lock to remove.

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fork lock set screw</td>
<td>10-12 in-lbs</td>
</tr>
</tbody>
</table>

NOTES

- There is an internal boss in the left side of the steering head opposite the external boss. The end of the lock fits into this internal boss.
- See Figure 2-131. There is a flat (1) in the bottom of the lock into which the set screw fits. This flat must be at the bottom when the lock is installed.
- When the lock is correctly installed, a forward-facing flat (2) on the lock will fit against a flat inside the external lock boss and the face of the lock will be flush with the face of the external boss.

1. Grease the end of the lock (the part that goes into the internal boss) and slide lock into external boss.
2. Insert steering stem into frame. See 2.20 STEERING HEAD.

NOTE

Stem must be in locked fork position.

3. Move steering stem into locked fork position. Rotate steering stem slightly, while fully installing lock.
4. See Figure 2-130. Apply LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to set screw (1).
5. Install set screw. Tighten to 10-12 in-lbs (1.1-1.4 Nm).
6. Insert key in the lock and tighten set screw (1) until lock begins to bind; then back set screw out 1/2 turn.
7. Seal screw with a good quality sealant.
8. Finish steering stem installation including installing upper fork bracket and handlebars. See 2.20 STEERING HEAD.
REPLACEMENT

NOTE

If the retention washer is removed, the retention nut will fall through the fender. The procedure below lifts the retention nut up through the fender on the cable strap for ease of replacement.

1. Slide retention nut over tapered end of cable strap so that larger O.D. of nut rests on cable strap eyelet.
2. From bottom of rear fender, feed cable strap up through fender hole.
3. See Figure 2-132. With tab (1) on retention nut (2) seated in notch of fender hole, pull up on cable strap to hold nut snug against underside of rear fender.
4. From the side opposite the tab, slide on the retention washer (3) to lock the position of the retention nut.

Figure 2-132. Seat Retention Nut

Figure 2-133. Retention Nut In Use

1. Bracket for seat/pillion
2. Retention nut and retention nut washer
3. Seat strap (FXST/C/B/D style shown)
REPLACEMENT

Removal
1. See Figure 2-135. Remove seat mounting screw from top of rear fender.
2. See Figure 2-134. Push seat rearward to free tongue at front of seat from slot or bracket in frame back.
3. Two-up seats: gently slide seat out of grab strap.
4. Remove seat from frame.

Installation
1. Two-up seats: slide seat into grab strap.
2. Place seat on frame back.
3. Slide seat toward front of motorcycle until the tongue locks into the bracket or slot in frame back.
4. Push seat forward until rear fender seat retention nut is centered in hole of mounting bracket.
5. Hand-tighten the seat mounting screw.

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. (000700b)
6. Pull up on seat to verify that it is properly secured.

Figure 2-134. Seat Tongue (typical)

Figure 2-135. Seat: FXST/FXSB/FLS

1. Seat (FXST)
2. Seat (FXSB)
3. Pillion (FXSB)
4. Seat (FLS)
5. Grab strap
6. Seat mounting screw
7. Seat mounting nut (2)
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)

See Figure 2-136. The passenger seat attaches with a single screw (1) at the rear and engages the seat mounting fasteners (6) at the front.

To remove seat (7, 8, 9), remove passenger seat (2, 3, 4) and seat mounting fasteners (6). When installing seat, insert tang at front of seat into the channel in the frame and install seat mounting nuts. Install passenger seat.

Figure 2-136. Seat: FLSTN/FLSTF/FLSTFB/FLSTC

1. Screw
2. Passenger seat (FLSTN)
3. Passenger seat (FLSTF/B)
4. Passenger seat (FLSTC)
5. Seat strap
6. Seat mounting fastener (2)
7. Seat (FLSTN)
8. Seat (FLSTF/B)
9. Seat (FLSTC)
# LUGGAGE RACK: FLSTN

## REMOVAL AND INSTALLATION

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<tr>
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<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luggage rack rear fasteners: FLSTN</td>
<td>12-14 ft-lbs, 16.3-19.0 Nm</td>
</tr>
<tr>
<td>Luggage rack front fasteners: FLSTN</td>
<td>96-120 in-lbs, 10.8-13.6 Nm</td>
</tr>
</tbody>
</table>

1. Remove seat. See 2.43 SEAT: FLSTN, FLSTF, FLSTFB, FLSTC.
2. Remove front fasteners (1) and rear fasteners (3) to detach luggage rack (2) from fender.
3. Place luggage rack on fender.
4. Install, but do not tighten front fasteners.
5. Install rear fastener. Tighten to 12-14 ft-lbs (16.3-19.0 Nm).
6. Tighten front fasteners to 96-120 in-lbs (10.8-13.6 Nm).

![Figure 2-137. Luggage Rack](image)

- 1. Front fasteners
- 2. Luggage rack
- 3. Rear fastener
REMOVAL

1. See Figure 2-138. Remove acorn nut (7) and washer (8) from lower support.

2. Remove flange nuts and washers (5) from inside saddlebag.

3. Lift saddlebag away from motorcycle. Remove nuts (1) and studs (4) if necessary.

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fender support studs: FLSTC</td>
<td>21-27 ft-lbs</td>
</tr>
<tr>
<td>Saddlebag flange nuts: FLSTC</td>
<td>120-144 in-lbs</td>
</tr>
<tr>
<td>Saddlebag lower bracket acorn nut: FLSTC</td>
<td>120-144 in-lbs</td>
</tr>
</tbody>
</table>

NOTES

- See Figure 2-138. On FLSTC models, there are no washers between studs (4) and sissybar sideplate (3).

- If replacing isolator (9), long (silver) threads face saddlebag and short (yellow) threads face support.

1. If removed, install studs (4) and tighten nuts (1) behind fender support (2) to 21-27 ft-lbs (28.5-36.6 Nm).

2. Install flange nuts and washers (5) inside saddlebags. Tighten to 120-144 in-lbs (13.6-16.3 Nm).

3. Install lower bracket acorn nut (7) and washer (8). Tighten to 120-144 in-lbs (13.6-16.3 Nm).
1. Nut  
2. Fender support  
3. Sissy bar sideplate  
4. Stud  
5. Flange nut and washer  
6. Saddlebag  
7. Acorn nut  
8. Washer  
9. Isolator  
10. Lower front support  

Figure 2-138. Saddlebag: FLSTC
REMOVAL

1. See Figure 2-139. Use a finger to raise the wireform latch springs on each side of the windshield.

2. Standing at the front of the vehicle, gently pull the top of the windshield until the upper notches (2) on the side brackets are free of the upper grommets.

3. Carefully raise the windshield until the lower notches (3) in the side brackets are free of the lower grommets.

4. Remove windshield from vehicle.

INSTALLATION

1. See Figure 2-139. Lower the windshield into position until the lower notches (3) are seated on the lower grommets.

2. Standing at the front of the vehicle, gently push the top of the windshield toward the rear until the upper notches (2) fully engage the upper grommets.

3. Push down on the wireform latch springs (1) so that they overhang the rubber grommets. If some adjustment is necessary, loosen the retaining bolts and rotate the latch springs into the proper position.

Figure 2-139. Windshield: FLSTC
**UPPER SAREE GUARDS: ALL BUT FXSB**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saree guard, upper, nut: all but FXSB</td>
<td>21-27 ft-lbs, 28.5-36.6 Nm</td>
</tr>
<tr>
<td>Saree guard, upper, fasteners: all but FXSB</td>
<td>21-27 ft-lbs, 28.5-36.6 Nm</td>
</tr>
<tr>
<td>Fender support fasteners - first torque</td>
<td>30-35 ft-lbs, 40.7-47.5 Nm</td>
</tr>
<tr>
<td>Fender support fasteners - final torque</td>
<td>38-42 ft-lbs, 51.5-56.9 Nm</td>
</tr>
</tbody>
</table>

**Removal**
1. See Figure 2-140. Loosen fender support fasteners (1).
2. Remove three fasteners (2).
3. Remove nut (3) located behind strut cover.
4. Remove upper saree guard.

**Installation**
1. See Figure 2-140. Set upper saree guard into position. Install nut (3) finger-tight.
2. Loosely install three fasteners (2).
3. Tighten nut (3) to 21-27 ft-lbs (28.5-36.6 Nm).
4. Tighten fasteners (2) to 21-27 ft-lbs (28.5-36.6 Nm).
5. Tighten fender support fasteners (1) to an initial torque of 30-35 ft-lbs (40.7-47.5 Nm). Loosen fasteners and final-tighten to 38-42 ft-lbs (51.5-56.9 Nm).

---

**UPPER SAREE GUARDS: FXSB**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saree guard, upper, fasteners: FXSB</td>
<td>21-27 ft-lbs, 28.5-36.6 Nm</td>
</tr>
</tbody>
</table>

**Removal**
1. See Figure 2-141. Remove screws (1), washers (2) and spacers (3).
2. Remove saree guard (4).

**Installation**
1. See Figure 2-141. Set saree guard into position.
2. Install spacers (3) between saree guard and fender.
3. Install screws (1) and washers (2). Tighten to 21-27 ft-lbs (28.5-36.6 Nm).

---

**LOWER SAREE GUARD**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saree guard, lower, fasteners</td>
<td>21-27 ft-lbs, 28.5-36.6 Nm</td>
</tr>
</tbody>
</table>

**Removal**
1. See Figure 2-140. Remove screws (4).
2. Remove lower saree guard.

**Installation**
1. Install lower saree guard.
2. See Figure 2-140. Install screws (4) with washers. Tighten to 21-27 ft-lbs (28.5-36.6 Nm).
REMOVAL AND INSTALLATION

1. See Figure 2-142. Remove fastener securing front license plate bracket.

2. Install new license plate bracket and tighten fastener finger tight.

3. Adjust headlamp. See 1.20 HEADLAMP ALIGNMENT.
REMOVAL

1. Mark location of emblem with masking tape.

   NOTE
   Wear protective gloves.

2. Saw behind emblem with mono-filament fishing line or waxed dental floss to remove emblem.

3. Use 3M GENERAL PURPOSE ADHESIVE REMOVER to remove remaining foam backing tape and adhesive from mounting surface.

   NOTE
   For maximum bond, surface must be clean and dry.

4. Clean with a mixture of 50 percent isopropyl alcohol and 50 percent distilled water.

   NOTE
   Apply medallion within minutes of cleaning.

5. Allow to dry completely.

INSTALLATION

NOTES

- Apply in ambient temperatures between 70-100 °F (21-38 °C).
- Do not remove protective film from adhesive until ready to apply.
- Do not bend emblem to fit contour of mounting surface.

1. Test fit medallion in intended location.
   a. Check medallion against curve of mounting surface.
   b. Match left and right sides of fuel tank.

   NOTES
   - Protect adhesive from grease, oil, dust, dirt and finger prints.
   - Once applied, do not shift medallion.
   - The adhesive bonds in 72 hours at room temperature.

2. Remove protective film from back of medallion.

3. Apply even pressure across entire surface with palms and fingers of both hands. Hold in place for 15 seconds.

4. Wait 20 minutes before touching medallion.

5. Wait 24 hours before washing.
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# FASTENER TORQUE VALUES

## FASTENER TORQUE VALUES IN THIS CHAPTER

The table below lists torque values for all fasteners presented in this chapter.

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<td>42-47 ft-lbs</td>
<td>56.9-63.7 Nm</td>
</tr>
<tr>
<td>Balance shaft support screws</td>
<td>18-22 ft-lbs</td>
<td>24.4-29.8 Nm</td>
</tr>
<tr>
<td>Breather assembly screws</td>
<td>120-156 in-lbs</td>
<td>13.6-17.6 Nm</td>
</tr>
<tr>
<td>Cam chain tensioner fasteners</td>
<td>100-120 in-lbs</td>
<td>11.3-13.6 Nm</td>
</tr>
<tr>
<td>Cam cover screws</td>
<td>125-155 in-lbs</td>
<td>14.1-17.5 Nm</td>
</tr>
<tr>
<td>Cam sprocket flange bolt, 1st torque</td>
<td>15 ft-lbs</td>
<td>20.3 Nm</td>
</tr>
<tr>
<td>Cam sprocket flange bolt, final torque</td>
<td>34 ft-lbs</td>
<td>46.1 Nm</td>
</tr>
<tr>
<td>Cam support plate screws</td>
<td>100-120 in-lbs</td>
<td>11.3-13.6 Nm</td>
</tr>
<tr>
<td>Counterbalance assembly bearing</td>
<td>40-70 in-lbs</td>
<td>4.5-7.9 Nm</td>
</tr>
<tr>
<td>Crankcase bolt, 1st torque</td>
<td>120 in-lbs</td>
<td>13.6 Nm</td>
</tr>
<tr>
<td>Crankcase bolt, final torque</td>
<td>15-19 ft-lbs</td>
<td>20.3-25.8 Nm</td>
</tr>
<tr>
<td>Crankcase oil fittings</td>
<td>120-168 in-lbs</td>
<td>13.6-19.0 Nm</td>
</tr>
<tr>
<td>Crankcase pipe plugs</td>
<td>120-144 in-lbs</td>
<td>13.6-16.3 Nm</td>
</tr>
<tr>
<td>Crankshaft sprocket bolt, 1st torque</td>
<td>15 ft-lbs</td>
<td>20.3 Nm</td>
</tr>
<tr>
<td>Crankshaft sprocket bolt, final torque</td>
<td>24 ft-lbs</td>
<td>32.5 Nm</td>
</tr>
<tr>
<td>Cylinder headbolts, 1st torque</td>
<td>120-144 in-lbs</td>
<td>13.6-16.3 Nm</td>
</tr>
<tr>
<td>Cylinder headbolts, 2nd torque</td>
<td>15-17 ft-lbs</td>
<td>20.3-23.0 Nm</td>
</tr>
<tr>
<td>Cylinder headbolts, final torque</td>
<td>90 degrees</td>
<td>90 degrees</td>
</tr>
<tr>
<td>Cylinder head bracket bolts</td>
<td>35-40 ft-lbs</td>
<td>47.5-54.2 Nm</td>
</tr>
<tr>
<td>Cylinder head bracket bolts</td>
<td>35-40 ft-lbs</td>
<td>47.5-54.2 Nm</td>
</tr>
<tr>
<td>Cylinder stud</td>
<td>120-240 in-lbs</td>
<td>13.6-27.1 Nm</td>
</tr>
<tr>
<td>Cylinder torque plate bolts, 1st torque</td>
<td>120-144 in-lbs</td>
<td>13.6-16.3 Nm</td>
</tr>
<tr>
<td>Cylinder torque plate bolts, 2nd torque</td>
<td>15-17 ft-lbs</td>
<td>20.3-23.0 Nm</td>
</tr>
<tr>
<td>Cylinder torque plate bolts, final torque</td>
<td>90 degrees</td>
<td>90 degrees</td>
</tr>
<tr>
<td>Electrical panel fastener: FXSB</td>
<td>36-60 in-lbs</td>
<td>4.1-6.8 Nm</td>
</tr>
<tr>
<td>FASTENER</td>
<td>TORQUE VALUE</td>
<td>NOTES</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>--------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Electrical panel fasteners: all but FXSB</td>
<td>36-60 in-lbs</td>
<td>4.1-6.8 Nm</td>
</tr>
<tr>
<td>Engine/transmission bracket bolts</td>
<td>30-35 ft-lbs</td>
<td>40.7-47.5 Nm</td>
</tr>
<tr>
<td>Engine mount bolt, top</td>
<td>45-50 ft-lbs</td>
<td>61.0-67.8 Nm</td>
</tr>
<tr>
<td>Engine mount bracket nuts, top</td>
<td>20-25 ft-lbs</td>
<td>27.1-33.9 Nm</td>
</tr>
<tr>
<td>Engine mounting bolt, upper</td>
<td>45-50 ft-lbs</td>
<td>61.0-67.8 Nm</td>
</tr>
<tr>
<td>Engine mounting bolts, front</td>
<td>70-80 ft-lbs</td>
<td>94.9-108.5 Nm</td>
</tr>
<tr>
<td>Lifter cover screws</td>
<td>100-120 in-lbs</td>
<td>11.3-13.6 Nm</td>
</tr>
<tr>
<td>Oil pump screws, 1st torque</td>
<td>40-45 in-lbs</td>
<td>4.5-5.1 Nm</td>
</tr>
<tr>
<td>Oil pump screws, final torque</td>
<td>90-120 in-lbs</td>
<td>10.2-13.6 Nm</td>
</tr>
<tr>
<td>Oil tank bolts: FXSB</td>
<td>12-15 ft-lbs</td>
<td>16.3-20.3 Nm</td>
</tr>
<tr>
<td>Piston jet screw</td>
<td>25-35 in-lbs</td>
<td>2.8-3.9 Nm</td>
</tr>
<tr>
<td>Pivot shaft nut</td>
<td>90-110 ft-lbs</td>
<td>122-149.1 Nm</td>
</tr>
<tr>
<td>Right main bearing retaining screws</td>
<td>40-70 in-lbs</td>
<td>4.5-7.9 Nm</td>
</tr>
<tr>
<td>Rocker arm support plate bolts</td>
<td>18-22 ft-lbs</td>
<td>24.4-23.8 Nm</td>
</tr>
<tr>
<td>Rocker cover screws</td>
<td>15-18 ft-lbs</td>
<td>20.3-24.4 Nm</td>
</tr>
<tr>
<td>Rocker housing bolts</td>
<td>120-168 in-lbs</td>
<td>13.6-19.0 Nm</td>
</tr>
<tr>
<td>Secondary cam chain tensioner fastener</td>
<td>90-120 in-lbs</td>
<td>10.2-13.6 Nm</td>
</tr>
<tr>
<td>Spark plug</td>
<td>12-18 ft-lbs</td>
<td>16.3-24.4 Nm</td>
</tr>
<tr>
<td>Splash guard fastener: all but FXSB</td>
<td>36-48 in-lbs</td>
<td>4.1-5.4 Nm</td>
</tr>
<tr>
<td>Splash guard fastener: FXSB</td>
<td>36-60 in-lbs</td>
<td>4.1-6.8 Nm</td>
</tr>
<tr>
<td>Timer cover screws</td>
<td>20-30 in-lbs</td>
<td>2.3-3.4 Nm</td>
</tr>
<tr>
<td>Transmission mounting bolts, 1st torque</td>
<td>15 ft-lbs</td>
<td>20.3 Nm</td>
</tr>
<tr>
<td>Transmission mounting bolts, final torque</td>
<td>34-39 ft-lbs</td>
<td>46.1-52.9 Nm</td>
</tr>
</tbody>
</table>

3-2 2015 Softail Service: Engine
Table 3-1. Engine: Twin Cam 96

<table>
<thead>
<tr>
<th>ITEM</th>
<th>SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cylinders</td>
<td>2</td>
</tr>
<tr>
<td>Type</td>
<td>4-cycle, 45 degree V-Type, air-cooled</td>
</tr>
<tr>
<td>Compression ratio</td>
<td>9.2:1</td>
</tr>
<tr>
<td>Bore</td>
<td>3.75 in, 95.3 mm</td>
</tr>
<tr>
<td>Stroke</td>
<td>4.38 in, 111.3 mm</td>
</tr>
<tr>
<td>Displacement</td>
<td>96.0 in³, 1585 cm³</td>
</tr>
<tr>
<td>Lubrication system</td>
<td>Pressurized, dry sump</td>
</tr>
</tbody>
</table>

Table 3-2. Engine: Twin Cam 103

<table>
<thead>
<tr>
<th>ITEM</th>
<th>SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cylinders</td>
<td>2</td>
</tr>
<tr>
<td>Type</td>
<td>4-cycle, 45 degree V-Type, air-cooled</td>
</tr>
<tr>
<td>Compression ratio</td>
<td>9.6:1</td>
</tr>
<tr>
<td>Bore</td>
<td>3.875 in, 98.42 mm</td>
</tr>
<tr>
<td>Stroke</td>
<td>4.375 in, 111.12 mm</td>
</tr>
<tr>
<td>Displacement</td>
<td>103.0 in³, 1690 cm³</td>
</tr>
<tr>
<td>Lubrication system</td>
<td>Pressurized, dry sump</td>
</tr>
</tbody>
</table>

Table 3-3. Oiling System

<table>
<thead>
<tr>
<th>OIL PUMP</th>
<th>DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Twin gerotor, dual scavenge, crank mounted and driven, internal oil pump, dry sump</td>
</tr>
<tr>
<td>Pressure</td>
<td>30-38 psi (207-262 kPa) at 2600 rpm and normal operating temperature of 230 °F (110 °C)</td>
</tr>
<tr>
<td>Filtration</td>
<td>5 micron media, filtered between pump and engine</td>
</tr>
</tbody>
</table>

Table 3-4. Rocker Arms Specifications

<table>
<thead>
<tr>
<th>ROCKER ARMS</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft fit in bushing (loose)</td>
<td>0.0005-0.0020</td>
<td>0.013-0.051</td>
</tr>
<tr>
<td>End clearance</td>
<td>0.003-0.013</td>
<td>0.08-0.33</td>
</tr>
<tr>
<td>Bushing fit in rocker arm (tight)</td>
<td>0.002-0.004</td>
<td>0.051-0.102</td>
</tr>
</tbody>
</table>

Table 3-5. Rocker Arm Shaft Specifications

<table>
<thead>
<tr>
<th>ROCKER ARM SHAFTS</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft fit in rocker arm support plate (loose)</td>
<td>0.0007-0.0022</td>
<td>0.018-0.056</td>
</tr>
</tbody>
</table>

Table 3-6. Hydraulic Lifter Specifications

<table>
<thead>
<tr>
<th>HYDRAULIC LIFTERS</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fit in crankcase (loose)</td>
<td>0.0009-0.0026</td>
<td>0.002-0.066</td>
</tr>
</tbody>
</table>

Table 3-7. Cylinder Head Specifications

<table>
<thead>
<tr>
<th>CYLINDER HEAD</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve guide in head (tight)</td>
<td>0.0022-0.0033</td>
<td>0.051-0.084</td>
</tr>
<tr>
<td>Valve seat in head (tight)</td>
<td>0.003-0.0045</td>
<td>0.076-0.114</td>
</tr>
<tr>
<td>Valve stem protrusion (min)</td>
<td>2.022</td>
<td>51.36</td>
</tr>
<tr>
<td>Head gasket surface (flatness)</td>
<td>0-0.005</td>
<td>0-0.152</td>
</tr>
</tbody>
</table>

Table 3-8. Valve Specifications

<table>
<thead>
<tr>
<th>VALVES</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exhaust: fit in guide</td>
<td>0.001-0.003</td>
<td>0.0254-0.0762</td>
</tr>
<tr>
<td>Intake: fit in guide</td>
<td>0.001-0.003</td>
<td>0.0254-0.0762</td>
</tr>
<tr>
<td>Seat width</td>
<td>0.040-0.062</td>
<td>1.02-1.58</td>
</tr>
<tr>
<td>Stem protrusion from cylinder head boss</td>
<td>2.012-2.032</td>
<td>51.10-51.61</td>
</tr>
</tbody>
</table>
### Table 3-9. Valve Springs Specifications

<table>
<thead>
<tr>
<th>VALVE SPRINGS</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed</td>
<td>135 lbs @ 1.850 in.</td>
<td>61.2 kg @ 47.0 mm</td>
</tr>
<tr>
<td>Open</td>
<td>342 lbs @ 1.300 in.</td>
<td>141.5 kg @ 33.0 mm</td>
</tr>
<tr>
<td>Free length</td>
<td>2.325 in.</td>
<td>59.1 mm</td>
</tr>
</tbody>
</table>

### Table 3-10. Piston: Twin Cam 96

<table>
<thead>
<tr>
<th>PISTON</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piston pin fit (loose)</td>
<td>0.0014-0.0025</td>
<td>0.036-0.064</td>
</tr>
<tr>
<td>Piston pin fit (loose)</td>
<td>0.0002-0.0005</td>
<td>0.005-0.013</td>
</tr>
<tr>
<td>Ring end gap</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top compression</td>
<td>0.010-0.020</td>
<td>0.254-0.508</td>
</tr>
<tr>
<td>2nd compression</td>
<td>0.014-0.024</td>
<td>0.356-0.610</td>
</tr>
<tr>
<td>Oil control ring</td>
<td>0.010-0.050</td>
<td>0.254-1.27</td>
</tr>
<tr>
<td>Ring side clearance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top compression</td>
<td>0.0012-0.0037</td>
<td>0.030-0.094</td>
</tr>
<tr>
<td>2nd compression</td>
<td>0.0012-0.0037</td>
<td>0.030-0.094</td>
</tr>
<tr>
<td>Oil control rails</td>
<td>0.0031-0.0091</td>
<td>0.079-0.231</td>
</tr>
</tbody>
</table>

### Table 3-11. Piston: Twin Cam 103

<table>
<thead>
<tr>
<th>PISTON</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piston pin fit (loose)</td>
<td>0.0014-0.0025</td>
<td>0.036-0.064</td>
</tr>
<tr>
<td>Piston pin fit (loose)</td>
<td>0.0002-0.0005</td>
<td>0.005-0.013</td>
</tr>
<tr>
<td>Ring end gap</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top compression</td>
<td>0.012-0.022</td>
<td>0.305-0.559</td>
</tr>
<tr>
<td>2nd compression</td>
<td>0.018-0.025</td>
<td>0.381-0.635</td>
</tr>
<tr>
<td>Oil control ring</td>
<td>0.010-0.050</td>
<td>0.254-1.270</td>
</tr>
<tr>
<td>Ring side clearance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top compression</td>
<td>0.0012-0.0037</td>
<td>0.030-0.094</td>
</tr>
<tr>
<td>2nd compression</td>
<td>0.0012-0.0037</td>
<td>0.030-0.094</td>
</tr>
<tr>
<td>Oil control rails</td>
<td>0.0031-0.0091</td>
<td>0.079-0.231</td>
</tr>
</tbody>
</table>

### Table 3-12. Connecting Rod Specifications

<table>
<thead>
<tr>
<th>CONNECTING ROD</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piston pin fit (loose)</td>
<td>0.0007-0.0012</td>
<td>0.018-0.030</td>
</tr>
<tr>
<td>Side play between flywheels</td>
<td>greater than 0.005</td>
<td>greater than 0.13</td>
</tr>
<tr>
<td>Connecting rod to crankpin (loose)</td>
<td>0.0004-0.0017</td>
<td>0.0102-0.0432</td>
</tr>
</tbody>
</table>

### Table 3-13. Flywheel Specifications

<table>
<thead>
<tr>
<th>PLYWHEELS</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runout (shaft measured in case)</td>
<td>0.000-0.010</td>
<td>0.0-0.254</td>
</tr>
<tr>
<td>Runout (measured in truing stand)</td>
<td>0.000-0.004</td>
<td>0.0-0.102</td>
</tr>
<tr>
<td>End play</td>
<td>0.003-0.013</td>
<td>0.076-0.330</td>
</tr>
</tbody>
</table>

### Table 3-14. Crankshaft/Sprocket Shaft Bearing Specifications

<table>
<thead>
<tr>
<th>CRANKSHAFT/SPROCKET SHAFT BEARINGS</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roller bearing fit (loose)</td>
<td>0.0002-0.0015</td>
<td>0.005-0.038</td>
</tr>
<tr>
<td>Bearing fit in crankcase (tight)</td>
<td>0.0038-0.0054</td>
<td>0.097-0.137</td>
</tr>
<tr>
<td>Bearing inner race on crankshaft (tight)</td>
<td>0.0004-0.0014</td>
<td>0.010-0.038</td>
</tr>
</tbody>
</table>
### GENERAL

Wear limits are given here as a guideline for measuring used engine components. Replace components when they exceed values listed here.

#### Table 3-15. Rocker Arm/Rocker Arm Shaft

<table>
<thead>
<tr>
<th>ROCKER ARM/ROCKER ARM SHAFT</th>
<th>REPLACE IF WEAR EXCEEDS</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft fit in bushing (loose)</td>
<td>0.0035</td>
<td>0.089</td>
<td></td>
</tr>
<tr>
<td>End clearance</td>
<td>0.025</td>
<td>0.635</td>
<td></td>
</tr>
<tr>
<td>Shaft fit in rocker arm support (loose)</td>
<td>0.0035</td>
<td>0.089</td>
<td></td>
</tr>
</tbody>
</table>

#### Table 3-16. Hydraulic Lifter

<table>
<thead>
<tr>
<th>HYDRAULIC LIFTER</th>
<th>REPLACE IF WEAR EXCEEDS</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fit in crankcase</td>
<td>0.006</td>
<td>0.152</td>
<td></td>
</tr>
<tr>
<td>Roller fit</td>
<td>0.0015</td>
<td>0.038</td>
<td></td>
</tr>
<tr>
<td>Roller end clearance</td>
<td>0.022</td>
<td>0.559</td>
<td></td>
</tr>
</tbody>
</table>

#### Table 3-17. Cam Support Plate

<table>
<thead>
<tr>
<th>ITEM</th>
<th>REPLACE IF WEAR EXCEEDS</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cam chain tensioner shoe thickness</td>
<td>0.060 min.</td>
<td>1.52 min.</td>
<td></td>
</tr>
<tr>
<td>Crankshaft bore maximum ID</td>
<td>0.8545</td>
<td>21.704</td>
<td></td>
</tr>
<tr>
<td>Camshaft bore</td>
<td>1.1023</td>
<td>27.998</td>
<td></td>
</tr>
<tr>
<td>Flatness</td>
<td>0.010</td>
<td>0.25</td>
<td></td>
</tr>
</tbody>
</table>

#### Table 3-18. Oil Pump

<table>
<thead>
<tr>
<th>OIL PUMP</th>
<th>REPLACE IF WEAR EXCEEDS</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotor tip clearance</td>
<td>0.004</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>Rotor thickness variation</td>
<td>0.001</td>
<td>0.025</td>
<td></td>
</tr>
<tr>
<td>Rotor protrusion (pump assembled)</td>
<td>0.015-0.025</td>
<td>0.38-0.64</td>
<td></td>
</tr>
</tbody>
</table>

#### Table 3-19. Cylinder Head

<table>
<thead>
<tr>
<th>CYLINDER HEAD</th>
<th>REPLACE IF WEAR EXCEEDS</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve guide press fit in head</td>
<td>Less than 0.002</td>
<td>Less than 0.05</td>
<td></td>
</tr>
<tr>
<td>Valve seat press fit in head</td>
<td>Less than 0.002</td>
<td>Less than 0.05</td>
<td></td>
</tr>
<tr>
<td>Valve seat width (max)</td>
<td>0.062</td>
<td>1.57</td>
<td></td>
</tr>
<tr>
<td>Valve margin (min)</td>
<td>0.031</td>
<td>0.80</td>
<td></td>
</tr>
<tr>
<td>Valve stem protrusion (max)</td>
<td>2.069</td>
<td>52.55</td>
<td></td>
</tr>
<tr>
<td>Head warpage (max)</td>
<td>0.006</td>
<td>0.15</td>
<td></td>
</tr>
</tbody>
</table>

#### Table 3-20. Cylinder

<table>
<thead>
<tr>
<th>CYLINDER</th>
<th>REPLACE IF WEAR EXCEEDS</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taper</td>
<td>0.002</td>
<td>0.051</td>
<td></td>
</tr>
<tr>
<td>Out of round</td>
<td>0.002</td>
<td>0.061</td>
<td></td>
</tr>
<tr>
<td>Warpage of gasket surfaces: top</td>
<td>0.006</td>
<td>0.152</td>
<td></td>
</tr>
<tr>
<td>Warpage of gasket or O-ring surfaces: base</td>
<td>0.004</td>
<td>0.102</td>
<td></td>
</tr>
</tbody>
</table>

#### Table 3-21. Cylinder Bore (Twin Cam 96)

<table>
<thead>
<tr>
<th>CYLINDER BORE</th>
<th>REPLACE IF WEAR EXCEEDS</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>3.752</td>
<td>95.301</td>
<td></td>
</tr>
<tr>
<td>0.005 in oversize</td>
<td>3.757</td>
<td>95.428</td>
<td></td>
</tr>
<tr>
<td>0.010 in oversize</td>
<td>3.762</td>
<td>95.555</td>
<td></td>
</tr>
</tbody>
</table>
### Table 3-22. Cylinder Bore (Twin Cam 103)

<table>
<thead>
<tr>
<th>ITEM</th>
<th>REPLACE IF WEAR EXCEEDS</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td></td>
<td>3.877</td>
<td>98.48</td>
</tr>
<tr>
<td>0.005 in oversize</td>
<td></td>
<td>3.882</td>
<td>98.60</td>
</tr>
<tr>
<td>0.010 in oversize</td>
<td></td>
<td>3.887</td>
<td>98.73</td>
</tr>
</tbody>
</table>

### Table 3-23. Piston

<table>
<thead>
<tr>
<th>PISTON</th>
<th>REPLACE IF WEAR EXCEEDS</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fit in cylinder (loose)</td>
<td></td>
<td>0.003</td>
<td>0.076</td>
</tr>
<tr>
<td>Piston pin fit (loose)</td>
<td></td>
<td>0.0008</td>
<td>0.020</td>
</tr>
<tr>
<td>Ring end gap</td>
<td>Top compression</td>
<td>0.030</td>
<td>0.762</td>
</tr>
<tr>
<td></td>
<td>2nd compression</td>
<td>0.034</td>
<td>0.864</td>
</tr>
<tr>
<td></td>
<td>Oil control rails</td>
<td>0.050</td>
<td>1.27</td>
</tr>
<tr>
<td>Ring side clearance</td>
<td>Top compression</td>
<td>0.0045</td>
<td>0.114</td>
</tr>
<tr>
<td></td>
<td>2nd compression</td>
<td>0.0045</td>
<td>0.114</td>
</tr>
<tr>
<td></td>
<td>Oil control rails</td>
<td>0.010</td>
<td>0.254</td>
</tr>
</tbody>
</table>

### Table 3-24. Connecting Rod

<table>
<thead>
<tr>
<th>CONNECTING ROD</th>
<th>REPLACE IF WEAR EXCEEDS</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piston pin fit (loose)</td>
<td></td>
<td>0.002</td>
<td>0.051</td>
</tr>
<tr>
<td>Fit on crankpin (loose)</td>
<td></td>
<td>0.002</td>
<td>0.051</td>
</tr>
</tbody>
</table>

### Table 3-25. Breather Assembly

<table>
<thead>
<tr>
<th>BREATHER ASSEMBLY</th>
<th>REPLACE IF WEAR EXCEEDS</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breather cover warpage</td>
<td></td>
<td>0.005</td>
<td>0.13</td>
</tr>
<tr>
<td>Breather baffle warpage</td>
<td></td>
<td>0.005</td>
<td>0.13</td>
</tr>
</tbody>
</table>

### Table 3-26. Valve Stem to Guide

<table>
<thead>
<tr>
<th>VALVE STEM TO GUIDE</th>
<th>REPLACE IF WEAR EXCEEDS</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intake</td>
<td></td>
<td>0.0038</td>
<td>0.0965</td>
</tr>
<tr>
<td>Exhaust</td>
<td></td>
<td>0.0038</td>
<td>0.0965</td>
</tr>
</tbody>
</table>

### Table 3-27. Flywheel

<table>
<thead>
<tr>
<th>FLYWHEEL</th>
<th>REPLACE IF WEAR EXCEEDS</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runout (shaft measured in case)</td>
<td></td>
<td>0.012</td>
<td>0.305</td>
</tr>
<tr>
<td>Runout (measured in truing stand)</td>
<td></td>
<td>0.005</td>
<td>0.127</td>
</tr>
<tr>
<td>End play</td>
<td></td>
<td>0.013</td>
<td>0.330</td>
</tr>
</tbody>
</table>

### Table 3-28. Crankshaft Roller Bearing

<table>
<thead>
<tr>
<th>CRANKSHAFT ROLLER BEARING</th>
<th>REPLACE IF</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roller bearing fit (loose)</td>
<td>More than 0.0015</td>
<td>More than 0.038</td>
<td></td>
</tr>
<tr>
<td>Bearing fit in crankcase (tight)</td>
<td>Less than 0.0038</td>
<td>Less than 0.097</td>
<td></td>
</tr>
<tr>
<td>Inner race on crankshaft (light)</td>
<td>Less than 0.0004</td>
<td>Less than 0.010</td>
<td></td>
</tr>
</tbody>
</table>

### Table 3-29. Counterbalancer

<table>
<thead>
<tr>
<th>COUNTERBALANCER</th>
<th>REPLACE IF WEAR EXCEEDS</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sprocket flatness</td>
<td>0.008</td>
<td>0.203</td>
<td></td>
</tr>
<tr>
<td>Tensioner guide grooving (max)</td>
<td>0.0060</td>
<td>2.03</td>
<td></td>
</tr>
<tr>
<td>Tensioner spring length (min)</td>
<td>1.85</td>
<td>47.0</td>
<td></td>
</tr>
</tbody>
</table>
ENGINE OIL FLOW

OIL FEED

See Figure 3-1. Oil flows from the oil tank feed line (1) to the engine feed connection (2) at the rear right side of the crankcase.

1. Oil tank feed line
2. Feed connection on engine
3. Return line
4. Vent line
5. Oil tank

Figure 3-1. Oil Flow from Tank

See Figure 3-2. Running through a passageway in the crankcase (1), oil exits a hole in the crankcase and then enters a hole in the cam support plate (2). Passing through a channel in the cam support plate, oil enters the feed side of the oil pump (3). See 3.5 OIL PUMP OPERATION. The feed gerotors of the pump direct the flow up a second channel in the cam support plate.

A passage (5) connects to a pressure relief valve (6) mounted in the bypass port of the cam support plate. When the oil pressure exceeds the setting of the valve spring (35 psi (241kPa)), the orifice opens to bypass (7) excess oil back to the feed side of the pump (3).

See Figure 3-3. Oil not returned to the feed side exits the cam support plate and passes through a hole in the crankcase. Flowing through a passageway in the crankcase, the oil exits the lower hole in the oil filter mount. The oil pressure sending unit (8) also reads the pressure within that passageway.

1. Crankcase passage
2. Cam support plate/crankcase connection
3. Feed side of oil pump
4. Oil pump output
5. Overflow passage
6. Pressure relief valve
7. Bypass passage
8. Oil pressure sending unit
9. Return from oil filter into cam support plate
10. Feed to chain guide bracket

Figure 3-2. Cam Support Plate Oil Flow

See Figure 3-2. After circulating through the oil filter, oil is directed back into the crankcase through the spigot in the oil filter mount. Exiting through a passageway in the crankcase, oil reenters the cam support plate (9).

Filtered oil is then routed to the top and bottom ends of the engine. See 3.4 ENGINE OIL FLOW, Top End, 3.4 ENGINE OIL FLOW, Bottom End and 3.4 ENGINE OIL FLOW, Chain Guide Bracket.
Two illustrations accompany this explanation.

- Cam support plate oil flow is shown in Figure 3-4.
- Top end oil flow is shown in Figure 3-5.

Oil passes through a channel in the cam support plate. It exits on the crankcase side through two holes near the top (A11, A12). Oil enters two holes in the crankcase flange (B13, B14). One passage leads to the front cylinder and the other to the rear cylinder. Oil then travels through passageways in the crankcase to the hydraulic lifter bores (D15).

Oil enters each lifter bore through oblong holes (E18), 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 pushrod socket rises to eliminate lash of the valve train components. Oil then exits a hole centered in the lifter socket and flows up the hollow pushrods.

**NOTE**

An additional round hole (E17) drilled into the lifter bores feed oil to the piston jets.

Exiting holes at the top of the pushrods, oil enters the rocker arms lubricating the rocker arm bushings. Oil flows along the rocker arm shafts and exits a pin hole in the outboard side of each rocker arm (F18). This oil lubricates the valve springs and the top of the valve stem.

Oil runs to the low side of the rocker housing and enters the exhaust valve spring pocket. 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 cylinder flange. Oil flows through a vertical passageway in the cylinder. It then passes through a second dowel pin on 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. Finally, 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 (B23).

Figure 3-4. Engine Oil Flow: Cam Support Plate/Right Crankcase Half
**BOTTOM END**

Three illustrations accompany this explanation.
- Cam support plate oil flow is shown in Figure 3-4.
- Top end oil flow is shown in Figure 3-5.
- Bottom end oil flow is shown in Figure 3-6.

Oil traveling through the horizontal passage (A11-A12) at the top of the cam support plate (en route to the cylinders) also passes through a hole at the top of each camshaft bore. This oil lubricates the journals of the plain bearing cams. Some oil flowing to the rear cylinder sprays through a pin hole to lubricate the secondary cam chain.

Oil to the rear cylinder also travels down the vertical passage (A27) at the rear of the cam support plate. This oil exits a hole on the outboard side to supply oil to the primary cam chain tensioner (A26).

The flow of oil in the vertical passage (A29) at the center of the cam support plate passes through a hole on the inboard side. This supplies oil to the secondary cam chain tensioner. Oil also sprays through a pin hole (A30) to lubricate the primary cam chain. Oil then flows through a hole in the crankshaft bushing where it enters a passage in the crankshaft (L27).

Oil flows through the center of the crankshaft and through a cross passage into the right side of the flywheel. Oil enters the
crank pin and exits through three holes to lubricate the lower rod bearing set.

Oil splash and mist created by flywheel rotation lubricates the crankshaft and the camshaft bearings in the right crankcase half. This same action serves to lubricate the sprocket shaft bearing in the left crankcase half (M28).

Since the oil mist also lubricates the cylinder walls, three holes on each side of the piston (in the area of the third ring land) evacuate excess oil scraped from the walls on the piston downstroke.

The piston jets (N29) receive oil from the intake lifter bores. They 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 12-18 PSI (82.7-124.1 kPa), at which point the engine is operating above idle speed. Oil pressure at idle speeds will be 9-12 PSI (62.1-82.7). At this pressure, the valve remains closed to prevent over-oiling and to provide proper system operating pressure.

Oil spray from each piston jet also enters a hole at the bottom of each pin boss (O30) to lubricate the piston pin. The spray also allows a portion of the oil to reach the upper rod bushing (O31).

Surplus oil falls back to the bottom of the flywheel compartment where it collects in the sump area (P32). Oil in the sump is drawn to the scavenge side of the oil pump (P35) through an internal channel (P33, C34).

Figure 3-6. Engine Oil Flow: Bottom End
CHAIN GUIDE BRACKET

Three illustrations accompany this explanation.
- Cam support plate oil flow is shown in Figure 3-4.
- Bottom end oil flow is shown in Figure 3-6.
- Chain guide bracket oil flow is shown in Figure 3-7.

The flow of oil travels down the vertical passage at the rear of the cam support plate (A27).

As oil exits the inboard side of the cam support plate, it enters a crankcase dowel. The hole contains the chain guide screen and O-ring (Q40).

NOTE

This screen blocks any debris which might enter the chain guide bracket. The screen has no regular maintenance schedule. However, clean the screen and replace the O-ring every time the engine is disassembled.

Oil travels through the right side crankcase (R41) and goes into the chain guide bracket rubber interconnect (S42). Inside the chain guide (T43), oil travels to both the front and rear hydraulic tensioners (T45, T44). The tensioners are underneath the front and rear tensioner guides which provide support for the counterbalancer chain. A small hole at the top of each tensioner vents any trapped air into the flywheel compartment.

![Diagram of Engine Oil Flow: Chain Guide Bracket](image)

Figure 3-7. Engine Oil Flow: Chain Guide Bracket

OIL RETURN

The "dual kidney" designation given to the oil pump refers to its two scavenging functions, whereby it simultaneously draw oil from both the cam and flywheel compartments.

Oil sucked up by the scavenging lobes passes through the scavenging gerotor of the oil pump and is directed through a return channel (A40) in the cam support plate. See 3.5 OIL PUMP OPERATION.

Exiting a hole on the inboard side of the cam support plate, the oil enters a hole in the crankcase flange (B41).

The oil flows through a passageway in the crankcase and exits the upper fitting (3) at the rear right side of the crankcase as shown in Figure 3-1. Passing through a flexible hose, the flow of oil returns to the oil tank.

A third hose (4) connects the cam compartment with the oil tank via a third passage in the transmission case. This crankcase breather connection provides the pressure balance necessary for oil circulation.
GENERAL

See Figure 3-8. The oil pump has two gerotor gear sets driven by the crankshaft.

- The feed gerotor set distributes oil to the engine.
- The scavenge gerotor set draws oil from the cam and flywheel compartments and returns it to the oil pan.

Each gerotor gear set has 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 3-8. Oil Pump Gerotors

OPERATION

The oil pump is driven by the crankshaft. The inlet and outlet sides of the pump are sealed by the tips and lobes of the inner and outer gerotors. This prevents oil on the outlet side (high pressure) from being transferred to the inlet side.
See Figure 3-9. As the gerotors rotate, the cavity volume increases between the inner and outer gerotors on the inlet side of the pump. This creates a vacuum causing oil to be drawn in. The cavity increases until the volume is equivalent to that of the missing tooth on the inner gerotor.

See Figure 3-10. As the oil moves to the outlet side of the pump, the cavity decreases in volume. This forces pressurized oil out the discharge port. In operation, the gerotors provide a continuous flow of oil.

1. Seal
2. Oil out
3. Continuous flow

Figure 3-10. Outlet Side Oil Flow
GENERAL

The crankcase breather system relieves crankcase pressure produced by the downstroke of the pistons. Crankcase vapors are then directed into the intake air stream to be burned during normal combustion. Buming crankcase vapors eliminates the pollutants normally discharged from the crankcase.

See Figure 3-11. As pistons push downward, displaced air in the crankcase is vented through the crankshaft oiler bearing into the cam compartment. The air then flows up the pushrod covers (1) into the rocker housing. The moving air absorbs a small amount of oil vapor as it travels through the engine.

The oil/air vapor rushes under the rocker arm support plate 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 allow the separated oil to drain back into the crankcase.

Passing through the oil filter gauze, the vapor passes through the umbrella valve (3) into the breather compartment. The umbrella valve only allows air to be vented one way.

In the breather compartment, air flows downward through holes aligned in the breather baffle, rocker arm support plate and rocker housing. Exiting the rocker housing, 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.

Air flows through the cylinder head passageway and through a passage in the air cleaner backplate bolt (4). It passes through a breather tube (5) into the air filter element. It then joins with the intake air stream and is burned during normal combustion.

NOTE

Always connect breather tubes. Loose or detached tubes vent crankcase gases into the atmosphere which violates emissions standards.

Figure 3-11. Breather Air Flow

1. Pushrod cover
2. Breather baffle compartment
3. Umbrella valve
4. Air cleaner backplate bolt
5. Breather tube
OIL PRESSURE INDICATOR LAMP

See Figure 3-12. 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 extinguish once the engine is running.

NOTICE

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 does not extinguish, it may be caused by:
- Low oil level or diluted oil supply
- Oil feed and return lines clog with ice or sludge
- Other conditions that may cause the lamp to remain lit are:
  - Faulty lamp wiring
  - Faulty oil pressure sending unit
  - Damaged oil pump
  - Plugged oil filter element
  - Incorrect oil viscosity for the operating temperature
  - Fractured or weak spring in the oil pressure relief valve
  - Incorrectly installed O-rings in the engine

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.

3. See Figure 3-14. Install OIL PRESSURE GAUGE SET (Part No. HD-96921-52D).
   a. Hand-tighten adapter (2) in oil pressure switch mounting hole.
   b. Assemble banjo bolt (3), washer (4), oil pressure gauge (1), banjo fitting and second washer onto adapter Hand-tighten.

4. Run motorcycle until engine is at normal operating temperature.

NOTE

Engine oil should be at normal operating temperature, 230 °F
(110 °C), for an accurate reading.

5. Oil pressure should be within specifications. Refer to Table 3-30.

6. See 3.8 TROUBLESHOOTING if readings are not within specification.

7. Stop engine. Remove oil pressure gauge assembly.

8. Install oil pressure switch. See 7.31 OIL PRESSURE SWITCH.

<table>
<thead>
<tr>
<th>CHECK</th>
<th>SPECIFICATION *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil pressure - min at idle</td>
<td>5 psi 34.5 kPa</td>
</tr>
<tr>
<td>Oil pressure - normal at</td>
<td>30-38 psi 207-262 kPa</td>
</tr>
<tr>
<td>2000 rpm</td>
<td></td>
</tr>
<tr>
<td>Oil pressure - max</td>
<td>50 psi 345 kPa</td>
</tr>
</tbody>
</table>

* With oil at normal operating temperature of 230 °F (110 °C)

CHECKING OIL PRESSURE

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-96921-52D</td>
<td>OIL PRESSURE GAUGE SET</td>
</tr>
</tbody>
</table>

Check operating oil pressure as follows:

1. Verify engine oil is at the proper level. See 1.6 ENGINE OIL AND FILTER.

2. See Figure 3-13. Remove oil pressure switch from crankcase. See 7.31 OIL PRESSURE SWITCH.
Figure 3-14. Oil Pressure Gauge Set

1. Gauge
2. Adapter
3. Banjo bolt
4. Washer (2)
DIAGNOSING VALVE TRAIN NOISE

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 the following for restrictions or blockage:
   a. Oil pump
   b. Crankcase passages
   c. Oil hoses

2. Repair or replace parts as necessary.

3. If oil is not reaching the hydraulic lifters, remove and inspect. See 3.19 PUSHRODS, LIFTERS AND COVERS. Lifter Inspection. Clean lifter bore of all foreign material. Replace hydraulic lifter if required.

4. Inspect pushrod, lifter and lifter block for proper fit and unusual wear. Replace parts as necessary.

5. Visually inspect camshaft lobes for abnormal wear.

6. Check cam chain tensioning shoe for wear.

7. 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.


COMPRESSION TEST

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-33223-1</td>
<td>CYLINDER COMPRESSION GAUGE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spark plug</td>
<td>12-18 ft-lbs</td>
</tr>
</tbody>
</table>

A compression test can help determine the source of cylinder leakage. Use CYLINDER COMPRESSION GAUGE (Part No. HD-33223-1) with a screw-in type adapter.

NOTE

All Twin Cam engines use a 12 mm adapter with the compression gauge.

1. Run motorcycle until engine is at normal operating temperature.

2. Disconnect spark plug wires, clean around plug base. Remove spark plugs.

3. Remove air cleaner. See 4.3 AIR CLEANER ASSEMBLY.

4. Connect compression tester to front cylinder per manufacturer's instructions.

5. Verify transmission is in NEUTRAL. Hold throttle at wide open throttle position and crank engine continuously through 5-7 full compression strokes. Note gauge readings at the end of the first and last compression strokes. Record test results.

6. Repeat test on rear cylinder.

NOTE

Verify that throttle is closed before assembling air cleaner.

7. Install air cleaner. See 4.3 AIR CLEANER ASSEMBLY.

8. If the final readings are a minimum of 125 psi (862 kPa) and readings do not indicate more than a 10% variance between cylinders, compression is considered normal. If compression does not meet specifications, refer to Table 3-31 for possible causes.

9. If readings do not meet specifications, inject approximately 1/2 oz. (15 ml) engine oil into each cylinder. Repeat the compression tests on both cylinders. Readings that are considerably higher during the second test indicate worn piston rings.

10. Install the spark plugs. Tighten to 12-18 ft-lbs (16.3-24.4 Nm). Connect spark plug wires.

Table 3-31. Compression Test Results

<table>
<thead>
<tr>
<th>DIAGNOSIS</th>
<th>TEST RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ring trouble</td>
<td>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.</td>
</tr>
<tr>
<td>Valve trouble</td>
<td>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 pushrod length.</td>
</tr>
<tr>
<td>Head gasket leak</td>
<td>Same reaction as valve trouble.</td>
</tr>
</tbody>
</table>

CYLINDER LEAKDOWN TEST

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-35667-A</td>
<td>CYLINDER LEAKDOWN TESTER</td>
</tr>
</tbody>
</table>

NOTE

On vehicles with automatic compression release (ACR), verify the ACRs are closed for this test. Perform the test with the ignition/ignition switch in the OFF position.

The cylinder leakdown test will help pinpoint leaking valves, worn, damaged or stuck piston rings and blown head gaskets. The cylinder leakdown tester applies compressed air to the cylinder at a controlled pressure and volume. It then measures the percent of leakage from the cylinder.

Use the CYLINDER LEAKDOWN TESTER (Part No. HD-35667-A). Follow the specific instructions supplied with the tester.

The following are some general instructions that apply to Harley-Davidson V-twin engines:

1. Run motorcycle until engine is at normal operating temperature. Stop engine.

2. Disconnect spark plug wires. Clean around plug base and remove plugs.
3. Rotate crankshaft until piston in the cylinder being tested is at top dead center (TDC) of compression stroke (both valves closed) during the test.

4. Engage transmission in highest gear and lock the rear brake. This prevents the engine from turning over when air pressure is applied to the cylinder.

**NOTE**
Before performing the cylinder leakage test, verify the tester itself is free from leakage. Apply a soap solution around all tester fittings. Connect cylinder leakage tester to compressed air source. Look for any bubbles that indicate leakage from the tester.

5. 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 percent indicates internal engine problems.

6. Listen for air leaks at throttle body, 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, verify that piston is still at TDC or check for correct pushrod length.

7. Repeat procedure on rear cylinder.

---

**DIAGNOSING SMOKING ENGINE OR HIGH OIL CONSUMPTION**

Perform both a compression test and a cylinder leakage test. See 3.8 TROUBLESHOOTING, Compression Test and 3.8 TROUBLESHOOTING, Cylinder Leaking Test. If further testing is needed, remove suspect head(s) and inspect for the following:

**Check Prior to Cylinder Head Removal**

1. Oil level too high.
2. Oil carryover.
4. Restricted oil filter.

**Check After Cylinder Head Removal**

1. Oil return passages for clogging.
2. Valve guide seats.
3. Valve guide to valve stem clearance.
4. Gasket surface of both head and cylinder
5. Cylinder head casting porosity allowing oil to drain into combustion chamber.
6. O-ring damaged or missing from oil pump/crankcase/junction.
7. If the above checks do not reveal the cause, remove the cylinder to inspect for excess piston ring wear. Also verify the piston ring gaps are properly staggered.
TOP END REPAIR

NOTE

During top end disassembly, the engine may be left in the chassis for service.

If servicing only cylinder head components, pistons, cylinders and/or upper rod bushings, two options are available depending upon engine status.

- 3.10 TOP END SERVICE, Engine in Chassis.
- 3.10 TOP END SERVICE, Engine Removed from Chassis.

BOTTOM END REPAIR

NOTE

Servicing components in the cam compartment requires only partial disassembly. This can be done with the engine left in the chassis.

After disassembling as far as the cylinder heads you may find that bottom end repair is necessary. Bottom end service may require either partial or complete disassembly of the engine.

- To service the cam compartment, see 3.24 CAM COMPARTMENT AND COMPONENTS.
- To service components in the flywheel compartment, the engine must be removed and the crankcase halves split.

See 3.11 CAM COMPARTMENT SERVICE, Engine Removed From Chassis.

TYPICAL SYMPTOMS

Symptoms indicating a need for engine repair are often misleading. If more than one symptom is present, possible causes can be narrowed to make at least a partial diagnosis.

For example, an above normal consumption of oil could be caused by several mechanical faults. But when accompanied by blue-gray smoke from the exhaust and low compression, it indicates the rings need replacing. Low compression by itself is more likely to be caused by improperly sealed or burned valves, not worn rings.

Certain “knocking” noises may occur because of loose bearings, others by piston slap. Piston slap is a condition where piston or cylinder or both are out of tolerance. This excessive clearance allows the piston to “slap” the cylinder as it moves up and down.

Most frequently, valves, rings, pins, bushings and bearings need attention at about the same time. If the symptoms indicate that any one of the above components is worn, service all related parts.
## Engine In Chassis

### Table 3.32. Engine In Chassis

<table>
<thead>
<tr>
<th>SERVICE PROCEDURE</th>
<th>COMPONENT REPAIR PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove parts to gain access to all components above cylinder deck. See 3.12 STRIPPING MOTORCYCLE FOR SERVICE.</td>
<td></td>
</tr>
<tr>
<td>Disassemble top end. See 3.16 TOP END OVERHAUL: DISASSEMBLY.</td>
<td></td>
</tr>
<tr>
<td><strong>BREATHER ASSEMBLY</strong></td>
<td>Inspect and repair. See 3.17 BREATHER ASSEMBLY*.</td>
</tr>
<tr>
<td><strong>ROCKER ARM SUPPORT</strong></td>
<td>Inspect and repair. See 3.18 ROCKER ARM SUPPORT PLATE*.</td>
</tr>
<tr>
<td><strong>PUSHRODS, LIFTERS AND COVERS</strong></td>
<td>Inspect and repair. See 3.19 PUSHRODS, LIFTERS AND COVERS*.</td>
</tr>
<tr>
<td><strong>CYLINDER HEAD</strong></td>
<td>Inspect and repair. See 3.20 CYLINDER HEAD*.</td>
</tr>
<tr>
<td><strong>CYLINDER</strong></td>
<td>Inspect and repair. See 3.21 CYLINDER*.</td>
</tr>
<tr>
<td><strong>PISTON</strong></td>
<td>Inspect and repair. See 3.22 PISTON*.</td>
</tr>
</tbody>
</table>

Assemble top end. See 3.23 TOP END OVERHAUL: ASSEMBLY.

Assemble motorcycle. See 3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE.

Note: *If no other work is to be done, you may advance to 3.23 TOP END OVERHAUL: ASSEMBLY when this step is completed during top end service.*
Table 3-33. Engine Removed From Chassis

<table>
<thead>
<tr>
<th>SERVICE PROCEDURE</th>
<th>COMPONENT REPAIR PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove engine from motorcycle. See 3.14 REMOVING ENGINE FROM CHASSIS.</td>
<td>Inspect and repair. See 3.17 BREATHER ASSEMBLY*.</td>
</tr>
<tr>
<td>Disassemble top end. See 3.16 TOP END OVERHAUL: DISASSEMBLY.</td>
<td>Rocker arm support. See 3.18 ROCKER ARM SUPPORT PLATE*.</td>
</tr>
<tr>
<td>BREATHER ASSEMBLY</td>
<td>Pushrods, lifters and covers. See 3.19 PUSHRODS, LIFTERS AND COVERS*.</td>
</tr>
<tr>
<td>CYLINDER HEAD</td>
<td>Inspect and repair. See 3.20 CYLINDER HEAD*.</td>
</tr>
<tr>
<td>CYLINDER</td>
<td>Inspect and repair. See 3.21 CYLINDER*.</td>
</tr>
<tr>
<td>PISTON</td>
<td>Inspect and repair. See 3.22 PISTON.</td>
</tr>
</tbody>
</table>

Assemble top end. See 3.23 TOP END OVERHAUL: ASSEMBLY.
Install engine in motorcycle. See 3.15 INSTALLING ENGINE IN CHASSIS.

Note: * If no other work is to be done, you may advance to 3.23 TOP END OVERHAUL: ASSEMBLY when this step is completed during top end service.
### Table 3.34. Engine In Chassis: Cam Compartment Service

<table>
<thead>
<tr>
<th>SERVICE PROCEDURE</th>
<th>COMPONENT REPAIR PROCEDURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove parts to gain access to all components above cylinder deck. See 3.12 STRIPPING MOTORCYCLE FOR SERVICE.</td>
<td></td>
</tr>
<tr>
<td>Disassemble top end. See 3.16 TOP END OVERHAUL: DISASSEMBLY.</td>
<td></td>
</tr>
<tr>
<td>BREATHER ASSEMBLY.</td>
<td>Inspect and repair. See 3.17 BREATHER ASSEMBLY.</td>
</tr>
<tr>
<td>ROCKER ARM SUPPORT PLATE.</td>
<td>Inspect and repair. See 3.18 ROCKER ARM SUPPORT PLATE.</td>
</tr>
<tr>
<td>PUSHRODS, LIFTERS AND COVERS.</td>
<td>Inspect and repair. See 3.19 PUSHRODS, LIFTERS AND COVERS.</td>
</tr>
<tr>
<td>Disassemble bottom end. See 3.24 CAM COMPARTMENT AND COMPONENTS.</td>
<td></td>
</tr>
<tr>
<td>COVER AND CAM SUPPORT PLATE</td>
<td>Inspect and repair. See 3.24 CAM COMPARTMENT AND COMPONENTS*.</td>
</tr>
<tr>
<td>OIL PUMP</td>
<td>Inspect and repair. See 3.25 OIL PUMP.</td>
</tr>
<tr>
<td>Assemble bottom end. See 3.24 CAM COMPARTMENT AND COMPONENTS.</td>
<td></td>
</tr>
<tr>
<td>Assemble motorcycle. See 3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE.</td>
<td></td>
</tr>
</tbody>
</table>

Note: * If no other work is to be done, you may advance to 3.29 CRANKCASE ASSEMBLY when this step is completed during bottom end service.
**ENGINE REMOVED FROM CHASSIS**

Table 3-35. Engine Removed: Flywheel Compartment Service or Complete Engine Overhaul

<table>
<thead>
<tr>
<th>SERVICE PROCEDURE</th>
<th>COMPONENT REPAIR PROCEDURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove engine from motorcycle. See 3.14 REMOVING ENGINE FROM CHASSIS.</td>
<td></td>
</tr>
<tr>
<td>Disassemble top end. See 3.16 TOP END OVERHAUL: DISASSEMBLY.</td>
<td></td>
</tr>
<tr>
<td>BREATHER ASSEMBLY</td>
<td>Inspect and repair. See 3.17 BREATHER ASSEMBLY.</td>
</tr>
<tr>
<td>ROCKER ARM SUPPORT PLATE</td>
<td>Inspect and repair. See 3.18 ROCKER ARM SUPPORT PLATE.</td>
</tr>
<tr>
<td>PUSHRODS, LIFTERS AND COVERS</td>
<td>Inspect and repair. See 3.18 PUSHRODS, LIFTERS AND COVERS.</td>
</tr>
<tr>
<td>CYLINDER HEAD</td>
<td>Inspect and repair. See 3.20 CYLINDER HEAD.</td>
</tr>
<tr>
<td>CYLINDER</td>
<td>Inspect and repair. See 3.21 CYLINDER.</td>
</tr>
<tr>
<td>PISTON</td>
<td>Inspect and repair. See 3.22 PISTON.</td>
</tr>
<tr>
<td>Disassemble bottom end.</td>
<td></td>
</tr>
<tr>
<td>COVER AND CAM SUPPORT PLATE</td>
<td>Inspect and repair. See 3.24 CAM COMPARTMENT AND COMPONENTS.</td>
</tr>
<tr>
<td>CRANKCASE</td>
<td>Inspect crankcase and repair. See 3.26 CRANKCASE DISASSEMBLY AND REPAIR.</td>
</tr>
<tr>
<td></td>
<td>Inspect and repair flywheel/connecting rod assembly. See 3.27 FLYWHEEL AND CONNECTING RODS.</td>
</tr>
<tr>
<td>Assemble bottom end. See 3.29 CRANKCASE ASSEMBLY and 3.24 CAM COMPARTMENT AND COMPONENTS.</td>
<td></td>
</tr>
<tr>
<td>Assemble top end. See 3.23 TOP END OVERHAUL: ASSEMBLY.</td>
<td></td>
</tr>
<tr>
<td>Install engine in motorcycle. See 3.15 INSTALLING ENGINE IN CHASSIS.</td>
<td></td>
</tr>
</tbody>
</table>
PROCEDURE

NOTE

If performing top end service (or both cam compartment and top end), follow all the steps listed. If servicing cam compartment components only, perform steps 1 through 8.

1. Position motorcycle on a suitable lift.
2. Remove seat.

WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

3. Disconnect negative battery cable.
4. Drain engine oil. See 1.6 ENGINE OIL AND FILTER.
5. Remove right footboard.
6. Remove exhaust system. See 4.17 EXHAUST SYSTEM.
7. Remove air cleaner cover and backplate. See 4.3 AIR CLEANER ASSEMBLY.
8. Drain and remove fuel tank. See 4.6 FUEL TANK.
9. Loosen and remove throttle control cables, if equipped, from induction module.
10. Remove spark plug cables from spark plugs. Remove spark plugs to avoid damaging them.
11. Remove top engine mount as an assembly.
12. Remove induction module connectors and induction module. See 4.11 INDUCTION MODULE.
**PROCEDURE**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder head bracket bolts</td>
<td>35-40 ft-lbs</td>
</tr>
<tr>
<td>Engine mounting bolt, upper</td>
<td>45-50 ft-lbs</td>
</tr>
</tbody>
</table>

**NOTE**

If top end service was performed (or both cam compartment and top end), follow all the steps listed. If only cam compartment components were serviced, start with step 5.

1. Install induction module. See 4.11 INDUCTION MODULE.
2. Install top engine bracket assembly to frame tab and cylinder heads.
   a. Tighten two cylinder head bracket bolts to 35-40 ft-lbs (47.5-54.2 Nm).
   b. Tighten the upper engine to frame mounting bolt to 45-50 ft-lbs (61.0-67.8 Nm).
3. Install spark plugs to cylinder heads. Connect spark plug cables to spark plugs. See 1.17 SPARK PLUGS.
4. Install throttle cables to induction module.
5. Install fuel tank, fuel gauge connector, fuel tank crossover tube and instrument console. See 4.6 FUEL TANK.
6. Fill fuel tank with fuel.
7. Install backplate and air cleaner cover. See 4.3 AIR CLEANER ASSEMBLY.
8. Install heat shields and exhaust. See 4.17 EXHAUST SYSTEM.
9. Install right footboard.
10. Fill engine oil to proper level. See 1.8 ENGINE OIL AND FILTER.
11. Connect negative battery cable.

**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)

12. Install seat.
13. Remove motorcycle from lift.
PROCEDURE

1. Position motorcycle on a suitable lift.
2. Remove seat.

⚠️ 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. (080408a)
3. Disconnect both battery cables, negative cable first. Remove battery.
4. Drain primary chaincase and oil tank. See 1.6 ENGINE OIL AND FILTER and 1.9 PRIMARY CHAINCASE LUBRICANT.

⚠️ 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)
5. Drain fuel tank. Remove instrument panel and fuel tank. See 4.6 FUEL TANK.
6. Remove left and right footboards or footpegs.
7. Remove voltage regulator bracket. See 7.23 VOLTAGE REGULATOR.
8. Remove exhaust system. See 4.17 EXHAUST SYSTEM.
9. Remove belt guard.
10. Loosen rear axle. Loosen belt adjusters, Remove drive belt from rear pulley. Move rear wheel back to provide access to electrical panel.
11. Remove electrical panel. See 7.3 ELECTRICAL PANEL.
12. Remove oil tank. See 3.30 OIL TANK: ALL BUT FXSB or 3.31 OIL TANK: FXSB.
13. Remove starter. See 7.13 STARTER.
14. Unplug the vehicle speed sensor (VSS).
15. Remove primary chaincase cover and primary chaincase. See 5.6 PRIMARY CHAINCASE HOUSING.
16. Remove upper and lower fasteners from seat post. Disconnect coil connector and remove the post with the coil attached.
17. Position a jack with a wooden block under the engine. Remove the shift arm.
18. Remove the bracket (right side) connecting the frame to the transmission case.
19. Remove the four fasteners connecting the engine to the transmission.
20. Note routing of clutch cable before removing. Disconnect clutch cable from clutch lever. Unclip cable at left side frame downtube and pull cable through chassis to right side of motorcycle. Leave cable installed on transmission.
21. Models equipped with evaporative emissions: remove the three hoses from the evaporative emissions canister.
22. Remove the pivot shaft. Disconnect neutral switch wires and slide the transmission back and then out the right side.
23. Remove bolts from horn bracket and cylinder heads. Remove bracket as an assembly. Disconnect horn wire.
24. Remove induction module connectors. Remove air cleaner cover and backplate. See 4.3 AIR CLEANER ASSEMBLY. Disconnect throttle cables.
25. Models equipped with ACRs: disconnect ACR connectors.
26. Detach oil pressure sending unit connector.
27. Remove two bolts on front engine mount. Lift engine out from right side of frame.
PROEDURE

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission mounting bolts, 1st torque</td>
<td>15 ft-lbs</td>
</tr>
<tr>
<td>Transmission mounting bolts, final torque</td>
<td>34-39 ft-lbs</td>
</tr>
<tr>
<td>Pivot shaft nut</td>
<td>90-110 ft-lbs</td>
</tr>
<tr>
<td>Engine mounting bolts, front</td>
<td>70-80 ft-lbs</td>
</tr>
<tr>
<td>Engine/transmission bracket bolts</td>
<td>30-35 ft-lbs</td>
</tr>
<tr>
<td>Cylinder head bracket bolts</td>
<td>35-40 ft-lbs</td>
</tr>
<tr>
<td>Engine mount bolt, top</td>
<td>45-50 ft-lbs</td>
</tr>
<tr>
<td>Engine mount bracket nuts, top</td>
<td>20-25 ft-lbs</td>
</tr>
</tbody>
</table>

1. Using a suitable hoist, install engine in chassis from the right side.
2. Loosely install the front two mounting bolts and spacers from the right side.
   a. The shorter top bolt has a spacer installed on the right side between the frame and the engine.
   b. The longer lower bolt has a spacer on both sides. Loosely install corresponding washers and nuts.
3. Attach induction module connectors and horn wire.
4. See Figure 3-15. Loosen nuts (1).
5. Loosely install upper engine to frame mounting bolt with washer (2). Loosely install both cylinder head bracket bolts with washers (3).
6. If equipped with ACRs: attach ACR connectors.
   NOTE
   Use new transmission mounting bolts when installing transmission case. Do not reuse old bolts.
7. See Figure 3-16. Install transmission case from the right side. Align all four transmission mounting holes verifying that the two lower locating dowels engage their holes in crankcase.
8. Tighten the four transmission mounting bolts in a crosswise pattern:
   a. Tighten finger-tight.
   b. Tighten to 15 ft-lbs (20.3 Nm).
   c. Tighten to 34-39 ft-lbs (46.1-52.9 Nm).
9. Apply ANTI-SEIZE LUBRICANT to pivot shaft. From the right side, install pivot shaft and spacers with spacer collars facing transmission case.
10. Apply LOCTITE 262 HIGH STRENGTH THREADLOCKER and SEALANT (red) to pivot shaft nut.
11. Install pivot shaft nut. Tighten to 90-110 ft-lbs (122-149.1 Nm).
12. Apply LOCTITE 262 HIGH STRENGTH THREADLOCKER and SEALANT (red) to both front mounting bolts. Tighten to 70-80 ft-lbs (94.9-108.5 Nm).
13. Install lower bracket (right side). Apply LOCTITE 262 HIGH STRENGTH THREADLOCKER and SEALANT (red). Tighten bracket bolts to 30-35 ft-lbs (40.7-47.5 Nm).
   NOTE
   Always tighten the top engine mount hardware in the order listed below to alleviate stress on the engine mount.
14. Final tighten upper engine mount hardware in the order below.
   a. Tighten two cylinder head bracket bolts to 35-40 ft-lbs (47.5-54.2 Nm).
   b. Tighten the upper engine to frame mounting bolt to 45-50 ft-lbs (61.0-67.8 Nm).
   c. Tighten the upper bracket to lower bracket nuts to 20-25 ft-lbs (27.1-33.9 Nm).
15. If equipped with evaporative emissions: install the three hoses on the evaporative emissions canister.
17. Install air cleaner backplate and cover. See 4.3 AIR CLEANER ASSEMBLY.
18. Install voltage regulator bracket. See 7.23 VOLTAGE REGULATOR.
19. Install rear electrical panel. See 7.3 ELECTRICAL PANEL.

   **NOTE**
   Replace the gasket between the primary chaincase cover and chaincase each time the cover is removed. Failure to replace this gasket could cause primary chaincase leaks.

20. Install primary chaincase. Attach the clutch cable, adjust the clutch and fill with LUBRICANT. Start with 5.5 PRIMARY CHAINCASE HOUSING and follow all necessary steps.

21. Install the left footpeg or footboard.

22. Install the seat post. Connect the coil connector and the neutral switch wires.

23. Connect VSS to transmission.

24. Install starter. See 7.13 STARTER.

25. Install oil tank and connect all oil lines. See 3.30 OIL TANK; ALL BUT FXSB or 3.31 OIL TANK, FXSB.

26. Install belt guard.

27. Tighten axle nut.

28. Install heat shields, exhaust and right foot peg. See 4.17 EXHAUST SYSTEM.

29. Install instrument console, fuel tank, fuel gauge connector and fuel tank crossover tube. See 4.6 FUEL TANK.

---

**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)

30. Install battery and connect battery cables, positive cable first.

---

**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)

31. Install seat.

32. Install new oil filter and fill oil tank to proper level. See 1.6 ENGINE OIL AND FILTER.

33. Check drive belt deflection and alignment. See 1.12 DRIVE BELT AND SPROCKETS.

34. Remove motorcycle from lift.

35. Check rear brakes, clutch and throttle for proper operation.

36. Check oil level after running motorcycle on jiffy stand. See 1.6 ENGINE OIL AND FILTER.
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

NOTE

Dirt caked on cooling fins and other areas can fall into crankcase bore. It can also stick to subassemblies as parts are removed. Abrasive particles can damage machined surfaces or plug oil passageways. Clean parts before disassembly to prevent component damage.

1. Use low pressure air to thoroughly clean exterior surfaces of engine prior to disassembly.

2. See Figure 3-17. 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.

ROCKER ARM SUPPORT PLATE

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48283</td>
<td>CRANKSHAFT ROTATING WRENCH</td>
</tr>
</tbody>
</table>

1. See Figure 3-18. Insert the blade of a small screwdriver into tab (1) of spring cap retainer. While pushing down on spring cap (2), rotate bottom of screwdriver toward outboard side to remove. Repeat step on second pushrod cover.
2. Collapse upper and lower pushrod covers.

**NOTE**
Do not attempt to rotate the crankshaft by placing a socket on the crankshaft or compensating sprocket bolt.

3. When removing the rocker arm support plate, both lifters must be on the base circle (lowest position) of the cam. Rotate the crankshaft using one of the methods presented below.
   a. With primary cover installed: Remove spark plugs. With the rear wheel raised, place the transmission in sixth gear and rotate rear wheel backward until the base circle is found.
   b. With primary cover removed: Remove spark plugs. Place the transmission in neutral. Using a large socket on the compensating sprocket retainer, rotate counterclockwise until the base circle is found.
   c. See Figure 3-19. With engine mounted in engine stand: Install CRANKSHAFT ROTATING WRENCH (Part No. HD-48283) on sprocket shaft and rotate counterclockwise until the base circle is found.

4. Rotate engine until piston is at TDC of compression stroke.

**NOTE**
Breather baffle assembly is manufactured with gaskets attached. Any time the breather is disassembled, the baffle assembly must be replaced with a new assembly.

5. See Figure 3-20. Remove breather assembly (arrow) and filter element from the rocker arm support plate. For inspection and repair information, see 3.17 BREATHER ASSEMBLY.

6. Loosen the four rocker arm support plate bolts 1/4 turn at a time in the sequence shown. Remove the rocker arm support plate bolts with flat washers.

7. Remove the rocker arm support plate assembly. For inspection and repair information, see 3.18 ROCKER ARM SUPPORT PLATE.

8. See Figure 3-21. Remove and discard breather O-ring from rocker housing.

**NOTE**
If the other cylinder also requires service, find the cam base circle for that cylinder before disassembling.
PUSHRODS, LIFTERS AND COVERS

NOTE

Mark parts for location and orientation upon removal.

1. See Figure 3-22. Remove the intake and exhaust pushrods and pushrod covers.
   a. Remove pushrods.
   b. Remove pushrod covers.
   c. Remove three O-rings from pushrod covers and discard. If O-ring is missing from upper pushrod cover, make sure to dislodge it from the cylinder head bore.

2. See Figure 3-23. Remove lifter covers:
   a. Using a crosswise pattern, remove four screws (1).
   b. Remove the lifter cover (2) and gasket. Discard gasket

3. Remove lifters:
   a. Remove the anti-rotation pin to free the hydraulic lifters.
   b. Remove the lifters and place in clean plastic bags to prevent contamination.

4. For inspection and repair information, see 3.19 PUSHRODS, LIFTERS AND COVERS.

CYLINDER HEAD

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-42324-A</td>
<td>CYLINDER TORQUE PLATES</td>
</tr>
</tbody>
</table>

1. See Figure 3-24. Following the sequence shown, loosen the six rocker housing bolts. Remove rocker housing bolts.

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 3-25. Remove cylinder head bolts:
   a. Alternately loosen cylinder head bolts 1/4 turn at a time the sequence shown.
   b. 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 3.20 CYLINDER HEAD.

Figure 3-24. Rocker Housing Bolts Removal Sequence

Figure 3-25. 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
   Do not bend 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 ID of 0.5 in (12.7 mm) to protect cylinder studs and piston from damage.

5. See Figure 3-26. Remove O-ring seal (4) from the bottom of the cylinder liner. Discard O-ring seal.
6. See Figure 3-27. Remove O-ring from dowel pin (4) on base of cylinder deck. Discard O-ring.

7. For inspection and repair information, see 3.21 CYLINDER.

![Figure 3-26. Cylinder Assembly](image)

1. Dowel pin
2. Head gasket
3. Cylinder
4. O-ring seal

PISTON

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-42317-A</td>
<td>PISTON PIN RETAINING RING INSTALLER</td>
</tr>
<tr>
<td>HD-42320-B</td>
<td>PISTON PIN REMOVER</td>
</tr>
</tbody>
</table>

1. Place clean shop towels over crankcase bore. This prevents the piston pin retaining ring 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)

**NOTE**

It is not necessary to remove both piston pin retaining rings for piston removal.

2. See Figure 3-27. Using PISTON PIN RETAINING RING INSTALLER (Part No. HD-42317-A), remove and discard one piston pin retaining ring.
   a. Insert tool (1) into piston pin bore. Position claw on tool in slot of piston (2) (directly under retaining ring).

3. See Figure 3-28. Remove the piston pin. If piston pin is difficult to remove, use PISTON PIN REMOVER (Part No. HD-42320-B).

4. Remove the piston. Hold the connecting rod upright to prevent it from striking the crankcase.

5. Place a 3.0 in. (76.2 mm) long piece of foam-type water pipe insulation around connecting rod to prevent damage. Use material with an I.D. of 1.0 in. (25.4 mm).

6. Turn the piston over. Mark the pin boss with the letters F(front) or R(rear) to identify location.

7. For inspection information, see 3.22 PISTON.

8. Complete engine repair:
   a. If performing a top end overhaul only, see 3.23 TOP END OVERHAUL: ASSEMBLY.
   b. If performing a complete engine overhaul, see 3.24 CAM COMPARTMENT AND COMPONENTS and 3.26 CRANKCASE DISASSEMBLY AND REPAIR.
Figure 3-28. Piston Pin Removal

1. Spacer and acorn nut
2. Rubber coated tip
3. Handle
DISASSEMBLY

NOTE

See Figure 3-29. Breather baffle assembly is manufactured with gaskets attached. Replacement part is supplied with the filter element (5) and umbrella valve (3). Any time the breather is disassembled, the baffle assembly must be replaced with a new assembly.

1. Remove rocker cover. See 3.16 TOP END OVERHAUL: DISASSEMBLY, Rocker Covers.
2. Remove two fasteners (1) and remove breather cover (2).
3. Remove breather baffle (4). Discard breather baffle, filter element (5) and umbrella valve (3).

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 cover and screws in a non-volatile cleaning solution or solvent. Dry parts with low pressure compressed air.
2. Set a straightedge diagonally across the length of the breather cover intersecting the opposite corners of the gasket surface.
3. Slide a feeler gauge beneath the straightedge to check the breather cover flatness.
4. Repeat the step checking the opposite diagonal.
5. Replace the breather cover if warpage exceeds 0.005 in. (0.13 mm).

ASSEMBLY

See Figure 3-29. Install breather assembly and rocker cover using new baffle assembly. See 3.23 TOP END OVERHAUL: ASSEMBLY, Breather and Rocker Cover.

Figure 3-29. Breather Assembly
DISASSEMBLY

1. See Figure 3-30. Remove four bolts and flat washers (1) from the rocker arm support plate (5).

2. Remove the rocker arm shafts (4) so that the notched ends exit the rocker arm support plate (5) first. Use a hammer and brass drift if necessary. Mark the shafts so that they are installed in their original locations at time of assembly.

3. Remove the rocker arms. Mark the rocker arms to indicate location.

CLEANING AND INSPECTION

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. Dry parts with low pressure compressed air.

2. See Figure 3-30. 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 pushrod ends. Replace rocker arm if excessive wear is found.

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 3-30. Rocker Arm Assembly**

Rocker Shaft Fit

1. See Figure 3-31. Measure the inside diameter of the rocker arm support plate bore.

2. See Figure 3-32. 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 exceeds service wear limit of 0.0035 in. (0.009 mm).

---

**Figure 3-31. Checking Support Plate Bore**
Rocker Arm Shaft to Bushing

1. Check rocker arm shaft to bushing fit.
   
   a. See Figure 3-33. Measure the inside diameter of the rocker arm bushing.
   
   b. See Figure 3-34. 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 exceeds service wear limit of 0.0035 in (0.089 mm).

Replace Rocker Arm Bushings

NOTE

Bushing replacement and reaming must be done one at a time to achieve proper alignment. Follow all steps for one bushing and then repeat for the other bushing.

1. See Figure 3-35. Remove bushing from rocker arm:
   
   a. Turn a 9/16-18 tap (2) into bushing until tight.
   
   b. Place rocker arm under ram of arbor press with tap at bottom.
   
   c. Slide a discarded rocker arm shaft (1) through open end of rocker arm until contact is made with tap.
   
   d. Using shaft as driver (and untapped bushing as pilot), press against shaft until both tap and bushing are free.

2. See Figure 3-36. 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 the reamer out of rocker arm or new bushing will be damaged.

3. Ream bushing:
   
   a. See Figure 3-37. Lock rocker arm in a vise using brass jaw inserts or shop towels to prevent casting damage. Note that old bushing on drive side of reamer as pilot.
   
   b. Rotate reamer until the new bushing on the far side is reamed.
   
   c. Continuing in the same direction, draw drive side of reamer from new bushing.

4. Repeat steps to remove, install and ream second bushing.
ASSEMBLY

1. Place the rocker arms into position on the rocker arm support plate.

2. Install rocker arm shafts:
   a. Push un-notched ends of rocker arm shafts into right side of support plate and then into rocker arms.
   b. As they approach their fully installed positions, rotate shafts until notches are aligned with bolt holes in support plate.

3. See Figure 3-38. 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 pushrod side (right) must engage the notches in the rocker arm shafts for proper assembly.
**DISASSEMBLY**

1. See Figure 3-39. Separate upper (2) and lower (8) pushrod covers.
2. Remove and discard O-ring (9).
3. Remove O-ring (1). Slide O-ring (7), flat washer (6), spring (5) and spring cap (4) from upper pushrod cover (2). Discard O-rings.

**CLEANING AND GENERAL INSPECTION**

1. See Figure 3-39. Clean old gasket material from the lifter cover (11).
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 pushrod 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. (00081a)

3. Dry parts with low pressure compressed air. Verify that all oil holes are clean and open.
4. Verify that the hydraulic lifter rollers turn freely and are free of flat spots, scuff marks and pitting. If flat spots exist, examine the cam lobe on which the lifter operates.
5. Inspect the lifter socket for signs of wear. Verify that the plunger of the hydraulic lifter is fully extended up against the O-ring. Use index finger to pump plunger to verify lifter operation.
6. Examine the pushrods (15). Replace any pushrods that are bent, dented, damaged, discolored or 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.

**LIFTER INSPECTION**

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 0.007 in (0.076 mm).

3. 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).


**ASSEMBLY**

With the exception of the pushrod covers, all parts will be assembled during the installation procedure.

1. See Figure 3-40. Apply a very thin film of clean engine oil to new O-rings (1, 7 and 9) before installation.

2. Install small O-ring (1) on seat at the top of the upper pushrod cover (2).

3. Slide the spring cap (4), spring (5), flat washer (6) and intermediate size O-ring (7) onto the body of the upper pushrod cover. Move parts up body until spring cap contacts upper O-ring seat.

4. Fit the straight end of the upper pushrod cover into the flared end of the lower pushrod cover (8).

5. Install large O-ring (9) on seat at bottom of lower pushrod cover.

---

**Figure 3-40, Assembled Pushrod Cover**
DISASSEMBLY

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-34736-B</td>
<td>VALVE SPRING COMPRESSOR</td>
</tr>
<tr>
<td>HD-39786</td>
<td>CYLINDER HEAD HOLDING FIXTURE</td>
</tr>
</tbody>
</table>

1. Before proceeding with disassembly procedure, determine if valve reconditioning is necessary.
   a. Raise valve ports of cylinder head to strong light source. If light is visible between valves and seats, the cylinder head and valves require reconditioning.
   b. Fill ports with solvent. Wait ten full seconds and check for leakage past valve seats. Recondition cylinder heads and valves that leak.

2. See Figure 3-41. 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.

![Figure 3-41. Cylinder Head Holding Fixture](image)

1. Holding fixture
2. Cylinder head
3. 12 mm end of fixture

![Figure 3-42. Valve Spring Compressor](image)

1. Holding fixture
2. Compressor

3. See Figure 3-42. 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. See Figure 3-43. Rotate forcing screw to compress valve spring until keepers (1) can be removed from valve stem (11).
   c. Rotate forcing screw to release valve spring compression.

4. Remove spring retainer (2) and valve spring (3).
5. Remove valve (11) from the valve guide (5).
6. Remove valve seal assembly.
7. Mark valve head F(front) 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. Remove remaining valve and components.
9. Remove fixture tool from spark plug hole.
**NOTICE**

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. (90534b)

**NOTE**
Bead blasting materials could also enter threaded holes. This would adversely affect 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. Do not remove any metal material.

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 previous step 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. (90061a)

5. Dry parts with low pressure compressed air.

**INSPECTION**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-45525</td>
<td>VALVE GUIDE HONE</td>
</tr>
<tr>
<td>HD-34751</td>
<td>VALVE GUIDE CLEANING BRUSH</td>
</tr>
<tr>
<td>HD-42324-A</td>
<td>CYLINDER TORQUE PLATES</td>
</tr>
</tbody>
</table>

**Cylinder Head**

1. Check for scratches and nicks on all gasket sealing surfaces.

2. Check for warpage.
   a. Place a straightedge diagonally across the cylinder head gasket surface.
   b. Slide a feeler gauge beneath the straightedge to check the head for warpage.
   c. Repeat the procedure on the opposite diagonal. Discard the head if warpage is 0.006 in. (0.152 mm) or greater.

**CLEANING**

1. See Figure 3-43. Remove old gasket material from cylinder head (9). Gasket material left on sealing surfaces will cause leaks. Scraping may result in scratches or nicks.
3. Check for warpage (alternate method.)
   a. Use one of the CYLINDER TORQUE PLATES (Part No. HD-42324-A) in lieu of the straightedge.
   b. Lay the upper plate (without vise grip) flat on the machined surface of the head.
   c. As a preliminary check, see if the plate rocks from side to side. A head on which the plate rocks is immediately suspect.
   d. Insert a feeler gauge between the plate and head at various locations.
   e. Discard the head if warpage is 0.006 in. (0.152 mm) or greater.

4. Verify that all passageways are open and clean.

Valve Guides
1. Inspect external surfaces, particularly the combustion chamber side, for cracks. Replace as necessary.
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 a ball gauge.
   b. Measure the outside diameter of the valve stem with a micrometer.
   c. Refer to Table 3-36. 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>
<thead>
<tr>
<th>VALVE</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intake</td>
<td>0.0038</td>
<td>0.0965</td>
</tr>
<tr>
<td>Exhaust</td>
<td>0.0038</td>
<td>0.0965</td>
</tr>
</tbody>
</table>

Valve Springs
1. Inspect springs for cracked or discolored coils. Replace as necessary.
2. Set the valve springs on a level surface. Check for proper squareness.
3. Check free length of springs using a caliper and load test using a commercially available valve spring tester. Replace springs if free length or compression force do not meet specifications. See 3.2 SPECIFICATIONS.

Tapered Keepers
Install new keepers any time valves are installed.

Valve Seats
1. Inspect seats for cracking, chipping or burning. Replace as necessary.
2. Check seats wear by measuring valve stem protrusion. See 3.20 CYLINDER HEAD, Valve and Seat Refacing.

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-45523</td>
<td>VALVE GUIDE REAMER</td>
</tr>
<tr>
<td>B-45524-1</td>
<td>VALVE GUIDE DRIVER</td>
</tr>
<tr>
<td>B-45524-2A</td>
<td>VALVE GUIDE INSTALLER SLEEVE</td>
</tr>
<tr>
<td>B-45525</td>
<td>VALVE GUIDE HONE</td>
</tr>
<tr>
<td>HD-34751</td>
<td>VALVE GUIDE CLEANING BRUSH</td>
</tr>
<tr>
<td>HD-39782-B</td>
<td>CYLINDER HEAD SUPPORT STAND KIT</td>
</tr>
<tr>
<td>HD-39786</td>
<td>CYLINDER HEAD HOLDING FIXTURE</td>
</tr>
<tr>
<td>HD-39847</td>
<td>REAMER T-HANDLE</td>
</tr>
<tr>
<td>HD-39964</td>
<td>REAMER LUBRICANT</td>
</tr>
</tbody>
</table>

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-B) ensures that valve guide and seat are perpendicular. Not keeping cylinder head valve guide bore perpendicular will result in damage during the press procedure.

1. See Figure 3-44. Prepare cylinder head for valve guide replacement.
   a. Obtain CYLINDER HEAD SUPPORT STAND KIT (Part No. HD-39782-B).
   b. Insert sleeve of appropriate seal adapter (3 or 4) into tube at top of support stand (2).
   c. Position cylinder head so that valve seat is centered on seat adapter.

NOTE
Always press valve guide toward combustion chamber. Carbon buildup on combustion chamber side of guide can damage cylinder head bore. This may prevent a proper interference fit.
2. Remove and discard lock ring from valve guide groove.

   NOTE
   Lock ring is present on OEM intake and exhaust valve guides.

3. Insert VALVE GUIDE DRIVER (Part No. B-45524-1) (1) into valve guide bore.

4. See Figure 3-45. Center valve guide driver under ram of arbor press. Apply pressure until valve guide drops free of cylinder head. Discard valve guide.

Figure 3-44. Valve Guide Replacement Tools

1. Valve guide driver
2. Cylinder head support stand
3. Intake seat adapter
4. Exhaust seat adapter
5. Valve guide installer sleeve

Figure 3-45. Remove Valve Guide

Installation

1. Check valve guide to valve bore interference fit.
   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 interference is not within specification, 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
   Pressing out guide may remove material. Using the next larger size is not uncommon to guarantee proper interference fit.

2. Select an oversize guide that will provide the correct interference fit.

   NOTE
   The support stand ensures that valve guide and seat are perpendicular. This alignment helps prevent damage during the press procedure.
   a. See Figure 3-44. Insert sleeve of the appropriate seat adapter (3 or 4) into tube at top of support stand (2). Position cylinder head so that valve seat is centered on seat adapter.
   b. Apply a thin film of petroleum jelly to lightly lubricate external surface of valve guide.
   c. Start valve guide into bore.
   d. See Figure 3-46. Place VALVE GUIDE INSTALLER SLEEVE (Part No. B-45524-2A) (2) over valve guide and then insert 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, then back off ram again to allow valve guide to center itself.
   g. Repeat previous step 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.

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.
7. See Figure 3-48. Clean valve guide bore with the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751).

8. See Figure 3-49. Hone bore to finished size.
   a. Install VALVE GUIDE HONE (Part No. B-45525) in a high-speed electric drill.
   b. Apply reamer lubricant to stones of hone and valve guide bore.
   c. Start stones of hone into bore.
   d. Rotate the hone while moving the stones through the entire length of the bore for 10-12 complete strokes. Work for a crosshatch pattern of approximately 60 degrees.

9. Remove debris with low pressure compressed air. Clean with the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751).

   NOTE
   Always check valve stem to valve guide clearance after honing.

10. Check valve stem to valve guide clearance. Refer to Table 3-37. If the clearance is not within specification, repeat the honing process and recheck.

    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. Remove metal shavings with low pressure compressed air.
11. Clean cylinder head assembly.
   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, clean the valve guide bore with the type of swabs or patches found in gun cleaning kits and a thin engine oil.
   c. Continue to wipe bore until a 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. Dry parts with low-pressure compressed air.

Table 3-37. Valve Stem to Guide Clearance

<table>
<thead>
<tr>
<th>VALVE</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intake</td>
<td>0.001-0.003</td>
<td>0.0254-0.0762</td>
</tr>
<tr>
<td>Exhaust</td>
<td>0.001-0.003</td>
<td>0.0254-0.0762</td>
</tr>
</tbody>
</table>

**NOTES**

- Verify correct valve stem to valve guide clearance before refacing. If new guides must be installed, complete that task before refacing valve seats. Refer to Table 3-37.
- This procedure is not based on the lapping of valves. The end result is an interference fit between the 45 degree valve face and the valve seat which will be 46 degrees.

1. Remove carbon deposits from valve head, face and stem with a wire wheel. Do not remove any metal. Carbon left on stem may affect alignment during valve refacing.
2. Polish valve stem with steel wool or crocus cloth to remove marks left by wire wheel.
3. Grind valve face to a 45 degree angle using a valve grinding machine.

**NOTES**

- Do not remove any more metal than necessary to clean up and true the valve face.
- Replace the valve if margin is less than 0.0313 in (0.795 mm). See Figure 3-50.

4. Wipe valve seats and valve faces clean. Install the valve into the valve guide. Push on head of valve until it contacts the valve seat.
5. See Figure 3-51. Measure valve stem protrusion.
   a. Use a dial caliper to check the distance from the top of the valve stem to the machined area on the cylinder head.
   b. If protrusion exceeds 2.069 in. (52.553 mm), replace the valve, valve seat or cylinder head as necessary.

   **NOTE**
   Do not shorten the valve by grinding the end of the stem. Grinding removes the hardened case which results in accelerated wear.

   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 degree angle or one that offers a comfortable working position.

7. To determine the correct location of the 46 degree valve seat in the head, measure the diameter of the valve head and subtract 0.060 in. (2.032 mm) from that number.

8. Set the dial caliper to the lesser measurement and lock down for quick reference. This is the diameter of the valve seat.

9. Use a permanent marker to highlight the valve seat area. Highlight all three angles. Allow marker to dry before proceeding.

---

**NOTES**

- Always verify cutter blades and cutter pilot are clean before beginning the cutting process. The correct cleaning brush is supplied with the Neway tool set.
- Always verify the inside of the valve guide is clean by using VALVE GUIDE CLEANING BRUSH (Part No. HD-34751).

10. See Figure 3-52. 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.

11. Choose the proper 45 degree cutter (intake or exhaust) and gently slide the cutter onto the pilot. Do not drop the cutter onto the seat.

12. While applying a constant and consistent pressure, remove only enough metal to provide a uniform finish and to remove pitting.

   **NOTES**
   - If the width of the clean-up cut is greater on one side of the seat than the other, the guide may need to be replaced due to improper installation.
   - If a groove cut completely around the seat is apparent, slightly stagger the blades of the cutter.
13. Measure the 46 degree cut at the outermost edge at the widest point of the circle to determine what cut will be made next.
   a. If the outer diameter is too large, use the 31 degree cutter to lower the valve seat.
   b. If the outer diameter is too small, use the 46 degree cutter to widen the valve seat or move it away from the port.

**NOTES**

* Because the OD measurement of the valve seat is used as a reference point it will usually be necessary to use the 31 degree cutter following the initial 46 degree cut.

* Always highlight the valve seat with the permanent marker in order to better view the location of the 46 degree valve seat.

---

14. If the location of the valve seat is not correct, repeat steps 10 through 13.

15. When a complete clean-up of the 46 degree angle is accomplished and the width is at least 0.062 in. (1.575 mm), proceed to the next step.

16. Select the proper 60 degree cutter and gently slide the cutter down the cutter pilot to the valve seat.

17. Remove just enough material to provide an even valve seat width of 0.040-0.062 in. (1.016-1.575 mm).

18. Remove cutter and cutter pilot.

19. Insert valve into the cylinder head. Use thumb pressure against valve to hold it closed.

20. Completely fill the port with solvent to verify proper seal between valve and 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. If necessary repeat the above valve grinding or valve seat cutting process.

21. Repeat the process on any valve seat that needs service.

22. 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)

23. Dry parts with low pressure compressed air.

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**ASSEMBLY**

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<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
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<tbody>
<tr>
<td>HD-34736-B</td>
<td>VALVE SPRING COMPRESSOR</td>
</tr>
<tr>
<td>HD-34751</td>
<td>VALVE GUIDE CLEANING BRUSH</td>
</tr>
<tr>
<td>HD-39786</td>
<td>CYLINDER HEAD HOLDING FIXTURE</td>
</tr>
</tbody>
</table>

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. Apply a liberal amount of SCREAMIN' EAGLE ASSEMBLY LUBE to valve stem.

4. Install the valve into the cylinder head.

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 SCREAMIN' EAGLE ASSEMBLY LUBE to the valve stem. Install the valve.

**NOTICE**

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 3-53. Hold valve against the valve seat. Slide plastic capsule over valve stem tip and keeper groove.

8. Apply a very thin film of SCREAMIN' EAGLE ASSEMBLY LUBE to capsule.

9. See Figure 3-54. Slide new valve stem seal/spring seat over capsule and down valve stem until seated against
cylinder head casting. Remove capsule from valve stem tip.

Figure 3-53. Plastic Capsule

Figure 3-54. Valve Stem Seal/Spring Seat Assembly

10. See Figure 3-55. Apply a liberal amount of SCREAMIN' EAGLE ASSEMBLY LUBE to valve stem tip and keeper groove (1).

11. With the smaller diameter coils topside, install the valve spring (3). Place the spring retainer (2) on top of the valve spring.

12. Install keepers:
   a. Place VALVE SPRING COMPRESSOR (Part No. HD-34736-B) 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. Arrange tapered keepers so that the gaps are evenly spaced and release valve spring compression.

13. Tap the end of the valve stem once or twice with a soft mallet to be sure that tapered keepers are tightly seated.

14. Install the other valve and components.

15. Release the cylinder head holding fixture from the vise. Remove fixture tool from spark plug hole.

16. Cover the cylinder head to protect it from dust and dirt until time of installation.

Figure 3-55. Valve Assembly
CLEANING
1. See Figure 3-56. Scrape any remaining cylinder head gasket material from the gasket surface at the top of the cylinder (3).

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. Dry parts with low pressure compressed air. Verify that oil passageways are clean and open.

3. Inspect the cylinder bore for obvious defects or damage in the ring travel area. Replace cylinders that are severely scored, scuffed, scratched, burnt or gouged.

4. Use a file to carefully remove any nicks or burrs from the machined surfaces of the cylinder.

INSPECTION

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-42324-A</td>
<td>CYLINDER TORQUE PLATES</td>
</tr>
<tr>
<td>TA360</td>
<td>SNAP-ON TORQUE ANGLE GAUGE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder torque plate bolts, 1st torque</td>
<td>120-144 in-lbs, 13.6-16.3 Nm</td>
</tr>
<tr>
<td>Cylinder torque plate bolts, 2nd torque</td>
<td>15-17 ft-lbs, 20.3-23.0 Nm</td>
</tr>
<tr>
<td>Cylinder torque plate bolts, final torque</td>
<td>90 degrees, 90 degrees</td>
</tr>
</tbody>
</table>

1. Using dye penetrant, inspect the cylinder for cracks. If no cracks are found, thoroughly wash cylinder to remove traces of dye.

2. See Figure 3-57. Check the machined surfaces for flatness using a feeler gauge and CYLINDER TORQUE PLATES (Part No. HD-42324-A):
   a. Lay gasket side of the upper torque plate (3) 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. Lay the seal side of the lower torque plate (2) flat against the O-ring seal surface and check flatness using a feeler gauge.
   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 exceeds specification.

NOTE
Failure to use cylinder torque plates can produce measurements that vary by as much as 0.001 in. (0.025 mm). This may result in the use of parts that are unsuitable for service.

Figure 3-56. Cylinder Assembly
3. Install CYLINDER TORQUE PLATES (Part No. HD-42324-A):
    a. Remove O-ring seal from cylinder sleeve, if installed.
    b. See Figure 3-58. Clamp the stepped side of the lower plate in a vise with soft jaws.
    c. Lightly oil threads and shoulders of four bolts (1) with clean engine oil and slide through holes of lower plate (2).
    d. Slide cylinder onto bolts with the indent in the cooling fins facing upward.
    e. Place a used head gasket on cylinder and install upper plate with blind holes aligned with dowel pins in cylinder. Secure with bolts (1).
    f. See Figure 3-59. Tighten the bolts to 120-144 in-lbs (13.6-16.3 Nm) in the sequence shown.
    g. Following the same sequence, tighten each bolt to 15-17 ft-lbs (20.3-23.0 Nm).
    h. Final-tighten each bolt an additional 90 degrees (90 degrees) in the same sequence.

**NOTE**
For best results use SNAP-ON TORQUE ANGLE GAUGE (Part No. TA360). If the tool is not available, mark a straight line on each bolt head continuing the line onto the lower plate.

![Figure 3-57. Cylinder Torque Plates](image)

1. Bolts
2. Lower plate
3. Upper plate
4. Vise grip step

---

4. See Figure 3-60. Using an inside micrometer or dial bore gauge, check cylinder bore for out-of-round and taper:
    a. At the top of the piston ring travel zone, 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 and again at the bottom of the bore at a point below the piston ring travel zone.
    c. See 3.3 SERVICE WEAR LIMITS. If the out-of-round or taper measurements are not within specification, the cylinder must be rebored and/or honed to accept the next standard oversize piston. See 3.21 CYLINDER, Boring and Honing Cylinder.
    d. If cylinders are not scuffed or scored and are not worn beyond the service limits, see 3.21 CYLINDER, Deglazing Cylinder.

![Figure 3-59. Cylinder Torque Plate Bolt Sequence](image)
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 degree crosshatch 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 crosshatch 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 degree crosshatch pattern in the piston travel area is the most important.

NOTE
The angular crosshatch pattern ensures an even flow of oil onto the cylinder walls and promotes longer cylinder, piston and ring life. An incorrect crosshatch pattern will result in insufficient oil retention and possible piston seizure and/or high oil consumption. (00536c)

NOTE
Failure to remove all abrasive particles may result in premature cylinder, piston and ring wear and engine failure. (00537c)

6. Thoroughly wash the cylinder bore with liquid dishwashing soap and hot 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 3.22 PISTON, Inspection.

BORING AND HONING CYLINDER

1. Bore cylinder with gaskets and torque plates attached. Bore the cylinder to 0.003 in (0.08 mm) under the desired finished size. Refer to Table 3-38 or Table 3-39.

NOTE
An incorrect crosshatch pattern or too fine a hone will result in insufficient oil retention and possible piston seizure and/or high oil consumption. (00538c)

2. Honing the cylinder:
   a. Hone the cylinder to its finished size using a 280 grit rigid hone followed by a 240 grit flexible ball hone.
   b. Honing must be done with the torque plates attached.
   c. All honing must be done from the bottom (crankcase) end of the cylinder. Work for a 60 degree crosshatch pattern.

3. Stop frequently to examine the cylinder bore and/or take measurements. Remember, a precise 60 degree crosshatch pattern in the piston travel area is important.

NOTE
Failure to remove all abrasive particles may result in premature cylinder, piston and ring wear and engine failure. (00537c)

NOTE
Example: A 0.005 in (0.13 mm) oversize piston for a Twin Cam 96 will have the proper running clearance with a cylinder bore size of 3.7550-3.7555 in (95.371-95.393 mm).

4. Thoroughly wash the cylinder bore with liquid dishwashing soap and hot water to remove all abrasive particles and residual grit. Continue cleaning until a clean cloth shows no evidence of dirt or debris.

5. 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.

6. With the cylinder at room temperature, check the piston clearance in the cylinder in which the piston will run. See 3.22 PISTON, Inspection.

### Table 3-38. Oversize Pistons/Cylinder Bores, Twin Cam 96

<table>
<thead>
<tr>
<th>PISTON SIZE</th>
<th>IN</th>
<th>MM</th>
<th>CYLINDER BORE FINISHED SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>N/A</td>
<td>N/A</td>
<td>3.7500-3.7505</td>
</tr>
<tr>
<td>Oversize</td>
<td>0.005</td>
<td>0.13</td>
<td>3.7550-3.7555</td>
</tr>
<tr>
<td></td>
<td>0.010</td>
<td>0.25</td>
<td>3.7600-3.7605</td>
</tr>
</tbody>
</table>

### Table 3-39. Oversize Pistons and Cylinder Bores, Twin Cam 103

<table>
<thead>
<tr>
<th>TYPE</th>
<th>PISTON SIZE</th>
<th>CYLINDER BORE FINISHED SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MINIMUM</td>
<td>MAXIMUM</td>
</tr>
<tr>
<td>Standard</td>
<td>STD</td>
<td>3.8750 in (98.425 mm)</td>
</tr>
<tr>
<td>Oversize</td>
<td>0.010 in (0.25 mm)</td>
<td>3.8850 in (98.679 mm)</td>
</tr>
</tbody>
</table>
**DISASSEMBLY**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNAP-ON PRS8</td>
<td>PISTON RING EXPANDER</td>
</tr>
</tbody>
</table>

**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 3-61. Carefully remove top (7) and second (6) compression rings using the proper PISTON RING EXPANDER (Part No. 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.

![Piston Assembly](image)

**Figure 3-61. Piston Assembly**

**CLEANING**

1. Remove all combustion deposits by soaking the pistons in hot water with dishwashing liquid or a cleaner specifically designed to remove carbon and will not corrode aluminum. Follow the manufacturer’s instructions when using these cleaners.

**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)

**NOTE**

Do not sand blast or glass bead blast pistons. Bead blasting rounds off ring lands. This will result in oil contamination leading to accelerated wear.

2. Thoroughly rinse the pistons. Dry parts 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. Do not damage or enlarge the holes. Do not use a wire brush.

4. Verify that all other oil holes are clean and open.

**NOTE**

Avoid scratching the sides of the piston ring grooves.

5. Thoroughly clean the three piston ring grooves of all carbon deposits. A portion of a compression ring properly ground to a sharp chisel-like edge works well for this purpose.

6. Using dye penetrant, inspect the piston for surface cracks. Particularly examine 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 3-62. Check piston pin. Pin must slide without binding.

   a. Insert a lightly oiled good piston pin 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. Measure pin and pin bore diameters to determine running clearance. 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 are acceptable for use.

2. Carefully inspect the pistons for damage or excessive wear. Discard if any of the following conditions are found:

   a. Cracked, worn or bent ring lands.

   b. Cracks, gouges, deep scratches or heavy scoring.

   c. Evidence of burning, etching or melting.

   d. 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 burns. 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 contaminate 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 3-63. 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 cylinder must be deglazed and have torque plates installed when measuring bore.
   - This inspection is very heat-sensitive. Both the piston and cylinder must be at room temperature before proceeding. Do not check piston running clearance immediately after honing or deglazing cylinder. Even holding the piston for too long can cause measurements to vary by as much as 0.0002 in (0.0051 mm).
   - See upper frame of Figure 3-64. Piston measurement is taken on the bare aluminum for greatest accuracy. The coating has an oval-shaped opening (1) on each side of the piston for proper micrometer placement.
   - See lower frame of Figure 3-64. The oval openings are too small for a standard flat anvil micrometer which would result in measuring errors. Use a blade or ball anvil style micrometer to measure piston.

5. See Figure 3-64. Measure running clearance of pistons as follows:
   a. Measure the piston skirt at the bare aluminum openings (1) in the coating. Transfer that measurement to dial bore gauge.
   b. 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.
   c. Replace piston and/or cylinder if running clearance exceeds 0.003 in (0.075 mm).
**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)

**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.

1. Use compressed air to remove any dirt or dust that may have settled in the oil drain holes and piston ring grooves.

**Table 3-40. Piston Ring End Gap**

<table>
<thead>
<tr>
<th>PISTON</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twin Cam 103</td>
<td>0.012-0.022</td>
<td>0.305-0.559</td>
</tr>
<tr>
<td>Top compression</td>
<td>0.015-0.025</td>
<td>0.381-0.635</td>
</tr>
<tr>
<td>2nd compression</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil control ring</td>
<td>0.010-0.059</td>
<td>0.254-1.270</td>
</tr>
</tbody>
</table>

**Figure 3-65. Measuring Ring Gap**

**ASSEMBLY**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNAP-ON PRS6</td>
<td>PISTON RING EXPANDER</td>
</tr>
</tbody>
</table>

**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.
- Insufficient ring gap may cause the ends to abut at operating temperatures. This will result in ring breakage, cylinder scuffing and/or piston seizure.
- Excessive ring gap results in high oil consumption and blow-by of exhaust gases. Blow-by contaminates the oil supplied to the crankcase, it also reduces engine efficiency by weakening the combustion seal necessary for efficient transfer of energy to the piston.

1. See Figure 3-65. Check ring end gap of each ring before placing on the piston. Insert the new ring into the cylinder and square it in the bore using the top of the piston. Measure the ring end gap with a feeler gauge. Refer to Table 3-40.

**Installing Piston Rings**

1. See Figure 3-66. Apply clean engine oil to three piston rings.
2. Install expansion ring (4) into third ring groove.
3. Spiral bottom oil rail (5) into space below expansion ring (4). Position gap 90 degrees from the gap in the expansion ring.
4. Spiral top oil rail (3) into space above expansion ring (4). Position gap 180 degrees 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. Damaged or distorted rings result in blow-by of exhaust gases. This will result in 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. This will result in excessive oil consumption and lower service life on valves and other components.

5. Using PISTON RING EXPANDER (Part No. 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 degrees from the gap in the oil expansion ring.

6. 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 degrees 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 3-67. Verify the ring gaps are still properly staggered.

![Piston Rings Diagram]

1. Top compression ring
2. Second compression ring
3. Top oil rail
4. Expansion ring
5. Bottom oil rail

Figure 3-67. Piston Ring Gap Alignment
TOP END OVERHAUL: ASSEMBLY

GENERAL

NOTES

- It is assumed that each step performed on one cylinder is automatically repeated on the other.
- Do not use 2006 and earlier connecting rods with 2007 and later pistons. 2007 and later pistons have a tapered wrist pin boss. The wrist pin portion of the 2007 and later connecting rod is tapered to match the boss on the piston.

This section provides a sequential process for top end assembly after a complete disassembly. If only a partial disassembly was performed, start where necessary and continue to the end of the section.

PISTON

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-42317-A</td>
<td>PISTON PIN RETAINING RING INSTALLED</td>
</tr>
</tbody>
</table>

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 SCREAMIN' EAGLE ASSEMBLY LUBE to piston pin, piston bosses and upper connecting rod bore.

3. Remove water pipe insulation from connecting rod shank.

4. See Figure 3-68. 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 3-69. Insert piston pin (1) through pin bore and upper connecting rod bore. Push pin until it contacts retaining ring installed in opposite pin boss. Verify that end gap (3) for retaining ring is 180 degrees from opening (2).

6. Place clean shop towels over the cylinder and lifter bores to prevent the piston pin retaining ring from falling into the crankcase. Verify that the retaining ring groove is clean and free of dirt and grime.

7. Install new piston pin retaining ring with the PISTON PIN RETAINING RING INSTALLER (Part No. HD-42317-A).
   a. See Figure 3-70. Slide retaining ring down nose of tool until it contacts claw. Lightly squeeze handles of tool to capture retaining ring in claw.
   b. Releasing pressure on handles, rotate retaining ring so that the end gap is centered at top of tool and then recapture in claw.
   c. Till the retaining ring forward until the end gap contacts nose of tool.
   d. See Figure 3-71. 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 retaining ring to verify that it is fully seated in the groove.

Figure 3-68. Piston Installation Arrow

Figure 3-69. Pre-Installed Retaining Ring

NOTE
Do not reuse piston pin retaining rings. They could weaken during removal causing them to break or dislodge during engine operation. This condition will result in engine damage.
degrees from the gap in the ring above it. Locate the top piston ring (5) gap towards the intake port.

4. Apply clean 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 3.16 TOP END OVERHAUL: DISASSEMBLY, Rocker Arm Support Plate for different methods of engine rotation.

6. See Figure 3-74. 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 3-75. Install cylinder using PISTON RING COMPRESSOR (Part No. HD-96335-51F).
   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. The word "bottom" refers to the piston bottom.
   b. Place band around piston. Press the lever on the right side of the pliers to open the jaws for band expansion.
   c. Orient tool so that the top of the band is positioned between the top compression ring and the piston crown.
   d. 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.
   e. 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.
   f. 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.
   g. 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 and 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.

10. See Figure 3-76. 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.
Figure 3-72. 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 3-73. Piston Ring Alignment
CYLINDER HEAD

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>TA360</td>
<td>SNAP-ON TORQUE ANGLE GAUGE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder headbolts, 1st torque</td>
<td>120-144 in-lbs</td>
</tr>
<tr>
<td></td>
<td>15.6-16.3 Nm</td>
</tr>
<tr>
<td>Cylinder headbolts, 2nd torque</td>
<td>15-17 ft-lbs</td>
</tr>
<tr>
<td></td>
<td>20.3-23.0 Nm</td>
</tr>
<tr>
<td>Cylinder headbolts, final torque</td>
<td>90 degrees</td>
</tr>
<tr>
<td></td>
<td>90 degrees</td>
</tr>
<tr>
<td>Rocker housing bolts</td>
<td>120-165 in-lbs</td>
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<tr>
<td></td>
<td>13.6-19.0 Nm</td>
</tr>
</tbody>
</table>

NOTES

- "Front" or "Rear" is cast into the top of the cylinder head to verify proper installation. The indent in the cooling fins always faces the right side of the engine.
- 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.
- Thoroughly clean and lubricate the threads of the cylinder headbolts before installation. Friction caused by dirt and grime results in a false torque indication.
- See Figure 3-77. With the part number facing up, place the head gasket over the two dowel pins in the upper flange of the cylinder.
- Slide cylinder head squarely over the two cylinder flange dowel pins.
- Lightly coat the threads and bottom face of the cylinder headbolts in clean engine oil. Wipe off any excess oil.
- See Figure 3-78. Loosely install the cylinder headbolts. Place two short bolts on the left side of the engine and two long bolts on the right.
NOTE
Improperly tightened cylinder head bolts may result in gasket leaks, stud failure or distortion of the cylinder and/or cylinder head.

5. Tighten the cylinder head bolts:
   a. See Figure 3-78. Following sequence shown, turn each cylinder head bolt until finger-tight.
   b. Following the same sequence, tighten the cylinder head bolts to 120-144 in-lbs (13.6-16.3 Nm).
   c. Continuing the same sequence, tighten each bolt to 15-17 ft-lbs (20.3-23.0 Nm).

6. See Figure 3-79. Final-tighten each bolt an additional 90 degrees (90 degrees) in the same sequence. For best
results, use SNAP-ON TORQUE ANGLE GAUGE (Part No. TA360).

a. If using a grease pencil, mark a straight line on the cylinder head bolt continuing the line over onto the cylinder head.

b. Use the marks as a guide to achieve the 90 degrees.

- The rocker housing gasket can be installed upside down resulting in an open breather channel. This causes 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.

7. See Figure 3-80. Install a new rocker housing gasket on the cylinder head. Verify that the rocker housing gasket covers the breather channel.

![Figure 3-79. Final Tightening for Cylinder Head Bolts](image)

![Figure 3-80. Install Rocker Housing Gasket (Rear Cylinder Shown)](image)

1. CORRECT: Breather channel covered
2. INCORRECT: Breather channel exposed
8. See Figure 3-82. Install rocker housing.
   a. With the indent (1) facing forward, place the rocker housing into position aligning the holes in the housing with those in the gasket.
   b. See Figure 3-81. Apply a drop of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to threads of six rocker housing bolts.
   c. Loosely install the rocker housing bolts.
   d. Place two long bolts on the left side of the engine and four intermediate bolts in the interior.
   e. Tighten the bolts in the sequence shown to 120-168 in-lbs (13.6-19.0 Nm).

   **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.
   • Since many O-rings are similar in size and appearance, always use new O-rings, keeping them packaged until use to avoid confusion. **Use of the wrong O-ring will result in either oil leakage or low oil pressure.**
9. See Figure 3-82. Apply a very thin film of clean 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 pushrod O-ring (Part No. 11293, small inner diameter).

   [Figure 3-8f. Rocker Housing Torque Sequence and Bolt Size]

   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)
6. Install pushrod covers.
   a. Assemble pushrod covers with new O-rings.
   b. Hand compress the pushrod cover assembly and fit the pushrod cover into the lifter cover bore.
   c. Extending the assembly, fit the pushrod cover into the cylinder head bore.
   d. Do not install the spring cap retainers at this time.

   NOTE
   To install spring cap retainers, see 3.23 TOP END OVERHAUL: ASSEMBLY, Rocker Arm Support Plate.

7. Apply a small amount of SCREAMIN' EAGLE ASSEMBLY LUBE to the ends of each pushrod.

8. See Figure 3-84, install the pushrods. If installing original parts, install them in their original locations and orientation. Always remove any tags that may have been used for identification.

PUSHRODS, LIFTERS AND COVERS

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lifter cover screws</td>
<td>100-120 in-lbs</td>
</tr>
<tr>
<td></td>
<td>11.3-13.6 Nm</td>
</tr>
</tbody>
</table>

1. Remove any labels used on the hydraulic lifters. Apply a thin film of SCREAMIN' EAGLE ASSEMBLY LUBE to over surface of each lifter. Pour a small amount onto each cam lobe.

2. 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.

3. See Figure 3-83. Place the anti-rotation pin (4) on the machined flat between the blocks cast into the crankcase.

4. Install new O-rings in the lifter cover bores and the cylinder head pushrod cover bores.

   NOTE
   During cover installation, verify that the anti-rotation pin (4) is held in place by the ribs (3) cast into the inboard side of the lifter cover. Movement or loss of the pin can result in lifter rotation causing engine damage.

5. Install the lifter cover (1) and new gasket (2). Install four socket head screws. Tighten the lifter cover screws to 100-120 in-lbs (11.3-13.6 Nm) in a crosswise pattern.
ROCKER ARM SUPPORT PLATE

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRDH161</td>
<td>SNAP-ON &quot;DOG BONE&quot; TORQUE ADAPTER</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rocker arm support plate bolts</td>
<td>18-22 ft-lbs</td>
</tr>
</tbody>
</table>

**NOTE**
Installing the rocker arms and rotating the crankshaft with the valve train loaded can result in bent pushrods, damaged bushings or a warped support plate.

1. Rotate the crankshaft to position both lifters of the cylinder being serviced on the base circle (or lowest position) of the cam lobe.
2. See Figure 3-85. Place the rocker arm support plate assembly into the rocker housing and loosely install four rocker arm support plate bolts with flat washers.

**Engine in chassis:** Final tighten rocker arm support plate bolt on rear left side of rear cylinder using 3/8 in. drive torque wrench with 1/2 in. flank drive SNAP-ON "DOG BONE" TORQUE ADAPTER (Part No. FRDH161) or equivalent.

3. Tighten rocker arm support plate bolts.
   a. Following the sequence shown, alternately tighten each of the four rocker arm support plate bolts 1/4 turn at a time until snug.
   b. Following the same sequence, tighten the bolts to 18-22 ft-lbs (24.4-29.8 Nm).
4. Verify that both pushrods spin freely.

**NOTE**
Always service each cylinder separately. After the first cylinder is serviced, rotate the crankshaft to find the base circle on the second cam.

5. Repeat steps on remaining cylinder.

6. Complete installation of the pushrod covers.
   a. Verify that the O-ring ends of the upper and lower pushrod 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, verify that screwdriver, spring cap and spring cap retainer are free of grease and oil.

   d. See Figure 3-88. Press spring cap down with tip of screwdriver and slide bottom edge of retainer towards tip of screwdriver.
   e. Verify that spring cap retainer seats tightly against upper pushrod cover.
BREATHER AND ROCKER COVER

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
<th>1.</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
<th>6.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNAP-ON FRDH141</td>
<td>&quot;DOG BONE&quot; TORQUE ADAPTER</td>
<td>1.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</table>

<table>
<thead>
<tr>
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<th>TORQUE VALUE</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Breather assembly screws</td>
<td>120-156 in-lbs</td>
<td>1.36-17.6 Nm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rocker cover screws</td>
<td>15-18 ft-lbs</td>
<td>20.3-24.4 Nm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE
For breather assembly service procedures, see 3.17 BREATHER ASSEMBLY.

1. To secure breather assembly, tighten two screws to 120-156 in-lbs (13.6-17.6 Nm).

NOTE
If the engine is in the chassis, first 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 (Part No. Snap-on FRDH141). Failure to properly use this combination will over-tighten the bolts causing distortion of the rocker cover.

2. Apply a drop of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to threads of rocker cover screws.

3. See Figure 3-37. Install rocker cover and a new rocker cover gasket. Tighten screws following the sequence shown to 15-18 ft-lbs (20.3-24.4 Nm).

   a. If engine was left in the chassis for service, see 3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE.
   b. If engine was removed for service, see 3.15 INSTALLING ENGINE IN CHASSIS.

Figure 3-37. Rocker Cover Bolts Torque Sequence
CAMS COMPARTMENT AND COMPONENTS

CAM SUPPORT PLATE AND COVER REMOVAL

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>93979-10</td>
<td>SCREAMIN' EAGLE MAGNETIC LIFTER HOLDERS</td>
</tr>
<tr>
<td>HD-47941</td>
<td>CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL</td>
</tr>
</tbody>
</table>

Prepare Engine

NOTE
The following steps outline removal with the rest of the engine intact. If performing a complete engine overhaul, perform all steps under 3.16 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly, rocker arm support plate, pushrods and pushrod covers. Do not remove lifters. See appropriate topics under 3.16 TOP END OVERHAUL: DISASSEMBLY.

2. See Figure 3-89. Support lifters using SCREAMIN' EAGLE MAGNETIC LIFTER HOLDERS (Part No. 93979-10).

   NOTE
   Label cam cover screws to aid during assembly.

3. See Figure 3-88. Remove the socket head screws to release the cam cover. Remove and discard the cam cover gasket.

   Figure 3-88. Cam Cover Screws

   Figure 3-89. SCREAMIN' EAGLE Magnetic Lifter Holder

Cam Chain and Sprockets Removal

1. See Figure 3-90. Using a colored marker, mark one of the links (1) of the primary cam chain to identify the visible side. Maintaining the original direction of rotation during assembly may prolong service life.

   NOTE
   Use a piece of wire in 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
   Verify side of tool labeled "crank side" faces crankshaft sprocket.

3. See Figure 3-91. Install CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL (Part No. HD-47941) between cam sprocket (2) and crank sprocket (5).

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.

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.

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. Use a small pry bar between rear cam sprocket and cam support plate to carefully ease off rear cam sprocket until loose on camshaft.
8. Use a small pry bar to ease off crank sprocket. Remove both sprockets and primary cam chain.

Figure 3-90. Cam Support Plate Assembly

1. Link
2. Rear cam sprocket
3. Primary cam chain tensioner
4. Primary cam chain tensioner fasteners
5. Crank sprocket
6. Retention hole

1. Rear cam sprocket bolt (large) and flat washer
2. Rear cam sprocket
3. Camshaft locking tool
4. Crank sprocket bolt (small) and flat washer
5. Crank sprocket

Figure 3-91. Cam Support Plate Assembly

Cam Support Plate Removal

1. See Figure 3-92. Following the sequence shown, remove four socket head screws.
2. See Figure 3-93. Following the sequence shown, remove six socket head screws to release the cam support plate from the crankcase.
3. See Figure 3-94. Use a small pry bar between the cam support plate and crankcase flange in areas near the ring dowels (2, 3). Work cam support plate and camshafts from end of crankshaft.
CAM SUPPORT PLATE CLEANING AND INSPECTION

Oil Pressure Valve
Inspect oil pressure valve. See 3.24 CAM COMPARTMENT AND COMPONENTS. Oil Pressure Relief Valve.

Cam Support Plate
1. Measure the diameters of the camshaft bores and crankshaft bore. See 3.3 SERVICE WEAR LIMITS, General.
2. Measure flatness of support plate. See 3.3 SERVICE WEAR LIMITS, General.
3. Inspect gear area for excessive wear or deep grooves.
4. Verify that all oil holes are clean and open.

NOTE
The oiling system is carefully designed for optimum efficiency. All oil holes and passageways are specially sized. Avoid enlarging oil holes during cleaning. Any modification of the oiling system will adversely affect oil pressure or cooling and lubrication efficiency.

CAMSHAFTS

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-47956</td>
<td>CAMSHAFT ASSEMBLY TOOL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary cam chain tensioner fastener</td>
<td>90-120 in-lbs</td>
</tr>
</tbody>
</table>

Removal
1. See Figure 3-95. 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. (06312a)

2. Remove retaining ring securing 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.

---

**Installation**

1. See Figure 3-90. Align timing marks on teeth of secondary cam sprockets.

   **NOTE**

   Do not mix camshafts during installation. The rear camshaft, identified by the splined shaft, must go into the hole at the rear of the cam support plate.

2. Place secondary cam chain around sprockets of both front and rear camshafts while keeping timing marks (3) in alignment. To maintain original direction of rotation, verify mark placed on chain link during disassembly is visible during installation.

3. See Figure 3-97. 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 SCREAMIN' EAGLE ASSEMBLY LUBE.

6. Install cam support plate over guides.
7. Remove guides and base.

8. See Figure 3-98. Using a straightedge, verify that the timing marks are in alignment. If they are not, then the camshafts must be removed, realigned and reinstalled.

9. Install 0.100 in. (2.54 mm) thick front camshaft spacer over end of front camshaft.

**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)

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 3-99. 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 and fasteners. Tighten to 90-120 in-lbs (10.2-13.6 Nm).

**Figure 3-98. Verify Alignment of Timing Marks**

**Figure 3-99. Cam Chain Tensioner Assemblies**

**OIL PRESSURE RELIEF VALVE**

**Removal**

1. See Figure 3-100. Secure the cam support plate in a vise with soft jaws.

2. Measurement between piston and bore in cam support plate:
   a. With piston in place, insert straight stiff wire into bore until it bottoms in the piston.
   b. Mark wire at edge of bore in cam support plate.
   c. Remove wire and measure distance from the end to the mark. With piston fully seated in the bore, depth should be approximately 2.25 in (57.15 mm).
   d. If it is less than specified, the piston is not fully seated and a low oil pressure condition will likely be the result.

3. Use a 1/8 in punch to remove roll pin (1). Discard roll pin.

4. Remove spring (2) and piston (3) from bypass port.

**Inspection**

**NOTE**

A stretched spring or sticking piston can result in high oil pressure.

1. Inspect spring for stretching, kinks and distortion.

2. Inspect piston and bore for burn, scoring or other damage. Look for steel particles or aluminum chips. Replace cam support plate and piston if any of these conditions are found.

3. Measure running clearance of piston in bore. If running clearance exceeds 0.003 in (0.076 mm), install new piston and measure again. Replace cam support plate if running clearance still exceeds specification.

---

2015 Softail Service: Engine 3-73
Installation

1. Secure the cam support plate in a vise with soft jaws.
2. See Figure 3-100. Lubricate piston (3) with SCREAMIN' EAGLE ASSEMBLY LUBE. Slide piston into bypass port of cam support plate with the open side facing outward.
3. Slide spring (2) into bypass port until seated in piston.
4. Start new roll pin (1) into hole in cam support plate. Compress spring using the blade of a small screwdriver.
5. Hold spring compressed and 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. Use a 1/8 in punch to install roll pin until flush with casting.

2. See Figure 3-102. Remove four thumb screws (1) from threaded holes in support plate (2), if installed.
3. Sparsingly apply clean engine oil (3) to threads of collet (3) to prolong service life and verify 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. Install thumb screws to secure support plate to crankcase.
7. Center expandable end of collet in bearing bore and slide 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.

CAM NEEDLE BEARINGS

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-42325-A</td>
<td>CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER</td>
</tr>
</tbody>
</table>

Removal

1. Obtain the CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER (Part No. HD-42325-A).
1. Thumb screw
2. Support plate
3. Removal collet (Threaded end: left, Expandable end: right)
4. Installer forcing screw
5. Flat washer

Figure 3-102. Camshaft Needle Bearing Remover/Installer

6. Installer (1 in., 25.4 mm)
7. Bearing
8. Hex nut
9. Graphite lubricant

9. Holding collet to prevent lateral movement, finger tighten hex nut until bearing contacts support plate.
10. See Figure 3-101. Hold flat on collet to prevent rotation and expand collet by turning hex at end of shaft clockwise. Expandable end of collet makes contact with needle bearing ID.
11. See Figure 3-103. Turn hex nut clockwise 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 counterclockwise to close collet. Remove and discard needle bearing.
14. Repeat procedure to remove second needle bearing.

Figure 3-103. Bearing Removal

Installation
1. Obtain the CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER (Part No. HD-42325-A).

NOTE
To avoid engine damage, install needle bearings to the correct depth.

2. See Figure 3-104. Using a dial caliper, measure thickness of support plate.

3. Determine the required distance from the top of the support plate to the edge of the installed needle bearing by adding
support plate thickness to 3.10 in. (78.7 mm). Record this value.

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).

4. See Figure 3-102. Slightly apply clean engine oil to threads of installer forcing screw (4) to prolong service life and verify smooth operation.

5. Thread installer forcing screw into stamped side of support plate (2) until threads begin to emerge from opposite side.

6. Place installer (6) at end of installer forcing screw.

7. Place new needle bearing on installer with lettered side facing shoulder of installer.

8. See Figure 3-105. Aligning two large holes in support plate with needle bearing bores, hang right side of plate on ring dowel in crankcase flange.

9. Install thumb screws to secure support plate to crankcase.

10. Install first needle bearing as follows:
   a. See Figure 3-106. Turn forcing screw clockwise to press needle bearing into bore.
   b. Back out forcing screw and remove installer. Remove forcing screw from support plate.
   c. See Figure 3-107. Insert dial caliper through forcing screw bore and measure distance from top of support plate to edge of needle bearing.
   d. Repeat steps until bearing is at correct installed depth. Temporarily leave tool in this position.

11. See Figure 3-108. Once the bearing is at correct depth, measure from head (top) of installer forcing screw to support plate. Record this measurement.

12. Remove forcing screw from support plate and install over second needle bearing bore. Place installer at end of forcing screw. Place new needle bearing on installer with lettered side facing shoulder of installer.

13. Turn forcing screw until distance from head (top) of forcing screw to support plate equals measurement obtained previously.
CAM SUPPORT PLATE AND COVER INSTALLATION

<table>
<thead>
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<th>PART NUMBER</th>
<th>TOOL NAME</th>
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<tbody>
<tr>
<td>HD-47941</td>
<td>CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL</td>
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</tbody>
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<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
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<tbody>
<tr>
<td>Cam support plate screws</td>
<td>100-120 in-lbs</td>
</tr>
<tr>
<td>Oil pump screws, 1st torque</td>
<td>40-45 in-lbs</td>
</tr>
<tr>
<td>Oil pump screws, final torque</td>
<td>80-120 in-lbs</td>
</tr>
<tr>
<td>Cam sprocket flange bolt, 1st torque</td>
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</tr>
<tr>
<td>Crankshaft sprocket bolt, 1st torque</td>
<td>15 ft-lbs</td>
</tr>
<tr>
<td>Cam sprocket flange bolt, final torque</td>
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<td>Crankshaft sprocket bolt, final torque</td>
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<tr>
<td>Cam chain tensioner fasteners</td>
<td>100-120 in-lbs</td>
</tr>
<tr>
<td>Cam cover screws</td>
<td>125-155 in-lbs</td>
</tr>
<tr>
<td>Timer cover screws</td>
<td>20-30 in-lbs</td>
</tr>
</tbody>
</table>

1. See Figure 3-109. Apply a very thin film of SCREAMIN' EAGLE ASSEMBLY LUBE to new O-ring (1) and install in groove around oil feed hole.
2. Lubricate cam needle bearings with SCREAMIN' EAGLE ASSEMBLY LUBE.
3. See Figure 3-110. Verify that the timing marks on the ends of the front and rear camshafts are in alignment.
4. Slide cam support plate over crankshaft and onto two ring dowels in crankcase flange. Use a rubber mallet to fully seat cam support plate on ring dowels.
5. See Figure 3-111. Install cam support plate screws. Tighten to 100-120 in-lbs (11.3-13.6 Nm) in the sequence shown.

NOTES
- Rotating the crankshaft while tightening screws will allow the oil pump to find its natural center. For methods of
crankshaft rotation, see 3.18 TOP END OVERHAUL: DISASSEMBLY, Rocker Arm Support Plate.

- Numbers cast adjacent to the bolt holes indicate the oil pump torque sequence.

6. See Figure 3-112. Secure oil pump.
   a. Start four screws to secure oil pump.
   b. While rotating the crankshaft, install screws (1 and 2) until snug.
   c. Install screws (3 and 4) until snug.
   d. Tighten all four screws to 40-45 in-lbs (4.5-5.1 Nm) in the sequence shown.
   e. Final tighten all four screws to 90-120 in-lbs (10.2-13.6 Nm) in the sequence shown.

7. With the lettering facing inboard, install rear cam sprocket spacer onto the rear camshaft.

8. Engines with one or more of the following new parts: cam support plate, camshafts, primary cam sprocket, crankshaft sprocket or flywheel assembly.
   a. Install primary cam sprocket without chain using the long flange bolt with thicker flat washer.
   b. Install crankshaft sprocket without chain using the short flange bolt and a smaller diameter flat washer from bulk inventory.
   c. Position the CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL (Part No. HD-47941) between the crankshaft and primary cam sprockets. Tighten both 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.
   e. 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.
   f. See Figure 3-113. Place a straightedge across the sprocket faces. Attempt to insert a 0.010 in. (0.254 mm) feeler gauge between the straightedge and 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.
   g. If measurement is not within specification, replace the rear cam sprocket spacer using Table 3-41 as a guide.
   h. Repeat alignment inspection with the new spacer installed. Remove both sprockets when measurement is within specification and discard temporary small washer.
### Table 3-41. Rear Cam Sprocket Spacers

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>25729-06</td>
<td>0.100</td>
<td>2.54</td>
</tr>
<tr>
<td>25731-06</td>
<td>0.110</td>
<td>2.79</td>
</tr>
<tr>
<td>25734-06</td>
<td>0.120</td>
<td>3.05</td>
</tr>
<tr>
<td>25736-06</td>
<td>0.130</td>
<td>3.30</td>
</tr>
<tr>
<td>25737-06</td>
<td>0.140</td>
<td>3.56</td>
</tr>
<tr>
<td>25738-06</td>
<td>0.150</td>
<td>3.81</td>
</tr>
</tbody>
</table>

9. See Figure 3-114. Apply a light film of SCREAMIN' EAGLE ASSEMBLY LUBE to splines on rear cam. Install the primary cam chain and sprocket assembly.
   a. Place both cam sprockets (2, 4) in the primary chain with the timing marks aligned. Verify that the colored mark placed on the chain link (7) is on the same side as the timing marks and is visible during installation.
   b. 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.
   c. Maintaining the position of the camshaft sprocket on the chain, rotate the rear cam sprocket clockwise until the flat on the camshaft sprocket is aligned with the flat on the camshaft. Install the camshaft sprocket.

10. Rotate the camshaft clockwise until the timing marks on the sprockets are aligned and also aligned with alignment mark (5) on cam support plate.

**NOTES**
- Both crank and rear cam sprocket flange bolts are specially hardened and 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.
- Apply a small amount of LOCTITE 262 HIGH STRENGTH THREADLOCKER AND SEALANT (red) before installation.
- Both sprocket bolts must be installed by hand.
- The camshaft and rear cam sprocket flange bolts and flat washers are not interchangeable.
- Refer to Table 3-41.

11. Apply a film of oil to the bottom of both sprocket bolt heads and washers. Loosely install to secure sprockets.

12. Position the CRANKSHAFT/CAMS HAF SPROCKET LOCKING TOOL (Part No. HD-47941) between the crankshaft and rear cam sprockets to prevent rotation.

The handle of the tool is stamped "Crank" and "Cam" to verify 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 crankshaft sprocket bolt (3) to 24 ft-lbs (32.5 Nm).
   e. Remove the sprocket locking tool.

13. Install primary cam chain tensioner. Tighten to 100-120 in-lbs (11.3-13.6 Nm).

14. Apply SCREAMIN' EAGLE ASSEMBLY LUBE to both sprockets.

**NOTE**
Inserting a screw into a blind hole with debris can damage the crankcase.

15. Clean all blind holes in crankcase.

16. See Figure 3-115. Install cam cover and new cam cover gasket.

![Diagram](image)

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 3-114. Primary Chain and Sprockets
17. See Figure 3-116. Secure cover with socket head screws. Following the sequence shown, tighten the screws to 125-155 in-lbs (14.1-17.5 Nm).

18. If removed, install timer cover with five screws. Tighten to 20-30 in-lbs (2.3-3.4 Nm).

   a. If engine was completely overhauled, see 3.23 TOP END OVERHAUL: ASSEMBLY. Perform all steps.
   b. If only cam compartment components were serviced, install pushrod covers, pushrods, rocker arm support plate and breather assembly. See appropriate topics under 3.23 TOP END OVERHAUL: ASSEMBLY.

Figure 3-115. Cam Cover Gasket

Figure 3-116. Cam Cover Screws
REMOVAL

1. See 3.16 TOP END OVERHAUL: DISASSEMBLY.
   a. Remove breather assembly.
   b. Remove rocker arm support plate.
   c. Remove pushrods and pushrod covers. Do not remove lifters or lifter covers.
   d. Support hydraulic lifters from dropping into the cam compartment using SCREAMIN' EAGLE MAGNETIC LIFTER HOLDERS (Part No. 93979-10). See 3.24 CAM COMPARTMENT AND COMPONENTS.

2. Remove cover and cam support plate. See 3.24 CAM COMPARTMENT AND COMPONENTS.

3. Carefully remove oil pump assembly from crankshaft.

4. See Figure 3-117. Remove and discard O-rings (1, 2).

5. See Figure 3-118. Disassemble and inspect oil pump components.

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. Dry parts using low pressure compressed air. Verify that all oil passages are clean and open.

3. Inspect for scoring, gouging or cracking caused by foreign material.

4. Inspect for grooves or scratches on the cam support plate.

5. Check for excessive wear or damage on lobes of outer and inner gerotor gears.

6. See Figure 3-119. Check gerotor wear.
   a. Mesh rotors 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 and compare thickness of each rotor in both gerotor sets. Replace the gerotor set if the difference exceeds 0.001 in. (0.025 mm).
8. See Figure 3-118. Assemble the oil pump.
9. Verify that gear rotors extend past the oil pump surface 0.015-0.025 in. (0.38-0.64 mm).
10. If measurement is less than 0.015 in. (0.38 mm), remove gear rotor set and reassemble using new wave washer.
11. Repeat measurement and replace oil pump body if not within specification.

1. Outer gear rotor
2. Inner gear rotor
3. Wear limit

Figure 3-119. Measure Gear Rotor Sets for Wear

1. Narrow gear rotor set (feed)
2. Separator plate
3. Wave washer
4. Wide gear rotor set (scavenge)
5. Oil pump housing
6. Scavenge port O-ring

Figure 3-120. Assembling Oil Pump

**INSTALLATION**

**NOTE**
Lubricate parts with SCREAMIN' EAGLE ASSEMBLY LUBE during assembly.

1. See Figure 3-118. Apply a very thin film of SCREAMIN' EAGLE ASSEMBLY LUBE to new scavenge port stub O-ring (6). Install O-ring on scavenge port stub of oil pump housing.

2. Slide oil pump housing (5) onto crankshaft while fitting O-ring on scavenge port stub into crankcase bore.
   a. Firmly push on scavenge port stub with thumb to verify that it is snug in bore.
   b. Inspect O-ring to verify that it is not pinched or distorted.

3. Assemble the wide gear rotor set (4). Install on the crankshaft until it bottoms in the oil pump housing.

4. Install inside separator plate (2) on the crankshaft until it contacts the wide gear rotor set (4). Install wave washer (3) and outside separator plate (2).

5. Assemble the narrow gear rotor set (1). Install on the crankshaft until it contacts the outside separator plate (2).

6. See Figure 3-117. Apply a very thin film of SCREAMIN' EAGLE ASSEMBLY LUBE to new O-ring (3) for crankcase post. Install new O-ring in groove on crankcase post.

7. Complete engine assembly. See 3.24 CAM COMPARTMENT AND COMPONENTS and 3.23 TOP END OVERHAUL: ASSEMBLY.

1. Oil feed hole O-ring
2. Rear ring dowel
3. O-ring on crankcase post

Figure 3-121. Oil Feed Hole
CRANKCASE DISASSEMBLY AND REPAIR

CRANKCASE DISASSEMBLY

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-42310-25A</td>
<td>SOFTAIL ENGINE CRADLE</td>
</tr>
</tbody>
</table>

NOTE
Be sure engine is in SOFTAIL ENGINE CRADLE (Part No. HD-42310-25A).

1. Remove oil pump from crankshaft.
2. See Figure 3-122. Remove and discard O-rings (1, 2).

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 3-123. Remove the twelve 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.

5. Separate crankcase halves.
6. See 3.26 CRANKCASE DISASSEMBLY AND REPAIR for inspection and repair information.

Figure 3-123. Crankcase Bolt Sequence

7. See Figure 3-124. Remove and discard rubber interconnect from balance shaft support assembly.
8. Remove and disassemble counterbalancer assembly. See 3.28 COUNTERBALANCER ASSEMBLY REPAIR.
9. Remove flywheel assembly from the crankcase. Inspect crankshaft/flywheel assembly. See 3.27 FLYWHEEL AND CONNECTING RODS.

Figure 3-124. Rubber Interconnect

COUNTERBALANCER ASSEMBLY

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-44062</td>
<td>BALANCE SHAFT RETENTION PINS</td>
</tr>
<tr>
<td>HD-44063</td>
<td>HYDRAULIC TENSIONER COMPRESSOR</td>
</tr>
<tr>
<td>HD-4408</td>
<td>HYDRAULIC TENSIONER RETAINERS</td>
</tr>
</tbody>
</table>

1. See Figure 3-125. Rotate flywheel assembly to align holes in balance shafts with holes in balance shaft housing (3).
2. Insert BALANCE SHAFT RETENTION PINS (Part No. HD-44062) inside front and rear shaft supports to lock balance shafts in place. Locking the balancers in this position times the balancers to the engine.

3. See Figure 3-126. Compress hydraulic tensioners using HYDRAULIC TENSIONER COMPRESSOR (Part No. HD-44063) (1). Slide HYDRAULIC TENSIONER RETAINERS (Part No. HD-44408) over lip of tensioner (3) and release tool.

![Figure 3-125. Balance Shaft Support (Front Balance Assembly Shown)]

1. Bolt and washer
2. Screws (6)
3. Balance shaft housing
4. Retention pin

![Figure 3-126. Hydraulic Tensioner Tools (Front Tensioner Shown)]

1. Hydraulic tensioner compressor
2. Hydraulic tensioner retainers
3. Hydraulic tensioner
4. Bolt and washer

![Figure 3-127. Chain Tensioner Guides](image)

1. Front tensioner guide
2. Rear tensioner guide
3. Lower guide
4. Retention tabs
5. Front sprocket
6. Rear sprocket
7. Balance chain
8. T40 TORX screws (6)

**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)

**NOTE**

If necessary, soften 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. Loosen the bolts (4) on the front and rear balance shafts.

5. See Figure 3-127. Pry tabs on front and rear tensioner guides (1, 2) clear of locking post and remove guides. Use a small screwdriver to pry guide upward from locking post.

6. Release retention tabs and pry lower chain tensioner guide (3) away from chain guide bracket assembly.

7. See Figure 3-126. Remove bolts and washers (4) on the front and rear balance shafts.

8. See Figure 3-127. Remove front (5) and rear (6) sprockets and balance chain (7). Remove spacers from balance shafts.

9. Remove six screws (8)
NOTE
See Figure 3-128. Inspect tip of BALANCE SHAFT RETENTION PINS (Part No. HD-44062) after removal. If the ball at the end of the tool should separate and become loose in the engine assembly, severe engine damage could occur.

10. See Figure 3-128. Remove both balance shaft retention pins from front and rear shaft supports. Check that ball on tip of tool has not separated from pin.

11. See Figure 3-129. Remove balance shaft support housing (5) from left crankcase half.

12. Inspect and repair components as necessary.
   a. See 3.28 COUNTERBALANCER ASSEMBLY REPAIR for balance shaft support assembly and outer bearings (6).
   b. See 3.26 CRANKCASE DISASSEMBLY AND REPAIR for balance shaft bearings in left crankcase half.
   c. See 3.27 FLYWHEEL AND CONNECTING RODS for flywheel inspection and repair information.

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. Dry parts with moisture free 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.
10. Inspect crankshaft/flywheel assembly. See 3.27 FLYWHEEL AND CONNECTING RODS.

**RIGHT CRANKCASE HALF**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-42720-4</td>
<td>CRANKSHAFT (ROLLER) BEARING DRIVER SHIM</td>
</tr>
<tr>
<td>HD-44065-1</td>
<td>CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL PILOT/DRIVER</td>
</tr>
<tr>
<td>HD-44065-4</td>
<td>CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL SUPPORT TUBE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right main bearing retaining screws</td>
<td>40-70 in-lbs 4.5-7.9 Nm</td>
</tr>
<tr>
<td>Piston jet screw</td>
<td>25-35 in-lbs 2.8-3.9 Nm</td>
</tr>
</tbody>
</table>

**Chain Guide Screen**

See Figure 3-130. Remove, clean and install screen (3). Replace screen O-ring with each removal.

**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.

1. See Figure 3-130. Remove two main bearing retaining screws (5) from the cam compartment side.

2. See Figure 3-131. Obtain CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL PILOT/DRIVER (Part No. HD-44065-1) and CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL SUPPORT TUBE (Part No. HD-44065-4).

3. Place support tube (2) on press table with the REMOVAL end up. Note that the support tube is stamped to provide proper orientation.

4. With the cam compartment facing downward, position crankshaft bearing bore over support tube. Verify the curved edges on pilot/driver (1) match the curved edges of crankcase (4) or damage will result.

5. Slide pilot/driver (1) through bearing into support tube.

6. Center pilot/driver under ram (3) of press. Apply pressure to pilot/driver until bearing is free.

Main Bearing Installation

1. See Figure 3-132. Obtain CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL PILOT/DRIVER (Part No. HD-44065-1), CRANKSHAFT (ROLLER) BEARING DRIVER SHIM (Part No. HD-42720-4) and CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL SUPPORT TUBE (Part No. HD-44065-4).

2. Spread a thin film of clean H-D 20W50 engine oil on O.D. of new bearing (4).

3. Place support tube (2) on press table with the INSTALL end up. The support tube is stamped to provide proper orientation.

4. Place SHIM (Part No. HD-42720-4) on support tube (2).

5. With cam compartment side facing upward, position crankshaft bearing bore over support tube. Lip on support tube (5) must contact edge of crankcase as shown. This allows curved portion of inboard crankcase to contact top curved portion of support tube (2).

6. Start the new bearing in bearing bore with the lettering facing into the cam compartment (up).

7. Slide pilot/driver (1) through bearing into support tube.

8. 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.

9. Remove pilot/driver and crankcase half from support tube.

NOTES
• Verify that the bearing is flush or slightly below the surface of the crankcase. Never "pull" the bearing into position using the retaining screws.

• If new bearing fastener is not available, apply LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) before installation.

10. See Figure 3-130. Install two new main bearing retaining screws (5) from the cam compartment side. Tighten screws to 40-75 in-lbs (4.5-8.3 Nm).

Piston Jets Removal

1. See Figure 3-133. Remove two screws (1) to free piston jet (2) from crankcase.

2. Remove O-ring (3) from groove in mounting flange of jet. Discard O-ring.

Piston Jets Installation

1. See Figure 3-133. 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 screws (1) to secure piston jet (2) to crankcase. Tighten to 25-35 in-lbs (2.8-3.9 Nm).

NOTE
If piston jet is being reused, apply LOCTITE 222 LOW STRENGTH THREADLOCKER AND SEALANT (purple) to threads of screws before installation.
LEFT CRANKCASE HALF

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-45655</td>
<td>CRANKCASE BEARING REMOVER/INSTALLER</td>
</tr>
<tr>
<td>HD-42720-5</td>
<td>REMOVER/INSTALLER SUPPORT TUBE</td>
</tr>
</tbody>
</table>

Main Bearing Removal

**CAUTION**

Do not rotate crankcase half in engine stand when flywheel is installed. The flywheel assembly can fall out, resulting in parts damage or moderate injury. (00552c)

**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. Hold flywheel assembly to prevent it from falling 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. 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 3-134. Using a flat blade screwdriver, carefully lift edge of bearing retaining ring up out of its groove in crankcase.

6. Slide screwdriver tip around edge of bearing, lifting retaining ring up and out of groove. Do not damage lip of groove in crankcase.

**NOTE**

See Figure 3-135. If the ram of the press is wider than the head of pilot/driver (2), a suitable press plug will be needed in order to remove the main bearing.

7. Obtain CRANKCASE BEARING REMOVER/INSTALLER (Part No: B-45655) and REMOVER/INSTALLER SUPPORT TUBE (Part No: HD-42720-5).

8. See Figure 3-136. Place support tube (3) on press table with "A" end up. Note that support tube is stamped "A" and "B" to provide 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 the main bearing into support tube (3).

Figure 3-134. Removing Retaining Ring

Figure 3-135. Left Main Bearing Remover and Installer Tools

Figure 3-136. Left Main Bearing Removal
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

NOTES

- 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.
- Always replace sprocket shaft bearing inner race whenever left main bearing is replaced. See 3.26 CRANKCASE DISASSEMBLY AND REPAIR, Sprocket Shaft Bearing Inner Race.

1. See Figure 3-135. Obtain CRANKCASE BEARING REMOVER/INSTALLER (Part No. 8-46656) and REMOVER/INSTALLER SUPPORT TUBE (Part No. HD-42720-5).

---

**SPROCKET SHAFT BEARING INNER RACE**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-25070</td>
<td>ROBINAIR HEAT GUN</td>
</tr>
<tr>
<td>HD-34902-B</td>
<td>MAINSHAFT BEARING INNER RACE PULLER/INSTALLER</td>
</tr>
<tr>
<td>HD-44358</td>
<td>FLYWHEEL SUPPORT FIXTURE</td>
</tr>
<tr>
<td>HD-95637-46B</td>
<td>WEDGE ATTACHMENT</td>
</tr>
<tr>
<td>HD-97225-55C</td>
<td>SPROCKET SHAFT BEARING INSTALLER</td>
</tr>
</tbody>
</table>

---

Removal

If reusing flywheel, remove bearing inner race and thrust washer as follows:

1. See Figure 3-138. Install brass jaws or shop towels around teeth of vise to prevent damage to tool. Obtain FLYWHEEL SUPPORT FIXTURE (Part No. HD-44358). Clamp tool in vise with 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.

---

2015 Softail Service: Engine 3-89
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. Sparsely apply graphite lubricant to threads of forcing screw to prolong service life and verify 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.

![Diagram]

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 3-139. Remove Inner Race from Sprocket Shaft

**WARNING**

Do not use heating devices with penetrating oil. Penetrating oil is flammable which could result in death or serious injury. (00375a)

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 assist removal without heat, apply a light penetrating oil to shaft and leading edge of bearing inner race.

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.

**NOTICE**

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 3-139. 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.

**WARNING**

Do not use heating devices with penetrating oil. Penetrating oil is flammable which could result in death or serious injury. (00375a)

NOTE
To assist installation without heat, apply a light penetrating oil to shaft and leading edge of bearing inner race.

**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.

---

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4. See Figure 3-140. Obtain the SPROCKET SHAFT BEARING INSTALLER (Part No. HD-97225-55C). Assemble tool as described below.
   a. See Figure 3-141. 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 bearing and large flat washer over pilot shaft.
   f. Sparingly apply graphite lubricant to threads of pilot shaft to prolong service life and verify smooth operation.
   g. See Figure 3-142. Thread handle onto pilot shaft.

5. See Figure 3-143. Rotate handle of tool clockwise until bearing inner race makes firm contact with thrust washer. Verify that thrust washer cannot be rotated by hand.

6. Remove handle, flat washer, bearing, short collar, long collar, pilot shaft and pilot adapter from sprocket shaft.

Figure 3-140. Sprocket Shaft Bearing Installer

Figure 3-141. Thread Pilot Adapter into Sprocket Shaft

Figure 3-142. Press Inner Race onto Sprocket Shaft: Setup

Figure 3-143. Press Inner Race onto Sprocket Shaft: Operation
CYLINDER STUDS

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder stud</td>
<td>120-240 in-lbs</td>
</tr>
<tr>
<td></td>
<td>13.6-27.1 Nm</td>
</tr>
</tbody>
</table>

Removal
1. Thread a 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 120-240 In-lbs (13.6-27.1 Nm).

PIPE PLUGS AND OIL FITTINGS

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crankcase oil fittings</td>
<td>120-168 in-lbs</td>
</tr>
<tr>
<td></td>
<td>13.6-19.0 Nm</td>
</tr>
<tr>
<td>Crankcase pipe plugs</td>
<td>120-144 in-lbs</td>
</tr>
<tr>
<td></td>
<td>13.6-16.3 Nm</td>
</tr>
</tbody>
</table>

Removal/Installation

NOTE
See 3.30 OIL TANK: ALL BUT FXSB or 3.31 OIL TANK: FXSB for information on replacing O-rings and retainers within oil tank fittings.

1. See Figure 3-145. Remove parts.
   a. Turn hex on oil fittings (1, 2, 3) counterclockwise until free.
   b. Turn pipe plugs (4, 5) counterclockwise until free.
2. Apply LOCTITE 565 THREAD SEALANT to fitting threads.
3. See Figure 3-145. Install parts.
   a. Turn hex on oil fittings (1, 2, 3) clockwise until snug. Tighten to oil fittings to 120-168 in-lbs (13.6-19.0 Nm).
   b. Install pipe plugs (4, 5). Tighten to 120-144 in-lbs (13.6-16.3 Nm).
GENERAL

Symptoms
Flywheels that shift out of true at the crank pin generally exhibit one of two symptoms: no oil pressure or vibration. This condition is also known as scissored flywheels.

No Oil Pressure
When the crankshaft shifts more than 0.015 in (0.381 mm), it can break the oil pump gear sets, resulting in a loss of oil pressure.

If a very low or no oil pressure condition is confirmed, inspect the oil pump and cam support plate. If the oil pump gear sets are bound or damaged, the cause is likely from a contaminant running through the pump or a shifted crankshaft. If this type of damage is found, always replace the oil lines and clean all debris from the oil pan or oil tank. See 1.23 TROUBLESHOOTING for general diagnostics of low oil pressure.

Vibration
Generally, left crankshaft runout must exceed 0.020 in. (0.508 mm) to be noticeable to the rider. It is much more likely that vibration issues will be resolved by following the checklist in 1.23 TROUBLESHOOTING.

If correct chassis set-up has been verified and other items in 1.23 TROUBLESHOOTING have been eliminated, checking left crankshaft runout is appropriate.

INSPECTION

NOTE
Do not attempt to straighten connecting rods. Straightening rods will damage both the upper bearing 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.
   e. The crankshaft runout exceeds specification.

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 3-146.
   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. Measure crankshaft runout if the crankshaft is suspected of being out-of-true.

NOTE
If the flywheel, connecting rods or right side bearing inner race need to be replaced, then replace the entire flywheel assembly.

Figure 3-146. Connecting Rod Bearing Clearance

MEASURING CRANKSHAFT RUNOUT

Crankshaft Installed

NOTES

- Perform the following checks during engine disassembly as a method to determine condition of crankshaft and whether crankshaft is suitable for reuse. The checks can be done with the engine either installed in the frame or removed.

- Dial indicators must be set up and zeroed perpendicular to the shaft in both directions. The indicator must be 90 degrees when viewed from the end and from the side.

- For a reliable reading, only measure on the cam support plate bushing machined surface of the crankshaft, never on a shaft adapter or the bolt holes.

- Never secure the dial indicator base to the vehicle frame. Movement within the engine mounts will result in a false reading.

- While rotating the crankshaft, the indicator needle may move to both the minus and plus sides of zero. The total indicator reading is the value to record.

1. Right Side
   a. Remove spark plugs.
   b. Remove the cam support plate. See 3.11 CAM COMPARTMENT SERVICE.
   c. Secure a dial indicator base to a stable location (crankcase, engine stand, etc.).
NOTE
To obtain an accurate measurement, the dial indicator must be set up perpendicular in both directions to the shaft being measured.

d. Attach a dial indicator and set it up to measure runout at the cam plate bearing contact area of the crankshaft. Adjust the indicator to zero.

e. Slowly rotate the crankshaft one complete revolution and record the total needle movement.

f. Compare results of measurements. If the total indicator reading exceeds service wear limit, the crankshaft/flywheel assembly should be removed and checked on a truing stand. Refer to Table 3-42.

2. Left Side

a. Remove spark plugs.

b. Remove the primary cover and compensating sprocket. See 5.4 Drive Components.

c. Secure a dial indicator base to a stable location (crankcase, engine stand, etc.).

NOTE
To obtain an accurate measurement, the dial indicator must be set up perpendicular in both directions to the shaft being measured.

d. Attach a dial indicator set up to measure runout near the end of the splined area of the crankshaft. Adjust the indicator to zero on the “high” part of one spline.

e. Mark the crankshaft and crankcase to use as reference for the amount of rotation.

NOTE
Pay attention to only the values from the “high” part of the splines.

f. Slowly rotate the crankshaft one complete revolution and record the total needle movement.

g. Compare results to Table 3-42. If the total indicator reading exceeds service wear limit, remove the crankshaft/flywheel assembly and check on a truing stand.

Crankshaft Removed

NOTES

- The following procedure should be performed if the crankshaft/flywheel assembly is suspected of being out-of-round.

- The crankshaft must be supported by the bearing races during inspection. Never use centers as the holes may not be perfectly centered.

- Verify that the bearing races are in good condition and suitable for performing this inspection.

1. See Figure 3-147. Mount crankshaft in truing stand so it is supported on the bearing races (1) by the roller supports (2).

2. Secure a dial indicator mount near each end of the crankshaft.

NOTE
Dial indicators must be perpendicular to the shaft in both directions.

3. Set up each indicator (3) to measure the machined surface (4) on one end and splines (5) on the other.

4. Adjust both indicators to zero.

5. Slowly rotate the crankshaft assembly while observing the total indicator reading.

NOTE
Twin Cam crankshaft/flywheel assemblies are not serviceable. Replace parts not within specifications.

6. Compare results of measurements. If the total indicator reading exceeds service wear limit, replace the crankshaft/flywheel assembly. Refer to Table 3-42.

Figure 3-147. Checking Crankshaft Runout

<table>
<thead>
<tr>
<th>Table 3-42, Flywheel</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FLYWHEEL</strong></td>
</tr>
<tr>
<td><strong>IN</strong></td>
</tr>
<tr>
<td>Runout (shaft measured in case)</td>
</tr>
<tr>
<td>Runout (measured in truing stand)</td>
</tr>
<tr>
<td>End play</td>
</tr>
</tbody>
</table>
COUNTERBALANCER ASSEMBLY REPAIR

CLEANING, INSPECTION, AND REPAIR

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>14900004</td>
<td>SCREAMIN' EAGLE® ENGINE CASE SUPPORT BLOCKS</td>
</tr>
<tr>
<td>HD-48309</td>
<td>BALANCER/BEARING INSTALLER</td>
</tr>
<tr>
<td>HD-48457-6</td>
<td>REMOVAL COLLET</td>
</tr>
<tr>
<td>HD-48457-A</td>
<td>BALANCER AND BEARING REMOVER</td>
</tr>
<tr>
<td>HD-48474</td>
<td>OUTER BALANCER BEARING REMOVER AND INSTALLER</td>
</tr>
<tr>
<td>HD-95635-46</td>
<td>ALL-PURPOSE CLAW PULLER</td>
</tr>
<tr>
<td>HD-95937-46B</td>
<td>WEDGE ATTACHMENT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Countershaft assembly bearing</td>
<td>40-70 in-lbs 4.5-7.9 Nm</td>
</tr>
</tbody>
</table>

General
1. Clean all parts except bearings 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. Dry parts with low pressure compressed air.

Balance Shaft Removal
1. See Figure 3-148. Remove bearing fastener (4) from crankcase (1).
2. See Figure 3-149. Assemble BALANCER AND BEARING REMOVER (Part No. HD-48457-A).
   a. Slightly apply clean engine oil to forcing screw (1) for smooth operation and to prolong service life.
   b. Install puller studs (3) in crankcase.
   c. Install plate (2) over puller stud with appropriate side marked "Front" or "Rear" facing up.
   d. Install forcing screw in balance shaft (4).
   e. Install washer, bearing and nut on forcing screw.

3. See Figure 3-150. While holding forcing screw (1) from turning, turn nut (2) to remove balance shaft (4) and bearing from crankcase.
4. Using ALL-PURPOSE CLAW PULLER (Part No. HD-95635-46) and WEDGE ATTACHMENT (Part No. HD-95937-46B), remove bearing from balance shaft. Discard bearing.
5. Repeat removal on other shaft.

![Figure 3-150. Removing Balance Shaft]

**Bearing Removal**

1. See Figure 3-151. Install puller studs (2) and REMOVAL COLLET (Part No. HD-48457-6) (1).
2. Install puller plate, rear side facing up, onto the puller studs.
3. See Figure 3-152. Place washer (3) onto puller plate.
4. Insert BEARING PULLER SCREW (Part No. HD-48457-6) through washer (3) and puller plate.
5. Insert bearing puller screw into removal collet.
6. While holding bearing puller screw (1), rotate nut (2) until bearing separates from crankcase.

![Figure 3-151. Bearing Removal Collet]

![Figure 3-152. Removing Bearing]

**Balance Shaft Installation**

1. With lettering side facing up, press balance shaft into new bearing.
2. See Figure 3-153. Place balancer shaft (3) and bearing in crankcase (4).
3. Place BALANCER/BEARING INSTALLER (Part No. HD-48309) (2) over balance shaft.

**NOTE**

Use caution when supporting crankcase half. Failure to have adequate support may cause damage to crankcase.
4. Support crankcase half in a press using SCREAMING\nEAGLE® ENGINE CASE SUPPORT BLOCKS (Part No. 14900004).

5. With crankcase level and perpendicular to the balance shaft, press balance shaft and bearing into crankcase.

   **NOTE**
   If new bearing fastener is not available, apply LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to threads of fastener before installation.

6. See Figure 3-149. Install new bearing fastener (4). Tighten to 40-70 in-lbs (4.5-7.9 Nm).

7. Repeat installation on other shaft.

   ![Figure 3-153. Balance Shaft Installation](image)

   1. Ram
   2. Balancer shaft installer
   3. Balancer shaft
   4. Crankcase

   **Balance Shaft Support Bearings Removal**

   1. Inspect bearing for rough spots or binding. Always replace all four bearings (crankcase and housing, front and rear) during a complete bottom end overhaul.

   2. See Figure 3-154. Remove retaining ring (3)

   3. See Figure 3-155. Place housing (3) on a suitable support with top surface facing up.

   4. Place bearing remover end of OUTER BALANCER BEARING REMOVER AND INSTALLER (Part No. HD-49474) (2) over bearing.

   5. Center bearing remover under ram (1) of press. Slowly lower ram to remove bearing.

   6. Discard retaining ring and bearing.

   **Balance Shaft Support Bearings Installation**

   1. See Figure 3-156. Place balance shaft support (4) upside down on a suitable support.

   ![Figure 3-154. Balance Shaft Support Bearing](image)

   1. Balance shaft support
   2. Bearing
   3. Retaining ring

   ![Figure 3-155. Removing Bearing from Shaft Support](image)

   1. Ram
   2. Bearing
   3. Balance shaft support

   **Figure 3-154. Balance Shaft Support Bearing**

   **Figure 3-155. Removing Bearing from Shaft Support**
Front and Rear Balance Sprockets

1. See Figure 3-157. Sprockets must be flat within 0.008 in. (0.203 mm).

2. Inspect sprocket teeth for any irregular wear patterns or chipping.
   a. The most common type of sprocket wear is polishing. This results from the chain contacting the sprocket surface and creating a shiny, mirror-like surface. Moderate polishing is not cause for replacement.
   b. Sprocket teeth may exhibit surface deformations or areas where the material has been compressed. This is known as brinelling. Replace sprockets showing brinelling.
   c. If small chunks of metal are removed from the surface, it is known as pitting. Replace sprockets showing pitting.
   d. Inspect base of each sprocket tooth for hooking. Hooking occurs when chain wears away the tooth in a scalloped shape pattern. Replace sprockets showing signs of severe hooking.

3. Check the mating surface that fits around the balance shaft. Improperly installed sprockets may show wear on inside edges.

4. Replace sprockets during a major bottom end overhaul. Always replace sprockets in sets, including the sprocket on the flywheel.

Hydraulic Tensioners

1. Test hydraulic tensioners using the leakdown test for the balance shaft support on an assembled engine. See 3.29 CRANKCASE ASSEMBLY.

2. Check if more air is flowing from the front or rear tensioner. Place your hand over the piston while applying compressed air to the interconnect passage.

3. See Figure 3-158. Disassemble components. Verify plastic vent cap (2) is on spring (3) and seated under tensioner piston (1). Minimum free length for spring (3) is 1.85 in. (47.0 mm).

4. Inspect exterior surface of piston (1) for damage. While some moderate amount of polishing is normal, surface pitting is cause for piston replacement.

Chain Tensioner Guides
Inspect tensioner guide surface. Replace any guide with grooves deeper than 0.080 in. (2.03 mm) or signs of melting, burning or cracking.

Balance Shaft Support
Replace rubber interconnect on outside of balance shaft support each time right crankcase is removed.

The hydraulic tensioner piston, plastic vent cap and spring are the only service parts for the balance shaft support.

If bracket fails leak down test and rubber interconnect has been replaced, replace balance shaft support as an assembly.
Balance Chain

1. Check balance chain for missing bushings, side plates and turning marks. Inspect for tooth hooking or burn marks. Replace as necessary.

2. Chains will darken in color as the result of wear and exposure to engine oil. This darkening will almost always be some hue of brown. If the chain turns blue, it may be the result of heat exposure.

3. Replace balance chain any time the sprockets are replaced. Always apply a thin film of SCREAMIN' EAGLE ASSEMBLY LUBE before installation.
COUNTERBALANCER ASSEMBLY
INSTALLATION

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-43236-B</td>
<td>CRANKSHAFT GUIDE</td>
</tr>
<tr>
<td>HD-44062</td>
<td>BALANCE SHAFT RETENTION PINS</td>
</tr>
<tr>
<td>HD-44063</td>
<td>HYDRAULIC TENSIONER COM- PRESSOR</td>
</tr>
<tr>
<td>HD-44068</td>
<td>HYDRAULIC TENSIONER RETAI NERS</td>
</tr>
<tr>
<td>HD-48615</td>
<td>BALANCE SHAFT SPROCKET ALI GMENT TOOL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balance shaft support screws</td>
<td>18-22 ft-lbs 24.4-29.8 Nm</td>
</tr>
<tr>
<td>Balance shaft bolts</td>
<td>42-47 ft-lbs 56.9-63.7 Nm</td>
</tr>
</tbody>
</table>

1. Install balance shafts and bearings. See 3.26 COUNTERBALANCER ASSEMBLY REPAIR for balance shaft installation information.

**NOTE**
Never move or lift the crankcase by grasping the cylinder studs. The crankcase is too heavy to be carried in this manner.

2. If removed, install the flywheel assembly.
   a. Secure left crankcase half upright in engine stand.
   b. Slide CRANKSHAFT GUIDE (Part No. HD-43236-B) onto flywheel sprocket shaft.
   c. Slide flywheel assembly into left crankcase half. Remove guide.

3. Rotate left crankcase in the engine stand until the balance sprocket on the flywheel is facing straight upward.
   **NOTE**
   Do not apply crankcase sealant to edge surface of balance shaft housing. Improper preparation of housing could cause balance sprocket misalignment and result in engine damage.

4. With hydraulic tensioners compressed, slide balance shaft support assembly over front and rear balance shafts.

5. See Figure 3-159. Apply LOCTITE 262 HIGH STRENGTH THREADLOCKER AND SEALANT (red) to threads of screws for balance shaft housing. Insert screws and tighten to 18-22 ft-lbs (24.4-29.8 Nm) in the sequence shown.

6. See Figure 3-160. Rotate flywheel assembly to align the mark (1) on flywheel balance sprocket to the 6 o'clock position.

7. Insert BALANCE SHAFT RETENTION PINS (Part No. HD-44062) inside front and rear shaft supports to lock balance shafts in place.

8. Place spacer over front balance shaft.

9. Install front sprocket (labeled "F") and rear sprocket (labeled "R") over balance shafts with labels visible.

10. Loosely install a bolt and washer on each balance shaft.

![Figure 3-160. Flywheel Alignment Mark](image)

11. See Figure 3-161. Check alignment of flywheel sprocket to each balance shaft sprocket using BALANCE SHAFT SPROCKET ALIGNMENT TOOL (Part No. HD-48615).
   a. Slide tool over crankshaft and shoulder on timing chain gear. Tighten screw onto crankshaft until it bottoms on shoulder screw.
   b. Swing tool to each sprocket face.
   c. Alignment must be within 0.019 in. (0.48 mm) as indicated by the step on the bottom of the tool.
   d. The tool's outside step must clear the top surface of the sprocket. The inside step must not pass over the sprocket edge.
   e. To adjust alignment, add or remove spacers behind front sprocket as necessary.
   f. Remove bolts, washers and front and rear sprockets from balance shafts.
12. See Figure 3-162. Install balance chain.
   a. Apply a very thin film of SCREAMIN’ EAGLE ASSEMBLY LUBE to balance chain.
   b. Insert front sprocket (labeled “F”) and rear sprocket (labeled “R”) inside chain with colored links on chain aligned with timing marks on sprockets.
   c. Slide rear chain/sprocket assembly onto rear balance shaft with alignment marks visible. Align flywheel sprocket to mark on chain. Install front sprocket.

13. Install new bolt and washer in each balance shaft. Tighten to 42-47 ft-lbs (56.9-63.7 Nm).

14. Verify alignment of all three timing marks on chain and sprockets.
15. See Figure 3-163. Install chain tensioner guides. A small screwdriver may be used to aid installation.
   a. Install chain tensioner guide (1) (labeled "F" for front) with label visible. Push down on guide until it snaps into place on post.
   b. Install chain tensioner guide (2) (labeled "R" for rear) with label visible. Push down on guide until it snaps into place on post.
   c. Install lower chain tensioner guide (3) by snapping both retention tabs (4) into place on chain guide support assembly.

16. See Figure 3-164. Release both hydraulic tensioners using HYDRAULIC TENSIONER COMPRESSOR (Part No. HD-44063) (1).
   a. Pump handle on tool to compress hydraulic tensioner.
   b. Remove HYDRAULIC TENSIONER RETAINERS (Part No. HD-44408) (2) from tip of tensioner.
   c. Slowly release pressure on tool. Remove tool.
   d. Repeat procedure on remaining tensioner assembly.

NOTE
See Figure 3-165. If the ball at the end of the pin should separate and become loose in the engine assembly, severe engine damage could occur.

17. Remove both BALANCE SHAFT RETENTION PINS (Part No. HD-44062). Check that ball at tip of tool has not separated from pin.
4. See Figure 3-162. Verify correct alignment of all three timing marks on chain and sprockets.

5. Apply a bead of HARLEY-DAVIDSON HIGH PERFORMANCE SEALANT - GRAY approximately 0.056 in. (1.42 mm) wide to the split line face of the right crankcase half.

6. See Figure 3-166. Place CRANKSHAFT GUIDE (Part No. HD-42326-B) (2) over end of crankshaft until it contacts shoulder on shaft.

7. Mate case halves. Remove tool.

8. See Figure 3-167. Start the twelve crankcase bolts and tighten in the following order:
   a. Finger-tighten each crankcase bolt.
   b. Tighten the crankcase bolts to 120 in-lbs (13.6 Nm) in the order shown.
   c. Following the same sequence, tighten each bolt to 15-19 ft-lbs (20.3-25.8 Nm).

9. Rotate crankcase assembly so that sprocket shaft is pointing straight up.

10. Apply a liberal amount of SCREAMIN' EAGLE ASSEMBLY LUBE into main bearing and rotate flywheel assembly to distribute.

11. Install thrust washer on sprocket shaft with "OUT" facing out (and the chamfer inboard). If using original part without markings, orient as required to preserve existing wear pattern.

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**CRANKCASE**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
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</thead>
<tbody>
<tr>
<td>HD-35667-A</td>
<td>CYLINDER LEAKDOWN TESTER</td>
</tr>
<tr>
<td>HD-39361-B</td>
<td>SPROCKET SHAFT OIL SEAL INSTALLER</td>
</tr>
<tr>
<td>HD-42326-B</td>
<td>CRANKSHAFT GUIDE</td>
</tr>
<tr>
<td>HD-97225-55C</td>
<td>SPROCKET SHAFT BEARING INSTALLER</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
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<tbody>
<tr>
<td>Crankcase bolt, 1st torque</td>
<td>120 in-lbs 13.6 Nm</td>
</tr>
<tr>
<td>Crankcase bolt, final torque</td>
<td>15-19 ft-lbs 20.3-25.8 Nm</td>
</tr>
</tbody>
</table>

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1. Secure left crankcase half in engine stand.
2. Rotate crankcase assembly so that flywheel pinion shaft is pointing straight up.
3. See Figure 3-163. Install new rubber interconnect (5) on balance shaft support assembly.

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12. See Figure 3-168. Install new oil seal into bearing bore. Obtain pilot adapter, pilot shaft, short collar, 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 outward, 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.

NOTE

Lightly apply clean engine oil to pilot shaft threads. This prolongs service life and provides smooth operation.

g. Slide short collar, bearing, large flat washer, and thread handle onto pilot shaft to complete assembly of tool.

13. Rotate handle clockwise until oil seal installer makes firm contact with crankcase stator mount.

14. Remove tool components from sprocket shaft.

Figure 3-167. Tighten in Sequence Shown

Figure 3-168. Sprocket Shaft Oil Seal Installer

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)

NOTES

* Individuals not using MAC leakdown testers supplied by KENT-MOORE TOOLS must also calibrate line pressure to 35 PSI (241 kPa) using a remote pressure regulator if necessary.

* All SNAP-ON meters will use a baseline of a 50% change when outlet is plugged.
15. See Figure 3-169. Remove screen and O-ring from chain guide oil passage (2). Perform leakdown test to verify proper assembly.
   a. Obtain CYLINDER LEAKDOWN TESTER (Part No. HD-35667-A) and a leakdown tester nipple which will fit inside the chain guide oil passage.
   b. Allow compressed air to run to discharge any water.
   c. Regulate air pressure to 35 PSI (241 kPa). Feed shop air into leakdown tester and test for calibration. Place your gloved thumb on and off the adapter outlet and watch the pressure change.
   d. Apply a light coat of SCREAMIN' EAGLE ASSEMBLY LUBE to nipple. Insert nipple into chain guide oil passage (2).
   e. Record the change in pressure. A typical system will read a 1-8 PSI (7-55 kPa) drop on a MAC meter or a 6-16% drop (SNAP-ON meter reads 56-66) from 35 PSI (241 kPa).
   f. If pressure drop is greater than 11 PSI (75 kPa) on a MAC meter (greater than 20% on a SNAP-ON meter (meter reads 70 or greater)), disassemble the engine and inspect the rubber interconnect. Replace if missing or damaged. If the interconnect is fine, replace the chain guide bracket.
   g. Install chain guide screen and O-ring.

16. Rotate crankcase on engine stand so that cam cover flange is facing upward.

17. Apply a liberal amount of SCREAMIN' EAGLE ASSEMBLY LUBE into main bearing and rotate flywheel assembly to distribute.

18. Install oil pump and cam support plate. See 3.24 CAM COMPARTMENT AND COMPONENTS.

OIL TANK: ALL BUT FXSB

REMOVAL AND DISASSEMBLY

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-44455</td>
<td>OIL LINE REMOVING TOOL</td>
</tr>
</tbody>
</table>

Oil Tank

1. Remove seat.

**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)

2. Disconnect both battery cables, negative cable first, and remove battery. See 1.19 BATTERY MAINTENANCE.

3. Remove battery caddy. See 7.12 BATTERY CABLES.

4. Remove rear exhaust pipe. See 4.17 EXHAUST SYSTEM.

5. Drain oil tank. See 1.6 ENGINE OIL AND FILTER.

6. Remove rear fender assembly.

7. Remove splash guard.
   a. Remove fastener securing bottom of splash guard.
   b. Pull bottom of splash guard from frame tabs.
   c. Detach top of splash guard from rear fork tube.

**NOTE**

To ease installation, make note of wire and hose routing before removing electrical panel and oil tank.

8. Remove EVAP hose and wiring from clip on left side of electrical panel.


10. See Figure 3-171. Remove two bolts from behind main fuse.

11. See Figure 3-172. Remove two bolts (22).

12. Remove two bolts with washers (19) from top bracket (18).

13. Cut lower drain hose clamp (2) from frame.

14. Cut clamp (4) from either side of oil feed hose (5).

15. Remove positive battery cable from starter motor post.

16. See Figure 3-170. Detach vent (1) and return (2) oil lines at front of tank using OIL LINE REMOVING TOOL (Part No. HD-44455).
   a. Slide cover (3) away from oil line.
   b. Insert tool (4) inside retainer (5).
   c. Pull oil line straight out from tank leaving oil line retainer (5) inside tank.

Figure 3-170. Line Cover

Figure 3-171. Wire Shield Fasteners

17. Remove oil tank from right side of vehicle.
1. Drain plug and O-ring
2. Clamp (2)
3. Drain hose
4. Clamp (2)
5. Oil feed hose
6. Oil line clip
7. Feed line
8. Return line
9. Vent line
10. Oil line retainer (large) (2)
11. Oil line fitting (large) (2)
12. O-ring (3)
13. Oil line retainer (small) (3)
14. Oil line fitting (small)
15. Oil tank
16. Spacer (3)
17. Grommet (3)
18. Top bracket
19. Bolt (2)
20. Bolt
21. Dipstick
22. Bolt (2)
23. Clip nut (2)

Figure 3-172. Oil Tank
Oil Line Fittings/Retainers

NOTES

- There are two sizes of oil line retainers and fittings. Use the appropriate sized oil line tool for all service procedures. See Figure 3-173.
- See Figure 3-174. Small retainers connect the vent (1) and return lines (2) to the oil tank. A small retainer and fitting also connects the vent line (3) to the engine.
- Large retainers and fittings attach the return (4) and feed lines (5) to the engine.
- See Figure 3-175. Do not remove oil line retainers from engine fittings or oil tank unless retainers, O-rings, and/or spacers are damaged.
- See Figure 3-176. O-rings (1) and spacer (2) are not sold separately. If either O-rings or spacer are damaged, oil line retainer assembly must be replaced.

1. Insert OIL LINE O-RING TOOL (Part No. HD-44455) (4) inside retainer (3).
2. Squeeze tabs on retainer and withdraw tool, retainer, both O-rings and spacer. Discard retainer, O-rings and spacer.
3. Insert tool (4) through new retainer (3).
4. Insert tool, retainer, spacer and O-rings into engine fitting or oil tank until tabs on retainer lock into place. Do not damage O-rings during installation.
5. Carefully withdraw tool leaving retainer assembly in place.

Figure 3-173. Oil Line Tools

Figure 3-174. Oil Line Fittings/Retainers

1. Vent line to oil tank (small retainer)
2. Return line to oil tank (small retainer)
3. Vent line to engine (small retainer and fitting)
4. Return line to engine (large retainer and fitting)
5. Feed line to engine (large retainer and fitting)

Figure 3-175. Oil Line Retainers (Parts Removed From Engine for Clarity)
1. O-rings (2)
2. Spacer
3. Retainer
4. Tool

Figure 3-176. O-rings and Spacer

INSTALLATION

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-97087-65B</td>
<td>HOSE CLAMP PLIERS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical panel fasteners: all but FXSB</td>
<td>36-60 in-lbs, 4.1-6.8 Nm</td>
</tr>
<tr>
<td>Splash guard fastener: all but FXSB</td>
<td>36-48 in-lbs, 4.1-5.4 Nm</td>
</tr>
</tbody>
</table>

1. See Figure 3-172. Slide oil tank into position within frame. Install two bolts (19) through top bracket to hold tank in place.
2. Install two bolts (22) from back side of tank.
3. Install new clamp (4) to attach oil feed hose (5) to oil tank.
5. Position drain hose outboard of the electrical panel and inboard of the brake line and frame harness. Attach drain hose to frame.
6. Install new clamp (2) over oil drain line and install drain line.
8. See Figure 3-170. Connect vent and return lines to tank. No tools are necessary for this step. Insert lines straight into fittings without digging or gouging O-rings. Remove any labels used to identify lines during removal process.

**NOTE**

In next step, make sure electrical box is located under wire shield.

9. See Figure 3-177. Install two bolts to attach wire shield to frame.
10. Install the three fasteners securing the electrical panel and tighten to 36-60 in-lbs (4.1-6.8 Nm).
11. Install EVAP hose and wiring into clip on left side of electrical panel.
12. Install splash guard.
   a. Attach top of splash guard to rear fork tube.
   b. Push in bottom of splash guard until it snaps into place over frame tabs.
   c. Install fastener securing bottom of splash guard and torque to 36-48 in-lbs (4.1-5.4 Nm).
13. Install rear fender.
14. Install exhaust system. See 4.17 EXHAUST SYSTEM.
15. Install positive battery cable to starter and install battery caddy. See 7.12 BATTERY CABLES.

**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)

16. Install battery and connect cables, positive cable first.

**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)

17. Install seat.
18. Fill oil tank and check oil level after running motorcycle on jiffy stand. See 1.6 ENGINE OIL AND FILTER.

Figure 3-177. Wire Shield Fasteners
REMOVAL AND DISASSEMBLY

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-44485</td>
<td>OIL LINE REMOVING TOOL</td>
</tr>
</tbody>
</table>

Oil Tank

1. Remove seat.

**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)

2. Remove battery. See 1.19 BATTERY MAINTENANCE.

3. Remove battery caddy.

4. Remove rear exhaust pipe. See 4.17 EXHAUST SYSTEM.

5. Drain oil tank. See 1.6 ENGINE OIL AND FILTER.

6. Remove rear fender assembly. See 2.35 REAR FENDER; FXSB.

7. Remove rear wheel. See 2.5 REAR WHEEL.

8. Remove two fasteners securing wire shield to frame.

9. Remove splash guard. See 2.23 REAR FORK.

10. Remove fasteners securing top of electrical panel to oil tank.

11. See Figure 3-179. Remove two bolts (21) securing rear of oil tank.

12. Remove two bolts with washers (18) on top front of oil tank.

13. Cut lower drain hose clamp (2) from frame.

14. See Figure 3-178. Detach feed line to engine (1), return line to oil tank (2), and vent line (3) using OIL LINE REMOVING TOOL (Part No. HD-44485).
   a. Insert oil line removing tool (4) inside retainer (5).
   b. Pull oil line straight out, leaving oil line retainer inside tank.

15. Remove oil tank from right side of vehicle.
Figure 3-179. Oil Tank

1. Drain plug and O-ring
2. Clamp
3. Drain hose
4. Clamp
5. Dipstick
6. Feed line
7. Return line
8. Vent line
9. Oil line retainer (large) (4)
10. Oil line fitting (large) (2)
11. O-ring (3)
12. Oil line retainer (small) (2)
13. Oil line fitting (small)
14. Oil tank
15. Spacer (3)
16. Grommet (3)
17. Top bracket
18. Bolt (2)
19. Bolt
20. Cap
21. Bolt (2)
Oil Line Fittings/Retainers

NOTES
There are two sizes of oil line retainers and fittings. Use the appropriate sized oil line tool for all service procedures. See Figure 3-180.

- See Figure 3-181. Small retainers connect the vent line (3) to the oil tank and to the engine.
- Large retainers connect the feel line to engine (1) and return line to oil tank (2) to the oil tank and to the engine.
- See Figure 3-182. Do not remove oil line retainers from engine fittings or oil tank unless retainers, O-rings, and/or spacers are damaged.
- See Figure 3-183. O-rings (1) and spacer (2) are not sold separately. If either O-rings or spacer are damaged, oil line retainer assembly must be replaced.

1. Insert OIL LINE REMOVING TOOL (Part No. HD-44455) (4) inside retainer (3).
2. Squeeze tabs on retainer and withdraw tool, retainer, both O-rings and spacer. Discard retainer, O-rings and spacer.
3. Insert tool (4) through new retainer (3).
4. Insert tool, retainer, spacer and O-rings into engine fitting or oil tank until tabs on retainer lock into place. Do not damage O-rings during installation.
5. Carefully withdraw tool leaving retainer assembly in place.

Figure 3-180. Oil Line Tools

1. O-ring tool (2 sizes)
2. Oil line tool (2 sizes)

1. Feed line to engine
2. Return line to oil tank
3. Vent line

Figure 3-181. Oil Line Fittings/Retainers

1. O-ring tool
2. Engine fitting and retainer
3. Tool, retainer, O-rings and spacer
4. Engine fitting without retainer
5. Tabs

Figure 3-182. Oil Line Retainers (Parts Removed From Engine for Clarity)
3. Attach drain hose and install new clamp (2) to frame. Crimp clamp using HOSE CLAMP PLIERS (Part No. HD-97087-65B).
4. Secure wire harness and rear brake line to drain at frame with a cable strap.
5. Secure wire shield to frame with both fasteners.
6. See Figure 3-178. Connect vent line, return line to oil tank, and feed line to engine.
7. Install fasteners securing top of electrical panel to oil tank. Tighten to 36-60 in-lbs (4.1-6.8 Nm).
8. Install splash guard. Tighten to 36-60 in-lbs (4.1-6.8 Nm).
9. Install rear wheel. See 2.5 REAR WHEEL.
10. Install rear fender. See 2.35 REAR FENDER: FXSB.
11. Install exhaust system. See 4.17 EXHAUST SYSTEM.
12. Install battery caddy. See 1.19 BATTERY MAINTENANCE.

**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)

13. Install battery and connect cables, positive cable first.

**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)


15. Fill oil tank and check oil level after running motorcycle on jiffy stand. See 1.6 ENGINE OIL AND FILTER.

---

**INSTALLATION**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-97087-65B</td>
<td>HOSE CLAMP PLIERS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil tank bolts: FXSB</td>
<td>12-15 ft-lbs</td>
</tr>
<tr>
<td>Electrical panel fastener: FXSB</td>
<td>36-60 in-lbs</td>
</tr>
<tr>
<td>Splash guard fasteners: FXSB</td>
<td>36-60 in-lbs</td>
</tr>
</tbody>
</table>

1. See Figure 3-179. Slide oil tank into position in frame.
2. Install bolts (18, 21). Tighten to 12-15 ft-lbs (16.3-20.3 Nm).
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<th>SUBJECT</th>
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<td>4.7 CONSOLE: FXSD</td>
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<td>4.8 THROTTLE POSITION SENSOR (TPS)</td>
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<td>4.9 INTAKE AIR TEMPERATURE SENSOR (IAT)</td>
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<tr>
<td>4.10 ENGINE TEMPERATURE SENSOR (ET)</td>
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<td>4.11 INDUCTION MODULE</td>
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<td>4-18</td>
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<tr>
<td>4.13 MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP)</td>
<td>4-19</td>
</tr>
<tr>
<td>4.14 OXYGEN (O2) SENSOR</td>
<td>4-20</td>
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<tr>
<td>4.15 FUEL INJECTORS</td>
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<td>4.16 FUEL PUMP AND FUEL GAUGE SENDING UNIT</td>
<td>4-24</td>
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<tr>
<td>4.17 EXHAUST SYSTEM</td>
<td>4-29</td>
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<tr>
<td>4.18 INTAKE LEAK TEST</td>
<td>4-33</td>
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<tr>
<td>4.19 EVAPORATIVE EMISSIONS CONTROL SYSTEM</td>
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</table>
## FASTENER TORQUE VALUES IN THIS CHAPTER

The table below lists torque values for all fasteners presented in this chapter.

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<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air cleaner bracket screws</td>
<td>40-60 in-lbs</td>
<td>4.5-6.8 Nm</td>
</tr>
<tr>
<td>Air cleaner cover screw</td>
<td>36-60 in-lbs</td>
<td>4.1-6.8 Nm</td>
</tr>
<tr>
<td>Breather bolts, cylinder head</td>
<td>22-24 ft-lbs</td>
<td>29.9-32.6 Nm</td>
</tr>
<tr>
<td>Charcoal canister screws</td>
<td>90-114 in-lbs</td>
<td>10.2-12.9 Nm</td>
</tr>
<tr>
<td>Console mounting nut, FXSB</td>
<td>30-50 in-lbs</td>
<td>3.4-5.7 Nm</td>
</tr>
<tr>
<td>Engine temperature (ET) sensor</td>
<td>120-180 in-lbs</td>
<td>13.6-20.3 Nm</td>
</tr>
<tr>
<td>Exhaust carriage bolt flange locknut: FLSTN, FLSTF/B, FLS</td>
<td>20-25 ft-lbs</td>
<td>27.1-33.9 Nm</td>
</tr>
<tr>
<td>Exhaust interconnect clamp: FLSTC, FXST, FXSB</td>
<td>25-30 ft-lbs</td>
<td>33.9-40.7 Nm</td>
</tr>
<tr>
<td>Exhaust manifold clamp lower nut, 1st torque: FLSTC, FXST, FXSB</td>
<td>9-18 in-lbs</td>
<td>1.0-2.0 Nm</td>
</tr>
<tr>
<td>Exhaust manifold clamp lower nut, 1st torque: FLSTN, FLSTF/B, FLS</td>
<td>9-18 in-lbs</td>
<td>1.0-2.0 Nm</td>
</tr>
<tr>
<td>Exhaust manifold clamp lower nut, final torque: FLSTN, FLSTF/B, FLS</td>
<td>100-120 in-lbs</td>
<td>11.3-13.6 Nm</td>
</tr>
<tr>
<td>Exhaust manifold clamp lower nut, final torque: FLSTC, FXST, FXSB</td>
<td>100-120 in-lbs</td>
<td>11.3-13.6 Nm</td>
</tr>
<tr>
<td>Exhaust manifold clamp upper nut: FLSTC, FXST, FXSB</td>
<td>100-120 in-lbs</td>
<td>11.3-13.6 Nm</td>
</tr>
<tr>
<td>Exhaust manifold clamp upper nut: FLSTN, FLSTF/B, FLS</td>
<td>100-120 in-lbs</td>
<td>11.3-13.6 Nm</td>
</tr>
<tr>
<td>Exhaust pipe clamp locknut: FLSTN, FLSTF/B, FLS</td>
<td>20-25 ft-lbs</td>
<td>27.1-33.9 Nm</td>
</tr>
<tr>
<td>Exhaust system interconnect tube fasteners: FLSTC, FXST, FXSB</td>
<td>20-25 ft-lbs</td>
<td>27.1-33.9 Nm</td>
</tr>
<tr>
<td>Fuel pump/fuel gauge sending unit screws</td>
<td>18-24 in-lbs</td>
<td>2.0-2.7 Nm</td>
</tr>
<tr>
<td>Fuel supply tube fastener</td>
<td>90-110 in-lbs</td>
<td>10.2-12.4 Nm</td>
</tr>
<tr>
<td>Fuel tank screw, front</td>
<td>28-32 ft-lbs</td>
<td>38.0-43.4 Nm</td>
</tr>
<tr>
<td>Fuel tank screw, rear</td>
<td>18-22 ft-lbs</td>
<td>24.4-29.8 Nm</td>
</tr>
<tr>
<td>Fuel tank screw, rear, FXSB</td>
<td>18-22 ft-lbs</td>
<td>24.4-29.8 Nm</td>
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<tr>
<td>Instrument console acom nut</td>
<td>30-50 in-lbs</td>
<td>3.4-5.7 Nm</td>
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<td>Instrument console acom nut</td>
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<td>Instrument console acom nut</td>
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<td>3.4-5.7 Nm</td>
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<tr>
<td>Intake air temperature sensor (IAT) fastener</td>
<td>15-20 in-lbs</td>
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<tr>
<td>Manifold mounting screws, 1st torque</td>
<td>16-20 in-lbs</td>
<td>1.8-2.3 Nm</td>
</tr>
<tr>
<td>FASTENER</td>
<td>TORQUE VALUE</td>
<td>NOTES</td>
</tr>
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<td>---------------------------------------</td>
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<tr>
<td>Manifold mounting screws, final torque</td>
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<td>10.9-17.6 Nm</td>
</tr>
<tr>
<td>Muffler clamp: FLSTN, FLSTF/B, FLS</td>
<td>38-43 ft-lbs</td>
<td>51.6-58.4 Nm</td>
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<td>Muffler clamps: FLSTC, FXST, FXSB</td>
<td>38-43 ft-lbs</td>
<td>51.6-58.4 Nm</td>
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<tr>
<td>Muffler fasteners: FLSTC, FXST, FXSB</td>
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<td>10.9-13.6 Nm</td>
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<tr>
<td>Muffler support fastener: FLSTN, FLSTF/B, FLS</td>
<td>96-120 in-lbs</td>
<td>10.9-13.6 Nm</td>
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<tr>
<td>Oxygen sensor, front</td>
<td>14.0 ft-lbs</td>
<td>19.0 Nm</td>
</tr>
<tr>
<td>Oxygen sensor, rear</td>
<td>14.0 ft-lbs</td>
<td>19.0 Nm</td>
</tr>
<tr>
<td>Throttle cable bracket fasteners</td>
<td>20-35 in-lbs</td>
<td>2.3-4.0 Nm</td>
</tr>
<tr>
<td>Throttle position sensor fasteners</td>
<td>18 in-lbs</td>
<td>2.0 Nm</td>
</tr>
<tr>
<td>Vapor valve bracket nut</td>
<td>120-144 in-lbs</td>
<td>13.6-16.3 Nm</td>
</tr>
<tr>
<td>Voltage regulator bracket fasteners</td>
<td>70-100 in-lbs</td>
<td>7.9-11.3 Nm</td>
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### Table 4-1. Capacities

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<th>ITEM</th>
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</thead>
<tbody>
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<td>18.9</td>
</tr>
<tr>
<td>Low fuel warning light on</td>
<td>1.0 gal</td>
<td>3.8</td>
</tr>
</tbody>
</table>
REMOVAL

1. See Figure 4-1. Remove screws (1) and air cleaner cover (2).
2. Remove three TORX screws (4) and bracket (5) from filter element (6).
3. Gently pull both rubber breather tubes (9) from the element. Remove filter element (8) and gasket (7).
4. Replace the filter element if damaged.
5. Gently pull breather tubes (9) from breather bolts (10) on the backplate.
6. Check filter element and clean as necessary. See 1.7 AIR CLEANER AND EXHAUST SYSTEM.
7. Inspect seal ring (3) for cracks or tears. Verify that it seals tightly to backplate. Replace as required.
8. Alternately back out both breather bolts (10) a few turns a time while pulling backplate (8) away from induction module.
9. Continue previous step until breather bolts are clear. Remove backplate (8) and gasket (11). Discard gasket.
10. Wipe inside of air cleaner cover (2) and backplate (8) with damp cloth to remove dust.

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breather bolts, cylinder head</td>
<td>22-24 ft-lbs</td>
</tr>
<tr>
<td>Air cleaner bracket screws</td>
<td>40-60 in-lbs</td>
</tr>
<tr>
<td>Air cleaner cover screw</td>
<td>36-60 in-lbs</td>
</tr>
<tr>
<td></td>
<td>29.9-32.6 Nm</td>
</tr>
<tr>
<td></td>
<td>4.5-6.8 Nm</td>
</tr>
<tr>
<td></td>
<td>4.1-6.8 Nm</td>
</tr>
</tbody>
</table>

1. See Figure 4-1. Position new gasket (11) on backplate. Insert two breather bolts (10) into backplate. Thread bolts loosely into each cylinder head. Final tighten bolts to 22-24 ft-lbs (29.9-32.6 Nm).

NOTE

Always connect breather tubes. Loose or detached tubes will vent crankcase gases into the atmosphere. This violates legal emissions standards.

2. Insert two breather tubes (9) into the holes in the filter element. Place the element back into position and attach breather tubes to breather bolts.
3. Install air filter element (6) and bracket (5).
   a. Make sure gasket (7) holes are aligned with backplate holes.
   b. Use three TORX screws (4) to secure bracket and filter element. Tighten to 40-60 in-lbs (4.5-6.8 Nm).
4. Install air filter cover (2).
   a. Apply a drop of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to threads of air cleaner cover screw (1).
   b. Install screw to secure air cleaner cover. Tighten to 36-60 in-lbs (4.1-6.8 Nm).
BACKPLATE ASSEMBLY: HDI MODELS

See Figure 4-2. HDI models have unique backplates. These parts may be distinguished by:

- A different intake with a solenoid-operated trap door assembly at the mouth of the intake.
- An intake solenoid connector (2) on the backplate.

Perform the same routine maintenance on HDI models, but also check that the trap door in the backplate operates properly.

Figure 4-2. Backplate: HDI Models
PURGING FUEL SUPPLY LINE

1. Remove seat.

**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)

2. Remove instrument console from fuel tank, but do not disconnect console wiring at this time.
   a. All but FXSB: see Figure 4-3. Remove acorn nut (1) and washer (2) on instrument console to separate console from fuel tank.
   b. FXSB: see 4.7 CONSOLE: FXSB.

3. Purge the fuel supply line of high pressure gasoline.
   a. See Figure 4-4. Unplug fuel pump module connector [96].
   b. Start the engine and allow the vehicle to run.
   c. When the engine stalls, operate the starter for 3 seconds to remove any remaining fuel from the fuel lines.

DISCONNECTING FUEL SUPPLY LINE

**WARNING**

Gasoline can drain from quick-connect fitting when removing fuel line. 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. (00267a)

See Figure 4-5. Pull up on chrome sleeve of quick-connect fitting (1) and pull down on fuel supply line (2) to disconnect.

Figure 4-3. Instrument Console

Figure 4-4. Fuel Pump Module Connector (Typical)

Figure 4-5. Fuel Supply Line Fitting
FUEL PRESSURE TEST

GENERAL

The fuel pump delivers fuel through the fuel line to a cavity in the induction module. This cavity supplies the fuel injectors.

The fuel pressure regulator is located in the fuel tank. Excess fuel pressure is bypassed into the fuel tank.

Improper fuel system pressure may cause 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

See the electrical diagnostic manual for further information on the function and testing of the fuel system.

TESTING

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-41182</td>
<td>FUEL PRESSURE GAUGE</td>
</tr>
<tr>
<td>HD-44061</td>
<td>FUEL PRESSURE GAUGE ADAPTER</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrument console acorn nut</td>
<td>30-50 in-lbs</td>
</tr>
</tbody>
</table>

The fuel pressure gauge allows for fuel injector and fuel system pressure diagnosis. A special adapter allows the gauge to be attached to the external fuel supply line.

NOTE

Avoid crimping of fuel line when installing/removing fuel pressure gauge and adapter.

1. Purge and disconnect fuel supply line. See 4.4 FUEL SUPPLY LINE.

NOTE

The next step requires two fuel pressure gauge adapters. Failure to use two adapters will cause the fuel line to twist. This may result in a damaged fuel line or fuel line fitting.

2. Attach fuel line to gauge assembly.
   a. See Figure 4-6. Install a second adapter in series with the first.
   b. See Figure 4-7. Pull up on chrome sleeve of quick-connect fitting. Insert neck of FUEL PRESSURE GAUGE ADAPTER (Part No. HD-44081) into fuel supply line.
   c. While pushing up on bottom of adapter, pull down on chrome sleeve until it “clicks” into the locked position. Tug on adapter to be sure that it will not come free.
   d. See Figure 4-8. In the same manner, install neck of second fuel supply line fitting into quick-connect fitting on fuel tank. Tug on fuel supply line to be sure that it will not come free.

WARNING

To 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. (062868a)

3. Verify that the fuel valve and air bleed petcock on the FUEL PRESSURE GAUGE (Part No. HD-41182) are closed.

4. See Figure 4-6. Remove protective cap from free end of fuel pressure gauge adapter. Connect fuel pressure gauge to Schroeder valve.

5. Connect fuel pump module connector [85].

6. Install instrument console on fuel tank.
   a. All but FXSB: Attach acorn nut and washer to secure instrument console to fuel tank. Tighten to 30-50 in-lbs (3.4-5.7 Nm).
   b. FXSB: see 4.7 CONSOLE; FXSB.

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. 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 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 fuel pressure gauge reading is not within specifications, 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 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 the adapter. Install protective cap over Schroeder valve.
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 4-7. Fuel Line**

**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 sleeve of quick-connect fitting and remove fuel supply line from fuel pressure gauge adapter. Release adapter from fuel tank in the same manner.

**WARNING**

To 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 sleeve of quick-connect fitting. Insert neck of fuel supply line fitting. Push up on bottom of fuel supply line fitting and pull down on sleeve until it "clicks" into the locked position. Tug on fuel supply line to verify it is secure.

14. Clear any DTC that was set due to running the engine with fuel pump module connector [86] disconnected.

**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. (00670b)

15. Install seat.
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)

**WARNING**

Do not use solvents or other products that contain chlorine on plastic fuel system components. Chlorine can degrade plastic fuel system components, which can cause a loss of fuel system pressure or engine stalling and could result in death or serious injury. (000621b)

The fuel tank is treated to resist rusting. However, long term storage requires special treatment, see 1.22 STORAGE.

For information on the tank-mounted fuel gauge, see the electrical diagnostic manual and 7.25 FUEL GAUGE.

REMOVAL

**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 and disconnect fuel supply line. See 4.4 FUEL SUPPLY LINE.

**WARNING**

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. Remove main fuse.

3. Disconnect instrument console wiring.

**WARNING**

Gasoline can drain from the crossover 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. (00259a)

4. Drain fuel tank.
   a. Obtain a short section of hose (5½ inch I.D.), insert boll in one end of hose and install hose clamp to verify that end is securely plugged.
   b. Cut clamp from one end of crossover hose. Quickly replace crossover hose on fuel tank fitting with open end of short hose while directing flow of gasoline from free end of crossover hose into suitable container.

5. Remove fuel tank.
   a. See Figure 4-10, Remove the rear T40 TORX screw and washer (7).
   b. Remove the acorn nut (6), washers (2), and front mounting screw (1).
   c. Remove continuous vent line (12) from nipple on fuel tank tcp plate.
   d. All but FXSB: See Figure 4-9, Disconnect fuel gauge connector (3) and remove from clip.
   e. See Figure 4-10. Remove fuel tank. Remove rubber trim (13) to access connectors along frame. Remove bushings and grommets (3) if necessary.

![Figure 4-9. Under Fuel Tank Left Side](image-url)
CLEANING AND INSPECTION

1. Remove fuel pump. See 4.16 FUEL PUMP AND FUEL GAUGE SENDING UNIT.

2. Clean the tank interior with commercial cleaning solvent or a soap and water solution. Shake the tank to agitate the cleaning agent.

3. Flush the tank thoroughly after cleaning and allow it to air dry.

4. Inspect the interconnect lines, evaporative emissions system vent line (California models) and fuel line for cuts, cracks or holes. Replace lines as needed.

5. Inspect the tank for leaks and other damage. Repair or replace as necessary.

6. Install fuel pump. See 4.16 FUEL PUMP AND FUEL GAUGE SENDING UNIT.
### INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel tank screw, rear</td>
<td>18-22 ft-lbs</td>
</tr>
<tr>
<td>Fuel tank screw, front</td>
<td>28-32 ft-lbs</td>
</tr>
<tr>
<td>Instrument console acorn nut</td>
<td>30-50 in-lbs</td>
</tr>
</tbody>
</table>

1. See Figure 4-10. Install continuous vent line (12) to nipple on fuel tank top plate. Make sure vent line runs along right side of frame backbone under rubber trim (13).

2. All but FXSB: see Figure 4-9. Connect the fuel gauge connector (3) and secure under clip.

3. Attach tank mounts:
   a. See Figure 4-10. Place a washer (2) over front screw (1). Starting on left side, loosely install screw and washer through tank, bushings and grommets (3) and frame. Place washer (2) and acorn nut (6) on right side.
   b. See Figure 4-11. Verify that rubber grommet (5) and metal insert (6) are protruding through frame (4). Metal insert has flats on bottom for positioning. Place rubber ring (3) around grommet/insert and lower fuel tank tab (2).
   c. Install washer and rear screw (1) through fuel tank tab. Tighten to 18-22 ft-lbs (24.4-29.8 Nm).
   d. Tighten the front screw to 28-32 ft-lbs (38.0-43.4 Nm).

4. See Figure 4-10. Connect crossover line (5) with new clamps (4).

5. Connect fuel supply line.

6. Connect fuel pump module connector [96].

7. Install instrument console wiring:
   a. All but FXSB: Install instrument console with acorn nut and washer. Tighten to 30-50 in-lbs (3.4-5.7 Nm).
   b. FXSB: see 4.7 CONSOLE: FXSB.

8. Install fuel pump.


10. Clear any DTC that was set due to running the engine with fuel pump module connector [86] disconnected.

### 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)

11. Install seat.

![Figure 4-11. Rear Tank Screw](image)

**Figure 4-11. Rear Tank Screw**

1. T40 TORX screw and washer
2. Fuel tank tab
3. Rubber ring
4. Frame
5. Rubber grommet
6. Metal insert for grommet
REMOVAL

1. Remove seat.

WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. See Figure 4-12. Remove trim insert (1) from console (2).
3. Remove nut (3) from front of console.
4. Remove fastener (4) and washer (5) from rear of console.

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel tank. screw, rear, FXSB</td>
<td>18-22 ft-lbs 24.4-29.8 Nm</td>
</tr>
<tr>
<td>Console mounting nut, FXSB</td>
<td>30-50 in-lbs 3.4-5.7 Nm</td>
</tr>
</tbody>
</table>

NOTE

Be sure front console fastener (6) is installed in bracket in fuel tank.

1. Place console on fuel tank.
2. See Figure 4-12. Install washer (5) and screw (4) to rear of console. Tighten screw to 18-22 ft-lbs (24.4-29.8 Nm).
3. Install nut on front of console. Tighten to 30-50 in-lbs (3.4-5.7 Nm).
4. Install trim insert (1) on console (2).

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)
THROTTLE POSITION SENSOR (TPS)

GENERAL

See the electrical diagnostic manual for information on the function and testing of the throttle position sensor (TPS).

REMOVAL

1. Remove seat.

WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. Remove main fuse.

3. Remove air cleaner assembly. See 4.3 AIR CLEANER ASSEMBLY.

4. See Figure 4-13. Unplug TP sensor connector [88].

5. Remove two fasteners to detach TP sensor from throttle body. Discard fasteners.

![Figure 4-13. Throttle Position Sensor](image)

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throttle position sensor</td>
<td>18 in-lbs</td>
</tr>
<tr>
<td>fasteners</td>
<td>2.0 Nm</td>
</tr>
</tbody>
</table>

NOTE

Close throttle for proper installation of throttle position sensor.

1. See Figure 4-14. Replace O-ring (2) if necessary.

2. Fit pocket (3) of throttle position sensor over throttle shaft while engaging index pin (1) with hole on machined flange of induction module.

3. Install two new fasteners (4) to fasten throttle position sensor to induction module. Tighten to 18 in-lbs (2.0 Nm).

4. Using the throttle lever mechanism, open and close the throttle plates to check for proper operation. Be sure that the mechanism operates smoothly without binding or sticking.

5. Connect TP sensor connector [88].

6. Install air cleaner assembly. See 4.3 AIR CLEANER ASSEMBLY.

7. Install main fuse.

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)

8. Install seat.

![Figure 4-14. Throttle Position Sensor Installation](image)
GENERAL

See the electrical diagnostic manual for information on the function and testing of the intake air temperature sensor (IAT sensor).

REMOVAL

1. Remove seat.

WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. Remove main fuse.

3. Remove air cleaner backplate. See 4.3 AIR CLEANER ASSEMBLY.

4. See Figure 4-15. Unplug IAT sensor connector [89].

5. Remove fastener to detach IAT sensor. Discard fastener.

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intake air temperature sensor (IAT)</td>
<td>15-20 in-lbs</td>
</tr>
</tbody>
</table>

1. See Figure 4-16. Inspect O-ring (1) in groove of intake air temperature sensor for cuts, tears or signs of deterioration. Install new O-ring if necessary.

2. See Figure 4-15. Insert sensor into induction module with electrical connector facing toward the left side of the motorcycle.

3. See Figure 4-16. Install fastener (2) and tighten to 15-20 in-lbs (1.7-2.3 Nm).

4. Connect IAT sensor connector [89].

5. Install air cleaner assembly. See 4.3 AIR CLEANER ASSEMBLY.

6. Install main fuse.

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)

7. Install seat.

Figure 4-15. Intake Air Temperature Sensor Location

Figure 4-16. Intake Air Temperature Sensor
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)

See the electrical diagnostic manual for information on the function and testing of the engine temperature sensor (ET sensor).

REMOVAL

1. Purge and disconnect fuel supply line. See 4.4 FUEL SUPPLY LINE.

WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. Remove main fuse.

NOTE

On some models, removing horn may simplify procedure.

3. See Figure 4-17. Pull back boot to reveal ET sensor at back of front cylinder.

4. Unplug ET sensor connector [90] by pulling external latch outward and using rocking motion to remove.

5. See Figure 4-18. Loosen ET sensor using socket. When sensor starts to turn easily, finish removing by hand.

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine temperature (ET) sensor</td>
<td>120-180 in-lbs</td>
</tr>
<tr>
<td></td>
<td>13.6-20.3 Nm</td>
</tr>
<tr>
<td>Instrument console acorn nut</td>
<td>30-50 in-lbs</td>
</tr>
<tr>
<td></td>
<td>3.4-5.7 Nm</td>
</tr>
</tbody>
</table>

1. Hand start new ET sensor into cylinder head bore 2-3 turns.
2. Tighten sensor to 120-180 in-lbs (13.6-20.3 Nm).
3. Connect ET sensor connector [90].
4. Pull boot over connector.
5. Install fuel supply line.

6. Connect fuel pump module connector [86].
7. Install instrument console.
   a. All but FXSB: Install acorn nut and washer. Tighten acorn nut to 30-50 in-lbs (3.4-5.7 Nm).
   b. FXSB: see 4.7 CONSOLE: FXSB.
8. Install main fuse.
9. Clear any DTC that was set due to running the engine with fuel pump module connector [86] disconnected.

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)

10. Install seat.

Figure 4-17. Engine Temperature Sensor

Figure 4-18. Engine Temperature Sensor Removal
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. Gain access to the induction module by removing fuel tank mounting fasteners and fuel line. Carefully pivot tank upward and prop in position. See 4.6 FUEL TANK.

2. Loosen cable adjusters on throttle cables.

3. Remove air cleaner backplate. See 4.3 AIR CLEANER ASSEMBLY.

4. See Figure 4-19. Pull purge hose from fitting (5) at top of induction module (California and select models only).

5. See Figure 4-20. Pull idle cable barrel (1) from upper hole in throttle wheel. Pull throttle cable barrel (2) from lower hole. Using slots, release idle and throttle cables from guides in throttle cable bracket.

6. See Figure 4-19. Remove idle air control connector [87] (3) and manifold absolute pressure sensor connector [80] (7).

7. Remove front fuel injector connector [84] (1) and rear fuel injector connector [85] (8).

8. Remove throttle position sensor connector [86] (4) and intake air temperature sensor connector [89] (6).

9. On left side of vehicle, loosen two screws holding front and rear mounting flanges (9, 11) to cylinder head.

10. On right side of vehicle, remove two screws holding front and rear mounting flanges to cylinder head. Remove induction module.

11. MAP sensor [80]

12. Rear fuel injector [85]

13. Rear mounting flange

14. Fuel supply tube

15. Front mounting flange

16. Purge hose fitting (not used)

Figure 4-19. Induction Module

WARNING

Gasoline can drain from the fuel line when disconnected from induction module. 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. (00269a)
11. See Figure 4-21. If replacing fuel supply line (2), squeeze ends of tab (1) and pull tab away from fuel supply line to release from fuel supply tube (3).


3. See Figure 4-21. Slide fuel supply line (2) onto fuel supply tube (3). Push in on tab until it locks the fuel supply line (2) on fuel supply tube (3). Tug on fuel supply line (2) to verify that it is locked in place.

4. See Figure 4-20. Install sleeve on throttle cable housing into cable guide at top of throttle cable bracket (4).

5. Drawing throttle cable downward, fit barrel end (2) into lower hole in throttle wheel (3).

6. Install sleeve and spring on idle cable housing into cable guide at bottom of throttle cable bracket. Insert barrel end (1) into upper hole in throttle wheel.

7. Adjust throttle cables. See 1.13 THROTTLE CABLES.

8. See Figure 4-19. On California and select models, attach purge hose to fitting (5) on throttle body.

9. Connect front (1) and rear (8) fuel injector connectors, IAC (3) connector, MAP sensor (7) connector, TP sensor (4) connector and IAT (6) sensor connector.

10. Install air cleaner backplate. See 4.3 AIR CLEANER ASSEMBLY.

11. Tighten manifold mounting screws to an initial torque of 16-20 in-lbs (1.8-2.3 Nm).

12. Tighten manifold mounting screws to a final torque of 96-156 in-lbs (10.9-17.6 Nm).

13. Turn the Ignition/Light Key Switch to ON and then back to OFF to reset idle air control to park position.


15. Install fuel tank. See 4.6 FUEL TANK.

**INSTALLATION**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manifold mounting screws, 1st torque</td>
<td>16-20 in-lbs 1.8-2.3 Nm</td>
</tr>
<tr>
<td>Manifold mounting screws, final torque</td>
<td>96-156 in-lbs 10.9-17.6 Nm</td>
</tr>
</tbody>
</table>

1. See Figure 4-19. Place a new seal in each manifold flange (9, 11) with the beveled side in against the counterbore.

**NOTE**

When induction module is positioned on manifold mounting screws, verify that the mounting flanges are correctly installed on the manifold. Verify that the rubber seals are in place.

2. Place intake manifold seal, flanges and induction module in position. Install the manifold mounting screws finger-tight.

---

**Figure 4-20. Throttle/Idle Cables**

**Figure 4-21. Fuel Supply Line**
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)

See electrical diagnostic manual for information on the function and testing of the idle air control (IAC).

REMOVAL

1. Remove induction module. See 4.11 INDUCTION MODULE.
2. See Figure 4-22. Remove two fasteners (2) to release throttle cable bracket (1) from induction module. Discard fasteners.
3. See Figure 4-23. Pull IAC (1) and O-ring (2) from throttle body.

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throttle cable bracket fasteners</td>
<td>20-35 in-lbs 2.3-4.0 Nm</td>
</tr>
</tbody>
</table>

1. See Figure 4-23. Apply clean engine oil to IAC O-ring (2). Install O-ring in counterbore of induction module.
2. With the electrical connector facing the rear left side of the induction module, install idle air control into bore.
3. Place idle air control and O-ring into throttle body. Be sure O-ring is properly seated in throttle body groove.
4. See Figure 4-24. Insert index pin (2) at bottom of throttle cable bracket (1) into hole in boss at top of induction module.
5. See Figure 4-22. Install new throttle cable bracket fasteners (2). Tighten to 20-35 in-lbs (2.3-4.0 Nm).
6. Install induction module. See 4.11 INDUCTION MODULE.
REMOVAL
1. Remove induction module. See 4.11 INDUCTION MODULE.

2. See Figure 4-25. Remove two fasteners (2) to release throttle cable bracket (1) from induction module. Discard fasteners.

3. Gently push up on MAP sensor and attached seal to remove from intake manifold.

![Diagram of throttle cable bracket and MAP sensor](sw17019)

1. Throttle cable bracket
2. Fastener (2)
3. Manifold Absolute Pressure Sensor (MAP)

Figure 4-25. Throttle Cable Bracket Location

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throttle cable bracket fasteners</td>
<td>20-35 in-lbs</td>
</tr>
</tbody>
</table>

**NOTE**

See Figure 4-25. Prior to installing the original sensor, inspect the seal (1). Worn or damaged seals could cause vacuum leaks. Install new seal if necessary.

1. Push MAP sensor and seal into intake manifold.

2. With the electrical connector facing toward the rear of the induction module (side opposite throttle wheel), insert MAP sensor into hole in induction module.

3. See Figure 4-24. Insert index pin (2) at bottom of throttle cable bracket into hole in boss at top of induction module.

4. See Figure 4-25. Install new throttle cable bracket fasteners (2). Tighten to 20-35 in-lbs (2.3-4.0 Nm).

5. Install induction module. See 4.11 INDUCTION MODULE.

![Diagram of MAP sensor](sw02500)

1. Seal
2. MAP sensor

Figure 4-26. MAP Sensor
GENERAL
See the electrical diagnostic manual for information on the function and testing of the heated oxygen sensor (HO2).

REMOVAL

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRX181</td>
<td>OXYGEN SENSOR SOCKET</td>
</tr>
<tr>
<td>HD-50652</td>
<td>OXYGEN SENSOR SOCKET</td>
</tr>
</tbody>
</table>

Front O2 Sensor

NOTE
See Figure 4-27. The O2 sensors are installed in threaded bosses on the inboard side of front and rear exhaust pipes.
1. Remove fasteners securing voltage regulator bracket to crankcase.
2. See Figure 4-28. Disconnect front O2 sensor connector (1).
3. Use OXYGEN SENSOR SOCKET (Part No. HD-50652) to remove front O2 sensor.

Rear O2 Sensor
1. Remove seat.
2. Remove battery.
3. See Figure 4-29. Disconnect rear O2 sensor connector (1).
4. Use OXYGEN SENSOR SOCKET (Part No. FRX181) to remove rear O2 sensor.

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen sensor, front</td>
<td>14.0 ft-lbs</td>
</tr>
<tr>
<td></td>
<td>19.0 Nm</td>
</tr>
<tr>
<td>Voltage regulator bracket</td>
<td>70-100 in-lbs</td>
</tr>
<tr>
<td>fasteners</td>
<td>7.9-11.3 Nm</td>
</tr>
<tr>
<td>Oxygen sensor, rear</td>
<td>14.0 ft-lbs</td>
</tr>
<tr>
<td></td>
<td>19.0 Nm</td>
</tr>
</tbody>
</table>

NOTES
- Do not install sensors that have been dropped or impacted by other components. Damage to the sensing element may have occurred.
- Replacement sensor assemblies have threads coated with ANTI-SEIZE LUBRICANT and new seal rings.
- If O2 sensor will be reused, replace the gasket. Use a high-quality professional grade side cutter for gasket removal. Make sure larger side of new gasket faces exhaust.
- If O2 sensor will be reused, apply a thin coat of ANTI-SEIZE LUBRICANT to threads of each oxygen sensor prior to installing in header. Do not use any other grease or sealant product on sensor threads.
- The electrical connector must be clean and free of any dielectric grease.

Front O2 Sensor
1. If reusing oxygen sensor:
   a. Remove used seal and install a new one.
   b. Apply a light coating of ANTI-SEIZE LUBRICANT to threads.
2. Thread sensor into threaded boss on exhaust pipe. Tighten to 14.0 ft-lbs (19.0 Nm).
3. See Figure 4-28. Install front oxygen sensor connector (1).
4. Install voltage regulator bracket. Tighten to 70-100 in-lbs (7.9-11.3 Nm).

Rear O2 Sensor
1. If reusing oxygen sensor:
   a. Remove used seal and install a new one.
   b. Apply a light coating of ANTI-SEIZE LUBRICANT to threads.
2. Thread sensor into threaded boss on exhaust pipe and tighten to 14.0 ft-lbs (19.0 Nm).
3. See Figure 4-29. Install rear oxygen sensor connector (1) and place harness in battery caddy clip (2).
4. Install battery.
5. Install seat.
1. Front oxygen sensor connector
2. Crank position sensor connector
3. Stator connector lock
4. Crank position sensor connector stud
5. Voltage regulator connector lock
6. Jiffy stand interlock connector

Figure 4-28. Voltage Regulator Connectors

1. Rear oxygen sensor connector
2. Battery caddy clip

Figure 4-29. Rear O2 Sensor Connector
FUEL INJECTORS

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)

**WARNING**

Do not use solvents or other products that contain chlorine on plastic fuel system components. Chlorine can degrade plastic fuel system components, which can cause a loss of fuel system pressure or engine stalling and could result in death or serious injury. (000621b)

See the electrical diagnostic manual for information on the function and testing of the fuel injectors.

REMOVAL

1. Remove induction module. See 4.11 INDUCTION MODULE.

   **NOTE**
   
   If not replacing fuel supply tube or O-rings, do not remove.

2. See Figure 4-30. Remove fastener (1) retaining fuel supply tube (2).


4. See Figure 4-31. With a rocking motion, pull fuel injectors with attached fuel rail from the induction module.

5. See Figure 4-32. Remove spring clips (2) from fuel injectors. Pull fuel injectors from fuel rail. To overcome the resistance of the top O-ring, gently rock each fuel injector while pulling.


INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel supply tube fastener</td>
<td>90-110 in-lbs</td>
</tr>
</tbody>
</table>

1. See Figure 4-32. Apply a thin coat of clean engine oil to new fuel injector O-rings (1). Install on fuel injectors.

2. See Figure 4-31. Push electrical connector side of fuel injectors into fuel rail.

3. With the concave side toward the fuel rail, install spring clip into slot on fuel injector. In the installed position, openings (3) in sides of clip engage lip (2) on fuel rail, while fork (1) at back of clip captures rail tab (4) on fuel injector.
4. Rotate fuel injectors, so that the electrical connectors are on the outboard side. Push fuel injectors into induction module bores until tab on fuel rail engages machined slot at top of induction module.

5. See Figure 4-30. Slide new O-ring (3) down shorter neck of the fuel supply tube until it contacts the collar. Slide new sealing washer (4) down tube until it contacts O-ring. Install second O-ring (3) in fuel rail bore.

6. Push fuel supply tube (2) into fuel rail bore until clamp is seated on round step of fuel rail. Install fastener (1) and tighten to 90-110 in-lbs (10.2-12.4 Nm).

7. Install induction module. See 4.11 INDUCTION MODULE.

Figure 4-32. Fuel injector

1. O-rings
2. Spring clip
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)

**WARNING**

Do not use solvents or other products that contain chlorine on plastic fuel system components. Chlorine can degrade plastic fuel system components, which can cause a loss of fuel system pressure or engine stalling and could result in death or serious injury. (000621b)

See the electrical diagnostic manual for information on the function and testing of the fuel pump.

REMOVAL

1. Purge and disconnect fuel supply line. See 4.4 FUEL SUPPLY LINE.

2. Disconnect console wiring.

**WARNING**

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

3. Remove main fuse

4. Drain fuel tank.
   a. Obtain a short section of hose (5/16 inch I.D.). Insert bolt in one end of hose and install hose clamp to verify that end is securely plugged.
   b. See Figure 4-33. Cut clamp (1) from one end of crossover hose (2). Quickly replace crossover hose on fuel tank fitting with open end of short hose while directing flow of gasoline from free end of crossover hose into suitable container.

5. Remove screws securing top plate to fuel tank. Discard screws.

6. See Figure 4-34. Pull top plate out of fuel tank enough to expose fuel hoses (1, 3).

7. Disconnect hoses (1, 3) from filter housing (2).

**WARNING**

Do not replace the special Teflon coated fuel pump wiring with ordinary bulk wire. Ordinary insulation materials can deteriorate when put in contact with gasoline and cause an explosion, which could result in death or serious injury. (00566b)

8. See Figure 4-35. Disconnect electrical connectors (2-4). Move top plate with filter and regulator out of the way.

9. See Figure 4-36. Pull up on bracket (2) and slide forward. Remove fuel pump assembly (1) from fuel tank.

   **NOTE**

   Do not bend float rod of fuel level sender. A bent float rod will result in erroneous gauge readings.

10. See Figure 4-37. Pull out and up on fuel sending unit and remove from fuel tank.

---

Figure 4-33. Crossover Hose
VAPOUR VALVE

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vapor valve bracket nut</td>
<td>120-144 in-lbs</td>
</tr>
<tr>
<td></td>
<td>13.6-16.3 Nm</td>
</tr>
</tbody>
</table>

1. See Figure 4-38. Remove nut.
2. Pull bracket with vapor valve from fuel tank.
3. See Figure 4-39. Cut clamp (1) and remove hose from vapor valve (2).
5. Attach hose to vapor valve and secure with new hose clamp.
6. See Figure 4-38. Install bracket with nut. Tighten to 120-144 in-lbs (13.6-16.3 Nm).
**DISASSEMBLY AND ASSEMBLY**

**Fuel Filter**
1. See Figure 4-40. Remove retainer clip (1).
2. Separate filter manifold (2) from fuel filter housing.
3. See Figure 4-41. Remove O-ring (1) and fuel filter (2).
4. Install new fuel filter.
5. Install new O-ring.
6. See Figure 4-40. Install filter manifold (2) and retainer clip (1).

**Regulator**
1. See Figure 4-42. Remove retaining clip (1).
2. Remove regulator (2).
3. See Figure 4-43. Check seal (3), O-rings (4, 6), and screen (5) for damage. Replace if necessary.
4. Install O-ring (4) in regulator housing outlet port (1).
5. Install screen (5) with inner shoulder facing O-ring (4).
6. Install O-ring (6) in regulator housing.
7. Place seal (3) on regulator (2) with shoulder facing away from regulator.
8. See Figure 4-42. Place regulator in housing and secure with retaining clip (2).
Inlet sock

1. See Figure 4-44. Press tabs (2) securing inlet sock (1) to upper retainer (3).
2. Remove inlet sock from upper retainer.

NOTE
See Figure 4-45. In next step, be sure inlet sock (2) engages fuel pump inlet (1).
3. See Figure 4-44. Install inlet sock (1) on upper retainer (3). Be sure tabs (2) engage slots in body.

Fuel Pump

1. Disconnect electrical harness from fuel pump.
2. Remove mounting bracket.
3. See Figure 4-44. Remove fuel sock.
4. See Figure 4-46. Press tabs (3) and remove lower retainer (2) from upper retainer (1).
5. See Figure 4-47. Remove upper isolator (1) from fuel pump and replace pump.
6. Install upper isolator (1) onto fuel pump.
7. Install fuel pump into upper retainer.
8. Make sure lower isolator (3) is properly positioned in lower retainer. Groove in lower retainer (2) should be visible with lower isolator installed.
9. See Figure 4-46. Install lower retainer.
10. See Figure 4-44. Install fuel sock.
11. Install mounting bracket onto upper retainer.
12. Connect wiring harness to fuel pump.
1. Upper isolator
2. Groove in lower retainer
3. Lower isolator

**Figure 4-47. Fuel Pump Isolators**

**INSTALLATION**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel pump/fuel gauge sending unit screws</td>
<td>18-24 in-lbs</td>
</tr>
<tr>
<td>Instrument console acorn nut</td>
<td>30-50 in-lbs</td>
</tr>
</tbody>
</table>

**WARNING**

Do not replace the special Teflon coated fuel pump wiring with ordinary bulk wire. Ordinary insulation materials can deteriorate when put in contact with gasoline and cause an explosion, which could result in death or serious injury. (00566b)

**NOTE**

Do not bend float rod of fuel level sender. A bent float rod will result in erroneous gauge readings.

1. See Figure 4-37. Slide fuel sending unit down into welded bracket on right side of fuel tank until it snaps into position.
2. See Figure 4-38. Install fuel pump assembly (1) into fuel tank. Slide bracket (2) rearward into welded bracket until it snaps into place.

**NOTE**

Do not apply any type of sealant to gasket.

3. Install new gasket under top plate.
4. See Figure 4-35. Place top plate with filter housing and regulator on fuel tank. Connect electrical connectors (1-4).
5. See Figure 4-34. Install new O-rings on hoses (1, 3).
6. Attach hoses (1, 3) to filter housing (2).
7. Install top plate on top of fuel tank.
8. See Figure 4-48. Install new screws and tighten using the pattern shown, to 18-24 in-lbs (2.0-2.7 Nm).
9. Connect fuel pump module connector [86].
10. Connect console wiring if present.
11. Install instrument console.
    a. All but FXSB: install instrument console with acorn nut and washer. Tighten to 30-50 in-lbs (3.4-5.7 Nm).
    b. FXSB: see 4.7 CONSOLE. FXSB.
12. See Figure 4-33. Connect crossover hose (2) with new clamps (1).
13. Fill tank with gasoline. Check for leaks.
15. Check fuel system pressure. See 4.5 FUEL PRESSURE TEST.
16. Clear any DTC that was set due to running the engine with fuel pump module connector [86] disconnected.

**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)

17. Install seat.
MUFFLERS: FLSTC, FXST, FXSB

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muffler clamps: FLSTC, FXST, FXSB</td>
<td>38-43 ft-lbs</td>
</tr>
<tr>
<td>Muffler fasteners: FLSTC, FXST, FXSB</td>
<td>96-120 in-lbs</td>
</tr>
</tbody>
</table>

Removal

1. See Figure 4-49. Apply penetrating oil to seams of mufflers and exhaust pipes (7, 23).
2. Remove muffler shield clamps (30) to detach muffler shields (29) from mufflers.
3. Remove muffler fasteners (24).
4. Remove and discard muffler clamps (3) to separate mufflers from exhaust pipes (7, 23).
5. Slide mufflers rearward off of pipes.

Assembly

1. Install new muffler clamps (3) to attach front (28) and rear (1) mufflers to exhaust pipes. Tighten clamps to 38-43 ft-lbs (51.6-53.4 Nm).
2. Install muffler fasteners (24). Tighten to 96-120 in-lbs (10.9-13.6 Nm).
3. Open muffler shield clamps (30) and install the muffler shields (29). Position clamps so the screws are on the outboard side in the most accessible position.

SYSTEM: FLSTC, FXST, FXSB

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exhaust interconnect clamp: FLSTC, FXST, FXSB</td>
<td>25-30 ft-lbs</td>
</tr>
<tr>
<td>Exhaust manifold clamp lower nut, 1st torque: FLSTC, FXST, FXSB</td>
<td>9-18 in-lbs</td>
</tr>
<tr>
<td>Exhaust manifold clamp upper nut: FLSTC, FXST, FXSB</td>
<td>100-120 in-lbs</td>
</tr>
<tr>
<td>Exhaust manifold clamp lower nut final torque: FLSTC, FXST, FXSB</td>
<td>100-120 in-lbs</td>
</tr>
<tr>
<td>Exhaust system interconnect tube fasteners: FLSTC, FXST, FXSB</td>
<td>20-25 ft-lbs</td>
</tr>
</tbody>
</table>

Removal

1. Disconnect O2 sensor wiring. See 4.14 OXYGEN (O2) SENSOR.
2. See Figure 4-49. Remove heat shields (9, 22) by opening exhaust shield clamps (21).
3. Remove nuts (16) from front and rear cylinder head exhaust studs.
4. Remove two locknuts (25) attaching interconnect tube assembly (26) to frame.
5. Remove exhaust system as an assembly. Disengage rear pipe from port, then front pipe. Replace interconnect gaskets (27) and clamps (31) any time the connections are disassembled.

Installation

NOTE
Replacement cylinder head exhaust port gaskets (17) are tapered internally. Be sure the tapered side is facing exhaust pipes. Also check condition of retaining ring (18) before installation.

1. If either exhaust tube was removed from the interconnect tube, replace exhaust interconnect gasket (27) and exhaust interconnect clamp (31). Tighten new clamp to 25-30 ft-lbs (33.9-40.7 Nm).
2. Install new gaskets in both the front and rear cylinder heads with the tapered side facing exhaust pipes.
3. Position ends of exhaust pipes into front, then rear cylinder head exhaust ports placing holes in exhaust manifold clamp (19) over cylinder head exhaust studs. Loosely thread on flange nuts (16).
4. Loosely install locknuts (25) to attach interconnect tube assembly (26) to frame.
5. Tighten nuts (16) at cylinder studs as follows:
   a. Install upper nut and tighten finger-tight.
   b. Install lower nut and tighten to 9-18 in-lbs (1.0-2.0 Nm).
   c. Tighten upper nut to 100-120 in-lbs (11.3-13.6 Nm).
   d. Tighten lower nut to 100-120 in-lbs (11.3-13.6 Nm).
6. Align exhaust system and tighten all nuts and bolts; beginning at cylinder head exhaust ports and working backwards. Tighten interconnect fasteners to 20-25 ft-lbs (27.1-33.9 Nm).
7. Open the muffler shield clamps (21) and install front and rear heat shields (9, 22).
8. Connect O2 sensor wiring. See 4.14 OXYGEN (O2) SENSOR.
1. Rear muffler, typical (FLSTC shown)
2. Active exhaust cable
3. Muffler clamp (2)
4. Bellcrank
5. Cable retainer
6. Ferrule
7. Rear exhaust pipe
8. Rear oxygen sensor
9. Rear exhaust shield
10. Cable housing
11. Ferrule
12. Fastener
13. Active exhaust module
14. Active exhaust module bracket
15. Spacer stud (2)
16. Nut (4)

17. Exhaust port gasket (2)
18. Exhaust gasket retaining ring (2)
19. Exhaust manifold clamp (2)
20. Front oxygen sensor
21. Exhaust shield clamp (4)
22. Front exhaust shield
23. Front exhaust pipe
24. Fastener
25. Locknut (2)
26. Interconnect tube assembly
27. Exhaust interconnect gasket (2)
28. Front muffler, typical (FLSTC shown)
29. Muffler shield (2 on HDI vehicles)
30. Muffler shield clamp (2, 4 on HDI vehicles)
31. Exhaust interconnect clamp (2)

Figure 4-49. Exhaust System: FXST, FLSTC, FXSB
MUFFLERS: FLSTN, FLSTF/B, FLST

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muffler clamp: FLSTN, FLSTF/B, FLST</td>
<td>38-43 ft-lbs</td>
</tr>
<tr>
<td>Exhaust pipe clamp locknut: FLSTN, FLSTF/B, FLST</td>
<td>20-25 ft-lbs</td>
</tr>
<tr>
<td>Muffler support fastener: FLSTN, FLSTF/B, FLST</td>
<td>96-120 in-lbs</td>
</tr>
</tbody>
</table>

Removal
1. See Figure 4-50. Loosen clamps (21).
2. Apply penetrating oil to seams of mufflers and exhaust pipe (2).
3. Loosen flange locknut (12) on carriage bolt (17).
4. Remove muffler fasteners (29) to detach mufflers from muffler support (30).
5. Remove muffler shield clamps (23) to detach muffler shields (22, 26) from mufflers.

Assembly
1. See Figure 4-50. Place new clamps (21) over exhaust pipe (2).
3. Loosely attach mufflers to muffler support (30) using muffler fasteners (29).
4. Loosely install flange locknut (12) on carriage bolt (17).
5. Tighten all muffler fasteners.
   a. Tighten muffler clamps to 38-43 ft-lbs (51.6-58.4 Nm).
   b. Tighten flange locknut (12) on carriage bolt (17) to 20-25 ft-lbs (27.1-33.9 Nm).
   c. Tighten muffler support fasteners to 96-120 in-lbs (10.9-13.6 Nm).
6. Open muffler shield clamps (23) and install the muffler shields (22, 26). Position clamps so the screws are on the outboard side in the most accessible position.

SYSTEM: FLSTN, FLSTF/B, FLST

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exhaust manifold clamp lower nut, 1st torque: FLSTN, FLSTF/B, FLST</td>
<td>9-18 in-lbs</td>
</tr>
<tr>
<td>Exhaust manifold clamp upper nut: FLSTN, FLSTF/B, FLST</td>
<td>100-120 in-lbs</td>
</tr>
<tr>
<td>Exhaust manifold clamp lower nut, final torque: FLSTN, FLSTF/B, FLST</td>
<td>100-120 in-lbs</td>
</tr>
<tr>
<td>Exhaust carriage bolt flange locknut: FLSTN, FLSTF/B, FLST</td>
<td>20-25 ft-lbs</td>
</tr>
</tbody>
</table>

Removal
1. Disconnect O2 sensor wiring. See 4.14 OXYGEN (O2) SENSOR.
2. Remove two bolts and nuts to detach right side footboard from mount.
3. See Figure 4-50. Detach heat shields (1, 10, 13, 14, 15) from exhaust pipe (2) by removing clamps (9).
4. Remove all four exhaust header nuts (7).
5. Loosen flange locknut (12) from carriage bolt (17). Slide exhaust pipe clamp (16) from the exhaust bracket (11).
6. Remove two locknuts (27) and bolt (28) to detach exhaust system from frame.

Installation

NOTE
See Figure 4-50. Replacement cylinder head exhaust port gaskets (4) are tapered internally. Be sure the tapered side is facing exhaust pipes. Also check condition of retaining ring (5) before installation.
1. Install new gaskets (4) in both the front and rear cylinder heads with the tapered side facing exhaust pipes.
2. Position ends of exhaust pipes into front, then rear cylinder head exhaust ports placing holes in exhaust manifold clamp (6) over cylinder head exhaust studs. Loosely thread on flange nuts (7).
3. Loosely attach exhaust system to frame using locknuts (27).
4. Loosely attach exhaust pipe clamp (16) to exhaust bracket (11) using flange locknut (12) and carriage bolt (17).
5. Align exhaust system and tighten all nuts and bolts beginning at cylinder head exhaust ports and working backwards.
   a. Install upper nut and tighten finger-tight.
   b. Install lower nut and tighten to 9-18 in-lbs (1.0-2.0 Nm).
   c. Tighten upper nut to 100-120 in-lbs (11.3-13.6 Nm).
   d. Tighten lower nut to 100-120 in-lbs (11.3-13.6 Nm).
6. Tighten flange locknut (12) on carriage bolt (17) to 20-25 ft-lbs (27.1-33.9 Nm).
7. Open clamps (9) and install heat shields (1, 10, 13, 14, 15).
8. Install right side footboard with two bolts and nuts.
9. Connect O2 sensor wiring. See 4.14 OXYGEN (O2) SENSOR.

1. Rear cylinder exhaust pipe shield
2. Exhaust pipe
3. Rear oxygen sensor
4. Exhaust port gasket (2)
5. Exhaust gasket retaining ring (2)
6. Exhaust manifold clamp (2)
7. Nut (4)
8. Front oxygen sensor
9. Exhaust shield clamp (7)
10. Front exhaust shield
11. Exhaust bracket
12. Flange locknut
13. Crossover heat shield: FLSTFB
14. Front exhaust shield extension: FLSTN
15. Interconnect shield: FLSTN
16. Exhaust pipe clamp
17. Carriage bolt
18. Ferrule
19. Cable retainer
20. Bellcrank
21. Clamp (2)
22. Front muffler shield
23. Muffler shield clamp
24. Rear muffler
25. Rear muffler
26. Rear muffler shield
27. Locknut (2)
28. Muffler support fastener
29. Muffler fastener
30. Muffler support
31. Spacer stud (2)
32. Active exhaust module bracket
33. Active exhaust module
34. Fastener
35. Ferrule
36. Cable housing
37. Active exhaust cable

Figure 4-50. Exhaust System: FLSTFB, FLSTN, FLS
**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. It will cause false readings.
- Be careful when testing vehicle with Screamin' Eagle air cleaner assembly. This type of air cleaner has an open backplate. Even with air cleaner cover on, directing nozzle too close to backplate can give false readings.

**LEAK TESTER**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-41417</td>
<td>PROPANE ENRICHMENT KIT</td>
</tr>
</tbody>
</table>

**Parts List**

- Standard 14 oz propane cylinder.
- PROPANE ENRICHMENT KIT (Part No. HD-41417).

**Tester Assembly**

1. See Figure 4-51. Make sure valve knob (6) is closed (fully clockwise).
2. Install valve assembly (5) onto propane bottle (1).

**Tester Adjustment**

1. See Figure 4-51. Press and hold trigger button (8).
2. Slowly open valve knob (6) until pellet in flow gauge (7) rises 5-10 SCFH on gauge.
3. Release trigger button.

**PROCEDURE**

1. Run motorcycle until engine is at normal operating temperature.

   **NOTE**
   
   Do not direct propane stream toward air cleaner. Propane in the air cleaner creates false indicators.

2. See Figure 4-52. Aim nozzle (3) toward possible sources of leak such as intake manifold mating surfaces.

3. Press and release trigger button (2) to dispense propane. The tone of the engine changes when propane enters source of leak. Repeat as necessary to detect leak.

4. When test is finished, close valve knob (turn knob fully clockwise).

---

Figure 4-51. Leak Tester
1. Propane bottle
2. Trigger button
3. Nozzle

Figure 4-52. Checking for Leaks
Motorcycles sold in some markets are equipped with an evaporative (EVAP) emissions control system. See Figure 4-53. The EVAP system functions as follows:

- The fuel vapor vent tube is connected to the vent tube on the fuel tank top plate. It allows fuel vapors in the fuel tank to be vented to the charcoal canister.

- 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 in the charcoal canister through the purge tube to the induction module. They are then 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. Verify that there is no contact between the tubes and engine parts.

---

1. Fuel tank vent tube
2. Purge solenoid-to-induction module tube
3. Purge solenoid
4. Charcoal canister-to-purge solenoid tube
5. Vent tube-to-charcoal canister tube
6. Charcoal canister

**Figure 4-53. Evaporative Emissions Control System**
CHARCOAL CANISTER

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charcoal canister screws</td>
<td>90-114 in-lbs</td>
</tr>
<tr>
<td></td>
<td>10.2-12.9 Nm</td>
</tr>
</tbody>
</table>

Removal

The EVAP charcoal canister is mounted on the side of the primary chaincase housing.

1. Remove primary chaincase housing. See 5.5 PRIMARY CHAINCASE HOUSING.
2. See Figure 4-53. Note the two hose connections on the canister. After hoses are marked, gently pull hoses off the canister.
3. Remove charcoal canister from primary chaincase housing.

Installation

1. Install charcoal canister to primary chaincase housing with screws. Tighten to 90-114 in-lbs (10.2-12.9 Nm).
2. See Figure 4-53. Attach hoses to charcoal canister.
3. Install primary chaincase housing. See 5.5 PRIMARY CHAINCASE HOUSING.

PURGE SOLENOID

Removal

1. Remove seat.

WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)
2. Remove main fuse.
3. Remove splash guard. See 2.23 REAR FORK.

NOTE

The purge solenoid is attached to the top of the rear electrical panel.

4. See Figure 4-53. Disconnect electrical connector from purge solenoid (3).

NOTE

Label evaporative emissions tube for ease of installation.

5. Remove tubes (2, 4) from purge solenoid.
6. Remove purge solenoid from electrical panel.

Installation

1. See Figure 4-53. Attach purge solenoid (3) to top of rear electrical panel.
2. Attach tubes (2, 4) to purge solenoid.
3. Connect electrical connector to purge solenoid (3).
4. Install splash guard. See 2.23 REAR FORK.
5. Install main fuse.

 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)

HOSE ROUTING/REPLACEMENT

NOTE

Record location of cable straps before removal. Install cable straps in same location when installing.

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)

Fuel Tank Vent Hose

1. Remove console and fuel tank. See 4.6 FUEL TANK.
2. Remove splash guard. See 2.23 REAR FORK.
3. Route fuel tank vent tube.
   a. See Figure 4-53. If replacing fuel tank vent tube (1), add hose to end of vent tube.
   b. Route fuel tank vent tube (1) along right side of frame. Cross over to the left side just before the battery. Continue past the battery and then down between the wire harness and frame crossmember. The end of the vent tube should end just below the left side of the rear electrical panel.
   c. Attach the other end of the tube to the nipple on the fuel tank top plate.
   d. If equipped with a charcoal canister (6), connect the fuel tank vent tube, at the rear electrical panel, to the purge tube-to-charcoal canister tube (5).
4. Install splash guard. See 2.23 REAR FORK.
5. Install fuel tank and console. See 4.6 FUEL TANK.

Purge Solenoid-to-Induction Module Tube

1. Remove console and fuel tank. See 4.6 FUEL TANK.
2. Remove splash guard. See 2.23 REAR FORK.
3. Route purge solenoid-to-induction module tube.
   a. See Figure 4-53. Route purge solenoid-to-induction module tube (2) along right side of frame. Cross over to the left side just before the battery. Continue past the battery and then down between the wire harness and frame crossmember. The end of the vent tube will attach to the upper nipple on the purge solenoid (3).
   b. See Figure 4-19. Attach the other end of the tube to the inboard purge nipple on the induction module.
4. Install splash guard. See 2.23 REAR FORK.
5. Install fuel tank and console. See 4.6 FUEL TANK.

Charcoal Canister-to-Purge Solenoid Tube

1. Remove splash guard. See 2.23 REAR FORK.
2. See Figure 4-53. Route charcoal canister-to-purge solenoid tube (4) from the bottom nipple on the purge solenoid down between the shocks and over to the charcoal canister.
3. Attach the other end of the tube to the outer nipple on the charcoal canister.
4. Install splash guard. See 2.23 REAR FORK.

Vent Tube-to-Charcoal Canister Tube

1. Remove splash guard. See 2.23 REAR FORK.
2. See Figure 4-53. Route vent tube-to-charcoal canister tube (5) from vent tube (1) on left side of rear electrical panel down between the shocks and over to the charcoal canister.
3. Attach the other end of the tube to the inner nipple on the charcoal canister.
4. Install splash guard. See 2.23 REAR FORK.
SUBJECT | PAGE NO.
--- | ---
5.1 FASTENER TORQUE VALUES | 5-1
5.2 SPECIFICATIONS: DRIVE | 5-2
5.3 PRIMARY CHAINCASE COVER | 5-3
5.4 DRIVE COMPONENTS | 5-4
5.5 PRIMARY CHAINCASE HOUSING | 5-9
5.6 CLUTCH | 5-13
5.7 TRANSMISSION SPROCKET | 5-18
5.8 DRIVE BELT | 5-21
FASTENER TORQUE VALUES IN THIS CHAPTER

The table below lists torque values for all fasteners presented in this chapter.

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clutch diaphragm spring retainer bolts</td>
<td>70-100 in-lbs</td>
<td>7.9-11.3 Nm</td>
</tr>
<tr>
<td>Clutch hub mainshaft nut</td>
<td>70-80 ft-lbs</td>
<td>94.9-108.5 Nm</td>
</tr>
<tr>
<td>Compensating sprocket bolt, final torque</td>
<td>175 ft-lbs</td>
<td>237.3 Nm</td>
</tr>
<tr>
<td>Compensating sprocket bolt, initial torque</td>
<td>100 ft-lbs</td>
<td>135.6 Nm</td>
</tr>
<tr>
<td>Primary chaincase cover fasteners</td>
<td>12-13 ft-lbs</td>
<td>16.3-17.6 Nm</td>
</tr>
<tr>
<td>Primary chaincase housing seating fasteners</td>
<td>26-28 ft-lbs</td>
<td>35.3-38.0 Nm</td>
</tr>
<tr>
<td>Primary chain tensioner fasteners</td>
<td>21-24 ft-lbs</td>
<td>28.5-32.6 Nm</td>
</tr>
<tr>
<td>Transmission lockplate screws</td>
<td>90-120 in-lbs</td>
<td>10.2-13.6 Nm</td>
</tr>
<tr>
<td>Transmission sprocket nut, final torque</td>
<td>35 ft-lbs</td>
<td>47.5 Nm</td>
</tr>
<tr>
<td>Transmission sprocket nut, initial torque</td>
<td>100 ft-lbs</td>
<td>135.6 Nm</td>
</tr>
</tbody>
</table>
Table 5-1. Sprocket Specifications

<table>
<thead>
<tr>
<th>SPROCKETS</th>
<th>NO. OF TEETH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compensating</td>
<td>34</td>
</tr>
<tr>
<td>Clutch</td>
<td>46</td>
</tr>
<tr>
<td>Transmission</td>
<td>32</td>
</tr>
<tr>
<td>Rear wheel</td>
<td>66</td>
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</tbody>
</table>

Table 5-2. Clutch Specifications

<table>
<thead>
<tr>
<th>CLUTCH</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Wet-multiple disc</td>
</tr>
<tr>
<td>Clutch lever free play</td>
<td>1/16-1/8 in (1.6-3.2 mm)</td>
</tr>
</tbody>
</table>

Table 5-3. Gear Specifications

<table>
<thead>
<tr>
<th>GEAR</th>
<th>OVERALL GEAR RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DOM/HD1</td>
</tr>
<tr>
<td>First (low)</td>
<td>9.311</td>
</tr>
<tr>
<td>Second</td>
<td>6.454</td>
</tr>
<tr>
<td>Third</td>
<td>4.793</td>
</tr>
<tr>
<td>Fourth</td>
<td>3.882</td>
</tr>
<tr>
<td>Fifth</td>
<td>3.307</td>
</tr>
<tr>
<td>Sixth (high)</td>
<td>2.790</td>
</tr>
</tbody>
</table>

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 CHAINCASE LUBRICANT.

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. Remove shift lever.
3. Drain the primary chaincase lubricant. See 1.9 PRIMARY CHAINCASE LUBRICANT, Changing Primary Chaincase Lubricant.
4. See Figure 5-1. When lubricant has drained, remove short (1) and long (2) fasteners and primary chaincase cover.
5. Remove and discard cover gasket.

![Figure 5-1. Primary Chaincase Cover and Fasteners](sm02110)

1. Fastener, short (9)
2. Fastener, long (4)

**NOTICE**

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 CHAINCASE LUBRICANT, Changing Primary Chaincase Lubricant.

5. Connect negative battery cable.

![Figure 5-2. Primary Chaincase Cover Gasket](sm02563)

1. Cover gasket
2. Primary chaincase cover

**INSTALLATION**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary chaincase cover fasteners</td>
<td>12-13 ft-lbs</td>
</tr>
</tbody>
</table>

**NOTE**

Always install a new gasket between primary chaincase cover and chaincase. Failure to replace this gasket may cause primary chaincase leaks.

1. See Figure 5-2. Install new cover gasket (1).

![Figure 5-3. Primary Chaincase Cover Torque Sequence](sm02748)
REMOVAL

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-47977</td>
<td>PRIMARY DRIVE LOCKING TOOL</td>
</tr>
</tbody>
</table>

**NOTE**
To remove the primary chain, remove compensating sprocket, clutch assembly and primary chain as an assembly.

**WARNING**
To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

1. Remove primary chaincase cover. See 5.3 PRIMARY CHAINCASE COVER.
2. See Figure 5-4. Install cable strap (2) as shown. Exposed portion below cover will indicate need for removal before cover installation.
3. See Figure 5-18. Remove chain tensioner fasteners (2) and chain tensioner (1).
4. Using a colored marker, mark one of the outboard links of the primary chain. Maintaining the original direction of rotation during assembly may prolong service life.
5. See Figure 5-6. Loosen locknut (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. (8312a)

6. Remove retaining ring (1) and release plate (2).
7. See Figure 5-7. Place the PRIMARY DRIVE LOCKING TOOL (Part No. HD-47977) between the teeth of the engine and clutch sprockets as shown.

**NOTE**
The clutch hub mainshaft nut has left-hand threads. Turn clockwise to remove.

8. Rotate clutch hub mainshaft nut in direction shown to remove.
9. See Figure 5-8. Place the PRIMARY DRIVE LOCKING TOOL (Part No. HD-47977) between the teeth of the engine and clutch sprockets as shown.
10. Rotate compensating sprocket bolt in direction shown to remove.
11. FXSB: see Figure 5-9. Remove oil spinner (11).
12. See Figure 5-9. Remove bolt (10), sprocket retainer (9), washers (7) and thrust bearing (8).
13. See Figure 5-10. Remove clutch assembly, primary chain and compensating sprocket as a single assembly.
1. Engine compensating sprocket
2. Primary drive locking tool
3. Clutch sprocket
4. Clutch hub mainshaft nut

Figure 5-7. Removing Clutch Hub Mainshaft Nut

1. Bolt
2. Primary drive locking tool

Figure 5-8. Removing Engine Compensating Sprocket Bolt

1. Shaft extension
2. Large spring washers
3. Medium spring washers
4. Small spring washer
5. Sliding cam
6. Compensating sprocket
7. Thrust washer
8. Thrust bearing
9. Sprocket retainer
10. Bolt
11. Oil spinner: FXSB

Figure 5-9. Engine Compensating Sprocket Assembly

Figure 5-10. Remove Drive Components
### INSTALLATION

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-47977</td>
<td>PRIMARY DRIVE LOCKING TOOL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compensating sprocket bolt, initial</td>
<td>100 ft-lbs</td>
</tr>
<tr>
<td>torque</td>
<td>135.6 Nm</td>
</tr>
<tr>
<td>Compensating sprocket bolt, final</td>
<td>175 ft-lbs</td>
</tr>
<tr>
<td>torque</td>
<td>237.3 Nm</td>
</tr>
<tr>
<td>Clutch hub mainshaft nut</td>
<td>70-80 ft-lbs</td>
</tr>
<tr>
<td></td>
<td>94.9-108.5 Nm</td>
</tr>
<tr>
<td>Primary chain tensioner</td>
<td>21-24 ft-lbs</td>
</tr>
<tr>
<td>fasteners</td>
<td>28.5-32.6 Nm</td>
</tr>
</tbody>
</table>

**NOTES**

- Install the primary chain, compensating sprocket and clutch as an assembly.
- The O-ring inside the sprocket extension is for manufacturing assembly only. No replacement parts are necessary or available.

1. See Figure 5-11. Install engine compensating sprocket.
   a. Apply a thin layer of primary chaincase oil to the inner diameter of the compensating sprocket (6).
   b. Apply a thin layer of primary chaincase oil to the splines of shaft extension (1).
   c. Assemble shaft extension, large spring washers (2) and medium spring washers (3).

**NOTE**

Outer diameter of spring washers will contact each other.

2. Install small spring washer (4). Outer diameter will contact sliding cam (5) once installed.
3. Install sliding cam (5).
4. Place drive components (primary chain, compensating sprocket, and clutch assembly) into position.
5. Install washers (7), thrust bearing (8), sprocket retainer (9), and new bolt (10). Tighten bolt finger tight.
6. FXSB: install oil spinner (11).

**NOTE**

Clutch hub mainshaft nut has left-hand threads.

7. Clean and prime threads of clutch hub mainshaft nut. Apply two drops of LOCTITE 262 HIGH STRENGTH THREAD-LOCKER AND SEALANT (red) to the threads of the nut. Start nut onto mainshaft and tighten finger tight.

### Figure 5-11. Engine Compensating Sprocket Assembly

**NOTE**

See Figure 5-12. Make sure the PRIMARY DRIVE LOCKING TOOL (Part No. HD-47977) is placed between the teeth of the engine and clutch sprockets as shown, when tightening the compensating sprocket bolt (1).

8. Tighten compensating sprocket nut to 100 ft-lbs (135.6 Nm).
9. Loosen compensating sprocket nut one full turn (360 degrees).
10. Tighten compensating sprocket nut to 175 ft-lbs (237.3 Nm).

### Figure 5-12. Installing Engine Compensating Sprocket Bolt

1. Bolt
2. Primary drive locking tool
NOTE
See Figure 5-13. 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 as shown.

11. Install primary drive locking tool.

12. Tighten clutch hub mainshaft nut to 70-80 ft-lbs (94.9-106.5 Nm).

Figure 5-13. Installing Clutch Hub Mainshaft Nut

1. Primary drive locking tool
2. Clutch hub mainshaft nut

13. See Figure 5-14. Install release plate (2) with locknut (3) and adjuster screw 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 pilers and could be propelled with enough force to cause serious eye injury. (00312a)

14. Inspect retaining ring (1) 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.

15. Adjust clutch. See 1.11 CLUTCH, Adjustment.

Figure 5-14. Clutch

1. Retaining ring
2. Release plate
3. Locknut

NOTES
- Primary chain tensioner is non-repairable. Replace as an assembly.
- See Figure 5-15. Although primary chain tensioner is sold as an assembly, tensioner parts can be disassembled. If primary chain tensioner becomes disassembled, assemble in order shown.

16. Locate end of spring rod (2) on roll pin (3).

17. See Figure 5-16. Slide wedge of primary chain tensioner in direction of arrow until all travel is removed.

18. See Figure 5-17. Push shoe (1) down until it contacts wedge. Keep tension on shoe so wedge stays in place.

19. Install cable strap (2) as shown. Exposed portion below cover will flag need for removal before cover installation.

NOTE
Primary chain tensioner will not complete chain adjustment until vehicle is ridden. After tensioner removal/installation procedure, test ride vehicle to verify adjustment.

20. See Figure 5-18. Install primary chain tensioner (1). Install chain tensioner fasteners (2) and tighten to 21-24 ft-lbs (28.5-32.6 Nm). Remove cable strap.

NOTE
Always install a new gasket between primary chaincase cover and chaincase. Failure to replace this gasket may cause primary chaincase leaks.

21. Install primary chaincase cover with new gasket and fill with lubricant. See 5.3 PRIMARY CHAINCASE COVER, Installation.
Figure 5-15. Spring Rod Location

1. Shoe
2. Spring rod
3. Roll pin

Figure 5-16. Primary Chain Tensioner

1. Shoe
2. Wedge

Figure 5-17. Securing Chain Tensioner

1. Chain tensioner shoe
2. Cable strap

Figure 5-18. Chain Tensioner

1. Chain tensioner
2. Chain tensioner fasteners
3. Cable strap
REMOVAL

WARNING
To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00648a)

1. Disconnect negative battery cable.
2. Remove primary chaincase cover. See 5.3 PRIMARY CHAINCASE COVER, Removal.
4. Remove primary chain, clutch, and compensating sprocket. See 5.4 DRIVE COMPONENTS, Removal.
5. See Figure 5-19. Remove sealing fasteners (5) securing primary chaincase housing (9) to crankcase and transmission. Discard the crankcase gasket (11) and sealing fasteners (5).

![Figure 5-19. Primary Chaincase Housing](sn03077)

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 5.5 PRIMARY CHAINCASE HOUSING, Mainshaft Bearing and Seal.

MAINSHAFT BEARING AND SEAL

Removal

WARNING
Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the piers and could be propelled with enough force to cause serious eye injury. (00312a)

1. See Figure 5-19. Remove seal (1). Use a seal remover or rolling head pry bar for best results.
2. Remove retaining ring (2).

NOTE
Support the bearing support area on the transmission side of the primary chaincase while pressing bearing out.

3. Place inner primary chaincase in an arbor press with clutch side up.
4. 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.

NOTE
Support the bearing support area on the clutch side of the primary chaincase while pressing bearing in.

2. Place primary chaincase in arbor press with the transmission side up.
3. Apply a thin film of oil to outer diameter of bearing.
4. Applying pressure to the outer race, press new bearing letter side up until it makes solid contact with the bearing support area.
5. See Figure 5-20. Retaining ring (1) must be oriented as shown to prevent blocking of oil passage (2). Install retaining ring. Verify that the ring is fully seated in the groove and is properly oriented.

NOTES
- The 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.
- Minimum allowable depth: Oil seal case is flush with machined surface of primary housing.
- Maximum allowable depth: Oil seal case contacts retaining ring.
6. Install mainshaft oil seal:
   a. Lubricate the OD of the new seal with SCREAMIN' EAGLE ASSEMBLY LUBE. Place over bore with the lip garter spring side (stamped "OIL SIDE") facing toward the bearing.
   b. See Figure 5-21. Press the seal into bore until outer edge of seal is flush with machined surface of inner primary housing.

7. Lubricate the bearing and seal lip with multi-purpose grease or SCREAMIN' EAGLE ASSEMBLY LUBE.

---

**INNER RACE REMOVER/INSTALLER (Part No. HD-34902-C).**

1. See Figure 5-22. Install end cap (2) into end of mainshaft.
2. Position puller (3) around mainshaft, under bearing inner race.
3. Turn forcing screw (4) clockwise while holding puller to remove bearing.

![Figure 5-22. Pulling Mainshaft Inner Bearing Race](image)

**Installation**

1. See Figure 5-23. Slide bearing inner race (1) onto mainshaft.

   **NOTE**
   
   *Extension shaft has left-hand threads.*

2. Install 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 until edge of race contacts step on shaft.
6. Lubricate race with SCREAMIN' EAGLE ASSEMBLY LUBE.

---

**MAINSHAFT BEARING INNER RACE**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-34902-C</td>
<td>MAINSHAFT BEARING INNER RACE REMOVER/INSTALLER</td>
</tr>
</tbody>
</table>

---

**Removal**

**NOTE**

*Bearing outer race installation requires properly aligned bearing inner race. Use the recommended tool, MAINSHAFT BEARING*
4. See Figure 5-27. Tighten fasteners in sequence shown to 26-28 ft-lbs (35.3-38.0 Nm).
5. Install the primary chain, clutch, and compensating sprocket as an assembly. See 5.4 DRIVE COMPONENTS, installation.
6. Install starter. See 7.13 STARTER, Installation.

**NOTE**
Always install a new gasket between primary chaincase cover and chaincase. Failure to replace this gasket may cause primary chaincase leaks.
7. Install primary chaincase cover. Fill with lubricant. See 5.3 PRIMARY CHAINCASE COVER, Installation.
8. Adjust drive belt tension.
9. Connect negative battery cable.

---

**Figure 5-23. Installing Bearing Race**

**Figure 5-24. Crankcase Gasket**

**Figure 5-25. Crankcase**

**Table 1**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary chaincase housing sealing fasteners</td>
<td>26-28 ft-lbs 35.3-38.0 Nm</td>
</tr>
</tbody>
</table>

**NOTES**

- Cover mainshaft clutch hub splines with tape to prevent the splines from damaging the inner primary cover oil seal.
- See Figure 5-24. In next step, be sure dowels (1) in crankcase gasket (2) engage holes in crankcase.
- See Figure 5-25. Place crankcase gasket in place on gasket surface (2). Be sure dowels in gasket engage dowel holes (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.
- See Figure 5-26. Insert new sealing fasteners.
CLUTCH

REMOVAL AND INSTALLATION

To remove the clutch without disassembly or for installation instructions, see 5.4 DRIVE COMPONENTS, Removal.

CLUTCH PACK ONLY

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clutch diaphragm spring retainer bolts</td>
<td>70-100 in-lbs</td>
</tr>
</tbody>
</table>

Partial Disassembly

This procedure can be performed on the motorcycle without removing the clutch shell or hub.

1. Remove primary chaincase cover. See 5.3 PRIMARY CHAINCASE COVER, Removal.
2. See Figure 5-28. 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).

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. Dry parts with low pressure compressed air.

2. Check friction plates:
   a. Use compressed air to remove 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.

3. Check the steel plates:
   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. Hold the clutch hub and rotate the clutch shell to check bearing for smooth operation. Replace the bearing if it runs rough, binds or has any end play.
5. Inspect the primary chain sprocket and the starter ring gear on the clutch shell. Replace the clutch shell if either are badly worn or damaged.
6. Check the slots that mate with the clutch plates on both the clutch shell and hub. Replace if slots are worn or damaged.

   **NOTE**
   Springs are identified by a dab of paint on one face. See the parts catalog to verify the correct spring is installed.

7. Check the diaphragm spring and diaphragm spring retainer for cracks or bent tabs. Replace part if either condition exists.
Assembly

NOTE
Submerge and soak all friction plates in primary chaincase lubricant for at least five minutes.

1. See Figure 5-29. Install the narrow friction plate on the clutch hub.

2. See Figure 5-28. Install damper spring seat (9) on clutch hub (11). It must sit inboard of narrow friction plate (7).

NOTE
See Figure 5-34. Notice damper spring (4) orientation with respect to damper spring seat (3).
3. See Figure 5-28. Install damper spring (8) on clutch hub with the concave side 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 to 70-100 in-lbs (7.9-11.3 Nm).

**NOTE**
Always install a new gasket between primary chaincase cover and chaincase. Failure to replace this gasket may cause primary chaincase leaks.

9. Install primary chaincase cover. Fill primary chaincase with lubricant. See 5.3 PRIMARY CHAINCASE COVER, Installation.

**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**
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 5-30. Remove retaining ring.

5. See Figure 5-31. Support clutch shell in arbor press with ring gear side up. Use a suitable press plug to press hub from bearing in clutch shell.

6. See Figure 5-32. Remove retaining ring from groove in clutch shell bore.

7. See Figure 5-33. Support clutch shell in arbor press with ring gear side is down. Use a suitable press plug to remove bearing.

8. Clean and inspect components. See 5.6 CLUTCH, Clutch Pack Only.

---

**CLUTCH PACK AND BEARING**

**Complete Disassembly**

1. Remove the primary chaincase cover. See 5.3 PRIMARY CHAINCASE COVER, Removal.

2. Remove clutch assembly. See 5.4 DRIVE COMPONENTS, Removal.

3. Follow all partial disassembly information under 5.6 CLUTCH, Clutch Pack Only.

---

![Figure 5-29. Friction Plates](image)

1. Narrow plate
2. Regular plate

---

![Figure 5-30. Clutch Hub Retaining Ring](image)
Assembly

1. Place clutch shell in arbor press with ring gear side up. Support clutch shell bore on sprocket side to avoid damage to ears on clutch basket.

2. 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. (60312a)

3. See Figure 5-32. Install retaining ring with flat side toward bearing.

4. Place clutch shell in arbor press with sprocket side up. Center hub in bearing. Support bearing inner race with a sleeve on transmission side.

5. Press hub into bearing until shoulder contacts bearing inner race.

6. See Figure 5-30. Turn assembly over. Install retaining ring in groove of clutch hub.

7. Assemble clutch components. See 5.6 CLUTCH, Clutch Pack Only.

8. Install clutch. See 5.4 DRIVE COMPONENTS, Installation.

NOTE

Always install a new gasket between primary chaincase cover and chaincase. Failure to replace this gasket may cause primary chaincase leaks.

9. Install primary chaincase cover. Fill primary chaincase with lubricant. See 5.3 PRIMARY CHAINCASE COVER, Installation.
Figure 5-34. Clutch Stackup

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 5-35. Assembled Clutch

1. Diaphragm spring
2. Jamnut
3. Adjuster screw
4. Retaining ring
5. Bolt (6) (metric)
## REMOVAL

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-46282-A</td>
<td>FINAL DRIVE SPROCKET LOCKING TOOL</td>
</tr>
<tr>
<td>HD-47910</td>
<td>MAINSHAFT LOCKNUT WRENCH</td>
</tr>
<tr>
<td>HD-94660-2</td>
<td>PILOT</td>
</tr>
</tbody>
</table>

1. Remove primary chaincase. See 5.5 PRIMARY CHAINCASE HOUSING. Removal.

2. Remove debris deflector. See 2.21 BELT GUARD AND DEBRIS DEFLECTOR.

**NOTE**

Loosen both axle adjusters an equal number of turns to maintain wheel alignment.

3. See Figure 5-36. Remove e-clip (1). Loosen rear axle nut (2). Loosen both axle adjusters (3) to release tension on the drive belt.

**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.

4. Remove transmission sprocket.
   a. See Figure 5-37. Remove both screws (1) and lockplate (2).
   b. See Figure 5-38. Secure sprocket using FINAL DRIVE SPROCKET LOCKING TOOL (Part No. HD-46282-A) (3). Final drive sprocket locking tool must rest against lower portion of rear fork 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).

5. Remove belt from sprocket as sprocket is removed.

---

![Figure 5-36. Axle Adjusters](image1)

![Figure 5-37. Transmission Sprocket](image2)
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 DRIVE BELT AND SPROCKETS, Inspection.
3. Inspect both main drive gear and mainshaft seals. Replace if damaged.

INSTALLATION

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-46282A</td>
<td>FINAL DRIVE SPROCKET LOCKING TOOL</td>
</tr>
<tr>
<td>HD-47910</td>
<td>MAINSHAFT LOCKNUT WRENCH</td>
</tr>
<tr>
<td>HD-94660-2</td>
<td>PILOT</td>
</tr>
<tr>
<td>SNAP-ON TA360</td>
<td>TORQUE ANGLE GAUGE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission sprocket nut, initial torque</td>
<td>100 ft-lbs 135.6 Nm</td>
</tr>
<tr>
<td>Transmission sprocket nut, final torque</td>
<td>35 ft-lbs 47.5 Nm</td>
</tr>
<tr>
<td>Transmission lockplate screws</td>
<td>90-120 in-lbs 10.2-13.6 Nm</td>
</tr>
</tbody>
</table>

Install sprocket nut only 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.
2. If reusing the sprocket nut, apply LOCTITE 271 HIGH STRENGTH THREADLOCKER (red) to the threads of the sprocket nut.

NOTE

1. Never get oil on the threads of the sprocket nut or the integrity of the lock patch may be compromised.
2. The transmission sprocket nut has right-hand threads. Turn the nut clockwise to install.
3. See Figure 5-37. Apply a thin film of clean engine oil to the mating surfaces of the sprocket nut (3) and the sprocket (4). Install the sprocket nut until finger-tight.
4. See Figure 5-39. Lock transmission sprocket with the FINAL DRIVE SPROCKET LOCKING TOOL (Part No. HD-46282A) (2). The locking tool must rest against the rear fork pivot (3).
5. Install PILOT (Part No. HD-94660-2) on mainshaft.
6. Using MAINSHAFT LOCKNUT WRENCH (Part No. HD-47910), tighten sprocket nut to 100 ft-lbs (135.6 Nm) initial torque.
7. Loosen sprocket nut one full turn.
8. Tighten to 35 ft-lbs (47.5 Nm).

NOTE

See Figure 5-40. To determine proper angles during final tightening, scribe lines (3) or use TORQUE ANGLE GAUGE (Part No. SNAP-ON TA360) after the 35 ft-lbs (47.5 Nm) torque is applied.

9. Continue turning sprocket nut an additional 35-40 degrees.

NOTE

The lockplate has four screw holes and can be turned to either side. This should provide screw hole alignment without having to additionally tighten the nut. If the screw holes cannot be properly aligned, tighten the nut slightly until the holes align. Do not exceed 45 degrees. Never LOOSEN nut to align the screw holes.

10. Install lockplate over transmission sprocket nut with two of lockplate’s holes aligned with sprocket’s two tapped holes.

NOTE

Never screws have lock patches.

Scres can be reused up to three times if LOCTITE 271 HIGH STRENGTH THREADLOCKER (red) is applied before installation.

To confirm the lockplate security, install BOTH screws.

11. See Figure 5-37. Install two screws (1) to secure lockplate (2) to sprocket (4). Tighten to 90-120 in-lbs (10.2-13.6 Nm).

12. Install primary chain assembly. See 5.4 DRIVE COMPONENTS.

NOTE

Always install a new gasket between primary cover and housing. Not replacing this gasket may cause primary chaincase leaks.

13. Install primary chaincase cover. Fill with lubricant. See 5.3 PRIMARY CHAINCASE COVER.

14. Verify pivot shaft torque. See 2.23 REAR FORK.

15. Adjust drive belt deflection. See 1.12 DRIVE BELT AND SPROCKETS.
16. Verify vehicle alignment and tighten rear axle. See 2.10 VEHICLE ALIGNMENT.

17. Install debris deflector. See 2.21 BELT GUARD AND DEBRIS DEFLECTOR.

![Image of sprocket nut installation](image)

1. Mainshaft locknut wrench
2. Final drive sprocket locking tool
3. Rear fork pivot nut
4. 1/2 in. breaker bar

**Figure 5-39. Sprocket Nut Installation (Typical)**

**Figure 5-40. Sprocket Nut Final Tightening**

1. Sprocket nut
2. Transmission sprocket
3. Line scribed
REMOVAL

1. Remove rear wheel. See 2.5 REAR WHEEL.
2. Remove primary chain, clutch, engine compensating sprocket, and chain adjuster as an assembly. See 5.4 DRIVE COMPONENTS.
3. Remove primary chaincase housing. See 5.5 PRIMARY CHAINCASE HOUSING, Removal.
4. Place a support under rear fork and engine. Remove pivot shaft and spacer. See 2.23 REAR FORK.
5. See Figure 5-41. Slip drive belt (2) from transmission sprocket (1).

INSTRUCTION

1. Remove transmission sprocket
2. Belt
3. Rear wheel sprocket

Figure 5-41. Belt and Transmission Sprocket

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. (06339a)

1. See Figure 5-41. Install belt (2) over transmission sprocket (1).
2. Install pivot shaft and spacer. Remove support holding engine and rear fork. See 2.23 REAR FORK.
3. Install the primary chaincase housing. See 5.5 PRIMARY CHAINCASE HOUSING.

NOTE

Always install a new gasket between primary chaincase cover and chaincase. Failure to replace this gasket may cause primary chaincase leaks.

4. Install primary chain assembly. See 5.4 DRIVE COMPONENTS.
5. Install primary chaincase cover. Fill with lubricant. See 5.3 PRIMARY CHAINCASE COVER.
6. Install rear wheel. See 2.5 REAR WHEEL.
7. Align vehicle. See 2.10 VEHICLE ALIGNMENT.
8. Adjust belt tension. See 1.12 DRIVE BELT AND SPROCKETS.
<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>PAGE NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1 FASTENER TORQUE VALUES</td>
<td>6-1</td>
</tr>
<tr>
<td>6.2 SPECIFICATIONS: TRANSMISSION</td>
<td>6-2</td>
</tr>
<tr>
<td>6.3 TRANSMISSION</td>
<td>6-3</td>
</tr>
<tr>
<td>6.4 SHIFTER</td>
<td>6-5</td>
</tr>
<tr>
<td>6.5 CLUTCH RELEASE COVER</td>
<td>6-7</td>
</tr>
<tr>
<td>6.6 TRANSMISSION ASSEMBLY</td>
<td>6-9</td>
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<tr>
<td>6.7 MAIN DRIVE GEAR AND BEARING</td>
<td>6-22</td>
</tr>
<tr>
<td>6.8 TRANSMISSION CASE</td>
<td>6-29</td>
</tr>
</tbody>
</table>
The table below lists torque values for all fasteners presented in this chapter.

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clutch cable fitting</td>
<td>90-120 in-lbs</td>
<td>10.2-13.6 Nm, 6.5 CLUTCH RELEASE COVER, Assembly and Installation</td>
</tr>
<tr>
<td>Clutch release cover screws</td>
<td>132-156 in-lbs</td>
<td>14.9-17.6 Nm, 6.5 CLUTCH RELEASE COVER, Assembly and Installation</td>
</tr>
<tr>
<td>Mainshaft/countershaft nuts</td>
<td>85-95 ft-lbs</td>
<td>115.3-128.8 Nm, 6.6 TRANSMISSION ASSEMBLY, Assembly</td>
</tr>
<tr>
<td>Shift drum detent arm fastener</td>
<td>120-150 in-lbs</td>
<td>13.6-17.0 Nm, 6.6 TRANSMISSION ASSEMBLY, Assembly</td>
</tr>
<tr>
<td>Shift drum lock plate fasteners</td>
<td>57-63 in-lbs</td>
<td>6.4-7.1 Nm, 6.6 TRANSMISSION ASSEMBLY, Assembly</td>
</tr>
<tr>
<td>Shifter pawl centering screw</td>
<td>18-23 ft-lbs</td>
<td>24.4-31.2 Nm, 6.8 TRANSMISSION CASE, Assembly</td>
</tr>
<tr>
<td>Shifter peg</td>
<td>96-144 in-lbs</td>
<td>10.9-16.3 Nm, 6.4 SHIFTER, Shift Lever Replacement</td>
</tr>
<tr>
<td>Shifter rod jam nut</td>
<td>80-120 in-lbs</td>
<td>9.0-13.6 Nm, 6.4 SHIFTER, Shifter Rod Adjustment</td>
</tr>
<tr>
<td>Shifter rod lever pinch screw, transmission lever</td>
<td>18-22 ft-lbs</td>
<td>24.4-29.8 Nm, 6.8 TRANSMISSION CASE, Assembly</td>
</tr>
<tr>
<td>Shifter rod to lever locknut</td>
<td>96-144 in-lbs</td>
<td>10.8-16.3 Nm, 6.4 SHIFTER, Shifter Rod Adjustment</td>
</tr>
<tr>
<td>Shift lever pinch bolt: FXSB, FXST</td>
<td>13-16 ft-lbs</td>
<td>17.6-21.7 Nm, 6.4 SHIFTER, Shift Lever Replacement</td>
</tr>
<tr>
<td>Shift lever pinch bolts: all but FXSB, FXST</td>
<td>18-22 ft-lbs</td>
<td>24.4-29.9 Nm, 6.4 SHIFTER, Shift Lever Replacement</td>
</tr>
<tr>
<td>Transmission bearing housing screw</td>
<td>23-25 ft-lbs</td>
<td>31.2-33.9 Nm, 6.6 TRANSMISSION ASSEMBLY, Installation</td>
</tr>
<tr>
<td>Transmission drain plug</td>
<td>14-21 ft-lbs</td>
<td>19.0-28.5 Nm, 6.6 TRANSMISSION ASSEMBLY, Installation</td>
</tr>
<tr>
<td>Transmission drain plug</td>
<td>14-21 ft-lbs</td>
<td>19.0-28.5 Nm, 6.6 TRANSMISSION CASE, Installation</td>
</tr>
<tr>
<td>Transmission mounting bolts, 1st torque</td>
<td>15 ft-lbs</td>
<td>20.3 Nm, 6.8 TRANSMISSION CASE, Installation</td>
</tr>
<tr>
<td>Transmission mounting bolts, final torque</td>
<td>34-39 ft-lbs</td>
<td>46.1-52.9 Nm, 6.8 TRANSMISSION CASE, Installation</td>
</tr>
<tr>
<td>Transmission top cover</td>
<td>90-120 in-lbs</td>
<td>10.2-13.6 Nm, 6.8 TRANSMISSION ASSEMBLY, Installation</td>
</tr>
</tbody>
</table>


### Table 6-1. Transmission Specifications

<table>
<thead>
<tr>
<th>TRANSMISSION</th>
<th>DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>6-speed forward constant mesh</td>
</tr>
<tr>
<td>FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT</td>
<td>Part No. 99851-05 (qt)</td>
</tr>
<tr>
<td>SYN1 20W50 Oil</td>
<td>Part No. 99824-03/000QT (qt)</td>
</tr>
<tr>
<td>Capacity (dry)</td>
<td>32 oz. (946.4 ml)</td>
</tr>
</tbody>
</table>

### Table 6-2. Transmission Gear Ratios

<table>
<thead>
<tr>
<th>GEAR</th>
<th>GEAR RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>First (low)</td>
<td>3.34</td>
</tr>
<tr>
<td>Second</td>
<td>2.31</td>
</tr>
<tr>
<td>Third</td>
<td>1.72</td>
</tr>
<tr>
<td>Fourth</td>
<td>1.39</td>
</tr>
<tr>
<td>Fifth</td>
<td>1.19</td>
</tr>
<tr>
<td>Sixth (high)</td>
<td>1.00</td>
</tr>
</tbody>
</table>

**NOTE**

Final gear ratios indicate the number of mainshaft revolutions required to drive the output sprocket one revolution.

### Table 6-3. Main Drive Gear Specifications

<table>
<thead>
<tr>
<th>MAIN DRIVE GEAR (6th)</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bearing fit in transmission case (loose)</td>
<td>0.003-0.0017</td>
<td>0.0076-0.043</td>
</tr>
<tr>
<td>Fit in bearing (press-fit)</td>
<td>0.001-0.003</td>
<td>0.025-0.076</td>
</tr>
<tr>
<td>End play</td>
<td>none</td>
<td>none</td>
</tr>
</tbody>
</table>

### Table 6-4. Mainshaft Tolerance Specifications

<table>
<thead>
<tr>
<th>MAINSHAFT TOLERANCE</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mainshaft runout</td>
<td>0.000-0.003</td>
<td>0.00-0.08</td>
</tr>
<tr>
<td>Mainshaft end play</td>
<td>none</td>
<td>none</td>
</tr>
<tr>
<td>5th gear end play (axial)</td>
<td>0.002-0.026</td>
<td>0.05-0.66</td>
</tr>
<tr>
<td>5th gear clearance (radial)</td>
<td>0.004-0.0020</td>
<td>0.009-0.052</td>
</tr>
<tr>
<td>Main drive gear (6th) fit</td>
<td>0.0009-0.0022</td>
<td>0.023-0.056</td>
</tr>
</tbody>
</table>

### Table 6-5. Countershaft Tolerance Specifications

<table>
<thead>
<tr>
<th>COUNTERSHAFT TOLERANCE</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Countershaft runout</td>
<td>0.000-0.003</td>
<td>0.00-0.08</td>
</tr>
<tr>
<td>Countershaft end play</td>
<td>0.001-0.003</td>
<td>0.025-0.08</td>
</tr>
<tr>
<td>1st gear end play (axial)</td>
<td>0.001-0.023</td>
<td>0.03-0.58</td>
</tr>
<tr>
<td>1st gear clearance (radial)</td>
<td>0.0004-0.0020</td>
<td>0.010-0.052</td>
</tr>
<tr>
<td>2nd gear end play (axial)</td>
<td>0.001-0.040</td>
<td>0.03-1.02</td>
</tr>
<tr>
<td>2nd gear clearance (radial)</td>
<td>0.0004-0.0020</td>
<td>0.010-0.052</td>
</tr>
<tr>
<td>3rd gear end play (axial)</td>
<td>0.001-0.042</td>
<td>0.03-1.07</td>
</tr>
<tr>
<td>3rd gear clearance (radial)</td>
<td>0.0004-0.0020</td>
<td>0.010-0.052</td>
</tr>
<tr>
<td>4th gear end play (axial)</td>
<td>0.001-0.028</td>
<td>0.03-0.71</td>
</tr>
<tr>
<td>4th gear clearance (radial)</td>
<td>0.0004-0.0020</td>
<td>0.010-0.052</td>
</tr>
</tbody>
</table>

### Table 6-6. Shifter Dog Clearance Specifications

<table>
<thead>
<tr>
<th>SHIFTER DOG</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>0.013-0.121</td>
<td>0.33-3.07</td>
</tr>
<tr>
<td>2nd</td>
<td>0.016-0.138</td>
<td>0.41-3.51</td>
</tr>
<tr>
<td>3rd</td>
<td>0.010-0.125</td>
<td>0.25-3.17</td>
</tr>
<tr>
<td>4th</td>
<td>0.018-0.129</td>
<td>0.48-3.28</td>
</tr>
<tr>
<td>5th</td>
<td>0.007-0.117</td>
<td>0.18-2.97</td>
</tr>
<tr>
<td>6th</td>
<td>0.022-0.131</td>
<td>0.56-3.33</td>
</tr>
</tbody>
</table>

### Table 6-7. Bearing Housing Bearing Specifications

<table>
<thead>
<tr>
<th>BEARING HOUSING BEARING</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fit in bearing housing (tight)</td>
<td>0.0001-0.0014</td>
<td>0.0025-0.0366</td>
</tr>
<tr>
<td>Fit on countershaft (tight)</td>
<td>-0.0004</td>
<td>-0.010</td>
</tr>
<tr>
<td>Fit on countershaft (loose)</td>
<td>+0.0012</td>
<td>+0.030</td>
</tr>
<tr>
<td>Fit on mainshaft (tight)</td>
<td>-0.0004</td>
<td>-0.010</td>
</tr>
<tr>
<td>Fit on mainshaft (loose)</td>
<td>+0.0012</td>
<td>+0.030</td>
</tr>
</tbody>
</table>

### Table 6-8. Shifter Fork Specifications

<table>
<thead>
<tr>
<th>SHIFTER FORKS</th>
<th>IN</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shifter fork to cam groove end play</td>
<td>0.004-0.012</td>
<td>0.102-0.306</td>
</tr>
<tr>
<td>Shifter fork to dog ring end play</td>
<td>0.004-0.016</td>
<td>0.102-0.4060</td>
</tr>
<tr>
<td>First and second gear shift fork pad thickness wear limit</td>
<td>0.258</td>
<td>6.55</td>
</tr>
<tr>
<td>Third and fourth gear shift fork pad thickness wear limit</td>
<td>0.198</td>
<td>5.03</td>
</tr>
<tr>
<td>Fifth and sixth gear shift fork pad thickness wear limit</td>
<td>0.258</td>
<td>6.55</td>
</tr>
</tbody>
</table>
POWER FLOW

See Figure 6-1. 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 gears that 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 on the sides of 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 bearing housing.

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. No power is transferred to the countershaft since countershaft 1st, 2nd, 3rd and 4th gears are freewheeling gears.

First 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).

**Second 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).

**Third 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. At the same time 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).

**Fourth 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).

**Fifth 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. At the same time 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).

**Sixth Gear**

The shift from fifth to sixth gear occurs when the dog ring between mainshaft 5th and 6th is shifted out of mainshaft 5th. It is shifted directly into the main drive gear (6th gear). The main drive gear is locked to the mainshaft. This results in a direct one-to-one drive ratio from the clutch to the sprocket as shown (6).
1. First gear
2. Second gear
3. Third gear
4. Fourth gear
5. Fifth gear
6. Sixth gear
7. Mainshaft
8. Countershaft

Figure 6-1. Transmission Power Flow
SHIFTER

ADJUSTMENT

If operating problems exist, check the shift linkage for wear, interference or adjustment. Adjust if necessary.

SHIFTER ROD ADJUSTMENT

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shifter rod to lever locknut</td>
<td>96-144 in-lbs</td>
</tr>
<tr>
<td>Shifter rod jam nut</td>
<td>80-120 in-lbs</td>
</tr>
</tbody>
</table>

The shifter rod length is set at the factory and should not require adjustment under normal circumstances. However, if full engagement or full lever travel is not achieved, adjust the shifter rod.

**NOTE**

Do not allow shift levers to contact footboard when shifting. This prevents proper gear engagement. Contact may also damage the transmission.

1. See Figure 6-2. Remove locknut, lockwasher and flat washer (3) to free front end of shifter rod from inner shift arm.
2. Loosen jamnuts (1) and adjust rod (2) as necessary.
3. Install flat washer, lockwasher and locknut to fasten shifter rod to inner shift arm.
4. Tighten locknut (3) with lockwasher and flat washer to 96-144 in-lbs (10.8-16.3 Nm).
5. Tighten jamnuts (1) to 80-120 in-lbs (9.0-13.6 Nm).

**SHIFT LEVER REPLACEMENT**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift lever pinch bolts: all but FXSB, FXST</td>
<td>18-22 ft-lbs</td>
</tr>
<tr>
<td>Shift lever pinch bolt: FXSB, FXST</td>
<td>13-16 ft-lbs</td>
</tr>
<tr>
<td>Shifter peg</td>
<td>96-144 in-lbs</td>
</tr>
</tbody>
</table>

**NOTE**

After placing shift lever on pivot lever, make sure footboard does not interfere with shift lever range of motion:

- See Figure 6-3. Position shift levers for comfort.
- All but FXSB, FXST: tighten pinch bolts to 18-22 ft-lbs (24.4-29.9 Nm).
- FXSB, FXST Only: tighten pinch bolt to 13-16 ft-lbs (17.6-21.7 Nm).
- Tighten shifter peg to 96-144 in-lbs (10.9-16.3 Nm).
1. Pinch bolt, front (all but FXSB)
2. Shifter peg, rear (all but FXSB)
3. Shift lever, rear (all but FXSB)
4. Pinch bolt, rear (all but FXSB)
5. Shifter peg, front (all but FXSB)
6. Shift lever, front (all but FXSB)
7. Pinch bolt (FXSB)
8. Washer (FXSB)
9. Shift lever (FXSB)
10. Shifter peg (FXSB)
11. Spacer
12. Bushing (2)
13. O-ring (2)
14. Pivot lever

Figure 6-3. Shift Lever Assembly
REMOVAL AND DISASSEMBLY

1. Remove main fuse.
2. Remove exhaust system if needed. See 4.17 EXHAUST SYSTEM.

NOTE
Actuate clutch hand lever, after removing the clutch release cover screws, to break the cover free.

4. See Figure 6-4. 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 6-5. Remove retaining ring (4). Lift inner ramp (5) and ramp coupling (3) out of clutch release cover. Disconnect clutch cable end (2) from the ball and ramp coupling.

7. See Figure 6-6. Remove balls (4) and outer ramp (2).
8. Unscrew clutch cable fitting from clutch release cover.

CLEANING AND INSPECTION

1. See Figure 6-7. 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 as necessary.

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 damage.

6. Check the bore in the clutch release cover (5) where the ramps (1, 3) are retained. There should be no wear that would cause the ramps to tilt, causing improper clutch adjustment.

1. See Figure 6-5. Apply a drop of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to clutch cable fitting (1) and screw fitting into clutch release cover. Do not tighten at this time.

2. See Figure 6-7. 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 (2) and outer ramp sockets. Place a ball in each of the outer ramp sockets.

4. Connect cable end to ramp coupling (4). Install coupling on inner ramp (1) and place inner ramp and coupling in position in clutch release cover (5).

**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. (90312a)

**NOTE**

See Figure 6-5. Center retaining ring opening above the break in the ribbing at bottom of the clutch release cover.

5. Figure 6-7. Install retaining ring (6).

6. Verify that two dowel pins are in place on transmission bearing housing flange. Place a new gasket (7) on dowel pins.

**NOTE**

See Figure 6-4. Clutch release cover screws in positions (1) and (6) are shorter than the others.

7. See Figure 6-4, Install clutch release cover. Tighten all six screws to 132-156 in-lbs (14.9-17.6 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.

10. Adjust clutch cable. See 1.11 CLUTCH.

11. Install exhaust system if removed. See 4.17 EXHAUST SYSTEM.

12. Install main fuse.

---

**ASSEMBLY AND INSTALLATION**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clutch release cover screws</td>
<td>132-156 in-lbs</td>
</tr>
<tr>
<td></td>
<td>14.9-17.6 Nm</td>
</tr>
<tr>
<td>Clutch cable fitting</td>
<td>90-120 in-lbs</td>
</tr>
<tr>
<td></td>
<td>10.2-13.6 Nm</td>
</tr>
</tbody>
</table>

**NOTE**

Replace cable fitting O-ring if damaged or deformed.
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 6.8 TRANSMISSION CASE.

1. Remove exhaust system. See 4.17 EXHAUST SYSTEM.

2. Remove oil tank. See 3.30 OIL TANK: ALL BUT FXSB or 3.31 OIL TANK: FXSB.

3. Relieve drive belt tension. See 1.12 DRIVE BELT AND SPROCKETS.

4. Remove primary chaincase cover, clutch assembly, primary chain, compensating sprocket assembly and primary chaincase. See 5.5 PRIMARY CHAINCASE HOUSING, Removal.

5. Remove the bearing inner race from the transmission mainshaft. See 5.5 PRIMARY CHAINCASE HOUSING, Mainshaft Bearing Inner Race.

6. Remove the clutch release cover from the transmission bearing housing. See 6.5 CLUTCH RELEASE COVER, Removal and Disassembly.

7. See Figure 6-8. Remove oil slinger assembly from mainshaft. Remove pushrod.

8. Remove transmission top cover, leaving the cover gasket in place.

9. See Figure 6-9. Place shifter cam pawl on top cover gasket.

Figure 6-8. Pushrod Assembly: Cable Clutch

1. Retaining ring
2. Thrust washer (2)
3. Throw out bearing
4. Oil slinger
5. Pushrod
6. Pushrod end, left side

Figure 6-9. Set Shifter Pawl on Gasket

NOTE
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.

10. If main drive gear is to be removed, see 6.7 MAIN DRIVE GEAR AND BEARING, Removal.

NOTES
- Replace the main drive gear bearing and retainer if the main drive gear is removed. The bearing will be damaged during the removal procedure.
- Never attempt to remove bearing housing by tapping on shafts from opposite side. Tapping them with a hammer will damage the bearing housing bearings. If the bearing housing sticks or binds on the ring dowels, pry loose using indents at each side of bearing housing.

11. Cover mainshaft clutch hub splines with tape to prevent the splines from damaging the main drive gear bearings.

12. See Figure 6-11. Remove the transmission bearing housing:
   a. Remove the transmission bearing housing mounting hardware.
   b. Remove exhaust bracket, if equipped.
   c. Pry the bearing housing loose.
   d. Remove bearing housing, mainshaft, countershaft and shifter cam from transmission case as an assembly.
   e. Discard gasket.
### DISASSEMBLY

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>J-5566A</td>
<td>TRANSMISSION SHAFT RETAINING RING PLIERS</td>
</tr>
</tbody>
</table>

#### Shifter Cam/Shifter Forks

1. See Figure 6-12. Disassemble bearing housing assembly:
   a. Place bearing housing on end (shafts pointing upward).
   b. Remove shift fork shafts using easy-out screw extractor (14) (non-flute design) or vise grips. Shafts have slight interference fit. Shafts can be reused; do not damage end of shaft.
   c. Mark end of shaft to aid during assembly.
2. Remove shift forks from dog rings.
3. See Figure 6-13. Remove lock plate fasteners (3) from lock plate (2). Discard fasteners.
4. See Figure 6-14. 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**
   Many transmission parts can be installed in either direction. To prolong usable life, install used parts in same direction as when removed.
6. See Figure 6-15. 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. **Main shaft**
2. Countershaft
3. **Main shaft 1st gear**
4. **Main shaft 2nd gear**
5. **Main shaft 3rd gear**
6. **Main shaft 4th gear**
7. **Main shaft 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 6-12. Gear Set**

1. Bearing housing
2. Lock plate
3. Lock plate fastener (2)
4. Shift cam

**Figure 6-13. Shift Drum**
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. (06312a)

**NOTE**

The mainshaft 4th gear, 3rd gear, 2nd gear and 1st gear are integral parts of the shaft. Damage to any gear requires mainshaft replacement.

1. See Figure 6-16. 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. Press mainshaft out of bearing housing bearings.
1. Retaining ring pliers
2. Guiding hub
3. Dog ring
4. Mainshaft 5th gear

Figure 6-16. 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 6-17. 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 bearing housing 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 bearing housing bearings.
2. See 6.8 TRANSMISSION CASE for bearing housing bearing replacement.
3. See Figure 6-18. Remove washer (1), countershaft 1st gear (2) and bearing.

NOTE

See Figure 6-19. Note the direction that the 2nd gear locking ring is installed.

4. Remove countershaft 2nd gear lock ring.
5. See Figure 6-20. Remove securing segments (1), guiding hub (2), countershaft 2nd gear (4) and bearing.

1. Washer
2. Countershaft 1st gear

Figure 6-18. Countershaft 1st Gear

1. Securing segment
2. Guiding hub
3. Dog ring
4. Countershaft 2nd gear

Figure 6-20. Securing Segment

NOTE

See Figure 6-21. Note the direction that the 3rd gear locking ring is installed.

6. Remove countershaft 3rd gear lock ring.
7. See Figure 6-22. Remove securing segments (1), internal spline washer (2), countershaft 3rd gear (3) and bearing.

NOTE

See Figure 6-23. Note the direction that the 4th gear locking ring is installed.

8. Remove 4th gear lock ring (1), securing segments, dog ring (3), guiding hub (2) and countershaft 4th gear (4) and bearing.
NOTE
The countershaft 5th gear and 6th gear are integral parts of the shaft. Damage to either gear requires countershaft replacement.

Figure 6-21. Third Gear Lock Ring

NOTE
Always replace bearing housing bearing if the shaft is pressed out.
1. See Figure 6-24. Remove the retaining rings (2).
2. Press the bearings out of the bearing housing.

Figure 6-22. Countershaft Third Gear

Figure 6-23. Countershaft Assembly

Removing Bearing Housing Bearings

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)
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. Dry parts with low pressure compressed air.
2. Check gear teeth for damage. Replace gears that are pitted, scored, rounded, cracked or chipped.
3. Inspect the engaging dogs and pockets on the dog rings. Replace the dog rings if dogs and/or pockets are rounded, batered 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 6-25. Using a small 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 bearing housing bearings. Bearings must rotate freely without drag. Replace the bearings if pitted, grooved or if the shafts were removed.

**ASSEMBLY**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>J-5586A</td>
<td>TRANSMISSION SHAFT RETAINING RING PLIERS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mainshaft/countershaft nuts</td>
<td>85-95 ft-lbs 115.3-128.8 Nm</td>
</tr>
<tr>
<td>Shift drum detent arm fastener</td>
<td>120-150 in-lbs 13.6-17.0 Nm</td>
</tr>
<tr>
<td>Shift drum lock plate fasteners</td>
<td>57-83 in-lbs 6.4-7.1 Nm</td>
</tr>
</tbody>
</table>

**Installing Bearing Housing Bearings**

**NOTES**

- Always replace bearing housing bearing if the shaft was pressed out.
- Always use a plate to support the bearing housing when pressing in bearings.
- When pressing new bearings into bearing housing, press on the outside diameter of the bearing side with the numbers stamped on it.

1. Support the bearing housing from the opposite side at the bearing bores with a flat plate.
2. Position new bearing over bore with number side UP.
3. Press the outer diameter of the bearing until the bearing seats in the bore.
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 6-24. Install beveled retaining ring (1) with the flat side against the bearing.

Countershft

NOTES

- Replace retaining ring and all gear roller bearings with new parts during assembly. Lubricate needle bearings and races with SCREAMIN' EAGLE ASSEMBLY LUBE before installation.
- Install securing segments so the side with the rounded edge is facing up and the side with the straight edge is down. Verify segments fully engage grooves in counter-shaft.
- One side of the 2nd, 3rd and 4th gear lock rings have a waved, stepped face. The waved, stepped face always faces the securing segments.

1. See Figure 6-23. Install new needle bearing, countershaft 4th gear (4), guiding hub (2), dog ring (3) securing segments and 4th gear lock ring (1) on countershaft.

2. See Figure 6-22. Install new needle bearing, countershaft 3rd gear (3), internal spline washer (2) and securing segments (1).

3. See Figure 6-21. 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.
- Countershft 2nd gear bearing is wider than other bearings on the countershaft.

4. See Figure 6-20. Install new needle bearing, countershaft 2nd gear (4), guiding hub (2), dog ring (3) and securing segments (1) on countershaft.

5. See Figure 6-19. Place lock ring over securing segments with the stepped face of the lock ring against the securing segments.

6. See Figure 6-18. Install new needle bearing, countershaft 1st gear (2) and washer (1).

NOTES

- If installing countershaft only, hold countershaft 3rd and 4th gear shaft dog up while pressing bearing housing bearing onto countershaft.
- Failure to press on inner bearing races while pressing bearings on the shafts will damage the bearings.

7. See Figure 6-26. Place countershaft in an arbor press supporting countershaft 6th gear. Using a suitable sleeve, press on inner bearing race until bearing housing bearing contacts countershaft 1st gear washer.

Mainshaft

NOTES

- Failure to press on inner bearing race while pressing bearing on the shaft will damage the bearing.
- See Figure 6-27. Hold dog ring so that it is engaged with countershaft 3rd gear during the press procedure. Otherwise bearing and gear damage is possible.

1. Place mainshaft in an arbor press, supporting mainshaft 4th gear.

2. Place rear bearing housing bearing over mainshaft. Using a suitable sleeve, press on inner bearing race until bearing housing bearing contacts mainshaft 1st gear.

3. See Figure 6-16. With bearing housing on end (shafts pointing upward), install new bearing and mainshaft 5th gear (4).

4. Verify guiding hub counterbore is facing mainshaft 5th gear. Install guiding hub (2) and dog ring (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)

5. Install new retaining ring using TRANSMISSION SHAFT RETAINING RING PLIERS (Part No. J-5596A) (1).
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 to 85-95 ft-lbs (115.3-128.8 Nm).

3. Remove transmission assembly from case.

4. Place bearing housing on bench with shafts pointing upward.

5. If removed, install detent arm assembly:
   a. See Figure 6-28. Clean detent screw mounting hole in transmission bearing housing.
   b. Assemble new detent screw, detent arm, sleeve and detent spring. Make certain to orient spring and detent arm as shown.
   c. Mount detent assembly in bearing housing as shown.
   d. Tighten to 120-150 in-lbs (13.6-17.0 Nm).

6. See Figure 6-29. Using screwdriver (1), pull detent arm back to allow installation of shift cam assembly.

7. Install shift cam assembly (5).

8. See Figure 6-30. Install lock plate (2) and new lock plate fasteners (3). Tighten to 57-63 in-lbs (6.4-7.1 Nm).

**NOTE**
See Figure 6-31. The forks are different from each other and are identified as shown.

9. See Figure 6-32. Insert shifter fork (2) into the slot of the dog ring in between mainshaft 5th and 6th gear.

10. Slide long shift shaft through 5th and 6th gear shifter fork. Install shaft in hole in bearing housing.

11. Install short shift shaft:
   a. Insert shifter fork (6) into the slot of the dog ring in between countershaft 3rd and 4th gear.
   b. Insert shifter fork (9) into the slot of the dog ring in between countershaft 1st and 2nd gear.
   c. Slide short shift shaft through countershaft shifter forks.
   d. Install shaft in hole in bearing housing.
1. Bearing housing
2. Lock plate
3. Lock plate fastener (2)
4. Shift cam

Figure 6-30. Shift Drum

1. Screwdriver
2. Detent fastener
3. Detent spring
4. Detent arm
5. Shift cam

Figure 6-29. Detent Assembly

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 6-31. Shifter Forks and Shafts
4. Install the transmission assembly in the transmission case.

5. If equipped, place exhaust bracket into position. Install bearing housing fasteners.

6. See Figure 6-33. Tighten all bearing housing hardware in the sequence shown to 23-25 ft-lbs (31.2-33.9 Nm).

![Figure 6-33. Bearing Housing Hardware Torque Sequence](image)

7. Install mainshaft bearing inner race. See 5.7 TRANSMISSION SPROCKET.

8. See Figure 6-8. Install pushrod assembly (items 2-5) in mainshaft hole. Secure with new retaining ring (1) if removed.

**NOTE**
The two top side cover fasteners are shorter than the others.

9. Install the clutch release cover, using a new gasket. See 6.5 CLUTCH RELEASE COVER.

10. Remove shifter cam pawl from top cover gasket surface and place on shift cam. Install new transmission top cover gasket. Install transmission top cover. Install top cover fasteners and tighten to 90-120 in-lbs (10.2-13.6 Nm).

11. Install vent hose to top cover fitting, if removed.

12. Install transmission sprocket nut. See 5.7 TRANSMISSION SPROCKET.

13. Install primary chaincase, clutch assembly and primary cover. See 5.3 PRIMARY CHAINCASE COVER, Installation.


15. Fill transmission to proper level with fresh transmission fluid. See 1.10 TRANSMISSION LUBRICANT.

16. Install oil tank. See 3.30 OIL TANK: ALL BUT FXSB or 3.31 OIL TANK: FXSB.

17. Install exhaust system. See 4.17 EXHAUST SYSTEM.
REMOVAL

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
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<tr>
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<td>PILOT</td>
</tr>
<tr>
<td>HD-35316-11</td>
<td>RECEIVER CUP</td>
</tr>
<tr>
<td>HD-35316-3A</td>
<td>CROSS PLATE</td>
</tr>
<tr>
<td>HD-35316-4A</td>
<td>8 IN. BOLT</td>
</tr>
<tr>
<td>HD-35316-5</td>
<td>12 IN. BOLT</td>
</tr>
<tr>
<td>HD-35316-7</td>
<td>WASHER</td>
</tr>
<tr>
<td>HD-35316-9</td>
<td>BEARING DRIVER</td>
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<tr>
<td>HD-35316-C</td>
<td>MAIN DRIVE GEAR/BEARING REMOVER AND INSTALLER</td>
</tr>
<tr>
<td>HD-95637-10</td>
<td>LONG BOLTS</td>
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<tr>
<td>HD-95637-46B</td>
<td>WEDGE ATTACHMENT</td>
</tr>
<tr>
<td>RS-25100-200</td>
<td>BEARING</td>
</tr>
</tbody>
</table>

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 4.17 EXHAUST SYSTEM.
2. Remove the primary chaincase cover, clutch assembly, primary chain, compensating sprocket and primary chaincase. See 5.5 PRIMARY CHAINCASE HOUSING.
3. Remove the bearing inner race from the transmission mainshaft. See 5.5 PRIMARY CHAINCASE HOUSING, Mainshaft Bearing Inner Race.
4. Remove the transmission bearing housing. See 6.6 TRANSMISSION ASSEMBLY.

NOTICE
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 bearing housing 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 replaced. The bearing will be damaged during the removal procedure.
* The CROSS PLATE (Part No. HD-35316-3A) is stamped, "UP & SPEED." Mount cross plate with this end pointing up.
6. See Figure 6-34. 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), 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.

NOTE
See Figure 6-35. 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 6-35. 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 6-36. 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 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.
Figure 6-34. Removing Main Drive Gear

1. Cross plate
2. Screw (2)
3. 12 in. bolt
4. Main drive gear
5. Washer
6. Bearing
7. Flat washer
8. Nut

Figure 6-36. Removing Main Drive Gear Bearing

1. 8 in. Bolt
2. Bearing driver
3. Pilot
4. Main drive gear bearing
5. Receiver cup
6. Bearing
7. Flat washer
8. Nut

CLEANING AND INSPECTION

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
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<tbody>
<tr>
<td>HD-47932</td>
<td>MAIN DRIVE GEAR BEARING AND SEAL INSTALLATION TOOL</td>
</tr>
</tbody>
</table>

**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. Dry with compressed air.

**NOTE**

Never wash the transmission case and needle bearings with solvent unless replacing the needle bearings. Normal cleaning methods will wash dirt or other contaminants into the bearing case (behind the needles) and will lead 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.

Figure 6-35. Removing Inner Bearing Race From Main Drive Gear

1. Main drive gear
2. Long bolt (2)
3. Wedge attachment
4. Press ram
4. Replace the sprocket if teeth are cracked or worn. See 5.7 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 replacing the main drive gear needle bearings and/or seal, continue as follows. Otherwise, proceed to 6.8 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 6-38. 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 6-37. 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).

![Figure 6-37. Main Drive Gear Assembly](image)

![Figure 6-38. Main Drive Gear Retaining Rings](image)

3. See Figure 6-39. 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 6-39. Installing Clutch Side Needle Bearing in Main Drive Gear](image)

**NOTE**
An alternative method is provided which allows the mainshaft seal to be pressed into place after installation of the main drive gear. See 6.7 MAIN DRIVE GEAR AND BEARING, Installation.

4. See Figure 6-40. 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 6-41. 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 6-37. Install new retaining rings (1).
8. Install new O-ring (4) into groove in main drive gear.

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<td>HD-47856-6</td>
<td>NUT</td>
</tr>
<tr>
<td>HD-47856-7</td>
<td>CROW'S FOOT WRENCH</td>
</tr>
</tbody>
</table>

**NOTICE**

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 6-42. 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 with large bolt hole in cross plate aligned with main drive gear bearing bore.

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), BEARING (6), FLAT WASHER (7) and NUT (8) over end of bolt.

4. Tighten nut until main drive gear bearing bottoms against tip cast into transmission case bearing bore.
Installing Main Drive Gear

NOTE
See Figure 6-43. Make sure new O-ring (4) is installed onto main drive gear (3). Lubricate O-ring with SCREAMIN’ EAGLE ASSEMBLY LUBE before installing drive gear into transmission case.

1. See Figure 6-43. 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), 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 6-44. 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 6-45. Install new retaining ring (2).

Installing Main Drive Gear Large Seal

1. See Figure 6-45. From outside of crankcase, install PILOT (Part No. HD-47856-2) over end of main drive gear bearing inner race.

2. Coat tips of new main drive gear seal with FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT.

3. See Figure 6-46. 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 6-47. Thread ADAPTER (Part No. HD-47856-3) onto end of main drive gear until it contacts main drive gear.

5. See Figure 6-48. 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 6-49. 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 is controlled by tool.

9. Remove nut, installer, adapter and pilot.

10. Install bearing housing and transmission components. See 6.6 TRANSMISSION ASSEMBLY, Installation.

11. Install sprocket and drive belt. See 5.7 TRANSMISSION SPROCKET. Do not adjust belt at this time.

12. Install the bearing inner race on the transmission mainshaft. See 6.8 TRANSMISSION CASE, Assembly.

13. Install the primary chaincase housing. See 5.5 PRIMARY CHAINCASE HOUSING, Installation.

14. Install the clutch assembly, primary chain, chain tensioner assembly and compensating sprocket components. See 5.4 DRIVE COMPONENTS, Installation.

15. Install the primary chaincase cover. See 5.3 PRIMARY CHAINCASE COVER, Installation.

16. Adjust the drive belt. See 1.12 DRIVE BELT AND SPROCKETS, Adjusting Belt Deflection.

17. Install exhaust system. See 4.17 EXHAUST SYSTEM, System: FLSTC, FXST, FXSB or 4.17 EXHAUST SYSTEM, System: FLSTN, FLSTFB, FLS.
Figure 6-48. Installer and Nut

1. Installer
2. Nut

Figure 6-49. Press Seal Into Crankcase

1. Crow's foot wrench
2. 1/2 in breaker bar
3. Adjustable wrench
REMOVAL

For information on pulling transmission case from frame, see 3.14 REMOVING ENGINE FROM CHASSIS.

**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. See 1.19 BATTERY MAINTENANCE, Battery Disconnection and Removal.

2. Drain engine oil. See 1.6 ENGINE OIL AND FILTER, Changing Oil and Filter.


4. Remove starter. See 7.13 STARTER, Removal.

5. Remove upper and lower fasteners from seat post. Disconnect coil connector and remove the post, with coil attached.

6. Remove transmission assembly. See 6.6 TRANSMISSION ASSEMBLY, Removal.

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.

**NOTE**

When removing pivot shaft, make note of spacer position on each side of transmission. Spacers differ slightly in length from each other and must be installed on the same side from which they were removed.

8. Remove pivot shaft. See 2.23 REAR FORK, Removal.

9. Disconnect vehicle speed sensor (VSS). See 7.27 VEHICLE SPEED SENSOR (VSS), Removal.


11. Mark splines on shift arm and shift shaft to assist in assembly. Remove shift arm from shift shaft.

12. Remove four fasteners that connect transmission to engine.

**NOTE**

See Figure 6-50. 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 pry point.

13. Move transmission rearward until two ring dowels in lower flange are free of crankcase. Remove transmission case from left side of the motorcycle.

INSTALLATION

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<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
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<tr>
<td>Transmission mounting bolts, 1st torque</td>
<td>15 ft-lbs</td>
</tr>
<tr>
<td>Transmission mounting bolts, final torque</td>
<td>34-39 ft-lbs</td>
</tr>
<tr>
<td>Transmission drain plug</td>
<td>14-21 ft-lbs</td>
</tr>
</tbody>
</table>

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 gasket engaging two index pins in holes of transmission flange.

4. See Figure 6-51. Verify that transmission dowels are seated. Place transmission case into position behind crankcase. Make engine and transmission flanges.

**NOTE**

Use new transmission mounting bolts when installing transmission case. Do not reuse old bolts.

5. Tighten fasteners.

   a. Using a crosswise pattern, hand tighten fasteners. Shorter bolts are installed at the top, longer bolts are installed at the bottom.

   b. Alternately tighten bolts to 15 ft-lbs (20.3 Nm) in the same crosswise pattern.

   c. Final tighten bolts to 34-39 ft-lbs (46.1-52.9 Nm).

**NOTE**

When installing pivot shaft, make sure spacers are installed on the same side from which they were removed. Spacers differ slightly in length from each other.
6. Install pivot shaft. See 2.23 REAR FORK, Installation.
7. Install shift shaft on shift arm.
8. Install transmission assembly and main drive gear. See 6.6 TRANSMISSION ASSEMBLY, Installation.
9. Adjust drive belt tension. See 1.12 DRIVE BELT AND SPROCKETS.
10. Install primary chaincase. See 5.5 PRIMARY CHAINCASE HOUSING.

**NOTE**
Always install a new gasket between primary chaincase cover and chaincase. Failure to replace this gasket may cause primary chaincase leaks.

11. Install primary chaincase cover. See 5.3 PRIMARY CHAINCASE COVER.
12. Install the exhaust system. See 4.17 EXHAUST SYSTEM.
13. Clean and install transmission drain plug. 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.

**NOTICE**
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)

14. Fill primary chaincase. See 1.9 PRIMARY CHAINCASE LUBRICANT.
15. Fill oil tank with engine oil. See 1.8 ENGINE OIL AND FILTER.

**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)

16. Connect battery cables, positive cable first.

---

**DISASSEMBLY**

**Shifter Arm Assembly**

1. See Figure 6-52. After removing bearing housing 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. Dry parts with low pressure compressed air.

**NOTE**
Never wash the transmission case and needle bearings with solvent. Normal cleaning methods will wash dirt or other contaminants into the bearing case (behind the needles) leading to bearing failure.

2. See Figure 6-52. 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 damage. Replace as necessary. Use low-pressure compressed air to verify that hose and fitting are unobstructed.

3. Lubricate the bearing with SCREAMIN' EAGLE ASSEMBLY LUBE.

**Shifter Pawl Lever Assembly**

1. See Figure 6-52. Verify that sleeve (2) is inside transmission case.

2. Install screw (11) and washer (10) into side of transmission case. Tighten to 18-23 ft-lbs (24.4-31.2 Nm).

3. See Figure 6-53. Slide shifter lever centering spring (3) over shaft of shifter pawl lever assembly (2). Align opening on spring with tab on lever.

4. Place shifter shaft lever spring (4) on shifter pawl lever assembly.

   **NOTE**
   
   Do not bend shifter shaft lever spring more than necessary for assembly.

5. See Figure 6-54. Insert the assembly into the transmission case.

6. See Figure 6-55. Verify that pin sits inside shifter shaft lever spring.

7. See Figure 6-56. Using SHIFTER SHAFT SEAL INSTALLATION TOOL (Part No. HD-51337), install a new seal. Make sure the seal's garter spring faces the transmission. Drive the seal in until the tool bottoms out on the transmission case. This installs the seal to the correct depth.

8. See Figure 6-54. 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.

9. See Figure 6-52. 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).

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**ASSEMBLY**

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<thead>
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<td>SHIFTER SHAFT SEAL INSTALLATION TOOL</td>
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<td>Shifter rod lever pinch screw,</td>
<td>18-22 ft-lbs</td>
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<tr>
<td>transmission lever</td>
<td>24.4-31.2 Nm</td>
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<tr>
<td></td>
<td>24.4-29.8 Nm</td>
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**Countershaft Needle Bearing Replacement**

1. Find a suitable bearing driver 1.25 in (31.75 mm) in diameter.

2. Check bearing position.
   a. From the outside of the transmission case place the needle bearing open end first next to the bearing bore.
   b. Hold the driver squarely against the closed end of the bearing and tap the bearing into place.
   c. 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).
1. Washer (with seal behind)
2. Retaining ring
3. Shifter shaft lever
4. Pin

**Figure 6-54. Shifter Shaft Lever, Exterior View**

1. Transmission case surface
2. Shift shaft seal
3. 0.120-0.140 in (3.05-3.56 mm)
4. Transmission sprocket

**Figure 6-56. Shift Shaft Seal Installation**

**Figure 6-55. Shifter Shaft Lever Spring**
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<td>7.38 LEFT HANDLEBAR CONTROL MODULE</td>
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</tr>
</tbody>
</table>
### FASTENER TORQUE VALUES IN THIS CHAPTER

The table below lists torque values for all fasteners presented in this chapter.

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACR</td>
<td>13-17 ft-lbs</td>
<td>17.6-23.0 Nm</td>
</tr>
<tr>
<td>Active exhaust module fasteners</td>
<td>32-40 in-lbs</td>
<td>3.6-4.5 Nm</td>
</tr>
<tr>
<td>Auxiliary lamp bracket: FLSTC</td>
<td>72-120 in-lbs</td>
<td>8.1-13.6 Nm</td>
</tr>
<tr>
<td>Auxiliary lamp bracket: FLSTN</td>
<td>72-120 in-lbs</td>
<td>8.1-13.6 Nm</td>
</tr>
<tr>
<td>Auxiliary lamp nut: FLSTC</td>
<td>15-18 ft-lbs</td>
<td>20.3-24.4 Nm</td>
</tr>
<tr>
<td>Auxiliary lamp nut: FLSTN</td>
<td>15-18 ft-lbs</td>
<td>20.3-24.4 Nm</td>
</tr>
<tr>
<td>Battery cable to battery fasteners</td>
<td>60-72 in-lbs</td>
<td>6.8-8.1 Nm</td>
</tr>
<tr>
<td>Battery cable to battery fasteners</td>
<td>60-72 in-lbs</td>
<td>6.8-8.1 Nm</td>
</tr>
<tr>
<td>Coil cover screw: all but FXSB</td>
<td>30-40 in-lbs</td>
<td>3.4-4.5 Nm</td>
</tr>
<tr>
<td>Coil mounting screw: FXSB</td>
<td>96-120 in-lbs</td>
<td>10.9-13.6 Nm</td>
</tr>
<tr>
<td>Crank position sensor (CKP)</td>
<td>90-120 in-lbs</td>
<td>10.2-13.6 Nm</td>
</tr>
<tr>
<td>Electrical panel fasteners: all but FXSB</td>
<td>36-60 in-lbs</td>
<td>4.1-6.8 Nm</td>
</tr>
<tr>
<td>Handlebar clamp to clutch lever bracket screws</td>
<td>60-80 in-lbs</td>
<td>6.8-9.0 Nm</td>
</tr>
<tr>
<td>Handlebar clamp to master cylinder screws</td>
<td>60-80 in-lbs</td>
<td>6.8-9.0 Nm</td>
</tr>
<tr>
<td>Handlebar switch assembly retainer screws</td>
<td>8-10 in-lbs</td>
<td>0.9-1.1 Nm</td>
</tr>
<tr>
<td>Handlebar switch assembly retainer screws</td>
<td>8-10 in-lbs</td>
<td>0.9-1.1 Nm</td>
</tr>
<tr>
<td>Handlebar switch assembly retainer screws</td>
<td>8-10 in-lbs</td>
<td>0.9-1.1 Nm</td>
</tr>
<tr>
<td>Handlebar switch assembly retainer screws</td>
<td>8-10 in-lbs</td>
<td>0.9-1.1 Nm</td>
</tr>
<tr>
<td>Handlebar switch housing screws</td>
<td>35-45 in-lbs</td>
<td>4.0-5.1 Nm</td>
</tr>
<tr>
<td>Handlebar switch housing screws</td>
<td>35-45 in-lbs</td>
<td>4.0-5.1 Nm</td>
</tr>
<tr>
<td>Headlamp circuit board/pin housing screw: all but FLSTN</td>
<td>40-48 in-lbs</td>
<td>4.5-5.4 Nm</td>
</tr>
<tr>
<td>Headlamp lens base screws: All but FLSTN</td>
<td>20-24 in-lbs</td>
<td>2.3-2.7 Nm</td>
</tr>
<tr>
<td>Horn bracket clamp: All but FXSB</td>
<td>80-100 in-lbs</td>
<td>9.0-11.3 Nm</td>
</tr>
<tr>
<td>Horn bracket mounting bolt: FXSB</td>
<td>13-15 ft-lbs</td>
<td>17.6-20.4 Nm</td>
</tr>
<tr>
<td>Horn bracket nut: All but FXSB</td>
<td>80-100 in-lbs</td>
<td>9.0-11.3 Nm</td>
</tr>
</tbody>
</table>

7.20 AUTOMATIC COMPRESSION RELEASE (ACR), Installation/Apply three equally spaced dots of LOCTITE 246 MEDIUM STRENGTH/HIGH TEMPERATURE THREADLOCKER (blue) around lower third of threads.

7.34 ACTIVE EXHAUST, Installation.

7.17 AUXILIARY LAMPS: FLSTC, FLSTN, FLSTC Models.

7.17 AUXILIARY LAMPS: FLSTC, FLSTN, FLSTN Models.

7.17 AUXILIARY LAMPS: FLSTC, FLSTN, Adjustment: FLSTC/FLSTN Models.

7.17 AUXILIARY LAMPS: FLSTC, FLSTN, Adjustment: FLSTC/FLSTN Models.

7.12 BATTERY CABLES, Routing Procedure.

7.12 BATTERY CABLES, Routing Procedure.

7.21 IGNITION COIL, Installation.

7.21 IGNITION COIL, Installation.

7.19 CRANK POSITION SENSOR (CKP), Installation.

7.3 ELECTRICAL PANEL, Installation: All But FXSB.

7.3 LEFT HANDLEBAR CONTROL MODULE, Installation.

7.3 LEFT HANDLEBAR CONTROL MODULE, Clutch Switch Replacement.

7.3 LEFT HANDLEBAR CONTROL MODULE, Front Brake Switch Replacement.

7.38 LEFT HANDLEBAR CONTROL MODULE, Installation.

7.38 LEFT HANDLEBAR CONTROL MODULE, Clutch Switch Replacement.

7.38 LEFT HANDLEBAR CONTROL MODULE, Installation.

7.15 TAIL LAMP: ALL BUT FLSTN, Base Replacement.

7.15 TAIL LAMP: ALL BUT FLSTN, Base Replacement.

7.33 HORN, Removal and Installation: All But FXSB.

7.33 HORN, Removal and Installation: FXSB.

7.33 HORN, Removal and Installation: All But FXSB.

2015 Softail Service: Electrical 7-1
<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horn bracket screws: All but FXSB</td>
<td>35-56 in-lbs</td>
<td>4.0-6.2 Nm</td>
</tr>
<tr>
<td>Ignition/light switch nut: FXSB</td>
<td>140-160 in-lbs</td>
<td>15.6-18.1 Nm</td>
</tr>
<tr>
<td>Ignition coil screws: all but FXSB</td>
<td>120-180 in-lbs</td>
<td>13.9-20.3 Nm</td>
</tr>
<tr>
<td>Ignition switch nut: FXSB</td>
<td>140-160 in-lbs</td>
<td>15.6-18.1 Nm</td>
</tr>
<tr>
<td>Indicator lamp screws: FXSB</td>
<td>20-30 in-lbs</td>
<td>2.3-3.4 Nm</td>
</tr>
<tr>
<td>Instrument panel acorn nut: all but FXSB</td>
<td>84-132 in-lbs</td>
<td>9.5-14.9 Nm</td>
</tr>
<tr>
<td>License plate bracket fasteners: FLSTN</td>
<td>30-50 in-lbs</td>
<td>3.4-5.6 Nm</td>
</tr>
<tr>
<td>License plate support fasteners: FLSTN</td>
<td>60-90 in-lbs</td>
<td>6.8-10.2 Nm</td>
</tr>
<tr>
<td>Neutral switch</td>
<td>120-180 in-lbs</td>
<td>13.6-20.3 Nm</td>
</tr>
<tr>
<td>Oil, pressure switch</td>
<td>95-144 in-lbs</td>
<td>10.8-16.3 Nm</td>
</tr>
<tr>
<td>Rear electrical panel fasteners: FXSB</td>
<td>96-60 in-lbs</td>
<td>4.1-6.8 Nm</td>
</tr>
<tr>
<td>Rear fender support to fender fasteners: FLS</td>
<td>21-27 ft-lbs</td>
<td>28.5-36.6 Nm</td>
</tr>
<tr>
<td>Rear stop lamp switch</td>
<td>12-15 ft-lbs</td>
<td>16.3-22.3 Nm</td>
</tr>
<tr>
<td>Rear turn signal housing fastener</td>
<td>12-16 ft-lbs</td>
<td>16.3-21.7 Nm</td>
</tr>
<tr>
<td>Rear turn signal housing fastener: FLS</td>
<td>12-16 ft-lbs</td>
<td>16.3-21.7 Nm</td>
</tr>
<tr>
<td>Signal lamp mounting bracket screws: FLSTC</td>
<td>36-60 in-lbs</td>
<td>4.1-6.8 Nm</td>
</tr>
<tr>
<td>Signal lamp mounting bracket screws: FLSTN</td>
<td>36-60 in-lbs</td>
<td>4.1-6.8 Nm</td>
</tr>
<tr>
<td>Solenoid contact post jamnut</td>
<td>82-80 in-lbs</td>
<td>7.3-9.0 Nm</td>
</tr>
<tr>
<td>Solenoid terminal post nut</td>
<td>72-90 in-lbs</td>
<td>7.9-10.2 Nm</td>
</tr>
<tr>
<td>Speedometer console nut: all but FXSB</td>
<td>84-132 in-lbs</td>
<td>9.5-14.9 Nm</td>
</tr>
<tr>
<td>Speedometer fasteners: FXSB</td>
<td>12-17 in-lbs</td>
<td>1.4-1.9 Nm</td>
</tr>
<tr>
<td>Splash guard screw</td>
<td>36-48 in-lbs</td>
<td>4.1-5.4 Nm</td>
</tr>
<tr>
<td>Splash guard screw: all but FXSB</td>
<td>36-48 in-lbs</td>
<td>4.1-5.4 Nm</td>
</tr>
<tr>
<td>Splash guard screw: all but FXSB</td>
<td>36-48 in-lbs</td>
<td>4.1-5.4 Nm</td>
</tr>
<tr>
<td>Splash guard screw: all but FXSB</td>
<td>36-48 in-lbs</td>
<td>4.1-5.4 Nm</td>
</tr>
<tr>
<td>Starter end cover screw</td>
<td>90-110 in-lbs</td>
<td>10.2-12.4 Nm</td>
</tr>
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<td>Starter mounting bolts</td>
<td>25-27 ft-lbs</td>
<td>33.9-39.6 Nm</td>
</tr>
<tr>
<td>Starter nut</td>
<td>70-90 in-lbs</td>
<td>7.9-10.2 Nm</td>
</tr>
<tr>
<td>Starter terminal nut</td>
<td>60-80 in-lbs</td>
<td>6.8-9.0 Nm</td>
</tr>
<tr>
<td>Starter through bolts</td>
<td>39-65 in-lbs</td>
<td>4.4-7.3 Nm</td>
</tr>
<tr>
<td>Stator screws</td>
<td>55-75 in-lbs</td>
<td>6.2-8.4 Nm</td>
</tr>
<tr>
<td>Tail lamp connector cover fastener: FLSTN</td>
<td>8-30 in-lbs</td>
<td>6.9-3.4 Nm</td>
</tr>
<tr>
<td>Tail lamp fastener: FLSTN</td>
<td>8-30 in-lbs</td>
<td>0.9-3.4 Nm</td>
</tr>
<tr>
<td>Tail lamp fasteners: FLSTN</td>
<td>60-90 in-lbs</td>
<td>6.8-10.2 Nm</td>
</tr>
<tr>
<td>Tail lamp lens screws</td>
<td>20-24 in-lbs</td>
<td>2.3-2.7 Nm</td>
</tr>
<tr>
<td>Tail lamp, FLSTN, Tail Lamp Replacement</td>
<td></td>
<td>7.16 TAIL LAMP, FLSTN</td>
</tr>
<tr>
<td>Tail lamp, FXSB, Tail Lamp Replacement</td>
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<td>7.16 TAIL LAMP, ALL BUT FLSTN</td>
</tr>
<tr>
<td>Tail lamp, FLSTN, Bulb Replacement</td>
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<td>7.15 TAIL LAMP, ALL BUT FLSTN</td>
</tr>
<tr>
<td>FASTENER</td>
<td>TORQUE VALUE</td>
<td>NOTES</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>--------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>Turn signal bar screws: FLSTN</td>
<td>15-19 ft-lbs</td>
<td>20.4-25.8 Nm, 7.18 TURN SIGNALS AND RUNNING</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LIGHTS, Lamp Replacement</td>
</tr>
<tr>
<td>Upper handlebar clamp fasteners: FXSB</td>
<td>12-16 ft-lbs</td>
<td>16.3-21.7 Nm, 7.29 INDICATOR LAMPS,</td>
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<tr>
<td></td>
<td></td>
<td>Installation: FXSB</td>
</tr>
<tr>
<td>Voltage regulator</td>
<td>50-80 in-lbs</td>
<td>5.7-9.0 Nm, 7.23 VOLTAGE REGULATOR,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Installation</td>
</tr>
<tr>
<td>Voltage regulator bracket to crankcase</td>
<td>70-100 in-lbs</td>
<td>7.23 VOLTAGE REGULATOR, Installation</td>
</tr>
<tr>
<td>fasteners</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VSS mounting bolt</td>
<td>84-108 in-lbs</td>
<td>9.5-12.2 Nm, 7.27 VEHICLE SPEED SENSOR</td>
</tr>
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<td>(VSS), Installation</td>
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### Table 7-1. Ignition System Specifications

<table>
<thead>
<tr>
<th>IGNITION</th>
<th>DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idle speed</td>
<td>950-1050 RPM</td>
</tr>
<tr>
<td>Spark plug size</td>
<td>12 mm</td>
</tr>
<tr>
<td>Spark plug gap</td>
<td>0.038-0.043 in.</td>
</tr>
<tr>
<td></td>
<td>0.97-1.09 mm</td>
</tr>
<tr>
<td>Spark plug type</td>
<td>Harley-Davidson No. 6R12 (no substitute)</td>
</tr>
<tr>
<td>Ignition coil primary resistance</td>
<td>0.5-0.7 ohms</td>
</tr>
<tr>
<td>Ignition coil secondary resistance</td>
<td>5500-7500 ohms</td>
</tr>
</tbody>
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### Table 7-2. Circuit Breaker/Fuses

<table>
<thead>
<tr>
<th>CIRCUIT BREAKER/FUSES</th>
<th>RATING (AMPERES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main fuse</td>
<td>40</td>
</tr>
<tr>
<td>P&amp;A fuse</td>
<td>15</td>
</tr>
<tr>
<td>Battery fuse</td>
<td>15</td>
</tr>
</tbody>
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### Table 7-3. Charging System

<table>
<thead>
<tr>
<th>CHARGING SYSTEM</th>
<th>DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery</td>
<td>19 A hour/315 CCA</td>
</tr>
<tr>
<td>Alternator AC voltage output</td>
<td>16-23 VAC per 1000 rpm</td>
</tr>
<tr>
<td>Alternator stator coil resistance</td>
<td>0.1-0.2 ohms</td>
</tr>
<tr>
<td>Regulator voltage output @ 3600 rpm</td>
<td>14.3-14.7 VDC @ 75 °F (24 °C)</td>
</tr>
<tr>
<td>Regulator amperes @ 3000 rpm</td>
<td>35-50 A</td>
</tr>
</tbody>
</table>

### Table 7-4. Starter Specifications

<table>
<thead>
<tr>
<th>STARTER DATA</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Free speed</td>
<td>3000 rpm (min) @ 11.5 V</td>
</tr>
<tr>
<td>Free current</td>
<td>90 A (max) @ 11.5 V</td>
</tr>
<tr>
<td>Cranking current</td>
<td>200 A (max) @ 88 °F (20 °C)</td>
</tr>
<tr>
<td>Stall torque</td>
<td>8.0 ft-lbs (10.8 Nm) @ 2.4 V</td>
</tr>
</tbody>
</table>
GENERAL

All Softail models use a panel under the rear fender to mount important electrical components. This electrical panel contains:

- Body control module (BCM).
- Security siren, if equipped.
- ABS ECU, if equipped.
- FXSB: ECM

REMOVAL: ALL BUT FXSB

1. Remove seat.

⚠️ WARNING ⚠️

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. Remove main fuse.
3. Remove right side saddlebag if present.

NOTE

Rear wheel may have to be raised slightly to allow for splash guard removal.

4. Remove bolt from lower end of splash guard. Lift up on tabs and pull lower end of splash guard toward rear tire.
5. Pull upper end of splash guard off rear fork and move splash guard from motorcycle.
6. See Figure 7-1. Remove BCM (1).
7. Remove wheel speed sensor connector (4) from electrical panel.
8. If installed, remove security siren (5). If not installed, disconnect security siren connector [142] from receptacle (3) in electrical panel.
9. If installed, remove purge solenoid from top of electrical panel. If not installed, disconnect purge solenoid connector [95] from receptacle (2) on top of electrical panel.
10. See Figure 7-2. If equipped with ABS, remove ECU (1) from electrical panel.
11. Remove electrical panel fasteners (2) and remove electrical panel.
1. Install main fuse.

**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)

12. Install seat.

**REMOVAL: FXSB**

1. Remove main fuse.
2. Remove rear wheel. See 2.5 REAR WHEEL.
3. Remove splash guard.
4. See Figure 7-3. Press in on tab and pull ECM panel away from latch.
5. See Figure 7-4. Remove security siren (2), BCM (3), ECU (4) and ECM with panel (5).
6. Detach purge solenoid (1) from rear electrical panel.
7. See Figure 7-5. Remove three fasteners securing rear electrical panel to frame.
8. Remove rear electrical panel.

**INSTALLATION: FXSB**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear electrical panel</td>
<td>36-60 in-lbs</td>
</tr>
<tr>
<td>fasteners: FXSB</td>
<td>4.1-6.8 Nm</td>
</tr>
<tr>
<td>Splash guard screw: all but FXSB</td>
<td>36-43 in-lbs</td>
</tr>
<tr>
<td></td>
<td>4.1-5.4 Nm</td>
</tr>
</tbody>
</table>

1. Install rear electrical panel.
2. See Figure 7-6. Install three fasteners securing rear electrical panel to frame. Tighten to 36-60 in-lbs (4.1-6.8 Nm).
3. See Figure 7-4. Attach purge solenoid (1) to rear electrical panel.
4. Install BCM (3), security siren (2), ECU (4) and ECM (5) with panel.
5. See Figure 7-3. Push ECM panel forward and engage latch.
6. Install splash guard.
7. Install rear wheel. See 2.5 REAR WHEEL.
8. Install main fuse.
GENERAL

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48650</td>
<td>DIGITAL TECHNICIAN II</td>
</tr>
</tbody>
</table>

All But FXSB: the ECM is mounted under the seat.

FXSB: the ECM is mounted on the rear electrical panel.

See the electrical diagnostic manual for information on the function and testing of the ECM.

NOTES
- The ECM cannot be repaired. Replace the unit if it fails.
- If replacing the ECM, perform calibration using DIGITAL TECHNICIAN II (Part No. HD-48650).

REMOVAL: ALL BUT FXSB

1. Remove seat.

WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. Remove main fuse.
3. See Figure 7-6. Pull ECM from mount.
4. Detach connectors [78-1, 78-2].

INSTALLATION: ALL BUT FXSB

2. Install ECM on mount.
3. Install main fuse.
4. If new ECM was installed, calibrate ECM and perform password learn procedure using DIGITAL TECHNICIAN II (Part No. HD-48650).

⚠️ 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)

5. Install seat.

REMOVAL: FXSB

1. Remove main fuse.
2. Remove rear wheel. See 2.5 REAR WHEEL.
3. Remove splash guard.
4. See Figure 7-7. Press in on tab and pull ECM panel away from latch.
5. Disconnect ECM connector.
6. Remove ECM from panel.

INSTALLATION: FXSB

1. Install ECM onto panel.
2. Connect ECM connector.
3. See Figure 7-7. Push ECM panel forward and engage latch.
4. Install splash guard.
5. Install rear wheel. See 2.5 REAR WHEEL.
6. Install main fuse.

Figure 7-6. ECM Location

Figure 7-7. ECM

1. Figure 7-6. Attach connectors [78-1, 78-2] to ECM.
GENERAL

The BCM is located in front of the rear tire. The BCM supplies ignition and accessory power to most of the vehicle. It controls the lighting and other functions by using the switches as inputs, and the power circuits for the lights as outputs. The BCM is also connected to the CAN bus and shares information with the other modules on the vehicle. See the electrical diagnostic manual for more information.

BCM CONFIGURATION

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48650</td>
<td>DIGITAL TECHNICIAN II</td>
</tr>
</tbody>
</table>

After replacing BCM, perform configuration/password learn using DIGITAL TECHNICIAN II (Part No. HD-48650).

REMOVAL: ALL BUT FXSB

1. Remove seat.

   **WARNING**

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. Remove main fuse.

3. Remove right side saddlebag, if present.

   **NOTE**

   Rear wheel may have to be raised slightly to allow for splash guard removal.

4. Remove bolt from lower end of splash guard. Lift up on tabs and pull lower end of splash guard toward rear tire.

5. Pull upper end of splash guard off rear fork and move splash guard from motorcycle.

6. See Figure 7-8. Detach body control module (BCM) (1) from electrical panel and remove both electrical connectors.

INSTALLATION: ALL BUT FXSB

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Splash guard screw: all but FXSB</td>
<td>36-48 in-lbs</td>
</tr>
</tbody>
</table>

   **NOTE**

   All replacement BCMs are configured for keyless ignition. If the battery is reconnected with the run/stop switch in the run position, the vehicle will enable all ignition functions and not respond to the ignition switch. If this situation occurs, turn the ignition and run/stop switches off. Then turn the ignition on.

1. Verify ignition and run/stop switches are in the OFF position.

2. See Figure 7-8. Connect both BCM connectors and install BCM (1) onto electrical panel.
REMOVAL: FXSB

1. Remove main fuse.
2. Remove rear wheel. See 2.5 REAR WHEEL.
3. Remove splash guard.
4. See Figure 7-9. Press in on tab and pull ECM panel away from latch.
5. See Figure 7-10. Move security siren (1) out of the way.
6. Remove BCM (2).

INSTALLATION: FXSB

1. See Figure 7-10. Install BCM (2).
2. See Figure 7-11. Install BCM connectors with harness routed as shown.
3. Install security siren (1).
4. See Figure 7-9. Push ECM panel forward and engage latch.
5. Install splash guard.
6. Install rear wheel. See 2.5 REAR WHEEL.
Do not add sidecar to this motorcycle. Operating motorcycle with sidecar can cause loss of vehicle control, which could result in death or serious injury. (00590d)

**ACTUATION**

Activation consists of assigning two fobs to the system and entering an initial PIN. The PIN can be changed by the owner. See 7.7 PERSONAL IDENTIFICATION NUMBER (PIN), Changing The PIN.

1. Configure vehicles by assigning both fobs to the vehicle.
2. Configure vehicles by entering a PIN picked by the owner. The personal PIN allows the owner to operate the system if the fob is lost or inoperable. Record the PIN in the owner's manual. Instruct the customer to carry a copy (use the wallet card found in the owner's manual). See 7.7 PERSONAL IDENTIFICATION NUMBER (PIN).

Once the system has been activated, it "arms" within 5 seconds of switching the OFF/RUN switch to OFF and no motorcycle motion.

**FOB ASSIGNMENT**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48650</td>
<td>DIGITAL TECHNICIAN II</td>
</tr>
</tbody>
</table>

Use DIGITAL TECHNICIAN II (Part No. HD-48650) to assign both fobs to the H-DSSS. Follow the menu prompts to scan the fob serial number with the bar code reader. Alternatively, enter the number using the keyboard. The initial PIN entry should be performed using DIGITAL TECHNICIAN II (Part No. HD-48650) in conjunction with fob assignment.

**NOTE**

Each fob has a unique serial number. Attach fob label to a blank NOTES page in the owner’s manual for reference.
GENERAL

The PIN consists of five digits. Each digit can be any number from 1 through 9. There can be no zeros (0) in the PIN. Use the PIN to disarm the security system in case the job becomes unavailable.

CHANGING THE PIN

The rider can change the PIN at any time. Refer to Table 7-5.

Modifying an Existing PIN

If a PIN was previously entered, the odometer will display the equivalent digit. Each additional press of the left turn switch will increment the digit.

Examples:
- To advance from 5 to 6, press and release the left turn switch 1 time.
- To advance from 8 to 2, press and release the left turn switch 3 times (9-1-2).

<table>
<thead>
<tr>
<th>STEP NO.</th>
<th>ACTION</th>
<th>WAIT FOR CONFIRMATION</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Select a 5-digit (1 thru 9) PIN and record on the wallet card from owner's manual.</td>
<td>ENTER PIN will scroll through the odometer window.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>With an assigned fob present, turn the OFF/RUN switch to OFF.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Turn the ignition switch to IGN.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Cycle the OFF/RUN switch twice: RUN - OFF - RUN - OFF - RUN.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Press left turn signal switch 2 times.</td>
<td>Turn signals will flash 3 times. Current PIN will appear in odometer. The first digit will be flashing.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Press right turn signal switch 1 time and release.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Enter first digit of new PIN by pressing and releasing the left turn signal switch until the selected digit appears.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Press right turn signal switch 1 time and release.</td>
<td>The new digit will replace the current in odometer window.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Enter second digit of selected PIN by pressing and releasing the left turn signal switch until the selected digit is present.</td>
<td>The new digit will replace the current in odometer window.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Press right turn signal switch 1 time and release.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Enter third digit of the selected PIN by pressing and releasing the left turn signal switch until the selected digit is present.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Press right turn switch 1 time and release.</td>
<td>The new digit will replace the current in odometer window.</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Enter fourth digit of new PIN by pressing and releasing the left turn signal switch until the selected digit is present.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Press right turn switch 1 time and release.</td>
<td>The new digit will replace the current in odometer window.</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Enter fifth digit of the new PIN by pressing and releasing the left turn signal switch until the selected digit is present.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STEP NO.</td>
<td>ACTION</td>
<td>WAIT FOR CONFIRMATION</td>
<td>NOTES</td>
</tr>
<tr>
<td>---------</td>
<td>--------</td>
<td>------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>16</td>
<td>Press right turn switch <strong>1 time</strong> and release.</td>
<td>The new digit will replace the current in odometer window.</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Turn the OFF/RUN switch <strong>OFF</strong>, then turn the ignition switch to <strong>OFF</strong>.</td>
<td></td>
<td>Pushing the OFF/RUN switch to OFF stores the new PIN in the module.</td>
</tr>
</tbody>
</table>
FOB BATTERY

Battery Replacement Schedule
Replace the fob battery every year.

Battery Replacement
1. Open the fob case.
   a. See Figure 7-12. Place a thin blade in the thumbnail slot (1) between the two halves of the case.
   b. Slowly twist the blade.

   NOTE
Use a CR2032 or equivalent battery.

2. Replace the battery.
   a. Remove the original battery.
   b. Install a new battery with the positive side down.

3. Close the case.
   a. See Figure 7-12. With O-ring (3) in place, align case halves.
   b. Snap case halves together.

NOTE
The internal siren battery may not charge if the motorcycle's battery is less than 12.5V.

Battery Replacement
1. Disarm system and remove siren.

2. See Figure 7-13. With a small screwdriver or pick, push the catches (1) in through the two slots (2) in the end of the siren to release the battery cover (3).

   NOTES
   - For protection against corrosion, battery terminals and battery clip are covered with a special grease. Do not wipe away this substance. Apply all available existing grease to terminals on new battery.
   - Use only a 9V nickel metal hydride battery in the siren.

3. Replace battery (4) by removing old battery from polarized battery clip.

4. Recharge and install or install a new 9V nickel metal hydride battery.

5. Install battery cover (3).
   a. Carefully replace the rubber seal (5) on the cover.
   b. Align battery cover with case placing round corners on cover away from connector (142A) (6).
   c. Snap cover into place.

6. Install siren and check operation. Two chirps after an arming command indicate a working siren.

SMART SIREN (IF INSTALLED)

Battery Replacement Schedule
The siren's internal 9V battery is rechargeable and does not require replacement on a regular basis. Battery life under normal conditions is approximately three to six years.
REMOVAL: ALL BUT FXSB

1. Remove seat.

**WARNING**

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. Remove main fuse.

3. Remove right side saddlebag, if present.

**NOTE**

Rear wheel may have to be raised slightly to allow for splash guard removal.

4. Remove bolt from lower end of splash guard. Lift up on tabs and pull lower end of splash guard toward rear tire.

5. Pull upper end of splash guard off rear fork and move splash guard from motorcycle.

**NOTES**

- Anti-theft units see Figure 7-15. The anti-theft tracking module is combined with the security siren. An antenna is hard wired to the anti-theft module and needs to be detached from its mounting position.

- Cutting antenna wire will activate anti-theft device. See the electrical diagnostic manual for more information.

- Note the routing of the anti-theft module antenna wire for installation.

6. See Figure 7-14. Detach security siren (5) from electrical panel and remove electrical connector.

INSTALLATION: ALL BUT FXSB

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Splash guard screw: all but FXSB</td>
<td>36-48 in-lbs 4.1-5.4 Nm</td>
</tr>
</tbody>
</table>

1. See Figure 7-14. Connect security siren connector and install security siren (5) onto electrical panel.

2. Place splash guard into position and snap upper end onto rear fork.

3. Press lower end against rear fork until the tabs snap into place.

4. Install screw to secure splash guard. Tighten to 36-48 in-lbs (4.1-5.4 Nm).

5. Install right side saddlebag, if removed.

6. Install main fuse.

**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)

7. Install seat.

REMOVAL: FXSB

1. Remove main fuse.

2. Remove rear wheel. See 2.5 REAR WHEEL.

3. Remove splash guard.
4. See Figure 7-16. Press in on tab and pull ECM panel away from latch.
5. See Figure 7-17. Disconnect electrical connector.
6. Remove security siren.

**INSTALLATION: FXSB**

1. See Figure 7-17. Install security siren.
2. Connect electrical connector.
3. See Figure 7-16. Push ECM panel forward and engage latch.
4. Install splash guard.
5. Install rear wheel. See 2.5 REAR WHEEL.
6. Install main fuse.

---

Figure 7-16. ECM

Figure 7-17. Security Siren
REMOVAL
1. Remove seat.
2. See Figure 7-18. Pull fuse block away from cover.
3. See Figure 7-19. Replace suspect fuse.

INSTALLATION
1. Place fuse block back into cover and make sure cover is secured to frame.

**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)

2. Install seat.

![Fuse Block Location](image)

**Figure 7-18. Fuse Block Location**

![Fuse Block](image)

**Figure 7-19. Fuse Block**

1. Main
2. P&A
3. Battery
GENERAL

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)

Softail model ignition/light/key switches are non-repairable. If a switch is damaged, it must be replaced. Key switch functions and locations are listed in Table 7-6.

REMOVAL AND INSTALLATION: ALL BUT FXSB

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>instrument panel acorn nut: all but FXSB</td>
<td>84-132 in-lbs</td>
</tr>
</tbody>
</table>

1. Remove seat.

WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00231b)

2. Remove main fuse.
3. See Figure 7-20. Remove acorn nut and washer (1) from panel (2 or 5) and remove panel.
4. Remove electrical connector from switch.
5. Remove mounting screws (4). Replace switch.
6. Install mounting screws (4).
7. Install electrical connector to switch.
8. Install instrument panel using acorn nut and washer. Tighten to 84-132 in-lbs (9.5-14.9 Nm).
9. Install main fuse.

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)

10. Install seat.

NOTE

Harley-Davidson recommends removing key from lock before operating motorcycle. Keys left in the ignition switch can fail out while riding.

Figure 7-20, Ignition Switch: All But FXSB
Table 7-6. Key Switch Functions and Positions

<table>
<thead>
<tr>
<th>MODEL AND LOCATION</th>
<th>DOMESTIC SWITCH</th>
<th>HDI SWITCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>All but FXSB: tank console. FXSB: left side of engine.</td>
<td>OFF - Ignition and lights are off. ACC - Instrument lights are on. Brake light and horn can be activated. IGNITION - Hazard warning flasher can be turned on. Ignition, lights and accessories are on.</td>
<td>Same; in addition, position lamp, tail lamp are ON. Same; in addition, position lamp is ON.</td>
</tr>
</tbody>
</table>

REMOVAL AND INSTALLATION: FXSB

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-50988</td>
<td>IGNITION SWITCH SPANNER WRENCH</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ignition/light switch nut: FXSB</td>
<td>140-160 In-lbs 15.8-18.1 Nm</td>
</tr>
</tbody>
</table>

1. Remove seat.

**WARNING**

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding (00231b).

2. Remove main fuse.
3. Turn ignition/light switch to ON position.
4. See Figure 7-21. Loosen set screw (6) and remove knob (5).
5. Remove nut (4) using IGNITION SWITCH SPANNER WRENCH (Part No. HD-50988).
6. Disconnect ignition/light switch electrical connector.
7. Replace ignition/light switch (1).
10. Install nut (4) using IGNITION SWITCH SPANNER WRENCH (Part No. HD-50988). Tighten nut to 140-160 In-lbs (15.8-18.1 Nm).
11. Install knob (5) and tighten set screw (6).
12. Install main fuse.

**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).

13. Install seat.

**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)

14. Test vehicle operation. Refer to Table 7-6.

**Figure 7-21. Ignition/Light Switch: FXSB**
BATTERY CABLES

7.12

ROUTING PROCEDURE

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starter nut</td>
<td>70-90 in-lbs</td>
</tr>
<tr>
<td>Battery cable to battery</td>
<td>60-72 in-lbs</td>
</tr>
<tr>
<td>Battery cable to battery</td>
<td>60-72 in-lbs</td>
</tr>
<tr>
<td></td>
<td>7.9-10.2 Nm</td>
</tr>
<tr>
<td></td>
<td>6.8-8.1 Nm</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. See Figure 7-22. Position positive battery cable properly at starter. Cable end must face 35 degrees +/- 10 degrees forward from left side of vehicle.

**WARNING**

Be sure rubber boot covers starter solenoid terminal connected to positive (+) battery cable. An uncovered terminal can short and cause sparks, which could result in a battery explosion and death or serious injury. (00463a)

2. Tighten starter nut to 70-90 in-lbs (7.9-10.2 Nm) and cover with boot.

3. See Figure 7-23. Place battery caddy into position and install battery caddy clip (1) under front of battery tray (3). Make sure tabs (2) of battery caddy fit over rear of battery tray.

4. See Figure 7-24. Install positive battery cable (1) into clip (3) in caddy.

5. Route rear oxygen sensor harness (2) through clip (3).

**NOTICE**

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. (00063a)

6. See Figure 7-25. Install battery. Tighten positive battery terminal fastener to 60-72 in-lbs (6.8-8.1 Nm).

7. Install negative battery cable (2) at battery frame ground (1) before any accessory ground wires.

8. Install negative battery cable (2) at battery. Tighten negative battery terminal fastener to 60-72 in-lbs (6.8-8.1 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)

9. Install seat.

Figure 7-22. Positive Battery Cable Routing

Figure 7-23. Battery Caddy

Figure 7-24. Battery Caddy Wire Routing
1. Battery frame ground
2. Negative battery cable
3. Positive battery cable

Figure 7-25. Battery Connections
GENERAL

The starter assembly includes a field coil, solenoid and drive assembly.

NOTES

- For troubleshooting and diagnostic information see the electrical diagnostic manual.
- Use touch-up paint as necessary prior to installation. Paint flashing does not require starter replacement.

REMOVAL

WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

1. Remove rear wheel. See 2.5 REAR WHEEL.
2. Remove electrical panel. See 7.3 ELECTRICAL PANEL.
3. Remove battery.
4. Remove positive cable from starter.
5. See Figure 7-30. Detach solenoid wire (4).
6. Remove both starter mounting fasteners (2).
7. Remove starter.
8. Before disassembling the starter, perform diagnostics listed in the electrical diagnostic manual.

DRIVE ASSEMBLY

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starter through bolts</td>
<td>39-85 in-lbs</td>
</tr>
<tr>
<td>Solenoid terminal post nut</td>
<td>70-90 in-lbs</td>
</tr>
<tr>
<td>Starter end cover screw</td>
<td>90-110 in-lbs</td>
</tr>
</tbody>
</table>

Disassembly

1. Remove end cover, if equipped.
2. Remove two nuts to release end cover bracket from through bolts, if equipped.
3. See Figure 7-26. Pull up rubber boot (1). Remove hex nut with captive lockwasher. Release field wire from terminal post on solenoid housing.
4. Loosen two through bolts (2) to release field coil housing from solenoid housing.

NOTE
Do not remove armature and brush plate from housing. No replacement parts are available.
5. Remove armature housing (3) keeping all contents together for reassembly.
6. Remove two screws to release drive housing from solenoid housing. Use a rubber mallet to separate drive and solenoid housings, if necessary.

7. Remove idler gear (5) from bearing cage in drive housing. Remove bearing cage with five roller bearings (6) from shaft in drive housing.
8. Push on end of drive shaft to remove clutch starter sub assembly (7) from drive housing.
9. Remove solenoid spring and ball from the output shaft of the clutch starter sub assembly.

Inspection

1. Inspect two O-rings on drive housing for damage. Replace if necessary.
2. See Figure 7-26. Verify that the idler gear (5) rotates freely without drag or sticking.
3. Remove and inspect idler gear. Replace starter motor if the gear is damaged.
4. Inspect roller bearings (6). Bearings must rotate freely without drag or sticking. Replace starter motor if the bearings are pitted or grooved.
5. Inspect the steel ball for damage. Replace if necessary.

NOTE
Replace entire starter motor if solenoid return spring fails.
Assembly

1. See Figure 7-26. Assemble starter.
   a. Lubricate parts with high temperature grease such as LUBRIPASTE 110 during assembly.
   b. Install bearing cage with five roller bearings (6) onto shaft in drive housing.
   c. Confirm that all five roller bearings are installed in grooves of bearing cage and install idler gear (5) over bearing cage.
2. Lubricate bearings with LUBRIPASTE 110 before installation. Install new clutch starter sub assembly (7) in drive housing sealing the larger bearing in the counterbore.
3. Apply a light film of LUBRIPASTE 110 to solenoid plunger shaft. Install return spring on solenoid plunger shaft.

   NOTE
   Before mating the solenoid and drive housings, apply a thin layer of HARLEY-DAVIDSON HIGH PERFORMANCE SEALANT - GRAY to drive housing between the two housings.
4. Mate the solenoid and drive housings with two screws. Alternately tighten until snug.
5. Install through bolts to fasten field coil to solenoid housing. Tighten to 39-65 in-lbs (4.4-7.3 Nm).
6. Secure field wire ring terminal to short post on solenoid housing with hex nut with captive lockwasher. Tighten to 70-90 in-lbs (7.9-10.2 Nm). Cover field wire ring terminal with rubber boot (1).
7. Install end cover bracket onto through bolts, if equipped. Orient longest end of bracket on the field wire side. Install two nuts. Tighten until snug.
8. Install end cover, if equipped. Tighten to 90-110 in-lbs (10.2-12.4 Nm).

   SOLENOID

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solenoid contact post jamnut</td>
<td>65-80 in-lbs</td>
</tr>
<tr>
<td>Starter ring terminal hex nut</td>
<td>60-80 in-lbs</td>
</tr>
</tbody>
</table>

   Cover and Plunger Removal
   1. See Figure 7-27. Remove fasteners (1), cover (2) and gasket (3).
   2. Remove the plunger (4) with spring (5).

   Figure 7-27. Solenoid Plunger

   Short Post Contact: Starter
   1. Disassemble the short post contact:
      a. Remove the hex nut and the ring terminal from the post.
      b. See Figure 7-28. Remove jamnut (8), wave washer (7), O-ring (6) and round bushing (5).
      c. Remove the post bolt (1).
      d. Remove the hold-in terminal (2) from the post bolt.
      e. Remove the contact plate (3) and the square bushing (4).
   2. Assemble the short post contact:
      a. Insert the square bushing into the housing.
      b. Install the contact plate with the 90 degree part of the contact plate against the solenoid winding.
      c. Install the post bolt through the hold-in terminal, the contact plate and the square bushing.
      d. Install the round bushing, O-ring, wave washer and jamnut.
Long Post Contact: Battery Positive

1. See Figure 7-29. Remove the long post contact:
   a. Remove hex nut (9).
   b. Remove jam nut (8), wave washer (7), O-ring (6) and the round bushing (5).
   c. Remove post bolt (4), contact plate (3), square bushing (2) and paper insulator (1).

2. Install the long post contact:
   a. Insert the square bushing through the paper insulator into the housing.
   b. Install the contact plate with the foot against the solenoid winding.
   c. Install the post bolt.

   **NOTE**
   Check that the index pin on the round bushing fits the blind hole in the housing.
   d. Install the round bushing, O-ring, wave washer and jam nut.

**Plunger and Cover Installation**

1. Apply LUBRIPLATE 110 to the plunger shaft. Install the spring.
2. Install the plunger and spring in the housing.
3. While compressing the plunger, alternately tighten the contact post jam nuts to 65-80 in-lbs (7.3-9.0 Nm).
4. Check that the contact plates are aligned to the solenoid winding.
5. Install the cover:
   a. Install a new gasket on the cover.
   b. Install the cover.
   c. Install the fasteners until snug.
6. Install the starter positive ring terminal.
7. Install the hex nut. Tighten to 60-80 in-lbs (6.8-9.0 Nm).

**INSTALLATION**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starter mounting bolts</td>
<td>25-27 ft-lbs</td>
</tr>
</tbody>
</table>

1. Install starter.
2. See Figure 7-30. Apply LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to threads of both starter mounting fasteners (2). Install and tighten to 25-27 ft-lbs (33.9-36.6 Nm).
3. Attach solenoid wire (4).
4. Install positive battery cable to starter. Make sure cable is angled properly. See 7.12 BATTERY CABLES.
5. Install electrical panel. See 7.3 ELECTRICAL PANEL.
6. Install rear wheel. See 2.5 REAR WHEEL.
7. Install battery. See 1.19 BATTERY MAINTENANCE.
GENERAL

NOTICE

When replacement is required, use only the specified sealed beam unit or bulb, available from a Harley-Davidson dealer. An improper wattage sealed beam or bulb, can cause charging system problems. (00209a)

If either headlamp bulb filament burns out, replace the bulb. Use only direct replacement bulbs as specified in the parts catalog and 1.4 BULB REQUIREMENTS.

NOTE

Align slots and tabs in headlamp, mounting ring and trim ring during assembly.

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)

HEADLAMP ASSEMBLY REMOVAL AND INSTALLATION

Removal

NOTE

Fuel tank crossover hose does not need to be disconnected. Fuel tank can be slid back enough to remove required connectors.

1. Slide fuel tank rearward. See 4.6 FUEL TANK.
2. See Figure 7-31. Disconnect headlamp connector (5).
3. Fender tip lamp equipped: disconnect front fender tip lamp connector (6).
4. Auxiliary lamps equipped: disconnect headlamp connector at auxiliary switch connector.
5. See Figure 7-32. Remove horizontal adjusting bolt (2) and headlamp assembly.

Installation

1. See Figure 7-32. Install headlamp assembly with horizontal adjusting bolt (2).
2. Auxiliary lamps equipped: connect headlamp connector to auxiliary switch connector.
3. Fender tip lamp equipped: see Figure 7-31. Connect front fender tip lamp connector (8).
4. Connect headlamp connector (5).
5. Install fuel tank. See 4.6 FUEL TANK.
6. Adjust headlamp alignment. See 1.20 HEADLAMP ALIGNMENT.

BULB REMOVAL AND INSTALLATION

NOTICE

Never touch the quartz bulb. Fingertips will etch the glass and decrease bulb life. Handle the bulb with paper or a clean, dry cloth. Failure to do so could result in bulb damage. (00210b)
Handle bulb carefully and wear eye protection. Bulb contains gas under pressure, which, if not handled carefully, could cause serious eye injury. (00062b)

Figure 7-33. Wire Retaining Clip

**FXST, FXSB Models**

1. See Figure 7-34. Loosen trim ring screw (4). Remove trim ring (3).

2. Pull wiring connector block from bulb prongs.

3. Remove rubber boot (7) from back of headlamp (5).

4. See Figure 7-33. Squeeze wire retaining clip ends to unhook them from notches in headlamp assembly.

5. Pivot wire retaining clip away from bulb. Replace old bulb with new bulb.

6. Assemble headlight components. See 1.20 HEADLAMP ALIGNMENT to adjust light beam.

**FLSTC, FLSTFB, FLSTN and FLS Models**

1. See Figure 7-34. Remove trim ring screw (4) and trim ring (3). Be careful not to bend the two tabs that hold the top of the trim ring in place.

2. Remove mounting ring screws (16) and mounting ring that holds sealed beam headlamp in place.

3. Pull wiring connector block from bulb prongs.

4. Remove rubber boot (7) from back of headlamp (5).

5. See Figure 7-33. Squeeze wire retaining clip ends to unhook them from notches in headlamp assembly.

6. Pivot wire retaining clip away from bulb. Replace old bulb with new bulb.

7. Assemble headlight components. See 1.20 HEADLAMP ALIGNMENT to adjust light beam.
Figure 7-34. Headlamps

1. Headlamp housing
2. Adapter ring
3. Trim ring
4. Screw
5. Headlamp
6. Halogen bulb
7. Boot
8. Nut
9. Lockwasher
10. Washer
11. Lockwasher
12. Bolt
13. Bolt
14. Mounting block
15. Mounting ring
16. Screw
GENERAL

FXSB (with tail lamp for Canada) and FLS (all but Domestic and California) license plate lamp use a non-replaceable LED bulb. The entire lamp assembly must be replaced. See 7.18 TURN SIGNALS AND RUNNING LIGHTS. Lamp Replacement for license plate lamp (with tail lamp for Canada) replacement.

FLSTC and FLSTF/B models are equipped with a tail lamp that uses a mini harness and circuit board to simplify replacement. The FXST uses the same type assembly, but the lens and base are oriented 180 degrees opposite from the other models. These models also use a different mini-harness than the other models.

BULB REPLACEMENT

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tail lamp lens screws</td>
<td>20-24 in-lbs</td>
</tr>
<tr>
<td></td>
<td>2.3-2.7 Nm</td>
</tr>
</tbody>
</table>

1. See Figure 7-35. Remove two screws and lens (1) from base.

2. Press locking tab and remove 4-Pin multilock connector (3) from circuit board.

3. Rotate bulb socket 1/4 turn counterclockwise and remove from tail lamp assembly. Gently pull bulb from socket.

4. Coat base of new bulb with ELECTRICAL CONTACT LUBRICANT. Install new bulb into socket.

5. Insert socket into tail lamp assembly and rotate 1/4 turn clockwise.

6. Connect 4-Pin multilock connector to circuit board.

7. Install lens to base with two screws. Tighten to 20-24 in-lbs (2.3-2.7 Nm).

![Figure 7-35. Tail Lamp: FLSTC, FLSTF/B](image)

**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)

8. Turn ignition on. Test for proper tail lamp operation.

BASE REPLACEMENT

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-41475-100</td>
<td>FLAT BLADE L-HOOK</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headlamp circuit board/pin housing screw: All but FLSTN</td>
<td>40-48 in-lbs</td>
</tr>
<tr>
<td></td>
<td>4.5-5.4 Nm</td>
</tr>
<tr>
<td>Headlamp lens base screws: All but FLSTN</td>
<td>20-24 in-lbs</td>
</tr>
<tr>
<td></td>
<td>2.3-2.7 Nm</td>
</tr>
</tbody>
</table>

1. Remove two screws and lens from base.

2. Press locking tab and remove 4-Pin multilock connector from circuit board.

![Figure 7-36. Removing 2-Pin Connectors](image)
1. Pin housing
2. Circuit board

Figure 7-37. Pin Housing and Circuit Board

6. Install new base to rear fender. Install circuit board/pin housing to base with screw, nut and washer. Tighten to 40-48 in-lbs (4.5-5.4 Nm).

7. See Figure 7-38. Install connectors to circuit board.

8. Install lens to base with two screws. Tighten to 20-24 in-lbs (2.3-2.7 Nm).

**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)

9. Turn ignition on. Test for proper tail lamp and turn signal operation.

Figure 7-38. Wire Location at Connectors

**NOTE**

Refer to Table 7-7. Cavity numbers are on back side of secondary locks. All FXST components are oriented 180 degrees from above and the turn signal connectors are reversed.

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>NO.</th>
<th>TYPE</th>
<th>WIRE COLOR</th>
<th>CAVITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right turn signal</td>
<td>[18]</td>
<td>2-pin Multilock</td>
<td>V</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BK</td>
<td>2</td>
</tr>
<tr>
<td>Left turn signal</td>
<td>[19]</td>
<td>2-pin Multilock</td>
<td>V</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BK</td>
<td>2</td>
</tr>
<tr>
<td>Tail lamp</td>
<td>[93]</td>
<td>4-pin Multilock</td>
<td>BE</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>HDI only/O/W or open in U.S. Markets</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>R/Y</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BK</td>
<td>4</td>
</tr>
<tr>
<td>Power in</td>
<td>[40]</td>
<td>6-pin Multilock</td>
<td>OW</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BN (V on FXST)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BE</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>R/Y</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>V</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(BN on FXST)</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BK</td>
<td>2</td>
</tr>
</tbody>
</table>
BULB REPLACEMENT
See Figure 7-39. To change a bulb, remove the lens (4), turn the bulb 1/4 turn counterclockwise while pressing the bulb into the lamp housing (3), and remove the bulb. Replace the bulb and install the lens.

TAIL LAMP REPLACEMENT

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>License plate support</td>
<td>60-90 in-lbs</td>
</tr>
<tr>
<td>fasteners: FLSTN</td>
<td></td>
</tr>
<tr>
<td>Tail lamp fasteners: FLSTN</td>
<td>60-90 in-lbs</td>
</tr>
<tr>
<td>Tail lamp connector cover</td>
<td>8-30 in-lbs</td>
</tr>
<tr>
<td>fastener: FLSTN</td>
<td></td>
</tr>
<tr>
<td>License plate bracket</td>
<td>30-50 in-lbs</td>
</tr>
<tr>
<td>fasteners: FLSTN</td>
<td></td>
</tr>
</tbody>
</table>

1. Remove rear fender. See 2.36 REAR FENDER: FLSTN.
2. See Figure 7-40. Remove reflector (1). Remove license plate bracket fasteners (6).
3. Remove bolt (2), washer (4) and nut (5) securing clamp to license plate bracket.
4. See Figure 7-41. Remove fastener (1). Disengage tail lamp connector cover (2) from clip (3).

Figure 7-39. Tail Lamp Assembly

Figure 7-40. License Plate Bracket

Figure 7-41. Tail Lamp Connector Cover
5. See Figure 7-42. Disconnect tail lamp connector (2).

6. See Figure 7-43. Remove plastic covers (3) from tail lamp threads. Remove fasteners (1).

7. Push grommet (2) to outside of fender.

8. See Figure 7-44. If license plate support (1) was removed, install clip on inside of fender and tighten fasteners (2) to 60-90 in-lbs (6.6-10.2 Nm).

**NOTE**
Before removing tail lamp wires from connector, or harness from fender clips, carefully note routing for reinstallation.

9. Remove tail lamp wire terminals from connectors. See A.13 DEUTSCH DT SEALED CONNECTORS.

10. Install new terminals into connector. See A.13 DEUTSCH DT SEALED CONNECTORS.

11. See Figure 7-43. To install tail lamp, route harness through hole in fender and lubricate rubber grommet (2) with alcohol or glass cleaner. Place grommet into position.

12. Place tail lamp into position and install fasteners (1). Tighten fasteners to 60-90 in-lbs (6.6-10.2 Nm). Install plastic covers (3).

13. See Figure 7-42. Connect tail lamp connector (2).

14. Figure 7-41. Slide tail lamp connector cover (2) into clip (3). Install fastener (1) and tighten to 8-30 in-lbs (0.9-3.4 Nm).

15. See Figure 7-40. Place license plate bracket in place on tail lamp. Install but do not tighten license plate bracket fasteners (5). Install clamp (3). Install bolt (2), washer (4) and nut (5).

16. Tighten license plate bracket fasteners to 30-50 in-lbs (3.4-5.6 Nm).

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7-32 2015 Softail Service: Electrical
AUXILIARY LAMP BULB

Removal
1. See Figure 7-45. Loosen trim ring fastener (1) as required to pull trim ring (2) from lip of auxiliary lamp housing (5).
2. Disconnect auxiliary lamp connector (4) from bulb (6).
3. Remove nesting ring (7) at back of auxiliary lamp (8).

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. See Figure 7-46. Rotate bulb/pin housing 1/4 turn counterclockwise and remove from auxiliary lamp. Discard bulb/pin housing.

Installation

NOTICE
Never touch the quartz bulb. Fingertips will etch the glass and decrease bulb life. Handle the bulb with paper or a clean, dry cloth. Failure to do so could result in bulb damage. (00210b)
1. See Figure 7-46. Install new bulb/pin housing in auxiliary lamp and rotate 1/4 turn clockwise.
2. See Figure 7-45. Place nesting ring (7) at back of auxiliary lamp (8) with the concave side up.
3. Connect auxiliary lamp connector (4) to bulb (6).
4. Place nesting ring over edge of lamp housing (5). Rotate nesting ring until index tab engages slot at bottom of lamp housing.
5. Holding nesting ring in place, rotate auxiliary lamp so that index tabs at back engage slots in nesting ring.
6. Install trim ring (2) over lip of lamp housing. Rotate trim ring so that fastener (1) is centered at bottom, and then tighten fastener until snug.

Figure 7-45. Auxiliary Lamp Bulb: Typical

Figure 7-46. Auxiliary Lamp Bulb/Pin Housing

FLSTC MODELS

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auxiliary lamp bracket: FLSTC</td>
<td>72-120 in-lbs</td>
</tr>
<tr>
<td></td>
<td>8.1-13.8 Nm</td>
</tr>
</tbody>
</table>

Auxiliary Lamp Bracket Removal
1. Detach quick release windshield. See 2.46 WINDSHIELD: FLSTC.
2. Detach wiring.
   a. Remove fuel tank fasteners and slide tank back to reveal connectors. See 4.6 FUEL TANK.
   b. Disconnect 2-place Multilock auxiliary lamp connector [73] under fuel tank, left side.
   c. Disconnect 6-place Multilock front turn signal connector [31] under fuel tank.
3. See Figure 7-47. Remove upper and lower bracket hardware (6, 7) and spacer (8). Remove auxiliary lamp bracket (9).

**Auxiliary Lamp Bracket Installation**

1. See Figure 7-47. Place auxiliary lamp bracket (9) in position. Loosely install upper and lower bracket hardware (6, 7). Verify that spacers (8) are installed on upper fasteners.
2. Attach auxiliary lamp housings (11) to bracket if necessary. See Auxiliary Lamp Housing Installation later in this section.
3. Connect wiring for front turn signals [31] and auxiliary lamps [73].
4. Tighten the auxiliary lamp bracket hardware (6, 7) to 72-120 In-lbs (8.1-13.6 Nm).
5. Slide fuel tank into position and install fasteners. See 4.6 FUEL TANK.
6. Place windshield in position. Adjust windshield height so that top of windshield is at rider's eye level while seated on motorcycle and fasten securely. See 2.46 WINDSHIELD: FLSTC.

**Auxiliary Lamp Housing Removal**

1. See Figure 7-47. Remove screws (5) that secure the turn signal lamps (1) to the mounting bracket (3).
2. Detach auxiliary lamp connector [73].
   a. Remove fuel tank fasteners and slide tank back to reveal connectors. See 4.6 FUEL TANK.
   b. Disconnect 2-place Multilock auxiliary lamp connector [73] under fuel tank, left side.
   c. Remove auxiliary lamp terminals. See A.21 TYCO 070 MULTILOCK UNSEALED CONNECTOR.
3. Remove appropriate terminal(s) from socket housing.
4. Use a flare nut socket to remove the nuts (2) that secure the auxiliary lamp housings (11) to bracket. Remove auxiliary lamp and pull wires through vinyl conduit.

**Auxiliary Lamp Housing Installation**

1. See Figure 7-47. Place auxiliary lamp housings (11) in position. Use a flare nut socket to snug the nut (2) that secures the lamp to the bracket.
2. Push lamp wires back into the vinyl conduit. Insert wire terminals into connector. Route the harness back into position and mate connectors.
4. Install the screws (5) that secure the turn signal lamps to the mounting bracket (3).
1. Turn signal lamp
2. Nut
3. Mounting bracket
4. Clamp block
5. Screw
6. Bracket hardware, upper
7. Bracket hardware, lower
8. Spacer
9. Lamp bracket

10. Auxiliary lamp connector
11. Auxiliary lamp housing
12. Toggle switch nut
13. Label
14. Toggle switch
15. Auxiliary lamp wiring harness
16. Cable strap
17. Belleville Washer
18. Swivel block

Figure 7-47. Auxiliary Lamp Bracket: FLSTC
<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auxiliary lamp bracket: FLSTN</td>
<td>72-120 in-lbs</td>
</tr>
</tbody>
</table>

**Auxiliary Lamp Bracket Removal**

1. Detach wiring.
   a. Remove fuel tank fasteners and slide tank back to reveal connectors. See 4.6 FUEL TANK.
   b. Disconnect 2-place Multiplex auxiliary lamp connector [73] under fuel tank, left side.
   c. Disconnect 6-place Multiplex front turn signal connector [31] under fuel tank.
2. See Figure 7-49. Remove upper and lower bracket hardware [8, 9]. Remove auxiliary lamp bracket.

**Auxiliary Lamp Bracket Installation**

1. See Figure 7-49. Place auxiliary lamp bracket (5) in position. Loosely install upper and lower bracket hardware (8, 9).
2. Attach auxiliary lamps to bracket if necessary. See 7.17 AUXILIARY LAMPS: FLSTC, FLSTN, FLSTN Models.
3. Connect wiring for front turn signals [31] and auxiliary lamps [73].
4. See Figure 7-49. Tighten the auxiliary lamp bracket hardware (8, 9) to 72-120 in-lbs (8.1-13.6 Nm).

5. Slide fuel tank into position and install fasteners. See 4.6 FUEL TANK.

![Figure 7-48. Auxiliary Lamp Bracket: Typical](image)
Auxiliary Lamp Housing Removal

1. Remove auxiliary lamp bulb. See 7.17 AUXILIARY LAMPS: FLSTC, FLSTN, Auxiliary Lamp Bulb.
2. Detach auxiliary lamp connector [73].
   a. Remove fuel tank fasteners and slide tank back to reveal connectors. See 4.6 FUEL TANK.
   b. Disconnect 2-place Multilock auxiliary lamp connector [73] under fuel tank, left side.
   c. Remove auxiliary lamp terminals. See A.21 TYCO 070 MULTILOCK UNSEALED CONNECTOR.
3. Remove appropriate terminal(s) from auxiliary lamp bulb socket housing.
4. See Figure 7-49. Remove nut (11) that secures auxiliary lamp housing (10) and turn signal lamp (3) to auxiliary lamp bracket (5). Remove auxiliary lamp and turn signal lamp.
5. Remove adapter (4) from turn signal lamp.

Auxiliary Lamp Housing Installation

1. See Figure 7-49. Install adapter (4) on turn signal lamp bracket (5) then turn signal lamp in auxiliary lamp bracket (5).
2. Install auxiliary lamp housing (10) over turn signal lamp threads.

   NOTE
   See Figure 7-50. In next step, be sure top of collar (1) is facing up.

3. See Figure 7-49. Install collar (12) and nut (11) over turn signal lamp wire. Tighten nut finger tight. Do not fully tighten nut at this time.
4. Place auxiliary lamp ring at back of new lamp with the concave side up.

5. Install terminals into auxiliary lamp bulb socket housing.

6. Install lamp fitting auxiliary lamp ring over edge of lamp housing. Rotate auxiliary lamp ring so that index tab engages slot at bottom of lamp housing.

7. Holding auxiliary lamp ring in place, rotate lamp so that index tab at back engages slot in auxiliary lamp ring.

8. 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.


10. Leave the headlamp covered. Remove cover from right auxiliary lamp and place over left auxiliary lamp. Adjust the right auxiliary lamp so the entire high intensity zone is both below and to the right of the centerlines (5).

11. FLSTC models: tighten auxiliary lamps.
   a. See Figure 7-47. Loosen screws (5) to detach turn signal lamps (1) from mounting bracket (3).
   b. Insert flange nut socket at bottom of turn signal mounting bracket and tighten locknut to 15-18 ft-lbs (20.3-24.4 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).

12. FLSTN: Tighten auxiliary lamps.
   a. See Figure 7-49. Loosen trim ring fastener (18) and remove trim ring (15) from auxiliary lamp housing (10).

   **NOTE**
   Minimize auxiliary lamp movement while tightening to maintain alignment.

   b. While holding auxiliary lamp steady, tighten nut (11) to 15-18 ft-lbs (20.3-24.4 Nm).
   c. Install lamp fitting auxiliary lamp ring over edge of lamp housing. Rotate auxiliary lamp ring to engage index tab with slot at bottom of lamp housing.
   d. Start two screws securing turn signal lamp to mounting bracket. Verify that conduit fits in slot at back of bracket and is not pinched. Tighten screws to 36-60 in-lbs (4.1-6.8 Nm).

13. Verify auxiliary lamp alignment.

---

**ADJUSTMENT: FLSTC/FLSTN MODELS**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auxiliary lamp nut: FLSTC</td>
<td>15-18 ft-lbs 20.3-24.4 Nm</td>
</tr>
<tr>
<td>Signal lamp mounting bracket screws: FLSTC</td>
<td>36-60 in-lbs 4.1-6.8 Nm</td>
</tr>
<tr>
<td>Auxiliary lamp nut: FLSTN</td>
<td>15-18 ft-lbs 20.3-24.4 Nm</td>
</tr>
<tr>
<td>Signal lamp mounting bracket screws: FLSTN</td>
<td>36-60 in-lbs 4.1-6.8 Nm</td>
</tr>
</tbody>
</table>

---

1. Check headlamp alignment. Adjust if necessary. See 1.20 HEADLAMP ALIGNMENT.

2. With a rider seated on the motorcycle and the front wheel pointed straight ahead, turn on the headlamp high beam.

3. See Figure 7-51. 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 (1).

4. Turn the headlamp off.

5. Measure the distance from the headlamp horizontal centerline down to the horizontal centerline of the left auxiliary lamp. Now measure the distance from the headlamp vertical centerline out to the vertical centerline of the same lamp.

6. Repeat measurements performed in previous step on right auxiliary lamp.

7. From the headlamp high beam centerlines, perform the measurements taken in previous steps to locate the left and right auxiliary lamp centerlines on the wall (2, 3).

8. Turn on the headlamp high beam again. With a rider seated on the motorcycle, verify that it is still aligned with the horizontal and vertical centerlines.

9. Turn on the headlamp low beam and cover both the headlamp and the right auxiliary lamp. Adjust the left auxiliary lamp so the entire high intensity zone is both below and to the right of the centerlines (4).

10. Leave the headlamp covered. Remove cover from right auxiliary lamp and place over left auxiliary lamp. Adjust the right auxiliary lamp so the entire high intensity zone is both below and to the right of the centerlines (5).

11. FLSTC models: tighten auxiliary lamps.
   a. See Figure 7-47. Loosen screws (5) to detach turn signal lamps (1) from mounting bracket (3).
   b. Insert flange nut socket at bottom of turn signal mounting bracket and tighten locknut to 15-18 ft-lbs (20.3-24.4 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).

12. FLSTN: Tighten auxiliary lamps.
   a. See Figure 7-49. Loosen trim ring fastener (18) and remove trim ring (15) from auxiliary lamp housing (10).

   **NOTE**
   Minimize auxiliary lamp movement while tightening to maintain alignment.

   b. While holding auxiliary lamp steady, tighten nut (11) to 15-18 ft-lbs (20.3-24.4 Nm).
   c. Install lamp fitting auxiliary lamp ring over edge of lamp housing. Rotate auxiliary lamp ring to engage index tab with slot at bottom of lamp housing.
   d. Start two screws securing turn signal lamp to mounting bracket. Verify that conduit fits in slot at back of bracket and is not pinched. Tighten screws to 36-60 in-lbs (4.1-6.8 Nm).

13. Verify auxiliary lamp alignment.
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 7-51. Auxiliary Lamp Aiming
BULB REPLACEMENT: BULLET STYLE

1. Locate latch slot on circumference of turn signal lamp lens. Insert a small flat blade screwdriver or coin and turn 1/4 turn to remove lens.
2. Push bulb in and rotate 1/4 turn counterclockwise to remove.
3. Inspect contacts in socket. If necessary, clean contacts with a small wire brush and electrical contact cleaner.
4. Evenly apply dielectric grease to the contacts and bottom of the new bulb.
5. Push and rotate new bulb into socket.
6. Snap in and rotate lens to position latch slot on bottom.

BULB REPLACEMENT: FLAT LENS STYLE

To change a bulb, remove the lens, turn the bulb 1/4 turn counterclockwise while pressing the bulb into the housing, and remove the bulb. Replace the bulb and install the lens.

**NOTE**

If after replacing a bulb, the turn signal or running lamp will not light, check the wiring, the ground at the socket and/or the switch.

**LAMP REPLACEMENT**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear turn signal housing</td>
<td>12-15 ft-lbs</td>
</tr>
<tr>
<td>fastener: FLST</td>
<td></td>
</tr>
<tr>
<td>Rear fender support to fender</td>
<td>21-27 ft-lbs</td>
</tr>
<tr>
<td>fasteners: FLSTC</td>
<td></td>
</tr>
<tr>
<td>Rear turn signal housing</td>
<td>12-16 ft-lbs</td>
</tr>
<tr>
<td>fastener</td>
<td></td>
</tr>
<tr>
<td>Turn signal bar screws:</td>
<td>15-19 ft-lbs</td>
</tr>
<tr>
<td>FLSTN</td>
<td></td>
</tr>
<tr>
<td>Tail lamp fastener:</td>
<td>8-30 in-lbs</td>
</tr>
<tr>
<td>FLSTN</td>
<td></td>
</tr>
</tbody>
</table>

**All Models**

**NOTE**

See 7.17 AUXILIARY LAMPS: FLSTC, FLSTN for front turn signal replacement on FLSTC and FLSTN models. For all other models, follow the instructions below:

1. Remove seat.

**WARNING**

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. Remove main fuse.

3. Change turn signal lamp following the steps outlined in one of the procedures which follow.

4. Install main fuse.

**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)

5. Install seat.

Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)

6. Turn ignition on. Test for proper turn signal operation.

---

**Figure 7-52. Lens Cap Removal**

**Figure 7-53. Under Fuel Tank Right Side**
**Front Turn Signals**

**NOTE**

Before removing turn signal wires, carefully note routing and cable strap locations.

1. **All but FLSTC, FLSTN:** The turn signal wiring is hard wired to the handlebar switch assemblies. Remove switch assembly. See 7.36 HANDLEBAR CONTROL MODULES or 2.28 HANDLEBAR: FLSTFB.

2. **FLSTC, FLSTN:** Remove fuel tank to reveal front turn signal connector [31]. See 4.6 FUEL TANK.

3. **FLSTC, FLSTN:** Disconnect [31] and remove terminals from turn signal connector.

4. **All but FLSTC, FLSTN:** Detach front turn signals from mounting point.
   a. See Figure 7-54. On right side, hold retainer (6) and loosen ball stud clamp (4) to remove turn signal.
   b. On left side, remove nut (5) from mirror, loosen jamnut and remove ball stud clamp (4) to detach turn signal.

5. **All but FLSTC, FLSTN:** Detach front turn signals from mounting point.
   a. Hold retainer (6) and loosen ball stud clamp (4) to remove turn signal.
   b. See Figure 7-55. On left side, loosen locknut (3) from turn signal bracket (2), remove ball stud (6) to detach turn signal.

6. Install new front turn signal.
   a. Attach signal to mounting point as appropriate to model being serviced.
   b. **FLSTC, FLSTN:** Route wiring to connector [31] location and install terminals in connector. Attach connectors.
   c. Verify that turn signal points straight ahead.

7. **All but FLSTC, FLSTN:** Install handlebar switch assembly, handlebars, switch housing.

8. Slide fuel tank into position and install fasteners. See 4.6 FUEL TANK.

---

1. Turn signal
2. Jamnut
3. Ball stud
4. Ball stud clamp
5. Nut (left side only)
6. Retainer and washer (right side only)
7. To handlebar switch assembly (hardwired)

Figure 7-54. Front Turn Signals: FXST, FLSTFB
Front Turn Signals: FLSTC, FLSTN

For lamp replacement of FLSTC and FLSTN models, see 7.17 AUXILIARY LAMPS: FLSTC, FLSTN.

Rear Turn Signals: All But FLSTN, FLS, FXSB

NOTE

Before removing turn signal wires, carefully note routing and cable strap locations.

1. Disconnect turn signal wiring.
   a. Disconnect right turn signal [18] and left turn signal [19] connectors from within tail lamp. See 7.15 TAIL LAMP: ALL BUT FLSTN.
   b. Remove wire terminals from turn signal connectors.

2. Detach turn signal from mount.
   a. FLSTC: see Figure 7-56. Remove the screw (1) to detach turn signal from mount (2).
   b. All but FLSTC: see Figure 7-57. Detach fender support hardware. See 2.33 REAR FENDER: FXST. Remove screw and washer (1) from inside fender support to detach turn signal from mount (2).

3. Install new rear turn signal.
   a. Attach signal to mounting point as appropriate to model being serviced.
   b. All but FLSTC: install rear fender support.
   c. Route wiring to connector location and install terminals in connector. Attach connectors.
   d. Verify that turn signal points straight behind.

Rear Turn Signals: FLS

1. Remove rear fender. See 2.34 REAR FENDER: FLS.

2. See Figure 7-58. Remove fasteners (2) securing fender support to fender.

3. Disconnect pins from 4-Pin connector [18, 19] (1) as needed. Refer to Table 7-8 or Table 7-9. See A.16 DEUTSCH DTM SEALED SOLID BARREL MINI TERMINAL REPAIR.
4. See Figure 7-59. Carefully remove wire from retainer clips (2).

5. Remove fastener and washer (1) securing lamp assembly to fender support.

6. See Figure 7-56. If equipped with side mount license plate bracket, separate turn signal from license plate bracket.

7. When installing new turn signal lamp assembly, install side mount license plate bracket if equipped.

8. See Figure 7-59. Install fastener and washer (1) securing lamp assembly to fender support. Tighten fastener to 12-16 ft-lbs (16.3-21.7 Nm).

**NOTE**

*Make sure retainer clips are securely fastened to fender. If installing new retainer clips, clean affected surface with isopropyl alcohol. Remove protective paper and press on surface for 1-3 minutes.*

9. Route wires of new lamp along fender support. Make sure new wires are properly positioned in the retaining clips (2).

10. Refer to Table 7-8 or Table 7-9. Attach new wires to 4-pin connector [18, 19]. See A.16 DEUTSCH DTM SEALED SOLID BARREL MINI TERMINAL REPAIR.

11. See Figure 7-58. Clean threadlocking compound from fasteners (2) and threaded holes prior to assembly.

12. Apply LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to fasteners (2) and install fender support to fender using fasteners (2). Tighten fasteners to 21-27 ft-lbs (28.5-36.6 Nm).

13. Install rear fender. See 2.34 REAR FENDER: FLS.

**Table 7-8. FLS Turn Signal Lighting Connector Pin Location (Domestic and Canada)**

<table>
<thead>
<tr>
<th>PIN</th>
<th>COLOR</th>
<th>FUNCTION</th>
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<tbody>
<tr>
<td>1</td>
<td>W</td>
<td>Tail</td>
</tr>
<tr>
<td>2</td>
<td>R</td>
<td>Brake/Turn</td>
</tr>
<tr>
<td>3</td>
<td>-</td>
<td>Not used</td>
</tr>
<tr>
<td>4</td>
<td>BK</td>
<td>Ground</td>
</tr>
</tbody>
</table>

**Table 7-9. Turn Signal Lighting Connectors Pin Location (HDI)**

<table>
<thead>
<tr>
<th>PIN</th>
<th>COLOR</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>W</td>
<td>Tail</td>
</tr>
<tr>
<td>2</td>
<td>GN</td>
<td>Turn</td>
</tr>
<tr>
<td>3</td>
<td>R</td>
<td>Brake</td>
</tr>
<tr>
<td>4</td>
<td>BK</td>
<td>Ground</td>
</tr>
</tbody>
</table>

**Figure 7-58. Turn Signal Housing: FLS**

1. Rear wiring harness connectors [18, 19, 40]
2. Fastener (3)

**Figure 7-59. Turn Signal Wire Routing: FLS**

1. Fastener and washer
2. Retaining clip (2)
Rear Turn Signals: FXSB

1. Remove and disassemble rear fender. See 2.35 REAR FENDER: FXSB.

2. Disconnect pins from 4-Pin connector [18, 19] as needed. Refer to Table 7-10 or Table 7-11. See A.16 DEUTSCH DTM SEALED SOLID BARREL MINI TERMINAL REPAIR.

3. Carefully remove wire from retainer clips along fender support.

4. Remove fastener and washer securing lamp assembly to fender support.

5. See Figure 7-62. If equipped with side mount license plate bracket, separate turn signal from license plate bracket.

6. Canada and HDI models: See Figure 7-61. If needed, remove harness retainer (4) and tail lamp (1) or license plate lamp (2).

7. Canada and HDI models: If installing tail lamp (1) or license plate lamp (2), secure harness with a new harness retainer (4).

8. When installing new turn signal lamp assembly, install side mount license plate bracket if equipped.

9. Install fastener and washer securing lamp assembly to fender support. Tighten to 12-16 ft-lbs (16.3-21.7 Nm).

   NOTE
   Make sure retainer clips are securely fastened to fender. If installing new retainer clips, clean affected surface with isopropyl alcohol. Remove protective paper and press on surface for 1-3 minutes.

10. Route wires of lamp along fender support. Make sure wires are properly positioned in the retaining clips.

   Table 7-10. Turn Signal Lighting Connector Pin Location (Domestic and Canada)

<table>
<thead>
<tr>
<th>PIN</th>
<th>COLOR</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bl</td>
<td>Tail</td>
</tr>
<tr>
<td>2</td>
<td>V</td>
<td>Brake/Turn</td>
</tr>
<tr>
<td>3</td>
<td>-</td>
<td>Not used</td>
</tr>
<tr>
<td>4</td>
<td>BK</td>
<td>Ground</td>
</tr>
</tbody>
</table>

Table 7-11. Turn Signal Lighting Connectors Pin Location (HDI)

<table>
<thead>
<tr>
<th>PIN</th>
<th>COLOR</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bl</td>
<td>Tail</td>
</tr>
<tr>
<td>2</td>
<td>GrN</td>
<td>Turn</td>
</tr>
<tr>
<td>3</td>
<td>R</td>
<td>Brake</td>
</tr>
<tr>
<td>4</td>
<td>BK</td>
<td>Ground</td>
</tr>
</tbody>
</table>

Figure 7-60. License Plate Bracket (Domestic and California Models)

Figure 7-61. Rear Lighting
Rear Turn Signals: FLSTN

1. Remove rear fender. See 2.36 REAR FENDER: FLSTN.

2. See Figure 7-63. Remove fastener (1). Disengage tail lamp connector cover (2) from clip (3).

3. See Figure 7-64. Disconnect left [19] (1) and right [18] (3) turn signal connectors.

4. Remove wire terminals from turn signal connectors. See A.13 DEUTSCH DT SEALED CONNECTORS for connector disassembly.

5. See Figure 7-65. Remove screws (1) to release turn signal bar (2) from fender.

6. Install new turn signal bar. Tighten screws (1) to 15-19 ft-lbs (20.4-25.8 Nm).

7. Install wire terminals into turn signal connectors. See A.13 DEUTSCH DT SEALED CONNECTORS for connector assembly.

8. See Figure 7-64. Connect left [19] (1) and right [18] (3) turn signal connectors.

9. See Figure 7-63. Slide tail lamp connector cover (2) into clip (3). Install fastener (1) and tighten to 8-30 in-lbs (0.9-3.4 Nm).
1. Screw
2. Turn signal bar

Figure 7-65. Rear Turn Signals: FLSTN
CRANK POSITION SENSOR (CKP)

GENERAL

The crank position sensor (CKP) is a variable reluctance (VR) sensor. It 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 CKP sends a signal to the electronic control module which references engine position (TDC) and engine speed.

NOTE

CKP sensor connector is not serviceable. Replace the entire assembly if it fails.

REMOVAL

1. Remove seat.

WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. Remove main fuse.

3. Detach wiring behind regulator bracket.
   a. Disengage connector from bracket.
   b. See Figure 7-66. Disconnect the 2-place Mini-Deutsch CKP connector [79A] (3).

4. Remove screw and captive washer (2) to detach CKP sensor and O-ring (1) from crankcase. Carefully remove crank position sensor.

   NOTE

Before removing wiring, carefully note wire routing. In particular, pay close attention to the locations of cable straps which must be replaced.

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crank position sensor (CKP)</td>
<td>90-120 in-lbs</td>
</tr>
</tbody>
</table>

1. See Figure 7-66. Lubricate CKP sensor O-ring (1) with clean engine oil.

2. See Figure 7-68. Install new CKP sensor with screw and captive washer. Tighten to 90-120 in-lbs (10.2-13.6 Nm).

3. Route wiring to connector behind regulator bracket.

4. Attach wiring:
   a. Mate connector [79].
   b. Attach connector to bracket.

5. Install main fuse.

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. (00670b)

6. Install seat.
GENERAL

NOTE
ACR is used only on 103 cu. in. and larger engines.
See Figure 7-69. The ACR is opened and closed by the ECM to assist starting.
See Figure 7-70. When open, compressed gases are released through the exhaust port.

REMOVAL

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48498-A</td>
<td>ACR SOLENOID SOCKET</td>
</tr>
</tbody>
</table>

1. Remove the rocker cover and the rocker box. See 3.10 TOP END SERVICE.
2. Separate the ACR rear [203R] or front [203F] connector from the main wiring harness and remove connectors from retainer clip.
3. See Figure 7-74. Use ACR SOLENOID SOCKET (Part No. HD-48498-A) to remove the ACR from the cylinder head.

INSTALLATION

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48498-A</td>
<td>ACR SOLENOID SOCKET</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACR</td>
<td>13-17 ft-lbs</td>
</tr>
</tbody>
</table>

1. Verify that the copper gasket is in place on the ACR.
2. See Figure 7-72. Identify a location around the threads of the ACR approximately 1/3 of the way up from the end.
3. See Figure 7-73. Apply three equally spaced dots of LOCTITE 246 MEDIUM STRENGTH/HIGH TEMPERATURE THREADLOCKER (blue) on threads.
4. To prevent cross threading, install and finger tighten.
5. See Figure 7-74. Using ACR SOLENOID SOCKET (Part No. HD-48498-A), tighten to 13-17 ft-lbs [17.6-23.0 Nm].
6. Route the wire harness between the cylinders.
7. Install rocker box and rocker cover. See 3.10 TOP END SERVICE.
8. Mate the ACR connectors [203R] and [203F] to the main wiring harness. Secure connectors to retaining clip.
Figure 7-73. Three Dots of LOCTITE 246 MEDIUM STRENGTH/HIGH TEMPERATURE THREADLOCKER (blue)

Figure 7-74. ACR Solenoid Socket and ACR
IGNITION COIL

REMOVAL

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48904</td>
<td>IGNITION SWITCH SPANNER</td>
</tr>
<tr>
<td></td>
<td>WRENCH</td>
</tr>
</tbody>
</table>

All But FXSB

1. Remove seat.

**WARNING**

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. Remove main fuse.

**NOTE**

Remove spark plug cable by pulling on rubber boot at end of cable. Do not pull on cable or damage may result.

3. See Figure 7-75. Remove spark plug cables from coil.

4. Remove screw (4) to detach cover (5) from coil (1).

5. Remove two mounting screws (2) to detach coil from seat post.


FXSB

1. Remove seat.

**WARNING**

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. Remove main fuse.

3. See Figure 7-76. Remove spark plug cables (3, 8) from coil.

4. Loosen set screw (6) and remove knob (5).

5. Remove nut (4) using IGNITION SWITCH SPANNER WRENCH (Part No. HD-48904).

6. Remove screw (9).


INSTALLATION

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48904</td>
<td>IGNITION SWITCH SPANNER</td>
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<td></td>
<td>WRENCH</td>
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</tbody>
</table>

**FASTENER**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ignition coil screws: all but</td>
<td>120-180 int-lbs</td>
</tr>
<tr>
<td>FXSB</td>
<td>13.6-20.3 Nm</td>
</tr>
<tr>
<td>Coil cover screw: all but FXSB</td>
<td>30-40 in-lbs</td>
</tr>
<tr>
<td></td>
<td>3.4-4.5 Nm</td>
</tr>
<tr>
<td>Coil mounting screw: FXSB</td>
<td>96-120 in-lbs</td>
</tr>
<tr>
<td></td>
<td>10.9-13.6 Nm</td>
</tr>
<tr>
<td>Ignition switch nut: FXSB</td>
<td>140-160 in-lbs</td>
</tr>
<tr>
<td></td>
<td>15.8-18.1 Nm</td>
</tr>
</tbody>
</table>

All But FXSB

1. Attach connector [83] to backside of coil.

2. See Figure 7-75. Position coil (1) on seat post. Install two screws (2). Tighten to 120-180 in-lbs (13.6-20.3 Nm).

3. Fasten cover (5) to coil with screw (4). Tighten to 30-40 in-lbs (3.4-4.5 Nm).

4. Attach spark plug cables to coil. Rear cylinder spark plug cable attaches to upper coil tower.

5. Install main fuse.

**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)

6. Install seat.

FXSB

1. Attach connector [83] to backside of coil.

2. See Figure 7-76. Position coil (7) on bracket (2). Install screw (9). Tighten to 96-120 in-lbs (10.9-13.6 Nm).


4. Install nut (4) using IGNITION SWITCH SPANNER WRENCH (Part No. HD-48904). Tighten nut to 140-160 in-lbs (15.8-18.1 Nm).

5. Install knob (5). Tighten set screw (6).

6. Attach spark plug cables to coil.

7. Install main fuse.

**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)

8. Install seat.
1. Ignition/light switch
2. Bracket
3. Rear cylinder spark plug cable
4. Nut
5. Knob
6. Set screw
7. Coil
8. Front cylinder spark plug cable
9. Screw

Figure 7-76. Ignition/Light Switch: FXSB

Figure 7-75. Coil (All But FXSB)
GENERAL

Resistor type high-tension spark plug cables have a carbon-impregnated fabric core, instead of solid wire, for radio noise suppression and improved reliability of electronic components. Use the exact replacement cable for best results.

NOTE
See 1.17 SPARK PLUGS for spark plug information.

REMOVAL

WARNING

Disconnecting spark plug cable with engine running can result in electric shock and death or serious injury. (004646b)

NOTE
Remove spark plug cable by pulling on rubber boot at end of cable. Do not pull on cable or damage may result.

1. Disconnect spark plug cables from ignition coil and spark plug terminals. Inspect all removed cables for damage.

2. All but FXSB: see Figure 7-77. Remove cable straps on horn bracket for front spark plug cable.

INSTALLATION

1. See Figure 7-77 (all but FXSB) or Figure 7-78 (FXSB). Connect spark plug cables to ignition coil and spark plugs. Fasten boots/caps securely. Tight connections provide the necessary moisture-proof environment for the ignition coil and spark plug terminals.
   a. All but FXSB: rear cylinder plug cable connects to top coil terminal.
   b. FXSB: front cylinder plug cable connects to front coil terminal.

2. All but FXSB: secure front spark plug cable to horn bracket with new cable straps.

Figure 7-77. Spark Plug Cable Routing (All But FXSB)

Figure 7-78. Spark Plug Cable Routing (FXSB)
DISASSEMBLY

1. Remove seat.

WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. Remove main fuse. See 7.10 FUSES.

3. See Figure 7-79. Loosen fasteners (1) securing voltage regulator.

4. Remove fasteners (2) securing voltage regulator bracket to crankcase.

5. See Figure 7-80. Rotate connector locks (3, 5) out of the way and disconnect voltage regulator connectors.

6. Remove voltage regulator.

![Figure 7-79. Voltage Regulator](image1)

1. Voltage regulator fasteners
2. Bracket fasteners

![Figure 7-80. Voltage Regulator Connectors](image2)

1. Front oxygen sensor connector
2. Crank position sensor connector
3. Stator connector lock
4. Crank position sensor connector stud
5. Voltage regulator connector lock
6. Jiffy stand interlock connector

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage regulator bracket to crankcase fasteners</td>
<td>70-100 in-lbs</td>
</tr>
<tr>
<td>Voltage regulator</td>
<td>50-80 in-lbs</td>
</tr>
</tbody>
</table>

1. See Figure 7-79. Install voltage regulator to regulator bracket with fasteners (1). Do not tighten fasteners at this time.

2. See Figure 7-80. Connect voltage regulator connectors and rotate connector locks (3, 5) down into position to secure connections.

3. See Figure 7-79. Install fasteners (2) securing voltage regulator bracket to crankcase. Tighten fasteners to 70-100 in-lbs (7.9-11.3 Nm).

4. Tighten fasteners (1) securing voltage regulator to regulator bracket to 50-80 in-lbs (5.7-9.0 Nm).

5. Install main fuse. See 7.10 FUSES.

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)

6. Install seat.
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. Remove primary chaincase housing. See 5.5 PRIMARY CHAINCASE HOUSING.
3. Disconnect stator connector from voltage regulator. See 7.23 VOLTAGE REGULATOR.
4. See Figure 7-81. Remove alternator rotor (4). Two bolts can be inserted through the holes in the rotor face to aid during removal.

NOTE

See Figure 7-81. Use contact cleaner, alcohol or glass cleaner in the next step as a lubricant.

5. Move grommet (3) to one side and spray lubricant into gap to lubricate grommet and ease removal. Repeat for other side.
6. Remove TORX screws (2) and discard.
7. Remove stator (1) while pulling rubber grommet (3) and wires through crankcase hole.

CLEANING AND INSPECTION

1. Remove debris from rotor magnets. Clean rotor by wiping thoroughly with a clean cloth.
2. Check rotor for:
   a. Loose or cracked magnets.
   b. Stator bolt contact with rotor.
   c. Spline damage to rotor center mounting bolt hole.
3. Clean stator, stator leads and grommet thoroughly with a clean cloth.
4. Check stator for:
   a. Contact with rotor.
   b. Damaged or cracked insulation.
   c. Electrical failures. See the electrical diagnostic manual.

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stator screws</td>
<td>55-75 in-lbs 6.2-8.4 Nm</td>
</tr>
</tbody>
</table>

NOTE

Discard and replace stator Torx screws after each removal.

1. Insert wires through crankcase hole.
2. See Figure 7-81. Push rubber grommet (3) with wires through crankcase hole. If necessary, apply the same lubricant used during removal.
3. Install the stator (1) on the crankcase and fasten in place using new TORX screws. Tighten to 55-75 in-lbs (6.2-8.4 Nm).
4. Mate connector [47] (5) onto voltage regulator and engage latch to secure. See 7.23 VOLTAGE REGULATOR.
5. Install rotor (4) on the sprocket shaft.
6. Install primary chaincase housing, clutch, primary drive and primary cover. See 5.5 PRIMARY CHAINCASE HOUSING and 5.4 DRIVE COMPONENTS.
7. Connect negative battery cable.

Figure 7-81. Rotor and Stator (Typical)
GENERAL

- See Figure 7-82. The fuel gauge is mounted in the left fuel tank cap. Remove by gently pulling upward. Do not twist.
- Three wires attach to the bottom of the gauge (1).
- The fuel gauge sending unit is under the console in the middle of the tank.

REMOVAL

1. Remove seat.

WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. Remove main fuse.

NOTE

The gauge wires are routed through a tube in the tank and are secured at the bottom of the tank.

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)

3. Remove fuel tank fasteners and slide tank back to reveal fuel gauge connector [117]. See 4.6 FUEL TANK.

4. See Figure 7-83. Disconnect fuel gauge connector [117] (3) and remove terminals. See B.1 CONNECTORS.

5. Remove fuel gauge wiring from clamp at bottom of fuel tank.

NOTE

Do not twist gauge and wiring during removal.

6. See Figure 7-82. Pull up on gauge (1). Remove gauge, gasket (2) and wiring from fuel tank. Discard gasket.

INSTALLATION

1. See Figure 7-82. Install wiring harness (3) through new gasket (2).

2. Push wiring harness through tube in fuel tank.

3. While gently pulling on wiring harness, install gauge (1) and gasket by carefully moving gauge back and forth while pushing down at the same time.

4. See Figure 7-83. Install wiring into fuel gauge connector [117] (3). Mate connector halves and secure connector into clip as shown.

5. Slide fuel tank into position and install fasteners. See 4.6 FUEL TANK.

6. Secure wire to clip at bottom of fuel tank.

7. Install main fuse.

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)

8. Install seat.
**NOTE**

The low fuel lamp will not turn off until there is sufficient fuel in the tank, the ignition switch has been turned off and back on, and the vehicle has begun forward speed.

---

1. Instruments [20]
2. Left hand control [24]
3. Fuel gauge [117]
4. Front wheel speed sensor [167]
5. Headlamp [38]
6. Front fender tip lamp [32]: FLSTC

*Figure 7-83. Under Fuel Tank Left Side*
GENERAL

- Both the ECM and the speedometer retain the odometer value. If the speedometer is replaced, the new speedometer will display the odometer value stored in the ECM. The new speedometer will lock to the mileage stored in the ECM after 31.1 mi (50 km) have been accumulated. The trip B odometer will display the countdown mileage.
- If the speedometer is installed on another vehicle after it has locked to the ECM, the odometer will display "VIN ERR" on the new vehicle. If the speedometer is removed from the vehicle before the countdown reaches zero, it will reset the mileage countdown to 31.1 mi (50 km). This mileage countdown allows for a road test to verify that speedometer replacement was the proper repair.

REMOVAL: ALL BUT FXSB

1. See Figure 7-84. Remove nut and washer (4) and lift console (5) from fuel tank.
2. Position clean shop rags on fuel tank and flip console over to expose underside.
3. Press on connector tab and disconnect connector [39] (2) from speedometer under console.
4. See Figure 7-85. Pry between three tabs and speedometer with a screwdriver to raise and release back clamp from speedometer. Remove back clamp from speedometer.
5. See Figure 7-84. Remove speedometer from console.
6. Remove gasket (3) from speedometer.

INSTALLATION: ALL BUT FXSB

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speedometer console nut: all but FXSB</td>
<td>84-132 in-lbs 9.5-14.9 Nm</td>
</tr>
</tbody>
</table>

1. See Figure 7-84. Install gasket (3) to speedometer.
2. Position speedometer in console (5).
3. See Figure 7-85. Press on back clamp (3) until three tabs engage on back of speedometer.
4. See Figure 7-84. Connect connector [39] (2) to speedometer under console.
5. Remove shop rags. Attach console to fuel tank with nut and washer (4). Tighten to 84-132 in-lbs (9.5-14.9 Nm).
6. Test speedometer for proper operation.

REMOVAL: FXSB

1. See Figure 7-86. Remove fasteners (3).
2. Disconnect speedometer wire connector.
3. Remove speedometer.
1. See Figure 7-86. Install speedometer (1) with seal (2).
2. Connect speedometer wire connector.
3. Install fasteners (3). Tighten to 12-17 in-lbs (1.4-1.9 Nm).

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speedometer fasteners: FXSB</td>
<td>12-17 in-lbs 1.4-1.9 Nm</td>
</tr>
</tbody>
</table>
GENERAL

The vehicle speed sensor is powered and monitored by the ECM. The ECM processes the vehicle speed signal and transmits this signal to the BCM and speedometer through serial data.

The vehicle speed sensor is located on the transmission just behind the transmission top cover.

REMOVAL

1. Remove seat.

WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. Remove main fuse.
3. Remove electrical panel. See 7.3 ELECTRICAL PANEL.
4. See Figure 7-87. Disconnect 3-place vehicle speed sensor connector [65].
5. Remove sensor mounting bolt and lift sensor from transmission case.

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSS mounting bolt</td>
<td>84-108 in-lbs, 9.5-12.2 Nm</td>
</tr>
</tbody>
</table>

1. See Figure 7-87. Install sensor into transmission case using mounting bolt. Tighten to 84-108 in-lbs (9.5-12.2 Nm).

2. Mate 3-place vehicle speed sensor connector [65].
3. Install electrical panel. See 7.3 ELECTRICAL PANEL.
4. Install main fuse.

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)

5. Install seat.
FRONT WHEEL SPEED SENSOR

NOTE

Fuel tank crossover hose does not need to be disconnected. Fuel tank can be slid back enough to reveal handlebar switch assembly connectors.

1. Slide fuel tank rearward. See 4.6 FUEL TANK.
2. See Figure 7-88 or Figure 7-89. Disconnect front WSS connector (1).
3. See Figure 7-90. Cut cable straps (1) and remove clips (3) to release front wheel speed sensor cable from brake hose.
4. All but FLSTC: Remove clip (2).
5. FLSTC: Cut cable straps (4).
6. See Figure 7-91. Remove front wheel speed sensor clip.
7. Retract axle until front wheel speed sensor is free. See 2.4 FRONT WHEEL.

NOTE

The wheel speed sensor works in conjunction with the ABS encoder bearing installed in the wheel hub. If necessary, see 2.6 SEALED WHEEL BEARINGS for removal and installation instructions.

Figure 7-88. Under Fuel Tank Left Side: FXSB

Figure 7-89. Under Fuel Tank Left Side

Figure 7-90. WSS Cable Routing

1. Instruments [20]
2. Left hand control [24]
3. Fuel gauge [117]
4. Front wheel speed sensor [167]
5. Headlamp [38]
6. Front fender tip lamp [32]: FLSTC

1. Front WSS [167]
2. Left hand control [24]
3. Headlamp [38]
4. Auxiliary lamp switch [109]
Installation

NOTES

- Always keep the wheel speed sensor and ABS encoder bearing away from magnetic fields. Items such as magnetic parts trays, magnetic base dial indicators, alternator rotors, etc. will damage sensor. Never pull wheel speed sensor cable (aut or use to retain wheel, axle or other components.

- Install wheel speed sensor with index pin on the outboard side or sensor will be damaged during installation.

1. Push axle through new front wheel speed sensor and left fork slider.

2. Secure front wheel. See 2.4 FRONT WHEEL. Be sure to rotate front wheel speed sensor until index pin makes contact with shoulder on fork slider as shown in Figure 7-92.

3. See Figure 7-88 or Figure 7-89. Connect front WSS connector (1).

4. See Figure 7-90. Install new cable straps (1) to crimped ends of fitting and install clips (3) to secure front wheel speed sensor cable to brake hose.

5. All but FLSTC: Install clip (2).

6. FLSTC: Install new cable straps (4).

7. See Figure 7-91. Install front wheel speed sensor clip.

8. Install fuel tank. See 4.6 FUEL TANK.

REAR WHEEL SPEED SENSOR

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Splash guard screw</td>
<td>36-48 in-lbs</td>
</tr>
</tbody>
</table>

Removal

1. Remove right saddlebag, if installed.

2. Remove splash guard.

3. See Figure 7-93. Disconnect rear wheel speed sensor connector (4).

4. See Figure 7-95. Remove cable strap (1) and both clips (3).

5. Remove axle. See 2.5 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 removal and installation instructions.
Installation

NOTES

- Always keep the wheel speed sensor and ABS encoder bearing away from magnetic fields. Items such as magnetic parts trays, magnetic base dial indicators, alternator rotors, etc., will damage sensor. Never pull wheel speed sensor cable taut or use to retain wheel, axle or other components.

- Install wheel speed sensor with index pin on the outboard side or sensor will be damaged during installation.

1. See 2.5 REAR WHEEL and Figure 7-96. Install axle with new rear wheel speed sensor in place. Make sure index pin is pointed outboard toward rear fork. Rotate wheel speed sensor so that the index pin is against the lower edge of the rear caliper mounting bracket.

2. See Figure 7-95. Install cable strap (1) and both clips (3).

3. See Figure 7-93. Connect rear wheel speed sensor connector (4).

4. Install splash guard.

5. Tighten splash guard screw to 36-48 in-lbs (4.1-5.4 Nm).

6. Install right saddlebag, if equipped.
Figure 7-96. Rear Wheel Speed Sensor Index Pin (ABS Equipped)
GENERAL

The indicator lamp assembly is equipped with Light Emitting Diode (LED) indicators. The indicator lamp assembly is not serviceable. If one LED is bad, the entire assembly must be replaced.

See the electrical diagnostic manual for troubleshooting procedures.

REMOVAL: ALL BUT FXSB

1. Perform steps to remove fuel tank. Do not remove crossover tube. See 4.6 FUEL TANK.
2. See Figure 7-97. Slide fuel tank rearward and disconnect instruments harness connector [20] (1).
3. See Figure 7-98. Remove connectors (1-3).
4. See Figure 7-99. Remove indicator lamp assembly.
   a. All but FLSTC, FLS: Squeeze clips of bezel (3) together and gently pry indicator lamp assembly (4) out of console.
   b. FLSTC, FLS: Remove screws (5) and gently pull indicator lamp assembly (4) out of console.

INSTALLATION: ALL BUT FXSB

1. See Figure 7-99. Attach indicator lamp assembly to console.
   a. All but FLSTC, FLS: Make sure clips of bezel (3) engage to secure assembly in place.
   b. FLSTC, FLS: Install screws (5).
2. See Figure 7-98. Install connectors (1-3).
3. See Figure 7-97. Connect instruments harness connector [20] (1).
4. Install fuel tank. See 4.6 FUEL TANK.

Figure 7-97. Under Fuel Tank Left Side

Figure 7-98. Instruments Harness Connectors

Figure 7-99. Indicator Lamp Assembly
REMOVAL: FXSB

1. Slide fuel tank back to access instrumentation connector. See 4.6 FUEL TANK.
2. Disconnect instrumentation connector.
3. Disconnect speedometer connector.

NOTE
Support handlebar in position.

4. See Figure 7-100. Remove fasteners (2).
5. Remove both screws (4) securing indicator lamp assembly (3) to upper handlebar clamp (1).
6. Remove indicator lamp assembly.

INSTALLATION: FXSB

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicator lamp screws: FXSB</td>
<td>20-30 in-lbs</td>
</tr>
<tr>
<td>Upper handlebar clamp fasteners: FXSB</td>
<td>12-16 ft-lbs</td>
</tr>
</tbody>
</table>

1. See Figure 7-100. Attach indicator lamp assembly (3) to upper handlebar clamp (1) with screws (4). Tighten to 20-30 in-lbs (2.3-3.4 Nm).

NOTE
The slight gap between upper and lower handlebar clamps should face the rider.

2. Loosely install upper handlebar clamp (1) with fasteners (2).
3. See Figure 7-101. Align marks with seam of clamps.
4. Tighten forward fasteners then rear fasteners to 12-16 ft-lbs (16.3-21.7 Nm).
5. Route indicator lamp wiring to instrumentation and speedometer connectors. Connect connectors.
6. Install fuel tank. See 4.6 FUEL TANK.
NEUTRAL SWITCH

GENERAL

See Figure 7-102. The neutral switch is located on the transmission top cover. The two terminal switch is normally open. 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. Remove battery and battery caddy. See 1.19 BATTERY MAINTENANCE, Battery Disconnection and Removal.
2. Make sure transmission shifter is in NEUTRAL.
3. See Figure 7-103. Remove connectors from switch studs.
4. Remove neutral switch and O-ring from transmission top cover.

NOTE
To replace connectors, use heat-sealed butt splice connectors. See A.24 SEALED SPLICE CONNECTORS.

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutral switch</td>
<td>120-180 in-lbs</td>
</tr>
</tbody>
</table>

1. Place transmission in NEUTRAL.
2. See Figure 7-103. Lubricate O-ring with transmission oil.
3. Install switch with O-ring to transmission top cover. Tighten to 120-180 in-lbs (13.6-20.3 Nm).

NOTE
The neutral switch is not polarity sensitive. The connectors can be attached to either stud.

4. Install connectors to switch studs.
5. Install battery caddy and battery. See 1.19 BATTERY MAINTENANCE, Battery Installation and Connection.

6. Test neutral switch for proper operation.
   a. Turn ignition switch to IGNITION position.
   b. Verify that transmission shifter is in NEUTRAL.
   c. Check to see that NEUTRAL indicator light illuminates.
GENERAL
See Figure 7-104. The oil pressure switch monitors oil pressure in the crankcase. If the oil pressure drops below 3 psi (20.6 kPa), the oil pressure switch is tripped and illuminates the low oil pressure indicator light. The oil pressure switch is located on the right side of the crankcase.

REMOVAL
1. See Figure 7-104. Remove connector (2) from oil pressure switch (1).
2. Remove oil pressure switch from crankcase.

![Figure 7-104. Oil Pressure Switch](image)

1. Oil pressure switch
2. Connector jumper

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil pressure switch</td>
<td>96-144 in-lbs</td>
</tr>
</tbody>
</table>

1. Coat threads of oil pressure switch with LOCTITE 565 THREAD SEALANT.
2. See Figure 7-104. Install oil pressure switch (1) to crankcase. Tighten to 96-144 in-lbs (10.8-16.3 Nm).
3. Attach connector (2) to oil pressure switch.
4. Test oil pressure switch for proper operation.

NOTE
If connector (2) requires replacement, see A.24 SEALED SPLICE CONNECTORS.
GENERAL

See Figure 7-105. The rear stop lamp switch monitors brake fluid pressure in the rear brake line. When pressure in the line reaches a preset level, the rear stop lamp switch is tripped and illuminates the tail light/stop lamp.

REMOVAL

| NOTICE |

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)

1. See Figure 7-105. Remove both connectors (2) from rear stop lamp switch (1).
2. Place a clean container under the rear stop lamp switch and brake line to catch escaping fluid.
3. Remove rear stop lamp switch.

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rear stop lamp switch</td>
<td>12-15 ft-lbs</td>
</tr>
</tbody>
</table>

1. Coat threads of stop lamp switch with LOCTITE 565 THREAD SEALANT. Do not allow thread sealant to make contact with end of switch.
2. See Figure 7-105. Install rear stop lamp switch (1). Tighten to 12-15 ft-lbs (16.3-20.3 Nm).
3. Install both switch connectors (2).

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)

4. Bleed brake system. See 2.18 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. Check stop lamp for proper operation.

Figure 7-105. 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 cannot be repaired or adjusted for tone. Only the mounting hardware is replaceable.

REMOVAL AND INSTALLATION: ALL BUT FXSB

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horn bracket screws: All but FXSB</td>
<td>35-55 in-lbs</td>
</tr>
<tr>
<td>Horn bracket clamp: All but FXSB</td>
<td>80-100 in-lbs</td>
</tr>
<tr>
<td>Horn bracket nut: All but FXSB</td>
<td>80-100 in-lbs</td>
</tr>
</tbody>
</table>

1. See Figure 7-106. Remove acorn nut (4) and washer (5) to detach horn bracket (6) from vehicle.
2. Disconnect wires from posts on back side of horn.
3. Remove screws (8) and nut (10) to detach horn from bracket. Free wires from clamp (9).
4. Install new horn on bracket.
   a. Secure with screws (8), and push nuts (3). Tighten screws to 35-55 in-lbs (4.0-6.2 Nm).
   b. Install nut (10) and tighten to 80-100 in-lbs (9.0-11.3 Nm). Fold wires under clamp (9).
5. Attach wiring.
6. Attach horn bracket to vehicle using washer (5) and acorn nut (4). Tighten nut to 80-100 in-lbs (9.0-11.3 Nm). When tightening fasteners, be sure the horn does not contact the horn cover or other parts.

Figure 7-106. Horn: All But FXSB
REMOVAL AND INSTALLATION: FXSB

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horn bracket mounting bolt:</td>
<td>13-15 ft-lbs 17.6-20.4 Nm</td>
</tr>
<tr>
<td>FXSB</td>
<td></td>
</tr>
</tbody>
</table>

1. See Figure 7-107. Remove bolt (3) and washer (2) to detach horn bracket (1).
2. Disconnect wires from posts on back side of horn.
3. Remove locknut (5) to detach horn from bracket.
4. Replace horn.
5. Attach horn to bracket with new locknut (5).
6. Attach wiring.
7. Attach horn bracket using washer (2) and bolt (3). Tighten to 13-15 ft-lbs (17.6-20.4 Nm).

Figure 7-107. Horn: FXSB
ACTIVE EXHAUST

GENERAL

The active exhaust system utilizes an actuator valve located in the rear exhaust pipe which is connected to a servo motor via a cable. The valve position automatically adjusts to enhance engine performance.

The active exhaust module is located on the exhaust bracket. The attached cable is routed to a bellcrank located on the rear exhaust pipe.

REMOVAL

1. Remove exhaust system. See 4.17 EXHAUST SYSTEM.
2. See Figure 7-108. Disconnect active exhaust module connector [179] (5).
3. Remove active exhaust cable housing (1) from notch in shroud (2). Remove ferrule (3) from active exhaust module to free cable (4).
4. See Figure 7-109. Remove module fasteners (4) from active exhaust module bracket (2).

REPAIR

NOTE

See Figure 7-108. Active exhaust module shroud (2) can be replaced. Replace shroud if active exhaust cable housing (1) is a loose fit in shroud.

1. Remove fasteners securing shroud.
2. Replace shroud. Replace fasteners and tighten securely.

INSTALLATION

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active exhaust module fasteners</td>
<td>32-40 in-lbs</td>
</tr>
</tbody>
</table>

1. See Figure 7-109. Install active exhaust module (3) to bracket (2) using fasteners (4). Tighten to 32-40 in-lbs (3.6-4.5 Nm).
2. See Figure 7-108. Install ferrule (3) into slot shown. Wrap cable around active exhaust module shroud as shown.
3. Clip active exhaust cable housing (1) into shroud (2).
5. Install exhaust system. See 4.17 EXHAUST SYSTEM.
REMOVAL

NOTES

- See Appendix B for the main wiring harness schematic and a description of all connector locations.
- Disarm security system before removal.
- Note position of all clamps and cable straps before removal to aid during installation.

1. Remove seat.

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)

2. Disconnect battery cables, negative cable first. Remove battery. See 7.12 BATTERY CABLES.
3. Remove battery caddy.
4. Disconnect harness grounds (just forward of battery).
5. Remove right saddlebag if present.

NOTE

Rear wheel may have to be raised slightly to allow for splash guard removal.

6. Remove rear splash guard to access electrical panel.
7. Remove rear electrical panel. See 7.3 ELECTRICAL PANEL.
8. Remove vehicle speed sensor connector [65] located on transmission case.
9. Disconnect rear oxygen sensor connector [137] located between battery and ground terminals.
10. Remove fuel tank. See 4.6 FUEL TANK. This includes detaching fuel gauge connector [117] (not present on FXSB) and fuel pump and sender [141].
11. Remove voltage regulator and connectors located behind regulator. See 7.23 VOLTAGE REGULATOR.
   a. Voltage regulator [77].
   b. Stator [47].
   c. Front oxygen sensor connector [138].
   d. Crank position sensor [79].
   e. Front HCU connector [254].
   f. Jiffy stand interlock connector [133].
12. Disconnect front wheel speed sensor (WSS) [167].
13. Remove active exhaust connector [179] from active exhaust module if equipped, or remove cable straps securing connector to frame.
14. Remove air cleaner and disconnect active intake solenoid connector [179]. See 4.3 AIR CLEANER ASSEMBLY.
15. See Figure 7-110. Remove push-in fastener (2) from rubber trim (1) on frame. Disconnect connectors:
   a. MAP sensor [80].
   b. Right handlebar controls [22].
   c. Left handlebar controls [24].
   d. Instruments [20].
   e. Front turn signals [31].
   f. Front turn signal lamp [32] (FLSTC only).
   g. Headlamp [38].
   h. Spotlamp switch (if present).
   i. Horn wires [122].
   j. IAT sensor [89].
   k. ET sensor [90].
   l. IAC [87].
   m. TP sensor [88].
   n. front and rear ACRs [203F, 203R], if equipped.
   o. Front [84] and rear [85] fuel injectors.
16. Disconnect connectors:
   a. Electronic control module [78].
   b. Stop lamp switch.
   c. Oil pressure switch [121].
   d. Main harness power wire from starter stud.
   e. Starter solenoid [128].
   f. Tail lamp [7].
   g. Rear HCU [255].
   h. Neutral switch wiring [131].

17. Disconnect coil connector [83].

18. Slowly remove harness from frame taking note of wire routings.

**INSTALLATION**

**NOTE**

Securely attach ground terminals to their proper frame locations. Replace all cable straps.

1. Place harness wires into their original positions.

2. Attach the following connectors:
   a. Neutral switch wiring [131].
   b. **ABS equipped:** rear HCU [255].
   c. Tail lamp [7].
   d. Starter solenoid [128].
   e. Main harness power wire from starter stud.
   f. Oil pressure switch [121].
   g. Stop lamp switch.
   h. Electronic control module [78].

3. Attach connectors under fuel tank trim.
   a. front and rear ACRs [203F, 203R], if equipped.
   b. Front [84] and rear [85] fuel injectors.
   c. TP sensor [88].
   d. IAC [87].
   e. ET sensor [90].
   f. IAT sensor [90].
   g. Horn wires.
   h. Spotlamp switch (if present).
   i. Headlamp [88].
   j. Front fender tip lamp [32] (FLSTC only).
   k. Front turn signals [31].
   l. Instruments [20].
   m. Left handlebar controls [24].
   n. Right handlebar controls [22].
   o. MAP sensor [80].

4. See Figure 7-110. Install push-in fastener (2) to rubber trim (1) on frame.

5. Connect active intake solenoid connector [179] and install air cleaner. See 4.3 AIR CLEANER ASSEMBLY.

6. Connect active exhaust connector [179] to active exhaust module, if equipped. Or secure connector to frame with cable straps.

7. **ABS equipped:** connect front wheel speed sensor (WSS) [167] and secure wire with clips and cable straps. See 7.28 WHEEL SPEED SENSORS, Front Wheel Speed Sensor.

8. Install voltage regulator and connectors located behind regulator. See 7.23 VOLTAGE REGULATOR.
   a. Jiffy stand interlock connector [133].
   b. **ABS equipped:** connect front HCU connector [254].
   c. Crank position sensor [79].
   d. Front oxygen sensor connector [138].
   e. Starter [137].
   f. Voltage regulator [77].

9. Install fuel tank. This includes attaching fuel gauge connector [119] and fuel pump and sender [141]. See 4.6 FUEL TANK.

10. Connect connectors and install instrument console. See 7.26 SPEEDOMETER.
     a. Ignition key switch [83].
     b. Indicator lamp connector [21].
     c. Speedometer connector [39].

11. Install vehicle speed sensor (VSS) connector [65]. VSS is located on the transmission case.

12. Install electrical panel, connectors and splash guard. See 7.3 ELECTRICAL PANEL.
     a. **ABS equipped:** ECU [166].
     b. Purge solenoid [96].
     c. Security siren [142].
     d. BCM [242].
     e. **ABS equipped:** rear wheel speed sensor [168].
     f. FXSB: ECM.

13. See Figure 7-111. Attach connectors under seat.
     a. Secure main fuse connector (4) in cover.
     b. Secure data link connector [91A] to frame.
     c. Rear oxygen sensor connector [137].
     d. All But FXSB: ECM.
14. See Figure 7-112. Attach ground wires to frame in front of battery. Negative battery cable attaches to right side post (2). See 7.12 BATTERY CABLES.

**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)

15. Install battery caddy, battery, and connect battery cables, positive cable first. See 7.12 BATTERY CABLES.

16. Install right saddlebag, if removed.

**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)

17. Install seat.

**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)

18. Turn ignition ON. Test switches for correct operation.
   a. Left and right turn signals, front and rear.
   b. Four-way hazard warning flashers.
   c. Rear brake lamp.
   d. Headlamp.
   e. Horn.
   f. Indicator lamps.
   g. Starter.
   h. Speedometer.
GENERAL

The left hand control module includes headlamp HI - LO, horn, trip and left turn signal functions. The right hand control module includes engine start, RUN - OFF, right turn signal and flasher functions. The left and right hand control modules are non-repairable.

NOTES

- On certain models, the turn signal wiring is hard wired to the hand control modules.
- To replace the right or left hand control modules, see 7.37 RIGHT HANDLEBAR CONTROL MODULE or 7.38 LEFT HANDLEBAR CONTROL MODULE.

REPAIR PROCEDURES

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-25070</td>
<td>ROBINAIR HEAT GUN</td>
</tr>
<tr>
<td>HD-39969</td>
<td>ULTRA TORCH</td>
</tr>
<tr>
<td>HD-41183</td>
<td>HEAT SHIELD ATTACHMENT</td>
</tr>
</tbody>
</table>

1. Push conduit back to better access wires and avoid damaging conduit with radiant heating device. Secure conduit with extra 7.0 in (177.8 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 repair kit into 1.0 in (25.4 mm) segments. Slide tubing over each wire of new switch assembly.

4. Splice existing and new switch wires, matching wire colors. Solder the spliced connections. For best results, splice one wire at a time.

5. Center the heat shrink tubing over the soldered splices.

6. See Figure 7-113. Use ULTRA TORCH (Part No. HD-39969) or ROBINAIR HEAT GUN (Part No. HD-25070) with HEAT SHIELD ATTACHMENT (Part No. HD-41183) or equivalent. Uniformly heat the heat shrink tubing to insulate and seal the soldered connections. Apply heat just until the metal sealant oozes out both ends of tubing and assumes a smooth cylindrical appearance.

7. Inspect solder connection.
   a. Inspect the melted sealant for solder beads.
   b. Excess solder or heat may force some solder out with the melted sealant.
   c. Remove any solder found.
   d. Briefly heat the connection to reseal the tubing if solder beads were removed.
   e. Use less solder or reduce heating time or intensity when doing subsequent splices.

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)

1. Ultra Torch UT-100
2. Robinair Heat Gun
3. Heat Shield Attachment

Figure 7-113. Radiant Heating Devices
REMOVAL

WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

1. Remove main fuse.

NOTE
Fuel tank crossover hose does not need to be disconnected. Once all other connections to fuel tank have been removed, fuel tank can be slid back enough to reveal handlebar switch assembly connectors.

2. Remove fuel tank. See 4.6 FUEL TANK.
3. See Figure 7-114. Disconnect right hand control connectors (1, 2).
4. Loosen the upper handlebar clamp-to-master cylinder housing screw. Remove the lower handlebar clamp-to-master cylinder housing screw.
5. Remove the upper and lower switch housing screws.
6. Remove the friction shoe from the end of the tension adjuster screw.

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

7. Loosen cable adjusters. See 1.13 THROTTLE CABLES.
8. See Figure 7-115. Remove the brass ferrules (4) from the notches on the inboard side of the throttle control grip. Remove the ferrules from the cable end fittings.
9. Remove the throttle control grip from the end of the handlebar.
10. See Figure 7-116. If replacing lower switch housing, pull inserts (1, 2) from lower switch housing. Use a rocking motion while pulling. Place a drop of light oil on the retaining rings, if necessary. Remove the cables from the switch housing.
11. See Figure 7-117. Remove screws (3) and retainer (1).

NOTE
Record wire routing before removal.
12. Carefully remove brake switch (2) and switch assembly from lower switch housing. Remove switch assembly.
2. Install retainer (1) with screws (3). Tighten screws to 8-10 in-lbs (0.9-1.1 Nm).

3. See Figure 7-116. If previously removed from lower switch housing, push the throttle and idle control cables into the lower switch housing until they snap in place. Note the different diameter inserts crimped into the end of the throttle and idle cable housings.
   a. Push the silver insert (2) of throttle cable housing into the hole in front of tension adjuster screw (3).
   b. Push the gold insert (1) of idle cable housing into the hole at the rear of tension adjuster screw (3).

**NOTE**
To aid assembly, place a drop of light oil on the retaining rings of the crimped inserts. Always replace the retaining rings if damaged or distorted.

4. Slide the throttle control grip over the end of the right handlebar until it bottoms against the closed end. Rotate the grip so that the ferrule notches are at the top. To prevent binding, pull the grip back about 1/8 in. (3.2 mm).

5. With the concave side facing upward, install the friction shoe so that the pin hole is over the point of the adjuster screw.

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

6. See Figure 7-115. Position lower switch housing beneath the throttle control grip. Install the brass ferrules (4) onto the cable so that the end fittings seat in the ferrule recess. Seat the ferrules in their respective notches (3) on the throttle control grip. Verify that the cables are captured in the grooves (2) molded into the grip.

**INSTALLATION**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handlebar switch assembly retainer screws</td>
<td>8-10 in-lbs, 0.9-1.1 Nm</td>
</tr>
<tr>
<td>Handlebar clamp to master cylinder screws</td>
<td>60-80 in-lbs, 6.8-9.0 Nm</td>
</tr>
<tr>
<td>Handlebar switch housing screws</td>
<td>35-45 in-lbs, 4.0-5.1 Nm</td>
</tr>
</tbody>
</table>

**NOTE**
When installing switch assembly and retainer, verify wires do not get pinched. Check that the rubber grommet on the wire harness is properly placed on the switch housing.

1. See Figure 7-117. Place switch assembly into position on lower switch housing and carefully install brake switch (2).
NOTE
See Figure 7-118. When installing right handlebar switch assembly for motorcycles with internally wired handlebars, make sure the clamping surface (1) stays within the range marks (2) or damage to the wires will occur.

7. Position the upper switch housing over the handlebar and lower switch housing.
8. Start the upper and lower switch housing screws. Do not tighten.
9. See Figure 7-119. Position the brake lever/master cylinder assembly inboard of the switch housing assembly, engaging the tab (2) on the lower switch housing in the groove (3) at the top of the brake lever bracket.
10. Install the lower handlebar clamp-to-master cylinder housing screw (with flat washer). Position for rider comfort. Beginning with the top screw, tighten to 60-80 in-lbs (6.8-9.0 Nm).
11. Tighten lower and upper switch housing screws to 35-45 in-lbs (4.0-5.1 Nm).

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

12. Adjust throttle cables. See 1.13 THROTTLE CABLES.
13. See Figure 7-114. Connect right hand control connectors (1, 2).
14. Secure harness with clamps and cable strap as noted during removal.
15. Install fuel tank. See 4.6 FUEL TANK.
16. Install main fuse. See 7.10 FUSES.

WARNING
Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (06316a)
17. Test the switches for proper operation.

FRONT BRAKE SWITCH REPLACEMENT

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handlebar switch assembly retainer screws</td>
<td>8-10 in-lbs</td>
</tr>
</tbody>
</table>

1. Remove upper switch housing cover. See 7.37 RIGHT HANDLEBAR CONTROL MODULE, Removal.
2. See Figure 7-117. From inside the switch housing, remove screws (3) and retainer (1). Remove brake switch (2) from housing.
3. Cut wires flush at inoperative brake switch.
4. If new brake switch wires have terminals installed, cut wires at terminal end.
5. Remove 0.25-0.3125 in. (6.4-7.9 mm) of insulation from each wire end.
6. Cut two pieces of dual wall heat-shrink tubing to a length of 0.5 in. (12.7 mm).
7. Solder wires together and cover with heat-shrink tubing. See 7.36 HANDLEBAR CONTROL MODULES, Repair Procedures.
8. See Figure 7-117. Install brake switch (2) into housing. Install retainer (1) and screws (3). Tighten screws to 8-10 in-lbs (0.9-1.1 Nm).
**REMOVAL**

**WARNING**

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

1. Remove main fuse.

**NOTE**

Fuel tank crossover hose does not need to be disconnected. Once all other connections to fuel tank have been removed, fuel tank can be slid back enough to reveal handlebar switch assembly connectors.

2. Remove fuel tank. See 4.6 FUEL TANK.

3. See Figure 7-120. Disconnect left hand control connector (2).

4. Loosen the upper handlebar clamp-to-clutch lever screw. Remove the lower handlebar clamp-to-clutch lever screw.

5. Remove the upper and lower switch housing screws. Remove upper switch housing.

6. See Figure 7-121. Remove screws (3) and retainer (1).

7. Carefully remove clutch switch (2) and switch assembly from lower switch housing.

**NOTE**

Record wire routing along with clamp and cable strap locations before removal.

8. Remove switch assembly from motorcycle.

**INSTALLATION**

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handlebar switch assembly retainer screws</td>
<td>8-10 in-lbs</td>
</tr>
<tr>
<td>Handlebar clamp to clutch lever bracket screws</td>
<td>60-80 in-lbs</td>
</tr>
<tr>
<td>Handlebar switch housing screws</td>
<td>35-45 in-lbs</td>
</tr>
</tbody>
</table>

**NOTE**

When installing switch assembly and retainer, make sure wires do not get pinched and that the rubber grommet on the wire harness is properly placed on the switch housing.

1. See Figure 7-121. Place switch assembly into position on lower switch housing and carefully install clutch switch (2).
NOTE
See Figure 7-122. When installing left handlebar switch assembly for motorcycles with internally wired handlebars, make sure the clamping surface (1) stays within the range marks (2) or damage to the wires will occur.

2. Install retainer (1) with screws (3). Tighten to 8-10 in-lbs (0.9-1.1 Nm).
3. Position the upper switch housing over the handlebar and lower switch housing.
4. Start the upper and lower switch housing screws, but do not tighten.
5. See Figure 7-123. Position the clutch hand lever assembly inboard of the switch housing assembly, engaging the tab (3) on the lower switch housing in the groove (2) at the bottom of the clutch lever bracket.
6. Secure the handlebar switch clamp to the clutch lever bracket with two screws (with flat washers). Position for rider comfort. Beginning with the top screw, tighten to 60-80 in-lbs (6.8-9.0 Nm).
7. Tighten switch housing screws to 35-45 in-lbs (4.0-5.1 Nm).

NOTE
Always tighten the lower switch housing screw first. Any gap between the upper and lower housings is at the front of the switch.
8. See Figure 7-120. Connect left hand control connector (2).
9. Secure harness with clamps and cable strap as noted during removal.
10. Install fuel tank. See 4.6 FUEL TANK.

11. Install main fuse. See 7.10 FUSES.

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. Test the switches for proper operation.

Figure 7-123. Clutch Lever Bracket

CLUTCH SWITCH REPLACEMENT

<table>
<thead>
<tr>
<th>FASTENER</th>
<th>TORQUE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handlebar switch assembly</td>
<td>8-10 in-lbs</td>
</tr>
<tr>
<td>Retainer screws</td>
<td>0.9-1.1 Nm</td>
</tr>
</tbody>
</table>

1. Remove upper switch housing cover. See 7.38 LEFT HANDLEBAR CONTROL MODULE, Removal.
2. See Figure 7-121. From inside the switch housing, remove screws (3) and retainer (1). Remove clutch switch (2) from housing.
3. Cut wires flush at inoperative clutch switch.
4. If new clutch switch wires have terminals installed, cut wires at terminal end.
5. Remove 0.25-0.3125 in. (6.4-7.9 mm) of insulation from each wire end.
6. Cut two pieces of dual wall heat-shrink tubing to a length of 0.5 in. (12.7 mm).
7. Solder wires together and cover with heat-shrink tubing. See 7.36 HANDLEBAR CONTROL MODULES, Repair Procedures.
8. See Figure 7-121. Install clutch switch (2) into housing. Install retainer (1) and screws (3). Tighten screws to 8-10 in-lbs (0.9-1.1 Nm).
9. Assemble left handlebar switch housing. See 7.38 LEFT HANDLEBAR CONTROL MODULE, Installation.
A.1 AUTOFUSE UNSEALED ELECTRICAL CONNECTORS ............................................. A-1
A.2 BOSCH COMPACT 1.1M CONNECTOR .................................................................. A-2
A.3 BOSCH BTC SEALED CONNECTOR .................................................................... A-3
A.4 DELPHI 100W MICRO-PACK SEALED CONNECTOR ........................................ A-5
A.5 DELPHI 150 METRI-Pack SEALED CONNECTORS .............................................. A-8
A.6 DELPHI 280 METRI-PACK UNSEALED CONNECTORS ..................................... A-10
A.7 DELPHI 440 METRI-PACK UNSEALED CONNECTORS ..................................... A-11
A.8 DELPHI 630 METRI-PACK UNSEALED CONNECTORS ..................................... A-12
A.9 DELPHI 800 METRI-PACK SEALED MAIN FUSE HOUSING ............................... A-13
A.10 DELPHI METRI-PACK TERMINAL REPAIR ..................................................... A-14
A.11 DELPHI MICRO 94 SEALED CONNECTORS .................................................... A-16
A.12 DELPHI GT 150 SEALED CONNECTORS ........................................................ A-19
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A.16 DEUTSCH DTM SEALED SOLID BARREL MINI TERMINAL REPAIR ............ A-27
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A.18 MOLEX CMC SEALED CONNECTORS .......................................................... A-30
A.19 MOLEX MX 150 SEALED CONNECTORS ....................................................... A-32
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A.21 TYCO 070 MULTILock UNSEALED CONNECTOR ......................................... A-38
A.22 TYCO GET 64 SEALED CONNECTOR ......................................................... A-41
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AUTOFUSE UNSEALED ELECTRICAL CONNECTORS

AUTOFUSE UNSEALED CONNECTOR REPAIR

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>GA500A</td>
<td>SNAP-ON TERMINAL PICK</td>
</tr>
</tbody>
</table>

General

Autofuse Unsealed connector terminals are found in ignition switches and some fuse blocks.

Disassembly

1. See Figure A-1 or Figure A-2. Insert smallest pair of pins on the SNAP-ON TERMINAL PICK (Part No. GA500A) into chamber on mating end of socket housing to press tangs on each side of terminal simultaneously.
2. Gently pull on wire to remove terminal from wire end of socket housing.
3. If necessary, crimp new terminals on wires.

Assembly

1. Carefully bend tang on each side of terminal outward away from terminal body. Use the thin flat blade from a hobby knife.
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-1. Removing Autofuse Unsealed Terminal from Ignition Switch

Figure A-2. Removing Autofuse Unsealed Terminal from Fuse Block
BOSCH COMPACT 1.1M CONNECTOR

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>GA500A</td>
<td>SNAP-ON TERMINAL PICK</td>
</tr>
</tbody>
</table>

**General**

See Figure A-3. The Bosch Compact 1.1M connector is found on MAP and TMAP sensors.

**Housings**

Separate: Snap back the secondary lock. Press on the latch while pulling the socket connector from the sensor.

Join: Align the sockets and press the housings together until the latch snaps. Snap in the secondary lock.

Figure A-3. Bosch Compact 1.1M Connector

**Installing Socket Terminal**

1. See Figure A-5. Use a hobby knife to bend the tangs on each side of the terminal outward.

2. Align terminal to socket housing. Press terminal into housing until it snaps.

   **NOTE**
   
   The teeth on the locking bar face down.

3. Slide the locking bar onto the connector.

Figure A-5. Tungs: Bosch Compact 1.1M Socket Terminal

**Removing Socket Terminal**

1. See Figure A-4. Slide the locking bar off the terminal housing.

2. Insert the smallest pins of the SNAP-ON TERMINAL PICK (Part No. GA500A) into the gaps on each side of the socket to compress the tungs on each side of the terminal.

3. Gently pull on the wire to remove the terminal.

Figure A-4. Terminal Removal: Bosch Compact 1.1M Connector
BOSCH BTC SEALED CONNECTOR REPAIR

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-50085</td>
<td>TERMINAL EXTRACTOR</td>
</tr>
<tr>
<td>HD-50120-A</td>
<td>BOSCH TERMINAL REPAIR KIT</td>
</tr>
</tbody>
</table>

The Bosch BTC sealed connector is used to connect the ABS module to the wire harness on Touring models.

**Plugging and Unplugging Connector**

1. See Figure A-6. To unplug connector:
   a. While pressing latch lock (1), lift latch handle (2).
   b. See Figure A-7. Raise latch handle into the full upward (open) position (1).
   c. Pull connector straight out of socket.

   **NOTE**
   Do not attempt to close latch handle while connector is out of socket. Damage to latch mechanism could result.

2. To plug in connector:
   a. Insert connector. Press gently into socket.
   b. Pull latch handle down (closed) until it clicks.

![Figure A-6. Bosch BTC Sealed Connector (Latched)](image1)

![Figure A-7. Bosch BTC Sealed Connector (Unlatched)](image2)

**Removing and Installing Connector Cover**

1. To remove connector cover:
   a. See Figure A-7. Remove and discard cable strap (2).
   b. See Figure A-8. Insert the blade of a small screwdriver into cover release latch (1) slot.
   c. Gently pry the cover away from the tab on the body of the connector. Repeat for other release latch slot.
   d. Grasp cover and pivot up (2) and away from connector.

2. To install connector cover:
   a. See Figure A-8. Start cover into connector body at an angle. Engage tabs (4) in slots (5).
   b. Rotate cover down onto body until an audible click is heard, indicating that cover is locked in place.
   c. See Figure A-7. Install new cable strap (2).
Removing and Installing Wire Terminals

NOTE

See Figure A-10. The Bosch BTC Sealed connector has three sizes of terminals: 12 gauge, 14 gauge and 20 gauge.

1. To remove terminals from connector:
   a. See Figure A-9. With the blade of a small screwdriver, gently pry the terminal lock (1) open (2).
   b. See Figure A-10. Insert TERMINAL EXTRACTOR (Part No. B-50085) into cavity next to terminal being removed. Carefully pry terminal latch back. Grasp wire and gently pull terminal from terminal cavity.

2. To install terminals in connector:
   a. Carefully insert terminal with wire lead into appropriate terminal cavity.
   b. Gently push terminal into cavity until it clicks, indicating that it is locked in place.
   c. When all terminals are in place, use the blade of a small flat screwdriver to pry the terminal lock closed (1).

Figure A-9. Bosch BTC Sealed Connector Terminal Lock

Figure A-10. Bosch BTC Sealed Connector Terminals
Crimping Terminals to Leads

The BOSCH TERMINAL REPAIR KIT (Part No. HD-50120-A) contains the crimper tool, dies and all terminals necessary to repair the Bosch BTC sealed connector. For the correct terminal crimping procedure, refer to the instruction sheet provided with the tool or available through h-dnet.com.
DELPHI 100W MICRO-PACK SEALED CONNECTOR REPAIR

General
A Delphi 100W Micro-Pack Sealed connector connects the electronic control module (ECM) to the main harness.

Separating Socket Housing From ECM
See Figure A-11. 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.

![Figure A-11. Delphi 100W Micro-Pack Sealed Connector to ECM](image)

1. Thumb lever
2. Latch
3. Catch (ECM)

Removing Socket Terminal
1. See Figure A-12. To remove, gently press latch (1) on each side of the clear plastic secondary lock (2). 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-13. 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 tabs on the secondary lock on the same side as the external latch, install over terminals until latches lock in place.

![Figure A-12. Delphi 100W Micro-Pack Sealed Connector](image)

1. Latch
2. Secondary lock
3. Cable strap
4. Strain relief collar
5. Conduit
CRIMPING TERMINALS

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-50120</td>
<td>UNIVERSAL CRIMPER SET</td>
</tr>
<tr>
<td>HD-50120-2</td>
<td>HAND CRIMP FRAME</td>
</tr>
<tr>
<td>HD-50120-7</td>
<td>TYCO AND DELPHI TERMINAL CRIMP DIE</td>
</tr>
</tbody>
</table>

1. Strip the wire insulation to specification. Refer to Table A-1.
2. Install the TYCO AND DELPHI TERMINAL CRIMP DIE (Part No. HD-50120-7) in the handle of the HAND CRIMP FRAME (Part No. HD-50120-2) of the UNIVERSAL CRIMPER SET (Part No. HD-50120).
3. Place the new terminal in the specified nest.
4. Insert the wire to the wire stop. Crimp the terminal.
5. Inspect the crimped terminal.

Table A-1. Delphi 100W Micro-Pack Crimper Die (Part No. HD-50120-7)

<table>
<thead>
<tr>
<th>TERMINAL</th>
<th>PART NO.</th>
<th>STRIP LENGTH</th>
<th>NEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socket: 18 AWG</td>
<td>72076-00</td>
<td>0.200</td>
<td>B</td>
</tr>
<tr>
<td>Socket: 20-22 AWG</td>
<td>72568-08</td>
<td>0.200</td>
<td>C</td>
</tr>
</tbody>
</table>

Figure A-13. Delphi 100W Micro-Pack Sealed Connector: Separate Halves of Socket Housing
**General**

Delphi 150 Metri-Pack Sealed 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. Push the pin and socket halves of the connector together.

**Removing Socket Terminal**

1. See Figure A-14 for pull-to-seat connector or Figure A-15 for push to seat connector. Remove wire lock (1) from wire end of socket housing on pull-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. The tangs are on the same side as the external latch.

3. Gently insert a small diameter straight pin into the chamber about 1/8 in (3.2 mm).
   - For pull-to-seat: Stay between the terminal and the chamber wall and pivot the end of the pin toward the terminal body.
   - 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. This indicates the tang is pressed in.

   **NOTE**

   After repeated terminal extractions, the click may not be heard, but pivot the pin as if the click was heard at least three times.

6. Remove the pin.
   - For pull-to-seat: Push on the lead to extract the terminal from the mating end of the connector.
   - 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-14 for pull-to-seat connector or Figure A-15 for push to seat connector. Carefully bend tang on each side of terminal outward away from terminal body. Use the thin flat blade from a hobby knife.

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.

**NOTE**

**For push-to-seat:** See Figure A-15. 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.
1. Locate tang in chamber
2. Pivot pin to release tang
3. Push to remove
4. Raise tang to install

Figure A-14. Delphi 150 Metri-Pack Sealed Connector: Pull-to-Seat

1. Remove wire lock
2. Pivot pin to release tang
3. Pull to remove
4. Raise tang to install

Figure A-15. Delphi 150 Metri-Pack Sealed Connector: Push-to-Seat
FUSE BLOCK REPAIR

Removing Socket Terminals

1. See Figure A-16. 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. Use the thin flat blade from a hobby knife. Gently push tang away from terminal and 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-17. Alpha (1) and numeric (2) coordinates identify the main fuse block terminal cavity. Refer to the main harness wiring diagram.

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 wire ends to verify that all terminals are locked.

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. 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 can require different crimping dies found on separate crimpers.
DELPHI 480 METRI-PACK UNSEALED CONNECTOR REPAIR

General

A 480 Metri-Pack connector is frequently used for the B+ (battery voltage) connector to power P&A accessories.

See Figure A-18. An AFL housing (5) is used on many ignition/flight switches. The secondary lock (4) must be opened before removing the terminal from the housing.

Separating Pin and Socket Housings

NOTES

- Record position of cable straps anchoring wire conduits of the pin and socket housing before removing them.
- Cut any cable strap anchoring the wire conduits of the pin (accessory connector housing) and the socket (B+) housing.

See Figure A-18. Using small flat blade screwdriver, press 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-18. 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 stock 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 press 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.10 DELPHI METRI-PACK TERMINAL REPAIR.

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 original equipment location. Tighten cable strap to capture conduit of both accessory connector and B+ connector approximately 1.0 in (25.4 mm) from housings.
DELPHI 630 METRI-PACK UNSEALED CONNECTOR REPAIR

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>TT600-3</td>
<td>SNAP-ON PICK</td>
</tr>
</tbody>
</table>

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. 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. It engages a rib in the chamber wall to lock the terminal in place.
3. Moving to the mating end of the connector, find the small opening on the chamber wall side of each terminal.
4. Insert SNAP-ON PICK (Part No. TT600-3) into opening until it stops. Pivot the end of the pick toward the terminal to press 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. See A.10 DELPHI METRI-PACK TERMINAL REPAIR.

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. Carefully bend tang on each side of terminal outward away from terminal body. Use the thin flat blade from a hobby knife.
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 wire ends to verify that all terminals are locked.
4. Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.
DELPHI 800 METRI-PACK SEALED MAIN FUSE HOUSING REPAIR

Removing Socket Terminals

**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. (00068a)

1. Disconnect battery.
2. See Figure A-13. Disengage slots (1) on secondary lock (2) from tabs (3) and remove secondary lock.
3. Insert flat blade of pick or small screwdriver into opening (4) until it stops.
4. Tug on cable to pull socket from connector housing. Pivot the pick toward the terminal body to release the latch if necessary.
5. Repeat to remove remaining socket terminal.

**NOTE**
The battery positive cable and power wire for the main fuse are crimped together at the starter ring terminal. Replace both as an assembly if either requires replacement.

Installing Socket Terminals

1. See Figure A-20. Carefully bend tang outward away from the terminal body.
2. Properly orient terminal to the cavity in the housing. Push terminal into connector housing until it clicks in place. Verify that socket will not back out of chamber.
3. Push rubber seal into connector housing.
4. Repeat to install remaining socket terminal.
5. Install secondary lock onto connector housing. Verify slots engage tabs on sides of connector housing.

**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)

6. Connect battery cables.
METRI-PACK TERMINAL CRIMPS

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-38125-6</td>
<td>PACKARD TERMINAL CRIMPER</td>
</tr>
<tr>
<td>HD-38125-7</td>
<td>PACKARD TERMINAL CRIMPER</td>
</tr>
<tr>
<td>HD-38125-8</td>
<td>PACKARD TERMINAL CRIMPER</td>
</tr>
</tbody>
</table>

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-21. A crimp can require two crimping dies. The dies are found on the PACKARD TERMINAL CRIMPER (Part No. HD-38125-6) and the PACKARD TERMINAL CRIMPER (Part No. HD-38125-7). The terminal and the wire gauge determine the core crimp die and the insulation/seal die.

NOTE

The PACKARD TERMINAL CRIMPER (Part No. HD-38125-8) also crimps sealed splice connectors in wire gauge sizes 18-20, 14-16 and 10-12.

Preparing Wire Lead

Strip 5/32 in (4.0 mm) of insulation from the wire lead.

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. Make sure that the core crimp tails are facing the forming jaws.
4. Gently squeeze the handles only until crimpers secure the core crimp tails.
5. Insert stripped wire between crimp tails. Verify that wire is positioned so that short pair of crimp tails squeezes core wire strands, while long pair is positioned over the insulation or seal material.

Figure A-21. Metri-Pack Terminal Crimp Tools
Crimping Insulation/Seal

NOTE
Always perform Crimping Wire Core before Crimping Insulation/Seal.

1. See Figure A-22. Identify the correct die for the insulation/seal crimp (2).
2. Position the insulation/seal crimp in the nest. Make sure that the core 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-22. Inspect the wire core crimp (1). Make sure that the tails are folded in on the wire core without any distortion or excess wire strands.
2. Inspect the insulation (2) or seal (3) crimp. Make sure that the tails of the terminal are wrapped around the insulation without distortion.

Figure A-22. Metri-Pack Connector: Inspect Core and Insulation/Seal Crimps
DELPHI MICRO 64 SEALED CONNECTOR REPAIR

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-45928</td>
<td>TERMINAL REMOVER</td>
</tr>
<tr>
<td>HD-45929</td>
<td>TERMINAL CRIMPER</td>
</tr>
</tbody>
</table>

General

Delphi Micro 64 Sealed connectors are frequently found on speedometers, tachometers and the ECM of Touring Models.

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. Align pin and socket housings. Push the pin and socket housings of the connector together until the latches click.

Removing Terminal

1. See Figure A-23. 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-24. Obtain the TERMINAL REMOVER (Part No. HD-45928).

5. See Figure A-25. 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-24. Terminal Remover (HD-45928)

Figure A-25. Delphi Micro-64 Sealed Connector: Insert Tool and Remove Terminal

A-16 2015 Softail Service: Appendix A Connector Repair
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-23. 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 removed, the terminal may not lock in place when first installed. Until the lock engages, move the terminal back and forth slightly while wigging 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 1/8 in (3.0 mm) of insulation from the wire lead.

Crimping Terminals

1. **Inspect new** socket terminal for bent or deformed contact and crimp tails. Replace as necessary.

2. See Figure A-27. Squeeze the handles of the 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. Position wire that the 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. Open position
2. Raising locking bar
3. Insert terminal
4. Crimp terminal

Figure A-27. Delphi Micro-64 Sealed Connector: Terminal in Crimper
DELPHI GT 150 SEALED CONNECTOR REPAIR

General
Delphi connectors are embossed with the brand name, Delphi, on the housing latch or terminal block.

Separating Pin and Socket Housings
See Figure A-28. Bend back the external latch(es) slightly and separate pin and socket halves of the 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, these instructions are universal.

1. See Figure A-29. If present, free one side of wire lock (1) from ear on wire end of socket housing. Release the other side if necessary. Release wires from channels in wire lock. Remove appropriate terminals from housing.

2. Use a fingernail to pry colored terminal lock (2) loose. Remove from mating end of socket housing.

3. Use the thin flat blade from a hobby knife. Gently pry tang (3) outward away from terminal. 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, preventing it from backing 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.
1. Remove wire lock
2. Remove terminal lock
3. Pry tang outward

Figure A-29. Delphi GT 150 Sealed Connector: Removing Socket Terminals
DEUTSCH DT SEALED CONNECTORS

DEUTSCH DT SEALED CONNECTOR REPAIR

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-41475</td>
<td>DEUTSCH TERMINAL REPAIR KIT</td>
</tr>
<tr>
<td>HD-41475-100</td>
<td>FLAT BLADE L-HOOK</td>
</tr>
</tbody>
</table>

General

Deutsch DT sealed connectors are color coded for location purposes. DT connectors associated with left side accessories, such as the front and rear left turn signals, are gray. All other DT connectors are black.

NOTES

- A DEUTSCH TERMINAL REPAIR KIT (Part No. HD-41475) contains a selection of seals and seal plugs, locking wedges, attachment clips and terminals.
- Also included is a FLAT BLADE L-HOOK (Part No. HD-41475-100) used to remove locking wedges, compartmented storage box and carrying case.

Separating Pin and Socket Housings

See Figure A-30. To separate the connector halves, Press 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 attached to the wiring harness.
- Six-place and smaller 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: Six-place and smaller Deutsch connectors have one external latch on the socket housing. To join the housings, align the latch on the socket side with the latch cover on the pin side.
   b. For Two External Latches: 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.

NOTE

For Two External Latches: 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.

Removing Socket Terminals

1. See Figure A-31. 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-34. Use a pick or small screwdriver to press 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-33. Fit rear wire seal (1) into back of socket housing (2), if removed.

3. Gasp 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

Install seal plugs (6) into 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-32. While rectangular wedges do not require a special orientation, align arrow (1) on conical secondary locking wedge towards external latch for three-place connectors.

- If the secondary locking wedge does not slide into position easily, check the installation of all the terminals. Unseated terminals prevent the locking wedge from proper installation.

Figure A-31. Deutsch DT Sealed Connector: Remove Secondary Locking Wedge

Figure A-32. Deutsch DT Sealed Connector: 3-Place Locking Wedges

1. Arrow on socket locking wedge
2. Arrow on pin locking wedge

1. Wire seal
2. Socket housing
3. Wire lead
4. Internal seal
5. Secondary locking wedge
6. Seal plug

Figure A-33. Deutsch DT Sealed 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 press 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.
- The 8-place and 12-place gray and black connectors are not interchangeable. If replacing both the socket and pin housings, the black may be substituted for the gray.
- The socket and pin housings of all other connectors are interchangeable. Black may be mated with the gray since the alignment tabs are absent and the orientation of the external latch is the same.

![Image of Deutsch DT Sealed Connector: Press Terminal Latch and Back Out Pin]

Figure A-34. Deutsch DT Sealed Connector: Press Terminal Latch and Back Out Pin

Installing Pin Terminals

1. See Figure A-35. 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. 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-32. White rectangular wedges do not require a special orientation, align arrow (1) on conical secondary locking wedge towards external latch for three-place connectors.
   - If the secondary locking wedge does not slide into position easily, check the installation of all the terminals. Unseated terminals prevent the locking wedge from proper installation.

![Image of Deutsch DT Sealed Connector: 2, 3, 4 and 12-Place Pin Housings]

Figure A-35. Deutsch DT Sealed Connector: 2, 3, 4 and 12-Place Pin Housings

Crimping Terminals

Identify which of the types of Deutsch terminals are used with the connector. Follow the corresponding crimping instructions. Refer to Table A-2.
<table>
<thead>
<tr>
<th>TYPE</th>
<th>CRIMPING INSTRUCTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DT Sealed (with crimp tails)</td>
<td>A.14 DEUTSCH DT SEALED TERMINAL REPAIR</td>
</tr>
<tr>
<td>DTM Mini Sealed Terminal (solid barrel)</td>
<td>A.16 DEUTSCH DTM SEALED SOLID BARREL MINI TERMINAL REPAIR</td>
</tr>
<tr>
<td>DTM Mini Sealed Terminal (with crimp tails)</td>
<td>A.15 DEUTSCH DTM SEALED MINI TERMINAL REPAIR</td>
</tr>
</tbody>
</table>
DEUTSCH DT SEALED TERMINAL CRIMPS

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-39965-A</td>
<td>DEUTSCH TERMINAL CRIMP TOOL</td>
</tr>
</tbody>
</table>

Preparing Wire Leads for Crimping

1. Use a shop gauge to determine gauge of wire lead.
2. Strip 5/32 in (4.0 mm) of insulation from the wire lead.

Crimping Terminal to Lead

1. See Figure A-36. 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. Match the wire gauge to the crimp tool die. Refer to Table A-3.

NOTE

Rest the rounded side of the contact barrel in the nest (concave split level area) with the crimp tails facing up.

3. Insert (2) terminal (socket/pin) through hole of the locking bar.
4. Release locking bar to lock terminal in die.

5. Insert stripped wire core between crimp tails until ends make contact with locking bar. Position wire that the wide pair of crimp tails squeeze bare wire strands, while the narrow pair folds over the insulation material.
6. Squeeze handle of crimp tool until tightly closed. Tool automatically opens after the terminal is crimped.
7. Raise locking bar up to remove wire lead and terminal.

Inspecting Crimps

Inspect the wire core and insulation crimps. Distortion should be minimal.

Table A-3. Deutsch DT Sealed Terminal Crimp: Wire Gauge To Die

<table>
<thead>
<tr>
<th>WIRE GAUGE (AWG)</th>
<th>CRIMP TOOL DIE</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>Front</td>
</tr>
<tr>
<td>16-18</td>
<td>Middle</td>
</tr>
</tbody>
</table>

Figure A-36. Crimping a Deutsch DT Sealed Terminal
DEUTSCH DTM SEALED MINI TERMINAL REPAIR

DEUTSCH DTM SEALED MINI TERMINAL CRIMPS

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-38125-7</td>
<td>PACKARD TERMINAL CRIMPER</td>
</tr>
</tbody>
</table>

Inspecting Crimps
Inspect the core and insulation crimps. Distortion should be minimal.

Preparing Wire Leads for Crimping
Strip 5/32 in (4.0 mm) of insulation from the wire lead.

Crimping a Mini Terminal to Wire Lead

1. See Figure A-37. 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 crimpler. Verify 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 the short pair of crimp tails squeeze bare wire strands, while long pair squeeze over the insulation.

5. Squeeze handle of crimpler until lightly closed. Tool automatically opens when the crimping sequence is complete.

   NOTE
If the crimpler does not open, squeeze the ratchet trigger (2).

6. Position the insulation crimp on nest C of the crimpler. Verify the insulation crimp tails are facing the forming jaws.

7. Squeeze handle of crimp tool until lightly closed. Tool automatically opens when the crimping sequence is complete.

Figure A-37. Packard Terminal Crimper (HD-38125-7)
Preparing Wire Leads For Crimping
For size 20, 16 and 12 contacts, wire ranges 26-12 AWG.
Strip 1/4 in (6.4 mm) of insulation from the wire lead.

Adjusting Crimper Tool
1. See Figure A-38. 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. Rotate knob 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-39. 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 recess in indentor cover. Tighten knurled locknut.
3. Slowly squeeze handles of crimp tool until contact centers 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
Adjust the crimper tool for each contact/wire size.
6. Install pin to lock selector knob.

Inspecting Crimp
Inspect the crimp. All core wire strands are to be crimped in the barrel.
1. Contact barrel
2. Indentor cover
3. Indentor point
4. Stripped wire lead

Figure A-39. Deutsch Solid Barrel
Connector Housings

Separate Housings: See Figure A-40. Press the two release buttons on each side of the housing to separate the connector.

Connect Housings: Align housings. Press together until the locking tabs click.

Removing Terminals
1. Modify a TERMINAL EXTRACTOR (Part No. B-50085) by filing the front edge to 45 degrees.
2. See Figure A-41. Insert the extractor (1) into the opening above the terminal and press the plastic molding (2) up and out of the way.
3. Pull the wire lead and terminal out of the back of the housing.

Installing Terminals
1. Inspect the plastic molding and replace the connector housing if necessary.
2. Orient the terminal to the housing. Push terminal into housing until it clicks into place.

CRIMPING TERMINALS

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-50120</td>
<td>UNIVERSAL CRIMPER SET</td>
</tr>
<tr>
<td>HD-50120-2</td>
<td>HAND CRIMP FRAME</td>
</tr>
<tr>
<td>HD-50120-6</td>
<td>JAE DIE</td>
</tr>
</tbody>
</table>

1. Strip the wire insulation to specification. Refer to Table A-4.
2. Install the JAE DIE (Part No. HD-50120-6) in the handle of the HAND CRIMP FRAME (Part No. HD-50120-2) of the UNIVERSAL CRIMPER SET (Part No. HD-50120).
3. Place the new terminal in the specified nest.
4. Insert the wire to the wire stop. Crimp the terminal.
5. Inspect the crimped terminal.

Table A-4. JAE MX19 Crimper Die (Part No. HD-50120-6)

<table>
<thead>
<tr>
<th>TERMINAL</th>
<th>PART NO.</th>
<th>STRIP LENGTH</th>
<th>NEST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>72910-11</td>
<td>0.051-0.098</td>
<td></td>
</tr>
<tr>
<td></td>
<td>72909-11</td>
<td>0.051-0.098</td>
<td></td>
</tr>
</tbody>
</table>

2015 Softail Service: Appendix A Connector Repair A-29
**MOLEX CMC SEALED CONNECTORS**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-50423</td>
<td>0.6 MM TERMINAL EXTRACTOR TOOL</td>
</tr>
<tr>
<td>HD-50424</td>
<td>1.5 MM TERMINAL EXTRACTOR TOOL</td>
</tr>
</tbody>
</table>

**Installing Terminals**

1. Orient the terminal to the housing cavity. Snap the terminal in place.
2. Slide the cap over the lead bundle. Snap the cap in place.
3. Install a cable strap through the guide and around the lead bundle.

**Separating the Connector**

**Release:** See Figure A-42. Press the catch and rotate the lever arm down.

**Connect:** Press on the front guard to release the latch and rotate the lever arm up until the catch clicks in place.

**Removing Terminals**

1. With the lever arm open, cut the cable strap around the wire bundle.
2. See Figure A-43. Open a wire cap latch (1) with a small screwdriver.
3. Maintain pressure on the cap and open the opposite latch (2) with the screwdriver.
4. Slide the cap off (3).
5. See Figure A-44. Use the screwdriver to open the secondary lock. Pull the locking bar all the way out.
6. See Figure A-45. Locate the wire lead cavity by the alphanumeric coordinates.
7. Identify the size of the terminal and select either the CMC extractor 0.6 MM TERMINAL EXTRACTOR TOOL (Part No. HD-50423) or the 1.5 MM TERMINAL EXTRACTOR TOOL (Part No. HD-50424).
8. See Figure A-46. Insert the pins of the CMC extractor tool (1) into the access slots (2) of the terminal cavity and retract the lead and terminal.
### CRIMPING TERMINALS

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-50120</td>
<td>UNIVERSAL CRIMPER SET</td>
</tr>
<tr>
<td>HD-50120-2</td>
<td>HAND CRIMP FRAME</td>
</tr>
<tr>
<td>HD-50120-3</td>
<td>JAE DIE</td>
</tr>
<tr>
<td>HD-50120-4</td>
<td>JAE DIE</td>
</tr>
</tbody>
</table>

1. Select the crimping die according to the terminal part number from the UNIVERSAL CRIMPER SET (Part No. HD-50120).

2. Strip the wire insulation to specification. Refer to Table A-5 or Table A-6.

3. Install the JAE DIE (Part No. HD-50120-3) or JAE DIE (Part No. HD-50120-4) in the handle of the HAND CRIMP FRAME (Part No. HD-50120-2).

4. Place the new terminal in the specified nest.

5. Insert the wire to the wire stop. Crimp the terminal.

6. Inspect the crimped terminal.

#### Table A-5. Molex CMC Sealed Crimping Die (Part No. HD-50120-3)

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>TERMINAL: WIRE GAUGE</th>
<th>STRIP LENGTH</th>
<th>NEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>72226-11</td>
<td>Socket: 18 AWG</td>
<td>0.177 in, 4.5 mm</td>
<td>B</td>
</tr>
<tr>
<td>72227-11</td>
<td>Socket: 18 AWG</td>
<td>0.177 in, 4.5 mm</td>
<td>A</td>
</tr>
</tbody>
</table>

#### Table A-6. Molex CMC Sealed Crimping Die (Part No. HD-50120-4)

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>TERMINAL: WIRE GAUGE</th>
<th>STRIP LENGTH</th>
<th>NEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>72222-11</td>
<td>Socket: 18 AWG</td>
<td>0.138 in, 3.5 mm</td>
<td>B</td>
</tr>
<tr>
<td>72222-11</td>
<td>Socket: 20 AWG</td>
<td>0.138 in, 3.5 mm</td>
<td>A</td>
</tr>
</tbody>
</table>

---

**Figure A-45. Alpha-Numeric Coordinates**

**Figure A-46. Terminal Removal**
MOLEX MX 150 SEALED CONNECTOR REPAIR

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48114</td>
<td>TERMINAL REMOVER</td>
</tr>
</tbody>
</table>

Separating Pin and Socket Housings
See Figure A-47. Press 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-48. 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-49. 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-50. Insert 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-51. 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. Determine the cavity number by counting the cavities up or down along the row from each stamped number.

2. Orient the terminal 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-47. Molex MX 150 Sealed Connector: Latch**

**Figure A-48. Secondary Lock Pry Slot (Socket Housing)**

**Figure A-49. Pull Up Secondary Lock**
Prepare Tool

1. Identify the punch/die in the jaws of the TERMINAL CRIMPER (Part No. HD-48119) for the wire gauge. Refer to Table A-7.

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-52. 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>
<thead>
<tr>
<th>AWG (WIRE GAUGE)</th>
<th>PUNCH/DIE</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>Left</td>
</tr>
<tr>
<td>18-20</td>
<td>Middle</td>
</tr>
<tr>
<td>14-16*</td>
<td>Right</td>
</tr>
</tbody>
</table>

* Crimp 16 AWG pin terminals in the 18-20 middle die.

CRIMP TERMINAL TO LEAD

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-48119</td>
<td>TERMINAL CRIMPER</td>
</tr>
</tbody>
</table>

Prepare Lead

1. Cut the damaged terminal close to the back of the terminal to leave as much wire length as possible.

2. Strip wire lead removing 3/16 in (4.70-5.60 mm) of insulation.

   **NOTE**
   The strip length is the same for both pin and socket terminals and for wire gauges from 22 to 14.
**Position Terminal in the Punch/Die**

1. See Figure A-54. 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-53. A socket terminal stops against the back face of the socket locator bar (1).
   b. **Pin Terminal**: See Figure A-55. 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-56. Ratchet the handles together until the crimp tails are held in vertical alignment between the punch and the 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 open the tool and release the terminal.

**NOTE**
Open a stuck or jammed tool by pressing the ratchet release lever found between the handles. Do **not** force the handles open or closed.

---

**Insert Stripped Lead**

See Figure A-57. 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.**
Inspect Crimp

1. **Inspect Crimp**: inspect the core and insulation crimp.
   a. See Figure A-58. 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. Pull the lead.

![Figure A-57. Stripped Lead at Up Angle](image)

![Figure A-58. Terminal Crimp](image)
TYCO 040 MULTILOCK UNSEALED CONNECTOR REPAIR

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-50085</td>
<td>TERMINAL EXTRACTOR</td>
</tr>
<tr>
<td>HD-44695-A</td>
<td>MULTI-LOCK CRIMPER</td>
</tr>
</tbody>
</table>

**General**

Tyco 040 Multilock Unsealed connectors are found between wire harnesses and component wiring.

See Figure A-59. To maintain serviceability, always return connectors to OE locations after service.

Obtain the necessary tools to repair the connector and terminals.

**NOTE**

Use the MULTI-LOCK CRIMPER (Part No. HD-44695-A) for terminal crimping.

**Separating Pin and Socket Housings**

1. See Figure A-59. Press the release button (1) on the socket terminal side of the connector.
2. Pull the socket housing (2) out of the pin housing (3).

**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 clicks in place.

**Removing Terminals from Housing**

1. See Figure A-60. 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. Using TERMINAL EXTRACTOR (Part No. B-50085), 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**

If the tang is released, a click is heard.

4. Gently tug on wire to pull wire and terminal from cavity.

---

**Figure A-59. Tyco 040 Multilock Unsealed Connector**

**Figure A-60. Tyco 040 Multilock Unsealed Connector: Socket and Pin Housings**
Inserting Terminals into Housing

NOTE
See Figure A-61. 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 cavity until it snaps in place.

NOTES

- The release button is always on the top of the connector.
- On the pin side of the connector, tangs are positioned at the bottom of each cavity. Therefore, 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. Therefore, the socket terminal slot (on the same side as the crimp tails) must face upward.

2. Gently tug on wire ends to verify that all terminals are locked.

3. Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.

Crimping Terminals to Leads

Terminals are crimped twice: once over the wire core and a second time over the insulation tails. For the correct terminal crimping procedure, refer to the instruction sheet provided with the MULTI-LOCK CRIMPER (Part No. HD-44665-A) or available through h-dnet.com.

Inspecting Crimped Terminals

See Figure A-62. Inspect the wire core crimp (2) and insulation crimp (1). Distortion should be minimal.

Figure A-62. Tyco 040 Multilock Unsealed Connector: Terminal Crimp

1. Insulation crimp
2. Wire core crimp

Figure A-61. Tyco 040 Multilock Unsealed Connector
(socket housing shown)
TYCO 070 MULTILOCK UNSEALED CONNECTOR REPAIR

PART NUMBER  TOOL NAME
B-50085  TERMINAL EXTRACTOR
HD-41609  AMP MULTI-LOCK CRIMPER

General

Tyco 070 Multilock Unsealed connectors are found between wire harnesses and component wiring. They are either floating or anchored to the frame with attachment clips.

See Figure A-63. Attachment clips (1) on the pin housings are fitted to T-studs on 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

Use the AMP MULTI-LOCK CRIMPER (Part No. HD-41609) for terminal crimping.

Separating Pin and Socket Housings

1. If necessary, slide connector attachment clip so T-stud is in the large end of the clip opening. Remove connector from T-stud.

2. See Figure A-63. Press the release button (2) on the socket terminal side of the connector.

3. 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 clicks in place.

3. If OE location is a T-stud, fit large opening end of attachment clip over T-stud. Slide connector to engage T-stud to small end of opening in clip.

Removing Terminals from Housing

1. See Figure A-64. 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. Using TERMINAL EXTRACTOR (Part No. B-50085), 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

   If the tang is released, a click is heard.

4. Gently tug on wire to pull wire and terminal from cavity.
Inserting Terminals into Housing

NOTE

See Figure A-65. 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.
Crimping Terminals to Leads

**NOTE**

Crimping with the AMP Multi-lock Crimper is a one-step operation. One squeeze crimps both the wire core and the insulation tails.

For the correct terminal crimping procedure, refer to the instruction sheet provided with the AMP MULTI-LOCK CRIMPER (Part No. HD-41609) or available through h-tnet.com.

**Inspecting Crimped Terminals**

See Figure A-66. Inspect the wire core crimp (2) and insulation crimp (1). Distortion should be minimal.

Figure A-66. Tyco 970 Multilock Unsealed Connector: Terminal Crimp
TYCO GET 64 SEALED CONNECTOR REPAIR

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-50085</td>
<td>TERMINAL EXTRACTOR</td>
</tr>
</tbody>
</table>

**General**

See Figure A-67. The Tyco GET 64 Sealed connector is found on the ECM of most models.

![Image of connector latch](image)

Figure A-67. Tyco GET 64 Sealed Connector Latch

**Housings**

See Figure A-68. **Separate:** Lift the latch lock to open (1). Press the latch (3). Pull the socket housing off the ECM.

**Join:** Align the socket housing latch with the catch on the ECM. Press housing onto ECM. Press down the latch lock to close (2).

1. Latch lock (open)
2. Latch lock (closed)
3. Connector latch

![Image of latch and lock](image)

Figure A-68. Tyco GET 64 Sealed Connector Latch and Lock

**Removing Socket Terminals**

1. Remove the black wrap to access the back of the connector.

2. See Figure A-69. Use needle nose pliers to pull the secondary lock out of the housing.

3. See Figure A-70. Orient the bevel of the TERMINAL EXTRACTOR (Part No. B-50085) (1) to the upper or lower terminal row. Insert the extractor into the slot next to the terminal.
4. Rotate the extractor to release the retention beam and simultaneously pull on the wire lead to remove the terminal.

**Figure A-69. Tyco GET 64 Secondary Lock**

1. Terminal extractor
2. Retention beam

**Figure A-70. Removing Terminals: Tyco GET 64 Sealed Connector**

**Installing Socket Terminals**

1. See Figure A-71. Locate the wire lead cavity by number.
2. See Figure A-72. Orient the open side of the crimp to the lower or the upper terminal row.
3. Press the terminal in through the rear cover and the seal until it clicks.
4. Press the secondary lock into the locked position.
5. Black wrap the wire lead bundle.

**Figure A-71. Cavity Numbers**

**Figure A-72. Socket Terminal Orientation: Crimp Open Side**

**CRIMPING TERMINALS**

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-50120</td>
<td>UNIVERSAL CRIMPER SET</td>
</tr>
<tr>
<td>HD-50120-2</td>
<td>HAND CRIMP FRAME</td>
</tr>
<tr>
<td>HD-50120-7</td>
<td>TYCO AND DELPHI TERMINAL CRIMP DIE</td>
</tr>
</tbody>
</table>

Crimping Tyco GET 64 terminals requires the use of the TYCO AND DELPHI TERMINAL CRIMP DIE (Part No. HD-50120-7) in the HAND CRIMP FRAME (Part No. HD-50120-2). These items are included in the UNIVERSAL CRIMPER SET (Part No. HD-50120).

For the correct terminal crimping procedure, refer to the instruction sheet provided with the tool or available on h-dnet.com.
## General

The Tyco MCP sealed connector is used on certain ABS modules.

### Housing

**Separate:** See Figure A-73. Press and hold the lock tab. Pulling on both ends of the lever, open the lever.

**Join:** Gently mate the pins to the socket. Press and hold the lock tab. Pressing on both ends of the lever, close the lever.

### Removing the Large Terminals

1. Snap the wire harness cover off of the back of the connector.

   **NOTE**

   Insert a thin flat bladed screwdriver all the way to the bottom behind the tab of the secondary lock.

2. See Figure A-74. Gently slide the secondary lock out of the connector with a screwdriver.

3. See Figure A-75. Insert the smallest pins of the SNAP-ON TERMINAL PICK (Part No. GA500A) into the gaps on each side of the socket to compress the tangs on each side of the terminal.

4. Gently pull on the wire to remove the terminal.

### Removing the Small Terminals

1. Snap the wire harness cover off of the back of the connector.

   **NOTE**

   Insert a thin flat bladed screwdriver all the way to the bottom behind the tab of the secondary lock.

2. See Figure A-74. Gently slide the secondary lock out of the connector with a screwdriver.

3. See Figure A-76. Insert the TERMINAL EXTRACTOR (Part No. B-50085) into the cavity on the outside of the terminal.

4. Tilt the extractor to lift the molding latch and release the terminal.

5. Gently pull on the wire to remove the terminal.
Installing Terminals
1. See Figure A-77. Locate the wire lead cavity by number.
2. Use a hobby knife to bend the tangs on each side of the terminal outward.
3. Align the socket.
4. Push the socket in until it clicks.
5. Press the secondary lock back into the connector.
6. Snap the wire cover in place.

<table>
<thead>
<tr>
<th>TERMINAL</th>
<th>PART NO.</th>
<th>STRIP LENGTH</th>
<th>NEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large socket: 14 AWG</td>
<td>72579-12</td>
<td>0.165-0.189</td>
<td>A</td>
</tr>
<tr>
<td>Large socket: 16 AWG</td>
<td>72579-12</td>
<td>0.165-0.189</td>
<td>B</td>
</tr>
<tr>
<td>Small socket: 20 AWG</td>
<td>72560-12</td>
<td>0.130-0.153</td>
<td>C</td>
</tr>
</tbody>
</table>

Crimping Terminals

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-50120</td>
<td>UNIVERSAL CRIMPER SET</td>
</tr>
<tr>
<td>HD-50120-8</td>
<td>TYCO MCP DIE</td>
</tr>
</tbody>
</table>

1. Strip the wire insulation to specification. Refer to Table A-8.
SEALING SPLICING CONNECTORS

SEALING SPLICING CONNECTOR REPAIR

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>TOOL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-25070</td>
<td>ROBINAIR HEAT GUN</td>
</tr>
<tr>
<td>HD-38125-8</td>
<td>PACKARD TERMINAL CRIMPER</td>
</tr>
<tr>
<td>HD-39969</td>
<td>ULTRA TORCH</td>
</tr>
<tr>
<td>HD-41183</td>
<td>HEAT SHIELD ATTACHMENT</td>
</tr>
</tbody>
</table>

**General**

Splice connectors and several OE ring terminal connectors use heat shrink covering to seal the connection.

**Preparing Wire Leads**

**NOTE**

When splicing adjacent wires, stagger the splices that the sealed splice connectors will not touch each other.

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-9.
3. Strip insulation off the wire lead. Refer to Table A-9.

<table>
<thead>
<tr>
<th>WIRE GAUGE</th>
<th>COLOR</th>
<th>PART NO.</th>
<th>STRIP LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-20</td>
<td>Red</td>
<td>70585-93</td>
<td>3/8</td>
</tr>
<tr>
<td>14-16</td>
<td>Blue</td>
<td>70586-93</td>
<td>3/8</td>
</tr>
<tr>
<td>10-12</td>
<td>Yellow</td>
<td>70587-93</td>
<td>3/8</td>
</tr>
</tbody>
</table>

**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-80. The connector is crimped on one side and then the other.

1. See Figure A-79. Open the PACKARD TERMINAL CRIMPER (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. Insert one end of the sealed connector.
3. Gently squeeze the handles until the connector is held in the jaws.
4. See Figure A-80. 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. 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 electrical system component that is not being serviced.
- Always keep hands away from tool tip area and heat shrink attachment.

7. Use an ULTRA TORCH (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-90. 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-79. 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-80. Sealed Splice Connector
## CONNECTORS

### CONNECTOR LOCATIONS

#### Function/Location

All vehicle connectors are identified by their function and location. Refer to Table B-1.

#### Place and Color

The place (number of wire cavities of a connector housing) and color of the connector can also aid identification.

### Table B-1. Softail Connector Locations

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>TERMINAL PROBE COLOR</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>[7]</td>
<td>Tail lamp harness to main harness</td>
<td>8-place Tyco 070 Multilock Unsealed (BK) (except FXSB)</td>
<td>Gray</td>
<td>Under seat</td>
</tr>
<tr>
<td>[18]</td>
<td>Right rear stop, tail and turn assembly</td>
<td>2-place Tyco 070 Multilock Unsealed (except FLSTN, FXSB, FLS) (BK), 2-place Deutsch DTM Sealed (FLSTN), 4-place Deutsch DTM Sealed (FXSB, FLS) (GY)</td>
<td>Gray/Brown</td>
<td>Inside tail lamp lens (except FXSB, FLS), Under seat (FXSB and FLS)</td>
</tr>
<tr>
<td>[19]</td>
<td>Left rear stop, tail and turn assembly</td>
<td>2-place Tyco 070 Multilock Unsealed (except FLSTN, FXSB, FLS) (BK), 2-place Deutsch DTM Sealed (FLSTN), 4-place Deutsch DTM Sealed (FXSB, FLS) (BK)</td>
<td>Gray/Brown</td>
<td>Inside tail lamp lens (except FXSB, FLS), Under seat (FXSB and FLS)</td>
</tr>
<tr>
<td>[20]</td>
<td>Console harness</td>
<td>6-place Molex MX 150 Sealed (FXSB and FLS) (BK), 8-place Molex MX 150 Sealed (Except FXSB and FLS) (BK)</td>
<td>Gray</td>
<td>Under console</td>
</tr>
<tr>
<td>[21]</td>
<td>Indicator lamps</td>
<td>6-place Molex MX 150 Sealed (BK)</td>
<td>Gray</td>
<td>Under console</td>
</tr>
<tr>
<td>[22-1]</td>
<td>Right hand controls</td>
<td>4-place JAE MX19 Sealed (BK)</td>
<td>Yellow</td>
<td>Under fuel tank, right side</td>
</tr>
<tr>
<td>[22-2]</td>
<td>Right hand controls</td>
<td>2-place JAE MX19 Sealed (BK)</td>
<td>Yellow</td>
<td>Under fuel tank, right side</td>
</tr>
<tr>
<td>[24]</td>
<td>Left hand controls</td>
<td>4-place JAE MX19 Sealed (BK)</td>
<td>Yellow</td>
<td>Under fuel tank, left side</td>
</tr>
<tr>
<td>[31]</td>
<td>Front turn signals</td>
<td>6-place Tyco 070 Multilock Unsealed (BK)</td>
<td>Gray</td>
<td>Under fuel tank, right side</td>
</tr>
<tr>
<td>[32]</td>
<td>Front fender tip lamp</td>
<td>2-place Tyco 070 Multilock Unsealed (BK)</td>
<td>Gray</td>
<td>Under fuel tank, left side</td>
</tr>
<tr>
<td>[33]</td>
<td>Ignition switch</td>
<td>2-place Delphi GT 150 Sealed (GY)</td>
<td>Gray</td>
<td>Under fuel tank console (except FXSB), Behind ignition coil (FXSB)</td>
</tr>
<tr>
<td>[38]</td>
<td>Headlamp</td>
<td>4-place Tyco 070 Multilock Unsealed (BK)</td>
<td>Gray</td>
<td>Under fuel tank, left side</td>
</tr>
<tr>
<td>[39]</td>
<td>Speedometer</td>
<td>12-place Delphi Micro 64 Sealed (GY)</td>
<td>BOB</td>
<td>Back of speedometer</td>
</tr>
</tbody>
</table>

### Connector Number

On wiring diagrams and in service/repair instructions, connectors are identified by a number in brackets.

### Repair Instructions

The repair instructions in Appendix A are by connector type. Refer to Table B-1.

---

2015 Softail Service: Appendix B Wiring B-1
<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>TYPE</th>
<th>TERMINAL PROBE COLOR</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>LP, stop and tail lamp</td>
<td>4-place Deutsch DTM Sealed (FLSTN) (BK)</td>
<td>Brown</td>
<td>Inside tail lamp lens (except FXSB, FLS) Under seat (FXSB and FLS)</td>
</tr>
<tr>
<td>45</td>
<td>Rear fender lip lamp</td>
<td>3-place Tyco 070 Multilock Unsealed (BK)</td>
<td>Gray</td>
<td>Inside tail lamp lens</td>
</tr>
<tr>
<td>47</td>
<td>Voltage regulator to stator</td>
<td>3-place Dekko (BK)</td>
<td>Green</td>
<td>Back of voltage regulator</td>
</tr>
<tr>
<td>64</td>
<td>Fuse block</td>
<td>Delphi 280 Metri-pack Sealed (main fuse)</td>
<td>Purple/Red</td>
<td>Under seat</td>
</tr>
<tr>
<td>65</td>
<td>VSS</td>
<td>3-place Delphi GT 150 3.5 Sealed (BK)</td>
<td>Gray</td>
<td>Top of transmission case</td>
</tr>
<tr>
<td>73</td>
<td>Auxiliary lamps</td>
<td>2-place Tyco 070 Multilock Unsealed (BK)</td>
<td>Gray</td>
<td>Behind front fork panel</td>
</tr>
<tr>
<td>77</td>
<td>Voltage regulator</td>
<td>2-place Dekko (BK)</td>
<td>Green</td>
<td>Back of voltage regulator</td>
</tr>
<tr>
<td>78-1</td>
<td>ECM</td>
<td>18-place Tyco (BK)</td>
<td>BOB</td>
<td>Under seat in front of rear fender (except FXSB) Electrical panel behind fender extension (FXSB)</td>
</tr>
<tr>
<td>78-2</td>
<td>ECM</td>
<td>18-place Tyco (GY)</td>
<td>BOB</td>
<td>Under seat in front of rear fender (except FXSB) Electrical panel behind fender extension (FXSB)</td>
</tr>
<tr>
<td>79</td>
<td>CKP sensor</td>
<td>2-place Deutsch DTM Sealed (BK)</td>
<td>Brown</td>
<td>Back of voltage regulator bracket</td>
</tr>
<tr>
<td>80</td>
<td>MAP sensor</td>
<td>3-place Delphi 150 Metri-pack Sealed (GY)</td>
<td>Gray</td>
<td>Top of induction module</td>
</tr>
<tr>
<td>83</td>
<td>Ignition coil</td>
<td>4-place Delphi GT 150 Sealed (BK)</td>
<td>Gray</td>
<td>Back of coil</td>
</tr>
<tr>
<td>84</td>
<td>Front fuel injector</td>
<td>2-place Delphi GT 150 3.5 Sealed (GY)</td>
<td>Gray</td>
<td>Beneath fuel tank</td>
</tr>
<tr>
<td>85</td>
<td>Rear fuel injector</td>
<td>2-place Delphi GT 150 3.5 Sealed (GY)</td>
<td>Gray</td>
<td>Beneath fuel tank</td>
</tr>
<tr>
<td>87</td>
<td>IAC</td>
<td>4-place Delphi GT 150 3.5 Sealed (BK)</td>
<td>Gray</td>
<td>Beneath fuel tank</td>
</tr>
<tr>
<td>88</td>
<td>TPS</td>
<td>3-place Delphi GT 150 Sealed (BK)</td>
<td>Gray</td>
<td>Behind air cleaner backing plate</td>
</tr>
<tr>
<td>89</td>
<td>IAT sensor</td>
<td>2-place Delphi GT 150 3.5 Sealed (GY)</td>
<td>Gray</td>
<td>Behind air cleaner backing plate</td>
</tr>
<tr>
<td>90</td>
<td>ET sensor</td>
<td>2-place Delphi GT 150 Sealed (BK)</td>
<td>Gray</td>
<td>Back of front cylinder, left side</td>
</tr>
<tr>
<td>91</td>
<td>DLC</td>
<td>6-place Deutsch DT Sealed (GY)</td>
<td>Black</td>
<td>Under seat</td>
</tr>
<tr>
<td>93</td>
<td>Tail lamp</td>
<td>4-place Tyco 070 Multilock Unsealed (BK)</td>
<td>Gray</td>
<td>Inside tail lamp lens</td>
</tr>
<tr>
<td>94</td>
<td>Rear fender lights harness in circuit board</td>
<td>6-place Tyco 070 Multilock Unsealed (BK)</td>
<td>Gray</td>
<td>Circuit board under tail lamp assembly</td>
</tr>
<tr>
<td>95</td>
<td>Purge solenoid</td>
<td>2-place Delphi 150 Metri-pack Sealed (BK)</td>
<td>Gray</td>
<td>Electrical panel behind fender extension</td>
</tr>
<tr>
<td>109</td>
<td>Auxiliary lamp switch</td>
<td>Tyco insulated Spade terminal</td>
<td>Gray</td>
<td>Fork back panel</td>
</tr>
<tr>
<td>NO.</td>
<td>DESCRIPTION</td>
<td>TYPE</td>
<td>TERMINAL PROBE COLOR</td>
<td>LOCATION</td>
</tr>
<tr>
<td>-------</td>
<td>------------------</td>
<td>----------------------------</td>
<td>----------------------</td>
<td>--------------------------------------------------------</td>
</tr>
<tr>
<td>[117]</td>
<td>Fuel gauge</td>
<td>4-place Tyco 040 Unsealed (BK)</td>
<td></td>
<td>Left front side of fuel tank</td>
</tr>
<tr>
<td>[120]</td>
<td>Oil pressure switch</td>
<td>Right Angle Push On Molded (BK)</td>
<td></td>
<td>Front right crankcase</td>
</tr>
<tr>
<td>[121]</td>
<td>Rear stop lamp switch</td>
<td>Tyco Insulated Spade terminal (BK)</td>
<td>Red</td>
<td>Right side of transmission</td>
</tr>
<tr>
<td>[122]</td>
<td>Horn</td>
<td>Flag terminals (BK)</td>
<td>Red</td>
<td>Between cylinders, left side (except FXSB) Front of frame above voltage regulator (FXSB)</td>
</tr>
<tr>
<td>[128]</td>
<td>Starter solenoid</td>
<td>Tyco Insulated Spade terminal (W)</td>
<td>Red</td>
<td>Top of starter</td>
</tr>
<tr>
<td>[131]</td>
<td>Neutral switch</td>
<td>Right Angle Push On Molded (BK)</td>
<td></td>
<td>Top of transmission</td>
</tr>
<tr>
<td>[133]</td>
<td>JSS</td>
<td>3-place Molex MX 150 Sealed (BK)</td>
<td>Gray</td>
<td>Back of voltage regulator bracket</td>
</tr>
<tr>
<td>[137]</td>
<td>HO2 sensor (rear)</td>
<td>4-place Molex MX 150 Sealed (BK)</td>
<td>Gray</td>
<td>Under seat in front of battery</td>
</tr>
<tr>
<td>[138]</td>
<td>HO2 sensor (front)</td>
<td>4-place Molex MX 150 Sealed (BK)</td>
<td>Gray</td>
<td>Behind voltage regulator</td>
</tr>
<tr>
<td>[141]</td>
<td>Fuel pump and sender</td>
<td>4-place Delphi GT 150 Sealed (BK)</td>
<td>Gray</td>
<td>Top of fuel tank</td>
</tr>
<tr>
<td>[142]</td>
<td>Security siren (optional)</td>
<td>3-place Delphi GT 150 3.5 Sealed (BK)</td>
<td>Gray</td>
<td>Electrical panel behind fender extension</td>
</tr>
<tr>
<td>[143]</td>
<td>Front fender tip lamp</td>
<td>2-place Tyco 070 Multilock Unsealed (BK)</td>
<td>Gray</td>
<td>In front fender tip lamp</td>
</tr>
<tr>
<td>[166]</td>
<td>ABS ECU</td>
<td>20-place Molex MX 150 Sealed (BK)</td>
<td>BOB</td>
<td>Electrical panel behind fender extension</td>
</tr>
<tr>
<td>[167]</td>
<td>Front WSS</td>
<td>2-place Delphi 150 Metri-pack Sealed (BK)</td>
<td>Gray</td>
<td>Under fuel tank, left side</td>
</tr>
<tr>
<td>[168]</td>
<td>Rear WSS</td>
<td>2-place Delphi 150 Metri-pack Sealed (BK)</td>
<td>Gray</td>
<td>Electrical panel behind fender extension</td>
</tr>
<tr>
<td>[178]</td>
<td>Active intake solenoid</td>
<td>2-place Tyco Superseal 1.5 Sealed (BK)</td>
<td>Gray</td>
<td>Air cleaner backing plate</td>
</tr>
<tr>
<td>[179]</td>
<td>Active exhaust</td>
<td>5-place Tyco Superseal 1.5 Sealed (BK)</td>
<td>Gray</td>
<td>Exhaust bracket</td>
</tr>
<tr>
<td>[200]</td>
<td>Resistor assembly</td>
<td>3-place Molex MX 150 Sealed (GY)</td>
<td>Gray</td>
<td>Under seat</td>
</tr>
<tr>
<td>[203F]</td>
<td>ACR (front)</td>
<td>2-place Tyco Superseal 1.5 Sealed</td>
<td>Gray</td>
<td>Bracket attached to the throttle body</td>
</tr>
<tr>
<td>[203R]</td>
<td>ACR (rear)</td>
<td>2-place Tyco Superseal 1.5 Sealed</td>
<td>Gray</td>
<td>Bracket attached to the throttle body</td>
</tr>
<tr>
<td>[209]</td>
<td>Security antenna</td>
<td>2-place Molex MX 64 Unsealed (BK)</td>
<td>Light Blue</td>
<td>Under seat</td>
</tr>
<tr>
<td>[242]</td>
<td>BCM</td>
<td>48-place Molex CMC Sealed (BK)</td>
<td>BOB</td>
<td>Electrical panel behind fender extension</td>
</tr>
<tr>
<td>[254]</td>
<td>Front HCU</td>
<td>4-place Delphi GT 150 Sealed (BK)</td>
<td>Gray</td>
<td>Front of frame above voltage regulator</td>
</tr>
<tr>
<td>[255]</td>
<td>Rear HCU</td>
<td>4-place Delphi GT 150 Sealed (BK)</td>
<td>Gray</td>
<td>Below electrical panel behind fender extension</td>
</tr>
<tr>
<td>NO.</td>
<td>DESCRIPTION</td>
<td>TYPE</td>
<td>TERMINAL PROBE COLOR</td>
<td>LOCATION</td>
</tr>
<tr>
<td>-------</td>
<td>------------------------------</td>
<td>-----------------------------</td>
<td>----------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>[259]</td>
<td>BCM battery power</td>
<td>1-place Delphi 800 Metri-pack Sealed (BK)</td>
<td>Red</td>
<td>Electrical panel behind fender extension</td>
</tr>
<tr>
<td>[266]</td>
<td>Anti-theft Tracking Module</td>
<td>4-place Delphi GT 150 Sealed (BK)</td>
<td>Gray</td>
<td>Electrical panel behind fender extension</td>
</tr>
<tr>
<td>[GND1]</td>
<td>Left side ground stud</td>
<td>Ring terminals</td>
<td></td>
<td>Under seat</td>
</tr>
<tr>
<td>[GND2]</td>
<td>Right side ground stud (Regulator)</td>
<td>Right side ground stud</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[GND2A]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
WIRING DIAGRAM INFORMATION

Wire Color Codes

Wire traces on wiring diagrams are labeled with alpha codes. Refer to Table B-2.

For Solid Color Wires: See Figure B-1. The alpha code identifies wire color.

For Striped Wires: The code is written with a slash (/) between the solid color code and the stripe code. For example, a trace labeled GN/Y is a green wire with a yellow stripe.

Wiring Diagram Symbols

See Figure B-1. On wiring diagrams and in service/repair instructions, connectors are identified by a number in brackets [ ]. The letter inside the brackets identifies whether the housing is a socket or pin housing.

A=Pin: The letter A and the pin symbol after a connector number identifies the pin side of the terminal connectors.

B=Socket: The letter B and the socket symbol after a connector number identifies the socket side of the terminal connectors. Other symbols found on the wiring diagrams include the following:

Diode: The diode allows current flow in one direction only in a circuit.

Wire break: The wire breaks are used to show option variances or page breaks.

No Connection: Two wires crossing over each other in a wiring diagram that are shown with no splice indicating they are not connected together.

Circuit to/from: This symbol indicates a more complete circuit diagram on another page. The symbol is also identifying the direction of current flow.

Splice: Splices are where two or more wires are connected together along a wiring diagram. The indication of a splice only indicates that wires are spliced to that circuit. It is not the true location of the splice in the wiring harness.

Ground: Grounds can be classified as either clean or dirty grounds. Clean grounds are identified by a (BK/GN) wire and are normally used for sensors or modules.

NOTE

Clean grounds usually do not have electric motors, coils or anything that may cause electrical interference on the ground circuit.

Dirty grounds are identified by a (BK) wire and are used for components that are not as sensitive to electrical interference.

Twisted pair: This symbol indicates the two wires are twisted together in the harness. This minimizes the circuit's electromagnetic interference from external sources. If repairs are necessary to these wires they should remain as twisted wires.

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. Wire break
9. No connection
10. Circuit to/from
11. Splice
12. Ground
13. Twisted pair

Figure B-1. Connector/Wiring Diagram Symbols

Figure B-2. Fuse Block and Socket Terminals
<table>
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## Wiring Diagram List

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Figure B-4. Ignition and Accessory Power Distribution: Except FXSB and FLS
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Figure B-9. Ground Circuit: FXSB and FLS
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Figure B-11.
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Main Harness 2 of 2: 2015 Softail (Except FXSB and FLS)
Figure B-13.
Main Harness 1 of 3: 2015 Softail (FXSB)
Figure B-14.
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Main Harness 3 of 3: 2015 Softail (FXSB and FLS)
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## Length Conversion

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UNITED STATES SYSTEM

Unless otherwise specified, all fluid volume measurements in this 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 manual include the metric system equivalents. In the metric system, 1 liter (L) = 1,000 milliliters (mL). To convert between U.S. units-of-measure and metric units-of-measure, 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 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. To convert between U.S. units and British Imperial units, 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 manual. To convert units, use the following equations:

- foot pounds (ft-lbs) $\times 12.00000 = \text{inch pounds (in-lbs)}$
- inch pounds (in-lbs) $\times 0.08333 = \text{foot pounds (ft-lbs)}$

**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) $\times 0.737563 = \text{foot pounds (ft-lbs)}$
- Newton meters (Nm) $\times 8.85085 = \text{inch pounds (in-lbs)}$
- foot pounds (ft-lbs) $\times 1.35582 = \text{Newton meters (Nm)}$
- inch pounds (in-lbs) $\times 0.112985 = \text{Newton meters (Nm)}$
### Table C-2. Acronyms and Abbreviations

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<td>Banjo bolt to HCU</td>
<td>120-144 in-lbs</td>
<td>13.6-16.3 Nm</td>
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<td>Brake hose bracket bolt, front</td>
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